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## IEWS, NEWS AND INTERVIEWS.

"A lot of energy is wasted," said the man with the bulging forehead, "by these new-fangled, four-leaved revolving doors that you encounter in the front entrances to all the hotels and office buildings nowadays. Properly geared up with a dynamo they ought to be a good and economical source of electric power, especially if they are used in connection with a storage battery. Of course, a speed regulator is a necessary part of the scheme, and—well, I'm at work designing one now."

In the Hawaiian Islands there are said to be 2,000 telephones to a population of 110,000, or one telephone to every 52 inhabitants. On the Island of Oahu, on which Honolulu is situated, there are 1,090 telephones to a population of about 45,000, or about one to each 41 of the population.

The famous Hoosac tunnel, near Fitchburg, Mass., will soon be ventilated thoroughly. One of the largest ventilating fans ever built will be placed at the western end of the tunnel, in the hope of solving a problem that has baffled engineers ever since the work of boring the mountain was finished in 1875. The fan will be 16 feet in diameter, with a capacity of drawing 600,000 cubic feet of air per minute. The fan will be driven by electric power. When the fan is in operation it will suck the smoke-laden gas and atmosphere from the tunnel. With the interior of the tunnel clear, trains will be enabled to run at a faster rate of speed.

The changes that electricity has wrought in metallurgical processes have acted to render less expensive many of the rarer metals. Callium, the rarest metal, as produced by electrical processes, is 230 times as expensive as gold.

A conductor on the Brooklyn Heights Railroad Company, of Brooklyn, N. Y., who had been injured in three trolley-car accidents within six

months, recently went to the offices of the company and threatened to shoot President Rossiter and other officers of the company unless certain de-

suggestion has, it will be remembered, been confirmed by Dewar's experiments. Other observations, according to a London contemporary, seem

## SOME EXPERIMENTS IN TESLA'S LABORATORY WITH CURRENTS OF HIGH POTENTIAL AND HIGH FREQUENCY.

TO THE EDITOR OF ELECTRICAL REVIEW:

Since the unfortunate accident of four years ago, which crippled and delayed my labors in a number of lines so seriously, I have had but little time to devote to the fulfillment of a duty which, next to that of turning his best efforts to diligent inquiry in the fields he has chosen, is the most important to a scientific man; namely, that of giving an exact record of the results obtained. I realize with sorrow every day that, despite of all pains taken to this end, I am gaining but very slowly on the material accumulated. Ideas come through a happy inspiration, apparently without much exertion, but it is the working out of the many harassing details and putting into a presentable form which consumes time and energy. It was impossible to abandon research in new directions, in which I have felt myself irresistibly drawn, and it was equally impossible to do full justice to the work partially completed, and I can only hope to gradually retrieve my losses by the only expedient available, which is to redouble the zeal. It is not the best plan to follow, I confess, and is in radical opposition to the kindly advice given to me by a great philosopher, but this admission may serve to refute the statements attributed to me to the effect that I intended to live 200 years by sleeping most of the time! It may also show that it is not this mode of life which is responsible for the delay in the commercial introduction of my system of vacuum tube lighting, as has been asserted by some people who have found a singular satisfaction in dwelling extensively in their columns on my proposed glass house on Long Island, which was to cover acres of ground, and which was to be built for the purpose of catching the sun's rays; on my claims of the discoveries

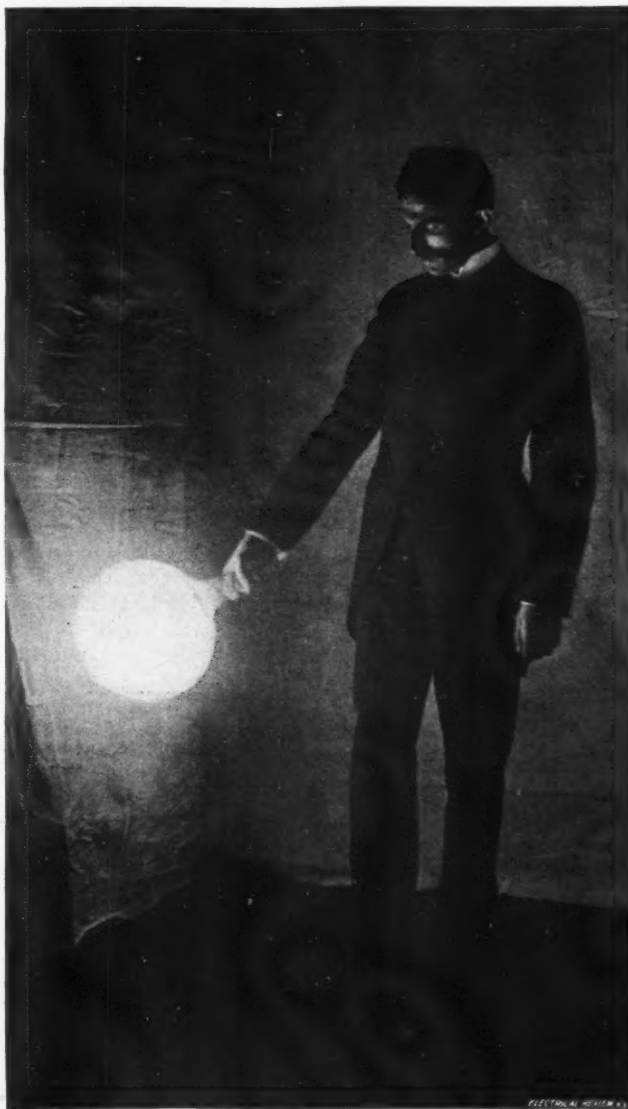


FIG. 1.—"SOME EXPERIMENTS IN TESLA'S LABORATORY WITH CURRENTS OF HIGH POTENTIAL AND HIGH FREQUENCY"—LIGHTING A DISCONNECTED VACUUM BULB OF 1,500 CANDLE-POWER BY HIGH-FREQUENCY CURRENTS—PHOTOGRAPH TAKEN BY THE LIGHT OF THE BULB ITSELF, EXPOSURE ABOUT TWO SECONDS.

mands he made were satisfied. He was arrested.

Clausius some years ago predicted that the electrical resistance of pure metals should vanish near the absolute zero of temperature, and this

to show that the specific heat of such metals should also vanish at zero temperature. Hence, were it possible to cool a metal to this degree, its properties would be such that an indefinitely small addition of heat would raise its temperature appreciably.

of Roentgen; on my invention enabling me to move and explode torpedo boats by will power, and on my

abling scientific men to push investigation far out into these practically unknown regions? This work was

estimate how much science has been advanced by the beautiful instruments of measure which Lord Kelvin

that the conversion is economical. Another suggests to determine the efficiency of conversion through such a device by the calorimetric method. Now, as a matter of fact, if there was such a contrivance, absolutely perfect in its action, which would behave as I have explained on another occasion, and change the resistance of a gap from zero to infinity without any loss in the gap itself, it still might happen that 99 per cent of the energy supplied to the circuit would be wasted in radiations, useless for the purpose contemplated. The calorimetric method would in this, or generally in any other instance, in which the disturbances produced are very sudden, entirely fail in giving an approximation as to the energy dissipated in the circuit, for the simple reason that the friction encountered by a wave in its passage through a medium, which determines the amount of heat generated, is no measure whatever of the energy of the wave. Thus, certain well understood cases excepted, the only method at present available in such estimates is to take account of the energy consumed by the source of supply. This remark alone will show that the economical conversion of currents by make and break devices is a much more difficult problem than it appears to those who have studied it superficially. Not only must the devices used in the transformation possess certain character-

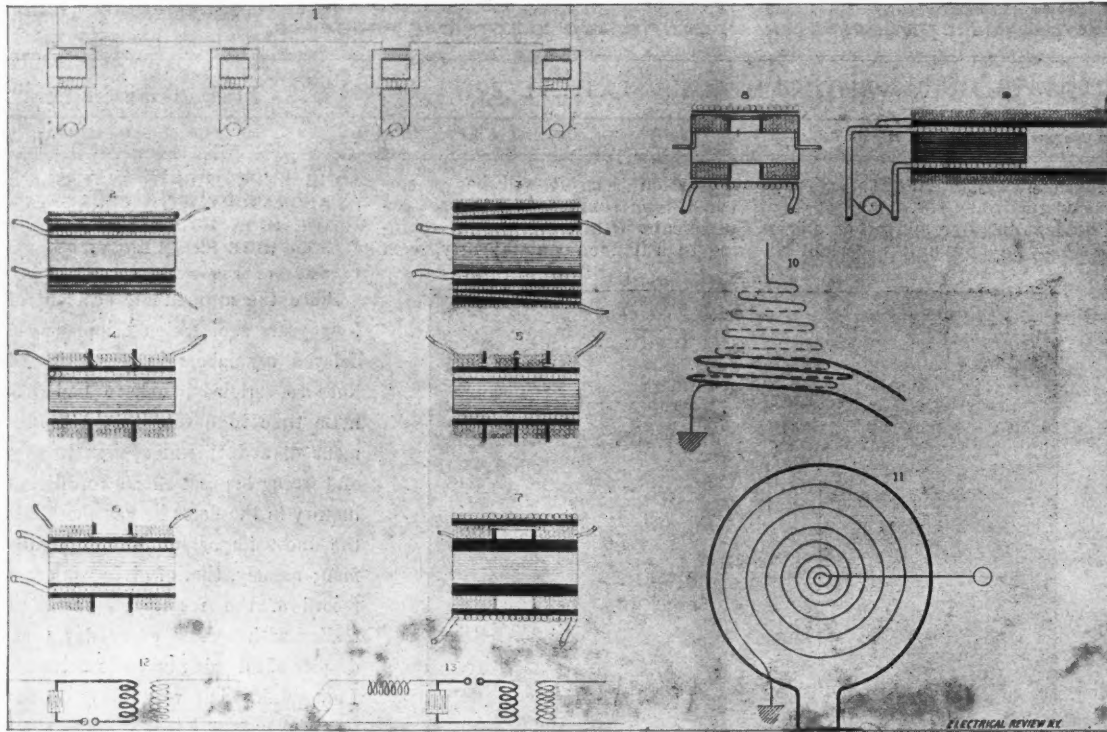


FIG. 2.—“SOME EXPERIMENTS IN TESLA'S LABORATORY WITH CURRENTS OF HIGH POTENTIAL AND HIGH FREQUENCY.”—TABLE OF DIAGRAMS ILLUSTRATING THE EVOLUTION OF A HIGH-TENSION TRANSFORMER ENABLING THE PRODUCTION OF ELECTRO-MOTIVE FORCES OF MANY MILLIONS OF VOLTS.

efforts to annihilate the entire British navy. It is to be hoped that the limit of patience of the readers has been finally reached.

At that time, still painfully remembered, my energies were taken up principally by some mechanical problems of great importance, and the few observations in electricity which I was fortunate to make came like ever so many refreshing berries found on the road by a weary wanderer. The journey is not finished yet, and the wanderer is well-nigh exhausted. He longs for more sweet berries, and anxiously asks, “Did any one pass this road before?”

It was chiefly in three directions that electrical investigation was attractive and promising: There were the excessive electrical pressures of millions of volts, which opened up wonderful possibilities if producible in practical ways; there were the currents of many hundreds of thousands of amperes, which appealed to the imagination by their astonishing effects, and, most interesting and inviting of all, there were the powerful electrical vibrations with their mysterious actions at a distance. What better work could one do than inventing methods and devising means for en-

difficult and tedious and involved a certain amount of material sacrifice, but promised a higher reward if suc-

cessfully accomplished—the gratitude of those many who exercise their gifts in different directions and are compelled to rely on the expert for providing them with implements suitable for their special purpose. Who can



FIG. 4.—PHOTOGRAPH SHOWING AN INCANDESCENT LAMP LIGHTED BY A SYNCHRONIZED CIRCUIT COMPOSED OF A WIRE LOOP AND CONDENSER, AND ENERGIZED BY WAVES TRANSMITTED FROM A DISTANCE.

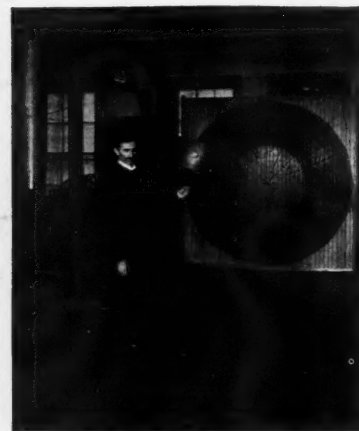


FIG. 5.—PHOTOGRAPH SHOWING AN INCANDESCENT LAMP LIGHTED BY MEANS OF WAVES TRANSMITTED THROUGH SPACE TO A COIL SYNCHRONIZED WITHOUT A CONDENSER.



FIG. 6.—EXPERIMENT ILLUSTRATING THE ACTION OF A SYNCHRONIZED CIRCUIT ENERGIZED BY WAVES TRANSMITTED FROM A DISTANT OSCILLATOR—THE ENERGY RECEIVED IS TRANSFERRED UPON ANOTHER UNRESPONSIVE CIRCUIT, LIGHTING THE INCANDESCENT LAMP ATTACHED TO THE SAME.

cessfully accomplished—the gratitude of those many who exercise their gifts in different directions and are compelled to rely on the expert for providing them with implements suitable for their special purpose. Who can

if one is to judge from statements frequently made in technical periodicals on a variety of subjects. An experimenter, for instance, measures the current through a make-and-break device, and, finding it small, he infers

istics, but the entire circuit must be properly designed. One can not help admiring the confidence and self-possession of experimenters, who put

forth carelessly such views and who, with but a few days', not to say hours', experience with a device, venture before scientific societies, apparently unmindful of the responsibility of such a step, and advance their imperfect results and opinions hastily formed. The sparks may be long and brilliant, the display interesting to witness, and the audience may be delighted, but one must doubt the value of such demonstrations. There

being the erroneous idea which they create in scientific circles as to the importance of an advance made. It grieves one to observe that, for example, such great work as that of Professor Dewar, which he turns out with clock regularity, is scarcely commented upon in the technical columns, whereas a worthless trap for interrupting currents, which usually consumes nine-tenths of the energy, and is, besides, useless for other reasons,

careful study, and have little to correct afterward.

The importance of the task of providing proper implements for research in these various fields once recognized, it became the question in what line the efforts to this end would be likely to be most profitable. A little thought showed that it was in investigating high electrical pressures, for these were needed in most instances. More than a passing thought was given to

high-pressure source with perfect ease and safety, no matter how high the tension. Soon, however, it was recognized that with the above object in view generators of steady pressure were entirely impractical, quite apart from their incidental limitations. It was exactly as if one attempted to drive piles into the ground by the application of continuous pressure. This would require cumbersome and powerful machinery, and would be

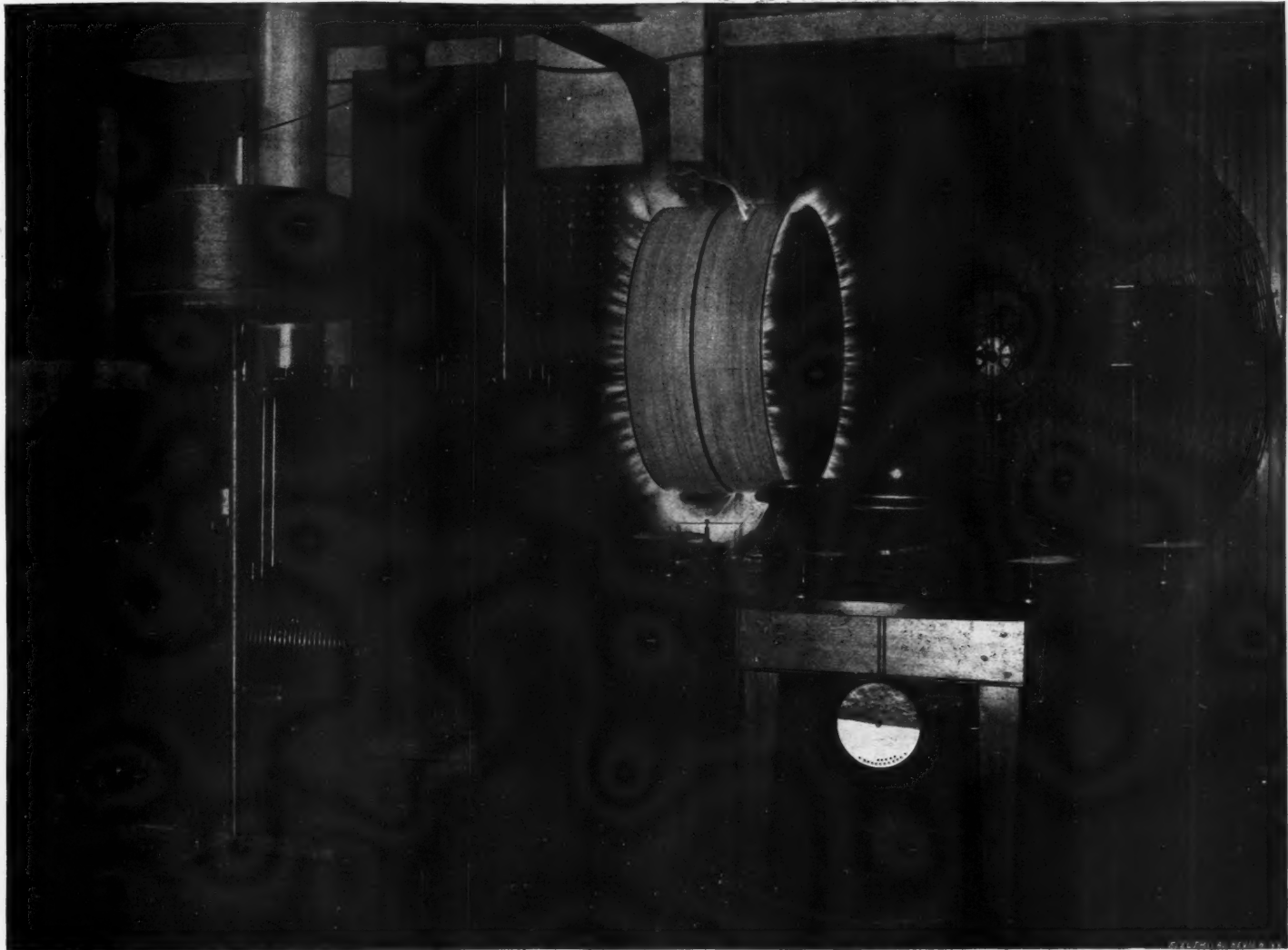


FIG. 3.—“SOME EXPERIMENTS IN TESLA'S LABORATORY WITH CURRENTS OF HIGH POTENTIAL AND HIGH FREQUENCY”—PHOTOGRAPH SHOWING A PART OF THE LABORATORY, WITH A DISCONNECTED RESONATING COIL SUPPORTED ON AN INSULATING STAND, AND ILLUMINATED BY THE STREAMERS PRODUCED, OTHER COILS REMAINING UNAFFECTED—THE PRESSURE DEVELOPED IN THE RESONATING COIL IS OVER HALF A MILLION VOLTS.

is so little novelty in them, that one might easily perform a practical joke on the lecturer by describing in advance all his drawings, apparatus, experiments and theories, thus placing him in an awful predicament. Though such a course would be naturally impolite, it might be found justified and excused by the circumstances, for premature expressions of opinion and demonstrations of this kind are responsible for much evil, one of these

and just suitable for the amusement of small boys, who are beginning their electrical experience with Leclanche batteries and \$1.50 induction coils, is hailed as an important scientific discovery. An agreeable contrast is afforded by those few who patiently investigate, contented to lose the credit for advances made rather than to present them to the world in an imperfect state, who form their opinions conscientiously, after a long and

static electricity, with the experiments of Franklin as starting point. Various forms of generators of static electricity were experimented upon, and some new ones designed, to which I hope to revert some time, as they present some features of interest. The most valuable outcome of these experiments was a method of conversion which I have described, and which enables the operation of any kind of devices of low tension from such a

very inconvenient. An incomparably better way of developing high pressure is by delivering violent blows as with a hammer. In such a case the motion of the hammer being suddenly arrested pressure is developed on the point of impact, which is all the greater the smaller the displacement caused, and if there were material absolutely rigid, incompressible and inelastic, an infinite pressure might thus be developed by a small blow.

Hence one is forcibly driven to the use of a transformer or induction coil as means for producing great electrical pressures. The first difficulty encountered was that of insulation, and it might be interesting and useful to show, chiefly to those who are less familiar with this special subject, how by gradual improvement, from the ordinary inductorium capable of furnishing currents of very moderate electro-motive force, an apparatus was finally evolved in which there is practically no limit as to the pressure obtainable.

Selecting first the closed core transformer, one easily recognizes that it is unsuitable for the attainment of the object in view for obvious reasons. Nevertheless, by adopting the plan illustrated in the first diagram of Fig. 2, I succeeded in obtaining nearly 200,000 volts, and I think that more than twice this tension is practicable by means of such an arrangement, which involves the use of independent and entirely insulated

of the closed-core type in the way of insulation, rate of change and frequency of the current impulses, led to the adoption of an open-core type,



FIG. 8.—PHOTOGRAPH OF THE EXPERIMENTER STANDING IN THE MIDDLE OF THE LABORATORY AND LIGHTING A VACUUM BULB BY WAVES FROM A DISTANT OSCILLATOR—HIS BODY IS, IN THIS CASE, SUBJECTED TO GREAT ELECTRICAL PRESSURE.

as a matter of course, and the various diagrams of the figure referred to illustrate the modifications as

indicated. In diagram 3 the succeeding layers are insulated by material increasing in thickness gradually from one end to the other, being thickest on the place of greatest difference of potential. The thickness is easily calculated beforehand, and is such that all the insulation is as nearly as possible uniformly strained. As it was impracticable to pile up many layers in the manner illustrated in diagram 3, naturally the modification illustrated in diagram 4 was made, which led to a further improvement, indicated in diagram 5. It was recognized, however, that there was no advantage in winding many coils, and that all that was needed were two secondary coils joined in the middle, as illustrated in diagram 6, the secondaries being, of course, wound as shown in diagram 3. Next, in order to increase the output of the coil and gain other advantages, the relative customary position of the primary and secondary windings was reversed and the coil as shown in diagram 7 produced, the

illustrated in diagram 6, as the primary and secondary coils were placed in closer inductive relation. But when with this coil the tension had been pushed far enough, it was found that the iron core limited the spark length, and then two insulated cores, one in each coil, were resorted to, which were finally discarded, and so the coil shown in diagram 8 resulted, which I have described on several occasions and which, of all other constructions, permits the attainment of the highest possible tension with a two-terminal coil in a given space.

But even in this perfected type it was not possible to go beyond a certain potential difference, and a further investigation led to a new type, which I have called a single terminal coil, and which is illustrated in diagram 9 and is now well known. In this coil the adjustment is so made that the secondary is nearly equal to a quarter of the wave length, the highest potential being, under these conditions, pro-



FIG. 7.—"SOME EXPERIMENTS IN TESLA'S LABORATORY WITH CURRENTS OF HIGH POTENTIAL AND HIGH FREQUENCY"—EXPERIMENT SHOWING A COIL ENERGIZED BY THE WAVES OF A DISTANT OSCILLATOR AND ADJUSTED TO THE CAPACITY OF THE BODY OF THE OPERATOR, WHO PRESERVES HIMSELF FROM INJURY BY MAINTAINING A POSITION AT THE NODAL POINT, WHERE THE INTENSE VIBRATION IS LITTLE FELT—THE PRESSURE ON THE END OF THE COIL TOWARDS THE READER, WHICH IS ILLUMINATED BY THE POWERFUL STREAMERS, IS NEARLY HALF A MILLION VOLTS.

sources for supplying the primaries, as will be understood from an inspection of the diagram without further explanation. The evident limitations

they were gradually made in the manner of insulating and winding of the coils. In diagram 2 the old, primitive method of insulation is in-

two secondary coils being joined on their outer, instead of on their inner ends, as before. This construction was considerably better than that il-

duced on the free terminal. Subsequently I extended such adjustment also to the coils in diagram 8, improving the same materially.



FIG. 10.—IN THIS EXPERIMENT THE OPERATOR'S BODY IS CHARGED TO A GREAT PRESSURE BY A DIRECT CONNECTION WITH AN OSCILLATOR—THE PHOTOGRAPH SHOWS A CONDUCTING BAR, CARRYING ON THE END A SHEET OF TIN OF DETERMINED SIZE, HELD IN HAND—THE OPERATOR IS ON THE TOP OF A STATIONARY ELECTRICAL WAVE AND THE BAR AND SHEET ARE BOTH ILLUMINATED BY THE VIOLENTLY AGITATED AIR SURROUNDING THEM—ONE OF THE VACUUM TUBES USED IN LIGHTING THE LABORATORY, THOUGH AT CONSIDERABLE DISTANCE ON THE CEILING, GLOWS BRIGHTLY, BEING AFFECTED BY THE VIBRATIONS TRANSMITTED TO IT FROM THE OPERATOR'S BODY.

During these efforts I fortunately discovered the important part which rapidly with the rarefaction of the atmosphere and augmentation of the

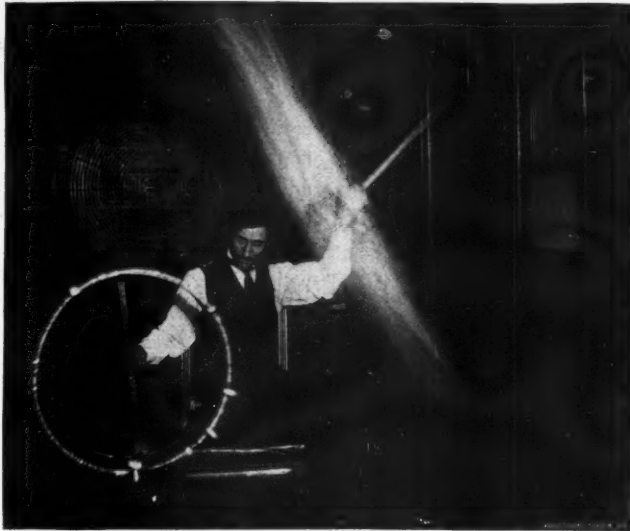


FIG. 9.—“SOME EXPERIMENTS IN TESLA’S LABORATORY WITH CURRENTS OF HIGH POTENTIAL AND HIGH FREQUENCY”—THE OPERATOR’S BODY, IN THIS EXPERIMENT, IS CHARGED TO A HIGH POTENTIAL BY MEANS OF A COIL RESPONSIVE TO THE WAVES TRANSMITTED TO IT FROM A DISTANT OSCILLATOR, AND A LONG GLASS TUBE WAVED IN THE HAND IS LIGHTED TO GREAT BRILLIANCY BY THE ELECTRICAL CHARGES CONVEYED TO IT THROUGH THE BODY.

air played in the breaking down of the insulation, and by adopting proper methods for the exclusion of gaseous matter, I was able to increase the electro-motive force to more than 10 times the value without breaking down the secondary. I have described this method since, which I am using in the manufacture of coils and condensers, and without which it would be entirely impossible to reach any such results as I have obtained. The industrial world has profited by the recognition of the action of the air, for it has helped to extend power transmission to greater distances than heretofore practicable. It has also been useful in determining the limits of the electro-motive forces with ordinary apparatus used in power transmission, but I see that no attempt is yet made to overcome the streamers by a suitable construction of the cables, as I have indicated, and thus make higher electro-motive forces available.

Further experimentation with the original single-terminal coil, before referred to, finally led step by step to the adoption of a coil of large dimensions, which, in two typical forms, is illustrated in diagrams 10 and 11. With such a coil I found that there was practically no limit to the tension obtainable, and it is by its means that I discovered the most important of all facts arrived at in the course of my investigation in these fields. One of these was that the atmospheric air, though ordinarily a perfect insulator, conducted freely the currents of immense electro-motive force producible by such coils and suitable accessories. So great is the conductivity of the air, that the discharge issuing from a single terminal behaves as if the atmosphere were rarefied. Another fact is that this conductivity increases very

electrical pressure, to such an extent that at barometric pressures which

will lie for centuries unaffected in contact with oxygen, but the combustion once started, the process continues as long as there are elements to combine. While improving the construction of the transformers, every effort was made to perfect the apparatus for generating the currents. The objective point from the outset was to obtain the greatest possible rate of variation. High-frequency alternators were first used, but their limitations were soon apparent. I then turned again to make and break devices, chiefly with the object of using them in connection with a novel form of transformer, which I have previously described, and which is now well known and understood. In its original form, as I first showed it, it is illustrated in diagram 12, which need not be dwelt upon, beyond saying that one of the characteristic features of such an instrument is the energizing of the primary of the induction coil by the rapidly succeeding discharges of a condenser. In a more recent type, specially adapted for ordinary supply circuits, which I have described and shown before several scientific societies, the transformer comprises, as indicated in diagram 13, three coils, there being, in addition to the primary and secondary coils, one which receives the cur-

rents from the supply circuit, and is designated the charging coil. Pref-

erent from the supply circuit, and is designated the charging coil. Pref-

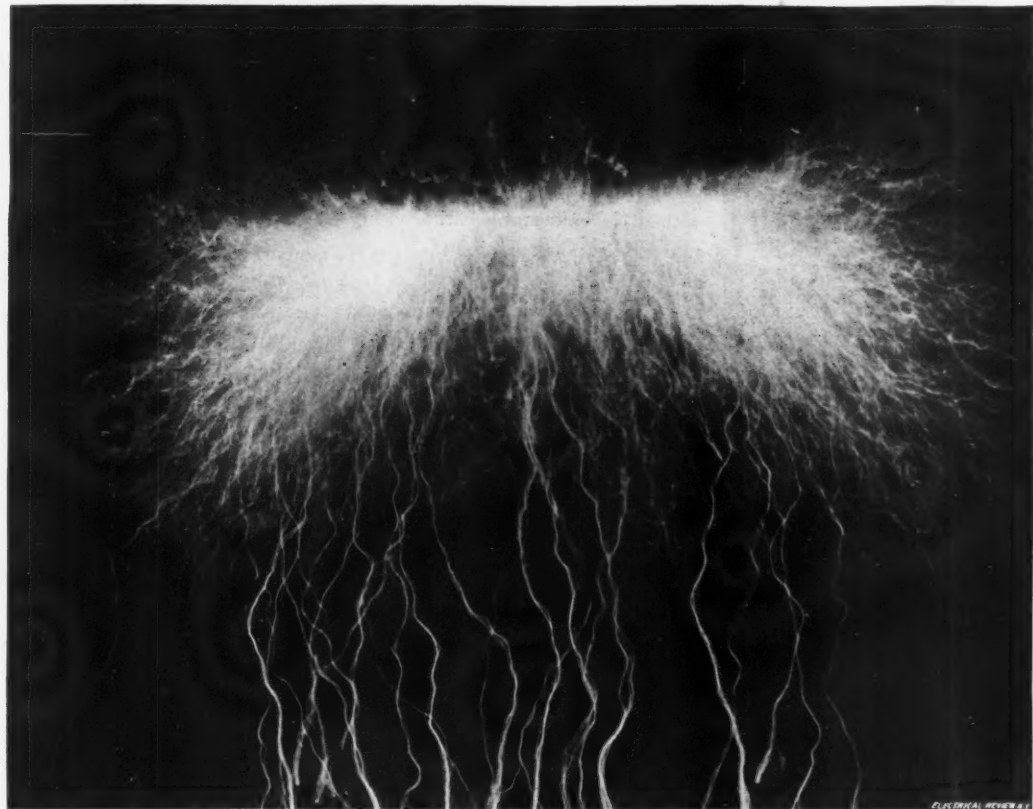


FIG. 11.—PHOTOGRAPH OF AN ACTIVE TERMINAL OF AN IMPROVED OSCILLATOR, USED IN TESLA’S EXPERIMENTS FOR TRANSMITTING ELECTRICAL ENERGY TO GREAT DISTANCES WITHOUT WIRES—WIDTH OF ILLUMINATED SPACE IS 18 FEET—THE PRESSURE ON THE TERMINAL IS ABOUT EIGHT MILLION VOLTS.

permit of no transit of ordinary currents, those generated by such a coil pass with great freedom through the

its life-sustaining qualities, accidentally or as a consequence of some accumulative change? A lump of coal

rents from the supply circuit, and is designated the charging coil. Pref-

(Concluded on page 204.)

# Electrical Review

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The latest and biggest thing in the way of trusts that Wall street has heard about is a combination of seven copper companies into one concern, with a proposed capital of \$1,000,000,000, of which \$500,000,000 is to be issued at once—or, rather, as soon as the combination is effected.

## PROFESSOR PUPIN'S PAPER ON LONG ELECTRICAL WAVES.

At the last meeting of the American Institute of Electrical Engineers, a paper entitled "The Propagation of Long Electrical Waves" was presented by Dr. M. I. Pupin.

In this paper are described a series of experiments intended to form a basis for the experimental investigation of long electrical waves, such as are employed in telephony and in alternating-current transmission of power. The investigation of sound waves, such as are exhibited in a vibrating string, have, of course, long been studied, the nodes being easily detected by old and well known methods. In the study of short electrical waves, such as may be generated by oscillators and measured within the space of a small room, we have the now classical method of Hertz.

When it comes to dealing with waves of hundreds of miles in length, it is obvious that neither the acoustic method nor the Hertzian method are available; some different plan must be followed. It is in providing this plan that the experiments of Professor Pupin become of interest. Not only are his experiments themselves of value, but he has furnished us with an elaborate mathematical theory supporting and explaining the results he obtained.

The new theory is very voluminous, and will be printed in full in the transactions of the institute.

In a general way it may be said that Professor Pupin has employed a "slow-speed" conductor so that, although low-frequency waves may be impressed upon it, their actual length will not be great owing to the comparatively long time required in their propagation through it. Thus a telephone wave, normally 100 miles long, would be reduced in length to less than 10 feet.

The slow-speed conductor employed is really an artificial line in which are represented in correct proportions the resistance, self-induction and capacity of the actual telephone line.

By this means it will be seen that the equivalent of a telephone line of hundreds of miles in length may be

arranged in the laboratory and divided into sections of any desired dimensions, and that current measurements may be made simultaneously at different parts of the circuit.

The paper was well received by those present at the meeting, but owing to its technical nature, and to the fact that advance copies had not been distributed until just before the meeting, the discussion was not exhaustive.

Immense works for making calcium carbide are in operation and under construction in the United States, and already large quantities of this acetylene-forming product are manufactured daily. It may be looked upon as a sort of solidified and condensed electric light, locking up in itself the energy of the current used in making it, to be liberated later as light and heat in the acetylene flame. But the process is highly inefficient. One kilowatt-hour of electrical energy consumed in an ordinary arc lamp will give from 1,200 to 1,500 candle-power-hours of light, and in incandescent lamps 320 candle-power-hours. Used to make carbide, and the resulting acetylene burned, only 106 candle-power-hours can be obtained.

We congratulate our esteemed contemporary, *The electrical world and electrical engineer incorporated*, on the fact that it has so adjusted matters as to be able to shed one of its covers. Its name, however, has not yet moulted. The decrease in bulk is an added improvement. But how did it happen that our esteemed, etc., missed so many items of good news as were chronicled fully in last week's ELECTRICAL REVIEW? There was the important suit of Westinghouse vs. General Electric, the combination of independent telephone manufacturers, the independent telephone convention at Des Moines, not to mention our lovely "scoop" on the central station plant at Manila, the scene of operations of vital importance to every American, and on which the eyes of the world are centered. As always, the ELECTRICAL REVIEW gives the news as it occurs, and extends to its contemporary the assurances of its distinguished consideration.

## TESLA'S LABORATORY EXPERIMENTS.

It is with great pleasure that we present to our readers, in this issue, the extraordinary results obtained by Mr. Tesla. The photographs taken in his laboratory are, we believe, the first of this kind that he has ever permitted to be published. The experiments on which he dwells, and which are evidently the result of years of patient labor, are, in our opinion, the most striking and promising that have been shown in years, and they can not fail to create a profound impression on scientific minds.

There is one thing the electric conduits under city streets never do and which is one of the ineradicable objections to the old gas conduits; namely, the creation of nauseating smells which fill the air whenever a street is opened in the vicinity of a gas main. It is too late now to remedy where the mains have lain any length of time, but the authorities should see to it that in all future laying of gas mains leakage at the joints will be absolutely prevented. There can be no excuse for such a nuisance here that is prevented elsewhere by the operation of a joint-cover and leakage pipe to the atmosphere.

A good idea of the extent and importance of the telephone service of London was given by Mr. Hanbury in his speech for the government before the House of Parliament in committee when he said:

The area of the London exchanges is enormous. It comprises 634 square miles, it has a population of 6,000,000, its public wires number 19,000, representing more than one-fifth of the whole of the wires in the country. In that large area the post office is determined to compete at once.

The post office will do its work, I hope, on business lines, and in real and genuine competition with the company. We shall go on the principle of a small subscription of about £3 per year, and then we shall charge a toll rate. I believe there is work for the National Telephone Company as well as for ourselves, and that we shall draw our subscribers from a different class, and that we shall be able to work side by side.

We fail to see how a telephone company operated by a government, national or municipal, can "work side by side" with a private telephone corporation "in real and genuine competition." "It's heads I win, tails you lose" for one party, and that party can be named in one guess.

**The Independent Telephone Combination.**

As outlined in the ELECTRICAL REVIEW last week, a combination of independent telephone manufacturers is probably nearing completion. Mr. W. T. Blaine, president of the Victor Telephone Manufacturing Company, of Chicago, who is the moving spirit in the consolidation, has issued a prospectus.

"The new company will be organized for the purpose of supplying telephone apparatus, doing construction and entering the various branches of the service," said Mr. Blaine, in an interview with a representative of the ELECTRICAL REVIEW. "I may say that we already have 20 companies, and that we will organize and incorporate promptly under the laws of New Jersey. The names of the principals I am not able to give out at present, but I may say that two of the best and safest financial institutions of the country are back of this concern. The operations of the company are upon a cash basis, and we are simply purchasing the companies. We expect to include all of the independent manufacturers. Apparatus will be standardized, and probably three centers of manufacturing will be continued. We are not trying to control the telephone business or to create a monopoly. We shall sell to every one who desires to buy our apparatus."

The following named companies are said to be included in the consolidation, which is evidently not yet comprehensive:

- American Electric Telephone Company, Chicago.
- De Veau & Company, New York.
- Connecticut Telephone and Electric Company, Meriden.
- Victor Telephone Manufacturing Company, Chicago.
- Keystone Electric Telephone Company, Pittsburgh.
- Reliable Electric Manufacturing Company, Worcester, Mass.
- Mayson Telephone Pay-Station Company, Ludington, Mich.
- Williams Electric Company, Cleveland, Ohio.
- Northwestern Electric Telephone Company, Milwaukee, Wis.
- Sterling Electric Company, Chicago.
- Farr Telephone and Construction Company, Chicago.
- Viaduct Manufacturing Company, Baltimore, Md.
- Butler-Taylor Company, Ravenna, Ohio.
- National Automatic Telephone Company, Chicago.
- Central Telephone and Electric Company, St. Louis, Mo.

Mr. Blaine spent the early part of this week in Boston on business connected with the formation of the new company.

Lieutenant Commander L. C. Heilner, U. S. N., is in charge of a new course of electrical instruction at the Navy Yard, Brooklyn, N. Y., designed to prepare naval apprentices for service as dynamo tenders and electricians.

**BOOK NOTICES.**

"Roentgen Rays"—The third number of Harper's Scientific Memoirs, edited by George Barker, LL. D., professor of Physics in University of Pennsylvania.

"The Modern Theory of Solution"—The fourth number of the same series, edited by J. S. James, Ph. D., professor of physics in Johns Hopkins University, has been published from the press of Harper & Brothers. The former contains the memoirs of Professor Roentgen, Sir G. G. Stokes and Prof. J. J. Thomson, of Cambridge, with biographical sketches of the three. The book thus collects the earliest experiments and theories on the X rays, which are destined to play a most important part in the world as they become better understood. The fourth volume presents memoirs by Dr. W. Pfeffer, of Leipsig University; Professor Van't Hoff, of Berlin University; Prof. Arrhenius, of Stockholm High School, and F. M. Raoult, professor of chemistry in Grenoble. The combined memoirs present a brief exposition of the great advances made in physical chemistry during the past 15 years. Both volumes are valuable additions to the student's shelves.

"Fourteenth Annual Report of the Massachusetts Board of Gas and Electric Light Commissioners"—This has just been issued, and as usual contains a vast amount of useful information. The board is a strong institution of the state, somewhat similar in jurisdiction to our State Board of Railroad Commissioners, but having probably more judicial powers in the settlement of questions arising between municipalities and the electric light and gas companies. An interesting part of the volume is that giving data about municipal ownership of lighting plants.

One table is worthy of note. Some sixteen "towns" went into the lighting business, and the last year reported, ended June 30, 1898, they showed gross receipts of \$88,181, and operating expenses, \$150,536, a loss in operating account of \$62,354. Interest and depreciation are not included in these expenses, and municipal ownership gets a pretty black eye in the comparison.

The report shows for the year 1898 a total of 77 persons killed and 45 injured by gas accidents, while accidents from electricity showed six deaths and 12 injured.

The report finally deals with all the financial and physical details of all the gas and electric lighting companies of the whole state, and contains much information of value to all interested in these subjects.

**PERSONAL.**

Mr. H. M. Byllesby, of Great Falls, Mont., was among the visitors to New York last week.

President Fred Gilbert, of the Boston Electric Light Company, dropped into the metropolis last week.

Mr. Rosenthal, the St. Louis representative of the General Electric Company, was in New York last week.

Mr. S. M. Hamill, of the General Electric Company, Schenectady, N. Y., was among the visitors to New York city last week.

Mr. Edwin O. Waymire, secretary and treasurer of the Dayton Fan and Motor Company, Dayton, Ohio, was a recent visitor to New York city.

Mr. P. O. Ackerman, New York representative of the American Electrical Works, of Providence, R. I., will remove his offices on April 1 from 10 Cortlandt street to the Havemeyer Building, at Cortlandt and Church streets.

Mr. Walter C. Burton, chief operator of the Western Union Telegraph Company's race bureau, in New York city, has been named as a delegate, representing the telegraphic fraternity, to the Volta centennial celebration to be held at Como, Italy, in May.

Mr. George B. Francis, of the New York, New Haven & Hartford Railroad Company, has been retained by the Third Avenue Railroad Company, of New York city, as consulting engineer, in charge of the foundation work of the latter company's new electric power-house.

President C. L. Rossiter, of the Brooklyn, N. Y., Rapid Transit Company, has begun the installation of the third-rail system on the Brooklyn Elevated Railroad, and expects to have the road in electrical operation within three months. The new system will cost between \$2,000,000 and \$3,000,000.

Mr. J. P. McKinstry has been elected vice-president of the South Western Telegraph and Telephone Company, and also of the North Western Telephone Exchange Company, both of which concerns are controlled by the Erie system. Mr. P. Yensen, superintendent of the Cleveland Telephone Company, has been advanced to the position of general manager of the same company.

Mr. Saitaro Oi, of the Ministry of Communications, is now in New York on his way across the continent to San Francisco and thence to Japan. Mr.

Oi is the technical head of the telephone and telegraph systems of the Japanese Empire. He has just completed a careful investigation of the principal telephone and telegraph systems of Europe and America. Mr. Oi is a great admirer of our telephone methods and apparatus, and has a large acquaintance among American telephone men with whom he is a great favorite.

**Wall Street and the Electrical Stock Market.**

A general and pronounced rise occurred in the stock market this week. An increasing volume of business is largely responsible for the higher prices. It is intimated in well informed quarters that the prevailing high figures will prevail at least during the Spring season.

On the New York Stock Exchange, General Electric closed to-day at 118½ bid and 118¾ asked, a gain of 1¾ points for the week. Metropolitan Street Railway, of New York, closed at 256 bid and 256½ asked, a gain of ½ point for the week. Third Avenue Railroad, of New York, closed at 207 bid and 209 asked, a loss of 4 points for the week.

On the Boston exchange, American Bell Telephone closed at 365 bid and 367 asked, a gain of 23 points for the week. Erie Telephone closed at 95 bid and 96 asked, a gain of 7 points for the week.

On the Philadelphia exchange, Electric Storage Battery common closed at 163 bid and 165 asked, a gain of 6 points for the week. Union Traction closed at 36¾ bid and 36½ asked, a gain of ¾ point for the week.

Wall street, March 25.

**Is Chicago Edison in a Gas Combination?**

The ELECTRICAL REVIEW learns, from what it considers a reliable source, that negotiations are under way for the purchase of the Chicago Edison Company and the Commonwealth Electric Company, which it controls, by the Chicago Gas Company. The price mentioned is above \$220 per share for the Edison stock, which carries with it the control of the Commonwealth company.

The Chicago Edison Company, as is well known, operates its circuits under ground in the business district of Chicago. The Commonwealth Electric Company is a consolidation of small companies in the outer districts controlling overhead lines.

Chicago Edison stock is now selling around 175 ex-div., and Chicago Gas at about 125.

### AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

NEXT GENERAL MEETING TO BE HELD IN BOSTON IN JUNE.

The 133d meeting of the Institute was held at 12 West Thirty-first street, Wednesday evening, March 22. President Kennelly in the chair. A paper was presented by Dr. M. I. Pupin, of Columbia University, on "Propagation of Long Electrical Waves." The paper was discussed by Messrs. Bradley, Carty, Kennelly and Steinmetz.

At the meeting of council in the afternoon the following associate members were elected: Tom Howard Gregg, Harold J. Horn, Howard S. Johnson, Herbert S. Miller, William D. Pomeroy and Thos. Byrd Whitted.

The returns from the nomination blanks sent in by the membership were canvassed, and the following gentlemen were announced as the council nominees: For president, Dr. Arthur E. Kennelly; vice-presidents, J. W. Lieb, Jr., Charles F. Scott, L. B. Stillwell; managers, C. O. Mailloux, S. Dana Greene, C. S. Bradley, W. D. Weaver; secretary, Ralph W. Pope; treasurer, George A. Hamilton.

The council appointed Dr. F. A. C. Perrine to fill out the unexpired term of Mr. W. F. C. Hasson, who has resigned from the office of manager on account of his removal to the Hawaiian Islands. The following local honorary secretaries were also appointed: H. F. Parshall, London, for Great Britain; James S. Fitzmaurice, Sydney, for Australia; Prof. Robert B. Owens, Montreal, for Canada. The regular election will proceed after the distribution of the ballots, early in April, and the result will be determined at the annual business meeting, which will be held in New York city, Friday, May 19, 1899.

The council decided to hold the fifteenth general meeting at Boston during the last half of June, the exact date to be fixed by the executive committee.

#### Electric Alarm Matting.

Mr. A. DeForest Riskey, of Richfield Spa, N. Y., is the inventor of the electric alarm matting illustrated herewith. The matting consists of an elastic non-conducting fabric which is provided with a series of aligned orifices. On both the upper and lower sides of these orifices are placed conducting strips. Those on the upper side are connected and form one terminal; those on the lower side are connected and form the other terminal.

In each orifice is placed a shot or other conductor of a diameter some-

what less than the thickness of the non-conducting fabric. The conducting strips may be held in place by a piece of cloth covering the whole, and fastened in place by rows of stitching on both sides of the strips,

#### A New Transformer.

A new type of transformer has recently been perfected and is now ready for mercantile introduction. It is known as the "Peerless," and is be-

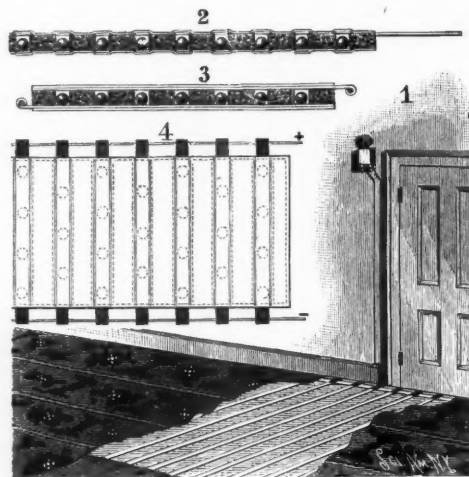
the "Peerless" transformers will regulate within one per cent from one kilowatt to five kilowatts capacity, and within two per cent in all sizes above five kilowatts capacity.

In relation to the use of oil in transformers, a leaflet issued by the designer of this transformer gives the following reasons as to its advantages:

Oil being a much better heat conductor than air, it helps to a great extent in radiating the heat from the coils to the walls of the casing, and thus greatly reduces the temperature of the coils. The use of oil greatly increases the insulation strength, and tends to preserve the insulation, and in case of lightning discharges, renders the transformer less liable to injury.

In constructing the "Peerless" transformer only the best electrical sheet steel is used in the iron cores and, owing to the large regulation surface of the coils, the temperature rise is exceeding low; the claim for the transformer being that it will "test out" to lower core loss than any other placed on the market. The transformers are enclosed in weatherproof cast-iron boxes which are made to hold oil and are furnished either japan or aluminum coated. Two separate lines of the standard transformer are made, one for 125 cycles and the other for 160 cycles.

The manufacturers have erected a



FIGS. 1-4.—ELECTRIC ALARM MATTING.

as represented in the cut by the dotted lines.

When the matting is in use the shot will rest on the lower conducting strip, but will be held out of contact with the upper strip by virtue of the thickness of the non-conductor; but when the mat is stepped upon the fabric will be compressed, and the shot will touch both strips, thus completing the circuit.

This matting may be manufactured quite cheaply. The non-conducting

ing manufactured by the Warren Electric and Specialty Company, of Warren, Ohio. This company has developed a very successful line of incandescent lamps, and this Spring has put on the market a new series of fan motors, both of which also bear the name "Peerless."

The theory which has been carried into practical application in the construction of this transformer, is



FIG. 1.—NEW "PEERLESS" TRANSFORMER.



FIG. 2.—NEW "PEERLESS" TRANSFORMER, REAR VIEW.

fabric may be of heavy cloth or felt. There are no springs to become bent and form a continuous contact.

The matting may be made of the same thickness as the paper matting commonly placed under carpets, and when a piece of this is removed and the alarm matting put in its place, no change can be noticed in the carpet. Fig. 1 of the cut shows matting in place. Fig. 2 is a longitudinal section. Fig. 3 is a transverse section, and Fig. 4 is a top view.

that an essential feature of a good transformer is its close regulation—that is, the variation of no load and full load. The transformer may be in every way sufficient, yet if it fails to maintain a uniform voltage at the lamps, it fails in a most important function. Good regulation admits the use of high-efficiency lamps as necessary both to long life and satisfactory service. It is asserted that

commodious building and equipped it with the latest and most modern machinery, as addition to their large factory, which will be used exclusively for the manufacture of transformers.

"The Trial of the 'Oregon,'" by Rear-Admiral Beardslee, in the April issue of *Harper's Magazine*, is an article that should interest every one who takes a national pride in the "bull-dog" of the American navy.



**New Lundell Fan Motors.**

Probably there is no fan motor better known in the United States than the "Lundell," manufactured by the Sprague Electric Company, 20 Broad

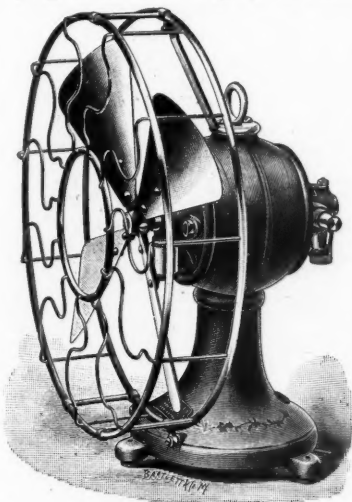


FIG. 1.—LUNDELL STANDARD FAN MOTOR. street, New York. These have been manufactured for eight years, and while the first models put out are yet in use and giving satisfactory service, there has not been a year passed in which improvements have not been made. It would be hard to imagine a

ever, there are many other details which must enter into the successful building of a fan motor, and it is to the perfection of these various points that a great amount of attention has been directed.

One of the changes in the models for the coming season is the substitution of drop forged field shells instead of cast-iron. The arrangement of field magnets is very clearly shown in the sectional view in Fig. 3. The two field frames which form the incasing shell are absolutely alike, as they are forged in the same die. By reason of the high magnetic permeability of the iron it has been possible to reduce the cross-section of the projecting pole pieces at their bases. This allows the single energizing coil to assume a nearly vertical position, so that the armature may be entirely withdrawn by merely removing either one of the end brackets.

The armature shaft has been increased in diameter about 25 per cent, giving a much better bearing. The self-adjusting bearings in which the shaft runs are of bronze. The self-feeding oil cups have also been made in such a way that the wick will feed every drop of oil in the cup.

proved by making it more substantial, and also by a change in the manner of attaching it to the 12-inch and 16-inch desk patterns. It will be noticed that only one brace is used. This is fixed at the top, and secured by screws and not soldered. This removes a point of considerable annoyance which occurred with previous patterns where the braces were soldered at an angle which made it a difficult matter to pack the guards without breaking them off. The guard is secured to the bottom of the motor-frame by two small projecting lugs.

**Helmholtz's Brain.**

The brain of Helmholtz has been examined by Professor Hausemann, of Vienna, and found not to be remarkable in the matter of weight, but to be above the average in that respect. It weighed 1,440 grams, and was found to have convolutions of extraordinary complexity.

**American Electrical and Maintenance Company.**

Judge Gildersleeve, of the Supreme Court, has appointed Aldred K. Warren and Francis Higgins permanent

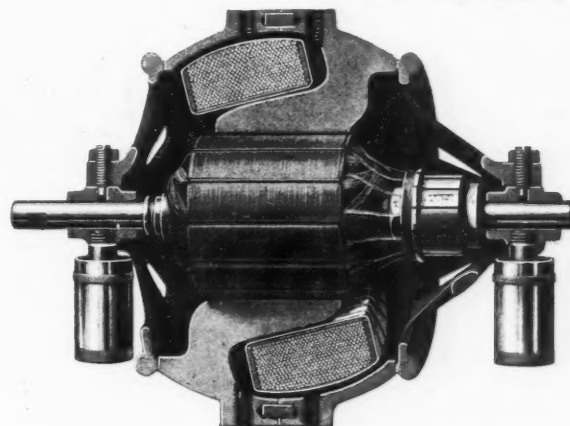


FIG. 3.—SECTIONAL VIEW THROUGH LUNDELL FAN MOTOR.

All of the various styles of desk and ceiling motors are simply, but tastefully, decorated; fans, guards and trimmings are finished in polished and lacquered brass or nickel-plate, as desired by the customer.

From advance orders, which the company has already received, running into the thousands, they feel encouraged to think that this is to be the greatest fan motor season yet experienced. An order recently booked calls for a shipment of 5,000 motors to one of our newly acquired dependencies.

**Interior Conduit-Makers Unite.**

The entire plant and business, including patents, of the Armorite Interior Conduit Company, of Pittsburgh, Pa., have been sold to the Safety Conduit Company, of Rankin Station, Pa. The capital of the latter company, it is said, will be increased to \$250,000.

**Long-Distance Telephone Company Increases Its Capital.**

The American Telephone and Telegraph Company, of New York, certified to the Secretary of State at Albany, on March 27, an increase of capital from \$25,000,000 to \$75,000,000, divided into \$100 shares. The capital paid in is \$23,500,000; debts and liabilities, \$209,736.

receivers of the American Electrical and Maintenance Company, of No. 451 Greenwich street, New York city, for which temporary receivers were appointed in October last.

**The Electrical Automobile in Surgery.**

[From the Medical Record.]

In taking X-ray pictures at the patient's house it is no longer necessary in large cities to transport large electric batteries from the office. New York physicians call up an automobile over the telephone, and, as it stands at the door, attach to its storage battery wires leading to the sick room, and the skiagraph is taken without further trouble.

**Westinghouse vs. Western Electric.**

The Westinghouse Electric and Manufacturing Company began suit on March 22 in the United States Circuit Court in New York city, to restrain the Western Electric Company from making, using and selling direct-current dynamo-electric generators, the patent for which, it alleges, was granted to Benjamin G. Lamme in December, 1896. A preliminary injunction is asked pending the termination of the suit. The principal officers of the Western Electric Company are made defendants to the suit.

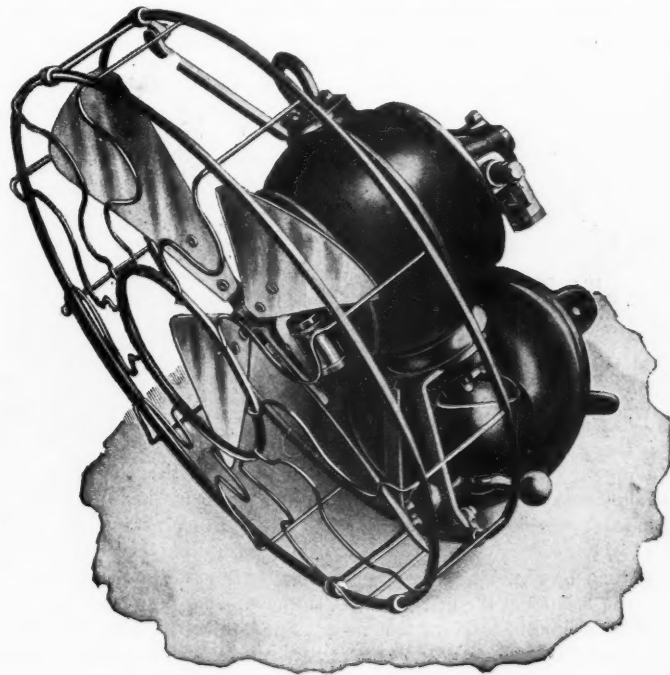


FIG. 2.—LUNDELL BRACKET FAN MOTOR.

more compact or symmetrical arrangement of parts than is shown in the motor.

To the single coil feature, which is broadly covered by patents, may be attributed the major share of the success which has marked the career of this comfort-disbursing motor. How-

The general increase of efficiency of the motor makes it possible to increase the pitch of the fan blades, so that the motor will deliver a larger volume of wind at a given speed without any increase in consumption of current.

The fan guard has also been im-

### Lincoln Electric Company's Dynamos.

In the illustrations herewith are shown two types of dynamos manufactured by the Lincoln Electric Company, of 71 and 73 Ontario street, Cleveland, Ohio. In Fig. 1 is shown

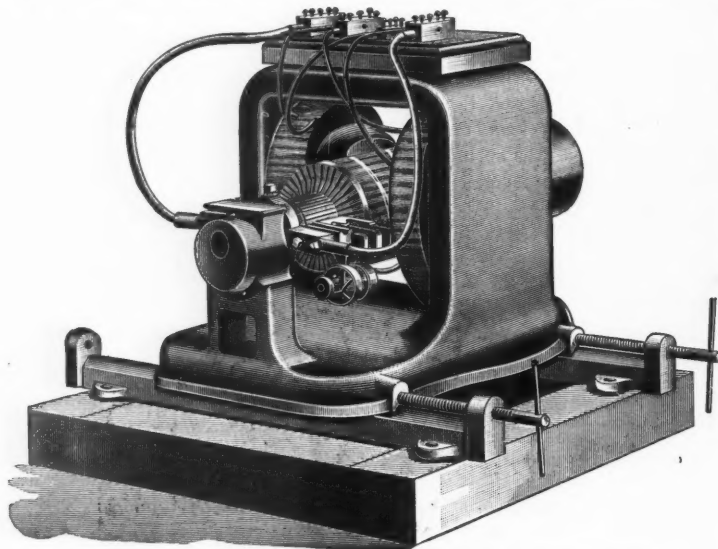


FIG. 1.—LINCOLN ELECTRIC COMPANY'S 60-LIGHT BIPOLAR DYNAMO.

a 60-light bipolar dynamo, which, the makers claim, will do the same work with less current than it is possible to do with a four-pole machine. The company state that they have proved this claim in many instances by reducing the meter bills over such four-pole machinery, while doing the same work.

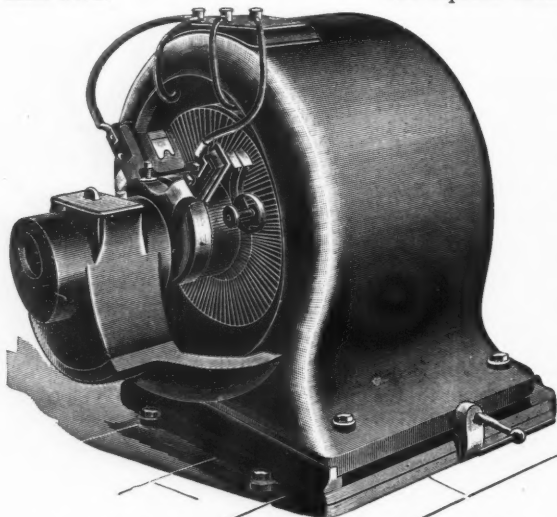


FIG. 2.—LINCOLN ELECTRIC COMPANY'S 13.75-K.-W. DYNAMO, WITH STEEL FRAME.

The speed of this bipolar machine is so low that the motors can drive main shafts direct without the use of counter-shafts. The machine is designed to stand abuse and neglect. It is so shaped as to prevent anything falling on the moving armature, the

oil wells are large enough to contain six or eight weeks' supply of oil, the carbon brushes will last several months; as the machine runs absolutely sparkless, the wear of the commutator is not appreciable after a year's run. The armature is of the

so-called iron-clad type—that is, the armature wire is buried in slots in the armature. It is almost impossible to mechanically injure the wires on an armature. All the coils are exact duplicates, and when assembled the armature is perfectly symmetrical both mechanically and electrically. The especial advantage of this machine, when used as a motor, is the small amount of current it uses to do its work.

In Fig. 2 is shown the Lincoln Electric Company's multipolar steel frame machine. This was designed to produce a machine of ample capacity for its rating, and to be as light as possible, and is adapted for all places where it is desirable to avoid weight. It has been used on cranes and elevators with great satisfaction.

Plenty of material is used in all sizes to accomplish good results. It is not possible to find any magnetism on the outside of the machine when working at full load. The bearings are large and long, shaft is heavy, commutator is massive and well ventilated, and armature is assembled on a ventilating spider.

### The Electric Appliance Company, of Chicago.

The Electric Appliance Company are now doing business in their new building, at 92 and 94 West Van Buren street, Chicago. They have been able since getting into larger quarters to greatly increase their stock of all kinds of electrical supplies, and are in better shape than ever before to fill orders promptly.

The new building, the interior construction of which was especially arranged for its present use, is a model of convenience and adaptability. Every time and labor-saving device is utilized, as modern methods must prevail in the supply house of to-day.

The five stories and basement, crowded with electrical goods of every description, give the "pick-up man" a vacation and make the filling of an order as easy as falling off the proverbial log.

The illustrations presented herewith will give a fair idea of the interior arrangement and appointments of the building.

On entering, the visitor will find on the left the offices of Mr. W. W. Low, the president of the company. To the right and opposite, those of Mr. T. I. Stacey, secretary and treasurer. To the right of this latter, and



MR. W. W. LOW, PRESIDENT ELECTRIC APPLIANCE COMPANY.



MR. T. I. STACEY, SECRETARY AND TREASURER ELECTRIC APPLIANCE COMPANY.

extending back about 70 feet, are the general offices.

The store occupies the space to the left of the general offices. In the rear of the offices and store, and occupying the balance of the first floor, is the room devoted to outgoing and incoming freight and express.

On the second floor the manager of the shipping department has his offices. His assistants' desks and the benches for assembling and for the packers use about one-half of the space on this floor, the rest being used for bins for shades and shade-holders, sockets, switches and miscellaneous stock.

The third, fourth and fifth floors,

with the exception of the list of goods stored on each, might be well described in the same paragraph. They are arranged with bins, racks and shelves to best suit the stock carried in them. The telephone department and shop is located on the third floor, as well

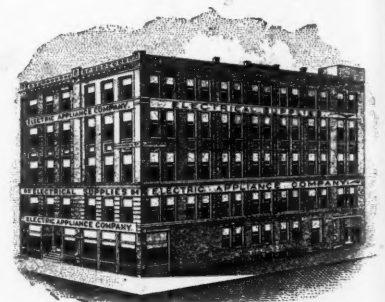


FIG. 1.—NEW BUILDING OF THE ELECTRIC APPLIANCE COMPANY, CHICAGO.

as the offices of Mr. S. A. Dinsmore, the manager of this department.

And last, but by no means the least important part, is the basement, with its accommodations for heavy goods—Armorite and Armorduct tubing; "O. K." bare copper and iron wire, cross arms, brackets, polesteps, etc.

On each floor is a stock clerk, who must be thoroughly posted on the stock under his immediate control. All bins and shelves are lettered or numbered, classified and indexed in

such a manner that the assembler can at once place his hands on the item wanted. Every arrangement or device which would in any way help toward the desired end—a quick shipment—has been employed.

The quick-running elevator and lifts, the extensive house telephone system, connected by the switchboard on the first floor with the city exchange, and with the long-distance lines leading into Chicago, perform an important part in the dispatch of business.

The history of the house, which has grown in a few years to the position which gives it the right to the claim of being "America's Largest Elec-

trical Supply House," is briefly as follows:

The company started in business December 1, 1891, using one floor of the building at 242 Madison street, with 2,500 square feet of space. One

**New York Electrical Society.**

By courtesy of the American Society of Civil Engineers, the 196th meeting of the society will be held at its house, 220 West Fifty-seventh street, on Wednesday, March 29, at 8 P. M.

**Electric Railways in Moscow, Russia.**

The City Council of Moscow, Russia, announce that all contractors who are desirous of bidding for the construction of electric railroads in that

**Death of Captain Samuel Trott.**

Captain Samuel Trott, who died at Miami, Fla., on Saturday, March 11, of heart disease, after a lingering illness of nearly half a year, was generally considered one of the greatest experts of his time in the laying and repairing of ocean cables, and by his inventions and successes added immensely to the value of cable property.

He was born in Sussex County, Eng., in 1832, and took to the sea at the age of 17 as an apprentice, becoming a master or captain at 27. He made voyages all over the world, and was for many years in command of a passenger steamer running between England and South America. He assumed command of the cable-laying steamer "Faraday" in 1874, and remained in command until 1880. During this time he laid the French and the direct cables, and made some remarkable repairs in mid-ocean.

Captain Trott assumed command of the cable-repairing steamer "Minia" in 1880, and retained the command until his death. He was the joint inventor of a new type of deep-sea cable, and was the sole originator of an electric grapnel, which is now in very general use, the electric mechanism being such that a bell is rung on the



FIG. 2.—A WORKROOM IN THE ELECTRIC APPLIANCE COMPANY'S TELEPHONE DEPARTMENT.



FIG. 3.—A CORNER ON THE SECOND FLOOR OF THE ELECTRIC APPLIANCE COMPANY'S NEW BUILDING.

year later another floor was added. In the latter part of 1894 the entire building, or 8,000 square feet, was required. Their present location, at 92 and 94 West Van Buren street, has 30,000 square feet of floor space. So much in the way of history. With the increased facilities for quickly handling goods, which their new building affords, and with the additions to the strong list of agencies which they represent, the company may

Prof. Elihu Thomson will lecture on "Electricity at High Pressures." Professor Thomson, the distinction of whose work in this field has long been generally recognized, will describe various methods or means for obtaining high potentials, and show the limits thus far reached. In connection with this, the construction of high-frequency apparatus will be explained, and for the first time will be shown a novel machine for high poten-

city must make application to the City Council not later than April 12. The sum of 750 roubles must accompany each application. The council will give all parties presenting applications the terms and conditions of the concessions, with all necessary drawings and statistics as to the working



FIG. 4.—CITY SALES DEPARTMENT, ELECTRIC APPLIANCE COMPANY.



FIG. 5.—A VIEW OF THE ELECTRIC APPLIANCE COMPANY'S GENERAL OFFICES.

confidently look forward to another prosperous period. The prompt and businesslike policy which has pleased and multiplied their customers during the past eight years will hardly fail to bring like results in their future business.

The Electric Appliance Company extend a hearty greeting to electrical people everywhere, and invite them to make their office headquarters when in Chicago.

tials, which has just been devised by Professor Thomson. A further branch of the subject to be treated covers the actions occurring at high pressures, and insulation at high pressures. The useful applications of high-pressure currents will also be discussed, together with their conditions and limitations. The lecture will be accompanied by illustrative experiments.

of the tramways in Moscow for the past five years, profits of the different localities, list of lines existing, and approximate prices for making out the estimates. For foreign bidders, there are issued copies of the contracts printed in foreign languages, which will be sent on demand to all electrical companies. Copies will be sold to all applicants desiring particulars of the contract to be issued. The date of presenting the final tenders will be October 1, 1899.

cable steamer whenever the prongs of the grapnel come in contact with the cable. Just previous to the outbreak of the Spanish war he laid the cable connecting Key West and the Dry Tortugas for the United States Government.

**Truth Tersely Told.**  
[From Printers' Ink.]

People remember your goods because you force them to. Stop forcing and they'll stop remembering.

### TESLA'S LABORATORY EXPERI- MENTS.

(Concluded from page 197.)

erably the latter is not in inductive relation with the former. On a number of occasions I have described high-frequency apparatus embodying this beautiful method, which has already been of great value to science in my hands as well as in those of others. But a defect, to which I called attention early, still confronted me. It lay in the make and break devices which performed the function of charging and discharging the condenser. Many of such devices, based on a variety of principles, formed the subject of experiments carried on with the aim of doing away with this imperfection. To cite one of these, the current from the source of supply was passed through a minute column of conducting liquid maintained in a variety of ways, and in this simple manner rapidly succeeding impulses were obtained. Incidentally, some useful results were secured with these contrivances, as, for example, the generation of currents of differing phase and the production of rotating fields moving with constant velocity; but, interesting as these simple devices were, they naturally precluded the possibility of economical conversion. Their study, however, was useful as a means of recognizing the requirements of such make and break apparatus, and, finally, led to forms based on scientific and economical principles. A number of these were recently described in technical periodicals and, as stated on a former occasion, they fulfill their difficult duty surprisingly well and make it possible to obtain currents of very high frequency from ordinary supply circuits with great economy. These novel contrivances lend themselves well also to the uses of the ordinary induction coil, and I have employed them with equal success in a form of Planté's rheostatic machine and for many other useful purposes. Thus, after a continuous effort extending through a number of years, I have the supreme satisfaction of having carried this hard and important task to a satisfactory end.

The annexed photographs will serve to convey an idea of what can be done with these perfected implements. Referring to Fig. 1, illustrative of the high rate of change obtained in the current, a vacuum bulb of about 12 inches in diameter is held in front of a coil of four turns of specially constructed heavy cable, through which a condenser is discharging, and, although at a distance of several inches from the coil, the gas in the bulb is brought to intense incandescence, the light emitted being fully equal to 1,500 candles. Such a powerfully energized coil, when the frequency, as in this instance, is measured in millions per second, shows little repellent action, but when the frequency of the impulses is low, closed conductors, as washers of conducting material, are thrown off with a force of a magnitude which can be only

explained on the assumption that the currents have maximum values of many hundred thousand amperes.

The remaining photographs will be understood from the titles, which are made explicit for this purpose. I hope to have in the near future an opportunity for describing more of such experiments, and dwelling in detail on the apparatus used. For the present I am compelled, for want of time, to merely state that the vibrations used in most of them were from 400,000 to 800,000 per second.

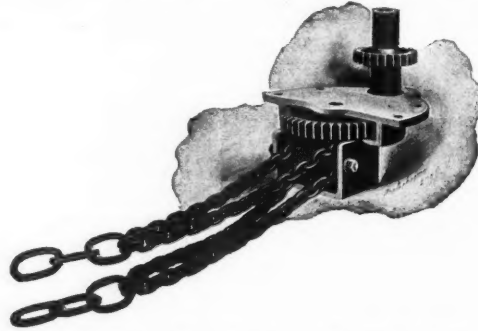
In conclusion I wish to apologize for the frequent appearance of my likeness in these photographs, which is distasteful to me, but was unavoidable. Most of the advances indicated, and a number of others, have resulted from the application of the beautiful principle upon which the operation of this apparatus is based. Scientific men have honored me by identifying it with my name, and I have earnestly endeavored to show myself worthy

useless by the play of a small induction coil, but by means of apparatus producing powerful oscillations and circuits in exact synchronism, with which it is impossible to interfere; they have shown that atmospheric nitrogen can be readily combined and valuable products manufactured, merely by the application of cheap water power, and that light, diffusive like that of the sun, can be produced with an economy greater than obtainable in the usual ways and with lamps that never consume. N. TESLA.

New York, March 26.

### Modern Street-Car Brakes.

The question of power brakes for motor cars has been much discussed of late, as the ordinary chain and spindle brake, which answered the purpose very well in the days of the old horse car, has proved inadequate



A MODERN BRAKE FOR HIGH-SPEED-AND HEAVY ELECTRIC CARS.

of this great distinction by devoting to it much of my energies. No desire for material advantages has animated me in all this work, though I hope, for the sake of the continuance of my labors, that these will soon follow, naturally, as a compensation for valuable services rendered to science and industry. To the scientific experts, who are familiar, in theory and experiment, with electrical vibrations, the results here shown will, I believe, speak in eloquent language. But those readers to whom they are naturally less intelligible will ask: What are they good for, and what do they or have they demonstrated? To them it may be said that they have shown and proved among many other things: That ordinary currents can be transformed with high economy into electrical vibrations of any pitch, which are needed in many novel arts; they have shown that electrical energy in great amounts can be efficiently and safely transmitted without the use of wires to any point of the globe, however distant; they have furnished proof that the movements and operation of bodies and machinery carried by the same can be controlled from a great distance without any tangible connection whatever and with absolute precision; they have proved the practicability of a system of signaling without wires, not with the imperfect appliances as before attempted, which can not be tuned and are rendered

for use on modern high-speed motor cars and, in fact, is practically out of date for the heavy double-truck cars of to-day. A great number of accidents are due to defective or improper brakes, and the demand for a more effective braking apparatus is generally recognized by street railway companies.

A number of auxiliary power brakes, both electric and air, have been invented and tested, but the most efficient mechanism for single car braking seems to be the mechanical power brake. The illustration herewith shows a simple and ingenious brake of this style, called the "Sterling" safety brake, which has proved highly satisfactory in service.

The device is extremely simple, having few parts, and none which is liable to get out of order.

It is made up of a pinion, operated by the brake shaft, and geared to a double sprocket wheel, in the ratio of five to two. The double sprocket wheel carries two continuous chains, which connect with the brake-shoe rod. By this simple gearing device the motorman's power is multiplied and a quick, powerful and positive action is secured. The double-chain

connection insures safety, as, in the event of one chain breaking, the other becomes operative instantly. The wear on chain is equally distributed through the double sprocket wheel, thus avoiding the continual "grinding," wearing through and replacing of chain, common to the ordinary brake. This is quite an important item, as the old-fashioned chain on a spindle shaft wears out on an average in from six to ten months and costs considerable for maintenance. The double sprocket wheel and gears are protected by housing. The pinions and gears are made of cast steel, the castings of the best gun metal, and the chain is a special Y. & T. quality. The device is easy and inexpensive to apply, and its cost is about one-sixth that of an auxiliary power brake. It is in successful operation on hundreds of cars, and is said to have given universal satisfaction.

### TRADE NEWS.

The Victor Telephone Manufacturing Company, Chicago, have recently appointed as their representative in Cuba and Porto Rico, Mr. E. C. Bird, with headquarters at Havana. They are shipping Mr. Bird a full line of samples of their apparatus, and expect to realize a good business from that section of our new territory.

The Illinois Electric Company, of 239 Madison street, Chicago, have been doing an extraordinarily large business in telephone line supplies, including the sale of brackets, pins and telephone wire. They have been particularly rushed in this branch of their business, and, with the season for construction near at hand, they are having a very heavy trade.

Elmer P. Morris, 15 Cortlandt street, New York city, the well known dealer in electrical supplies, reports the following recent and very satisfactory orders: Elmira & Seneca Lake Electric Railway Company, 2,000 tons 56-pound rail and all special work, including turnouts and curve work, 900 wood poles, 45,000 oak and chestnut ties, 140,000 pounds copper wire, 6,000 rail bonds, 650 flexible brackets, 17 miles overhead line material; United States Government, Norfolk, Va., 100 forty-three-foot iron poles; Union Railway Company, New York, 250 twenty-eight-foot iron poles; Brooklyn Heights Railway Company, 425 thirty-foot iron poles; Phoenixville, Pa., Railway Company, 100 twenty-eight-foot iron poles; Lemuel W. Serrell, for Plainfield Railroad, 1,100 twenty-eight-foot iron poles; J. G. White & Company, 400 iron poles for Sydney, Australia; Bridgeport Traction Company, Bridgeport, Ct., 200 iron poles; Frazer & Chalmers, 450 iron poles for Mexico; War Department, 600 telegraph keys, 450 sounders, 600 relays, for Manila and Cuba.

**Improved Edison Fan Motors for Telephone Booths.**

The problem of designing a fan motor that is both efficient and economical when run by battery power is one that has engaged the attention of many electrical workers. The Edison Manufacturing Company, of New York, and Orange, N. J., are placing on the market several fan outfits that are greatly superior to anything they have produced up to the present time.

The "ironclad" outfit carries a seven-inch fan with a guard and is operated by a battery of three Edison-Lalande cells. The speed is about 1,200 revolutions a minute; the motor is very efficient and the battery will run for 150 hours before needing to be recharged.

The nine-inch Edison fan motor shown herewith has been greatly improved this season. The motor is much more efficient and will run at about 900 revolutions a minute on a little less than two amperes of current when using the battery supplied with it, consisting of four Edison-Lalande cells in a polished oak case. The greatest attention has been paid to the elimination of all unnecessary friction in the moving parts, and the motor now placed on the market is claimed to be the most efficient battery motor that has been constructed.

This company also has a nine-inch fan motor, similar in construction to the battery fan motor, and is wound for the 110 or 120-volt direct-current circuit. It is provided with three speeds, and will run 1,400, 1,600 and 1,850 revolutions per minute respectively.

An improved and convenient outfit for use in a telephone booth is the very latest novelty exploited by this company. Its use is not limited to any time or season, as every telephone booth is close, hot, ill-ventilated and uncomfortable at all times. Its many points of superiority have won for it great favor from a large number of New York firms who have used these fans. It has also been indorsed by the Long-Distance Telephone Company and several of the local Bell telephone companies, who are using them quite extensively.

The outfit as shown in the accompanying illustration, is designed for use with either 110 or 120-volt direct current or a primary battery. It is perfectly noiseless and produces absolutely no vibration, two very important features for recommending it highly for the use for which it was designed.

It has self-aligning, self-oiling bearings and is suspended by a double spiral spring from an ornamental bracket easily adjusted to the interior woodwork of a telephone booth.

In motors for the 110-volt circuit, connection is made from the stop and start switch on the motor by means of the connecting cord to the nearest electric light. The lamp bulb is unscrewed from its socket and the current tap is inserted. The connecting cord leads to the binding-posts on the sides of the current tap. The switch on the motor is so arranged that the lighting of the lamp will start the fan,

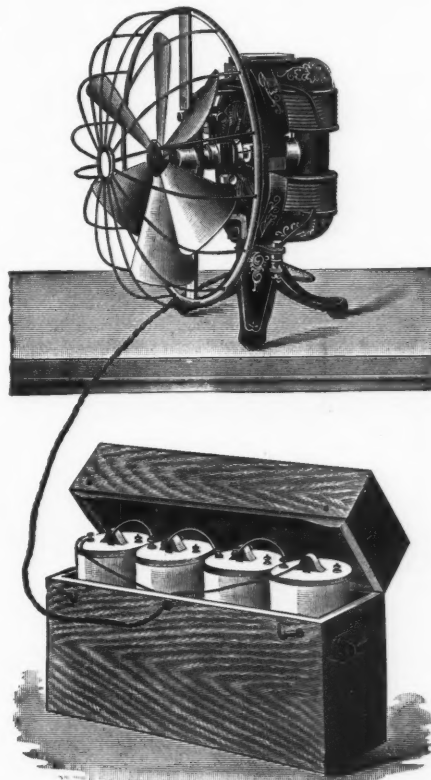


FIG. 1.—IMPROVED EDISON BATTERY FAN MOTOR.

or the lamp can be lighted without the motor running, if so desired. It costs no more to run both the lamp and the fan motor than to run the lamp only, and as neither need run while the telephone booth is not in use, the economy of the outfit is most apparent.

When an office is not wired for electric light, or when the current is not the 110 or 120-volt direct current, an Edison-Lalande battery of three cells may be purchased at a slightly increased cost. The efficiency of this battery is too well known to need much description. It has a capacity of 150 fan-hours, and renewals cost comparatively little.

**LITERARY.**

The annual catalogue of the Massachusetts Institute of Technology, Boston, for 1898-1899, descriptive of its various engineering courses, especially that in electrical engineering, has been issued.

"Electricity in Town and Country Houses," by Percy E. Scrutton, is the title of a popular, practical and fully illustrated handbook, to be issued immediately by the McMillan company. Domestic applications of electricity have been treated in this volume in as concise and complete a manner as possible, so that it may come

by Mrs. Dorr, with decorations by Henry McCarter; "Easter in Town," a poem with a picture by W. Glackens, and a story with a great deal of religious feeling in it by Henry van Dyke, entitled "A Lover of Music." This is one of several stories of life in the woods, which every reader of "Little Rivers" knows that Dr. van Dyke is well fitted to write by reason of his long and ardent companionship with nature. The illustrations by Walter Appleton Clark confirm that young artist's position as one of the leading American illustrators.

"The Universal Electrical Directory" (J. A. Berly's) for 1899 contains the names of the members of the electrical and kindred industries throughout the world. The amount of work entailed in its compilation has considerably increased. It has been most thoroughly revised, and the British alphabetical section now comprises about 9,845 distinct names; Continental, 8,195; American, 5,304; Colonial, 2,120; a total of 25,464; approximately 1,670 names of indi-

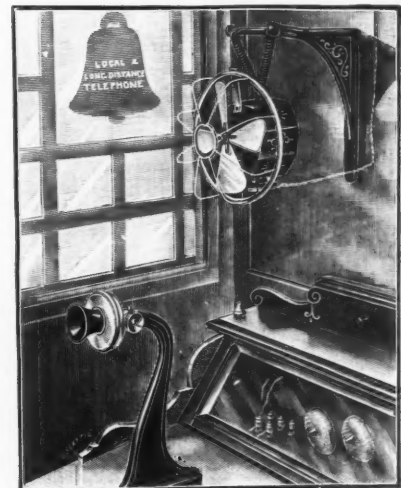


FIG. 2.—IMPROVED EDISON FAN MOTOR FOR TELEPHONE BOOTHS.

viduals and firms more than were contained in the book for 1898. For simplicity and facility of reference it is divided into four groups; namely, British, Continental, American and Colonial, which are again sub-divided into alphabetical and classified sections. In the case of the British a geographical section is given, making in all nine sub-divisions. In addition to the new names incorporated in the present issue, much financial information is given, the telegraphic addresses and local telephone numbers are given, and the total of pages added to the work is 64 as compared with that of 1898, making in all about 1,182 pages entirely of directory matter. It is therefore the largest as it is the oldest electrical directory in the world. The price is six shillings.

Ian Maclaren, who is now on a lecturing tour in this country, begins in an early issue of *The Ladies' Home Journal* his latest piece of literary work. It is a series of popular articles in which he defines the relation that a minister holds to his congregation; how a preacher is helped by his people; how a congregation can make the most of a minister, and other phases of the most satisfactory attitude of a congregation to a pastor.

*Scribner's Magazine* for April is an Easter number with a special colored cover designed by Maxfield Parrish. It contains a poem for Good Friday,

## Telephone News .....and Comment

The Dominion Government of Canada has decided to construct a telegraph line to connect the Yukon territory with British Columbia.

The Bell company's new exchange building at Harrisburg, Pa., will not be ready for occupancy until the coming Fall, owing to delays in building operations, due to inclement weather.

At the annual meeting of the stockholders of the Newark, N. J., District Telegraph Company, the following were elected directors for the ensuing year: George W. Hubbell, Thomas T. Kinney, Edward Weston, Marcus L. Ward, Frederick T. Fearey, Fernanda C. Runyon.

It is reported that Hon. E. J. Clapp and others, connected with the Warren & Jefferson Telephone Company, have purchased a controlling interest in the Madison, N. J., Telephone Company. It is also further stated that there will be no change in the present service of the home company.

The Valley Junction Council has passed an ordinance giving a 20-year franchise to the Mutual Telephone Company, of Perry, Iowa. The franchise gives to them the right to put in an exchange, run wires in the streets, and all the concessions necessary to operate a complete telephone system.

The statement of the Mexican Telephone Company for January is as follows:

	1899.	1898.	Inc.
January, gross...	\$11,837	\$10,991	\$845
Net.....	4,166	3,402	763
11 months gross..	126,946	117,330	9,616
Net.....	48,584	43,040	5,543
Subscribers 2,639, an increase of 203 since March 1, 1898.			

A syndicate composed of Chicago capitalists is trying to secure control of all local telephone companies in Westmoreland County, Pa. It has purchased the Latrobe company, and is now trying to buy the Greensburg line. In towns where no local companies operate a line, the Chicago men intend to establish a telephone system.

The property of the Citizens' Mutual Telephone Company, of Decatur, Ill., established here several years ago, is announced to be sold on March 22, under a chattel mortgage by the trust,

J. M. Dodd. The outstanding bonds amount to \$20,000, on which the interest has defaulted for over a year. The company has about 600 subscribers and valuable plant and franchise.

A meeting of the stockholders of the Interstate Telephone Company, of Frederick City, Md., will be held in Baltimore the last of March to consider the sale of the exchange of the company at Frederick and the entire property of the Interstate Telephone Company, of Frederick, city and county. L. A. Carr, of Durham, N. C., is president of the company. The company has about 350 telephones in use, and covers nearly every town in the county.

The board of managers of the Swedish state telegraph system has asked for an allowance of \$789,000, to be expended during three years, for the extension of the telephone system in the kingdom. The government makes about six per cent net profit on the money thus far advanced for such purposes. The number of interurban telephone conversations during last year exceeded 2,700,000, and the frequency of the telephone calls necessitates the building of new lines.

A new telephone company has been organized at Xenia, Ohio, to compete with the Miami Telephone Company, which has heretofore occupied the field alone. The new organization will be known as the Xenia Telephone Company, and the following officers have been elected: H. E. Schmidt, president; H. M. Barber, vice president; J. C. Conwell, secretary; Marcus Shoup, treasurer. A franchise has been secured from the City Council and the new company will be incorporated shortly, with a capital stock of \$30,000. Work on the new system will begin April 1.

The Chesapeake & Potomac Telephone Company is arranging for an extensive system of suburban service, and is establishing a number of branch exchanges. Work is under way in almost every direction in the company's territory. Among the villages to be connected with each other and with Baltimore city are Catonsville, Chattolane, Dickeyville, Ellicott City, Garrison, Govanstown, Ilchester, Lake, Mount Washington, Mount Wilson, Mount Hope, Owings' Mills, Pikesville, Roland Park, Walbrook, Relay, Ruxton, Sherwood, Stevenson, Sunbrook Park and Towson.

### ELECTRIC RAILWAY NOTES.

New York and Philadelphia capitalists propose to build an electric road to connect Bloomsburg and Berwick, Pa. The state charter has been obtained. The company is capitalized at \$250,000.

The Ottawa, Ill., Railway, Light and Power Company has been incorporated, with \$150,000 capital, to operate railway, light and power plants; incorporators, F. S. Donnell, Louis W. Hess, Jacob I. Warner.

The Norfolk-Hampton Roads, Va., Company, capitalized at nearly \$2,000,000, has purchased 3,000 acres of land at Sewall's Point, and a new electric line between Norfolk and that coast will be built at once.

At a meeting of the Richmond, Ind., Interurban Railway Company Benjamin Starr, of Richmond, was elected president; B. F. Wisler, vice-president; J. H. Rolling, secretary, and J. W. Barnes, treasurer.

The Evansville, Ind., and Southern Railway Company, which proposes to build electric lines from Evansville to New Harmony, Princeton and Cannelton, has been incorporated by Dayton, Ohio, capitalists. The entire system will be 50 miles in length.

The Pittsburgh United Traction statement for February shows:

	1899.	Increase.
Gross.....	\$1,046,443	\$176,554
Net.....	566,961	41,715
Fixed charges..	914,613	528,192
Surplus.....	152,347	12,947

An item of interest to electric railway companies is contained in the action of the defeat of the Wentz bill in the Pennsylvania Senate. This bill proposed to give electric railway companies the right of eminent domain. The report against it was 13 to 1.

A trolley line between Dunkirk, N. Y., and Hickoryhurst, a fine Summer watering-place on Lake Erie, seems to be an assured fact. Representative citizens of both places are back of the enterprise and a 50 year franchise has been secured. The line will be four miles in length.

The Brookfield, Ohio, Railroad Company has been incorporated by James W. Rose, William G. Rose, Reese J. Erman, John J. Davies and Thomas H. Gilmer. The road is to be operated by steam or electricity and to extend from a point on the east line of Brookfield township to the Mahoning road.

The Kokomo, Ind., Railway and Light Company has been incorporated for the purpose of operating an electric railway and lighting plant in Kokomo. The capital stock of the new company is \$18,000, and the directors are William P. Stephens, Henry L. Woolfenden, L. J. Kirkpatrick, C. L. Harry and Fremont Woodruff.

The Washington, D. C., & Arlington Electric Railway Company propose to extend their line from Arlington Junction through Glenlaryn and Falls Church to Fairfax Court House. The old grist mill, to which Washington took his "grist," still stands, near Fairfax Court House. The road will eventually be continued to Manassas, Va., on the Southern Railway line.

The Pittsburgh syndicate of capitalists, headed by Senator Kennedy, is reported to be negotiating to build an electric railway between Laporte, Ind., and Michigan City, and ultimately extending the line to South Bend, where extensive interests are operated by Pittsburgh capital. Surveys will soon be made for the branch lines into Michigan, which the Pittsburgh syndicate is scheduled to build this year. A number of lines are now in successful operation.

Plans have been projected for an electric railroad between Newcomers-town, Ohio, and Uhrichsville. The Panhandle Railroad will be paralleled. Another new trolley line between Massillon and Canal Dover is also being planned. Beach City, Wilmot and possibly Navarre will be on the line. It is believed that the chief object in building the Massillon-Canal Dover line is to secure a route from Cleveland southward across the state to the Ohio River, via Cadiz, and terminating at Marietta.

At the annual meeting of the stockholders of the Houston, Tex., Electric Street Railway Company, the following directors were elected: A. N. Parlin, George E. Smith and F. A. Magee, of Boston; Austin Corbin, of New York; W. D. Cleveland, T. W. House, J. H. Kirby, E. P. Hill and H. F. MacGregor, of Houston. These directors subsequently met and elected the following officers: A. N. Parlin, president and treasurer; H. F. MacGregor, vice-president and general manager; F. J. DeMerrett, secretary; E. M. Champion, assistant treasurer; J. W. Payne, auditor; E. S. Ells, superintendent; C. W. Pace, assistant superintendent.

**SELF-INDUCTION EXPERIMENTS.**

BY ALFRED G. DELL.

The following appears to be a beautiful method of examining self-induction of coils and wires.

The figure will explain the arrangement; *f* is a cell of battery as free from polarization as possible; *g* is a sensitive galvanometer; between *b* and *c* is connected a coil or straight wire, or whatever is to be tested for its self-induction; *k* is a connecting key; *h* is a coherer, a small phial containing some very fine brass filings, and two wires passing through the filings to the bottom of the phial. Two stiff brass wires are better than copper ones, as they are not so liable to be bent in tapping. Two opposite points worked, but they seemed to be too sensitive to slight jars. I will give some of the most important experiments made with the above arrangement. When I pressed the key there was no deflection of the galvanometer needle, but when I raised it after being pressed the needle was deflected, a coil of wire being connected between *b* and *c*.

I tried wires between *b* and *c* without any coils or iron cores, and found the permanent throws of the needle, until the coherer was tapped, were greater with long wires than with shorter ones. With quite a short wire between *b* and *c* I obtained small or no throws of the needle at all, and with a long insulated wire paralleled back, close together, I obtained but small throws, while with the same wire coiled up I obtained relatively long throws.

Everything depends upon the amount of filings in the coherer. If there is only a small amount of filings, the two wires have to be quite close together, especially at some point in the filings. If there is what might be called a considerable amount of filings, say a small phial one-half or two-thirds full, and the wires are straight, they can be some distance apart, as there are more paths for the self-induced impulses to pass and make the partial connections. If the parallel wires are close together, with the phial half full of filings it will conduct too much at all times. By using care in tapping the coherer and frequently turning it upside down and tapping it to remove any filings that may be sticking to the two wires, and turning it over and tapping again, it will vary the throws of the needle nearly with the lengths of the wires or sizes of the coils used, the key being manipulated in the same manner at each throw.

The following appears to be what takes place: On closing the key the circuit is completed between *b*, *c* and *k*, but little or no current passes through *h* and *g*. On letting the key spring up the self-induced discharge passes into the coherer, and by means of sparks between the fine filings makes minute connecting bridges, the strength of the bridges, and of consequence their conductivities, depending upon the strength of the self-induced discharge.

Repeated tapping of the key, without any tapping of the coherer, will advance the throw of the needle until some limit is reached, beyond which it appears it will not go. With wires or coils giving short throws of the needle, tapping of the key fails to make the needle reach the throws caused by frequent tapping, when

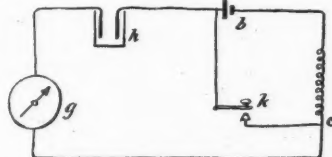


DIAGRAM ILLUSTRATING "SELF-INDUCTION EXPERIMENTS."

coils are used that give large throws. Of course, after the first throw of the needle, there having been no disturbance of the coherer, there is not as much current between *b*, *c* and *k* as before the throw, as part of it is passing through *h* and *g*, and of consequence there is not the same amount of self-induction at subsequent manipulations of the key.

If the coherer conducts to any extent after tapping, the throws of the needle will also include an additional strength of current, as the whole current is thrown on the circuit containing *h* and *g* when the key is raised. On letting the key spring up after being pressed, the needle swings around past the place at which it finally stops. It seems as the self-induced discharge passes into the coherer, it makes the partial connections between the filings, and the circuit being then partially completed, it swings the needle of its own accord, and immediately afterwards the conduction current rushes across the connections made by it and brings the needle to rest. The strength of the conduction current passing in the circuit containing the coherer and galvanometer depends upon the conductivities of the connections in the filings made by the self-induced discharge.

In making the above experiments, if the galvanometer coil has a high

resistance, it is better to place a shunt containing a break key across the galvanometer. Press the new key and tap the other, and then let the new key spring up. If the galvanometer has only several turns of fairly large size wire, the key is of no use, but when it has, say, over 25 feet of wire, if it is as large as No. 22, it will work without the second key in an uncertain manner, and the throws of the needle will not be much greater than with a few turns of larger size wire. The throws of the needle will diminish and the coherer work more erratic as the coils of wire of the galvanometer increase and their size diminishes, without the use of the second key.

**American Street Railway Association.**

Secretary T. C. Pennington has issued a circular letter, of which an abstract follows:

The American Street Railway Association will hold its eighteenth annual convention at Tattersall's, State and Sixteenth streets, Chicago, Ill., on Tuesday, October 17, 1899, continuing in session four days. The exhibits and displays of the supply men are so important a part of our conventions that the executive committee, in making arrangements for the meeting, have been as mindful of our wide-awake allies and as zealous in providing for their convenience and accommodation as for any other feature of the gathering.

The exposition will be held in Tattersall's, the largest exposition hall in the city. We will have an abundance of floor space, with all the light, heat and power required. Every applicant is assured that they will get all the space desired, as our resources in this direction are unlimited.

The convention will be held on the second floor of the exhibit hall, all stairways leading up from the inside, thus insuring the attention of all delegates and visitors to the exhibits.

The income from the sale of space will go to the American Street Railway Association. The executive committee of the association has fixed the price at 10 cents per square foot, and ruled that no space of less than 100 square feet will be assigned, but applicants may have as many multiples of this quantity as they wish, all in one body. Payment for space should be made to Mr. T. C. Pennington, secretary and treasurer of the American Street Railway Association, 2,020 State street, Chicago, Ill. Application for space should be made to Mr. Jas. R. Chapman, 444 North Clark street, Chicago, chairman Committee on Exhibits. Please state in your application for space the shape desired, number of feet wide and long, and the Committee on Exhibits will comply with your request if possible. Cars, sweepers and plows will be

placed outside of the building on the street.

It is earnestly requested that all exhibits shall be in place and all work finished by Monday evening, October 16, which is the evening prior to the opening of the convention. The local committee has rented the building from October 10 to 24, so you can ship your goods early and will have ample time to remove them. Watchmen will be in charge of the building, so that exhibits will be safe.

We expect a large exhibit, and perhaps it would be in the interest of the exhibitors to make arrangements to have the building open in the evening, as it is well lighted, and the electrical companies expect to make a large display.

Space must be applied for by September 1. Assignments will be made as promptly as possible after that date and exhibitors notified of their location. Exhibits of like character will be grouped together, and space will be assigned in the order of application.

The Committee on Exhibits will make contracts with carpenters, electrical workers and laborers at regular prices, so the exhibitors will not be overcharged for lumber, labor, etc.

Friday, the 20th, has been set apart by the executive committee for the examination of exhibits. No session of the association will be held on that day and no entertainments of any kind will be given by the local committee, so all delegates will have ample time to call upon you and see what you have to show them.

The headquarters of the association will be at the Auditorium Annex. All our hotels are within a radius of one-half mile and within 10 minutes' ride of the hall. They include Auditorium, Victoria, Leland, Great Northern, Wellington, Grand Pacific, Tremont and Sherman.

The executive committee advises all who desire rooms to apply at once, as they will be assigned in the order in which applications are received.

The annual dinner will be held at the Auditorium, Friday, October 20, at seven o'clock p. m. Tickets will be sold at the actual cost to the association. The railroads will sell tickets on the certificate plan.

The April *Home Magazine* (ready March 25) will contain the first authentic life of Admiral George Dewey ever published. The author, Mr. Adelbert M. Dewey, of Washington, D. C., is the official biographer of the Dewey family, and has had access to a mass of material that has been denied every one else. The illustrations, of which there will be a great number, are many of them from photographs never before reproduced. And to give particular weight and value to this life, it has been prepared with the sanction and approval of Admiral Dewey himself, and is therefore authoritative. Every patriotic American will preserve a copy of this number.

## ADVANCE INFORMATION

## New Electric Railways.

**WILMINGTON, DEL.**—The Wilmington & New Castle Electric Company has decided to extend its trolley line to Delaware City, and make a resort on the Delaware River near that place.

**PHONETON, OHIO.**—The National Traction Company, of Miami County, has been incorporated. The capital stock of the company is \$10,000. The company proposes to build a railway to be operated by steam or electric motive power along the old national road from Columbus through Madison, Clarke, Miami, Montgomery and Preble counties. Ex representative N. H. Albaugh, of Tadmire, Ohio, is interested.

**WAUKEGAN, ILL.**—Having secured nearly all the right of way for its proposed double-track electric line extension from Highland Park to Evanston, the Chicago & Milwaukee Electric Railway is preparing to build the road by July 1. Contracts have been let for the entire electrical construction, including a large extension of the main power plant at Highwood, new cars and other equipment.

**SALINE, MICH.**—Capt. E. P. Allen, of Ypsilanti, has secured a franchise from the Township Board for continuing the Ypsilanti & Saline Electric road through the township to Tecumseh.

**LYONS, N. Y.**—Charles W. Field and Lucius L. Moses, of the Clyde Electric Company, have secured the right of way from Clyde, via Rose and North Rose, to Bonnie Castle, on Great Sodus Bay, for an electric railroad. It will start from Clyde, cross the Rome, Watertown & Ogdensburg at North Rose, and reach northern Summer resorts on Lake Ontario.

**LEBANON, IND.**—The County Commissioners have granted an electric franchise on the Michigan road to the Indianapolis & Logansport Traction Company.

**MUNCIE, IND.**—The commissioners of Delaware County have granted the franchise for the Electric Traction Company that is to run a line between this city and Anderson through Daleville. Mr. McCulloch, who, with Charles Henry, of Anderson, is the owner of the road, has succeeded in obtaining the right of way also for a line between Daleville and Middletown, to connect with the Muncie-Anderson line at Daleville.

**CHILLICOTHE, OHIO.**—The Chillicothe, Bainbridge & Hillsboro Electric Railroad Company has been incorporated with \$1,000 capital, to build an electric railway from this place to Millsboro; the incorporators are J. K. Duffy, T. S. Mitchell, J. F. Harmon, Samuel Ryland and F. C. Jeffreys.

**LANSING, MICH.**—The construction of an electric railroad between this place and Grand Ledge is contemplated.

## Electric Light and Power.

**YONKERS, N. Y.**—The Consumers' Electric Company has been incorporated; capital, \$100,000; incorporators, F. A. Stratton and George M. Curtis, Jr., of New York city; Leonard B. Lampman, Coxsackie.

**RIPLEY, OHIO.**—The Ripley Gas Light and Coke Company have just been granted a contract for 10 years for lighting the streets by electric lights, and the company is now arranging to put in a first class electric light plant and run it in connection with their gas plant.

**CARBONDALE, PA.**—The Lackawanna Valley Electric Light and Power Company has been incorporated; capital stock, \$200,000.

**MANISTIQUE, MICH.**—The electric lighting plant at this place will be greatly enlarged, the capacity being trebled. A stock company is now being organized to provide funds for the improvements.

**CAMDEN, N. J.**—The Spring Lake Electric Light, Heat and Power Company has been incorporated. Electric light, heat and power works; capital, \$50,000; incorporators, Jas. E. Hayes, No. 301 Market street, Camden, N. J.; George H. S. Young, No. 273 South Tenth street, Philadelphia; John M. Fultz, Fraser, Pa.

**WRIGHTSTOWN, N. J.**—The Wrightstown Water, Electric Light and Sewer Company has been incorporated to carry on the business of an electric light company, etc.; capital, \$5,000; incorporators, Albert Watson, Sarah Newbold, Lydia A. Stockton, Lee C. Davis, Joel Haines, Frank B. Davis, Charles H. Smith, S. D. Harker, Charles D. Walters and Wilbur G. Davis, all of Wrightstown, N. J., and about 40 others.

**FRANKLIN, IND.**—The City Council has granted an electric light franchise to W. C. Thompson, of Chicago, who represents the bondholders of the Franklin Water, Light and Power Company, present holders of the franchise.

**PATERSON, N. J.**—The Hawthorne Heat, Light and Power Company has been incorporated. Its objects are to operate in gas and electric light and to build a waterworks. The incorporators are Irving Meyers, Adam Vreeland, William H. Post, Samuel Van Blarcom, J. E. Barker and Louis J. Jones, all residents of North Paterson. The authorized capital stock is \$10,000, but business will be commenced with a paid-up capital of \$1,000. The shares are \$100 each. Messrs. Meyers and Vreeland hold three shares each and the others one.

**HOUSTON, TEX.**—The contract for reconstructing the Citizens Electric Light plant—that is, the building—has been awarded to Mr. August Baumbach, of this city. Northern and Eastern firms will furnish the machinery. This plant equipped will cost about \$150,000, not including the extra poles and wires that will be used in a proposed extension of the service.

## New Telephone and Telegraph Companies.

**SPRINGFIELD, Mo.**—A second telephone line is to be built between this place and Lamar.

**FREMONT, OHIO.**—This city is to have a new telephone company in opposition to the Central Union. John W. Bath, of Elyria, has been granted a franchise. They will commence work at once putting in the new plant.

**NORTH BRANCH, MINN.**—The Minnesota Telephone Company has been incorporated; capital, \$50,000; incorporators, Fred W. Murray, Helen L. Murray, Charles Avery, Anna V. Avery, Jerry R. Beggs, all of North Branch, Minn.

**STREUBENVILLE, OHIO.**—The Phoenix Telephone Company will soon have long distance connection with all the cities and towns of Ohio where independent telephone companies exist, which will be in the nature of a boom for the local organizations.

**LEWISBURG, TENN.**—The Cumberland Telephone and Telegraph Company, under the direction of their general manager, J. R. Nance, have just completed a telephone line to South Berlin, connecting Lewisburg, which will be extended to Silver Creek.

**HANCOCK'S BRIDGE, N. J.**—Hancock's Bridge and Pennsville are to be connected by telephone.

**MAYVILLE, N. Y.**—The Mayville Telephone Company has been incorporated; capital, \$15,000; incorporators, S. Fred Nixon, Vernon A. Kent, C. J. Bannister, all of Westfield; Alvi T. Baldwin, Mayville; Geo. H. Frost, Buffalo.

**BROCKTON, N. Y.**—The Portland Telephone Company has been incorporated; capital, \$15,000; incorporators, Thos. C. Moss, Geo. W. Fuller, Ralph A. Hall, Augustus Blood, all of Boston.

**BRYAN, TEX.**—Telephone connection between this place and Madisonville has been reestablished, and, by a connection which has been formed at the latter place with another line, direct communication by telephone from Bryan to Huntsville is now established. In addition to this, Bryan has telephone lines extending to Iola and Pankey in Grimes County, and to Tabor and Edge in this county.

**PORT CLINTON, OHIO.**—The Clinton Telephone Company has been incorporated, to operate a local exchange, and is authorized to issue \$15,000 capital stock. Ed L. Barber, James S. Beatty, Jr., Fred J. Bollmeyer, B. W. Welson, W. H. Althoff and E. A. Powers are the incorporators.

**NORWICH, CT.**—A new telephone line is about to be constructed between this place and the county house at Preston.

**WILLOW GROVE, PA.**—The Bell telephone system will soon be extended from this place to Hatboro.

## New Incorporations.

**NEW YORK, N. Y.**—The Knickerbocker Electrical Maintenance Company has been incorporated; capital, \$10,000; directors, Louis B. Jennings, W. W. Bonneau and W. G. Cochran.

**ALEXANDRIA, N. Y.**—The National Electrical Supply Company has been incorporated to manufacture electrical apparatus; capital, \$25,000; incorporators, Henry D. Merrick, president; Morell Mareau, vice-president; Edwin C. Graham, secretary and treasurer; James B. Lackey, Henry F. Taff, all of Washington, D. C.; A. W. Armstrong, Alexandria, Va.

**NEW YORK, N. Y.**—The Meriden-Alberti Incandescent Mantle Company has been incorporated to manufacture electrical goods; capital, \$10,000; paid in, \$500; incorporators, David Ottensoser, Otto Kaufmann, Jacob K. Loewinger, all of No. 206 Center street, New York.

**CHICAGO, ILL.**—The Gregory Central Station Company has been incorporated; capital, \$10,000; furnish light, heat and power; incorporators, C. E. Wetton, Oscar M. Wolff, E. C. Lindley.

**CLEVELAND, OHIO.**—The Interstate Electric Company has been incorporated; capital stock, \$20,000.

**ST. LOUIS, Mo.**—The Mountain Water, Electric Power and Mining Company has been incorporated; capital stock, \$5,000; incorporators, Paul A. Fusz, M. Rumsey, C. Jagels and L. M. Rumsey.

**JERSEY CITY, N. J.**—The Pneumatic Fire Alarm Company has been incorporated; capital stock, \$1,100,000; incorporators, Albert Goldstein and Max Radt, of this city; Bernard Ewing, of Newark, and J. V. Bannier, of Nutley, N. J.

**CLEVELAND, OHIO.**—The Interstate Electric Company has been incorporated to manufacture electric machinery; capital, \$20,000; incorporators, Fred Haffner, Master Roach, John G. Haffner, all of Cleveland, and others.

**WATERLOO, IND.**—The Star Electric Company has been incorporated; capital, \$1,500; directors, A. C. Grublike, E. G. and A. L. Flack.

**GUTHRIE, OKLA.**—Territorial Secretary Jenkins has granted a charter to the Chandler Cotton Oil Company. The company will manufacture and sell the products of cotton and other seeds and carry on the business of electric lighting and power; directors, P. H. Hoffman, C. A. Filtsch, Chandler; H. L. Scales, W. Burgess, Corsicana, Tex., and J. J. Culbertson, Paris, Tex.; capital stock, \$50,000, of 500 shares at \$100 each.

**CHICAGO, ILL.**—The Martin J. Insull Company has been incorporated; capital, \$6,000; electrical machinery, etc.; incorporators, A. H. Reece, G. E. C. Johnson, Robert L. Elliott.