THE STORY OF AN ELECTRIC FARM

# POPULAR ELECTRICITY MAGAZINE

IN PLAIN ENGLISH
(NON TECHNICAL)

CONCRETE POWER DAM ON THE ELECTRIC FARM
See Page 289

Vol. IV AUGUST, 1911 No. 4

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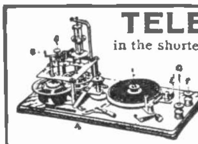

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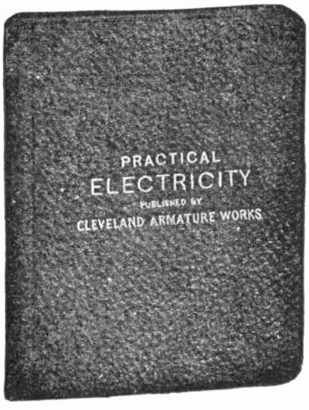


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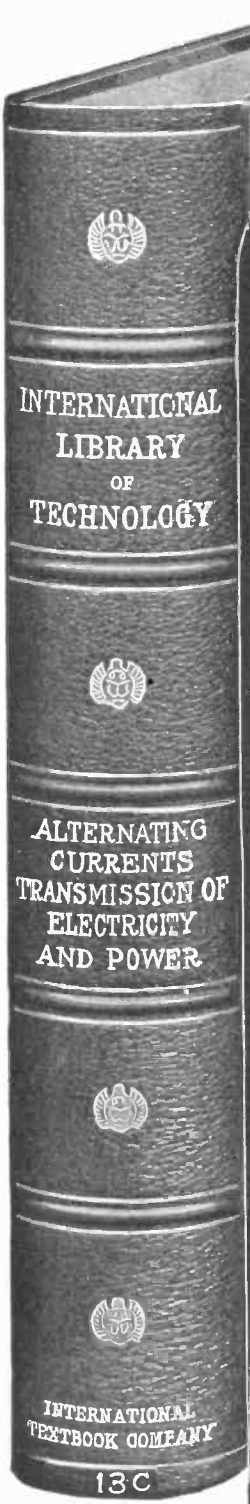


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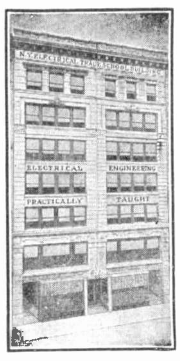


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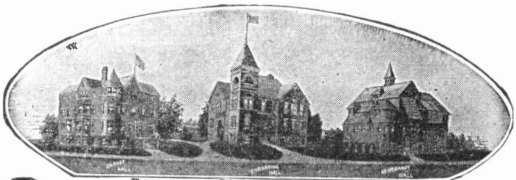

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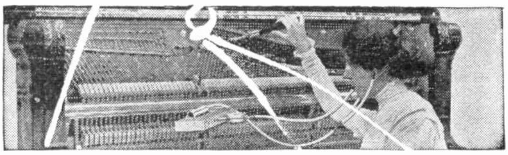

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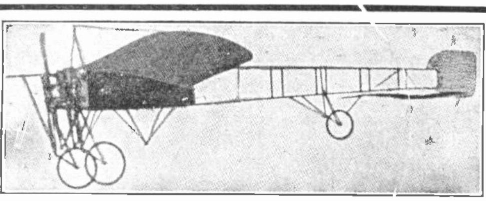

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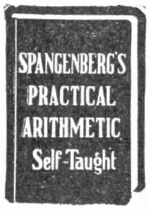


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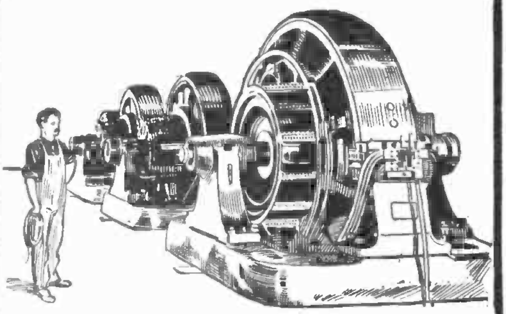

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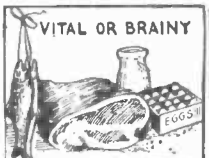


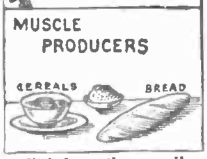


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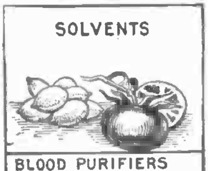



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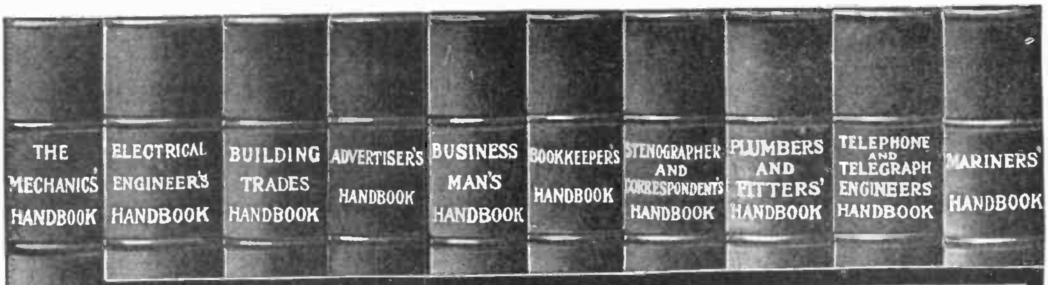


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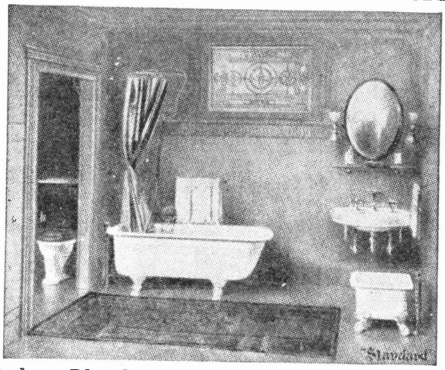


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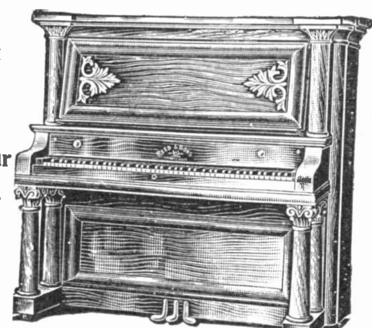

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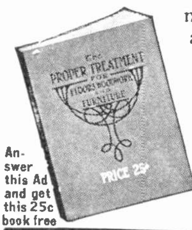


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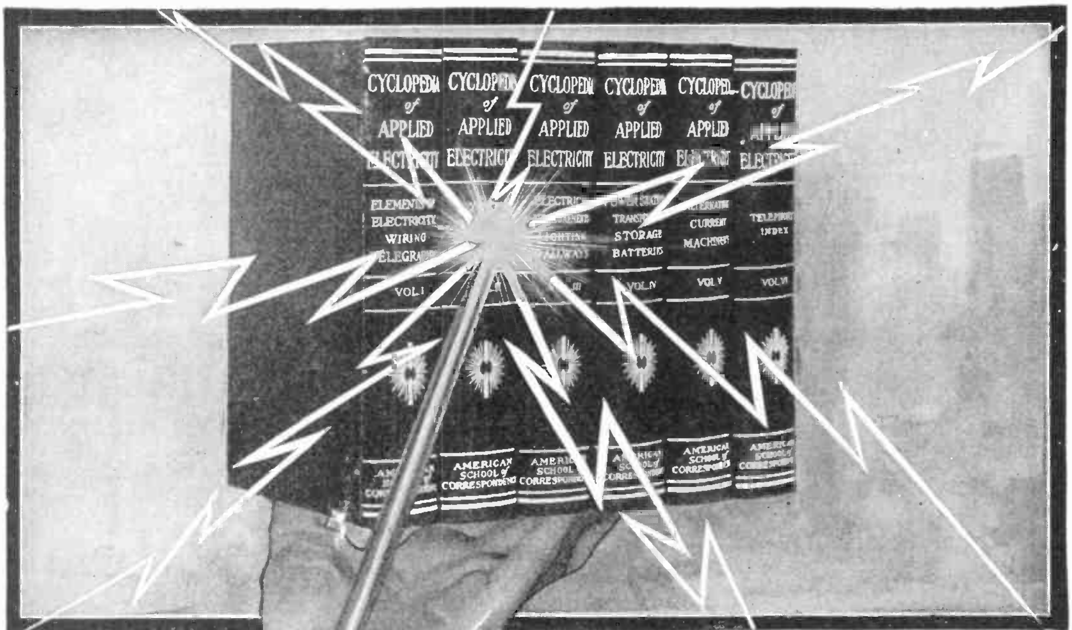


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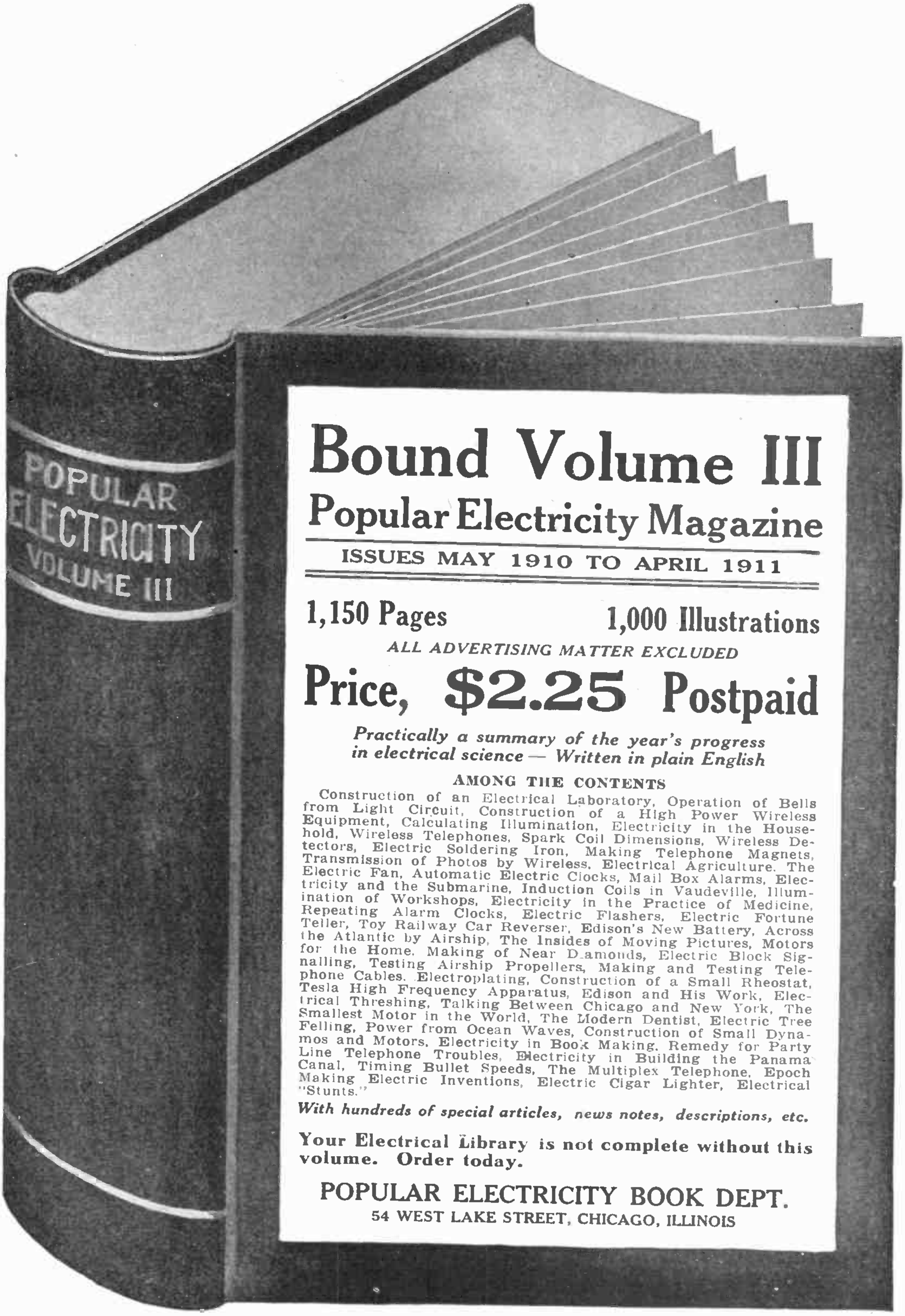
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# POPULAR ELECTRICITY

## IN PLAIN ENGLISH

HENRY WALTER YOUNG, Editor

241

Vol. IV | August, 1911 | No. 4


## CONTENTS




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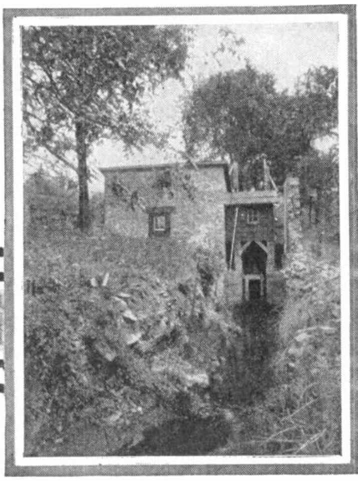
THE CROSIAR HOME, A COMMODIOUS, TWO-STORY FARMHOUSE WHERE ELECTRICITY IS THE SERVANT

Popular Electricity
In Plain English

VOL. IV AUGUST 1911 No. 4



# The Story of an Electric Farm

Some forty years ago the settlers just west of the town of Utica, Ill., carried their wheat and corn to be ground to a little old mill standing on the banks of the Pequamsagin creek, which adds itself to the Illinois River farther down in the valley. Two boys, Eli Crosiar and Henry Grove, used to watch the old mill wheel turn, and go swimming in summer and skating in winter at the mill pond.

But the mill was finally abandoned. The wooden part of the structure fell into decay. Some of the old stone and mortar walls, however, remained to mark the spot. Water gradually washed away the dam until the creek, released from its captivity, wound its way down the ravine just as it had done before the white man tamed it.

Years went by, but the two boys remembered the mill. One became the owner of the 320-acre dairy farm, including the site of the old structure. The other manages the Electric Light and Power Company at Utica, and with the renewal of the friendship of old days arose the question of making use of the water in the creek to generate electricity for service on the farm, the story of which is here told with the intent of helping readers of POPULAR ELECTRICITY who are similarly situated to do likewise.

The first thing to do in developing the power was to determine the quantity of water available. This was solved by using a weir. This weir was constructed as shown in the illustration and with the table may be used in any case to determine the number of cubic feet of water available in any small stream. The way to proceed is as follows: A board long enough to reach across the stream with each end in the bank is put in place. Cut a notch in the board deep enough to pass all the water, and long enough to reach about two-thirds the way across the stream. This constitutes a weir-dam. The bottom and ends of the notch (B) in the board should be beveled on the down-stream side, leaving the upper edge almost sharp. The stake (E) should be driven into the bottom of the stream several feet from the


THE WEIR METHOD OF MEASURING THE FLOW OF A STREAM

board, on a level with the sharp edge of notch (B). The level of the top of this stake can be easily found, when the water is beginning to spill over the notch.

| Inch. | | 1/8 | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 7/8 |
|---|---|---|---|---|---|---|---|---|
| 1 | .40 | .47 | .55 | .65 | .74 | .83 | .93 | 1.03 |
| 2 | 1.14 | 1.24 | 1.36 | 1.47 | 1.59 | 1.71 | 1.83 | 1.96 |
| 3 | 2.09 | 2.23 | 2.36 | 2.50 | 2.63 | 2.78 | 2.92 | 3.07 |
| 4 | 3.22 | 3.37 | 3.52 | 3.68 | 3.83 | 3.99 | 4.16 | 4.32 |
| 5 | 4.50 | 4.67 | 4.84 | 5.01 | 5.18 | 5.36 | 5.54 | 5.72 |
| 6 | 5.90 | 6.09 | 6.28 | 6.47 | 6.65 | 6.85 | 7.05 | 7.25 |
| 7 | 7.44 | 7.64 | 7.84 | 8.05 | 8.25 | 8.45 | 8.66 | 8.86 |
| 8 | 9.10 | 9.31 | 9.52 | 9.74 | 9.96 | 10.18 | 10.40 | 10.62 |
| 9 | 10.86 | 11.08 | 11.31 | 11.54 | 11.77 | 12.00 | 12.23 | 12.47 |
| 10 | 12.71 | 12.95 | 13.19 | 13.43 | 13.67 | 13.93 | 14.16 | 14.42 |
| 11 | 14.67 | 14.92 | 15.18 | 15.43 | 15.67 | 15.96 | 16.20 | 16.46 |
| 12 | 16.73 | 16.99 | 17.26 | 17.52 | 17.78 | 18.05 | 18.32 | 18.58 |
| 13 | 18.87 | 19.14 | 19.42 | 19.69 | 19.97 | 20.24 | 20.52 | 20.80 |
| 14 | 21.09 | 21.37 | 21.65 | 21.94 | 22.22 | 22.51 | 22.79 | 23.08 |
| 15 | 23.38 | 23.67 | 23.97 | 24.26 | 24.56 | 24.86 | 25.16 | 25.46 |
| 16 | 25.76 | 26.06 | 26.36 | 26.66 | 26.97 | 27.27 | 27.58 | 27.89 |
| 17 | 28.20 | 28.51 | 28.82 | 29.14 | 29.45 | 29.76 | 30.08 | 30.39 |
| 18 | 30.70 | 31.02 | 31.34 | 31.66 | 31.98 | 32.31 | 32.63 | 32.96 |
| 19 | 33.29 | 33.61 | 33.94 | 34.27 | 34.60 | 34.94 | 35.27 | 35.60 |
| 20 | 35.94 | 36.27 | 36.60 | 36.94 | 37.28 | 37.62 | 37.96 | 38.31 |
| 21 | 38.65 | 39.00 | 39.34 | 39.69 | 40.04 | 40.39 | 40.73 | 41.09 |
| 22 | 41.43 | 41.78 | 42.13 | 42.49 | 42.84 | 43.20 | 43.56 | 43.92 |
| 23 | 44.28 | 44.64 | 45.00 | 45.38 | 45.71 | 46.08 | 46.43 | 46.81 |
| 24 | 47.18 | 47.55 | 47.91 | 48.28 | 48.65 | 49.02 | 49.39 | 49.76 |

When the water has reached its greatest height, a careful measurement can be made of its depth, from the top of the stake to the surface of the water. The dotted line (C) represents the level or top of the running water, and the distance between this line or level of water and the top of stake gives the true depth or spill over the weir-board; because if measured directly on the notch, the curvature of water would reduce the depth. The surface of water after passing away from the board should not be nearer the notch (B) than ten or fifteen inches, depending on the size of stream and quantity of water flowing.

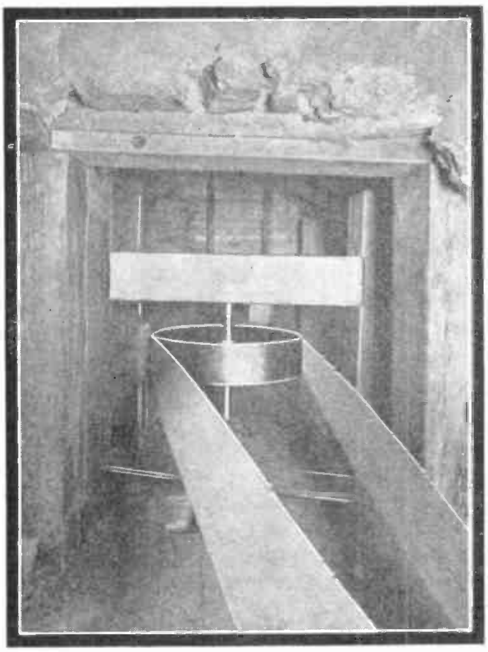
The nature of the channel above the board should not be such as to force or hurry the water to the board; but must be wide beyond the ends of the notch and deep enough below the bottom of the notch to allow the water to approach the notch quietly. If it is otherwise, there will be a larger quantity forced over the notch than the weir table accompanying this article indicates, and consequently unreliable results will be obtained.

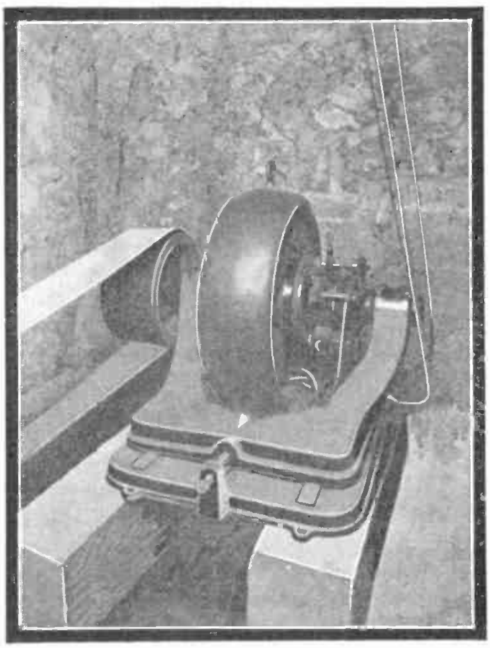
The weir table contains figures 1, 2, 3, etc., in the first vertical column; these indicate the inches depth of water running over weir-board notches. Frequently the depths measured represent also fractional inches, between 1 and 2, 2 and 3, and 3 and 4, and so on. The horizontal line of fractions at the top represents these fractional parts of an inch by eighths for all depths from one to 25 inches. Each of these results is for only a one-inch width of weir. To estimate, therefore, for any width of weir, the result obtained for one-inch width must be multiplied by the number of inches constituting the whole horizontal length of weir.

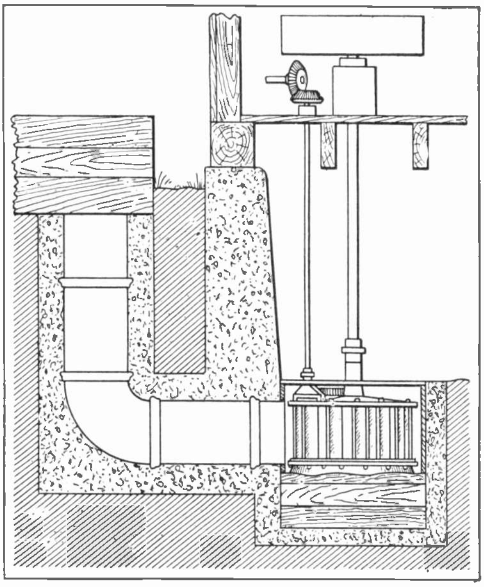

THE HEADRACE

In applying the weir to the Pequamsagin creek and allowing the notch to be 20 inches wide, the water measured 5¼ inches over the stake. Referring to the first vertical column in the table and choosing five and taking the fraction ¼ at the top where the vertical column meets the horizontal the square gives 4.84 as the number of cubic feet of water per minute passing for each one inch of the weir width, consequently 20 times 4.84 gives nearly 97 cubic feet of water per minute available.

Having found the water available, the water marks on the old head race, some of which yet survived in a dilapidated condition, indicated that a 17-foot head could be obtained by building a dam on the site of the old one. Accordingly a concrete structure was determined upon, as the right sand for its construction could be obtained from a hillside a few rods away. A wooden


PULLEY AND BELT WHICH TRANSMITS THE POWER TO THE DYNAMO


THE DYNAMO



ARRANGEMENT OF THE PENSTOCK AND TURBINE

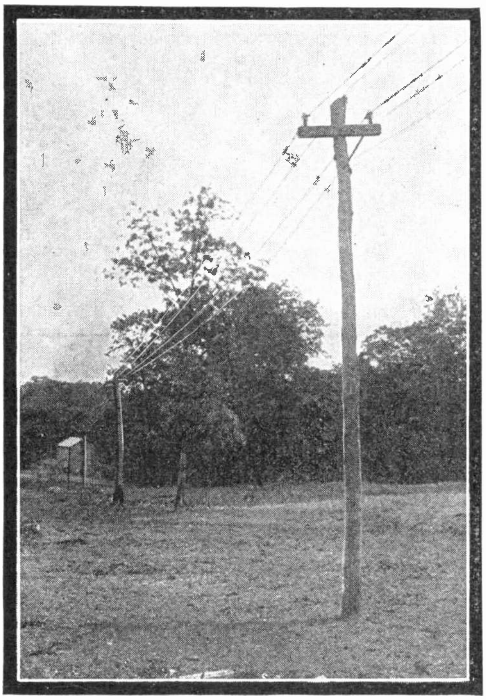
form was built from bank to bank across the bed of the stream and capable of receiving cement to form the dam which is 130 feet in length along the top, eleven feet in height, measuring from the center of the bed of the stream to the top of the wall, and 24 inches thick. The picture shows the dam after completion and also a concrete brace on the lower side.

A rather amusing problem and yet one that gave the builders some trouble before it was solved was how to close up a 24 by 24 inch hole left in the wooden form and also in the concrete at the lowest point of the dam for the water to flow through during construction. A heavy board somewhat larger than the opening was prepared and felt tacked upon it where it would come against the edge of the opening. While two men crowded this against the opening from the lower side others filled in with cement on the upper side of the dam. The water rose too rapidly for the two men to keep the board in position and the concrete was washed out. The next scheme succeeded. The same board was placed over the opening on the upper side of the dam and a five-inch cylinder of wood having a one-inch hole through it was laid in on the lower side of the opening to take away any water leaking in around the edges. Cement was filled in about the cylinder and as soon as this hardened a wooden plug was driven into the one inch hole and the dam was now water tight.

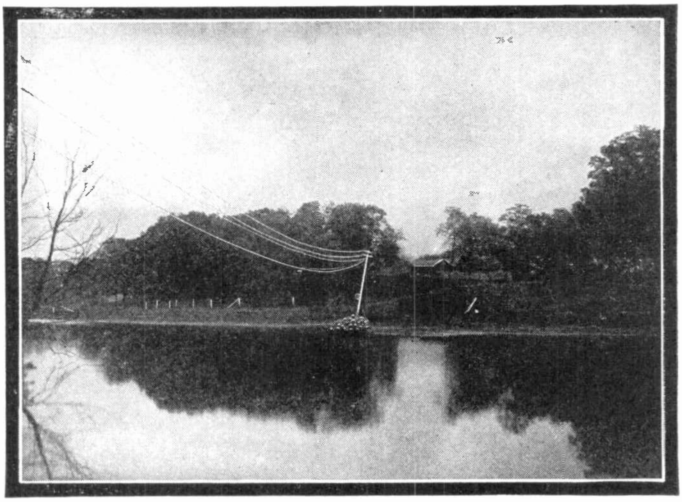
The headrace is of concrete and is five feet deep by 4½ feet wide and terminates in a penstock at the power house. At both ends of the race are metal bar screens to prevent leaves, sticks, etc., from entering the penstock. The penstock is made of about an 18-inch tube of tile set vertically and terminating in an elbow into the casing about the wheel. This tile is surrounded by concrete as is also the casing and the 17-inch Sampson turbine wheel.

A 40-inch horizontal metal pulley on the verticle shaft of the turbine conveys its power to a vertical wooden pulley on the generator by a belt making a quarter turn and this operates very satisfactorily and does away with shafting and bevel gears. This generator is a direct current Fort Wayne "Wood" rated at twelve kilowatts and 220 volts at 950 revolutions per minute.

The power house is constructed partly of stone and mortar and partly of wood. From the generator which is set solidly upon two 8 by 10-inch timbers, two No. 2 wires run to fuses upon the wall and thence through



A SECTION OF THE TRANSMISSION LINE



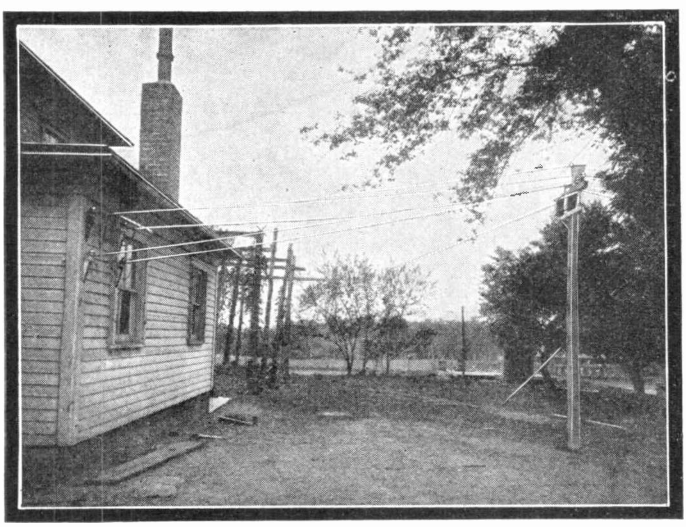
TRANSMISSION LINE CROSSING THE STREAM

porcelain tubes to glass insulators on wooden brackets on the outside of the building, thence to the pole line. Number 2 bare copper is used on the pole line. Enclosed cartridge fuses are installed on the main line wires at the power house, the main switch being upon the switchboard up at the house. A Garton lightning arrester is installed on each line wire just inside the power house and the ground wire securely connected to the metal of the waterwheel. Two more arresters are placed on the last pole before the line wires enter the house, the ground wire for these being run to the pipe of a nearby deep-well pump. Before the two sets of arresters were installed some trouble was experienced from lightning, but since this protection was added, there has been no mishap.

The poles of the line are of oak ranging in length from 20 to 25 feet and are set about four feet in the ground. Wooden cross-arms having one metal brace and glass insulators carry the wires. The third wire seen on the middle insulator of the pole runs from the field of the dynamo to a rheostat on the switchboard at the house, from which point the field current is controlled.

The switchboard which is of Fort Wayne make is of slate substantially mounted on iron posts and secured two feet from the wall by iron braces. Upon the board are mounted a metal-clad voltmeter and an ammeter. The main line wires from the power house connect to 65-ampere fuses and a main service switch. From two small copper bus-bars on the back of the board one circuit is taken off through fuses and a 50-ampere switch for motor circuits. Another circuit through fuses and a 35-ampere switch controls the lighting circuits, branch circuits being protected by small porcelain encased cartridge plug fuses. The switchboard is situated in a room off the sitting room, for Mrs. Crosiar is "chief engineer" of the plant and besides regulating the voltage she starts and stops the generator by an ingenious arrangement shown in one of the illustrations.

A handwheel and a grooved metal wheel are used to operate a wire rope which runs through blocks on the poles from the house to the plant. At the plant this rope runs into the power house and around a grooved wheel on a horizontal shaft having at the



WHERE THE WIRES ENTER THE HOUSE

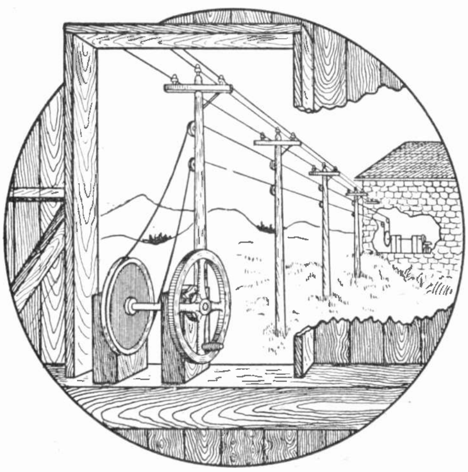
other end a bevel gear. The vertical shaft from the bevel gear regulates the opening and closing of the vanes of the wheel in the penstock and the flow of water to the wheel may be thus started, stopped or regulated. By means of push-buttons and bells located in the barn corn-crib, creamery, etc., and in the case of the cow-barn a dinner bell hung on the outside, Mrs. Crosiar is kept informed of what is wanted by prearranged signals and knows when motors are to be started or shut off and when the field rheostat on the switchboard needs attention.

The total cost of the equipment is as follows:

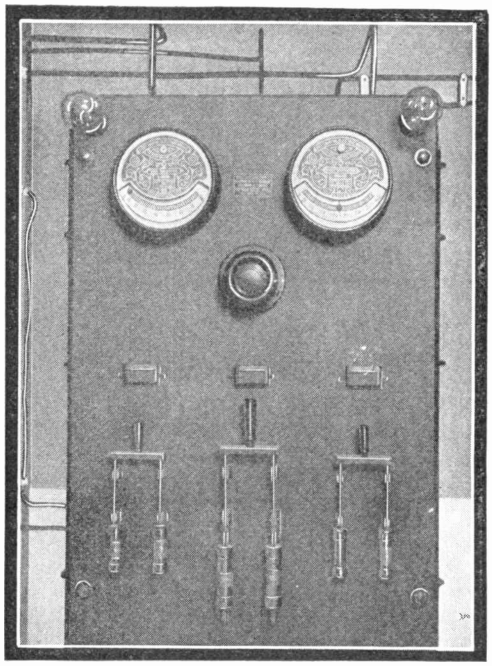
| | |
|---|---|
| Powerhouse | $ 115.00 |
| Dynamo | 245.00 |
| Turbine wheel and 40-in. pulley | 205.00 |
| Repairing old headrace and tailrace | 225.00 |
| Building Penstock | 200.00 |
| Pole line and wire | 175.00 |
| Switchboard | 78.00 |
| Dam | 450.00 |
| Total | $1,693.00 |

The above does not include motors, cream separator and other apparatus which Mr. Crosiar states made the entire cost of the plant and equipment reach $2,500. His friends sometimes tell him that this is a good deal of money to invest in such a plant, but he usually gets even by telling them that this represents his automobile money.

In the house electricity has been made to do everything possible. The dwelling is a large typical two-story farm house with



METHOD BY WHICH MRS. CROSIAR STARTS AND STOPS THE TURBINE



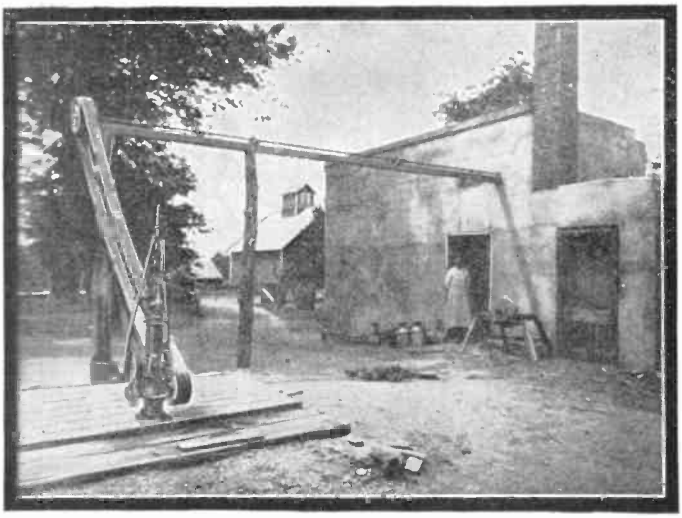
SWITCHBOARD WHICH IS LOCATED IN THE FARMHOUSE

recessed porches. The wiring is knob and tube work, some of the boards on the second floor being removed to run the circuits. Number 14 B. & S. gauge rubber covered wire is used on concealed work. Where knobs and tubes could not be used, the wires are fished in loom from outlet to outlet. Both tungsten and carbon filament lamps are provided, the latter being installed where liable to be subjected to shock or rough usage. The voltage being 220, and 110-volt lamps being used, the circuits are wired so that two lamps are in series.

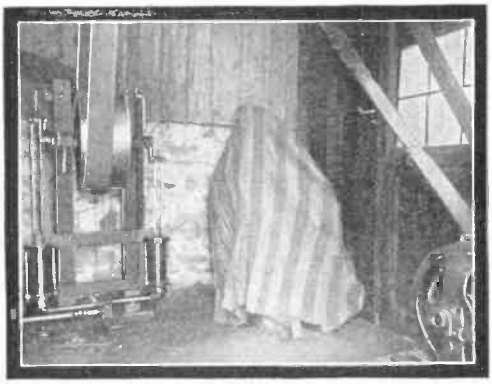
Every room is provided with a heavy current receptacle into which may be placed an attachment plug for a 1500-watt luminous radiator or the vacuum cleaner. The radiator proved its usefulness this past spring during the baby's sickness when the room was kept warm and at an even temperature and was lighted without the obnoxious fumes of an oil lamp.

Mrs. Crosiar does her ironing with an electric iron and of the convenience of electricity says: "I have once or twice been obliged to use the ordinary flatiron to do the ironing and I can assure you that it is then that the housework drags. At first the electric iron was new to me but now I am lost without it. I do my ironing when the plant is supplying current for some other purpose also. And the luminous radiator is one of the handiest things to move to a cold room in the fall or spring and saves coal and fussing with a stove."

In the outbuildings lights and switches are scattered about where convenience dictates. The grain house uses its share of current. When a wagon load of corn is driven in upon the floor the rear wheels are stopped on

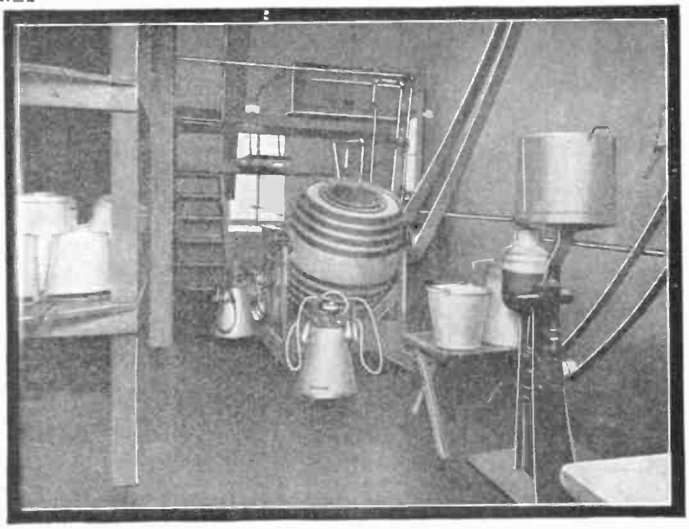


AN ELECTRIC MOTOR RUNS THE PUMP

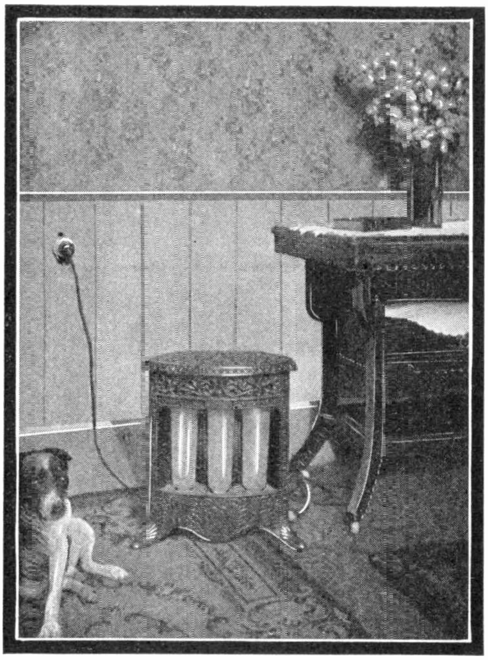


MOTOR DRIVEN VACUUM PUMP FOR THE MILKING MACHINES

certain boards. By turning a handwheel on the wall the rear wheels of the wagon are lowered into the floor, and with the end board of the wagon removed, the corn runs out the rear end and through a trap-door opening in the floor into a big hopper below. This hopper terminates in an elevator similar to those used in grain elevators. This elevator is run by a nine horsepower motor and conveys the grain to the second floor, where through an adjustable metal spout the grain is put into bins. On the second floor also is located a feed grinder which is motor driven, the ground feed being stored in second-floor bins terminating in spouts on the first floor from which the feed is taken in bags when needed. Mr. Crosiar also uses the grain elevator to load grain on the wagon. Each bin in the building is equipped with a spout leading to the grain hopper in the basement. Grain from any bin desired is let into the hopper and the grain elevator then carries it up and drops it through an adjustable spout into the wagon.



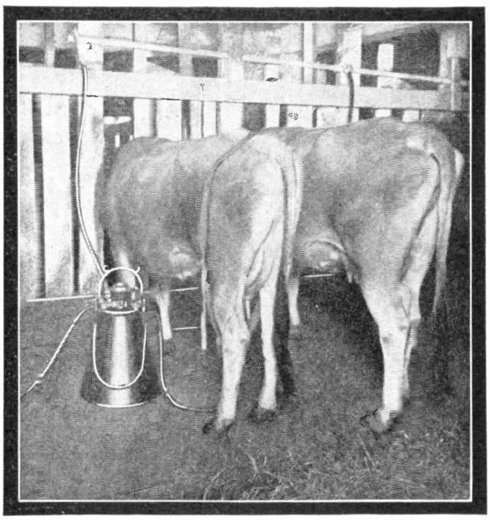
MOTOR OPERATED CHURN AND SEPARATOR



COMFORT BY THE ELECTRIC RADIATOR

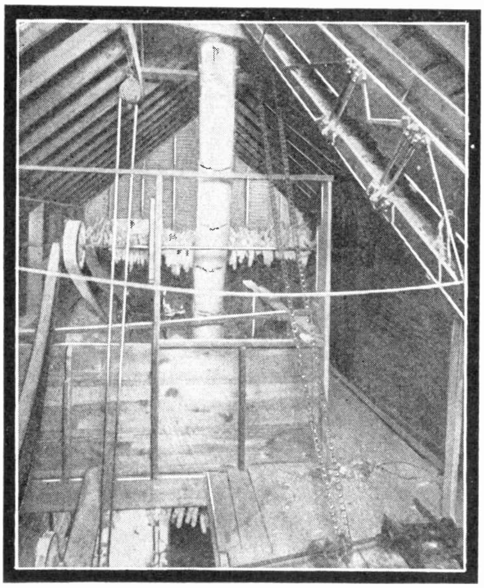
Just outside the grain barn stands a circle saw which may be belted to the motor in the barn to cut the winter's wood.

A short distance in the rear of the farmhouse is the creamery containing a large galvanized iron water tank near the ceiling, a cream separator, a big churn and shelving for the electric milking machines. Upon a platform from a side wall is a three horsepower motor which runs a jack shaft. From this shaft is operated the cream separator, grindstone and churn. The churning is done twice a week with an average of 80 pounds of butter to the churning, which at present is disposed of at around 30 cents a pound or close to $25.00.



THEY RATHER ENJOY BEING ELECTRICALLY MILKED

In the yard between the creamery and house is a deep well pump driven by the creamery motor by means of a shaft and belt shown in the picture. Throwing a lever on the pump in one direction pumps water into the creamery tank; throwing the lever in the other direction the water is pumped into a tank in the house.

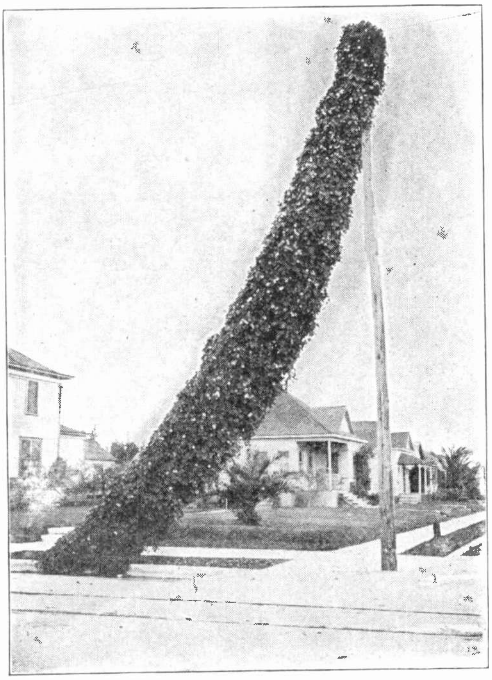


MOTOR OPERATED GRAIN ELEVATOR

But it was nearly four o'clock, almost milking time. Loading the two milking machines and milk pails into a two-wheeled handcart, we made our way to the cow-barn where long rows of stanchions are ready to receive the heads of the cows to be milked. Over across the creek on the grassy hillside 26 Jerseys roused themselves at the call of "Co-boss" and as if in mute approval of "milking the electric way" hurried across the creek and up the hill, each taking her right place in the barn. Stepping to the corner of the barn Mr. Crosiar rang a bell which summoned the "chief engineer" at the house to the switchboard and in half a minute current was on the line to supply the motor running the vacuum pump for milking. Four cows were milked at a time and seemed to enjoy the process.

## Garlands for Telephone Poles

The unsightly appearance of telephone poles in residential neighborhoods can be modified until they are actually things of beauty by planting morning glories about the base. In this case the guy wire was decorated in this novel manner, but often the poles are covered in the same way. A mass of beautiful flowers and green foliage suspended in this way is an ornament rather than an eyesore to any street.



BEAUTIFYING A GUY WIRE

## Circus Uses Electric Sign

An electric sign as a part of a circus equipment is something out of the ordinary. A circus touring this country carries an electric sign which is erected upon the roof of some building wherever the circus remains longer than a day in the town. Tungsten sign lamps are used, and a flasher causes these to show a bareback rider and horse outlined in rapid motion.

## How Earthquakes Record Time

Man long ago found out that in order to get at many of Nature's secrets he must contrive some plan of catching her at work while he himself slept, or was busy with other occupations. The numerous automatic instruments that we now possess, such as thermometers that register with a pen the variations of temperature, without interruption by day or night, have been invented to supply this want of a sleepless eye in the service of science. Among these inventions is one devised in Italy to make earthquakes and earth tremors record, in clock time, the instant of their own occurrence.

Everybody knows that a seismograph is an instrument in which a delicately suspended pointer marks the oscillations due to any shaking of the earth's surface. Cancani added to the seismograph a contrivance by means of which every earthquake shock makes, together with the telltale drawing of its own oscillations, a photograph of the face of a chronometer, thereby recording its exact time of occurrence.

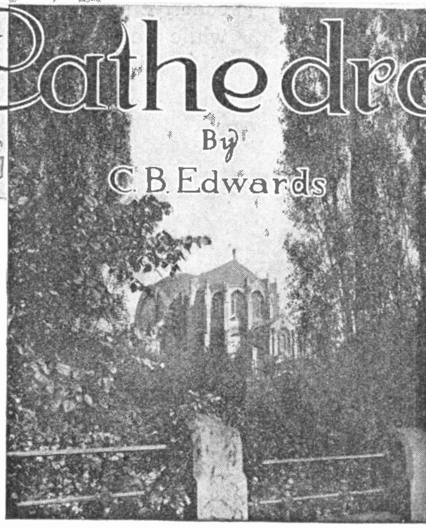
This is affected with the aid of an incandescent electric lamp, connected with a circuit which is only closed when a shock affecting the seismograph causes a lever to form the electric connection. The face of the chronometer is thus brilliantly illuminated for the fraction of a second, and the position of its hands is photographed upon a sensitive plate exposed for the purpose. The instant the shock is over the instrument automatically adjusts itself in readiness for the next disturbance.

## Is the Earth Electrically Charged?

According to investigations made by M. Brunkes in the vertical shaft of a mine at Messeyx, in France, there may be static charges or earth currents of which scientists have not been aware. This experimenter found that by running wires between points 170 and 500 feet below ground he could detect a potential difference of from two-fifths to one-half a volt between these points, the voltage being highest at night. The tests are to be continued in deeper shafts and may throw some new light on the hidden forces that have long been at work.

# America's Greatest Cathedral

By C. B. Edwards

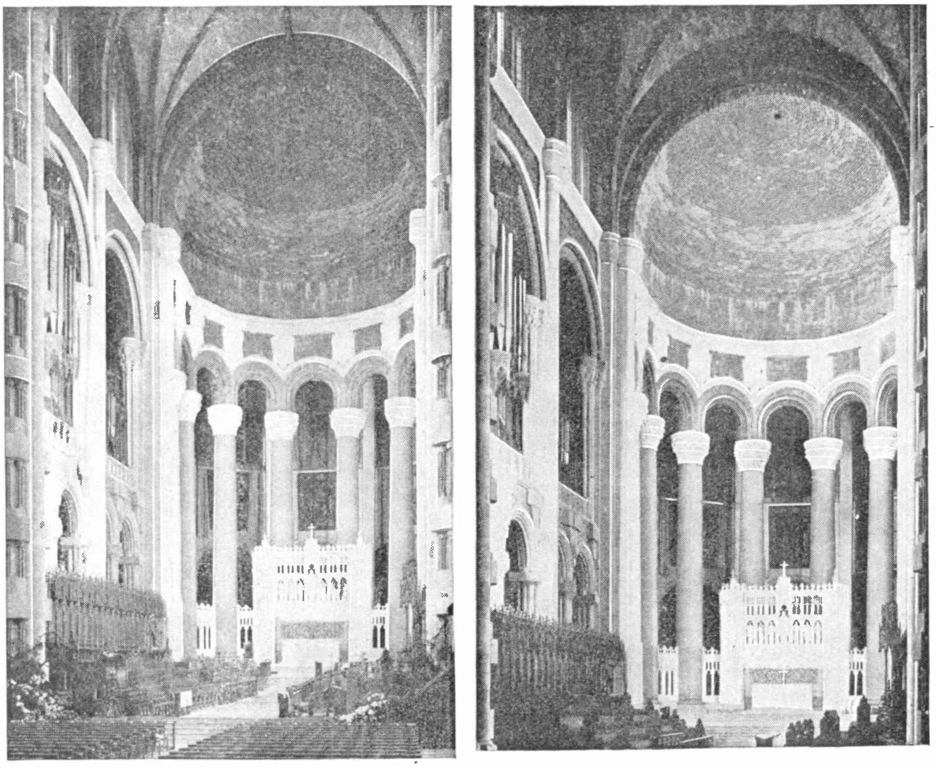


Surpassed in size by only three cathedrals in the Old World, St. Peter's in Rome, and those of Milan and Seville, and the greatest church edifice in this country, the Cathedral of St. John the Divine at Morningside Heights, New York City, was dedicated on April 19th with religious pomp seldom seen in this country. Although it has been under construction for a score of years, to-day only the crossing, choir, and sanctuary with the three adjoining chapels are finished. But from this one may gather to a great degree what the completed structure will look like when it is finally completed some 30 years hence. Over $6,000,000 has been expended on the work and yet the gigantic structure rising over 100 feet above the smoke and din of the huge city at its feet stands "only in the rough," so to speak. When it is finally completed it will be the only church edifice in this country that will stand comparison with the ancient cathedrals of Europe.

It is hardly possible for the reader to realize the immense size of this first great American cathedral. But when he ponders over the fact that a ten-story building of considerable size could be placed in the sanctuary and still not appear to be cramped, he can realize the immense proportions of the building. While the structure on completion will take its place as the fourth largest in the world in point of size, it will be first when the question of modern conveniences and electrical illumination is raised.

It has been the custom for the cathedrals of Europe to be dimly and somewhat gloomily lighted, simply because it seemed to be impossible to devise a lighting scheme that harmonized with and did not detract from the massive architecture and perspective of these impressive domes. Because of this fact the public has grown to consider the inefficient and crude methods of lighting in these cathedrals of other countries as contributing to their religious atmosphere. In the Cathedral of St. John the Divine the architects and promoting Episcopal faith have pursued the broad-minded course of adapting every convenience that the hand of man has devised along either electrical or mechanical lines to their needs without regard to the timeworn customs. The result has been truly wonderful. The great organ situated in the sanctuary, the largest in the world, peals forth its thunderous notes with air compressed by electric motors. The great dome, crossing and archways commencing with barely a glimmer of light at the pressure of a button grow into dazzling brightness as the battery of "dimmers" below allow the full current to flow through the hundreds of lamps which illuminate the church with even more splendor by night than by day.

One of the most generally believed fallacies in regard to the lighting of buildings is the notion that daylight is the ideal and that all that can be accomplished with artificial lighting is the simulating or reproducing of daylight effects. With electric lighting developed to its present stage this is not the case. Plans can now be made for a definite, unchangeable intensity of the light and one that will not shift in direction from hour to hour. Moreover, the light can be thrown where it may be most needed, instead of having the direction of the light and the consequent difference in prominence of various parts of the interior depend on the location of the windows. The illumination of the cathedral is an excellent example of this flexibility of the electric lighting system. As seen by the two pictures of the dome, during the day the columns and the reredos behind the altar stand out almost glaringly, while the beautiful dome is too dimly lighted to show all of its grandeur. But at night the lighting easily allows the dome to have its proper share of prominence without detracting from the beauty of the lower portions.

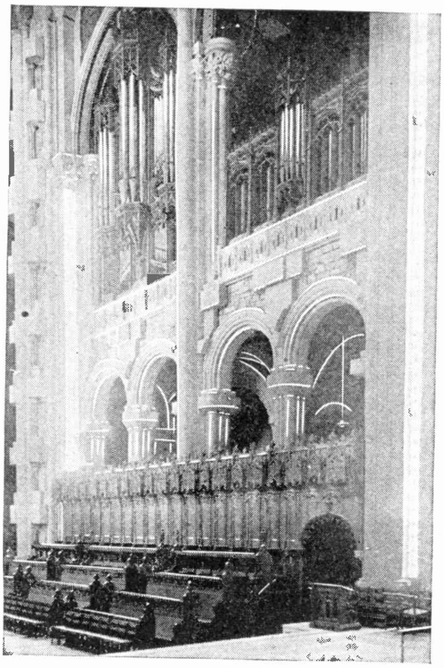


ELECTRICAL ILLUMINATION BRINGS OUT THE FEATURES OF THE DOME BETTER THAN DAYLIGHT. THE PICTURE ON THE LEFT WAS TAKEN BY SUNLIGHT AND THE ONE ON THE RIGHT BY ELECTRIC LIGHTS ONLY

In the cathedral the only sources of illumination are two strips of reflectors, ingeniously concealed behind the sanctuary pier and over the tympanum of the huge arch 120 feet above the floor. Tungsten lamps spaced one foot apart are used in these reflectors and the effect is as if a group of powerful search-lights were trained on the huge columns and colossal dome. An interesting feature of this installation is the clever scheme for the relamping of the reflectors worked out by the engineer, James R. Moore, with the aid of I. P. Frink. So great is the height of the sanctuary piers and tympanum of the arch that it proved impossible to relamp by ordinary means. It was impossible to build a scaffold each time the lamps were renewed, and extremely inconvenient to do so by means of swinging baskets. The difficulty was overcome by the installation of a complex system of tracks, with suitable switching arrangements whereby, by means of an automatic windlass, any one of the six sections of the arch can be lowered to the floor after being snapped out on the track, relamped and again whisked back to its proper position.

In the section at the apex of the dome which is close to 200 feet above the floor, a small hole is made in the brickwork, so that a person above the dome may reach the lamps of the top section as they pass back and forth. That this complicated mechanism works with such precision that not a panel of the silver plated corrugated glass, which is used as a reflecting surface for the reflectors, has been broken in raising and lowering the various sections, is proof of the efficiency of the ingenious device.

One of the most difficult problems of the installation was the installing of the reflectors. In any building, practically the final work is the installing of the lighting equipment, and for this reason, when the cathedral was ready for the placing of the reflectors, all the scaffolding for the dome had been taken down. It was necessary, therefore, for the men to work in swinging baskets, fastened only by means of iron pegs driven into the brickwork of the dome. As much of the work was considerably above the height of 100 feet, ordinary electricians were unable to install this work, and it was necessary for a man to have both practical knowledge in electrical devices and more or less the experience of a steeple jack. The installing of the reflectors consumed a period of three months and formed an interesting and novel sight to the visitors.



ILLUMINATION OF THE CHOIR AND SANCTUARY

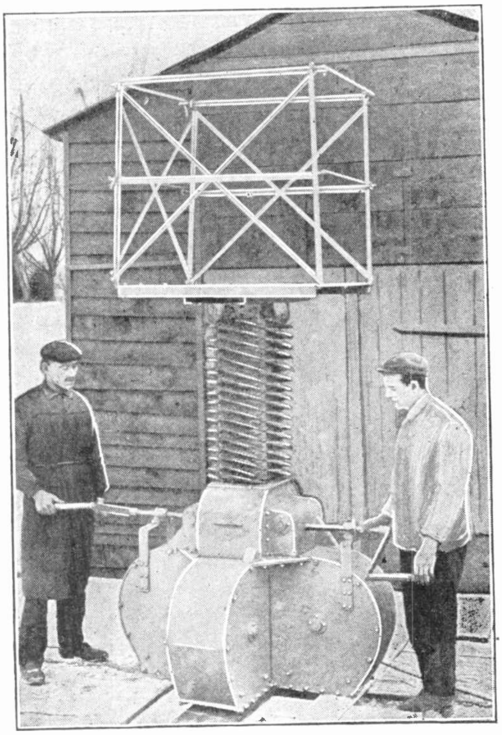
The choir and sanctuary are lighted chiefly by the strips hidden behind the piers and numerous pockets in the floor are also placed in the mosaic tiling of the choir and sanctuary floor wherever fixtures are apt to be desired. The strips used in lighting the sanctuary are in 24 foot sections and on each side of the piers are 68 tungsten lamps rated at sixteen candle power each.

A unique feature is involved in the lighting of the canopies surrounding the stalls of the clergy. A number of openings are made in the canopies covered by glass of the same color as the canopy and oak wood of which the screens are constructed. These glass covered openings are entirely invisible by day on account of their color and finish, but at night 21 lamps hidden in these openings shine through with a surprisingly beautiful appearance.

The control of the lighting of the choir and sanctuary, which is easily the most important feature of the installation, is effected through special remote control switches. The control is centralized in a push button board in the rear of the choir screens, and other switches are located to one side of the great organ, thus giving the organist also control of the lighting of the choir. A pilot lamp near the push button serves to show whether all or part of the lamps are in circuit and whether the automatic switches are open or closed before starting the motor that actuates the "dimmers."

## A Jack-in-the-Box Mast

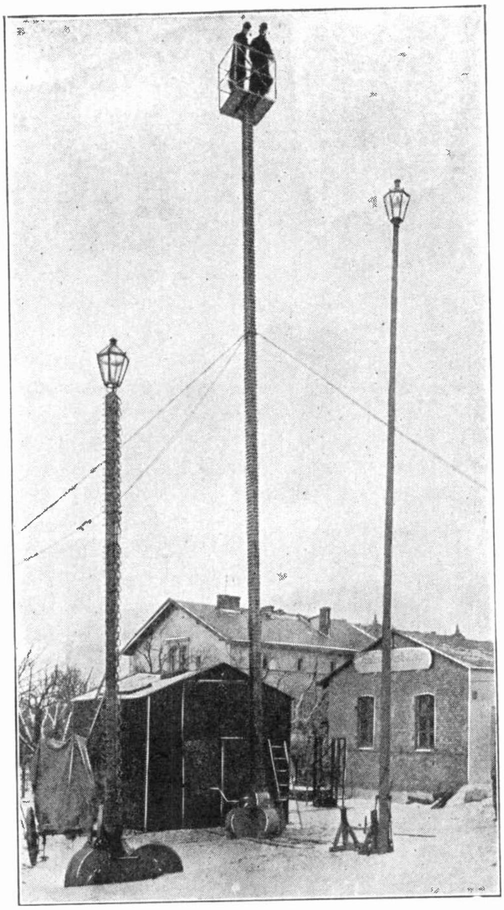
The new Fontana steel mast may be called on to produce effects which are almost sensational. By simply turning a crank a strong steel column shoots up into



THE FONTANA STEEL MAST CLOSED

the air, bearing two men, a light gun, searchlight or wireless apparatus to a height of 70 or 80 feet, and it descends again as quickly as it rose. It is the invention of German engineers, and is the object of much attention in army and electrical circles at present.

It finds quite a number of uses in the electrical field, and one of these is for wireless telegraphy where a mast carrying an aerial wire can be raised at a moment's notice. Such a mast takes up very little room



FONTANA STEEL MAST EXTENDED

and can be carried about by hand or on a wheeled truck. No doubt it will soon be fitted on a special automobile. We could imagine it as entering into a thrilling tale where an officer suddenly appears on the spot and projects a powerful searchlight which gives the clue to some mysterious affair or else sends a wireless message.

What is new about the Fontana mast is that it does not telescope, but is made up of four thin steel bands each wound on a drum. When the four drums are turned, the bands rise and form a hollow steel column by means of their interlocking teeth, and at the same time this is strengthened by light steel disks which act as brace plates and are fitted on automatically as the mast rises, so that the whole is very strong and will carry a great weight. This is a new principle which does not seem to have been used up to the present.

# Five Epoch-Making Electrical Inventions

By ELMER E. BURNS

## V. WIRELESS TELEGRAPHY

The earliest form of telegraph was wireless. The semaphore signal described in the first article conveyed the message without wires. At an earlier time the only telegraph known was a bonfire on a hilltop. Whether a bonfire or a semaphore was used, light was the conveyor of the message. The receiver was the human eye. Strangely enough the wireless telegraph of today uses an exactly similar form of radiation. At first the world was amazed that a message could be sent and received without connecting wires. The relation between the light from the bonfire and the radiation from the wireless sending apparatus was not seen because the human eye could discern the one but not the other. It was not strange that the light from the bonfire should go out in all directions and so convey a message wherever the receiving party might be, not strange because common. It was strange, almost surpassing belief, that the radiation from an electric discharge should go out in all directions without wires to guide it.

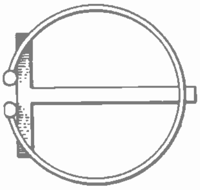
This is no fanciful comparison. Light and electro-magnetic radiation are one and the same thing. Faraday with the vision of a genius first caught a glimpse of this truth. With him it was only an intuition. Early in his career Faraday suggested that vibrations, which in a certain theory are assumed to account for radiation and radiant phenomena, may occur in the lines of force which, he said, connect particles of matter together. What Faraday saw by intuition, Maxwell demonstrated to a practical certainty. It is not true as sometimes stated that Maxwell proved that light waves and electric waves are identical. What he did prove was that an electrical disturbance such as that sent out from a stroke of lightning or a Leyden jar discharge travels through space in the form of waves with a speed equal to that of light.

The speed with which light travels had been carefully measured and was known to be 186,000 miles in a second. Before electric waves had been detected by instruments of any kind, Maxwell proved mathematically that such waves travel with the same speed as light waves. This made it highly probable that electric waves and light waves are of the same kind. When it was shown later that electric waves act in every respect like light waves the identity was established. Light waves and electric waves differ only in length, as ripples on a pool differ in size but not in kind from ocean waves. Sixty thousand of the shortest light waves following one after the other occupy the space of an inch. One electric wave may be many miles in length.

Maxwell knew that electric waves can be reflected, that they are bent on passing through certain substances as light is bent on passing through the lens of a telescope. He knew that an electrical discharge such as a discharge from an electrical machine or a Leyden jar is not a discharge in one direction but a rapid surging back and forth. It consists of many discharges following one after another so rapidly that they appear to be one discharge. It is an alternating discharge changing direction millions of times in a second. This alternating discharge produces a disturbance which travels in the form of waves through space.

All this was known before electromagnetic waves, or as they are more commonly called electric waves, were detected by any instrument. It was known how to produce such waves of any desired length from a foot to many miles and how such waves are produced in nature up to thousands of miles in length.

It was not enough to know that from every stroke of lightning, from every discharge of a Leyden jar or electrical machine there goes forth a strange invisible light, a form of radiation of the same nature as the light which affects our eyes but consisting of longer waves. To capture these waves and make them produce effects that the eye could see or the ear could hear was the next step to be taken. This first step toward the practical application of electric waves in wireless telegraphy was the work of Heinrich Hertz, professor of physics in the technical high school at Karlsruhe, Germany. A prize was offered in 1879 to the scientist who should successfully conduct a certain electrical investigation. Hertz attempted the investigation but at first without success. He was alert, however, for anything relating to the subject which had to do with electric radiation. While in this state of mind he was performing lecture experiments with a pair of Reiss's spirals, short flat coils of insulated wire. He noticed that the discharge of a small Leyden jar or a small induction coil passed through one of the spirals caused a spark to pass across a small gap in the other. This observation was the experimental starting point of wireless telegraphy. Here were electric waves producing a visible effect. Hertz followed the clew by placing conductors of different forms in the path of the electric waves, conductors in which he believed there might occur electric oscillations induced by the waves.



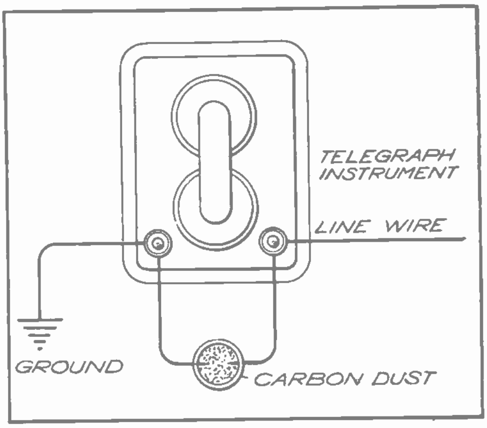
HERTZ'S RECEIVER

The transmitter used by Hertz was a static electrical machine, the two knobs between which the discharge took place being connected to two large spheres in order to intensify the waves. The receiver was a circle of copper wire with a small spark gap. The electric waves passing over the circle caused a surging of electricity in the wire like that in the discharge of the transmitter. This surging was strong enough to break across the spark gap and produce very small sparks. This was an important result. It proved by actual observation the existence of electric waves which Maxwell had proven by mathematics. It was the beginning of wireless telegraphy.

But Hertz did not stop with a proof of the existence of electric waves. He measured the length of waves from different sources. He showed that the waves travel in straight lines like light, that they cannot pass through metals but are reflected by them, that a plate of metal forms a screen behind which there is an electric shadow because the electric waves are stopped by such a screen as light is stopped by any opaque object. He showed that electric waves can pass through wooden doors and stone walls. A stone wall is transparent to electric waves as glass is transparent to light. He made a prism of pitch weighing 1,200 pounds and found that electric waves are bent on passing through such a prism as light is bent on passing through a glass prism.

The receiver used by Hertz was not suitable for a practical wireless telegraph. A more sensitive detector was needed. The first detector with sufficient sensitiveness was the coherer invented in a practical form by Edward Branly of the Catholic University of Paris. Coherer action was probably discovered by Varley in England. Varley employed a coherer as a proctection for telegraph apparatus. He found that finely powdered charcoal will not conduct any appreciable current at low tension, but at high tension the particles cling together making good electrical contact and forming a bridge across which the current freely passes. He constructed a "lightning bridge" of carbon particles so that under the high pressure of a lightning stroke the discharge would take place across the bridge and not through the telegraph instrument.

An Italian professor, Calzecchi-Onesti, made further discoveries concerning the coherer principle, and Professor Branly, taking Onesti's observations as the starting point, developed the coherer and discovered the fact, vital in wireless telegraphy, that the conducting power imparted to filings by electric waves can be destroyed by simply shaking or tapping them.




VARLEY'S "LIGHTNING BRIDGE"

The action of the coherer might be likened to a peculiar form of electric welding. Under the influence of the electric waves the metal filings used in the Marconi coherer are made to stick together, or cohere, temporarily so that they form a good conductor of the electric current. A battery current flowing through the coherer gives the signal. This battery current may be made to ring a bell or give any form of signal desired. The battery current has nothing to do with the cohering of the filings. In fact the battery may be connected to the coherer after the electric waves have caused the filings to coherer and the current will flow readily, giving the signal as before.

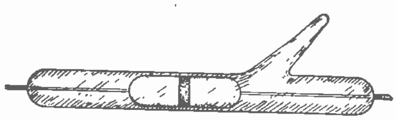
Cohering action may be seen in many forms. A room may be cleared of smoke by a very strong electric charge. If an electrified rod of glass, sealing wax, or ebonite is brought near a small fountain which rises from a smooth round orifice and breaks into a jet of fine spray, the spray will cohere and fall in great drops of water. Perhaps the shower of large drops that sometimes precedes a thunder storm is the result of cohering action.

In 1895 Popoff, in Russia, made experiments with an apparatus very similar to that of Marconi. One purpose of Popoff's work was a study of the electricity of the atmosphere. For this purpose he used an "exploring rod," a wire extending upward a considerable distance. Popoff's exploring rod was the origin of the antenna of the present day wireless equipment.

There were predictions of a telegraph without connecting wires before the time of Marconi. The possibility of using electric waves in space telegraphy was suggested by Professor Threlfall of Sydney, Australia, in 1890. In 1892, Sir William Crooks said, referring to electric waves: "Here is revealed the bewildering possibility of telegraphy without wires, posts, cables, or any of our present costly appliances." The discoveries already discussed provided the elements of such a telegraph. There was needed a man who should combine the elements, increase their power, and prove the practicability of telegraphing by means of electric waves. This was the work of Marconi. Though others had discovered the essential elements, and predictions of the invention had been made, we are justified in regarding Marconi as the inventor of wireless telegraphy. A dream is not an invention if it ends in a dream. A device mechanically perfect but which does not meet practical requirements is not an invention in the real sense. The man who first makes a thing practical is the true inventor.

Guglielmo Marconi was born in Italy, his father Italian, his mother Irish. It was on his father's estate near Bologna, Italy, that he set up his first wireless telegraph. He had studied for a short time in the University of Bologna, becoming familiar with the work of Hertz and others and coming under the personal influence and inspiration of Professor Righi. It was Professor Righi's oscillator that Marconi at first used in his sending instrument. In this oscillator the spark passed through oil instead of through air. He used a modified form of Branly's coherer shown in the figure. The pole pieces were of silver and the space between them was filled with a mixture of sixteen parts of nickel and four of silver, powdered. He used the relay and the antenna, both of which had been used by Popoff. Innumerable details, however, had to be worked out to give the apparatus sufficient power and sensitiveness for practical work.

Marconi patented his invention in Italy in 1895, but not receiving sufficient encouragement there he went to England and continued his experiments until he had developed his system to a commercial basis. His first experiments were in London over a distance of 100 yards and through several walls. A little later he sent messages over a distance of two miles. This was in 1896. In May, 1897, he sent messages across the Bristol channel. In 1898, when the Prince of Wales was confined to his yacht by an accident, communication was kept up between the Prince and his royal mother by means of Marconi apparatus. But Marconi's great ambition was to telegraph across the Atlantic. For this purpose he had a powerful station erected at Poldhu, Ireland. Another station was established at St. Johns' Newfoundland. At the latter



MARCONI'S FIRST COHERER, ACTUAL SIZE

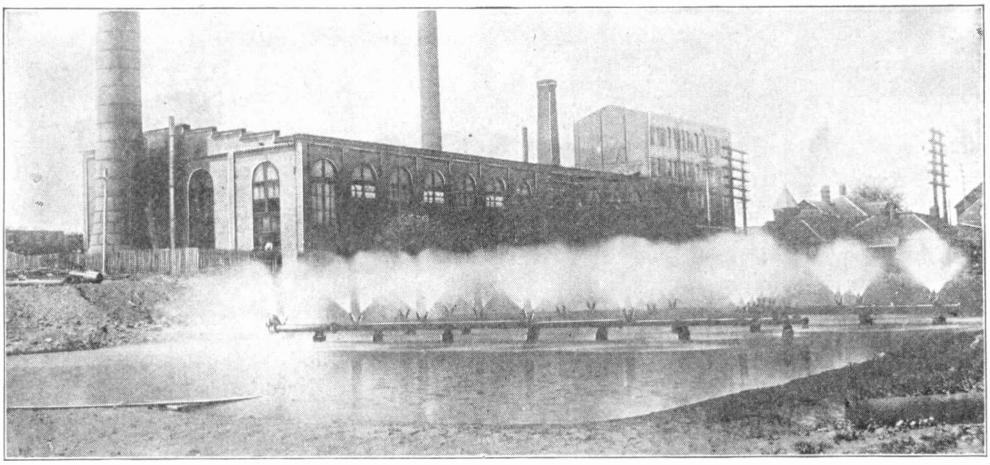
station the aerial wires were held up by a kite which was lashed about by the wind. It was in this decisive test that Marconi's inventive genius was displayed. He knew that the distance could be increased both by increasing the height of the aerial wires and increasing the power of the oscillator. He had discovered the law that governs the relation between height of antenna and distance; namely, that the distance increases very nearly in proportion to the square of the height. Doubling the height of the wires makes the sending distance about four times as great and so on. Though the public doubted and said it was only imagination, Marconi knew that the experiment was successful. A message had traveled over the ocean. This was in December, 1901. It was not long until commercial messages were sent. The first official wireless message across the Atlantic was from President Roosevelt to King Edward on January 19, 1903. The first paid messages sent by wireless passed between Lord Kelvin and Lord Tennyson in England, in 1898.

At this point we may say that the beginning stage had passed and the wireless telegraph had entered upon its commercial career. There have been many developments in the decade and a half since Marconi's early experiments in England; new receivers and other new devices have come into use. Three other important systems are competing with that of Marconi, but this is a story of beginnings only and may here be brought to a close.

## Cooling Water for a Power Plant

The sprays of water in the foreground of the accompanying picture are not fountains to beautify the surroundings of this power plant, although they may have that appearance. They are a means of cooling the condensing water for the big steam turbines in the station.

The plant is at Chattanooga, Tenn. Its location is such that a supply of cold water for the condensers could not be obtained cheaply, so in the old plant the engines were run "non-condensing," as the engineers say; that is, the exhaust steam was allowed to escape into the air.



COOLING THE WATER FOR THE TURBINE CONDENSERS

In the new plant steam turbine generators were installed, and as a great deal more power can be obtained from them if they are allowed to exhaust into a condenser some means had to be devised for cooling the circulating water in the condensing system.

For this purpose a reservoir was constructed in a vacant lot close to the station and pipes carrying a group of 46 spray nozzles, which discharge the hot circulating water from the condensers into the air in the form of a fine spray, were led over the pond.

This arrangement admits of rapid evaporation and cooling of the water, the latter falling to the pond, to be lifted by centrifugal pumps and used over again. The spray nozzles discharge at the rate of 150 gallons per minute, requiring a pressure of 15 pounds.

# Problems of the Circus Electrician

Just as American energy has made possible the traveling circus on its present scale of magnitude so has American determination and ingenuity overcome the handicaps that for a long time barred electricity from the tented show. The up-to-date circus is now making use of electrical power for illumination (by means of both arc and incandescent lights) in all its departments and it is predicted that it is only a question of time until the current will also be called upon to perform other functions,—notably in connection with the operations in the circus kitchens and the circus laundry.

The circumstance that makes the use of electricity by the road show unique from every standpoint is found in the nomadic character of the enterprise. It is not so much that the exhibition is housed in tents, although that does supply a few problems of itself. The rather unstable character of the shelter would be a minor matter if the circus were located at one site for, say a fortnight or a month at a stretch. Indeed we see on every hand electricity successfully used for illuminating and power purposes by small shows, carnivals, merry-go-rounds and similar amusement projects which are carried on under canvas but on sites that are occupied for weeks at a time. Under such circumstances regulation electric light poles are erected and the necessary current is obtained from wires led to the scene by the local commercial electric company or by tapping the lines of an adjacent trolley system.

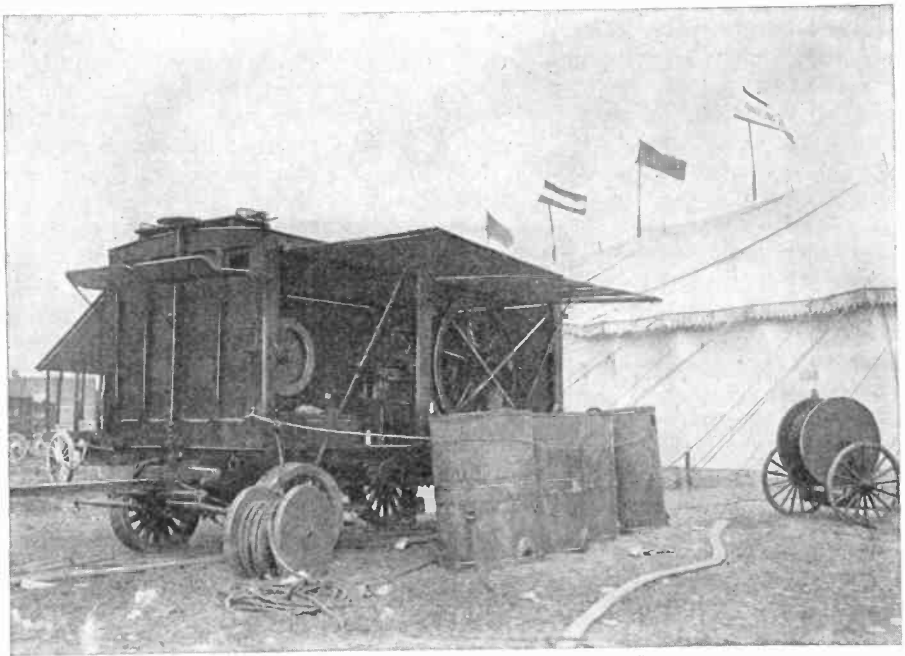
With the great traveling circus, however, the situation is vastly different. Save in exceptional instances performances are given every day in a different town or city. And it must be apparent that it can only be by virtue of the liveliest work on the part of all hands that a vast tented city can be leveled after an evening performance concluding at eleven o'clock, the paraphernalia placed on cars, transported a distance of anywhere from 50 to 150 miles by rail, unloaded and re-erected at a new site ere nine o'clock in the morning at which hour the morning parade claims the attention of practically the entire force of employees. And as though such a hop, skip and jump existence were not enough to baffle the electrical engineer, there is the further necessity for triumphing over all sorts of weather conditions,—even to the extremities of tornadoes and floods.

Thus when one stops to think of it for a moment he will be inclined to give liberal measure of credit to the plucky and resourceful electricians who have made an electric plant an asset of the Twentieth Century circus.

The showmen who first conceived the idea of taking advantage of electricity to illuminate circus grounds and tents originally planned to simply carry the necessary poles, cables, lamps, etc., and to depend for current on a local power company in each city visited. However, investigation and experience demonstrated that this scheme had certain disadvantages from the standpoint of the circus management and thus it came about that the up-to-date show of the first rank is now rendered independent because it carries its own electrical plant complete.

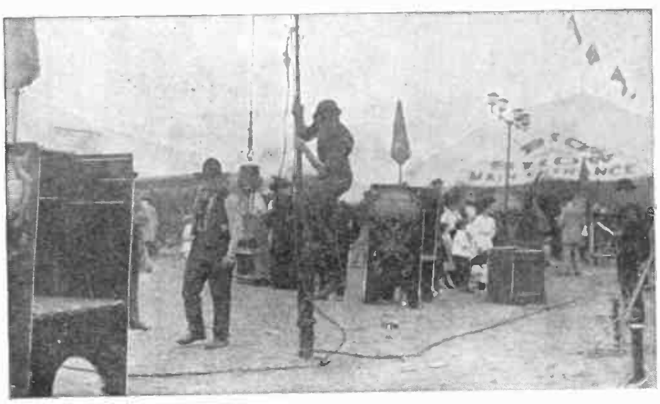
The most interesting feature of this portable electric lighting system is the power house on wheels. When traveling to or from the circus grounds, drawn by eight or ten horses, this great red wagon does not differ in outward appearance from the other heavy circus vans such as are employed for the transportation of tents, seats, etc. But when the wagon is in place close beside the "big top," as the main tent is dubbed in circus parlance, and the sides are raised there is a sudden transformation which is emphasized when four immense water tanks are placed in position beside the wagon. The entire interior of the wagon is given over to a 40 horse-power gasoline engine operating a 30 kilowatt generator, giving direct current.

The generator wagon with its contents weighs between twelve and fourteen tons and is with the single exception of the wagon which carries the center poles, the heaviest vehicle in the circus outfit. However some marvelous



CIRCUS POWER PLANT ON WHEELS

BURYING ELECTRIC CABLE ON THE CIRCUS GROUNDS



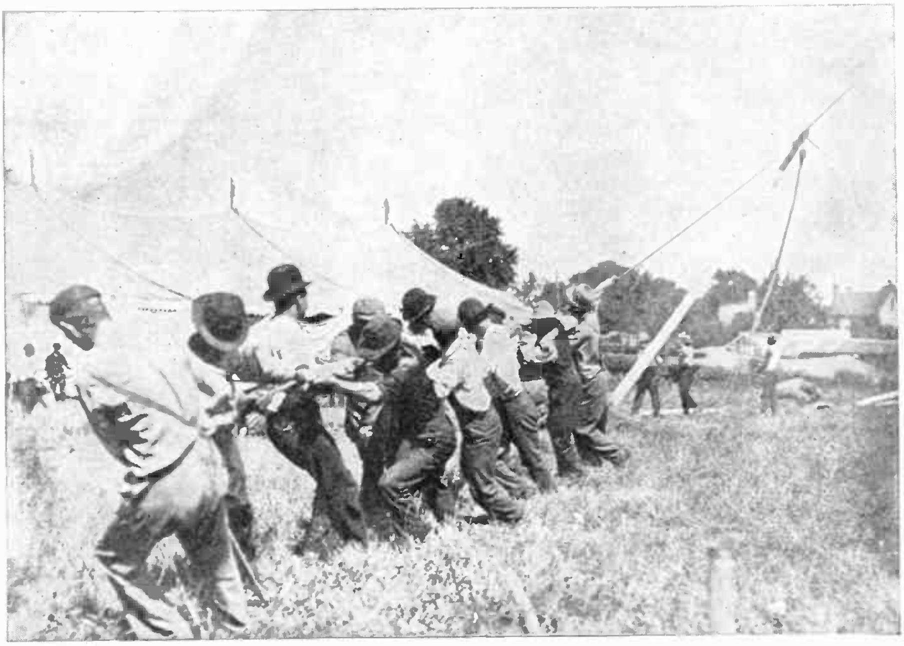
CIRCUS ELECTRICIANS AT WORK HANGING ARC LAMPS feats have been performed in getting it over weak bridges and moving it on muddy roads. Occasionally when a circus "lot" is very soft or muddy and there is a paved street adjacent the portable power house is stationed at a convenient point on the street, there being sufficient cable at hand to meet such an emergency. However, that is a rare occurrence. Ordinarily there is no occasion for ultra-rapid work on the part of the electrical force in making preparations to turn on the current inasmuch as there is no need of illumination until the hour for the evening performance but it is seldom that more than one hour to one hour and a half is required to complete preparations for service and in one instance a record of 34 minutes was established as the total elapsed time between the arrival of the generator wagon on the ground and the turning on of the current.

Electrical illumination in a circus such as Ringlings' is twofold. The primary system for which the power house on wheels supplies current consists of 32 flaming arc lights of 3,500 candle power each. Four of these arcs are mounted on standards in the vicinity of the main entrance to the big show and the side shows whereas the remaining 28 arcs are located in the "big top" or main tent where the circus performance takes place, illuminating the rings and stages, the hippodrome track surrounding them and the seats which have an aggregate capacity of 14,000 to 15,000 spectators. The electrical cables and most of the supports for the arc lamps are carried on the center poles of the big tent and this makes it necessary for the electrical linemen of the circus to work early and late. They must be on hand in the gray dawn to attach their paraphernalia to the big sticks ere they are hoisted into position as the first task of tent raising and similarly they must be on hand to detach the cables, etc., when the poles are leveled at midnight as the final operation in the proverbial silent folding of the tents.

The second function of the fly-by-night electrical plant of the modern circus is to furnish current for some 75 32-candle-power incandescent lamps that are placed in the menagerie tent and inside the wagons occupied by the ticket sellers. In the menagerie the incandescent lamps have solved a problem that long perplexed showmen and have conferred the greatest kind of a boon by making it possible to illuminate the interiors of the animal cages. To put oil lamps in proximity to the straw on the floor of the cages was not to be thought of and on the other hand gasoline or other open-flame illuminants endangered the wooden cages to say nothing of maddening the animals. And yet it was almost imperative to place some sort of an illuminant inside the cages if evening spectators at the show were to be enabled to get a satisfactory view of the animals. The incandescent lamps have pointed the way out of the dilemma very nicely. An average of three lamps are placed in each cage. They are readily installed, adjusted or removed; they do not annoy the animals nor endanger them as would a sputtering open flame and yet they serve the double purpose of showing up the wild beasts to advantage and also of keeping them awake at night, always a problem for the keepers in the old-time poorly lighted tents.

The circus carries heavy electrical cables of varying lengths. The cable which leads from the power plant to the "big top" is 800 feet in length and others are 600, 400 and 300 feet respectively. They are handled expeditiously by means of reels mounted on wheels, suggestive on a large scale of the familiar reels used for garden hose. The cables are never strung on poles but are laid on the ground. Often they are dragged into position over stony ground or laid through the mud but they seem to stand an inordinate amount of hard usage. Where the cables cross parts of the circus grounds where there is heavy traffic it is customary to "bury" them. This process would probably cause any painstaking electrical engineer, who had never been in the show business, to gasp in astonishment. A shallow trench is dug in an incredibly short space of time; the cable is dropped in, and the earth is shoved back in place. The cable is duly buried but it is at a depth of not more than six inches below the surface of the ground. However, this has its advantages when the cable is to be taken up in a hurry.

It might be supposed that the breakage of lamps in circus service would be appalling but this is not the case. To be sure there have been nights when a big show was struck by a hurricane when every lamp in



RAISING THE CENTER POLE WHICH CARRIES THE ELECTRIC CABLES

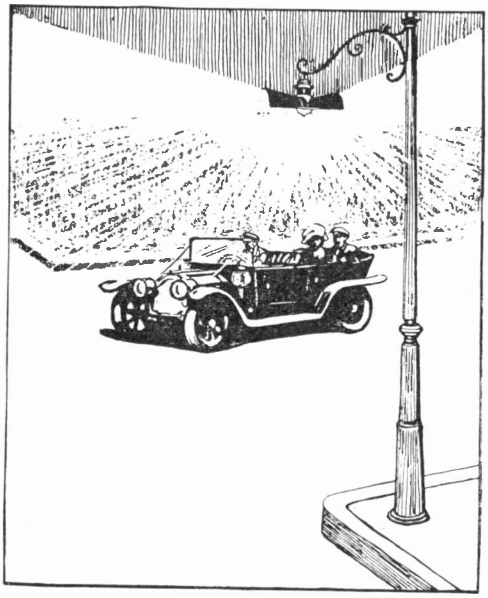
UNPACKING ARC LIGHTS, SHOWING THE STANDARD CASE IN WHICH THEY ARE TRANSPORTED

TYPE OF SEARCHLIGHT USED IN ILLUMINATING THE CIRCUS LOT both the big tents was shattered but then again in ordinary practice there have been instances where an arc light globe has seen two months of continuous service ere it met with mishap. However, all these globes are covered with a protective network of heavy wire which saves them somewhat when the whole tent structure is swinging and swaying on a windy day. No large surplus stock of globes is carried—perhaps no more than a dozen or two arc lamp globes—the circus people depending on obtaining these as needed from supply houses en route. The arc lamps are packed for transportation in heavy wooden cases, four arcs to the case. The circus also carries a couple of electric searchlights for emergency use on dark or stormy nights when all other means of illumination fail and when they are likely to prove of great assistance in connection with the lowering of the tents, the loading of wagons, etc.

The circus makes use of a gasoline illuminating system as well as the electric lighting plant, the same force of about 40 men looking after both installations. The gasoline lights are preferred for certain more or less isolated locations on the show grounds to which it would not be worth while to lay a cable. The time-tried gasoline equipment has also been continued by conservative showmen with the thought that it would save the day should electricity ever fail. It may be explained that any misgivings on this score are not to be attributed to any lack of confidence in electricity for circus uses but simply to the suspicion that the best of gasoline engines will "balk" occasionally. As a matter of fact, however, the gas engine driven electric plant has performed splendidly in the face of all sorts of conditions. Last season the plant of the world's biggest circus was in constant operation for five months without a breakdown, although on one memorable occasion the gasoline engine was operated for 25 minutes with a perilously scanty supply of water—a hint of the exigencies which constantly confront the circus electricians.

## Parabolite Street Lamp Reflector

The Benjamin street lamp reflector which goes under the name "Parabolite" is designed according to scientific principles to give the proper amount of general illumination with the maximum amount of illumination on the roadway over which it is suspended. It is used in connection with tung-

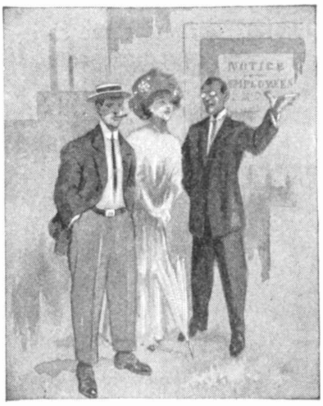


THE PARABOLITE STREET LAMP REFLECTOR

sten incandescent lamps now so frequently used with success for street lighting. In general the light rays are thrown downward on the roadway but the shape of the trough like reflector is such that they are directed mostly in a broad line in the direction of the road but are shut off from the sides.

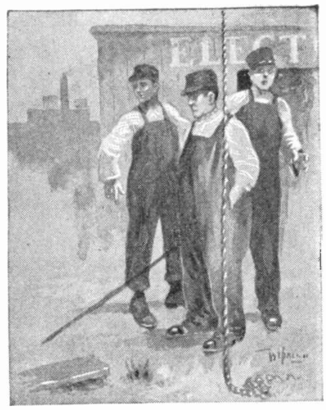
## How Far Can Time Clocks be Scattered?

Factories and schools commonly have a large number of clocks scattered through the building and actuated in unison by batteries connected with a single master clock. This plan has gradually been extended to include clocks located at considerable distances from the controlling timepiece and recently the celebrated English electrician, Sir William Preece, made an investigation to see how effective such timing systems work at a distance. His conclusions show that with the methods already in common use, a single master clock can readily actuate 500 clocks strung along 50 miles of wire.



# Visiting the Works

By George Frederic Stratton



Every factory, large or small, has its visitors. Some come because they are acquainted with the proprietor or manager, and make the inspection a sort of social function; others because they are in the vicinity, and it is a free show. Undoubtedly many are impelled by a real desire to increase their knowledge of the industry.

In one of the great machine manufacturing plants devoted to electrical appliances, visitors are constantly being received from all parts of the world. These are chiefly scientific or technical men, deeply interested not only in the p-ocesses of manufacture, but also in the scientific development of new apparatus. Large bodies of students from technical colleges are frequently conducted through the works, the parties sometimes numbering as high as 75 or 100. Interpreters are always available for the reception of any foreign visitors: men from nearly every European country being engaged on either the office or engineering staffs.

When a visitor or a party arrives, one or more young men from the engineering force take them in charge; a very necessary step, when it is considered that no less than 54 great buildings, in which operations are carried on, are comprised in this great plant.

To the guide selected, these tours afford excellent opportunities for broadening his knowledge of the works, for seeing the numerous changes which are continually occurring, for becoming familiar with new designs in apparatus and incidentally making many pleasant and valuable acquaintances. No matter how much the guide may know about the apparatus, he will find he knows it far better after he has explained its operation to some interested and persistent sight-seer.

It very often happens that the visitor who knows the least about electrical matters will ask the stiffest questions and make the most disconcerting remarks. It is rather staggering, for instance, after you have made your clearest and most concise explanation of the phenomena of the flow of electricity through a wire as you understand it, shown the visitor many devices for measuring it, machines for making it and others for "burning it up" as one man expressed it, to be met with the comforting remark: "After all, Mr. ———, you don't really know what electricity is!" A way to retaliate on that is to inquire of him, if a knowledge of the true cause of gravitation would make a load of bricks any lighter when they fell on him. The average working electrician worries no more about the nature of the force he handles than he does about the doctrines of Confucius. He knows that both will keep.

One of the linemen demonstrates this by the recital of past experience: "When I worked on a third-rail line at Hartford, the boss says, says he: 'Youse fellows don't care where the juice comes from or where it goes; all you got to care about is where to get it and where not to get it; so you Hinnissey keep your crowbar offen that third-rail, or you'll have a beautiful shor-rt circuit, and a pirate-technical display that'll make yer so blind ye'll not tell bad whisky from water the next six months.'"

Any man doing escort duty is expected by the visitor to be a walking information

WOULD A KNOWLEDGE OF THE TRUE CAUSE OF GRAVITATION MAKE A LOAD OF BRICKS ANY LIGHTER?

bureau; to tell offhand what the company's stock is quoted at that morning; which jobs are piece-work, and which on day-rates; where the company buys the sand for the foundries and if a man gets hurt who takes him home; how many calls per day are made over the shop phones, and what do they do it for; when a man was killed last, and how; whether mica is the same as isinglass; how long the girls usually work in the insulating department before they get married, and why there are so many engineers in the great office when there are only two engines to run.

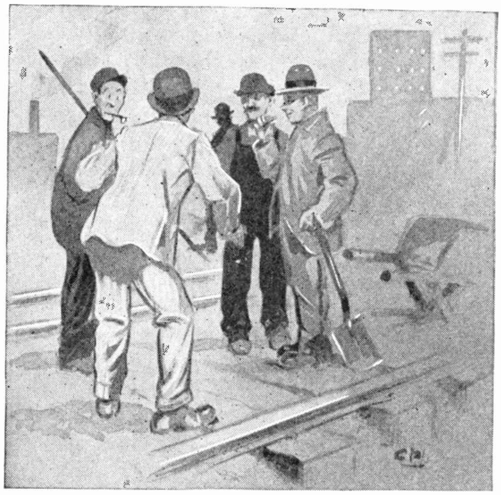
One matter which gives the average visitor no little concern is the rate of wages paid in the various departments. This is a difficult question to answer, and a guess is inevitable. One guide speaking of this said: "I always make the amount as liberal as I dare: first, because if you've got to give figures you may as well make them big enough to be impressive; and second, if the boys overhear you it pleases them to know that their rate is so high even if they don't get the money."

If these, or hundreds of similar questions cannot be answered without reserve or hesitation, the visitor, who may be a very important customer, goes away feeling that some information is withheld for special reasons, or that his conductor is unacquainted with the job. Very often, however, such questions can be switched off onto a foreman on that particular job, and some satisfaction obtained, or at least a little recreation in roping another man into the dilemma.

There are visitors and visitors. One will want to rush the trip as he does his noon lunch. He sees the greatest variety of machine tools in the United States gathered under one management, and when he is through he doesn't know what one of them does. Another will so thoroughly and critically examine, that the day closes with but one-quarter of the works having been viewed.

One gentleman from Canada, who had but four hours to devote to his visit, halted at one of the first machines he saw—a simple turning lathe—and devoted half an hour to silently watching its operation. This was tedious for the guide, who finally got him started down through the great shop, 600 feet in length. As they reached the end and were stepping out to visit another building, the visitor stopped and said: "Would you mind if we went back and had another look at that first machine?" They went back and he watched it for fifteen minutes longer.

"What do you do with these shavings?" he inquired.



SAY YOU HINNESSY, KEEP YOUR CROWBAR OFFEN THAT THIRD RAIL

"Send them over to the foundry to be melted up," was the reply.

"Well, say! I think I could invent a machine which would cut those shavings a heap sight quicker than that."

One young engineer, whom we'll call Steve, because his name is something else, is frequently detailed for this service on account of his fund of information and his clear and lucid manner of explanation. His experiences are naturally extensive and varied.

On one occasion he escorted a guest from the West; a light haired little gentleman who seemed duly impressed with all that he

RUSHES HIS TRIP AS HE DOES HIS LUNCH HOUR

saw, but made no comment. He was apparently drinking in and criticizing every word which Steve uttered, and that usually confident young man grew nervous and suspicious. "This fellow," he thought, "must be some bright electrician, perhaps a consulting engineer of the Metropolitan Transit Commission, and he is just taking all my statements with a big grain of salt." At last when they arrived back at the office, and Steve was feeling limp and anxious, the little gentleman held out his hand and exclaimed:

"I'm exceedingly obliged to you. I don't know much about the electrical trade. I'm a barber. If you ever come to Chicago be sure and look me up."

It is told of Steve, and the story passes as absolute fact about the plant, that, having recovered from this experience he was detailed again to escort another visitor through the works. This was a silent and undemonstrative man who paid considerable attention to rather insignificant machines and details, and Steve quickly concluded that he had another barber to amuse. Moreover as the quiet visitor showed no surprise at, or appreciation of the many really remarkable machines and operations, Steve felt greatly aggrieved and for the honor of the works determined that he would shake some enthusiasm out of him; so he proceeded to load him up with many wonderful stories. He pointed out a dynamo so powerful that it never had been, nor ever would be, run up to full capacity, it being impossible to control the current. He called attention to a carload of barrels on a siding loaded with "juice" for export. He gave a dissertation on the incandescent lamp, and its manufacture, asserting that its discovery was due to the accidental observation of a lightning flash playing on a two pronged fork in a pickle bottle. Waxing eloquent, he rose on his toes, stretched out his arm and declaimed: "And so, that inestimable boon to mankind, the incandescent lamp, was born!"

At that moment the visitor stepped up to a workman who was winding coils, slapped him on the back, and exclaimed:

"Hello, Dan!"

The man started, looked up and his face flushed with surprise and pleasure as he grasped the outstretched hand. "God bless me!" he exclaimed, "It's my old boss, Mr. Edison himself."

Steve staggered back and sat down on a casting. He tried to think it over—to recall

AND SO THAT INESTIMABLE BOON TO MANKIND, THE ELECTRIC LAMP, WAS BORN some of the stuff he'd been telling to the greatest practical electrician of the age, but his mind was a blur. One thing only stood out in lurid distinction; he had told the Wizard of Menlo Park, the persevering inventor of the incandescent lamp, that it was the evolution of a pickle bottle and a two pronged fork. He looked around for some convenient and welcome 2,000 volt live wire, but changing his mind, he sneaked back among the machines to the shop telephone, and calling the office, requested that a man be sent down to relieve him, as he was taken seriously and suddenly sick. Then he disappeared.

A week or two later he received from Mr. Edison, a book on electrical wonders, written for juveniles; and on the fly leaf was a pen drawing of a fork in a pickle bottle. Below it, in the wizard's handwriting, was the inscription: "And so, that inestimable boon to mankind, the incandescent lamp, was born."

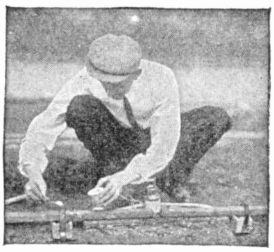
Some time in the future perhaps that little book may fetch a round sum of money. At present, no money would buy it.

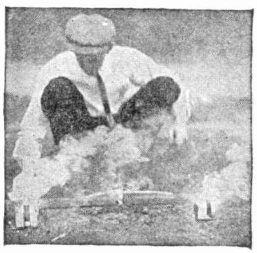
## A MINIATURE VOLCANO

As most people are aware, the electric current which operates a trolley car comes out from the power house over the trolley wire, passes down through the trolley pole connections, through the motors and back to the power house through the earth and the track rails. It has been found that the most efficient operation is obtained by making the track rails one continuous conductor, so that the current does not need to depend to any great extent on the earth for a return path. This is accomplished by bonding the rail joints; that is, by electrically joining the abutting ends of the rails by a copper bond. A common method of attaching the bonds is to drill holes in the rails and then, by means of a powerful compressing machine, to force the bond terminals into the holes and expand them. Another way is to solder the bonds.

A combination of these two processes has recently been perfected by the Ohio Brass Company. The bonds are first compressed in the ordinary way, giving great mechanical strength and resistance to vibratory stresses. Afterwards, by an interesting chemical process the bonds are soldered to the rails, adding to the electrical conductivity of the joint.

The Thermo process consists of heating the bond terminal, after compression, and the adjacent web of the rail practically instantaneously, independent of cold or windy weather conditions, by a chemical reaction. (See illustrations.) The heat produced is so concentrated that while the terminal and the adjacent web are quickly brought to a soldering heat the ball of the rail remains so cool that the hand can be laid upon it while the soldering is being done so that no injury to the rail or to the body of the bond can possibly result.

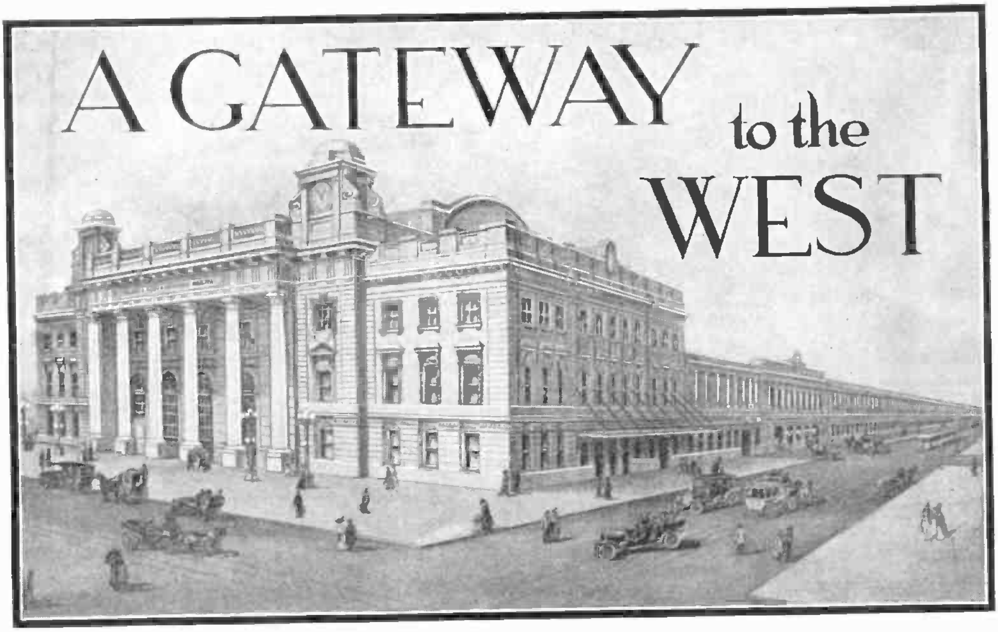

READY FOR IGNITION


DURING REACTION


APPLYING THE SOLDER

A cup like arrangement is applied to the rail and including the joint to be heated. Into this is placed what is called "Thermo-ignition Powder." This powder is then ignited and burns like a miniature volcano, with a chemical reaction so terrific that the rail joint is heated clear through and to a temperature to make the solder run freely.

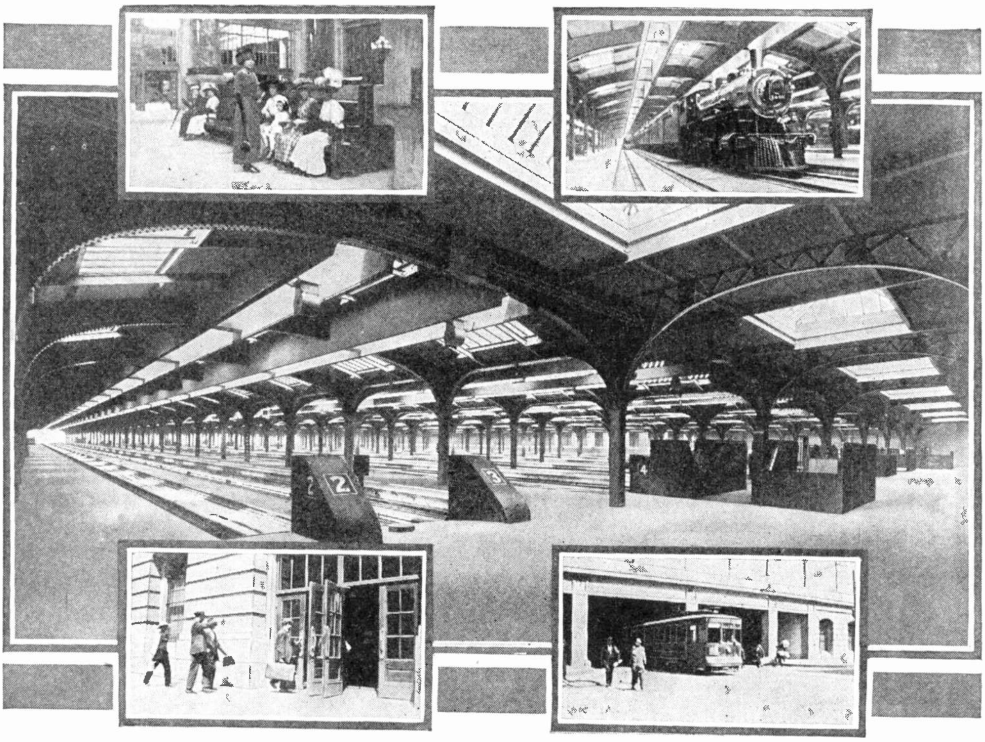
# A GATEWAY to the WEST



A fitting monument to Chicago, the Key to the West, the new station of the Chicago and Northwestern Railway was opened to the public Sunday, June 4. In probably no other station in the world is electricity called upon to perform so many and varied tasks.

This great building with the train sheds occupies a ground area of thirteen acres, has ten acres of floor space for the public's use and was erected at a cost, including the site, of $23,000,000.00. It is with one exception the largest railway terminal in the United States. To make room for the sta-

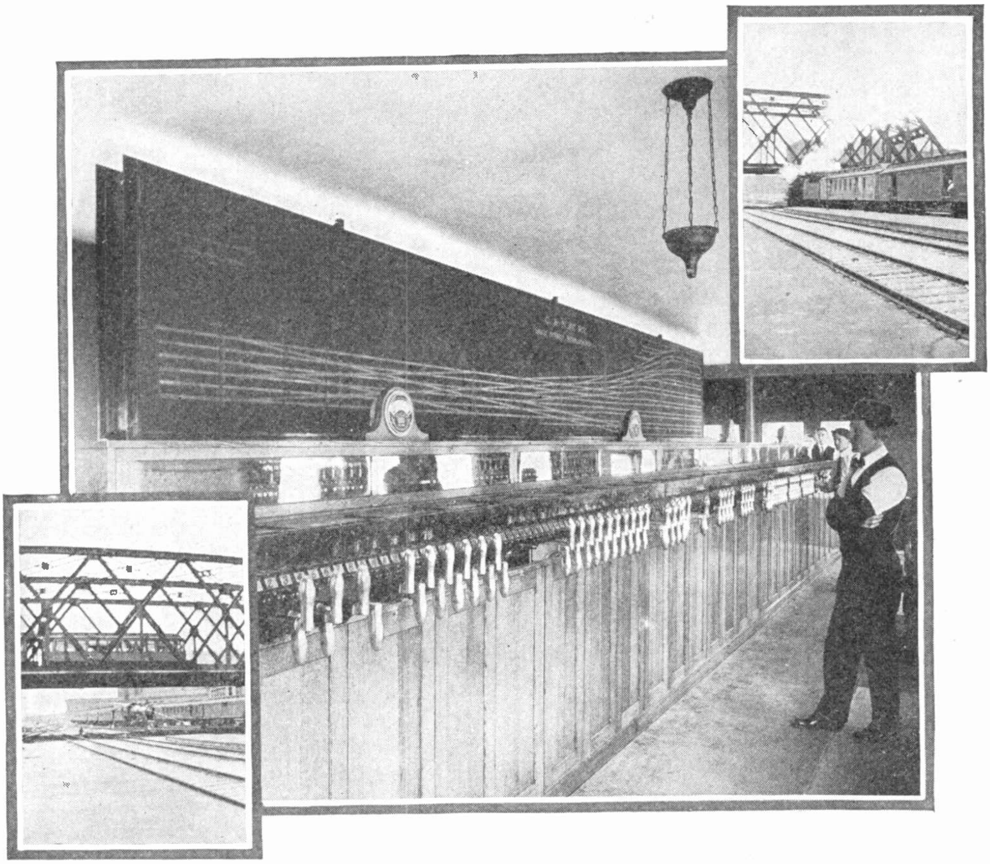
MAIN WAITING ROOM OF THE NORTHWESTERN RAILWAY TERMINAL tion, 455 buildings were wrecked or moved, 66 of which were four stories in height. Sixteen tracks accommodate the traffic, 346 passenger trains being cared for every 24 hours. The building aside from train sheds is 218 by 320 feet and is built of granite and marble. The total length, including train sheds and power house, is 1,586 feet, or practically one-third of a mile. To understand the architecture, the structure may be divided into levels: first the street; second the train level or main floor; and above this is a third floor containing rest and tea rooms, a hospital and rooms for numerous other purposes. The entire structure is absolutely fireproof. All floors are of marble or of marble tile, the interior finish of waiting rooms and lobbies is of marble and the exterior of the building is of a light gray granite.



TRAIN SHED CONTAINING SIXTEEN TRACKS WITH A CAPACITY OF 346 TRAINS A DAY

The traveler who enters this edifice from the Madison street level finds the essential feature of the whole floor to be the great lobby, where all the business of preparing for travel is conducted. The lofty vestibule or portico which forms the Madison street entrance opens directly into this public lobby, which has an area of 100 by 250 feet. Surrounding it are ticket offices, cab offices, news-stands, baggage checking rooms, telegraph offices, telephone booths, a motor carriage office and a well-stocked shop or store in which may be purchased practically everything that a traveler is likely to be in need of, from a hand-bag or box of shoe polish to the usual fruits, candies and materials for luncheons. The management proposes to develop this store into a feature the like of which has never been seen in Chicago, and it is already completely stocked with all travel conveniences.

And in this lobby electricity begins its work. When you step to one of the 33 ticket windows, a pull at a switch on the part of the ticket seller lights up the window ledge and at the same time turns on the ticket seller's lamp. Behind him is a portable many-drawered ticket cabinet having a line-o-light trough fixture at the upper front edge from which a cord and plug extend,



BY WATCHING LITTLE LAMPS ON THE DIAGRAM BOARD THESE MEN CONTROL THE MOVEMENTS OF EVERY TRAIN IN THE TERMINAL BY MEANS OF INTERLOCKING SWITCHES

making it possible to move the cabinet about and yet illuminate the ticket drawers. The 20 telephone booths and a switchboard on this floor give ready access to the outside world, while those who are hungry may at the next doorway step into the well lighted restaurant which seats 125.

One need never ask the time, for located in conspicuous places about the station are thirteen large clocks all electrically controlled from a master clock.

Leaving the street lobby and ascending to the main waiting room by the grand stairway, we are attracted at the first landing by a bright light thrown from out of the wall upon this landing by a recessed linear light behind which is a reflector. Every stairway landing in the station is thus illuminated so that the aged or weary traveler need never be uncertain of his footing.

The main waiting room surpasses all other parts of the building in architectural beauty. The curved ceiling finished with tile and terra cotta assists in diffusing the light from 750 lamps concealed from view in the window arches. The massive Greek marble columns of greenish hue have their beauty still further heightened by suspended bronze fixtures supporting lights within white globes and by solid bronze pillars at the end of the waiting room, carrying lights of similar design. The picture of the room here shown was taken from a balcony and hardly impresses one with the massiveness of the pillars and size of the room as when viewed from the floor. Off from this room is the main dining room, illuminated by the indirect system, and here the traveler will find meals and service equal to that in the best hotels.

But we are now on a level with the tracks. Passing out through the train concourse, we are confronted by a vast expanse of train sheds where passengers, mail and baggage are handled with despatch. First noticed are the sheet metal enclosures marking the elevators for handling the baggage. This loaded upon electric trucks is run upon the lifts and lowered to the baggage room below with little manual labor. A look along the concrete walks between the tracks shows numerous metal trap doors. These mark the first step towards a rapid handling of the mail. As soon as a mail car comes in, a trap door is opened and the mail bags are dropped into the opening. A wide conveyor belt below run by a motor quickly carries the bags into a post office substation where the mail is sorted and sent on its way without going to the main post office. While watching the mail disappear one can not but note the slot openings in the concrete roof of the train shed through which each locomotive discharges into the open air, thus leaving the train sheds free from smoke and fumes so characteristic of such places.

Returning to the street level lobby again, elevators wait to carry us to the third floor. Here, away from the noises of the street and the crowds, the architects have planned with much skill and forethought a series of rooms where invalids or ladies with children or infants, or others seeking privacy may go to rooms for rest while waiting for connecting trains, and have at hand the conveniences for which one must usually go to a hotel or to one's own home. Here are baths, tea rooms, retiring rooms, and emergency rooms where hospital service is rendered, with nurses in attendance, and a competent matron in charge.

On the other side of the building on this same floor are baths, barber shops and a lounging room for men. This suite is also reached by separate elevator service and here are private rooms where the suburban dweller or the traveler from a distance may remove the stains of travel, change to evening clothes and proceed to his various social appointments—a service that will be appreciated.

All drinking fountains are the new bubbling-up type and cooled water is supplied to them through a circulating system. In winter the building is heated and ventilated by fresh air drawn from above the roof by electric fans, passed over steam coils, and then filtered through a sheet of falling water. In summer the air is cooled by the same system and completely changed every 20 minutes.

The emigrant waiting room warrants a deviation from things strictly electrical, it being one of the features of the station. Reached directly from the train shed, this room is on the street level and is commodious and sanitary, with a separate lunch room where emigrants can purchase wholesome food at economical prices. The men's toilet rooms are equipped with tub and shower baths and the women's room is provided with baths, laundry tubs and a laundry dryer, which dries a batch of clothing in fifteen minutes. With a chance to remove the dust of a long journey the newcomer is thus helped to start life aright in his adopted country. Interpreters are provided by the railroad and to safeguard the emigrant no one is allowed to come to him but his friends.

The switching of the trains in the thirty acres of yards is controlled by a system of electric interlocking signals consisting of 212 levers and 171 control switches and signals. An immense board in the interlocking plant contains strips of glass to represent the tracks. Back of these glass strips are numerous small lights. As a train enters a section of track, the lights go out, thus enabling the operator at the levers to know just where this and every train in the yard is and enabling him to hold the train, or by signals to send it on by throwing the proper switch levers. These levers control motor-driven switches at various points along the tracks. In the interlocking plant is a telautograph to which are connected eighteen similar instruments in the station. When a train comes within control of the interlocking system a message, for instance: "No. 6 coming in on track 3" is written on the telautograph and every usher and train man is thus notified in advance of a train's approach before it reaches the station.

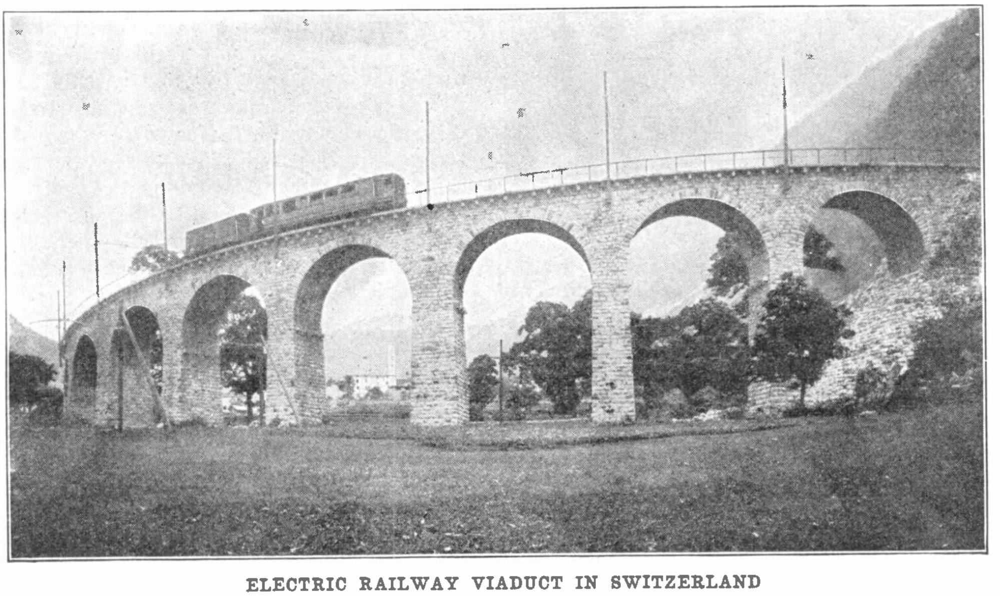
For the electric lighting system in the station building, train shed and various street subways on the approaches, the operation of elevators, ventilating fans, refrigerating system, signaling and interlocking systems, providing in each case a surplus for future growth, a plant of 4,000 K. W. has been installed. The boilers, engines and generators are housed in the power plant at the extreme northern end of the station which with its modern appliances represents in itself an investment of nearly one million dollars.

To us, who, by long contact, are familiar with the great undertakings of this kind which have made this country the wonder of the rest of the world, the great structure with its perfection of detail is profoundly impressive. How then must it impress the emigrant who here enters upon the last stage of his journey to the Golden West? The Slav from far-off Russian steppes, the Hun and the Finn, the laughing Celt and the serious Scot; they all come together here at last, men of every nation, country and tribe. Then:

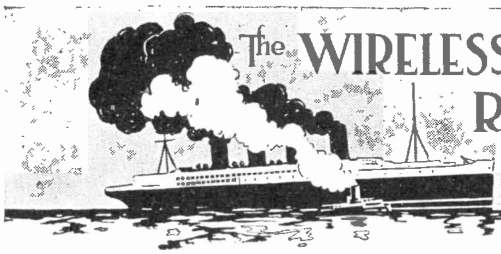
"New brightness dances in the migrant's eye.
A fresher tint comes to his cheek as fast
Expanding Hope glows in his heart, and to
His ear the soft Aeolian music spells
Articulately, Home and Peace and Rest.
With head erect and buoyant stride he threads
The teeming streets, nor pauses till he stands
A while and pays his silent tribute to
The giant pillars, lure to Fortune's quest,
That sentinel the Gateway of the West."

## A FAMOUS SWISS VIADUCT

Among the now famous Swiss mountain electric railways is one known as the Berninabahn, which extends between St. Moritz and Tirano, a distance of 38 miles. One of the most beautiful viaducts ever constructed for an electric railway forms part of this line. It consists of a series of massive masonry arches nearly 50 feet in height, and the whole viaduct is erected on a sharp curve. Structural steel might have been erected at less expense and served the purpose just as well, but it would not have harmonized as well with the majestic mountain background. The Swiss engineer realizes full well that one of the greatest assets of his country is its world-famous mountain scenery, and he is careful not to mar its beauty by unsightly structures.



ELECTRIC RAILWAY VIADUCT IN SWITZERLAND



# The WIRELESS OPERATOR REMINISCES

By J. M. Baskerville

## Padding News for the Paper

Some ships carry newspapers, and the news is supplied by wireless telegraphy from land stations, or supplied by ships having the "fresh stuff."

There are many times, on account of bad atmospheric conditions, that it isn't always practicable to handle a bunch of stuff for the paper and in that case the operator must use his imagination, and his ingenuity.

His paper *must* be printed. If he is slack about it, some passenger usually comes along and reminds him. Sometimes he has offers of assistance from them, and if he accepts such offers, he usually gets some rich and original "news."

Once, during the Jamestown Exposition, I received at sea an item of news stating that a $300,000 fire had ravaged the grounds. Why not let it be three million, by carelessly adding an extra nought? That's what I did and it certainly woke up the passengers and furnished a topic for conversation the rest of the trip. And it did no harm.

**Led by W. J. Bryan and Lydia Pinkham**

Another time, in the West Indies, near Trinidad, we had a straw ballot and Taft was elected President, even before he was nominated. Mr. George Ade was aboard and wrote up my "Extra" and Mr. McCutcheon of the *Chicago Tribune* illustrated it for me with hektograph ink. I recall that of the entire ship's passengers, I alone voted for Bryan.

Another time, being hard up for news, and having a New York newspaper man aboard while we were en route from New York to New Orleans, I was compelled to manufacture my news, with his help.

One item we built was from Nebraska, and gave an account of a great german being lead by W. J. Bryan and Lydia E. Pinkham.

Another item was from Mexico stating that a young lady had been arrested there for impersonating a princess. She had tearfully confessed that in disguise she was looking for material for her new book, entitled "Four Weeks," or "Nearly a Month."

## Foolish Questions

Satisfying the curiosity of the passengers upon a steamer at sea sometimes requires the ingenuity of all ship officers, and particularly the wireless telegraph operator. The questions about the wonders of the sea are not hard to answer, but the crazy questions about wireless are sometimes hard to reply to, and the operator does not always confine himself to facts in his explanations. Frequently he doesn't know the real answer himself, and rather than show his ignorance he sometimes puts his own imagination to a supreme test and invents some phraseology that answers. But he must be careful and not tell the same person a different tale if asked twice about the same thing. On other occasions the operator really knows what would be the correct answer but does not feel that the necessary lengthy lesson in electricity that would facilitate his explanation is justifiable, as he isn't running a wireless school.

"Can you get a message through this stiff wind?" asks a passenger, when we have just received a message against the wind in a heavy gale. When shown the message as evidence he again asks, "Is it *possible* to work through this wind. Looks like the wind would blow the message away."

"What are those two little steam gauges for?" inquired a young man, pointing at the ammeter and voltmeter on the wireless switchboard.

"Those are the distance meters," I replied. "Multiply one by the other and you get the number of miles that this set will transmit under certain circumstances."

"Wonderful! Wonderful!" he muses, scanning the rest of the equipment. "And may I ask what that little cage is?" indicating the helix.

"That keeps careless people from touching that dangerous spark," I replied, and he was satisfied.

## The Old Telegraph Operator Listens In

The work of a wireless operator on a ship must be secret and confidential. What he does he must say nothing about, for fear it would cause worry among the passengers, particularly if the movements of the ship are affected.

But sometimes there happens to be a good telegraph operator among the passengers, who can read everything the operator sends, though all is well if such a person is discreet.

One time, with a party of tourists aboard, our ship put in at ——, where we were scheduled to stay several hours before proceeding to the next point on our itinerary. While we still lay at —— I began to work the wireless and picked up the station at our next port of call. After a conversation with the operator I found out that the health officials at that point would refuse our ship entrance, as we had visited islands in the West Indies supposed to be infected with yellow fever.

It was ordered that a big noise be kept going all night

I informed the ship officials aboard of the sad news. They were very much surprised, and indeed embarrassed for a time. What could they tell the passengers, some of whom were already grumbling? They talked the matter over and sent many messages, trying to persuade the health officials to permit us to land, as was our schedule, the following day. There was no use. They told us point blank "No."

So it was agreed that the engines should "break down" and we would lay at St. Thomas all night. Accordingly it was ordered that a big noise be kept going all night in the engine room,—"fixing the engines."

After I had done my work, and stirred up all this trouble, I sat back and lighted a fragrant Havana. I was thinking over the situation, when a large fat individual came into the room. He had been up many times before. I liked his looks. Furthermore, he smoked good cigars. As he entered he said:

"So they have quarantined us at ——? Quite a stroke of diplomacy that—breaking down the engines," punctuated with a laugh.

I knew he was an operator. Years before he had worked the wire. But I liked to hear him talk, so I asked him how he knew.

"Easy," he said. "I used to sling lightning. I have pounded the brass myself, and while outside on the deck below, I heard you talking to the other man. I inferred we are quarantined. Am I right?"

I knew I could trust this baldheaded nice man. His good nature removed all objections. I swore him to silence, and told him as he knew one side he might as well know the other. He listened and at times in the narrative he grinned with satisfaction.

He kept his word, too. Never a whisper got out among the other hundreds of passengers. No one ever guessed that we knew aboard the ship what kind of reception we would get the next day at the next port of call. It was a huge bluff, this going in and pretending we were surprised to be turned away. But we got away with it.

## Nicknames

Nicknames applied to a wireless operator aboard ship are mostly the extreme of ridiculous. Sometimes they are consistent, and other times you wouldn't expect to see a human being rise and answer to them when applied.

They used to call me "Sparks," "Wireless," "Wizard," "Trouble," "Big Noise," "Nuisance," "Marconi," "Dr. De Forest," "Imagination," "Stunts," "Long Distance," "Waldorf" (account of working with that hotel station), "Telegrafter," "Soft Snap," "Air Fixer," "Message Shooter." And even "Lord Bolingbroke" (why, I don't know).

# A Tribute to a Business Woman's Mothering

By RENE MANSFIELD

On a conspicuous wall of the headquarters of the National Electric Light Association hangs a portrait of an elderly woman whose face bespeaks energy, resourcefulness, cheery courage,—in whose eyes, behind their spectacles, there is kindliness and a hint of quiet humor.

Impressed, as one is bound to be, by the dominant note of vigorous personality that the portrait strikes, the stranger in the office will inquire who the subject may have been. You may be sure his business is not likely to be in any way connected with electrical industries; and that he is not a member of the N. E. L. A. is certain, because there is not one among their nine thousand who has not heard, at least, of the woman whose portrait, painted by Jane Peterson, has recently been given a place of honor in the Association's headquarters.

Should the questioner have chanced to address his query to a member who has grown up with the Association, he will have eyes of skeptical astonishment turned upon him.

"That portrait? You don't know who that is? Well, well, I declare! Why, that—that is the "Mother of the Association," man! That's Miss Harriet Billings, our assistant secretary."

"Twenty years ago it was she came to serve the Association,—to support our toddling footsteps, and poultice up our bumps, and bandage up our fractures. She was secretary and treasurer then, and she had a harder job than the president, I can tell you. Of course, after awhile, we got to taking such mighty long strides, no one mother could keep up with us. But you can bet we never let go of her apron strings!

"Why, for a fact, I don't know what the Association would have done without that woman, back in those years of struggling infancy. The papers that were read at some of the meetings in those days,—well, they weren't exactly models of style, nor choice examples of lucid presentation. They bristled with technicalities, and I've no doubt they bristled with other little things, too,—punctuation gone wrong, and words spelled phonetically before that method was sanctioned in cultured communities.

"Miss Billings had to edit these papers and also prepare all the reports that appeared in the printed proceedings of the Association. Of course, she had practically no technical knowledge to guide her in this work, but her intuition was simply amazing.

"I've known her to hunt up a member whose paper she was preparing for the printers, and ask him if there wasn't something the matter with some formula or other. She couldn't tell what it was, but it didn't sound just right to her. He would always pooh-pooh the suggestion of any technical fallibility on his part, but he was pretty sure to find a slip somewhere that might have caused a great deal of trouble had it gone through.

"As a consequence of this interest, I tell you you'd have a hard time to find more concise, exact, well-expressed records than those of the early meetings of the N. E. L. A. They are a monument to the patient doctoring, the tireless care and the flawless English of Miss Billings."

It was not only appreciation of these qualities alone, valuable as they have been to the Association, that prompted Mr. Henry L. Doherty to present the portrait of Miss Billings to the N. E. L. A. at their 34th convention held in New York last month, through W. C. L. Eglin of Philadelphia—Mr. Doherty being in Europe at the time. It was a recognition of the inspiring personality of a woman who looked upon every member of the Association as one of her "boys" and who mothered them for 20 years with all the interest and confidence of a genial, genuine character. Her loyalty and enthusiasm have been no small factor in the remarkable success of the Association.

At the St. Louis convention last year, the first one she had ever missed, resolutions were drawn up and passed upon by the entire convention sympathizing with her in the illness that had made it impossible for her to attend, and expressing the greatest regret at her absence.

Neither was she able to be present at the convention recently held in New York, as she is taking a needed rest and a long vacation, under full pay. But the five thousand delegates who beheld Miss Peterson's striking portrait of Miss Billings felt strongly the spirit of friendliness and the sturdy camaraderie that the artist has so successfully conveyed.

Indeed, this painting is considered one of the best things Miss Peterson has done in the way of portraiture. In it are emphasized the qualities which have put her in the foremost ranks of the younger and distinctively modern artists,—sure, strong drawing, breadth and freedom, brilliant technique and vibrant color.

Mr. Eglin, in presenting the portrait to the Association, said very truly, among other things, that "Her portrait hanging in a fitting resting place in the Association's headquarters should be an ever-present reminder of a mother watching over them, insisting that her 'boys' must always do their best when doing any work for the Association."

## FROM OUT THE LEYDEN JAR

During the last six years one of the larger lighting companies has purchased for use in direct current meters a total of 17,000 diamond jewels.

* * *

A cable to carry 3,000 horsepower is being laid on the bottom of Narragansett Bay between Nayett Point and Connecticut Point. This cable is 7,000 feet long.

* * *

Deposits of copper ore have been discovered on the Vestmanna Islands, south of Iceland. The deposits are understood to be of considerable magnitude.

* * *

The Marconi Wireless Telegraph Company has erected a steel pole and wooden mast, together 210 feet in height, close to their works at Chelmsford, England, to be used for experimental work in connection with high-power currents.

It is stated that the postoffice department at Washington will experiment with the installation of mail boxes on street cars in Washington and if they prove popular will extend the service to other cities.

* * *

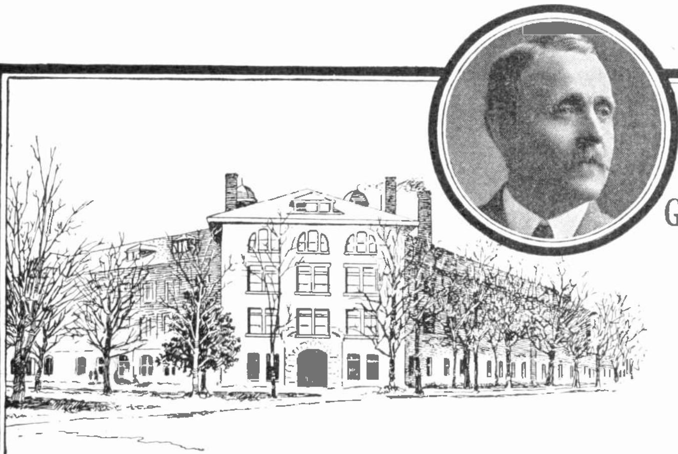
A writer in a recent German periodical states that he excluded outside noises from his telephone booth entirely by lining the booth with sheet tin nailed to the walls. Some of our readers may wish to verify this result.

* * *

The town of Boley, Oklahoma, has an electric light and power plant which was installed and is owned and operated by colored men. All of the inhabitants of Boley are colored people, and the town and lighting plant were started under the auspices of the Wiley University for colored people, Marshall, Texas.

# ADVICE TO ENGINEERING STUDENTS

**Views of prominent educators on the scope of a college course and how a young man may derive the most benefit from it**



BY
GEORGE W. PATTERSON
PROFESSOR OF
ELECTRICAL
ENGINEERING
UNIVERSITY
OF MICHIGAN
ANN ARBOR, MICH

A college course should aim to make the foundation for a man's life work. If the student follows courses having an immediate "bread and butter" value, he will undoubtedly earn more money in his first few years out of college, provided he has made the right guess as to the work he will enter, but on the other hand he probably will not have the foundation he needs to take advantage of what fortune may throw in his path. Many of the men of whom the University is proud have developed into electrical engineers when they thought in their college days that they would be mechanical or civil engineers and vice versa.

Many men are in business or in administrative positions in which they have little actual use for the particular technical courses which they thought would be "bread and butter" for them. I think that the general all around work which many of them thought waste time has done much for their success. Of course, the big man would be big even if he never went to college, for he would have been a success wherever fate took him.

We are trying at Ann Arbor to lead men into getting a liberal education. A man has only one life to live in this world and the success of his life is not altogether measured by dollars earned or position attained. The broader his education the more he will enjoy the good things of life of which the narrowly educated man knows little. Literature, art, music, sympathy with what is going on around him are apt to be lost to the man who begins in a narrow way and always follows it, even if it leads to many dollars and high position in some branch of work.

But I believe the man of broad education will rise faster in his particular profession than the man of narrow education. He will be in better touch with the men about him and this leads to broader opportunity.

College trained men in the field today will remember how some of their classmates looked upon work in English, for example, and well know how few engineers are able to write a good report or to make a favorable impression on a city commission from whom they wish to receive a contract. Those men would probably now advise more instead of less study of English in engineering courses.

Clear reasoning is probably the best asset any man can have, for he must not only reason things out for himself, but also as a rule convince others that he is right. A narrow education is not food for the reasoning power. I shall not make a plea for mathematics. They are "bread and butter" to the engineer who plans outside of the things covered by hand books. Modern languages are not really learned in college. At best a fair start only is made, but enough is done to give a man a fighting chance to go on if his work takes him into non-English-speaking countries, and to enable him to read the latest scientific literature in the original.

Broadness of education, with some reasonable specialization in other words, is my idea of what is best for the student, to put him in a position to make the most of what life may offer him, the result to be measured not only in dollars, but in living.

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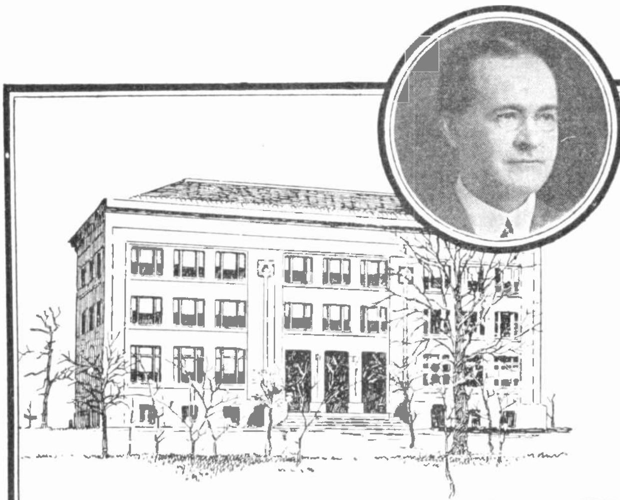


BY
JOHN S. HAYFORD
DIRECTOR OF COLLEGE OF ENGINEERING
NORTHWESTERN UNIVERSITY,
EVANSTON, ILL.

The young man about to leave the high school is confronted with momentous questions. He must decide upon a career. To many students the answer is clear and definite; to others it is difficult, for many courses offer themselves. Business attracts its number; law and medicine appeal to many. This article is concerned with others who are anxious to become men of action, to plan and execute for manufacturing establishments, to devise and carry out large enterprises for railroad and mining companies, to build bridges and erect great buildings. Such see their manifest destiny in engineering.

These have already seen enough of mechanical, thermal, and electrical energy to know something of the marvelous possibilities of power transmission and of rapid communication, and they are already familiar with such names as Thomson, Bell, Edison, Steinmetz, Westinghouse, Goethals.

Let us suppose that such a young man has been convinced by his success in the laboratory, by his study of mathematics, or by his reading, that he has ability for engineering. Then his first question, the choice of a career, has been answered.

Now arises another question, which is usually more difficult—how shall he best prepare for engineering? The remainder of this article gives an answer that has recommended itself highly to many men of large experience who have given the subject much thought.

First. Let him get a clear conception of what it is to be a high-grade engineer. To be an excellent machinist is a laudable ambition, but an engineer is more, for the engineer designs and improves machinery, directs a whole factory, or designs a great bridge. The dynamo-tender who thoroughly understands his business commands high respect, but an electrical engineer is more than a dynamo-tender, for the engineer is familiar with the principles of electricity and magnetism, he designs electrical apparatus, plans power stations, suggests economies and other improvements in electric railways, etc.

More than this, a good engineer knows men, knows how to approach them, knows good business methods, knows how to write clear and forcible English, knows what other engineers are doing, learning this from their journals, both home and foreign. In short, he is familiar with many subjects outside of his specialty; he is a man of liberal education. Yet the would-be engineer cannot spend many years of his early manhood in training and must plan his course with care.

Second. Let him go to college, and let him select a college with a good liberal scientific curriculum. It will be well to select an institution in which there are classical courses pursued by a goodly number of men. Acquaintance and association with these men will prove to be of great value to him.

Third. During the first two years in college let him master the principles of English composition, and make sure of a reading knowledge—more is not essential—of French and German.

During these years he should acquaint himself with analytic geometry and calculus, two branches of college mathematics most essential to engineering, and he must find time for chemistry, and especially for physics, the science most fundamental to engineering. Close attention should be given to drawing, the accurate and compact language in which the engineer speaks to the contractor and workman.

Fourth. These things done, let him take up more advanced work and special work bearing more directly upon engineering practice. At this point lies a danger which should be carefully avoided. It is much easier to learn a rule for doing things than to discover the reason that leads to the rule, and many a young man is tempted to prefer the immediately practical rule to the permanently useful reason. To think clearly about engineering problems is immensely more difficult than to learn the current practice, but the student who fails to master the general principles of the sciences on which his profession is founded, such as mathematics, physics, chemistry, thermodynamics, electricity, geology—he who neglects these things has little chance to rank as a first-class engineer.

It is important, therefore, to emphasize these pure-science subjects during the first two years in college, and also during the later years.

Fifth. Let him spend two months of each summer vacation in practical work in some electrical or manufacturing concern, in the engineering department of some railway, or on a survey. The experience will be of great value to him and he will still have a month of his summer vacation for rest and recreation.

With a broad training of this type, obtained in a liberal academic atmosphere, the student meets the world with the following advantages:

1. Among his acquaintances are a goodly number who in the near future are to be men of affairs.

2. His literary work will enable him to say what he has to say in a forcible and convincing manner; it will enable him to write letters and reports in a clear and definite style.

3. His knowledge of French and German will put him into touch with work in foreign countries.

4. He will certainly have much to learn when he enters upon his first position after graduation; but on the other hand, his training and grasp of principles will enable him to assimilate ideas rapidly; to follow the work of his colleagues intelligently, and what is more important—it will put him in a position to advance and to improve upon present practice by invention, by investigation and by discoveries of his own.

5. Such a training will enable him to forge ahead farther and more surely than under a less broad even though more technical and more immediately practical, system of training.

6. Best of all, he has acquired habits of study, modesty of opinion, and correct methods of thinking which will stand him in good stead for life.

# ELEVATORS IN THE METROPOLITAN TOWER

The Metropolitan Life Insurance Building tower in New York rises nearly 700 feet, measured from the street level to the bottom of the flag pole, yet there is elevator service almost to the top. Many people who are familiar only with the plunger or hydraulic type of elevators will wonder how the cages are sent up to these enormous heights. The answer is simple. Electric elevators are used. Such elevators are operated by motors located at the tops of the shafts. They simply draw the cages up and lower them again, like buckets in a well. There is almost no limit to the heights which may be overcome in this manner.

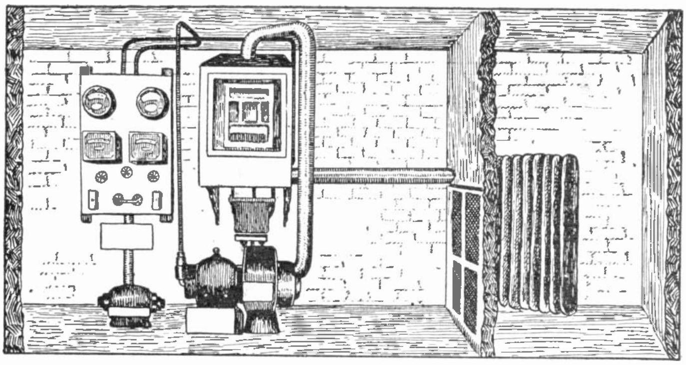
ELEVATORS IN THE METROPOLITAN TOWER

In the Metropolitan tower there are six Otis electric elevators. Five of these rise to the 41st floor and one to the 44th floor. The actual travel of the last mentioned is 585 feet, 6½ inches.

## Ozonair Ventilates a Subway

The first large application of electric ozone making apparatus to a ventilation problem is being made in one of the "Tube" railways of London, where thirteen plants having an aggregate capacity of 90,000,000 cubic feet of ozonized air are being installed.

The air entering these plants, one of which is shown in the picture, first passes through a filter which not only removes dust and mechanical impurities but takes out such soluble gases as ammonia and sulphurous acid, which are commonly present in the air of large cities, as well.



OZONIZER FOR SUBWAY PURPOSES

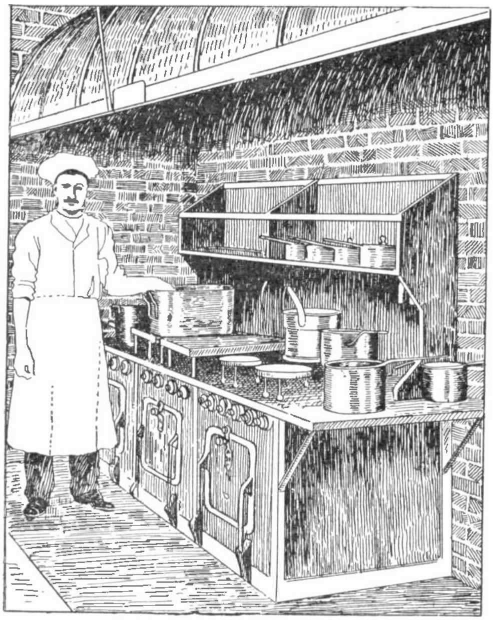
The ozone making apparatus is similar to that used in this country, ozone being formed by the passage through the air of a brush discharge at high voltage. The chemical action involved is the combination of three atoms of oxygen to form one molecule of ozone. Ozone is literally oxidized oxygen and is an unstable compound, the extra atom being anxious to detach itself and enter into combination with any carbon or other element which may be present. This oxidation is the real purifying value of ozone. Poisonous carbon monoxide given off by the lungs is oxidized into comparatively harmless carbon dioxide when ozone is present, and dangerous germ life is burnt up—oxidation being nothing more nor less than burning at slow speed.

One difficulty met with in ozone machines was the formation of nitrous oxide from the free nitrogen in the air. This gas is poisonous and makes the ozonizer worse than useless. By regulating the velocity of the air passing through the brush discharge, however, it has been found possible to secure ozone without any of the nitrogen oxides.

Ozonair, cooled or warmed according to the season, is now furnished to subway tunnels, to the great relief of the passengers.

## Electric Range Cooks for 250 People

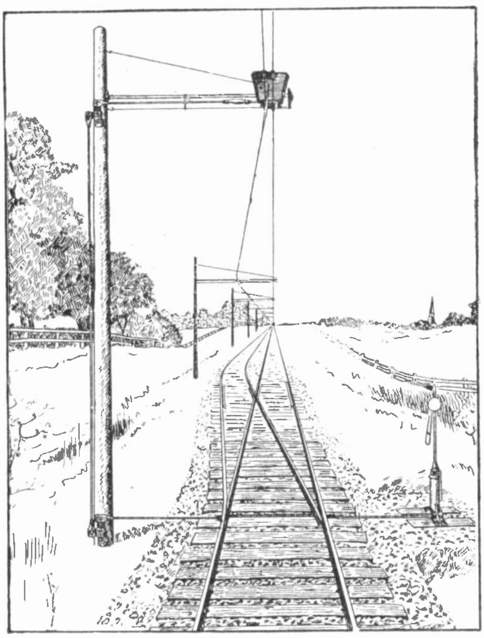
Electric cooking ranges long ago passed the stage in which they were called a fad—everything radically new must in the beginning bear that stigma. But though most people are well aware now of the practicability of these devices for household use few realize that they are also built on a large scale for use in hotels and restaurants. Just to give an idea of the size of one of the large ranges, a drawing is shown, made from a photograph, of a Simplex range having a cooking capacity for 250 people. It is no different in appearance from the ordinary range except that the burner valve handle is replaced by a snap switch and the evil smelling gas flame by an electric heating element.



ELECTRIC RANGE THAT COOKS FOR 250 PEOPLE

## Automatic Trolley Switch

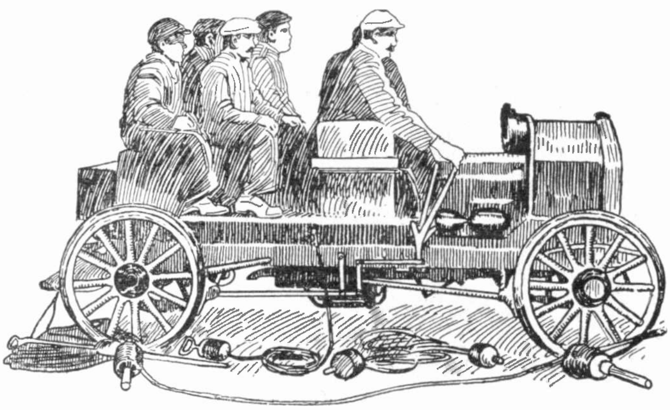
When an electric railway car switches off the main track to a siding there is always a delay to change the trolley after the track switch has been adjusted. A decided improvement over the old way of doing this has been made possible by the use of the Rymco automatic trolley switch, an installation of which is shown in the illustration. Under a metal hood to protect from sleet and snow is a six-foot metal tongue fastened at one end to the siding trolley wire. By means of bell cranks and a rod attached to the movable tongue, this tongue is crowded against the main wire to run the car on the siding, or drawn away from it when the car is to proceed on the main line; and this action is controlled by the track switch to which the bell levers and rods are connected. Then, too, the main line trolley wire is always clear with no danger of the trolley wheel jumping the wire when it is desired to proceed on the main track.



AUTOMATIC TROLLEY SWITCH

## Portable Electric Plant for Railroads

To transport men and tools quickly from one point to another on its lines the Chicago & Rock Island Railroad has adopted a railroad automobile. Although this car is propelled by gasoline, electric power for operating the electric tools carried is supplied by a generator, operated by the same engine which propels the car.



TRAVELING POWER PLANT AND ITS EQUIPMENT OF TOOLS

If necessary eight to ten men can be conveniently carried, and as many tools as can be placed upon it. The tools furnished with this car include: two electric spike screwing machines, six electric drills, electric saw for rails and portable emery wheels.

Where occasion requires, or where it is desirable for any reason, additional cars or tenders can be readily coupled to this car for carrying spikes, extra cable, or anything in the way of material, additional tools, or men.

A portable turn table with extension rails is provided to remove the car to a siding when a clear track is needed. This feature does not show in the illustration.

To eliminate the necessity of constantly moving the car along the track from one small operation to another, a quantity of cable is carried, which can be laid along the track as far as a quarter of a mile in any direction from the car. About 20 feet apart, all along this cable, are plug-in switches, and each electric portable tool is equipped with a special plug. Therefore the tool is simply carried along the length of this cable to any point needed and plugged in at the most convenient switch.

## For the Shoemaker

To the wearer the inside of the shoe is of as much importance as the outside. The shoemaker often judges of this by using the sense of feeling. An ingenious invention

NOVEL USE OF AN INCANDESCENT LAMP

on which a patent has been issued to Cassius M. Thompson, Stoneham, Massachusetts, enables the shoemaker to use an incandescent lamp and mirror to scrutinize this part of the shoe. A metal shield about the lamp holds a mirror having a small opening at the lower edge. By setting the apparatus in the shoe as illustrated any portion of the shoe may be examined by looking into the mirror.

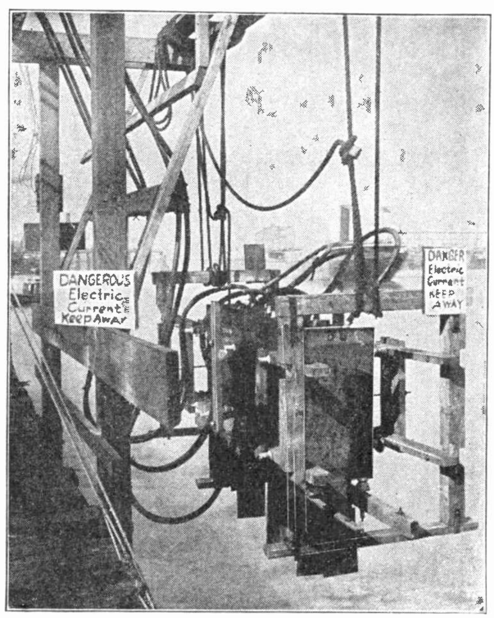
## Safeguarding Moving Picture Shows

As long as so inflammable a material as celluloid is used for the films of moving pictures, there will always be danger of having a film catch fire. In the modern theaters, even if of the nickel variety, this can do no harm as the picture machine is screened by fireproof materials from the rest of the hall. However, if the lens projects the flames upon the screen, the sight may create a panic in the audience. To avoid this, a Swedish inventor has placed a highly combustible cord near the film, attaching the cord to the weighted arm of an electric light switch. If the film should catch fire, the cord will instantly burn also, releasing the weight which closes the shutter and turns on the electric lights for the whole theater.

## Feeding a Dynamo on Test

In making preliminary tests of the great dynamos in a power plant it is necessary to furnish a load for them to work upon; that is, some sort of arrangement for them to pump current into as they will be called upon later in furnishing current to the lines. It is then "up" to the engineer in charge to fill the want quickly and economically.

The installation of a 9,000 horsepower horizontal turbine generator at the central




A GIANT WATER RHEOSTAT

station at Toledo, called for a loading device that would not only accomplish the overloading of the generator but at the same time cause no "fireworks" or entail unnecessary expense.

The problem was met and solved satisfactorily by the engineer in charge in the manner shown in the accompanying illustration.

The current at 4,400 volts was carried from the generator by means of a specially constructed line of six heavy cables to the edge of the nearby river. Here a derrick operated by a hand wheel was constructed and a set of heavy iron plates, forming a huge water rheostat, was secured to the wooden framework and raised and lowered with the winch by means of pulleys.

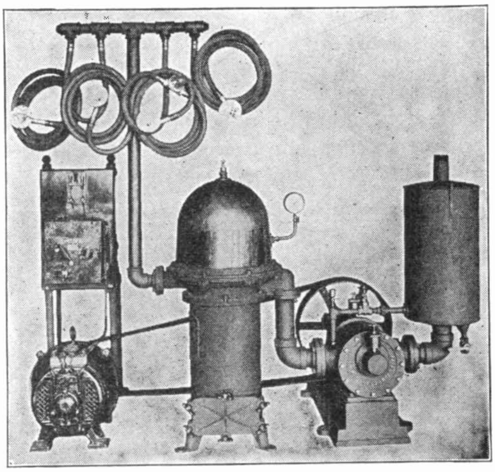
When the plates were immersed, the current was turned on and flowed through the water between adjacent plates. By the addition of smaller plates to those already in place, the capacity of the loader was increased to such an extent that over 10,000 horsepower was drawn from the generator, thus establishing a safe margin of overload.

Needless to say the large amount of current concentrated within such a small area caused a tremendous bubbling and heated the water several yards beyond the plates.

## The Electric Hostler

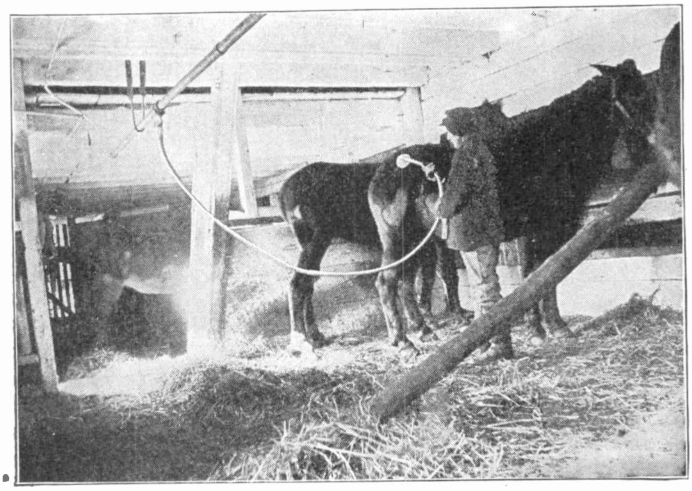
What might be termed an electric hostler is the modern device for massaging and grooming horses by an ingenious adaptation of the vacuum cleaner with an electrically operated air pump. The outfit consists of a rotary vacuum pump, water sealed; a dust collector, water tank, and aluminum curry tools which will take care of from one to four horses at the same time. The suction power can be transmitted from some point outside the stable by means of a line of piping if desired.

The great advantages of the electric curry comb process are that a horse can be thoroughly cleaned in four minutes, as against half an hour or more by the hand method, and the dirt thus removed does not settle about the stable or on the garments



ELECTRIC HORSE GROOMING MACHINE

of the hostler, but is sucked into a dust catcher, together with loose hair, dandruff, etc., and thence easily disposed of. The horses seem to like it, and the owner of a large stable likes it too when he notices how it enables one man to do several men's work, besides keeping his horses in good condition. It is claimed that by using a machine fitted with four grooming tools, 60 horses can be cleaned and massaged in one hour.



GROOMING MULES THAT NEVER LEAVE THE MINES

Among the stables where this machine has been thoroughly tried out are those of Pennsylvania collieries, where mules which work underground, are cleaned of the coal dust and grit by this method.

# Electrostatic Separation of Ores

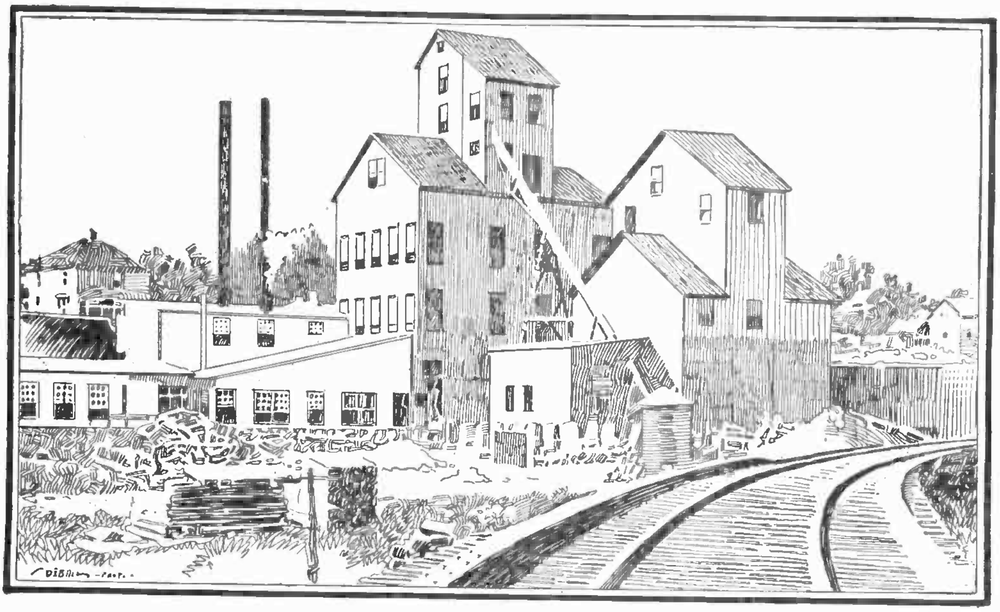
By H. R. LOW

The electrostatic method of obtaining a practical separation of the different minerals found in complex ores has been the subject of much study during the last ten years. As many as three separate and entirely independent systems have been tried in order to perfect machines that would stand up under all conditions found only in field operations. The Huff electrostatic separator has succeeded in meeting the requirements. Its success is entirely due to foresight into the one vital difficulty, that of perfecting an electrical circuit, simple and practical in every way that would stand up under all weather conditions and would deliver every day a constant and unvariable static charge.

The separation is dependent entirely upon the difference of conductivity of the minerals submitted to the charge. Science has long recognized this property in minerals and today its records are practically complete as to the position each mineral holds in regard to its degree of conductivity. The wider the range of conductivity, the more complete will be the separation.

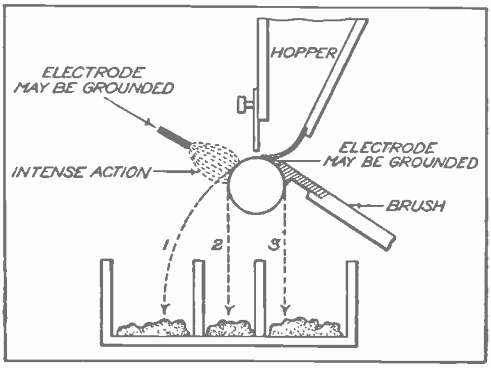
The American Zinc, Lead & Smelting Company, in connection with the Huff Electrostatic Separator Company, erected their first commercial plant in Platteville, Wis., a little over three years ago. This plant has been in practically continuous and successful operation since that time. It is a custom plant treating zinc ores secured from the various mines in the Wisconsin district.

The ore in that district contains sulphides of zinc, iron and lead, and ore found in a limestone formation. It is milled over jigs making a lead concentrate, zinc-iron middlings and a lime tailings. This zinc-iron jig product offers a very simple proposition. The iron pyrite, or marcasite, has a very high degree of conductivity, while the zinc sulphide, or sphalorite, has little or no conductivity as compared with the marcasite. These minerals when fed to an electrostatic separator immediately take their different courses; the marcasite on entering the static field becomes charged instantly and is repelled from the zinc, following the fundamental law of static elec-



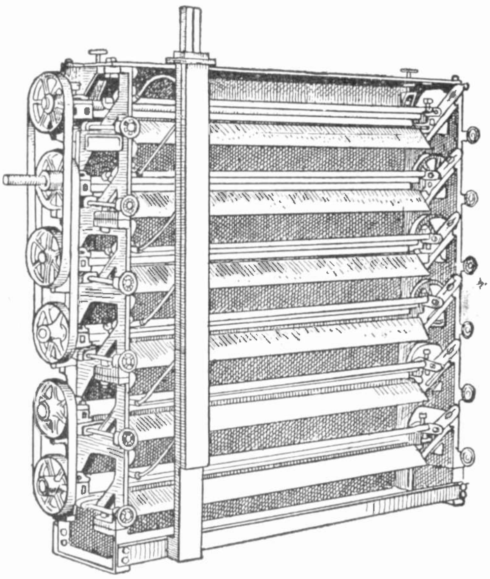
PLANT WHERE ELECTROSTATIC SEPARATION WAS FIRST USED COMMERCIALLY tricity; like poles repel, unlike poles attract. The zinc sulphide, on account of its lesser degree of conductivity, passes through the field unaffected.

The small diagram will give an idea of how an electrostatic separator works. The hopper at the top contains the ores to be




SHOWING THE OPERATION OF AN ELECTROSTATIC SEPARATOR

separated. Between the two electrodes is produced the powerful static field, in which revolves a drum of small diameter. Underneath are the receptacles for the separated ores. The lines (1), (2) and (3) show the paths of three different ores, which have varying degrees of conductivity and consequently differing degrees of electrification. As the drum revolves and the mixed ore falls over it, one kind of ore will be repelled and fall in a curve over into the left-hand box. The second ore, scarcely repelled at all, falls into the middle box, while the third ore actually clings to the drum and finally falls into the third box.



ELECTROSTATIC SEPARATOR

This view is only diagrammatic to show the principle. In another illustration the machine is shown as it really appears and having three sets of two electrodes each.

Another static plant is under construction in Sonora, Mexico, by the Calumet & Sonora of the Cananea Mining Company. This plant is expected to be in operation the first part of June and will enable these people to produce a very high grade zinc, and at the same time a high grade copper product carrying values in gold, silver and lead. Up to this time this property has been operated for high grade lead. The zinc product resulting from wet concentration is too low grade to be marketable as a zinc product and too high in zinc to make it desirable for its copper contents.

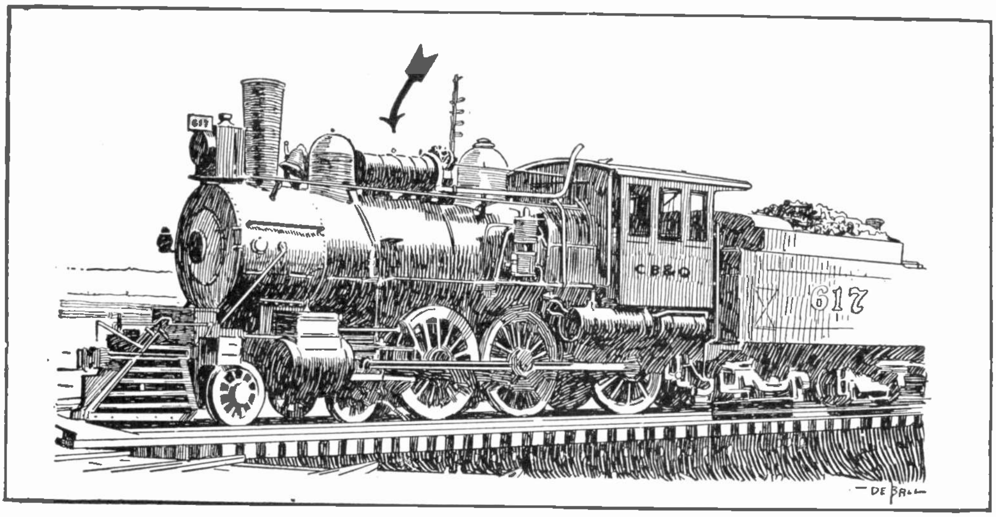
The static process, as applied to zinc ores, not only makes the zinc contents marketable at a higher price but in every case it makes in addition a very desirable smelter product, carrying the iron, lead, copper, gold and silver. In many cases this smelter product makes it profitable to operate where with the zinc product as a source of income the margin is too small.

## An Old Prophecy Fulfilled

In 1865, Wendell Phillips, the mellifluous Boston orator, made an address on a public occasion connected with the schools of that city, when, after expatiating on the wonders of the telegraph and the Atlantic cable, which were then of recent date, further stated that he confidently expected that in forty years messages would be sent without the use of wires or submarine cables.

Strange to remark, it was forty years later, or in 1905, that the achievements of Marconi fully established the truth of the prophecy.

Although his experience and surroundings were academical in their trend, Phillips was a close student of science and inventions, and his lecture on the lost arts represented years of investigation.—*Electrical Review and Western Electrician.*



STEAM TURBINE GENERATOR MOUNTED LONGITUDINALLY ON THE LOCOMOTIVE BOILER

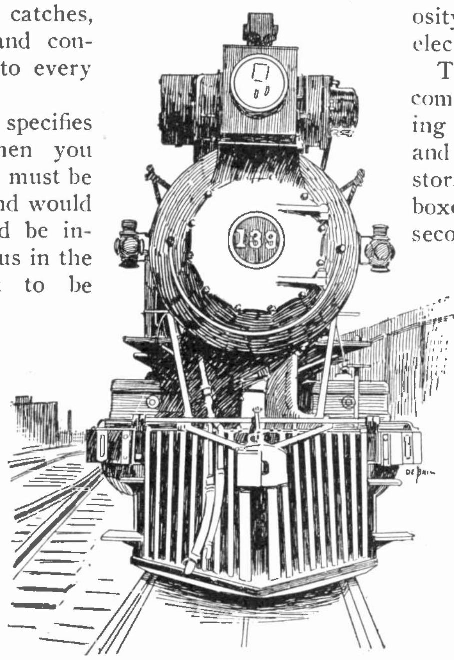
# Electric Lighting a Railway Train

By RALPH BIRCHARD

"Electric lights in every berth" is a catch phrase that has recently come into use for advertising railway passenger service. And it is a catch phrase that catches, too, for the comfort and convenience of it appeals to every traveler.

The advertisement specifies electric lights but when you come to think of it, they must be electric, for no other kind would be possible. Gas would be inconvenient and dangerous in the extreme, and oil not to be thought of. And the objections to these forms of lighting for berths apply in a lesser degree to other parts of the car so that it may well be said that the time is not far hence when a train not lighted by electricity will be hopelessly out of date.

Where does the "juice" for these lights come from? This question may not bother the average traveler very much as long as it comes and keeps coming, but it will interest anyone who has that insatiable curiosity which characterizes the electro-fiend.

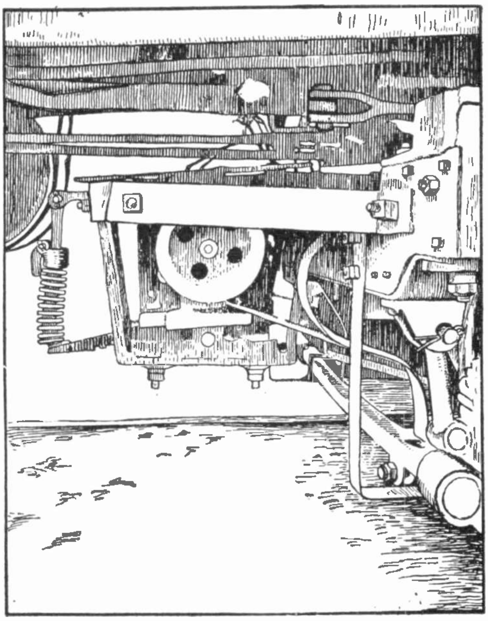


ANOTHER METHOD OF MOUNTING THE TURBINE

There are three ways in common use for electric lighting railway trains. The first and simplest is by means of storage batteries carried in boxes beneath the car. The second is by means of a steam engine or turbine located either on the baggage car or the locomotive, and direct-connected to a dynamo. The third is by means of a small dynamo carried on suspension irons beneath the car and belted to a pulley on the axle. It may be added that the last two also make use of auxiliary storage batteries.

With the "straight-storage" method the

batteries must be large enough to carry the entire lighting load of the car during its run. In fact they must have some excess capacity to take care of delays and accidents which keep the car away from a source of current longer than usual. This means



AXLE CAR LIGHTING SYSTEM

that a very considerable weight is added to the train. The storage batteries to light one car on the straight storage system weigh several tons.

With the head-end system, the entire train is lighted from the generator in the baggage car or on the locomotive. But as the steam to run this generator comes from the locomotive it is necessarily shut off when engines are changed at division points, and some means must be provided to light the train during these periods. Small storage batteries are used for this purpose. They are charged from the dynamo during the later hours of the night when most of the lights in the train have been turned off, and automatically connected to the lamps when the cars of the train are separated.

The axle-generator system gives each car a complete central station. It does not matter where the car goes nor how far it travels away from home; the lighting system travels with it and is always ready. This system is being quite generally adopted by the railroads. The apparatus for it has been developed to a really remarkable degree of perfection. The dynamo is so arranged that when the car is standing still or traveling at a speed below 20 miles an hour, the lamps are lit from the storage battery When this speed is exceeded, the dynamo automatically "cuts in" and carries the lighting, or sends current into the battery if it is not already fully charged.

The lighting load on a first class train is quite heavy. As many as 140 lamps are used in a compartment sleeper In addition to this there may be up to a dozen electric fans. Tungsten lamps are used very largely which seems strange in view of the fact that less than two years ago the Tungsten filament was considered too fragile even for building lighting.

## Ironing a Silk Hat

As Ed Howe would say, what has become of the old fashioned man who used to polish his silk hat on his coatsleeve or with a silk handkerchief? He may not be altogether extinct, but the Simplex French hat iron is surely working a revolution in the

USING THE ELECTRIC HAT IRON

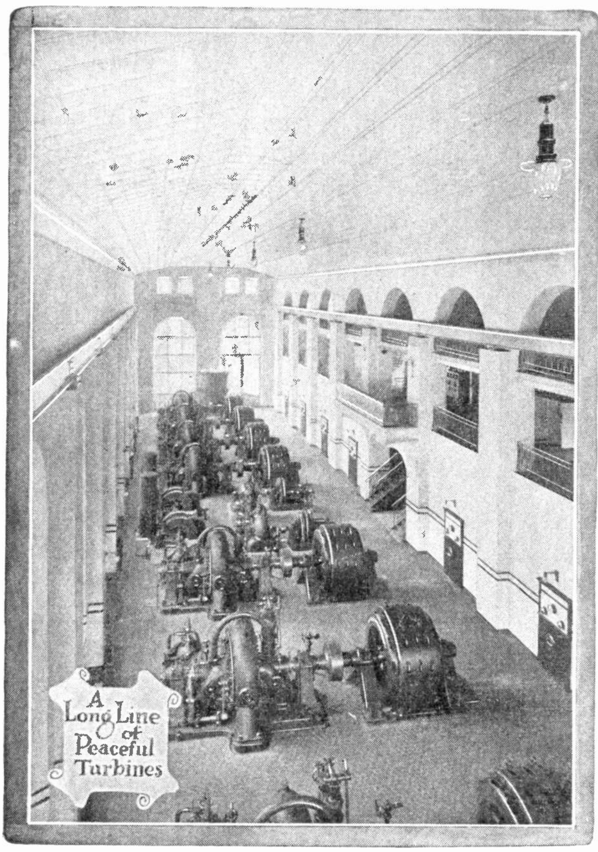
methods of keeping a "stovepipe" in order. The iron is nickel plated and has a wooden handle and of course is electrically heated. The shape of the iron is suitable for reaching every part of the hat brim as well as the crown.

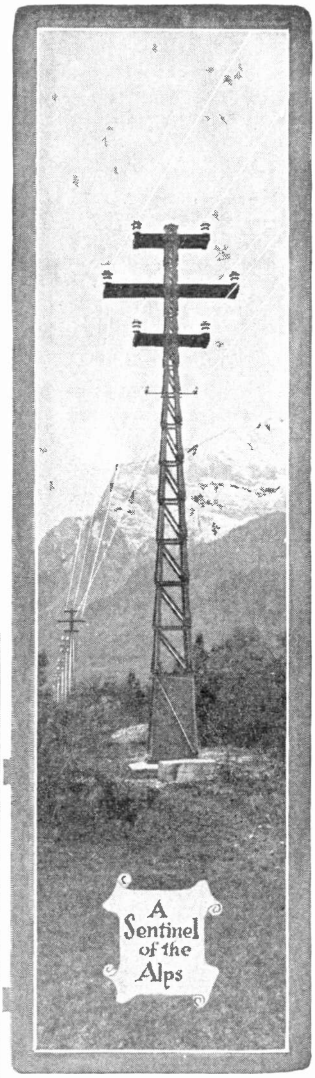
# Switzerland's Latest Power Achievement, the Albula Station

By EMILE RUEGG

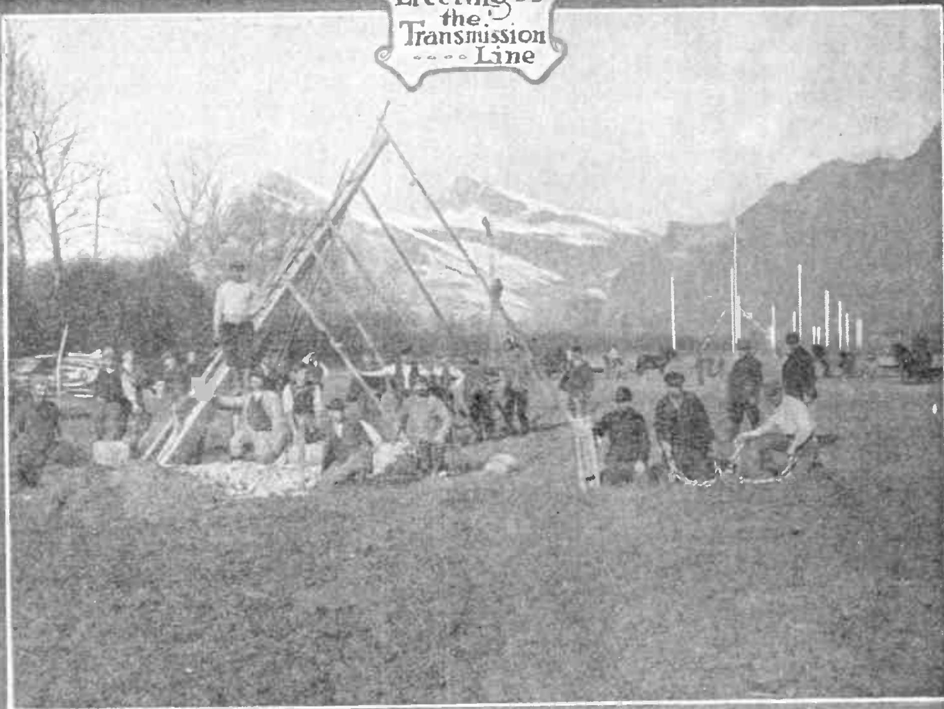
About 100 miles east of the city of Zurich, Switzerland, situated at the foot of a dark forest-covered mountain and surrounded by the most charming scenery, particularly in summer when millions of flowers cover the mountains and valleys, one of the latest great power undertakings of Europe was recently put into commission. This is known as the Albula power station.

The enterprise was undertaken by the city of Zurich which had been forced to enlarge its power supply, the use of current having spread very rapidly in the last few years. After much discussion, it was determined to make use of the waters of the Albula river near the little village of Sils, in the Canton of Graubunden.


A Long Line of Peaceful Turbines


A Sentinel of the Alps

The energy which the Albula river furnishes is 20,600 horsepower, which is quite sufficient for several years to come. How this resistless hydraulic energy is secured from the empounded waters of the river, how the water is led down the mountain side through giant penstocks of steel, how it hurls itself with the fury of a Niagara against the blades of the spinning turbines are details perhaps more interesting to the en-



Erecting the Transmission Line

Operatives Homes in Sils

gineer than to the general reader. To the visitor at the plant none of this turmoil is evident. What he sees, principally, in the interior of the plant is a long line of peaceful hydraulic turbines, each one with its purring electric generator attached to a horizontal shaft.

These dynamos generate current which is afterwards stepped up to 47,000 volts, for transmission through the mountain wilds to the city of Zurich 100 miles away.

In order to have the attendants for the machines and apparatus at hand in times of emergency it has been found necessary to build homes for the electricians and workmen. These homes have been built around every power or transformer station along the whole line. The rent for these homes runs from 70 to 90 dollars a year in which price is included the water and electric power supply. The cost of these houses amounted to about $3,000 each, so that the rent does not represent the full interest on the capital. The difference is reckoned in with the expense of running of the plant. One of the pictures shows a group of these homes near the main plant, in Sils. The city of Zurich has gone even further, as far as the comfort of the working people is concerned, and established stables and bought land so as to guarantee the men a supply of milk and meat and, in summer, fresh vegetables.

It is almost needless to say that all the villages along the line have taken out concessions for electric power supply, so that all the roads and all the homes, even to the very poorest shoemaker, are supplied with electric light.

For the transmission of the current three different systems were employed, as far as the poles are concerned. The round iron tubes with cement mantle belong to the Siegwart type, while the concrete poles of the square type as seen in the picture, including the group of linemen, represent the Jaeger system. The illustration of the main line shows the construction of poles of the system of the Von Roll'schen iron works near Berne.

A visit of this hydro-electric plant and its many transforming substations is not easily forgotten, for it is not only the marvelous machines and apparatus which attract the eye but also the beauty of the surrounding country.

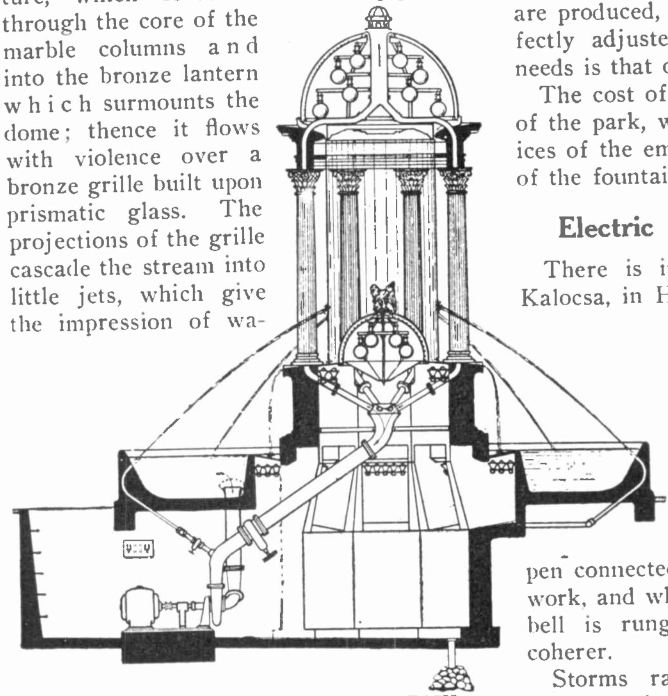
## San Diego's Electric Fountain

Occupying the position of honor in the plaza of San Diego, Cal., is an electric fountain which is altogether original in design. The ordinary electric fountain with which the public has been familiar for years, while it produces a dazzling display by night, is not a thing of beauty by day; in fact, it is a decidedly ugly arrangement of iron pipes in the middle of a pond. Across the street from this fountain is the beautifully designed U. S. Grant hotel, and the architect of the fountain did not forget what many builders do—to make his work conform to the general scheme of nearby buildings.

In the forenoon, when the fountain is not in operation, one sees a small but monumental structure patterned after those Greek and Roman memorials to famous citizens which are still found in the ancient home of art—a dome of bronze upheld by eight marble shafts which rest upon an octagonal granite pedestal. On four sides of the octagon are bronze tablets, one dedicating the fountain to the use and enjoyment of the citizens of San Diego, while the other three present portraits in relief of a trio of great men who were intimately connected with the history of the city—Cabrillo, the discoverer of San Diego bay, Junipero Serra, the priest and founder of the nearby mission, and Horton, the shrewd Yankee pioneer to whom the modern city owes its origin.

At noon the water is turned on. The dome has the appearance of being formed of jets of water shot directly up from below and this water cascades between the bases of the marble Corinthian columns, while streams are projected at an angle from the rim of the basin to the center. By night the waters play in streams of many colored fire. The artist created something entirely different from what has gone before without resorting to the cheap device of producing a freak. So here we have for the circumference of an imaginary circle the green sod; a step nearer comes an area of burnt earth or tile composing the pavement about the basin. Then, a few feet nearer the center is the basin itself of composition stone, after which come the granite of the pedestal, the marble of the shafts, the

The motive power is a fifteen horsepower electric motor concealed below the structure, which forces water in pipes up through the core of the marble columns and into the bronze lantern which surmounts the dome; thence it flows with violence over a bronze grille built upon prismatic glass. The projections of the grille cascade the stream into little jets, which give the impression of water being shot up from below, thus forming a roof of foam on the structure.



INTERIOR OF THE ELECTRIC FOUNTAIN

The flow is caught in the hollow cornice and allowed to run over a perforated plate beneath the dome whence it falls as a shower between the columns and finally leaps in eight streams into the basin. From there it is carried by pipes to the starting point, for as a matter of economy the water is used again and again.

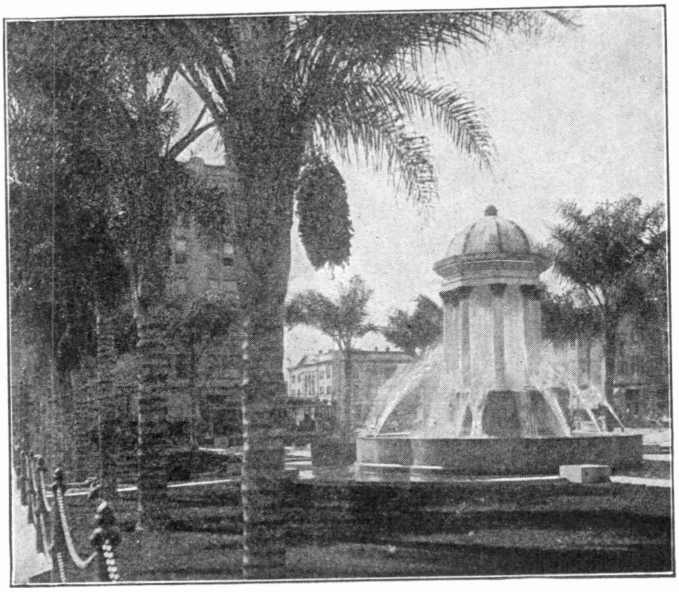
The electric illumination is furnished by clusters of tungsten lamps in the dome, whose light is diffused by the shield of prismatic glass. A similar arrangement is used for a smaller dome below it. Under each of the jets and each of the cascades are light boxes with holophane reflectors and clusters of bulbs, which vary in number with the importance of the position of each. By means of a flasher, which operates automatically, the various color combinations are produced, and the mechanism is so perfectly adjusted that the only attention it needs is that of the park caretaker.

The cost of operation, including the care of the park, water and lights and the services of the employe, is $5 a day. The cost of the fountain itself was $15,000.

## Electric Registration of Storms

There is in use at the observatory at Kalocsa, in Hungary, an electric apparatus for recording distant thunderstorms. An electrical wave, set in motion by a flash of lightning, is registered by a detector resembling in its action that used in wireless telegraph systems. The impulse, it is said, is communicated to a pen connected with a disk moved by clockwork, and when the pen makes its record a bell is rung whose vibration resets the coherer.

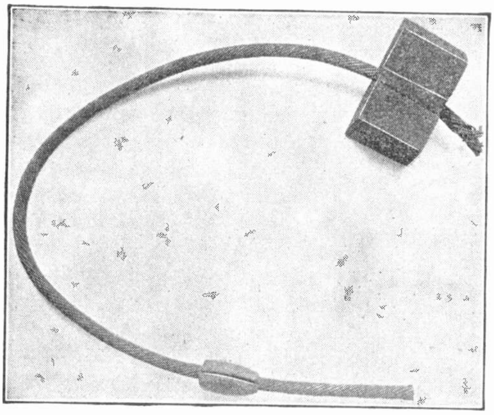
Storms raging invisibly twenty miles away are, it is reported, thus recorded, and on one occasion it is said that the apparatus, on a bright day, made known the prevalence of a violent storm in Budapest, 68 miles distant.



THE ELECTRIC FOUNTAIN OF SAN DIEGO

# Electrical Relics in the National Museum

The United States government possesses one of the largest, if not the largest and most remarkable collection of electrical relics in the world. It comprises more than 7,000 specimens and is growing at the rate of from 300 to 500 acquisitions per year.



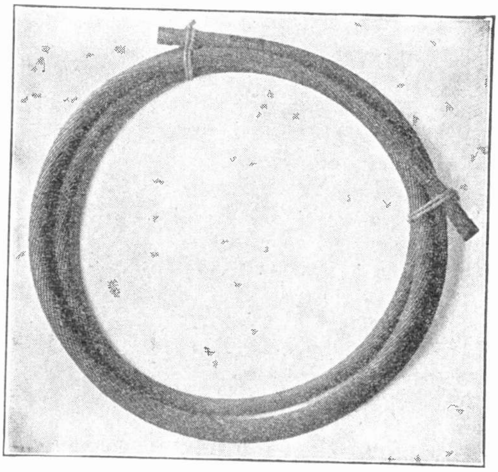
SECTION OF THE FIRST OCEANIC CABLE, NANTUCKET TO MASSACHUSETTS SHORE, 1858. IT IS FITTED WITH LEAD AND IRON WEIGHTS

Inasmuch as almost all of the most notable inventions in the whole field of electricity have been the products of American genius it is particularly appropriate that this nation should possess the most interesting and most complete permanent exposition representative of the development of the art. It is also a matter for congratulation that the beginning of the electrical era has been recent enough and its importance was realized promptly enough to obtain for preservation those early mementoes and products of experiment which have been lost to the world in the case of many another art or industry.

Uncle Sam's electrical museum, as it might be denominated, is the fruit of many years growth. It owes its inception to Prof. Joseph Henry who donated as its nucleus a number of the original experimental machines with which he commenced his experiments in the electrical field about the year 1831. As the scope and purpose of the collection became known suitable specimens were donated in increasing numbers by electrical inventors, manufacturers and others. During the last twelve years the collection has been in charge of Mr. George C. Maynard, who is especially qualified for the responsibility, having been associated with Prof. Henry since 1864.

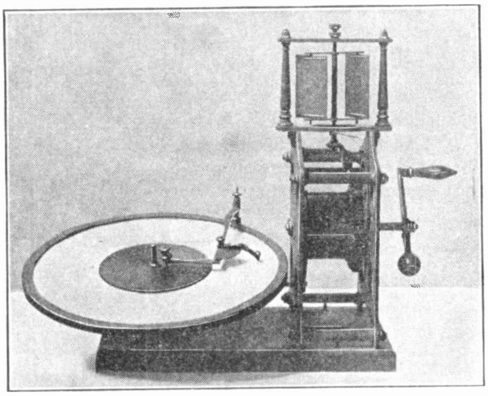
The electrical relics and exhibits are housed at the United States National Museum at Washington, an institution supported by government appropriations, although its affairs are administered by the officials of the Smithsonian Institution.

The recent completion by the government of a new $3,000,000 National Museum Building supplementing the old museum structure which covers an area of 2 1-3 acres on the Mall at the national capital will, by its provision of additional space for the electrical collection, work great improvements in the conditions governing this exhibition. The electrical relics are arranged in glass cases and glass-fronted wall cabinets and in the current rearrangement of the accumulation every effort is being made to so group the exhibits according to classes and in accordance with the trend of development as to make it easy for persons who wish to follow chronologically the series of object lessons reflecting the transformation of any standard class of electrical apparatus.



SECTION OF THE FIRST TRANSATLANTIC CABLE

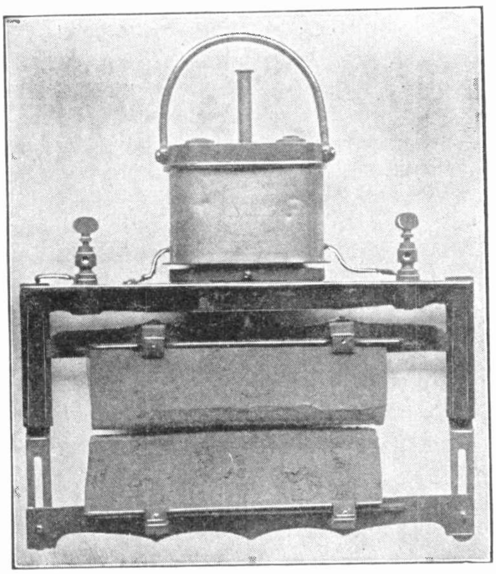
Even in a collection such as this it is, of course, impracticable to include everything electrical, indiscriminately. The effort is to show by original apparatus, experimental equipment and reproductive models the beginnings and the important steps in the development of every branch of the electrical



ORIGINAL AND ONLY SPECIMEN OF THE BAIN CHEMICAL TELEGRAPH

field. Thus every epoch-marking invention in the history of applied electricity is here represented—usually by the most interesting relic in that particular sphere.

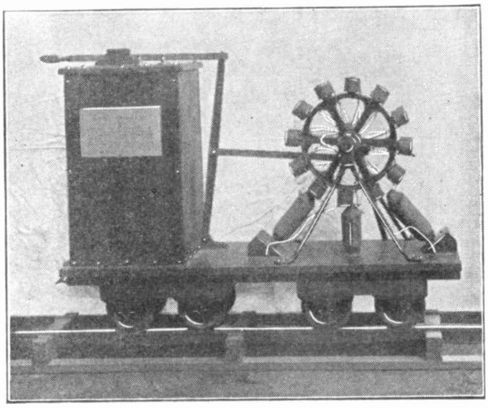
The government officials in charge of the electrical collection have been especially keen to secure whenever possible original "first" instruments. Thus we see in the collection Prof. Henry's initial large lifting magnet—the forerunner of a most important class of present day electrical toilers and



ORIGINAL ARC LAMP INVENTED AND MADE BY WILLIAM WALLACE IN 1878

Morse's first telegraph instrument which he made with his own hands. Here, too, are Bell's original telephones; Elihu Thomson's first electric welding machine; the first Edison incandescent light dynamo used for commercial purposes, and Thompson's first arc light dynamo.

A very interesting relic is a Morse telegraph receiving instrument which was used in 1844 on the line between Baltimore and Washington—that first telegraphic line constructed by appropriation of Congress and which proved the practicability of the invention. In the same division of the collection and striking in contrast is a standard Morse set of the present day consisting of key, sounder and relay. This particular set is especially interesting by reason of the fact that it is the one used some years ago by

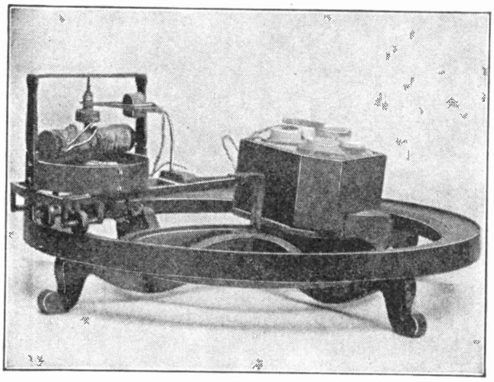


MODEL OF MOSES G. FARMER'S RAILWAY MOTOR

Thomas A. Edison in receiving the telegraphic message sent around the world for the purpose of demonstrating how expeditiously this could be done.

A group of exhibits that attracts much attention is that devoted to submarine cables. One of the notable objects in this section is a section of what is accounted the first American oceanic cable—the one laid about 1858 from Nantucket Island to the Massachusetts mainland. This specimen bears the lead and iron weights which were employed in connection with this pioneer cable to hold the cable on the floor of the ocean. A rival of this specimen in popular interest is a section of the first Atlantic cable, this particular section having been donated to the government by C. V. De Sauty, the first operator of this cable at the terminal at

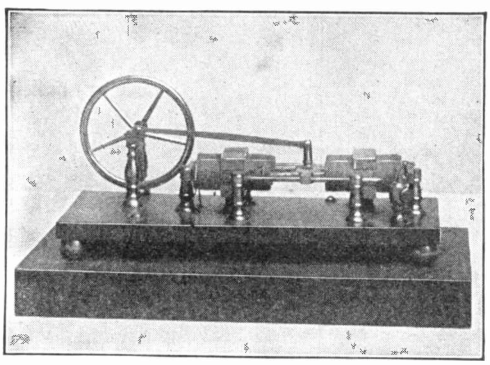
Plaster Cove, Newfoundland. An unusual feature in connection with this first long-distance cable was that the cable throughout its entire distance was of the dimension shown in the specimen instead of having, as



THOMAS DAVENPORT'S ORIGINAL MODEL OF HIS RAILWAY MOTOR

is the present practice, the heavily armored or reinforced "shore ends" designed to avoid damage in shallow water.

Conspicuous among the curiosities in the government's electrical treasure trove is a Bain chemical telegraph instrument—a memento of a most ingenious invention. This is not only an original but it is believed to be the only one in existence. The Bain system of telegraphing was invented and put in operation as a competitor of the Morse system and was supposed to avoid infringement of the Morse patents. In this system dots and dashes of the Bain alphabet were marked on a circular sheet of paper moistened with a solution of potassium ferrocyanide by means of chemical action



MODEL OF THE ELECTRIC MOTOR INVENTED BY CHARLES G. PAGE IN 1850

through the instrumentality of the electrical current transmitted from distant sending stations.

Another novelty that is shown is the original arc lamp, invented and made by William Wallace of Ansonia, Conn., about 1878. The distinctive feature of this lamp was that carbon plates were used instead of rods and were so adjusted that the electric arc passed from one side of the plate surface to the other across the width of the lamp—a supposedly economical arrangement.

Electrically operated phonographs are included in the big collection and among them several of the earliest designs evolved by Edison. So, too, ere long, will be a model of a high power wireless telegraph station as representing one of the latest utilizations of the magic current.

Railway motors receive much attention in Uncle Sam's continuous exposition of things electrical as is fitting in view of the importance of this class of apparatus in the industrial and transportation world. By means of models or originals every important step in development may be traced. For instance there is Thomas Davenport's original model of his electric railway motor, one of the earliest inventions made by the Vermont inventor who caused quite a stir three-quarters of a century ago. This model shows the motor traveling on a circular track with a Grove battery placed on a platform in the center and traveling with the motor. There is likewise a model of the electric railway motor invented by Moses G. Farmer and, among a number of others a model of the motor invented about 1850 by Charles G. Page, and which was used to operate a full-size freight car. In this early electric motor a lever connected to the axles of the car was operated by a reciprocating mechanism, power being derived from rather large chemical batteries carried on the car.

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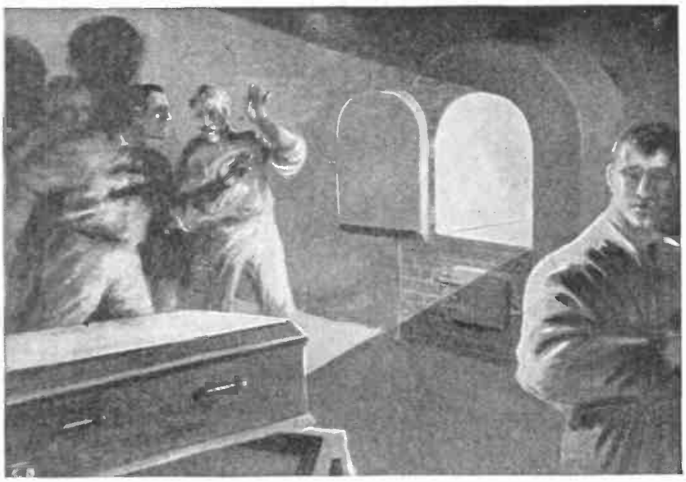
An alloy containing 8 per cent of molybdenum, 0.3 per cent of vanadium and 0.6 per cent of carbon is said to make good permanent magnets, which retain their magnetism up to a temperature above 1,000 degrees centigrade. Four per cent of tungsten with 0.4 per cent of vanadium has also been found to be a good combination.

## After Death—What?



AN ELECTRIC CREMATORY FURNACE

The repulsive feelings which enter into the thought of having friends or relatives cremated after death may be lessened if the result is accomplished without flames reaching the body.

Apparently following out this idea Lawson H. Giddings, Pasadena, California, has received a patent upon a crematory furnace in which electric heater coils installed in the walls will raise the temperature of the interior to a white heat. The furnace is designed to be built of fire brick or other heat resisting material, and although the heat developed by the coils is intense no flames are visible any more than in the ordinary electric furnace.

## Illuminating An Art Shop

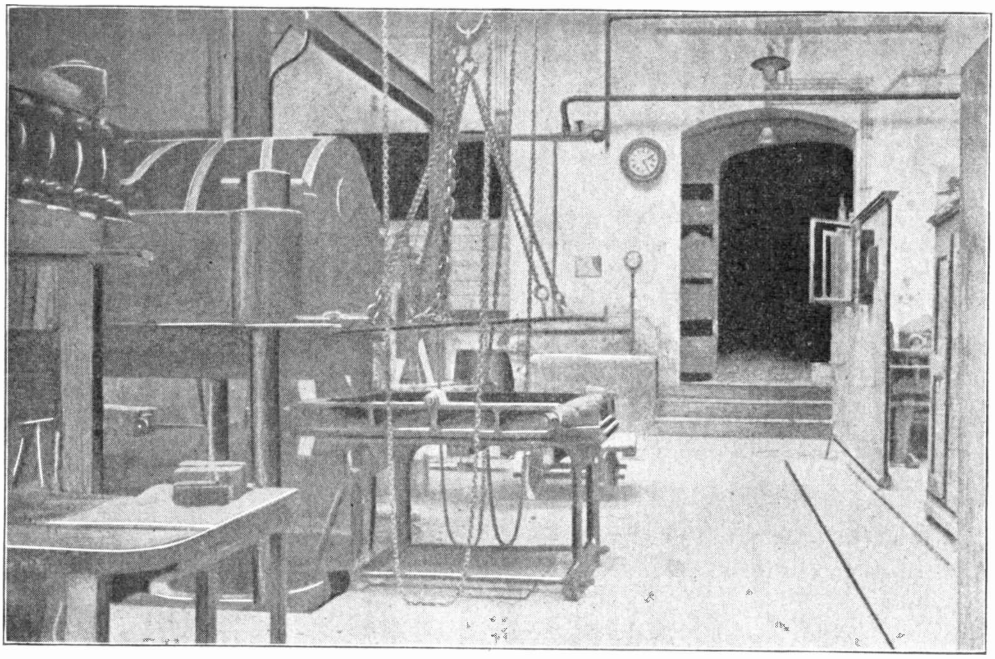
The lighting of pictures to best display them is a difficult problem but one in which each case must be given individual attention. The accompanying picture presents the solution offered by the owner of a Chicago art shop and successfully brings out the detail in each piece of work. A Federal ceiling cluster containing four 60-watt tungsten lamps has suspended below it a rectangular screen of oak molding. The upper side of the screen is covered with glass over white paper, thus acting as an indirect reflector and keeping the lamps hidden. The outfit fills the room with soft white light and displays the works of art to advantage.

EFFECTIVE ILLUMINATION IN AN ART SHOP

# Asbestos Insulating Materials

On every electrical machine, on every telegraph or telephone pole, on the trolley wires, we find insulating material which has to guard the current from leaking to the ground. In fact, the tremendous development which has taken place in all electrical applications is due, to a great extent, to the finding of new and better ways of insulating. Naturally, this has led to the development of a special industry closely allied to the electrical industry; namely, the manufacture of insulating materials.

In the January number of POPULAR ELECTRICITY we have seen that mica has gained the largest. Asbestos is found in large blocks; to the layman it appears to be an ordinary stone. But the expert, of course, knows better. He first breaks the blocks into smaller workable pieces. Then these pieces are put into a machine which tears the stones into very thin fibers. The most expensive fibers are those which retain the greatest length after being torn. The white fiber is more expensive than the blue. Such fibers are worked by the manufacturers of insulating material into solid pieces again by means of very high pressure and the use of special molds.



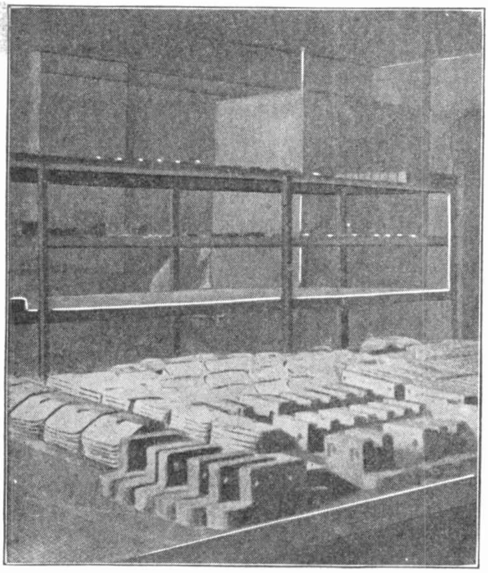
HYDRAULIC PRESS OF 350 ATMOSPHERES USED IN MOLDING ASBESTOS INSULATING MATERIAL

very widely spread application as an insulating material. However, it cannot be employed everywhere, neither for all purposes, and so we had to seek for another mineral which could be worked the same as mica, but which would possess certain other qualities. This mineral has been discovered in asbestos.

The world's asbestos market is supplied from the Canadian mines, which are by far,

With the fiber there is mixed for spark guards, for instance, some Portland cement and waterglass (a substance consisting of silicates of sodium or potassium). This is done in a special mixing machine until the whole has become of absolutely uniform appearance. The material thus prepared is now put in the right proportion into the mold. The top part of the mold is set on the material and the whole placed under a hydraulic press. Then the piece is pressed into one solid mass and is carefully taken out of the mold and placed in a hot room where it is dried. After this, it is placed once more into the waterglass to be impregnated. Then it is dried again, and finally it is baked in an oven at about 300°F.

The pieces so formed are smoothed down by means of machines, very similar to wood-working machines. Where the pieces should have a brilliant finish they are polished. Some firms only varnish them with waterglass. The pieces thus prepared will be



SMALL SECTION OF THE AIR DRYING ROOM FOR PRESSED PIECES

able to stand the very highest temperatures and are therefore used chiefly for spark guards and in places where the electric arc is apt to burn up other insulating material. If the process is carefully done, such material will stand about 5,000 volts to each one-eighth inch of thickness.

For other purposes there are also employed other bases and for pieces where no heat is to be expected many manufacturers use as a basis for insulation combinations with tar, asphalt or some such material. With linseed oil, benzol and turpentine this material is melted into a liquid and then put with the asbestos fiber. The liquid is, of course, almost stiff and is slowly put into the mixing machines where the asbestos fibers are already being mixed. Thus there is obtained a material which, when pressed together, will remain in the form given. The material is so mixed until the whole is completely uniform and almost dry, yet just slightly sticky. It is now molded either into plates or special shaped pieces, washers, etc. Sometimes metal parts are molded into the insulating piece.

The finished articles are dried out during about six to twelve days, in a warm place. Once they are sufficiently dried out, they are baked in the oven. Here the binding process takes place and the pieces become extremely hard and acquire mechanical strength. Then they are smoothed and varnished, or smoothed and highly polished. If a very high insulating quality is required, it becomes necessary to impregnate the pieces once more after their having been baked. The various firms use different methods for doing this. Some take the pieces out of the oven and plunge them thus hot and dried out into boiling linseed oil, where they are left for four hours. Then they are once more baked for ten hours and then smoothed and finished. Others take the pieces out of the oven and put them into a vacuum impregnating oven, where the pieces are impregnated with insulating varnish.

There is still another process of molding by heat. In this case the mixture is applied differently and also made up differently. The basis used is pitch and bitumen, which is crushed into the finest powder and then mixed with the asbestos fibers. During the mixing some turpentine is added to the mass. Linseed oil is also used, and also other oils. Some firms put some Montana wax into the mixture and colophonium (Dragon's blood). Others, again, put powdered sulphur into the mixture; others shellac. But the latter being rather an expensive article, it is not very frequently used. The whole mixture is mixed until it becomes one black dust. As a rule it is dry and not like the other material of the cold process.

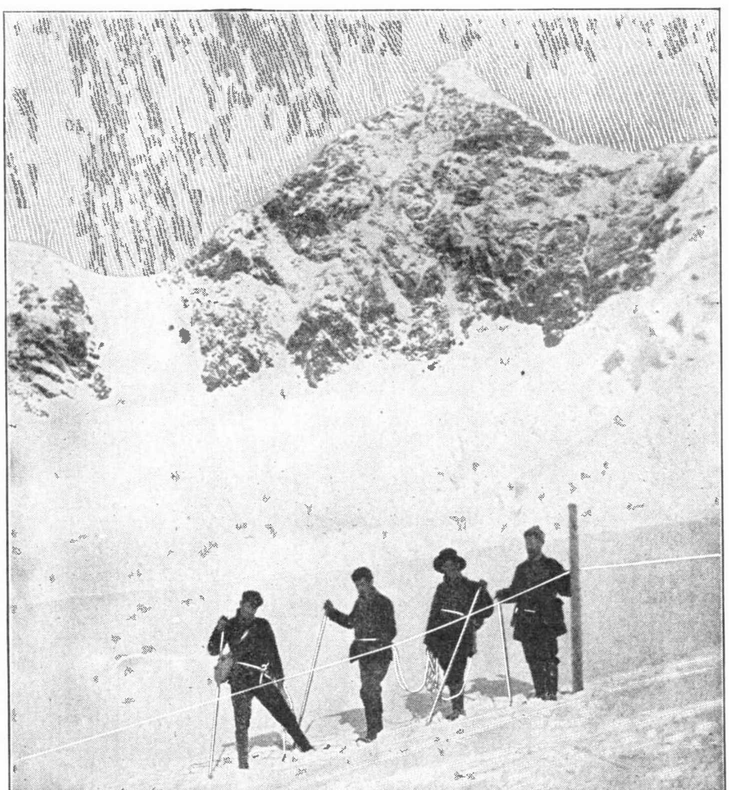
Then the material is weighed, as is done in cold molding, placed into the mold and then the mold is put into the oven and heated. Next the mold is taken out of the oven and set under high pressure. This process takes half a minute. The mold is taken down with a towel and is then cooled with cold water, the piece is taken out and is in most cases finished and does not need polishing.

# A Telephone in Eternal Snow

By DR. ALFRED GRADENWITZ

WHEN Dr. Camillo Alessandri, the courageous director of the Regina Margherita Observatory on Mount Rosa in the summer of 1908, first conceived the plan of carrying a telephone wire up to the mountain top, he was fully aware of the difficulties likely to be met in his task. The Government authorization having been obtained, he at once set to work in order, if possible, to finish the installation within the brief season during which the observatory is habitable. While conductors, insulators, telephone apparatus and accessories had been ordered from the Milan telegraph and telephone office, the telephone poles were purchased at Alagna and conveyed up to the Colle d'Olen (at about 11,000 feet above sea level), mostly by women carriers, and with the aid of mules. The most difficult part of the transport, viz., from the Colle d'Olen to the mountain top, was taken charge of by two athletic carriers—Giovanni and Lorenzo Scolari—to whose daring the success of the enterprise is mainly due. In fact, these men, assisted by the line-keeper Scopello, also fixed the poles in the snow and ice of the glacier and, generally speaking, did all the difficult or dangerous work entailed by the task.

The telephone line was to connect the Regina Margherita Observatory, situated at 15,050 feet above sea level, with the Capanna Gnifetti Observatory, located at an altitude of 12,050 feet on the mountain side, and thence with Alagna in the Lombardian plain. In the section between the Capanna Gnifetti and the Colle del Lys, telephone poles thirteen feet in height were fitted into the snow to a depth of about 6.5 feet, leaving a distance of about 300 feet between poles. As the snow, even at these medium heights, was likely to be dry enough for ensuring electrical insulation, it was thought possible to allow the lowermost portion of each



TELEPHONE LINE IN THE COURSE OF CONSTRUCTION. PROF. ALESSANDRI NEXT TO THE POLE span of wire to rest on the snow. From the Colle del Lys to the summit of Mount Rosa no poles were used, as the insulating power of the always pulverulent snow was known to suffice for insuring telephone communication, even through a bare wire stretched out completely on its surface or buried in its mass.

After a thorough testing of the apparatus and conductors, the line would not work. The drawback was found to lie in the insufficiency of the ground connection at the Capanna Gnifetti. Then it occurred to Dr. Alessandri that a ground connection could possibly be found at the bottom of some of the crevasses on the Lys glacier, close to Capanna Gnifetti. A test was made on August 26th. Tied to a rope and carrying with him the copper plate intended to form the ground connection, if this could be found, Dr. Alessandri was let down into the crevasse chosen for the experiment. This had the form of a funnel with the broad end turned downwards, being relatively narrow at the top. Down about 65 feet Alessandri found a horizontal sheet of smooth ice; in fact, a real frozen lake. While admiring this fantastical grotto and observing, not without awe, the enormous ice stallactites hanging down from the vault and threatening to fall on his neck, he suddenly felt the ground give way below his feet and found himself immersed in water. After recovering from the surprise of this involuntary dip, he let the copper plate down into the underground lake and signaled to his companions to raise him up to the surface. On that very day a telephone connection with the Regina Margherita Observatory was at last obtained.

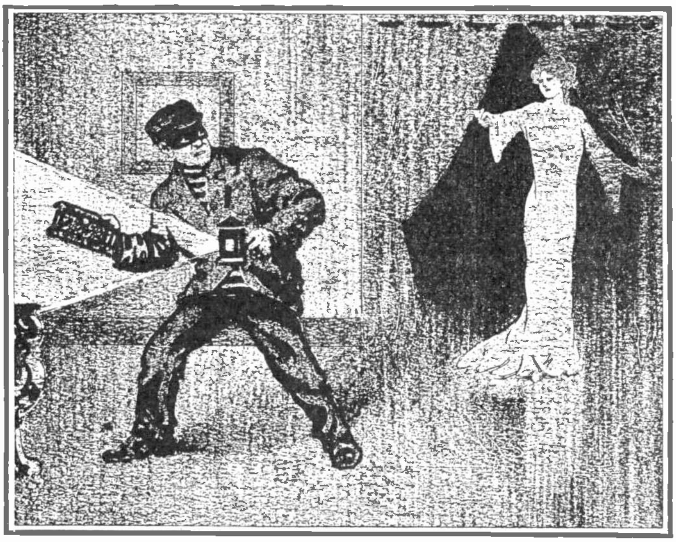
HEAD END OF WIRE SPAN MORE THAN 1100 YARDS IN LENGTH

After installing the most difficult portion of the line, its extension to the Colle d'Olen and Alagna was left for the following year. However, during the summer months of 1909 the director of the observatory was prevented by a dangerous illness from returning to his wonted post on the summit of Mount Rosa. As soon as he had regained sufficient strength to drag himself up to the observatory, he threw all medical advice to the winds and returned to his mountains in order at least to form an idea of the damage wrought in the telephone line during the intervening months of desertion. Though the downward motion of the glacier had disturbed considerably the alignment of the telephone poles, an occurrence perfectly foreseen at the outset, a few days' work was sufficient to restore everything to working order and to re-establish telephone communication between the two observatories.

Though only two days were left before the closure of the mountain observatories, Alessandri decided to make the best of the time at his disposal and, if possible, to complete the telephone line down to the plain. A number of difficulties were encountered also in the lower section of the line, especially in traversing the Pisse Valley (covered by a single span of thick steel wire more than 1,100 yards in length), and between the Garstelett and Indren glaciers (another span of nearly equal length). In a surprisingly short time everything had been finished and on September 8, 1909, the telephone wire for the first time conveyed the human voice from the summit of Mount Rosa down to Alagna.

## Jewel Box Electrical Alarm

There is upon the market in Paris a cash and jewel box with an electric alarm attachment calculated to startle a would-be thief into forgetting everything except a "get-a-way."



THE JEWEL BOX ALARMS THE HOUSEHOLD

In the bottom of the jewel box is placed a small mechanism consisting of a dry battery, a magnet, a system of levers and an electric bell. In the center of the bottom of the box is a small orifice, through which hangs suspended a small pendulum. As long as the box is stationary this pendulum hangs perpendicularly and does not close the electric circuit. But if moved only in the slightest degree one way or the other, or if the box is raised off the table, the pendulum drops down, thus closing the circuit and causing the alarm to sound. It makes a noise as loud as an alarm clock and does not cease ringing until it is "shut off." This can only be done by opening the lid of the box and shifting a lever.

## Artificial Comets and Auroras

Natural phenomena are often counterfeited in the laboratory. For instance, during a series of experiments with the pressure of light upon floating particles of extreme minuteness, there was obtained a very accurate reproduction of a comet's tail.

A powder consisting of emery and the spores of puffballs was put in a vacuum tube whence the air was exhausted as completely as possible. When the rays from an arc light were concentrated upon the powder the lighter particles were seen to be blown out as if repelled by the light, presenting a striking resemblance to a comet's tail According to Arrhenius and others, this is analogous to the way in which the sun actually produces the tails of comets. The experimenters found that the effect upon the powder was of the same order of magnitude as would be expected from the value of the pressure of light deduced from other experiments.

Experimental proof of the electrical nature of the northern lights was once adduced in an interesting way by Professor Ramsay. The result was an artificial aurora borealis.

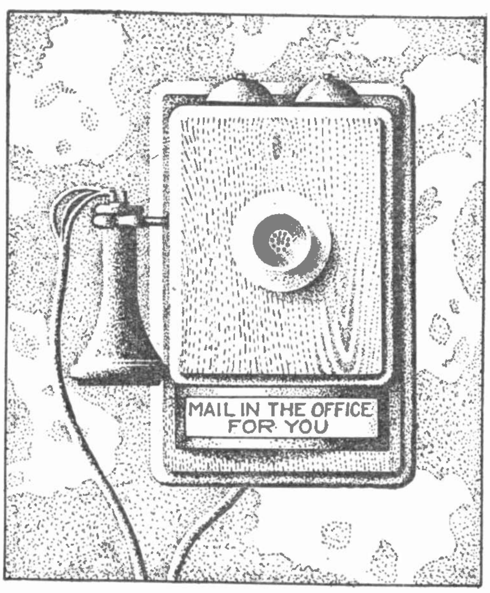
Between the poles of a powerful electromagnet he suspended an exhausted glass globe, containing at the top a metallic ring. An alternating current discharged through the ring in the globe produced an annular glow, and when a current was sent through the coils of the electromagnet the glow was deflected downward in streamers resembling those of the aurora borealis. The spectrum of the natural aurora shows the presence of krypton, and in Ramsay's experiment krypton was also produced.

## Magnetic Alloys

It is generally understood that the only substances which are magnetic, or may be magnetized, are a certain natural magnet, called lodestone, and iron. There are certain manganese alloys, however, which are magnetic, called the Heusler alloys, so named after their discoverer, Dr. Heusler. They are composed of copper, manganese and aluminum and are remarkable from the fact that, in certain proportions they are magnetic, although the component metals are not magnetic. Dr. Heusler made the discovery by accident in 1901. He was turning a metal alloy containing manganese in a lathe, when he noticed that the turnings adhered to the tool. This led to a general investigation of the magnetic properties of manganese alloys.

## A Hotel Convenience

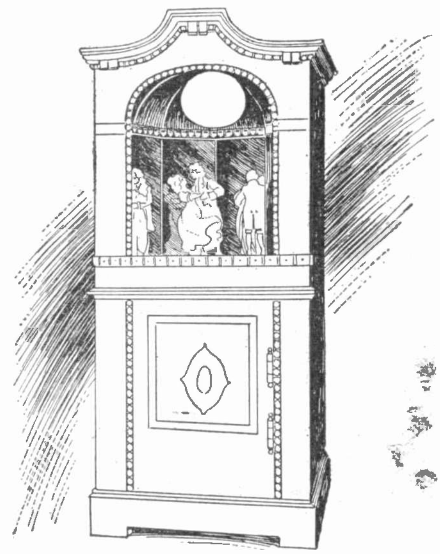
In the high class hotels in the larger cities electricity is made to perform a great many little services for the patron, which in the aggregate tend to impress him with the fact that no expense has been spared to make everything convenient and comfortable. For instance, he will find in such a hotel that under the telephone in his room there is a slightly convex case of opaque glass. Suddenly he may be surprised to see the case light up from within and to read the words "Mail in the office for you," the letters being painted on the inside and only visible when the electric light within is turned on. Inquiring later at the office he finds that the mail distributing rack back of the clerks desk is fitted with little shutters to each compartment. When a letter is thrust into a compartment the shutter is pushed back and this closes a circuit leading to the lamp in the corresponding room.




"MAIL IN THE OFFICE" SIGNAL

## A Novel Music Box

Dance music suggests motion, and even small-sized music boxes have had their charm increased by the addition of a couple of figures which would rotate to the tune which the box was playing. Now a builder of larger music boxes has gone still further by giving the rotating couple not only a stage setting, but a changeable lighting effect also. The figures appear to dance in a niche with mirrored sides, thereby giving the impression that there are several couples, and are brightly lighted by a pair of incandescent lamps placed on opposite sides of the megaphone. The lamps are hidden from the observers' view and a slowly rotating color screen keeps changing the color of the light.



A NOVEL MUSIC BOX

# ELECTRIC CURRENT AT WORK

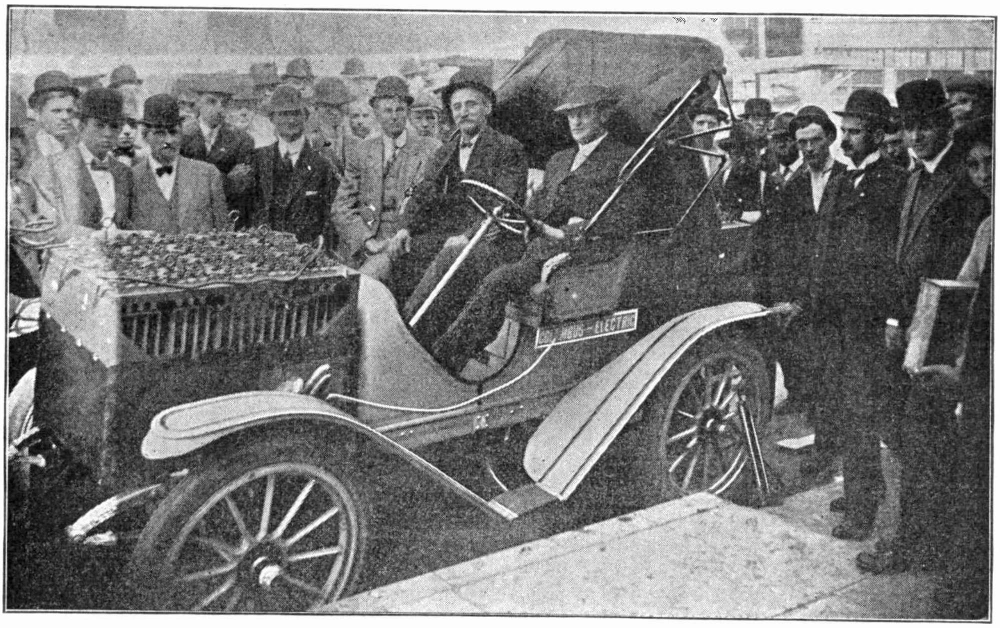
*NEW DEVICES FOR APPLYING ELECTRICITY*

## New Primary Battery

An electrician and inventor in Los Angeles, Cal., believes that he has discovered a way of making primary batteries so that they will have great enough efficiency to make them practicable for running automobiles, and even cars.

One of these batteries, weighing 600 pounds, was able to develop three horsepower and drive a roadster at the rate of fifteen miles an hour over the city pavements. The inventor claims that his battery will generate one horsepower for ten consecutive hours at a cost of one cent. Nothing is said, however, of the cost of renewing or recharging the cells when run down.

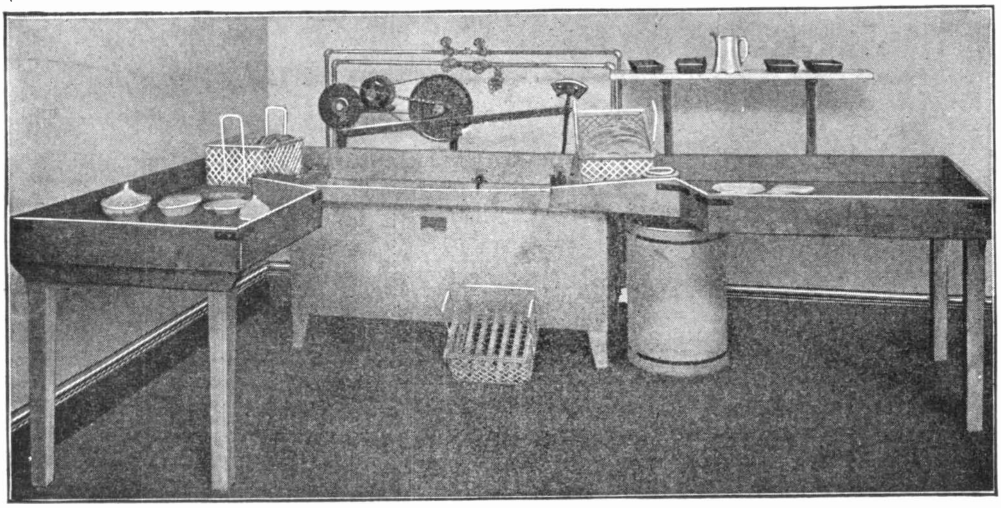
Each cell consists of four sheets of zinc and three sheets of carbon, all having the dimensions of 4 by 8 inches, the zinc being ¼ inch in thickness, the carbon ½ inch. The weight of each cell is fifteen pounds, charged. Unlike storage batteries, it is not necessary to charge it with a dynamo; it is self-generating, and as soon as the liquid is poured into the batteries the current is produced. The inventor claims that his secret compound is very cheap to manufacture, and may be carried concentrated or diluted. The mixture of four pounds of crystals with ninety-six pounds water will generate at once 170 amperes at 1¾ volts.



NEW PRIMARY BATTERY IN USE ON AN AUTOMOBILE

## A Dish Washing Machine

The notion that dishes can be washed thoroughly only by hand has been the cause of perpetuating the most tiresome form of kitchen drudgery. The dishes must be picked up by hand, there is no getting around that fact, but there the handwork



A DISH WASHING MACHINE

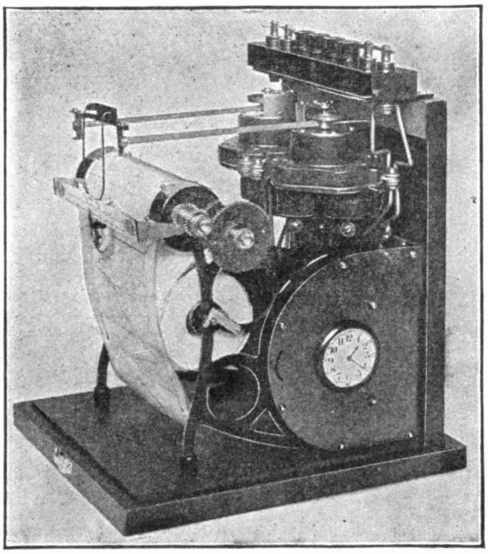
may cease if people will only realize that the rest of the process may be effectually carried out by the aid of a little motor.

Practical dish washers are on the market and here is one of them. A copper tank containing soap and water, into which the dishes are lowered in metal baskets, is arranged with a one-eighth horsepower motor to drive the gear on the outside for imparting motion to the dishes. A sloping bottom makes the tank readily drained and cleaned. The dishes are brought from the table in the metal baskets and placed in the washer where the current completes the work, and thoroughly. Afterwards wipe them if you think this is necessary, or else simply rinse in hot water and allow them to drain and dry. The roomy tables at each side are convenient in either case

## A Tireless Timekeeper

The work done by machine tools is very largely proportional to the work done by the men running them. Hence any recording instrument that will show just what the tools are doing gives a very good check on the efforts of the men.

The graphic recording wattmeter shown herewith does keep an exact record of the exertion of the tool. It shows just how much power the machine was using every instant during the day. It does this by drawing a curve on a moving strip of paper. The paper is fed at so many inches per hour and is divided horizontally into spaces equalling a certain power. Thus at the end of the day, the manager can see what proportion of the time the machine was working and what portion it was idle. In fact, he can go further. He can set the meter



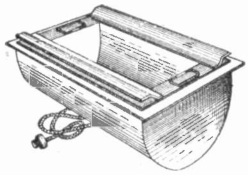
GRAPHIC RECORDING METER

up in his office and tell at any instant by looking at it whether the machine out in the shop is working.

As a result of the weighing frauds in the customs house of New York the government has just placed electrical weighing machines in the customs houses of New York and Boston.

## Chocolate Warmer for Candy Making

In making chocolate candies it is very necessary to keep the chocolate for dipping in the proper fluid state so that the work



CHOCOLATE HEATER

can be carried on rapidly and to insure getting a uniform coating of chocolate on all pieces. The Cutler-Hammer electrically heated chocolate warmer permits of regulating the heat by means of a three-heat

MAKING CHOCOLATE DROPS

snap switch. The heating element is entirely enclosed in a metal casing and the chocolate pan having the same shape rests intimately in contact with the heater. The pan, however, is separate and can be lifted out to facilitate washing.

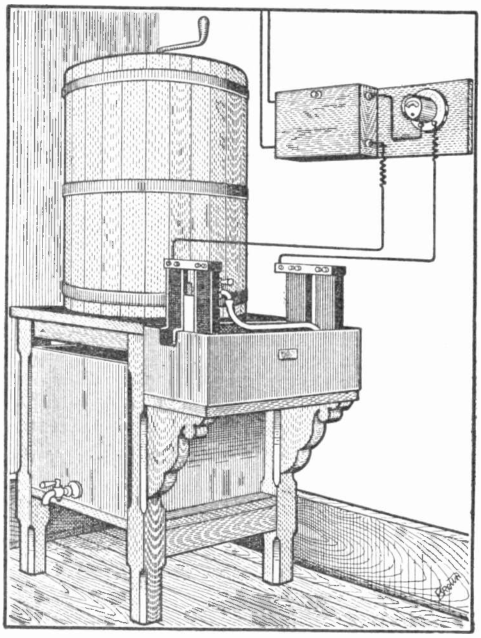
These chocolate warmers can be attached to any lamp socket by the cord and attachment plug provided. The inherent advantages by the use of electric heat, such as cleanliness, safety, readiness for operation, etc., make these devices of great value in the large or small candy factory. The current consumed is about equal to that required by an ordinary 16-candlepower lamp.

## Hotel of a Thousand Fans

At the Hotel Astor in New York one of the things which impresses the visitor very favorably is the great number of large ceiling fans. Of course every hotel nowadays is provided with fans of various types, but here they have been installed one might say almost by the thousands. Every guest room is provided with a large ceiling fan, representing altogether a very great number, and in the main lobby a big 36-inch fan hangs every twelve or fourteen feet, as also in the dining rooms. One would almost think there were more than necessary, but after sitting in the lobby for a few minutes on a hot day and luxuriating in the constant, cool breeze that is maintained all through the rooms, what at first sight appears to be unwarranted profusion turns out to be a very good investment, for there is no doubt but that this effort to make guests comfortable is a very strong advertising feature.

## Keeping the Clothes White

Common salt has in it an element called chlorine which in gaseous form is of a yellowish green color and has a disagreeable, suffocating odor. It is a powerful oxidizing

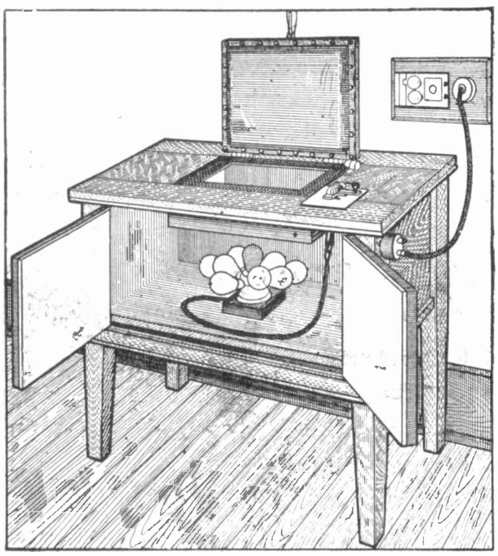


THE "CHLORINATOR" FOR MAKING A BLEACHING COMPOUND and bleaching agent and can be obtained from salt brine by electrolysis.

The accompanying illustration shows the Valhalla chlorinator, an apparatus for making "chloritone." Chloritone is produced by the decomposing electrolytic action of 110 or 220 volts direct current on a solution of common salt while flowing through the vat attached to the side of the table. This produces a bleaching liquor at a cost of one-half cent a gallon, which is stored in the tank under the table. It is said to be more easily rinsed from the clothes and to leave a clean, sweet odor.

## Automatic Photograph Printer

In printing photographs by natural light, a photographer spends much of his time in watching the effect of the light which is not always uniform. The Calhoun photo

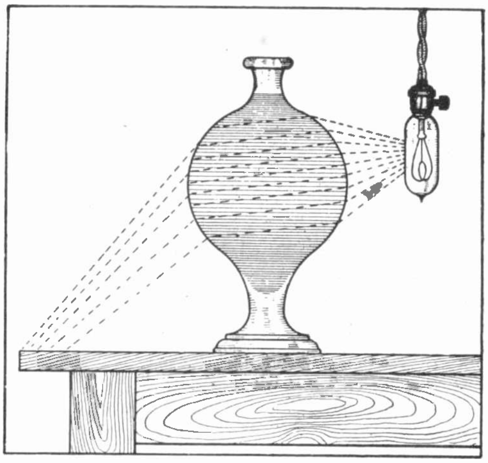


AUTOMATIC PHOTOGRAPH PRINTER

printer enables the photographer to use steady electric light and to set an automatic timing device which cuts off this light at the proper time. The light is provided by a movable cluster of incandescent lamps within a cabinet. It is claimed that with good weather and sunlight a photographer can print 200 photographs in a day. With the device described 2,000 photographs may be printed in the same time. The machine requires three amperes to operate.

## Green Light for Jewelers

It is an interesting fact that green light seems to be the best adapted for fine jewelry work. A simple way to obtain such a light for the work bench is to use a special water lens, colored green, as shown in the

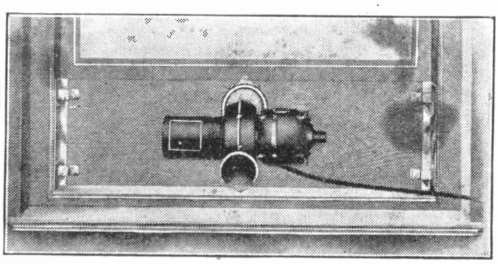


GREEN LIGHTS FOR JEWELERS

drawing. This may be on the order of the large colored globes seen in drug store windows. The lamp is then suspended on the opposite side of the globe from the work in hand.

## Window Ventilator

To purify the atmosphere in theatres, offices, hospitals and other public buildings a small but very powerful multivane fan, operated by electricity, is now frequently used, and is readily placed under an or-



WINDOW VENTILATOR

dinary window. It can be adjusted either to blow fresh air into a room or to suck out the foul air. Dust is taken care of by a dust collector.

A portable ventilator is part of this system, by means of which unused vaults or store-rooms may be made fresh and sweet in a few moments. The same portable set can be used for ordinary ventilating purposes when such a temporary need is met.

The pressing need of such an invention is shown by the report of the New York Board of Health a few years ago, which stated that 40 per cent of all deaths in that city could be ascribed to breathing impure air. The cost of operating this ventilator is between one and two cents an hour—surely a low price for pure air.

## AN OLD-TIME CENTRAL STATION

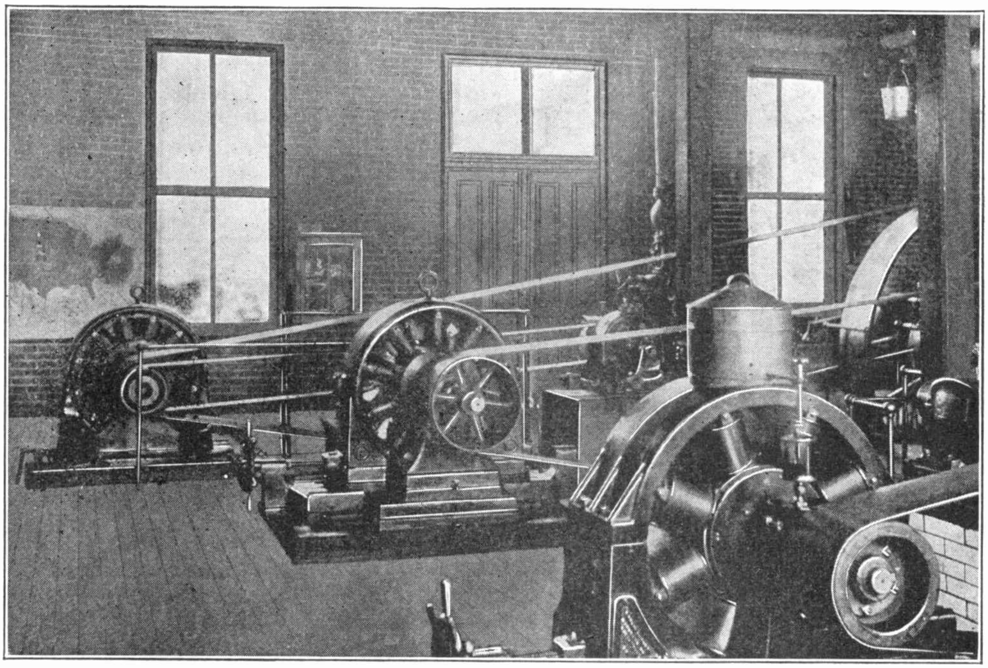
Manufacturers today are apt to pride themselves on the perfection of modern manufacturing methods and the expected long life of modern electrical machinery. The designer finds in the factory records, types in which the factory took great pride in the 80's or 90's and refers to them as "the types used in the Ark." The world does move, and styles change in electrical machinery as they do in other things.

It is somewhat of a shock, therefore, to discover here and there plants otherwise up-to-date still using some of those old types which are decidedly out of style, and which, in the opinion of modern manufacturers, should have been scrapped long ago. Still more of a shock is it to discover that these same old types are still giving satisfaction, with a maintenance charge as low as that on modern apparatus.

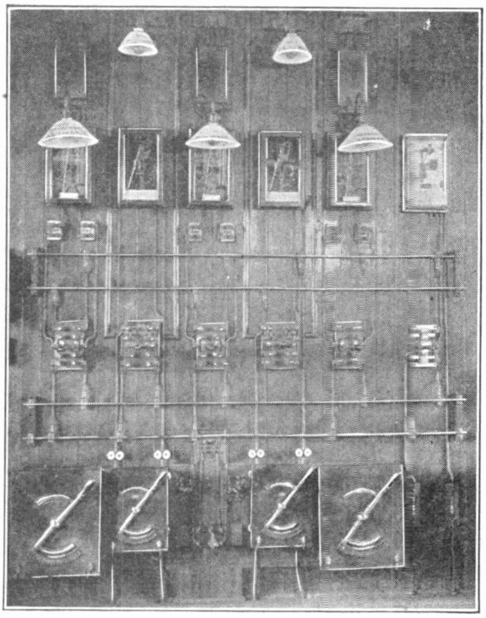
The municipal electric plant at Oxford, Ohio, is operating a plant installed 22 years ago, about a decade after the incandescent light came into being.

The entire plant, including generating apparatus, station equipment, power house and lines, was installed by the Westinghouse Electric Company in 1889. Since that time it has been operating regularly, and from present indications will continue to do so for a good many years.

Part of the original generating equipment still in use consists of two duplicate units, each a 500-light, generator driven by a vertical automatic engine. The revolving armatures have been re-wound, but the field



AN OLD PLANT INSTALLED IN 1889



THE SWITCHBOARD IS ARCHAIC ACCORDING TO MODERN NOTIONS

coils, except one or two, remain as originally installed. The original oil cups have been supplemented by a reservoir on the top of each generator feeding by gravity. One of the engines has its original cylinder and has never been re-bored. The other engine had a new cylinder shortly after installation.

The switchboard is archaic according to modern notions, but efficient and serviceable. The wiring and connections are of the old surface type on wooden backing, and the switches are mounted on wood bases. The meters, too, have wood cases. The coils of some of these meters have been open-circuited in several cases by lightning but have been reconnected by the attendant. A portable voltmeter of modern design is kept at the station for checking the feeder voltmeters. As the photograph shows, the switchboard wiring was done in an exceptionally neat manner.

No doubt a large measure of the success of the machinery is due to the care taken in operating it. Nevertheless this and other old-time plants like it show that machinery is not necessarily worthless because it is old.

## Power Plant at Barnett Shoals

Completion of the Barnett Shoals plant makes the fourth source of electrical energy for Athens, Ga., which is a city of 15,000 people. The Athens Railway and Electric Company has leased the plant from the builders for a period of 99 years.

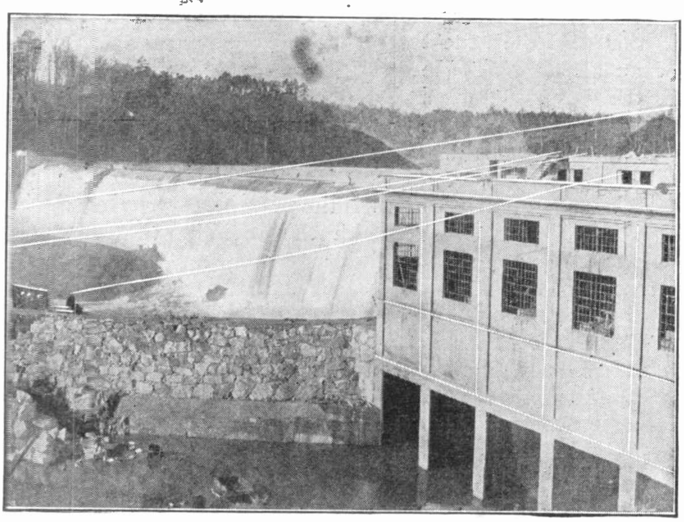
The dam is 43 feet high, and the spillway is 522 feet long, the end abutments making the total length 852 feet. It is the open face type Amburson dam with eighteen feet between each buttress, and has a passage-way through the buttresses near the top. This passage-way has an iron gate in the end from the power house and a wooden door leading into the house.

The power house is equipped with four generators of 700 kilowatts each, making a total of about 3,700 horsepower.

The water was shut off, to fill up the dam, on March 7, 1911, at 5:15 p. m. At 9:15 p. m., March 8, the water ran over the crest, taking 28 hours to fill. This was 40 hours sooner than the engineers had expected. The water obtained its full height at two a. m., March 9, when five inches flowed over the crest.

The time required to build the dam was one year, two months and fifteen days.

The increasing number of such plants but indicate the trend of the times to utilize the now wasted water power of the country.



POWER PLANT AT BARNETT SHOALS

# Electrical Men of the Times

## GANO DUNN

It is seldom that a man can prove himself master of one trade and at the same time demonstrate marked ability in other fields as well. Mr. Gano Dunn, however, is an exception and evidence of this dual power. Seemingly his work outside the engineering field augments the finish of his work within.

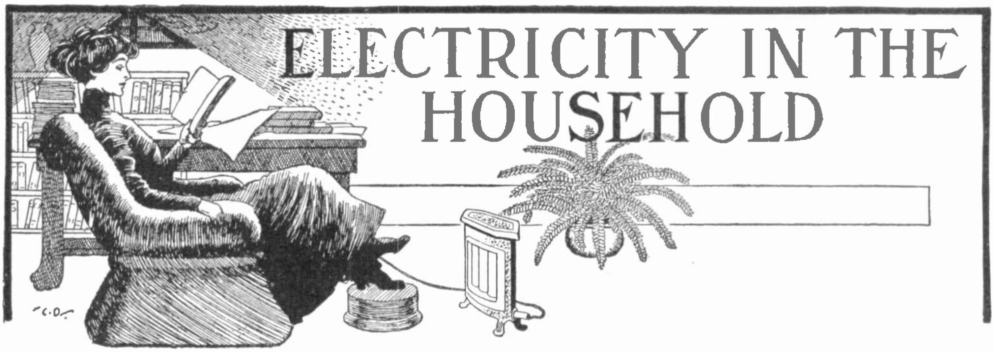
Now vice-president and chief-engineer of the Crocker-Wheeler Company, Mr. Dunn has arrived at this position by 22 years of devotion to engineering work with them. He is a wide reader with an inviolable rule that he shall be the owner of every book he reads. His library therefore is large and diversified. By his friends in the legal profession he is credited with being a good student of Blackstone. He has likewise many friends among literary men and women, and in the interest of children he has given problems in this field the benefit of an alert mind. He is the possessor of a high-power microscope with which he has prepared a large collection of specimens in his hours of leisure. Intimately acquainted by long walks with the region of the Palisades of the Hudson, he is a member of the American Scenic and Historic Preservation Society and of the New York Historical Society.

Reverting to his early life, at fifteen he was a Western Union telegraph operator working afternoon and night. During six years of this kind of work he not only acquired a college training, but also supported himself and aided in caring for his family.

His thesis "The Distribution of Electric Power in Factories," which he prepared at the college of the City of New York, gave him immediate standing in the engineering world.

In his chosen field Mr. Dunn has to his credit a large number of patents which were developed in the service of his company and besides this, in mechanical design he has been a valuable producer. As an instance of this, his company's competitors were using a machine costing something like $60,000.00 to do certain work. Attacking the problem in the shops of Ampere, N. J., Mr. Dunn in practically three weeks' time produced a machine that would do better work than the costly one and furthermore it could be built for $300.00.

In recognition of his worth, Mr. Dunn has served in an official capacity in several organizations. He is a member and past president of the New York Electrical Society; member of the Standardization Committee, Illuminating Engineering Society; Franklin Institute, and in all 32 organizations claim some of his time and tactful attention. Of all the honors which have been bestowed upon him, however, perhaps the greatest of all is his recent election to the presidency of the American Institute of Electrical Engineers. The Institute embodies within its membership the very foremost electrical engineering talent in the world and to be its president is a signal triumph for any man who makes the problems of electrical engineering his life work.




# My Experience With a Fireless Cooker

By MRS. M. R. KAVANAGH

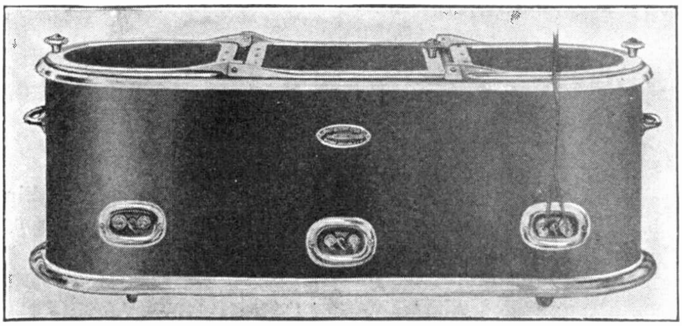
The idea of owning an electric fireless cooker had long been in my mind, and when one morning I found at my door a little four-page circular describing one of them and offering it on a month's trial, I immediately came to the conclusion that I wanted it. I resolved to visit the factory, which was in my own town, and see the cooker for myself. I was pleased with the appearance of it, although since that time it has been even more improved, and one of the new three-oven stoves was installed in my kitchen on Christmas eve as a gift from my husband.

At first the firm was in the experimental stage and had not yet published any table of recipes, so that I was compelled to compute my own schedule for time required to cook different articles. I experienced some difficulty in this in the beginning and I fear there were a few times when we found our vegetables not quite properly cooked, or a meal a little later than usual. After a short time, however, this difficulty was a thing of the past and, at the present time, by using the table already computed in the little book of recipes, it would not be encountered at all.

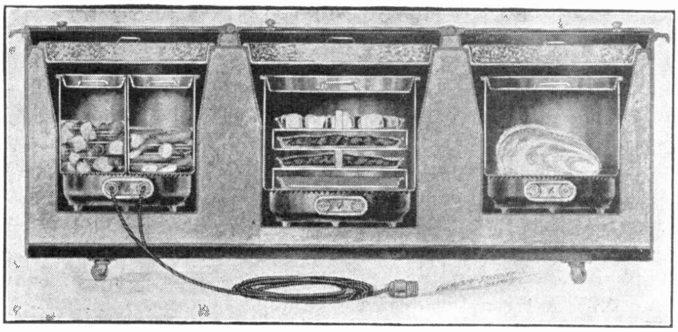
We had a number of visitors during the holidays, and as we spent a great deal of our time in an automobile we would have had many a late meal had it not been for the cooker. Before going out, I turned on the current and as soon as the oven was hot (about 20 minutes), put in my roast, or whatever meat I had planned for dinner, browned it, got it to cooking nicely, prepared my potatoes and sometimes another vegetable and put them in with the meat; the potatoes around the meat, the other vegetable above, separating the two with a cover which was bored full of holes. Covering the oven up tightly, I turned off the current and heated up another oven. Into this I placed pies, or a pudding and after they were baking nicely, I again turned off the current and we were ready to depart. Upon our return, it was but the work of a few moments to place the hot meat, potatoes and other vegetables upon the table, thicken the gravy and be in readiness to serve the dessert hot. In this manner we could and did enjoy as appetizing a meal as would have taken at least an hour to prepare by any other method.

During the hot weather, another advantage becomes apparent, and that is absence of heat in the kitchen which is not made intolerably warm as in the case of a gas stove, particularly when the oven is used for roasting or baking. One can keep as cool by using this cooker as with no fire at all and yet have all the benefits, and more than a fire gives. By more, I mean that in using a fireless, as all who have used them will tell you, none of the goodness escapes from the food and an added flavor is obtained which cannot be gotten by any other process of cooking, and, too, a tough piece of meat or chicken can be cooked so tender in this manner that it can be cut with a fork. You have only **to try** it to prove my statement true, and for this reason alone, if not for the many other conveniences afforded, will one who has used a fireless cooker hold to it in preference to all other ways of cooking.

Another advantage of this cooker, which, by the way is called the "Comet," was made apparent to me though a combination of circumstances. It so happened that it became necessary for me to have my gas stove moved and the man who came to do the work arrived at almost the noon hour. He worked hard to finish the job in time for me to use the stove in the preparation of my lunch, but left for his dinner with the work only about half completed. I was puzzled as to how to have a hot lunch with no stove to prepare it on when it occurred to me why not use the electric heaters in the fireless cooker. This I did, heating each in turn and each retaining its heat sufficiently for me to prepare my little lunch of potatoes, warmed over meat, coffee and warmed over pudding with no difficulty whatever. My coffee continued to boil for so long a time that I had to remove it from the heater.



THREE COMPARTMENT FIRELESS COOKER



SECTIONAL VIEW OF FIRELESS COOKER

Toast may also be prepared upon one of these electric heaters, and by increasing the heating surface, say by placing a sheet of tin or a toasting iron on the top of the heater, several pieces could be prepared at the same time.

## The Artistic Touch

The transposition of outdoor effects to indoor conditions may be wonderfully aided by the use of ferns and flowers, but no touch of the florist can approach the complete effect produced by the addition of running water. The electric fountain gives the delightfully soothing effect of softly falling water, and as an artistic decoration

A HANDSOME ELECTRIC FOUNTAIN

is equally appropriate in a reception room, library, hall, conservatory, or upon the dining table.

The Battaglia portable fountain, as illustrated, shows some of the beauties that a combination of colored glass, flowing water and electric light can produce. The construction is extremely simple and not liable to get out of order. It consists of a specially constructed motor attached to a centrifugal pump; the latter placed in the interior of a metal basin. The pump gets the water directly from the basin and conveys it through small pipes to a multiplicity of nozzles, which direct a large number of small streams over the figure. The water then flows down into the basin to be used over again by the pump.

The motor is run by the same current that operates a fan or an incandescent light.

## No More Cold Feet

The adaptation of the electric warming pad to the foot in the form of a shoe is one of the latest developments in the use of electrothermal garments, and is the subject of a patent issued to Phyllis E. Charles, Portland, Ore. The shoes are made in the same manner as the warming pad and ar-

ELECTRIC FOOT WARMER

ranged to take current from a block on the large robe warming blanket or independently, as desired. The user may move about as much as the flexible conductors will permit.

Nova Scotia is becoming an important source of supply of tungsten. The demand for this metal has had an enormous increase since the advent of the metal lamp, and all available deposits of ore are being sought.

# Where Art and Science Meet

**By T. VERNETTE MORSE**

With the arrival of August it is not strange that all scientific ideas apparently take wings and leave the average mind in a state bordering on dissolution. Where and how to spend the vacation becomes the all important question. To the city dweller there is nothing that offers greater attractions than a few weeks in camp. "Back to nature" is the feeling that is uppermost to those who are constantly surrounded by the narrow confines of brick walls.

Camp life, unfortunately, has a few drawbacks. There is water to bring, fires to build and food to be prepared for the hungry crowd. For illumination there is the beautiful, beautiful moon, the cheery camp fire or the smoking lantern. All of this is doubtless near to nature, but it is hard work and as a rule there is a most delightful feeling of relief when the time arrives to break camp and hie away to some good hotel for a first class dinner.

The vacation that means total relaxation is but a shade more tiresome. The busy mind and body does not easily adjust itself to absolute inaction for any length of time.

The members of the Artcraft Institute have from time to time adjusted the summer outing in a variety of ways that are especially interesting to the participants.

For those who wish to study real country life there is the educational farming that offers a variety of country occupations in which there is something of interest for every month. Many who have taken advantage of this opportunity during the past few years have settled permanently in the country after having learned from personal experience that they preferred the country occupations.

For many years the Institute maintained summer camps in Michigan that proved most attractive. Locations for these camps were selected near towns on the lake that were supplied with electricity. The electricity was a most important factor as one of the tents had to be fitted up as a shop for arts and crafts work and supplied with a motor.

The running of the wires from the main line to the camping ground was easily accomplished, consequently we used electricity in all the tents.

At night the great white tents were a beautiful sight surrounded, as they were, by the severe sentinel like trees.

It was an ideal life in the open with all the advantages of the fresh lake air and excellent bathing. We were at liberty to prepare our meals or walk into town for them as we preferred.

These camps were discontinued when the grounds were sold for summer hotels, but they will be resumed again as soon as a permanent location can be obtained and will of course, be a much greater success than ever, owing to the great improvements that have been made in electrical household supplies.

It has always been the rule of the Artcraft Institute to combine the principles of the simple life with the conveniences of modern invention and, as a result, we fully appreciate the fact, that it is not difficult to do things if we only know how to take advantage of the conveniences that are near at hand.

A member of the association who was familiar with the Michigan camp is enjoying a similar experience this summer on a somewhat more elaborate scale.

She had for many years occupied her large country home with a retinue of servants and the many cares of the hostess who feels it her duty to entertain numberless week end parties. She longed for the real old time country life.

Like all other mothers (for there were several young children) she was confronted with the problem of choosing between a comfortless country boarding house and the care of a cottage, and finally decided that it would be wise to combine the two.

She was familiar with a sleepy country town sufficiently ambitious to own an electric plant. Near the lake was a rambling old house where she could obtain rooms and board and after considerable persuasion was permitted to have the electric wires run into the house, as they passed within a short distance the work could be done at slight expense.

The electric washer and iron was shipped out, as one maid could in that way do the entire laundry work, which is an important item where there are children.

A good sized tent was secured for the use of the children on rainy days.

The next move was to select a few of the new electrical household appliances that would add to the comforts of the somewhat fastidious family. There was besides the necessary hot water heater a percolator and chafing dish. Hot water could be had at any moment of the day or night. A light luncheon could be prepared on short notice whenever the children came in from a tramp with appetites that could not possibly wait for the regular meal, or when an early bedtime was in view.

Rainy days were looked forward to with delight as the maid was permitted to move the electrical equipment into the children's tent and assist them in preparing a special meal while the rain pattered merrily on the canvas.

An electric fan cooled the air of the rooms on sultry days. As a matter of convenience this clever woman did not forget to include a few of the dry battery equipments. Near the bed was an ordinary looking clock fitted with a little electric bulb that lighted the face when required. For dark nights there was the convenient flashlight and electric lanterns. All of these things occupied but small space, and helped greatly in the general comfort of the family.

Fresh air is as ever the great life tonic. Camp life is popular and generally advocated for invalids. It is not possible to do these things up in the northern pines, but it is a most delightful way in which to spend the vacation. It is comparatively easy to procure a location nowadays that does not take the campers entirely away from civilization, consequently the delights of camp life may be combined with home comforts.

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## The Modern Summer Kitchen

**(With apologies to William Shakespeare of Avon and Daniel Macfie of Edinburgh)**

To cook, and how to cook, that is the question:
Whether 'tis better in the heat of summer
To have a kitchen like a furnace heated;
Or to discard the gas-stove; fiery fierceness,
Its flickering flames, its smoke, fumes and matches—
To substitute the cleanly, cool, electric
Which at the turning of a switch is ready
To roast or boil, to bake or toast, at pleasure
And in perfection? 'Tis a transformation
Devoutly to be wished. To cook at will,
Now varying the heat as need requires:
For in a kitchen cool the work is done
With ease and comfort, and with quick dispatch
Where current rules. And then as to the cost:
'Tis for the current you consumed—no more!
No waste through ill adjusted burner valves
Nor for the heating of the kitchen, too.
No vitiated air, but healthy, clean,
Awaiting instant use by night or day.
Who then would bear the trouble and the cost
Of blazing ranges holding health at bay?
Now flickering and threat'ning now to scorch
But seldom giving forth an equal heat
To do the needful at the appointed hour?
Why bear the ills that even gas involves,
With current offered as a public boon,
Free from all risk of disappointing failure?

# JUNIOR SECTION

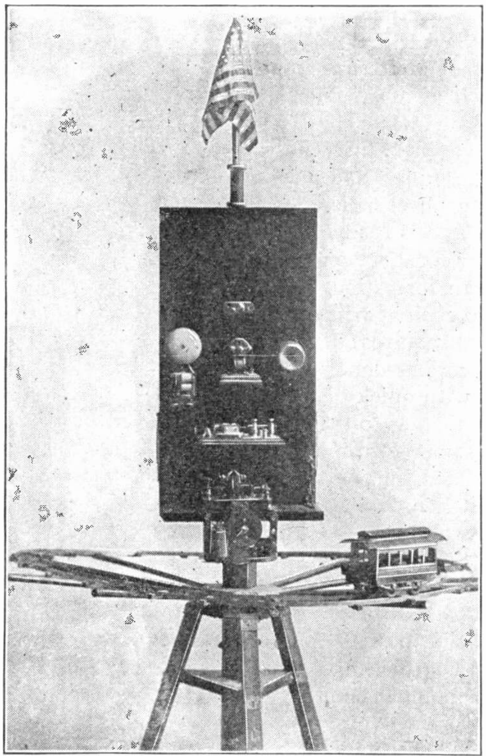
A wholesome, fascinating study is the study of electricity. No boy who spends his spare time and his spare money in making and learning to operate electrical apparatus will go far wrong. This department is for such boys.

## A Wireless Stage Entertainment

By BURT K. BUNCH

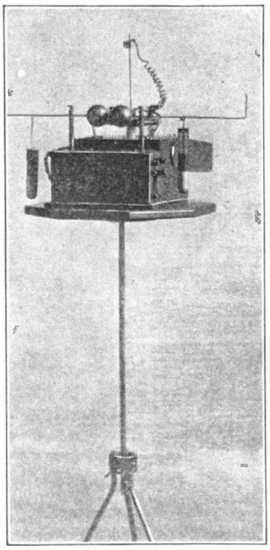
It is possible to give a very interesting entertainment by means of wireless apparatus alone and I will describe an outfit with which I have obtained excellent results for lecture purposes.

In the first place, to eliminate all suspicion, I did away with all ground connections in both the sending and receiving apparatus, and mounted each set of apparatus on a tripod fitted with rollers so that the distance between them might easily be changed. This arrangement, I found, worked very satisfactorily for distances up to 150 feet or more.



STAGE APPARATUS WORKED BY WIRELESS

The sending apparatus is shown below and consists of a Ruhmkorff coil capable of producing a ten-inch spark. Upon the secondary binding posts are two 1½-inch oscillators. Two small Leyden jars made from test tubes are also bridged across the secondary terminals of the coil. The power for operating the coil is taken from the lighting circuit of 110-220 volts, either direct or alternating. In series with the primary of the coil is an electrolytic interrupter, also an ordinary Morse key. The interrupter may be seen just back of the coil. The receiving instruments are seen in the figure opposite and are as follows: A filings coherer and tapper — a 75 ohm pony relay, and an "automatic control" relay — for controlling the following apparatus: A fire alarm (electric bell); fog horn (electric whistle); electric light; electric motor; a miniature cannon, and an electric railway



INDUCTION COIL USED FOR STAGE WORK

car. By means of the "automatic control" relay the lecturer may stand at the sending instruments in one end of a large hall, and with the receiving instrument placed at the other, sound the fire alarm, start and stop the motor, fire the cannon, light and extinguish the light, or start, stop, and reverse the car in regular succession without ever leaving the sending key.

The power for operating these various instruments is obtained from four dry-cells located back of the board. The writer uses the cannon as a finale, and as it makes a very loud report and comes so unexpectedly it is quite startling. It may be seen mounted on the top edge of the board. It is a large wooden tube with a fine german silver wire stretched across the bottom. A small quantity of gunpowder is placed in the tube and the top corked. When the current from the batteries on the back of board is made to flow through the wire it becomes heated, thereby igniting the powder. A loud report follows, the cork is blown from the tube, a weight is released which hoists the stars and stripes to the top of the antenna pole, and at the same time starts a spring motor phonograph, not shown in cut, to playing "The Star Spangled Banner." The roar of the cannon—the waving of "Old Glory"—intermingled with the music of the band, never fails to bring forth a patriotic yell.

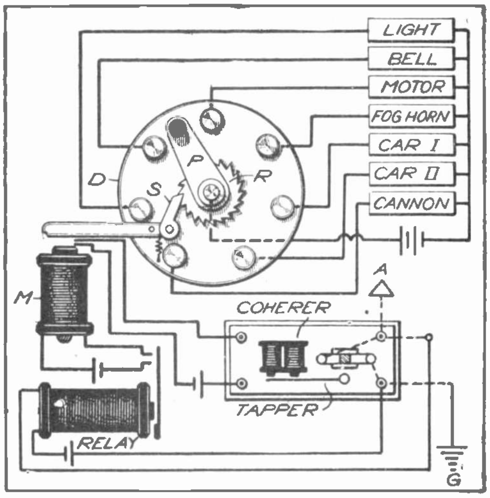


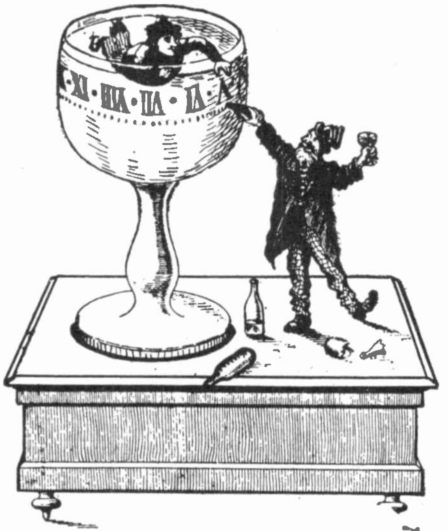

DIAGRAM OF THE AUTOMATIC CONTROL FOR STAGE APPARATUS

The "automatic control" relay is constructed as follows: The dial (D) (see diagram) is of hard rubber and has, set flush with its face, as many contacts as there are circuits to be controlled, in this instance seven. The pointer (P) is caused to move on and off the contacts by means of the ratchet wheel (R) and pawl (S). This motion is imparted each time an impulse is sent through the magnet (M). A complete diagram of the wiring, shown herewith will, I think, be clearly understood by those familiar with wireless circuits.

The entire outfit knocks down so that it may be packed in suitcases, thus making it an ideal portable set.

## A Comical Clock

In France, where the raising of grapes for wines is the chief occupation in many districts, the sight of jolly topers is not as offensive as it is in this country, and a goodly share of the local humor centers around the handicap which a convivial man encounters on his way home. A fine instance of this is found in a clock made for a jeweler's show window by Antony Jacques of Grenoble, which has the numerals painted on a slowly rotating wine glass. Instead of having a pivoted hour hand, the time is indicated by the hand of a figure floating on the water in the glass. The curious feature about it is that while the glass rotates, the figure which floats freely on the surface of the water always remains in the same direction, appearing to reach

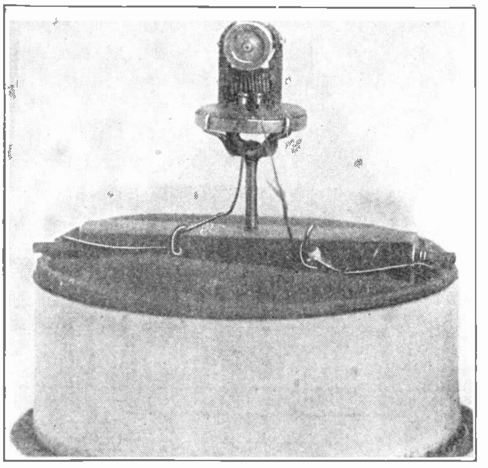


A COMICAL CLOCK

for a bottle in the hand of a companion figure.

The explanation is simple: The outstretched hand has a magnetized wire embedded in it and the arm of the chum with the bottle is made of iron to attract the magnet.

## Another "Smallest" Motor

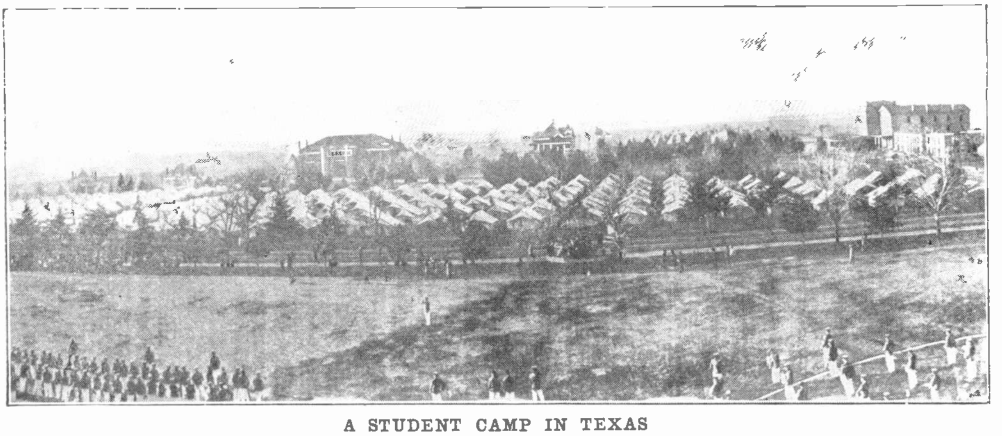


MINIATURE MOTOR OF S. G. ASQUITH

Not to be outdone by the unusual specimens of the miniature machinery building which are so popular in Europe, an Iowa mechanic (Mr. S. G. Asquith of Waterloo) has built an electric motor, having only about half the dimensions of the one which recently surprised the French scientists. It stands on a hard rubber base 5-16 of an inch in diameter, is only half as high as its French rival and runs on a single cell of battery, while the Trevet motor described in the January, 1911, issue of this magazine required two cells. Some idea of the difficulties encountered in building so miscroscopic a motor may be inferred from the size of the commutator which is only one-thirty-second of an inch in outside diameter and yet has two copper segments carefully insulated from each other.

## STUDENTS LIVE IN ELECTRICALLY LIGHTED TENTS

At the Texas A. & M. College, at Bryan, the college students live in the most unique tent colony that has ever been established. Nearly 500 students at this western institution live in tents the whole year round and, what is more, actually prefer it to the customary dormitory system. It is not necessary to go far for the reason, for the tents are provided with all the comforts that the students have in the dormitories. Each tent is lighted with electric incandescent lamps and heated with stoves. Moreover the tents are floored and wainscoted so that they are practically wind tight and yet allow the students plenty of fresh air. There are 243 tents in all, each being sufficient for two students and being provided with an electric light and stove. The tents are spread over many acres of ground and it is indeed a novel sight to see the brilliantly lighted tents at night. The illumination from the electric lamps at once distinguishes the camp from the ordinary.



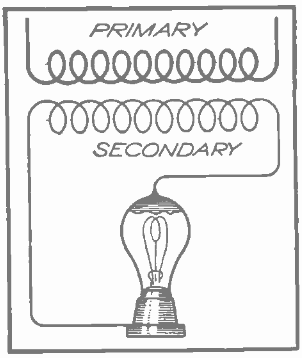
A STUDENT CAMP IN TEXAS

# THE YOUNG EDISONS' CLUB

Under this heading will be published letters from readers of the Junior Department. These letters should describe briefly and accurately your experiences in the making and operation of electrical devices and in the performing of electrical experiments. See how good an "engineering report" you can make of your investigations.

*The Young Edisons' Club*:

I performed the following interesting experiment with an electric light bulb and a spark coil. The tip end of the bulb was covered with tinfoil. A wire was connected to the foil and the other end of the wire was attached to one of the secondary terminals of the coil. Another wire was connected to one of the lamp terminals and the other terminal of the secondary coil. On turning on the current the interior of the bulb was filled with violet colored light and rainbow effects.




EXPERIMENT WITH A SPARK COIL

MACKENZIE BARNES.

64 W. Harris St., Atlanta, Georgia.

*The Young Edisons' Club*:

A very interesting experiment I have performed is making a needle float on water. I found it by playing with a needle in a glass of water and making it come up the sides with a magnet. I took a glass of water and put a fine needle in the glass and took a magnet and brought the needle to the top of the water until it floated, by holding the magnet above it, but far enough away not to pull the needle out. I moved the magnet farther and farther away until to my surprise the needle still floated without the assistance of the magnet.

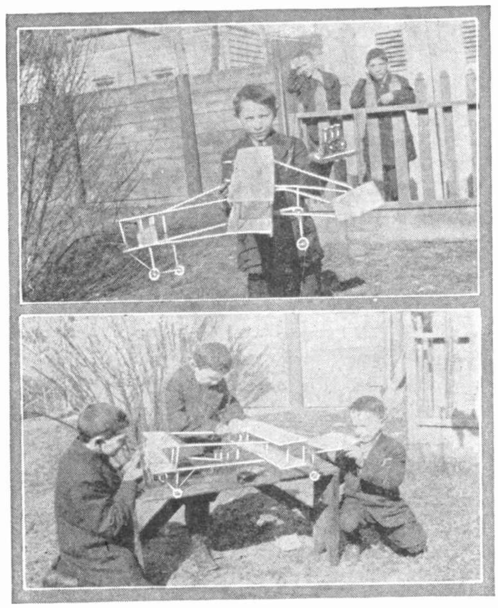
In the course of this experiment the needle became magnetized and pointed north and south, acting as a compass. I cannot understand what causes it to float and would be glad to find out from some of the other Young Edisons. PAUL DARR.

Blairstown, Missouri.

*The Young Edisons' Club*:

I am sending you two pictures of my friends and myself, showing the airship we have built. We are only from ten to twelve years of age and we can build our own flying machines just as well as the big fellows.

The battery motor that you see is an electric engine which works on three pocket batteries connected to a propeller by means of a pulley and strap. The engine and batteries were put on the lower frame of the airship and held very tight by nails. It could only fly about 10 to 12 feet from the bench which we were working on.



SOLOMON WOLFE AND HIS FRIENDS WITH THEIR AEROPLANE

We are going to try again. We tried it with a motor first but we could not make a good way of connecting the propeller to the armature of the motor. We got better results with the electric engine, three pocket batteries, wire and switch for which I paid \$3.50. SOLOMON WOLFE.

141 Stockton St., Brooklyn, N. Y.

# FOR PRACTICAL ELECTRICAL WORKERS

*HOW TO MAKE AND OPERATE ELECTRICAL DEVICES*

## Underground Telephone Cable Splicing

**By GEORGE M. PETERSON**

Although cable splicing deals not only with joining the ends of new sections of cable, but also with work on live cables and clearing trouble on same, we shall only consider work on dead cables in this article.

A telephone cable consists of a certain number of pairs of wires, each wire of which is insulated by being wrapped with a layer of paper. The two wires of a pair are twisted together and must be kept together all the way through the cable from the central office to the end. The sides of a pair are designated by the terms "odd" and "even," "line" and "test," "tip" and "ring," etc., the odd, line or tip wire being the first wire of the pair, as fanned out on the main distributing frame in the central office, the even, test or ring wire being its mate. It is

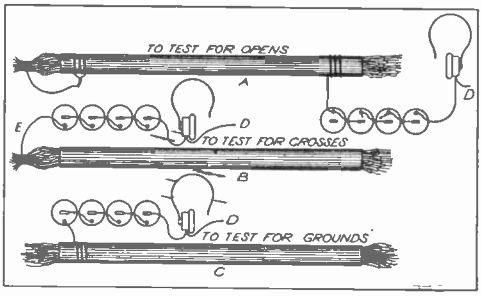



FIG. 1. HEAD PHONE USED IN TESTING

usually shown in the cable by a lighter colored insulation. For example: In the ordinary pair of cable wires one is white and the mate to it is red. Therefore white is the tip and red is the ring side.

The first operation before splicing up a new cable is to test each section for opens, grounds and crosses. (Fig. 9 near the end of this article shows what is meant by each of these terms.) This testing is accomplished by the aid of a head phone and four cells of dry battery connected as illustrated in Fig. 1.

The armor, or sheath, is first stripped off the section or piece of cable to be tested, for about eight inches. The stripping is accomplished by the aid of a chipping knife and hammer. The cable is first grooved around with the knife and the armor is removed by holding the knife in the position shown in the small sketch, Fig. 2, and cutting from the groove to the end of the cable.

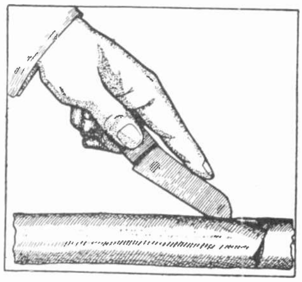


FIG. 2. REMOVING THE ARMOR

The paper insulation is then removed from the wires at the far end of the cable and the wires bunched and grounded by means of a copper wire which is bound around the bared ends of the bunch and grounded by being wrapped tightly around the cable sheath. The ends of the wires in the test hole are then "cleared" or separated and the headphone and battery connected as shown in Fig. 1(A). Each wire is touched individually with the wire (D), which is attached to the shears, and a click should be heard in each case which shows continuity.

Again making sure that all our ends are clear, we take the head phone and battery to the opposite end of the section for a test for crosses Fig. 1(B). We take the ground wire off the sheath and attach it to the battery lead and touch the sheath of the cable with the other lead from the phone. If no click is heard in the receiver, there are no grounded wires in the cable and the cross test is then made as follows: Being connected up as illustrated in Fig. 1(B), we pull one wire from the bunch and touch it with our search wire or shears. Each individual wire must be tested this way and there should be no sound in the receiver. If a click is obtained when a wire is touched, that wire is crossed with another and should be tagged until the test is finished, when we clear our ends, connect lead (E) to the wires upon which we obtained the cross and pick through the bunch until we find the wire it is crossed with. If we hear a click in our receiver before starting our cross test, when we touch the sheath, we will have to connect up as shown in Fig. 1(C), test for grounds, and touch each wire as for a cross test, keeping out every wire upon which we received a signal that it is grounded. All bad pairs should be marked at each end by testing from both ends, and the trouble reported to the foreman before splicing is begun.

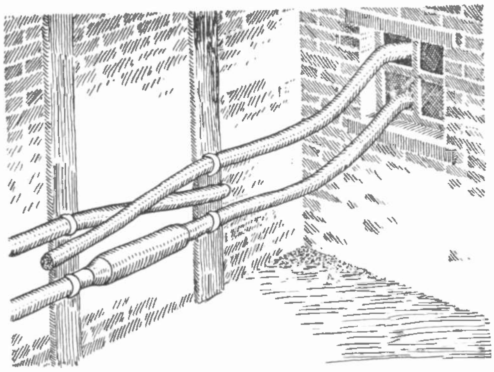


FIG. 3. CABLE IN THE MANHOLE READY FOR SPLICING

After testing two sections we are ready to begin splicing. The cable is first set up or bent as in Fig. 3 so that the ends are against the wall of the manhole in the position shown. The length of the splice is usually about fifteen inches for 50, 100 and 150 pair 22 gauge cable and seventeen inches for larger sizes. The armor is stripped off so as to leave the ends of the wires at least two feet long. A strip of tape about one and one-half inches wide is now wrapped around the wires and crowded under the sheath as in Fig. 4 to prevent damage to the insulation of the wires. The cable is then unfurled and boiled out with hot paraffin to prevent the paper insulation from absorbing the moisture from the hands and the atmosphere, to hold the wires of a "pair" together and to prevent the paper insulation from unwinding. A lead sleeve large enough to cover the splice and long enough to allow about 1¼ inches of the sheath inside when beaten down is then slipped over one end of the cable, Fig. 4, and run back out of the way for the time being. The cable wires are then laid back, Fig. 5, (A), and one pair at a time pulled out of the bunch and tied up as at (D). This will obviate the danger of splitting pairs, Fig. 9. Care must also be taken to splice the wires farthest from the splicer first and to allow slack enough in them to make a symmetrically finished splice. Fig. 5, (B) and (C).

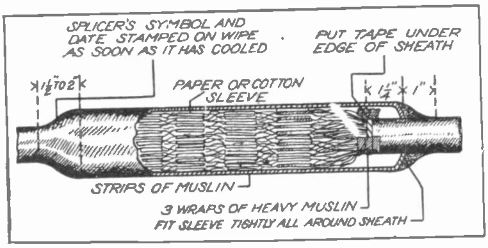



FIG. 4. A COMPLETE SPLICE

Fig. 6 illustrates the proper method of tying and splicing the wires together, and close attention must be given in seeing that all wires are spliced color to color and that only pairs are spliced together. When all the wires are spliced the splice is boiled out with hot paraffin to expel any moisture which may have gathered. The splice is now wrapped all the way along with heavy muslin cut in strips about three inches wide, Fig. 4. The splice is again boiled out and the lead sleeve slipped over it. The ends of the sleeve are then beaten down tight to the cable sheath, Fig. 4, and pasters put in position as shown in Fig. 7(P). A paster is a strip of gummed paper about two inches

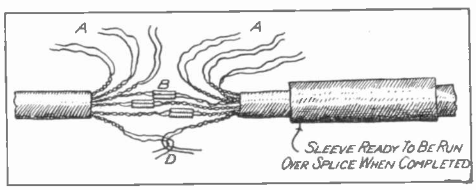



FIG. 5. METHOD OF SPLICING

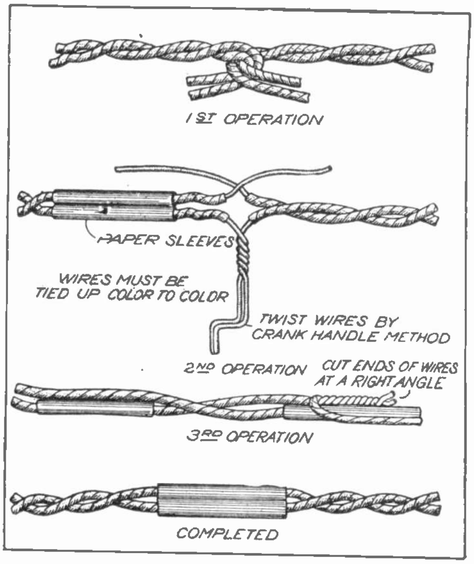



FIG. 6 DETAILS OF THE TYING AND SPLICING OPERATION

wide and eighteen inches long which is glued to the sleeve and cable before wiping a joint and removed afterwards. Its purpose is to prevent solder running over the cable or sleeve beyond the points desired. Fig. 4 shows a complete straight splice in detail.

When a cable is to be terminated at the main distributing frame or at a cable box or at any place where a "form" is to be spliced to it a pothead, Fig. 8, is necessary. The same method is used as for making a straight splice, but the sleeve is wiped only at the bottom joint then filled with insulating compound. The upper end of the sleeve is beaten in tight to a leather collar which surrounds the pothead form. This is to prevent moisture and dampness from working down into the head and causing trouble from grounds.

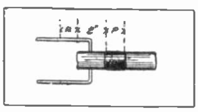


FIG. 7 PASTER

The various kinds of cable troubles are shown in Fig. 9 with the terms used to designate them. Moisture in a cable causes grounds through the paper insulation to the sheath as well as where the wire is bared. Extreme caution must be used in all cable work to prevent moisture from entering the cable, and a splice should never be left open over night without special orders.

A bridged splice is shown in Fig. 10, but only two pairs of wires are shown in each cable. Fig. 10 (A) shows the wires from the three cables ready to splice while Fig. 10 (B) shows the splice made. In a case of this kind where a 200-pair branch is to be spliced to a certain 200 pairs in a 400-pair main, test out the 400-pair cable to get the proper bunch on which to cut in the 200-pair branch. This testing is done with an ordinary head phone and battery as shown in Fig. 11 and after we have the right 200 pairs picked out, we splice them up at random. If the 200-pair branch is cut into a box or onto a frame, we must fan out both cables; that is, number each pair in the 200-pair branch and each of the 200 pairs which we are to pick out of the 400-pair main in the man hole. This test is the same as in Fig. 11, but instead of simply pulling out or separating the 200 pairs which we are to use, we put them, one by one, into holes in a fanning strip which are numbered the same as pairs which we pick out. We now pick out pair one of the branch cable and splice it to pair one of the main, pair two of the branch to pair two of the main cable and so on. Instead of a fan strip, small numbered cards are now frequently used, a punched hole allowing them to be slipped on the wires.

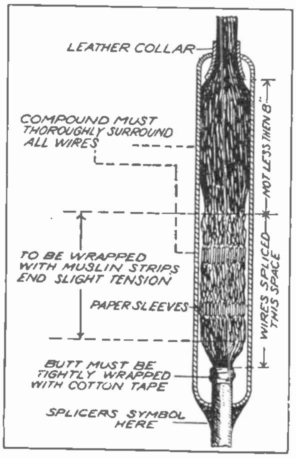



FIG. 8 POTHEAD SPLICE

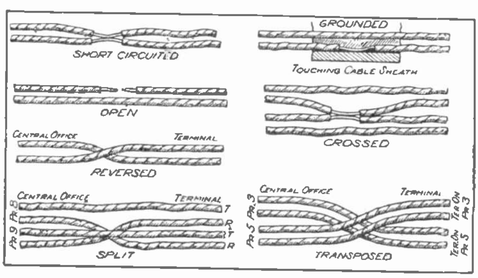



FIG. 9 KINDS OF CABLE TROUBLE

The tool kit usually furnished to a splicer contains the following articles:

One splicer's canvas tool bag.

Two fanning strips or test boards numbered from one to 51.

Two fanning strips or test boards numbered from 51 to 101.

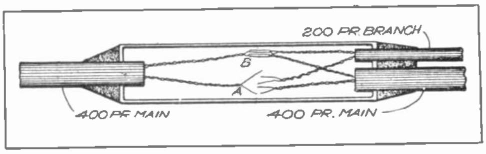



FIG. 10 BRIDGE SPLICE

Two fanning strips or test boards numbered from 101 to 152.

Two fanning strips or test boards numbered from 152 to 202.

Other strips numbering up to 606 can be drawn when the cables are large enough to require them.

One two-gallon gasoline can (gasoline for furnace and torch).

One cold chisel ½-inch by six-inch.

Four lineman's test clips (for receiver cords).

Two soldering coppers—six pounds to the pair (for soldering pothead wires to terminating lugs, etc.)

One paraffin dipper (to pour paraffin over splice, etc.)

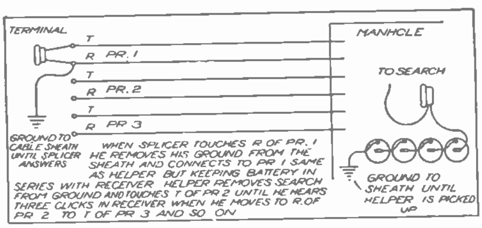



FIG. 11 TESTING FOR BRIDGE SPLICE

One plumbers' dresser (for dressing in the lead sleeves and dressing out dents in the sheath).

One ¼-inch star-faced drill.

One two-pound claw hammer.

One manhole bar and one manhole hook (for opening manholes).

One pothook and rope (for lowering material into manhole).

One chipping knife (for stripping the armor from cables).

One 3½-inch solder ladel (used to pour solder when wiping a joint).

One solder pot—capacity about 25 pounds.

One pair eight-inch side cutting pliers.

One blow torch for finishing joints and blowing off old sleeves).

One pair twelve-inch burner pliers.

Two head receivers.

Two receiver cords.

One shave hook (for cleaning sleeve and sheath before wiping).

One fourteen-inch plumber's saw (for sawing off sleeving and cable).

One six-inch screw driver.

One set of 0 to 9 steel figures 3-16-inch high (for putting date on splices, etc.).

Two tarpaulins 8 by 8 feet; one tarpaulin 3 by 3 feet (to wrap up splice when leaving it at meal time).

One combination test set (for calling the office on a working line).

Four dry cells (for testing).

One fuse wrench (for inserting or removing fuses from cable box).

One gasoline furnace (for heating solder, paraffin, etc.).

One furnace hood (to protect flames and aid heating of materials).

One paraffin pail.

One compound kettle.

One twelve-inch flat file.

One twelve-inch rasp.

One twelve-inch half round file.

Two breast transmitters (to be used in combination with headphones as talking set on long time tests).

One corn broom (for sweeping up duffel from the street, etc.).

One 50-foot tape line.

One splicer's tent 8 by 8 by 8 feet (for use over manhole in bad weather).

One tent pole.

One two-wheel tool cart (for carrying tools from job to job).

One padlock with two keys (for tool cart).

One iron drift plug.

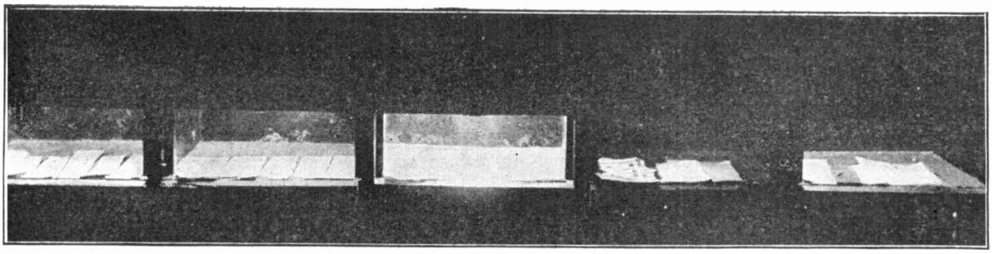
One buzzer test set (for testing out working cable).

One pair splicer shears (for cutting the cable wires, etc.)

A good sized book could be written on this subject without fully covering the field, but the intent is to give the future splicer and some of the younger splicers a fair theoretical knowledge about doing new work and experience will teach them the practical end in a short time. To work on working cables requires a knowledge which can only be gained on the job and my advice is to ask questions. No man will get angry if asked a question in a civil manner, but many a man has lost his job through a single error. Above all things, learn to wipe a good symmetrical sound joint and take time enough to do your work right.

## Recording Telephone Messages

A device recently shown for the first time before the London Academy of Sciences records an incoming telephone message on a phonograph cylinder so that it can be repeated later on. The idea is to avoid the frequent mistakes made in jotting down telephone messages and to deliver the message in the same tone in which it was spoken into the distant receiver.



HOMEMADE PHOTOMETER

## Homemade Photometer

The engineer of a large wholesale grocery concern in Chicago found it difficult to decide what kind of lamps to install in the store. Every salesman who called had the "very best" of illuminants. The arguments were so good that when they were paralleled they became confusing. Therefore, the engineer determined to test several lamps with the view of helping himself in his choice. As he is not a man of science, his photometer was a rather crude arrangement; nevertheless, it served the purpose well.

The photometer consisted of a five-compartment wooden cabinet and was mounted on a bench. A door in the front of each compartment could be opened to permit mounting the lamp in its socket, a four-inch open space below the door made it possible to observe the effect of the various illuminants on objects placed on the bottom of the compartment. The lamps were placed equally distant from the bottoms of the compartments; about eight inches.

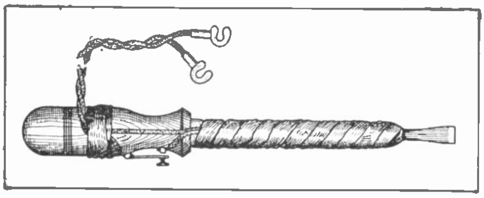
The accompanying pictures shows some of the lamps on test. The photograph was taken with an exposure of about twenty minutes. Beginning with the first compartment on the left the following lamps are shown burning:

No. 1, 110-watt tungsten; No. 2, 80-watt tungsten; No. 3, 110-watt Nernst; No. 4, 56-watt carbon; No. 5, 175-watt carbon.

Other conditions in the store being favorable the Nernst lamp was adopted since it showed the strongest light in the homemade photometer.

## A Magnetic Screw Driver

A magnetic screw driver is very convenient in starting screws in places difficult to get at. I have a driver which was made as follows: Wrap the metal part with a layer of paper or tape, then wind on about four layers of No. 28 magnet wire from the handle down to about an inch of the point of the driver, as shown in the cut. A steel spring or a piece of copper for a spring will serve



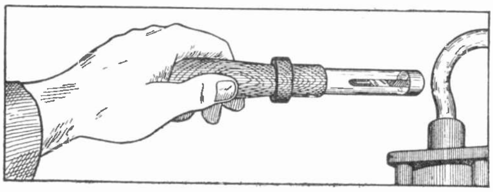

A MAGNETIC SCREW DRIVER

to make and break the circuit. This device will operate nicely on two dry cells.

SHANNON JARBEAU.

## The Electroscope

The electroscope is an instrument for indicating the presence of dangerous current in wires. In other words, it tells you whether a wire is "alive" or "dead" without the dangerous experiment of touching it to find out. A very delicate silver leaf is mounted



TELLS WHEN CONDUCTORS ARE ALIVE

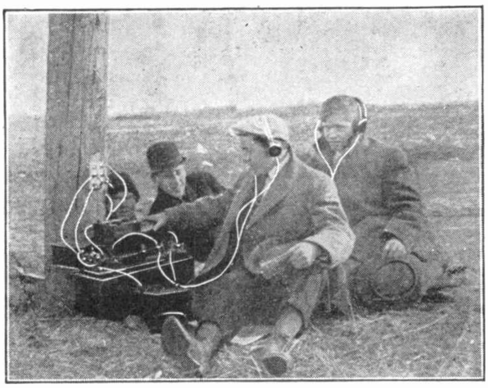
upon a copper terminal, which is hermetically sealed within a glass tube. The metal cap of this tube forms the test terminal which is advanced toward the conductor or apparatus. The glass of the tube affords absolute protection for the operator. The silver leaf will stand perpendicular to the terminal when in an electrical field, and lie in its normal position if there is no potential present. The electroscope gives a good indication on any voltage over 500.

# POPULAR ELECTRICITY WIRELESS CLUB

**Membership in Popular Electricity Wireless Club is made up of readers of this magazine who have constructed or are operating wireless apparatus or systems. Membership blanks will be sent upon request. This department of the magazine will be devoted to the interests of the Club.**

## A Picture and a Sermon

Ordinarily we do not print pictures of amateur outfits, although each mail brings contributions of this kind. There are several reasons for not doing this. In the first place the views have a great similarity and moreover when reduced to cuts do not show enough detail to be of real value to the readers of this department. We believe the department is of more value when confined to the giving of real instruction in the building and operation of the apparatus. If we were to publish the pictures to please the readers who send them in we would be up against it, as the saying is, because there are so many that some would necessarily be left out and it would be impossible to treat all alike.



THERE IS A LESSON IN THIS PICTURE

Occasionally, however, there comes a photograph which is of such genuine interest that we cannot refrain from publishing it. An instance of this kind is represented by the cut herewith, showing a portable set owned by John W. Smith, 1191 Lawrence Street, Camden, N. J., together with himself and some of his friends. This little view shows not only successful achievement in setting up a set of complicated apparatus but teaches a moral lesson as well. People may say all they like about the mischievous amateur who interferes with public and government wireless work. Early in the game a few thoughtless ones may have given some groundwork for such gossip, although the cases are becoming scarcer. But we wish every self-constituted critic of the wireless amateur could see this picture. These four boys are at just the age when they are bound to turn their surplus energies either in the direction of some useful purpose or in the direction of some mischief. You can rest assured that these four experimenters, who have "hiked" out into the country on a cold day to follow in the path of the great Marconi, are not the kind who are found kicking the lamp post in front of the corner drug store or hatching up mischief while they are banging the balls in some pool room.

We maintain that the wireless fiend is better off for manipulating a sending key than for juggling a billiard cue; that familiarity with a tuning coil is better than familiarity with a two dollar and a half revolver. In other words, if there was an antenna over the home of every boy in the country the country would be better off.

## Sacramento Wireless Signal Club

The Sacramento (California) Wireless Signal Club desires to communicate with other wireless clubs. The officers are as follows: F. Strader, president; L. C. Huber, vice president; E. Rackliffe, secretary; G. B. Vard, treasurer; E. Miller, chief operator; F. P. Bruner, assistant operator; D. Sullivan, sentinel. Address correspondence to the club, 2119 H street, Sacramento, California.

# Dubilier's System of Wireless Telephony

By VICTOR H. LAUGHTER

William Dubilier of Seattle, Washington, in recent tests of his wireless telephone has been able to maintain constant communication between Seattle and Tacoma, a distance of 30 miles. The voice tones, though, on a number of occasions were plainly heard at the Tatoosh station 128 miles away. The Seattle and Tacoma stations were used for the actual experimental work owing to the facilities for power, although the clearness with which the voice tones were read indicates that the tests would have held good over a much greater distance.

A view of the complete transmitter set is shown in Fig. 1. It consists of the arc or oscillator mounted on top of the box in which is contained the condensers and windings.

One of the special features of this set is the arc, which employs electrodes of a secret alloy and serve to eliminate the irregularities so common in the usual arc. The arc is burned in a field of ordinary house gas. The construction is of such nature that the cathode burns away and the particles are decomposed by the gas and deposited back on it, thus building the arc up in the same proportion and holding it regular.

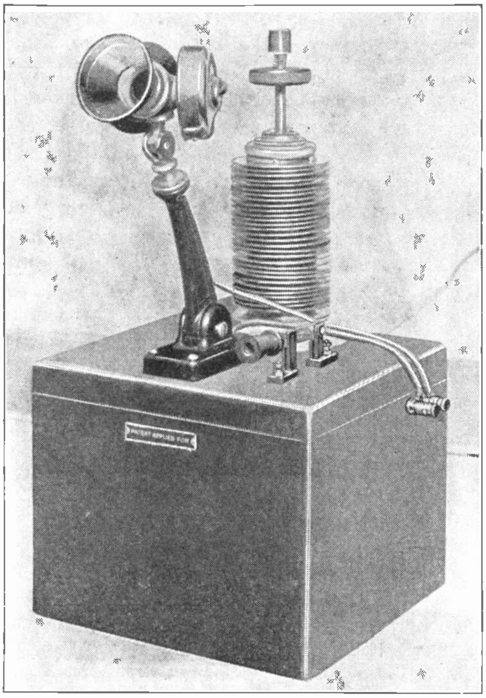


FIG. 1. DUBILIER TRANSMITTING SET

The receiving set is shown in Fig. 2. It is of the inductive type with a suitable provision for a wide variation in wave length. Completed, it consists of a loose coupled tuning coil, fixed condensor, two combination crystal detectors and a pair of 2,000 ohm head receivers. The tuning coil is so made that all sliding contacts are eliminated, therefore overcoming troubles due to short circuited turns.

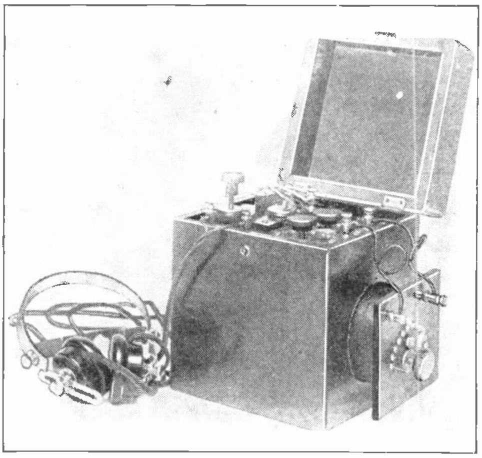


FIG. 2. DUBILIER RECEIVING SET

In Fig. 3 is shown a view of the tower which is second to the highest in the world. The structure consists of eight pillars running parallel to a height equivalent to 36 stories of an ordinary building, or 320 feet, and is situated on a bluff which will make it 820 feet above sea level.

The aerial for sending and receiving consists of 40,000 feet of phosphor bronze wire especially made for this purpose and is in the shape of an umbrella, the lower part having a diameter of 1,000 feet and the complete aerial covering almost 30 acres of ground.

## Combined Silicon and Electrolytic Detector

The following is a description of a silicon detector I made which can be used also as an electrolytic detector quite easily. This detector is very sensitive and has a very fine adjustment. All the holes in the brass are drilled with a No. 23 drill and tapped with an 8-32 tap. Any one who has access to a lathe can make the parts.

The base (I) may be a piece of ⅞-inch oak or mahogany, six inches long and four inches wide. The post (A) is a piece of ⅝-inch hexagonal brass, two inches long. A hole is drilled and tapped in the bottom, and another ¼ inch down from the top as shown in the drawing. The other post (B) is 1 7/16 inches long with a hole drilled and tapped in both ends. The cup (C) is ¾

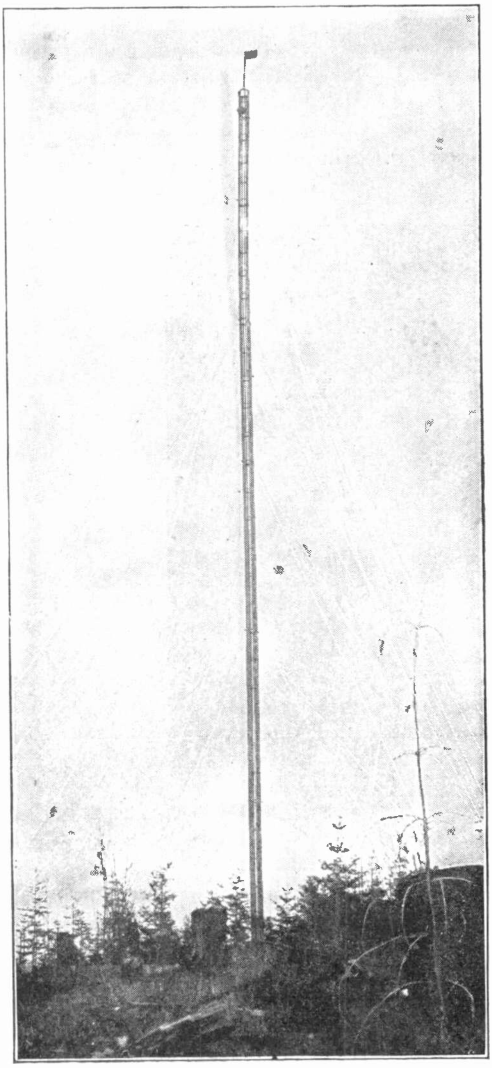
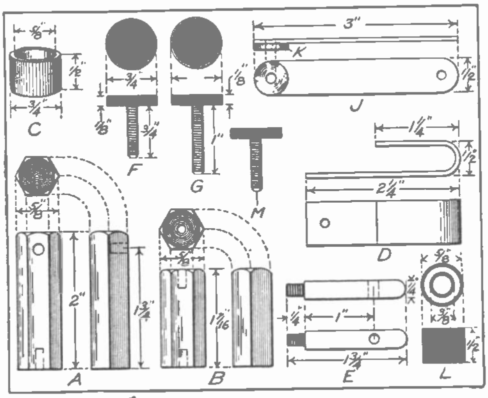
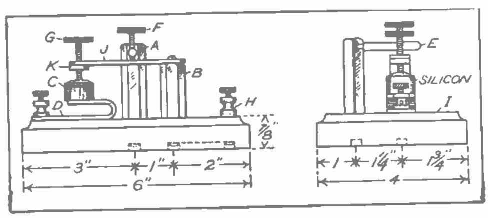


FIG. 3. TOWER OF THE DUBILIER STATION STANDING 300 FEET HIGH




DETAILS OF DETECTOR

inch in diameter and ½ inch long with a ⅝-inch hole inside. A spring (D) used to rest the cup on is cut from a piece of 1/32-inch brass, 3⅞ inches long, ⅝ inch wide, and bent as shown in the drawing. An arm (E) is made from ¼-inch round brass 1¾ inch long, with one end turned down for an 8-32 thread and a hole drilled and tapped ½ inch from the other end as shown in the drawing. Two screws are made from 5/32-inch brass threaded rod, one (F) ⅞ inch




DETECTOR ASSEMBLED

long and the other (G) ⅛ inch long. The tops of the screws are the tops off two ink bottle corks with a hole drilled and tapped in the center of each. These screws are turned into the tops and held with a little sealing wax. A spring (J) is made from a piece of spring brass three inches long and ½ inch wide with a hexagonal nut for a collar (K) soldered on one end. The silicon is held in the cup by means of lead or solder. Two binding posts are put in place and the detector assembled. To make the electrolytic detector all the parts are made the same except the spring (D) which is then cut two inches long and not bent. The screw (G) has a piece of platinum wire soldered on the end. A carbon cup is made ½ inch long and slightly less than ⅝ inch round with a ⅜-inch hole drilled ⅜ inch deep in the center. The acid is a 20 per cent solution of nitric acid and water. For adjustment the screw (G) is turned down until it nearly touches the silicon and then the rest of the adjustment is made with screw (F). Adjust the electrolyte detector in the same way except that the platinum point (M) must just touch the solution.

ALFRED R. WAGSTAFF.

# Fong Yee, the Wireless Expert

An interesting sign of the times, connected with the awakening of China, especially in military matters, is the departure of Fong Yee, aviator and wireless expert, from San Francisco to Pekin.

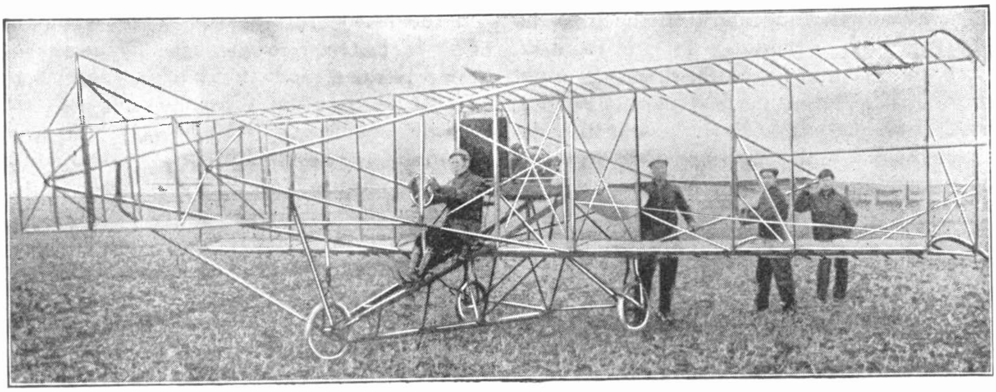
Fong Yee has been summoned by the Imperial government to demonstrate his improved biplanes before the officers of the Chinese army, and his flying machine, which is said to be an improvement on the Curtis model, will probably be utilized in that country.

Fong Yee is also the discoverer of a wireless telegraph apparatus for field use, which is said to excel in compactness and efficiency. This instrument he perfected in his laboratory at Oakland, near San Francisco, where for the past three years he has labored incessantly and has aroused the wonder of many American experts who have seen his wireless apparatus in action.

During the recent aviation tournaments in Los Angeles and San Francisco, Fong Yee was a contestant for honors and made some remarkable flights. Previously he had demonstrated his improved biplane in a number of successful cross-country trips from Oakland, where the machine was built.

Not long ago Fong Yee quite unexpectedly received an offer from the Chinese government to instruct army officers in the mysteries of aviation and wireless telegraphy. It is also believed that Prince Tsai Suin, head of the Celestial army, has made the young San Francisco inventor a

FONG YEE THE WIRELESS EXPERT



FONG YEE IN A BIPLANE OF HIS OWN INVENTION

flattering offer to remain in China, superintend the manufacture of the apparatus he has invented and restrict the secret of their construction to China. If the Fong Yee biplane and wireless apparatus are successfully demonstrated at a series of army maneuvers soon to be held near Pekin, Fong Yee's fortune is made and China may take a certain precedence in two important branches of military science.

## Revolving Mineral Detector

This article is intended for wireless amateurs who wish a detector in which several minerals are always ready for use.

The first step is to make the base according to dimensions in the figures. Hard rubber is good material for this purpose, but

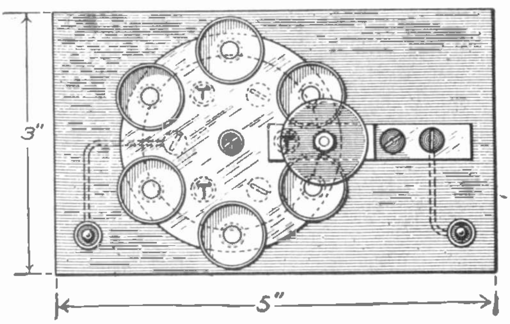



FIG. 1 PLAN OF DETECTOR

oak will do if hard rubber cannot be procured. Two inches from one end and equidistant from each side of the base, a ½-inch hole should be drilled through the base.

Procure a small quantity of quite heavy sheet brass and cut from it two disks, one having a diameter of two inches and the other a diameter of 2½ inches. On the two-inch disk, with a pair of compasses, draw a circle having a radius of ⅝ inch. Then with the same radius divide the circumference into six equal arcs. At every other division (T), Fig. 1, in the circumference drill a 3/16-inch hole, thus making three holes in all. Between these holes at the remaining marks solder three pieces of ¼-inch brass tubing ⅜-inch long. In the center of this disk drill another 3/16-inch hole. Directly over this hole solder an 8-32 binding post

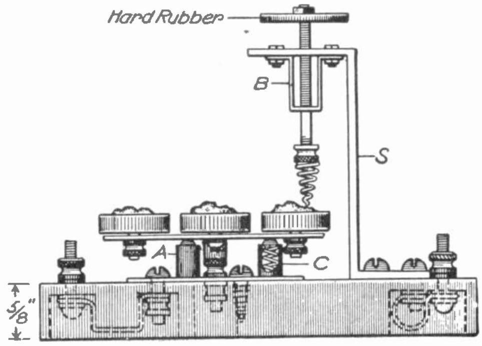



FIG. 2 SIDE VIEW OF DETECTOR

nut. On this nut solder a piece of ¼-inch tubing ¼-inch long.

On the other disk draw a circle concentric to the circumference of the disk with a radius of 1 1/16 inch. With the same radius divide this circle into six equal arcs as on the other disk. At each of these divisions, and also in the center of the disk, drill a 3/16-inch hole.

Procure six 8-32 binding post nuts and solder one in direct line with each of the outside holes on the under side of the disk. Taking the smaller disk, place it on the base so that the center comes directly over the hole in the base, and mark on the base the exact position of the three holes in the disk. Drill the base and fasten the disk with wood screws as shown, using also an 8-32 binding post. Two binding posts for connecting up should be placed as illustrated and connected on the under side, using about No. 18 wire.

Make three spiral springs out of spring brass wire to fit in the three outer pieces of tubing on the lower disk. These springs should be about ¾-inch long before they are subjected to any force. Three ball-bearings just large enough to drop in the tubings without friction should be procured. Put the three springs in the pieces of tubing (A), (B) and (C), Fig. 2, and let the ends project out. Then put a ball-bearing on top of each spring. Place the other disk on the three balls so that the hole in the center is exactly over the middle tubing underneath, then press the upper disk upon the springs and balls in the tubes. When the disk touches the middle tubing pass a ¼-inch 8-32 brass machine-bolt through the hole in the disk and the tubing, and screw it into the nut on which the tubing is soldered. Screw this down until the disk revolves without much friction. When this has been adjusted screw an extra nut on the bolt. Now procure six brass cups with 8-32 threaded stems on the under side. These cups may be filled with molten solder, and the minerals placed in them while hot. For a standard to support the contact spring and the adjusting screw procure a piece of brass 5 by ⅜ by ⅛ inch. Bend this in the shape shown at (S). The top part is 1¼ inches long, the lower section is one inch long and the upright section is 2¾ inches long. In the exact center of the top section a hole should be drilled with a ⅛-inch drill and then tapped out with an 8-32 tap. Three-eighths of an inch either way from the center of this hole drill two 3/16-inch holes.

Take a piece of 8-32 threaded brass rod about 1¼ inches long and attach an insulating thumbscrew to the top. Screw this into the threaded hole in the top of the section, passing it through the guide (B), which is a piece of thin brass 2⅜ inches long, bent and drilled as shown. Now take a thick 8-32 binding post nut and saw a shallow slit in the bottom. Then make a conical spiral spring from spring brass wire and solder the larger end in the slit on the nut. Screw this nut on the threads on the bottom of the rod. This standard (S) is fastened to the base by means of wood screws, and the binding post here should be placed in a countersunk hole. A groove should be cut between the two countersunk holes and the two binding posts connected by a wire.

The writer has made one of these detectors, and it has not only proved convenient, but also very efficient.—LAWRENCE E. HAMMOND.

# WIRELESS QUERIES

**Answered by A. B. Cole**

*Questions sent in to this department must comply with the same requirements that are specified in the case of the questions and answers on general electrical subjects. See "Questions and Answers" Department.*

### Forced Oscillations

*Questions.*—(A) Please explain "Forced Oscillations" as applied to wireless telegraphy.—E. A. B., Lowell, Mass.

*Answer.*—(A) Consider any ordinary diagram of connections for a transmitting set, including coil or transformer, spark gap, high-tension condenser, helix, aerial and ground. There is a circuit, including the spark gap, condenser and part of the helix, and another circuit comprising the aerial, ground and part of the helix. The first circuit is called the closed circuit, because it is a complete metallic circuit broken only by the condenser. The second circuit is called the open circuit, for the path of the oscillations through the helix, to aerial, and back to ground is broken by the air between the aerial and ground.

If the open circuit were charged to a certain potential and allowed to discharge, the aerial would emit a certain wave length, dependent upon its inductance, capacity and resistance. The closed circuit has also a certain natural wave length. The station is most efficient when the natural wave lengths of these two circuits are the same. But if they are not the same, the open circuit, being excited from the closed circuit, cannot maintain its own wave length, but assumes a wave length nearer that of the closed circuit.

Thus the open circuit is forced into changing its wave length.

# QUESTIONS AND ANSWERS

**Rules:—Questions must be addressed to the "Question and Answer Department" and contain nothing for other departments. Full name and address of the writer must be given; only three questions may be sent at one time; 2-cent stamp must be enclosed for answer by mail. No attention will be paid to questions which do not comply with these rules.**

### Selective Ringing

*Question.*—I would like to know the best way to equip a bridging telephone generator so it will give either an alternating or a pulsating current so subscribers may ring central and not ring telephones on the line, and also ring the line telephones when desired.—J. B., Victor, Kansas.

*Answer.*—There are several systems of selective ringing On a metallic circuit the

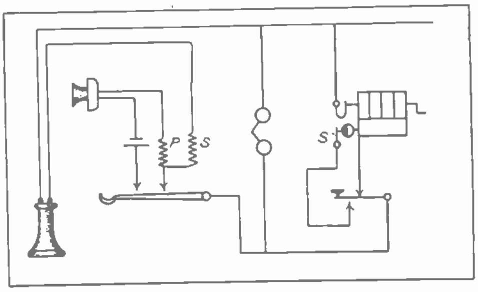



FIG. 1 SELECTIVE RINGING

generator is equipped with a commutator and two-way strap key. The commutator may be mounted on an ordinary generator and so placed on the shaft that the generator is in circuit only when projection (S) Fig. 1 strikes the spring on the side, which is

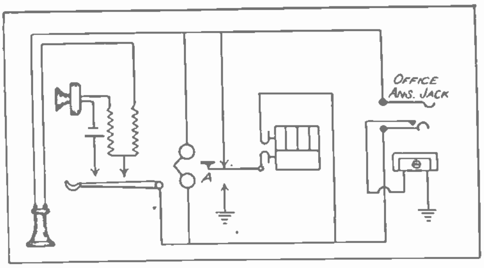



FIG. 2 SELECTIVE RINGING

during only part of a revolution. This gives pulsating current. To ring with alternating current, ring in the ordinary manner. To ring with pulsating current push the button or key closing contact (S), turning the crank at the same time.

A simpler way is to equip each telephone with a two-way strap key (A) Fig. 2, and ground the drop at central in such a way that when the operator inserts a plug in the jack it will disconnect the ground. This gives a clear metallic circuit, and to signal central push key (A), Fig. 2, down and turn crank. This opens the metallic circuit to other bells on the line, and sends alternating current from ground at key (A) through the jack and drop (D) to ground. To signal other parties turn the generator crank while the key is in the normal position.

### Constant Current and Potential; Arc Lamp Carbons.

*Questions*—(A) What is the meaning of constant current? (B) Constant potential? (C) Why are arc lamp carbons copper plated? —E. J. S., Chicago.

*Answers.*—(A) A system in which the number of amperes flowing in the circuit is always the same. In series incandescent or arc light circuits constant current is employed. Constant or steady current is maintained by a dynamo governed by an automatic regulator. The Brush, Wood and Thomson-Houston machines are examples of this type of dynamo.

(B) The ordinary system of incandescent lighting is a constant potential one, the voltage being kept steady. The candlepower of an ordinary carbon lamp is reduced from sixteen to fifteen by a drop from 110 volts to 109 volts. A lamp burned above volts to 109 volts. A lamp burned above its rated voltage has its life reduced.

(C) Arc lamp carbons are copper plated to increase their conductivity, especially where held by the clamp and to prolong their life. The copper sheathing protects the carbon near the arc from oxidizing.

# Licenses Under Patents

## License Before Patent—Sublicenses—Duration of License—Construction and Operation

By OBED C. BILLMAN, L. L. B., M. P. L.

LICENSE BEFORE PATENT.—A license may be granted before the invention is patented.

GOVERNMENT AS LICENSEE.—In England the grant of a patent for an invention is considered as simply an exercise of the royal prerogative, and not to be construed as precluding the Crown from using the invention at its pleasure and therefore no recovery can be had of right against the government for such use. But in the United States patents are not granted in the exercise of prerogative or as a matter of favor, but are secured by the Constitution as an absolute right. And this right is exclusive as against the government as well as against private individuals, and the government has no more right than any private person to use a patented invention without license from or making compensation to the owner. But a claimant seeking to recover a royalty for the use of a patented article must show a contract express or implied. The United States may be sued by the owner of a patent for the use of the invention under an authorized contract made with him for such use.

IMPLIED CONTRACT.—Where the government uses a patented invention with the consent of the owner it may ordinarily be held liable for compensation upon an implied contract. And the fact that the amount of compensation was not fixed is immaterial, but in such a case a reasonable compensation will be allowed.

THE STATUTE OF LIMITATIONS applies to suits against the government for compensation for the use of a patent as in cases of contracts generally.

JURISDICTION OF COURT OF CLAIMS.—The court of claims has jurisdiction of all suits against the United States to recover compensation for the use of a patented invention, the action being an action on contract.

ASSIGNMENTS AND SUBLICENSES.—A license under a patent is ordinarily a mere personal privilege and is not assignable without the consent of the licensor in the absence of words showing that it was intended to be assignable. But a license may be assigned where it appears from the express terms or the circumstances of the case that it was intended to be assignable. And a license may be assigned with the assent of the licensor although in terms not assignable, where such provision was inserted for the sole benefit of the licensor. Moreover, the licensor may ratify an unauthorized assignment of the license by thereafter recognizing and dealing with the assignee as licensee and accepting royalties from him.

SUBLICENSE.—The licensee under a personal license cannot grant a sublicense to another without the licensor's consent. Where a sublicense is authorized the sublicensee can acquire thereby no greater rights than his licensor possessed.

PARTIAL ASSIGNMENTS.—Licenses are not divisible unless expressly so provided, and the licensee cannot split up his license and assign a portion of it to another, notwithstanding the grant is to him and his assigns.

ASSIGNEE BOUND BY TERMS OF LICENSE.—The assignee of a license is bound by the terms.

NONASSIGNABLE LICENSE does not pass to a receiver of the licensee's property.

DURATION OF LICENSE.—*In General.*—The duration of a license may be the subject of express stipulations in the contract. But in the absence of any express provisions on the subject, the license continues until the expiration of the original term of the patent, and expires therewith. But the license may be made to cover renewals by express agreement.

OF VENDEE'S RIGHT TO USE PATENTED ARTICLE.—The sale of a patented article ordinarily takes it out of the monopoly, and the right of the purchaser and subsequent owners to use it continues until the article is worn out. But where the ownership of the article does not carry with it the right of use, the owner may use it only during the period covered by the license.

Construction and Operation.—*In General.*—Contracts and licenses affecting patent rights should be construed, like other contracts, according to the intention of the parties as expressed by the language used. The licensee, of course, acquires only such rights as are granted by his license and such as his licensor has power to grant.

Particular Covenants, Conditions, or Limitations.—A license may contain special stipulations as to the place where or within which it may be exercised, or as to the extent of the use.

License for Public Use.—*Unlawful Restriction.*—But where the owner of a patent grants a license thereunder for a public use, he cannot restrict such use to a portion of the public; such restriction is void as against public policy.

License to Use Once Only.—The owner of a patent selling the patented article may restrict it to a single use by marking thereon a notice that the license is to use once only.

Protection Against Infringements.—There is ordinarily in a license no implied covenant for quiet enjoyment or agreement on the part of the licensor to protect the licensee from infringement; but such covenant or agreement may be express.

Estoppel of Licensee.—The licensee, while he remains such, is estopped to deny the validity of the license and the right of the licensor to royalties, or that he is a licensee.

## NEW BOOKS

Three-Phase Transmission. By William Brew. New York: D. Van Nostrand Company. 1911. 178 pages with 82 illustrations. Price, $2.00.

In this work the writer proposes to discuss from the station engineer's standpoint the subject of three-phase power transmission, in connection with which huge sums of money have been invested in the past, and much larger sums will probably be expended in the future with the natural growth of transmission schemes and the extended distribution of electricity for power, lighting and traction purposes. Mathematics have been omitted as far as possible. The book contains some original investigations and keeps in view all the time the question of cost and returns.

Electric Motors. Their Action, Control and Application. By Francis B. Crocker and Morton Arendt. New York: D. Van Nostrand Company. 1910. 291 pages with 158 illustrations. Price, $2.50.

The authors have endeavored to supply information that may be useful to those who operate or are interested in the operation of electric motors. Steps in problems and examples are, when possible, based upon standard commercial motors.

Solenoids, Electromagnets and Electromagnetic Windings. By Charles R. Underhill. New York: D. Van Nostrand Company. 1910. 342 pages with 223 illustrations. Price, $2.00.

The treatise describes in as connected a manner as possible the evolution of the solenoid and various other types of electromagnets. Some of the data is the result of tests by the author, the matter having been already published in technical journals. The book is a valuable addition to the too meager data in this field.

Electric Light for the Farm. By Norman H. Schneider. New York. Spon and Chamberlain. 1911. 171 pages with 64 illustrations. Price, $1.00.

A book full of practical information on small, low voltage, electric lights plants suitable for farms, isolated houses, stores and country homes in general. Part I consisting of 85 pages is given over to the plant and its installation. Part II of 86 pages explains in detail how to wire houses.

The Seven Follies of Science. By John Phin. New York. D. Van Nostrand Company. 1911. 226 pages with 34 illustrations. Price, $1.25.

The author has endeavored to give a simple account without mathematical formulae of those problems which have occupied the attention of the human mind ever since the dawn of civilization, and which will no doubt continue to be worked upon during all time, for the circle-squarer and the perpetual motion seeker are still with us. The Seven Follies considered are: I. Squaring the Circle. II. The Duplication of the Cube. III. The Trisection of an Angle. IV. Perpetual Motion. V. Transmutation of Metals—Alchemy. VI. Fixation of Mercury. VII. The Elixir of Life. In addition are described additional follies, paradoxes, illusions, marvels and curious problems.

# ON POLYPHASE SUBJECTS

**The National Electric Light Convention**

It is difficult to form any mental conception of the magnitude of the electric light and power industry which has grown up in the last quarter of a century. But those who came away from the 1911 convention of the National Electric Light Association, which was held in New York on May 29th to June 3d, were able to realize better than they did before what electricity means to this country today and how much more the future holds.

This great Association represents primarily the unified interests of the light and power companies, great and small, that are furnishing current to the people all over the United States, Canada and Mexico. Linked with it are the manufacturing interests which furnish the complex systems of generation and distribution which makes electric service possible. Once a year the delegates representing the hundreds and thousands of companies so united by a common cause, come together to discuss questions of construction, operation, maintenance and accounting which have a bearing on the general efficiency, economy and welfare of the business.

This year the convention was held in the United Engineering Societies Building in New York and the total attendance recorded was 5,149, or nearly twice that at the St. Louis meeting last year. As pointed out by President W. W. Freeman, the expenditures for travel and hotel accommodations would easily reach $250,000. The programs for the convention provided for sixteen sessions, held in the various meeting rooms of the engineering building. The engineers had their technical sessions, the accountants theirs, also the new business agents.

One afternoon during the convention, just before the opening of the regular session, announcement was made that Thomas A. Edison would make his appearance on the platform of the main assembly room. There was a general stampede for the elevators and in a very short time the large hall was filled to overflowing. Mr. Edison came in and took his seat, accompanied by Mr. W. W. Freeman, president of the Association, Mr. C. A. Coffin, president of the General Electric Company, Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago and Mr. T. C. Martin, executive secretary of the Association. It was the signal for a grand demonstration. Everyone in the great assemblage rose to his feet and cheered and shouted till the echoes rang. For fully five minutes the outburst of applause continued. Through it all Mr. Edison sat with that genial smile on his face which great writers love to describe and which his old personal friends will always cherish. At times when it seemed as if the roof would soar away. a look of almost boyish embarrassment would pass over his face as he let it fall into his hands with a depreciatory gesture.

Mr. Edison never speaks in public, so Mr. Insull thanked the convention for the ovation and paid handsome tribute to the great inventor, as he could do with great freedom, for Mr. Edison could not hear what he said.

At this meeting Mr. Coffin was elected an honorary member. By an interesting coincidence he is the twenty-sixth honorary member of the Association and this is the twenty-sixth year of the Association's life. In the brief address following his election he emphasized the fact that electrical pursuits constitute possibly the most fascinating occupation in which a man can be engaged. One should experience a feeling of happiness and satisfaction in his own particular calling, he said: be proud of it and devoted to it. The electrical industry offers this feeling of satisfaction in a peculiar degree; there is nothing old or humdrum about it. Compared with what might be called the older industries, the career offered to a young man engaged in electrical pursuits is one which few would exchange for any other.

Recognition of the Association and its advanced policies also came from Washington. Hon. Charles Nagel, secretary of the Department of Commerce and Labor addressed the Public Policy meeting which was held in the New Theatre and was one of the features of the convention. This is the first convention that has been honored by the especial attendance of a member of the President's Cabinet. It is also a significant fact that twice within the last two months a member of the Cabinet has come to New York from Washington especially to attend meetings of the association, the first occasion being the waterpower conference called by the Power Transmission Section of the association and held in New York on April 8th. At this conference Mr. Walter L. Fisher, Secretary of the Interior, made a brief address.

The new president of the Association is Mr. John F. Gilchrist, of Chicago. He has grown up in the electric service industry and won this signal recognition on his merit. Throughout his entire business career he has been connected with the Commonwealth Edison Company and its predecessor, the Chicago Edison Company. In reaching his present position of assistant to the president, his influence has been felt in many departments.

To mingle in a gathering in which were some of the greatest business men and greatest engineers of the time, to absorb enthusiasm for and loyalty to a great cause, to exchange ideas and promote good fellowship—these were the inducements that drew men from every state in the Union to the great convention. It is safe to say that not one went home dissatisfied.

**The American Institute of Electrical Engineers**

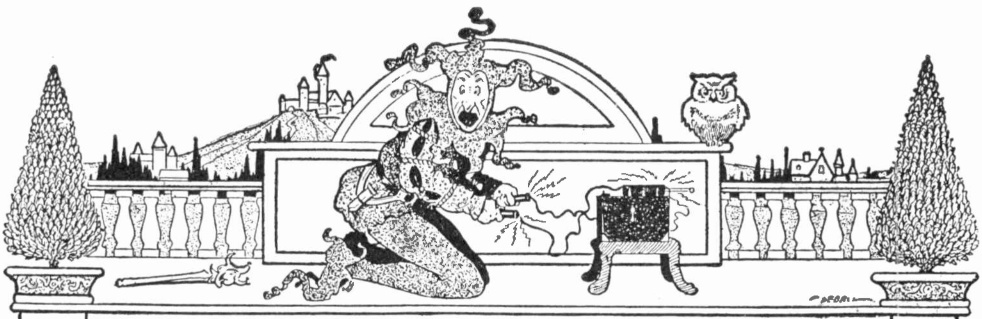
As this issue goes to press the American Institute of Electrical Engineers is holding its annual convention in Chicago. This body comprises among its membership the foremost electrical engineers in the country, and we may say, without undue national conceit, that that means in the world. Here are gathered together the men of the profession who are not only practical but also highly technical and they discuss problems which to the layman seem almost as intangible as the ether itself. To most people such subjects as: "The Use of Power Limiting Reactances with Large Turbo-generators;" "Commercial Loading of Telephone Circuits;" "Dielectric Strength of Air," and "Wave Shape of Currents in an Individual Rotor Conductor of a Single Phase Induction Motor" are worse than Greek. But it must be remembered that the solving of such questions as these, and thousands of others, to the lay mind just as abstruse, has made possible the great systems of electrical generation and distribution from the utilization of which the general public today is reaping the benefits.

All honor and respect, then, to the electrical engineer. His time is spent in endless research, experimenting, mathematical computation and the adaptation of laboratory results to actual practice, and so, perhaps, the public does not know him by name or reputation as well as it does the politician or the masters of finance. But he is content to be known by his works and his works are all around you.

## Lighting Gas Lamps Takes Time

Few people stop to consider how much longer it takes to light gas jets than it does to turn or push an electric light switch. In residences this difference in time may not be serious, although most people like to avoid a waste of time. But in stores and factories it takes considerable time for the man in charge of the lighting to make the rounds both for lighting the jets and turning them off, consequently the lamps on the average are lit earlier and burnt later than they are actually needed. Where lights are placed far apart, as in street lighting, the difference in time is still greater, often amounting to an hour or more a day.

A striking instance of this was shown in the estimates recently considered by the Southend (England) Town Council for the lighting of lamps on the pier at Southend. In order to obtain the same effective burning hours for the lamps, the electric light plant figured only on the actual time (400 hours a year) which they were to burn. The gas company, however, had to allow for the time of lighting and extinguishing, so to obtain the same minimum burning hours for every lamp they had to figure on 564 hours per year as the total elapsed time. As usual, electric lighting was adopted.



# SHORT CIRCUITS

Gentlemen—Er—where can I find the silk counter?
Floorwalker—Third battle to the right.

* * *

One day a man addicted to stuttering, but who had also a sense of humor, met a friend on the street and asked:

"H-a-l-loa, Ned, c-can you g-g-give m-m-me f-f-fifteen m-m-minutes?"

"Certainly," replied the friend. "What is it?"

"I w-w-want to have f-f-five min-minutes' t-t-talk with you."

* * *

Hostess: "Will you have some bread and butter, darling?"

Small boy: "Bread and butter! I thought this was a party?"

* * *

They tell a good story of Judge Baldwin, governor of Connecticut, when he was a small boy. He was subjected to punishment for something or other by being shut up in the closet, where he raised an awful row, screaming and kicking. Finally the row ceased, and his mentor approached the closet, to whom the youthful Baldwin replied: "I ain't good, I'm simply resting."

* * *

Employer—"We want a diplomatic, tactful, smart office boy."

Boy—"Well, I used to send sister's beau away satisfied when she didn't want to see him."

* * *

Chief Editor—Look here, Sharpe, here's a fiddler been hanged for murder. How shall I headline it?

Musical Editor—How would "Difficult Execution on One String" do?.

* * *

Papa—"Where have you been, James?"

"Fishin'."

"Come into the wood shed and we'll have a whaling expedition."

* * *

A Missouri man went to Washington to sell horses and reported to his local editor as follows: "The people here travel on cars run by electricity and do not need roadsters; they ride on bicycles and in automobiles and don't need fast trotters; they go up in airships and get their thrills without riding bronchos; they gamble by telephone and don't need race horses, and the government is run entirely by jackasses—so there you are!"

* * *

"My electric bill is too heavy."

"My dear sir, in its very nature an electric bill must be logically light."

* * *

It was the girl's mother who made the announcement, as she ran wildly down the stairs to the flat below and called through the open door:

"Mrs. Cohen! Oh, Mrs. Cohen! Give me half a dollar's worth of nickels. Blanche is engaged!"

* * *

Gracious, what is all that crepe for?"

"I had a chance to get it at a bargain, and, you know, my husband goes in for flying!"

* * *

"When I order poultry from you again," said the man who quarrels with his grocer, "I don't want you to send me any of those aeroplane chickens." "What kind do you mean?" "The sort that are all wings and machinery and no meat."

Little Teresa, five years old, accompanied her father to the boiler room and stood by while he fixed the fire. The water gauge and thermometer on top of the boiler attracted her attention, and she said:

"Papa, light a match and see how much fever it has."

* * *

"The clinging type of girl is disappearing."

"Yes; modern woman, with her numerous hatpins, is more like a cactus than a vine."

* * *

A man was at breakfast at a hotel and encountered a piece of tough beefsteak. Having failed to make an impression on it, he quietly laid down his knife and fork and remarked to the company, "Ladies and gentlemen, it's my opinion that this steak is an infringement on the Goodyear patent."

* * *

"Now, Lottie," said the teacher to a pupil in the juvenile class, "can you tell me what 'vice versa' means?"

"Yes, ma'am," answered the little miss. "It means sleeping with your feet toward the head of the bed."

* * *

"Mildred is a decided blonde."

"You don't say. When did she decide?"

* * *

Farmer Silow—Do you alternate your crops?

Farmer Timothy—Yep. Have 'em killed by one thing one year, and another the next.

* * *

Some sportsmen were examining an old shotgun of murderous build. It looked as if it would be an effective weapon against anything less than an elephant, and its owner was boasting of its power with that scorn of fact which is allowed the successful hunter. "Doesn't it kick like anything?" asked one. "Oh, yes, it kicks hard" said the owner, "but that's the beauty of it! Why, once I shot at a grizzly that was charging me! I missed him and on he came with a rush. If it had not been that the gun kicked me so far back that I had time to reload I shouldn't have been here to tell the story!"

* * *

A Boston girl who was watching a Sedgwick County farmer milk a cow adjusted her glasses and said: "It is all very plain except that I don't understand how you turn it off."

* * *

A stranger wishing to play golf at the North Berwick links sought out some one in authority to make arrangements. "What name" asked the official. "De Neuville," replied the stranger. "Mon," said the man, in a tone of disgust, "we canna bother oorsels wi' names like that at North Berwick. Ye'll start in the mornin' at ten-fifteen to the name o' Faairgusson!"

* * *

She—Tell me one thing, dear; I want to know.

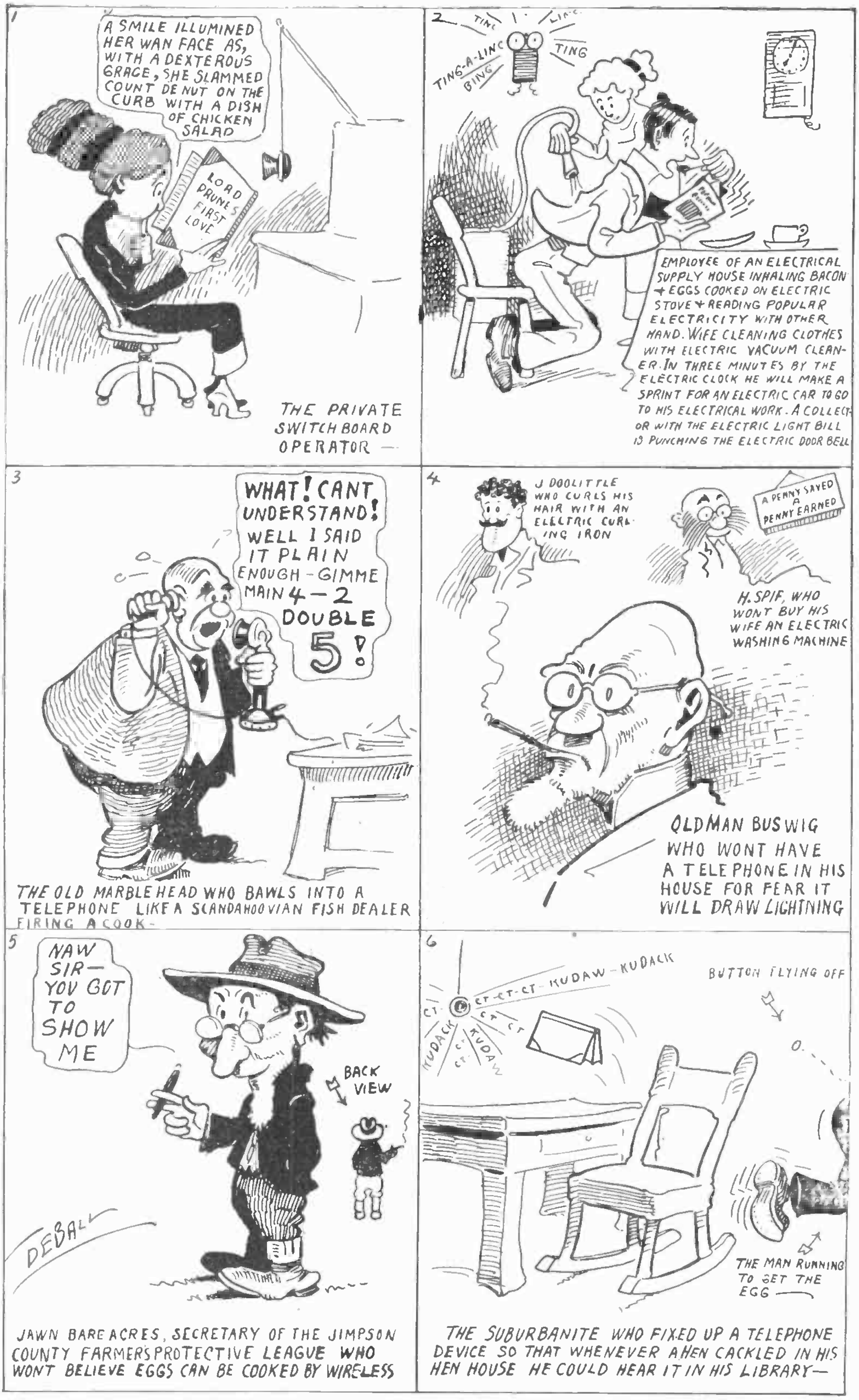
He—Yes, pet; what is it?

She—Are the fans they have at the baseball games electric or just plain palm leaf?

* * *

"Where are you going with that goat, little boy?"

"Down to the lake. Come along if you wanter see some fun. This here goat has jest ate a crate of sponges, an' I'm goin' down an' let him drink."


1
A SMILE ILLUMINED HER WAN FACE AS, WITH A DEXTEROUS GRACE, SHE SLAMMED COUNT DE NUT ON THE CURB WITH A DISH OF CHICKEN SALAD
LORD PRUNES FIRST LOVE
THE PRIVATE SWITCHBOARD OPERATOR —
2
TING-A-LING
TING
BING
EMPLOYEE OF AN ELECTRICAL SUPPLY HOUSE INHALING BACON + EGGS COOKED ON ELECTRIC STOVE + READING POPULAR ELECTRICITY WITH OTHER HAND. WIFE CLEANING CLOTHES WITH ELECTRIC VACUUM CLEANER. IN THREE MINUTES BY THE ELECTRIC CLOCK HE WILL MAKE A SPRINT FOR AN ELECTRIC CAR TO GO TO HIS ELECTRICAL WORK. A COLLECTOR WITH THE ELECTRIC LIGHT BILL IS PUNCHING THE ELECTRIC DOOR BELL
3
WHAT! CANT UNDERSTAND! WELL I SAID IT PLAIN ENOUGH - GIMME MAIN 4 — 2 DOUBLE 5!
THE OLD MARBLE HEAD WHO BAWLS INTO A TELEPHONE LIKE A SCANDAHOOVIAN FISH DEALER FIRING A COOK-
4
J DOOLITTLE WHO CURLS HIS HAIR WITH AN ELECTRIC CURLING IRON
A PENNY SAVED A PENNY EARNED
H. SPIF, WHO WONT BUY HIS WIFE AN ELECTRIC WASHING MACHINE
OLD MAN BUSWIG WHO WONT HAVE A TELEPHONE IN HIS HOUSE FOR FEAR IT WILL DRAW LIGHTNING
5
NAW SIR— YOU GOT TO SHOW ME
BACK VIEW
DEBALL
JAWN BAREACRES, SECRETARY OF THE JIMPSON COUNTY FARMERS PROTECTIVE LEAGUE WHO WONT BELIEVE EGGS CAN BE COOKED BY WIRELESS
6
CT-CT-CT-CT- KUDAW - KUDACK
KUDACK
KUDAW
BUTTON FLYING OFF
THE MAN RUNNING TO GET THE EGG
THE SUBURBANITE WHO FIXED UP A TELEPHONE DEVICE SO THAT WHENEVER A HEN CACKLED IN HIS HEN HOUSE HE COULD HEAR IT IN HIS LIBRARY—

# 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.

DRUM ARMATURE.—An armature of a dynamo or motor in which the armature windings are wound lengthwise and upon the surface of a cylinder. To distinguish from a ring armature in which the coils are wound upon a ring shaped core.

DRY BATTERY.—See Battery, Dry.

DUPLEX CABLE.—See Cable, Duplex.

DUPLEX TELEGRAPHY.—The system of telegraphy by which two messages may be sent over the same wire in opposite directions.

DURATION OF ELECTRIC SPARK.—Wheatstone determined the duration of a spark given by an ordinary Leyden jar to be 1-24000 second. The time increases with the distance between the spark gap terminals and does not depend upon the size of the balls between which the spark passes.

DYNAMO.—The name applied to a machine used to generate electric current. The essential parts are: Coils of wire wound upon a core and constituting the revolving portion or armature, field magnets for producing a field of lines in which the armature coils revolve, a commutator and brushes for taking off direct current, or slip-rings upon which sliding contacts stand and take off alternating current.

E.—A contraction used to signify voltage, as in Ohm's law, $C = \frac{E}{R}$.

E. M. F.—A contraction for electromotive force.

EARTH PLATE.—A plate often of copper buried in the earth to form a good ground for telegraph wires or other electric conductors, thus using the earth for one side of the circuit. Also applied to the plate to which the ground wire of a lightning arrester is connected.

EARTH RETURN.—By grounding a circuit at both ends the earth acts as the other side of the circuit or as an "earth return."

EBONITE.—A term applied to vulcanized India rubber. This material is a good insulator.

EDDY CURRENTS.—If a solid conductor be moved in a field of lines or the strength of the lines be varied about such a conductor, currents are produced in this conductor, some of which are converted into heat. These currents are called eddy currents. Also referred to as parasitical or Foucault currents.

EDISON EFFECT.—An electric discharge which takes place between one of the terminals of an incandescent lamp filament and a metal plate placed near it, but not connected to it, as soon as the lamp reaches a high voltage.

EDISWAN.—An abbreviation of the trade name Edison-Swan, used in the incandescent lamp trade of Great Britain.

EFFICIENCY.—A comparison between the amount of energy put into a machine and the work which the machine will perform with this input.

EFFICIENCY OF CONVERSION.—The relation of the energy absorbed by a dynamo to the total electrical energy produced by it. This efficiency may be expressed in per cent by dividing the energy produced by the energy absorbed.

ELECTRIC ANNEALING.—See Annealing.

ELECTRIC CHARGE.—A quantity of electricity stored upon the surface of an insulated electrified conductor.

ELECTRIC EEL.—A species of eel (gynotus electricus) possessing the remarkable power of generating electricity and of striking with it through water. These eels are most abundant in the Amazon and its tributaries.

ELECTRICITY.—It is impossible to give a satisfactory definition of electricity. We know it as a form of energy capable of being made to do work and readily convertible into heat, light, magnetism and various other forms of energy.

ELECTROCUTION.—Capital punishment inflicted by means of an electric current. The criminal is seated in a chair and strapped there. One electrode with a wet padded surface is applied against his head and another electrode is placed against some lower part. Alternating current at 1,500 to 2,000 volts is applied.

ELECTRODE.—Either of the terminals of an electric source of supply.

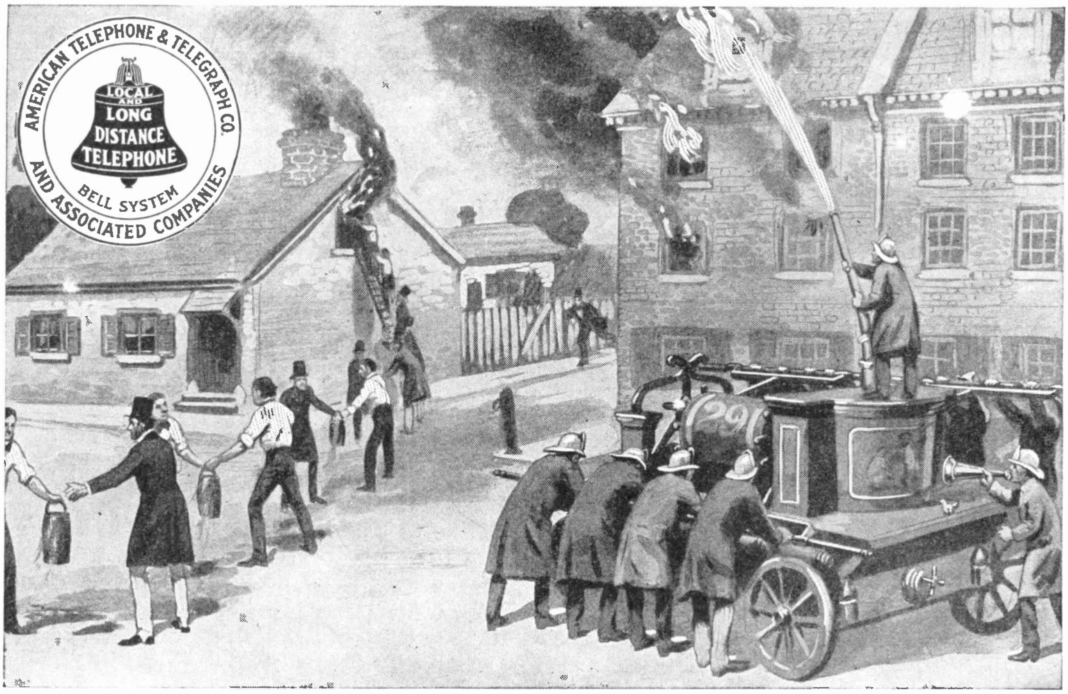
ELECTROLYTIC DETECTOR.—A device used in wireless telegraphy for showing the presence of electric oscillations gathered by the antennae. It consists of a cup containing either dilute nitre or sulphuric acid (20 per cent solution) into which a platinum wire is introduced and which is attached to an adjustment screw for ready regulation.

ELECTRO-GILDING.—A deposit of gold upon an object by means of the electroplating bath.

ELECTROLIER.—A name used to designate a fixture supporting electric lights only.

ELECTROLYSIS.—The separation of a compound into its elements by the passage of any electric current through a solution of the substance. The electrolyte or solution must be a conductor. Water slightly acid begins to decompose into hydrogen and oxygen upon the application of three volts.

ELECTROLYTE.—Any fluid body which may be decomposed by passing an electric current through it.




# Fire Fighting and Telephoning

## Both Need Team Work, Modern Tools and an Ever Ready Plant, Everywhere

Twenty men with twenty buckets can put out a small fire if each man works by himself.

If twenty men form a line and pass the buckets from nand to hand, they can put out a larger fire. But the same twenty men on the brakes of a "hand tub" can force a continuous stream of water through a pipe so fast that the bucket brigade seems futile by comparison.

The modern firefighter has gone away beyond the "hand tub." Mechanics build a steam fire engine, miners dig coal to feed it, workmen build reservoirs and lay pipes so that each nozzleman and engineer is worth a score of the old-fashioned firefighters.

The big tasks of today require not only team work but also modern tools and a vast system of supply and distribution.

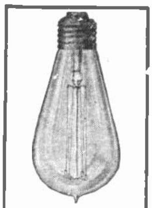
The Bell telephone system is an example of co-operation between 75,000 stockholders, 120,000 employees and six million subscribers.

But to team work is added an up-to-date plant. Years of time and hundreds of millions of money have been put into the tools of the trade; into the building of a nation-wide network of lines; into the training of men and the working out of methods. The result is the Bell system of today—a union of men, money and machinery, to provide universal telephone service for ninety million people.

**AMERICAN TELEPHONE AND TELEGRAPH COMPANY**

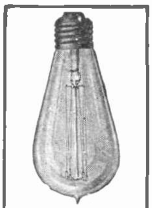
**AND ASSOCIATED COMPANIES**

***One Policy*** ***One System*** ***Universal Service***



*The Mazda Lamp*
*Inexpensive*
*Electric Light*

# Electric Light Is the Artistic Light



*The Mazda Lamp*
*Best Quality*
*of Light*

**IT IS LEAST EXPENSIVE**

WHAT is the magical something which makes a home inviting, interesting and "different"? A bit of color—the clever grouping of furniture or pictures, an antique or an unusual drapery, each have their part, but

**Of what avail are color harmonies and artistic furnishings with garish, inappropriate lighting?**

Craftsmen and designers have brought into being wonderful shades and fixtures. Electric bulbs are made in many sizes and so improved that electric light is cheaper than any other light.

**The Mazda Lamp** is a wonderful, current economizing electric lamp, which will produce 2½ times the light for the same current consumption as the old style lamp.

**The Mazda Lamp** is sold by dealers and lighting companies everywhere.

**National Electric Lamp Association**
CLEVELAND

# Facts in Plain English

**House Wiring** has a mistaken rating. It is not necessary to raise the dust and tear down the house to wire it. The modern electrician works quietly and cleanly without disturbance.

**Electric Light** is now cheaper because Mazda Lamps produce 2½ times the light of the old style lamp and thereby cut the cost to a figure less than all other practical illuminants.

See your lighting company or electrical dealer, they will show the Mazda Lamp to you.

THE BANNER ELECTRIC CO., Youngstown, O.

THE BRILLIANT ELECTRIC CO., Cleveland, O.

THE BRYAN-MARSH COMPANY, Central Falls, R. I.

THE BRYAN-MARSH COMPANY, Chicago, Ill.

THE BUCKEYE ELECTRIC CO., Cleveland, O.

THE BUCKEYE ELECTRIC LAMP CO., Mexico City, Mexico

THE CLEVELAND MINIA. LAMP CO., Cleveland, O.

THE COLONIAL ELECTRIC CO., Warren, O.

THE COLUMBIA INC. LAMP CO., St. Louis, Mo.

THE GENERAL INC. LAMP CO., Cleveland, O.

FEDERAL MIN. LAMP CO., Cleveland, O.

NEW YORK & OHIO COMPANY, Warren, O.

THE SHELBY ELECTRIC CO., Shelby, O.

THE STANDARD ELECTRICAL MFG. CO., Warren, O.

SUNBEAM INC. LAMP CO., Chicago, Ill.

SUNBEAM INC. LAMP CO., New York City

THE SUNBEAM INC. LAMP CO., of Canada, Toronto, Ont., Can.

THE WARREN ELECTRIC & SPECIALTY CO., Warren, O.

THE FOSTORIA INC. LAMP CO., Fostoria, O.

**National Electric Lamp Association**

CLEVELAND

# Classified Advertisements

**The cost of advertising in this section is 5 cents per word for one insertion, with**
**5% discount for 3 insertions**
**10% discount for 6 insertions**
**15% discount for 9 insertions**
**20% discount for 12 insertions**
**within one year.**
**Remittance must accompany order, or advertisement will not be inserted. Forms for the Sept. issue will close on August 1st**

## AERONAUTICS

RACING MONOPLANE 30 IN. x 14 IN. Flies 950 feet. Very durable. Excellent prize winners. This wonderful racer, $1.25 postpaid. Robie Monoplane Co., Williamson, N. Y.

MODEL BALLOONS AND FLYING MAchines. How to Make Them, by J. H. Alexander. Contains complete directions for constructing models with five folding plates of working drawings, also an account of the progress of aviation. $1.50 postpaid. Popular Electricity Book Dept.

COMPLETE PLAN, DRAWN TO SCALE, for building three-foot flying Bleriot monoplane model, with full instructions, 15c. postpaid. Complete material for same with plan, $3.00. Everything for model making. Stamp brings list. Ideal Aeroplane & Supply Co., 1200½ Bedford Ave., Brooklyn, N. Y.

## AGENTS

"PERFECTION POCKET ADDING MAchine—lightning seller. Agents wanted. Cincinnati Specialty Mfg. Co., Dept. E, Cincinnati, Ohio.

IGNITERS, 10c POSTPAID, LIGHTS gas, gasolene or acetylene, 5,000 sparks. Dealers supplied. Jobber, 3525 Broadway, N. Y.

LIVE AGENTS WANTED FOR ARTICLE which sells at sight; no talking; customers waiting for it. Particulars free. C. M. Cunningham, Dept. A., Sims, N. D.

MAKE MONEY AT HOME; SEND $1; WE will send you five of the latest and best candy recipes. McCann & Jameson, 1001 E. 9th St., Pittsburg, Kan.

DON'T ACCEPT AN AGENCY UNTIL you get my samples and particulars. Money makers. Address, SAYMAN, 706 Sayman Bldg., St. Louis, Mo.

AGENTS—OUR HOUSEHOLD NECESsity appeals to everyone. Quick sales, big profits. Investigate. Jersey Supply House, Dept. D, Washington, N. J.

ONE MILLION AGENTS WANTED—FAST seller costing 5c., selling 50c. Every firm needs. Orders to $50. Postal brings samples. Embossed Co., 2600 Milwaukee Ave., Chicago.

AGENTS MAKE MONEY SELLING THE Dollar adding and substracting machine. Particulars free. F. Bassett, 5921 Indiana Ave., Chicago.

## AGENTS

2-TICLE-U, 3c. STIX, STOCKTON, CAL.

NEW ARTICLES FOR HOUSEHOLD and Mechanical Trades. Quick sales, good profits. North Chicago Tool Works, North Chicago, Ill. 3 Broadway.

BIG CHANCE FOR HUSTLERS—OUR Salary Plan offers splendid opportunities for making money. Send stamp for particulars. Popular Electricity Magazine, Circulation Department, Commercial Bldg., Chicago.

WANTED—EXCLUSIVE AGENCY COVering Dominion of Canada for first-class novelties and specialties. Address, Fowler & Wheeler, Manufacturers' Agents, Foreign Domestic, Calgary, Alberta, Canada.

BOKARA DIAMONDS—AGENTS, EVERYone wanted to wear and sell these Famous Gems. Big profits. Samples offer and catalogue free. Northwestern Jewelry Co., 80 Northwestern Bldg., Chicago.

MAKE $20.00 DAILY OPERATING OUR Minute Picture Machines. Experience unnecessary. Small investment; large profits. Free book, testimonials, etc. Write, American Minute Photo Co., Dept. 37, Chicago, Ill.

AGENTS! MAKE 14c. ON EVERY 25c. bottle of suit-cleaning fluid sold. For removing paint, pitch, tar, oil, grease and tallow candle spots. 1 bottle, 25c.; 6 bottles, 66c. Money order. Address Pacific Chemical Co., Box 583, Oakland, Cal.

AGENTS MAKE BIG MONEY SELLING our new gold letters for office windows, store fronts and glass signs. Any one can put them on. Write today for a free sample and full particulars. Metallic Sign Letter Co., 400 N. Clark St., Chicago, Ill.

BE INDEPENDENT! START A MAIL order business in your own home. We tell you how and furnish everything needed wholesale. An honorable and profitable business for man or woman. Particulars free. Many make $3,000 a year. Murphy Mfg. Co., South Norwalk, Conn.

AGENTS—BIGGEST MONEY MAKER known. The new Canchester Incandescent Kerosene Lamp revolutionizes old lighting methods. Burns air, not money. Six times brighter than electricity, gas or acetylene at 1-10th cost. Burns with or without mantle. Burner fits any lamp. Saves 75 per cent. oil. No trimming wicks. Showing means selling. Territory going fast. Write today. Handsome outfit furnished. Cancester Light Co., Dept. P. E., 8, Chicago.

WE MANUFACTURE GLASS PAPER. Plain glass windows made to look like real stained glass. Easily applied and beautifies the home. Something new for agents. Two sheets of this glass paper sent as a sample with catalogue in colors and complete instructions on receipt of 10c. S. H. Parrish & Co., 202 S. Clark St., Chicago.

## WIRELESS

WIRELESS BARGAIN LISTS, FREE. Burtt Co., Wollaston, Mass.

GO TO CHAMBERS FOR WIRELESS. Guaranteed first class. Parts sold separately, if desired. Send 2c. stamp for catalogue. F. B. Chambers, 217 N. 9th St., Philadelphia, Pa.

2 K. W. WIRELESS SET, COMPLETE. Will sell cheap. Address J. Hair, 3442 W. 18th St., Chicago.

A DECIDEDLY NEW ROTARY VARIable Condenser, $10.00, the best out. 1-2 K.W. Alwco Sending Transformer with condenser and spark gap, $35.00. Complete Receiving Set with 1000 ohm double-pole receiver, $5.95. Guaranteed double-pole 1000 ohm receivers, $1.75 each; pair with split head-band and six foot silk cord, $5.25. Double-slide Tuning Coils wound with spaced bare wire, $2.25. Slider rod, 10c foot; sliders, 23c. Reliable apparatus and supplies of all kinds. Send stamp for catalogue. Alden Wireless Co., Dept. D, Campello, Mass.

## HELP WANTED

WANTED—DISTRIBUTERS OF ADVERtising matter everywhere. Oliver B. Barkley, Blairsville, Pennsylvania.

CIRCULAR MAILERS WANTED EVERYWHERE. Write Walters Printery, Brooklyn, N. Y.

MONEY IN MSS. WE TEACH STORY writing; we buy, or sell short stories on commission. Make money writing. Big pay. Free booklet tells how. United Press Syndicate, San Francisco.

CIVIL SERVICE EXAMINATIONS OPEN the way to good government positions. I can coach you by mail at small cost. Full particulars free to any American citizen of eighteen or over. Write today for Booklet E50. Earl Hopkins, Washington, D. C.

CIVIL SERVICE GOVERNMENT POSItions are very desirable for young people. Full information and questions recently used by the Civil Service Commission free. Columbian Correspondence College, Washington, D. C.

WANTED — ONE MAN OR WOMAN IN every locality to start a "candy kitchen." Best paying small business on earth! Few dollars starts you. Write for particulars. Humboldt Publishing Co., Dept. D., 4743 State St., Chicago, Ill.

A COMPLETE COURSE IN PRACTICAL Automobile Engineering under experienced instructors, with all modern equipment and appliance. Our four-story building offers special accommodation to out-of-town students. Call or write for our liberal proposition on Resident or Home Courses. Automobile School of Chicago, 1839 Michigan Ave., Dept. P. E.

BIG MONEY WRITING SONGS, THOUsands of dollars for anyone who can write successful words or music. Past experience unnecessary. Send us your song poems, with or without music, or write for free particulars. Acceptance guaranteed if available. Washington only place to secure copyright. H. Kirkus, Dugdale Co., Dept. 13, Washington, D. C.

## HELP WANTED

WANTED—MEN TO LEARN WATCHmaking. Earn pay while you learn. Write for our free book "How to be a Watchmaker." Stone Watchmaking School, 908 Globe Bldg., St. Paul, Minn.

$25 WEEKLY AND EXPENSES TO MEN and women to collect names, distribute samples and advertise. Steady work. C. H. Emery, M. N., Chicago, Ill.

YOUNG MEN WANTED — TO HAVE charge of our amusement devices in all parts of the country. $100 to $400 per month profit. No expense. Pleasant employment. No experience required. Universal Amusement Co., 825 Essex Bldg., Newark, N. J.

WANTED—MEN BY LARGE CONTRACTing company. Can learn trade of plumbing, electricity, bricklaying, automobiles, in few months. No apprentice or helper's work and no expense. $20,000.00 contract work going. Catalogue free. United Trade School Contracting Co., Los Angeles.

WANTED—A MAN OR WOMAN TO ACT as our information reporter. All or spare time. No experience necessary. $50 to $300 per month. Nothing to sell. Send stamp for particulars. Sales Association, 611 Association Building, Indianapolis, Ind.

MOTION PICTURE PLAYS WANTED—you can write them. We teach you by mail. No experience necessary. Writers earn $50 a week. Demand increasing. For particulars address Ass'd M. P. Schools, 112 Clark St., Chicago, Ill.

WANTED—ACTIVE, EDUCATED MEN and women of good address. High grade educational specialties. Our plan has become a necessity in homes having children. Commission or guaranteed income. Give references. Address, Chautauqua Mfg. Co., Valparaiso, Ind.

THE AUTOMOBILE BUSINESS OFfers magnificent opportunities to sober and reliable men. Learn this business in the Largest, Oldest and Best equipped school where only PRACTICAL INSTRUCTION is given. We give a thorough knowledge of theory and principles without the use of books, driving instruction on all modern machines, and PRACTICAL REPAIR SHOP EXPERIENCE. Our graduates holding the best positions all over the United States at salaries ranging from $80.00 to $150.00 per month. Send for our 32 page booklet "How to Drive" free. Greer College of Motoring, 1459 Wabash Avenue, Chicago, Ill.

**MAGIC** POCKET TRICK FREE
Catalog included, send 6c stamp.
Dept. 17 270 W. 39th St., New York


**Big Mail FREE**

Your **NAME PRINTED** in our Mailing Directory and sent to 10,000 firms all over the world so they can send you **FREE Samples, Catalogs, Books, Papers, Magazines, etc., etc.** Send 20c to cover cost of printing your name and you will receive a big mail **Free.**

Ingram, Va., Jan. 7, 1910. Mr. Anderson, I have already received more than 2,000 parcels of mail, and still they come, scores of papers, samples, magazines, etc., for which I had often paid 10 to 25c each. R. T. James.

**Send to ANDERSON, The Mail Man, 565K, Jamestown, N. Y.**

# Knowledge Will Put YOU in the Spot Light

The fellow that does only what he has to, and spends his spare time in theaters or pool rooms or on the street corner—that fellow does not expect to go very high

How did your superintendent, or general manager, or foreman, or department chief land the position he holds? By showing knowledge of his work; by proving that he had ability; by getting ready when he was in the same job you now hold.

How can you get into the spot light? How can you mount over the crowd and attract the attention of the "big man"?

By your own efforts properly directed. By being willing to devote to study a part of your spare time. By giving the International Correspondence Schools a chance to direct your efforts and lead you to the front.

Your spare time, if you would but realize it, could be made more profitable than the time sold to your employer.

Mark and mail the coupon to find out all about the I. C. S. plan to put you into the spot light. Doing so will cost you nothing, and will bring to you a full explanation of just what kind of Course you will get, what you will learn, and what has been done by other students of the same Course.

Three hundred I. C. S. students a month write to tell of progress.

Don't wait.

**Mail the coupon NOW.**

**International Correspondence Schools**
**Box 1102, Scranton, Pa.**

Please explain, without further obligation on my part, how I can qualify for a larger salary and advancement to the position, trade, or profession before which I have marked X.

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| Electrical Engineering | Mechanical Engineer |
| Electric Lighting | Mechanical Draftsman |
| Electric Railways | R. R. Constructing |
| Electrician | Concrete Construction |
| Electric Car Running | Architect |
| Dynamo Foreman | Contracting & Building |
| Dynamo Tender | Architectural Draftsman |
| Wireman | Plumbing & Heating |
| Mining Engineer | Chemist |
| Telephone Expert | Bookkeeper |
| Civil Engineer | Advertising Man |
| Automobile Running | Civil Service Exams. |

*Name* ______________________

*St. & No.* ______________________

*City* ______________ *State* ______________

*Present Occupation* ______________________

## I want every reader of *Popular Electricity* to know *two* things about the wonderful

# KIMBLE

**VARIABLE SPEED, SINGLE PHASE, REVERSIBLE A. C.**

# MOTORS

*FIRST*—That these motors reverse, from any speed forward to any speed back by the mere pull of a chain and that this same chain or lever control regulates their **speed,** at will, from 80 to 800 r. p. m. either forward or back.

*SECOND* — That the entire absence of starting coils, compensating coils or any outside controlling device guarantees that **every watt of current metered is put to useful work,** and none of it is wasted in forcing the current to do, in an unnatural way, what it does in the Kimble naturally.

### PROFIT SHARING PLAN

**Send me a list of names, addresses and lines of business of responsible power-users on A. C. circuits** who operate printing presses, ventilating fans, sewing machinery or any other type of machine that carries a **fairly uniform load,** and in which variable speed, or reversibility, would be useful, and I will send them catalogs, inquiry blanks, etc.

**For every sale I make** to such parties, I will see to it that you are properly compensated.

I have felt from the start that the thousands of readers of this paper could be made a **power** in spreading the Kimble gospel—the gospel of new and larger efficiency of alternating current—and now I believe I have discovered the way to get thousands of you busy making money for yourselves, for your friends and for us.

Write plainly, on one side of the paper only, arranging names in lists, thus:

Name St. Address City Business No. of Employes

Then sign your name and address at the bottom. All these names will be put on cards with your name and address also on each card. When a sale is made and money collected, I will at once notify you.

*Do not send names in D. C. Territory as we have nothing to sell them, and your time, theirs and ours will be wasted.*

**DO IT NOW! Address**

**James K. Bass, Treas. and Gen'l Mgr.**

**KIMBLE ELECTRIC CO.**

**1119 Washington Boulevard CHICAGO**

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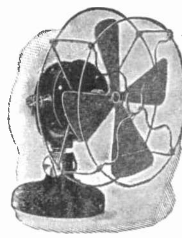
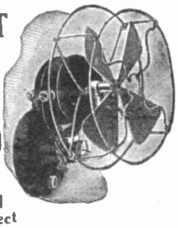


## A PERFECT 110 VOLT FAN FOR $6.50



**Electrically, Mechanically and Aesthetically Perfect**

Finish, black enamel and nickel. Any adjustment. For home and office, telephone booth, picture show, or where a ceiling fan is not needed. You can buy a larger or a higher priced fan but you **positively can not get a better one. Noiseless** and sparkless. Say whether for alternating or direct current, and give dealer's name. We **prepay express** and guarantee **satisfaction.**

Six volt battery fan at same price.

**The Carleton Company**

**178 Summer St., Boston, Mass.**

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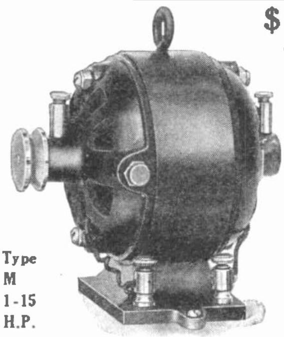


Type M 1-15 H.P.

## $3.50 for this HIGH GRADE MOTOR

*Runs on a. c. and d. c current, 110 volts. Includes complete set of blue prints showing how to assemble. Has laminated field and armature, mica insulated commutator, 3-16 carbon brushes, bronze bearings, brass grease cups, pulley and terminals.*

*Assembled complete ready to run*

## $5.50

*Set of blue prints showing motor in detail* 12c. *Catalogue* 4c.

**JOSEPH WEIDENHOFF**

**1215 S. Ashland Ave. CHICAGO, ILL.**

---

## *No More "Battery Trouble"*

Cease sending for the electrician to "fix that bell." Let the electric light current ring your annunciators, burglar alarms, etc. Our

## *"Junior" Transformer*

will do it more cheaply than any other way. Consumes no current, and can't be damaged by short circuits. Fireproof and durable. For alternating current only. **Price $3.00, at dealers or direct from us.**

**THORDARSON ELECTRIC MFG. CO.**

**214 Jefferson Street CHICAGO**

---

## *Will Not Burn Out*

An important feature of these motors is that they will not heat under any circumstances.

1/12 and 1/8 H.P. for A.C. and D.C. Finished in Black Enamel.

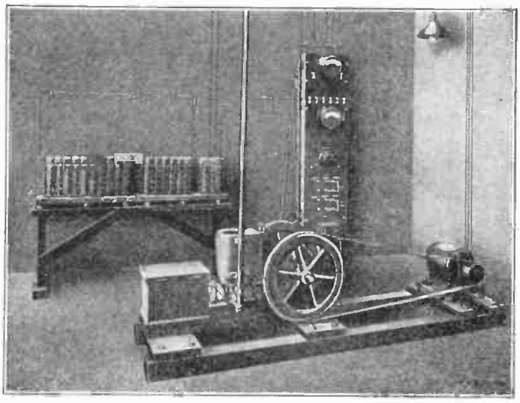
**THE BARNES**

**VARIABLE SPEED AND REVERSIBLE**

Are especially adapted for **Washing Machines, Printing Presses, Coffee Mills, Dental Apparatus, Vacuum Cleaners, Wireless Apparatus, etc.**

Let us figure on your requirements

**BARNES MFG. CO., 107 Belmont Street Susquehanna, Pa.**



# Here's Some Convincing Evidence

*If you want the opinions of some users of our small low voltage electric lighting plants, concerning the reliable service, simplicity and ease in operating a plant, write any Sales Office for a copy of a new book we have just published entitled* ***"A Book Full of Satisfaction."***

The use of small electric lighting plants, in districts where Central Station current is not available, has increased most rapidly.

A complete plant consists of small gas engine, dynamo, switchboard and storage battery. Electric lighting is available any time of the day or night—a full 24-hour service—by only an occasional running of the engine to charge the battery.

**The "Chloride Accumulator"** used with these plants is exactly the same type of battery used by the large electric lighting companies, electric railways, telephone and telegraph companies, etc.

*Write the nearest office for the book mentioned above and at the same time secure our book entitled* ***"How to Have Your Own Electric Lighting Plant"***

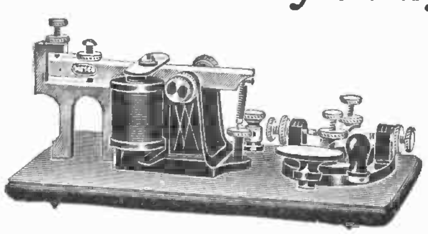
## THE ELECTRIC STORAGE BATTERY CO.

1888 **PHILADELPHIA, PA.** 1911

**New York Detroit Boston San Francisco Chicago Portland, Ore. St. Louis Seattle Cleveland Los Angeles Atlanta Denver Toronto**

For Gas Engine Ignition, the "Exide" Sparkling Battery will give you the very best service

# Something Electrical for Everybody



**Eureka Telegraph Instrument,** illustrated herewith with **hundreds** of other electrical specialties, are described in our 192 page Catalog 24E, which will be mailed on request.

## Manhattan Electrical Supply Co.

NEW YORK, 17 Park Place
CHICAGO, 112 S. 5th Ave.

# Jones' Electric Fountain *Patented* Jet

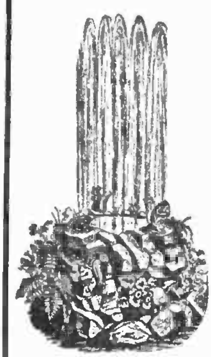


*Figure 1*

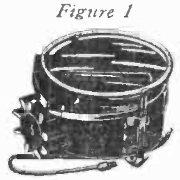


*Figure 2*

This **Electric Fountain Jet** colors the water and runs without a motor.

When playing as shown in figure 1 the waste water flows over a wheel as shown in figure 2 and revolves a colored glass screen around a 32 candle-power incandescent lamp coloring the spray from red to green, yellow, blue, etc., also blending the different colors.

This **Electric Jet** makes a very attractive display for lawns, conservatories, hotels, club houses, florist windows, etc. Can be attached to any fountain pipe.

*Manufactured by*

## The M. D. Jones Company

71-73 PORTLAND STREET, BOSTON, MASS.

# Contribute to Hot Weather Comfort in Your Home

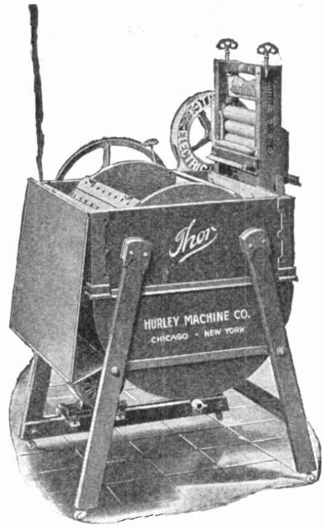
THROUGH THE PURCHASE OF A

## Thor Electric Home Laundry Machine

No other method can equal the work of this machine.

Made in Galvanized Steel, Zinc, Copper, White Enameled Cast Iron and in Solid Porcelain. Sizes to meet all requirements.

Prices to suit every purse, yet every machine guaranteed.




## Thor Electric Home Laundry Machines

are now doing the weekly laundry work in 31,876 homes.

Laces, Blankets and all kinds of washable goods made spotlessly clean without injury and without any laborious work.

Cost of electricity to operate less than 2 cents per hour.

**Sold for Cash or on Monthly Payments** **Send for Free Illustrated Booklet No. 50**

**HURLEY MACHINE COMPANY**

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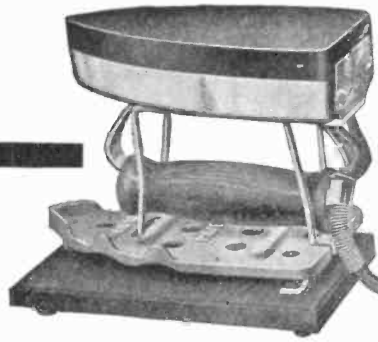

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Has some dainty ribbons or laces which cannot stand being rubbed with the iron, or some pieces of velvet on which she wants to raise the nap. This Simplex attachment enables her to do it safely, conveniently and perfectly. Just one of the features of the 1911 Model Simplex Iron. Ask your lighting company or dealer to show you a Simplex Household Iron or let us tell you more about it.

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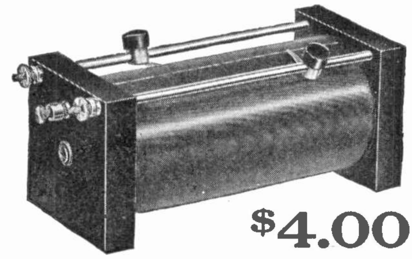

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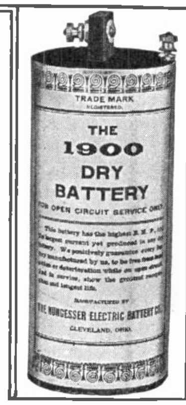


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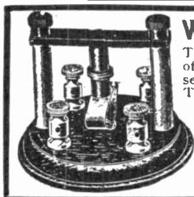

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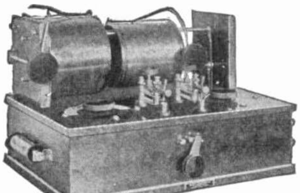

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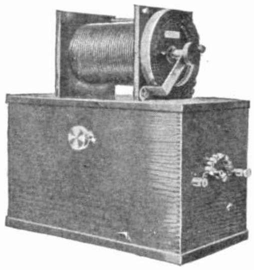

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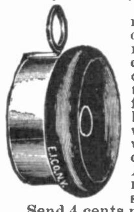

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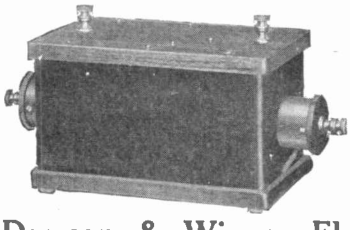

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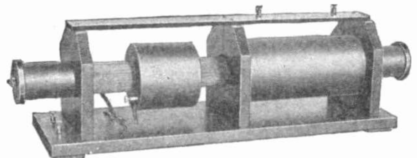

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**$30.00**

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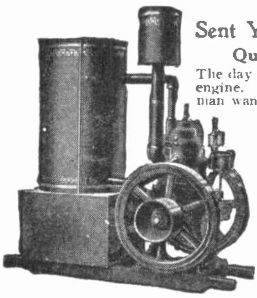

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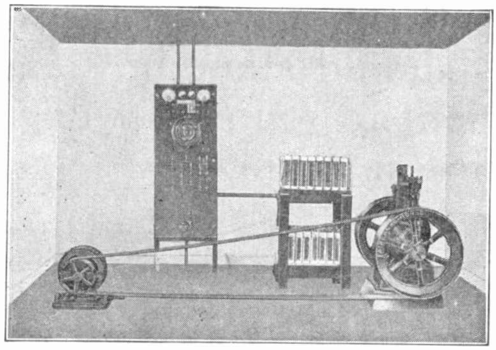

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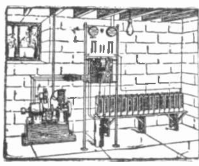

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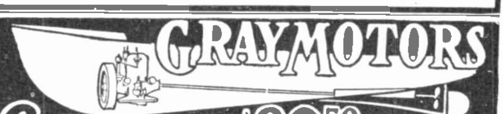


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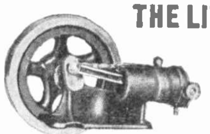

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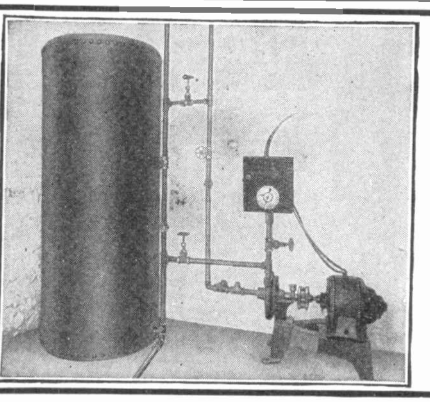

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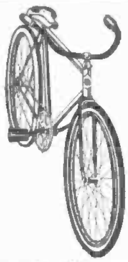

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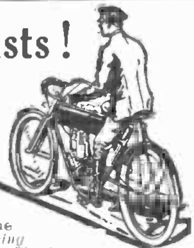

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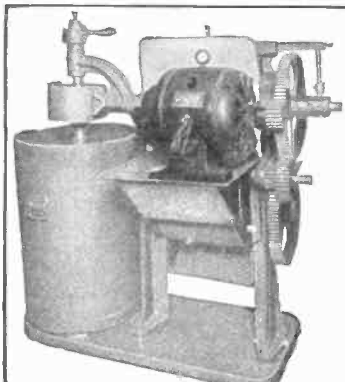

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These machines are built unusually substantial, and are guaranteed to give satisfaction.

Made in 20 and 40 quart sizes. The 40 quart size runs both fast and slow on A.C. current. Write to-day for circular

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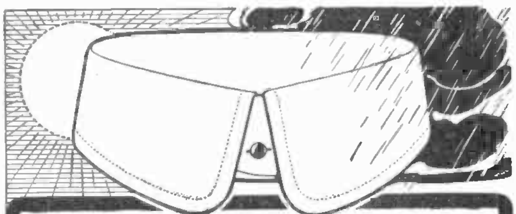

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cannot affect the appearance of a

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