35

ELECTRICAL AGE

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy

VOL XII.—No. 1. NEW YORK, JULY 8, 1893. Subscription, $3.00 per year. Foreign Countries, $5.00 per year

STEVENS INSTITUTE OF TECHNOLOGY,

HOBOKEN, N. J., Feb. 12, 1889.

BISHOP GUTTA-PERCHA CO.

Gentlemen: I have made an extensive series of tests of your WHITE CORE INDIA RUBBER INSULATION, under various conditions of temperature and times of immersion in water, with the following results:

INSULATION RESISTANCE IN MEGOHMS PER MILE:

Time	5 min.	1 h'r	24 h'rs	10 days	24 days
Temperature	60° F.	60° F.	60° F.	60° F.	60° F.
Resistance	3,200	3,300	3,300	3,300	3,300

Time	30 min.	30 min.	30 min.	30 min
Temperature	40° F.	115° F.	167° F.	200° F.
Resistance	3,900	162	12	5.2

The cable had been immersed in water for a month before the first temperature test was made.

This wire also showed no deterioration from exposure to moist air, fresh plaster, damp earth, etc., after several months' exposure. Its insulating power also was unaffected by a like exposure to illuminating gas.

Very truly yours,

(Signed) HENRY MORTON.

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☞ NEWARK, N. J., ELECTRICAL INDUSTRIES DESCRIBED IN THIS NUMBER.

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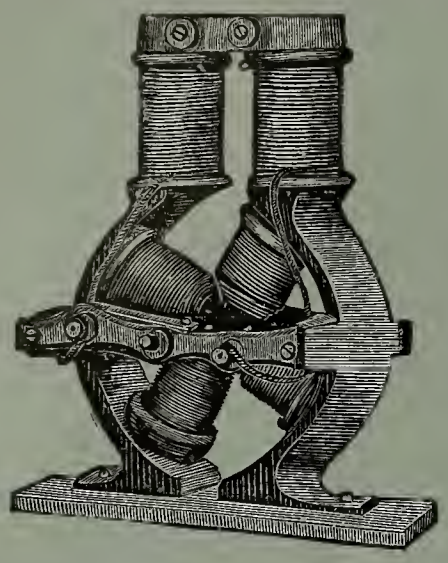
Notice to One and All

IN WANT OF

FAN and SEWING MACHINE MOTORS

THE LITTLE



WONDER

To be sure and call at No. 43 South Main street, Room No. 5, or at the elegant store of Messrs. Drake, Payson & Whittier, No. 170 Weybosset street, the General Agents of Providence, R. I., and procure or see the **Little Wonder,** called the **Clyde Electric Motor,** as it has no equal in this country, of its size, for power and comfort in every way, and it is the only motor that can be run and produce power with perfect satisfaction from batteries and the alternate currents. This Motor, as aforesaid, is proving itself to be a great wonder to every one that has seen it, and is fast becoming the favorite above all others for the above named purposes, as it can be run in any position, and be utilized in thou-ands of ways and places for half the cost of any yet manufactured, viz.: It is being used in offices, insurance houses, hotels, over dining rooms, parlors, over couches—thereby doing away with all nettings and mosquitos, and producing as much comfort to the sleeper as in the fall of the year, at home or aboad; in colleges, in studios, in markets, over meat benches, doing away with so much handling and covering up of meats, etc., and by removing the fan and placing on the shaft a small pulley, with small belt attached to your sewing machine, your ladies can do all their sewing with solid comfort.

CLYDE ELECTRIC MOTOR CO.,

R. F. CAPWELL, Treasurer. PROVIDENCE, R. I.

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ALBERT C. COURTER,

The CROWN DYNAMOS.

Electro-Plating and Electro-Typing Machines.

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Special Features of Crown Dynamos.

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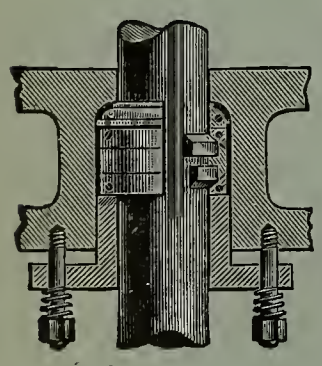

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— FOR —

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May be applied to any stuffing box without alteration or disconnecting. Is steam, air and water-tight under highest pressure and piston velocity without using any fibrous matter whatever. Seals by perfect contact instead of by excessive friction. Works perfectly on rods having excessive lateral vibration. Every packing warranted to give full satisfaction. Send for handbook of particulars. Address

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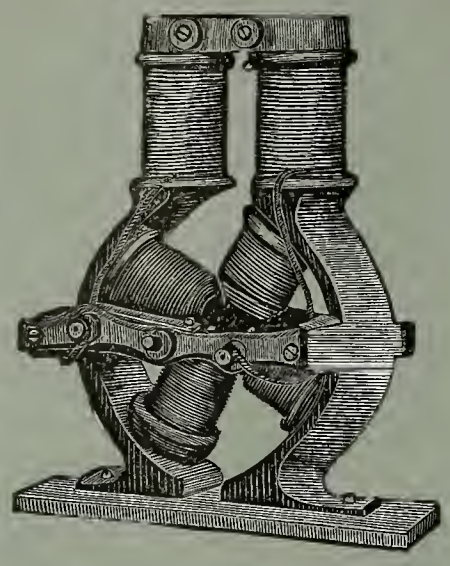

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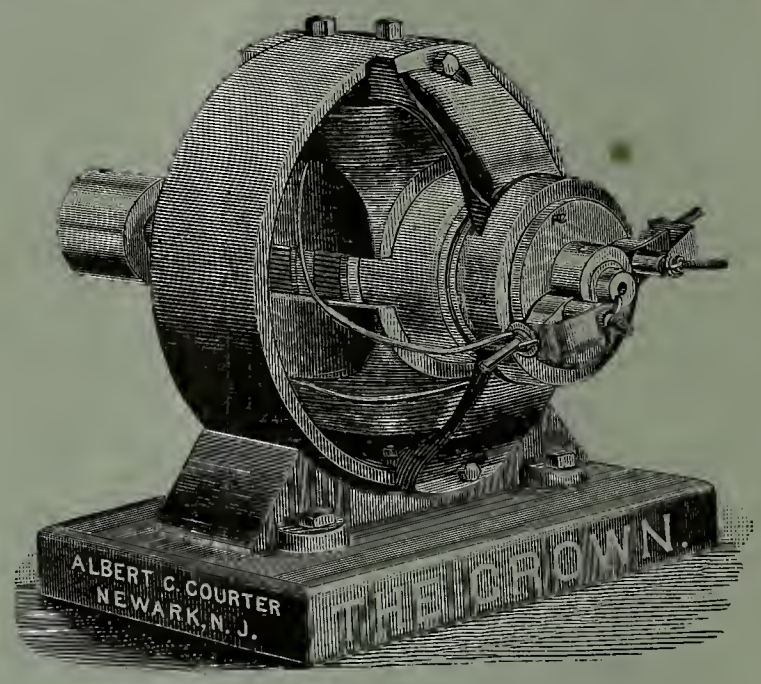

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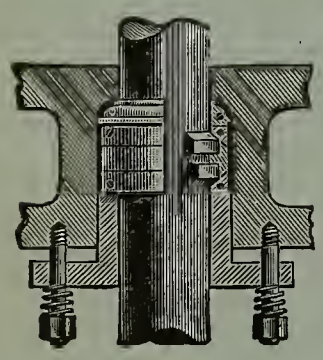

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T. R TALTAVALL, Secretary and Editor.
F. H. DOANE, Associate Editor.

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FIRST FLOOR, WORLD BUILDING.
Telephone, 2361 Cortlandt. NEW YORK.

NEW YORK, JULY 8, 1893.

CONTENTS.

HOW TO BECOME SUCCESSFUL.

We are glad to give the space in this issue to a communication from Mr. J. Stanford Brown in regard to the necessary qualifications of a successful electrician. Mr. Brown points out, and very truly, that a technical education alone is not sufficient to insure success in business. It is valuable as far as it goes, but a practical business training is just as necessary, and such training can come only by patient attention to business methods for a long period of time. Mr. Brown's paper will be of great benefiit to those who come within the limits of its application, as it tells clearly what a young man must know and go through if he would be successful in business. We would like to receive more articles of this character.

RAILWAY TELEGRAPH SUPERINTENDENTS.

The association of Railway Telegraph Superintendents held its annual convention in Milwaukee on the 20th and 21st ulto. The successful railway telegraph superintendent these days must needs be an electrical engineer, because dynamos, motors, electric lights, etc., come within his bailiwick. and judging from the character of the papers read at these meetings, the authors show themselves to be thoroughly versed in electrical science. This association is, of necessity, growing in importance every year.

OPENING THE WORLD'S FAIR EVENINGS.

It is very gratifying to learn that the Council of Administration of the World's Fair has decided to keep the gates of the great show open until 11 o'clock every night. The order took effect on June 21, and from personal observation it seems to us that the night patronage will equal that of the day. It will give an opportunity to see the sights to thousands of people who are employed in the city during the daytime, and the crowds of visitors from other places will be glad of the chance the new order of things will give them to see the beautiful electric effects, which surpass in grandeur anything ever before attempted. Everybody who can, should go to Chicago and see the great fair. It is worth the time and expense.

LESSONS OF THE VICTORIA DISASTER

The awful disaster to the British ironclad "Victoria" has not been barren of lessons. Such events usually teach men many things they did not know or provide for before, and they are proof of the unalterable law that perfection can only be attained through failure, or experience. Perfection in anything human, of course, can never be realized, but improvements in that direction can always be made, and it frequently requires a costly lesson to show men weak points in their works. As invulnerable a structure as the "Victoria" was supposed to be, she became utterly helpless and sank an inert mass in a few seconds of time through the failure to close the doors of her watertight compartments, which were intended for use in an emergency of this nature. A correspondent of a New York daily paper thinks that some electro-mechanical device could be applied for the operation of these doors, so they could be closed quickly in case of emergency. The engineer, he thinks, should be on the bridge, and the appliances for starting and stopping the engines, on the upper deck. With the aid of electricity all this could, no doubt, be easily accomplished, and the clumsy, old fashioned methods now in vogue, and persistently adhered to, would have to give way. In these days of electricity there is no excuse for the use of old fashioned and inefficient devices on board of these costly ships, and we would note with pride any initial steps towards improvement in this direction on the part of our own navy.

NOVELTIES IN TROLLEY APPLIANCES.

A new line of trolley fixtures of novel design have just been placed upon the market. Illustrations and descriptions of these devices follow.

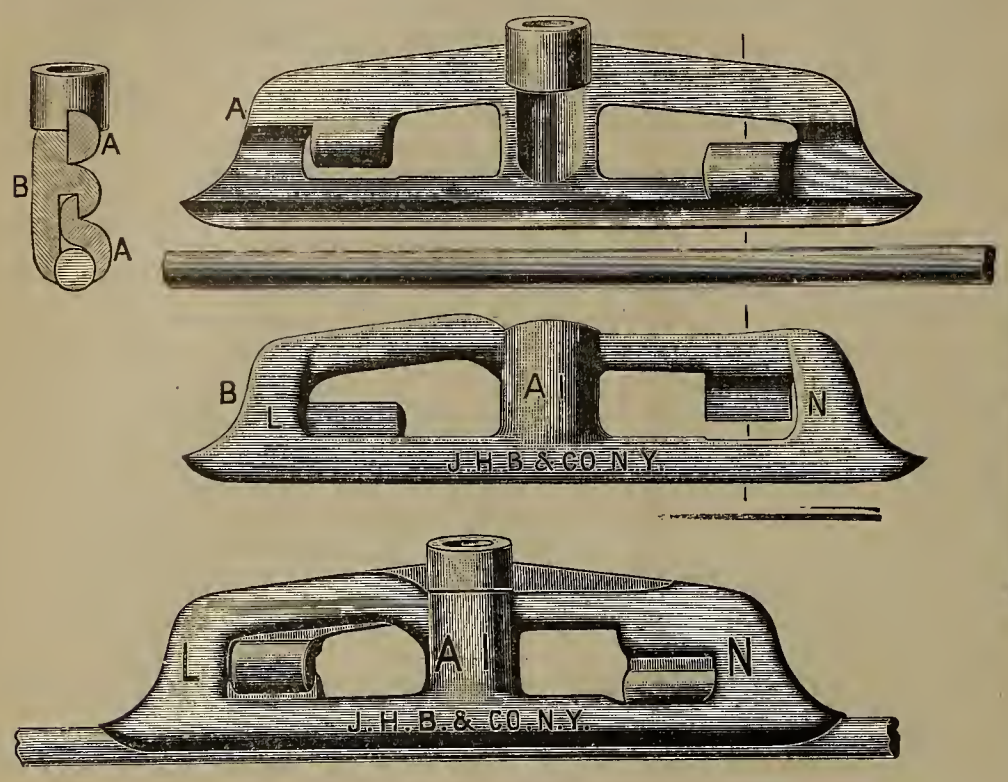


FIG. 1.

Fig. 1 shows Lain's Improved Mechanical Clamp for suspending the trolley wire. This clamp is made of malleable iron, and consists of two essentially similar parts, each having a groove near its lower edge for the trolley wire, and also provided with interlocking lugs, the faces of which are inclined at a small angle with the grooves. These parts are so proportioned that when placed facing, but not registering with each other on the wire, the lugs will interlock, and as the parts are driven nearer and nearer to opposition, the inclined faces of the interlocking lugs clamp more and more firmly on the wire. A great clamping force is thus obtained, which originates from points near the ends where it is most needed.

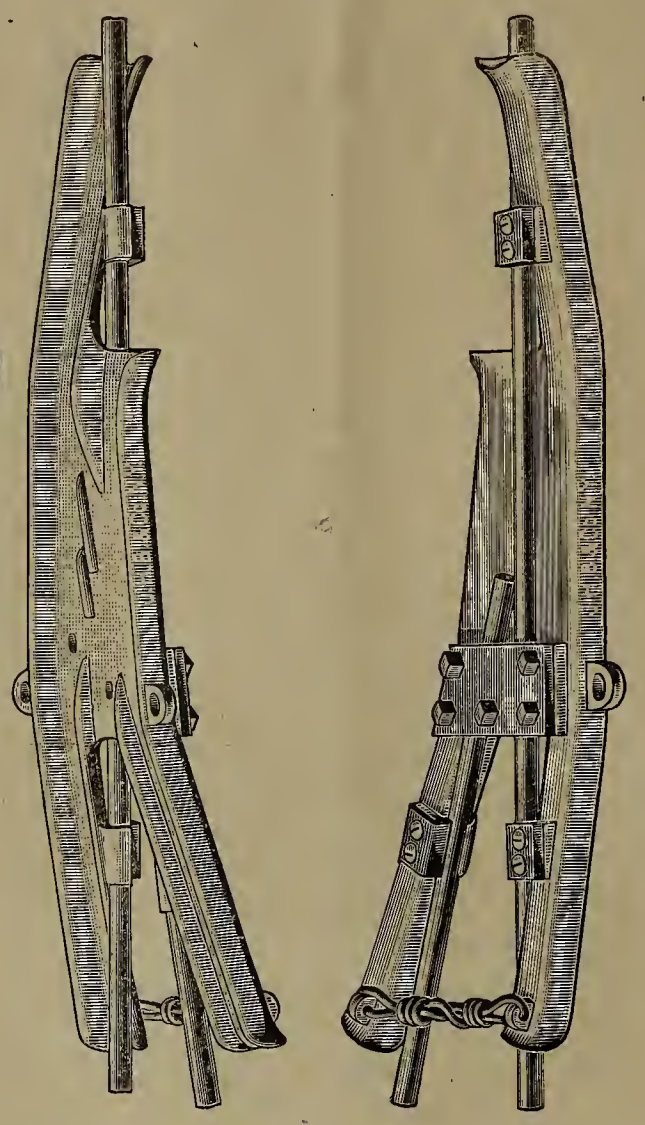


FIG. 2.

The strength of the material of which these clamps are made is such that they are ground down sufficiently thin along the lower edges to provide an uninterrupted path for the trolley wheel along the under side of the wire, and yet firmly secure the wire. Another lug on one

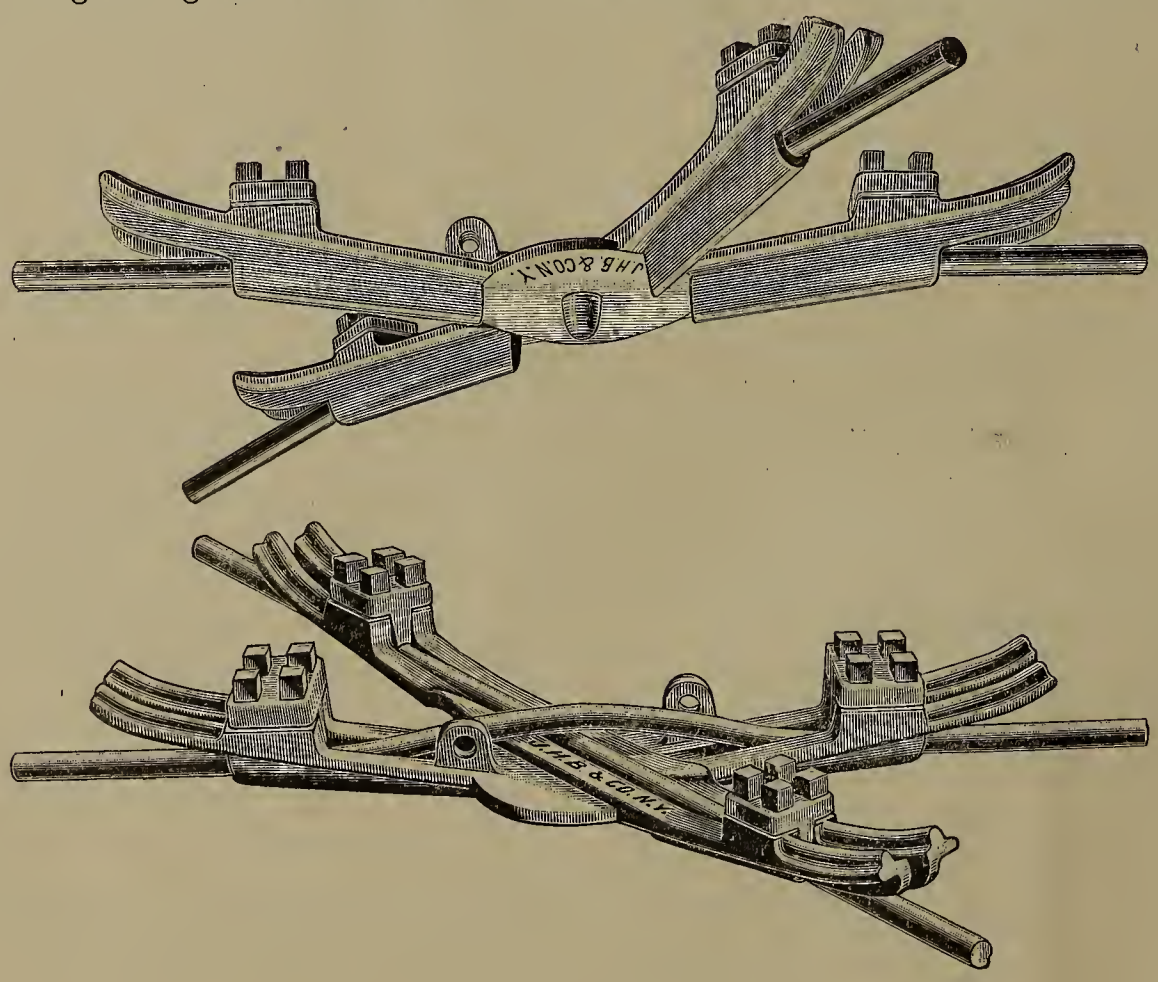


FIG. 3.

of the parts is tapped for the screw on the insulator bell and this screw enters far enough below the lug to lock the other part in its place. These clamps are supplied tapped to fit any insulator.

Fig. 2, shows Lain's Improved Non-sparking Trolley Frog. The novelty in this frog consists in the form of its approaches; the floor of which are extensions of the central floor of the frog sufficiently inclined upward so that one of the flanges of the trolley wheel is the first to strike the approach, and is gradually depressed until it is below the wire, when it may cross the central portion of the floor of the frog on its flanges, and the sparking which often occurs between the wire and the wheel when the wheel groove enters on the inclined rib, as usually constructed, is avoided.

Fig. 3 shows Lain's New Adjustable Crossing. It possesses all the notable non-sparking qualities of the Lain Frog. It is very light, neat and simple.

Fig. 4 illustrates Lain's Section Insulator which combines the best features of the two most usual types. A strong piece of fibre is provided at each end with a brass casting suitably shaped for attachment to the end of

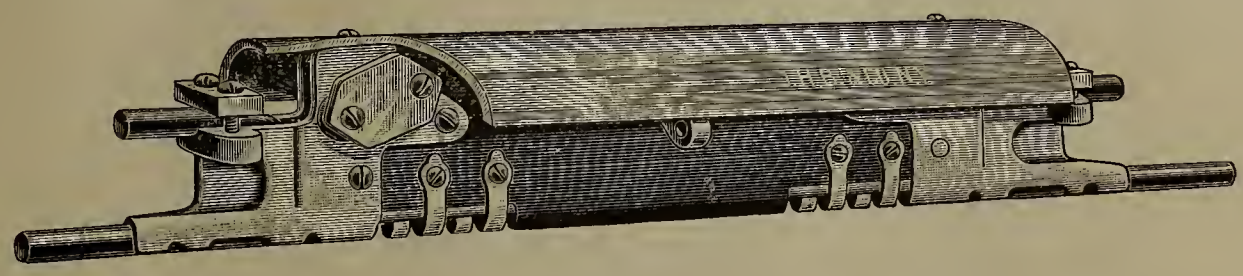


FIG. 4.

the trolley wire. Each of these castings is provided with a strong screw clamp for connecting in the feeder wires, and the break between the castings and the fibre is rendered less sudden by four short blocks of brass separated by short spaces and insulated from each other. Several layers of mica are placed between these blocks and the fibre, in order to protect it from the sparking incident to the interruption of the current. The spark is thus reduced in destructive effect and is borne by the metal rather than by the fibre, and the long space of unbroken insulation in the middle of the device insures reliable insulation.

Fig. 5 shows Lain's Screw Clamp Bridle and Anchor Ear. The trolley wires pass through a deep groove in a brass ear and is securely clamped in the bottom of the same by means of a screw clamp the cap of which

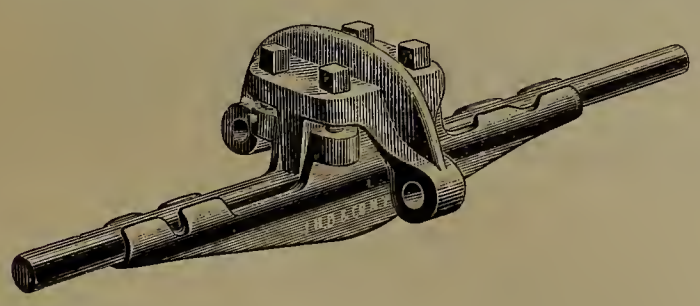


FIG. 5.

has projecting arms that bend downward on either side as far as the horizontal plane of the wire. These arms afford places for attaching the guy wires at points in the horizontal plane of the trolley wire. Thus the strain on these wires does not deflect the trolley wire out of the horizontal plane, and since the bridle is attached by screw clamps it is quickly placed in position and as easily moved when so desired.

On some of these devices patents have already been obtained and the novel features of the others are subjects of applications now in the patent office. They are the invention of David E. Lain, Yonkers, N. Y., and are being put upon the market by Messrs. J. H. Bunnell & Co., 76 Cortlandt street, New York city.

ADVICE TO THOSE DESIRING TO BECOME ELECTRICIANS.

NEW YORK, June 22, 1893.

EDITOR ELECTRICAL AGE:—T. D. H. offers some remarks under the above head in your issue of the 24th inst., Vol. XI., No. 25, p. 397, which perhaps it may be worth while to add to.

There can be no doubt but that a large proportion of the young men of the day who are proposing to take up a professional career are turning to the field of applied electricity as offering "great opportunities."

That it would be advantageous for all possible to pursue "a course of electrical engineering in some first-class college," cannot be doubted, but that in all cases "the instruction is thorough and practical in every branch of the science, and when a young man is graduated from such an institution he is sufficiently equipped for life's battle along this particular line" may be fairly questioned.

The writer very much regrets that he himself never had the advantages of such a course, as there were no such courses in existence at the time when he entered the electrical business. He has, however, known intimately quite a large number of graduates of the various institutions giving courses in electrical engineering and, while such graduates have acquired a fairly thorough and accurate knowledge of what exists in the text books, they have invariably found themselves very far from being thoroughly equipped when it comes to the question of earning a satisfactory salary by means of such knowledge as they have acquired in college.

They usually have to undergo a course in practical work, lasting from one to two years, before they can be considered at all as engineers in the true sense of the word. Of course, in such a discussion the goal to be attained should be mutually understood; in other words, is it the young man's ambition to become merely the operator of a dynamo, the superintendent of an electric light plant, or the manager of electric light works, or a consulting engineer, upon whom would devolve the supervision of all the detail of working out the particular system, both electrically and mechanically, best suited for the highest possible results under any given conditions.

In every article hitherto brought to the notice of the writer, there has been a total disregard of the necessity for and experience in purely business training. This would involve a knowledge of at least simple bookkeeping, a thorough knowledge and acquaintance with the various articles used in electric light construction, to say nothing of the additional material of various kinds included in street railway work, steam apparatus, fittings, etc. with their prices and relative merits, all of which cannot be acquired in a day, or in fact in several weeks, by one who has never been in business.

It may be argued that a thorough knowledge of what is sometimes called the purely business end of the undertaking is not required by an electrical engineer, but the successful engineer usually finds it necessary to have a very thorough acquaintance with all such matters. Neither have we considered at all, the acquaintance

with business methods and the art of negotiation, the detail of contract forms, etc., which must be acquired before the highest position can be reached by our electrical engineer.

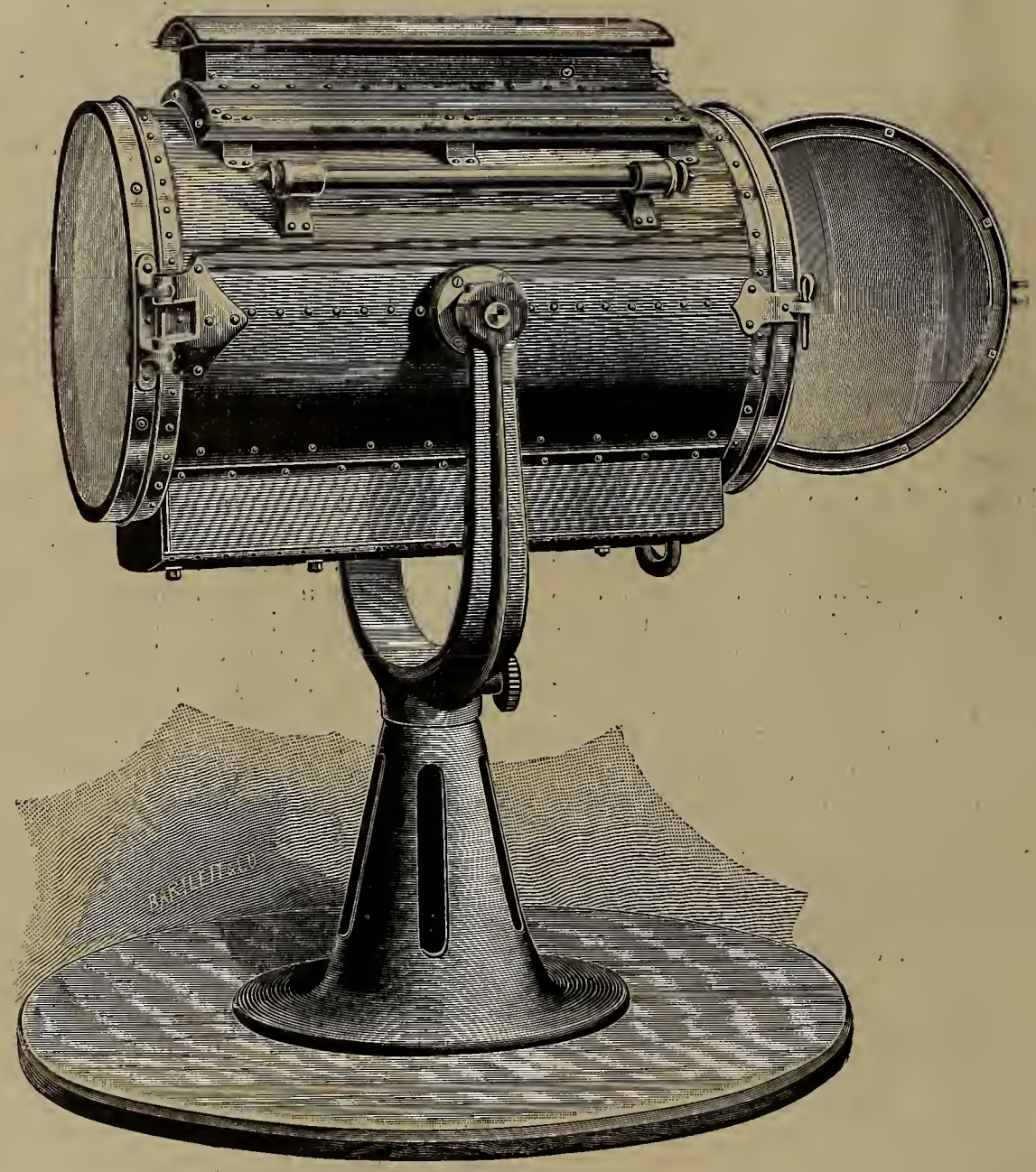
Some few years ago there were possibilities for very large fortunes to be made with comparative ease by those who went into the electrical business, but today the business has come down to the same commercial basis as the other engineering professions and it cannot be doubted that among the thousands of young men rushing into the business, a larger percentage of them are going to be disappointed than would be the case if they were contemplating any other engineering profession, simply because of a lack of general knowledge of what may be expected in the way of remuneration.

J. Stanford Brown.

SEARCH LIGHTS AND PROJECTORS.

Although the general public does not know as much about electric search lights as it does about street lights, yet it is a matter of general interest that vast improvements have been made in the search light in this country as well as along other electrical lines.

Search lights are, in these days, indispensable to steamers of all classes, and in military and naval operations. By their use objects miles away can be revealed and illuminated in the darkest night, and their powerful beams of light can be thrown in any direction. Every ship of war has search lights as part of its equipment and a vessel of this class not so provided would indeed be regarded as very much behind the times. Steamboats of every description are being equipped with these valuable devices, and in foggy or misty weather navigation is rendered much safer by the use of the light.



WARD SEARCH LIGHT.

These lights have been greatly improved by American manufacturers, so that it is possible now to get a lamp of American make equal in every particular to the finest foreign made lamp. The newer lamps are light, easy to handle and do not require the services of an expert to manipulate and care for them. They are, moreover, very neat in appearance, simple in construction, and devoid of any unnecessary parts.

The Electric Construction and Supply Co., of 18 Cortlandt street, New York city, the manufacturer of the celebrated "Ward" arc lamps and search lights, is making projectors embodying all the desirable features above referred to, and does something else of vast importance—it makes its own lenses for these search lights.

Government Telegraph Rates.—President Thomas T. Eckert, of the Western Union Telegraph Company spent last Tuesday in Washington in conference with the heads of the various government departments regarding the annual contract for the government telegraph service.

Resignation.—John D. Crimmins has resigned the Presidencies of the Houston, West Street and Pavonia Ferry Railway Company and the Metropolitan Crosstown Railroad, New York city. He finds it necessary, he says, out of consideration for his health, to relinquish some of his business cares. Mr. H. H. Vreeland, General Superintendent of the New York and Northern Road, it is expected, will be elected President of the two companies named.

These lenses are in every respect said to be equal to the imported Mangin lenses, and cost very much less. Their reduced cost, together with the saving on the duty of the imported goods, enables the manufacturer to offer projector lenses at a price almost as low as that of the old-fashioned silvered metal reflector. The quality of the reflecting lens is very high, and the loss of light is exceedingly small. The lenses are so mounted that they can be kept in proper condition with great ease, it being necessary to keep only the exposed surface clean.

The lenses are made in the following sizes : 12, 16, 18, 20 and 22 inches.

The search lights manufactured by the Electric Construction and Supply Co., are constructed of non-magnetic metal, and fitted with a lens projector and a balance automatic focussing arc lamp that will feed at any angle. The distance of the lamp from the lens is varied by a hand screw so that the beams of light can be concentrated or scattered, as desired. Ball bearings are used on these lamps, so that their manipulation is a matter of very great facility, and the lamp can be turned in a horizontal direction with the smallest effort.

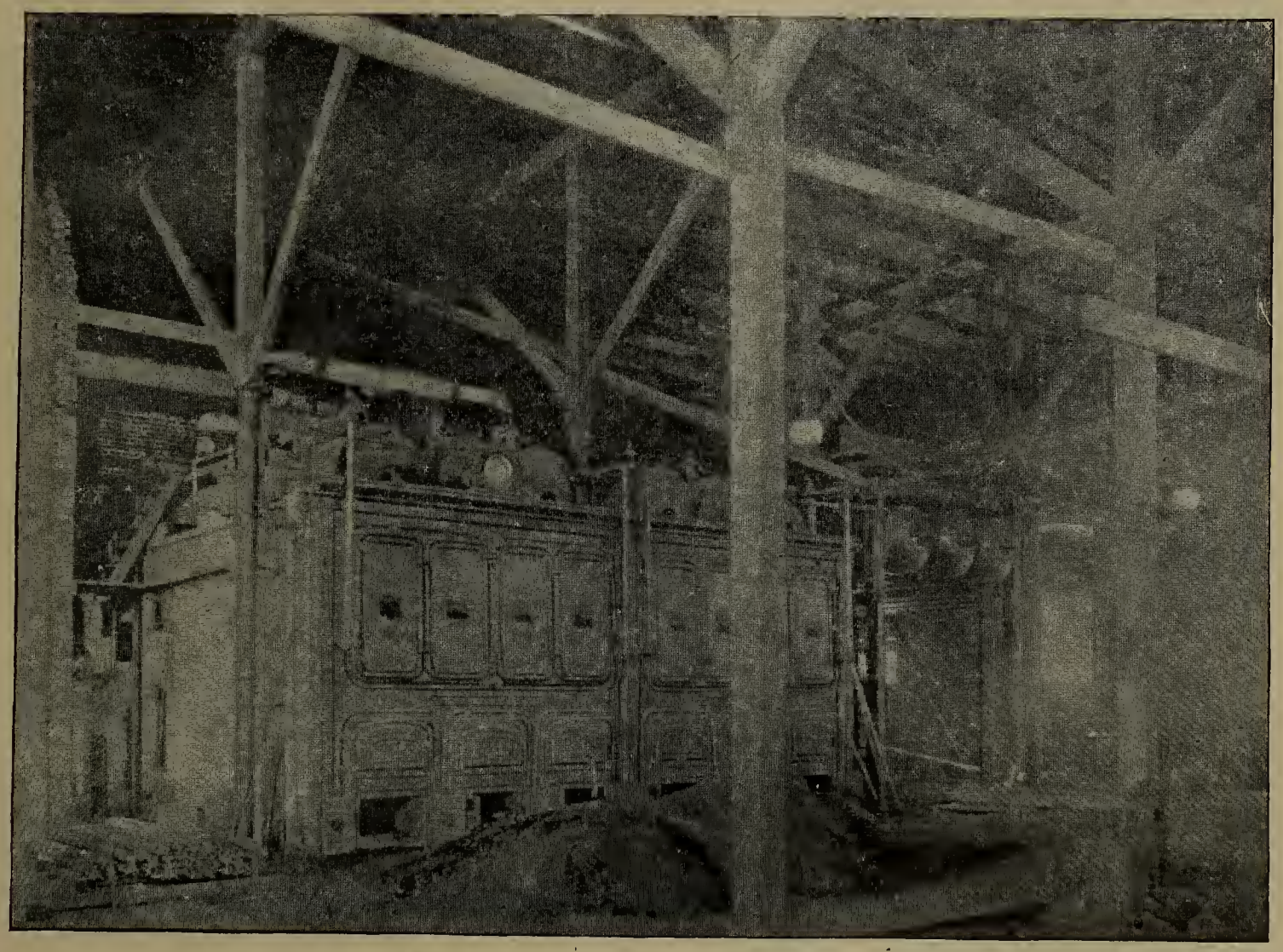
These lamps are light in construction and in finish are made to conform with their surroundings. A 12-inch projector, highly finished in brass and copper, provided with an automatic focussing lamp, a pilot house attachment, and complete in every respect, weighs only about 125 pounds. Considering the strength and durability of the apparatus, this is a very light weight.

The Electric Construction and Supply Company deserves much praise for the enterprise displayed in producing this class of lamps wholly itself. This is purely an American lamp, and considering the low price there is no reason why steamboat owners should hesitate in buying search lights. In many cases goods of American make are in every way equal to those of foreign manufacture, and this is one of them.

NATIONAL WATER TUBE BOILERS.

The Narragansett Electric Lighting Co., whose station in Providence, R. I., was illustrated in our issue of February 21, 1891, and has been understood to be the model plant of New England, is making additions which will largely increase its facilities. It has just placed an order with the National Water Tube Boiler Company, of New Brunswick, N. J., for a battery of 500-H. P. nominal, with an actual capacity of over 750-H. P.

It is worthy of note that the National Company supplied the first boilers for this plant, the accompanying illustration showing this battery of boilers, and a portion of the boiler room. The working pressure which was then considered high, was set at 140 lbs. per square inch.



NATIONAL WATER TUBE BOILERS, NARRAGANSETT ELECTRIC LIGHTING CO.'S STATION, PROVIDENCE.

The advantages secured by high pressure in connection with triple expansion engines were so marked, that still higher pressures were thought advisable, and later, the Babcock & Wilcox Co. supplied a battery of its boilers of the most modern construction, with wrought iron headers, saddles, etc. These boilers were used at a working pressure of 160 lbs. per square inch, and the National boilers were made to conform to the same pressure.

The advances in the practice of steam engineering have since been so marked, that a boiler pressure largely

(*Continued on page 11.*)

WOODS' CONDUIT RAILWAY SYSTEM.

A very interesting and successful test was made of a new electric conduit road at West Brighton, Long Island, Tuesday afternoon, June 20. The system is based on the broad patents issued to Mr. G. T. Woods, an electrical engineer, of New York city.

The principle of the system is that of picking up the current from one set of contact points placed at seven

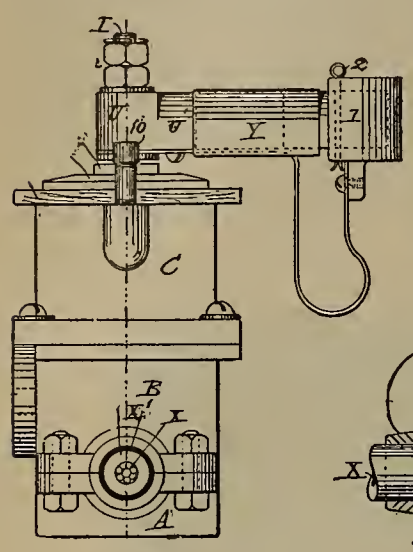


FIG. 1.

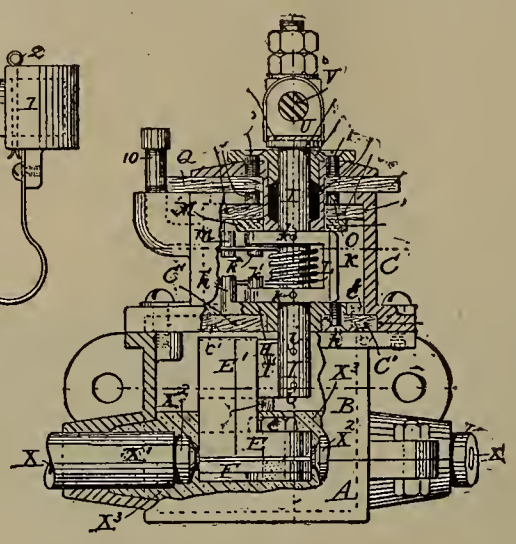


FIG. 2.

foot intervals along one side of the conduit, by means of a metal slide on the side of an insulated shoe under the car and returning the current to the return conductor by means of the opposite side of the shoe and a similar set of contact points arranged on the other conduit wall.

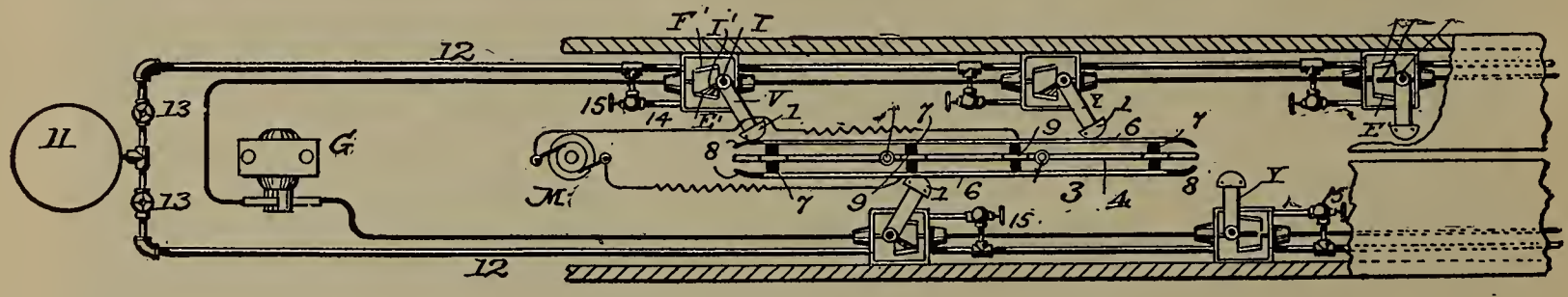


FIG. 5.

The contact points are so spaced and the shoe made of such length, that at least one of each of the two sets of contacts are constantly bearing against the metal parts of the shoe, the path of the current being contact, shoe, motor, shoe, contact to return conductor. The experimental road is a quarter of a mile in length and is equipped with a return copper conductor thus making two sets of contact points necessary. If the earth is used as a return, one set of contacts and a device making constant contact with the ground would suffice. One of the most important features of this system is, that the contact points are placed in circuit, with the insulated conductors and motors, only when the collecting shoe is pressed against them, thus obviating leakage on the line except the slight loss that might occur while the points were in contact with the shoe.

Fig. 5 illustrates very clearly the general system of contacts and connections. As shown, one contact point is just leaving the shoe and is on an insulated strip at the end while another of the same set has just come in contact with the metal strip on the shoe. The opposite contact has passed the middle of the shoe and contact is about to be formed with the next box and arm.

Details of the contact box are shown in Figs. 1, 2, 3 and 4. The heavily insulated conductor passes through the bottom of the box through stuffing boxes. Inside of the box the insulation of the condutor is removed and a clamp, A (Fig. 1), secured to the bare wire which has two vertical projecting lugs shown in Fig. 3. The contact arm, Y (Fig. 1), is connected to a vertical shaft bearing at its lower end a stiff copper brush, the normal position of which is between, but not touching the above mentioned clamp lugs. The position of brush and lugs is shown in I and E' Fig. 2. When the contact arm is pressed against the shoe it is deflected, thus turning the shaft and causing the copper brush to press firmly against one of the lugs. The direction of motion of the car determines the side of the clamp on which the brush makes contact. As soon as the contact point reaches the metal strip on the side of the shoe the electrical connection is complete. The contact point is given flexibility by having a slight play in the hollow lever, being forced out to its normal position by means of a spring. A wide strip of copper carries the current to the contact point or head. The contact boxes are placed 7 feet apart on the sides of the conduit. They are so arranged that a box of one set is equi-distant from the two neighboring boxes of the opposite set. The boxes are filled with paraffine oil for insulating purposes. Fig. 6 illustrates the contact box The shoe shown in Fig. 7 is a long narrow device and is well insulated and provided on each side with a strip of conductor metal 7 feet in length. These strips make contact with the contact points on either side. Insulating pieces are provided at the ends of the shoe in order to insure that contact is made in the box before it is made on the metal strip of the shoe. The circuit is thus completed and broken on the shoes and not in the contact box. The shoe is so constructed as to be very flexible, taking a curve of less radius than the car truck. It is connected to the car truck in such manner, that in case of derailment of the car the shoe will unship and remain in the conduit. This latter fact was unintentionally tested and proved to the satisfaction of all.

Fig. 8 illustrates a section of the experimental road.

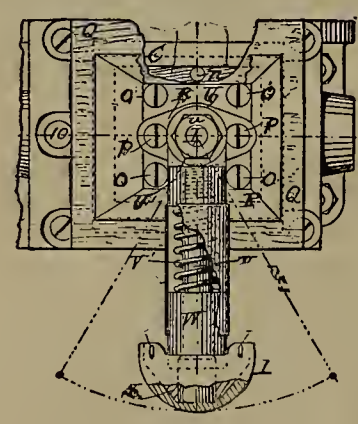


FIG. 4.

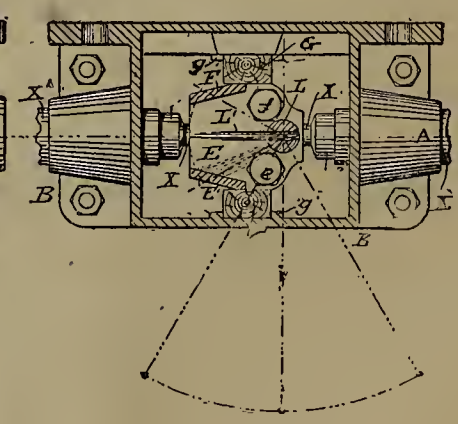


FIG. 3.

The trial was made before representatives of the technical press, and a thorough test given the system. The test was conducted very nicely, and proved good the claims made for this system. A banquet was tendered to the party at the conclusion of the trial, which also met with hearty approval.

The system is owned, and being developed by the Universal Electric Company of New York, 50 Broadway, New York city.

The inventors, whose patents are incorporated in this

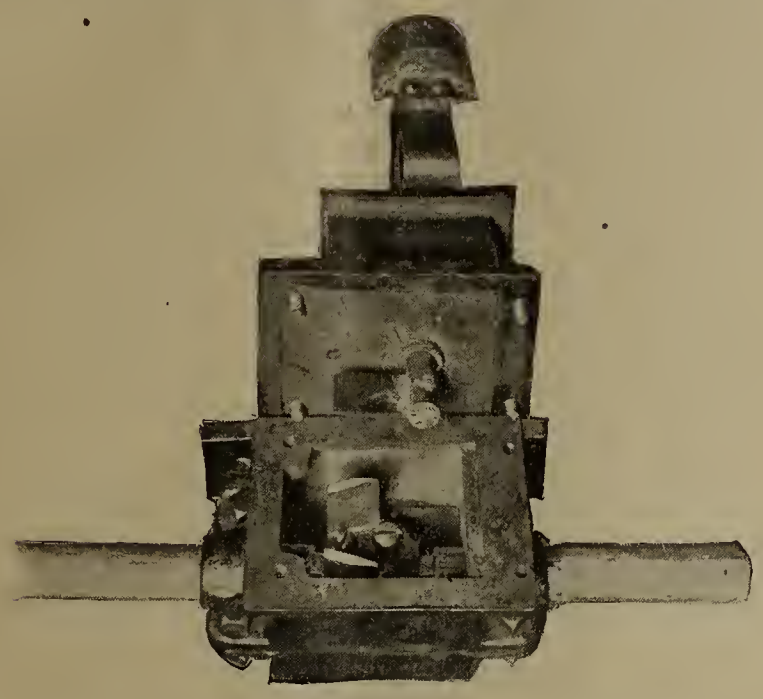


FIG. 6.

system, are Messrs. Wood, Green, Dale and Van Nuis. The experimental road was installed by Mr. Stetson, the manager of the company, assisted by Mr. Brown.

CONVENTION OF THE ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

Mr. W. J. Jenks, Secretary of the Association of Edison Illuminating Companies, is sending out notices to the members regarding the next meeting of the association. The meeting will be held in Chicago, on Tuesday August 8, and arrangements have been made for accommodation of the delegates at "The Rochester,"

FIG. 8.

a new and desirable hotel, operated on the European plan, at South Park avenue and 23rd street.

It is proposed to hold the sessions of the convention in the fair grounds. The hotel is handy to the grounds.

The terms at "The Rochester" will be as follows: Single rooms (a limited number) $2 per day. First-class room, $3 per day. Suites with private hall at reasonable rates. A deposit of $5 will be necessary to secure an engagement of one or more rooms.

Applications for rooms should be made as soon as possible, indicating as nearly as may be what is desired, and for how long a time. They should be made through the secretary.

Later announcement will be made of special features, including the programme of the Convention.

THE CHICAGO EDISON COMPANY.

On June 19, Mr. F. S. Garton, Secretary of the Chicago Edison Company, issued the following notice: The outstanding temporary debenture bonds of the Chicago Edison Company can now be exchanged according to their terms for engraved coupon debenture bonds at the office of the Merchants' Loan and Trust company, Chicago. The coupon maturing July 1, 1893, on the engraved bonds will be paid at the same place upon maturity. Holders of the debenture scrip are reminded that the scrip bears no interest, and that interest can be obtained upon the amount represented by the scrip only

FIG. 7.

by converting the scrip into bonds according to its terms. Scrip not converted into bonds on or before July 1, 1893, will not be entitled in any subsequent exchange to the benefit of the coupon maturing on that date.

TESTING COAL BY ELECTRICITY.*

It is not, perhaps, too great a flight of imagination to assign this title to a method which W. Hempel has recently devised for use in determining the character of coal. Sulphur is a troublesome constituent which the gas companies would rather have absent from, than present in their coals; moreover, it seriously impairs the quality of the gas produced. The "monopolists" recognize *now* that they must strain every point in order to produce good gas; this has been forced upon them by competition, hence in this respect, too, electricity has done the public good service. W. Hempel is one of the leading authorities on coal-gas in Germany, and he has recently adapted a method, first devised in more complex form by Berthelot, whereby the sulphur in coals may be estimated, and hence their suitability for gas-making determined before purchase. In doing this he has taken advantage of the cosmopolitan aid which electricity offers. The coal to be tested is powdered and pressed into a little platinum wire cylinder, to which a long platinum wire is attached, and then burned. The combustion is effected in an ordinary glass bottle, which is fitted with a trebly perforated India-rubber stopper. Through this passes a tube with a glass stopcock, and which widens out into a cylinder; also two glass tubes, to the lower ends of which are fused two long thick platinum wires. One of these wires carries the little platinum cylinder or basket already referred to. A little mercury is poured into the tube so as to establish sure contact with wires which lead the electricity. When the current is passed the platinum basket becomes white hot, the combustion of the coal is effected, and the gaseous products containing the sulphur compounds are led off through the stopcock and examined chemically. This method is exceedingly neat, and gives, it is said, very satisfactory results, which enable the character of the coal to be accurately determined.

* From the *Electrical Review*, London, June 9.

CONVENTION OF RAILWAY TELEGRAPH SUPERINTENDENTS.

(*Continued from Page* 410.)

SECOND DAY'S PROCEEDINGS.

The meeting was called to order at 10 a. m. by President Fry.

The Secretary read invitations from the Chicago and Northwestern Railroad to the members to return to Chicago by special train on that road; and the Johnson Railroad Signal Co., of Chicago, for them to visit that company's exhibit at the World's Fair. Mr. S. M. Young, general agent of the Hall Signal Company, suggested by letter that the members return to Chicago via the Northwestern line in order that they might witness the operation of his company's signal system on that line between Waukegan and Chicago.

Letters of regret were read from Superintendent J. J. Dickey, of the Western Union Telegraph Company, Omaha, and others, at their inability to be present at the meeting.

The committee appointed to take suitable action on the death of Mr. C. S. Jones, ex-president of the association, reported through Mr. Selden, an appropriate set of resolutions, which were adopted by a rising vote.

A letter from Mr. L. H. Korty was then read in which that gentleman recommended for consideration the subject of the adoption of a set of standard signals on railroad telegraph lines. Under the present practice there is great lack of uniformity, which necessitates the memorizing of different signals on the part of new operators. Confusion was the inevitable result.

On motion of Mr. Charles Selden, Mr. W. S. Logue, of the Edison Manufacturing Co., was elected an honorary member of the association.

The meeting then, on motion of Mr. Selden, reconsidered the vote taken on Tuesday, selecting Niagara Falls as the place of the next meeting. Mr. Selden then proposed Detroit instead of Niagara Falls and the motion was carried.

A lengthy but interesting paper entitled "The Commercial Telegraph Error Sheet; its cause, adjustment and prevention, from a railroad standpoint," by President L. H. Korty, was then read by Mr. Charles Selden.

The revenue derived from the operation of the commercial telegraph is, Mr Korty said, composed of a great many small items, thus adding much to the necessarily complicated handling and treatment of the business. Considering this as well as the vast number of offices operated, and the numerous conditions involved, it is a matter of wonder to all, and congratulation to those in charge, that operators make as few mistakes as they do, and that the whole business is so systematically conducted.

He then pointed out many of the most common causes of errors, and in regard to prompt and satisfactory adjustment of the same, said it was a difficult as well as desirable matter. The greatest difficulty encountered in adjusting error sheets, he said, was admittedly the disposition on the part of managers to neglect them.

The destroying of records and messages before the proper time also hinders and prevents the adjustment of many error sheet items.

He then described the methods employed on his lines, the Union Pacific, for the adjustment of errors, and suggests that they can be lessened in numbers and the complications simplified in a great measure, by diligent and constant application and instruction. They can also be prevented, he thought, by the "discouragement and obliteration of the traveling operator, who lives for no other purpose than to migrate from place to place, working long enough here to enable him to go on further." This class, he said, was always a menace to the best interests of his employers as well as the profession in general.

After a discussion on the subject of Mr. Korty's paper in which Messrs. Stewart, Darlton, Selden, Lang, Swift, Leonard, Hope and Supt. McMichael, of the Western Union Telegraph Company, participated, the committee on service card made its report.

The committee recommended a change in the form of card in order to avoid forgery, which is possible with the existing style. It was also recommended that the cards be returned to the men instead of being destroyed.

The subject provoked a lengthy discussion and it was finally decided that the committee should prepare a new form of blank, which the secretary was instructed to print and distribute among the members.

At 12 o'clock a recess was taken until 2 p. m. to enable the members to go in a body and inspect the exhibits.

On reassembling, Mr. G. L. Lang read a paper on batteries. He referred to the rapid disappearance of batteries in favor of dynamo current, and briefly traced the evolution from the first telegraph batteries to the modern dynamo as adapted to the uses of the telegraph. He concluded his paper with a brief description of the means and methods of utilizing dynamo currents adopted by the Western Union Telegraph Company in Boston.

Mr. Lockwood complimented Mr. Lang on the excellence of his paper, and referred to the use of dynamo currents for the excitation of telephone transmitters. He then referred to the value of the hydrometer in the care of batteries, and further said batteries worked better in damp places on account of greater uniformity in temperature of such places.

Mr. Thos. D. Lockwood then read a paper entitled "Energy," which title was suggested to him by an advertisement of an electric light employè who desired a position. This man could do almost everything necessary in such a business, and was not afraid to take his "shirt off" and work. Mr. Lockwood showed how energy of the "shirt-off" variety, when properly used, was a good thing, and how depraved it was when not properly directed.

After touching on his subject in various forms, he referred to the progressive superintendent who has a keen scent for really valuable improvements and suggestions which promise well, whereby real economies and not cheapnesses are to be achieved—ideas which will enable a thing to be done quicker, or better, at no greater cost, or as quick and well, but with greater economy; or as economically, as well, and also as quick, by means of simpler mechanism. One such improvement was the substitution of copper for iron line wire.

The superintendent who is a true embodiment of the best form of energy, said he, knows all his men, and not only knows, but knows well those who have been with him a long time; moreover, he knows them with sufficient energy as to have sized up their relative capacities, fitness for promotion and general merit, and in making promotions is not governed by impulse or personal preference; but in each individual case considers the peculiar characteristic of such case, and which, if any, of the force at his disposal has the peculiar physical, mental, moral and educational endowments which best will meet the case, and who is thereby best qualified to deal with the characteristics in question. He advised the railway telegraph superintendent not to expend their energy either in himself inventing or becoming concerned in the electrical inventions of others; he should be absolutely unbiassed. The ideal superintendent, he thought, was the one who has plant, force and records in such perfect order that he could absolutely disappear for six months and yet "never be missed."

A discussion on the method of making joints in copper wire followed the reading of Mr. Lockwood's paper,

in which Messrs. Ryder, Lockwood, Selden, Adams and Leonard participated. The merits of the common joint and the McIntire connection were compared, the burden of the argument being decidedly in favor of the McIntire method. Mr. Lockwood referred to a case where 40 miles of telephone wire was levelled by a sleet storm in New England and not a single joint was broken, the poles proving weaker than the wire joints. The joints in this case were made with the McIntire connectors.

The next paper read was one by Mr E. R. Adams, entitled "Introduction of Telephone Wires into offices, with Special Reference to Line or Way offices." A copy of this paper will be given in our next issue.

The paper excited an interesting discussion and was followed by the reading by Secretary Drew, of an historical sketch of the associaton, which was organized in Chicago, on November 20, 1882. He briefly reviewed the work of each of the subsequent meetings up to the present time, and concluded his paper as follows: "Our Association now numbers 100 members connected with 75 railroads, with headquarters in 31 different states. Its power of usefulness in advancing the important branch of railway service—the telegraph department—is greater than ever."

Since the organization of the association eight of its members have died.

On motion the president was instructed to appoint committees on a code of telegraph signals, on badges, and on standard rules for the government of operators, all of which committees shall report at the next meeting. The first committee is to act on the suggestion of L. H. Korty, contained in the letter from that gentleman, which was read earlier in the meeting, and the badge committee is to prepare a design for an official badge of the association.

Mr. J. W. Lattig then read a paper entitled "The Railroad Signal; Signaling and Its Relation to the Telegraph Department," an abstract of which will be found on another page.

A vote of thanks was then passed for courtesies extended by the various railroads, the Goodrich Line of steamers, the Western Union Telegraph Company, the North American Phonograph Company, Thos. A. Edison, the Johnson Electric Company, the press and others, after which the president announced the appointment of the following committees as per previous orders:

Committee on Arrangements—Messrs. Torrey, Fortune and Kinsman.

Committee on Official Badge—Messrs. Swift, Selden and Pope.

Committee on Topics—Messrs. Adams, Evans and Fox.

Committee on Standard Signals—Messrs. Adams, Leonard, Lingafelt, Bullard and Lang.

Committee on Rules for the Government of Operators—Messrs. Kinsman, Sprague, Swift, Dugan and Wright.

The convention then adjourned to meet in Detroit, on June 13, 1894.

ATTENDANCE.

The following is a list of the members present at the meeting:

E. R. Adams,
M. A. Baker,
S. K. Bullard,
S. S. Bogart,
G. M. Dugan,
C. A. Darlton,
P. W. Drew,
R. J. M. Danley,
J. S. Evans,
W. F. Fox,
U. J. Fry,
O. C. Greene,
H. C. Hope,
G. C. Kinsman,
M. B. Leonard,
G. L. Lang,
T. D. Lockwood,
A. R. Lingafelt,
J. W. Lattig,
W. S. Logue,
K. McKenzie,
R. W. Pope,
W. W. Ryder,
H. C. Reed,
J. B. Stewart,
Chas. Selden,
F. S. Spafard,
C. G. Sholes,
A. R. Swift,
T. R. Talbavall.

Several of the members were accompanied by their wives and daughters.

EXHIBITS.

A few exhibits were made of electrical and railroad devices at the convention of Railway Telegraph Superintendents held in Milwaukee on June 20 and 21.

The National Switch and Signal Company, of Easton, Pa., represented by Mr. J. W. Lattig, electrical engineer of the company, exhibited an automatic railroad block signal of Mr. Lattig's invention. This is said to be the only automatic semaphore signal outside of the pneumatic system. By this system a signal can be operated practically at any distance, and the cost of maintenance is reduced to a minimum. The current may be supplied by twelve cells of Edison-Lalande battery, or four jars of any good acid battery. The mechanism includes a 1-6 horse-power Crocker-Wheeler electric motor, which pulls the signal from danger to safety in from 1 to 2½ seconds. The signal goes to danger by gravity when the battery is cut off, through the instrumentality of the track relay, and remains there as long as the train is on the section and the relay is on the back contact. When the train passes beyond the protected section, the track relay is energized and closes on its front contact, thus starting the motor and its train of gearing, winding upon the drum connected therewith, a phosphor bronze rope, which is connected to the balance lever of the signal, thereby pulling the signal to safety position. When the signal has reached the position of safety, a set of contacts are automatically opened which cuts the current from the motor and at the same time transfers a very small portion of it to a high resistance magnet which is arranged to grasp and hold the gearing mechanism at the point where it requires the least power. A very neat feature of the device is the arrangement by which a severe shock or jar is prevented when the signal goes to the danger position. This consists of a connection from the back contact of the relay, so arranged that when a train enters the block and the relay falls upon its back contact, a short circuit is formed across the terminals of the motor, causing it to generate sufficient current to retard and break the shock which would otherwise result from the momentum.

Mr. J. B. Stewart, of the West Shore road exhibited a model of a railway grade crossing electric signal of his own invention. This signal is electrically interlocked. Its main features are front and back contacts of a relay. The closed, or front contact controls the signal of the track to which it is connected. The back, or open contact, is connected with the signal on the cross track, all circuits being normally open. A train on one track closes the circuit through its relay and this attracts the armature which closes the circuit of the signal connected therewith. This action, of course, opens the back contact and makes it impossible for the signal on the cross track to be operated. If two trains approach the crossing at the same time, the armatures of both relays are attracted, having the circuits of both signals open, so that neither train can get a clear signal. No consumption of battery takes place except when the train is on the circuit. In connection with this signal is a clock with a recording device operated by an electro-magnet which records the exact time a train receives its clear signal. The circuit of this magnet in series

with the magnet controlling the signal and cannot record unless the clear signal is given.

Mr. U. J. Fry, of the C. Mil. & St. Paul road showed in practical operation an automatic telegraph repeater of the Toye type, adapted by himself to the needs of the service on his road.

Mr. Charles Selden, of the Baltimore & Ohio R. R., had a working model of a highway crossing bell, invented by Mr. H. V. Riley, of Baltimore. This device is very simple in construction and very reliable in operation.

The Mozier Safety Signal Co., of Galion, O., exhibited a model of its block signaling system. The semaphore of this signal is set in three positions, giving distinct and positive information to trainmen.

Mr. C. P. Mackie, general manager of the Electric Selector and Signal Company, of New York, was present at the convention. His company has a large exhibit of its system at the World's Fair, and he came up to Milwaukee from Chicago, to attend the convention.

Mr. S. Marsh Young, general agent of the Hall Signal Co., New York, was in attendance at the convention, and took the party in charge on the return trip to Chicago, over the Northwestern road. He explained the operation of the Hall system with which that road is equipped between Chicago and Evanston, as the train passed over that section of the line.

BATTERIES.*

BY G. L. LANG.

Constant experiment, backed up by the inventive genius of the dynamo makers, has at last given us a current absolutely constant under all circumstances at a very low cost. Many of our larger offices have taken down the last cell of battery. In the main office of the Postal Telegraph Company of Boston not a cell of battery is used for any purpose, the machine currents being used for all purposes, even for call bells and district messenger service. The Western Union office is but a lap behind their neighbors, as they will be ready in a few weeks to banish their last gravity cell, for which we are hardly prepared. Now comes the announcement that the machine currents can be adapted to our locals just as economically as to main wires. * * * *

Following this we come to the local, with which we are so familiar, and which for our smaller offices must be our mainstay for some time to come—the Callaud gravity cell. It has had its place at the head of the line for many years as the most reliable and economical of all liquid batteries. Various so called improvements have appeared from time to time, usually to disappear after a trial. As we must continue to depend upon this battery for our country locals, a few words regarding its care may not be out of place. No rules or instructions will take the place of common sense, and there is no place where it can be used to greater advantage than in the care of a battery. Rules and instructions must not only be issued but enforced.

My experience has been that too much vitriol is usually put into a cell at a time. Half a pound is sufficient in starting a cell, then add a few ounces as required. Supply every office with a hydrometer and battery syringe. When the hydrometer shows the zinc solution to be too dense, draw it off and fill up carefully with water. In this way a battery can be made to last for months. The quality of the water used is quite important, soft water being the best, but where soft water cannot be readily obtained it will be found of great advantage to wrap the zinc in thin cotton cloth, the impurities of the water collecting upon the cloth instead of on the zinc, adding greatly to the life of the battery. If possible keep your battery at an even temperature, from 50 to 60 degrees. Our early teaching was that our battery must be kept in a dry place. Theoretically this is all right, but in my signal work I have found we get the very best results when the battery is under ground, and where there is more or less dampness. I do not argue from this that the dampness is a benefit to the battery, but I do claim that moderate moisture is far less detrimental than the frequent and often times extreme changes of temperature which are inevitable when batteries are kept above the ground simply to keep them dry. Underground there is no creeping of the solution over the jar, always found elsewhere, and practically no evaporation.

In conclusion, a brief description of the means and methods adopted by the Western Union in Boston may be interesting. There we have exceptionally favorable conditions.

The Edison Company maintains a complete system of power circuits in triplicate, all underground, radiating from three central power stations, giving us an assurance of perfect and continuous service. Fire or other causes may cripple one station, but that all three should be disabled at once, is very improbable to say the least. For nearly three years the Western Union took the current from the Edison Company, using it direct on all their wires not requiring over 110 volts, that being the maximum furnished, without a minute's interruption. Where higher voltage was required, the Edison was reinforced by batteries. The new plant of the Western Union is composed of 19 Crocker-Wheeler motor-dynamos, a little machine no larger than a water pail, being as its name indicates, a combination of the motor and dynamo.

Taking their original power from the Edison leads, they are able to supply any voltage desired from six volts for their locals to 350 for the quads, and by combining two or more machines, can increase the voltage to any possible requirement. It is proposed to furnish the larger branch and railroad offices in the city with storage batteries for locals, charging them from the main office. With the perfect storage battery that is sure to come, and power and light plants in every village, what is to prevent us from eventually doing away with the old style local batteries at most of our offices?

* Abstract of paper read at the convention of the Railway Telegraph Superintendents, held at Milwaukee, Wis., June 20 and 21, 1893.

A CONTRIBUTION TO THE LAMP CONTROVERSY BY A FRENCH COURT.

The ninth department of the tribunal of the department of the Seine hands down a decision in the case of the Société Génerél des Lampes Incandescentes, proprietress of the Edison patent in France against D. Angé, representing the Khotinsky Incandescent Lamp, to the following effect and for defendant. 1. Edison's patents are void on account of the alleged invention not being new. In their claims relating to a carbon filament of high resistance enclosed in a vacuum in a glass bulb and connected by platinum wires through the glass.

2. The Khotinsky filament being made of a cellulose collodian like amorphous paste, has nothing in common with the Edison filaments which are made of fibre. The court also decided that the use by unauthorized parties of old parts protected by patents in building new lamps is unlawful.

A Life Fellow.—The many friends of Mr. T. D. Lockwood will be pleased to learn that that gentleman has recently been elected a Life Fellow of the Imperial Institute. This institute was founded during the Queens' Jubilee in 1887, and the Prince of Wales is its president. We congratulate Mr. Lockwood on the honor, knowing that he will carry it with becoming dignity.

(*Continued from page 5.*)

exceeding any before used, is now demanded, and in the meantime the National Company has been steadily improving the quality of its workmanship, and methods of construction. It now takes the front rank as embodying in its up-to-date boilers, the best results of modern practice in design and construction throughout. The company thus comes forward with boilers for the Narragansett Co., which will be adapted for a working pressure of 200 lbs. per sqare inch, with a large margin of safety above, and which will illustrate results obtained by careful attention to details of manufacture, and the best shop appliances for reaching the highest grade of mechanical construction.

The new battery of boilers will be similar in general appearance in the matter of boiler fronts and setting, as those shown in our illustration.

THE RAILROAD SIGNAL; SIGNALLING AND ITS RELATIONS TO THE TELEGRAPH DEPARTMENT.*

BY J. W. LATTIG.

The first requisite of a signal, signal system, or a device of any description, either electrical or mechanical, used in signalling, is that it shall be safe. The second, that it shall be reliable. This means (1) that its indication of danger shall never be made or given by a positive act. It might fail to display safety for danger. (2) It means that any breakage of its parts shall cause it to indicate danger. The writer has had occasion during his official career, to examine a great many patents on railroad signalling and can bear testimony to the fact that at least one-half of the signal patents have some such defect. He knows of one instance where a company was incorporated with quite a large capital and with some railroad men in its directory who might have been supposed to have known better, that introduced an automatic block system which was counterweighted to go to safety when left to itself, which required a positive act to put it to danger and the engagement of a detent to hold it there, the failure of either of which would result in its remaining at or returning to safety when it should be at danger. The inventor being a bright minded mechanical engineer succeeded in inducing his backers to spend several thousand dollars on the device which was finally abandoned. (3) The natural and unfailing law of gravity should always be relied upon to place the signal to danger. (4) The crossing, breaking, or grounding of a singnal wire of any kind should place the signal to danger. (5) Rubbing electrical contacts should be insisted upon wherever possible on the score of reliability. (6) No rubbing contact can be relied upon which, when closed, joins two metallic surfaces, and which when open, allows one of such contacting surfaces to pass to, over or rest upon an insulating surface such as hard rubber; they are always unreliable. The writer has even known electric motors to fall off materially in power, due to this cause. (7) No contact should be used that permits or is subject to rapid oxidation. It will be a source of unending failures and trials. I have in mind an apparatus sold by a certain signal company to a certain railroad company over the electrical signals and appliances of which I had charge at the time, which was so defective in this respect that a pair of platinum contacts would not last over from ten days to two weeks and even iridium would burn out and fail in from three weeks to a month. The device promising to cost more for contacts than it saved by replacing a watchman, was finally abandoned for a less "improved" device which is still working (8) Every appliance of this character should be critically examined to see whether it is liable to failure from expansion and contraction due to changes in temperature, or if the changes and conditions of weather are liable to affect it and how. (9) It should be substantially made and not so delicate as to be interfered with by accumulations of dust, gummed oil or rust, and have a reasonably high percentage of power for its operation over and above that required to operate it.

* Abstract of paper read at the Convention of Railway Telegraph Superintendents, held in Milwaukee, Wis., June 20 and 21, 1893.

ELECTRIC LIGHTING OF RAILWAY TRAINS.

The Paris-Lyons-Mediterranean Company has just decided, after many experiments, upon lighting by electricity fifty first-class carriages, each divided into four compartments. Each carriage will be provided with a battery of multi-tubular Tommasi accumulators of 12 elements connected in series. Each element will contain 12 kilogrammes of electrodes. The battery will be divided into four groups of three elements, and each group will be placed in a case divided into three compartments. Each case will in its turn be placed in a sheet-iron coffer lined with wood. These coffers are fixed to the sides of the carriage. Connections are arranged so that the accumulators are grouped in circuit automatically as soon as they are placed in the coffer. The accumulators are connected with the lamps placed in the carriages by means of insulated cables. Each circuit comprises a lighting commutator, an Aubert hour meter, and a rheostat. This last is to compensate during the first part of the discharge for the excess in the voltage of the battery over that necessary for the lamps. Each compartment is lighted by a lantern containing two incandescent lamps of 10 candles at 20 volts. One lamp only is lighted for the ordinary service; the other is kept in reserve, and is lighted automatically if any accident happens to the first. The total weight of the four movable cases enclosing the battery of the 12 accumulators is 228 kg. The energy that this battery is capable of furnishing is 5,600 watt-hours. The duration of the lighting is 36 hours.

POWER FOR SMALL ENTERPRISES.

The supply of power to small enterprises for special occasions has long been a missing factor in our humbler industries. Those that are not financially equal to the expenses of an ordinary power plant are by no means so limited as some suppose, while the disadvantages are too keenly felt to require comment. It would seem that the escape lies in the direction of electricity, especially in our cities and larger towns, where electric lighting is permanently established. In this sense the electric motor is destined to be the poor mechanic's friend. Its management and control is simple, its service is in direct and immediate command, it requires no licensed engineer or fuel, and in economy of space occupied has no competitor. In some instances where needed for intermittent use, power can be furnished at one-tenth to one-fifth of the cost of steam. It has found its way into plumbing, metal spinning and machine shops in New York, and as an economic factor, with the other advantages named, there can be no grave question as to its more general adoption. We predict the renting of electric power to yet become a remunerative and general enterprise.—*Age of Steel.*

THE MONEY AND SILVER QUESTION.

BY F. M. F. CAZIN.

Acute as the money question has become, electrical and railway industry is not less interested in the outcome of the existent stringency than any other industrial or commercial business is, and therefore we may be pardoned for saying a few words on the subject, and more justly so because what we shall say is not in the common line of either daily, weekly or monthly journalism, most of which cater to class favors; but from the standpoint of equal rights to all.

Were all creditors to whom money is due at this date, to demand pay in real money—that is in money that is worth in international intercourse the value that it is made to represent; in other words, in gold—not one per cent. of all debts due at this date could so be paid with all the gold existing in the hands of humanity at large, and if creditors were to retain their money and continue their demands, until all debts of the living generation became due, not one per mil of humanity's debts could be paid or received with all the gold in existence. In other words, the relation or proportion between obligations contracted, or between business done on the one hand, and the bulk of existing real money on the other, is entirely out of rational relation. That human business intercourse must rest in part on credit, is admitted, but the fact is, that it actually rests proportionately on credit almost exclusively. All this means that humanity needs more actual money, aside from the credit-paper or part-credit-money now in circulation.

The name "part credit-money," we apply to all silver money now in circulation. In our own case of the dollar, it is the credit of ourselves at large as a people, ready to come up to its obligations, that causes the silver dollar to circulate at par with gold in our home intercourse, because if it comes to the worst the government of our own creation has to accept that silver dollar in taxes, the same as a gold dollar. But Europeans will not accept sixty cents worth of silver for a gold dollar, because our government stamped it with the mark of a dollar. And yet there has been a time in the history of the human race when 10, or 15½ or 16 weight-units of silver coined into money were accepted all over the world as equally good and real money, as the one weight unit of gold so coined. And again, the time has been, when the then known world's business was brought to the border of perdition because the parity of gold could not be maintained with its statutory equivalent in silver-money; and again, the time has been, when the parity of silver-coin became untenable with its statutory equivalent in gold coin. About just so the matter stands at this date. But the world's commerce, industry and business of any kind did in neither case go to perdition. Two remedies were applied in each case; first, to bridge over the crisis; second, to take away its cause. The first consisted in a rational, almost generous, credit on the basis of the best accredited real money, and the second consisted in revising, modifying by statute and law the proportionate weight of the two metals in the same money-unit.

British India coined, until but a few days ago, equivalents in silver money of 15 weight units to one of gold; France and the other States belonging to the Latin Union, until a very few years ago coined, and now hold in their banks, more than half of all their money in coin, in silver money of 15½ weight units to one of gold in the same denomination. The United States buying silver at the rate of $4,500,000 per month in the open market, gives of that silver 16 weight units to the mint to coin therewith the statutory equivalent of a gold dollar, while it could as well give 20 or even 24 such units for such purpose and not suffer as against its said purchases.

All of this shows and proves, that the time has come when the second remedy should be applied; that is the modification by statute, of the proportion between weight-units of the two money-metals in the same money-denomination. To do this will be for the American people and government—the sole fair and square thing to do—the exclusive remedy to apply at this juncture. And we may apply it independently, and go before the money conference of nations and state that we have done it, and quietly wait to see what the other nations will do to save their credit.

No rational argument can be advanced against such course, and such clap-trap arguments as the one presented by the word "car-wheel-dollar" has no reasonable foundation, because as the French have their franc, the Germans their mark, we Americans may coin our *Colomb* as an equivalent to a half of our gold dollar, being worth as much in silver and of commodious use in small and big transactions, where credit-values are not wanted. As long as that silver Colomb does not cost our government more than half a dollar in gold, so long it may continue to coin the same, and when it can not so buy the silver to do this with; then the moment for free silver coinage has come, and it may then be a long while before it need again be restricted as an indication of a new modification being required. Our silver certificates may be redeemed in such new, honest silver coin, while to keep it at par at present, gold must be ready for it. What an anomaly! It is time to stop it. But to revoke the Sherman law would be very poor policy. In continuing to buy silver at a very low price our treasury can average its cost per ounce, so as not to suffer under the new regulation of proportionate weight-units in the coin-dollars as severely as it would suffer with the Sherman law repealed. But let it be understood, that greenbacks, silver-certificates, silver dollars are redeemable by a dollar in gold, or a dollar or two Colombs in silver, that contain the full value in silver of a gold dollar. A statute to that effect created in September next and agreed upon today will end the crisis as far as the money question has anything to do with it.

G. T. WOODS' CONDUIT ELECTRIC RAILWAY.

Editor Electrical Age.—The demand for a good underground electric conduit system for street railways seems to have been met by a system recently devised by Granville T. Woods.

The daily use at Coney Island, of a road equipped according to the plans and specifications of Mr. Woods fully meets his expectations. The shoe and the method of insulating the various parts were invented by Mr. Woods, and covered by him in two applications for patents. Several other inventors and mechanics worked up a portion of the details as the installation of the aforesaid plant progressed and their efforts have been protected by other applications for patents which have been assigned to the Universal Electric Company, a corporation organized for the purpose of introducing the invention of Mr. Woods.

The daily papers have erronously given the honor of the fundamental invention to those who merely improved the details thereof as the patent records show.

W. S. Hanford,
136 Liberty street, New York.

The Berlin Iron Bridge Co., of East Berlin, Conn., is putting up a new foundry for the Watts-Campbell Co., at Newark, N. J.

THE EARTH AS AN ELECTRICAL CONDUCTOR. *

BY A. F. MCKISSICK.
Alabama Polytechnic Institute, Auburn, Ala.

Steinhill, at Munich in 1837, was the first to discover that the earth might be used instead of a return wire, contact being made to the earth at the two ends, by means of metal plates sunk in the ground. He discovered this while experimenting on the Nürnberg-Fürther railroad, for the purpose of determining whether the track could be used for telegraphic purposes. He noticed that the current passed from one rail to the other and the idea to use the ground as a return circuit occurred to him, which he afterwards found to be perfectly feasible. The earth is almost universally used as the return circuit in telephone and telegraph lines. While it is true that in the former a complete metallic circuit is sometimes found, it is not on account of the failure of the earth to conduct the current, but for the purpose of diminishing the induction, caused by the presence of electric light and power circuits.

The earth-plates are made of zinc or copper and are sunk in moist earth, in a spring, or in the bed of a river. It has been generally considered that the earth offers no resistance at all, as its cross-section is so large, although its specific resistance may be very high. While the resistance of the earth may be neglected when we have to deal with telephone and telegraph circuits, we must consider its resistance when it is to be used for conducting currents of large volume.

The element of danger to life and property forbids its use as a return in commercial lighting and motor circuits.

In street railway circuits, however, the earth is used partly as a return. It has been found that the earth alone, as a general rule, offers too much resistance, so that it is now almost the universal custom to use in connection with the earth the rails bonded together and also a bare copper wire. I had occasion during the past year to notice very closely this resistance in installing a motor at the experiment station of the A. and M. College of Alabama. I had expected to use the earth as a return, but owing to the very high resistance had to abandon this idea. It was with the idea of finding out how much the resistance of the earth near this motor was, that the following experiments were made.

An earth-pit was dug six feet deep, eight feet long, and two feet wide, at each end of the line running from generator at college to motor at experiment station. This line is by measurement three thousand feet long. A plate of copper, seven by two feet, and a plate of tin of same dimensions, soldered to a No. 0000 B and S wire were used as the earth-plate at each end. The plates were packed firmly with charcoal and iron filings and the pit filled with old iron. The water rose in one of the pits to a depth of two feet. With all connections soldered, the resistance measured by a Wheatstone bridge was found to be 102 ohms. Supposing the earth connection was not a good one at each end of the line, an additional earth connection at each end was made by sinking a large piece of iron in a well. With this additional connection there was no appreciable difference in the resistance. Connections to the earth were then made at different distances from the college by connecting one end of a wire to the overhead wire, the other end soldered and tied to a piece of iron six feet long, driven down flush with the ground. These distances were respectively 500, 1,000, 1,500, 2,000 and 2,500 feet from the college. These connections were made at different times, always removing an earth connection when its resistance had been measured. The resistances in the same order were 307, 567, 153, 707 and 217 ohms The comparatively small resistances of stations 3 and 5 are probably explained by the fact that they were located near branches (small streams).

From these results we may conclude that the resistance of the earth is a very unknown quantity, and the assumption that the resistance of the earth can be neglected in any soil is an unsafe one when the object in view is to transmit currents without very much loss.

* *Science*, June 16.

PACIFIC SUBMARINE CABLE.

The following interesting account is given by Commander Tanner, U. S. N., of the work of surveying possible routes for a submarine cable between San Francisco and the Hawaiian Islands, is given in the Transactions of the Geographical Society of the Pacific. The Surveys were conducted on board the U. S. steamers *Albatross* and *Thetis*. Commander Tanner commenced work in the *Albatross* on October 11, 1891, off Salinas, in the Bay of Monterey, at the head of a great submarine canon, which carried deep water close to the shore. The axis of this trough was followed until oceanic depths were reached, and a great circle course was then followed to the island of Oahu, soundings being taken at intervals of 5, 10 and finally 15 miles. The gradual increase of depth continued for 486 miles from Salinas, where it was 2,895 fathoms, then gradually diminished to 2,014 fathoms about 690 miles from the Californian coast. This elevation was steeper on the western side, and in crossing it close soundings were made. For 146 miles farther the line showed depths of 2,400 to 2,700 fathoms. On another trip the ship passed within eight miles of the elevation previously found, without any change of depth. A somewhat remarkable depression with one sounding of 3,186 fathoms was found in 31° 54′ N., 136° 44′ W., which was the deepest water found on the survey. A slight rise followed on, which at a depth 2,085 fathoms, particles of sand were detected by the microscope in the ooze which covered the bottom, a circumstance of very rare occurrence. A stretch of 700 miles followed with average depths of 2,900 fathoms, but 210 miles from the east end of Oahu an elevation, with a depth of 1,256 fathoms, was found separated from the land by a depression of over 2,800 fathoms. Several lines of soundings were taken up the relatively steep slope to the coast, all of which showed a gradual rise, forming a good bed for a cable. Waikiki, about three miles from Honolulu, was fixed on as the best landing place for a cable.

On December 12, 1891, the *Albatross* started to sound a rhumb line to San Francisco, the maximum divergence of which from the great circle route followed in the outward voyage, was 70 miles. From a depth of 603 fathoms, 20 miles from land, there was a descent of 1,178 fathoms in four miles, a slope of 1 in 3.5, but notwithstanding its steepness, no rocks were indicated. On the whole the character of the depths was similar to that of the outward voyage, the greatest depth met with being 3,038 fathoms. There were several gentle rises, on which the depth was under 2,000 fathoms. Commander Reiter, on the U. S. S. *Thetis*, surveyed a third possible line for the cable in April, 1892, from Point Conception to Hilo, in Hawaii. Similar conditions were found, the most notable rise, named after Reiter, occurring on the great circle course, 405 miles from Point Comception, with only 976 fathoms over it, while the surrounding ocean bed had a normal depth of 2,500 fathoms. The latter part of the line showed greater depths and a more rugged sea-bed, with signs of recent volcanic disturbance. The maximum depth of 3,228 fathoms occurred within 230 miles of Hawaii, indicating an extensive trough surrounding the whole island group

on the east. The *Albatross* great-circle line was 2,091 miles, the *Thetis* line 2,050 miles in length. No obstacle remains to the laying of a cable save those of an economic kind.

NEW VOLUME.

With this issue we commence a new volume. We expect to have the index of volume XI ready for distribution with the next issue.

NEW YORK NOTES.

Office of Electrical Age,
First Floor, World Building,
New York, July 1, 1893.

We understand that business is very brisk with the New York branch of the Mather Electric Co., 95 Nassau street, and that it has recently added to its force the services of the following gentlemen: Mr. Henry M. Stiles, formerly with the T.-H. Co., as electrical engineer; Mr. Harry W. Colby, formerly with the General Electric Co., of Boston, as general agent for the sale of power apparatus and lighting plants; Mr. A. E. Bowers has entered the service of Messrs. Claflin & Kimball, who are sole agents for the new "Novak" lamps, and can be found at the office of the above named company. He will in future take entire charge and look after this line of the business. They closed a contract last week with the Lynchburg Electric Co., of Lynchburg, Va., for one 100-horse power generator, and also closed several contracts for small motors.

William B. Halsey, a lineman for the Postal Telegraph Company, was fined $50, on June 27, for stringing a wire across Mulberry street without a permit. He thought he could run the wire without special permission because it was to replace an old one.

The Architects' Electrical Bulletin for June contains a timely article headed "The Architect's Opportunity." It is a plain statement of facts to architects. The number contains other articles excellently illustrated, and as far as appearances go the paper is prosperous. Messrs. Little and Paine are building up an interesting journal.

Stanley & Patterson, 32 Frankfort street, city, are hustlers in the fan motor line. The firm has placed one of the new Hill revolving fan motors, in front of its salesrooms. All comers are greeted with a "hades freezing" breeze from its cyclonic action. A stationary disc in front of the fan causes the motor and fan to revolve, thus giving a circular breeze. The firm has motors of many sizes and prices. Its new combined outfit of battery and fan motor is selling well. The firm is the headquarters for the Atlantic Covering Company's insulated wires. It can supply you with everything in the electrical line except a central station.

The Mason Electric Company, 10 and 12 Vandewater street, city, has a small De Mott 8-inch fan motor outside of the window of its office, facing the Brooklyn Bridge which has been running for 40 hours. Two No. 2 Mason cells have been furnishing the current for this motor. The jars are 6 by 8 inches, and the guaranteed life of the battery is 25 continuous hours, but this run of 40 consecutive hours is a surprise even to the maker. As the motor has been running out of doors during bad weather, it is a very severe test.

The Brooklyn Electric Manufacturing Company, 286–290 Graham street, Brooklyn, N. Y., is the manufacturer of the Baehr Quick Break Switches. The switches are made in several sizes for currents from 25 to 1,000 amperes and voltages up to 500. Mr. T. J. Murphy, of 136 Liberty street, city, is furnishing the slate for a handsome marbleized switchboard made by this company, to be installed in the Hotel Regent, Clinton avenue, Brooklyn, N. Y. The company has a large factory and has recently added much new machinery. It does special work of all kinds, inventions developed, experimental machinery made from drawings, and figures furnished for anything in the electrical or mechanical line. Mr. F. B. Sharp is general manager of the company, and Mr. Samuel O'Conner, president. Mr. Sharp is a successful business man, as proved by the rapid enlargement of the company's trade.

The Phoenix Iron Works Co., 15 Cortlandt street, city, makers of the well-known automatic cut-off engines, are inviting all interested to visit their exhibit of high speed engines at the World's Fair. The exhibit is located in Machinery Hall, section C, column No. 7. All callers will be welcome. The exhibit is an excellent one, consisting of one single engine of 250 H. P., one tandem compound of 250 H. P., and one triple expansion of 500 H. P.

The General Electric Company has declared a quarterly dividend of two per cent. on its common stock, payable August 1.

Wm. F. Breidenbach, representative of the F. P. Little Electrical Construction and Supply Company, 135 Seneca street, Buffalo, N. Y., was in this city this week. Mr. Breidenbach is traveling in the interest of his company for the purpose of locating agencies for its improved Kester Arc Lamps. The lamps are giving great satisfaction. Mr. J. F. Kester, the inventor of the lamp is with the Little company, as general superintendent of the manufacturing department. W. T. H.

CATALOGUES.

A. M. Morse & Co., contracting engineers, St. Louis, and the Southwestern representative of the Buckeye Engine Co., report several important recent contracts for Buckeye engines. Prominent among them are a 500 horse power plant for the electric lighting station of the new St. Louis Union Depot, consisting of three tandem compound non-condensing engines, direct coupled to Siemens & Halske slow speed multipolar generators. Also an 800 horse power plant, consisting of four medium speed engines for the Alton Electric Street Railway, Alton, Ill.

We are in receipt of a copy of the new illustrated catalogue of the Safety Steam Power Company, 30 Cortlandt street, New York city. It contains illustrations, descriptions and data of the horizontal, high speed, automatic cut off, steam engines made by the company.

We are in receipt of a copy of the neat catalogue just issued by the Manhattan Electrical Supply Company, 36 Cortlandt street, New York city. It contains illustrations, descriptions and price lists of the large variety of electrical goods manufactured and handled by this company, including house furnishings, novelties, supplies, etc. At the end of the book is given a list of electrical books.

Conduit System.—A new electric conduit system is being worked up by a New York inventor. It is extremely simple and it is claimed that the system may be installed for $5,000 a mile. Prof. Francis B. Crocker of Columbia College, New York city, has examined the system and reports favorably upon it. The inventor wants about $30,000 capital to develop his system. For further information see "Open Contracts for Electric Business," on another page.

THE MIAMISBURG ELECTRIC COMPANY has been incorporated with a capital stock of $100,000. The directors are: T. V. Lyons, Christian Weber, W. A. Mays, Elwood Allen, D. H. Allen, Wm. Burnley, Wm. Gamble. The following officers have been elected: T. V. Lyons, president; W. A. Mays, vice-president; Wm. Gamble, treasurer; D. H. Allen, secretary; Frank Young, superintendent of Tempered Copper Department, Wm. Burnley, superintendent of Battery Department. The company will manufacture The Burnley Cartridge Batteries, The imperial Dry Batteries, Tempered Copper, Commutator Segments, Commutator Brushes, Copper Brushes and various attachments for dynamos and electric machines in which copper is used.

"QUEEN" APPARATUS AT THE WORLD'S FAIR.

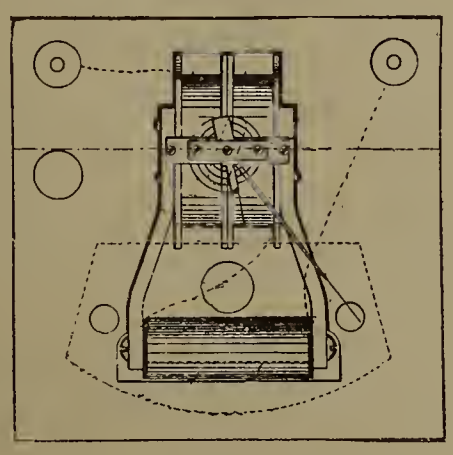
The standard electrical instruments exhibited by this company are attracting increased attention each day, and prove of considerable interest to all who appreciate strictly high-class workmanship. The Armour Institute, of Chicago, is equipping an electrical laboratory in good style, and has already reserved some $3,000 worth of instruments exhibited by Queen & Co. These are to be delivered in November after the exposition has closed. The manufacturers consider this as a happy compliment to their product, as Mr. Armour spares no money in making his equipment the best in the country.

The Electrical Age's Illustrated Record of Patents.

Issued June 27, 1893.

500,110. Push-Button. Wm. H. Berrigan, Jr., Jersey City, N. J., assignor of one-half to Chas. G. F. Wahle, Jr., New York, N. Y. Filed Dec. 19, 1892.

500,135. Electric-Motor. Chas. S. Jones, Chicago, Ill.; Susan H. Jones executrix of said Chas. S. Jones, deceased. Filed Apr. 7, 1890.



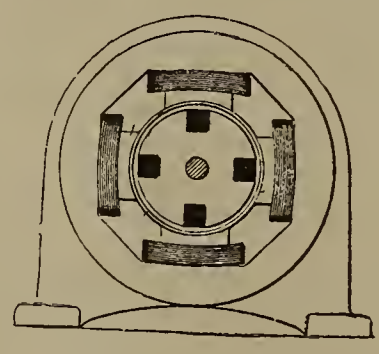
500,264—GALVANOMETER.

500,144. Brush-Holder, Sam. H. Libby, Lynn, Mass., assignor to the General Electric Company, of New York. Filed Jan. 19, 1893.

500,172. Electrotherapeutic Device. Wm. E. Washburn, Cedar Rapids, Iowa, assignor of two-thirds to F. S. Washburn and F. E. Washburn, same place. Filed Nov. 11, 1892.

500,178. Lightning-Arrester. Montraville M. Wood, Chicago, Ill. Filed Sept. 22, 1892.

500,192. Electric-Lighting Device. Wm. H. Clewley, Providence, R. I. Filed Apr. 15, 1893.



500,301—ELECTRIC GENERATOR AND MOTOR.

500,199. Push-Button. James S. George, Jr., Philadelphia, Pa. Filed Oct. 20, 1892.

500,200. Push-Button Cut-Out. James S. George, Jr., Philadelphia, Pa. Filed Nov. 28, 1892.

500,201. Cut-Out for Electric Lighting Systems. James S. George Jr., Philadelphia, Pa. Filed Dec. 30, 1892.

500,226. Telegraphy. Chas. Cuttriss, New York, N. Y. Filed Feb. 21, 1893.

PATENTS.—Continued.

500,229. Electric Cut-Out. Ernst Egger, New York, N. Y., assignor of one-third to Aaron Naumburg, same place. Filed Nov. 8, 1892.

500,236. Static Voltmeter. Arthur E. Kennelly, Orange, N. J., assignor to Thomas A. Edison, same place. Filed Aug. 6, 1892.

500,256. System for Supplying Electricity to Railways. Michael H. Smith, Halifax, England. Filed Oct. 26, 1887. Patented in England Dec. 28, 1886, No. 17,018, and in Belgium June 13, 1887, No. 77,792.

500,263. Trolley-Support. William Duncan, Allegheney, Pa. Filed Dec. 7, 1892.

500,264. Galvanometer. Adrian H. Hoyt, Manchester, N. H., assignor to the Whitney Electrical Instrument Company, Saco, Me. Filed Sept. 5, 1892.

500,272, Electric Heater. Charles E. Roehl, Chicago, Ill., Sidney Z. Mitchell, Portland, Oreg., and Earl P. Wetmore, Helena, Mont. Filed Dec. 23, 1892.

500,274. Regulating-Switch for Electric Elevators. Alonzo B. See and Walter L. Tyler, Brooklyn, N. Y. Filed Nov. 12, 1892.

500,279. Filament for Incandescent Electric Lamps. John Criggal, Newark, N. J. Filed Oct. 31, 1891.

500,280. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed Nov. 21, 1890.

500,281. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed Nov. 21, 1890.

500,282. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed Dec. 3, 1890.

500,284. Galvanic Battery. Mortimer M. Hayden, New York, N. Y., assignor to the Law Battery Company, of New Jersey. Filed April 28, 1892.

500,285. Police Signaling Apparatus. William H. Kirnan, Bayonne, N. J., assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed Dec. 28, 1892.

500,288. Electrical Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car-Heating Company, Wheeling, W. Va. Filed Oct. 1, 1892.

500,301. Electric Generator and Motor. William Stanley, Jr., and John F. Kelly, Pittsfield, Mass., assignors to the Stanley Laboratory Company, same place. Filed Jan. 9, 1893.

500,306. Conduit Railway-Trolley. Ernest P. Warner Chicago, Ill., assignor to the Western Electric Company, of Illinois. Filed July 30, 1892.

500,341. Electric-Arc Lamp. Wilhelm Mathiesen, Leipsic, Germany. Filed Sept. 5, 1892.

500,359. Indicator. August Utzinger, Nuremberg, Germany, assignor to Shuckert & Co., same place. Filed Feb. 9, 1893. Patented in Germany Feb. 19, 1891, No. 63,938; in England Jan. 16, 1892, No. 936, and in Belgium March 7, 1892.

500,362. Resistance-Box. Edward Weston, Newark, N. J. Filed Sept. 10, 1892.

500,375. Trolley. William H. Brodie, Brooklyn, N. Y. Filed March 15, 1893.

500,376. Rail-Brace. Elbert W. Bryant and Samuel Kinkerter, Ithaca, Mich. Filed May 23, 1892.

500,388. Rail-Joint. Frederick H. Heath, Minneapolis, Minn., assignor to the Heath Rail Joint Company, Waterloo, Iowa. Filed Aug. 12, 1892.

500,389. Rail-Joint. Frederick H. Heath and Edward P. Caldwell, Minneapolis, Minn., assignors to the Heath Rail Joint Company, Waterloo, Iowa. Filed Sept. 6, 1892.

500,390. Rail-Joint. Frederick H. Heath and Edward P. Caldwell, Minneapolis, Minn., assignors to the Heath Rail Joint Company, same place. Filed Jan. 21, 1893.

500,394. Secondary Battery. Frank King and Edward Clark, London, England. Filed Mar. 16, 1893.

500,400. Dynamo-Electric Machine or Motor. Philip Lange, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Apr. 28, 1891.

500,403. Dynamo-Electric Machine. Frederick H. Loveridge, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed Oct. 22, 1892.

500,404. Electric Indicator. William B. Luce, Brookline, Mass. Filed Jan. 4, 1892.

500,417. Automatic Disconnector for Trolley-Wires. Ray N. Noyes, Haverhill, Mass. Filed Jan. 23, 1893.

500,422. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill. Filed Oct. 31, 1892.

500,423. Double-Pole Switch. Charles A. Pfluger, Chicago, Ill. Filed Dec. 19, 1892.

ELECTRICAL AGE

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NEW YORK, JULY 15, 1893.

CONTENTS.

THE OUTLOOK.

We are glad to note that there is an increasing feeling of hope and confidence in the trade respecting the electrical business. Whether it is due to the action of the president in calling an extra session of congress for the purpose of repealing the so-called Sherman silver bill, or to other causes, it would, of course, be impossible to say positively. No doubt it has had some influence in restoring confidence, but whatever may be the causes, the fact is apparent that there is a more general feeling of buoyancy and we trust that it will prove to have been well-founded.

POISONED WATER.

An English medical journal suggests that the action of electricity on lead water pipes may sufficiently impregnate the water with lead to cause poisoning. Here is a chance for some experiments with a view to determining whether water is thus affected, or not, under the conditions named. If it is, it might result in cases of serious illness the cause of which ordinarily would be difficult to determine.

THE TELEPHONE IN COURT.

The question of the validity of the Bell patents will be determined in a suit brought by the Bell Company against two Chicago concerns, which recently established a telephone business. There has been considerable speculation as to whether the Bell Company would interfere with any attempt to make or use telephones without its authority, but all doubts are removed by this action in Chicago, and it is evident that the company intends to protect its rights to the last. It would be remarkable to see a great corporation sit hard by and see others using its property without proper consent. That is not in the nature of things.

TO WIND UP ITS AFFAIRS.

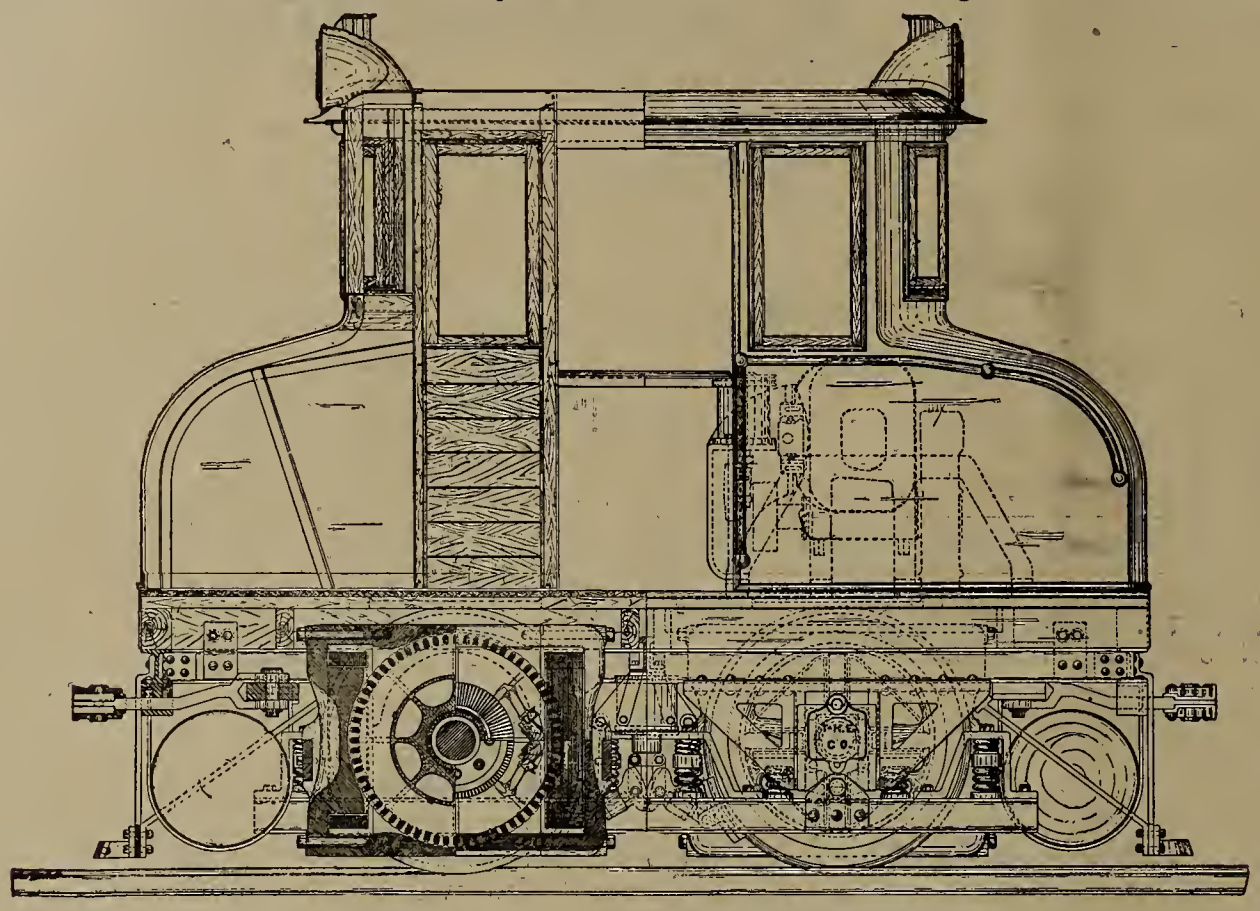
On March 10 last, the Sawyer-Man Illuminating Company, of this city, applied to Judge Ingraham, of the Supreme Court for permission to wind up its business. A financial statement presented at the time showed that there were no liabilities, and assets of $4 60. The application was assigned to Perry J. Fuller, as referee, who on July 6, filed a report in favor of the dissolution of the business. He suggested that Hugh R. Gardner be appointed receiver. The company was organized in 1883, and should not be confounded with the Sawyer-Man Electric Company, which is an entirely different concern, and in no way involved in the case or related to the illuminating company.

ELECTRIC LOCOMOTIVE.

For a long time the public has been looking for the appearance of an electric locomotive, designed for heavy railroad work. It has, at last, made its bow, and in this issue we give a description and several illustrations of this machine, which may properly be regarded as the forerunner of great achievements. While it is not intended to run at very high speed it will demonstrate many things that have not yet been learned by practical experience and there is no doubt that it will be a stepping stone to greater developments in this direction. Some such departure has long been anxiously looked for, and the General Electric Company, which is always up to date in new things, has taken a positive, and we trust, wise, step towards the application of electricity to the movement of heavy railroad trains.

THE FIRST ELECTRIC LOCOMOTIVE.

The first electric locomotive of any considerable size in the United States, and the first practically operative high speed electric locomotive in the world, adapted to the steam railroad, has recently been completed at the Lynn works of the General Electric Company, and will shortly be exhibited at the World's Fair. Its completion marks a distinct advance in electrical development.



LONGITUDINAL SECTION VIEW OF ELECTRIC LOCOMOTIVE.

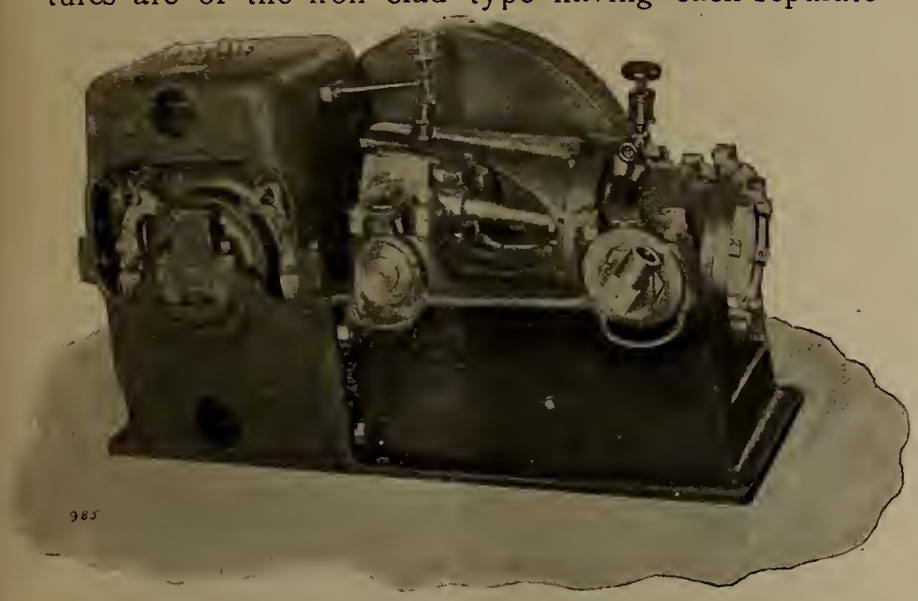
It is a thirty ton locomotive, designed for a normal speed of thirty miles an hour, primarily intended for operation on elevated railways, and for passenger and light freight traffic on less important steam roads. It is of compact construction, solidly and substantially built, and runs on four 44-inch wheels. Its dimensions are: 16 feet 6 inches long, 11 feet 6 inches high, 8 feet 4 inches broad, having its draw bars 2 feet 6 inches from top of rail—the Manhattan Elevated Railroad standard height. The draw bar pull is calculated at 12,000 pounds.

ELECTRIC LOCOMOTIVE HAULING A FREIGHT TRAIN.

The propelling power is furnished by two electric motors of especial design and construction, each axle

being provided with one motor. The motors are gearless, and are supported on special springs resting on the side frames of the locomotive truck. This method of suspension leaves the wheels free to adjust themselves to the irregularities of the road bed, and consequently the wear to both tracks and motors is diminished.

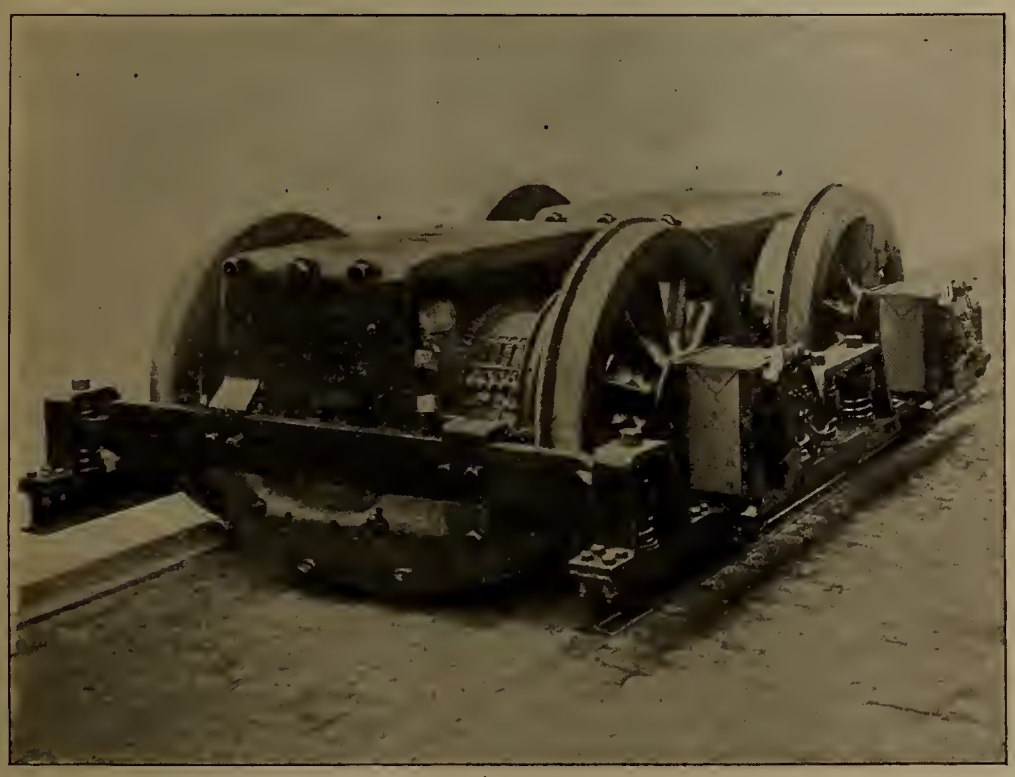
The motor fields consist of massive iron castings, to which the hollow field spools are bolted. The armatures are of the iron clad type having each separate



ELECTRICAL AIR COMPRESSOR.

winding embedded in a mica lined slot cut into the curved surface of the laminated iron armature body. The axles of the locomotive pass through the hollow shafts on which the armatures are mounted. These shafts rest in bearings of the motor frame, and are connected to the axles by universal couplings, which allow of freedom of motion in all directions. The commutators are of massive construction and there are four sets of brushes to each commutator.

The motors are controlled by means of a series paral-



TRUCK AND MOTORS OF ELECTRIC LOCOMOTIVE.

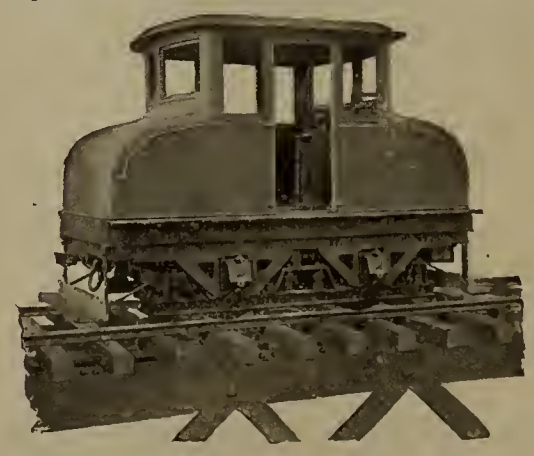
lel controller, set up in the interior of the cab. This device embodies all the latest improvements made in this type of apparatus by the General Electric Company. Under test it is found that the series parallel controller allows of a more gradual and easier starting of the electric motor and the speed can be more delicately and instantaneously controlled than in the case of the steam locomotive.

The truck, suspended from the journal boxes, is constructed of heavy I beams, and forms the foundation for the locomotive cab, of sheet iron, of symmetrical design, and so curved off as to diminish the atmospheric resistance, as far as possible. The interior is finished in hard wood. The sliding doors are placed at each side of the cab. and the windows are so arranged as to permit of an unobstructed view in all directions. There is ample space in the cab for the motor man's movements, and it affords him considerably better protection than that usually vouchsafed the steam locomotive engineer. The position of the headlights is shown in one of the accompanying illustrations.

The air for the brake is supplied by a special electrical air compressor, which also operates the whistles. This air pump has an oscillating cylinder of 6-inches diameter, with a 6 inch stroke, supplying 6,000 cubic inches, of air per minute at 70 pounds pressure The motor is similar to the N. W. P. 2½ in general appearance, but is wound for a higher speed. The normal speed of the armature shaft is 675 revolutions, and of the crank shaft of the pump 110 revolutions. The dimensions of the air compressor are: length, 41 inches; width, 16½ inches; height, 25 inches. The pump motor is controlled by a special rheostat This, by an intermediary device, is automatically regulated by the air pressure.

The use of these locomotives over very long distances is at present limited only by the cost of long lines of electric feeders, and until the problem offered by this condition is solved, restriction of its employment must necessarily exist. But for places comparatively near each other and where traffic is dense—the denser the better—the electric locomotive is peculiarly adapted, for here all the advantages of electric propulsion are available, unhampered by the extreme expense involved in long feeder lines.

The evolution of the use of the electric locomotive will probably follow along the lines dictated by expediency and favoring conditions. At first they will probably be used in elevated railroad service, and in New York, Brooklyn and Chicago alone, and their advent will be hailed with a feeling of deep gratitute. They will then probably be adopted as feeders to the trunk lines, both



ELECTRIC LOCOMOTIVE ON ELEVATED ROAD.

for freight and passenger traffic; and to operate short suburban lines, where a rapid, efficient service is requisite. Their peculiar fitness for switching purposes will advance their use another step and then slowly as the different problems presented are overcome, they will invade the province of the trunk line steam locomotive, and the millenium of railroad travel will be within the realities of life.

Dividend.—The Brooklyn Traction Co., on June 30, declared a dividend of 3 per cent. upon preferred stock for the six months ending June 30.

THE BROOKLYN ELECTRIC MANUFACTURING CO.

Brooklyn has within her limits a good many electrical concerns but none is better known in the trade than the Brooklyn Electric Manufacturing Company, 286–290 Graham street. This company's reputation is based mainly on the Baehr Quick-Break switches, which it manufactures. This particular make of switches has a high repu ation for satisfactory work, the apparatus embodying every necessary quality to make a perfect switch.

The Baehr switches are made in 25, 50, 100, 150, 200, 300, 400, 600 and 1,000 amperes, and are positive and reliable in their action. Their carrying capacity has on tests, proved to be far above the rating, and the break is effected as quickly on a voltage of 500 as on 50 volts.

Mechanically, these switches are correct in design and firstclass in workmanship and finish, and the very best of metal, with the highest conductivity, enters into their construction.

The company has recently completed the installation of a handsome switchboard in the Hotel Regent, Clinton and Greene avenues, Brooklyn. The board is of marbleized slate, furnished by T. J. Murphy, the well-known switchboard maker, of 136 Liberty street, New York city, and is 5 feet 8 inches wide, 6 feet high, and 1¼ inches in thickness. It is fitted with the Brooklyn Electric Company's switches, as follows: one double 3-pole Baehr quick break switch with a capacity of 1,000 amperes at 110 volts; two double-pole 500-ampere Baehr switches; six of the same, of 100 amperes capacity; and sixteen 50-ampere double-pole switches, besides four Edison ammeters, one voltmeter and one special voltmeter switch to aid in reading the voltage of either dynamo.

The wiring of the hotel was done by the Tucker Electrical Construction Company, 14–20 Whitehall street, New York city, and the plant is arranged so that current may be taken from the Edison street mains in case the house plant is shut down for any reason.

An illustration of the switchboard is given herewith, the double 3-pole switch being shown in the centre of the lower line of switches. The switches at the sides are those of 500 ampere capacity, and are connected with the dynamos. The heavy switch in the middle is connected with both the dynamos and street mains.

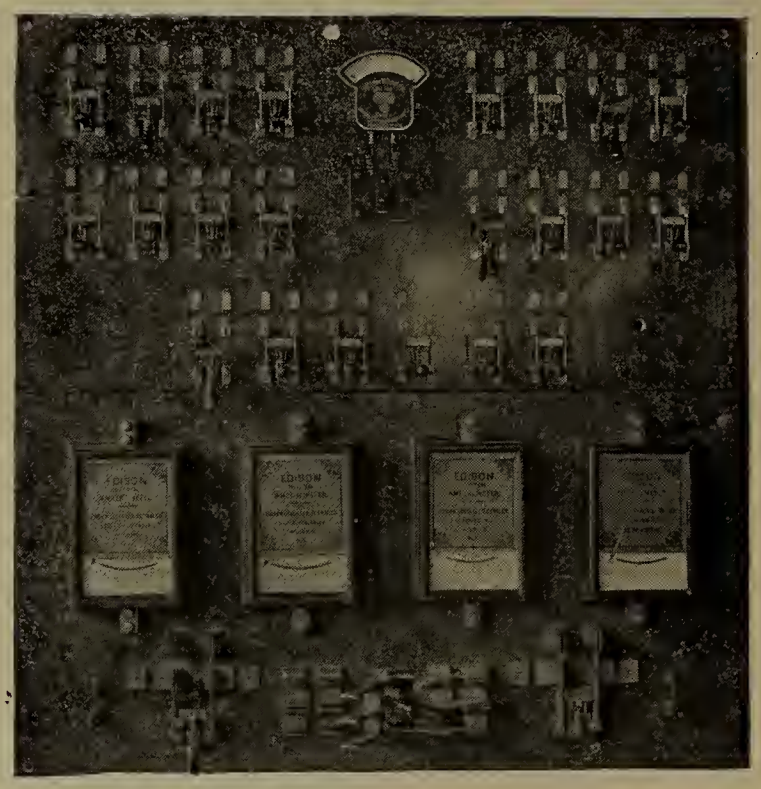
The company is now engaged in the construction of a switchboard for the residence of Mr. C. P. Huntington, on Fifth avenue, New York city, which will be very compact and complete. The board is 2 feet by 5½ feet, of black marbleized slate, furnished by T. J. Murphy, and will be equipped with one 500 ampere, 3-pole single throw Baehr switch; four of the same style of 100 amperes, two of the same of 50 amperes and two of 25 amperes.

Besides the main board, the company is constructing for the same installation 20 panel boards with automatic switches. The switches on the main board will be mounted right on the board, with connections at the back. The Tucker Electric Construction Co. is also wiring the Huntington plant.

The factory of the Brooklyn Electric Co. is completely equipped with modern machinery and tools, and has a capacity of 50 switches a day. It occupies the third floor of a brick building, and everything is done in a very systematic manner. This company, it will be remembered, succeeded the old Baehr Electric Manufacturing Company, which occupied the same premises. The Brooklyn company has as its president Mr. Samuel O'Connor, who is well known in the electrical trade. Mr. F. B. Sharp is the general manager, and to this gentleman the success of the company is largely due. He put the company on a solid basis, when it was reorganized, by adopting sound principles in the carrying on of its business, and it is largely through his individual efforts and business tact that it enjoys the high reputation that it does today.

Mr. Sharp is quite a young man in years, but old in experience, and is just the kind of person to take hold of an infant industry and build it up. He possesses the faculty of seeing well into the future and being able to calculate with reasonable accuracy about how an enterprise will turn out. He has showen this in his management of the business, and his success has been such that older men would feel proud of like results.

Mr. Sharp was born in Drakestown, N. J., 23 years ago, and commenced the practical part of life when he was 16 years of age. His first electrical venture was with the old firm of Hazazer & Stanley, of New York city; this was in 1887. He was afterwards connected



SWITCHBOARD, HOTEL REGENT, BROOKLYN, N. Y.

with the Princeton Enameling Co., of Princeton, Ill., as secretary and treasurer, and later returned east and took charge of the plant of the Nyack (N. Y.) Electric Light and Power Company. He left this company to accept a position with the Baehr Electric Manufacturing Company and at first worked at the bench, where he learned the practical side of the manufacturing business. With all his experience Mr. Sharp is well equipped for a successful battle with the obstacles in life. He is naturally of a quick and active temperament, and believes faithfully in doing things well.

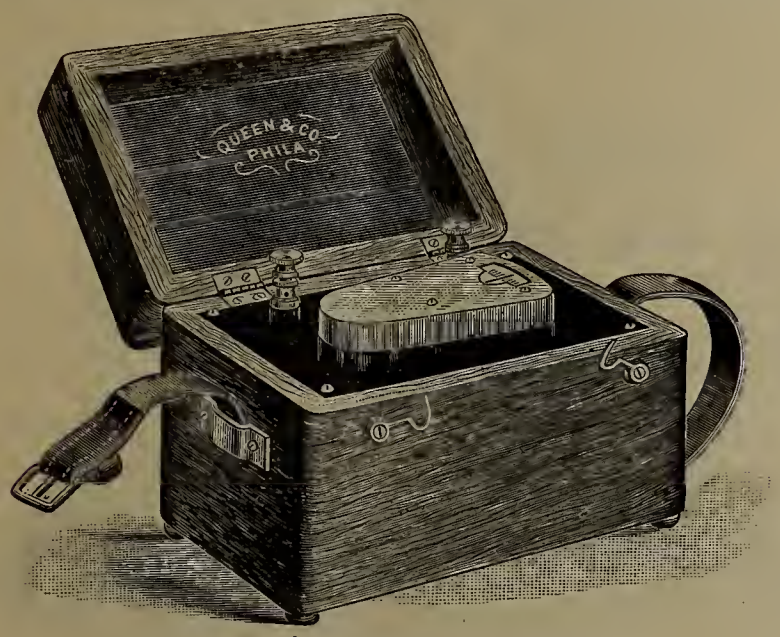
We give at the head of this article a picture of Mr. Sharp, who, will, about July 15, make the World's Fair a visit for a couple of weeks. The trip will be partly for business as well as pleasure.

The State of General Business—R. G. Dun & Co. report 307 business failures in the United States during the week ending June 30, as against 171 failures during the corresponding week last year. During the quarter ending the same date the failures numbered 3,199, against 2,119 during the same period last year.

Storage Batteries.—It is reported that the Pacific Telephone and Telegraph Co. has decided to use River and Rail storage batteries in its service.

QUEEN PORTABLE D'ARSONVAL GALVANOMETER.

In completing a line of portable testing instruments, Queen & Co., Philadelphia, have placed on the market a D'Arsonal galvanometer as illustrated which deserves more than passing notice. It is of the type used heretofore in their testing sets and is admirably adapted to laboratory or station measurements and for use as a detector of faults in line wire. The index is quite deadbeat, so that rapid readings are possible, and because of the



PORTABLE D'ARSONVAL GALVANOMETER.

principle of construction employed, magnetic fields and mechanical vibrations produce practically no effect.

As the galvanometer is a "zero" instrument, readings cannot be made by direct deflection, but to determine resistance a rheostat and bridge are necessary exactly as in regular testing sets.

For manufacturing companies, especially where quick work is an item, the above will prove of much value. It is well suited for ascertaining the resistance of carbon filaments for incandescent lamps, and has been used for this purpose by some of the large lamp makers. As a simple ground detector the galvanometer is quite complete in itselt, being conveniently mounted in a handsome mahogany case with leather strap.

THE ENGLISH PATENT SYSTEM.

In an article on "Patents and Inventions" the *Mechanical World* of London says that the English system for granting patents on inventions is far inferior to patent practice in the United States and in Germany, yet these systems cannot be considered perfect. Since the English Patent Act of 1884, an increase in the number of applications for patents has been noted

The greatest defect of the present English patent system is the fact that no examination is made as to the novelty of the submitted application. By this means patents are granted if the specifications read all right and if the invention is novel as far as the memory of the patent office is concerned, thus patents are granted for devices which are sometimes found to have been invented and pat ned at a previous date.

Sioux City, Iowa—C. H. C. Moller has been appointed receiver of the Sioux City Cable Railway Company on application of President John Pierce. In the petition Pierce says the road has not paid operating expenses since it was built, and lost $75,000 in four years.

THE PALMER MOTOR.

We illustrate herewith the Palmer No. 3 motor, manufactured by Palmer Bros., Mianus, Conn., which has some novel features.

Usually the breeze generated by electric fans is in one direction, but in this machine the breeze can be thrown upward by turning a thumbscrew under the base which gives a tilting position to the motor.

This machine will run a light running sewing machine or other light machinery, and has from $\frac{1}{16}$ to $\frac{1}{12}$ horse power. It runs a 6-inch blade fan very vigorously, and every motor is furnished with a grooved brass pulley for driving machinery. When wanted for the latter purpose the fan can be easily removed.

These motors are wound for 110 volt circuits, and weigh but four pounds each. They are furnished completely finished or unfinished as desired.

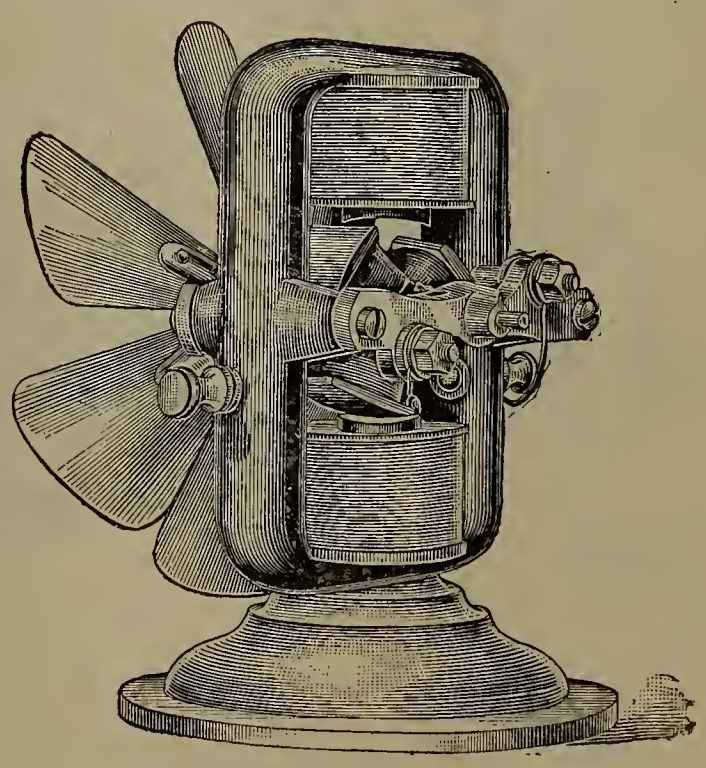
Palmer Bros. furnish these motors unwound to parties desiring to do the winding themselves. The price of these machines is so low that there is little excuse for any one having a light circuit available not keeping cool during the hot weather.

EARLY ELECTRIC RAILWAY.

That the idea of electric railways is not so recent as many suppose may be inferred from the subjoined article which is reprinted from the issue of the *Pictorial Times*, of London, of January 17, 1846 :

MAGNETIC RAILWAYS.

Experiments of a highly satisfactory nature are being made with regard to the application of electro-magnetism to railway propulsion. The great difficulty to be



PALMER NO. 3 MOTOR.

surmounted is the weight and size of the galvanic batteries requisite for sufficient energy. To obviate this difficulty, it has been proposed to have stationary batteries at regulated distances and to make the rails themselves the conducting lines of the batteries.

PARIS EXPOSITION.—The motive power at the Industrial Exposition in Paris, which will open in the fall, will be electric, and will be supplied from the Champs Elysées central station.

ELECTRICAL INSTRUMENTS.

(*Continued from page 410, Vol. XI.*)

"N. 2597. Three Steel Lever Keys, with legs, J. H. Bunnell & Co., New York. Usual form as at present adopted more generally than any or all other keys in the United States. The especial feature being the very light, and at the same time very strong steel lever, in *one* piece. Fig. 4.

"N. 2598. Legless steel Lever Keys, J. H. Bunnell & Co., New York. Being in all respects like the usual steel lever key except that the "legs" are omitted and he connections made at binding posts so as to permit the key to be screwed down to desk, or table, from the top.

"N. 2599. One New Model Open Circuit Combination Set, J. H. Bunnell & Co., New York. In this apparatus is used a transmitter operated by the key and actuated by the same local battery as that by which the relay actuates the receiving sounder. By this means the operator is enabled to hear his own transmission, and the transmission of the signals is not subject to the variable peculiarities of the hand on the key, as is the case when the transmission is directed by the key. In this way the work of the operator is better, because he can distinctly hear it, and the liability of imperfect contacts is much less. Fig. 5.

"N. 2600. One Set Automatic Repeaters, J. H. Bunnell & Co, New York. Bunnell patent open circuit. This is a special system of repeaters for open circuits, so arranged that the two sets of instruments constituting the complete repeater may be used at will, whether for repeating from one line to another, or as two separate instruments, each one operating independently its own individual line.

"N. 2601. Polechanger, J. H. Bunnell & Co., New York. Quadruplex form; arranged with *adjustable* contact springs, so placed that their operation shall be in plain front view of the operator for better convenience and accuracy of adjustment.

"N. 2602. One Pocket Relay, in case; J. H. Bunnell & Co., New York. Special form pocket relay devised with the aim of containing within the smallest limits all the working parts of as nearly full size and power as possible, with special view to the military telegraph, etc.

"N. 2903. Two No. 2 Polar Relays, J. H. Bunnell & Co., New York. Twenty ohms each. Special form polar relay, particularly for use requiring convenient manipulation of the magnetic adjustments and also for powerful polarization.

"N. 2604. Two Main Line Relays, J. H. Bunnell & Co., New York. One hundred and fifty ohms each. Usual form of standard relay as used on all American telegraphs, except as the armature, which in this case is

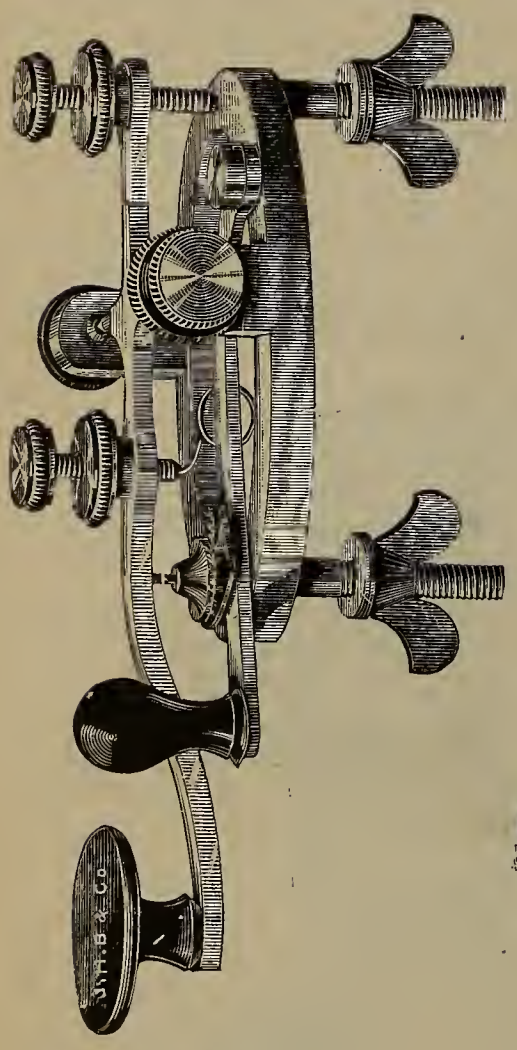


FIG. 4.

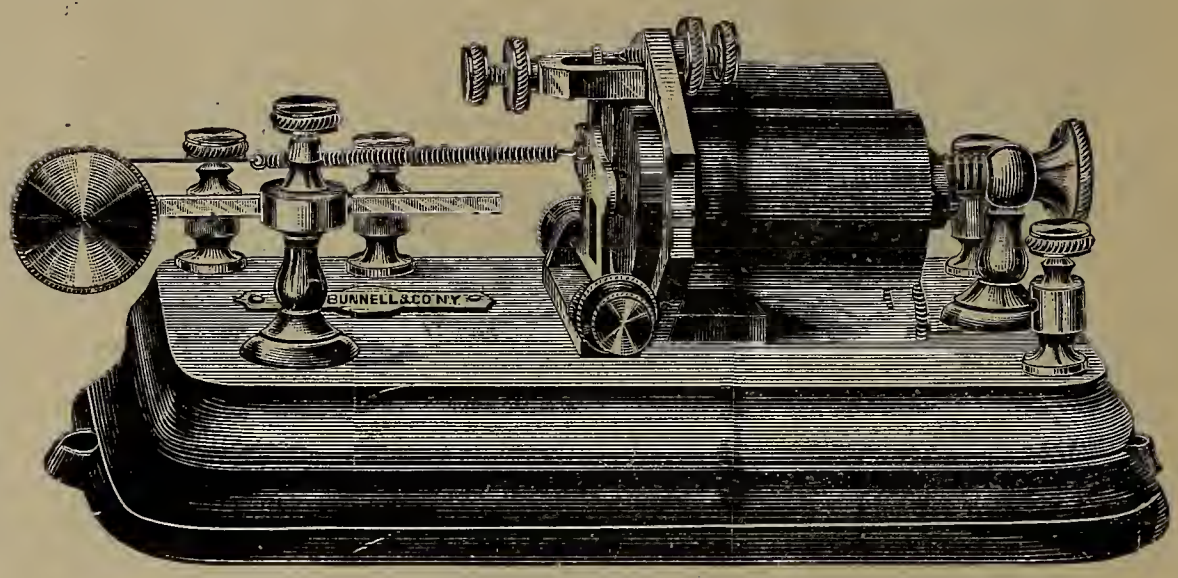


FIG. 6.

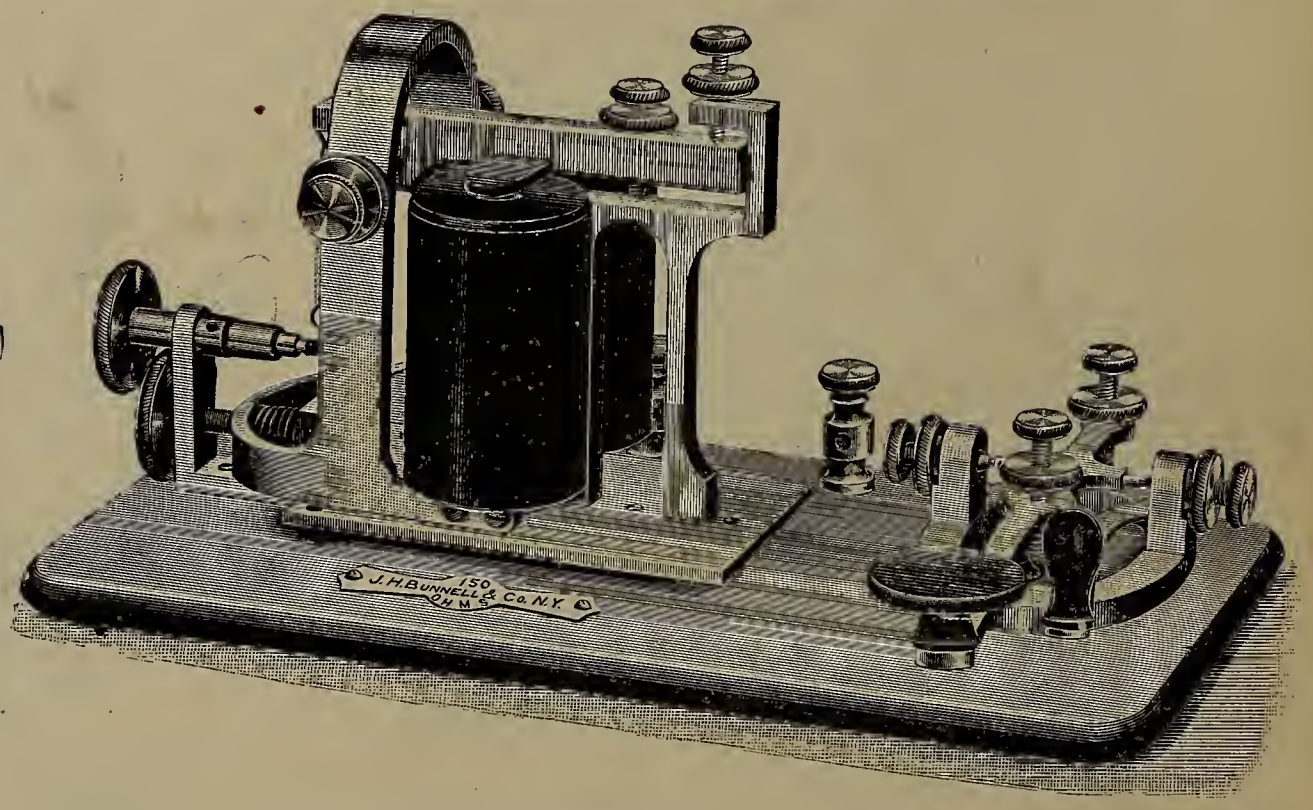


FIG. 5.

stamped out in one piece, giving needed rigidity with much lighter weight of metal than required if otherwise put together. Fig. 6.

"N. 2605. Three Main Line Sounder Relays, J. H. Bunnell & Co., New York. One hundred and fifty ohms, with key on base. An entirely new form (1893) of main line instrument, which combines the sound-giving qualities of the best local sounders with the large fine wire magnets and special adjustments of a relay, and which, in practice, gives more than three times the volume of sound given by the very best box relays, or any other form of sounding relays, for short or long main lines, ever before produced.

"They are unequaled for wrecking instruments, testing sets, field telegraphs, switchboard sets, temporary

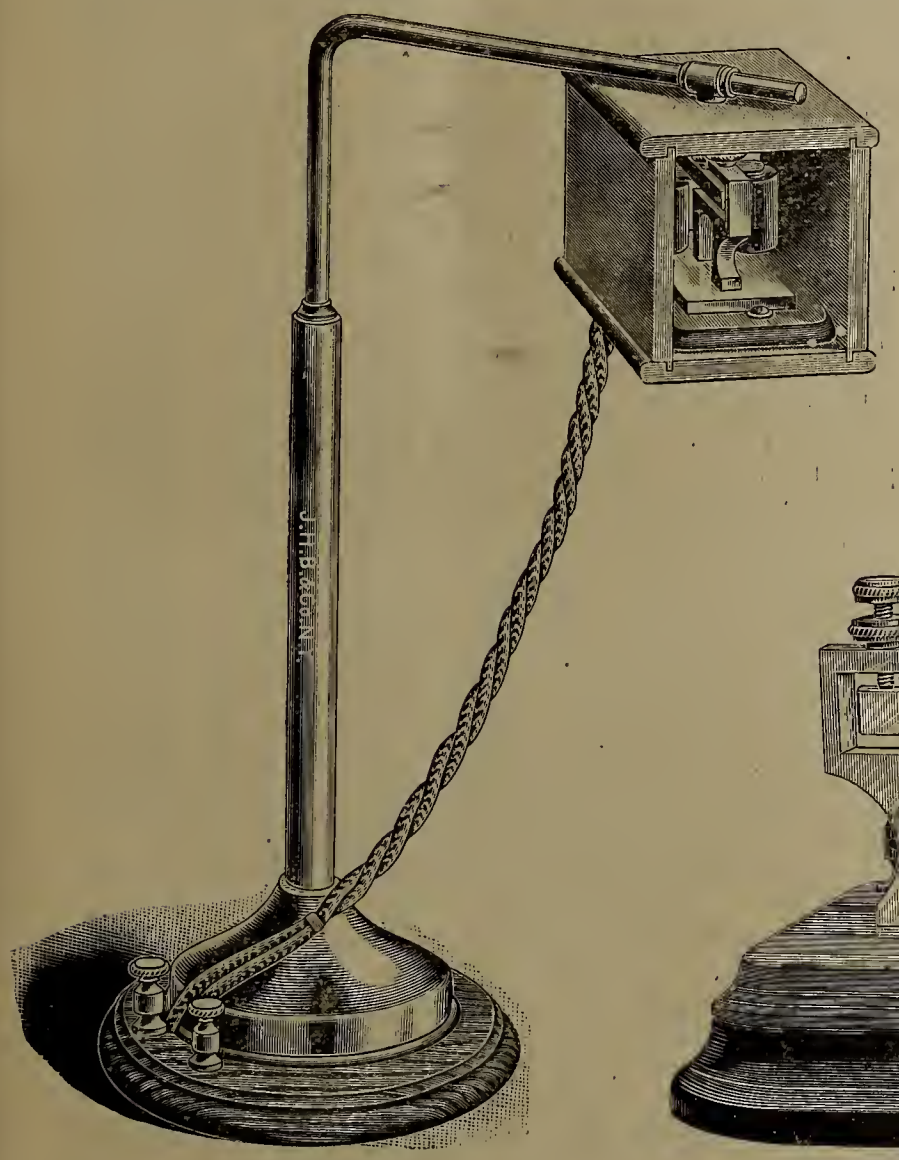


FIG. 7.

offices, and all places where it is desirable to dispense with the use of local batteries. These instruments are made with full size relay magnets of 150 ohms resistance, having both magnet and armature adjustments, and fully suited for doing, in a greatly improved manner, the work of regular main line box relay. They are highly sensitive to the weakest currents and will give a clear working sound on circuits where, without them, a relay with local sounder and battery would be absolutely necessary. Fig. 7.

"N. 2606. Three Main Line Sounder Relays, J. H. Bunnell & Co., New York. Without key on base (form of 1893). The same as the similar instrument described fully in reference to the sample which has a key on the same base.

"N. 2607. Two Bunnell Resonators, J. H. Bunnell & Co , New York. Resonating box (on swinging arm) in which sounder is placed and connected. The object being first, to amplify the sound; second, to bring it as nearly as desired to the ear of the operator. Especially adapted for receiving operators using the type-writer, and for noisy railway stations, or for all situations where the sound of the instrument is subject to interference from outside noises. Fig. 7.

"N. 2608. Three Postal Resonators, J. H. Bunnell & Co., New York. With 1892 local sounders. Being similar in form to the resonators used on continental lines, and containing the 1892 *one cell local sounder.*

"N. 2609. Six Local Sounders (1892), J. H. Bunnel & Co., New York. An improved form of standard local sounders arranged with magnets larger than usual, together with sounding parts, in such manner as to produce fully efficient working sound with but *one cell* of local battery, instead of two, as generally employed with ordinary sounders.

"N. 2610. Six Spring-point Repeating Sounders, J. H. Bunnell & Co., New York. Ordinary repeating sounders with spring contacts for repeating in direct Morse circuits.

"N. 2611. Four Circuit Time-Repeating Sounders, J. H. Bunnell & Co., New York. Repeating sounder arranged with four sets of contact springs which are simultaneously actuated by the sounder lever for the purpose of transmitting on four lines at the same moment, the signals used in sending time. The same form is, with a greater or lesser number of contact springs, adaptable for from one to six circuits.

"N. 2612. Six Giant Sounders, J. H. Bunnell & Co., New York. Usual and well known American form of standard sounder such as found in more general use than any other, in railway and commercial telegraph service.

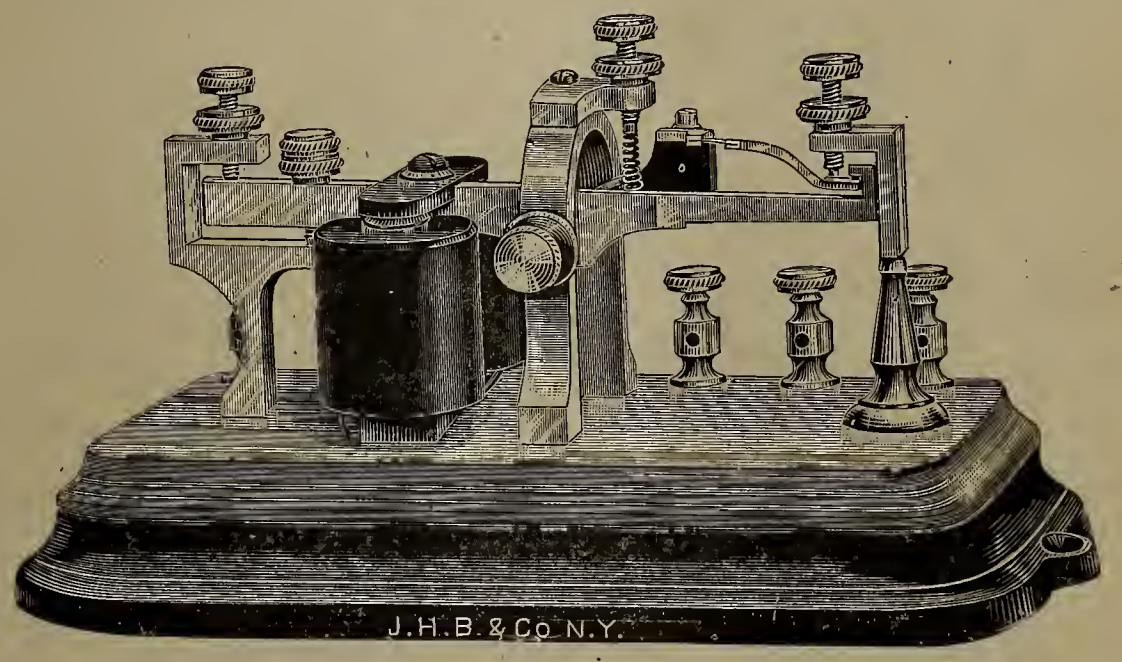


FIG. 8.

"N. 2613. Three Circuit Preserving Transmitters, J. H. Bunnell & Co., New York. Ordinary circuit preserving transmitter.

"N. 2614a. Three Single Transmitters, J. H. Bunnell & Co., New York. 'Shovel Nose' these are the usual circuit preserving transmitters as used with duplex and quadruplex telegraphs. Fig. 8.

"N. 2614b. Electrical Supplies, J. H. Bunnell & Co., New York. This firm also furnished, in addition to the above-named instruments, the following electrical material, now in use in the Naval Observatory exhibit: One 6-inch and one 8-inch electro-mechanical gong, office wire, connectors, binding posts, standard dry battery, new form of compound Fuller battery, staples, switches, etc."

RECEIVER—*The Pacific Electrician* states that the Rainier Electric Railway and Power Co., and the Seattle Consolidated Street Railway Co. have gone into the hands of a receiver. Inability to place bonds is said to have been the cause of the trouble.

INTRODUCTION OF TELEGRAPH WIRES INTO OFFICES; WITH SPECIAL REFERENCE TO LINE OR WAY OFFICES.*

BY E. R. ADAMS.

From personal observation, in passing over the lines of many railroad and telegraph companies, I am lead to believe there is not sufficient attention paid to the details of the construction and insulation in connection with office work. I sometimes think there has been less advancement and improvement in this branch of the telegraph service than in any other since the construction of the first telegraph line, yet, in my opinion, it is a matter of the utmost importance if we desire good working wires, and therefore believe that a little agitation of the subject at this meeting may not prove fruitless.

This condition of affairs may be due, in many cases, to the prevalent idea that there is only one way to do office work and that every lineman knows how to do it, so that when a new office is to be opened, the lineman is directed to go to the objective point, connect certain designated wires into the building and report when the work is completed. An inspection of the office would probably show that the man, unless he is an experienced and reliable one, in a hurry to complete the work, enters the wires in the most convenient way, making use of porcelain knobs or rubber hook insulators and iron staples, wherever he finds it most convenient to do so.

Telegraph wires are frequently noticed to jump from the office pole to porcelain or rubber hook insulators attached to the outside of office buildings, fully exposed to rain and snow, or long spans of wire from the office pole, with a downward pitch, direct through the woodwork of the building to a fastening inside, thus providing a natural water course for the rain to enter and saturate the walls, causing leakage and weather crosses.

Wherever practicable, an arm, bored for the number of pins or wires it is desired to accommodate, should be securely fastened to the outside of the building, cupola or dormer window, into which it is desired to enter the wires. The arm should be fastened by using special iron brackets or braces, sufficiently removed from the building to prevent snow from packing over it against the walls, and a pole planted close enough to the building to avoid long spans; the line wires should be taken from the pole to glass insulators on the arm, securely tied and terminated there. Hard rubber or porcelain tubing should be placed in the wall several inches above the glass insulators at an upward angle and the rubber insulated office wire brought out through the tubing, passed down to the glass insulators with several turns around the glass, and joined to the end of the line wire with a twist sleeve connector; or if this is not available, the ends should be brought together and soldered, care being taken to arrange the ends so that all pulling strain is removed; this can be accomplished by giving both the line and office wire several turns around the glass, tieing them and soldering the loose ends; if the line wire is hard drawn copper, particular pains should be taken not to make any soldered joints between the insulator and pole, as the process of soldering will anneal and weaken the wire.

I am aware that the prevailing custom is to carry the line wire into the building and connect the office wire to the line wire on the inside; this is all right where the point of entrance is under cover, but if the wires enter the building where rain or snow may strike them, I consider it objectionable for the reason that even if the wire is passed through an insulating tube, escapes will occur during wet weather, whereas if the wire is protected with a good rubber insulation, these escapes will be prevented.

I advocate the use of McIntire or similar make of twisted sleeve connectors, because we have used them for years and am fully convinced that they make the best and most durable joint, far preferable to any kind of soldered joint. I have recently had some of these connectors cut out that were in use upwards of four years, at a point exposed to the smoke and gas of manufacturing establishments, and upon opening them, found the wires inside practically as clean and bright as when first inserted.

Small railroad stations are frequently of such design as to render it impracticable to fasten an arm as above described, and as I insist upon having a glass insulator in an upright position wherever the wire reaches the building, we keep in stock a number of different patterns of iron brackets with screw heads for holding the glass insulators; these brackets are right and left hand, of different designs, so that we seldom find a place where we cannot fasten one in such position as to meet the requirements for entering wires into the sides of the buildings or to drop under a platform shed roof, and having the glass insulators in an upright position.

I might add, we furnish our linemen with a copy of a blue print and as each bracket is designated by a number, they can readily order the particular style required. Burlap or heavy paper should be placed over the screw thread of the iron bracket before screwing on the insulator.

Porcelain knobs and rubber hook insulators should not be used at any place where moisture or dampness can reach them, as they will prove defective insulators. In my opinion, nothing except rubber-covered insulated wire should be used for running wires in offices, for both main and local circuits, and the rubber insulation should be covered with proper protective braid; iron office staples, or double-pointed tacks and paraffined cotton covered office wire should be relegated to the rear. I find a good plan to prevent staples being used is not to furnish them to the men nor keep them in stock. All wires should be placed in hardwood cleats, with holes bored through the center so as to keep the wires clear of the walls. Care should be taken in drawing the wires through the holes of the cleats to not injure or abrade the protective braid of the insulated wire; this is important because rubber insulation is known to deteriorate when exposed to atmospheric influences, and the braid should therefore be kept intact. Particular attention should be paid to the running of office wires below the switchboard, as it is generally inconvenient to run wires through cleats under the instrument tables, and the temptation for using iron staples is frequently too great to be resisted. Joints or splices should not occur in office wires, but where unavoidable they should be soldered carefully, the joint painted with a good compound and covered with good adhesive tape, or better still, use a twist sleeve connector. The use of tape on unsoldered joints should not be permitted.

The use of binding posts screwed in the woodwork of offices or battery rooms is often the cause of leakage. To overcome this I have adopted a post screwed into a socket made out of a solid hard rubber block, one-half inch round, with thread cut on the outside and a collar to keep the base of the binding post from coming in contact with dampness; this insulated post holds firmly wherever placed and is proof against moisture. At offices where it is desired to enter a large number of wires it is often preferable to use a cable from the office pole to the switchboard, and for this purpose I prefer using a cable made up of rubber insulated wire, boxing it carefully as far as practicable. The pole end of the cable should be

* Paper read at the Convention of Railway Telegraph Superintendents held in Milwaukee, Wis., June 20 and 21, 1893.

placed in a weather-proof box running the entire distance between the top and bottom arms, and the conductors taken out through the sides of the box at each arm, and carried through cleats underneath the arms to their respective insulators, protecting them as far as possible from the heat of the sun; this will keep the conductors firmly in place and prevent them from being swung to and fro by the wind and causing breaks in the wire under the insulation. Only a few days ago I noticed in an eastern city, where a cable containing a large number of conductors was ended on an office pole, without any protection whatever, and the conductors were legged out to the line wires on the insulators in lengths of four to ten feet, flapping loose in the wind. I am confident the linemen in charge of that division will be out "chasing" a break in a short time. This work was done on the lines of a progressive telegraph company, and I only mention it to emphasize the necessity for "eternal vigilance" in order to maintain lines up to the highest standard.

PROGRAMME OF THE INTERNATIONAL ELECTRICAL CONGRESS.

We give below the preliminary programme of the International Electrical Congress, to be held in connection with the World's Columbian Exposition, Chicago, beginning August 21, next.

OPENING SESSION OF THE GENERAL CONGRESS,*

Monday, August 21, 3 o'clock P. M.

ORDER OF BUSINESS.

1. The Congress will be called to order by the Chairman of the Advisory Council, Dr. Elisha Gray, Highland Park, Ill.
2. Election of temporary Chairman and Secretary.
3. Appointment of a committee to nominate permanent officers. The officers will consist of a President; a Vice President for each nation sending delegates to the Chamber; a Secretary.
4. Report of this committee.
5. Short addresses by the President, and by a few of the Vice-Presidents.
6. Announcement and adjournment.

At the close of this meeting

THE CHAMBER OF DELEGATES

will assemble for preliminary organization, which will proceed as follows:

1. The Chamber will be called to order by one of the delegates representing the United States.
2. Election of a temporary Secretary.
3. Appointment of a committee of five on credentials.
4. Fixing a time for regular session. Adjournment.

At the next meeting of the Chamber the committee on credentials will report, and a permanent organization will be completed.

DIVISION INTO SECTIONS.

The General Congress will be divided into three sections, as follows:

A—The section of *Pure Theory*, including electric waves, theories of electrolysis, electric conduction, magnetism, etc.

B—The section of *Theory and Practice*, including studies of dynamos, motors, storage batteries, measuring instruments, materials for standards, etc.

C—The section of *Pure Practice*, including telegraphy and telephony, electric signalling, electric traction, transmission of power, systems of illumination, etc.

These sections will meet for organization and work at 10 A. M., August 22.

Their organization will consist of the election of a Chairman, a Vice-Chairman, a Secretary and a Sectional Committee of three in addition to the officers named above. Temporary presiding officers will be as follows:

Section A—Prof. H. A. Rowland.
" B—Prof. Charles R. Cross.
" C—Prof. A. Graham Bell.

Sections will meet at 10 o'clock, A. M., on Tuesday, Wednesday, Thursday and Friday, continuing in session at will, except on Friday, when they will finally adjourn as Sections not later than 1 o'clock, P. M.

Each Section will have authority to divide into subsections if it is thought to be desirable.

Papers are solicited upon the following subjects or upon other topics which may be considered suitable in character.

They should be sent to the chairman of the Programme Committee, not later than August 1, 1893. Such as are accepted by that committee, will be put upon the programme of the Congress, to be presented in full or by abstract according to the time available.

Magnetic units and modes of embodying them in concrete standards.

Methods of avoiding electrical interference and risks to person and property.

National and municipal testing laboratories.

Materials for standards of electric resistance.

Points of difference of the electrical vocabulary used in different countries.

The direct conversion of the energy of fuel into electric energy.

Comparison of the various methods employed for the electric transmission of power.

The cost of insulation in relation to high pressure for the electric transmission of power.

Comparison of the economies of the various systems of electric distribution.

Alternate current motors.

The behavior of transformers when supplying power to alternate current motors.

The construction of condensers for alternate current purposes.

The measurement of power in polyphase currents.

Direct coupled and non-direct coupled dynamos.

The use of equalizing dynamos in a three and a five-wire system.

The use of accumulators in central stations.

The proportions between output of dynamos and the weight of copper and iron employed in their construction.

Electric traction

Application of electric power in mining.

The adoption of a uniform method of distinguishing positive and negative mains.

Electric supply meters, American, British, Continental.

Criterion of sensibility of galvanometers.

Commercial instruments for measurement of electric quantities.

The relation between the voltage of the arc and the quality and composition of the carbons.

The aging of glow lamps.

The electric working of metals.

The use of electric and magnetic tests for ascertaining the mechanical properties of metals and alloys.

The best material and mode of erection of lightning conductors in the light of recent researches in electric discharges.

The prospecting for iron by magnetic surveys.

*NOTE.—The "General Congress" will include a smaller body to be known as the "Chamber of Delegates," which will consist of those especially designated as representative delegates from the various governments, appointed for the purpose of considering electric units and their values, and making recommendations as to the legalization of the same.

International telegraphy.
Fast-speed and long-distance telegraphy.
The use of batteries or other generators for telegraphy.
Telegraphic lines—land and sea.
Harmonic telegraphy.
Writing telegraphs.
Long-distance telephony.
The possibility of providing telephonic communication without wires.
Application of electric signaling to the working of railways, (alarms, time, etc.,) and to naval and military purposes.
Magnetic separators.
The use of electricity in engraving and in art reproductions.

The time alloted to the discussion of the papers presented will be determined by the several sectional committees. In the discussion of papers the Chairman of the Section will name the first speaker.

THE CHAMBER OF DELEGATES.

The following topics will be considered by the Chamber of Delegates:

Adoption of definitions and values of fundamental units of resistance, current and electro-motive force.
Adoption of definitions and values of magnetic units.
Adoption of definitions and value of the unit of self-induction.
Definitions and values of light, energy and other units.
The standardization of electric lights.
The consideration of an International System of Notation and Conventional Symbols and of a more uniform and accurate use of terms and phrases in electrical literature.
A commercial standard of copper resistance.

Together with such other topics as may properly come before this body.

The hours of meeting for the Chamber of Delegates shall be determined, after the first session, by the Chamber itself; and it shall also decide upon the admission of persons not delegates to its sittings.

It shall finally adjourn not later than 1 o'clock P. M., on Friday, August 25, and at the last meeting of the General Congress, the officers of the Chamber shall report to it a summary of its proceedings, and the conclusions reached.

Public lectures of a popular character will be delivered by eminent electricians at 8 o'clock P. M., on Tuesday, Thursday and Friday of the Congress week.

The General Congress will assemble to hear reports and for final adjournment at 3 o'clock, P. M., Friday, August 25.

Prof. T. C. Mendenhall, Washington, D. C., *Chairman.*
Carl Hering, Philadelphia, Pa.
Prof. W. A. Anthony, Manchester, Conn.
Prof. H. A. Rowland, Baltimore, Md.
A. E. Kennelly, Orange, N. J.
Prof. F. B. Crocker, New York City.
Prof. E. L. Nichols, Ithaca, N. Y.,
Prof. H. S. Carhart, Ann Arbor, Mich.

Committee on Programme.

THE TELEPHONE PATENTS.

A press dispatch from Chicago states that on June 30, the Bell Telephone Company begun its expected fight to protect its unexpired patents, and the issue was made on that date in suits in the United States Court against the recently established firms of William Hubbard & Co. and the Cushman Telephone Company. In the bills of complaint the whole history of the Bell patents is given, with an exhaustive account of all the litigation which has been necessary to preserve the rights of the company intact and the various decisions which have been rendered.

THE DAY LOAD.

The question of the day load weighs still heavily upon us, says the *Electrical Review*, of London, and the practical solution of the problem seems to be as far off as ever. It has been claimed, with what at first sight appears to be a certain reasonableness, that the general adoption of motors on the lighting circuit would do something in the way of flattening the load curves. Motors, to some extent, have been tried, but it cannot be said that they have much furthered the matter In the district of St. Pancras, as well as at Bradford, special terms have been offered to users of small powers, but generally speaking, small users have shown no great disposition to avail themselves of electric current for power purposes. The question which arises in one's mind is whether the number of motors which can be placed safely on a lighting circuit is likely to be remunerative or not, for we take it that one cannot keep on increasing motors on a lighting circuit to any indefinite extent. Of course, if lighting and power could be kept quite distinct, there would be little objection to urge against the placing of motors on a lighting circuit, that is, if the current for power purposes was used only at the time it was not required for lighting, but such a happy state of things is absolutely impossible on an ordinary supply company's circuit In London the supply companies are often called upon for a heavy supply of current for lighting purposes during the day, and under these conditions it is not difficult to imagine the effect of suddenly throwing off or on the circuit of heavy motors. Then, again, to utilize motors in a manner satisfactory to the users, the supply company ought to be ready to turn on current at any time, for it is well known that the man who uses machinery which can be driven by small motors is a man in a modest way of business, who in the exigencies of his calling, is likely to want power at all hours.

It is obvious, therefore, that to be commercially successful, lighting and power must be kept distinctly separate from each other, and those who are endeavoring to create a demand for power purposes must be prepared to lay down separate mains. This fact has been fully recognized by the Southampton Electric Light Company in the case of the cranes at the Southampton Docks. These cranes are called upon at all hours of the day and night to do heavy work, and, under the circumstances, the only rational arrangement was to have special mains. This, of course, is a real day load, but it is not the day load for which central station engineers have long hoped. At the same time, it is a day load which fills up to the best advantage the idle hours of a central station, and will materially help the profits of any undertaking.

It has been urged by many that the use of electricity in the household for purely domestic purposes would have a marked effect on the day load. The objects of the advocates for such a use of electricity are most praiseworthy, and their efforts should be appreciated, but we cannot go beyond the line that with cooking there might be an increased consumption, if we may use the term, the day load would not be seriously affected, because, as we have already pointed out, as soon as it is worth the while of a company to supply electricity for power purposes, they must be prepared to lay down fresh mains. It is difficult to see that electricity will compete successfully with gas for cooking and similar operations in the absence of storage. In the case of gas, there is a constant pressure in the mains

without the necessity of running machinery, so no matter whether the demand be small or large, it would not affect the efficiency of the gas plant. It is very different with electric machinery, for to supply power you must run your machines, no matter how little the load may be.

PHOTOMETRY.

At the meeting of the Physical Society, London, on June 9, last, Mr. A. P. Trotter read a paper on a new photometer. It was a description of a modification of the author's "illumination photometer" with the object of adapting it to the measurement of candle-power.

The principle employed according to the London *Electrical Engineer*, is to view a screen illuminated by one source through an aperture in a second screen illuminated by the other light, the aperture becoming invisible when the illuminations are equal. After using perforations of various patterns, a series of narrow slits cut in thin paper were found to give the best results. The plain screen is mounted behind the slatted one in a box sliding on the photometer bench, and they are arranged so that the light falls on them at equal angles. The screens are viewed from a distance of 6ft. or 7ft. through on opening in the front of a box, cords being provided for producing the traversing motion. Two "sights" set respectively at the middle of the length of the plain screen, and on the lower edge of the front opening, serve to show when the middle of the band of equal illumination is vertically above the pointer on the carriage. The photometer is found to be particularly valuable when it is desired to determine the maximum power of a variable source. When lights of different color are being compared, say a gas flame and an arc, one end of the screen shows blue strips on a yellow ground, and the other end yellow strips on a blue ground; at the centre the colors seem to blend. To facilitate the comparison of such lights, Mr. Crompton, who has been working at the subject simultaneously with the author, uses one screen tinted pale yellow and the other pale blue.

Details of construction of the new photometer are given in the paper, and the accuracy obtainable when comparing the equal lights of about eight candles stated to be about 1 per cent.

Prof. S. P. Thompson read "some notes on Photometry." The first note relates to "The Use of Two Overlapping Screens as an Isophotal," and describes the evolution of the Thompson-Starling photometer. In this instrument a prismatic block with apex upwards rests crosswise on the photometer bench, and the inclined sides are respectively illuminated by the two sources to be compared. In testing differently colored lights, colored stuffs were placed over the surfaces of the wedge. In some cases, notched and overlapping cards were used to form the overlapping surfaces; and inclination of about 70 degrees, between the two surfaces was found convenient. The second note refers to the "Periodic Principle of Photometry," and in it the author discusses the various methods which have been or may be, used for producing small difference of decreasing amount between the two sides of a photometer screen By employing a device of this kind much greater accuracy of adjustment is possible. In one form of vibration photometer worked out by the author, the paraffin blocks of a Jolly's photometer are mounted at one end of a spring, the other end being fixed to the carriage. The act of moving the carriage starts the blocks vibrating, thus producing the desired variations. In a third note the question of using "The Electric Arc as a Standard of Light," is dealt with. Since 1878 the positive crater has been used as a standard of whiteness, and last year both the author and Mr. Swinburne suggested that a given area of crater might be used as a standard of light. This proposal has since been carried out by M. Blondel. Since the intrinsic brilliancy of the crater is high, it necessitates very small apertures, or else the use of standards of large candle-power. Advantages of using powerful standards are pointed out in the paper. With a circular hole 1mm. in diameter, a standard of about 55 candles could be obtained; with such a source, benches longer than usual would be preferable. At the end of the note, the errors which may be introduced by using as an arc standard a hole in a plate of sensible thickness, when viewed obliquely, are investigated as well as those due to inaccuracy of setting the plane of a hole made in full perpendicular to the photometer bench.

AN ELECTRIC PUMPING PLANT.

An electric pumping plant has recently been installed in San Antonio, Tex. The plant acts as a supplement to two other pumping stations supplying the city with water It helps to keep up the pressure in case of fire. Three 30 horse-power 500 volt C. & C. standard motors are connected by gearing to three Goulds' triplex pumps, of a combined capacity of 2,250,000 gallons per day. The plungers are 10 inches diameter with 12 inch stroke.

Four 8-inch artesian wells flow into a stand pipe, the water in which, when at a height of 45 feet, has a pressure of 19 pounds at the base of the pipes.

The water flows from the stand pipe through a 20-inch pipe to each pump, and is discharged through the 10-inch check valve into a 20-inch pipe connected with the city mains.

The four wells are from 340 to 370 feet deep and are close to the pumping station. The water is clear and sparkling, and San Antonio has the purest and most abundant water supply of any place in Texas.

The power for the electric motors is at present supplied by the electric light and power station, but it is intended to obtain the power from generators to be driven by the water wheels driving the pumps at the head of the river stations.

FOREIGN NOTES OF INTEREST.

PROFESSOR OF ELECTRICAL ENGINEERING.—Herr Zipernowski has been appointed to the position of professor of electrical engineering, in the University of Budapest. This position is a recently established one.

SUEZ CANAL—The directors of the Suez Canal have recently established a rule requiring vessels passing in the night, to use an apparatus dividing the light from their electric projectors into two divergent streams; thus the pilots of the vessels advancing in opposite directions will not be dazzled by each other's electric lights.

ELECTRIC ELEVATED ROAD IN BERLIN.—The projected electric elevated railway in Berlin is now likely to be built. Objections to it were raised by the ecclesiastical authorities because it is to pass the Luther Church, but the Emperor, to whom the matter was referred, overruled them. It will take two years to build the road.

THE USE OF WATERFALLS.—A large electric transmission power plant is to be installed near the waterfalls of Rheinfelden, which are owned by the cantons of Aarau and Baden. The falls are estimated to be about 15,000 horse power in the upper reaches, to 8,000 in the lower. The electrical energy generated is to be used in the production of aluminum and for general industrial purposes.

Electric Railway at Hanover.—The Hanover (Germany) electric railway which was constructed by Siemens & Halske, began operation on May 20. The opening trial went off in a most satisfactory manner. The generating station has a capacity at present of 500-horse power. This will be increased as the system is enlarged.

A Curious Experiment—An interesting experiment has been made by M. D. Hurmuzescu, a foreign electrician. He sent a current through a platinum wire stretched between two supports, bringing the wire to a red heat; then, by increasing the tension on the wire, it will vibrate in a vertical plane, slowly at first and then increasing in rapidity of vibrations. Nodes can be produced in the wire and in different gases the amplitude of the vibrations differ if the tension and current are kept constant; in hydrogen it is seven times as great as in air. No vibrations are set up in carbonic anhydride.

The Copper Output—The London *Financial News* of June 30, says that the representatives of American and European producers of copper, with the exception of the agent of one small American group, have agreed to renew the compact which expired on that date, restricting the output of that metal. According to the terms of this compact the American producers undertook to limit the exports of copper from the United States to 40,000 tons a year. The American exports of the metal during the past year actually amounted to 37,000 tons.

Electrical Lead Poisoning.—The *Lancet*, of London, advances a theory that is of sufficient importance to warrant careful investigation. The small though distinct currents that are set up when the gas and water pipes are connected are, that journal states, attributed to a slow chemical change in the pipes, which may thus represent the plates of a battery. This hypothesis leads one to think of the probable nature of these changes and to wonder whether any effect is produced in the water contained in the water-pipes, or whether perchance minute traces of metal as a result of the change would find their way in solution into the water. If the latter event took place another and hitherto unsuspected source of lead poisoning might possibly be traced.

Ship Dynamos and Compass Needles.—All ships of the English navy fitted with 300 and 400 ampere dynamos are to be specially swung for the purpose of ascertaining the effect of the dynamos on the ships' compasses. The effect on all the compasses is to be specially noted, and a report forwarded to the admiralty. The Lords of the Admiralty have directed that the minimum distance between dynamos and compasses is to be 60 feet in the case of a 300 and 70 feet in the case of a 400 ampere machine, and in the light of the experiments that are now to take place, says the *Electrical Review*, of London, it would be interesting to know the distances between the dynamos and compasses of three of Her Majesty's ships that have recently been damaged by getting into positions at direct variance with the navigator's intentions.

Testing Incandescent Lamps.—A simple method of testing incandescent lamps as to the condition of the vacuum and probable life of the filaments is mentioned in a French paper. As large a number of lamps as possible is arranged on a testboard provided with a rheostat, care being taken only to have at one time lamps of equal voltage and luminous intensity. These lamps are then tested at a low voltage, which allows of those of a darker red than the average being immediately observed. These are noted as doubtful; then current at a higher pressure is passed and the less brilliant lamps noted. Finally, the lamps are energized at from seven to eight volts higher than the normal. Some of the lamps will not withstand this excess of pressure, and it is suggested that they should be returned to the makers. The lamps already noted as doubtful are afterwards run for twenty-four hours at their normal voltage, at the end of which very few remain intact, and even these cannot, it is said, be relied upon.

Electric Mining in New Zealand—The New Zealand Miners seem to have been among the first to recognize the advantages of electric power in mine operations. As far back as 1887 a Brush plant was put in on the Phœnix Gold mine, at Skipper's Creek, consisting of two 65-light dynamos, driven by two 6-feet Pelton wheels, running at 160 revolutions per minute under a head of 165 feet. These give a full load of 20 amperes at 2,000 volts, or about 54 H. P., which is conveyed nearly two miles, by four No. 8 B.W.G. bare copper wires to the Victoria dynamo that serves as a motor, driving the stamping battery at 80 blows a minute, and working also the air compressor and a stone-breaker. The plant is still successfully working, and about two years ago an adjacent mine adopted a similar plant about 50 H. P., for working a bucket dredge which is used to scoop up the bed of the river, which is carefully washed in the improved fashion for the purpose of sorting out the grains of gold which are found mixed with the river sand.

Electric City.—In our issue of July 1, was printed a paragraph headed "English Humor." A correspondent calls our attention to the fact that there is another organized community not far from New York city, which is purely electric in its nomenclature. He refers to Electric City, Ocean Co., N. J. In this modern city are found Westinghouse avenue, Thomson avenue, Edison avenue, and many other thoroughfares bearing the names of celebrated electricians. Dr. De Lery, ex-president of a prominent dynamo company in Baltimore, Md, was the founder of Electric City, where he has a handsome home. Our correspondent thinks electrical people of this vicinity in search of country homes should interest themselves in this place, where familiar names would be seen and heard on every corner. Several prominent electrical men own lots in Electric City.

American Institute of Electrical Engineers.—The latest catalogue of the American Institute of Electrical Engineers is revised to July 1, and embraces some new features. Besides the usual list of members a new one is given, showing the geographical distribution of the membership—that is, according to cities. A calendar is also given showing the dates of regular meetings during the second half of this year and the first half of next, and with other changes the catalogue is made more valuable. Members, and non-members can obtain a copy by applying to the secretary, Mr. Ralph W. Pope, either at the Institute headquarters, 12 West 31st street, New York city, or at the World's Fair headquarters, Chicago.

New Corporations.—The following named corporations have been organized in California recently:

Dos Pueblos Water Company, Naples, Cal. Capital stock, $300,000. Directors: J. H. Williams, A. P. Williams, J. P. Brown, T. D. Gaman and Geo. S. Edwards.

Mutual Building and Investment Company, Alameda, Cal. Capital stock, $300,000. Directors: George B. Clark, W. F. Schilte, W. H. Pennie, J. H. Ponder and J. P. Striegel.

City Development Company, San Francisco. Capital stock, $50,000. Directors: Louis Landler, M. S. Eisner, C. Cohn, T. E. Ryan and James P. Sweeney.

No Patent Record This Week.—For some unknown reason our copy of the *Patent Gazette* for this week has not yet reached us. This explains the absence in this issue of our usual patent page.

ELECTRICITY USED IN BOILER PRESERVATION.

A new method of cleansing and preserving steam boilers against pitting and general corosion was tried on the steamship Tenasserim, Glasgow, by the Electric Anticorrosion Company, of Cardiff, Wales.

Electrodes are placed in the boiler and currents passed from them to the boiler shell. The current is controlled by an automatic mechanism. When the current is passing from the anodes suspended in the boiler to the shell, hydrogen is liberated on the shell and tubes, and oxygen on the anodes; then by means of the depolarizing apparatus the action is changed, and most of this hydrogen and oxygen recombine, the result being that during the first period the hydrogen performs two distinct functions; first, it disintegrates mechanically by its volume the scale formed on the shell and tubes; and secondly, some of the hydrogen combining chemically with the oxygen of the oxide of iron on the shell and tubes reduces this oxide to metallic iron, thus doing away with the oxidation of the boiler without wearing away the metal.

It is claimed that it will be impossible for corrosion to take place on the interior of the boiler shell, as oxidation cannot be carried on in the presence of hydrogen gas.

By this process an old boiler may be renovated, the scale removed and a deposit of iron formed on the shell and tubes.

MARRIED.—Dr. F. A. C. Perrine and Miss Margaret J. Roebling were married at Trenton, N. J, on June 28, last. It was an elegant affair. Dr. and Mrs. Perrine will return to Palo Alto, Cal., where the Doctor is engaged as professor of electrical engineering in the Leland Stanford, Jr., University.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, July 8, 1893.

F. W. ROYCE, of Washington, D. C., spent a day in New York recently, visiting friends in this city.

THE EDISON ELECTRIC ILLUMINATING CO., of this city, has declared a quarterly dividend of 1½ per cent., payable August 1, next.

MR. HERBERT LAWS WEBB, of the Electric Selector and Signal Co., 45 Broadway, returned from Europe on Wednesday, June 28.

MR. H. L. SHIPPY, of the John A. Roebling's Son's Company, Trenton, N. J., has recently returned from Europe, where he has been on an extended visit.

A CIRCULAR is being issued by Henry R. Worthington, 86 and 88 Liberty street, city, giving an account of the exhibition at the World's Fair of the Worthington pumping engines.

MR. SHAW, of Charles E. Chapin's general electric supplies and manufacturers' agency, 136 Liberty street, city, has just returned from the West. He had a successful business trip.

AMONG those recently returning from Europe are Messrs. E. A. Leslie and H. J. Smith, prominent members of the electrical fraternity in New York city. They look like "blarsted hinglishmen, you know."

MR. GEORGE T. MANSON, general superintendent of the Okonite Company, has become a foreign citizen. He is now residing in that beautiful suburb of New York—Montclair, N. J. New Jersey is absorbing New York's best people right along.

MR. G. d' INFREVILLE, inventor and maker of the celebrated "Wasteless" battery zincs, has moved to larger quarters at 10 Desbrosses street. This change was made necessary by the rapid expansion of his business and consequent demand for these very desirable zincs.

PRESIDENT DANIEL F. LEWIS, of the Brooklyn City Railroad, on June 28 completed his twenty-fifth year of continuous service in the Brooklyn City Railroad Company. His first position with the company was that of ticket agent.

AFTER an absence of several weeks Mr. M. M. Hayden, of the Law Battery Company, has returned to New York with his pockets full of orders taken in the West. Mr. Hayden is the inventor of the all carbon circular battery cup with screw cap.

THE GAS COMMISSION has directed that Jackson, Abingdon and Christopher Parks be lighted by electricity. They have also ordered forty electric lamps for Canal, Gold, Pearl, Worth, State, Wooster, Duane, Reade, White and Morton streets.

MR. ARTHUR E. BOWERS, New York manager for Claflin & Kimball, incorporated, 116 Bedford street, Boston, general selling agents for the "Novak" incandescent lamp, reports large sales of these well-known lamps. Mr. Bowers' office is at 95 Nassau street.

MR. LOUIS NAHM, secretary and treasurer of the American Electrical Manufacturing Company, of St. Louis, was in New York the past week. Mr. Nahm made an arrangement with Stanley & Patterson, 32 Frankfort street, city, by whom the popular lamp made by the American Company will be sold—here in the East.

THE ELSON & BREWSTER ENGINEERING CO., 122 Liberty street, city, is a firm of electrical and mechanical engineers and contractors. It does mechanical draughting and handles a full line of the fan motors of the Hill Electric Company, of Boston, which concern it represents here. The members of the company are L. E. Elson, M. E. and F. C. Brewster.

THE HAZELTON BOILER COMPANY, city, has recently issued a circular to the trade giving notes about the Porcupine boiler made by this company. One hundred thousand horse power of this water tube boiler are in successful operation in various industries. The company is prepared to furnish plants of boilers of any desired capacity.

COL. DAVID B. PARKER, vice president and general manager of the Bell Telephone Company, of Buffalo, was in town recently. Col. Parker, besides having an extensive knowledge of the telephone business is one of the most popular men in the electrical industry. He met with a warm welcome by his many New York friends.

THE BROOKLYN ELECTRIC MANUFACTURING CO., 286-290 Graham street, Brooklyn, has just completed a large order for 1,000 ampere switches for the Edison Illuminating Co., of Brooklyn. These switches were made from special plans. The company makes electrical apparatus from drawings, does experimental work, and does considerable business in developing inventions, etc. It is run by thoroughly experienced men.

STANLEY & PATTERSON, 32 Frankfort street, city, have secured the agency for the American lamp made by the American Electrical Manufacturing Company, of St. Louis, Mo. These lamps are recommended because of their long life, brilliancy and non-blackening properties. The American Company made a good deal, when it appointed Stanley & Patterson as agents, as they are hustlers. They disposed of thousands of the lamps, during the first week after taking the agency.

C. S. Merrill, 38 Cortlandt street, city, agent for the Underwood Cotton Leather Belting, continues to do an excellent belt business among electric light and power companies. He is shortening a 41 foot 12 inch cotton leather belt for the electric light plant of the Arion Society. This belt has been in use six years, and was so full of oil that the ends had to be chemically treated before the cement would hold Mr. Merrill claims that the oil in his belts makes them adhere more strongly to the pulleys.

The Acme storage battery car is still making daily trips on the Ninth avenue surface line, and giving the best of service. It was started on the first of last November and the original batteries and plates are still in use, and show no signs of deterioration. The car has been run regularly since that time, with the exception of one month, when it was laid off. During that month the batteries retained their charge with no perceptible loss, showing a voltage of 2½ when the car was again started. This car was fully described and illustrated in our issue of January 21, 1893.

The Dahl Electric Co., 120 Liberty street, city, is now prepared to take orders for 3, 6 and 10 H.P., alternating current motors to be delivered in thirty days. It can deliver one H.P. motors immediately. This latter type of machine is being improved in several details of construction. These changes are made in order to enable any one, however inexperienced he may be, to get the best work from the motor, and do not involve any essential feature. Longer springs are put on the brush holders, for instance, so as to secure a finer adjustment, and consequently greater efficiency. These alternating current motors are selling on their merits, and of the difficu'ties heretofore met in the practical operation of this class of motors seem to have been successfully overcome in this one. Mr. F. H. Leonard reports that he is doing a very nice business with these motors, and it is steadily increasing as they become better known W. T. H.

TRADE NOTES.

The Buckeye Electric Company reports that its entire output is being absorbed, the demand for its double coiled filament, 32 c. p. lamp being enormous.

A. L. Ide & Son, the manufacturers of the "Ideal" engine, propose moving their plant from Springfield, Ill., to Des Moines, Ia.

The Fort Wayne Electric Company is doing a rushing business. The aggregate sales of arc light apparatus for the five months following Jan 1, 1893, amounts to 6,866 lamp capacity (lamps, dynamos and station fittings). The sales for the same period in 1893 were 4,965; for 1891, they were 4,195.

The Massachusetts Chemical Company, of Boston, reports a lively demand for its well-known Insullac. The managers of twelve large electric railroads in this country, will not accept new motors unless they are insulated with Insullac. The foreign trade of this company is also brisk, large shipments being made to European ports.

The W. S. Hill Electric Co., 133 Oliver street, Boston, Mass., is out with a brand new and artistically devised catalogue of the switches and rheostats, made by this concern. Standard sizes are always kept on hand, while special sizes are made to order. This company's goods are well-known throughout the trade for their high grade.

The R. A. Crawford Manufacturing Co., 35 Water street, Pittsburg, Pa., has issued a well illustrated catalogue of its patent Automatic Wheel Guard and Pick-up Fenders for cars. These devices are adapted to all traction cars, and are extensively and successfully used on several of the Pittsburgh street car lines. Several half tone illustrations are given, showing the practical application of both devices. The officers of the company are: R. A. Crawford, president; S. D. Warmcastle, treasurer; W. J. Crawford, secretary. The New England agent is the Consolidated Railway Supply Co., Boston, Mass.

The Carpenter Enamel Rheostat Co., Bridgeport, Ct., has just issued a neat catalogue of its well-known devices. It contains descriptions of several novelties of interest to all electrical people, besides its standard goods. The officers of this company are: H. Ward Leonard, president; George H. Finn, vice president; Charles Shain, 136 Liberty street, New York city, is general selling agent.

Price List No. 6 has just been issued by the Okonite Company, Ltd., from the New York headquarters, 13 Park Row. It is a pamphlet of over fifty pages, containing a fund of valuable information concerning the celebrated product of the company and should be in the possession of every one interested in the perfect insulation of telephone, telegraph, electric light and power wires and cables. The covers are rich in appearance and elaborately designed and show a lithographed title into which the well-known Okonite trade-mark enters conspicuously, the whole showing off finely on a gold background. There is also a view of the company's extensive works at Passaic, N. J., and Manchester, England. The company has made an innovation in the old method of arranging by making three thicknesses of insulation, covering low tension currents, or currents used for incandescent lighting, bell work, telephone and telegraph; medium tension currents; or currents more especially adapted for electric railways and telegraph, and high tension currents, especially adapted for currents of high voltage. The price list embraces line wires, tubing and tapes, both Okonite and Manson, the former being used especially where high insulation is a factor, and the latter, or Manson tape, for protection against abrasion and dampness.

Boiler Compound.—Steam users would further their own interests by giving Lord's Boiler Compound a trial, if they have not already done so. This compound is used in over 3,000 steam plants in North America and satisfaction is given in every case. Address George W. Lord, 316 Union street, Philadelphia, for further particulars.

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, JULY 22, 1893.

CONTENTS.

DERELICTION IN THE PATENT OFFICE.

We have for two successive weeks failed to receive our copy of the *Patent Office Gazette*, consequently we are unable to publish our usual patent record this week. As no explanation has been offered by the Patent Office authorities we have entered a complaint with the Commissioner of Patents and asked him to investigate the matter. We trust that we may be enabled to resume the service next week.

MAKING NEW YORK ITS HEADQUARTERS.

It is reported that the General Electric Company proposes to close its Boston headquarters, and transfer the business to the New York office. The railway department, it is said, will be transferred to New York at once, but as regards the other departments, nothing definite has been ascertained It is claimed that it will be easier to transact the railway business in New York than in Boston, and the move is looked upon by some as indicating the commencement of hostilities with the Westinghouse interests over the railway business.

THE SEARCH LIGHT IN WARFARE.

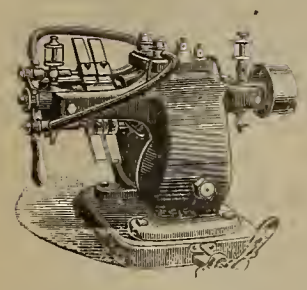
Some experiments are being carried on at the torpedo station, Newport, R. I., which, aside from their scientific interest, will be of real practical value in warfare. The objects sought are to determine the best color to paint torpedo boats in order to avoid detection in the glare of the search light, and, on the other hand, to test the value of the search light in revealing approaching torpedo boats.

NEWARK.

We devote almost the entire space in our reading columns this issue to a description and illustration of the electrical and kindred interests of Newark, N. J. It will be seen that these interests are large and numerous, and very many familiar names appear among them. Necessarily only a general description of each concern can be given in our limited space, but enough is said to convey a comprehensive idea of the character and scope of each firm or company described. Newark is essentially an industrial city. Indeed it ranks among the most important manufacturing cities in the country, and, we believe, no other city in the world carries on so great a variety of manufacturing as it does. It has a population now of nearly 200,000 people, a great majority of whom are artisans. Newark is about eight miles from New York city, on the line of all the railroads running from the New Jersey shore opposite New York city, with one exception, and, naturally, it is to a very large extent the manufacturing headquarters of concerns doing business in New York city. Its electrical interests are very large and important, and a great many of the greatest of electrical inventions were given birth here. Not far from Newark is the historic Menlo Park, "the birthplace of the incandescent lamp," and one of its suburbs is West Orange, where Mr. Thomas A. Edison's laboratory and residence are located. Were we to attempt to enumerate the important electrical work that has been done in Newark and its vicinity, and specially mention those who give their best time and thought to its development, we would require a volume. History, however, has recorded these deeds and to us remains the simple duty of chronicling improvements and advances made in the various branches of the trade, based upon this early work.

ELECTRICAL AND KINDRED INTERESTS OF NEWARK, N. J.

THE HANSON AND VAN WINKLE COMPANY.



The art of electro-plating is one of the long established branches of electrical industry. Improvements in the details of the system are, however, being constantly made, and special machines and apparatus for this purpose are being turned out by various electrical houses throughout the country.

Fig. 1 illustrates a new special dynamo for plating work. The machine has many good points of construction. The field magnets are of wrought iron and have a round core for the field spool, which is wound on a bobbin and is easily replaced. The commutator is easily detached and new segments placed in position. The armature is away from the base of the machine and is protected from dirt and oil. The machine is very simple, therefore not likely to get out of order.

The various parts of this machine are so constructed as to allow of their being easily dissembled for repair, or for the substitution of new parts. This is an important factor, as in most cases a machine when only slightly damaged has to be sent to the factory for repairs. The company manufacturing this machine was the first to introduce electro-plating dynamos in this country, and naturally takes pride in this its latest and most improved machine.

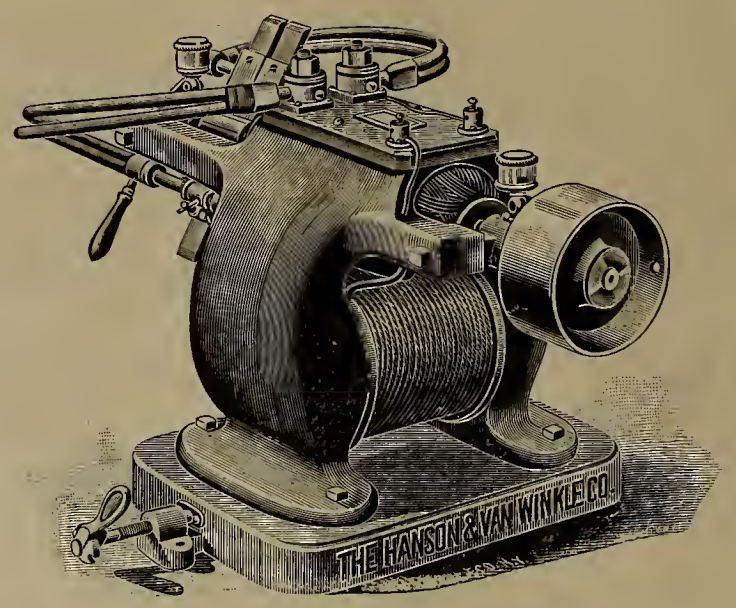


FIG. 1.

The great advantage of these boards over others is that the resistance may be gradually and smoothly regulated, not by steps as in the ordinary form. For special plating work it is almost imperative to use a board of this description as the regulation in the old kind was not sufficiently even. The wire ribbons are made of different thickness for use with dynamos of greater or less power.

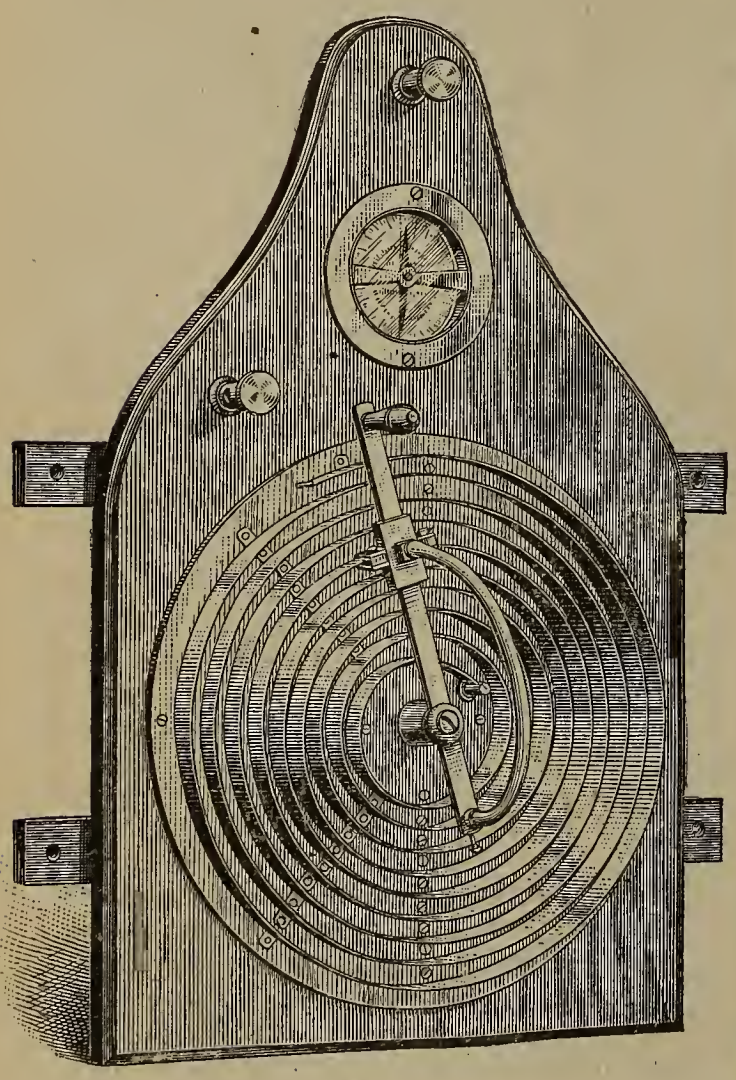


FIG. 2.

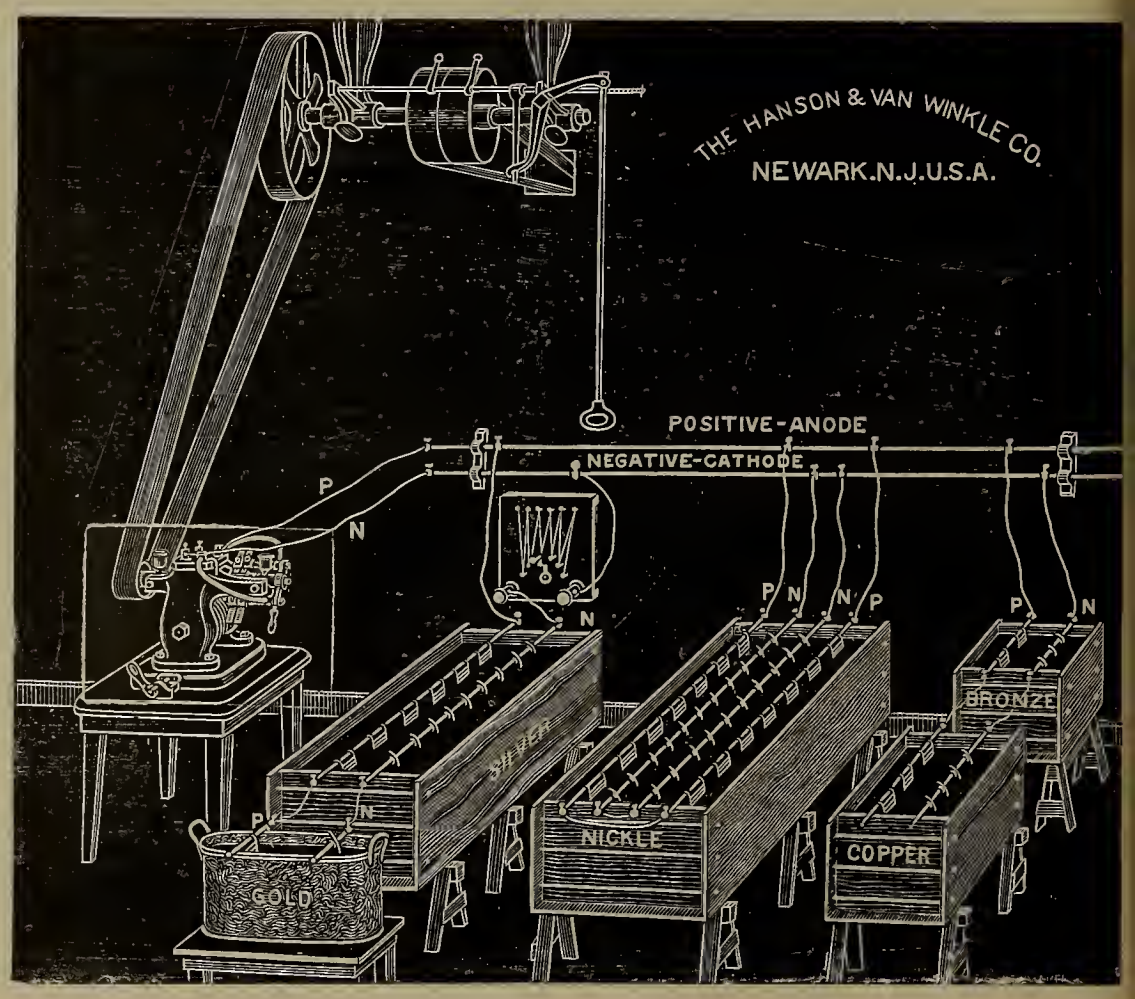


FIG. 3.

An ingenious rheostat is shown in Fig. 2. The spiral is of German silver and resistance is thrown in or out, by moving the lever which carries a sliding contact. A galvanometer is placed on the board to determine the direction of the current in the wire. Ammeters and voltmeters are also placed on these boards.

A complete electro-plating plant is shown in Fig. 3. The method of electrical connections is here clearly illustrated.

For small plating outfits a few cells of primary battery may be used. Fig. 4 illustrates a plant of this kind. This is convenient for experimental use.

The above apparatus is manufactured by the Hanson & Van Winkle Company, 219-221 Market street, Newark, N. J.

GOULD & EBERHARDT.

One of the chief industries of Newark, is that of manufacturing machinery of all descriptions and prominent in the line is the firm of Gould & Eberhardt, 97 to

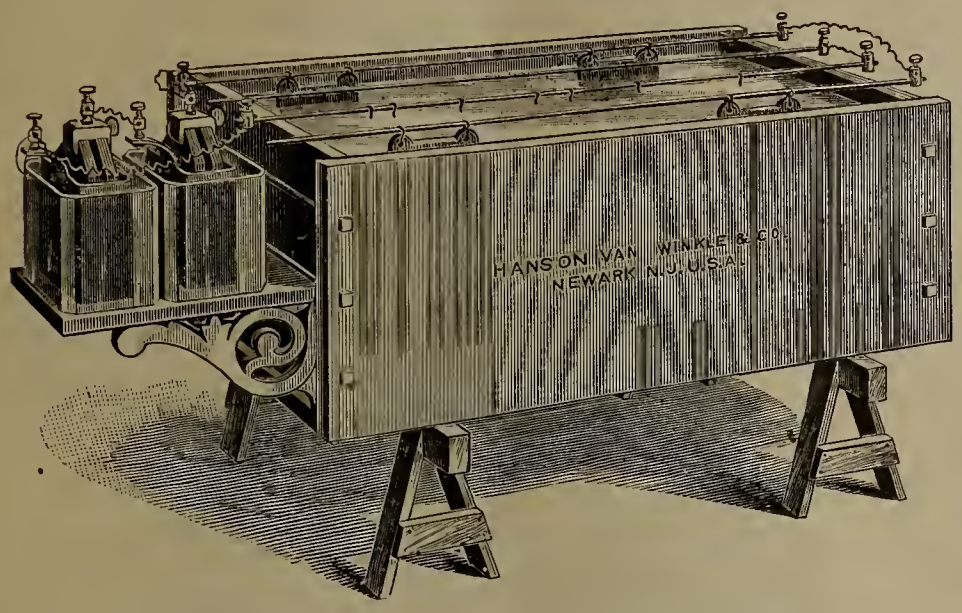


FIG. 4—BATTERY PLATING OUTFIT.

111 N. J. R. R. avenue, Newark, N. J., manufacturers of drill presses, shapers, gear cutters, etc. The machines made by this firm are of the best designs and embody all the latest principles. They are used extensively throughout the United States and Europe, by the largest electrical manufacturing companies.

Fig. 1 illustrates the new upright drill press, Eberhardt patent. It is claimed to be the most efficient and convenient drill press ever placed on the market. The shafts are large and have long bearings and the spindles are made of special spindle steel. There are several new features about this drill which are of great importance. An index is placed over each step of the lower cone whereby the operator can see where to place the belt for the size of drill he is about to use. Another index is placed on the feed rod which tells the proper feed for the size ot drill used. A coarse feed is provided for reaming or

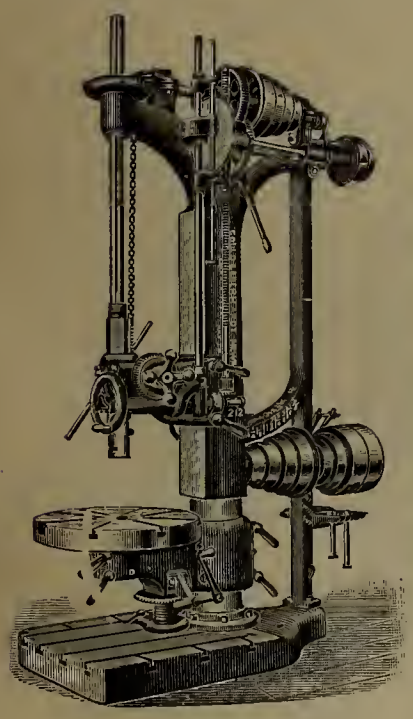


FIG. 1.

finishing. There are also many improvements in other details.

Fig. 2 illustrates the 26-inch gear cutter, lever feed, made by this firm. This is a reasonable price machine, is designed for light work and will cut gears from 0 to 26 inches in diameter and 6 inch pitch, with accuracy and dispatch. It is substantially built and is finished with an index and change wheels for cutting all numbers from 0 up to 50 and nearly every number up to 200.

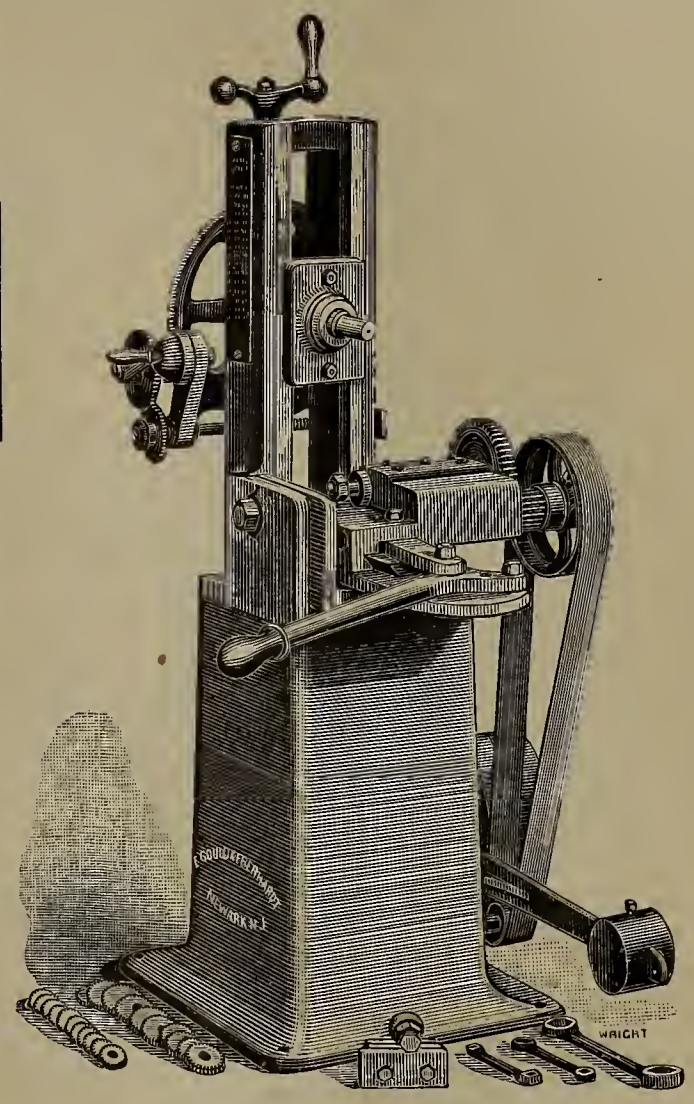


FIG. 2.

The counter pulleys are 9x2½ and should make 95 revolutions.

Eberhardt's patent shaper is illustrated in Fig. 3.

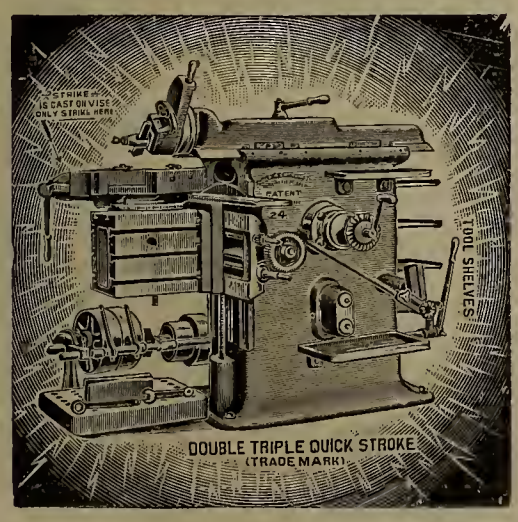


FIG. 3.

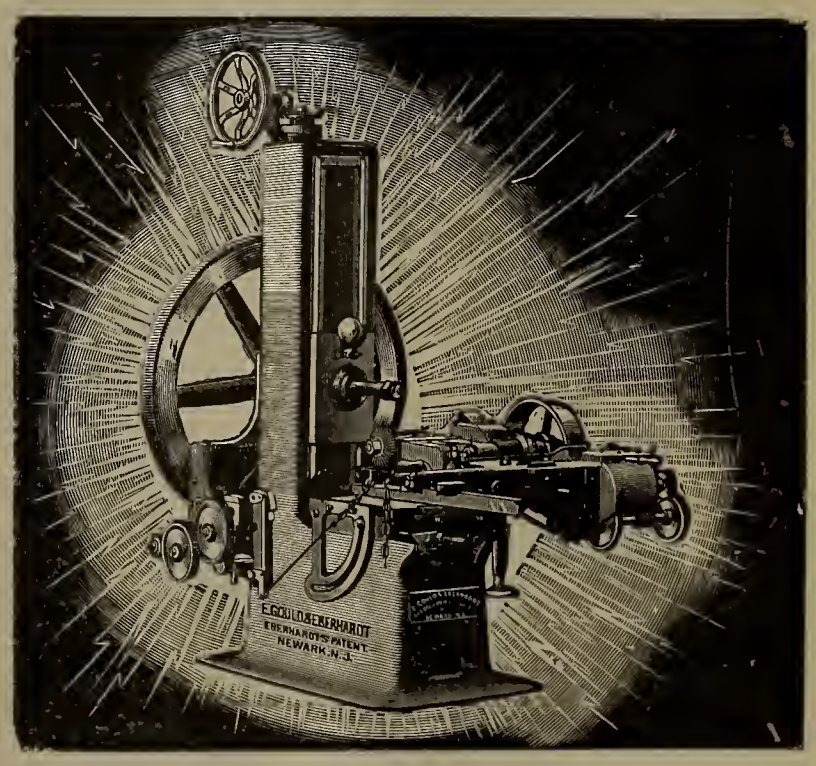


FIG. 4.

This machine is designed for finishing, planing and shaping metal articles. It has a wide range of usefulness and can be applied to many kinds of work. The machine is compact in size and is finished and constructed in the best possible manner. It is used by many of the large electrical manufacturing companies throughout the country.

Fig. 4 illustrates Eberhardt's patent entirely automatic gear cutter. The machine cuts gear wheels of many sizes and has the great advantage of being entirely automatic in its operation. It is claimed that it cuts nearly all the motor gear wheels made in this country, and a more recent machine just coming out on the market is producing, it is said, 100 per cent. more gears per day than any other machine ever made. This machine is patented in Europe and some firms there use as many as fifteen of them. In this country one firm alone has twenty-four of them in operation.

BACKUS WATER MOTOR CO.

With the advent of warm weather the fan motor business is receiving a fresh impetus. There is no question but the added comfort derived from these breezy little machines more than repays the cost of installation.

Fig. 1 illustrates a handsome compact ceiling fan with motor. The motor is enclosed within a small drum, 10 inches in diameter made of embossed brass and finished in polished brass or nickel. Each fan has a motor attached to the pipe supporting it. The brushes are carbon pencils and are automatically fed on the commutator by springs. They are renewed about once in two years.

A very ingenious oiling device is used with these motors as shown in Fig. 2. The case hardened collar revolves on the bearing, and the whole is submerged in the oil well. It is necessary to oil but once a year. There is no trouble from the oil dripping with this bearing.

The motors are wound for 110 volts. The fan arms are made of wood finished in any desired style.

Fig. 3 illustrates the Backus Speed Regulator by means of which the speed of the motor may be regulated.

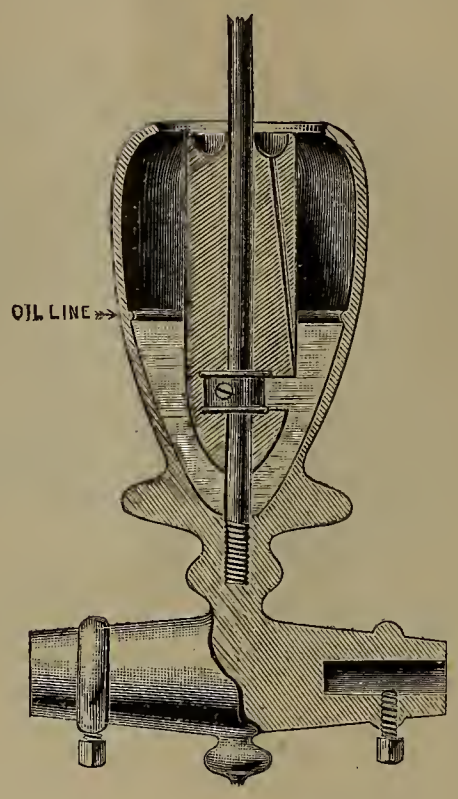


FIG. 2.

Although the standard fans made by this company are wound for 110 volt circuits, special motors are constructed suitable for any voltage. When necessary resistance plates are placed in series with the motor to reduce the current so that a 110 volt motor may be used on a 220 or 500 volt circuit.

That the fan motor business will increase from year to year is a well known fact. From using fans in public places, private houses will generally adopt them. When the fan motor comes to be of general use in the household, the business will be of much greater proportions than it is today.

The Backus Electric Ceiling Fans and apparatus are made by the Backus Manufacturing Company, Newark, N. J.

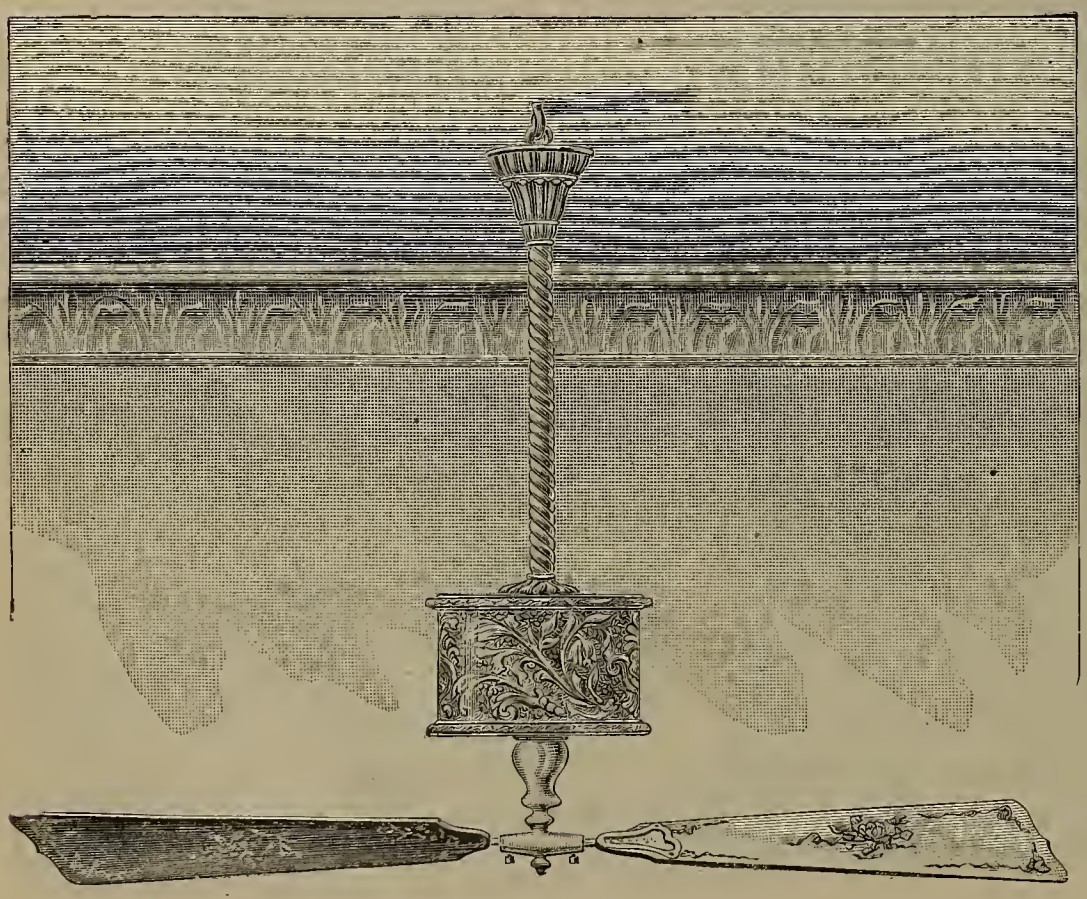


FIG. 1.

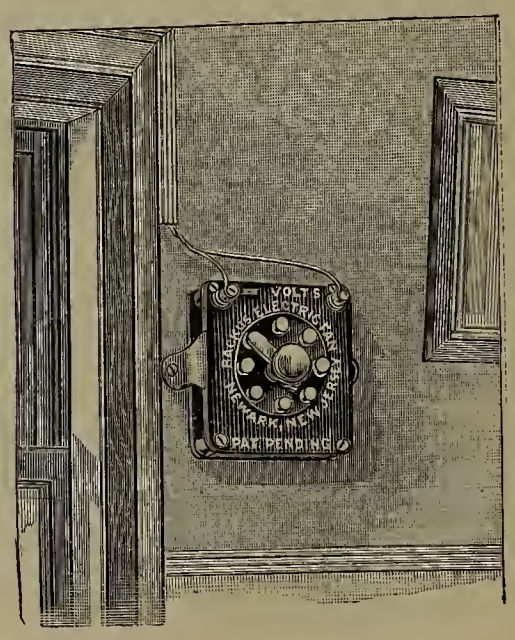


FIG. 3.

These handsome and compact ceiling fan motors are of service in a great variety of places, including hotels, cafés, restaurants, drug stores, as well as in private houses, where they serve as an ornament as well as an article of utility.

CROCKER-WHEELER ELECTRIC CO.

One of Newark's industries which is a credit to this great industrial centre, is the manufacturing establishment of the Crocker-Wheeler Electric Company, situated at Ampere, a suburb of Newark. The factory is

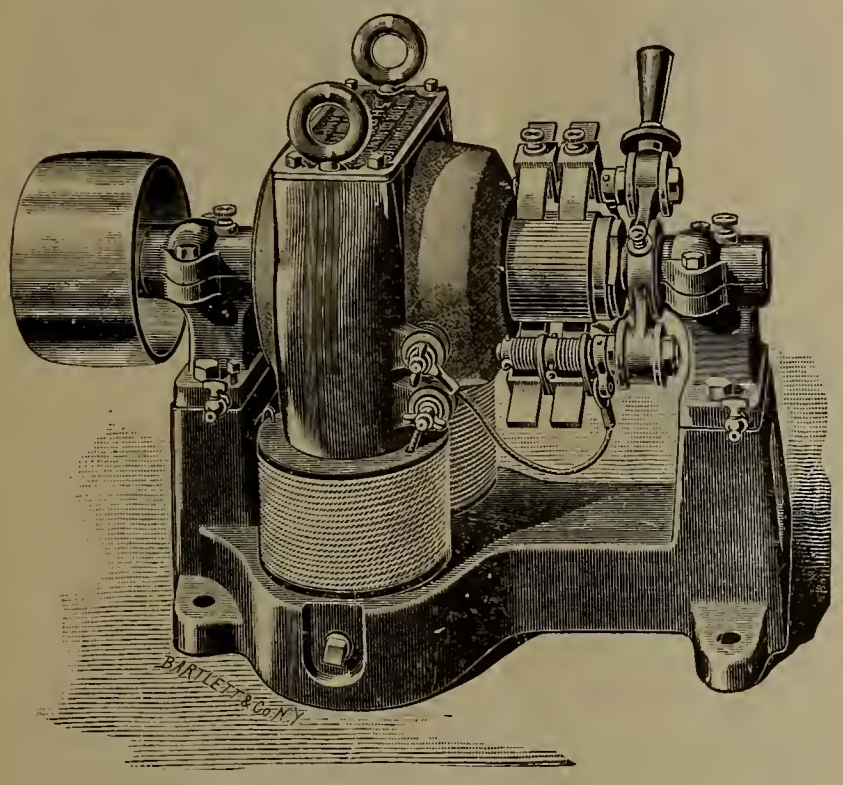


FIG. 1.

built in the most approved modern manner and serves as a model electrical manufacturing plant.

Perhaps the most interesting feature of this plant is the almost entire absence of belting and shafting. The machine tools are driven by motors attached securely to the frame. A tool may thus be set up in any convenient place and the wires brought to it from the nearest main. The factory is divided into several parts where everything is arranged to facilitate the handling and manufacture of the electrical appliances made by the company. A more complete description of this factory is given in the ELECTRICAL AGE of May 27, 1893.

The Crocker-Wheeler dynamos and motors have a high reputation on account of their great excellence in design and workmanship. These machines are used

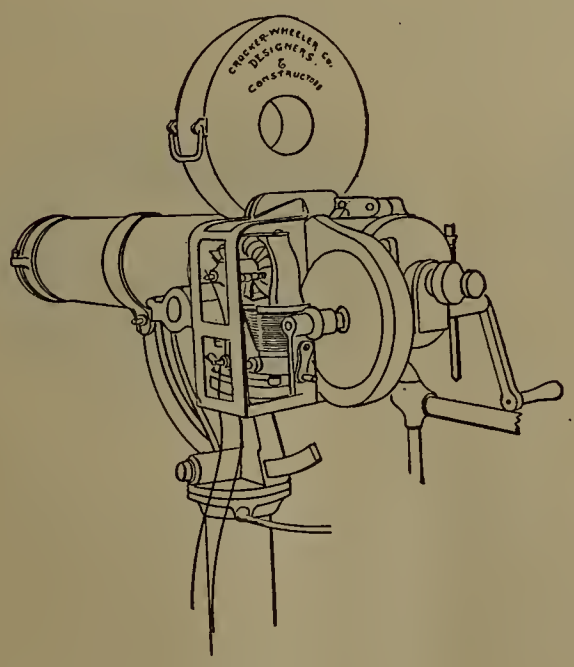


FIG. 4.

for a great variety of purposes and because of their compactness and simplicity, are exceedingly useful both in the household and in business.

A 5-horse power perfected motor is illustrated in Fig. 1. This motor is of such construction as to be strong and yet comparatively light. It may be applied to numberless uses and will run economically even when not at full load.

Fig. 2 illustrates a constant current motor designed for arc light circuits. These motors are wound for 5, 6, 9, 15, or 18 ampere circuits. Sizes of ¼ horse power and above are provided with an automatic centrifugal regulator and the $\frac{1}{6}$-horse power size is furnished with a hand or treadle regulator. As shown by the illustration,

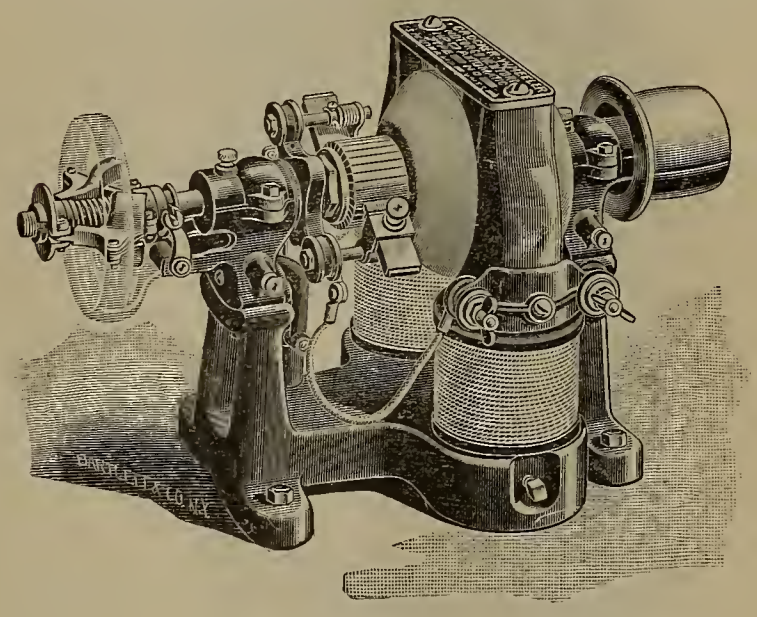


FIG. 2.

the machine is very solid and compact, the governer being set directly on the main shaft.

The electric lighting dynamos made by the Crocker-Wheeler Electric Company stand especially high in ex-

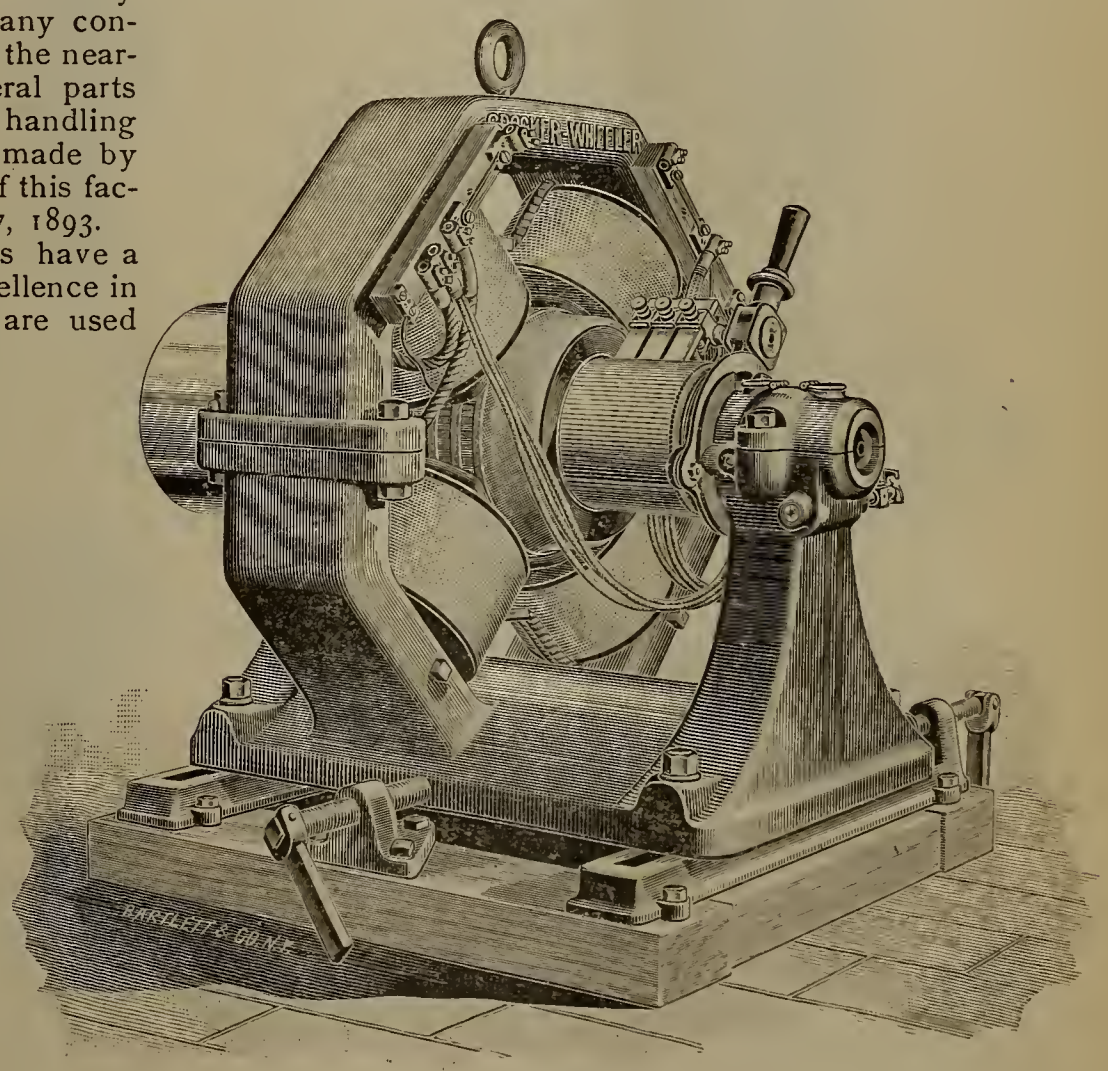


FIG. 3.

cellence, because of their fine design and workmanship. The machines are made in all the standard sizes. Those above 10 kilowatts are of the multipolar type and

are 3 per cent over compounded. Fig. 3 illustrates one of the company's electric lighting dynamos.

Owing to the extreme flexibility of the electric power system the small electric motor is taking the place of a great many hand machines. We give in Fig. 4 an illustration of a motor applied to a gatling gun and in Fig. 5 an illustration of an electric cloth cutter. The combined motor and drill press (Fig. 6.) is an application of

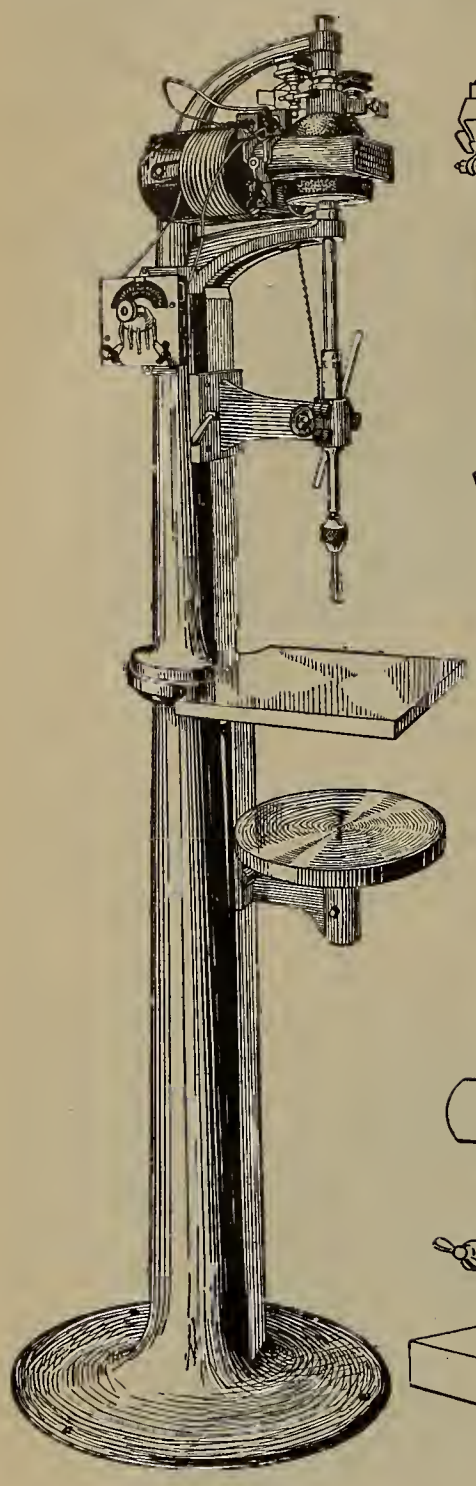


FIG. 6.

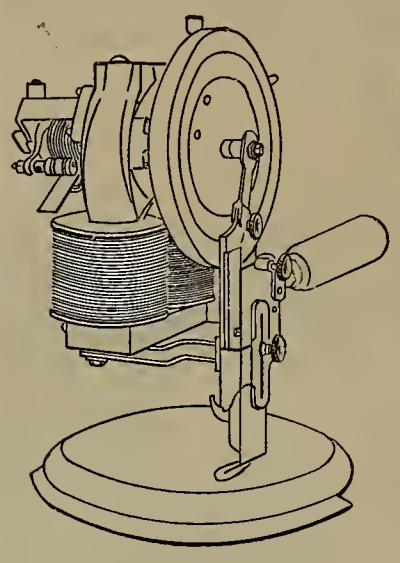


FIG. 5.

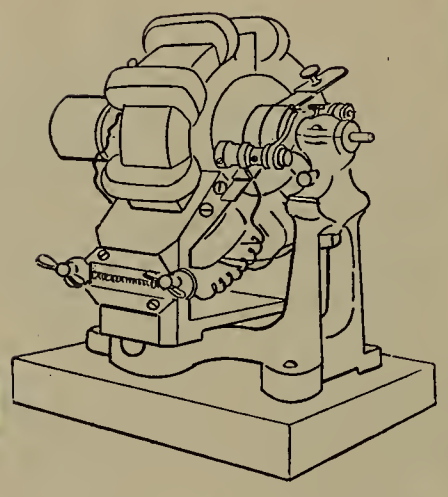


FIG. 7.

an electric motor to a machine tool which is of great service to the mechanic. The size of drill press shown is of ¼-horse power.

An alternating current dynamo which was built by this company for the Columbia College laboratory is illustrated in Fig. 7.

THE FIBRONE TERRALOID CO.

The electrical industry has many branches, some of which, though not in themselves purely electrical, are closely allied to the mother industry. The manufacture of insulating material is one of these and has become a business of great magnitude.

The Fibrone Company of New York and the Terraloid Plastic Department of the late Crane-Cahoone-Barnet Company of Newark, N. J., are consolidated, under the name of The Fibrone Terraloid Company, the combined plant being at 91 Oliver street, Newark, N. J.

This company is the manufacturer of the well-known Fibrone and Terraloid supplies, the former of which is a perfect substitute for hard rubber. Fig. 1 illustrates a bell box, cap and back made of Fibrone. It can be made in all colors and finished in imitation of marble

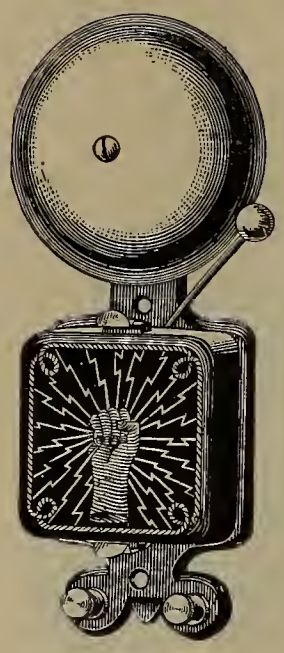


FIG. 1.

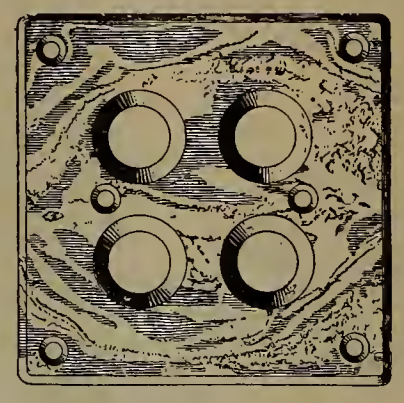


FIG. 2.

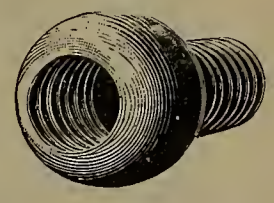


FIG. 4.

and wood. Plates for push buttons may be made in a very artistic manner, serving as ornaments as well as for use. A four hole push plate is shown in Fig. 2.

A switch handle is, especially in large sizes, in a try-

FIG. 3.

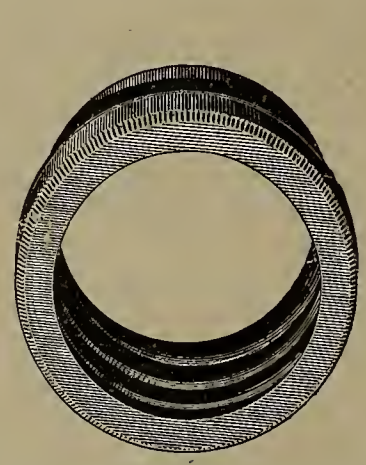


FIG. 5.

FIG. 7.

ing position. Fig. 3 illustrates one style of switch-handles made of Fibrone, which possesses strength, durability and insulating properties. These properties are secured in a large degree, and are necessary in a

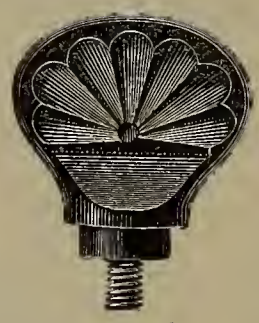


FIG. 6.

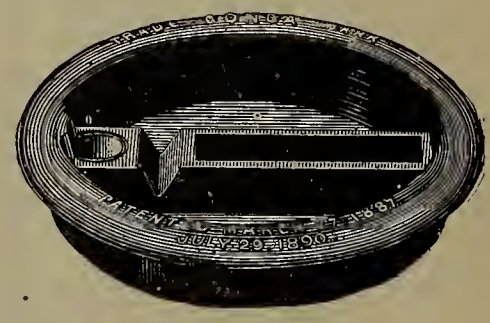


FIG. 8.

switch-handle which, usually has a vast amount of work imposed upon it, especially in the larger sizes.

Fig. 4 shows a nipple for socket bushings for incandescent lamps, and an Edison lamp ring is shown in Fig. 5.

A 10-ampere switch-handle and lamp key are illustrated in Figs. 6 and 7, and Fig. 8. shows a battery jar cover.

These goods are well and favorably known throughout the country, and the test of time has proved them to be what is claimed for them.

HEWES & PHILLIPS IRON WORKS.

The standard steam engine of the world is that of the Corliss type, this engine having been before the public for about 40 years. Its popularity is increasing and the demand for it at the present day, is very large.

The Corliss engine is manufactured by several different engine builders throughout the country. Their engines are all of the same general type, but differ in regard to the improvements made by the several companies. An improved Corliss steam engine is made by the Hewes & Phillips Iron Works, corner of Orange and Ogden streets, Newark, N. J., and which has met with long continued success by steam power users.

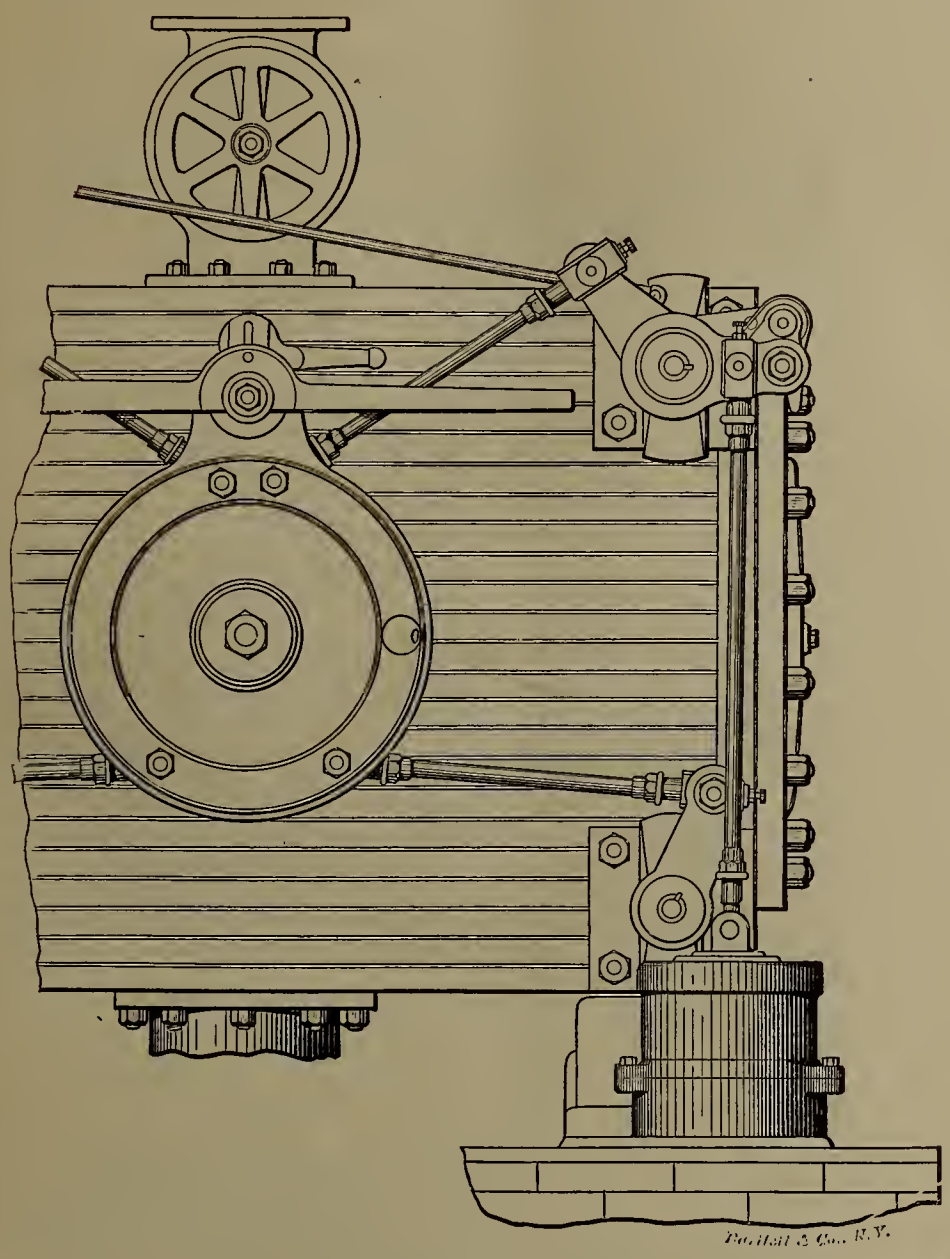


FIG. 1.—VIEW OF VALVE GEAR.

As one of the most important parts of an engine is the valve gear, we herewith illustrate (Fig. 1) a portion of the steam cylinder giving a general view of the valve gear, as made at the above mentioned works. This gear admits the steam at the beginning of the stroke, maintains the boiler pressure up to the point of cut off, when the steam valve instantly closes and the stroke finished by means of the expansive force of the steam. The exhaust is free and care is taken to isolate the cold exhaust from again coming in contact with the cylinder.

The gear consists of four cylindrical valves, operated by a central swing or wrist plate. The two upper valves admit the steam, the two lower are exhaust valves. The latter, as they are placed below the counter bore, relieve the cylinder of all condensation water, thus dispensing with drain cocks. The exhaust being free from back pressure, "wire drawing" of the steam is prevented.

The cylinder is constructed on special designs made by the builders and embodies several features of merit over other makes. The most direct route for the steam is provided and the exhaust steam is isolated from contact with the live steam cylinder.

The frame is made heavy and of graceful outline. A centre leg is provided which supports the front end of the crosshead slides and extends to the outermost end of the backbone.

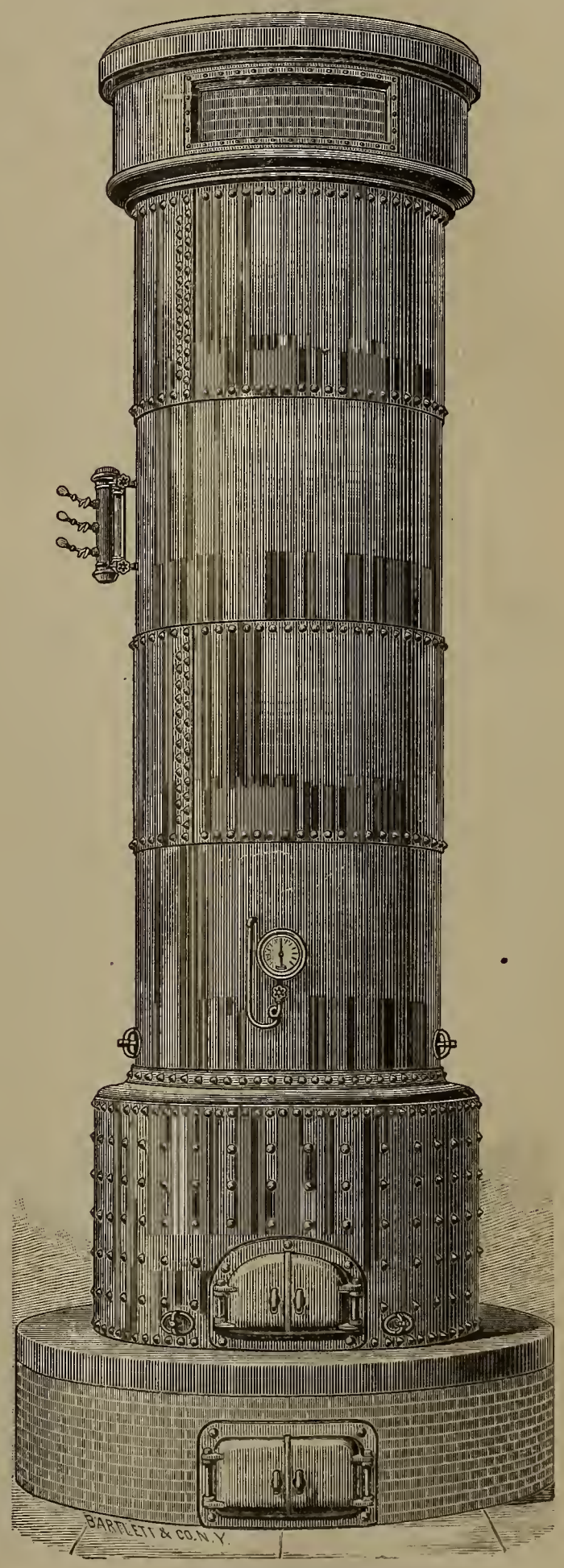


FIG. 3.—MANNING VERTICAL BOILER.

The other parts of the engine are made in a substantial manner and are adjustable to wear. The result is an engine capable of maintianing a heavy overload.

Fig. 2 illustrates a tandem compound engine. This engine preserves a uniform motion throughout the stroke and the saving of fuel, by using a com-

pound engine is an important item in the running cost. Triple and quadruple expansion engines are also built at these works.

The Manning patent vertical tubular boiler (Fig. 3) is constructed at the Hewes and Phillips Iron Works. The boiler embraces the essential qualities, strength, simplicity, compactness and high economical duty. It is internally fired and the fire box has a large grate surface.

The tubes are 2½ inches in diameter and for boilers over 100-horse power are 15 feet in length.

In operation the water line is carried 11 feet high, leaving a steam place of 4 feet through which the tubes pass, thus the heat from the furnace is thoroughly absorbed.

In a continuous run of several years the boilers have shown a record of 10.47 pounds of water evaporated per pound of coal; and 13.09 pounds of water per pound of combustible.

The boilers are made with care and the material used is of excellent quality.

A variety of styles of boilers are here manufactured, horizontal, locomotive, small vertical, etc., and in all these the A1 workmanship and design characteristic of these builders are shown.

ELECTRICAL CONTRACTING.

The calling of an electrical engineer is a congenial one although it entails much hard work. To be a successful electrical engineer one must thoroughly understand all the known laws governing the application of electricity to light, power and general use, and none is more familiar with these laws and application than Mr. Alfred Sommer, of 171–173 Halsey street, Newark, N. J. As an electrical contractor he has had extensive experience. Some eight years ago, in the early days of electric lighting Mr. Somers became interested in this line. His early work in the general application of electricity stirred him on to a higher knowledge of the business. Among his various installations of electric light plants is one of 125 lights in the Palace Hotel and the installation of a 40 drop return call annunciator. With this system of annunciator the guest, upon being called at any special hour, can notify the office that the call has been received. Mr. Sommers has installed seventy-five lights in the residence of Dr. Underhill, one of Newark's elite physicians. He has also installed the multiple electric gas lighting plants used in all of Newark's prominent theatres. Some five years ago he arranged an electric call system for forty targets at the Newark Shooting Park, to be used for a tournament. The system operated so well that the proprietor of the park made ten of the apparatus permanent, which are in regular use every week. Mr. Sommers does not confine his work to Newark, but contracts to install all kinds of electrical appliances, call bell systems, electric light plants, etc., in any of the surrounding States. He has installed plants in Connecticut and other Sta es, and is prepared to undertake a contract of any dimension from A to Z.

DURANOID.

Among the several substitutes for hard rubber now on the market, the substance known to the trade as Duranoid has several meritorious features.

Duranoid has many uses. It has great strength and durability and high electrical resistance.

Duranoid and the goods made from this material, are manufactured by the Duranoid Manufacturing Company, 20–24 Prospect street, Newark, N. J.

The company makes goods in any quantity, from dies, by contract.

The officers of the company are John M. Gwinnell, president; Wm. B. Gwinnell, treasurer; Henry T. Meyer, secretary.

INCANDESCENT LAMPS.

The business of selling incandescent lamps is one which has to do with large and frequent orders, to supply the constant demand, and as these lamps become more general in private houses, the business will receive a fresh impetus

Traphagen, Baker & Co, the well-known dealers in incandescent electric lamps and manufacturers of gas and electric fixtures, are well located in their handsome

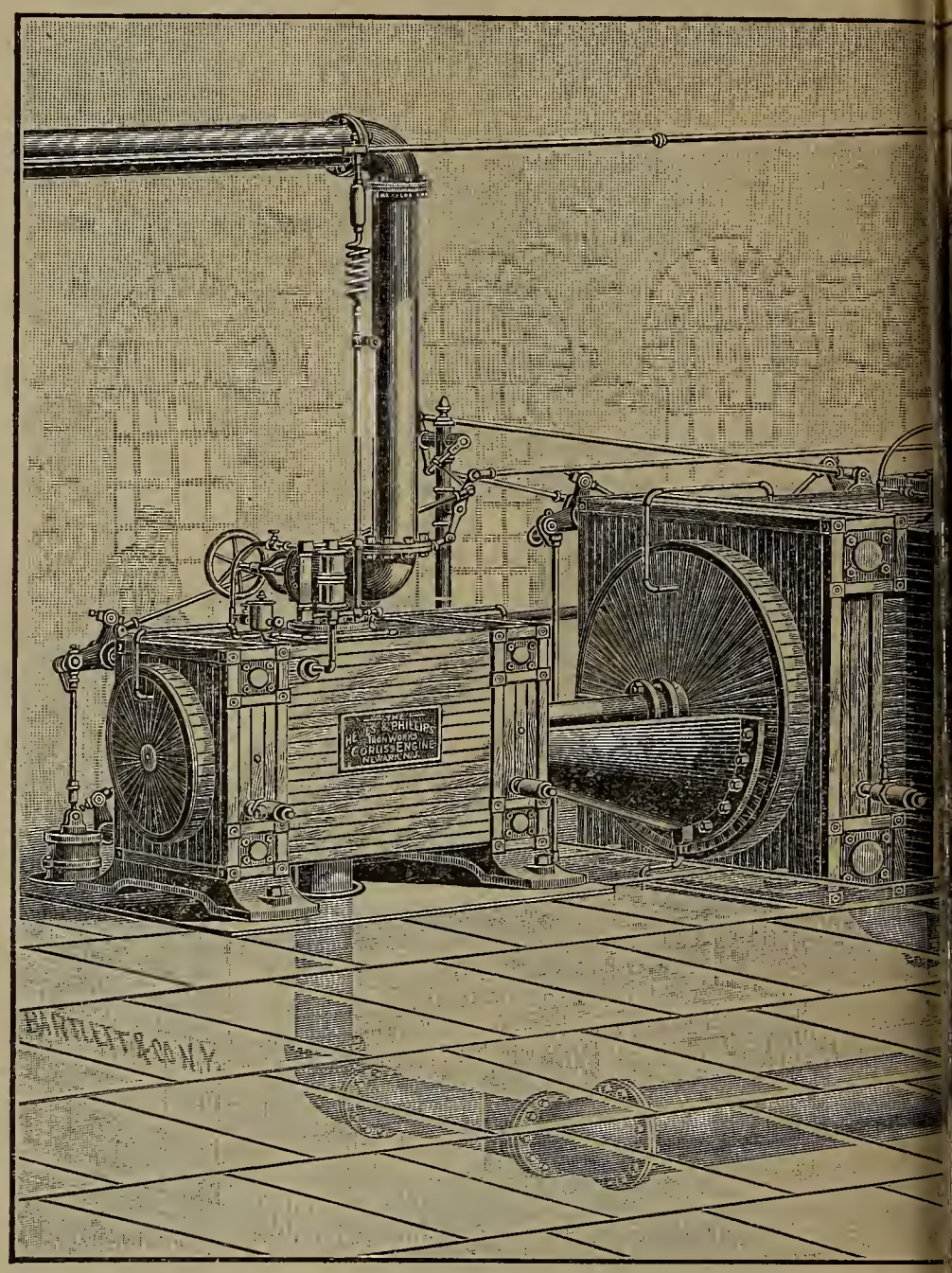


FIG. 2—HEWES AND PHILL

building at 251 Market street, Newark, N. J. In accordance with the lowering of the rate by the Newark Electric Light and Power Company, on all incandescent lighting, this firm has decided to place their lamps at the lowest market price. The electric light company does not now supply lamp renewals, therefore the best place to get the lamp is where one can buy to the best advantage.

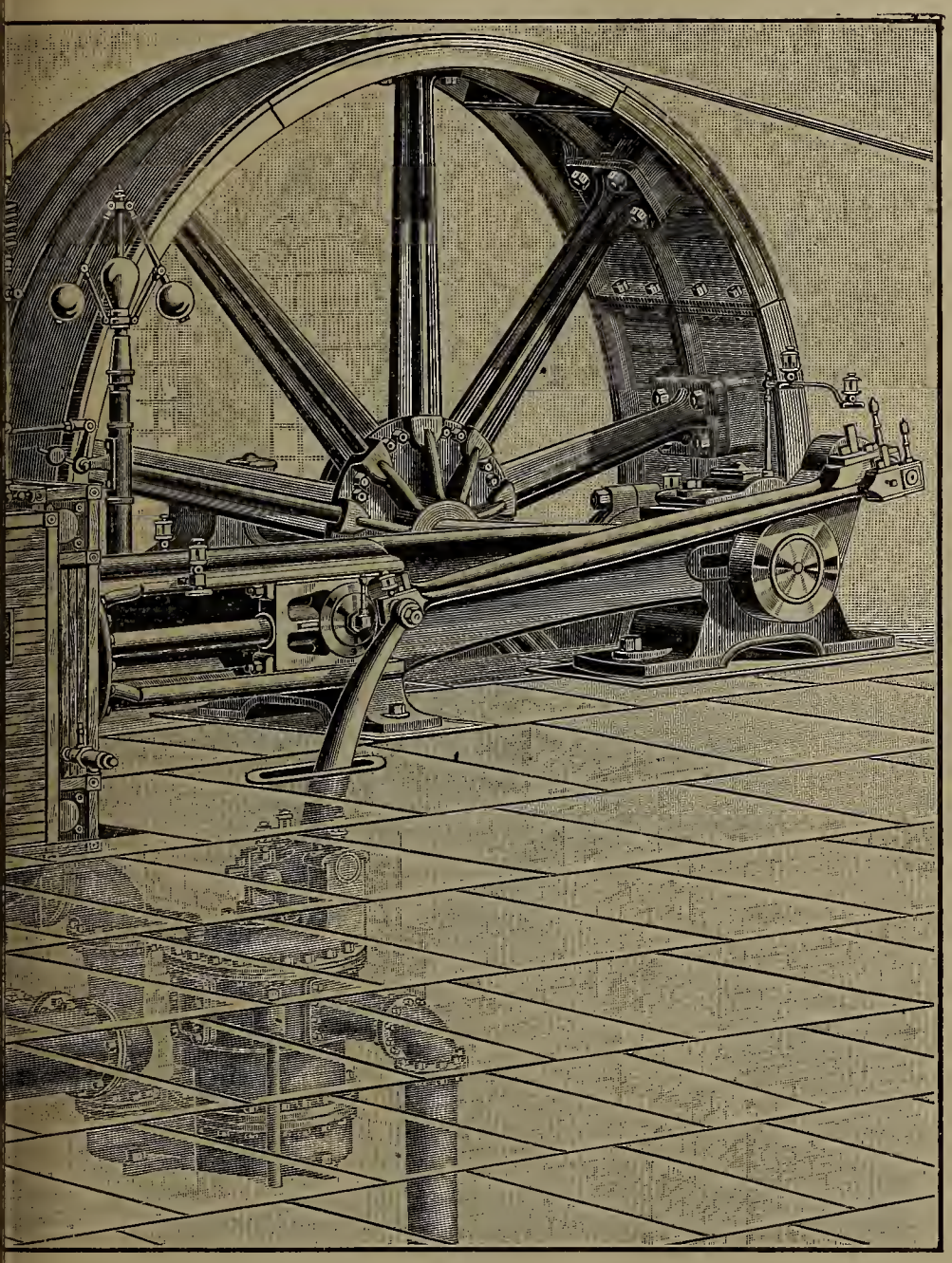
The firm has established handsome gas and electric fixture salesrooms and carry a large assortment of them as well as the globes for same.

Telephones in Greece.—Telephone service with 300 subscribers, between Athens and Piræus, is about to be established by the Greek administration.

THE WACHTEL ELECTRICAL MFG. CO.

Among the electrical industries of Newark, N J., the Wachtel Electrical Manufacturing Co., 66 N. J. R. R. avenue, occupies a prominent place. It is the maker of the "Leader" motors and dynamos, and exhausl electrical fans. These apparatus are claimed to be equat in quality and finish to those of any other make on the market. In addition to the manufacturing, the company carries on a large and complete repair department. Here repairing of all kinds is promptly and skilfully prosecuted with the aid of improved machinery.

The "Leader" dynamos and motors possess many meritorious features which render them satisfactory in every respect. They are well built, simple in design



COMPOUND CORLISS ENGINE.

and efficient in operation. The armature is well ventilated and its winding is a modification of the Crane system. The dynamos are wound for the generation of any size of current, and the motors are designed for small and medium powers, the latter class of machines being made in sizes from 1 to 50 H. P.

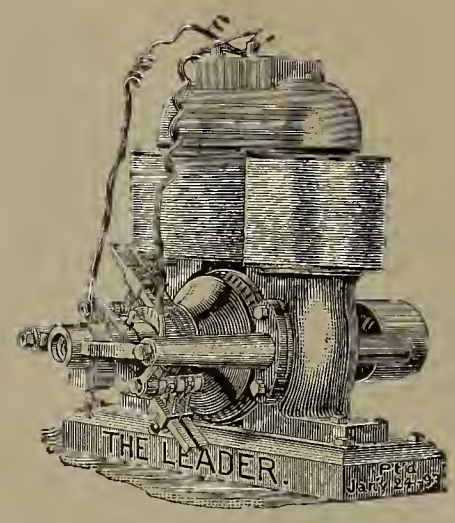
The company also contracts to install its motors for general power use, and makes a specialty of ventilation, combining its motors with blowers and exhaust fans; also of running ceiling fans for cooling offices, stores, etc.

Dangers of the Telephone.—A soldier stationed at Metz, Germany, placed his ear against a telephone receiver during a thunder storm and was killed by the lightning striking the line wire.

THE "CROWN" PLATING DYNAMO.

Newark, N. J., has become a manufacturing headquarters for electro-plating apparatus, and it is well-known in the trade that the goods coming from there stand at the top of the list for excellence.

Perhaps there is no better known plating and typing machine than the "Crown" dynamo, made by Alberr C. Courter, 209 Market street, cor. Beaver, Newark, N. J. This machine, an illustration of which is given here-

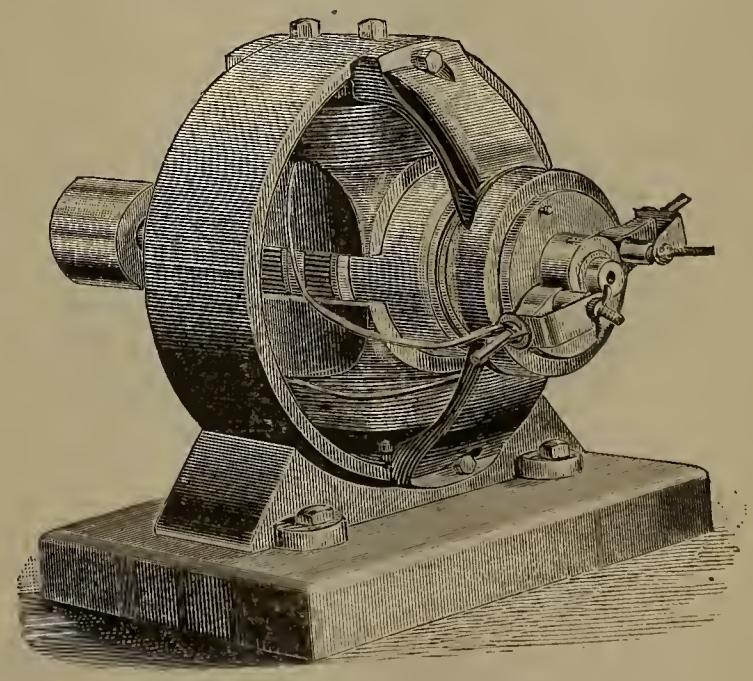


THE "LEADER."

with, possesses some features which it will be worth the while for electro-platers to carefully consider, asthey are the ones most directly concerned.

The "Crown" is simple in construction, which means to the practical man, less liability to get out of order; ti is efficient, that is, gives the best results from the least power expended; it is slows peed, consequently there is less wear and tear on the machine; it does not spark, which ruins the commutator; it runs cool, and does not damage or burn the insulation, the maintenance of which is very essential, and it will not reverse the direction of the current, and spoil the work.

These machines are made in the best possible manner, and are low priced.



THE "CROWN" DYNAMO.

Mr. Courter is very liberal in his terms; he gives thirty days' trial of his machines.

Mr. Courter is also manufacturer of nickel-plater's, electro-plater's and polisher's materials, including rouge, composition, chemicals, etc., and those who deal with him may rely on what they get.

This house was established in 1862, and only the best of everything is handled. Mr. Courter's laboratory and factory are at 21 Abel street.

WESTON ELECTRICAL INSTRUMENT CO.

It is doubtful if there is another electrical concern in this country that is as well known through its products as is the Weston Electrical Instrument Company, of Newark, N. J. It would be difficult indeed to find an electric light or power station, or any other electrical plant, for that matter, anywhere in the country that did

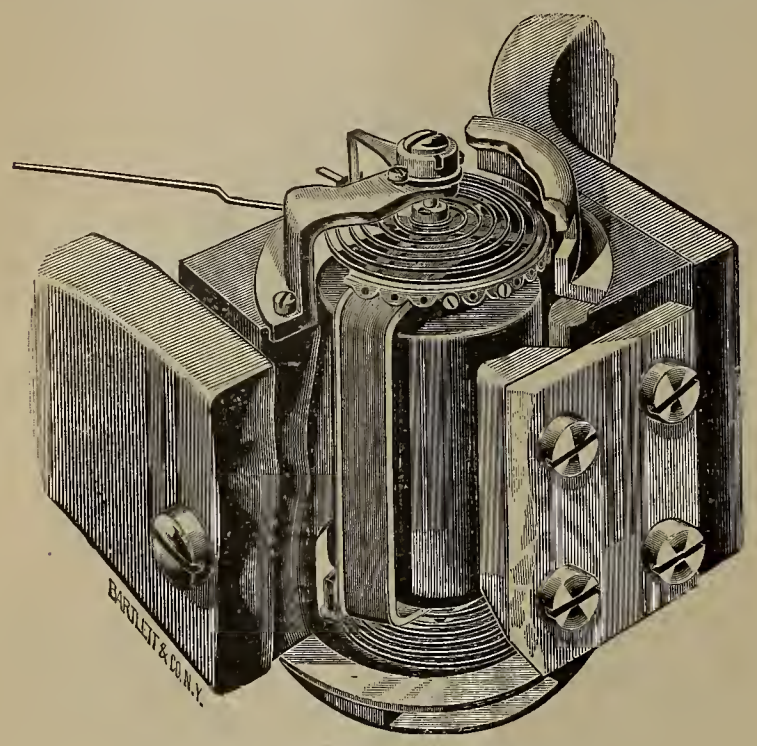


FIG. 1.—VIEW OF MECHANISM.

not possess an equipment of Weston instruments, and if an opinion is asked, concerning these instruments, wherever you may be the uniform reply is always given, viz: "We haven't seen anything better."

Now what makes Weston instruments so popular among electrical people? There must be some good reason for it. A poor instrument of any kind will not sell, however cheap it may be, and when we see one make of instruments in use wherever we go, it is reasonable to suppose that that particular make must possess some extraordinary qualities.

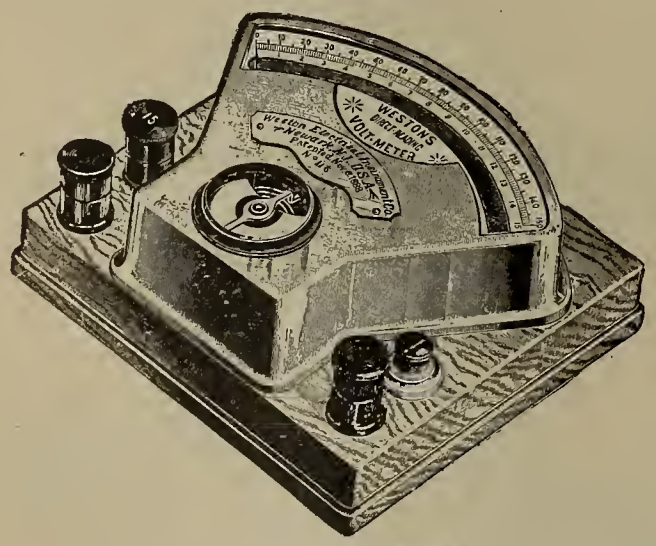


FIG. 2.—VOLTMETER.

What are the prime qualities necessary in first-class electrical instruments? They are accuracy, reliability under changed conditions, and sensitiveness. We often see these claims made but they are not always substantiated in practice. Those three words mean a great deal when applied to electrical instruments, and any instrument that truly possesses these qualities certainly meets every exacting requirement in practice, all other things, of course, being equal.

The Weston instruments have the reputation of coming closer to the standard of these requirements than any instrument made, and the fact that they are so generally used is proof that their reputation must be based on merit.

The factory of the Weston Electrical Instrument Co. is located at 114–120 William street, Newark, N. J. It is a substantial brick structure, three stories high, and well lighted, and here all the work of the company is carried on, from beginning to end.

In the Electrical Age of March 25, 1893, was given a fully illustrated description of various styles of ammeters and voltmeters made by this company, and we now give some additional facts concerning these instruments which will be opportune at this time.

The principle embodied in the Weston instruments consists in the simple movement of a small coil of wire through a uniform magnetic field against the opposing force of a very light spring. There being no moving iron parts, magnetic lag is entirely eliminated.

Fig. 1 is an illustration of the essential mechanism of these instruments. The moving parts are supported in the very best sapphire jewels, and the pivots are of hardened steel, ground and highly polished to secure sensitiveness.

The following important advantages are claimed for these instruments; direct reading, dead beat, the temperature correction is neglible, and the instruments can be kept in circuit any length of time without undue heating, except those of high range.

Two general classes of standard instruments are manufactured by the Weston Company, viz: portable and

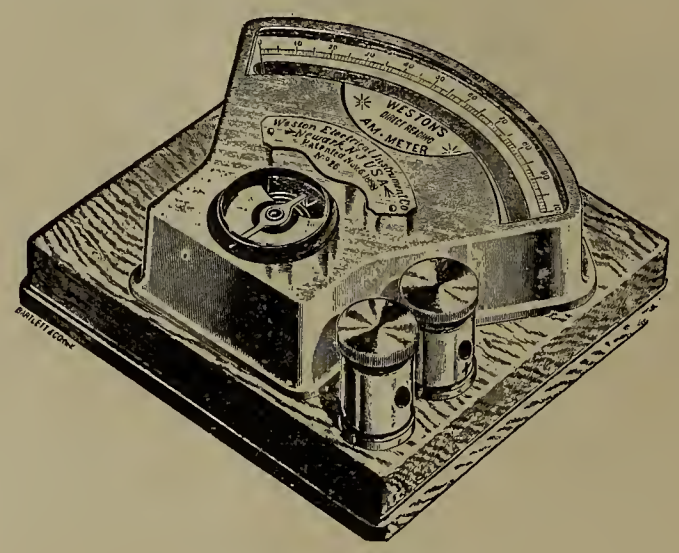


FIG. 3.—AMMETER.

stationary; the portable ammeters and voltmeters are shown in Figs. 2 and 3.

The illustration of the voltmeter (Fig. 2) is half the actual size of the instrument. The instrument has three binding posts, connecting with two coils of different lengths and resistances, and giving two grades of sensibility. By the use of this instrument the aggregate potential of a series of cells of battery can be determined with great accuracy, and the electro-motive force of one cell can be read off to the nearest hundredth of a volt; the instrument is especially valuable in the care of storage batteries, and for general laboratory use and general testing, it has no superior.

The portable direct reading ammeter is shown in Fig. 3 This instrument is of the same general appearance as the voltmeter and possesses all of the same features of permanency and accuracy.

Of the stationary instruments Fig. 4 shows the illuminated dial station voltmeters. This instrument is based on the same general principle as the portable instruments above referred to, but is much larger and the working parts are enclosed in an iron case to protect the mechanism from injury. They possess all the mechanical and electrical features of the portable instruments. The scale is made of opal glass, at the back of which is placed an incandescent lamp and a pair of mirrors so disposed as to illuminate the scale uniformly from be-

hind, thus making it possible to take readings at a long distance from the instrument.

The illuminated station ammeters are of the same general design and application.

Besides the instruments thus briefly described the company manufactures mil-ammeters especially designed for physicians' use, potential indicators and watt meters.

The company has a very beautiful exhibit of its instruments at the World's Fair, in Electricity Building. The exhibit is in the gallery in a very commanding location, and is enclosed in a very artistically designed booth. In the show cases are handsomely finished specimens of the various styles of instruments made by the company. Besides the display in the counter cases there are four large panels to which are attached the different parts of the four main types of instruments.

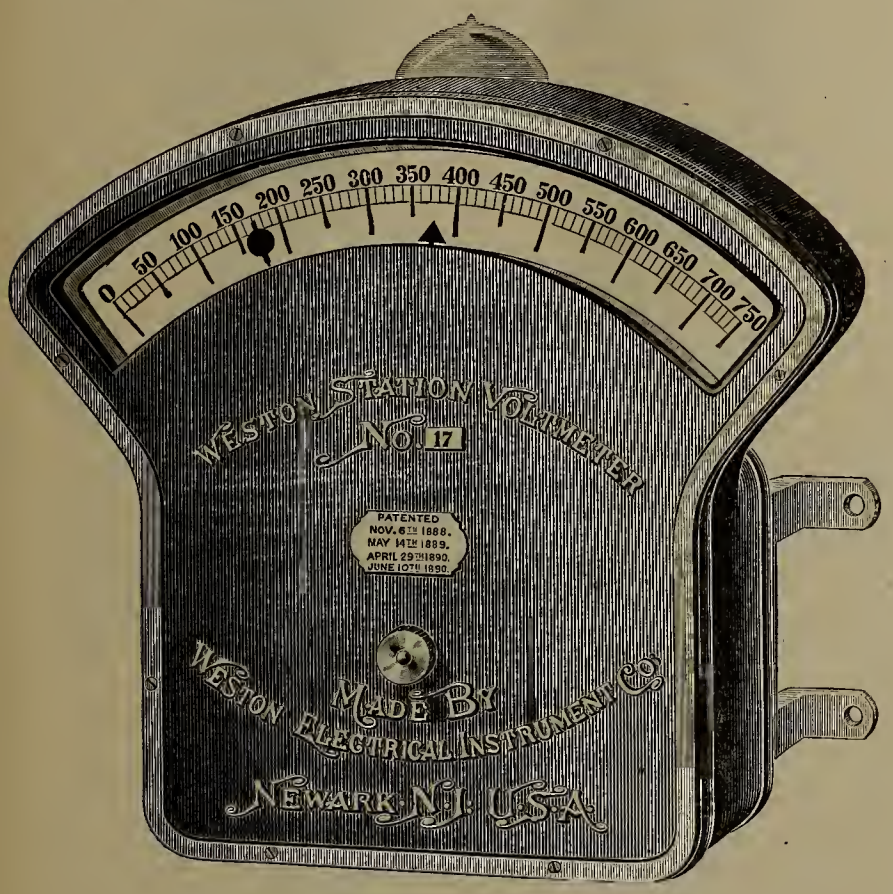


FIG. 4.—ILLUMINATED STATION VOLTMETER.

The Weston Electrical Instrument Company has made a success that is rarely attained in these days of fierce competition, and this success strongly emphasizes the unalterable fact that a good thing, like a good deed, is sure to win favor.

BAKER & CO.

A business closely allied to the electrical industry is that of the manufacture of platinum articles for use in the electrical laboratory and work shops.

A platinum, gold and silver refining and smelting business is carried on by Baker & Co., 408 to 414 N. J. Railroad avenue, Newark, N. J. They manufacture platinum sheet, or wire, of any degree of hardness and for all purposes. The following are some of the uses platinum is put to in the electrical industry: in incandescent lamp manufacture, contact points, electric gas lighting, electrical surgical appliances, electrodes and laboratory experiments. They also deal in gold, silver, aridium, palladium, osmium, aluminum, mercury, tin, ruthenium and rhodium. The metals are made up into any desired form, such as silver solder, aluminum sheet or wire, silver and gold anodes, surgical apparatus, crucibles, lighting rod tips, etc. Waste and scraps containing these metals are purchased, or refined. In a catalogue issued by the firm much valuable data concerning platinum wire, crucibles, etc., are given.

The works of Baker & Co. in Newark are adjacent to the tracks of the famous Pennsylvania railroad, and very conveniently located as regards shipping facilities. Mr. C. O. Baker, Jr., the junior member of the firm is well-known to most every electrical man in the country through his connection with the National Electric Light Association, and all agree that a finer gentleman never lived. Mr. Baker has for many years acted in the capacity of master of transportation for the association, and those who have ridden on his special trains can best tell how well he fills the office. Mr. Baker is very popular in the general trade, and a succeesful business man in his line.

NEWARK NOTES.

THOS. W. LANGSTROTH'S SON, 14 Mechanic street, Newark, N. J, is a manufacturer and dealer in electrical supplies and builders' hardware. He also repairs electric and mechanical bells, speaking tubes, etc.

THE SAFETY ELECTRICAL COMPANY, 88 Mechanic street, Newark, N. J., manufactures motors for use with any voltage, and makes a specialty of motors wound for 500 volts. Dynamos for lighting and plating are also manufactured by this company.

MR. L. M. WILCOX, 219 Market street, Newark, N. J., manufacturing electrician, does construction work, installs annunciators, burglar alarms, gas lighting apparatus, etc., and is doing a good business. He has just completed the electrical work for Mr. John Gibb, of the firm of Mills & Gibb, Broadway and Grand street, New York city, at Islip, L. I. Mr. Wilcox has also recently finished a large plant of electrical work in the residence at Montclair, N. J., of Mr. Bradley, of the Bradley & Currier Company, New York city. Mr. Wilcox also manufactures hotel annunciators and automatic burglar alarm indicators.

S. J. MEEKER, successor of D. M. Meeker & Son, 87 to 95 Clay street, Newark, N. J., has malleable and grey iron foundries, where there are facilities for making castings for dynamo electric machines and motors from the smallest to the largest size. The business was started 43 years ago, and stands high in the trade. Mr. Meeker's work is of the best character, and with his large experience and facilities no one is better equipped to carry on this class of work than he, especially for electric machines.

EDMUND JOST, 350 and 352 Plane street, Newark, N. J., is a machinist, brass founder and finisher, and manufactures light machinery, special tools, dies, experimental and patented articles, and brass goods of all kinds. Brass and composition castings for electrical work are made to order at short notice.

OF INTEREST TO USERS OF INCANDESCENT LAMPS.

Judge Lacombe, of the United States Circuit Court, on the 1st of July, granted injunctions to the Edison Electric Illuminating Company, of New York, against the Holland House and the Hotel Imperial, prohibiting them from using incandescent lamps infringing the Edison patent, under which the Edison Electric Illuminating Company is sole licensee in the city of New York. The injunction is suspended in its operation for ten days to enable the hotels in question to obtain other means of illumination.

These cases were the first that have been brought against *users* of the Edison lamp patent as distinguished from *manufacturers*, and the decision is claimed to be far reaching in its effects. It is said to be of great importance especially, in view of the recent refusal of an injunction

by Judge Hallett, in St. Louis, against a Western manufacturer. It is thought that the decision will be regarded as a rule for all users of other than Edison lamps in the States constituting the second circuit, and other suits, it is reported, will be immediately brought against other users similarly situated. It is said that the decision will doubtless secure to the Edison Electric Illuminating Company the incandescent lighting business in New York city, and go a long way toward securing to similar licensees the same privilege in other cities.

C. McINTIRE CO.'S FUSE WIRES.

Among the many electrical protecture devices invented in late years, none is so important and so generally used as the simple fuse wire. The short length of tinny-looking wire stands sentinel between safety and danger in electric installations; if it does its duty then everything is saved; if not, fire is likely to devour our stores, factories and houses. The integrity of the fuse wire is, therefore, of the utmost importance, and it is no wonder that some concerns have made a scientific study of the subject with a view to producing a reliable fuse wire, one that could be depended upon at all times to act when abnormal conditions were present.

The fuses are the safety valves of an electrical plant; if there is more current on a wire than the wire is intended to carry then the fuse makes the fact known at once by melting, and, the circuit being thus opened all danger is removed.

A long chapter could be written on fuses and their

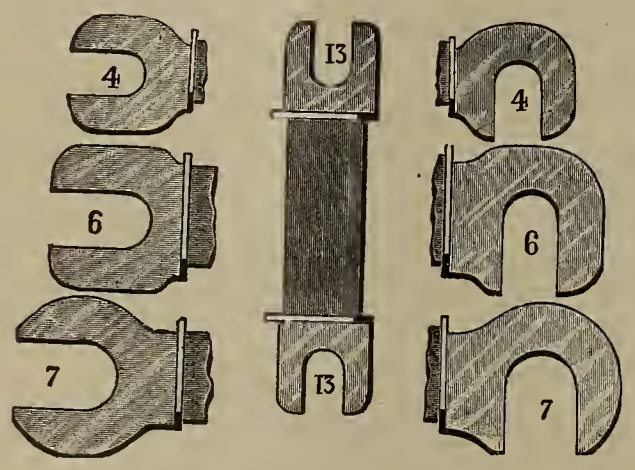


FIG. 1.

functions, but our limited space precludes anything more than a few brief references to a leading concern in Newark, N. J., where fuses of all sizes are made. We refer to The McIntire Co., of 13–15 Franklin street.

This company has gone into the subject on a scientific basis, with the result of producing a reliable system of fuses for practical use. That the company's efforts have been entirely successful is evident from the fact that it secured the contract for all of the fuse wires and links used in connection with the lighting of the buildings and grounds at the World's Fair.

The company has a testing laboratory, equipped with a storage battery plant of over 1,000 amperes capacity, which plant is used constantly in testing samples from all lots of fuse wire. The fuse wires made by the McIntire Company range, in carrying capacity, from ¼ to 500 amperes, and are claimed to be thoroughly reliable for the capacities at which they are rated.

Plain fuse strips are also furnished in various widths, in sizes from 50 to 1,000 amperes, and, unless otherwise ordered, they are packed in 10-inch lengths.

The company is making a specialty of copper terminal fuses for any voltage, and branch block fuses. Fig. 1 shows copper terminals of three styles of connection. These fuses are made in sizes from 25 to 1,000 amperes.

Fig. 2 shows branch block fuses of various sizes. They are made for use on any system, or to any specifications and for any voltage. These fuses are made from 1 to 100 amperes capacity.

Fig. 3 is an illustration of the Edison link, for use on

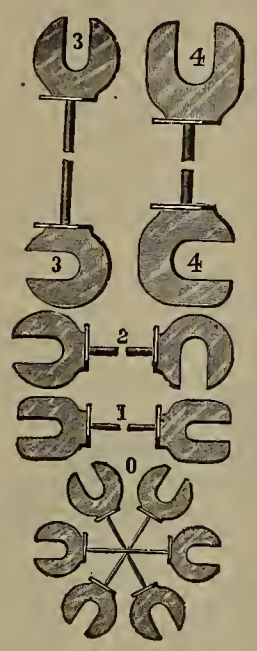


FIG. 2.

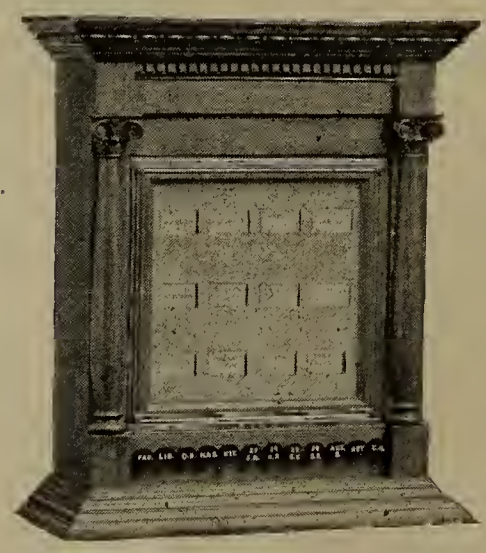
FIG. 3.

circuits of not over 125 volts. They have a carrying capacity of from 25 to 600 amperes.

The high reputation of this house is in itself a sufficient guarantee that the fuses are reliable, but the company does not trust so much to its reputation as it does to real practical facts. If the fuse wires it makes prove to be reliable that is the best of recommendation anyone can give.

GEORGE ZIMMERMANN.

Mr. George Zimmermann, 191 Market street, Newark, N. J., manufacturer and dealer in electrical supplies, began business nine years ago at 613 Broad street, and moved to his present quarters in May, 1889. In 1880 he invented a burglar alarm annunciator with some very valuable features. Since then he has installed nearly



ZIMMERMANN'S BURGLAR ALARM.

300 of these devices, ranging from 8 to 150 drops. Only a single spool magnet is used on the drop. The latter is held rigidly in place and will not fall under any circumstances except by closing the circuit through the magnet.

The main feature of the annunciator is the various uses to which it can be put. It is arranged so as to

automatically light and extinguish the gas, and at the same instant gives an alarm. It can also be used to connect or disconnect any circuits in the house, as may be desired.

In the accompanying illustration the switches are shown underneath the alarm.

Mr. Zimmermann is contractor for the installation of electric light plants, on both the arc and incandescent systems, and wires buildings for all systems of lighting. He also instals all kinds of household, hotel and office annunciators, speaking tubes, burglar alarms, multiple, automatic and pendant electric gas-lighting for churches, halls, etc.

THE NEW YORK CARBON WORKS.

THE NEW YORK CARBON WORKS, office 18 Cortlandt street, city, and factory at Newark, N. J., have great facilities for turning out carbons for all purposes. The works are equipped with six powerful grinder and pulverizer mills. A 150-horse power Whitehall-Corliss engine, and a Hanson and Van Winkle dynamo and plating outfit is used in the works. The carbons of the Chas. W. Holtzer battery are, in the United States, exclusively manufactured at these works. Improved motor brushes and special mold works of every description is here carried on.

The carbon plates made by this concern, and which are used by all the leading battery manufacturers, are made from selected gas retort carbon only. All the standard sizes are constantly kept on hand, and special sizes and shapes are made to order on short notice. The officers of the company are: Mr. Albert Storey, president; Henry Müller, Jr., secretary and treasurer, and William Mills, superintendent. The works were established in 1884.

ELECTRICAL REPAIRS.

Kessner & Dorris, 15–15½ Mechanic street, Newark, N. J., do a general electrical repair and construction business. They rewind and repair armature and field coils of all kinds and sizes, as well as repair work on all kinds of electrical appliances. The firm makes a specialty of large work, such as railway generators and motors and electric light machines. They also manufacture rheostats, commutators, brushes and other parts of electrical apparatus which occasionally need replacing.

PERSONAL.

Mr. R. D. Nuttall, of the R. D. Nuttall Co., Allegheny, Pa., on July 1 last, cut loose from the company of his creation, and is now independent. He has not yet announced what he proposes to do in the future, but it is understood that he will remain among street-railway interests.

Mr. Richard O. Heinrich, of the Weston Electrical Instrument Company, Newark, N. J., has just returned from the World's Fair where he set up the Weston exhibit which attracts so much attention because of the artistic taste displayed in its arrangement.

NEWARK'S ELECTRIC ROADS.—There is now some doubt, it is reported, about the extension of electric roads beyond the Newark limits in Essex county. The railroad companies do not see much prospective profit in suburban travel under any circumstances, and the township committees, while really desiring the improved facilities, impose restrictions which are prohibitory in character.

THE INTERNATIONAL ELECTRICAL CONGRESS.

We are in receipt of the following interesting letter from Prof. H. S. Carhart, secretary of the Advisory Council of the Chicago World's Congress of Electricians:

ANN ARBOR, Mich., July 10, 1893.

EDITOR ELECTRICAL AGE:

Dr. Elisha Gray has just received a letter from Professor von Helmholtz, announcing that he will take part in the conferences of the International Electrical Congress at Chicago, beginning August 21. He comes as the official delegate appointed by the German government. He will be accompanied by Drs. Feussner, Kurlbaum, Leman, Lindeck, Lummer and Pringsheim from the Berlin Reichsanstalt.

American electricians should be prepared to give Professor von Helmholtz a royal welcome.

Dr. Lindeck will read a paper on "materials for standards of electrical resistance and their construction."

Papers are also promised from Mr. W. H. Preece, Professors Ayrton and Thompson, of London, and Professor Hospitalier of Paris.

American electricians are invited to contribute papers on subjects appropriate to the occasion, and particularly on those enumerated in the provisional programme prepared by the committee in Washington the latter part of April.

Yours truly,
H. S. CARHART,
Secretary.

THE MAGNETIC CLUB.

The Magnetic Club of New York city, will hold its midsummer meeting at the Whitestone House, Whitestone, L. I., on Wednesday, July 26. The Western Union Telegraph Company has placed at the disposal of the club its steamer "Western Union," which will convey the members to Whitestone via the East River and Long Island Sound. Those who cannot avail of this delightful ride, can take the train by the Long Island road. The "Western Union" will leave the pier at the foot of Vesey street at 3:15 P. M. on the date named. An excellent menu is provided, and a general good time is promised.

WORLD'S FAIR BULLETIN—Our enterprising monthly contemporary, *Electrical Industries*, of Chicago, is issuing a World's Fair weekly bulletin. Each number contains much interesting reading matter and excellent illustrations of exhibits. The World's Fair, alone, is a subject of sufficient magnitude to fill the columns of a good sized weekly, and judging from appearances our contemporary is making a success of its enterprise.

THE SEARCH LIGHT IN THE NAVY.—A series of interesting search light experiments is now being carried on at the torpedo station, Newport, R. I. The object of the experiments is to test the value of search lights in the discovery of torpedo boats, also to determine the best color to use in painting torpedo boats in order to avoid detection. The plan of operations is this: The torpedo boat Cushing enters the harbor from Peconic Bay between the hours of 7 and 9 o'clock at night and the torpedo class in the naval station with search lights try to detect her. Three times a week coming from Peconic Bay she will enter in the night between certain hours. Those on board try to evade the search lights in every way.

THE QUEEN CONDUCTIVITY BRIDGE.

Probably one of the most difficult and at the same time important measurements to make is that of conductivity. As usually conducted long lengths of wire or cable are required and extraordinary precautions taken as to temperature, while a number of expensive instruments, perhaps not adjusted to each other, form the testing outfit. Under these conditions accurate results are only obtainable at the hands of skillful operators.

The accompanying illustrations show in perspective and in diagram a "Conductivity Bridge" designed by Queen & Co., incorporated, of Philadelphia, by means of which the measurement of minute resistances is greatly simplified and freed from many of the errors to which it is commonly subject. Referring to Fig. 2, R_1 and R_2 are two approximately equal resistances (not necessarily known); S_1 and S_2 represent two *groups* of resistances each group consisting of a fundamental resistance connecting together two copper bars, as b and b′, and six accessory resistances arranged so that any one can be placed in parallel with the fundamental. One end of each accessory resistance is joined to a mercury cup between the two outside bars; a small copper connector, C, joins the mercury cup to the lower bar as shown in the diagram. These fundamental resistances are initially adjusted very accurately, so that the two groups will differ in resistance by the decimal engraved below whatever cup the connector C, is bridged into. A, A, A, A, are heavy copper connectors making connections between the various copper bars as shown. These connectors are carried by a heavy rubber plate as shown in Fig. 1.

In the front of the apparatus is a massive pair of ways, G, upon which slide heavy clamps, D; each of these ways is joined as is evident from the diagram, to one of the groups S_1 and S_2. The conductor to be tested, H (Fig. 2) seen as a massive square bar in Fig. 1 is slipped into the heavy clamps, D, and clamped down by means of the screw nut H and wrench I. A scale, U, 50 cms. long and divided to millimeters is supported in front of the test piece as shown in Fig. 1. Upon a rod behind this scale moves a slider by which galvanometer contact is made upon the test piece. A fine adjustment of the slider may be obtained by means of the micrometer screw, T. The vernier, V, allows settings to be made to $\frac{1}{20}$ mm.

The method of operation is very simple. The test piece being in position, connector C is placed in such a cup as will make S_1 and S_2 differ by *about* the resistance of the test piece. A few trials will determine this or the resistance of the test piece as given by any wire table will be close enough. Battery and galvanometer circuits being connected as shown, the slider is moved along until no deflection of the galvanometer is produced, when the circuits are closed. The heavy connectors A, A, A, A, are now rotated through 180°; this is accomplished by merely lifting the head, K, of the plate which supports them and turning it through the above angle. The smaller plate carrying connectors L, L, will thus be rotated so as to leave L, L, in the same relative position. The effect of rotating A, A, A, A, will be as is evident on tracing out the connectors, to exchange S_1 and S_2 and this, obviously, will push the position of the slider contact corresponding to zero galvanometer deflection along the test piece, until the amount of test piece moved over equals in resistance

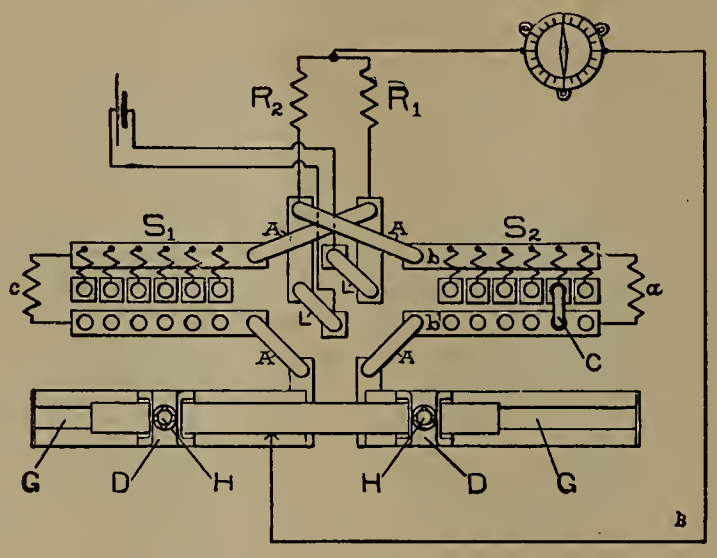


FIG 2.

the difference between S_1 and S_2. All that must be done, therefore, is to take two balance readings; the lengths of test piece moved over equals in resistance whatever difference may be originally established between S_1 and S_2.

All contact errors, where the test piece is clamped in, are eliminated in this apparatus. For example, any contact resistance in the left hand clamp merely oprates to throw *both* balance readings to the right, leaving their *difference* unchanged.

The entire apparatus being constructed of copper, thermal currents will not usually be of any appreciable moment. They may be eliminated, however, by reversing the battery and taking the mean of two readings as the true slider readings; that is easily accomplished by lifting head K and rotating connectors L, L, through 90°.

To accommodate conductors of different sizes and shapes, a number of little adjusting blocks, E, are provided; these blocks fit into the clamps, D, and hold the axis of the test piece whether round, square, or otherwise shaped in cross section exactly in the axis of the clamp. With this apparatus the conductivity of copper bars up to $\frac{3}{4}''$ in diameter and less than 12″ long may be measured with an accuracy of $\frac{1}{50}$ of 1 per cent. The re-

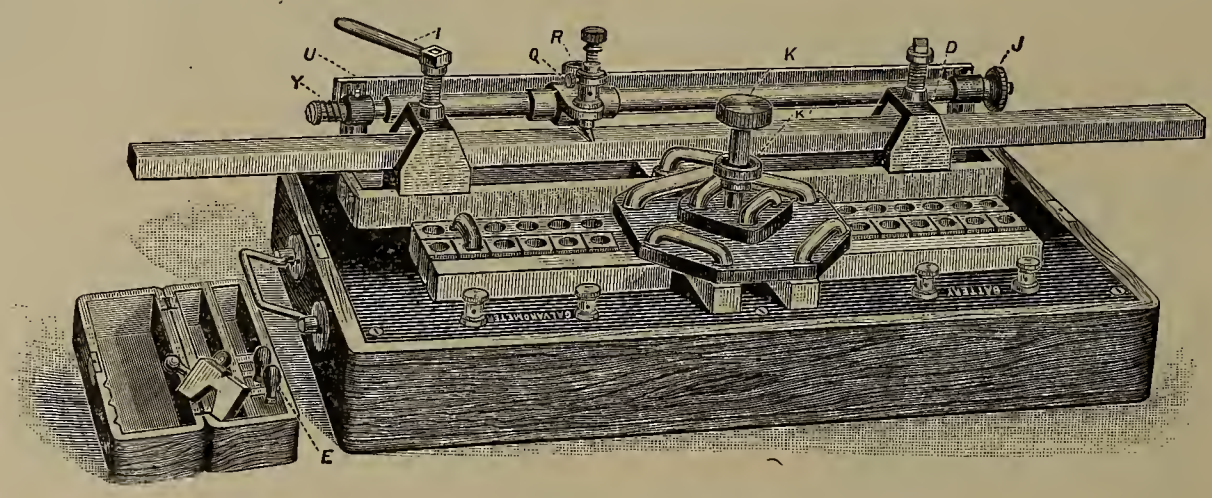


FIG. 1.

sistance R_1 and R_2. S_1 and S_2 are standards, permanently a part of the apparatus, and guaranteed accurate to $\frac{1}{100}$ of one per cent.

This method and apparatus is the result of long continued study and experiment in the laboratory of Queen & Co. The set is handsomely and substantially made, and when complete occupies a rectangular case 22⅜ by 11½ by 8⅜ inches deep. Wire manufacturers will see in this apparatus a means of saving much time and expense, as well as of raising the standard of their goods. Manufacturers of dynamos and motors, also will find the set extremely valuable in determining whether their armature conductors are up to the proper standard of conductivity. A sample set now in the Queen exhibit at the World's Fair attracts great attention, and has been purchased for installation in the testing department of the Armour Institute, Chicago.

Telephone Meter.—Messrs. Mix and Genest, the well-known telephone apparatus makers of Berlin Germany, have constructed a device for indicating the length of time taken for conversation over the telephone. A clock gear is released when the receiver is taken from the hook and registers time till it is stopped by again placing the receiver on the hook. When the clock runs down, a signal for rewinding is shown and communication cannot take place till the rewinding has been attended to. Instead of charging by contract for telephone service, it is desired by aid of this instrument, to charge the subscriber for the actual time, which his telephone is in service.

Medal.—Mr. Gisbert Kapp has been awarded the Society of Arts' silver medal for his paper on "Some Economic Points in Connection With Electric Supply."

Primary Battery Competition.—This competition, which is now being held in Europe, has attracted many inventors to place their cells in the trial. A prize of about $500 is offered for the best cell, which is to be patented, manufactured and the inventor to receive 30 per cent. of the profits. Fourteen cells have so far been entered. Among the cells presented, is one single liquid cell without depolarizer, five single liquid cells with solid depolarizer, four salammoniac cells, one with potash or caustic soda, one with gaseous depolarizer, four with liquid containing depolarizer and three double liquid cells.

NEW YORK NOTES.

Office of Electrical Age.
First Floor, World Building,
New York, July 15, 1893.

The name of the Wright Universal Electric Company 26 Whitehall street, city, has been changed to American Universal Electric Co.

The General Electric Company has adopted the Carpenter Enamel Rheostat as its standard, for use on apparatus brought directly in contact with the general public.

Dr. D. T. Everts, the New York representative of Simplex wires, was met last week by the writer. He is handling big orders for railway feeder wires, etc., in a very quiet and unassuming manner.

The Board of Electrical Control has recently received a proposition from the Metropolitan Telephone and Telegraph Company. The company states that if it is allowed to erect 25 or 30 terminal or distributing poles, it will agree to remove within a year, 1,500 of its poles and 450 miles of wire, and to clean the entire west side of the city south of Eighty-fifth street, of poles and wires, except in West and Thirty-ninth streets.

Mr J. B. Olsen, who has for the past few years so successfully represented the New York Insulated Wire Company. of 15 Cortlandt street, has settled in Chicago, where he has taken entire charge of the Company's Western interests. He has moved his family to the Fair city, which will hereafter be their permanent home. Mr. Olsen has our best wishes for success among the Westerners. There is no doubt that the New York insulated Wire Company's affairs in the West are in good hands, and that abundant success will follow.

Mr. R. E. Gallagher of the New York Insulated Wire Company, 15 Cortlandt street, has returned to headquarters after a three-month's stay in Chicago Mr Gallagher's time was occupied in inspecting the Company's wire installations at the World's Fair. It will be remembered that this company supplied all the wire used for incandescent lighting in the buildings and grounds, also for some of the alternating arc lighting. On account of this the celebrated Grimshaw White Core wires have been given the nameof the "Nation's Choice."

On Tuesday last a break occurred in the stock market and among the prominent shares that suffered heavy declines was General Electric. The starting point of the slump was the sale of Vanderbilt stocks, which have always been closely held and very few are traded in. General Electric was the centre of interest and was offered all day, with a weak market. The quotation at the opening was 68¼ and it fell to 61½ during the course of the day, closing a little stronger, at 62. On Wednesday the stock was weak, opening at 60. The highest quotation reached was 62⅞ and the lowest was 58½, closing at the highest figure. On Thursday the stock showed more firmness and opened at 64¼, closing at 62⅝. The fluctuations ranged from 64¼ to 62¼. Western Union lost 3 points on the first day of the flurry, and on Thursday closed at 78 bid.

Mr. John H. Longstreet, a well-known electrician, and a member of the firm of Hawthorn & Co., 42 Dey street, city, on July 11, started from Bordentown, N. J., where he resides, for the World's Fair in his handsome steam yacht "May." He goes to the Fair via the Hudson River, Erie canal and the lakes.

Mr. A. B. Laurence, New York Manager of the Shultz Belting Company, paid his respects to the Electrical Age last Friday. Mr. Laurence is one of the pleasantest men in the trade and his friends are always glad to meet him There is as great a resemblance between him and Henry Irving, the English tragedian, as there is between two peas, and in the trade he is frequently given the name of the famous actor.

W. T. H.

Old Cars.—The cars and car horses formerly used on Broadway, New York city, are being transported to New Jersey. Many of the horses are to be used on the street railroads of Newark not yet equipped with the electric system. The cars are to be used on roads in Newark and Jersey City.

TRADE NOTES.

The Orient Electric Co. which is about to manufacture incandescent lamps and other goods at Youngstown, Ohio, organized by electing Linus S. Dennison, Clyde O. Shatto, C. N. Sadler, F. Wayland Brown, A. It Powers, directors. Mr. Dennison was elected presiden. and Mr. Shatto secretary, treasurer and general manager. It is understood that C. N. Sadler, formerly of the Packard Electric Works in this city, will be superintendent.

We have received from the India Rubber Comb Company and the Goodyear Hard Rubber Company, 9–13 Mercer street, New York city, a copy of the catalogue and price list of the Chicago Electric Wire Company, of Wilmington, Del. The electric insulated wires made by this company, are claimed to be superior to all other makes now on the market for electric light, telegraph, telephone, electric railway, underground and submarine service. The insulation resistance is very high and the wire will stand bending without deterioration. The book contains many valuable tables and much general electrical information as well as the wire price lists. The Goodyear Company is general selling agent for the Chicago Electric Wire Company.

We are in receipt of a copy of the finely illustrated catalogue issued by J. H. Bunnell & Company, 76 Cortlandt street, New York city. It contains illustrations, descriptions and price lists of the many forms of railway, telegraph, telephone and electric light supplies handled by this firm, and is much larger than any of its predecessors. We notice that several new lines of goods have been added to the firm's already long list.

The Berlin Iron Bridge Co., of East Berlin, Conn., has received from E. D. Leavitt, consulting engineer of the Calumet & Hecla Mining Co., a contract for the iron roof over the latter company's new engine house. The building will be 80 ft. wide and 200 feet long.

Catalogue.—We are in receipt of a copy of the tastefully designed price list just issued by W. R. Brixey, 203 Broadway, New York city, manufacturer of the famous Day's Kerite insulated wires and cables. The book is generously illustrated and contains information and price lists on the many kinds of insulated wires and cables, for telephone, telegraph, electric light and railroad signal use, Kerite tape, rubber tape, elastic tape, etc , made by Mr. Brixey.

ELECTRICAL AGE

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NEW YORK, JULY 29, 1893.

CONTENTS.

ANOTHER LAMP DECISION.

The so-called "Oconto Lamp Case" was decided on July 20 in favor of the Edison General Electric Company. The decision was rendered in Milwaukee, Wis., by Judge Seamans of the United States Circuit Court for the District of Wisconsin, and it would seem likely to have a very important bearing on similar cases. The Edison Company brought suit against the Electric Manufacturing Company, of Oconto, Wis., for infringement of the Edison lamp patent by manufacturing and selling incandescent lamps, and Judge Seamans' decision grants an injunction against the Oconto Company restraining it from any further manufacture or sale of such lamps. The issue of the injunction is the finding by the court against the Goebel defence.

NO PATENT GAZETTE YET.

We are still in the same position with regard to our weekly patent record that we were last week and the week before. The patent office authorities informed us that we would receive the *Gazette* of July 4, during the present week, but they have failed to keep their promise. For the sake of a difference of a few thousand dollars the contract for publishing the *Gazette* was given to a new concern, which has, so far, failed to produce its first copy, and it is four weeks behind now.

THE TELEPHONE ON RAILROADS.

Two of the most prominent railroads in this country have recently introduced the telephone in their operating service. The Chicago, Rock Island and Pacific road we understand, proposes to use the system in the transaction of the business connected with all its departments at Chicago, such as communicating with the various freight yards, depots, etc., and the Pennsylvania Railroad Company will use the long distance telephone between its offices in the large cities along the railroad system. In the latter case, we are informed, the telephone is to be used by the high officials alone, for the executive business of the company, while in the former case it is to be used in the practical work of the road. While there is nothing extraordinary in the use of the telephone for such purposes these innovations indicate that the telephone is probably better adapted for this class of work than the telegraph, and we should not be surprised to see it very generally adopted by railroads.

THE STORAGE BATTERY CASE.

We give in this issue the principal points of the decision of Judge Coxe in the Accumulator case, which was rendered on the 18th instant. This case was a remarkably mixed-up one and probably the lawyers connected with it were the only ones who could tell how matters stood. It is a pretty long story, but the points in brief are given in the article referred to. It was thought, when the decision was rendered, that the manufacture of storage batteries of the Faure type could be undertaken now by any one, and such a statement was actually made by a prominent New York daily paper, but it transpires that such is not the case. The storage battery is tied up as much as ever, apparently. Apart from its bearing on the storage battery, Judge Coxe's decision will be of very great interest to those possessing foreign patents. It brings up some new and valuable points in this connection.

ELECTRIC CLOTH CUTTER.

It is said that "to bookmaking there is no end," and it might as truthfully be said that to the applications of electric current there is no end. Almost every day some new use is found for electricity, and there would seem to be very just grounds for the claims made by a great many people that electricity is the motive power of the world. There is no department of human activity

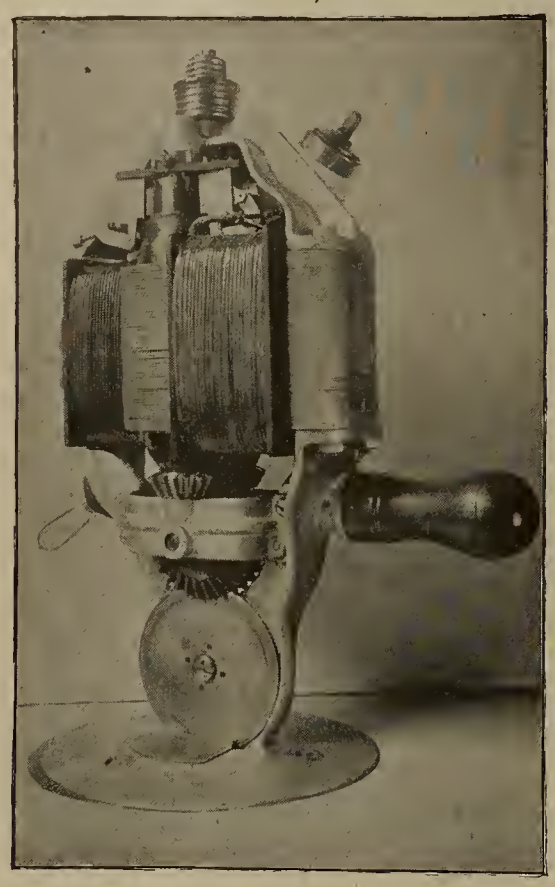


FIG. 1.—STYLE 3, ELECTRIC CLOTH CUTTER.

that is not invaded by the invisible, silent force, and who can estimate the great benefits it has conferred upon mankind? As a laborer, and a labor-saver it is incomparable. The same force will do a man's work for him and fan him at the same time to keep him cool, and in countless ways it lightens the burdens of life.

Everybody is familiar with the manifestations of electricity in one form or another. We see it as light in our streets, hotels, homes, etc., it drives our street cars; operates the machinery in our factories, and performs so many other useful offices that it would be difficult to enumerate them all.

One of the most ingenious applications of electricity that has been brought to our attention recently is in the cloth cutting machine which is illustrated and described herewith.

It is not necessary to say that there are great multitudes of people in this great country of ours to be clothed, and to supply them with suitable clothing re-

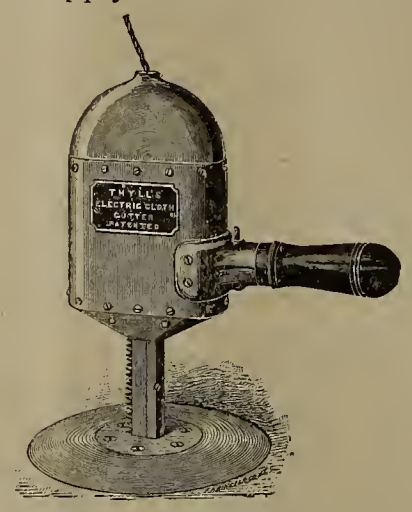


FIG. 2.—STYLE I, ELECTRIC CLOTH CUTTER.

quires a vast amount of labor on the part of a large army of workers. Were it not for the labor saving machinery continually being brought out, it would be an impossibility to supply this vast demand.

The electric cloth cutter is an instrument that will cut fabrics of every description, of many thicknesses, with remarkable rapidity. It will cut the finest of linen as easily as it does coarser goods, and it will cut through thicknesses of three and one-half inches.

The improved and perfected machine is shown in Fig. 1. This is known as the new style 3, and weighs about 35 pounds complete. Its dimensions are: height, seventeen inches; base diameter, eight inches. It is constructed with two armatures placed in a vertical position, to the lower end of the shafts of which bevel gear-

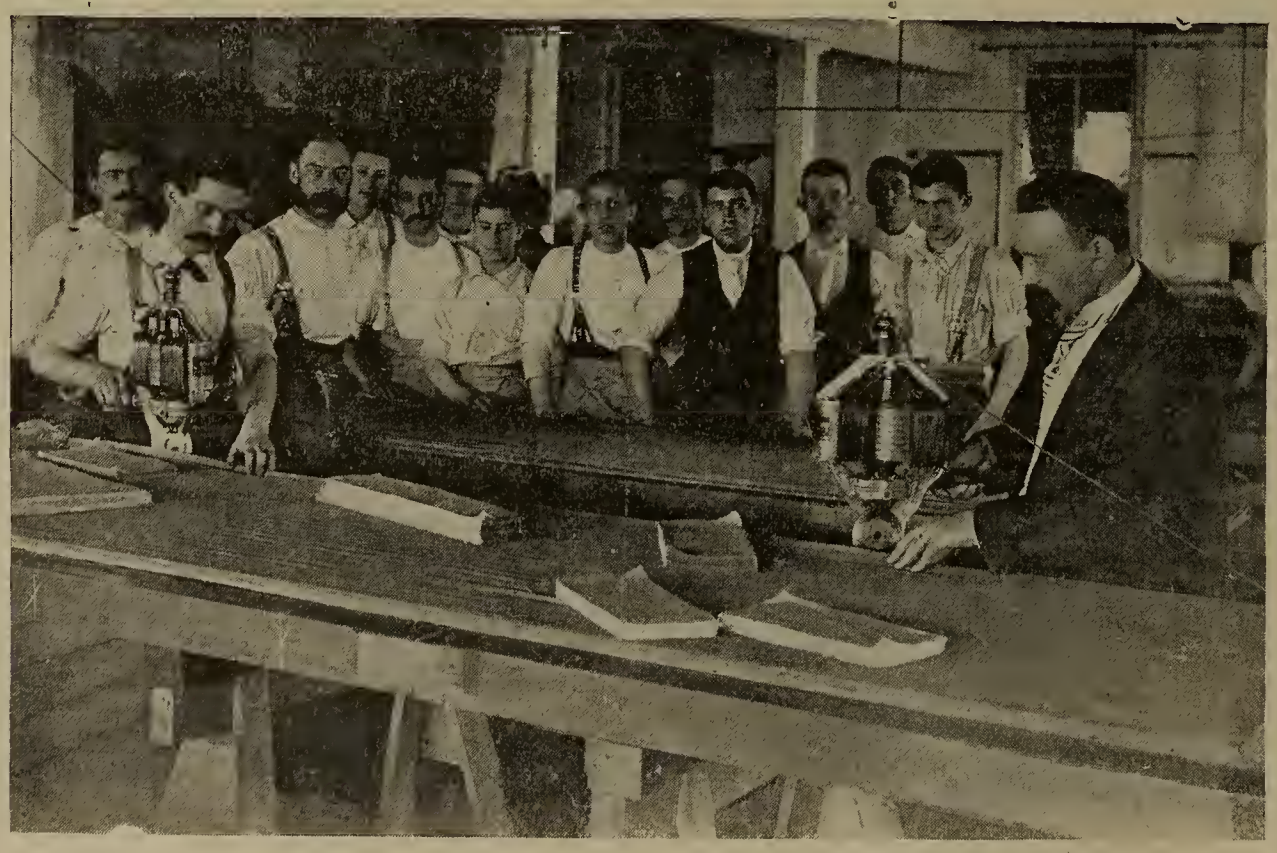


FIG. 3.—ELECTRIC CLOTH CUTTERS IN SHIRT FACTORY OF V. HENRY ROTHSCHILD.

ing is attached to the knife by means of this gear. The knife revolves at a speed of 2,500 revolutions a minute, and is kept sharpened by a little attachment carrying a small emery wheel which can be applied to the rapidly revolving knife at the proper angle, so as to ensure a perfect cutting edge.

There are three pole pieces to the field system, the centre one being common to both armatures. This method of construction, it will be seen, effects considerable economy in space and material, and makes the machine more compact.

The armatures are of the drum type, and the machine is shunt-wound and is rated at one-quarter H.P.

These machines can be operated on any incandescent circuit, and owing to their simplicity of construction cannot get out of order. No special training is required to operate them; with half an hour's instruction any novice can use them.

The cost of operation is, of course, an item always to be considered in any machine, but in this one it is claimed to be at a minimum, the cost, it is said, being less than three cents per actual working hour. The success of the system lies chiefly in its simplicity, portability and convenience of handling.

A valuable feature of the machine is the use of an incandescent lamp to illuminate the work. The lamp

FIG. 4—STYLE 2, ELECTRIC CLOTH CUTTER.

The style 2 cutter, shown in Fig 4, is similar in construction to style 3, except that it has but one armature and is consequently lighter, weighing but fifteen pounds. It is rated at one-eight H.P.

The original machine, an illustration of which is shown in Fig. 2, was constructed on a different principle. The cutter consisted of an arrangement of scissor blades, but this form soon gave way to the circular revolving cutter mainly on account of the inconvenience in sharpening. The style 2 and style 3 machines have entirely superseded those of the original type.

The details of the latest improved machine represent much time and labor in their development. The question of form and efficiency of motor was a difficult one to solve but the problem was most successfully mastered after several years of practical experiments.

is attached to the machine but is independent therewith as far as the current is concerned, being fed by its own wires. This lamp enables work to be carried on with great facility in dark lofts and on dark days.

Fig. 3 is a view of the shirt-room of the Sullivan street factory of V. Henry Rothschild & Co., of New York city, where these electric cutters are in constant operation, giving the most satisfactory results.

There is no class of cutting that this machine cannot do, however difficult it may otherwise be, and it cuts every thickness of the lay exactly the same size and shape. It also cuts arm scyes and square corners with the same facility, and it is guaranteed to do more work than any other cloth machine in the market, and at less cost.

The machine can be used on any table, a special table

not being required. It is handled very easily and it is really astonishing how perfectly and easily it does its work.

These electric cloth cutters, which are manufactured by the Electric Cutter Company, 166 Elm street, New York city, are now used in large numbers in New York, Boston, Buffalo, Rochester, Utica, Chicago, and many other places, and at a recent meeting of cloak makers in Boston this machine was the subject of considerable and warm discussion. It was there stated that one machine would do the work of eight men.

In one house in New York city, one machine alone is cutting 1,000 dozen pair of trousers per week, of 5½ working days.

The claims made for this machine are, cheapness, cleanliness, and durability, and it is said to be the best device of the kind ever put upon the market.

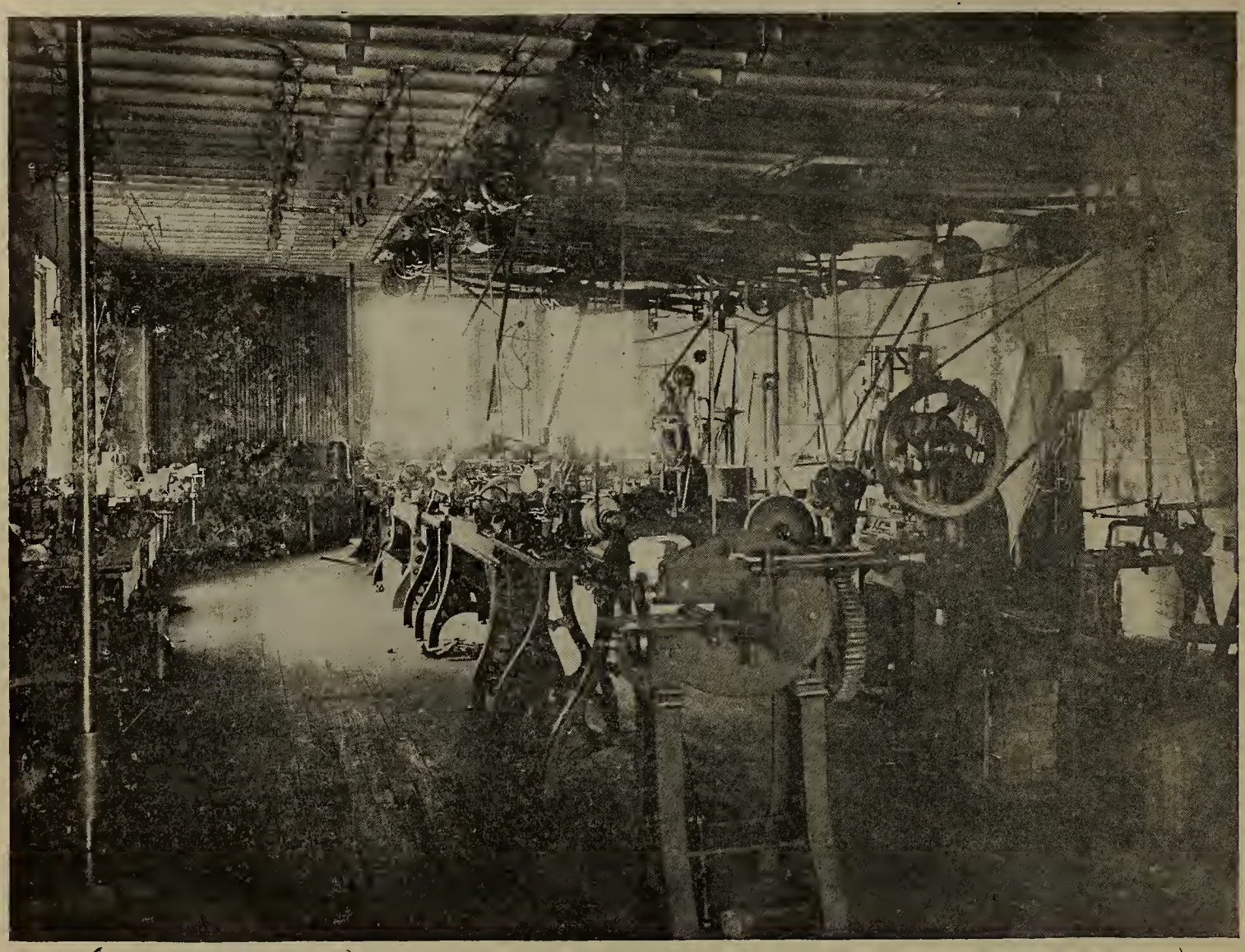


FIG. 5—ONE END OF FACTORY OF ELECTRIC CUTTER COMPANY.

Every machine is carefully tested before it leaves the company's shop and warranted for one year. The frames of the machines are made of aluminum castings to secure greater lightness.

This system of cutting is a vast improvement on all others. It does away with the use of trolleys on the ceiling, which are unsightly and clumsy. The flexible cord drops from a small bracket to the machine and the slack, as the machine is moved about, is taken up by a counter weight.

The company has every facility for manufacturing and finishing these machines. The factory, a view of one end of which is given in Fig. 5, gives constant employment to 25 men, and is equipped with the latest improved machinery and special tools for turning out the cutters. It is lighted by electricity.

The company will put upon the market shortly an electrically heated sad-iron, which it is said will surpass all others in service. It can be heated in two minutes and the heat can be regulated by simply turning a knob.

There is a great and constantly increasing demand for electrically heated irons on account of the extreme convenience they afford in practical operations.

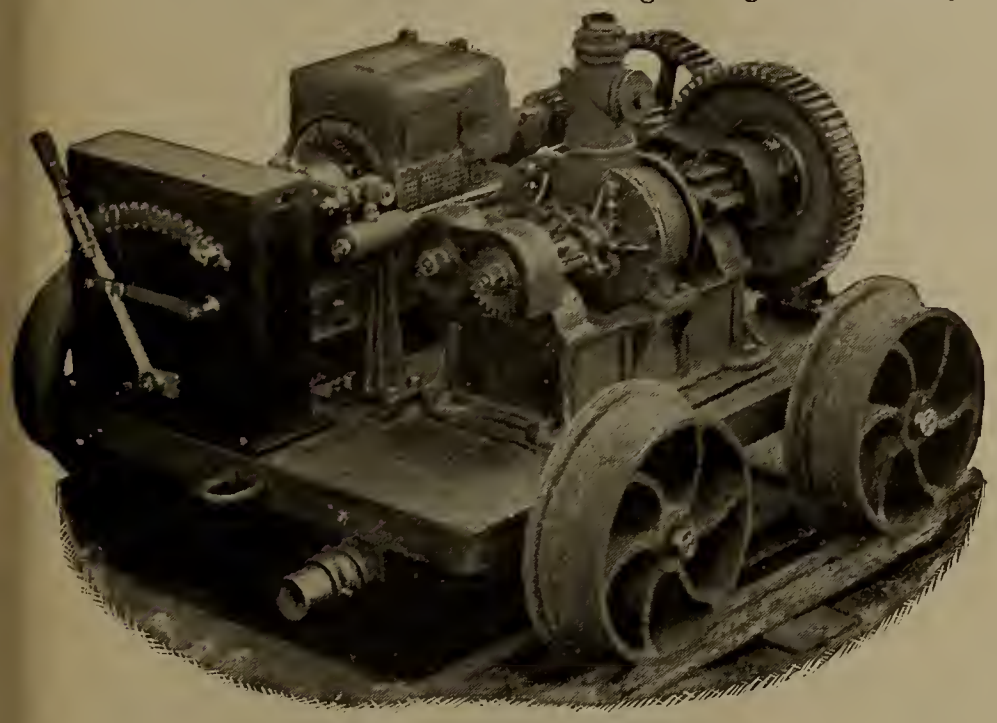
TESTS FOR INDIA RUBBER.

A series of tests have been recently carried out by a Russian naval officer at the St. Petersburg Technical Institute, says the London *Electrical Engineer*, in order to establish a set of definite rules for judging the quality of vulcanized india rubber. The following, in brief, are the conclusions arrived at, recourse being had to physical properties, since chemical analysis did not give reliable results: 1. India rubber should not give the least sign of superficial cracking when bent to an angle of 180 deg. C. after five hours of exposure in a closed air bath to a temperature of 125 deg. C. The test-pieces should be 2.4 in. thick. 2. Rubber that does not contain more than half its weight of metallic oxides should stretch to five times its length without breaking. 3. Rubber free from all foreign matter, except the sulphur used in vulcanizing it, should stretch to at least seven times its length without rupture. 4. The extension measured immediately after rupture should not exceed 12 per cent of the original length, with given dimensions. 5. Suppleness may be determined by measuring the percentage of ash formed in incineration. This may form the basis for deciding between different grades of rubber for certain purposes. 6. Vulcanized rubber should not harden under cold. These rules have been adopted for the Russian navy.

MINING PUMP.

One of the most useful of modern mining machines is the electric mining pump. This, with the other electrical appliances in modern mining practice, shows the wonderful progress made in this kind of work within the last few years.

The accompanying illustration shows an electric mining pump made by the Jeffrey Manufacturing Company, of Columbus, Ohio. On a small four wheel truck are mounted an electric motor with regulating box, a rotary



MINING PUMP.

pump and suitable gearing. The motor is enclosed to prevent dirt and dust from getting into the mechanism, and by being mounted on a truck it is very easily moved from place to p'ace. It is used to pump water in and about mines.

The motors are usually wound for 220 volts, but can, if desired, be wound for other voltage. The suction pipe is shown near the bottom of the truck; the discharge pipe is at the top of the pump. The outfit is very neatly and compactly arranged and is giving satisfaction in practical operation.

EXTENDING THE TROLLEY IN BROOKLYN.

Gradually the Brooklyn horse car lines are being transformed into electrics. On July 10 the Seventh avenue, Putnam and Halsey street lines were, for the first time, operated on the electric system. On the same day the Brooklyn Board of Aldermen granted the petition of the Broadway Railroad Company to change its motive power from horses to electric, also to construct lines over various new routes.

Trolley Car Guards.—Circulars have been sent by the New York State Board of Railroad Commissioners, to every street service railroad in the State of New York, recommending that platform gates for all electric cars on double track systems should be used and that one rear gate, the one away from the opposite track, should alone be used for ingress and egress of passengers, and that no persons should be allowed to ride on the platform with the motorman. The Board also recommends that on all open cars there shall be attached a guard on the side of the car next to the opposite track, running the entire length of the car, to prevent passengers entering or leaving the car on that side.

AN INTERESTING ELECTRIC PLANT.

The General Austrian Gas Company, of Budapest, Austro-Hungary is installing an electric plant for the lighting of that town, which possesses some very interesting features from an electrical point of view. The following facts taken from the London *Electrical Engineer* will be of interest to our readers:

The system chosen includes both alternating and continuous current, not used separately, but organically connected together. The advantages of both are thus obtained: (1) Small section of long-line mains by the use of high-tension alternate currents, and (2) security of working and economy of distribution by the use of accumulators.

The generating station is situated two miles from the town. Plant for 10,000 16-C.P. lamps simultaneously lighted will first be installed. The mains are calculated for 16,000 lamps, but everything is arranged so as to be trebled in case of need. The distance of the station away determined the choice of the alternate current; from the main station two currents will be sent to a sub-station, with a difference of phase of a quarter period direct to two-phase motors coupled to continuous-current dynamos, which will feed the three-wire mains by the intermediary of a battery of accumulators.

The driving plant consists of two vertical triple-expansion steam-engines of 500 H.P., each driving a two-phase dynamo; the two dynamos will run in parallel, each giving about 100 amperes to each circuit at 1,800 volts, corresponding to 360 kilowatts for each machine.

The exciting current will be supplied by a low tension dynamo, which will also light the station. The primary mains will consist of three cables of two concentric conductors, lead-covered and double iron-sheathed, one set being for reserve. The sub-station will contain two batteries of accumulators of 148 cells each, having a capacity of 1,500 to 2,200 ampere-hours, and a discharge current of (2 × 500) 1,000 amperes. The voltage at the motors (which are in parallel) is twice that across one

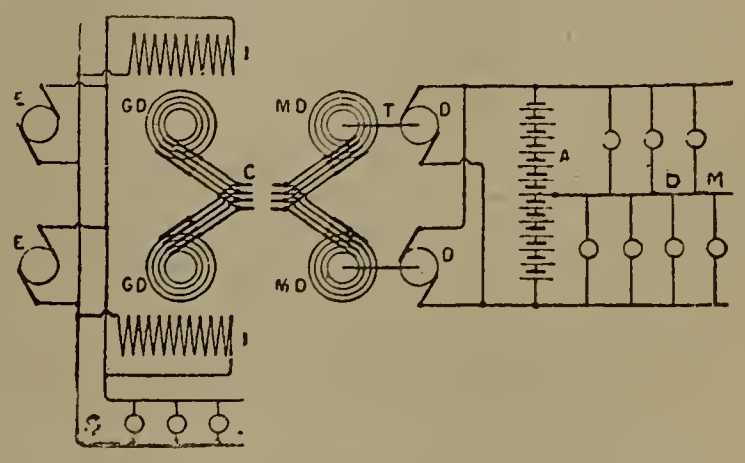


DIAGRAM OF CONNECTIONS.

bridge of the three wire system. The distribution is carried out in the usual manner by means of accumulators, with regulators to vary the number of cells. The entire installation is being carried out by Messrs. Schuckert, of Nurenberg, and part is to be ready for work in the coming winter.

The following is an explanation of the features of the diagram: E E exciters; I excitation of generators; G D generators, diphase; C conductors for alternating current, diphase; D direct current generators; A accumulators; D M distributing mains, S station lighting.

Azores Cable.—The Eastern Telegraph Company, of London, England, has received the contract for laying a cable from Portugal to St. Michael, in the Azores. It is proposed to extend this cable to Bermuda, thus forming another channel of communication with the United States.

THE PHYSIOLOGICAL EFFECTS OF CURRENTS OF HIGH FREQUENCY.*

By H. Lewis Jones, M.D.

The application to medicine of electrical currents of great rapidity of alternation, or high frequency currents, as they are commonly called, has occupied the minds of medical men to a great extent during the past 12 months. In France especially is this the case, where D'Arsonval has given much study to this difficult subject. The demonstrations which were given at the Royal Institution by Tesla in the spring of last year left an impression upon the minds of many people that enormous voltages were harmless to the human body if only they could be made to alternate with sufficient rapidity, and people were astounded at the spectacle of a lecturer placing himself in a circuit carrying a current alternating some hundreds of thousands of times per second, at a pressure of many thousands of volts. These experiments, coming not long after the accounts of the execution of criminals by electricity in America, with pressures of 1,200 or 1,500 volts, and compared with the occasional notices in the newspapers of fatal accidents to workmen engaged upon electric light cables at 1,000 volts, made it seem as though the rapidity of alternation was the factor which protected Tesla from injury by the enormously high voltages which he was handling. The same view is taken by D'Arsonval in his papers before the Société de Biologie. He there describes an apparatus consisting of an induction coil supplying current to Leyden jars, the jars being made to discharge through a circuit including a helix of 10 to 15 turns of thick wire and an air gap. In this way there is set up in the circuit a succession of sudden rushes of current, which oscillate hundreds of thousands or even millions of times per second, the rate being determined by the Leyden jars; and the wire helix becomes the seat of electro-magnetic induction effects, comparable exactly to the induced primary currents of a medical induction coil, but very much more intense. These induced currents of the helix are the subject of D'Arsonval's experiments. By attaching wires to the beginning and end of the helix, the induced current or extra currents can be led off; their energy was sufficient to bring to full incandescence a lamp requiring two amperes to light it, and it was therefore assumed that they had a magnitude of 2 amperes. The electromotive force of the currents was at least 8,000 or 10,000 volts, because they were able to leap across an air gap of several millimeters, and yet their effect upon the tissues of the body was very slight; in fact, they were hardly felt.

Now it is certain that a current of far less than 1 ampere, either steady or alternating 20, 50, or 100 times per second, would produce unbearable and dangerous shocks in its passage through the tissues; and the inference drawn is that the extreme frequency of alternation can render a current of dangerous magnitude innocuous. But I am not satisfied that such an inference is a proper one, for the following reasons:

1. A Leyden jar discharging through the body, produces effects which are painful and severe, as all who have felt them will agree; but yet this is a discharge of high frequency of alternation; in fact, it is by the Leyden jars in the circuit that the oscillatory character and the rapid rate of alternation of the discharge is determined. Oliver Lodge gives the rate of oscillation for a pint-sized Leyden jar at ten million per second; for jars of greater capacity the rate is less rapid.

2. The high frequency and high potential discharges of Tesla's apparatus are not altogether harmless, but can produce severe shocks and can kill small animals, as Elihu Thomson has shown. The discharges from the terminals of such an apparatus can produce severe muscular contractions even with the resistance of a considerable air space interposed in the circuit; so much so, that in some recent experiments which the writer was enabled to make through the kindness of Mr. Campbell Swinton, it was considered prudent to proceed no further with the experiment of actually touching both the terminals of the coil at once.

3. It is very doubtful whether D'Arsonval's estimation of the magnitude of the current of his apparatus is correct. The incandescence of a lamp filament with currents of high frequency has been recently under discussion in some of the electrical journals, and a very satisfactory explanation of the phenomenon has been forthcoming. It is well known that for alternating currents the resistance of a conductor is greater than it is for steady currents, and the increase of resistance rises rapidly as the rate of alternation becomes greater; and with frequencies approaching one million per second, the effective resistance of the lamp used by D'Arsonval would be raised enormously; this would require the energy needed to bring it to incandescence to be applied at a proportionately higher voltage, while the magnitude

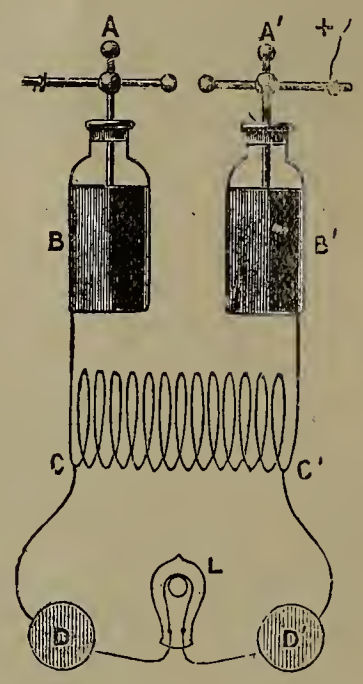


DIAGRAM OF EXPERIMENTAL APPARATUS.

of the current would be lessened in an equal degree. For example, the energy of 2 amperes at 100 volts is the same in amount as that of 0 02 of an ampere (20 milliamperes) at 10,000 volts.

We are, therefore, able to say that the current which raised D'Arsonval's two-ampere lamp to bright incandescence was very much less than two amperes, and was probably only a few milliamperes, and herein lies the pith of the whole question. The experiments with high frequency currents of high tension are harmless if the magnitude of the current is small, and as the high potential is, in fact, obtained at the expense of the current, this latter diminishes in proportion as the potential is raised by each successive step-up in the transforming apparatus. For the present, it may be taken as not yet proved that high frequency of alternation can render electrical currents harmless; and it may still be acccepted that the effect produced by the passage of a current through living tissues depends primarily upon the magnitude of the current, as measured in amperes, which is made to traverse them, and upon its density or concentration therein.

* *British Medical Journal.*

SMOKELESS FIRES.

There have been many attempts within the last ten years to do away with the smoke from fires in boilers, stoves, furnaces, etc. The problem has been treated from several standpoints and one of the most economical results that has been obtained is the smokeless fire system.

The apparatus used to produce this desirable result is exceedingly simple and inexpensive. The fire box in this system is so arranged that the fuel is evenly distrib-

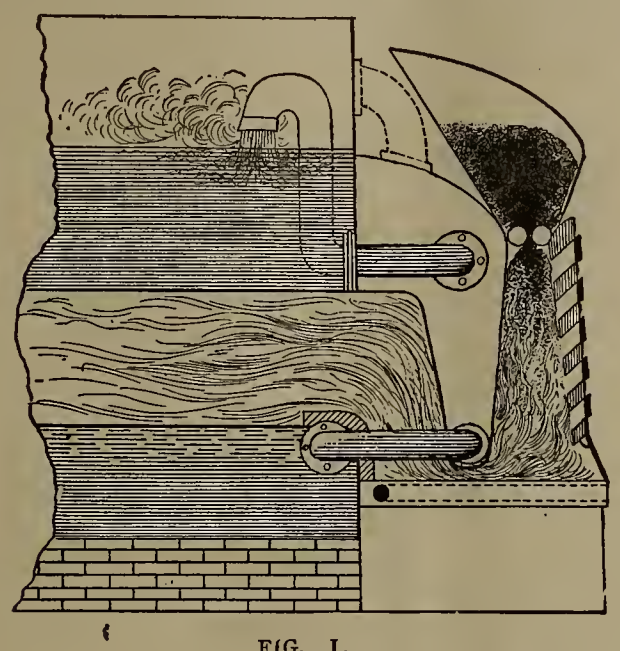


FIG. 1.

uted in a finely regulated rain-like feed ; the air supply being so adjusted that the burning product is well furnished with oxygen, thus the result is a nearly perfect combustion, nothing but pure flame passing into the flues and no smoke. The caloric value of the fuel is still further increased by a simple arrangement whereby a larger percentage of hydrogen is obtained and introduced into the body of the fuel, facilitating perfect smokeless combustion.

The kind of coal most suitable for these fires, is the slack or smudge, or an inferior kind of dust coal and nut coal, the cost of which is much lower than the best steam coal. Ordinary coal can also be used.

Among the points claimed for this system are the positively smokeless fires, no chimney sweeping, large economy in fuel (never less than 30 per cent.) no clink-

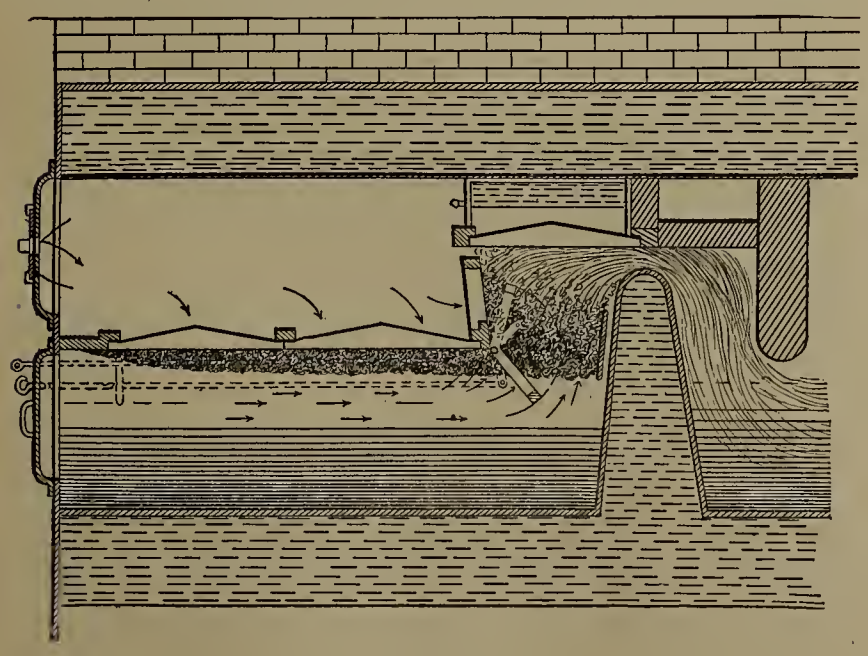


FIG. 2.

ers, consumes over 60 per cent. of ashes formed under present fires, and can be applied to fires of all description.

Fig. 1 illustrates the system applied to a steam boiler, with front fire box with automatic feed. By the arrangement of water supply pipes in the boiler the heat is rapidly taken up by the water and its scouring action through the bridge and the boiler prevents the deposit of scale.

Fig. 2 illustrates a rear fire box with hand fuel feed. Fig. 3 illustrates the system as applied to a vertical steam boiler.

These fires are very valuable in the household as they are quick in action, and very economical in fuel ; it is claimed that they save at least 60 per cent. of the fuel. Absence of smoke and soot, and ease with which the fire is kept alight, are desirable features of this system. This system is also applicable to domestic fires, such as ranges, etc. These fires have been used in Great Britain and other foreign countries for some time, and are the result of 25 years of tests and experience by the well-known authority on smokeless fires, J. Knapton Thompson, C. E., of Leeds, England.

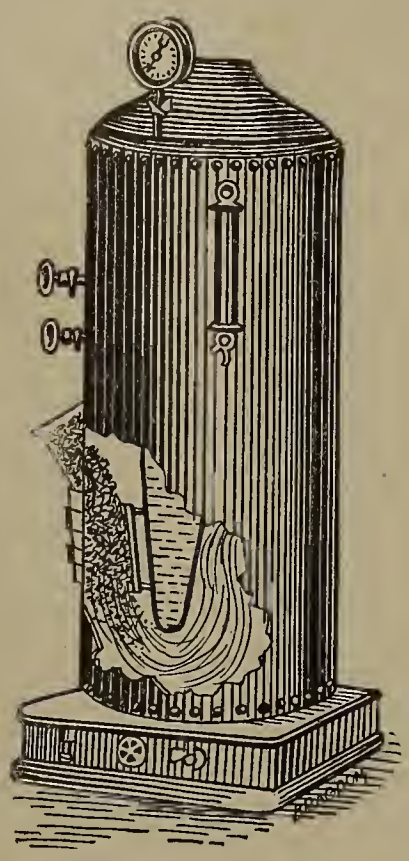


FIG. 3.

The Thompson Smokeless Fire Company, 803 and 804 Hamilton Building, Pittsburg, Pa., is the manufacturer of this smokeless fire apparatus.

LONG DISTANCE TELEPHONE ON THE PENNSYLVANIA RAILROAD.

The Pennsylvania Railroad Company has adopted the long distance telephone as the medium of communication between the leading offices of the company, and it is calculated will save much valuable time and will aid in the more rapid transaction of urgent business.

The important points on the Pennsylvania system thus brought into close call with Philadelphia are New York, Jersey City, Wilmington, Baltimore, Washington, Harrisburg, Altoona, Chicago and St. Louis.

The wires in these and other cities on the Pennsylvania system where important executive offices are stationed will run into the private offices of the higher officials and a vast saving of time as well as other advantages will be the result.

The introduction of this system, which has been under consideration for some time by the Pennsylvania officials is largely due to Charles E. Pugh, third vice-president, who has given a great deal of personal attention to the project, and in whose hands the working out of the sys-

tem was largely placed. Mr. Pugh developed the plans, decided upon the points to be reached, and made the final contracts with the telephone companies.

The system is intended for the exclusive use of the high officials in the transaction of the company's business and will be extended. No one will be allowed to use the telephones except these officers, even though they desire to communicate with an official.

The telegraph, with all its advantages over former methods, did not insure the inviolate confidence between officials that the direct word by mouth over the telephone will, because the message invariably passes through the hands of two and sometimes three or four operators. Consequently, under such conditions, the questions under consideration could only be settled after a personal meeting between the officials and this necessitated a large amount of traveling. Much of the valuable time will now be saved and the business transacted in much quicker time.

IMPORTANT STORAGE BATTERY DECISION.

On July 18, Judge Coxe in the U. S. Circuit Court for the Southern District of New York, rendered a decision in the case of The Electrical Accumulator Company *vs.* The Julien Electric Company, declaring the famous Faure patent to have lapsed and expired, by reason of the prior expiry of the Faure Spanish patent for the same invention.

This decision is the outcome of the long and protracted litigation between the parties now representing The Consolidated Electric Storage Company, on the one hand, and the parties representing The Accumulator Company, successors of The Electrical Accumulator Company, on the other hand. The contest has been maintained with unabated vigor for nearly seven years. At first, the victory seemed to be on the side of The Electrical Accumulator Company, who obtained an injunction against the defendants on April 12, 1889, compelling the stoppage of the electric cars on Fourth avenue. Then the defendants got control of the Brush storage battery patents and joining in the Brush suit, vigorously attacked the complainants, defeating them; but the complainants maintained that it was but half a victory, for the reason that without the aid of the Faure process—"paint, paste and cement"—the defendants could not make a practical storage battery, although possessed of the Brush storage battery patents—the fundamental patents—in other words, the complainants contended that the active matter or layer must, to be successful, be applied in the form of a paste and not in the form of a powder, as practiced by the defendants.

Late in 1890, the defendants became aware that the Faure Spanish patent would expire the following year. Steps were immediately taken to secure the proper documents from Madrid. The formalities to be observed in doing this were numerous and difficult to follow. However, after many disheartening set-backs and untold obstacles, the defendants succeeded in getting a complete record of the papers at Madrid, and had a re-hearing in the case with the result that the patent was declared to have expired.

The situation now as reported, is that although "paint, paste and cement," as such, is no longer patented, yet it is not open to the public; for the reason that its application to the plate or support is covered by the fundamental Brush patents, of which The Consolidated Electric Storage Company is the exclusive licensee. As a matter of fact, the process it is stated is now owned by The Consolidated Electric Storage Company, instead of by The Accumulator Company, as fully as if the Faure patent were still alive and owned by The Consolidated Electric Storage Company—as if there had been a transfer from The Accumulator Company to The Consolidated Electric Storage Company. Thus, by operation of law, the Faure process, hitherto owned by The Accumulator Company, has become the property of The Consolidated Electric Storage Company.

The following are the main points of Judge Coxe's decision:

It is proved beyond question that a Spanish Patent was issued to Camille A. Faure, June 27, 1881, for a term of ten years, and that this patent expired June 27, 1891.

If the Spanish patent was for the same invention as the patent in suit, it is manifest that the latter expired June 27, 1891. This is the only question: Was the Spanish patent for the same invention?

Section 4887 of the Revised Statutes provides: "But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent; or, if there be more than one at the same time, with the one having the shortest term."

In the leading cases of *Siemens' Adm's vs. Sellers, 123 U. S., 276, and Commercial Manufacturing Co vs. Fairbank Canning Co., 135 U. S, 176* the Supreme Court has made the test of identity to depend upon the following propositions:

Is the principal invention of the domestic patent found in the foreign patent?

Is the subject matter of the one the same in all essential particulars as that of the other?

In other words, will a structure made pursuant to the foreign patent infringe the domestic patent?

Could both the patents have been granted in this country?

Would a person skilled in the art, after reading the description of the invention covered by the Spanish patent, be able to construct the electrode described and claimed in the United States patent?

In approaching the subject of identity, it should be remembered that Faure is a Frenchman, and that the first description of his invention was written in the French language. From this original it was translated into Spanish and English. Making allowance for philological differences, for errors and unavoidable changes in translation, and for dissimilarities in Patent Office procedure, it would hardly be expected that the United States and Spanish patents would emerge from such an ordeal in identical garb, even though it were the avowed purpose of the inventor to make them the same.

There seems to be no doubt that the application as filed in the Patent Office at Washington was almost an exact counterpart of the Spanish patent, and that both the patent and the application were translated from one and the same French origin.

"It is evident," says the complainant's brief, "that the original American application was very much like the Spanish patent. The claims were differently phrased, but it is quite possible that they were intended by the translator to cover the same subject matter."

Faure's invention was described by him in the same language, and was presented for their approval to the patent officials of three countries differing widely in their methods for the protection of inventors. If he had made any new discoveries between the date of the French patent and the dates, respectively, of his application in Spain and the United States, he certainly failed to note the fact in either specification. The proof that he did make such discoveries is very unsatisfactory. This being so, it precludes the idea that Faure had made many kindred inventions along the same lines, which

he was desirous of protecting. Like Mr. Brush, for instance (*47 Fed. Rep., 48, 51, 54*). It clearly was intention to take out a patent for the same invention in the two countries. This is not disputed. One of the experts for the complainant says: "These patents (Faure's) intended to cover the same invention differ widely."

Faure had taken an important step forward in the construction of secondary batteries, which may be broadly stated as an improvement on the method of Planté, by adding directly to the support the layer of active material which Planté produced by disintegration after weeks and months of effort. This invention Faure described; this invention he endeavored to have patented in France, Spain and the United States. It is now said that he failed in this undertaking; that he patented one invention in Spain, and another in France and in this country.

It is argued that this result was accomplished because Faure failed to patent in Spain the invention in the form in which he had actually embodied it, and in which its success had been proved in France—the one form which makes it thoroughly practical and useful. In other words, that he failed to describe the most valuable part of his invention although fully known to him at the time.

The inquiry naturally suggests itself, how can this be? How can such a result be reached—an attempt to patent one invention and the actual patenting of another—without the participation or knowledge of the inventor? It will be found on examination that the supposed differences, which are so greatly magnified, are differences of form and not of substance and grow out of different environments and forms of expression. The inventor has described several ways in which the active layer may be applied and it is not surprising that the officials of Spain should have given prominence to one way and those of this country to another way.

Again, there is an express admission that the United States and French patents are the same, the specification of the former stating that the invention was "Patented in France, October 20, 1880," and in the oath attached to the application Faure swears that the invention "has been patented by him by Letters Patent of the French Government."

There is also an admission, at least, by implication, that the Spanish and French patents are the same. The Spanish law permitted a patent for twenty years, "if it has for its object new and original inventions," but if the inventor had obtained a patent therefor in one or more foreign countries the term was for ten years only. The French patent had been granted (October 20, 1880), when the application for the Spanish patent was filed (April 16, 1881) The inventor asked for a ten years' term in Spain presumably because he knew that he was not entitled to a twenty years' term, the invention having been patented in France.

Furthermore, the proceedings instituted on behalf of the complainant to reinstate the Spanish patent proceeded upon the theory that the French and Spanish patents were for the same invention. In other words, a concession that the Spanish and French patents are the same, is also a concession that the Spanish and United States patents are the same. The latter two cannot both be like the French patent without being like each other also. The description of what Faure discovered was the same in both cases. If the domestic patent is for another invention, the patent should have been granted to the Patent Office officials and not to Faure; the changes are theirs and not his.

Not only are the two descriptions from the same source, but the drawings, except in a few unimportant details, are identical.

It is a mistake to start out with the hypothesis that the United States patent, in terse and perspicuous language, describes the application of the active material in the form of paint, paste or cement, and stops there. It is a mistake to compare the Spanish patent with a patent thus assumed to be clear in language and limited in scope, for it will be found on examination that neither patent is free from ambiguity, and that the real invention of Faure is as plainly proclaimed in the one as in the other. The comparison should be instituted between the patents as they were issued, and not between the Spanish patent and the United States patent as it now exists after being cut down by a disclaimer, and limited by an art existing in this country, of which the inventor knew nothing. If a patent, when granted, covers an invention which has been previously covered by a foreign patent, it expires with the foreign patent, notwithstanding the fact that it has subsequently been pared down to cover only one method of practicing the invention, or restricted to a single claim. A disclaimer cannot add a new invention to the patent. Assume the case of a foreign patent and a United States patent subsequently granted in language precisely identical. Assume that, pursuant to the decision of the Court, or for other reason, the inventor has disclaimed all of the claims but one, and that one is so restricted that it covers only one feature not made prominent in the original patent; can it be said that this proceeding wholly changes the scope and purport of the patent, making it, in fact, a patent for a different invention. If so, disclaimers will be put to new and important uses never dreamed of before. When it is remembered that Faure intended to claim broadly in both patents all described methods of adding the active material, giving no especial preference to any one, there will be less difficulty in perceiving that "the principal invention is in both."

But let it be assumed that the inquiry is: Was the invention of the United States patent, as now construed and limited, previously patented in Spain?

Does the Spanish patent cover the method of constructing a secondary battery electrode to which the active material, insoluble in the electrolyte, has been mechanically employed in the form of a paint, paste or cement prior to immersion in the battery fluid, so as instantly to become porous? Does it cover that? If so, it must be conceded on all sides that it is for the same invention.

Both the Spanish and American patents relate to secondary batteries and to improvements upon the method of Gaston Planté.

Other similarities and differences will be best appreciated by placing side by side the parts of the two patents which relate chiefly to the invention when limited as above stated.

Then follow, in parallel columns, the parts of the Spanish and United States patents referred to.

Judge Coxe then proceeds to consider whether or not what is now called the principal invention is found in each of the Spanish and United States patents, and concludes as follows:

After giving the complainant the benefit of every reasonable doubt, the court is convinced that the question must be answered in the affirmative. The longer the record is studied, the more settled becomes the conviction that the invention which Faure patented in Spain and in the United States was the invention which he made and patented in France, that, so far as the inventor was concerned, the language was substantially identical and that the changes in phraseology made by the translators and Patent Office officials, of which changes the inventor was ignorant, did not and could not operate to change the invention.

It follows that the defendants are entitled to a decree dissolving the injunction issued April 12, 1889.

PRACTICAL ASPECTS OF LOW FREQUENCY ELECTRICAL RESONANCE.*

BY M. I. PUPIN, PH. D., COLUMBIA COLLEGE.

1. *On the Natural Period of an Electrical Circuit.*

An electrical circuit possessing self-induction and capacity behaves in a great many respects as a body does in consequence of its inertia and elasticity. The fundamental reason for this analogy is simply this:—The electrogmagnetic energy of a coil through which a current flows, has all the characteristic properties of the kinetic energy of a moving body, whereas the energy of the static charge of a condenser has all the characteristic properties of the potential energy of a strained elastic body. If the neutral state of such an electrical circuit is disturbed, it will return to it again after performing a certain number of oscillations about the position of its neutral state. But a return to the neutral state is impossible until the energy which is spent upon the circuit to disturb its neutral state has left the circuit, or to use a more technical expression, until the energy has been dissipated or given off to some other circuit. The two principal causes which produce dissipation and compel the circuit to return to its neutral state again, are frictional resistances and radiation. Just as in the case of vibrating bodies, so also in the case of electrical oscillations, losses due to radiation, especially when no other electrical circuits are near, are exceedingly small when the oscillations are slow. In Herzian oscillations they are quite considerable. In oscillations of the Tesla frequency they are probably not negligible. My remarks refer to electrical oscillations of long period, therefore, losses due to frictional resistances are the only losses which I shall consider. Consider now an electrical circuit consisting of a coil *A* and a condenser *B* (Fig. 1) in series with it. It is a circuit with localized self-induction and capacity. I trust that my discussion will lose as little in its generality as it will in its practical bearing if I confine it to such circuits only. Let a sudden electrical impulse disturb the neutral state of this circuit; electrical oscillations will result. These oscillations follow laws practically identical with the laws of the motion of a slowly vibrating body. Their period is constant, as we all know, and it is in general completely determined by *the electromagnetic moment of inertia and the dielectric elasticity* of the circuit—that is, by its coefficient of self-induction and its capacity. When, however, frictional losses due to ohmic resistance, magnetic and dielectric hysteresis are large, then the period of this circuit is no longer defined by the self-induction and capacity alone, but it is also influenced by these frictional losses.

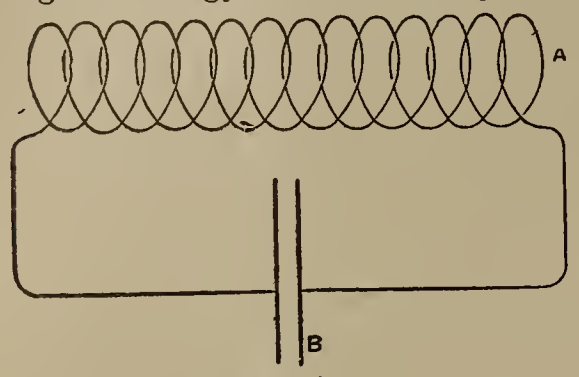


Fig. 1.

When ohmic resistance and hysteresis losses are small enough, then the natural period of the circuit is given by the well-known formula

$$T = \frac{2\pi}{10^{9}}\sqrt{L\,C}$$

Where T is the natural period of the circuit in seconds, L its coefficient of self-induction in henrys, and C its capacity in microfarads. For instance, a large Bell telephone whose coefficient of self-induction is 0.5 henrys when connected in series to a condenser of 1 microfarad capacity will have a natural period of very nearly $\frac{1}{225}$ seconds, that is to say, an electrical disturbance would set up oscillations in it, 225 of which would take place in one second. If a permanent magnet were brought into the vicinity of the telephone coil and then suddenly removed, the telephone would sing a note whose pitch would be a little below the well-known note C. But it would not sing it very long. For since the ohmic resistance is 100 ohms these oscillations would disappear almost entirely after 10 complete oscillations, somewhat in the manner represented in diagram Fig. 2, that is to say the telephone would sing only during about $\frac{1}{22}$ part of a second. By diminishing the resistance we could prolong its song. But diminish resistance as much as you please, the pitch of the note of the telephone will remain the same, because, as I said, the natural period of the telephone circuit just described is within wide limits independent of the ohmic resistance.

2. *On the Tuning of an Electrical Circuit.*

To change the note, say to make it higher, it would be necessary to diminish the capacity of the condenser. When a piano tuner wishes to raise the pitch of a piano string he gives it more tension; so in *tuning an electrical circuit*, in order to change its pitch, it is necessary to change its *electrical elasticity*, that is, its capacity. But there are other ways of tuning an electrical circuit, just as there are different ways of tuning musical instruments. Consider a reed pipe, say a clarionet. The musician places a little bit of wax on the reed. When the instrument is too low in pitch he takes off some of the wax, so as to diminish the moment of inertia of the reed, and when the pitch of the instrument is too high, he sticks on more wax so as to increase the moment of inertia. At any rate this used to be the method of old-fashioned country musicians. And so it is in tuning an electric circuit. Instead of varying its *electrical elasticity*, that is, its capacity, we can vary its *electromagnetic moment of inertia*, that is to say, its coefficient of self-induction. To show how this may be done in the telephone circuit just mentioned, insert into this circuit a small coil, *a* (Fig. 3) an auxiliary coil, with a removable iron core *c* made up of very fine iron wire. In doing this we do exactly what the country musician does when he puts wax on the reed of his clarionet. If the electrical pitch of the circuit does not suit, say it is too high, then simply put on more electro-magnetic wax, that is to say, insert the iron core and move it

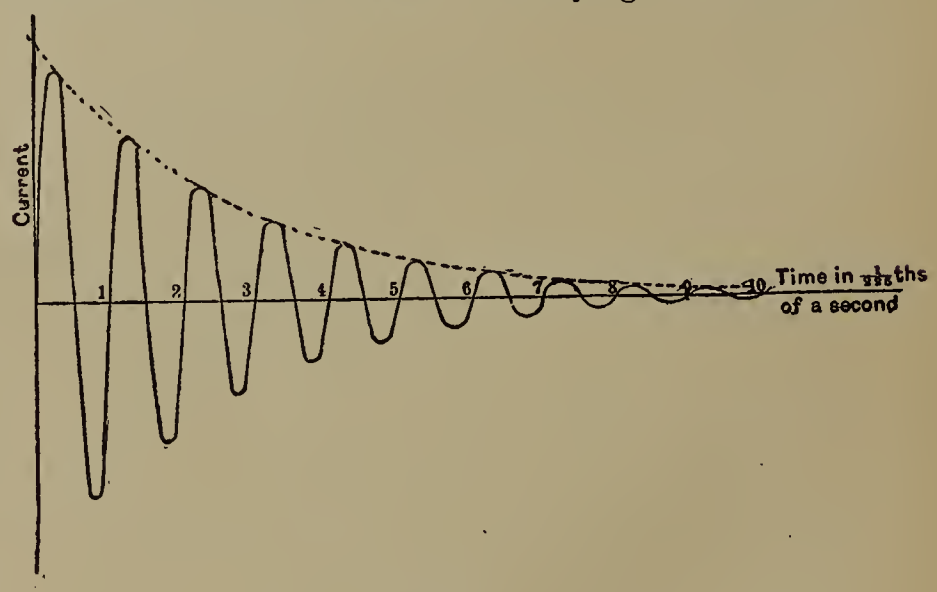


FIG. 2.

* Abstract of a lecture delivered at the Tenth General Meeting of the American Institute of Electrical Engineers, Columbia College, New York, May 17, 1893.

back and forth until the correct position is found which will give the correct electrical moment of inertia, that is to say, the correct coefficient of self-induction. This is, briefly stated, what I mean by the expression *tuning an electrical circuit.* From the simple expression given above for the natural period of an electrical circuit, it is evident that the tuning of an electrical circuit, if not simpler, is certainly quite as simple a process as the tuning of a musical instrument.

3. *On the Determination of the Pitch of an Electrical Circuit.*

If we wish to know the pitch of a musical instrument, say of a tuning fork, to choose a simple illustration, we simply give it an impulse, say a tap with the finger, and then listen to the vibrations, which in general will last for several minutes, and give us sufficient time to make up our minds as to what the vibrations sound like. In examining the pitch of an electrical circuit, it is more convenient to adopt a different method. The reason is that as a rule electrical oscillations are, as pointed out in the example above, much more damped,

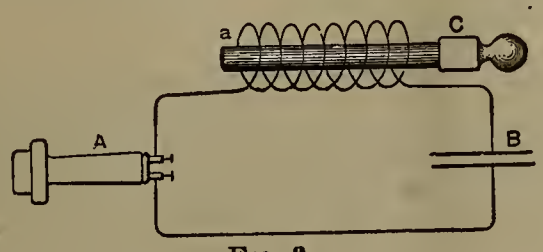


FIG. 3.

so that the oscillations resulting from a single impulse would not last long enough to give us sufficient time to see what they look like, or to listen and hear what they sound like. The method suggested by the stroke of a violin bow over the string is preferable. The stroke of the bow produces a series of impulses which quickly succeed each other and maintain the string in uniform vibration. It is interesting now to observe that the same thing can be done with an electrical circuit. Consider the circuit A B C Fig. 4. The condenser B represents the tension on the violin string, coil A represents its inertia. The air-gap C stands for the point where the bow by its stroke excites the string. If you now wish a musician who plays with a one-sided stroke, use a high potential direct current generator D, and for an alternating stroke substitute an alternator. The discharges at the air-gap C succeeding each other quickly enough, and at proper intervals will maintain in the circuit A B C practically uniform electrical oscillations. This is one of Tesla's favorite circuits, and I have no doubt but that he will accomplish great things with it yet.[1] Bring a few turns of wire of a telephone circuit into inductive influence of this circuit, and you will have in the telephone a musical note of exactly the same pitch as the pitch of the electrical oscillations in the circuit A B C. The note is not perfectly pure. It is marred by the noise of the spark discharge of the air-gap C. Neither is the note of the violin string pure; there is always more or less of the scraping noise of the bow. Just as it is necessary to keep the bow well rosined so as to give it a good grip upon the string, so it is necessary to apply a strong current of air or the action of some other of Tesla's devices upon the air-gap C, otherwise an arc is formed and the generator D loses its grip upon the circuit A B C.[2] If we had a number of different coils with condensers like A and B alongside of each other, and arranged in such a way as to be able to place them at will, now the one and now the other, and now again a number of them in multiple under the action of the electrical bow which the generator D keeps moving over the air-gap C and at the same time vary the capacities, we should be able to change the electrical vibrations of our system with that ease, precision and grace which the violin player displays when with the one hand he guides his obedient bow, while the busy fingers of the other hand glide over the trembling strings, eliciting from them delightful notes which blend into pleasing harmonies. So with our system of properly tuned electrical circuits, we could produce harmonies, but they would be harmonies of silence, harmonious oscillations in the ether that affect neither eye, nor ear, nor taste, nor smell. But bring a part of a telephone circuit into inductive action of our harmonic system, and let a skilled experimentalist manipulate a properly constructed keyboard which controls the coils and condensers of the various circuits, and harmonies which before were as silent as the grave, will now agitate the responsive diaphragm of the telephone and produce music that could be made to re-echo in every telephone in the United States.

But after all, such an arrangement, when used for such a purpose, would be a mere toy in comparison to the purpose for which our distinguished colleague, Mr. Tesla, employs it. To convert high-potential but small current electrical energy into low-potential big current energy, or *vice versa*, accompanied by all possible variations in the frequency of oscillations was the purpose for which Mr. Tesla constructed the device. To a physicist who delights, not less than the engineer, in neat, simple devices for the accomplishment of big and brilliant effects, this device of Tesla naturally appeals more than all his other ingenious inventions. Many a delightful hour have I spent in watching experiments on a circuit like the one in Figure 4. The

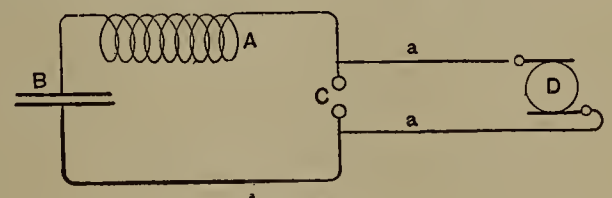


FIG. 4.

coil A consisted of a short, stout copper wire; the condenser B consisted of a battery of Leyden jars, which my distinguished teacher, Prof. Rood, of Columbia College, kindly lent me. The wires *aa* were thin copper wires connecting the air-gap C to the poles of an induction coil which is now in the hospital. It is a delightful sight to see the stout wire aglow under the powerful agitation of the rapid oscillations, whereas the thin wires *aa* adjoining them remained perfectly cool. Twist now the thick wire A into a few convolutions, say ten or twelve, and surround them by a few hundred turns of fine wire and you will have the now well-known oscillatory transformer with which Mr. Tesla and Prof. Elihu Thomson produced some brilliant effects, a transformer that will give you any number of volts especially if—and now I am going to touch a point which forms the central point of my discourse—especially if the thin wire coil contains *capacity in series with it, so that the natural period of this circuit is the same as the period of the thick wire coil, that is if the two circuits are in resonance.*

4. *On Resonance.*

Here again I have borrowed a term employed in music. But a few simple considerations will show you that it is very natural that I should, for the phenomena of sound and those of oscillatory flow of electricity are governed by nearly the same laws. Very high frequency electrical oscillations would in all probability be identical with light, as first announced by immortal

1. It must be observed, however, that Hertz, in 1887, produced his oscillations by a circuit of this identical form.

2. The importance of blowing out the arc for the production of powerful oscillations seems to have been first recognized by H. Classen, Wiedemann Annal. d. Physik und chemie, Band xixxx, p. 647, 1890.

Maxwell. It is, therefore, not surprising to find that low frequency electrical oscillations should resemble so much the other group of oscillatory phenomena which next to light pleases our senses best, namely, the phenomena of sound, especially agreeable sound, that is music.

To gain a clear conception of what is meant by electrical resonance consider the following simple mechanical analogon— I call it the *torsonial pendulum* ;—I used it often with my students in discussing alternating current phenomena and they liked it very much. A heavy bar A (Fig. 5) is suspended on a stiff elastic wire B, which is attached to a plate C whose weight may be neglected. This plate C slides in a groove *aa* which in consequence of friction acts like a brake. Suppose now that the friction between C and *aa* is such that when the angular velocity of C is ω the rate at which heat is generated by the friction between C and *aa* is equal to $\omega^2 R$ where R is independent of angular velocity. This torsional pendulum resembles then very much an electrical circuit having localized self-induction, capacity and ohmic resistance. The moment of inertia of A, the elasticity of B, and the friction in C act exactly the same as the coefficient of self-induction of the coil, the capacity of the condenser, and the ohmic resistance of the circuit. Let $\frac{1}{B}$ stand for the elastic capacity of the wire, that is, if the wire be twisted through an angle θ, then the moment of the elastic force which opposes this twisting is $\frac{\theta}{B}$. Let I stand for the moment of inertia of the weight A, then as long as the frictional resistance is within certain limits we shall have for the natural period of the pendulum

$$T = 2\pi\sqrt{I \times B}.$$

You see that this expression is exactly the same as the one which epresses the natural period of the circuit in terms of its coefficient of self-induction and capacity.

(*To be Continued.*)

THE EDISON LAMP

ANOTHER DECISION IN FAVOR OF THE EDISON INTERESTS.

The case of the Edison General Electric Company against the Electric Manufacturing Company, of Oconto, Wis., for an injunction, was decided in favor of the plaintiff on July 20, by Judge Seamans of the United States Circuit Court, Milwaukee, Wis.

The Electric Manufacturing Company, manufacturer of incandescent lamps, was, previous to the trial of the Columbia Incandescent Lamp Company's case, closed down by a restraining order. The Oconto Company asked the court to modify the injunction so that it might be permitted to manufacture its lamps under bonds. After several postponements, the case finally came to trial on July 3, and was concluded on July 8, Judge Seamans rendering his decision on July 20, as above indicated.

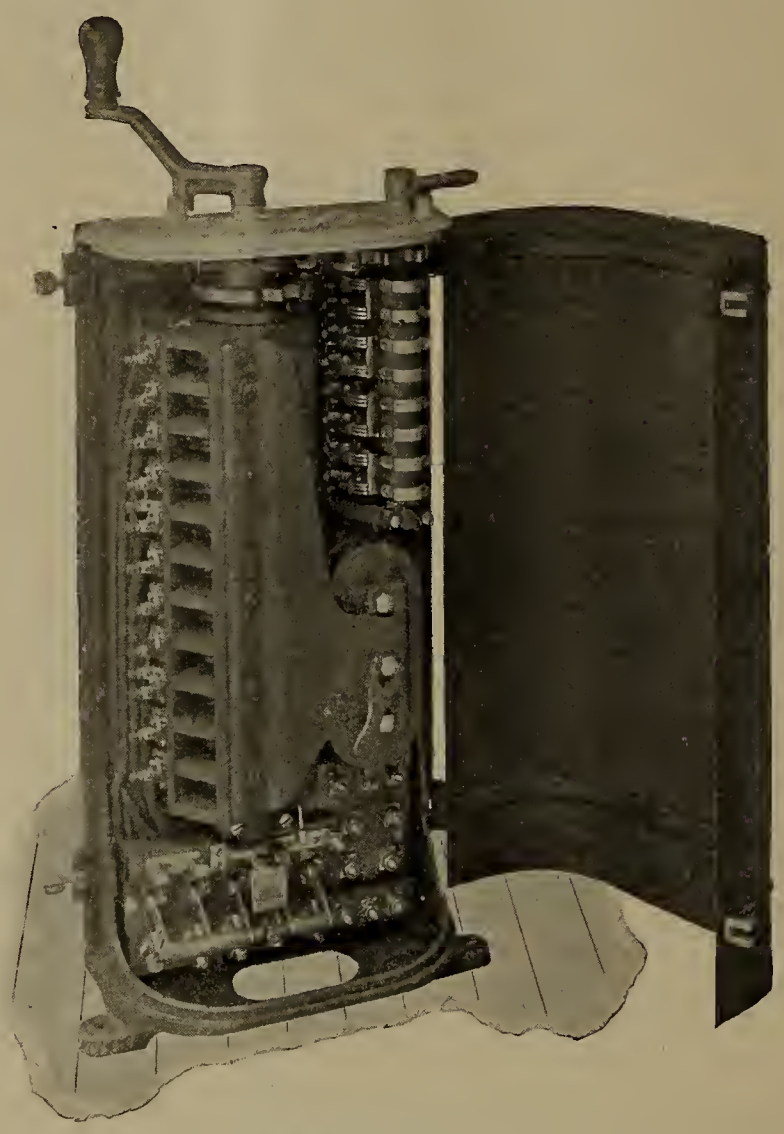
The decision of Judge Seamans is in line with the decisions of Judges Wallace, Shipman and Lacombe of the Second Circuit and of Judge Colt of the Massachusetts Circuit. The case was bitterly fought and charges of bribery and perjury were made on both sides. The issue of the injunction is a finding by the court against the Goebel defence.

NEW CONTROLLING SWITCH.

Guided by the experience gained from the progressive manufacture and close study of the operation of car controlling-switches, the General Electric Company has perfected a new type of controller, type K, in which are combined all the good points of its predecessors, while avoiding any defects which their operation may have manifested.

This new device comprises in itself all the necessary controlling movements. As will be seen, the case contains with the regulating device, the connection board, motor cut-out switches and reversing switches: rods and bell cranks are entirely eliminated and the necessity for moving parts beneath the floor of the car done away with. Each set of contacts is strongly insulated, and the tendency to arc on making circuit is prevented by means of the magnetic blow-out which deflects the arc side-wise from the segments and spring contacts and extinguishes it.

The general design of the reversing switch is similar to that of the controller, the segments being carried by a small cylinder, and making contact with spring fingers. Movements of the reversing switch handle



CONTROLLING SWITCH.

through 60° changes the combination of the armature leads of both motors and reverses the motion of the car.

The motor cut-out switches attached to the connection board of the controller, permit of rapid and absolute disconnection of the motor from the circuit. The value of such an arrangement in ease of disablement of motor on the road, will be readily appreciated by practical railroad men.

This coutroller is extremely simple in its mechanical construction, and is easily accessible. By loosening two thumb nuts in the outer case, it may be opened and the removal of a bolt in the pole piece allows it to be swung back giving access immediately to the interior parts.

All the excellent features of controller "E" which we described at the time of the Cleveland convention, have been retained. The sequence of connections and speeds has been preserved, but placing the field on the ground aside of the armature has necessitated a modification of the interior connections, admitting, without change, of either the shunt or loop method of control.

Every precaution seems to have been taken to secure easy and perfect operation. Proper make and break of contacts are ensured by means of a star wheel attached to the upper part of the cylinder shaft; this wheel is actuated by a spring, and throws the pointer of the handle positively to the notch on the dial, indicating to the motor man the running positions of the motor.

By means of an interlocking device between the reversing switch and controller, the operation of either, unless it is in proper position relative to the other, is impossible. The reversing switch cannot be moved over unless the controller is in the "off" position nor can the controller be operated while the switch is between its forward and reverse position. A similarly ingenious device insures proper adjustment of the motor cut-outs; thus, should one motor be cut-out, the combinations suitable for the other can alone be made.

This controller has been carefully tested under conditions of actual service and by its satisfactory operation demonstrates how great an advance has been made in the design and construction of car controlling apparatus in recent months.

CURRENT NOTES.

Fire in Telephone Exchange.—On the morning of July 10, the Telephone Exchange at the corner of Broadway and 18th street, New York city, was damaged by fire. The switchboard was saved, and the destroyed connections were all restored by the next day.

Rather Improbable.—An electric light cable crossing the San Juan River, at Matanzas, Cuba, was recently burned, both ends falling into the river. No change in the light was noticed, the current having used the water of the river as a conductor between the broken ends of the wire. This story comes from Havana.

Correction.—In our report of the proceedings of the Convention of the Association of Railway Telegraph Superintendents, which was held in Milwaukee, June 20 and 21 last, it was reported that Mr. G. M. Dugan was elected vice-president of the association. This was an error. Mr. O. C. Greene, of the Northern Pacific Railroad, St. Paul, Minn, was elected vice-president.

Boynton Railroad.—A very succeessful test of the Boynton Bicycle Railroad was made July 18, at Heyermans, Long Island. The car was propelled by an electric motor over the two-mile track at the rate, it is said, of seventy miles an hour A measured mile was covered in just fifty seconds. The motion of the car was very easy, and, as the speed increased, it seemed to become still easier.

The Telephone on Railroads.—The Chicago, Rock Island and Pacific Railroad Company is introducing the telephone between its yards, depots, etc., in Chicago. The various departments of this road can thus quickly communicate with each other. A central station will be established at the company's headquarters, where all the switching of lines will be done. The territory to be covered by the telephone system will be about 18 miles long and 9 wide. This is the first instance where the telephone has been applied so extensively to railroad work.

Ask for a Receiver—The Philadelphia *Record* states that a petition has been made to the chancellor of New Jersey for a receiver for the Penn Electric Company, of Philadelphia. The chancellor is asked to declare illegal the trust under which it is claimed the stock is void, and to restrain the Guarantee Trust and Safe Deposit Company from voting the deposited stock, also to restrain the Electric Trust of Philadelphia from voting the stock alleged to be held by it. The bill also asks to have the Electric Trust, of Philadelphia pay the stockholders of the Penn Electric Company, what it should have received for the use of its conduits had they been rented to other companies besides the Edison company.

Reduction of Force.—At the Westinghouse Electric and Manufacturing Company's big works in Newark, 400 men were temporarily laid off on July 17. This is about half the force. For several weeks the shops have been run day and night. The order, it is said, was a great surprise to the men, and the only satisfaction they got was the information that they could return to work in a few days. An official stated that it was a discretionary measure. The men had been working very hard, he said, the output had been large, and the collections poor. He said that there was no trouble, and that the men would be taken back in a few days. It is said that the company intends consolidating all its works at Brinton, in the outskirts of Pittsburg, and that soon the Newark plant is to be removed to that place.

Gettysburg Trolley—Acting Attorney-General Maxwell has recently rendered a decision in relation to the trolley road on the Gettysburg battlefield. He calls attention to the act of the General Assembly of Pennsylvania giving the Government the right to acquire such land at Gettysburg as the Secretary of War should consider necessary for making the improvements authorized by Congress. The provision of law, he holds, seem to be ample to enable the Government, by condemnation proceedings, to acquire such property and rights as may be necessary to carry out the act of Congress. In case the War Department begins such proceedings he says that it would be justified in applying to the court for an injunction to prevent further construction of the road pending the condemnation. The department authorities have taken no steps in the matter, but have referred the decision to the National Battlefield Commission.

The Largest Search Light in the World.—A correspondent asks for some facts regarding the big search light now in operation at the World's Fair. The lamp is 8½ feet high and contains a parabolic mirror five feet in diameter and ⅞ of an inch in thickness. It is properly ventilated for the purpose of avoiding damage by heat to the mirror. The arc lamp is automatically adjusted, the positive carbon containing a soft glass core in order to secure an even shaped crater. The two carbons are of different diameters, the positive being 38 millimeters and the negative 36 millimeters The object of this is to keep the arc in focus at all times by providing for an equal rate of consumption of both carbons. The position of the arc can however be changed when a divergence or concentration of the rays is desired. The search light may be operated by a motor in the base of the stand. The lamp takes a current of about 150 amperes at 60 volts (over 12-H. P.) and with the aid of the reflector the candle power is said to be about 194,000,000. The arc lamp alone has a candle power of 47,000. This immense lamp was made by Schuckert & Co., of Nurenburg, Germany.

Catalogue.—We are in receipt of a copy of the finely illustrated twenty-fifth anniversary souvenir of the Page Belting Company, of Concord, N. H. It gives a brief history of the company's growth from a small concern to its present large dimensions. Descriptions and illustrations are given of the numerous kinds of belts made by the company, and of some of the machines used in their manufacture. The souvenir is made up in good style and is a credit to the company. The New York office is at 16 Dey street.

Niagara Falls, N. Y.—The Buffalo & Niagara Falls Electric Light and Power Company has announced that the agreement for the purchase of the plant of the Brush Electric Light and Power Company of Niagara Falls had been consummated. The local company will dissolve and the Buffalo company will take its plant on October 1.

AMERICAN STREET RAILWAY ASSOCIATION.

At the next annual meeting of the American Street Railway Association, which will be held in Milwaukee, Wis., on Wednesday, October 18, next, the following special committees will report on the subjects named:

Best Method of Lighting and Heating Street Railway Cars—G. F. Greenwood, General Manager Pittsburgh, Allegheny and Manchester Traction Company, Pittsburgh, Pa.

Can the T rail be Satisfactorily used in Paved Streets—C. Densmore Wyman, Vice-President Central Park, North and East River Railroad, New York city.

Direct Driven Generators—C. J. Field, Electrical Engineer, New Jersey Traction Company, Newark, N. J.

Power House Engines—E. G. Connette, Superintendent United Electric Railway, Nashville, Tenn.; L. H. McIntire, Electrical Engineer Atlantic Avenue Railroad Company, Brooklyn, N. Y.; F. S. Pearson, Electrical Superintendent West End Railroad Company, Boston, Mass.

Standards for Electric Street Railways—O. T. Crosby, Boston, Mass.; Charles W Wason, Cleveland, O.; L. H. McIntire, Brooklyn, N. Y.; Thomas H. McLean, New York city; C. G. Goodrich, Minneapolis, Minn.

Storage Batteries in Connection with Central Stations for Utilizing Surplus Energy for Lighting or Power—C. O. Mailloux, Electrical Engineer Metropolitan Railroad Company; Washington, D. C.

PURIFYING WATER BY ELECTRICITY.

Dr. Cyrus Edson, of the Board of Health of New York city, has been recently making some tests of an electric system of water purification. The water of New York city has of late been rather unpalatable, and while engaged on the analyses of the water this system was tested. Dr. Edson states that the tests convinced him that a discovery had been made that would cause a revolution in sanitary science. The new method was the discovery of Dr. Albert Wolff, a pupil of Prof. Ogden Doremus. By passing an electric current from a powerful dynamo through salt water he obtained a liquid which had a powerful effect on water with a bad taste or smell. Ten drops to a gallon was enough to make the water sweet and clear and remove from it the harmful nitrites. In the laboratory where the tests had been made a number of fish were swimming about in the salt water treated in the manner described, and they were in no perceptible way affected by it. From this and other facts, it was certain that the liquid is harmless

The manner of applying the remedy to the evil, Dr. Edson said, would be to establish plants at each one of the reservoirs, owned by the city. To build suitable houses, put in steam engines or water-wheels, and set up dynamos, it would require from $4,000 to $6,000. It is estimated that the operating expenses would be about $4 per day, exclusive of the wages of an engineer. Where there was a waterfall in the neighborhood, steam would not be used, but it would make no difference except in cost, as the running of the dynamo was the main consideration.

In these stations, Dr. Edson continued, there would be immense tubs or tanks, with coils of wire inside, and provided with pipes for receiving and discharging water. Any pure water obtained from a spring or by filtration if necessary, may be used for making the brine, which will be as strong as a generous quantity of coarse salt can make it. Then the current will be turned on the wires within the tanks, when chemical action takes place. After a certain time, the process of imparting certain properties to the brine is completed and a force-pump carries it to the body of water to be purified.

The system is new and has only just come under Dr. Edson's notice, and there had been no chance to see if large bodies of water could be successfully purified by the ad-mixture of such a small proportion of so simple a solution But the experiments had been so successful and positive that there seemed to be no room to doubt its efficacy. It is not the claim of the discoverer that any sort of dirty, filthy water will be purified, but that by the use of his system an ordinarily clear supply can be made clear and sparkling.

STRIKE IN THE EDISON LAMP WORKS.

The girls employed in the filament department of the Edison Lamp Works, Harrison, N. J., on leaving the factory, Monday night, July 17, saw a notice of reduction of prices for piece work. The reductions were from 35 cents a thousand for one grade to 25 cents. In another grade they were from 25 cents to 16 cents, and in another from 25 cents to 12 cents.

The next morning after being told by Superintendent Hipple that the new prices were to hold, and if they were dissatisfied they could leave, fifty-three girls went out on a strike.

The girls claim that with the old scale of prices they could by hard work make only from $5 to $7 a week, and with the new rate they could not earn enough to support themselves.

It is reported that the reduction was made necessary by competition with other lamp makers, who had adopted new processes by which lamps could be made cheaper than at the Edison works

NEW BOOKS.

The Electric Transmission of Intelligence, and other Advanced Primers of Electricity. By Edwin J. Houston, A. M., New York: The W. J. Johnston Company, Limited. 330 pages; 88 illustrations. Price $1.00.

The third and concluding volume of Prof. Houston's Advanced Primers of Electricity is devoted to the telegraph, the telephone, electrolysis, electro-metallurgy, the storage battery, electric welding, electricity in warfare, electro-therapeutics, electric annunciators and alarms and several miscellaneous applications of electricity.

The primers on multiple and cable telegraphy and telephones will be particularly appreciated by those who have had no previous knowledge of electricity, as the author places these subjects in such a light as to make them easily understood by any reader. The quadruplex and other systems of multiple telegraphy as well as the principles of cable and time telegraphy need not therefore remain mysteries to the intelligent public in the future as they have in the past.

The other subjects are handled in the admirable and lucid manner that characterizes the writings of Prof. Houston.

The extracts from standard authors at the end of each primer is a feature that has been highly praised in the preceding volumes and has been retained in the present one.

Each primer is, as far as possible, complete in itself and there is no necessary connection between the several volumes of the series of which the present one is the third and last.

World's Fair Souvenir.—A very handsome and artistically arranged souvenir of the World Columbian Exposition is being issued by the Schultz Gas Fixture and Art Metal Company, Baltimore, Md.

WIRES TO COME DOWN.

Mayor Gilroy attended the meeting of the New York Board of Electrical Control, held July 18, and took a decided stand against the companies which have violated the law, by stringing wires without permits. He is thoroughly in earnest over the matter, and states that unless the companies who have poles and wires on the route of the recently completed subways put their wires in the subways within ninety days, orders will be given to the Commissioner of Public Works to cut down the poles.

The subway built in First avenue for the Thomson-Houston Company, it was reported, was not yet occupied. "Give them thirty days to remove the poles," the Mayor said. "If they don't do it, we'll do it for them.'

OF INTEREST TO ADVERTISERS.

"Good morning, I suppose you manufacture your goods to sell, don't you?"

"That's exactly what we are in business for."

"And I suppose you take advantage of every means of increasing your sales?"

"We let none slip."

"Then why don't you advertise in the ELECTRICAL AGE?"

"Oh, we don't believe in newspaper advertisements."

"I saw you looking over some advertisements as I came in."

"Well what has that to do with the matter?"

"If you read the advertisements of others, certainly others will read yours—its a poor rule that won't work both ways."

"Well, you are right."

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, July 22, 1893.

THE LAW BATTERY CO., 85 John street, city, has gotten up a handsome glass paper weight, on the back of which is a very finely executed colored illustration of a cell of the celebrated Law Battery. and the name and address of the company surrounded by gold scroll work. The background is of a delicate green.

LEO DAFT, the inventor of the Daft electric railway system is in this city. Mr. Daft has been in the West for several years.

R. D. NUTTALL, formerly of the R. D. Nuttall Company, Allegheny, Pa., is in town. He has a large eye for business and the writer expects to see him, very shortly established in a successful enterprise.

THE EDISON ELECTRIC ILLUMINATING COMPANY has asked permission to tear up Nassau street between Beekman and Fulton, in order to lay some underground wires. The application will be laid before Commissioner Daly.

AN EXPLOSION occurred at 9 A. M., July 18, in a manhole of the electrical subways, situated in front of 1027 Second avenue, city. The manhole cover was thrown up in the air several feet; no one was injured. It is thought that the trouble was caused by illuminating gas getting into the subway.

THE NEW YORK THERMOSTATIC FIRE ALARM COMPANY has applied for permission to place its wires in the electrical subways.

IN OUR issue of last week the name of our friend R. E. Gallaher, of the New York Insulated Wire Company was disguised by appearing as "Gallagher." "Let her go Gallagher" must have been ringing in somebody's ears.

S. LENOX TREDWELL, as an interested stockholder, has brought suit in the Supreme Court against Hugh R. Garden, Henry C. Davis, and the Consolidated Electric Light Company, to compel the individual defendants to surrender 2,500 shares of the company's stock issued to them in 1888. It is charged that as officers of the company the defendants issued the stock to themselves. Garden denies the charge of fraud and says that he and Davis served the company in an executive capacity prior to 1888 on contracts for cash salaries and percentage of profits, but the company was merged in the Westinghouse Company, and they agreed to accept 1,250 shares each in lieu of salary and percentages.

GEORGE T. MANSON, of Manson tape fame, and formerly one of the New York managers of the Okonite Company, 13 Park Row, city, has become superintendent of the manufacturing department of this company, at Passaic, N. J. Mr. Manson's extensive experience especially fits him to supervise this work.

THE MASON ELECTRIC COMPANY, 10 Vandewater street, city, is meeting with more than usual success with its Mason batteries and specialties. Travelers over the Brooklyn Bridge have become familiar to the sight of the littlefan motor, running from two cells of Mason battery, which blows the air out toward the bridge. Mr. J. H. Mason, the general manager, reports an increasing business. Some of the most prominent electricians from Texas, California, and numerous other States are applying for section agencies. Motors and battery outfits, small electric light outfits, electric motors and general electrical supplies are carried in stock. This company has a large electrical supply and construction store in Brooklyn, with a good business, which it wishes to dispose of to reliable parties.

MR. JEAN A. WETMORE, the ambitious lieutenant of the Okonite Company, 13 Park Row, city, has recently returned to New York city from an extended trip for this company. Mr. Wetmore has great success in taking large orders for Okonite wires. He has the utmost confidence in Okonite, as it is giving the best of service for every kind of electrical work.

MR. MOTT, the electrician and inventor of the Mott visual signal, now on exhibition at the office of W. A. Vail, 136 Liberty street, city, has invented and patented a novel pipe for pipe smoking fiends; he will always be found with samples in his pockets.

A NOVEL lead covering machine for encasing insulated wires and cables has just been completed by W. H. Hibbard, 45 York street, Brooklyn, N. Y., two blocks below the entrance to the Brooklyn Bridge. Mr. Hibbard makes special machinery, power and foot presses. It will pay insulated wire makers to see this lead covering machine. The machine takes cold lead and forms it around the wire or cable in the most ingenious and economical manner. W. T. H.

TRADE NOTES.

THE G. C. KUHLMAN COMPANY, Cleveland, Ohio, manufacturers of street railway cars and interior wood work, is very busy and has cars of its make running on the tracks of the Cleveland Electric Railway Company and the Cleveland City Railway Company. Several new styles of cars are about to be placed on the market by this company. The outlook for winter work is very good; orders enough being in, at present, to keep the company running till spring.

Heavy Decline of General Electric Stock.—General Electric stock took an extraordinary tumble on July 20. It opened at 55 and dropped during the day to 46½ the extreme decline being 9¼ points, and the net loss for the day 5¾ per cent. Liquidation appears to have been the only real cause for the drop, although the decline was accompanied by sundry rumors concerning the company's financial condition.

QUEEN & CO. AT THE WORLD'S FAIR.

Queen & Co., incorporated, of Philadelphia, have recently issued a circular letter in regard to their extensive electrical exhibit at the World's Fair.

As it contains information of interest to our readers, a copy is appended.

"Dear Sir: While your visit to the World's Fair may be largely for enjoyment, business interests will doubtless claim a certain amount of time, so that we take pleasure in inviting a careful study of our collection of Standard Electrical Instruments as exhibited in the Electricity Building, Section E, ground floor, north end.

"For months past we have been preparing for the Exposition, with the result that many of the pieces shown are quite new in design and can hardly fail to prove extremely interesting.

"Among them are the Ryan Electrometer, Modified Mascart Electrometer, Contact Maker, Horizontal Magnet d'Arsonval Galvanometer, Queen-Thomson Galvanometer, Queen-Siemen's Galvanometer, Standard Ballistic Galvanometer, Anthony Tangent Galvanometer, Portable d'Arsonval Galvanometer, Compensated Shunt Box, Standard Resistance Box (Anthony form) Standard P. O. Box, 100,000 ohms Box, Oil Immersion Standard Coils, Standard Meter Bridge, Standard Cylindrical Bridge, Carey-Foster Commutator and Bridge, Conductivity Bridge, Complete Cable Testing Set, 'Acme' Portable Testing Set, 'Decade' Portable Testing Set, Standard Condenser, new design, Adjustable Carbon Rheostat, Aluminum-Iodine Testing Battery, Electric Light Photometer, Cardew Voltmeters, Electro-dynamometers, Station Ammeters and Voltmeters, Kelvin Standard Balances, Electrostatic Voltmeters, Pair of Hertz Mirros, Arc Light Projector, etc., etc.

"The Photometer and Projection Lantern can be seen in practical operation in our dark room, and when possible, every facility is afforded for a thorough working examination of all the apparatus we show.

"Some of the instruments are finished more highly than usual, but are offered for sale at regular net prices except where actual increase results in efficiency as well as appearance.

"Intending purchasers will kindly remember this fact and avail themselves of a rare chance to secure exceptionally high grade apparatus at what is really but slight advance over cost of labor and material.

"The Armour Institute of Chicago, has already reserved a number of these pieces to be delivered when the Fair has closed, and we anticipate an early disposal of the remaining important instruments.

"The cordial welcome assured by our experts in attendance does not depend, however, upon immediate orders, and we are always glad to receive calls from scientific friends who may be interested in our work whether or not any business results.

"The Sessions of the American Association for the Advancement of Science and of the International Electrical Congress, to be held in August, will be largely attended and we have arranged to be properly represented at both. We desire that at these times our various exhibits shall be utilized for resting places, meeting friends and in other ways as may best suit the inclination or convenience of visitors.

"Kindly note that in addition to the above we have five exhibits in the Liberal Arts Building, as per card enclosed, to which we also ask your kind attention.

"Hoping very much to have a call from you this summer at Chicago or Philadelphia, or both, we are,

"Very respectfully,

"Queen & Co., Incorporated,

"Electrical Dep't."

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Copy for advertisements or changes therein should be in our hands before the Saturday preceding publication day.

NEW YORK, AUGUST 5, 1893.

CONTENTS.

THE PATENT RECORD.

In our next issue we shall resume the publication of our patent record. Our copy of the *Gazette* for the week ending July 4, has just reached us, too late, however, for use in this issue. The *Gazette* used to reach us as regularly every week as night follows day, but since the recent default we dare not make any promises as to the future, and whether or not we shall be in position to regularly continue the record depends upon circumstances at Washington.

MORE LAMP SUITS.

The Edison Electric Illuminating Company of this city intends to "make hay while the sun shines," or in other words to make the best of the short life remain- to the Edison lamp patent. It has just begun two more suits in this city against users of lamps manufactured by alleged infringers of the Edison patents. The defendant's carry on operations in this city.

RIPE FOR ELECTRICITY.

The Broadway cable road has been rather unfortunate lately. Several mishaps have occurred in the past two or three weeks, the results of which have been rather trying to the patience of the vast number of people depending upon the road for transportation along the great thoroughfare. Each time anything has gone wrong it has always caused a suspension of traffic on the section of road so affected. The cable is all right while it is in operation, but it will get stranded and do other untoward things at the wrong moment. The conduit would make a fine one for electric conductors, and we opine that to turn the cable out and put electricity in to run the cars, would be money in the company's pocket. Electric cables do not strand; neither do they kink.

LET US HAVE TRUTH.

It is a matter of regret that some of our English contemporaries have allowed themselves to be unfavorably influenced by false and otherwise misleading reports regarding Chicago and the World's Fair. There seems to be an impression abroad that robbery is the first law in Chicago, and that visitors to the fair are fleeced in one way or another every time they turn around. An English electrical paper of recent date contains a paragraph to the effect that sleep in Chicago is a costly luxury, and cites cases where "sums ranging from four dollars to four pounds" have been paid for a small bed-room. The writer does not state for how long the bed-room was secured for the four dollars; but that is immaterial; it is the animus back of it. It is about time our friends looked at the matter in a reasonable light. From our own experience we can say without any hesitation and with perfect truth that no one need be robbed in Chicago unless he wants to be. He can be robbed in London, Paris, New York or anywhere else if he does not keep his eyes open. There is an abundance of accommodations in Chicago at reasonable prices, but if a person wants to live in style he must pay accordingly, just as he would anywhere else. The truth of the matter is, living in Chicago at the present time is very reasonable and in very few cases is there any increase over rates prevailing in ordinary times. There is one thing that is very noticeable in this connection, and that is that the cry of "robbery," etc., comes from persons who have not been to the fair; but those who have been there know how absurd and utterly baseless these wails are.

PHOTO-ENGRAVING LAMP.

The electric arc lamp as applied to photo-engraving and other photographic work is meeting with success. The advantages of being able to dispense with sunlight, for this kind of work, is very apparent. Work need not be interrupted by dark days or by night.

In our illustration is shown an improved automatic electric focussing arc lamp for photographic purposes. The lamp which is mounted on an iron stand has a telescoping rod for height adjustment. Spots and shadows are overcome by means of the white surface of the reflector and an even diffusion of light obtained. The lamp is automatically regulated in whatever position it is placed and hissing is obviated. By means of improved mechanism for regulating the automatic feed of the carbons, weights and cords are dispensed with. It is used on any direct incandescent circuit and is thereby free from danger in handling. The apparatus is easily portable as its entire weight is only 50 pounds. The Scott Electrical Manufacturing Company, 89 Liberty street, New York city, is the sole manufacturer of this lamp.

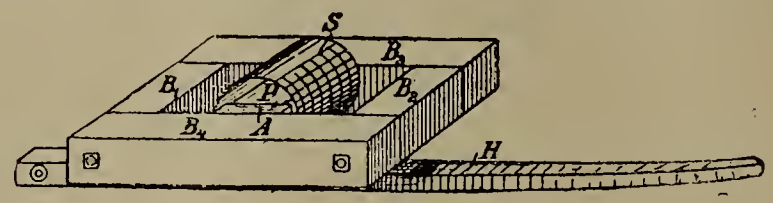
NEW PHOTO-ENGRAVING LAMP.

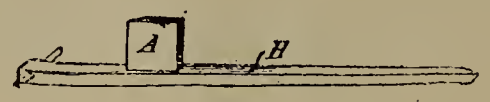
Gas Engines.—In an article by M. Hospitalier, in an English contemporary, on gas engines and their applications many interesting facts in regard to the substitution of gas engines for steam engines in electric generating plants are given. It is stated that the gas engine is more efficient in action than a steam engine and much is being done in the manufacture of cheap gas for power purposes. Several 100 horse power gas engine plants have been installed and one of 200 horse power is soon to be erected in Paris, France. A modern gas engine plant consists, briefly, of a cheap gas producer, a washer, holder, engine and fan blower for current of air in the furnace. The plants have met with success and several other installations are proposed.

MAGNETIC PROPERTIES OF DIFFERENT KINDS OF IRON.*

BY DR. BEHN-ESCHENBURG, OERLIKON.

This apparatus serves the purpose of comparing different kinds of iron with regard to the strength of the total and residual magnetism with given magnetizing forces. The apparatus consists of a right-angled frame of four wrought-iron pieces or blocks, B_1 B_2 B_3 B_4, screwed one to the other; a coil, S, for magnetizing; the piece to be tested, P, placed in the coil and screwed to the Block B_3, and a wrought-iron plate, A, which fits exactly between the piece, P, and the block B_4, and may be pushed up by the lever, H, in the direction perpendicular to the block B_4, so that it may be easily adjusted or taken out of contact with P. There are a few turns of thin wire round the plate, A, and the ends of these may be joined with a ballistic galvanometer. If a current be sent through the coil, S, then B_1, B_2, B_3, B_4 with P and A, form a magnetic double ring. All the lines of





FIGS. I AND 2.

force that go through P must also go through A; if, then with a given strength magnetization, the plate be entirely taken out of the magnetic circuit, so that it does not cut any of the lines of force passing through the test piece, it follows that the induction effect upon the wire round the plate will give a measure of the total number Z, of lines of force which in closed magnetic circuit go through the test piece, P.

Now, if the magnetizing current of the coil, S, be interrupted, with closed circuit, there will remain Z lines of force of residuary magnetism, which can similarly be measured by sliding the plate, A, out of the circuit. And if the plate be again placed in position, the magnetizing current being interrupted, a measure can be obtained for the lines of force which are still residuary in the iron ring. These lines of force are found to be so few that they may be taken into account only for checking and correction purposes. All the pieces tested by Dr. Behn-Eschenburg were parallelopiped in form, the length being 25cm., and the cross-section 81 square centimetres. The plate, A, was 1cm. thick, and its cross-section, as also that of the pieces B_1 . . . B_4, equal to that of the test piece. The coil had 300 turns, in several sections. The current was produced by an accumulator battery. The strength of the current was measured by a Siemens dynamometer. All sources of error from self-induction, etc., were eliminated.

The experiments referred to six kinds of iron: (1) wrought iron, (2) Pilsen cast steel, (3) Remscheid I. cast steel, (4) Remscheid II. cast steel, (5) Belgian cast

* Abstracted from the *Elektrotechnische Zeitschrift*.

steel, (6) cast iron. The curve for wrought iron was taken as normal. In the curve, diagram 3, only the curves for two kinds of cast steel are shown, the other curves lying between them. The conditions of the experiments were varied as to increase and decrease of the magnetizing force and the results for a given magnetizing force agreed remarkably well in repeated tests. The experiments showed that the number of measured lines of force with closed magnetic circuit was greater at the moment of forming the magnetizing current than at its cessation, and that the difference increased with increasing ampere-turns, and was greatest where the residual magnetism was greatest.

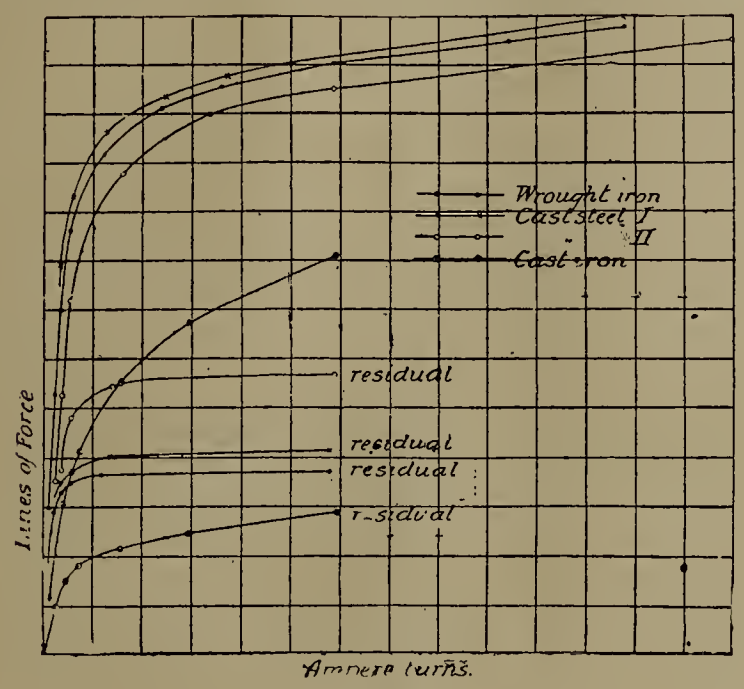


FIG. 3.

The magnetization of the iron was continued up to saturation.

Finally, it may be mentioned that the lever used in the experiments was about three meters long and 5cm. thick, and that a considerable pull, corresponding to about 30kg (66 lbs.), was required in some of the tests to cause the plate to slide out of the magnetic circuit.—London *Electrical Engineer.*

PRACTICAL ASPECTS OF LOW FREQUENCY ELECTRICAL RESONANCE.

BY M. I. PUPIN, PH. D., COLUMBIA COLLEGE.

(*Continued from page 56.*)

If this pendulum is set in motion by a single impulse it will oscillate with a constant period. The first elongation will be largest, and the successive elongations will be smaller and smaller, just as represented in Fig. 2, until the pendulum is reduced to rest again. This will happen when the energy of the impulse has been entirely dissipated into heat, which is the work done against frictional resistances in the break at *C*. The smaller this frictional resistance, the larger will the pendulum swing in consequence of the impulse, before it is reduced to rest. On the other hand we can increase the resistance in *C* to such an extent as to make the swing a periodic or dead beat, as is for instance the case in the Weston voltmeters and ammeters.

Repeat the impulse at regular intervals, alternating them, the pendulum will keep on swinging; but you can easily see that if the intervals of the impulses are measured off in such a way that every time the pendulum passes through its position of equilibrium, the impulse strikes it, and strikes it in the direction in which the pendulum is moving, then the amplitude of the swing will be much larger than if the intervals of the impulse are not measured off in such a way. In other words, when the period of the impulses is the same as the natural period of the pendulum then the swing is largest. The impulses are said then to *be in resonance* with the pendulum.

The same effect will be produced if for the impulses we substitute a periodically but gradually alternating force, say a simple harmonic force, having the same period as the natural period of the pendulum.

Such a force when acting upon the torsional pendulum just described, will continually increase the amplitude of the swing, until the swing is so large that the work done during a swing against the frictional resistances, is just equal to the work of the moving force

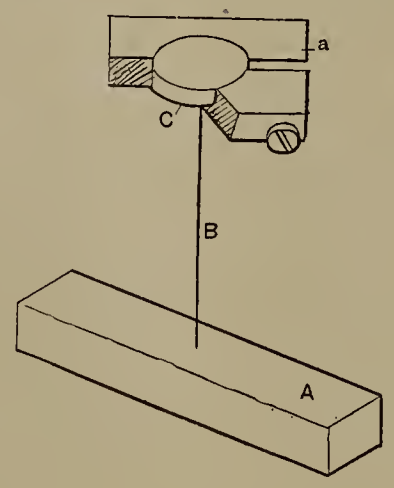


FIG. 5

during that time. From that point on, the pendulum will swing with constant amplitude. It is evident, therefore, that the larger the amplitude of the moving force and the smaller the frictional resistances, the larger will be the amplitude of the swing. But a large amplitude implies two things :—1st, A large torsional reaction in the suspension wire, and secondly, a great velocity whenever the pendulum passes through its position of equilibrium.

The bearing of this mechanical analogon upon the electric curcuit having self-induction and capacity is very direct, as I shall presently point out. Let a simple

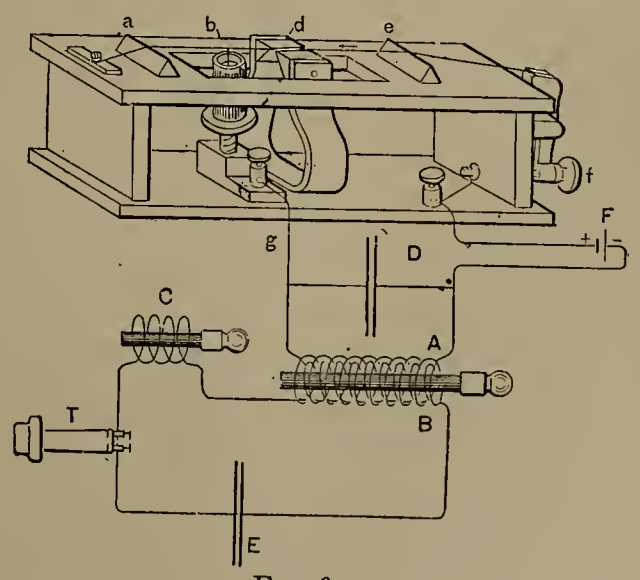


FIG. 6.

harmonic E. M. F. $E \sin pt$. act upon such a circuit. I shall presently consider a complex harmonic E. M. F., and also circuits possessing Foucault current losses, and losses due to magnetic and dielectric hysteresis. They will form the last, and in my opinion the most important part of my discourse. A simple harmonic E. M. F. acting upon an elastic electrical circuit in which the only frictional losses are those due to ohmic resistance, will, when its period is the same as the natural period of the circuit, that is when it is in

resonance with the circuit, continually increase the amplitude of the electric displacement, that is the amplitude of the condenser charge and therefore also of the current, until the work done against the ohmic resistance is exactly equal to the work of the impressed E. M. F. From this point on the amplitude of the current will remain constant and equal to the amplitude of the impressed E. M. F. divided by the ohmic resistance. Or, to state it in terms which are more generally employed: Capacity and self-induction neutralize each other when the circuit is in resonance with the impressed E. M. F.

It is evident also that in a resonant flow, there can be no difference in phase between the current and the impressed E. M. F. Since in this case the current at any moment depends on the E. M. F. and the resistance, and on nothing else.

It is clear, however, that if losses due to Foucault currents, magnetic and dielectric hysteresis are present, then the current cannot be made equal to the ratio between the E. M. F. and the ohmic resistance by any combination of capacity and self-induction, although as a simple reflection will show, the difference in phase between the current and the E. M. F. may be reduced to zero in this case also,[1] in which case we should have no false current, as it is generally called. I shall presently discuss this point a little more fully.

5. *Resonance in Circuits with an impressed Complex Harmonic Electromotive Force.*

If the impressed E. M F. is a complex harmonic, then the circuit may be brought into resonance with any of the component harmonics. I have an apparatus here which is capable of producing E. M. F.'s of almost any complexity. I call it an electro-dynamic current interrupter, for want of a better name. It consists of a phosphor-bronze wire, the vibrator, *a*, *b*, *e*, (Fig. 6), stretched between the poles of a Weston horseshoe magnet *d*. A short, thin, amalgamated copper wire *b*, the dipper, is soldered on the vibrator. The vibrator is stretched like the wire of a monochord, over two hard rubber bridges, *a e*, and its tension can be varied by a screw and lever *f*. The dipper *c* whenever it dips into the mercury cup closes an electrical circuit *F f e b c g A*, and the vibrator is then repelled upward by the force of repulsion between the magnet and the current flowing through the vibrator. One gravity cell *f* is sufficient to work this apparatus. It is evident that the fundamental period of the interrupted current will be equal to the period of the vibrator. To change this period, say to make it equal to the period of this tuning fork, which is 256 complete vibrations per second, I simply strike the tuning fork, hold it then near my ear and by turning the screw *f* of the stretching lever I vary the tension of the vibrator until the rate of the vibrator and that of the tuning fork are in perfect unison, which can be easily recognized by watching the beats. This whole process of tuning takes up, as you see, only a few seconds. In series with the cell F and the vibrator, we have a small coil *A*, containing a well packed bundle of very thin iron wire, and in shunt with A is a condenser D. This condenser performs the function of bringing this primary circuit into partial resonance with the vibrator which is recognized by the circumstance that at the moment of resonance the spark at the dipper is a minimum.

A simple reflection will show you that the current generated by this interrupter is a complex harmonic. To analyze it into its component harmonics I shall adopt the method employed in acoustics.

A complex sound is analyzed by the well-known resonators of Helmholtz. These resonators are constructed in such a way that they will respond to one vibration only, and also in a measure to its upper harmonics. To any other vibration they are practically mute. By a number of such resonators we can find out, in the manner first pointed out by Helmholtz, all the vibrations which are contained in a complex sound.

The secondary clrcuit B C T E, given in the diagram of Fig. 6, performs the function of such a resonator, it is in fact an adjustable electrical resonator; c is a small auxiliary coil which you see here: E is a Marshall condenser, and T is a telephone whose note tells me to which of the component harmonics the electrical resonator responds. The telephone is silent now, at any rate as far as you can tell, because the condenser plugs are all out. Now, with this plug, I insert a small capacity. The note which you hear is evidently much higher than even the octave of the vibrator. The electrical flow in the resonating circuit is approximately the same as if we had in it a simple harmonic E. M. F. of the same frequency as this note. I insert another plug, so as to increase the capacity. The note which you now hear is deeper. The difference between the two notes is rendered very striking by making and breaking the contact of the second plug in rapid successions, as I do now. The sound of the two notes, succeeding each other at regular intervals, resembles very much the sound of bagpipes. I insert another plug, so as to increase the capacity still more. The note which you now hear is still deeper. It is the note of the fundamental electrical vibration, which is the same as the vibration of the vibrator. I know that, because, as I continue inserting more and more plugs, you do not perceive any further change in the sound. The capacities which I introduced by the three plugs are to each other very nearly in the ratio of 1 : 9 : 25, hence the frequency of the three harmonics contained in the impressed E. M. F. and which I have detected by the resonating secondary circuit are to each other in the ratio of 1 : 3 : 5.

The impressed E. M. F. can therefore be written

$$E = E_1 \sin pt + E_3 \sin 3pt + E_5 \sin 5pt.$$

Still higher harmonics are present, but they are too weak to be heard all over this room.

I shall presently discuss a method by means of which we not only detect the presence of these harmonics, as I have just done by means of this telephone, but also determine the relative strength of each. The method imitates in a certain measure Prof. Langley's bolometric method of determining the distribution of energy in the spectrum of a given complex luminous vibration.

Before making the next step in my discourse I wish to call your attention to an application of resonant circuits (in connection with the electro-dynamic interrupter) to a method of producing simple harmonic currents of constant and easily determinable frequency.* I simply tune the vibrator by means of a standard tuning fork, and then weed out the upper harmonics by successive transformations. In this conection I ought to mention that Professor Duncan of Johns Hopkins University informed me several weeks ago that he was also weeding out harmonics. I now remember that I got the expression "weeding out" from him, but I have used it in my papers on "Low Frequency Resonance" without giving him credit for this beautifully selected expression.

(*To be continued.*)

1. Professor Duncan, of Johns Hopkins University informed me yesterday that he deduced the same result in the course of an investigation, a short account of which he read before the Institute at its General Meeting in Chicago in 1892, "Note on some Experiments with Alternating Currents." TRANSACTIONS, vol. ix, p. 179.

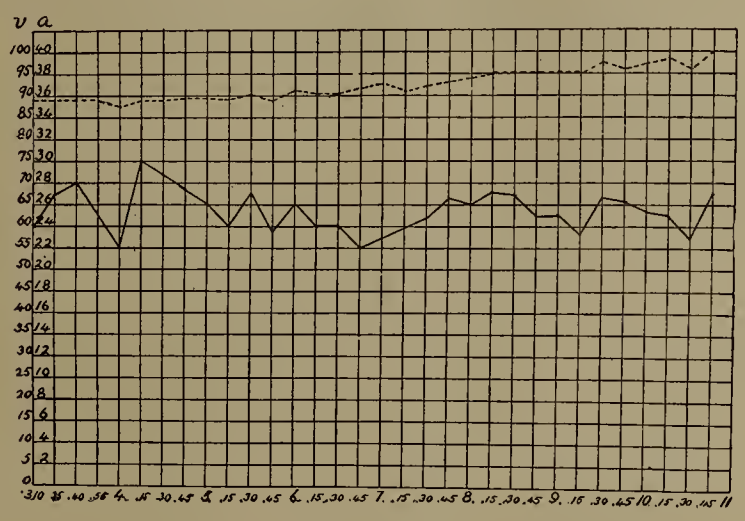
* Pupin, "Electrical Oscillations of Low Frequency and their Resonance." *American Journal of Science*, April, 1893.

ACCUMULATORS.

With the gradual increase in the number of storage battery installations, a few points as to their management might prove of interest.

Let us follow the cells from the time they are received till they become in first class working order. A substantial table with the necessary number of shelves is to be constructed, on which the cells, when set up, are to be placed. Long narrow carriages bearing a row of cells may be used instead of shelves. The supports for these can be so arranged as to permit any row of cells to be drawn out to one side and inspected from above, similar to the device used in storage battery street car work. Small boards with porcelain insulators are provided as bases for every cell.

Too much care cannot be taken that every thing about the storage battery room and table is well insulsulated. The room should be dry and clean, provided with a vitrified brick floor, furnished with ample drains. A wooden floor would soon be injured by the acid spray and spillings. A band of paraffin wax placed around and near the rim of each cell prevents the liquid from creeping over the top. Small plates should be inverted over the cell to prevent spray from flying. When the plates arrive, they should be unpacked and



CHARGING CURVE.

thoroughly cleaned. No foreign substance should be allowed to lodge between them. The plates are put in the cells and these are set in their proper places on the shelves.

Connect up the cells to suit the kind of work the battery is required to perform. Protect the connections by paraffin after they have been made up. The cells are now ready to receive the acid. Purchase the acid properly diluted if possible. If the concentrated H_2SO_4 is obtained, great care should be used in diluting it. The mixing jars are partly filled with water and the acid poured slowly and cautiously into them till the solution becomes of the right density, usually from 1.130 to 1.170. The cells are filled with this preparation. It is well to have near at hand a pail of water rendered alkaline with washing soda, in which to dip the hands when acid has been upon them. A little caustic soda is added to the solution in the cells to keep the plates in good condition.

The positive terminal of the battery is connected to the positive main of the charging dynamo, the negative terminal to the negative main.

The first charge of a new battery should always be of long duration. A run of about thirty hours or ten hours a day for three successive days is good practice. The charge should be continued until the electrolyte in all the cells has a milky appearance. Some few cells may be slow in coming to the point of full charge, if so disconnect them when discharging and connect in at the next charging.

The cell should have, when charged, a potential of at least 2.1 volts; if much below this it needs more charging. For all plates of the pasted type a charging current of 5.3 amperes per square foot of positive plate is considered safe. The E. M. F. of the charging current should be about ten per cent. above that of the accumulator. As the cells become charged their E. M. F. increases and if the charging current is to be kept constant, the E. M. F. of the dynamo must be raised to overcome the back pressure from the battery. This effect is shown in the accompanying illustration. The voltage curve is drawn with broken lines, the curves of amperes with a full line. It will be seen that the voltage rises toward the last of the run, while the amperes average about the same throughout the charge. If sulphating sets in from the cell being allowed to run too low, frequent and prolonged charging runs, with the current about thirty per cent. below maximum will usually remove it.

The safe rate of discharge is about 6.1 amperes per square foot of positive plate. As the internal resistance of the cells diminishes, the current increases and there is practically no fall of E. M. F. for any rate of discharge within safe limits. Care should be taken that no sudden heavy discharges take place, as these buckle and force the paste from the plates.

Frequent examination of the cells should be made for pieces of paste between plates. If these are found, a thin strip of hard rubber may be used to clear the space. It is well to take the densities and voltage of each cell occasionally.

This gives one an idea of the working condition of the battery.

ELECTRO-THERAPEUTIC COURSE.

A strong tide of progress in electrotherapeutics has set in during the last two years in this country, and many medical men of acknowledged standing have become so convinced of the importance of electricity in the medicine of the future, that they have undertaken a course of special study in the subject, and so been enabled to place themselves abreast of the newest and most approved practice. Many practitioners, however, are unable to avail themselves of the regular post-graduate college course, and will gladly welcome such an opportunity for tuition as is afforded by the private clinic of Dr. Robert Newman, in this city. After many solicitations from practitioners to give private lectures in electrotherapeutics, and particularly in surgical electrolysis, Dr. Newman decided to give such a course. The instruction is given in the same manner as that in post-graduate colleges, except that it is private, and limited strictly to a small number of students. The course consists of twelve lectures, in which clinical instruction is predominent, the modus operandi of all operations being shown. The past course has been eminently successful, and the class for the next course, which will begin on November 1, is already made up. Dr. Newman has been called "the father of medical electrolysis," and his labors in this field for the last quarter of a century have been abundantly recognized. He has designed many of the most effective electrodes, now in use, and has contributed in a marked degree to the placing of electrolytic practice in medicine on its modern basis. Dr. Newman has been invited to deliver clinical lectures in electrolysis in Chicago, by the Post Graduate Medical School during the course which begins on September 1.

Obituary.—Dr. Philip Teneyck, who was associated with Prof. Henry in the investigations which led to the invention of the telegraph, died in Albany, N. Y., on July 15, at the age of 91.

INCLINED ELEVATOR.

The elevator is a device which has come to be of the utmost use and importance in large buildings in our cities and towns. It occupies a place in our every-day life similar to that of the street car; it saves us from fatigue and economizes our time.

A new form of elevator is now being placed on the market and from its meritorious features its success should be assured. It is known as "The Reno Inclined Passenger Lift." Fig. 1 illustrates the general plan of the device. It is designed for use at elevated railway stations, in retail dry goods stores, theatres and other places where people have to be transferred from one level to another. This elevator moves continuously and is ready for use at all times; thus avoiding the waiting which is so common with elevators of the ordinary type.

The apparatus consists of an endless inclined platform, which moves at a uniform rate and on which the passengers are transferred from one landing to the other. There is also a moving hand-rail for the use of the passengers. The platform, which is made up of a series of iron sections, supported on rollers, linked together and running on tracks, is driven by two pairs of sprocket wheels, the teeth of which engage with projections on the sections. A combed landing is provided at the top and bottom. The prongs at the combed landing are placed in the grooves between the ridges of the platform, thus doing away with the danger of ladies' dresses, or anything else, being caught.

Fig. 2 illustrates some of the details.

One of these elevators is now installed in Brooklyn, N. Y., and is working successfully. The speed is 75 feet per minute and it has an inclination of 25°. The maximum capacity of a single file elevator is about 3,000 passengers per hour. An electric motor is admirably adapted for driving this form of elevator, although other power motors may be used.

This elevator is manufactured by Otis Brothers & Company, 38 Park Row, New York City.

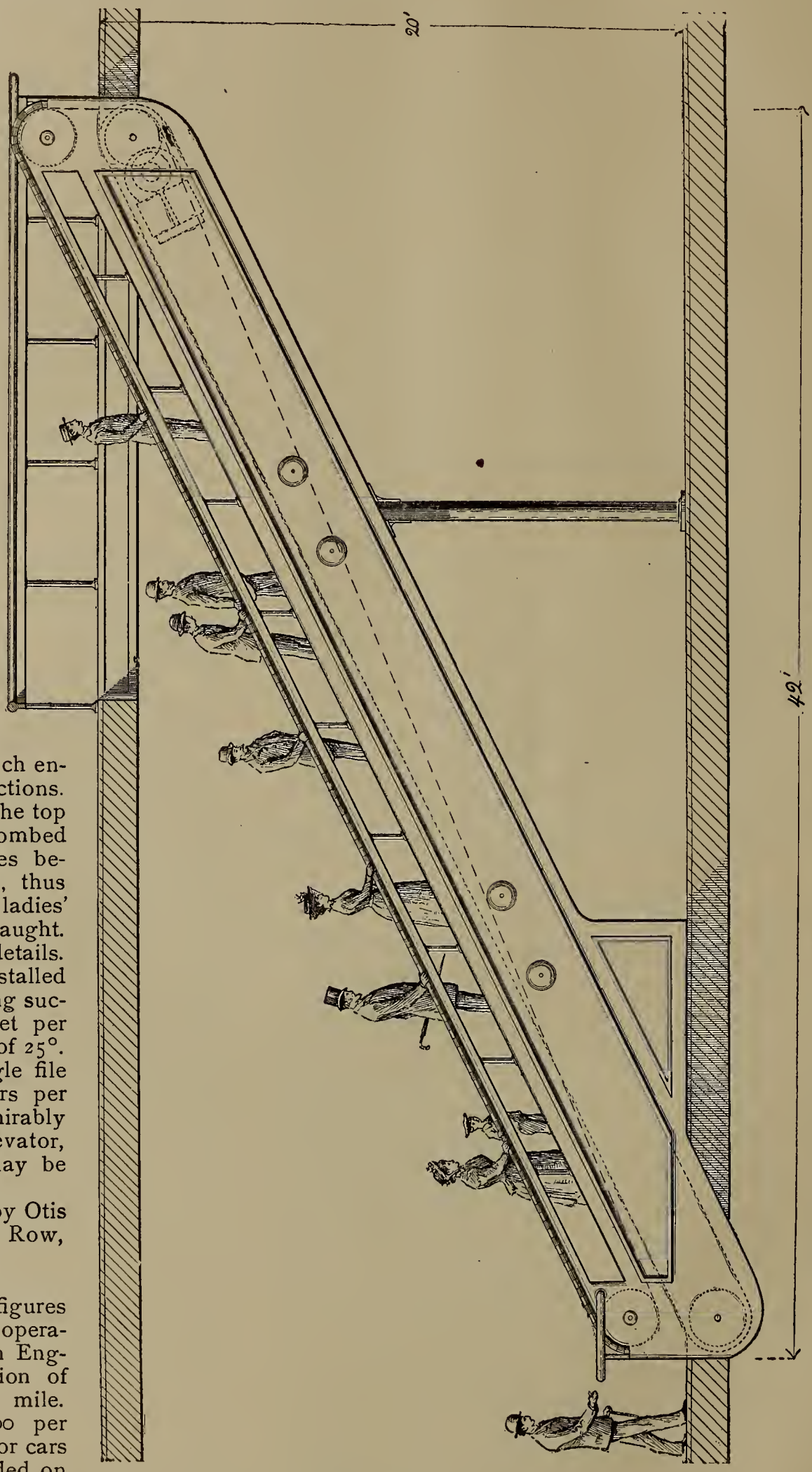


FIG. 1—SIDE VIEW OF INCLINED ELEVATOR.

Storage Battery Cars.—Some figures on the cost of storage battery car operation have recently been given in England. The first cost of installation of the trolley system is £4,000 per mile. For the conduit system, £6,000 per mile. The number of accumulator cars at £500 each for capital expended on trolley, six mile system, is forty-eight; service provided every 2½ minutes. Number of cars provided on conduit system is seventy-two; service every 1⅔ minutes. With a car service every five minutes the cost of installing accumulator cars on the line costs 50 per cent. less than the trolley system and 60 per cent. less than the conduit system, while the running expenses, compare favorably with either system. Accumulator cars, however do not seem to take a strong hold on street railway people.

Assigned.—The Southern Electric Company, of Baltimore, Md., on July 24, made an involuntary assignment. Inability to collect money due was the cause of the trouble. The assets are estimated at $175,000; liabilities $100,000.

ELECTRICAL EXECUTION FAILURE.

An unfortunate accident occurred in connection with the electrical execution at Auburn, N. Y., on July 27, of a colored murderer named William G. Taylor. The condemned man was duly strapped to the chair, and a current of 1,820 volts turned on. In due time the current was turned off, and when it was attemped to turn it on for the second time, as is customary, it was found that there was no current. To the horror of the attendants, the victim began to show signs of returning life, but all attempts to get current failed. An investigation developed the fact that the armature of the dynamo had burned out at the critical moment, and as such a contingency was never considered, there was no spare armature available. A hurried connection was made with the street circuits, and the awful job was completed after an hour's delay. In the meantime, the attending physicians were compelled to administer morphine and chloroform to the half-dead man to keep him from returning to consciousness. The scene, after it was discovered that the armature was burned out, is described by the daily papers as being an awful one. Every moment seemed to bring the condemned man nearer to life, and it is reported that his arms and body convulsed violently.

This horrible experience will teach the State authorities a valuable lesson in electrical engineering.

ELECTRICAL STOCK MARKET.

The stock market this week reached a very low level of prices, all active stocks being affected. On Wednesday General Electric dropped to 40½, a loss of 7 points during the day. On the same day Western Union found its lowest level at 67⅛; 73¼ being the highest price paid for the stock early in the day. On Thursday, however, the general market took a turn the other way and developed considerable strength. The feeling became general that the lowest level of prices had been reached and that investors were taking advantage of the cheap stock and were buying. General Electric opened at 41, and rose to 44¾ before the close of the day—these quotations representing the range for the day. At the close 44¼ was bid and 44⅜ was asked. Western Union also showed up in a little better form, opening up at 67½ and reached 72⅜.

On Friday General Electric received a severe hammering by the bears and dropped 12½ points. It opened at 45¾ and in the afternoon sold at 31¼, closing at 35½.

It is stated that one cause for distrust in General Electric stock among the brokers was the fear that the company's floating indebtedness would cause it trouble and necessitate its asking for a receiver. This uneasiness, however, was somewhat settled by the official announcement later in the day to the effect that the company had decided to offer to the stockholders treasury assets sufficient to liquidate the floating indebtedness of $4,000,000. These assets, it is stated, consist of stocks and bonds of corporations which the General Electric Company had acquired in payment for privileges, rights and apparatus furnished to local companies throughout the country. It was further stated that securities to the amount of seventy-five per cent. of the $4,000,000 had been underwritten by prominent bankers and capitalists.

Regarding the reports that the company would ask for a receiver, counsel for the company stated that no such application had been made, and as far as he knew, none was likely to be made.

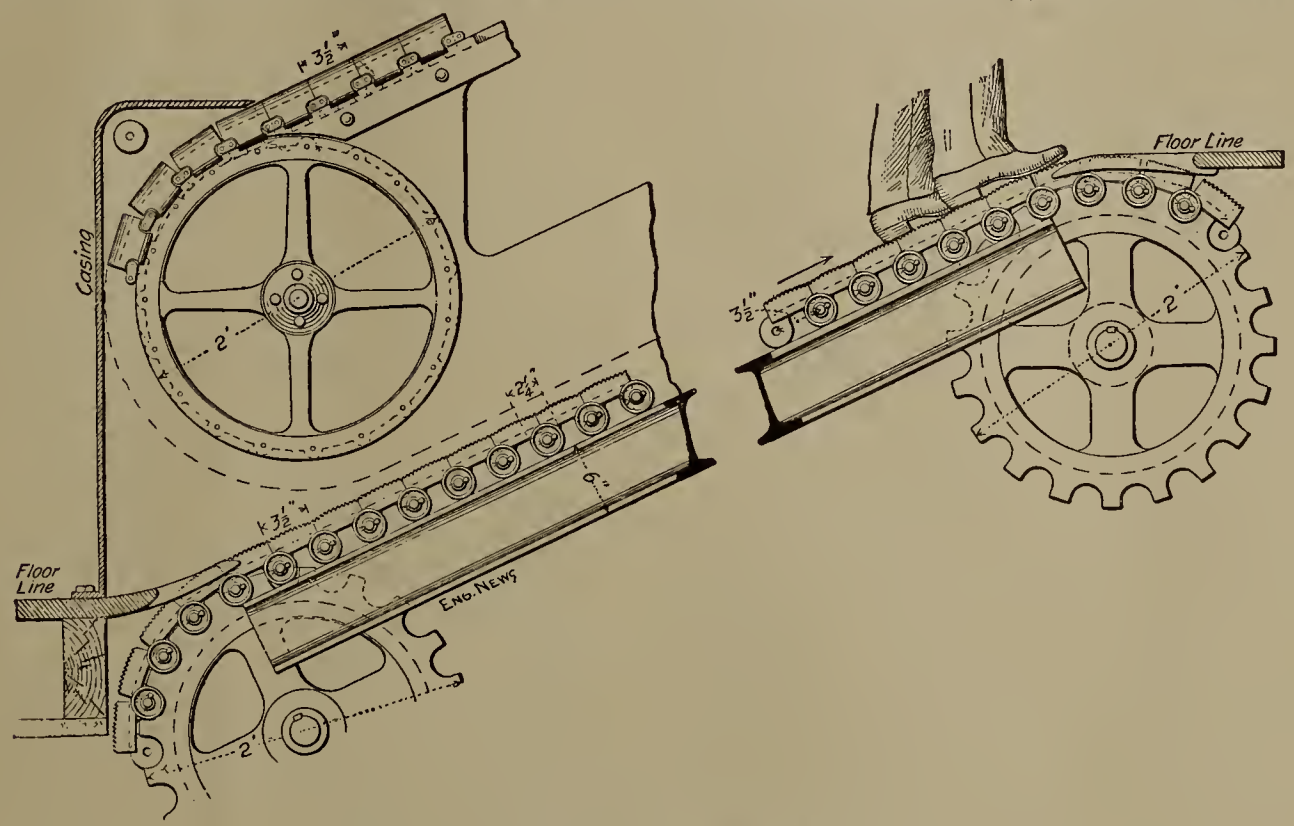


FIG. 2.—DETAILS OF INCLINED ELEVATOR.

Dynamo Shields.—Experiments have been made at the Johnson & Phillips factory, Charlton, England, to determine the effects on magnetographs of a dynamo, with and without a magnetic shield, placed in their vicinity. It was found that when the dynamo was provided with a triple shield the disturbing effect was practically insensible. It is proposed to install a dynamo in the Greenwich Observatory grounds, and the experiments were carried out in order to determine its effects on the delicate observatory instruments.

The Berlin Iron Bridge Co., of East Berlin, Conn., is building the iron roof on the new purifier house for the Philadelphia Gas Co., at Philadelphia, Pa. The building will be 70 feet wide and 160 feet long, and the roof constructed entirely of iron, covered with slate. The new power house for the Worcester Traction Co., will also be designed and built by the same company.

Incorporation.—The Central Light and Power Co., of Rochester, N. Y., was incorporated at Albany, July 24. The capital is $25,000 and the directors are: J. Dewitt Butts, Frank W. Elwood, George Wilson, E. V. Stoddard, Joseph C. Tone, Hiram L. Barker, Isaac W. Butts and F. S. Macomber of Rochester.

HYDRAULIC CEMENTS AND CONCRETE.

BY ALFRED O. DOANE.

In the construction of electric light and power stations it is of the utmost importance that firm foundations be provided in order to secure the best results. As cement enters largely into the construction of foundations for buildings, machinery, etc., a few words on the subject of cement and its uses may prove of interest to the readers of the Electrical Age.

Two principal varieties of hydraulic cement are used in engineering work—natural cement, also known as American, or Rosendale cement, and Portland, or artificial cement. The former is made by burning a shaley limestone in kilns and grinding the clinker produced with burrstones to a very fine powder which, when mixed with water, soon sets and forms an artificial stone nearly as hard as the original rock.

Portland cement is made by combining chalk, or some other form of limestone free from magnesia, with silicious clay; these materials are intimately mixed and made into bricks which are burned in kilns with coke fuel at an intense heat. The resulting clinker is ground in the same manner as natural cement, and is much stronger and sets quicker than Rosendale cement.

In using cement it is important to determine its quality, as, owing to the process of manufacture it is liable to considerable variation. Cement is also injured by dampness or by keeping too long before using.

The tests usually applied are, first, to determine the firmness of the cement, which is very important, as only the finest dust has any hydraulic qualities; the coarser particles acting like sand. A small sample about four ounces is passed through a sieve having 2,500 meshes per square inch; the residue remaining on the screen should not exceed eight per cent. for American or five per cent for Portland cement. Some engineers also use a screen with 10,000 meshes per square inch. In this case the residue should not exceed 18 per cent. for American or 15 per cent. for Portland cement.

The other test is for tensile strength.

The cement is made into briquettes, in moulds having a central section of one square inch. The cement may be mixed with water alone or with varying proportions of sand. These test pieces are kept in water, after they have set for twenty-four hours, seven days, or one month, according to the length of test desired; they are then broken in a machine designed for the purpose, and the force required to pull them apart noted in pounds per square inch.

A good American cement should have a tensile strength of at least 65 pounds per square inch, twenty-four hours test without sand. For Portland cement under the same conditions 125 pounds should be required.

One of the largest uses for hydraulic cement is in making concrete. This material consists of a mixture of cement, sand and gravel or broken stone. It is much used for foundations of all kinds. It is more durable in moist ground than brickwork, and is of course, all in one piece, with no joints to fail or leak; it is easily laid and is considerably cheaper than brick or stone masonry. The strength and quality of concrete depend largely on the care and skill used in laying it, and in rightly proportioning the materials used.

The proportions commonly used are as follows:

One barrel cement,

Two barrels sand,

Four to five barrels gravel or broken stone.

The sand should be sharp, gritty and free from loam, dirt or fine sand. The gravel should contain no pebbles which will not pass through a 2½ inch ring. The sand and cement should be well mixed, dry, then enough water added to make a stiff mortar. The stone or gravel is then moistened, and thoroughly mixed with the mortar by turning over in the bed with shovels and hoes; this should be done three or four times. The concrete is then shoveled into wooden moulds, of the shape desired. In order to obtain the strongest work the concrete should be laid in six inch layers, as dry as possible, and have it work well, and each layer well rammed until the water flushes to the top. In order to make a foundation extra strong and bind it together, old iron rails or rods are sometimes incorporated in the mass and dowels, for holding cap stones or engine beds, could be inserted in the soft concrete in the same manner.

Concrete should be allowed to set for twenty-four hours at least before removing moulds or disturbing it in any way. If laid in cold weather it requires much longer to set and if the temperature is below freezing the sand, stone and water should be heated and the work covered from the frost until entirely set.

By the use of concrete in connection with a timber cribwork, heavy foundations may be successfully placed in very treacherous ground such as quicksand or peaty soils.

New applications for concrete are being found all the time and a knowledge of its valuable properties will often be of use in all branches of engineering.

NEW BOOKS.

The Law of Incorporated Companies, Operating under Municipal Franchises. By Allen R. Foote and Chas. E. Everett. Robert Clarke & Co., Cincinnati, O.; 2,930 pages; three volumes including index volume. Price $15.00.

This important work fills a place in legal literature which has up to the present time been neglected, and the matter contained in the three volumes is arranged with regard to logical progression and to its adaptability as a work of reference. The first fourteen chapters are given up to the discussion of the economical principles involved in the formation and growth of corporations.

These fundamental economic principles are treated in a novel and masterly manner, and open up a broad field of thought for students of political economy, legislators and others interested in this subject.

The discussion of the principles involved is followed by a general consideration of the law and legal principles involved in incorporated companies. Grants, franchises, power of state legislatures, etc., are herein treated in a clear manner and numerous references are cited.

The State laws pertaining to corporate bodies are grouped under state headings, and the matter in each of these sections is compiled by one or more experienced attorney's practicing in the State referred to.

Several long appendices are given in Vol. 2, embracing much matter of interest to the reader, such as ordinances, United States and State reports, etc., etc.

Vol. 3, the general index, a book of 470 pages, is so arranged as to permit of the use of the first two volumes, as works of reference, with great facility.

The contents of the first two volumes by chapters are:

Chap. IX. The Ownership and Use of Municipal Thoroughfares.
Chap. X. Municipal Governments are Political Trusts.
Chap. XI. Municipal Industrial Monopolies are Economic Trusts.
Chap. XII. Industrial Corporations for Supplying Municipal Needs.
Chap. XIII. State Control of Municipal Political and Industrial Corporations.
Chap. XIV. Conclusions and Practical Suggestions.

Chap. I. Introductory.
Chap. II. Historical.
Chap. III. Constitutional Limitations.
Chap. IV. Powers of State Legislatures.
Chap. V. Public Use — Public Policy — Vested Rights.
Chap. VI. Franchises.
Chap. VII. Streets and Highways.
Chap. VIII. Monopolies—Conflicting Grants.
Chap. IX. Municipal Corporations.
Chap. X. Franchise Companies—Individual Rights.
Chap. XI. Conclusion.

Appendix "A"—United States and State Reports.
Appendix "B"—Municipal Ordinances.
Appendix "C"—Sketches of Editing and Co-editing Attorneys.
Appendix "D"—Topical Index of State Sections.

The value of having the laws of all States pertaining to franchise corporations intelligently presented in a form admitting of ready comparison, together with a discussion of the economic and legal principles involved in such legislation, cannot be easily overestimated, viewed solely in its effect on future legislation. The inevitable tendency of such work must be to correct the errors of ill-considered or misinformed legislation; to change the laws in every State in those particulars in which a comparative study of the laws of all States discloses imperfections; to secure uniformity in laws which is the first step in securing a uniform basis for a comparison of the results of legislation and of the economic conditions developed for the users of the services rendered by public service corporations; the security and profitable employment of investments in such industries; and the well being of those employed in their management and operation.

This valuable work is designed for the use of judges, lawyers, corporations and business men, and it is of especial value to electric light and electric railway companies, whose interests are constantly, in different parts of the country, being assailed through city councils and State legislatures.

Mr. Foote contemplates continuing this work by issue ing annual volumes in which all changes in State constitutions, legislative enactments, court decisions and municipal policy regarding the class of subjects dealt with. will be fully reported in a section for each State covering the year of issue, providing the value of his first work is properly recognized. If the demand requires it he will also enlarge the scope of the work so that it will include public service corporations.

Mr. Foote deserves great credit for the results of the years of untiring labor involved in the production of this valuable work, and we trust that his reward will come in the shape of large sales.

Conquests of the Trolley.—It is reported that the Cleveland City Railway Company will substitute electricity for the cable on its Payne avenue line, which is 3¼ miles in length. It is also reported that the Superior street cable line will eventually be transformed into the electric system.

THE FAURÉ STORAGE BATTERY PATENT.

In addition to the decision of Judge Coxe in the storage battery case, and corelative facts given in our last issue, we have obtained some additional facts bearing on the subject, which will be of interest to our readers. The additional matter, together with the decision, gives a comprehensive history of this remarkable case.

The first storage battery suit in the long line of litigation between the Electrical Accumulator Company and the Julien Electric Company, and its successors, was brought by the Electrical Accumulator Company against the Julien Electric Company, on the Fauré patent No. 252,002, being the patent declared expired by Judge Coxe's decision of July 18 last. In that suit, Judge Coxe sustained the Fauré patent No. 252,002, but limited it by a disclaimer, in which Fauré was awarded merely the application of the active matter to a conducting support in the form of a "paint, paste or cement." At this time Mr. Brush's patents had not been passed upon by the courts; although Judge Coxe in that decision intimated that although Fauré was *de facto* the first inventor, yet Brush was *de jure* the first inventor. Then came on the Brush suit against the Electrical Accumulator Company, which culminated in Brush being awarded the broad claim of the *mechanical application* of the active matter to the support plate *in any form*. That is,. no matter what the form of the oxide might be, whether paste or powder, only Brush or his licensees have the right to apply it to the support. In other words, Brush was awarded the invention of applying active matter mechanically, as distinguished from Planté's method of producing the active matter by disintegration. This left the Fauré patent in the position of being an invention for making the oxide into a paste, but without the right to apply it to the support, unless licensed by the Brush Company. The licensees of the Brush Company, the Consolidated Electric Storage Company, therefore applied the active matter in the form of a powder; but the Accumulator Company contended that a successful battery could not be made by applying it except as a paste. The expiry of the Fauré patent, therefore, allows the Consolidated Electric Storage Company, licensees of the Brush Company, to apply the active matter in the form of a paste if they so desire.

AUSTRALIAN ELECTRIC WIRING RULES.

A committee was appointed for the purpose of drafting rules and regulations for the erection of electric light and power wires, etc., at the Postal and Telegraph Conference, held at Hobart, Australia, March, 1892. The committee reported at the next annual meeting in March, 1893, held in Brisbane, Australia.

The following is an abstract of the rules and regulations drawn up by this committee, which will be of interest to electric wiremen in America.

An aerial conductor in any street or thoroughfare shall be at least 20 feet from the ground; where, crossing a street thirty feet, and is not to be less than six feet from any buildings other than a support for the conductor. When necessary to run aerial conductors over house tops the wires must be at least seven feet above the buildings. The maximum intervals between supports is 200 feet for straight wires, and 150 feet on curve. On crossing a street the span shall be as short as possible. Every metal support shall be efficiently connected to earth and all aerial conductors shall be protected by approved lightning protectors.

When high pressure conductors other than aerial conductors, are laid above ground, they shall be completely

enclosed in brickwork, masonry, or cement concrete, or in strong metal casing efficiently connected to earth, at a height of at least ten feet above the ground. Wires in crossing must have a clear all around space of at least one foot.

The maximum working current in any aerial conductor shall not be sufficient to raise the temperature of the conductor in any part to such an extent as to materially alter the physical condition or specific conditions of the insulating covering, if any: or in any case to raise such temperature to a greater extent than 30° Fahrenheit, and efficient automatic means shall be provided which will render it impossible for the maximum working current to be by any accident exceeded to the extent of 25 per centum, even for short intervals of time; and special care shall be taken that the cross sectional area and conductivity at joints is sufficient to avoid local heating, and that the joints are properly soldered and protected against corrosin. High pressure conductors are to be continuously insulated with an approved durable and efficient material to a thickness not less than $\frac{1}{10}$ of an inch, and in case the voltage is over 2,000, the thickness of the insulation shall be increased by $\frac{1}{30}$ of an inch for every 1,000 volts or part thereof.

The insulation resistance of any circuit using high pressure or extra high pressure aerial conductors, including all devices for producing, consuming, or measuring energy, connected to such circuit, shall be such that should any part of the circuit be put to earth, the leakage current shall not exceed one twenty-fifth of an ampere in the case of continuous currents, or one-fiftieth of an ampere in the case of alternating currents. Every such circuit containing high pressure or extra high pressure conductors shall be fitted with an indicating device, which shall continuously indicate if the insulation resistance of either conductor fall below the conditions required by this regulation. Every aerial conductor having a sectional area greater than 7. No. 18, S. W. G. shall be suspended by means of non-metallic ligaments to a suspending wire securely fixed and connected to earth. No single wire less than No. 14, S. W. G. shall be used, and no smaller wire than No. 20, S. W. G., shall be used in any stranded cable. No stranded cable shall have a sectional area less than the equivalent of No. 14, S. W. G. Except where otherwise permitted by the constituted authorities, in the case of aerial conductors carrying alternating currents, the two conductors constituting the lead and return for any circuit shall be run parallel with each other, and at a distance apart not exceeding eighteen inches ; and the position of such lead and return shall be interchanged by crossing every half mile, or at least once in any shorter length of parallel telegraph or telephone wire, which would be liable to induction. Owners of conductors are responsible for supports. Every aerial conductor shall be maintained and supervised by the owner. Unused wires are to be removed within one month of the time the use of the wire is discontinued.

ELECTRICAL ENGINEERING AT THE UNIVERSITY OF MINNESOTA.

The department of Electrical Engineering at this institution is associated with the department of Physics, and has free use of all its apparatus and facilities for work.

The equipment includes three rooms with eight solid masonry pillars for the support of sensitive instruments; dynamo room with engine, dynamos, motors, etc.; battery room ; four laboratory rooms for general work; photometer room; photographic room ; library and reading room ; professor's private study and laboratory ; also a floor space of 190 by 70 feet for a·c light photometry.

All rooms in this department are wired for electric light, time, experimental current and call bells. In the attic are a meteorological room and a photograph room, provided with exposed window, skylight, etc.

The department of physics possesses a large and valuable collection of instruments for lecture purposes and practical laboratory work. Besides a great variety of instruments for general physical measurements, the department possesses a large projecting lantern with Ward focussing arc lamp, one Bunsen photometer, Holtz, Toepler-Holtz and frictional electric machines, storage batteries, Thomson's quadrant electrometer, spark micrometer, electric condensers, a variety of direct reading and reflecting galvanometers, two magnetometers, two induction coils, large and small, a collection of magnets of various forms, Verdi's chronograph, a complete set of meteorological instruments as furnished by the U. S. weather service, and the requisite glassware and mirror instruments to render the above a very complete physical equipment.

In addition, the department of electrical engineering possesses a number of dynamos, including a 150-light Edison, 300-light Slattery alternator, 15-ampere Slattery exciter, 9-light Thomson-Houston arc machine, full complement of instruments for each of the dynamos, 0.5-KW and 0.6-KW Edison motors, C. & C. constant current motor, seven arc lamps of different types, 10 transformers, 12 adjustable rheostats for heavy currents, 3 lamp boards for 10, 20 and 60 lamps in various combinations, 33,300-ampere-hour secondary cells, 150 secondary cells for potential, 50 primary cells for various types, a cradle dynamometer, Weston double-scale (0-150 and 0-750) D. C. voltmeter, Weston double-scale (5-75 10-150) A. C. and D. C. voltmeter, Weston (0-150 and 0-15) ammeters, 12 other ammeters and volt-meters, 33 galvanometers of various kinds (including 3 torsion, with shunt and series coils for potential and current, 3 D'Arsonval, 3 ballistic, 2 electro dynamometers, and 2 Thomson reflecting), 8 S. & H. resistance boxes, 3 standard ohms; 2 box bridges, 6 divided wire bridges, Queen portable testing set, Kruss incandescent lamp photometer, arc light photometer, 12 telescopes and scales, magnetometer, a number of silver and copper voltameters, sets telegraph and telephone instruments, a large variety of switches and other electrical supplies. There are also available a 2 h. p. "D. & D." motor in the mining department and other machines and apparatus which are loaned or sent in for testing.

During the past year the students have designed and constructed a series motor, an arc light photometer, several rheostats, lamp boards, magnetometers, an instantaneous contact maker, multiple-point D. P. switch, and an A. C. ammeter. They have also installed dynamos and motors ; erected heavy lines ; examined at least sixteen isolated plants in Minneapolis and vicinity ; directed or assisted in several efficiency tests of light and power plants and electric railway motors. The graduating thesis in this department is expected to include some original invesligation, generally of an experimental nature. Research work is also carried on by advanced students and by the instructors. At the present time such work is being pursued along the following lines :

The variation of distribution and intensity of arc lights as affected by the use of different globes.

The " bucking " of motors.

Efficiency test of an incandescent electric lighting and steam heating plant.

The compound winding of a constant potential dynamo.

The use of windmills with electric generators.

A method of regulating dynamos operated at variable speed.

The effects of electricity on the growth of wheat.

ENERGY AS A FUNDAMENTAL IDEA.

In an article under this title Mr. E. Tremlett Carter, in the *Electrical Review*, of London, considers the recent suggestion made by Prof. Ostwald that *energy* should replace *mass* among the three fundamental qualities which are the basis of the C. G. S. system of units. In surveying the grounds of the proposed change Mr. Carter says :

Space and time must ever remain fundamental, subjective conceptions ; and no other quantity can be discovered by which they can be more simply expressed than in terms of themselves alone. In dealing with them we are necessarily dealing with the inner world of thought, rather than with the outer world of conditions underlying phenomena. Mass, however, is not so essentially fundamental to thought, and serves the purpose of a stop-gap in the evolution of the idealistic notions of the outer world. Still, the hypothesis—for it is nothing more—of the indestructibility, the conservation, of matter has led to mass being assigned a prime place in physical science ; while the evidence of our senses has invested all phenomena with the same basic quantity. During the last two or three decades the progress of science has developed, slowly but surely, the conviction that matter, *per se*, is nothing, that *energy* is everything. First came the doctrine of "the correlation of the physical forces," by which was intended that they all were mutually convertible ; and the discovery that the vehicles of sensation—light, heat, sound, elasticity—are all forms or functions of energy. Rapidly following, came the discovery of the equivalence of the various forms of energy, which led to the doctrine of the conservation of energy, a doctrine as firmly established as that of the indestructibility of matter. Science thereby entered into the not altogether comfortable possession of two equally fixed things in the universe, energy and matter; and the "white elephant" which it had acquired began to show itself when it was found that neither of these two things could be defined or accurately thought about without the other. The inevitable tendency which this produced may be seen in the discoveries of Newlands, Mendelejeff, and Meyer, and in the hypothesis of matter and energy which have been put forward by Thomson and by Crooks Matter and energy are but functions of one another and, perforce of some unknown thing, which is simpler than either; all energy is one, all matter is one. Such is the present limit of speculation and hypothesis about the physical universe; and it leaves us with as much right to formulate our ideas in terms of energy as of mass, of either as scientifically as of the other.

So much, then, as to the scientific right to supplant mass by energy. It is another story when we try to discover if it will be *convenient* to do so. All our physical knowledge may be expressed either in terms of space, time and mass or of space, time and energy; but the whole of that knowledge is derived, initially, through sensation. By touch, sight, smell, &c., we get hold of a bundle of ideas which, whether we treat them according to Berkeley or according to Hume, compel the notion of an inexplicable, tangible something, a material presentment—*mass*. Do our senses as readily assist us to form a conception of energy? Is the conception of energy which we derive from them as fundamental, as primitive and as simple? If so, we may with equal convenience construct our physical science upon either basis. If not, we may no more reasonably make our conception of energy the basis of our knowledge of matter than we may teach simple arithmetic by the rules of the integral calculus. If we analyze our primitive ideas and sensations, to see if they yield as readily a notion of energy as of matter, we shall, I think, be compelled to admit that they do not. It is the advanced scientist who thinks in terms of energy ; the beginner is obliged to think in terms of mass.

Conceive, for example, a system of elementary science based upon the proposed change. The student starts with definitions and ideas of time and space ; he then proceeds to a more or less tentative definition of energy. He must next construct a definition of force apart from mass, and must derive the notion of force from the three quantities that have been selected. To do this would be difficult, perhaps impossible, for a beginner; but what shall be said of his attempt to get a notion of *mass* from this complex idea of force and the three other ideas? Work could no longer be explained as "foot pounds," and the horse power would be metamorphosed entirely ; while the zenith of difficulty would be reached when he attempted to find out what was meant by a pound weight! All this topsy-turvydom would arise from the futile attempt to proceed from the complex to the simple ; from the desire to express the element to terms of the compound which it partly forms. Assuming, for the sake of argument, that the beginner struggles through and gains an advanced knowledge of physics, he would find his new pattern of thought only on certain occasions more useful to him than the old and discarded one. In tracing the path of a fixed amount of energy from system to system of material particles, it would undoubtedly be advantageous to have a set of ideas which fixed the mind fundamentally on the energy rather than on the matter; but in studying the action of a varying flux of energy out of or into a fixed system of material particles, it would be more than confusing to find that every idea had to be treated in terms of the secondarily important and ever-changing quantity, energy. To engineers the new system would come as no help whatever in dealing with the theory or practice of machinery; while the inversion of ideas which would arise from its adoption would produce a revolution which would be a long while in settling down to order and quiet. Only the advanced scientific world, the world of research and speculative thought, would benefit by the change; and to this, it would be without a boon indeed. But in an informal and private manner, each one for himself, that world has already made the change; the leaders of scientific thought no longer think along the trammels of the old material science; to them energy is equally if not more important than matter as a factor in the scientific idea of physical phenomena.

Conductivity of Liquids.—Some interesting liquid conductivity experiments have recently been made by Mr. R. J. Holland, an English electrician; the influence of small quantities of non-conducting liquids in modifying the conductivity of other liquids was the subject of the investigation. Non-conducting substances which possess no solvent action on the salts employed were used; the water was extracted from the solution of the salts, in pure methyl alcohol. The salts used were the nitrates of potassium, sodium and lithium, and the non-conductors were pure benzene, toluene, xylene and oil of turpentine. Solutions $\frac{1}{100}$, $\frac{1}{1000}$, $\frac{1}{2000}$ of normal strength were prepared, and 5, 10, 15, 20 per cent. of the non-conductor added; the results of the test were as follows:—1. The conductivity is diminished by the addition of a non-conductor in direct proportion. 2. The diminution in conductivity varies according to the nature of the dissolved salt and the non-conductor. Benzene, toluene xylene, and oil of turpentine diminish the conductivity in the order given, the last-named having the greatest effect. 3. The molecular conductivities may be expressed graphically by straight lines.

Green Bay, Wis.—Work has commenced on the new electric street railway at Green Bay.

ON THE NOTATION PROPOSED BY M. HOSPITALIER.*

BY PROFESSOR ALEXANDER MACFARLANE.

I wish to make some observations on the "Table of Symbols of Physical Quantities and of Abbreviations" proposed by M. Hospitalier at the Frankfort Congress, and recently recommended for adoption by the Sub-Committee of the Institute on Programme for the Chicago Congress. My observations have reference to some features of the plan which it seems ought to be discussed and perhaps amended. The account of the system which I have before me is that published in the London *Electrician* for the 15th of January, 1892.

The analysis upon which the system is based is thus stated: "The first and most indispensable point is to establish a clear and precise distinction between a *physical quantity*, its *magnitude*, and the *unit* which serves as a common measure in a given system to all magnitudes of the same kind. A physical formula always establishes a relation between physical quantities, each physical quantity being represented by a special symbol. The magnitude of a physical quantity is represented by the ratio between a physical quantity and the physical quantity of the same kind which is taken as unity. The magnitudes of physical quantities are, therefore, essentially abstract numbers. Finally, the unit is a physical quantity, of a particular size, which serves as a common measure, multiple or sub-multiple, to quantities of the same kind, which is designated by a special name, and which allows of abbreviations intended to simplify speech or writing. The symbols of physical quantities enter into physical formulæ, but units never do."

The above would be a sufficient analysis, if all physical quantities were of the non-directed or scaler kind. But it is not so; there are many electrical quantities of the vector kind, not to speak of more complex kinds. Thus in Clerk-Maxwell's "Electricity and Magnetism," vol. 1, page 10, we find: "When we wish to denote a vector quantity by a single symbol, and to call attention to the fact that it is a vector, so that we must consider its direction as its magnitude, we shall denote it by a German capital letter, as $\mathfrak{A}$ $\mathfrak{B}$, etc." In the writings of Fleming, Heaviside and other electricians, such vector quantities are denoted by simple black letters, such as **A B**, which are much easier to write and to read.

To avoid interference with such higher analysis or to provide for it, we require more extended view of physical quantities. Physical quantities are either non-directed or directed. A non-directed quantity consists of magnitude only; a directed quantity consists of magnitude and axis. Magnitude is further analyzed into ratio and unit. In M. Hospitalier's scheme, symbols are provided for magnitudes only, none for physical quantities involving direction. Thus v denotes the magnitude of a velocity, without regard to direction; F the magnitude of a force; the German $\mathfrak{M}$ means the magnitude of the magnetic moment, not the magnetic moment itself; $\mathfrak{B}$ the magnitude of the magnetic induction, not the magnetic induction itself. This defect may be removed by retaining the black letters **M** and **A** to denote the magnetic moment and magnetic induction, while corresponding italic letters M and A denote the respective magnitudes.

Another feature of the plan, which appears of doubtful ability to one who has studied the higher analysis, consists in denoting by the same symbol all physical quantities which have the same dimensions. For instance, W the symbol for work is also made the symbol for moment of a force, because the dimensions of both are $L^2 M T^{-2}$. But, though their dimensions are the same, these quantities are very different in nature; work is a non-directed quantity, while moment of a force is a directed quantity. In work the two lengths have a common direction, while in moment of a force they are transverse to one another. To give the same symbol to two quanties so different in their nature is not sanctioned by established notation, and it proceeds upon a principle which is novel and not in accord with the results of the higher analysis.

In the higher analysis it is important to have not only a symbol for an angle, but also a symbol for an axis. The Frankfort Congress recommended physical constants and angles to be represented by Greek letters. An axis is also best denoted by a Greek letter Let **B** denote a directed physical quantity; then if the italic B denotes its magnitude, and the Greek β its axis, we get a compact systematic notation which is very easily remembered.

In the plan of M. Hospitalier centimetre per second is abbreviated by cm/s, dyne per square centimetre by dyne/cm^2, and centimetre per second, per second by cm/s^2. Here we have a contradiction. If dyne/cm^2 expresses dyne per square centimetre, then by the same rule cm/s^2 expresses centimetre per second squared. The unit centimetre per second per second is properly abbreviated by (cm/s) /s; the idea cannot be unambiguously expressed without the use of a bracket. For example, 980 (cm/s)/s expresses the acceleration of gravity, while 490 cm/s^2 expresses the connection between the fall and the square of the time elapsed.

* June and July Transactions, American Ins.itute Electrical Engineers.

COMMENTS ON THE REPORT OF THE COMMITTEE ON THE PROVISIONAL PROGRAMME FOR THE CONGRESS.[1]

By Dr. John Sahulka, Austrian Delegate to the Congress.

[translation.]

I. New Units.

1. In the calculation of magnetic circuits the field strengths which occur in practice would have to be expressed in very small decimals, and magnetic resistances in very large numbers. In order to have convenient numbers, it would therefore be necessary to use the units micro-gauss and mega-oersted. This makes it desirable to retain the absolute c. g. s. system of units. The practical units volt, ampere and ohm, were introduced only because the absolute c. g. s. units would have given inconvenient figures for the quantities occuring in practice. In magnetic circuits no reason exists for giving up the absolute system of units.

2. The introduction of a unit (the mho) for the electrical conductivity of a circuit is not a necessity, as all calculations can be made with the units ohm, ampere and volt.

II. Names for New Units.

1. Should the absolute c. g. s. system of units for magnetic circuit be retained, which from recently expressed opinions seems probable, the introduction of new names would not be necessary.

2. The name "mho" for the unit of electrical conductivity was probably used by some one because it was introduced by Sir Wm. Thomson; should the new unit be introduced, it would be easy to find an appropriate name (thomson). In order to be consistent, one would

1. June and July Transactions American Institute Electrical Engineers.

then have to introduce a practical unit for magnetic conductivity (reluctivity[2]), and give it a name which is the reverse of the name oersted.

3. The name henry for the practical unit of self and mutual induction is preferred to the term quadrant, because induction coefficients are not lengths.

The importance of the use of a bracket in expressing a derived unit in terms of the fundamental units, is well shown in the case of the unit of specific resistance. In some English works such as Ayrton's Practical Electricity, specific resistance is expressed in terms of "ohm per cubic centimeter." In a recent paper, printed in the *Electrical Engineer*, for December 28, 1892, M. Hospitalier critizes this usage as follows: "For the same reason, only the units of the quantities which define that quantity should enter into the definition of a unit of measure for a given quantity. Thus, for example, the English persist in expressing specific resistance in ohm, per cm^3 on the assumption that the specific resistance of a substance is the resistance of a cube of 1 cm, cross section between opposite faces. Specific resistance cannot be measured in ohms per cm^3, it is the product of a length and a resistance, and should be measured in centimetre-ohms."

I drew attention to this matter in a paper read before the American Association for the Advancement of Science at the Washington meeting in 1891. Specific resistance is not properly expressed in ohms per cm^3 because *per* denotes proportionality, and the resistance is not proportional to the volume. The true unit can be expressed with the help of a bracket, thus: ohm per (cm per cm^2), that is, the resistance is proportional to the length divided by the cross-section. This is the direct definition of the quantity, and much more logical than the definition by means of dimensions.

In M. Hospitalier's table no names are suggested for the c.g.s. magnetic and electro-magnetic units. It is to be hoped that the principle of defining them by means of their dimensions will not be adopted. Given words for the c.g.s units of intensity of pole, current electromotive force, and resistance, then the others can be defined by compound words which express not the dimensions, but the relations of the units to one another. Let P denote the word chosen for c.g.s. unit of intensity of pole; X the word of c.g.s. unit of current; Y the word for the c.g.s. unit of electromotive force; Z the word for the c.g.s. unit of resistance. Then,

the unit of magnetic moment is P—centimetre.
" " intensity of magnetization, P per cubic centimetre.
" " intensity of field, dyne per P.
" " magnetic flux, dyne per P—square centimetre.
" " quantity of electricity, X—second.
" " capacity X—second per Y.
" " specific resistance, $Z\,X$ per (centimetre per square centimetre.)
" " conductivity, X per Y.
" " resistance, Y per X ($=Z$.)
" " specific conductivity, centimetre per square centimetre per Z.
Etc. Etc.

III. *Definitions.*

1. "The impressed electromotive force is the ratio of the total activity of an electrically conducting circuit to its instantaneous current strength" Formerly the term "impressed electromotive force" was understood to mean the difference of potential measured at an alternating current apparatus, or in case the whole circuit is considered, the total electromotive force. This cannot be meant by the proposed definition as the instantaneous current strength occurs in it. But if by impressed electromotive force is meant the instantaneous value of the difference of potential at the terminals or the electromotive force, there is a contradiction, for if, for instance, a circuit traversed by an alternating current contains a self-induction, then at the instant when the instantaneous value of the electromotive force is equal to zero, neither the current nor the accumulated energy in the form of a magnetic field, are zero, and therefore the quotient of these values will likewise not be equal to zero; there is also a contradiction if a condenser is inserted in the circuit.

2. The universally used term permeability should not be replaced by the term inductivity.

3. It is very desirable that the definitions of induction resistance (inductance), and of the coefficient of self and mutual induction, be adopted in accordance with the suggestions of the Committee. taking into consideration the total field which is linked with a definite current strength, and not by taking into consideration the electromotive force induced during separate intervals of time. In the latter case the self-induction coefficient is a different one at every step of the magnetization, and is dependent on whether the magnetization increases or decreases. The change of value of the self-induction coefficient cannot be represented by a simple formula on account of the irregular form of the magnetization and hysteresis curve. Only such a definition of the self-induction coefficient is suitable in practice, according to which one can measure these values with the usual instruments and according to which one can make calculations. Therefore, of the three different ways in which the self-induction coefficient can be defined, only that one is adapted to practice which takes into consideration the total field which is generated. In order not to obtain incorrect values from the proposed definition, it should be added that the same is correct only for conductors which are not branched. Mr. Blondel has called attention to this feature. When a *periodical alternating electromotive force*, and not a constant one, is acting in a circuit, special relations arise which make it desirable to introduce also the quantities "effective ohmic resistance" (*effective resistance*), and "effective induced resistance" (*effective inductance*); only in the case of a coil without iron, which exerts no action on any other conductor, are these quantities unnecessary. If a coil without iron is traversed by an alternating current, the difference of potential which acts can always be divided into two components, one of which overcomes the ohmic resistance, and the other the inductive resistance. The latter component precedes the former in phase by 90°; the overcoming of the inductive resistance requires the production of no energy. But if the coil contains an iron core, the energy of magnetization will have to be generated besides the heating effect of the current. In this case also there are two components of the difference of potential, the one E_1 overcomes the ohmic resistance, the other E_2 overcomes the electromotive force induced by the periodically changing field in the coil. This component E_2 *is no longer in advance of* E_1 *by a difference in phase of* 90°, *but by a smaller angle a.* The inductive resistance could be determined by dividing this second component E_2 by the current strength I; from this inductive resistance one would obtain the self-induction coefficient by dividing by $2\,\pi\,n$. The component E_2 can also be resolved again in two components, of which the one $E_2 \cos a$ has the same phase as E_1, while the other $E_2 \sin a$ is advanced in phase by 90°. The compenent $E_2 \cos a$ involves the energy of the foucault currents and hysteresis, the component $E_2 \sin a$ involves the expenditure of no energy. The coil with an iron core acts like a coil without iron which has the ohmic resistance $(E_1 + E_2 \cos a) \div I$, and the inductive resistance

2. Inductivity, or magnetic permeability, is doubtless what was meant. *Tr.*

$(E_2 \sin a) \div I$. These values are the effective ohmic resistance (effective resistance), and the effective inductive resistance (effective inductance) of a coil with an iron core. In the same way one also obtains this effective resis ance for every transformer, motor, condenser, etc. For the primary circuit of a transformer these values were calculated by Maxwell in the year 1865, and were represented in the above manner. The effective resistances of an alternating current apparatus can in every case be found when the current strength, the required difference of potential, and the energy consumed, are measured. The definitions of these values are as follows :

The effective resistance of a circuit ts the ratio of the absorbed power to the mean square of the current.

The effective inductance is the square root of the difference of the squares of the impedance and the effective resistance.

The effective coefficient of self-induction is the ratio of the effective inductance to $2 \pi n$.

4. The definition of reluctivity cannot be given by saying :—It is the reluctance per unit volume, as one does not obtain the total magnetic resistance by multiplying reluctivity by the volume ; it would be preferable to have it read :—Reluctivity is the magnetic resistance of a portion of the material in question, having a length of 1 cm. and a cross section of 1 cm_2.

5. A definition of Mattheissen's standard is supurfluous as the Congress is not concerned with researches regarding this unit.

Vienna, June 14, 1893.

Electric Light at Cape Town.—A very interesting electric light plant is now being installed in Cape Town, says the *Electrical Review* of London. The general plan of the plant is a continuous current, five wire system, with a primary system at the distance of two kilometres from the centre of the city, and an accumulator system situated in the city. The accepted plans was made by Siemens & Halske of Berlin, Germany. For motive power, there is a constant water power derived from the Tessina stream, rising on the Table Mountain. A fall of 1,350 feet is available. A pressure tube conveys the water to the turbines set up at the central station. Two turbines with horizontal axles are constructed, each directly coupled with a continuous current dynamo of about 135,000 watts, or about 200 effective H.P., at 250 revolutions per minute. Reserve steam power is provided. The current produced by the dynamos is conveyed to the accummulator sub-station in the city by a main 2,140 metres in length. It consists of Siemens's patent double lead covered cables of 2 x 95 square millimetres of copper sheathed with iron. In this there will be erected a battery of accumulators (272 Tudor cells) of a discharging capacity of 468 amperes and 1,404 ampere hours, as also the apparatus for regulation and distribution, by which the current is conveyed through the main leads to the chief points of distribution. All the main and distributive mains in the principal streets are laid underground, whilst the remainder of the mains, consisting of bare copper wire, are fixed on iron masts supplied by Siemens Brothers, of London. The total length of the underground mains is 35,985 metres ; that of the aerial leads is 244,800 metres. The installation is to supply 6,000 lamps, including 400 glow lamps at 25 and 35 candles, and 30 arc lamps at 8 amperes for lighting the streets. The entire installation must be so far advanced by December, next year, that the supply of light may be effected to all consumers connected, and the street lighting must be undertaken to its full extent. So long an interval for the completion of the entire installation has been stipulated, because the motor arrangements, especially the water works, will take the chief share of the time.

SOUND ADVICE.

The following advice given by the *Tradesman,* is both sensible and practical, and is well worth reproduction here for the benefit of many of our readers who are engaged in manufacturing and kindred lines:

"By all means keep a record of all changes that occur in your work, changes that occur in design or in methods of manufacture, so that you can replace any part by simply knowing when the machine was made, and its size. Too many places seem to keep no record whatever, and are unable to replace a broken part without having the machine returned and fitting it in place. When the machine is a large one, and in some distant part of the country this is neither convenient nor pleasant for the man who pays the bills. There should also be a record kept of the cost of each lot of machines, so as to compare the next lot with them and note the difference in cost, and if the cost should be more, you can inquire into the cause; if less you should also inquire into its cause and see who deserves the credit for its accomplishment. And the credit should be as freely given as the blame, should the product increase in price. Strict watch should be kept, and those who work to the best advantage and whose little devices make the work go easier and better should receive credit both in words and in cold cash, as their work saves you money, and why should not a portion of it go to them? These little things go to make up the justice of rewards."

ELECTRIC CAR BRAKES.

We notice with much pleasure the gradual replacing of the old fashioned street car brake by modern air or electric brakes.

Several cars on the electric road from Boston to Lynn, Mass , have been fitted with air brakes. The result obtained from the tests of these cars are very satisfactory. A car running at the rate of ten miles an hour may be brought to a full stop almost within its length. In this brake the air pressure is brought up to the maximum, in the air pressure cylinder, by a pump connected to the car axle.

Several electric brakes have been invented and some of them have been placed in actual operation. A powerful electro-magnet exerts a tremendous pull upon a piece of iron placed near one of its poles, and it would seem from this fact that electric brakes could be devised that would answer all the requirements for a brake for one of the heavy street cars of the present day.

Think for a moment of the motions a motorman has to go through with to suddenly stop an electric car. With one hand he revolves the handle controlling the rheostat, while with the other he endeavors to turn the brake handle, at least two revolutions. He has to finish turning the rheostat handle before he can use both hands on the brake handle ; thus allowing some little time to elapse from the moment of starting to stop the car, to the time when he can apply his full strength on the brake. Even when he has the brake as tight as he can get it the car will cover quite a space in which to come to a full stop. How much better it would be to have on the dashboard of a car a little lever, which by a slight motion will set in action the powerful electric or air-brake.

If brakes of this nature are generally adopted throughout the country, much of the danger to life, of rapidly moving cars in a crowded thoroughfare, will, to a great extent, be eliminated. Let companies installing new electric roads thoroughly investigate the merits of these brakes and help in their general introduction.

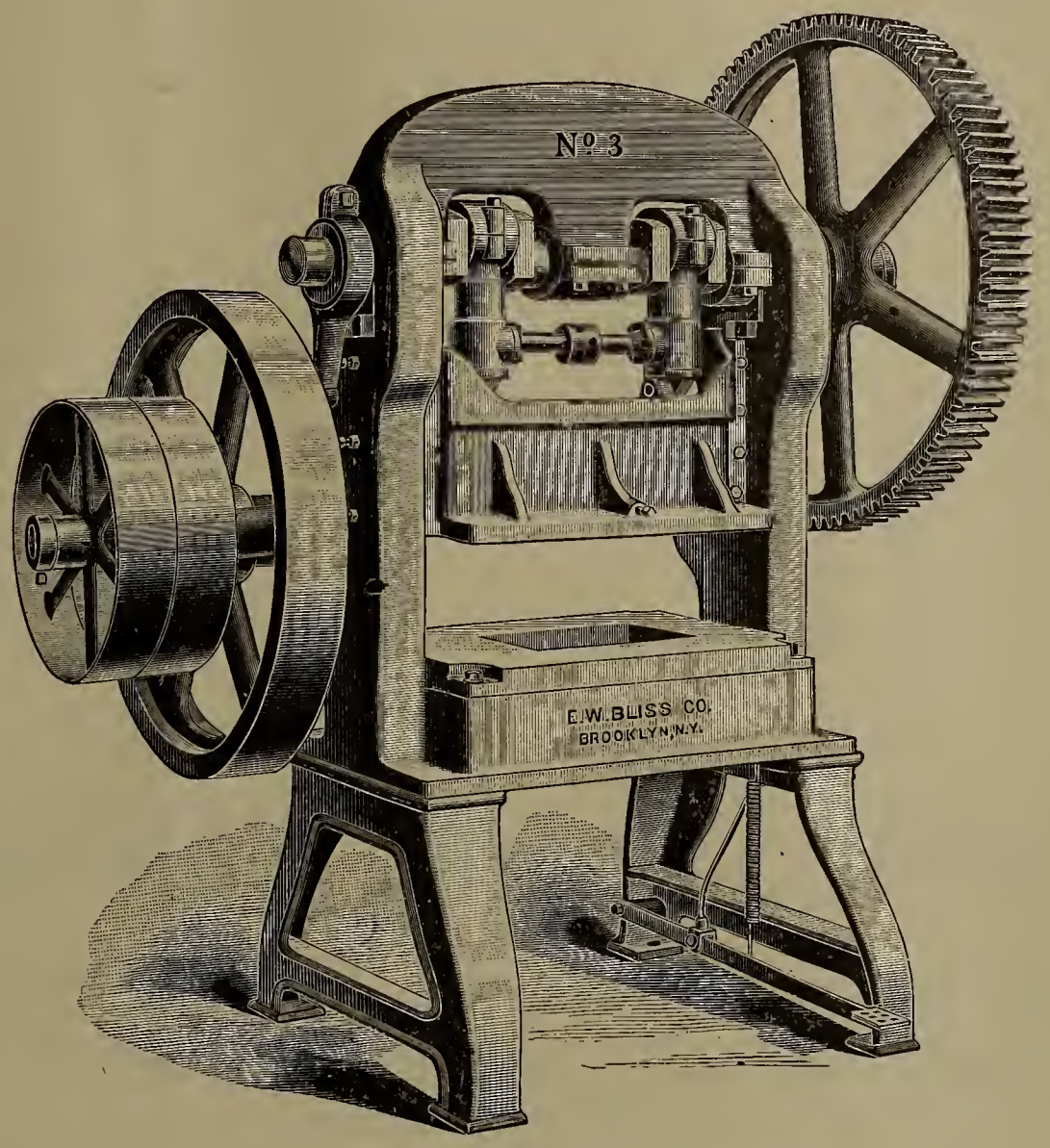
Receiver.—A despatch from Cleveland, Ohio, states that the Bodifield Belting Co. of that city was placed in the hands of a receiver on July 29.

DOUBLE CRANK PRESS.

In the manufacture of dynamo electric machines, the stamp presses plays an important part. They are especially useful in the stamping of laminated armature discs.

In the accompanying illustration is shown the No. 3 double crank press made by the E. W. Bliss Co , 71 Adams street, Brooklyn, N. Y., which is especially adapted for such work.

The two pitmans of this press are so connected as to allow of the operator quickly raising and lowering the slide, without danger of getting the pitmans out of aligments with each other and with the guides. It measures 36 inches between the upright, 2 feet 4 inches stroke, die space (up and down) 10 inches, 2 inches adjustment, height 90 inches and weighs 5,500 pounds. Similar presses are also made up to 50,000 pounds in weight.



BLISS' DOUBLE CRANK PRESS.

The machines may be put to a variety of uses in electrical manufactories. It is especially adapted for operating large cutting, forming, perforating and bending dies. The press can be made without gearing and with overhanging frame instead of straight upright.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, July 29, 1893.

R. A. Falconer, of the Falconer Mfg. Co., manufacturer of incandescent light supplies, 1 Hartford street, Boston, was in town this week.

On July 27, the Edison Electric Illuminating Co.. of this city, began two suits in the United States Circuit Court for the Southern District of New York. One suit is against the Mount Morris Electric Light Company, Edward May and Julius May, and the others against the United Electric Light and Power Company, Caleb H. Jackson, Herman H. Westinghouse and Geo. Westinghouse, jr. Both suits involve the use of incandescent lamps other than the Edison, and injunctions and accountings of profits are asked for. Judge Lacombe will hear the case on August 2.

Mr. J. H. Seymour, president of the Clark Electric Company, is one of the vice-presidents of the New York Board of Trade and Transportation, of this city. This body recently passed resolutions urging the repeal of "the compulsory silver purchasing section of the Sherman law." Copies of the resolutions have been sent to 1,100 commercial bodies in all sections of the United States with a request that suitable action be taken in the premises. The resolutions, we are informed, were framed by Mr. Seymour.

The American Universal Electric Company, 126 Liberty street, has an attractive display of its goods in the window. Fan motors of various designs run by the company's well-known and efficient battery are in constant operation, showing the adaptability of this battery to such work. Call in and get cooled off.

The Brooklyn Elevated Railroad Companies want to have a lower valuation placed on their lines by the assessors. They argue that the competition of the trolley lines has caused a very great falling off in their receipts, and for this reason the valuation of $200,000 per mile would make the taxes onerous. It is stated that since the trolley lines began operation the receipts of the elevated roads have fallen off from 8 to 13 per cent.

W. T. H.

TRADE NOTES.

Lord's Boiler Compound is used in over 3,000 steam plants in North America, and it is said to have no equal. A sample of it can be had by sending to Geo. W. Lord, 316 Union street, Philadelphia.

Some novel circulars have just been issued by the E. W. Bliss Company, Adams street, Brooklyn, N. Y., manufacturers of presses, dies and special machinery. The circulars are written in English, German and French, and contain illustrations, descriptions and price lists of the punching presses, drop hammers, drawing presses, etc., made by the company.

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NEW YORK, AUGUST 12, 1893.

CONTENTS.

TWO MORE INJUNCTIONS.

Two more incandescent lamp factories have been closed up by order of court at the instance of the General Electric Company, the Buckeye and Packard. The General Electric Company seems to have the law entirely on its side, but the defendant companies in all the suits have won praise for the plucky stand they took in the face of all the odds against them.

FRIEND OR FOE.

In a paper read before the Pacific Coast Gas Association, Mr. J. L. Hallett discusses the subject "Is the electric light a friend or foe of the interests of gas lighting," and comes to the conclusion that it is a friend rather than a foe. It has been the direct cause of increasing the gas consumption in most places where the two kinds of light are in service, and at the same time it brought about an improvement in the quality of the gas. Mr. Hallett's opinion is probably not shared in by all gas men. There are many places in the country where the gas interests have received the blackest kind of an eye, and it would hardly be in the nature of things for the sufferers to say that a friend was the cause of their ruin. However, looking at the matter broadly, the electric light is unquestionably a friend rather than a foe to the gas interests.

IMPROVED CABLE CONSTRUCTION.

It is with satisfaction that we note the tendency towards improvement in the construction of submarine cables, with a view to the elimination of the evil effects of induction and other influences which materially retard the speed of signaling on long cables. Mr. W. H. Preece, the well-known English electrician, has given the subject his earnest attention, and in this issue we publish a brief reference, with illustrations, to some new forms of cables devised by himself. His scheme involves the necessity of a metallic circuit, but whether the increased cost for copper will be at least offset by the advantages gained by the increased speed of signaling is a question that can only be determined by a practical test.

THE MARCH OF IMPROVEMENT.

The observing reader cannot fail to notice the diversity of applications of electricity as described in this issue. A portable electric drill renders it practicable to take the drill to the work instead of bringing the work to the drill; the electric lighter stores the hydrogen gas generated in the battery and the gas is ignited at will by the same current; the electric hoist is usurping the place of the noisy and dirty steam engine in loading and unloading vessels, and, in the nature of an extension of an old idea, is the incandescent current Adapter which enables us to tap an electric light circuit and take therefrom just the current we need. All these improvements evidence the efforts put forth in every quarter to get what we want and do what we want with the least expenditure of energy and time.

GENERAL ELECTRIC STOCK.—On Friday July 28, General Electric stock was hammered down to the lowest notch, falling to 30, and closing at 38. The stock received greater strength during that time and Monday. On Monday it opened at 37 and closed at 40⅛, and during the rest of the week it showed more tone, ranging from 40 to 51½—the latter being the highest quotation recorded on Thursday. There seems to be a little more confidence in stock.

THE VETTER CURRENT ADAPTER.

When small electric currents have been desired for some specific purpose it has been customary hitherto to obtain them from a special source. For instance, when we wanted to operate a fan motor, a sewing machine motor, an electro-medical apparatus, or any other device of like nature the primary battery or storage battery

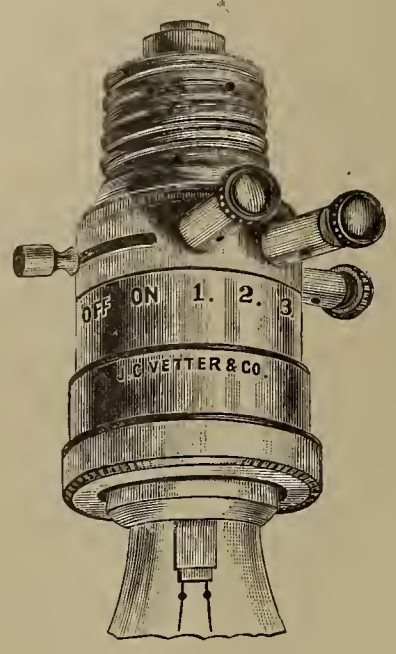


FIG. 1.

was usually called into requisition. Such batteries do well enough, but many people consider the work of cleaning them a hindrance to their very general use. This feeling naturally turned the attention of electricians to the idea of generating electricity in large units, and by the use of proper translating devices take from the mains what current we might need for any specific purpose, just as we obtain water in large or small quantities. The idea has been worked out practically in some direc-

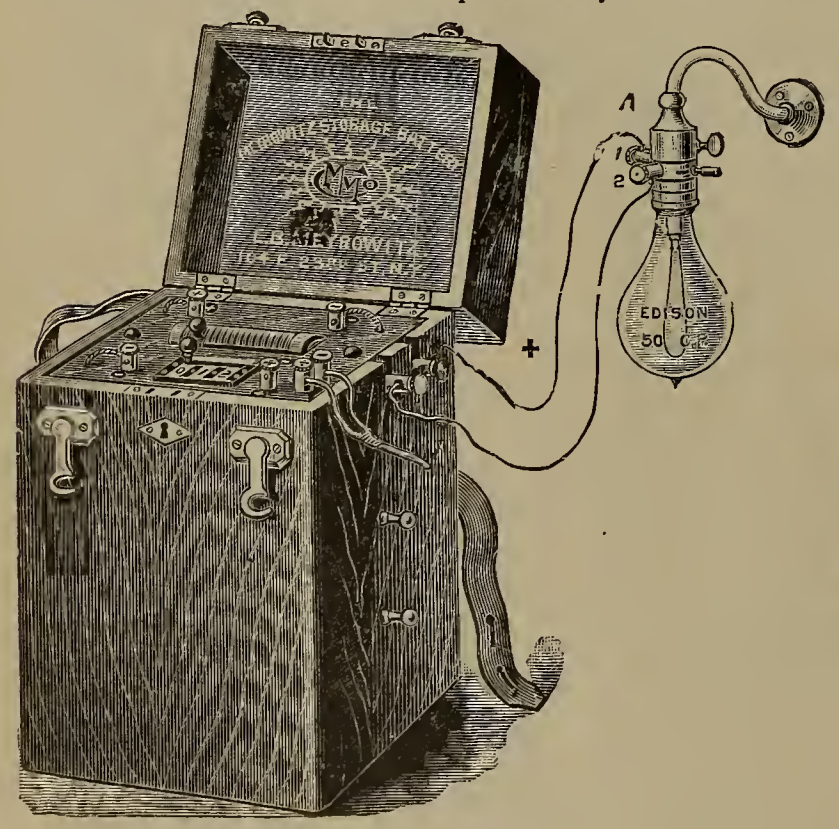


FIG. 3.

tions, and it is not uncommon now-a-days to find electric light currents, for instance, being used for other than lighting purposes.

In electro-therapeutics, improvements are constantly being made, and the primary and storage battery are gradually giving way to the more convenient and reliable electric light current, which, of course, must be reduced to proper proportions according to each specific use we desire to make of it.

A new and simple device has recently been brought out for the adaptation of the incandescent light current to the operation of electro-medical apparatus, electric motors, fans, dental and sewing machines, faradic induction coils, electric bells, small lamps, etc. It is

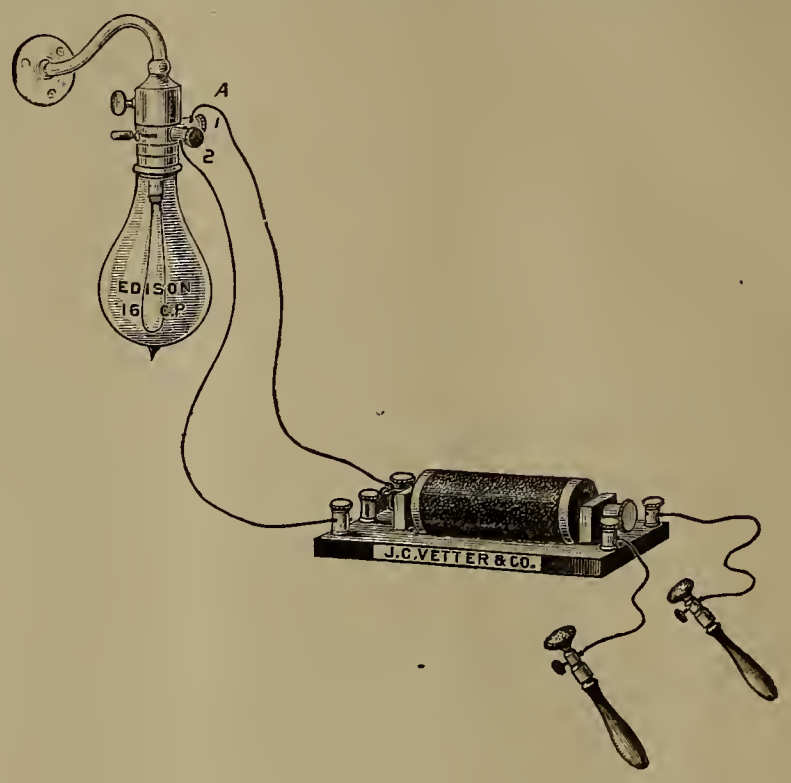


FIG. 2.

called the "current adapter," and is manufactured by J. C. Vetter & Co., the well-known dealers in medical apparatus, 104 East 23d street, New York city.

By the use of this Adapter, in connection with the Vetter system of electro-medical apparatus, physicians are enabled to employ the electric light current for galvanic and faradic treatment. Its function is to trans-

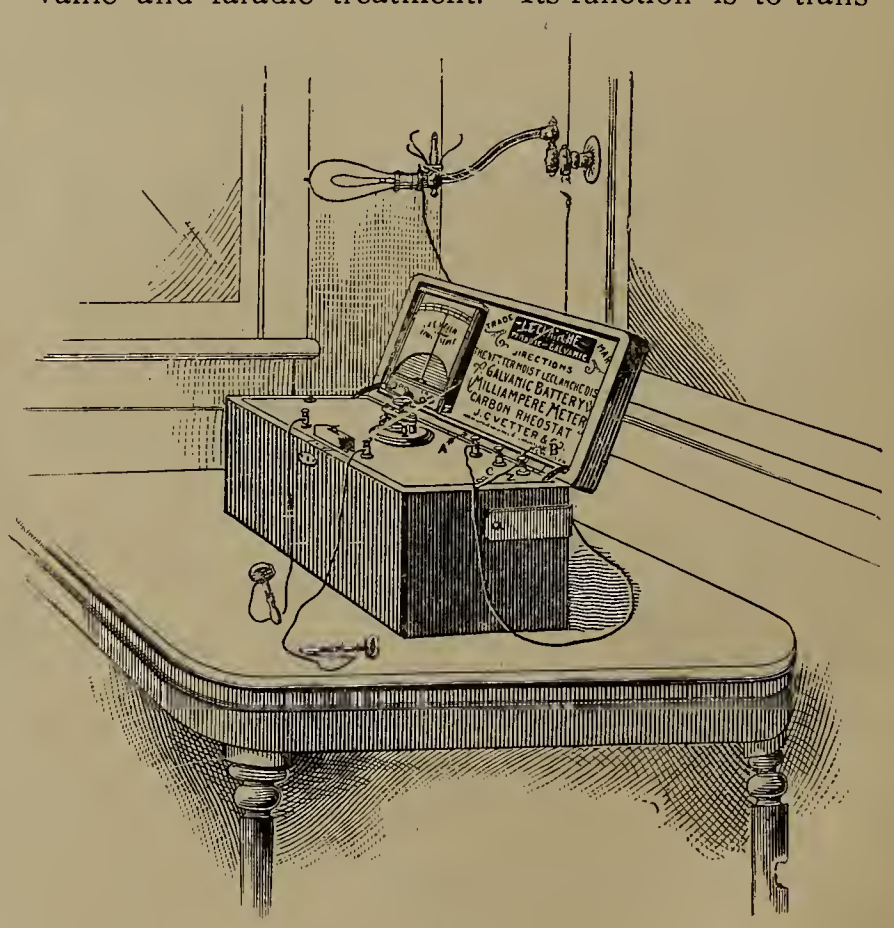


FIG. 4.

form the original, or primary current, into one of different dimensions for special work, and in appearance it resembles an ordinary incandescent lamp socket, as shown in Fig. 1.

A lever is provided on the socket to switch the current

on and off, and there are three binding posts, numbered 1, 2 and 3. Connection with posts 1 and 2 gives a current in series with the lamp, and with posts 2 and 3 the current is in parallel. The switch is for lighting the lamp only.

Fig. 2 shows the method of connecting a faradic coil to the Adapter. In this arrangement the coil is in

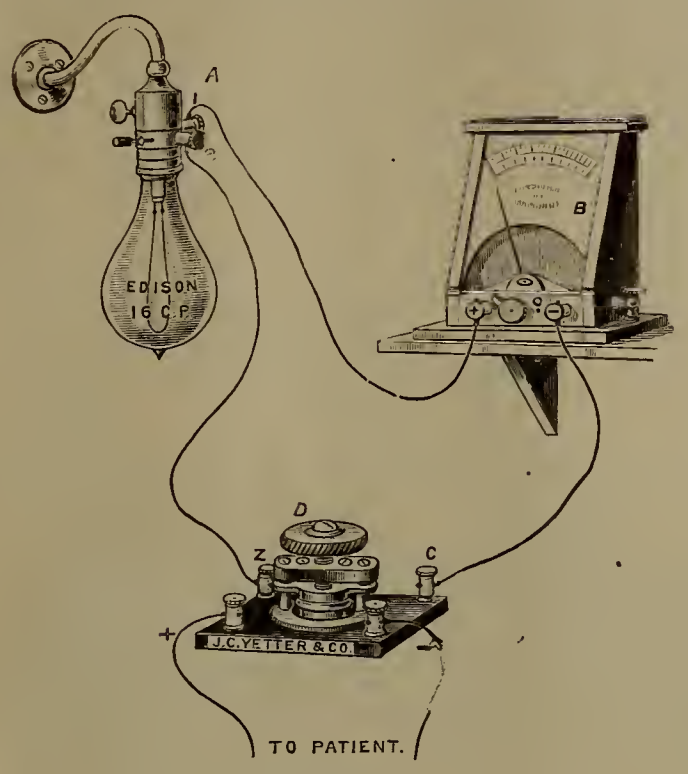


FIG. 5

series with the lamp, consequently the quantity of current is reduced.

The Adapter is also used in charging storage batteries, as shown in Fig. 3. For this purpose a 50-candle power lamp, requiring 1½ amperes, should be inserted into the Adapter; this gives a current best suited for charging the battery. For electro-medical use, however, an 8 or 16-candle power lamp should be used.

The application of the Adapter to the Vetter complete portable dry galvanic battery is shown in Fig. 4. When this outfit is used in connection with the Current Adapter the dry cells are cut out of circuit, their current being held in reserve for outside use. This form of apparatus is very convenient for office or hospital work, besides being portable.

In Fig. 5 is illustrated a complete arrangement of various instruments for adapting, controlling and measuring the current in galvanic treatment. This outfit consists of a Vetter incandescent current Adapter, standard direct-reading milli-ampere meter, carbon current controller and improved pole-changer.

The combination shown in Fig. 6 is a wall or table outfit, including a complete set of Vetter instruments of latest improved form. The case contains a milli-ampere meter, current controller, complete faradic apparatus, pole-changer, switches, post, etc. This outfit is adapted for either incandescent light or battery current.

By using binding posts 2 and 3, connection is made in parallel with the lamp, without interfering with the light. By means of this connection a ready means is furnished for drop lights or power purposes, and wherever an incandescent current is available the Adapter is applicable for many uses.

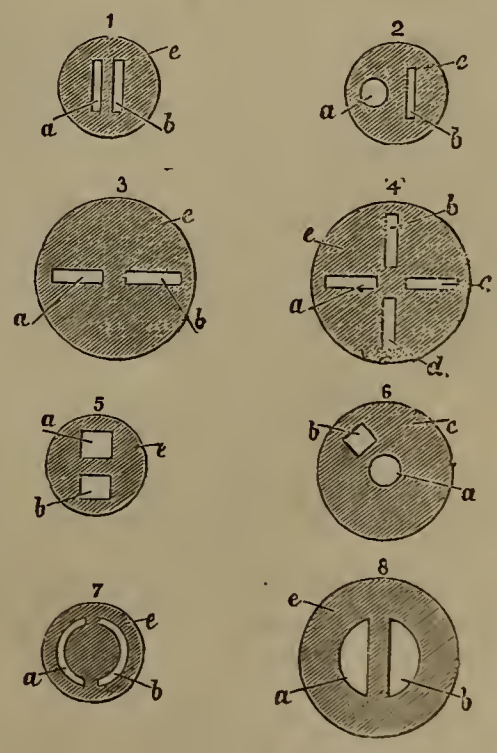
The firm has a large and complete exhibit at the World's Fair, which includes the Adapter, and other apparatus referred to above. It is located near one of the central stairways on the west gallery of Electricity building. It is very attractively arranged.

FIG. 6.

IMPROVEMENTS IN SUBMARINE TELEGRAPH CABLES.

In his recent inaugural address before the Institution of Electrical Engineers, London, Mr. W. H. Preece announced that he had devised a new method of submarine cable construction which would enable a quadrupling of speed in working across the Atlantic Ocean. The improvements relate to the form of and disposition of the conductors.

The method as described by the patent specification, which is published in the *Electrical Review* of London, is as follows :



FIGS. 1–8.

"In long submarine cables as at present constructed, the speed of working and therefore the rate of flow of successive currents of electricity, whether intermittent or alternate, is regulated by the electrostatic capacity and the resistance of the core. It follows a distinct and

definite law which is expressed by the formula, speed of waves $= a$ K R, K being the total inductive capacity, and R the total electric resistance of the core.

"I have found by experiment that the value of K can be very materially modified by the influence of mutual induction between two parts of the circuit when the circuit is metallic and the core compound; in fact, the geometrical relations between the insulator and conductors can be so modified that K may be practically eliminated.

"In submarine cables I propose, therefore, according to my present invention to avoid the use of the earth as a part of the circuit, and to make the circuit entirely metallic; I propose to construct the core of two conductors either cylindrical and parallel, or cylindrical and concentric, or rectangular and parallel, separated from each other and from the water by insulating media, and so arranged as regards geometrical form, that the effect of the mutual induction of the two conductors shall oppose and neutralize the effect of their inductive capacity. In this way I propose to materially expedite the rate of working by telegraph, to extend the distance to which speech by telephone through submarine cables is possible, and to eliminate from cable working many existing sources of trouble and difficulty owing to the use of earth.

"The drawings show, by way of example, sections of various forms and arrangements of submarine cable cores having two conductors forming a complete metallic circuit according to the invention.

"In Fig. 1, the two flat rectangular conductors, *a* and *b*, forming the metallic circuit are imbedded in one and the same insulating sheath, *e*, side by side and parallel to each other, at a suitable distance apart for insuring perfect insulation from each other; in Fig. 2, the one conductor, *a*, is cylindrical and the other, *b*, flat; in Fig. 3, two flat conductors, *a*, *b*, are placed edge to edge; in Fig. 4, there are two metallic circuits formed by four flat rectangular conductors, *a*, *b*, *c*, *d*, any two of which may together form a circuit.

"Fig. 5 shows two conductors, *a* and *b*, of a square section.

"Fig. 6 shows a conductor, *a*, of circular section and one, *b*, of a square section.

"Fig. 7 shows two conductors, *a*, *b*, of a semicircular or arc shaped section, placed opposite each other so as to form a circle, with part of the insulating core intervening between the meeting edges.

"Fig. 8 shows two conductors of segment shaped section.

"The current would be worked by any suitable known method in cables of the above described construction.

"The weight of the conductors would vary with the length of the cable. The serving of the cable and its armoring would be the same as for ordinary cables."

ELECTRIC HOIST.

An interesting example of an advantageous substitution of electrical power for that of steam is afforded in the installation of electrical motor hoists which have been in operation during the past two years and a half on the wharves of Sanderson & Sons, in Brooklyn, where the Wilson transatlantic steamers discharge.

ELECTRIC HOIST ON WHARF.

The installation, made by Messrs. Curtis & Dean, comprises nine 10 H.P. general electric hoists of the drum and winch head type in continual use, loading and unloading the vessels which are constantly arriving and departing. The driving motors are of the well known bi-polar type.

When the hoists were first installed, opinions were freely expressed that they could not possibly do the work as cleanly nor as rapidly as the donkey engine, and that they would soon get out of order, prove costly of repair and give way to the triumphant returning

steam hoist. The workmen especially viewed the innovation with disapproval.

The hoists have been in operation for two and a half years and the trend of opinion is now diametrically opposite. The owners would not be without them, and the men are so convinced of their many superior features that any proposal to return to steam hoists would arouse an active protest, if not cause actual strike. The hoists have so completely accomplished every duty they have been called upon to preform, that the installing company has yet to hear the first complaint against them. They are readily moved from place to place on the wharves or upon the vessels themselves, wherever

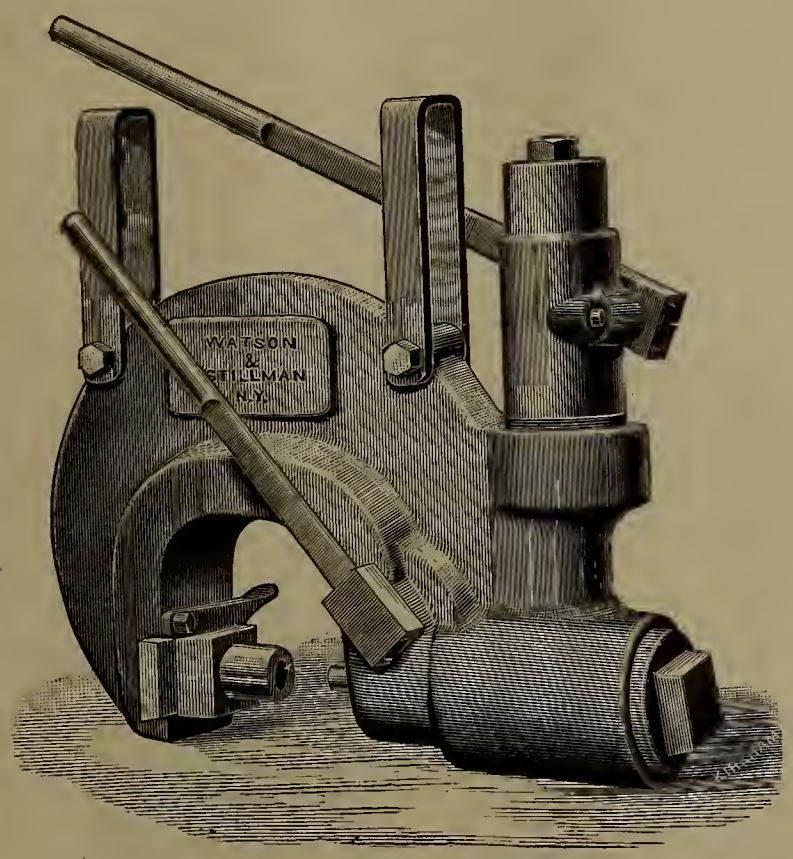


FIG. 1.—HYDRAULIC PUNCH.

they may be needed, require little or no attention and are made ready for service by the mere connection of the conductors to the service wires.

Perhaps the most important feature emphasizing the superiority of these electric hoists over their predecessor, the steam hoisting engine, is that of repairs. During the two and a half years in which these hoists have been under continual daily duty, the total cost of repairs has amounted to the phenomenal sum of $24.75, or $2.75 average for each hoist. It may be doubted whether any such fact as this has ever been recorded about a steam hoist.

This installation is by no means exceptional. Electric hoists are superseding the steam hoist, not only in marine and wharf work, but in factories, mines, engine shops and other places where economy, rapidity of work and perfect operation is requisite.

HYDRAULIC PUNCHES.

With the growth of street railway work, demands are constantly arising for special tools and devices to aid in the construction work of new roads Among the most useful of these machines is the hyraulic punch.

Fig. 1 illustrates a hydraulic punch used for punching the web of "Johnson" street girder rails. The head of a rail of this pattern being very wide and the punch low down a special form of punch was necessary. A recent improvement in this punch, whereby the ram can be brought down to the work without the loss of time and labor of pumping, has been augmented by placing the die in a sliding block which can be removed by simply raising a latch, thus getting a clear opening of five inches and at the same time keeping the length of the cylinder short enough to not be in the way of the work. The head is smaller and the whole tool lighter. This tool can also be used to punch "I" beams. The tool is steadied by bringing the punch against the work, with the quick acting lever, before beginning to operate the pumping lever. The upper socket must be brought down against the lug on the head, before the quick-acting lever can be used.

A hydraulic punch for use on the web of cable slot rails is shown in Fig. 2. The jaws of the punch are raised from below and have an opening large enough to let the base of the rail pass the die and the punch. The punch is also short enough to be dropped down between the slot and wheel rails and yet be convenient for operation. The punch has an opening of seven inches, a depth of jaw of five inches and weighs about 300 pounds. The body is of steel.

These punches, as well as many other styles of punches and shears are manufactured by the the "W. & S." Hydraulic Machinery Works, Watson & Stillman, proprietors, 204–210 East Forty-third street, New York city.

POLYPHASE CURRENTS.

An important instalation of a polyphase current lighting and power plant is now being made near the neighboring towns of Elgoibar and Eibar in Spain.

The work is being carried out by Messrs. Siemens and Halske, using the power of the River Deva, which, with about 30 ft. fall, gives 300 available horse-power. Hercules turbines are used at 200 revolutions, driving an 80-kilowatt "Drehstrom" dynamo. The current generated at 120 volts will be transformed up to 5,000 volts,

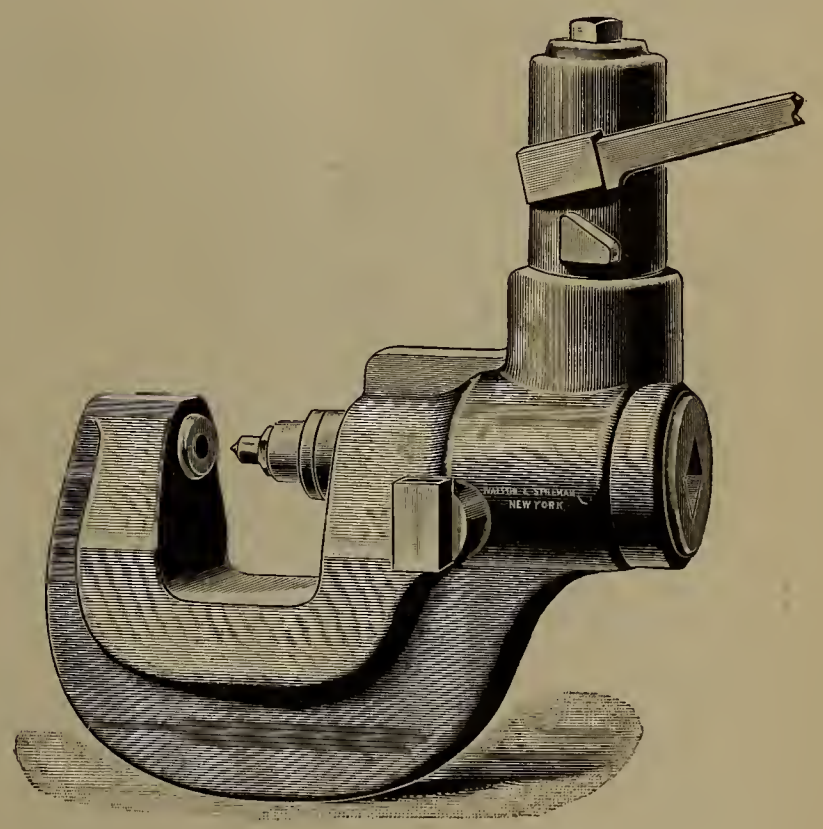


FIG. 2.—HYDRAULIC PUNCH.

and conducted by overhead wires on oil insulators to the two towns situated one and three miles distant respectively. About 60 incandescent lamps will be used in the street-lighting in Elgoibar, and several hundred private lights. In Eibar, an industrial town, 120 lamps will be required for street-lighting, and 400 lamps for private lighting are ordered. Electric motors of from 1 H.P. to 25 H.P. will be installed for transmission of power.

WESTON CIRCUIT TESTER AND GROUND DETECTOR AND HIGH RANGE AMMETER.

The high reputation which the instruments of the Weston Electrical Instrument Company, of Newark, N. J., have among electrical people, is sure to excite interest in anything new brought out by this company.

WESTON CIRCUIT TESTER.

One of the latest instruments that has passed through the laboratory in its experimental stage, and emerged as nearly perfect as human ingenuity can make it is the Circuit Tester and Ground Detector.

This instrument, as its name implies, is used for the double purpose of testing circuits and detecting grounds, and like all the other instruments made by the Weston Company, it stands pre-eminently at the head in every essential quality necessary in apparatus of this class.

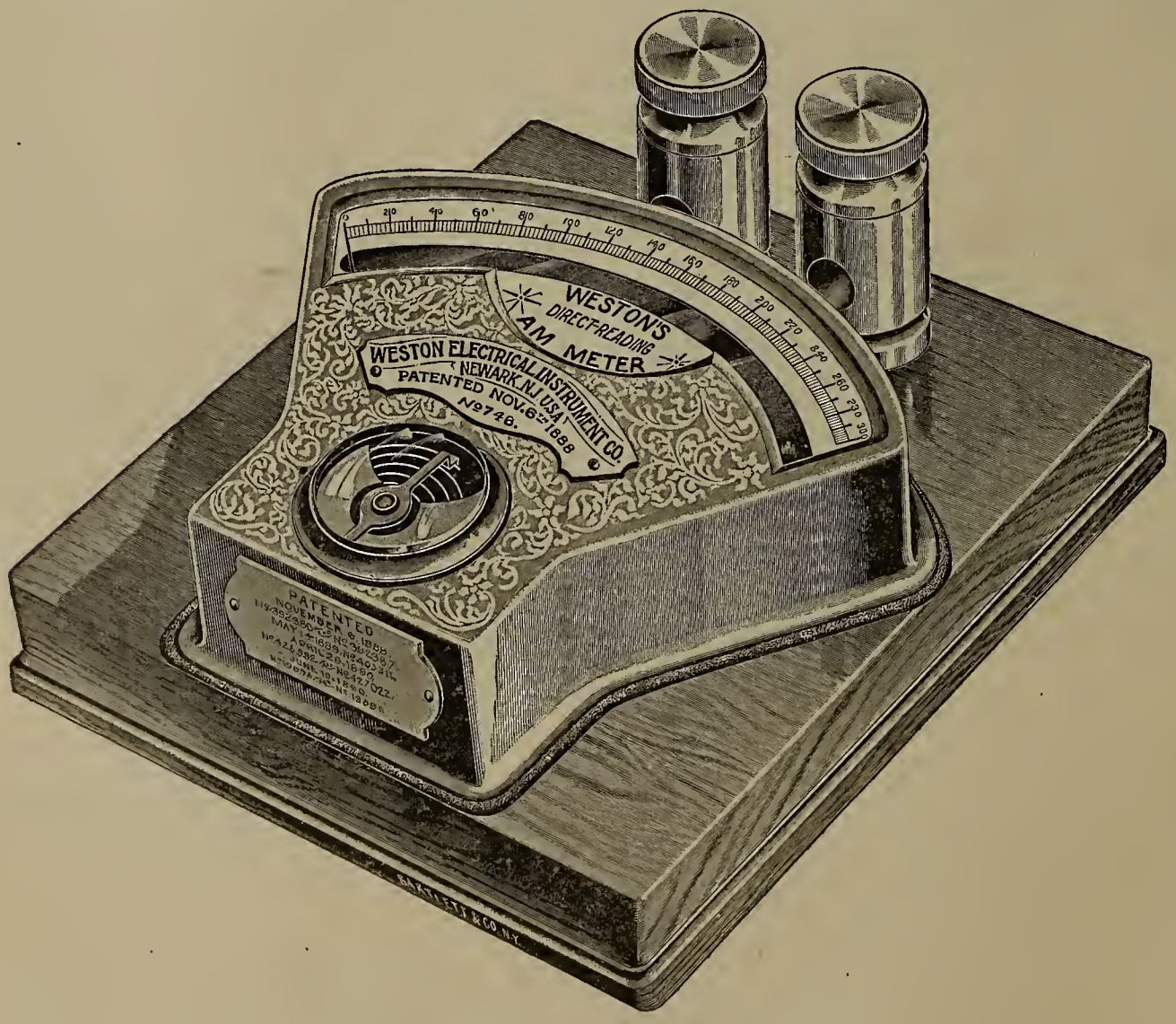
By the use of the Circuit Tester and Ground Detector the condition of the circuit from hour to hour and from day to day can be accurately determined, and in measuring the insulation of a circuit any serious change therein can at once be detected.

It must be borne in mind that no circuit can be absolutely insulated; there will always be some leakage, and the leakage will increase in direct proportion to the reduction of the insulation resistance of the circuit

The insulation resistance of an electric lighting plant, when first started, may be very high, even if the insulating material on the wires be of poor quality; because everything may be very clean and dry, and thus favor the poor insulation on the wire, but when dirt and moisture have collected around the wires, the insulation resistance will decrease and may reach a dangerous point before discovered, unless means are employed to test the insulation from time to time.

This instrument can, therefore, be trusted as a guide to determine whether the insulation is deteriorating, and to indicate when the circuits need attention. If properly used it will be found invaluable as a means of preventing fires from defective insulation, a not uncommon occurrence in electric lighting plants which are supposed to be properly erected and in good order.

An excellent illustration of the instrument is given herewith. The projection noticed on the top edge is the visible portion of the binding post to which the ground wire is connected. On the left hand lower corner is the negative post; on the right hand the positive, and in between them are two contact buttons, which are pressed down to close one side of the circuit or the other, when tests are being made.



WESTON HIGH RANGE DIRECT-READING AMMETER.

The instrument is so adjusted as to give the full scale deflection on either side of the zero with a "dead ground" and with 125 volts. That is to say, suppose one side of the lighting circuit to be directly connected with the water or gas pipe and to the dynamo to be run under such conditions as to give exactly 125 volts, then by pressing one or the other of the contact buttons the needle of the instrument will move to the right or left, from the zero mark on the scale of the uppermost line. If the ground be not a perfect one, or if the electromotive force be less than 125 volts, the deflection will be less than 125. The term "dead ground," therefore, means a perfect ground connection.

The "dead grounds" are not the only things to be

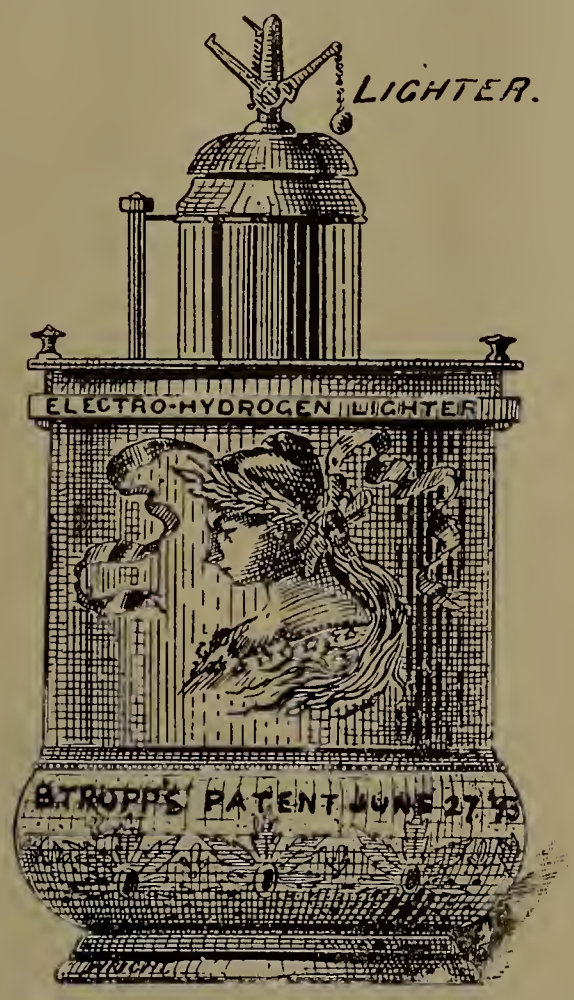


FIG. 1—ELECTRO-HYDROGEN LIGHTER.

feared and guarded against in lighting plants. In fact a "dead ground" on one side of a circuit may, of itself, be perfectly harmless, if the insulation on the other side of the circuit is good; leaks or low insulation resistances are much more to be feared It must not be understood from this however, that a "dead ground" on one side of a circuit should be neglected. They are only harmless as long as the other side of the circuit is in good condition; but if anything happens to reduce the insulation of the side which is not grounded, then trouble may ensue.

This instrument will measure from a "dead ground" to five million ohms, or as it is commonly called, "five megohms." The insulation resistance of a circuit of a well erected isolated incandescent light plant of moderate size, seldom exceeds 500 000 ohms, or half a megohm, and a plant may be considered very satisfactory if the insulation resistance measures 250,000 ohms. Plants are sometimes found in which the insulation resistance is much lower than these figures.

Such low resistance is very dangerous, if found in buildings which are not fireproof, or, if fireproof, contain much woodwork in the form of partitions, fixtures, etc.. or contain much combustible material.

The Circuit Tester and Ground Detector is constructed with the same attention to details, accuracy and finish which are the chief characteristics of all the Standard Weston instruments, and, like them, it is portable.

Another instrument recently put upon the market by the Weston Company is the High Range Ammeter, for direct current, an illustration of which is also given herewith. This instrument is constructed on the same principle as those of lower range, the only visible difference being in the position of the binding posts, which are placed at the front of the instrument instead of at the back.

The 300 ampere ammeter is direct-reading as are all the other instruments of this company, and all the readings begin at zero. The readings extend by practically uniform increments to the maximum, and this uniformity of the scale divisions permits of their visual subdivision with uniform accuracy.

As the instrument is very "dead beat," readings can be taken in a very short space of time, the pointer coming to rest at once. The "magnetic lag" factor is entirely eliminated in this instrument, and the deflections with a given current are always the same. This condition is attained by the entire absence of iron in the moving parts, which is one of the most important features of all Weston instruments.

PORTABLE ELECTRO-HYDROGEN LIGHTER.

A very ingenious piece of apparatus is the electro-hydrogen lighter, described and illustrated below. The operation of the device will be readily understood by reference to the accompanying illustrations in connection with the general description given herewith.

The object of this electric lighter is to provide a small temporary light for cigar lighting and for other igniting purposes, domestic use, etc., and the device is

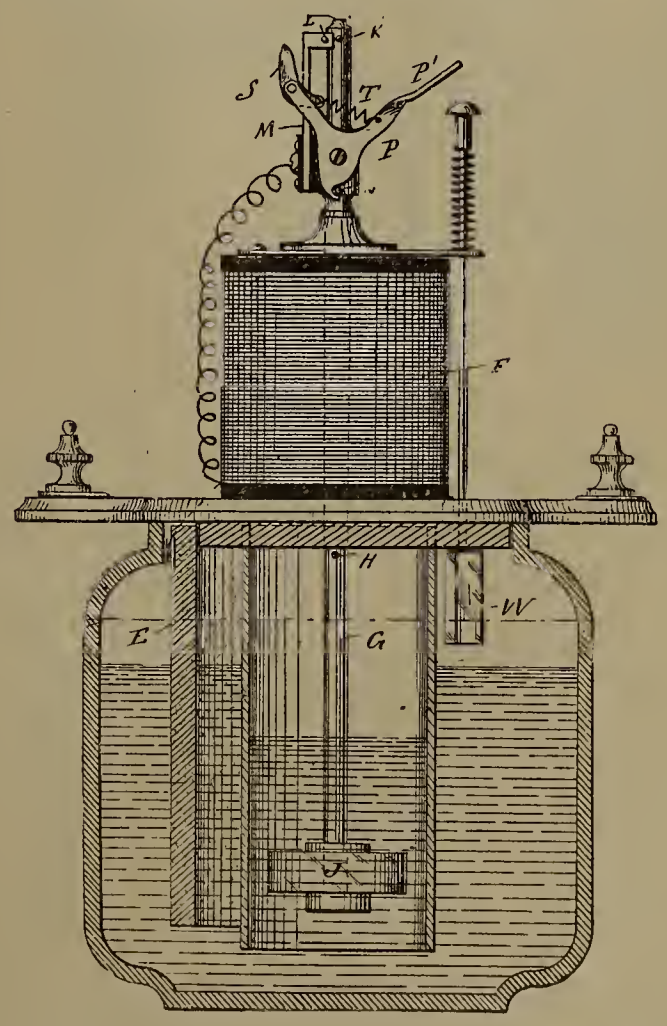


FIG. 2—ELECTRO-HYDROGEN LIGHTER,

made in a compact and very neat form, convenient for easy handling.

Fig. 1 gives a general external view of the lighter, from which it will be seen that the apparatus is ornamental in design, as well as useful. It is a radical de-

parture from other electric gas lighters in its construction. The outside jar is really a battery cell, which contains dilute sulphuric acid (one part of sulphuric acid to six parts of water and two ounces of bichromate of potash) as shown in the cross-sectional view in Fig. 2. The carbon electrode of the battery is shown at *E*, Fig. 2, and the zinc at *J*. The zinc is attached at the end of the gas tube *G*, the whole being placed within a gas tight vessel with its opening at the lower end and placed in the liquid after the manner of a porous cup. The tube *G*, terminates at its upper end, in a gas tip, and at *H* is a small hole which allows the accumulated gas within the inverted cup to escape into the upper part of the tube.

In operation, the hydrogen gas given off at the zinc *J* is collected within the inner inverted cell, and as it accumulates in the upper part, and the pressure increases, the liquid is forced out of the inner cell until it reaches a level below that of the zinc, then the generation of gas ceases until some of that accumulated has been allowed to escape, when the same operation is repeated.

On the outside of the jar, on top, but suitably enclosed, is a spark coil, *F*, (Fig. 2,) one terminal of which is connected to the carbon electrode in the battery; the other terminal is connected with the contact pin *L*, which is insulated from the gas tube, to which it is attached at *M*. The lever *P*, being in metallic contact with the gas tube causes an electric spark to be generated when it is pressed down by the finger plate *P*, and contact is made with the contact pin *L*, and by the same movement the gas cock is opened, allowing the gas to issue from the small hole *K*, at the top of the tube.

The electric spark occurring in the path of the escaping gas, the latter is ignited in consequence, burning with the hot blue flame characteristic of hydrogen gas.

In Fig. 2, *W* is a supplementary zinc which is depressed into the liquid in the cell when the lever *P* is pressed down. The object of this supplementary zinc was to establish an electric circuit, but it has since been found dispensable and it is not put on the latest form of apparatus. It is unnecessary, because, when the gas cock is turned on once or twice, sufficient gas escapes to allow the liquid to rise in the inner cell to a sufficient height, to more or less immerse the zinc *J*, thus completing the circuit.

It is said that the inner cell will hold sufficient gas to burn about ten or fifteen minutes, and the cost of the maintenance of the lighter is not over ten cents a month.

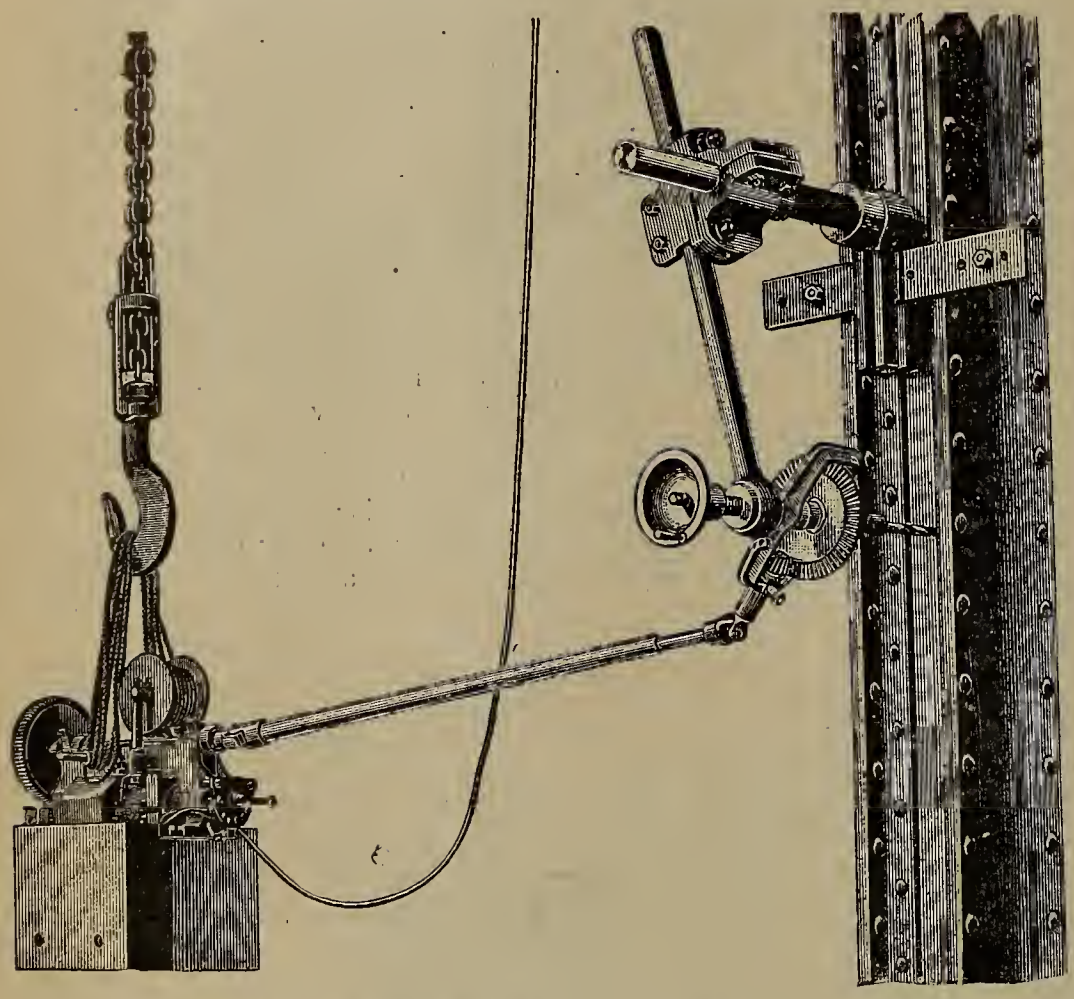
This handy device is very useful and ornamental in the household, smoking room, cigar stores, offices, steamers, yachts, smoking cars, and in all places where a temporary light is required.

The outside cell is made in Flemish stoneware in blue and granite, and it has a cover of hard rubber, the exposed metal parts being nickel plated.

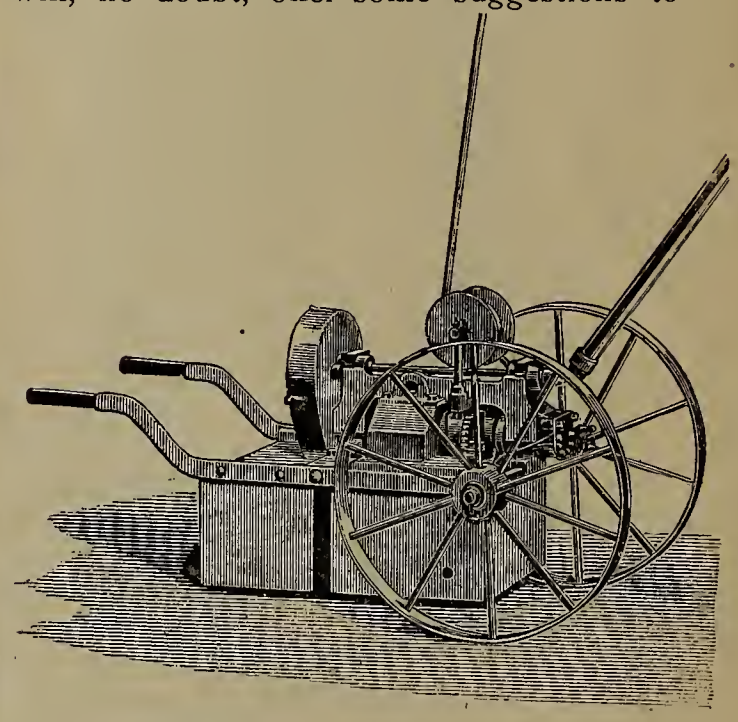
This invention has recently been patented by Mr. B. Tropp, 101 East 90th St., New York city.

PORTABLE ELECTRIC DRILL.

The following description and illustrations of a portable electric drill made by the firm of Ganz & Co., of Budapest, Hungary, taken from the *Electrical Review*, of London, will be of general interest to our readers, and will, no doubt, offer some suggestions to American engineers.



PORTABLE ELECTRIC DRILL AT WORK.



PORTABLE ELECTRIC DRILL MOTOR ON TRUCK.

The essential parts of this device are:

1. The travelling electromotor with the transfer fittings, supply of current and tool chest. 2. The boring apparatus.

The travelling motor consists of a light frame with two wheels carrying the electromotor itself and the accessory starting rheostat, the arrangement for transfer and a cylinder to receive the conductive cable. From the shaft of the motor a second shaft, fixed above the motor is driven by means of a pair of wheels capable of being exchanged, from which the motion is transferred to the boring apparatus. All the parts are combined in a simple manner to form a whole, which is secured to the frame-work of the wheels by means of four screws.

In order that the boring machine may be applicable even in cases where the size of the article to be acted upon does not permit of the motor being driven sufficiently near, it is arranged so that the entire apparatus, after the four screws have been slightly eased (not taken out) may be lifted from its support and suspended in any desired position.

The arrangement for transfer is formed by a tubular shaft capable of being drawn out to the length of two

metres, which, on the one hand receives the motion of the driving shaft by means of Hooke keys applied at its ends, and on the other hand transfers it to the boring apparatus.

The supply of current is effected by a flexible cable, well insulated, coiled up on a drum placed above the motor. The convenient supply of the necessary motive power, together with its universal applicability and ready portability constitute the chief advantage of this boring machine. The working current is simply taken from a light installation which is, in general, already at hand. For this purpose the supply cable is provided with terminals by means of which a connection with the lead can be at once effected anywhere.

The boring apparatus consists of a strongly constructed arrangement for connection, a universal joint and a boring apparatus in the stricter sense of the word. It can be easily and safely fixed anywhere, and the boring spindle can receive any desired direction independent of the position of the motor.

The rapidity of the boring spindle can be adapted to any purpose. To this end the toothed wheels on the motor and the intermediate shaft are made interchangeable. As a rule two different pairs of wheels are supplied along with every boring machine.

The normal type of the travelling motors is built for a working tension of about 100 volts. The motor shaft makes about 1,000 revolutions per minute corresponding to 67 or 145 revolutions per minute, according as the toothed wheels for slow or quick movement have been fixed to the motor. The maximum power required is rather less than 1 H. P., and it is sufficient to bore with ease holes of 35 millimetres in diameter.

It may be added that in the wheel work, bronze runs upon cast-iron, and that the principal journals are fitted with a long-tried annular lubrication in which a single supply lasts for several weeks' permanent work. The weight of the complete apparatus is 245 kilos , that of the boring apparatus 110 kilos.

SELF-SETTING ANNUNCIATOR.

Mr. A. A. Vanderpool, 372 South Nineteenth street, Newark, N. J., fits up buildings of all kinds with electrical appliances in the line of bells, burglar alarms, fans, motors, gas lighting, electric lighting, door openers, speaking tubes, letter boxes, etc.

A special device of Mr. Vanderpool's is his patent self-

VANDERPOOL'S SELF-SETTING ANNUNCIATOR.

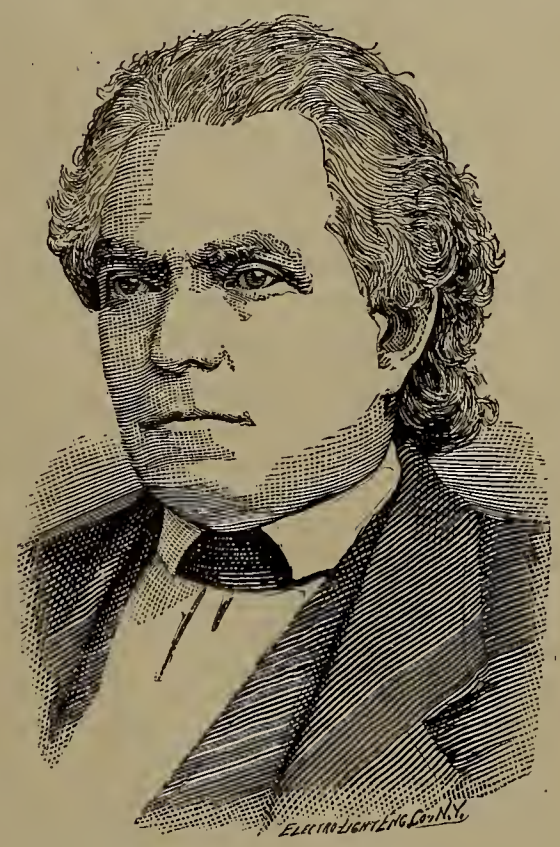
adjusting annunciator. It is finished in an ornamental manner and is very compact.

The device being self-adjusting, no drops have to be replaced by an attendant, and there is no spring or clock-work to be wound up and to get out of order. The indicators are placed around the edge of the annunciator. The numbers in their normal condition show black, but when the button corresponding to a number is pushed, the number becomes illuminated and a bell placed in the middle of the frame is set in action. The number remains illuminated after the bell stops ringing and until another button from another part of the premises is pushed, when the number corresponding to the last button pushed is illuminated and the former number becomes darkened. The mechanism is simple and does not get out of order easily. The accompanying illustration shows this new annunciator, the patent for which is for sale. The Mason Electric Company, 10 and 12 Vandewater street, New York city, has one of these annunciators on exhibition.

OBITUARY.

JOHN STEPHENSON

John Stephenson, the well-known street car builder, died July 31, at his home on the Boston post road, New Rochelle, N. Y. Mr. Stephenson's illness was due to a



THE LATE JOHN STEPHENSON.

general breaking down of the system. Three years ago he was taken dangerously ill with a complication of pneumonia and grip. Although he survived the attack, he had been weak ever since. He attended to his duties as President of the John Stephenson Company, to within a few days of his death.

The life of Mr. Stephenson teaches a lesson that every ambitious youth should strive to emulate. To Mr. Stephenson belongs the honor of having built the first street car ever run. This car, called the John Mason, after the president of the New York and Harlem Railroad Company, for which it was constructed, was put in operation on November 26, 1832, carrying the mayor and common council in honor of the event

Mr. Stephenson was born July 4, 1809, in the North of Ireland, of English and Scotch parentage. Two years later the family came to this country. He received his education at the Wesleyan Seminary, in New York city, and his father intended that he should engage in mercantile pursuits. For about three years he was engaged in this direction, when his inclination for mechanics became so strongly developed, that his father was induced to apprentice him to a coachmaker when he was 19 years of age.

After young Stephenson had completed his apprenticeship, at the suggestion of Abram Brower, a livery stable

keeper, who ran a line of stages and promised to give him all of his building and repairing, he opened a shop on his own account at 667 Broadway, on May 1, 1831.

Here Mr. Stephenson designed and built the vehicle known as the omnibus. Business prospered until March 29, 1832, when fire destroyed his shop and all of the stock, on which there was no insurance. Nothing daunted, he commenced business again at 264 Elizabeth street.

It was here that Mr. Stephenson branched out into the street car business and built the car mentioned above, as also others for use in Brooklyn, Paterson, N. J., Jamaica, L. I., Matanzas, Cuba, and Tallahassee, Fla. Mr. Stephenson's shops soon became too small for his rapidly increasing business, and in 1836 he built a new factory at Fourth avenue and 129th street, Harlem.

Mr. Stephenson was doing an enormous business when the panic of 1837 struck the country, and the railroads being the first to suffer, he was carried under, his factory and estate bringing but 50 cents on the dollar. He bore his misfortunes bravely, and in 1843, started business again at 47 East 27th street. From time to time he paid his creditors back the balance due them. One of them, however, Jordan L. Mott, absolutely refused to accept his debt, telling Mr. Stephenson that the failure had been an honest one and that the debt had been legally and fairly wiped out by the bankruptcy law. Some time afterwards Mr. Mott ordered a truck from Mr. Stephenson, who, when the truck was delivered, sent a receipted bill endorsed "Received payment by bankruptcy debt, John Stephenson."

For some time after his failure Mr. Stephenson dropped the manufacture of railroad cars and devoted himself entirely to the building of omnibuses. for which there was a great and growing demand. He built all of the old Broadway stages.

In 1852 the street-car business began to increase and all the orders for cars were naturally given to Mr. Stephenson. From that time on orders kept pouring in from all over the world, and today there is not a civilized nation where the name of John Stephenson is not known.

Mr. Stephenson won this position in the world by his sterling integrity and strict attention to business.

Mr. Stephenson belonged to the Methodist Episcopal Church, as did his parents. As a child he attended the first Sunday school in this city, which was established in 1816 in public school 1, at Chatham street and Tryon row. His fondness for music was very marked. He was a performing member of the New York Sacred Music Society, which, fifty years ago, met in Chatham Theatre, then a chapel. He was also a member of the Harmonic Society, and for forty years was a choir leader. Thirty years of this time he was a member of the volunteer choir of forty voices selected from Sunday schools and classes. Mr. Stephenson would never consent to become a candidate for political office, except that of School Trustee in the Twenty-first ward. This post he filled for twenty years.

Mr. Stephenson leaves a daughter, Mrs. D. W. Pugh, and two sons, J. B and S. A. Stephenson. His wife died about twelve years ago.

Death.—M. Marie Davy the electrician and astronomer died at Clamecy, Nièvre, France, July 16, 1893, at the age of 77. Mr. Davy was best known to electricians through the battery which bears his name. The battery was never used in pratice in this country, but in France it was at one time quite extensively used until the appearance of the Leclanche battery. It was brought out in 1859.

IS THE ELECTRIC LIGHT FRIEND OR FOE TO THE INTERESTS OF GAS LIGHTING? *

Without doubt electricity has done much to promote the interest of gas lighting. The glaring brilliancy of the arc light has created demand for better light, and more of it in the home and place of business, making gas of a high candle power imperative, also general enlargement of the plant, notwithstanding the arc light has superseded gas for street lighting—formerly a large factor in the yearly output.

With this exception, will we admit the superiority of electricity over the vitalized gas of the present day—vitalized, for it is different in kind, purity and intensity in contrast with that produced a few years ago.

Modern appliances, devices and methods of manufacture have developed a nearly perfect illuminant. Before the advent of the electric light, 14 to 16 candle power of sombre orange color was the correct basis of illumination. Now a beautiful white light is made of 18 to 30 candle power. Then 3½ cubic feet per pound of coal was considered a choice result. Now, by improved methods of carbonizing, the yield is 30 to 40 per cent. greater.

Leakage or unaccounted for gas, formerly 15 to 25 per cent., has been much reduced—36 out of 72 companies in Massachussetts reported last year less than 10 per cent.; one company, making 8,500,000 cubic feet, only 2.71 per cent.; another, with an output of 89,000,000, 3.63 per cent.

To what degree we are indebted to the modern light for these improvements it is impossible to estimate. The question is, "Are we keeping up with the procession and meeting competition with the best weapons at our command?" Our competitors are oil and the incandescent electric lamp of 16 candle power, never more, and *less* when the machinery is overloaded, and sometimes no light at all, to the discomfort of the consumer.

The utility and the reliability of gas for all purposes is its stronghold, and seldom will a storekeeper using electricity consent to the removal of the meter for protection when the electric lights fail.

In one case where the electric system was introduced through the business part of the town, the electric consumers' meters recorded 75 per cent. as much gas, and there was an increase in the annual sales of 10 per cent. with substantial gains each succeeding year, caused largely by the effects of the blinding arc lights in public streets.

Complaint is sometimes made that gas bills are more than they used to be, which is true with many. The 2,000 candle power electric lamp is an educator to light, and the consumer alone can control the evolution of the gas meter. For example, a hotel displaced 40 gas jets in the dining hall, substituting arc lights, and the next month's bill for gas was larger than before. There was no unusual number of guests. The intense brilliancy of the concentrated arc lamps in the brief hour or more devoted to dinner had so disturbed the optics that twice the number of gas jets were lighted in the parlors and sleeping apartments, and the proprietor, seeing the point, sensible man that he was, discarded electricity and returned to gas.

As an educator, electricity surely is a friend to gas lighting. In this city we see electricity vieing with gas in a large number of business stores, a strange and unusual exhibition of profligacy of lighting, and unprejudiced judges must admit that gas outshines them all in intensity and diffusion of light. Having advantages over other means of illumination and domestic use the secret of

* Abstract of paper read by J. L. Hallett, of Portland, Ore., at the meeting of the Pacific Coast Gas Association.

prosperity lies in producing the best article possible and of uniform quality. Have any fear of losing ground? Would it not be well to note if they are giving the public as good an article and service as their competitor. This may require additional machinery and changes in operating, also looking to the needs of the consumer, service pipes, burners and fixtures, but it would pay, rather than follow antiquated ways, losing custom, and those lost might be regained.

ELECTRIC RAILROAD IN BANGKOK, SIAM.

The recent troubles between France and Siam, have done much towards bringing out a good deal of information of an interesting character regarding the latter country and the daily papers have given a good deal of their space to the description of the country, its capital (Bangkok) and its people. Those in this country engaged in electrical pursuits naturally ask themselves, in this connection, what progress Siam is making electrically. It is like most other oriental countries, in the matter of adopting progressive ideas—very slow. We are not advised that electric lighting is carried on to any extent, but there is an electric railroad in Bangkok. The plant was put in by the Short Electric Railway Company, of Cleveland, Ohio, the latter part of 1892, and the line is a little more than three miles in length.

The plant consists of two 80-H P. single cylinder automatic cut-off engines, built by the McIntosh & Seymour Engine Company, having a 12½" cylinder and 12" stroke, working at 284 revolutions per minute. The engines are driven by steam conveyed from two horizontal tubular boilers, 16 feet long by 60" in diameter, having a working pressure of 80 lbs. and supplied water feed by a Worthington pump, through a Jones feed-water heater. The furnaces are large and specially adapted for wood fuel. There are two generating dynamos giving 100 amperes at 500 volts, capable of being worked singly or in parallel. The electric current is controlled at a switchboard by instruments of the latest and most approved design.

The overhead wire consists of No. 2 hard drawn copper, and is suspended by steel brackets and insulated hangers from poles at the side of the road. The entire length of 17,200 feet is in three pieces only, jointed by two sleeve joints. The return current is conveyed through the rails, which have in this instance, owing to defective conductivity, been carefully connected by galvanized iron wire bonds passing through holes drilled in the extremities of each rail and riveted. These bonds have in turn been soldered on to a supplementary wire running the whole length of the track and are connected with the switchboard at the central station.

The cars, very solidly built of teak, are mounted on an all-iron truck especially adapted for tramway service and carrying a 20 H P. motor. They are also fitted with five incandescent lamps of 16 candle-power each.

The Bangkok *Times*, of February 25, 1893, gave an account of the opening of this road. The event was an important one in that country, and the success of the road was established at the beginning of practical operations.

Phonograph Works Closed.—On July 31 three hundred employes of the Edison Phonograph Works at Orange, N. J., were notified that the works would be closed temporarily from that date. It is stated that the closing is for the purpose of taking stock.

To Sue Infringers.—Prof. N. S. Keith, the well-known electrical engineer of San Francisco, is coming East and it is reported he intends to proceed against infringers of his electrical patents.

BUCKEYE AND PACKARD LAMP FACTORIES CLOSED.

Following up recent decisions of the United States Circuit Court in the matter of the Edison incandescent lamp patent, the General Electric Company on the 28th of July secured restraining orders, under a decision of Judge Ricks of the United States Circuit Court for the Northern District of Ohio, against the Buckeye Electric Company of Cleveland, Ohio, and the Packard Lamp Company of Warren Ohio, both manufacturers of incandescent lamps, infringing the Edison patent.

This is a further and very important victory for the Edison lamp patent. The orders of the court, it is stated, closed the factories of the two companies in question and the immediate effect will, it is claimed, be a large increase in the lamp orders of the General Electric Company, as nearly all the factories in which infringing lamps have been made have now been closed by the courts.

The decision of Judge Ricks is not only of importance to the General Electric Company, but is also to the numerous illuminating companies scattered throughout the States, operating under the Edison license.

THE ELECTRICAL CONGRESS.

Rapid progress is being made in the preparation for the International Electrical Congress, to be held in Chicago on August 21, Prof. Elisha Gray, the president of the advisory council, has appointed Mr. C. O. Baker, Jr., chairman of a transportation committee. Mr. Baker's headquarters will be at the office of the National Electric Light Association, 136 Liberty street, New York city, and a circular of information will be sent out by that gentleman. It is proposed to run a congress special train for the benefit of Eastern members of the Congress. Nearly 950 individual invitations have been issued by the Congress committee on invitations; about 600 of these were to American and Canadian electricians. Invitations have also been issued to 12 foreign electrical and scientific societies, having a membership of about 3,000. The foreign element at the Congress will be of large size and will be made up of some of the most distinguished electricians and scientists of the old world. The Congress, from present indications will be a most brilliant and successful affair. It is believed that at least 500 persons will be in attendance at the Congress. The programme of the papers and topics will be issued previous to the meeting.

EFFECT OF LIGHTNING ON THE BODY.

A despatch from an eastern city, printed in the daily papers a few days ago, reported the death, by lightning, of a boy. The despatch further stated that an accurate picture of trees and foliage in the vicinity of the accident was made on the boy's body, which phenomena was supposed to have been produced by the lightning, in a manner similar to that of making pictures by the photographic process.

This, however, is not correct. While such marks are observable sometimes on the bodies of persons killed by lightning they bear no relation whatever to the foliage or trees surrounding the unfortunates, although they do resemble such objects to some extent. The appearance of these marks naturally gives rise, though erroneously, to the notion that the lightning actually photographed the image of trees, etc., on the body.

The real cause is quite different, as can be proved by experiment in the laboratory. When electricity of very high tension, as lightning is, is discharged on the surface of a body having very poor conducting power, a luminous arborescent image is formed, showing the

path of one or more of the sparks resulting from the discharge. It is thought that the irregular course taken by the spark may be due to the compression of air in the path of the discharge, or to superior conductivity of some parts of the surface of the body.

This action takes place in such an infinitesimal portion of time that it would seem beyond the possibility of science to determine exactly what does occur, and how and why. All we are positively cognizant of is the result.

Some very interesting experiments of this nature were described by Mr. George M. Hopkins, in the *Scientific American* of May 28, 1887, and he there gives an illustration of the effects above described in the case of a boy who was killed by lightning.

MUNICIPAL ELECTRIC LIGHT PLANT.

The following abstract from the annual report of the Board of City Trustees of Alameda, Cal, on the city lighting plant, for the fiscal year ended June 30, 1893, will prove of interest to our readers.

The station apparatus consists of two boilers, two engines, heaters, pumps and four dynamos. In the system of distribution there are 19½ miles of wire, 435 poles, 9 iron towers 125 feet high, 3 towers 100 feet high; 37 lamps on towers, while 54 lamps are suspended at street intersections from 40 foot poles and on most arms 45 feet high. The pole line is nearly 16 miles long; an average of 89 lamps were burning 1,490 hours. The total expense for maintaining, operating and extensions was $10,941, itemized as follows: Fuel, $3,286.50; carbons, $179.10; globes, $77.25; oil and waste, $99.45; hardware, $59.15; wire and cable, $99.45; keeping up horse, $96; new equipment and sundry repairs, $2,205.50; salaries of employees and extra labor, $4,837.65; total, $10,941. Deducting from this credit by rental of light, $31.50, makes net cost $10,909.50. Average price paid for coal, $7.35 per gross ton. Cost of lamps per hour, .0822 cents. There are now 90 lamps in service, which will be increased to 93 when your present order is filled. Table showing comparative cost for 5 years:

Year.	No. Lamps	Hours Run.	Expenses.	Cost per Hour.
1889	82	1,247	$12,635.10	$.1086
1890	85	1,281	11,401.84	.1019
1891	91	1,292	14,597.91	.1241
1892	89	1,420	12,018.21	.0955
1893	89	1,490	10,909.50	.0822

FOREIGN NOTES OF INTEREST.

Telegraphy on Telephone Lines.—Experiments have been made recently on the Paris-London telephone line to determine, if the line can serve for both telephonic and telegraphic purposes. Several methods were tried, some with good results.

Books Burned.—Workmen employed in installing electric light wires in the dome of the Manchester Reference Library, Manchester, England, by the careless use of their candles, started a fire, which caused damage to 10,000 of the volumes kept in this library.

Electric Traction at Paris.—It is proposed to establish more electrical tramways at Paris, France, worked by accumulators. The first will be composed of three cars, and will run from the Place Saint-Augustin to Vincennes; the second will start from Neuilly, and proceed to Saint-Ouen. A special charging station, with Farcot steam engines and Desrozier's dynamos will be established at the tramway depot.

White Lead by Electrolysis.—In a German paper there is given an account of an installation for the manufacture of white lead by electrolysis. Lead anodes, 3 mm. in thickness, are employed in electrolyzing the solution, the latter containing 300 cc. of nitric acid in 2,000 cc. of water; the lead salt formed when the current passes is precipitated as true white lead by means of a stream of carbonic acid gas, which is passed through the solution. In this process, any silver which the lead may contain is deposited on the cathodes, and can be recovered in a tolerable state of purity.

PRACTICAL ASPECTS OF LOW FREQUENCY ELECTRICAL RESONANCE.

BY M. I. PUPIN, PH. D., COLUMBIA COLLEGE.

(*Continued from page 66.*)

6. *On the Resonant Rise of Potential.*

The question arises now, how are we to tell experimentally whether a circuit is in resonance to an impressed E. M. F. or not? Several methods suggested themselves to my mind in the course of my work. I selected the one which appeared to me to be the most sensitive and most interesting. It also suggests a new way of transforming electrical energy which some day may perhaps be of some practical importance. I wish to discuss this method now, but only very briefly.

As I observed before in the discussion of the motion of the torsional pendulum, represented in Fig. 5, when the moving force and the pendulum are in resonance then both the amplitude of oscillation and the amplitude of the velocity reach their maximum value. And so it is also with a circuit possessing self-induction and capacity. By varying gradually the one or the other, the current (which corresponds to the velocity of the pendulum) will continually increase. But the difference of potential in the condenser (which corresponds to the elastic reaction of the suspension wire) will also increase continually. When the point of resonance has been reached then evidently both the current and the difference of potential in the condenser have reached their maximum values. This maximum difference of potential in the condenser can be many times greater than the impressed E. M. F., because just as in the case of the torsional pendulum the elastic reaction of the suspension wire is an accumulative effect of the moving force, so in the electrical circuit, the potential difference in the condenser is an accumulative effect of the impressed E. M. F.

To show you how strong this resonant rise of potential can be I have within the last few days wound these two inertia coils (see coil *a' b'* in Fig. 8) and borrow this most excellent mica condenser from our well-known electrican, Mr. Wm. Marshall, for which kindness I feel very grateful to him. The impressed E. M. F. is obtained in the following way: A small 16-pole alternator running at about 2800 revolutions per minute and generating an E. M. F. of about 600 volts feeds the primary of this small transformer (*c d*, Fig. 8.) Diagram Fig. 7 gives the form of armature A and field B of the machine. Coils a b c d e show how the machine is wound. The transformer consists of a hard rubber spool wound with about 3,000 turns (Fig. 8) of No. 20 A. W. G. wire for the primary. The secondary h k consists of about 500 turns of No. 16 wire. A well packed bundle e of very fine iron wire is the iron core. This transformer is indicated by c in Fig. 7. In series with the secondary we have inertia coils d and the above mentioned mica condenser e of 0.2 m. f. capacity. The inertia coils consist of hard rubber spools like a' b'

Fig. 8, wound with No. 14 wire. The total self-induction of the secondary circuit is about 1 henry, without iron in the inertia coils. The poles of the condenser E are connected to a Sir William Thomson electrostatic voltmeter F and also to a vacuum tube G with condenser electrodes, that is to say tinfoil coatings on the outside of the tube. (Indicated by the shaded part in the diagram.) I now start the machine and by weakening the field of the driving motor, I gradually increase the speed of the machine. As you see the voltmeter needle is steadily advancing with the speed. To get the greatest deflection of the needle I ought to have about 350 periods per second. Now I shall advance to very near this speed. The voltmeter indicates now 2,000 volts. The impressed E. M. F. in this secondary resonating circuit is only about 100 volts. Instead of increasing the speed so as to reach the point of perfect resonance I prefer to leave the speed constant, and by gradually inserting these five iron wires to increase the co-efficient of self-induction until that value is reached which with the given speed and capacity brings the circuit in resonance with the impressed E. F. M. I am doing this now and watching the voltmeter needle at the same time. Now the voltmeter indicates 3,000 volts, which is 30 times the value of the original E. M. F. This is the point of reasonance, because if I push the iron wire lower, the needle goes back. The point of resonance is very sharply defined, because the slightest motion of the iron wire one way or the other makes quite considerable difference in the reading of the voltmeter. The point of resonance can be shown to a large audience like this much more easily by connecting the poles of the condenser to the tinfoil electrodes of the vacuum tube G. A discharge starts in this tube at about 2,000 volts. Now as I insert these iron wires into the inertia coil you see the intensity of the discharge increases. [The room was darkened.] The point of maximum resonance is clearly marked by the intensity of the discharge, as you see. Now I insert the iron wire too far; as you see the discharge is stopped. I can start it again by raising the iron and stop it again by taking the iron wire entirely out, as you see.

By working with high frequencies and small ohmic resistance any voltage within practical limits can be obtained. Ohmic resistance, however, is not the only thing which limits the resonant rise of potential. Dielectric hysteresis and the peculiar behavior of iron when under the inductive action of a rapidly alternating current, modify this rise very much. The other day I employed this home-made condenser in parallel with that Marshall mica condenser. I obtained only 2,000 volts rise, whereas preliminary calculation led me to expect at least 4,000 volts. But the smell of melting wax reminded me forcibly of the cause of this discrepancy. The home-made condenser got so hot in about two minutes that all the wax (which when boiling hot was compressed between its mica plates to drive out the air and moisture) between its plates was melted. The energy which was thus used up in overcoming the dielectric hysteresis of the wax had prevented the resonant rise from reaching that value which it ought to have reached according to calculation. Taking this condenser out and using the mica condenser alone the rise went right up to a point considerably above 3,000 v. Paraffin and glass behave in a similar way. So that owing to dielectric hysteresis alone the resonant current (which takes place when capacity and self-induction neutralize each other) is never equal to the electromotive force divided by the ohmic resistance, and it can be very much less. The presence of iron is incomparably more powerful in destroying the resonant rise of current and potential, as will be seen presently. This is very unfortunate in view of the brilliant expectations which not a few electricians hoped to realize from the employment of condensers in the running of alternating current machinery.

It is well to observe here that if we substitute a Weston voltmeter for the Thomson Electrostatic Voltmeter, F Fig. 7, then we shall have practically the condenser in parallel with the inertia coils. It is easy to see from purely theoretical considerations that the resonant rise will be less in this case. Experiments show that the rise can be then very much less if the resistance of the voltmeter circuit is reduced. The bearing of this observation on the so-called Ferranti effect with and without a load in the mains needs, I venture to suggest, no further discussion.

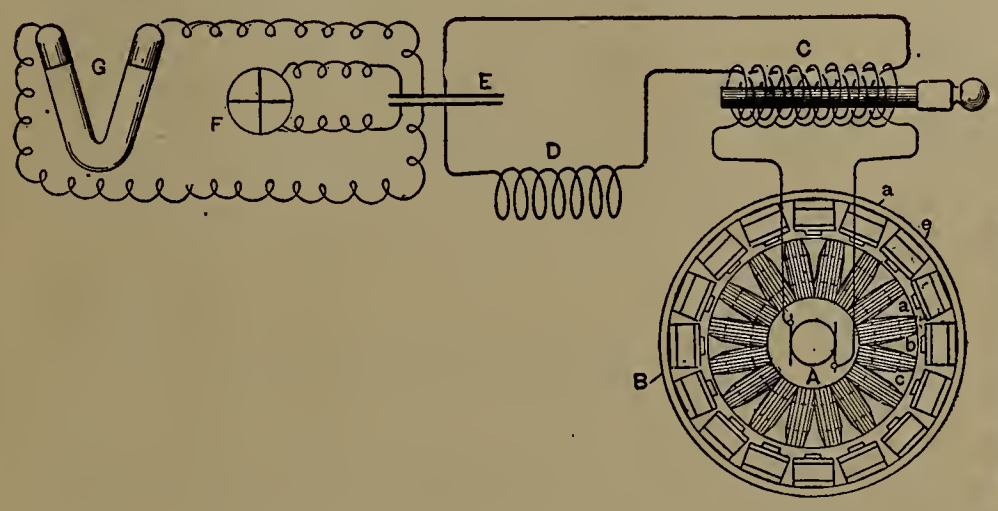


FIG. 7.

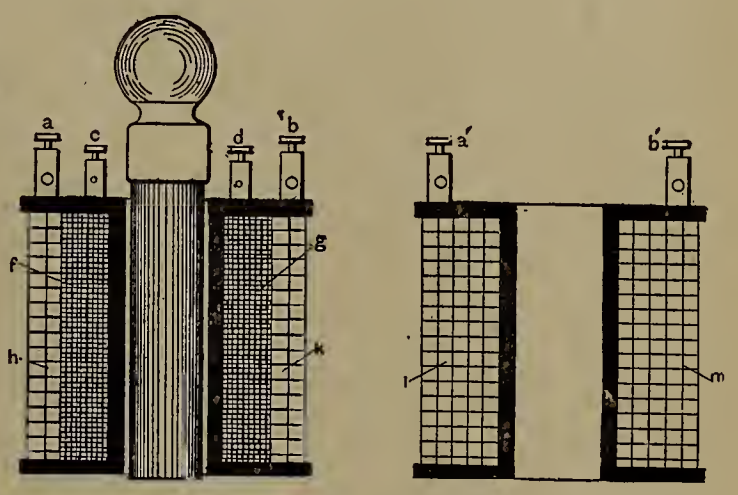


FIG. 8.

* * * *

The practical bearing of "Low Frequency Electrical Resonance," in so far as I have worked out the subject, seems to rest on the following characteristic features:

It brings out very prominently the purely mechanical character of the phenomena of electricity, and it does that not by referring to carefully prepared delicate experiments of a skilled physicist, but by referring to phenomena which every electrical engineer can observe every day in the testing room, telegraph and telephone stations, and in central stations for power and lighting. A full appreciation of this purely mechanical character of the phenomena of electricity is of the greatest practical importance, for we must remember that the founder of this mechanical view, the immortal Maxwell, in opening this new view of electrical phenomena contributed to the advance of this science as much as, if not more than, any other investigator of this century.

It offers a new, simple, and exceedingly convenient method of transforming electrical energy from low to high potential.

It enables us to observe very accurately the behavior of dielectrics and of iron when under the inductive action of resonant currents, and thus to determine the exact limits within which condensers can be employed in the solution of electrical engineering problems.

It offers a new and exceedingly simple method (the

method of harmonic analysis mentioned above) of studying the working of alternating current machinery under various conditions of load.

It points out a new, and apparently very promising, direction in which the difficult but exceedingly important study of the magnetic properties of iron can be pushed ahead.

In closing my remarks I wish to thank my pupil, Mr. Milton C. Canfield, for the very efficient assistance he has given me in the preparation of this lecture.

NEW YORK NOTES.

There were 459 failures in the United States during the week ending August 4, as reported by *Bradstreet's*, against 489 the week previous, and 155 during the corresponding week last year.

Hine & Robertson, 45 Cortlandt street, city, are the manufacturers of the Eureka packing for all kinds of engines. Eureka packing has been in use twelve years, and has given the greatest satisfaction. It makes a tight joint with a small amount of friction, lasts for a long time and is low in price.

Mr. M. Norden has purchased all the rights, title and interest of the H. N. H. Electric Co., 136 Liberty street. He will continue the business at the same place. Among the many large contracts secured by Mr. Norden are the following: Everard's Brewery, 134th street and Madison avenue for 300 lights; Galvanotype Engraving Co., 20 Rose street, 100 lights, New York city; the fireboat Edwin S. Stuart, of the Philadelphia Fire Department, engine, dynamo and two motors, also the wiring complete, and the decorative wiring of the store of Friethal, Elting & Co., Third avenue and 56th street, of this city.

The manager of the Gillett Electric Company, Red Bank, N. J., was in New York recently. He had with him one of the company's magnetos and explained to the writer some of its advantages. The field magnets are composed of stamped soft iron laminae. The armature has three cores and the whole device is of strong construction. On the side of the box is a push button whereby one can cut the two bells, on the face of the box, in or out of circuit. The magneto is well made, efficient and low priced.

E. C. Frady and C. L. Radway have opened offices at 136 Liberty street, city. They are agents for the Nutting arc lamp for incandescent circuits, which is made in Chicago, and the McNutt incandescent lamp, also a Chicago invention. Mr. Frady is an energetic Chicago business man, and Mr. Radway is a New York hustler. Together they make a team hard to beat. Mr. Radway has an extensive acquaintance among lamp buyers in this vicinity.

The American Universal Electric Co., 126 Liberty street, city, reports that the orders for battery fan motor outfits far exceed its ability to fill them. The electric sand, which this company controls exclusively, is one of the most convenient ingredients ever devised for battery charging. It is easily shipped, and when dissolved in the battery the latter acts immediately. Large quantities of electric sand are being shipped West and South. The company is making some improvements in its bicycle outfit which will surely be greatly appreciated by wheelmen. The whole outfit will weigh only 3 lbs. The battery jar, which will contain three cells, will be swung on a pivot so that by turning the jar upside down the zincs will be freed from the solution, and consequently there will be no useless waste when the battery is not in use. Each cell will have an e.m.f. of 2 volts, the battery e.m.f. being 6 volts. The battery jar will be liquid-tight, so it will make no difference how it is turned, the solution cannot leak. A hole will be provided on the top to facilitate the recharging of the battery; this too will be made liquid-tight by means of a screw plug. The company is getting up a new 3-candle power lamp to go with this outfit, that will contain some novel features in lamp construction, and will in no way infringe the Edison or any other lamp. It will be of low voltage, and will take less than .45 ampere of current to bring it up to candle power. By aid of a reflector the light from this lamp will be greatly magnified The company is doing a large business in miners' lamps. These are made in very portable form, and give a strong light, at the same time the light is perfectly safe. The new battery-motor for general power work, which the company is working on will soon be out, we understand.

Western Union Telegraph fluctuated during the week between 67⅛ and 78½, the latter quotation being about the ruling price at this writing. The stock showed greater strength as the week advanced. W. T. H.

AUSTRIAN DELEGATES TO THE ELECTRICAL CONGRESS.

In response to the invitation extended to it to participate in the Electrical Congress to be held in Chicago, the Electrotechnischer Verein of Vienna has appointed the following of its members delegates to represent it at the meetings: Nikola Tesla, A. Prosch, inspector of the Austrian State Railways; Ernst Egger, Dr. Johann Sahulka, Constructor at the Imperial High School, Vienna, Fred. W. Tischendorfer and Joseph Wetzler.

RECEIVER'S SALE OF THE NATIONAL ELECTRIC MFG. CO.

The following notice of the sale of the property of the above named company is just received:

State of Wisconsin, in Circuit Court, Eau Claire County.

James T. Barber and the McDonough Manufacturing Company, plaintiffs; against The National Electric Manufacturing Company, a corporation, defendant.

Notice is hereby given that pursuant to the order and direction of the Circuit Court of Eau Claire County, in the above entitled matter, on the 18th day of July, 1893, the undersigned, as receiver of said defendant, The National Electric Manufacturing Company, will, on the 4th day of September, 1893, at nine o'clock in the forenoon of said day, at the east front entrance of the factory building of the National Electric Mannfacturing Company, in the city of Eau Claire, Wisconsin, situate on the land and real estate hereinafter described, in said city of Eau Claire aforesaid, offer for sale at public vendue and sell as a whole and in one lump, to the highest bidder therefor, for cash, the following described land and real estate, constituting the site of the plant of said National Electric Manufacturing Company, in the city of Eau Claire, and described as follows, to-wit:

Commencing at a point where the west line of Ninth avenue extended northerly intersects the low water line of Half Moon Lake, thence southerly along the westerly line of said Ninth avenue and the extension thereof to the northwesterly line of the present right of way of the Chicago, St. Paul, Minneapolis & Omaha Railway Company, where the same crosses said westerly line of Ninth avenue, which point is distant about thirty (30) feet northerly along said line from the centre of the present switch track of said railway company where the same crosses said line, thence southwesterly along

the northwesterly line of said right of way four hundred and ninty-two (492) feet; more or less, to a point, thence southwesterly on the line running in the direction of the north seventy degrees and thirty-two minutes east one hundred and fourteen feet more or less, to the east line of land owned by the Valley Lumber Company of Eau Claire, Wis., thence northerly on said east line of the Valley Lumber Company's land to the low water mark on Half Moon lake, thence northwesterly along the shore of Half Moon lake to place of beginning, thereby including the premises known as the McVicar mill site, or a portion thereof; the land and premises above described, being embraced in and conveyed by the Eau Claire Lumber Company to the National Electric Manufacturing Company, in a certain deed and conveyance recorded on pages 315 and 316 of volume 47 of deeds in the office of the register of deeds of Eau Claire county. And also the factory and works and all other buildings and improvement thereon, or connected with the same, and all tools, machinery, electrical instruments and other appliances in the said buildings, or used in connection therewith, and heretofore used by said company in the business of designing and manufacturing, testing and building electrical apparatus and also all patterns, electrical determinations, blue prints, charts and memoranda, heretofore used or prepared for use in the said business and also all patents for things of an electrical character, so far as the same were heretofore used by said National Electric Manufacturing Company, and also the safe and office furniture of all kinds now or heretofore in use in the said plant for the said business, and each and every item and thing connected with the manufacturing of electrical apparatus, machinery and manufacturing establishment constituting a part of the said plant of the said National Electric Manufacturing Company, so situated in the city of Eau Claire, Wis., aforesaid.

Each bidder at said sale, before any bid shall be received from him, will be required as a condition to bid at such sale, to deposit with said receiver, the sum of twenty five hundred dollars ($2500) in cash, or certified check from a bank satisfactory to said receiver, the same to be forfeited to said receiver as assessed and liquidated damages for the failure of the bidder to pay the balance of the purchase price, within the time limited, in case the property is struck off to him; and otherwise, at the close of said sale to be returned to such respective parties so depositing such cash or check.

Dated this 18th day of July, A. D. 1893.

R. E. Rust,

Receiver of the National Electric Manufacturing Company, of Eau Claire, Wis.

T. F. Frawley, Attorney for said receiver.

QUEEN'S "MAGNETIC VANE" INSTRUMENTS.

Queen & Co., Incorporated, Philadelphia, are congratulating themselves upon the large number of "Magnetic Vane" ammeters and voltmeters which they have sold up to date this year. An increase of two hundred per cent. over the first seven months of '92 is not a bad record, especially in the face of recent and present financial disturbances. The causes of this great advance are naturally accounted for in the high quality of the instruments and the remarkably low prices at which they are supplied.

In consequence the makers have special contracts with several dynamo building companies to supply switchboard apparatus for the plants which they instal, and also receive substantial orders from central stations, both light and power, and from the trade in general. Circular 420, giving prices and interesting particulars, can be had from them for the asking.

TRADE NOTES.

The Holtzer & Cabot Electrical Works at Brookline Mass., have been undergoing a thorough overhauling.

We are in receipt of an invitation from the C. W. Hunt Company, New York office, 45 Broadway, to visit its extensive exhibit of machinery for handling coal, ores, etc., in the Transportation Building, World's Columbian Exposition. The company has issued a pamphlet describing its exhibit.

The following is a copy of a letter which shows the value of Lord's Compound for Boilers:

Office of Superintendent
Penn Gas Coal Company,
Westmoreland County.

Irwin, Pa., December 1, 1890.

Geo. W. Lord, Esq.,
Philadelphia, Pa.

Dear Sir: Herewith please find order for another ton of Compound. We find by reference to books that we have used your Compound since 1876, and we have had no trouble with boiler scale, or pitting or any form of corrosion since we commenced its use.

Respectfully yours,

Albert Ford.

Mr. Lord's address is 316 Union street, Philadelphia, Pa.

The Electrical Age's Illustrated Record of Patents.

Issued July 4, 1893.

500,545. Telephone System. George L. Anders, London, England, assignor of three-fourths to Walther Kottgen, same place. Filed Dec. 1, 1892.

500,563. Signaling System. William E. Decrow, Boston, Mass., assignor to the Gamewell Fire Alarm Telegraph Company, of New York. Filed Dec. 31, 1892.

500,601. Safety Cut-out. Olof Offrell, Middletown, Conn., assignor to the Schuyler Electric Company, of Connecticut, Filed Dec. 5, 1892.

500,606. Device for and Method of Adjusting and Equalizing the Magnetic Density in the Pole-pieces of Magnetic Separators. Clarence Q. Payne, Stamford, Conn. Filed May 26, 1892.

500,614. Brush-holder for Dynamo-electric Machines. Henry G. Reist, Lynn, Mass., assignor to the General Electric Company, of New York. Filed Jan. 28, 1893.

500,622. Secondary Battery. William L. Silvey, Lima, Ohio. Filed July 9, 1892.

500,629. Electric Switch. Elihu Thomson, Lynn, Mass, assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Apr. 20, 1890.

500,630. Method of and Means for Producing Alternating Currents. Elihu Thomson, Swampscott, Mass. assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 18, 1892.

500,631. Rheostat. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. Filed Aug. 25, 1892.

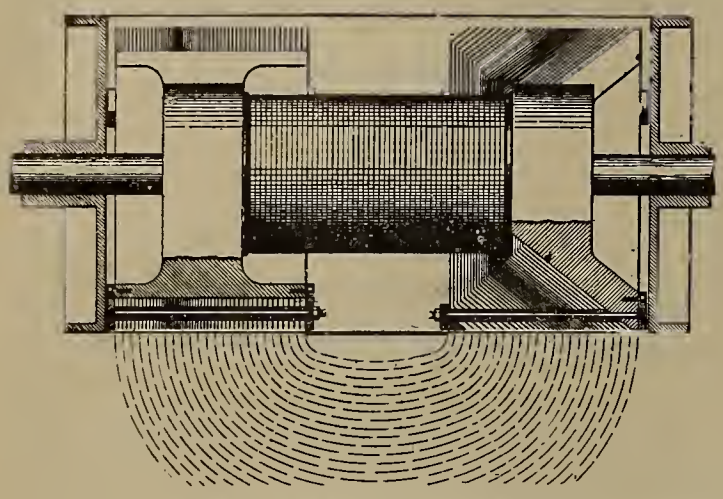
500,644. Electric Ignitor. William F. West, New York, N. Y., assignor to Clement Gould, same place. Filed Feb. 4, 1893.

500,657. Electric-Arc Lamp. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Apr. 3, 1893.

500,663. Electric Motor John MacHaffie, Schenectady, N. Y. Filed Oct. 8, 1891.

500,670. Incandescent Electric Lamp. William E Nickerson, Cambridge and Edward E. Cary, Boston, Mass. Filed Apr. 1, 1893.

500,671. Incandescent Electric Lamp. William E. Nickerson, Cambridge, Mass. Filed Apr. 3, 1893.



500,606—DEVICE FOR EQUALIZING MAGNETIC DENSITY.

500,681. Electric Soldering-Iron and Heater. August Tinnerholm, Schenectady, N. Y. Filed July 11, 1892.

500,726. Lightning-Arrester. Charles S. Van Nuis, New Brunswick, N. J. Filed Aug. 20, 1892.

500,767. Electro-Medical Appliance. Sophia Hetherington-Carruthers, Sydney, New South Wales, Filed Oct. 6, 1892.

500,775. Apparatus for Recording the Flexure of Bridges. Emile Parenthou, Paris, France. Filed July 8, 1892. Patented in France Sept. 15, 1891.

500,776. Coin-Operated Induction-Coil. William R. Pope, Baltimore, Md., assignor to the National Electric Machine Company, New York, N. Y. Filed Apr. 3, 1888.

500,822. Electric Hose-Coupling. Joseph B. Strauss, Cincinnati, Ohio, assignor of one-half to Moe C. Weil, same place. Filed Jan. 31, 1893.

500,828. Lightning-Arrester. William A. Turbayne, Detroit, Mich Filed Nov. 5, 1892.

500,829. Electric-Arc Lamp. William A. Turbayne, Detroit, Mich. Filed Nov. 5, 1892.

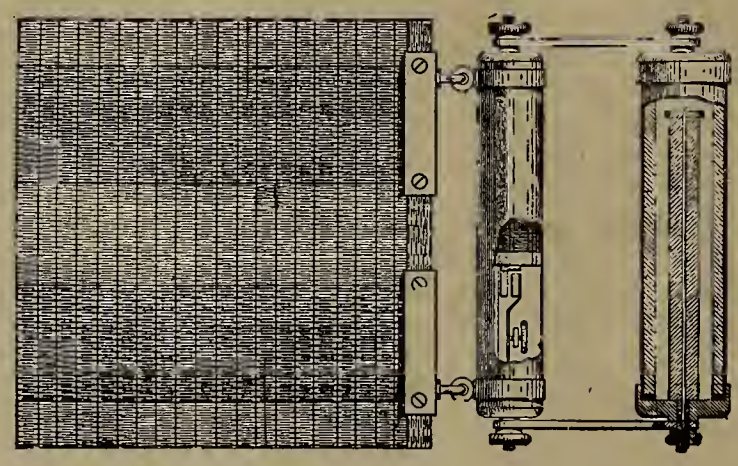
500,841. Incandescent-Lamp Globe. Thomas B. Atterbury, Pittsburg, Pa. Filed July 26, 1892.

500,849. Electric Incandescent Lamp. Henry D. Burnett. Lynn, and Samuel E Doane, Swampscott, Mass., assignors to the General Electric Company, of New York. Filed Oct. 28, 1892.

500, 868. Multiphase Meter. Thomas Duncan, Fort Wayne, Ind. Filed Sept. 3, 1892.

500,902. Ring-Armature. Charles W. Jefferson, Schenectady, assignor to Eugene Munsell & Co., New York, N. Y. Filed Feb. 13, 1893.

500,918. Electric Switch. George E. Linton, Worcester, Mass. Filed Apr. 11, 1893.



500,767—ELECTRO MEDICAL APPLIANCE.

500,973. Electric Welding Machine. Maximilian M. Suppes, Johnstown, Pa. Filed Sept. 10, 1892.

500,978. Secondary Electric Battery. Charles Theryc and Alfred Oblasser, Paris, France. Filed Dec. 2, 1892.

501,000. Meter for Alternating, Pulsating, or Intermittent Electric Currents. Thomas Duncan, Fort Wayne, Ind. Filed Oct. 10, 1892.

501,009. Overhead Electric Railway. John C. Henry, Westfield, N. J. Filed Sept. 27, 1889.

501,021. Insulating Coupling. Louis McCarthy, Boston, Mass. Filed Mar. 7, 1892.

INDEX TO ADVERTISERS.

DIRECTORY FOR BUYERS.

BOSTON MASS.

Ziegler Bros., Contractors, Manufacturers and Dealers in Fine Electrical and Mechanical Apparatus of every description, 73 Federal street.

BROOKLYN N. Y.

Costilo, J. E., Machine Works. Cor. Hudson ave. and Concord st., Brooklyn. Electrical and Experimental Work done promptly.

Empire China Works, 144-156 Green st., near Manhattan ave, Greenpoint. Brooklyn, N. Y. Our production is the GENUINE HARD PORCELAIN and includes Cut-Outs, Switch Bases, Insulators; all sizes.

Hubbard, Norman, 93-97 Pearl st. The Packard Vacuum Pumps, designed especially for Incandescent Lamp Manufacturers. Refer to Thomson-Houston and Sawyer-Man Electric Companies. Send for circulars.

Jaeger, H. J., 173 and 184 Pearl St., near Bridge entrance, Brooklyn, N. Y. Manufacturer of Glass Mercury Pumps of all descriptions for Incandescent Lamp works. Minature Lamps in all colors and shapes. Experimental glass blowing for electrical inventors.

CHICAGO, ILL.

Chicago Electric Motor Co., 313 South Canal st. We make a Specialty of Electrical Repairs, Motor and Generator Armatures rewound. Dental 3 speed reversible foot Switches. Fan Motors, wound for Incandescent Arc and Storage-Battery Circuits.

Midland Electric Works. Manufacturers of Electrical Apparatus, Experimental and Repair Work a Specialty. 108 5th ave., Chicago.

GENEVA, OHIO.

Forest City Electric Works.

MINNEAPOLIS, MINN.

Lennon, J. M., 22 Loan and Trust Building.

NEW JERSEY.

McIntire's Patent, Connectors and Terminals for all Electrical Purposes. Incandescent Lamp and Cut-Out Terminals for all makes of Lamps. General Electrical Supplies. The C. McIntire Co., 13 and 15 Franklin st., Newark, N. J.

NEW YORK CITY.

A. Kolon Primary Battery for Closed Circuit Work. Internal resistance, .025 ohm. Constant E. M. F., 2 Volts; Short Circuits, 125 Amperes. No Fumes or Corrosion. Highest Economy in Maintenance for Fan Motors, Cautery and Dental Outfits, Sewing Machines, Phonographs, Small Lights and Automatic Machines. Converse D. Marsh. Sole Selling Agent. 136 Liberty st.

A Fine Line of Disc Fans, High-Speed Engines, Electric Motors, Fan Ventilators, Gas Engines, etc., etc. Electric Lighting. L. J. Wing & Co., 136 Liberty st.

Bateman & Pollard, contractors for Electr Light Wiring of Buildings, Isolated Plant Complete Installations. Electric Railroad Marine, Village and Station Work solicited Electric Bells, Burglar Alarms and Speaking Tubes. 143½ East 23d Street, N. Y.

Bishop Gutta-Percha Co., Wires and Cables, 420-426 E. 25th st.

Brooke, Homer, 44 Barclay st., Manufacturer of Moulds for Glass, also for casting Lead, Zinc, Carbon, etc., Manufacturer of Special Glass Articles for Electrical purposes.

Consulting Electrical Engineer. Robert S. Dobbie, 177 Times Building.

Copeland, C. H. W. Rice Automatic Engine. N. Y. Office, Electrical Exchange Building, 136 Liberty st., Room 427.

Disbrow, Chas. H., 335 W. 16th st. Manufacturer and Builder of Gramme Armatures for the American System, and American Lamp Supplies. Also Dealer in New and Second-hand Electric Light and Power Machinery, including Steam Engines, Boilers, etc. Write for prices.

Columbia Bar Lock No. 4. 150 Centre street. Every Improvement found in all other machines combined in this one and many others all its own. Send for Catalogue.

Electric Stocks, Room 7, 5th floor Edison Bldg. Perry & Noyes.

Himmer & Anderson Dry Battery Co., 123 Chambers street, New York.

$30 Indicators, Straight Line, Reducing Wheels, Planimeters, Shaking Grate Bars, Reliance Water Columns, Exhaust Pipe Heads, Steam Separators, Damper Regulators, Filters, Eureka and Garlock Packing. Hine & Robertson, 55 Cortlandt street, New York.

Jerome Kidder, Manufacturing Co. 820 Broadway.

McLeod Pneumatic System, The, of Heating, Ventilating and Cooling of Buildings, Mines and Plants. Pumps for Smelting and Fusing purposes. Circulars, etc., etc. McLeod American Pneumatic Co. (now being organized), 125 and 127 Worth st., N. Y.

New York Carbon Works Manufacturers of Carbon Plates, Cylinders and Motor Brushes. Sole Manufacturers of Carbon Cylinders under Holtzer Patent. 18 Cortlandt street.

Pan-American Engineering & Supply Co., 136 Liberty St., Room 232 Construction of Steam and Electrical Railways, Electric-Light Plants and Transmission of Power by most modern systems. Machinery Supplies and Equipments. General Exporting and Importing Commission Merchants.

"Paradox" Reflector Shades, with Metal Top and Ground Glass bottom. F. Holman Electric Co., 128 Pearl st.

Selden's Patent Packings for Stuffing-Boxes on Engines, Pumps, Ice Machines, etc. Will prevent Leakage with least Friction. Send for Circular and Prices to Randolph Brandt, 38 Cortlandt st., New York.

Security Insulator Company, 136 Liberty st., N. Y. Manufacturers of the safest and best Porcelain Insulators and Cleats on the market. Circulars, Price-Lists and Samples Free. Furnished on application.

Shaver Corporation, The. Telephones. Washington Building. No. 1 Broadway, N. Y.

Smith of New York. The Original Car Lamp Manufacturer. Our goods are in daily use throughout the civilized world. Send for Catalogue. 350 and 352 Pearl street, New York.

Van Saun, E. J. Electrical Work, Plumbing and Gas Fitting. Electric Gas Lighting for Churches, Theatres and Private Dwellings a Specialty and Electric Bells. 551 Columbus ave., between 86th and 87th sts.

Waddell-Entz Co., The, 203 Broadway, New York. Direct-Driven Generators, Improved Slow-Speed Generators and Motors. Isolated Plants a specialty. Estimates furnished.

NORTH EAST. PA.

Eureka Tempered Copper Co. Sole Manufacturers of Pure Tempered Copper Journal Bearings. Electric Commutators, Commutator Segments, Brushes, Rolled Goods and Copper Castings of all kinds. North East Pa.

PHILADELPHIA.

Yearsley, T., New and Second-hand Machinery 123 North 3d st.

QUEBEC.—CANADA

Leofred, A. (Graduate of Laval and McGill), Mining Engineer. Mines, Mineral Products.

SYRACUSE, N. Y.

Pass & Seymour, Toughened China Insulators.

MURPHY'S ELECTRICAL SLATE.

All statements to the effect that I have no place of my own to turn out goods, and therefore cannot be relied upon to turn out goods promptly, are FALSE!!

When I receive an order for Slate I immediately forward it to my partner and representative in Fair Haven, Vermont, Mr. James McNamara. This gentleman has been in the Slate business for the past twenty years, and has been in business with me for the past three years. He is thoroughly competent in making a selection of Slate, and immediately upon receipt of all orders from me he places same with whatever quarry has the desired size and quality of slate required. As it is hard at times to get large sizes, he places the order with whatever quarry can get out the desired size in the quickest possible time, and for that reason I know what I am saying when I say that there is no one in the Slate line who can turn out orders any quicker than I can, and I very much doubt if there is any who turn out orders as quick as I do, as I depend upon no individual quarry to fill orders, which I have proven time and time again in making quick shipments, and which can be vouched for by dozens of my customers here in the city, as well as others in most all of the Eastern and Western cities.

As most switchboards being erected now have all the instruments attached directly to the board, doing away with all bases, it is advisable to do all drilling, "where it is possible to do so," before the Slate is marbleized, or in other words finished. In order to meet with this requirement I have erected a steam drill in New York City, and I have the Slate shipped to New York plain, do all drilling necessary for the mounting of instruments and fastening of frame. And then after all holes are drilled it is marbleized in New York, then packed and shipped to wherever desired.

IRON FRAMES FURNISHED

I also sell Italian, Tennessee and Vermont Marble, as well as all others, drilling same when required. I also furnish Slate in about 50 different marbleized finishes, imitating all kinds of Marble, Wood, Stone, etc. I make a specialty of perfect imitations, a few of which are Mexican Onyx, Numidian Marble, and first-class imitations of all woods, some of which are: Cherry, Oak, Ash, Mahogany, Maple, etc., etc.

All my finishes are Baked In, and therefore will last!!

All my imitations of Wood, Marble, Stone, etc., are as perfect as any imitation can be, and in most cases cannot be detected without a thorough examination from the genuine article.

Address all communications to

T. J. MURPHY, 136 Liberty St., New York City.

SLATE WORKS AND FACTORY, Fair Haven, Vermont,

JAMES MCNAMARA, Manager.

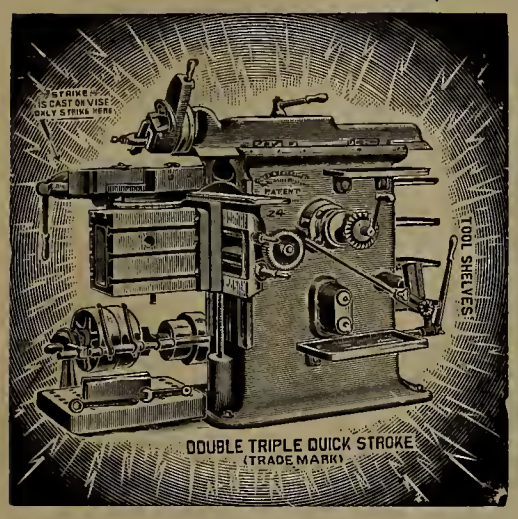
GOULD & EBERHARDT, Newark, N. J.

BUILDERS OF

High-Class Machine Tools for Electrical Plants.

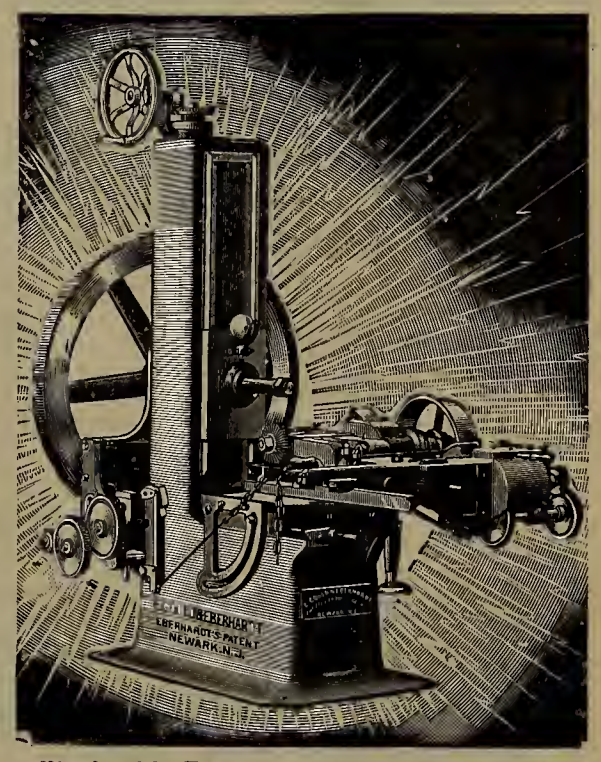
MOTOR GEAR-CUTTERS A SPECIALTY.

We Get Orders Because Our Tools Turn Out The Work Both Quickly and Well Done.

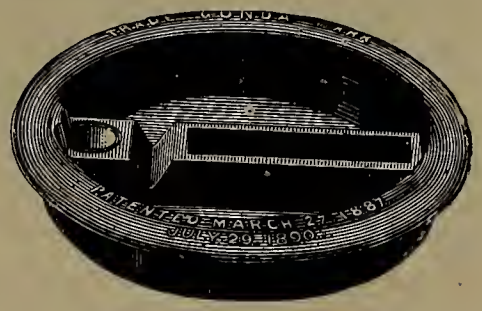


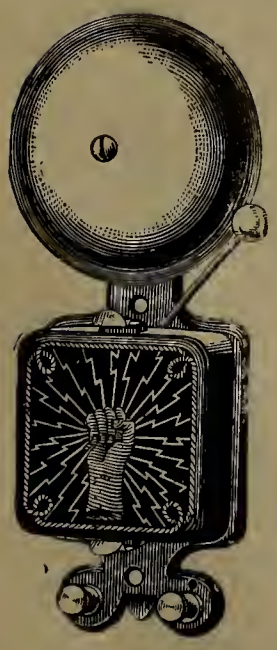
Eberhardt's Patent "Double Triple-Quick Stroke" Shapers. 12, 16, 20, 24, 26 and 32 ins.

Tools can be seen in operation in Manning, Maxwell & Moore's Machine shop, Annex Machinery Hall, World's Columbian Exposition Chicago, Ills.



Eberhardt's Patent Entirely Automatic Gear Cutters.





VACANCIES FOR EMPLOYEES

Employers are tendered the use of this advertising column free of charge.

The Electrical Age publishes this complete record of vacant positions FOR THE BENEFIT OF ITS SUBSCRIBERS. *We request those in need of a position to inform us of the fact at their very earliest convenience, and as new advertisements meeting their case will appear, we shall mail advance copies to them. For this service we make no extra charge, but we expect remittance of postage with the request of the subscriber for these advance sheets. All communications in relation to vacancies should be directed to ("The Electrical Age," Department C,) World Building, New York, in writing and not personally.*

As all advertisements under this heading will be consecutively numbered, reference to such number is required, where applications have to pass our hands.

60. ELECTRICAL and mathematical instrument makers wanted. Apply by letter as above requested.

61. ELECTRICIANS—A few good electric light wiremen and helpers. Address as above requested.

62. BRASS TURNER WANTED on chandelier work; steady employment; references required. Address as above requested.

63. STEEL LETTER CUTTER—First-class, sober man, capable of cutting small punches and who understands tempering. Address as above requested.

68. WANTED—Electrician who understands gas lighting and bell work thoroughly; steady job. Address as above requested.

69. WANTED—An armature winder familiar with Thomson-Houston arc dynamos; pleasant shop and nice place fo the proper parties. Also for electrical repairing, experienced men on arc lamps, converters and armature winding. Address as above requested.

70. WIREWORKER WANTED—Steady work. Address Hartford Wire Works, 247 Asylum St., Hartford, Conn.

71. WANTED—A young man to make himself generally useful in an electric engineering company, must have some experience in electric installation work and have no exagerated expectations.

73. WANTED—Good wheelwright. Address as above requested.

74. WANTED—A man thoroughly posted as to the localities where mechanics of the mechanical and electric trades assemble, to introduce "Electrical Age" and "Street Railway News," containing free lists of vacancies, and to gather official notices. Liberal commission will be allowed.

76. WANTED—Experienced electric wiremen in the city of New York. Address as hereabove directed.

77. WANTED—Die cutter for silverware, in Philadelphia, Pa. Address as hereabove directed.

78. WANTED—A1 die maker for steady job, for Jersey City. Address as hereabove directed.

79. WANTED—Moulder in foundry, expert on loam and sand. Good wages paid and steady employment to first-class man. Address: The Elec. Age, Dept. C, No. 79.

80. WANTED—Engraver, must be A1, for half-tone work. Send your application in writing with forwarding and answering postage to Electrical Age, Dept. C, World Bldg. If you are not a subscriber to either "Electrical Age" or "Street Railway News" send $1.50 for half year subscription on either. Subscribers are favored always in these matters as against strangers.

81. WANTED—Fitter for gas fixtures on outside work. Send your application in writing as directed under No. 80.

82. WANTED—A finisher on fine woodwork for hairbrushes. Send your application as directed under No. 80.

83. WANTED—Model and mould maker in terra-cotta works, as well as other skilled labor for new terra cotta works, for steady well paid work. Send your application in writing as directed under No. 80.

84. WANTED—A tinsmith for jobbing work. Send your application in writing as directed under No. 80.

85. WANTED—Joiner for picture frames; used to power-saw. Send your application in writing as directed under No. 80.

86. WANTED—Plumbers and gasfitters. Send your application in writing as directed under No. 80.

87. WANTED—Marine engineer for small lighter. Send your application in writing as directed under No. 80.

88. WANTED—Brass melter. Send your application in writing as directed under No. 80.

89. WANTED—Core maker, having experience on valve-cores. Send your application in writing as directed under No. 80.

91. WANTED—Stone planers. Send your application in writing as directed under No. 80.

92. WANTED—BRASS-MOULDERS and Brass-Finishers on Fox-lathe. Send your application in writing with forwarding and answering postage to Street R'y News, Dept. C, World Bldg. If you are not a subscriber to either "Electrical Age" or "Street Railway News" send $1.50 for half year subscription on either. Subscribers are favored always in these matters as against strangers.

93. WANTED ENGRAVERS—Type-metal engravers for color work on type-metal plates; steady situation to competent men. The U. S. P. Co., Hinds & Ketcham factory, 91 North 3d street, Brooklyn, E. D.

94. WANTED FURNACEMEN—Six good furnace and range men who are used to doing their own brick work and setting; none but first-class men need apply. Janes & Kirtland, 110 Beekman street, New York.

95. WANTED—A1 Orthopaedic instrument maker; steady work. For New Orleans, La Apply as stated under No. 92.

96. WANTED—A jobbing locksmith at Norman's, 286 Eighth avenue, New York.

97. CAR BUILDER—good, wanted; and running gear men. Send your applicatton as directed under No. 92.

98. FITTERS WANTED—Experienced hands to hang gas and electric fixtures. Send your application as directed under No. 92.

99. A GOOD JOB for an experienced, reliable mechanic that understands repairing and manufacturing electric arc lamps; works in Chicago, Ill.; state age, experience; and wages wanted: must be steady and industrious. Apply as stated under 92.

100. ENGINEER. machinst and steam-fitter, first-class, does repairs, wages moderate, wants work. Apply as stated under 92.

101. ENGINEER, electrical (assistant), one who is familiar with dynamos, high-speed engines and can do all repairing on electric lights, fans and motors for a hotel; wages $50 a month and board. Address, with references, as stated under 92.

102. ENGINEER; single, must have certificate; wages $30 month, board and room. Apply as stated under 92.

103. BOILER MAKERS WANTED. Apply as stated under 92.

104. A MAN to run drilling machine and cut slate and marble. Apply as stated under 92.

Mention the ELECTRICAL AGE when communicating with advertisers.

POSITIONS WANTED

Advertising Rates: 20 cents per line. To Subscribers, 50 per cent. off.

It being customary to advertise anonymously for positions, and as in consequence, employers will as a rule have to direct their communications to us ("THE ELECTRICAL AGE," Department C), we make request, that reference be made in each case to the number preceding the offer of service that they contemplate accepting.

Advertisers' instructions as to disclosing their address will be scrupulously adhered to.

Postage for answers or forwarding must accompany all communications.

45. DRAUGHTSMAN — ship and mechanical, wants a position; 10 years' experience. Address as above directed.

46. DRAUGHTSMAN—Mechanical draughtsman and designer of first-class ability desires employment. Address as above directed.

47. ELECTRICAL WIREMAN wants a position with a construction company. Address as above directed.

48. ELECTRICAL ENGINEER — Thoroughly capable man, with 12 years' experience, desires a position in which a general understanding of the various branches of the electric business is of value. Address as above directed.

49. ELECTRICIAN, at present in charge of 1,000 light plant on one of the large Sound steamers desires similar position with hotel or business house; thoroughly experienced in all repair work; also practical armature winder on drum or ring armatures. Address as above directed.

50. ENGINEER—Experienced machinist wants a situation; first class references. Address as above directed.

51. ENGINEER wants employment; can do all his repairs; will fire if necessary. Address as above directed.

52. ENGINEER wants a position; best references; understands Corliss engines, dynamos and elevators Address as above directed.

53. ENGINEER wants a situation; understands his business; not afraid of work. Address as above directed.

54. ENGINEER—Experienced, reliable man, competent machinist; well posted in large engines, boilers and general machinery, wants a position, A1 references. Address as above directed.

55. ENGINEER, Swede, with license, wants position; city or country; good machinist, can do all repairs. Address as above directed.

56. ENGINEER—Single young man, competent machinist, with city license and best references, familiar with all kinds of tools and qualified to do all his own repairing, wishes a situation where he will be appreciated. Address as above directed.

57. ENGINEER, understands dynamo and electric lighting; can do steam-fitting and all repairs; have my own tools, best of references. Address as above directed.

58. ENGINEER, licensed; single; steady; hard worker; thoroughly experienced with hotel machinery; repairs; best references. Address as above directed.

59. ENGINEER, licensed, wants position; understands dynamos, ice machines, steam boilers, elevators in flats, offices, hotel or factories; city or suburbs. Address as above directed.

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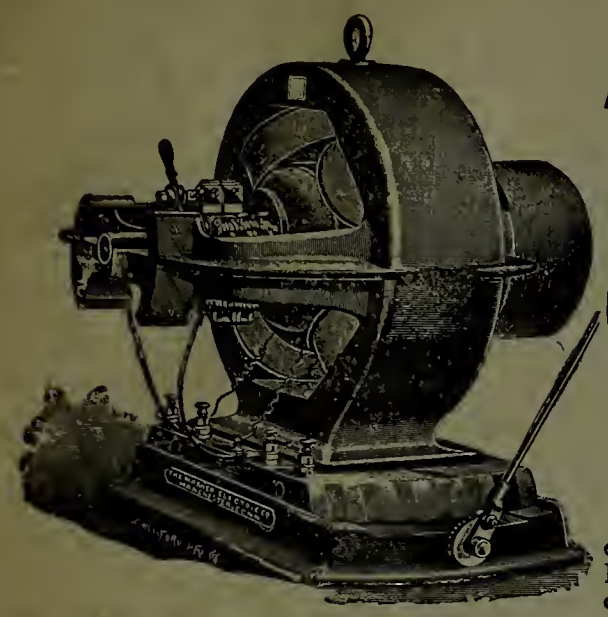

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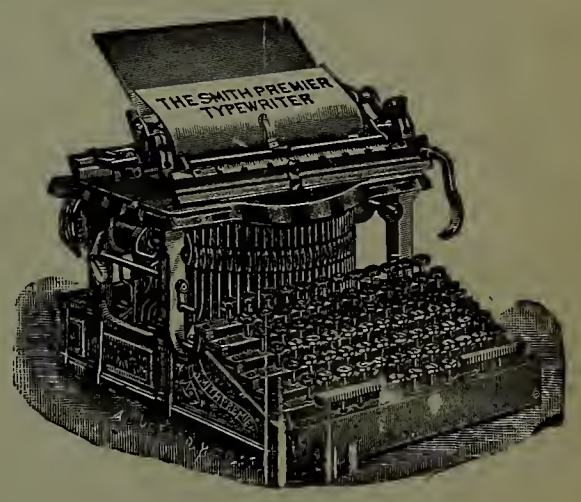

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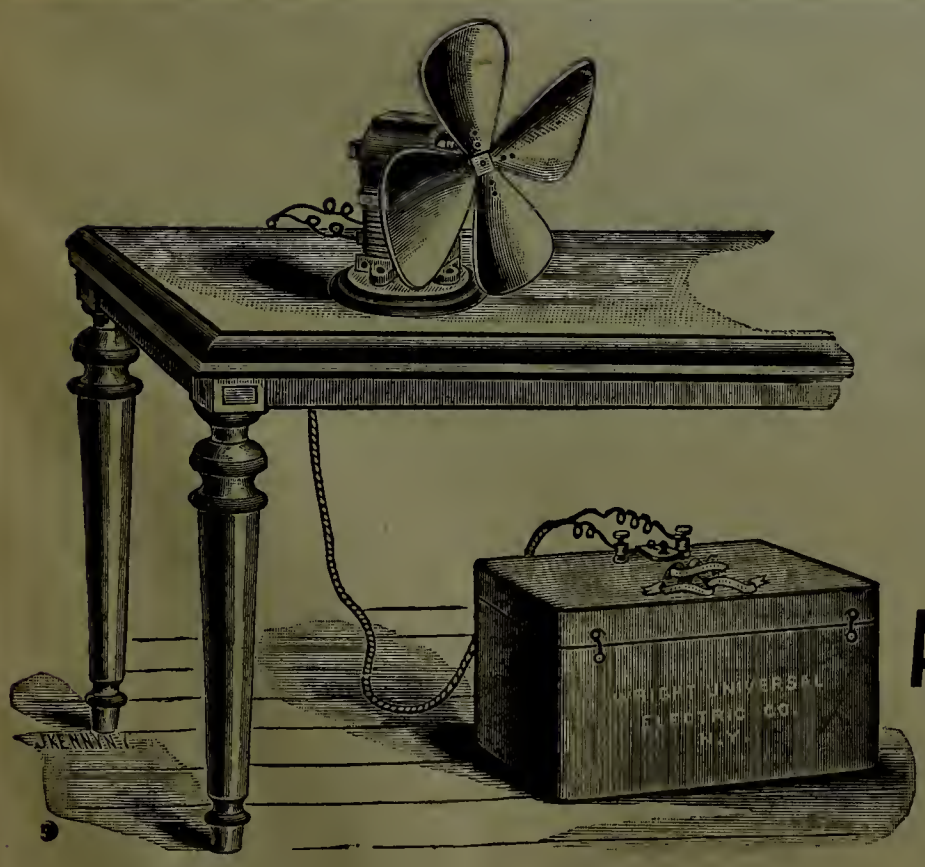

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