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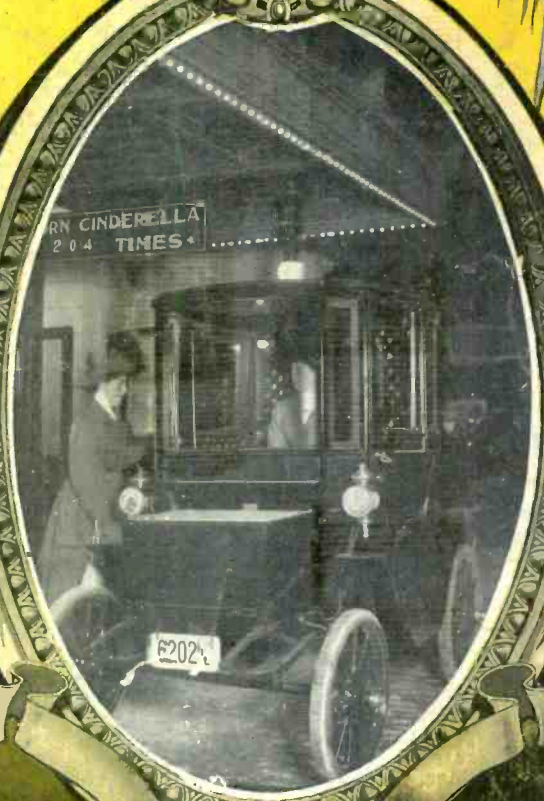

Vol. I. DECEMBER 1908 No. 8

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The Abyssinian government seems to have held out for some time against the proposition to "electrify" Ethiopia, but the French promoters of the enterprise brought such weighty arguments to bear that the authorities finally surrendered at discretion.

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The natives were surprised and the foreigners pleased at the condescension shown by Menelik. He claims descent from King Solomon, and is known in his own realms as the "Negus Negusti," or King of the Kings of Ethiopia, and conquering Lion of Judah.—Boston Herald.

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POPULAR ELECTRICITY

IN PLAIN ENGLISH

H. W. YOUNG, Editor.

Vol., 1. DECEMBER 1908. No. 8.

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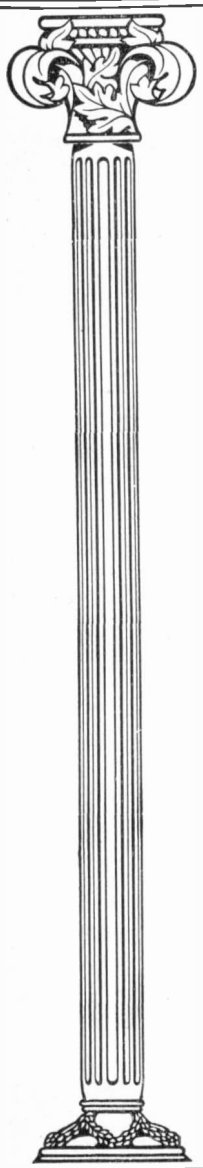
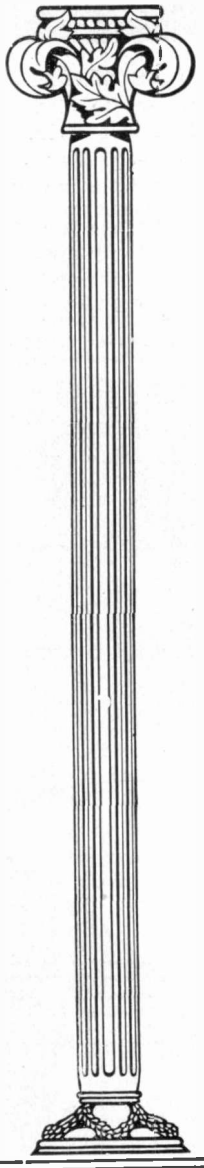
DIFFICULTIES IN RUNNING THE CARS IN CHINA.

The operation of tramways in Shanghai is beset with rather unusual difficulties. The motormen and conductors are of necessity Chinese.

It is doubtful if any other city in the world presents such a conglomerate street traffic on such a large scale as does Shanghai. During the busy hours of any week day upon the main thoroughfares may be seen heavy handcarts loaded with a ton or more of merchandise, each drawn by 10 or 12 coolies; wheelbarrows heavily laden with freight or passengers (sometimes as many as 12 persons ride on one wheelbarrow), dodging hither and thither in an effort to avoid collisions with faster vehicles; numberless rickshaws running pell-mell, bicycles and motor cycles with bells ringing, and motor cars and public and private carriages endeavoring to pass everything on the street. When to this surging mass of people, horses, and every kind of vehicle is added a double-track street railway, running down the middle of the streets that in some places are less than 20 feet in width, one is able to realize something of the difficulties encountered in maintaining an efficient street-car service. The difficulties of operation, however, are gradually growing less as the native employees become more experienced and as the public grows accustomed to the new means of transportation.

PUBLISHER'S PAGE





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It is a known fact that buyers patronize a medium which gives them the particular information they want concerning subjects in which they are interested. This pertains to the text as well as the advertising pages.

Real, live, up-to-date people who are interested in the wonders of electricity read this magazine 60,000 of them. Articles in its pages exploit every month *the very goods which you manufacture.* These are in no sense "trade" articles, but all the same they stimulate an interest in and awaken a desire for the pleasures and conveniences obtained through the use of electricity.

You will readily realize, therefore, that one of the chief functions of Popular Electricity is the carrying out of a unique and vastly efficient selling campaign for the whole electrical industry.

In view of these facts, is there any logical reason why you should not give a share of your business to Popular Electricity, which is not only giving impetus to the whole electrical industry, but will also give you greater direct results than any other form of advertising you have ever employed.

A MAGAZINE OF THE ELECTRICAL AGE

In announcing the publication of Popular Electricity some ten months ago, we stated that we were going to give the people the first and only magazine exploiting electricity in all its phases and in "Plain English." We realized that the field was large, that there were thousands of people interested in electricity who had hitherto had no medium free from technicality with which to satisfy their craving for knowledge on this subject. But confident though we were of the demand for such a publication, the results obtained so far have far more than fulfilled our expectations.

The past half century will go down in history as the Mechanical age. But the mechanical age must now give ground to a new and more wonderful era—the Age of Electricity, which is upon us. It is not surprising, therefore, that hundreds of thousands of people in all walks of life are awakening to the fact that if they are to keep abreast of the World's endeavors they must know Electricity. To make this magazine a real aid to those who are seking such knowledge will be our constant aim.

POPULAR ELECTRICITY PUBLISHING CO.
MONADNOCK BLOCK, CHICAGO, ILL.
W. A. WADSWORTH, Advertising Manager H. W. YOUNG, Editor J. A. HARNEY, Circulation Manager

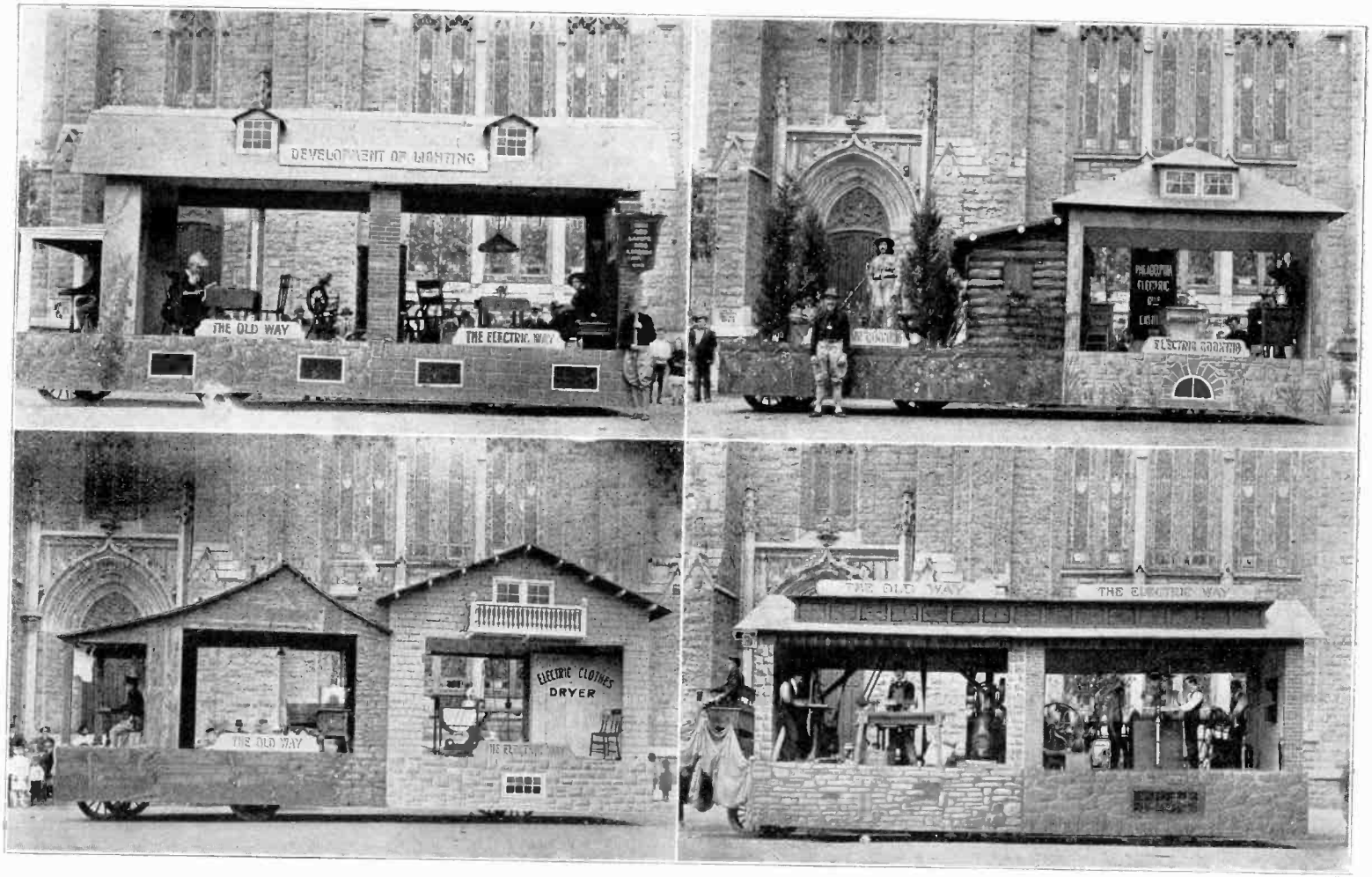
AN ELECTRIC CHRISTMAS.

With a snap and a whir and a flurry of wing.
Old Santa Claus comes to town;
His sleigh with electrical melody rings
As it hovers, and settles down.
No longer the deer and the commonplace way,
For Old Santa a-motor goes,
While a current now sparks to the tune of his larks,
As he bounces along the o'er the snows.

His gifts, we opine, are as equally quaint,
For the children are wise of course.
An electrical gift from the merry old Saint,
An electrical bear or a horse.
He rigs up the tree, with a grin on his face,
In a garland of glittering globes.
Then with grin and with hitch, he turns on the switch,
And he smiles in his "Chaufferish" robes.

When all of the wee ones come down at the dawn
They are charmed by the wisdom of "Nick,"
There's a little third rail that a train hums upon
While electrical toys do the trick.
A spark, or a flash and a halo of light
And the Christmas is one to remember,
For the motor puts vim in the presents of him
In this up-to-date day of December.

W. Livingston Larned.



(See Page 470.)

FOUR FLOATS IN THE PHILADELPHIA FOUNDERS' DAY PARADE ILLUSTRATING THE OLD AND THE NEW ELECTRICAL WAY OF DOING THINGS.

POPULAR ELECTRICITY
IN PLAIN ENGLISH

VOL. I DECEMBER 1908 No. 8

ELEMENTARY ELECTRICITY.

BY EDWIN J. HOUSTON, PH. D. (PRINCETON.)

CHAPTER VIII.—MECHANICAL EFFECTS OF ELECTRIC DISCHARGES.

The passage of electricity through any circuit is capable of producing a variety of what are known as mechanical effects. As the phrase is generally employed, by mechanical effects are meant any effects that change or influence the masses as distinguished from the molecules or the atoms. When a board is ruptured by an explosion, cut by a chisel, smoothed by a plane or a piece of sandpaper, bent or flexed by force, or changed in volume by compression, the effects so produced are generally known as mechanical effects. Necessarily all the changes above referred to influence the molecules and atoms as well as the masses. Nevertheless, by mechanical effects are meant those influencing the masses rather than the molecules or atoms. In other words, mechanial effects, as we shall use the phrase in this article, may briefly be defined as molar effects, or effects influencing the masses as distinguished from molecular or atomic effects that especially influence either the molecules or atoms.

Electricity produces mechanical effects in a variety of ways. Since all mechanical effects are produced by force acting on the masses through distances, they require the expenditure of energy. In accordance with the doctrines of the conservation and the correlation of energy referred to in a preceding article, the amount of mechanical effect—that is, the amount of work done by electricity—is necessarily fixed and definite. A given quantity of electricity flowing through a circuit is capable of producing a given amount of mechanical effects requiring the expenditure of a given amount of energy, and therefore capable of being expressed in units of work as foot-pounds, or in electrical units as volt-coulombs or joules. So, too, the amount of activity, power, or rate of doing work is capable of being expressed in foot-pounds per second or in units of electrical activity as volt-amperes or watts. In every case the amount of work done by a given amount of electricity is fixed and definite. One coulomb of electricity passing through a difference of potential of one volt—that is, one volt-coulomb or joule—is capable of expending energy and so producing a total amount of mechanical effects equal to 0.738 foot-pounds, or of exerting an amount of power or activity equal to one watt or 0.738 foot-pounds per second.

There are various ways in which electricity is capable of producing mechanical effects or doing mechanical work. These effects may be produced either by electricity at rest or by electricity in motion, or, as it is generally called, by electric charges or by electric discharges or currents.

By an electric charge is meant the condition in which electricity exists when it has been permitted to collect on the surface of an insulated conductor; that is, on a body which, being supported on and surrounded by an insulating medium, is unable to leave the conductor. It can be shown that under such circum-

stances the electricity immediately passes to the outer surfaces of the conductor where it collects in the condition known as an electric charge. If the charged body be touched by a conductor connected with the earth, the electricity is discharged to the earth in what is known as an electric discharge or current.

Without entering now into further details it suffices to say there are two kinds of electricity, positive and negative, so that a body is capable of receiving either a positive or a negative charge. It is also true that these different charges are capable of mutually attracting or repelling each other. Like charges repel and unlike charges attract each other, two positive charges or two negative charges repel each other and a positive and a negative charge attract each other.

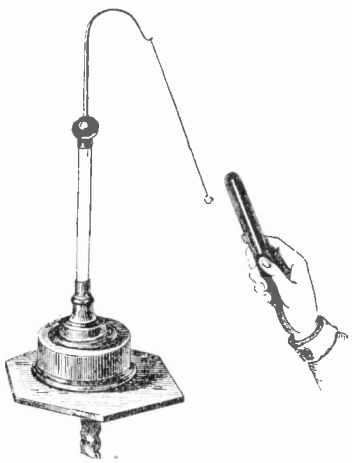


FIG. 59. ATTRACTION OF THE ELECTRIC PENDULUM.

The mutual attractions and repulsions of electric charges may either produce actual motion and thus do work or expand kinetic energy, or they may simply exert a pull or stress on the medium separating the two bodies, thus exerting potential energy. For example, in Fig. 59 (Ganot) is represented a piece of apparatus known as the electric pendulum. It consists of a pith ball suspended by a silk thread. When an electrified body such as a rubbed piece of sealing wax or hard rubber is brought near the pith ball, an attraction is exerted and the ball is drawn towards the electrified body. Here work is done, work that is capable of being expressed in fractions of a foot-pound, by the weight of the pith ball in fractions of a pound multiplied by the distance in fractions of a foot through which the attraction has raised the ball.

If an electrified body is brought sufficiently near the pith ball the latter is drawn towards it until they touch. Repulsion then occurs and work is done by the repulsion of the ball as represented in Fig. 60 (Ganot). This work can be measured by the weight of the ball multiplied by the vertical distance through which it is moved.

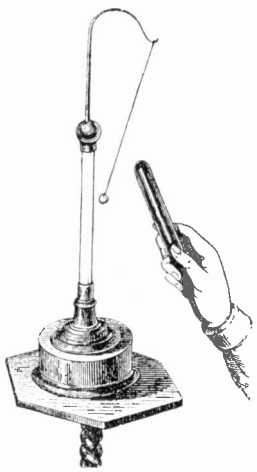


FIG. 60. REPULSION OF THE ELECTRIC PENDULUM.

The successive attractions and repulsions due to electric charges can be made continuous. In the apparatus known as the electric chime, represented in Fig. 61 (Ganot), three bells are suspended from a horizontal metallic rod hung as shown on the terminal of a frictional electric machine. Two of the bells (A) and (B) are suspended by conductors to the horizontal bar, while the third (C) is insulated from the bar by a silk thread but

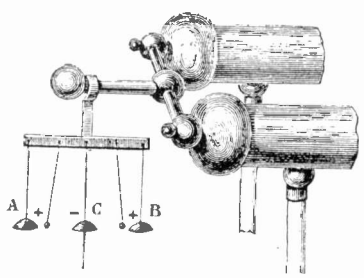


FIG. 61. ELECTRIC CHIME.

connected to the earth by a metallic conductor. Between the bells two small copper balls are suspended, as shown, by silk thread.

When the machine is worked, the bells (A) and (B), receiving positive electric charges, at once attract the copper balls by reason of an opposite charge, received in a manner that need not now be explained. The clappers strike the bells (A) and (C), when they are at once discharged to the earth, and are again attracted by the charges (A) and (B) and are again repelled. These to and fro movements, together with the consequent ringing of the bells, will be maintained as long as the machine is operated. They are, therefore, examples of mechanical effects produced by electric discharges.

A simple mechanical effect is shown in Fig. 62 (Ganot). Here a glass bell jar

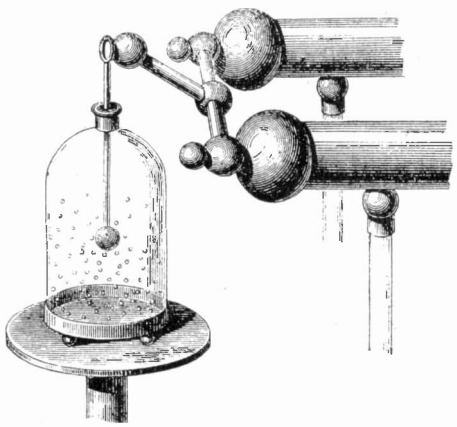


FIG. 62. PITH BALL EXPERIMENT SHOWING MECHANICAL EFFECT OF ELECTRICITY.

is placed on a metallic support connected with the earth and connected with one of the conductors of a frictional electric machine. The bell jar is provided inside with a metallic ball placed as shown. When an electric discharge is passed between the ball and the metallic case of the vessel, a number of pith balls that have been placed in the vessel are set into violent mechanical motions, being first attracted to the metallic ball, afterwards repelled from it, and as soon as they have lost their charge by contact with the earth are again attracted. Here again we have an example of mechanical effects as produced by the action of electric discharges.

It sometimes happens that the charges which collect on the opposite sides of a glass plate, or on the coatings of a Leyden jar exert sufficient attraction on each

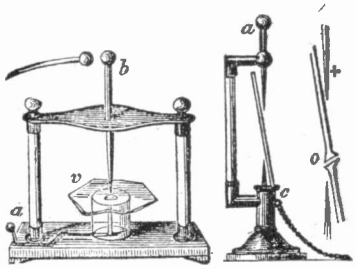


FIG. 63. PIERCING GLASS AND PAPER BY ELECTRIC DISCHARGES.

other to pierce or break the plate. For example, as shown at the left in Fig. 63 (Silliman), a plate of glass (v) is placed between two pointed conductors (a) and (b). On the discharge of a Leyden jar or battery between these conductors the mechanical stress produced by the opposite charges that collect under their extremities becomes sufficiently strong to pierce a small hole through the glass, just as if it had been made with a drill. In order to ensure this result, the charge must be concentrated on the glass immediately opposite the points, by placing a small drop of oil at the point to be pierced. An examination of the hole so formed will show that it is circular in shape and frequently remains filled with fine powdered glass dust, that can, however, be readily removed. With sufficiently powerful discharges, plates of glass several inches in thickness can be pierced.

It frequently happens during the use of a Leyden jar battery that one of the jars is broken by the discharge through the glass. A jar so affected is useless since it cannot be satisfactorily mended.

If instead of the plate of glass a piece of cardboard is placed between the pointed conductors (a) and (c), as shown at the right in Fig. 63, on the passage of a sufficiently powerful discharge a hole will be pierced at (o) through the paper. This hole is situated nearer the negative or — conductor than the positive or + conductor. A peculiarity about the perforation is that its edges are raised or burred on both faces of the card. This

fact, which has long been known, was at first hard to explain. It is now generally recognized, however, that its cause is very simple. The high temperature produed by the discharge results in the explosive liberation of moisture or other vapors that rapidly escaping raise the burr on both faces. With sufficiently powerful discharges, a hole may be pierced through a book of several hundred pages.

Similar effects are seen on a much larger scale in the rending of trees and the tearing of stone or brick walls by lightning discharges. The passage of the discharge produces considerable heat and is attended by the explosive escape of gases or vapors liberated in the mass of the material, thus producing some of the destructive effects of lightning flashes.

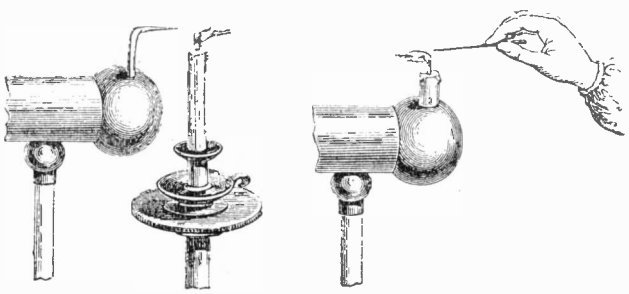


FIG. 64. STREAM OF ELECTRIFIED AIR PARTICLES BLOWS THE FLAME.

Reference has already been made to the fact that when the distance between a charged conductor and an approached earth-connected body exceeds that at which a disruptive discharge is capable of passing, the discharge becomes branched, and that if the distance is sufficiently increased, the discharge entirely loses its disruptive character. Moreover, instead of being accompanied by a loud, noisy report or snap, it becomes a quiet discharge. Such a discharge is especially apt to occur when a pointed conductor is placed in connection with the charged body. Under such conditions it is impossible for the conductor to receive a very high charge, since it tends to discharge itself. It is for this reason that the conductors of an electric machine are always made blunt or rounded.

Let us now inquire why a charged conductor thus provided with a point is capable of discharging itself. If a machine thus provided with a pointed conductor is examined in a dark room during action, a luminous brush discharge will appear to pass off from the point into the air. A discharge of this character is called a convective discharge, and is accompanied by a stream of air particles that continue to be thrown off from the point as long as the machine is in operation. The origin of the air stream is simple. It can be shown that the density of the electric charge on any body rapidly increases at those parts of its surface that are pointed. The body will therefore possess a very high charge, near the ends of the pointed conductor. Consequently, when the air particles come in contact with this high charge they will be rapidly charged and violently repelled. A constant stream of air particles is therefore shot off from the ends of the points, and since each of these particles carries off a small electric charge, the conductor is soon discharged.

That a stream of electrified air particles actually exists in convective discharges can be shown by the arrangement represented in Fig. 64 (Ganot), where a candle flame is brought into the neighborhood of a metallic point bent into the horizontal position as shown. Here the stream of particles thrown off from the points in a horizontal direction blows the flame of the candle in the position shown. When the amount of the discharge is sufficiently great, the convective discharge may be strong enough to extinguish the candle flame. Indeed, the air current is sufficiently strong to be felt by the hand if held near the point.

A similar piece of apparatus is represented in Fig. 65 (Ganot), where an electrical vane or whirl, consisting of the six horizontal wires bent as shown, is

fixed to a central cup and so supported on a vertical point as to be capable of rotating. When the electric machine is put in operation the escape of the air streams from the points by their reaction causes the vane to revolve in a direction opposite to that of their escape. This rotation is similar to that observed in the well known device called the rotary lawn sprinkler.

As already seen, the passage of an electric discharge between metals results in the mechanical tearing off of fragments of the metal that are afterwards volatilized and impart a characteristic color to the spark. This may therefore be cited as additional mechanical effect produced by a discharge. This effect, however, is by no means limited to solids. The passage of an electric discharge through liquids produces mechanical movements of the liquid in the direction of the discharge; that is, from the positive and negative electrodes. Curious results are sometimes produced by these movements. One of these is seen in a phenomenon known as the electric osmose.

By osmose is meant the unequal mixing of liquids of different densities through the pores of a diaphragm or wall separating them. If a solution of sugar and water is placed in a moist pig's bladder, and a glass tube, open at both ends, is tightly secured to the mouth of the bladder and then placed as shown in Fig. 66 (Silliman), in a vessel filled with

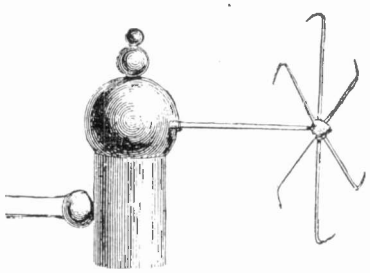


FIG. 65. AN ELECTRICAL VANE OR WHIRL.

pure water, a gradual mixture occurs between the two liquids through the capillary or hair-like openings in the wall of the bladder. The sugar solution flows out of the bladder into the water in the outside vessel, and the water from the outside vessel flows into the sugar and water in the bladder. These two streams, however, are of unequal strength. More water passes into the sugar solution. If, therefore, the bladder is immersed in the water, so that the level of the water is the same as that of the sugar solution, after the mixing has gone on for several hours, the level of the sugar solution will be much higher than that of the water.

The two currents thus set up are known as the endosmotic current, or

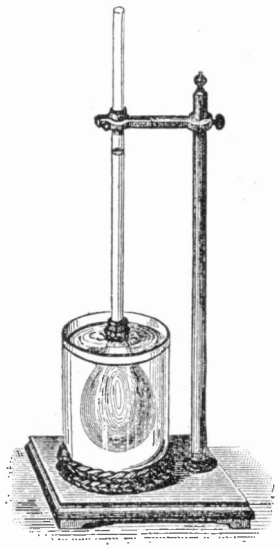


FIG. 66. OSMOSE OR THE MIXING OF LIQUIDS.

that which is directed towards the denser liquid, and the exosmotic current or that directed towards the less dense liquid. The endosmotic current is the stronger, thus causing a higher level of the sugar solution.

Now it has been observed that if matters can be arranged so as to permit an electric current to pass through the pores of the bladder, or of the medium separating the two liquids, that the passage of the discharge is accompanied by a movement of the liquid. Osmose caused in this way is known as electric osmose. If, for example, a vessel provided with a vertical wall or diaphragm of pig's bladder, is filled on one side with pure water and on the other with a solution of sugar and water, the passage of the current through the walls of the bladder will carry with it a water current in the same direction as that in which the elec-

tricity moves; i. e., from the positive to the negative electrode.

It is curious to note in this connection that if by mechanical pressure the liquid is forced to move through the pores of the diaphragm, that electric currents known as diaphragm currents are produced. Such currents have been actu-

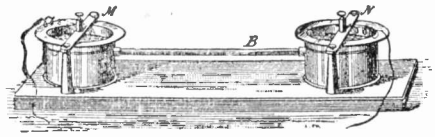


FIG. 67. CAPILLARY ELECTROMETER.

ally employed in the operation of a telephone that will be subsequently described under electro-receptive devices.

Another instance of the motion of liquids produced by an electric discharge is seen in a device known as the capillary electrometer. Here, as shown in Fig. 67 (Houston's Dictionary of Electrical Words, Terms, and Phrases), a drop of sulphuric acid and water is placed in the horizontal branch of a glass tube provided with two vertical arms that are dipped into vessels filled with mercury. The passage of an electric current through the tube results in the movement of the liquid drop from the positive to the negative electrode or in the direction in which the current is moving. A change of direction of the current therefore is accompanied by a change in the direction of the movement. The name capillary electrometer is given to this device because, when the differences of potential are less than one volt, the amount of the movement is proportional to the difference of potential causing it, so that the electric pressure or difference of potential can be measured by the amount of the movement.

By far the most powerful mechanical effects are produced by electric currents. As Oersted has shown, the passage of an electric discharge through any conductor results in the setting up of circular lines of force around the conductor. For this reason electric circuits are capable of attracting or repelling one another according to the direction in which the electric discharges are passing through them.

By arranging the conductor in the shape of the hollow solenoid or coil shown in Fig. 68 (Ganot), and supporting it as shown, the solenoid acts as a magnet, and will come to rest when pointing approximately north and south. If another solenoid be brought into its neighborhood as shown in the figure, attraction or repulsion will result according to whether dissimilar or similar poles are thus brought near one another. The amount of tnese effects is greatly increased by placing cores of soft iron inside the solenoid. It is in this, as well as in other similar ways that electric motors are produced. These constitute by far the most striking examples of the mechanical effects of the electric cur-

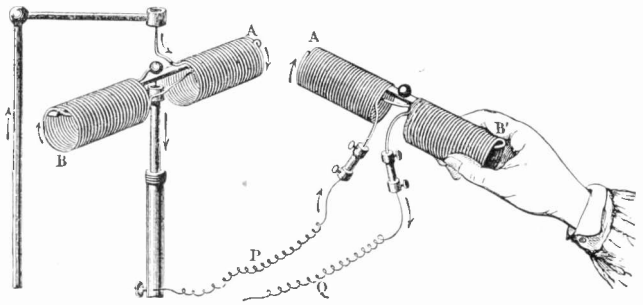


FIG. 68. ILLUSTRATING MECHANICAL EFFECT PRODUCED BY ELECTRIC CURRENT.

rent. They will be described in another place.

A curious class of phenomena produced by the passage of an electric discharge is seen in the motion caused either by electric currents or by magnets on the streams of luminous matter produced by the discharge of electricity through vacuous spaces. An electric charge differs from an electric current solely in that in the charge the electricity is at rest on the surface of the conduc-

tor; while in the current it is in rapid motion through the conductor. Now, as we have already seen, the luminous discharges that pass through vacuous spaces consist of streams of molecules each of which carry with them minute electric charges that are moving with tremendous velocities through the empty spaces. Very curious effects are therefore produced by the action of other currents or magnets on these discharges. Some of these effects will be referred to in a subsequent chapter.

(TO BE CONTINUED.)

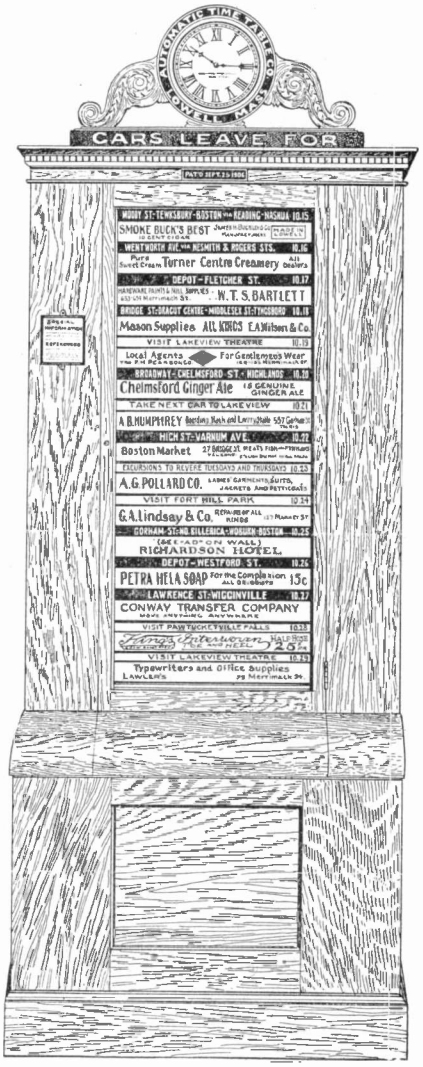
AUTOMATIC ELECTRIC TIME TABLE.

Any one along the line of a particular trolley route naturally knows the running time on that line or the time of the day when an electric car is expected to pass a certain spot, but that, generally, is the extent of his knowledge of the running time of the road. When these same people arrive at the transfer station and wish to know when the next car leaves for some other section, the starter is invariably looked up for the desired information.

In one look at the automatic time table you can tell almost at a glance the running time of any of the lines for 15 minutes in advance. The time clock runs continually, similar to any other clock, this portion of the machine being the make of the Standard Electric Time Company, which is used in all large stations and waiting rooms throughout the United States. The sheet upon which the time table is written operates from 6 a. m. until 12 o'clock midnight, 18 hours in all, or during the time that the cars are in operation. By the use of a battery system the clock winds itself every minute.

Each individual minute of the 18 hours is represented on the endless chain of cards which revolve about through the use of an electric contrivance. There are 15 cards showing at one time, the top card agreeing with the clock and the other 14 showing the schedule for the a corresponding number of minutes to come.

During the 18 hours of service there are 1,080 sheets or cards displayed on the face of the time table. As the card passes from view at the top the sheet moves up one, a new card appears at the bottom, and the one which disappears gradually works its way down in the rear of the machine, is folded and put in readiness to appear in its proper



AUTOMATIC ELECTRIC TIME TABLE.

turn during the next 18 hours of service.

A portion of the space on the cards is used for advertising purposes. The space where no cars are scheduled is used by the railroad during the summer months to advertise the various attractions and places of interest along the line, as shown by the cut.

PROGRESS OF ELECTRICITY.

SHOWN BY THE FOUNDERS' DAY PARADE IN PHILADELPHIA.

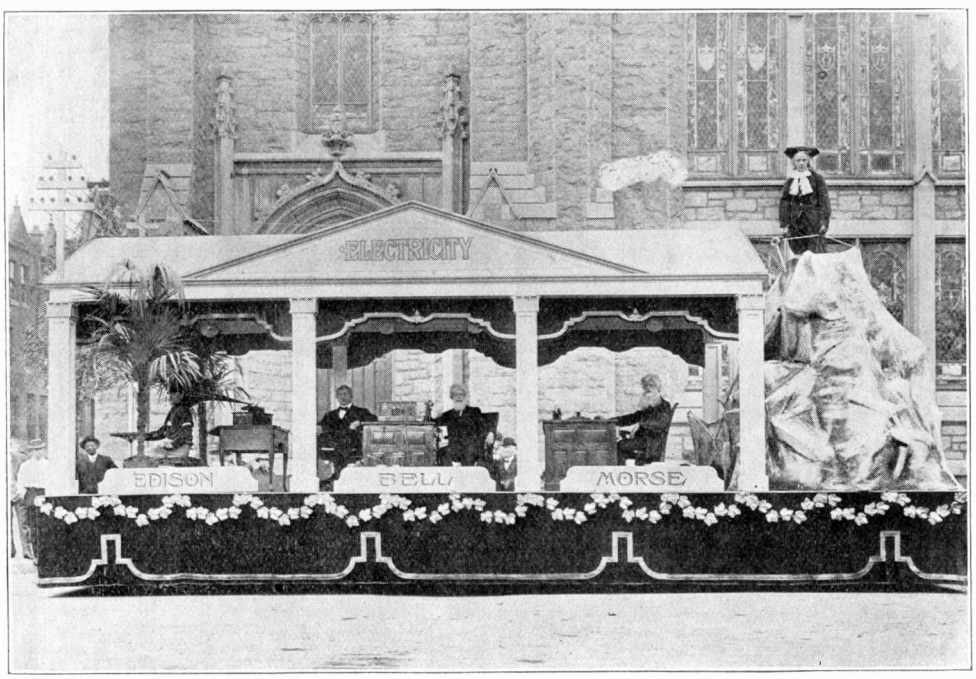
BY FREDERIC BLOUNT WARREN.

Early in October, Philadelphia devoted an entire week to a celebration of the two hundred and twenty-fifth anniversary of the arrival in the Delaware River of William Penn, the city's founder. After a day of introductory religious ceremonies, there followed six days of pageantry, on which were told the stories of the city and the state's military, municipal, industrial, maratime and historical greatness.

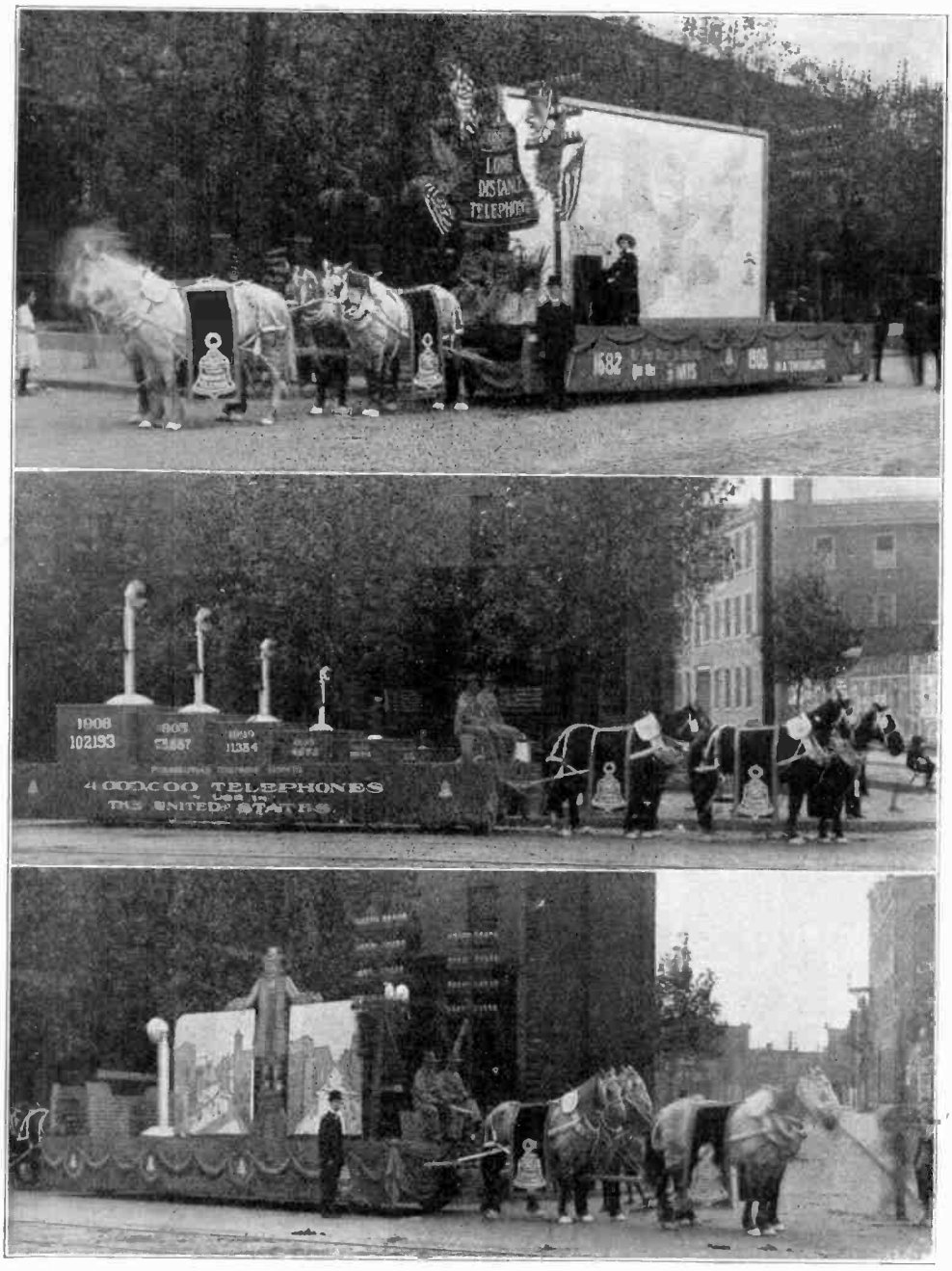
On the historical parade it is natural that the greatest thought, the greatest care in conception and fidelity to detail should have been lavished—and it was. But from a practical viewpoint the industrial parade of Founders' Week was, by all odds, the most interesting and significant.

The commercial supremacy of Philadelphia, as one of the most extensive manufacturing centers in the New World, was exemplified in this industrial line of march before at least three-quarters of a million spectators. In the pageant was the work of thousands of men. There were floats representing industries which employ a quarter of a million skilled workers. Thousands of dollars had been spent to make the floats distinctive and attractive. For weeks before, designers had labored with their exhibits, and the result was one of the most versatile and original pictures ever presented on wheels.

There were 160 floats in the pageant representing 100 separate business concerns and 50 distinct classifications of industries. Under one of these classifications was grouped the electrical industry, and so rigid were the rules pertaining to advertising on the part of the participants, and the difficulty encountered in making floats explanatory without advertising, that the number of concerns represented in the electrical division was



ALLEGORICAL FLOAT REPRESENTING AN ELECTRICAL HALL OF FAME.



FLOATS SHOWING THE DEVELOPMENT OF THE TELEPHONE.

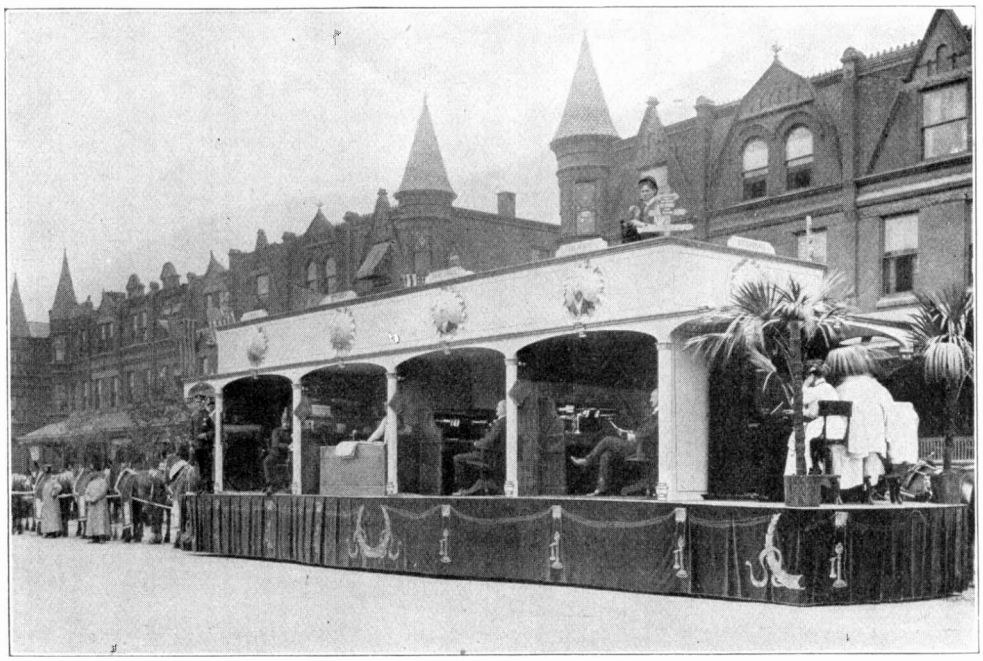
finally restricted to three. They were: The Philadelphia Electric Company, with six large floats; the Bell Telephone Company, with three floats; the Keystone Telephone Company, with one float. Thus, this important industry received a total numerical representation afforded by ten floats, on which, however, great care had been lavished and large sums of money spent, that weakness in numbers should not be emphasized by weakness in individual exhibits. That the money was well spent is shown by the illustrations.

After considering ways and means and going into construction details of every sort, the Philadelphia Electric Company decided to enter a series of six floats—the first float to be semi-allegorical and the next four floats to demonstrate, as attractively as possible, what electricity has done for the city of Philadelphia—or any other city, for that matter—in the way of modern methods of working and living; the last float being merely a lamp exhibit.

The chief problem was that of how to obtain advertising of a value commensurate with the expense of the floats. It was finally decided that the very best advertising result could be obtained by drawing a contrast on each float between methods of working and living before electricity was available—which was termed "The Old Way"—and the present method—which was termed "The Electrical Way."

Designs of the floats called for a uniform size of 30 feet by 10 feet; the height being regulated by the distance from the ground to the lowest overhead trolley wire on the line of the parade. Six of the electric trucks and service wagons of the company were dismantled, trailers were built for each and solid platforms constructed covering the two beds.

Float No. 1 was of allegorical nature. The greater part of the float was covered by a booth representing a kind of hall of fame, divided into three sections. In these sections, seated at desks or in their workshops, were figures representing Edison, Morse and Bell. At the rear end of the float, on a raised section, stood an individual made up to represent Franklin. A kite and string, to which was attached a key, flew over the entire float and by means of a static machine Franklin would, from time to time, cause long sparks to be emitted, with the crackling noise common to machines of this character. This float was merely entitled "Electricity."



A COMPLETE TELEPHONE EXCHANGE ON WHEELS.

Floats Nos. 2, 3, 4 and 5, shown in the frontispiece of this issue, represented miniature dwellings and workshops, all of them roofed over and painted so as to represent true sections of the structures.

Float No. 2 illustrated the development of the lighting of dwellings. The first half of the float showed the interior

of an old colonial room, completely furnished, with old colonial candlesticks and lamps as the principal features, with a girl in colonial dress seated at a table reading. The second half showed the interior of a modern living room, also completely furnished, with electric wall brackets, electric dome light, luminous radiator and electric fans, the lamps being lighted from the batteries of the truck, and the fans also in operation.

Float No. 3 represented the development in cooking methods. The first half of the float showed the interior of an old log cabin with a trapper, in costume, cooking his meal over a log fire. The details of this were completely worked out and the effect of the logs burning was obtained. The second half of the float showed the interior of a modern electric kitchen with girls, smartly dressed, operating the "kitchenette," and the various electrical dough-mixing and egg-beating appliances. All the small motors and the kitchenette on this float were operated from the batteries on the truck, as were also the lamps.

Float No. 4 represented the development of laundry methods. The first half of the float showed an old negress at the wash tub in a cabin, with children playing around the floor, old stove in the corner and a chimney actually throwing out smoke. The second half showed the interior of a modern electric home laundry, with electric irons, electric washing machine, electric clothes dryer—all this apparatus being demonstrated by neatly dressed maids and operated by current furnished from the batteries on the truck.

Float No. 5 demonstrated the development in factory methods. The first half of the float showed the interior of an old style wood working establishment operated by a stationary engine in one corner of the float. This float was completely equipped with shafting, belting and machinery, all being operated by the steam engine which was burning soft coal and throwing out clouds of black smoke. Men were at work at the various machines. The second half of the float showed the interior of a modern machine shop, all of the machines being direct connected to electric motors and in operation. The contrast of cleanliness and convenience was sharply drawn and every detail on the float was minutely worked out.

Float No. 6, not illustrated, was merely a large service auto, completely covered by a frame, over which was stretched blue and yellow cloth, the colors of the city. Over the entire frame were studded, in neatly worked out designs, various types of electric lamps. In the center on both sides the words "Founders' Week" were spelled out in miniature electric lamps and on the back of the auto was the Philadelphia Electric Company's monogram in miniature lamps. The wording, "Founders' Week," and the monogram were illuminated from time to time by means of a flasher, the result being effective.

A large banner carried by eight men led the electric company's section. It bore the wording, "The Philadelphia Electric Company's Exhibit," in gold letters. At the side of each float smaller banners, similarly made up, were carried, bearing various inscriptions, such as:

"In Philadelphia in 1889—135 Horsepower in Motors Were in Use. In 1908—41,000 Horsepower."

The various banners were adjacent to the floats to which they applied.

Not the least of the difficulties in preparing such an exhibit as this—from an electrical standpoint—was the fact that the parade was a daylight one, thus making the illuminating feature difficult to illustrate. Nevertheless all of the floats and the standards which carried the banners were completely wired and fitted with both standard and miniature lamps, so that in the event of the parade being postponed until darkness had set in, the appearance of the floats at night would have been even more effective than was the case during the day. The floats were designed and constructed by the company in conjunction with decorators.

The Bell Telephone Company's impressive exhibit was as follows:

Float No. 1. A map showing the scope of the Bell Telephone Company's system in the United States, and Philadelphia's connections with other cities. This map was wired from city to city, and at the larger cities the centralization of wires from widely separated and remote territory was well illustrated. The

map was one of the largest ever built, being 30 x 11½ feet.

Float No. 2. A series of seven telephones from one to nine feet in height, illustrating the telephone development in Philadelphia from 1883 to 1908—from 2,000 telephones in 1883 to 103,000 in use now.

Float No. 3. This float showed William Penn on the Philadelphia City Hall holding two pictures: One showing Market street, the principal thoroughfare, as Penn would have seen it in 1890, filled with telephone and telegraph wires, and one showing it in 1908 virtually free from wires. On this float there was also shown a cross section of the company's underground plant. At the head of this float there appeared an enlarged old-style "Blake" transmitter and two poles loaded with wires, illustrating the old-style construction, and in the rear of the float was the modern underground section showing the present type.

The Keystone Telephone Company's float was drawn by 20 horses, manned by 24 men and contained seven young women operators. It represented a complete telephone exchange.

TELEPHONE LINE OVER THE ALPS.

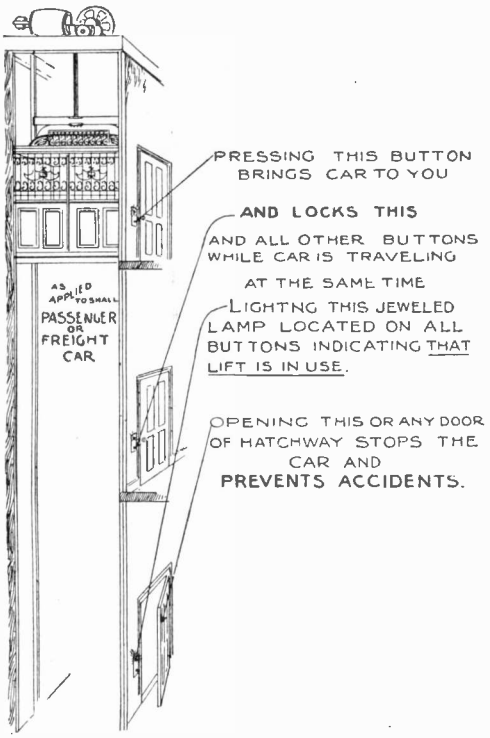
Across the Alps, at a height of 11,962 feet above the sea level, there is being constructed a telephone line which is at a greater altitude than any other in the world. The first section of the line is 2¼ miles long and its construction presented exceptional difficulties. Owing to the strong winds and to the snow and storms prevailing in these high regions, an overhead line supported on poles was quite out of the question. On the other hand, an insulated cable laid on the ground would have sunk gradually in the snow and ice, and have made repairs impossible.

Acting upon the suggestion of Dr. Alessandri, chief of the Physical Observatories of Mount Rosa, who had been carrying out experiments on the high insulating qualities of dry snow in those elevated regions, it was decided to lay a naked wire the whole length on the ground and across the snowfields and glaciers. It was also pointed out that, owing to the slow movements of the glaciers—even at the time of the year when the ice and snow are melting—and to the high plastic qualities of the ice, the wire would cut its way gradually through and suffer no breakage or injury. So far the wire has been laid for more than six weeks, and no damage is reported.

ELECTRIC AUTOMATIC LIFT.

Users of hand power dumb-waiters and small lifts realize the inconvenience of operation. To eliminate the troubles encountered in the past the Kenny automatic electric lift was designed.

The accompanying diagram explains at a glance the operation of the system.



A button switch, mounted on every floor, operates a small lamp and a special lock. Pressing any button brings a car to that particular floor, locking all other buttons and at the same time indicating by the lamps in the other floors that the car is in use.

If a door is left open, the car will not start until it is closed. It is made in various sizes to lift from 50 to 5,000 pounds, and can be installed very reasonably, whether as a dumb-waiter or for small passenger and freight purposes.

MODERN PHOTO-TELEGRAPHY.

The portrait of the King of England reproduced in the accompanying halftone illustration was taken by the latest method of photo-telegraphy. This picture was transmitted by cable from The Illustration, a magazine in Paris, to The London Daily Mirror.

The photograph, or rather the original negative, must be in the form of a celluloid film. It is placed around a glass cylinder in the sending apparatus. The apparatus is so arranged that the glass cylinder has a rotary screw motion similar to the record on an ordinary phonograph cylinder. All light is shut off from the cylinder by means of an external box, except for a very small hole in the front, on which the light of a Nernst lamp is concentrated by a lens. Instead of a traveling needle, as in the phonograph, the pencil of light passes over the film. It will be seen that the light will thus meet the consecutive tiny portions of the film, one after the other, and which are of different intensities.

A prism is placed inside the glass cylinder which reflects all the light which penetrates the film on to a selenium cell arranged at the other end of the box. As the film rotates, and the portions of it which intercept the light vary in intensity, so the amount of light which is reflected to the cell varies correspondingly.

By a peculiar physical phenomenon, the electrical resistance of selenium varies in proportion to the amount of light falling upon it. The selenium cell above referred to is therefore connected in the telegraph circuit, and as the light passing through the film is reflected upon it the resistance of the circuit varies in accordance with the density of the light coming through the film, and striking the cell, and the current traveling over the line fluctuates accordingly. At the receiving station, miles away, the instrument receives this fluctuating current.

The receiving apparatus is somewhat similar. There is a revolving drum inside a dark box which rotates at the same speed as the sending cylinder. Over this drum is wound an unexposed photographic film. One tiny opening lets a pencil of light enter the box and fall on the film. A little aluminum screen covers the light opening, and this screen is operated by electromagnets in circuit with the telegraph line. The magnets vary in strength in proportion to the fluctuations of the current coming from the sending station, and they move the screen ever so little, back and forth, so

as to let more or less light enter the box and fall on the revolving film. These variations of light are in consequence in direct proportion to the variations of light falling on the selenium cell at the sending end, therefore the film is exposed to exactly the same degree, at the different points on its surface, as was the sending film. When developed, the film at the receiving station is an exact reproduction of the one at the sending station.

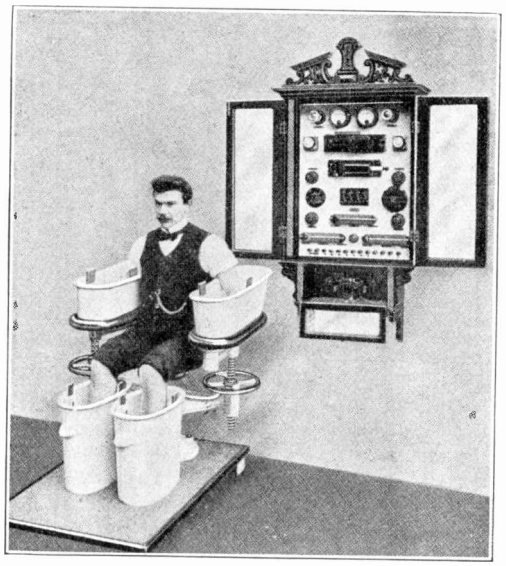
POACHING BY ELECTRICITY.

On the Teltow Canal, in Germany, where the boats are propelled by electricity, an ingenious rogue conceived the idea of making use of the electric current for obtaining a supply of fish. All that was necessary was to attach one end of a piece of wire to the boat trolley wire and dip the other end in the water. All the fish within a radius of 30 feet were instantly paralyzed.

GERMAN ELECTROTHERAPUETIC APPLIANCES.

The Multostat is the firm name of a contrivance of German manufacture which enables the practicing physician to make every possible use of electric currents, including motor operation. Mounted on a small plate, the Multostat contains all regulating, switching and contact apparatuses necessary for galvanization, faradization, for caustic and endoscopic current, and for the motor-transformer. The latter generates the caustic, the faradic and the endoscopic current, and simultaneously drives a flexible shaft transmitting rotary movement to the hand pieces for vibratory massage.

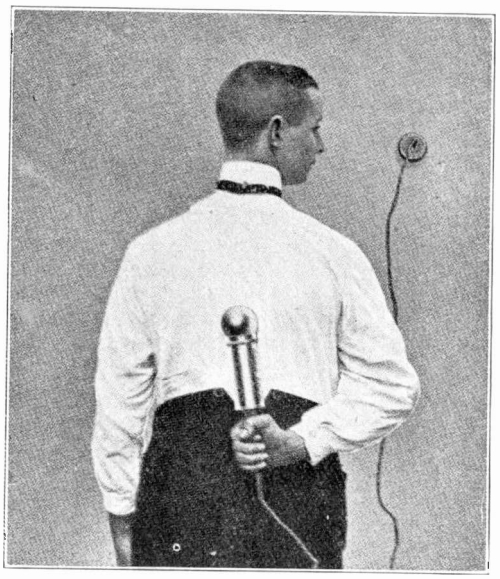
All the regulating contrivances permit of finest gradation. A feature of



THE SCHNEE FOUR-CELL BATH TREATMENT.

the Multostat offering special advantages is that cauterization and endoscopy may be executed simultaneously. The entire apparatus takes up but little space and, being provided with handles, can be transported with ease. Placed on a small table with rubber castors it can be rolled about. This mobility makes it possible to shift the apparatus from room to room, and it is therefore not necessary for sanatariums, hospitals, etc., to keep on hand a number of fixed equipments. One use of the Multostat is in connection with the four cell bath treatment shown in one of the pictures, devised by Li Schnee, by which hydro-electric baths may be given.

The easy operation of an electric massage machine is also illustrated. Ex-



ELECTRIC MASSAGE MACHINE.

changeable working parts of the instrument permit of its use for massage of the face as well as of the body. The strength of the vibratory movement can be regulated.

ELECTROCUTION OF ANIMALS.

Very satisfactory experiments in electrocution of animals for food consumption have been made within the past year by Dr. Stephane Leduc, of the Medical School of Nantes, France, and they undoubtedly demonstrate that animals can be electrocuted very easily and without causing pain. During the course of researches made by Doctor Leduc with a view of causing electric sleep, he discovered this new and rapid method of inflicting painless death, a method which is very simple and inexpensive. The apparatus necessary is simple and not very costly, and the direct current used does not require to be stronger than such as is used for lighting purposes of low voltage.

The current is interrupted at frequent intervals per second, and these frequent

interruptions are produced by a special apparatus designed by Doctor Leduc. If an animal is submitted to this current, and if functions of life, circulation, respiration, etc., are stopped, a perfect and general insensibility is produced, while none of the essential organs is injured. If the current is stopped before two minutes have elapsed, life is restored again, and the animal does not appear to have suffered from the experiment. An animal subjected to this current for more than two minutes dies without pain from asphyxia.

The animal to be electrocuted is placed upon a platform insulated from the ground by glass or porcelain stands. One electrode is placed upon the forehead between the eyes, and the other is placed at the extremity of the spinal column so as to concentrate the current through the brain and spinal marrow, the two places where the electrodes are applied having previously been shaved in order to secure a perfect contact. As soon as the current is established the animal falls senseless, and it is then bled. Owing to the great contraction of the muscles the bleeding is very profuse, and consequently the meat is supposed to be of better quality. It is doubtful if this slow method would find favor in this country.

ELECTRICITY IN COAL MINING.

PART III.—COAL CUTTING MACHINES.

Although there is no likelihood that the services of the hand miner will be dispensed with entirely in production of bituminous coal, still his work is now principally odd job work—for production on a high tonnage basis his place has been taken by the electric chain cutting machine. The electric chain machine is essential nowadays for rapid development, maximum continuous production and greatest effectiveness per man employed, which means least cost per ton of output.

Experiments with various types of cutter bars led to the development of the chain machine, which is now within the reach of every producer of bituminous coal and is adaptable to almost every condition of coal mining. The machine is simple in principle and operation. It consists essentially of two parts: First, a rigid base frame, held firmly in place on the floor of the room by jacks, front and rear, to the face and roof respectively. A pan foot under the front jack and the two rollers resting on a skid at the rear give all the firmness of three-point support, regardless of floor irregularities.

Second, fitted to guides on the rigid base is a traveling frame of long triangular form, with an endless cutter chain embracing its three sides, passing around two idle sprockets at the forward end and a driving sprocket at the rear. An electric motor attached to the rear end of the traveling frame performs the double duty of driving the cutter chain around the frame and of forcing the frame itself, with the chain, continuously forward along the rigid guides. The links of the chain carry inserted cutter bits; some horizontal, others inclined upward and downward. As the traveling frame advances into the coal these bits make a kerf or channel four inches high.

In clean coal with smooth bottom the chain may run close to the floor and leave practically no bottom coal to be taken up. Where rolls are common the chain may be set to enter at any desired height and pitch. The depth and breadth of cut, as also the rate of feed, are variable to suit the hardness and character of the coal.

Fig. 1 is a view of an electric chain cutter making an undercut. It is firmly braced, front and rear, and the motor which operates the endless chain with its cutting tools is shown mounted on the traveling frame. Fig. 2 is a view of the same machine as the cutter is being withdrawn from the face. Current is brought to the motor through a cable attached to the conductor wires in the main entry, the cable being paid out from a reel as the machine is advanced to the face.

The machine runner, stationing himself at the controller of the motor, attends to the operation of the machine as

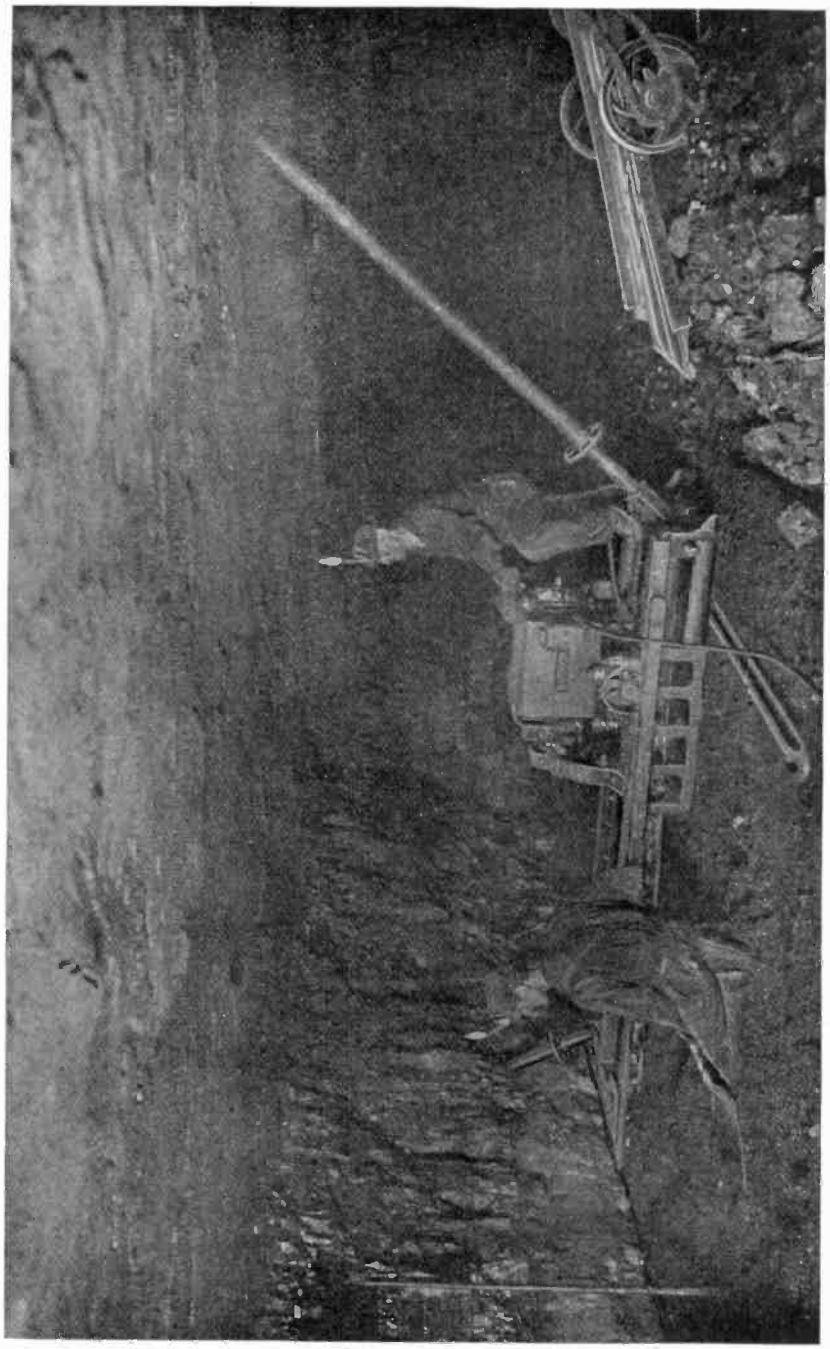


FIG. 1. ELECTRIC CHAIN CUTTER AT WORK UNDERCUTTING A DEEP VEIN.

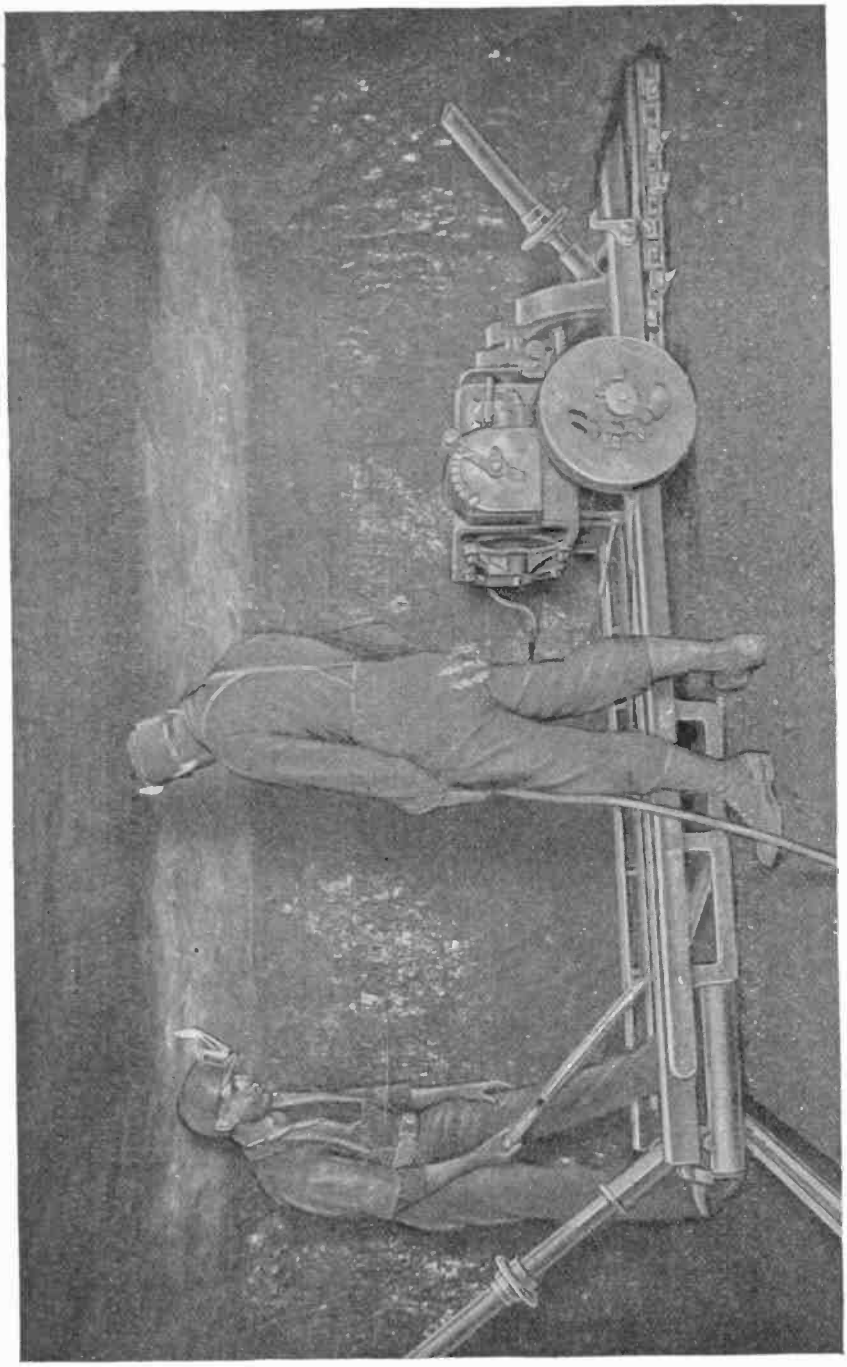


FIG. 2. RUNNING THE ELECTRIC CHAIN CUTTER BACK FROM THE FACE AFTER A CUT HAS BEEN MADE.

the cutter chain advances under the coal. His helper, shovel in hand, clears away the cuttings as brought out by the chain. The depth of the cut is determined by the length of the machine used, and this, like the breadth of the cutter head and the rate of forward feed, must be governed by the height and character of the coal, the nature of the roof and floor, etc. Reaching the full depth of the cut, the feed stops automatically, and the movement of a reverse lever throws in the quick return device, which backs the machine rapidly out from the coal. While the machine thus withdraws, the men release the jacks and prepare to move the machine to the right a distance equal to its own width, there to reset the jacks and make a second run.

Self-propelled trucks for moving the cutting machines are the most convenient for general utility purposes. In this type the motor which operates the cutting machine is also connected by means of sprocket and chain drive to the wheels of the truck. There are two types of these self-propelled trucks, one in which the current is collected by a regulation trolley pole similar to that on a street car, Fig. 3, and the other in which a small hand-operated trolley pole is used as shown in Fig. 4. In the latter type the operator sits on the rear of the machine and holds the trolley wheel against the wire by means of a handle shaped like a policeman's club. This handle is, of course, insulated from the wheel which collects the current.

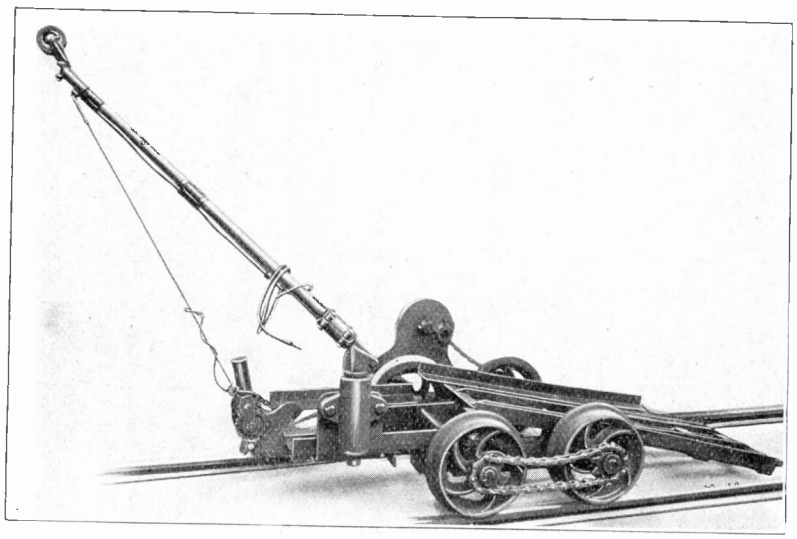


FIG. 3. SELF-PROPELLED TRUCK WITH TROLLEY POLE.

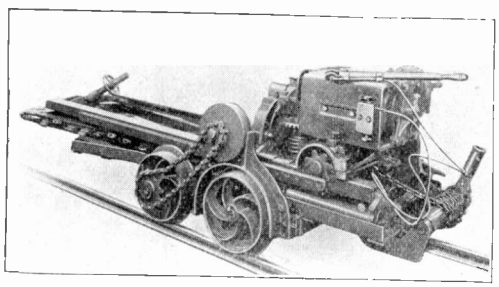


FIG. 4. SELF-PROPELLED TRUCK WITH HAND TROLLEY POLE.

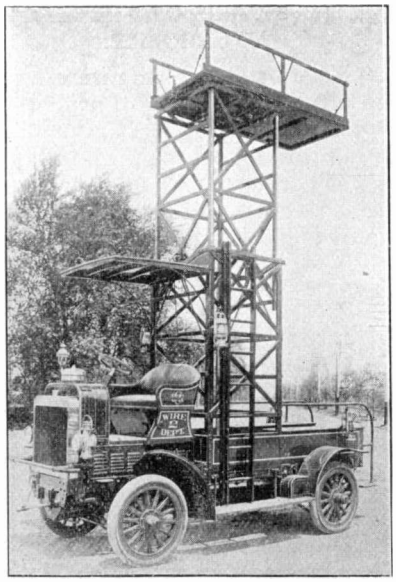
STATIC ELECTRICITY FROM BELTS.

To show how great may be the generation of static electricity experiments were performed in some German factories. The experimenter succeeded in drawing sparks an inch to an inch and a half long from a five-inch belt on a wheel making 1,000 revolutions a minute. The risk of explosion in dust or gases was also subject to investigation with a view to elimination of the danger. Coatings of bronze or aluminum powder prevented static charges, while a weekly application of acid-free glycerin was a remedy and added durability to the belt.

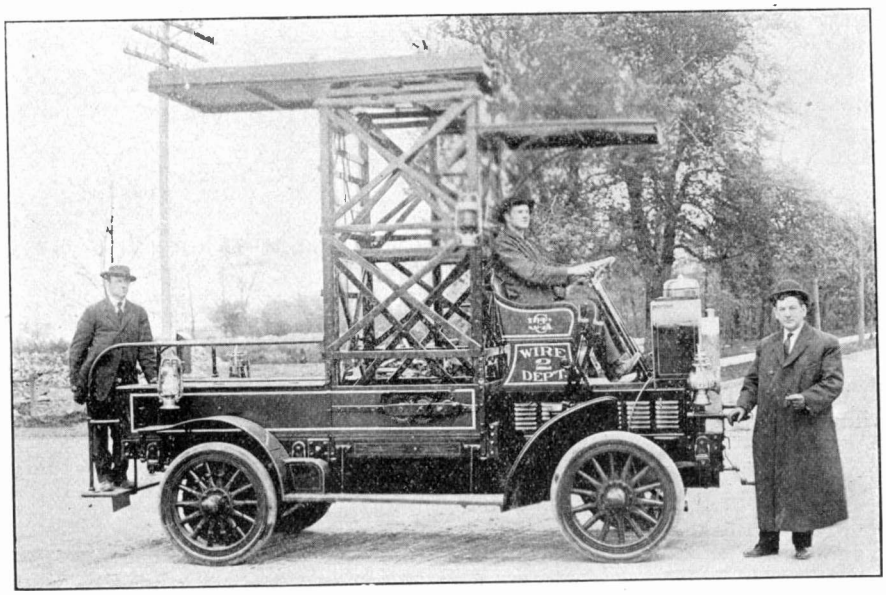
AN UP-TO-DATE "TROUBLE" WAGON.

When a trolley wire or hanger breaks or some other accident happens to the overhead construction of a city railway, there is reason for quick action on the part of the railway company to make repairs. Damage suits may result from people coming in contact with the broken wire. Delay of traffic is also bound to occur, and this is another thing that is a bugbear to the management. Consequently most of the larger companies keep a number of emergency or trouble wagons ready to rush to the scene of the accident at a moment's notice, and they go clattering through the streets at a rate which sometimes makes the fire engine companies jealous.

An indication of the up-to-date methods of the United Railways Company of St. Louis is shown by their "trouble" wagon which they built in their own shops and which is giving efficient service. The car is driven by a 30 horsepower, four cylinder, water cooled gasoline engine and is geared to 20 miles an hour. The gear is of the sliding transmission type and has four speeds forward and one reverse.



"TROUBLE" WAGON WITH PLATFORM RAISED READY FOR WORK.



AN UP-TO-DATE "TROUBLE" WAGON.

The car weighs 6,000 pounds without tools, and the tires are solid rubber with a four-inch face. It is provided with platform which is raised by a telescope frame and which is insulated from the ground. The linemen who stand on this platform and make the repairs are all past masters in the use of the pliers and the "come along," and can make a splice in record time.

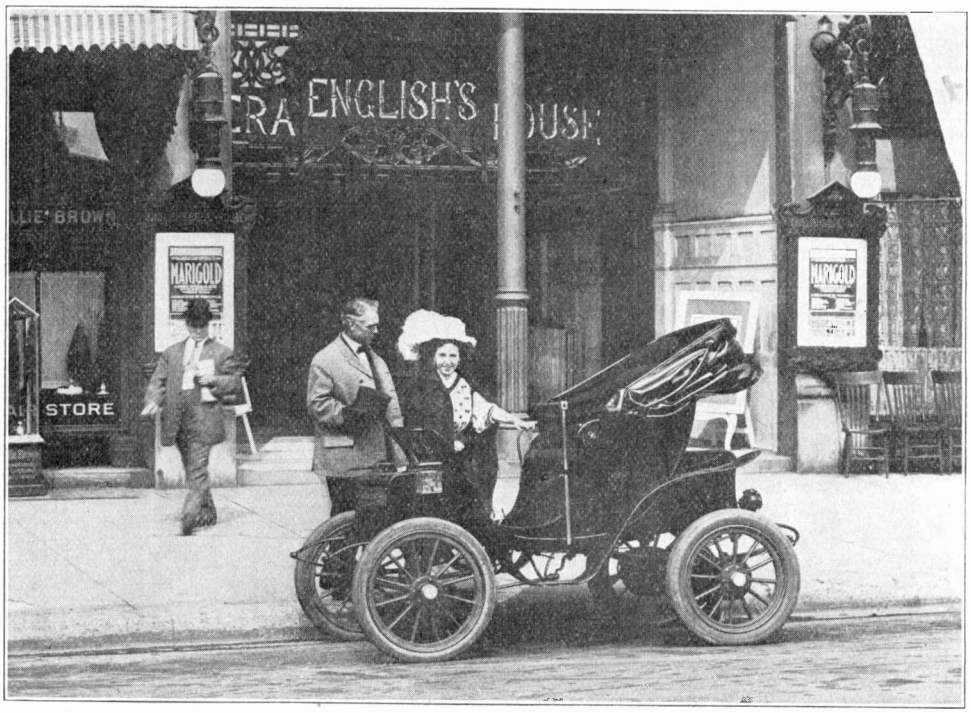
PRESENT STATUS OF THE ELECTRIC AUTOMOBILE.

Rapid as have been the improvements in gasolene automobiles during the last few years, the electric automobile has been improved just as much, although it does not perhaps have the center of the stage as does its rival. The electric motor used today is 50 per cent better than it was when all automobiles were in the experimental stage. The storage battery has improved in many ways. The class of materials and construction methods have improved in the electric class just as much as in the gasolene class. Five years ago the average ability of an electric was 25 miles on a battery charge. Today the average electric does 50 to 80 miles per charge, at less expense.

Many people have the idea that electric automobiles are expensive to maintain. This is probably because five years ago all automobiles were of comparatively small ability. The fact is that the electric car is now a very inexpensive one from every point of view.

Gasolene and electric cars are not competitors—the two fields are entirely distinct and separate. The electric is not capable of high speed, except at great expense. Neither can it make great mileage except at great expense. It is therefore unfitted for long distance tours. But within its field, charged for a distance of say 50 miles per day, for city and suburban use, it is not only the most economical automobile to maintain, but in most cases it costs about the same as a horse, and often less. In addition to its inexpensive maintenance, the electric has many attractive features. It is simple, and easily kept in perfect condition. It has no complications—anyone can understand it easily. No other vehicle is so easily controlled and guided. No other vehicle is so safe. And what is more important, no other vehicle, whether horse-drawn or motor-driven, is so thoroughly dependable. You can rely on the fact that an electric is going to start when you want it to, and run as long as you want it to, as long as there is current in the battery.

Another popular delusion about the electric is that "When an electric can



GRACE AND SIMPLICITY CHARACTERIZE THE MODERN ELECTRIC VEHICLE.

make 100 miles, it will be a practical car." So general is this talk that the fact is lost sight of that any of the better types of electrics can now make more than 100 miles on a single battery charge. But it isn't worth while to do so, for several reasons.

In the first place great mileage is expensive. There are two principal ways of attaining great mileage. One is by using a large battery. The other is by using more plates in a small battery. A large battery adds expense for size and adds weight. A driver who maintains a 60 cell battery where a 30 cell battery would give him all the mileage he actually needs is throwing his money away.

The use of a large number of plates in a small battery produces greater mileage, but shortens the life of the battery itself. For instance, the Pope-Waverley Company made some interesting experiments along this line at Indianapolis recently. They took a car with the standard 30 cell battery, and by using 15 plates instead of 11 in each cell, they made 142 miles at 14 miles per hour, without recharging the battery. Using the standard 11 plates, this same car would make about 80 miles per battery charge—one at Denver made 87 miles with heavy tires. These figures, of course, are based on brand new batteries. After the newness of the battery wears off, the car that actually ran 80 miles will do from 40 to 60 miles, and it is easily maintained at about this efficiency.

Big mileage in an electric car is spectacular, but not necessarily important. The thing to be considered is the way in which mileage is attained and the expense per mile. For instance, the 11 plate battery, in the average electric car will need renewing. The 15 plate battery is much shorter lived, so that the sensational mileage it might give would be rather costly.

The kind of tires used makes a wonderful difference in electric mileage. Experiments show that light "fast" tires alone will increase the mileage from 47 to 87 per cent, depending on the rate of speed. Light tires are all right if you are willing to pay for more tires and run more risk of blow-outs and punctures.

The speed at which a car is driven makes a big difference, because wind resistance is proportionally a larger problem at high speed than at moderate speed. The spectacular records are always made at low speed.

The much talked of "hundred miles in an electric" has already arrived, but for the reasons above given, the expense per mile for such travel is too high to be practical. The only thing that Edison can probably accomplish with his now famous battery-to-be, would be to reduce the cost per mile in electric vehicles. It is believed any of the standard makes of electric automobiles can be equipped with the Edison battery if it ever reaches the practical stage.

As a matter of fact, the present mileage of electric vehicles is more than sufficient for the purpose. Probably not more than one electric driver in a hundred travels more than 35 miles a day. The busiest physicians rarely have to go more than 25 miles a day.

The electric of today with standard equipment and heavy tires, insuring long life to the battery and low cost per mile to travel, making 50 to 60 miles on a single battery charge, is more than able to meet every reasonable demand upon it. Anyone who wants a mileage of over 100 miles can get it by paying the price per mile. But with standard durable equipment, the electric of today is a thoroughly practical, simple and inexpensive vehicle; clean, quiet, stylish and fast enough for city and suburban use.

TELEPHONES AND ELECTRIC LIGHTS FOR THE TURKS.

One quick sign of the times in Turkey is the absolute removal of all restrictions upon the importation of telephones and electrical apparatus. This has followed fast upon the granting of a constitution. The 400,000 inhabitants of the historic city of Smyrna expect soon to indulge in an occasional Turkish "Hello," and it is predicted that every Turkish city of any size will install a system just as soon as contracts can be made.

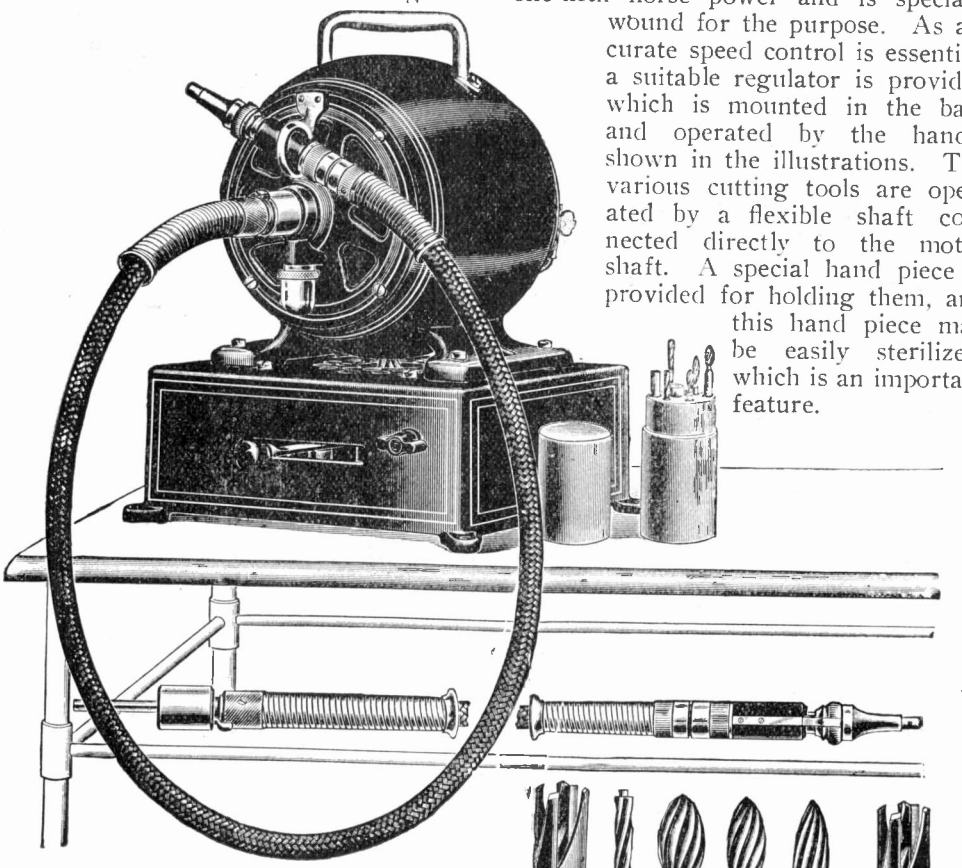
Telephones and electric light are the first, and most natural demand of a people whose wives have whispered in curtained zenanas, while their husbands gathered in secret midnight conclaves through so many years.

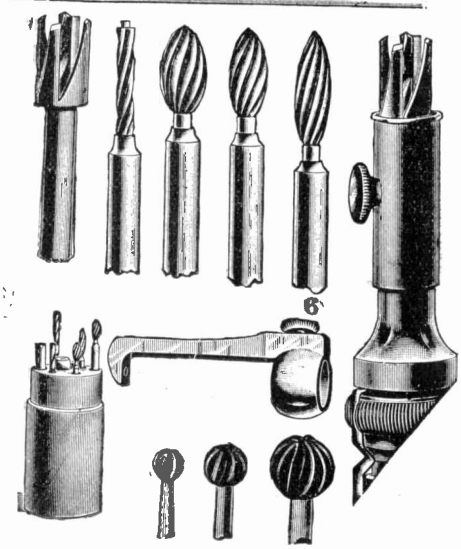
THE ELECTRIC MOTOR IN BONE SURGERY.

Before the electric motor was added to the surgeon's equipment, most of the operations were performed by the old chisel and mallet plan, and by hand operated instruments. The advantages to be derived from power driven cutting tools are apparent even to the layman, especially in such operations as trephining the skull. The two illustrations show a complete motor operated outfit for bone surgery and one of the applications which may be made of it.

The engine as a whole is well adapted to almost all operations upon the bony structures. It is at all times under perfect control, and, in the hands of an experienced surgeon, greatly shortens the time of and simplifies such operations as resection, or the removal of necrotic portions of bones, etc. It is also of particular advantage in cases where it is necessary to open the brain-case and make fenestræ of any shape or size as in operations on the mastoid, on the temporal bone, making new sutures on the brain-case, and for removing necrosis of the maxillary bones, etc.

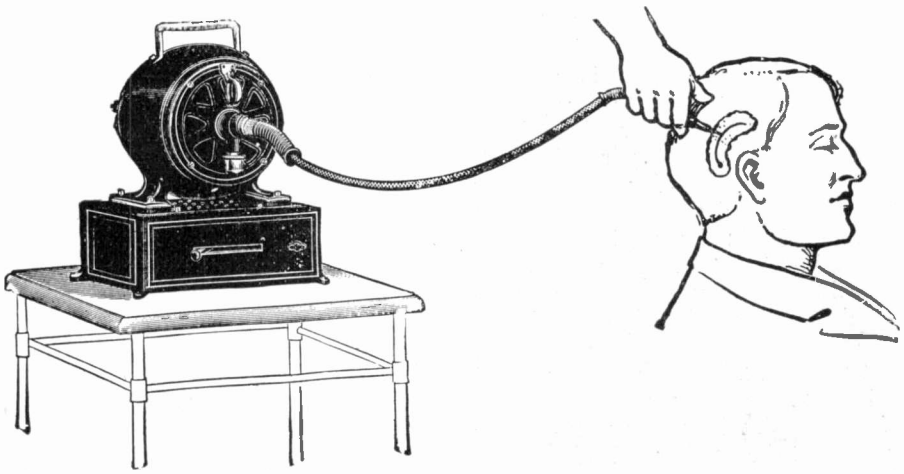
The motor is capable of developing one-fifth horse power and is specially wound for the purpose. As accurate speed control is essential, a suitable regulator is provided which is mounted in the base and operated by the handle shown in the illustrations. The various cutting tools are operated by a flexible shaft connected directly to the motor shaft. A special hand piece is provided for holding them, and this hand piece may be easily sterilized, which is an important feature.





ELECTRIC MOTOR AND ATTACHMENTS FOR BONE SURGERY.

There are all kinds of cutting instruments, as shown in the large cut; little drills for drilling holes in bones in order to wire them together, trephines for opening the skull, burs which will penetrate bone very readily, spherical burs for trimming, beveling and cleaning cavities, etc.



SKULL TREPHINING WITH ELECTRIC DRIVEN TOOL.

WHEN USING A NEIGHBOR'S TELEPHONE.

There are a great many pretty nice people who would not think of borrowing their neighbors' money or good clothes but who think nothing of "running in" to use the telephone. The idea of intruding upon a man's castle and tracking up the wife's hall carpet with muddy feet never occurs to them as being inconsiderate, says the Michigan State Gazette, yet it is just as much an imposition as anything can be.

One man who felt that he was being imposed upon drafted the following set of rules and had them neatly printed on a card which he posted conspicuously by the telephone. The rules were as follows:

1. Neighbors will kindly note the number of this telephone, and tell all their friends where it may be found.
2. This telephone is yours; we only pay the rent for it. "It is more blessed to give than to receive."
3. Please ring the door bell loudly upon calling and retiring, as our maid needs exercise.
4. Our meal hours are 7 a. m., noon and 6 p. m. Kindly arrange to disturb us at meal times.
5. If this phone is not in a suitable position we will have it altered.
6. Please scribble on the walls, as they need decorating anyway.
7. Callers will kindly stand in line, and not wipe their feet, as it might spoil the door mat.
8. Long distance calls are our specialty. Kindly do not offer to settle.
9. Loud and long conversations desired at all times, especially at midnight.
10. Make all the noise you can, in order to keep the baby awake. He has no right to sleep anyway.
11. Please do not destroy the telephone directory, as it and the Bible are the only books we own.
12. Do not hesitate to ring us up at midnight about anything. We stay awake for that purpose.
13. Do not consider us for a monent if you wish to use the phone. We will wait indefinitely.
14. The public telephone close by is only a bluff. Use this one always.
15. Our family is prohibited from using the phone except between 6 and 7 a. m. Sundays.
16. These rules apply to everyone except you.

ELECTRIC SCRUBBING BRUSH.

One of the latest electric household utensils is a machine which scrubs, sandpapers, waxes or polishes any kind of floor. It is claimed that the electric scrubbing brush does the work cleanly and rapidly, and that it is as effective in the corners as in the middle of the floor. The adjustable parts include in addition to the palmetto scrubbing brush, a steel wire brush, carborundum stones and holder, a sheep's fleece polishing pad, and carborundum paper cut ready to use.

THE NEW YORK ELECTRICAL SHOW

Of all the various exhibitions or "shows," as they are generally called, which are held to familiarize people with the advances made in any particular industry, the electrical show is without doubt the most interesting to the general public. Electricity is a marvelous force which interests everybody; it offers admirable opportunities for spectacular demonstrations, and the advances which are being made in its application and utilization in almost every walk of life are so rapid that it is no wonder that people will flock to an exhibition of this nature to see something new and startling.

The Chicago and New York electrical shows have for several years been an annual feature, with increasing attendance each year, but the smaller cities have also taken up the idea, and shows of this nature, on a smaller scale, have been held with success in many other places.

The New York Electrical Show was held this year on October 3d to 14th in the Madison Square Garden, and it presented a brilliant and animated scene. The great interior of the building was lighted up with every form of illuminant known to modern electrical science, for in the general illumination and in the exhibitors' quarters were to be found flaming arc lamps, ordinary arcs, mercury vapor lamps, Nernst lamps and all of the numerous family of incandescent filament lamps which have sprung up in the last few years. Prominent among the latter was the new tungsten lamp, which was noticeable for its remarkable brilliancy and white light.

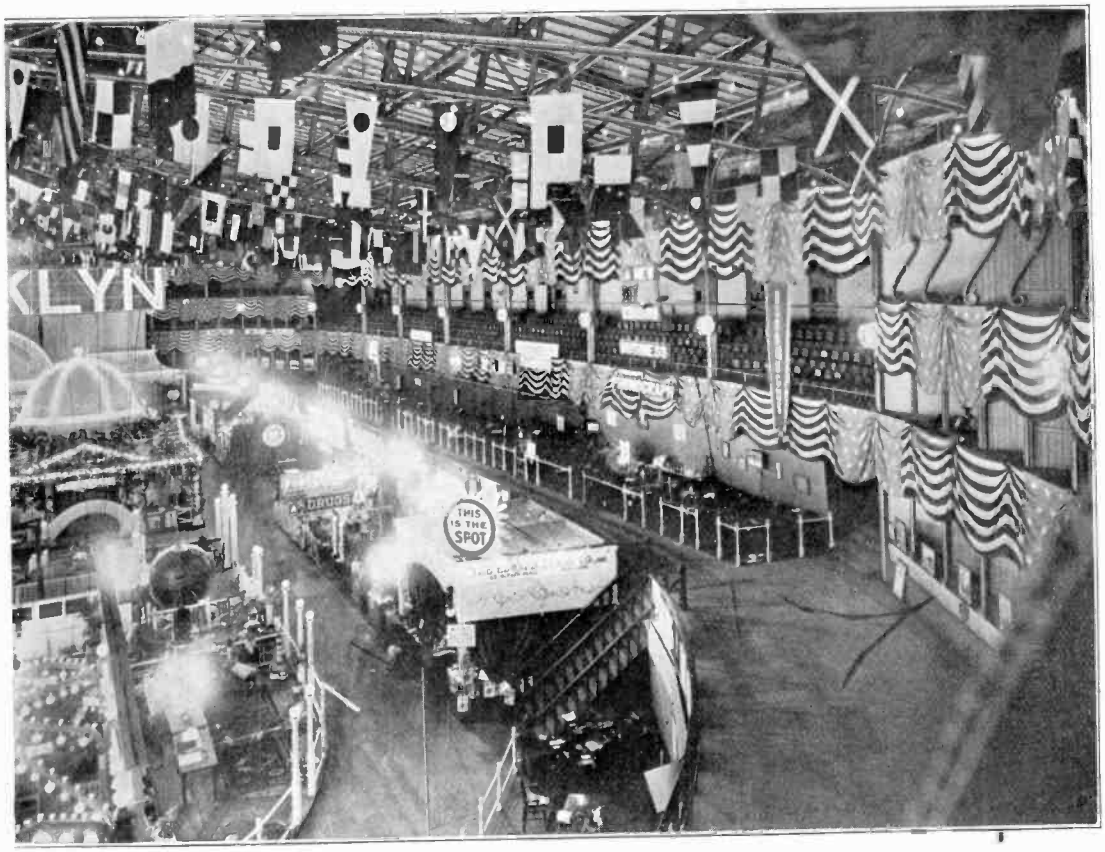
As emphasized by Thomas A. Edison,

AT MADISON SQUARE GARDEN.

the show this year had a double significance, as it was not only indicative of the degree to which electrical science has been developed but it was also commemorative of the beginnings of the science which were centered upon the project of laying the first Atlantic cable just half a century before.

The illustration herewith gives a fair idea of the scene presented by the interior of Madison Square Garden during the two weeks that electricity held sway. As in the past the electric light companies were the largest exhibitors and in the case of the New York show there are always two—the New York Edison Company and the Edison Electric Illuminating Company of Brooklyn. Clustered about these two big exhibits were exhibits of electrical manufacturing concerns, each with something new and interesting to show the visitor. If he were an electrical engineer, interested perhaps in the newest type of alternating current motor, it was there for him to inspect; if he were a butcher, a baker, or a candlestick maker there was sure to be found some electrical device that would fit into his business; for the housewife there were the most modern electrical kitchen and household appliances; for the boy, fascinating electrical toys and experimental electrical equipments.

Exhibitions are great teachers of the human race. They reach all classes and impress, with object lessons, with a force that mere reading cannot accomplish. So says Thomas Carlyle, and truly these words are particularly applicable to an electrical show.



ARGUMENTS FOR ELECTROCUTION.

There has been considerable discussion of late concerning electrocution of criminals, some contending that electrocution does not actually bring death, but simply a form of suspended animation. However this may be, electrocution has many supporters, and there are many arguments to support its adoption.

This method of execution has just been adopted by the state of Virginia. In that state the authorities believe that "the chair" has great advantage over the sheriff's noose, in that it is swift, quiet and mysterious. With the negro, who constitutes so large a proportion of the criminal population of all southern states, this argument is undeniably important. The excitement and the general hurrah-and-holiday air attending the old-time hanging were a positive allurement to the negro. His strong theatrical sense reveled in a final melodrama in which he was the conspicuous central figure. The electric execution wholly does away with that. The time set for turning on the death current is unannounced, the public is rigorously excluded, and the whole affair is conducted with secrecy and mystery, well calculated to inspire terror in the heart of the superstitious African.

SURGEONS ELECTRIC KNIFE.

Surgery by electricity is what is alleged to be possible with a remarkable electric knife just devised by a Berlin firm of medical instrument manufacturers. The knife is now undergoing exhaustive trials at the hands of Professor Bier, the head of the University Surgical Clinic, with the view of demonstrating its efficacy.

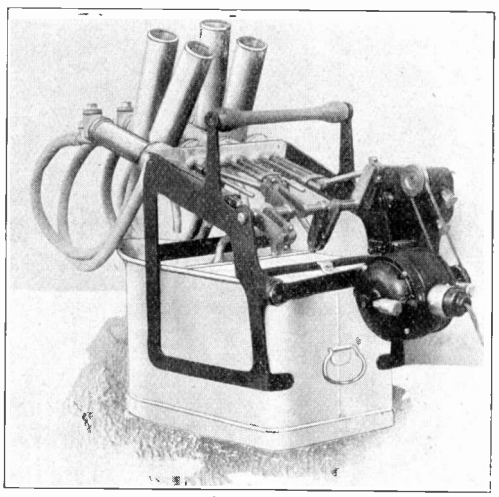
To one end of a six or eight-inch glass rod, through the center of which passes a conducting wire, is fastened the blade without a cutting edge, of a form similar to that of the commonly used surgical knives, or like the simple probe. A high frequency current is employed and when this is turned on a noiseless spark half an inch long appears from the point of the knife or probe. The spark incises the soft tissues with the same ease as a hot knife goes through butter, without any apparent cauterization, but Professor Bier's experiments have so far shown that a more profuse hemorrhage ensues than by the use of the common knife.

It is further claimed for the instrument that it sterilizes as it cuts, requires no sharpening and can be easily cleaned.

MILKING COWS BY ELECTRICITY.

The process of milking cows by any other method than that hitherto employed has been considered as an impossible, or if possible, an impracticable or unprofitable method. The fact, however, that a German inventor, Mr. Wm. Ohlhaver, of Chicago, has constructed a practical cow milker which he, later on, adapted for use with an electric motor, more than convinces the most skeptical dairy man and farmer that the machine is not only a practical possibility but also is profitable and economical.

Fig. 1 shows one of the new electrical cow milkers. It is not a complicated and delicate machine, and it is manipulated with little cost and trouble. One horsepower of electric current is sufficient to operate eight such milkers. The



ELECTRIC COW MILKING MACHINE.

whole machine can easily be lifted with one hand and be removed from the pail. Each machine is provided with an electric motor which may be removed by simply lifting it up from the frame. There is no danger of being shocked. The machines are almost noiseless. In order to milk, it is necessary to plug in the contact device, whereupon the motor sets to work the four alternately sucking pumps.

One of the greatest advantages of the electric milker lies in the fact that there is absolutely no possibility of dirt getting into the milk. The pail is closed during the operation, the only entrance being through the sucking nipples.

The motor in each outfit drives four little vacuum pumps, one for each nipple, and the pistons of these pumps are operated by a crank shaft with four arms set at the proper angle to operate the pumps successively, instead of all at the same time. Fig. 1 shows this very plainly.

In Fig. 2 is illustrated the fact that one man with five electric milkers is able to perform the work of five men. By the time the nipples are set on the fifth cow, the first cow is almost milked out and the machine may be removed to the sixth cow. As will be seen in the picture the two wires from the dynamo follow the top of the stanchion. Above each cow there is a receptacle into which the conducting wires from the milker may be plugged. The installation was made by Mr. Arthur E. Joerin, who has already successfully installed a number of electrical farm equipments.

Most farmers will say that they have no electric current at hand in order to make use of such electric milkers. Those who are uncertain as to the cost would do well to inquire what an investment would be necessary to install an electric plant if they are now in possession of a two horse power gasoline engine. A one kilowatt dynamo would cost them about $50 and the wiring from $25 to $30. Thus the complete electric plant would cost them about $75 to $85. The cost of running five electric milkers and half a dozen electric lights per hour would be about two cents or less, according to the make of the gasoline engine. With such an electric plant the farmer can also light his barn, house and the rest of the premises.

ELECTRIC COW MILKERS IN OPERATION.

The time is now approaching when there will be a complete change in farm and dairy work, all of which will all be done by electricity sooner or later. It is beyond doubt that the farmer who now is troubled in securing farm help will, in the future, milk his own cows, separate his milk, churn his butter, make his cheese, grind his grain, cut his feed, etc., all by electricity.

LATEST METHOD OF INDIRECT ILLUMINATION.

BY AUGUSTUS D. CURTIS.

Indirect illumination is acknowledged by all who make a study of artificial interior illumination as the most aesthetic. This form of illumination having the light source concealed and usually depending upon reflection from ceiling, walls or other reflecting sources for an even illumination of the room has hitherto been limited in its application, owing

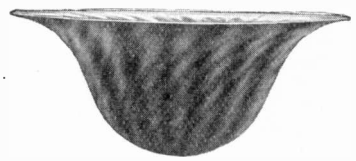


FIG. 1. INVERTED REFLECTOR.

to the great loss or absorption of light after leaving its original source before it reaches the working plane.

Various attempts have been made to

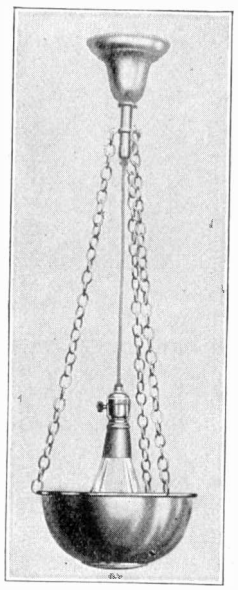


FIG. 2. SUSPENDED TYPE OF REFLECTOR.

solve the problem and there are a considerable number of installations in which indirect illumination is applied in different ways, the most successful heretofore being that in which the light is hidden behind brackets or cornices around the edge of, and the light reflected towards the ceiling of the room.

Recent developments have been made along this line which have resulted in the perfection of a new system of indirect illumination which is brought within the reach of the person of ordinary means.

The successful solving of this problem and its practical working depended upon two things:

First, a light of high candle power at low cost.

Second, a reflecting surface that would give the first reflection of light upward without material loss.

Where electricity is used, the high efficiency of the tungsten lamp proves an

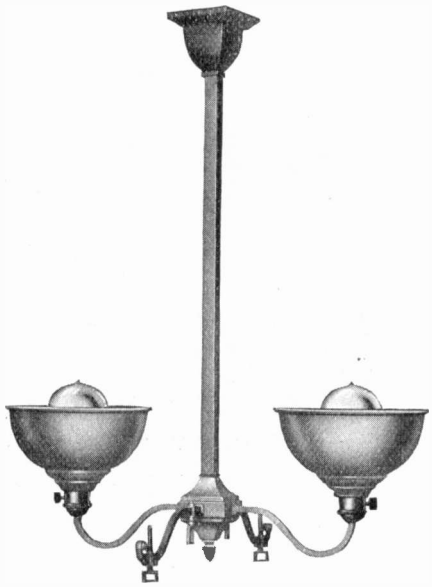


FIG. 3. REFLECTOR USING VERTICAL LAMPS.

ideal source of light for this indirect lighting system. The intrinsic brilliancy of this lamp makes inadvisable its use in small rooms on ordinary chandeliers because of the blinding effect.

The reflecting surface of the reflector surrounding the lamp offered no difficulties, that problem having been solved already by what is known as the "X-ray" reflector, a somewhat misleading name. Reflectors of this type consist of a single

piece of blown glass coated on the outside with pure silver, giving a reflection of remarkably high efficiency. The silvering is protected on the outside by coats of elastic enamel. The process of manufacture differs from ordinary mirror coatings, but is not made public. One of these reflectors, as adapted to the new system of lighting is shown in Fig. 1.

FIG. 4. BEDROOM 15 FEET SQUARE ILLUMINATED BY INDIRECT SYSTEM.

The correct shape of this inverted reflector for throwing the rays of light to the ceiling without shadows, as adopted, has been the result of considerable calculation and experiment. The perfected design is of a bell shape and contains peculiar circular and vertical corrugations. Being fire glazed the exposed glass surface is easily cleaned with a soft cloth.

The indirect lighting units worked out consist of this scientifically correct bell-shaped reflector, fitting in a spun brass casing. On electric fixtures this spun brass casing can either be suspended by chains as shown in Fig. 2 or supported from below, as is the case of gas fixtures. The designs also permit of the use of a vertical instead of a suspended lamp as seen in Fig. 3. This latter form is now practicable since the latest tungsten lamps may be used in that position.

These lighting units can easily be installed on gas or electric chandeliers already in use. Unless the chandelier arms are very heavy, it can be applied on any electric chandelier where the sockets are pendent, as the arms do not cast annoying shadows on the ceiling because the light comes from so many directions when passing the arms, due to the corrugations.

The lighting units should be at or near the center of the room, though side lights can and have been used with satisfactory results. Light colored walls are not essential, as most of the light is directed to the ceiling.

Indirect illumination is not only more aesthetic, but even enables one to see better. While it is true that there is a loss of light, another factor enters to overbalance this. The more easily details can be seen, the more effective is the illumination. When there is a bright naked lamp in front of the eye, the pupils contract and therefore the eye takes in less of the light and the things that are illuminated are not seen as clearly as with less light and a wide-open pupil. Hence, the fact that there may be less light with indirect illumination does not mean that we see less clearly, but on the contrary, we really see better. Many are of the opinion that we are suffering not from under illumination, but from over illumination.

These units can of course be arranged in a variety of ways, Fig. 4 being an example of the lighting of a bedroom.

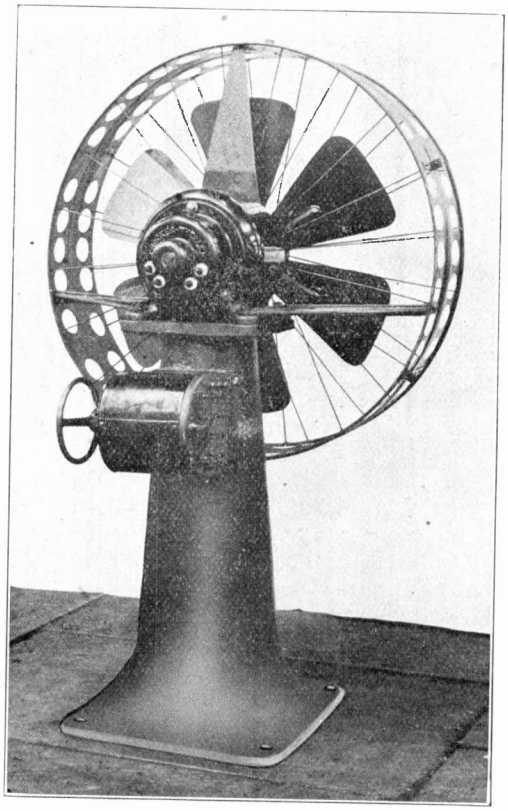
The fixtures can be installed in single units or multiples thereof, either electric, gas or combinations of both, and it is practical to illuminate in this way, not only residences, but halls and auditoriums.

A unit of one reflector and one 100-watt tungsten lamp gives a beautiful illumination in a room up to 15 feet square. This consumption makes the

cost very reasonable, being, at the usual cost of electric current, about one-half to one cent per hour.

COOLING FURNACE MEN WITH ELECTRIC FANS.

Did you ever see a man at work in front of a blast furnace or over the fiery pits where crucible steel is made? He is a grotesque figure, swaddled in a great bulky suit of asbestos, and other heat resisting materials over which water is doused at frequent intervals. In



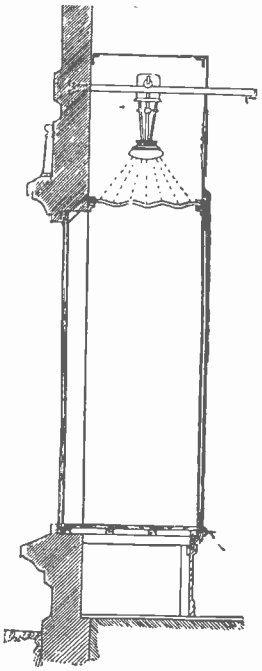
ELECTRIC FAN FOR FURNACE MEN.

spite of all precautions, and regardless of the fact that men who perform this work become inured by long practice to heat that would shrivel up an ordinary man in a few minutes, the work is extremely trying and can only be performed on short shifts with long intervals for rest and for cooling off.

To relieve the men some one suggested an electric fan which would blow a strong current of air over them while at work or at rest. The suggestion resulted in the design of a special pedestal fan shown in the accompanying picture. In one large steel mill there are about 30 of these fan equipments in use. The motors are connected direct to 36 and 48-inch, six-blade fans, placed on columns four to 10 feet high.

SCHEME FOR SHOW WINDOW LIGHTING.

The object of illuminating shop windows is to attract the attention of passersby and cause them to look at the goods displayed. This object is accomplished most effectively when the source of light is entirely concealed, because then the whole attention can be concentrated on the contents of the window



SCHEME FOR SHOW WINDOW LIGHTING.

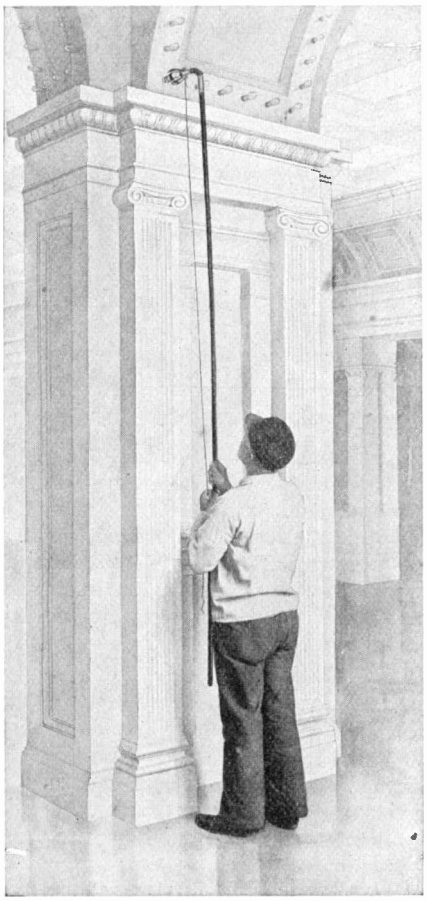
and the eye left entirely free from glare.

One method of effective lighting is shown in the diagram. The lamps are arranged high up in the windows and entirely cut off from the vision by heavy fluted glass, which also diffuses the light perfectly. The scheme is used effectively with Carbone and Radiante Economy arc lamps, two new types of lamps which are said to give light which very nearly approximates daylight in color values.

ELECTRIFICATION OF STEAM RAILROADS.

The prediction that the railroads will ultimately come to the electric method of propulsion as a matter of economy, safety, convenience and necessity is no longer regarded with the skepticism once prevalent.

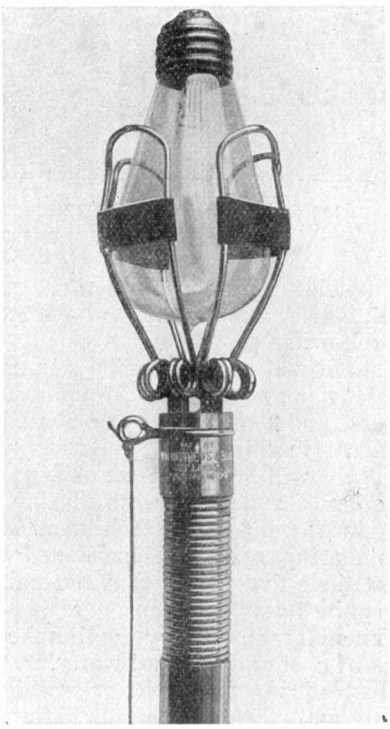
At a recent meeting of the Western Society of Engineers in Chicago F. A. Sager, a prominent member and agent for an important company, stated that the railroads will have to spend approximately $5,000,000,000 within a few years to keep up with the increase of traffic. By electrification at a cost of $4,000,000 they would increase their capacity to such an extent that no new trackage would be needed. This conclusion was reached after a careful review by Mr. Sager of what has been done or is in the way of accomplishment by the New York Central, the Baltimore & Ohio, the Erie and other railroad companies East and West.



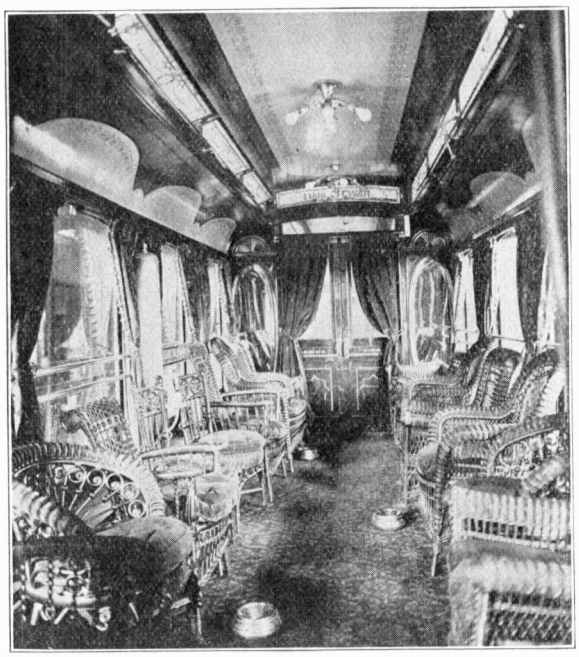
APPLICATION OF THE EASY LAMP CHANGER.

EASY LAMP CHANGER.

Incandescent lamps are often located in almost inaccessible places, as in high ceilings, domes, etc. When the lamps are to be taken out and changed or cleaned it is necessary to employ some device by which they may be removed from the sockets. The Easy Lamp Changer fills the requirements. It consists of wire jaws, protected by rubber or like substance, which fit over the bulb. The jaws are attached to a long pole, so that the operator may reach the lamps from a considerable distance. A flexible member holds the jaws to the pole, which may be pulled over by a cord, as shown in one of the illustrations. This permits lamps to be unscrewed which are at right angles to the pole.



THE EASY LAMP CHANGER.



INTERIOR OF AN ELECTRIC "SPECIAL."

ELECTRIC "SPECIALS."

One of the recent developments in modern electric street car service, which is becoming very popular where introduced, is the special electric trolley car used by some street car companies for special service. These cars are luxuriously furnished and rival the modern Pullman in appointment. The accompanying illustration of one of these cars, in the service of The Cincinnati Traction Co., shows the comfortable willow chairs with their soft upholstered cushions, conveying an idea of the comfort one may secure while riding through the streets of his own city in one of these special cars. The popularity of these modern electric cars is increasing rapidly, and the half dozen specials of the Cincinnati company are constantly busy.

MARCONI'S PREDICTIONS.

Guglielmo Marconi, inventor of the wireless telegraph, is said to have uttered the following prophecy:

"There will not always be steamships. They will pass the way of their predecessors, and before long we shall cross the ocean in ships run by electric power.

"There will be no coal smoke, no sickish odor of stale steam, no blazing caverns in the hold, where human beings with staring eyes and blackened faces sweat their lives away that the pulse of the engines may not stop.

"The storage battery will take the place of coal and fire and water.

"Instead of coaling, the great ship will quietly and cleanly renew its batteries at its journey's end, and if coal is used it will be far from the linen and the noses of men.

"In time coal will cease to be our only source of energy. In every land men of science are patiently studying the problem of utilizing the energy of the sun—storing it, in fact, so that the generation of electric force may be cheapened by its use to a point where the storage battery on a large scale will be an economic as well as an academic possibility.

"The wasted energy in coal as now used may in the interval be brought to do its work and so bring about the monster storage battery sooner than we now expect.

"But sooner or later we shall enslave the sun's rays to our uses as we have the other products of his being."

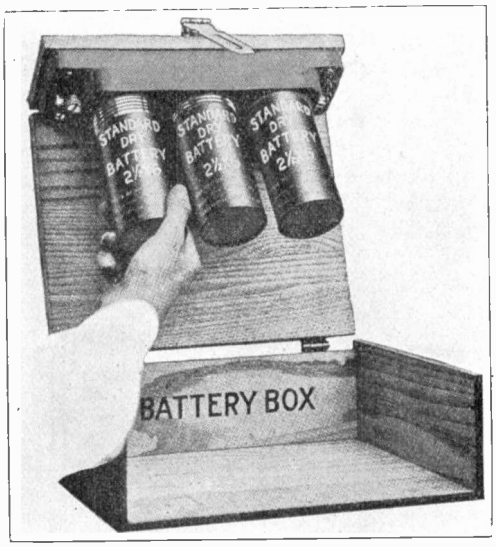
ELECTRICITY CURES LOCKJAW

That most famous product of the state of Missouri—the mule—not satisfied with past achievements, has broken into science, and there is a possibility that not only quadrupeds at large, but mankind as well and stockmen in particular, will again have cause to bless his creation. It came about this way:

There had been many deaths from lockjaw in a certain brewing company's stables. One day a valuable mule became afflicted and it was about decided to kill the animal, when the engineer suggested an electric treatment. Contact plates were attached to the mule's jaws and tail and a 120-volt direct current was turned on. After several treatments reports have it that the mule was taking his regular feed of oats and hay.

WIRELESS BATTERY HOLDER.

Renewing a set of batteries in the Patterson wireless battery holder is an operation that can be performed as easily as placing so many incandescent lamps in sockets. An automatic bridge



WIRELESS BATTERY HOLDER.

in each cell receptacle permits the removal of one or more cells, without interrupting the circuit.

These holders are adapted to automobiles, boat and building use.

ORIGINAL MANUSCRIPTS OF JOSEPH HENRY.

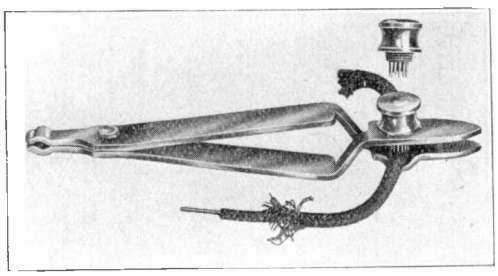
In one of the locked alcoves of the library of Princeton University is a manuscript volume of some 76 pages written by Prof. Joseph Henry, the famous electrical scientist, giving an account of his researches while a professor at Princeton. He was called from Albany to the chair of natural philosophy, or physics as it is now called, at Princeton in 1832 and remained there until 1848, during which period he made some of his most remarkable anticipations of modern electrical science such as for example wireless telegraphy.

In 1848 he went to Washington to organize the Smithsonian Institution of which he had been appointed the first secretary. In 1876, two years before his death, he was asked to write an account of his work at Princeton. This is the document now in the university library.

A NEW TEST CLAMP.

A new device for telephone testing is shown in the accompanying cut and is known as the Williams test clamp. The jaws of the clamp are provided with knurled faces for fastening to bare conductors. When the clamp is used with insulated wire the little needles on the thumb screw penetrate the insulation and make perfect contact with the wire. The pores of the insulation close up when the clamp is removed, and no taping is necessary. The rear end of the clamp is provided with jaws for grasping one of the terminals of the voltmeter or ammeter that is being used to test out the circuit.

Another use for the device is for connecting an emergency lamp. Workmen in dark places such as attics and basements often find insulated lighting wires



A NEW TEST CLAMP.

but no lamp sockets. By using two of these clamps, one connected to each wire of a lamp cord, an incandescent light can be connected to the house wires in a minute's time.

CERIUM FILAMENT LAMP.

A patent was recently issued, covering an incandescent lamp filament formed of nitride of cerium. It is claimed that the metal cerium when at a red heat has the remarkable property of reacting with pure nitrogen and thereby forming a nitride which has a metallic lustre, and is a good electrical conductor. In this reaction, the compound, being exothermic, enormous heat is generated, which makes the mass undergoing reaction glow with a brilliancy equal to the arc light.

AUTOMATIC TELEPHONE AND ITS OPERATION.

BY F. J. TRUBY.

The average person who has ever used an automatic telephone knows that a few mysterious passes connects him with the desired party. Beyond this his knowledge does not extend. The object of this article is to explain in as simple and non-technical a manner as possible how the seeming miracle is accomplished.

Comparitively few know that the problem of connecting one telephone subscriber automatically with another was developed to a limited extent shortly after the invention of the telephone. To the average person, whether he understands it or not, it seems a very simple matter to signal an operator and request her to connect him with another line. If he does not understand the method he feels that he can understand should the inclination to do so ever strike him. But that a few mysterious passes, as it were, at a telephone should quietly accomplish that which he formerly obtained only through the medium of a central operator does not inspire him with the same confidence in himself. Of the simplicity with which this is done, however, there can be no question, as may be seen from the study of the schematic drawings Figs. 1 and 2.

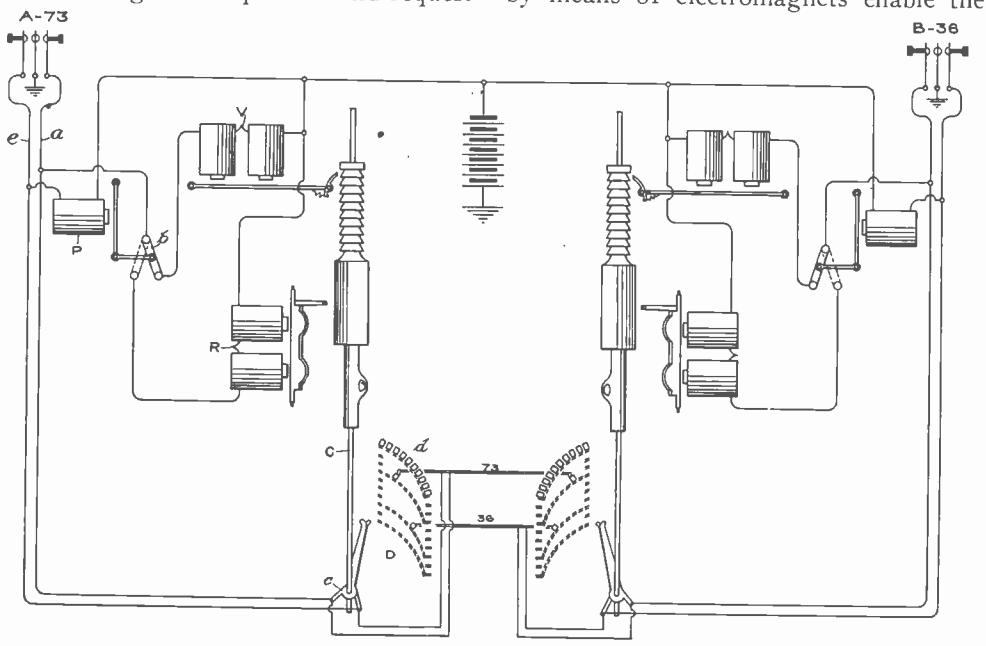


FIG. 1. DIAGRAM SHOWING THE PRINCIPLE OF THE AUTOMATIC TELEPHONE.

Fig. 1 shows in a simple manner the principle involved in what are known as the Strowger patents. The push buttons (A) and (B) represent the telephones of two subscribers. The two pairs of metallic lines from (A) and (B) are carried to the exchange where they terminate in individual switches. These switches by means of electromagnets enable the subscriber to impart a vertical and rotary motion to a shaft (C).

Each subscriber's line has three terminations. The line (a), for instance, is connected to a small knife switch (b), to a "wiper" or contact maker (c) on the shaft, and to a contact (d) of the bank group (D). The other side of the line (e) is connected to a magnet (P), and likewise to a wiper and a bank contact.

As shown here the line (a) passes through the side switch (b) in one position to the magnets (V), in another position to the magnets (R). This side switch is shifted from one position to the

other by the magnet (P). All the magnets, it will be seen, are connected to one side of battery the other side of which is grounded. The wipers upon the shaft (C) are adapted to make sliding connection with any of the contacts of the bank.

At the telephone a lead from ground is carried to a contact which permits either side of the line (a) or (e) to be grounded by the subscriber by means of the two push buttons. The lines from upon the 6th position of the third bank row. The lines of the two subscribers are now connected.

Should (B) desire to call (A) he will select in a similar manner the third contact of the seventh row in his bank to a multiple of which the lines from telephone (A) are connected.

By this arrangement alone the number of subscribers is necessarily limited to the number of contacts that it is mechanically possible to bring within range of

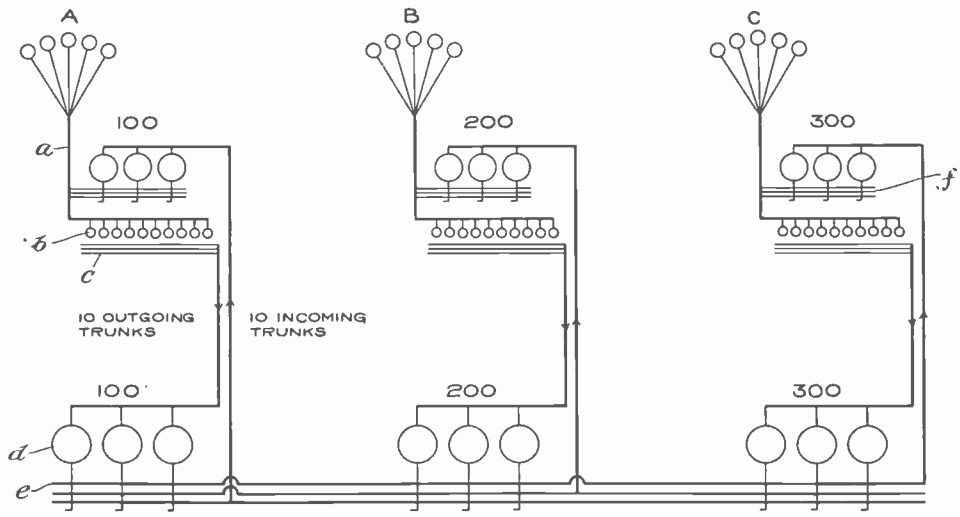


FIG. 2. DIAGRAM SHOWING CONNECTION OF SWITCH GROUPS.

(B) end in the 36th pair of contacts of the bank (D), counting in horizontal rows. That is, the line ends in a pair of contacts which is number (6) in the third row from the bottom.

A subscriber at (A) who wants to talk with one at (B) will first ground the line (a) three times by pressing the push button connected with that line. Each time that he grounds the line the vertical magnet (V) is energized and by attracting its armature raises the shaft one step. In this way the line wipers are brought opposite the third row of bank contacts. The other side (e) of the line is then grounded once which results in magnet (P) pulling the side switch (b) into its second position. This connects the first side (a) with the rotary magnets (R). Again grounding the line (a) the requisite number of times, in this instance 6, the rotary magnet (R) turns the shaft (C) around until the line wiper rests the line wipers. There are as many switches and sets of banks as there are subscribers. The contacts of the banks in each set are connected to the corresponding contacts of every other set. The multiples are brought out to a terminal strip where connection with the various lines are made. By the addition of a few simple relays a ringing circuit is provided, a release for restoring the switch after the conversation is completed, a release from a busy contact and a signal to the calling subscriber that the line is already engaged, and a "central energy" current for energizing the talking line.

So far the number of subscribers able to communicate with one another is very limited. Of course there may be many groups of this kind, but each group must necessarily be isolated from the others unless some means of connection can be devised. This problem is very easily

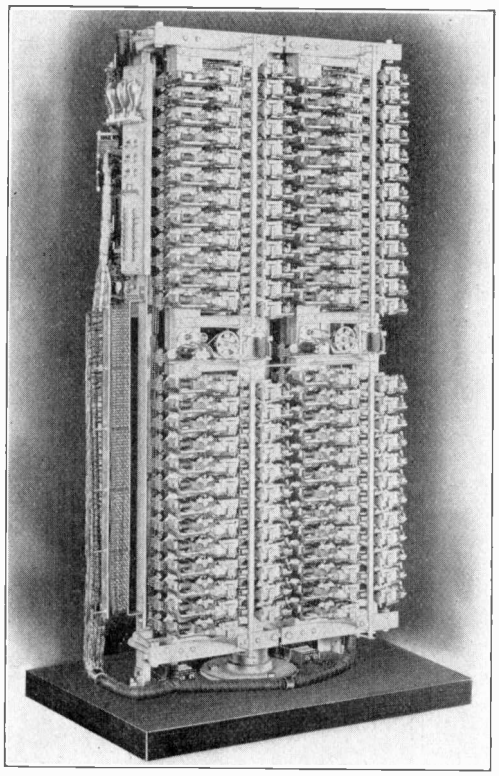


FIG. 3. FRONT OF SWITCH BANK.

solved. By treating each group as a subscriber, groups may be selected just as individual subscribers were selected. For instance, 36 now instead of leading to a subscriber's station may only connect the calling subscriber with a connector in the 36th *group* of subscribers to which the person wanted belongs. From this connector the subscriber then makes his call in the usual manner. To carry out his method throughout, however, without modification would not only be too expensive to be practicable but would also require an impossible amount of space in a large exchange, since each subscriber in addition to the individual switch to which his line is first attached would require a similar switch in each group. The difficulty is easily overcome by employing the principle of the automatic selection of trunks. Only a certain percentage of subscribers are conversing at one time. If judicious distribution of subscribers into groups is employed this percentage for any group rarely exceeds 20. The only automatic system used extensively at the present time employs a unit of 100, that is, the bank of contacts allotted to a connector switch contains 100 pairs of line contacts, as illustrated in Fig. 1, taking care of 100 subscribers. An exchange of 1,000 is thus made to consist of 10 groups of 100 each, an exchange of 10,000 of 10 groups of 1,000, etc. These units of 100 instead of consisting of 100 connectors are equipped with 100 individual line switches. These switches are of very simple construction and give a subscriber automatically one of ten connectors as soon as he removes his receiver. Connection between the subscriber's line and the trunk is accomplished by means of a plunger on the line switch, which, when not in use, is always kept directed to a vacant trunk by a master switch. The same number of subscribers are now reached over these ten trunks which lead to ten connectors as were reached when each subscriber was provided with an individual connector.

In order now to pick out hundred groups the ten trunks from a group of

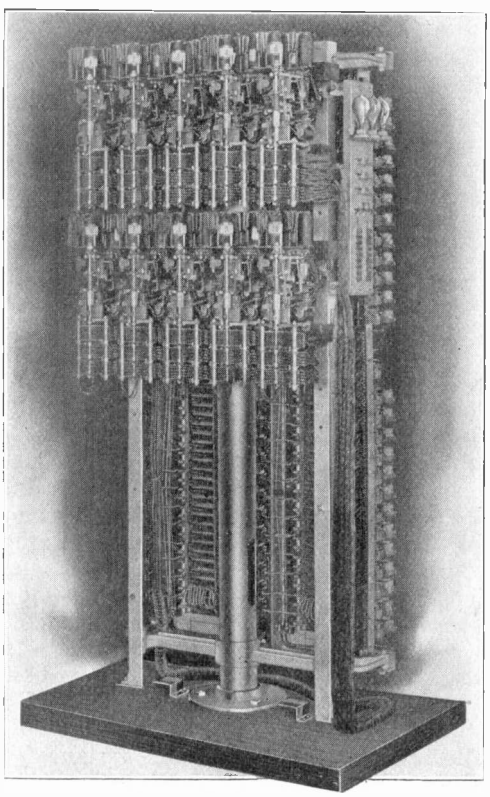


FIG. 4. BACK OF SWITCH BANK.

100 line switches are carried to ten selectors. These selectors are provided with the same kind of banks as the connectors, namely 100 pairs of contacts arranged in ten vertical rows so as to be engaged by line wipers attached to the ten trunks from the individual line switches. Each level in a first selector bank represents a

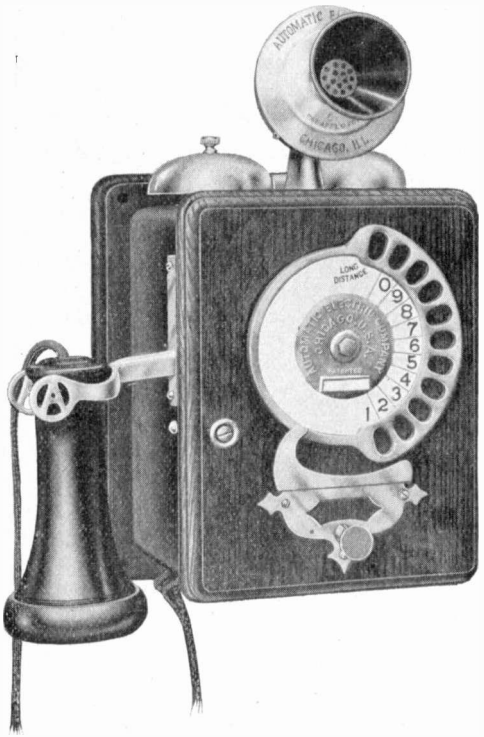


FIG. 5. SUBSCRIBER'S AUTOMATIC TELEPHONE SET.

one hundred group and the ten pairs of contacts in the row are the terminals of the ten trunks assigned to that group. This scheme it will be seen, enables the subscriber to reach any one of a thousand. In an exchange of 1,000, then, there will be ten groups of 100 subscribers, each 100 group being equipped with 10 connectors, 10 selectors and 100 line switches.

After the subscriber is placed in connection with his selector, just as he was previously attached to his connector, he picks out the group wanted by raising his line wipers to the required level. He does this in the regular manner by grounding one side of his line a certain number of times. On then imparting to the other side one ground impulse the rotary magnets of his selector carries his wipers to the first pair of contacts. It may be that several other subscribers from his own group are using trunks on this level. In this case the first trunks will be busy and the wipers will rotate automatically without the knowledge of the subscriber until they reach a vacant trunk where they will stop. If subscriber No. 36 of Fig. 1 now belongs to the eighth hundred group his calling number will be 836.

If the exchange is designed to accommodate 10,000, a first selector will be used to pick a thousand group, a second selector to pick a hundred group in that particular thousand, and a connector to pick out the particular subscriber of that hundred. The calling number will thus consist of four figures. Every time an exchange is multiplied by 10 in this manner an additional selector will be required and the calling number will be increased by one digit.

Fig. 2 represents in a diagramatc manner three one-hundred groups in an exchange of 1,000.

At (A) the subscribers' lines are shown entering the cable (a) at the exchange. This cable leads to the 100 individual line switches (b) of which 10 are here shown. The line switch plunges in on one of the ten trunk lines (c) leading to the selectors (d). If a subscriber in the first hundred group (A) desires to call a subscriber in the third hundred (C), after raising the wipers of his selector (d) to the third bank level, the selector automatically chooses one of the 10 trunks (e) leading to (C). Operating his connector he then picks out on the connector banks the particular line (f) which belongs to the called subscriber.

Instead of a push button for giving the impulses a dial is used as in the cut of the wall telephone, Fig. 5. The dial is operated by putting the finger in the hole opposite some particular digit, pulling it around to a stop, and releasing. The dial on returning to its original position imparts to the line at regular intervals ground impulses corresponding to the number pulled. To call a number such as 365, the finger is placed successively opposite these numbers each time pulling the dial to the stop and releasing. After grounding the line, by

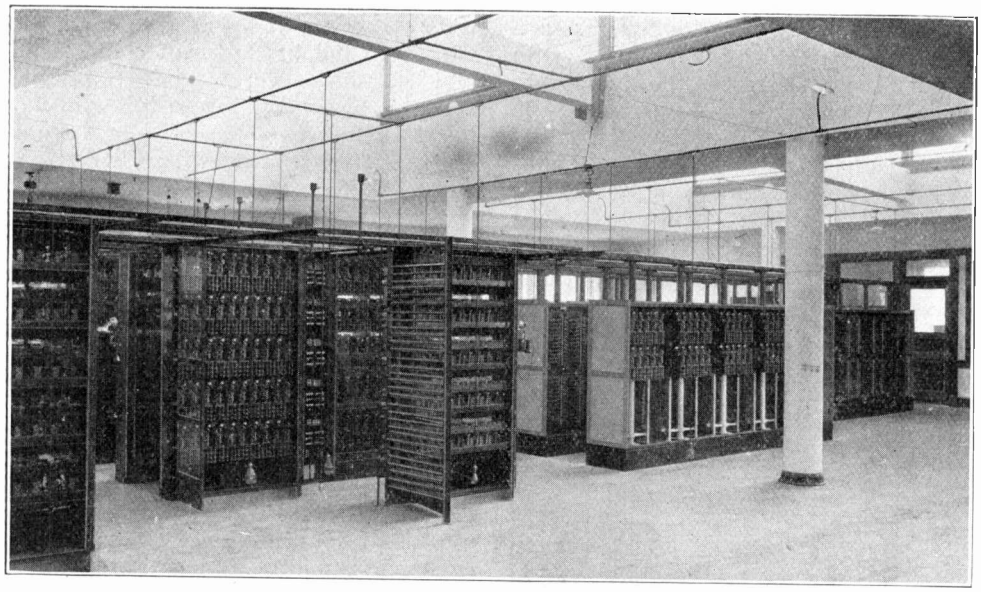


FIG. 6. INTERIOR OF AN AUTOMATIC TELEPHONE EXCHANGE.

pressing a button the bell of the called subscriber is operated.

Fig. 6 is a view in the exchange of the Independent Telephone Company of Omaha, Neb., showing the switch banks. The system is beautifully simple. Seemingly complex at first sight because the mind is not able to grasp at once the uniformity existing throughout, it is not long until wonder at its complexity is changed to amazement at its simplicity.

ADAPTABILITY OF THE TUNGSTEN LAMP.

The new tungsten lamp is one of the most economical electric incandescent lamps so far devised. It should be borne in mind, however, that for purposes of illumination where it is to be moved or jarred in any way the tungsten lamp is impracticable, owing to the fragility of the filament. For instance, at a recent street fair in a western state an attempt was made to light a small Ferris wheel with these lamps, and 250 of them were used for this purpose. They were of 32-candle power each and represented an expenditure of several hundred dollars. The first night that they were put in operation the filaments were all broken after a few revolutions of the wheel.

A little more knowledge of the characteristics of the tungsten lamp and the range of its adaptability would have saved the consumer a considerable sum of money.

The tungsten lamp is looked upon by many as the coming incandescent lamp, but there are still limits to its adaptability.

TELEGRAM WENT TOO FAST.

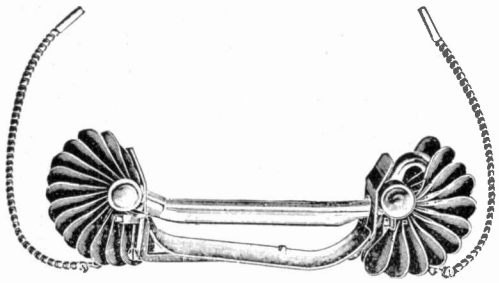
People often complain of delayed telegrams, but when delivery is made in record time it is accepted as a matter of course. A gentleman in Richmond, Va., recently sent a telegram of 35 words to Washington, and 15 minutes later had urgent reason for desiring its non-delivery. The manager of the Richmond office did all in his power to recall the message immediately, but without avail. The record of the Washington office shows that the message was delivered to the addressee in Washington 16 minutes after it was filed by the sender.

RAISING TOMATOES BY ELECTRICITY.

James Heston, a gardner in Kings Wells, Ontario, is said to have obtained excellent results in raising tomatoes under the influence of electricity. While the plants were still young they were daily submitted to charges of electricity from an induction coil. The fruit plants thrived under this treatment, and the fruit was superior to that grown under ordinary conditions.

THE QUARTZ LAMP AND ITS APPLICATIONS.

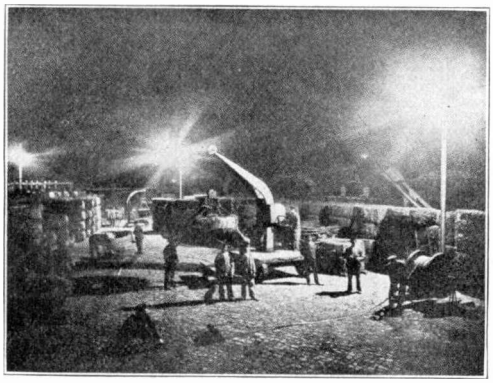
The quartz lamp, invented by Dr. Küch of Hanau, Germany, was originally designed for medical work. In principle it consists of the concentration of an arc formed between mercury electrodes within a short illuminating tube of so-called quartz glass (mountain crystal), a material not easily brought to the melting point. This is somewhat on the principle



THE QUARTZ LAMP.

of the Cooper-Hewitt or mercury vapor lamp. In one of the illustrations are seen the chief parts of the quartz lamp.

The illuminating tube of quartz glass carries on each end a pole vessel of the same material and containing the mercury electrodes. The fan-shaped bodies



THE QUARTZ LAMP ILLUMINATING A STORAGE YARD.

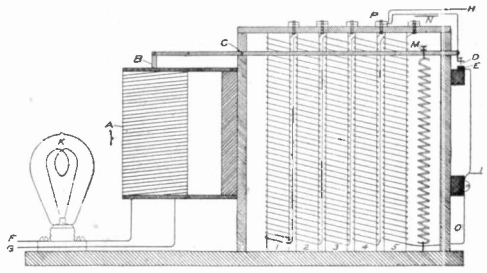
are for radiating the intense heat generated at the poles. Current enters one end, passes through the vapor of mercury, which collects in the body of the vacuum tube, and passes out at the other end. The mercury vapor is heated to incandescence by the passage of the current.

On account of its special qualities the quartz lamp is adapted to lighting extensive spaces, of large shops, for instance, where fine work must be done. Large halls, switching yards of railroads, also manufacturing plants of a certain kind and for advertising, furnish a field for the new lamp. One of the illustrations shows three of the lamps in use in a storage yard and gives a good idea of the brilliancy of the lights.

A HOME MADE VOLTAGE REGULATOR.

To the Editor Popular Electricity:

I am sending you a description of a little device which helped me out of a bad fix and perhaps it will benefit some of your many readers. We have a 20 kilowatt generator coupled to a 25 horsepower gas engine and the governors on the gas engine are not very sen-



CONNECTIONS FOR HOME MADE VOLTAGE REGULATOR.

sitive. I had a lot of trouble with the voltage varying under different loads, the loads fluctuating rapidly anywhere from one to 20 horsepower; so I finally built the regulator described below.

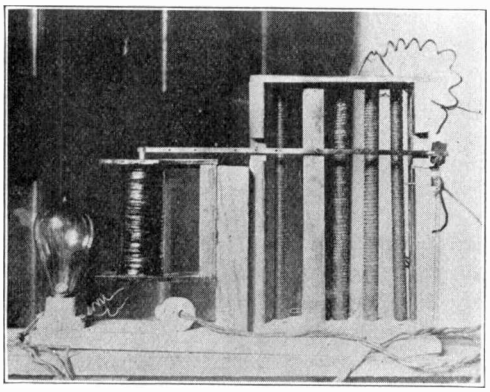
In the diagram, (A) is a solenoid whose terminals (F) and (G) are connected to the mains from the generator, having a 32 candle power light in series. (B) is the core, fastened to a rocker arm, pivoted at (C) and carrying on the other end a platinum point (D), which under normal conditions rests in cup (E) filled with mercury.

The height of the arm is regulated by the spring (L) and screw (M). The coils (1), (2), (3), (4) and (5) are resistance coils, made of German silver wire.

The wires (H) and (I) lead from the fields of the generator and are ordinarily attached to the field rheostat, which same

may be left in series with the regulator.

When the generator is first started up the point (D) rests in the mercury cup and the current from the fields takes the path (I), (E), (D), (N), (H). The voltage can be regulated by the field rheostat, and the spring (L) must be



HOME MADE VOLTAGE REGULATOR.

adjusted so that the point (D) will just touch (E). Now it will be readily seen that any rise in the voltage caused by a sudden removal of the load or a change of speed in the generator, will cause a harder pull on the core (B), thereby raising the point (D) from its connection with (E). As soon as this happens the current from the fields takes the path (I), (O), (5), (4), (P), (H), thereby placing resistance in the field circuit, which of course causes the voltage to drop back to its proper value. Any number of coils can be cut in by changing the connections of (H) and (N) farther to the left. In the diagram only two coils (4) and (5) are in use. I have had this little device in use for about three months and it has given perfect satisfaction so far.

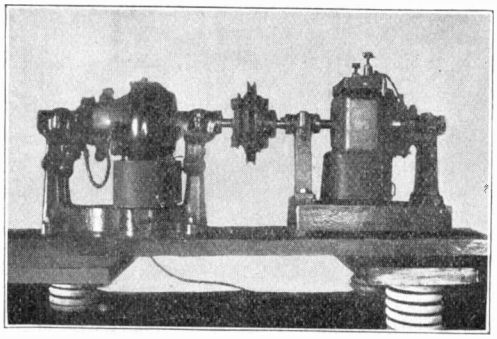
Carey Smith.
Kansas City, Mo.

HOLY CITY OF MEDINA AND THE TOMB OF MAHOMET INVADED BY ELECTRICITY.

Of all the surprises which the East has sprung upon the West of late, none seems more incredible than that the Holy City of Medina has been invaded by the railroad, and that the Tomb of Mahomet is now illuminated by electricity. Such, however, is the case. The Medina section of the Hedjaz railway was opened recently and on the same occasion the lighting of the sanctuary by electricity was inaugurated.

OVERCOMING NOISE AND VIBRATION IN MOTORS.

In many cases it is necessary in operating dynamos, motors and motor-generators to do away as far as possible with all noise and vibration. The accompanying illustration shows a method of motor support of an English designer for accomplishing this result which is said to have worked successfully. It consists of steel springs mounted on a table or bench for supporting the common base of the motor and generator.



MOTOR MOUNTING.

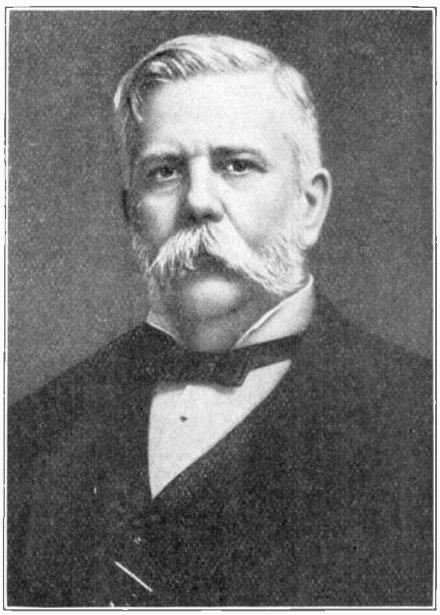
ELECTRIC ORGAN.

Electricity has entered a new field and now threatens to supplant one more of the old "standbys." Through the genius of a Pennsylvania man we now have the electric organ, in which a series of vibrators take the place of the reeds that have been used for so many years. These vibrators are tuned in perfect harmony and so far as sound goes cannot be told from the reeds. Series of switches and magnets, which may be worked separately or in concert, operate the whole. The organ is played, as is any of the old-style instruments, from a keyboard.

ELECTRICAL MEN OF THE TIMES.

GEORGE WESTINGHOUSE.

One of the most interesting characters in the industrial world today is Mr. George Westinghouse. In this age of wonderful achievement his name stands in the first rank as an inventor, an organizer, a financier and an active manager of great enterprises. Mr. Westinghouse possesses in an eminent degree those qualities that have characterized the great military commanders of history, and he has carried into the realms of invention and manufacture the same masterful spirit that has won the great battles of the world.



The air-brake, from its wide application and revolutionary effect upon transportation methods, has perhaps directed the attention of the general public to Mr. Westinghouse, its inventor, more than any one thing. But in the great field of electricity he is none the less one of the most imposing figures.

He early recognized the wonderful possibilities of electricity and began making experiments. Then he formed a company for the manufacture of electrical apparatus. The direct current system of generating electricity had too many limitations and his keen foresight saw the possibilities for a much broader field with the alternating current system, so in the face of many adverse conditions and despite the protests of his warmest friends he undertook its development. The wide application of the alternating current system today and the many achievements that it has made possible attest the soundness of his judgment. Though but 22 years old, the Westinghouse Electric & Manufacturing Company is today one of the largest manufacturing institutions in the world.

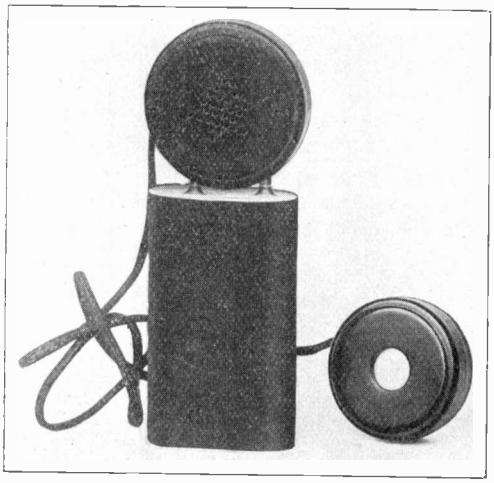
In all there are 23 different companies scattered throughout the world in which Mr. Westinghouse is the dominant spirit. To direct their affairs requires a man of great force and activity and such is Mr. Westinghouse. He is all activity and he makes his activity count. He is not only active as the head of these different companies, but he is active in mechanical research as well, and the working out of the ideas that find their inception in his brain keeps no small force of engineers busy.

George Westinghouse was born in Central Bridge, Schoharie County, N. Y., October 6, 1846. He was educated in the public and High School and Union College. He served in the U. S. Volunteers (12th N. Y. National Guard and 16th N. Y. Cavalry), and as assistant engineer in the United States Navy. His great work as an engineer and organiz- has won him the recognition, among the honors that have been bestowed upon him being the decorations by the Legion of Honor, Royal Crown of Italy and Leopold of Belgium. He was second recipient of the John Fritz medal, is honorary member of the American Society of Mechanical Engineers, honorary member of the American Association for Advancement of Science and of the National Electric Light Association.

It goes without saying that Mr. Westinghouse's great genius, foresight, activity and ability to overcome obstacles have been the means of producing for him wealth, but there are few to whom wealth in the abstract means less than it does to him. To him it is but the medium that permits the unbounded exercise of his talents.

THE AUROPHONE.

The Aurophone is a scientifically constructed instrument designed to assist partially deaf persons to hear. It works on the principle of the telephone, and consists of a sound transmitter, or artificial ear, a receiver, or ear-piece, and a



THE AUROPHONE.

battery, the three being connected electrically so that the sound waves striking the transmitter are conducted in a magnified form to the ear-piece.

The transmitter and battery may be

AUROPHONE WITH TELESCOPE HANDLE.

directly connected to one another, or the battery may be detached from the transmitter, so that the transmitter can be worn pinned to the front of the coat or dress and the battery placed in the hip pocket or waist, or in a bag carried at

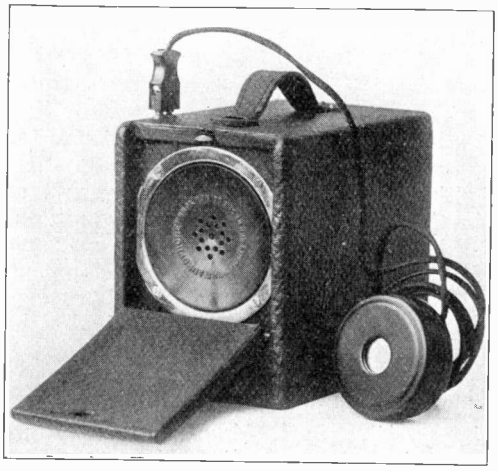
THE AUROPHONE IN THE HOME.

the belt; the transmitter and battery are then connected by a special, easily adjusted cord.

When in use, the instrument is no more conspicuous than an eye-glass.

The ear-piece can be held firmly to the ear by means of a light headband, thus giving the wearer the free use of both hands, to work, eat or play. A telescopic handle can also be used for holding the ear-piece.

A special adaptation of the Aurophone



OPERA AND DESK SET.

is the opera and desk set, which is especially adapted for office work, church, theater and lectures. It is made in various strengths, the same as the other types. It is small in size, measuring five inches high, three and one-fourth inches wide and four and one-half inches deep. Being about the size of a small camera, it is portable and weighs one and three-quarters pounds.

EFFECTS OF A BURSTING FLY WHEEL.

The "explosion" of the great flywheel in the plant of the Keokuk (Iowa) Electric Railway and Power Company recently was a remarkable illustration of dynamic force. The accident, in which the

engineer of the plant lost his life, occurred at night, and the roar like the explosion of a steam boiler was heard throughout the city. Immense masses of iron, some of them weighing 1,200 pounds, were carried a distance of over 400 feet. One of these fragments struck a frame house near by, partially wrecking the structure. The accompanying pictures show the havoc that was wrought by the accident.

ELECTRIC HEATING PAD FOR NURSERY AND SICK ROOM.

Think of the comfort to be derived from the electric heating pad, woven of finest camel's hair and to be handled like an ordinary cushion. Compare it with the old-fashioned hot water bottle for nursery use and for the sick room.

The current consumption of the heating pad is about the same as that of a sixteen candlepower incandescent lamp. It is provided with a flexible cord and plug like a portable lamp, and a regulating switch makes it possible to increase the uniform generation of heat within the bed at three stages, up to the maximum of 80 degrees.

ELECTRIC HEATING PAD IN THE NURSERY.

Just consider what it means to the patient, that this cushion, having no weight to speak of, and at the same time being highly flexible, can be adjusted to any part of the body that may be in especial need of warmth.

The electric current flows uninterruptedly through the heating coils from the moment it is turned on, and the cushion need not be re-heated.

ELECTRICITY IN THE HOUSEHOLD

ELECTRIC LIGHTED BIRTHDAY CAKE.

What can I do that will be a little different? This question comes up every time a home entertainment of any kind is being planned. The next time you have a birthday party why not have an electric lighted birthday cake as the *piece de resistance* at the celebration.

ELECTRIC LIGHTED BIRTHDAY CAKE.

The cake shown herewith, and described in the "Electric City," gives an idea of the unique and artistic effect that may be produced. It was nearly 20 inches high and the number of lights indicated the age of the young woman in whose honor the party was given.

This masterpiece of modern art in pastry had concealed in its center a wooden core through which the electric wires were run, the current regulator being fastened to the base plate of the cake. The light streamed out through multi-colored miniature lamps, such as are now used to so great an extent in Christmas tree lighting. The frosting was white, and the ornamentation in glistening colors.

WITH OUR WOMEN READERS.

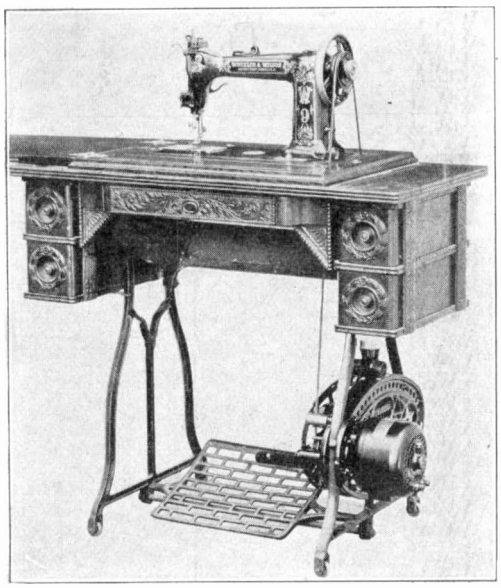
Now that electric current is available in such a large proportion of city homes and even in many country places, women are becoming more and more enthusiastic over the possibilities which its use presents in lightening their household duties. The use of electricity is, however, a comparatively new phase of domestic science, and there are many things regarding it which are not perfectly clear to the uninitiated, although in reality electricity is just as easy to handle and control as gas or any other form of fuel.

We want all readers of this department to feel free to ask questions at any time, concerning the use of electric appliances in the home. These questions will be answered in simple language, and the queries and answers will be printed for the benefit of others. For instance, you may desire to know if you should put your electric flatiron in water to cool it off; how you can read your own electric meter; how you can operate your door-bell by electric light current instead of batteries; what it will cost to operate certain devices by electric current, etc. There are hundreds of questions of this nature that arise; don't hesitate to ask them. Simply address your

question to the Household Department, Popular Electricity Publishing Co., Chicago, Ill., and it will be answered in the magazine. No questions will be answered direct unless accompanied by a stamped and self-addressed envelope.

SEWING IS EASY THE ELECTRIC WAY.

Did you ever feel tired and nervous after a day's work at the sewing machine? Of course you have, and at the same time you have no doubt wondered why it would not be possible to have some other power besides foot power to operate the machine. The men have motors nowadays to operate almost every-



ELECTRIC SEWING MACHINE.

thing. Why can't a motor be applied to the sewing machine? Well, it can, and you will no doubt be pleased to know that just such machines are on the market today. One of them is shown in the illustration.

With the electric motor equipment the operator has perfect control of the speed of the machine and can obtain an instant start, a quick, positive stop or any desired speed by a slight movement of the treadle. There are suitable guards provided, as shown, to protect the dress from contact with the working parts, which cannot therefore soil the clothes or work. The motors used on family sewing machines are of one-eighth or one-sixth horsepower.

Operation is simple, the motor being allowed to run continuously while the machine is in use and the belt is left sufficiently loose to slip on the motor pulley. The machine is started by depressing the treadle, the lever changing the position of the idler pulley, which tightens the belt over the motor pulley. The speed of the motor is increased as the belt is drawn still tighter, when greater pressure is placed on the treadle.

Showing the perfect speed regulation, it is stated that the machine may be started and only a single stitch taken if desired. With the double action of the idler pulley, much finer gradations of speed can be obtained than otherwise, while with electric power maximum speeds approximating 1,000 stitches per minute are obtained if desired.

"BREAKING THE ICE" AT A PARTY.

In "ye olden tyme," when it was right and proper at the party to get out the book of College Songs or the Gospel Hymn Book and all join in and sing together, there was not much opportunity for an awkward or chilly period to occur. But in these days of more or less formality we gladly welcome some innovation which may be introduced at the proper moment to give zest to the evening's enjoyment.

It may seem rather daring for the hostess to say suddenly, "My, how I used to like popcorn; didn't you? Let's have some. We will make it ourselves, right here in the drawing room. Mary, the electric corn-popper."

Fun? It certainly is. Get an electric corn-popper at once in time for the good times coming in the holidays. It has a cord and plug which fastens in place of an electric lamp anywhere and a little cage over it to keep the corn from popping out on the floor. Do not allow any butter or salt to be used with it; just let your guests pop the corn and eat it while it is beautiful, fluffy white and piping hot. One thing more. Secure the best popcorn and test some of it beforehand to make sure that it will pop satisfactorily.

THE NUMATICON.

The Numaticon is a portable vacuum machine operated by electricity taken from the electric lamp socket by means of a flexible cord. It removes dust and germs from carpets, rugs, bedding, clothes, walls, draperies, etc.

In a neat appearing little cabinet there is an electric motor which drives a series of turbine air pumps which suck the dust through the long hose-like tube and deposit it in a receptacle in the cabinet where it is passed through water. The receptacle can then be discharged in a minute and made ready for operation again.

Ten feet of steel bound, corrugated hose go with the Numaticon. There are several kinds of nozzles or "tools" that go with the outfit. They are easily slipped on the ends of the hose and are for various purposes. One is for cleaning furniture and walls, another is for ceilings, carpet, rugs and other heavy work. Still another, shaped like a brush,

CLEANING WALLS WITH THE "NUMATICON."

CLEANING UPHOLSTERY WITH THE "NUMATICON."

cleans clothing, billiard tables, etc. These parts are constructed entirely of aluminum and nickel and are easily adjusted.

The cabinet is mounted on ball bearing casters and is easily moved about. As it weighs only 38 pounds it is also easily carried from floor to floor.

"NUMATICON" AS A CARPET CLEANER.

The pictures herewith were obtained through the courtesy of the New York Edison Company, and show some of the applications of the Numaticon.

WOMEN TO GROW FLOWERS BY ELECTRICITY.

Madam Davidoff, a Russian-American of New York city, is planning to found a colony on Long Island which bids fair to rival the famous Brook Farm colony in Massachusetts or Upton Sinclair's Helicon Hall. The location will be at Bellecrest, near Northport, and the business of the colony, which is to consist entirely of women, will be to raise fruits and flowers under glass and under the influence of electricity.

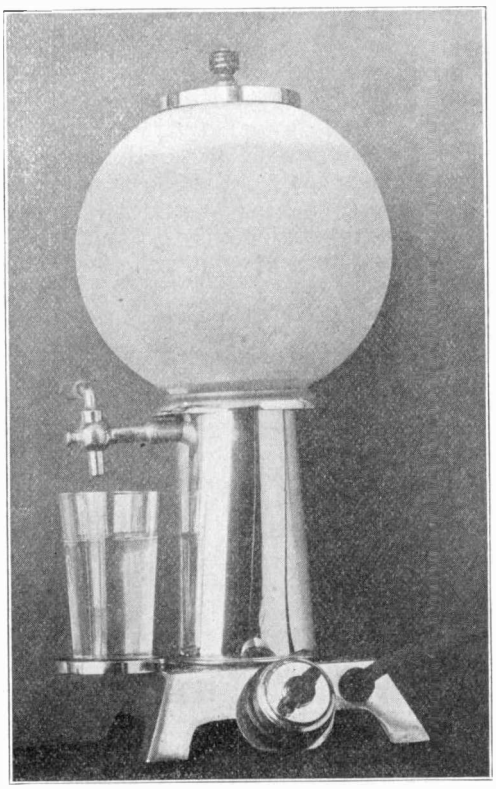
Madam Davidoff has experimented along these lines with success, her experiments being similar to those recently carried on by Sir Oliver Lodge, the noted English scientist. The results of her investigation have satisfied her that the flowers raised are larger, more fragrant, and of a prettier color than those grown unaided by the electricity and the glass. The same is true of the fruits.

Convinced that the plan is practical, she has taken up the matter from a semi-philanthropic standpoint and acquired for present use one and one-half acres of land and will have the work done entirely by women.

NOVEL ELECTRIC WATER HEATER.

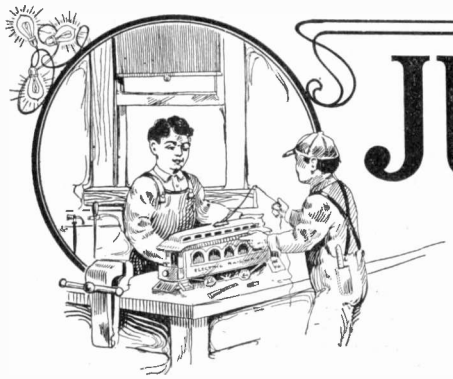
Turn the switch and in 15 seconds you will have warm water—in 45 seconds the water will boil. These are the results that can be obtained with the Marvelous electric water heater.

The device is simple in construction,



NOVEL ELECTRIC WATER HEATER.

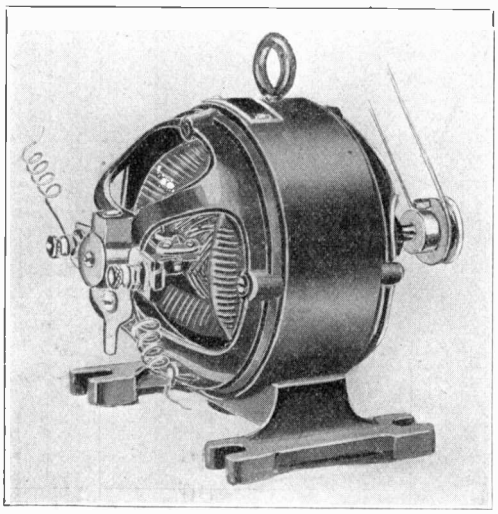
although involving some of the latest scientific principles in electricity. The pilot light in the glass bowl indicates whether electric current is on or off.



JUNIOR SECTION

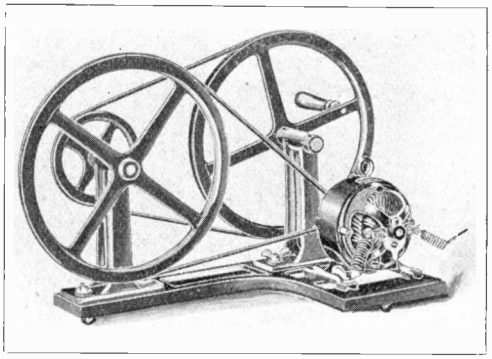
HOLIDAY ELECTRICAL TOYS.

For the boy who wants to do things—and what boy who is worth his salt does not?—the electrical toys of to-day present a veritable scientific fairyland, a fairyland of which the boundaries are only fixed by the limits of his desires and capacity. It is now possible to obtain the parts of a dynamo of the enclosed type, drum armature, six-part commutator, rocker-arm adjustable, so that the machine may be run at the point of highest efficiency, with all of the necessary machining done. The machine can be put together without a hitch, all



A MODERN TOY DYNAMO.

parts, wire, bolts, and screws, being furnished complete. The boy who comes into possession of this, and following the directions furnished with each set, finally, through the fruits of his own labors, is in control of a complete 24-watt machine, and knows more about dynamos than a month of schooling in the ordi-



COMPLETE MINIATURE POWER PLANT.

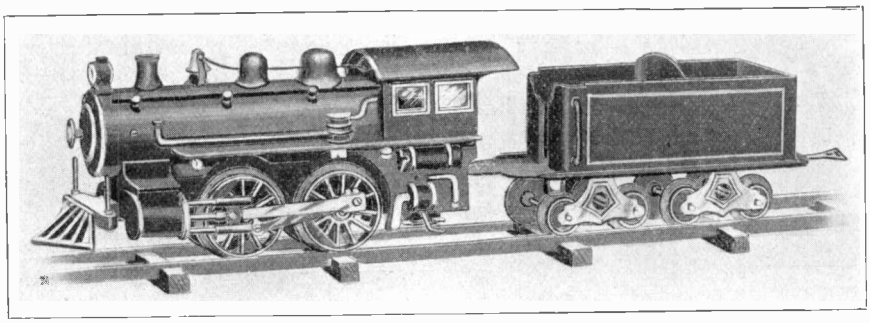
nary way could have taught him. And this is but the key to a whole field of endeavor, since being now in the possession of a source of current, he is enabled to try the numberless experiments which immediately suggest themselves to his whetted appetite.

For those who prefer it, the dynamos are supplied all ready finished, every detail, even to the enamel, being carefully looked after. If desired, a hand-power drive may be obtained, splendid in its working, tastefully enameled, belt driven, with arrangements for taking up the slack as the belts stretch.

The dynamo and hand drive complete form a complete power plant, as carefully designed and finished as the bigger plants which they miniature. And this

whole plant may be had for about $10.

With this as a nucleus, the boy ventures further afield; bells may be rung, storage batteries charged, supplying current for a telegraph instrument with which he can set up a small line to communicate with his chum across the street.



ATLANTIC TYPE TOY ELECTRIC LOCOMOTIVE.

Electroplating may be done, as for a few cents enough of the salts for either copper or nickel plating may be obtained. With a borrowed fruit jar he is ready for business, and soon we hear our young friend talking "cathode," and "anode," and "electrolysis," and doing things that but a few years ago were yet to be discovered. Yes, this is a scientific age.

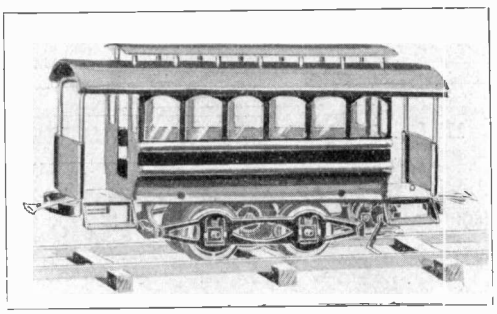
A complete electric lighting outfit is also within the boy's grasp. Small incandescent lamps may be obtained. The Christmas tree may be lighted without the old-time danger of fire, by small electric lamps, strung by almost invisible wires, lighted by current obtained first-hand from the dynamo or from current stored in a storage cell by turning the dynamo at odd moments.

And then there is the motor, obtainable in many sizes, from the $1.00 or less, up to the twin brother of the dynamo described above. Those of the enclosed type are furnished with a reduction gear, so that speed may be obtained at the expense of power, or power at the expense of speed, at will.

The boy learns the limitatons of machines; learns, learns, all the time, and the learning is a pleasure.

Only a boy can suggest the numberless ways in which a motor may be used. He runs fans, or a miniature machine shop, or a windmill, or attaches it to a derrick. The uses are endless, and the motors may be run cheaply by storage, dry or the ordinary salammoniac batteries—or by his dynamo.

Then the electric railways—there's a field. If the boy prefers the steam type locomotive, he can have a duplicate of the Atlantic type high-speed passenger locomotive, perfect in every detail, running as smoothly as a watch over an improved track that does not warp or pull apart, and capable of pulling ten trail cars. If he is fortunate enough to have lighting current at his disposal, either direct or alternating, the appliance which will convert this current to a tension suitable to use is to be had. If he wants to use straight track, a specially designed trip is obtainable, which can be attached to any part of the track in-



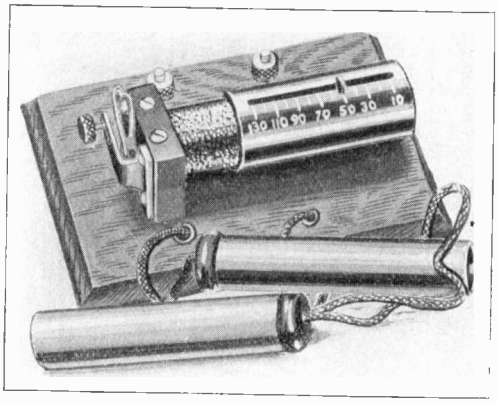
TOY ELECTRIC CAR.

stantly without tools, and will stop the onward flight of the engine and start it running the other way. The motor of this high-speed locomotive is of the consequent pole type and concealed within the boiler of the engine.

The trolley car, another form of the traction engine, is also obtainable. This may be run upon the same tracks as the

locomotive. As it is not intended to pull as many trail cars, it is geared to run at higher speed. Here, too, the current reaches the car through the rails, the trolley pole method having long been abandoned as unfeasible.

The smaller boy has by no means been neglected. He can buy a magneto for

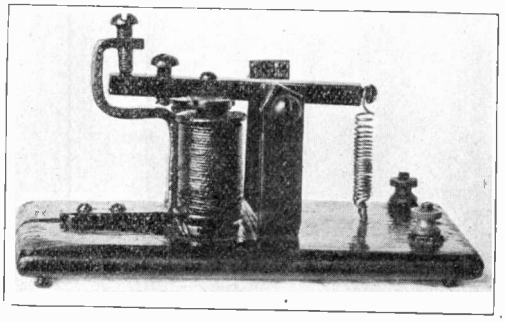


TOY INDUCTION COIL.

$1.00 with "shocking" qualities sufficient to keep both him and his friends amused for a long time, and if he dislikes to turn the handle he can secure the same effects with a miniature induction coil, which will cause his friends to tremble with delight, if he can get them to hold both handles. This, of course, runs from a single dry cell and has a current regulator which enables him to win the confidence of his friends before giving them the full effects.

HOME MADE TELEGRAPH SOUNDER.

The accompanying picture is from a photograph of a telegraph sounder, made by a Chicago boy. The parts are all



HOME MADE TELEGRAPH SOUNDER.

made of strap iron and no castings were employed, but it works as well as any sounder made up with brass or iron castings. It is a simple affair. The magnet coils were procured from an old electric bell and wired in series with the line. The yoke for the magnets was made from a piece of iron ¼ inch wide by ⅛ inch thick. And the U and S shaped pieces were also bent out of strap iron, five cents worth, procured at a blacksmith's shop, being sufficient. In all respects the sounder is similar to the ordinary sounder except that it is made of materials within the reach of every boy.

LIGHTNING CAUGHT IN THE ACT.

Many photographs of lightning discharges have been taken, but it is seldom that one is obtained showing the bolt actually striking a building as in the case shown in the picture herewith. This photograph was taken from a hill overlooking Wilkinsburg, Pa., at about 9 p. m. A thunder storm was brewing in the west and the camera was set up

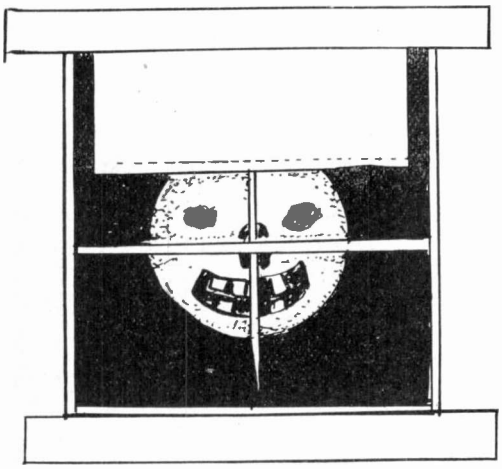
LIGHTNING CAUGHT IN THE ACT.

facing it in hopes of getting a flash. A lightning bolt struck the house as shown, which was about 300 yards from the camera and directly in front of it. An arc lamp located behind the tree throws the house into prominence and spoils the effect of the flash somewhat.

ELECTRIC LIGHTS AN EFFECTIVE BURGLAR ALARM.

BY GEORGE RICE.

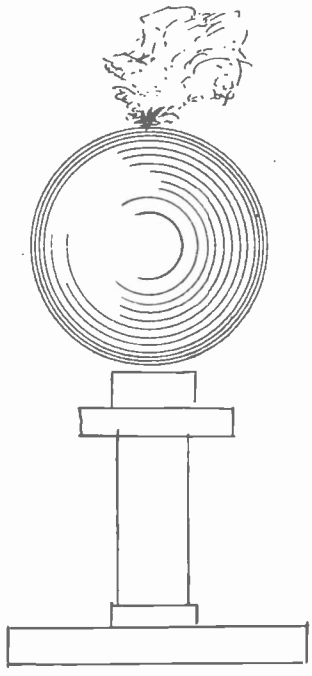
In years gone by, many houses and shops were freely ornamented at all entrances with patented forms of burglar alarms. There were spring devices for announcing the opening of a door or a window. There were ingeniously contrived window catches for holding burglars in check. There were traps and locks of all descriptions. But the detectives have long since demonstrated that when a burglar desires to enter a building, he is not going to be checked by any new-fangled mechanical contrivance. He carries the necessary devices to combat with improved traps and alarms. He can turn the key of a room with thin-jawed steel nippers while he is on the outside. He has a method of breaking the window pane by pasting cloth over the glass and forcing a hole by presure and without making any noise. Then he simply reaches through the opening in the broken pane and loosens the lock.



A PUMPKIN FACE SHOWED.

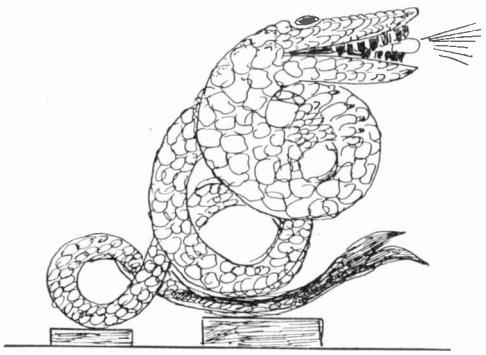
After years of experimenting with these supposed window protective devices, door mechanisms, traps, alarms, etc., the police tell us that the burning of a light outdoes the whole collection. There is a great deal of common sense in this assertion. It has been found that a lighted apartment is seldom entered. There may be no person in the apartment, but the burglar cannot be sure. Rather than take chances with the light burning, the would-be robber passes on.

Ingenious people have not been slow in discovering the advantage of letting a light burn in some part of the house all night. If a light is burning in a chamber the burglar may think that some one is sick. He will imagine that there is some one stirring and he postpones his raid. Of course there is always danger when a light is left burning in a careless way. For illustration, if you use a candle, and fall asleep with it burning, it may burn down to a point where it might ignite something. Frequently candles are fixed to wood and these will burn the wood when down to the last part. Then if the oil light is left burning low, it may give forth an odor. Lanterns are tolerably safe and gas jets can be burned satisfactorily. The electric light is, however, recommended as least dangerous and most effective.



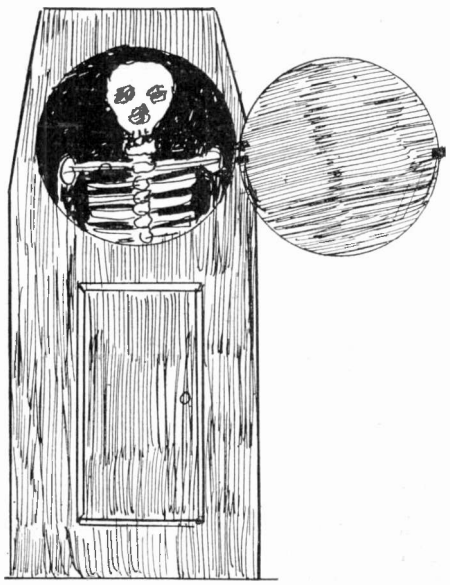
IT LOOKED LIKE A BOMB.

There are persons who have fooled the intruders of houses by using odd devices of a home-made nature. One of the illustration shows a pumpkin head which was fixed up and placed in a window in a locality where the night



THE FIERY DRAGON.

raiders had been looting the suburban residences. Now burglars are often superstitious. They do not like to break into a house where there are any signs of forthcoming trouble, particularly

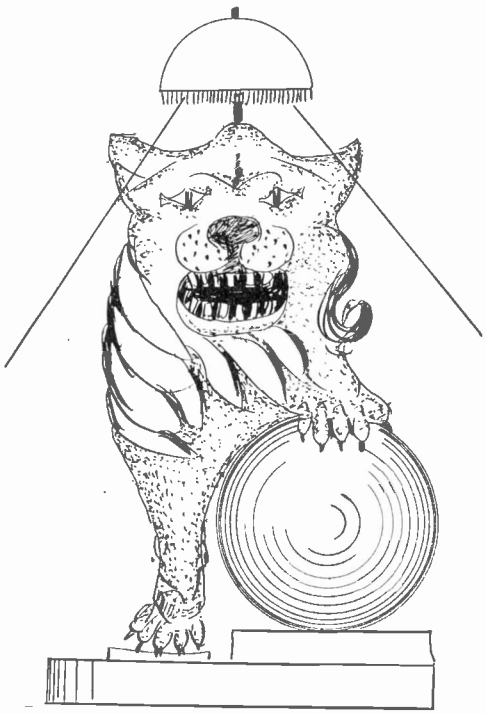


SKELETON IN A CASKET.

when there are plenty of other houses where the people have not taken the trouble to discourage night visits of robbers. Hence I am told that the pumpkin figure head shown in the cut kept a certain house safe from burglars and tramps all one season while the inmates were away.

An attendant turned on and off the light each time. An electric light was placed inside the pumkin and any one hanging about the house after dark would be confronted in this window with the eyes, nose and mouth gleaming with light.

In another case the host rigged up a wooden ball which he painted black and adjusted to the top of a stand. Then he fixed some white cotton to the top. Then an incandescent light was hung near by.



THE FIGURE FRIGHTENED.

This light made the thing resemble a bomb. Of course, any burglar looking into the hall through the front plate glass would understand that it was all an illusion. But somehow the picture of the play bomb would jar his nerves. He would argue that the man of the house expected a visit from thieves and that the man might be ready with a loaded gun. Therefore he would pass on.

Still another effect was produced with the electric light and a serpentine figure. This thing was purchased from a dealer in antiques by a man who liked hall or-

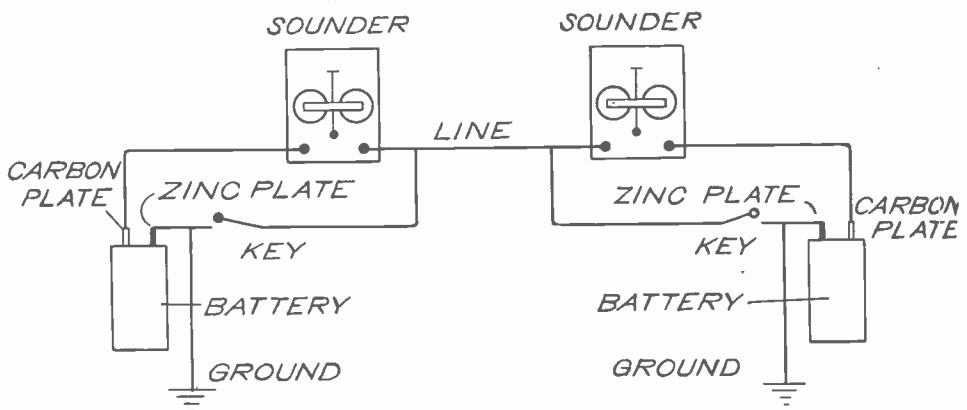
naments of a strange character. This figure was painted white and was furnished with a light in its jaws. A glimpse of tnis figure through the window glass at night would startle any one. It does not take much to make a gang of looters change their minds about robbing a certain house. They do not like to take chances. They want the chance of picking up valuable loot without detection. When they find lights burning in any form, the plans are all upset.

Another scheme was adopted by a certain party who utilized electric light to frighten off burglars. This man had been robbed a number of times. His house was on the outskirts of a large town. Burglar alarms failed to work and patented devices were not effective in checking the looters. Valuable articles were missed and the robbers were not caught. Even the watch dog had been poisoned. So the man bought an old style hall clock and placed it in the hall. Then he bought the framework of a skeleton of a human being. This skeleton was made of a white composition and it glistened in the dark. An electric light shaded with green paper was placed where the briliancy was reflected direct to the bony form in the supposed casket. This combination was kept set up all night. At daybreak the circular door, where the face of the clock used to be, was closed. There were no more burglaries at this house. A glance at the supposed genuine skeleton in the casket was all that was needed to keep the night raiders away.

A BOYS' TELEGRAPH LINE.

BY JEROME L. ALLEN.

Sometime ago two boys came to me to get my opinion on a telegraph line they intended building between their homes, and as they did not want to go to too much expense they wanted to get it done with as much economy as possible. I suggested a means of connecting their instruments and batteries as shown in the diagram. It proved very valuable to them, as it did not necessitate the purchase of gravity batteries and at the same time gave them an efficient open circuit system that allowed signalling from either end without the key at the other end being closed. Only one wire was used between the houses and the connections were as shown.



A BOY'S TELEGRAPH LINE.

The batteries were so connected that the electromotive force of one opposed that of the other, that is, the carbon plate of one was connected through the two relays and the line to the carbon plate of the other, as shown in the diagram.

When both keys are open, no current will flow as the two cells are, to use a common electrical expression, "bucking" each other.

When one of the keys is pressed down, however, current flows from the corresponding sounder to ground. Current from the other battery also flows through the other sounder over the line and to ground through the same key. Pressing the key at either station will in this way operate both sounders.

QUESTIONS AND ANSWERS.

Readers of Popular Electricity are invited to make free use of this department. Knowledge on any subject is gained by asking questions, and nearly every one has some question he would like to ask concerning electricity. These questions and answers will be of interest and benefit to many besides the one directly concerned. No consideration will be given to communications that do not contain the full name and address of the writer.

HIGH FREQUENCY APPARATUS.

Questions.—(A) If 10 amperes flow through a circuit which has .0005 microfarad capacity, over and above that necessary to balance the inductance, what will be the frequency of the current flowing through an arc in the circuit, the voltage being 5,000 direct current?

(B) If a high frequency transformer having 10 turns in its primary and one million turns in its secondary be connected in series with the arc, what will be the voltage in the secondary, the radius of the primary being ten inches, and with an air instead of an iron core?

(C) What would the inductance of the primary be?—E. K., Wabash, Ind.

Answer.—(A) Your question is not clear. Do you refer to the arc method of producing high frequency currents?

(B) The leakage loss in such a coil would be so enormous that a predetermined ratio figure would be very difficult to give, and probably unreliable.

(C) Very low; probably not over .001 milli-henry.

POWER FACTOR FORMULA.

Question.—Kindly publish some formulæ for working out the power factor meters of the following loads: 6,600 volts, single phase, 180 amperes on the two ammeters, 90 power factor lag. The above single phase is taken from a three phase Westinghouse turbo-generator. Four hundred volts, three phase, 500 amperes, or 166 2-3 amperes per phase, 90 power factor lead.—X. Y. Z., Michigan City, Ind.

Answer.—The power formula for a single phase alternating current circuit is

$$W = V. A. P.$$

For a three phase circuit

$$W = 1.732 \text{ V. A. P.}$$

between mains, where W signifies watts, V volts, A amperes in any main and P power factor.

From these formulæ we find the power of your single phase circuit is

$$W = 6600 \times 180 \times 0.90 = 1,069,200 \text{ watts.}$$

The power of your three phase circuit is

$$W = 1.732 \times 400 \times 166\tfrac{2}{3} \times 0.90 = 103,860 \text{ watts.}$$

CHANGING WINDINGS OF FAN MOTOR.

Question.—I have an induction fan motor wound for 108 to 115 volts and 133 to 140 cycles which has 10 poles wound with .020 wire. The power plant has changed to 60 cycles, 110 volts. Is there any way I can change the field connections or the motor for 60 cycles?—J. E. D., Maywood, Ill.

Answer.—Since the voltage of your supply remains the same, no change is necessary in the winding or connections of your field. However, the iron cross section of the field for 60 cycles should be about twice as great as for 133 cycles—a rather difficult requirement to meet. Moreover, the motor will attain only one-half its former speed on the lower frequency. To bring the speed back to its rating would necessitate reducing the present number of poles in the field to five; and that is impracticable because five is not an even number. This is all the help we can offer without more information on the construction of the motor.

PECULIAR CONDENSER PHENOMENON.

Question.—I have noticed that by connecting a receiver with a telephone condenser I am able to detect a discharge in the condenser, and this at any time, although the condenser has not been near an electric circuit. I do not understand how a condenser can become charged in this way. This discharge, although quite feeble, represents a certain amount of energy, and why could not a greater amount be obtained in the same way, without any expense whatever?—F. W., Pekin, Ill.

Answer.—Your experiment is very interesting. We have been unable to secure the results you observe, and suggest that you write us more fully as to the capacity of the condenser, whether it has been tested recently for insulation resistance, and whether the experiment may be repeated immediately. Like many other similar phenomena, this action of your condenser admits of several theories. The ordinary static or influence machine depends for its self-starting ability on the presence of infinitesimal electric charges where theoretically none need exist. A sensitive elec-

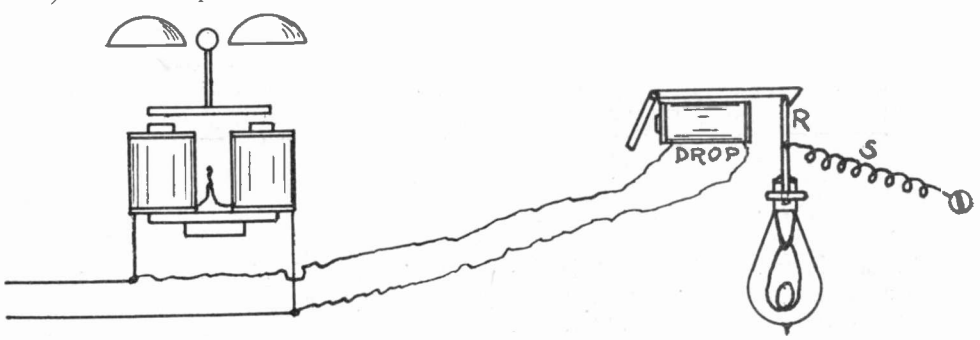
tioscope reveals electrical unstability in the least expected places.

On the other hand, we can imagine that the least chemical difference in the two opposing metal surfaces of the condenser would set up a difference of potential if the least suspicion of moisture existed in the paper dielectric. This action would be similar to that of the old "dry pile" of Zamboni, one of which, it is said, has been oscillating a miniature pendulum continuously since 1823 in the University of Innsbruck, the whole arrangement being sealed under a glass cover. The actual power delivered, of course, amounts to nothing.

AUTOMATIC TELEPHONE LIGHT.

Question.—Will you please inform me how to connect an automatic drop (Bell circuit) to a telephone so that a call from the central exchange will light an eight candle power, 110-volt, direct current lamp. I have the lamp circuit thoroughly insulated from the telephone.—M. E. H., W. Philadelphia, Pa.

Answer.—We suppose your idea is to have the lamp remain lighted until the telephone call is answered, or until it is turned off. The best method to employ will be to fasten a bar (R) (see diagram) to the lamp button, so that when



AUTOMATIC TELEPHONE LIGHT.

released it will be pulled over by the spring (S) and close the switch. If an ordinary telephone switchboard drop is used and the lamp switch rod is engaged by the armature of the drop, we have a purely electrical arrangement, and the lamp may be placed where convenient, without regard to the location of the telephone. A high resistance drop should be bridged across the ringer terminals, as shown. If the drop be a low resistance one it should be arranged in series with the ringer

REWINDING AN INDUCTION FAN MOTOR.

Question.—The four fields of an alternating current induction fan motor, to run on 52 volts, 60 cycles, were burned out by being run on a 110 volt circuit. They were each wound with 75 feet No. 20 magnet wire. I wished to rewind them, so I put on 150 feet of No. 27 wire. But on trial the fields became hot. So I added 125 feet more to each one, but they still became hot after two or three minutes of running. I do not like to add more wire, because the speed has been greatly reduced by the amount I have on now. Can you tell me what to do beside putting in some external resistance, such as a lamp or choke coil?—A. R. P., Chicago, Ill.

Answer.—The correct winding for 110 volts would be 150 feet of No. 23 wire on each of the four poles. All connections should be exactly as they were for 52 volts. So wound, the motor should operate as satisfactorily on 110 volts as it originally did on 52, provided the frequency remains the same.

REGULATOR FOR STATIC ELECTRICITY.

Question.—Has there ever been a device invented for the purpose of regulating the flow of static electricity?—C. A. D., Granite City, Ill.

Answer.—Properly speaking, there is no such thing as a flow of static electricity, since the word static signifies "at rest." An influence machine such as the Wimshurst or Toepler-Holtz, when not connected to condensers or large conducting surfaces, affords a fairly continuous discharge, or flow, of electricity. But any apparatus introduced into the circuit destroys the regulation, because the very existence of static electricity depends on accumulation of charge. Leyden jars or their equivalent serve to concentrate and direct the discharge, but the actual flow of current lasts for only an infinitesimal period of time.

QUADRUPLEX TELEGRAPH; STATIC MACHINE.

Questions.—I would like to know the principal points of the quadruplex telegraph, also of a static machine.—X. Y. Z., Chicago, Ill.

Answers.—The quadruplex telegraph permits the transmission of four messages, two in each direction, over a single wire at the same time. It is really a combination of two different types of duplex systems. In the illustration, (K) and (K′) are transmitting keys and (R) and (R′) are differentially wound polarized relays. The relays are adjusted to respond to positive currents and to be held open by negative currents. There is constantly on the line a current sufficient to hold the relays in the position shown. When (K) is depressed a current is sent out on the line which pulls relay (R) to contact, but is too weak to break the contact (T). This acts on the sounder (S). When (K′) is depressed. A stronger current closes both relays and opens contact (T). This operates sounder (S′) only. Thus two messages may be sent over the line simultaneously. The relays being wound differentially, the instruments at the sending station are left unaffected by outgoing currents, but respond to incoming currents. This makes possible the receiving of two messages while two others are being sent over the same wire.

A static machine is simply a device for accumulating charges of static electricity, usually by rotating plates of glass or other insulating material. Frictional machines simply excite an electrical charge by the rubbing together of positive and negative dielectrics. Influence machines multiply an existing minute charge to any desired intensity. The construction of these machines is described in all books on elementary electricity.

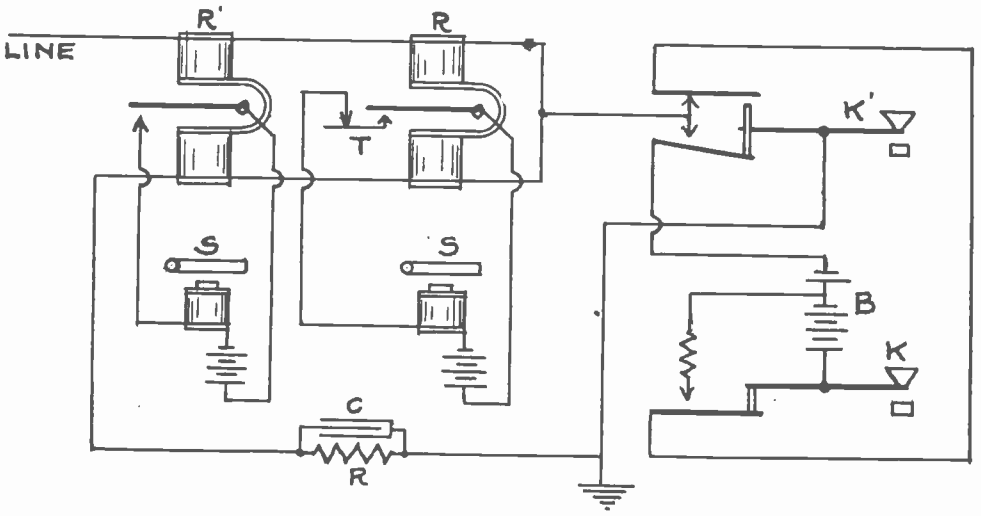


DIAGRAM OF QUADRUPLEX TELEGRAPH SYSTEM.

SPARK COIL FOR GAS LIGHTERS.

Question.—Will you kindly give me the formula for making a spark coil for electric gas lighting? I would like to install three gas lighters.—F. A. S., Corona, N. Y.

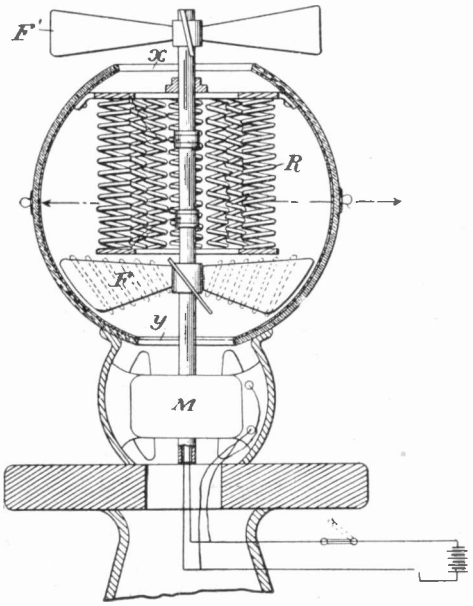
Answer.—No exact formula exists for the design of simple spark coils. A core consisting of a bundle of iron wires 1¼ inches in diameter and 8 inches long, wound with four or five layers of No. 16 cotton covered magnet wire, forms about the smallest coil practicable. Six large dry cells, or better, two such sets in multiple, should be used.

In submitting questions to the Question and Answer Department, it should be remembered that no attention will be paid to communications that do not contain the full name and address of the writer. It is necessary that we should have this information even though only the initials are printed in the magazine.

NEW ELECTRICAL INVENTIONS

A NEW ELECTRIC HEATER.

A new type of electric heater, which is the invention of A. I. D. Kyle of Aberdeen, S. D., is shown in the accompanying diagram. It consists of a spherical casing in which coils of resistance wire (R) are located. This casing has an opening (X) at the top and another opening (Y) at the bottom. A vertical shaft extends through the casing and is driven by a motor (M). To the shaft is fixed a fan (F), inside the casing and another fan (F′) above the upper



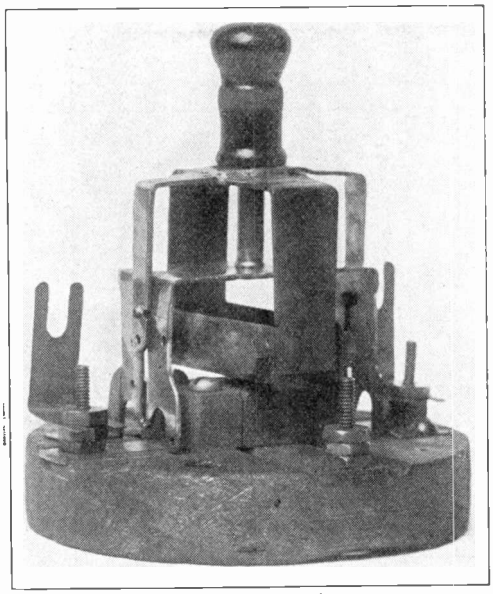
NEW ELECTRIC HEATER.

opening. Current is passed through the resistance coils, heating them, and when the motor is in operation the fan (F) draws cold air from below and forces it over the heating coils, out through the upper opening, where it is distributed about the room by fan (F′).

The device may easily be constructed in ornamental designs, suitable for mounting on newel posts, etc. It may also be used effectively without the fan attachment.

TELEPHONE LIGHTNING ARRESTER.

Most telephone lightning arresters of the carbon type are so constructed that slightly separated carbon bodies are inserted in a connection leading from the line to ground. The high voltage lighting discharge jumps across the little air gap and passes to earth, but the low voltage telephone currents cannot cross the gap, so that normally the arrester

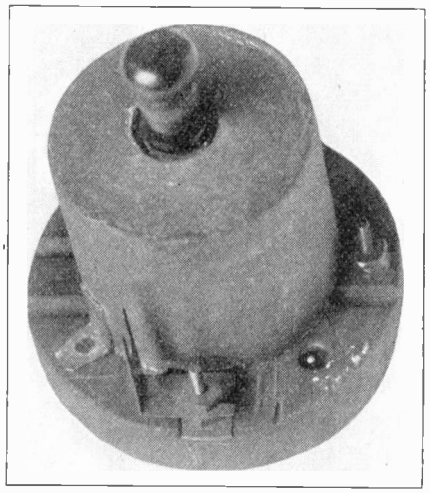


TELEPHONE LIGHTNING ARRESTER CLOSED.

does not offer a ground to the telephone current. It has been found, however, that these arresters, after a lightning discharge has passed through them, often become obstructed by particles of carbon which become detached and bridge across the gap, giving a direct ground path for the telephone current and putting the telephone out of service until the trouble has been cleared. Most telephone users, not understanding the principle of the arrester, cannot clear the trouble themselves and consequently a man must be sent out by the company to perform the comparatively simple operation.

Mr. John H. Cook of Logansport,

Ind., has invented a very simple arrester as shown in the illustrations, in which anyone can clear the trouble. The device operates on the principle of an ordinary rubber dating stamp used in most offices. As shown in one of the cuts, the carbon blocks of the arrester are



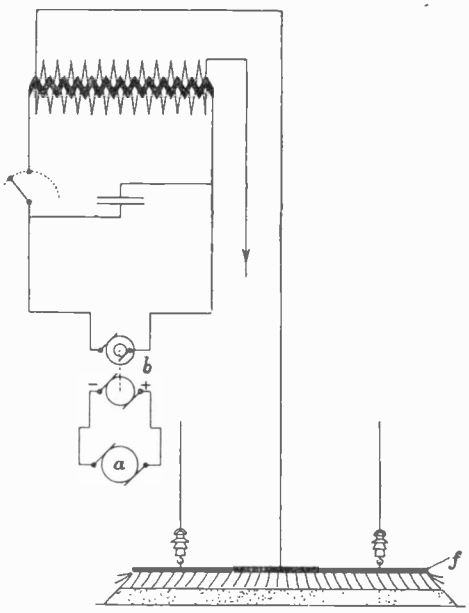
TELEPHONE LIGHTNING ARRESTER; COVER OFF.

separated by a small fraction of an inch. By simply pushing down on the handle, two thin knives are thrust through the air gaps, dislodging any particles that may have collected there. The handle then springs back to its original position and the trouble is cleared.

ELECTRIC MALTING PROCESS.

A German inventor, Alfred Oertel, has devised an electric malting process in which the grain is subjected to the action of dark electric rays produced by an alternating electric current having an electromotive force above 1,000 volts and below that of the so-called Tesla currents. It is said a more rapid and satisfactory germination of the grain is produced.

In the practice of the process the grain to be malted is moistened and spread over a floor and high tension currents of the character above referred to are employed to produce brushes of dark electric rays which are passed from an electrode (f) extending over practically the whole surface of the grain. The distance



ELECTRIC MALTING PROCESS.

between the electrode and the surface of the grain is such that no sparks or arcs can pass between them, only the "brush" discharge.

MINERS' LAMP.

The electric miners' lamp shown here is operated in conjunction with a specially designed cap, in which is placed an electric storage battery. Light is fur-

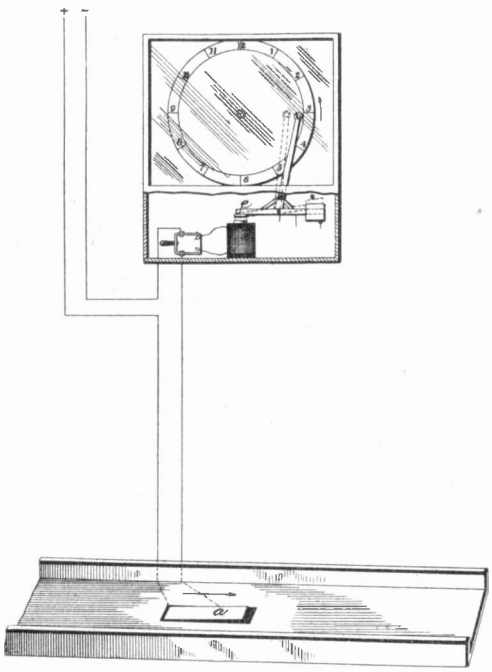
MINER'S LAMP.

nished by a small incandescent lamp surrounded by a reflector on the fore part of the cap. The light is operated by a push button secured to the under surface of the vizor, where it is constantly in convenient reach of the wearer. The cap and attached lamp are light in weight and in no way interfere with the movement of the arms. The battery is readily recharged at little expense.

The chief advantage of this lamp is the elimination of danger from explosions which so often are caused by flame lamps.

RECORDER FOR ICE PLANTS.

This device is designed automatically to record the number of blocks of ice drawn up the chute into the ice house. It consists of a thin strip of metal (a) in the bottom of the chute which is depressed when a cake of ice passes over it and closes an electric circuit to the elec-

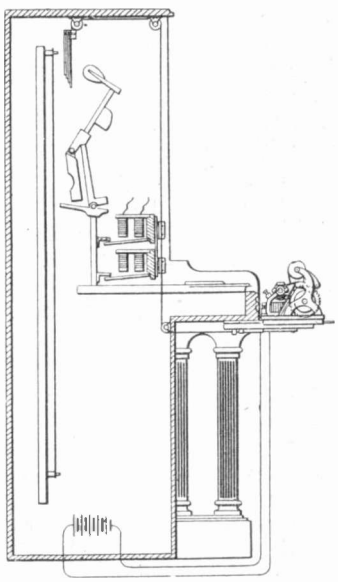


RECORDER FOR ICE PLANTS.

tromagnet. As the resulting current flows through the electromagnet its core attracts the lever (e), drawing the latter down and working the dial counter When the cake has passed over (a) the latter springs up and breaks the circuit, and is thus in position for the next count. The device is the invention of W. D. Cain and W. H. Williams, of Durant. Okla.

ELECTRIC PIANO PLAYER.

The usual form of automatic piano-player operates by little jets of air blcwn through the perforated paper strip as it is slowly unwound from one roll and wound up on the other. The electric piano player shown herewith, the invention of Alvan L. Hart, of Burlington, Ia., also makes use of a perforated sheet, but in this case the perforations permit



ELECTRIC PIANO PLAYER.

electrical contact to be made, which for an instant closes the circuit to an electromagnet which operates the striking hammer corresponding to the particular note represented by the perforation. The diagram illustrates one hammer and string with the electromagnets which operate the hammer.

Arnold Bartels of Los Angeles, Cal., has invented a camera shutter which is opened and closed by an electromagnet instead of the usual air bulb device. The object of the device is to enable the operator to stand away a considerable distance from the camera when operating the shutter.

THE THEORIZERS' CORNER.

No one knows what electricity really is. Neither has its relation to visible forms of matter, nor to other manifestations of energy, such as life, light, heat, etc., been fully explained. Nearly everyone, however, has a theory of his own on this subject, and these theories are interesting. Readers of Popular Electricity are invited to make free use of this department and give others the benefit of their views.

ANOTHER THUNDER AND LIGHTNING THEORY.

The thunder and lightning theory set forth in the July issue I think was too radical a departure from all previous theories, which have been advanced on this subject, to be generally accepted, and besides, there seems to be one flaw in not having any receptive agent on which to store the electric charges during the process of generation, granting that this generation be possible. The following is a theory which I believe will be more easy to accept.

When vapor rises we will grant that the invisible atoms are charged with a minute quantity of static electricity. These atoms may have received their loads either through friction with one another or through the disintegration of the water which formed them.

It is a generally accepted theory that an electric charge occupies the surface of the charged body. So, when this vapor begins to condense, the loads of thousands of atoms are added together. But as the drop formed is spherical the volume and also the charge has increased rapidly, while the surface has not increased nearly so much, consequently the charges of the individual drops grow denser and denser.

The raindrops forming in the clouds eventually become charged to their full capacity. By the combination of these drops some soon become overcharged. These overcharged drops may individually discharge to drops of lower potential, but in doing this the receptive drop is overcharged and the process is repeated.

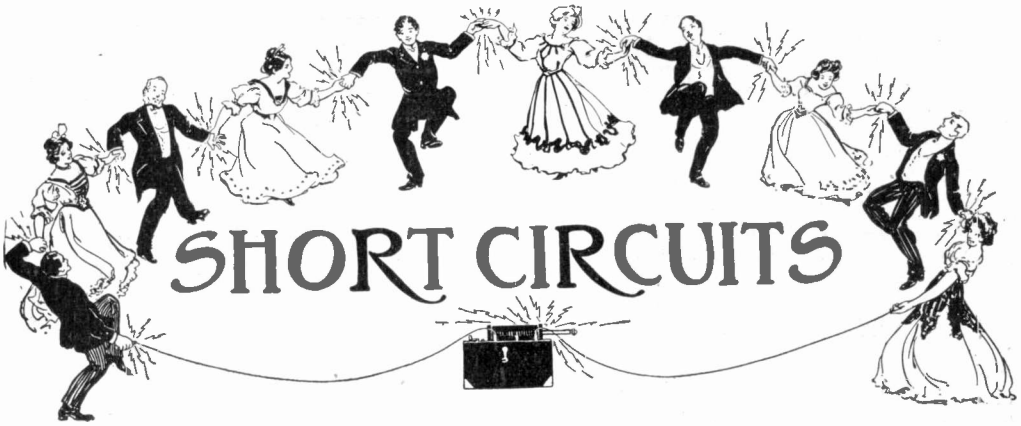
During this time the combinations of drops has continued until practically every drop in the cloud is overcharged and a strain in the ether is produced between the cloud and some other body at a lower potential. This body may be the earth or another cloud. This strain becomes so great that an arc is formed and the whole cloud discharges to the lesser charged body. The arc thus formed is called lightning. Thunder is caused by the sudden filling of the vacuum formed by this arc.

L. A.

TRAVELING BY VORTICES.

"Traveling by vortices," the remarkable theory set forth in the October issue by "Wheels," appears to have had its origin in a brain vortex or storm. I am not disposed to question the vortex theory of matter. It has been indorsed by some scientists and may or may not be true. But in any case, the vortex theory applies only to sub-atomic volumes, and the vortices are supposed to compose the atoms, which themselves are smaller than the most powerful microscope can show. As the vortices are infinitely small, according to the theory, how does he propose to use the vortices as means of transportation by his "vortex car" or otherwise? This would require a vortex several feet in diameter at least, and the very theory which he seeks to apply presupposes that the vortices are infinitesimal.

As a matter of fact, the vortex theory is held to be true only by a few, the electron theory being acknowledged by most authorities. According to this theory the electron is the ultimate unit of all matter. The atoms are made up of electrons or disembodied electrical charges, in rapid motion, the atom of one elementary substance, such as hydrogen, differing from the atom of another elementary substance, such as oxygen, only in the number and arrangement of the electrons contained in it. Thus we have at last the ultimate unit of matter, of which all forms of matter are composed; and the remarkable feature is that this ultimate unit of which all matter is composed is not matter at all, as we ordinarily understand the term, but electricity.



A negro on passing a country grave yard on a dark night saw what he took to be a ghost. He immediately departed from the scene on a run, while a few feet ahead of him a jack rabbit led the way down the path. When the negro saw the rabbit he cried out: "Lawd, save me. If you'all can't run get out o' de way and let someone run what can."

* * *

Friend—"How'd you come to write that best seller?"

Modern Literary Gent—"First I was struck by a thought; I epigrammatized the thought; I sketchized the epigram; playised the sketch; novelized the play, and advertised the novel!"

* * *

"You must let the baby have one cow's milk to drink every day," said the doctor.

"Very well, if you say so, doctor," said the perplexed young mother; "but I really don't see how he is going to hold it all."

* * *

During the recent financial flurry a German farmer went to the bank for some money. He was told that the bank was not paying out money, but was using cashier's checks. He could not understand this, and insisted on money. The officers took him in hand, one at a time, with little effect. Finally the president tried his hand, and after a long and minute explanation the situation seemed to be dawning on the farmer's mind. Finally the president said: "You understand now fully how it is, Hans, don't you?"

"Yes," said Hans, "I tink I do. It's like dis, aind't it? Ven my baby vakes up at night and vants milk I gif him a milk ticket."

* * *

"There's going to be a big demand for those new-fangled divorces," said Mr. Mumm the other evening.

"What new-fangled divorces?" asked Mrs. Mumm.

"Why, that new kind, where a man can keep his wife, but gets an absolute divorce from her relations."

* * *

Traveling Man—"My good man, what time does this train leave Swamp Centre?"

Agent—"My friend, I'm only the agent. I'm not a fortune teller."

* * *

Conductor—"This here transfer expired an hour ago, lady."

The Lady (digging in her purse, snappishly—"No wonder!—with not a single ventilator open in the whole car!"

* * *

Fake Oil Capitalist (smilingly)—"How's your latest gold mine panning out?"

Fake Mine Promoter—"Beyond expectations. Why, old man, it's assaying over a thousand suckers to the ton of literature!"—Puck.

"Long introductions, when a man has a speech to make, are a bore," says former Senator John C. Spooner. "I have had all kinds, but the most satisfactory one in my career was that of a German Mayor of a small town in my State, Wisconsin.

"I was to make a political address, and the opera house was crowded. When it came time to begin, the Mayor got up.

"'Mine friends,' he said, 'I haf been asked to introduce Senator Spooner, who is to make a speech, yes. Vell, I haf dit so, und he vill now do so.'"

* * *

One morning a farmer found a score of men putting up telephone poles through his field. He ordered the men out, but they wouldn't go. They showed him a paper which, they said, gave them authority to put up the poles. The old man looked at the paper, saw it was lawful and walked silently away. He went to the barn and turned a savage red bull into the field. As the bull made for the men, they fled at the top of their speed, and the farmer shouted after them: "Show him your paper."

* * *

A judge in North Carolina was sentencing a big, loose-jointed negro who had been convicted of murdering another negro.

"George Earley," his honor said, "you have been found by a jury of twelve men tried and true to be guilty of murder in the first degree, for having killed, in cold blood, Moses Stackhouse, and it is the sentence of this court that on the 10th day of August the sheriff of Polk County take you to a place near the county jail and there hang you by the neck until you are dead, dead, dead! And may God have mercy on your soul. Have you anything to say for yourself?"

The negro shifted from one foot to the other and twisted and untwisted the old felt hat he held in his hands. All eyes in the court room were upon him. Finally, rolling his eyes up at the judge, he said:

"Look y'here, jedge, you-all don't mean this comin' August, does you?"

* * *

Teacher—"What little boy can tell me the difference between the quick and the dead?"

Willie's hand waved frantically.

"Well, Willie?"

"Please, ma'am, the quick are the ones that get out of the way of automobiles; the ones that don't are the dead."

* * *

Farmer—"See here, boy, what yer doin' up that tree?"

Boy—"One of your pears fell off the tree an' I'm trying to put it back."

* * *

Conductor—"I had a narrow escape last night. I fell off the rear platform, but luckily wasn't injured."

Motorman—"Well, they say Providence takes care of intoxicated men and fools."

Conductor—"But I never drink."

Motorman—"That's all right, old pal. I know you don't."

ELECTRICAL DEFINITIONS.

Accumulator.—Storage battery.

Alternating Current.—That form of electric current the direction of flow of which reverses a given number of times per second.

Ammeter.—An instrument for measuring electric current.

Ampere.—Unit of current. It is the quantity of electricity which will flow through a resistance of one ohm under a potential of one volt.

Ampere Hour.—Quantity of electricity passed by a current of one ampere flowing for one hour.

Anode.—The positive terminal in a broken metallic circuit; the terminal connected to the carbon plate of a battery.

Armature.—That part of a dynamo or motor which carries the wires that are rotated in the magnetic field.

Branch Conductor.—A parallel or shunt conductor.

Brush.—The collector on a dynamo or motor which slides over the commutator or collector rings.

Bus Bars.—The heavy copper bars to which dynamo leads are connected and to which the out-going lines, measuring instruments, etc., are connected.

Buzzer.—An electric alarm similar to an electric bell, except that the vibrating member makes a buzzing sound instead of ringing a bell.

Candle Power.—Amount of light given off by a standard candle. The legal English and standard American candle is a sperm candle burning two grains a minute.

Capacity, Electric.—Relative ability of a conductor or system to retain an electric charge.

Charge.—The quantity of electricity present on the surface of a body or conductor.

Choking Coil.—Coil of high self-inductance.

Circuit.—Conducting path for electric current.

Circuit-breaker.—Apparatus for automatically opening a circuit.

Collector Rings.—The copper rings on an alternating current dynamo or motor which are connected to the armature wires and over which the brushes slide.

Commutator.—A device for changing the direction of electric currents.

Condenser.—Apparatus for storing up electrostatic charges.

Cut-out.—Appliance for removing any apparatus from a circuit.

Cycle.—Full period of alternation of an alternating current circuit.

Diamagnetic.—Having a magnetic permeability inferior to that of air.

Dielectric.—A non-conductor.

Dimmer.—Resistance device for regulating the intensity of illumination of electric incandescent lamps. Used largely in theaters.

Direct Current.—Current flowing continuously in one direction.

Dry Battery.—A form of open circuit battery in which the solutions are made practically solid by addition of glue jelly, gelatinous silica, etc.

Electrode.—Terminal of an open electric circuit.

Electromotive Force.—Potential difference causing current to flow.

Electrolysis.—Separation of a chemical compound into its elements by the action of the electric current.

Electromagnet.—A mass of iron which is magnetized by passage of current through a coil of wire wound around the mass but insulated therefrom.

Electroscope.—Instrument for detecting the presence of an electric charge.

Farad.—Unit of electric capacity.

Feeder.—A copper lead from a central station to some center of distribution.

Field of Force.—The space in the neighborhood of an attracting or repelling mass or system.

Fuse.—A short piece of conducting material of low melting point which is inserted in a circuit and which will melt and open the circuit whon the current reaches a certain value.

Galvanometer.—Instrument for measuring current strength.

Generator.—A dynamo.

Inductance.—The property of an electric circuit by virtue of which lines of force are developed around it.

Insulator.—Any substance impervious to the passage of electricity.

Kilowatt.—1,000 watts. (See watt.)

Kilowatt-hour.—One thousand watt hours.

Leyden Jar.—Form of static condenser which will store up static electricity.

Lightning Arrester.—Device which will permit the high-voltage lightning current to pass to earth, but will not allow the low voltage current of the line to escape.

Motor-dynamo.—Motor and dynamo on the same shaft, for changing alternating current to direct and vice versa or changing current of high voltage and low current strength to current of low voltage and high current strength and vice versa.

Multiple.—Term expressing the connection of several pieces of electric apparatus in parallel with each other.

Multiple Circuits.—See parallel circuits.

Neutral Wire.—Central wire in a three-wire distribution system.

Ohm.—The unit of resistance. It is arbitrarily taken as the resistance of a column of mercury one square millimeter in cross sectional area and 106 centimeters in height.

Parallel Circuits.—Two or more conductors starting at a common point and ending at another common point.

Polarization.—The depriving of a voltaic cell of its proper electromotive force.

Potential.—Voltage.

Resistance.—The quality of an electrical conductor by virtue of which it opposes the passage of an electric current. The unit of resistance is the ohm.

Rheostat.—Resistance device for regulating the strength of current.

Rotary Converter. — Machine for changing high-potential current to low potential or vice versa.

Secondary Battery.—A battery whose positive and negative electrodes are deposited by current from a separate source of electricity.

Self-inductance.—Tendency of current flowing in a single wire wound in the form of a spiral to react upon itself and produce a retarding effect similar to inertia in matter.

Series.—Arranged in succession, as opposed to parallel or multiple arrangement.

Series Motor.—Motor whose field windings are in series with the armature.

Shunt.—A by-path in a circuit which is in parallel with the main circuit.

Shunt Motor.—Motor whose field windings are in parallel or shunt with the armature.

Solenoid.—An electrical conductor wound in a spiral and forming a tube.

Spark-gap.—Space between the two electrodes of an electric resonator.

Storage Battery.—See secondary battery.

Thermostat.—Instrument which, when heated, closes an electric circuit.

Transformer.—A device for stepping-up or stepping-down alternating current from low to high or high to low voltage, respectively.

Volt.—Unit of electromotive force or potential. It is the electromotive force which, if steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere.

Voltage.—Potential difference or electromotive force.

Volt Meter.—Instrument for measuring voltage.

Watt.—Unit representing the rate of work of electrical energy. It is the rate of work of one ampere flowing under a potential of one volt. Seven hundred and forty-six watts represent one electrical horse power.

Watt-hour.—Electrical unit of work. Represents work done by one watt expended for one hour.

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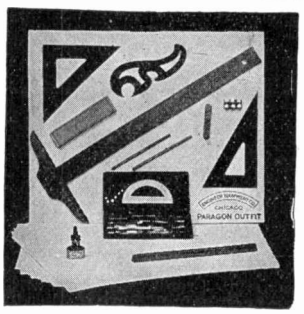

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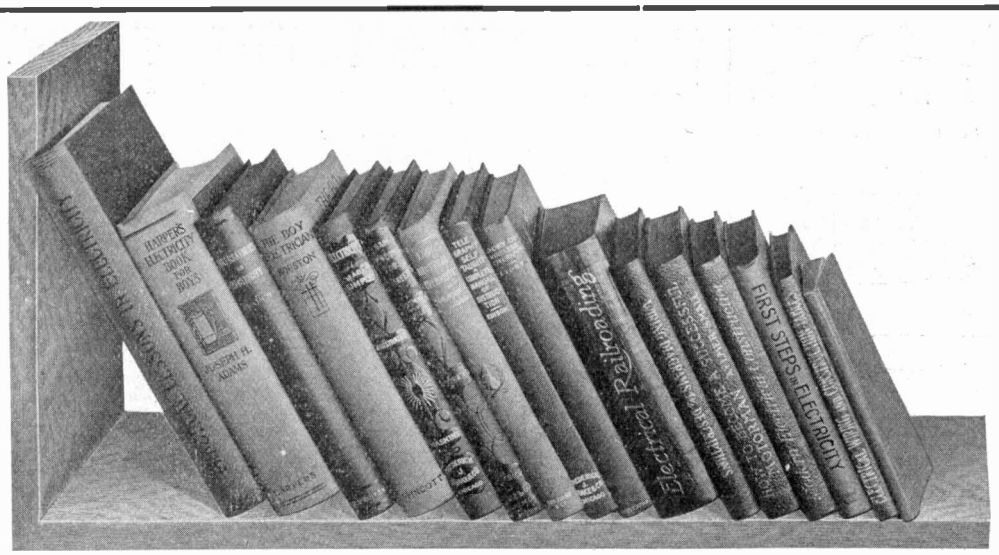

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WOODPECKERS DESTROY TELEPHONE AND TELEGRAPH POLES.

Birds are destroying the telephone and telegraph poles in the South and Southwest, particularly in Texas, Arizona and California. In some places 50 per cent of all the poles along the right-of-way have been riddled by these innocent offenders, which belong to the woodpecker family. One of the Western Union officials, who has recently returned from an inspection through the West, reported having seen twenty-five telephone poles with two or three hundred holes drilled clear through them. Some of the holes were three or four inches in diameter.

An officer of the Illinois Central Railroad counted the white cedar telephone poles along the right-of-way near Covington, Tenn., which had been affected by woodpeckers, and found that out of 268 poles, 110, or 41 per cent, had been bored. In some cases destruction of the pole takes only a few months and the weakened condition makes it dangerous for a lineman to climb the stick.

The real object to the birds in drilling the holes is uncertain. One telephone man said that the humming of the wires was mistaken by the birds for insects excavating beneath the surface of the wood, and that they drilled the poles in quest of these imaginary insects. It is very probable, however, that the holes are excavated for an entirely different purpose. The woodpecker is a provident bird. At the proper season it stores up a supply of acorns and other foods for future consumption. In the summer these holes are often found stored with acorns.—Journal of Electricity, Power and Gas.

The Forest Bureau of the United States has recently been investigating the preservation of cross arms for telegraph and telephone wires. The trouble heretofore has been that the wood subjected to the creosote process has not been of uniform porosity, some of the arms absorbing more of the preservative than was necessary, while others did not receive sufficient treatment. The Forestry Bureau divides the wood into three grades according to grain and air-dries them thoroughly in piles protected from rain and snow. The different grades are separately treated, receiving from six pounds to ten pounds per cubic foot.

ELECTRICAL DEVELOPMENT IN THE WEST

The 1908 edition of the WESTERN ELECTRICAL and GAS DIRECTORY lists a total of 1021 electrical, gas, railway and kindred companies, including a comprehensive record of companies controlled by and absorbed, operating in the states of Arizona, California, Nevada, Oregon and Washington, together with complete information concerning the organization and engineering details of all companies constituting the industry. Of this total, 686 companies are devoted to the generation, transmission, distribution or utilization of electric light and power; 145 are gas companies, and 190 electric railway companies. In all, nearly three-quarters of a million kilowatts of electrical energy is being actually generated or is in process of installation for the operation of the electrical industries of the five states named,—that is, approximately one-million horse power. In addition, the gas companies of these states annually produce close to fourteen billion cubic feet of artificial gas.

The Directory, which has just been issued, is so arranged that the names of companies, firms and individuals engaged in the electrical and gas industries located within the states of Arizona, California, Nevada, Oregon and Washington are given alphabetically, not only by cities and towns under their respective states but also under the industry or industries which they represent, i. e., the "Gas," "Electric Light and Power," and "Electric Railway Industries." This listing gives the capitalization of the companies, names of officials, plant equipment, etc.

The price of the Directory is $10 and copies may be obtained from Popular Electricity Publishing Co.

AUSTRALIAN MUTTON-BIRD INDUSTRY.

Consul Henry D. Baker, of Hobart, presents certain facts regarding the mutton-bird industry of the Furneaux group of islands, situated to the northeast of Tasmania and under the government of that Australian State. The consul visited these islands during the month of May in order to make some study of the birds and their curious habits, and now writes from a commercial standpoint:

The interesting study of "mutton birding" is peculiar to many of the small islands about the Tasmanian coast, particularly on the Furneaux group in Bass Straits, where it constitutes the principal means of support of the inhabitants. The mutton bird, or sooty petrel (Nectris brevicaudus), is, when full grown, about the size of the well-known silver gull of North America, and its color, at first a grayish-black, with age becomes a jet black. Their most important breeding places are in the vicinity of Tasmania and New Zealand, in the latter island being of somewhat different variety and white instead of black.

Every year, about September 20, almost to a day, these birds arrive in enormous numbers at their rookeries, and for about one month the male and female are busy in restoring their old nest or in building a new one. Where the soil is light and loose the nests are burrowed into the ground close together, but when there is sufficient shrubbery to afford shelter the birds simply deposit their eggs on the bare ground. Frequently large snakes occupy these nests in common with the mutton birds.

As the birds are away at sea in quest of food in the daytime the nest making is carried on at night, the birds making a great noise while thus occupied. After the nests are prepared each female lays one egg, which closely resembles a duck egg, and the male and female then take turns at hatching, usually the male taking the first turn, while the female goes in search of food, chiefly shrimp and kelp berries, with which she returns each evening. After the lapse of a fortnight, by which time the first sitter has wasted considerably, the partner relieves him, and the male bird will then take upon himself the responsibility of bringing in food.

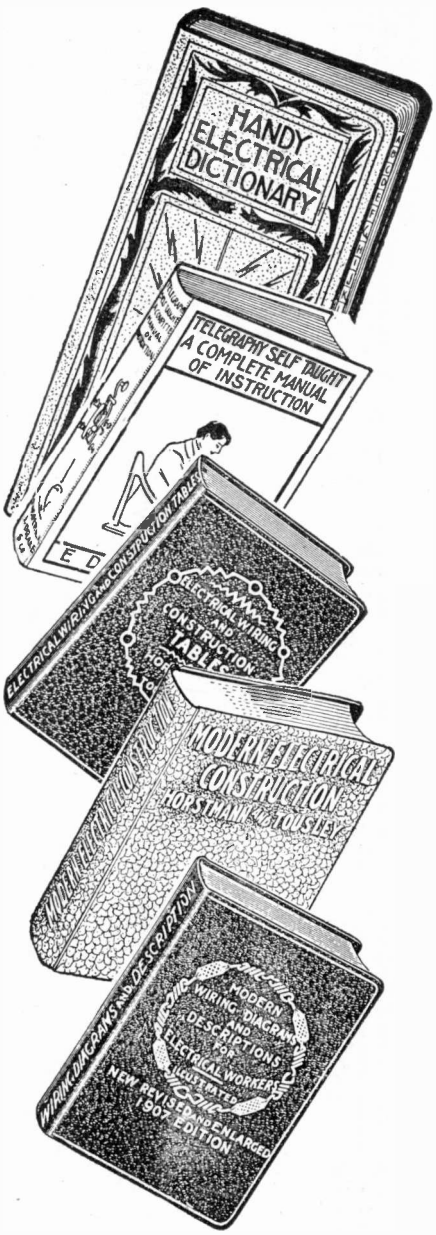
By the end of six weeks incubation is complete, and the attention of each parent is bestowed upon the protection and rearing of the young bird, each now taking a daily instead of fortnightly turn—one bird always remaining with the young one while the other goes away for food. When old enough to take care of itself the young bird is entirely forsaken. By this time it has become inconveniently fat, so great has been the attention bestowed upon it, but it does not attempt to stir from the nest until compelled by hunger to do so. The effect, however, of a few days' starvation tells upon the bird, so that it makes a great effort and removes itself from its nest and finds its way toward the sea, and from some rocky eminence makes its flight.

It is not known where the birds go when they leave the islands, about the middle of May. Their flight is extremely swift and irregular, and if the birds strike any obstruction, like a rock or the mast of a ship, the collision is usually fatal to them. The lighthouse at Goose Island, one of the Furneaux group, has to be protected with iron screen work and frequently hundreds of dead birds are found at the base of it. Captain Flinders, of the British royal navy, once computed that a flock of birds which he saw was 40 miles in length.

It is only the newly hatched mutton birds which have a commercial value, the purposes for which they are taken being for salted human food, for oil (used in tanning leather and for the lubrication of machinery), for the fat used chiefly for greasing timber skids, and for feathers. The season's work at mutton birding covers about six weeks, from about April 1 until about the middle of May, when the rookeries are completely deserted. During this six weeks' period the inhabitants of the islands (about 400 altogether) earn sufficient money to support themselves in practical idleness for the rest of the year.

The first stage in mutton birding is known as oiling. A stick pointed at one end and stuck in the ground at the other serves as a kind of spit or skewer on which to fix the birds as they are gathered. Search is then made for the young birds, and as they are caught their necks are broken by a skillful jerk of the hand and they are then fixed by their beaks to the sticks.

It is rather dangerous capturing the birds, as the rookeries are infested with poisonous snakes and frequently the mutton birder, when he puts his hand and arm into the hole, lays hold of a snake



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Name.....

Address.....

Occupation.....

Popular Elec. 12-08.