Popular Electricity
In Plain English

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The Electrical Factor in Grand Opera Productions

By MAURICE ROSENFELD

Traditions of the operatic stage pertain to the interpretation more than to the production of opera. In other words, the mechanics of the elaborate paraphernalia of the scenic investiture of grand opera have kept pace with the progress of the applied arts and sciences, and the properties (stage utensils), scenery and lighting devices have made remarkable advances since the time of the Greek chorus, when much that was neither heard nor seen by the theater audience had to be imagined.

Electricity, undoubtedly, of all scientific improvements utilized on the stage today, is the most important factor in representations not only of the drama but of grand opera as well.

The illusions of the stage are not merely imagined today; they are made more realistic and are brought to a more artistic perfection than ever before in the history of histrionics and in the more elaborate field of grand opera, represent the ingenuity of the stage electrician and the stage mechanician.

Grand opera is the co-ordination of drama and music, or perhaps it should be music and drama. The composers and librettists of these works invariably select such subjects which in the first place are of vital dramatic interest, and are of mythological, historical, fanciful or picturesque origin. The locales of their texts give both the composer and the poet the greatest scope for the expression of their imagination, as well as the exercise of their musical and dramatic gifts. As in most operas there are various transformations, sometimes gradual and again sudden, of the different divisions of the day and night, the "lights" upon the stage play a very important part in the enfoldment of the plot of the opera.

In the days of lamps and candles naturally not much could be done in the way of faithful stage representation as far as artistic lighting and such detailed effects as gradual changes from darkness to light, sunshine, or vice versa, could be accomplished, and therefore the audience was naturally lenient in regard to the lighting of the stage and the scene. And then the real opera goers of 50 years ago, and even of earlier

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Henry Walter Young, Editor

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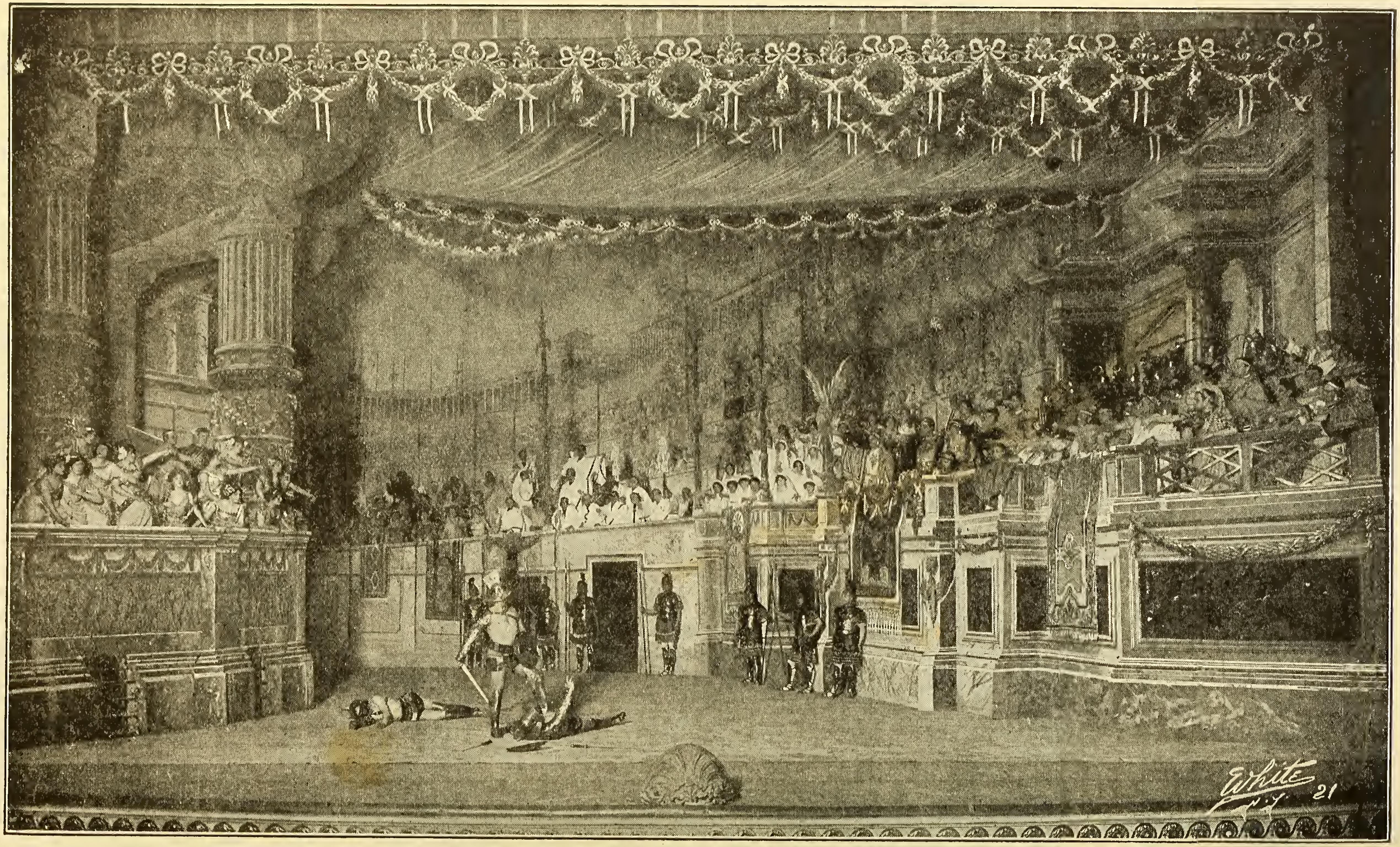


THE BATTLE OF THE GLADIATORS BEFORE NERO—THE FAMOUS ARENA SCENE IN QUO VADIS AS PRODUCED BY THE CHICAGO GRAND OPERA COMPANY operatic performances, cared little about how the operas were scenically produced, so long as the vocal and instrumental essentials of the works were well given.

Most of us can recall our own childish amateur theatrical performances which were often given in a barn or a cellar, when Thermopylæ was held against an uncountable host, or when Jupiter's throne on Mount Olympus was a soap box covered with a piece of discarded carpet, and our imaginations stood us in good stead to help us picture the scenes. Early theater goers were not any less imaginative and contented themselves with very meager stage properties in viewing dramatic or operatic productions before the managers of theaters found it expedient to add to the visual requirements of their stage offerings.

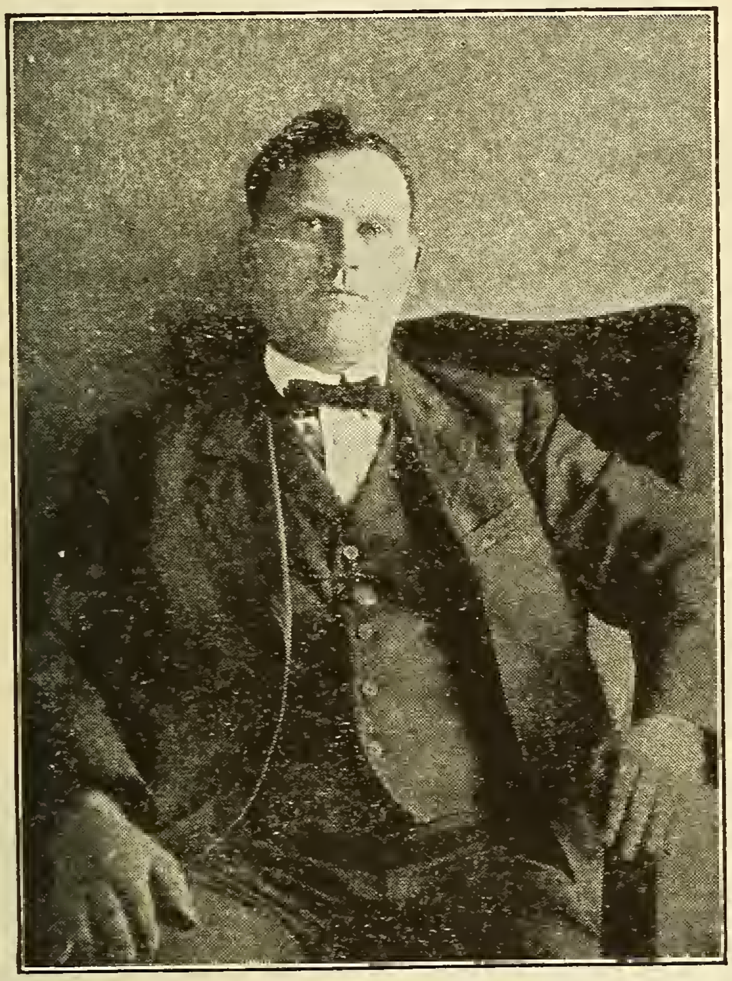
Electricity, however, with its practical application has accompished much in the way of realism on the stage, and in the matter of lighting alone, while in the safeguarding of the lives and property of the theatrical and operatic professions, it has proved an inestimable boon. The fear of fire in theaters was one of the greatest difficulties which the profession had to contend with in its early days, and as a great quantity of inflammable material was used on the stage, there were of course great corresponding risks. Oil lamps for footlights, unprotected lights and lamps behind the scenes, and a general system of lighting the audience chambers with tapers and so forth, all gave frequent occasions for disastrous fires. Of late years, electricity has been introduced in all the playhouses of the great centers of the world, in fact whereever electric power is obtainable, electricity is now used, so that the danger from fire in theaters and opera houses has been almost entirely eliminated if not quite done away with, for candles, lamps and matches find but little use to-day either in front or behind the stage.

The precision and the celerity with which electrical stage apparatus is handled, its wide and manifold means of application, and its superiority of artistic and practical utility, has made it a most important element of stage appliances, and most particularly in opera do we find it almost indispensable.

Such grand operas of the standard repertory for instance as "Faust," "Carmen," "Aida," "Ottello," etc., require less of the highest achievements of the stage electrician than the more modern operas like "Parcifal," "Die Walkuere," "Cendrillon," "Louise," "Haensel and Gretel," "Le Jongleur de Notre Dame," "The Secret of Suzanne," and a number of others of the later music dramas of the day, and those just mentioned above require all of the most elaborate electric effects that can be devised, and the skill which is necessary in the proper employment of electricity on the operatic stage is only surpassed by the musical artists who sing, and the instrumentalists who play the opera scores.

The first time that I heard Wagner's music drama "Die Walkuere" was in New York City in 1883, at the Metropolitan Opera House, under the direction of Dr. Leopold Damrosch, with Materna as "Brunhilde," Robinson Anton Schott and Emil Fisher in the leading roles, and the "Magic Fire Scene" in the last act was made particularly realistic. It was in the days before electricity had been generally adopted in the opera house, and before the rigid fire regulations which are now in vogue had been adopted. The scene is that part of the music drama where Wotan determines to surround Brunhilde with a circle of fire, to protect her in her sleep, to which she has been condemned by him for disobeying his orders, so Wotan invokes the aid of Lodge, the god of fire, and every time he, Wotan, smote his spear into the ground, a real flame of fire shot forth, until Brunhilde is completely encircled by flames, when the curtain descends.

I spoke to Andreas Dippel, the general director of the Chicago Grand Opera Company, about this scene, which in former years was very inadequately given, and he explained that it could not be presented in Chicago now, in the manner in which it was produced in the Metropolitan Opera House at that time, on account of the fire ordinances, but with his electrical arrangements, the scene is given a very natural and picturesque representation by means of dry steam



JOSEPH A. BAKER, CHIEF ELECTRICIAN OF THE AUDITORIUM, CHICAGO

and electric lighting, which fill the stage with a luminous glow, and answer the purposes very well.

The Chicago company has a force of 27 men employed in looking after the electrical affairs of the Auditorium. Joseph A. Baker is the chief electrician, and his duties are of the most minute and accurate character. He presides over a switchboard which controls every light in the vast theater, and its dimensions are so large that it requires a separate division of the stage for its installation.

There are white, amber, blue and red lights, and they are distributed over the entire stage and auditorium. There are besides, over a hundred different shades and colors employed in giving different graduations of light from darkness to brilliant sunshine, and the stage itself is covered with pockets, as he calls them, sort of depositories for connections for separate parts of the lighting divisions. One of his principal assistants is George A. Fuller, the chief electrician of the company, and both of them explained the very intricate arrangement of electric lights used in the second act of "Haensel and Gretel", where a golden staircase is gradually illuminated as the chorus, a company of some 50 "angels" descends it.

This flight of 20 stairs is connected with a special switchboard, and while one man keeps time with the music and the steps of the girls descending the stairs, another man, after receiving a signal connects the apparatus flooding the successive steps, one at a time, with light, until the entire staircase is lit up, resembling a veritable golden flight of steps. In combination with the electrical apparatus is also a system of revolving lenses lighted with electricity which produces snow effects and the moonlight ripple on water. At the first performance of "Haensel and Gretel" by Humperdinck I happened to meet Mr. Dippel, who had watched the lighting of the stairs which I have just described and he heaved a sigh of relief. "I was afraid that the man at the switchboard would pull the No. 8 lever before No. 5, or No. 20 before No. 12," he said. But happily, there has never occurred the slightest mishap in the four performances that I have witnessed. A very pretty electrical effect is also introduced in the other fairy opera of this company, that of Massenet's "Cendrillon," in which there are several spot lights, and also a scene called the "Fairy Oak." A large oak tree in the center of the stage is the home of the fairy, and its trunk opens up where the branches begin, during the act. This is suffused with a glow of crimson light, while the rest of the stage is in semi-darkness. The effect is very beautiful and has always been successfully accomplished.

There are some novel electric innovations in "Le Jongleur De Notre Dame." In the last act, after the jongleur, Jean, a role made famous by Mary Garden, has offered up his only manner of devotion to the statue of the Virgin Mary, his simple tricks, his songs and his dances, the monks of the convent come in to stop the seeming sacrilege, when the statue becomes illuminated with light to indicate its approval of Jean's artless endeavor for the favor of the Virgin, and as suddenly returns to its opaque placidity, while above the head of Jean, who has fallen at the feet of the statue, a violet halo shines forth with a mystic and phosphorescent effect. Such scenic elaborations display the art of electricity of the day upon the operatic stage only partly, for the effects are more complete than can be described by words alone.

The curious stage directions for the electrician during a performance of Victor Herbert's American grand opera "Natoma" are of peculiar interest. The chief electrician must be on the stage in such a position that he can get the "cues," that is the different words from which he manipulates his lights, and I here append the entire plan of directions —somewhat mystifying to the reader, but plain as day to the stage electrician.

NATOMA.

ACT I.

Amber and white full.

Color change.

Bring down 5 and 8, white first, red 5 and 6, full, red, 1-6 one-half.

5 and 6 blue down, come up full, after 1-6 is full up.

ACT II.

Borders, red three-quarters, 1-8 4, 5, toned down.

Borders, blue 1-8, 1, 2, 4, 5, toned down.

Color change to full amber and white.

Take ten minutes to make changes.

Start one minute after the rise of the curtain.

ACT III.

4, 5, 6, 7, borders, amber and white.

Footlights, amber, right one-half, left, one-third, at cue, up one-half.

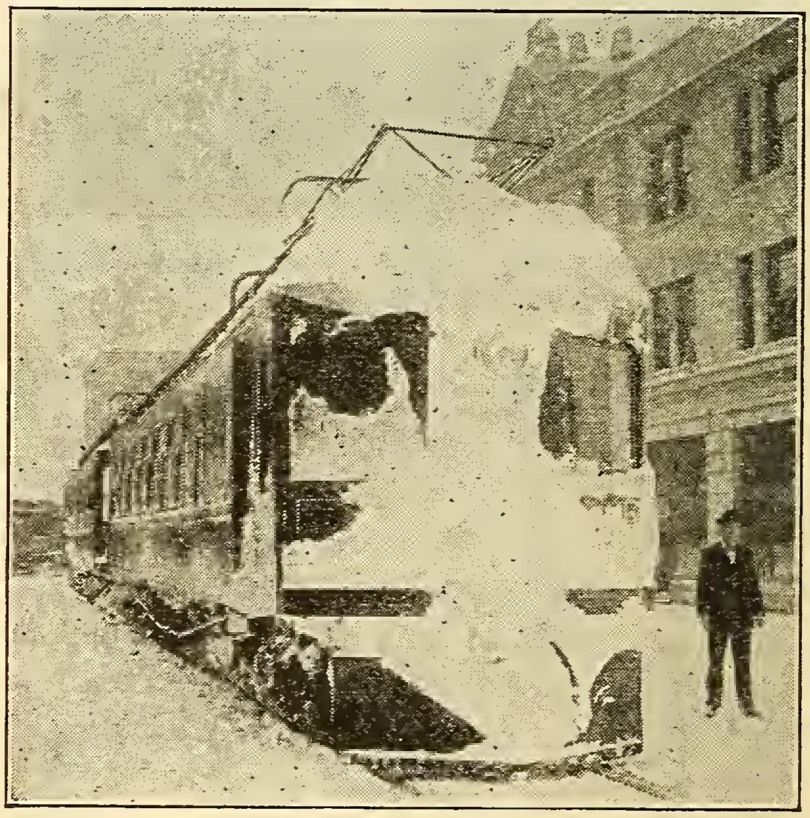
Footlights red left, three-quarters, right, one-half. At cue, footlights amber up when doors of stage open, down again as doors close.

The border lights are strings of lights both on and above the stage.

During a performance the entire staff of electricians has places assigned to it and the work is all laid out with the greatest attention to detail. A single slip may mean the marring of a beautiful scene.

Breaking a Snow Blockade

The illustration shows a Spokane and Inland suburban electric train arriving in Spokane only twenty minutes late after driving through snow and storm that tied up the steam roads in the same country. This trolley line is operated at 11,000 volts with single phase Westinghouse motors and control on the cars. The only type of plough used is shown on the front of the car. Although cuts in which the snow is often from six to ten feet deep have to be negotiated, no trouble has so far developed in "bucking" the snow and maintaining the schedule, aside from an occasional delay like the one mentioned.

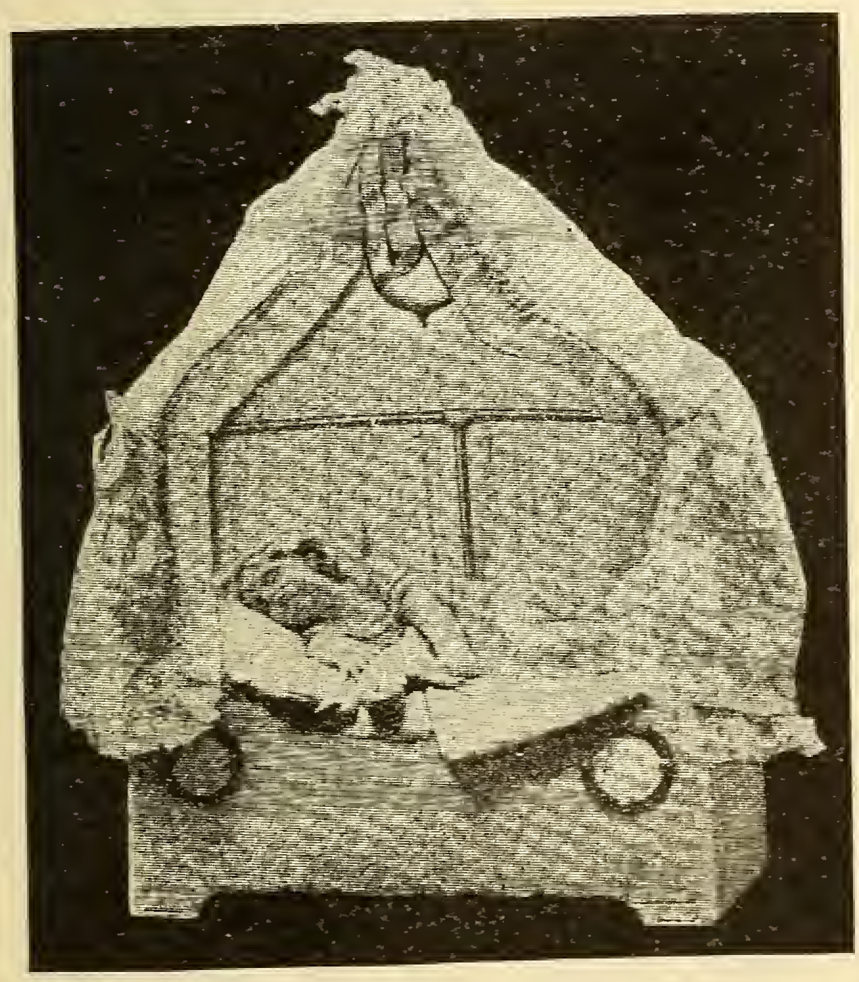


ELECTRIC TRAIN AFTER A HARD RUN

Light Effects on Works of Art

The photographic reproductions of these two porcelain objects, obtained from the bulletin of the German Trans-atlantic Electric Company of Buenos Aires, furnish a clear idea of the aid which electric light can give in the intelligent arrangement of a hall or dining room.

Artists know well how to make profitable use of the transparencies of the Saxon ware, the alabaster and the marbles, in the execution of scenes full of beauty and life. These, when illuminated by a soft hidden light, take on the appearance of reality as seen in a dream, producing unexpected and enchanting effects.



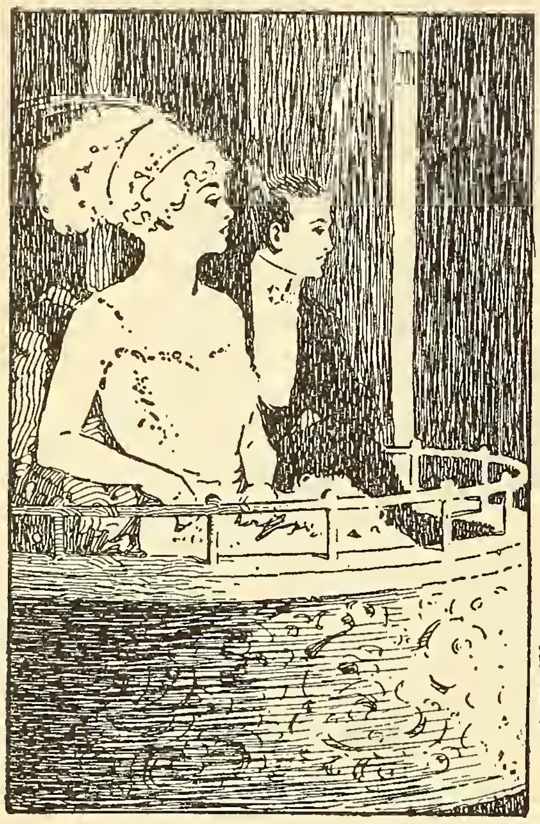
LIGHT EFFECTS ON WORKS OF ART

Good Reading Light

"Have you a good reading light?" This is an important question which the *Illuminating Engineer* assumes that 99 people out of 100 would be compelled to answer in the negative. Why?

"The reason why good reading lights are so uncommon is not so easy to give. Perhaps the best explanation may be found in the well known proclivity of the human mind to accept without question the things it is most familiar with, and to turn to the unfamiliar and remote in its efforts at improvement. It is only within very recent times that it has been possible for every one to have an artificial reading light that is practically as good as daylight, and we are still clinging to the customs of our ancestors who had nothing better than the candle and the little oil lamp; so that we continue to accept poor light as a sort of necessary evil which we can endure smilingly or otherwise, according to our humor.

"If electric light is used in a dome over the library table, the dome should be arranged to take a single Mazda or tungsten lamp, which should be fitted with a prismatic or opal glass reflector, and the lamp itself should be what is called 'bowl frosted', i. e., have the lower part of the lamp bulb frosted. A 60 watt tungsten lamp will give ample light under all ordinary conditions, and will use very little more current than a single sixteen candlepower bulb."



Some Secrets of Electrical Stagecraft

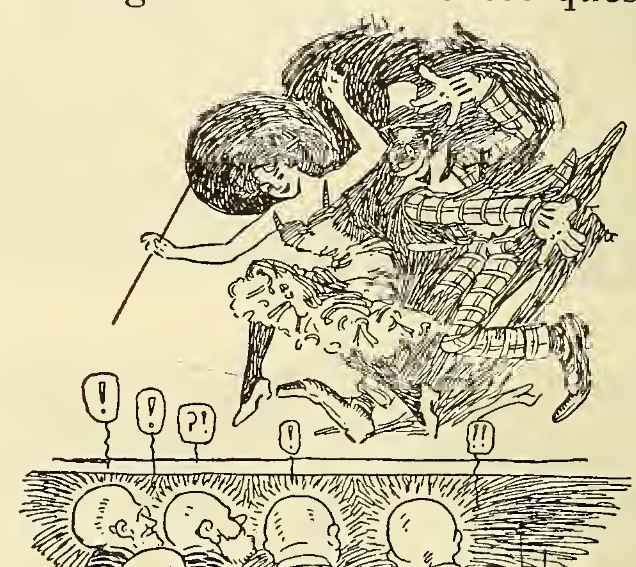
By T. J. Newlin

PART I

Anyone who has ever tried to obtain admittance behind the scenes of a theater will readily realize that the hidden mystery of the stage and its peculiar workings is guarded at each theater by a jealous, yet intelligent crew of skilled mechanicians. That they should thus preserve their secrets and the products of their knowledge from the prying eyes of the outside world is natural, since the knowledge of how to do, what to do and when to do it is paramount to success in stage work and the basis on which their salaries are established. The greater the skill of the stage electrician in the line of original research work, such as producing new electrical illusions, dances and novel electrical effects, the more he is in demand. Like every other profession, it has its imitators and its originators, and the latter receive good, snug salaries while the others simply plod along in the same rut.

The stage is a source of wonder. One has to see it but once in actual operation never to forget it. His imagination will revert again and again to the scenes of magic. Where on canvases of the great artists of the past or present is there anything to compare with it? Where can one view such a natural daybreak, such heavenly sunsets and such beautiful soul-absorbing moonlight scenes?

But people are continually asking the "how" and "why" of things, and the very mysteriousness of everything back of the stage itself makes these questions



THE STAGE IS A SOURCE OF WONDER

more insistent. It is partly to satisfy this curiosity on the part of the theater-going public and partly to suggest ways and means to the novitiate in stagecraft. that this series of articles have been prepared, and no pains have been spared to make the text as simple as possible, for the benefit of the non-technical reader.

THE REAL NATURE FAKER

You have all, no doubt, heard of the medical faker and the well-known, world-wide optical faker; so I am going to tell you the tricks of another, the stage electrician, who is, we are well pleased to admit, the greatest Nature faker in the world in every sense of the word. To the uninitiated it is well to understand that to be a stage electrician it is required that a person be quick and of active mind and ever on the alert for the cue to "go" to a red, blue or any other color change required by the show. The stage electrician is often called upon to make an electrical contrivance to imitate the elements and scenic effects of Nature, such as lightning, moon effects, water ripples, snow scenes or even lightning bugs, fireflies, sky rockets, etc. In fact, he must be up to every phase of Nature faking to be, as they are wont to say, "onto his job." For the benefit of the reader I will show the simple contrivances used to produce some of these realistic electrical illusions.

THE GREATEST NATURE FAKER IN THE WORLD

FAKING THE SKYROCKET

Nearly everyone remembers the history attached to the outbreak of the Civil War, the Yankees having notified the Confederates that if they attempted to stock or provision Fort Sumter they would be fired upon by the enemy. The signal for action was to be the skyrocket. In the play of the famous "Shenandoah," as the third skyrocket majestically rises high into the air and bursts defiantly into red, white and blue, the opening hostilities of the great Civil War begin, hurling brother against brother in the most bitter strife that has ever been known.

A simple diagram, Fig. 1, shows how the skyrocket effect is produced. The lamps of the set piece which is to indicate the path of the rocket are marked (L) while (L1) (L2) and (L3) are lamps in red, white and blue to represent the burst of the rocket. These lamps are of the miniature type, requiring current at a pressure of only about 3½ volts to operate them. Three cells of battery (C) will do the work. A single wire runs from one terminal of the battery to one terminal of all the lamps (L). The remaining terminal of each lamp is connected to one of the contact buttons of a rotating switch. The other terminal of the battery is connected to the pivoted metallic handle (H) of the switch. As yet no current can flow through the lamps. Everything being in readiness, the cue is given and handle (H) is revolved in the direction indicated by arrow (A) until it touches the first contact and lights the first lamp. As it goes to the next succeeding contact the last lamp is extinguished and the one ahead is lighted up, etc., until it reaches contact (C1), which lights up

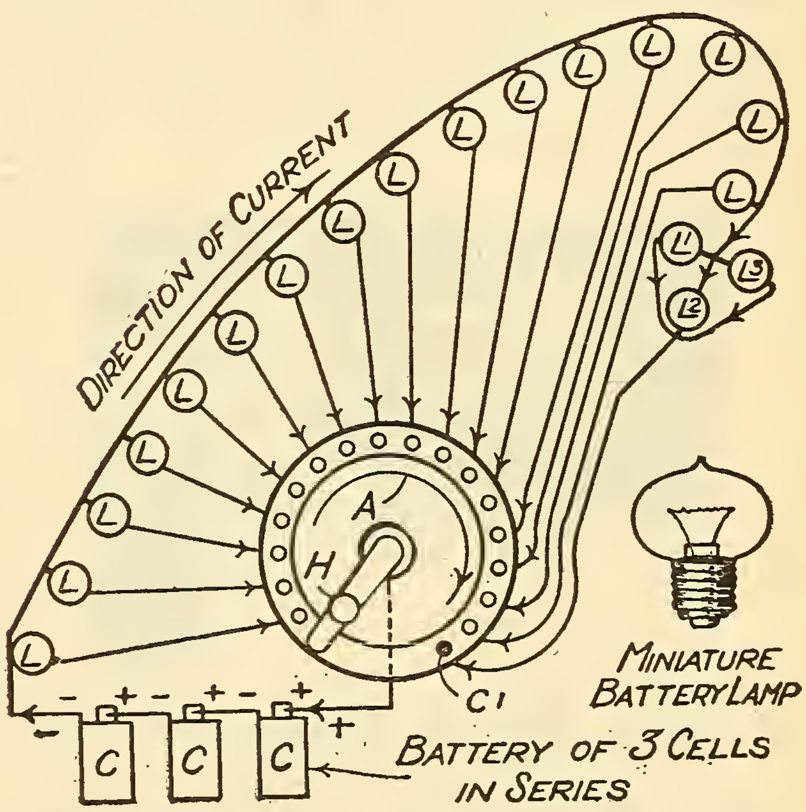


FIG. 1. HOW THE SKYROCKET IS PRODUCED

lamps (L1), (L2) and (L3) and gives the "burst" of the rocket. Better to explain the apparatus to the lay mind, as well as to the expert, the wires in the diagram are drawn in the form of arrows, which indicate the direction of the intended flow of the current.

In George Cohan's famous "Little Johnny Jones" a similar effect is used. George Cohan as Little Johnny Jones has been disqualified for the great Derby race of England and as his friends depart for America, it is arranged that the signal of a skyrocket be given if he is found by wireless to be "on the square." The audience applauds vociferously and simply screams, so great is its delight at seeing the skyrocket rising from the ship which has put out to sea. At the rocket's "burst" there is a soft, subdued exclamation of "Ah-a-a-ah," as the effect silently disappears in the darkened sky, thereby clearing the stain upon the hero.

ELECTRIC LIGHTNING

In all storm scenes of the stage, midst the howling and shrieking of the wind, the clapping peals of thunder and the swishing downpour of the rain, there is nothing more startling, more weird and fascinating than the vivid flashes of lightning. In fact, the whole effect depends upon its intermittent appearance. Each flash lights up the surrounding scene, revealing to your fascinated and excited mind the "villain" about to throw the heroine from the steep cliff to the

OF COURSE THE HERO APPEARS JUST IN TIME

jagged rocks below, at which juncture, of course, the hero appears just in the nick of time.

To the average mind the lightning effect always appeals the most strenuously. Therefore we will show to the reader just the part the stage electrician plays in these important scenes. Standing behind the wings of the stage settings, so as to give the scene the best light or optical effect at the psychological moment—at the cue given—he touches an ordinary lamp carbon to an ordinary file, thereby making an electrical contact, the carbon being attached to the positive wire and the file to the negative wire.

In Fig. 2 is shown a simple wiring diagram for stage lightning, to be worked by the hand of the operator. The

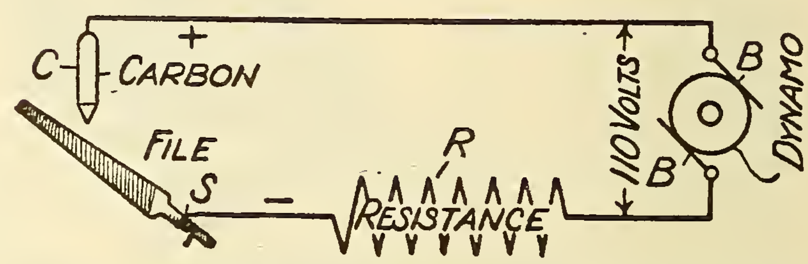


FIG. 2. CARBON AND FILE METHOD OF PRODUCING LIGHTNING

dynamo has brushes (B) (B) connected to the two sides of the line. Between the wires, (+) and (—), there is a pressure of 110 volts, the same as in the ordinary lighting circuit. After passing through a resistance (R) one wire is soldered to the file at (S). It can be readily seen that when the carbon (C) is brought in contact with the file, current flows in this circuit and is held in check by the resistance (R). When the carbon is drawn away from the file a flash of fire takes place, and on a darkened stage imitates the lightning of Nature in a very realistic form. This flash is caused by the discharge or what is known to electricians as the "kick" of the resistance (R) which in this instance serves two purposes; one purpose being to balance the line, and the other to store up the current for this "kick" or momentary surge of high pressure. This flash is what is called the "arc" of the current, and its heat intensity is so great that if the file and carbon be held close and long enough at the break" it will heat the file to a white heat and melt it. Therefore the stage electrician will always see to it that the file is placed at a safe distance from the carbon after use in order to eliminate the possibility of fire. And it is to be understood at all times that this one danger of the stage must be carefully guarded against.

THE AUTOMATIC LIGHTNING EFFECT

It oftentimes happens that the lightning, on account of the stage setting, must be operated within the interior setting of the scene or from the front part of the stage. As the stage electrician dare not be exposed to the view of the audience, and thus spoil the illusion, another method must be pursued. In this instance an automatic lightning effect is used. This contrivance is then set upon the apron or extreme front part of stage and hidden among the footlights. Sometimes, if the necessity arises, enough lamps are removed to make room for the device. This effect is always placed in position before the arrival of the audience, at the point of best advantage, and always ready to be operated at the proper cue. The stage electrician in this instance stands "off stage" and simply throws a switch rapidly in and out which operates the effect on the darkened stage as explained in Fig. 3.

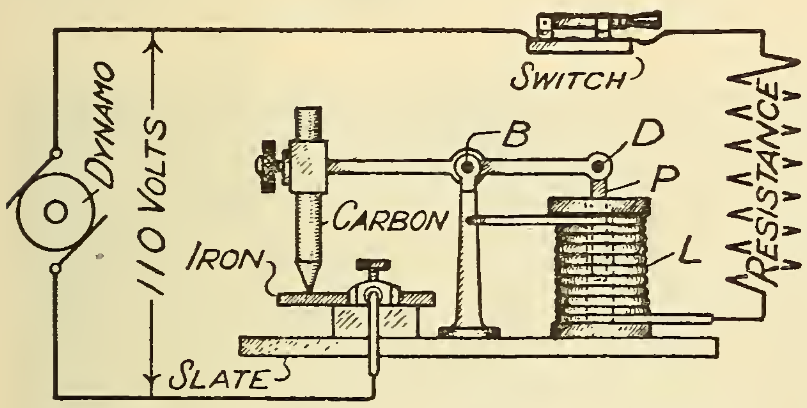


FIG. 3. AUTOMATIC LIGHTNING MACHINE

A switch is connected in series with the circuit from the dynamo which at the "make and break" cuts current in and out. At each break of the circuit a flash takes place. This contrivance can only be used on direct current circuits, from the fact of its having a solenoid coil (L) interposed, to operate the core (P) by its magnetic influence. It will be seen that when the switch is cut in, a current flows through the circuit. Coil (L) is then saturated with current which builds up a magnetic influence and attracts the iron core (P), which is drawn down into the hollow of the coil. At (D) and (B) are elbows. One can readily see that when the core (P) is drawn into the coil (L), the carbon (C) will be lifted and the circuit broken, which will cause a current flash at the point where the carbon touches the iron.

By following the circuit you will observe the wires always return to the dynamo, forming a complete circuit.

The illustration, Fig. 4, shows the stage "set" ready for the operation of the automatic lightning effect when the cue is given.

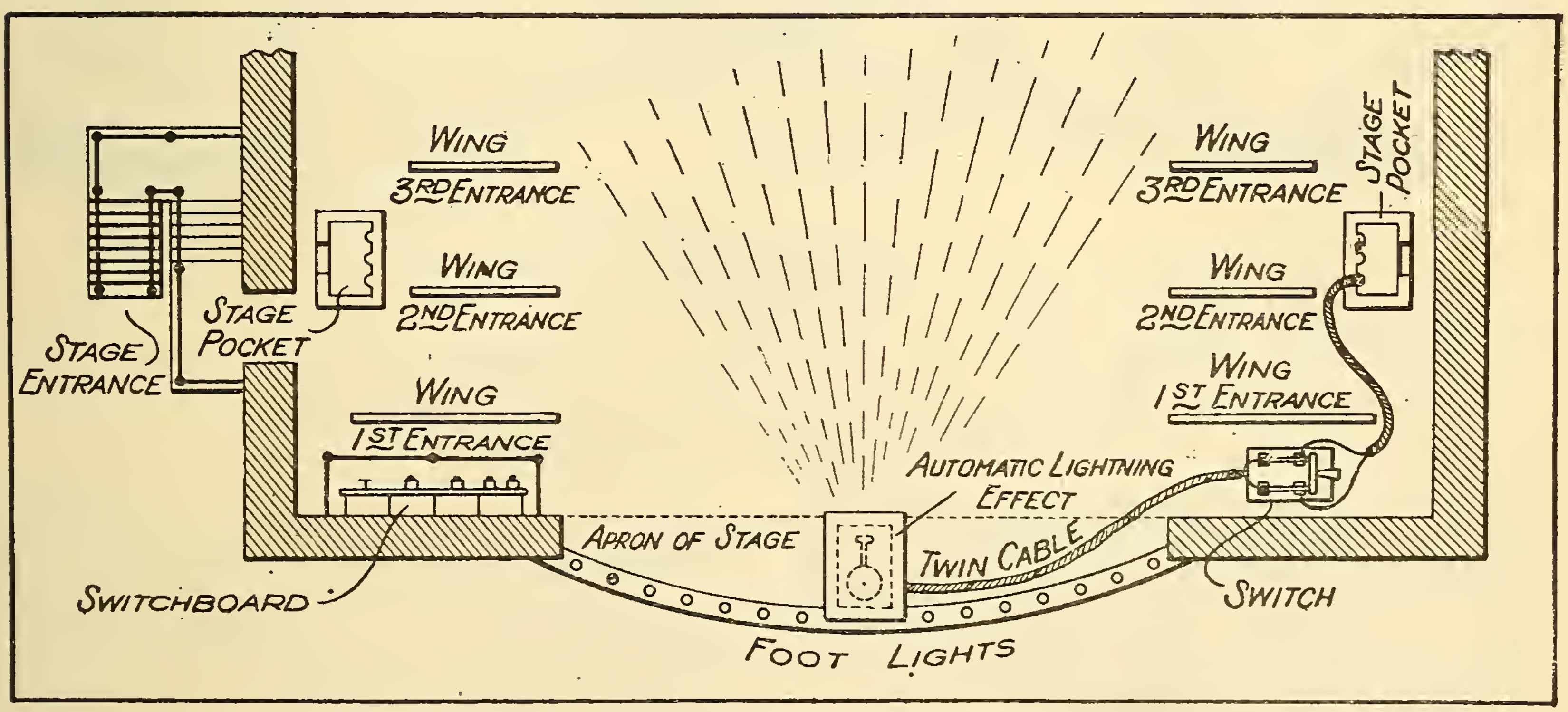


FIG. 4. HOW THE STAGE IS SET FOR THE AUTOMATIC LIGHTNING MACHINE

METHODS OF FINDING THE POSITIVE WIRE

In cases where it is of utmost importance to attach the positive wire to the positive binding post and the negative wire to the negative binding post, as when working on direct current, the stage electrician is never at a loss to determine the polarity of the current, and it must sometimes be determined quickly or else spoil the effect in the

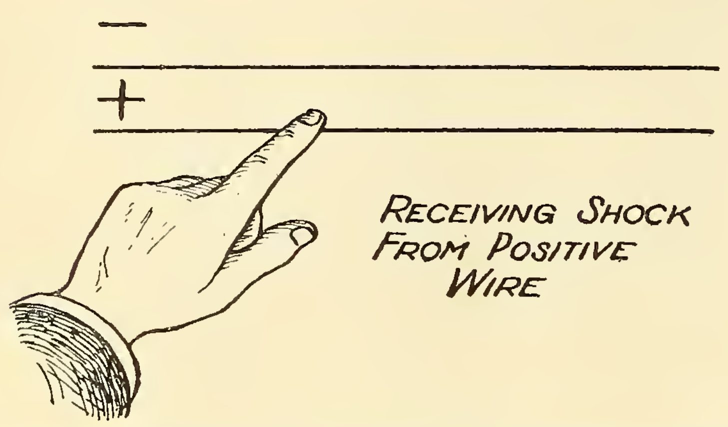


FIG. 5. FINDING THE POSITIVE WIRE BY THE TOUCH METHOD

show. One way, of course, is the tangible way; namely, if a person stands on a "ground" and touches the negative wire, he will receive no shock, as both the ground and the negative wire are of the same polarity. But if he touches the positive wire he will receive a current shock. As it is of the utmost importance to act quickly on the stage, the shock is ignored in the effort to "get there" at the cue. See Fig. 5. The electrician simply touches the wire to find out, and takes his medicine.

Another but slower method is to secure a bucket of water and place the ends of both wires in it, being careful not to allow the ends to touch each other. Bring the ends close enough together so that bubbles will pass from one to the other. The wire from which the bubbles pass off is the negative, so naturally the other must be the positive. The scheme as explained in Fig. 6 illustrates the method of procedure.

MYSTERY OF THE SWORD FLASHES

No doubt there are many persons who have been greatly mystified by the duel scene in "Faust" and have often won-

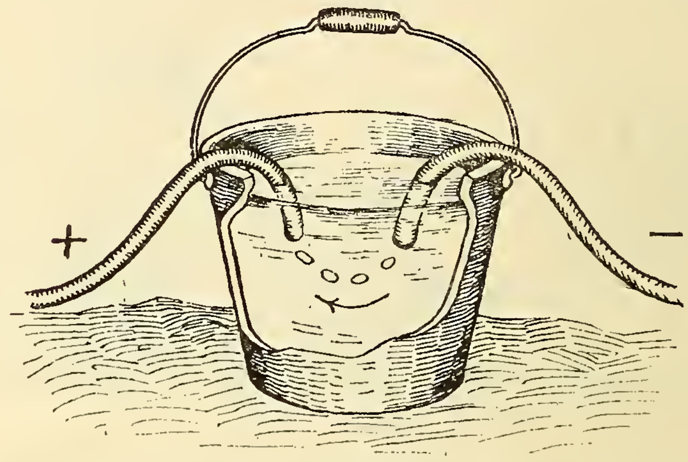


FIG. 6. ANOTHER METHOD OF TELLING POSITIVE WIRE

dered how it is possible for the touch of the third sword to flash fire. While the two duellists, Faust and his opponent Valentine, are crossing swords, and about to fight, Mephistopheles steps

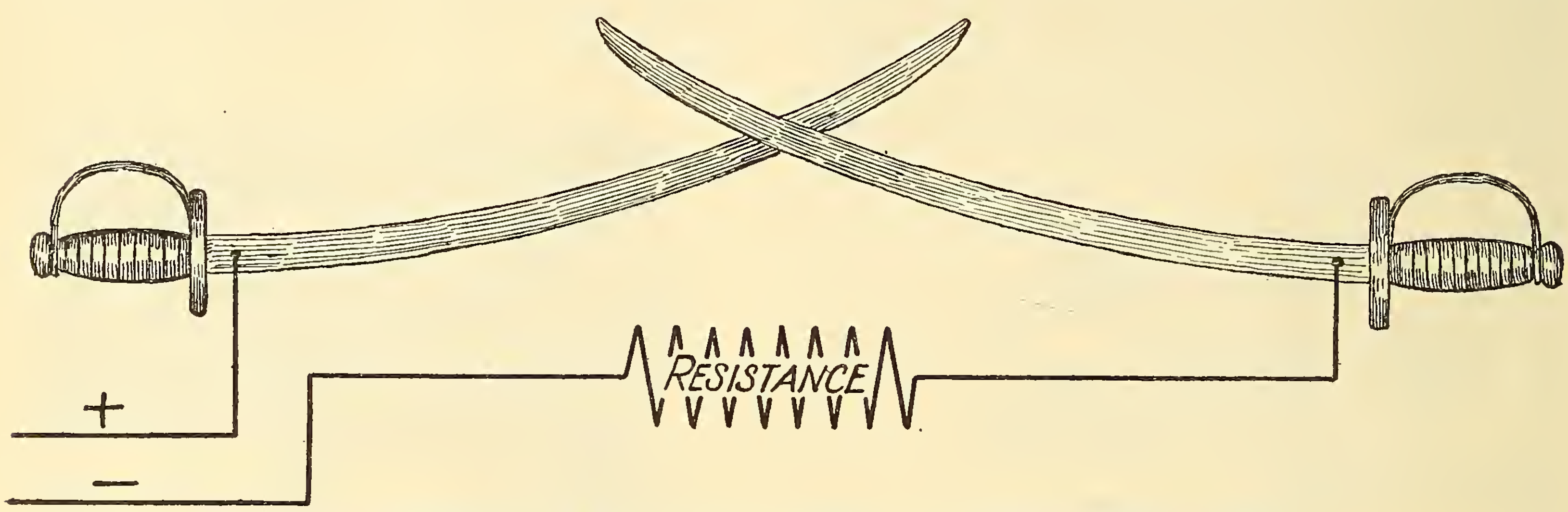


FIG. 7. METHOD OF PRODUCING SWORD FLASHES WITH VISIBLE WIRES CONNECTED TO THE BLADES

upon the scene and, passing his sword upward, touches one of the swords of the combatants that is wired in opposite polarity of current to his, thus producing a vivid flash of fire. The weird scene has a thrilling effect upon the audience and is long remembered, as is the plot of the play wherein Faust, an aged and learned philosopher, seeking by alchemy to regain his youth, is accosted by Satan while in his laboratory and agrees with him to be his slave if Satan will give him youth in exchange for age. Satan has designs upon the pure, chaste Marguerite and seeks through the instrumentality of Faust to secure another sinner. Faust learns to regret his indiscreet compact later, realizing his great love for the pure Marguerite, which turns out so sadly and ends in his eventual undoing.

There are several methods of arranging the wiring system for this effect, a few of which I will here illustrate by diagram.

In Fig. 7 two swords are shown with wiring connections to the handles. A vivid electric flash is produced when the sword of Mephistopheles touches the one held by Faust, which is attached to wire of opposite polarity. One is connected to the positive wire and the other to the negative wire and a resistance is placed in series with one side of line to balance it and simultaneously store up the charge of the current as in the case of the lightning apparatus. When the actors in the duel scene clash their swords together a vivid flash of fire is created by the arcing of the current at the air gap formed by the breaking of the circuit, the stage being dimmed to show the effect to good advantage.

By the wiring system shown in Fig. 8 two contact plates of copper or other metal are inserted in the stage at the proper positions, so arranged that at the very moment the actors reach the point where the duel is to take place, one will be standing on the positive plate and the other on the negative plate, each receiving the current from the stage plate through the heel plates of his shoes and the current following the wires up the trouser-leg and out the sleeve to the sword handle. It can be readily seen that at the moment their swords touch there will be a flash of fire. As in the other cases, a resistance coil of iron wire to hold the charge of current must be introduced in the circuit.

FIG. 8. IN WHICH THE CONTACT PLATE METHOD IS USED, CURRENT BEING CONDUCTED TO THE SWORDS THROUGH CONCEALED WIRES IN THE CLOTHING

Figure 9 shows another method of producing a flash of fire, together with the connections to the stage lighting system. By closing the wires at the (+) and (—) marks, this effect can be run

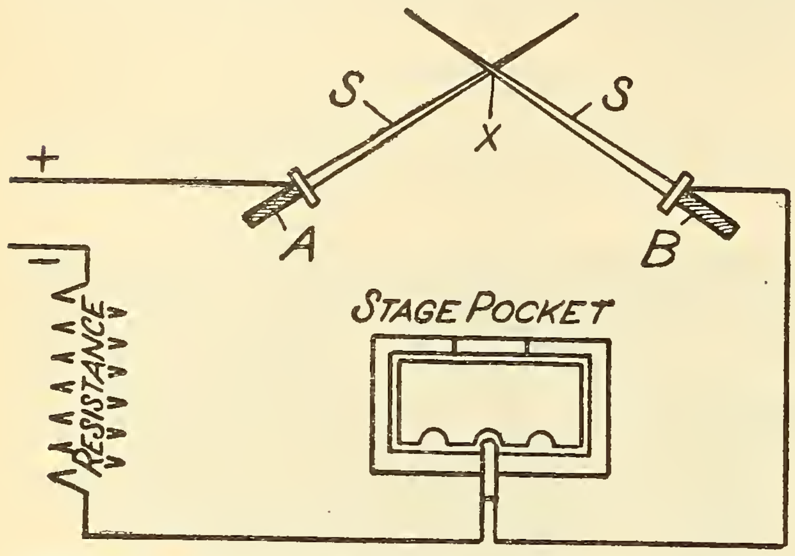


FIG. 9. METHOD OF WIRING FROM THE STAGE POCKET

from one of the stage pockets or outlets. Or by connecting the two wires together outside of the stage pocket it can be run from the points marked (+) and (—) if connected there. A resistance is shown at (R) and (S) (S) are swords which, when clashed together in fencing at the point (X), will produce a vivid flash of flame and create a weird effect. Sword (A) is held in the hand of Faust and a sword without any electrical connection is clashed against it by his opponent Valentine. At the psychological moment Mephistopheles appears, and, touching with his sword (B) (which is wired in opposite polarity to Faust's) at the point where the other two swords cross, there is a vivid flash of fire owing to the sword being wired with the opposite polarity.

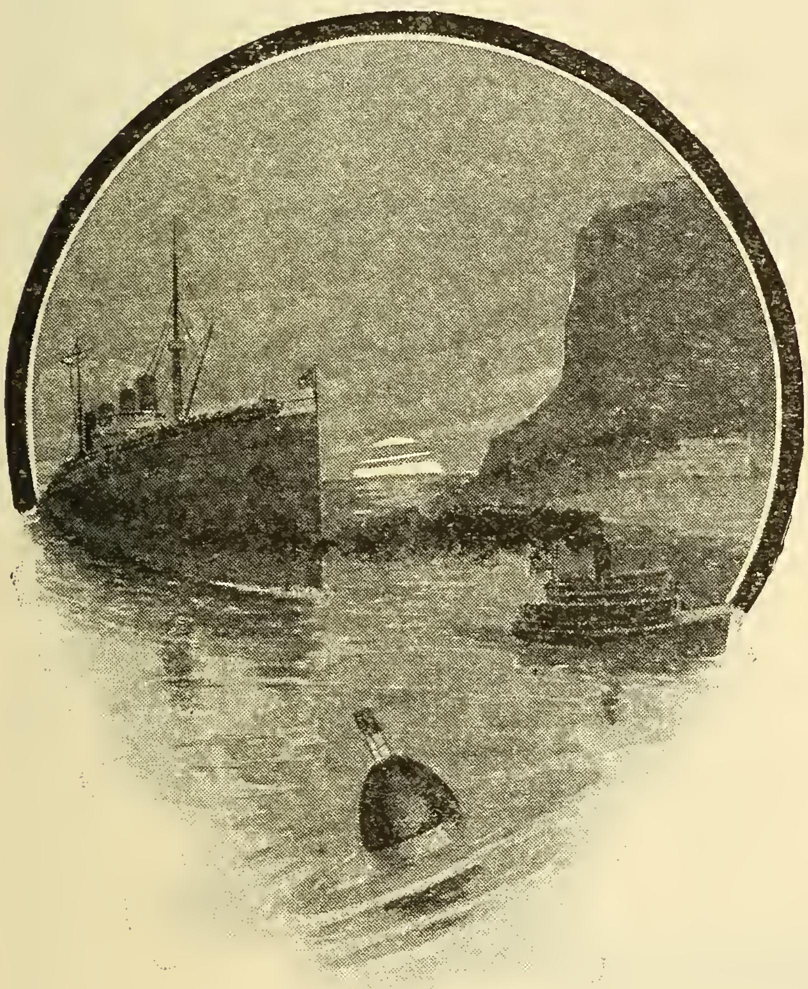
In all these effects where a sword touches one charged with opposite current it is well to remember that the wire resistance placed in series with the circuit serves to retain the current, store it up and at the moment of break, discharges the whole charge at once. Even if the swords were held together there would be no short circuit, as the resistance coils are capable of holding from 25 to 45 amperes and throwing it off in heat after the manner of a line resistance.

In the next issue there will be described a few tricks of the road man in overcoming obstacles encountered while playing the "Kerosene Circuits," also how the great locomotive scene is produced in the dramatization of Tolstoy's famous book, "Anna Karenina."—Editorial note.

Light Buoy Extinguished by the Rising Sun

A wonderful invention of recent date is the electrically controlled buoy operating automatically with a selenium cell. Mr. Ernest Ruhmer, of Germany, is credited with being the inventor.

Mr. Ruhmer has attached a selenium cell in the top of the buoy which is connected with a switching device. The amazing feature is the fact that the rise of the sun in the morning extinguishes the gas light on the buoy.



THE RISING SUN EXTINGUISHES THE LIGHT

Selenium is a peculiar substance which has the property of being highly resistant to the flow of electric current in the darkness. When light strikes it, however, it becomes a fairly good conductor.

When the sun rises its rays affect the selenium. Current from a battery flows through the circuit of the switching arrangement, and the gas from the compression tank is turned off. At sunset, or on dark days, the current is shut off once more, by reason of the current ceasing to flow through the selenium and a little pointer, which had been drawn over by flow of current through the selenium, falls back and makes a contact reversing the current through the switching device and turning on the gas, which is lighted by an electric spark.

White Ants Eat Into Lead Cables

White ants are causing much trouble in South Australia in telephone cables and also in the underground electric light lines, according to the *London Electrical Review.* On the lead sheathed telephone cables crosses between the circuits began to occur. Upon withdrawing some of this cable from the ducts it was found that the ants had eaten through the lead in many places. On the Sidney system of electric lighting the ants ate through the bitumen compound and then through the lead and high tension insulation next to the wire.

To stop the ravages which will incur an enormous expense if not checked, arsenious oxide mixed with bitumen, a sort of pitch, is being applied to the cables. Carbon bisulphide is also being tried with the idea that the odor will drive the ants away.

Making Furnace Gases Work

Says Frederick Sargent, consulting engineer of Chicago, who recently made an extended tour abroad: "The latest thing in electrical work in England is that being done at Newcastle-on-Tyne, where a company's system extends for 40 or 50 miles, and picks up a lot of industrial centers. They take the waste heat from iron furnaces, turn it into current, and put it back into light and power; instead of letting the heat blaze away into the air they put it under boilers and make it work. A favorite scheme is to take the coke gas that is thrown off in the preparation of by-products and use that for making electricity."

ELECTRIC VEHICLES

FOR BUSINESS AND PLEASURE

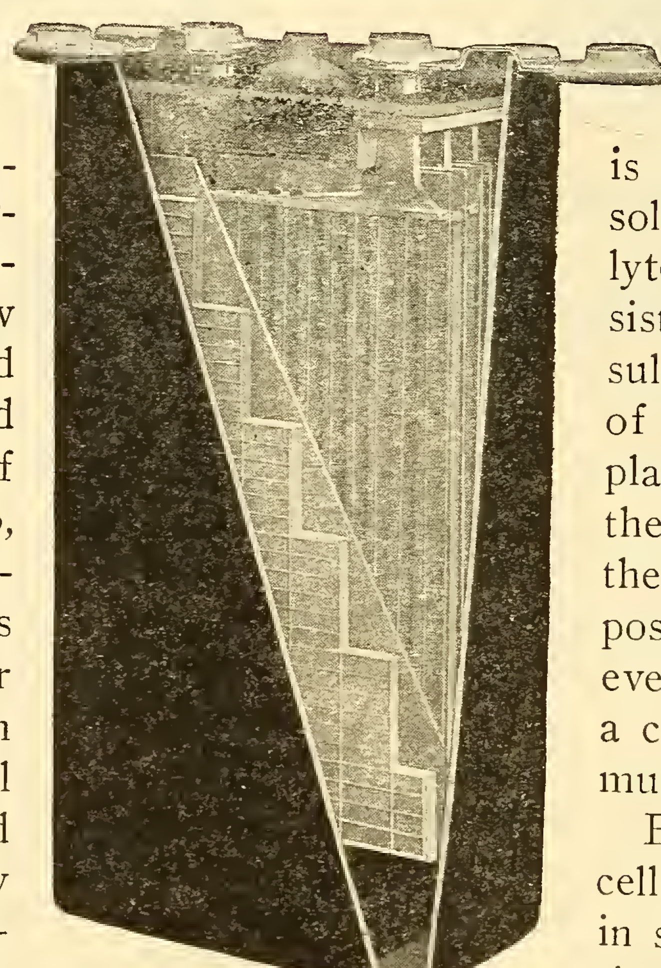
by

W.C. JENKINS

PART II.—THINGS TO KNOW ABOUT VEHICLE BATTERIES

Although it has taken a great many years to develop and perfect the electric storage battery, as it is now on the market, it is a comparatively simple device, presenting few difficulties in maintenance and operation to the vehicle owner who will take the pains to study its characteristics.

At the outset it may be said that the storage battery does not "store electricity," but rather chemical energy, which at will may be converted into electrical current. There are two general types of battery now on the market—the lead type cell gradually evolved from the experiments of Planté over 50 years ago, and the new Edison storage battery put out in its perfected state about a year ago. A simple description of the two types of cell will disclose their simplicity and show how little in reality there is about them to puzzle the vehicle owner who is not necessarily an electrician.



ARRANGEMENT OF A BATTERY CELL—IRONCLAD-EXIDE TYPE

All batteries are made up of a number of units called cells, contained in jars of rubber or other acid proof material. In the lead type of cell there are two series of plates called the positive and the negative plates. The positives and the negatives alternate as they hang in the cell, all the positives being connected to one terminal of the cell and all the negatives to the other terminal. The space in and around all the plates is filled with a dilute acid solution called the electrolyte. This solution consists of about one part of sulphuric acid to ten parts of distilled water. The plates themselves are in the form of grids having the greatest amount of area possible. In this state, however, a cell will not deliver a current of electricity. It must be charged.

Before charging, all the cells are connected together in series; that is, the positive terminal of one being connected to the negative terminal of the next, and so on, leaving a free negative terminal at one end of the complete battery and a free positive terminal at the other. These two terminals are then connected to the terminals of a source of direct current electricity and current passed through the battery.

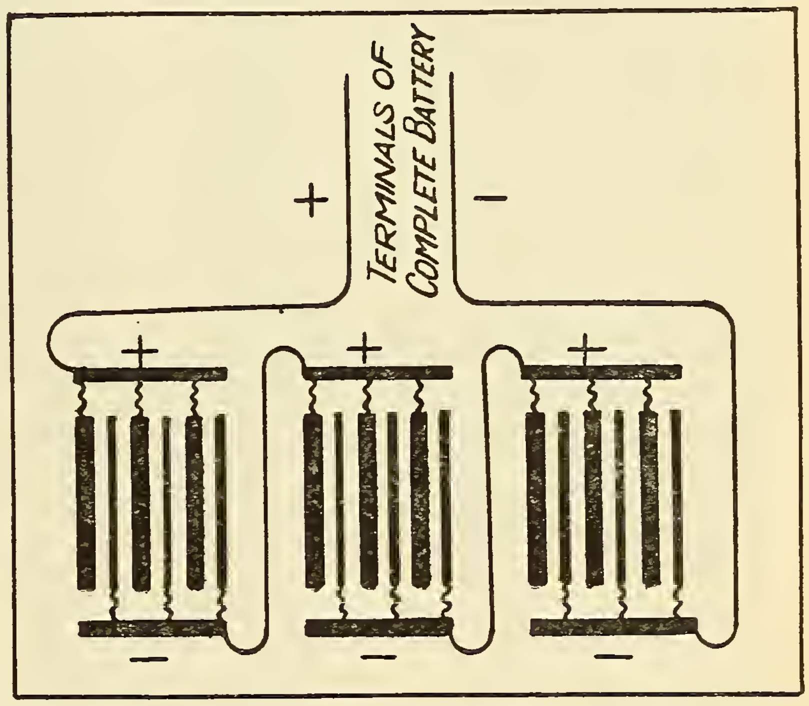
The set of plates through which the current enters each cell is called the anode, or positive. The other set is called the cathode, or negative. When the current starts to flow through the cell a very lively chemical action takes place. The anode at once begins to receive a coating of lead peroxide (red lead) while the cathode turns gray and spongy although it still remains metallic lead. As soon as the anode becomes completely covered with the peroxide of lead, which takes quite a long time, the cell as *charged* and must be taken out of the circuit.

Now we have an altogether different cell from the one with which we started out. Before the cell was charged we did not have a battery in any sense of the word because we did not have two different metals for the plates, which is necessary for a battery. After the charging however, we have one plate of metallic lead and one of peroxide of lead and the charged cell is capable of delivering current in a manner similar to any primary battery. Connect its terminals to the motor circuit and the battery is ready to do work.

From the moment the cell begins to furnish current, or *discharge,* it begins to run down. Current begins to flow from the gray plates through the electrolyte to the red plates; that is, in a direction opposite to that during charging, and the chemical action is also opposite, undoing the work of the charging process. The oxide of lead changes to sulphate of lead, and the spongy lead on the other plates also to sulphate of lead. The current continues to flow until both sets of plates are changed to sulphate of lead and then it ceases because the plates are then *alike,* as no battery will operate unless the plates are of *different* metals or compounds.

The discharge being complete the cell must be charged over again before it will give current.

The new Edison storage battery is somewhat different in principle. The active materials are oxides of nickel and iron, respectively, in the positive and negative elements, the electrolyte being a solution of caustic, potash and water. The retaining cans are sheet steel.



SHOWING HOW CELLS ARE CONNECTED IN SERIES

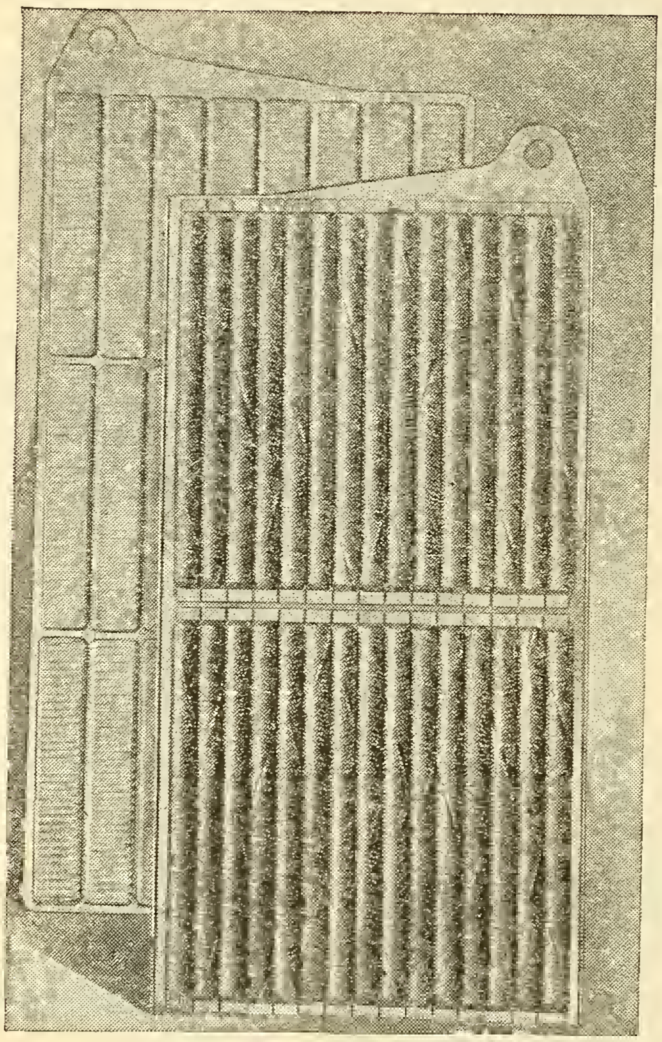
Each positive plate consists of a grid of nickel-plated steel, holding 30 tubes filled with the active material, in two rows of fifteen each.

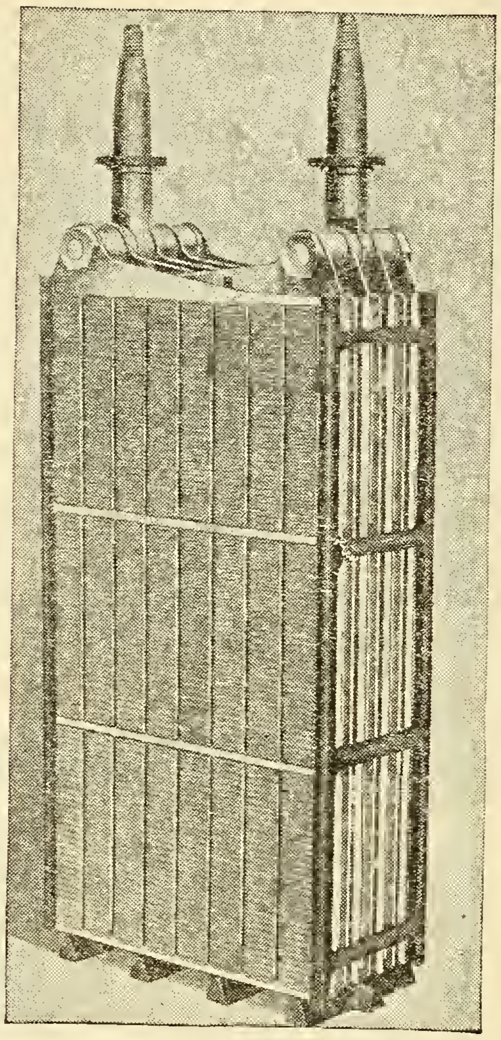
The tubes are made of very thin sheet steel, perforated and nickel-plated. Each tube is reinforced and protected by small ferrules, eight in number. These prevent expansion.

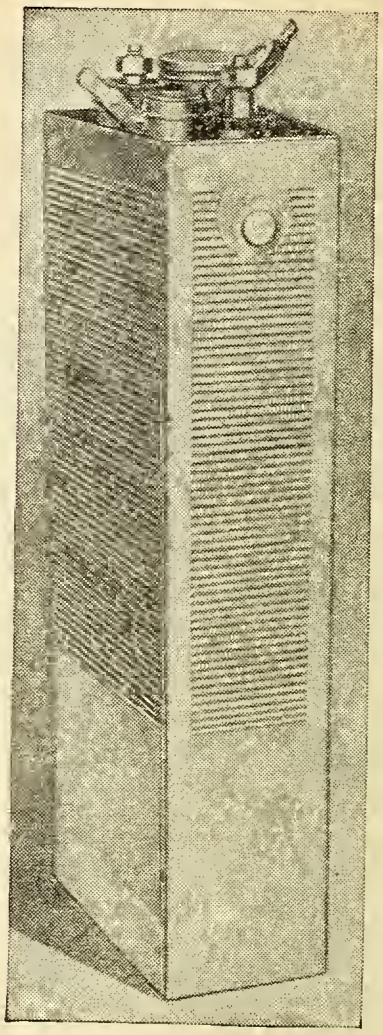
The active material in the tubes is interspersed with thin layers of pure metallic nickel in the form of leaves or flakes.

Each negative plate comprises 24 flat rectangular pockets supported in three horizontal rows in a nickel-plated steel grid.

The pockets are made of thin nickel-plated steel, perforated with fine holes, each pocket being filled with an oxide of iron very similar to what is commonly


PLATES OF THE EDISON BATTERY


PLATES ASSEMBLED


CELL COMPLETE

called iron rust. In the negative plate each pocket is subjected to very heavy pressure, so that it becomes practically integral with the supporting grid.

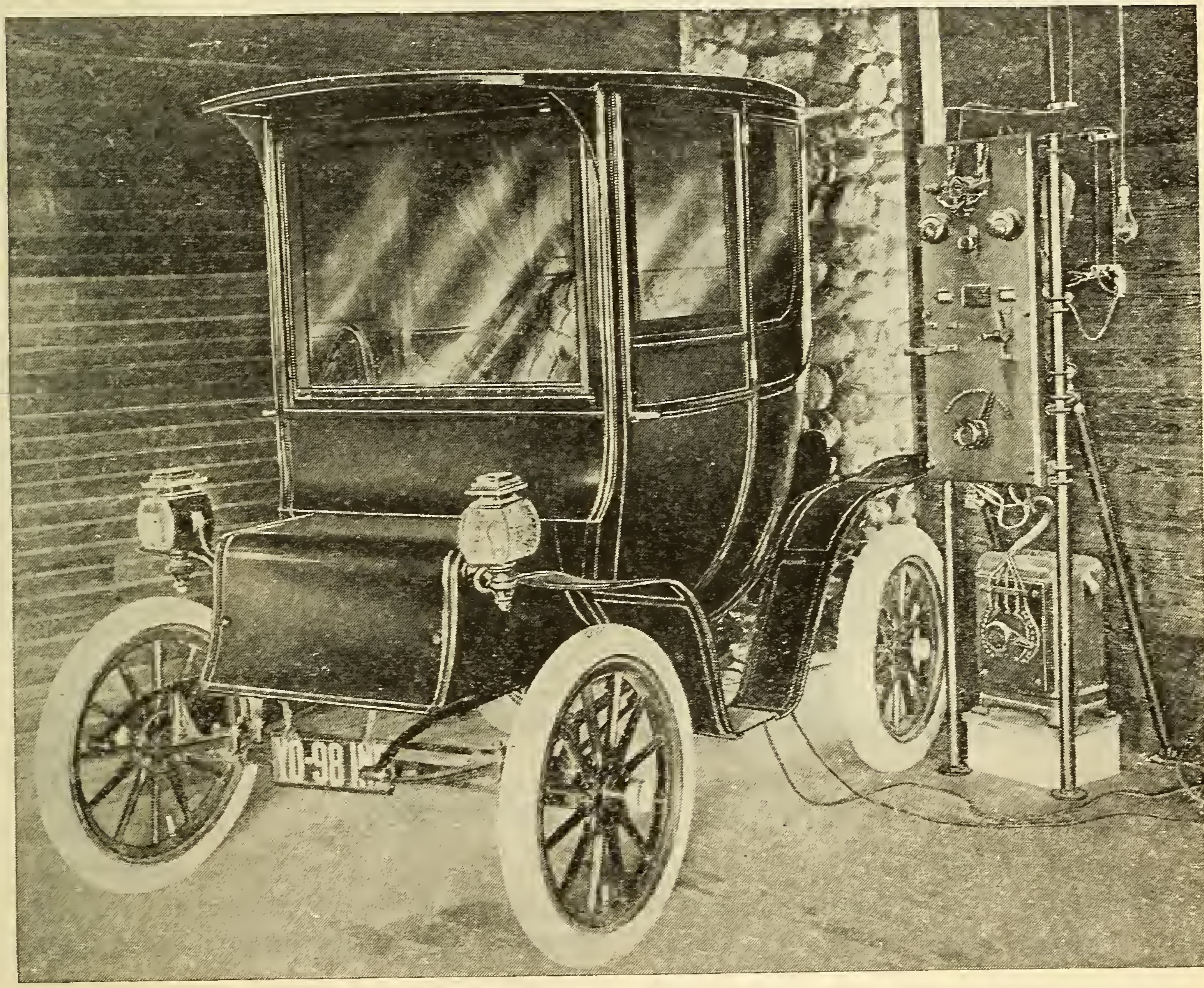
Thus it is seen that there are few parts to any storage battery—little of a complicated or technical nature to be understood, as compared with a gas engine with its multiplicity of cylinders, valves, carburetters, ignition system, etc.

The next question which naturally arises is: How is this battery to be charged? As stated before, this is done by passing direct current through it. Direct current is the kind which flows in one direction only, in contradistinction to alternating current which flows back and forth in the circuit many times per second. As alternating current is now used almost exclusively for lighting and power except in the most congested portions of the largest cities, some way must be employed by which to convert it to direct current for battery charging.

If the machine is kept in a public garage of course the charging does not devolve upon the owner but if it is kept in a private garage the owner must employ means for effecting the change of alternating to direct current. This is most easily and inexpensively performed by using what is known as a mercury-arc rectifier.

It is not necessary to go into the theory of the rectifier very deeply here. Suffice it to say that the rectifier proper consists of an odd shaped vacuum tube containing mercury vapor, on the principle of the mercury-vapor lamp now a common sight. The alternating current is passed into this tube through one set of terminals and direct current is taken out through another set. The tube, measuring instruments, switches, rheostat, etc., are all mounted on a convenient panel.

The long connecting cable is already attached to the panel. Back the machine close up; plug the cable terminals into the battery terminals (the plugs and terminals are so shaped that a mistake cannot be made); close the alternating current line switch; then the circuit breaker, which is nothing more than an electric safety valve; next hold the starting switch down and gently rock the handle found in the center of the panel and the charging has begun. It is so simple that a woman or child can do it after a lesson or two.



MERCURY ARC RECTIFIER OUTFIT FOR CHARGING ELECTRIC VEHICLE BATTERIES

Batteries must, however, be charged at a certain voltage or electrical pressure and a certain number of amperes per minute or per hour must be sent into them, the same as if you were charging a watertank at a rate of so many gallons of water per minute from a hose stream under a pressure of a given number of pounds per square inch. This charging rate depends upon the number of cells and other conditions. Knowing what this charging rate should be for the battery, it is possible to regulate to the right amount by turning the rheostat handle and watching the ammeter and voltmeter on the panel.

The first requisite for the beginner is to learn from the manufacturers the capacity of the battery in kilowatt hours, or in other words, the number of kilowatt hours of electrical energy that must be put into the battery so that the specified mileage may be obtained. An account should be kept of the kilowatt hours used for each charge by reading the kilowatt hour meter.

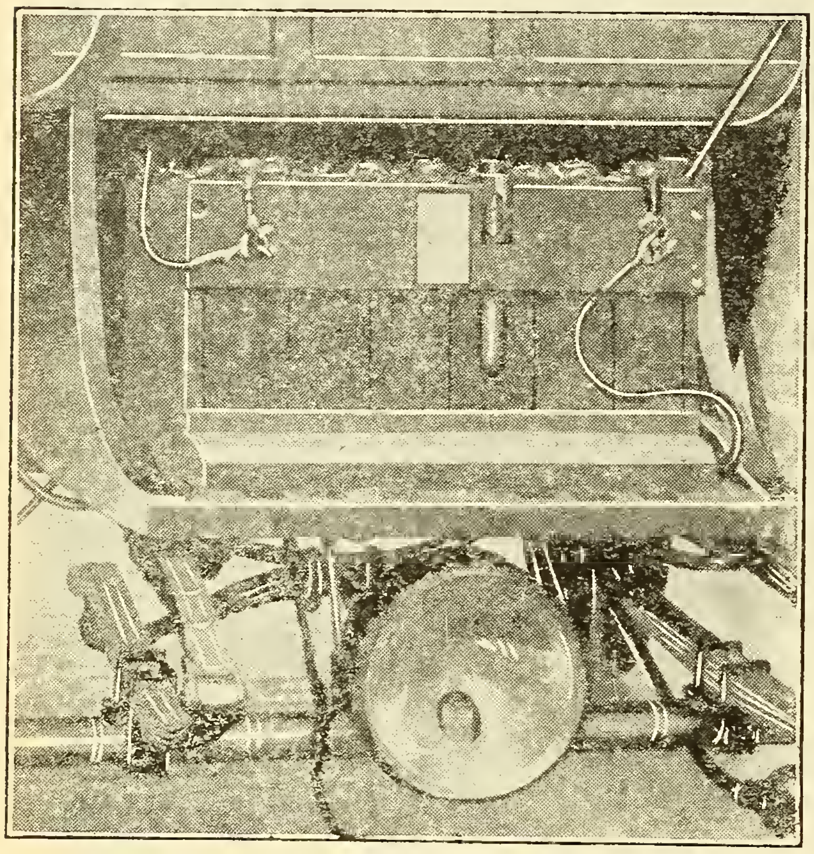
When the capacity of a storage battery has been expressed by the manufacturers in ampere hours capacity per cell the kilowatt hour capacity can be easily calculated when the number of cells in the battery and the voltage of each cell are known. The average charging voltage of each cell of a lead battery is 2.3 volts per cell; a battery of 40 cells will, therefore, have a voltage of 40 by 2.3, or 92 volts. If the capacity of each cell is 112 ampere hours the capacity of the battery will be 112 by 92, or 10,304 watt hours, or a little over 10.3 kilowatt hours.

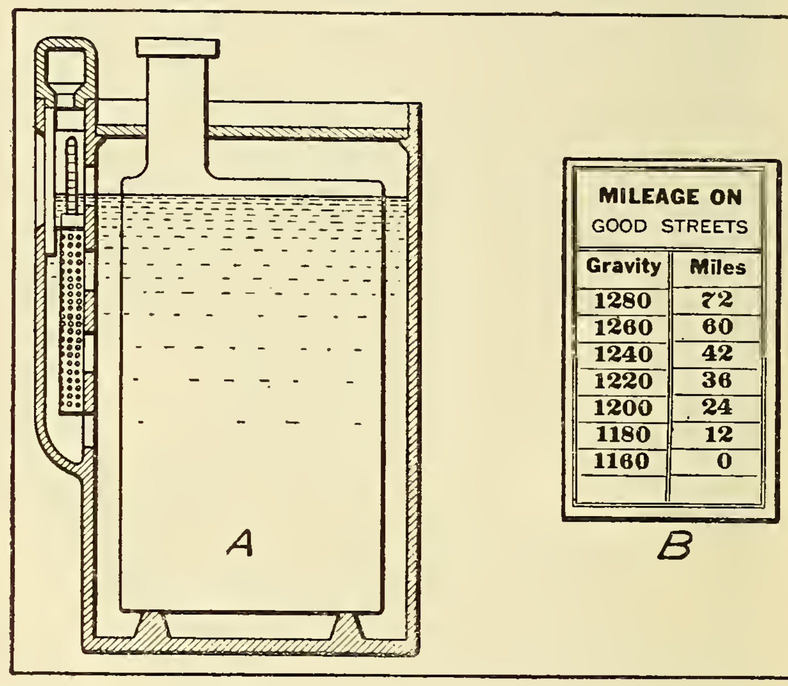
To insure continued efficient service a record should be kept of the amount of current that is put into the battery and the strength of the acid in the individual cells must be frequently tested in order to determine if all the cells are working uniformly. If for any reason one or more cells are working differently from the others the effect may not be noticed at once in the operation of the vehicle, but the voltmeter reading can no longer be relied upon, and as a consequence the charging is likely to be done in a manner injurious to the battery and with a consequent waste of current. If a defective cell be found prudence dictates that it be removed at once.

There are no set rules for charging the battery that will apply equally well under all conditions — the reason being that a lead battery will absorb the current faster at the commencement of the charge than towards the end, and consequently the rate that will charge the battery in the shortest time and without injury to the plates will taper gradually from the commencement to the end of the charge. It is usually recommended that the charging be started at a comparatively high rate and reduced towards the end to about one-half of that rate. As primary information the starting and finishing rates should be ascertained. The battery manufacturer will cheerfully furnish this information.

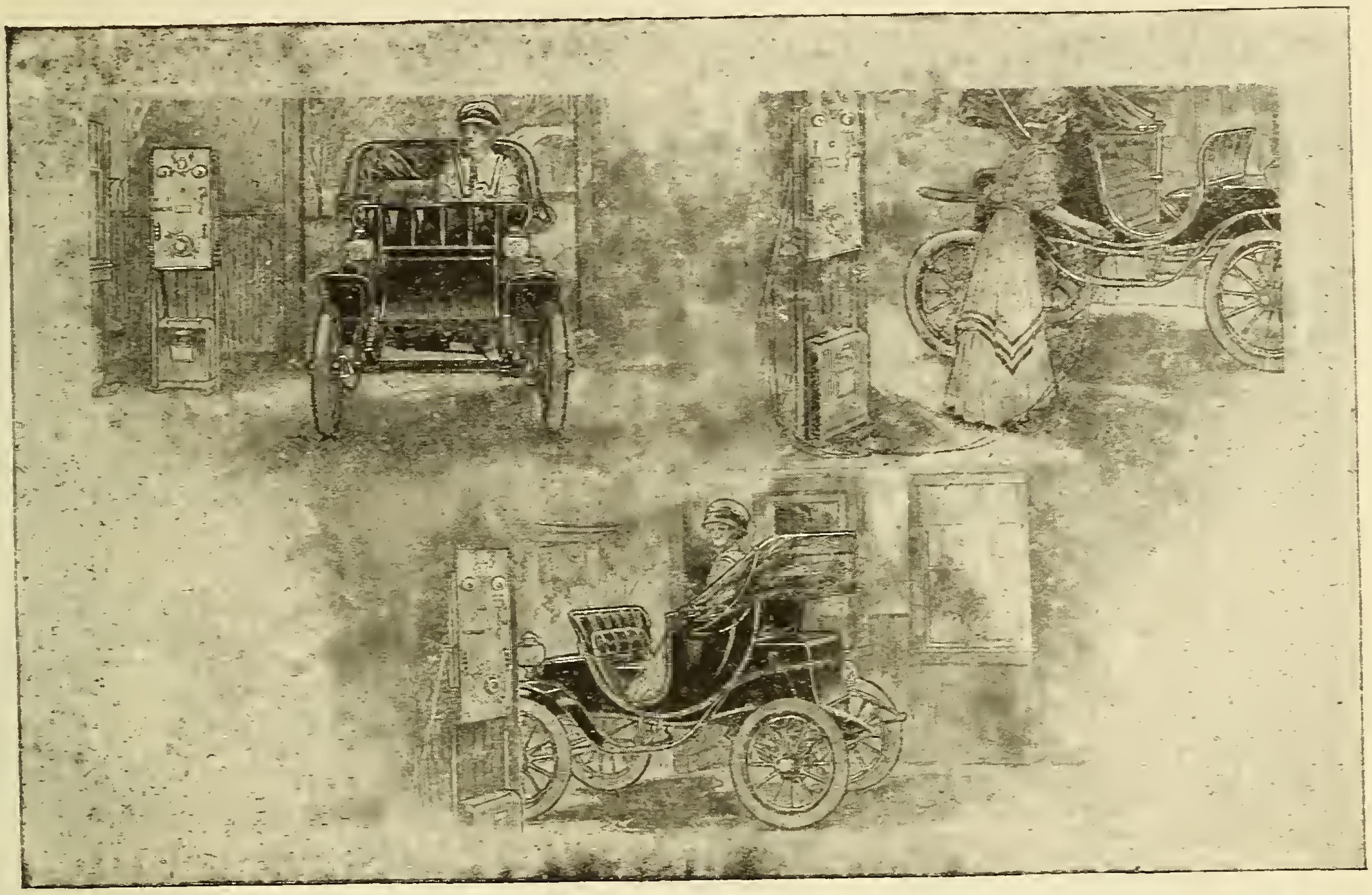
An instrument called a hydrometer is made for testing the specific gravity of the electrolyte. This instrument, which is allowed to float in the liquid, has a scale reading from 1100 to 1300 degrees specific gravity. When a battery is fully charged the best results are obtained when the strength of the acid is about 1280 specific gravity. When the battery is practically empty the reading is about 1180.

With the battery fully charged and ready for a run the following instruments are needed on the machine in order to watch the general condition of the battery: A voltmeter to indicate the voltage of the battery; an ampere meter to show the rate at which the current is going out of the battery; a hydrometer to test the strength of the acid in the battery, and a mileage indicator.





HYDROMETER BUILT IN THE SIDE OF A CELL AND CHART WHICH SHOWS HOW MANY "MILES" ARE LEFT IN THE BATTERY

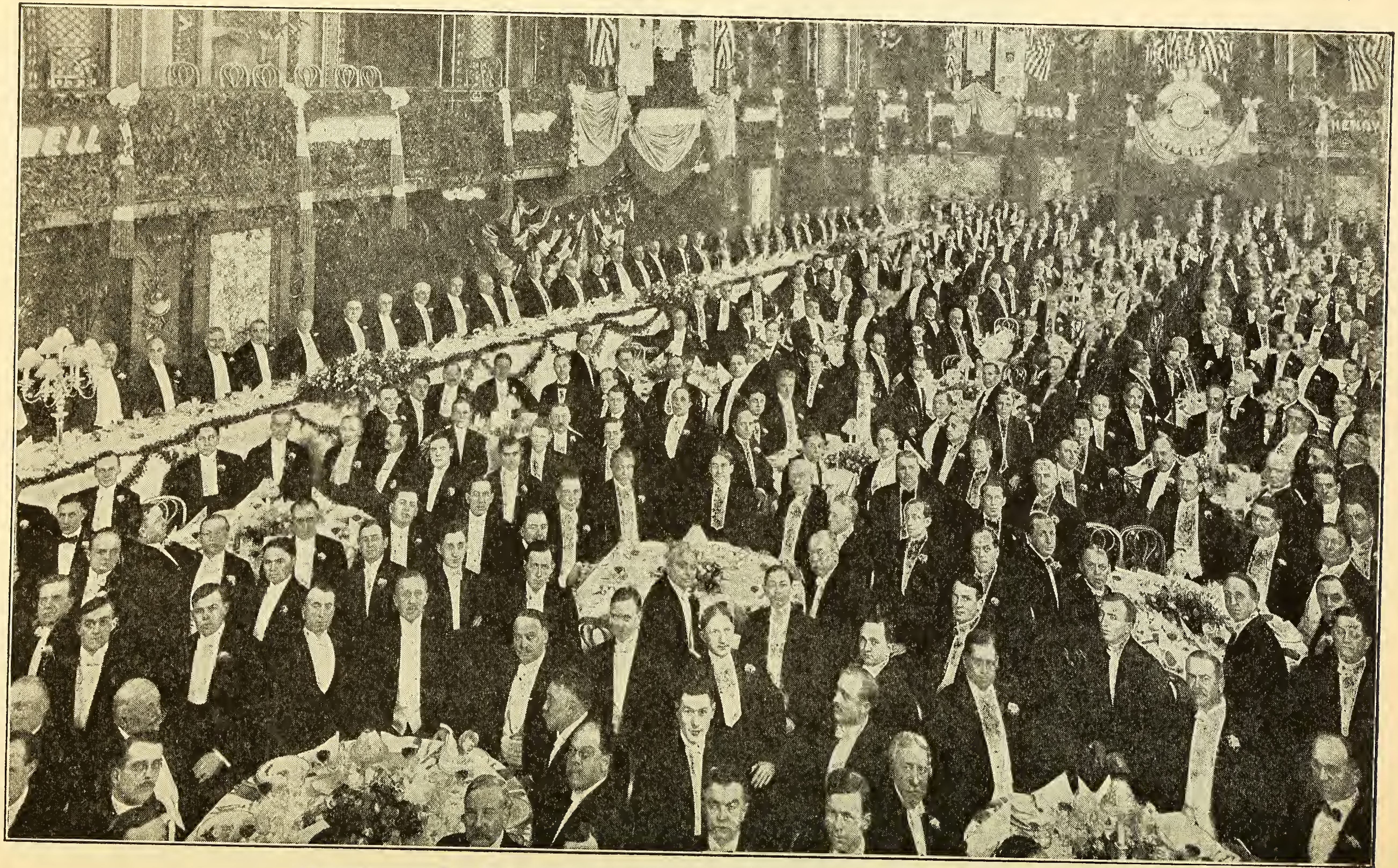


THE CHARGING OF THE BATTERY IS SUCH A SIMPLE OPERATION THAT A WOMAN MAY EASILY ACCOMPLISH IT

In a general way you know about how many miles a single charge is good for and the mileage indicator gives a rough check. The ammeter shows whether or not you are overworking the battery by a too heavy drain of current. The voltage shown on the voltmeter tells quite clearly after a little practice in reading how nearly the cells are becoming run down. The hydrometer, by showing the specific gravity, is also another check.

A very simple arrangement has been gotten up in the last few months by which the amateur even can tell the exact state of the battery. A hydrometer is built into one side of one of the cells, but so that it is readily visible. Back of it is a graduated card against which the hydrometer scale shows, without any interpolation, approximately how many "miles" are still left in the battery.

(To be Continued.)



BANQUET OF THE H. M. BYLLESBY COMPANY, AT WHICH THOMAS A. EDISON WAS A GUEST

Edison Sees Chicago After Eighteen Years

An event of unusual interest to citizens of Chicago was the visit of Thomas A. Edison on January 5th to 7th. It had been eighteen years since last he had been in the city. The object of his return this time was primarily to attend a banquet given by the H. M. Byllesby Co. to the staffs of its own and affiliated companies, and held on the night of January 5th in the Gold Room of the Congress Hotel. Mr. Byllesby was one of the young men who started to work for Mr. Edison 38 years ago, and like the few others so favored holds deep reverence for the great inventor, at whose feet he sat, figuratively speaking, in the early and exciting days of electrical development.

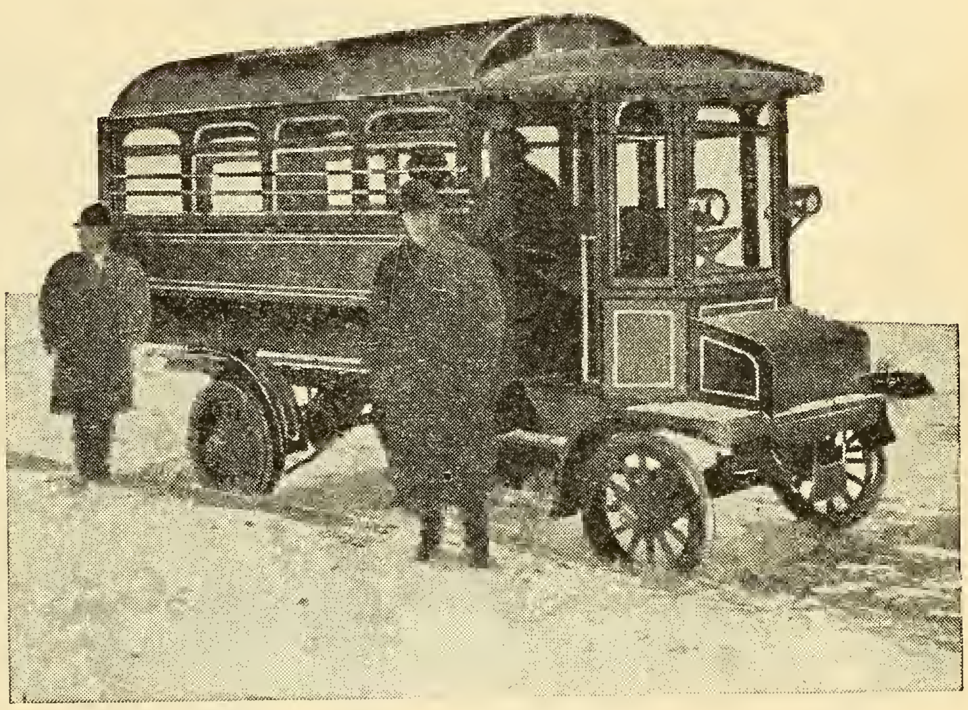
Mr. Edison was accorded a remarkable ovation at the banquet, which was attended by more than 400 members of the Byllesby organization and invited guests. Among the latter were a number of very prominent men in electrical and financial circles, including Governor A. O. Eberhardt, of Minnesota; C. A. Coffin, president of the General Electric Company, of Schenectady, N. Y., and Charles G. Dawes, president of the Central Trust Company; B. E. Sunny, president of the Chicago Telephone Company; George M. Reynolds, president of the Continental and Commercial National Bank, and Samuel Insull, president of the Commonwealth Edison Company, of Chicago.

Following a rule as fixed as the Rock of Ages, Mr. Edison did not make a speech, but Mr. Insull, who, like Mr. Byllesby, was connected with and received inspiration from Edison in those epoch making years when the incandescent lamp was taking form, spoke for him. He was followed by other speakers and such opinions as: "The greatest private citizen of the age;" "The foremost American citizen of the time;" "The name which carries the greatest and best inspiration to young men;" "The man who has done more for mankind than any other in the history of the world's workers," were expressed.

Time after time the man whose marvelous ingenuity and patience has given to the world some of its greatest blessings bowed in acknowledgment of the storms of applause which greeted each reference to his wonderful work.

In the course of the speaking, Mr. Edison passed to Mr. Insull a note to be read—a word of advice to the younger element present.

"To the young men here tonight, I would say: When you get a job, pitch into your work and pay no attention to the clock or to time. Think of nothing, talk of nothing but shop and when the boss comes around, pay no attention to him, but to your work and my word for it, when you want to leave for some other job, the old man won't let you go, but will likely take you in as a partner."



MR. EDISON POSING BESIDE ONE OF THE NEW ELECTRIC OMNIBUSES

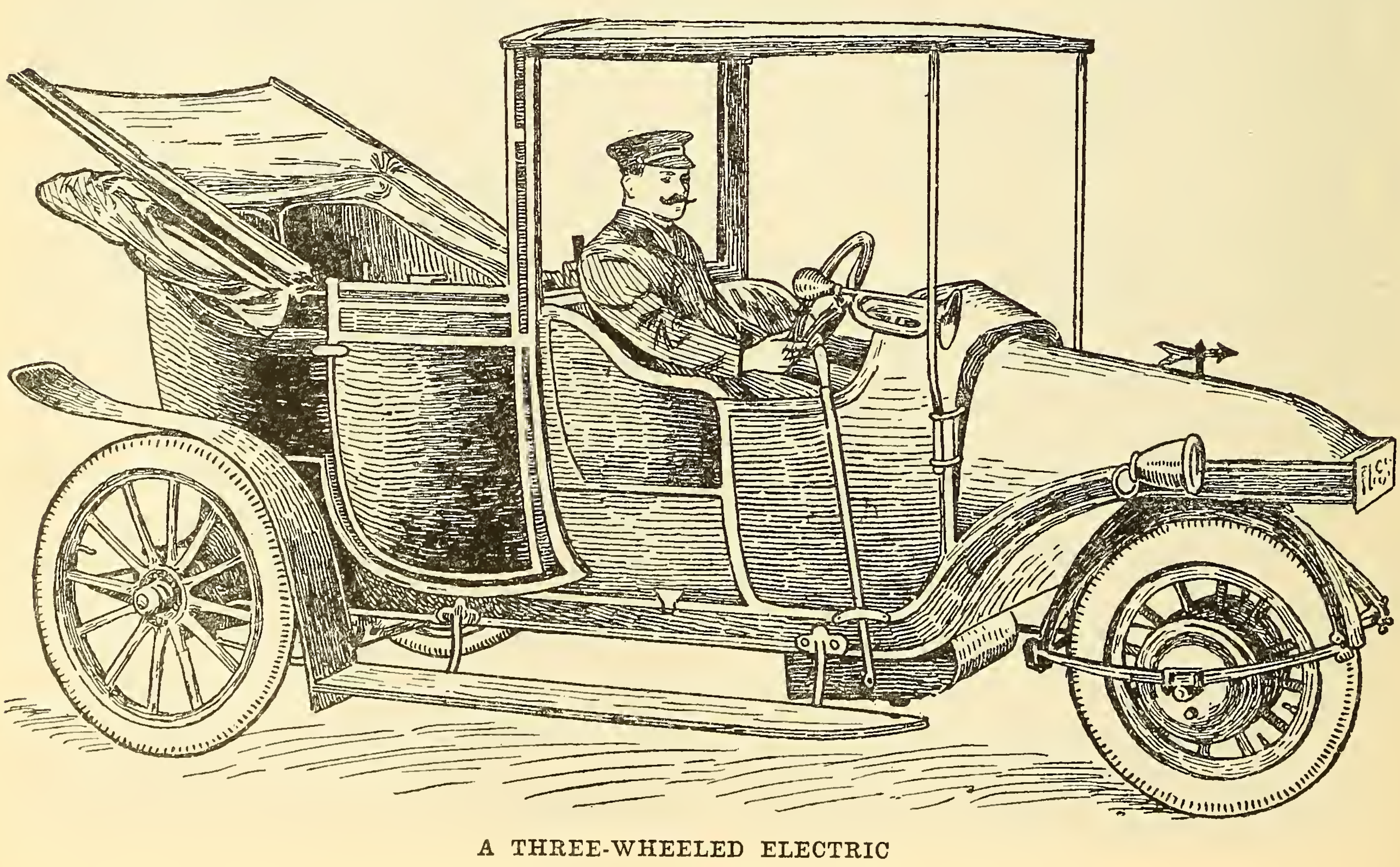
A significant circumstance in connection with Mr. Edison's visit to Chicago is one which may possibly result in future alleviation of the smoke evil. In a conference with President Markham of the Illinois Central Railroad, the suburban trains of which are operated by steam locomotives, Mr. Edison enthused the railroad chief over the possibilities of the Edison battery to such an extent that two or three electric locomotives, equipped with special tenders carrying batteries, will be built and given a thorough trial. This system, which was described in the December, 1911, issue of this magazine, does away with trolley wires and third rails. Each locomotive draws a battery tender as a steam locomotive draws its water and coal. A tender is switched off when its batteries are discharged and one with freshly charged batteries taken on, at regular charging stations. The present development of the Edison storage battery in line of output per unit weight has made this an economic possibility.

Mr. Edison is also interested in the development of electric omnibuses, using his batteries on omnibuses and trucks. The omnibuses are equipped with the batteries, which are placed under the seats and in the bonnet in front. They are of sufficient capacity to give a daily run of from 70 to 90 miles on one charge. In fact, this method of providing a popular mode of rapid and comfortable transportation in cities is one of his pet ideas.

In the picture on the preceding page Mr. Edison is posing beside one of these omnibuses, which has been supplied to one of the department stores, the photograph being taken in front of the Blackstone Hotel, where he was staying while in Chicago.

Three-Wheeled Electric Autos

Among the unusual types of automobiles now seen in daily service in Germany, is the three-wheeled electric type used both for pleasure purposes and for light store delivery work. In the latest of these, the motor is built right into the single front wheel, which does both the driving and the steering, so that even the usual slight purring noise of the power transmission in the electric autos as we know them, is eliminated. The steering wheel turned by the driver locks itself in any position, so that his arms are not wrenched in controlling the single wheel. The arrow at the front of the machine shows how the drive wheel is heading.



A THREE-WHEELED ELECTRIC

Electrical Securities

Fake Electrical Securities and How to Avoid Them

By "CONTANGO"

A great deal of money has been lost in the past few years in "fake" electrical schemes and others of a like nature. This article will try to show what to avoid and give the reason why. As this year is likely to see unusual activity in both stocks and bonds the country over, you should get posted and be in a position to put your spare cash with the safe and growing concerns. It is the year of readjustment after troublous times.

Avoid the false, stick to the true.

"By your works shall ye be known" is an old scriptural injunction, or wise saw. Today it might be well changed or paraphrased, in so far as it might be applied to securities, particularly those of an electrical nature, to read: "By your words—your written words—shall ye be known."

The past three or four years has seen a multitude of offerings of stock and securities by accepting which we might all become millionaires in a few years, not to mention months. Of course this has been all rubbish—mere promises, nothing else. Unfortunately the public has been badly fooled and badly hurt to state the bald fact in blunt English. Confidence has been disturbed and the worst of it is that the best efforts of science have always been used to deceive and exploit the public. Somebody discovers something. There are millions in it. Then at once unscrupulous promoters form companies using the name of the particular drawing card in one way or another, and ask the public to subscribe to huge stock issues in something that is going to revolutionize the homes or business life of the whole world.

For example, take "wireless." A few years ago a dramatic episode on the Atlantic coast brought prominently before the people the practical value of this wonderful invention. Immediately the astute promoters of wild-cat schemes saw an excellent opportunity for gulling the public. This time the magnitude of the publicity already at command brought a corresponding magnitude in the crime perpetrated. A huge so-called wireless company was formed and stock was brought out which it was possible to buy for a nominal sum, and millions of dollars were garnered in by all manner of promises alluring and deceptive, telling of the extraordinary profits to be made out of such a "very extraordinary *investment*" opportunity.

It is true that a few years previously office boys and other peddlers had been selling wireless stock in another company at five cents a share, or anything they could get, strictly on commission, but their efforts were nipped in the bud by the legal actions taken by the substantial promoters of what has since proved to be a conservative and genuine enterprise. The fever was then excited, as it always is, by the newspaper stories coming out from time to time.

But at that time wherever was there a physical asset or a possible piece of tangible property?

Before you invest, consider this, just ask yourself: Are problematical, not even that, but hypothetical, earnings good enough for me? No, a thousand times no. To be more definite. What earthly assets are there behind something quite in the air, except that here and there might be found a few stations or ships equipped with something that might or might not come into universal use? It was at best speculation of the worst kind.

It has taken the old, original wireless company going about its business in a conservative and methodical manner, many years to acquire rights, government recognition and any contracts worth while. Yet it has had behind it men of enterprise, character, money and well known probity.

It is always true that in any sphere of life, even in the smallest village, there may come a moment when money can be made easily and simply because some man grasps a situation, gets in a stock of goods, say, and sells it like hot cakes, but that does not represent an investment, it is purely a speculative chance. A change in the weather may "boost" it or "knock" it endwise. This is not what you or any other sane man or woman wants.

Again to illustrate, take another case, that of a certain "cold" electric company. Even wise politicians thought they could make money quickly here by asking the people of the country to subscribe for shares in something they must have known was not only an unknown quantity, but merely a hocus-pocus resting on the imagination of anyone influenced by the term "latest electrical wonder" and who lacked the common sense to quietly consider, investigate and ask those better and more practically informed, before parting with their hard earned money.

It is not the particular purpose here to give a list of all the vile and disgraceful efforts made by the mere use of the word "electricity" or a suggested use of an illustrious name. To influence and rob the public, and by playing around this most distinguished name a lot of harm has aforetime been attempted. There have been wireless telephone companies, wireless cooking companies, wireless opera companies and there still will be.

But where are their physical properties, their tangible assets? Ask yourself that. Is problematical good will all you care about when you give up your funds?

Take the electric traction companies, most of which have some attribute of property, property rights and right of way. Are they all solid, based on a solid foundation? Not by any manner of means.

Hundreds of little lines are projected and even started that lead to nowhere, except possibly between one small point and another. Therefore rolling stock, road bed and connections to and from the centers of population are things you must and should consider. A year or so ago attention was directed in Popular Electricity by the writer of these articles to the electric traction proposition taking it by and large. It was then pointed out that the underlying principle of anything worth while, must rest in the connection with or certainty of becoming part of a "system."

Concentrate your funds in buying into the concentration of a system. Be yourself systematic. That is the best advice that can be given.

There is in point of fact no opportunity like the present for acquiring a partnership in the really big things of the day. For surely the electrical development of the times is little short of marvelous. With the steady growing of the interburban and the progress in the use of electric power and light there would seem to be no end to the possibilities before us. But be careful. Do not be led astray by the false use of the word "electricity."

In this connection the writer may observe that as far back as 1893 an electric air line from Chicago to St. Louis was one of the schemes of the day. Yet after the lapse of eighteen years we have just arrived at the McKinley System of Illinois and the McKinley bridge across the Mississippi. Working along the lines of consolidation and careful systematic linking up, you bit by bit arrive at such results. Therefore be careful.

To turn once more to the valueless or "fake" security.

We take an investment offered you in this guise. It promises ten per cent as a sure return the first year and the certainty of greatly increased earnings year by year. This merely means that out of the money your neighbor has paid in or subscribed for stock after you, they pay your first dividend, then they pay your neighbor his ten per cent dividend and yours of the following year out of the money taken in from yours or his friends and neighbors, and so it goes on—an endless chain seemingly, but to the final weak spot. For one fine day you get a letter saying that owing to the vast needs for development of the property, they will have to apply the interest earnings in extending the business, meantime will you not accept a note for the interest earned "just for the time being." That is the end. They never earned anything and there not being enough money coming in to go around they began to pay in paper promises. Therefore to come back to the suggestion made in these columns last month, you at once begin to look up the men behind the gun. You then find that there is absolutely nothing to them or their proposition except the glittering generalities involved in the bare use of the name "electricity," or even sometimes the talking around the distinguished name by means of which they have fooled you. This point is mentioned to bring out the fact that while the name of some one or the other great inventor has never been directly used commercially in a wrong way, yet often by inference you have been led to believe a stock or "security" offered you was concerned with something of which this personage had cognizance or of which he approved or which he had invented.

As a matter of fact honestly and directly his name never has been used except in connection with the great companies in all centers with which he is to a positive and very certain extent associated.

The postoffice inspectors are usually appealed to as the result of these deceptions, and it is found that unless there are certain definite fraudulent statements coming within that section of the United States Postal Regulations under which they work, nothing can be done. Great credit should be given the department, however, for its work in the past year or two in helping to weed out the bad and "fake" propositions put before the public through the mails or by the use of the public press. As to the latter all newspapers are now comparatively careful lest they be found *particeps criminis;* that is to say, the safeguards thrown around their advertising columns are now more based on common sense and common probity with a more perfect view of their responsibility toward their readers.

Circulars through the mails coming from irresponsible sources, teeming with intangible promises, huge advertisements speaking of what may be done and asking for your money on such grounds, are to be very carefully eschewed, left alone and eyed with suspicion.

What you want to know is the extent of the property behind the proposition and the reason why men with such a good thing want to make the public partners in it.

After all, the money for all *big* enterprises comes from the public at large, because no one can control the necessary amount of capital. The best way, the only way to secure that capital is to be frank, square and entirely honest, giving full publicity as to what is behind the offer, not what is in front of it, for that must ever be the aftermath or likelihood beyond the solid foundation.

To particularize again: It is usually stock to which your subscriptions are solicited. Your fake enterprise very rarely gets to the bonding period, partly because there is nothing to bond and mainly because there is the possible crime attached to the selling of a bond based on property which does not exist, a crime not attached to the mere distribution of more or less speculative shares of stock. Moreover, bonds quickly get into legitimate financial channels and are promptly tabbed and classified and the answer comes back —"worthless fake," or "nothing doing," or "good" as the case may be, and usually very promptly. But even bonds have been issued or sold quite well for which there was no property security whatever.

It might be well to say here that while no man can be expected to know the reputation of any given individual outside of his immediate locality, yet every man can ask the nearest reputable banker as to whether the names associated with any given enterprise are good or not. As to stocks or so-called securities peddled hand to hand, by agents working for salaries and commission, they are on the face of it not worthy of any serious consideration.

To summarize a difficult situation, for it is impossible to reach everyone, and one can but hope to influence a few, put your money every time with the big amalgamations of capital and real property whenever you have such opportunities. It may be only a hundred dollar share or a thousand dollar bond, but it is safe and good at all times. A five or six per cent investment of this kind is "Good as a Government Bond" and better; it brings in much higher interest and is progressive. Such companies don't make great claims in glittering generalities as to what they are going to do—they tell you what they have done and what, with an ever growing population, substantial property and reasonable franchises, they are *likely* to do in the future. They do not go backwards, but in businesslike manner take care of future business by getting it.

A few direct words of warning will be in place here. The time has gone by when the electrical engineer can wrap himself up in the purely scientific aspect of his profession, looking to the academic end alone. He now more and more realizes the necessity for being down on earth and for commercializing his knowledge along practical lines, knowing that there is a lull in the matter of great scientific discovery. It is the improvement of the inventions of the past and immediate present which at this time concern him. So, just because a company with a scientific sounding name of Latin or Greek beginnings such as *Radi* or *Radio,* or *Tele*—advertises in an attractive way the certainty of great wealth if you invest in its stock or bonds, you most certainly should not jump at and swallow the bait. No doubt you may think of the telephone and telegraph and other wonders, but it is perfectly possible even at this time to acquire an interest in the great organizations controlling those inventions, and a safe interest is much better than the get-rich-quick chance.

It may be found a useful guide to follow these suggestions: Keep away from all stock propositions that are based on a small, very small sum of money, such as a few cents for a single share and which state that the price of the stock will be advanced 50 per cent in six weeks or six months, as the case may be.

Remember the fate of those who bought the much advertised wireless company, the shares of which were offered to the public at one price in one city, another price in another city, and so on all along the line.

Keep away from all propositions promising ten per cent interest the first year or even paying it.

If it is paid at all, it is done by using the money of later subscribers than yourself, and thus keeping the game going as long as "the suckers bite;" that is to say, send in their money. When the money ceases to come in they begin to pay in paper promises, until even that fails and then the government or other authorities step in.

Do not bother with any perpetual motion or never stopping clock projects. They sound wonderful, but are merely tricks by which to catch the unwary.

Remember the "cold" electric invention, described as the "most marvelous, scientific discovery of the age." It took in quite a lot of money from the unwise.

Also look out for those who constantly talk around some famous name and "Electricity," with a big "E," but without either of them having any real relation to the stock offered for sale. This is an old trick.

In regard to taking stock in small lighting and power or traction companies, be very careful unless you are acquainted with the promoters and the locality. It must not, however, be forgotten that there are various big holding companies directly interested in these little concerns, the stocks and securities of which are carefully guarded and which therefore may really be considered as part of a big system—at any rate they are under the ægis of big supporting interests. Find out as to these by asking your best banker.

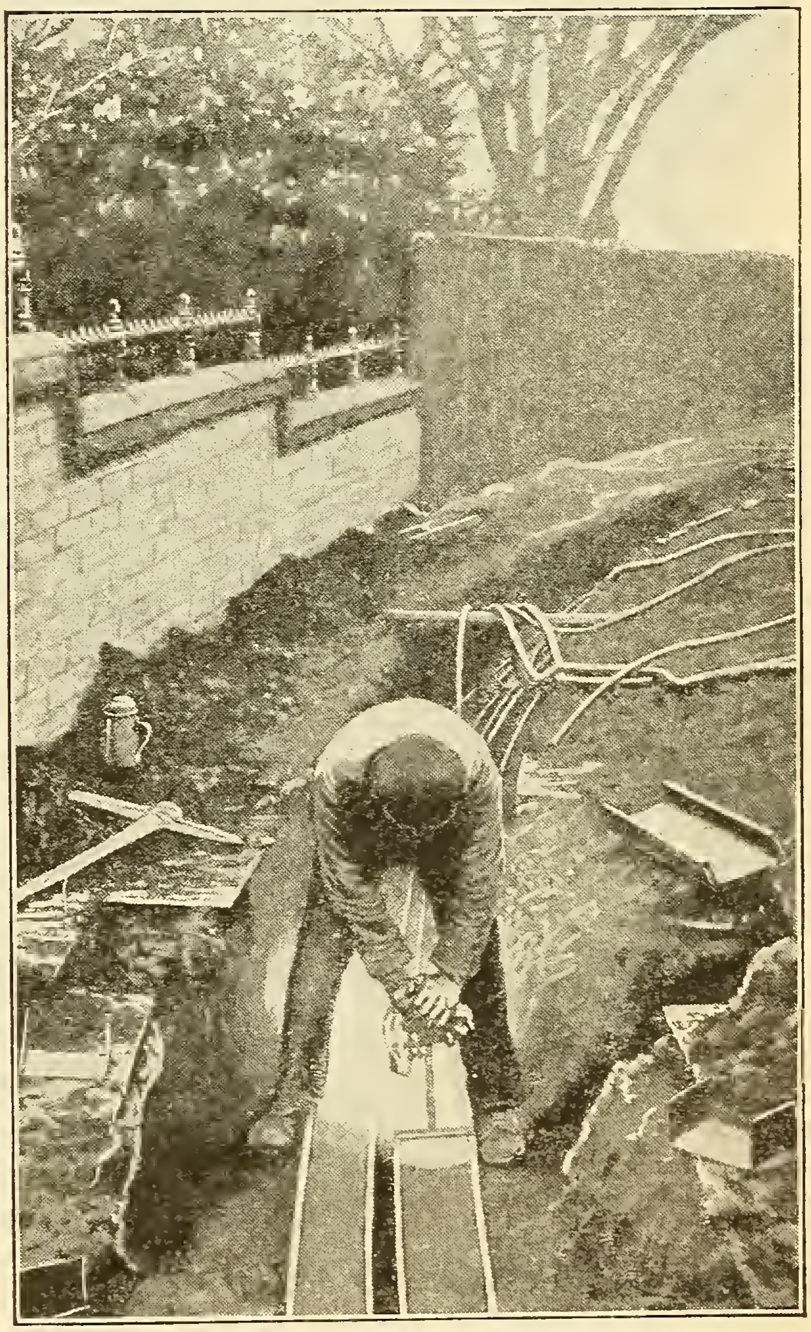
As to publicity and what you see in the papers, times are changing, reputable papers are less and less inclined to take bombastic and illusive financial advertisements. As already noted it has been forced upon them that one fine day they may find themselves held as parties to the crime of deceiving the public. The plainer an advertisement, the less it gives of promises and the more it gives of facts, the more likely is it to be sincere and not bogus. Nevertheless even the best newspapers cannot guarantee all the financial statements appearing in their columns.

Finally remember that when a man, or set of men, has or have, a very good thing out of which much money is quite likely to be quickly made, it is very unlikely that the good thing will be shared widespread with the public at large. On the other hand, it is to the interest of the big public service corporation having a great and growing business to offer its stock and securities quite freely to the public because the more the public is its partner in some form or another, the greater the certainty of an ever increasing business.

Stick to the stocks and bonds of such companies then and leave vain promises alone.

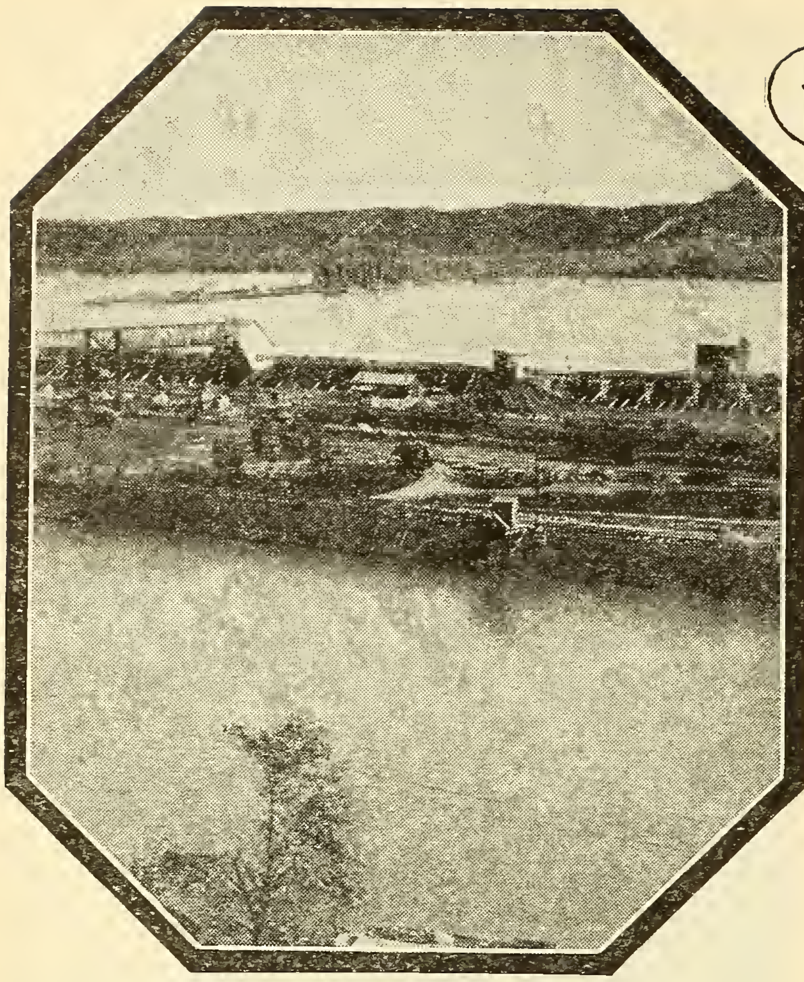
English Method of Cable Laying

This illustration shows the way in which electric cables are often laid in England, being a view of a section of construction work in Trafford Park, Manchester. The cables are laid in a



CABLE LAYING IN ENGLAND

wooden trough in the bottom of a shallow ditch and the trough is then filled with hot asphalt and smoothed off as shown, a wooden cover being added. The cable is thus thoroughly protected from moisture and from damage by the picks and spades of the gardeners who might have occasion to dig around it.



Harnessing The Father of Waters

"All the rivers run into the sea, yet the sea is not full; unto the place from which the rivers come, thither they return again." This principle was expounded by the Teacher centuries and centuries ago; it is the working principle of all the hydro-electric plants which in recent years have followed one another so rapidly that the public scarcely gives the matter a thought when a new one is announced. Yet there is one now rapidly taking form which merits more than passing attention. The Mississippi, Father of Waters, is being harnessed. A bit is being placed in its teeth in the form of a concrete dam larger than any ever before constructed, aside from the Assuan dam on the Nile, which latter is for irrigation purposes.

This is the greatest single hydro-electric power proposition in the world. Ultimately it will be able to deliver 200,000 horsepower of electrical energy. Its site is at the junction of the Des Moines River with the Mississippi, at Keokuk, Iowa.

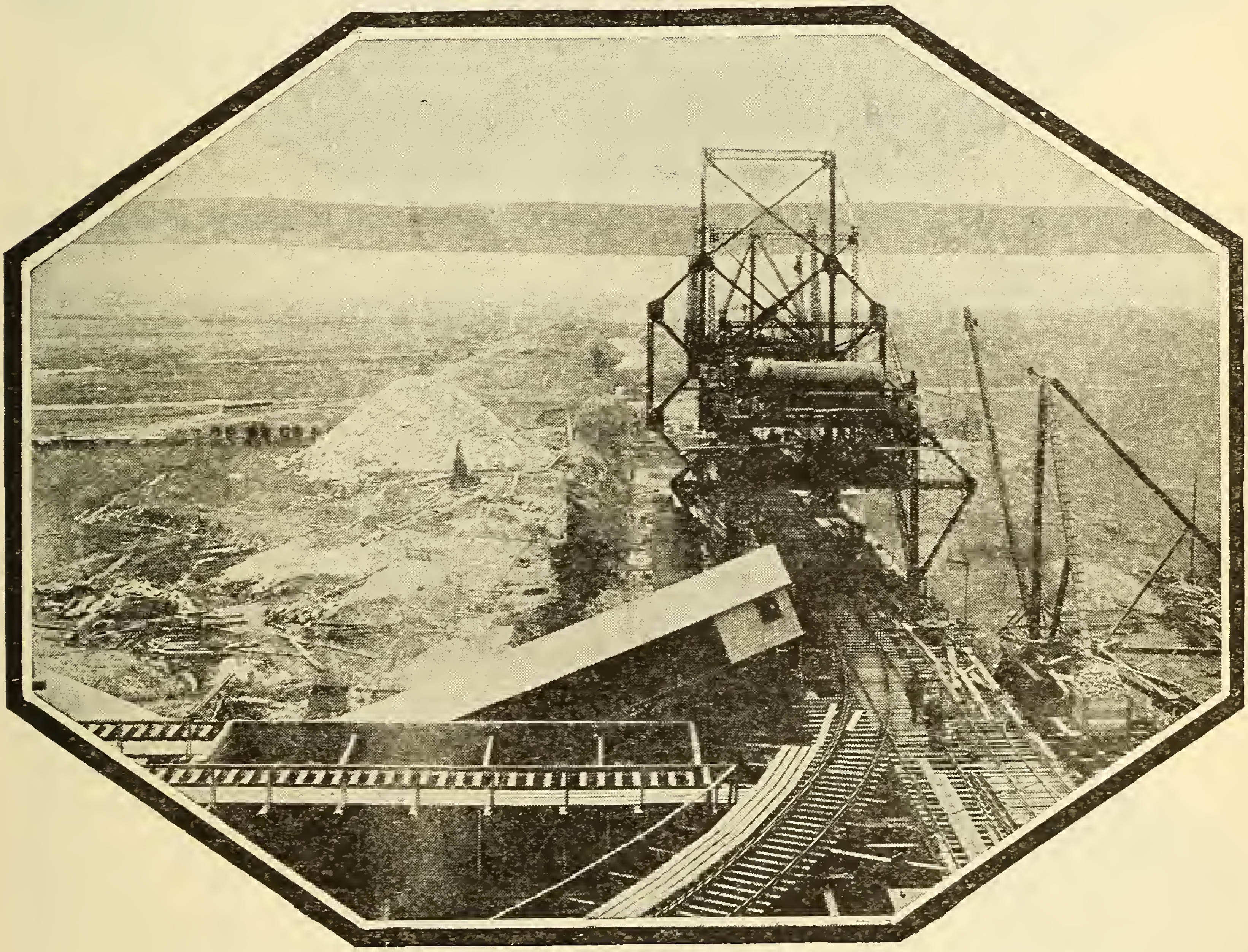
Briefly stated, the work embodies: First, a dam 4,400 feet long, running squarely across the river from the Illinois side; second, a power house, 1,700 feet long, connecting with the west end of the dam, and lying very nearly parallel to the flow of the river; third, a lock and dry dock which will tie the south end of the power house with the limestone bluff of the Iowa side, and in this way complete the wall of masonry nearly a mile and a quarter in length. This will concentrate at one place the fall, which, in the good old days before dams were thought of, old Father Mississippi took 40 miles of its length to accomplish.

The first definite step taken toward the development of the vast power of the river was the formation of the Mississippi River Power Company in 1900, a charter being granted by Congress in 1901. This contemplated the construction of a wing dam at Nauvoo, Ill., twelve miles above Keokuk, and at the head of the Des Moines Rapids. From there a canal was to be dug parallel with the river to Hamilton, opposite Keokuk. Such an undertaking would permit of the development of no more than 10,000 horsepower, and it was abandoned for the far broader scheme of a dam clear across the river. As a result of this, an act was signed by President Roosevelt in 1905 granting the company the right to build such a dam.

Since then the preliminary and actual construction work have been going on, the financing being in the hands of a syndicate, of which Stone & Webster of Boston are managers. Stone & Webster are doing the electrical construction, the hydraulic construction being in the hands of Mr. Hugh L. Cooper. The Stone & Webster Management Association will act as managers of the company on the completion of the plant.

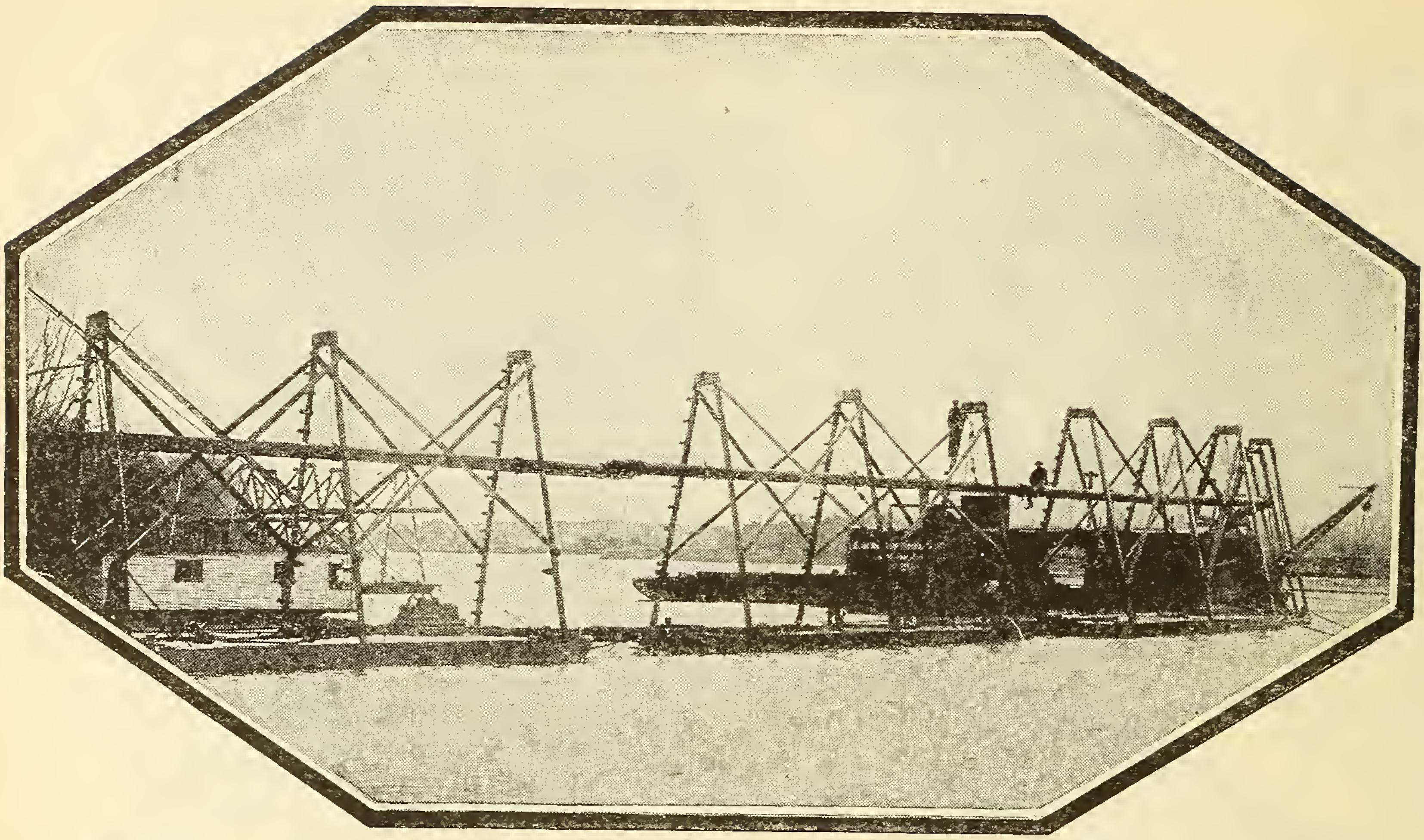
At hand are the materials for construction. Close to the Mississippi on each side are bluffs of clean, hard limestone, and the bottom of the river is of stone. Below the dam site, and in the Des Moines River, are deposits of the right kind of sand for concrete. Within easy reach of Keokuk are many of the largest cement factories in the United States. So, of course, a concrete dam, built upon and anchored to the solid rock foundation was the type chosen, and engineers maintain that it will last longer than the old Roman concrete work, made of natural cement, much of which is in good condition after standing 2,000 years.

Early in March, 1911, the crib work for the power house coffer dam began to be pushed out from the Iowa side, and by July first the last section of this coffer dam had been completed, the enclosure pumped out and 39 acres of the river's rock bottom exposed to view. On this site, which might be termed a sunken island, the immense power house is being built. This will contain as its initial installation water driven generators of 10,000 horsepower each.



TRAVELING CANTILEVER CRANE WHICH DEPOSITS THE CEMENT FOR THE DAM

One of the illustrations shows the mouths of the draft tubes for the first eight units, 22 feet high by 40 feet wide. Each of them is capable of discharging the water, after it has passed through the turbine, at the rate of 3,000 cubic feet a second. This is equivalent to 20 times the low water flow of the Connecticut

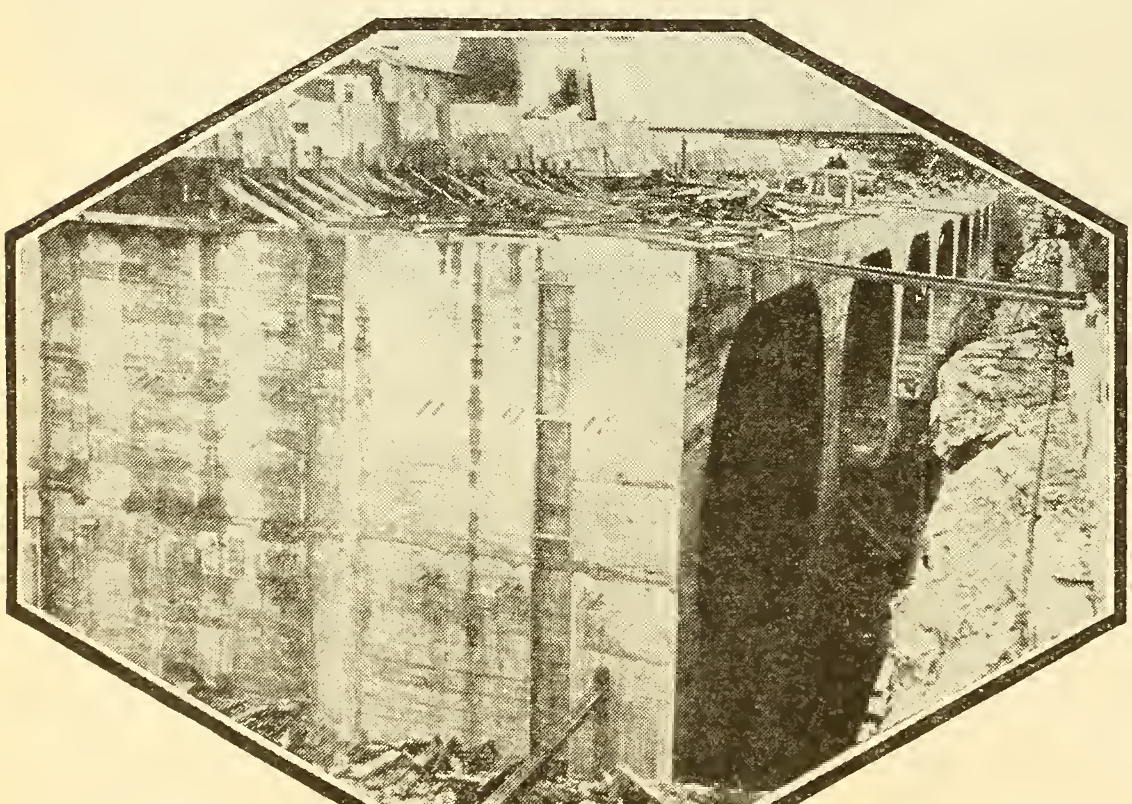


PUMPING SAND OUT OF THE BED OF THE DES MOINES RIVER FOR USE IN MAKING CONCRETE

River at Holyoke. So bereft of its energy will the water be when it leaves the draft tubes, that its velocity will be reduced to a paltry four feet per second.

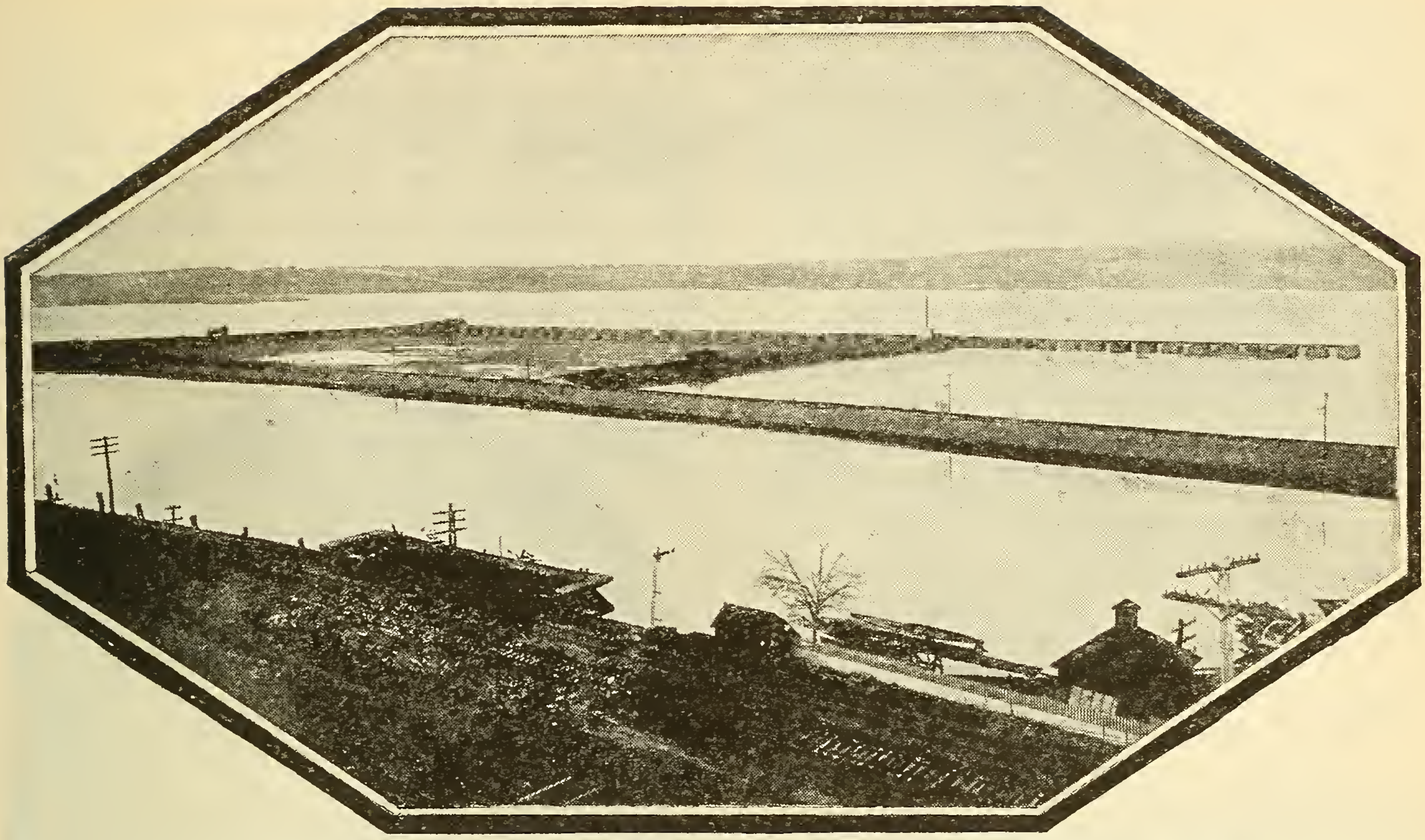
Far across, on the opposite side of the river from the power house, the dam proper is being pushed out and out, until it will finally close the intervening gap. It consists of 119 massive arches superimposed upon a spillway, the upstream side of which is vertical, and whose downstream side follows an ogee curve. The deck of the bridge formed by this series of arches is some 53 feet above the bed of the river, the top of the spillway 21 feet lower, while the use of flashboards controlled by travelers on the bridge will enable the operator to hold the level of the water eleven feet above the top of the spillway.

The construction scheme adopted at the beginning of the work, and adhered to throughout, is to build the bridge first, clear across the river, allowing the space between the piers to take care of the flow of the stream and then to come back and construct the spillway only as fast as progress on the other parts of the work warrants, with the idea of not raising the water above the dam until the power house and lock are ready for operation.



EIGHT OF THE DRAFT TUBES. EACH WILL DISCHARGE AN AMOUNT OF WATER EQUIVALENT TO FOUR TIMES THE LOW WATER FLOW OF THE CONNECTICUT RIVER AT HOLYOKE

The dam is being built entirely of massive concrete, without reinforcement. It is being locked



POWER HOUSE COFFER DAM ON THE ILLINOIS SIDE. WHEN COMPLETED AND PUMPED OUT THIS LAID BARE 37 ACRES OF THE RIVER BED ON WHICH TO BUILD THE POWER HOUSE

into the rock bed of the river by potholes and other excavations, and is practically a monolith. All concrete, except at special isolated spots, is machine mixed, carried from the mixing plant to the point of use in large buckets by trains running on the completed portion of the dam, where a traveling cantilever picks up the buckets from the cars, carries them out and dumps the contents into the forms. On October 15th there remained only 1,700 feet more of bridge to construct; in other words, our friend the traveler has completed considerably more than one-half of his journey. Between him and the Illinois bluff there stands an unbroken line of white arches which it requires only a small stretch of the imagination to compare to the aqueduct of the Emperor Claudius.

But why, you ask, is this great undertaking being pushed to completion? Where will the 200,000 horsepower of electrical energy be used? There is little danger that it will not find a ready market. Even before the first step in actual construction had been taken, the public service corporations of St. Louis, 130 miles south of Keokuk, had contracted for 60,000 horsepower, one-half of the initial installation. The balance of the initial development of 120,000 horsepower and the 80,000 horsepower to be developed later, will, it is believed, furnish the communities within a radius of

NEAR VIEW OF THE GREAT MONOLITH ARCHES FORMING THE DAM

150 miles of Keokuk with the one factor that is needed for the exploitation of their great industrial potentialities. With the rapid increase in industrial development the output of a great waterpower, situated as is this in the heart of an immense territory of natural wealth, will not go begging — not for a minute.

In addition to the development of power, the dam is of value in another direction. A great lake will be formed above the dam, 55 miles long and with a surface of 74 square miles. This will increase the value of the river as a navigable stream. The Des Moines Rapids are not now navigable except at high stages of the river, and were it not for the canal eleven and one half miles long around the rapids, which the Federal Government built some 40 years ago, and a system of three locks maintained by the United States Government, there would be no continuous navigation of the Mississippi River between St. Paul and St. Louis. The dam will create a deep lake, which will extend throughout the length of the rapids and above them to Burlington, Iowa.

Vessels will enter this lake through a single lock at Keokuk, built long enough, wide enough and deep enough to accommodate vessels very much greater in length, width and draft than any now plying on the Mississippi, thus protecting future navigation when, through deepening of the channel, larger vessels may be attracted to the river trade.

Theater Lighting in England

Electricity has very nearly a monopoly of the theater lighting business in England. There are in England 2,900 permanent places of amusement which are open every night. This includes 1,800 picture shows, 300 theaters, and 800 music halls. Only 400 of these places are lighted by gas, 2,500 using electricity, a fact which certainly speaks well for electric lighting. The lamps installed include 375,000 incandescents and 10,000 arcs, all of which are lighted every night.

Taking a Bird's Pulse

The bird in the illustration is having the frequency of its heart beats recorded by what is known to scientists as a capillary electrometer. It is a fact, though the meaning is not sufficiently understood, that the electrical changes accom-

TAKING A BIRD'S PULSE

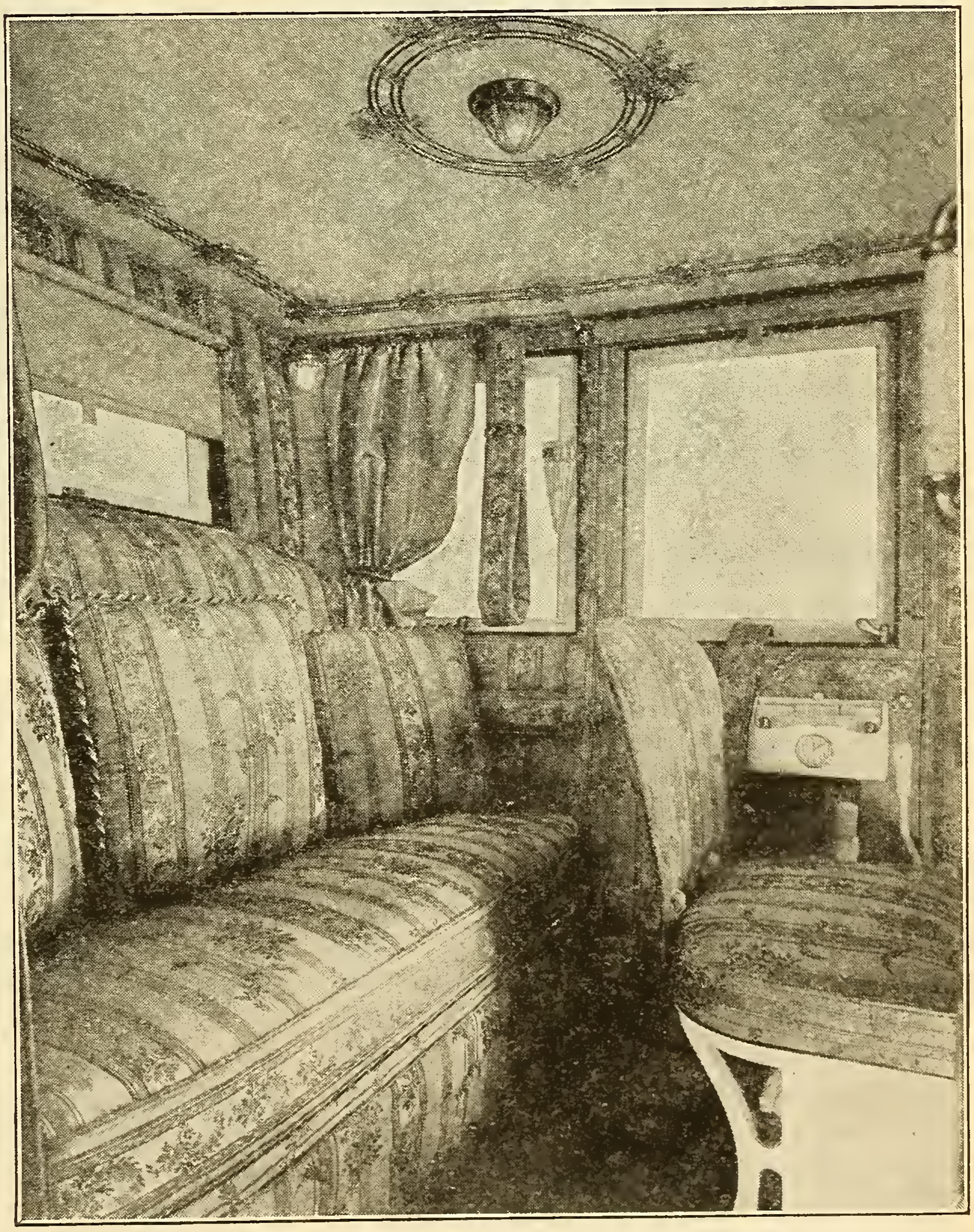
panying all muscular activity, and therefore that of the heart, produce in the case of hearts of mammals, birds and certain, if not all reptiles, two electric fields, one of which pervades the anterior and the other the posterior part of the body.

In order to record the rate at which the fields appear and disappear, as described by Florence Buchanan, D. Sc., in a lecture delivered to the Oxford University Junior Scientific Club, a spot is selected in each, e. g., the mouth and one of the legs of the bird and a good conductor of electricity (such as wood or thread soaked in salt water) connected to these points. The ends of the conductors dip into two basins of salt water. Conductors from the two basins then lead to the terminals of a capillary electrometer, a fine glass tube drawn out to a few thousandths of a millimeter diameter and filled with mercury.

The open end of the capillary tip dips into a dilute solution of sulphuric acid which enters as far as the mercury permits. As the mercury becomes alternately positive and negative to the solution, owing to the changing fields set up by the heart beats, it moves toward or from the solution, respectively. These little movements, up and down, of the mercury column, are then photographed on a moving slide (not shown) traveling at a predetermined rate past the mercury column, and the little indulations or waves shown on the developed plate constitute an exact record of the number of heart beats in a given period.

A Sitting Room on Wheels

This view does not show a nook in a den in some beautifully furnished home, or a corner in the sun parlor of a bungalow. Instead it is the interior of an electric automobile with most elaborate furnishings. The main seat is upholstered like a commodious davenport, plentifully supplied with comfortable pillows. The forward-facing driver's seat is also upholstered and furnished with an easy back. In the frescoed ceiling is a handsome lighting fixture, and properly placed reading lamps are in the corners. To ride in an electric of this kind, even in cold weather, is like staying right in your own comfortable home.

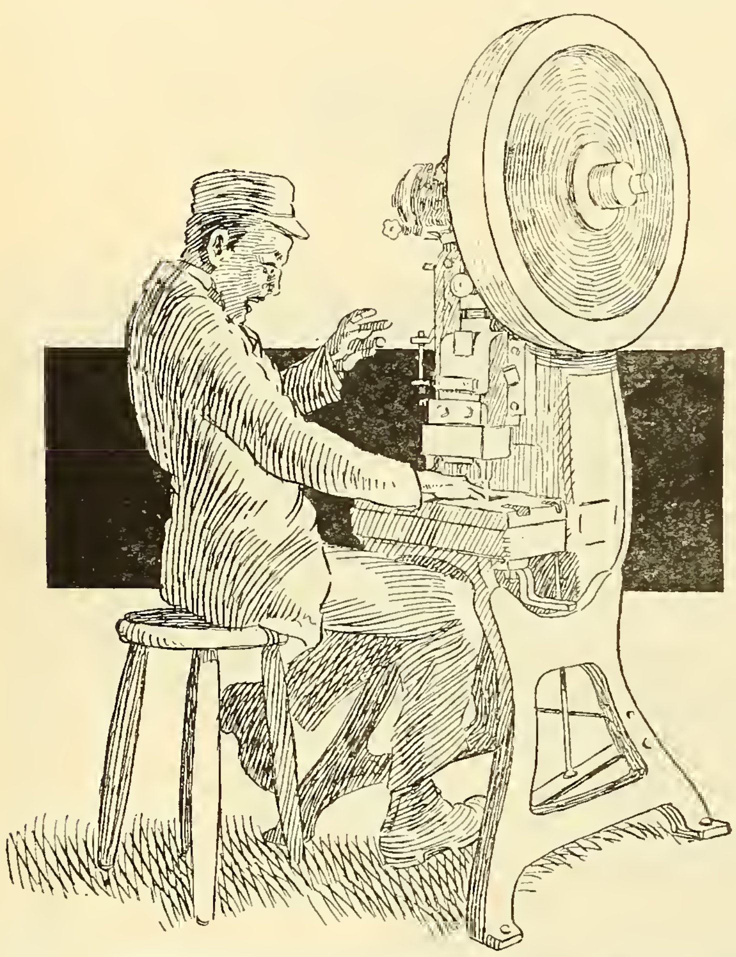


BEAUTIFUL INTERIOR OF AN ELECTRIC AUTOMOBILE

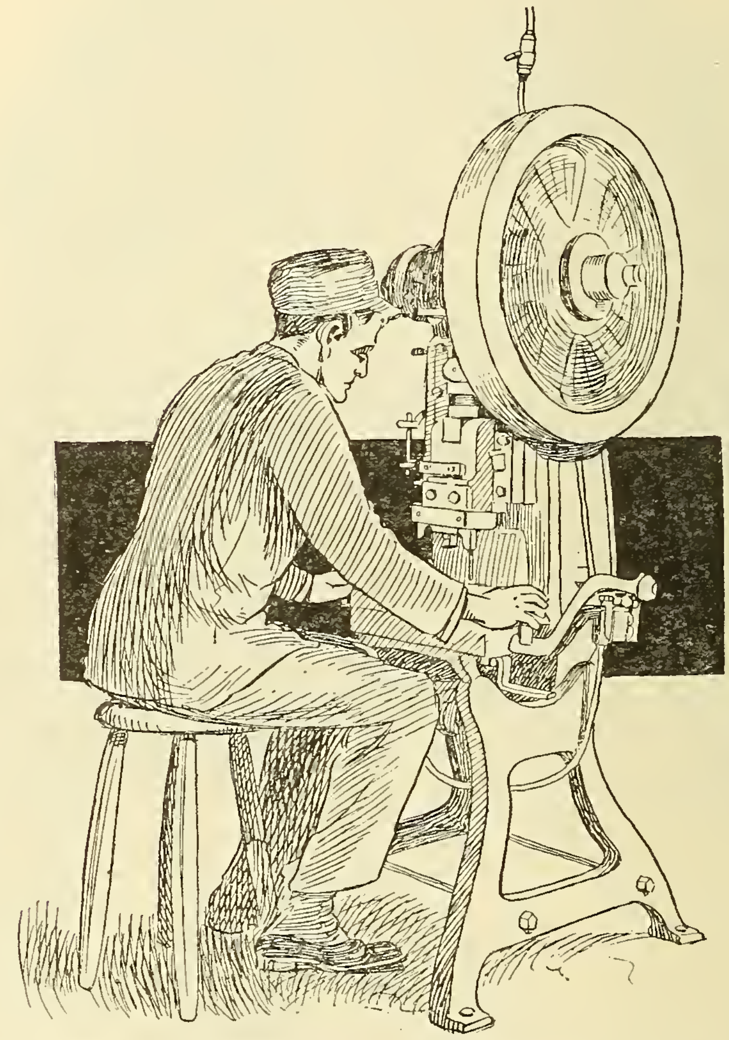
The Maiming Stamping Press Made Safe

There is no more prolific cause of cut off fingers and smashed hands than the ordinary stamping press so largely used in factories where small metal parts are punched and pressed into a desired form by these machines. The blow struck by the descending die or punch varies from hundreds of pounds to tons, and flesh and bone are as nothing under it. In operating such a machine the man stands or sits in front of it. He inserts the metal blank in the lower half of the die, presses a foot lever which trips the mechanism and down comes the stamp. It rises immediately, he inserts another blank and down it comes again. The operations are performed hour after hour and the man becomes expert and very rapid in making the few movements required. He is instructed to remove his foot each time from the foot lever. He may do so at first, but as he gains in dexterity he finally ceases to do it, simply easing up on the lever each time.

Then comes the fatal moment. He is putting in a blank when there is an unexpected noise in the shop, some one speaks to him suddenly or from nothing more perhaps than the mere tiring of his muscles—down comes his foot at the wrong time and he finds himself minus anywhere from a finger to a whole hand. This has happened over and over again in shops. The machine has exacted its pound of flesh which the victim can never replace. The depressing moral effect on the rest of the shop force is incredible—for two or three days the output of the department falls off, perhaps 50 per cent, due to everyone's extreme caution.



DOWN COMES HIS FOOT AT THE WRONG TIME AND HE FINDS HIMSELF MINUS ANYWHERE FROM A FINGER TO A WHOLE HAND



THE NEW, ELECTRICALLY OPERATED ATTACHMENT REQUIRES BOTH HANDS TO BE ON THE TRIPPING LEVER, OUT OF HARM'S WAY

Realizing just what such accidents mean to the victims, to the rest of the men and to the company itself, the Benjamin Electric Manufacturing Co., of Chicago, a large user of stamping presses, set about finding a remedy for the evil. It has succeeded in designing an electrical device which will obviate all danger and which may be readily attached to any press. Every press in the Benjamin shops is being fitted with one and quantities will be manufactured for sale to other manufacturers interested enough to buy for the sake of humanity and economy as well.

In place of the old foot lever, the machine is provided with two hand levers, one on each side, and it cannot be tripped unless both levers are depressed. This necessitates the removal of both hands from the point of danger, to trip the press before the ram starts in its downward direction. The release of either hand permits the trip to return to its normal position, thus making it impossible for the press to repeat unless both hands are kept on the levers until the repeat operation is begun, in which event the operator would not have time to get his hands back into danger before the operation is completed.

The device consists of an operating lever normally *inoperative,* although free to move downward. This lever is made operative by the action of an electric retaining magnet through a circuit-closer located on the opposite side of the press. Consequently the press cannot be tripped by the operating lever unless the circuit through the magnet is first closed and retained closed until after the press has been tripped.

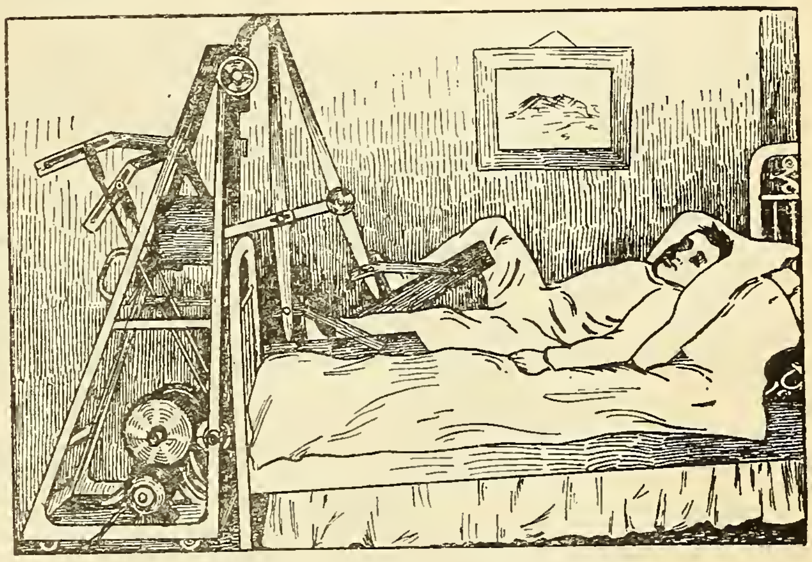
In addition to the protective feature, the use of the device results in an increased output of work where it is necessary to bring the hand into a position of danger for handling individual pieces. The operator knows the press cannot trip until both hands are removed. The increased confidence thus created materially increases the number of operations actually performed, with a corresponding increase in the amount of work done.

Trouble Shooter Finds Rifle Useful

A lineman in the employ of the Puget Sound Electric Company has demonstrated that a rifle is a necessary part of a trouble shooter's equipment. A toppling pole too dangerous to climb threatened to pull down the high tension wires. The lineman, perhaps mindful of similar depredations of the small boy with his gun, shot away the insulators on the damaged pole and thereby released the line so that the pole could be pulled down without damage.

Taking Exercise in Bed

To benefit patients who are confined in bed for any length of time a device has been invented to exercise the lower



TAKING EXERCISE IN BED

limbs. Motion is imparted to the limbs by the apparatus, which is motor driven, in such a manner as to approach the movements and results obtained by walking.

Electricity as a Water Carrier

A very singular property of electric currents, which is not generally known, is that called electrical osmose. An electric current flowing through the ground will cause water—slowly and in small quantity of course—to travel along with it in the direction of the negative electrode. During some recent experiments water was thus caused to enter a glazed pipe set in the ground. It penetrated the walls of the pipe when electricity was passed through them. It has been suggested that this principle might be applied to supply moisture to plants. Electric currents passed through the ground would collect water dispersed through the soil and condense it around the roots.

The Tunnel Through Montmartre Hill

The construction of the Paris Metropolitan systems has filled us with enthusiasm at times by the daring of the work on certain subterranean sections, but at no point has it presented as many difficulties as in tunneling through Montmartre hill for the Northern-Southern underground railway.

At Montmartre the engineers were placed in an extremely unfavorable situation. The famous hill, in fact, had been honeycombed from top to bottom by the ancient gypsum quarries placed almost without system. In certain places they proceeded under the open sky, when the depth to be attained was not too great; elsewhere shafts carried the quarrymen to underground passages, many of which still remain, just as they were. The open quarries received deposits of earth which became piled up in the course of time, and upon which houses were erected. The owner built a ground floor in the middle of his garden, then he raised it a story several years later, adding another afterward when his resources permitted him to do so—all of this without considering the foundation of his house. How many of those old dwelling places are still standing at the present time, which owe their support to the compression of the soil, due to neighboring concrete shafts! Let an unfilled quarry, a pit, give way and the whole structure disappears!

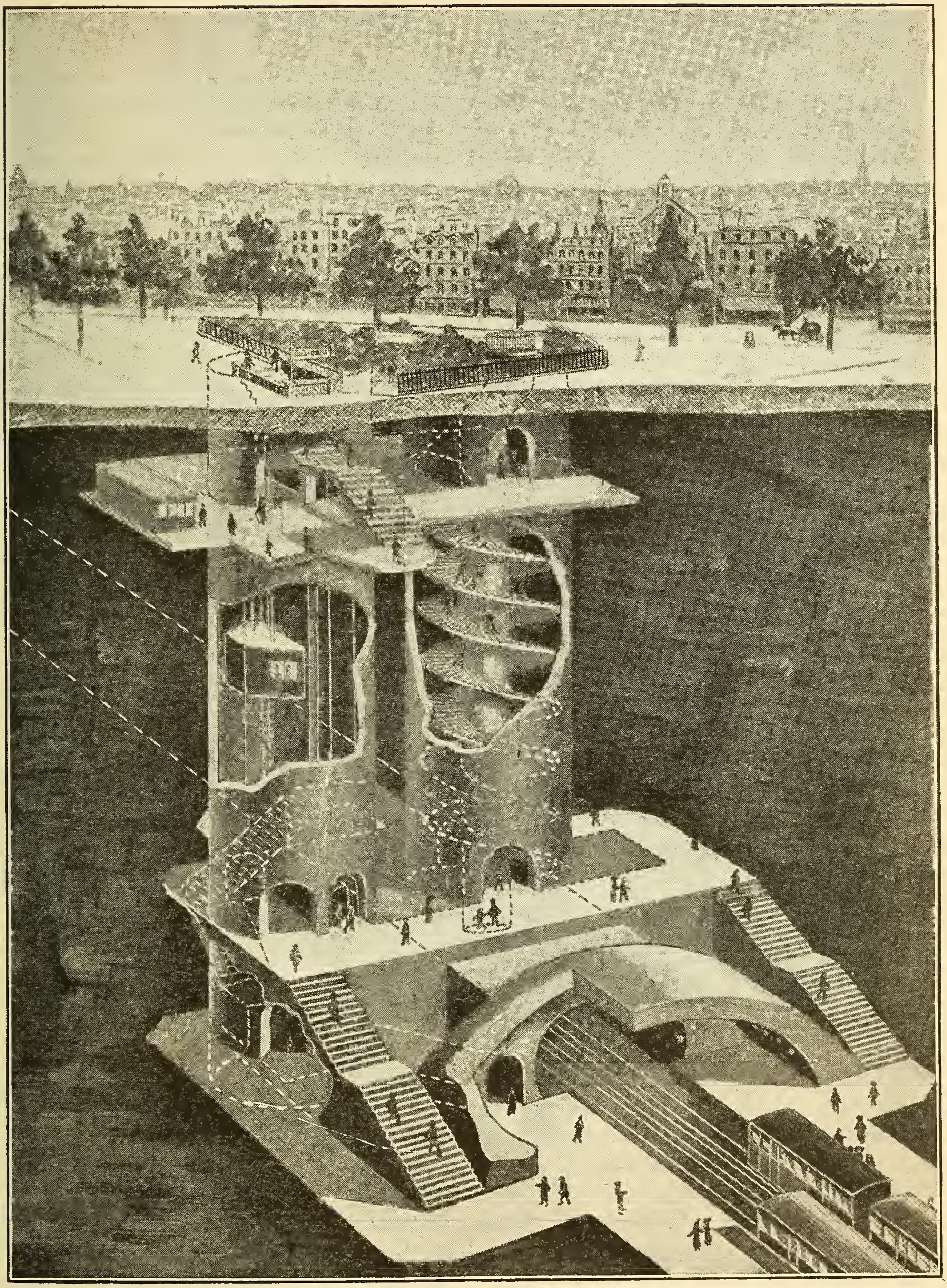
The solidity of certain structures being dependent on that of a subsoil essentially lacking in resistance, when the establishment of the Northern-Southern electric railway line was decided upon, the elementary course was to take precautions against all risk of caving in, by avoiding contact with the old quarries. Their location is perfectly determined, but their depth is only known in a very insufficient manner; so, the engineers who undertook this work were obliged from the very start, to sink the level of the profile and proceed to a new laying out, in order to pass completely under the quarries.

The tunnel begins to cross the hill at the station of Pigalle square; from there it follows the passage of the Elysée-Beaux-Arts, crosses Abbesses Square, from which point it enters the dangerous zone, to come out at Feuchère Street.

Leaving the Pigalle station, the line makes its way under the narrow passage of the Elysée-Beaux-Arts, bordered by constructions more or less firm on their foundations. In many places it was necessary to brace these primitive works of substructure buried in the rubble work. The piers are blocked up by masonry under the foundations of the houses, assuring to these latter an absolutely solid foundation. In order to effect this work they could not think of employing the regular procedure, which consists in digging an axial gallery, making the vault excavations, executing the masonry of this vault by successive rings and finally constructing the underpinning piers. Instead there were excavated two galleries of piers and these were built up by fractions as fast as the gallery advanced. As soon as one section was walled up they proceeded to the removing of the earth and to the masonry of the vault along the length of the masonry pier; there was thus constituted a ring comprising the piers and the vault, from which they passed on to the following ring.

During this construction care was taken to leave within the vault, from place to place, holes intended to receive injections of cement, so as to consolidate the surrounding earth.

Under the Place des Abbesses there are large quarries filled up with a great mass, and then with a second mass of



TUNNEL AND RAILWAY STATION UNDER MONTMARTRE HILL

gypsum on top, all particularly dangerous. The least disturbance of the base of these lands would cause an extended disturbance throughout the whole ground lying above, and would lead to the fall of the buildings situated on these lands. It was therefore important to avoid, at any cost, contact with these dangerous lands, during the work; and it was for this reason that the level of the bore was lowered.

The station of the Abbesses presents this particular feature of being a clear span without piers. The vault rests, in fact, upon two low abutments. The illustration on the preceding page indicates the layout of this novel underground station.

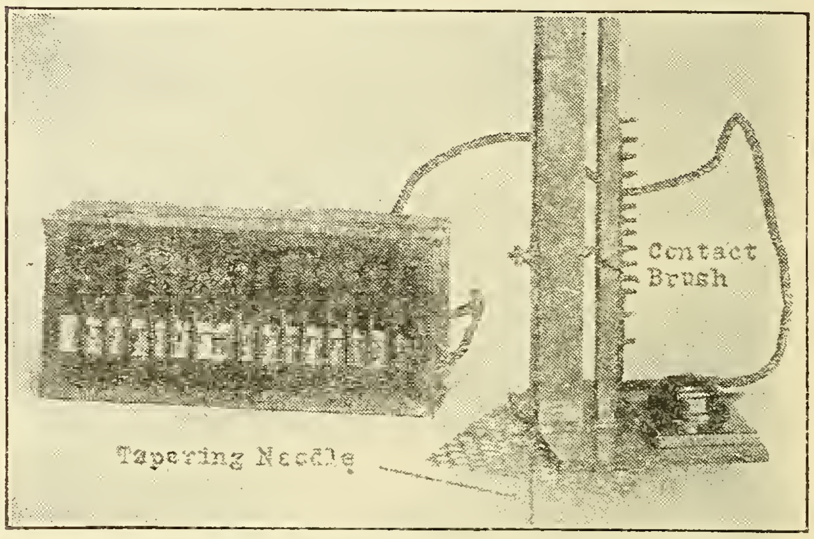
The car rails are 110 feet below the surface of the street and the approaches had to be considered. As it was impossible to require the passengers to leave the underground station by stairways, it was decided to build an elevator shaft flanked by another shaft reserved for an emergency stairway, access to which will constantly be kept free. It would have been possible to place both the elevators and the stairway in a single shaft, but the engineers preferred to construct two neighboring shafts, each for its own special purpose, and with ways of access permitting passage from one to the other at will. At the upper landing, some 20 feet below the surface, the elevators discharge the passengers into the exit galleries which serve at the same time for the entrance, and which contain the ticket offices.

The construction of the shafts preceded that of the underground passage itself, and during the work they were utilized for the removal of the debris and for the entrance of the construction materials. Their mass is imposing. They recall the famous elliptical caissons of Place Saint Michel and of La Cité, the metallic carcass of which presented itself for so long a time as an object of curiosity to the passerby.

The works under Montmartre have necessitated the establishment of two plants only, one at each station, each being served by a special electrical machinery equipment, and leaving sufficient space for the circulation, which has never been hindered by their presence.—Translated from *La Nature*, Paris, by *Annette E. Crocker*.

Measuring Holes by Electricity

A new device for measuring the diameter of holes by electricity has recently been contrived by a mechanical engineer. A factory dealing with perforated metal sheets for flour mills has acquired the rights to this invention,



HOLE MEASURING DEVICE

which enables it to match readily samples brought in by customers.

A tapering needle, which is pushed into one of the perforations as far as it will go, carries a brush which passes a series of electric contact pieces. The latter are connected to a set of solenoids, and when the circuit is closed by pressing a button, one of these solenoids operates to uncover a dial indicating the correct size of the hole.

Shadow Pictures of Cable Messages

One of the most ingenious devices ever employed to record cable messages is that of French invention.

A fine wire is stretched vertically between the poles of a powerful electromagnet, and the currents from the cable passing through the wire cause it to be deflected, according to their direction, at one time to the north and at another to the south pole of the magnet.

The shadow of the wire, projected across a narrow slit, falls as a black spot upon a strip of photographic paper that is caused to travel at a fixed rate.

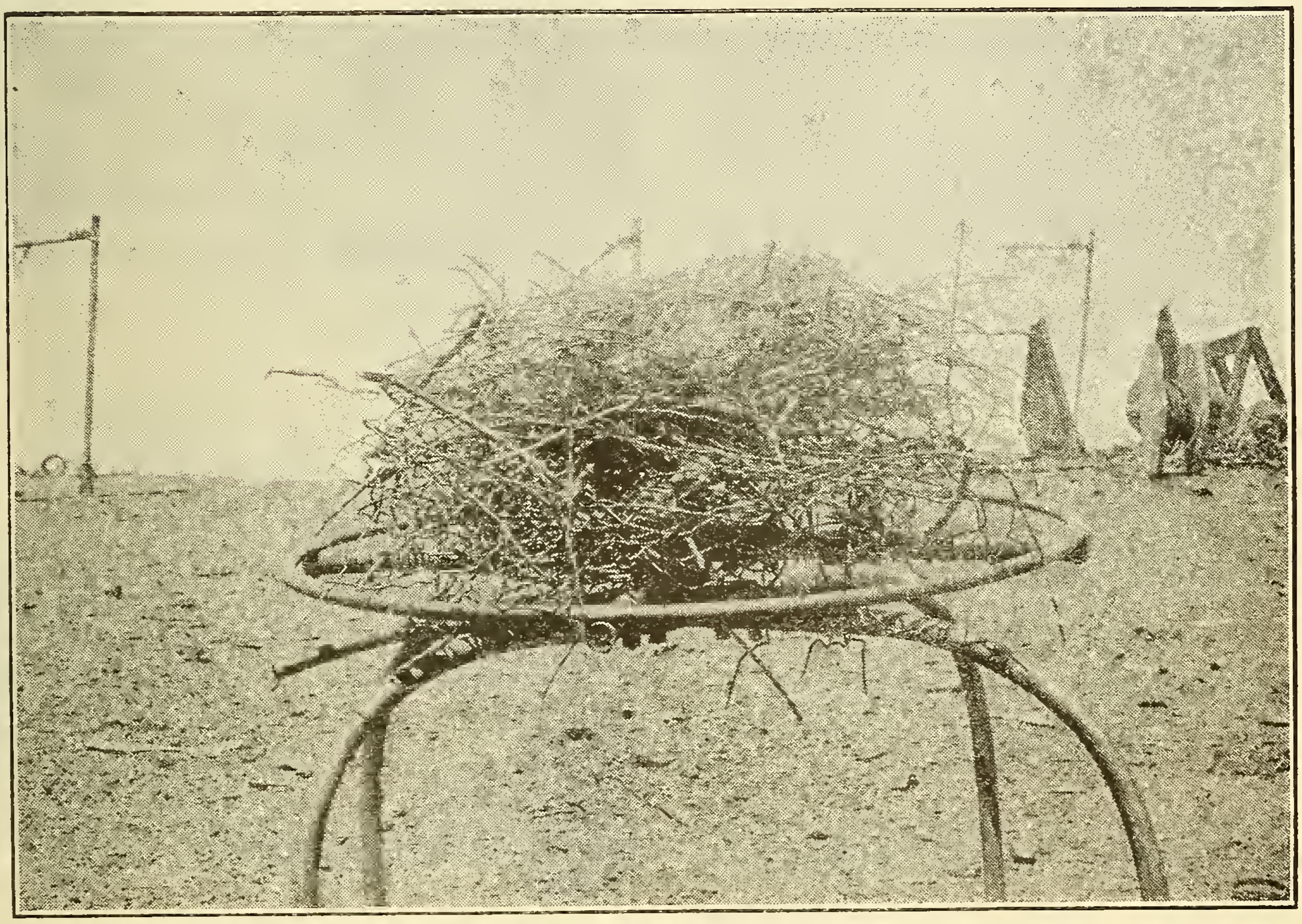
When a message has been received the photographic trace of the moving shadow is automatically developed and becomes, as it were, the handwriting of the instrument, to be read when desired.

It is said that a speed of 70 words a minute has been attained.

Raven's Nest of Telephone Wire

The silly ravens of a certain district of Mexico where wood is scarce and trees are miles apart, have solved their nesting problem at the expense of the telephone company. The accompanying illustration, reproduced by courtesy of the *Mountain States Monitor,* shows a nest brought in by Mr. Gooding, chief electrician in charge of toll lines between Naco and Cananea, Mexico.

This raven's nest consisted of 255 pieces of rusty iron wire, 30 tie wires and 81 large twigs covered with a mat of cow hair. It was only one of numerous nests which had been built on the roofs of poles carrying two-pin cross arms, as a result of which short-circuits were frequently reported on the toll line.



RAVEN'S NEST OF IRON WIRE "COLLECTED" IN MEXICO

Resuscitation Commission Organized

Some months ago Past President W. W. Freeman of the National Electric Light Association undertook the organization of a commission to study and report definitely upon the best methods to be employed in resuscitation from electric shock. He brought together representatives of the various engineering societies and of government departments to consider the matter, and after full discussion, it was determined to leave the formation of the commission to the American Medical Association. The personnel of the commission has now been announced and is as follows:

Dr. W. B. Cannon, chairman, Department of Physiology, Harvard Medical School, Boston, Mass.

Nominated by the American Medical Association: Dr. Yandell Henderson, Department of Physiology, Yale University, New Haven, Conn.; Dr. George W. Crile, 214 Osborn Building, Cleveland, Ohio; Dr. S. J. Meltzer, Rockefeller Institute, New York City, N. Y.

Nominated by the National Electric Light Association: Dr. Edward A. Spitzka, Professor of Anatomy, Jefferson Medical College, Philadelphia, Pa.; Mr. W. C. L. Eglin, Philadelphia Electric Company, Philadelphia, Pa.

Nominated by the American Institute of Electrical Engineers: Prof. Elihu Thomson, ex-President of the American Institute of Electrical Engineers, Lynn, Mass.; Dr. Arthur E. Kennelly, Harvard University, Cambridge, Mass.; Mr. W. D. Weaver, secretary, editor *Electrical World*, 239 West 39th St., New York City.

The commission has already taken up its work.

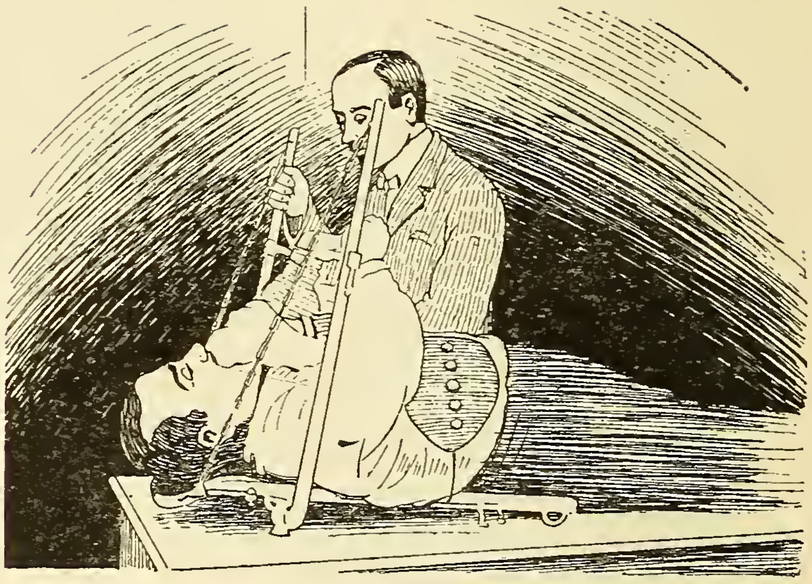
It may be stated that the National Electric Light Association is to meet all the expenses incurred in this investigation, and enjoys the fullest coöperation of the National Bureau of Standards, which has volunteered to undertake the distribution of the findings to the general public when the commission has finished its work. There is a possibility that the study may take on an international character before the end is reached.

Apparatus for Artificial Respiration

A device for the application of the Sylvester method of resuscitation has been placed on the market in Europe. It performs, mechanically, the operations of artificial respiration. With it one person can do all the work and at the same time give attention to the tongue, which must be drawn out during the manipulation.

The injured person is placed on a board, which is raised a little at the head end, and the arms are strapped to the levers, the latter being made of ordinary pipe. Across the chest a broad pad is placed, which serves to compress the chest and is connected with and operated by the levers. Wires running from the end of the levers through small pulleys are connected to the pad by hooks. Several holes at each end of the pad allow for adjustment.

Referring to illustrations, it will be seen that the operator is holding out the tongue with one hand and operating the levers with the other. In the first position the chest of the injured person is expanded to its fullest extent, no pres-



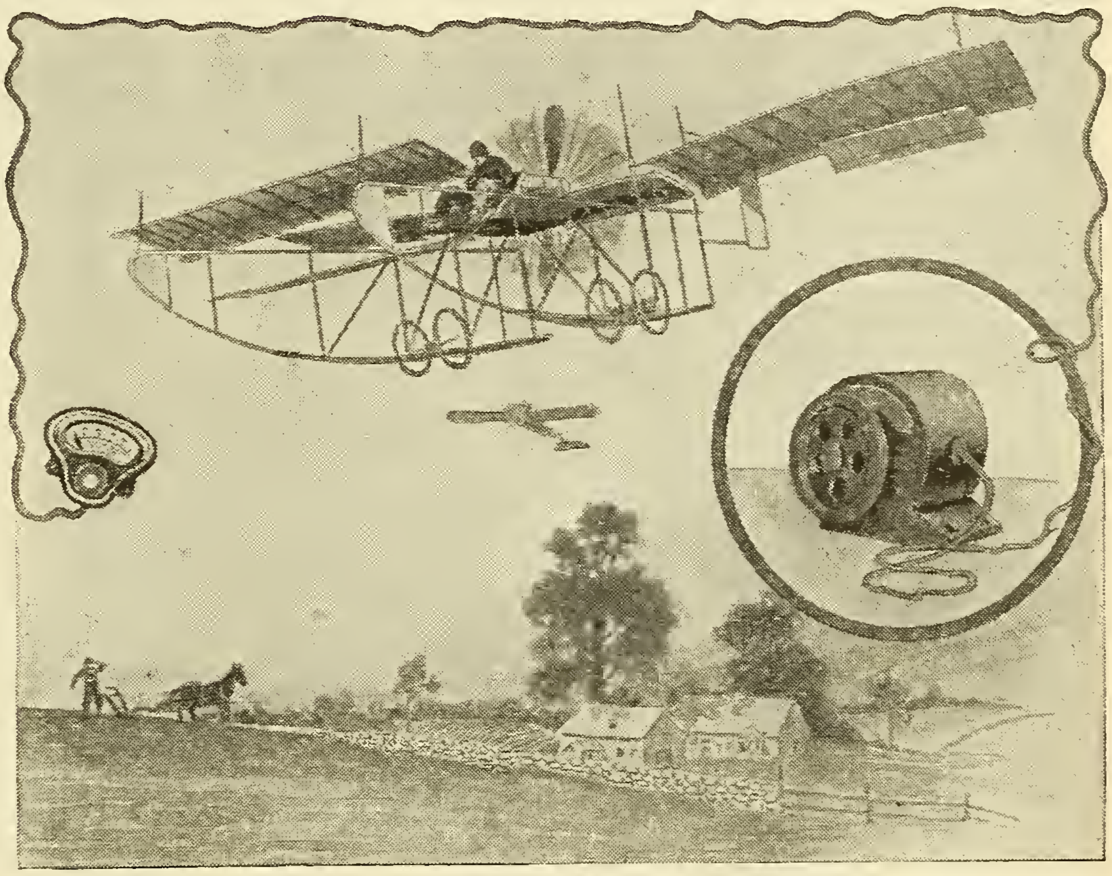
APPARATUS FOR ARTIFICIAL RESPIRATION

sure being exerted by the pad. In raising the levers the chest is compressed partly by the movement of the arms of the patient, but more by the pressure of the pad, which is pulled down by the wires. The uniform movement obtained in moving the lever up and down is stated to have a more beneficial effect than manual operation.

In 1904 there were only four electric furnaces used in Europe in preparing steel for castings. There are now over 400.

Propeller Speed Indicator

The voltage or electrical pressure developed by a dynamo bears a certain fixed relation to its speed—the faster it turns the higher the voltage. This principle has been employed in the design of the Hopkins propeller speed indicator for aeroplanes. A little dynamo or magneto is belted to the propeller shaft. For every speed a given voltage is developed by the magneto. This voltage is registered by a voltmeter mounted immediately under the eye of the aviator. The scale of the voltmeter is, however, calibrated to read in revolutions per minute instead of volts. The readings can easily be taken without distracting the attention from the management of the machine.



PROPELLER SPEED INDICATOR FOR AEROPLANES

A Startling Calculation

There are two kinds of electricity—electro-static and electro-magnetic. The first is electricity at rest, while the second is electricity in motion. It has been quite conclusively shown that electro-magnetic electricity—or in plainer words, an electric current—consists of many minute electro-static charges moving at a high velocity.

An electro-magnetic unit of electricity—or a coulomb—is that quantity of electricity which passes through a conductor when a current of one ampere flows for one second. This amount of electricity will flow from an ordinary dry battery if it is short circuited a very small fraction of a second, or it is equal to the amount of electricity which passes through an ordinary electric incandescent lamp in a second or two.

If one coulomb of electricity is accumulated on a very small insulated sphere and another coulomb is placed on a like sphere one inch distant, the force of repulsion between the two small spheres would be 1,600,000,000 tons.

It seems incredible that the electricity which flows from an ordinary dry battery in a small part of a second if divided and placed on two small spheres one inch apart would produce a force sufficient to lift the combined weight of all the battle ships in the world!

Why can't we do it? We can if we are willing to do the great amount of work necessary to place the two coulombs on the two spheres. Even though two coulombs of electricity are insignificant and easily obtained from an ordinary dry cell, in order to place this small amount of electricity on the two small spheres it is calculated that the total power of Niagara falls would be utilized for many days.

When trimming a flame arc lamp with carbons containing metallic cores, care should be taken that the wires in the carbons are placed on the side away from the arc as otherwise the arc will operate badly and flicker.

Wonderful Illuminations of ST. PATRICK'S CATHEDRAL

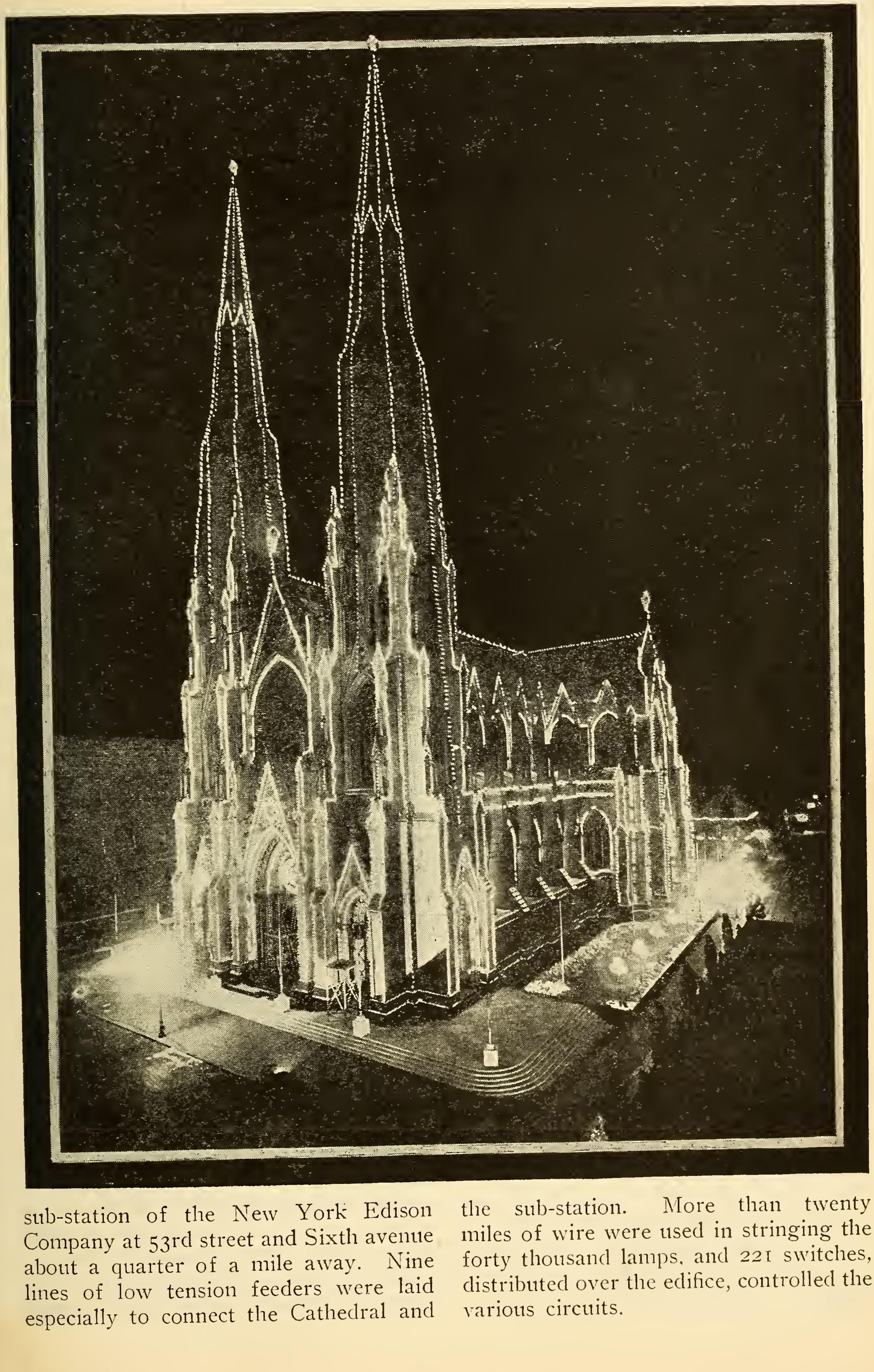
There was no blinding flash as the darkness of a winter's evening was dispelled by a wonderful pillar of fire. First two crosses, high above the street, shown faintly against a black sky, and as they slowly reached their full brilliance, the lamps on the Cathedral began to glow dimly, then with increasing power as more and more current was supplied them. Finally the whole mass of light shed its brilliant rays far up and down the avenue. Such was the illumination of St. Patrick's Catheral in New York on the first night of the celebration of Cardinal Farley's homecoming.

Every detail of the beautiful Gothic architecture, the tips of the twin spires, the pinnacles, each buttress, each window, the doors and the straight lines seemed gradually to grow out of the darkness and finally to burst into all the beauty of fire.

Full five minutes elapsed before this wonderful transformation was wrought. It was a scene the like of which had never been witnessed in New York, and only once before in the history of outdoor illumination. At the Pan-American Exposition in Buffalo, the lights were thus turned on in the fair grounds every evening, but never since has this spectacular method of lighting been attempted.

So effective was it, on the first night of the celebration and so much impressed were the visiting thousands, that it seemed unjust not to have the spectacle repeated. For this reason, it was determined that beginning with the second night of the celebration the Cathedral should be darkened shortly before eight, nine and ten o'clock each evening. Then at the stroke of the hour, the lights were to be gradually turned on until the whole edifice blazed once more. This plan was followed each evening from January 18 to 25.

This effect was controlled from the



sub-station of the New York Edison Company at 53rd street and Sixth avenue about a quarter of a mile away. Nine lines of low tension feeders were laid especially to connect the Cathedral and the sub-station. More than twenty miles of wire were used in stringing the forty thousand lamps, and 221 switches, distributed over the edifice, controlled the various circuits.

Each hour the switches were thrown in, closing all the circuits, and word was sent to the sub-station to send the current along the dead cables. Slowly, as the big rotary converter got under way the life came over the lines, and dimly the light began to glow in the bulbs. Steadily the big machine gathered speed, and gradually the illumination became stronger till at last, after five or more minutes the lights shown with all their power. Four times each evening this was repeated; then finally at eleven o'clock the Cathedral faded into the blackness of night.

To realize what a wonderful sight was presented by the Cathedral, it should be remembered that never before, in this country, had so many lights been placed on a single building. During the Hudson-Fulton celebration, the Queensborough Bridge, the longest span over the East River, required only fifteen thousand lamps to outline the massive arches and towers.

To place the lamps upon St. Patrick's Catheral, required the services of nearly a hundred electricians, all experts in outdoor work, and a dozen of them the country's most famous steeple-jacks. The lighting scheme was planned by Charles R. Lamb and H. P. Poole, ecclesiastical architects in consultation with the officials of the New York Edison Company.

The men on the outside work encountered many difficulties. During the first week the biting cold compelled them to stop work and several days were lost. Snow storms, followed by rain, which left the spires and the roof of the Cathedral coated with ice made the task doubly hazardous, but it was decided to push the work regardless of difficulties. The force of men was increased, electric heating pads were supplied, plenty of coffee and beef stew was provided and the job was tackled, the men working in relays. Night work was necessary, and was made possible by the aid of search lights.

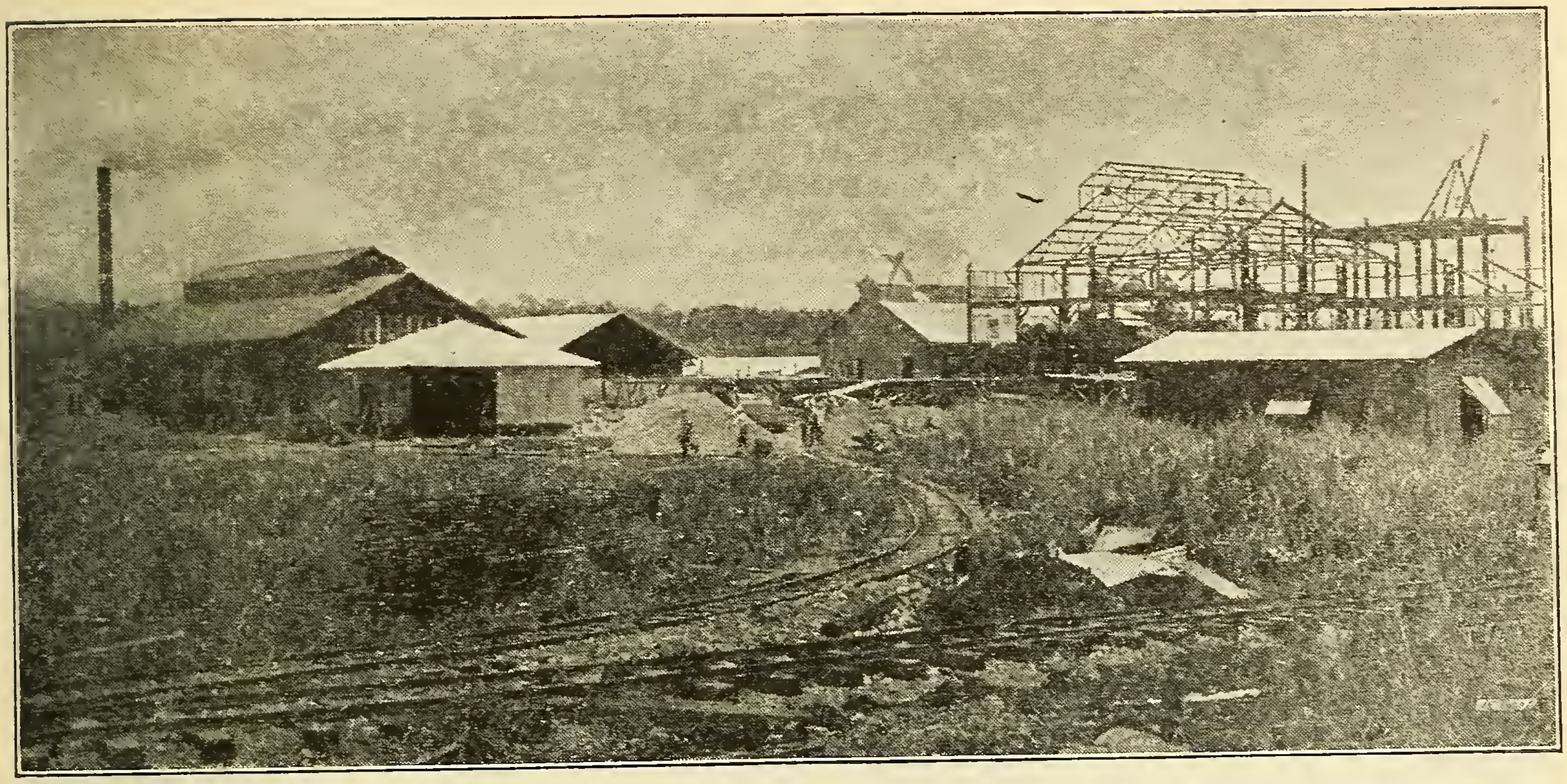
The heating pads were an innovation and won the highest praise of the steeplejacks. Strapped under coats, by means of the flexible cord attachment the pads were connected with the lamp sockets on whatever part of the church the men were working. To protect their feet, the men encased them in thick rolls of burlap, and the fingers which stiffened quickly in the cold were soon warmed when placed under the coats on the pads. During the nights the Cathedral was illuminated, a gang of twenty-five men did picket duty on the roof watching to repair any damage that might be done.

Electrifying Philippine Sugar Mills

Since the passage of legislation granting free trade between this country and the Philippines, the sugar industry which has been dormant since our occupation, and which never was developed along modern lines, is growing with rapid strides. Big American companies, owning vast estates, are putting up large mills throughout the entire archipelago.

Eventually, one of these plants will have a daily capacity of 2,000 tons of cane. At present there are twelve crushers and centrifugal drying machines, and the main power plant is run by steam generated from the bagasse, or fibrous refuse of cane stalks after the juice is extracted. All the auxiliary power in the big mill is furnished by electricity generated by this same steam plant. Current is applied to the drying machines, the cane carrier, and the circulating pumps. In time the steam railroad making a network over the plantation, and the line running from the estate to the sea shore, eleven miles distant, may be electrified.

There are few towns or communities in the jungles of the outlying provinces which can boast of electric lights and ice plants, but the mill employees, numbering nearly a thousand souls, are to have these advantages. The quarters of the Filipino laborers, in the shape of small



THE TYPE OF SUGAR MILL NOW GOING UP IN ALL PARTS OF THE PHILIPPINES

pine bungalows, are being lighted with electricity, as are the more pretentious dwellings for the mill management.

Before American occupation there were very few steam sugar mills in the islands, if there were any at all. Certainly no one dreamed then that in ten years huge plants such as this, employing hundreds of men, would go up within a decade, and the homes of the workmen be lighted with the electric light.

Franklin, George III. and Lightning Rods

Benjamin Franklin, George the Third, and lightning rods seem an incongruous combination, but there is a well authenticated incident that places them in an amusing light.

As is well known, several years previous to the Revolution, Doctor Franklin was the London agent of Massachusetts. While hostile to the measures of the King's ministers, he was opposed to a separation of the colonies from England.

For a long time he tried to persuade the King to govern his American provinces through their local legislatures, as he governed Great Britain through the Parliament.

But "Farmer George," as his subjects called him, from his love of farming, though mentally weak, was very obstinate, and had conceived a strong prejudice against Franklin. He looked upon him as an able but dangerous man, and therefore refused to listen to advice which, if heeded, might have postponed the independence of America.

So strong was the royal prejudice against the man who was trying to save her colonies to England, that it extended to the lightning rods that Franklin had introduced.

Franklin's rods were pointed at the ends that rose above the house-tops. But one, Wilson, introduced rods with blunt conductors, which he asserted were better than pointed ones. The political opponents of Franklin favored Wilson's conductors, and so the King, thinking Franklin had a pecuniary interest in his invention, ordered the pointed rods to be removed from Buckingham Palace and blunt ones to be substituted.

The day after the change was made the following prophetic epigram appeared in a London newspaper:

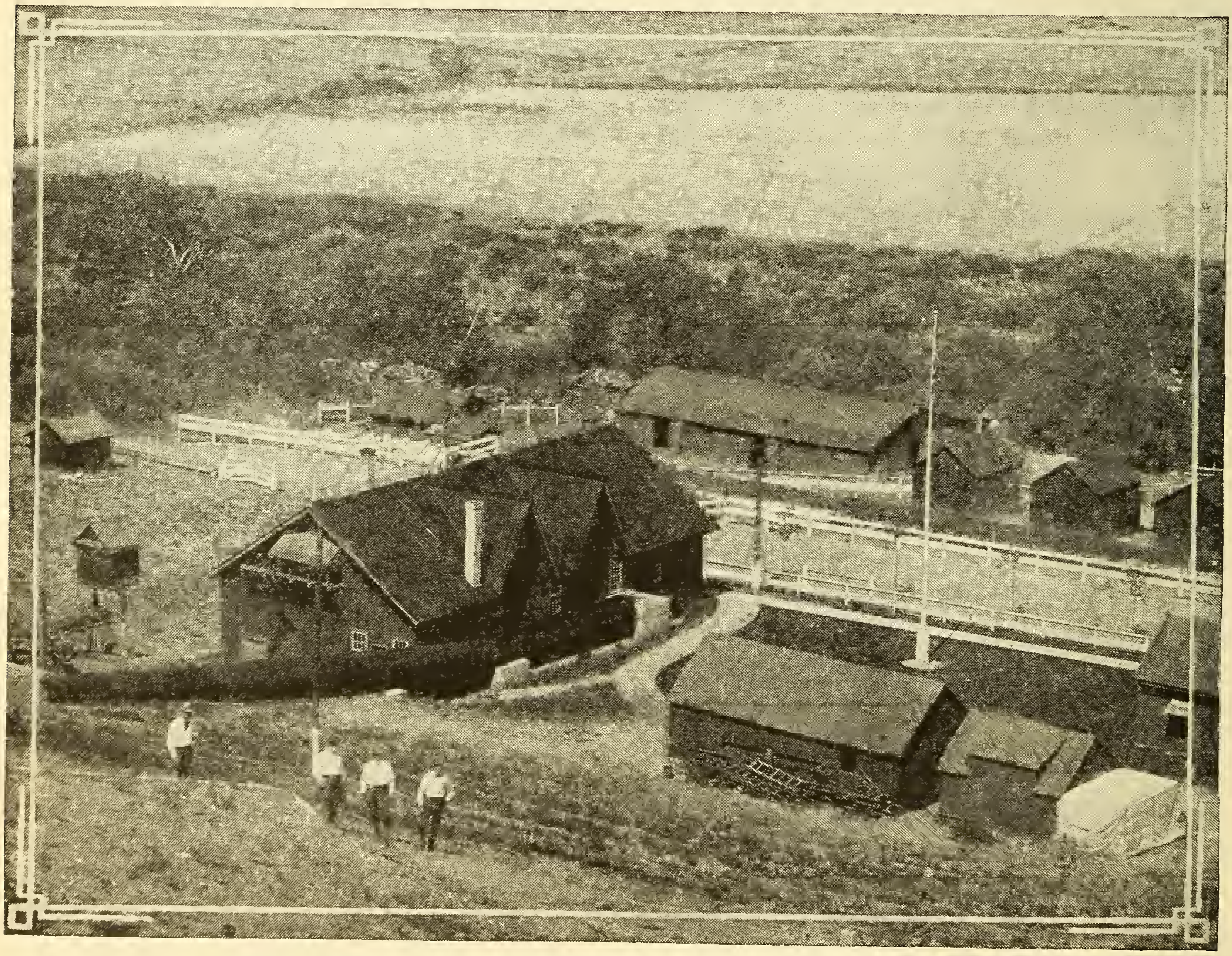
"While you, great George, for knowledge hunt,
And sharp conductors change for blunt,
The nation's out of joint;
Franklin a wiser scheme pursues,
And all your thunder heedless views,
By sticking to the point."

Uncle Sam to Sell Electricity

By WALDON FAWCETT

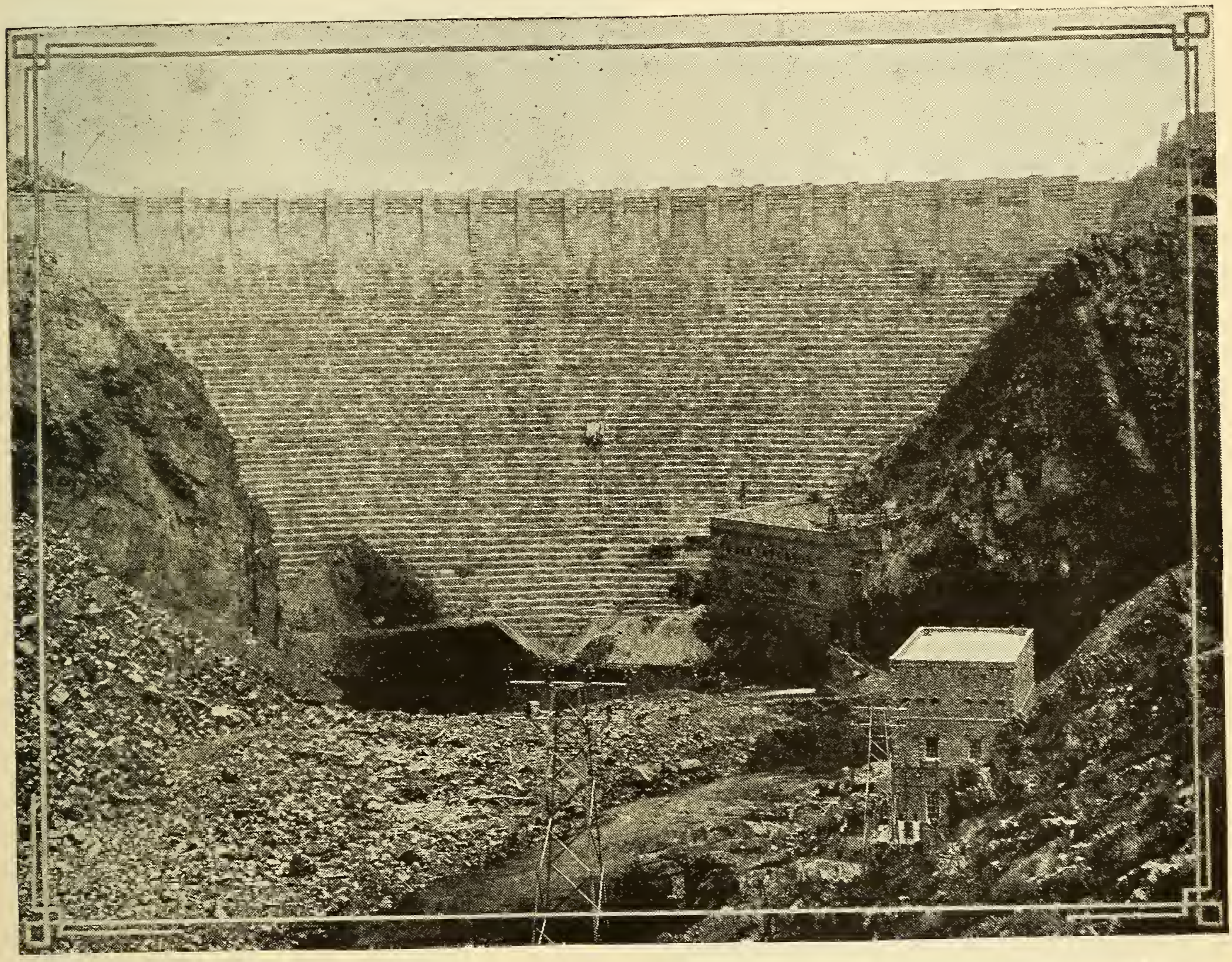
The United States government is going into the business of supplying electric light and power to private interests, and what is more, it is planning to enter upon the enterprise on quite an extensive scale. Indeed, strictly speaking, this interesting innovation in federal procedure is not all in the future, since Uncle Sam has already assumed in a modest way the role of purveyor of the magic current. However, the development thus far can be accounted no more than a beginning compared with the extensive plans that are in prospect. The electricity which is to be offered in the open market at most favorable prices is a "by-product," if so it may be termed, of the great engineering works of the United States Reclamation Service.

This interesting branch of the Interior Department is carrying on or has projected in various parts of the West a number of stupendous projects for irrigating vast areas of land that would otherwise be valueless for agricultural purposes. The basis of every one of these schemes for conserving the rainfall is found in water control, as, for instance, by the erection of great dams and the creation of storage reservoirs. It goes without saying that such control of water power has pointed the way for the incidental development of electricity and the thrifty government engineers have



POWER HOUSE ON THE STRAWBERRY VALLEY PROJECT IN UTAH seized every such opportunity. Indeed, they have been virtually compelled to do so, for these great irrigating works are almost without exception planned for remote localities or desert tracts where there were no existing power stations, and the federal engineers had no choice but to generate electricity for conveying their material and all other power purposes, and incidentally for lighting the buildings in the camps or towns which came into existence as a result of such an undertaking.

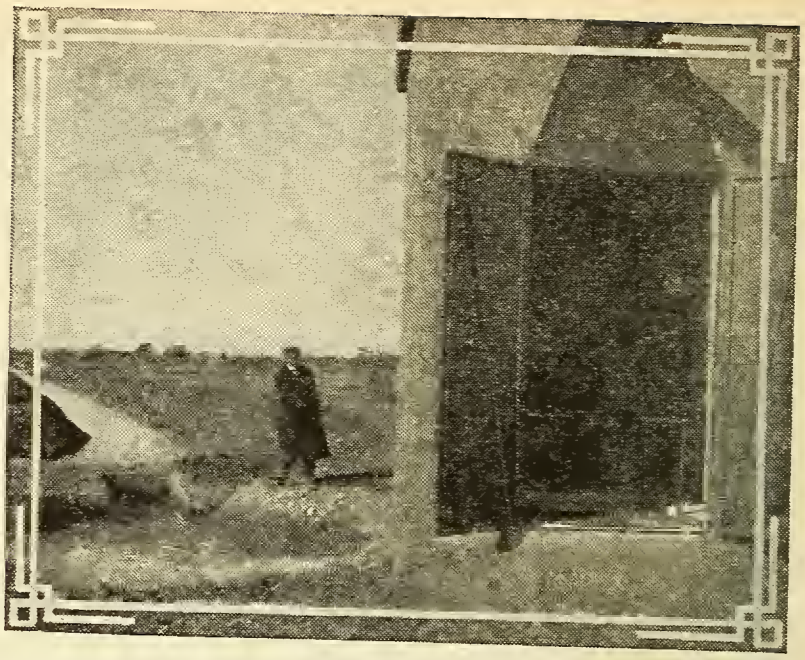
There will always be need for a considerable amount of electric power in the operation of completed irrigating works, particularly in connection with the manipulation of the gates and other control devices of the huge dams, but such requirements will by no means exhaust the electrical power resources of the various governmental plants, and it is the surplus electricty thus provided that Uncle Sam is planning to sell. Indeed, if the demand justifies it the generating plants at the various water power projects will be enlarged to meet this commercial demand. Not only will the government derive a tidy revenue from this sale of electrical power but, more important yet, the provision of ample current at a reasonable price will, by affording home comforts and ample energy for industrial and other work, tend to attract to the newly-irrigated areas the numbers and class of settlers without whose presence Uncle Sam cannot realize his ambitions for reclaiming the deserts.



THE FAMOUS ROOSEVELT DAM, SHOWING ALSO THE POWER HOUSE, TRANSFORMER HOUSE AND TRANSMISSION LINE COMPLETED

There will be no hard and fast rules in disposing of the current from these widely separated power stations, but in so far as possible there will be a disinclination to sell power to individuals and extreme care will likewise be exercised to guard against anything savoring of a monopoly or preferred privileges in the marketing of the power. The object of the government officials in not selling power to individuals is merely to relieve the government of the detail that would be inseparable from the maintenance of direct relations with thousands or tens of thousands of private consumers of power or lighting current. To get around this Uncle Sam will, whenever possible, sell the power to municipalities or to associations of power users.

The Federal authorities feel that the natural market for their electricity in bulk (if the use of that term may be permitted) should be found in the municipalities near the respective projects, these municipalities, in turn, selling the current to manufacturers or other power users, householders, etc., and even to electric railway companies, after reserving, of course, such current as would be needed or standard municipal requirements such as street lighting. That there will be no difficulty in supplying this electric power to the public through the medium of municipalities as middlemen is evident from the fact that progressive towns have already been established or will be established in the immediate vicinity of each of the big public works of the Reclamation Service. Furthermore, there are no serious obstacles to the transmission of the current considerable distances, so that it is the expectation that ultimately each of these big irrigating works may be furnishing electricity for anywhere from three to a dozen towns.



PUMPING WATER FROM WELLS—POWER FROM THE ROOSEVELT DAM, 70 MILES AWAY

ALONG THE TRANSMISSION LINE, JUST BELOW THE ROOSEVELT DAM

However, none of the farmers, fruit growers, dairymen, etc., located on the newly irrigated areas will be deprived of the use of governmental electricity merely because he does not happen to be located convenient to some municipality that has the current for sale. Rather than that any such contingency should arise the Reclamation Service would probably arrange to sell electricity direct to the tillers of the soil. But in each rural sphere as well as at the town sites there is ready to hand an admirable agency for marketing the electricity. The medium available is the water users' association which is found in every irrigated district — a sort of co-operative organization made up of the farmers and others who purchase water rights for the respective tracts of land they have under cultivation. Such an institution, with its facilities for making an equitable adjustment between consumers, with common respect for the rights of all, is, to be sure,

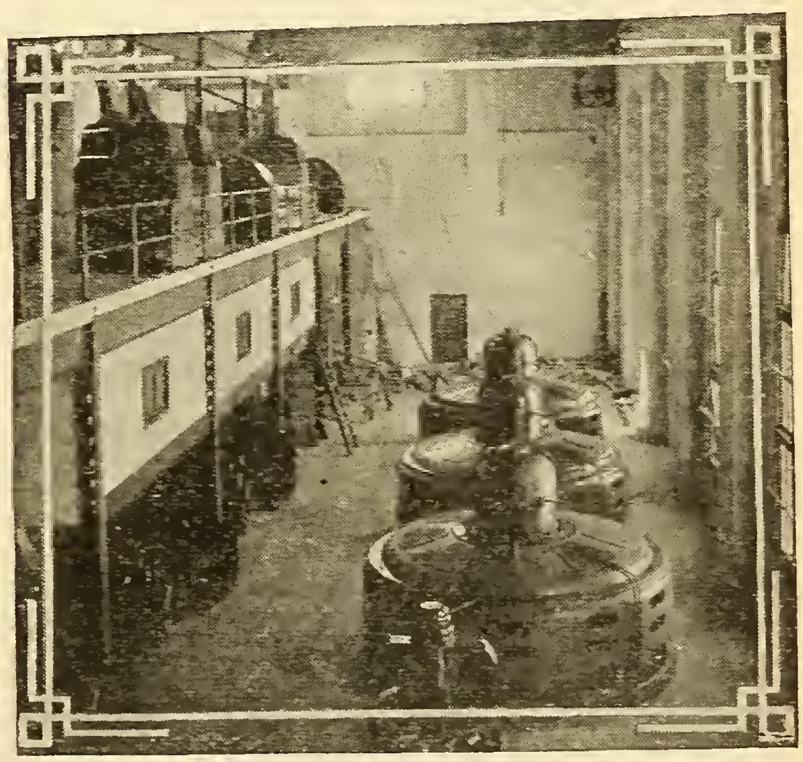
MINIDOKA POWER PLANT IN IDAHO

an ideal vehicle for retailing the electricity generated by the harnessed water.

The all-important question of the rates to be charged for Uncle Sam's electric product has not yet been determined. The whole proposition is so new that a definite policy has not been determined upon and such electricity as the government is already supplying to outsiders is being sold at what may be termed tentative rates. However, the charge will in every instance be as moderate as is consistent with conditions, and we may expect to see the farmer of the future in our reclaimed desert employing electricity not only to light his farm buildings and pump water but to milk the cows, churn the butter, operate feed cutters and other farm machinery, and perform most of the "chores" on the place while his wife may enjoy the aid of all those electrical cooking utensils and other apparatus which are the boon of feminine residents of the most luxurious city apartments and hotels.

A foretaste of the ingenious use of small electric power units under such conditions may be seen today on the Sacaton Indian Reservation in the Southwest. Here we find small electric pumping stations in operation pumping the water from wells. The wells in this territory are comparatively shallow, having a depth of say 60 feet, and the flow must needs be stimulated by artificial means. Accordingly, electric current is brought from the great Roosevelt dam, 70 miles away, and is employed most effectively to pump the water. The distance the current is transmitted not less than the novel employment convey a hint as to the almost limitless possibilities of the future in this rejuvenated region.

The famous Roosevelt dam, by the way, constitutes a monument to governmental daring and resource in the development and use of electric power. During all the years the dam was under construction electric power was used to operate the cement mill and perform other tasks. At the outset the machinery for generating current equivalent to 1,300 horsepower was installed in a cave in the canyon, but later was removed to a permanent power house, which will have an aggregate capacity of 6,100 horsepower. A main power transmission line extends from the power house at Roosevelt, a distance of 75 miles to Phoenix, Ariz. This line consists of two circuits of three wires each and carries current at 45,000 volts. The construction of this transmission line presented its own problems to the engineers and after the line was completed and put in operation yet other difficulties appeared, the most novel and most perplexing of which has only just been solved.



INTERIOR VIEW OF THE MINIDOKA POWER PLANT IN IDAHO

It was found that eagles, buzzards, and other large birds, flying over the desert, made a practice of alighting on the wires of the transmission line. When the birds perched at points between the towers or poles there was little danger that trouble would result, but they seemed to have a penchant for alighting on the wires at the poles and under such circumstances with two birds on adjacent wires flapping their wings there was every probability that the outstretched wings would come in contact, forming a circuit, killing the birds and incidentally playing havoc at the transformer house. This happened so frequently that the operation of the line was well-nigh demoralized. The engineers puzzled their brains for a remedy, and only lately have they installed with entire success a new type of "bird guard" consisting of projecting wires with upturned points which prevent the birds from alighting in the old-time favorite roosting places.

A model power house, as a source of widely utilized electrical energy has been completed for the government at the Minidoka Dam in Idaho. This power house is a reinforced concrete structure and consists of a turbine floor, a generator floor and galleries. The turbine floor, 26½ feet above the bottom of the tailrace, is supported by a series of arches between foundation walls, and between these foundation walls are spaces through which the draft tubes discharge.

Uncle Sam has in the vicinity of Garden City, Kansas, something of a novelty in the form of an electric power house where oil fuel is used. As originally installed, the equipment of this station consisted of steam turbines with coal for fuel, but latterly patent furnaces for the use of oil as fuel were installed under the boilers and a 55,000 gallon concrete oil storage tank was constructed. The change in fuel, be it related, has already resulted in a marked saving in the cost of operation. On the other hand Uncle Sam owns and operates his own coal mine as a source of fuel supply for the electric power plant which he has provided near Williston, N. D. Anywhere from 5,000 to 7,000 tons of coal per year will be mined for the use of this self-sufficient power plant. At what is known as the Strawberry Valley project in the State of Utah there is seen a condition which is not unusual in the case of the great public works undertaken by the Reclamation Service. Here the government built a 1,200 horsepower plant primarily for the purpose of furnishing power for construction purposes on the project and much of the energy generated is yet required for such purpose. However, upon the completion of the construction work, almost all the power that is developed will be available for lighting and other purposes in the several towns of the district and for pumping water to the agricultural lands lying above the gravity canals.

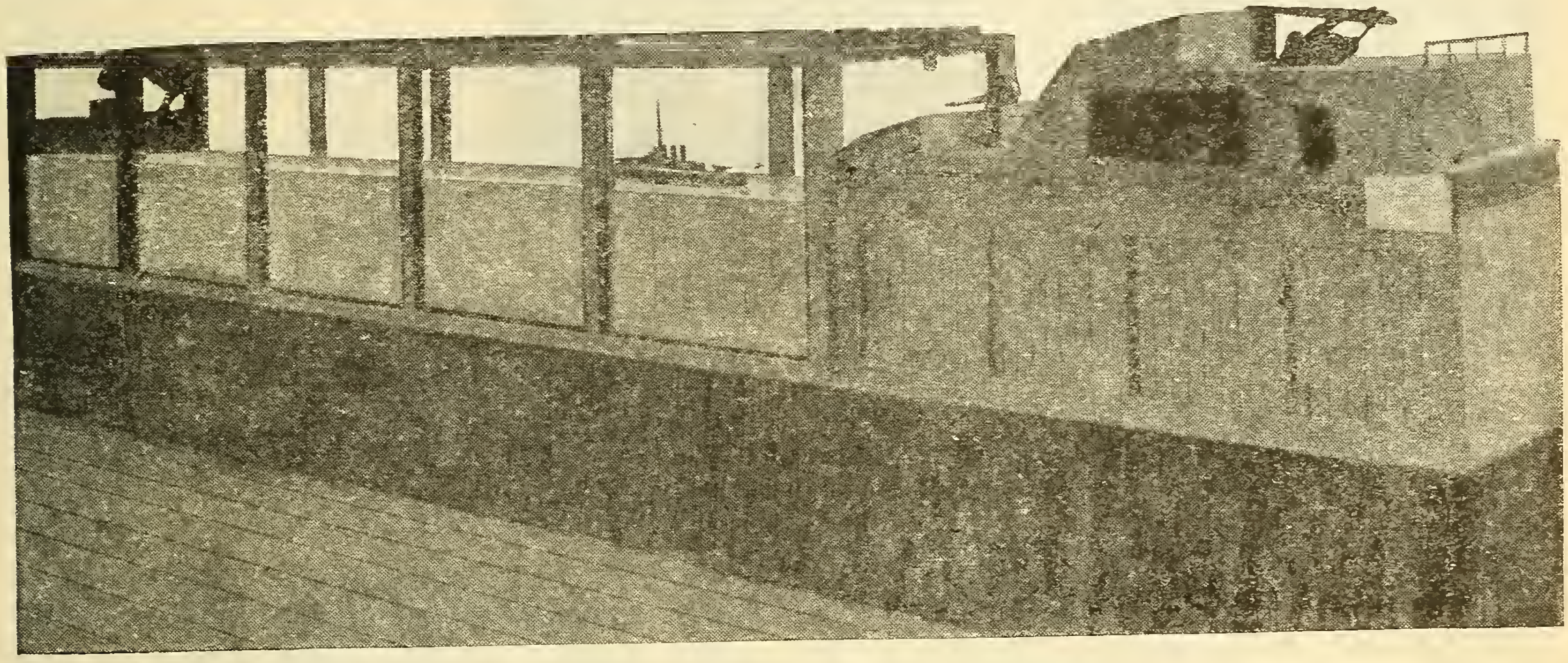
This represents the situation in many places. Uncle Sam, when his reclamation work is completed, will have at hand facilities for providing a liberal supply of commercial current and the water power will be available for generating a yet greater aggregate of electrical energy if the popular demand justifies the extension.

To Heat City by Electricity

The board of directors of the electric light plant of Stavanger, Norway, has asked the city council for permission to make contracts to electrically heat dwellings and business houses of the city up to a consumption of 100 horsepower. The price suggested for current thus used is $6.70 per horsepower (746 watts) per year. The matter of heating the city and government buildings in this manner is also under consideration. Stavanger has a population of 38,000, and water-power facilities to furnish 25,000 horsepower for electrical purposes.

Our Coast and Harbor Defenses

By a special act of Congress, the sum of $4,500 was appropriated for the construction of a working model, electrically operated, that would show the system of United States harbor defense by land batteries and submarine mines. In the accompanying picture are shown the shore batteries, built of reinforced concrete, equipped with the long range, twelve and fourteen inch guns, and below on the water's edge are the secondary or mortar batteries with powerful searchlights that sweep the harbor in all directions.



MODEL OF COAST AND HARBOR DEFENSE

The little engine shown in the picture buzzes around at lightning speed, furnishing the electric power to elevate and lower the immense guns, which majestically rise, pivot round, sweep the horizon in an arc of 60 degrees, and after firing, gracefully lower themselves behind the shellproof parapet for reloading.

The defense by the use of submarine mines is shown in the tank which is seventeen feet long, has two sides of plate glass, and is filled with water. Through the glass are plainly visible 23 miniature submarine mines. Riding on the water is a fully equipped model battleship.

The battleship is connected to a trolley wire, and is propelled across the tank, and when it comes in contact with one of the submarines, a very spectacular thing happens. The mine flashes up under the water, the vessel rocks and lists to port, her stacks, masts, hatches, and other above-deck equipment collapses, giving all the appearance of a ship being blown up. All of this is contrived through the aid of electric motors.

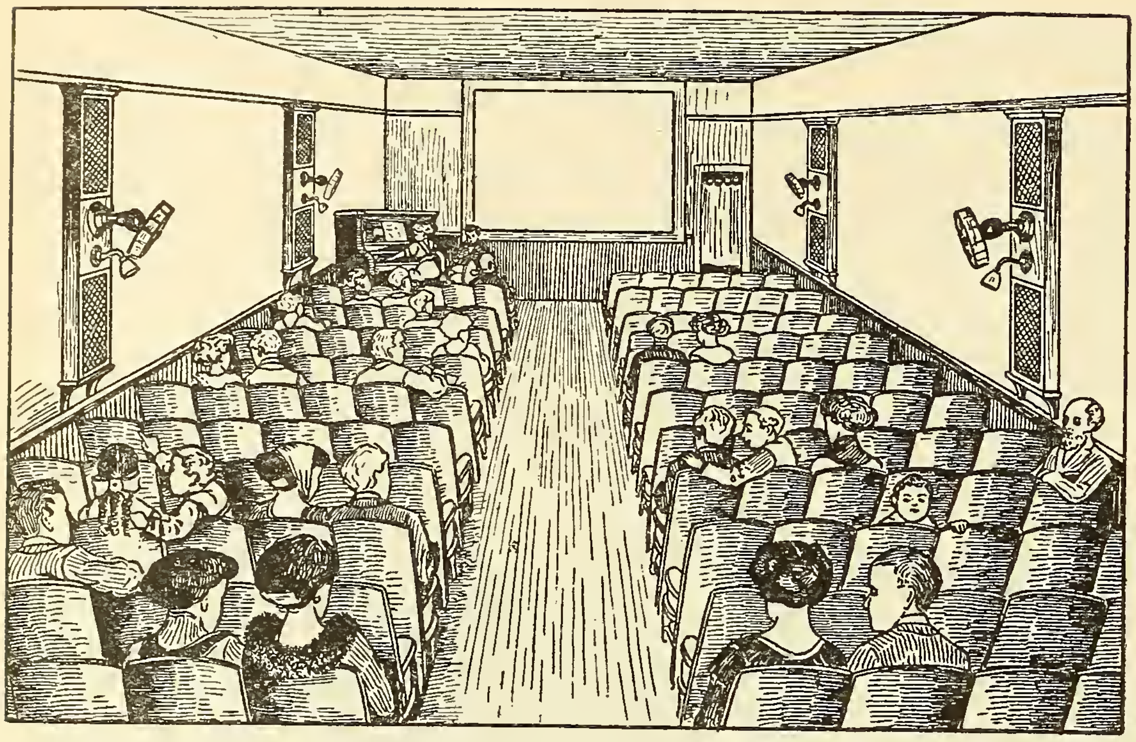
This model has been on exhibition but twice since it was constructed, the first time at the Seattle Exposition, and again last October at the Electrical Show in New York City.

Ingenious Electrical Music

On account of the great competition in the moving picture theatre business, the managers of these electrical playhouses are always trying to devise new attractions to draw the crowd to their own particular houses, and many and varied are the ideas thus produced.

An ambitious young manager of one of the leading moving picture theatres in Norfolk, Va., has hit upon a novel idea for producing music by electricity which has greatly surprised and pleased the audiences.

The pianist and drummer start in to play "Dill Pickles" or some other lively selection and, having played it over once, they start in to play it again, when lo, they are joined by a third instrument, which is not in one particular place, but seems to be all over the house. As the



INGENIOUS ELECTRICAL MUSIC

quick notes of the piano ring out, these mysterious bells, for bells they are, peal forth their sweet notes in perfect time and tune with the piano, first one note near the stage on the right hand side of the house and the next note from the left hand side at the rear of the house, and so on.

Here is how this "stunt" is accomplished: The manager procured 25 gongs, which were tuned to the musical scale, concert pitch. Then he bought 25 ordinary iron box electric bells and sawed the gongs off of these and wired them up so as to make them single stroke instead of vibrating. Next he put two boards on the wall on each side of the house, one board about ten feet from the stage, the other one at about an equal distance from the rear of the theatre. On these boards he mounted the gongs, three boards having six gongs each and the remaining board having seven.

After putting one of the electric bell tappers in close proximity to each one of the gongs, he put a series of contacts in the piano directly under the keys, and wired them up so that when the center pedal of the piano was pressed with the foot, it threw in a knife switch. Then when the keys of the piano were pressed, the gongs tuned to the same musical pitch would ring out. The gong tuned to the musical note "C" would be on one board, while "C sharp" would be on the opposite board. "D" would be on still another board and so on. When a lively piece was played the effect was bewildering, to say the least.

After covering these boards up with some ornamental woodwork to hide the bells, he mounted an electric fan and light on this woodwork and the device was complete. For current he uses dry cells.

Fanning Away the Frost

To the long list of methods already in use for protecting orchards and vineyards against frost, a new one has recently been discovered, according to the *Progressive Agricoli et Viticole,* which explains that frosts are not feared when the wind blows, and suggests the creation of an artificial wind by the installation of electric fans among the plants to be protected. It is considered that this plan is applicable chiefly to vineyards and possibly to orchards.

A New Insulation

A London chemist is reported to have found in a certain sea weed a composition possessing high electric insulating qualities. The substance is waterproof and fireproof and is unaffected by acids and oils. It has already been suggested as an insulation for deep sea cables and the term "Seagumite" has been applied to it.

Electricity at a King's Funeral

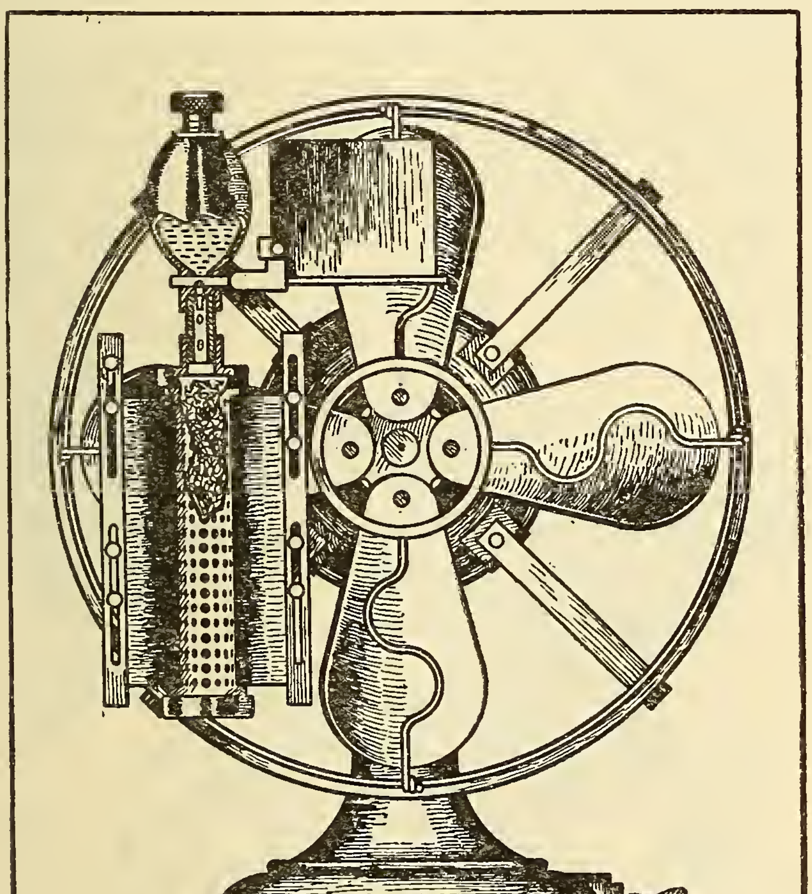
At the funeral of the late King of Siam recently, the illumination effect was produced by means of Osram lamps, representing in the aggregate more than 100,000 candlepower.

Electric Current at Work

Vapor Diffusing Device

The suggestion that perfume be wafted over the audience in a theatre has been carried out crudely by means of a large atomizer in the hands of an usher.

An apparatus for doing this automatically when attached to an electric fan



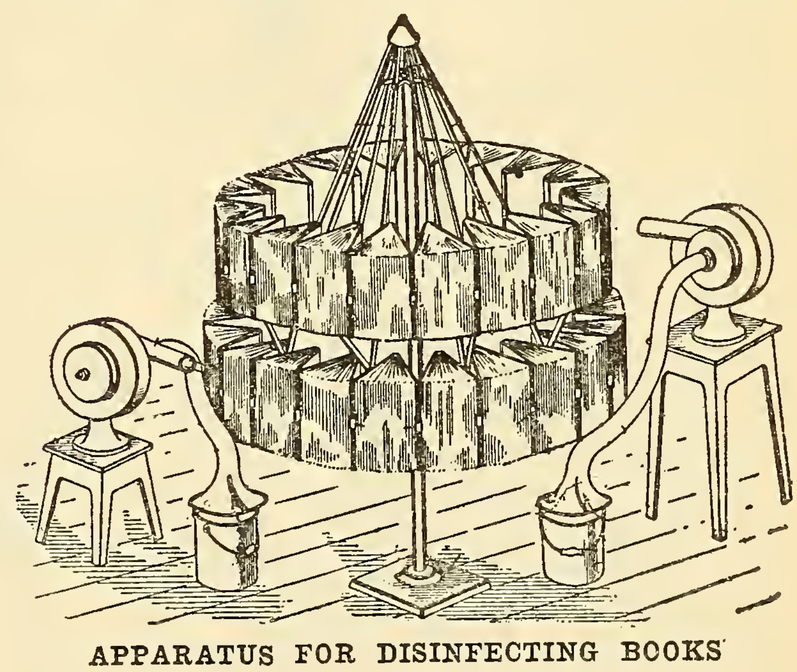
VAPOR DIFFUSING DEVICE

and for diffusing the vapor of any fluid is the subject of a patent issued to Harry W. Forbes and Frederick Linick, Chicago, Illinois.

The device attached to the fan consists of a reservoir for the fluid over a perforated receptacle containing an absorbent material. Attached to a valve stem under the reservoir is a wing against which some of the air from the fan is directed. This crowds the wing over and opens the valve permitting the gradual escape of the fluid into the receptacle below there to be blown away. When the fan stops a spring brings the wing to an upright position and closes the valve.

Disinfecting Books

Every public library faces the problem of disinfecting its books so as to prevent the spreading of contagious diseases and in some localities this has become quite a serious problem. A Mississippi man has a novel solution for it. He places the

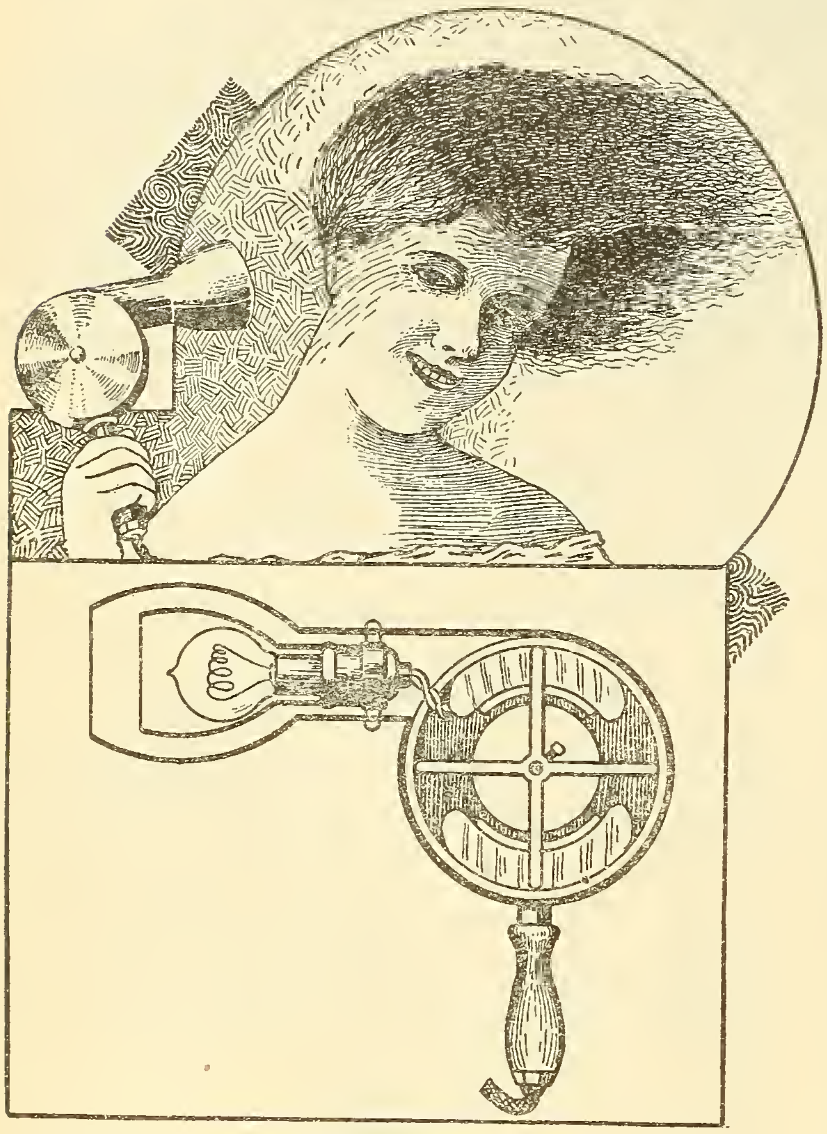


APPARATUS FOR DISINFECTING BOOKS

books on a revolving rack against which small electric blowers are forcing jets of air. The breeze not only rotates the whole rack, but also spreads out and flutters the leaves so that the air can readily pervade them. By dropping some disinfectant into the chamber from which the blowers get their supply of air, this is finely distributed through the books.

New Idea for Hair Drier

A device in which heat is applied to the hair in the form of radiant energy in connection with an electric hair drier is covered by a recent patent issued to Henry J. Manger, Schenectady, New York.



ELECTRIC LAMP HAIR DRIER

The source of radiant heat is an incandescent lamp within a reflector which concentrates the lamp rays upon the hair, the lamp receiving its current through a pair of conductors passing up through the handle of the device.

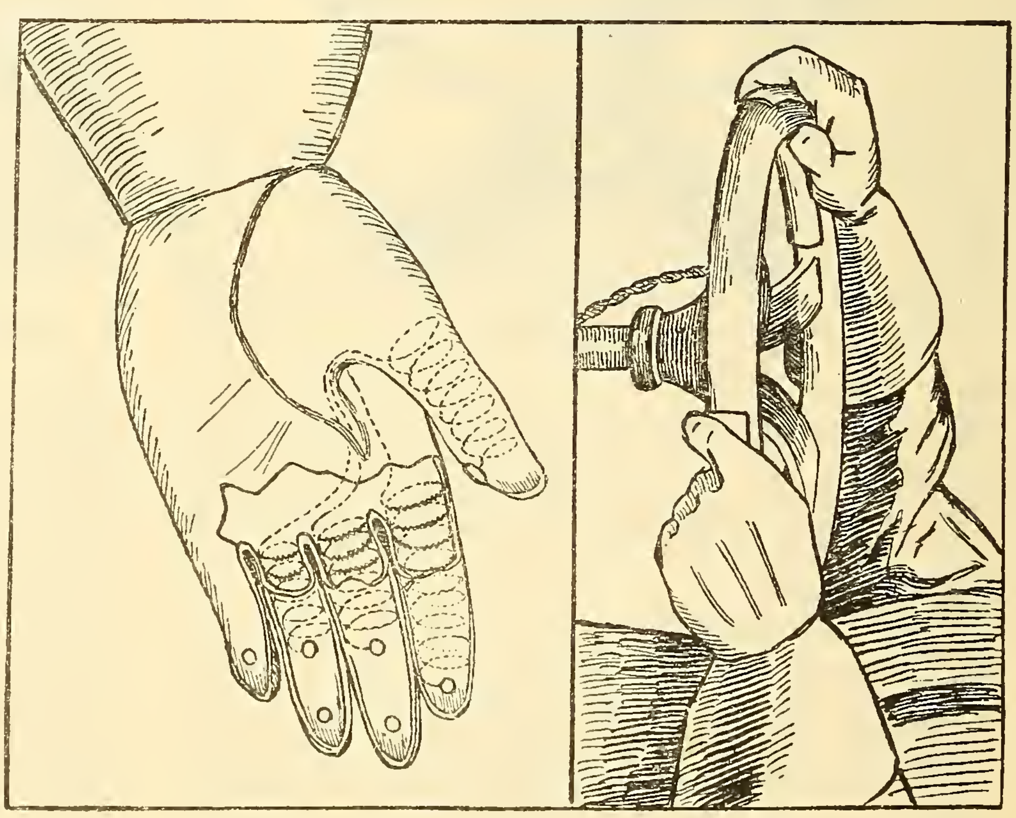
An outside casing directs the air upon the hair at the point where it is heated by the rays of the lamp. The only heat taken up by the air is acquired from passing over the lamp, but it is sufficient. The hair is thus given an electric light bath and dried at the same time.

Electrically Heated Gloves

One of the latest ideas in electric heating utilities is contained in a patent on an "electrically heated glove" granted to Arthur L. Carron, Binghamton, New York.

Aeroplanes, automobiles, motor boats and other conveyances which are guided by manually operated steering mechanism are usually controlled by suitable hand wheels which are necessarily gripped more or less firmly and constantly by one or both hands so that in extremely cold atmospheres and particularly when driving at a high rate of speed, the hands of the operator are liable to become frozen or numbed to such an extent as even to lose control of the machine.

Contacts on the hand wheel and corresponding contacts on the fingers of the glove enable the operator at will to connect the resistance wires in the glove fingers with the electric circuit and receive the warming effect of the heated wires in the gloves. One feature of the invention is the freedom of movement of the hands, the gloves not being connected to any flexible cord or feed wires, the latter being connected to the contacts on the steering wheel instead.



ELECTRICALLY HEATED GLOVES

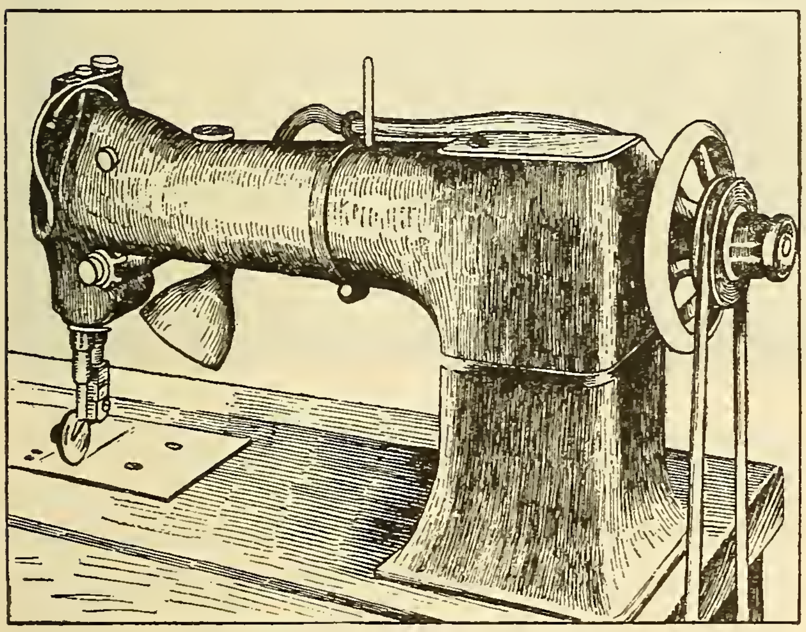
First Aid Electric Railway Car

An ambulance car to be used in case of accidents is being operated by the Milwaukee Electric Railway and Light Co. The car is equipped with two leather couches, a sink, an electric heater for supplying hot water and warming pads to take the place of hot water bottles. A case containing needed appliances for first aid work are part of the outfit.

Special Light for Sewing Machines

A lighting fixture of special design for use on sewing machines, particularly such as are used in manufacturing shoes, is here shown.

The fixture is one solid piece and the heavy brass tube which may be bent into position about the machine head carries the wires to the lamp. The Pernel fixture uses a six volt lamp one inch in diameter, which with the reflector pro-

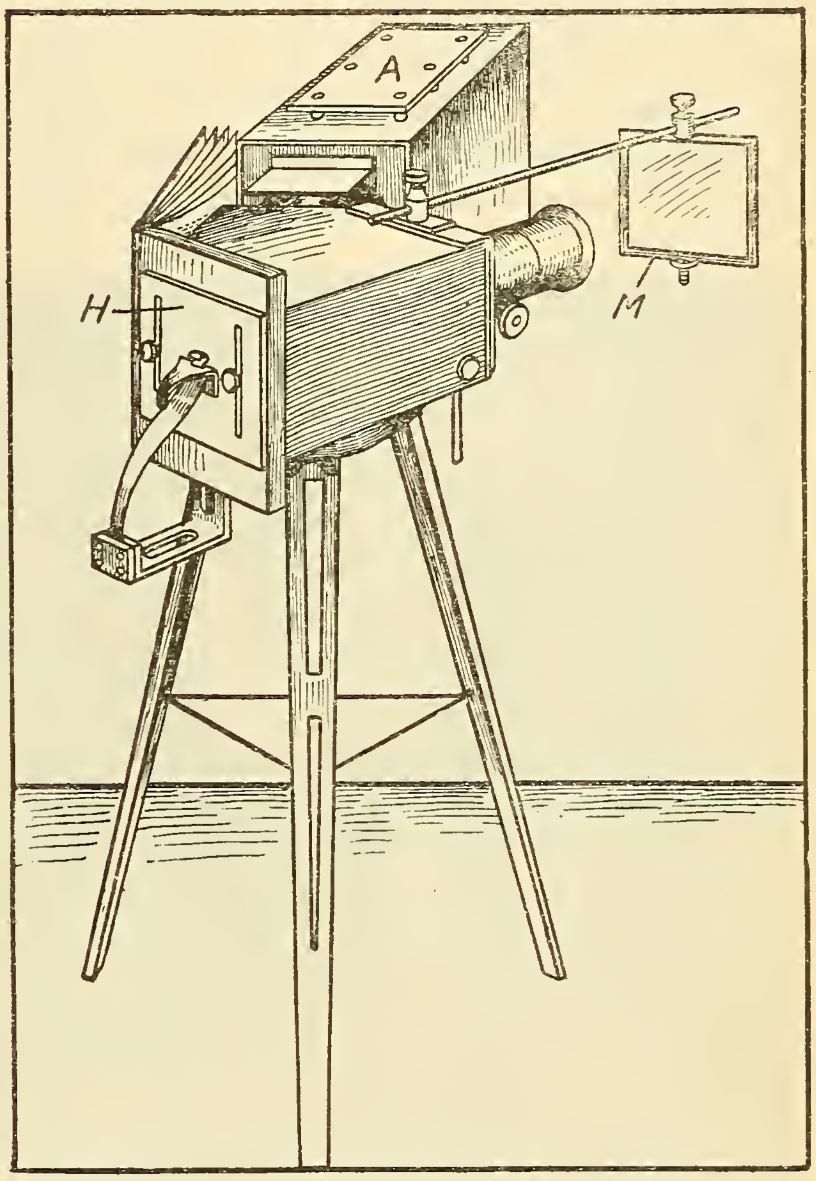


SEWING MACHINE LIGHT

vides ample light on the work. The flexible cord from the fixture through the bench makes it possible to throw back the head of the machine. The low voltage is supplied through an alternating current transformer or by a special direct current system. By using individual lights and protecting the operator's eyes with the reflector, more and better work is turned out with less fatigue than with general lighting only.

Pictures by Direct Reflection

Much experimenting to find a way to produce a picture upon a screen from just a photograph, postcard or book, without making the usual lantern slide, has been done and to a certain extent



DIRECT REFLECTION PROJECTOR

these efforts have succeeded. The accompanying illustration of the McIntosh lantern for this purpose serves to illustrate the method used. To the regular stereopticon, minus the slide holder, is connected a metal attachment containing a book or picture holder and proper lenses. The light from the arc is focused upon the picture in the holder and the picture itself, acting as a reflector, passes the light on through lenses to a mirror suspended at the proper angle to reflect the rays upon the screen

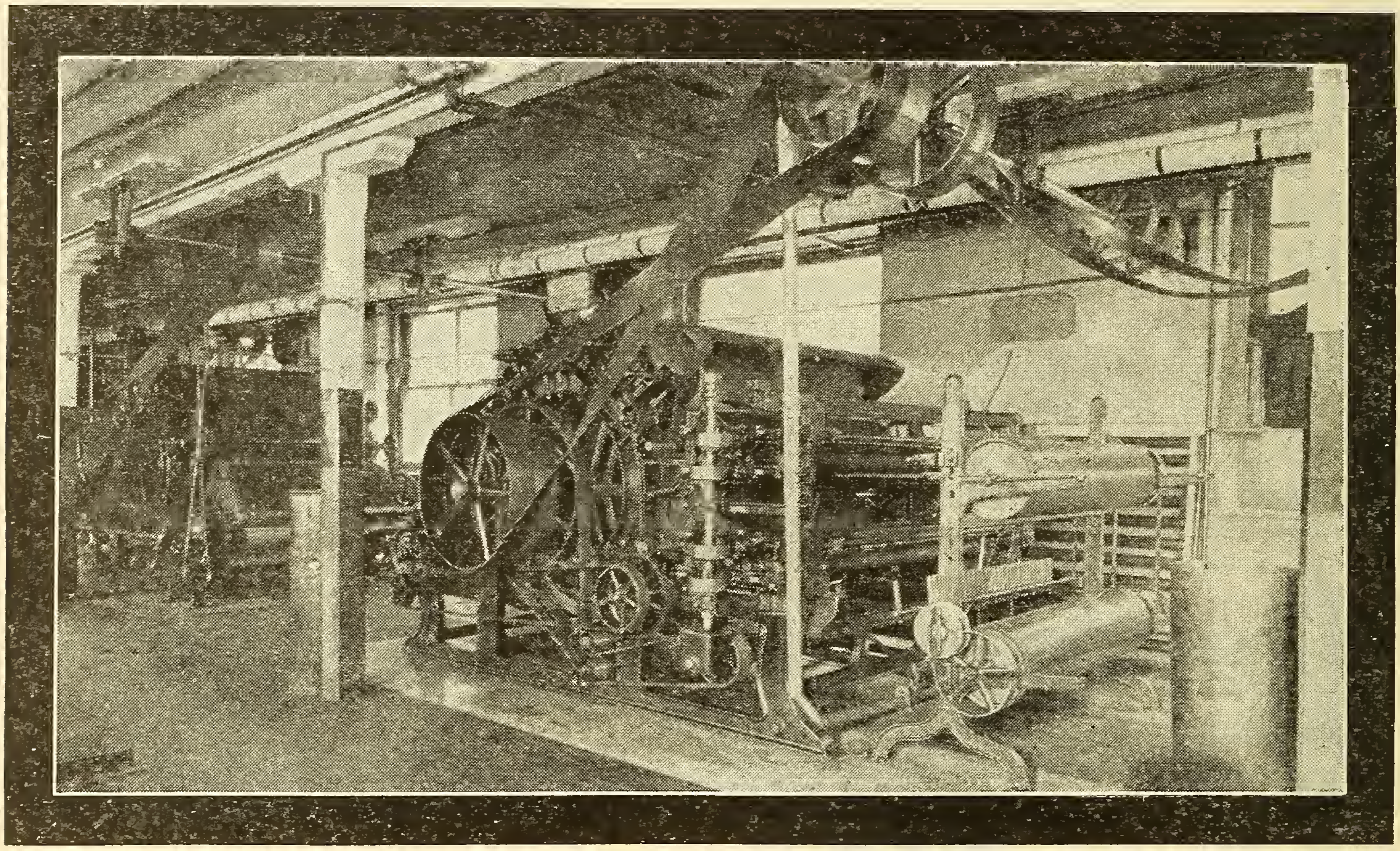
The apparatus produces clear pictures when located about 20 feet from the screen and displays any colors present on the postcard or picture in the lantern.

Fighting Static

By E. C. EMERSON

Static electricity, or electricity at rest, has perhaps more peculiar manifestations than any other form of this energy. Its effects have been deeply felt in textile mills where it has long been fought by the manufacturers, as one of the worst external enemies to the production of good cloth. For making cloth, whether cotton, woolen, worsted or silk, the fibres of the raw material are laid parallel and twisted into a smooth even thread, or, as it is technically called, a roving. Of course the more even this roving is made the better it can be worked in the weaving process and the higher the quality of the goods produced.

Everyone has experienced on certain frosty mornings the difficulty of brushing his hair down, as it insists on standing in all directions and even crackles under the comb. This is due to static electricity, and in the same way it affects the hairs of fibres in the roving of yarn causing them seemingly to bear a grudge against one another and try to pull away from each other. This results in giving the yarn a multitude of projecting fibres, called a beard, instead of the smooth even surface it should have.



A MODERN CARDING MACHINE. FORMERLY STATIC ELECTRICITY WAS A GREAT NUISANCE IN ITS OPERATION, SO NOW ANOTHER CHARGE OF ELECTRICITY IS SET TO KILL THE STATIC

A common method of producing static electricity is by rubbing a piece of silk cloth rapidly over a smooth surface after which it can be made to attract light objects as if it were a magnet. Now as the roving passes through the preliminary machines in its manufacture, it is subject to friction by rubbing, which has the effect of charging each thread with static.

The machine directly responsible for this is the woolen or cotton cord which prepares the stock into the form of roving. Both machines possess a large cylinder covered with a clothing of thin steel wires, points up, like the bristles of a brush, through which the stock is pulled by the action of another set of wire points above the cylinder. The friction thus given to the fibers is sufficient to charge them and make them unmanageable.

Up to a few years ago the boss carder and mill superintendent fought these effects as best they could by such means as sprinkling the stock with a solution of soda ash, borax and water.

Every conceivable method of prevention was employed—the use of vapor pots, the taking of live steam from circulating pipes, the sprinkling of the floor as well as the stock, the use of copper wires in water under the cards, the raising of the temperature of the room and the sprinkling of oil—and still only partial success was attained.

The old adage says, "The hair of the dog is good for the bite." According to this teaching an electrical device has been invented which has proven a success. The accompanying cut shows it mounted on a woolen card which is especially subject to electrical disturbances of the yarn since just before being wound on beams the finished yarn passes through two sets of rubber covered rolls which are vibrated back and forth to roll up the roving. The motion is much the same as rolling up plug pipe tobacco between the palms. There are two sets of threads leaving the rubber rolls to be wound on two beams, one above, the other below, there being 30 threads or "ends" to each beam. The problem is now to remove the electric charge from this roving.

Simplicity is the keynote of the device. It consists of a small motor-generator set which takes the direct current from the lighting circuit and transforms it into alternating current. If alternating current of the proper characteristics be available the motor-generator set may of course be omitted.

The current is transmitted to two inductor bars extending across the width of the card about three inches above the moving threads of wool. The bars are only 1½ inches in diameter and are fastened to the frame of the card by light iron brackets. One terminal of the transformer goes to the upper bar, being carried by a thoroughly insulated wire and is fastened to a composition binding post, then to a similar binding post on the lower bar. The other transformer terminal is led away and grounded to the iron water pipes or some other convenient ground.

Each inductor bar has a wire extending through its interior connected to 42 fine wire points on the under side, which are spaced by means of small porcelain blocks. These points carry the electric charge brought, through the transformer, from the motor-generator set and lighting line.

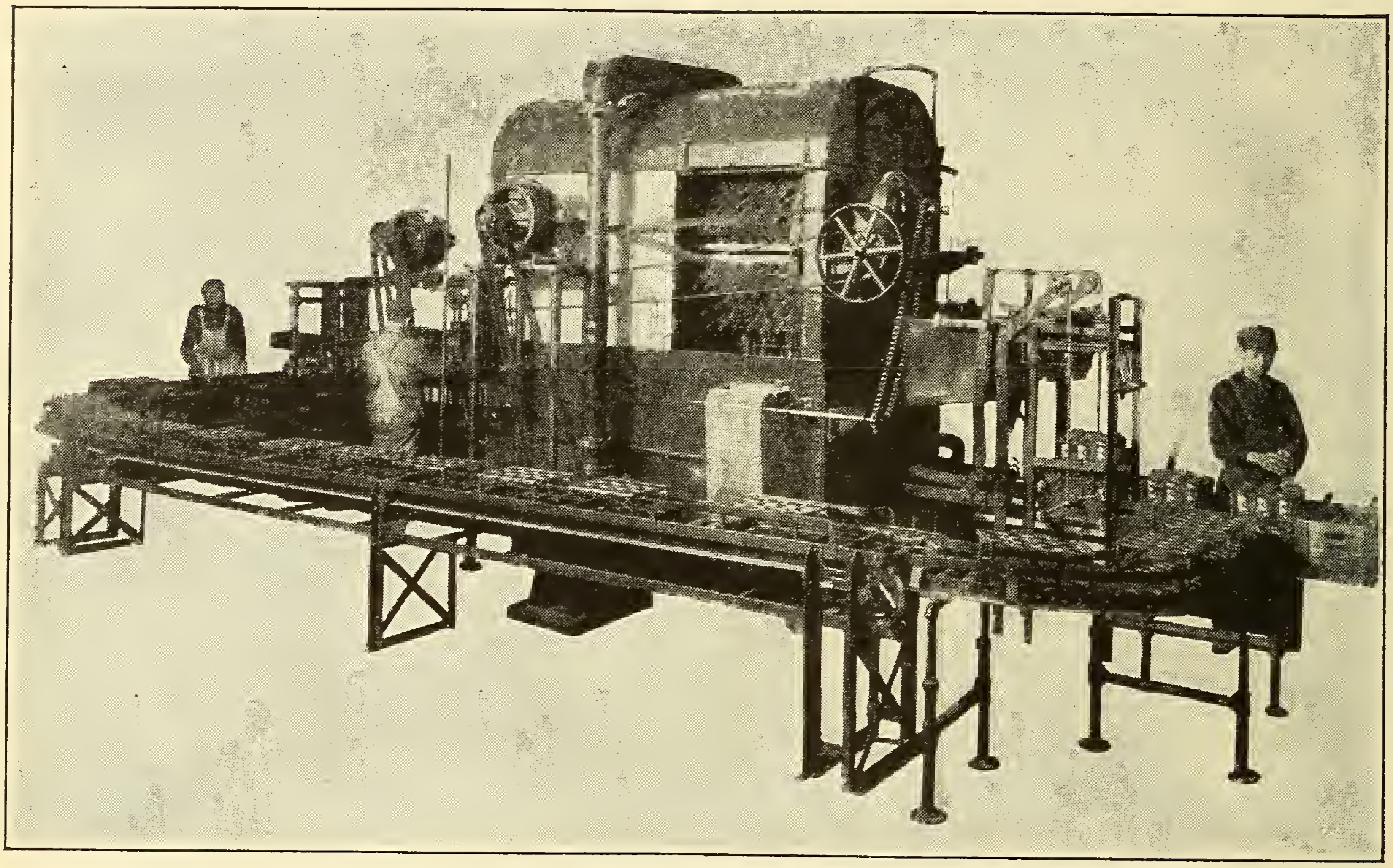
The principle of its operation is that a static charge spontaneously selects from a neighboring charge the kind and quantity to exactly neutralize itself. The hostile charge on the wool may be of a positive or negative nature. It makes no difference for the alternating charge on the inductor points has both kinds to select from. The choice is as unwavering as Nature's law and the result is perfect neutralization. This device is an active and direct one, the charge on the wool being killed by the charge generated on the inductor points.

Tests have shown that the wool is completely neutralized and remains so on the beam. The method is safe since the transformer does not give a current of more than a few thousandths of an ampere, so that it is safe to touch any part of the apparatus, even the active points underneath the bar. The division of the charge seems to be so complete that it will not even set fire to gasoline vapor.

This device is in use by a constantly increasing number of woolen, worsted, cotton, silk and paper mills, since it is of equal advantage wherever frictional electricity is encountered.

Cleans 6,500 Bottles an Hour

In the present day the popularity of bottled beverages and the system of returning empty bottles to the manufacturer have made necessary the use of machines which are apparently almost human for cleaning large numbers of bottles in a short time.



ELECTRICALLY OPERATED BOTTLE WASHING MACHINE

The illustration is of one of these machines operated by electric motors. The bottles are handled only when they are put into the crates, which the conveyor carries to the "soaker," and when they are removed from the crates after having been cleaned and made ready to be filled.

Some of the operations, which the "New Eick" bottle cleaning system performs automatically upon the bottles after they are placed neck down in the crates to allow any left over liquid to run out, are as follows:

The bottles are warmed up on the outside with warm water before they enter the soaker, in order to remove the worst dirt and to pre-heat them; in the soaker the old labels are removed; the bottles are then soaked ten minutes in 2½ per cent caustic soda solution and then filled seven times with a fresh charge of the solution under pressure. The bottoms of the bottles are brushed on the outside after they leave the soaker and are rinsed on the outside with a fresh warm water spray. The inside of the bottles is brushed twice with two different brushes and rinsed four times with fresh water, so that even the slightest trace of soda is removed. Only three men are required and the capacity of the system, according to size, is from 1,400 to 6,500 bottles per hour.

A Powerful Searchlight

What is said to be one of the strongest searchlights in the world has recently been placed in service on the roof of the Bank of International Pensions in Montevideo, Uruguay. The candlepower is 90 million. The light can be seen for eleven miles, and illuminates every portion of the city.

Electric Incubator

The electric incubator here described is heated directly by electric current as derived from the mains, any complicated accessories being dispensed with.

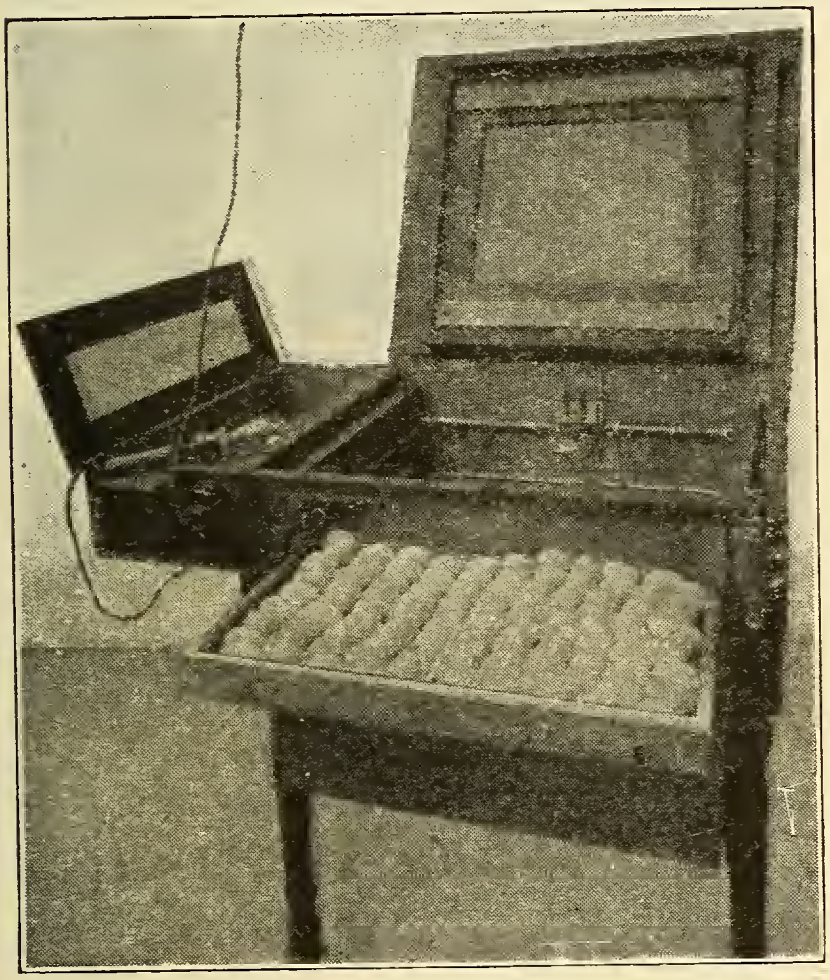


FIG. 1. ELECTRIC INCUBATOR

In Fig. 1, in which the apparatus is opened, a wire mesh may be seen on the lid. Back of this, the main radiator is arranged which takes up the whole of the lid, and which is worked only as long as the apparatus is kept closed. As the heating wires are strung uniformly throughout the lid, all eggs are submitted to the same heating effect, regardless of their location in the drawer. The main heating body in the lid of the apparatus is assisted by auxiliary radiators placed on the bottom of the outfit, which are continually energized even while the apparatus is opened.

One of the most difficult features of artificial poultry breeding is a proper supply of fresh air. In the electrical incubator, air is supplied from underneath, the entering fresh air coming in contact with the eggs after being properly preheated by the special radiators. This ventilation is controlled by opening to a variable extent the lateral slides fixed at the top of the apparatus. It should be remembered that ventilation plays the role of maintaining the life of the germ. Any excess of air, however, will prove detrimental. In fact the surplus air will exert a drying action on the contents of the eggs.

As soon as they are hatched, the chicks are moved to a compartment in which they are kept for a period of 24 hours without food. From this compartment they are taken to the brooding apparatus, Fig. 2. This is separated into two portions, one of which serves as a sleeping chamber, electrically heated, and the other as a feeding room.

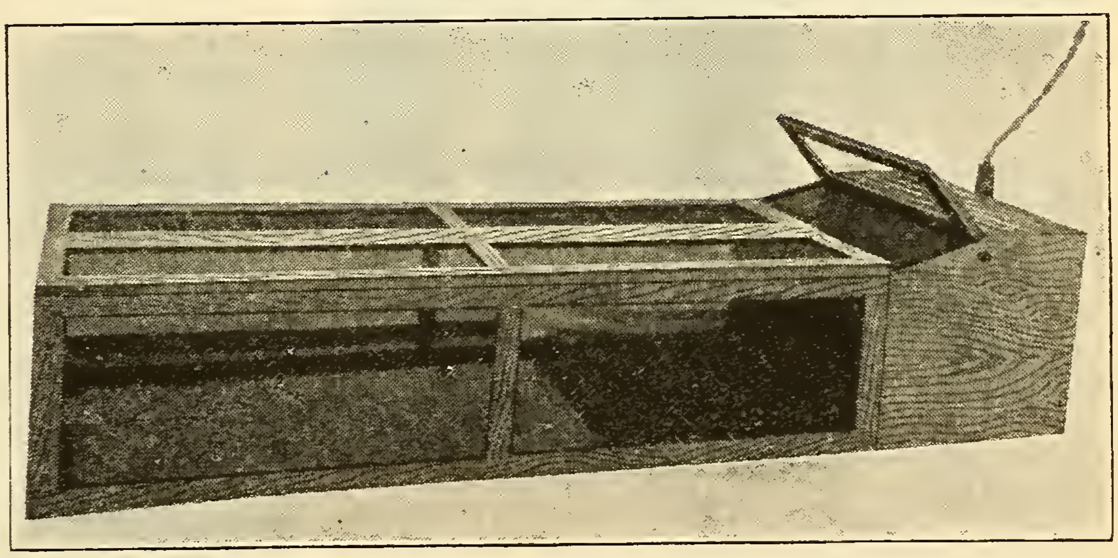


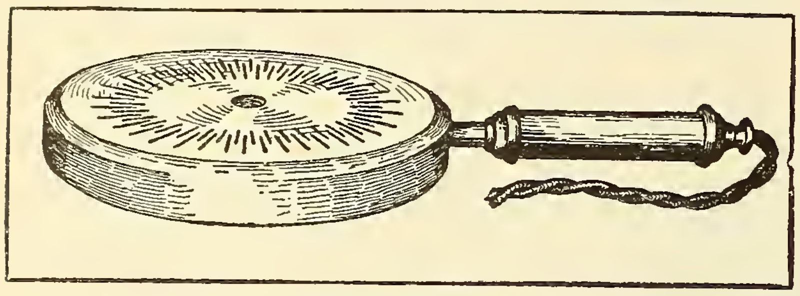
FIG. 2. ELECTRICALLY HEATED BROODER

Harbor Police in Touch by Telephone

Fourteen launches make up the harbor police squad of New York City. Each boat is manned by a sergeant and three policemen, one of the policemen being an engineer. The launches with their crews are to be kept in close touch with headquarters at all hours by having provided for them along the shore 74 places where telephone connection may be effected, thus enabling the men to report frequently and to be informed of any trouble where they may be needed.

An Electric Bed Warmer

English homes and hotels are not as bountifully supplied with steam or furnace heat as they are in this country. In

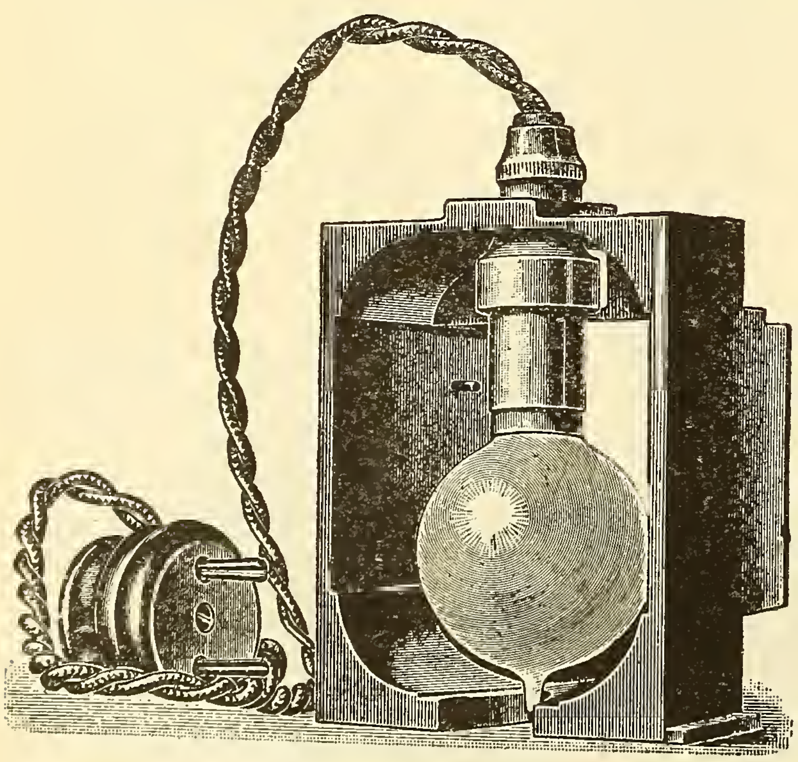


BED WARMER

consequence of this, a unique electric bed warmer has been developed by one of the English electric companies which is as yet unknown to our markets. It looks more like a frying pan with a cover than anything else. As a remedy for cold feet it is far ahead of the old-fashioned soapstone.

Lighting Microscope Specimens

Instead of clamping a miniature lamp socket to the table of a microscope, many users of such instruments prefer to mount the lamp separately. Then if the

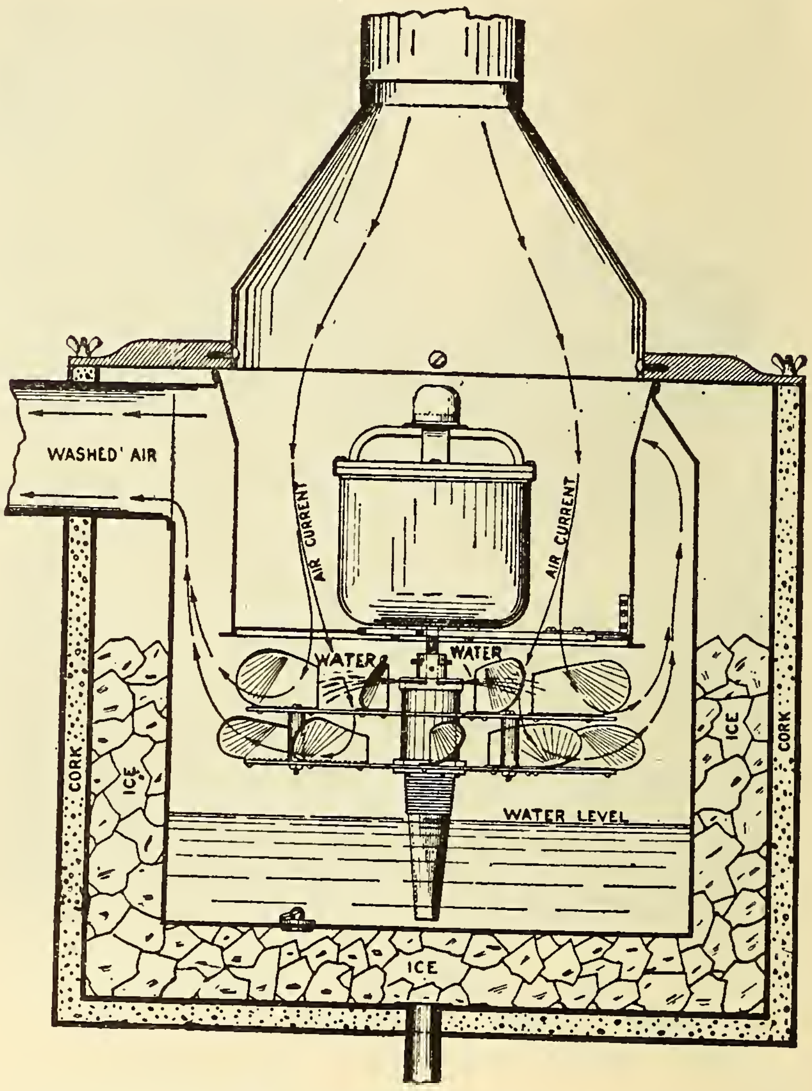


MICROSCOPE LAMP

supporting lamp frame has a suitable holder for glass plates (as shown at the back in the illustration), blue glass plates can be inserted there for dimming the light.

Air Washer on the "De Luxe Special"

On the new Santa Fe "De Luxe Special," one of the finest fast trains west of the Mississippi, both the buffet and dining car are equipped with an air



SHOWING THE CONSTRUCTION OF THE AIR WASHER

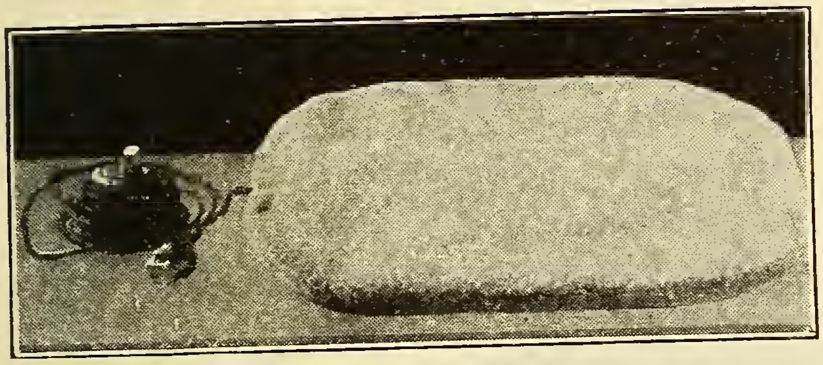
washer designed especially for railway service. It is electrically operated, and has a capacity of 90,000 cubic feet of air per hour, which, assuming 60 passengers; will provide a possible ventilation of 1,500 cubic feet of air per hour per passenger. This is more than ample for the requirements.

The air is drawn through a hood vent in the quarter deck as shown in the diagram, and goes directly into the air washer where all dust and cinders are removed.

The entire washer is packed in ice in such a manner that the current of air in passing through the spray of ice water, produced by a little centrifugal pump, is not only thoroughly cleansed but is cooled at the same time.

Electrical Pillowette

The latest thing in the electric heating line is the Jupiter pillowette here shown, designed to take the place of a hot water bottle. The heating element is completely



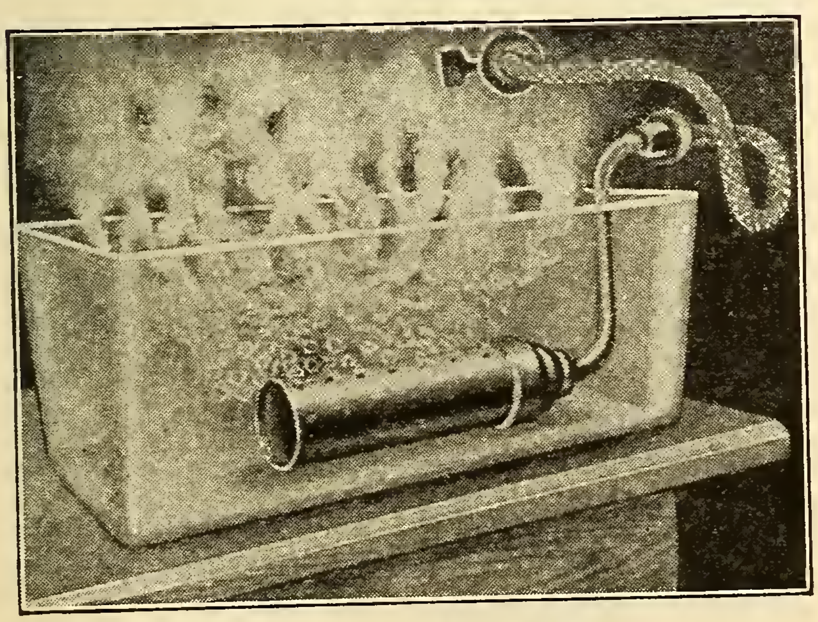
ELECTRICAL PILLOWETTE

surrounded both inside and out by asbestos and in addition it has a rubber casing which insures complete insulation. Especially, in the case of taking a sweat, it is impossible for the moisture to pass beyond the rubber case.

There is on the outside a soft eiderdown slip which is removable, much like a pillow case, so it may be washed and always kept fresh and sweet. A cut-out in the pad automatically cuts off the current when the heat rises to a point deemed expedient and automatically connects again when the heat is down to desired degree.

Electric Water Heater

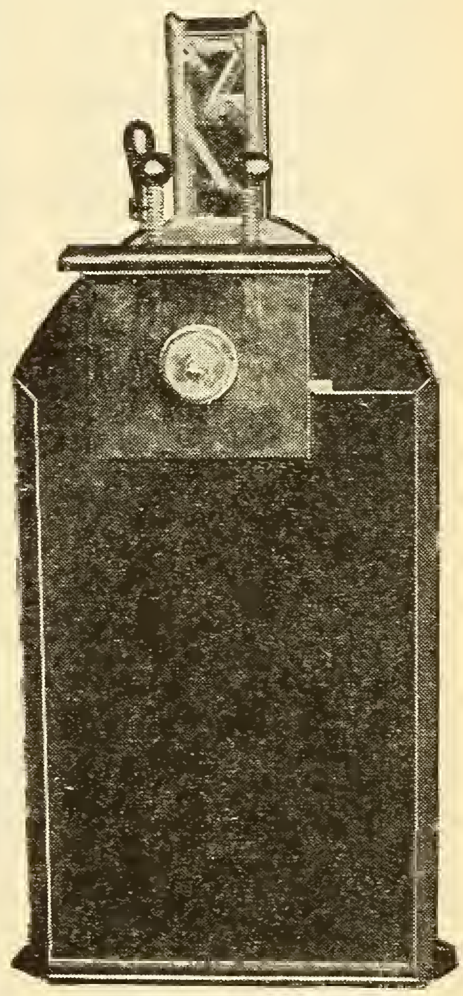
The Insto electric water heater is attached by a cord and plug to any electric light socket. The heater is then immersed in the liquid to be heated. The electric current flowing through the resistance of the heating element brings it to a very high temperature, and a small quantity of water may be made to boil in a few minutes. It is adaptable for heating milk and boiling water for tea, coffee, poaching eggs, etc. With a specially constructed receptacle it is also used as an instrument sterilizer by surgeons and dentists.



ELECTRIC WATER HEATER

Electric Fare Register Device

L. R. Gaw, of Saginaw, Mich., has invented an electric ringing device for registers on pay-as-you-enter cars which eliminates the present complicated foot levers and the overhead cord running through the car. The device may be attached to any register on an electric car, and consists of one, two or more push buttons beside the coin and ticket box at the rear of the car. As each passenger drops his cash or ticket in the box the conductor presses the button for cash, tickets or transfers, as the case may be and it registers in the usual register within the car, which is in plain view of all passengers.



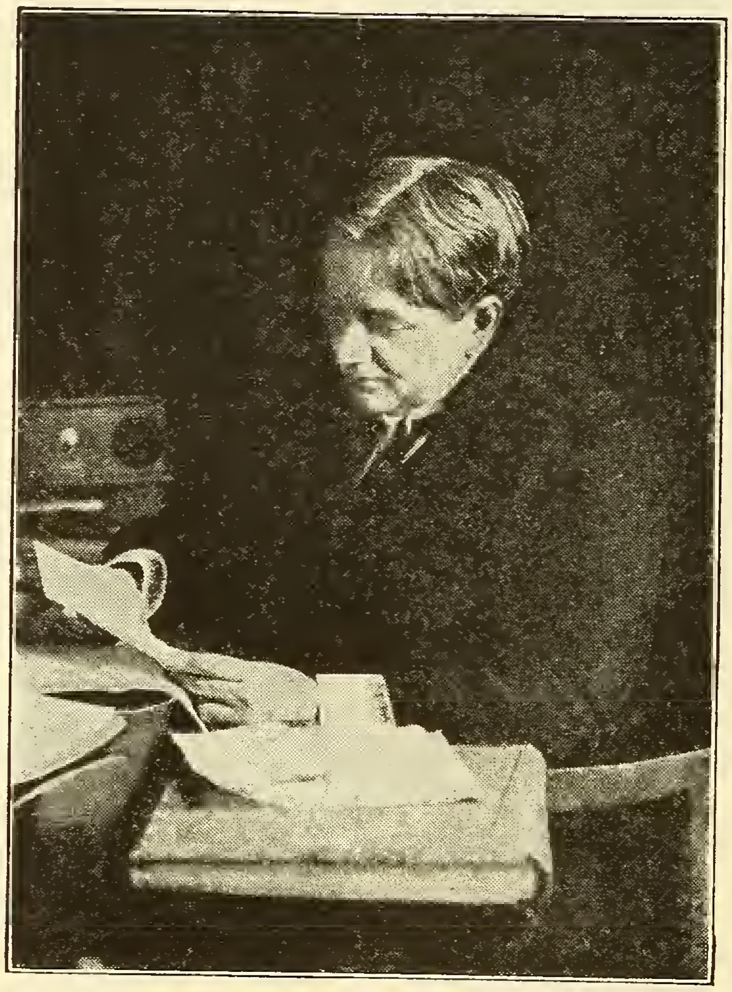
ELECTRIC FARE REGISTER

The electric hoist has almost completely superseded other forms of service in mines, and collieries where electric service can be obtained. The advantages of the electric type of hoist are becoming more widely appreciated by engineers of coal mining companies.

Electrical Men of the Times

ARTHUR WILLIAMS

An electric lighting company must not only produce current but it must sell current. That is axiomatic. As the scope and activities of a central station grow the problem of maintaining the proper relation between plant capacity and sale of current becomes correspondingly more complex. A certain amount of new business is obtained or comes in voluntarily. The capacity of the plant is about reached and more capacity must be added. For reasons of economy, this cannot be done in little bits, but rather by the installation of units of thousands of horsepower or even whole stations. Then comes increased desire for greater sales to keep all of the machinery busy all of the time. In short, whether it might wish to or not, a public service corporation of this kind can know not an instant of let-up in its activities, and there results an exciting race between the engineers of the company to install machinery sufficient for present needs and a little for the future, and the commercial department to load down that machinery and keep it running on an economical basis.



Arthur Williams, general inspector and general agent of the New York Edison Company, has built up a selling organization which combines the functions of general agency and advertising bureau with those of general inspection. To his unusual ability in organizing this department, in obtaining the best men available, and by directly representing it to the consumer, this company owes much of its success in the increase of customers' installations, which have been so great that last November the largest steam turbine generator in the world was added to the generating equipment.

Not only does Mr. Williams fill a very important position with the New York Edison Company, but in electrical circles, both at home and abroad, his intimate knowledge, based upon practical experience, of the commercial relations of the central station to the public is regarded as authoritative. He has also always been prominently associated with the affairs of the National Electric Light Association and was its president in 1906-07.

For several years Mr. Williams has been identified with the various movements in the electrical industry, looking to co-operation between employers and employees. It was during the period when Mr. Williams was president of the National Electric Light Association that that body undertook the investigation of questions regarding the welfare of employees in the electrical industries. Since then he has served on the Public Policy Committee of that organization, which has been engaged in studying this subject, and last June published the report recommending profit sharing, sickness and accident insurance, together with service annuities, and other arrangements tending toward the co-operation of capital and labor in electrical companies.

Mr. Williams' interest in these matters has led him to devote a large portion of his summer vacations to the study of labor conditions in various European countries and the different pension and insurance methods of Germany and Great Britain.

Of late years, Mr. Williams has become more and more convinced of the necessity for the commercial education of the men entering the employ of a public service corporation. As a result, he has been the prime mover in the scheme to have a commercial school for the Edison men right in the company. All must attend this school, each man being allowed so many hours a week off to join the classes most suited to his needs.

Arthur Williams was born in Norfolk, Va., August 14, 1868, and received his early education in the public and private schools at New York, Brooklyn and Hartford. Recognizing the great possibilities of the electrical field, he abandoned an early desire to enter the United States Naval Academy and identified himself with the authorized wiring contractors of the old New York Edison Electric Illuminating Company in September, 1884.

On February 6 of the year following, at the solicitation of the superintendent, Charles E. Chinnock, he entered the services of the Edison Electric Illuminating Company and was closely connected with the early history of the old Pearl Street station in the city of New York, which was the very starting point of the electric lighting industry in America. His work at this time was of a miscellaneous character, such as general repairs, lamp changes, reading of meters, etc. Step by step he advanced in importance in the company's organization, becoming station regulator, superintendent of interior construction, electrician, superintendent of the Third District, and superintendent of underground construction. In 1890 he assumed the position referred to above. He is a man of tireless activity in his work, but finds time for pleasure and relaxation in the numerous professional and social clubs of which he is a member, including several art clubs and societies—for combined with the practical elements of his nature are the high ideals of the artist.

Two Pronunciations

According to the dictionaries, *conduit* is pronounced as if it were spelled *kondit,* when as a matter of fact there are two pronunciations, each with a meaning of its own as distinct as if there were two separate words. The best engineering usage recognizes the word when pronounced with the *u* silent as meaning a water course, while when pronounced *con du it* (three syllables) it signifies a container for electric wires and cables. In this manner engineering usage distinguishes the electric from the hydraulic meanings of the word.

"Low-Grade" Electricity

Two commercial representatives, rivals they were, stood at the corner of a busy street in a large New England city. One man used his time and energy as a general thing to spread a knowledge of the advantage of gaslight in the home, factory and store. The other worked for the electric light company and his every seventh word was "tungsten."

After several minutes of friendly badgering the gas light man said, "Oh, the deuce with you, no one could convince you even if the reason was as big as the nose on your face. You talk to me about the public service commission's examining our gas and finding the quality poor; if they ever tested the electricity your company is putting out they'd find it is about half as good as what you put out five years ago."

Electricity in the Household

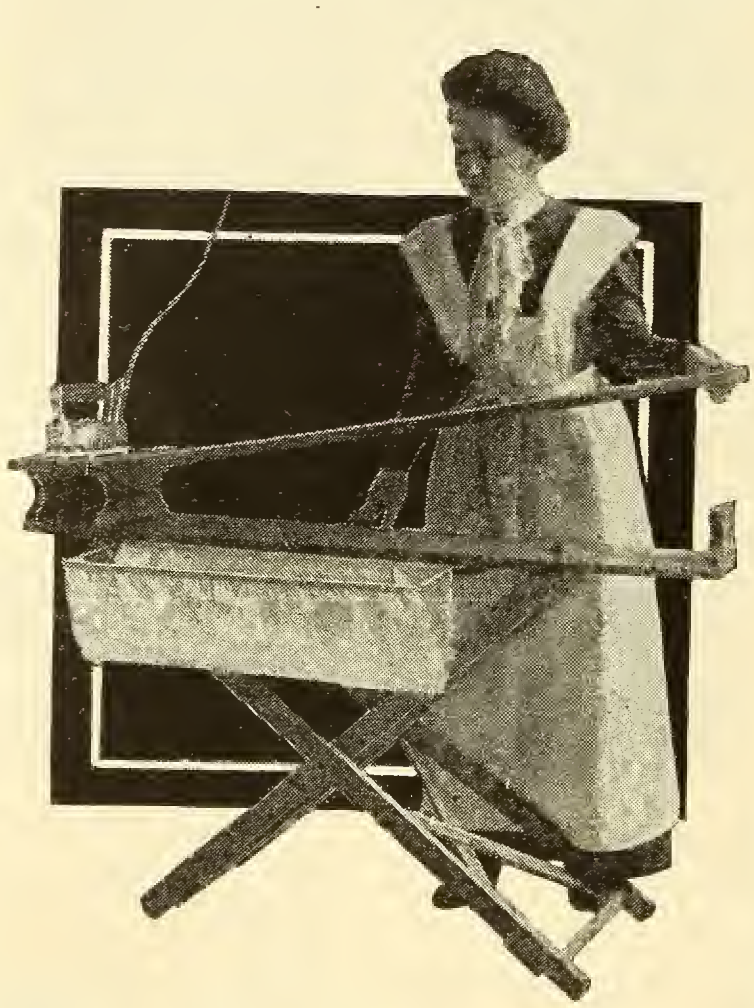
EDITED BY GRACE T. HADLEY

A Woman Invents an Ideal Ironing Board

Mrs. Mary R. Calkins of Hayward, California, is authority for the statement that the secret of all invention is being given the opportunity to see the need. Thousands of women have wrestled with the old-fashioned ironing boards and cumbersome methods so long in use, but if they felt the need of something better, they did not trouble themselves to think out a better board. Mrs. Calkins did and the result is the Calkins Ideal ironing board, which eliminates all the disagreeable features of the old time boards.

It was after watching all the preliminary preparations for ironing, making the board an even height with the table by using a box, hassock and sometimes the unabridged dictionary, then placing a sheet, newspaper or perhaps a basket always very much in the way to prevent clean garments coming in contact with the floor, that this woman inventor saw the need for a board that would eliminate all such unpleasant features and the bother of making ready to iron in the old way.

"Then," explained Mrs. Calkins, "out of the Everywhere into the Here, the idea of a double board flashed into my mind, the bottom board to receive the leg attachments and adjustment; and the top board resting on spacing blocks to be free from end to end thus allowing the skirt to be drawn on the board full length without obstruction and the lower board to prevent its coming in contact with the floor. Then came the idea of adjusting the height of the board so that a short woman could iron with as much ease as a tall woman." The top board is fitted with a lift off hinge.



THE WOMAN INVENTOR AND HER IRONING BOARD

One day a neighbor came to ask Mrs. Calkins if she might use her board to iron a four yard table cloth which she had neglected to send to the laundry. To quote the inventor again:

"I went into my laundry with her and adjusted the board for her height. Then I got a chair, laid something on it and put the dampened cloth on that. Immediately something said to me: 'Your board is not complete. You need some kind of an attachment that will serve this purpose.' This is the way I happened to think of the overfloor bag that slides in and out on a wire frame in little grooves underneath the bottom board. Of course I am very grateful to my friend for asking to use my board, otherwise I might not have thought of this extra attachment at the time."

This Ideal ironing board in combination with an electric laundry iron, solves a serious problem. With an ironing board so perfectly fulfilling all requirements and an electric iron eliminating all disagreeable features of the old-fashioned irons, ironing day has lost its terrors, not only for the housewife, but also for the maid, who is often called on to help with the laundry work in a small family.

Electric Chafing Dish of Blazier Type

The blazier type chafing dish is the most improved form of this ever popular utensil. There is absolutely no danger from fire or explosion which is an ever present menace when alcohol is used. The heat is uniformly distributed over the bottom of the pan thus eliminating the over-heated center and cold sides which are unavoidable when heat from a flame is used.

This dish is similar to the ordinary type except that it has three pans instead of two—a water pan, a food pan and a blazier. This latter contains the heating element hermetically sealed in the bottom. It is similar to the food pan in appearance and can either be used as such for operations requiring high temperature, as in frying, or it can be filled with water and used to heat the food pan, which fits within it, when mild heat is wanted.

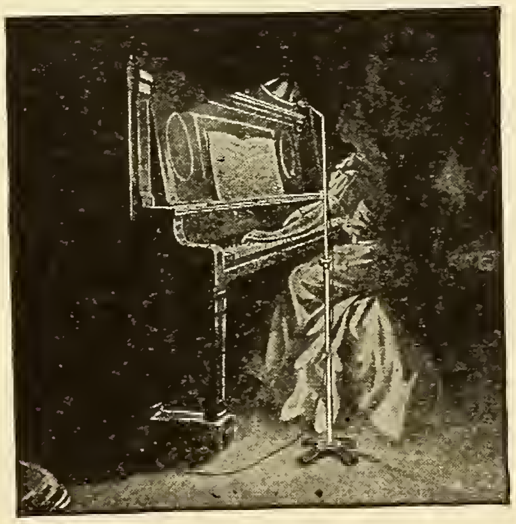
The dish may be operated at three heats, high, medium and low. An indicating plug switch controls the temperature. The high heat is ordinarily used to bring the chafing dish to the desired temperature. The low heat will keep water boiling after the boiling point is once reached and is useful for keeping food warm. The medium heat is the highest that is usually wanted for most

ELECTRIC CHAFING DISH

cooking in the blazier. The blazier is designed to fit the most popular sizes of chafing dishes and contains all parts necessary for electrical operation. By its use alcohol chafing dishes may be operated by electricity with no changes of any kind.

Floor Portable Lamp

"All the light is concentrated on the desired spot," describes the feature of the Badger portable lamp. Built with a substantial base and adjustable standard, the light may be directed by the oval shade to any particular place. In the



music room the lamp is an excellent piano light. It will find service in the library also to light the book, paper or game. The lamp is handsomely finished in either brush brass or Japanese bronze.

When electricity came into ordinary use for illuminating purposes in the home, and lights flashed out by pressing a button in the wall, there was a general exclamation of wonder, especially from the women who were relieved from the disagreeable work of cleaning and trimming oil lamps. That was a good while ago, and since then the unpleasant and hard tasks are being lightened, one by one, through the aid of this same magic button and the geniuses who supply us with new inventions for making our work easier.

Women, as a rule, take little interest in mechanics, but there is something mysterious and magical about electricity that appeals to the feminine nature, while the neat and sanitary devices that are being used in place of the old methods, at once attract her attention.

And it is no wonder that she is interested. Years of study along electrical and mechanical lines have brought many comforts and conveniences until every department of the house work is affected by its use.

That breakfast, a meal always dreaded by the woman who has her own work to do, can now be easily prepared at the table with an electric toaster, a disk stove and a coffee percolator; that the water for dishes is ready in a few moments when the electric heater, a nickel-plated device only six inches long, is immersed in the water, are not any longer facts to be wondered at or perhaps doubted by some as the dreams of over animated salesmen. Electrical household utensils such as these and scores of others have attained an established position on the list of necessities in any well appointed home.

Vacuum cleaning, the most sanitary and economical method of dust removal, is the direct outcome of the application of

THERE IS SOMETHING MAGICAL ABOUT ELECTRICITY THAT APPEALS TO THE FEMININE NATURE the small electric motor to a principle discovered years ago but applicable then only to contracting work in large office buildings and the like, for a heavy, cumbersome engine was then required. It was electricity that put this type of machine into the home.

Every few months we find some new device or an improvement on an old idea, until we begin to wonder what will come next. When we first used the electric iron we felt that no more wonderful or useful invention could possibly be imagined, yet, today, we have an electrical attachment to run the washing machine and the sewing machine, an electric radiator for heating the rooms, the electric cooking stove and the electric fireless cooker, which has certainly created a new system of housekeeping.

Fireless cooking is, perhaps, the most revolutionary contribution to domestic science which has appeared in recent years — the conservation of energy, the applying of a small quantity of heat solely to the purpose in mind, cooking— appeals to anyone's sense of economy. The electric fireless cooker is a step in advance of the old kind in which the food was first partially cooked over gas before placing it in the heat insulating cabinet. In the electric system the food is placed at once in the cabinet and the current turned on for a few minutes until the proper temperature is reached, when it is turned off and the fireless system completes the work. An improvement has been made on these cookers whereby the oven is kept at the proper heat by the automatic switching on and off of the current, by a thermometer device. This electric fireless cooker is not only a labor saver but a money saver as well, and really pays for itself in a very short time. It requires less fuel, and in the food to be prepared there is a saving, as cheaper cuts of meat can be purchased, and if put into the fireless early in the day will be as tender and delicate as the more expensive roasts.

Another advantage of the electric fireless is noticeable when the family is late for dinner, as must happen occasionally in every home. The food is not spoiled by being dried up in the oven but comes "just right" from the cooker which need not be opened until a few minutes before the family is seated at the table.

Where a woman does her own work and entertains at the same time, she can appreciate the convenience of not having to leave her guests alone for an hour before the meal is ready, to prepare the food. In fact, for the small home this solves the servant problem very nicely for those who like privacy and cozy meals with self-prepared dishes.

Perhaps nowhere is a woman so delighted with these new inventions as in her boudoir where she has electric curling tongs, face massage and many other electrical devices. Here again the immersion heater comes into use for preparing water for a shampoo or the hot water bottle in case of sickness.

A very handy combination set consisting of electric iron and curling tongs and a small vessel in which one can heat water or prepare a light breakfast is a great convenience and time saver for the girl who has to get up early to go to the office or store.

The science has developed to such an extent that our children play with toys run by electricity and the Christmas tree is made safe and even more beautiful than before with small many-colored incandescent bulbs made especially for that purpose.

When we remember the old style cooking range in the hot summer days, its grease and smoke, the beating of carpets and the many other disagreeable tasks, we are apt to think that the age of miracles is not in the past. We exclaim, "Isn't it wonderful!" and some practical person answers, "Why no, it is as simple as A, B, C." That is the most wonderful part of it, that these inventions are not complicated but can be understood by anyone without any special knowledge of the science of electricity.

The Red Electric

Many women who would like to have an electric washing machine to relieve them of the drudgery of laundry work are apt to regard such a machine as a luxury or entirely out of reach of a moderate income. The Red Electric is a low priced machine with special features of superiority over any other dolly type machine that is made. The dolly is a wooden instrument inside the tub used to beat or stir the clothes during the pro-

ELECTRIC WASHER

cess of washing. All the hard work of rubbing and wringing are entirely eliminated in this machine.

No time is lost. While the machine is washing one tub of clothes the maid is running the clothes from the rinsing water back through the reversible wringer onto the top of the machine, ready for the line. The machine and reversible wringer are under the direct control of the operator, thus the washing and wringing may go on at the same time or the wringer may remain stationary while the machine is washing. The tub is fitted with a special one inch drain faucet at the bottom for drawing off the waste water.

Two cents an hour for electricity will cover the cost of operating the machine, which has ample capacity for a small family wash.

Electrical Inventions by Women Inventors

The early patents issued to women of the United States covered straw weaving with silk or thread, weaving grass hats, manufacturing moccasins, whitening leghorn straw, extracting fur from skins and manufacturing it into yarn. Women of this country were 98 years making 2,300 inventions. Then they began to manifest more inventive genius. From 1888 to 1895, a brief period of seven years, women of the United States took out over 4,000 patents, and they are still taking out patents, moreover, they are taking out patents on electrical inventions.

Mrs. Sarah O'Connor of New York has invented an electric washing machine that washes easily and washes clean. It is said that her patent is very simple and may be put into any tub and removed again if the tub is needed for other uses. The patent washer is operated by a small motor placed on a near-by shelf. Necessity forced Mrs. O'Connor to invent her own washing machine. To quote the inventor's own words:

"I bought a washer some time ago and it wouldn't wash clean. Then I said to my husband: 'It's time a woman got up a washing machine, because a woman knows what she wants.' So I put the one I had down in the cellar and went to work on a better one. I made a hand washing machine first and patented that. I kept right on working along this line and finally I made an electric washing machine. When I turn on the current and start that motor and see it run my machine, it gives me a queer little feeling. I am surprised at it and yet I made every bit of it. I drew rough plans of all the iron parts and had them made, and I managed to work out the wooden parts myself. You ought to see how it works! I can't keep up with it hanging out the clothes. I have a good-sized family and a very big wash, but it will do all my wash in 20 minutes and I have no work to do except to lift the clothes in and out of the tub."

Practical Experience With An Electric Range

The practical experience of a progressive housewife is always interesting to other housewives, hence the following paper prepared by Mrs. W. E. Sweezey of Junction City, Kansas, and read by Mr. Sweezey at the fourteenth annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association held at Independence, Kan., September 21 and 22, 1911:

To prepare a paper to read before so august an assembly as "The Electric Light Association" of Kansas, is a task that I never expected to try to do. Still my subject is a good one, and one in which I have been very much interested ever since I began using an electric iron seven years ago.

If electricity could be made practical for ironing, why not for cooking? Our first attempt in cooking by electricity was with a little electric plate about eight inches in diameter, supposed to be a pan cake cooker, but on which I used to fry, broil and stew. Many a time have I prepared breakfast or supper on this little plate alone. Besides we used it as a chafing dish.

Three years ago Mr. Sweezey gave me a coffee percolator, a toaster and a double cooker. The coffee percolator has proved itself an item of economy. As good a cup of coffee, if not better, can be made from a 30-cent grade of coffee, than from a 40-cent grade made in the old fashioned way. As we use in the winter a pound of coffee a week and in the summer about 2½ pounds a month, counting six months to each summer and winter division, I find that where my coffee used to cost me $15.60 a year, it now costs me $11.70, making a difference of $3.90 saving, to say nothing of the ease in preparing.

As you all know, the beauty of toast is in having it fresh and crisp. We put the toaster on the dining table and make the toast as we use it.

The double cooker I have used in so many and such varied ways that I will not try to enumerate them. Only a housekeeper could understand in how many ways this little heater can be made practical.

After using many different electrical appliances, the climax was reached when two months ago we put in an electric range. This combines everything, and is certainly the ideal way of cooking. In my two months' experience I have not found anything that it will not do, besides adding all of the comforts and none of the discomforts of cooking.

To boil or fry turn the heat on the "high" until the plate is thoroughly hot, then turn to "intermediate." In boiling something that requires long cooking, turn the heat to "low," as that will continue boiling heat and is all that is necessary. Where quick heat is required, use the small plate.

At first the oven did not satisfy me, but I soon found out that it was because I did not understand it. The baffle plate must be moved up and down according to what is being cooked. To bake biscuit, move the baffle plate to within three inches of the grate where the biscuit pan is placed. For pie or cake, move the baffle plate higher, as a slower heat is required. To roast meats where great heat is required, leave the top off the roaster, and place the baffle plate just above it.

I find it best, no matter what I am baking in the oven, to first turn the heat to the "high" until the oven is well heated; then turn to "intermediate" or "low" according to what is being cooked. For meats leave the "high" on fully 30 minutes, then turn off to "intermediate." The oven will be hot enough for the meat in fifteen minutes after turning on. For biscuits, pie, cake, pudding or baked potatoes, turn to "intermediate" in fifteen minutes.

The broiler is a treasure in itself, as everyone knows how much better a broiled steak is than a fried one. The broiler may also be used as a toaster.

One day last week, as an experiment, I watched to see how much current was used during the day. For breakfast we had bacon and eggs, toast, coffee and fruit; for dinner, fried chicken and gravy, mashed potatoes, baked sweet potatoes, sliced tomatoes, hot biscuit, peach pie and coffee; the evening lunch was cold excepting we warmed the potatoes. At night I found that I had used just three kilowatts.

Aluminum cooking utensils are best. As a rule, they are more perfectly flat on the bottom, resting evenly over the plate. They take all the heat and reach boiling point much quicker than an uneven vessel would do. The half or triple pans would be more economical to use.

I have not tried baking light bread, but feel sure I could manage the oven without any trouble after what experience I have already had.

An electric range is certainly perfection in cooking. There is pleasure in getting up a good dinner, but no sentiment in poking a coal stove, putting in fuel, emptying ashes, standing over its intense heat, or scouring up after its smoke and black; then keeping the stove itself looking presentable. Cleanliness, which is such a great factor in the kitchen, is no longer an item, for with the electric range it is so easy to keep things clean.

I wish every lady in the land, especially those who do their own work, could have an electric range. Nothing in the home combines so much of comfort, convenience and cleanliness as this range. By simply turning a button the fire is ready for every meal; low, intermediate or high, just as we may wish. In the heat of summer, the kitchen will be cool, clean and inviting. In the hurry of the short winter mornings the range is always ready. No uncertainty as to whether it will draw or not, quick to respond when we are in a hurry, or with its four plates and big oven gives us plenty of room to get a nice dinner.

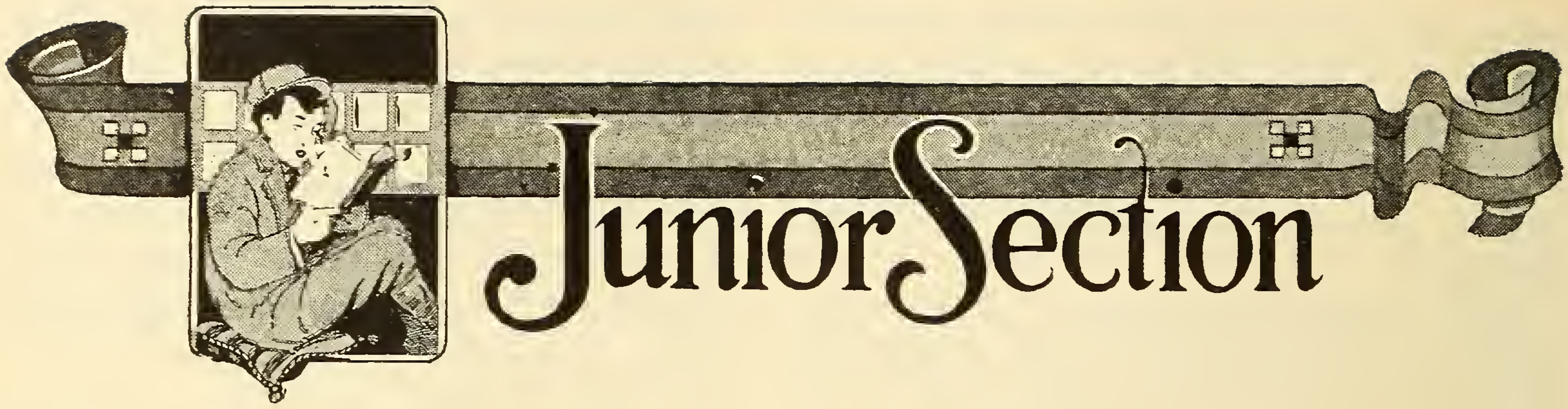
Give the bride of to-day an electric range, and as she works about her clean, cool kitchen, in her dainty white aprons and pretty house dresses, she will be such a contrast to her mother-in-law in her hot kitchen with her big gingham aprons and dark calico dresses made in "any old way" just to wear in the kitchen, that the young husband will forget that maybe his wife's pies and puddings do not rival those of his mother's after 30 years of housekeeping.

Quartzalite Heating Units

Among the newest applications of electricity to cooking is the Quartzalite system. In this appliance the heating element consists of spiral wires of special alloy, inclosed in a quartz tube. When heated, the quartz becomes transparent and can not be melted except by an electric furnace. When the current is switched on, the wires are raised in temperature to a bright red heat, and as the tubes do not wear out the cost of maintenance is low.

Use of the Pilot Light

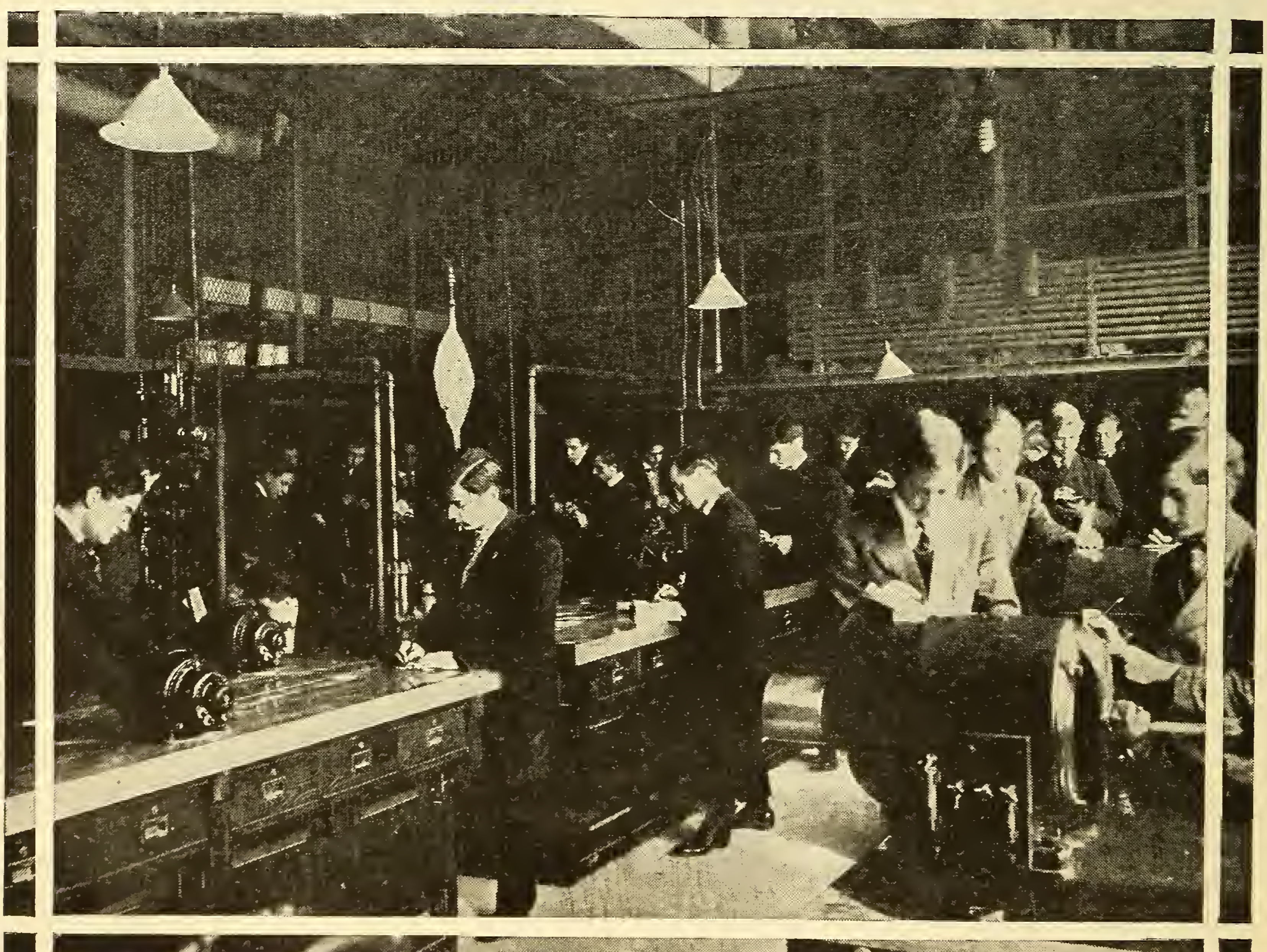
Current is often used needlessly by forgetting to turn off the light when leaving the basement, attic or other little used apartment. It is a good idea to have a pilot light, as it is called, connected in the same circuit with the little used lights, but located in the living rooms where it will be readily seen. It burns only when the previous mentioned lights are used and gives warning on returning to the living rooms if one has carelessly forgotten to turn them out.



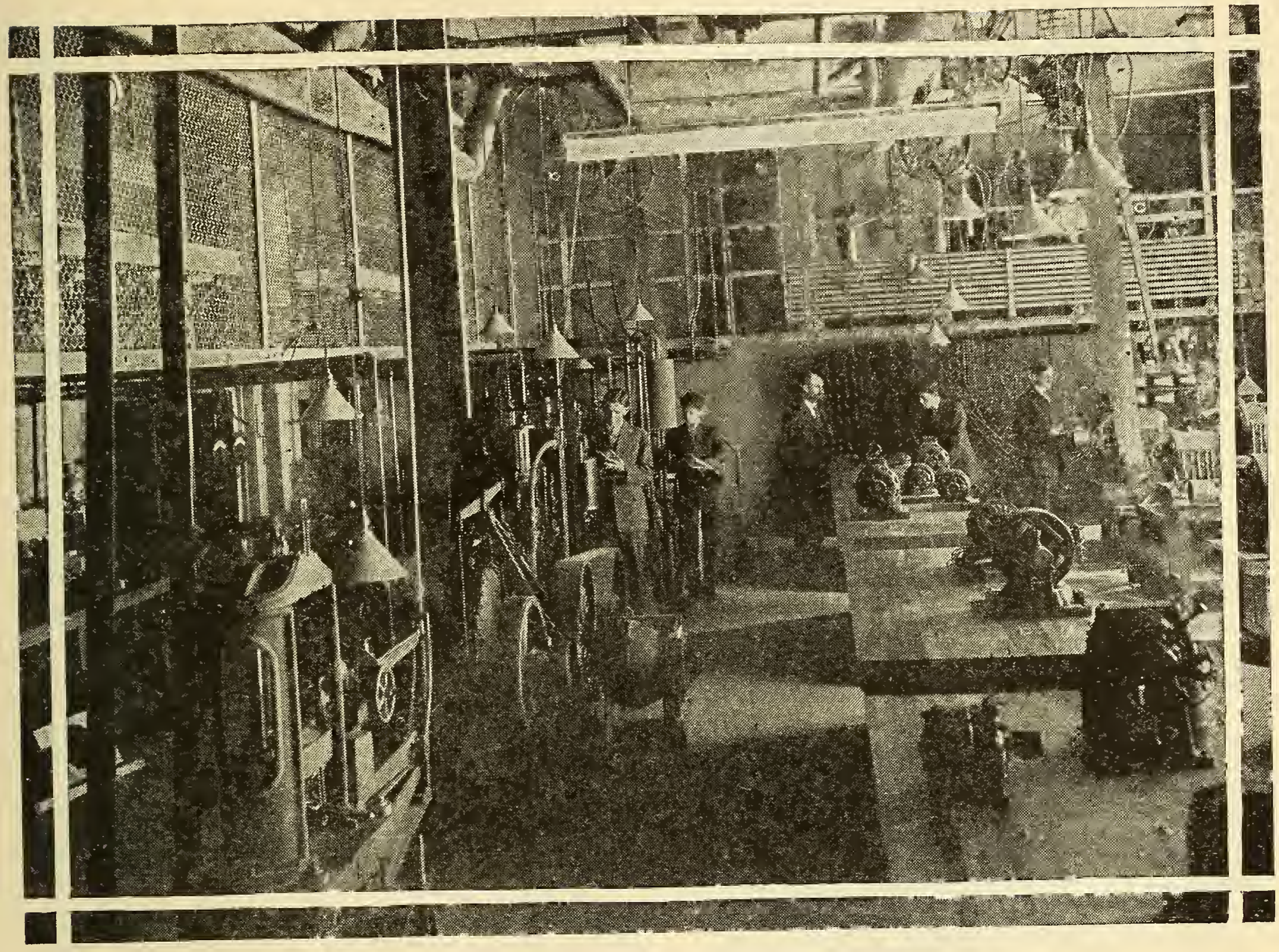
Where Young Men "Find" Themselves

If every boy and young man by some means could have in his mind's eye a rough picture of a majority of the various branches of the world's industries and professions before choosing a career there would be fewer failures. This privilege is open somewhat to those who can travel and to others who live in or near large cities. In many schools trips to industrial centers are taken by the students with this idea in mind and to make a connecting link between the school and industrial life, manual training courses are now offered.

Nearly all boys and young men enjoy this practical side where things are done with the apparatus about which only the theory was formerly taught. To the young fellow who is mechanically or electrically inclined these courses are a



STUDENTS AT WORK IN THE ELECTRICAL LABORATORY



GAINING PRACTICAL EXPERIENCE IN OPERATING AND TESTING

decided advantage. In addition to knowing how to handle the machines and instruments a record of the work done is neatly and systematically recorded in notebooks. This required arrangement of work, though it may not be recognized as a benefit at the time, is, nevertheless, a valuable training.

It is possible, too, that the student finds through these courses that certain work is not what he would like to enter for life. This early insight may save the more valuable time of later years in finding a vocation.

Manual training is not lost, for every business, whether it has to do with machines, buildings or people, has work that trained hands can perform better than those that are untrained.

The accompanying pictures show classes in the Stuyvesant High School, New York City, at work in their laboratory, which is plentifully equipped with apparatus for the study of mechanics and electricity.

"What Hath God Wrought!"

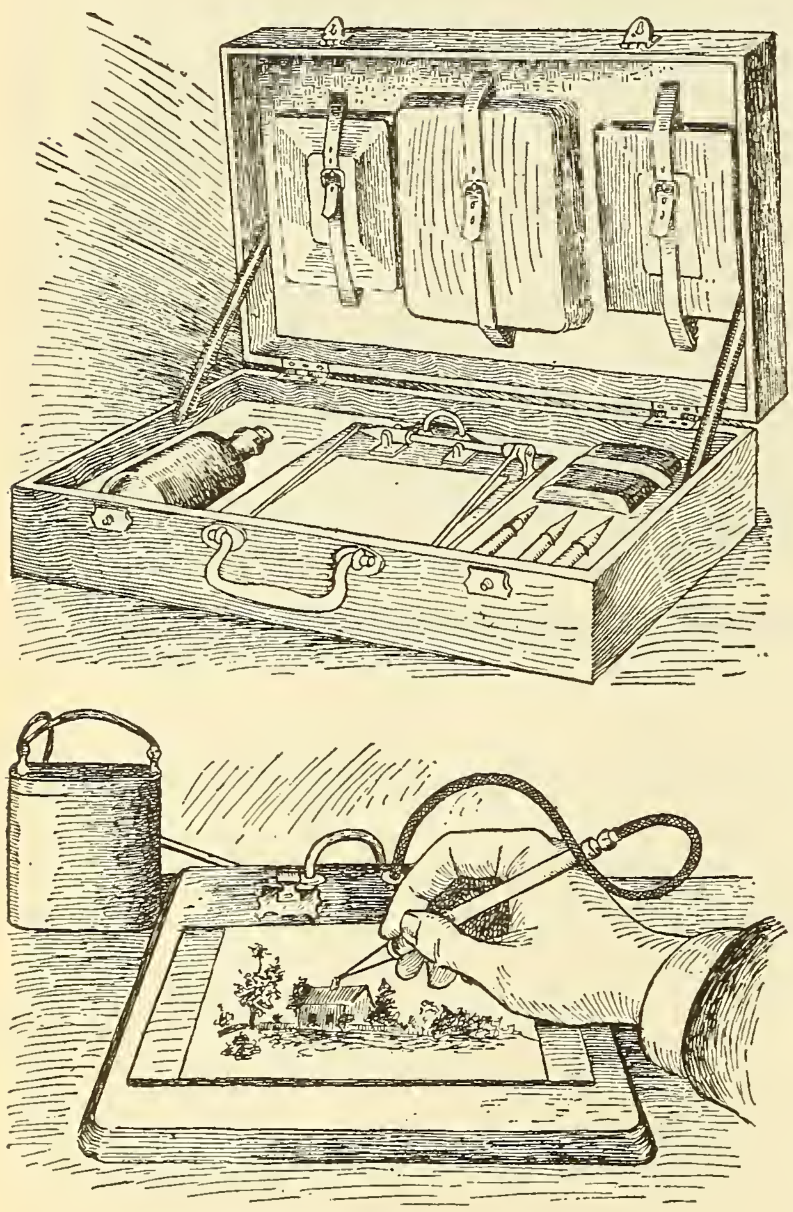
There is a story, not often told, connected with these now famous words. They were spoken by Miss Ellsworth, a friend of Samuel F. B. Morse, as the first message sent by telegraph.

When Mr. Morse was trying to get an appropriation from Congress to build a line between Washington and Baltimore, a senator told him to go home and forget his invention. He so far followed the advice as to return to his hotel, count his money and find that he would have 37 cents left after paying bills and car fare.

But an unexpected turn of affairs took place, for next morning Miss Ellsworth brought the good news that Congress had provided $30,000 for Mr. Morse to use. For bringing these tidings the inventor promised Miss Ellsworth that she should send the first message by telegraph, which she did about a year later.

The Electro-Chromograph

The electro-chromograph is an interesting novelty. Although the properties on which it is based have been known for a long time, they have never been applied. In principle, this toy is an apparatus intended to fix metallic colors on paper by means of electrolysis. This principle is also that of the Caselli and



THE ELECTRO-CHROMOGRAPH

Meyer telegraphic apparatus, among others, which reproduced on a sheet of paper, by means of a metallic point, the drawing transmitted by the aid of a sheet of tin covered with traces of insulating ink.

Here the apparatus is much more simple. It is a little mahogany desk on which is adjusted a nickeled zinc plate connected with one of the poles of any battery (the little pocket-lamp batteries are perfectly suitable). The second pole of the battery is connected with the point-holder, and the wire enters the point-holder to be soldered to a metallic capsule. The point to be added to this equipment is soldered to a common pencil point protector. The capsuled extremity is engaged in the point-holder, pressure is made with the ring and the contact is established. This describes the complete equipment.

In order to draw, the operator takes an ordinary sheet of white paper, unglazed, so that the pores will not be closed by the emulsion, and plunges it into a bath of nitrate of iron. After several minutes he takes out his sheet, sponges it sufficiently and lays it out on the metallic tablet of the desk. Then, with the metallic point which he has in his hand he can trace designs which will appear green, yellow or red, according to the metallic nature of the point. So under the action of a tungsten steel point, the decomposition of the electrolytic liquid in which the paper is soaked, gives a green precipitate. To obtain red lines, it is necessary to use a brass point containing a very slight quantity of zinc. Finally, the chrome point, taken from a chemically pure block of metal, will give a yellow precipitate.

The same drawing can then be traced, using three different colors. If one desires to obtain the different shades, nothing is easier; in fact, it is only necessary to press more lightly on the paper and to move the point more rapidly. Another method giving the same result consists in drying the paper more, using a blotter. Then the very fine lines are made with smaller points than those used for the heavier lines. For this purpose each point-holder is provided with two styles: one large one and another finer. If it is desired to change the green to Prussian blue, the sheet of paper drawn in green lines is plunged into water and allowed to dry; the change of color then takes place.

The ferro-prussiate paper (blue-print paper) printed in the light, which takes a Prussian blue tint, can also be used for the drawing, but the lines are white no matter what kind of a point is used. To obtain this result the paper is soaked in salty water.

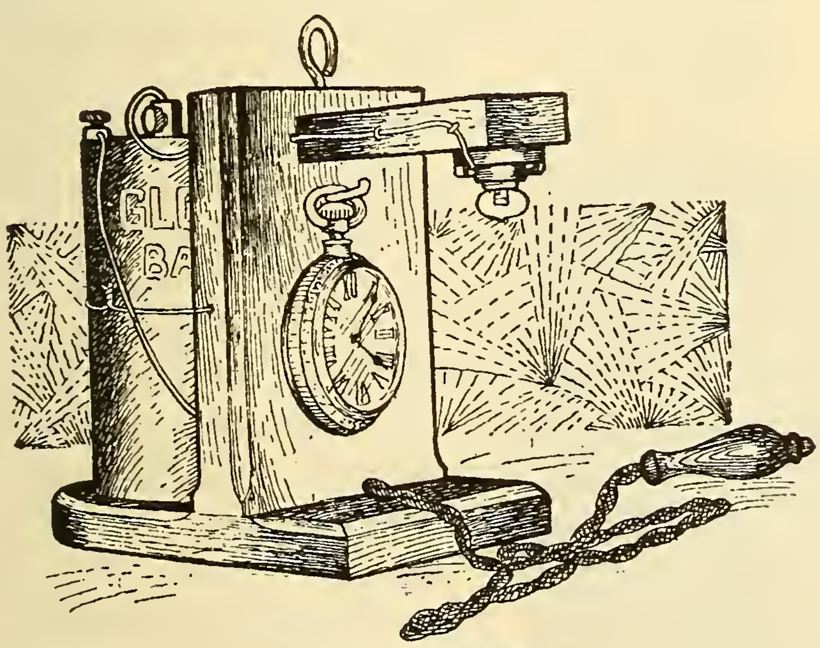
The decomposition of the metallic oxides by the batteries is an old discovery which Mr. Chomeau, the inventor of the electro-chromograph, has studied in a special fashion with a view to drawing from it an attractive application.

In fact, he encountered many difficulties before attaining the end in view. Thus, he was able to constitute a single bath to obtain the different tints which we have indicated and he was obliged to study certain alloys in order to fashion the points. This little plaything required a year's work of him before he was able to perfect it and render it suitable for interesting children.—Translated from *La Nature,* Paris, by *Annette E. Crocker.*

Home-made Night Watch Light

During the dark winter months I use my watch and the convenient home-made arrangement shown to tell the time without getting out of bed.

The following needed material may be obtained practically without cost:



WATCH LIGHT

One ¾ inch board 5 by 3 inches, one ¾ inch board 6½ by 3 inches, one piece wood 1 by ¾ by 2½ inches, four ¾ inch wood screws and four insulated staples. Material to be purchased is as follows: One 2½ volt, tungsten, battery lamp, 30 cents; one dry battery, 30 cents; ten feet No. 20 double conductor, lamp cord, 15 cents; pear-shaped, push button, 15 cents; miniature receptacle, 10 cents; total cost, $1.

The wooden parts are shaped and fastened together with wood screws. The battery is held in place by a wire about it and passing through a hole in the upright. The lamp is connected in series with the battery and button. A screw eye in the top of the upright serves for lifting the outfit, and a nail or hook supports the watch. The outfit is placed on the dresser or a chair and the cord is hung around the bedpost, with the button within easy reach.

E. B. Drahcnalb.

Foes to the Telegraph

The enemies of the telegraph are many, and among them will be found bears, monkeys, elephants, worms and spiders.

If one kicks or pounds a telegraph pole, or places his ear against one on a windy day, what will the noise remind him of? A hive of bees. So it does the bears.

Bears are passionately fond of honey, and when in one of the wind districts bruin hears the humming of the wires, he follows the sound to the post where it is loudest, and begins to tear away the soil packed around the poles in order to get at the hive which he imagines to be there. In his disappointment and disgust he usually leaves marks of his claws in the wood.

On our treeless plains the buffalo used to hail the telegraph poles as ingenious contrivances for his own benefit. Like all cattle, he delights in scratching himself, and he used to go through the performance so earnestly when he encountered a telegraph pole that he very often knocked it down.

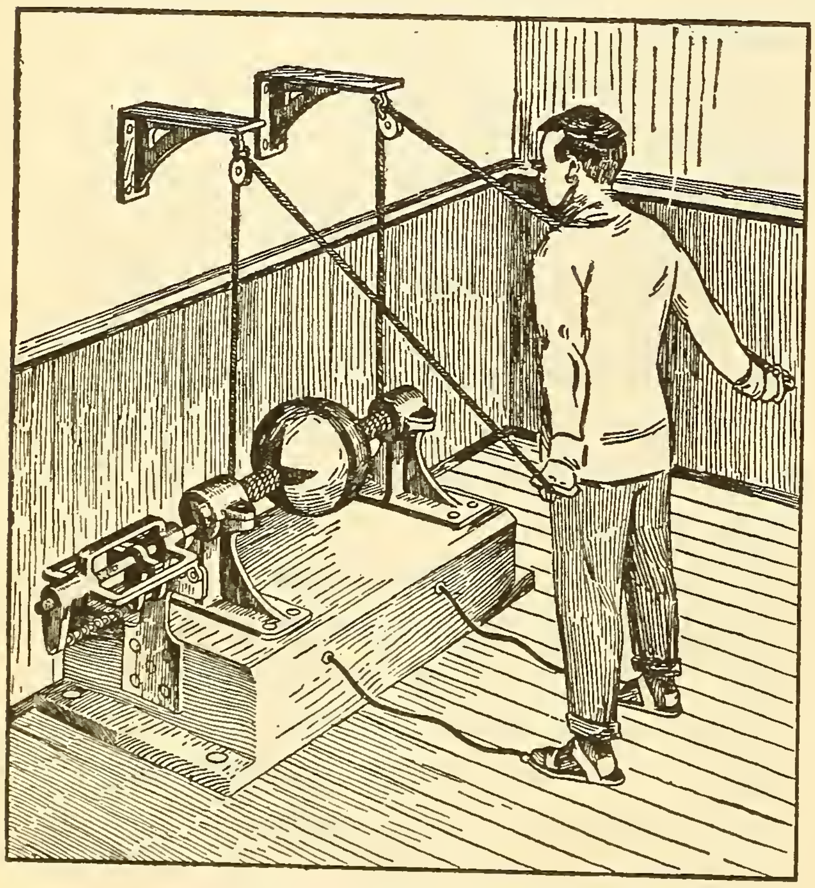
An early builder of telegraph lines undertook to protect the post by inserting bradawls into the wood, but the thick skinned buffalo found the bradawl an improvement, as affording him a new sensation, and scratched down more poles than ever.

In Japan the special enemies of the telegraph are the spiders, which grow to an immense size, and avail themselves of the wires as excellent framework for their webs. So thick are the cords the Japanese spiders spin that often, especially when they are covered with dew, they serve to connect the wires electrically with one another or with the ground, and so to stop them from working.

In the sea the wires are not any safer, as a small worm has developed itself since cables came into fashion which bores its way through iron wire and gutta percha, lets in the water, and so injures the line.

Combining Electrical Treatment and Exercise

The man who wishes to take electrical treatment along with his gymnasium work will find in the accompanying picture a hint of how it can be done. A



COMBINING ELECTRICAL TREATMENT AND EXERCISE

patent upon the apparatus has been issued to Matthew Duffner of Pittsburgh, Pa.

A rotating ball upon a shaft is operated by flexible cords, which also carry an electric circuit to the handles. The ball is used merely for providing the physical exercise as its shaft is made to unwind and wind the cords up again, but within the base of the apparatus is a battery and induction coil, the secondary of which furnishes the necessary current. The operator may be treated through the feet also, foot electrodes in the form of sandals being provided.

Birds and Lightning

The question has been raised whether birds are ever killed on the wing by lightning. Several observers have answered in the affirmative by recalling instances in which they have actually seen birds thus killed. Doubt seems to have been entertained as to whether a bird on the wing is not protected from lightning by virtue of its being separated from contact with the earth.

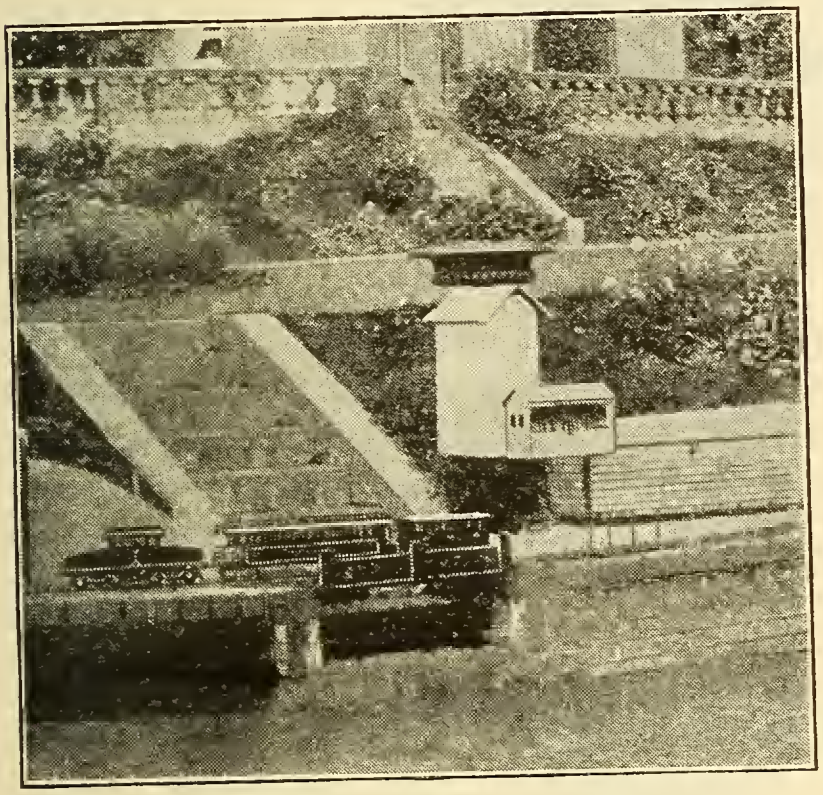
But even the mere shock caused by the passage of a lightning stroke through the air near it might be sufficient to kill a bird without any actual electrical contact. How great such a shock is, in many cases, every one knows who can recall the crashing sound of a near-by thunderbolt.

Some observers assert that birds are peculiarly sensitive to the approach of a thunder storm, and almost invariably seek shelter from it, as if fully aware of the peril of remaining upon the wing when there is lightning in the air. But for this exhibition of caution the number of birds killed by lightning would probably be far greater than it is.

It would be interesting to know whether birds possess any instinctive knowledge of the danger of perching in tall, exposed trees in the open fields during a thunder storm. One student is under the impression that they are in the habit of congregating in the forest undergrowth and in shrubbery on such occasions. This might be mainly due, however, to a desire to find shelter from the rain.

Garden Railways

In England, especially, and to some extent on the Continent, people of a mechanical turn of mind are much given to building models of all kinds. They have their associations of model builders, publications devoted to the subject,



A GARDEN RAILWAY

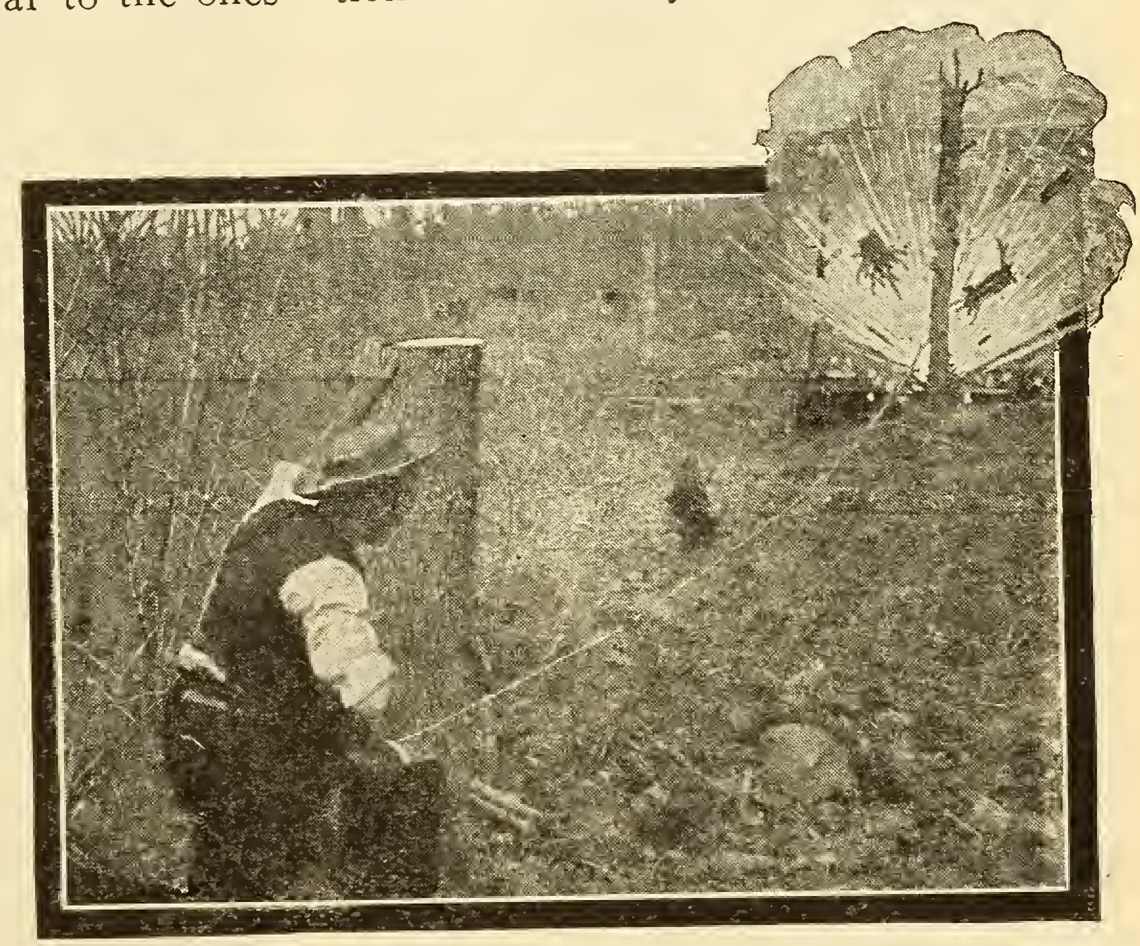
etc. The Englishmen must be given credit for being the first to construct miniature railways, garden railways they call them over there, similar to the ones which are a familiar sight at our amusement parks in this country. On some of the estates of wealthy men in England are to be found surprisingly complete installations of this kind, hundreds of feet in length and equipped with electric signals, ballasted tracks, tunnels, viaducts, passenger stations — everything, in fact, like a railroad on a small scale. Not a few are electrically operated.

The accompanying picture is a view of one of these garden railways, in this instance German, which is operated by an electric locomotive of approved design, evidently operated by a third rail for there is no trolley. By examining the picture closely it will be seen that the tiny train is just leaving a miniature station.

Electricity an Aid to the Dynamiter

This picture shows in a very graphic manner the ease and comparative safety with which an otherwise hazardous occupation is followed. Tearing out stumps, digging ditches, etc., is now quite commonly accomplished by the aid of dynamite. The old method of exploding the dynamite caps by means of fuses was dangerous—the things were apt to hang fire or burn slowly, and loss of life or limb was quite often the penalty paid by the dynamiter who went to investigate too soon.

Now, with a simple electrical appliance and a safe length of conductor the explosion is easily accomplished from a safe position. If the charge fails to go off, the battery is disconnected, when it is perfectly safe to make an investigation without delay.



THE DYNAMITER AT WORK

Condenser Insulation

By CLAYTON I. HOPPOUGH, Dean Dodge's Telegraph and Wireless Institute

Many students of wireless telegraphy have expressed surprise at the statements made by some companies manufacturing wireless equipment relative to the distances which they were able to cover with their apparatus. Although in many cases decided gains have been made over distances covered previously, unless some radical change has been made in the method of aerial excitation, these statements should be considered seriously before absolute credence is given them.

It was in search of proof for a statement made by certain manufacturers of wireless condensers for transmitters, relative to the efficiency of their apparatus, that the author recorded some results obtained by experiment which may prove of interest to many students.

One unit of the apparatus used in these experiments consisted of a plate glass condenser of 0.009 micro-farad capacity, the plates of which were held upright in a case of dry wood. The glass was coated with the usual tinfoil, contact to each plate being made by a strip of spring brass to which was soldered a square piece of sheet zinc for contact purposes. For convenience in handling and for radiation surface, the plates were spaced two inches apart. The zinc contacts were two inches square and the spring brass one-half inch wide and No. 20 gauge. Soldered to the brass springs were conductors consisting of 40 No. 32 copper wires twisted together in one strand. These were taken to terminal switches, and the same size conductor connected the switches to a condenser bus-bar constructed of ½ inch brass tubing. This condenser will be known here as "A," and the hook-up used is shown in Fig. 1.

Another condenser, which we will term "B," was used, of the same dimensions as A and like it in every particular except that the plates were held closely

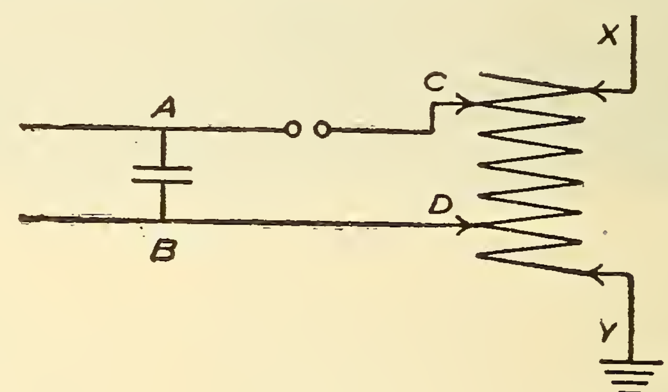


FIG. 1

together in a case containing a very good quality of insulating oil. Contacts to the plates were secured by an extension of the tinfoil itself to a position outside the plates where a brass clamp held each piece of tinfoil in tight contact with its neighbor, and afforded a means by which the condenser plates were connected to the stranded conductor.

It is the purpose of this article to compare the results obtained by employing these two condensers.

The entire transmitter consisted of the following: Transformer with 30,000 volt secondary; helix, with maximum inductance of 0.00006 Henry; condensers A and B and a zinc spark gap provided with radiators.

After all connections were made as perfect as possible, the open and closed circuits were resonated by means of a

General Electric hot-wire ammeter, using the condenser A only. That is, in Fig. 1, the open circuit (XY) was adjusted by means of a movable clip fastened to the aerial lead and indicated in the figure by an arrow until the natural frequency of the circuit (XY) was the same as that of the closed or oscillating circuit (ABCD). This is termed resonance, and it is under such conditions that the condenser circuit will induce currents of greatest value upon the radiating circuit (XY).

As the hot-wire ammeter was not of proper construction for use with high frequency alternating currents, only comparative readings were obtained, but these were sufficiently correct for purposes of comparison, as the wave length of the transmitter was very nearly the same in all cases, so that the high frequency resistance of the meter's active wire did not vary.

The current upon the primary of the transformer was eleven amperes at an E.M.F. of 114 volts. The spark gap was ⅜ inch in length and the spark very rough and flamey. It was found necessary to employ an air blast from a fan in order that the signals be readable.

While the key of the transmitter was depressed, a blue haze and streaky discharges were very noticeable around the edge of the condenser plates, which resulted in heating the glass dielectric. This is termed "brush" discharge, and often is the cause of the condenser dielectric being punctured, where if eliminated, the dielectric will stand the strain with no perceptible defects.

For experimental purposes, No. 10 B. & S. gauge copper wire was used in connecting the condenser, spark gap and helix, and a very marked rise in temperature of these leads was noticed after about five minutes of continued sending. As all heat radiated by a conductor of electricity requires the expenditure of some electrical energy, it is obvious that when the temperature of any part of a wireless transmitter rises, energy has been lost for electric wave radiation, and the efficiency of the set lowered. Therefore, to eliminate this loss as much as possible, a No. 4 B. & S. gauge copper wire was substituted for the No. 10, and a slight gain in current upon the aerial circuit was effected.

With conditions as perfect as possible, a reading of 5.2 divisions of the hot-wire ammeter was obtained, which after twelve minutes of continued sending fell to 5.1, probably due to imperceptible heat losses.

In order to determine the intensity of the signals from this set at a point some distance away using the condenser A, by prearranged agreement this intensity was measured by the "shunt telephone method" at a station a distance of 40 miles from the transmitting aerial. Fig. 2 shows the connections, (A) and (A′) representing the leads from the tuning coil, (T) the telephone receivers, (D) a carborundum detector, (L) a small choke coil, (R′) and (B) the usual potentiometer and battery for a carborundum detector, and (R) a non-inductive variable resistance box. The choke coil used was the secondary of a small telephone induction coil of 180 ohms resistance. The value of the current I in the receivers is approximately proportional to the energy of the incoming waves upon the aerial and is expressed by the equation

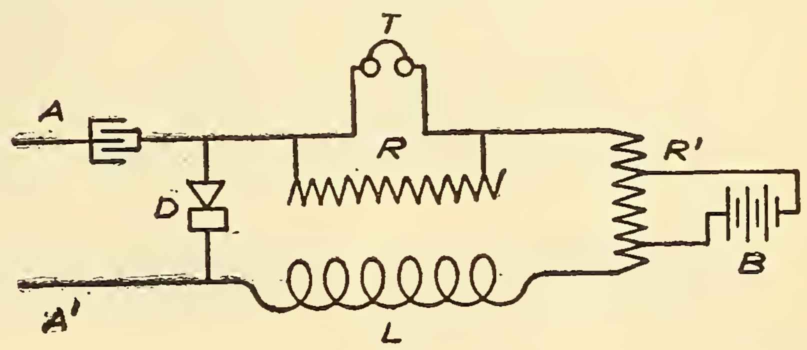


FIG. 2

$$I = \frac{r + r'}{r} I'$$

where r is the ohmic resistance of the shunt R, I′ the smallest current which will produce an audible effect in the receivers. Instead of the value of I′ being previously calculated, the intensity of the signal is sometimes expressed as being so many times audibility. In this case, the result obtained at the receiving station by using the shunt method and the above formula was 1.47.

After this test was finished, the operator at the testing station cut out condenser A and connected B in the circuit. This time the signals measured 1.78 times audibility. That is, the signals from the test station using *condenser B in oil,* were 22 per cent more intense than with the same capacity condenser and under the same conditions of charging, but having no oil insulation.

Comparing the action of B with A when operating, B showed no brush discharge, the spark was smooth at 3/8 inch using eleven amperes on the primary circuit, and it was unnecessary to use an air blast for keeping the spark gap cool.

Furthermore, the hot-wire ammeter showed a reading of 7.7 divisions for B against 5.2 for A.

Another test was made using the plates of condenser A coated thickly with paraffin. A gain of about seven per cent in efficiency over condenser A was noted. Also by diminishing the size of the condenser lead wire to No. 14 B. & S. gauge and using condenser A, a loss in efficiency of about nine per cent was observed.

Number 14 copper wire would easily carry continuous currents as great as those of the condenser discharge, but the apparent resistance of the conductors increases for high frequency currents to such an extent that too small a conductor in the oscillating or radiating circuit of a wireless transmitter may decrease the working radius of the station employing it many miles.

Also, as high frequency currents travel on the surface of conductors, particular attention should be given the leads and contacts, making their surfaces as large as permissible. As the high frequency resistance and true ohmic resistance of a No. 32 B. & S. gauge copper wire is nearly the same, this affords a basis for calculation from which it is ascertained that for a one K. W. wireless transmitter using 60 cycle current and a 30,000 volt transformer, a cable constructed by twisting together 40 No. 32 copper wires affords sufficient surface to reduce this loss to a minimum. However, sharp corners should be avoided, as these cause brush discharges and consequent losses; the condenser leads should be as short as possible and of equal length, that is, never make one lead to a condenser terminal longer than the other.

The author has seen a gain of 60 per cent in radiated energy from a wireless transmitter by careful insulation, employing oil condensers, and by providing sufficiently large conductors properly installed.

Although there are in all probability many types of condensers which would compare very favorably with the plate glass condenser in air, as insulating oil is very cheap, its use provides a very inexpensive yet simple means of raising the efficiency of any wireless transmitter, and therefore increasing the transmitting radius of a station.

As the experiments described in this article are very simple and can be performed and results obtained with very little outlay for apparatus, those students whose apparatus does not fulfill expectations nor statements made by manufacturers regarding its transmitting range might very profitably investigate the insulation of their instruments, keeping in mind the results which the author obtained from the experiments described above.

Wireless Operators' Union

For the purpose of promoting the mutual interests of wireless telegraph operators and their employers the International Wireless Telegraphy Operators' Union has been organized. Les. Bentley, Box 13, E., San Pedro, Cal., is Pacific Division Manager.

A Radial Oscillation Transformer

By ELLIS G. FULTON

For some time past the writer has been endeavoring to design a type of oscillation transformer which will give the sending instruments the advantages of loose coupling without the numerous disadvantages of the slide type of oscillation transformer.

It is now a recognized fact that the efficiency of transmitting circuits may be much increased if the open and closed, or aerial and transformer circuits are loosely or "inductively" connected. In fact, the present development of wireless telephony would have been impossible without this form of connection and it is equally advantageous in a sharply tuned wireless telegraph set.

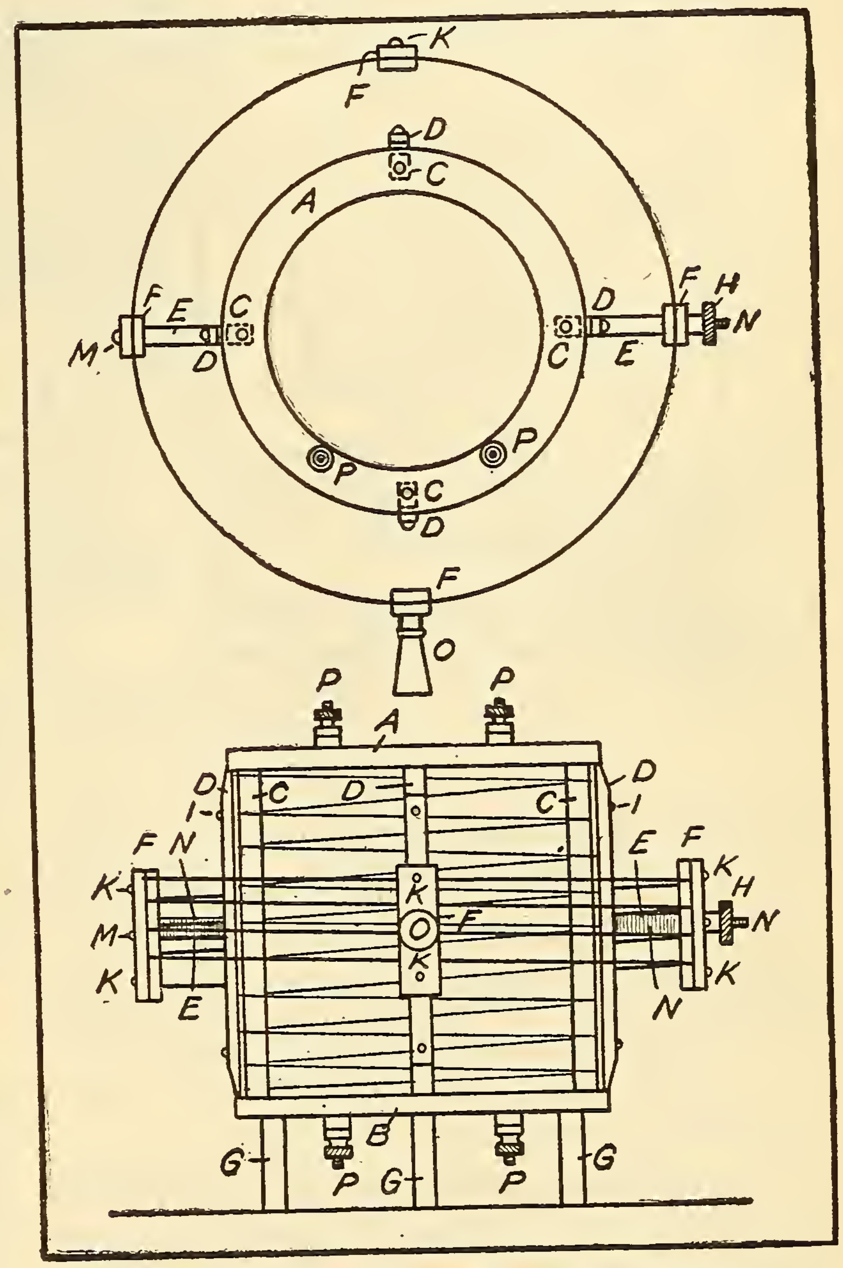
In the types of instruments now used to give this effect, however, the disadvantages almost outnumber the good features. In the slide type, when the secondary is pulled out to give an inductive coupling, the turns farthest from the primary are practically dead and merely load the circuit with that much more impedance.

As a matter of fact, moving the secondary away from the primary does not really change the coupling or the inductance between the two circuits at all, but merely decreases the amount of effective energy radiated by increasing the air gap resistance between the two coils.

In the radial type, however, there are no "dead ends," and a very slight change in the relation of the two coils gives a very perceptible change in the coupling without materially affecting the amount of energy radiated.

The instrument here shown follows in general design the radial loose coupler used with gratifying results by Dr. DeForest in receiving, and at present embodied in his famous variometer, and also the type of oscillation transformer built the first of this year for the government and used in the quenched spark sets of the Telefunken Company. Besides the higher efficiency of this type of instrument, it is much more easily constructed and occupies less space than do the other types.

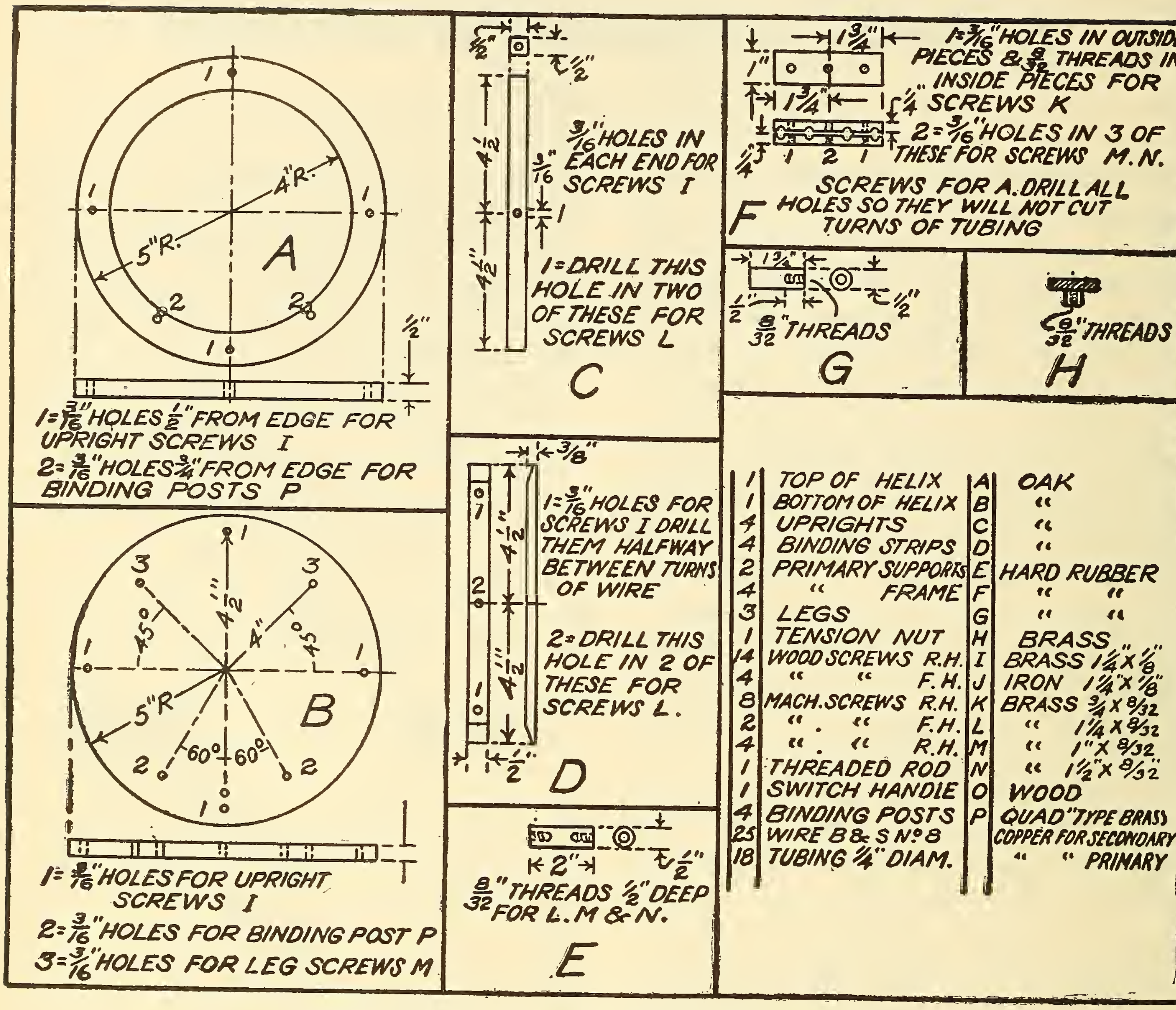
The first step in the construction of the instrument is the helix. After the helix frame is assembled it should be



RADIAL OSCILLATION TRANSFORMER

given a good coat of asphaltum or other insulating varnish before the wire is wound on. This will give a nice appearance as well as good insulating qualities, but the surplus asphaltum must be rubbed off before it hardens to bring out the grain properly.

No notches need be cut in the uprights for the wire, but it is advisable to bend the wire to shape on a cylinder ten inches



1	TOP OF HELIX	A	OAK
1	BOTTOM OF HELIX	B	"
4	UPRIGHTS	C	"
4	BINDING STRIPS	D	"
2	PRIMARY SUPPORTS	E	HARD RUBBER
4	" FRAME	F	" "
3	LEGS	G	" "
1	TENSION NUT	H	BRASS " "
14	WOOD SCREWS R.H.	I	BRASS 1¼"x⅛"
4	" " F.H.	J	IRON 1¼"x⅛"
8	MACH. SCREWS R.H.	K	BRASS ¾x8/32
2	" " F.H.	L	" 1¼x8/32
4	" " R.H.	M	" 1"x8/32
1	THREADED ROD	N	" 1½x8/32
1	SWITCH HANDLE	O	WOOD
4	BINDING POSTS	P	QUAD TYPE BRASS
25	WIRE B&S No 8		COPPER FOR SECONDARY
18	TUBING ¼" DIAM.		" " PRIMARY

DETAILS OF RADIAL OSCILLATION TRANSFORMER

in diameter before winding, after which it can be slipped on the helix and secured with the binding strips (D). Be careful when boring holes for screws (I) for binding strips to clear all turns of wire. If no cylinder is at hand, the wire may be wound directly on the helix.

The primary supports (E) may now be attached to the helix. Select two uprights opposite one another, and drill holes all the way through upright and binding strip. Screws which support (E) should be tightly fastened to binding strips (D). It may be necessary to move a turn of wire slightly up or down to clear these screw holes.

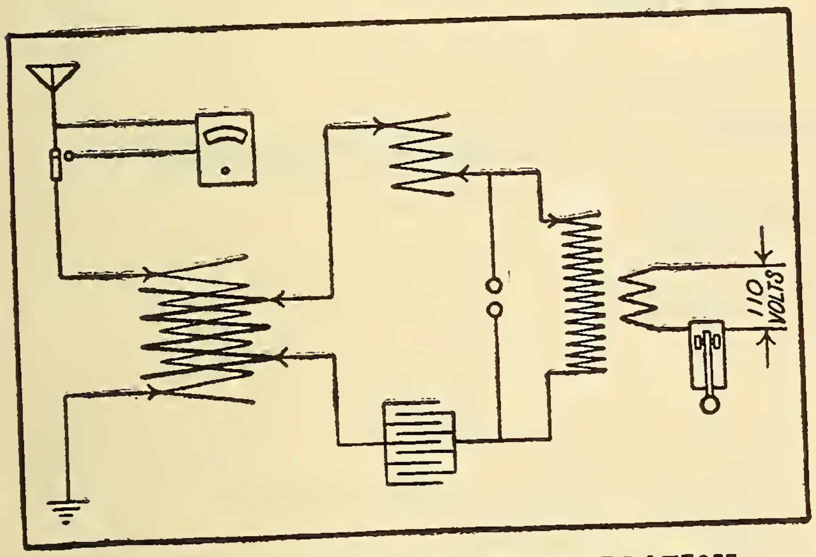
Notches in pieces (F) should next be cut as follows: At the left of the helix in assembled drawing start ¼ inch from the top of the piece and cut five slots ¾ inch apart. Second piece start 7-16 inch from the top, third piece ⅝ inch from the top, fourth piece, which is the one at the back of the helix in the drawing, start 13-16 inch from top. Cut only four notches in the second, third and fourth pieces.

Now wind the tubing on a cylinder fourteen inches in diameter, making four and one-half turns, and clamp the turns between these pieces by means of screws (K) for which the inside halves of pieces (F) have been threaded. Put a knife switch handle (O) on the front piece (F).

Now put the primary in position, and turn screw (M) through piece (F) into support (E) on the left, and threaded rod (N) into support (E) on the right, and after getting the axis of the two coils parallel tighten the tension nut on the outside end of threaded rod (N).

The legs (G) may next be put on with three remaining screws (M) and two binding posts put on the top and two on the bottom.

No flexible connections to coils are shown because good helix clips may be used. Fasten the two flexible connections from the primary under the bottom of the helix, allowing plenty of slack to provide for moving the primary. Make the two secondary connections under the two top binding posts, inside the helix,



CONNECTIONS OF RADIAL OSCILLATION TRANSFORMER

to keep them clear of the primary. The open top shown on the drawing will allow of easy adjustment.

Following are directions for connecting in the circuit: With a hot wire ammeter in series with the aerial, or the usual pilot lamp arrangement, adjust the condenser, or the primary clips, and then the secondary clips, until the highet radiation is obtained.

A good way is to connect the hot wire ammeter in the primary circuit with the secondary clips open, using a shunt around the ammeter if you think the current heavy enough to damage it. Then adjust the primary leads and the condenser repeatedly, until you find the point of highest efficiency. Now connect the ammeter in the aerial circuit and adjust the secondary in the same way.

It may be necessary to use an inductance in series with the primary to get highest radiation, especially if you employ considerable condenser. If so, use your present helix, or construct a simple one about eight inches in diameter by ten inches high, winding it with eight or ten turns of No. 6 B. & S. gauge copper or brass wire, and provide one connection to the end of the winding and one clip for connection to different points. This is explained by the connection plan shown. It is not always necessary to use this extra inductance as it depends upon how well the condenser used balances the inductance of the primary of the oscillation transformer.

When it is desired to work through interference, merely loosen the tension nut and with the knife switch handle move the primary to whatever angle the occasion requires, and as this can be done with the current turned on it will be found to enable you to work under many otherwise impossible conditions, as well as increase your efficiency at all times through the inductive coupling of the aerial and transformer circuits.

To the amateur who will construct this instrument and experiment with it until he thoroughly understands its use, an unlimited field of research and improvement is opened, because it is based upon principles which have as yet received very little development in the wireless telegraph field, and yet they represent almost ideal conditions of efficiency and sharpness of tuning.

Amateur Relay Stations Between Chicago and New York

The Chicago Wireless Association desires to communicate, through Popular Electricity, with amateurs having high powered stations in a direct line between Chicago and New York, N. Y.

It has long been the ambition of the Association to have an established line of amateurs' stations between these two cities, over which messages may be sent within two or three hours' time at the most. Therefore we make this call to all amateurs to give us their help.

All amateurs who wish to apply for one of the stations will please write to the Chicago Wireless Association, care of POPULAR ELECTRICITY, Chicago, Ill., giving their greatest sending radius, meaning actual distance over which communication has been held, and some idea of their apparatus. It is also necessary that they fully describe the position of the city in which they live, so that it will be convenient to insert pins in a map of the United States, thus showing where the stations are located and in order to choose those stations in the most direct line between Chicago and New York.

We ask each amateur who answers this call, not to be offended if some one having a higher powered station than his be given the right to act as one of the relaying stations between Chicago and New York. It is doubtless well understood that in order to get messages between the two cities with the greatest dispatch, it will be necessary to have as few relaying stations as possible.

The Wireless Operator's Government Certificate

By KENNETH RICHARDSON

June 24th, 1910, Congress passed the Wireless Ship Act to become effective July 1st, 1911, reading as follows:

"Be it enacted by the Senate and House of Representatives of the United States in Congress assembled:

"That from and after the first day of July, nineteen hundred and eleven, it shall be unlawful for any ocean-going steamer of the United States, or of any foreign country, carrying passengers and carrying 50 or more persons, including passengers and crew, to leave or attempt to leave any port of the United States unless said steamer shall be equipped with an efficient apparatus for radio-communication, in good working order, in charge of a person skilled in the use of such apparatus, which apparatus shall be capable of transmitting and receiving messages over a distance of at least 100 miles, night or day: Provided, That the provisions of this Act shall not apply to steamers plying only between ports less than 200 miles apart."

Before this became effective the wireless companies employed many ship operators who could either not operate in a satisfactory manner or repair their apparatus in case something went wrong, or both. Some were wire operators with little knowledge of the technical side of wireless. Others were from wireless schools, and these often fell far short of being expert at the key. This must not be mistaken for condemning all schools of this kind, but much caution must be exercised in selecting a school which turns out practical wireless operators and not "hams"—practical in sending and receiving the wireless signals, practical in their technical knowledge, practical in all daily, weekly and monthly reports and correspondence, and practical in all emergencies appertaining in any way to their position as wireless operator aboard ship.

It is for the purpose of eliminating all poor operators that the government requires that they be licensed, and the fine imposed against the captain of a ship coming under this Act is up to $5,000 if he leaves or attempts to leave port without an operator holding the government certificate.

Before a certificate will be issued to an operator, examinations must be passed with 70 per cent accuracy in: (a) Explanation of principles involved; (b) adjustment of apparatus; (c) correction of faults; (d) change from one wave length to another; (e) transmission and sound reading at a speed of not less than 20 words per minute, Continental and American Morse codes, for a period of over five minutes.

This includes everything from the motor generator, or source of current through the apparatus to the radiating circuit, and the receiving apparatus.

The examinations will be held at the United States Navy Yards at Boston, Mass., Brooklyn, N. Y.; Philadelphia, Pa., Washington, D. C., Norfolk, Va., Charleston, S. C., New Orleans, La., Mare Island (San Francisco), Cal., Puget Sound, Wash., and at the Bureau of Standards, Washington, D. C. Applicants for certificates should communicate in writing with the Commandant of the nearest Navy Yard or to the Director of the Bureau of Standards to ascertain the time and place they can be examined.

Now as to the requirements necessary to pass we will begin with (a), Explanation of principles involved. It must be remembered that this article is not dealing with the theory and construction of wireless apparatus, even in a very elementary way, but is merely intended as a guide. Be prepared, then, for questions on the nature and strength of the source of current. Be prepared to state what systems use direct current and what use alternating. If alternating current is required, state how the direct current from the ship's generators is converted. Give diagrams of a motor-generator with starting box, field rheostats, variable reactances and meters. Trace the circuit of the primary current from generator through reactance, switches, key, aerial switch to primary of the transformer or spark coil. Explain the theory of the induction coil. Give diagrams of the connections of the closed and open oscillating circuits of the United, Marconi, Massie and Fessenden systems, or as many as you know, and explain in detail the formation of a high frequency oscillation from a low frequency alternating current. Explain the function of the anchor gap. Give diagrams of the receiving apparatus and explain how intermittent high frequency oscillations cause a sound to be heard in the 'phones. Tell what you know about quenched and rotary gaps, the oscillation arc systems, the construction of antennae, etc.

These are a few examples of what you may be required to be familiar with.

Then comes (b), Adjustment of apparatus. Is a transmitting station using a loosely coupled helix easy to tune in or out at will; in other words, is such a transmitter conducive to sharp and close tuning at the receiving station? When are the open and closed circuits adjusted to maximum current effect in the antenna, and in the case of primary and secondary coils in the helix, when are the windings so adjusted in relation to each other that maximum selectivity is noted at the receiving station?

These are a few of the harder questions, but are only examples and not the actual questions that have been asked by the government examiners. But they serve to give you an outline of what is required.

In (c), correction of faults, you will have no trouble if you are familiar with (a), principles involved.

In (d), change from one wave to another, you are simply required to know how to vary, with maximum efficiency, the closed and open circuits of the transmitter or receiver to change the length of wave, and to state what effect a change of inductance or capacity will have on the emitted wave.

In (e) transmission and sound reading, we come to the practical side of the question, and this is most important. In the wireless room of the Navy Yard you will be tested in sending and receiving the codes at a speed of at least 20 words per minute, the test covering at least five minutes. If you are a good operator this test is exceedingly easy.

To those learning the codes to become an operator, I will say that he who keeps his sending well within his bounds of speed will become a better operator than he who is trying to show his pal how fast he can send. Although many prefer to learn both codes together, it is better to become proficient in one first, then after two or three months' practice, to memorize and practice the other. Of course, the key should be situated well back from the front of the table, so the elbow may rest on the table. A buzzer should be used in practice in place of the sounder, as a buzzer imitates the wireless buzz more accurately than a sounder. Accuracy and smoothness are essential. Be careful to send in proper time such spaced letters in the Morse code as "societies," "pierce," etc. In the Continental code be careful not to make "ma" for "q" or "tw" for "y," etc. You may make mistakes which you yourself cannot notice because they are made so often that you do not notice the error. Therefore never send faster than is easy for you and for the operator receiving the message. Always use an easy swing that does not tire, but do not exaggerate and make an "en" instead of "r" or a "j" for a "y," as formed in the Morse.

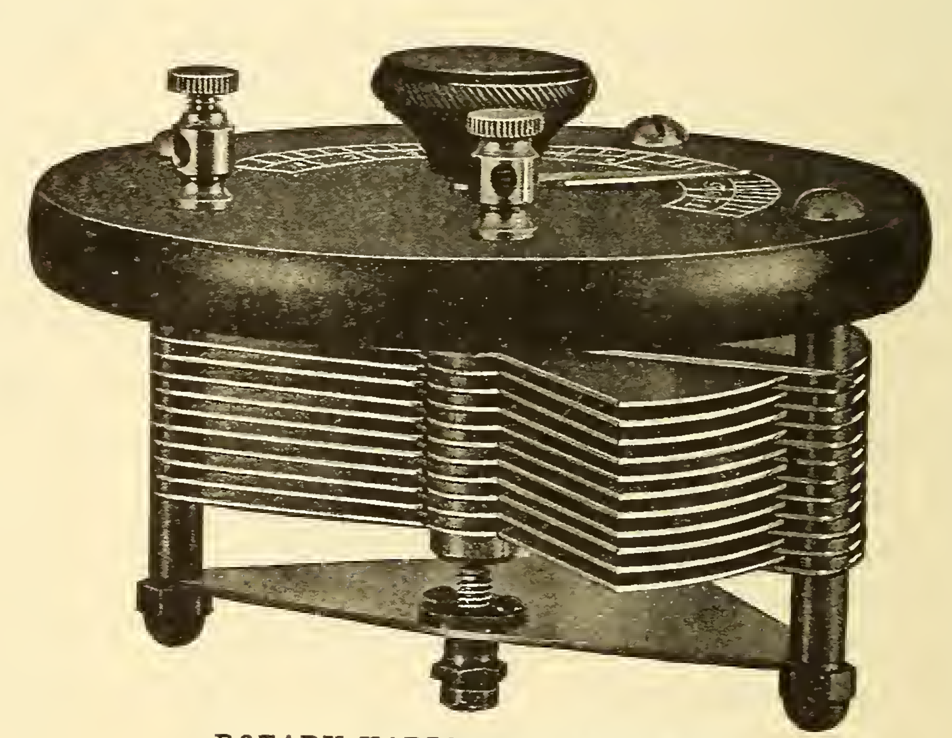
In receiving try to get into the habit of copying in a neat manner what you are receiving, so that a rewriting of the message is not necessary. With much practice you will become quite flexible in receiving, stopping to sharpen the pencil if necessary, then catching up with the sending operator again without losing a word. Expert operators can copy with ease several words behind the sender and get the complete message without a break.

A few days after going up for examination the Commandant of that particular Navy Yard will mail you a letter giving the percentages and, if the examinations were passed, the certificate of proficiency in radio-communication, as the Government calls it, will be enclosed.

After an applicant has secured a certificate he should go before a notary public to take the usual oath for the preservation of secrecy of messages received in the line of duty.

A Rotary Variable Condenser

The Alden rotary condenser is distinctive from the fact that, although only 3¾ inches in diameter it has a capacity of .002 M. F. or that of the usual six inch condenser. This large capacity is obtained in such a small compass by making the plates very close together—only fifteen one-thousandths of an inch. There are twelve stationary and twelve rotary plates. On the hard rubber top is imprinted a scale over which swings a pointer indicating the capacity as the movable member is revolved.



ROTARY VARIABLE CONDENSER

It is asserted that this condenser will work well on either the primary or secondary of a receiving transformer and it is a pleasing accomplishment, by moving the pointer perhaps only one or two points, to throw out one station and bring in another.

Questions and Answers in Wireless

By A. B. COLE

Aerials (Continued).

24.—Does the number of wires comprising the aerial affect the receiving distance as much as the transmitting?

No, but nevertheless the distance over which it is possible to receive is appreciably increased by an increase of the number of the wires.

25.—Does doubling the number of wires double the capacity of an aerial?

No, but increase of the number of wires increases the capacity and this increase will be still greater if the distance between wires is increased, up to certain limits.

26.—At what distance should the wires of an aerial be spaced?

A spacing of about six feet between wires gives very good results.

27.—What relation has the length of the aerial to the transmitted wave length?

If the aerial is a single vertical wire, with the lower end connected to one spark gap terminal, and the other spark gap terminal connected to the ground by a very short wire, the wave length transmitted will be approximately four times the length of the aerial wire. The wave lengths emitted by stations having different types of aerials than the one above mentioned, and all other conditions remaining the same, will be from three to five times the effective length of the aerial wire.

28.—At what point should the leading-in wire be attached to the aerial?

It should be attached to the lower end of the aerial, and should slant down toward the operating room. This is so that the general direction of the aerial may be up.

29.—How long should the leading-in wire be?

It should be made as short as possible. The purpose of this wire is to electrically connect the transmitting apparatus to the aerial system, and not to radiate electromagnetic waves as part of the aerial. When the lower end of the aerial is more than 25 or 30 feet from the instruments, the leading-in wire should be so designed that it will act as a part of the aerial; that is, it should be composed of the same number of wires of the same gauge as the aerial itself.

30.—How large in diameter should the leading-in wire be?

A large wire is desirable for this purpose. A No. 10 or No. 8 B. & S. gauge wire does well for leading-in purposes. A stranded wire consisting of seven or more strands of No. 12 or No. 14 B. & S. gauge enameled copper wire makes an excellent leading-in wire.

31.—What is the best type of aerial for receiving purposes?

Probably the directive aerial, shown in Fig. 12. This aerial consists of several wires starting at the top of the pole, where they all may, or may not, be connected electrically together. These wires run toward the earth in various directions. The lower end of each wire is connected to a single pole porcelain base switch, as shown, so that any one wire, or any number, may be used at the same time. If the aerial is to be used for transmitting purposes also, all the wires

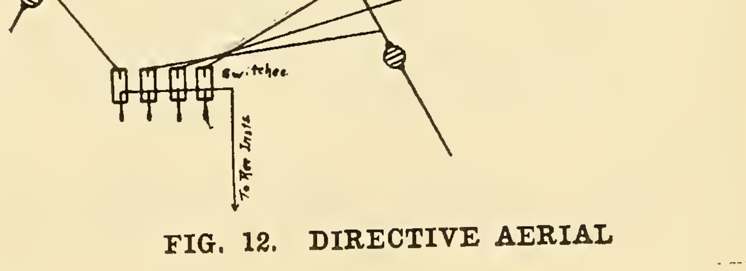


FIG. 12. DIRECTIVE AERIAL

are generally connected to an anchor gap, so that all are used for transmitting.

32.—What is the smallest wire which should be used in an aerial?

Wire smaller than No. 14 B. & S. gauge should not be used on account of its comparatively high resistance. Wires of less diameter have been used occasionally suspended from kites.

33.—What is a "spreader"?

A spreader is the rod which keeps the aerial wires apart and serves to support them. It may be made of wood, bamboo or metal. Wood is the most generally used material for this purpose. Bamboo makes an excellent spreader, as it is strong and light. A rod of 3/8 or 1/2 inch aluminum makes a good spreader.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue after receipt of such advice.

Amateur Experimental Wireless Association.—David Kirk, President; Cornelius Hobbs, Vice President and Librarian; Lewis Kobie, Spokane, Wash., Secretary and Treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richardson, Vice President; James Seamon, Leetsdale, Pa., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—L. Uphoff, President; L. Beebe, Vice President; L. Pohlman, Treasurer; D. F. Crawford, 405 Lennox Rd., Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 448 Castle St., Geneva, N. Y., Secretary.

Bridgeton (N. J.) Wireless Club.—Joseph P. Cox, President; Arthur Riley, Vice President; S. B. Ashmead, 275 Bank St., Bridgeton, N. J., Secretary and Treasurer.

Bronx (New York City) Wireless Association.—500 East 165th St., New York City.

Canadian Central Wireless Club.—Alexander Polson, President; Stewart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary.

Chicago Wireless Club.—John Walters, Jr., President; E. J. Stien, Vice President; C. Stone, Treasurer; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Central California Wireless Association.—G. DeYoung, President; B. K. Leach, 860 Callish St., Fresno, Cal., Secretary.

Cincinnati Wireless Signal Club.—A. J. Lyons, President; E. D. Achor, Vice President; J. L. Anderson, 1839 Hopkins St., Cincinnati, O., Secretary and Treasurer.

East Buffalo Wireless Club.—Bernhardt M. Zeufle, President; Arthur H. Benzec, 701 Walden Ave., Buffalo, N. Y., Secretary and Treasurer.

Gramercy Wireless Club.—J. F. Diehll, President; H. Green, Vice President; J. Gebhard, Treasurer; J. Platt, 311 East 23d St., New York, N. Y., Secretary.

Guilford County (N. C.) Wireless Association.—Hermon Cone, President; Ralph Lewis, Vice President; Robins Tilden, Treasurer; Theodore Mans, Greensboro, N. C., Secretary.

Hartford (Conn.) Wireless Association.—P. S. Southworth, President; W. I. Hickmott, Treasurer; H. E. Chapman, 320 Wethersfield Ave., Hartford, Conn., Secretary.

Haverhill (Mass.) Wireless Association.—Wilfred Vigneault, President; Riedel G. Sprague, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Nouse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Independence Wireless Association.—Boyce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Inter-Mountain Wireless Association.—E. L. Bourne, President; D. McNichol, Secretary; J. G. McCullom, 219-5 East St. Salt Lake City, Treasurer.

Manchester (N. H.) Radio Club.—Earl D. F. McKewin, President; Clarence Campbell, Vice President; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary and Treasurer.

New Haven Wireless Association.—Roy Wilmot, President; Arthur D. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sargeant-at-Arms; Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Plaza Wireless Club.—Paul Elliott, 162 East Sixty-sixth St., New York, N. Y., President; Myron Hanover, Treasurer.

Progressive Wireless Club.—George Holt, President; Silas Pace, Vice President; T. E. Story, Poplar Bluff, Mo., Secretary and Treasurer.

Rockland County (N. Y.) Wireless Association.—W. F. Crosby, President; Tracey Sherman, Vice President; Marquis Bryant, Secretary; Erskine Van Houten, 24 De Pew Ave., Nyack, N. Y., Corresponding Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Rochester (N. Y.) Wireless Association.—Edward T. Eastman, President; Merritt D. Mosher, Vice President; Lawrence Hickson, Treasurer; Arthur F. Wright, Secretary; Floyd E. Wright, Rochester, N. Y., Corresponding Secretary.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, 323 King St., Springfield, Mass., Secretary.

Sacramento Wireless Signal Club.—F. Strader, President; L. C. Huber, Vice President; G. B. Vard, Treasurer; E. Ratcliffe, 2119 H. St., Sacramento, Cal., Secretary.

Southern Wireless Association.—B. M. Oppenheim, President; J. Fishel, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Tri-State Wireless Association.—C. B. DeLaHunt, President; O. F. Lyons, Vice President; T. J. Daily, Treasurer; C. T. Cowan, Memphis, Tenn., Secretary.

Westchester (N. Y.) Wireless Association.—Stanley R. Maning, President; E. D. Moorhouse, 37 West Main St., Tarrytown, N. Y., Secretary.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillie, Vice President; Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 North Monroe St., Baltimore, Md., Secretary.

Waynesburg (Pa.) College Wireless Club—C. W. Frietage, President; James D. Thomas, Chief Engineer; John Meighn, Waynesburg College, Pa., Secretary.

Wireless Association of Easton, Pa.—W. Ballentine, President; John Q. Adams, Vice President; Weikel Jordan, Treasurer; E. J. Sortor, Recording Secretary; James Smith, Jr., 123 North Main St., Phillipsburg, N. J., Corresponding Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bothel, 300 Fourteenth Ave. E., Corresponding Secretary.

Wireless Association of Canada.—W. C. Schnur, 189 Harvard Ave., Montreal, Quebec, Can., President; Thomas Hodgeson, Financial Secretary.

For Practical Electrical Workers

Electric Soldering Iron

The construction of a simple and serviceable electric soldering iron is shown in the accompanying illustrations.

For the heating element one of the special heater alloy wires is recommended, such as Calido or Nichrome, having about 60 times the resistance of copper. German silver wire of course may be used, but will not meet the requirements so well. The commercial German silver alloys vary so that it is difficult to give the exact data. The eighteen per cent and the 30 per cent nickel German silver wires should have about eighteen and 30 times, respectively, the resistance of copper. Therefore, if German silver wire is to be used, it is obvious that the heating element must be correspondingly longer to provide the necessary resistance.

For 110 volt service, seventeen feet of No. 28 B. & S. gauge Calido wire will be required. For 220 volt work just twice as much resistance wire would have to be used. If German silver wire is used, 55 to 60 feet of the eighteen per cent alloy and 35 to 40 feet of the 30 per cent alloy will be required. Some difficulty will be experienced in efficiently disposing of the extra length of the German silver heating element, so the advantage of the higher resistance wires is obvious. Furthermore, the melting point of the special heater alloys is around 2800° F., considerably above that of German silver.

The soldering copper used is of standard size (No. 1½), obtainable in any hardware store, and is about four inches long and one inch thick, with beveled corners, as shown in Fig. 1 at (A).

Sheet mica is used for insulation. Asbestos is temporarily satisfactory, but in time it disintegrates. Four strips are cut as shown at (B), Fig. 1. These four mica strips are applied to the copper as shown at (C), just as though the copper were rectangular instead of octagonal. The pieces of mica are held in place temporarily with two pieces of soft copper wire as shown.

If asbestos insulated copper wire is obtainable, it should be used for the conducting leads. Otherwise, two pieces of

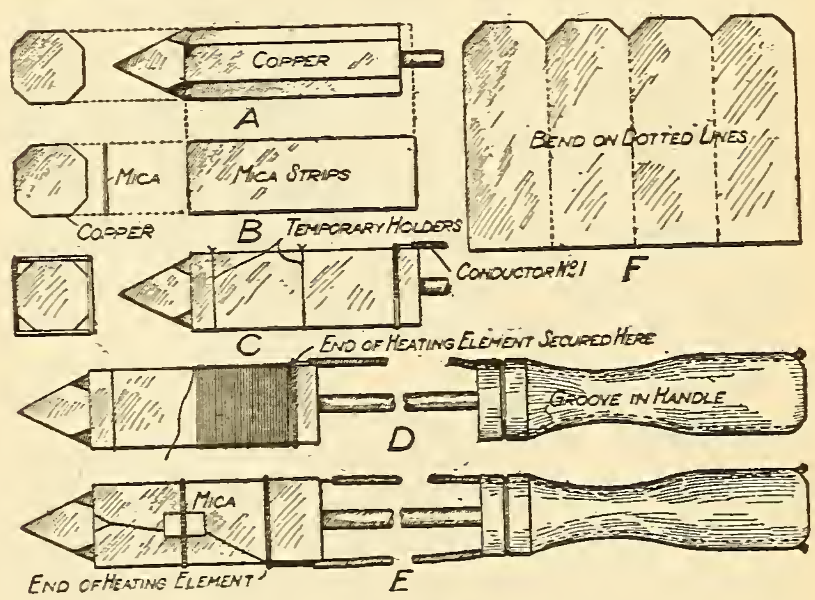


FIG. 1

double cotton covered copper wire about No. 16 gauge will be required. These should be about eighteen inches in length, and the insulation should be removed from one end of each piece for about five inches. The bare end of one is now twisted around over the mica, as shown at (C), Fig. 1. The wire bound around the wooden handle to hold the conducting leads should be removed and two grooves cut on opposite sides for these leads as shown at (D). The copper with the mica insulation in place ready for winding is shown in Fig. 2.

Measure off the wire for the heating element, allowing four or five inches for connections. It is well to wind the wire on a spool or bobbin. This will save some annoying kinks and twists. Attach one end of the heater wire securely to the bare end of the copper lead by twisting it around tightly several times. A good connection is very important. If a lathe is available the winding process will be greatly facilitated. However, a

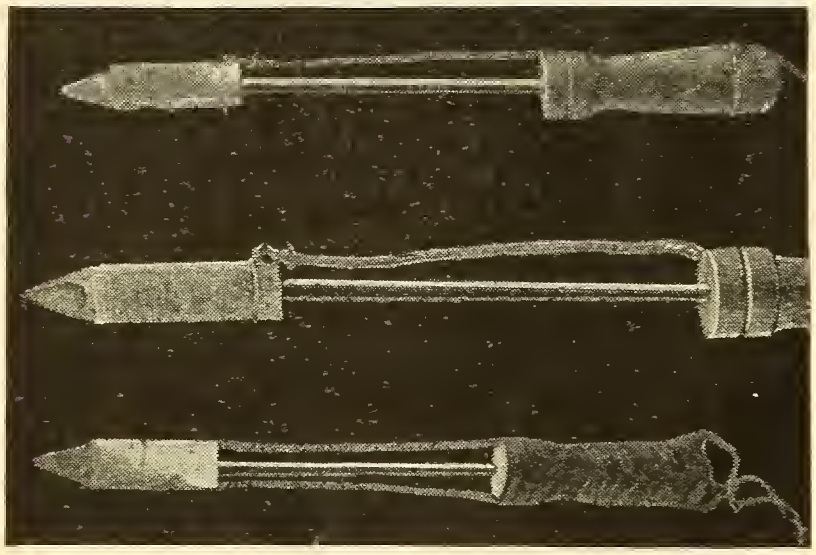


FIG. 2

good job can be done by hand. The turns must be wound tightly and evenly, making sure that no two adjacent coils touch. The pieces of copper wire used for holding the mica in place should be removed when the winding reaches them.

The seventeen feet can be wound in one layer. The second illustration, Fig. 2, shows the winding completed. The loose end of the heater wire should be secured so that the coils will not unwind. If German silver wire is used, several layers will be required. Between layers, mica insulation strips should be placed, just as between the first layer of wire and the copper.

If the wire has been applied in one layer, follow the winding from one end to the other, making sure that no two adjacent turns come into contact with one another. Then prepare four strips of mica, as shown in Fig. 1, (E), and fasten them in place over the heating element with a piece of copper wire near the end. Take the second copper wire lead and twist the bare. end tightly around over the mica as shown in (E). Be sure this bare copper is well insulated from the heating coil. It is well to slip in a piece of mica at each corner, as an additional safeguard. Contact between this lead and the heating element underneath the mica would immediately result in a short circuit and a burnout. Slip a piece of mica under the copper wire used to hold the mica in place, then run the end of the heater element under this and back to the bare end of the copper lead, to which it should be securely attached by twisting a number of times as shown in (E). If cotton insulated copper wire has been used for the leads, it is well to paint over the cotton with sodium silicate (water glass). This will in a measure serve to protect the insulation.

Now put the leads in the grooves in the wooden handle and wind a piece of adhesive tape two feet long around the handle two or three times for insulation. Then tightly twist a piece of large wire around the handle and over the tape to hold the leads in place. Finally wind a layer of adhesive tape over the handle from front to back.

Bare the ends of the leads and attach to flexible conducting cords six feet or so in length, having at the end a regular attachment plug. The tape wrapping around the handle should be carried out on the conductors a short distance to strengthen them. A little talcum powder or flour, or even whiting dusted over the adhesive tape, will prevent its sticking.

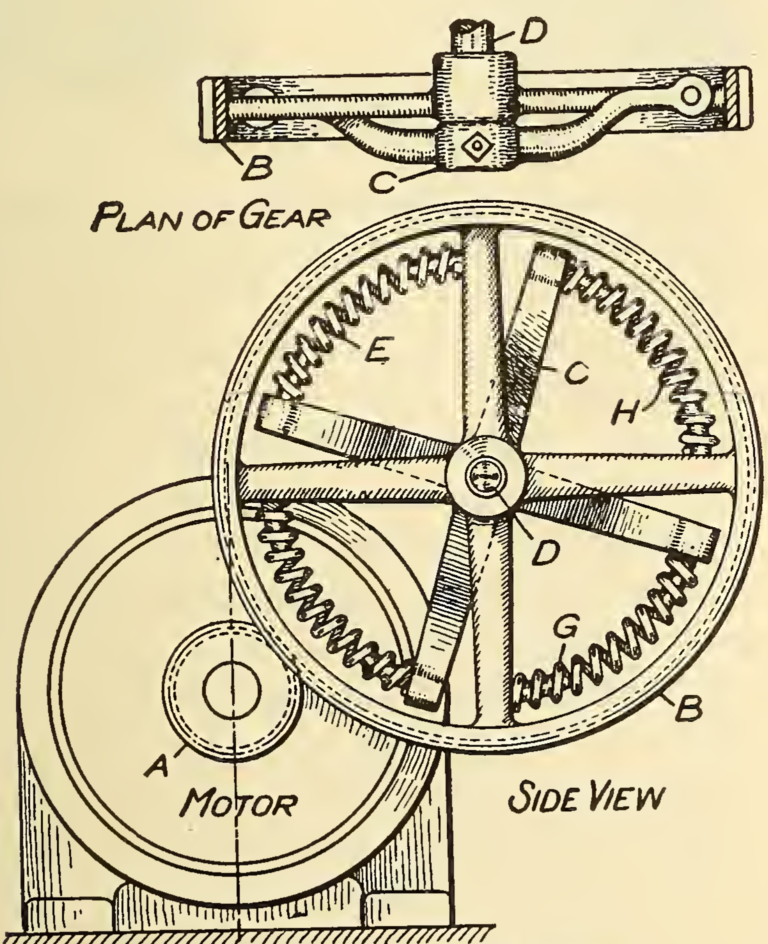
The soldering iron is now ready for a test. Turn on the current. The iron should be hot enough to melt solder in about four minutes. If it does not become hot enough, the heating element should be shortened a turn or two. If it becomes too hot, add several turns. By shortening or lengthening the heating element the desired working temperature can be obtained. When this has been reached, a protective cover should be prepared. Another layer of mica strips should be applied. Over this a layer of asbestos paper is placed and bound on with a layer of bare copper wire, about No. 20. This will make a very satisfactory covering, but the appearance of the iron will be much improved by a sheet iron housing made as shown in Fig. 1 (F) and bound in place with a single turn of wire, as shown by the finished iron in the lowest illustration, Fig. 2.

If the heating element has been carefully insulated and wound, this soldering iron will give long and satisfactory service. W. G. Paulson.

Spring Drive

A large number of machines equipped with motors are required to start up suddenly so as not to lose time. This is generally the case with textile machinery. In such cases oil switches, which throw the full current on suddenly are generally used.

In order to reduce the sudden shock, which is harmful to the machine and



SPRING DRIVE MECHANISM

often breaks the threads of the fabric which is being woven, a spring drive will be found to be of great benefit.

The illustration shows a motor with a pinion (A) on the armature shaft. This pinion is geared into a large gear (B) to reduce the speed. The gear (B) runs loose on the shaft (D) while the spider (C) is set-screwed to the same shaft.

As the current is turned on, the gear revolves and transmits its power to the spider by means of springs (E), (F), (C) and (H). These springs are held in position by means of lugs cast on the arms of both the gear and the spider. The gear starting up suddenly, forces the springs to compress, thereby causing the spider and shaft to start slowly.

G. B. Tanis.

Making a Green Light White

Any one who has had his picture taken in one of the three-for-a-quarter, finished-while-you-wait postal card studios knows the ghastly appearance of the smoothest complexion in the light of the mercury vapor lamp. The dainty pink of the "peaches-and-cream" skin becomes a sickly greenish purple and the freshness of youth is lost. This is due to the absence of red rays in the light given off from a mercury arc and it has been the greatest objection to this source. The light is very efficient and its low intrinsic brilliancy is a point in its favor, but its color has prevented its use wherever it is necessary that things should appear as they really are.

Many schemes were tried for overcoming this objection. One plan was to introduce a gas into the tube instead of having a vacuum. Most gases attacked either the mercury or the glass or would not keep up a continuous arc. Nitrogen gave a pink light as long as the tube was held in ice, but when removed it became green. This was because the mercury did not vaporize to the same extent at a low temperature. Some metallic ingredients were tried. Potassium gave a tube of light half red and half green. It proved impossible to mix the two spectra or superimpose them one upon the other.

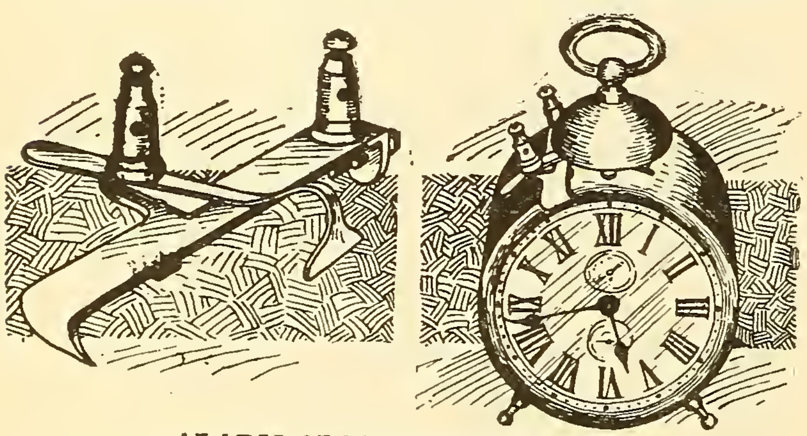
The plan of combining the mercury lamp with another source such as a carbon incandescent was tried but this complicated the lamp and lowered its efficiency. Colored glass tubes were of no avail. At last, however, a method has been devised which seems to meet all requirements.

This method consists of the use of a fluorescent reflector. A fluorescent body has the property of absorbing light waves of a certain length and giving out in their place rays of another length. In other words it may receive yellow light and give out red light. This, in fact, is just what the reflector designed for this purpose does. And since the mercury lamp is strong in yellow rays the reflector gives off red rays which combine with the green to produce a perfectly white light.

The substance used in this reflector is called rhodamine. It is an organic compound produced by synthetic chemistry. Some difficulty was encountered in making the rhodamine permanent; a plain coating would lose its effect in 24 hours. A process of treating paper screens was finally developed, and these screens are now used as reflectors.

Alarm Clock as a Switch

Instead of carrying the alarm clock to your bedroom where its loud ticking is an annoyance, it can be left elsewhere



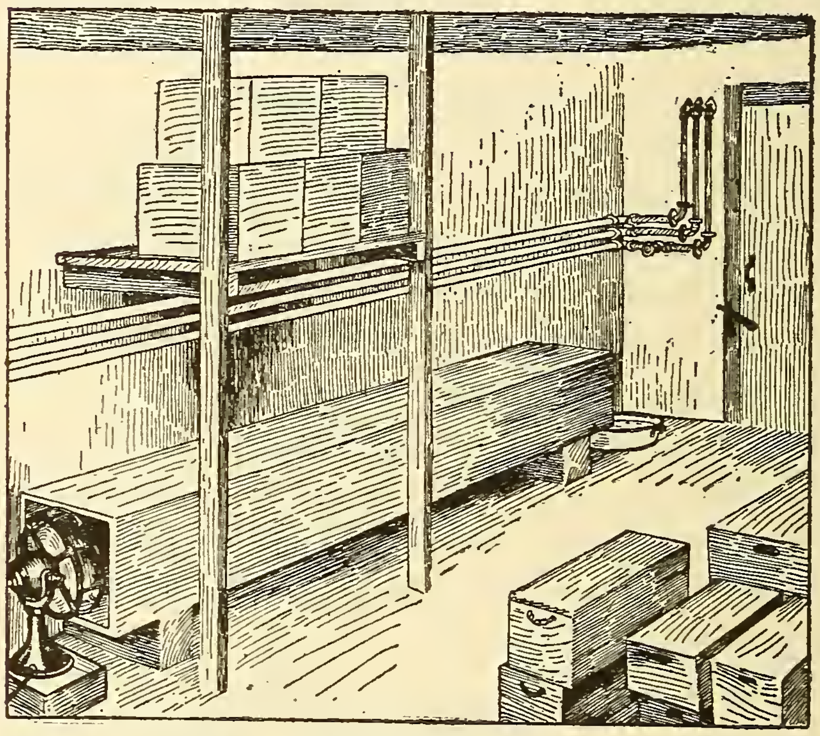
ALARM CLOCK AND SWITCH

and be just as useful when provided with the attachment shown placed over the top of the clock.

To the binding posts of this attachment an electric bell and battery in series are connected by wires. The lever and its binding post are insulated from the fastening cross piece by a strip of fiber. When the lever is swung up close to the bell hammer of the clock the circuit is completed from one binding post through the clock casing, hammer and lever to the other post as soon as the alarm is set off. The bell will continue to ring until the lever is removed from the hammer.

Fans In Cold Storage Warehouses

In the cold storage of eggs the electric fan is a valuable factor. When eggs are first placed in the "chill rooms" much



COLD STORAGE FAN IN OPERATION

moisture is produced by the comparatively high temperature of the eggs coming into contact with the cool air. One way of getting rid of this moisture is to place an electric fan so that it will blow the air in the room through a long wooden box about 14 by 14 inches square, ten or twelve feet long and open at the ends. The opening through this box is partially filled with calcium chloride which has a strong attraction for water. The chloride takes up much of the moisture which runs out the end of the box opposite the fan and into a basin.

It frequently happens also that goods are received in large quantities for storage and in being stacked away the interior of the pile would not cool very quickly. The equalizing of temperatures is hastened by directing a strong breeze from a fan upon the goods.

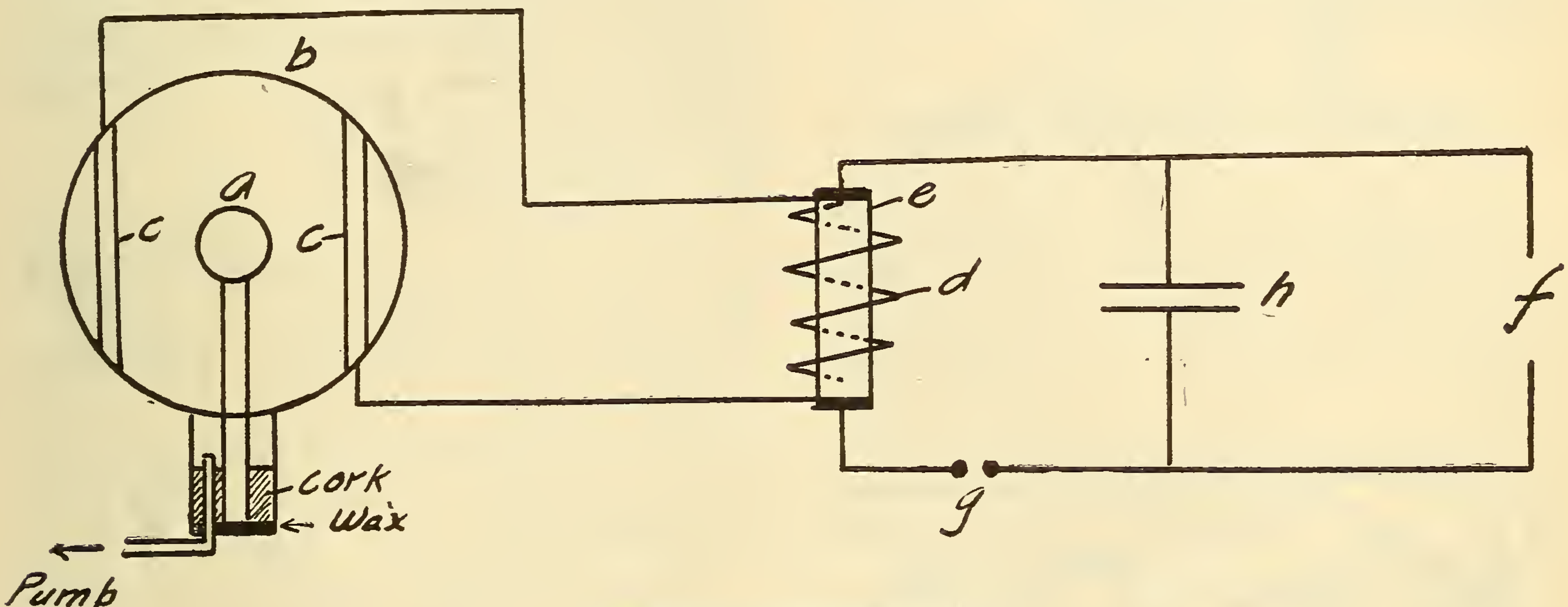
A Phosphorescent Lamp

Some chemical compounds have the property of emitting light if cathode or X-rays are projected against them. If the same compounds are subjected to high frequency oscillations in a vacuum they will become quite luminous, giving off light without any heat. A rather novel lamp can be made in a manner detailed below.

Cover a small spherical bulb (a), ¾ inch in diameter, with a good grade of varnish and sprinkle luminous zinc sulphide on its surface and allow it to dry thoroughly before placing it in a large spherical bulb (b). The bulb (a) can be made by blowing out the end of a sealed glass tube about ¼ inch in diameter. The bulb (b) which should be about five inches in diameter and should have a neck about two inches long, can be purchased. Make two holes in a cork and place the glass tube supporting the coated sphere in the center hole. Through the other hole pass an open tube which will serve as a connection to the pump. The cork and the end of the neck are liberally covered with red sealing wax.

The bulb is now ready to be exhausted by means of a good pump. A high vacuum is necessary, and owing to occluded gases it is well not to seal off the bulb from the pump until the lamp has been in operation for some time. On the outside of the large spherical bulb at (c c) are glued strips of tin foil to form circles. These circular strips constitute the electrodes or connections for the terminals of the high frequency apparatus. Any high frequency apparatus is satisfactory. If one is not at hand it can be made in a short time.

A dozen turns of highly insulated wire constitutes the primary of the high frequency transformer. This coil can be wound on a wooden skeleton frame about eight inches in diameter. The secondary of the high frequency transformer is made of several hundred turns of fine silk covered wire wound on a shellacked cylinder of well seasoned wood about four inches in diameter. The whole coil should be well covered with shellac when finished.



A PHOSPHORESCENT LAMP

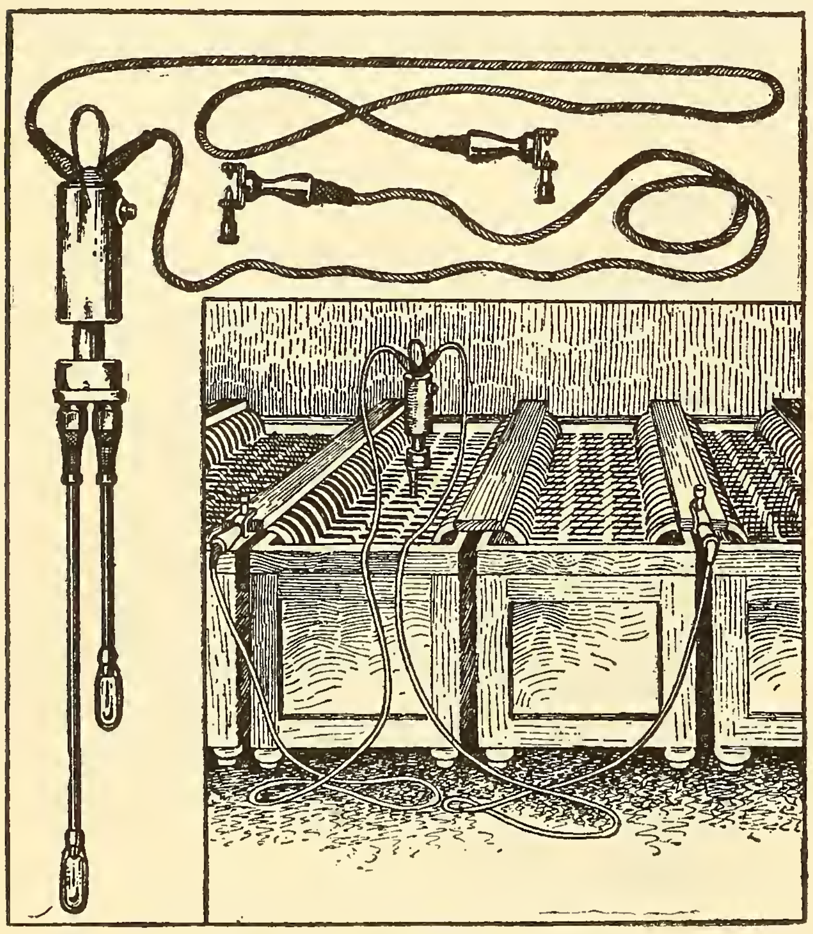
The terminals of the secondary coil (e) are connected to the tinfoil electrodes (c c). The apparatus is arranged as shown in the diagram. A step up transformer (110 to 3,000 volts) or an induction coil is placed at (f). In series with this is connected a spark gap (g) and the primary (d). A condenser of a capacity approximating that of six two quart Leyden jars is placed as shown at (h). When the vacuum is sufficiently high the zinc sulphide will glow under the action of the high frequency oscillations in the spherical bulb. The bulb should be spherical to obtain the best results.

This form of vessel which does not

have sealed-in electrodes is called electrodeless, and consequently this discharge is what is termed electrodeless discharge. The light is quite efficient. Although the intensity is not high sufficient light is emitted to enable a person to read easily. The lamp is novel in that it is an example of light emitted without the usual heat which accompanies commercial light sources. Such a light source is the ideal toward which scientists are striving.

Battery Inspection Lamp

The battery man likes to know daily the condition of the electrolyte and the plates of his battery. If the jars are of glass an incandescent lamp may be held



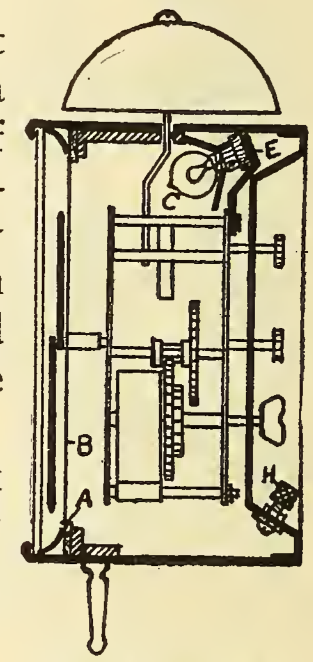
BATTERY INSPECTION LAMP

back of the jars and the examination made in this way. In the case of lead or other containers, samples of the electrolyte must be taken out carefully by means of a syringe.

All of these methods may be set aside by using the Duplex under acid inspection lamp. The lamp is protected by a celluloid tube and is fitted with cables and spring terminal contacts. By connecting the spring contacts across a few cells, current for the lamp is obtained and any part of the electrolyte examined without disturbing it except to lower into it the lamp and tube.

A Luminous Dial Clock

In jewelry stores and other shops, rather expensive clocks are often arranged so that the pressure of a button will cause the dial to be lit up brilliantly from the inside, the figures and hands standing out in bold relief. This pleasing effect is accomplished by a miniature light inside of the clock, and a semi-transparent dial, usually of ground glass. When there is no light behind it the dial appears like an ordinary one.



LUMINOUS DIAL CLOCK

It is not a difficult task to convert almost any clock into this form, and the result is well worth the trouble.

The first step is to remove the outer glass, or crystal, after which the hands are taken off. It will then be a simple matter to remove the regular dial. The one to be substituted is easily prepared. Secure a circular piece of glass, the same size as the dial just removed; perhaps another crystal from a similar clock is available. If so this will do very nicely, if the diameter is correct. The necessary ground surface can be satisfactorily produced by holding it lightly and carefully against an emery wheel, or grindstone, keeping the glass constantly in motion, so as to grind or scratch it uniformly. Test it from time to time by holding it to the light. A hole in the center will have to be bored, to allow the shaft carrying the hands to project through. Where the clock also possesses a second hand and alarm setting hand, additional holes will have to be bored. They can be bored by the usual method of using a rotating brass tube, emery dust and turpentine—and patience. Painting on the divisions and figures complete the dial.

While the above glass dial will work very well when so constructed, fully as pleasing results can be obtained, with a fraction of the work by using instead a piece of ordinary tracing cloth, such as draftsmen use.

This form of dial is prepared by first cutting a ring (A) (see figure) of tough cardboard. A circular piece of tracing cloth (B) is pasted to this ring, keeping it smooth and free from wrinkles. As elaborate figures as desired can be made with a drawing pen.

For the light, a flashlight bulb (C) of from one to six candlepower or more is best. The smaller the better, however. A miniature base is fastened to an arm (E), which in turn is secured to the framework of the clock. The bulb should be placed well back. The best position will have to be determined in each particular case. Probably it will have to be placed to one side about as illustrated, and the dial will not be quite evenly illuminated, but this will matter little. For a very even distribution of light, two or more bulbs might be used. A little reflector aids in directing the light. The lamp terminals can be run to two binding posts on the back of the clock. One is shown at (H). One of the posts at least must be insulated from the clock.

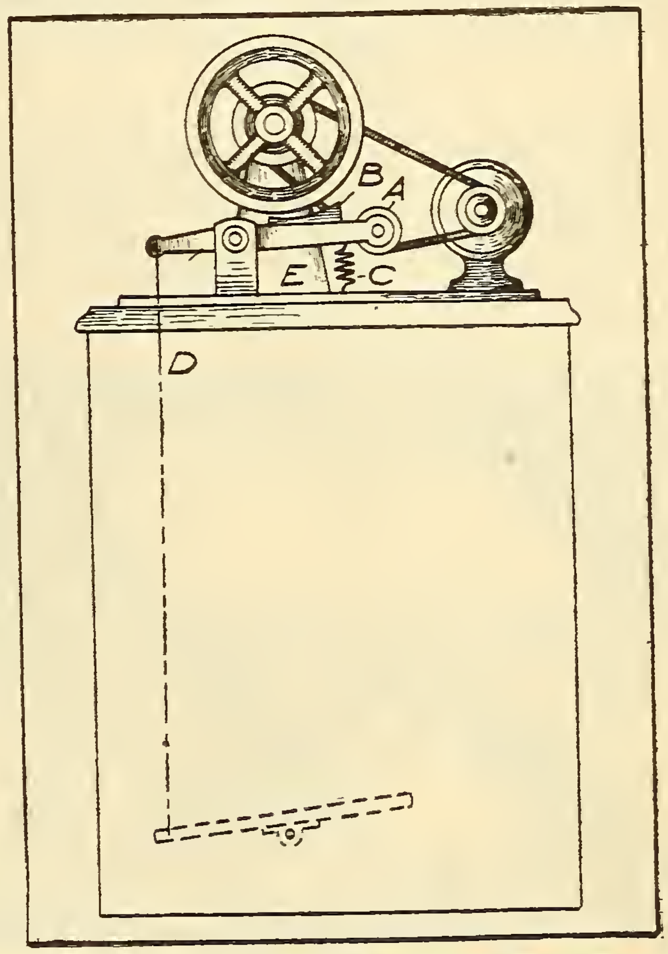
James P. Lewis.

Car Step Registers Passengers

A device for registering the number of passengers boarding a street car is the subject of a patent issued to R. W. and L. R. Balch of Neillsville, Wis. As a passenger mounts each step the step is depressed, which closes an electric switch upon an indicator. It is claimed for the device that it indicates whether the passenger is entering or leaving the car and does not register until the passenger has depressed more than one step.

Electric Sewing Machine Drive

A very simple form of adapting electric drive to the sewing machine is shown in the accompanying diagram. For this service, a constant speed motor is recommended. The writer has used a one-twelfth horsepower induction motor.

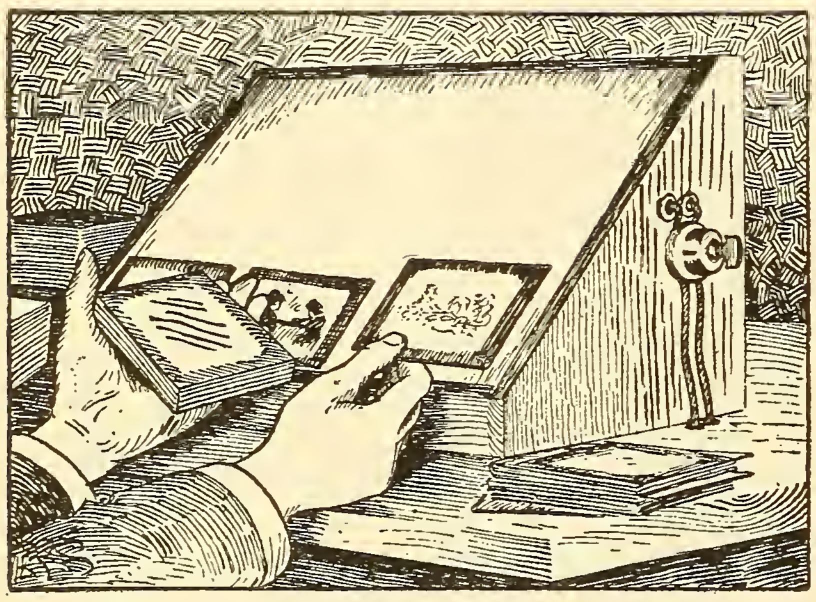


ELECTRIC SEWING MACHINE DRIVER

The lever (E) carries the leather pad (B), and the belt tightener pulley (A). This lever is connected by the wire (D) with the ordinary treadle—the regular belt, of course, having been removed from the sewing machine. By depressing the treadle, the lever (E) is raised, forcing the leather pad (B) against the wheel and stopping the machine, at the same time raising the pulley (A) and releasing the tension on the belt. When ready to resume sewing, the treadle is raised and the spring (C) (a heavy rubber band would do as well), draws the lever (E) down, removing the leather pad (B) from the wheel and gradually tightening the belt. By gradually raising the treadle, the desired speed may be found, as this arrangement permits of quite a range of speed through adjustment of the tension at (A). The great advantage, however, is that by depressing the treadle, the machine is instantly stopped at any desired place in the sewing, and as the motor continues to run, the sewing may be resumed very expeditiously, by simply raising the treadle.

For Examining Stereopticon Slides

A firm whose business is that of manufacturing and renting picture slides for use with a stereopticon provides a table equipped with devices by means of which



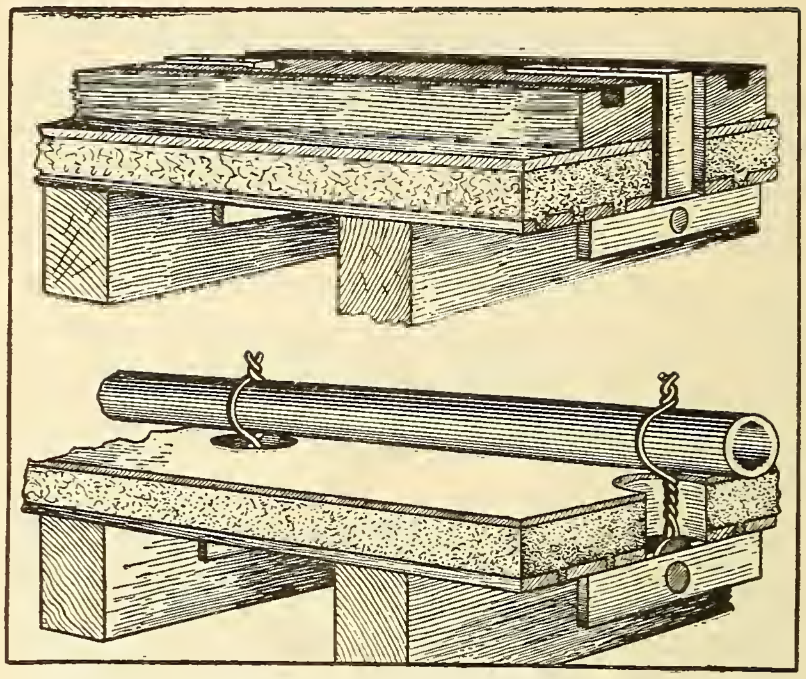
EXAMINING STEREOPTICON SLIDES

its customers may examine and select the slides desired.

The arrangement consists of a wooden box having a sloping top of ground glass within a frame. Under the glass is an incandescent lamp. The slides are laid upon the glass and with the lamp turned on the pictures are brought out clearly by the light diffused through the ground glass and without casting a disagreeable light in the customer's eyes.

Fastens Pipe or Molding on Ceiling

The use of this handy device or "toggle" for hanging pipe or molding to metal lath, wood lath or hollow tile ceiling is best explained by reference to the illustration. In putting up molding a ¼ inch hole is drilled in the molding and ceiling, the toggle is thrust through and

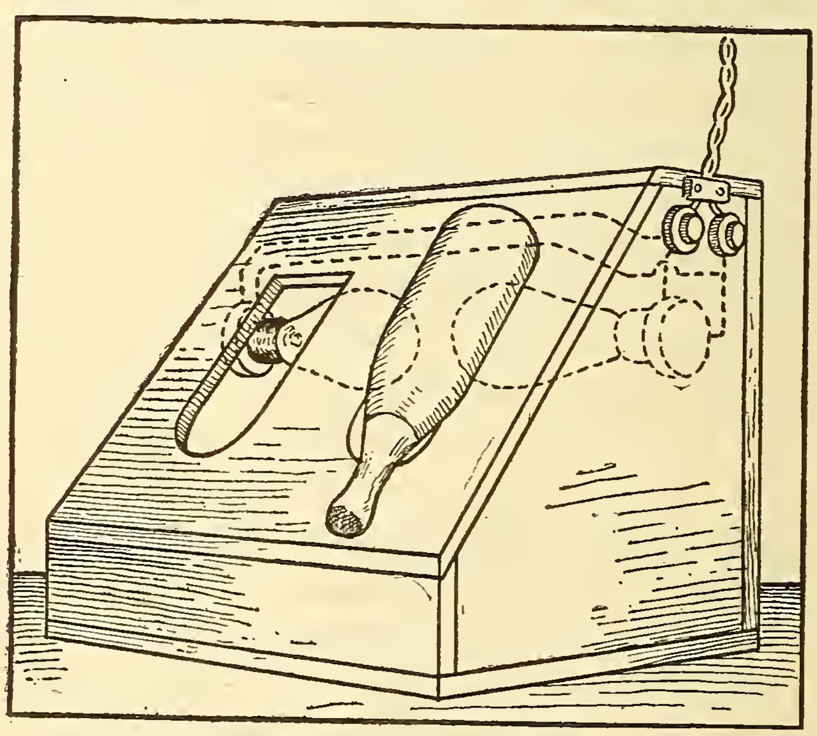


PATENT FASTENING FOR ELECTRICAL WORK

the cross head falls into position. The metal strap is then drawn down tight with pliers and fastened with brads or screws. Capping will fit over the strap without gouging. Wire takes the place of the strap on the pipe toggle.

Inspecting Filled Bottles

A very simple method by which any translucent liquid, such as ginger ale, pop, etc., is examined before labeling is illustrated by the cut. A box painted



ARRANGEMENT FOR INSPECTING BOTTLES

white on the inside and containing two sixteen candlepower lamps is used. The sloping front with two openings allows two bottles at a time to be placed in position and by the light shining through the inspector is able to detect any foreign matter.

Life of a Storage Battery

By FRANK M. EWING

The life of a storage cell depends very much upon how closely it is worked to its rated capacity as well as upon its mechanical construction. Some claim when worked to an average of 80 per cent of its full capacity it is safe to count on two years' service without any attention at all to the battery, except to add occasionally a little water for replacing evaporation. Others claim some storage batteries have been in use for over three years without any more attention than to add water occasionally in order to keep the tops of the plates covered. Of course the quality of water is an important factor. In some localities the water is very injurious to the elements of storage cells, consequently their life is very short. It is absolutely essential that the acid and water be free from impurities, such as iron, arsenic and nitric or hydrochloric acid. In selecting sulphuric acid none but the sulphur or brimstone acid should be used; acid made from pyrites is liable to contain impurities, such as iron or arsenic. In places where pure water is not available only distilled or rain water should be used.

Although storage batteries do not "store" electricity, they certainly do store energy by converting the kinetic energy of the electrical current into chemical potential energy, which may be realized as kinetic energy again. The efficiency of the accumulator (or of any other means of storing or transforming energy) is the output divided by the input. This quotient is always less than 1, as the accumulator is not a perfect storer of energy, that is, there are certain losses in the transformation of kinetic electrical to potential chemical energy, and vice versa, besides the loss of the energy required to force the current through the cell, that is, the loss due to the resistance of the plates and electrolyte.

I find from my experience in handling the Type E Chloride accumulators, which are used for telegraph and telephone work, that when not discharged at an excessive rate, nor to a lower electromotive force than 1.9 volts per cell, the positive plates last for about 1,200 or more discharges; while, if discharged each time below 1.8 volts per cell, or at an excessive rate, the life of the positive plates will not be more than 400 or 500 discharges. The negative plates, with good care, will usually outlast four or five sets of positive plates. The cells under my care last between four and five years, which is considerably longer than the various ratings, and only require water added to replace evaporation, keeping the tops of the plates covered at least ½ inch with water. Between the fourth and fifth year that they are in service the positive plates become distorted, which is known as buckling, and crumble to pieces.

The cause of buckling seems to be the formation of sulphate in the plugs of active material which fill the spaces of the grids, thus causing the plugs to expand. Lead having very little elasticity, the grid is forced out of shape. As usually constructed, the edges of the grid are heavier than the intermediate portion, so that the effect of the distortion is to bulge the plate in the center. If the plates are not discharged too far and too rapidly, the expansion of the active material is gradual, causing the grid to stretch evenly. This makes the plates "grow" or increase in area, sometimes as much as ten per cent.

Unless a battery is properly looked after, sulphating is liable to set in, and if allowed to go too far may cause a great deal of trouble. Lead sulphate is formed during each discharge of a cell. This sulphate ordinarily does no harm; in fact, it is essential to the operation of the cell.

However, under certain conditions a white insoluble sulphate, may be formed, and it is this that is credited with the action known as sulphating. When a cell is sulphated the plates, more particularly the positive, become covered in spots with this white insoluble sulphate, which is difficult to remove. As the sulphate usually accumulates in patches, and as it prevents to a large extent chemical action on the active material underneath it, the capacity of the cell is reduced and the uneven action is liable to lead to buckling unless the mechanical structure of the plate is such that buckling is practically impossible.

The most frequent causes of sulphating are overdischarging, strong specific gravity of electrolyte and allowing the battery to stand for a considerable length of time in a discharged condition. If a battery is looked after, as it should be, there will be no trouble from this source. If cells are repeatedly discharged below 1.7 volts, sulphating may be expected. At the end of a complete charge, a lodgment of white powder that may easily be brushed off will sometimes be noticed on top of the plates. Provided the body of the plates are the proper color (positive dark brown and negative slate color) no attention need be paid to this powder as it is composed of particles from the plates thrown off by the gassing at the end of the charge. These particles become sulphated and of a light color while in suspension in the electrolyte.

In case white insoluble sulphate appears on the plates, the battery should be given a long continued charge at a low rate, somewhat below the normal eight hour rate until the cells give all the signs of a full charge, and the plates have resumed their normal color. In case of badly sulphated cells, the color of the positive becomes lighter than normal and the negatives considerably darker.

There are several kinds of treatment that will injure the cells. Among these is the habit (which should never be allowed) of connecting the terminals through a small resistance, or short wire, to see if the battery is in working order, or how much of a spark it will give. A current of great magnitude will flow for a moment and it will be likely to loosen the paste and cause sulphating in the cell. Either a voltmeter or an incandescent lamp of known voltage should be used to determine the condition of the battery.

A complete charge should exceed the previous discharge, in ampere hours, from twelve to fifteen per cent. The principal indications of a complete charge are:

(1) The voltage and specific gravity reach a maximum value, which value is not necessarily fixed; for example, the voltage at the end of a charge may be from 2.4 to 2.7 volts. In the battery under my care the specific gravity always stands at 1,200 degrees and falls to 1,190 degrees on discharge.

(2) The amount of gas given off at the plates also increases when the cells are fully charged. Nothing is gained after the plates commence to gas freely, and it has been my practice to cut the charging current off when the plates commence to gas freely.

(3) The positive plates become a dark brown, and the negatives a light gray.

(4) With all the cells of the battery in normal condition, with pure electrolyte and no material lodged between the plates or sediment touching them at the bottom, the maximum voltage and specific gravity are reached when, with the charging current constant at the normal rate there is no further increase in either during a period from one quarter to one half hour; for example, if the charge has been carried on for eight or ten hours with a gradual rise in the voltage and specific gravity during that time and with an additional one-half hour of charging, there should be no further rise in either, then the charge is complete. When a storage cell has the electrolyte covered with paraffin oil, there may be at any time a thin white froth on top of the oil, but when this froth develops rapidly to a depth of one-quarter inch, the cells are charged sufficiently. Care should be taken to keep the plates immersed in the electrolyte more than half an inch above the top of the plates. A storage cell will not give its maximum capacity until it has been subjected to from ten to fifteen discharges, but will have at first about three-fourths of its maximum.

In order to secure satisfactory operation of a storage battery each of the cells should be inspected at regular intervals. It has been my practice to inspect the cells every day and watch them carefully while they are being charged. The voltage of individual cells may become low, the electrolyte may not be of the proper specific gravity, or foreign substances may become lodged between the plates or in the bottom of the cell, and regular inspection is necessary to locate any such defects that may develop.

For the inspection of individual cells, a portable lamp should be used so that any tendency for an accumulation or lodgment of material between the plates can be at once noticed. If the elements are in glass jars, an ordinary lamp with extension cord to attach to the electric service wires will be found most convenient. By holding the lamp behind the jars and looking through between the plates the condition of the cell can at once be seen. When examining a cell great care should be taken to look between all the plates, and any accumulation of material should be removed at once. A lighted match should never be used to examine cells as there is danger that the gas thrown off while charging will ignite. There have been cases where explosions were caused with a lighted match. If an accumulation is caused from the plates themselves, it may be pushed down to the bottom of the containing vessel by means of a stick of hard rubber or wood. If it is any foreign substance it should be removed from the cell. A metal rod should never be used for removing obstructions in a storage cell; it is sure to cause short circuits and do damage.

In addition to the examination of the cells with the lamp, an examination should be made near the end of each charge to see if all the cells are gassing equally and freely. If any of the cells show readings lower than normal and do not gas freely at the end of the charge they should be examined at once with a cell lamp to determine the cause of the falling off. Very likely it is due to short circuiting between the plates, caused either by a lodgment of material in the intervening space or else by an accumulation of sediment in the bottom of the cell.

The life of a storage battery is much longer when it is installed in glass jars on account of allowing the examination of the condition of the plates while the cells are in operation. A thorough inspection cannot be made while the cells are in operation when enclosed in hard rubber vessels and lead lined wooden tanks. Of course glass jars cannot be used for automobiles or coach lighting on railways because the ability to withstand rough usage and constant jarring is of more importance than long life for this class of service.

During my nine years' experience in handling storage batteries there was only one trouble developed that I could not at first understand. After the cells were cleaned and put in commission again, I discovered the negative plates would gas as much and freely on discharging as they would while charging. In a short time a large amount of black substance resembling crude rubber formed in the bottom of the cells. In about six or seven hours the battery would play out after giving it the regular charging rate. I could find no reading upon a trouble of this nature and those who had experience in handling storage batteries were puzzled; it was a new one to them. They all suggested an over charge which was given; the specific gravity was run up to 1,250 (fifty degrees above normal), but the trouble still remained and was not removed until new negative plates were installed. The trouble was caused by the negative plates being exposed in the air too long while the battery was being cleaned, although the men were cautioned to keep the plates in a jar immersed in water while cleaning. The plates had been in service six years when this occurred.

Battery Connector Puller

The individual cells in the various types of Exide batteries are joined together by connectors burned to the strap post. This burned connection is positive and satisfactory. When one or more

BATTERY CONNECTOR PULLER

cells have to be cut out, it has heretofore been customary to do this in one of two ways: Either by loosening the connector by putting a flame on the burn over the post, or by boring through the burn with a brace and bit.

The Electric Storage Battery Company puller is a device for uncoupling the connectors by shearing, leaving both the post and connector in condition for reburning.

The connector is made in two sizes to fit all types of Exide cells. In the illustration it is shown fitted to the pillar strap ready for operation.

Lamp Lighting With Batteries

In many states it is the law for motor boats to carry lights. If old style oil lamps are used it often becomes a problem as to how to light the lamps if one happens to be out of matches.

I have used the following method with satisfaction: Take the heavy insulated wire from the spark plug. Place one of the lamps so that the metal burner of the lamp will be in contact with the base of the engine. Put a drop of gasoline on the wick of the lamp. Now hold the wire about 1-32 inch from the wick casing, and switch the batteries on and the spark will light the lamp. This same method can be followed out by autoists, where electric ignition is used.

B. E. Vincent.

Vinson Lamp Tester

To aid in developing an entirely satisfactory lamp for railroad trains, Mr. Vinson, engineer for the West Railways of France, has constructed a simple device for vibrating lamps under test, as they would be vibrated on a train in motion. This is used in studying various kinds of filaments to ascertain the one least liable to break.

As the shocks given to the lamps by the rotating device are stronger than ordinary, the test does not take as much time as where the lamp is mounted on a railroad car. The lamp is fitted in a socket which is carried by a small board, and the board is hinged and is tripped up and then let drop each time by a revolving device operated by a small motor. It can easily be seen what kinds of filaments hold out the best, and the lamps can be made accordingly. An indicator shows the number of shocks given to the lamp, and by an electric device the apparatus stops as soon as the filament breaks and there is no more current passing in it.

Belt Dressing for Small Motors

Small motors play a great part in advertising and in running models and toys. Common string or cord is often used for belts, but to keep it from slipping it is often stretched too tight and the shaft brings unnecessary pressure on the bearings. To avoid this the belts should be dressed as large belts are. The best way is to wax the cord with soft wax, preferably beeswax. Also wax the pulley. The device will now run better, without strain.

On Polyphase Subjects

An Adventure in Wireless

It is now somewhat over nine years since the first wireless message was sent by the great Marconi across the Atlantic from the United States. The sending of such a message today is not a matter of especial comment, but the inside facts connected with the sending of that first message make a very interesting story. Frank Parker Stockbridge, at that time a reporter on the New York *Morning Journal,* was given the job of seeing that the first message so transmitted should be one from the owner of that paper, Mr. Hearst, to the editor of the London *Times.* Mr. Stockbridge carried out the command of his managing editor, and exactly how he turned the trick he will himself tell, for the first time in print, in the April issue of this magazine.

It is an exciting story from start to finish. It is chock full of that kind of action that always makes the "putting over" of a great newspaper scoop interesting reading. If you are looking for real thrills be sure and read "An Adventure in Wireless."

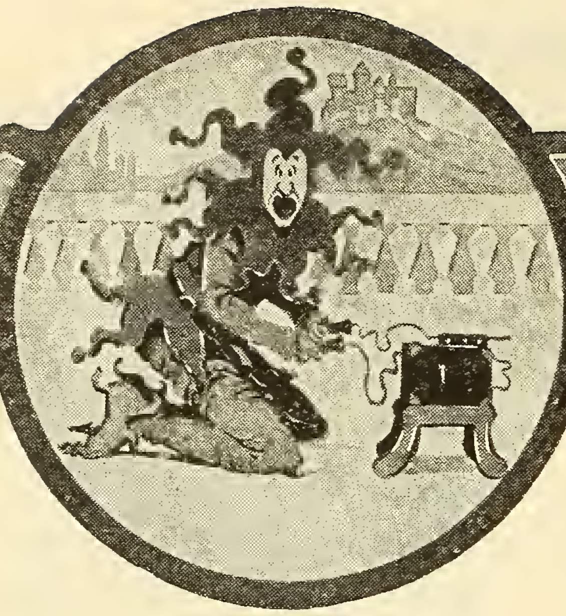
First Theatre to Use Electric Lights

The first theater to use electric lights was the Academy of Music, located on Halsted street, Chicago. The lights were installed in the auditorium only. On the night the 150 sixteen candlepower lamps were turned on the actors struck, asserting that they could not "make up" by gas light and look their parts under electric light. After some protesting, they proceeded with the play.

The first theater to have both the auditorium and stage equipped with incandescent lamps was the old Haverly Theater on Monroe street, Chicago, where the Inter Ocean building now stands.

Nitrogen and War

An interesting phase of the endeavor to make individual countries independent of others in case of war was raised at the last meeting of the British Association for the Advancement of Science by Mr. E. Kilburn Scott. After describing the various processes for making artificial fertilizers by securing the nitrogen from the air with the aid of cheap electric power, Mr. Scott reported on the extent to which such methods were already in commercial use on the European continent. He then made a plea for the establishment of similar industries in England, holding that the government should subsidize the same so as to have an inexhaustible supply of nitrogenous compounds available in case of war. At present, Great Britain is dependent on other countries for its supply of the nitrates and nitric acid without which no commercial explosives can be made. Should this supply suddenly be cut off—as might easily happen in case of a war with other nations—England might find itself in a very serious position. Mr. Scott therefore argued that even if an electrical plant for making nitrogenous compounds from the air might not be able to compete in price with the existing supply of mixed nitrates, its establishment would still be warranted as an insurance of England's holding its ground in case of an international war.



Short Circuits

When convalescing from typhoid one of the patients shouted for something to eat so lustily that the nurse brought him a teaspoonful of oatmeal. ''Now,'' said he peevishly, ''I want to read. Bring me a postage stamp.''

* * *

A school superintendent, making his rounds through the district schools, came to one in which he thought the scholars were not quite so attentive and quick in perception as they ougnt to be. He resolved to test them on these points and stepping to the blackboard said to the school:

''Give me some figures to write on the board. Any figure below 100.''

''Forty-five,'' sang out a scholar, and the superintendent put down 54. ''Thirty-two,'' said another urchin, and 23 was written down. ''Eighty-seven,'' hinted a third scholar, and the man wrote 78. Finally a little fellow put up his hand and said, ''Put down 77. You can't get that wrong.''

* * *

The Prodigal had returned.

''Father,'' he said, ''are you going to kill the fatted calf?''

''No,'' responded the Old Man, looking the youth over carefully. ''No, I'll let you live. But I'll put you to work and train some of that fat off you.''

* * *

''Speaking of etiquette, did you send the dollar for those advertised instructions on 'What to do at table?' ''

''Yes.''

''And what did you get?''

''A slip with one word printed on it: 'Eat!' ''

* * *

''Why do you put the hair of another woman on your head?'' he asked severely.

''Why do you,'' she replied sweetly, ''put the skin of another calf on your feet?''

* * *

Sir Robert (as sudden scurry is heard)—''What was that?''

Nervous Loader—''O-only a robert, Sir Rabbit!''

Farmer—''Here's a letter from city folks answerin' our ad, Mirandy. They want ter know if there's a bath in the house. What'll I tell 'em?''

His wife—''Tell 'em the truth. Tell 'em if they need a bath, they'd better take it before they come.''

* * *

Contractor—''I wish to get a permit to dig up the pavement on Main street.''

''Why, we can't give you that. There isn't any pavement in Main street.''

''I know; but I want the permit so that we can dig up the pavement as soon as there is one.''

* * *

Pat was hard at work digging a post hole when the boss strolled by.

''Well, Pat,'' said he, noting the progress of the work, ''do you think you will be able to get all that dirt back into the hole again?''

Pat looked doubtfully at the pile of dirt, and then at the hole, scratched the back of his head, and after some thought said:

''No, sor, sure I don't think I've dug th' hole deep enough.''

* * *

''Lady,'' said Meandering Mike, ''would you lend me a cake of soap!''

''Do you mean to tell me you want soap!''

''Yes'm. Me partner's got de hiccups an' I want to scare him.''

* * *

A small boy called on a doctor one evening.

''Say, Doc, I guess I got measles,'' he remarked, ''but no one knows. I can keep it quiet.''

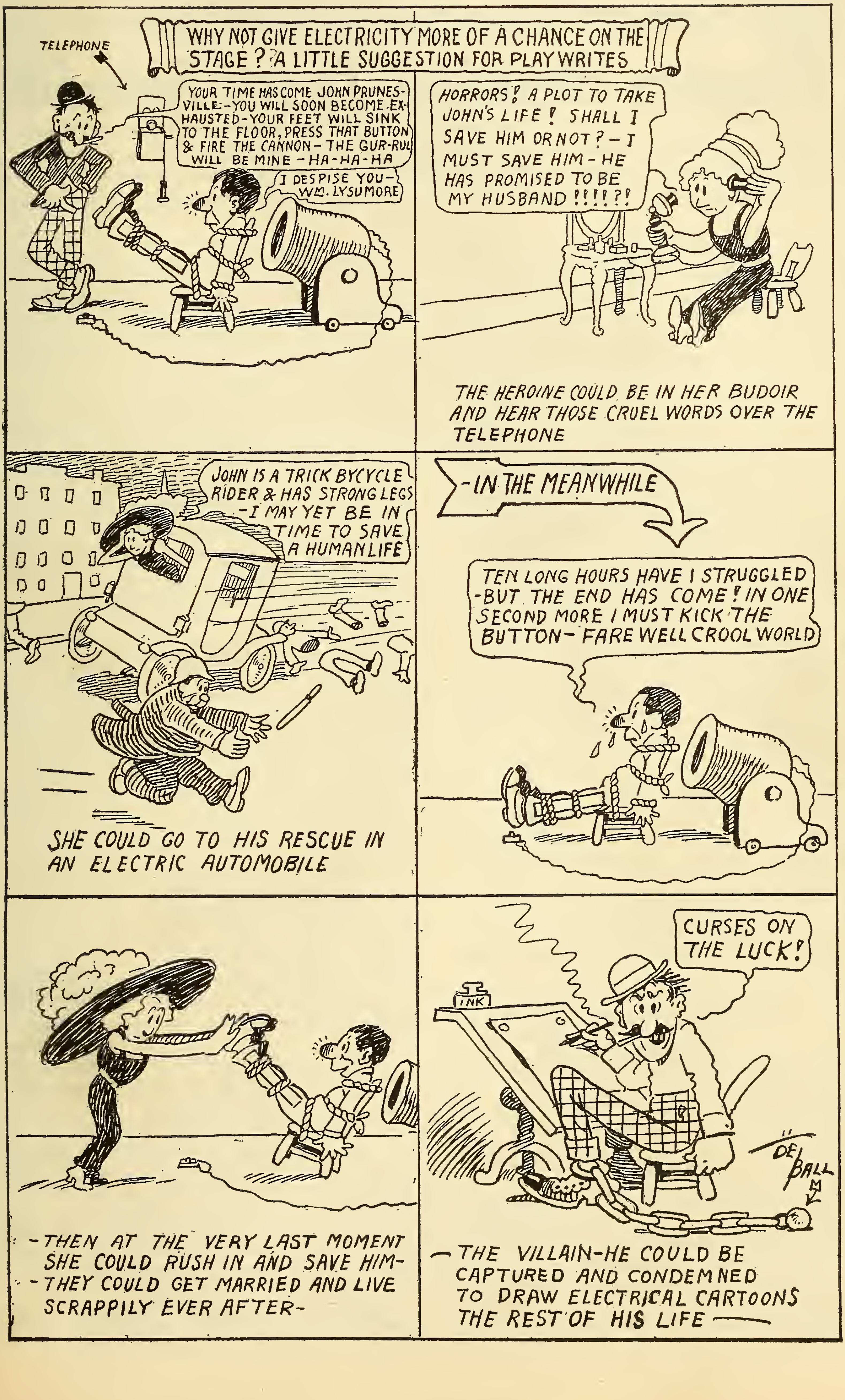
The doctor looked puzzled.

''Aw, get wise, Doc,'' suggested the small boy. ''What'll you give me to go to school and spread it among all the kids in the village?''

* * *

''My good friend,'' softly says the minister, leaning over the bedside, ''I trust that all is well with your soul. May I ask what are your beliefs as to the next life?''

''I don't know,'' feebly answers the dying man. ''You'll have to ask my wife. She had charge of my religious views.''


WHY NOT GIVE ELECTRICITY MORE OF A CHANCE ON THE STAGE ? A LITTLE SUGGESTION FOR PLAY WRITES
TELEPHONE
YOUR TIME HAS COME JOHN PRUNES-VILLE:-YOU WILL SOON BECOME EX-HAUSTED-YOUR FEET WILL SINK TO THE FLOOR, PRESS THAT BUTTON & FIRE THE CANNON-THE GUR-RUL WILL BE MINE-HA-HA-HA
I DESPISE YOU-WM. LYSUMORE
HORRORS! A PLOT TO TAKE JOHN'S LIFE! SHALL I SAVE HIM OR NOT?-I MUST SAVE HIM-HE HAS PROMISED TO BE MY HUSBAND!!!!?!
THE HEROINE COULD BE IN HER BUDOIR AND HEAR THOSE CRUEL WORDS OVER THE TELEPHONE
JOHN IS A TRICK BYCYCLE RIDER & HAS STRONG LEGS-I MAY YET BE IN TIME TO SAVE A HUMAN LIFE
SHE COULD GO TO HIS RESCUE IN AN ELECTRIC AUTOMOBILE
-IN THE MEANWHILE
TEN LONG HOURS HAVE I STRUGGLED -BUT THE END HAS COME! IN ONE SECOND MORE I MUST KICK THE BUTTON-FARE WELL CROOL WORLD
-THEN AT THE VERY LAST MOMENT SHE COULD RUSH IN AND SAVE HIM- -THEY COULD GET MARRIED AND LIVE SCRAPPILY EVER AFTER-
CURSES ON THE LUCK!
INK
"DE BALL"
-THE VILLAIN-HE COULD BE CAPTURED AND CONDEMNED TO DRAW ELECTRICAL CARTOONS THE REST OF HIS LIFE——

Common Electrical Terms Defined

In this age of electricity everyone should be versed in its phraseology. By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

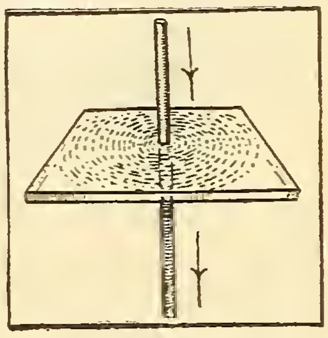
LIFE OF INCANDESCENT LAMP.—The length of time an incandescent lamp will burn before the filament is destroyed. This is called its total life. Its useful life is the length of time it burns before its candlepower falls below a certain percentage of its rated light. This percentage is set at 80. After this mark is reached a new lamp should be provided.

LIGHTNING.—An electric discharge between a cloud and the earth or between cloud and cloud. In theory the earth and cloud or cloud and cloud are charged with static electricity of opposite polarity. The air is the dielectric which is finally punctured by the high voltage and the two opposite charges neutralize each other by the discharge.

LIGHTNING ARRESTER.—A device by which a lightning discharge striking an electric circuit is carried to ground without damaging results to the apparatus connected to the circuit.

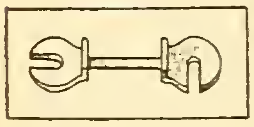
LINE.—Used to refer to electrical conductors connecting two or more points or stations.

LINES OF FORCE.—If a wire be passed through a hole in a piece of glass held horizontally, iron filings sprinkled upon the glass will arrange themselves in circular lines about the wire if a current be passed through the wire. The magnetism thus created is termed "lines of force." All magnetized bodies are surrounded by this invisible field which will cause soft iron filings to display this linear arrangement if brought into the field. (See cut.)



Lines of Force

LINK FUSE.—A strip or plate of low fusing metal placed upon a suitable block and connected in an electrical circuit to open it by melting in case too much current flows through it. (See cut.)



Link Fuse

LOAD FACTOR.—The ratio of the actual number of amperes output of a plant to the output of the plant operated at full load for the same time.

LOCAL ACTION.—The small currents set up within a battery because of the impurities in the zinc. Impure zinc in other words if placed in a battery becomes a mass of small batteries with minute circuits between the impurities and the zinc.

LOCAL BATTERY.—In telegraphy the battery supplying the current to the station instruments only, the circuit being opened and closed by a relay connected to the main line.

LOCK SWITCH.—A snap switch so made that it can be operated only by the use of a key.

LODESTONE.—A name applied to magnetic iron ore that possesses naturally the property of attracting pieces of iron to it.

MAGNET.—A body possessing the power of attracting soft iron, nickel and cobalt. Commonly applied to a bar or horseshoe shaped bar of magnetized steel.

MAGNETIC CUT-OUT.—A circuit-breaker in which the switch drawn open by a spring is kept closed by a latch which is released by the operation of an electromagnet.

MAGNETISM.—That branch of science that treats of magnets and magnetism. Also applied to the magnetic condition found about magnets and wires and coils carrying current.

MAGNET KEEPER.—See Keeper.

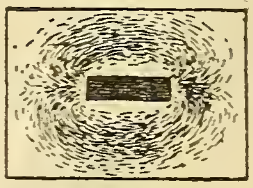
MAGNET COIL.—A coil of wire thrust over an iron core to make an electromagnet.

MAGNET CORE.—The iron core around which an insulated coil of wire is wound for the purpose of magnetizing the iron. An induction coil has a core of soft iron wires, while dynamo and motor field magnets have a core of cast or of wrought iron, the latter being preferable.

MAGNETIC BATTERY.—A compound magnet made up of a number of single permanent magnets bolted together.

MAGNETIC CONCENTRATOR.—An apparatus consisting of electromagnets arranged to separate the sand of magnetic ore from sand or soil with which it is mixed.

MAGNETIC CURVES.—Iron filings scattered upon a pane of glass or a sheet of paper held over a magnet will arrange themselves in curves to which the term defined is applied. (See cut.)



Magnetic Curves

MAGNETIC DECLINATION.—The angular deviation of the magnetic needle causing it to rest at the angle with the true meridian. In other words, owing to the north magnetic pole not coinciding with the true north pole, the compass needle does not point north and south except on the meridian intersecting the two poles.

MAGNETIC DIP.—The angle from the horizontal which a magnetic needle free to move assumes. The dipping is due to the effect of the earth's magnetism upon the needle.

MAGNETIC EQUATOR.—A line joining the points upon the earth's surface where the magnetic needle has no tendency to dip.