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IN THIS ISSUE { ELECTRICITY AND THE POOL ROOMS
R. R. ACCIDENTS AND THEIR PREVENTION

POPULAR ELECTRICITY

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IN PLAIN ENGLISH

SINGER TOWER ILLUMINATED

Vol. 1. APRIL 1909 No. 12.

Disease Can Be Cured

without the use of medicine

HEALTH AND STRENGTH

come from a good circulation full of magnetic life

This cut shows how the Magnetic waves from our Vest envelop the entire trunk of the body, and saturate the patient with powerful Magnetic vibrations. We make Shields for every part of the body, all described in our new book, "A PLAIN ROAD TO HEALTH," by C. I. Thatcher, M. D. Send for it today. Free to all.

WE PROVE IT TO YOU

We Prove Every Statement We Make. We Do Not Ask You To Take Our Word As Final Evidence.

When we say that disease can be cured without the use of medicine, we mean every word we say; every word of it is true. We know it to be true, because in the past quarter of a century we have proven it to our own satisfaction and to the joyful satisfaction of thousands of others. We are constantly on the lookout for other diseases to prove it on. We prove it to anybody; in fact, we want to prove it to everybody.

We do not care what the disease is, nor how severe it is, nor how many other diseases are complicated with it, we can show you parallel cases that have been cured by the Famous Thatcher Magnetic Shields, and these cases are sound and well to-day, as living monuments to the grand revitalizing power of Magnetism. Patients are often told that they have incurable diseases. We want to tell you right here that nearly all of these cases can be cured, and we can prove it to you. More than seventy-five per cent. of all the patients we have cured, were first given up as beyond hope of cure, and they were made sound and well by applying Magnetism according to scientific instructions.

We will point you to cases of Paralysis, Consumption, Diabetes, Bright's Disease, Locomotor Ataxia, Dyspepsia, Rheumatism, Tumors, Nervous Prostration, Obesity, and a hundred-and-one other diseases that are called incurable. We can show you the most incontestable proof that we have cured them. We have cured them after they had been given up to die.

Read the following letters from grateful patients:

THESE POSITIVE POWERFUL STATEMENTS ARE INDISPUTABLE

Serious Complication of Lung, Stomach and Kidney Trouble—A Marvelous Chicago Recovery.

Dr. Thatcher: Dear Sir:—It gives me great pleasure to testify to the perfect cure I have gained by using your wonderful Shields. After suffering 15 years with stomach troubles, although doctoring the greater part of the time, I kept getting worse, until I was the victim of a severe complication of stomach and kidney trouble, which a year and a half ago all seemed to go to my lungs. Had dreadful pains, lost my appetite, could not sleep, became so very weak that I could hardly walk across the floor, and not able to do my work. At times when my pains were not so severe I would try to read, but could not for more than five minutes at a time, as I was very nervous. My family and friends thought I would not live another month. I was getting tired of taking medicine. Nothing helped me. I happened to see your advertisement in the paper, which read "Magnetism Cures Without Medicine." I thought "While there is life there is hope." So just one year ago today I put on your wonderful Magnetic Vest, Leggings and Insoles. The result was a miracle, for in two days I felt relieved; in a week, very much better; in three weeks, entirely cured.

Words cannot express how thankful I am to you for your kind advice; also for the treatment to which I owe my life. May you live long for suffering humanity's sake. May your great and sure cure be known a great deal better than it is today. Yours respectfully, MRS. O. RAY, 654 Hirsch St., Chicago, Ill.

"The Shields Have Saved My Life"—Extreme Case of Paralysis Speedily Cured.

Dear Dr. Thatcher:—I feel as though I must give my testimonial in hopes that it may induce some poor suffering one afflicted with paralysis to get the shields and be cured, who otherwise would give up in despair and die, for the shields have saved my life, which I believe nothing else could ever have done, for, as you said when I came into your office eleven years ago, a poor, wreck of myself, so that I had to be half carried and could not help myself, and you were afraid it was too late, but advised that if I was covered up with the shields, that I might yet be saved. You did nearly cover me with the shields, and they did their work. They started the deadened blood and saved my life, which must otherwise have been of very short duration, for my bowels and stomach had stopped working entirely for nearly a week. They were the same as dead. I had the second stroke. The root of the tongue was also totally paralyzed and the eyes were set; could not move them and the brain was so far gone it felt just like a big basket on my shoulders, and I had to be held up while the shields were being put on, for my whole strength had given out and I think you had little hopes of saving me, but you said you would try, and only for your timely efforts I would not have stayed long. I began to feel better and improved with every hour after I put them on, and in eight weeks I was out traveling on the road. I was then past 50 years of age. I am now very much alive, smart and active, and I advise no one to hesitate trying the shields after they know what they have done for me, and I will be glad to answer any letter of inquiry that may come to me from any person suffering with paralysis or similar form of disease.

MRS. M. C. SCHWAGER, 646 W. 41st St., Chicago, Ill.

We have thousands of just such letters, stating that the patients had been cured of diseases that had been considered incurable. Do not be discouraged. Do not give up hope, even if you have been told your trouble could not be cured. Investigate our claims, for it is a duty you owe yourself. All we ask is for you to write us and send a complete description of your case, and let us prove to you that we can cure you.

We will send you FREE OF CHARGE our new book "A PLAIN ROAD TO HEALTH," by C. I. Thatcher, M. D., and will advise you just what application of Magnetism will be required to cure your case. Write us fully to-day, and we will take the same careful pains to advise you, as if you would call at the office and see us in person.

WARM FEET—A pair of FOOT BATTERIES, the very smallest shields we make, worn in the shoes, will convince the most doubting skeptic of the curative value of MAGNETISM. $1.00 a pair or three pairs for $2.00. Send size of shoe when ordering FOOT BATTERIES.

THACHER MAGNETIC SHIELD CO., INC., Suite 277, 169 Wabash Avenue, CHICAGO, ILL.

INDEX

Volume I.

Popular Electricity

(May, 1908, to April, 1909)

POPULAR ELECTRICITY PUBLISHING CO.
CHICAGO, ILL.

A

B

C

D

POPULAR ELECTRICITY

IN PLAIN ENGLISH

HENRY WALTER YOUNG, Editor

Vol. 1. APRIL 1909. No. 12.

CONTENTS

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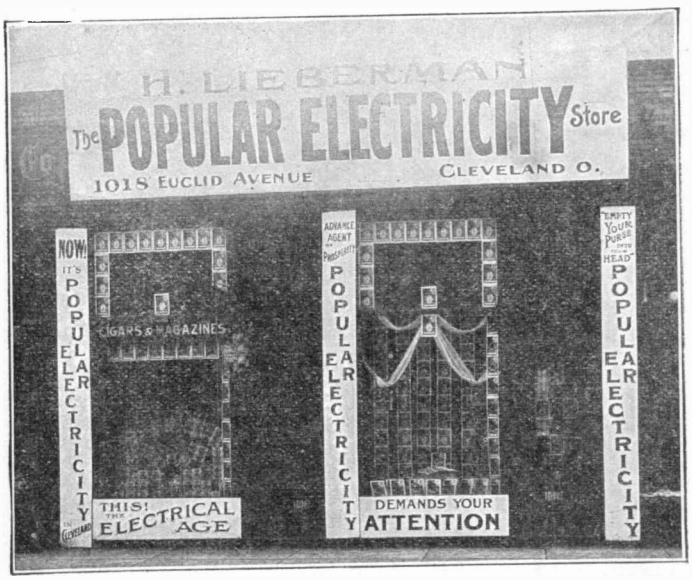
PUBLISHER'S PAGE

No Longer in the "Infant Class"

With this issue Popular Electricity completes one year of its existence. In another month it may take its place among the sedate and turn compassionate eye upon those that are still laboring mightily under the appellation—"Vol. 1." The first year in the life of any publication has a very important bearing on its future, and in many cases those twelve months actually determine whether it shall live or die. During this period the wants of the reading public must be determined, in the particular field which the publication covers, that it may be so shaped as to meet the requirements of the greatest number. During this same period the "dear readers" are also making a little investigation on their own account—and they are most discriminating. In the final analysis, upon their decision hinges the fate of the "infant."

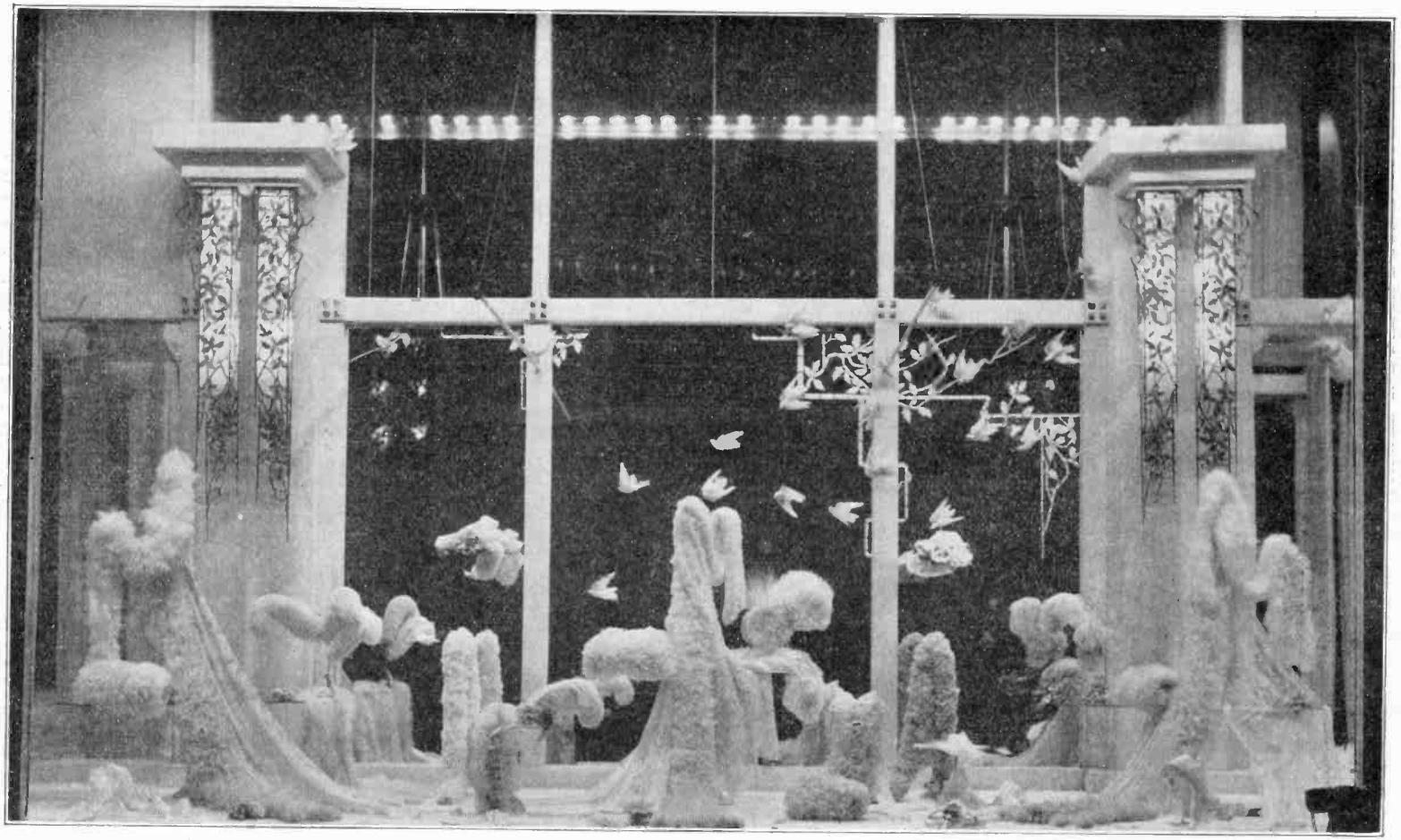
We are not going to boast, but we do feel that the results of the first year's work warrant some elation on our part. The reception of Popular Electricity has been flattering. Its circulation has been increased beyond expectations, and this circulation among a class of intelligent and earnest readers has brought to us and enables us to retain a rapidly growing clientele of satisfied advertisers. For this generous support we wish to express our sincere thanks, and to promise increased efforts to make Popular Electricity more worthy of its continuation.



WHAT THE NEWSDEALERS ARE DOING

Newsdealers have found in Popular Electricity a "live wire" and many of them are making special efforts to "push a good thing along." They realize that this is the age of electricity and are not slow to see the significance of a magazine, not a technical publication, that they can hand out to the general reader who comes along with the query "Got anything on Electricity?" The enthusiastic support which many of them are giving the magazine is exemplified by the attractive display shown herewith, which is but one among hundreds.

RENEWALS: **The date on the wrapper of your magazine shows the issue with which your subscription expires. No additional copies will be mailed after the expiration of a subscription, except upon renewal. Since each issue is printed a month before the date which it bears, renewals should be sent in at least four weeks in advance, in order that no copies be missed.**



SHOW WINDOW WITH INTERIOR ILLUMINATED GLASS PILLARS. SMALL LAMPS APPARENTLY SHOWING ARE REFLECTIONS FROM CONCEALED TROUGH LIGHTS.

POPULAR ELECTRICITY
IN PLAIN ENGLISH

VOL. I APRIL 1909 No. 12

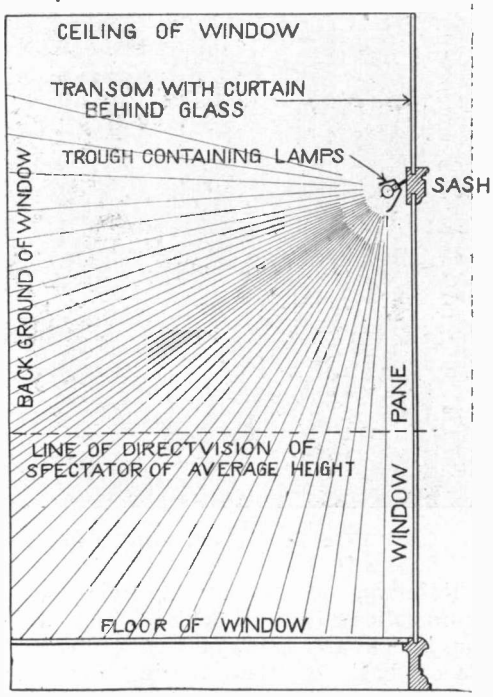
THE LIGHTING OF SHOW WINDOWS.

BY WILLIAM KEILY.

When the lighting of the show windows of stores is spoken of, it is of course assumed that electric lighting is meant, for this is certainly one branch of illumination where the advantages of electricity must be universally conceded. One has but to imagine the sorry figure that the store fronts in any of our American cities would present to our twentieth-century eyes, after dusk, if any other illuminant were used, to realize that it is a case of "Eclipse first; the rest nowhere."

But while all up-to-date show windows are lighted electrically, there are about as many methods of accomplishing the result as there are window-trimmers or designers, to say nothing of the illuminating engineers, who have ideas of their own on the subject. As might be expected, the engineers and the designers of window displays do not always agree. The engineer is a man whose shibboleth is "efficiency"; he is to do with one dollar what any fool can do with two. He wants to get the greatest amount of useful light in that window at the least cost. Very likely he will favor the tungsten lamp, with its high efficiency and its beautiful white light, directed where needed by reflectors designed with mathematical accuracy.

On the other hand, the high-class window trimmer is an artist. He aims to produce beautiful effects by combinations of color and form. He has in mind the apparent changes in form when viewed under different colors—a subject but little understood. He has his designs, his backgrounds, his complementary colors, his tones and tints. "Softly, softly," he may say to the engineer; "we do not want a white light; we want a yellow with some red in it—a warm, friendly flesh tint, not a glare

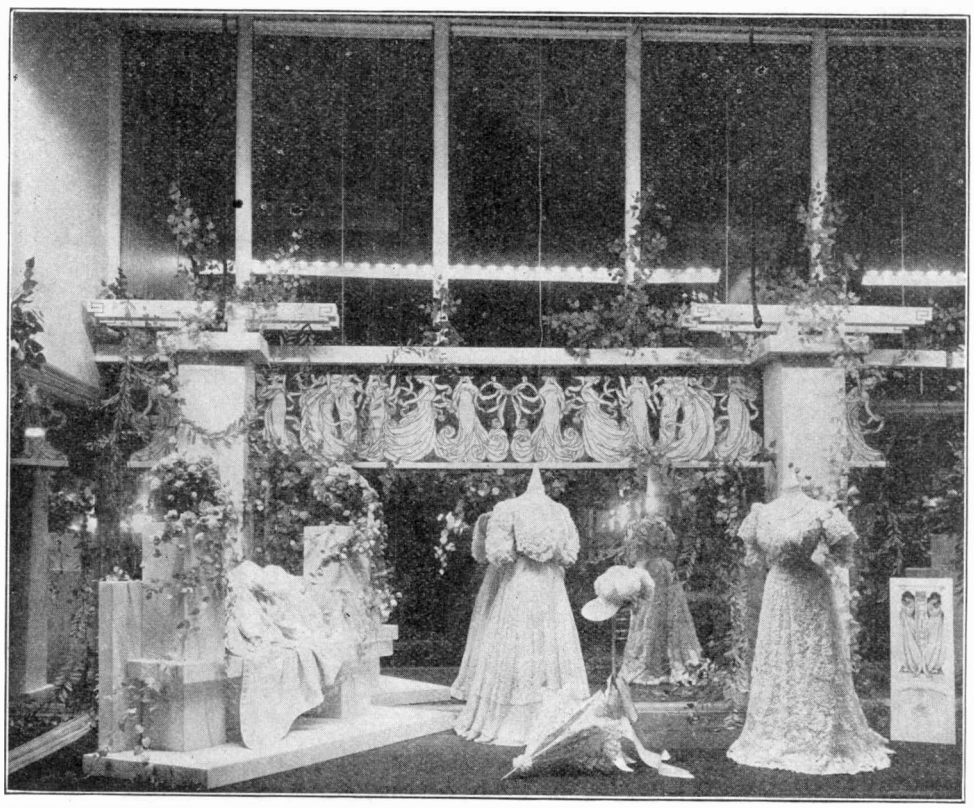


ARRANGEMENT OF CONCEALED TROUGH LIGHTS, SHOWING ANGLE OF GREATEST ILLUMINATION.

of white; white is harsh." And he will probably have his way.

The present article is accompanied by some photographs, taken about midnight or 2 o'clock in the morning, when the sidewalks are comparatively clear,

showing the beautiful window displays and window lighting of the famous retail store of Marshall Field & Co. in Chicago. Such effects as these are only obtained by the highest degree of artistic skill backed by lavish expenditure; but it is to be remembered that the lighting effects, which are excellent, are obtained by very simple means; they can be duplicated at small expense in windows much less pretentious.

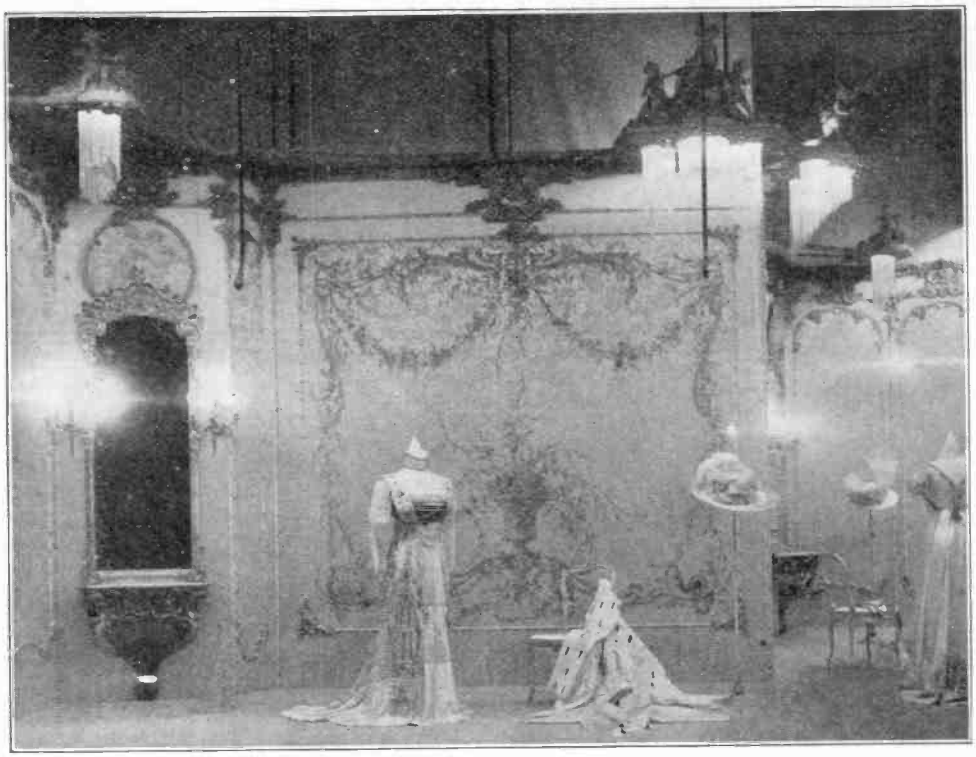


IN THIS VIEW THE ANGLE OF LIGHT IS PLAINLY SHOWN AT THE LEFT.

Referring to the accompanying diagrammatic sketch, it will be seen that the lamps are contained in a trough placed back of the framing or sash which separates the main part of the window pane (which is a single sheet of glass about 12 feet high and 17 feet wide) from the upper part or transom, behind which is a draped curtain. This trough is of wood, painted white on the inside and shaped as shown in the sketch. Inside it, at an angle of about 35 degrees, are round incandescent electric lamps of 16 candlepower each and spaced about six inches apart. These lamps have the ordinary carbon filaments and produce the familiar yellowish light. They are invisible to the spectator unless he twists his neck around and makes a particular effort to look at them. The idea is to show the merchandise, not the lights. Each lamp carries its own reflector; that is, the upper half of the round bulb is silvered like a mirror. When the reflecting power becomes lessened the lamp or lamps may be replaced easily.

As shown in the diagram the lamps are so placed that the greatest amount of light comes where it is most wanted, and that is on the plane extending from the eyes of a spectator of average height. The upper part of the window does not need much light and does not get it. In some of the pictures the angle of light is clearly shown. In two of them rows of lights can be seen appar-

ILLUMINATION OF OBJECTS OF ART.



SHOW WINDOW LIGHTING. OVERHEAD FIXTURES WITH GLASS TUBING PENDANTS.

ently, but these are reflections of lights in glass partitions; the lamps themselves are invisible.

While the source of general illumination is carefully concealed, it is sometimes desirable to show a few decorative lamps in the window setting. One of the pictures reveals some beautiful overhead fixtures, in which 16-candlepower lamps are concealed in circular fringes of glass tubing. The average length of these glass tubes is 18 inches. In the same photograph are to be seen some modern bracket fixtures arranged to look like candles. The frontispiece shows the pretty effect obtained by vines climbing on hollow pillars of glass with lights within.

Window decorating is an art by itself. In some respects it is like stage setting. For instance, in the retail store of Marshall Field & Co. there are 40 show windows facing the sidewalk. Each of these window spaces is 17 feet high, 22 feet wide and 9½ feet deep. Here is a room of considerable size, for which, on a grand occasion, a design, a setting, a picture, must be provided. At the opening of the new store in 1907 a force of 300 people was employed for six months making window decorations. The head window trimmer gets a larger salary than any other man in his profession in the United States.

But, unlike the stage, there is no illusion. Everything displayed is genuine and is shown both by daylight and artificial light. Imagine a stage setting in broad, garish day! In window dressing in the great retail stores the richest of satins, silks, damasks and gold embroidery are used. Sometimes the decoration, irrespective of the objects displayed, costs a thousand dollars for a single window.

Show window lighting is one of the most attractive features of city streets. It may be simple or elaborate, direct or indirect, with white light or colored, from any of a variety of lamps, arranged in one of a myriad of forms; there is no hard-and-fast rule to follow. Every merchant must adapt his means to his end, but one thing is certain, if he is to get the best value out of his windows, he must light them attractively by electricity.

THE SINGER TOWER AT NIGHT

Viewed at night from Brooklyn Bridge, or from any point on North River, East River, or the Bay, the lofty tower of the Singer Building in New York looms up above the shadowy outlines of the city as the brightest object in all the range of vision. The front cover picture in this issue is a striking view of this remarkable example of electrical illumination which was planned throughout by Mr. W. D'A. Ryan, illuminating engineer of the General Electric Company.

The dome of the building, which begins at the forty-fifth floor, is outlined with incandescent lamps, but the main body of the tower is thrown into bold relief by 30-inch searchlights, thirty in number. The east, south and west sides are lighted from the eighteenth to the thirty-fourth floor by searchlights on the fourteenth floor level, which is the point at which the tower proper begins. The north side is lighted from the twenty-fifth to the thirty-fourth floor, the lights being located on the roof of the City Investing Building, which conceals the lower portion of the face. The searchlights are provided with special lenses to insure an even distribution of light over the faces of the tower. The flag, which waves at a point 625 feet above the curb, is illuminated by a special 36-inch projector in addition to those provided for the tower lighting.

TO ASCERTAIN POLARITY.

A reader of Popular Electricity offers the following method of ascertaining the polarity of a circuit. Dip blotting paper in a solution of potassium iodide (it can be used any time by moistening with water). Place the two electrodes near together on the paper. The paper at the positive terminal will turn a deep violet.

At a recent 25-mile test in the crowded streets of New York an electric delivery wagon defeated a gasoline wagon of the same capacity by 12 minutes. The route lay through a very busy section where quick maneuvering and frequent stops were necessary.

CATCHING THE SPEEDING MOTORIST.

In the day time the constables who amuse themselves by timing motorists and arresting those who exceed the speed limits have it all their own way. The night time has been the motorists' time for turning the tables. It is difficult to catch a man's speed at night and counsel for the defense never had much trouble in tripping the local timer and witness for the prosecution.

"How do you know he was going at the speed you state?" asks counsel for the defense in thundering tones.

"I timed him by my watch," answers the witness.

"Oh, you did, did you," comes back the counsel with the cross examiner's tinge of sarcasm. "Well, how did you make out the time on your watch, considering the night on which you say you timed him was pitch dark and there was no lamp in your vicinity?"

This always reduces the witness to confusion or the necessity for inventing unconvincing tales of matches struck on a dark and windy night or of a positive recollection of the time as caught by the light of the whirling lamps of the victim's own machine.

In Europe they have tried all kinds of ideas to overcome the difficulty of accurately timing the speed of a motorist and doing it in a way that will be convincing in court. The police of England have resorted to signaling from roofs, an uncomfortable and unreliable method of timing the speeders. They have sworn to the time as caught from sun dials and have proved learned and positive concerning timing done by a watch without a second hand.

The ease with which an astute lawyer has made these witnesses appear ridiculous in court has at last prompted a scientific inventor to come to the rescue with a simple little contrivance that is proving the undoing of "scorchers" who exceed the speed limits at night, thinking they can do it with impunity on account of the friendly darkness.

The device, as used on the road from London (Eng.) to Portsmouth, is a small electric flash lamp that is used with a timing clock. The little apparatus is so small that it can easily be carried in a policeman's pocket. When he has reason to believe that an approaching automobile is going faster than the law allows he reaches for his pocket clock, holds this in one hand and with the other has in readiness the electric button that flashes a lamp on the face of the clock at the moment the motorist is passing. Down the line another policeman waits with his flash lamp ready and the time is taken at the given distance. There is no possibility of confusing a witness as to his

ELECTRIC TIMING DEVICE FOR POLICEMEN.

method of timing when one of these little electric flash lamps is used. The light is there and the pressing of the button at the time of the passing of the automobile is so obviously a mechanical way of ensuring the absolute accuracy of the timing of the motor's passing that there is little to be done except pay the fine and be more careful in future.

ELEMENTARY ELECTRICITY.

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

CHAPTER XII.—CATHODE RAYS.

Besides the effects produced by the passage of electricity through ordinary matter, there are additional effects that are observed only when the path of the discharge is through the residual atmospheres of very high vacua.

When a disruptive discharge is passed through a closed vessel containing air, as long as the pressure is the same as that of the outer atmosphere, no unusual phenomena are observed. If, however, the air is gradually removed, the sparks begin to widen, and when the vacuum reaches a certain, but not very high point, they occupy the entire space inside the vessel, filling it with a pale glow of a bluish or purplish light that is separated from the cathode, or negative electrode, by a narrow dark space, while a small bright point, or star of light, appears at the anode or positive electrode.

When a higher vacuum is reached, the light breaks up into numerous striæ or alternate light and dark bands. At a still higher vacuum the dark space occupies the entire vessel, all the light disappearing except a greenish light that appears at the wall of the tube that receives a bombardment from the cathode.

The following facts have been discovered concerning these discharges, namely:

(1.) Something is thrown with great velocity from the surface of the cathode. At one time these were believed to be the molecules of the residual gaseous atmosphere, but are now known to consist of minute particles torn from the atoms of the residual gas at the cathode.

(2.) During the discharge, the temperature of the cathode is higher than that of the anode.

(3.) The light produced is especially rich in rays capable of exciting fluorescence and phosphorescence.

(4.) The particles thrown off from the cathode move in straight lines in parallel paths until they strike portions of the wall of the tube directly opposite the cathode.

(5.) When the vacuum reaches a certain high point the dark space surrounding the cathode gradually increases in width until at last it occupies the entire tube. All light then disappears except that produced at the portions of the wall against which the particles strike.

(6.) The moving streams are deflected by the approach of a magnet, and, therefore, must consist of electrified particles, since they practically form the circuits of electric currents, and, like all movable electric circuits, are deflected by magnets.

The above principles were discovered

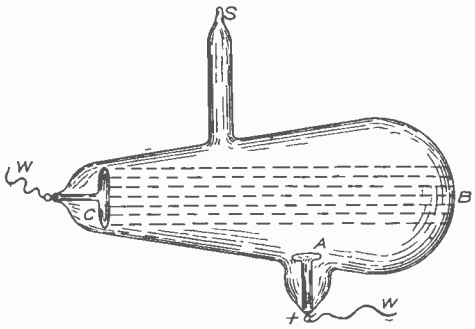


FIG. 77. CROOKES' TUBE.

by investigations made by a number of physicists as the results of researches extending from 1839 to the present time.

A glass tube containing a vacuum capable of exhibiting the above effects on the passage of a high-pressure electric discharge is known as a Crookes' tube. Such a tube is represented in Fig. 77. The leading-in platinum wires (W W) are provided with concave disk-like enlargements at (C) and (A). The connections are such that (C) is made the —, or negative terminal or cathode, and (A) the +, or positive terminal or anode. A small branch tube (S) is provided for connecting the tube to the mercury pump while exhausting. When the necessary vacuum has been reached the tube is sealed off by a blowpipe flame and thus disconnected from the pump.

When an electric discharge from a Ruhmkorff coil, or other high-pressure

source, is passed through the tube the particles thrown off from the cathode do not pass from the positive to the negative terminal, as is believed to be the direction in which ordinary electric currents pass, but move off from it in straight lines until they strike the opposite walls of the tube. These streams thus thrown off from the cathode, constitute what are called the cathode rays.

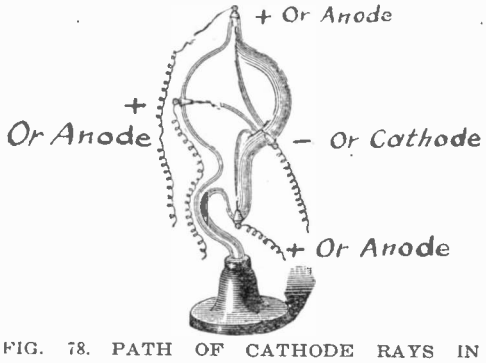


FIG. 78. PATH OF CATHODE RAYS IN LOW VACUUM.

When the vacuum is low, as represented in Fig. 78, the luminous streams pass from the cathode to the three different anodes connected as shown to the three positive terminals. When, however, as shown in Fig. 79, the vacuum is high the discharge from the cathode proceeds directly in straight lines until it strikes the opposite walls of the tube in streams that are entirely independent of the positions of the anodes. Since the cathode rays are thrown off from the surface of a concave mirror, in order to proceed in straight lines they are first collected at a single point or focus from which they pass in straight paths to the wall of the tube as shown.

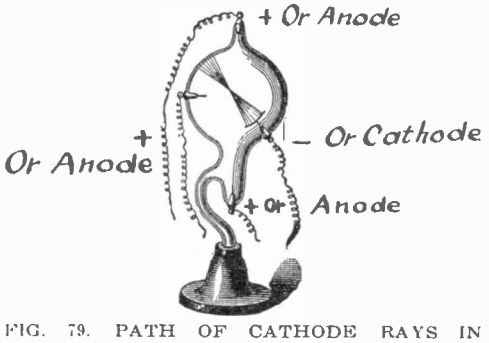


FIG. 79. PATH OF CATHODE RAYS IN HIGH VACUUM.

The cathode rays not only possess exceedingly curious and interesting peculiarities but are capable of throwing considerable light on many phenomena. We will, therefore, carefully study some of their peculiarities.

As early as 1859, Plücker, while passing high pressure electric discharges through the vacuous atmospheres of glass tubes, observed a greenish phosphorescent light on the inside of the tube in the neighborhood of the cathode. He correctly attributed it to something thrown off from the cathode.

In 1869, Hittorf observed that when a solid or liquid substance was placed between the cathode and the opposite wall of the tube, it cast a well-defined shadow on this wall whether it was an electric conductor or a non-conductor. Since this shadow was surrounded by phosphorescent light, he concluded that something thrown off from the cathode spread uniformly through the tube like rays of light and regarded it as probably a species of wave motion.

In 1876, Goldstein repeated Hittorf's experiment and found that a pointed cathode produced well defined shadows, but when the cathode was large the shadows produced were less sharp. It was Goldstein who first employed the name cathode rays. Like Hittorf he regarded them as peculiar waves in the universal ether.

A careful study by Crookes of electric discharges in high vacua resulted, in 1879, in the production of the radiometer or light mill. In this device a wheel, whose vanes are made of thin sheets of mica covered on one side with silver and on the opposite side with lamp black, supported on an axis so as to move with as little friction as possible, was placed inside a glass tube containing a very high vacuum. When exposed to the light of the sun, or to any artificial light such as that of a candle, or a burning match, the wheel is set into a rapid rotation in a direction away from or against the blackened sides. This is only another way of saying that the particles shot off from both sides of the mica vanes move with a greater velocity from the hotter sides, or the sides covered with lamp black, for those sides absorb the heat, and, therefore, become

hotter than the silvered sides which throw it off.

Crookes obtained higher vacua than any of the physicists who preceded him. He demonstrated that when the vacuum became sufficiently high to cause the black space surrounding the cathode to fill the entire tube, the streamings forming the cathode rays consisted of matter in a new state or condition. He called this matter ultra-gaseous or radiant matter. As is now known, he was actually dealing with a new kind of matter, rather than a new state or a condition of matter, but this was a subsequent discovery.

In this investigation, which as we have seen resulted in the production of the radiometer, Crookes thought that it was the molecules of the residual gaseous atmosphere that were thrown off at right angles from the surface of the cathode.

It was not difficult to explain why a dark space surrounded the cathode, nor why, as the vacuum became higher, the width of this space increased until it finally occupied the entire inside of the tube. As the vacuum became higher, and the number of residual molecules in the tube decreased, the distance any molecule could move without colliding with a neighboring molecule was increased. Since the light in the tube is produced by the collisions of the molecules, the distance any molecule could move outward from the cathode without colliding against other molecules would necessarily increase until, when the vacuum became sufficiently high to permit the molecules to pass through the entire distance between the cathode and the opposite walls, no collisions could occur, and consequently, no light could be produced.

That the particles thrown off from the cathode in a vacuous tube move in straight lines from the cathode was proved by Crookes as follows. A Maltese cross (b), formed of a thin sheet of mica, is placed opposite the cathode of the Crookes tube represented in Fig. 80. When the terminals are so connected that (P) and (N) form respectively the anode and the cathode, the walls of the tube at (c), opposite the cathode, show a dark shadow of the cross, surrounded by a phosphorescent light.

If the cross is so supported that after the shadow has continued for a fairly long time, it can be shaken down, thus exposing all the wall opposite the cathode to the rays, a curious phenomenon is observed. A pattern of the cross is

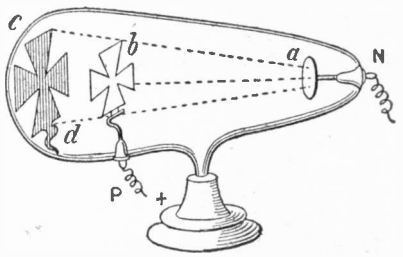


FIG. 80. SHADOW FORM IN CROOKES' TUBE.

still seen on the glass, but now the places formerly occupied by the shadow are brighter instead of darker than the adjacent parts, just as if the portions of the glass walls outside the shadow of the pattern had become fatigued by their long phosphorescence and were therefore less able to respond to the bombardment than the remaining portions. But what is still more curious this tired condition of the glass continued even after the glass of the tube had been fused and re-blown.

The color of the phosphorescent light produced by cathode rays varies with the kind of substance against which the rays strike. In the case of ordinary soda glass, the color is a greenish-yellow; in the case of lead glass the color is blue.

The phosphorescent effects produced by cathode rays are often of exceeding beauty. By employing different substances practically all the colors of the solar spectrum can be obtained. This is especially the case with chemical substances that consist of two different salts simultaneously thrown down from a solution so that the quantity of one is greatly in excess of the other. A marked difference exists both in the intensity and color of the light emitted by a pure salt and a salt that is mixed with a small quantity of another salt. For example, pure sulphate of lime, when exposed to the cathode rays, exhibits a faint orange phosphorescence, but when mixed with a small quantity of sulphate of manganese, fluoresces with a bright green light. Pure sulphate of strontium does not phosphoresce at all, but the

presence of a small quantity of sulphate of manganese causes it to emit a bright red light. Pure zinc sulphate produces a white phosphorescence, but the presence of one per cent of sulphate of manganese produces an intense red. Sulphate of sodium fluoresces with a bluish light while the presence of one-half per cent of sulphate of manganese changes the color of the fluorescence to an intense brownish-yellow.

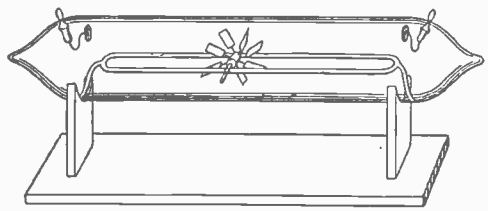


FIG. 81. MECHANICAL EFFECT PRODUCED BY CATHODE RAYS.

When exposed to the cathode rays certain bodies acquire the property of becoming luminous when their temperature is raised to a point far below that at which they ordinarily become luminous. This property is called thermoluminescence. Such bodies retain their property for weeks, and even for months after the cathode rays have fallen on them.

That the cathode rays are able to produce mechanical effects can be shown by a wheel, the vanes of which are made of sheets of thin mica, when placed as shown in Fig. 81, on glass rails, opposite electrodes at the top of a Crookes' tube. On the passage of an electric discharge the cathode rays strike the upper vanes and drive the wheel from the negative to the positive end of the tube. When it has reached this end a reversal of the polarity causes it to be driven in the opposite direction.

As has already been mentioned, the cathode rays are able to raise refractory bodies like platinum to intense incandescence, when permitted to strike against them. As would be expected, since the streams that form the cathode rays carry minute charges of negative electricity, and therefore act as movable conductors, adjacent cathode streams repel one another. This has been demonstrated by Goldstein in various ways, one of the simplest of which is to produce phosphorescent patterns by employing differently shaped cathodes, and noting the shapes of the phosphorescent figures produced on the walls of the tube that receive the bombardment from their particles. By employing differently shaped cathodes, cut from portions of the surface of a sphere, Goldstein found that when the vacuum was high the particles were thrown off from the surface of the cathode at right angles, so that the phosphorescent patterns had the same size and shape as the cathode except that they were inverted. When, however, the pressures were low, this was not even approximately the case.

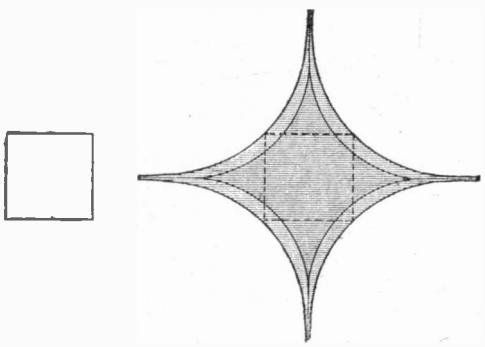


FIG. 82. CATHODE RAY PATTERNS AT HIGH AND LOW EXHAUSTION.

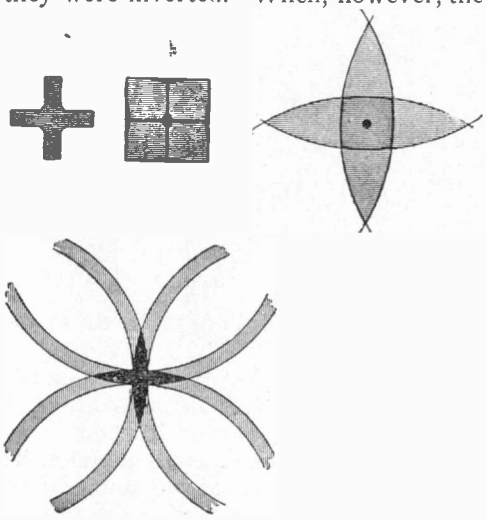


FIG. 83. PATTERNS PRODUCED BY CURVED CATHODE.

When, for example, as in Fig. 82, the boundary of the curved cathode was a square, at high exhaustions the phosphorescent pattern is the same size and shape as indicated by the dotted lines.

At low pressures, however, the patterns as shown are entirely different.

When the cathode is a curved, rectangular cross, as shown in Fig. 83, the patterns formed as the pressure is gradually decreased exhibit the changes of shape indicated.

When the cathode has the shape of a plane, rectangular cross, as shown in Fig. 84, then the shapes assumed by the phosphorescent patterns are as shown in the figure.

The cathode rays possess the power of discharging bodies that are either negatively or positively electrified, when suitably insulated and surrounded by dry air or other non-conducting gas. As we shall shortly see this property is also possessed by the X-rays or Röntgen rays, as well as by the rays thrown off from radio-active substances.

J. J. Thomson in his "Discharge of Electricity Through Gases," writes as follows concerning the cathode rays:

"Let us trace the consequence of supposing that the atoms of the elements are aggregations of very small particles, all similar to each other. We shall call

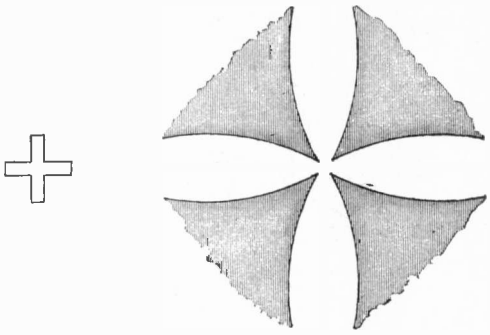


FIG. 84. PATTERNS PRODUCED BY PLANE CATHODE.

these small particles corpuscles, so that the atoms of ordinary elements are made up of corpuscles and holes, the holes being predominant. Let us suppose that at the cathode some of the atoms of the gas get split up into these corpuscles, and that these, moving at high velocities and charged with negative electricity, form the cathode rays. The distance these rays would travel before losing a given fraction of their momentum would be proportional to the mean free path of the corpuscles. Now the things these small corpuscles strike against are other corpuscles and not the molecule considered as a whole; they are supposed to be able to thread their way through the interstices in the molecule."

As will be described in the next chapter, the cathode rays led to the discovery of the X-rays. Before this was done, however, an intermediate step was taken by Lenard. This consisted in providing that portion of the Crookes' tube against which the cathode rays were projected with a thin sheet of aluminum of a

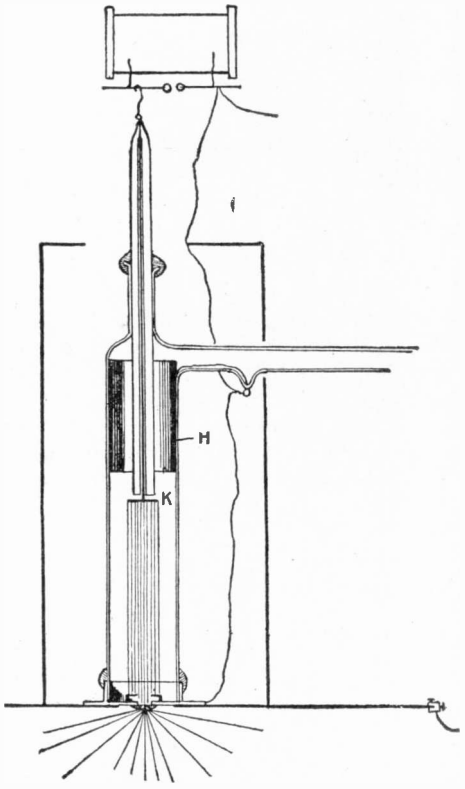


FIG. 85. LEONARD'S APPARATUS.

thickness of but .00265 mm., placed on that part of the walls of the tube that received the bombardment as shown in Fig. 85. When the vacuum in such a tube was so high that the dark space around the cathode occupied the entire tube a diffused light was seen in a dark room spreading from the window into the air outside the tube. This light was brightest in the immediate neighborhood of the window, and possessed like the cathode rays powers of producing phosphorescence, and was known as the Lenard rays.

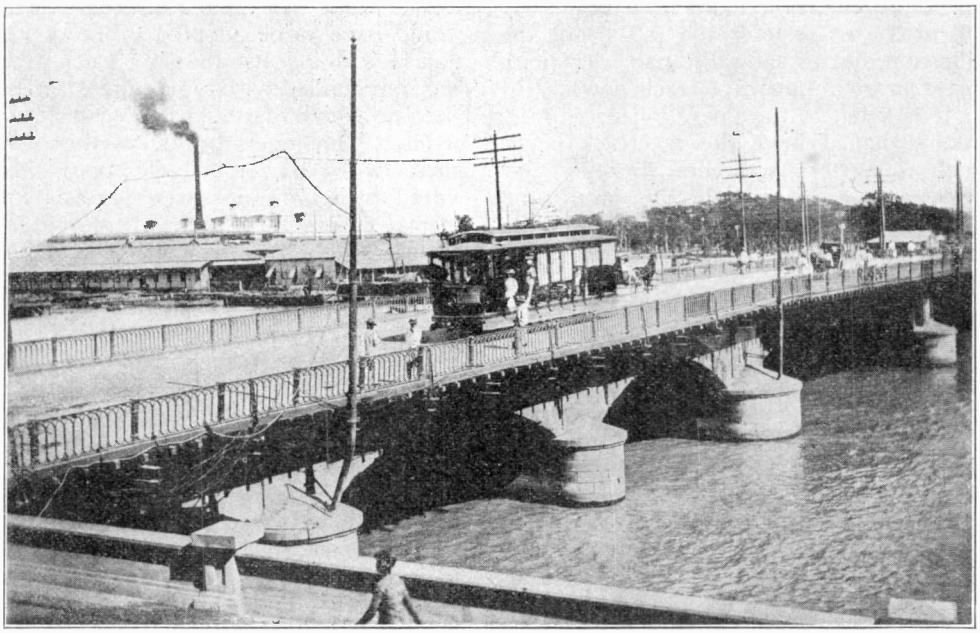
(To be continued.)

ELECTRIC RAILWAYS OF MANILA.

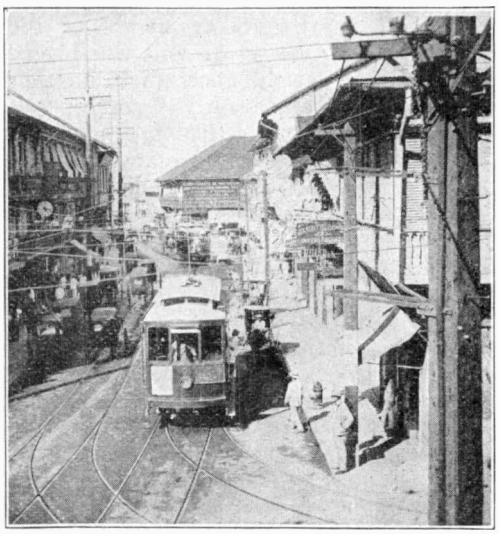
To those who have not visited far-away Manila, in the Philippines, the name is likely to bring up a mind-picture of a city built in the past, though living in the present—a city in which modern conveniences are lacking. Such is not the case, however, for Manila is a city with electric lights, telephones and an up-to-date street car service, and wherever electricity is called to the service of the public, there also will be found enterprise and Twentieth Century ideals of living.

Manila's electric railway system is adequate for its needs. It had its beginning, of course, with horse cars, but now the electric trolley has superseded antiquated methods. One of the views shows a street scene in what might be called the "congested" part of the city. It shows the Escolta—Manila's Broadway. The line is double-tracked, the cars are commodious and even the motorman is a model of the spic-and-span type and would be a credit to the service in any of our own cities.

The second view shows a trolley car on the Bridge of Spain, which, by the way, was the only bridge found by our soldiers upon the capitulation of Manila.



ELECTRIC RAILWAY ON "THE BRIDGE OF SPAIN".



THE ESCOLTA—MANILA'S BROADWAY.

One of the most novel uses for the electric motor is reported from Nevada, Iowa. A man who is extensively engaged in the poultry business has rigged up a revolving brush driven by a small electric motor for washing the feet of newly killed fowls before shipment.

ELECTRICITY AND THE POOLROOMS.

BY A. A. WEISS.

In this description of a phase of metropolitan life of which little is known, although its ramifications permeate all classes of society, it is not my intention to consider the morals of the question, but to show the part electricity plays in obtaining race track news.

It is vital, to the operation of a poolroom, that it have the racetrack news, such as starters, scratches, jockeys, winners, etc., at practically the same time the track bettor has it. Some years ago this end was accomplished by having a man stationed at the track, who telegraphed this news to New York headquarters, where it was redistributed all over the country. But owing to pressure being brought to bear, by conflicting interests, the racetrack management divorced itself from all poolroom connections. The telegraph company refused to allow the matter to pass over its wires and the telephone company wires, then used, were tampered with to such an extent, that something had to be done to save the business from ruin.

I was wire chief of the Coney Island telephone office, at the time, and had previously met these people in routine business transactions. They came to me in their extremity and an arrangement was effected by which I was to help them out. The Pinkerton detectives, engaged by the track people, were now active in preventing this news from reaching New York, although there were no difficulties in sending it out from the city.

The first plan of the telephone company to stop the transmission of news from the track was simply to put the line from that place out of commission, in the central office, during the racing hours. This was easily avoided by connecting the outside line to another number in the office. In this way they were using their own line, but it appeared in the office as another wire. Arrangements had been made with another subscriber to use his number for this purpose. So it was really his line that was put out of commission. This worked well for a few days, but the Pinkerton agents in New York found the news coming in as usual. They then adopted different tactics. They cut the outside lines.

We now saw that different tactics would have to be adopted. The opposition was doing its utmost. Each track was surrounded with high canvas screens and the whole district patroled by Pinkertons. Our operators were then supplied with powerful telescopes, that would bring six or seven persons into focus, life size, at a mile. "Long Tom," one of the telescopes, was about nine feet long. Rooms were rented where a view could be had of the grandstand, and the screens then offered no difficulties whatever. The transmission line now had to be looked to. The rooms were always engaged where telephone service was available in or near the house. We then used a set of "retardation" coils, which are nothing more than an iron core about ¼ by 3½ inches, rubber heads at each end, and wound with No. 36 wire to about 500 ohms resistance. These were connected as in Fig. 1. The coils will allow a current of slow fluctuation, such as a telegraph current to pass, but are a closed faucet to a high-frequency current such as a telephone talking current. This apparatus enabled us to telegraph over a telephone line, even though it were in use, without the conversing parties being aware of the telegraphing. One set of coils was placed in the house, at the race track, another in the central office, on the corresponding line. A tap was then taken off between the coils in the office and connected to a dead wire, in a cable running from Coney Island to Flatbush (a section of Brooklyn), where it was run into a house having a Flatbush telephone. This was far enough away to bar suspicion.

The operation was simple, the man in Flatbush, overlooking the races, would call New York on his telephone, then place the mouthpiece over the telegraph sounder; the Coney Island man would then telegraph over the line through the cable. The Flatbush man would have the telephone receiver to his ear. If he was advised that New York was not getting it all he would break in on Coney

Island and have him repeat. This worked like a charm for over a year. The Pinkertons would often talk over the very telephone line our operator was sending his Morse on.

In one case the "scope" man was located in a house where there were no telephone facilities. We ran a wire under sod for a short distance, then connected it to a fence, made of chicken wire. This fence abutted against a house where a telephone was located. The fence was then connected between the

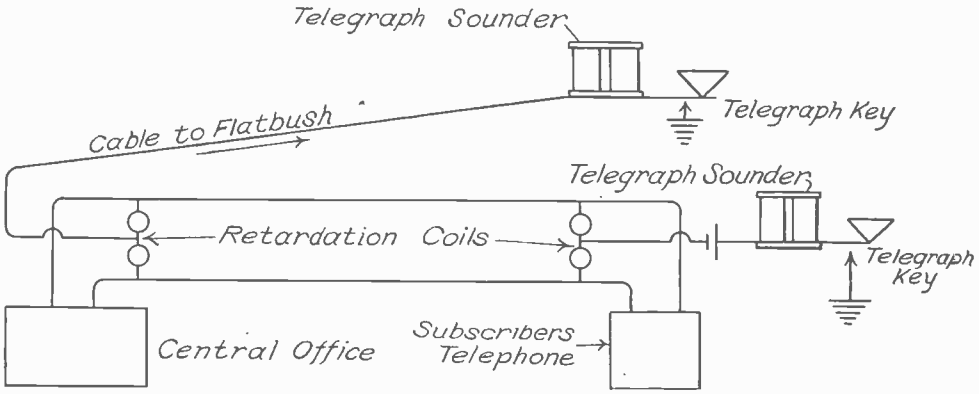


FIG. 1. ARRANGEMENT FOR SIGNALING THROUGH FLATBUSH CABLE.

coils, the outside coil running to terminals to the telephone line, and we had a very successful Morse line in operation. At times the Pinkertons would have from sixty to a hundred lines out of service in a vain endeavor to catch the proper one. They did this by short-circuiting each line. This of course put the telephone lines out of commission, but the Morse line was not affected. Had they grounded the wires properly we also would have been at sea.

The line, however, was eventually discovered, and then we hit upon a new scheme. Instead of using the dead cable line to Flatbush we let the exchange operator "put up" the connection herself. We engaged a room at Bath Beach, about three miles from Coney Island. There was a telephone office located at Bath Beach which had direct trunk connection with Coney Island, and as both offices were at that time of the magneto type, the trunk, when in operation, was simply a link between the two telephones without any apparatus whatever, differing in this respect from the common battery office equipment now in general use, as at that time, but not in these particular offices.

It was now a simple matter to place the coils on the Bath Beach line and on the Coney Island line and connect the telegraph again. The Coney Island man would then call Bath Beach and engage him in ordinary conversation while the Morse operator would at the same time send the real news over the same wire by telegraph.

At one time we had to modify this plan, as the proprietor of the house we had in Coney Island would not let us use his telephone for calls, so we hired another one whose line run on the same poles as the original line, and connected the two lines through a condenser placed on a pole, which enabled us to talk between the two houses without calling central. The connection was then completed to Bath Beach as before.

These conditions had existed for two years and the Pinkertons of course had not been idle. The last success we had was at the Sheepshead Bay track. We had arranged for a private wire running through Sheepshead Bay to New York. This was a grounded telephone line and was constantly under suspicion. We connected to it, through induction coils, apparatus which sent out weak impulses similar to wireless signals, which would not excite suspicion, owing to all lines in the vicinity being at all times more or less subject to such interference from the Marconi and DeForest stations, located at Coney Island.

We accomplished these results by

much forethought and close attention to details. Considerable experimenting had been done with wireless apparatus and we purposed giving it a trial. A large apparatus had been installed, engine, dynamo, and complete sending and receiving set. We strung an antenna in the garret and set up our transformer, sending helix, condensers and key, together with a small tuned detector. In testing out, the engine, which was an old French automobile affair, made such a noise and smoked so much that the attention of our friends, the Pinkertons, was attracted. That settled the wireless. The apparatus was confiscated on a trumped up charge together with the telescopes. It was later released, but not in time for further use.

Various other methods were considered to outwit our opponents in their little game of "find the operator." I remember one I proposed as shown in Fig. 2, which I think would have been more successful than the telegraph for the purpose and conditions. It consisted of a voltmeter whose needle was swung to 10 volts for a dot and 20 for a dash through a gradual step-down resistance. This if properly designed would not affect a telephone receiver as the current was negligible.

My connection with this business now ceased. It was for me a most interesting battle of wits while it lasted. I am no more in touch with the situation, but if there is any possible way of getting the news through, it is very probably being done on similar lines. The amount paid for this service by the various poolrooms of the country must be enormous, and of course the bettor pays for it all. The people I was associated with knew the game, were acquainted with jockeys and had chances for so-called inside information, but I never knew them to bet.

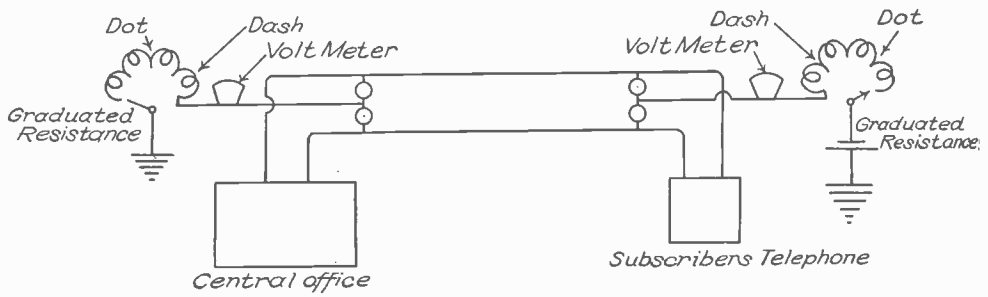


FIG. 2. PROPOSED VOLTMETER SIGNALING APPARATUS.

DIRECTIONS FOR REVIVING DRY CELLS.

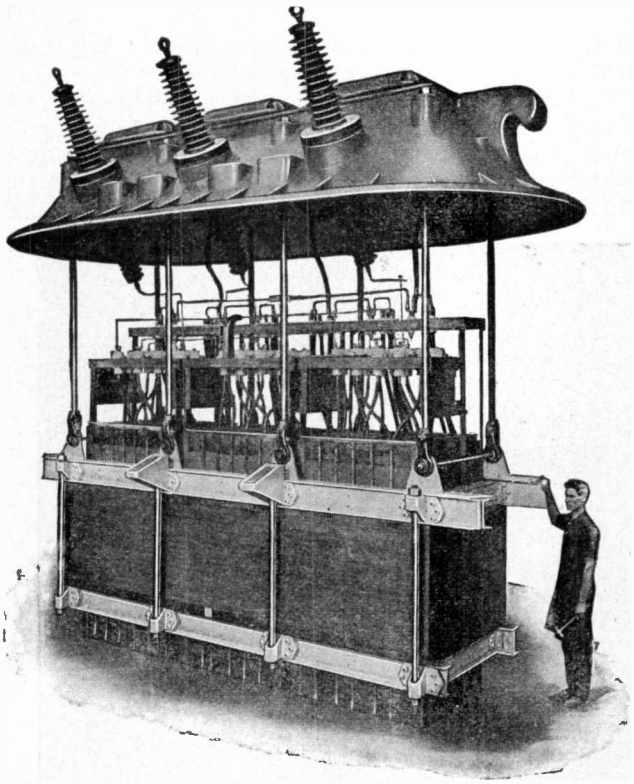
The ordinary dry cell battery is not "dry" in the strict sense of the word for there is moisture in it although of course, the cell is tightly sealed up and there is no inconvenience from slopping liquids. But the cells are never so tightly sealed that the moisture cannot slowly evaporate, and for this reason the cells will eventually become useless if kept for a long time, even if they are not used. They may be revived to a certain extent by the addition of various solutions, though they can never be made as good as "fresh" cells. One way of doing this is suggested by a reader of Popular Electricity and is as follows:

By means of a machine drill make about 15 holes in the circumference of the zinc shell of the battery. These holes should go clear through, or about one inch. The diameter of the hole should not be more than 1/8 or 3/16 inch. In an earthenware tank dissolve one pound of chloride of zinc in three pounds of water or equal proportions. Bring this solution to boiling. Place the batteries in this solution and leave them in it for about 30 minutes. When the batteries are taken out and dried they will be ready for use.

Two electric interurban sleeping cars have been operated for 18 months by the Illinois Traction Company with such success that more cars have been added. The cars are without motors or air pumps and are run as trailers to ordinary interurban electrics.

LARGEST TRANSFORMER EVER BUILT.

The accompanying picture shows the largest transformer ever built. It is about 20 feet in height and weighs complete, with the outer casing in place, 120,000 pounds. This weight does not include the water which is kept circulating in the casing to cool the interior parts.



LARGEST TRANSFORMER EVER BUILT.

Some will no doubt ask what such a transformer is for. The question may be answered by saying that a transformer is necessary in order to boost or step the voltage (pressure) of the electric current generated by the dynamos up to a value sufficient to force the current through a long transmission line, perhaps one or two hundred miles, to the locality in which it is to be utilized. Copper or aluminum wire being expensive, as small a size as possible must be used in the transmission line. The smaller the wire the greater the resistance to the flow of current, consequently the transformer is employed to furnish sufficient voltage to overcome this resistance.

A transformer is a comparatively simple piece of apparatus, with no moving parts. When two coils of wire are placed one over the other and alternating current is passed through one of them, an alternating current is set up in the other, although the two coils are entirely separated and insulated from each other. This is caused by an electrical phenomenon known as induction. This effect is increased if a mass of iron be placed within the coils. If the primary coil, or the coil receiving current from the source, has, say 100 turns, and the secondary coil has 1 000 turns, the voltage delivered by the secondary will be 10 times as high as that impressed upon the primary, although the current, measured in amperes, will be only one-tenth that delivered to the primary.

The above, in brief, is the principle of the step-up transformer. The one shown in the picture takes current from the dynamos at 11,000 volts and transforms it to current at 100,000 volts. Ten thousand kilowatts or 13,400 horse-power of electrical energy pass through its coils when it is operated at full load. Considerable heat is generated in the coils which are kept cool by water in the casing. Approximately 10 miles of wire is used in the secondary winding.

Man has much greater power of electrical resistance, or much less susceptibility, than many other animals. A leech placed upon a copper plate which rests upon a larger plate of zinc is unable to crawl off on account of the feeble electric action excited by the contact of the metals. Horses are troubled by slight differences of potential. An ox treated for rheumatism with electricity succumbed to a current absolutely inoffensive to man.

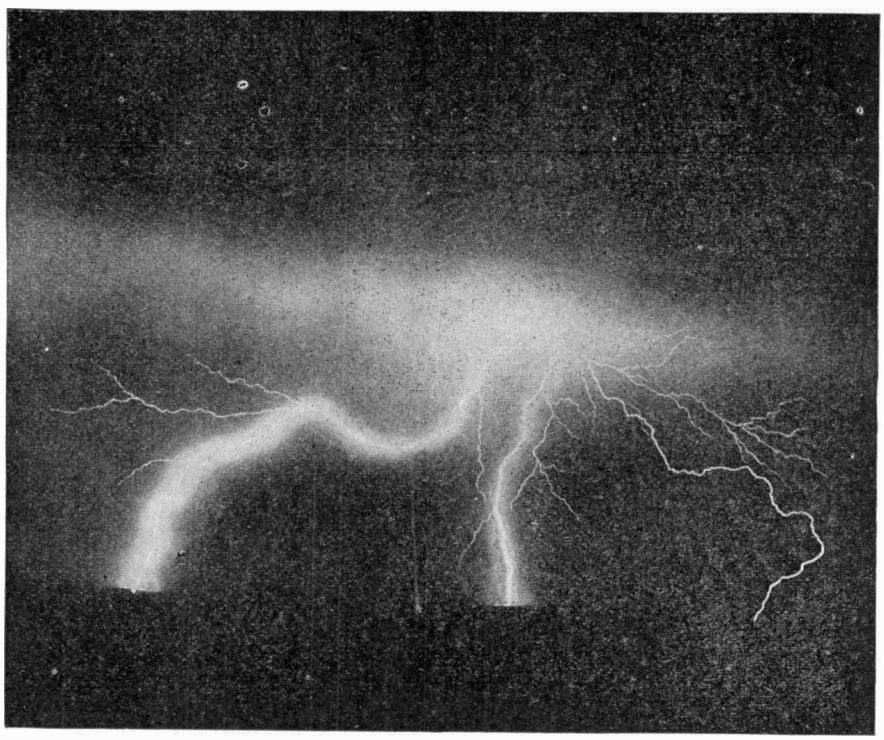
PROTECTION FROM LIGHTNING.

BY ALBERT WALTON.

Since good old Ben Franklin astonished scientists and the world in general by identifying lightning with electricity the world has seen and heard many thunder storms and suffered much from lightning, and yet we have added but little to the bare facts that Franklin brought out by the famous "Philadelphia Experiments." It is a very difficult subject for study at best. It will not submit to be measured and gauged, nor will it be controlled or regulated. Its very violence makes it all but impossible to get at its exact nature. The best that can be done is to observe the effects of its dread work and then reason back from these to the probable causes.

Scientific observation of the results of the workings of electricity of the milder sort, the electricity of commerce and the laboratory, has accumulated a great fund of facts and laws which have a strong relation to the problem of explaining the operations of the awful "shafts of Jove." Following out these trains of reasoning it has been possible to form theories that seem to be very satisfactory and truly to explain a large number of the strange things lightning does and in a measure to define what it probably is.

Up to very recent times lightning has been a matter of wonder and dread only. Since before history was written lightning has been held in awe and reverence predominated by a fear unspeakable. It has held the place of an instrument of the gods to punish and to warn mankind. The modern engineer, however, is a man of practical mind and, devoting his mind to practical things, is concerned with lightning chiefly with a view to preventing, if possible, its destruction of life and of the works of man. Until recent years this has meant the protection of buildings of various sorts, and Franklin, himself, was one of those who early pointed out that, though it was not possible to prevent the lightning discharge,



THE BEST MADE LIGHTNING ARRESTERS ARE NOT PROOF AGAINST A DIRECT DISCHARGE.

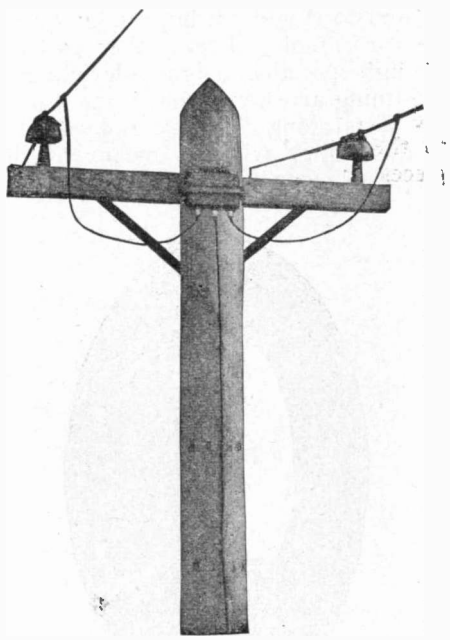
it was very possible to so guide its path to the earth that it would do no damage in its passage.

To this end lightning rods have been employed with good effect for many years. They form an attractive and easy path from the highly charged atmosphere to the earth and the lightning passes down them where otherwise it would expend its force through a path of bricks or timber, down chimneys or through roofs and walls, tearing and burning on its way. Often the discharge is so great that even the heavy lightning rods themselves have been burned in two from the heat.

One often hears people wondering why the great sky scrapers of our big cities are not frequently struck by lightning. Many people have a great fear of being caught in one of these huge steel buildings in a thunder-storm. As a matter of fact they are the very safest places one could wish for, as the whole building is one immense lightning-rod capable of carrying off the worst shock without the slightest damage. They are probably struck frequently in every heavy storm that sweeps over the city where they are and no one is the wiser. The principle of diverting the lightning through a path which will lead it to earth without damage is here brought into play without any extra precautions or visible devices, and as it is an invisible protection it is one that few people realize exists.

This principle, indeed, is at the bottom of all the vast number of ingenious devices that have been invented to protect the immensely more valuable property of the present day. Greater importance has become attached to lightning protection today, not only because the buildings are larger and more expensive, but mainly because of the extensive development of the practical use of electricity itself. It is not strange that the apparatus that is designed to make and to carry electricity for commercial purposes should be very sensitive to the effects of lightning. The network of wires that cover the land from end to end has, by its very omnipresence, been a source of continual and enormous losses from strokes of lightning.

Such is the nature of one of these fearful electric discharges that it is not even necessary that the wire itself be struck to produce damage. If a tree, or a house, or even the earth itself be struck in the vicinity of a wire a tremendous disturbance is caused in the wires which is almost as violent in effect as though the wire had received the full force of the stroke. The difficulty would not be so great were it only for the destruction of the wires, but it must be remembered that each wire leads to some electrical machine or other, and usually these are extremely expensive. The tremendous force of the lightning's effect in the wire finds an outlet in these machines, unless they are properly protected, with the result that they are often totally destroyed, with an enormous loss in money and a great danger to the lives of those working around them.

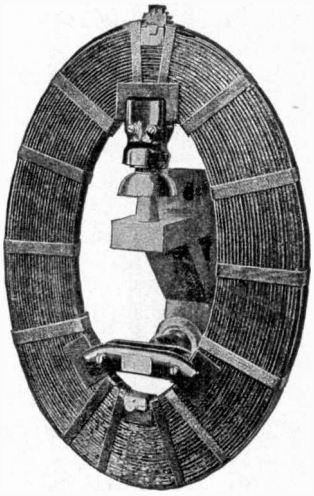


THE LITTLE IRON BOX IS THE LIGHTNING ARRESTER.

In order to minimize these losses and to prevent the disastrous interruptions to the service of telegraph, telephone, street car and lighting companies, great ingenuity has been shown in the development of devices to divert the force of the discharge into the earth instead of through the electrical machines.

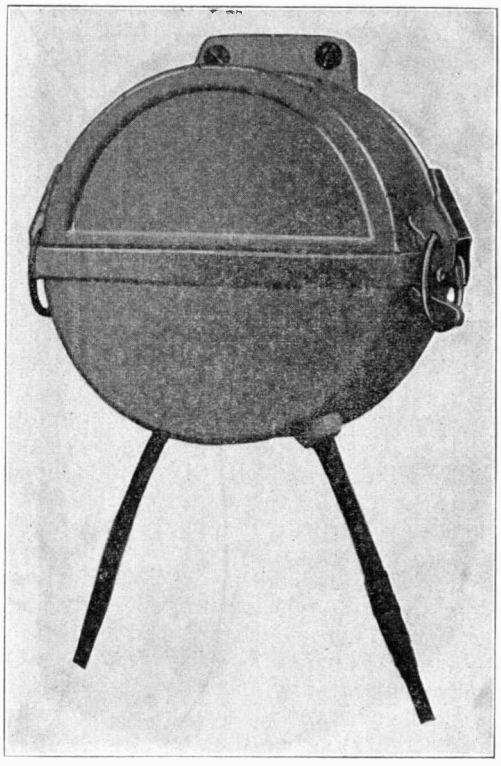
Many a panic has been caused in our

city street cars by the flash of a slight lightning stroke that has come along the trolley wire and followed down the trolley pole to the motors and through them to the rails. It is always a needless panic, however, for the passengers on the seats are as safe as the people in a house well protected by lightning rods, for the trolley pole and the wires of the car form a very effective lightning rod in themselves, conducting the lightning from wire to ground without danger to those inside the car. Such a discharge, though not dangerous to the passengers, is expensive to the company, since it damages the machinery in the car and makes expensive repairs necessary. To render these strokes harmless other ways are provided for the lightning to get to the ground so it will not have to go through the cars at all. These other paths are through specially designed devices called "lightning arresters," which are hung on the posts along the way and connected to the trolley wire by means of short pieces of copper wire. You may see



THE "CHOKE" COIL.

these little iron boxes if you look sharply. They will be seen on perhaps every hundredth pole from which the trolley wire is suspended. They are up near the top of the pole. A wire runs from one side of them out to the trolley wire and another wire runs from the other side down the pole to the ground. They are usually little round iron boxes somewhat bigger than a common alarm clock, though sometimes they are square and are about the size of a pound candy box. When the lightning hits the wire or comes near it most of the force of the bolt jumps through these little boxes and goes down the wire to the ground without doing any damage. Or if the stroke



ROUND TYPE OF LIGHTNING ARRESTER.

is so severe as to injure them they are so much less expensive than the motors of a car that the company has saved money by letting them take the force of the stroke.

Long ago it was realized that lightning had an aversion to turning a corner or to deviating from a straight path, and this peculiarity has been taken advantage of in practically all of the inventions for protective purposes. It acts as though it were traveling with such tremendous force and rapidity that when it comes to a curve or bend in its course it prefers to leave that path and strike out straight through the air till it reaches some more easy and direct path to the earth. On the other hand, fortunately,

the ordinary "working" electricity does not object to following a course of many bends and kinks, and for this reason it is possible to make use of the peculiar tendency of lightning to follow the straightest path, for the protection of electrical apparatus.

It has become the custom to place on the wall of an electric station a combination of devices for this purpose. The wire entering the station from the outside, where it is exposed to lightning, is brought to what is called a "choke coil." This is a copper ribbon wound up as a spiral. The electricity from the dynamos that has come in over the wires or is to pass out over them has also to pass around all those turns of the coil. These coils, in fact, form a part of the system of wiring from the machines to the outside lines of wiring, and the dynamo currents passing along this system find little or no resistance in going through the coils. When, however, a lightning disturbance comes in over the wires the coils offer such an obstruction to the discharge that it will find another path rather than go through them, even though it must go through several feet of air space to jump to some easier path. This, however, it is not permitted to do, for a wire is joined to the outside wires at a point just before they reach the choke coils and this wire runs in a straight line to a "lightning arrester," which consists generally of a series of little brass knobs mounted on a piece of marble. The knobs are separated so there is a slight space between them, although the general line of the posts is straight to the ground. From the last knob another wire is run down into the earth. The usual electric current in the main wires can run down the wire that leads from them to the knobs, but cannot get across the air gaps, so none is lost. A stroke of lightning, however, comes in over these same wires, finds the choke coil in its path, and, with its irresistible power, finds no difficulty in instantly jumping from knob to knob and from the last one to the earth through the wire provided for that purpose. Thus all the machinery beyond the choke coil is saved the blow and the force of the discharge is led to earth without the slightest damage. And furthermore, the device is instantly ready for another one should it chance to "strike twice in the same place" which, by the way, it does very often, the adage to the contrary notwithstanding.

It is very exciting to be in a power station whose wires cover a country for miles around while a lightning storm is in progress. Knobs are constantly joined by little angry snapping sparks, for there is always some part of the network outside of the station that is at least a little affected by the flashes that are playing over the country round about. It is very fascinating to watch, for one realizes that it represents a tremendous force that has travelled miles to find a way to escape. And while one is watching these little crackling sparks there comes the real stroke, and for an instant one would think that the knobs and the marble and the wall on which they were hung had all been destroyed together. A sharp report and a flash, that is dazzling for the instant, occurs and blots out the power of sight for a space, and then after the first second's astonishment one realizes that somewhere out on the line a real stroke has come to earth near the wire and that this is its effect for which he has been watching. It is worth waiting for, but like many such things, once is usually sufficient to satisfy the curiosity especially when the observer is told that during the last storm the line itself was struck and the whole device was destroyed in endeavoring to relieve the line and save the machines, for no "lightning arrester" has as yet been invented that will stand the direct stroke, which, however, is fortunately a comparatively rare occurrence.

NON-MAGNETIC YACHT.

A non-magnetic yacht will be built for the Carnegie Institute for making magnetic surveys over certain parts of the ocean where the earth's magnetic data have not yet been accurately determined. The only metal used, outside of the crank shaft, will be bronze and manganese alloy, so that there will be no iron to disturb the action of the delicate magnetic instruments.

RAILROAD ACCIDENTS AND THEIR PREVENTION.

BY LOUIS E. WALKINS.

Whenever a passenger train is wrecked and a number killed and many injured, as the result of a misplaced switch, a head-on, or rear-end collision, failure of an engineer to see a signal as he rushes towards it, or failure of a tower signal operator or station agent to set the proper signal for the engineer, there is at once a great hue and cry by the public and the press against the officials of the railroad company because of the apparent inefficiency of the signal and train control system employed by the railroad, or the apparent criminal carelessness of the employes held responsible for the accident. Then comes the shifting of the apparent error by these employes, one upon the other; "I saw no signal for me to stop," says the engineer; "I set the signal to danger," says the tower operator, or station agent.

To satisfy the constant clamor of the traveling public for the running of trains on schedule time, and for more rapid transit, the officials of our railroads have no easy problem on their hands to keep the service of the passenger traffic on time and run the trains with safety. They must rely upon the fidelity and judgment of those in charge of the trains, the safety appliances, and the telegraph. Those that hold these highly responsible positions of trust should be schooled to the positions they are to hold, and only the best of their class selected to fill the positions of trust. They should have sufficient salary so that they will value their positions so well they will render their best efforts in order to retain them.

But sometimes the best human mind will err in all vocations of life. Consequently human ingenuity and skill have ever been directed with marvelous results to produce apparatus or devices, not only to remind men of their duty, or error, but, should they fail, to register the error, thus fixing the responsibility. And for many important purposes these devices automatically of themselves may perform the duty and prevent what might have happened.

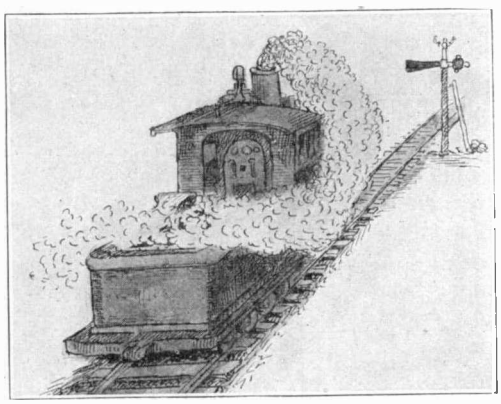
There is a long gruesome list of railroad wrecks that have resulted through the sleeping telegraph operator in a way station or signal tower. Why should not a operator, no matter where he is located on a line of railroad, have, above all men of responsibility, a detector registering more often than any other his service to duty? The ordinary business man employing a watchman to watch over his premises during the hours of night has such a device to keep that watchman attentive to his duty looking after possible thieves or for fire, on his premises.

To my mind the whole trouble with the railroad signal and train control situation in our country is that there are too many signals; too much complicated apparatus used and intricate working details; too much dependence upon poorly paid human responsibility in its control. There should be but one standard of railroad signal and train control; a system uniform throughout the railroad systems of the country. It should be a simple system thoroughly tested and then its adoption should be compelled by the Government. It should be regularly inspected and kept in thorough repair under the supervision of government inspectors. A matter of first cost should not be considered in a matter of so vital interest to all our people.

A locomotive traveling at a high rate of speed, say 45 miles an hour, passes a stretch of track of 1,000 feet in but a few seconds of time. The engineer may be approaching a way signal at this particular time. A current of air suddenly created through a suction current may drive a volume of smoke or steam to his side of the locomotive, obscuring from his vision the signal toward which he is rushing, and he passes without seeing it. It will be said that it is his duty to stop his train as quickly as possible, call for a brakeman to be sent back as per the rules of his company to provide a means of warning any following passenger or other train to stop, so he may back with safety to a point to see the signal. This he does we will say and finds it at safety. Then he recalls the brakeman sent back, waits for him, and then goes ahead again. All this takes time. And there is a delay, and a situation to be explained,

and there is only the word of the engineer.

Visible railroad signals should be of only one class. Danger signals; one color by day, and the same by night. They should be of such size and distinctive color as easily to be discernible over the whole stretch of the railway within the signal giving zone. Such a signal should have as an auxiliary apparatus means of



PERHAPS THIS HAPPENS WHEN PASSING A SIGNAL.

giving a loud audible alarm upon the locomotive, or to operate a locomotive engine stop when the signal is at danger. And right here the manager of a railroad will tell you, and with great truth, no apparatus of such character has as yet been produced for that purpose which is reliable in its operation.

No system of audible locomotive signal, or engine stop, can be operated with success except under the most favorable conditions; unless the service way conductor is always in connection with the locomotive so as to give, in sufficient block lengths of the rapidly moving locomotive, the electric power time to perform its highly important functions.

There is another problem where steam railroads are operated in conjunction with electric traction on the same right of way. At a discussion early last year at an Institute meeting in New York City the following statement was made by a member and agreed upon by the members present, while considering the installation of the under-running protected third-rail as in use on the West Shore and New York Central railroads, as follows: "The signal field also, is one in which there is room for improvement in reducing the cost of installation so as to make the use of electricity feasible from a financial standpoint. The use of electricity at the present day requires the throwing away of old type signal and interlocking systems, and the installation of an entirely new system at a vast cost, due to the necessity of using the track rails for the return current. On one of the branches of the New York Central railroad the substitution of electricity for steam has been indefinitely postponed, because of the attendant great cost of making a change in the block signals and interlocking, but one of the electrical companies now gives hope that a new method has been devised which will do away with the necessity for more expensive portions of the apparatus, and so far reduce the cost of the change of signaling as to make feasible the electrification of the branch line."

The safe operation of railroad trains was a problem of years after the advent of this means of transportation, and the problem has not by any means been fully solved as yet. The first great advance was the achievement of Mr. George Westinghouse—the invention of the air brake. The foundation of this great invention was the placing in direct connection with the locomotive boiler an automatically operated air pump equipment. The power that drew the train operated the air pump that furnished the air power to stop the train when it was necessary. Then came the vacuum, produced in the same way. The reliable block signal and train control system of the future must have its prime operative from the same source.

The power that moves the steam train, unlike the electric traction system which latter derives its power from conductors located upon the way, is from a steam prime mover which generates its energy while standing or moving. Therefore, for steam traction, the signal and train control must derive its power to perform its functions in the most simple and reliable way, from the locomotive boiler through an auxiliary equipment such as an electric power generating unit, similar to the Westinghouse air brake pump.

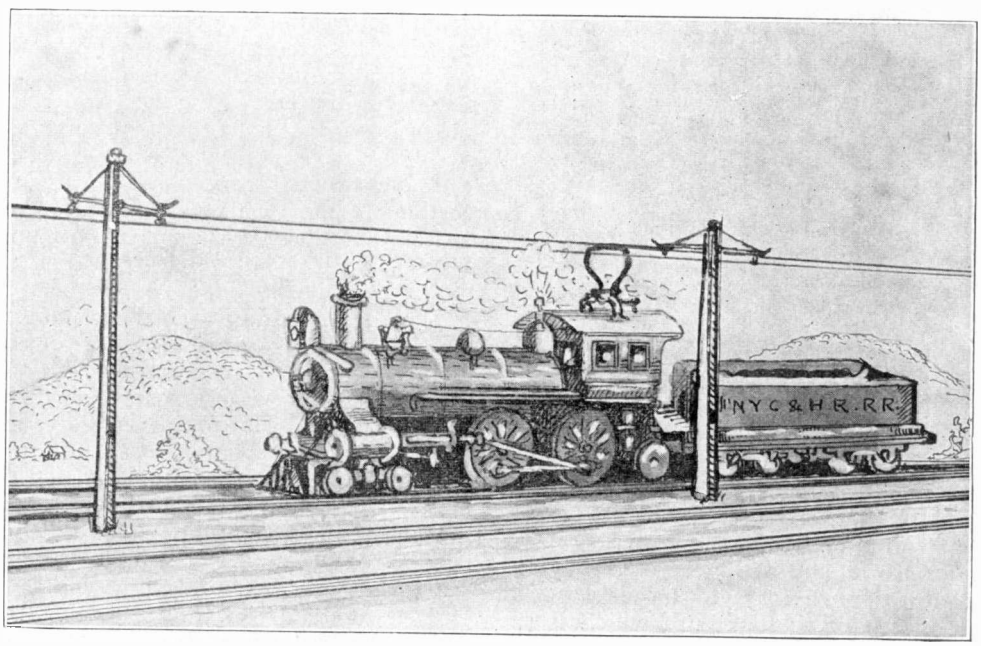
To such a system I have given much thought. As a result I suggest the fol-

lowing system, whose foundation is based on standard apparatus and equipment in combination.

Time and constant use, with the improvements up to date have proven the reliability of the over-head trolley conductor. For the purpose I am about to describe, I have selected what is called the loop trolley as so extensively used in Europe on all electric high speed railways. I propose that all steam locomotives on the line of railroad be equipped with one of these trolleys on top of the cab, and in connection with it and a ground that there be an automatically operated electric power generating unit, taking up no more room upon the locomotive than the air pump for the air brakes. An over-head conductor should be installed, sectioned off by insulated joints every three to five miles. Two locomotives within each block, the two power generating units combining, would thus complete a powerful electric circuit sufficient to operate any valve of standard make, and of a size sufficient to blow a very loud whistle upon each locomotive, and operate a locomotive engine stop. A tower switch operating lever has only to ground this three or five mile section of over-head wire to stop any locomotive entering or running in that block.

Instead of the over-head trolley, the inverted, or under-running third-rail of a much lighter construction than that so extensively in use for electric traction purposes could be used.

To perfect the present situation (the use of the present block signaling and train-control systems), I would recommend the use of a sealed automatic time registering device for the purpose of keeping an exact record of the movement of any visible railroad signal, the minute and second of each hour of the whole day, showing when the signal went to "danger" and the time it was in such a position. There should also be a duty register for every telegraph and signal operator, requiring them to register once so often each hour of the whole day. This would lay the blame, should an accident occur, where it belongs.

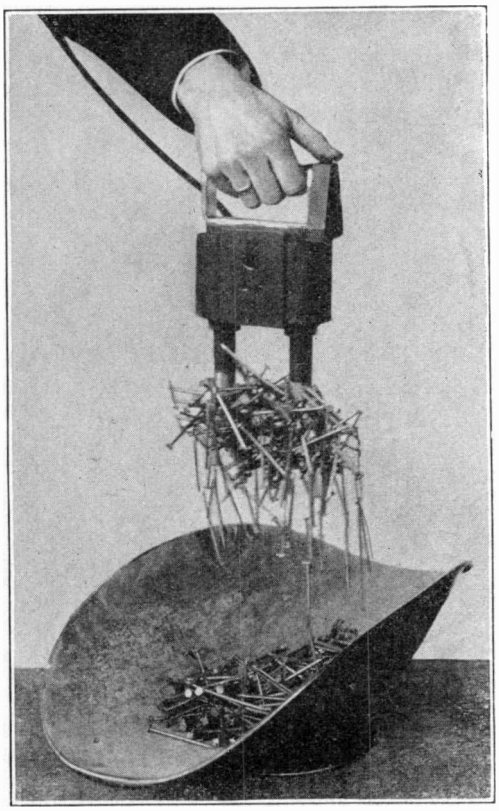


PROPOSED TROLLEY SIGNAL-OPERATING SYSTEM.

The first alarm of fire by an electric telegraph system was given at 8:30 p. m., April 29, 1852, in Boston.

A HANDY MAGNET.

Did you ever try to remove chips and borings from the almost inaccessible nooks in a machine tool or to fish a bolt or boring tool out of the bed of a lathe without leaving part of your knuckles behind? If you ever did you will appreciate the handy magnet. In shops where



HANDLING NAILS WITH A MAGNET.

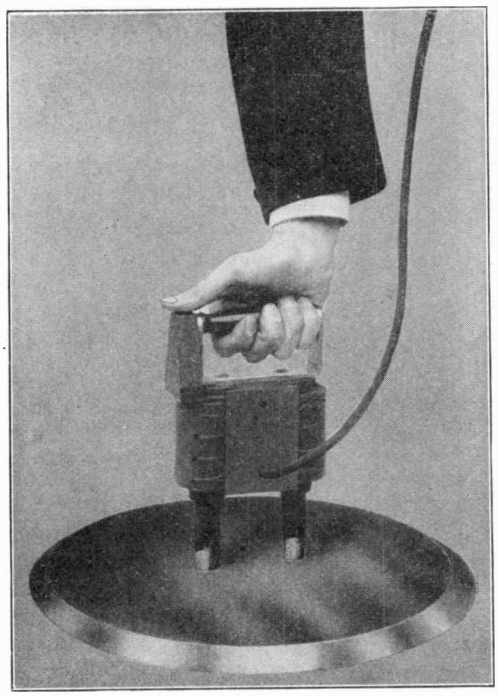
brass and iron filings accumulate it is necessary to separate the two metals before selling or melting them. Here again the handy magnet is especially useful, for it will attract only the iron or steel, making separation easy by simply passing the magnet through the mixed metals.

The new device is a hand magnet weighing only about seven pounds, but capable of lifting castings of from 10 to 15 times its own weight. It is designed for operation on 110-volt, direct current circuits and is furnished with drop cord and attachment plug so that it may be readily attached to any ordinary lamp socket. The push button mounted on top of the magnet and operated by the thumb closes the circuit to the coils and makes the magnet operative. On releasing the button the poles become demagnetized and the load is released.

In foundries the magnet may be used to pick up hot or awkwardly shaped castings; smooth plates, which are sometimes difficult to secure a hold on when laying on a flat surface.

Suspended with its two poles immersed in the liquid, the magnet will attract to itself any particles of iron or steel, which it may be desired to remove from the tubs in which paints, glazes, chemicals, etc., are mixed.

One user who has several automobile trucks in his business, put the magnet to a novel use. He was paving an alley in the rear of his store with ashes and finding that many nails from packing boxes, burned under the boilers, were



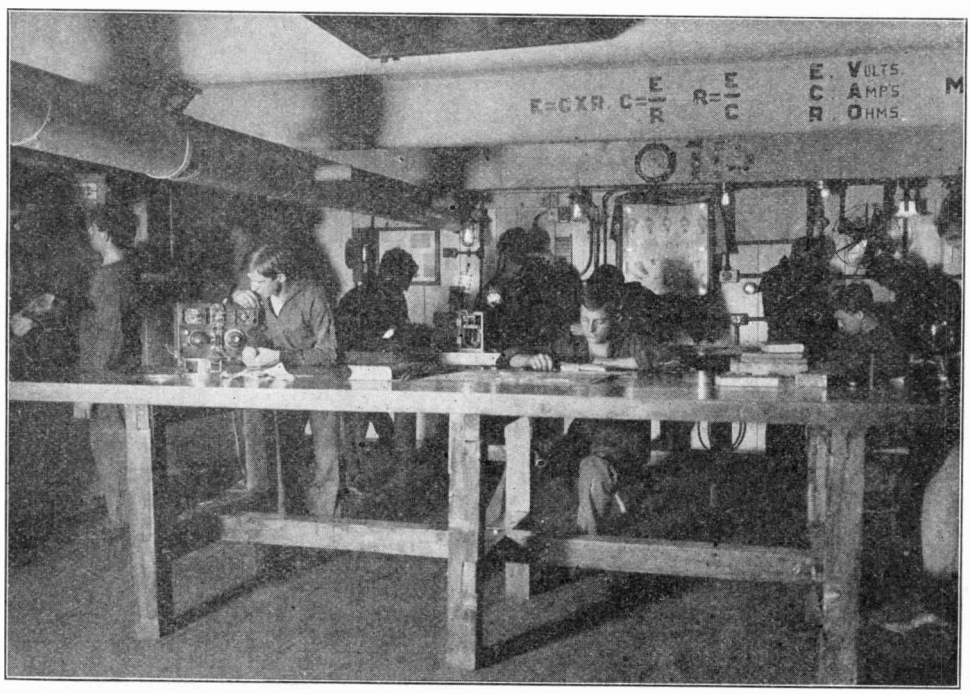
AN OBJECT THAT WOULD BE AWKWARD TO HANDLE WITHOUT THE MAGNET.

mixed with the ashes, he guarded against punctured tires by employing a magnet to remove nails from the ashes before strewing them in the alley.

THE NAVY ELECTRICAL SCHOOL.

BY LIEUT. COM. PHILLIP WILLIAMS.

Very few citizens in this large country of ours are aware of the fact that a technical school of high order for the specific purpose of teaching electricity is maintained by the United States government at New York. There is an increasing demand for electricians in the navy just as there is for them in civil life, and the government, realizing the importance of this great branch of science, is willing to educate those men who are eventually to handle the large power plants now necessary on modern battleships, a battleship of the type of the "Connecticut" requiring some 30 expert electricians on board to care for the electrical machinery and appliances.



STUDYING LINE WORK AND WIRING APPLIANCES.

All men upon entering the electrical branch of the Navy are sent to the Naval Electrical School before detailed to ships for sea duty. The men who attend this school are from all parts of the country, and must meet the qualifications required by the Bureau of Navigation. They must be American citizens, sound in mind and body, and be able to pass a rigid physical examination; must have some knowledge of electricity, and be able to solve problems in arithmetic through fractions and decimals. Those between the ages of 21 and 35 with a fair knowledge of electricity and electric machinery enter the school as electricians third class, and are paid $30 per month; those between the ages of 18 and 25, with little knowledge of electricity but a good high school education, enter the school as Landsmen for Electricians and are paid $16 per month.

The men at the school are all regularly enlisted in the United States Naval Service for four years and have all the privileges and allowances of enlisted men. When they join the service they are given an outfit of clothing to the value of $60. Their home is on board the U. S. S. Hancock at the Navy Yard,

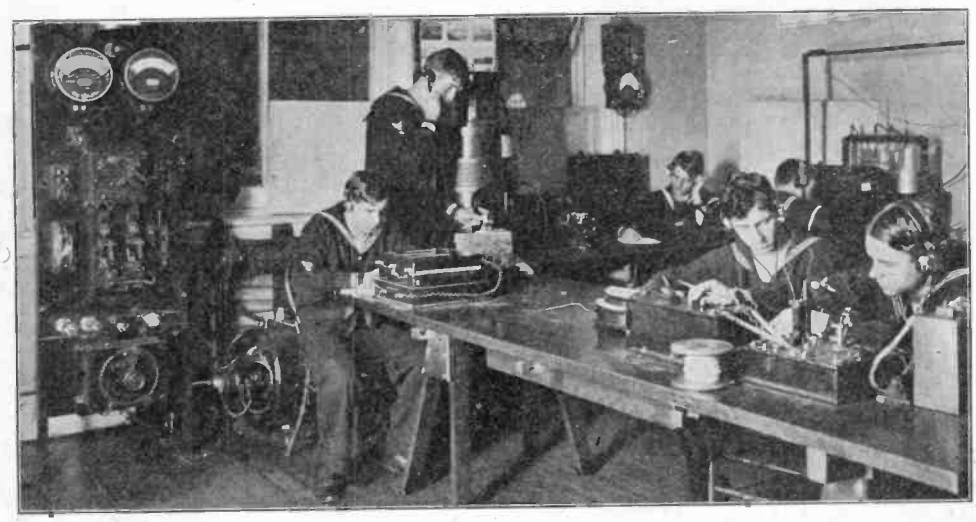
New York, and they are there furnished board, lodging and medical attendance.

The course at the school is unique. There are no classes; instruction is individual.

LABORATORY WORK IS COMBINED WITH THEORY.

The course covers 21 weeks altogether. Upon entering the school men are first assigned to the theory section where four weeks is devoted to the study of the principles of electricity, magnetism and electromagnetism. The men are made familiar with electrical units, the theory of dynamos and motors, the handling of electrical instruments and with simple electrical experiments.

The remainder of the course is entirely practical, the men going from the theory section to duty in the dynamo room of the U. S. S. Hancock where they become familiar with the ship's electrical plant and its routine and where they are taught its care and manipulation under the supervision of trained electricians.



TUNING AND ADJUSTING WIRELESS TELEGRAPH APPARATUS.

In order to satisfy the demands of the electrician on board ship the men must also be "ready men" with the lathe, tools, and at all repair work.

Entering the practical electricity section, the men have the handling, the actual assembling and taking apart, the adjusting and the manipulating of practically all the electrical machinery, appliances and instruments found on board ship.

After the work in practical electricity all the men are given a thorough course in wireless telegraphy. They are taught its principles, the arrangements of the different types, how to send and receive messages; each one actually doing the sending and receiving. They are detailed from time to time for duty at the Navy Yard Station, which is almost constantly in communication with other stations and with ships at sea, and which is one of the most important wireless stations in this country. They are taught the care and handling of instruments, and the routine of wireless telegraph stations.

After the course in this section, the men are well equipped for their duty as electricians in the navy, and are, by orders from the Navy Department, Washington, D. C., sent to various ships.

UNIQUE CENTRAL STATION ADVERTISING.

Window displays made by electric lighting companies are a form of advertising which has done much to popularize the use of electric current, especially for household purposes. A striking display of this character is shown in the picture and was fitted up by the Dayton (Ohio) Lighting Company.

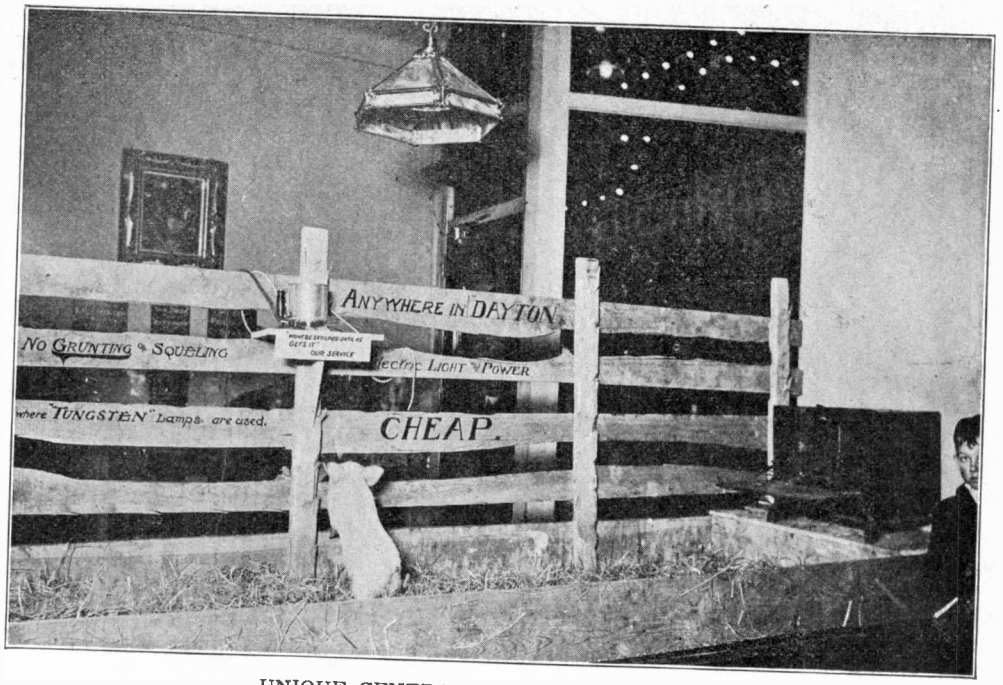
A live pig was allowed to roam around the window and the advertising ings that would tend to help the electric light and power business along.

light and power business along.

well as the electric milk warmer at the top.

The intended effect was to bring out the fact that you could roast a small pig in an electric oven, which appears on the right of the photograph.

The company changes its "New Business" department windows every week, and keeps them up-to-date and "alive," taking advantage of all the local happen-



UNIQUE CENTRAL STATION SHOW WINDOW.

By Courtesy of the Chicago Tribune.

AT THE TELEPHONE.

The daily newspaper cartoon, reproduced herewith, is a drawing that arrests attention. It is the work of John T. McCutcheon, and was published in the Chicago Daily Tribune. A temporary crib used in the work of building a tunnel for water supply beneath the bed of Lake Michigan, and located perhaps three-quarters of a mile from the shore, off Chicago, was burned on January 20, 1909. The alarm was given by telephone, as the picture depicts with such terrible intensity, although the man who gave it was never able to finish the message. The great value of the telephone is not fully realized until some great emergency arises.

THE MODERN ALADDIN'S LAMP.

Scarcely less marvelous than the magic power of the lamp of Aladdin in the good old eastern tale is the rapidity with which the tungsten electric incandescent lamp has come into use in the United States. In 1907 there were 48,000 of these lamps made in the United States; in 1908 the number was 3,500,000. The tungsten lamp has been "commercial" in this country for about two years. The reason for its extraordinary popularity is the fact that it gives about 2½ times the light of the ordinary carbon filament lamp, for the same consumption of electricity. It has been said to be the greatest development in electric lighting in the last 20 years.

The tungsten lamp was developed abroad, especially in Germany (although it is said that the first patent, but not practicable, was taken out in the United States in 1876), but it has received its greatest recognition and improvement in this country. On the electric lighting circuits ordinarily in use it is not available in small sizes, the "25-watt" lamp, of about 20 candlepower, being the smallest. But for "low-voltage" circuits, say for automobiles, train lighting, etc., the smallest sizes are made.

Tungsten is a metal, of course, but it has the characteristic that it cannot be drawn into a wire for the lamp filament by any practicable process now known. In the shape of a powder it is made into a paste with a binding material. It is then squirted under pressure through a small die, producing the unfinished filament. Next it is dried, cut into shape, and purified by the passage of an electric current. This must be done without oxidation, and it is said that the success of the lamp depends upon the purification process. When completed, owing to its crystalline structure, the filament is rather fragile, and consequently the larger lamps, with their long filaments, cannot be used where there is much vibration.

FIRST ELECTRIC RAILWAY IN NORWAY.

BY DR. ALFRED GRADENWITZ.

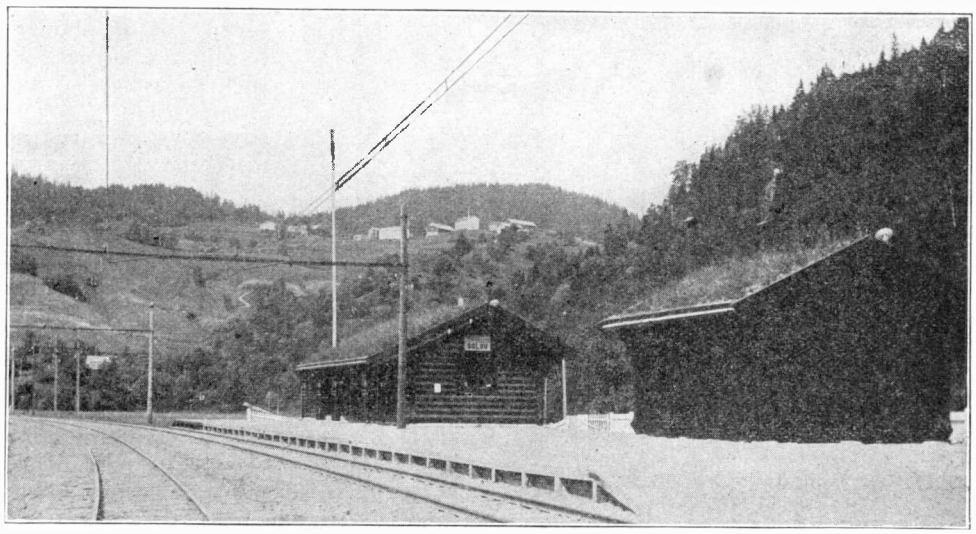
Until recently Norway had never had an electric railway. This was natural, for the larger cities were provided with steam railroad facilities and the outlying districts were too sparsely settled to give promise of profitable operation. One locality was found, however, which could better be served by an electric line than by any other means, and this was the picturesque valley of the River Orkla. Here an electric railway connects Thamshavn and Lokken mines, and runs along Orkedals Fjord, about 20 miles west of Trondhjem, with which town a regular steamer service has been established in connection with the railway.

The main line is about 16 miles long, and the freight line and sidings add another three miles. At the terminal station of Thamshavn is situated one of the largest Norwegian timber factories in which the well known wooden houses are made on a large scale.

Energy for operating the railway is derived from a large hydroelectric power house installed to the west of Thamshavn in another valley, near the Skjenald Falls, which yield a good flow of water throughout the year. The same power house also supplies current for lighting the town and the villages situated along the railway as well as for operating the Lokken mining machinery.

Solbu, a typical wayside station, is shown in one of the pictures. The station buildings, made of logs, are quaint in design, though substantial and exactly suited to the locality. The sod roofs of the buildings are in marked contrast to the very modern "catenary" trolley construction and the electric lights.

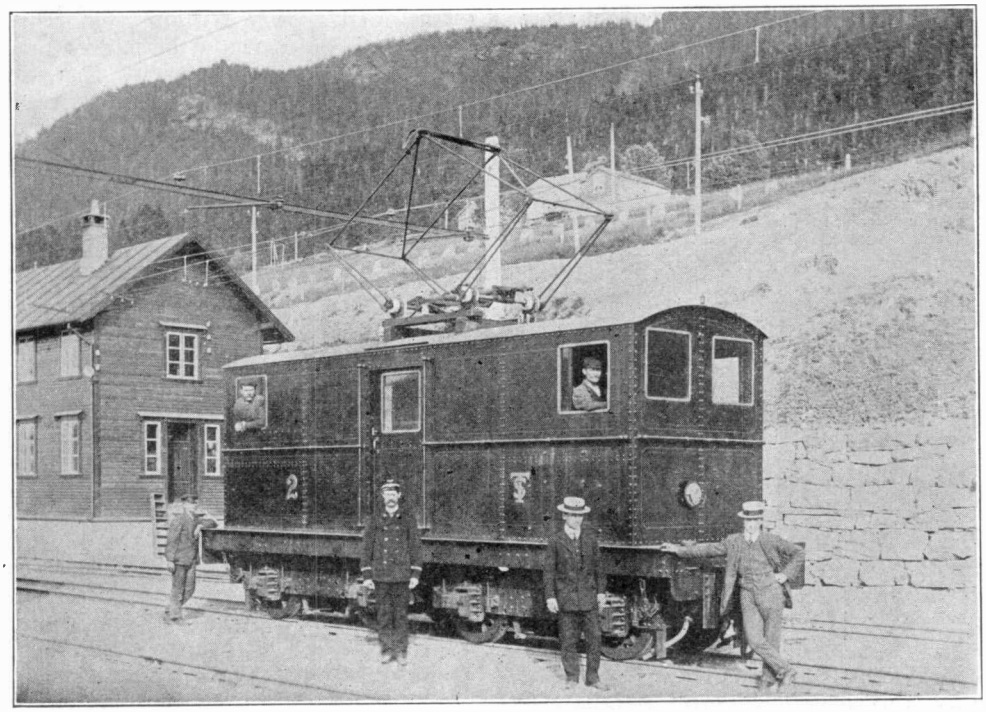
The railway is operated on what is known as the alternating current, single phase system. This system is the latest development in electric railroading, and is coming into quite extensive use in this country. In our ordinary city railways and in most interurban lines direct current is used (current flowing continually in one direction) at about 500 to 600 volts pressure. To obtain it the current is first generated in the power plant as alternating current at high pressure or voltage. It is then transmitted to substations along the lines. The pressure is then reduced by a transformer. Then by a special machine the alternating current is changed to direct-curent and fed into the trolley wires at frequent intervals. This all takes costly



QUAINT NORWEGIAN RAILWAY STATION.

machinery and numerous attendants. With the single phase system, however, current at high voltage is transmitted directly to the trolley wires, and there are specially made motors on the cars to utilize it. This results in a considerable saving in apparatus and line losses, and the system is now widely advocated by engineers for interurban roads.

The second illustration shows one of the 20-ton electric locomotives used in drawing the cars on the Thamshavn



ELECTRIC LOCOMOTIVE ON NORWEGIAN RAILWAY.

line. Instead of the usual trolley pole and wheel a "pantagraph" trolley is used which slides along under the wires, springing up and down with any irregularities in the contour of the line.

TELEPHONE NEWS SERVICE.

Private enterprise has established a unique telephone news service in Budapest, the capital of Hungary. The telephones which give this service are entirely distinct from the regular telephone system which is owned by the government.

For an annual subscription price of $7.31 a year the subscriber is entitled to two receivers and the full service of news, music, etc., the subscriber to pay the expenses of installation and removal, generally about $8.50. The service begins at 8.55 a. m., when a buzzing noise loud enough to be heard across a large room and lasting for 15 seconds, announces the correct time. At 9:30 the day's program of important events is announced; that is to say, the ceremonies, lectures, plays, races, etc. At 10 and 11 o'clock stock quotations and general news items are given.

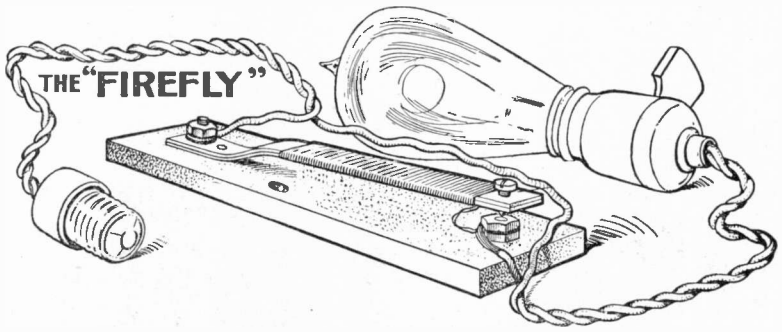
At noon comes a second announcement of the correct time, followed by parliamentary news and general items of interest. At 12:45 stock quotations from the local, Vienna and Berlin exchanges and general news. At 2 p. m. more parliamentary and general news, and at 3 p. m. the closing prices of stocks, meteorological forecast, local personals and small items, and in winter the condition of the various skating places. At 4 p. m. court and miscellaneous news. From 4:30 to 6:30 military music from one of the great cafes or

gardens. In the evening the subscriber may choose between the Royal Opera and one of the theatres, and later music by one of the orchestras.

This program is sufficiently varied to satisfy the desires of all classes of subscribers, and in general the service seems to give the utmost satisfaction.

AUTOMATIC LAMP FLASHER.

The "Firefly" thermostatic flasher, the basic principle of which was invented by Dr. C. O. Schneider of Chicago, is a very interesting little device to automatically open and close the circuit, to flash one or more electric lamps with which it is connected in series.



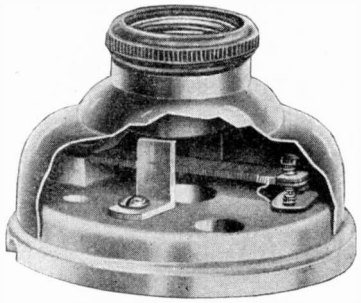
THE AUTOMATIC LAMP FLASHER.

It is a well understood fact that a like change in temperature will produce a greater or less amount of expansion or contraction in one kind of metal than in another. Brass when subjected to the same rise in temperature will expand considerably more than iron.

In this instrument two parallel bars of metal are used, the upper one being brass and the lower one iron, and they are riveted together in several places. This composite bar is then fastened tight to the porcelain base at one end, and the other end is free to move up or down when effected by a change in temperature.

Around this composite bar is a winding of extremely fine insulated wire of high resistance. This winding is connected to the bar at that end which is fastened to the base and the other end of the wire is not in contact with the bar, but is connected to the binding post below. In the free end of the bar beyond the winding is a screw with a piece of iridio-platinum in the end, and immediately below this, but separated by an air space of about 1-64 of an inch, is a disk also of iridio-platinum mounted in the tip of the binding post which is below. These form the contacts between which the current is made and broken. The flasher is connected with the lamp in series, as is shown in the picture.

Now when the current is turned on, the circuit through the lamp is completed only after the electricity has traversed the fine wire winding of high resistance, and this so impedes the current that only a very trifling amount can pass, and consequently the lamp remains dark. The little electricity that does pass, however, is enough to raise the temperature of the composite bar of iron and brass, and due to this heat, the upper or brass piece expands most, and consequently the free end of the bar moves down until the platinum contacts come together, thus cutting out the resistance of the winding by closing the circuit so the current will take the path



LAMP FLASHER INSTALLED IN BASE OF SOCKET.

of comparatively no resistance through the composite bar itself, and consequently the lamp is lighted. Now as there is no more current passing through the winding, the bar soon cools and con-

tracts so that the contact is again broken and the light goes out. Thus the lamp automatically flashes on and off 20 or 30 times a minute for an indefinitely long time.

TUNGSTEN LAMPS FOR AUTOMOBILES.

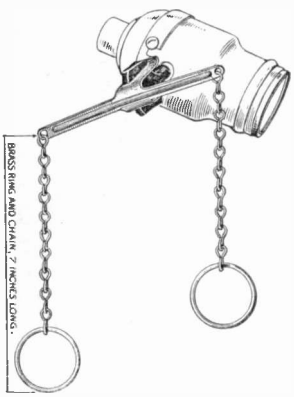
The new tungsten lamp, the economical features of which have revolutionized electric lighting, has been successfully applied to automobiles to take the place of the oil signal lamps or for instrument illumination.

The tungsten lamps are made in miniature sizes which can be run by low voltages from the ignition battery at such a high efficiency as to necessitate only one-third of the battery capacity required for carbon lamps.

It is very probable that electric lights will soon take the place of the acetylene headlights on automobiles used for city purposes. There is even some talk of passing ordinances in several cities against the use of these glaring headlights which blind pedestrians and other drivers. Oil headlights have been tried but they give too little light and the experiments recently conducted with the new tungsten electric lights warrant the statement that they make better headlights than gas for city machines.

THE "JUST PULL" SWITCH.

Are you short? Perhaps you are only just below medium height. But at any

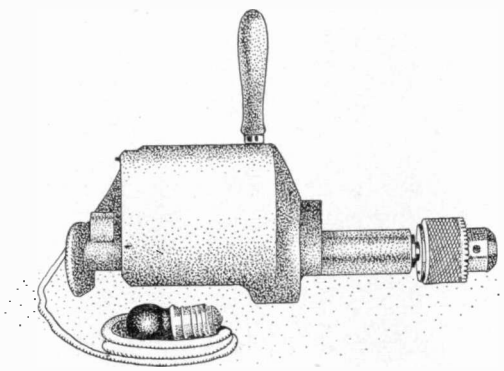


THE "JUST PULL" SWITCH.

rate you would rejoice to have all out-of-reach electric light buttons brought down to where you could reach them without standing on tip-toes. Here is a device that does this very thing. It is so simple that we wonder why some one did not think of it long ago. It consists of a little metal arm with a short chain on each end. In the middle is a spring jaw which snaps on over the button. Then, pull one chain and the lamp is turned on; pull the other and it is off.

PORTABLE ELECTRIC BREAST DRILL.

A portable drill for iron and steel work, operated by electricity, forms a very convenient addition to the machinist's kit. It is not too heavy to carry around and will do the work of a hand drill much more quickly and with a minimum amount of labor. The sketch



PORTABLE ELECTRIC BREAST DRILL.

shows a type of electric breast drill which operates on direct current. No electrical knowledge is required on the part of the operator, it only being necessary to screw the plug into a convenient lamp-socket and turn a snap-switch located on the frame of the machine. The end of the frame is provided with a breast-plate and the handle on the side, for steadying the drill while in operation, may be unscrewed when ready to pack up.

By simply removing two nuts the entire machine may be taken apart for inspection without in any way affecting the electrical connections. The running parts are enclosed by the frame, but suitable air-ducts provide for cooling of the armature. The machine is built in four sizes which will take drills up to ¼, ⅜, ½, and ¾ inches in diameter, respectively.

ELECTRICITY APPLIED TO HORTICULTURE

BY FRANK C. PERKINS.

If a discharge of high potential, static electricity will have a stimulating effect on animal life, why will it not also have a similar effect on plant life? So reasoned Sir Oliver Lodge, the noted English scientist, and he put his reasoning into effect with results which have been widely discussed, and which many believe will mark another step in modern agricultural methods.

The method employed in the application of electricity to horticulture and agriculture consists in stretching over the field to be treated a number of wires on poles just high enough for loaded wagons and ordinary farming operations to go on without difficulty below the wires. The wires are quite small and are supported by a few posts in long parallel spans, these being about 30 feet apart. At one post the electric current supply of high-potential static electricity, similar to that produced by a friction machine, is connected to the system of conductors, with power for maintaining a constant supply.

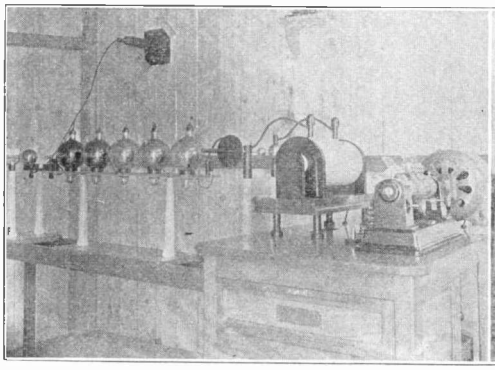


FIG. 1. HIGH TENSION APPARATUS USED IN HORTICULTURE.

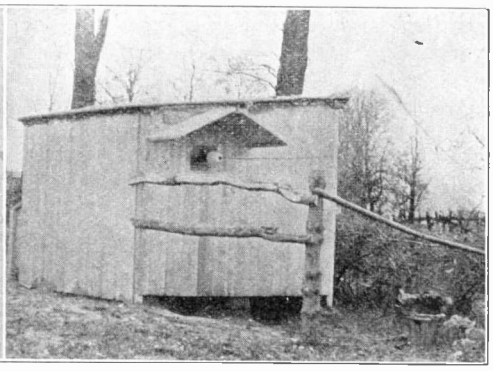


FIG. 2. THE APPARATUS IS INSTALLED IN SMALL QUARTERS.

It is said that leakage immediately begins, and the charge fizzes off from the wires with a sound which is sometimes audible, and with a glow just visible in the dark. Persons walking about below the wires can sometimes feel the effect on the hair of the head, as of a cobweb on the face. They are then feeling the stimulating action of the electrification.

It is held that the electrification should be maintained for some hours each day, but be shut off at night; it is probably only necessary to supply it during the early morning hours in summer time, and in spring time or in cold cloudy weather for the whole day. In bright sunshine it seems unnecessary or even harmful. But at what stages of the growth of a plant the stimulus is most effective has still to be ascertained. Probably the earlier the better; and since in the case of wheat, both the ear and the straw is valuable, the electrification should be applied for a time each day during the whole period of growth until stooling begins.

Power required to generate the electricity is very small, for although the potential is high the quantity is insignificant, and the energy is accordingly comparatively trivial.

Experiments carried out at the Bevington Hall estate near Evesham, England, by Sir Oliver Lodge, under the direct supervision of Electrical Engineer J. E. Newman, were performed on about 40 acres of land. The very high tension current was produced by an induction coil and a system of valve rectifiers as shown in Fig. 1. The current was thus supplied to the field wires at a tension of 100,000 volts.

The apparatus was all inclosed in a little shed shown in Fig. 2.

Some remarkable results were obtained, especially in growing wheat.

Fig. 3 shows two wheat stalks grown on good soil and each six weeks old. The one at the right was grown under the influence of the electric discharges while the one at the left was not. A much stronger and more luxuriant growth is noticeable in the former.

In discussing electricity in agriculture, Sir Oliver Lodge gave some interesting historical data as follows:

"Some thirty years ago a Swedish professor named Lemström sought to elucidate the Aurora Borealis by trying to imitate its appearance by electrical experiments. For this purpose he produced high-tension discharges of various kinds, and sent them through vacuum tubes until he got an appearance very like that of the Northern Lights. Some of these experiments he conducted in his greenhouse, and he noticed incidentally that the plants seemed to thrive under the treatment, and that the electrification thus produced in their neighborhood appeared to do them good. He also noticed, as remarkable, the flourishing development of plants in Arctic regions, where the sunlight was very weak; and he attributed part of this growth to the influence of electric discharges.

He says that when the plants in the north of Norway, Spitzbergen and Finnish Lapland, have resisted the frequently destructive night frosts they show a degree of development which greatly surpasses that of plants in more southern regions, where the climatic conditions are more advantageous. The rich development appears principally in the fresh and clear colors of the flowers, in their strong perfume, in the rapid development of the leaves on the trees, and their scent, but particularly in the rich harvest which different seeds—such as rye, oats and barley—will produce, when as before stated they are not destroyed by the frosts. From a bushel of rye sown they will often produce 40 bushels, and from barley 20 bushels and so forth. It is the same with grass. These results are attained, although the people cultivate their soil very imperfectly, using only ploughs and harrows of wood.

"He pursued the matter by careful observation, taking test plants in pairs or groups, electrifying one group—that is to say, discharging some electricity into the air above it—and keeping a similar group away from the electricity in order to compare them. Then he photographed the two groups side by side, and found in nearly all cases a marked improvement as the result of the electrical treatment. He concluded that the needle like shape of the leaves in fir trees, and the beard on the ears of most cereals, have the discharge of electricity,

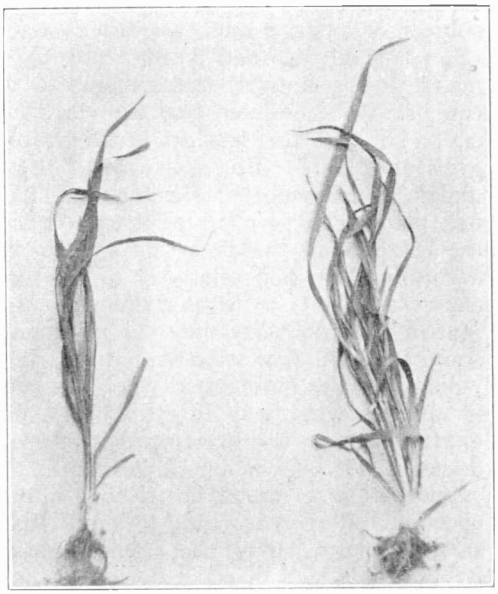


FIG. 3. WHEAT STOCK AT RIGHT WAS GROWN UNDER ELECTRICAL INFLUENCE.

as their function, and finds that they do act in this way.

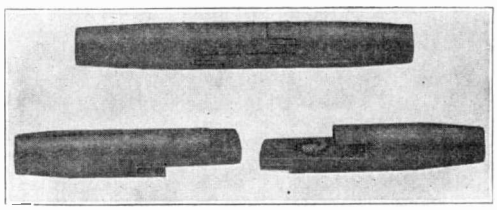
"This observation and these experiments of Professor Lemström were not, indeed, the beginning of the application of electricity to plant growth, because pioneer attempts had been made long before, as will be mentioned directly, but it was the beginning of a thorough and scientific treatment of the problem. Attempts of a different kind had also been made. Plates had been sunk in the ground, and a current passed between them among the roots of plants; but whatever effect is thus caused is of a totally different kind to that excited by high tension electricity supplied to the air above them. There are natural earth currents, and these must flow

among the roots of plants, though whether they produce an appreciable effect may be doubted.

"There is a natural atmospheric electrification, and this must be playing an important part in many phenomena. Atmospheric electrification is responsible for the formation of rain and hail. During fine weather the electricity in the air is usually of one sign; mainly positive. When wet weather sets in, the electricity in the air usually changes sign, becoming negative. The whole subject is a large one; a great deal is known about it, and vastly more remains to be known, but meanwhile it can hardly be doubted that the electrification of the air has some effect on growing plants. For it is found that, under the influence of sunshine, electrified plants can give off electricity from the leaves, and the fact that the air is naturally electrified relatively to the soil causes all plants to be electrified too, so that in all probability they are in a constant state of slow electrical discharge, which becomes more rapid when the sun is up. In what way this discharge of electricity from the growing tips is produced is not known, but it is natural to suppose that it cannot be without influence, and it is reasonable to think that the influence may be beneficial—a hypothesis which direct experiment confirms."

CONNECTOR FOR ELECTRICAL CIRCUITS.

In motor, transformer and other installations it is sometimes necessary to replace a broken piece of apparatus quickly. The process of unsoldering the old joints and soldering new ones is a slow one, and in case of emergency the time lost may represent a serious expense. A simple and ingenious device for making quick connections is known as the segment pin connector, made for circuits carrying 90 to 200 amperes. This connector is of brass, in two parts. One part is permanently soldered to the motor or transformer terminal, the other part to the lead. The two parts of the connector may be joined in a moment's time by turning them at right angles, inserting the segment shaped lug of one into the hole of the other and then

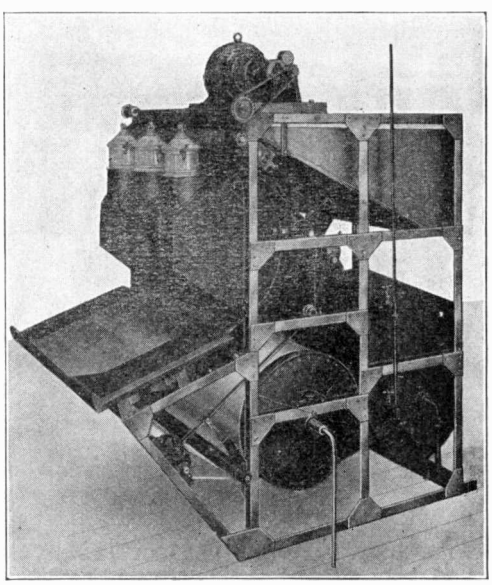


ELECTRICAL CONNECTOR.

bringing the two parts around into alignment. They may be disconnected with equal ease by reversing the process. These connectors are universal; that is, either part of one connector will fit either part of any other.

MACHINE FOR WASHING AND DRYING BLUEPRINTS.

An automatic electric machine of German design and construction performs the washing, drying and rolling of blueprints, delivering them complete. It is operated by an electric motor driving the rolling mechanism from the top of the machine by a chain and gearing. The printing is done by three arc lamps each consuming 1,300 watts of current.



MACHINE FOR WASHING AND DRYING BLUEPRINTS.

The tops of these three lamps show in the picture.

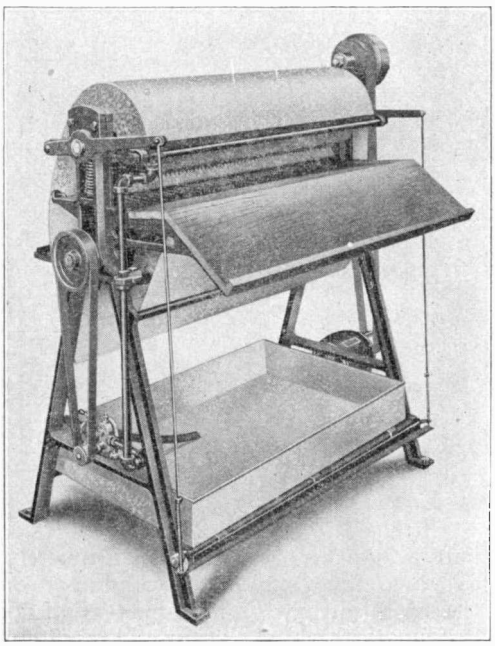
This machine is said to have a capacity for 1,600 feet of blueprints in a sin-

gle day of 10 hours. By a continuous operation the tracing cloth is fed through the machine, passing in front of the lamps along with the sensitized blueprint paper fed from another roll. The completed blueprint is then delivered washed and dried.

AUTOMATIC CLOTH SCOURING MACHINE.

One man and a helper can do with this machine work that would require six men to do by hand, in the scouring of cloth in dyeing and cleaning establishments. Again it is the electric motor that has made this possible.

The water and other ingredients used in the scouring process are stored in the tank under the machine (completely out



CLOTH SCOURING MACHINE.

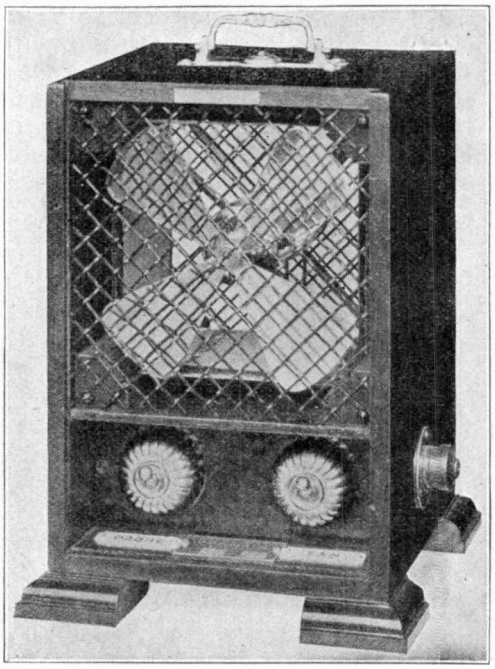
of the way) and are supplied to the goods being scoured through a perforated pipe, that distributes evenly over the surface of contact with the brushes.

The water is raised from the tank by a pump that starts and stops automtically as the machine is started or stopped.

The motor drives both pump and scouring brushes and is started and stopped by a pedal arrangement so that the operator has both hands free.

A PORTABLE OZONE PRODUCER.

Ozone is a peculiar form of oxygen which is formed by the chemical union of three atoms of oxygen with each other to form a tri-atomic molecule of oxygen, as it is called. It is the gas which gives off the peculiar odor that is noticed



PORTABLE OZONE PRODUCER.

when heavy discharges or sparks of electricity pass through the air. Ozone is a powerful disinfectant and germicide and consequently is beneficial for purifying air in houses, hotels, hospitals, etc.

A portable apparatus for making ozone is shown in the picture. The screen shown in front forms one electrode of a high voltage circuit, the other electrode is in the interior of the casing. The high voltage is produced by a transformer contained in the apparatus. The primary or low voltage winding of the transformer is connected by a cord and plug with any lamp socket in a 110-volt alternating current light circuit.

In operation, the high voltage impressed upon the two electrodes causes a "silent discharge" of electricity to take place between the electrodes. This discharge is very minute and can hardly be seen or heard, but it brings about a chemical union in the oxygen atoms in

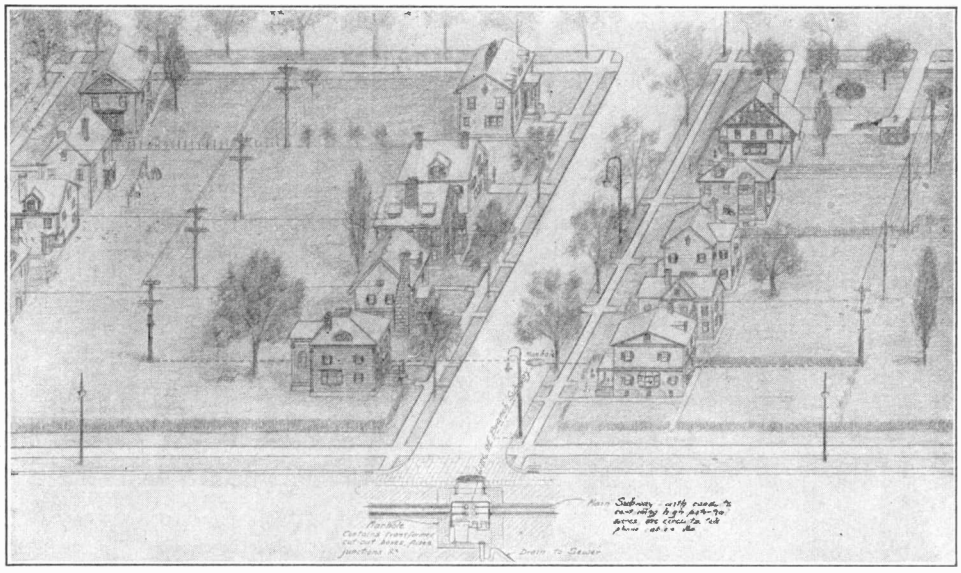
the air and forms an abundance of ozone, which is blown out into the room by the electric fan shown in the casing.

BACK-YARD ELECTRIC LIGHT CONNECTIONS.

Residents in suburban localities do not like to have their shade trees mutilated to make way for electric light wires. Neither do they want unsightly pole lines in the streets. On the other hand, to make complete underground connections in all the side streets and to the individual houses is very costly, and in some localities would prevent electric service being given. To meet such conditions the Rochester (N. Y.) Railway and Light Company follows the unique plan of making back-yard service connections, for, as in most cities, there are no alleys in Rochester where pole lines may be run.

The principal streets are already provided with an adequate underground conduit system. From this conduit leads are run underground to the back yards of the first of each row of houses on the side street. Here they leave the ground and are carried up to the cross-arms of a short pole line which only extends to the other side of the block. From this pole line wires are tapped off for the various houses in the block in which electric current is used.

The plan has been very successful in this instance. The light company has no difficulty in securing permission from the property owners to erect the short pole lines in the back yards, so anxious are they to secure electric service without at the same time marring the beauty of their streets.



By Courtesy of the Electrical World, New York.

PLAN OF BACK-YARD POLE LINES AS ADOPTED IN ROCHESTER, N. Y.

WHEN THE FUSE BLOWS OUT.

"It might have been," is sad enough but it does not cast the sable folds of gloom over the average business man half as quickly, nor half as completely, as when the grimy-fisted conductor on the street car bawls out, in his terse if not grammatical way, "The fuse blowed out; take the car ahead!"

The business man seldom knows just what has happened but he does know that he must hustle into another car or be late to business.

A fuse is a small piece of metal alloy wire having a low melting point and its purpose is to automatically open the electric circuit under abnormal conditions. The alloy may be in the form of a bare strip of wire or it may be encased in a fireproof tube. When the current is excessive this wire is the first thing to melt,

cutting out the current which would otherwise damage the motors. On street cars this wire usually melts with an explosion and a puff of smoke, harmless in itself but sufficient to startle nervous passengers.

But instead of being indicative of danger the fuse is devised to prevent accidents. Electric machinery differs from all other machinery in that it will work itself to death, so to speak. Overloaded engines will stop; but an overloaded motor will work right on until it burns up. To protect it fuses or circuit breakers are inserted in the circuit.

The fact that passengers have been so frightened when the fuse blew out as to jump off the moving car or even out of the windows necessitated the invention of the automatic circuit breaker. The circuit breakers are operated by an electric magnet whose core it attached so as to trip a release or trigger and allow a heavy spring to throw open a switch. This device does away with the explosion and the smoke.

SOUTHERN ELECTRICAL AND INDUSTRIAL EXPOSITION.

From the Southern Exposition to the Southern Electrical and Industrial Exposition is a long step. It is, long in respect to years and it is long in respect to developments, both electrically and industrially. The Southern Exposition was held in Louisville, Ky., 26 years ago. The Southern Electrical and Industrial Exposition, to be held April 12th to 24th, will show a development in electricity never dreamed of a quarter of a century ago.

One of the chief purposes served by the exposition was the introduction of the application of electricity to lighting and motive force. For the first time in Louisville there was installed at that exposition the electric arc lamp. It was a very crude affair compared to the present day lighting facilities, but it brought to the attention of those who saw it the possibilities which underlie the uses of electricity. At that time the city streets were lighted with primitive gas lamps. Several years later, these unsightly lamp posts or gas lamps gave place to the electric arc light, now awaiting removal to give place to artistically designed poles bearing high candle-power lights.

Another and greater service was that rendered by the introduction of the application of electricity to motive power in street railway service. What is now Central Park was at the time of the old exposition the "front yard" of Mr. A. V. DuPont, Louisville's pioneer street car magnate. Encircling this large plot of ground was a narrow gauge railway track on which were operated electrically propelled cars, among the first used in the United States. The cars were what operated on what is known as the third rail system, the trolley being then a discovery for the future. The cars were small and the service was anything but satisfactory. However, it was the fore runner of the line which seven years later was installed on Green street and which was the third electric line installed in the United States. Electric railway service in 1883, however, was a different proposition from what it is today. Then it meant a short ride and long walk in many instances, for there were many halts and frequently complete suspension. But, a visit to the exposition at that time was not complete without a ride on the "new wrinkle."

In contrast to the old exposition, the exposition to be held in April will be very distinct. Whereas there was shown at the old exposition the beginning of the application of electricity, there will be shown at this one the very latest developments, and there are many developments with which the people of Louisville and the people of the south are not at all familiar.

The Southern Electrical and Industrial Exposition will be held in the armory. An interesting feature will be the display of a giant painting showing the river front of Louisville from the Indiana shore. This painting will be 40 by 60 feet and will be one of the most perfect sketches ever made of this beautiful prospect. In it the artist, Guy M. Leber, expects to produce his masterpiece.

At the south end of the armory will be hung a giant swinging electric clock, which will indicate the time by means of shafts of vari-colored lights. There will also be an immense electric tower which will rise 80 feet from the main floor and lose itself in a blaze of light in the lofty dome of the armory.

POPULAR ELECTRICITY WIRELESS CLUB.

Membership in Popular Electricity Wireless Club is made up of readers of this magazine who have constructed or are operating wireless apparatus or systems. Membership blanks will be sent upon request. This department of the magazine is devoted to the interests of the Club and members are invited to assist in making it as valuable and interesting as possible, by sending in descriptions and photographs of their equipments.

WIRELESS TYPEWRITING AND TYPOGRAPHY.

The principle underlying the design of all wireless telegraph systems has been recently extended in a very promising manner to the operation of distant mechanisms. It has thus been possible to demonstrate the practicability of long-distance steerage of balloons and vessels, launching of torpedoes and controlling of all sorts of mechanisms connected by no material link with the operator.

The latest development in that field is a wireless apparatus adapted to the operation of typewriting and typesetting machines. This apparatus which has been designed by Mr. H. Knudsen (the inventor of an ingenious system of transmitting pictures by wireless telegraphy) can be connected to and worked in combination with any typewriting or linotype machine, or in fact, with any machine of a similar construction. By means of one sending apparatus, it allows a message to be received simultaneously on any number of typewriting or typesetting machines, situated at any distance from the sender.

One or more steamships having a wireless installation on board may by this system receive the electric impulses sent by a central transmitter, any number of receiving machines reproducing the message, typewritten or set in type. It is also possible so to tune and arrange the machines, that no foreign messages or signals can interfere with, or be received by them.

The transmitting and receiving machines, as represented in the Figs. 1 and 2 respectively, are practically identical in construction and in their simplest form consist of the following parts: The transmitting typewriter connected with an electric motor operating two pulleys, over which an endless belt with two contacts is wound. This belt travels in a constant direction, and the contacts, which are fastened at equal distances to its inside, come to a full stop at each half of a revolution, in fact, every time one of the contacts has passed over the alphabetic contacts connected to the levers of the transmitting typewriter.

In order to operate the machine, the contacts corresponding to each letter of the message are raised by pressing down the levers of the transmitting typewriter

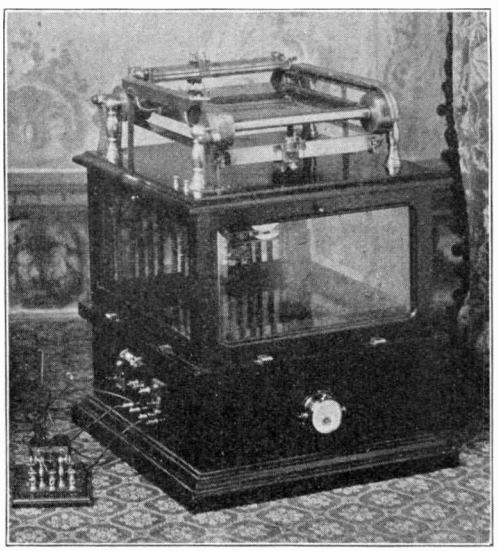


FIG. 1. WIRELESS TYPEWRITER TRANSMITTER.

keyboard. Those contacts then remain in a raised position until the starting key or lever has been pressed. This lever starts the belt of the transmitting machine, and at the same time sends out an electrical impulse which is received by the typewriter installed at the remote end, thus starting this typewriter. The belts of the transmitting and receiving machines accordingly travel at the same speed over their respective contacts. The transmitting machine obvious-

ly makes contact only with such types as have been previously raised, and on touching the raised pin the contact on the endless metallic belt, depresses this, thus sending an electric impulse out to the receiving station, where it completes a circuit through a coherer and relay.

The metallic contact fixed to the traveling belt thus completes a current through a magnet located above the corresponding key or lever of a typewriter or linotype machine, actuating the lever in exactly the same manner as an operator would do when handling the machine in the usual way. It is essential that

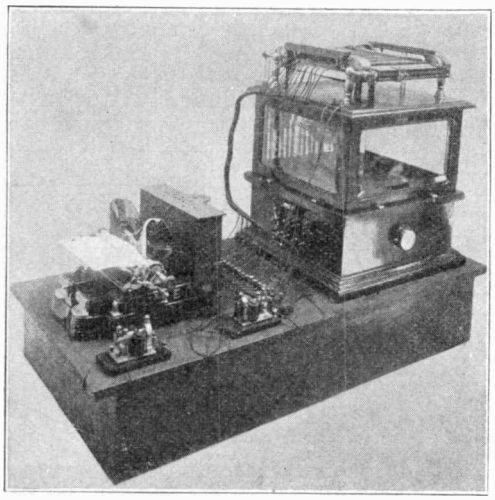


FIG. 2. WIRELESS TYPEWRITER RECEIVER.

both machines and metallic belts should come to a full stop after passing over their contacts, being held in this position until the first electric spark has been sent out from the transmitting machine.

The construction of Mr. Knudson's machine, while very simple, is of extreme accuracy. All the machines are of the same size and made from the same patterns.

As any number of typesetting machines may be operated in different parts of the country or in different countries simultaneously, all reproducing the same message, it is possible for one operator to type or set type on any number of receiving machines on land or sea, in fact, wherever anyone of these receivers, tuned to the transmitter, may be installed in connection with any wireless telegraph systems.

As everybody knows of what enormous value any saving of time is to a newspaper proprietor, it will be readily understood that this most direct and rapid transmission of news, directly from the sub-editor or correspondent to a number of typewriting or typesetting machines, will be universally appreciated and found very profitable by enterprising publishers.

When this ingenious system will have come into general use and, for instance, have been adapted to a trans-Atlantic station, a newspaper correspondent, comfortably seated in London, will be able to set type in the New York printing room at the very moment he dictates his message to his typist. It is hard to realize what a revolution this system which obviously makes the newspaper man independent of space and time, may produce in journalistic practice.

WIRELESS TELEGRAPHY ON THE HIGH SEAS.

The fact steamer Vilano has for a long time received messages from the main German station at Nauen, as far off as the island of Teneriffe. The latest German record has, however, just been made by communication between two vessels equipped with long-distance wireless apparatus. The steamer Frio, which was south of Cape Finistere, exchanged messages with the steamers Roca and Arcona at the remarkable distance of 925 to 1,000 English miles. The Roca was at the time of this exchange of messages south of Lisbon, Portugal, while the Arcona was in the North Sea in the latitude of Scheveningen, Holland.

Conversation between the two vessels was hardly ended when the North German Lloyd steamer Grosser Kurfurst, on board of which was King Friedrich August of Saxony, was announced by the English apparatus. Both vessels were in sight of each other. The Grosser Kurfurst vainly endeavored to forward a message from Scheveningen or some other continental port to the King of Saxony. Failing in this, the Frio was

spoken, and requested to send the message further. The Frio took the message and sent it without further loss of time to the wireless station of the Holland government at Scheveningen; the distance being 1,440 kilometers or 895 English miles. Scheveningen accepted the message, and remarked that the signals from the Frio were unusually legible. The Frio took advantage of the opportunity to send a greeting to the King of Saxony on board the Grosser Kurfurst—which message the King answered the next day.

The majority of the English wireless stations on the German fast steamers had up to that time refused to communicate with stations working with other systems, and especially with those having German instruments. The "emergency" created by the presence of the King on board the Grosser Kurfurst compelled the English stations, however, to break the rule. It was necessary to call in the assistance of the stronger and further-reaching stations. The technical papers remark in this connection that the Frio apparatus is a small and comparatively weak one, calling for only two horse-power.

AERIAL SYSTEMS.

ALFRED P. MORGAN.

Many amateurs are under the erronous impression that almost anything in the shape of wires run up into the air will serve for an aerial and consequently in traveling around the country one sees a queer assortment of wires, such as poultry netting and sheet iron, above the roofs of houses.

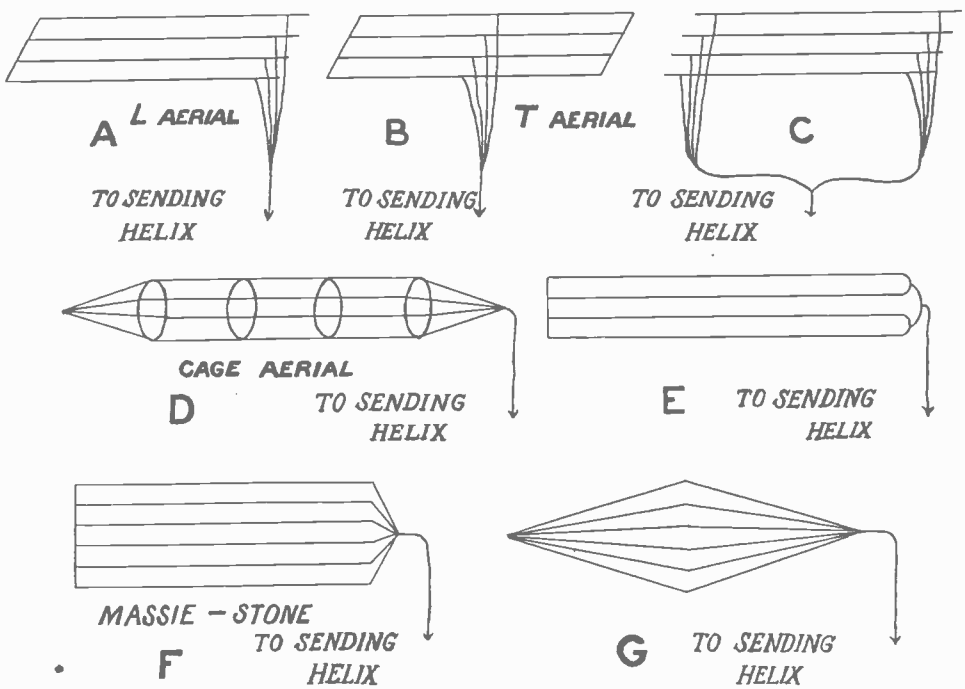


FIG. 1. MOST COMMON TYPES OF AERIALS.

In fitting up a station the aerial should receive first attention. The wires should be of the same size and length so as to permit of accurate tuning. If the owner cannot afford stranded phosphor bronze wire, copper wire not smaller than No. 16 B. & S. gauge is best. Aluminum wire is not to be desired for other than experimental purposes, for a short time, as the acid fumes in the air from smoke, etc., quickly attack and coat it. Connections made in aluminum

wire are very liable to become badly oxidized unless great care is exercised in soldering them.

It is needless to say that an aerial should be as high above neighboring objects and as well insulated as possible.

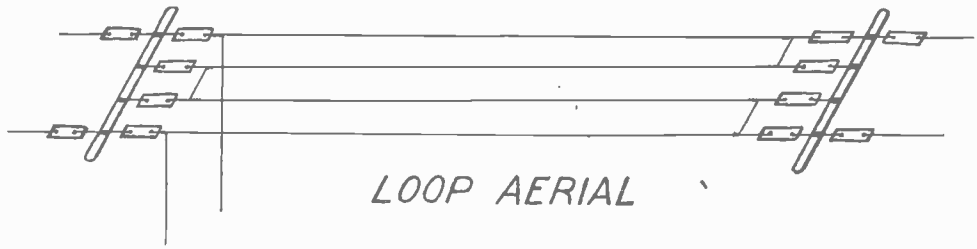


FIG. 2. LOOP AERIAL.

For small light aerials, strings of two or three glazed porcelain cleats make excellent insulators. Large heavy aerials, where the strain is great, require a special ebonite or composition insulator.

tion of energy when the transmitter is in operation.

Fig. 1 shows the most common types of aerials in use and the proper place for connecting the leading-in wires. (A), (B) and (C) are horizontal aerials having the opposite ends at the same heighth. (D), (E), (F) and (G) are vertical aerials having the end opposite the leading-in wires the highest.

Fig. 2 shows the "loop" type of aerial

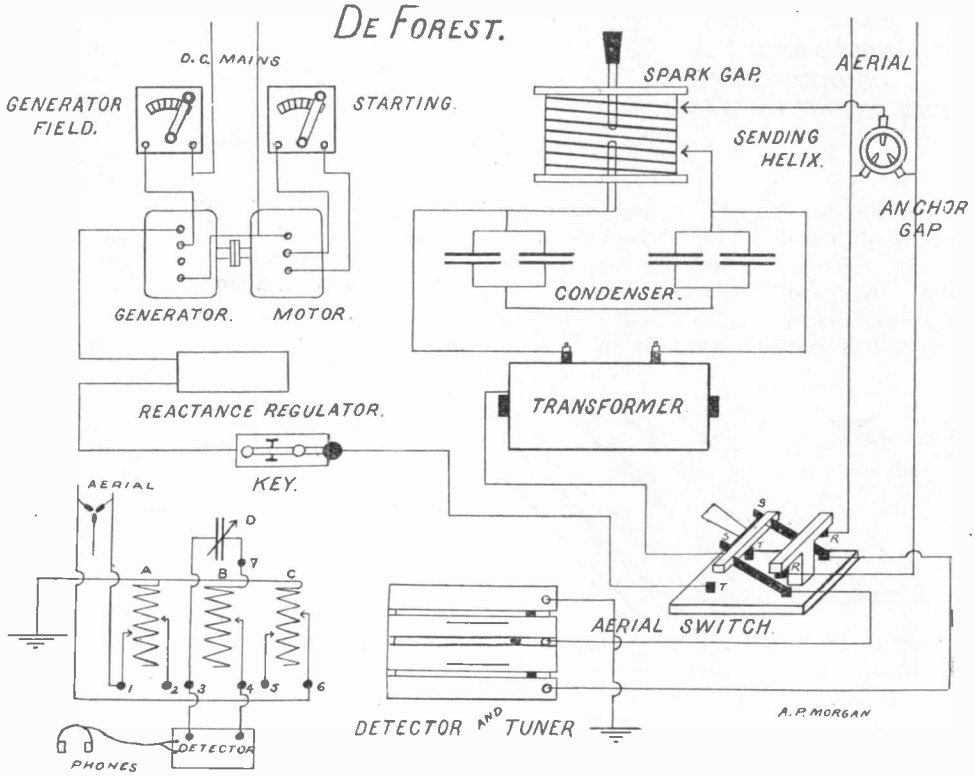


FIG. 3. COMPLETE SYSTEM AS WIRED ON THE DE FOREST PRINCIPLE.

Ropes make the best guys for holding a pole unless the wire guys are properly wrapped with iron wire so as to produce a choking effect and prevent the absorp-

used by the DeForest and Shoemaker companies. This type of aerial gives an increased signaling range and permits of very nice tuning. In towns where

alternating current is used for power and lighting purposes, amateurs are greatly annoyed by a humming in the telephone receivers due to the induction of neighboring lines. This humming

key while the switch is in position for receiving. Any double pole knife switch may be easily adapted to this type by moving the contacts (T T) forward so that they come beyond the insulating

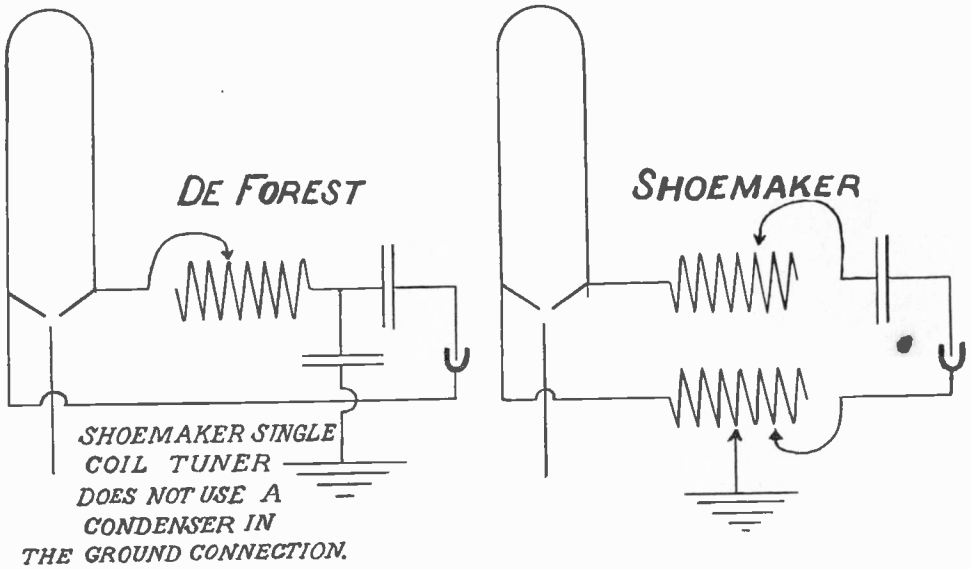


FIG. 4. CONNECTION OF TUNING COIL TO AERIAL.

may be almost entirely cut out by using the "loop" aerial. The two wires must be led separately into the operating room. A complete circuit of a "loop" aerial installation as wired on the DeForest principle is shown in Fig. 3.

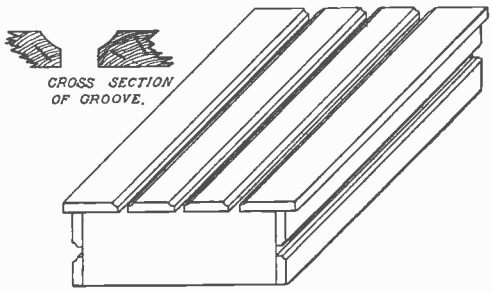


FIG. 5.

In most amateur stations an induction coil and batteries will replace the transformer and motor generator.

A special form of aerial switch as shown in perspective in Fig. 3 is used to prevent damage to the receptor through an accidental touch of the transmitter bar. A yoke of copper or brass is fastened on the insulating bar so as to touch the contacts (T T) and complete the primary transmitting circuit when the switch is down. A T-shape piece of hard rubber or fibre is provided with contacts (R R) and mounted on the base so that the knives strike the contacts and connect the aerial to the receptor when the switch is up.

The anchor gap is a small hard rubber or fibre ring about two inches in diameter having three small ⅛-inch zinc or brass rods around the circumference at equal distances apart. The sparking distances between them should be equal and never greater than 1-16 of an inch.

Either one, two or three tuning coils may be used with this type of aerial. The DeForest system usually contains three. These are mounted in a case about 12 by 15 by 4 inches. The proper circuits are shown in Figs. 3 and 4. The two outside tuning coils (A) and (C) have each two contacts arranged 90° apart to prevent interference and allow closer adjustment. Handles of hard rub-

ber project through the grooves which are shaped as in Fig. 5 so as to make room for the finger tips and permit a firm grip to be had without the handles being made to project too far. It is a wise plan to mount only the tuning coils in the case and provide it with binding posts so that connections may be made to the proper condensers, and different detectors as carborundum, silicon or the electrolytic may be used. The condenser (D) should be made adjustable if good results are desired. The wire commonly used for the coils is No. 25 B & S gauge enameled or cotton covered. Adjustable condensers are sometimes shunted across binding posts (3) and (4) and (6) and (7).

The top of the transmitting helix is connected to the adjustable electrode of the spark gap which has a rubber handle.

AN ADJUSTABLE INTERRUPTER.

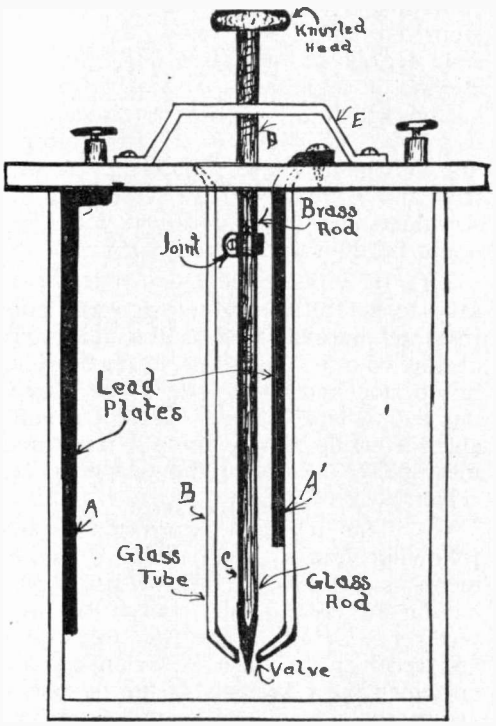
The interrupter here illustrated has the great advantage of being adjustable. As this is an important feature the writer undertook the designing of one with the following result.

After selecting the jar, which is straight sided, six inches in diameter, by eight inches tall, a cover is cut which overlaps the edges ¾ of an inch all around. In the center cut a hole 1¼ inches in diameter. Then procure a glass tube of one inch inside diameter and walls ⅛ inch thick; this must be six inches long. One end must be flared by heating and forcing a hardwood stick into the opening; the other end is drawn out to a point ¾ inch long. When cold the tip is broken off, leaving a hole 3/16 inch in diameter. This hole must be smoothed with a small round file wet with turpentine.

The glass rod (C) is of ⅜ inch stock, one end drawn to a long tapering point, the other end left square. A brass rod (D) ⅜ inch in diameter is cut three inches long and threaded for two inches. The unthreaded end is placed against the square end of the glass rod and a piece of brass ½ inch wide and long enough to be bent around the two rods and the ends fastened with a small bolt (see cut). A great deal of care must be used in this joining, so that the resulting rod is perfectly straight.

The brass support (E) is bent to shape, a hole drilled and tapped for the rod, which is now screwed in. A knurled nut is permanently fastened to the end of the rod and the bracket screwed down to the cover.

Two lead plates are cut, one for the large jar and the other for the glass tube. These plates are the electrodes and are connected to the binding posts mounted on top.



AN ADJUSTABLE INTERRUPTER.

Partly fill the jar with an electrolyte of water 10 parts, and sulphuric acid one part. Connect to the source of current and screw the rod into the opening. The resulting valve motion gives the desired adjustment.

GRADY B. MEDEARIS.

To give some idea of the extent of the incandescent lamp industry in this country it is noted that during the year 1907 a single electrical manufacturing company disposed of 32,000,000 lamps.

WIRELESS QUERIES.

ANSWERED BY V. H. LAUGHTER.

WIRELESS FROM AIR SHIP.

Questions.—(A) Can a wireless system be worked without being connected to the ground? I am going to build a flying machine and intend to send messages to the earth while sailing. (B) Are the instruments for wireless telephony much different from those of wireless telegraphy? (C) What are the principles of a common telephone?—E. L. F., Fort Worth, Tex.

Answers.—(A) We understand that experiments in communicating from baloons, etc., have been carried out with a fair degree of success. The common method is to suspend a wire from the baloon which is supposed to answer as the aerial radiating wire. At the receiving end the aerial wire picks up the signals and conducts to the receiving instruments. As an experiment it will no doubt be interesting.

(B) In wireless telephony it is necessary to set up a continuous wave current and impress thereon the inflections of the voice. The wave is changed to this period and picked up at the receiving end where it flows through a suitable detecting device and is translated into spoken words in the telephone receiver.

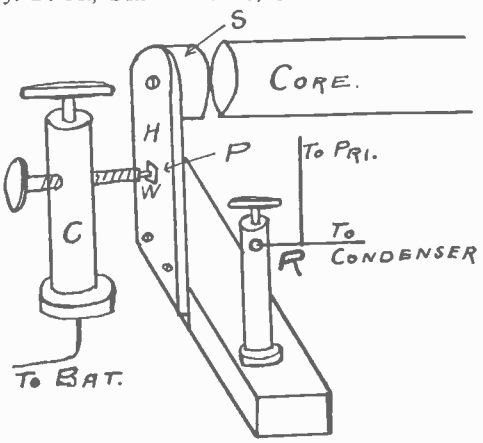
(C) The telephone consists of the following parts: Signalling arrangements, switch hook to throw from signalling to talking set, transmitter and receiver. Of the above the transmitter and receiver are the essential parts and on which the principals of the telephone are based. For a simple explanation we can take the transmitter connected in series with the battery and the telephone receiver. The transmitter consists of a metal cup full of carbon granules. In the front of the cup is placed a metal electrode resting against the carbon granules but insulated from the cup, the electrode being fastened to a diaphragm in the front.

The receiver is a coil of small magnet wire placed over a bar magnet near the end with a ferrotype diaphragm resting in close proximity to this but held from the magnet by means of the receiver case.

The current from the battery circulates through the transmitter and the coil of wire over the magnet. When the diaphragm of the transmitter is spoken against the electrode in the cup takes up the vibration and gives the same motion to the mass of carbon granules. As the current flows through the carbon granules, and this mass is varied in its resistance and conductivity by the vibrations of the electrode, the current is changed to the same proportion, and the fluctuations of this current therefore correspond to the sound fluctuations of the voice. The current flows through the winding of wire of the bar magnet and increases and decreases the magnetic pull against the ferrotype plate in proportion to the current, thereby resulting in a vibration of the ferrotype plate which corresponds to the form of the words as spoken at the transmitter. The telephones used at the present time combine several features not given above but the working theory is the same.

MAKE-AND-BREAK INTERRUPTER.

Question.—Please give drawing showing how to make a make-and-break interrupter.—J. D. M., San Francisco, Cal.



MAKE-AND-BREAK INTERRUPTER.

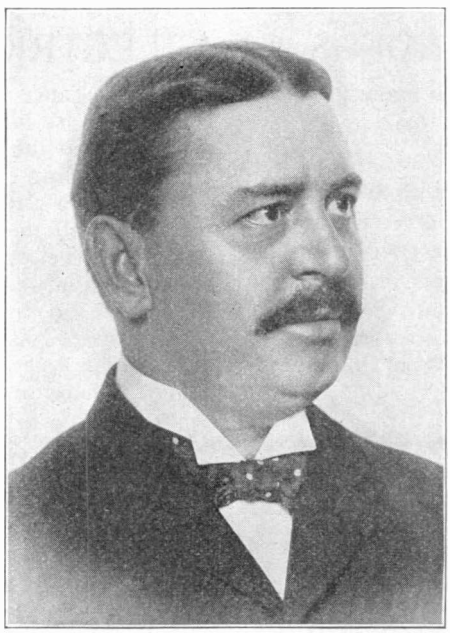
Answer.—See diagram. (C) bell contact screw pillar with platinum point (W). Brass spring (H) soldered or screwed at lower end to brass base upon which is soldered terminal (R). (S) is a soft iron cylinder screwed to (H). Connections are shown.

The first alarm of fire by an electric telegraph system was given at 8:30 p. m., April 29, 1852, in Boston.

ELECTRICAL MEN OF THE TIMES.

BERNARD E. SUNNY.

Nearly all men of prominence in the electrical industry have made their own way from the bottom of the ladder, and not a few, like Edison, began as telegraph operators. To this class belongs Mr. Bernard E. Sunny, president of the Chicago Telephone Company, who, from a position at a telegrapher's key in Brooklyn, has made himself, by native ability, untiring but intelligent application and very unusual gifts of persuasion and tact, one of the most conspicuous electrical men of affairs in the Central West and a leader in the civic advancement of the city of Chicago and the state of Illinois.



It is a very good test of a man's character to get the real opinions of those who work under him and are closely associated with him when he is in undress, as it were, in the rush and strain of daily life. Mr. Sunny, calm, fair-minded, considerate in all emergencies, has an enthusiastic admirer and eulogist in every man who ever worked for him, and only a just man, of strength and power but of good intent, could have made the impression he has made on so many other men.

Mr. Sunny's advancement has been rapid, and can only be sketched in the barest outline on this page. He was born in Brooklyn in 1856, and after attending the public schools in that city, became an operator for the Atlantic and Pacific Telegraph Co. In 1875, when hardly more than a boy, he came to Chicago as manager for the company named. Three years later he was married to Ellen Clifton Rhue, of Brooklyn, and the same year he became superintendent of the Bell Telephone Company of Chicago. In 1882 he was made superintendent of the Chicago Telephone Company, a consolidation of the Bell and Western Union telephone interests in Chicago. Twenty-six years later he returned to the company, grown mightily in the meantime, as its president. In the interval he became prominent in the electric light and power industry. He was president of the Chicago Arc Light and Power Company in 1888, and the year following found him western manager for the Thompson-Houston Electric Company. The General Electric Company succeeded this company in 1892, and Mr. Sunny was made western manager of this also, with a territory embracing thirteen states. In 1907 the great value of his services was recognized by his promotion to the vice-presidency of the General Electric Company, of which he is still one of the directors. Last year he became vice-president of the American Telephone and Telegraph Company and very soon after president of the Chicago Telephone Company.

Mr. Sunny is president of the board of trustees of the Illinois Eastern Hospital for the Insane at Kankakee, the largest institution of its kind in the world. He is president of the Grover Cleveland Memorial Association. Under his supervision, when president of the Civic Federation in 1902, an amendment to the state constitution was adopted, after a strenuous campaign, by which the "justice shops" of Chicago were abolished. This was a great advance. Mr. Sunny has held many other public positions.

ELECTRICITY IN THE HOUSEHOLD

THE WONDERS OF "ELECTRIC SHOP."

Electricity in the home makes for luxury, convenience or practical utility, according to one's taste and purse. All three of these characteristics are exemplified in a very striking degree in the new "Electric Shop" in Chicago, which has been opened at the corner of Michigan and Jackson boulevards to demonstrate the beauty and variety and usefulness of applications of electricity in the household.

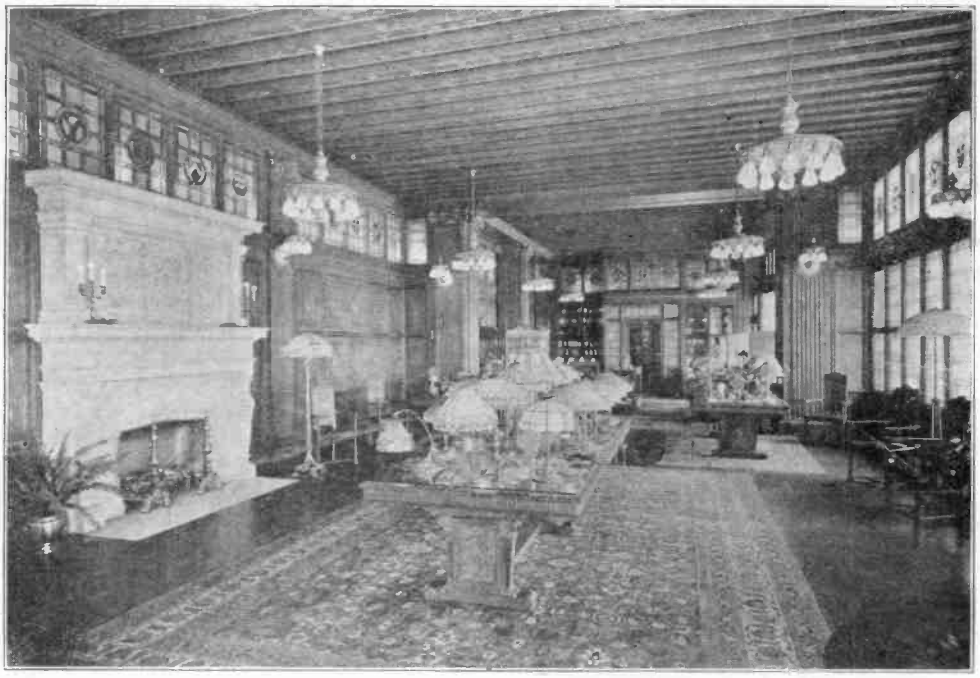
tasteful elegance, one must see it. There is nothing else like it anywhere.

Located in the imposing Railway Exchange building on the corner where the North, South and West Side boulevards meet, or will meet, the Shop could not have been better placed. Its principal feature is a large, imposing apartment on the corner, on the ground floor, architecturally treated as one room, but divided by a richly carved screen into two sections. There are two street entrances

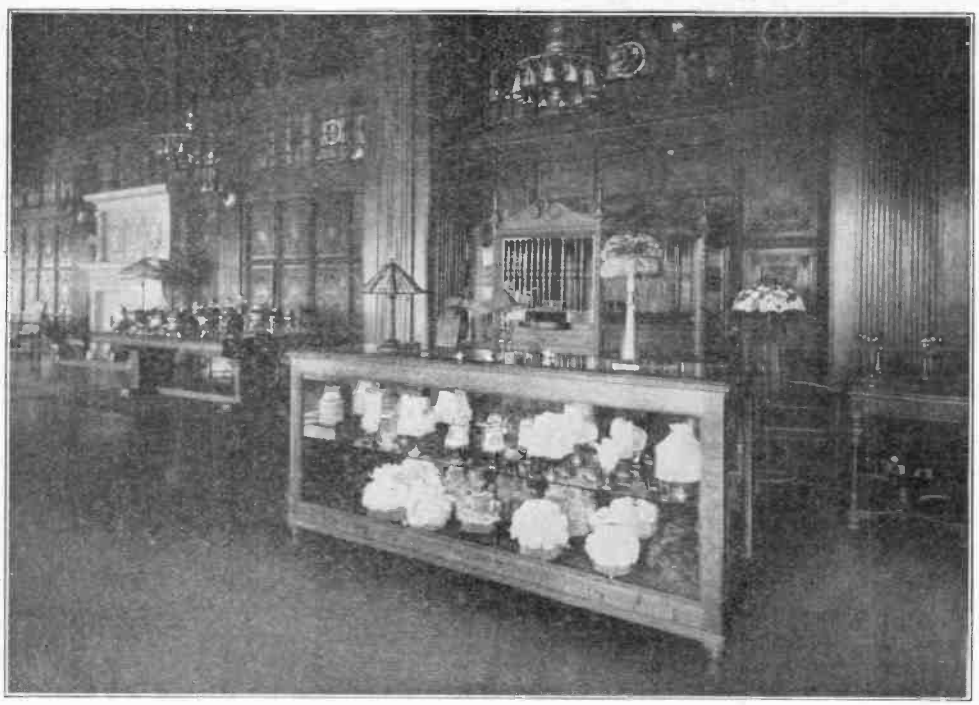
"ELECTRIC SHOP" IS A GLARE OF LIGHT.

The Shop has been fitted up in the most beautiful and lavish manner by the Commonwealth Edison Company and it is rapidly becoming one of the show places of Chicago—a really sumptuous demonstration of the wonders of electricity as applied to make life better worth living in the home. The illustrations give some idea of it, but to appreciate fully its rich,

into the Shop, one from each street, and it has seven show windows. Some 750 tungsten lamps arranged in a line running entirely around the street fronts of the building, just above the second story, make the structure conspicuous and also make the sidewalks beneath almost "as light as day" at night, for the Shop is open in the evening.



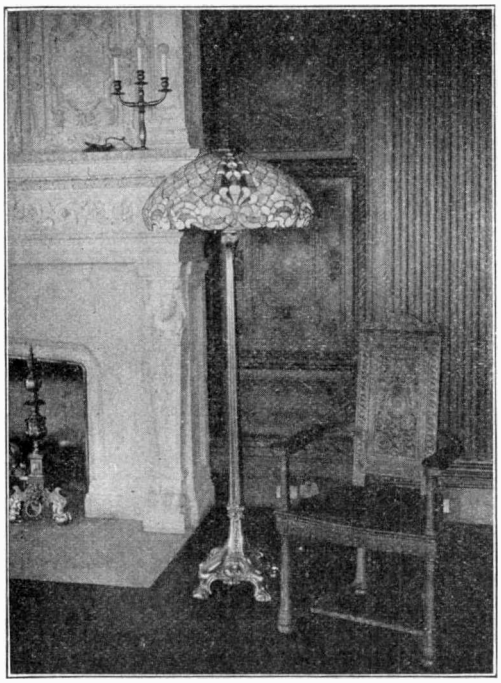
MAIN ROOM IN "ELECTRIC SHOP".



SALES ROOM IN "ELECTRIC SHOP".

The display windows themselves merit an extended description, did space permit. They show some of the beautiful and useful objects to be seen within and are lighted by tungsten lamps with Holophane shades placed in the ceilings of the windows and arranged between screens of art glass so as not to be themselves visible. There are handsome curtains especially designed, with lace borders matching the style of the room. Each window bears the crest of Electric Shop in colors.

The main entrance is on Jackson boulevard and leads into the reception room, as the southern part of the main



CORNER BY THE "ELECTRIC WOOD WIRE".

room is called. The general effect of the decorations is as though one stepped into a fine old room in a mansion. The architectural treatment, carefully and well worked out, is Elizabethan, with richly carved wainscot and beamed ceiling. The woodwork is oak in antique gray finish, and the panels of the wainscot are richly carved. These panels are also doors, behind which are concealed shelves for goods, or, in one case, a beautifully finished switchboard, from which the various electric circuits are governed on the "remote-control" principle.

Above the wainscot is a frieze of rich art glass running entirely around the room and made up of panels representing the old coats-of-arms in use in early English times. Behind the frieze are placed electric lights carefully planned to bring out the deep, warm colors of the designs in the glass to best advantage. When these are turned on there is a luminous band, softly but richly colored, running entirely around the room.

The floor is of interlocking rubber tile, dark green in color, while the beams of the ceiling are richly decorated with gold and the strong primary colors. The ceiling between the beams is treated in a deep old gold. Large and handsome Oriental rugs are scattered about the floor, and the furniture is of carved oak, especially designed for the Shop in the Elizabethan style and in finish the same as the wainscot walls. There is an imposing fireplace of white Bedford stone richly carved in the same style as the wainscot. In it, supported by andirons especially designed, a wood fire is burning—apparently. But this is an electric wood fire imported from Germany: it is a remarkably clever imitation, without dirt or ashes, and is greatly admired.

Besides the frieze lighting there are ceiling and wall fixtures for general illumination. They are notably handsome. Further, the portable and floor lamps displayed for sale, and which are such a conspicuous feature of the reception room, are all arranged to be "connected," so that they also may furnish light. These lamps are many of them very beautiful—real works of art. Various styles and periods are shown, as Viking, Greek, Roman, Renaissance, Louis XVI., Colonial, Modern Floral, and many others. In the reception room are also shown, on tables, a variety of highly finished utensils for dainty electric cooking, as chafing dishes, coffee percolators, tea kettles and the like, in silver, copper, bronze or nickel. Many have handles of ebony or other rare woods.

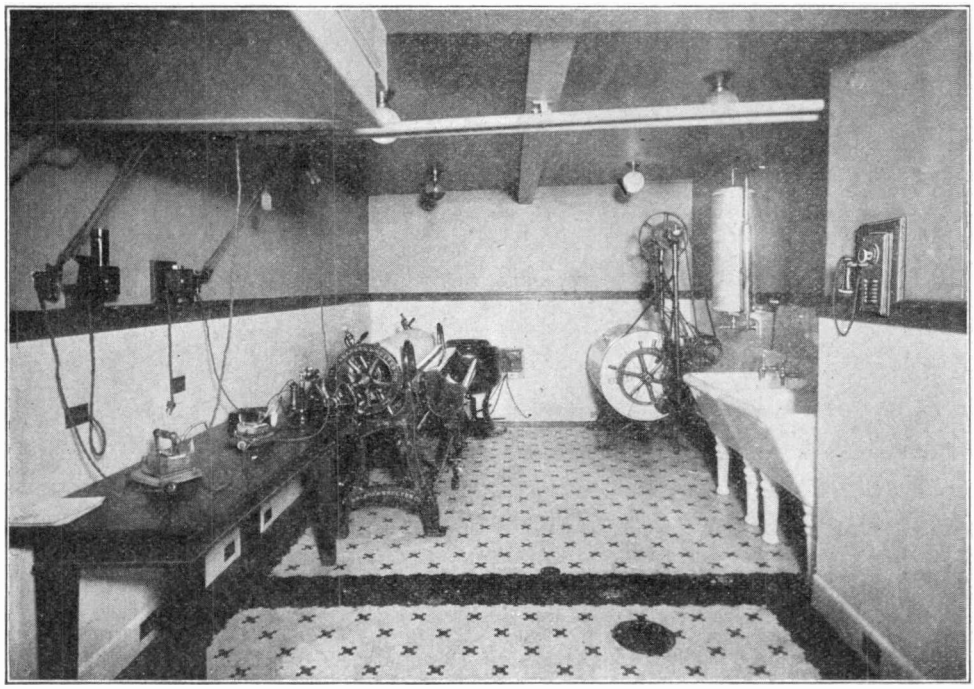
The sales room is the northern portion of the large room. It has a direct entrance from Michigan boulevard. Here are the cashier's desk and show-cases containing many electrical novelties.

Among these articles are vibrators, fancy silk shades, flashlights for the pocket, various kinds of sockets, adapters for candlesticks, gas or oil lamps, electric heating pads, hair dryers, curling irons, cigar lighters and numerous small specialties. Here also are to be found vacuum cleaning outfits, luminous and non-luminous heaters, electric stoves and all kinds of electric heating and cooking utensils as well as the less expensive portable electric lamps. In one wall-case are samples of the beautiful Quezal iridescent shades for lights and more silk shades in lovely colors.

Extending westward from the sales room, and with an entrance also from the lobby of the building, is the dining room of Electric Shop. This is designed in the style of the early English Renaissance, with wainscot of fumed oak and a vaulted ceiling ornamented in low-relief panels treated in gold and colors. The fireplace is of old English tile, and there are a sideboard and two serving tables as well as the dining table and chairs. The hangings are of silk brocade after a design of the period which the room represents.

This room illustrates four distinct methods of lighting—cover or trough lighting, side lighting, direct lighting from a central fixture suspended over the table, and indirect or "eye-comfort" lighting in which light from lamps concealed in fixtures suspended from the ceiling is first thrown on the ceiling and thus reflected throughout the room. The serving tables are connected most ingeniously for electric cooking conveniences and there is an electric "wood fire" in the fireplace.

Adjoining the dining room on the south are the kitchen and pantry and beyond the latter is a lavatory for women.

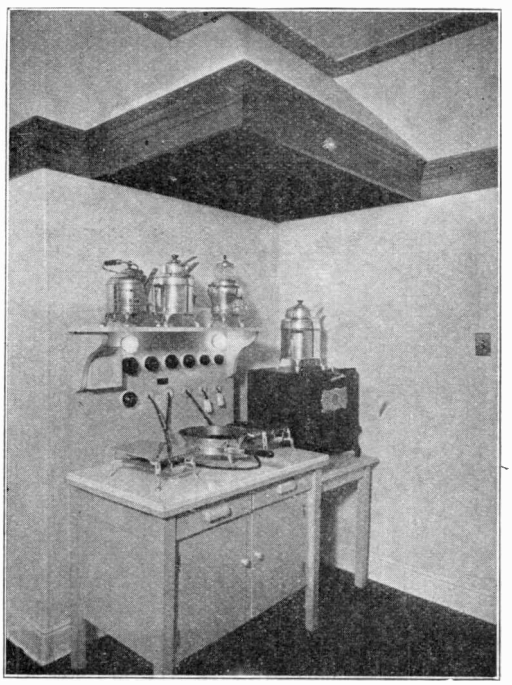


LAUNDRY IN "ELECTRIC SHOP".

The kitchen is designed to be a model one in every respect. All the fittings are of the most up-to-date character, nickel-plated or white-enameled where possible. The porcelain sink is said to be the finest in Chicago. There is an electric cooking range with a metal hood and provided with an oven, a grid, a frying pan, coffee percolator, cereal cookers, broiler and tea-kettle. A big white electric refrigerator, an electric dish-washing machine with a glass front and a kitchen table where all sorts of practical demonstra-

tions are carried out, complete the equipment of this interesting room.

In the pantry are a German-silver sink and a china closet. Here are an "instantaneous" electric water heater and an electric food warmer. The hangings at the doors in the kitchen and pantry, which are finished alike in maple, are of



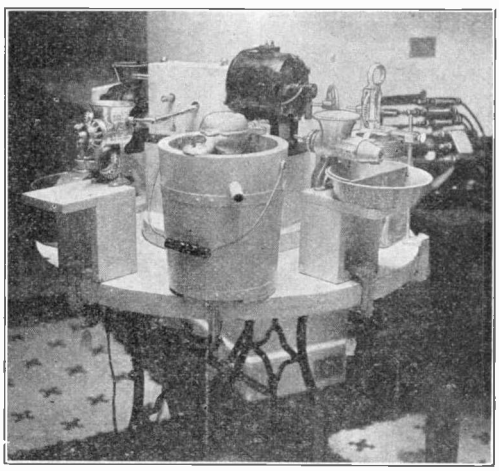
A CORNER IN THE ELECTRIC KITCHEN.

quaint design in white and yellow which recalls the work on the old English samplers.

A private automatic electric elevator, very handsomely finished, is used to convey visitors to the basement. It is of the type designed for household use, in which no operator is required. All that is necessary is to press the proper button, either in the car or at the entrance to it, and if the coast is clear and all is safe, the machine does the rest. The elevator will not operate if any door leading to the shaft is open. It meets with the unbounded approval of visitors.

In the basement are to be found the many ingenious labor-saving devices by which electric power is nowadays displacing manual labor in the home, to the great relief of the women of the household. The elevator, for instance, saves stair climbing. There are electrically driven sewing machines, coffee grinders, knife sharpeners and buffers for cleaning silver. One ingenious outfit, mounted on a circular table, consists of an egg beater, a small churn, a fruit-juice extractor, an ice-cream freezer, a meat chopper, a cake stirrer, a coffee grinder and a potato peeler. Surrounded by these little machines is one central electric motor, so arranged that it may be connected to any one of them and provided with two speeds.

All the laundry appliances are shown here—several washing machines, a centrifugal extractor to separate the water



ONE MOTOR OPERATES EIGHT UTENSILS.

from the clothes and so dry them, an electrically heated and turned mangle, the indispensable electric flatiron and ironing-table fixtures. There is also an electric water heater for the laundry. A very complete demonstration is also made of the system of cleaning houses and buildings by the vacuum process which is now attracting so much attention.

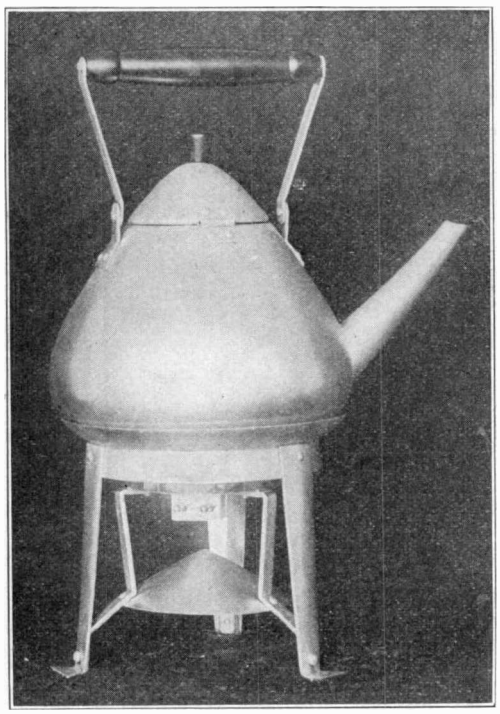
A "mercury arc rectifier" shows how electricity in the form of alternating current can be changed or "rectified" so as to be suitable to charge the storage batteries for the electric automobile in the garage. A "low-voltage transformer" demonstrates how bells may be rung by electricity supplied by the ordinary electric-lighting circuits in the house, if of the alternating current kind, doing away with batteries. The ammonia plant for operating the refrigerator in the kitchen is in the basement and is shown in opera-

tion. There is also an electric machine for making ice for table use.

In another basement room are displayed fixtures of all kinds for electric lighting. Here also is a demonstration of color effects under various forms of light. The inside working of the customer's electric meter is made clear in this room by a working demonstration. Indeed, it is characteristic of Electric Shop that everything is or can be shown in operation. By this means the display is not only of great interest as an exhibition but is of real educational value, for it is open every secular day and visitors are made welcome.

NEW DEVELOPMENT IN COOKING UTENSILS.

Almost every day something new in the line of electric cooking devices is brought out. Higher efficiency is being sought continually in order to reduce the cost of electric current for household



SOMETHING NEW IN TEA KETTLES

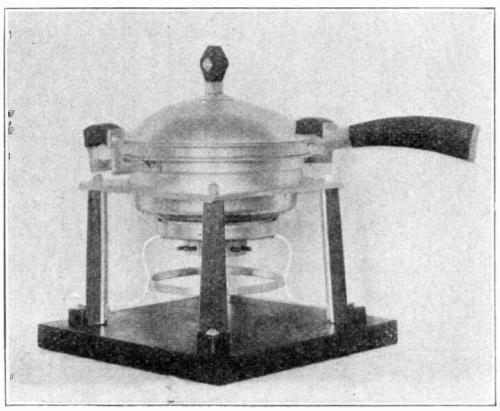
purposes and hasten the approach of the era of fireless, smokeless cooking. Among recent developments is the application of a new type of heating element to a line of unusually attractive utensils, some examples of which are here illustrated. This heating element consists in reality of a little flat top disk,

ARTISTIC COFFEE PERCOLATER.

or stove, which, by means of a special clamping device, similar to the cover of a fruit jar, is held firmly up against the bottom of the vessel to be heated. The only part of the heating element exposed to view is the projection which carries the terminals for attachment to the plug and cord, but the arrangement is such that the parts may be removed and washed.

The disk of the heating element is made of a special metal alloy which conducts heat very readily, and which will not rust. The resistance ribbons of metal, which are connected to the electric circuit, are situated very close to the under side of the disk, and as the current flows through them they are heated

so quickly that in five seconds the hand cannot be held to the disk. Beneath the ribbons is a dead air space which effectually prevents radiation, so that all the heat generated by the current, for which you are paying out your money, goes into the materials which are being cooked. None is radiated out into the



CHAFING DISH WITH NEW TYPE OF HEATER.

room as a waste and as an actual discomfort during warm weather.

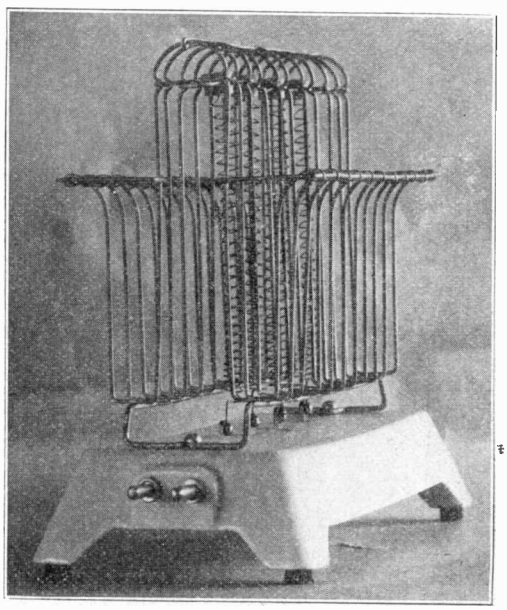
The chafing dish shown in one of the pictures is equipped with one of these heaters, having two sets of terminals as shown, giving two different heats. This heating element is known as a 500 watt unit; that is, it consumes current equal to that required for ten ordinary incandescent lamps. At ordinary rates for current this would not mean over five cents an hour for operation at full heat. With this device many appetizing dishes may be cooked which will constitute the principle item on the bill of fare and a substantial meal may be prepared at the cost of but a few cents for heat.

THE RADIANT TOASTER.

The proper making of toast involves the conversion of the starch in the bread into dextrine in the toast. In order to do this most thoroughly the heat should be given time to penetrate to the center of the slice before the outside has begun to change color. This ideal condition is most nearly realized when bread is toasted entirely by radiant heat. By subjecting bread to the heated air currents of a stove top it is quickly browned on the surface and easily burned. Thus the necessary chemical changes are not permitted to take place. Toast that is clammy in the middle and blackened on the outside is less nutritious than untoasted bread, and much harder to digest.

With the Radiant toaster browning is evenly distributed over the entire surface of both sides of the bread by means of radiant heat in about three and one-half minutes from the time current is turned on. Subsequent toastings may be made in three minutes or less.

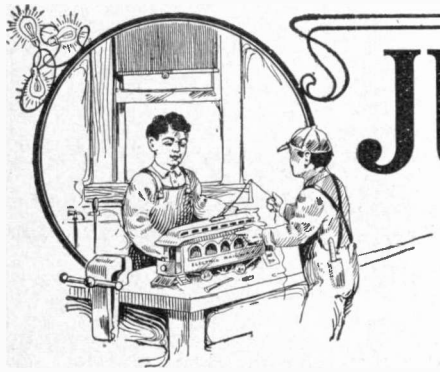
The toaster comprises a solid porcelain base upon which is mounted a nickel wire grid inclosing a radiant heating element. This heating element consists of little vertical coils of resistance wire which become red hot almost the instant



THE RADIANT TOASTER.

the current is turned on. The slices of bread are then placed in the grid with their surfaces almost in contact with the heating element and are promptly toasted entirely through and given a delicate brown on the outside.

Four slices may be toasted at one time, two on each side. The device may be used on the breakfast table as rubber feet are provided for the base which prevent injury to the table top. The two terminals at the end of the base enter a plug attached to the insulated wires which reach to the nearest lamp socket.

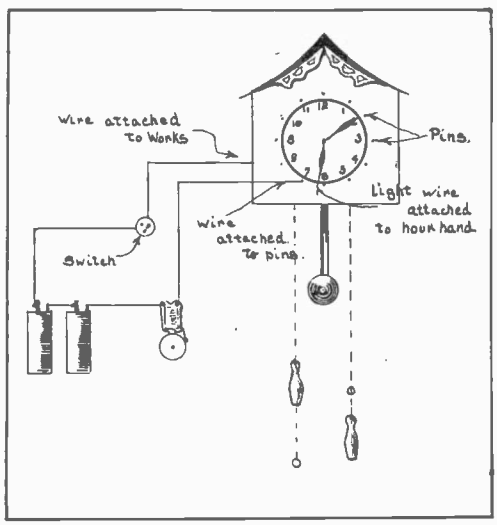


JUNIOR SECTION

HOW TO MAKE AN ELECTRIC ALARM CLOCK.

There are many kinds of mechanical alarm clocks, but here is an electrical one that anyone can make. All the materials needed are two dry batteries, about 20 feet of bell wire, a switch and some common pins.

Fasten one end of a wire to the works of the clock so as not to interfere with its mechanism. (See diagram.) Stick pins into the face about where every



ELECTRIC ALARM CLOCK.

hour is marked and fasten all of these to the end of another wire.

Wind around the hour hand a very fine uninsulated wire, so that one end will project far enough to strike the pins, and the other end will make a connection with the wire attached to the works.

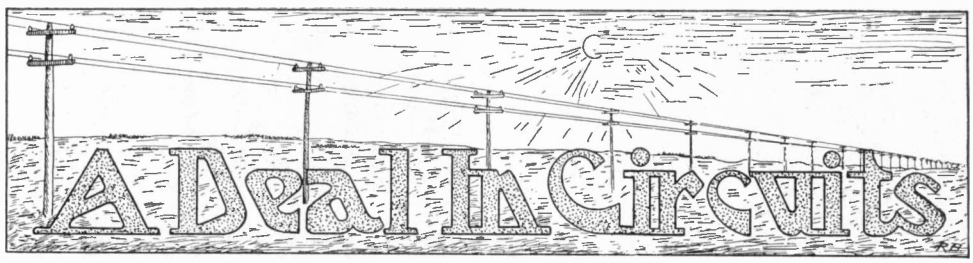
Fasten the other end of the wire, which is attached to the pin, to the bell and then to the batteries.

The other wire, which is attached to the works, fasten to the switch and next to the batteries.

When the wire on the hour hand comes in contact with the pin to which the wire is attached a contact will have been made, and the bell will ring until the wire has passed by the pin or the switch is turned off.

TELEPHONING UNDER WATER.

A Belgian named Debbaudt is reported from Antwerp to have introduced successfully a new system of telephonic communication between a diver at the bottom of the harbor and his mates in the boat or on land. The diving costume which he wears differs but little in outward appearance from the usual type, but in the helmet there is a telephone transmitter and receiver, in communication with the usual apparatus employed in telephony, above the water, by means of a wire passing through the air-supply tube. A Holland journalist on land was able to carry on conversation with a diver so equipped, without the slightest inconvenience resulting from indistinctness. The great advantage of this invention is that in future the diver who has any communication to make to those above will not either be limited to a code consisting of a few jerks of the life-line, or have to ascend to the surface every time he has anything to say. Those above will be able to communicate their directions to the workers on the bottom with accuracy and dispatch. Of course the saving of time will be an important feature, but safety to the diver is the first point to be considered.



BY PAUL H. WOODRUFF.

Dan Gilmore stood in front of the office of the Marengo Telephone Company and looked himself over. His glance had travelled from a pair of dilapidated shoes to the very baggy knees of his trousers, when he decided that further inspection would probably weaken his self-confidence, and so spoil his appeal for a job. He hastily entered the telephone office.

"Please tell the manager that Mr. Gilmore would like to see him," he said boldly to the only person in sight.

"About what?" queried the young lady, coldly.

"Why—er—work!" he announced, rather less confidently.

"Second door to the right." She was already at work on the books again, and Gilmore passed through the door he thought she had indicated.

The second door to the right was closed. He opened it slightly, with the caution of a man not sure he is right, and glanced in. Seated about a long table were five or six men, listening to another who stood at the head of the table, and spoke in rapid, vehement tones.

"In other words, gentlemen," he was saying, "twenty-five thousand dollars' worth of stock must be sold if we are to continue in business. The eastern market is flat—dead. And if that amount is thrown on the local market you know the result. The situation is critical."

Gilmore softly closed the door and tiptoed away.

"Wrong door; directors' meeting," he muttered. "No place to look for a lineman's job, though, that's plain."

He walked out of the building and surveyed it with some interest. Then he strolled along the main business street to the western edge of the town. As far as he could see was the desert; and overhead, glistening brightly in the sun, stretched four taut copper wires, whose supporting poles vanished at the horizon. Gilmore eyed the construction with approval.

"That's the long distance line to Reno," he commented. "A valuable property, or I'm no judge of telephone work. And the company owning it is up in the air!"

The best street corner in town was occupied by an assay office. Over it a gold-lettered window indicated the place of business of the Transplanetary Space Telephone Company; visitors welcome.

Gilmore stared at this inscription for fully a minute. Then he started up the stairs. As his eyes attained the level of the second floor his glance, directed through an open door, fell upon a large man seated at a splendid mahogany desk. The large man was smoking a large cigar and gazing into vacancy; and his thoughts were pleasant, judging by the smile which flickered across his not too refined features. Gilmore stopped abruptly, ducked his head, and for the second time crept noiselessly out again into the street.

"Whew!" he whispered. "Old Colonel Powers! Good thing I saw him first. I don't want to meet him; that is, until I find out what his game is."

He put his hand in his pocket and surveyed what came forth with interest.

"Two dollars and seventy cents," he announced to himself. "Good chance for another bankruptcy soon."

He entered the Palace Hotel and walked to a public telephone booth. There he consulted the directory, called a number and dropped a five-cent piece in the slot with something of a grimace.

"Hello!" he called presently. "Is this

the office of the Transplanetary Space Telephone Company? I am considering an investment, but want some information before taking time to call on you. You have a wireless system, I presume?"

"We have the only wireless system, my friend," came the reply, in a powerful voice fairly bubbling with enthusiasm. "A system that will revolutionize all existing methods of communication; a system that—"

"Can you demonstrate?" cut in Gilmore.

"Our system is open to you at any time you care to make an investigation. Our experimental receiving station is at Reno, and any party you name at that point will be put in connection with you. When do you desire a trial, Mr.—er—"

"This afternoon at three. Goodby," said Gilmore shortly.

Another call and another five cents gave him connection with the offices of the Marengo Telephone Company.

"What can you tell me about the Transplanetary Space Telephone Company?" he asked.

"Absolutely nothing," was the somewhat crisp response. "We are an operating company, with actual business to handle, and have no time to investigate promoters' schemes."

"But," protested Gilmore, "they claim wireless connections with Reno."

"Perhaps they have such connections."

"I believe," went on the inquisitive Gilmore, "that you have the only two lines to Reno, about two hundred miles. Do the Transplanetary people ever use those lines?"

"They never have and never will, sir! Good-day!" The receiver clicked, and Gilmore replaced it on its hook.

"Perhaps," he murmured, "you would profit by taking a little time to investigate promoters' schemes, especially when the particular promoter is Colonel Everard Powers. I wonder if his offer of a connection to Reno is a bluff?"

For a while he pondered the idea of calling on the Colonel in disguise, and putting his offer to the test. But another inspection of his pocket rather discouraged the thought.

"Two-sixty now," he mused; "I'll have to get busy if I'm going to eat tomorrow."

A luncheon reduced his hoard to two dollars and forty cents; but during its consumption he decided on his course. A few minutes later he was slowly following the line of poles of the Reno leads out into the desert.

"Lightning arrester and ground wire on every pole," he commented. He had carefully inspected eleven poles, without pausing, when a bright, silvery spot on one of the wires overhead caught his eye.

"Newly soldered connection," he muttered; "may be suspicious—may not."

He stared at the spot for a minute, then suddenly squatted at the base of the pole and closely examined the ground wire where it was connected to the ground rod. Something about the latter looked queer to him and as he tapped it with his knife, instead of the chink of metal it gave forth a dead, wooden sort of sound. He seized the ground wire and pulled vigorously. Another pull, and the cap came off the ground rod suddenly, revealing a pipe through which the wire continued down into the earth. Both the pipe and its cap were made, not of iron or copper, but of black fiber.

Gilmore was beginning to get interested. A ground rod made of insulating material seemed peculiar, to say the least. He stooped, and with a powerful effort drew it up out of the sand, rather to his own surprise. It was barely two feet long.

"H'm!" he panted. "I think there is a treasure chest buried here, waiting for me!"

Using his hands and the bit of fiber tube, he began digging. The loose, parched dust of the desert got in his eyes and nose, and ran back into the hole nearly as fast as he removed it, but in half an hour he felt something hard beneath his fingers. A few minutes later he opened a stout oak box about a foot square, and roughly tore from its inside two large, ironclad coils of insulated wire. Their removal revealed the end of an iron pipe that projected into the box from the side toward town. From the pipe protruded two wires.

"There's another of these machines about twelve poles out of Reno; but I think this one will settle the Colonel," he

said, as he triumphantly surveyed the dismantled apparatus.

He walked back to town with the confiscated coils, and hunted up the office of the Marengo *Mercury*. The evening edition was just going to press, but the advertisement clerk promised to insert a "personal" notice reading:

"Investors in Transplanetary Space Telephone stock will learn something of great importance by calling in person on Mr. Gilmore, Hotel Palace, at 9 this evening."

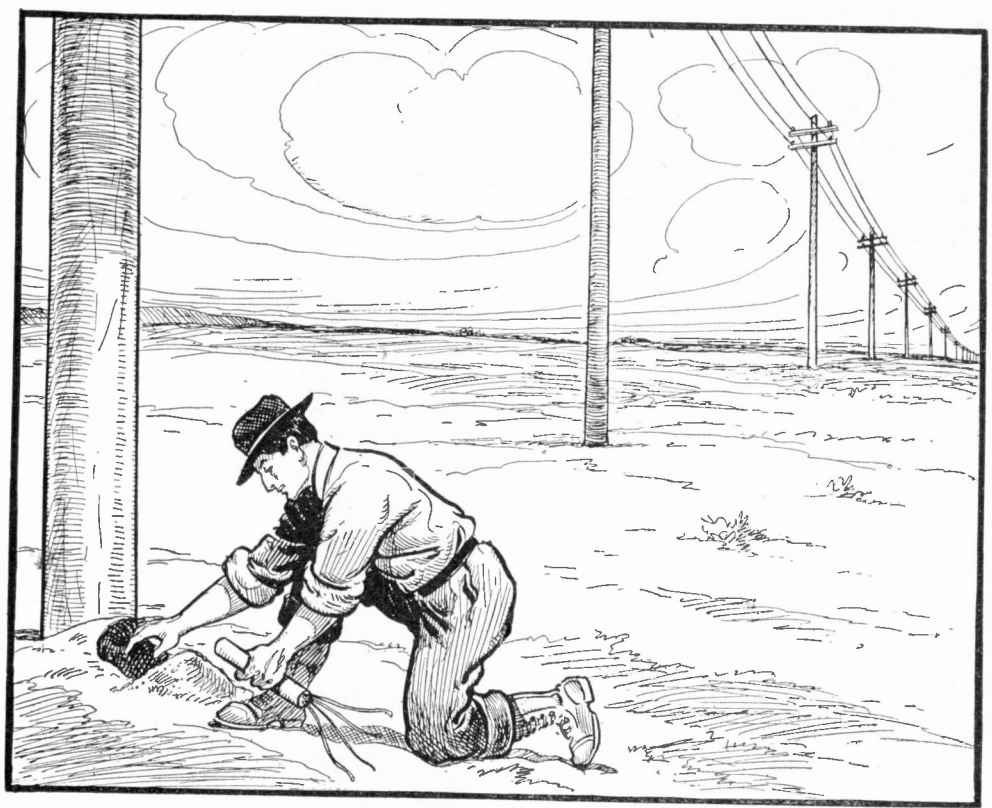
"Exactly!" said Dan, cheerily. "Up to your old tricks, eh, Colonel?"

Colonel Everard Powers straightened up suddenly.

"See here!" he said huskily. "I've got a good thing here. You spoil it and I'll—but hold on a minute. You're a telephone man, Dan. Come in with me, and you will have ten thousand in a week."

Dan smiled.

"I'm afraid the game is spoiled now, Colonel, even if I did want to become



HE UNEARTHED SOME IRON-CLAD COILS.

Then Dan Gilmore walked up the stairs over the assay office and entered the door of the Transplanetary Space Telephone Company without a hint of his former diffidence.

"Well, well, Colonel! I'm really glad to see you here!" he exclaimed heartily.

But the Colonel did not seem to share in the enthusiasm. His great body seemed to have shrunk down into his chair, and even his cigar hung limp and dejected from his half-open mouth.

"Dan Gilmore!" he gasped feebly.

your partner in crime," and he tapped the coils significantly.

The Colonel's face turned a livid purple, and he leaped from his chair.

"Sit down, Colonel, sit down!" said Dan coolly. "Ever since that little affair of yours in Chicago I have carried a gun handy, in case I should meet you. I have an item in the evening paper that will expose your whole scheme, and tomorrow you will be behind the bars."

The Colonel was speechless and seemed in danger of apoplexy.

"On second thought, though," said Dan, still smiling, "I ought to feel grateful to you. I came here looking for an honest job. Through you, I think I will get one. How much actual money have you taken in?"

"Not a cent; not a cent!" protested Powers, finding his voice suddenly. "If you think you can—"

"But you have subscriptions for stock," said Gilmore.

"Twenty-five thousand dollars," groaned the Colonel.

"All good?"

"As gold!"

"Now, Colonel, I'm going to be good to you. Pack your personal effects in a hurry, and vanish before the papers are out. No—stay a minute! You beat me out of the only thousand dollars I ever accumulated about a year ago. Pay me back a hundred and I'll call it square."

"I haven't but eighty dollars," said the Colonel.

Dan reflected.

"You will need a little," he said, "because I want you to get as far away from this town as possible, for the simple reason that I like the town, and think I will settle down here as one of its influential citizens. Give me fifty, and get out. I appoint myself receiver for the Transplanetary Space Telephone Company. Now get!"

At a quarter to nine that evening the clerk of the Palace Hotel began to receive inquiries for Mr. Gilmore. A bellboy piloted the visitors up to the biggest room in the house, where Dan Gilmore, attired in a well-fitting, new business suit, met them. At nine o'clock he had to send for more chairs. By nine-thirty the room was filled with the business men of the town, who met each other with some surprise.

"Gentlemen," said Dan Gilmore, "I am a telephone man of long experience, and first I want to congratulate you upon the excellent system with which your town is provided. The Marengo Telephone Company owns a property that for efficiency and excellence of construction I have seldom seen equalled. I predict that its stockholders will soon begin to reap very large rewards.

"In your other institution, the Transplanetary Space Telephone Company, I have today unearthed fraud and deception of large dimensions. I am prepared to prove that the demonstration circuit of the company to Reno, claimed to be wireless, was stolen from the Marengo Telephone Company through the surreptitious use of its splendid long-distance lines.

"As receiver for the wireless concern, gentlemen, I hold your stock subscriptions for twenty-five thousand dollars. This money I have saved to you from absolute loss. You have but to say the word, gentlemen, and these stock subscriptions will be returned to you. But you intended this money for investment. You were promised perhaps fifty per cent, without any proof. I offer you ten per cent, at par value, in an institution that is yours, and that you ought to be proud to have a part in. Tomorrow I will call upon each of you with your shares of stock in the Marengo Telephone Company, which thus becomes the strongest telephone company in this part of the country. Gentlemen, I thank you."

When the excitement and the questioning subsided, Gilmore found that he had sold twenty thousand dollars' worth of stock. To the few dissenters who made up the other five thousand he returned their subscriptions. Then he went to bed and slept the sleep that follows a good day's work.

The next morning, shaven, brushed and polished until he looked "fresh from New York" as the clerk remarked, he entered the offices of the Marengo Telephone Company. As he passed the newspaper office he thanked his stars that the *Mercury* did not get out a morning edition.

Mr. Daniel Gilmore of Chicago, capitalist, created quite a sensation in the telephone office. And when he announced that he was so well pleased with the plant that he intended to invest twenty thousand dollars in stock of the company at seventy dollars a share, one might almost have imagined tears in the eyes of those excellent people.

"And by the way," said Mr. Gilmore, "as I intend to remain here, some minor connection with the actual work of the company, enough to keep me occupied, would be acceptable, if convenient to you. I am an old telephone man."

The officers looked at each other.

"Would you care to accept the position of manager?" asked the president tentatively. "We intend to install a third long distance line to Reno soon, as the traffic is too heavy for the two we have; and we really need a man like yourself to see that everything is properly taken care of."

"Why don't you install a phantom circuit on the two you have at present?" asked Gilmore. "Your present lines are first-class, and in that way you will secure your three circuits without any new construction work."

The officers shook their several heads.

"We tried that only a month ago, Mr. Gilmore," said the secretary, "but the phantom apparatus would not work. Do you know of any case where such a circuit has operated successfully?"

Gilmore grinned.

"The last bit of telephone work I did was to inspect a very successful phantom circuit, over the same length of line as yours," he replied. "As to its working—I have a couple of phantom coils at the hotel that I will donate in honor of my new position with you; and I'll guarantee they will work!"

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.

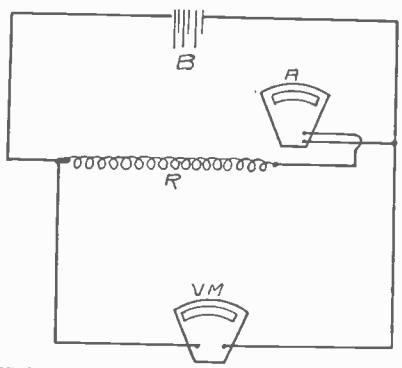
COMPOUND DYNAMOS; MEASURING BATTERY RESISTANCE.

Questions.—(A) What is the difference between an over compounded and an under compound dynamo? (B) What are the uses of each? (C) How can the internal resistance of a battery be measured?—N. G. B., Marlboro, Mass.

Answers—(A) In a compound wound machine each field magnet is wound with two separate coils, one of a few turns of heavy wire in series with the armature; the other, a shunt, consists of many turns of fine wire connected across the brushes. The shunt winding is proportioned to bring the voltage up to normal with no load. Then as the load comes on, the increasing current through the series winding and out to the line increases the field excitation in proportion as the load comes on and maintains the pressure constant across the brushes. Such a machine is compound wound. If this series winding is of enough turns to raise the voltage above the normal as the load comes on, such a machine is over compounded. If, on the other hand, the series turns are not sufficient to keep up the normal voltage as the load increases, the machine is under compounded.

(B) Compound dynamos are used in isolated plants and small central stations where automatic regulation is required, and are generally employed in electric railway houses where voltage fluctuation is considerable owing to changing load. Over-compound dynamos are used where it is necessary to generate somewhat above the normal voltage in order to deliver normal voltage at some distant point.

(C) The internal resistance of a cell is difficult to measure. The voltmeter—



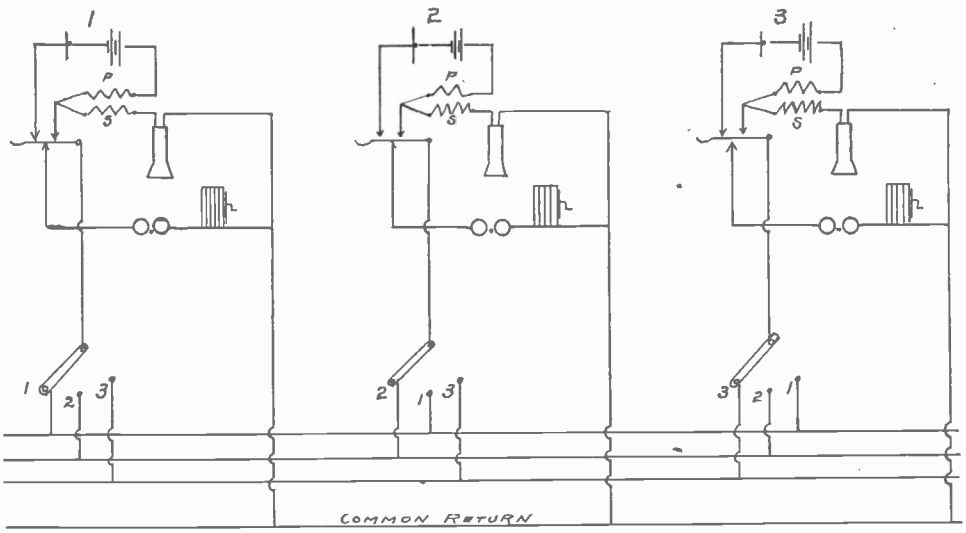
METHOD OF MEASURING BATTERY RESISTANCE.

ammeter method shown in the diagram is considered good, letting the battery replace (R). The voltmeter reading will be the drop over the ammeter and (R). The resistance of the ammeter must be known, then by Ohm's law, (C) times resistance of the ammeter equals the drop over the resistance of the ammeter where

(C) is the ammeter reading. Hence to be correct $R=\frac{E-(C \times \text{Am. res.})}{C}$. The drop over the ammeter is small and in every day work this correction may be neglected; then $R=\frac{E}{C}$.

HOUSE SYSTEM TELEPHONE CIRCUITS.

Question.—I have started to put telephones in our mill—one in the office and five in different parts of the mill. I wish to arrange so that the office can call any one of the five by using a switch, and also so that any one of the five can call the office without interfering with the other four.—R. K., Haledon, N. J.



HOUSE SYSTEM TELEPHONE CIRCUITS.

Answer—Arrange circuits as shown in diagram except that you should provide six separate wires, preferably in cable form, and a common return. With this arrangement and a six-point switch any telephone may call any other without interfering with the others, but care must be taken, when through talking, to place the switch on the home button for a future call.

TRANSFORMER; STORAGE BATTERY CHARGING.

Questions.—(A) How can a transformer be made that will step six volts direct current up to 10 or 12 volts. (B) can dry batteries be used for charging the storage battery described in the February issue, 1909.—R. L. N., Tilton, N. H.

Answers.—(A) Transformers can be used on alternating current only.

(B) They could be used but the process would be very costly.

SPARK COIL OPERATED FROM DYNAMOS.

Questions.—(A) Would a dynamo having two field coils, a six segment commutator and a twelve slot armature run a spark coil? (B) Would an eight segment commutator and eight slot armature do the work? (C) Could I use a magneto to operate a spark coil having a vibrator?—W. O., Grand Park, N. Y.

Answers—(A) and (B). Yes, though the current would be somewhat unsteady.

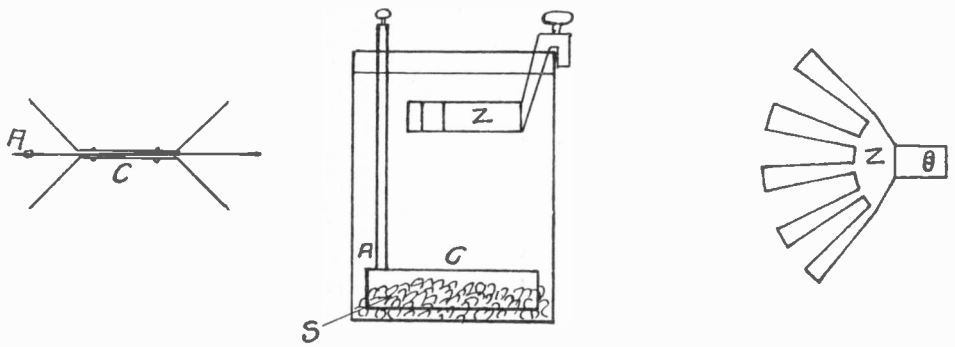
(C) No. The ordinary magneto generator is wound to give alternating current at high voltage and little current.

MOLDING CARBON.

Question.—Can powdered carbon be molded into sticks or cylinders, and if so how?—W. C., Rochester, Ill.

Answer.—Briefly, coke is crushed to the size of coarse gravel in a mill for this purpose. It is then placed in retorts, heated 30 to 40 hours to a white heat, then cooled. The solid so formed when cool is ground and bolted like corn meal so as to separate the coarse from the fine. Next, coal tar pitch is ground fine like the coke. These two are carefully

mixed (in which process lies the secret) in a revolving barrel kept at 300° F. The mixture left to cool for 12 hours becomes so solid that it is again pulverized. Into hot molds the pulverized material is poured, heated again for a short time to 300° F., then the molds are subjected to great pressure. The molds are then opened and carbons attached to each other by "fins" are taken out, placed in fine sand in a furnace and heated for 96 hours. The cooling requires 48 hours. The carbons are now uncovered, sorted and sent to the plating room to receive the copper coating that you see on arc lamp carbons.



CROWFOOT OR GRAVITY BATTERY.

CROWFOOT OR GRAVITY BATTERY.

Question.—Please give directions for making a crowfoot or gravity battery.—H. H., Kansas City, Mo.

Answer.—See sketch. The copper (C) is made of thin leaves of the metal riveted together as shown, having an insulated wire attached at (A). The zinc (Z) may be of any shape but is usually as shown. For a jar six inches in diameter and eight inches high use a three-pound zinc and three pounds of copper sulphate (S). Fill the jar with water. This cell should always be left working on a small resistance. When not in good condition the blue solution will rise and copper will be deposited on the zinc. The voltage is 1.07 and the current one-half ampere.

DRY BATTERY CONSTRUCTION.

Questions.—(A) Are not all dry cells packed solid with powdered carbon and manganese dioxide, to which is added a small amount of material other than moistening with the battery solution? (B) Is it not the function of carbon and manganese to act as conductors? (C) Does the saline solution act chemically on the manganese? (D) Is not the electricity produced by the corrosion of the zinc by the solution, and not by action on the manganese? (E) Sand and sawdust on top must become damp; do they not tend to short circuit to some extent?—J. M. McM., Port Townsend, Wash.

Answers—(A) Authorities agree in the use of battery solution for moistening except that some manufacturers use trade secret binding substances. The powdered carbon and manganese are moistened and stirred until no longer dusty.

(B) The carbon acts as a conductor and electrode, and the manganese is a depolarizer.

(C) No.

(D) The chemical action in the cell is as follows: When the circuit is closed the zinc (Zn) displaces ammonium (NH_4) in the solution forming zinc chloride (Zn Cl). The ammonium breaks up into ammonia gas (NH_3) which either unites with water or escapes, and frees hydrogen (H) which is liberated at the surface of the carbon. Without the manganese the hydrogen would soon collect on the carbon, but with the manganese rich in oxygen the hydrogen takes up oxygen and forms water (H_2O).

(E) Some moisture as an electrolyte is essential to the operation of the cell.

WINDING SMALL A. C. ARMATURE.

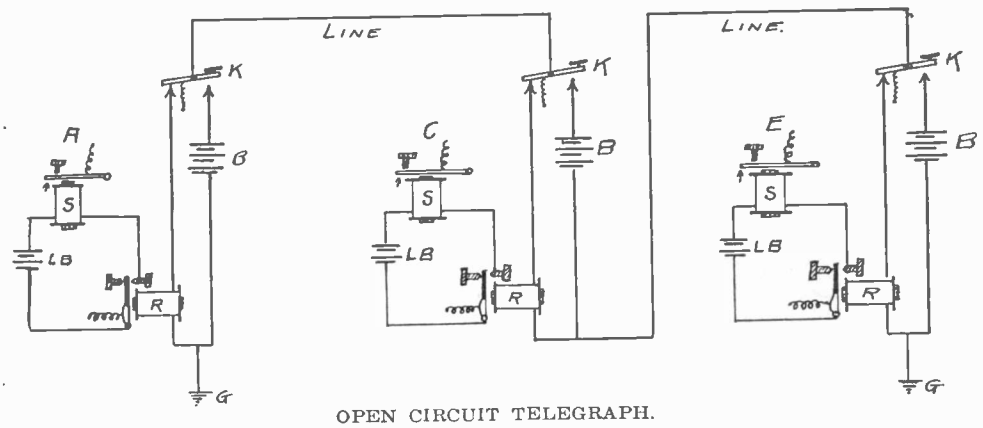
Question.—How may I wind a one-eighth horse-power motor armature for operation on alternating current?—P. C., Newkirk, Okla.

Answer—See answer to question (B) of F. E. B., Mendota, Wis., and also to M. B., Superior, Wis. March issue, 1909.

OPEN CIRCUIT TELEGRAPH SYSTEM.

Question.—How should I connect a telegraph line consisting of three instruments on an open circuit with only one main wire? L. R. D., St. Johnsburg, Vermont.

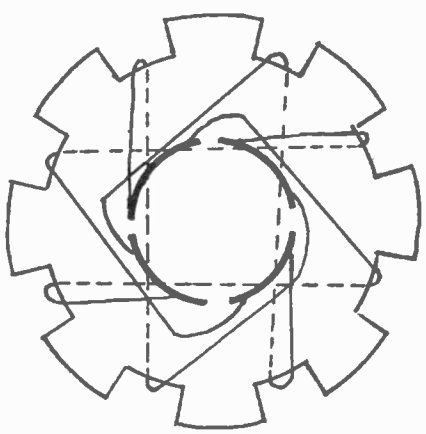
Answer.—The diagram shows three stations (A, C, E), keys (K), sounders (S), relays (R), local batteries (L B), main line batteries (B), and grounds (G). When not in operation all batteries are on open circuit.



OPEN CIRCUIT TELEGRAPH.

WINDING A 75-WATT DYNAMO.

Question.—Please tell me how to wind a drum armature of a small 75-watt dynamo.—T. F., So. Whitely, Ind.



DYNAMO WINDING.

Answer.—We assume two field magnet coils in shunt, diameter of armature two-thirds of the length, and eight slots. Use eight ounces of No. 20 B. & S. gauge double cotton covered wire on armature and four pounds of No. 20 B. and S. gauge on field magnets. Wind as in diagram.

ELECTROPLATING.

Questions.—(A) What capacity dynamos would it take to operate a 64 gallon copper solution to deposit on one-half dozen plates 18 by 25 inches? (B) What are the ingredients and quantities in the above bath?—D. W., Reading, Pa.

Answers—(A) Current of 15 to 18 amperes per square foot at six volts or less works most satisfactorily for copper.

(B) Fourteen per cent copper solution, two or three per cent sulphuric acid, and distilled water or filtered rain water.

A cyanide solution much used on iron, brass, and steel is made as follows: Pure potassium cyanide, ten ounces; potassium carbonate, two ounces; copper carbonate, five ounces. For each gallon of water use quantities above noted, dissolving nearly all of the potassium cyanide in part of the water, then adding copper carbonate which has been dissolved in the water. Now dissolve the potassium carbonate in water and add to the above solution while stirring. Use copper anodes and a weak current with this solution.

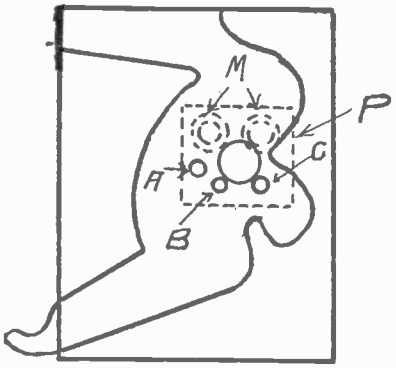
AN ELECTRIC CANNON.

Question.—How can I fire a small muzzle loading cannon by electricity?—R. W. Y., St. Joseph, Mo.

Answer—See answer to C. D. in March issue. A modification of this arrangement to suit your cannon, with wire tips at or in the touchhole of the gun will fire it.

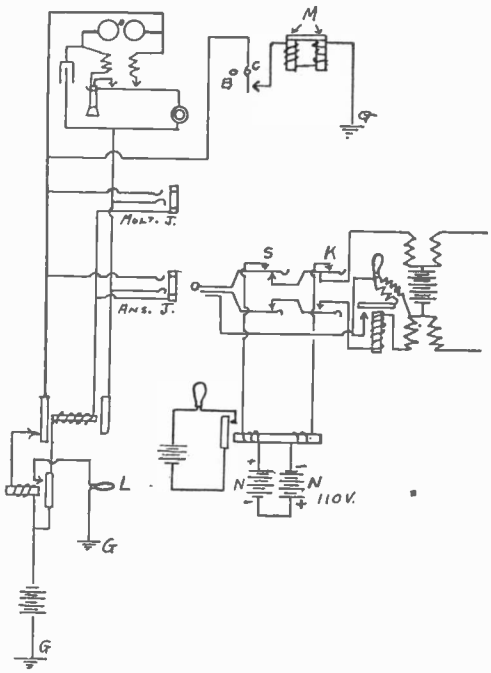
THE NICKEL TELEPHONE.

Question.—Would you give diagram of connections used in Chicago five-cent telephones?—W. H. S., Chicago, Ill.



NICKEL IN THE SLOT MECHANISM.

Answer.—Referring to both diagrams, the coin when deposited strikes projection (A) and drops between projections (B) and (C). This places a ground on the line through magnets

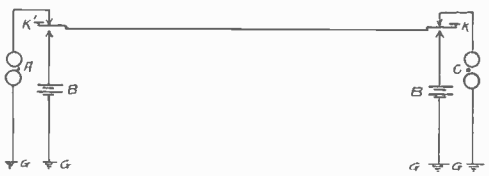


CONNECTIONS OF A NICKEL TELEPHONE.

(M) and lights lamps (L). This current is so small that magnets (M) will not operate. The operator answers by inserting answering plug, cutting off signal lamp (L) and talks to subscriber. If party called answers, the operator presses key (K) sending 110 volts through magnets (M) and (C) is drawn back and coin falls into box. (B) and (C) are fastened to a flat plate in front of (M). If party does not answer, key (S) is pressed, sending 110 volts in the opposite direction through (M) withdrawing (B) and allowing coin to fall out of box. In case a coin is dropped into box while another is still in place it rolls over coin and (A) and returns to party calling.

SINGLE WIRE SIGNALING CIRCUIT.

Question.—Is it possible to have a single-wire signaling system between two points consisting of a push button switch, bell, and battery at each end so arranged that when circuit is closed at (K'), bell will ring at (C) only, and if switch is closed at (K) bell will ring at (A) only.—F. C. L., Cleveland, Ohio.



SINGLE WIRE SIGNAL CIRCUIT.

Answer.—See self-explanatory diagram.

ARC FURNACE.

Questions.—In an arc furnace I use lamps for resistance. These are too expensive and short lived. My current is 115 volts, 60 cycles and I wish to draw six or eight amperes. (A) I should like to use iron or steel wire. (B) In furnace shown in the February number is there any way to empty the crucible while hot, because in taking it up with forceps the lower carbon comes out, leaving a hole in the bottom.—W. M., Salt Lake City.

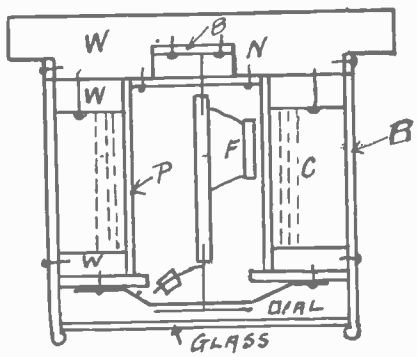
Answers.—(A) The resistance of one 32-candlepower lamp is 108 ohms. You are using eight in parallel placed in one lead to arc. The total resistance is then 13.5 ohms. No. 14 B. & S. gauge iron wire might be used but 725 feet would be necessary to give 13.5 ohms resistance. A high resistance wire such as German silver, or ferro-nickel, would be better. See answer to J. B., February issue.

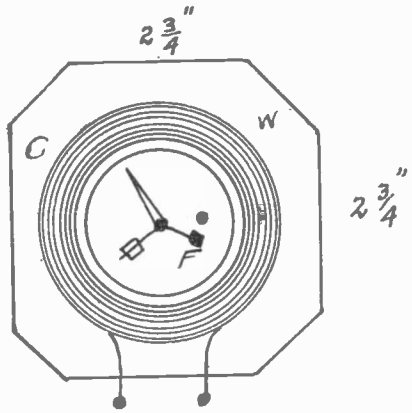
(B) No, unless the lower carbon is not fastened to base and is attached to an insulated flexible conductor.

TO MAKE AN AMMETER OR VOLTMETER.

Question.—Please tell me how to make a simple ammeter.

Answer.—Secure a piece of brass wire ⅛ inch thick and 1⅜ inches long. In





AMMETER OR VOLTMETER.

each end make a hole 3/16 inch deep with a needle drill. Cut the heads off two pins and solder in each end, these pins to act as pivots. Referring to drawings, make a bobbin of paper 1/16 inch thick (P), 1 5/16 inches in diameter and 1⅜ inches long. Parts marked (B) are brass, and those marked (W) are wood. To the brass shaft solder a piece of soft iron (F). In the base (N) and through the brass plate drive an iron nail. For a voltmeter, wind on No. 36 cotton covered wire until bobbin is nearly full. For an ammeter try 12 turns of No. 14 wire and vary until a full scale deflection is obtained. As a voltmeter the instrument will read 20 volts. As an ammeter full scale deflection is made by four amperes. When current is passed through the coil the nail and soft iron bar repel each other as both are magnetized.

DYNAMO WILL NOT RUN.

Questions.—I have made a dynamo with field magnets of the Edison type. The armature is laminated with 12 round slots. The armature is wound in diametrically opposite slots until they are full. (A) Is the winding correct? (B) Why will the dynamo not generate or run as a motor?—V. F., Watseka, Ill.

Answers.—(A) The winding is correct.

(B) This is a most difficult question to answer and requires a noting of numerous possible causes. We suggest that you look up the following: Wrong winding of field magnets; residual magnetism of the field magnets may be of wrong polarity; in small dynamos the average resistance is very easily computed too low, or a mistake made in gauge of wire; mistake in connecting armature winding to commutator; too wide an air gap; break in field or armature coils; a shunt dynamo will not "build up" with a low resistance in the outside circuit.

ELECTRO MAGNET WINDING.

Questions.—(A) I wish to make an electromagnet using a core three inches in diameter by four inches in length. What size and quantity of wire should I use to get the strongest magnet from the use of 20 cells of dry battery? (B) Can I use this magnet on a lighting circuit of 110 volts by reducing to 39 or 40 volts?—F. B., Excelsior Springs, Mo.

Answers.—Use ten layers of No. 20 B. and S. gauge double cotton covered wire.

(B) Yes.

RING WOUND ARMATURE.

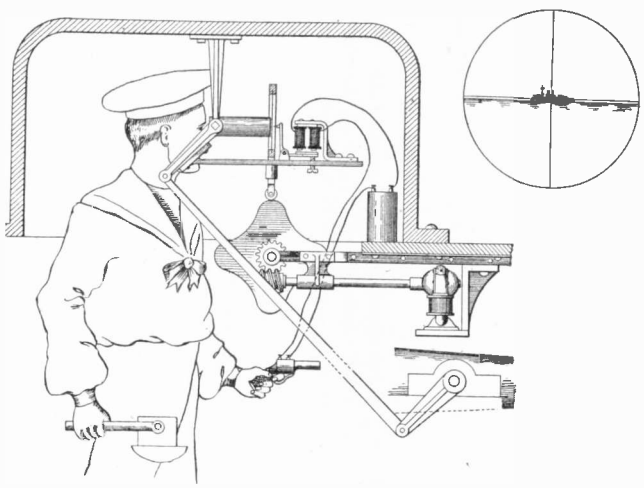
Question.—Will you tell me how much and what size wire to wind on a dynamo armature three inches in diameter and one and three-quarter inches long?—M. C., Louisville, Ky.

Answer—Assuming from dimensions that your armature is of the ring type, allow the field winding to remain, and use at least nine ounces of No. 20 wire. Ring armatures should not be wound more than three layers deep.

NEW ELECTRICAL INVENTIONS.

SIGHTING BIG GUNS.

In sighting practice with the big turret guns on battleships, without actually firing the guns, it is customary to provide miniature targets which are suspended in front of the guns and moved up and down. A small gun is attached to the large gun, so that the bullet from the former will strike the target at the point aimed at by the large gun. The gun captains obtain practice in sighting and aiming the guns by aiming the large gun at the moving target and then firing the small gun when the sight bears on the desired point, the bullet mark in the target indicating the accuracy of the aim.



SIGHTING APPARATUS FOR BIG GUNS.

In other devices, called "dotters," an electromagnetic marking device is arranged when actuated to make a dot on the target, and the gun captain is provided with a firing-pistol, which closes the electric circuit by which the electromagnetic marking device is actuated. Devices of this kind are very valuable in instructing men to fire correctly and to follow a moving target, but they require several men to work them. A further objection is that they cannot well be used in windy weather.

By employing a system recently patented by Bradley A. Fiske, of the United States Navy, it is said a gunner can practice sighting and firing by himself without requiring the assistance of others, and the use of the apparatus is not dependent upon the condition of the weather or the steadiness of the ship.

In accordance with his plan a sighting tube is arranged to be moved in the movement of the gun, and a target picture, seen edgewise in the cut, is placed in close proximity to the front of the sighting tube, this picture being independently movable. An electromagnetic marking device, the circuit of which is closed by the pistol-like device in the gunner's hand, is arranged to mark the target at the point aimed at by the sighting tube, the electromagnets pulling up one end of a right-angle lever on the other end of which is a sharp point which punctures the picture.

The picture is seen in the sighting tube which is provided with cross-hairs whose junction mark any spot aimed at by the tube. The picture is also mounted so that it may be moved up and down with a wave-like motion to make it more difficult for the gunner to bring the junction of the cross-hairs on any particular spot on the picture.

In the gunner's right hand is shown, diagramatically, the lever for controlling the motions of the gun.

The operation is simple. The gunner looks through the tube and marks some point on the pictured battleship he wishes to pierce. He then moves the gun controlling lever, elevating and depressing the gun, which also moves the sighting tube correspondingly, until the cross-hairs fall upon the point selected, then he pulls the trigger puncturing the picture at the point where the cross-hairs bisect. If his aim be good the puncture will be at

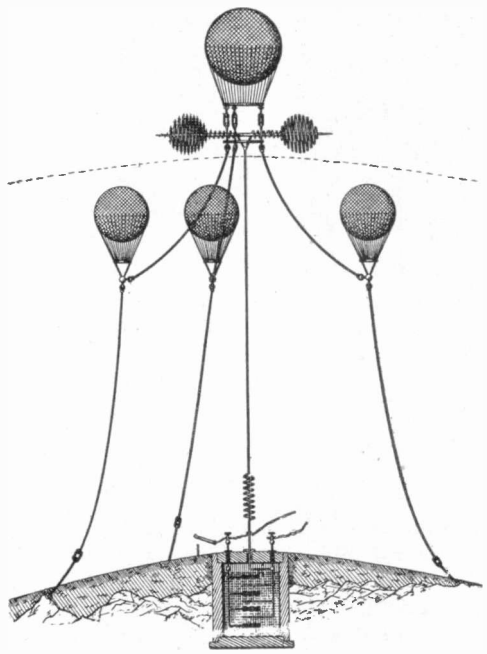
the point on the picture at which he aimed. At the same time he has gone through the actual movements of manipulating the gun.

COLLECTING ATMOSPHERIC ELECTRICITY.

It has been the dream of many inventors to devise some means by which the electricity in the atmosphere might be collected and utilized in the service of man. It is the opinion of many that vast quantities of electricity are present in the high altitudes or even in the regions of infinite space beyond the earth's atmosphere. Among the latest methods proposed is one patented by Walter I. Pennock of Philadelphia. In the words of the inventor the scheme relates to "a method of collecting electricity from a strata laden with electricity at high altitudes in the atmosphere, through the medium of a wire cable suspended from one or more balloons and in conveying this electricity to the earth's surface."

According to this inventor's theory the passage of the electrical current to the earth under ordinary conditions is prevented by an obstruction afforded by the dense lower strata of the atmosphere, which is a bad conductor of electricity, as shown by the electrodes of an ordinary static machine. When the electrodes are placed close together, the atmosphere is seen to carry the current across from one electrode to another, but if placed far apart the current is obstructed by the intervening air. The dense lower strata of the atmosphere affords one of the best non-conductors of electricity, as shown in the conduction of the electric current by telegraph, or trolley wires on the earth's surface, where only a small quantity of the electric current escapes through the atmosphere; while rarefied atmosphere affords a good conducting medium, as shown by the vacuum tube. The upper strata of the atmosphere being rare in proportion to the attitude, and being a good conductor of electricity while the lower strata of the atmosphere being dense and affording a non-conducting medium for the electric current, thus causes an obstruction to the electric current, or power in its passage to the earth's surface from the electric strata of the atmosphere under ordinary conditions.

When, however, the clouds of a thunder storm pass over the surface of the earth, these clouds being of very great height, the moisture in the clouds forms a better conductor of electricity than does the dry air, with the result



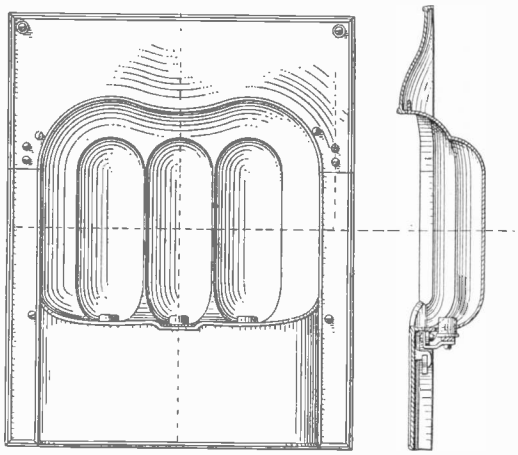
PROPOSED PLAN FOR COLLECTING ATMOSPHERIC ELECTRICITY.

that the electricity in the upper strata of the atmosphere breaks through the cloud as a streak of lightning and in that form reaches even to the earth's surface, while the thin or shallow strata of clouds, observed in the so-called "settled rain" storm, do not extend upward to a sufficient height to form a conducting medium for the electricity from the electric strata to the earth's surface. For this reason there is usually no lightning during the latter variety of rain storm.

The principle of the proposed electricity collector consists in elevating high up in the rarefied atmosphere, by anchored balloons, a sort of spiral collector with many sharp points. From this a wire passes down to earth and charges an electric accumulator.

AN ELECTRIC FIREPLACE.

This device consists of a frame or panel adapted to fit into an ordinary fireplace or grate. This frame is of metal and is provided with several polished concave recesses or reflectors. In front of these are placed long tube-like incandescent lamps of special design, not shown in the cut, which are adapted to

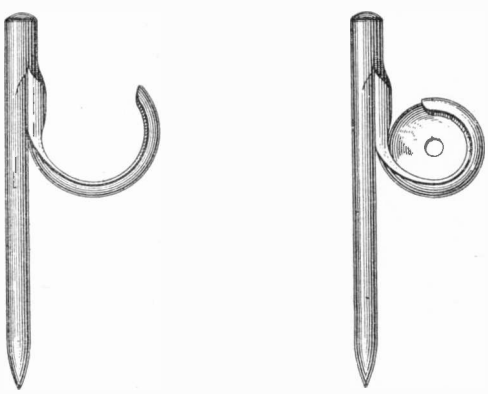


ELECTRIC FIREPLACE.

radiate a large amount of heat. The lamps are screwed into receptacles in the base and when they are burning will heat a good-sized room and at the same time give out a soft, pleasant light. The inventor of the device is Alfred D. Rathbone of Grand Rapids, Mich.

INSULATOR FOR TELEPHONE WIRES.

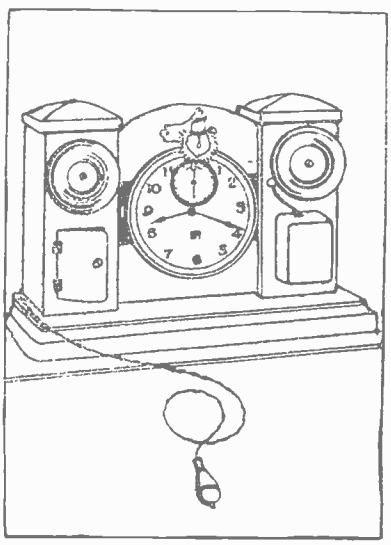
For attaching telephone and telegraph wires to walls, posts, trees, etc., the insulator shown in the diagram possesses some desirable features. The insulator comprises a spike adapted to be driven by a hammer into the mortar between bricks in a brick wall or into trees or into frame structures, and on one side of this spike there is formed a clip adapted to embrace and hold an insulating button or washer. The button, which is pierced in the center to hold the wire, is placed in the clip, which is then bent around it. The device is the invention of George B. Marshall, Shannon, Tex.



INSULATOR FOR TELEPHONE WIRES.

ELECTRIC ALARM CLOCK.

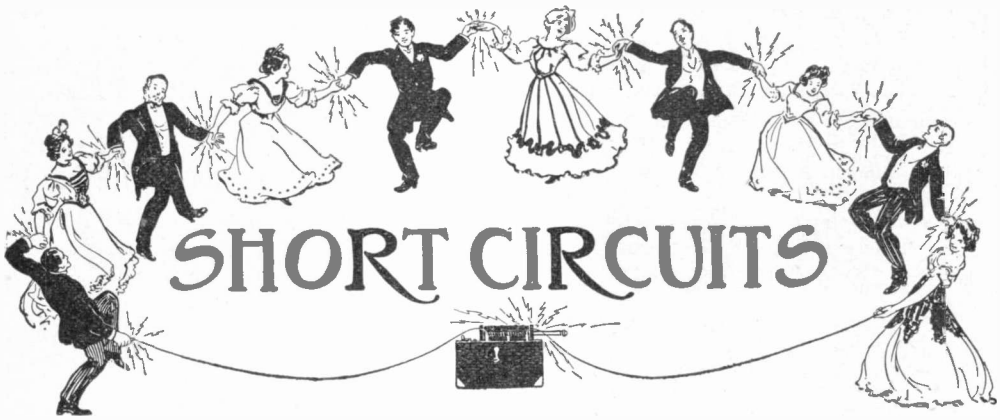
A new type of alarm clock is shown in the diagram. It is fitted with an electric lamp so placed as to illuminate the dial. This lamp is controlled by a push button on the end of a cord, which may be long enough to extend to the bed, so that the time may be ascertained without getting up. At the right of the clock is the usual alarm bell which may be set



ELECTRIC ALARM CLOCK.

to go off at any predetermined time. At the left is a bank for valuables which is so arranged that if it is tampered with the alarm will ring.

Competent engineers estimate that there is 2,000,000 horse-power which could be easily developed from water-power in this country. This would save annually 225,000,000 tons of coal.



Heard at the lunch counter: "Hey, waiter! I thought I ordered pork and beans. Where is the pork?"

"Excuse me, sir, but there it is, just behind one of the beans."

* * *

Weary (dejectedly): "Dey'se always inventin' useless tings, like de horseless wagon and de wireless telegraph. Why don't dey do sompin' for us poor hoboes. Give us a toothless bulldog."

* * *

Her waist begins just below her neck. Her hips have been planed off even with the rest of her body. She is usually buttoned up the back, and around her neck she wears a section of barbed wire, covered with lace. She wears on her head a blonde haystack of hair, and on top of this a central dome with rings about the same size as those of Saturn. She is swathed in her gown like an Indian papoose, and on the ends of her feet are dabs of patent leather. She walks on stilt-like heels with the expertness of a tight-rope dancer. The pores of her skin are full of fine white powder.

This is a Woman.

* * *

"Porter."

Thus the passenger for London hailed a railway servant at a small Scottish station.

"Yessir?" The man instinctively held out his hand.

"Do you think this parcel well enough tied to trust going in the van?"

"Weel, I'll see," answered the porter, dropping the parcel with a bang. "She'll get that here, and she'll get that at the junction."—giving it another drop—"and she'll get THAT at Perth!"—banging it so lustily that all the contents scattered over the pavement. "Weel, sir, if she be goin' farther than Perth, she'll nae do whatever!"

* * *

The telephone engineer was approached by a friend not posted in the science of telephony who asked: "Say, Bill, what are these sound waves I hear about?"

Without the least hesitation the engineer answered: "If you were familiar with the definition of the two words you would not ask such a foolish question, and I want you to remember every word so if anyone asks you the question you can answer it.

"As you perhaps know, silence in action is sound in motion. Sound and silence, then, belong to the order of dual substance in unity. This phonic unity is an independent, imponderable, phonic, chrystoplastic, suisysmoris which cannot be divided or destroyed. It resides in all non-metallic atoms, which are not only part with it, but transmit, reverberate and absorb it, and——" but the friend had gone.

Now, Mr. Editor, what I want to know is this: Was the definition of the first word correct?—Stephen Huckelheimer, Podunk, Mo.

Poeticus—"I wish to publish my poems, but have so many irons in the fire that I haven't been able to do it."

Cynicus—"Why not put them in where your irons are?"

* * *

"The members of the Women's Rights Society held their semi-annual meeting in the towr hall yesterday, and during the president's address it was so quiet you could have heard a coupling-pin drop."

* * *

The cross-eyed man was watching the activity of Niagara. "What a big waste!" he remarked to his friend.

The very stout lady standing near-by looked at him angrily. "Mind your own business!"

* * *

Goldstein and Abrahams with their wives were in a railroad wreck. Goldstein got $1,000 damages and Abrahams $2,000.

"Abrahams, how did you get two tousand dollars vile I got only von?"

"Dot is simple," said Goldstein, "I had de presence of mind to kick mine vife in de face."

* * *

A waiter on a B. & A. buffet car told me confidentially that the chef couldn't fry my eggs, "cause, suh, de road am dat rough, dem eggs 'd scramble 'fo' you know'd it."

* * *

An eastern college graduate applied for work in a Michigan lumber camp. He was told to get busy on one end of a cross-saw, the other end being in charge of an old and experienced lumberman. At first all went well, but at the end of the second day the young man's strength began to wane. Suddenly the old man stopped the saw and spat.

"Sonny," he said, not unkindly, "I don't mind yer ridin' on this saw, but if it's jest the same to you I wish you'd keep yer feet off the ground."

* * *

"I tell you I won't have this room," protested the old lady to the bell boy who was conducting her. "I ain't a-goin' to pay my good money for a pigsty with a measly little foldin' bed in it. If you think that jest because I'm from the country——"

Profoundly disgusted, the boy cut her short. "Get in, mum. Get in." he ordered. "This ain't yer room. This is the elevator."

* * *

The junior partner of the Wall street firm was slightly indisposed and the senior partner was calling him up every three minutes.

"Why do you telephone so often?" inquired a friend.

"Well, his temperature fluctuates considerably and some of my customers are speculating on the fluctuations."

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 when 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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You have no ***right*** to be sick. Pain, suffering and disease are unnatural, they are ***wrong.*** It is your ***duty*** to be well. Don't try to *stand* pain—***CURE IT.*** No matter *what* ails you—even if others have told you that your case was *incurable—DON'T GIVE UP HOPE.* The great natural forces, *Vibration and Electricity,* are curing more people today *than all the drugs and doctors in the world put together.*

THE WHITE CROSS ELECTRIC VIBRATOR combines *both* of these great natural curative agents. It gives you your choice of Vibration, Faradic and Galvanic Electricity, either separately or in combination, just as you wish. It relieves pain *instantly,* and its *cures are permanent.*

The White Cross Electric Vibrator cures the *cause* of disease. It sends the rich, red blood leaping and coursing through your veins and arteries *straight to where the disease begins.* It tones up your nerves and muscles and every vital organ. It makes you *fairly tingle with the joy of living.*

Don't neglect the FIRST symptoms. If you feel "run down," "out of condition," if you just feel "out of sorts" generally, *something is wrong.* The *most serious* diseases creep upon you unawares. *The White Cross Electric Vibrator* fills your body *so full* of vigorous, robust health that pain and disease cannot find a foothold.

VIBRATION FOR THE RACKING BACKACHE OF WOMEN

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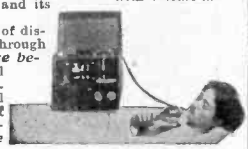

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Besides, this book tells you all about the wonderful *White Cross Electric Vibrator*—what it has done for thousands of others and what it will do for you. It tells you about the *very special offers* which we are making, *for just a short time,* on this wonder-working instrument, and how you can get a *White Cross Electric Vibrator* on a *genuine free trial.* Your name and address brings this intensely interesting book by return mail. Sign the coupon and mail it to us at once.

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Indigestion	*Stomach Trouble*
Rheumatism	*Scalp Disease*
Neuralgia	*Constipation*
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With the *White Cross Electric Vibrator,* you can transform any ordinary household chair into a Vibrating Chair, equal *in every respect* to those used in the big hospitals and sanitariums. You can give yourself the same treatments, including the *famous Swedish Movement* treatments, that specialists and sanitariums charge $2.00 to $3.00 apiece for. This is only one of the many marvelous things that can be done with the *White Cross Electric Vibrator exclusively.*

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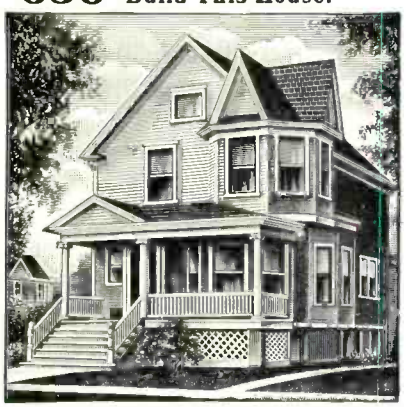

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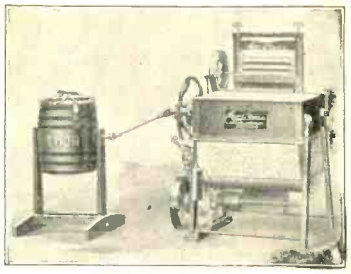

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