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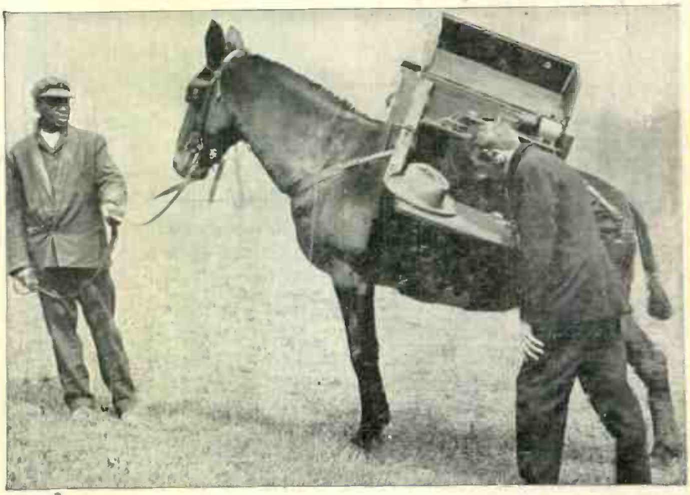

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Vol. II. NOVEMBER 1909 No. 7

POPULAR ELECTRICITY

IN PLAIN ENGLISH

HENRY WALTER YOUNG, Editor

Vol. II — NOVEMBER, 1909 — No. 7

CONTENTS

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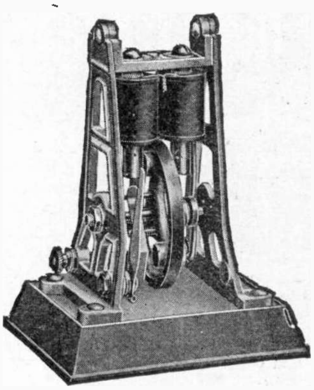

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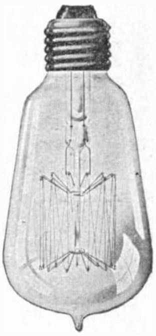

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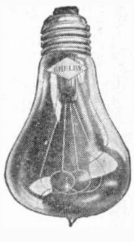

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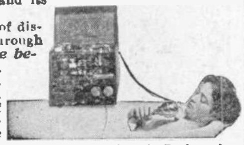

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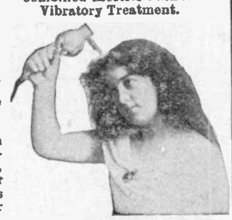

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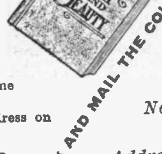

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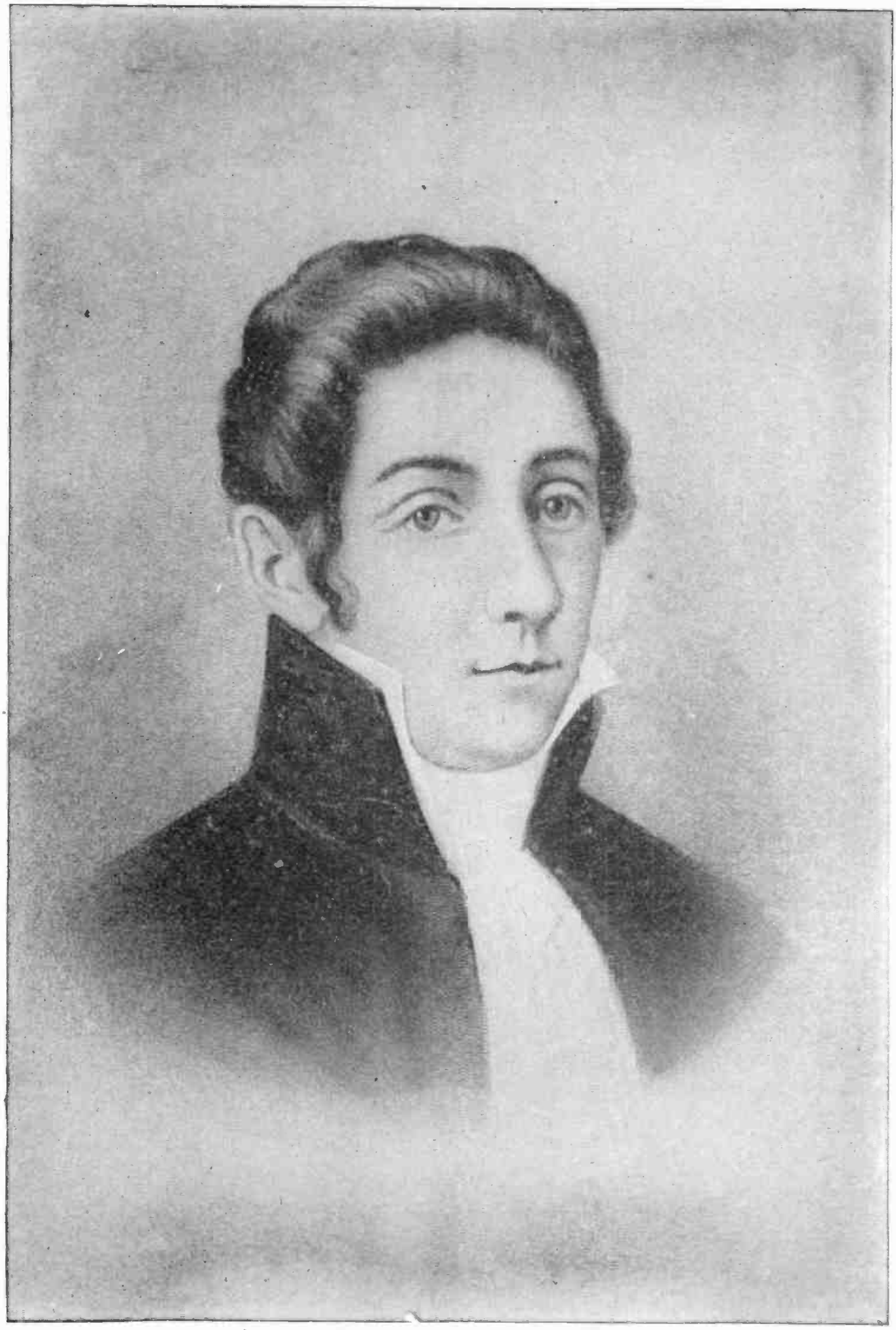


ALEXANDER VOLTA

POPULAR ELECTRICITY
IN PLAIN ENGLISH

VOL. II — NOVEMBER 1909 — No. 7

ALEXANDER VOLTA

The word "volt" is probably the most familiar of all words in electrical phraseology. It means, of course, the unit of electrical pressure or potential. The name volt was given to this unit in honor of Alexander Volta who lived more than a century ago and was one of the early experimenters who began to arouse the interest of the world in electricity and its possibilities.

Volta's early experiments had to do principally with contact electricity, but by far his greatest achievement was the discovery of the production of electric current through the agency of chemical action, leading to the discovery of the voltaic pile. Galvani had made his famous frog leg experiments and noticed the peculiar muscular contractions when the legs of a newly killed frog were brought in contact with iron. He assumed that this was caused by a vital fluid flowing out of the nerves of the frog and through the iron. Volta at first believed this to be true, but subsequent experiments convinced him that the true cause was a new form of electric current, produced by chemical action. He then built up an electric generator known after him as the voltaic pile, which consisted of a series of two sets of dissimilar metals arranged alternately one above the other with a liquid capable of conducting electricity between. The pile or battery so made was capable of producing a constant flow of current.

Results of his experiments then led Volta to classify electric conductors into two groups: (1) Conductors like carbon and metals which receive electric charges by contact; (2) conductors composed of liquids (which we now would term electrolytes). Current is then produced by arranging two different conductors of the first class with a conductor of the second class between them. This was the forerunner of the battery, which, before the invention of the dynamo, was the only means of producing current in any considerable quantities.

Alexander Volta was born in Como, Italy, in 1745. In 1774 he was appointed Professor of Physics in the Gymnasium of Como. In 1779 he was given the chair of physics at Pavia and in 1791 received the Copley Medal of the Royal Society. In 1801 Napoleon called him to Paris to show his experiments on contact electricity and a medal was struck in his honor. In 1815 the Emperor of Austria made him Director of Philosophy of Padua. He died in the year 1827.

Elementary Electricity

By PROF. EDWIN J. HOUSTON, Ph. D. (Princeton)

CHAPTER XIX—THERMO-ELECTRIC CELLS

In the year 1821, an experiment made by Seebeck, of Berlin, resulted in the invention of another electric source, the thermo-electric cell, that produces electricity by differences of temperature. In the frictional electric machine mechanical energy is converted into electric energy; in the voltaic cell, chemical energy is converted into electric energy, while in Seebeck's thermo-electric cell, it is heat energy that is so converted.

Seebeck's experiment was as follows: He bent a copper rod twice at right angles so as to form the three sides of a rectangle, and then as represented in Fig, 126, completed the fourth side by a bar of bismuth soldered at each end to the copper. When he heated one of these junctions, an electric current was produced that flowed in the direction indicated by the arrow, through the copper, from the hot to the cold junction.

In order to show the presence of this current as well as the direction in which it flows, Seebeck placed a magnetic needle inside the rectangle so that its upper and lower sides were parallel with the direction in which the needle came to rest under the influence of the earth's magnetism. This device practically formed a galvanometer by the use of which it was possible not only to tell when the current was flowing, but also the direction of its flow; for, as soon as one junction was heated and a thermo-current flowed through the circuit the needle was moved in a certain direction to an extent that depended on the amount of electricity flowing, and its direction depending on the direction of the current. Seebeck showed that when the junction instead of being heated by a spirit lamp was cooled by a lump of ice, the needle moved in the opposite direction, thus showing that the current was now flowing in the opposite direction.

Extended observations made by Seebeck and others showed that pairs or couples of practically all metals when formed into circuits similar to the above are capable of producing currents of electricity when one junction is heated or cooled more than the other.

In the following table a number of metals are arranged in such an order that the current produced by heating a junction of any two of these metals produces a current that flows from the metal first in the list to the other metal. Such a series in known as a thermo-electric series.

Bismuth	Silver
Platinum	Zinc
Lead	Iron
Tin	Antimony
Copper	

If, for example, bismuth and antimony were employed, on the heating of one of the junctions the current would flow from the bismuth to the antimony.

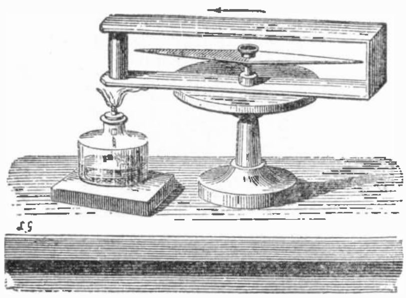


FIG. 126. SEEBECK'S THERMO-ELECTRIC EXPERIMENTS

It can be shown that, generally speaking, the electromotive force produced, and consequently the strength of the current, increases with the difference of temperature.

Electric currents produced by thermo-electric cells were formerly known as thermo-electric currents and the E. M. F.'s so produced as thermo-electromotive forces. These names were employed under the belief that there were different kinds of electricity produced by different electric sources. For example, frictional electric machines, that as we have seen produce powerful electric charges, or electricity at rest, were supposed to produce a peculiar variety of electricity known as static electricity; voltaic cells were supposed to produce what was known as voltaic electricity. It is now known, however, that electricity, no matter how produced, is one and the same; the only differences are in the strength, constancy and direction of the E. M. F.'s, that cause the electricity to flow, or in the steadiness with which the electricity flows; as well as to whether it continues to flow in the same direction or is constantly changing its direction. The terms thermo-electricity, static electricity, and voltaic electricity, however, are still employed, though only as a convenience for indicating the nature of the electric source by which they were produced.

A pair of metals so joined as to be capable of producing electricity when their junctions are unequally heated, is called a thermo-couple, and the combination itself is called a thermo-electric cell.

By the electric power of a metal is meant the E. M. F. it is capable of producing when employed as a thermo-couple with lead, for a difference of temperature of 1° C. These E. M. F.'s, are so small that their values are generally given in microvolts, or millionths of a volt. The following table of thermo-electric powers is taken from Sylvanus P. Thompson. The metals from bismuth to iron are positive and from antimony to selenium negative.

+ Bismuth	89 to 97
+ Nickel	22
+ German silver	11.75
+ Lead	0
+ Platinum	− 0.9
+ Copper	− 1.36
+ Zinc	− 2.3
+ Iron	− 17.5
− Antimony	− 22.6 to − 26.4
− Tellurium	502
− Selenium	800

The E. M. F. produced by a single copper-iron couple, when the junction is raised 1° C. above the other junctions, is − 16.14 microvolts. This, as will be seen, is obtained by subtracting − 1.36 from − 17.5.

It can be shown that it is not only couples formed of different metals that are capable of producing thermo-electric currents, but that the same kind of metal, when in different physical conditions, is capable of forming a voltaic couple. Sturgeon obtained electric currents from a thermo-electric couple of hammered iron and annealed iron. Becquerel has shown that if a piece of platinum wire coiled at one part of its length, as shown in Fig. 127, when heated near the coil by a spirit lamp produces a current that can be detected by a delicate galvanometer.

When subjected at its junctions to a difference of temperature of the freezing and boiling point of water, a bismuth-

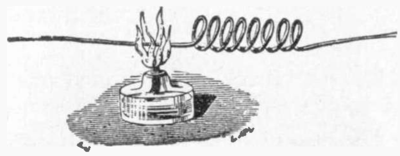


FIG. 127. CURRENT WITH ONE METAL

antimony couple produces an E. M. F. of 0.0115 volts. Consequently, in order to produce currents suitable for ordinary use it is necessary to connect a number of thermo-couples in series. Such a connection forms what is known as a thermo-electric battery.

As in the case of any electric source, such, for example, as the thermo-cell, in order to connect a number of such cells in series, the positive pole of one couple must be connected with the negative pole

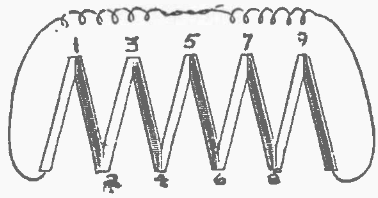


FIG. 128. THERMO-ELECTRIC COUPLES

of the next couple, the positive pole of the couple with the negative pole of the next couple, and so on throughout the series. This is only another way of saying that in a series connected battery of thermo-couples, the alternate junctions must be alternately heated and cooled. In order that this may be readily done the alternate bars of antimony and bismuth that form the successive couples are placed as shown in Fig. 128, where the light and shaded bars represent respectively bars of bismuth and antimony so placed that the successive junctions come at the bottom and the top, forming the junctions at (1), (2), (3), (4), (5), (6), (7), (8) and (9), as shown.

An inspection of this figure will show that all the odd junctions (1), (3), (5), (7) and (9) come at one end of the thermo-pile and all the even junctions, (2), (4), (6) and (8), at the other end. If, therefore, either end is heated or cooled to a different extent from the other, it will be the odd or the even junctions that are so affected, and thermo-electric currents will be generated.

Since in a thermo-electric battery a great number of couples must be connected in series, in order to be able to pack these couples in a small space, the successive couples are placed parallel to one another as shown in Fig. 129, where a series of five couples is seen. In this series the bismuth (−) of one series is soldered to the antimony (+) of another series, and so on for four vertical series placed on top of one another as shown in Fig. 130. In this arrangement, the couples separated from one another by strips of paper covered with varnish are then placed in a copper frame (P) Two binding screws (m) and (n), connected respectively to the antimony of the first pile and the bismuth of the last pile, constitute the positive and the negative poles respectively. This arrangement, as will be seen, brings all the even junctions at one end or face of the thermo-pile, and all the odd junctions at the other end or face.

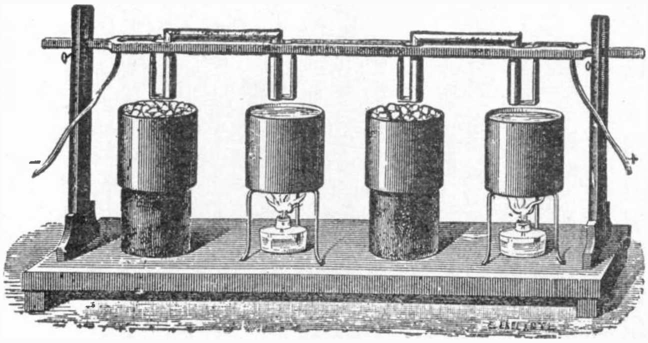


FIG. 129. THERMO-ELECTRIC BATTERY

Nobilli has employed Melloni's thermo-pile in connection with a galvanometer for the measurement of small differences of temperatures. This combination is shown in Fig, 42, where the terminals of a Nobilli pile are connected with a galvanometer by the wires as shown.

As we have already seen, the odd and the even junctions of the pile are exposed at its opposite faces. If, therefore, one of these faces be exposed to a source of heat, and the other face covered by a brass plate so as to protect it from the heat, as shown in the figure, the needle of the galvanometer will be deflected. Since the amount of the deflection depends on the strength of current produced and this in its turn on the difference of temperature between the odd and the even junctions, it is evident that the heat produced by different sources at different differences can be readily measured.

Moreover, since the direction in which the needle of the galvanometer moves determines the direction of the current it is possible, by exposing both faces of the pile to different sources of heat, so that one source heats the even junctions, and the other source the uneven junctions, to determine which of the two sources is hotter even when a very small difference of temperature exists between them; for, if the sources are equally hot, the failure of the needle of the galvanometer to move shows that neither junction has been heated above the other. The slightest movement in any direction shows that their temperatures are unequal, and by observing the direction of the motion it is easy to tell which source has the higher temperature.

Melloni, Tyndall, and other investigators, have successfully employed a thermo-pile and galvanometer for studying the phenomena of radiant heat. Far more sensitive methods, however, have recently been employed for measuring small differences of temperature.

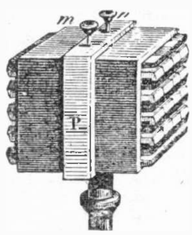


FIG. 130. THERMO-PILE

In 1881, Langley invented an instrument called a bolometer that was far more sensitive for the measurement of small differences of temperature than the device of Melloni. The bolometer consisted of two strips of platinum wire that were made the two sides of Wheatstone's electric bridge or balance. As long as these wires are equally heated, the arms of the balance remain in equilibrium, and no movement occurs in the needle of the galvanometer connected with them. As soon, however, as either arm is exposed to a source of radiation, the other arm being protected against it, a change occurs in the electric resistance of the strip that throws the bridge or balance out of equilibrium, thus permitting the needle of the galvanometer to be deflected. In this way it is possible to measure very small differences of temperature. Langley in speaking of his bolometer, says:

"With the instrument I am now using, a change of temperature of about 0.00001° C. in the strips is detected, a change of .0001 of a degree being noted instantly. As these strips are extremely minute, this implies a power of recognizing amounts of radiant heat smaller than those for which the thermopile is commonly employed. How small it is difficult to comprehend clearly, but it may be stated, in illustration both of the feebleness of radiant energy in some parts of the diffraction spectrum, and of the delicacy of the instrument, that the heat in certain ultra-violet rays can be detected by it in rather less than ten seconds, though the same radiation is so weak that falling uninterruptedly for over 1,000 years on a kilogramme of ice at 0° C., it would not wholly melt it."

A device has also been produced called the radio-micrometer, in which a wire is suspended by means of a delicate quartz fibre between the poles of a powerful magnet. The circuit of this wire is closed at its lower end by an antimony-bismuth couple. An exceedingly small increase of temperature in this coil, a difference less than one millionth of a degree Centigrade, produces a thermo-electric current that causes a depreciable deflection of the coil. This apparatus renders it possible to detect the heat emitted by a candle flame at a distance of two miles.

The thermo-electric pile of Melloni is only capable of producing very small electric currents. Many efforts have been made to construct thermo-piles of sufficient strength to produce currents powerful enough to permit this source to take the place of voltaic batteries or even dynamo-electric machines. So far, however, these efforts have been unsuccessful, for, although such thermo batteries are capable of producing fairly large currents when first constructed, yet they soon fail owing probably to physical changes in the character of the junctions possibly due to their continued expansions and contractions.

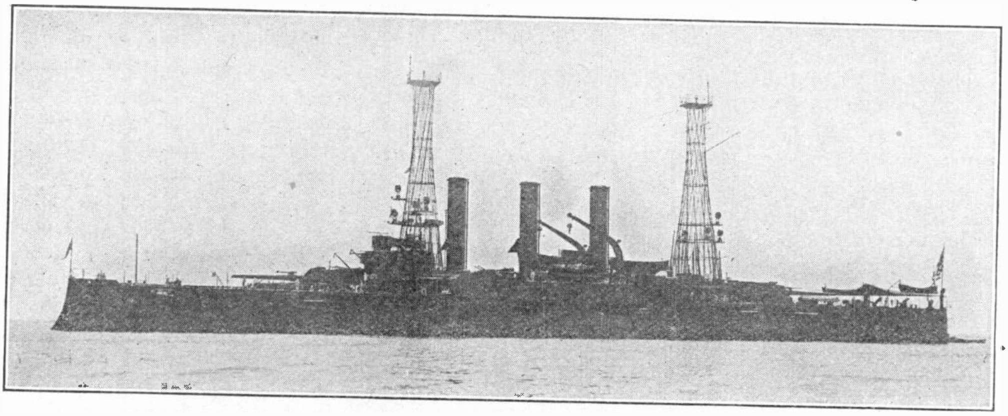
One of the largest of these early forms of thermo-piles was devised by Edmond Becquerel. Its couples consisted of native sulphide of copper and German silver. This battery which contained 50 couples in two series of 25, was capable of furnishing a current that when first set up could be employed successfully in the operation of the telegraph at considerable distances.

A curious fact, the converse of that described by Seebeck, is known as the Peltier effect, from Peltier, who first observed it in the year 1834. When an electric current is passed across the junctions of a thermo-electric couple, heat or cold are produced according to the direction in which the current passes. If, for example, electric current is passed across a junction of bismuth and antimony, from the bismuth to the antimony, heat is absorbed, so that the junction is cooled. If, however, the current is passed in the opposite direction, or from the antimony to the bismuth, the junction is heated. This phenomenon is known as the Peltier effect in order to distinguish it from the effects produced in a circuit owing to the resistance it offers and known as the Joule effect. If should be observed that the Peltier effect is reversible, since the current produces heat when passed in one direction, and cold when passed in the opposite direction. In the Joule effect, however, heat is produced no matter in what direction the current passes. Moreover, in the Peltier effect the heat produced is proportional to the current strength, while in the Joule effect the heat produced is proportional to the square of the current strength.

(To be Continued.)

Electricity on Our Reconstructed Battleships

Following their return from the memorable cruise around the world the battleships of the record breaking American fleet were sent to the various navy yards on the Atlantic Coast for the most extensive reconstruction worthy of unqualified endorsement. It is this new invention, distinctly an American conception and unique among the ships of the world, that has lately been installed on our battleships. Some of the ships have



U. S. S. LOUISIANA FITTED WITH NEW MASTS

in the history of the United States Navy. This program of alteration and improvement which is now practically completed and which involved the expenditure in the aggregate of hundreds of thousands of dollars, resulted not only in the radical reconstruction in many respects of our first class batteships but also involved a complete transformation in the appearance of these floating fortresses. Among the most important features of this modernizing of our heavy weight sea fighters has been the notable extension of the electrical activities on shipboard. This, it may be added, is but in accord with the fixed general policy of the U. S. Navy. Every year sees added dependence upon the magic current for the performance of all imaginable forms of service aboard Uncle Sam's fighting craft.

The factor most largely responsible for the altered appearance of the transformed battleships lies in the introduction of the new style mast or fire control tower. This innovation has been introduced primarily to safeguard the electrical utilities in time of battle. It has been realized for some time that the tapering steel tubes, commonly known as the military masts of our battleships in their old guise were by no means ideal for the functions they had to perform, but it was only after months of experiment and tests that there was devised a substitute each been provided with two of the new masts, whereas others, owing to the limited time available for the repair work, have taken their places in the battleship fleet with only one new tower apiece, the second tower to be supplied in the case of each vessel as soon as opportunity offers.

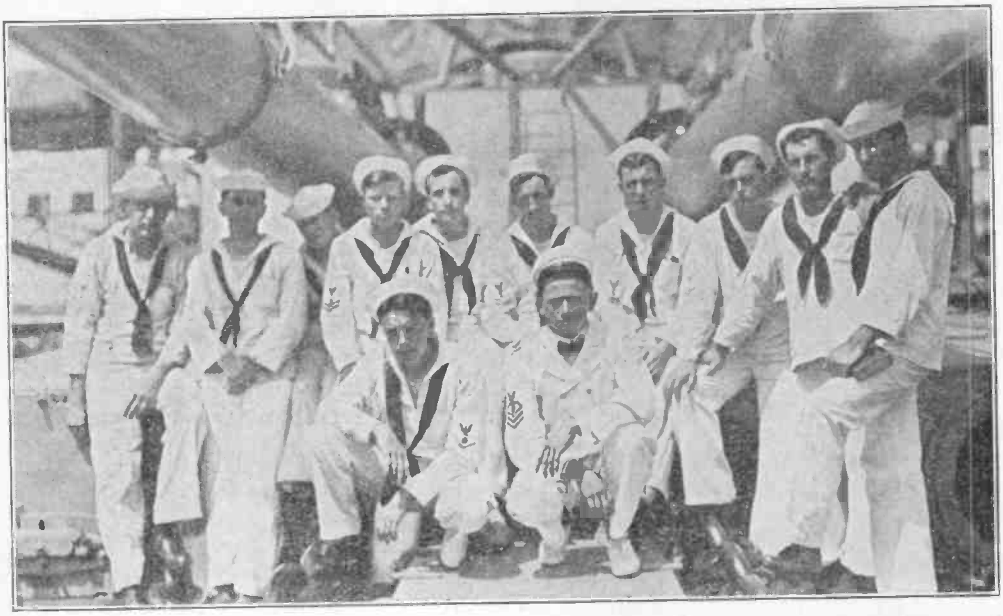
The new style mast which has been not inappropriately dubbed the "peach basket" is in most marked contrast to its predecessor. The old form of mast, for all that it was of steel, was, save for the gun and searchlight platforms, very suggestive in outline of the traditional masts of the old time sailing ships. The new substitute, on the other hand requires a considerable stretch of the imagination to be construed as a mast, at all. Rather it is a tower as per the official designation—an observatory tower wherein are located many of the mos important electrical nerves of the warship.

The secret of the displacement of the old-style mast by this unconventional Twentieth Century creation rests in the comparative immunity of the latter from destruction by gunfire. This was demonstrated some time ago by an intensely practical test in the course of which full service charges from thirteen inch guns at comparatively close range were fired at a steel tower of the new type which had been erected on one of the monitors. It was demonstrated by this and other tests that, in time of battle an enemy could shoot away fully 75 per cent of the steel latticework comprising one of these cylindrical towers without seriously impairing the electrical arteries within the skeleton structure.

It is difficult to overestimate the importance of this vehicle for safeguarding the interior communicative system of a battleship. The protection that the new style tower affords is quite as essential as is the latter day practice of protecting by heavier armor the vitals of the ship in the form of her engines and boilers. In these days of long-range fighting it is imperative to have lofty, well-nigh indestructible, observation stations for range-finding and fire control. The new style tower supplies this need and incidently it affords superior positions for the powerful searchlights which now play so conspicuous a part in naval warfare.

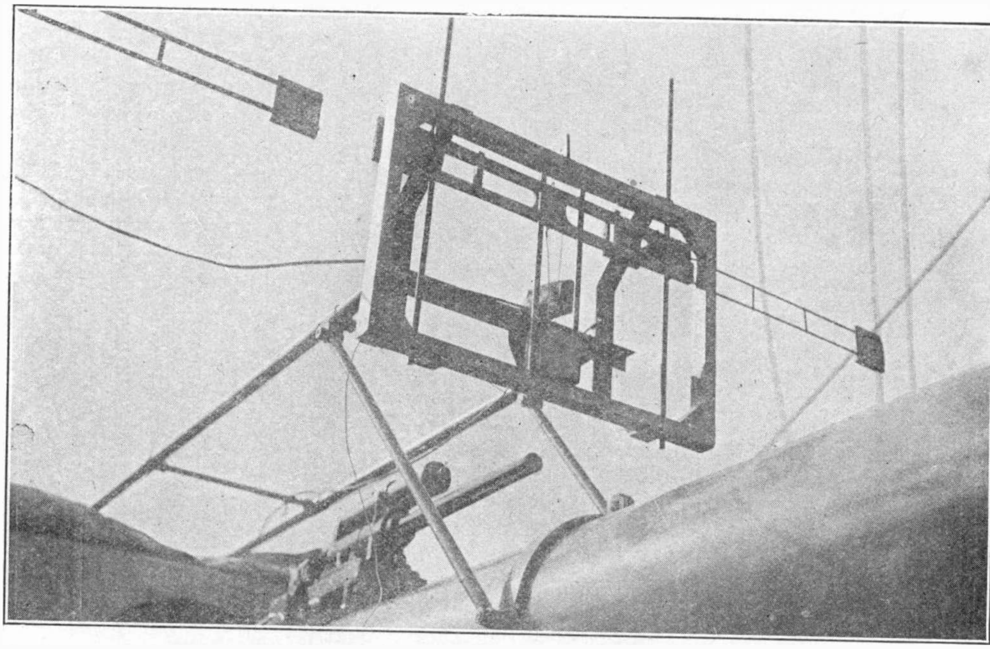
Finally the new invention, which will still stand though riddled with shot, is worth its cost merely as insurance for the wireless telegrapy system of a battlethip. Wireless communication has become very much of a necessity in the sea service and no battleship captain would like to risk having his wireless telegraph system put out of commission by a single shell from an enemy's rifle as might be the case were the aerial supported by one of the old style masts.

The recent revision of the electrical features of our battleships included improvement of the electrical turret turning machinery and elaboration in other spheres but, in the main, this means merely an extension of activities in fields where electrical energy had already been in use. Indeed, for several years past, the uses of electricity in the Navy have been so many and diversified that it would be difficult to discover openings for progress. It is significant that in almost no branch of naval work where electricity has once been introduced has it been abandoned for economic or other reasons. Perhaps the sole exception is furnished by electric launches which were introduced as tenders for the battleships but were abandoned because they were found to be too heavy.



TYPICAL GROUP OF ELECTRICIANS ON THE FIRST CLASS BATTLESHIP MINNESOTA

To measure the present advance of electricity in the United States Navy it is but necessary to cite that in 1871 the electrical energy supplied to a ship was limited to one or two small series dynamos, the armature of which was revolved by a hand crank and the output of which did not exceed 100 or 150 watts, an amount of energy that is nowdays required for two or three 16 candle power lamps. The Iowa, one of the first battleships built for Uncle Sam's steel navy (and no longer in commission) was a marvel in her day because she had an electrical output of 96,000 watts or about 125 horsepower. Then came the cruiser Brooklyn in the year 1896 with electrical plant of 150,000 watts. Just after the Spanish-American war the battleship Kearsarge was added to our navy with 350,000 watts of electrical energy and latterly has come the U. S. S. Connecticut—flagship of our present great battleship fleet—with a total of 400,000 watts at 33 per cent overload.

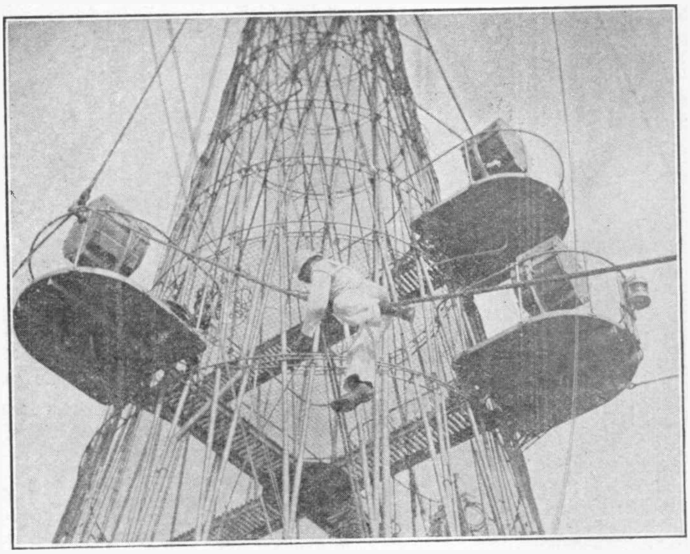


ELECTRICALLY OPERATED SIGHTING APPARATUS FITTED TO A 13-INCH GUN

The tremendous expansion has been due largely to the rapidly increasing demands for electrical drive, which latter consumes fully four-fifths of the total power allotted in the generators of a warship. Indeed, the efficiency and economy of electric drive as compared with all other systems, and its flexible adaptability to power use in general have caused the adoption of electricity as the actuating agent for practically all power purposes on warships outside of the engine and fire rooms and their immediate connections. In these compartments steam drive is still in general use but there is no telling how soon such monopoly will be ended.

The authorities at the U. S. Navy Department were, only a few weeks ago, brought by rather startling means to a realization of the trend of modern development upon the occasion of the opening of the competitive bids for the construction of the new 26,000-ton battleships Arkansas and Wyoming, the heaviest and most powerful battleships yet planned for the U. S. Navy. Among the proposals submitted was a unique one from the Fore River Ship Building Company of Quincy, Mass.,—a suggestion which carries all the more significance from the fact that the directing genius of the Fore River plant, Mr. Francis Bowles, was for years the Chief Constructor of the United States Navy and has always been regarded as one of the most progressive of naval experts. The suggestion that came from his firm in the case of the new battleships was to set aside the engineering specifications prepared by the Navy Department and to allow the substitution of a scheme of power generating provided by a combination of reciprocating engines and generators and electric motors. While this daring innovation was not adopted it has set naval experts to thinking and some naval engineers have already declared themselves as frankly in favor of it.

When one takes into consideration the limitations and exigencies of warship operation is it easy to understand the popularity of electric leads (easily maintained and repaired) over long lines of steam piping with their objectionable heat; hydraulic apparatus with its annoying leaks; and pneumatic machines with their inconvenient bulk and

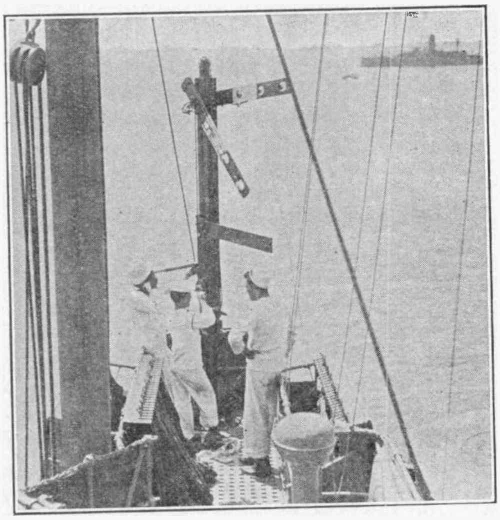


ELECTRICAL WORK ALOFT UNDER THE NEW CONDITIONS

weight. There is yet another factor that might not suggest itself to the average reader. In time of battle the men on board a warship are divided into groups, as, for instance, the gun crews, and each squad is in effect imprisoned in a closed, armor-clad compartment. With steam or the other enumerated forces employed, an accident that involved the cutting of a pipe line would have an injurious and distracting effect upon the men in the compartment or compartments affected, whereas with electricity there is, even in case of accident, no danger of panic. There has been a gradual extension of the use of electricity for operating warship auxiliaries until now only the steering engine and the capstan or windlass remain in the class of steam driven machines, though even in this sphere electrical means of handling the valves are sometimes employed.

One of our latest modern battleships as, for instance, the Connecticut, has a bewildering number and variety of direct current motors. There are motors of from 15 to 35 horse power each for turning the turrets—the steel cheese-boxes in which the big guns are enclosed; motors of from five to eight horse power each for elevating the guns; motors of from three to 10 horse power for gun ramming; and motors of from three to 55 horse power each for hoisting and conveying the ammunition for the huge rifles. Then there is a 50 horse power motor for lifting out of the water and depositing on the deck of the battleship, the power launches that act as tenders of the warship. There are likewise motors for operating doors and hatches and deck winches, to say nothing of the motors for the wireless telegraph, telephone, and for interior communication.

For ventilating purposes there are on ship-board no less than 106 motors, ranging in power all the way from one-twelfth of one horse power to 12 horse power each. In the workshop on board there are self-contained motors of from one-fourth to seven horse power for operating machine tools. There are two 80-horse power motors for operating the torpedo air compressers and four motors of two or three horse power each for operating fresh water and sanitary pumps. There is a motor in the laundry and in the galleys or kitchens are several motors for operating the dough mixers, dish washers, meat choppers and potato peelers. Indeed the preparation of the food for 900 officers and men on a battleship is done largely by electrical power.



SEMAPHORE SIGNALING ON A BATTLESHIP

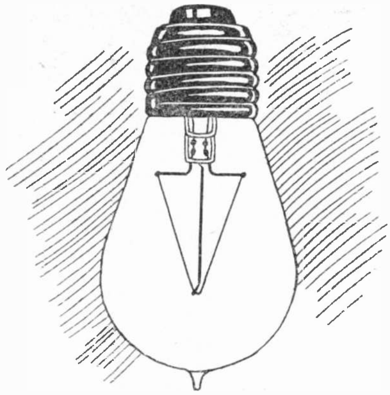
Electric lighting is universal in the navy. In addition to the regular 16 and 32 candle power lamps there are employed such novelties as a 150 candlepower diving lamp and a six candlepower torpedo lamp. This torpedo lamp is mounted on the end of a rod for examining the interior of automobile torpedos and is made long and narrow so that it can be inserted in the small orifices in the side of the torpedo. The 16 candlepower lamp is the working lamp for general lighting throughout a battleship, the 32 candlepower lamp being used for signals, running lights, truck lights, etc., and in the dimly lighted magazines and shell rooms where the ammunition is stored deep in the bowels of the ship.

A type of five candlepower instrument lamp is employed for illuminating the indications of "lamp indicating instruments" such as the helm angle indicator, helm telegraph, engine telegraph, etc., and for lighting binnacles and the mechanical telegraphs that flash orders simultaneously to all parts of the big ship. A number of searchlights have place on every battleship. The sizes most in use, rated by diameter of mirror, are 13-inch, 18-inch, 24-inch and 30-inch. Two 36-inch searchlights have been in use and one 60-inch has been installed on one of the ships.

Night signaling is one of the most important spheres in which use is made of electricity in our navy. The object of this class of apparatus is to rapidly and accurately transmit from one station on shipboard to another distant station, by means of lights, a pre-arranged code of signals when darkness prevents other means of visual signaling. The system is most frequently employed in signaling from one vessel to another; for squadron or fleet maneuvers; and for communication between warships and co-operating military commands on shore. The signalling is done by means of double lanterns, the upper half of which is red, and the lower half, white. The connections for individual signals are made by means of a keyboard which has thirty lamp indications and 56 interpretations. The blinker light is a device used as an auxiliary means of signalling by wigwag code, employing a flashing light for the purpose. Then on the bridge of the battleship is a two-arm semaphore. The two arms are used as shape signals in the daytime but they are also fitted with three lamps each for night use. The arms are operated independently by means of cranks and sprockets and at the top is a fixed red light which serves as a mark for fixing the attention of observers when awaiting signals. The light is screened for all directions save that in which the signal is to be sent.

Tungsten Sign Lamp

Tungsten lamps for electric signs are expected to offer great opportunities for the display of artistic taste and the designers' skill. The light is much whiter and more brilliant than that of the carbon filament lamp and a more striking and attractive effect may be obtained.



TUNGSTEN SIGN LAMP

The tungsten sign lamps have V shaped filaments, as shown in the sketch, which are strong and durable, being well anchored and supported. They are made in the five watt size giving four candlepower, and are used on 10 to 12 volts. Their life is about 2000 hours.

There are two ways of using these 10 volt lamps on ordinary 110 volt lighting circuits; either by connecting a number of them (10 to 12) across the circuit in series, or else by using special transformers or compensators as they are called, which are made for the purpose.

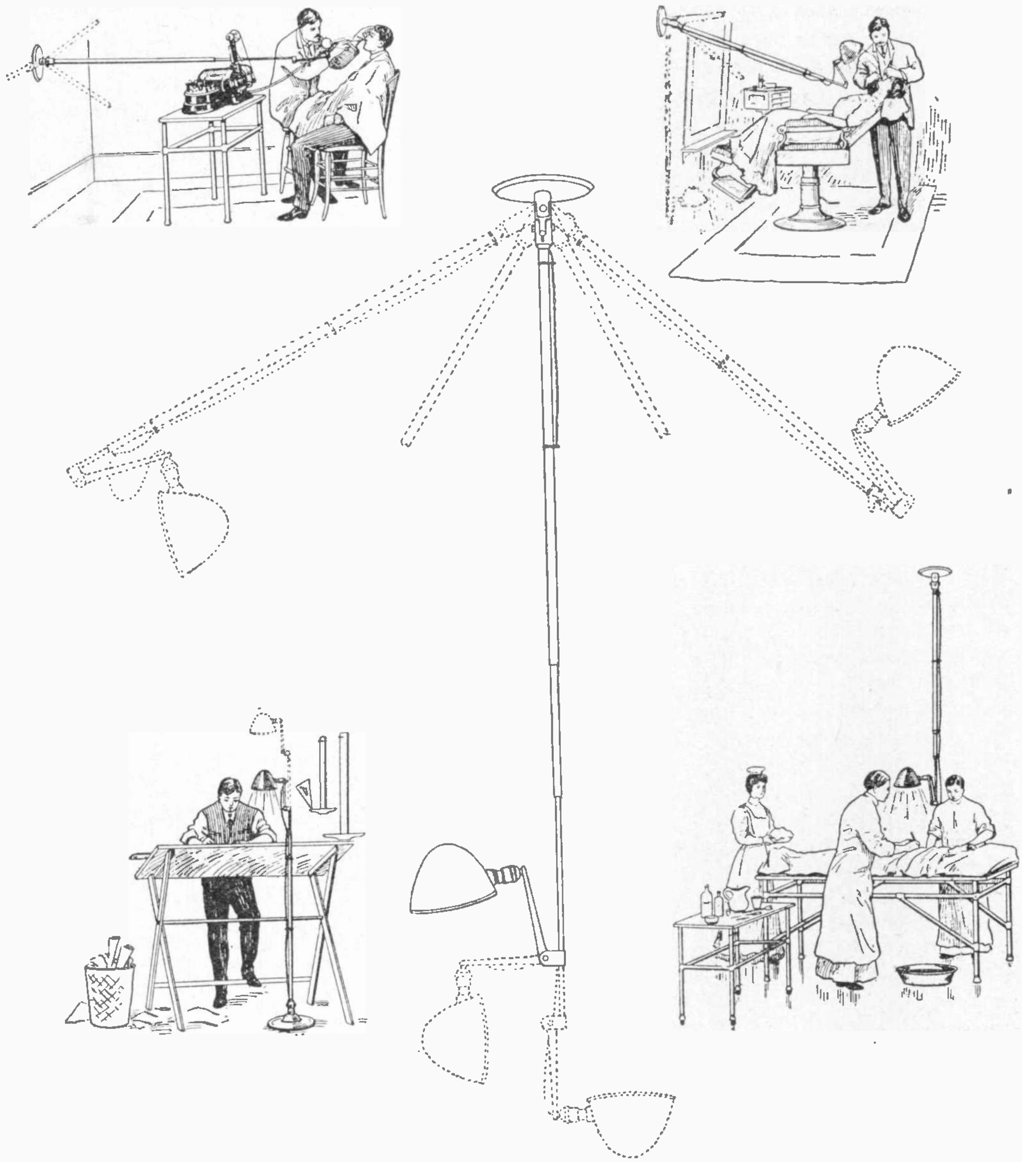
Nitrogen Fertilizers from the Air

Several representatives from European concerns interested in the manufacture of nitrogenous fertilizer from the air are in this country looking for options on good water power for hydro-electric development in connection with the fertilizing industry.

Convenient Bracket Light

A bracket electric light fixture particularly adaptable to the use of surgeons, dentists, draftsmen, etc., is shown in the sketches. This bracket is so designed that it may be fastened to either wall or ceiling at any convenient point desired, and being provided with a universal joint near its base, it can be swung or moved to any angle. The construction of the joint is such that a perfect spiral may be described with the end of the bracket, starting with a circle not more than two inches in diameter and, when the bracket is fully extended, ending with a circle twelve feet in diameter. There is sufficient friction in this joint so that the bracket will remain in any position in which it is placed.

The bracket may be telescoped until it extends outward not more than three feet, or may be extended to a distance of almost nine feet. In addition to this the terminal



CONVENIENT BRACKET LIGHT FIXTURE

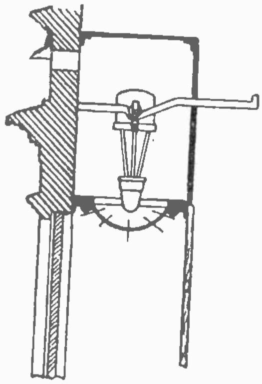
arm which holds the lamp proper is hinged and swiveled so that it is independently adjustable to any desired position. By means of a special device the bracket is made to retain its rigidity even when extended to its greatest length, and although the sections telescope smoothly one within the other, provision is made so that all lost motion is automatically taken up.

Show Window Lighted With Flaming Arcs

Merchants realize more and more the strong attractive power which plentiful illumination in their store windows exerts. Flaming arc lamps are among the most attractive illuminants that can be used; they are the kind you so often see in front of theaters, etc., giving the intensely brilliant yellow or orange colored light.

Hitherto it has not been possible to use these lamps in the store windows for two reasons; one being the fact that the peculiar light would not show the color values of the fabrics in their true relation, the other being that the flaming arcs are more apt to drop sparks than the ordinary arcs and the Board of Fire Underwriters would not sanction their use for window lighting.

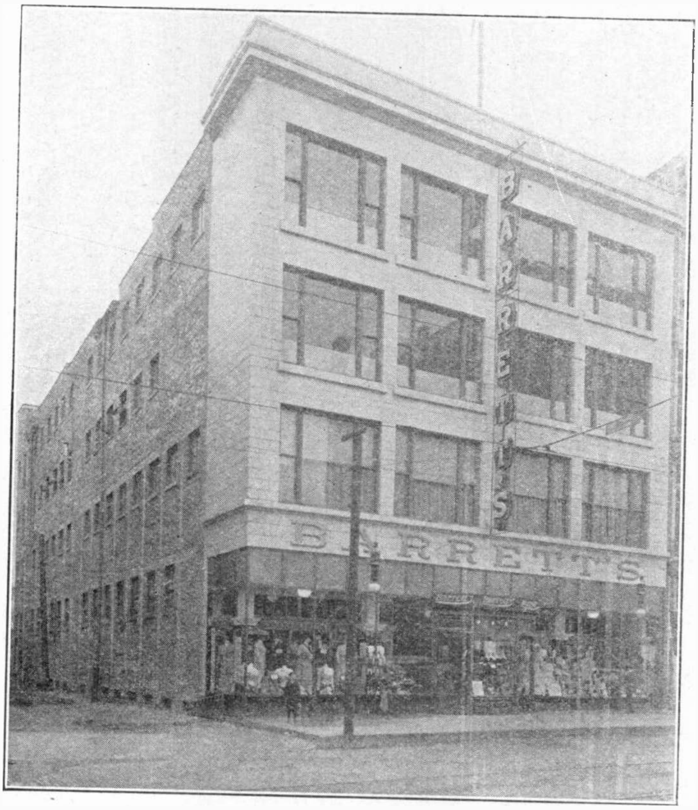
These objections have, however, been overcome by a new type of flaming arc and a new method of installation. The new lamp is known as the "Trucolor" and gives 2500 candle power of true white light, showing the fabrics in their true color values and enabling the colors to be distinguished almost as readily as in the daytime.



MOUNTING OF FLAMING ARC IN SHOW WINDOW

The method of installation employed, and which has been approved by the Underwriters, is shown in the sketch. The lamp is in a compartment shut off from the lower part of the window containing the inflammable fabrics. Immediately below the lamp in the ceiling of the window is a Holophane glass hemisphere which throws a beautifully diffused light in every part of the window and at the same time prevents any sparks from falling upon the goods displayed.

In the halftone illustration is seen one of Milwaukee's newest stores, which uses this system. On the poles in front are two Aurola flaming arcs, giving the characteristic flaming arc color. These attract the attention of the people from a considerable distance. In the window itself are visible the Holophane hemispheres of the Trucolor lamps installed as described above.



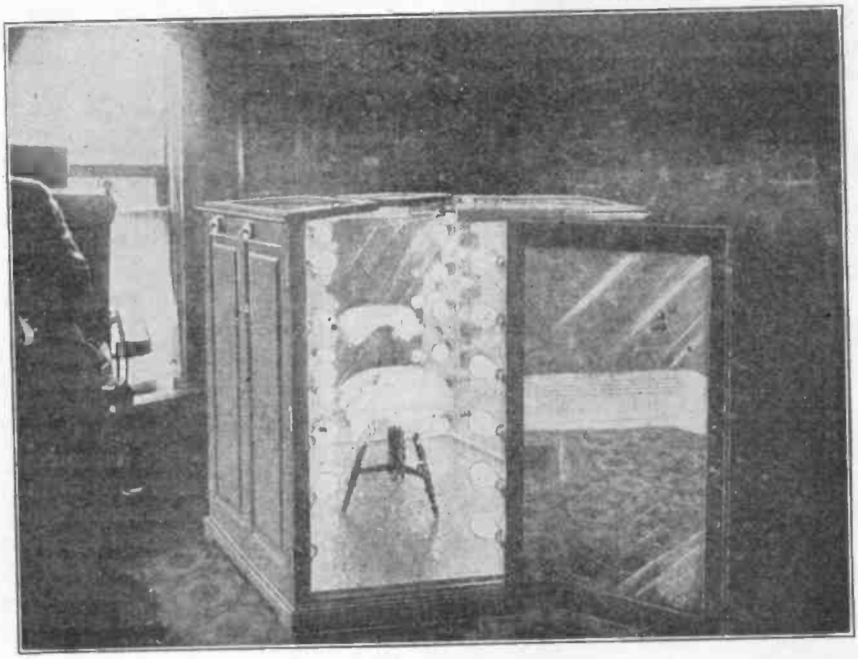
SHOW WINDOW LIGHTED WITH FLAMING ARCS

Light Therapeutics

Physicians today look upon light and also static electricity as auxiliary agents helpful in many cases, in conjunction with certain well defined methods of treatment, in bringing about the desired end. About a decade ago, or perhaps a little more, static electric machines were just coming into use and we also began to hear a great deal about light baths and light cures. There was at first a general rush to adopt these methods and many physicians were inclined to over estimate their value and look upon them more or less as cure-alls. A reaction then took place and the static machine and light bath got a severe bump. They have now, however, found their place in legitimate practice as efficient aids in many cases and as such they are used.

Light therapeutics, especially, is rapidly making a place in medical practice. When using light as a unity the nearer it approaches the quality of solar light, the better the results. When decomposed the different rays of the spectrum differing as they do as to wave length and rate of vibration, produce widely varying effects on animal organisms, thus the ultra violet rays have perhaps ten times the bacteriacidal power of the red, yellow and green rays, although there is indisputable evidence that these latter rays are by no means devoid of germicidal power.

It is Prof. Finsen's theory that the curative value of light was greatest at the ultra violet end of the spectrum, although he did not ignore the undoubted beneficial effect of the remaining rays in certain indications, and the Finsen apparatus for light treatment was and is designed with a view of producing light with the greatest possible number of ultra violet rays and the elimination largely of the remainder of the spectrum, and there is no question but that lamp outfits of the Finsen type possess greater germicidal power than those of any other pattern. The usefulness, however, of the ultra violet rays is greatly restricted because of their lack of penetrating power; a thin layer of blood will absorb a very large percentage of these rays and, but a comparatively small per cent will penetrate the tissues to any great depth.

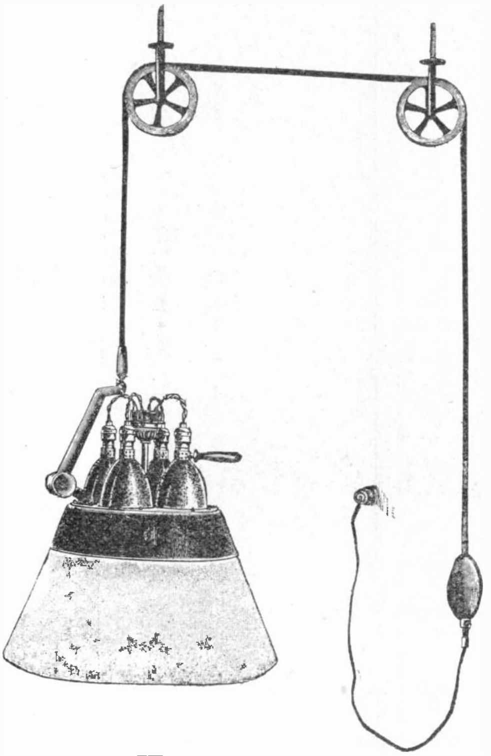


ELECTRIC LIGHT BATH

although it has been shown that a few of these rays will filter through to the underlying tissues, and modern technique has devised means for increasing their penetration by forcing the blood out of the intervening tissues by pressure and other means.

It is now claimed that other portions of the spectrum possess an equal, if not greater amount of curative value than the ultra violet. Physiological processes are rapid in light red, slightly slower in green, and considerably slower in violet. Experiment has shown that the same patient will feel perfectly comfortable in the red or orange light; not so well in the green, and a general faintness, and desire for sleep, in the violet.

Prof. Schlager in Vienna endeavored to quiet maniacs by exposing them to blue light, and in some instances the desired effect was



THERAPEUTIC LAMP

obtained by removing them to a room which had windows of blue glass, when all other measures to quiet them had failed.

As opposed to the lack of penetrating power of the ultra violet the blue rays possess the power of penetrability to a marked degree, red and ultra red to a still greater degree. It is the red rays that carry with them the greatest portion of the heat so useful in treating the deep parts of the organism.

To sum up; violet and ultra violet rays are bacteriacidal, antiseptic; blue rays and the central portion of the spectrum, tonic, sedative, penetrative; red and ultra red, stimulative, slightly irritant, deeply penetrative, and thermal.

Moist heat tends rather to promote suppuration while heat administered in light treatments aborts pus formation and suppuration, and it is owing to this fact that concentrated light and heat seems to be the ideal treatment for all suppurative diseases.

In order that all of the therapeutic properties of light may become available when the light is used as a unity it is absolutely essential first, that the light be produced in great volume, that it be of the proper quality and concentrated as greatly as the tolerance of the patient will permit. This is accomplished by various devices such as electric bath cabinets and portable incandescent lamps provided with reflectors.

American Telephones in Pekin

An American telephone system, with American instruments, switchboards, cable and appliances, is soon to serve the city of Pekin. The Chinese Empire, though absolutely lacking in any such improvement up to today, has at last awakened to the need of a modern system of communication.

The order amounts to about $150,000, and covers a complete telephone plant of the most modern type, including several hundred thousand feet of lead covered aerial and underground cable. The contract called for complete delivery at Tien-Tsin by February 2, 1910, allowing only six months from the time the order was received for making and delivering to the Chinese government

New Discoveries of Radium

Valuable deposits of radium-bearing pitchblende are said to have been discovered on the McCloud river in California. Similar discoveries are also reported in the Cripple Creek district in Colorado. Pitchblende is a rock, tons and tons of which must be ground up, treated chemically, washed, precipitated and filtered, over and over again to obtain a few grains of the precious radium-bearing salts.

Some Interesting Experimental Apparatus

When alternating current is flowing in a wire it will induce in another wire brought near it a current of like character even though the two wires do not touch. This is the principle of the ordinary transformer. By employing the principle in various ways many interesting experiments may be performed, which are very mystifying to the

FIG. 1. LAMP COIL

uninitiated, since there is no physical connection between the apparatus and the inducing current. Some simple devices for performing experiments with induced current are shown below.

Fig. 1 is known as a lamp coil. This is a well insulated coil which may be immersed in water, with inside terminals for attaching

FIG. 2. HAND COIL

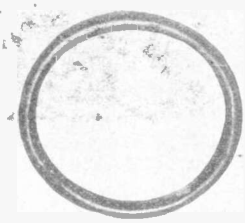


FIG. 3. COPPER RING

a lamp socket. The coil is proportioned so that its specific gravity is slightly greater than that of water, when the lamp is inserted, consequently the coil will sink to the bottom when immersed in water. When placed over an alternating current magnet pole the induced current in the coil will illuminate the lamp under water and the magnetic repulsion of the current in the coil will also raise the lamp and coil in the water and balance them at a certain distance above the magnet pole where the magnetic repulsion is exactly equal to the addition of weight of the lamp and coil over the water they displace.

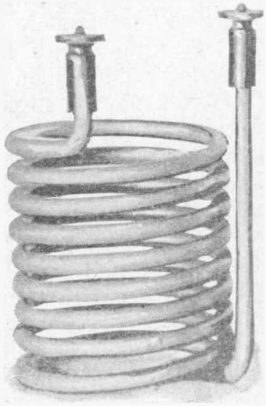


FIG. 4. ALUMINUM SPIRAL

It is also useful for showing the presence of the magnetic field around an alternating current magnet pole—its direction, shape and density.

A "hand coil" is shown in Fig. 2, and consists of a coil wound with very fine wire

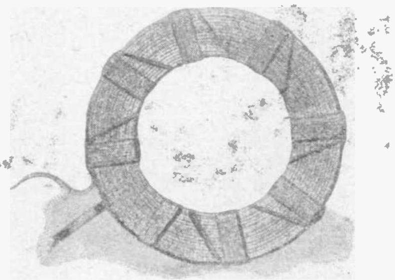


FIG. 5. FLAT COPPER SPIRAL

used for illustrating or explaining the magnetic field. With it a sufficiently high potential is obtained to give a strong shocking sensation if held in the uncovered hand and brought into the alternating magnetic field.

Fig. 3 is a solid copper ring five inches in diameter. This may be used for illustrating electromagnetic repulsion of an alternating current field. When held in an alternating field it will heat rapidly, although its sectional diameter is ½ inch. By spreading steel filings on a plate glass, placing them on alternating magnetic pole and using this copper ring, several instructive experiments can be illustrated.

The aluminum spiral shown in Fig. 4 is made of ⅜ inch aluminum rod with terminals for attaching a low potential lamp or piece of wire. When brought into a strong alternating current field the lamp can be lighted or the wire melted in what seems to be a very mysterious manner.

A spiral coil wound with flat, cotton-insulated copper wire or ribbon is shown in Fig. 5. This coil may be suspended from balance arm to illustrate electromagnetic attraction and repulsion. The ends are connected together and suspended from the balance arm over the magnet. While the coil is in this position pass the current through the magnet. This will cause the coil to be repelled. When the current is stopped it will be strongly attracted, and if ordinary alternating current is used in the primary coils, the spiral coil will be repelled.

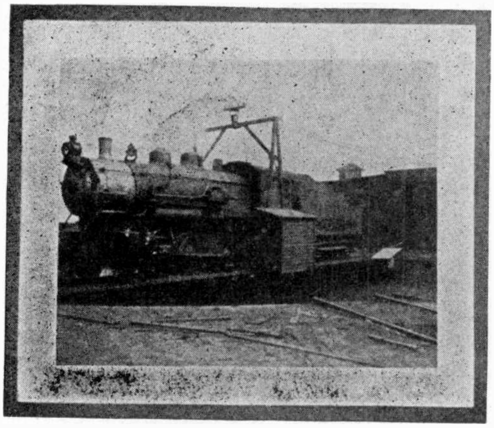
An Example of Economy

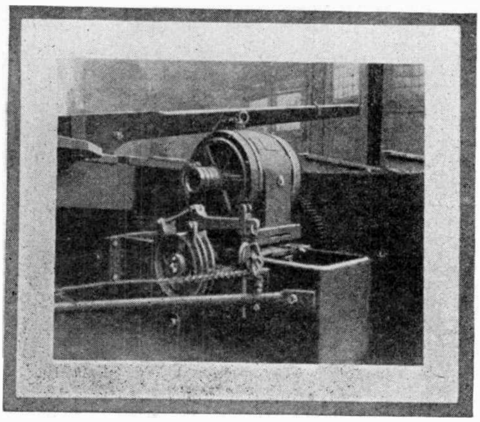
A striking example of the economy that can be effected by substituting electric power for hand labor is shown by the application of a 20 horse power alternating current motor to a turntable on one of the railroads in New York State. This turntable had previously been turned by men employed regularly at other duties, but called on every time a locomotive was to be turned. These two squads of men, by pushing on the handle, could accomplish the purpose but slowly, and hence their time at their regular work was of necessity materially shortened. In fact the average time lost by the men amounted to at least the continuous service of two men for twenty-four hours a day. But with the motor no men were needed to push, and only one attendant to operate the motor. Hence the decrease in cost for labor amounted to the sum paid for one man's service for 24 hours a day, or two on shifts of twelve hours, or three on eight hours. These men were paid 15 cents an hour or $3.60 a day or $1314 per year of 365 days. The cost for electrical power was but $96.00 in the year and there was no repair or maintenance cost. Hence the net saving was $1218 a year.

The total cost of installing the electrical equipment including wiring, construction of donkey, cost of motor, etc., was in round numbers $1500, so that the saving almost paid for the equipment in the first year, or looked on as an investment it was paying practically 80 percent dividends.

The saving in time effected by the use of the motor is perhaps more important than the actual cash economy, since the motor-operated turntable can handle several times as many locomotives in a given time. This is of great importance in relieving congestion of traffic near the turntable especially at terminals where many locomotives often come in at the same time. It is difficult to reduce rapid movement of equipment and freedom from delay in the movement of traffic to cash value, but the importance of the maintenance of the schedule is so great that railroad officials are warranted in heavy expenses for equipment that helps to this end. The motor may be applied and the current transmitted to it in several different ways, but the method very frequently used is shown in the illustrations.

S. ADAMS.





ELECTRICALLY OPERATED TURN TABLE AND EQUIPMENT

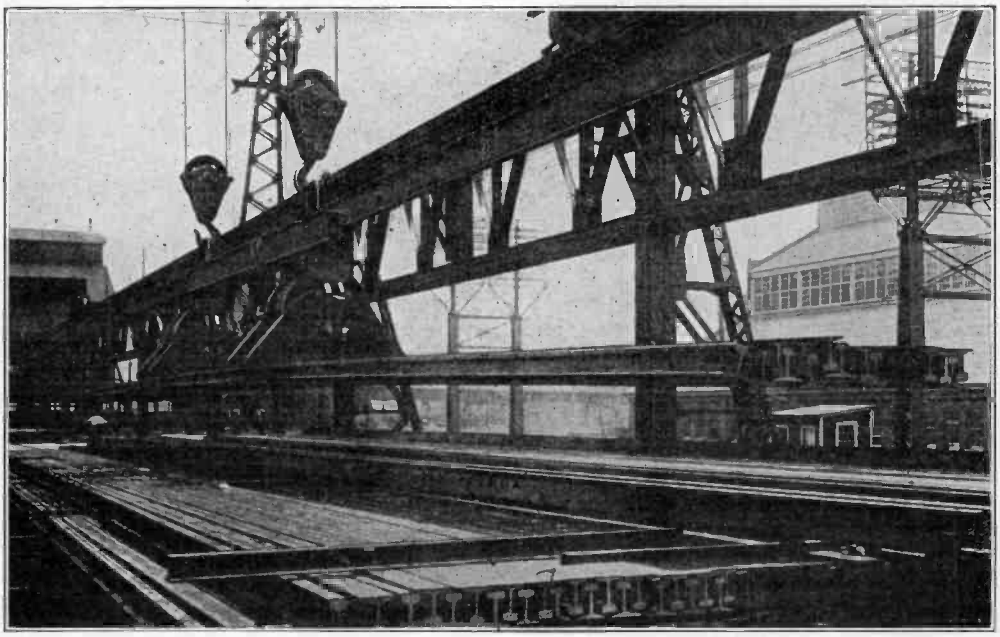
Magnets for Lifting Steel Rails

In the great steel plant at Gary, Ind., one of the most remarkable applications of electricity is presented by the massive lifting magnets, which, working in pairs, lift 10 tons of steel rails at a load and deposit them, all snugly arranged, on the waiting flat car.

The magnets which accomplish this task are known as electromagnets. They are built somewhat on the principle of huge horse shoe magnets but do not depend for their lifting power upon permanent magnetism, as in the case of the latter. They are wound in the middle with great coils of insulated wire, in the same manner that the fields of a dynamo are wound, and their lifting strength, when current is passed through the coils, then increases in direct proportion to the number of turns of wire in the coils and the strength of the current passing therein.

The pole pieces of the magnets are perfectly straight along the bottom and wide enough to rest across several rails at a time as shown in the picture. The magnets are lowered by powerful cranes until they rest on the rails, then the current is turned into the coils and the rails are gripped with an almost irresistible force and are picked up bodily and laid on the car. Then the current is switched off and the magnets let go their hold and are ready for another load.

In this way 3000 tons of rails can be loaded by a single pair of magnets in 20 hours. The rails, moreover, are not bent in the process of handling and loss on this score is eliminated.



ELECTROMAGNET LIFTING STEEL RAILS

Methods of Reviving Dry Cells

The term "dry cell" as applied to the small batteries which are so widely used for various purposes is a misnomer, since these batteries are really not dry inside but contain liquid absorbed in sawdust, plaster of paris, gelatine, etc. The liquid is generally a solution of sal ammoniac and water. The zinc and carbon elements of the cell are in contact with this "paste," and should the latter become dried out, as is pretty sure to be the case with cells several months old, they lose their efficiency and frequently become practically useless although they may never have been called upon to furnish current.

Once a battery has been dried out in this way it is never possible to make it as good as new or cause it to develop its full voltage for any considerable length of time.

but there are ways in which it may be revived to a certain extent and made better than none at all. Some of the readers of Popular Electricity have sent in descriptions of methods they have used in reviving cells, which are given below and which will answer the inquiries of many who have asked for information on this subject.

Method 1.—Remove the cover from the cell and scrape the outer surface of the zinc fairly clean. Next take a nail and punch quarter inch holes about three-quarters of an inch apart all over the surface. This completes the zinc and carbon elements of the cell. Next procure a quart wine bottle and remove the neck so as to leave a jar about six inches in height. The easiest way to do this is to take a piece of cotton string dampened with kerosene and tie it around the bottle at the proper place, light it, and after it has burned out, plunge the bottle neck downwards into a bucket of cold water.

Set the cell in the center of the jar and fill the remaining space with common salt to within one inch of the top, and pour in water until the salt is thoroughly wet, leaving a little to cover the surface so as to make up for evaporation. Let the cell stand for a few hours until the brine has had time to soak in through the holes in the zinc. Then it will we ready for use.

The above makes a very good cell for any kind of open circuit work such as working electric bells, etc. It is a very cheap cell to make as old dry cells can be procured for a very small sum of money at automobile shops.

Method 2.—Take a 60-penny spike and make about 25 or 30 holes through the zinc cover of the cell. These holes should start near the bottom and extend about one-half or two-thirds of the way up. Get a glass jar that is about an inch larger in diameter than the cell and put half an inch of coarse sawdust in the bottom. Now set the cell in the jar, leaving an equal space all around. Fill the space between the cell and jar with coarse sawdust and pour on a soultion of sal ammoniac to thoroughly soak the sawdust. The cell will then be found to deliver a fairly strong current once more. Be careful not to tamp the sawdust too hard or you will crack the glass jar.

Method 3.—The old pitch plug is broken out of the battery, and the pieces saved to be remelted. Pour out and save the sand or sawdust, which comes next to the pitch. Lift up the crimped paper which comes next, until the contents of the battery are exposed. Then take a large spike nail, and drive holes in the black composition that makes up the battery, sprinkle some powdered sal ammoniac over the holes, and fill them nearly to the top with water. Allow the battery to set until the water has thoroughly soaked into the composition, then pour back the sand. Next remelt the pitch which you saved and pour it back over the top; this thoroughly seals the battery and prevents evaporation. By this method the cells may be renewed until the zinc is eaten away.

Welding Tungsten Lamp Filaments

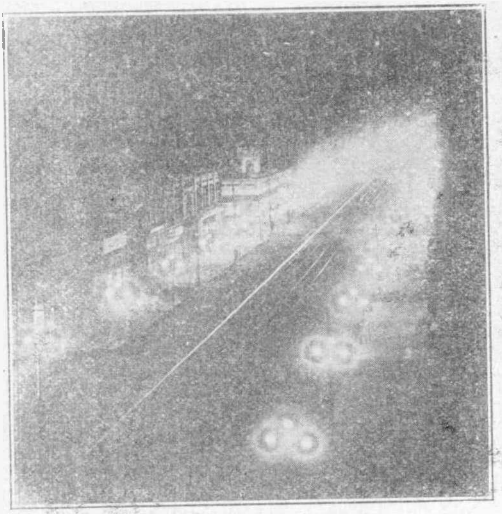
The chief drawback to the tungsten incandescent lamp now so extensively used is its liability to breakage. This is more liable to happen while the filament is cold, for the material from which it is made is more brittle then than while lighted and in a state of incandescence. It frequently happens that a jar or heavy vibration parts the filament at one point, leaving two ends separated from each other by the springiness of the filament though not drawn apart endwise. The break puts the lamp out by opening the circuit through the filament. With the old carbon filament lamp this meant a spoiled lamp, no repair of the break being possible. The ordinary user, basing his act on experience with the old type, when he finds his tungsten lamp similarly broken consigns it to the scrap heap with a sigh and a quick mental calculation to see if what he has saved in his monthly bills has paid for the new lamp he must buy.

Many times this replacement could be saved by repairing the broken lamp if the user would make the attempt. Leaving the lamp in the socket with current turned on gently tap the bulb with one finger to make the broken ends vibrate and wave about, the idea being to make them touch one another. If the lamp is on a drop cord or on a portable stand, turn it at various angles while tapping and a little patience will frequently reward the experimenter with gratifying results, for the instant the broken ends come into contact the current flows and the filament heats to incandescence and a weld is effected. The lamp can then be turned off and on as before and may be considered as a new one although the weld is probably not quite so strong as the rest of the filament.

Care must be taken not to tap the bulb too hard or a second strand may break, and then a weld becomes impossible. Remember the filament you are trying to fix is cold and brittle.

The "Great White Way" of Superior

Tower Avenue is the "Great White Way" of Superior, Wis. Visitors to this enterprising city at the head of the Lakes are immediately impressed with the lighting of this broad thoroughfare, which is at once artistic and fascinating.



TOWER AVENUE IN SUPERIOR

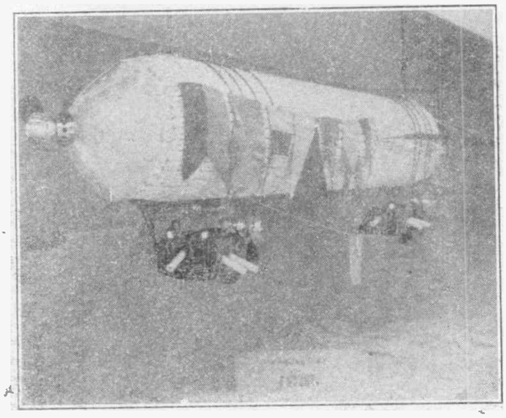
For a half mile on both sides of the street are located ornamental iron posts, 50 feet apart, making 16 to the block. There are three opalescent globes on each post. The top globe contains one 40 watt tungsten incandescent lamp and the two side lamps are of 100 watts each. The wiring is so arranged that the top lamp may be turned off and the side lamps left burning if so desired.

This unique lighting scheme was planned by the publicity committee of the Superior Commercial Club of which F. E. Spring is chairman, with the co-operation of the Superior Water Light and Power Company of which William H. Winslow is the general manager. The property owners of the city paid for the installation which amounted to about $80 per post and the merchants with frontage on the lighted section of the street pay for the current.

Altogether this is one of the most brilliantly lighted thoroughfares to be found in any city and has a marked advertising value.

Attractive Window Display

An attractive window display can be made to draw custom to the electrical supply store. By "attractive," however, is not meant the throwing of a lot of odds and ends into the window; a coil of lamp cord here, a motor there some sockets and plugs in another place—which only too often presents the sum and substance of the supply dealers' array.



ATTRACTIVE WINDOW DISPLAY

There is an electrical supply firm in Minneapolis, which makes a hit with its unique and interesting window displays, and the one shown in the picture is not the first of its ideas which has appeared in these pages. In this particular instance the display represents an air ship, copied from a picture of Count Zepplin's aerial craft. The ship is seen rising from its housing preparatory to its flight across a very realistic appearing lake.

The body of the craft is composed of 600 electrical wiring cleats—the little porcelain clamps which are used to fasten wires to ceilings. The front end consists of a large Holophane shade at the apex of which is an incandescent lamp for a headlight.

Suspended from the body are baskets consisting of outlet boxes used in wiring, and porcelain tubes coming out of the port holes represent guns—for the title of the display is "Fighting Craft of the Future."

Communication Methods on the Taft Tour

By WALDON FAWCETT

One of the most difficult tasks in connection with the carrying out of a Presidential tour and one to the very necessity for which the general public seldom gives a thought is that of maintaining constant interrupted communication between the White House at Washington and the President wherever he may be. It is a comparatively simple matter to keep in touch with the President when he is absent from Washington on a journey of only a day or two. This is particularly true, thanks to wireless telegraphy, when he is aboard a Presidential yacht or other government vessel. Similarly the problem is simplified when the President, though absent from the capital is located at a fixed abode—as, for instance, his summer home at Beverly—to which permanent lines of communication may be established.

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THE TELEGRAPH AND CIPHER BUREAU OF THE EXECUTIVE OFFICES

It is when the President sets out on a prolonged journey, as was the case September 14th when he began his 13,000 mile continental tour, that the "intelligence officers" at the White House are put to their wits end to forge an elastic communicative chain that will always link the "White House on Wheels" and the executive offices overlooking the Potomac. Not merely the distance is to be considered, although that does constitute a handicap when the Chief Magistrate is 3000 miles from home. Much more serious is the circumstance that the President is constantly jumping from place to place at the behest of a whirlwind itinerary and has at no time what could be dignified as a "permanent address." Finally, in the case of tours such as that of this autumn the fact that the Presidential party spends days now and then in isolated localities further complicates the chore of keeping the Presidential finger on the pulse of the nation.

The desirability of having our foremost wandering statesman ever within call of the "home office" in the District of Columbia is apparent to every citizen, but the actual necessity for it can be appreciated only by

FRED W. CARPENTER, SECRETARY TO THE PRESIDENT

those who realize to what an extent Presidential business is transacted through the White House even though the boss be thousands of miles away. When the President is settled at Beverly for the summer many of his correspondents address him there but when he is traveling on limited schedule very few of the letter writers attempt to catch him on the wing. Even those personal friends and political advisers whose communications, by means of a secret code of signals on the envelopes, pass the secretaries and reach Mr. Taft's hands unopened take the White House route at such times.

WENDELL W. MISCHLER, ASST. SECRETARY TO THE PRESIDENT

W. WHEELER, U. S. SECRET SERVICE OFFICER, WHO TRAVELS AHEAD OF THE PRESIDENTIAL "SPECIAL"

They address the White House just as persons who wish to communicate with the officers or men of the Atlantic Fleet address their letters "Care of the Postmaster, New York", even though the fleet be known to be at Provincetown. In other words, the recognized forwarding office constitutes the best, surest and quickest route to the desired destination.

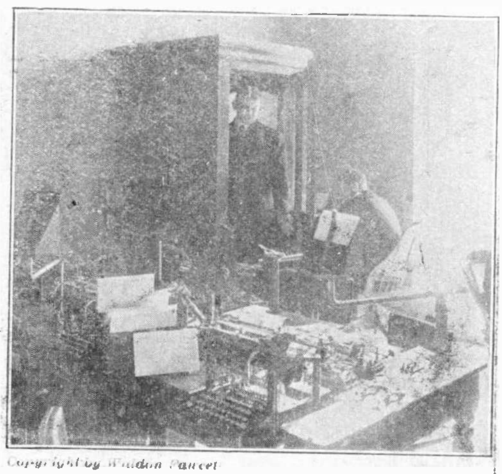
It is because of this vast volume of mail, often numbering a thousand letters a day, which pours into the White House, and by reason of the desirability of having as much of it as possible disposed of at the Executive Offices, that the President leaves at his base of operations his trusted Secretary, Mr. Fred W. Carpenter, and contents himself for the time being with Assistant Secretary Wendell W. Mischler as his immediate aide aboard the train. Mr. Carpenter, who, during more than six years of the closest association with Taft, has developed into as capable an "understudy" as such a chief ever had, is at all times able to answer the vast majority of the letters addressed to the President without so much as bothering the busy Chief Executive with a digest of their contents. When the President is undergoing the tension of a prolonged speech-making tour the Secretary redoubles his efforts to dispose of the greatest possible proportion of all letters received for he knows that the head of the house can ill spare the time for such details enroute.

TYPICAL GOVERNMENT WIRELESS STATION USED ON THE MISSISSIPPI VOYAGE

Of course there are some letters that require a personal reply from the President and cannot well await his return to Washington, and these, together with the commissions to be signed and other government documents requiring the President's autograph, are forwarded once a day to the Presidential train. With the system working smoothly the White House each day dispatches a batch of mail to the Presidential train and receives from the train a bundle of communications including the President's dictated instructions as to various matters, commissions and other papers returned with the Presidential signature, etc.

Regardless of the fact that there is this continuous interchange of mail, the main reliance for keeping the President in almost momentary touch with the White House is placed, of course, upon telegraphic and telephonic means. The responsibility for the maintenance of this electrical bond rests with what is known as the Telegraph and Cipher Bureau of the Executive Mansion—in effect the nerve center of American officialdom. The official in charge of this telephone and telegraph headquarters details one or more of his expert operators to accompany the Presidential train and keep open the communicative system at that end, whereas at the White House the telegraphers, working in "shifts" maintain an ever sensitive receiving station—an institution that is open for business every minute of the twenty-four hours, seven days a week. It is the only institution of the kind under the government that is never closed.

The telegraphic and telephonic experts upon whom so much depends at a time such as this begin their preparations long in advance of the departure of a Presidential party - in fact, just as soon as the itinerary



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TELEGRAPH AND TELEPHONE BUREAU AT THE WHITE HOUSE is completed. The Bureau first makes up its own itinerary with special reference to telegraphic and telephonic conditions in the territory to be visited, and usually a large map is prepared on which every stop of the Presidential party is indicated with its date, hour and duration. By means of this chart, and a thorough system of reports from train dispatchers the exact location of the President's train is always known at the White House and in emergency a message can be placed in the hands of the Chief Executive almost at a moment's notice. For the transaction of the main volume of Presidential business under such conditions efforts are made to handle the accumulated messages at points where the Presidential party tarries for some hours or even days. For the present trip the White House telegraphers arranged in advance to divide the route of the journey into districts in each of which will be available loops direct to Washington.

Something like two dozen telegraph wires enter the White House and it is consequently possible to secure a direct wire to any city at any time, reserving it for Presidential business as long as desired.

The President has a private telegraphic code which he can use while traveling, for the transmission of messages that it is desired shall reach the White House in absolute secrecy. This is seldom resorted to, however. President Taft, unlike his predecessor, is an enthusiast on the convenience of the long-distance telephone and has ever since he entered official life made extensive use of the instantaneous method of communication. Roosevelt, who would not have a telephone on his desk and regarded the invention as in much the same class as the automobile, seldom resorted to the telephone as a means of communication while traveling, but President Taft on the other hand made frequent use of the facilities in his car for talking with Mrs. Taft, or with Secretary Carpenter at the White House. Heretofore the Cabinet officials in Washington have been wont to go to the telephone and telegraph headquarters at the White House whenever they desired to communicate with the President on tour, but if President Taft elects to use the long-distance telephone this may not be necessary inasmuch as the President, if the distance be not too great, can talk from his car to any government department.

The modern Presidential circuit rider depends on the White House to keep him in touch with the news of the world, or rather that portion of it which might influence executive action. The chronicle of all the happenings of the day pours ceaselessly into the telegraphic hopper at the Presidential mansion and any tidings of importance would be promptly communicated to the distinguished absentee. Should any great national disaster occur or death overtake any of the world's rulers during the Presidential tour the Chief Magistrate would probably get his first news of it via the White House, and would be enabled to take promptly any action that might be necessary.

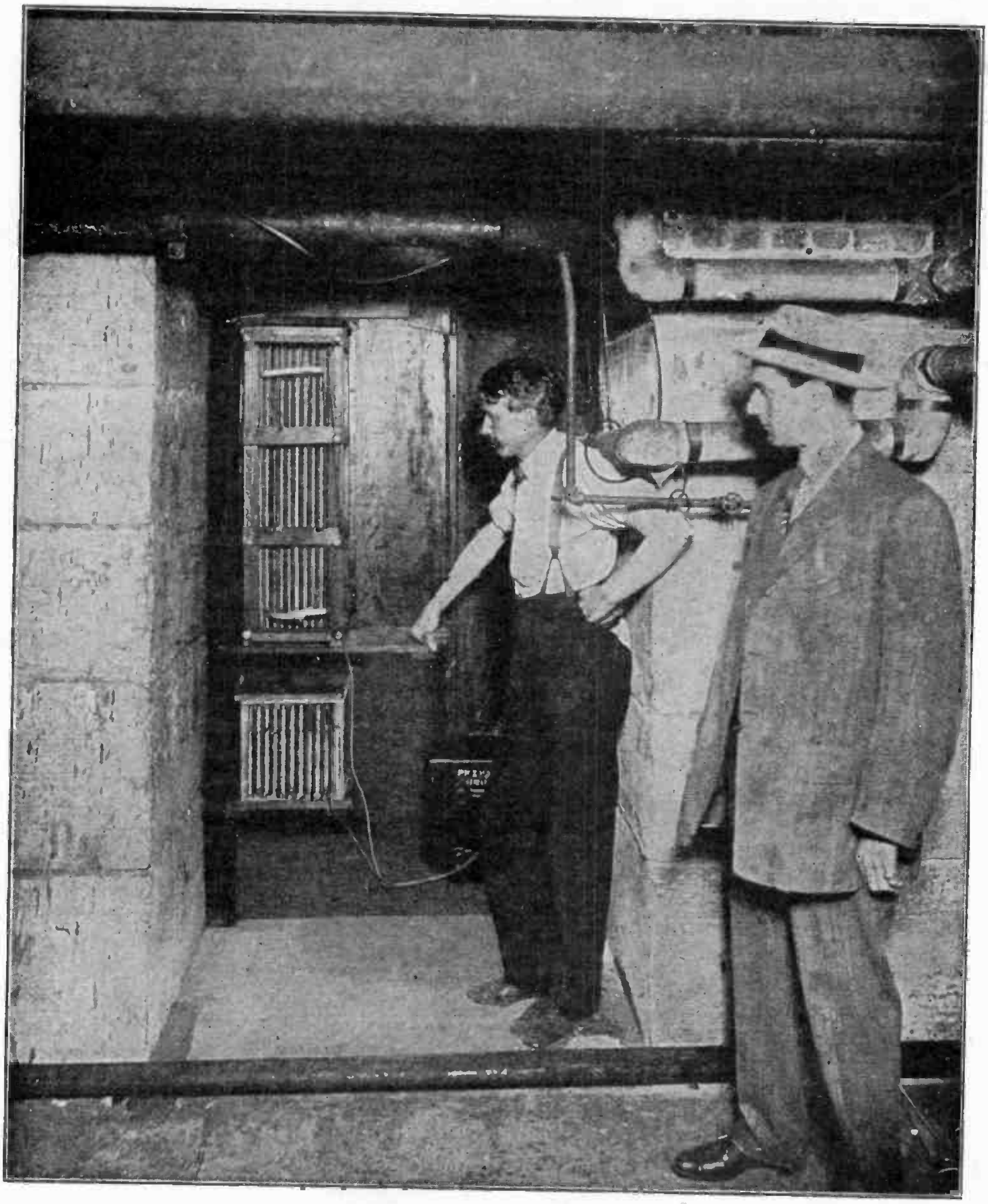
The one contingency that can upset previous calculations for keeping the White House in touch with a touring President and make necessary a readjustment of communicative lines is when unforseen circumstances, such as floods, landslides or wrecks make necessary a sudden change in the route of the Presidential "special". Of course, minor changes of route are liable to be made at any time, for the railroad officials very often amend the itinerary after the President has gone to bed, in order that the sleep of the official so sorely in need of rest may not be broken by the sound of clanging bells and shrieking whistles in towns where a small portion of the inhabitants would be awake to extend a noisy welcome to the distinguished visitor, even though he did not propose to tarry within their gates. Such minor digressions do not disrupt things in the communicative chain but any radical change of route temporarily upsets the force at the White House.

An interesting feature of the perpetual "intelligence service" of the present Taft tour grows out of the fact that 1,165 miles of the 12,759 miles embraced in the total journey represents water travel on the Mississippi River. It is the plan to have the Presidential craft equipped with a wireless telegraphy outfit, and most of the United States naval vessels which will be in the river at that time are similarly equipped, so that there should be no difficulty or delay in transmitting Presidential aerograms to shore stations and thence to the White House. Some of the progressive men in charge of the arrangements for the voyage down the Father of Waters have also suggested that a wireless telephone system be installed so that the President may be enabled to communicate en route with the vessels escorting the Presidential craft.

Ozone Generator in Chicago Public Library

A test of importance in the adapting of electric ozone generators to ventilating systems of large buildings is being made in the Chicago Public Library. This demonstration is unique in so far that it is said to be the first actual ozone apparatus installed in a large air duct, used wholly to convey fresh air to various rooms in a large building.

In selecting the Chicago Public Library building for this test, it was necessary to fulfill the requirement that 10,000 cubic feet of air per minute be ozonized complete, so as to be detected in the most remote part



of each room having leaders to it from the main air duct.

The foul air in the Chicago Public Library main reading room has been the source of much adverse comment and discussion for years, and only last March, Dr. W. A. Evans, health commissioner of Chicago, in addressing a large audience in the lecture room, stated that the air in the library building was entirely unfit for use.

Results which have been accomplished by the new system are as follows:

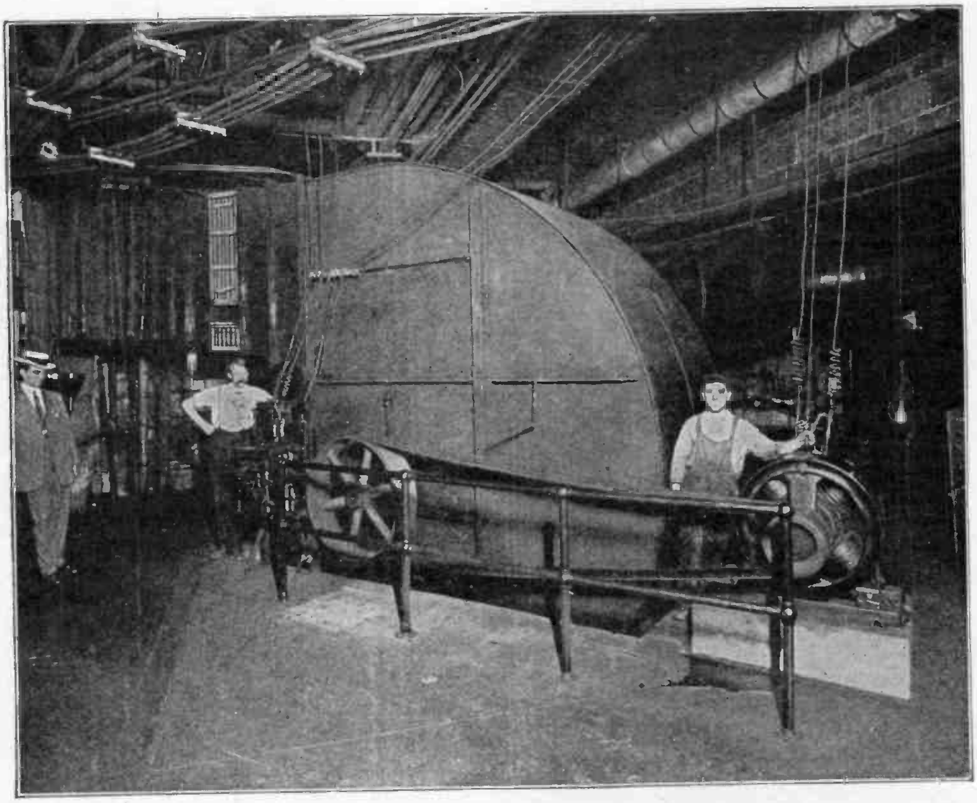
Complete deodorizing of the main reading room, freeing from the air odors which have for years so thoroughly permeated all papers, books, furnishings, etc., in this large room.

The injecting of absolutely fresh sterilized air into the room at all times and reducing the humidity in the various rooms during hot and oppressive days of last summer.

The disinfecting of all books, periodicals, etc., on shelves, racks and tables, which are of easy access to the public at all times.

The perfect comfort at all times that is experienced when occasion requires a visit to the large reading room and other rooms which were formerly almost unendurable most of the time on account of the lack of fresh air.

The air ducts of the ventilating system being so complex in the library building, there was afforded at first only the north portion of the building for demonstration.



The ozone generator, called the National, was installed in the large air duct in the basement measuring six by nine feet and is the largest unit built for this purpose, consuming about 6.5 amperes of current per hour with a discharge of more than 15,000 cubic feet per hour. It is neatly encased and inserted in the opening of the duct to permit the suction of air to pass through it, thereby becoming completely charged with ozone. By placing the ozone generator between the fan and spray of water used in washing the air greater efficiency was obtained than in placing it in front of the spray and thereby losing a large percentage of ozone which the water would naturally take up.

In describing the generator briefly, it is the result of the work of Mr. S. C. Shaffner and Mr. S. T. Hutton, electrical engineers of Chicago, who combined their ideas and developed ozone generators to their high state of efficiency. From a feed wire of 110 volts, a connection is made to a step-up transformer which discharges the current at about 7,000 volts, which feeds into the series of electrodes, which are in the form of ordinary hair brushes. A static electrical charge is thus maintained, playing against series of glass plates and forming ozone, which is a form of oxygen (O_3). The ozone so formed has a purity of 97.1 per cent.

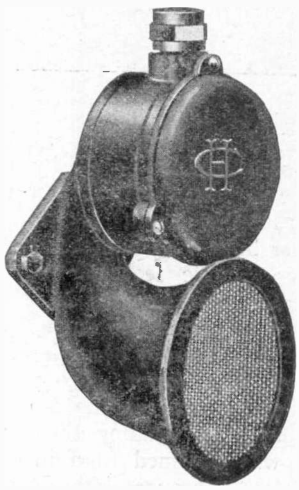
When the filtering electrodes become dirty or clogged, they are easily rubbed together and cleaned as one would clean two hair brushes. When placed back in position they are as good as new and will generate their full capacity.

The up-keep amounts to nothing, practically, and the consumption of current required for a certain volume capacity of ozone, as made by different sizes of the machine, is as follows:

25 cubic feet per hour	25 watts
250 " " " "	65 "
500 " " " "	75 "
1000 " " " "	140 "
10000 " " " "	660 "

Electric Horn

Metallic sounds in factories and other noisy places will often absorb the sound of electric bells for signal purposes and make them ineffective. In such instances an electric horn may be used to advantage. This horn, which is shown in the picture is operated by a vibrator which in turn acts upon a diaphragm in such a manner as to make it give out a peculiar sound readily heard and unmistakable amid the noise. The action of the electric vibrator is somewhat analogous to induction coil mechanism.



ELECTRIC HORN

The horn measures eight inches from the top to the lower part of the bell-shaped mouth, which is 4⅛ inches, outside diameter. It is water proof and is made for current of any voltage from 40 to 250, direct or alternating.

An Object Lesson

The days of the old fashioned machine shop, crowded and darkened by hundreds of leather belts from overhead line shafting, are numbered. Not only are most new shops provided with motor driven machine tools but owners are also rapidly finding out that it is possible to change over from belt driven to motor driven machines and save enough in operating expense to more than counterbalance the cost of installation.

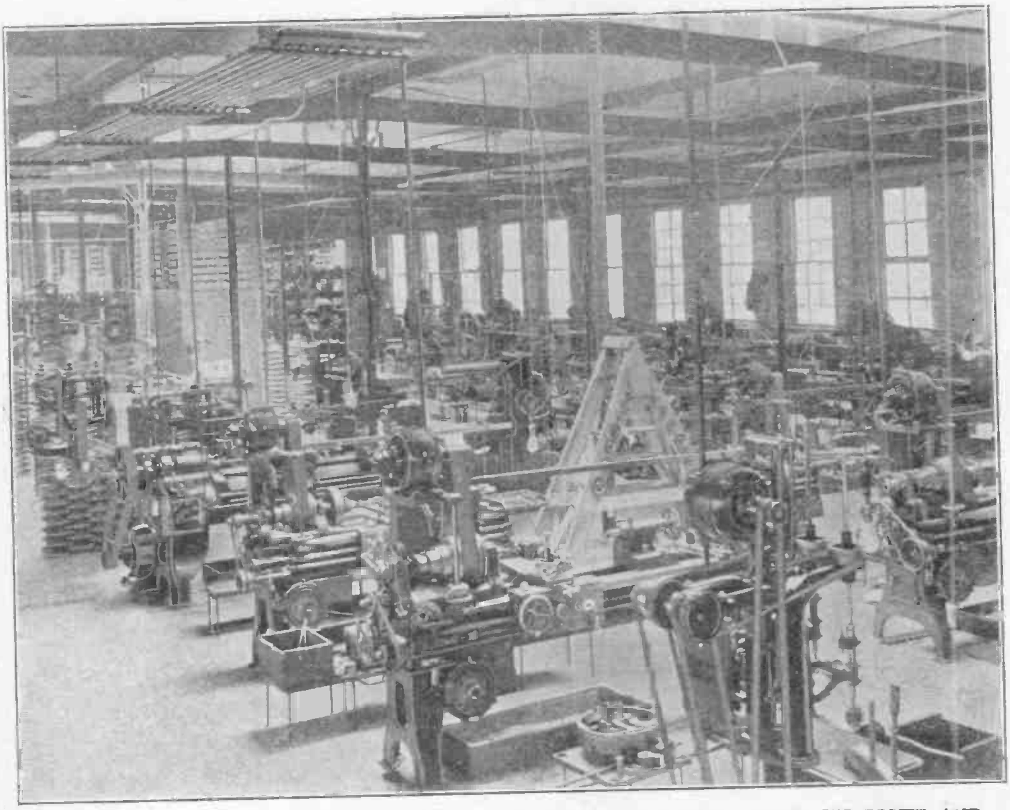
Two views are here presented showing a machine room in an old factory, where the method of drive is by belts and shafting, and a similar room in a new factory built by the same company where motor drive is employed. A glance is sufficient to show the advantages derived. In the first place it is much lighter and more airy in the new shop, and the conditions under which the men work are immeasurably better, tending toward greater efficiency and accuracy in turning out the product.

Safety to workmen is another element. With a myriad of whirling belts and the resulting confusion there is greater liability of accident.

Moreover, in a belt-driven shop the line shafts must be kept going all of the time, perhaps on occasions only operating a few machines. This is a useless waste of power. With motor driven machines power is only consumed during the operation of a machine or group of machines. When they are not in use a simple movement cuts off the electric power and waste is avoided.

It is an important fact that in the above example identically the same machines are used in the new plant that were employed in the old plant, as it was found to be a simple matter to equip them with motors and secure just as good speed regulation as could be had by belt drive.

TYPICAL MACHINE SHOP BEFORE THE INSTALLATION OF ELECTRIC DRIVE



MACHINE SHOP AFTER THE INSTALLATION OF ELECTRIC DRIVE. NOTE ITS LIGHT AND AIRY APPEARANCE

Unusual Applications of Electric Heat

Most of us are familiar with the usual applications of electricity to heating purposes such as flat irons, cooking utensils, soldering irons, etc., but we are not all aware of the

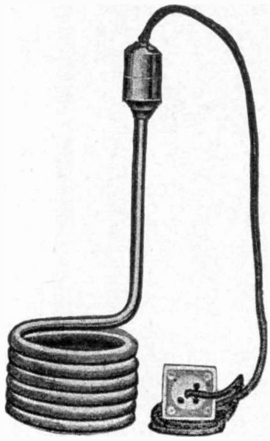


FIG. 1. IMMERSION HEATER

extent to which electricity may be applied in heating operations in various industries with which we do not come into daily contact. The object of this article is to illustrate and describe a few of these unique applications. It might be well also to explain

FIG. 2. SOLDER POT

that in these utensils heat is produced from the electric current by passing the latter through resistances of fine wire within the utensil. This wire is heated to a high temperature by the passage of the current.

In Fig. 1 is shown a queer device called an immersion heater. It consists of $\frac{3}{8}$-inch tubing bent in the form of a spiral inside of which is the heating element above described. The wires from the lighting circuit pass into the top of the tube and connect with the heating element. When current is turned on the whole spiral is heated to a high temperature and may then be set down into a pail of water to heat the contents. Current must not be left on when the spiral is not immersed in water.

FIG. 3. GLUE POT

The solder pot shown in Fig. 2 is designed and adapted for melting comparatively small quantities of solder, lead, babbitt metal, and similar metals. The smaller sizes are intended for use on the bench, for tinning,

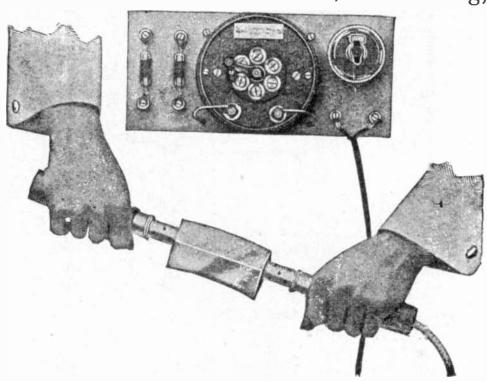


FIG. 4. LEATHER WORKING TOOL AND SWITCHBOARD

dipping, soldering small parts, etc. They are used for a great variety of purposes in various manufacturing establishments. Larger sizes are used for melting metal for bearings, etc.

An electric glue pot, Fig. 3, is ideal for use in a woodworking establishment, paper box factory, in fact any place where glue pots are used, for the reason that there is absolutely no fire risk. Glue pots are invariably used in places where there are in-

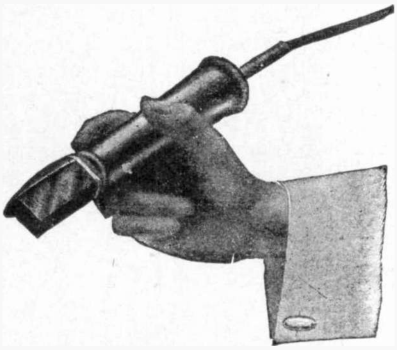


FIG. 5. LEATHER WORKING TOOL

flammable materials, and this single advantage of the electric glue pot is alone sufficient to cause its exclusive use. They are

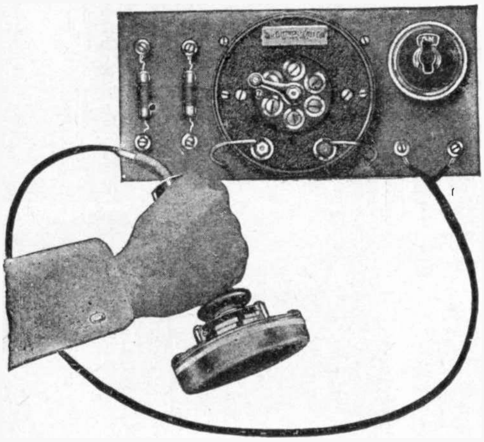


FIG. 6. SHOE IRONING TOOL

FIG. 7. WOOD BENDER

free from dirt, odor, fire or danger. They heat quickly, and by means of the regulating switch it is possible to reduce the heat so that the glue is kept at just the proper consistency.

In the manufacture and repairing of shoes,

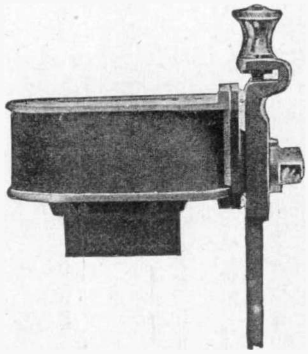


FIG. 8. CIGAR BRANDER

heated tools are employed in the working of the leather—to polish the edges of the soles and heels, to make the little creases across the toe, etc. Figs. 4, 5 and 6 are three types of electrically heated shoe ironing tools which are preferable to those heated over a gas flame. The temperature of the tools is readily regulated and may be kept constantly at the desired value. A small switchboard with fuses, snap switch and regulating rheostat is provided, which makes a perfectly safe and convenient installation.

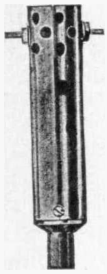


FIG. 9. CORK BRANDER

Electricity is also employed in the manufacture of musical instruments, Fig. 7 being an electrically heated wood bender. This

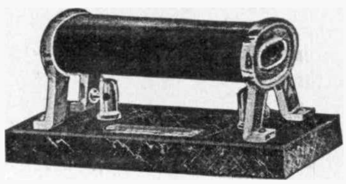


FIG. 10. TOOL HEATER AND ANNEALER

device may also be used by cabinet makers and in pattern shops for bending woods for veneers.

You have, perhaps, wondered how the brands are impressed on certain makes of cigars without crushing the cigar or injuring the wrapper. One way is to use an electric brander such as is shown in Fig. 8. The heater element maintains a constant temperature and the part which does the branding is interchangeable.

On somewhat the same principle is the cork brander shown in Fig. 9.

Fig. 10 is a device designed to heat flat tools used in melting wax or shellac for filling holes in furniture and similar purposes. It is also designed for use as an annealing furnace to draw the temper out of small steel articles.

Talks With the Judge

"I have noticed so many times when riding on the street cars or elevated trains at night that the lights burn very dim at times, when the car is being started. Sometimes they almost go out entirely and then come on again suddenly. I'd like to know the reason for that?" The Judge was in a question-asking mood.

"Suppose I answer that question by asking another," said I. "Suppose that just above a water faucet you were to drill a small hole in the water pipe; the water would rush out under high pressure.

"Now suppose you open the faucet wide open. The pressure on the pipe at that point and for some distance above will be relieved and the force of the small stream will be greatly diminished—you can see that? Well, exactly the same thing happens on the street car. To start the car requires more current than to run it, and the motors of a street car are so made that they will fairly eat up current in order to get the necessary starting power or torque as it is called. Therefore when the motorman turns on the current to start, especially if the going is hard or it is up grade, the motors consume an enormous amount of current, and this so relieves the pressure or voltage of the system that the lights burn dim until the car is under way.

"Street car systems generally operate on about 550 volts. The lamps on the car consume current at 110 volts in order to burn properly, and they are connected in groups of five in series across this 550 volts. Now if the voltage impressed upon a lamp drops a few volts below the number on which it is designed to operate not enough currnet will be forced through the filament to cause it to glow, or it may only glow at a dull red heat. So you see when the car starts suddenly under adverse conditions the motors take a great deal of current temporarily. This reduces the pressure to the lamps, as in the case of the water pipe analogy, and causes them to burn dim because of insufficient current."

"I see through that all right enough now," said the Judge; "but it brings to my mind another question. You said something about five 110-volt lamps being burned in series across 550 volts, which don't mean much to me. But I was just wondering if it has anything to do with the fact that when the conductor switches on the lights in the car every turn of the switch turns on five, also if one lamp is burned out there are usually five out; does it?"

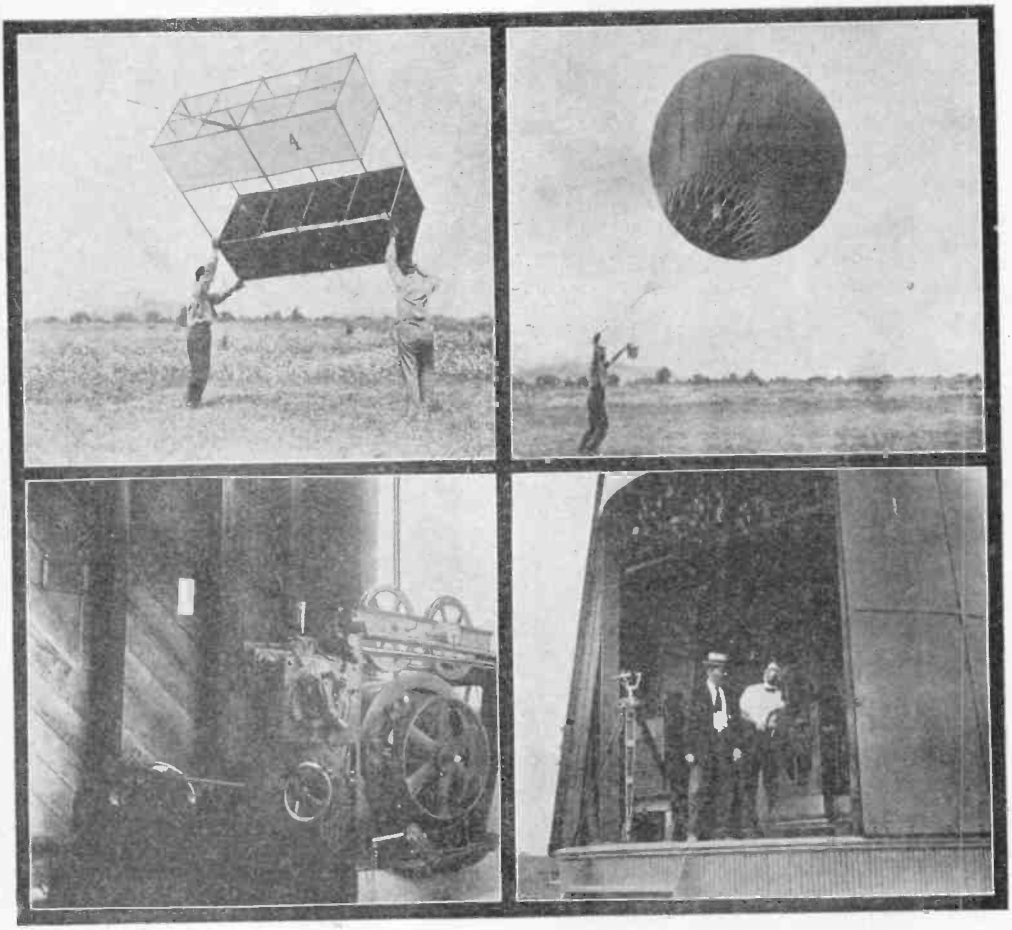
"Exactly," I said. "You see electric incandescent lamps are made to burn on certain voltages, maybe on two, four, 50, 110, 220 and so on, the most common kind burning on 110 volts, which is the most common voltage. A lamp of a certain voltage, therefore, when connected to the two terminals of a circuit carrying that voltage will have just enough current forced through its filament to heat it up to incandescence. Increase the voltage and the lamp burns with increased brilliancy or if a high enough point is reached it burns out. Reduce the voltage and it burns dimmer and dimmer until finally it does not glow at all.

"Suppose then that you have a 110-volt lamp. Connect it across a 110-volt circuit and it will burn all right, but connect it across a 220 volt circuit and it will burn up with a flash. However, if you connect two 110 volt lamps in series (one terminal of one lamp to one of the next and the two free terminals across the circuit) across a 220 volt circuit the resistance of the two filaments will be twice as great as that of one and therefore the same amount of current (½ ampere) will flow through the two lamps that flowed through the one lamp on the 110-volt current, and the two will then burn properly.

"It is the same with the 550-volt street car circuit. Five 110-volt lamps are connected in series across the 550 volts and enough of these groups of five are used properly to light the car."

The Mount Weather Observatory

Electrical circles, not only in the United States but throughout the world, have every reason to feel the keenest interest in the experiments which are to be conducted at the Mount Weather Observatory—one of the newest and one of the most important scientific institutions founded by the United States government. Not only is electrical energy being employed for much of the exploration of the upper air is designed primarily as an aid to weather forecasting, but incidentally the studies of the atmosphere will determine the state of its electrification under various conditions, afford data as to its absorption of electric waves, and otherwise contribute new-found technical information that will be of immense significance to students of electricity.



MAKING OBSERVATIONS AT MOUNT WEATHER

original research work at this station above the clouds, but electrical study along new lines is one of the functions of the unique institution. The newly established observatory, it may be explained, is a branch of the United States Weather Bureau and its purpose is upper air exploration. This

Government experts searched the country over ere they found a satisfactory site for this novel experiment station. The requirements were numerous and diverse. The study of the upper air, demanding as it does the daily use of kites and captive balloons, requires a location with a high average wind velocity. It also calls for a location 10 miles or more away from cities and from electric light wires, since in such localities the loose wires falling as the result of accidents to kites or balloons during a storm would be very troublesome and even a source of danger to transmission lines. The magnetic work which is carried on in connection with the upper air exploration also requires a location remote from trolley lines. All the specifications were fulfilled by the site which was finally chosen—a mountain peak in an isolated part of the Blue Ridge range in Virginia. This mountain top which the government has purchased and christened Mount Weather, is six miles from the nearest railroad and has an altitude of 1,725 feet above sea level.

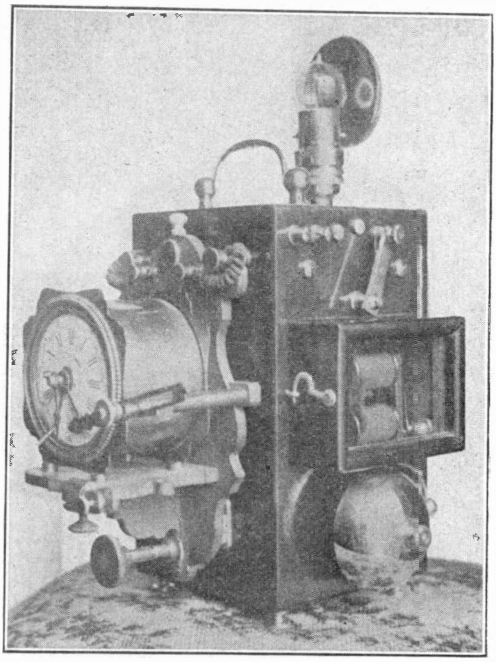
On the very crest of the mountain have been placed the substantial brick and stone buildings of this scientific outpost. The aerial department has been provided with a power house with engine and dynamo; an electrolytic plant for generating the hydrogen used for the balloons; and a small revolving building which contains the electrically operated kite reel from which the kites and captive balloons are flown. This reel, by the way, is a particularly interesting example of electrically operated apparatus owing to the strains imposed upon it.

The kite reel, carrying the line upon which the kites are flown is driven by a three-horse power motor. The drum is made of forged steel and is capable of carrying nearly 50,000 feet of piano wire line. In the power house of this kite and balloon station is a steam engine and electric generator of 17.5 kilowatts capacity.

Kites are flown whenever there is sufficient wind to carry them aloft. When there is a very light wind the scientists have recourse to small spherical balloons made of varnished cotton cloth and having a capacity of 905 cubic feet each. The upper air data is recorded automatically on self-registering apparatus carried aloft by the kites and balloons. The working principle of these instruments is that of a rotating cylinder upon which the pens connected with their respective elements trace the changing conditions of pressure, temperature, humidity and wind velocity. It is the plan of the officials to ultimately take up wireless telegraphy via kites and other lines of experimental activity for which the conditions at Mount Weather afford exceptional facilities.

An Ingenious Alarm Clock

The object of an alarm clock is, of course, to arouse one from sleep, but it fulfils its function all the better if in some way it can be made to induce us to obey its call. The electric alarm clock shown herewith is of French design and is very neat in appearance. On the dial you will see that there is a third hand like a small crank. This is



AN INGENIOUS ALARM CLOCK

set to any hour desired and when the hour hand comes in contact with the third hand an electric circuit is closed and an electric bell on the clock is made to ring until you find it necessary to get up and shut the "blamed thing" off. At the same time an electric lamp is turned on.

In case it is not desired to operate the lamp for any length of time for fear of running down the batteries there is ready at hand an exposed portion of the circuit containing a bit of platinum wire which is heated by the passage of the current and at which an alcohol lamp may be lighted.

This device is entirely self contained and the box includes the batteries, so that it may be moved from place to palce. It is the invention of René Dubosq, Professor of Philosophy in the High School of Theology of Bayeux, Calvados, France.

BROOKLYN BRIDGE IN FIERY OUTLINE

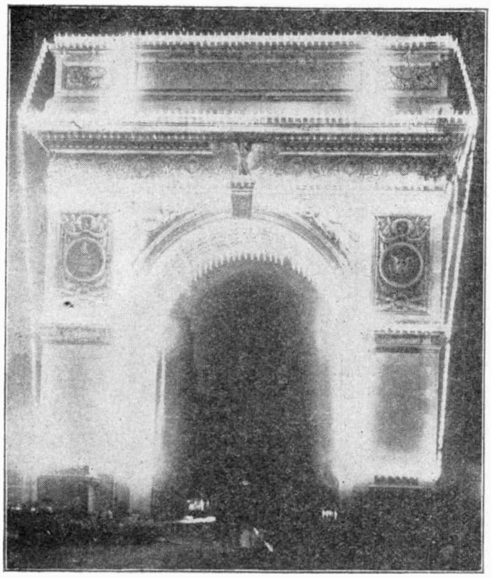
Night Scenes at the Hudson-Fulton Celebration

Electricity vied with Pyrotechnics to give splendor to the after-dark programme of the Hudson-Fulton Celebration held in New York the last week in September. While the fireworks were particularly effective, they could not take first place over the splendid electrical illuminations which were to be seen on every hand during the week of the celebration.

The electrically illuminated buildings, bridges and arches in New York and Brooklyn, some of which are here illustrated, present a scene which even New York will not expect to duplicate for many a day.

CITY HALL ILLUMINATED

Fifth avenue was festooned with incandescent lamps; the "Great White Way" was even whiter, and Brooklyn bridge a line of light from end to end.



WASHINGTON MEMORIAL ARCH

It is estimated that at least 100,000 horse-power of electrical energy was consumed nightly in producing the special electrical illuminations.

Difference Between the Magnetic Pole and the North Pole

Now that the North Pole has actually been discovered—that fascinating, only spot upon the earth's surface which receives the vertical rays of the pole star—endless have been the discussions as to how one would know when one were there, in what direction a compass needle at the pole would point, etc.

Not everyone understands that the North Pole and the north magnetic pole are two entirely different things. As a matter of fact there are few localities on the earth's surface where the compass points due north. The reason is because the north magnetic pole, or area, lies in the vicinity of King Williams Land just off the Arctic Coast of North America, in Bothia. These are strange lands that we don't hear much about after we have left our school geographies behind.

When this magnetic pole is between us and the North Pole the compass points due north. As we go either east or west from this line it is easy to see that the compass is "off" to a certain extent. If we were to travel north of the magnetic pole the needle would point south; west of it the needle would point east.

Sir James Ross in 1831 located the north magnetic pole approximately, at a point up in Bothia. But in 1903 Capt. Roald Amundsen, in the good ship Gjoa set out on an expedition which lasted till 1906, and during those three years he re-located the magnetic pole and incidentally made the "Northwest Passage," the goal for which mariners have striven since the days of Hendrik Hudson.

Amundsen and his assistants lived for nearly two years at Gjoahavn in King Williams Land, west of the Coast of Greenland. This was about 100 nautical miles from the magnetic pole and is a favorable point for making magnetic observations.

Terrestrial magnetic force is different on every part of the earth's surface and is not always the same at a given point. It is subject to regular daily and yearly changes, and Amundsen wanted to find out about these changes. Evidently the best place would be near the seat of the magnetic power, so there he posted himself, and for 19 months, day and night, his party took readings of their instruments—both inclination and declination.

Amundsen himself also made short excursions right into the very region of the magnetic pole and was able, by the aid of declination observations to prove absolutely that the magnetic north pole does not have a stationary situation but is continually moving. Its general location is, however, in the region mentioned above, and it does very well to steer by.

Dallas on the Safe Side

The city of Dallas, Texas, recently passed an electrical ordinance which it claims is the best in the country. The ordinance requires bonds of every person who handles electrical appliances in any manner, including contractors and the men employed by them, window decorators, stage employees, etc. Before a permit for an installation will be given plans must be submitted showing every connection, and when finished the work will be inspected to see that it corresponds to the plans submitted.

How to Make an Auto-Condensation Pad

By NOBLE M. EBERHART, A. M., M. S., M. D.

Auto-condensation is becoming rapidly popular among physicians as a method of treating diseases where there is an impairment of nutrition or failure in perfect elimination. It is only a question of a few years until it will take the place of other electrical

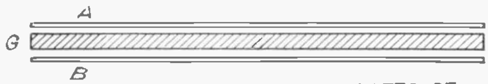


FIG. 1. REPRESENTING THE PLATES OF A CONDENSER

methods for this purpose. The principle involved in auto-condensation is the substitution of the patient's body for one layer of a condenser, and although several other forms fo current may be made use of in this way, the term auto-condensation has become restricted in its meaning to apply to the administration of the high frequency current of D'Arsonval given in this manner:

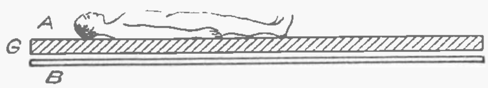


FIG. 2. THE PATIENT TAKES THE PLACE OF ONE PLATE

Let (A) in Fig. 1 represent in sectional view, one layer of a plate condenser, (B) the other layer and (G) the glass or di-electric, which separates them. Now, with this form of condenser a positive charge is held on (A) and a negative one on (B) (or vice versa), and they constantly attract one another through the glass (G) which separates them, and although the glass does not prevent this attraction, it does prevent the charges from actually getting through and neutralizing one another. Now if we substitute for (A) the body of a patient (Fig. 2) then when the condenser is charged, the body of the patient is charged just the same as if it were a layer of lead or zinc.

The original auto-condensation couch which is like an elongated Morris-chair, or steamer chair is shown in the accompanying sketch (Fig. 3) together with a coil and a high frequency generator of the D'Arsonval-Oudin type. This couch consists of a frame work underneath the back and seat of which is a layer of zinc, while the cushions are made of rubber and stuffed with rubber waste (sometimes with silk floss). The zinc plates are attached to one pole of the D'Arsonval apparatus and the other pole connects with metal handles, which the patient takes hold of while sitting on the couch. Thus the patient becomes layer (A) of a condenser as shown in Fig. 2. The rubber cushion takes the place of the glass (G) and the zinc plates represent layer (B) of the condenser. In the operation of this couch the D'Arsonval apparatus produces a rapidly alternating current, so that the patient is first charged, say with a positive current, while the zinc is negative. Then the charges are withdrawn and changed over so that the next instant the patient is negative and the plate positive,

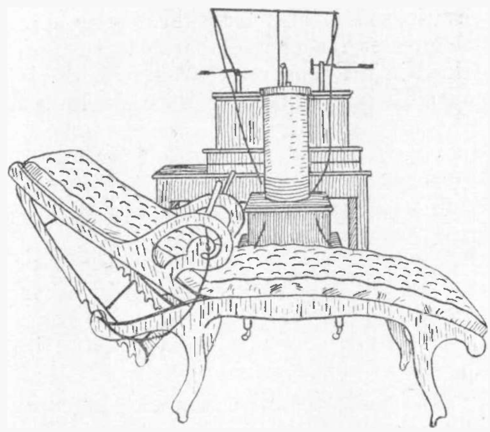


FIG. 3. THE AUTO-CONDENSATION COUCH

etc. It is claimed that with the ordinary apparatus used these alternations take place one million times per second.

Realizing that the arrangement of condenser layers and di-electric was all that was necessary for the obtaining of auto-condensation, I thought of several ways of producing apparatus for this purpose. My first method consisted in making a folding pad as shown in Fig. 4 which consisted of the rubber cushions with the zinc plate on a thin wooden base below. The connection from the patient to the other pole was made with an ordinary hand electrode such as is used with the galvanic or faradic battery. This form of pad is easily constructed by the doctor, by making use of two plates of zinc with metallic connection, but necessitates the purchase of the rubber cushions and for a home-made apparatus one of the other forms which I shall describe will be found easier to construct.

The next thought that occurred to me was that we have a number of different substances which make good di-electrics, such

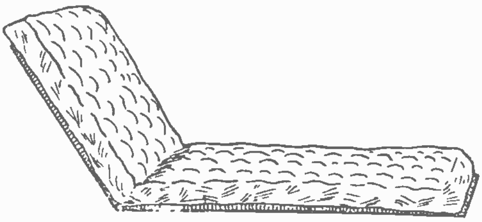


FIG. 4. AUTO-CONDENSATION PAD

as glass, silk, mica, etc. Furthermore there is a well-known law that the thinner the di-electric, so long as it keeps the charges apart, the greater the charge that may be maintained in the condenser. With this in view my most recent pad consists in a layer of condenser together with a sheet of flexible mica covered with leather to resemble the ordinary pad which is used on a physician's office treatment table and this has proved a most satisfactory one.

With these general statements I will suggest two or three ways in which the physician may make a suitable pad for office use.

First, a glass slab, five or six feet in length, 20 inches wide and about one inch thick, such as is used in a glass topped operating table, is fitted in a wooden frame and to the under surface is attached a strip of zinc or of sheet lead, 1-32 of an inch thick. This strip should be about 10 or 12 inches wide so that when placed on the lower surface of the glass it will leave a margin of about four or five inches between the edge of the zinc and the edge of the glass. It should extend lengthwise to within six inches of each end of the glass slab. The zinc or lead plate is connected by an ordinary covered conducting wire (say not smaller than No. 10 or 12), to one pole of the high frequency apparatus and the patient connected by the ordinary metal electrode to the other pole. The patient may be placed directly on the glass, but it is preferable to place him on a thin cushion upon the glass, for the sake of comfort,

Another method is to take a wooden table long enough for the patient to lie on and place underneath the table top, a layer of plate glass the full size of the top of the table with the strip of lead or zinc attached to the under surface of this glass, always bearing in mind that the essentials of an auto-condensation pad are to have a di-electric with a layer of condenser below it, and the patient attached to the apparatus to form the upper layer. Thus an ordinary Morris-chair or steamer-chair may be used and a layer of lead or zinc fastened underneath the back and seat of the chair, the two strips being fastened together with metallic connections (chain or wire). Underneath the ordinary cushion of the chair, four or five layers of rubber are placed to serve as the di-electric, although the cushions themselves, if they remove the body beyond the sparking distance of the charge on the zinc plate would really make the air space intervening serve as a di-electric. This is not as satisfactory, however, as when the layers of rubber are placed between. The patient then is connected by the ordinary metallic hand electrode and conducting cord, or metallic handles may be fastened on the arms of the chair, the two connected by a bifurcated conducting cord to the one pole; the zinc plates to the other.

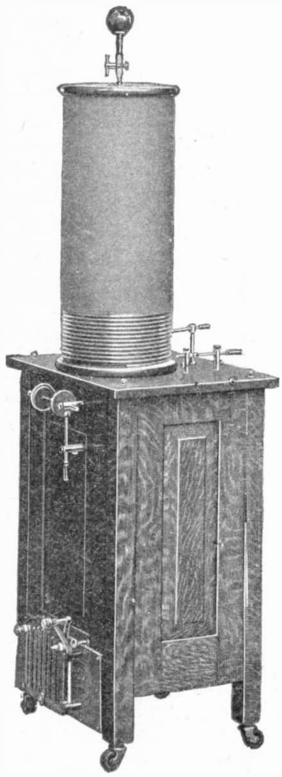


FIG. 5. TESLA-D'ARSONVAL-OUDIN GENERATOR

Lastly a pad may be constructed on the same plan as the one which I have designed, using one or more layers of sheet mica large enough to permit the body of the patient to rest thereon and making use of a layer of condenser (either lead or zinc) underneath the mica, taking care that it does not extend near enough to the edge of the mica to allow the charge to leak over. On top of the mica, place three or four layers of felt or cover with leather as desired. Should the mica be insufficient to prevent some sparking through, it may be obviated by placing another thin cushion on top of this pad.

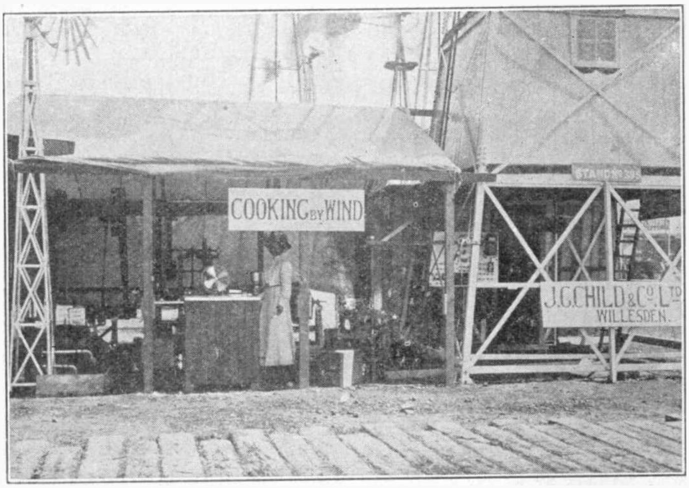
Now in the beginning I referred to the fact that auto-condensation was used with the D'Arsonval high frequency current, and to get a sufficient amount of current for auto-condensation we must have generating machines, which will deliver into the pad a charge of not less than 150 milliamperes; the ordinary dose for auto-condensation being from 150 to 600 milliamperes. The current can only be measured by a hot-wire meter, the ordinary milliameter used with galvanic apparatus being entirely useless in measuring high frequency currents. When the D'Arsonval apparatus is charged through an induction coil there is no trouble about getting a sufficient amount of current if not less than a 12-inch coil is employed.

Another method now frequently used is the production of high frequency currents through a Tesla transformer, in which case in order to get sufficient current for auto-condensation there must be a voltage of about 30,000 volts in the primary of the transformer. I have produced one form of apparatus consisting of a combined Tesla-D'Arsonval-Oudin apparatus, shown in Fig. 5, which works perfectly on the alternating current without any intervening apparatus; being attached directly to the lamp socket.

Wind Power Electric Plants

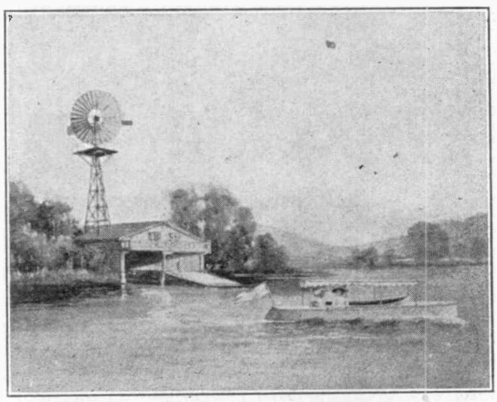
Despite the obstacles presented to the extensive use of wind power for the production of electric current, owing to the uncertainty of the wind and the variability of its velocity when it is blowing, experimenters are continually at work on the problem, especially in England.

At the Royal show at Gloucester there was an electric cooking display by wind power, as shown in one of the accompanying illustrations. A 24-foot wind turbine and complete electric plant was installed capable of generating 3000 kilowatt hours per year with wind averaging eight miles per hour for that period. It is stated that the electric current generated by the wind turbine plant was conducted a distance of 220 yards to the Cottage of the Country Gentlemen's Association, Ltd., for use in lighting and cooking service.



WIND POWER ELECTRIC PLANT AT THE ROYAL SHOW

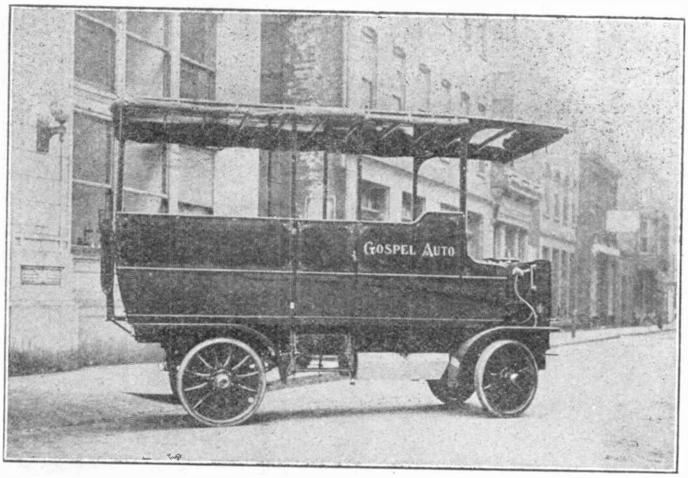
The second illustration shows a plant containing such an equipment for charging electric launches. These plants are supplied by J. D. Childs & Co., Ltd., of Willesten Green, London, and at the factory of the company a wind turbine plant has been in operation for several months with excellent results, supplying current for 150 10-watt lamps.



WIND POWER PLANT FOR CHARGING LAUNCH BATTERIES

A Church on Wheels

A church on wheels in the form of an electric Gospel automobile is being used extensively in Cincinnati's slum districts. The queer little church contains a pulpit and seats for 16 persons. It is run by powerful storage batteries which also electrically light the interior.

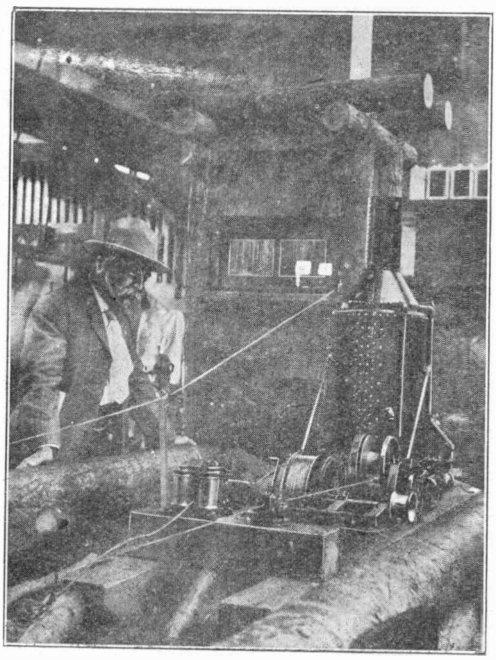


THE GOSPEL AUTO IN CINCINNATI

Three times a week the electric Gospel Auto with a quartet of singers and a minister makes its rounds in the slum districts. The innovation in church work attracts wide attention, and the "electric church" has been successful in its mission. The idea of bringing the church to the people that will not go to church has been so successfully solved with the new Gospel Auto that others like it will be put into service.

Miniature Saw Mill

One of the interesting and unique exhibits at the Alaska-Yukon-Pacific Exposition is a miniature logging camp, running by its own power and performing before the eyes of the spectator all the operations of making lumber. Ordinarily it is a hard task for man and beast to "snub" the logs or drag them onto the saw carriage. In this miniature plant as in many large mills the "snubbing" is done by means of an electric motor and winch as shown in the picture.


MINIATURE SAW MILL

Record in Cable Repairing

A hard record to beat in the quick repairing of a telephone cable was recently made in Nashville, Tenn. A large grain warehouse was destroyed by fire, burning in two a 50 pair cable. The cable department got a record of the damage at 22 minutes after four and at seven o'clock the repairs were entirely completed, in the meantime a section of cable having been strung, tested and spliced, the total length of time occupied by the repairs thus being two hours and 38 minutes.

Mighty Boiler for Electric Plant

A single boiler of unusual capacity has been installed in the new Delray electric power station of the Detroit Edison Company. This mighty boiler has a capacity of 2274 horsepower and has a grate 150 inches wide by 11 feet long. It takes four mechanical stokers to serve its voracious appetite for bituminous coal. As the station grows, more of these units will be added.

POPULAR ELECTRICITY WIRELESS CLUB

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

The Silicon Detector

The silicon detector is easily made by the amateur, although considerable care must be taken with the adjustment in order to insure sensitive operation. In the beginning it may be stated that the silicon detector operates upon the principle of the thermo-couple. The principle of this couple is that when two dissimilar metals are joined together and connected in a closed circuit, a small amount of heat applied to the junction

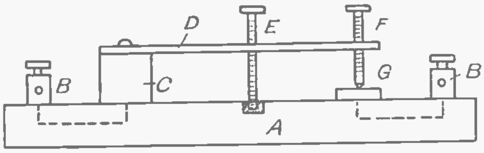


FIG. 1. SILICON DETECTOR

will cause a current of electricity to flow through the circuit. Conversely, if electricity from a battery or other source is sent through the circuit the junction will be heated.

A silicon detector is therefore nothing more than a couple of brass and silicon connected in the aerial circuit and having the telephone receiver bridged around it. The surging waves entering the aerial wire, although representing an extremely small amount of energy, are enough to slightly heat the brass-silicon junction. This causes a tiny current to flow through the telephone and permits the make and break of the incoming waves to be read by the clicks of the receiver.

Fig. 1 is a diagram showing the arrangement of the various parts of a silicon detector. (A) is a base of wood, (C) is a brass block ½ by ¾ inches screwed to the base. A brass strip (D), one-sixty-fourth of an inch thick and three inches long by ½ inch wide is screwed to (C). The thumb screw (E) works through this brass strip and into a threaded eyelet in the base. The thumb screw (F), also of brass, terminates in a sharp point resting against the piece of silicon in the cup (G). This forms the couple. The terminals (B) are connected to (G) and (C) as shown by the dotted lines, the wires being concealed in the base.

The metal cup (G) which holds the silicon is about an inch in diameter and about ¼ of an inch deep. Grind down a piece of silicon till it makes a fairly good fit in the cup. Next place some solder in the cup along with some soldering flux. Hold the

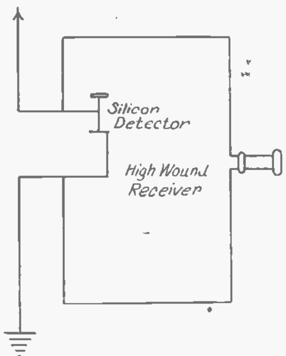


FIG. 2. CONNECTIONS OF SILICON DETECTOR

cup in the flame of an alcohol lamp till the solder is melted then stick in the lump of silicon.

When the parts are set up as shown by Fig. 1 the brass screw (F) may be adjusted to just touch the silicon. With practice you do this adjusting to a nicety.

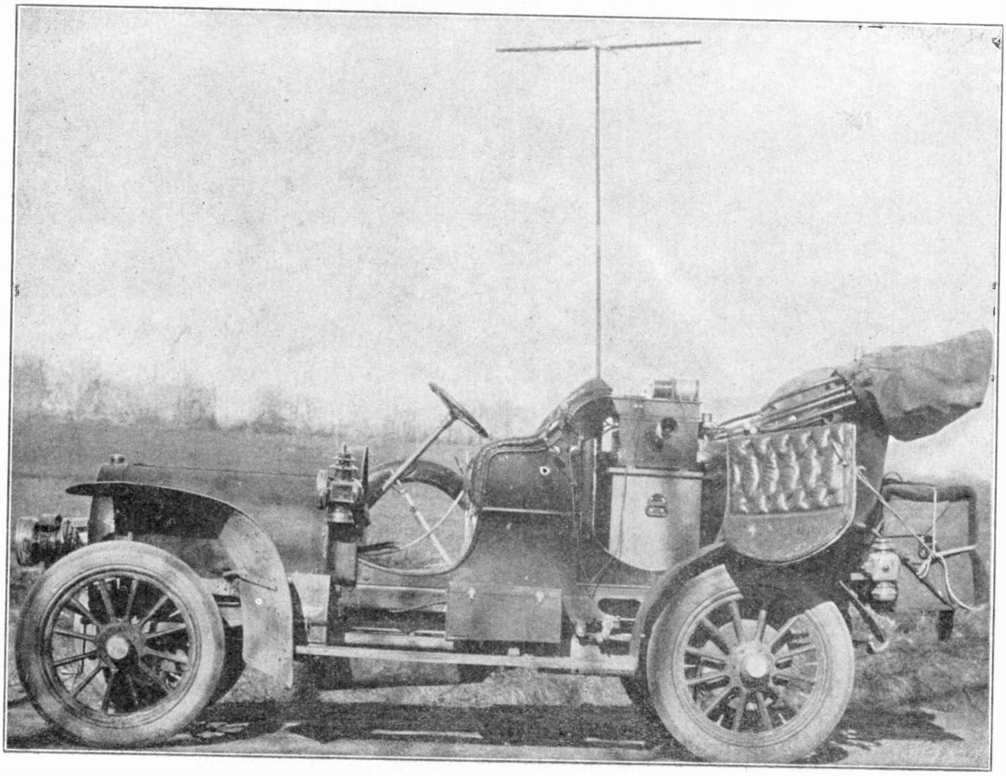
Connect the detector in the circuit as shown in Fig. 2. Use a high wound receiver.

Theory and Practice of the Radio System

By FRANK C. PERKINS

For field work in military and other service portable wireless telephone and telegraph sets may be utilized to advantage and may be carried on the back of a mule. For short distance service no visible antenna is neces-

This apparatus is supplied with a short antenna and has a range of nearly 100 miles, but for ordinary automobile work a much lighter and less powerful equipment might be employed to advantage.



GOVERNMENT AUTO WITH WIRELESS EQUIPMENT

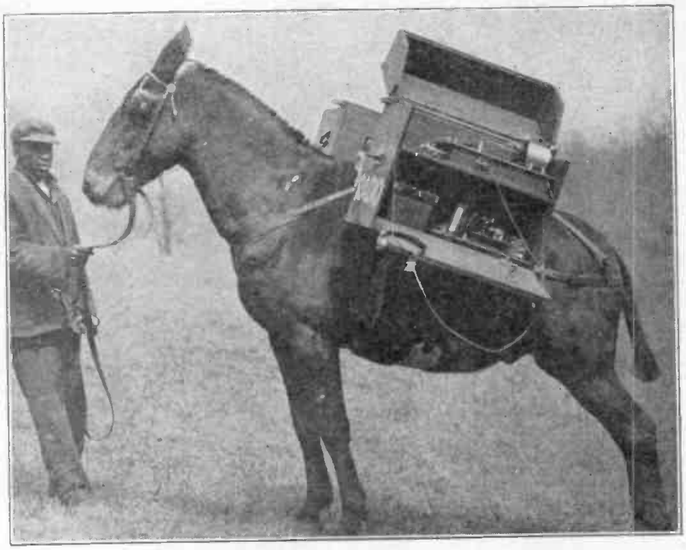
sary, the operator simply using the instrument without removing it from "Maud's" back.

The illustrations show the portable Radio Wireless Telephone and supplementary telegraph for this kind of service. With this instrument it is possible to talk up to 20 miles and telegraph from 80 to 100 miles with a a special antenna, although without using a visible antenna is only available for short distance service up to one or two miles.

The complete long distance Radio telephone and sparkless wireless telegraph may also be installed in an automobile to advantage as indicated in one of the pictures

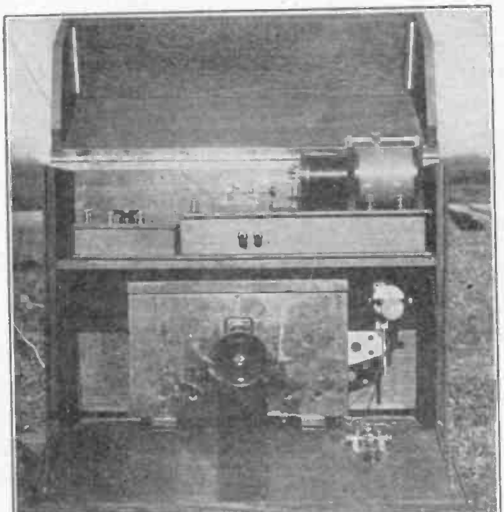
It is interesting to read the following description of the method of operation of the new Radio wireless equipment, as given by the designers of this apparatus, the analogy given greatly simplifying the matter to the mind of the student.

Every school boy knows that if he places several marbles in a row and strikes the marble at one end of the line, the one at the other end will roll away, although all of those intervening remain at rest. The theory of wireless is based to a very great extent upon just this principle. The molecules, ions or whatever you may call them, of the ether, transmit the energy from one to the next and so on, just as a blow is felt by the end marble, no matter how many intervene.



WIRELESS ON MULE BACK

Picture a man standing upon a bridge with his arm full of bricks. Under the bridge is a second man, to whom the first wishes to communicate an intelligible signal, advising him whether to stay under the bridge or come out. If a brick is dropped into the water below, it sends out a circle of waves which can be noted by the man below. The dropping in of two bricks, one after the other, might be one signal, while the dropping of three bricks at intervals would be another. In this way it would be possible for the two men to devise a code which would represent the alphabet, each signal depending upon the number of bricks dropped within a given time, or the number dropped in succession, followed by a



MILITARY PORTABLE SET

pause, and the dropping of more missiles. This represents in a pictorial way the transmission of wireless messages as it was done prior to the invention of the Radio sparkless wireless telegraph.

Now draw a picture of this newest invention in the art of wireless. Supposing that, instead of an armful of bricks, the man above the bridge has a bag of sand. This sand is permitted to run out in a small stream through a minute hole in the bottom of the sack. As the grains of sand strike the water, there is a very little splash, and the waves that circle out in all directions are ever so much smaller than those caused by the dropping of the brick, but, impelled by the continual stream of sand, these waves go just as far as the others. In order to note these waves, the man beneath the bridge places a small chip upon the surface of the water. While the sand continues to fall from the bag, the chip will be forced up and down by the movement of the water. If the man above places his finger over the hole in the bag and stops the stream of sand, the motion of the chip will cease to be energetic.

The man below would read his signals, not by the waves made by the falling of the sand, but by their interruption for an instant. Thus, instead of dropping a brick, the bridge operator merely places his finger over the hole in the bag to give the signal to the man below.

Briefly, the old system of wireless depends for a signal upon the creation of a wave strong enough to be perceptible at a distance, while the new sparkless telegraph sends out a continuous disturbance whose interruption for an instant causes the transmission of the signal; consequently, only a fraction of the energy is employed in the latter method with none of the disturbance which is necessary to the operation of the old system.

The inventor, Mr. De Forest, states that this interruption can be made by a machine transmitting system which will do the work of several hundred operators in the same time. Although details of the working of the system have not been made public it is claimed that with the advent of the new system, close tuning will become possible, and success has already been attained in transmitting several messages at once over the same general apparatus. Thus, multiplex transmission allows several machines, each many times more efficient than the average Morse operator, to operate over a single antenna wire.

Enameled Wire and The Tuning Coil

By A. B. COLE

In making inductance or tuning coils the general practice up to the present has been to use cotton covered wire. A few makers have attempted to use enameled wire, but have found that their coils were not nearly so efficient as those wound in the old way. The reason for this difficulty will be discussed in the present article.

At the start some of our readers will ask, "what is enameled wire," for this wire has not been on the market long, and is not yet well known. Enameled wire is bare wire with a thick, elastic coat of enamel, which insulates the wire as effectively as a covering of cotton. This wire takes up much less space, however, than the cotton covered, and for this reason many more turns can be had on a core of given length. From this it will be easily seen that the separate turns of wire are much closer together than if cotton insulation were used.

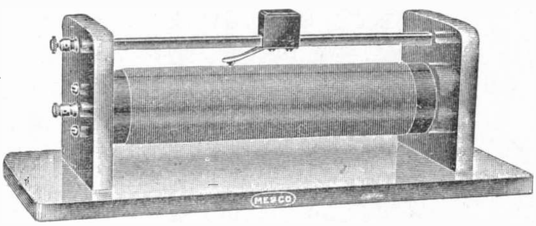


FIG. 1. SINGLE SLIDE COIL

Now we will consider two consecutive turns on a tuning coil. We have here two conducting surfaces (the two turns of wire), separated by an insulating medium (the enamel insulation). This condition constitutes a condenser. Every pair of consecutive wires therefore acts as a condenser, and the total condenser effect, known as "distributive capacity," is in direct proportion to the number of turns of wire in use. Now, the capacity effect acts in such a way as to give a greater wave length per inch of turns than would be had if the wires were spaced at a greater distance; that is, if they were cotton covered. Thus a slight increase in the number of "active" turns makes a comparatively large increase in the wave length, and consequently tuning is far less accurate than with cotton covered wire.

On the other hand the so-called American Black enameled wire has several advantages in other respects over cotton insulated wire where used in the construction of tuning coils. In the first place it gives the instrument a very neat appearance which would be costly to obtain with cotton or other insulation, as this wire is already in a finished state, and needs no further coats of enamel or shellac. Fig. 1 shows a coil wound with this wire, and its appearance needs no further comment.

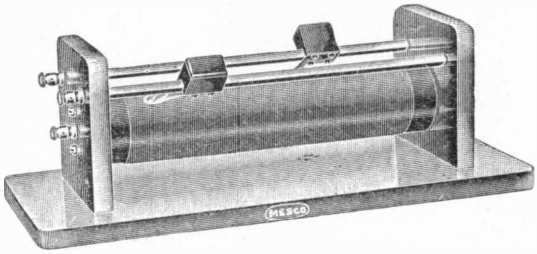


FIG. 2. DOUBLE SLIDE COIL

Where cotton insulation is used a strip must be scraped along the coil so that the slider may make contact with the wire. This operation takes considerable time, and it is quite difficult to make a good piece of work of it. On the other hand the pressure of the spring of the slider is sufficient to scrape a line of insulation from enameled wire. This advantage will appeal immediately to the amateur and to the manufacturer.

A third advantage of enameled wire is the fact that hard drawn copper is used. Soft copper is generally used with cotton insulation. It will be seen that the slider will not wear enameled wire away so quickly as it will soft copper wire.

From the above facts it would seem that enameled wire is to be preferred if the distributive capacity effect can in some way be overcome.

Since it can be shown that this effect is in direct proportion to the diameter of the coil, the best way to reduce this effect is therefore to reduce the diameter of the coil. Fig. 2 shows a two slider coil designed in this way. The relation of the diameter to the length is well illustrated by the cut. As to the efficiency of a coil designed in this way, it may be stated that with such a coil the writer read a commercial station nearly 500 miles away, with his aerial wire only 60 feet in length. Even under the best of conditions this is a performance out of the ordinary.

Wireless Association of New Orleans

The Wireless Association of New Orleans was organized by Mr. George Seibert and Mr. H. Schluter on August 17. The object of the association is to further the arts of Wireless Telegraphy and Telephony, and to put experimenters on the right footing with the commercial and naval stations in the matter of interference.

The meeting was well attended and the following officers were elected: J. Nadau du Treil, president; George Seibert, first vice-president; H. Schluter, second vice-president; P. Gernsbacher, secretary, and L. Reiss, treasurer.

The meetings will be held at Mr. A. Switzer's laboratory, 1508 St. Charles Ave., on Wednesday, every two weeks, beginning September 1st. The Association invites all to join who own or operate a wireless station in New Orleans. Those who wish to become members of the association may communicate with Mr. Gernsbacher, 2022 State Street.

WIRELESS QUERIES

Answered by Valentine B. Seitz

Potentiometer and Tuning Coil

Questions.—(A) How much No. 28 German silver resistance wire would be required on a potentiometer core 2½ inches in diameter having a thread in between the turns of wire? What would the resistance of this amount of wire be? (B) What is the capacity in meters wave length of a tuning coil having 316 turns of No. 24 bare copper wire wound on a 12-inch core and 2½ inches in diameter with a thread between the turns?—J. S. H., Crestline, Ohio.

Answers.—(A) About 350 feet having a resistance of 400 ohms. As this would make quite a large sized coil, would advise using about No. 30 wire.

(B) With a medium sized aerial it should respond to 2000 meter wave.

Relation of One to Twenty-five Mile Equipment

Questions.—(A) What receiving and transmitting apparatus is required for a station working over a distance of one mile? (B) Would this same outfit work 25 miles if increased in porportion, if not please state how it would differ. (C) How many Leyden jars should be used with a transformer capable of transmitting 25 miles? (B) How far will a six inch coil transmit and what is the approximate cost of constructing it?—H. N., Chicago, Ill.

Answers.—(A) A ½ inch coil for sending, a detector, tuning coil and pair of receivers is all that will be required for a one mile set.

(B) A tuned transmitting set should be used for a 25 mile set. This would include a transformer, condenser, spark-gap and helix. The receiving set should have a receiving transformer in place of the tuning coil, also one stationary and one variable condenser.

(C) A good plate glass condenser having a capacity of about .025 M. F. should be used instead of Leyden jars.

(D) The distance over which a six inch coil could be used, cannot be given with any degree of accuracy, as the results would depend upon the rest of the apparatus and the condition of the territory over which the instruments are to be used. It would cost about $18.

Auto-Spontaneous Repeating System

Questions.—The article by David Marcus, in the September issue is not altogether clear to me. Will you please explain the following? (A) There is only one wire going to the coils of his repeating relay. To what is the other side connected? (B) Is the choke coil on the same relay shunted across the other two terminals? (C) Of the four binding posts at the coherer end of the coherer and decoherer diagram which two binding posts are for the coherer and for what are the other two?—J. B. P., West Lafayette, Ind.

Answers.—(A) The other side should be connected to the terminal of the decoherer, to which the wire leading from the contact (C) of the switch (S^5) is connected. This connection was unfortunately omitted through an oversight by the draftsman.

(B) Yes.

(C) Two perpendicular binding posts carry the coherer tube, while the other two which are in series with the first two are merely used as independent terminals to avoid confusion in wiring. The latter two binding posts may be omitted by connecting the wires from the variable condenser and from the switch (S^1) directly to the perpendicular binding posts carrying the coherer tube.

Aerial Construction

Question.—Please tell me the most reliable method of erecting an aerial consisting of galvanized iron pipe in order to protect it in case of lightning.—O. C. K., Chicago, Ill.

Answer.—The only protection is that of grounding the aerial so as to let static charges that are accumulated pass to the earth. The method of joining your pipe is all right, but would advise insulating the pipe, by mounting on top of the wooden pole.

Battery and Condenser for 6-Inch Spark Coil

Questions.—(A) What is the voltage and amperage required for a 6-inch spark coil and how many dry cells will be needed? (B) How many glass plates and what size will be required for a 6-inch spark coil condenser? The plates are 1-16 inch thick. Please give number of square inches of tinfoil required. This is to bridge across the spark gap.—S. A., Birmingham, Ala.

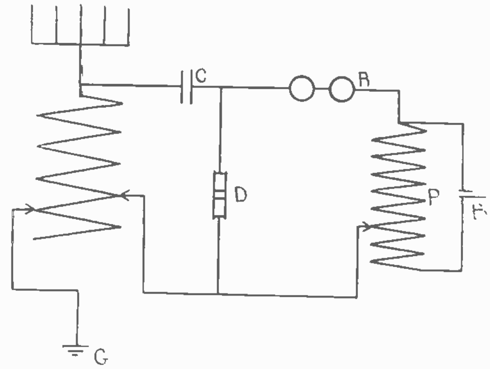
Answers.—(A) From 10 to 15 volts. Two sets of cells connected in multiple should be used; each set consists of seven batteries connected in series.

(B) This will depend upon the size of glass you wish to use. About 200 square inches of active glass surface should be used. This will take 400 square inches of tinfoil if the plates are not stacked.

Wireless Receiving Set

Question.—Please give diagram of how to connect a double slide tuning coil for use with the autocoherer, pony telephone receiver and one dry cell and one wet cell battery.—S. K., Denville, N. J.

Answer.—The small permanent condenser (C) must be used with a double slide tuning coil. (See diagram.) A potentiometer must

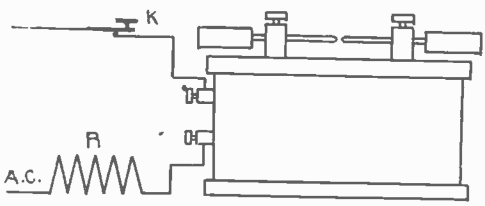


CONNECTION OF DOUBLE SLIDE TUNING COIL

be placed in the circuit when a detector that requires a battery, is used. Would advise using a detector that does not require the use of a battery.

Wehnelt Interrupter on 110 Volts A. C.

Questions.—(A) In the January issue '09 you describe a Wehnelt interrupter. Can this interrupter be used without any resistance on 110 volt alternating current for a two inch coil? (B) Would it not be better to use condensers with the coil? (C) Kindly give diagram of connections.—A. A. B., Seattle, Wash.



WEHNELT INTERRUPTER ON 110 VOLTS

Answers.—(A) A resistance must be used Otherwise the coil will take too much current. When used on alternating current, an interrupter of this type should be used in connection with a rectifier.

(B) No.

(C) (See diagram.) The interrupter on the end of the coil should be cut out by connecting the vibrator spring to the adjustable thumb screw or support.

Wireless Parts and How to Connect Them

Questions.—(A) My aerial is 20 feet high, made of four strands of No. 14 aluminum wire one foot apart and 30 feet long. Is this good construction? (B) How far should I receive with a single pole, 75-ohm watch case receiver and potentiometer? How far with 75-ohm double pole receiver? (C) How far can I send with a single unit Splitdorf automobile coil, zinc spark gap and De Forest sending helix (10 turns No. 8 copper wire on 8-inch core)? (D) How can I tell the primary and the secondary terminals of the above coil? (E) Will an Edison cell run the above coil? (F) Will a coherer consisting of two carbon rods end to end with a piece of steel wire between them, and separated from the ends by drops of mercury, work with this equipment? (G) How shall I connect a fusible cut-out?—A. L. M., Rochester, Ind.

Answers.—(A) Your aerial work should all right, but would advise spreading out the wires a little more, if possible, as this will make quite an improvement.

(B) A single pole 75-ohm watch case receiver is not at all adapted to wireless work. A double pole pair of about 1,500 ohms should be used.

(C) Under good conditions using the coil and apparatus mentioned you will be able to send about three miles.

(D) The secondary connection on the coil can be told by the thick hard rubber bushing. The other connection will have to be taken from one of the primary leads, as the secondary is grounded on one end.

(E) It will take at least three Edison cells in series, to run the coil properly.

(F) The coherer will work although it will not be very sensitive.

(G) The fuse would be of no use. To protect the receiving apparatus, shunt a short spark gap across your two leads coming from the aerial switch.

Five-Mile Equipment

Question.—Please advise what instruments are necessary for a complete sending and receiving station operating to a mean distance of about five miles. Also length, size of wire and kind, number of wires and connections of the aerial.—L. M., Minneapolis, Minn.

Answer.—The sending apparatus should consist of a 1-inch coil, batteries and key, while a tuning coil, detector, fixed condenser, and a pair of 1500 ohm receivers will answer for receiving. The aerial should be about 50 feet high and consist of four No. 14 hard drawn copper wires 18 inches apart.

Condenser; Lightning Arrester; Sending Helix; Anchor Gap

Questions.—(A) Please show by diagram how a "fixed condenser" should be used on my receiving set and what size should it be. (B) What size of leyden jar is necessary across a 2-inch spark gap? If more than one, should they be in series or parallel? (C) Please show by diagram how to use a lightning arrester to protect wireless instruments. Also give a brief description. (D) How should I make a sending helix? (E) What is the "anchor gap" and why is it used?—W. H. B., New York, N, Y.

Answers.—(A) The condenser should have about 40 square inches of active surface when paper is used as the dielectric. (See answer to S. K.)

(B) Three pint jars in parallel.

(C) Place a short safety gap between the aerial and ground.

(D) See answer to L. R., page 324, September issue.

(E) The anchor gap is a short gap placed in the aerial circuit, so that the circuit need not be broken by means of a switch, for receiving.

Tallest Single Stick Aerial

What is said to be the largest stick of timber ever brought into California was raised recently at East San Pedro by the United Wireless Telegraph Co., to serve as an aerial.

This huge piece of timber, which is a selected stick of seasoned Oregon pine, and which was brought to San Pedro on the barkentine James Johnson from the Columbia river three years ago, is 146 feet in length, four feet in diameter at the base and one foot in diameter at the top, and weighs nine tons.

The raising of the mast proved a difficult undertaking, but it was accomplished by hoisting it part way first by means of a gib pole. In attempting to raise the big stick higher, the fall line gave way. Then two lines were run, one to the extreme tip end of the pole and one to the middle, both lines being led through double blocks and tackles to the pile driver standing on the Salt Lake track.

The strain was put first upon the one end, then upon the other, until the mast was in an upright position. Several guy lines were made fast to the pole before it left the ground and were slackened or held taut as the occasion required. The pit in which the mast was set is about twelve feet in depth and will be filled with concrete.

Electricity in the Household

Beautiful Display of Electrical Fixtures

Beautiful! Exquisite! Splendid! Are a few of the adjectives almost involuntarily used to describe the effects which can now be obtained in scientific and artistic lighting, as exemplified by the magnificent display rooms just completed by one of Chicago's leading electrical supply companies. The black and white of the accompanying halftone pictures gives but a faint idea of the almost palatial splendor of these three rooms, which were fitted out at a very great expense, just to give you a chance to decide upon the particular type of fixture or fixtures which you wish to have installed in your new home.

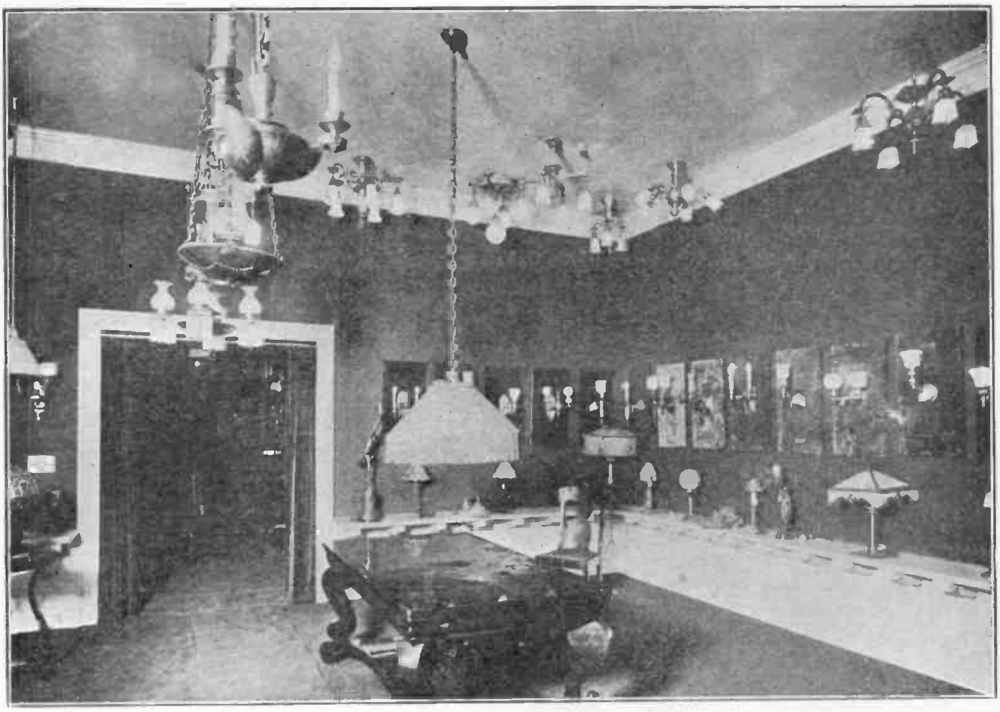
Did you ever have the experience of selecting at an electrical supply store a portable lamp, wall bracket, or ceiling lamp which seemed to you to be just the thing, and then, when it was in your home finding that it didn't seem to fit in with the general scheme you were trying to carry out—and you were disappointed?

THE FRENCH ROOM

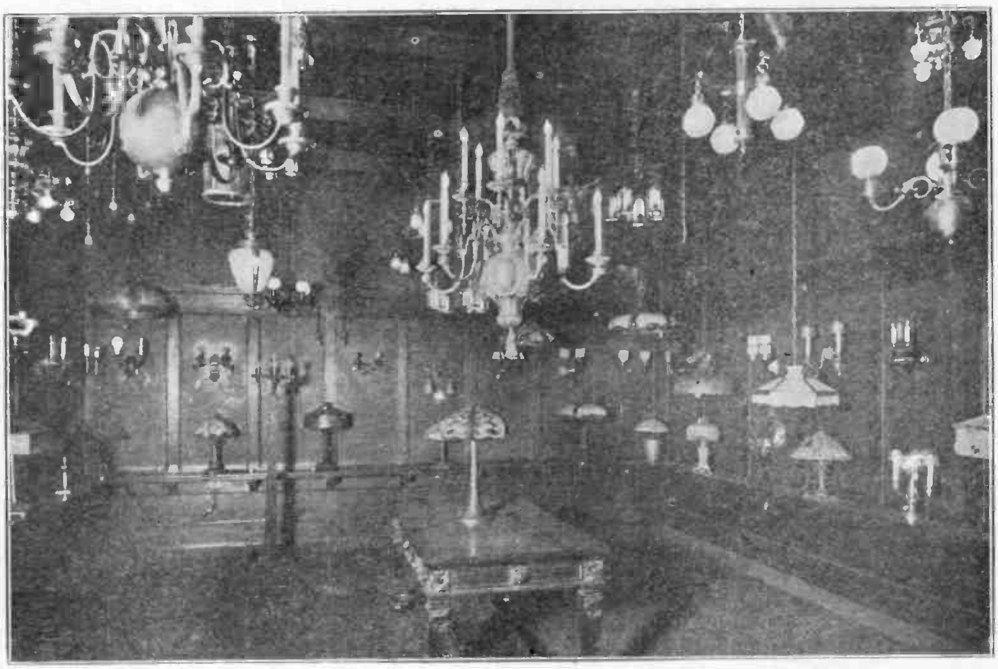
Experiences such as this have come to most of us, and consequently these elaborate rooms were fitted out with the object of enabling the buyer to select intelligently, from a great number of original designs, pieces most desirable for special conditions.

The rooms are three in number, located in the center of a large building and having no windows or other sources of external light. From a small general supply room in front you enter the first of the series, known as the Colonial Room, its finishings conforming in every respect to those in the interior of houses of the Colonial design. All around the walls are bracket lights, a shelf extending clear around supports portable table lamps, and the ceiling is hung with beautiful electroliers.

These lights are all wired and may be turned on and off singly, in groups or all at a time. If you are attracted by any particular design, for instance a beautiful little bracket lamp which you think you would



THE COLONIAL ROOM



THE ENGLISH ROOM

like to secure for a secluded nook in your home: Presto! All the other lights are turned off, and there it burns just as you would see it in your own apartment without the disturbing influence of other lights. This, in short, is the beauty of the whole scheme. It enables you to select just what you want.

From the Colonial Room we enter the English Room with designs altogether different, to harmonize with that particular style of architecture. In the center of this room is a beautiful electrolier of plated silver, built at a cost of hundreds of dollars. Here as in the first instance, the unit feature has been carried out so that you can see any one of all the lights burning by itself.

Perhaps the finest room of all is the French Room, done off in beautiful brown wood with a finish of satin like fineness. The picture can convey to your mind but a very inadequate conception of the effects there obtained by the skillful arrangement of the electric lights in fixtures of surpassing beauty.

When all of the lights are turned on in all the rooms you wander around in a veritable fairyland.

The designs of fixtures displayed are all of them exclusive, which appeals to the average buyer. You will not find one of them displayed in any other store. If you buy one of the more elaborate pieces you may rest assured that not another one like it will be sold, at least within a radius covered by many states, while if it is one of the smaller pieces no one in your immediate neighborhood can obtain one at any price. There is a certain comfort in this.

Christmas Suggestions

"The twenty-fifth of December isn't so very far away. What are we going to get for Willie?" It isn't a bad idea to give the subject a little serious consideration right now. If the boy is a real live boy—which goes without saying—the chances are ten to one that he takes an interest, and a pretty lively one, in electricity. Likely as not he has been doing a little experimenting on the side, and perhaps you have been out of patience when you were tripped up in a coil of wire or had to sweep up bits of insulation from the floor after he had been at work.

Now why not encourage him if he has an inclination in this direction? It isn't likely that he is a sprouting Edison, but still he may have the making of a mighty good electrical engineer. So if he wants to telegraph to his chum across the street, or across the city by wireless; if he wants to have motors and batteries and dynamos around, why not get him something of this sort for Christmas?

It is so easy to go to a department store now-a-days and get these very things or select from a dealer's catalogue. There are miniature trains driven by real electric locomotives; electric trolley cars; induction coil outfits which will amuse a half a dozen boys at once; telegraph instruments for amateur lines; wireless telegraph sets, both sending and receiving and complete in all their details; complete experimental outfits containing batteries, small dynamos, motors, wire, miniature lamps and a hundred other things.

These devices are no more expensive than other varieties of toys and are far more amusing and instructive for a boy who is naturally of a scientific turn of mind.

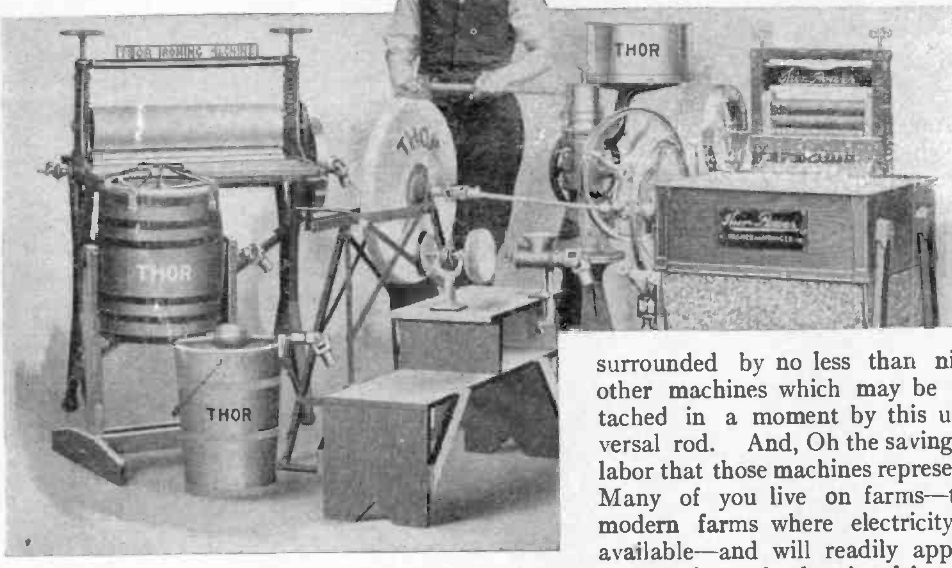
Electricity, the Busiest Worker

If an electrically operated washing machine is possible why not an electric ice-cream freezer, meat chopper, silverware polisher, grindstone, churn; in fact, why cannot all the heavy household tasks be performed in the same manner? Those of you who are not thoroughly posted on what electricity can do in the home would be surprised if you could but know of all the labor saving devices that have come into use even in the last year or two.

"What won't they think of next?" you say, and it does indeed seem that manufacturers are trying to outdo each other to see which can think up and execute the greatest number of new ideas in this line.

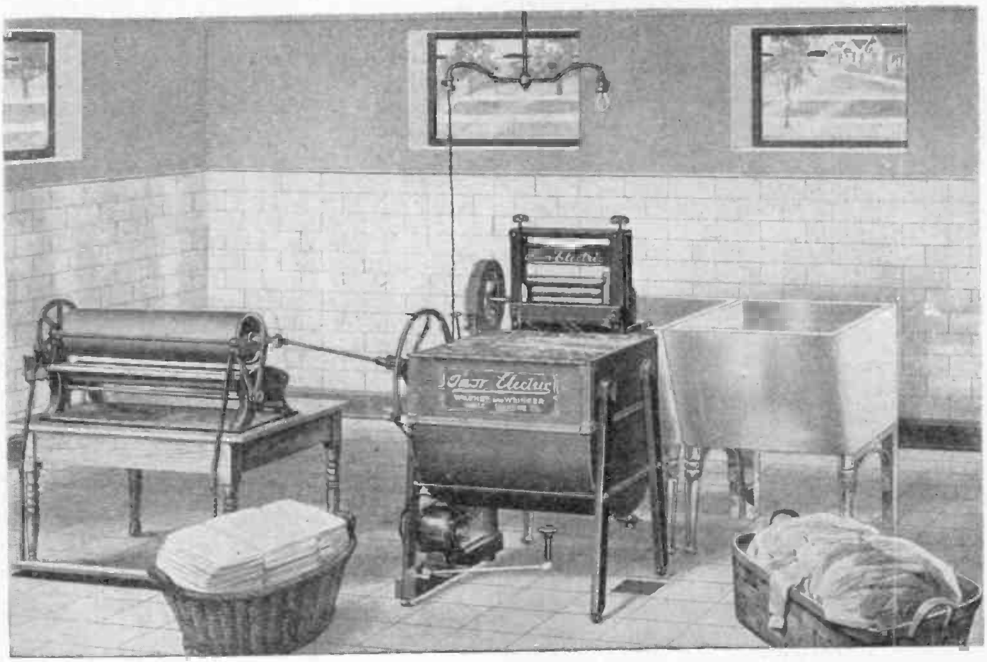
One maker of washing machines was early in the field with an electric motor driven machine, the motor being installed under the frame of the machine out of harm's way. Of course that tiresome backache producer—the wringer—by the aid of a little simple gearing was soon made to feel the magic touch of the spirit that lives in the wires, and inspired the proud designer to say that electricity now "does everything but hang out the clothes."

But the designer wasn't content to rest upon this achievement. He saw other things about the house that might just as well be run by electric current and only sought for some plan to apply the power of the motor already made necessary for the washer. It wasn't long in coming and he called it the universal rod. This simple affair is nothing more than two "universal joints" and a connecting rod. Now you don't need to know what a "universal joint" is if you don't wish to. Suffice it to say that it permits the drive wheel on the washer to operate other machines even if they are higher or lower than the shaft of the drive wheel.



In one of the illustrations you may see the washing machine and motor surrounded by no less than nine other machines which may be attached in a moment by this universal rod. And, Oh the saving in labor that those machines represent. Many of you live on farms—the modern farms where electricity is available—and will readily appreciate the adaptation of electric drive to such tasks as churning, separating cream, grinding tools, etc.

The other illustration is a view in a family laundry equipped with the "Thor" machine as it is called, and which operates, in addi-

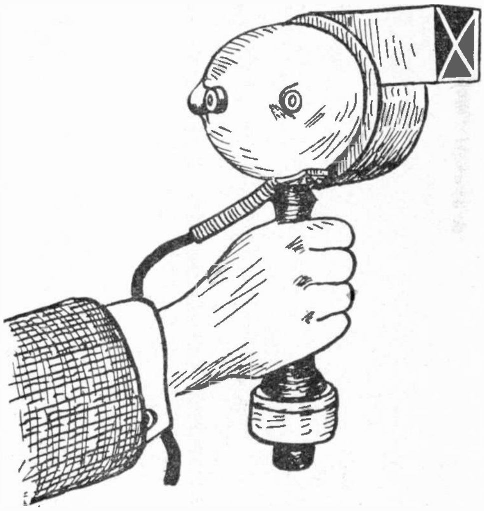


tion to the washer and wringer, an electric ironing machine.

In these cases electricity is the busiest worker in the house, being at once washwoman, house-maid, laundress and man-of-all-work, all in one.

Electric Hair Drier

And now we have the electric hair drier which is almost a blessing in view of the ease and quickness with which a one-time tedious operation may be performed. No need now to sit in the sun for an hour



ELECTRIC HAIR DRIER

combing and brushing. This may be a pleasant diversion at times but then again one may be in a hurry, and nothing dries more slowly than the hair when one has no time to waste.

An electric drier is used to drive a current of heated air through the hair. It consists of a small enclosed electric fan, held by a convenient handle in the lower end of which is a snapswitch for turning on and off the electric current. As the fan revolves it draws air in through holes in the casing and throws out a powerful blast from the nozzle-like opening. The air before it leaves the casing is also heated by a small heating coil on the order of the heating units of electric flat irons.

A sketch of one of these fans is shown. The blower case is made of an aluminum casting—light and very neat in appearance. The motor is a high grade machine adapted to operate on either alternating or direct current.

Don't Fear Electricity

To some women the very word "electricity" conjures up visions of a deadly something which lurks in the wires, and contact with which is a constant menace to safety. Fortunately this false notion is rapidly becoming eradicated as people in every walk of life are becoming more familiar with and dependent upon this form of energy. There are still some nervous ones, however, who, though they envy their sisters the comforts and conveniencies which only an electrically equipped home can offer are still a little afraid to work around "those dangerous switches and things" as they express it.

Now as a matter of fact electricity in the home is far safer to have around than gas or other forms of fuel. You are in infinitely more danger of injury when you hoist a bucket of coal to the top hopper of a coal stove or touch a match to the jet of a gasolene stove.

The reasons why electricity is safe are two in number—and very good ones. First, it is next to an impossibility to come in contact with it and second, if you did it wouldn't hurt you.

Current which is brought into our homes is at a pressure or potential of 110 volts, which is harmless. There are a very few somewhat hazy records of death resulting from 110 volt current where the victims were in conditions particularly favorable, as in electroplating rooms where the floors and the inmates were soaked in conducting solutions. But even these records are much like the stories of raining frogs—somebody else said so.

The common way for an electrician to test a lamp socket to see whether it is alive is to touch the tip of his finger to the two terminals. While it is not advised that this experiment be performed, as the sensation is somewhat unpleasant, still it shows that there is nothing to be really feared.

But as noted above it is practically impossible to come in contact with "live" parts unless you take something apart in order to do it. Wires from the outside are carefully conducted through the building in iron pipe conduits and are covered with insulation. They are brought to outlets or to lamp sockets. Insulated conductors lead from these outlets or sockets to your cooking utensils, flat irons, vacuum cleaners, etc. The plugs which are on these conductor cords to connect them with the utensils have rubber handles. The contacts in the switches are carefully enclosed. In fact the same precautions are used as if you were really dealing with something dangerous. Therefore, what have you to fear—not a thing.

Shaving Mirror

Morning or evening is generally the time when the man of the house makes the announcement: "Guess I'll take a shave." All the electric bulbs in the room are turned on and even the gas jets are resorted to, but

SHAVING MIRROR

the cumulative effect of all these light sources seems only to accentuate the shadow on the side of his face which is away from the light, and bitterly he talks to himself as he scrapes this dark side with trembling hand.

Some say that the new electric mirror makes shaving a pleasure. Perhaps that is a trifle overdrawn but it certainly does make it a safer and more rapid operation. As seen in the sketch this device consists of a portable mirror on the base of which is mounted a long tubular incandescent lamp enclosed in a cylindrical casing which constitutes the reflector. A small section of the casing is open through which the light rays are emitted. The casing can be revolved so that the light from the opening will fall on the lower part of the face and not in the eyes. A lamp cord to the nearest socket completes the apparatus.

But the man needn't think for a minute that he is going to have the exclusive use of the mirror. It will be found a fair share of the time on his wife's dressing table where its usefulness—for other purposes—will be just as fully appreciated.

The Electrical Home to Be

For electricity there is a vast and wonderful future. Before my mind's eye appears a panoramic view of the human race; its sorrows and its joys controlled by electricity, its pains alleviated, its life prolonged, and the burdens of the workaday world borne by this wonderful and apparently abstract quantity. What we see with the eye is not electricity itself, but effects of which it is the direct cause.

These thoughts found me in an impressible mood. I was visiting the beautiful grounds and buildings of the Alaska-Yukon-Pacific Exposition and I could not but wonder to myself, as I gazed inspired at the beautiful illuminations, if electricity were not some day to become the ruling force in this world of ours.

The kitchen department was naturally to me of particular interest. In passing through it we realize what electricity is doing for the feminine sex, for despite the fact that women are claiming a place in the commercial and political world, they are still more or less slaves to the kitchen by choice or compulsion.

Let us live and revel in the belief that the time is rapidly approaching when all household requisites shall move to and from us by the mere touching of a button; when we may sit comfortably at the table while the different courses glide noiselessly in and out, controlled by a switchboard attached to our dining table, and discarded plates will remove themselves, and in fact everything will move in perfect harmony. In those days our table conversation will not require to be regulated according to the gossiping capabilities of the dining room girl. It may even be that at some future time our emotions may be lessened or intensified by means of electricity, according to our desires and the resisting power of the will be backed up by so many volts.—MARGARET I. MACDONALD.

Some Simple Telegraph Circuits

From time to time the readers of Popular Electricity who are interested in amateur telegraphy have sent in descriptions and diagrams of the circuits which they use, some of which are printed below for the benefit of others who are experimenting along this line.

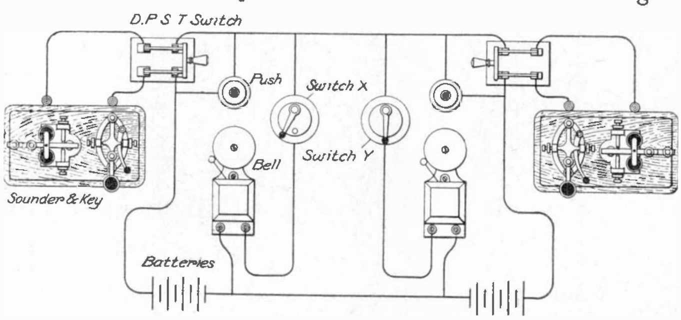


FIG. I. CIRCUIT WITH CALL BELL SIGNAL

CALL BELL CIRCUIT

A circuit by which the call signaling is done by electric bells is shown in Fig. 1. At each station is the ordinary key and sounder connected to the line through a double pole, single throw switch, a battery being also located at each station. The call bell at each station is then connected across the line together with a switch. The push button at each station for ringing the other station is connected around the double pole switch as shown.

The double pole switch is normally left open and the switch in the bell circuit is closed. The line is then in a position for signaling. When operating, the double pole switch is closed and the bell switch opened.

OPEN CIRCUIT LINES

Fig. 2 shows a form of open circuit telegraph line which is very easy to construct. In this case it is imperative that a battery be located at each station as shown. The switch at each station is normally left so

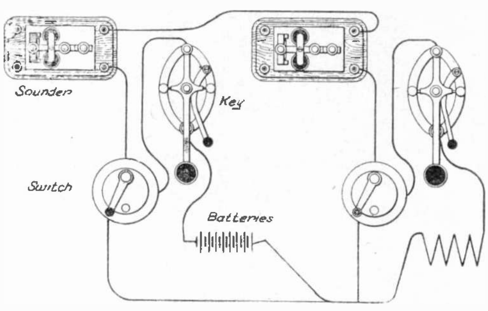


FIG. 2. OPEN CIRCUIT SET

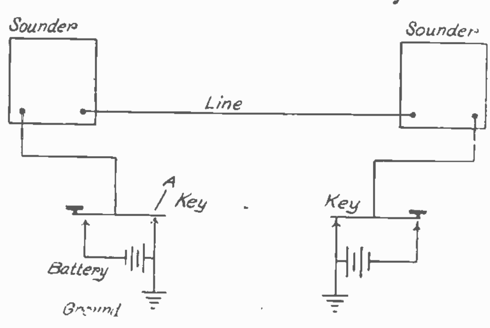


FIG. 3 OPEN CIRCUIT SET

that key and battery are cut out. When one operator wishes to call the other he throws his switch over to the other point, as shown on the diagram, which places his key and battery on the line in series with his

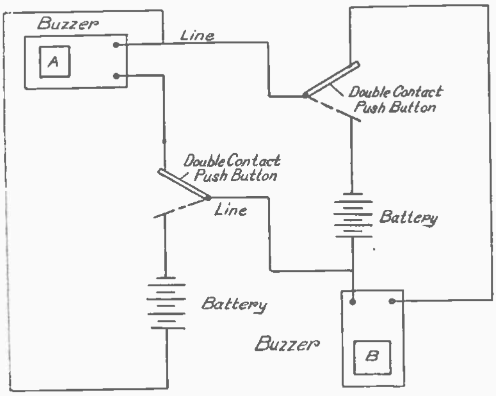


FIG. 4. BUZZER TELEGRAPH

sounder, and he is able to signal the other operator whose sounder is normally in circuit. The other operator in signaling does likewise.

Another type of open circuit telegraph is shown in Fig. 3. For this equipment there is required a regular sounder and key at

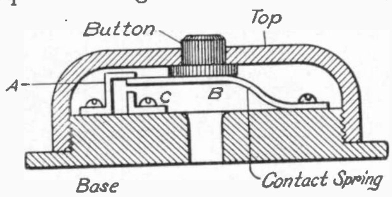


FIG. 5. DOUBLE CONTACT PUSH BUTTON

each station. The sounder should be wound to about 20 ohms resistance for lines over a few hundred feet.

On the back of the key at (A) in the diagram put a strip of brass (insulated from the base) in such a way that the set screw on the lever will touch it when not in use. Connect the strip with the ground in the case of a grounded line, or in the case of an all metallic line, with the second wire.

Connect the binding post or leg which connects with the frame to the binding post of the sounder, as indicated. Run the line wire to the other post of the sounder. Then connect the other post of the key to the battery, and from thence to the ground.

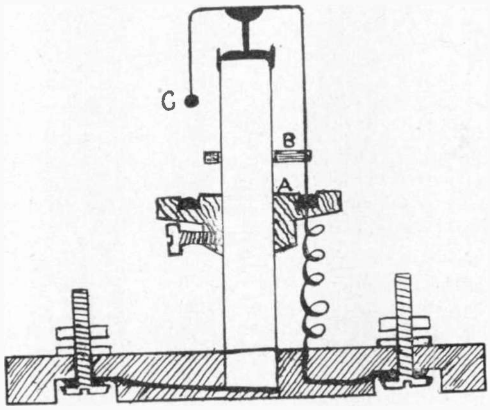
Strictly speaking, this is a closed circuit system, although the battery is not normally on the line.

BUZZER TELEGRAPH

A suggestion for a buzzer telegraph is shown in Fig. 4. It makes use of two line wires and double contact push buttons, a detail of the latter being shown in Fig. 5.

One of Faraday's Original Experiments

In following out the experiments outlined in Popular Electricity, I have noticed that the more classical experiments are for the most part omitted. In the September issue a picture of Michael Faraday brought back to my mind a number of his original



A CRUDE FORM OF MOTOR

experiments. One of his most interesting experiments can be carried out by means of the apparatus described below.

Obtain a bar magnet about six inches long and one quarter of an inch in diameter. Mount the magnet in a hole drilled in a suitable hardwood board. Solder a wire to the lower part of the magnet and connect to an old battery binding post. Around the top of the magnet glue a narrow piece of black paper to form a mercury cup. Turn another cup of the form shown in cross section at (A). This is best made of hard rubber though either vulcanized fiber or a piece of close grained wood will do. Drill a hole through the centre of the cup so that it fits the magnet closely. A set screw may be added which will greatly aid adjustment. Connect the bottom of the cup to a binding post as shown.

The revolving part of this instrument is made out of a piece of hard brass wire. Take a piece of No. 18 wire about six inches long and two inches from one end solder the point of a needle. Bend the wire as shown and pass through a thin, hard rubber guide ring (B), which fits the magnet rather loosely. A counter-balance (C) will also be needed. Adjust this so that the ring does not touch the magnet.

Fill both mercury cups with pure mercury, first amalgamating all conducting surfaces. Adjust the large cup till the brass wire just touches the surface of the mercury and then attach a dry battery to the terminals. If the instrument is properly adjusted the wire will revolve with considerable speed. The direction of rotation may be changed by reversing the current. This instrument aptly illustrates the principle of the direct current motor.—Gordon O. Philp.

Transformed Lighting Current for Small Motors

By LOUIS H. ROLLER

Every year there are many boys who get toy motors or miniature electric railways as Christmas gifts, and these are usually operated by dry batteries. The boy soon finds that dry batteries are not to be depended upon for motor work, and naturally seeks some other source of power. If alternating current is used in lighting his home he may transform it to a potential or voltage suitable for his motor, and thus obtain a cheap, steady, convenient, safe and flexible source of power. The small transformers described in the September, 1909, issue (page 331), may be used for this purpose, a potential of twenty volts having been found most satisfactory for railway operation. An equipment for controlling the current to and from the transformer is here described.

Fig. 1, shows a plan and side elevation of the apparatus. A hardwood box is used as a container, and the transformer is placed in the bottom, with abestos boards, (A) and (A′), above and below it, and abestos sheet rammed around it, making it tight in the box. Two cleats, (C) and (C′), are nailed to the inside of the box, just above the transformer, and on these are supported the asbestos covered wood girders, (G) and (G′), to which the ends of the resist-

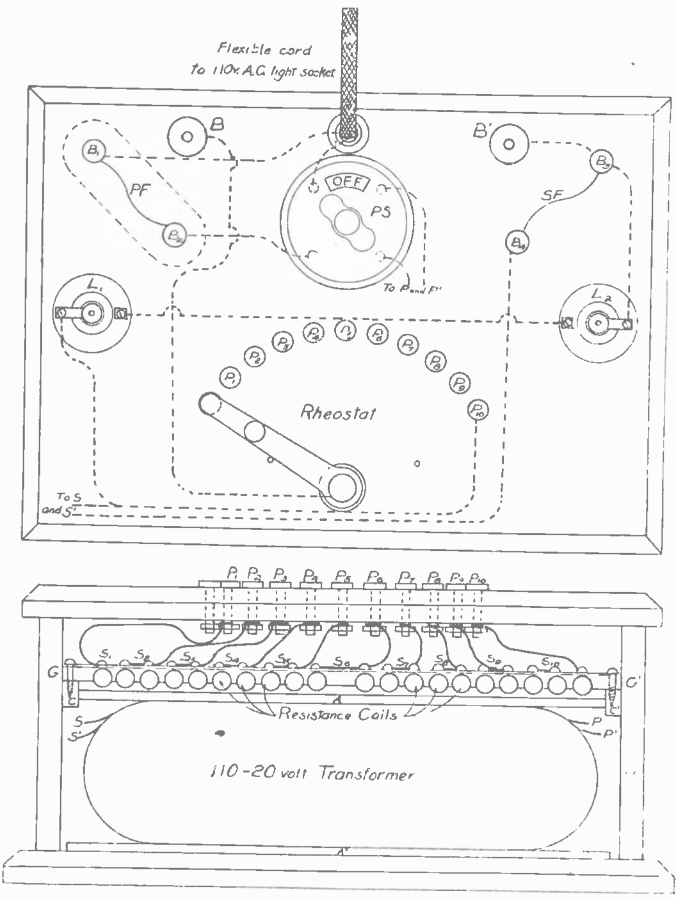


FIG. 1. PLAN AND SIDE VIEW OF CURRENT CONTROLLER

ance coils are then firmly and rigidly screwed.

The cover of the box is used as a switchboard, and contains a double pole snap switch, (PS), four small binding posts, (B1, B2, B3, B4), two large binding posts, (B) and (B′), two miniature lamp sockets,

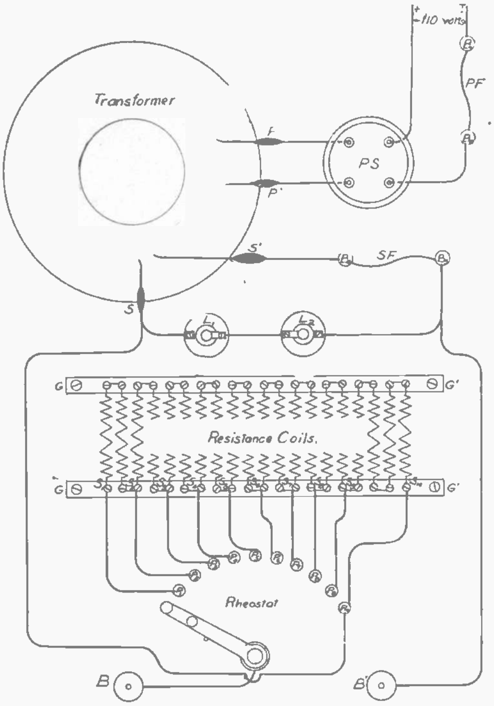


FIG. 2. CONNECTIONS OF CURRENT CONTROLLER

(L1) and (L2), and a rheostat with eleven points, (P1-P10). Fig. 1 is not intended as a detail or working drawing, but is used simply to give the amateur a general idea of what is necessary.

Fig. 2 shows the connections of this apparatus. The master switch, (PS), is used to turn the current to the transformer on or off. (B1) and (B2) hold the primary fuse, (PF), which will blow if a short-circuit occurs in the transformer or the switch. (B3) and B4) hold the secondary fuse, (SF), which protects the rheostat, motor, and wiring from short-circuits or heavy overloads. The girders, (G) (G′), are covered with asbestos sheet to prevent their burning in case the resistance coils get very hot, and the transformer is surrounded with asbestos so that it will not set fire to the box if it should burn out because of some defect in construction. The dotted line around (PF), (Fig. 1), represents a piece of asbestos on the under side of the cover to protect (B1) and (B2) from accidental contact with the wires to rheostat. Two 10 volt lamps are put in the sockets, (L1) and (L2), and by lighting up, they show that the transformer and fuses are all right, and that a current of 20 volts pressure may be taken from the binding posts (B) and (B′). This current, coming through the rheostat, may be regulated, thus giving various speeds to the motor. The resistance coils may be made of the same wire as that used in the transformer core, namely, soft iron; the length of wire to use cannot be specified here, since it varies with the size of motor and the guage of wire, and is best determined by experiment.

To give ample protection the primary fuse, (PF), must be two ampere fuse wire, while the secondary fuse wire may be of any capacity from five to ten amperes. If a fuse melts, the current to the box must be shut off, the cause of its melting ascertained, and the trouble remedied before the fuse is replaced. In railway work the secondary fuse may often blow because of accidental "shorts" on the track due to the car jumping off at a switch or crossing.

The cost of current for thus operating a small motor does not exceed a cent or two an hour.

The amateur had best keep in mind that he is now working with *power*, and that loose connections and "shorts" must be carefully avoided; this is best done by soldering and taping all joints, and using well-insulated wires.

How to Make A Direct Current Dynamo

By C. S. NEWCOMB

In the design of this machine it is intended to do away as far as possible with all patterns and molding, but it is assumed that the maker has access to a turning lathe and ordinary machine shop tools.

The field magnet (A) (Fig. 1) is made out of a good piece of soft iron 1 by 2 by 17

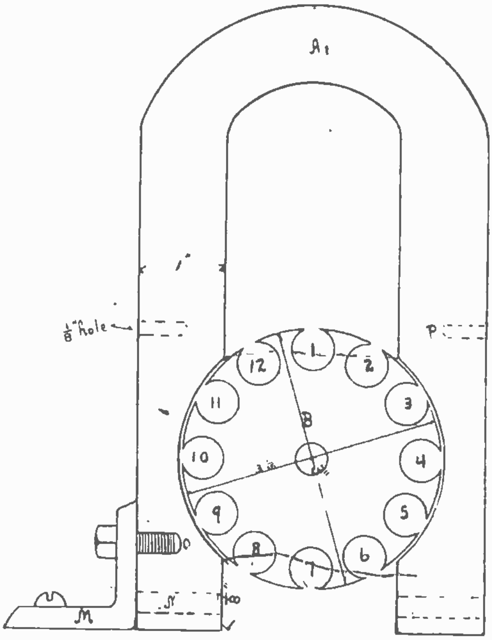


FIG. 1. FIELD MAGNET

inches, bent while red hot in the shape as shown, after which it should be carefully annealed, and then smoothed up clean on a flat emery wheel. Next bore a ½ inch hole in the toe as shown at (N) through both limbs. The hole (O) should be bored and

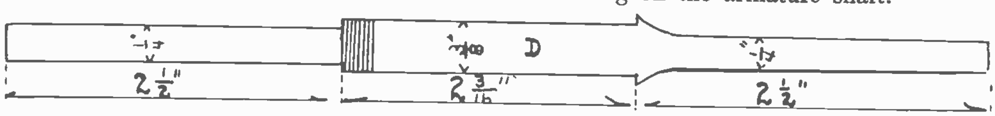


FIG. 2. ARMATURE SHAFT

tapped out ¼ inch, this should be done on both sides although in the diagram it is shown on one side only. Also bore the ⅛ inch holes on each side shown at (P); these holes need not be drilled through but should be drilled deep enough to hold a pin which will be driven in later to hold up the field coils. The distance between the limbs should be two inches. Finally the field should be cored out on a lathe, leaving the channel exactly 3 1-16 inches in diameter for the armature to run in. Shaft (D) (Fig. 2) is made out of a piece of ⅝ inch cold rolled steel, the dimensions being as shown, and a thin nut to go on the threaded part can be made by splitting an ordinary nut with a hacksaw and smoothing it up with a file.

The armature core is known as the laminated type; that is, it is made up of thin sheets of soft iron, three inches in diameter. An end view of the armature core as it rests between the pole pieces is seen in Fig. 1, the slots for the wires being of the shape shown. Now it is not an easy matter to

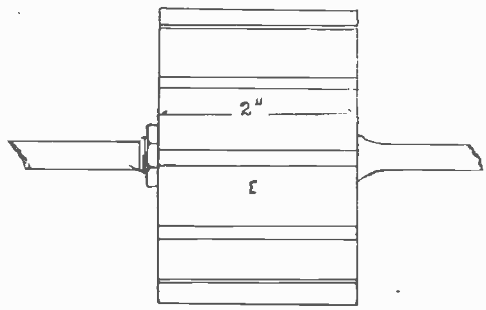


FIG. 3. ARMATURE CORE

cut or stamp out these thin sheets as there are quite a number of them. It is better to buy them outright from a manufacturer.

Whether you buy the armature stampings or make them, they should be given a thin coat of shellac on one side only, before assembling on the armature shaft.

Assemble the laminations on the shaft as shown in Fig. 3, making the core two inches long; they are held up close together by the nut on the thread portion of the shaft. After this the slots should be covered with a silk dipped in shellac, and the core ends and the shaft carefully covered with the same material and allowed to dry.

The ends of the slots, moreover, should be slightly enlarged and all sharp places in the slots removed before putting on the silk.

The bearings (G) (Fig. 4) are made by cutting a mold out of a ¾ inch board, as shown, without the holes. This is then

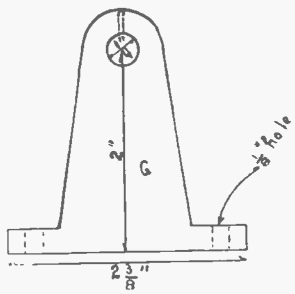


FIG. 4. BEARING

laid on a smooth, flat piece of iron and securely clamped down and run full of babbitt metal, after which the ¼ inch hole and the ⅛ inch holes should be bored. A small oil hole should also be bored in the top.

The commutator (Fig. 5) which is usually the hardest part of the machine to construct, is very simple in principle and is made out of a piece of two inch brass seamless pipe one inch long which should be perfectly round and smooth inside and out. A piece of good hardwood, well seasoned, is then secured. This is made one inch long, with a hole in the center. It is forced upon the

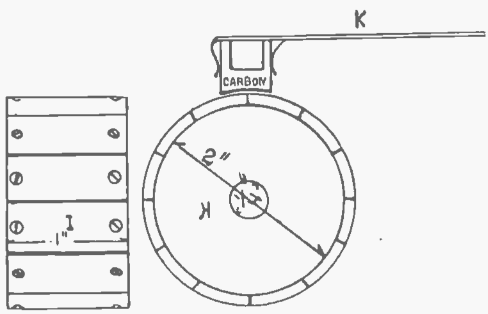


FIG. 5. COMMUTATOR AND BRUSH

shaft and trued up in the lathe until the brass cylinder makes a good snug fit. Then the brass cylinder is fitted on, first giving the wood a coat of shellac. Then inscribe on the surface of the cylinder 12 equidistant lines parallel to the shaft. Drill between the lines small holes as shown in Fig. 5, the outside end holes being countersunk. Small flat headed screws are set in the outer end. The end next to the armature core should have round headed brass screws. These screws go through into the wood core.

Then the metal along the lines should be cut out with a hack saw, clear through to the wood core, being careful to not leave any material between the cuts. The screws should not under any circumstances touch the shaft in the center of the wood core.

Brush holders (K) may be made out of thin spring brass or phosphor bronze as shown in Fig. 5, with two small holes in the end, and the lips bent to hold the carbon brushes as shown. They should be fastened to the block (C) (Fig. 6) at the ends, and this block is fastened to the base with screws.

The armature is wound with No. 16 B. & S. gauge double cotton covered wire. To

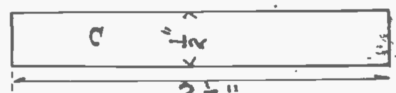


FIG. 6. BRUSH SUPPORT

wind this armature commence in slot No. 1 leaving about three inches of wire projecting out towards the commutator. Wind through slot No. 1 back through slot No. 7 until you have 12 layers in each slot. Then twist up a loop about three inches long and commence in slot No. 2 and back through slot No. 8, and so on. After winding slots Nos. 6 and 12 in this manner there will be 12 layers in each slot. Then continue in the same manner putting 12 layers more in all the slots over the 12 just wound.

To connect to the commutator in each instance the end of the first coil is connected to the beginning of the next throughout and these junctions carried to the corresponding round headed screws on the commutator.

Field coils should be wound with two pounds of No. 22 single silk covered magnet wire wound on a form which should be slightly larger all round than the magnet yoke, and two inches long. This will give about 700 turns or one pound to each coil. It will be well to wind the form with thick paper before commencing to wind the coil and to give each layer a coat of shellac and allow to dry before putting on the next. When the end is reached carefully tape and cover the coil with a layer of paper and then wind on one layer or 20 turns of No. 11 double cotton covered magnet wire for the series coil. When dry remove and tape the coil, slip it onto the magnet and drive in the

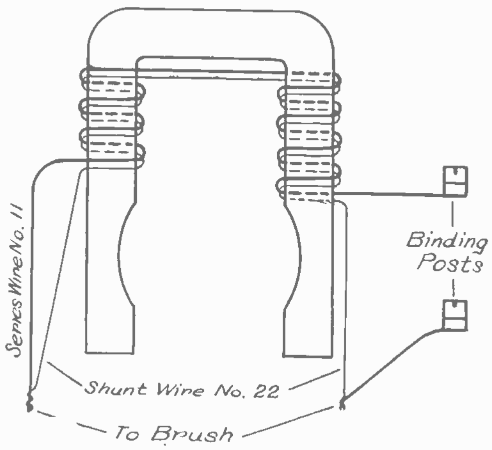


FIG. 7. FIELD WINDINGS

pin in the ⅛ inch hole, to hold in place. The next coil is wound in the same manner.

Connect the outside end of one of the No. 22 coils to the left hand brush and the inner end of this coil to the beginning of the other No. 22 coil. The opposite end of the latter coil is then connected to the right hand brush. The No. 11 left hand coil has the beginning end connected to the left hand brush and the other end to the beginning of the second No. 11 coil, the opposite terminal of the latter going direct to the line on the same side; that is, the series coil is in series with brush and one side of the line. This is made clear in Fig. 7.

The machine should be run at least 1500 revolutions per minute, and if the voltage is not enough increase the speed. To get the best voltage control it is recommended that a rheostat be cut in on the shunt wires, when if the power is constant the voltage can be regulated very closely. This machine has a capacity of 10 amperes but loads of 15 would not be safe for a long time as the machine is considerably overloaded at this amperage and would possibly get hot enough to ruin the armature windings.

Does Lightning Strike Twice in the Same Place?

The above question is graphically answered by the two excellent lightning photographs reproduced herewith. The photographs were taken by Charles F. Brooks and Frederick A. Brooks, sons of Morgan Brooks, who is Professor of Electrical Engineering at the University of Illinois.

The scene is on the shores of Lake Minnetonka near Minneapolis, Minn., the distant shore being within the limits of the village of Wayzata. The tree outlines were produced entirely from the brilliant flashes, which are also seen reflected in the water

One of the photographs was taken at about 5 a. m. of August 17th, while the second and more brilliant picture was secured about midnight, five days later. As seen in these pictures the flashes are in exactly the same place relative to the surrounding scenery; that is, as far as can be observed from one point. It is possible, of course, that one flash may have been further away from the camera than the other, but it is altogether more probable that the two flashes struck the same tree, or whatever the prominent point may have been.

QUESTIONS AND ANSWERS

Readers of Popular Electricity are invited to make use of this department. State your questions as clearly and concisely as possible. No consideration will be given to communications which do not contain the full name and address of the writer

Direct Current Generator as Alternating Current Motor

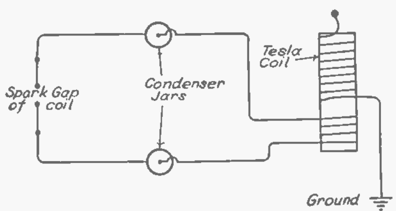
Question.—Could a 4-pole compound wound direct current generator be used as an alternating current 110 volt, 60 cycle motor without rewinding?—N. S. G., Sumpter, Ore.

Answer—No.

High Frequency Current in Therapeutics

Question—I am building a 12-inch induction coil and would like to know if the current from this coil can be converted into high frequency so that it may be used as a therapeutic agent. I understand that this can be done by means of a Tesla coil. If this is so, what would be the dimensions of such a coil?—C. L., Minneapolis, Minn.

Answer.—Form a hollow cylinder of dry birchwood 10 inches in dimaeter and 22 inches long. On one end of this cylinder



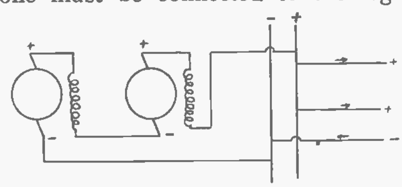
HIGH FREQUENCY APPARATUS

wind the primary, consisting of a single layer of 22 turns of No. 14 rubber-covered single-braid wire, such as is used in wiring. The ends of this wire are connected to two binding posts but not connected to the secondary in any way. The remainder of the cylinder, starting one inch from the primary, is wound with No. 19 rubber covered fixture wire in a single layer. The end of the wire near the primary is the end to by grounded, the other is connected to a terminal on the top of the cylinder, to which the electric appliances are connected. The condenser jars should be 12 inches high and about four inches in diameter, with tinfoil eight inches up from the bottom, inside and out. Connect to the coil as per diagram

Generators in Series

Question.—Please explain how to connect two generators in series, giving additional necessary information.—B. F. A., Nelsonville, Ohio.

Answer.—Generators are used in series on arc circuits and as boosters. To connect machines in series, the positive terminal of one must be connected to the negative



GENERATORS IN SERIES

terminal of the next, as shown in Fig. 1. Each machine must have a current capacity equal to the maximum current on the circuit, but they may differ as to voltage rating; that is, one machine may generate at 50 volts and the other at 450 volts. The voltages of the machines in series are added together, so that the danger to insulation is increased. Series wound dynamos have usually a regulator of some sort. These may not work together. If they do not, connect them so they must. As you do not state winding of your machines we would add that shunt dynamos run well where the field coils are connected to form one shunt across both machines. Again, on compound machines, both shunt coils may be connected so as to be supplied by one armature, the series coils being in the main circuit.

A common return may be used for both generators. In fact it may be connected to the negative bus bar.

Hydrogen Generator for Lead Burning

Question.—Explain the construction and operation of a hydrogen gas generator for lead burning.—W. S., Baltimore, Md.

Answer.—The gas generator used by the largest storage battery manufacturers is constructed as shown in the accompanying cuts. It is simply two wooden boxes, lead lined, one above the other as shown in Fig. 1, and connected by a lead pipe running from the bottom of the upper box to near the bottom of the lower box. The lower box must be air tight except for the pipe opening

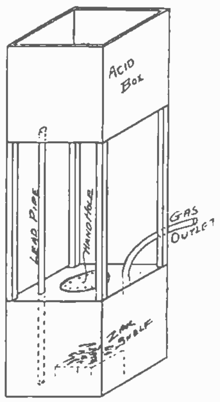


FIG. 1. HYDROGEN GENERATOR

and another pipe connection for the gas; it is also provided with a large hand hole made tight with a rubber gasket for cleaning and renewing. The upper box is open or partly open at the top. The boxes are generally of ¾-inch wood about 18 inches square,

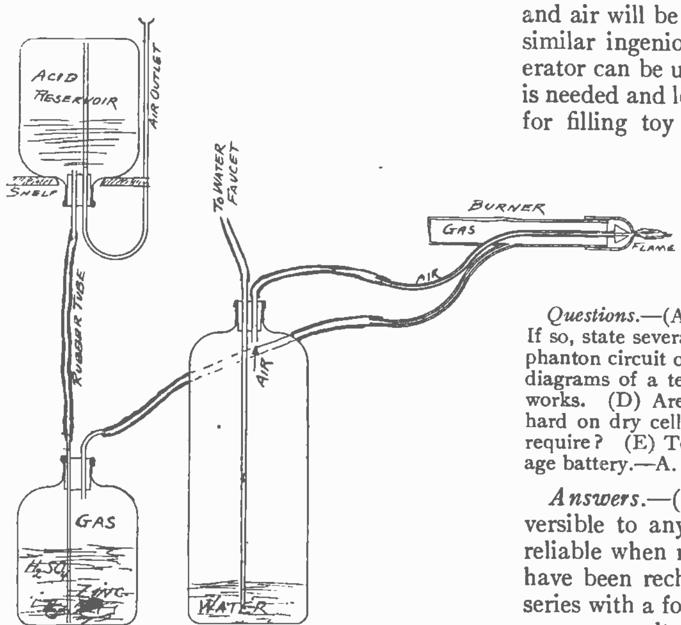


FIG. 2. HYDROGEN GENERATOR MADE FROM GLASS FLASKS

the top one about three feet above the other. You can make them of any convenient size and if you are not going to use them much you need not line them, but coat them when dry with a few good coats of rubber paint inside and out. Large glass flasks may be used to advantage instead of the boxes, as shown in Fig. 2. Two five gallon water bottles are sufficient. In operation a quantity of zinc is placed on a shelf in the lower box or in the lower bottle. The upper box is filled three-fourths full of sulphuric acid (H_2SO_4) diluted with twelve volumes of water and the stop cock opened to the burner. This allows the acid to run down in contact with the zinc, and hydrogen gas is generated. Care must be taken to get all the air out of the generator before the gas is lighted, or an explosion will follow. When the gas is shut off, the pressure forces the acid back to the upper box away from the zinc and stops the generator. The shelf keeps the zinc away from any little acid that remains below. The burner is clearly shown in Fig. 2 and may be constructed of brass tubing, or can be bought cheaply at any chemical house. You must have an air pressure to operate the burner successfully and this may be obtained from a bellows or similar arrangement, or, get a very large flask and fit up as shown, then allow water to run into it from a faucet and air will be forced out. There are many similar ingenious arrangements. This generator can be used where any pure hot flame is needed and leaving out the air may be used for filling toy ballons and similar devices.

Recharging Dry Cells; Current Consumption of Battery Tungsten Lamps; Pocket Storage Battery

Questions.—(A) Can dry batteries be recharged? If so, state several ways. (B) Show and explain a phanton circuit on a telephone line. (C) Show the diagrams of a telephone pole changer and how it works. (D) Are the new battery tungsten lamps hard on dry cells and how much current do they require? (E) Tell me how to make a pocket storage battery.—A. A. R., Glasgow, Mo.

Answers.—(A) Dry batteries are not reversible to any efficient extent and are not reliable when recharged. "Dead" batteries have been recharged by connecting them in series with a four or eight candle power lamp on a 110-volt direct current for from 15 to 30 minutes, but, although some batteries thus recharged have been kept on heavy service for a long time, other batteries similarily treated would not hold the charge. Care must be taken to connect the positive pole of the battery (carbon) to the positive wire. The positive wire may be determined by dipping the two wires in acidulated or salt water. The wire which gives off the most bubbles is negative.

(B) and (C) See October issue.

(D) Dry batteries are not designed for constant service and will run down quickly if used steadily on any lamp, but may be used intermittently with good results. The tungsten battery lamps require but 1¼ watts per candle. A one C. P. 1½-volt lamp would require about one ampere and would quickly run down the ordinary dry battery, but the one C. P. 6-volt lamp would require less than ¼ ampere, hence it is preferable to use higher voltage lamps. The same size carbon filament would require much more current.

(E) To answer this question would require too much space to be given in this department. An article on this subject is contemplated for a future issue.

Shunt and Compound Wound Generator

Questions.—(A) Assume a shunt-wound generator running under two-thirds load. Suppose the whole load to be suddenly removed without adjusting the rheostat. What would be the result? (B) Kindly answer the same question as to a compound wound machine.—E. D. B., Denver, Colo.

Answers.—(A) In a shunt-wound dynamo the field voltage decreases as the load comes on unless controlled by the rheostat. A sudden removal of the load would cause the voltage to rise, possibly burning out any lamps left on. The voltage rise would not harm the machine if the governor of the engine were properly adjusted.

(B) As the field excitation in a compound wound generator is made up of both a shunt and series winding, opening the external circuit would remove the effect of the series turns and lower the voltage.

Making a Voltmeter; Formula for Voltage; Lines of Force

Questions.—(A) In the September issue is described an ammeter operating on the principle of a solenoid. Can a voltmeter be made depending on the same principle. If so, what change is necessary? (B) Will you give a formula for voltage to be obtained from a dynamo, this formula to depend upon the number of active yards of wire on the armature. (C) How can the number of lines of force in the field of a four pole dynamo be estimated, not knowing the exact quality of the iron in the poles and armature?—C. F. S., Jr., Brooklyn, N. Y.

Answers.—(A) The pull on the solenoid depends upon the number of ampere-turns in the coil. To use the instrument as a voltmeter it would be necessary, by Ohm's law $C = \frac{E}{R}$, to make the resistance (R) of the coil large enough so that when the terminals were placed across mains having a difference of potential E, that C would be sufficient to give a full scale deflection, where E is the maximum voltage which you wish to measure with the instrument.

(B) The E. M. F. in an armature is expressed by the formula.

$$E = \frac{P\,B\,Z\,S}{M \times 10^8 \times 60}$$

where P = the number of field magnet poles.
O = the total number of lines of force entering or leaving the armature at each pole piece.
Z = number of conductors on the armature.
S = R. P. M. of the armature.
M = number of paths or circuits through the armature.
$\frac{Z}{M}$ = average number of conductors in series on each path or coil.

The formula you ask for would be difficult to state for armatures of various dimensions, while the above rule holds for all armatures.

(C) Solve the above quotation for B after substituting the values of Z, S, M and P.

500-Volt Motor and Engine; Switchboard to Pass Inspection

Questions.—(A) I have a 500-volt, one H. P. A. C. motor. Would it be advisable to rewind the armature or build a transformer, as I desire to run the motor as a dynamo and wish to get 110 volts? (B) Will a 1½ H. P. gasoline engine run the dynamo on a average load? (C) I am making a switchboard for a 110-volt system. Please tell me the rules to observe in order that it may pass inspection.—H. C. G., Haverhill, Mass.

Answers.—(A) We would advise that you build a one kilowatt transformer having a ratio of 5 to 1. The primary of such a transformer connected to your dynamo would carry about two amperes and the secondary slightly over eight. See "Construction of Ring and Core-Type Transformers" in September issue.

(B) Yes, but you may have to adjust the pulleys to get the proper speed on the dynamo.

(C) In answer to W. S. in the May, 1909, issue, connections and devices for a standard switchboard are shown. The panel should preferably be of slate of marble supported by metal brackets from the wall, or by angle iron posts from the floor, supports to be placed so as to give at least eighteen inches between the wall and apparatus on the board. The board should be built so that a space of at least ten or twelve inches is left between the floor and the board, except when the floor about the switchboard is of concrete or other fireproof construction, a space of three feet if possible being also provided between the top of the board and a combustible ceiling. The board should be located in a dry place. A main service switch and fuses equal to the rating of the dynamo must be provided. Provide a metal clad voltmeter and a ground detector, protecting these and pilot lights by standard fuses of not over six amperes capacity. This circuit should be wired with not less than No. 14 B. & S. gauge wire. All wires larger than No. 8. B. & S. gauge must be soldered into lugs for all terminal connections. Switches should be only such as are approved and noted in "List of Electrical Fittings" for use under the rules and requirements of the National Board of Fire Underwriters. Bus-bars of opposite polarity if mounted directly on the board must be spaced ¾ of an inch apart and where crossing in air ½ an inch separation is permissible. The National Code urges "that greater distances be adopted wherever conditions will permit." A common error is that of placing grounded bolts of the supporting angle irons too close to live current carrying parts. The last rule quoted applies here also.

Annunciator Circuit

Question—I have a fifteen-drop annunciator. There are eighteen binding posts and two pushes at the bottom. Please give diagram illustrating the connections of same with bells, pushes, and battery. I think the annunciator is of French make.—L. B., W. Somerville, Mass.

Answer—We are not able to answer your question explicitly from information given, but give two diagrams, Figs. 1 and 2 in common use. Fig. 1 shows a battery wire (B) and return wire (R). (B) connects through the bell to the coil of each drop From the other side of each coil a wire runs to a binding post, through a push button, thence to the return wire (R). Your drops on the annunciator may be arranged to ring the bell after the button is released and until the indicator is placed in position in which case another wire (S) common to one side of each coil would be necessary, the falling of the indicator shunting out the push button as shown in both figures, until the indicator is restored, and requiring an extra binding post. Another binding post may be provided to which bell wire may be connected if the bell is not on the annunciator. These hints may assist in determining the use of each binding post.

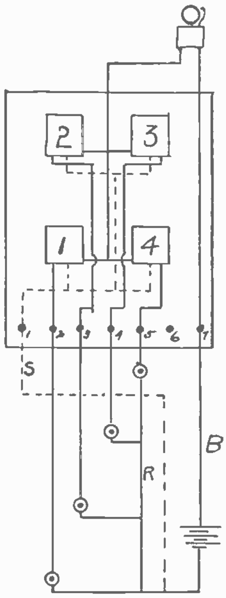


FIG. 1

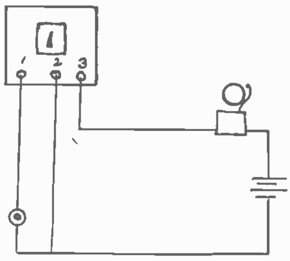


FIG. 2

Operation of a Manual Fire Alarm System

Question.—Please explain the operation of a fire alarm system. Why does the bell ring until the street box is set?—G. C., Denver, Colo.

Answer.—A fire alarm system may be divided into two parts: that inside a building, and consisting of manuals, local batteries, bells, testing apparatus, and an indicator on the outside telling firemen the floor where box is pulled; that outside, made up of the main alarm circuit, street signal boxes, and at the central office of a relay in each circuit, a register for each relay to make note on a tape of the signals, and an automatic signal repeater. One feature carefully observed regarding city and building boxes is that they shall not be connected electrically, and yet be so arranged that "pulling" the building manual sends in the street box.

Fig. 1 shows the general plan of such an arrangement, (AB) being the fire manual in the building, and (STB) the street box.

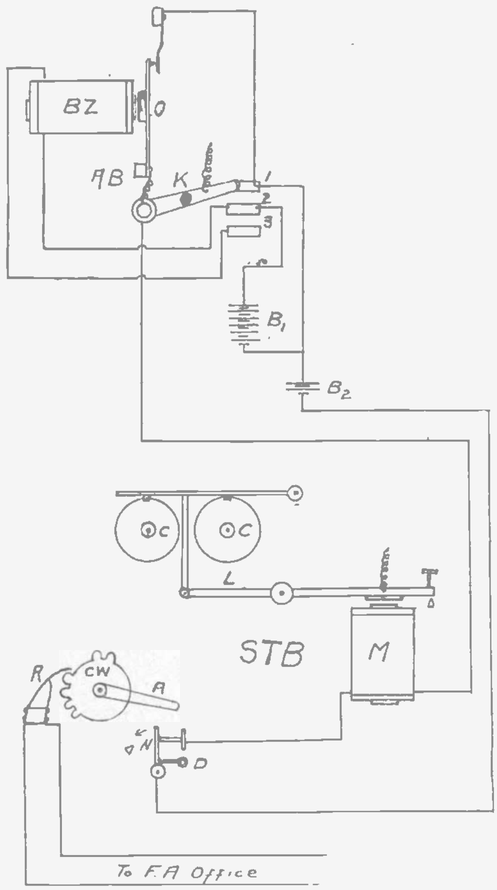


FIG. 1. GENERAL PLAN OF FIRE ALARM

The lever (K) on contact (1) cuts in battery (B_2) through (M), (B_2) not being sufficient to operate lever (L). In case of fire or test, (K) is pulled down to contact (2) which adds (B_1) to battery (B_2). This pulls the armature of (M) down, pushes (L) up and releases clock work (C) which turns contact wheel (CW), registering the number of the box as the circuit is broken and made at (R) by teeth on (CW). Immediately (K) is pulled from (2) to (3). This places battery on (BZ) which causes armature (O) to be attracted until (A) on (CW) strikes (N) and opens the circuit held closed by counter weight (D). The operation of armature (O) is called the "answer back" signal and indicates that the street box has gone in.

Fig. 2 represents the same equipment as in Fig. 1 with some additions, such as a galvanometer (G), a testing switch (S), fire bell (F), cross relay (C), disturbance bell .(D), and trip relay (T). This additional apparatus is usually located in the

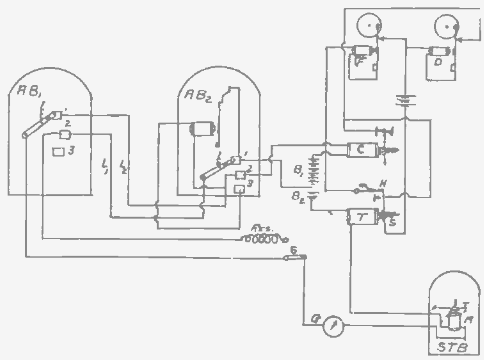


FIG. 2. FIRE ALARM CIRCUIT WITH ACCESSORIES

engine room, except the fire bells, which are placed on each floor. The circuit through the boxes (AB) to the street box (STB) is always closed through the battery (B_2). Now let us note the effect on the magnets of pulling a box. (C) and (T) are magnetized thus putting battery on (F) and (D), ringing the bells. Then the street box is opened at (N), Fig. 1, but armature of (T) has been pulled past the insulated end of spring (H) and locked, keeping (F) ringing, while (D) stops until a knob not shown is pushed, lifting (H) and allowing spring (S) to pull the armature of (T) back; but as the street box is still open, battery (B_2) is not in the circuit of (T) so its armature strikes the back contact and starts (D) again which rings until street box circuit is "set," when (B_2) pulls the armature up to (H).

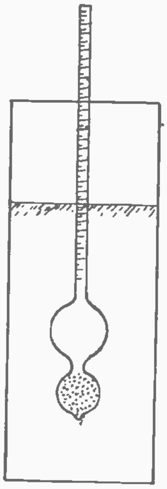
If (L_1) and (L_2), Fig. 2, get "crossed," relay (C) is attracted and disturbance bell (D) rings. If either (L_1) or (L_2) opens, armature (T) falls back and (D) rings. The reading of (G) shows the general condition of (B_2) and the system. Closing (S) on (Res) tests (B).

Small Motor; Hydrometer

Questions.—(A) How can the motor described in the May, 1909, issue be made into a dynamo giving six volts and four amperes? (B) What is a hydrometer and how made?—F. N., Braintree, Mass.

Answers—(A) Add a few more turns of wire to the armature coils and run at good speed.

(B) If a body floats in water without being wholly submerged, two forces act upon it—(1) the weight of the body; (2) the buoyancy of the water, which latter is equal to the weight of the water displaced. For example, ice floats in water with 0.918 of its bulk submerged. Water having 0.918 of the volume of a piece of ice weighs the same as the piece of ice; or, if the specific gravity of water be taken as one, the specific gravity of ice is 0.918. In place of a piece of ice, instruments called hydrometers are used to measure the density or gravity of various liquids as compared with water. The diagram shows one of these instruments, consisting of two glass bulbs, the upper terminating in a stem, while the lower bulb before being sealed is filled with shot to cause the instrument to float vertically. Mercury may be used in place of shot. Calibration may be made by placing another standard hydrometer in the liquid with the new one, marking the stem of the latter in accordance with what the standard instrument shows. A second method is to place the new instrument in water marking the point to which it sinks as 1. Place in other liquids of known specific gravity until sufficient points have been marked to give the range desired.



HYDROMETER

Three-way Switches; Equalizers

Questions.—(A) Please explain three-way switches. (B) Explain a balancing set used in a power house in connection with a three-wire system—a machine that boosts one side or the other according to requirement.—O. E. B., S. Omaha, Nebr.

Answers.—(A) See answer to W. W. H., February, 1909.

(B) In Fig. 1 (A) and (B) are two machines running on the same shaft. When running as dynamos they generate a voltage of one-half that of the dynamo (D). They are called "equalizers" or compensators." If one side of the system is lightly loaded the machine on that side will run as a motor driving the other as a dynamo. If the two sides are exactly balanced, both machines will run as motors not loaded, taking very little power. They require little attention and are automatic in their control.

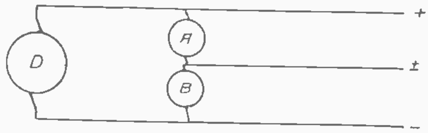


FIG. 1. EQUALIZERS IN CIRCUIT

Fig. 2 shows the same arrangement with a "booster" (C) added, and on the same shaft. The object of the booster is to raise the pressure in the positive wire to make up for some drop as in long transmission. Each of the machines may be excited by shunt windings connected to its own brushes, but a much better arrangement is to excite the field coils of all machines from the feeders coming from dynamo (D), which gives less liability of variation.

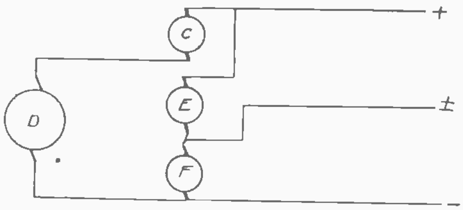


FIG. 2. EQUALIZERS AND BOOSTER IN CIRCUIT

Winding a Telephone Generator Armature

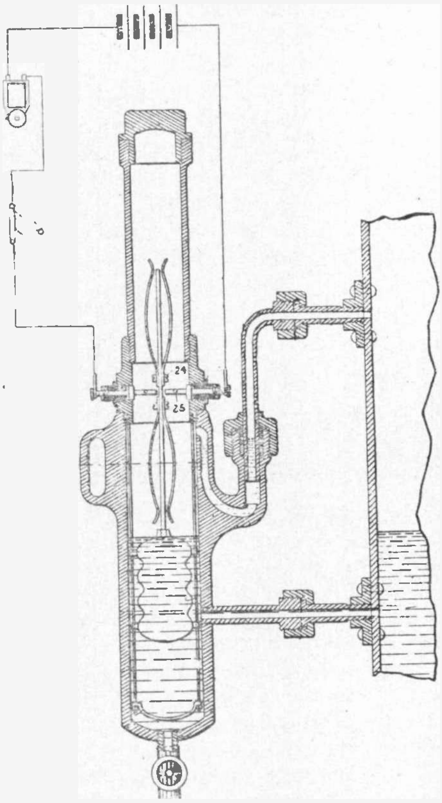
Question.—Kindly explain how to wind a telephone generator.—J. B. T., Lincoln, Me.

Answer.—Wind the armature with No. 35 to No. 32 single silk covered wire. Wind the wire in the same direction on both sides of the armature. It will take from 1800 to 2300 turns of wire. Connect the ends of the wire to slip rings or to a single split commutator if pulsating current is desired. It is a good idea to bind the coils with a string to prevent them bulging when turning the generator and to saturate the coils with shellac for better insulation.

NEW ELECTRICAL INVENTIONS

Electric Water Gauge

The water gauge comprises a casing in communication with the boiler, and in the casing is located a float adapted to be raised and lowered by water admitted to the casing

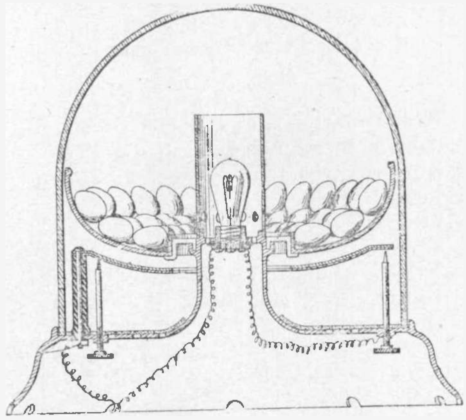


ELECTRIC WATER GAUGE

from the boiler. The casing is provided with electrodes and a circuit is established through electrodes by resilient contacts movable with the float of the gauge. Two alarms are sounded indicating high or low water, and these alarms are adapted to call the matter to the attention of an engineer in order that the supply water to the boiler can be discontinued or increased respectively. The inventor is J. Torok of Renvo, Pa.

Uuique Incubator

This incubator is operated from the heat given off by a single incandescent lamp and is designed to be used for exhibit purposes, as the top is composed of a glass dome

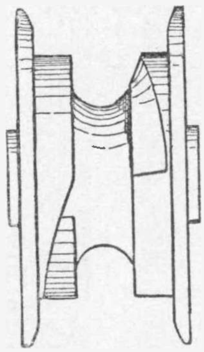


UNIQUE INCUBATOR

through which the eggs and chicks may be watched. It is provided with a thermostat arrangement which keeps the temperature at a constant value. A patent on the device has been granted to Frank C. Perkins and Clarence Z. Davis of Buffalo, N. Y.

Trolley Wheel

Dr. Frederick S. Yoder, a dentist of Eagle City, Pa., has patented a new type of trolley wheel which is to be given a practical test on the traction lines of that city. The device, which is slightly larger than the average wheel in use and has a double flange to provide against a tendency of the wheel to jump the wire against which it travels.



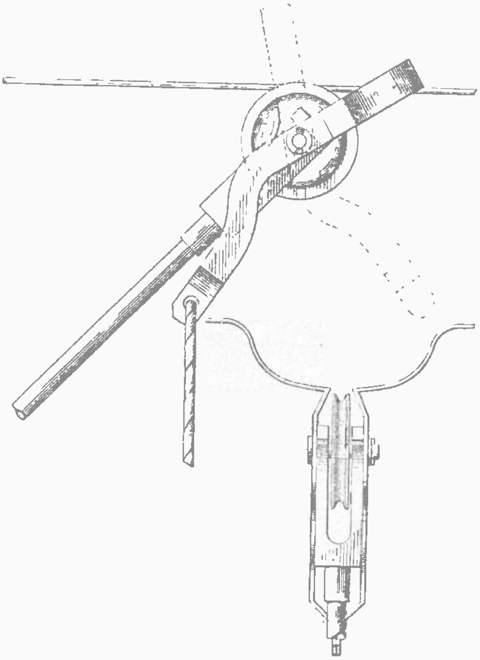
TROLLEY WHEEL

By this construction the tendency of the wheel to remain in contact with the wire is increased and maintained, as each quarter turn of the wheel will present to the wire one of the tapered walls shown in the illustration.

Under all ordinary circumstances, the central groove will remain in contact with the wire, but should a jar or other cause occasion the wheel to be run in the reverse direction the tendency would be to ride up on the tapered walls, thus presenting the side or surfaces of greater diameter to the wire and holding it by the flange from jumping the cable.

Trolley Pole Guide

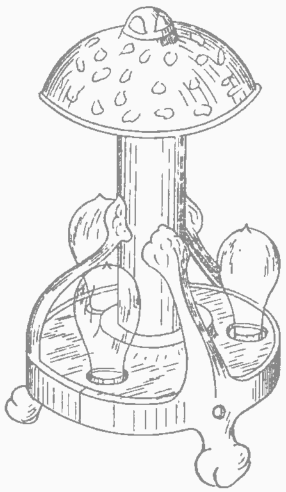
It is quite a trick under some conditions for the motorman on an electric car to restore the trolley wheel to the wire in case it accidentally runs off. To assist him to do



TROLLEY POLE GUIDE

this without delay the trolley pole guide here shown is proposed by James P. Brennan of Centralia, Pa. It consists of a sort of two-pronged fork pivoted on the trolley wheel shaft and manipulated by the cord as indicated in the diagram.

Electric Heater



ELECTRIC HEATER

An electric heater of ornamental design is shown in the accompanying cut and is the invention of Frank Kuhn, Detroit, Mich. The heat is derived from incandescent electric lamps mounted in the base as shown. These lamps are of a low efficiency as far as light is concerned but they give off a great deal of heat. This heat is reflected out in all directions by the polished metal standard and from the base.

AUTOMOBILES. By Hugo Diemer, M. E. Chicago: American School of Correspondence. 1909. 186 pages, with 194 illustrations. Price $1.50.

This book is designed to give to automobile owners or others interested in the science of automobiling, a general, clear idea as to the various parts which go to make up a self-propelled vehicle. It is of exceptional value to prospective chauffeurs or people driving their own cars, in that not only are all of the operating parts described with a view to their practical necessity and utility, but also with regard to the care and attention necessary in their proper use. The author divides the subject into its respective component divisions (the running gear, the power plant, and the body with its accessories) and then treats generally each part and the component elements which unite to form each division. The care and selection of cars occupies sufficient space to give this department its necessary attention. Gasolene and electric power plants are treated in such a way as to bring these subjects within the understanding of the student.

Notes on Patent Infringement

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

Definition; Scope of Patent; What Constitutes Infringement

Definition.—In the sense of the patent law an infringement is a wrongful invasion of the exclusive rights secured to a patentee by his letters patent. It is the unauthorized making, or using, or vending to be used, of an invention protected by patent.—Black's Law Dict.; Bouvier's Law Dict.

Scope of Patent.—*Claim:* (*a*) *Necessity and Purpose.*—In the patent the inventor must particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention. —U. S. Rev. Stat. Sec. 4888. The claim is the measure of the patentee's rights, and what is not claimed is not patented.—Pitts vs. Wemple, 1 Biss (U. S.) 87; Corn Planter Patent, 23 Wall (U. S.) 181; Brush Electric Co. 40 Fed. Rep. 834.

(*b*) *Form and General Requisites.*—No particular form is required in the claim. All that is necessary is for the inventor to claim specifically his invention in language sufficiently clear and certain to designate it completely and precisely.—Merrill vs. Yeomans 94 U. S. 568. The claim is part of the specification, and is to be inserted at the end just before the signature.—Wilson vs. Coon, 18 Blatchf. (U. S.) 532; 6 Fed. Rep. 611.

What Constitutes Infringement.—*Elements and General Principles.* (1) *Knowledge or Intent of Infringer.*—The general rule is that the motive or intent with which an act of infringement is committed is immaterial, and that a person may infringe a patent without even knowing of its existence. —Matthews v. Skates, 1 Fish Pat. Cas. 602, 16 Fed. Cas. No. 9,291.

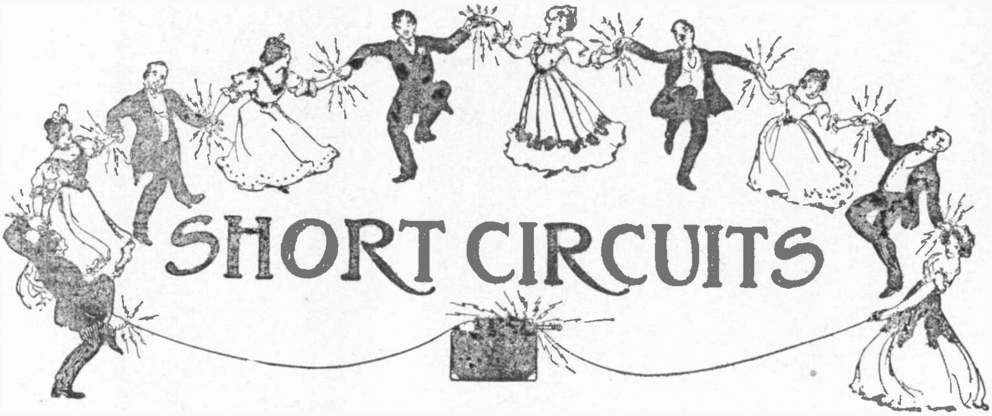
(2) *Use of Things not Claimed by Patent.*—When the language of the specification and claim shows what the patentee desires to secure as a monopoly, nothing can be held an infringement that does not fall within the terms which he has thus chosen to express his invention.—Chemical Rubber Co. vs. Raymond Rubber Co., 68 Fed. Rep. 570. But an immaterial change made for the sole purpose of avoiding the exact wording of the claim will not avail to avoid infringement. — Westinghouse vs. Boyden Power Brake Co., 170 U. S., 537.

(3) *Use of Part of Patented Invention.*—Except where the patent covers merely a particular combination of elements, it is an infringement to use any part of the invention embraced within the patent.—Union Sugar Refinery vs. Mathiesson, 3 Cliff (U. S.) 639, 2 Fish. Pat. Cas. 600, 24 Fed. Cas. No. 14,399. So also when a patent covers several new and independent machines working to a common end, the use of one alone is an infringement.—Wilkins Shoe Button Fastener Co. vs. Webb, 89 Fed. Rep. 982. Although each is capable of independent use.—Wyeth vs. Stone, 1 Story (U. S.) 273.

(4) *Application of Patented Invention to New Use.*—The unauthorized application of a patented machine or device, or a colorable evasion thereof, to a new use, without varying the principle or means, is an infringement.—Cincinnati Ice Machine Co. vs. Foss-Schneider Brewing Co. 31, Fed. Rep. 469.

(5) *Formal Variations.* (*a*) *When Form is Immaterial.*—The general rule is that when the substance of a patented invention is taken, and the patentee is not limited by his claim, or otherwise, to any particular form of construction, infringement is not avoided by mere change in the form of the infringing device or of the parts thereof, not resulting in the production of any new and useful result, such changes being merely colorable and evasive.—Westinghouse vs. Boyden Power Brake Co., 170 U. S. 537; National Hollow Brake Beam Co. vs. Interchangeable Brake-Beam Co. (C. C. A.) 106 Fed. Rep. 693. This rule applies to differences in appearance, name, shape, proportions, dimensions, and to mere structural differences generally. Union Paper Bag Mach. Co. vs. Murphy, 97 U. S. 120.

(*b*) *When Form is Material.*—On the other hand, even a slight change of form will avoid infringement, when form is of the essence of the invention.—Ball, etc., Fastener Co. vs. Ball Glove Fastener Co., (C. C. A.) 60 Fed. Rep. 399, or when the patentee is only entitled to protection for the precise form described in his claim.—Lewis vs. Pennsylvania Steel Co. (C. C. A.) 59 Fed. Rep. 129 rehearing denied (C. C. A.) 60 Fed. Rep. 1005.



SHORT CIRCUITS

Gossip is putting two and two together and making five.

* * *

Mother—And when he proposed, did you tell him to see me?

Daughter—Yes, mamma; and he said he'd seen you several times, but he wanted to marry me just the same.

* * *

She entered upon her stage life at the age of 15, had attained phenomenal success at 20. Ten years later she toured the states as a star. She was then 23. Eight years after, she left the glare of the footlights, married, got a divorce and returned to her old love at 24. Notwithstanding the fact that her long career upon the boards (25 years), has left its mark on her face, she seems as ambitious and nimble at the head of her own company as she ever did. She is now 28.

* * *

Mr. Brown, looking for his wife, asked the cook:

"Bridget, can you tell me of my wife's whereabouts?"

Bridget, evidently embarrassed, hestitated before replying, "I think they are in the wash, sorr."

* * *

"Isn't it a shame to keep those poor lions caged."

"Lady," answered the keeper at the Zoo, "they're much happier and safer there than they would be roaming the African jungles."

* * *

"Pa, what do they call a person that reads heads?"

"A phrenologist, my boy."

"Gee! Then ma must be one of those things. She felt of my head this afternoon and said right away: 'You've been swimming.'"

* * *

A knife-thrower who was performing in an English music-hall had a particularly attractive assistant, whose duty was to lean, with outstretched arms, against a soft pine board. This board was surrounded with electric lights which accentuated her beauty. The knife-thrower would then station himself a few feet distant and hurl knife after knife at the board. These knives would just graze the skin and plunge with a thud in the board and remain quivering. It was a thrilling act, and when the last knife was thrown the young woman would be so closely hemmed in by knives that they had to be drawn out before she could free herself.

One night the pretty assistant was taken ill, and the performer's wife was drafted for the work. She was far from pretty; in fact, she was distinctly homely. She walked out onto the stage and when she reclined against the board the pitiless lights threw into relief her crooked features, unshapely limbs, and general unattractiveness. The knife-thrower took deliberate aim, and a knife flashed across the room and sank into the board by her head. Just as the knife struck, a small boy up in the gallery shouted with a wail,

"My Gawd, 'e missed 'er."

"T'other day I asked a waiter ter bring me a chicken dinner—an' he fetched me a handful o' cracked wheat."

* * *

First Man—I called on a couple of ladies last night.

His Friend (absently)—So? I'll bet the other fellow held kings.

* * *

On a par with the school boy's definition of a mountain range, which he said was a very large cook stove, may be mentioned that of a student at Sheffield Scientific School who was asked to give the office of the gastric juice. "The office of the gastric juice is the stomach," said the budding scientist.

* * *

The regular ice man was sick and his young son weighed down with responsibility, was driving the ice wagon. He signalled up the dumb waiter to Mrs. Brown that her ice was ready to be drawn up. It was with great difficulty that she succeeded in drawing up the load, but congratulated herself meanwhile on the fact that the new ice man gave good weight. When the load arrived at the landing, there, perched on the cake of ice, was the ice boy. "What are you doing on that cake of ice," asked the exasperated Mrs. Brown. "Why, I thought I had better come up," said the boy. "I was afraid the ice would be too heavy for you to put into the refrigerator."

* * *

Apropos of the queer interpretation frequently placed by children upon remarks made to them, a Western professor related at a recent dinner some examination stories.

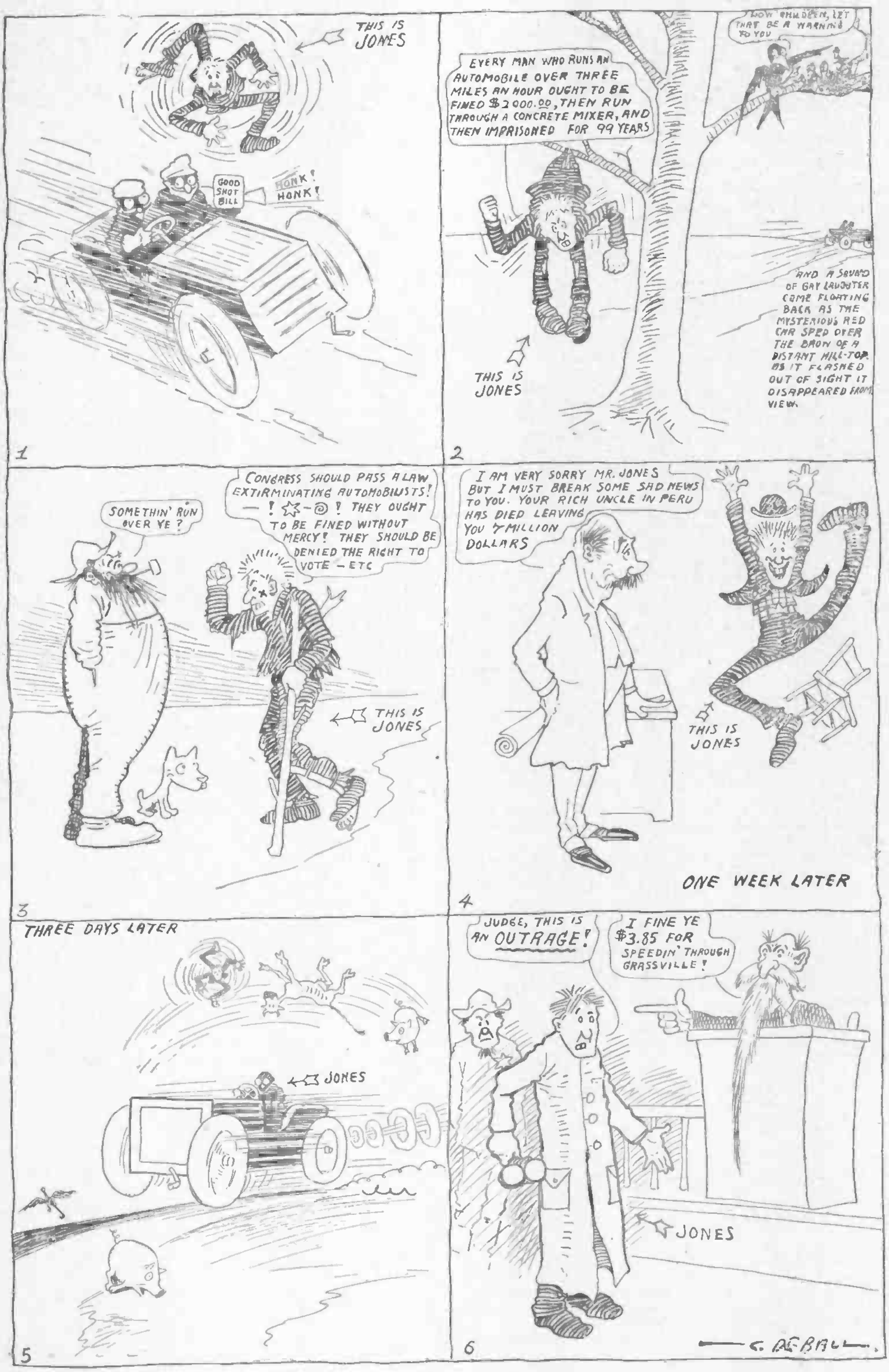
"Once, in a Bible lesson," he said, "I repeated the text, 'Arise and take the young child and his mother and flee into Egypt.' Then I showed the children a large picture in bright colors that illustrated the text. The children studied this picture eagerly. Then they all frowned; all looked rather disappointed. Finally a little girl said,

"'Teacher, where is the flea?'"

* * *

A charming young gentleman about four years of age used to pass a certain lady's house every day on his way to kindergarten. In course of time she made his acquaintance and gave him a penny each morning when they parted.

Eventually his mother requested her not to give him any more money, and the next morning she did not present the usual penny. He did not seem to notice the omission. The succeeding day, when the penny was not given to him, he said nothing. But on the morning of the third day, when the penny was not forthcoming, he sidled up to her and whispered: "Say, what's the matter? Ain't your husband working?"


THIS IS JONES
GOOD SHOT BILL
HONK! HONK!
1
EVERY MAN WHO RUNS AN AUTOMOBILE OVER THREE MILES AN HOUR OUGHT TO BE FINED $2000.00, THEN RUN THROUGH A CONCRETE MIXER, AND THEN IMPRISONED FOR 99 YEARS
NOW CHILDREN, LET THAT BE A WARNING TO YOU
THIS IS JONES
AND A SOUND OF GAY LAUGHTER COME FLOATING BACK AS THE MYSTERIOUS RED CAR SPED OVER THE BROW OF A DISTANT HILL-TOP. AS IT FLASHED OUT OF SIGHT IT DISAPPEARED FROM VIEW.
2
SOMETHIN' RUN OVER YE?
CONGRESS SHOULD PASS A LAW EXTIRMINATING AUTOMOBILISTS! — ! ☆ - @ ! THEY OUGHT TO BE FINED WITHOUT MERCY! THEY SHOULD BE DENIED THE RIGHT TO VOTE — ETC
THIS IS JONES
3
I AM VERY SORRY MR. JONES BUT I MUST BREAK SOME SAD NEWS TO YOU. YOUR RICH UNCLE IN PERU HAS DIED LEAVING YOU 7 MILLION DOLLARS
THIS IS JONES
ONE WEEK LATER
4
THREE DAYS LATER
JONES
5
JUDGE, THIS IS AN OUTRAGE!
I FINE YE $3.85 FOR SPEEDIN' THROUGH GRASSVILLE!
JONES
6
C. DE BALL

ELECTRICAL DEFINITIONS

Below are defined a few of the most common electrical terms. They are reprinted from month to month and will be of assistance in understanding the magazine text

Accumulator.—See secondary battery.

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

Ammeter.—An instrument for measuring electric current.

Ampere.—Unit of current. It is the quantity of electricity which will flow through a resistance of one ohm under a potential of one volt. The international ampere is the current which, under specified conditions, will deposit .001118 gram of silver per second when passed through a solution of nitrate of silver in water.

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

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

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

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

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

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

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

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

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

Choking Coil.—Coil of high self-inductance which retards the flow of alternating current. See self-inductance.

Circuit.—Conducting path for electric current.

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

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

Commutator.—A device on a dynamo shaft for gathering the current from the various coils of the armature and sending it out over the line as direct current. On a motor it takes current from the line and passes it on to the armature coils.

Condenser.—Apparatus for storing up electrostatic charges.

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

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

Dielectric.—A non-conductor.

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

Direct Current.—Current flowing continuously in one direction.

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

Electrode.—Terminal of an open electric circuit.

Electromotive Force.—Potential difference causing current to flow.

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

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

Farad.—Unit of electric capacity.

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

Field of Force.—The space in the neighborhood of an attracting or repelling mass such as a magnet or a wire carrying current.

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

Generator.—A dynamo.

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

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

Kilowatt.—1,000 watts. (See watt.)

Kilowatt-hour.—One thousand watt hours.

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

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

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

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

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

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

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

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

Potential.—Voltage.

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

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

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

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

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

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

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

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

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

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

Spark-gap.—Open space between the two electrodes of a spark coil or resonator.

Storage Battery.—See secondary Battery

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

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

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

Volt Meter.—Instrument for measuring voltage.

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

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

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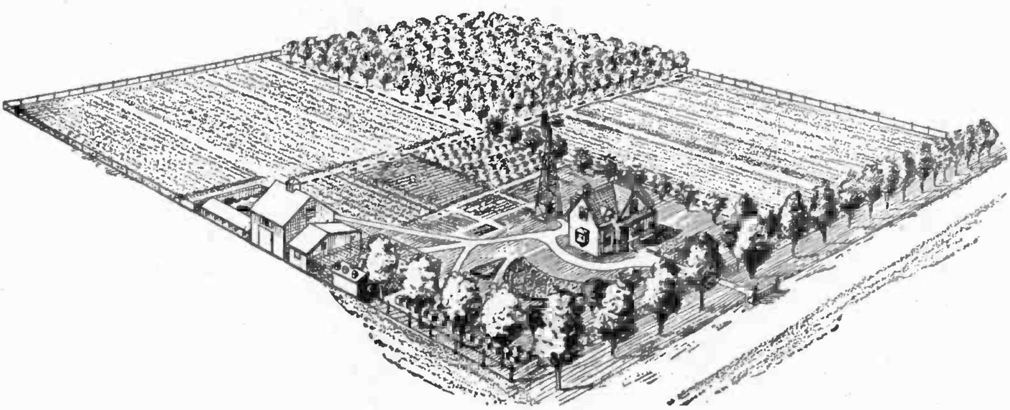

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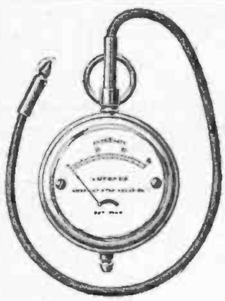

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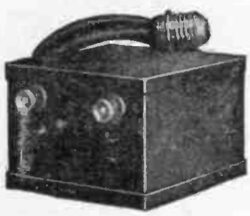

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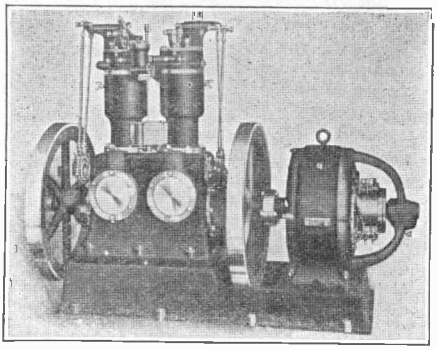

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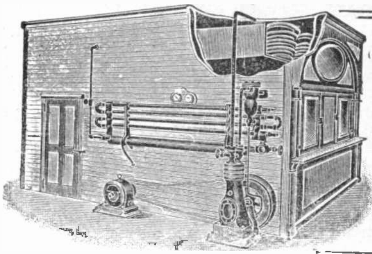

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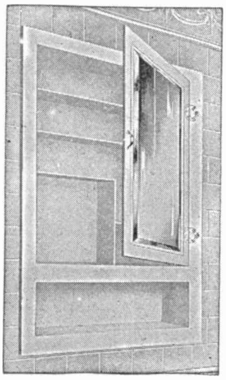

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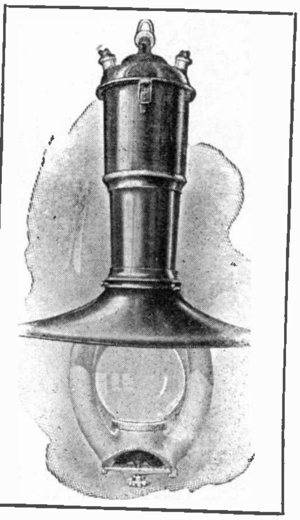

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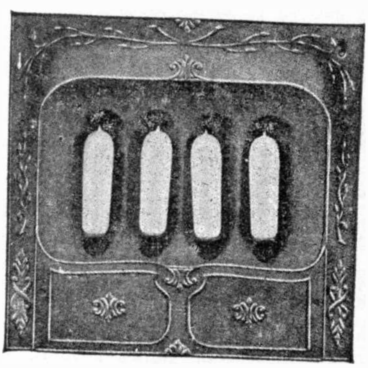

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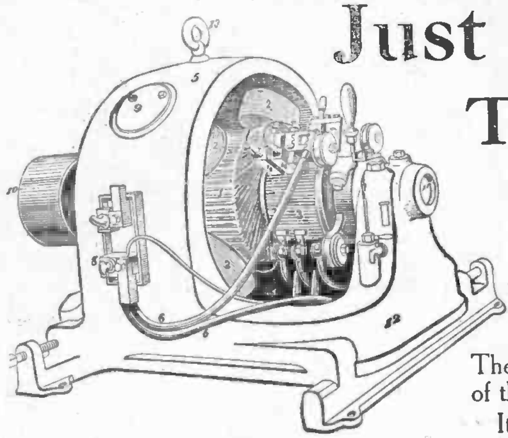

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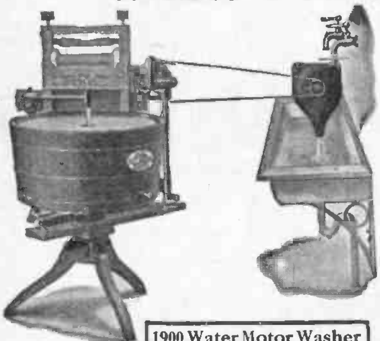

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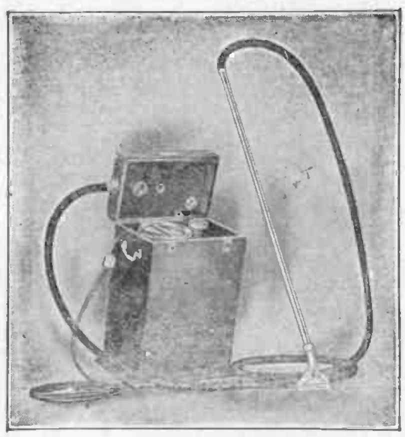

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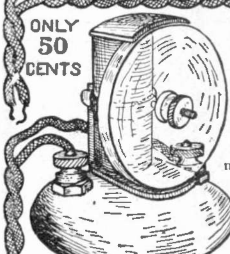

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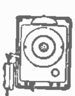

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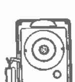

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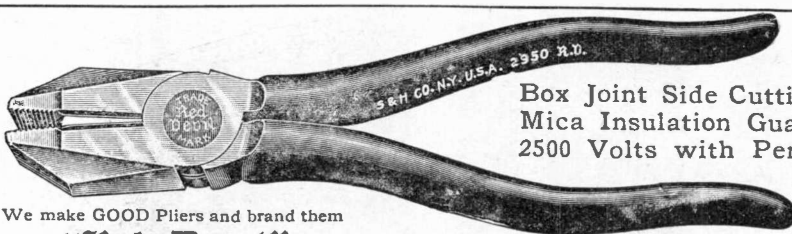

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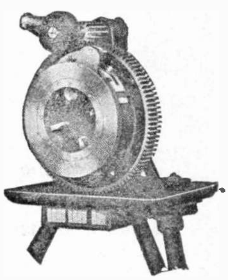

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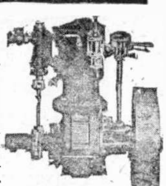

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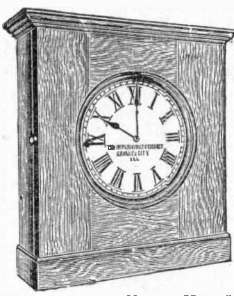

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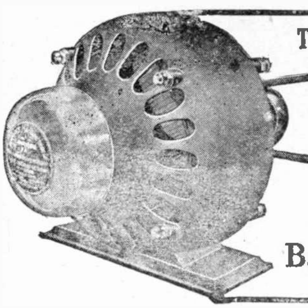

The Barnes Variable Speed Alternating and Direct Current Motor

1-12 and 1-8 H.P.

The only high speed, single phase, alternating motor that absolutely will not heat. Responsible agents wanted.

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For Pumping, Cream Separators, Churns, Wash Machines, etc. *Free Trial*

1 to 25 Horse Power

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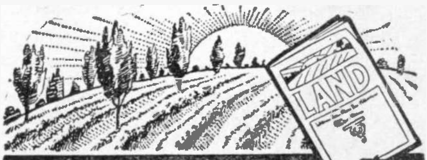

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New Electrical Novelties

Sent postpaid at Lowest Prices

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DEALERS Write for our favorable terms and big discounts on quantity order.

ELECTRIC NOVELTY CO.
Manufacturers and Importers
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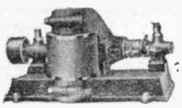

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This price includes **Dynamo, Storage Battery, Lamps, Wire** and **Fixtures.** Can be installed by any one.

The dynamo can be driven by any convenient power, steady or intermittent. Only one-half H. P. required.

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—From Toledo News-Bee of Sept. 18th, '09

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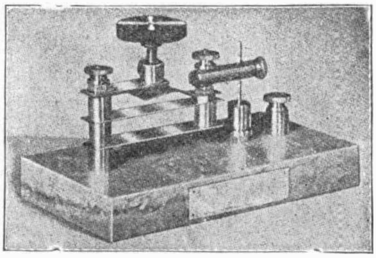

FERRON DETECTOR, PRICE $5.00

The Ferron Detector is fast becoming the acknowledged detector for high class wireless work. Guaranteed to be excelled by none for sensitiveness, and far superior to any detector in existence selling for $5.00, With our highest grade receiving set, it has a proven range exceeding 2,000 miles. Because of its extreme sensitiveness, no battery or potentiometer is required. It will withstand the strongest signals and remain adjusted for weeks. The users of electrolytic detectors will appreciate this point. The base is of finely polished Italian marble, and the metal parts beautifully nickel plated. The following enthusiastic letter unquestionably proves the Ferron to be much more sensitive than any silicon:

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Receiving set with a proven range of	100 to 300 miles	$12.75
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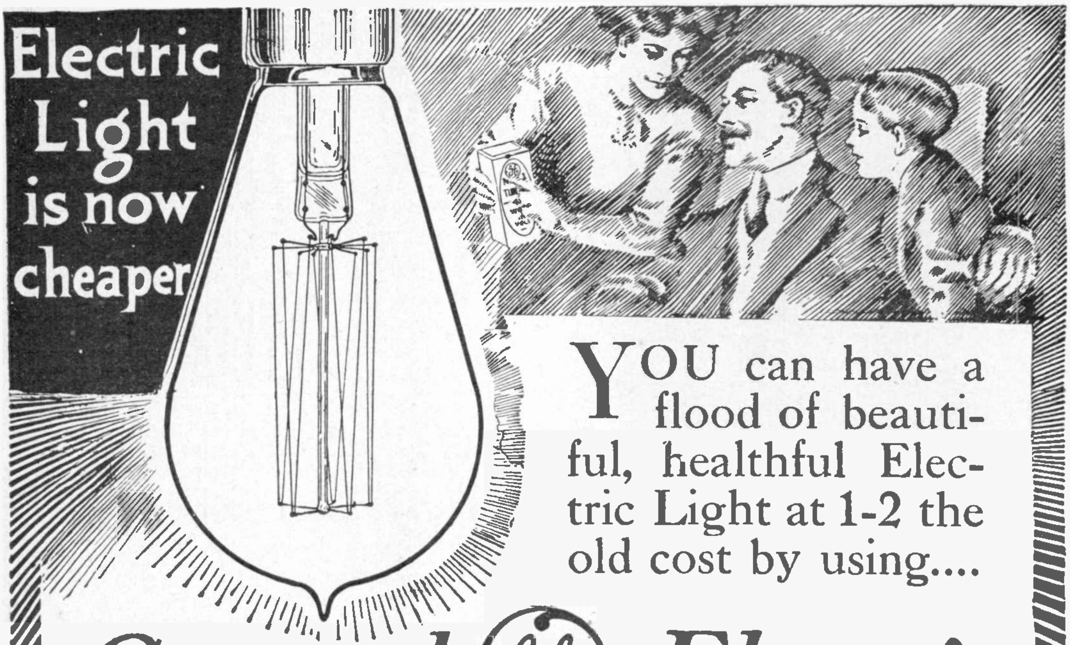

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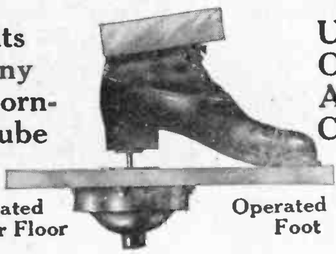

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Our master cutters and tailors will put into these trousers all the skill and workmanship that have made us famous. Made exactly to your measure, in new Fall style by experts: they are far superior to anything your local tailor can produce at twice the price. No extra charge for cuffs or belt straps or any of the newest wrinkles. Why wear ready-made, ill-fitting garments when you can wear the best for less money?

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Don't pay us a cent until you have the trousers and are perfectly satisfied in every respect. No matter where you live, we can serve you, as we prepay express everywhere and have customers from Main to California. We take the risk.

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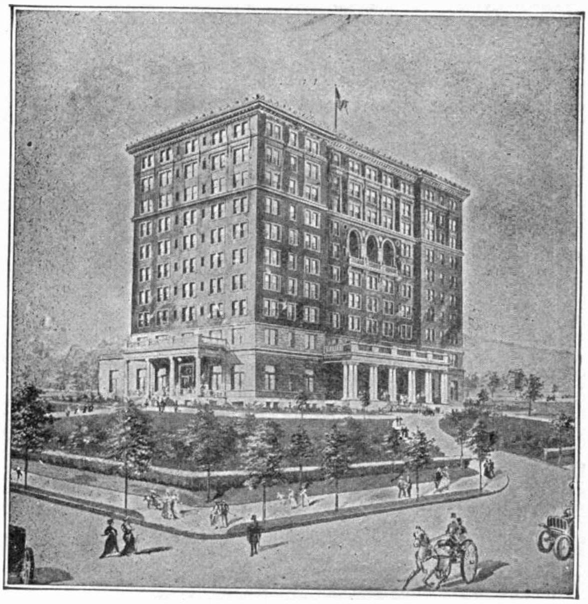

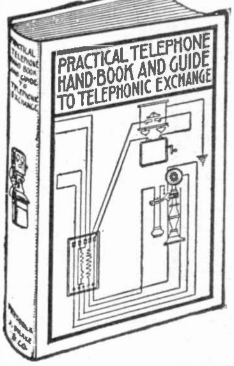
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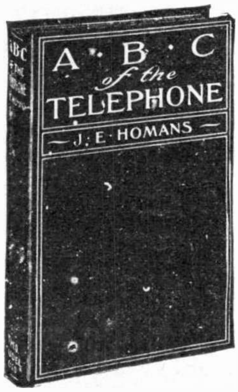
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We Guarantee

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Dealers We can make a very interesting proposition to furniture or hardware dealers, dealers in electric appliances and central power stations who take hold of this proposition with us now. Write.

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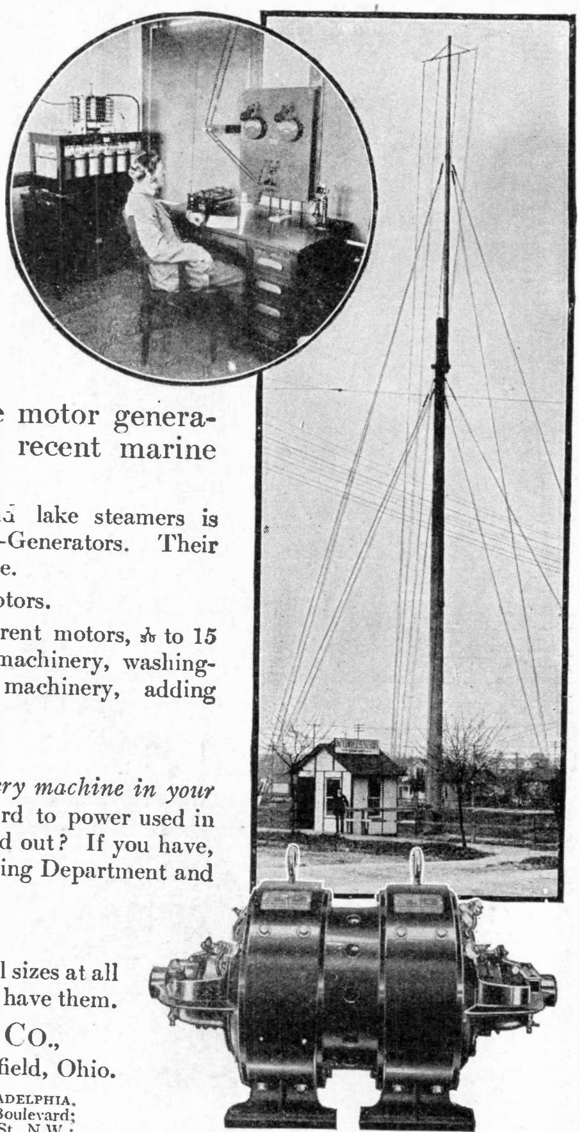
Where there are babies or frequent small washes the Jewel is a necessity

"Wireless" demands efficient motor service



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We carry a complete stock of motors in all sizes at all our branch offices and dealers everywhere have them.

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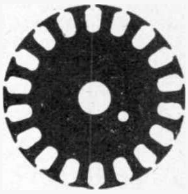

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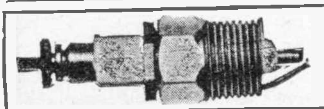

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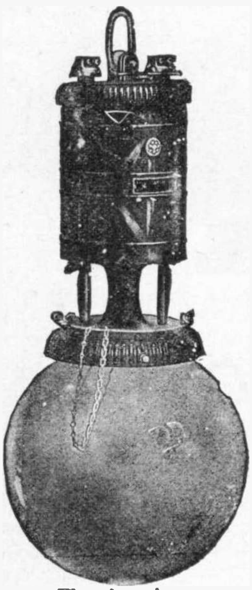

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Intense Light

Made by a Warner Flaming Arc attracts attention at a distance or close by.

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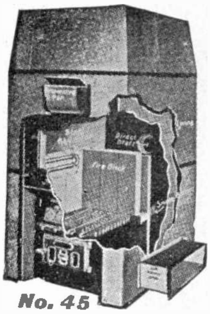

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"Leader" Hess
Steel Furnace
Price $49.00

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Pipes & Registers Extra

60 Winter Days

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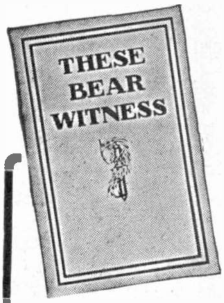
Send us a rough sketch of any building you wish to heat. Without any charge or obligation on your part, we will have our expert furnace draftsmen prepare a plan which you can easily understand, showing the best way to heat your building, including every detail of the furnace, pipes, registers, etc., in their proper places, with the exact cost to you of the complete equipment. No charge for this.

Write for our free booklets, **"Modern Furnace Heating"** and **"These Bear Witness."** They tell much you should know before ordering your heating equipment. Write now—today.



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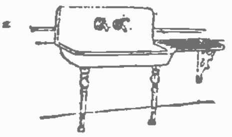

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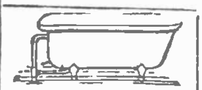

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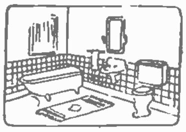

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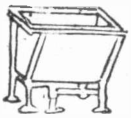

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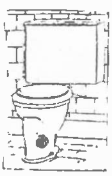

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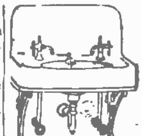

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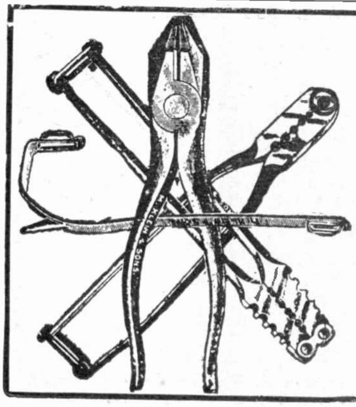

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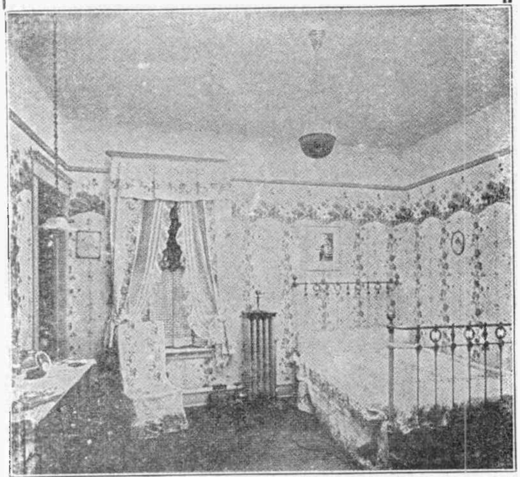

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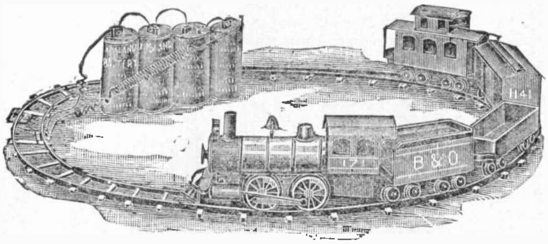

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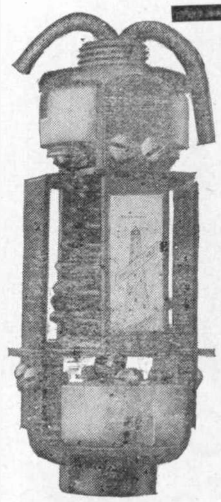

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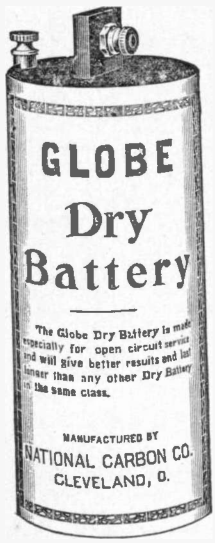

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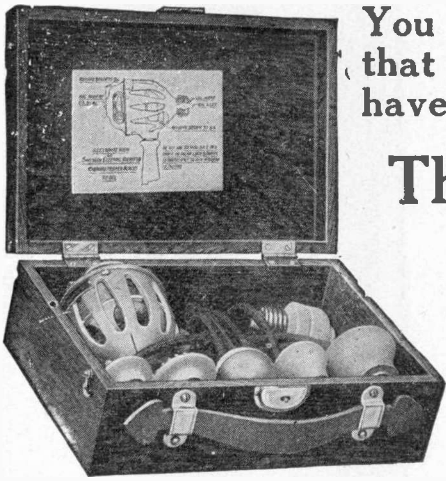

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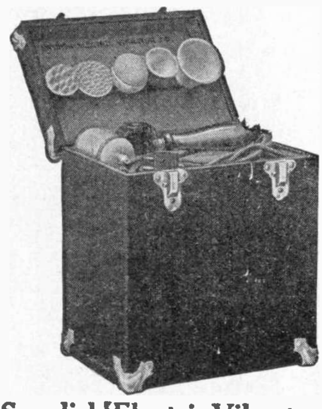

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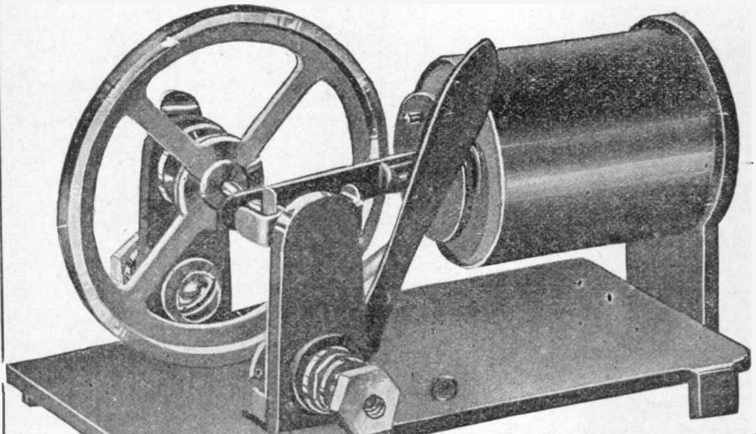


SPECIAL LOW PRICE ON THIS POWERFUL Solenoid Electric Engine

Runs like Lightning.

THIS engine is made to run for a long time on one cell of dry battery. This without doubt the best made electric engine for its size on earth.

The base and frame are made from cold rolled steel;—the coil is hollow, thereby allowing the driving shaft to be operated on the solenoid principle.

The position of the reversing lever controls the speed and direction the engine will run.

Speed about 1000 revolutions per minute. Two or three cells of battery increases speed and power wonderfully.

Will operate toy devices, attract attention in a show window, run a small fan, and is a source of endless amusement and instruction. Batteries can be purchased anywhere for 15 to 20c. each.

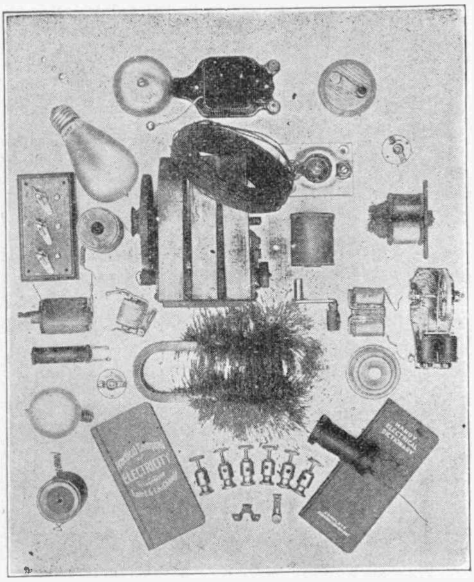
Finish of frame, fine black enamel, large brass fly wheel is bright dipped cylinder of coil casing in English vermillion red, which makes this also the finest finished and appearing engine.

Every engine comes in an individual box with complete directions for operating. *Delivered, charges prepaid,* to any address in the United States, on receipt of

50 CENTS EACH. CANADA 75 CENTS EACH.

SWEDISH AMERICAN ELECTRIC CO., 1755 Berwyn Ave., Chicago, Ill.

This Complete Electrical Experimental Outfit for $5.00



This big offer for short time only

New type Acme Multipolar 100 Watt generator. New and in original boxes. Nickel finish, bronze bearings, oil cups, brass gearing drive, weight of generator alone SIX AND ONE-HALF POUNDS. We have only 2950 in this lot and Reach nearly half a million readers in different magazines. **Act Quick.** The balance of the outfit consists of :—

4 pair electro-magnets 20, 40, 70 and 200 Ohms, 1 Switch, 1 push button, one-half pound coil of wire, 1 Bell, 2 Miniature Lamps and Sockets, 1 Laboratory test lamp and socket, 6 brass binding posts, 1 Permanent magnet, 1 solenoid magnet with brass core.

P. E.

FREE

Send in this coupon with your remittance of $5.00 before our next Ad appears and we will send you in addition to the outfit a 200 Ohm polarized Relay value $5.00 (weight ¾ lbs.) excellent for wireless. Also a $2 pair of (enameled covered wire) magnets 30 ohms originally made for Dating Stamps and electric clocks. ACT NOW and be ready for the winter nights.

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¶ Times have changed. Now-a-days, success is not an accident; it is a result.

¶ Business and Engineering enterprises have become so complex that corporations must have experts to handle them—trained men must be at the head of every department.

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¶ The American School, with its thirteen years of experience, with its modern and thorough system of teaching by mail, will qualify you in the higher branches of either business or engineering professions—will give you the training that will enable you to force your way to success.

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Please send me your Bulletin and advise me how I can qualify for position marked "X"

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Popular Electricity, 11-'09 Bus.

Thor-Electric

Makes The HARDEST WORK About The House The EASIEST

For One-third your Present Wash Day Cost

Water is heated in and by the washer. Putting clothes into the revolving drum and turning on the power is all you need to do. Not even necessary to interrupt other household duties. Feeding clothes through the reversible automatic wringer into blueing water and back again is the last operation before hanging out.

The clothes in the drum are carried on a cleat or shelf, then dropped. The action is simply the gentle one of ***LIFT AND DROP***—lift and drop. While the hot suds pour through and through the clothes, until every particle of dirt is loosened. There are no paddles to strain them. Nothing that can possibly wear the clothes in any way. As the clothes are constantly changing their position they ***CANNOT BECOME PACKED IN A WAD***—an exclusive thor-electric feature. The saving in clothes and the cheapness of operation will pay for a Thor-Electric Washing Machine in a few months.

By attaching the UNIVERSAL ROD (sold only with the Thor) the Thor-Electric can be made to perform by electricity countless daily household tasks now done by the housewife, housemaid, washwomen, butler or man-of-all-work. Such as:

Washing the Clothes
Wringing the Clothes
Working the Ironing Machine
Working the Food Chopper
Sharpening Knives
Churning the Butter
Turning the Grindstone
Freezing the Ice Cream and
Doing Scores of
Other Household Duties

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