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VOL. XVIII.—No. 481

NEW YORK, AUGUST 1, 1896.

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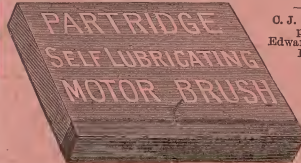
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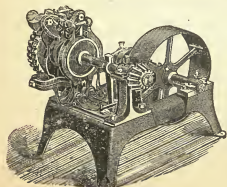
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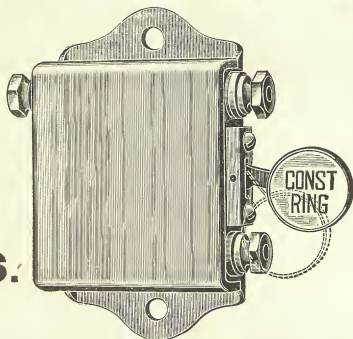


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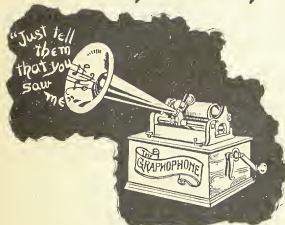
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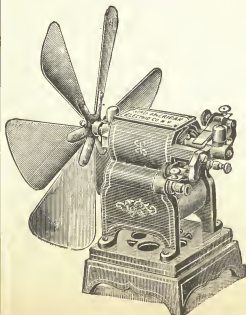
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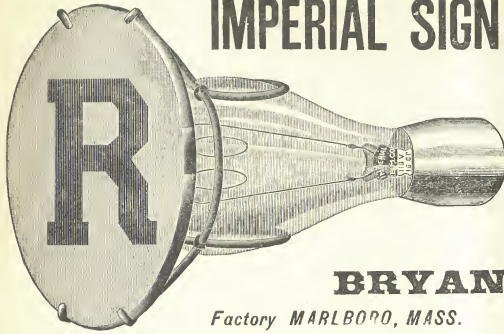
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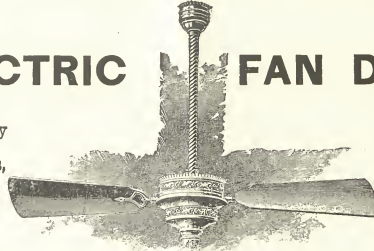
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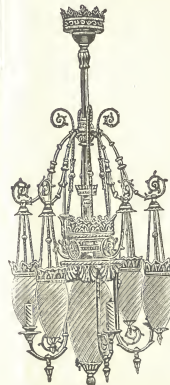
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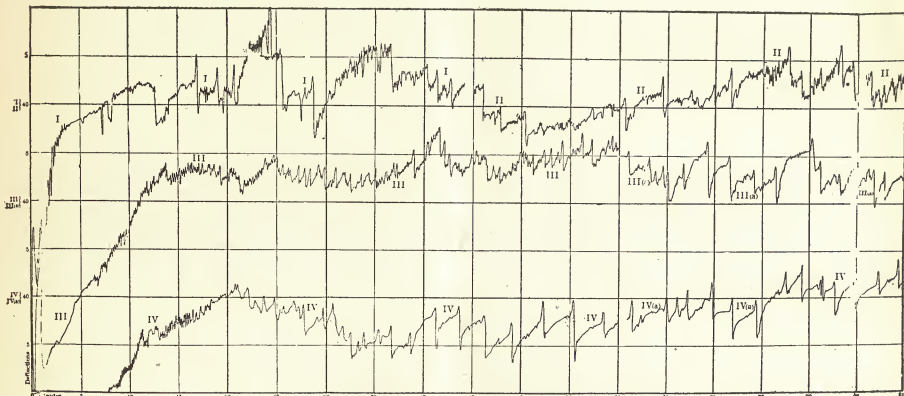
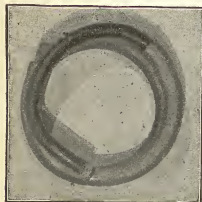


FIG. 3.

## STANDARDS OF LIGHT\*

PRELIMINARY REPORT OF THE SUB-COMMITTEE OF THE INSTITUTE.

BY EDWARD L. NICHOLS, CLAYTON H. SHARP, AND CHARLES P. MATTHEWS.



NE of the sub-committees appointed in 1893 to investigate the subject of a suitable standard of light for photometric purposes has been engaged upon preliminary experiments, and upon the collection of data concerning the existing standards, and also of such other sources of light as might be regarded as possible substitutes for

the standards now in use. Such investigation is a necessary preparation for the consideration of recommendations looking to the adoption of any new standard.

The committee is still at work upon these preliminary experiments, but it has reached a stage when it seems desirable to make the following report of progress:

The following sources of light have been in use in photometric work for a sufficient length of time to enable various observers to become acquainted with their merits and likewise with their imperfections:

- (1) The Carcel Lamp.
- (2) The British Standard Candle.
- (3) The German Standard Candle (Vereinskerze).

- (4) The Methven Screen.
- (5) The Hefner-Alteneck Amyl-acetate Lamp.
- (6) The Harcourt Pentane Standard.
- (7) The Harcourt Pentane Lamp.

In addition to these, the Violle platinum standard of light has been before the scientific public for several years and although it has not gone into extensive practical use, it has been subjected to severe tests in the laboratory of the German Imperial Institute for Research (Reichsanstalt in Charlottenburg) and elsewhere. Various luminous gas flames, also incandescent lamps, have been extensively used as secondary standards. The following standards have likewise been proposed, and a certain amount of work has been done to demonstrate their good properties and to determine the degree of accuracy with which they can be reproduced:

- (1) The crater of the positive carbon in the arc.
- (2) The surface of a strip of platinum heated by means of a current to an arbitrarily defined temperature.

Finally, there are a number of light sources which must be taken into account in the selection of a standard of light, aside from those which have been mentioned in the above list. Such are gas flames burning within a mantle of pure oxygen (the Bude Light), the acetylene flames, the various incandescent mantle burners, the light from other glowing metallic oxides, such as the zircon light and the light of burning magnesium.

The committee proposes to present in this report a

\*A report presented to the General Meeting of the American Institute of Electrical Engineers, New York, May 20, 1896.

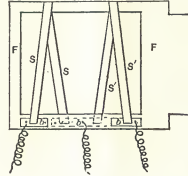


summary of measurements, which have been made upon the various sources of light mentioned above, with a view to reaching some decision with reference to their relative merits as light standards. It is hoped thus to pave the way for experiments leading to the recommendation of new definitions of the standard of light, or at least to the recommendation of greatly improved procedure in the handling of existing standards.

standard, it still maintains its position in Great Britain and America.

Messrs. Harcourt, Keats and Methven, appointed by a committee of the Board of Trade to investigate the performance of British candles, found a difference of 15% in the average illuminating power of legal candles, while two pairs showed a maximum variation of 22.7%.

Heisch and Hartley, acting for the committee on light



In the case of many of these sources of light, the members of the committee have made extensive measurements of their own, either in the verification of existing statements, or in the exploration of questions hitherto not definitely attacked. It is proposed in this report to give a brief resumé of these experiments, some of the results of which have already appeared elsewhere, and to summarize

standards of the Council of the Gas Institute, found that the differences in the illuminating power of candles ranged from 1.3 to 16%, the average difference being 7.05%. They also reached the conclusion that sperm candles developed more light per grain of sperm consumed than they had done several years before.

Dibdin conducted two long series of experiments with

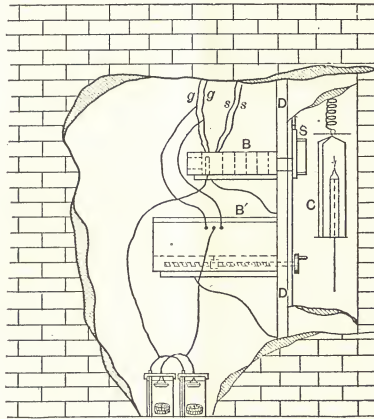


FIG. 2.

the existing work of previous investigators, so far as the committee is acquainted with the same.

## II.

Tests of standards of light belong to one of two general classes; in the first class are included all comparisons of flames with flames, the results of the tests being in this case affected by the change of the standard flame with the purity, temperature, and hygrometric state of the atmosphere. They show in general only the variations of the standard in question which take place during short periods of time, and demonstrate nothing concerning the variations which take place from day to day. In the second class are included all comparisons of light standards with glow lamps and also bolometer tests.

### TESTS OF BRITISH STANDARD CANDLES.

The British standard candles were specified by act of Parliament, in 1860, to be sperm candles weighing six to the pound, and burning 120 grains per hour. In spite of universal condemnation by all who have tested this stan-

various standards, reporting the results of the tests to the Metropolitan Board of Works. He compared the standards with the flame produced by a specially stored coal-gas. His tests were very extensive, and his reports voluminous and exhaustive. For the British candle he found in his first series of tests a maximum variation of 14.9%, which occurred twice, and a maximum total variation in a single group of 23.2% which also occurred twice. The mean variation, disregarding signs, was 3.6%. Variations of from 5 to 8% were common; 13.7% of the tests were within 1% of the mean. In the second series the maximum variation was 11.7%, and the maximum total for one group 19.3%. The mean variation was smaller on account of the fewer observations in each group. This may account for the fact that in this series 34% were within 1% of the mean.

In his next report he combats the view of Heisch and Hartley that candles gave more light per grain of sperm than, than they had given several years before. Comparing determinations of the candle power of the Carcel lamp, made in 1870, with other made in 1879, he found



that the illuminating power of candles had decreased rather than increased during these nine years.

A committee of the British Association, comprising numerous distinguished members of that body, in their fourth report rendered at the Plymouth meeting in 1888, gave the results of extensive tests of candles. Their comparison standard was a burner supplied with coal-gas which had been enriched with pentane. Of 178 experiments, 98 gave differences of 1% from the mean, 57 gave differences of 2%, 19 of 5%, while differences of 9 to 10% were produced only very irregularly. They concluded that candles are not worthy to be called standards, although they conform to the legal requirements, and that the intensity of their light is affected by the purity of the air in the room, the shape and construction of the wick, the nature of the sperm and by other causes.

They also pointed out that the spermaceti is not a substance of definite chemical composition; that improvements in the process of manufacturing have resulted in what is known as a "drier" sperm, one containing less oil; that to prevent crystallization, a variable quantity of beeswax is added. They inferred from these considerations that it is probably true that the illuminating power of candles has changed since the quality of sperm employed, the construction of the wick with respect to the number of strands, the tightness of the twist, etc., are not specified in the act, but are left to the option of the makers. This committee regarded as the chief source of the oscillations of the light:

- (1) Changes in the length and shape of the wick.
- (2) Difference in the height of the melted sperm in the cup of the candle.

Photometric observations by the many other observers have simply served to confirm the above conclusions. A

BOLOMETRIC MEASUREMENT.<sup>3</sup>

The extraordinary fluctuations of such sources as the British candle make photometric measurements difficult and uncertain. The consideration of the discrepancies exhibited in the results of previous observers suggested to the members of your committee the substitution of the bolometer for the eye, in the study of such sources of light. The following is a summary of the investigation which resulted from this suggestion:

DESCRIPTION OF APPARATUS.

A piece of Swedish iron wire, of No. 30 B. & S. gauge, was passed through jeweler's rollers until its thickness was about 0.045 mm. and its width 1.5 mm. It was then placed in dilute sulphuric acid, in which potassium bichromate had been dissolved, and a current was passed through it in such a manner as to dissolve the iron. The potassium bichromate was introduced into the solution to dispose of the hydrogen bubbles which would ordinarily have clung to the metallic surface, and which would have caused it to be dissolved unevenly.

In this way the strip was obtained which was about 0.025 mm. in thickness and still moderately strong. From this strip were cut out two pieces, each about 6 cm. in length, to constitute two arms of a Wheatstone bridge.

To carry the strips so obtained, a light oblong frame, F (Fig. 1), of thin wood was made, and to it were fastened small bits of sheet brass, *b, b, b*, to which the strips and the copper wires intended to connect them with the other arms of the bridge could be soldered. The strips, S, S', were then bent and placed over the frame, so that each strip crossed the frame twice. The free ends of each strip were displaced laterally from each other, so that, when viewed from the front, the portion of the strip on one side

TABLE I.

BOLOMETRIC MEASUREMENTS OF THE BRITISH CANDLE.  
(DATA FOR CORRECTIONS OF THE CURVES)

Number of curve.	Times of taking zero and sensitiveness readings.		Time of lighting.	Time of taking the curve.			Hourly rate of consumption.	Distance from bolometer.	Initial sensitiveness.	Correction for		Reduction of standard		
	h. m.	h. m.		h. m.	h. m.	h. m.				grams.	c.m.	Drift.	Change of sensitiveness.	Sensitiveness.
I.	8 47	and 10 01	8 50	8 50	to 9 35	7 910	25.3	16.2	+0.9	+0.2	0	-2.3	-0.70	
II.	9 41	10 50	9 33	9 50	10 35	7.767	26.0	16.1	-0.4	0	+0.3	0	+0.05	
III.	8 00	9 15	8 00	8 00	9 00	7.842	26.0	16.1	-2.9	+0.8	+0.3	0	-0.34	
III. (a)	9 38	10 30	8 00	9 45	10 15	7.842	26.0	16.08	+0.3	0	+0.3	0	-0.34	
IV.	7 50	9 05	7 50	7 50	8 50	7.692	25.3	16.15	+1.0	-0.1	+0.1	-2.1	+0.45	
IV. (a)	9 35	10 30	7 50	9 45	10 15	7.692	25.3	16.4	-0.1	0	-0.5	-2.3	+0.45	

recent Dutch commission, for example<sup>1</sup>, found, from many tests, the mean fluctuation in the intensity of British standard candles to be  $\pm 2.43\%$ , with a maximum of 9.70%.

Methven has shown the following variations in the intensity of a candle to take place with changes in the azimuth of the plane of the wick. Two candles were used, their intensities being as follows:

Plane of the wicks perpendicular to bar, c. p. equals 1.999.

Wicks pointing away from the photometer, c. p. equals 1.933.

Wicks pointing towards the photometer, c. p. equals 1.957.

He found also that a candle which gave in dry air an intensity of 1.104, gave in moist air an intensity of 1.196, — a variation of 8.38%.

of the frame hid only very little of the portion on the other side of the frame.

After the two strips had been arranged on the frame symmetrically with respect to each other, the one which was to receive radiations was carefully smoked on both sides. To accomplish this smoking without undue heating of the strip, a piece of sheet metal, through which a small hole had been punched, was held over a candle flame so that the flame was caused to smoke. The smoke passed through the hole, over which a tube was held to direct the current. The strip was passed back and forth over the top of the tube. In this way a very delicate strip can be blackened without injury. In their completed state, the strips had a resistance of about 0.5 ohm each.

(To be continued.)

Kensington, Pa.—Kensington will hold an election August 29 to vote on the question of issuing \$20,000 in bonds for the electric light plant and other improvements.

1. For an abstract by Krus, see *Journal für Gas Beleuchtung und Wasserversorgung* (1894).

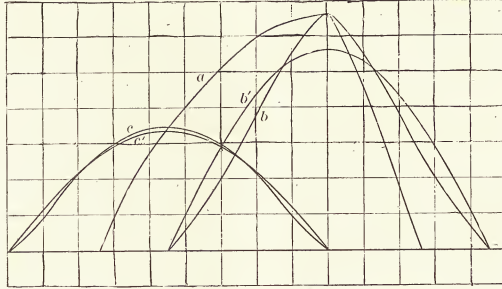
2. John Methven: *Diagler's Polytechnisches Journal*, vol. 377, p. 276, taken from *London Gas World*, 1889, p. 572. See also *Suez: Journal for Gas Lighting*, which is reprinted in the *Scientific American Supplement*, No. 484, p. 7736.

3. For a more detailed description of these measurements, see Sharp and Turnbull, *Physical Review*, vol. II, p. 1.

## ANALYSIS OF TRANSFORMER CURVES.

(Continued from Page 409.)

Figs. 4, 5, 6 give the magnetizing current curves for sinoidal flux curves, for  $B_{max}$ , 1360, 3720, and 5830, respectively, derived from these loops in the manner above described, with additional curves derived by analysis of the first.

Fig. 4.— $B = 1360$ .

In Fig. 4, for the lower range, 1360, the approximation is very close, but  $c$  is slightly more pointed than the sine.

In Fig. 6, for the higher range 5830, the approximation is not quite so close, but  $c$  is more flattened than the sine.

These approximations are quite close, but it is easy to determine the exact form of hysteretic characteristic

between the flux value at each successive epoch and the hypothetical hysteretic current at that epoch.

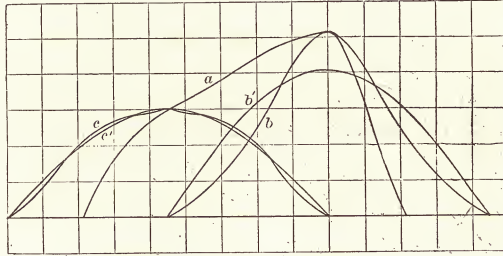
A hysteretic characteristic of the form thus determined will obviously satisfy the conditions.

This curve is the quadrant of an ellipse.

For  $E^2 + M^2 = A^2$ , where  $A = E_{max} = M_{max}$ . But  $H = \frac{E}{R}$  by assumption, whence  $H^2 R^2 + M^2 = A^2$ ,

which is an ellipse,  $H$  and  $M$  being the variables.

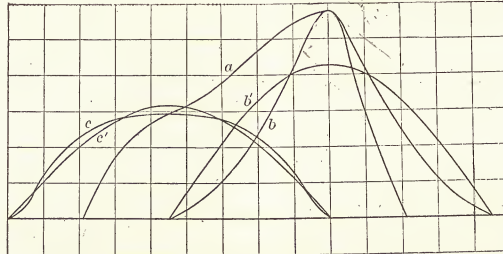
For our purposes the quadrant tells the whole story, so that we may say that the assumption, for sinoidal E. M. F., of hysteresis as due to a simple resistance, is absolutely correct when the hysteretic characteristic is a quadrant of an ellipse.

Fig. 5.— $B = 3720$ .

necessary for a sinoidal hysteretic current, when the flux curve is sinoidal.

Let  $E$  and  $M$  (Fig. 7.) be sinoidal E. M. F. and flux curves, respectively, drawn to same size for convenience.

If we compare this ideal curve with the hysteretic characteristics for the ranges used in Figs. 3, 4, 5, plotting each characteristic to a horizontal scale proportioned to the virtual value of its hysteretic current, as indicated

Fig. 6.— $B = 5830$ .

Assume the hysteretic current due to a simple resistance,

i. e.,  $H = \frac{E}{R}$  (instantaneous values). Then plot a curve

by its equivalent sine, we see the same manner and degree of approximation as in the cyclic curves. The ellipse is intersected by horizontal bars indicating the successive epochs in the cyclic curve, and by reference to these it is



seen that each characteristic intersects the ellipse at a point corresponding exactly to the intersection of the cyclic hysteretic current by its equivalent sine, and that the relationship is in every respect identical.

A glance at the hysteretic characteristics in Fig. 3 shows that for ranges higher than 5830, the hysteretic current curve will not only be more flattened, but actually depressed in the middle. But while the increased distortion of the hysteretic current will introduce higher harmonics, yet the rapid diminution in the permeability on approaching saturation will introduce them much more

As a final conclusion, then, we may say that Prof. Rowland's hypothesis that the higher harmonics in the transformer for sinoidal E. M. F. are due, not to hysteresis, but to variation in permeability, and that the effect of hysteresis may be represented by a constant resistance, is approximately correct, for reasonably good iron, is very nearly correct for the moderate ranges used in practice, and may, under certain conditions, be absolutely correct.

A study of hysteretic characteristics would, no doubt, shed some light on the phenomena of magnetism, but it is beyond the scope of this paper.

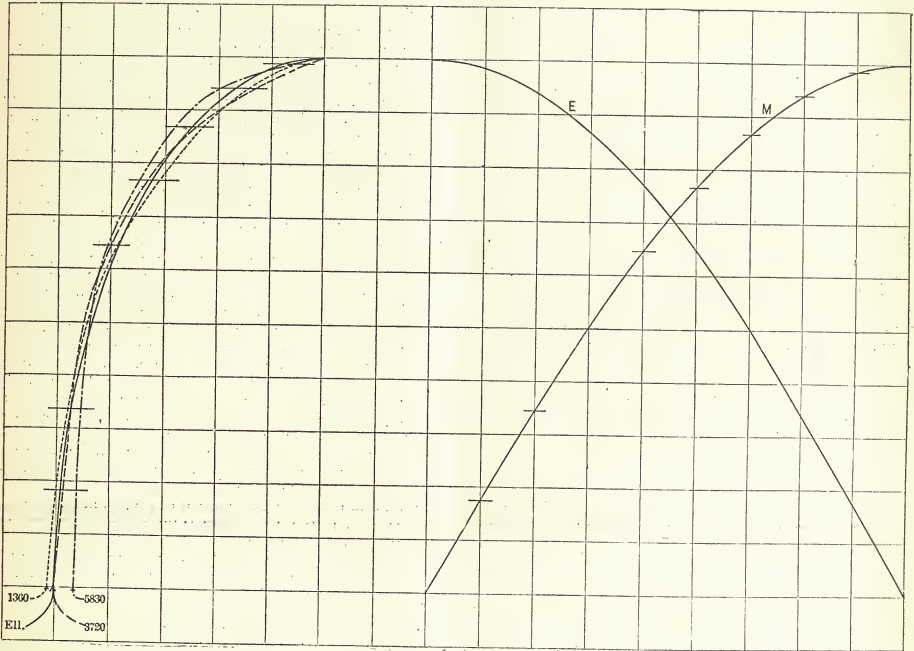


FIG. 7.

rapidly with increase of the range, so that the distorting influence of the hysteretic current will be comparatively slight even at the higher ranges. At the highest ranges, as the one given by Steinmetz<sup>1</sup>, mentioned above,  $B = 16,000$  the inordinate peak of the wattless magnetizing current throws into oblivion higher harmonics from any other source.

To conclude; for sinoidal E. M. F. :

(1) Hysteresis may in all respects be replaced by a constant resistance if the hysteretic characteristic be the quadrant of an ellipse.

(2) This condition is approximately satisfied for moderate ranges of magnetization (such as are used in practice,) in reasonably good iron, and the higher harmonics are negligible. There will usually be a particular range that will give a nearly perfect approximation. On contraction of the range, the hysteretic current becomes more pointed than the sine, and on expansion beyond the critical range, more flattened than the sine.

(3) The increased distortion of the hysteretic current for higher ranges will cause an increase in the higher harmonics, but the rapid diminution in the permeability on approaching saturation will cause a much greater increase in these harmonics, so that even at higher ranges the distorting influence of hysteresis is comparatively slight.

IRIDIUM.

Is a white brittle metal, fusible with great difficulty before the oxyhydrogen blow-pipe. Deville and Debray, by means of their powerful oxyhydrogen blast furnace, have fused it completely into a pure white mass resembling polished steel, brittle in the cold, somewhat malleable at a red heat, and having a density equal to that of platinum.

A complete and practical series of tables, the work of Thos. J. Fay, E. E., will be ready for sale next week. They cover all wiring problems, including—

- Distances from 10 to 1,000 ft.,
- Size of wire No. 14 to 1,000,000 C. M.,
- Losses from 1 to 100 volts,
- Current from 1 to 1,000 amperes,
- The resistance, safe carrying capacity, weight, etc.

Mr. Fay's experience has been very broad and his tabulated forms are immediately applicable to numerous cases. There are also additional tables on electric pumps and elevators, in a very convenient form. The practical nature and ready applicability of these tables make them far superior to anything published. Price complete, one dollar.

1. TRANSACTIONS, vol. xl., p. 719.

## OBITUARY.

Mr. Abraham L. Bogart, the noted manufacturing electrician of 22 Union Square, N. Y., fell dead into the arms of his son, A. Livingston Bogart, Saturday afternoon at 5.30 o'clock.

Mr. Bogart was left an orphan at the age of thirteen, with two brothers to support. He began as an errand boy for a dry goods house on Broadway, and in a few years owned the business. He was the first to put up fine-cut chewing tobacco in tin-foil, and also the first one to build smokestacks for locomotives. After this he introduced dry gas meters; also gasoline and gas stoves for heating, cooking, etc. He was an expert gas engineer, setting up photometric apparatus for gas companies. In 1867 he started in the electrical business, introducing the multiple gas lighting apparatus for churches, theatres, etc. Following this he patented sixty inventions for electric gas lighting apparatus. The leading theatres, churches, halls, etc., of the United States still use his inventions for lighting gas by electricity. His business continued to branch out extensively, keeping pace with the demands in electric lighting and household supplies. He was well known as a fighter for his rights under his patents, and was one of the few patent litigators who fought successfully, for he always came out of his litigations with more money than when he began them.

Mr. Bogart left his office at 12 o'clock noon, Saturday, July 25; met his son, A. Livingston Bogart, and proposed a ride on their wheels. Starting together, at 5.30, they had ridden between two and three miles, when both dismounted on a bridge over a stream. They were quietly talking together when, without any previous complaint of either fatigue or illness, and in the midst of the conversation, Mr. Bogart suddenly groaned and expired in the arms of his son.

Mr. Bogart was born Nov. 20, 1818, and had never been ill, to the knowledge of his family. He never complained of pain, excepting from falls in accidents; was very temperate in all his habits, and one of the most vigorous of men for his age.

The last thing he did in business was to procure a contract at 12 o'clock on the day of his death. He left three children by his first wife, two sons and one daughter, all adults; two children by his second wife, the oldest eight years. He died intestate. His sons, A. Livingston Bogart and Eugene E. Bogart, have always been associated with him in the electrical business, and it is expected they will continue it under the same firm name of A. L. Bogart. A. Livingston Bogart is a well-known expert and electrical and mechanical engineer, and Eugene has always looked after the books and finances. Both are known to have been devoted sons.

It is reported that a big combine has been formed to maintain the price of incandescent lamps, by the leading manufacturers in the United States. This new arrangement is expected to go into force Monday, August 3, and will practically put an end to the war of prices which has virtually done away with all the profits in this line of business. The factories and corporations under the new combine are: The General Electric, the Bryan-Marsh Co., Columbia, Packard, Westinghouse, Buckeye, Sunbeam, Adams-Bagnall, Perkins, Burnstein and Beacon.

Waukesha, Wis.—The National Telephone Construction Co., which has been operating a telephone exchange at Waukesha, has ceased business. The exchange was built a few months ago to compete with the Wisconsin Telephone Co., but it was found impossible to give satisfactory service with the instruments used, or a service that would bear comparison with that furnished by the older company.

## CARBON-CONSUMING BATTERIES.

It will be remembered that some time ago Dr. Coehn obtained what he believed to be a true solution of carbon in hot sulphuric acid, and proceeded to investigate the question whether a carbon-consuming cell could not be obtained in this manner. Dr. Coehn used lead peroxide on the other plate, but the results obtained have been subjected to serious criticism. To some of these criticisms Dr. Coehn has replied in the "Zeitschrift für Electrochemie. Part of this is concerned in what really happens when an element passes into solution, and has only an inferential bearing on the practical question. Prof. Mendelejeff is quoted as stating that with a weak current through a liquid compound of chlorine and carbon powdered diamond is deposited on the negative electrode, but it is thought that he referred to the work of Despretz, who obtained a diamond powder on a platinum electrode by passing a weak current for two months through acidulated water. He also obtained green crystals on the positive pole by a weak current for six months through an alcoholic solution of a compound of chlorine and carbon, while on the negative pole there was a brown warty substance having the same hardness as diamond. It is also stated that traces of carbon are sometimes contained in the deposited metals in an electrolytic bath. All this, however, only shows what a very long way Dr. Coehn is at present off a practical solution of the problem. With reference to the Jacques hot soda cell, little further has been heard of it except that a company has been or is to be formed to exploit the invention. The American criticisms of it run on the obvious lines, and do not appear to be based on any closer acquaintance with the battery than the descriptions that have appeared from time to time. Of course the first question to determine is whether it is merely necessary to get the soda to a high temperature in order to secure the desired reaction or whether heat is continuously absorbed from the furnace. The arrangement as it at present stands is obviously capable of improvement should the first supposition turn out correct.—London Electrical Engineer.

A 5-pound meteorite which fell last April in an orchard near Namur, in Belgium, nearly killing a young man who was digging there, has been examined at the university laboratory at Ghent. It consists of a whitish crystalline paste, containing iron, troilite, olivine, bronzite, etc.—Industrial World.

Among the results arrived at by the committee appointed by the American Association of Railway Superintendents, for the purpose of considering the strength of timbers for bridges and trestles, emphasis is laid on the fact that variation in strength are generally directly proportionally to the density or weight of the timber, and that structures should be, in general, designed for the strength of green, or moderately seasoned timber, of average quality, and not for a high grade of well-seasoned material, age or use not destroying the strength of timber unless decay or season checking takes place. It is found that timber, unlike materials of a more homogeneous nature, as iron or steel, has no well-defined limit of elasticity; for, as a rule, it can be strained very near to the breaking point without serious injury, which accounts for the continuous use of many timber structures with the material strained far beyond the usually accepted safe limits: while, on the other hand, sudden and frequently inexplicable failures of individual sticks at very low limits are liable to occur. Knots, even when sound and tight, are declared to be one of the most objectionable features of timber, whether for beams or struts. The full-sized tests demonstrate, not only that beams break at knots, but that invariably timber struts will fall, owing to the proximity of a knot, by reducing the effective area of the stick, and causing curly and cross-grained fibers.—Tradesman.

Tamworth, N. H.—An electric railroad is projected from Tamworth to West Ossipee.



# The Electrical Age.

ESTABLISHED 1888.

Entered at New York P. O. as second-class matter, January 18, 1891.

THE ELECTRICAL AGE PUBLISHING CO., PUBLISHER



TERMS OF SUBSCRIPTION :

One Copy, one year, .....	\$2 50
One Copy, six months, .....	1.25
Great Britain and other Countries, .....	3.50

Cable Address (all Cables), "Electage," New York.

W. T. HUNT, President. H. C. BECK, Vice-President.  
 NEWTON HARRISON, E. E., Sec'y, Treas. and Editor.

ADDRESS ALL COMMUNICATIONS TO

THE ELECTRICAL AGE PUBLISHING COMPANY,  
 FIRST FLOOR, WORLD BUILDING,  
 NEW YORK.

NEW YORK, AUGUST 1, 1896.

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THE ALTERNATOR.

Some departments of engineering are older and still less developed than others. While this may be due to a lack of interest in that branch, it is frequently caused by the absence of a mind which combines synthetic qualities with an analytical power. That this is the case may be proven by the labors of Tesla, Dobrowolosky and Ferranti.

For many years the alternator, with its hidden stores of latent applications, its great possibilities for the transmission of power and its unique features of distribution for municipal lighting, were undeveloped fields of science and engineering. It is extremely hard to see the tree in the tiny kernel, and harder still to pursue with confidence a line of investigation that is self-encouraged, self-sustained and possibly the outcome of mere hope and expectation. This, then, is the work the builders of a huge system of light, power and distribution have cut out for themselves and persistently followed. They have seen its dark beginnings, its refuted truths, its conservative and sluggish followers hypnotized into believing its great practical applications by their force and argument and deep-seated enthusiasm. They have passed through the war of criticism and moved unbewildered and unharmed. To the alternator, the emblem of genius and invention are forever attached the names of great men. Probably more efforts have been made at this period to bring it

into general use than any machine known. Its exponents see no limit to its application, and indeed, blessed as they are now with a long-wished-for joy—a self-starting motor—the boundaries drawn may not be the unlimited circle of an inventor's dream.

ELECTRICITY FROM HEAT.

The interest once displayed in the construction of thermo-electric apparatus has practically expired. When Seebeck in 1820 discovered the principle that "when one of the junctions of a closed circuit of two metals is raised to a higher temperature than the other, a current of electricity passes round the circuit and (in general) increases its intensity with increasing difference of temperature of the junctions. The direction of the current is, of course, reversed if the cold junction be now made the hotter," an unusual excitement was manifested in scientific circles. The great future of thermo-electric apparatus was pictured by many an ardent advocate. Unfortunately these enthusiastic demonstrations were without avail; a great stride forward had undoubtedly been made. Clamond and others built serviceable thermopiles, but they were inefficient and gradually deteriorated. This dismal fact eventually dismissed a horde of workers from the field; they had done what lay in their power and their labors, although commendable, were more the efforts of imitative mechanics than systematic or logical inventors. Thus it seems that the pathway has been trodden only near the gate. In the volume on "Heat," by P. G. Tait, M. A., is an interesting chapter on Thermo-Electricity. The proposition that the electromotive force due to a heated metal couple will rise to a certain point and then gradually fall, is an evidence that some peculiarity exists about the phenomena that has as yet not been removed. The interpretations of Thomson do not suffice, and in fact, although reduced in many cases to a diagrammatic basis, explanations are lacking at every turn.

This, then, is a comparatively new field—old in the history of electrical applications, but young indeed as regards its development. Some genius to be may now weave a garland that will crown him forever with immortal fame.

New Petroleum Motor.—Apropos of autocars, which are quite the topic of the hour, there is a new type of petroleum motor said to be characterized by great simplicity of mechanism, and which has just been introduced in France. The engine has been examined by a contemporary, and it is found that the principal feature is the independence of light to cause explosion after the machine is once started; thus, one explosion in some unexplained way serves to produce the next. We are not, however, informed how this arrangement is effected, and until we know a little more upon the subject, we are not able to judge of its practical capabilities. It seems that the patentee has been able to dispense with the electric spark or light of any sort in the bringing about of the explosion, and thus the great danger of fire is practically avoided. A mineral essence is employed mixed with air by means of a special pulverizer, and this mixture, finding its way into the cylinder through a trunnion in the same way as steam does in an oscillating steam cylinder, produces the further combustion by the explosion which has just preceded. Thus, it follows that the temperature of the cylinder remains stationary and so low that the cooling apparatus generally required is dispensed with. It is supposed that this system will be available for motors which range from 1 to 4 horse power, but not applicable to anything larger

"Do not advertise and stop,  
 But advertise and stay;  
 For those who read your ad. last month  
 Will look for it to-day."

## ELECTRO-MAGNETIC INDUCTION.

LESSON LEAVES  
FOR  
THE AMERICAN SCHOOL OF ELECTRICITY.

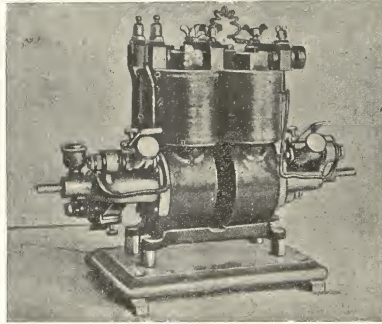
BY NEWTON HARRISON, E. E.

The ordinary lighting current is due to a series of pulsations, so small, however, that they appear to blend into one continuous whole. The arc-light current is a true pulsation, a rise and fall, of the current strength, but a

The entire principle of electromagnetic induction depends upon the mutual reaction occurring between a wire and a field of magnetism. Either, may be moved in the neighborhood of the other and an electro-motive force will be excited.

It is important that this fact be received as an absolute truth, which in any case can be depended upon with the same surety that gravitation, or the revolution of the earth, is relied upon.

An invincible principle like this is the mirror with which we reflect all other truths; it is the foundation—the stepping-stone—without which further progress is impossible.

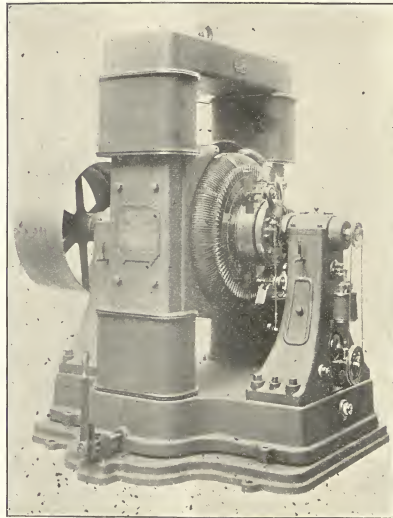


CONTINUOUS CURRENT TRANSFORMER.

flow which, whether weak or strong, does not change in direction. The remaining current used in commercial lighting is the alternating or sinusoidal current. It derives its name from the peculiar growth, decrease and reversal in direction. It may be observed that entirely dif-

ferent systems of lighting are built upon this difference between each. In the last, transforming devices are required, which have opened up a new field in the transmission and distribution of power.

It may be understood from the last statement that either a wire moves in a magnetic field, or the field is moved in the neighborhood of the wire. We can also add that both may take place and still produce the effects spoken of. By moving a wire and a magnetic field so



MACHINE PRODUCING MINUTE PULSATIONS.

that they mutually interact, we are simply transferring the power required for that motion to the wire. The elastic material required for the transference of this energy is the magnetic field; the strained ether. In what di-

ferent systems of lighting are built upon this difference between each. In the last, transforming devices are required, which have opened up a new field in the transmission and distribution of power.



rection does the current flow, and how can it be increased or diminished by this means? In other words, what limitations are there which give but a circumscribed value to the effects of all electromagnetic reactions?

The E. M. F. developed in any case depends upon the number of lines of force cut per second. If a coil is carrying a current and thereby generating a magnetic field, another coil in its vicinity will have excited in it a potential difference of 1 volt if it is moved across the streaming lines of force so that its turns and the magnetic lines give a product of 100,000,000 per second.

Supposing the coil to have ten turns and the field proceeding from the other coil to equal 100,000 lines of force. To excite one volt the product of 100,000,000 must be sustained in a second. At present, with but one move of the coil, only 100,000 lines of force are cut. Therefore, the coil must be moved ten times in a second to generate one volt.

In developing this principle, the same basis is taken that all electromagnetic phenomena consist merely of interactions between a magnetic field and a coil.

For commercial purposes it is necessary that we should know the exact value of the E. M. F. developed with a given number of lines of force and turns.

In all dynamos this first conclusion practically determines the size of the machine. By following this lucid principle still further, the great department of alternating current machinery may be investigated. We have to deal in this case with a series of special devices which have, because of their peculiar nature, successfully resisted all attempts to usurp them. Were it not for the ease of transformation, the life of alternating-current systems would be very short.

But in this fact lies its strength; it is simple and convenient and in certain cases, most economical. The transformer of an alternating-current system consists of a complete magnetic circuit and two coils. A ring of laminated Swedish iron with a coil on each side comprises the total apparatus.

The iron is called the frame of the transformer and the two coils, the

- Primary, and
- Secondary.

The Primary.—This coil is usually of finer wire than the other. It is the one which receives the current direct from the dynamo and turns it into magnetic energy. It must be carefully insulated from the iron frame and the other coil. In daily practice the primary receives anywhere from 1,000 to 2,000 volts; its function is to magnetize and demagnetize the iron of the frame. For this purpose the coil is specially designed, because it generates a lot of heat when these rapid reversals occur. The primary is made with the proper radiating surface to admit of the rapid emission of heat. It is wrapped around in several layers of insulating tape and in some cases dipped in oil and kept there. The resistance in ohms of the primary is not the only factor which prevents the current from the dynamo injuring it. There is a back electromotive force, called self-induction, which holds the dynamo-pressure in restraint. Its full effect is only felt when the secondary is supplying its full number of lamps with current. As an automatic valve, it is unequalled in its unflinching action at all times and under all circumstances. Were it not for the presence of this invisible regulator, the use of transformers could only be carried on with great difficulty. When the current flows into the primary the magnetized coil at once affects the secondary and causes it to generate an E. M. F.

The Secondary.—The principle elucidated now comes into direct application. The coil has been magnetized for an instant. Another coil wrapped around the iron in a similar manner to the primary is thus subjected to the influence of those lines of force the primary has just generated. If 100,000,000 of these lines of magnetic force sweep through the coil but once in a second, and the secondary consists of only one turn, the pressure developed in it will equal one volt. The design of a transformer hangs upon this fact

## ROENTGEN RAYS.

### Unaffected by Gravitation.

We are now assured that there is something in the universe which has no gravitative property at all, namely the ether. It was first imagined in order to account for the phenomena of light, which was observed to take about eight minutes to come from the sun to the earth. Then Young applied the wave theory to the explanation of polarization and other phenomena; and in 1851, Foucault proved experimentally that the velocity of light was less in water than in air, as it should be if the wave theory be true.

### A Universal Medium.

It was Faraday who put a stop to the invention of ethers, by suggesting that the so-called luminiferous ether might be the one conceived in all the different phenomena, and who pointed out that the arrangement of iron filings about a magnet was indicative of the direction of the stresses in the ether. This suggestion did not meet the approval of the mathematical physicists of his day, for it necessitated the abandonment of the conceptions they had worked with, as well as the terminology which had been employed, and made it needful to reconstruct all their work to make it intelligible.

### Function of the Ether.

We now have experimental proof as well as theoretical reason for believing that the ether, once called luminiferous, is concerned in all electric and magnetic phenomena, and that waves set up in it by electro-magnetic actions are capable of being reflected, refracted, polarized and twisted, the same as ordinary light waves can be, and that the same laws are applicable to both.

Albany, N. Y.—Sealed proposal for furnishing the necessary materials and performing the labor for erecting and installing the electric wiring and the fixtures for the north wing, dining-room extension for disturbed patients at the south wing, and the dining-room addition to ward eleven of the main building of the Hudson River State Hospital, near Poughkeepsie, N. Y., may be sent by mail or delivered in person up to twelve o'clock noon, August 6, 1896, to Hon. Amasa J. Parker, President of the Board of Managers, at the Hudson River State Hospital, Poughkeepsie, N. Y., at which time and place the Board of Managers will receive and open all proposals.

New York City.—Plans have been filed by the Hobart Estate, of San Francisco, Cal., for the erection of a fifteen-story brick and steel hotel, at Nos. 1372-1382 Broadway, and 121 W. 37th street, and 114 W. 38th street. Cost, \$2,000,000.

New York City.—The North River Electric and Power Co. will erect a one-story brick power house at the foot of 140th street, to cost about \$22,000.

Cumberland, Md.—The city government is considering the matter of putting in an electric light plant at its own expense.

Amherstburg, Ont., Can.—Architect A. B. Wood has prepared plans for the erection of a hotel, for L'Hotel Oriental of this place, at a cost of \$10,000. Two steel boilers, engines, 250 H. P., 2,000-light dynamo, etc., will be installed.

New York City.—The Y. M. C. A. is going to erect two more new brick club houses. One of the buildings is to be erected at 158 to 162 East 87th street. Architect, James E. Ware, 487 Fifth avenue. William E. Knowles, 111 Fifth avenue, has drawn plans for the other building, to be erected at 72 and 74 West 124th street. The structure will be three stories high and cost \$70,000.

Greenbush P. O., Albany, N. Y.—An electric railroad is to be built from Greenbush to Nassau.

Exeter, N. H.—The Exeter Boot and Shoe Co. is arranging to light its factory with electricity.

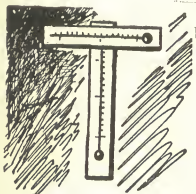
## NEW YORK AS A SUMMER RESORT.

A little book with this title, bearing the imprint of the American Bank Note Co., has just been issued by the Passenger Department of the New York Central as No. 19 of its popular "Four-Track Series." Perusal of its pages will reveal the fact that New York is not only one of the world's greatest cities, but that it is in all essential's the greatest summer resort in the world. No other resort has such amusement palaces, such hotels, such facilities for boating, bathing and fishing, such a variety of features for the entertainment and care of summer visitors.

The beautiful little book contains sights and scenes that will gladden the heart of any New Yorker. To strangers, as a souvenir of their visit, it will revive recollections otherwise forever gone. The elegant little photographic reproductions are unexcelled in their pure realism. We live in a mighty city; these sketches will soon prove it to you.

The New York Central is doing the public a real service in calling attention to attractions to be seen nowhere else on this continent.

A copy of "New York as a Summer Resort" will be sent free, post-paid, to any address, on receipt of two 2-cent stamps by George H. Daniels, General Passenger Agent, Grand Central Station, New York.



THE Interior Conduit and Insulation Company had the most unique and attractive exhibit at the recent Electrical Exposition. The eye of the visitor was immediately attracted by the large electric sign spelling out the name of the company. An interesting technical exhibit was the combination of a 2-h. p.

Lundell motor directly connected to a pony two-revolution printing-press, running at about 175 revolutions per minute. Exhaust fans and Sturtevant blowers were in operation, driven by Lundell motors directly connected.

A Mason & Hamlin two-manual organ, to which was attached the standard Lundell Organ Blowing outfit, was operated in the evenings by an organist.

The combination little electric light plant, consisting of a Case engine, directly connected to a 10 h.p. Lundell generator, on one bed plate, had the appearance of being both compact and of commercial utility.

The Company exhibited to the public for the first time their complete line of new underground conduits for the reception of trolley feeders, telephone and telegraph cables and electric light wires. Samples were also given to visitors of the new steel-armored interior conduit.

A very good idea of the exhibit can be gained from the accompanying illustration.

Mr. H. C. Mercer made a report on his recent exploration of certain caves in Tennessee which he had been able to prosecute under the patronage of the University of Pennsylvania, mainly through the liberality of Dr. William Pepper. In Zirkel's cave, on Dumping Creek, Jefferson County, Tenn., crusts of breccia projected from the walls and hung from the roof. From this material the teeth of the tapir, peccary, etc., projected, while in the cave earth below were found bones, nuts, two pieces of Nndian pottery and fragments of mica, probably indicating Indian cave burial. There were, therefore, two ages indicated: One ancient, by the breccia, and the other by the cave earth, comparatively recent. All the fossil remains belonged to the breccia and there was no association between them and the indications of human life.—Science.

## Interesting Facts in Science.

Mica Mines.—An interesting geological fact is that the wild and apparently worthless mountain region around Bakersville, N. C., is the main source of mica supply for the United States. Mica mining is one of the greatest industries in North Carolina, and has yielded fortunes to those engaged in it. Mica is found in all sorts of blocks of various thicknesses and shapes, and can be split and resplit almost ad infinitum, or until it becomes the thin, transparent, flexible wafer of commerce; the material is by nature embedded in or scattered through the feldspar in masses large or small, close together or far apart, and is blasted from the rocks by means of dynamite, the purer veins being found between walls of slate. From the mines it is taken to the 'shops, where it is split into thin sheets, trimmed into regular forms, and made ready for the market, the price varying with the size and color of the sheets. The average size is about 4 by 6, though rare sheets of 24 by 18 inches are sometimes found.—Tradesman.

## TELEPHONE VS. TROLLEY.

Tuesday, in Montreal, Judge Davidson rendered judgment dismissing the action of the Bell Telephone Company against the Montreal Street Railway Co. The case is an interesting one. The suit of the telephone company was for \$30,000 damages. The introduction of the electric trolley car system into Montreal in 1892, the plaintiff claimed, caused and has been causing ever since, serious disarrangement of the telephone service, necessitating the adoption of a number of expensive contrivances to counteract the effect of the presence of the trolley wires. We have not the judge's reasons for his ruling, but his action on general principles seems sound. When the telephone company erected their poles and stretched their wires along the streets of Montreal they undoubtedly did so subject to whatever improvements the city might see fit to make of its own motion, or might allow other parties to introduce. No monopoly of the streets was granted the telephone company. When, therefore, the time for electric propulsion of street cars arrived it was adopted, and the Montreal public were given the benefit of the invention. There seems no reason in equity why the telephone company should not be made to adjust itself to the new conditions without levying upon the street railroad company and through them on the public.—Salem (Mass.) "Mercury-Gazette."

## A VOLATILE SOLVENT FOR COTTON.

It is stated that a London chemist has discovered a volatile solvent for cotton—that is to say, the liquid, whatever it is, dissolves cotton, then it evaporates and leaves pure cotton behind in an amorphous pulp. The pulp may be rolled just as paper pulp is rolled into a homogeneous fabric of any thickness required. All the attempts to dissolve cotton hitherto have been unsuccessful. The nearest that has been attained is the conversion of the fibre into the amorphous condition known as cellulose, from which nitroglycerine and zylonite are made. These modifications of cellulose are highly dangerous, being subject to spontaneous combustion. The new solvent, however, does not change the chemical nature of the cotton fibre—it is cotton though not fibrous, after deposition from solution.—The Indian Textile Journal.

The Niagara Falls are reckoned to do as much work as 266,000,000 tons of coal could do in a year, taking the consumption of fuel at four pounds per horse-power per hour. That is to say, almost exactly as much as all the known coal in the world could do in one year.—Indian Textile Journal.

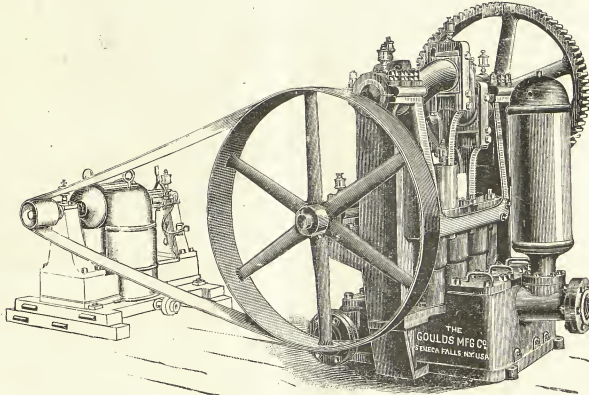


GOULD'S PUMPS.

The Goulds Manufacturing Co. have a plant for the manufacture of pumps which meets in every respect the requirements of the trade. Their Triplex Electric Power Pump is designed to carry a pulley and is driven by a motor. No special foundation is required and the pump and motor may be placed upon any support ten or twelve

feet apart. The pump has a large valve area, which allows of smooth running at high speed. Each connecting rod has bronze-bushed bearing in plunger and strap head at crank, with phosphor-bronze box, and adjustment for wear. The gear is machine-cut and pinion rawhide with bronze shroud. The working parts may be made of bronze, if so required. This pump can be

engineer the economy of high pressure steam multiple expansion engines; the efficiency of electric generators at 95 per cent. or better; the efficiency of electric motors at 90 per cent. or better, and the ease and safety with which electric conductors can be placed in a mine.  
The horizontal triplex pump they sell is mounted on a truck, to facilitate moving it about in the mine. The plungers are phosphor-bronze and outside packed. The cylinders and glands are bronze-lined. The gearing is

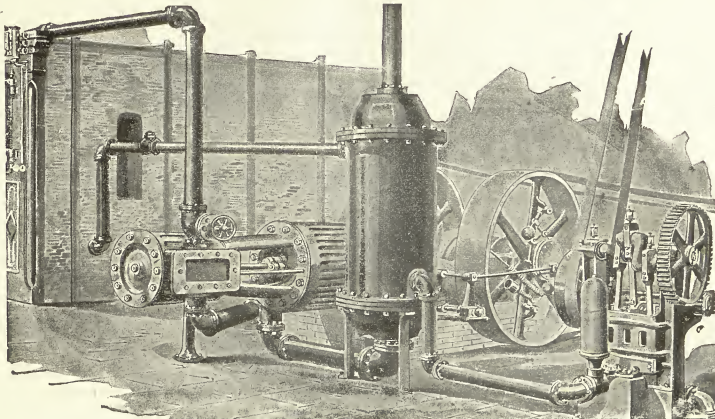


TRIPLEX ELECTRIC POWER PUMP.

feet apart. The pump has a large valve area, which allows of smooth running at high speed. Each connecting rod has bronze-bushed bearing in plunger and strap head at crank, with phosphor-bronze box, and adjustment for wear. The gear is machine-cut and pinion rawhide with bronze shroud. The working parts may be made of bronze, if so required. This pump can be

machine-cut and runs quietly. The motor pinion is of bronze. Adjustments for taking up the wear are provided. The truck complete is included with the pump, but not the motor.

The Gould's triplex power boiler feed pump is used in steam plants where compound engines are used, with boilers carrying steam at 100 to 150 pounds pressure.



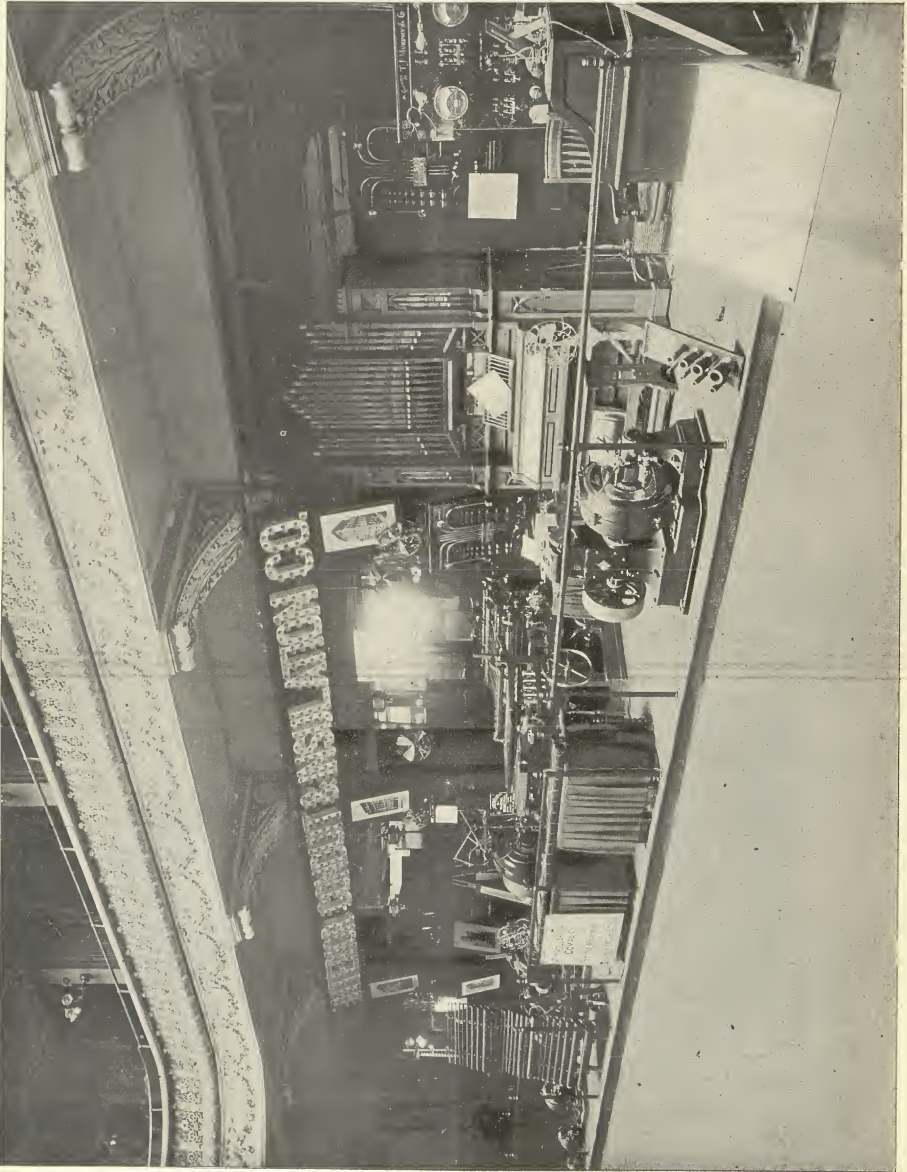
TRIPLEX HIGH PRESSURE BOILER FEED PUMP.

used for elevations to 300 feet, or equivalent pressure. The sketch illustrates the method of pumping and the installation of a complete outfit for this purpose. The portability, compactness and convenience of the Goulds Manufacturing Co.'s Triplex Electric Mine Pumps cannot be excelled.

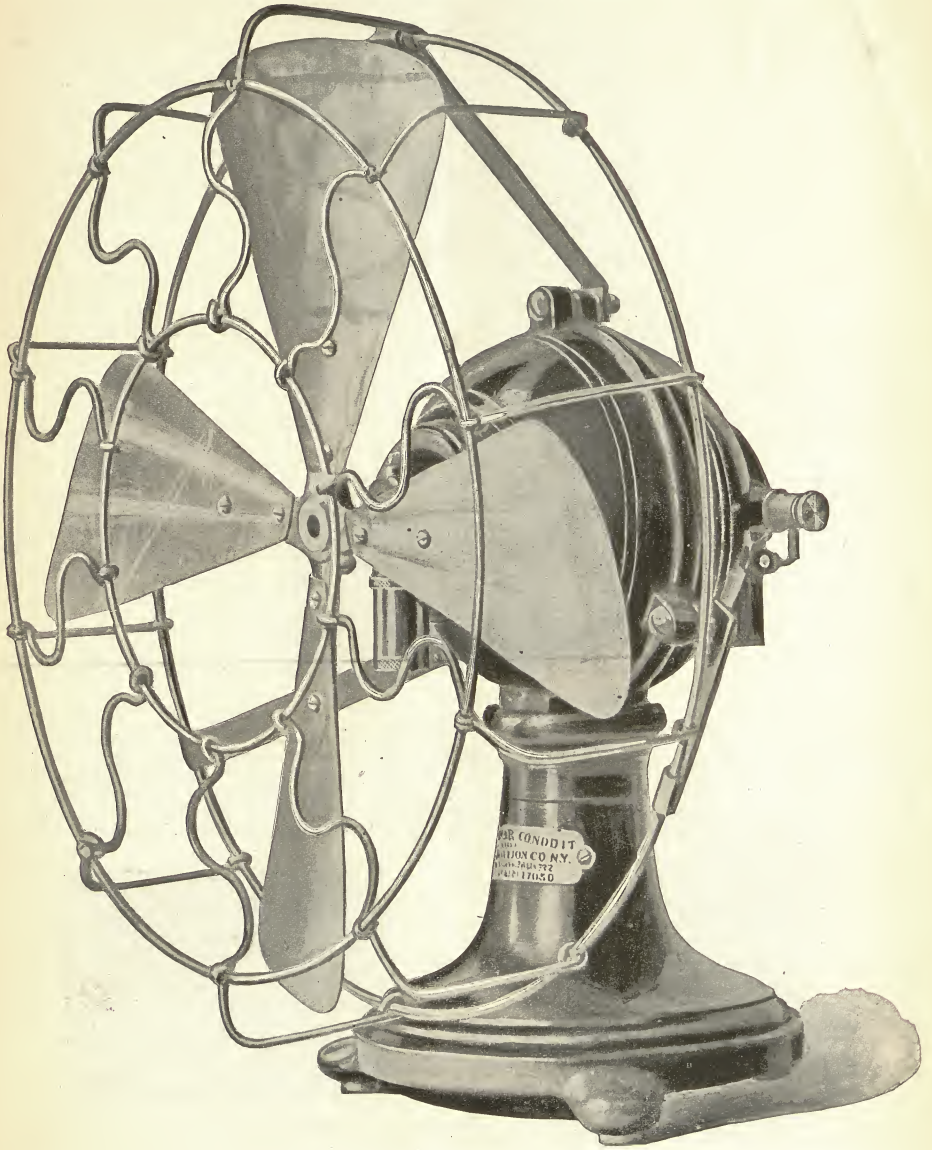
Their plan of using such happy combinations shows their shrewdness and long-headed business tact. They say: "At this point we would suggest to the mining en-

The economy of a geared power pump for a boiler feeder as compared with the direct acting steam pump has been long recognized by intelligent engineers. In all respects this company can claim just credit for the superiority of their work and the rapidity with which they supply pumps for all kinds of work.

The Goulds Manufacturing Co. have their large factory and main office at Seneca Falls, N. Y., and their warerooms at No. 16 Murray street, New York,



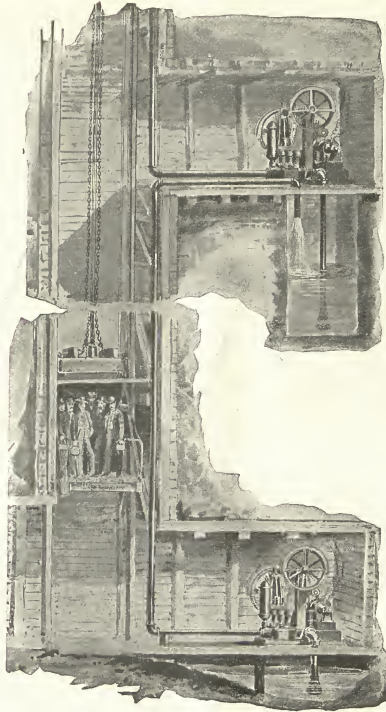






A large variety of pumps are shown in the sketches, which serve every imaginable purpose in mining and steam engineering.

able opaque coloring is obtained that is more solid than could be produced by any one of the compositions used, under the same conditions. This addition can amount to

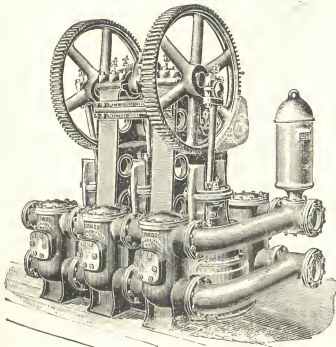


TRIPLEX ELECTRIC MINE PUMP IN OPERATION.

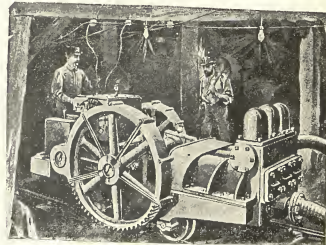
### EASILY FUSIBLE OPAQUE GLASS

The opaqueness obtained in fusible glass used for enameling, glazing, etc., by the addition of alkali fluorides

to per cent. of the batch. The same result is obtained when the combinations named are added to glass which already has been melted together with alkali or silica fluorides; of course, the whole mass has to be remelted in this case. Fluoride or silico-fluoride of tin, fluoride or silico-fluoride of cerium and fluoride of boron



DOUBLE-ACTING TRIPLEX POWER PUMP.



TRIPLEX ELECTRIC MINE PUMP.

or silica fluorides is known to be not very lasting. But if there are added to such a batch combinations of tin or cerium, for instance, fluoride of tin or cerium, an unalter-

used each for itself will produce equally unalterable opaque glass.—*Moniteur de la Ceramique et de la Verrerie.*

Montreal, Canada.—The Lachine Rapids are to be used to generate electricity for lighting Montreal.

POSSIBLE CONTRACTS.

Mason City, Ia.—A 25-year franchise has been granted for an electric street car system at Mason City. A line will also be built from that city to Clear Lake, a distance of ten miles. Work will be commenced within sixty days. Capitalists: L. B. Bradley, of Des Moines, W. E. Brice and L. A. Ong, of Tama. It is proposed by them to build 17½ miles of trolley street car line, and to put in a first-class plant of the latest improvements.

Washington, D. C.—Sealed proposals will be received August 11 for a hydraulic or electric passenger elevator for the United States Custom House and Post-Office building in Newark, N. J., in accordance with the drawings and specifications, copies of which may be had at this office or the office of the custodian, Newark. Wm. Martin Aiken, supervising architect.

Trenton, N. J.—Another new trolley road to connect Trenton and Philadelphia has been projected, and its speedy construction, according to the backers of the enterprise, is positively assured. It is to run from Fox Chase, the terminus of one of the Union Traction Co.'s branch lines, across the country for a distance of about 22 miles to the New Jersey capital.

Rockville Centre, L. I., N. Y.—The lighting question is again being agitated by the people of Rockville Centre.

Bangor, Me.—The special committee appointed by the city council for the examination of the street lighting system and its improvement has arranged for the purchase of a new plant.

New York City.—There is a plan on foot among the members of the New York Turn Verein, who occupy the large building at 66 East 4th street, to move uptown. The trustees are making estimates with a view of erecting a \$100,000 building on their plot at 85th street and Lexington Avenue.

Brooklyn, N. Y.—Percy G. William and Thomas Adams, Jr., owners of Bergen Beach, are in negotiation with a Philadelphia capitalist for the sale of about six acres of land with a large water front. The scheme involves the erection of a mammoth hotel and floating theatre. Estimated cost, \$1,000,000.

New York City.—A four-story brick municipal school is to be erected by the City of New York on Union avenue, west of 149th street, at a cost of \$100,000.

New York City.—Cyrus L. W. Eidlitz has completed plans for the erection of the building for the Western Electric Company, to be erected on the southeast corner of Bethune and West streets. It will be of brick, stone and terra cotta, ten stories in height and fireproof. The estimated cost of the structure will be about \$1,000,000.

Piedmont, W. Va.—Prices and information are being secured by the street committee in regard to an electric light plant, which the council think of installing in connection with the pumping station.

Port Richmond, S. I., N. Y.—The Midland Electric railroad is about to lay a double track on Jewett avenue and Richmond terrace, Port Richmond.

Morristown, N. J.—Work on the proposed trolley road at Mt. Arlington, Lake Hopatcong, has been postponed until September 18, when it will be hurriedly pushed to completion.

NEW CORPORATIONS.

Lyons, N. Y.—A corporation capitalized at \$60,000 to be known as the Wayne County Traction Company, to construct and maintain an electric railroad between Lyons and Newark, has been formed. President, A. C. Roberts, Athens, Pa. Vice President, Orlando F. Thomas.

New York City.—The Fischer Electric Clock Co., to manufacture electric clocks in New York City. Capital, \$100,000. Directors, James C. White, Frank L. Sheldon, 10 Wall St., and Edward Righter, of New York City.

San Francisco, Cal.—The M. Kollman Company, dealers in electrical devices, has been incorporated with a capital stock of \$100,000.

New York City.—A German cable company has been formed under the name of the Deutsche Seetelegraphengesellschaft, with a capital stock of \$800,000, to lay a cable between Germany and Spain, which will probably be continued to the United States later on.

Columbus, O.—The Century Power and Lighting Company has been incorporated with a capital stock of \$10,000.

Buffalo, N. Y.—The F. P. Jones Co. has been organized to manufacture electrical apparatus, with a capital of \$21,000. Directors: F. P. Jones and others.

Jefferson City, Mo.—The Montezuma Electric Co., of St. Louis, has been incorporated with a capital stock of \$2,400, by A. Beck, O. Shamsen, Henrietta Plate, and others, to do a general electric business.

English, Ind.—An electric light company was organized. Joseph H. Finch is president; Wm. L. Gregory, vice-president and secretary. Capital, \$5,000.

NEW TELEPHONE COMPANIES.

St. Paul, Minn. Articles of incorporation have been filed with the Secretary of State by the American Telephone and Telegraph Co. of Minnesota. Capital stock placed at \$10,000. Limit of liabilities, \$100,000. The incorporators are Edward J. Hall, E. P. Meany, Melville Eggleston, J. C. Vailand, A. E. Holcombe. To construct, maintain and operate telephone and telegraph lines in the State of Minnesota.

Old Monroe, Md.—A stock company is being organized by E. R. Williamson and others, for the building of a telephone line between St. Charles and Old Monroe, and intermediate points.

St. Louis, Mo.—The Grant City Telephone Co., of Grant City, has been incorporated by A. A. Keko, J. E. Schoter, J. J. Baker, and others. Capital stock, \$1,000.

Houston, Tex.—The Bosque County Telephone Company filed its charter today, with a capital stock of \$1,000. The purpose is to build a line from Morgan to Meridian, in the same county, and other points.

TELEPHONE NOTES.

Jacksonville, Fla.—The entire Orlando telephone system was sold last Monday, under foreclosure, to the Phoenix Telephone Company, of New York. This is the company that furnished the 'phones, wires, etc. It is generally understood that they will not operate it themselves, but that they will sell to some other party.

Carrollton, Ill.—An ordinance has been passed granting a franchise to the Citizens' Telephone Company, which is to connect neighboring cities with Carrollton.

Manchester, N. H.—The telephone system is to be extended from Epsom to Northwood Narrows.

Effingham is to have telephone connection.

Cottage Grove, Ore.—A telephone line is being constructed from Willamina, through Sheridan and Ballston, to McMinnville, where it will connect with the long distance line.

Milwaukee, Wis.—The Northwestern Electric Telephone Company has been granted a franchise to put in a system at Racine.

TELEPHONE PATENTS.

ISSUED JUNE 30, 1896.

562,807. Telephone Attachment. Will W. Dale, Fostoria, Ohio, assignor of two-thirds to Levi Harbaugh and S. L. Ghaister, same place. Filed July 10, 1895.

562,906. Signaling Apparatus for Telephone Lines. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed October 29, 1895.



- 563,073. Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 12, 1895.
- 563,084. Telephone System. James G. Smith, New York, N. Y., assignor of one-half to Robert G. Vassar, same place. Filed August 6, 1894.
- 563,245. Telephone-Switchboard System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed November 4, 1895.

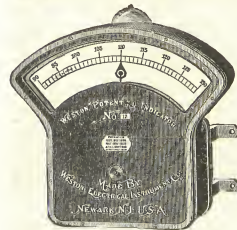
Ralph S. Townsend, No. 1300 Broadway, architect, has prepared plans for a brick office building to be erected at Nos. 12-16 John street, for the Anderson estate, Jerome avenue, near 165th street, at a cost of \$175,000.

## ELECTRICAL and STREET RAILWAY PATENTS.

Issued June 30, 1896.

- 562,796. Electric Railway. Henry Brandenburg, Chicago, Ill., assignor to Charles Austin Bates. Filed March 11, 1895.
- 562,806. Conduit for Electrical Conductors. James F. Cummings, Detroit, Mich., assignor of two-thirds to Charles H. Freeman and William C. Yawkey, same place. Filed March 4, 1895.
- 562,808. Means for Protecting Underground Electrical Conductors. Frederick Davis and Rookes E. B. Crompton, London, England. Filed April 11, 1893. Patented in England February 1, 1892, No. 1,878, and in Belgium May 6, 1893, No. 104,590.
- 562,850. Electric Gas-Lighting Apparatus. Frank O. Plummer, Worcester, Mass., assignor to himself and Edwin W. Ham, same place. Filed August 16, 1895.
- 562,864. Dynamo-Electric Machine. Norman W. Storer, Wilkingsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. Filed October 2, 1895.
- 562,868. Dynamo-Electric Machine. Charles C. Warren and Halbert B. Warren, Chicago. Filed January 31, 1896.
- 562,870. Car-Fender. Octavius A. White, New York, N. Y. Filed January 18, 1894.
- 562,890. Electric Railway. Bruce Ford, Johnstown, Pa. Filed August 30, 1895.
- 562,891. Electric Hand-Lighting Gas-Burner. George J. Galbraith, Boston, Mass., assignor to the Electric Gas Lighting Company, same place. Filed April 18, 1896.
- 562,894. Electric-Railway. William E. Hanshue, Kalamazoo, Mich., assignor of three-fourths to Edgar E. Brownson and Edmund S. Rankin, same place. Filed February 27, 1894.
- 562,904. Trolley-Wheel. Ignatius B. Metzger, Canton, Ohio. Filed June 20, 1895.
- 562,917. Thermostat. Charles B. Rogers, Stevenson, Md. Filed April 1, 1896.
- 562,924. System of Electrical Distribution. Gordon J. Scott, Philadelphia, Pa. Filed January 3, 1896.
- 562,925. Automatic Speed Controller for Electric Cars. Henry A. Seymour, Washington, D. C. Filed May 19, 1896.
- 562,929. Electric Signal. Charles H. Sherwood, Utica, N. Y., assignor of one-half to Henry C. Lyman, Sherburne, N. Y. Filed October 21, 1895.
- 562,937. Electric Hand-Lighting Gas-Burner. Henry C. Thomson, Boston, Mass., assignor to the Electric Gas Lighting Company, same place. Filed April 18, 1896.
- 562,942. Car-Fender. Harold A. Webster, Haverhill, Mass., assignor to Herbert B. Newton, same place. Filed March 30, 1896.
- 562,972. Trolley. Charles E. Powell, Bryn Mawr, Pa. Filed September 19, 1895.
- 562,980. Cut-Out for Electric Circuits. George W. Scovil and Edward F. Gooding, Elgin, Ill. Filed August 27, 1895.
- 563,016. Electrode for Galvanic Belts. Edmund S. Collicott, London, England. Filed May 18, 1896.
- 563,025. Electric Signaling Apparatus. Mortimer Du Perow, Washington, D. C. Filed August 3, 1895.
- 563,032. Electric Heater. William S. Hadaway, Jr., New York, N. Y. Filed February 27, 1896.
- 563,033. Automatic Alarm for Postal Chutes. Timothy F. Hagerty, Woburn, Mass. Filed January 21, 1896.
- 563,052. Electric Program-Clock. Dora Ogden, Columbus, Ind., assignor of one-half to Gernie L. Reeves, same place. Filed October 12, 1895.
- 563,062. Car-Fender. Richard B. Pullan, Cincinnati, Ohio. Filed January 9, 1896.
- 563,094. Electric Railway. James Tatham, Philadelphia, Pa. Filed September 1, 1891.
- 563,109. Car-Fender. Oscar L. Whitney, Cambridge, Mass. Filed September 21, 1895.
- 563,127. Galvanic Battery. Edward S. Boynton, Brooklyn, N. Y. Filed February 21, 1895.
- 563,148. Telegraph Alphabet. Samuel V. Essick, Yonkers, N. Y. Filed September 16, 1895.
- 563,149. Telegraphy. Samuel V. Essick, Yonkers, N. Y. Filed September 27, 1895.
- 563,203. Fire-Alarm. Josiah R. McCoy, Marshalltown, Iowa. Filed July 10, 1893.
- 563,232. Hanger for Lamps. Erastus F. Hershaw, Abingdon, Ill. Filed March 13, 1896.
- 563,244. Electric-Railway Trolley System. Willie C. Keithly, San Francisco, Cal. Filed October 22, 1895.

## WESTON STANDARD ILLUMINATED DIAL STATION INSTRUMENTS.



THESE INSTRUMENTS are based upon the same general principle and are just as accurate as our regular Standard Portable Direct Current Voltmeters and Ammeters, but are much larger, and the working parts are enclosed in a neatly designed dust-proof cast-iron case, which effectively shields the instruments from disturbing influences of external magnetic fields.

## WESTON ELECTRICAL INSTRUMENT CO.

114-120 William St., Newark, N. J., U. S. A.

# VULCANIZED FIBRE COMPANY,

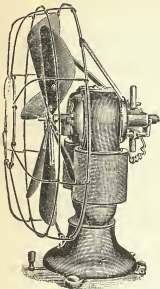
Established 1873.

SOLE MANUFACTURERS OF HARD VULCANIZED FIBRE

In Sheets, Tubes, Rods, Sticks and Special Shapes to order. Colors, Red, Black and Gray. Send for Catalogue and Prices.

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## The Eck Fan Motor

Based and shipped to any part of the United States on receipt of price, **\$15**

**EFFICIENT, DURABLE, PERFECT IN DESIGN,**  
Neat in Appearance, Economical and Self-Oiling, combining all the latest improvements. Address for circulars and prices.

Manufacturer of  
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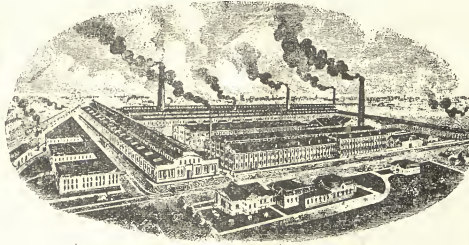
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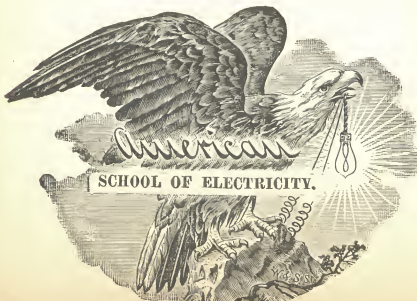
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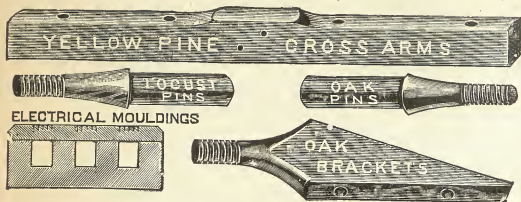
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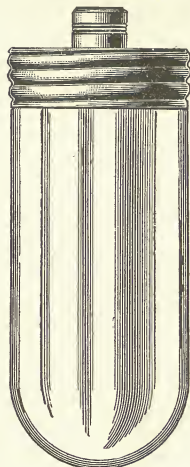
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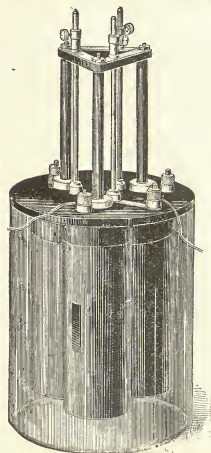
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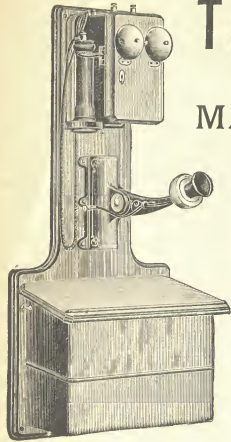
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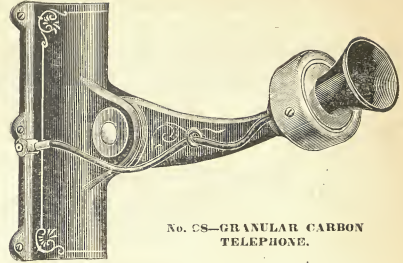
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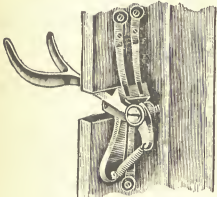
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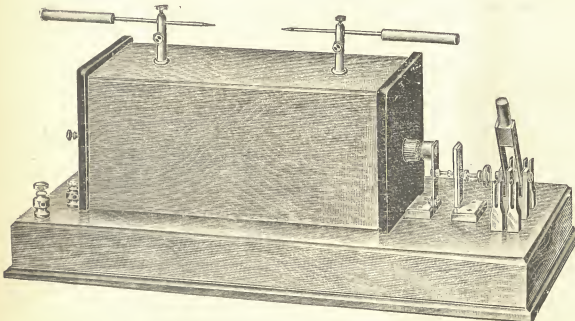
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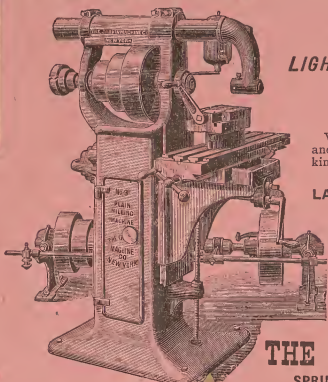
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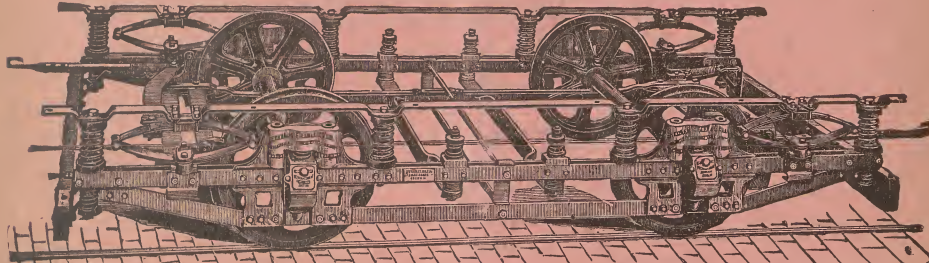
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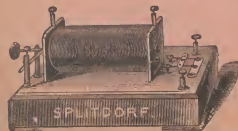
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