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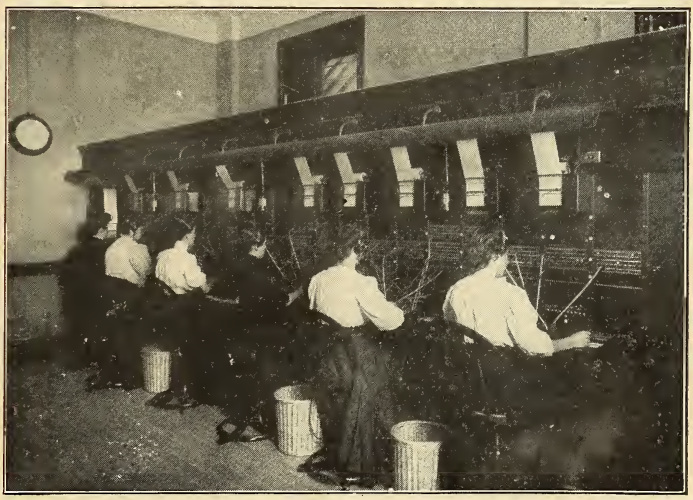

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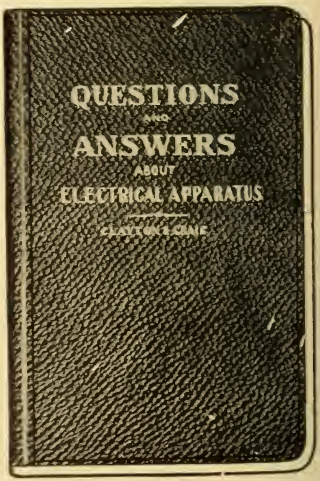

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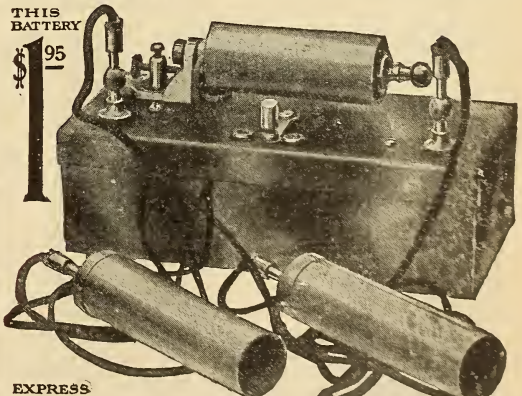

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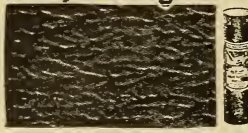

"Best Yet" Galvo Rubber Roofing is a very high-grade wool felt roofing thoroughly saturated with Gilsonite asphalt and coated with a secret rubber coat on both sides. Nothing better of this class manufactured. Each roll complete with nails and cement. **Price:** One-ply **$1.20 per sq.**, two-ply **$1.40 per sq.**, three-ply **$1.75 per sq.** We offer our Central Brand Flint Surfaced Asphalt Roofing, the highest grade of its kind, each roll complete with nails and cement. **Price:** One-ply **$1.20 per sq.**, two-ply **$1.45 per sq.**, three-ply **$1.80 per sq.** We offer Roofing Mill Ends of either the rubber surfaced or flint coated roofing at: one-ply **95c per sq.**, two-ply **$1.10 per sq.**, three-ply **$1.40 per sq.** *Samples free—charges prepaid.*

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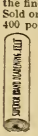

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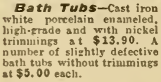
$39 Buys this complete high grade guaranteed Bath Room Outfit

Bath tub 5 feet long, white porcelain enameled, trimmed complete with full nickel trimmings. **Lavatory** white porcelain enameled, complete with nickel trimmings. **The closet** is a high-grade modern sanitary outfit, with polished oak copper lined tank, and seat and cover to match. Other bath room outfits from **$24.50** to **$105.00.**

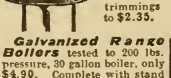
Bath Tubs—Cast iron white porcelain enameled, high-grade and with nickel trimmings at **$13.90.** A number of slightly defective bath tubs without trimmings at **$5.00** each.

Lavatories—Like illustration, complete with full nickel trimmings at **$10.00.** Lavatories without trimmings down to **$2.35.**

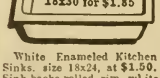
Glazed porcelain Basin Bowls—We carry all kinds of basin bowls for marble lavatories. 14-inch round patent overflow rubber plug like cut each **75c.** All other sizes in our catalog.



White Enameled Kitchen Sinks, size 18x24, at **$1.50.** Sink backs rolled rim, white porcelain enameled, 24 inch, at **$1.50**, 30 inch at **$1.80.**



Galvanized Range Boilers tested to 200 lbs. pressure, 30 gallon boiler, only **$4.90.** Complete with stand tube and couplings, **$5.90.**



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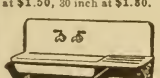

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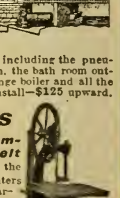

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Vol. II OCTOBER, 1909 No. 6

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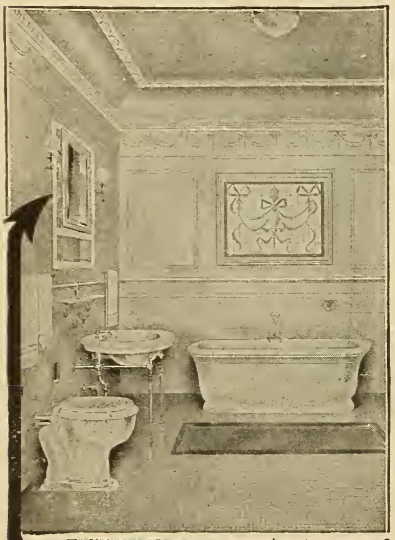
Hess Sanitary Bath Room Locker (Medicine Cabinet)

Something New For Your Home



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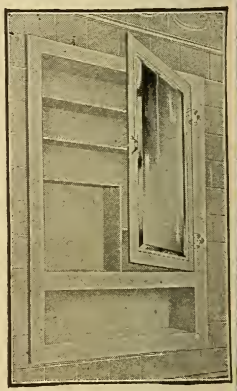

No home is complete without a Hess Sanitary Bath-Room Locker. It is germ and vermin proof.

Style "A" Locker is made to recess into the wall and projects one inch from face of wall. It has a beveled plate mirror 16x24 inches and measures 19½x24½ inches inside. Below the mirror is an open shelf 19½x6 inches.

Style "B" is the same size and finish, made not to recess into the wall, but to be suspended on the wall.

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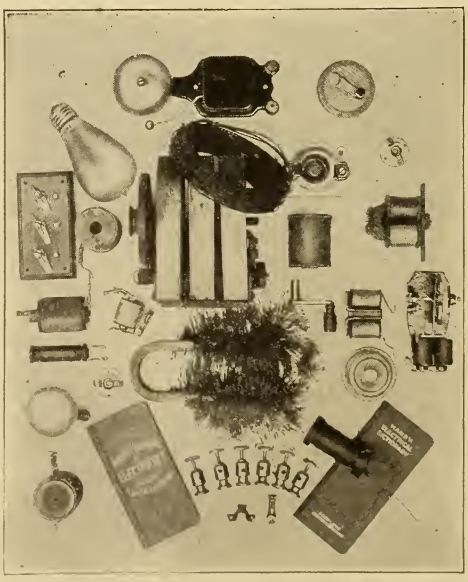

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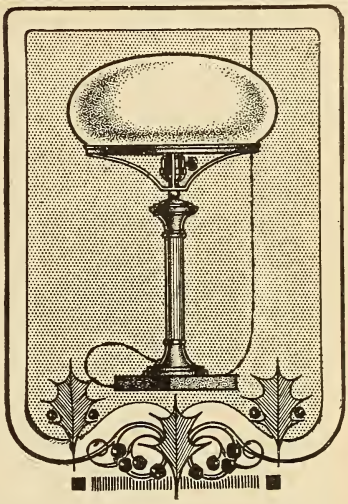

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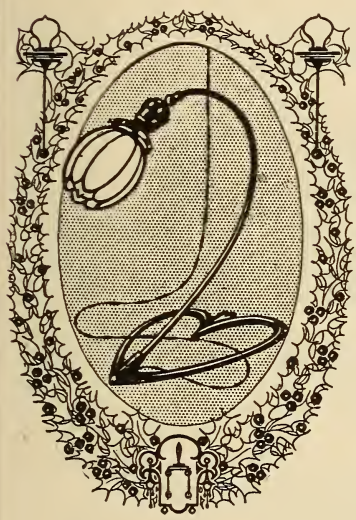

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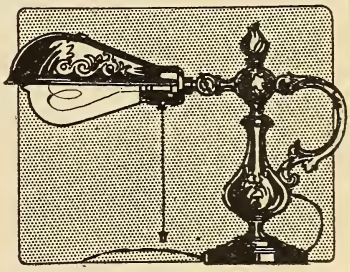
This unique and very artistic little lamp has been designed upon simple, yet most graceful lines. It may be hung on the wall or stood on a table. The socket may be tilted at any angle desired. Shade is frosted glass with leaded effect. Standard finished in handsome Brush Brass effect. Very popular for hall, library, desk, dresser or boudoir light. Price $4.00, express prepaid.

Electric Couch Bracket



This ingenious Couch Bracket for Electric Light has several uses. It may be hung upon the back of a bed to afford light to reclining readers. Or it may be placed upon the table or used as a piano lamp for illuminating music. Handsomely finished in antique brass, with cord and plug attached for $6.10, express prepaid.

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Why should you burn a 16 candle power lamp, when a medium or dim light would serve the purpose as well? Every user of electric light will readily appreciate the advantage of being able to turn it down like gas. A dim light can be maintained in the hall, bathroom or sick chamber at a saving of 70% by using the Dim-a-lite—a plug device that screws into any Edison base socket. A slight pull of the cord gives either a high, medium or low light as desired. Nothing to burn out or replace. Makes every lamp a turn-down lamp. Gun Metal finish. By mail, Price $1.00.

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All Sizes

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Upon the request of my sister, who urged me to use her great Electric Vibrator on my son when I was thoroughly hopeless of his cure from physicians' treatment, I write you this recommendation. My son is 16 years old, and eight months ago became paralyzed from the after-effects of diphtheria. He was so badly afflicted that his arms and limbs were twisted out of shape and was confined, all doubled up, in his bed. Medicine and attention did no good, and I had become discouraged in all ways. After treating first his spine at the base and then his limbs with your vibrator he felt such relief that I kept up the treatment regularly, with the result that we soon had him around in a wheel chair. Next he was going around on crutches, and now, after three months' treatment, he is going around with a cane and will soon be entirely cured.
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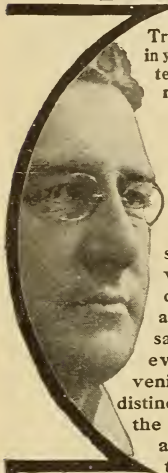

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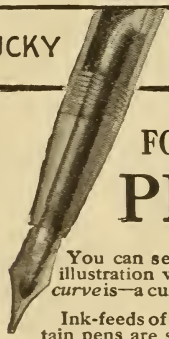

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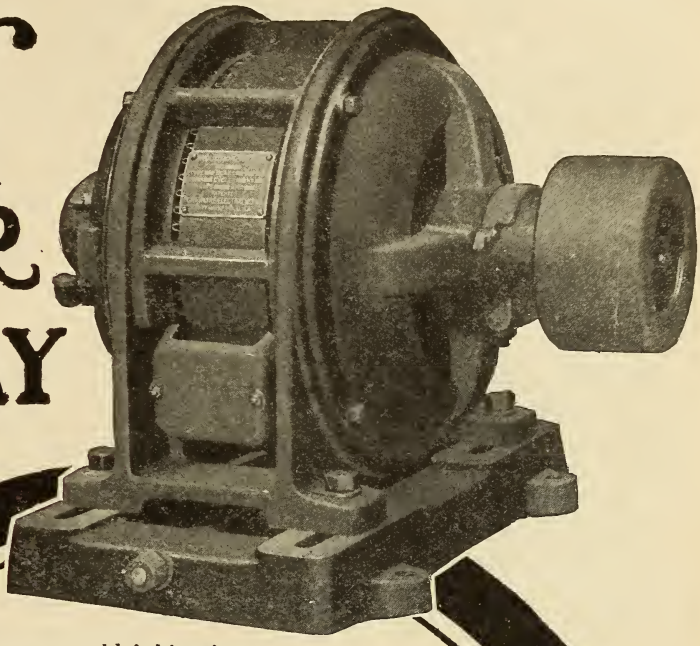

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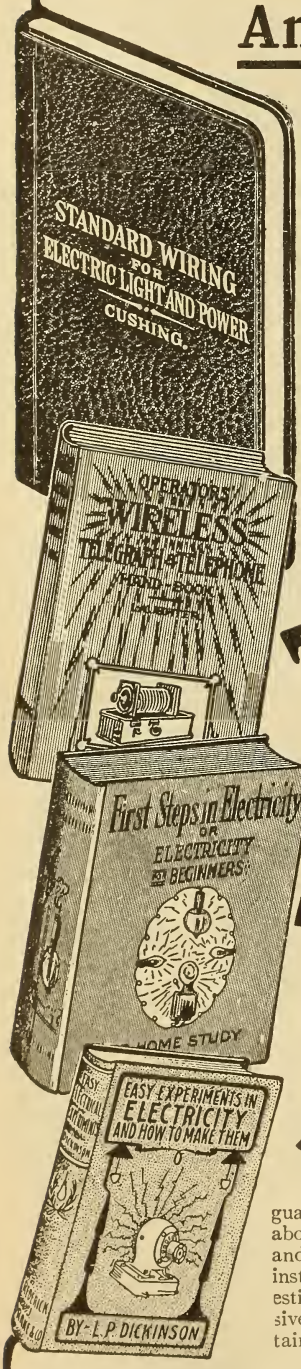

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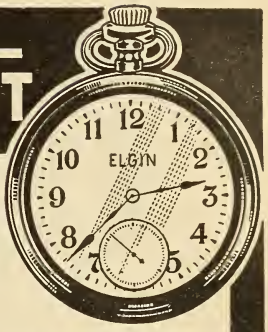

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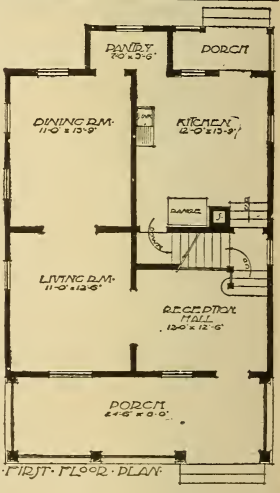

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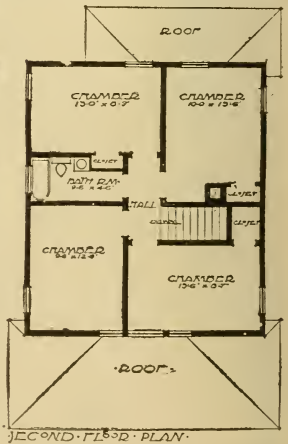

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ANDRE MARIE AMPERE

French Physicist, Mathematician and Naturalist

Ampere invented the astatic needle, of great value to science. He demonstrated that two currents of electricity passing through parallel conductors have an attractive or repellent influence upon one another according as they move in the same or opposite directions. He also made distinguished observations on terrestrial magnetism and earth currents, and established the connection of magnetism and electricity.

Andre Marie Ampere was born in Lyons, France, January 22, 1775, at the beginning of the American Revolution, and was destined to play a conspicuous part in the study of those forces and laws of Nature which were to so materially contribute to the peaceful revolution of the industrial world, and elevate his name and spirit into the company of the immortals.

He displayed his mathematical powers in early boyhood and attracted much public attention by one of his first essays "On the Mathematical Theory of Games of Chance." He gave the name Electrodynamics to that field of science in his "Theory of Electrodynamic Phenomena Deduced from Experiments." He also wrote on the "Undulatory Theory of Light," and an "Essay on the Philosophy of the Sciences, or an Analytical Exposition of a Natural Classification of all Human Knowledge."

He suggested the possibility, after his distinguished discoveries in electro-magnetism, of transmitting electric currents for signaling purposes by electro-magnetic apparatus, between distant points, which was realized in modern telegraphy. Michael Faraday subsequently worked out the fundamental principles of electro-magnetism by his extraordinary labor and results in experimental research.

Ampere was a man of deep emotions. His father was beheaded in France in 1791 during the revolution, producing in the young man a condition of great mental depression. From this after the lapse of a year he was restored to new life and energy by his readings of Rousseau and his love of Nature.

Later in life, again, this state of unhappy despondency fell over him from the death of his wife, whom he dearly loved.

He was distinguished and honored, a teacher and professor of great ability, Chevalier of the Legion of Honor, elected to the Academy of Sciences and heralded throughout the scientific circles of Europe for his discoveries in the field of electromagnetism and electrodynamics, and his announcement of Ampere's Rule, named in his honor by the leading body of scientists of his day. The ampere, named after him, is the unit of strength of an electric current.

Ampere was described as a man of genial disposition and noted for his simplicity of character. He died in the year 1836, at the age of sixty-one.

Elementary Electricity

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

CHAPTER XVIII.—SINGLE AND DOUBLE-FLUID VOLTAIC CELLS

As its name indicates, a single-fluid voltaic cell has a single electrolytic fluid into which its metals are dipped. There is required therefore a single vessel or cell only, to hold the electrolyte. In a double-fluid cell, however, when two different liquids are employed, it is, except in certain cases, necessary to employ two separate vessels to contain them. There are a great variety of both single and double-fluid voltaic cells, some of the more important of which will now be described.

Volta's original zinc-copper cell has undergone many modifications. In order to permit the zinc to be readily lifted out of the liquid, and thus avoid local action when the cell is not in use, various plans were adopted. In some cases the two elements were mounted on a suitable support. A voltaic battery of this character, represented in Fig. 116, was devised by Wollaston. The copper plate was bent so as to cause it to come near both sides of the zinc plate, accidental contact being avoided by pieces of wood placed as shown. Placing the negative plate in this way on both sides of the zinc decreases the resistance of the electrolyte by an increase in the active surface of the negative plate, and, consequently, by an increase in the cross-section of the electrolyte immediately between them. Then, too, since this form permits the two elements to be brought close together, a further decrease in the resistance of the electrolyte is ensured, by the decrease in its length between the two plates.

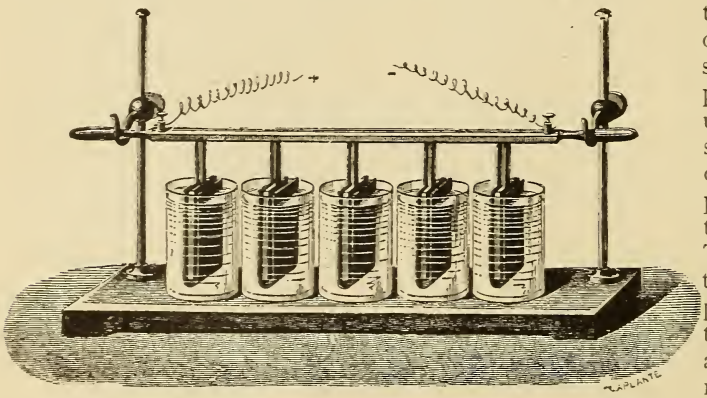


FIG. 116. WOLLASTON'S BATTERY

Where a large current is employed with only a small E. M. F., a single cell with very large plates was formerly employed. In the form devised by Dr. Hare, of Philadelphia, two large plates of zinc and copper were placed on each other, but prevented from touching by suitably placed strips of wood or other insulating material. The two sheets were then rolled in the form of a close spiral coil. This arrangement not only possesses the advantage of employing a large plate in a small space but also places the copper on both sides of the zinc plate. The spiral so formed was then plunged in a tub of acidulated water and arranged so as to be readily lifted out of the water and supported above the tub when the cell was not in use. The terminals or poles of the cell consisted of wires placed in good metallic contact with the plates of zinc and copper, the wire connected with the copper plate forming the positive pole or electrode, and that connected with the zinc, the negative pole or electrode. Hare called this cell a deflagrator, on account of the powerful heating effects he was able to produce with it.

It may here be said that at the present time, when powerful electric currents are required, electric sources consisting of voltaic cells are no longer employed, it being far more convenient to employ electric sources known as dynamo-electric machines, which will be described in a subsequent chapter.

A form of single-fluid voltaic cell capable of yielding fairly large currents for short intervals of time, is known as the Grenêt

or bi-chromate cell. It consists of a zinc-carbon couple immersed in an electrolyte known as electropoion liquid, prepared by dissolving one pound of bi-chromate of potash in 10 pounds of water, to which two and a half pounds of sulphuric acid are then gradually added. The zinc plate is placed between two carbon plates, so that both sides of the zinc are brought near the carbons. In order to avoid local action the zinc plate is attached to a movable rod which permits it to be raised out of the liquid when the cell is not in use. This cell is capable of producing an E. M. F., of about 1.9 volts. It rapidly polarizes, however, so that it cannot be satisfactorily employed for furnishing current for any considerable time. In this, as in all other cells in which zinc is employed, the zinc is carefully amalgamated.

There are other forms of single-fluid cells. These, however, are of comparatively little importance owing to the rapidity with which they are polarized. One of them, known as the Smee cell, consisted of a couple of zinc and silver inmmersed in an electrolyte of sulphuric acid and water. In order to decrease the polarization, the silver plate was provided with a roughened surface, by coating it with a thin layer of metallic platinum in the condition known as platinum black. The Smee cell gave an E. M. F. of .65 volts, and, before the introduction of the dynamo-electric machine, was employed to some extent in electroplating or coating conducting surfaces with thin layers of metal by electricity.

By far the most important voltaic cells are of the double-fluid type. As we shall employ this term it includes not only cells in which two different fluids are actually employed, but also those with a single fluid but in which the negative plate is surrounded by a solid substance capable of combining chemically with the hydrogen.

Where two different liquids are actually employed an additional cell called a porous cell, consisting of a jar of unglazed earthenware, is employed for holding the depolarizing electrolyte.

One of the earliest forms of double-fluid voltaic cells was invented by Grove, an English physicist. This cell, known as the Grove cell, consisted of a zinc platinum couple immersed respectively in dilute sulphuric acid and strong nitric acid. The nitric acid was contained in a porous cell of unglazed earthenware. Polarization was partly avoided by the fact that before the hydrogen could be set free, and collect on the surface of the platinum plate, it entered into combination with the oxygen in the nitric acid, and was thus oxidized so as to form water. The Grove cell is capable of producing an E. M. F. of 1.93 volts.

Owing to the cost of the platinum employed for the negative plate, the Grove voltaic cell was too expensive for extended

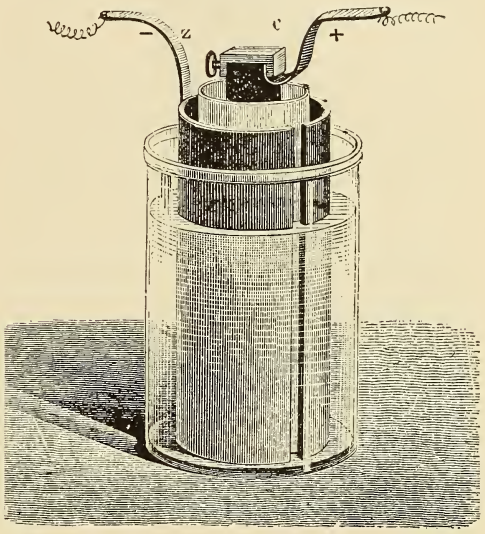


FIG. 117. BUNSEN CELL

use. It was replaced by a cell devised by Bunsen, the German chemist. In the Bunsen cell, as represented in Fig. 117, the platinum of the Grove cell is replaced by carbon. The elements are therefore zinc and carbon. The zinc is dipped in dilute sulphuric acid and the carbon in the strong nitric acid, placed in a porous jar or cell as shown. This cell will produce an E. M. F. of 1.96 volts.

None of the cells so far described is capable of producing a steady or constant current for an indefinite time. It was not until Prof. Daniell, of London, in 1836, employed the electro-chemical method of avoiding polarization, that a cell capable of furnishing a steady current for a practically indefinite time was produced.

The Daniell constant voltaic cell, as shown in Fig. 118, consisted of a couple of zinc and copper immersed respectively in dilute sulphuric acid and a saturated solution of blue vitriol or copper sulphate. The two

solutions are kept from mingling by the use of a porous cell containing the copper sulphate. The zinc was made in the form of a cylinder surrounding the porous cell, and the copper plate was provided with a perforated cage supported near its top so that when filled with a handful of crystals of copper sulphate the lower portion of the

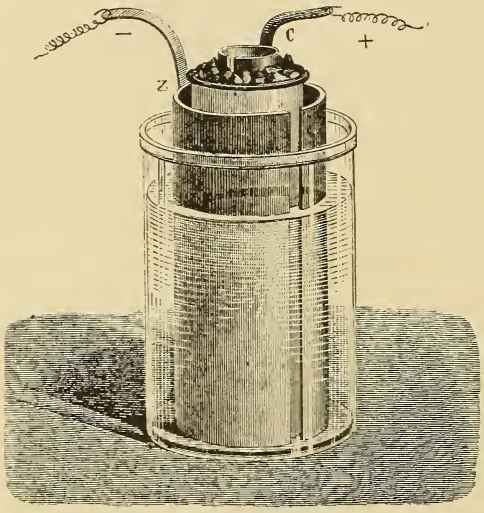


FIG. 118. DANIELL CELL

crystals was immersed in the solution of copper sulphate into which the copper plate was dipped. This cell produces a practically constant E. M. F., of about 1.072 volts, for an indefinite time, thus showing that all polarization has been prevented.

The action of the cell is as follows: the sulphuric acid acts on the zinc, forming zinc sulphate, and liberating hydrogen gas which passes through the porous cell. Before the hydrogen can reach the copper plate, however, it meets the saturated solution of copper sulphate which it decomposes, liberating free sulphuric acid, and depositing metallic copper on the surface of the plate. The strength of the sulphuric acid electrolyte is maintained practically constant, since for every molecule of the acid that combines with the zinc, a molecule of zinc sulphate is formed, and sufficient hydrogen liberated to again form a molecule of sulphuric acid when this hydrogen decomposes the molecule of copper sulphate, for the sulphuric acid liberated passes through the pores of the cell into the dilute acid into which the zinc plate is dipped.

As the strength of the solution of copper sulphate is decreased by its decomposition of the hydrogen, a portion of the crystals of copper sulphate is dissolved from the cage that dips into the solution, thus maintaining a saturated solution.

In actual practice the metallic copper is sometimes deposited on the outside of the porous cell, thus greatly increasing the electric resistance of the cell. In order to avoid this an improved form of Daniell's cell has been devised, known as the gravity cell, whereby the use of a porous cell is avoided, the two electrolytes being separated from each other by their differences of density, the lighter diluted sulphuric acid and zinc sulphate, floating on the top of the denser copper sulphate.

Varying forms are given to the gravity Daniell cell. That employed in America is shown in Fig. 119. Here, the zinc has the shape of an open wheel suspended by suitable supports near the top of the glass cell, while the copper plate, placed at the bottom of the jar, is covered with a few hand-

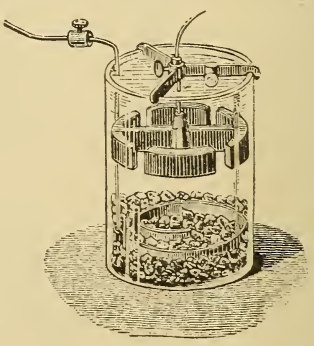


FIG. 119. GRAVITY CELL, AMERICAN TYPE

fuls of crystals of copper sulphate. An insulated wire, connected with the copper plate, passes up through the liquid and forms the copper or positive pole of the cell.

The gravity cell will furnish a steady current for a long time without much attention, it being only necessary occasionally to throw into the cell a handful of crystals of copper sulphate, to renew the water on top of the liquid that is lost by evaporation, and occasionally to draw off a portion of the zinc sulphate when it becomes too concentrated.

An important double-fluid cell is known as the Leclanche cell. The voltaic couple is

zinc and carbon. The carbon element consists of a carbon plate, placed inside a porous cell closely packed with a mixture of powdered carbon and black oxide of manganese. This packing is sufficiently

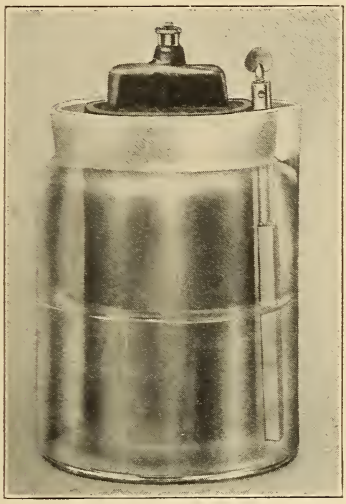


FIG. 120. LECLANCHE CELL

strong to insure a good electric contact between the carbon plate and the packed material. The zinc consists of a small rod placed in one corner of the glass jar in which the porous cell is placed, as shown in Fig. 120. The electrolyte is sal-ammoniac dissolved in water, this liquid being poured both into the outer jar as well as into the porous cell. The black oxide of manganese that surrounds the carbon plate acts as the additional de-polarizing substance.

The Leclanche cell is capable of producing an E. M. F. of 1.47 volts, and of furnishing a fairly strong current for a short time. It is, therefore, suitable for the operation of such electro-receptive devices as the bells of burglar alarms, annunciators, etc., that are only employed for short times; for, owing to the presence of the black oxide of manganese, the cell, if left on open circuit for a sufficient length of time, is completely de-polarized. The Laclanche cell is therefore called an open-circuited cell, since it requires to be left on open circuit in order to be satisfactorily operated.

The Laclanche cell is used in enormous numbers in connection with electric bells. When not used too frequently it will continue in satisfactory use for six months or a year without requiring any attention.

A recently devised double-fluid cell known as the Edison-Lalande cell, consists of a couple of zinc and copper immersed in an electrolyte of caustic potash or soda dissolved in water. The copper plate is prevented from polarizing by a coating of compressed oxide of copper. This cell is

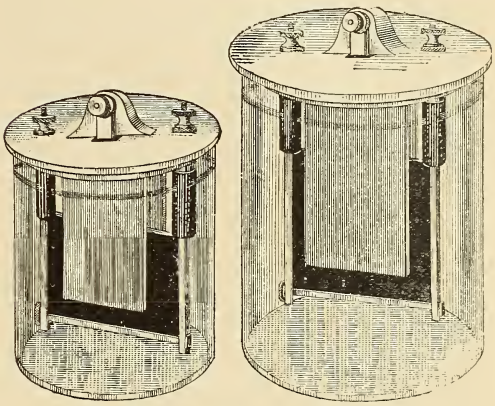


FIG. 121. EDISON-LALANDE CELL

capable of giving a powerful current for a fairly long time without marked polarization. Nor does it manifest marked local action when left on open circuit. An Edison-Lalande cell is shown in Fig. 121.

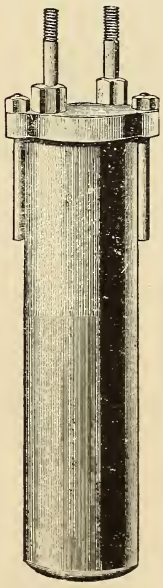


FIG. 122. SILVER-CHLORIDE CELL

A variety of voltaic cell known as the silver-chloride cell is employed in the series batteries used for medical purposes. This cell consists of a couple of zinc and silver immersed in an aqueous solution of sal-ammoniac or common salt. The silver element is formed of a silver wire that is surrounded by a mass of fused silver chloride. The zinc and silver plates are prevented from coming in contact by pieces of suitably placed insulating material. The two elements are placed inside a rubber jar, Fig. 122, containing the exciting liquid, a dilute solution of sal-ammoniac in water.

The advantage of the silver-chloride cell is to be found in its portability. As many as fifty separate cells can be placed in a

frame connected in series as shown in Fig. 123, and placed in a wooden box, Fig. 124, with the entire battery weighing in the neighborhood of but ten pounds. The

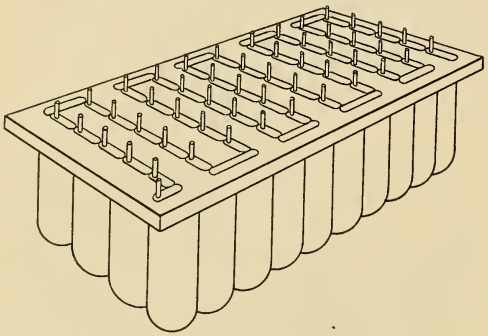


FIG. 123. ARRANGEMENT OF SILVER-CHLORIDE CELLS

silver-chloride cell can produce an electromotive force of 1.03 volts. Owing to the small size of its cells, however, it cannot furnish very powerful currents. It is especially useful when feeble current and high electromotive forces are required.

The inconvenience of carrying voltaic cells from place to place has led to the invention of what are known as dry cells

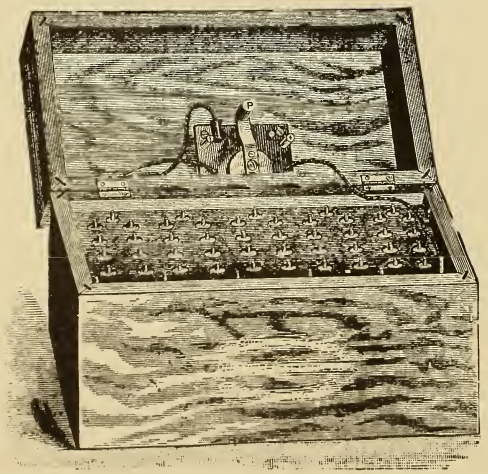


FIG. 124. BOXING OF SILVER-CHLORIDE CELLS

with which nearly every one is familiar. This name is a misnomer, since all dry cells contain water that has been absorbed, by sawdust, plaster of paris, or gelatine, and is thus prevented from splashing when carried about. The electrolyte is generally a solution of sal-ammoniac and water, and the couple, like the Leclanche cell, consists of zinc and carbon.

Voltaic cells are sometimes called galvanic cells, and the electricity produced was formerly known as galvanic electricity. The use of either of these names is, however, incorrect, since it was Volta and not Galvani who invented the electric source that produces electricity by means of chemical action.

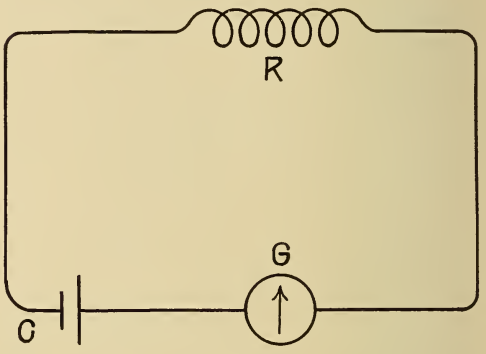


FIG. 125. SYMBOL FOR REPRESENTING A VOLTAIC CELL IN CIRCUIT

For convenience the following symbol is employed in electric diagrams for representing a voltiac cell. As will be seen this symbol consists of two lines of unequal length that represent the two elements of a voltaic couple, the space between them, indicating the electrolyte. In Fig. 125, (C) represents a voltaic cell, (R) a resistance coil, and (G) a galvanometer, all of these being placed in series with the voltaic cell.

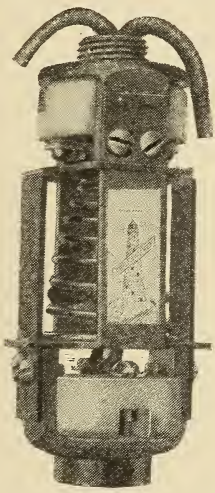
(To be Continued.)

Hydroelectric Power for Chattanooga

Manufacturing in Chattanooga entered on a new and greater epoch on June 17th, when electricity from the 56,000 horse-power plant at the lock and dam was sent over transmission wires into the heart of the city. Four years ago the Chattanooga and Tennessee River Power company obtained a franchise to operate in the city, on condition that electricity be sent over the wires in four years, and by turning on the current on the 17th the company fulfilled the terms of the contract, for the four years would not have expired until the 19th. The plant generating power, second in immensity only to that of Niagara Falls, is now in steady operation.

The Tungsten Life Saver

Filaments of the tungsten lamps are not as strong and will not withstand vibration and shock as well as the carbon filaments of the ordinary lamps, although their efficiency and light giving properties are far in advance of anything thus far developed in the line of electric incandescent lighting. The first tungsten lamps produced for commercial purposes were very fragile and would only operate in a vertical position. Upon the least jar they were broken. Since then great improvements have been made, such as anchoring the filaments, etc., which makes the lamp much more practicable. However,



TUNGSTEN LIFE SAVER

they are even now not vibration proof and accidentally striking the electrolier or bracket is apt to result in the destruction of the lamp filament.

The idea to protect the entire lighting fixture and thus stop the effects of the shock at a point as far removed from the lamp as possible has resulted in a little device known as the tungsten "life-saver." It consists of a very sensitive coiled spring arranged between two stirrup-like hangers. This spring is smaller at the top than at the bottom and permits of a lateral oscillatory motion in every direction. The hangers are supported by this spring and are also free to move in a lateral direction. The lighting fixture support is screwed into a receptacle attached to the strap hangers, the whole device being fastened to the ceiling.

Any constant vibration as in factories, engine rooms, etc., is taken care of by the spring which also neutralizes any shock resulting from a sidewise or vertical blow on the fixture.

When Ordering Motors

To many people a motor is a motor and in ordering one from the manufacturer they frequently give little information other than the horsepower required. As a consequence there is much unnecessary correspondence and delay. It is well to bear in mind, therefore, that the information given can hardly be too explicit. Let the manufacturer know in the beginning exactly what it is that you want.

In the first place he must know whether it is a direct or alternating current motor that you require. This of course depends upon the nature of the current that you have available. Then he must know the voltage of the circuit, whether alternating or direct, and the number of horsepower required. If it is an alternating current motor give the frequency of the alternations in cycles per second, also whether it is to run in one two or three phases of the current. The above data as to voltage, kind of current, frequency, etc., you can obtain from the lighting company which supplies your current.

The above are the fundamentals, but there is other information which it is well to give the manufacturer. Tell him the nature of the machine which your motor is to run; what the speed of the machine is to be and the size of its pulley (in order to determine the speed and size of motor pulley). Explain the nature of the location of the motor, whether in a wet or dry place, whether well ventilated or confined, etc. Also, if the motor must be confined in close quarters give the dimensions of the space available. Motors have been shipped which could not be used because of insufficient room. Also tell whether the motor is to run steadily on full or partial load.

If there is anything special about the service be sure and explain it. For instance, if a very heavy torque or turning power is required to start the machine as compared with the running power.

If it is desirable that the motor have automatic starting and stopping devices mention the fact and the manufacturer, knowing the conditions of the service, will be able to suggest appliances for doing this.

Making Old Poles New

The users of wooden poles are suffering especially from the failing supply of timber in this country. The qualities required in a good pole—durability, light weight and straightness—combined with relative smallness are most readily met by cedar. This wood has most generally been used for poles, with chestnut as a somewhat distant second; these woods, in fact, affording over 80 per cent of the poles used. A result of the enormous consumption, coupled with the wasteful and extravagant methods of cutting and use, has been to restrict the regions from which the present supply is obtained. The nearby timber was naturally used first, and at the present time the supply of cedar poles is confined almost entirely to the Lake States, the Northwest and parts of the Adirondacks. The region from which chestnut poles are obtained is even narrower, Pennsylvania, Maryland, Virginia and West Virginia furnishing the bulk. This means that the consumer, in addition to paying a higher price, due to increasing demand and decreasing supply, must in many cases add a higher transportation charge.

In 95 per cent of the cases the life of a pole is determined by decay, and only five per cent by breakage or mechanical abrasion. The point of decay is right above and below the ground level, as there the structure of wood is most susceptible to fungi and bacteria, which are living organisms and thrive only in a condition of moisture. Consequently, in practically every case of a pole which has decayed at the butt the portion above ground is sound and would be good for many years' service. Of late years there

STEPS IN THE METHOD OF POLE REENFORCEMENT

has been much experimenting with preservatives, applied to both the entire pole, but in most cases to the butt only. Much progress has been made, and with many companies the lower portion of the pole receives one or two coats of some preservative before setting. The government reports show that in 1907 over 11 per cent of

SECTIONAL VIEW OF REENFORCED POLE

the number purchased received some preservative treatment.

However much good these means accomplish, as far as the poles now standing are concerned (and there are estimated to be over 50,000,000 poles in use in this country) it seems very largely an instance of "locking the stable after the horse is stolen," as it is impractical to apply preservative treatment to a pole which has been standing for some time. When the butt is decayed to such an extent as to render a pole dangerous, a new pole must be put in, unless by some process the butt can be strengthened in an adequate fashion, and the sound upper portion continued in service.

The Pittsburg reenforcing process for extending the life of poles already decayed is one which is gaining ground rapidly and where employed is saving many thousands of dollars for the telephone and lighting companies. The pole to be reenforced is supported by tripods or held securely in place by temporary guy ropes or wires; the earth is then removed for a distance of about eighteen inches from the sides of the pole to a depth that will expose the solid portion of the butt remaining. The decayed portion of the pole is then scraped out. Half inch steel rod from three and a half feet to six feet long and pointed at both ends, the upper end being bent at right angles to form a dog or point from five inches to six inches long, are used for reinforcing. The straight end of the rod is driven into the sound portion of the butt at an angle by the use of a special driving tool. The upper portion of the rod is then bent in toward the pole and the dog driven in to its full length.

The length of the rod is such as to permit the proper anchorage of its lower end in the sound wood of the butt and to allow the portion extending above ground to be of sufficient length to span the decayed section of the pole and be driven into perfectly sound wood. The points of the rod are usually driven into the pole from 12 inches to 18 inches above the ground level. Concrete is filled in around the pole, replacing the decayed portion of the wood and forming a protecting sleeve or envelope. This concrete extends above the ground sufficiently far to cover the upper terminals of the rods and protect them from the action of the moisture in the air.

The above process is patented and of course those using it without license would be liable to infringement proceedings.

Tubelite Reflector

A new type of reflector for illuminating show windows and show cases is called the "Tubelite" reflector. It occupies space only 2¼ inches in width and can be made in any length up to 10 feet, without seams. It can be turned out with bright, nickel reflecting surface, matt finish, or lined with glass and finished on the outside to match woodwork. When desired, the reflector is supplied with adjustable fittings. Wiring trough and sockets can be removed without disturbing the reflector. Another feature is that standard base tubular lamps are used, which lamps can be purchased in any electrical supply store, and should a lamp burn out, there will be only a six-inch unlighted space. Illuminations from eight to 64-candle power per foot can be obtained.

TUBELITE REFLECTOR

How Cities Advertise

Any one riding into the city of Easton, Pa., over its principal railroad, after dark, sees the big slogan sign which reads: "Easton —City of Resources." Passengers crowding out by a firm of central station operators, who from past experience in other cities, where their plants are in successful operation, realize that co-operation between the

to the car windows first see two arrows of green light shoot out horizontally, pointing out the breadth of the city. Then a red sun looms up behind the green horizon. Suddenly athwart the sun the word "Easton" breaks out in letters of white light, and finally as the rays of the sun die away, the words "City of Resources" are flashed forth in a line of five-foot white letters. This great sign, installed through the co-operation of the Easton Gas and Electric Co. and the Easton Board of Trade, measures 54 by 45 feet over all and contains 2,000 electric incandescents. It was furnished to the city and is maintained in operation by the electric company and is a proof of the power of a progressive and broad minded central station company to invigorate a community.

Less than a year ago the old lighting company operating in Easton was bought company and the citizens in the general up-lift of the city is essential. "All get together and boost for the city" is the principle upon which they operate, so meetings were called of the prominent business men and property owners. New enthusiasm was put into the Board of Trade. Lantern slide lectures were given, demonstrating the advantages of outdoor display lighting and finally the great slogan sign was put up.

All these things have had a remarkable effect not only in arousing new activities in Easton, but also in getting the city talked about, far and wide, as the city of resources.

Much the same thing has been done in Montgomery, Ala. In this case it was the Montgomery Light and Water Power Co. which took the initiative and introduced the slogan, "Montgomery—Your Opportunity." In this case also a great sign,

contributed by the power company, blazes out by night a welcome to this progressive city of the South.

The sign was first lighted on Tuesday evening at 8 o'clock, July 20, 1909. Its brilliance rendered superfluous the fireworks in the sparks of which it received its baptism. With its mammoth red key transfixed against the sky and with the lettering, "Montgomery" and "Your Opportunity" playing on and off, it elicited great cheers from the crowd gathered to witness the dedication. The cavalry band was there, playing the march, "Montgomery, Your Opportunity," written especially in honor of the sign.

That the mammoth sign to be built should bear some slogan indicative of the city's progress and possibilities was agreed upon. As to what the slogan should be was left to the citizens. A contest was begun open to all citizens, who were to offer suggestions. Twenty-five citizens of prominence were named as a committee of judges to decide on the slogan.

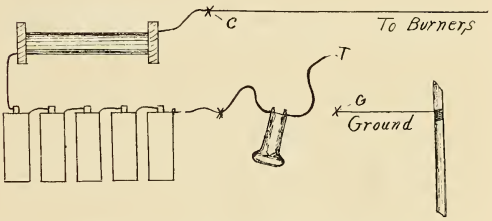
The slogan as finally adopted was the outcome of a dual intellect. Miss Anita Strassburger conceived the idea of the key, and Mr. Gordon McKinley, a reporter on the Montgomery Advertiser, originated the "Montgomery, Your Opportunity," wording. Thus the conception was carried into execution. The sign was built—a tremendous skeleton, containing 2,600 electric bulbs in letters about six feet high.

The sign is 85 feet in length and about 75 feet from top to bottom, and is located at Court and Jefferson streets. All railway trains in passing the city of Montgomery are in sight of this great sign when lighted at night.

Telephone Receiver as a Testing Instrument

An ordinary telephone receiver is one of the most useful accessories of the amateur electrician, as it is very useful for testing electric gas lighting, electric bell, and similar circuits for leakage. Two flexible leads about 18 inches long should be carried from the binding posts of the receiver for connecting, and for testing, this little instrument will many times take the place of a more expensive one.

The accompanying diagram shows how it may be used to test gas lighting circuits. One terminal of the receiver is connected to the battery which is usually grounded, the ground connection being temporarily broken. The other terminal (T) of the receiver is then applied to the burner circuit where it leaves the spark coil at (C), being put in contact with, and removed from the wire several times in order to note clearly the strength of the click caused in the receiver. Then the free terminal (T) is touched repeatedly to the ground connection or a gas pipe. If there is any leakage a click will be heard, and a comparison of the sounds obtained in the last test with those



TEST BY TELEPHONE RECEIVER

obtained when the receiver is connceted to the spark coil terminal will give a good indication of the extent of the leakage. If no click is heard when the receiver is connected to the ground and battery, then the circuit is clear, assuming, of course, that the wires from the spark coil to the burners are all sound.

The same method may be applied to electric bell circuits, in this case there is no spark coil, so that the terminal (T) is touched to the circuit terminal of the batteries in the first part of the test and to the ground or common return wire in the second. The receiver can also be used to tell whether or not a bell rings when a button is pushed, by connecting the receiver terminals to the contacts of the push-button and pressing the button two or three times. If a buzzing noise is heard in the receiver after the connection between the push-button contact is broken, then the bell rings. If the bell does not ring, the receiver will merely give a single click, and if the circuit is broken between the button and the bell, no sound will be heard in the receiver.

The receiver, in connection with a few cells of battery, can also be used to test dynamo and motor windings.

Profits that Electricity Brought

In a certain village in New England is located a textile mill. Now there is nothing strange or peculiar about this insignificant fact for textile mills are more or less common in New England. But this textile mill has added interest in that it is one of the oldest in the state, if not in the whole country.

Time was when this little factory hummed merrily by day through power obtained from a small creek which very seldom ran low and never went dry. But the settlements pushed further and further into the hills and before them vanished the great forests; they cleared the land for planting, and the green Irishmen ditched the farms until the spring-fed swails and swamps were things of the past. Before such inroads on nature's scheme for retarding the waters to keep the brooks and streams constant the power vanished. In the Springs and during heavy thaws or rains there was an abundance of power but there being no provisions to substitute nature's plan for storing this water it all ran away before it could be used and the water power became practically useless.

Very fortunately for the milling industry about this time human minds had perfected the steam engine to take the place of the damaged water powers. It is our greatest prerogative to first destroy a thing then to cast about until a substitute is found.

This mill was a paying institution and as soon as it was found that the water power was inadequate and unreliable the proprietors got their heads together and purchased a steam engine. A large power house was erected and in it was installed two huge boilers and a large reciprocating engine. Sweating, grimy men stood before the furnace doors and heaved coal into the fiery maw of the boilers. Another man in oil stained overalls and dicky watched the giant engine, the spinning fly wheel of mammoth proportions and the great leather belt which consumed hundreds of steer hides in the making. This leather belt turned the great shaft which had been run so many, many years by the noisy creek. The water wheel was abandoned and the dam was repaired and kept merely as a source of water for the boilers.

Year after year, year after year the great arm of this steam engine moved back and forth, back and forth, for ten hours a day in its well oiled bearing, spinning the great fly wheel and driving the great leather belt. As the years went by hundreds of thousands of dollars worth of good coal were hauled into the mill in the coal cars and thrown into the red furnaces. This was money almost thrown away if we consider the days when the noisy stream did the same work for nothing. But the stream, like a played-out horse, would never work again and the more costly energy of coal had to he employed or the mill closed.

About this time the cost of coal in carload lots began to increase so fast it threatened the profits of the mill and it began to look as though the plant would have to close.

One day the managers called the engineer into the office and told him that the profits of the concern were being eaten up in the power house and asked him for advice.

"This plant has always been a success and thousands of honest dollars have been made right here," remarked the president. "but unless steps are taken at once to lower the power cost we will have to close down. Competition is so severe we can ask no more for our goods and sell them. Our help here in the country is the cheapest to be obtained anywhere. It is only a question of cheaper power."

"Ah, if that old creek was what it was when I was a boy," sighed one of the aged directors.

"But it isn't," answered the young engineer, "and it never will be again. I have been seriously considering this power question myself and there are but two logical solutions. We have an old water power which might be restored if large storage reservoirs were erected. I have looked the ground over and hate to report that it would take a fortune to purchase the land required for such a dam and another fortune to erect the dam itself."

"And what is the other solution?" asked a director.

"Electricity," answered the engineer, very enthusiastically.

"But where are we to get the electricity?" asked the president. "We are far away from any electrical power producing stations and it would cost us just as much to produce electricity as it does steam power."

"And that is very true," remarked the engineer, very much interested in his subject, "but with electric drive installed in that plant the output of every machine would be increased from 15 to 20 percent, for the same cost as at present. This in itself would mean a handsome profit for the firm. Then we would not be wasting 20 percent of our power to turn useless shafting and belting."

"Prove that statement," cried the president, now thoroughly aroused.

"And, furthermore, I would recommend that that old steam engine be thrown on the junk heap," continued the engineer.

"But that engine cost ——," cried one of the directors.

"I don't care what it cost," answered the young man. "It has paid for itself already many times over and it is too costly and too extravagant in fuel and power for this day and age. What we must have is a small turbine engine, direct connected to an electrical generator, and equip this plant with motor drive and electric lights. Such a plant would cost considerable but it would pay in the end. It would save power and coal and increase the production without increasing the factory cost."

"Prove it," cried the president.

It took days and days to prove these statements to the directors but in the end the young man's determination won the day, but not until he carefully checked every statement through competent engineers.

The expenditure was authorized and the young man himself was sent to buy a steam turbine engine direct connected to an electrical generator. He also ordered the electric motors and the other necessities.

The mill was closed for a whole month and during that time the busy workmen removed the faithful old engine and threw it on the junk heap. The boilers were repaired and an automatic stoker installed to take the place of the sweaty, grimy firemen. It is worthy of note that the directors shook their heads when they saw the steam turbine setting up in the center of the large power house, looking pitifully small and inadequate to take the place of the giant just removed. It took all the engineer's time for hours explaining that the size of the new turbine had little to do with its power and as a matter of fact the small engine could develop a third more power than the old one, if necessary, although it took up less than a quarter of the floor space.

The huge fly wheel was tenderly laid on the junk heap beside the engine and the wide leather belt, made of hundreds of steer hides, was thrown away. Great quantities of belts, shafts and pulleys were also thrown on this same junk pile until the interior of the working rooms of this textile mill looked as though a forest of trees and fixtures had been removed. The light was far better and the men and women had more room to work and less danger from shaft ends and breaking belts to face. The mill was completely lighted by electricity.

When the mill reopened the young engineer was sufficiently conversant with electrical power to take care of the turbine and generator and to operate all the other electrical machinery. The turbine started smooth and steady, running without a jar and with very little noise. The motors throughout the plant drove the machinery as never before and the president and directors, to say nothing about the operators themselves, were perfectly delighted with the new power.

"Better not rejoice too much until we see the balance sheet at the end of the month," cautioned one old man who was noted for his wealth and his pessimism.

"It will show a good saving," predicted the young engineer.

While it is true that the balance sheet for the first month did not show as large a saving as was anticipated, owing to the machinery being all new and the men unfamiliar with its use and management, the saving grew from month to month until the profits for the little textile mill were restored to their old order and everyone, including the pessimistic one, was satisfied and pleased with the new electric power.

Storage Battery Mine Locomotives

By FRANK C. PERKINS

In Europe there are a number of mines which have been equipped with electric storage battery locomotives of unique construction, the batteries being mounted on the top and removable for charging, by means of a special gearing with permanent rolls fixed in the top of the locomotive frame. By providing this equipment it is possible to remove the discharged batteries and provide fully charged battery sets with a minimum expenditure of labor in making the exchange.

One of four locomotives in use at the Grillo shaft of the Monopol mine owned by the Gilsenkirchener Bergwerks-Aktiengesellschaft may be seen in Fig. 1. In Fig. 2 are seen the batteries removed from the locomotives and being charged on the charging tables. The electric motors are of eight horse power capacity, and there are 10 storage battery sets at this mine, in service, each set contains 80 cells having a capacity of 30 ampere hours each.

The storage battery locomotives are said to have several advantages over those operated by overhead trolleys or third-rail conductors almost universally used in this country. They are held to be very much safer in mines containing dangerous gases, there being no sparking from third-rail or trolley. They also have a large radius of action without extensive overhead construction.

FIG. 1. STORAGE BATTERY LOCOMOTIVE IN THE MONOPOL MINE

In Hungary at the Petrozeseny Mine there are eight storage battery locomotives in service of the type shown in Fig. 3, each having motors of a capacity of 12 horse power. These locomotives are operated in pairs, the double locomotive thus formed having a capacity of 24 horse power and

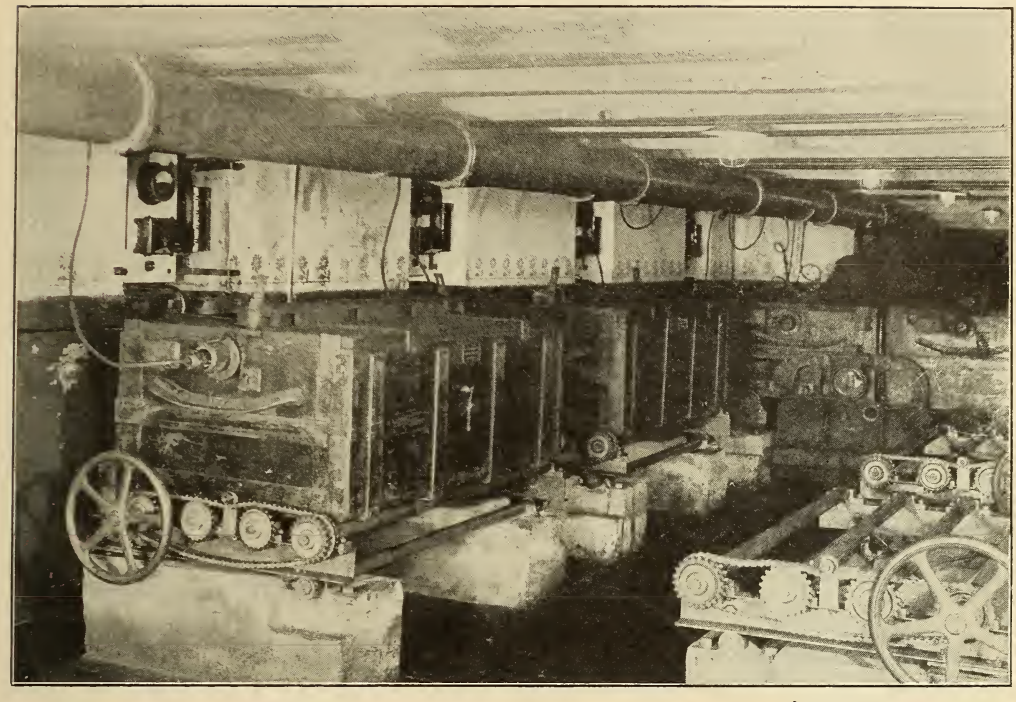


FIG. 2. LOCOMOTIVE BATTERIES BEING RECHARGED

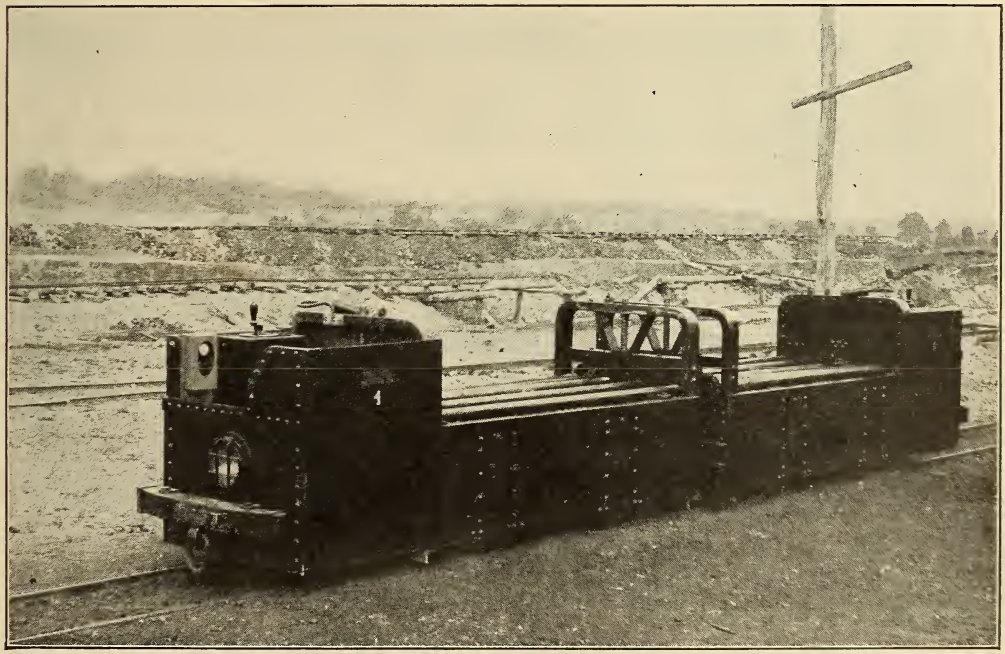


FIG. 3. TANDEM LOCOMOTIVE USED IN A HUNGARIAN MINE

being capable of hauling 40 coal cars without difficutly. At this mine there are 16 sets of batteries used, of the Tudor type, built at Budapest, and each locomotive has

51 cells with a capacity of 74 ampere hours. It may be stated that the batteries are seldom discharged more than 60 or 70 per cent of their capacity, and it requires for charging only about one third of the time usually taken for discharging while in operation in the mines. When partially discharged the storage batteries may be fully charged in about one and one-half hours.

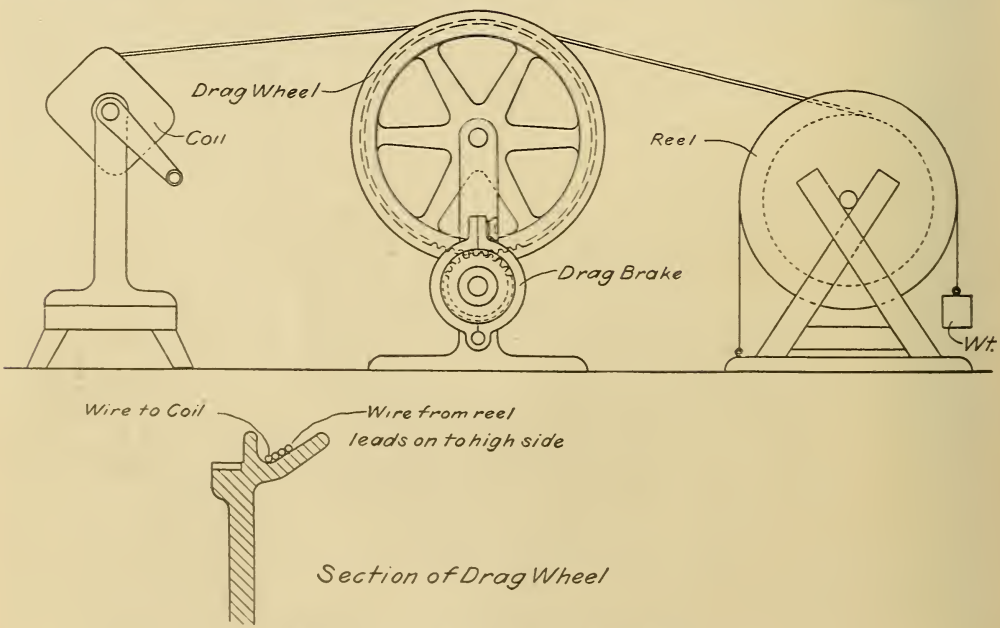
The cost of operation for these storage battery mining locomotives is from one-third to one-half the cost of animal power, and the current required is from one-fourth to one-third kilowatt hour per ton-kilometer capacity. Another advantage of these equipments over the trolley and third-rail mining engine is that no added weight is needed for adhesion as the storage batteries supply all the necessary weight.

The Making and Winding of Magnet Wire

From the earliest period of manufacture of electrical machinery the insulation of armature and field magnet coils has been the weak feature of their construction and the cause of the greatest number of failures. The chief weakness in insulation, which must be avoided, is its liability to destruction from overheating, and in certain classes of machinery, subject to frequent and excessive overloads, even for short periods, the serviceable life of the windings where poor insulation is used may be but a matter of a few months.

Many efforts have been made to devise an insulation for the wire used in this apparatus which would not be so readily affected or destroyed by the necessary heat rise. While this has been accomplished in a measure by the use of special material, generally asbestos, the results have not been satisfactory owing to the bulkiness of the product, and it has been found that the amount of space necessary in proportion to the actual allowable space practically prohibits its use. After experiments extending over a number of years a kind of insulation has been produced, called Deltabeston, in which all of these defects are said to have been eliminated As far as the temperature rise goes, it is practically indestructible, while at the same time the thickness of the insulation compares very favorably with that of ordinary double cotton insulation.

Deltabeston wire is insulated with pure asbestos which has been treated in such a manner that its insulating properties are exceptionally good. At the same time its wonderful resistance to heat renders it absolutely indestructible as far as any temperature rise to which it may be subjected



METHOD OF WINDING MAGNET WIRE

in commercial service is concerned. The following comparison of the heat resisting properties of cotton covered and Deltabeston wire will be of interest.

Investigation has shown that at a temperature of about 147° C. cotton covered wire will in time char to an extent that will break down its insulation. It was further ascertained that at 199° C. cotton covered wire began to smoke in 20 seconds. At 239° C. it was distinctly discolored in 50 seconds and complete carbonization had taken place at 245° C. in two minutes and 15 seconds. These temperatures are of course excessive, yet they go to show how short a space of time is necessary to ruin the field or armature windings on a railway motor, subjected as they frequently are to enormous overloads.

Deltabeston wire tested under identically the same conditions, in fact subjected to icentically the same volume of current, is absolutely unaffected. An interesting comparative test of the properties of the two wires is shown by coupling two pieces together and subjecting them to the same current, resulting in the complete destruction of the cotton insulation while not in the least affecting the Deltabeston wire, which may be further increased in temperature to a dull red heat without its insulation being destroyed. Thus, the only limit to the temperature at which this wire may be run is the oxidization of the copper itself, which will gradually occur if the coil is run continuously at a temperature of over 250° C.

In the winding of magnet coils with this wire the ordinary methods of clamping in order to secure tension do not give satisfactory results. A method recommended is to coil the wire three or more times about the periphery of a geared wheel, the surface of which is higher on one side than on the other, as shown in the cut. Special pains should be taken to feed the wire from the reel on to the high side and draw it off the wheel from the low side.

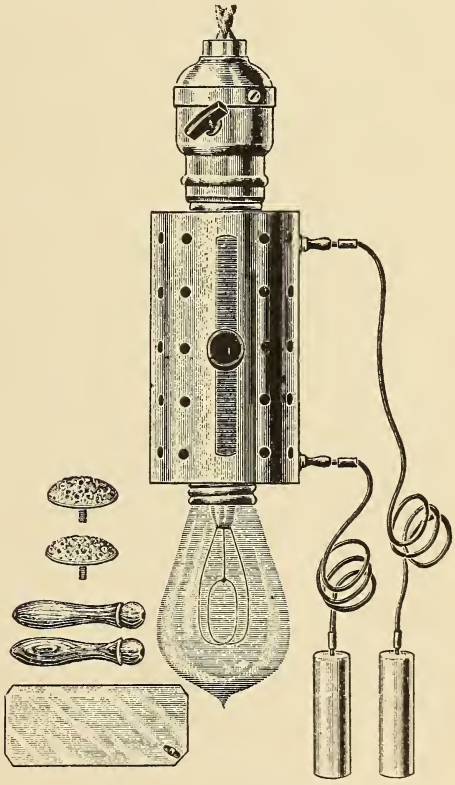
Notice to Chicago Subscribers

Don't fail to give us your new street number. (See notice and form in the Advertising section). This is very important in order that you may not miss any numbers due to their being sent to the old address.

Physician's Current Transformer

Electric current for medical purposes must of course be less powerful than the ordinary lighting current; that is, the voltage must be less. A simple little transformer for reducing the voltage by means of resistance inserted between the electrodes, which come in contact with the body, and the source of current is shown in the diagram, and is known as the White Cross transformer.

One wire from the 110-volt lighting circuit leads to a fine resistance wire wound on a porcelain tube contained within the



THE WHITE CROSS TRANSFORMER

cylindrical casing, from there a wire leads to one electrode. From the other electrode a wire passes to the incandescent lamp and then back to the other side of the 110-volt circuit.

By moving the little button seen on the front of the casing, up and down, the current passing through the body may be regulated by very fine gradations.

The device will give from one to twenty-five milliamperes of current.

Handwriting Duplicated by Wire

There is an extremely interesting device which has been used to a limited extent for ten or fifteen years which comparatively few people have ever seen and fewer still can explain when they do see it in operation. This instrument is the telautograph, a delicate electrical mechanism which will infallibly reproduce your own handwriting at a station as far distant from the sending station, where you are writing, as the wires of the system may reach.

You sit down to the instrument, take up the ordinary pencil attached to it, write the message on the paper pad, and instantly slender metal fingers will begin to work up and down like a jumping jack, apparently with random motions, and the message will be transmitted, letter for letter, and an exact copy of the words and handwriting will be recorded by the metal fingers at the receiving pad as instantaneously as the click of a tetegraph instrument flies from the sending to the receiving instrument. The distance does not matter. The writing at the other end will be recorded wherever the wires can be carried.

The sending pencil is attached by light rods to two lever arms which carry contact rollers at their ends. These rollers bear upon the surfaces of two current carrying rheostats which affect the strength of the current flowing out over the line.

When the pencil is moved, as in writing, the positions of the rollers upon the rheostats are changed and currents of varying strength go out upon the line wires.

At the receiver these currents pass through two light, vertically movable coils, suspended in magnetic fields, and the coils move up or down against the pull of retractile springs according to the strengths of the line currents. The motions of the coils are communicated to levers similar to those at the transmitter. At the junction of the levers is mounted the receiving pen, which by the motions of the coils, is caused to duplicate the motions of the sending pencil.

Ink is supplied to the pen automatically, and when not in use, the pen rests in the ink, preventing clogging and insuring an ample supply at all times.

Paper for use in the instrument is supplied from rolls five inches wide containing approximately fifty yards, and is moved forward as required by automatic shifters.

Perhaps the most interesting and useful application of the telautograph at the present time is in conjunction with the telephone system in a large hotel. The accompanying picture shows such an installation in the Hotel Astor in New York. Another modern hotel which will have such an equipment is the new Blackstone in Chicago, and following is a brief description of how this "long arm" system of writing will aid in giving good service to its future guests.

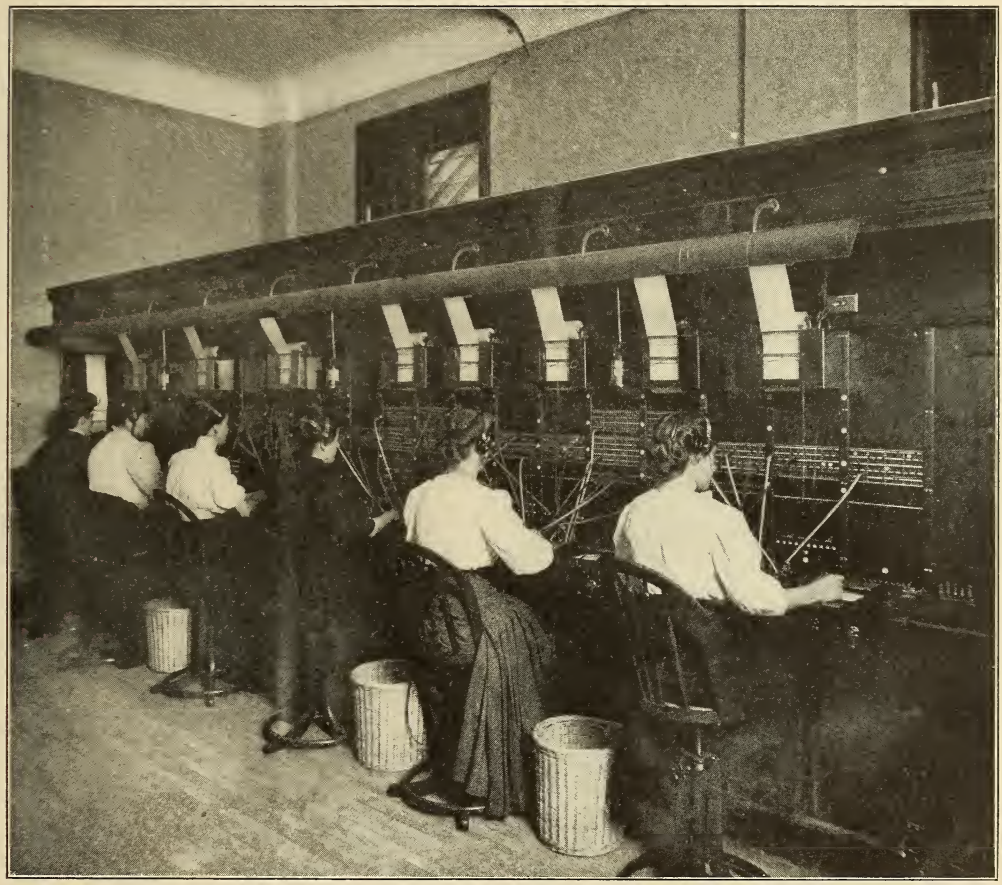
The general scheme of this system includes telephones in every room by means of which guests make known any and all of their wants to the telephone switchboard operator, who in turn is provided with telautograph equipment enabling her to immediately connect with and write to the proper department for information or execution of the request according to its nature. In this way a great deal of the business of the hotel is centralized at the telephone switchboard where each operator makes a permanent record of all the business she handles, whether it originates from a guest in his room, or from some department of the hotel, or from parties calling over the telephone from points outside of the hotel.

There are five "positions" at the switchboard, each position accommodating one operator and containing in addition to the usual telephone equipment, a telautograph transmitter and a pilot receiver and keys enabling the operator to write over any line she selects. Certain of the positions have additional receivers to enable the operator to receive written answers on some lines. The switchboard is what is known as the multiple type, that is, all jacks or telephone connections appear in multiple in each position, so that an operator at any position can supply connection through her mutliple jack to any telephone connected to the switchboard. For convenience the five positions are designated "A," "B," "C," "D," and "E," respectively, and the work of the switchboard is divided among the five positions, by distributing the answering jacks as follows:

"A" and "B" handle the incoming trunk lines and these two positions are equipped

with telautograph receivers for "Information" service between the switchboard and information clerk in the front office in addition to their pilot receivers which all positions have. "C" handles the house business telephones, that is, all the telephones not in the guest rooms, and also a proportional part of the room telephones. This position is equipped with a telautograph her position sign ("A" or "B" or "C," etc.), also to write the time on each message, except on "Information" messages, where only the position initial is required. This is necessary in fixing responsibility in case of errors or delays.

Taking up as an illustration the information service: Practically all of this service consists of incoming telephone calls on the



COMBINED TELAUTOGRAPH AND TELEPHONE SWITCHBOARD IN THE HOTEL ASTOR

receiver on the line connecting the manager's office with the switchboard and a receiver on the departure service line, in addition to its pilot receiver. "D" and "E" handle the remaining room telephones, which are divided between them, and a telautograph receiver on the announcing line to the front clerk is located between these two positions for the use of both of them in announcing callers to guests in their rooms. Each operator is required to initial every telautograph message with trunk lines to the "A" and "B" positions from outside parties wishing to talk to guests. The room number of the guest asked for, or his whereabouts, or whether such a party is registered at the hotel, is the information which the operator requires before she can complete the call, and the information clerks who have access to the guest index book are called on to furnish this information. Prompt and accurate information service is necessary to the good reputation of the hotel, and without it, a guest is like a

needle in a hay stack. The exact method of handling this service is as follows: Suppose "A" position picks up a party on one of her trunk lines calling for Mr. A. C. Brown. She connects her telautograph transmitter to the information clerk line and writes, "A. C. Brown—A". The clerk receiving the message looks up the name, and if he finds A. C. Brown registered and ready to receive calls, he connects his transmitter to the receiver on which the inquiry is recorded and writes "362." In the meantime the operator at "A" position has requested the party calling to "wait a minute," and while the information clerk is looking up the name, the operator attends to other calls or business requiring her attention, and when "362" appears on her information receiver under the name "A. C. Brown," she completes the connection between the party calling on the trunk line and room 362. Occasions may arise requiring any of the positions to write to the information clerk, in which case the position initial on the messages enables the "A" or "B" operator who receives the answer on the receiver before her to notify "D" or "E" position according to the initial. An operator handling an information call may find that the room does not answer when she completes the connection, in which case she offers to "page" the guest, or take a message to be left in his mail box. The procedure in this case is as follows:

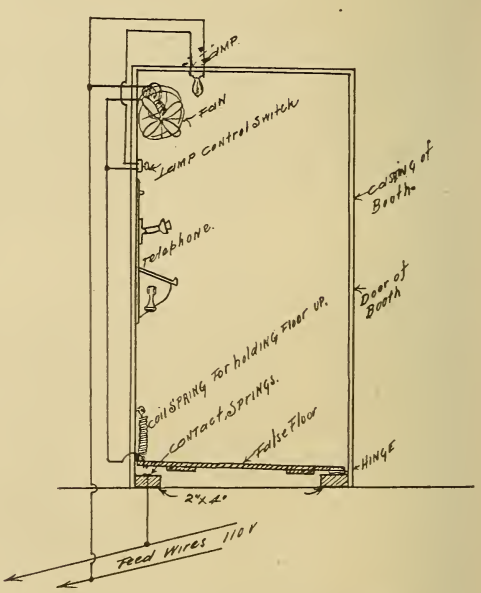
An outside party calling over the telephone for a guest who is found not to be in his room, desires to have the guest located if anywhere in the hotel. The party either agrees to hold the wire while the guest is being paged, or asks to have the guest call him at a certain telephone number. In either case the operator connects her telautograph transmitter to the paging line and writes, "Mr. A. C. Brown, Mr. Smith is waiting to talk to you on telephone No. 2568." She uses the number of the trunk line on which Mr. Smith is waiting if he is holding the wire, or the telephone number Mr. Smith gives her, if he does not want to hold the wire. This paging message appears at the front clerk, who tears it off the telautograph receiver and calls a page to execute it. If Mr. Brown is not found, or a message is simply left to be delivered, Mr. Smith is notified, and the message is properly stamped by the front clerk and left in Mr. Brown's mail box.

In much the same manner the telautograph is applied to a score of other purposes such as giving kitchen, bar and cigar orders, hall boy service, departure service and room changes, porter, cashier and all kinds of inter-department service in the hotel. And the great value of the system is that everything is "down in writing."

Wiring Telephone Booth Fan

One of the readers of Popular Electricity sends the accompanying drawing of a plan by which he wires telephone booths, using the type of telephone booth fan described in the June issue. He says:

"It is for practically the same purpose as your article treats except that there is a



WIRING TELEPHONE BOOTH FAN

false floor placed in the booth, with hinges near the door, so that when the floor is depressed by being stepped upon it closes the circuit starting the fan and lighting the lamp, which both cease to operate when party leaves the booth.

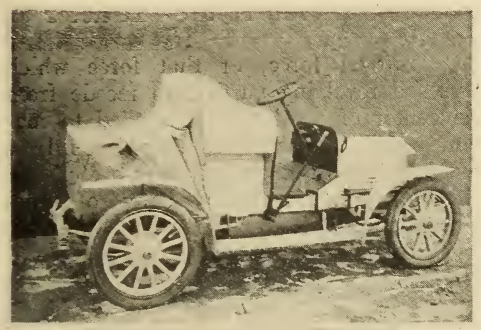
"The lamp is provided with separate switch to act independently of the floor, when the latter is pressed, to be turned off during daylight.

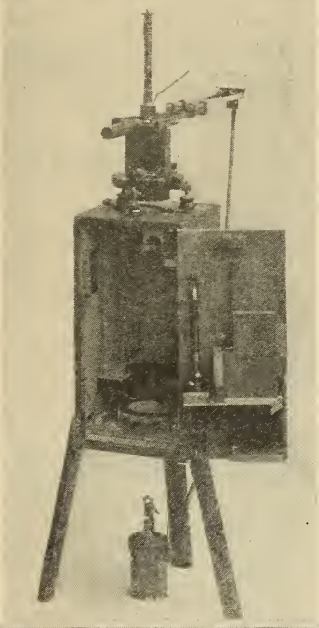
"This system does away with unnecessary wear on the fan and greatly reduces the expense of current."

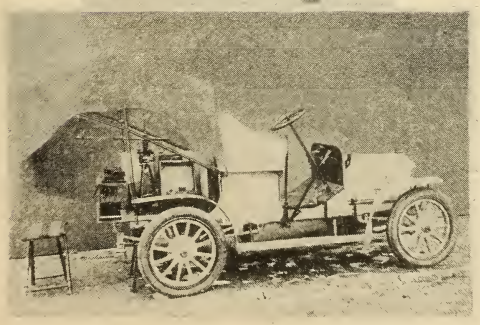
The Testing of Electric Cables

By DR. ALFRED GRADENWITZ

The cable system of a light and power company in any large city is a copper network covering an area of perhaps scores of square miles. In a system so vast there are, in spite of the utmost precautions, weak points where there is a tendency for the insulation to break down and allow the current to escape. Consequently the system needs constant watching and testing that precautions may be taken to prevent breakdowns, also to see that new work is properly constructed. These tests involve the use of more or less delicate apparatus for determining the insulating properties, electric capacity, resistance, etc., of the cables.

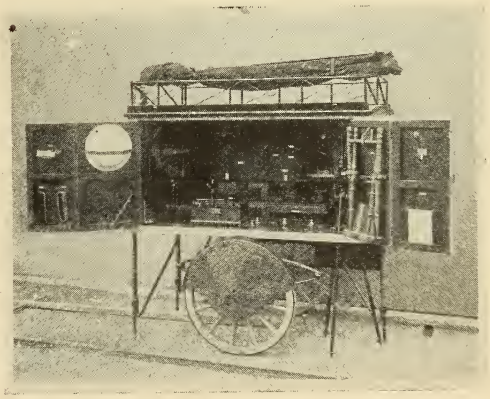






In making the tests portable testing outfits are often necessary, and in the design and fitting out of portable testing equipments the Germans have shown both skill and ingenuity.

One German manufacturer has developed a special style of automobile to serve as a traveling testing station. The cars either comprise an enclosed case accommodating the operator with his apparatus, or, in its place, a simple folding tent. Pictures of the latter type are here shown, in traveling and working order.



The whole testing apparatus is so arranged in this car as to be readily erected and rapidly and safely unmounted. The rear extension of the car comprises all the parts required for the testing of electric cables. Being readily detached, it is replaced either by a double seat or by a box for transporting tools, materials, etc. Thus modified, the automobile proves of much help in transporting raw materials.

The apparatus, arranged in working order, comprises all the instruments necessary for measuring the insulation, capacity and resistance, and ascertaining defects in the circuit.

For the purpose of making similar tests a push cart fully equipped with instruments has been devised by the same company, also a portable tripod case and mirror galvanometer.

Novel German Street Cleaner

Berlin can boast of being the cleanest city that exists. This is the opinion of the many thousands of foreigners visiting it every year. It is also a fact that German municipal institutions in general are of the highest class. This is due to the method of using the latest inventions and improvements made for the welfare of a city.

NOVEL GERMAN STREET CLEANER

Besides a large army of street sweepers and many mechanical brush sweepers, some years ago machines were installed with a water tank and a rubber broom which sprinkles and washes the pavement at the same time. This is indeed a great advantage over any other system, as the street is dried off immediately after sprinkling, while the ordinary water-cart leaves the ground wet and muddy.

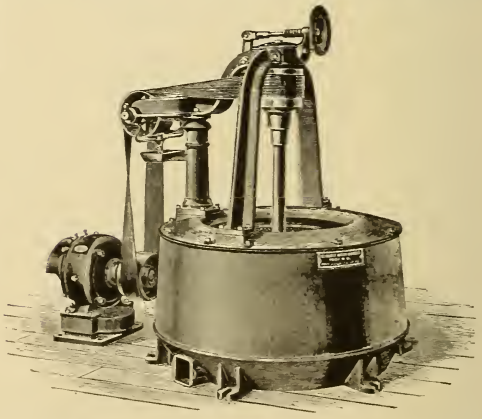
Such washing machines were originally drawn by horses, but recently a motor-driven car was introduced. This new electric sprinkler has a greater capacity, the speed is higher, and the whole vehicle requires less room, which permits it easily to be turned and pass through narrow streets.

As a result of the introduction of this machine, the society of German team owners has asked the authorities to prohibit sprinkling asphalt streets by the ordinary carts, and to enforce the use of these washing machines exclusively.

Motor Driven Hydro-Extractor

Centrifugal force, or that force which causes a revolving particle to recede from the center of revolution is applied to machines called extractors, largely used in laundries, mills, chemical works, etc. An extractor, or more properly a hydro-extractor, used in a laundry for example, consists of a rapidly revolving basket-like cylinder inside of a cylindrical casing. The wet clothes are placed in the basket and as the latter revolves the water is drawn out by the centrifugal force, passes through the basket and is caught in the casing from which it runs off through a suitable outlet. The clothes as they come from the extractor are almost dry.

After exhaustive tests the electric motor has been found to be the most effective for the operation of these machines, the principal advantage being the rapidity with which the basket may be made to attain full speed and this saves time as a great many basketfuls are run through in an hour.



MOTOR DRIVEN HYDRO-EXTRACTOR

A self balancing hydro-extractor is shown in the illustration. The belt provides a flexible connection between the motor and the shaft of the extractor and the vibration of the latter does not affect the motor.

Talks With The Judge

The "Judge," by the way, was not a judge at all, but an advertising man. He was, moreover, one of those men whom we so often hear to remark: "I wish that when I was going to school I had studied electricity. The subject has always interested me, but these are so many things about it that I can't understand that I guess I might as well quit trying to learn at this late date." But in spite of his avowed inability to ever be able to grasp the fundamentals of the subject it was only necessary for me to mention electricity to turn him into an animated question box.

He always prefaced his remarks with: "What I can't understand is this," or "I wish somebody would tell me," and then he was off on anything from street cars to the latest type of electric vacuum cleaners. A talk with the Judge on electricity was always interesting to me because to answer his questions in "Plain English" was a constant mental brushing up, and the questions were, at the same time so indicative of the kind of information that the public at large stands in need of concerning the great force which is so rapidly attaining the front rank in all the world's activities.

"I wish somebody would tell me about a trolley wire," said the Judge. "I thought I knew what it was and how it worked. But something happened the other morning that stumped me. I was on a car and we came along to a place where the trolley wire had been broken and wasn't spliced yet. Somebody had fastened it over out of danger, but there it was, a clean break in the line. Well, do you know what the motorman did? He simply put on full speed, jumped the gap and after we had grabbed the wire on the other side we went on again as fine as you please. Now I always thought that the trolley wire brought current from the power house to the car. I had also been told that the current must have a continuous conductor to flow in. Now tell me how the current got across that gap so as to run the car after it had coasted over to the other side."

"Judge," said I, "Did you ever notice that on the poles carrying the trolley wire or else on poles near by there is a heavy cable running parallel to the trolley wire. Well, there usually is, and if it is not there it is in some underground conduit out of sight. This cable is called a "feeder" and is considerably larger than the trolley wire. Its function is to bring current from the power house and distribute it to the trolley wire at numerous points along the line. This feeder, being large, carries current more easily on account of its low resistance and it helps to keep the voltage up to the full 500 or 550 volts at all points on the line. Every few blocks a tap from this feeder leads over to the trolley wire, and consequently you might cut the trolley wire in two between each of these taps, making it into a number of isolated sections and still the car would get current from the feeder taps to run it.

"Therefore, when you came to the break in the trolley and jumped across the gap you found a current supply awaiting you on the other side which had come into the trolley wire beyond the break through the taps from the feeder wire farther along."

"That straightens out the trolley wire business," said the Judge, "but there is something about the third rail that I can't understand. They call it the "deadly third rail," but as far as I can see it is about as deadly as an ordinary turnpike.

"Last week I was riding on an elevated train and we came to a blockade. A lot of the passengers became tired of waiting and got out of the cars to walk along the ties to the next station so as to get down and take the surface cars.

"Well, sir, do you know, I watched those people for quite a time and I noticed at least a half dozen women step onto that rail and never know the difference.

"Why weren't they electrocuted?"

"I'll try and make that plain, too, Judge," said I.

"On the third rail system current from the power house is carried along the third rail, which is insulated from the elevated structure. It is collected by the little shoes hung from the motor car, passes through the car motor and out through the wheels to the track rails, thence back to the power house.

"The third rail is therefore no more or less than a great big trolley wire laid along side of the track. To get a shock from it you would have to have one foot on the

third rail and the other on the track rail at the same time. In the same manner it would be necessary for you, in order to get a shock from the trolley wire, to have one foot on the trolley wire and the other on the track rail or ground.

"In either case you would be placed in the position of the car motor and would receive current through your body.

"Evidently the women didn't touch both third rail and track rail at the same time; which, by the way, from their relative positions is not the easiest thing in the world to do.

"Moreover, if they had done so it would not necessarily have meant death. The difference in pressure between the third and track rails is from 500 to 550 volts, by no means a deadly pressure, especially since the shoes and stockings offer a partial insulation. The chief danger comes in being knocked down by the shock and lying across the two rails, unconscious. Then if help does not arrive soon death may result from burning."

Handling Lumber by Electricity

This picture shows in operation a motor driven crane used in handling lumber and heavy timbers in one of Chicago's lumber yards. Three of these equipments are used in this one yard.

Control of the apparatus is centered in the motor house built around the vertical mast some distance from the ground. This house contains a 15 horse-power motor, the necessary starting and stopping devices, and a wire rope drum for raising and lowering the block and for moving the load back and forth along the extension arm. At the right

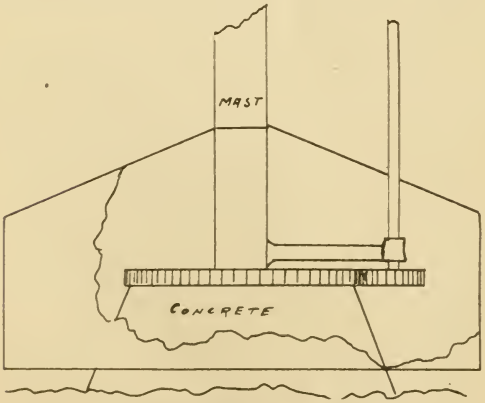


FIG. 1. ARRANGEMENT OF CRANE BASE

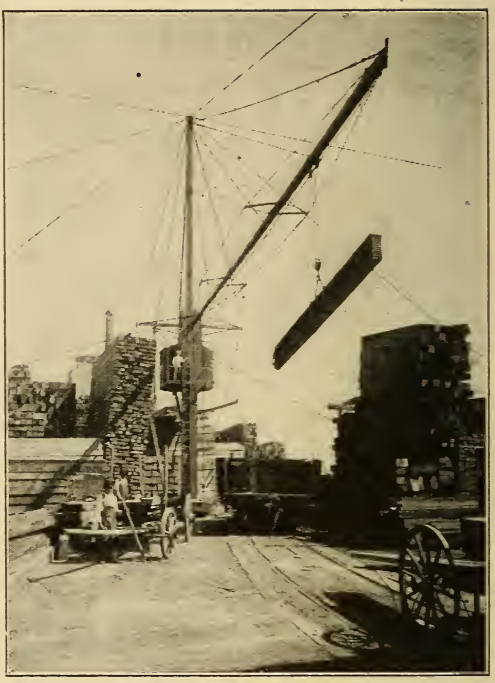


FIG. 2. CRANE IN OPERATION

of the mast may be seen a shaft running from the motor house down into the base of the structure. The lower end of the shaft runs through a bearing on the base, and on its lower end has a small toothed wheel meshing into the circumference of a large fixed wheel. As the small wheel turns, the crane travels in a circle on the center mast as a base, the arrangement being shown in Fig. 1. The

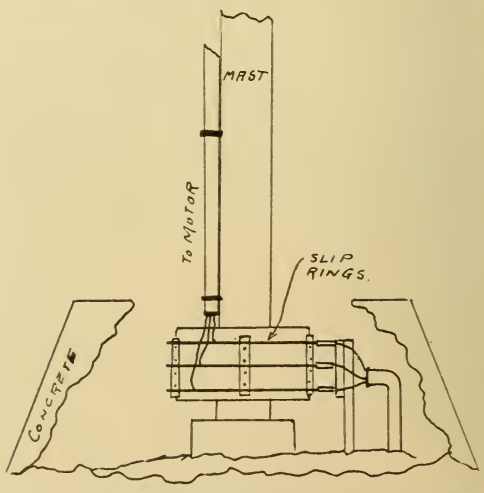


FIG. 3. COMMUTATOR TAKES CURRENT FROM UNDERGROUND WIRES

wagon in Fig. 2 has just received two crane loads and a third is about to be swung over and lowered.

The electric wires are brought to the structure in conduit run underground. Fig. 3 shows these wires carried to slip rings at the base and then to the motor.

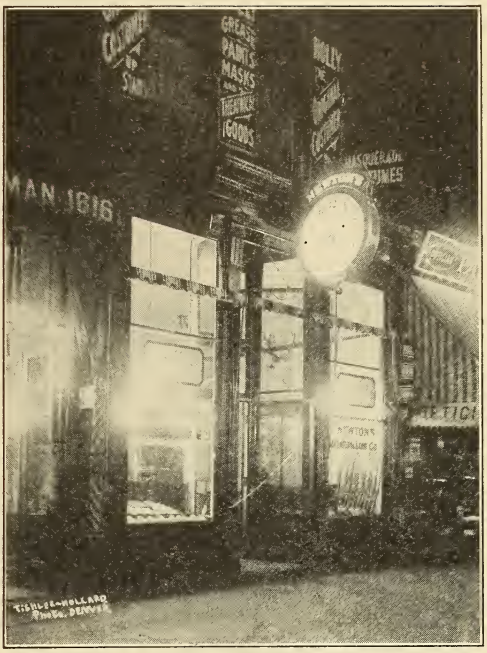
By the use of this device lumber is handled easily and quickly, requiring fewer men, and piles are built higher, economizing space.

Electric Advertising Clock

In front of one of Denver's prominent business places is a unique clock which is illuminated and operated by electricity and which by a simple electric mechanism is made to ring a bell in the doorway of the store every minute. Since the photograph here reproduced was taken, the gas jets placed in the window for advertising purposes have been replaced by the best of all window illuminants —tungsten lamps.

This is an example of the right kind of central station solicitation. The business of the store keeper made a clock the best sign for his purpose. The lighting company's expert showed him how he could illuminate the clock by electricity, and at very little expense put in the bell to attract still more attention. With these new features adding to the appearance of his store front the proprietor could no longer permit his windows to be lighted with dismal flickering gas jets —the tungstens followed.

The result is a permanent customer for the lighting company, who is intensely pleased with the transformation electricity has made in the appearance of his store.



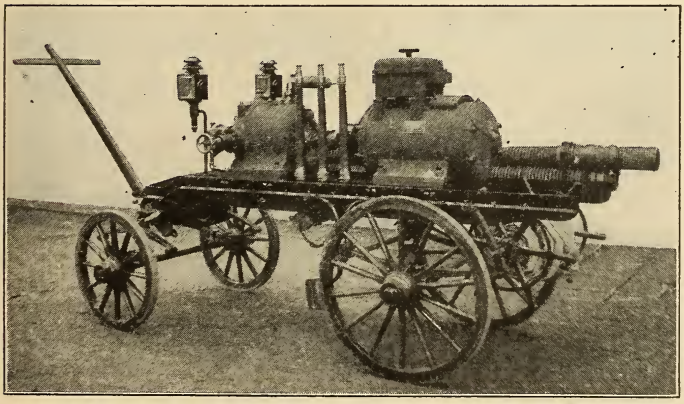
ELECTRIC ADVERTISING CLOCK

Novel Swiss Fire Pump

This fire pump wouldn't be of much use in a city of sky scrapers but for villages and hamlets, around factories and industrial plants, etc., it can be used to advantage wherever it is possible to connect with live electric wires, for the pump is driven by electric power.

The motor drives a multiple, high pressure centrifugal pump and together with hose-drum and nozzles is mounted on a light truck. The whole outfit is easily portable and will discharge about 130 gallons of water a minute under a pressure of 100 pounds to the square inch.

In a large chemical works in Switzerland one of these pumps was given a very severe test and worked for 72 hours at a stretch without a stop, demonstrating the practicability of using electricity for the operation of this class of apparatus.

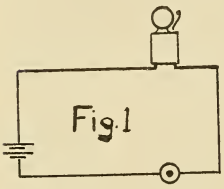


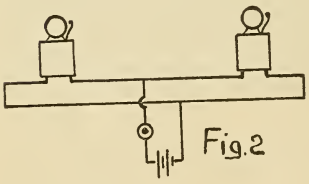
NOVEL SWISS FIRE PUMP

Electric Bell Wiring

Many of the readers of Popular Electricity have asked for varied information on bell and signal wiring. These questions have been answered from time to time through the Question and Answer Department, but in order to present the information in more readily available form the following description of various combinations is given.

What is commonly known as "annunciator wire," No. 16 or 18 B. & S. copper wire wound with two layers of cotton and treated with paraffine is least expensive for dry





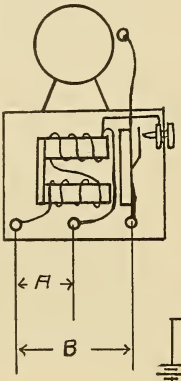
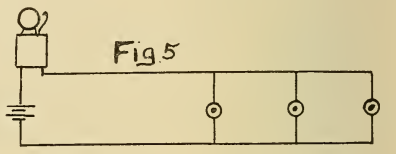
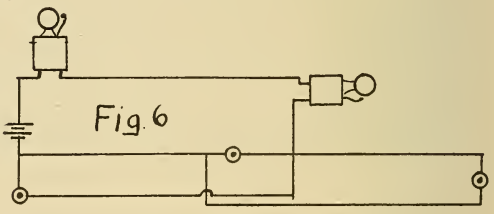
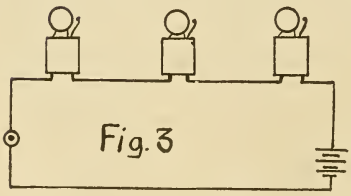
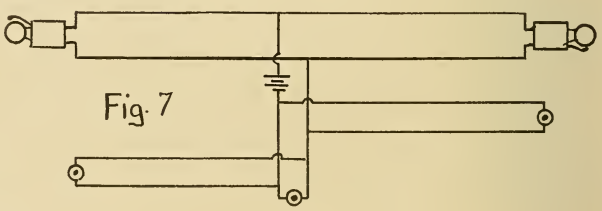


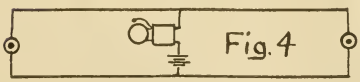
Fig 10

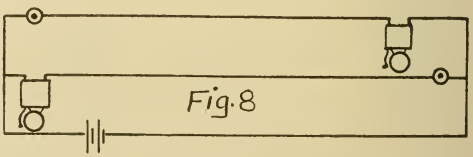


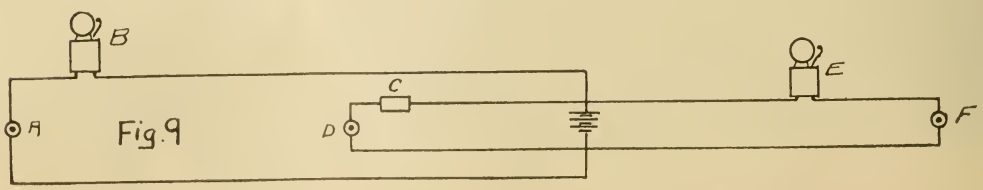












places. This wire is, however, not thoroughly moisture proof, and consequently rubber covered wire is more satisfactory, and by signal service companies operating local fire and other alarm systems is almost universally used, No. 16 being preferred on account of lower resistance and greater mechanical strength.

Underwriters' requirements regarding electric light and signal wires are as follows:

"Signaling wires and electric light or power wires may be run in the same shaft, provided that one of these classes of wires is run in non-combustible tubing, or provided that when run otherwise these two classes of wires shall be separated from each other by at least two inches.

"In no case shall signaling wires be run in same tube with electric light or power wires.

"Electric gas lighting must not be used on the same fixture with the electric light."

Below are various diagrams of circuits and bells.

Fig. 1 shows one bell operated by one push button.

Fig. 2 shows two bells in parallel operated by a single push button.

Fig. 3 provides for the operation of three bells in series from one button. When bells are operated in series all but one should be single stroke so that the breaking of the circuit will be done by only one bell.

One bell rung from either of two push buttons is shown in Fig. 4, while Fig. 5 shows one bell operated from any one of three points.

In Fig. 6 two bells in series may be rung from three different points, while Fig. 7 provides for the same thing with the bells in parallel.

Fig. 8 is a three-wire return bell and call circuit.

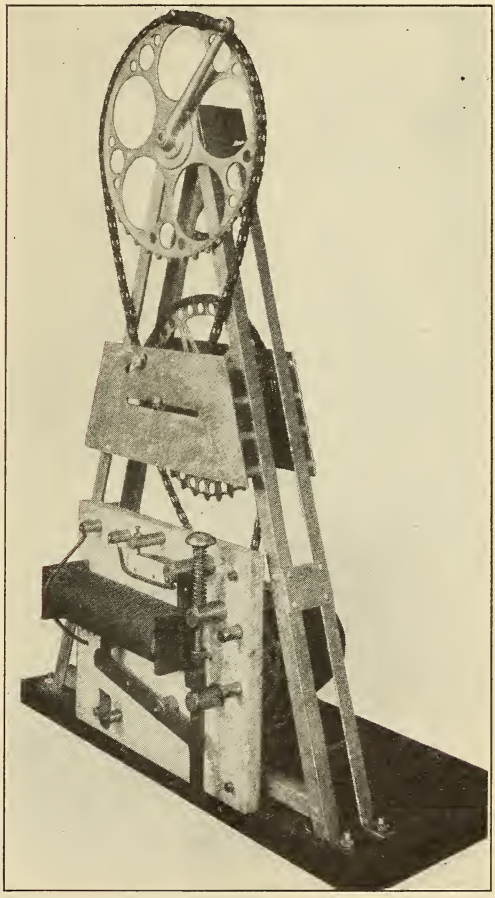
Fig. 9 shows how a small house may be wired, (F) being the back door push button, (E) the back boor bell, (D) the dining table push button, (C) the kitchen buzzer, (A) the front door push button, and (B) the front door bell.

Fig. 10 shows the arrangement and windings of a bell which may be operated either as a single stroke by connecting to terminals (A) or as a vibrating bell by connecting to terminals (B).

John Hollingshead was the first man to use electric lights in London. In 1878 he installed six arc lamps at the old Gaiety.

Machine for Exploding Blasts

In order to obtain the accumulative effect of a number of charges in blasting it is necessary that the charges be all exploded at exactly the same instant, in which case there is one grand upheaval, far more effective than intermittent explosions, even if they are but a fraction of a second apart. The machine shown in the picture is designed for this purpose and will explode over one hundred charges simultaneously.



MACHINE FOR EXPLODING BLASTS

"Oh, I love to figure out such problems during spare moments," said Mr. Forée Bain, patent expert and engineer, of Chicago, who designed the machine. "I have never taken out a patent on it but occasionally my friends the contractors and quarrymen want such a machine, and I have it made up. It does the business, and in

one case they were able to make a reduction of 30 per cent in the amount of explosive used, owing to the simultaneous firing of the charges."

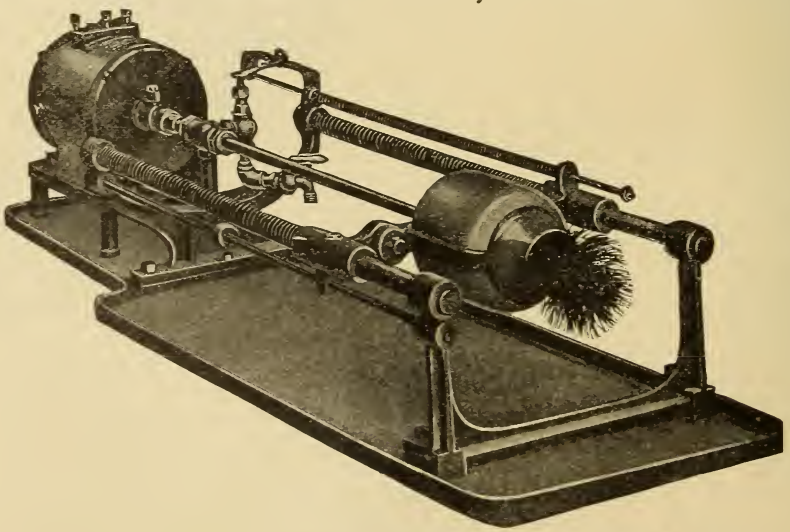
The machine is simple but effective. A small dynamo mounted on the base and just visible back of the frame is driven with a crank by means of the sprocket wheels and chains. This furnishes the current for melting the fuses which set off the blasts. In starting up the dynamo by hand it would be impossible to bring the current up to full strength at once, as that depends upon the speed. So it would also be impossible to explode all the fuses at the same instant, for in order to do this a very heavy current wave must be thrown on them suddenly. To accomplish this end the electro-magnetic switch shown on the front of the marble slab is added.

Current from the dynamo first passes around the coil of the electromagnet, which has an iron core. As the current around the coil becomes stronger, while the dynamo is being speeded up, the magnetic strength of the iron core increases and when the dynamo is up to full speed and the current strong enough to explode all the fuses at once, the iron core is energized sufficiently to pull the vertical armature over. This releases a catch on the vertical shaft seen at the right of the coil, and the spring pulls the shaft up with a jerk. Beneath the coil is a switch which is operated by the shaft, and this switch when thrown to the lower contact suddenly throws the whole current of the dynamo onto the fuse circuit. The heavy surge of current, accentuated by what electricians call the "inductive kick" of the coil itself, melts all the fuses at a flash.

Electric Bottle Washer

Owners of small bottling establishments were in the past confronted by a serious problem in the cleansing of the bottles. Large power washers were so costly and expensive to operate as to be almost prohibitive for the small bottler. Hand washing, too, was a tedious process, and a foot power machine was almost as unsatisfactory, for one man could not keep at the washing all day long with these methods. Yet no other power was then thought available, so the make-shift methods continued.

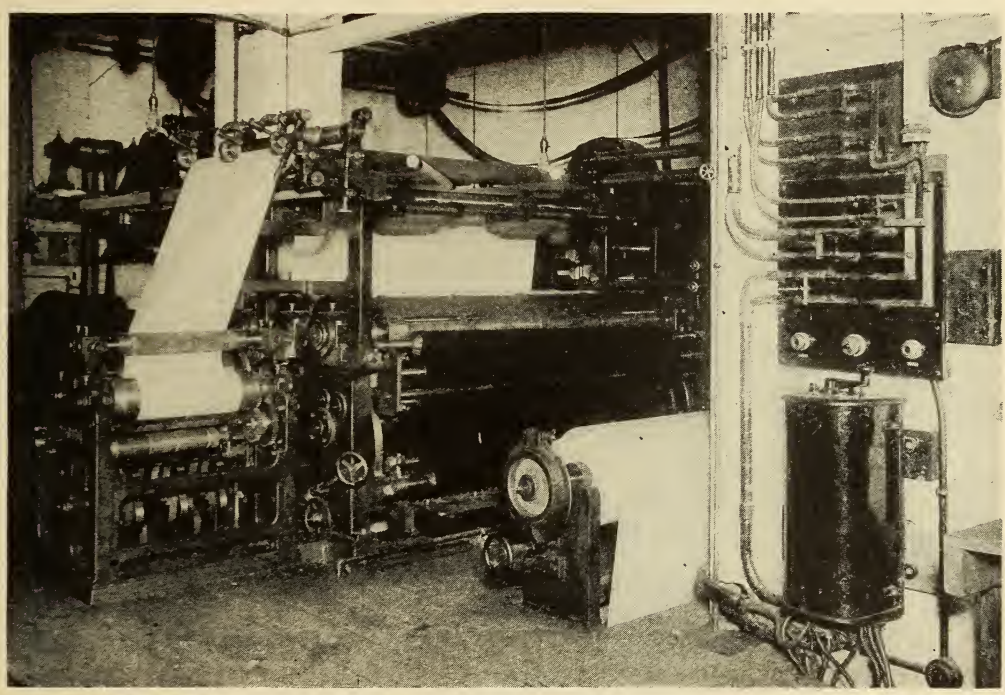
Now, however, since the small motor has been developed to a degree which makes it applicable to almost any mechanical process the small bottle washer is found in moderate sized establishments to be operated by electricity. One of these machines is shown in the picture and works as satisfactorily in its limited field as does the big power driven washer in large establishments. The motor is entirely enclosed and water-proof and consumes only $\frac{1}{6}$ horse-power.



ELECTRIC BOTTLE WASHER

Control of Large Printing Presses

The great presses which print and fold in a few hours hundreds of thousands of copies of our metropolitan dailies are operated by electric motors for several reasons. In the first place the control of this, perhaps the most complicated piece of mechanism in existence, may be accomplished with an accuracy and certainty not to be approached by any other method of drive. It provides means for the protection of the men working about the press and is also economical of floor space, which is an important item where rents are high.



MOTOR CONTROL FOR A DUPLEX ROTARY PRESS

In the ordinary web press the motor equipment consists of a large, variable speed motor for driving the press on producing speeds, also a small motor with a special clutch for driving the press slowly in threading in paper, but which is automatically relieved by the large motor when the real work begins.

In order to control the action of these motors wonderfully sensitive electric controllers are employed, which may be actuated by push buttons located at any number of stations desired, about the press room and the great press itself.

In one type of controlling apparatus each station is provided with four push buttons which are used for accelerating, decelerating, stopping and putting in safety. When the accelerating button is pushed the motor is gradually and automatically brought up to speed. This process may be interrupted, however, by releasing the button at any stage, and the motor will continue to run at the speed attained when the button was released.

If it is desired to decrease the speed, as is often the case when nearing the end of a roll of paper to avoid tearing, the decelerating button may be pushed, and the reverse process takes place.

The press may be stopped promptly at any time by simply pressing the stop button at any station; in which case the controller automatically returns to the off position.

To avoid accident due to starting the press before everything is in readiness, and as a safeguard to the pressmen who may be

making adjustments, each station is equipped with a safety button which is so connected that it is impossible to start the press unless all of these buttons are placed in the "run" position.

The controller described above is known as the "master" type. There are other types known as drum controllers (something like street car controllers) which are only applicable to single station control, although they are provided with push buttons and auxiliary circuits which may be used to stop the press instantly in case of accident.

Some of the drum type controllers also work in conjunction with push button control systems marked "start," "run," "safe" and "stop," and any number of these stations may be included in the equipment. Such a one is shown in the illustration of a large duplex rotary press of the Journal of Commerce, New York City. The drum controller is here seen at the right, and above it are the switches and fuses for the various circuits.

Electric Fire "Whistle"

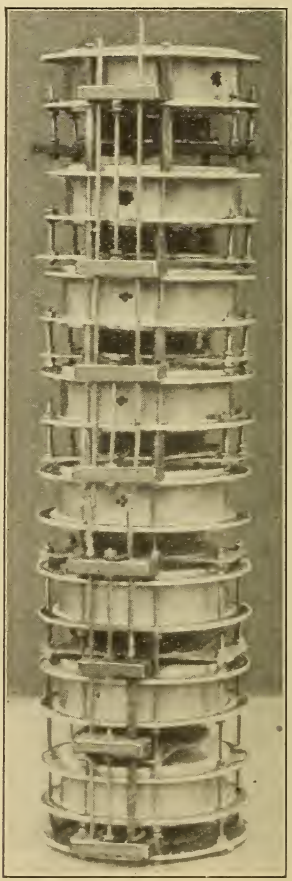
Captain Obed De Champ of the Everett, Mass., fire department has saved that city a considerable sum of money by an ingenious invention which cost only $10.00. It is an electric fire "whistle," which works somewhat upon the plan of the telephone receiver. Diaphragms of considerable size are caused to vibrate rapidly by the use of small induction coils. The volume of sound may be increased or decreased by adding to or taking from the number of sections which form the whistle. The whistle prepared for the city of Everett has diaphragms about ten inches in diameter and is made up of eight sections, as shown in the photograph. Each section contains a diaphragm and is a complete whistle in itself, only giving less volume than the eight sections combined.

It is the first fire whistle of its kind in the country. When in position the working parts are encased in a cylindrical galvanized iron covering, which concentrates the volume of sound at the opening in the top.

This electric device, costing only $10.00, will do the work of the ordinary compressed air whistle, which with its compressed air tanks costs about $2500.

Hints About Soldering

A subscriber to Popular Electricity offers the following hints which are helpful in soldering for electrical work. To keep iron clean while soldering, dissolve one part



ELECTRIC FIRE "WHISTLE"

of sal-ammoniac in four parts of water, and heat the iron and give it a quick dip in the solution. If the least bit of solder is placed on the iron, it will spread farther and farther over the surface.

In soldering electrical connections the following flux is excellent: Take six parts of vaseline and one part of chloride of zinc. Heat the vaseline and pour in the chloride of zinc and stir till cold to keep the heavier parts from settling.

Seven million dollars have been appropriated for the electrification of the Italian railways.

Beautiful Example of Ballroom Lighting

No example of modern electrical illumination is more attractive or more completely fulfills the practical and artistic requirements of the case in hand than that of the new ballroom of the South Shore Country Club in Chicago. The pictures shown herewith, from photographs taken with no other light than the indirect illumination, give but a faint idea of the softness and effectiveness of the perfectly diffused rays.

This club has sixty acres of lake front at Seventy-first Street and has expended nearly a million dollars in improvements. The latest addition to its buildings is a magnificent ballroom, 90 by 140 feet in size, of classic style of architecture. Ionic columns separate a 12-foot promenade on all four sides of the main ballroom, following what is known as the clear story treatment. The main ballroom ceiling is 28 feet, that of the promenade 20 feet. This constitutes practically one auditorium, the promenade being divided from the main ballroom by 30 of the large columns. The room is finished in old ivory and gray; the trimmings of American beauty red, and the architectural features and decorations of this room are conceded to be among the finest of any auditorium of its kind in this country.

The question of the proper illumination of this room was a serious one. Mr. B. F. Winston, chairman of the Buildings and Ground Committee, and Mr. Bode, president of the club, were both abroad early in the year and they investigated the illumination of many auditoriums, both there and in this country. They decided upon indirect illumination; the covering of the light source from range of vision.

The outlets as originally placed for direct lighting proved to be admirably located for the indirect system. There were three at equal distances in the 28-foot center ceiling and one in every 12-foot panel in the ceiling of the promenade. So there were located in the main room three large central chandeliers, each one containing 23 "I-Comfort" lighting units, and single fixtures around the promenade, as shown, each containing one lighting unit. One hundred watt tungsten lamps are used and the results are far beyond the architect's most sanguine expectations. The fixtures are made of composition with bronze metallic finish and are very handsome in design. The cost of all metal work for a direct system of lighting would have approximated $2,000, whereas the indirect system was put in for about half that amount.

All those who enter the ballroom are immediately impressed with the magnificent results obtained and almost their first expression is regarding the beauty of the illumination. During a ball the scene is one of unusual splendor, the colors of the different gowns being brought out with a distinctness that is most surprising. The illumination, while brilliant, is peculiarly aesthetic, and at the same time the perfectly diffused light gives marked eye comfort.

Handling Coal in German Power Plants

As pointed out in a recent lecture by Mr. Datterer, director of the Berlin Electricity Works, the total capacity of the central stations supplying the German capital with electric light and power has increased, from 1902 to 1908, from 62,000 to 154,000 horsepower, the heating surface of their steam boilers having increased from 25,000 to 45,000 cubic meters. In step with this growth, marked improvements have been made in the design of mechanical coaling apparatus. It may be said that the Berlin Electricity Works in most cases is free to choose between waterways and rail, for the coal supply, the latter alternative affording the advantage of allowing of an approximately uniform supply, even in the winter time, when the various plants are put to the highest strain. As, however, the saving in the transport expenses greatly exceeds the additional outlay required for the provision of winter stores, most of the plants of Berlin have preferred transportation by water.

An especially interesting coaling plant has been recently erected for the Rummelsburg central station (near Berlin), where

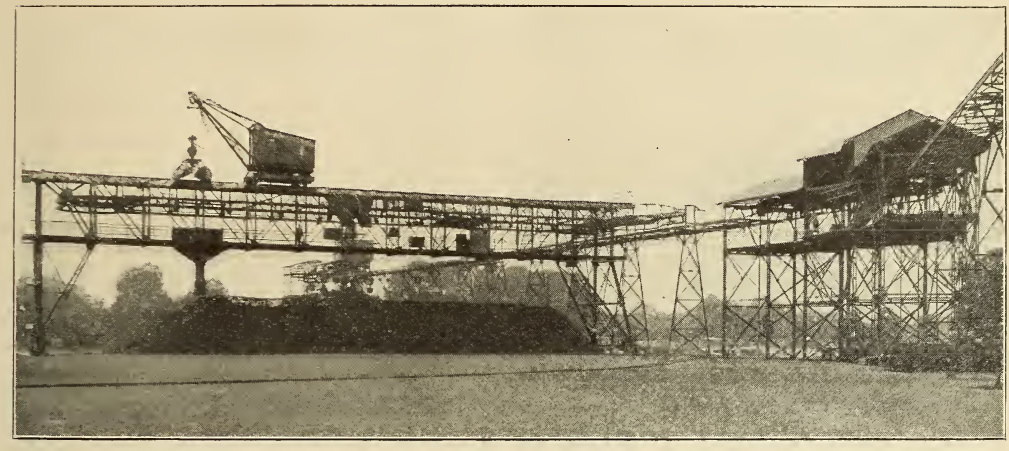


FIG. 1. ELECTRICALLY OPERATED DUMPING BRIDGE

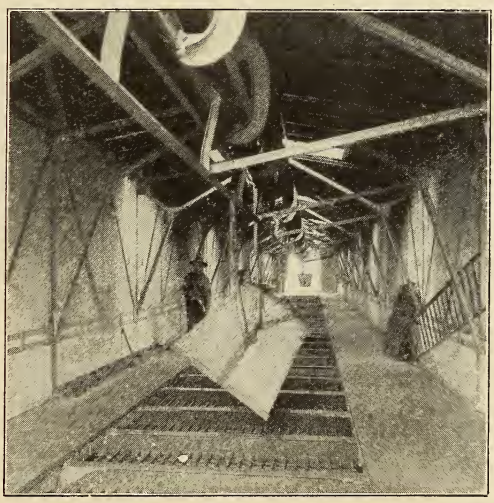


FIG. 2. AUTOMATIC COAL CARRIER IN BOILER HOUSE

wire rope railways are used on an extensive scale.

The ground covered by the coaling plant consists of two parts, the one immediately on the river Spree being used for the storing of coal, and the other mainly for the boiler and engine house, and accessory installations. The storage yard contains an elevated tank of 1,500 tons' capacity, made of iron structure, at the bottom of which there are chutes with locking gates for each boiler, so that the coal may glide down automatically into the hoppers of the mechanical stokers.

One of the distinctive features of the plant is that the wire-rope railway, leading from the banks of the river across the coal

stores to the boiler house, is divided into two self-contained parts. The device chosen for connecting the trucks with the traction cable, therefore, had to be such as to seize cables of different diameters with equal safety, and a patented automatic clutch had to be adopted. This clutch utilizes, for throwing the jaws together, the total weight of the truck body inclusive of its contents and suspension, so that a considerable amount of energy for effecting its closure is available.

The following conditions had to be complied with in designing the coaling plant: Transports with a capacity of 50 tons per hour had to be provided for; (1) from the ship into the boiler house bunkers; (2) from the ship to one of the three store yards; (3) from any one of the store yards to the boiler house or (in the case of a coal fire) to some other store yard; (4) from railway cars into the boiler house or to any one of the store yards, transports by rail being provided for as reserve, in cases of emergency.

A further requirement was that transportation from the river barge to either of the two store yards situated on the Spree and the transfer from the third store yard into the boiler house, should be performed simultaneously. This is why the wire-rope railway was divided into two sections.

The crane (Fig. 3) with inclined runway and stationary winch, provided with an automatic grab bucket of two cubic meters capacity, is used for unloading the coal from the barges. This crane throws the fuel into a bunker whence it is discharged into suspended railway trucks.

The first section of the wire-rope railway leads in a straight line from the bank to one of the angle stations, where the driving gear actuated by a 15 horse power motor, in common with the second section, is located. The filled trucks travel over the dumping bridge (Fig. 1) and are there tilted automatically by striking against an adjustable stop on the bridge, and after being transferred at the driving station onto the emptied truck, return to the loading loop near the crane. Before arriving again at the traction cable, the useful capacity of the filled trucks is ascertained by a self-recording weighing machine. If the coal is to be taken to the store yard near the boiler house, or into the elevated reservoirs, the trucks are transferred at the angle station to the second wire-rope line

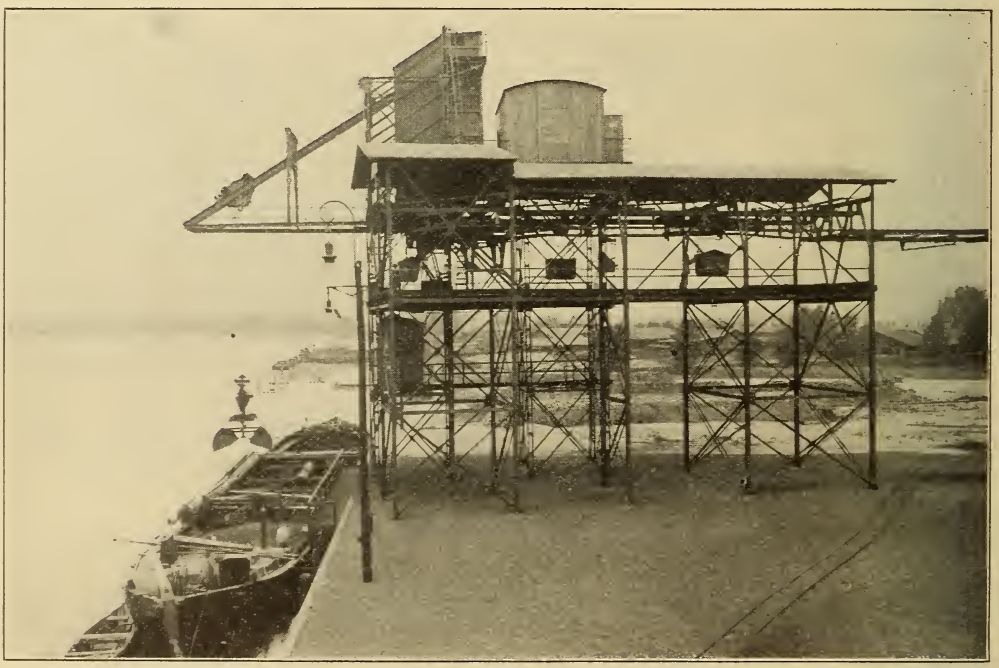


FIG. 3. A MOTOR OPERATED GRAB BUCKET LIFTS THE COAL FROM THE BARGES

in order to be tilted either on the store-yard bridge or at the boiler house (Fig. 2). Any pieces of excessive dimensions are there kept back by a grate and crushed by the workmen entrusted with the superintending and adjusting of the stop. The empty trucks return across the angle station to the river barge.

Rotary cranes traveling on the store yard bridges and covering any point of the yards, are used for taking the coal back from the latter into the wire-rope railway in order to convey it to the boiler house or to some other store yard. These cranes seize the coal by means of grips, and throw it into hoppers in the middle of the bridge, whence it is supplied in a continuous flow to the wire-rope railway trucks which pass continuously

The wire-rope railway trucks have a capacity of 1,500 pounds each, so that 74 trucks per hour have to be run in order to ensure the required output of 50 tons. The trucks, accordingly, follow up one another at intervals of 49 seconds, or about 150 feet apart.

The working costs for conveying the coal from the barges to one of the store yards, or to the boiler house, amount to $0.047 per ton. The total amount of coal to be conveyed from the store yards to the boiler house amounts to about 23,000 tons and has to be dealt with in five months. Working expenses in this case amount to about three-tenths of a cent more per ton.

A Glimpse into the Future

[Time, 2500 A. D. Place, forward deck of airship "Queen of the Air" en route from New York to Chicago. Speakers, Mr. A. D. Rocks of Chicago and Mr. J. K. Brocks of New York.]

Mr. R.—So this is your first trip to Chicago? That seems strange when you think that the time by airship has been reduced to forty minutes.

Mr. B.—Yes, I know I should have made the trip before, but I have been so busy with my building operations lately that I have not had time.

Mr. R.—What are you putting up now?

Mr. B.—Oh, just a little building 125 stories high.

Mr. R.—Is that so? There's a company in Chicago that is erecting one that is to be the tallest in the world, 310 stories high. They had a hard fight to keep the city council from passing an ordinance limiting the height of buildings to 300 stories. I understand that it took ten millions to get the aldermen to see things their way.

Mr. B.—I expect to go about quite a little in Chicago. How is your suburban transportation?

Mr. R.—Very unreliable out west of the city where I live. The other day something went wrong with the pneumatic pressure and it took me at least eight minutes to reach the office and I only live thirty miles out. What do you think of that?

Mr. B.—Awful. But just think what it must have been like five or six hundred years ago when people had to rely on those old fashioned trolley cars and railroad trains that crawled along at the rate of thirty or forty miles an hour.

Mr. R.—Say, by the way, did you know that we had just received a wireless despatch to the effect that a great battle has been fought between the German and French armies. The German electrical artillerists, it seems, have wiped out the entire French army of six million men by hurling a bolt of electritity at them by wireless. The entire battle was fought in six minutes.

Mr. B.—Terrible, terrible! But at least the soldiers were all electrocuted instantly so that they did not suffer any pain.

Mr. R.—Excuse me a moment. I'm going to ask the captain to turn on a little liquid air; it's getting so warm here. (Goes forward to speak to captain and returns a moment later.) Say, what do you think! The captain informs me that one of the French aerial men-of-war has succeeded in electrocuting the entire German army by wireless bolt so that now the two nations will have to come to terms by arbitration as neither has any troops left.

Mr. B.—I read a notice in the paper the other day to the effect that a movement is on foot in Europe to unite all the countries on the continent into one nation in order to prevent this fearful waste of life.

Mr. R.—I think it would be a good idea. It will undoubtedly become necessary in

time just as it was found expedient to establish universal free trade when the use of airships became general, as their adoption made it impossible to prevent smuggling.

Mr. B.—Have you heard of the latest moving picture scheme?

Mr. R.—No, what is it?

Mr. B.—Why, one of the New York papers has installed an apparatus to take the place of a bulletin board. If you want to find out what is going on anywhere all you have to do is to stand in front of the canvas and see the leading events of the world take place before your eyes in moving pictures.

Mr. R.—Well, that's great! How is it done?

Mr. B.—Why, simply enough when you come to think of it. All they have to do is to have their correspondents in various parts of the world provided with machines for taking moving pictures and transmit them instantly to New York by wireless. It saves the time of printing the news and you can see an eruption of Vesuvius or a Georgia lynching at the same time it occurs.

Mr. R.—Well, I'll have to take a look at that the next time I'm in New York. It must be very interesting.

Mr. B.—Where are you going to spend the summer this year?

Mr. R.—I'm going to take a trip to Europe.

Mr. B.—Are you contemplating an air voyage?

Mr. R.—No, my wife always gets so terribly airsick that we'll have to take the submarine tube. I don't care for these long pneumatic tube trips myself. It is always a tedious five hours to me. I understand, however, that improvements are being made by which it will be possible shortly to make the trip from New York to Liverpool in two hours and a half. That will be a little more bearable.

Mr. B.—Have you taken the trip over the Alps by airship yet?

Mr. R.—No, we haven't.

Mr. B.—Oh, you must take that trip by all means. The scenery looking down on the snowclad mountains is magnificent; the sunsets rival description.

Mr. R.—Excuse me a moment; I'll call up my wife and ask her to make a note of it. (Takes out a pocket wireless telephone and speaks briefly to Mrs. R. in Chicago.) There, that's settled. She's sure to remember it, she's so fond of scenery.

Mr. B.—Have you noticed by the papers what a lively time they are having in Mars nowadays?

Mr. R.—Yes, I should say. I took a look through one of the big telescopes the other evening and witnessed one of the great land battles between the two nations at war. They seem to be away behind us in the art of warfare; I noticed that they still employ the old fashioned guns and cannons our ancestors used in the Twentieth Century.

Mr. B.—Yes, being in the age of art and philosophy they are naturally behind us in scientific matters. They are taking lessons from the earth, however, and I understand their scientific journals are printing technical accounts of our method of carrying on battles, the articles being sent to them by wireless.

Mr. R.—They resemble the people of Mercury in that respect. The only planet that approaches the earth in scientific development appears to be Venus.

Mr. B.—Yes, I was reading a psychological treatise the other day by a writer of that planet and I could see that they are far ahead of us.

Mr. R.—That's true. If you want the latest scientific information you have to go to Venus for it. Mercury furnishes us with some very good musical compositions, however. My daughter has been getting some very fine ones for the piano lately.

Mr. B.—It's wonderful what the wireless has done for us since we have gotten into communication with the other planets, isn't it?

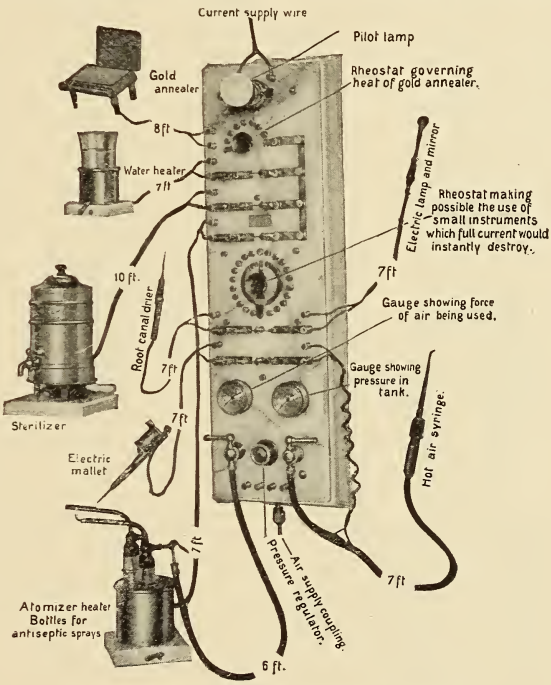
Mr. R.—Yes, and to think that the people of Venus had been sending signals to us for years before we had invented telescopes strong enough to observe them.

Mr. B.—Well, the world and all the other planets do move, don't they? One of these days some smart scientific chap will be inventing an airship that will enable us to fly from one planet to the other and then we'll have a chance to meet some of these interesting people up in the sky face to face. Well, here we are at Chicago. Glad to have seen you again. Good-bye.

Mr. R.—Good-bye.

Electricity in Modern Dentistry

Not so many years ago the small villages and towns about the country were visited on the average twice a year by "medicine shows" for the purpose of selling and advertising certain patent medicines. In fact, these wandering troupes are still to be found in many localities. Invariably among the members of the company was a professional tooth extractor who pulled teeth without pain. Toward him all the aching molars of the country side would naturally gravitate, and owing in part to the novelty and excitement of having the operation performed in front of a smiling and appreciative audience, instead of the more awe-inspiring dentist's office, and in part to the dexterity and strength of the operator, with perhaps a touch of cocaine here and there, most of the operations were in fact practically painless. "How does he do it?" The question was asked on all sides and invariably the wise ones who thought they knew would say that is was "by electricity." To have one's teeth extracted "by electricity" thus became quite the vogue.



THIS SHOWS THE FUNCTIONS OF THE DENTIST'S SWITCHBOARD

However amusing this conception of electrical dentistry may have been, it is nevertheless a fact that in the modern dentist's office electric current is made to perform a multitude of tasks, and the ingenious devices which the dentist has at his disposal are even more wonderful than the reputed electrical methods of the traveling tooth puller.

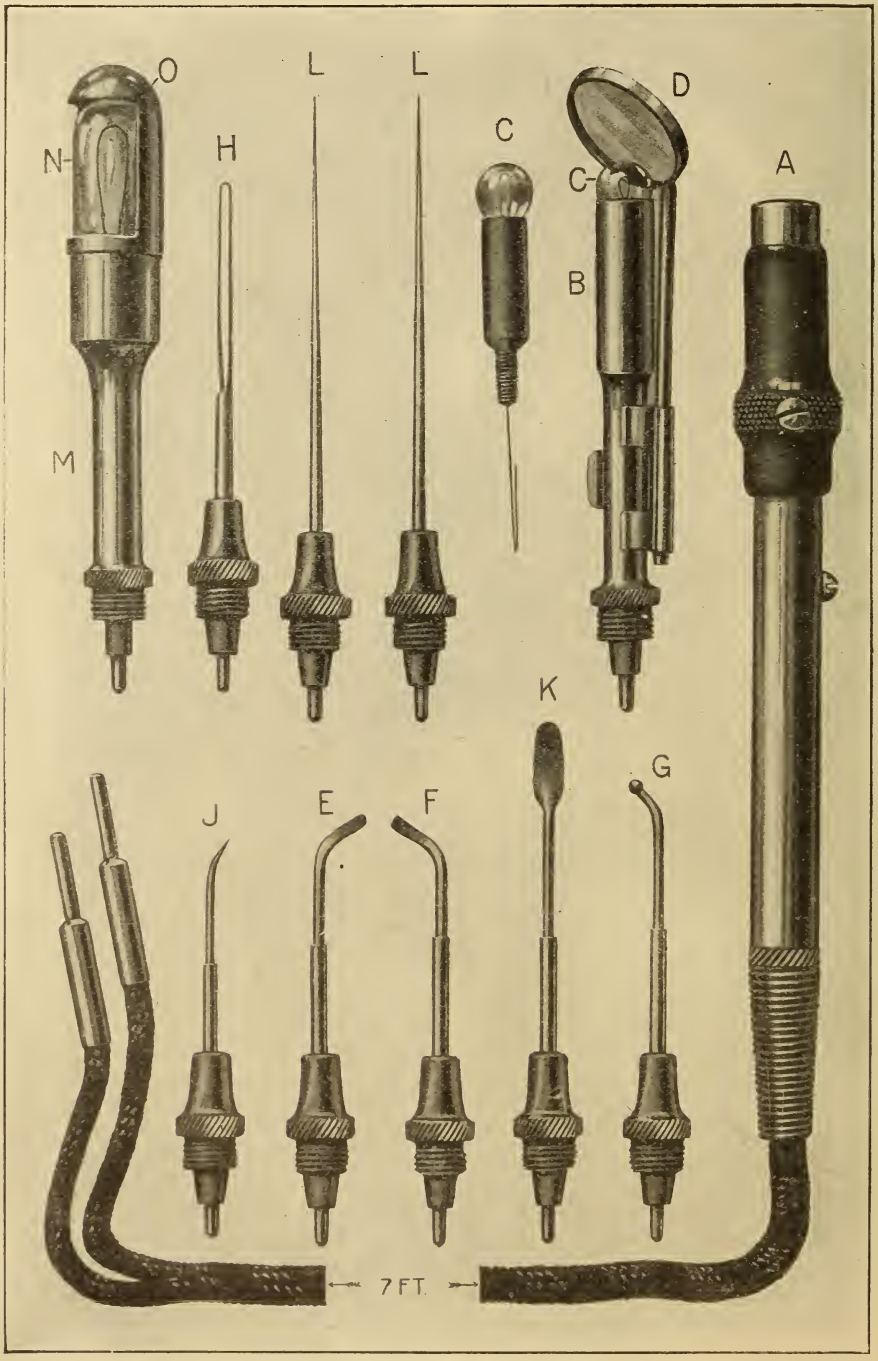
In the modern dental equipment the switchboard comes first and from it the dentist is able to control the flow of current to all the various devices which employ electricity. The particular board shown in the picture is of a pattern employing what is known as the shunt system of control used to increase or decrease the flow of current for the atomizer lamp, heating instuments, hot air syringe, etc., and is applicable to either direct or alternating current. The voltage for these instruments is first reduced by passing the current through one or more resistance lamps which are mounted on the top of the panel.

These boards sometimes have outlets for the 110-volt current, to which may be attached the engine, illuminator, fan, etc., each controlled by a separate snap switch. On the upper section of the board is a rheostat with a semi-circular row of button contacts. The function of this rheostat is to control the temperature of the gold annealer water heater, sterilizer, atomizer heater, bottles for antiseptic sprays, etc. These cups which are used for heating the atomizer bottles and water glasses are a distinctive feature. The circular row of buttons which you see at the center of the board is the rheostat which controls the low voltage current to the mouth lamp and heating instruments.

The dentist is likewise a user of compressed air for various purposes and the air pipe connections are also made to the switchboard which carries indicators showing the pressure at the tank and in the atomizers, syringes, etc.

Those instruments of the dentist in which

the victim has a sort of personal interest are shown in detail in the illustration below, the various instruments being lettered. (A) is the switch handle with a seven-foot conductor which leads to the low voltage outlets of the switchboard and is there con-



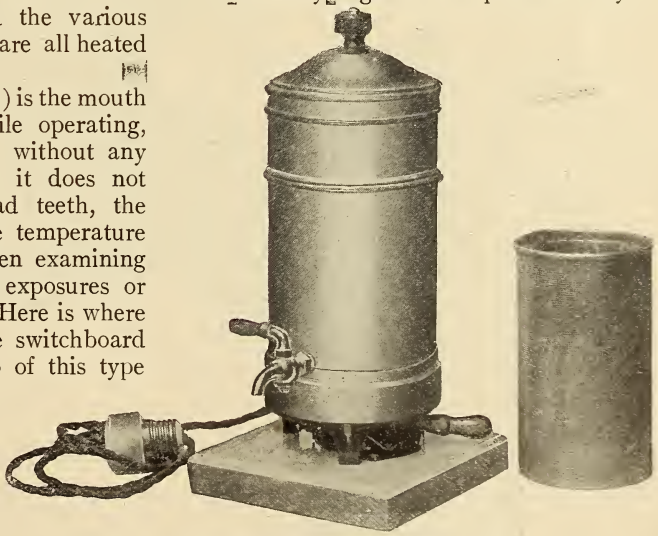
MOUTH LAMPS AND HEATING INSTRUMENTS USED BY DENTISTS

HOT AIR SYRINGE—THE AIR IS HEATED BY THE ELECTRIC WIRES AT THE LEFT

nected by the two small plugs. To this switch handle may be connected any of the instruments shown in the cut, and the various needles and wires and lamps are all heated by the electric current.

For instance, (C), (B) and (D) is the mouth lamp which can be used while operating, like an ordinary hand mirror, without any discomfort to the patient, as it does not get hot. For diagnosing dead teeth, the mouth lamp is surer than the temperature test, and it is very useful when examining approximal cavities, locating exposures or finding the orifices of canals. Here is where the low voltage feature of the switchboard comes in, for if a small lamp of this type were connected to the ordinary 110-volt circuit direct, it would be burned out immediately.

(H) and (L) show respectively a cautery and root canal driers. The former consists of a loop of platinum wire attached to the insulated sections of the tubular stem. It can be heated to an intense white heat and is highly recommended for sensitive dentine. It is frequently used for cutting off gum tissues overhanging into cavities, which can be done without hemorrhage. It is also used for puncturing abscesses, arresting hemorrhage after extraction and stimulating old sockets that are slow to heal. This instrument is made quite slender so as not to obstruct the vision and is just the proper length for manipulation. The cautery requires more current than any other instrument in the set, consuming eight amperes at six volts, or about the same number of watts taken by an ordinary 16 candle power lamp. The root canal driers are made of silver, which is an excellent conductor of heat and any degree of temperature may be instantly obtained by the electric current.



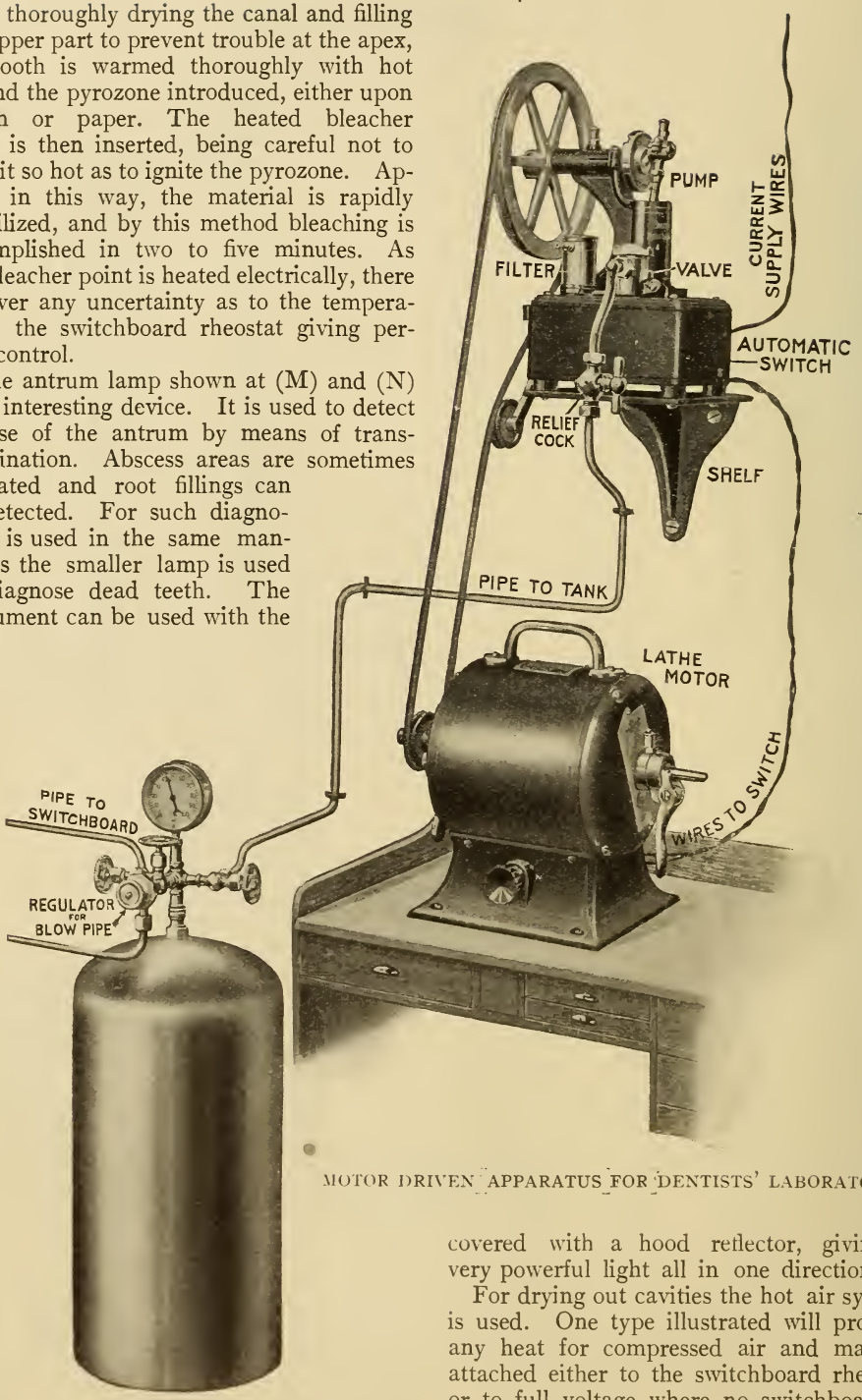
ELECTRIC INSTRUMENT STERILIZER

For softening gutta percha and working the material into a plastic state the instruments (E), (F) and (G) are used. (K) is a wax spatula for waxing up a plate.

The bleacher point shown at (J) was suggested by Dr. F. L. Stanton, and is used to hasten the action of pyrozone in bleaching.

After thoroughly drying the canal and filling the upper part to prevent trouble at the apex, the tooth is warmed thoroughly with hot air and the pyrozone introduced, either upon cotton or paper. The heated bleacher point is then inserted, being careful not to have it so hot as to ignite the pyrozone. Applied in this way, the material is rapidly volatilized, and by this method bleaching is accomplished in two to five minutes. As the bleacher point is heated electrically, there is never any uncertainty as to the temperature; the switchboard rheostat giving perfect control.

The antrum lamp shown at (M) and (N) is an interesting device. It is used to detect disease of the antrum by means of transillumination. Abscess areas are sometimes indicated and root fillings can be detected. For such diagnosis it is used in the same manner as the smaller lamp is used to diagnose dead teeth. The instrument can be used with the lips closed, and in a darkened room gives a very effective illumination of the tissues. The bulb, which is 15 candle power, is



MOTOR DRIVEN APPARATUS FOR DENTISTS' LABORATORIES

covered with a hood reflector, giving a very powerful light all in one direction.

For drying out cavities the hot air syringe is used. One type illustrated will produce any heat for compressed air and may be attached either to the switchboard rheostat or to full voltage where no switchboard is used. The instrument is mounted at right angles to the end of the tube and is easy to hold and operate. When the lever is pressed

air from the tube is allowed to escape through the nozzle. The air in the tube is heated electrically by resistance wires in the collar which encompasses the tube at the left.

The electric sterilizer shown in one of the cuts consists of a cylindrical vessel and a disk heater mounted on a marble base. It will boil a pint of water in 20 minutes. The perforated basket with two compartments holds both small and large instruments in the heated sterilizing bath in the vessel. In the dental laboratory, which the patient seldom sees, are many interesting devices for making teeth, inlays, etc. The dentist generally has a lathe, and polishing and grinding machines. In the up-to-date laboratory a motor is used for this purpose. This motor may also be made to drive the air compressor outfit as shown in one of the cuts.

Why High Efficiency Lamps should be Frosted

By ROSCOE SCOTT

Non-technical persons who have been accustomed to the use of carbon filament lamps sometimes regard the illuminating expert with suspicion if he advises them to use frosted bulbs when installing tungsten or tantalum lamps. They regard such advice with incredulity much like that of the small boy who is told that green apples are not good for him. Lamp consumers of this matter-of-fact persuasion reason thus: "Frosting hides the light source; *ergo*, it cuts down the light; *ergo*, if I buy frosted lamps, I am actually paying for a decrease in illumination."

Let us look into the case a little more fully, and we shall see that the practice of frosting arose from no desire to gull the consumer, but from easily proved physiological and scientific facts.

Look at the lighted filament of a clear tungsten lamp steadily for a few moments. Now close your eyes, and you will continue to "see filaments" for a long time. If your eyes are not strong, they will "weep," and you may even find that you have given yourself a headache. Continued repetitions of the experiment would be ruinous. These physiological effects are due to what is vaguely called "glare," and in the technical language of illumination, "intrinsic brilliancy." Intrinsic brilliancy may be expressed numerically as so many "lumens" per square inch of luminous surface. A lumen is the commonly accepted unit of light-flux, and may be defined very simply as follows: If a light-source having a strength of just one candlepower in every direction be placed at the middle of a transparent sphere one foot in radius, then every square foot of surface of that sphere will have exactly one lumen of light passing through it.

Some actual measurements which were made on two high-efficiency lamps will make the effect of frosting clear.

TABLE NO. 1 (LAMPS CLEAR)

	Lamp No. 1	Lamp No. 2
Lighted diameter of filament (inches)	.00207	.00172
Length of lighted filament (inches)	23.4	20.6
Area of surface of lighted filament (sq. in.)	.152	.111
Total number of lumens of light given out	424	282
Lumens per square inch	2790	2530

The process of frosting these lamps reduces the intrinsic brilliancy (glare) from the above values of over 2500 (intolerably high for general use) to comfortable values of about ten, as will be seen in Table No. 2.

TABLE NO. 2 (LAMPS ENTIRELY FROSTED)

	Lamp No. 1	Lamp No. 2
Area of surface of the luminous bulb (sq. in.)	36.6	29.6
Number of lumens passing through frosting (only 10 per cent absorbed)	382	254
Lumens per square inch	10.4	8.6

Where bowl-shaped diffusing reflectors of holoplane glass are used, it is not necessary to frost more than the lower half of the bulb, as the reflector itself diffuses the light from the upper portion.

The beneficial effects of frosting may be further illustrated by the following rather whimsical parable.

Gold, like artificial light, is one of the luxuries which civilized man has come to regard as a necessity. Suppose that gold descended in intermittent showers from the

Seeing Things at Night

If O. U. Bill Elk, just back from the big reunion of the herd at Los Angeles, tells you that he saw pretty girls riding around the streets on giraffes, and tries to describe the horrible sea serpent, green and scaly and shooting fire out of its eyes, it is not necessary for you to urge him to sign the pledge. You see, such things actually exist in California, though they are not to be found all the year round, but only on occasions like the recent national conclave. Then, with the efficient help of the electric railway and lighting companies, wonderful electrical spectacular effects are obtained.

The photographs are of two floats out of a score or so which literally made night hideous. They were mounted on trucks and propelled by a trolley through the main streets, forming the finest electric parade ever witnessed in the Southern California metropolis.

Besides the sea serpent and the rubber-neck giraffes, there were many old friends in new guise: the wild man of Borneo, the Teddy bear, the trick elephant, Mary's little lamb and Maud (a Kicker), besides a number of others too awful to talk about, and which could only be conceived by the versatile mind of an Elk.

skies and that in order for a man to possess any of the precious metal it was absolutely necessary for him to catch it with bare hands as it fell. It is safe to assume that the maiming effect of gold nuggets falling with express-train speed would detract largely from the pleasure of feeling them in one's hands. Now suppose that instead of descending in nugget form, the metal were beaten into gold-leaf, strips of which were dropped from the clouds and wafted their way down to the expectant hands of mortals below. Men would welcome such a change even if the amount of gold falling were decreased.

The decrease in velocity of falling gold corresponds, in the everyday world, to the decreased glare of light sources which have been frosted. There is, however, this difference, that the harmful effects of brilliancy in overdoses are not always felt at first. Sometimes an evening of close work by the light of unconcealed tungsten filaments will cause eye-strain, when the same annoying glare could be endured for a shorter length of time with impunity.

As a general rule one can well afford to cut down his total lumens of light, 10 per cent by frosting, when the same process reduces his lumens per square inch by several thousand per cent.

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

Some Notes on Spark Gaps

By ALFRED P. MORGAN

The oscillator or spark gap is one of the most important yet often the most poorly adjusted parts of a wireless station. The possible distance of transmission with a given set of instruments is greater with an increase of energy, and the energy stored in the oscillation circuit varies with the capacity of the circuit and the square of the difference of potential to which the opposite

FIG. 1. SPARK GAP FOR SMALL UN-TUNED TRANSMITTER

sides of the oscillator are raised. Therefore by lengthening the spark gap, since a greater potential then exists and more energy is stored, the radius of the station may be increased. Also if the gap is too short the discharge will form an arc and the only oscillations taking place will be those corresponding to the frequency of the charging current.

But there is a strong tendency for an amateur operator to open out his spark too wide. He is tempted to open it ou as long as sparks jump steadily, for the extra noise thus occasioned seems to please him. The greatly increased resistance thereby offered to the released charge may be so great that the disruptive discharge will not oscillate but merely set up a unidirectional current. To obtain a good oscillatory discharge with little damping it is necessary to make the resistance of the transmitting circuit as small as possible. The greatest part of the resistance is in the spark gap, and therefore this should be kept short. The proper length for a spark gap is a compromise between the two extremes.

Arcing is often caused by insufficient condenser capacity in the oscillation circuit. But if the capacity is increased the spark gap must also be made slightly longer, provided of course that an increase in the amount of energy supplying the coil or transformer is available, as otherwise the potential of the condenser may not be sufficiently raised to permit a discharge to pass across the arc.

The proper length for the gap may be approximated by an experienced operator by the appearance of the discharge. If too short, the spark will be hissing and

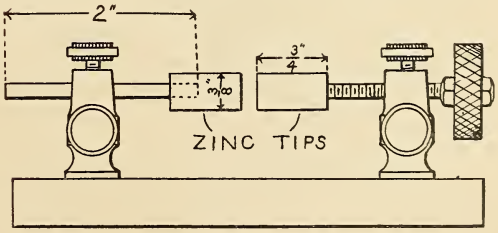


FIG. 2. SIMPLE ZINC SPARK GAP

flaming and is in extreme cases red or yellow colored. It should be lengthened out until it is thick and white and a slight increase in the sound is noted. The spark should not be, as commonly thought, stringy and crackling.

The only way the adjustment may be really ascertained is by means of a hot wire ammeter placed in the aerial circuit.

The proper gap length is then indicated by a maximum reading on the meter.

Spark gaps exist in various sizes and forms. The different types all possess inherent advantages and each is best suited to the style of apparatus for which it was designed.

The best spark gap for use with a small untuned transmitter making use of neither tuning helix or condenser is shown in Fig. 1. It consists of two brass balls about one inch in diameter supported by suitable binding posts. The balls tend to thicken the spark and make it more disruptive than if it passed between rods or points. The balls also increase the potential required to leap the gap and permit the aerial to become more highly charged before a spark takes place. For this reason the spark balls or knobs must always be kept free from rough spots and points by frequent polishing.

Zinc has some peculiar property whereby it is the most efficient material for a spark gap. Brass is second. The use of zinc is somewhat limited to any but small stations as the excessive heat generated by large transformers or induction coils rapidly corrodes and melts the zinc electrodes. Amateur stations using small induction coils will secure good results with the simple and efficient type of zinc spark gap shown in Fig. 2. It is easily made by fitting two pieces of zinc battery rod $\frac{3}{4}$ inch long and $\frac{3}{8}$ inch in diameter to the ends of two brass rods $\frac{1}{8}$ inch in diameter and $2\frac{1}{2}$ inches long. The rods are supported by two ordinary double binding posts, one of them provided with screw threads for adjusting.

A spark gap of the type just described would be unsuitable for a large transformer or induction coil. One having heavier parts of less resistance and better able to stand the heat is shown in Fig. 3. If desirable the dimensions of a gap of this type may be reduced and made suitable for a small coil in place of the gap shown by Fig. 2.

A piece of hard rubber rod (R) one inch in diameter and $2\frac{1}{2}$ inches high serves as a standard. Four grooves $\frac{1}{8}$ inch apart better the general appearance and also reduce leakage in event of any moisture collecting on the rubber. The upper electrode is supported by (S) a strip of brass one inch wide, $3\frac{1}{2}$ inches long and $\frac{1}{4}$ inch thick. A hole is bored and tapped to receive (P) which is a piece of brass rod $\frac{1}{4}$ inch in diameter and $2\frac{1}{2}$ inches long. A second hole permits a binding post to be screwed into the top of (R). A small brass pin (Z)

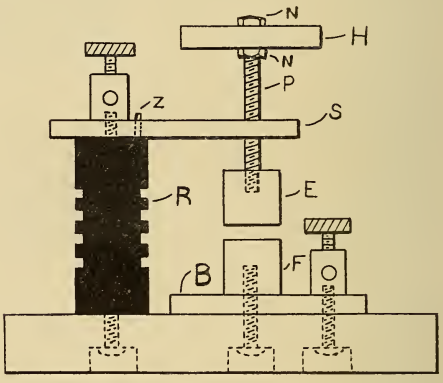
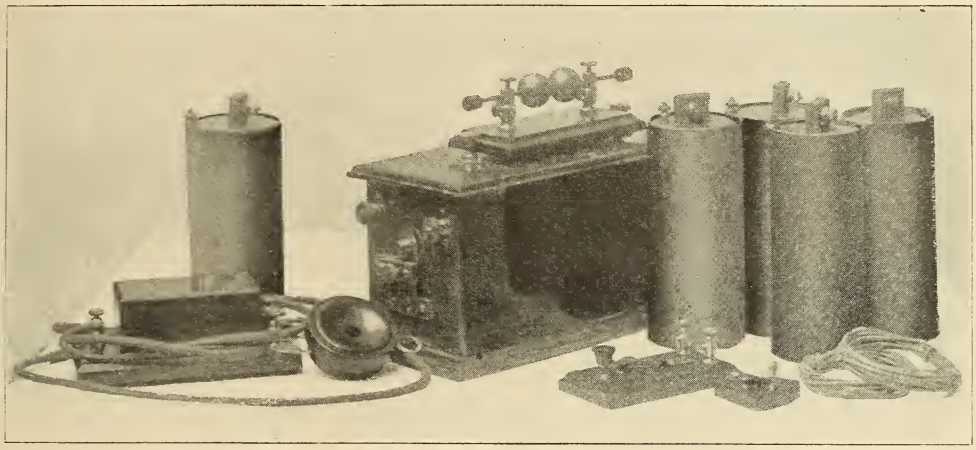


FIG. 3. ZINC SPARK GAP FOR HEAVY WORK

one-sixteenth inch in diameter and $\frac{1}{2}$ inch long projects into (S) from (R) in order to prevent (S) from slipping. A fibre head (H) two inches in diameter and $\frac{1}{4}$ inch thick is clamped on the upper end of (P) by means of the two nuts (NN). The electrodes (E) and (F) are cylinders of brass $\frac{3}{4}$ inch in diameter and $\frac{3}{4}$ inch high. The upper electrode (E) is bored and tapped to fit the lower end of the rod (P). The lower electrode (F) is fastened to the base by means of a screw passing through (B). (B) is a strip of brass $2\frac{3}{4}$ by 1 by $1\frac{1}{4}$ inch. A second hole allows a binding post to be fitted on (B). The base is made preferably of hard rubber or fibre.

Five-Mile Wireless Outfit

Many amateur wireless experimenters will no doubt derive a great deal of pleasure and benefit by building their own apparatus, but there are also many who would prefer to obtain a good working equipment at the start, from some reliable manufacturer. A small equipment of this sort is here illustrated. It is intended for actual work up to five miles under all conditions; not simply when the atmosphere is just right or when the detector happens to be "feeling fine."



FIVE MILE WIRELESS OUTFIT

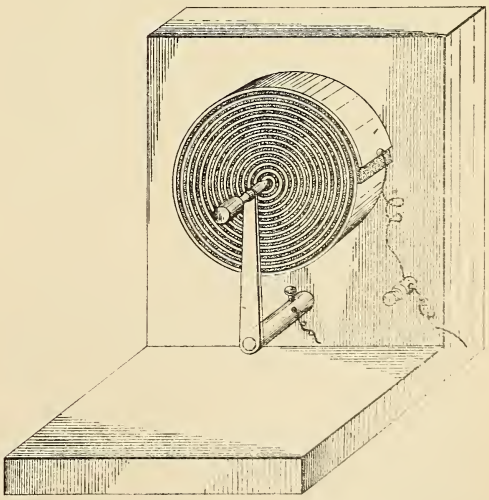
The detector is of special design and is one of the important features of the set. It needs no more attention than a telephone receiver, and is less liable to get out of order. Unlike the electrolytic, it cannot be burned out by the transmitting station, and requires no potentiometer. Unlike the needle-carbon detector, it does not arc, and is not affected by jarring and at the same time it is sensitive.

The head receiver is a neat little instrument built to be sensitive and light, the weight having been reduced to a minimum. The permanent magnet is constructed with a view to giving the greatest efficiency.

Another important feature of the outfit is the induction coil, which was designed exclusively for wireless. The secondary is wound with comparatively heavy wire in order to produce the thick, hazy spark so desirable for wireless transmission. Dry cells are shown in the cut which work satisfactorily for experimenting, but for commercial use, primary or storage cells are preferable.

Wireless Tuning Coil

Lee De Forest has recently taken out a patent on a new type of tuning coil which is shown in the illustration. The coil consists of a thin strip of copper or brass ribbon wound in the form of a spiral, the convolutions being separated by a thin ribbon of silk insulation or cellulose acetate. It is then mounted on a frame with the edge of the ribbon outward, and a contact maker in the shape of a crank is arranged so that the contact point as it is moved outward cuts out the successive convolutions.



DEFOREST'S NEW TUNING COIL

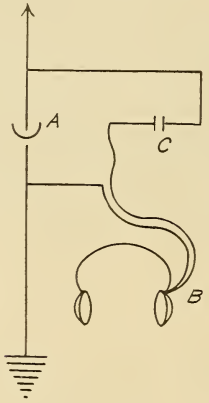
WIRELESS QUERIES

Answered by Valentine B. Seitz

Head Band Receiver and Condenser

Questions.—(A) Please give a diagram of the connections of a wireless receiving station with a head band and receivers. (B) How large should the plate condensers be for a set of receivers of 75 ohms each? (C) Are plate condensers as good as leyden jars?—H. T., Marysville, Ohio.

Answers.—(A) The diagram of a receiving set using head telephones is given below. (A) is the detector, (B) the receiver and (C) the battery. In this case you must use the liquid or some other type of self-restoring detector.



RECEIVING SET USING HEAD TELEPHONES

(B) The condensers used in the receiving circuit are made of very thin metal plates and the plates so arranged that the capacity can be easily and quickly varied by moving the plates over or from one another. In the receiving circuit shown in answer (A) no condenser is needed.

(C) Yes.

A 100 Mile Transmission

Questions.—One hundred miles from this city there is a station of ten kilowatts and between us are mountains higher than the place where the city is located. (A) Could messages be heard over this distance? (B) What height must the antenna have? (C) What kind of apparatus is necessary? (D) Would a soldered connection with the tubing be sufficient? (E) What resistance must the apparatus have, the tuning coil and the telephone?—F. T., San Jose de Costa Rica.

Answers.—(A) Yes.

(B) About 70 or 80 feet.

(C) A tuning coil, condenser, pair of 1500 ohm receivers and any good thermo-electric detector.

(D) Your question is not clear.

(E) The sensibility of a receiving set is never given by its resistance. Telephone receivers are spoken of by their resistance; 1500 ohms being a good average for wireless work.

Spark Coil and Condenser

Questions.—I have wound a jump spark coil consisting of 42 turns of 14 gauge copper wire for the primary and 2450 turns of 28 gauge d. c. c. copper wire for the secondary. I want to operate this with 10 volts. (A) What will be the limit of the spark gap? (B) Can I make a condenser of 14 gauge rubber covered copper wire, if so, how much will it take?—L. R., Cottonwood, Idaho.

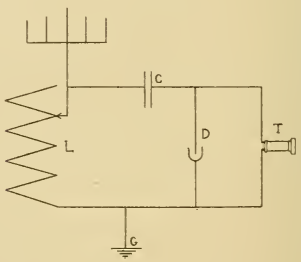
Answers.—(A) As you have not given size of core, etc., we cannot tell the length of spark. You will probably find that both your primary and secondary have too few turns. With a high speed vibrator and a well-proportioned core you will probably get about $\frac{1}{8}$ inch.

(B) No.

Connections for Wireless Outfit

Questions.—(A) Please show diagram for connecting outfit consisting of a tuning coil, silicon detector, one 75 ohm receiver, condenser and aerial 50 feet from ground. (B) Do I need other instruments to make my receiving set complete? (C) With what wire should I re-wind my receiver to make it 2000 ohms and how much?—H. J., Gloucester, Mass.

Answers.—(A) See diagram.



CONNECTIONS OF WIRELESS OUTFIT

(B) The set described is complete in itself, but if you wish to make any improvement would advise using a receiving transformer in place of the tuning coil.

(C) Rewind your receiver with No. 40 enameled wire, getting on as many turns as the magnet spools will hold. Receivers having from 1500 to 2000 ohms resistance per pair, give the best results.

Sending Helix; Wave Length; Ground Connections

Questions.—(A) What size of wire shall I use on my sending helix and what is the diameter and number of turns and distance between each turn? (B) How do you put on the slider? (C) How do you find wave length with this tuning coil and 100 foot aerial suspended 75 feet high? (D) Should the ground be near the instruments? What size of wire is best?—R. R. L., Washington, D. C.

Answers.—(A and B), See answer to L. R. in the September, 1909, issue.

(C) The data given is not enough to find what the wave length will be. You can find out near enough, by having some one compare your tuning point with that of some other station having a known wave length.

(D) It is not necessary to have the ground near the instruments, but the straightest or shortest distance is the best. You will find No. 10 wire heavy enough for a one K. W. set, but the Board of Fire Underwriters call for No. 4 in some sections.

United Wireless Apparatus

Questions.—(A) Please show diagram lilustrating the connections of the United Wireless Company's equipment. (B) Is the potentiometer the same as the DeForest tuning coil and may it be used instead? (C) Could 110 volt current be used for this equipment?—M. T. B., St. Francisco, Wis.

Answers.—Your question is rather general, as you do not mention any special type of set. The different sets put out by the United Wireless Company vary in construction and method of connection.

(B) The potentiometer and tuning coil are quite different in construction and use. The potentiometer is used to vary the voltage in the detector circuit, while the tuning coil is used to bring the receiving set in resonance with the sending station.

(C) One hundred and ten volts alternating current with a transformer would give most satisfactory results.

Apparatus to Receive 100 Miles

Question.—What instruments are required to receive wireless messages up to 100 miles and how are they connected?—O. E. H., Baltimore, Md.

Answer.—(A) The above question is quite frequently asked by different people, and is one that cannot be answered, unless all conditions are taken into consideration. A ¼ K. W. transmitting set, working under good conditions, over water at night, should be heard over a distance of 100 miles with a good receiving set. The receiving set should consist of a tuning coil, condenser, receivers and electrolytic or any good thermo-electric detector. The same sending set working in the day time and not under such favorable conditions, probably would not operate over 10 miles. It can therefore be seen that the answer to the above question as to the receiving ability is one that can be better judged by the amateur himself. See diagram to C. H. C.

Potentiometer; Rotary Condenser; Electrolytic Detector

Questions.—(A) Is it best to have one or one-half ohm steps on a potentiometer? (B) Explain the rotary type variable condenser. (C) Is there a commercial wireless station in Kansas City, Mo., or Kansas City, Kas.? (D) How strong a battery current should be used with an electrolytic detector?—I. H. W., Eskridge, Kas.

Answers.—(A) This would depend upon the total resistance and number of turns in the potentiometer. If the coil has a resistance of 500 ohms and is to be used with an electrolytic detector, steps of about two or three ohms will be sufficient.

(B) The use of the rotary condenser is the same as that of the slide type, the only difference being in the construction. A bank of semi-circular plates, pivoted between two bearings, are placed so that they can revolve between a set of similar stationary plates.

(C) None, to our knowledge.

(D) Electrolytic detectors work on about 1.6 volts.

Microphone Transmitter; Break in Antenna

Questions.—(A) How is a microphone transmitter for very high voltage made? (B) If the cable leading to the antenna breaks so there is no more electrical connection with the spark gap what would happen if the coil were kept working? Would any damage be done to the apparatus?—O. S., Clinton, Mass.

Answers.—(A) Microphone transmitters for high voltages are more or less troublesome and are not generally used. We would advise the use of one of the common types in connection with a transformer in a shunt circuit.

(B) The spark at the gap will continue, but no harm will be done. If the spark gap is opened beyond sparking distance, the voltage on the free end of the coil might be raised enough to puncture the insulation.

ELECTRICITY IN THE HOUSEHOLD

The Evolution of Electric Heating

It seems almost incredible that within the span of less than a half dozen generations there could have been made such a remarkable advance in the methods of the comparatively simple process of boiling water. The cover design of a little booklet issued by a manufacturer of electric water heaters emphasizes in a striking manner the course of this development, and shows us in a manner more forceful than words that this is truly the electrical age in which we are living. The savage Indian heated water as best he could by raking hot stones out of the campfire and throwing them into the liquid. To our grandfathers the open fireplace with its ponderous kettle was a substitute for the crude methods of the natives. Later the familiar cookstove with its complement of pots and kettles was a much appreciated improvement. And now, at the turn of a switch it is possible to procure boiling water at any time and anywhere that the current giving wires are available.

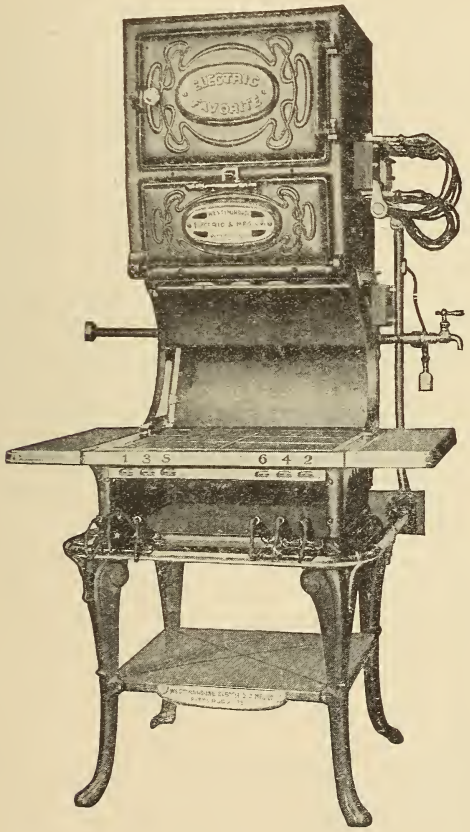
The uses of an instantaneous water heater are many. In the home it will serve in the sick room, as well as at the buffet. To the physician it is valuable for sterilizing water. In dentistry the needs of hot water are more frequent, and the device is especially adapted for this work, even satisfying the demands of the laboratory. In cafes, etc., there is a constant demand for an instantaneous heater. Hot water may be obtained while the glasses are being procured. At soda fountains and in candy stores such a heater may be adapted to a score of purposes.

There are, in fact, hundreds of classes of people to whom the electric heater is invaluable, but how many stop to think how comparatively short has been the time in which this and similar labor saving electrical conveniences have been taking form.

The Latest in Kitchen Ranges

Cooking by electricity means no fire to kindle and keep up, no ashes, no smoke, no dirt, no gas fumes, no menacing probability of explosion. These things are what make it the only form of heat that is absolutely sanitary and free from all objectional features. That it is ideal for cooking purposes is apparent from its very nature.

The principle of the electric heater has been known and made use of in a limited



LATEST KITCHEN RANGE

way for many years. There has remained, however, a problem for the engineer to work out; namely, the construction of a heating element combining efficiency, simplicity and durability in a manner that the stove may be recommended for daily domestic use. The latest solution of this problem is a heating element which is embodied in one of the latest types of electric range, which is shown in the picture. This element is made of a practically indestructible material that converts the electric current into heat at the exact point where it is wanted and in the most effective manner. The range which contains it corresponds in appearance with the most modern design of gas range, and the cooking surface consists of six distinct heating units, each of which can be used independently of the others.

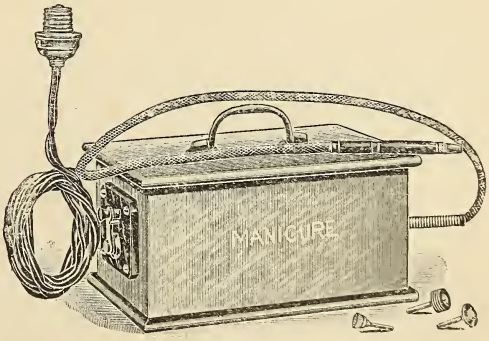
Both the oven and the broiler are located above the stove so that no stooping is required. The oven is heated by five distinct heating units, so connected that any one or combination may be used without switching in the others.

The broiler is heated by five units similar to the oven. This heating by separate units makes it possible to regulate the heat with great exactness, and keep it at the temperature desired.

Beneath the broiler is located the reservoir, getting its heat from a double immersion coil. Under the cooking surface is an open plate warmer and beneath this is a shelf for cooking utensils. All of the heating units are readily accessible for cleaning. There are no stove lids to bother with for the heat is in the stove top itself and not underneath, as in all other stoves except the electric.

Electric Manicuring Outfit

This outfit consists of a motor and flexible shaft for holding the manicuring instruments, all mounted in a compact mahogany case. Current is supplied through a cord

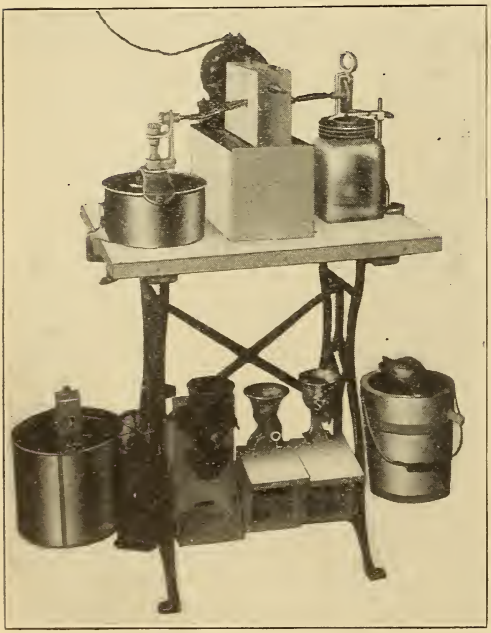


ELECTRIC MANICURING OUTFIT

and plug from the lighting circuit. There are various little grinding, polishing and buffing wheels which go with the equipment.

The Automatic Kitchen

We know all about necessity being the mother of invention, etc., and it was for this reason that Adolph Aderer was impelled to invent the "automatic kitchen." Mrs. Aderer was not very robust, and as they lived in New York she was severely tried by the servant problem which has become so complex in the larger cities. In order to



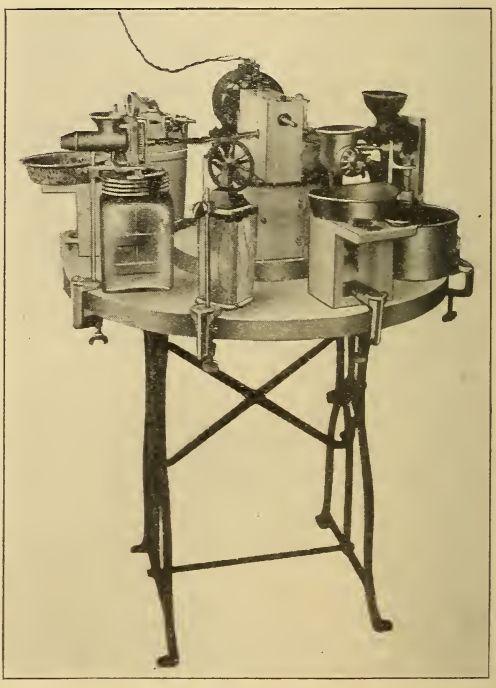
AUTOMATIC KITCHEN NO. 2

lighten her task Mr. Aderer worked out the idea of the automatic kitchen. The first machine was used in their home and in the early stages of its development it worked so imperfectly that both machine and inventor were at times near being thrown out of the window.

But it was no Mr. Bowser idea, as results finally proved, for after much thought and experimenting, and aided by helpful suggestions from the future user of the machine, he was able finally to bring it to such a practicable stage that it made the kitchen absolutely independent of servants. Then of course the next step was to make machines for the market and give other housewives the advantage of its labor-saving possibilities.

The mechanism of the machine is very simple. Extending from the motor is the main shaft, a part of which carries two worms connected to two worm gears, each of different size, giving two speeds. The worm gear spindles or shafts are set inside of an eccentric bushing, the turning of which by means of small handles permits the bringing of the gears into or out of mesh with the worms, this allowing each of the gears to be run independent of or together with the other. Attached to each of the gears is a flexible shaft, the ends of which have half round sockets.

All utensils to be used are provided with half round spindles fitting into the sockets



AUTOMATIC KITCHEN NO. 3

on the shafts. These spindles are inserted into the sockets, the utensils are clamped to the table, and are then ready for operation.

The above description appertains to automatic kitchens Nos. 1 or 2, No. 2 being shown in one of the illustrations. The former has only one flexible arm for the use

of only one utensil at a time, while the No. 2 has two flexible arms, permitting the use of either one or two utensils at a time.

The No. 3 machine is the same as number 2, except that it is mounted on a round table top, part of which revolves around the base; base and motor being stationary.

All the utensils are clamped to the table in their respective positions and are only removed for cleaning purposes. Each of the flexible shafts of this machine is provided at its end with a slip-joint socket, permitting the attaching and detaching of the arm by the simple pressing backward of the socket, without the necessity of unclamping the utensils from the table.

These machines may be operated by a child, after a half an hour of instruction, and that without any trouble or danger.

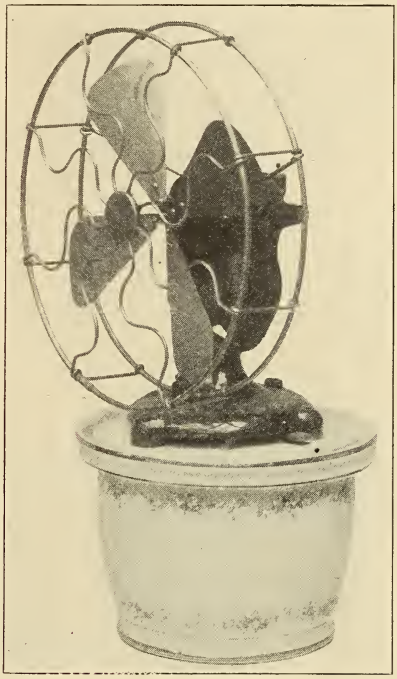
Cooking With Incandescent Lamps

The "fireless cooker" is the latest departure in electric cooking devices and the unique feature about it is that all the heat necessary to do the cooking is derived from four incandescent lamps. As everyone knows, a comparatively small amount of heat is required to perform the simpler cooking operations, such as boiling water, cooking cereals, etc. The trouble lies in confining the heat and applying all of its energy to the cooking process. This is what the fireless cooker does.

As will be seen in the illustration, the cooker consists of a cylindrical pail the sides of which are double and interlined with asbestos, which almost entirely prevents loss of heat by radiation. In the bottom of this pail are arranged four incandescent lamps provided with a cord and plug for attachment to an ordinary lamp socket. Above the lamps and suspended from the rim of the pail is a conical vessel containing the materials to be cooked. Over this is a heat retaining cover. The lamps are arranged so that all or a part of them may be used at once, providing for a quick, strong heat or a slow, simmering heat.

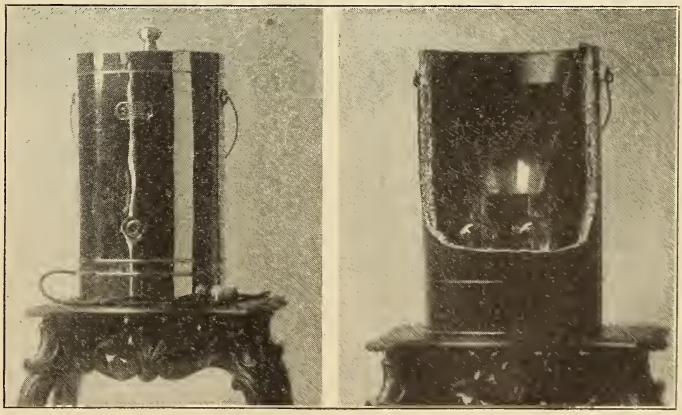
Portable Fans

Any office, home or place of business not having electric wires may still have an electric fan, for a portable one driven by a storage battery is at last obtainable. The battery is carried in an ornamental jar and

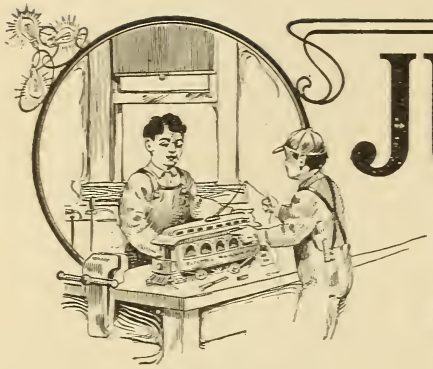


PORTABLE FAN

it furnishes sufficient current to operate the nine inch fan for 50 hours' continuous operation, after which it may be recharged for 50 cents.



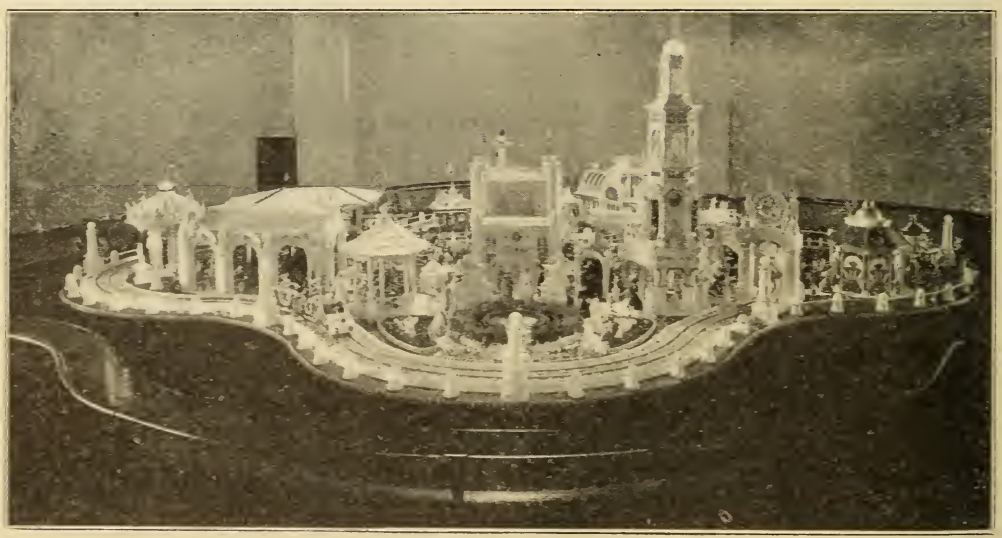
ELECTRIC "FIRELESS" COOKER



JUNIOR SECTION

A Magic City

"Magic City," which is to be found at San Souci Park in Chicago is one of the most marvelous in detail and picturesque in appearance, of any of the notable miniatures that have been shown from time to time in America. It represents the ingenuity of two young Chicagoans—George McCall Black and Arthur Frazier—and their undivided attention during the working hours for nearly four years. This little miniature, occupying a platform about 20 feet in circumference, possesses everything in the way of life and architecture, that would combine to create the city beautiful. It includes fourteen separate and distinct buildings, set among gardens, statuary, fountains and lagoons. It is illuminated by 14,000 four-volt incandescent electric lamps, some in colors, and the majority of them flashing alternately. It is operated from its own plant by electricity and compressed air. Among the buildings are a power house in operation, a band pavilion with a miniature band playing by phonograph attachment. a German beer garden filled with merry-makers, a lighthouse in the lagoon, an administration building with an illuminated tower, an electric pavilion. an Italian fruit stand, grand central railway station, and a menagerie in which all of the lions, tigers, bears and alligators seem to be alive. There are singing, moving birds on the lawns, a little railway train "toots" as it runs around the city, and the boats and swans on the lagoons are moving all the time.



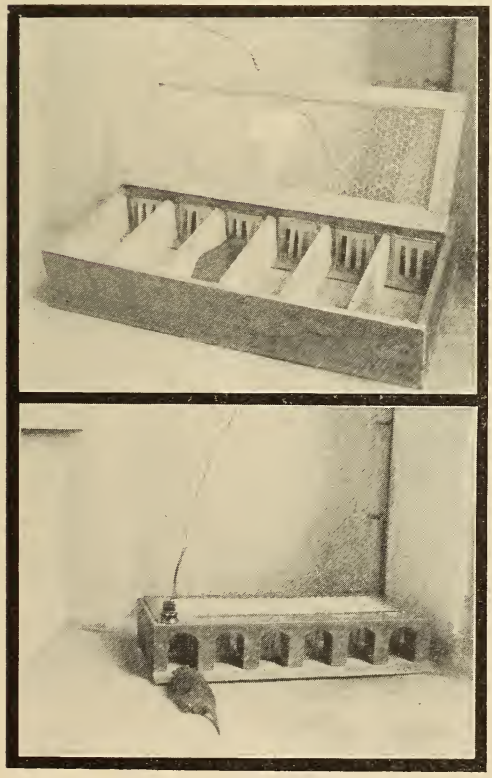
"MAGIC CITY"—A WONDERFUL MINIATURE

The detail is so perfect that a midget man is seen mowing the lawns, a fortuue teller is displaying her cards in the Hindu booth and a bridal party actually walks out of the Cathedral. The buildings are all in white enamel, decorated with gold.

The "Magic City" was originally intended for the Alaska-Yukon exposition, but would not be completed in time for the opening of that affair. It required the services of four men an entire month to install it, so intricate and innumerable are the details.

Killing Rats by Electricity

The problem of rat extermination becomes a serious one, especially in seaport cities, where the danger of infectious diseases, brought in by the rodents, becomes alarming. Traps, poison, smoke, etc., are em-



ELECTRIC RAT TRAP

ployed for the extermination of the pests, but they all have their drawbacks.

A method of killing rats by electricity has been invented by a citizen of Vienna, Austria, which is certainly cleanly and humane. The device consists of a box with a number of entrances through which the rat must pass to get to the bait within. Little metallic gates, hinged at the top, are provided, which the rat pushes open as he enters. These gates are made one terminal of an electric circuit. The other terminal is connected to wires in the bottom of the box.

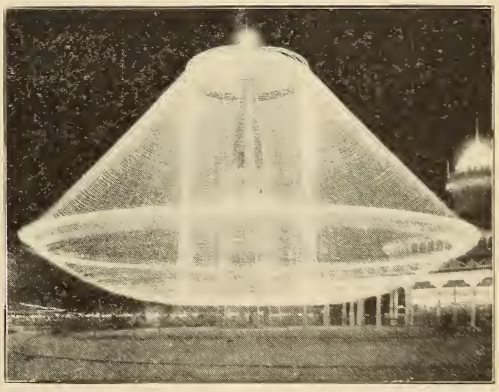
The rat, having thrown open the gate, closes the circuit by touching the wires. He is then almost instantly killed by the current flowing through his body, and no blood is to be seen.

The inventor made experiments in the presence of officials from the German Navy, the police, slaughtering house, municipal markethalls, in the Berlin electric power stations, etc. It was even found that three rats, having been imprisoned in the same compartment, were killed at one time.

The apparatus has been so much improved, recently, that 110 volt continuous current, or even only 40 volt alternating current, is sufficient to kill a rat. This permits the trap to be installed everywhere, in the private homes, cellars, stables, kitchens, etc., where such current is to be found.

Unusual Photograph of Moving Lights

At first sight one would be led to believe that some extraordinary new scheme had been devised for utilizing electric lights to amuse the public. This freak picture is however nothing more or less than a reproduction of a time exposure photograph



PHOTOGRAPH OF MOVING LIGHTS

made of one of the giant airship amusement devices, frequently seen in summer parks.

Miniature airships are suspended by long cables from a lofty tower. The platform from which they are suspended is then made to revolve. As the ships travel in a circle, faster and faster, the centrifugal force tends to throw them outward, and, as the cables cannot elongate, they are of course lifted at the same time. The cables, the tower and the ships are all outlined with electric incandescent lamps, and all these individual points of light, as they move across the photograph plate, leave a path which shows white on the photograph print.

How to Build a Simple "Shocking" Coil

Many questions have been asked by readers of the Junior Section, and others, relative to the construction of a simple induction coil or "shocking coil," as it is often called. More pleasure can be derived

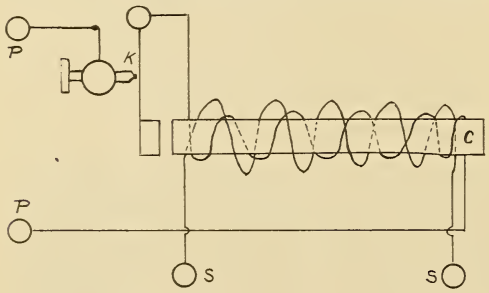


FIG. 1. CIRCUITS OF A "SHOCKING" COIL

from one of these simple coils and a few cells of dry battery than from many a costly toy, and the youthful experimenter will find in its making instruction in some of the fundamental principles of the application of electric current. The following

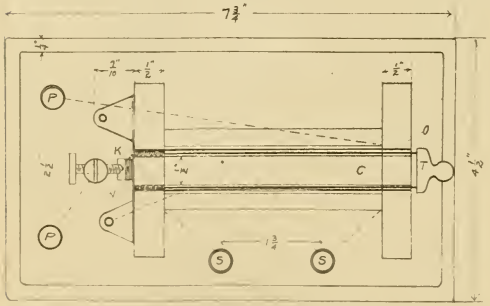


FIG. 2. PLAN VIEW OF "SHOCKING" COIL

description tells just how to proceed in making one.

Fig. 1 shows circuits and connections necessary in the construction. Connections from the battery or other source of energy are made at (PP). The secondary wires are taken off at (SS), (C) represents the core, and (K) the "make and break" device. The same letters refer to like parts in Figs. 2 and 3. Dimensions and explanations of parts of the device that may be arranged to suit the fancy of the builder are omitted.

For the core (C) soft iron wire No. 20 to No. 24 B and S gauge may be used. Anneal the wire first by placing it in a coal or coke fire about ready to die down. Sandpaper the oxide from the wire when cool, dip in hot water, dry with a cloth and then paint with thin shellac. Now cut the wires into lengths 4¾ inches long. Into any metal tube three inches long, having a smooth inner surface force as many of these wires as possible. Where the wires extend from the ends of the tube make them even, bind them about with a wire and dip the ends into melted solder. The bundle may be held tightly together at the middle after removal from the tube by binding with several turns of stout linen thread. Schellac again with a thin coat.

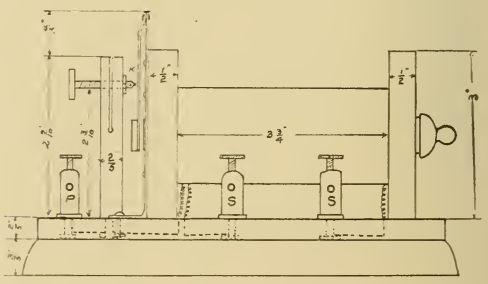


FIG. 3. SIDE VIEW OF "SHOCKING" COIL

Referring now to Figs. 2 and 3, provide four pieces of good close grained wood (see dimensions), two pieces for uprights to support the ends of the coil, and two pieces for the base. Note on the upper base that binding post nuts are counter sunk in it and also that the wires are run

through holes to its under side and follow grooves provided. After the coil is complete, the lower base may be fastened to the upper by small wood screws, small holes being drilled first to prevent cracking the wood.

Returning again to the core, provide a hard rubber collar (N), $\frac{1}{2}$ inch wide, 1-16 inch thick, and just a little larger than the core. On the end of the core wind a $\frac{1}{2}$-inch strip

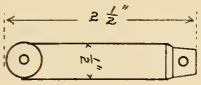


FIG. 4. INTERRUPTER SPRING

of light manilla paper soaked with flour paste, and over this slip the rubber ring indicated in Fig. 3 by the cross lines. If rubber is not at hand, this collar may be made of paper. Next provide a paper cylinder, Fig. 3 (O), just large enough to fit the collar (N) when pasted as shown. This cylinder should be $4\frac{3}{4}$ inches long, and may be made by winding paper of the above

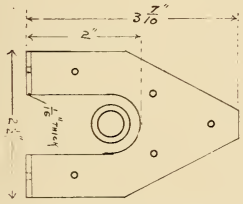


FIG. 5. INTERRUPTER SPRING SUPPORT

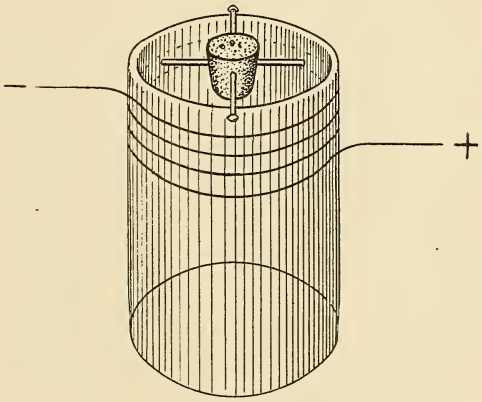
width ($4\frac{3}{4}$ inches) upon a metal cylinder just large anough to slip tightly on collar (N). This paper should be saturated with paste, slipped off the cylinder and allowed to dry in cylindrical shape. When dry slide this cylinder over the core and collar (N), after sliding the copper or brass tube (T) up to the rubber collar. This tube (T) may be moved back and forth by its wooden handle thus cutting off the effect of the primary current on the core and increasing or decreasing the shocking effect. The whole, core, paper tube and sliding tube, may now be fitted into $\frac{1}{2}$-inch supporting blocks, and plenty of glue or paste applied.

Over the paper cylinder wind two layers of No. 22 single cotton covered wire, soaked in paraffine, for the primary coil, bringing the wires out at the ends as indicated in Fig. 2. Cover the primary with a layer of stout paper and schellac in place. Now wind on $\frac{3}{4}$ of a pound of No. 36 double cotton covered wire, paraffined, bringing the terminals out as shown in Figs. 2 and 3. Silk covered wire may be used if preferred, without paraffine. The interrupter screw (K) should be platinum tipped. The spring, Fig. 4, may be of thin German silver or steel, with a soft iron disk riveted to the end. The interrupter spring support, Fig. 5, may be of 1-16-inch sheet brass. Use four volts of battery, or about three cells in series. Brass tubing soldered to flexible drop cord may be used for handles.

Simple Current Detector

To make a simple current detector, wrap several turns of about No. 26 insulated copper wire around the top of a glass tumbler in the manner shown in the sketch.

Next procure a cork, and having ascertained the centers of the ends with a compass thrust two brass pins in them. Magnetize a sewing needle and put it through the cork



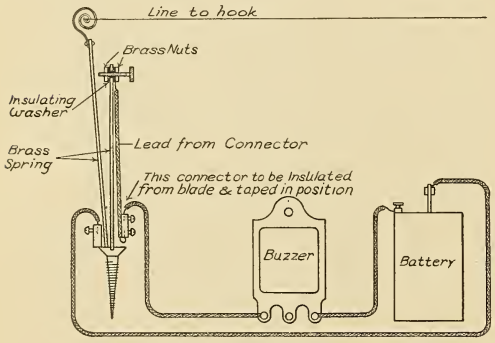
SIMPLE CURRENT DETECTOR

at right angles to the pins so that it balances in a horizontal position. Notch the glass at two opposite points, put a drop of oil in each notch, and rest the pins in them. When a current goes through the wire the needle will dip. The needle should be kept pointing in an east and west position.

This device should only be used to detect weak currents, as from dry cell batteries. It must not be used across 110 volt mains unless an 110 volt lamp be connected in series with the coil or else wire of sufficient resistance be used in the coil so as not to throw a short circuit on the line.

Fishing Signal

Following is a description of a unique fishing signal which may be rigged up on a wharf or pier, and so arranged as to operate an electric bell or buzzer, located in the fisherman's cottage or any other place desired, whenever a fish pulls upon the line. All that is necessary to make the device are two pieces of spring brass or old hack saw blades, one about six inches and the other about seven inches long, a



FISHING SIGNAL

large flat head screw, two wire connectors, one dry battery, a piece of ⅜-inch fiber bushing and fibre washers, adjusting screw and nuts, some rubber insulated wire and a bell or buzzer.

First set the screw in place on the wharf and solder the six-inch piece in place in the slot and solder the seven-inch piece and one of the connectors to the top of the screw head at the left as shown. The seven-inch piece should slant away from the six-inch piece.

The six-inch piece, before it is soldered in place, should have a ⅜-inch hole drilled near the top in which should be placed the bushing. On each side of the hole are the fibre washers, followed up by the adjusting screw and nuts as indicated in the diagram. The adjusting screw is therefore insulated from the six-inch piece.

The other connector is fastened near the lower end of the six-inch piece by tape and is insulated from it.

A piece of spring brass may be fastened to the top of the seven-inch piece and made into the form of a spiral to which the fish line is fastened.

If the apparatus be set up with the head of the adjusting screw toward the water, and a fish pulls upon the line, the seven-inch piece is pulled over and touches the end of the adjusting screw. Current then flows from the battery, through the left hand connector and seven-inch piece, through the adjusting screw, down through the insulated lead to the right hand connector, on through the buzzer to the other side of the battery, completing the circuit and operating the buzzer.

Laminated Motor on Alternating Current

Laminated-field motors designed for direct current, such as the one described in the May, 1909, issue of Popular Electricity, page 46, will operate on alternating current, since the polarity of both the field and the armature terminals reverse with each reversal of the alternating current. Operated by alternating current they are, however, less efficient, owing to the great self-induction in the fields. Still with plenty of power available, as from an alternating current lighting circuit, they may be made to run very satisfactorily. In regard to this, A. W. Jefts, of 6 Hudson street, Worcester, Mass., writes as follows:

"In the May issue of Popular Electricity there appeared plans and details for a small battery motor with laminated fields and laminated armature of three coils. I call your attention to it for the reason that it may interest some of your readers to know that, while the motor was designed to run on direct current from two to four dry batteries, which it does very nicely, it will run like a whirlwind on alternating current of 104 to 110 volts, 60 cycle, single phase; this by simply putting it in series with a 32 candlepower lamp. Connected in this way it was very strong. With a 100 candlepower lamp in series it is a little giant and would make an excellent fan motor, easily made and of little cost.

"The one I have made cost me 40 cents for material. I made changes in the design, making it a little heavier, by using thicker laminations and more wire on both field and armature windings.

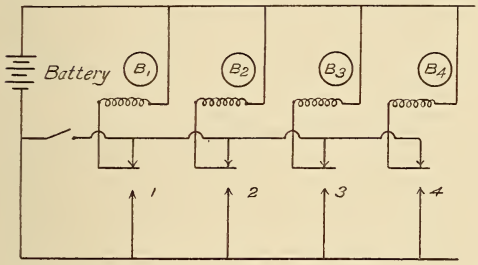
"The details were somewhat simplified. It is self-starting on alternating current and is more unique than the originator seemed to know. I will give working details to anyone interested enough to write for them."

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

More Doorbell Engineering

The question of how to ring four doorbells from a fifth push button and still have the bells all work independently has brought in a long train of solutions. Some were wrong, some too expensive, and some unmen-



FOUR BELLS RUNG FROM A FIFTH BUTTON

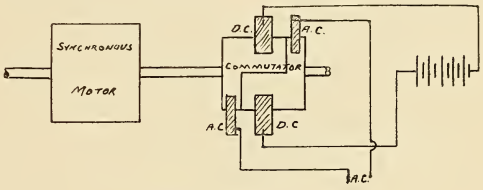
tionable. But a doorbell engineer comes along with the only real, up-to-date, Twentieth Century method of attacking this "complex" problem. The diagram shows how it should be done. Connect the back contacts of all the bells to the middle wire, which contains the fifth push button.

The discussion will now be considered closed, and further reference to this particular problem will result in a waste of postage stamps.

Pole Changer for A. C. to D. C.

Question.—Would you kindly advise me if such an arrangement as is sketched here would change A. C. to D. C. on a non-conductive load such as storage battery charging, also if it would work on an inductive load.—C. E. H., Jr., Chicago, Ill.

Answer.—In the diagram, which we reproduce, you state that the synchronous motor runs at half frequency speed by gearing, which is impossible, as the speed must depend upon the number of poles of dynamo and motor. The commutator device might be so geared. Your device would not work at half speed because if the dynamo were only bi-polar, which is unlikely, the current would change in direction once during each revolution and hence the commutator would have to run at exactly the same speed. If the dynamo is multipolar your commutator will have to run as many times faster than the dynamo as there are pairs of poles on the dynamo. If



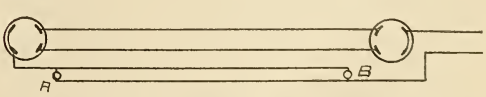
POLE CHANGER

the dynamo is twelve-poled the commutator will have to run six times as fast as the dynamo. Also, the D. C. brushes will have to be set so that they are passing from one commutator bar to the other when the A. C. current is at zero. Exact synchronism must be maintained. You will find that this device is generally impractical. The current it would produce would be pulsating and not smooth, and while it can be used on battery charging it will act upon inductive loads much as an alternating current would, but not to so great an extent.

Controlling Lights from Two Points

Questions.—(A) Will you explain to me by diagram how to wire two lights and switches so as to turn on light from downstairs and shut same off by switch upstairs. (B) Can two lights be on the same switch, one downstairs, and one in the hall, to be turned on upstairs and shut off downstairs? —A. S. L., West Point, Cal.

Answers.—(A) The better way is to use two three-point switches, one upstairs and one downstairs, wired as shown in the diagram.

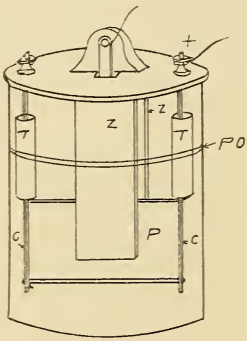


(B) The two lights may be separated, (A) being in the hall and (B) downstairs.

Edison Cell

Questions.—(A) Please explain the construction of an Edison cell. (B) Does this cell wear itself out when not in use? (C) Should it be kept on a closed circuit when not in use? (D) What is the voltage of this cell? (E) Will a common earthen jar of proper dimensions be suitable for this cell? (F) How long will this cell last with ordinary usage?—W. W., Colorado City, Colo.

Answers.—(A) Magnesium chloride mixed with cupric oxide is molded under pressure into a plate of the required weight and size. Heating this plate binds the mass together.



EDISON CELL

Referring to the drawing, the cupric-oxide plate (P) is shown suspended by a copper frame (C) protected in the electrolyte above the plate where the rods run to and through the cover, by porcelain tubes (TT). One of these copper rods from the frame is used as a binding post for the positive lead (+). Supported through the cover are two zinc plates (ZZ) between which is suspended the cupric oxide plate. A bolt and binding post connects the two zinc plates and is the negative lead (—) connection. A thin layer of paraffin oil (PO) is used to cover the electrolyte and adds one-third to the life of the cell. The 300-ampere cell is 10 inches high by 6¾ inches in diameter. The cover of the jar should preferably be of porcelain. The internal resistance of the cell is about .03 ohm. This cell will give 12 or 14 amperes but runs most efficiently at six amperes. For the 300-ampere hour cell the copper-oxide plate should weigh at least two pounds. To set up the cell, place water in the jar and into this sprinkle granulated potash, stirring the solution until the potash is all dissolved and the solution is "saturated." Next put the plates in place and pour on the heavy paraffin oil. Be careful that the surface of the electrolyte is at least one inch above the oxide plate.

(B) No.

(C) No.

(D) .7 of a volt.

(E) Yes.

(F) That will depend upon the output required and also upon the size of the plates. The cell is built to give as high as 900-ampere hours being then used for lamps and small motors.

Grounded Telephone Lines

Questions.—(A) How may cross talk on grounded party lines be eliminated where such lines parallel on the same line of poles for four or five miles? Would running an extra wire for each line and grounding it beyond the point of intersection and transposing these wires the same as for a metallic circuit be any benefit? (B) Will a grounded line carry more telephones and give getter service than a metallic line when there are no other lines paralleling? (C) How would you compute the resistance of a grounded line 10 to 12 miles long with 16 and 17 bridging telephones equipped with 1600 ohm ringers and what allowance should be made for each bell added to or removed from the line? Lines are constructed of No. 12 and No. 14 E. B. B. galvanized iron wire. (D) Please inform me how to solder galvanized iron wire to a galvanized ground rod, with a torch or copper.—W. M., Mapleton, Minn.

Answers.—(A) There is no possible method of preventing cross talk on grounded lines, while they remain grounded lines, especially when of such length, and you must resort to some method of making them metallic at least for the length that they are paralleling. It is best to make them metallic their entire length. Running an extra wire as you suggest would do no good and would probably aggravate matters by

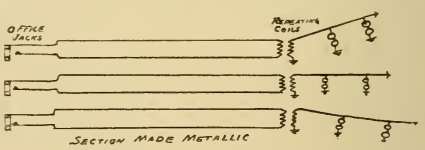


FIG. 1

producing extra grounds. If the lines extend for several miles beyond the point of intersection, making it too costly to run metallic circuits and the lines diverge materially, the method shown in Fig. 1 will help you out. Briefly make your lines metallic as far as possible, at least as far as they parallel, and connect to repeating coils as shown, grounding one side of the re-

peating coil. Be sure and keep the metallic ends of these lines free of grounds. The method shown in Fig. 2 has been used successfully where two grounded lines parallel for a short part of their length only.

FIG. 2

(B) No, there is no excuse whatever for running grounded lines except cheapness, and it is impossible to free grounded lines from noises and induction. When the trolley and power wires begin to parallel your leads, you will find conversation impossible on your grounded lines, and even the changing magnetic field of the earth or storms will make your line noisy.

(C) Use the formula,

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+\frac{1}{R_4}+\frac{1}{R_5}+\cdots\frac{1}{R_{17}},$$

where R is the total resistance of the line, R1, R2, R3, etc., the resistance of each individual telephone plus the resistance of the line from the office to the telephone. The resistance of No. 14 E. B. B. galvanized iron wire is 49.08 ohms per mile; of No. 12 is 28.46 ohms. The resistance of the earth can be neglected, it depending mostly on the resistance of your ground connections. The reciprocal of the above formula is the one generally in use. Roughly the resistance of your line will be the resistance of each bell divided by the number of bells, plus the line resistance to the first telephone if the remaining telephones are fairly close together. You can easily figure out for yourself the effect of adding to or taking away telephones by the formula.

(D) You should have no difficulty in soldering galvanized iron. First clean the rod and wire, taking care not to scrape off the galvanizing. Then wrap the wire tightly around the rod in a spiral with convolutions about $\frac{1}{8}$ inch apart. Heat the rod with a blow torch, not on, but near to the joint to be soldered, until the joint is hot enough to melt wire solder. Apply a good soldering flux (one made by adding an excess of zinc to muriatic or hydrochloric acid is best) and then work the solder into the joint until it flows freely. Be sure and wash off the excess of acid or it will corrode the joint. A quicker way, if you have a large number to solder is to dip the joint into a pot of hot solder instead of using the torch. A soldering iron is not practical for such large work. The main point is to get the rod hot.

Telephone Phantom Circuits; Telephone Pole Changer

Questions.—(A) Show by diagram and explain a phantom circuit on a telephone line. (B) Show diagrams of a telephone pole changer and tell how it works.—A. A. R., Glasgow, Mo.

Answers.—(A) A phantom telephone circuit employs the wires of other telephone circuits for its operation, and properly installed and equipped is as efficient as the

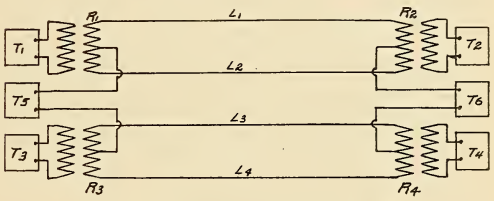


FIG. 1. A PHANTOM CIRCUIT

circuits of which it is composed, and none of the circuits interfere with each other. There are several methods of connecting up a group of wires so that more telephones can be served with metallic circuits than there are pairs of wires, but the diagram shows the standard phantom arrangement for obtaining one phantom from two metallic circuits. In Fig. 1 (L1), (L2), (L3) and (L4) represent the wires of two metallic telephone circuits of any length connecting telephones (T1) with (T2) and (T3) with (T4) through repeating coils (R1), (R2), (R3) and (R4), as indicated. These repeating coils are similar to ordinary induction coils or transformers with primaries and secondaries of equal resistance and with a closed magnetic circuit. A connection is brought out from the exact center of the secondary or line side of each repeating coil. Telephones (T5) and (T6) connected to these connections will operate over a phantom circuit and we thus have three non-interfering, metallic telephone circuits operating over four wires. The current from telephone (T5) passes to the center of coil (R1) and divides equally, half going over (L1) and half over (L2) to the outsides of coil (R2) and uniting at its center to telephone (T6), thence back in a similar manner through coil (R4), line wires (L3) and L(4) and coil (R3) to (T5), thus

completing the circuit. Since the current divides and travels in opposite directions in the line side of the repeating coils it has no effect on their primaries and therefore does not disturb the other telephones. Similarly it will be seen that the current from the telephones (T1), (T2), (T3), and (T4) cannot pass out through the central connections of the repeating coils and therefore cannot interfere with the phantom.

For successful operation it is necessary that the lines must be similar in every respect and the repeating coil resistances, etc., be exact, so that the currents will divide evenly and the phantom circuit must be treated and transposed similarly to the other circuits.

(B) The ordinary pole changer consists of a pendulum (P) Fig. 2 fastened at one end and caused to vibrate by means of an electromagnet (M) operated by the battery (B), the same as an ordinary doorbell

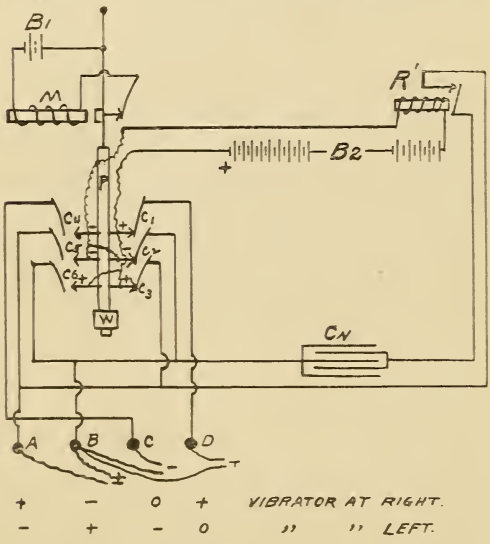


FIG. 2. THE ORDINARY POLE CHANGER

operates, and arranged to make connections to a ringing battery. The period or frequency of this pendulum is regulated by its length and the adjustment of the weight (W). The pendulum carries, at its lower end, contacts (C1) to (C6), which are connected to the ringing battery (B2) as indicated, and in vibrating alternately make contact with the spring contacts indicated on each side of the pendulum. The spring contacts are connected to the line terminals (A), (B), (C) and (D). The battery (B1) is a closed circuit battery designed to keep the pendulum operating continuously, which requires very little power. The battery (B2) is in circuit only while ringing and generally consists of sufficient dry batteries to deliver 75 to 85 volts on the line. Connecting to posts (A) and (B) will give alternating current and to posts (B) and (C) and to (B) and (D) will give negative and positive pulsating current respectively. In series with battery (B2) is a relay (R) which throws the condenser (C) across the line when ringing so as to smooth out the pulsations. The pendulum is shown thrown against the right hand contacts and by tracing the circuits from the battery it will be seen that (A) and (D) are positive and (B) negative, (C) being open. With the pendulum to the left (A) and (C) will be negative and (B) positive, (D) being open. Thus (A) and (B) are alternately positive and negative; that is, we obtain alternating current between them.

Transposing Telephone Phantom Circuits

Question—How can I transpose telephone lines for phantom circuits?—E. B., Chico, Cal.

Answer.—You do not state any specific phantom system or the number of lines to be transposed, but in general you will

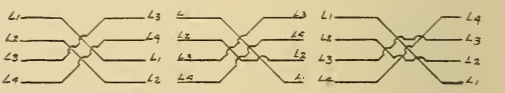


FIG. 1 FIG. 2 FIG. 3

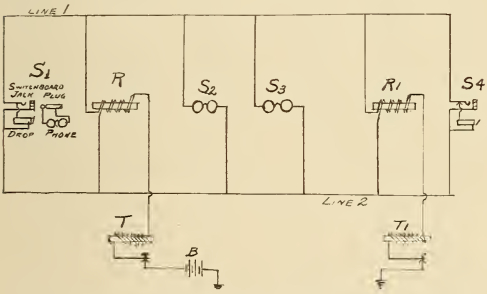
transpose successfully if you treat the phantom circuits as separate metallic circuits. The component parts of the phantom should always occupy adjacent pins on the cross arm and should be of the same kind and size of wire. Considering the phantom described in the answer to A. A. R. it can be seen that there are three ways of transposing a phantom composed of four wires. In Fig. 1 neither metallic circuit is transposed. In Fig. 2 (L1) and (L2) are transposed. In Fig. 3 all the lines are transposed. Fig. 4 shows a section of transpositions to prevent cross talk between two metallic circuits and one phantom.

FIG. 4

Telegraph and Telephone Circuit on Same Wires

Question.—We have a toll line that is 40 miles long, of two No. 9 iron wires, that has four drop and jack stations on the line, and expect to duplex it for telegraphing from station No. 1 to station No. 4. Please explain by diagram how this can be done and how many coils will have to be used.—H. C. E., Boone, Ia., also T. G., Brockwayville, Pa.

Answer.—The accompanying diagram will give you the information sought. We assume that the line runs through each station and cannot be cut in two at the intermediate stations. (S1), (S2), (S3) and (S4) represent the stations on the line. (R) and (R1) are impedance coils, split with two equal windings, and connected across the line. The telegraph instruments are connected between the central connection of these impedance coils and the ground as shown. These impedance coils are best made by



COMBINED TELEGRAPH AND TELEPHONE CIRCUIT

winding two wires of about No. 30 B. & S. gauge wire in parallel, around a bundle of soft iron wires, to about 150 ohms resistance for each wire and then bending the ends of the iron wires back over the coils so as to cover them and make a closed magnetic circuit. Care must be taken to insulate the wire properly and to bring out the four connections as shown. The ordinary coils of a bridging bell may be often used by connecting the coils directly across the line and connecting the telegraph instruments at the point where the coils are connected together. Pieces of soft iron should be fastened between the poles of the iron cores so as to make a complete magnetic circuit, or often two magnetically wound resistance coils may be connected in series across the line and the tap for the telegraph taken out between them. In all cases the coils and the line wires must be of equal resistance so that an equal current will flow over each side of the line, otherwise the telegraph impulses will be heard in the telephone receivers. If the lines are not equally balanced they should be overhauled both for the sake of good telephone as well as telegraph service. If the telegraph clicks are heard on the telephones it may be necessary to bridge condensers across the telegraph keys so as to smooth out the telegraphic waves. These condensers may be from 2 to 12 microfarads capacity depending upon conditions. The batteries used with the telegraph instruments should be of the closed circuit type (gravity) and the number of cells determined by experiment.

Transformer Theory

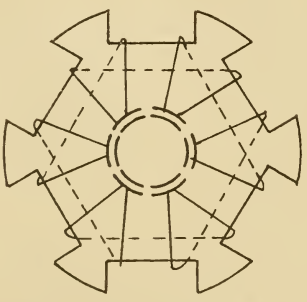
Question.—A static transformer with its primary circuit connected to the mains of an alternating dynamo, and its secondary circuit open, or disconnected from any load, takes from the mains supplying it, very little current due to self-induction, that is, there is only enough current flowing in the primary when the secondary is open to set up the magnetic flux which in turn produces a current which is equal to, and opposite in direction of flow to that of the current supplied by the mains from the alternator. Now the opposing or induced current allows little current from the mains to flow in the primary circuit when the secondary is open. This being true, why is not this self-induction effect produced in the telephone receiver and secondary of the induction coil of the party listening, as well as the receiver of the party talking? It appears that this effect of self-induction would be present and sufficient to allow little or no current, or at least not sufficient current, to flow in the circuit to operate the receiver of the listening party.—J. C. S., Jefferson, Ia.

Answer.—Your statements are all true, but only as generalities. You must understand that self-induction and impedance and resistance are only relative terms. There is no self-induction in any coil until there is current and this of a varying nature flowing through it. An impedance coil used upon a direct current loses its identity and becomes merely a resistance coil. Also when this coil is used on an alternating current, some current must pass through the coil in order to produce magnetization of the core, self-induction between the convolutions and the other factors which go to make up impedance. This current is called the magnetizing current in transformers and depends upon the design of the coil, frequency of the current, etc., but is always present whenever a voltage is impressed upon a coil. When a current flows in the secondary of a transformer it has an action (demagnetizing) to counteract the effects of the primary current and therefore more

current must flow in the primary to produce the proper inductive effect upon the secondary and this is exactly what happens. The whole idea that you should gain, however, is that, no matter what the conditions, some current will flow through a coil if there is a voltage impressed upon it. The quantity of this current depends upon the design of the coil, frequency of current, etc., other things, such as voltage, being equal. The problem of the receiver and induction coil secondary is therefore to produce an impedance effect so that there will be at least enough magnetizing current flowing in the receiver to produce the proper effect upon the diaphragm, i. e., a problem of design which has been admirably solved. When you consider how little current is actually required to operate a telephone receiver you will gain an idea of the meaning of the word design as here used. If it required more power, the receiver coils would have to be wound so as to absorb more magnetizing current. The effective current in a telephone receiver is generally so small that it cannot be measured by ordinary means. In many common battery systems most of the current passing through the receiver is direct and has practically no effect upon the sound.

Winding a Six Slot Armature

Question.—How should a six slot armature be wound and connected.—H. L., Chicago, Ill.



WINDING A SIX SLOT ARMATURE

Answer.—The diagram shows one way of doing this, each coil occupying one-half the depth of the slot.

Soldering Flux; Melting Zinc; Resistances of Iron and Steel Wire

Questions.—(A) Can you tell me how to make a soldering paste or flux that will be equally effective on brass, copper, zinc and iron? (B) How can zinc be melted? I have been told that it would run into the pores of a crucible. Is this so? (C) Will you give a table of the resistance of iron and steel wire?—E. M. C., Rocky Ford, Colo.

Answers.—(A) Place chips or filings of zinc in strong hydrochloric acid until a saturated zinc chloride is obtained. Add one-third spirits of sal ammoniac and one-third rain water and filter. This flux will leave no rust spots on iron and steel. To solder zinc, the zinc chloride should be used without the sal ammoniac.

(B) Use an earthenware crucible such as is used in making alloys of different metals. The trouble you speak of we have not been able to verify.

(C) Roebling gives the following table:

No. B. W. G.	Dia. Mils	Weight 1000 feet	Res. per Mile in Ohms		
			E. B. B.	B. B.	Steel
0	340	304	2.93	3.42	4.05
1	300	237	3.76	4.4	5.2
2	284	212	4.19	4.91	5.8
3	259	177	5.04	5.9	6.97
4	238	149	5.97	6.99	8.26
5	220	127	6.99	8.18	9.66
6	203	109	8.21	9.6	11.35
7	180	85	10.44	12.21	14.43
8	165	72	12.42	14.53	17.18
9	148	58	15.44	18.06	21.35
10	134	47	18.83	22.04	26.04
11	120	38	23.48	27.48	32.47
12	109	31	28.46	33.3	39.36
13	95	24	37.47	43.85	51.82
14	83	18	49.08	57.44	67.88
15	72	13.7	65.23	76.33	90.21
16	65	11.1	80.03	93.66	110.7
17	58	18.9	100.5	120.4	139.
18	49	6.3	140.8	164.8	193.8

Grades of wire as referred to by letters in the above table have the following properties: "E. B. B." is a very soft, high grade material, having the highest conductivity of all. Its breaking strength is three times its weight per mile. "B. B." wire is better mechanically and has a breaking strength of 3.3 times its weight per mile. "Steel" wire is the strongest, its breaking strength being 3.7 times its weight per mile, but it is lacking in conductivity. This wire is the cheapest, is used much for telephone work on short lines, and Miller states that as far as talking results are concerned on such lines no difference can be noted between the use of an iron, steel or copper circuit.

Galvanized Iron for Motor Laminations

Question.—Could galvanized iron be used for the laminations in an alternating current motor? —J. D., Cleveland, O.

Answer.—No. The iron is not soft enough. It would cause too great a core loss in the motor. Also the plates would not be insulated from one another and would allow eddy currents to flow through, causing heating and other loss.

The Fuller Cell

Questions.—(A) Explain the construction of a Fuller cell. (B) If purchased, what would one cost?—D. S., St. Paul, Minn.

Answers.—(A) The Fuller cell is a two-fluid one. It consists of the following parts: Provide a glass jar similar to one used for any fluid or gravity battery. Next secure a porous cup of nearly the same depth as the glass jar, and having one-third of the latter's capacity. Get a rod of zinc and secure to its end a lump or cone of the same metal. The upper end of this zinc rod is one terminal of the cell. Outside the porous cup and in the glass jar suspend a carbon block having a connecting terminal at its top. The cover of the jar may be of any non-conducting material and so constructed as to hold the upper end of the zinc rod and also the carbon plate. To set the cell up, pour a little mercury into the porous cup, then put the zinc electrode in place. Now fill the porous cup nearly full of very dilute sulphuric acid. In an earthen jar make the following solution called "electropoion:"

Bichromate of potash or sodium bichromate	3 parts
Sulphuric acid	1 part
Water	9 parts

The bichromate is best prepared by adding it to hot water, to which, when cool, should be added sulphuric acid very slowly.

To hasten the action of this cell a teaspoonful of salt may be dissolved in a pint of water and a little of this added to the porous cup solution.

This cell gives two volts and for a considerable time 0.6 of an ampere. Its internal resistance is from one-half to one ohm.

(B) See manufacturers' catalogues.

Batteries

Questions.—(A) What solution is used in an Edison primary battery? (B) What is the difference between a primary and a secondary battery? —S. P., Morristown, Pa.

Answer.—(A) The electrolyte is a solution of potassium hydrate.

(B) A primary battery converts chemical energy directly into electric energy, while a secondary battery is made up of such materials that when they undergo chemical action due to the current being sent through the cell. This cell then acquires the properties of a primary cell, and if its external circuit be closed is capable of giving back the original charge.

Tesla Coil for X-Ray

Questions.—(A) In the high frequency apparatus in the March issue, (answer to E. H. B., Brooklyn) I wish to ask whether this coil can be used for X-ray purposes? (B) If this coil will perform the experiment on page 162 in July issue? (C) Can I use No. 35 wire in place of No. 31, and if so, what would be the effect? (D) How can I build a fluoroscope?—T. R. F., Pryor Creek, Okla.

Answers.—(A) Yes.

(B) No.

(C) Yes, but the Tesla coil would have to be varied to suit the change in the induction coil or transformer, as the coil voltage would be greater but the current less. Therefore a smaller condenser would have to be used, and the Tesla coil wound to suit the condenser. The induction coil described would require more careful insulation between secondary and primary if No. 35 wire were used as the voltage would be greater.

(D) To make a fluoroscope take a sheet of paper or other substance transparent to X-rays and cover it with a fluorescent substance such as tungstate of calcium or platino-barium-cyanide. Mount it in the large end of a stereoscope with the fluorescent surface turned toward the inside.

ELEMENTARY LESSONS IN ELECTRICITY AND MAGNETISM. By Silvanus P. Thompson. Chicago: Thompson & Thomas. 1906. 499 pages with 193 illustrations. Price $1.50.

The sciences of electricity and magnetism are based on exact laws determined through laborious experimental work performed by generations of indefatigable workers. To afford the beginner in electricity a clear and accurate knowledge of these fundamental and epoch making experiments is the object of the book; and it fulfils the requirements admirably. Three distinct sets of phenomena are observable at the outset—frictional electricity, current electricity and magnetism, and accordingly the first three chapters are devoted to an exposition, in "Plain English" of the prominent experimental facts of these three branches of the subject, reserving for the later chapters the points of connection between them, and such parts of electrical theory as are admissible in a strictly elementary work.

A series of exercises and problems has been added at the end of the book in order to enable students, when they so desire, to test their power of applying thought to what they read, and to ascertain how far they have digested the matter contained in the text.

The theory of electricity adopted throughout the lessons is that whatever may be its true nature it is *one*, not *two:* whatever it may prove to be, it is not *matter*, and is not *energy;* that it resembles both matter and energy in one respect, it can neither be created nor destroyed. It conforms, therefore, to the great doctrine of the conservation of matter, established a century ago by Lavoisier, and to the doctrine of the conservation of energy built up by such great scientists as Helmholtz, Thomson, Joule and others,—which teach that we cannot create or destroy energy or matter, although we may cause them to change from one form to another.

Modern Electric Railway Practice. Volumes 1, 2, 3 and 4. By Sidney Alymer-Small, Calvin F. Swingle and Paul E. Lowe. Chicago: National Institute of Practical Mechanics. 1909. 831, 709, 713 and 676 pages respectively, with 433, 356, 368 and 58 illustrations respectively. Price $25.00 per set.

With this work at hand it would be hard to find a phase of electric railroading, as far as the electrical equipment is concerned, upon which exact and practical information would not be immediately forthcoming. This information is not a rehash of material which is out of date through the rapid advance of electric railway development, but is practically up to the minute as far as a textbook can be made. To attempt to outline the scope of this work fully would be to write another small book, but the following will give an insight into contents of these four large volumes, which, by the way, are beautifully bound and an ornament to any library.

Volume I takes up elementary electricity, railway motors and motor control. To obtain a good insight into any subject it is necessary to begin at the bottom, hence the introductory lessons on static electricity, condensers and electrical machines in general. Lightning and lightning arresters are also given full consideration. Transmission lines, feeders, trolley wires and third rails come in this volume and then the various kinds of motors and systems of control now used are reviewed.

In Volume II the air brake is discussed beginning with a full and clearly illustrated description of the Westinghouse A. M. M. equipment for electric traction work; also the G. E., Christensen and others. The electric locomotive is also fully described in all its details.

Power stations, steam and gas engines, and generators and switchboards are the subjects taken up in Volume III. The operation of the various machines is dealt with mainly, rather than their construction and installation. It tells you all about boilers and engines, how to make and analyze indicator diagrams; about steam turbines, railway generators, sub-stations, switchboards, etc.

In Volume IV electric railway troubles are analyzed with a treatment on standard train rules; and, finally, an electrical dictionary.

In each volume there are questions and catechisms to increase the practical value of the work.

It may also be mentioned that with each of these sets goes a certificate of membership in the National Institute of Practical Mechanics, good for one year, during which time the member is privileged to ask questions on engineering which are answered free by the consulting department of the Institute.

Spons' Workshop Receipts. Vol. I. London: E. & F. N. Spon (New York: Spon & Chamberlain). 1909. 518 pages with 223 illustrations. Price $1.50.

This is a condensation and more accessible alphabetical arrangement of the publishers' original "Workshop Receipts." It is for manufacturers, mechanics and scientific amateurs, and this first volume, which only includes names from "Acetylene" to "Drying," contains nearly 2,000 receipts, formulas, mechanical and other processes, etc. Glancing through the pages we find treated such subjects as these: "Baking powder;" "Bell founding and bell metal;" "Bleaching;" "Burnishing;" "Candles;" "Chimney construction;" "Clock and watch mending;" "Distillation;" "Drying and desiccating," etc., which gives a faint idea of the scope of the work. This work complete will be a comprehensive cyclopedia of mechanical and chemical processes.

NEW ELECTRICAL INVENTIONS

Coin-in-the-Slot Curling Iron Heater

Hotel keepers will be interested in the invention of an electric curling iron heater, operated by a coin, which has been patented by Mary M. Buck of Machias, N. Y. The object is to provide means for direction of the current into the heater upon insertion

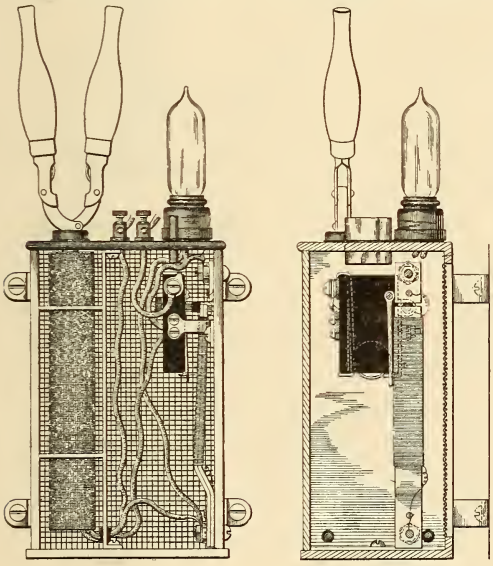


FIG. 1 COIN-IN-THE-SLOT CURLING IRON HEATER

of the coin and to automatically break the circuit when a predetermined length of time shall have elapsed.

Fig. 1 is a side and edgewise view of the interior of the heater. When the curling iron is inserted the tongs are surrounded by the heating coil of fine resistance wire. Current flowing through this coil heats up the wires as in an incandescent lamp filament, which in turn heats the curling iron. To start the current a coin is inserted in the slot which closes the circuit as shown in Fig. 2, the current flowing directly through the coin.

To heat up the iron to the proper temperature will require a certain definite period of time and to release the coin at the end of that period, and so shut off the current from the heating coil, the thermostat shown in Fig. 2 is added. This thermostat consists of bars of dissimilar metal firmly riveted together. These metals have different coefficients of expansion when under the influence of heat, and consequently one will expand more than the other and draw the composite bar into the form of a curve. This curving of the bar releases a little

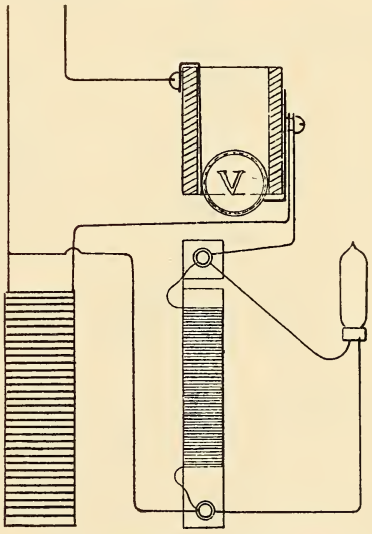


FIG. 2. CONNECTIONS OF CURLING IRON HEATER

catch which allows the coin to drop into a receptacle at the end of the desired period, opening the circuit.

But what causes the thermostat bar to heat up, is asked. This is done by another coil of resistance wire wound around the bar and deriving its current from the main circuit. Current flowing through this coil gradually heats up the bar, slowly enough, however, to give the curling iron time to be heated before the coin is released.

In circuit with the thermostat is a miniature electric lamp which glows as long as the device is in operation. When the circuit is broken by the dropping of the coin the lamp goes out, indicating that the iron is properly heated.

Unique Telephone Attachments

In using the telephone it is oftentimes convenient to have both hands free for making notes, etc. In looking up information, also, it may be necessary to set the receiver down for a moment, which operation sounds to the party on the other end of the line like the clatter of a dozen tin pans.

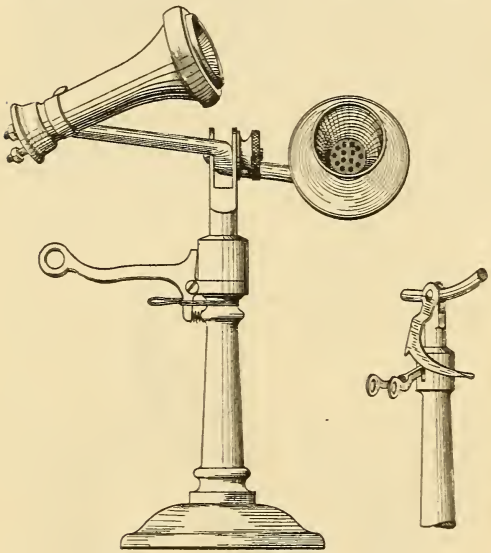


FIG. 1

Two patents have appeared simultaneously on devices for holding the receiver while in use, one awarded to Howard F. Hansell, Jr., of Philadelphia, Pa., (Fig. 1) and the other to Benjamin E. Detrick of New Albany, Ind. (Fig. 2).

In Mr. Hansell's attachment there is a slotted projection above the ordinary desk stand in which are clamped the receiver and transmitter as shown in Fig. 1, the relative positions being such that when the ear is at the receiver the mouth is at the proper position in front of the transmitter. They are held in this position at all times. When not in use the ordinary switch hook must of course be held down to disconnect the telephone, as is the case when the receiver is hung on the hook. The small detail view in Fig. 1 shows how this may be done by means of a small cam lever which is readily released when the telephone is in use.

In Mr. Detrick's device the receiver is held on a swinging bracket arm and normally holds the switch hook down in the disconnect position as shown by the dotted lines in Fig. 2. To use the telephone the arm is swung up as shown, relieving the pressure on the switch hook which signals the central

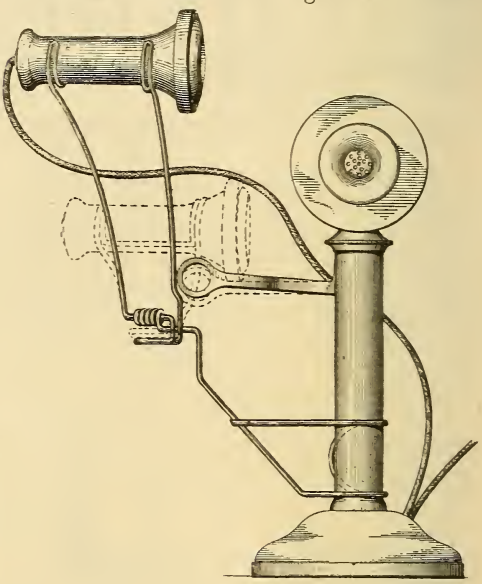
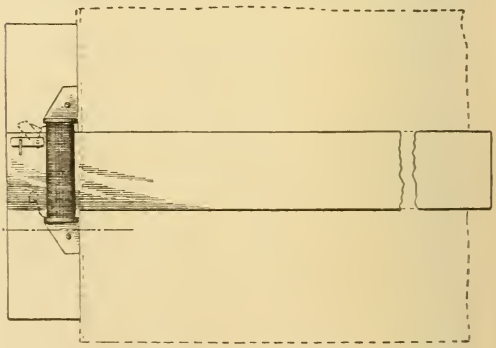


FIG. 2

office. Both receiver and transmitter are then in the proper relative position for use without the aid of either hand.

Magnetic T-Square

The T-square is one of the most important articles in a draftsman's outfit and its adjustment must be perfect in order to do accurate work. James C. Draper and Joseph



MAGNETIC T-SQUARE

W. Reid of Memphis, Tenn., are the inventors of a unique magnetic T-square. The head of the square, which rests against the edge of the drafting board, carries an electromagnet. The edge of the board is provided with an iron strip against which

the pole pieces of the electromagnet rest. Current from batteries or any other suitable source is made to pass through the coil of the electromagnet whenever it is desired to clamp the T-square in a given position. This current energizes the magnet and causes the pole pieces to cling firmly to the iron strip, holding the square in place. If it is desired to move the square about over the board the current is shut off by a simple switch and the magnet thereupon loses its power.

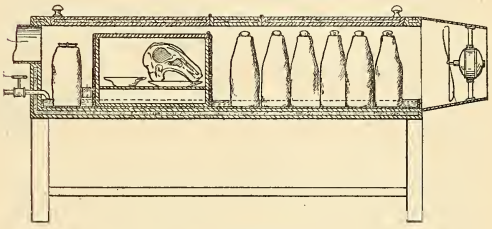
Guard for High Tension Wires

Where high tension light and power wires cross over telephone and telegraph lines there is always danger that the high tension wires may break and fall down on the telegraph or telephone lines and send a dangerous current into the latter. Many kinds of guards have been devised to eliminate this danger, among the latest being that of Charles J. Elliott of Oxnard, Cal. In this invention a rectangle of metal tubing is made to enclose the high tension line and is supported from the pole by suitable brackets. This rectangle is then connected to the earth by a heavy wire running down beside the pole. If one of the high tension wires breaks the end drops onto the rectangle and is grounded before it can touch the telegraph or telephone wires and do serious damage.

Novel Refrigerator

When air, even warm air, is blown over a moist surface, the surface is cooled, sometimes far below the temperature of the adjoining atmosphere. The reason for this is that in the evaporation of moisture a certain amount of heat is required, the same as in the production of steam, and the only place this heat can come from is the body whose surface is moistened. The body therefore gives up its heat and its temperature is consequently lowered.

William A. Merralls of San Francisco, Cal., makes use of this principle in a novel

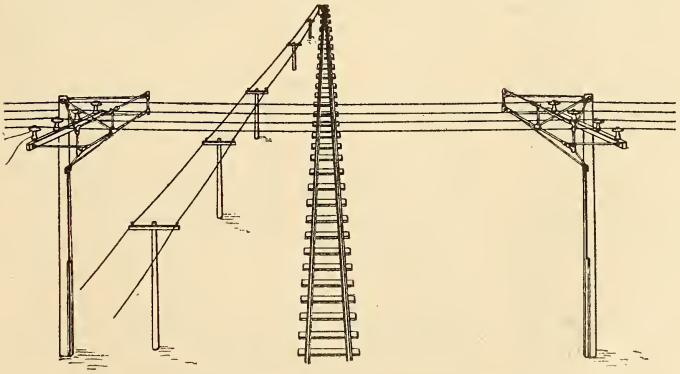


NOVEL REFRIGERATOR

refrigerator. The refrigerator consists of a long, box-like compartment with sides which are non-conductive of heat and the bottom of which contains water. The articles to be cooled, such as milk bottles, little boxes containing food, etc., are wrapped in absorbent material which sucks up water by capillary attraction. In one end of the refrigerator is an electric fan which draws air in from the outside and blows it over all the moist wrappings of the articles in the cabinet and out at the opposite end. This performs the cooling operation, and no ice is required.

Arc Lamp with Disk Carbon

A new and interesting type of arc lamp has been patented in England in which the carbons, instead of being long rods are made in the form of disks. These disks are mounted with their edges almost touching, the arc being formed across the gap. They are also kept constantly rotating so that the carbon is equally consumed at all points. The advantage lies in the fact that the lamps may be made shorter for use where the ceilings are low.



GUARD FOR HIGH TENSION WIRES

Notes on Patent Law

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

Regulation of Dealings in Patent Rights and Patented Articles—1. State Regulation. 2. Marking Patented Articles. 3. Marking Unpatented Articles

1. **State Regulation.**—"The right of property in letters patent exists by virtue of federal laws exclusively, and one incident of such right is the right to sell the patent anywhere within federal jurisdiction. Hence it has been declared that state statutes which impose conditions upon the sale of patents, as by requiring the patent to be registered, are unconstitutional and void. Such conditions are regarded as curtailing and nullifying the federal laws, and the imposition of punishment for non-compliance is an attempt to punish the patentee for doing what Congress has authorized him to do."—Ex Parte Robinson 4 Fisher Patent Cases 186; 2 Bliss (U. S.) 314, 20 Fed. Cas. No. 11,932; People vs. Russel, 25 Pat. Off. Gaz. 504.

"Emphasis has been laid upon the distinction between control of the letters patent and control of the patented articles. It is generally recognized that as properly patented articles are not under federal jurisdiction, and may be subjected to control and taxation by the states, so far as such control is not repugnant to other recognized principles of law." Patterson vs. Kentucky, 97 U. S. 501. State vs. Bell Telephone Co., 36 Ohio St. 296.

2. **Marking Patented Articles.**—It is the duty of the patentee or of his assigns and legal representatives, and of all persons making or vending any patented articles for or under them, to give sufficient notice to the public that the same is patented, either by fixing thereon the word "patented," together with the day and year the patent was granted; or when, from the character of the article, the word "patented" cannot be so affixed, by fixing to it or to the package wherein one or more of them is inclosed a label containing the like notice.—U. S. Rev. Stat. Sec. 4900. Sessions vs. Romadka, 21 Fed. Rep. 124.

Penalty for Failure to Mark.—The penalty prescribed for failure to comply with this rule is that in a suit for infringement no damages shall be recovered by the party failing so to mark the articles, except on proof that the infringer was notified of his infringement and continued, after such notice, to make, use, or vend the patented article.—U. S. Rev. Stat. Sec. 4901; and Goodyear vs. Allyn 10 Fed. Cas. No. 5,555. "When an article contains such mark an infringer is liable although ignorant of the existence of letters patent."—Hogg vs. Gimbel, 94 Fed. Rep. 518.

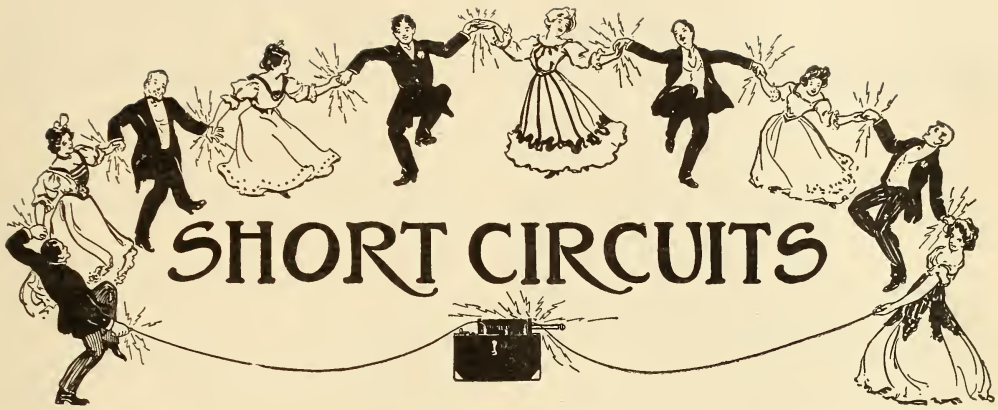
3. **Marking Unpatented Articles.**—"Any one who, having no patent therefor, marks an article with the name of any person who has a patent, or who affixes an imitation or counterfeit of a patented device or affixes the word "patent" or its equivalent to an unpatented article, is liable to a penalty of not less than one hundred dollars with costs; one-half to go to the informer, the other half to the United States, to be recovered by suit in any district court of the United States, in whose jurisdiction the offense was committed." U. S. Rev. Stat. Sec. 4901.

"The intention to secure a patent subsequently does not excuse the offense, if it was intended to deceive the public." Stephens vs. Caldwell, 22 Fed. Cas. No. 13,367.

Marking Patent Applied For.—After application for a patent the article may be stamped "patent applied for," and the word "patented" may be affixed when the patent has been allowed but not issued.—Schwebel vs. Bothe, 40 Fed. Rep. 478; Lauferty vs. Wheeler, 11 Daly (N. Y.) 194.

Marking After Patent Expires.—"The word 'patented' may be affixed to an article after the patent has expired, since the public is presumed to know from the date that the patent has expired."—Wilson vs. Singer Mfg. C.o, 11 Biss (U. S.) 298.

Restraining Disclosure of Secret.—The state court may, at the instance of the inventor or discoverer, restrain a person from divulging the secret of an unpatented device or improvemant.—Hammer vs. Barnes, (Supreme Court Spec. T.) 26 How. Pr. (N. Y.) 174.



Knicker—How long does your wife plan to be away?
Bocker—Two trunks.

* * *

Pat—I hear your woife is sick, Moike.
Mike—She is that.
Pat—Is it dangerous she is?
Mike—Divil a bit. She's too wake to be dangerous anny more!

* * *

A teacher in one of the Topeka schools, read at a recent teacher's meeting from a collection of quaint examination answers that she had been gathering for some years.

The gems were:

"A blizzard is the inside of a hen."

"The equator is a menagerie lion running round the earth."

"Oxygen is a thing that has eight sides."

"The cuckoo never lays its own eggs."

"A mosquito is a child of black and white parents."

* * *

A traveler from a distant country came to Victoria in the season of plagues, of rains and sessions. Among the strange sights he beheld was a man who progressed by walking backward; and, turning to a native, the traveler begged him to explain this strange phenomenon.

"That locomotively reversed personage," replied the courteous informer, "is a legislator. He walks backward because the god he worships is precedent; and he is ever under the illusion that he is backing out of his deity's presence."

"How interesting!" exclaimed the traveler. "But do all your legislators walk backwards?"

"No," said the native, "not all. Many of them progress sidewise like a crab."

"But why, pray—why?"

"In order to sidestep issues, of course," responded the native, patiently.

"Then whatever gets done in this remarkable country?" cried the traveler.

The native looked pityingly upon him. "The people, of course," he said.

* * *

"Pardon my ignorance," said Mrs. H—— to the captain of the boat, "but how do you manage to find your way across this pathless lake?"

"By means of the compass, madam," answered the captain. "The needle invariably points to the north."

"But," queried Mrs. H——, "suppose you wish to go south?"

* * *

Among the attendants at the funeral of a lawyer who, though an agnostic, had led a singularly upright life, was a prominent Philadelphian who arrived just after the minister had begun his sermon.

"What part of the services have they reached?" he asked an old Quaker.

"Just opened for the defense," was the reply.

Johnny was given to gross exaggeration and had been severely reprimanded by his mother, who told him that it amounted to the same thing as lying and that she would whip him the next time he was guilty. About five minutes later he came rushing into the house with the news that an immense yellow lion had chased him and almost eaten him up. Upon investigation the lion was found to be a very small yellow dog, and application of the slipper followed.

"Now," said mamma, when it was over, "I hope that will be a lesson to you. But before you go out again I want you to go to your room and tell God how sorry you are for having told stories and ask Him to forgive you."

Johnny disappeared upstairs, to return almost immediately, much relieved.

"Well, has God forgiven you already?" said his mother.

"Sure," said Johnny. "Just as soon as I started to tell Him He said: 'Oh that's all right Johnny. You couldn't help it. The first time I saw that dog I thought it was a lion myself.'"

* * *

A young New York broker of convivial habits fell in with an old school friend who had gone on the road.

"Whenever you're in town come up and bunk with me," he urged his friend as they separated. "No matter what old time it is. If I'm not there just go ahead and make yourself at home. I'll be sure to turn up before daybreak."

Soon after this the salesman arrived in town about midnight, and, remembering his friend's invitation sought out his boarding house. There was only a dim light flickering in the hall, but he gave the bell a manful pull. Presently he found himself face to face with a landlady of grim and terrible aspect.

"Does Mr. Smith live here?" he faltered.

"He does," snapped the landlady. "You can bring him right in!"

* * *

"Did you hear about that man who died the other day and left all he had to the orphanage?"

"No. How much did he leave?"

"Twelve children."

* * *

An eminent lecturer, self-made and proud of it, was addressing a young people's meeting.

"My dear young people," he began, "let me refer to the humble auspices under which I made my start in life. Without a dollar in my pocket and with no worldly possessions of consequence, my indomitable nature and an inborn determination to utilize to the fullest advantages my abilities constituted my assets. But even with this modest beginning, what do you suppose was the very first thing I sought—that which, at the very outset of my career, I strove most earnestly to attain?

Enthusiastic juvenile chorus:

"Milk."

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.

CLASSIFIED ADVERTISING

Advertisements in the section of Popular Electricity, will cost 40 cents a line, cash with order, and in order to secure proper classification must be in this office the first of the month preceding date of issue

AGENTS

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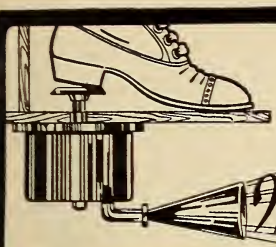

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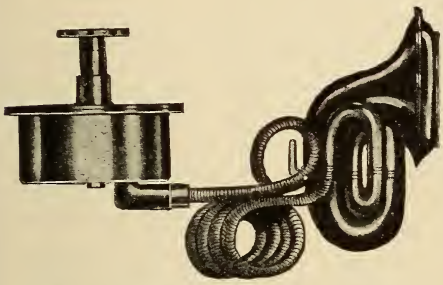

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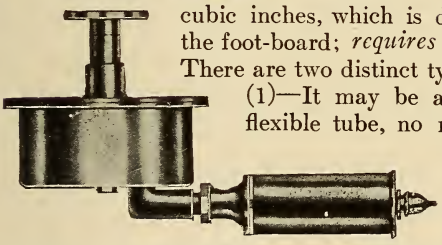

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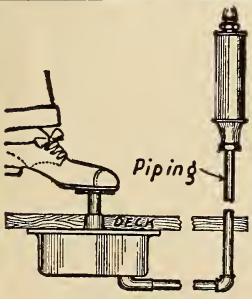

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Write for our book—and we will also send you a free pass over the W. & C. Railroad, whether you buy or not.

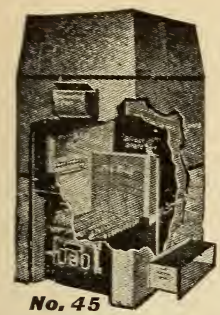
Don't buy land anywhere until you investigate this.

Write today and we will send our book.

ADDRESS

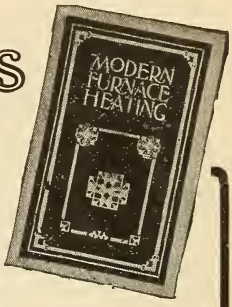
WASHINGTON & CHOCTAW LAND CO.

6146 Times Building, ST. LOUIS, MO.



No. 45
"Leader" Hess
Steel Furnace
Price $49.00
Delivered East of Cmaha
and North of Ohio River
Pipes & Registers Extra

60 Winter Days



Free Test at Our Risk and Cost

As manufacturers, directly responsible to you for satisfactory results, we will send you a **Hess Steel Furnace** and complete heating outfit, including pipes, registers, fittings and everything needed, made to fit your measurements, with correct plans and instructions for installing, at **$50 to $100 less** than you can buy from dealers. We deliver the outfit at your station, freight prepaid. You place the purchase price in the hands of your local banker, who will hold the money 60 days while you test the heater.

In case the test is not satisfactory in every way, you may return the goods at our expense and the banker will refund your money.

Don't Pay an Exorbitant Price for a Heating Outfit

We have manufactured heating outfits for 36 years, and can assure you that there is no necessity for paying the exorbitant prices demanded by others in order to have a modern, high-grade furnace and outfit installed in your building.

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—before the usual rush begins.

Installing a Hess Furnace is Easy

By following our simple, clear plans and directions, any man handy with tools can easily install a Hess Furnace and outfit. We furnish all the necessary tools.

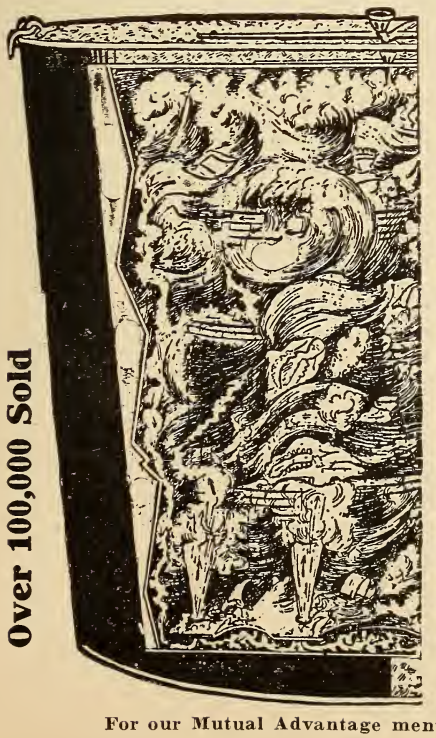
Write Today for Booklets and Estimate. 912 Tacoma Bld.

Hess Warming and Ventilating Co. CHICAGO

New Invention! No More Wash Day!

New Method of Cleaning Clothes

Cleans Family Wash in 30 to 50 Minutes —Woman's Hardest Work Made Easy— No Rubbing, No Motors, No Chemicals



Over 100,000 Sold

Not a Washing Machine Does in one operation the work of Wash Board, Washing Machine and Wash Boiler.

See How Simple, Different, Easy. Put on any stove—add water, then soap, then clothes—*move knob occasionally.* In 5 to 8 minutes first batch clean—next batch same way, same water—in 30 to 50 minutes family wash clean. *No labor, no injury to clothes. Cleans woolens, flannels blankets,* or colored clothes, as well as white goods, finest laces, curtains, bed clothes. *Saves times, fuel, labor.*

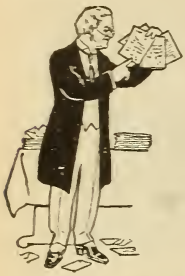
EASY WAY in 30 to 50 minutes cleans washing which before took entire day. All metal, strong, durable, sanitary, light in weight. Easily used, cleaned, handled—always ready. Child or weakly woman can use it. Saves washday drudgery.

Users Praise the "Easy Way" J. McGee, Tenn., writes:—"One young lady cleaned *day's washing in one hour* with Easy Way—another in 45 *minutes.*" Mrs. T. Bullen, Canada, writes:—"I washed *bedding, heavy quilts, curtains, etc., without rubbing.*" Lauretta Mitchell, O., writes:—"Done a *big washing in 45 minutes—sold 3 already.*" A. D. Poppleton, N. Y.:—"Gives perfect satisfaction. Washed bed quilts, *greasy overalls* and fine clothes. Greatest thing on earth." F. E. Post, Pa., writes:—**"Two weeks washing in 45 minutes.** Clothes cleaned *without rubbing.*" J. H. Barrett, Ark., after ordering 38 Easy Ways, says:—"You have the grandest invention I ever heard of." J. W. Myers, Ga., says: "Find check for 12 Easy Ways. Greatest invention to womanhood, forever abolishing miserable wash day. *Sells Itself.*"

Agents Getting Rich *R. O. Cowan, N. Y., placed 13 in 6 hours*—(profit $39.00). Mrs. J. Brown sold 10 in 3 days —(profit $30.00). K. J. Blevins, O., writers:—"*Made 7 calls, sold 5 one day.*" —(profit $15.00). R. H. Latimore, Pa., writes—"Sold 4 this morning. *Never yet turned down.*" A. G. Witt, Pa., "Received Easy Way yesterday; sold 4 to-day —not out for orders." Mrs. Gerrish, Mont., ordered sample, then 1 dozen, then 100—(profit over $300.00). *Just made one shiptment* 1000 *Easy Ways* to Russian Agent. N. Boucher, Mass., orders 75 more, says: "Everybody wants one, *best business I ever had.*" A. S. Verrett, La., sold 8 in 1 day—(profit $24.00.)

FREE SAMPLE TO AGENTS We want managers, agents, men or women, home or traveling, all or part time, to show, take orders and appoint agents. **Easy Way new article,** not worked to death. Best seller out. Every family wants one. People glad to see it demonstrated; buy without being asked, and throw away costly washing machines to use it. **Only two sales a day means $36 00 a week profit. Price only $6 00** ready for use. Sent anywhere. Not sold in stores. *Order one for your own use.* **Your money refunded if not satisfactory.** *Send for free sample offer special, agents' proposition, etc.* **Costs nothing to investigate.** Send name and address anyway for full description.

Harrison Mfg. Co., 145 Harrison Bldg., Cincinnati, O.



LEARN THE

Automobile Trade

WITH

DYKE'S COURSE OF

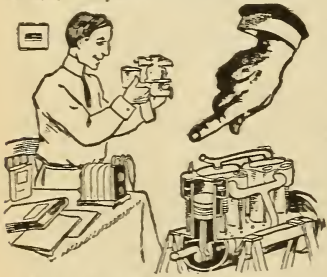
Automobile Instruction

A NEW METHOD WITH WORKING MODELS

Listen! We have *Testimonial Letters* from each and every customer. Study during spare time—Dyke's Course is now only $10 and you would never miss the amount. The Automobile and Gasoline Engine profession is the best profession, and there is a big demand for help in this line.

IF YOU OWN an auto, or launch, or in any way connected or interested in gasoline engines then this course will be of great benefit to you. If you wish to learn the trade this is your opportunity.

DYKE'S COURSE is the only course in the world which can successfully be taught by mail. We use wonderfully clever **Working Models** (made in Europe) of the **Gasoline Engine** and **Magneto** and **Carburetor** that actually work, and they picture the meaning while you study our interesting Instruction Pamphlets.



JUST IMAGINE, having in your room an engine cut in half and with each and every part lettered and numbered, also a Carburetor and Magneto lying on your study table while you study our interesting course—that's practically what we give you in our **working models.** You will play with these models like a boy with a toy and the more you play the clearer the subject will be to you.

IN ADDITION we give 24 lessons which are so interesting you will finish them all—they are illustrated with 34 large clear charts.

WE TEACH YOU everything there is to learn about the Automobile and Gasoline Engine such as valve setting, timing ignition, how the cylinders fire, construction of all forms of Magnetos and how to set them, storage batteries and all systems of wiring, and many other important subjects.

ONE CUSTOMER SAYS:

"I've learned more in three weeks study of your Course than during my ten years work around the shop."

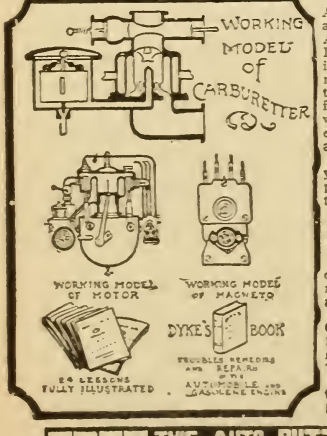
Another customer who knew nothing about the Auto or Gasoline Engine says he can now run any car and set valves, etc.

OUR LIBERAL OFFER of inspection is proof of our claims, get our fine pamphlet and testimonials.

AUTOMOBILE OWNERS will save the cost the first month.

Automobile Engineering is a profitable trade to learn. Our Course qualifies you—write today.

NOTE We are considering the advisability of raising the price on this wonderful Course. Even our students say it is worth a great deal more and it is.



MR. DYKE was the first Auto Supply man in America and built the fifth successful Automobile in this country. His experience is embodied in this course. Mr. Dyke made a special trip to Europe to secure additional matter for this great Course. The working models were designed and are made in Europe by a leading mechanical artist.

NO MATTER how much you would pay you could not possibly get a course equal to this one,

Here They Are:

The working models of our Gasoline Engine, Magneto and Carburetor—they **actually work.**

The really feature of our Course, however, are our **24 simple illustrated lessons.** We also include a Text book.

It is great—all our customers say so—not one, but all.

FREE THIS AUTO BUTTON AND INSTRUCTIVE PAMPHLET SEND FOR IT TODAY

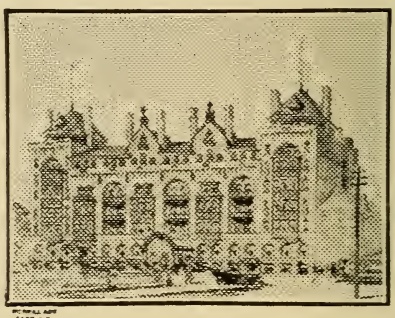
DYKE'S Correspondence School Motoring

1300 Bk. Commerce Bldg., ... St. Louis

The Rittenhouse Hotel

Twenty-second and Chestnut Streets

Philadelphia - - - - Pennsylvania



One of the most exclusive Hotels in PHILADELPHIA. Within five minutes walk of the BUSINESS CENTRE, RAILROAD STATIONS, the SHOPPING DISTRICTS and THEATRES.

One half block from the College of PHYSICIANS and SURGEONS.

A home-like Hotel catering to transient and permanent guests. Special attention to ladies traveling alone.

Conducted on the AMERICAN and EUROPEAN PLAN. Cuisine and service of the highest standard. Distilled water.

Unique cafe, attractive parlors, spacious exchange and ladies' reading room.

European $1.50 per day and up

American $4.00 per day and up

R. VAN GILDER, Mgr.

Smaller Central Stations Need Our Services

What has been accomplished in selling more current in Chicago, New York, Buffalo and Cleveland, by Central Station advertising in the newspapers, can be accomplished in smaller cities with proportionate effect.

We have an exceptional proposition to submit to any Central Station open to conviction. Our proposition will show how you can test the business-getting value of our advertising service at a cost ridiculously low.

The service will be equal to that which we have rendered the Commonwealth Edison Co., the Buffalo General Electric Co., the Cleveland Illuminating Co., and the New York Edison Co.

Ask for particulars.

Wm. D. McJunkin Advertising Agency

167 Dearborn Street, Chicago

$20 to $35 and EXPENSES WEEKLY

At home or traveling, all or spare time. Easily learned.

GET MONEY—I DID—GOT $301.27

worth of plating in two weeks, writes M. L. Smith, of Pa. (used small outfit.)

George P. Crawford writes:—"Made $7.00 a day." J. J. S. Mills, a farmer, writes:—"Can easily make $5.00 a day plating." Thos. Parker, school teacher, 21 years, writes:—"I made $9.80 profit one day, $9.35 another." Others making money—you can do the same.

Costs Nothing to Investigate.

WRITE TODAY

LET US START YOU in the Gold, Silver, Nickel and Metal Plating business. **$5.00 to $15.00 a day** can be made doing plating with **Prof. Gray's new line of guaranteed Plating Outfits.** Unequalled for plating watches, jewelry, tableware, bicycles, all metal goods. Heavy plate. **Warranted. No experience required.** We do plating ourselves. Have years of experience. Use same materials we sell. Materials cost about 10c to do $1.00 worth of plating. Manufacture the only practical outfits, including all tools, lathes, and materials. All sizes complete. Ready for work when received. **Guaranteed. WE TEACH YOU the art, furnish recipes, formula and trade secrets FREE. THE ROYAL, Prof. Gray's New Immersion Process.** Quick. Easy. Latest method. Goods dipped in melted metal, taken out instantly with fine, brilliant, beautiful plate, ready to deliver. Thick plate every time. **Guaranteed from 5 to 10 years. A boy plates from 100 to 200 pieces tableware daily, $10 to $30 worth of goods. No polishing, grinding or electricity necessary. DEMAND FOR PLATING IS ENORMOUS.** Every family, hotel and restaurant have goods plated instead of buying new. It's cheaper and better. Every store, jeweler, shop, factory, has goods needing plating. Agents have all the work they can do. People bring it. You can hire boys cheap to do your plating, the same as we, and solicitors to gather work for a small per cent. Replating is honest and legitimate. Customers delighted. **WE ARE AN OLD ESTABLISHED FIRM.** Been in business for years. Capital, $100,000.00. Know what is required. **Our customers have the benefit of our experience, so that failure is next to impossible. WE ARE RESPONSIBLE and guarantee everything.** Reader, here is a chance of a lifetime to own and boss a business of your own. WE START YOU. **Now is the time to make money.** CALL OR WRITE TODAY. Our new plan. Samples of plating, testimonials and circulars FREE. Don't wait. Send us your address anyway.

GRAY & CO. PLATING WORKS, 54 GRAY BUILDING, CINCINNATI, OHIO

WIRELESS COMMUNICATION

Now is the time to engage in the study of the new art of wireless. The demand for trained wireless operators is growing constantly. The recent government action has increased the demand 100 per cent. Salaries of trained operators range from $15.00 to $40.00 per week.

THE AMERICAN WIRELESS INSTITUTE

is the only universally recognized school in the world for the teaching of this art.

APPLICATIONS NOW ON FILE FOR 100 EXPERT OPERATORS

Come in and be one of the first to take a position in this new field that offers promotion, good salaries and boundless opportunities.

Descriptive matter free on request. Address nearest office.

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UNIVERSITY BUILDING
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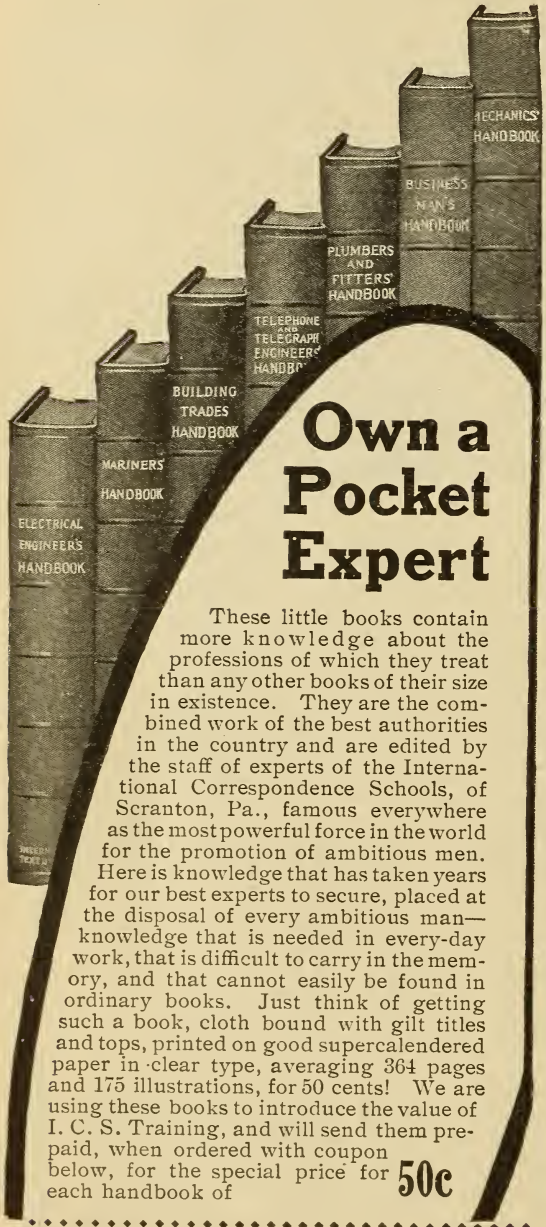

Own a Pocket Expert

These little books contain more knowledge about the professions of which they treat than any other books of their size in existence. They are the combined work of the best authorities in the country and are edited by the staff of experts of the International Correspondence Schools, of Scranton, Pa., famous everywhere as the most powerful force in the world for the promotion of ambitious men. Here is knowledge that has taken years for our best experts to secure, placed at the disposal of every ambitious man—knowledge that is needed in every-day work, that is difficult to carry in the memory, and that cannot easily be found in ordinary books. Just think of getting such a book, cloth bound with gilt titles and tops, printed on good supercalendered paper in clear type, averaging 364 pages and 175 illustrations, for 50 cents! We are using these books to introduce the value of I. C. S. Training, and will send them prepaid, when ordered with coupon below, for the special price for each handbook of **50c**

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I enclose $_____ in stamps, for which please send me the books before which I have marked X.

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BEWARE OF IMITATIONS
OF THE FASTENERS
MEN SWEAR BY, NOT AT

To be sure you are getting the genuine

WASHBURNE PAT. IMP. FASTENERS

(The Fastener with a Bulldog Grip)

look carefully for name **"Washburne"** stamped on every fastener. It is your protection against a **poor infringement,** the perpetrators of which are being prosecuted.

The genuine Washburne Fasteners are **"Little But Never Let Go."**

There is **Comfort for Men** in their use.

They are the greatest little utilities ever invented for men's dress, and are applied to

Key Chain and Ring,	**25c**
Scarf Holder,	**10c**
Bachelor Button,	**10c**
Cuff Holders,	**20c**
Drawers Supporters,	**20c**

Catalogue Free. Sold Everywhere. Sent Prepaid.

Look for the Name Washburne.

AMERICAN RING COMPANY
Dept. 5, Waterbury, Conn.

The "Baby" TORCH

Invaluable for Home, Workshop and Repair Kit.

$1.25 Prepaid

Produces intensely hot flame for soldering, welding, removing paint and 101 odd jobs around the home, repair shop, automobile, motor boat, etc. Powerful, compact, purely automatic, absolutely safe, works without air pressure, lights with match, burns two hours with one filling. Has no objectionable features of other torches. Size of tank 3x2 inches. Used and recommended by Householders, Autoists, Electricians, Jewelers, Dentists and Repair Shops everywhere. Price $1.25 prepaid. Money back if not satisfactory. Send today.

H. W. HARROLD, Valparaiso, Ind.

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The new method of drugless healing
EARN $50 TO $100 PER WEEK

Our free book tells how you can learn to detect disease and remove the cause by Howard's method of Spinal Adjustment. Positively the most simple, direct, advanced and scientific method of drugless healing. Based on unerring natural laws. Anyone can understand it; learned in spare time. Improve your social prominence and financial standing. Start now on the road to honor and success. Write for free book and special scholarship offer

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1732 W. Congress St., Dept. 8 Chicago, Ill.

The "IMPERIAL"

A Portable Vacuum Cleaning Machine
combining efficiency, practicability and economy. Can be attached to any electric light socket

"The Only High-Grade, Efficient Machine on the Market." Guaranteed

A Dividend Payer for Central Stations

Growing concerns and responsible parties wanted as agents. Exclusive territory given. Send for Catalogue and Particulars.

Price $100, Complete

EMPIRE VACUUM COMPANY
112 West 30th Street, New York

HOTEL CUMBERLAND
NEW YORK

Broadway at 54th Street

Near 50th St. Subway Station, 53d St. Elevated and all surface lines.

Near Depots, Shops and Central Park

New and Fireproof

Strictly First Class Rates Reasonable

$2.50 with bath and up

All Hardwood Floors and Oriental Rugs

Ten minutes' walk to 20 Theatres

Excellent Restaurant Prices Moderate

Send for Booklet

HARRY P. STIMSON, Formerly with Hotel Imperial
R. J. BINGHAM, Formerly with Hotel Woodward

Only New York Hotel window-screened throughout

MORTON R. EDWIN
PANATELAS
$2.40 per hundred instead of $5.00

By all standards of comparison this is a 10c cigar. It will satisfy the most cranky smoker of imported brands. It is fully 5½ in. long, strictly hand made, of choicest Havana tobacco—genuine Sumatra wrapper. It smokes freely and evenly—never chars down the side, keeps burning coolly and fragrantly to the last toothhold.

The reason this cigar is sold at $2.40 instead of $5.00 per hundred is because I buy and sell for cash. I ask no credit, neither do I give it. I personally buy my tobacco direct from the grower in Cuba, and pay him at least five weeks before the tobacco reaches the U. S. Custom House. I buy for less and sell for less. I believe in what Elbert Hubbard said in April, 1907, issue of the *Philistine:*

> "A Credit Account is the most insidious form of borrowing money. When you don't pay the merchant at once for the goods you buy from him, you are borrowing money from him, and disguised in the price is much more than the legal rate of interest. Better to borrow the actual cash and know how much you have to pay for the accommodation; but it is better still to practice self-denial and go without the thing you want till you have the cash to pay for it."
>
> "All the losses of the merchants who give credit are made good by the people who pay."
>
> "The merchant who gives credit is not in business for his health any more than the pawnbroker is."

ACTUAL SIZE

Among my 35 different brands I have an "in between" smoke called "Old Fashioned Havana Smokers." I want you to be on smoking terms with them, because they are just the thing you want when you *don't* want a big cigar. They are Havana filled—4 in. long—blunt at both ends—made the way the Cuban planter rolls tobacco for his own use—without a binder.

I'm so eager to have you try this smoke that I'll send you a sample box of 12 free along with an order for my Panatelas, because you'll buy them again.

Send me $2.40 for 100 Morton R. Edwin Panatelas. Smoke as many as you like—smoke them all if you want to, and if you then tell me that you didn't receive more than you expected, I'll return your money and we'll remain friends.

If you want to know who I am and whether or not I run my business on the square, if you have any doubts as to my making good if my cigars don't, just inquire from any bank or commercial agency about me. If you don't like the report you get, keep your cash at home.

Illustrated price-list sent on request.

MORTON R. EDWIN
Dept. P. E. 64-66 and 67-69
West 125th Street, New York

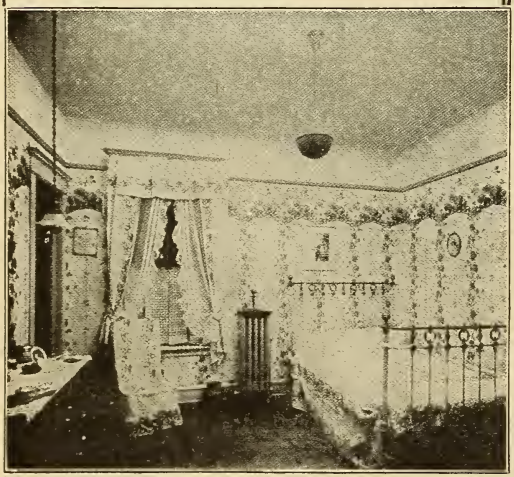
Make checks payable to the Edwin Cigar Co.

DO YOU WANT BETTER LIGHT

Let us show you our new system of lighting (indirect Illumination) for

Homes, Stores, Hotels Factories

all places where light is needed.



Imagine a room evenly illuminated, a mellow radiance from a concealed source flooding it with a light soothing to the nerves, becoming to the complexion and yet *perfect for reading or sewing*.

Those who experience discomfort after a short time under a direct light, suffer no unpleasant effects from an evening's work under the I-COMFORT. Scientists and oculists have long agreed on the perfection of such a system of lighting but heretofore the cost of maintaining and installing has proven prohibitive. The I-COMFORT is simple and inexpensive; under a 60 to 100 Watt Tungsten electric lamp is placed a glass reflector with spiral and vertical corrugations over pure silver, giving the most perfect reflecting surface known to science; the light is thus thrown upon the ceiling and is evenly distributed throughout the room with wonderful efficiency, artistic effect and eye comfort.

Thousands already in use in residences, offices, hotels, banks, clubs, art rooms and auditoriums.

Indorsed by the leading architects, oculists, and illuminating engineers.

If your electrical dealer does not handle them address Department F. A. Write at once for our new booklet with illustrations of our Installations.

National X-Ray Reflector Co.
247 Jackson Blvd., Chicago, Ill.

Wire, Coils and Cordage

NORWAY IRON WIRE for cores. **COTTON, SILK and ENAMELED MAGNET WIRE**, heavy and fine sizes for primary or secondary windings, receiver coils or coils of any kind.

COILS wound to your specifications.

BELL WIRE and ELECTRICAL CORDS for every purpose.

The above furnished at lowest prices in small quantities for wireless telegraph or experimental purposes, or in large quantities for manufacturers.

Write for prices to Dept. E.

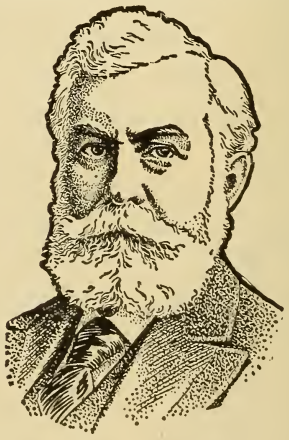
BELDEN MANUFACTURING COMPANY
194 Michigan Street - - CHICAGO, ILL

RHEUMATISM

Don't Take Medicine. Try My Guaranteed External Remedy WITHOUT COST

Send Your Name on a Postal

Return mail will bring you, prepaid and without your paying a cent, a regular $1 pair of Magic Foot Drafts, the great Michigan External Cure for Rheumatism, chronic or acute, muscular, sciatic, gout, etc., no matter where the pain or how severe.



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The Drafts are curing old chronics after 30 and 40 years of cruel suffering, as well as all the milder stages. Why not test this harmless, simple cure—the trial costs you nothing. Just send us your name and address, and try the Drafts when they come. The directions are very simple. Then, if you are fully satisfied with the benefit received, send us One Dollar. If not they cost you nothing. **You decide** and **we take your word.** Address **Magic Foot Draft Co.,** 1040F Oliver Building, Jackson, Mich. Send no money—only your name. **Write today.**

AN APPEAL TO INTELLIGENT "INTENSIVE" ADVERTISERS:

WITH DUE APOLOGIES FOR ALLITERATION

¶ If you were to be told about a field of over 15,000 organized companies, where there were fewer failures than among National banks and where over $50,000,000 was expended annually for supplies—

Wouldn't you consider it a field worth covering?

¶ If you further learned that this particular field had over 50,000 readers who drew good salaries and spent same with the advertisers in their favorite publication—

Wouldn't you consider them worth reaching?

¶ If you also found that there was one old-established journal of surpassing excellence, covering every desirable buyer in this large and prosperous field—

Wouldn't you consider it a medium worth using?

¶ Ask us about Telephony. THE AMERICAN TELEPHONE JOURNAL for that, in short's the sequel to our story. Full details on request.

TELEPHONY PUBLISHING CO.

MONADNOCK BLOCK - - - CHICAGO, ILL.

ELECTRIC LIGHT IS NOW CHEAPER

Every one wants electric light—its luxury—comfort—cleanliness—convenience. Everyone can now afford it.

You can now have electric light at 1-2 the old price. Can you longer afford to use gas or kerosene?

The General Electric Company's Tungsten Lamp has made this big reduction possible and at the same time gives the most beautiful artificial light known.

General Electric

Tungsten Lamps

The G.E. Tungsten is a wonderful improvement even over the ***G. E. Edison*** carbon incandescent lamp, for 25 years the standard of the world.

In these new lamps the light source is a filament, or wire, made from the rare metal Tungsten instead of carbon.

The advantage of the Tungsten filament is that when heated by the same electric current it becomes far more brilliant than carbon.

By the General Electric Company's processes Tungsten Lamps are produced which give nearly three times as much light as carbon lamps.

All over the country thousands and thousands of public buildings, offices, stores, factories and homes have already been equipped with G.E. Tungsten Lamps.

Everybody admits that electricity is ***better*** for business or home lighting than gas or kerosene.

With the G.E. Tungsten Lamp you can have Electric Light at one-half the old price.

Every day you go without G.E. Tungsten Lamps you pay more than you should for an inferior light such as gas or kerosene.

Electric Light History

In 1880 the General Electric Company (then the Edison Electric Light Co.) made and marketed the first Edison carbon incandescent lamp.

Since then this company has manufactured and sold 270,000,000 lamps of this type—the world record.

All notable improvements in electric lighting during the last 30 years *have been introduced* by the General Electric Company.

The genuine G.E. Tungsten Lamps are always packed in individual boxes bearing the famous G.E. monogram. *Look for it! Insist!*

How to Get G.E. Tungsten Lamps

Any electric light company will be glad to show you G.E. Tungsten lamps and tell you all about their superiority.

Write to us for our G.E. Tungsten Book No. 33. This interesting brochure tells more about the wonderful metal Tungsten and explains how to get the best results from G.E. Tungsten Lamps in home, office, store or factory.

General Electric Company, Dept. 25, Schenectady, N. Y.

I am King, the Tailor

I Tailor Clothes to Your Measure

at lower prices than you pay for ready-made clothes. I do not sell through stores or agents, but deal direct with the consumer, saving you the middlemen's profits. The manufacturer must make a fair profit, and the dealer or agent must make a good profit. When you buy from me you save the dealer's or agent's profit. That's why I can save you money.

Let Me Be Your Tailor

I'll make a snappy, stylish, perfect-fitting suit or overcoat to your measure—a better looking, better wearing garment than you can possibly get from your local dealer or tailor—**and save you money besides.**

Suit or Overcoat to Your Measure $15

The kind your local tailor would ask $30 for. I make suits and overcoats to measure for $12.50 to $25.00 and **prepay the express.** My system of home measurement is so easy there is absolutely no chance for mistakes. I guarantee you perfect fit, and **take all the risks.** If the suit or overcoat does not fit, or you are not entirely satisfied, the loss is mine. I'll either make a new one or refund your money. What stronger guarantee could you ask? My plan makes it possible for you to **positively** secure by mail stylish, perfect-fitting, tailor-made garments **at less than ready-made prices.**

Style Book and Samples FREE

My Style Book contains samples of the newest weaves and designs for Fall and Winter, correct dress chart, color chart, and also fashion plates showing the latest New York modes. It is FREE—send for it today.

For ten years in the same location I have made clothes for thousands of satisfied customers; I'll satisfy you or refund your money. I give such extraordinary value for your money that you will be glad to give me your future trade. The Wisconsin National Bank of Milwaukee, with resources of over $20,000,000, and with whom I have been doing business for over ten years, will tell you I am responsible.

Send for My Style Book; it's FREE!

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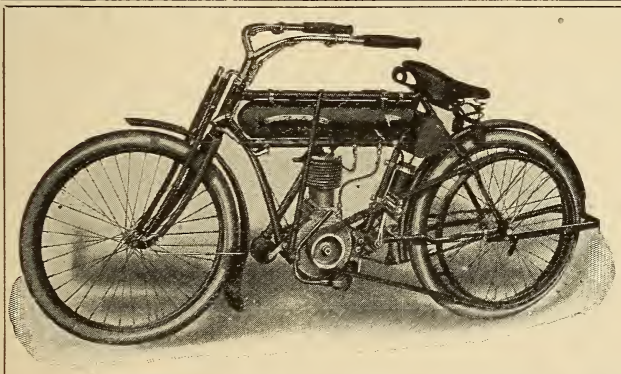

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The Arnold Electric Cleaner

Only $35.00

Sent Anywhere on Free Trial

¶ This machine is one of the greatest labor savers ever invented.

¶ With an Arnold Electric Cleaner you can thoroughly clean an entire room in a few minutes—a whole house in less than one-third the time heretofore required.

——**Cleans it thoroughly.**
——**Without damaging your carpets and rugs.**
——**No dust or germs in the air, consequently no dusting necessary.**
——**It is the only sanitary way.**
——**Saves time and energy, and, best of all, saves the woman.**

¶ It cuts out all the drudgery, and goes far toward solving the servant problem. Makes it unnecessary to ever send your rugs and carpets to the cleaners, where they are generally injured more in one cleaning than they would be by several years of actual use.

¶ The Arnold is easiest to operate because it weighs only 8 pounds. Therefore, can also be easily carried about even by a small child.

¶ The electric motor does all the work. First it loosens up the dirt by operating a patented agitating brush. Then a strong, steady suction, equal to that of any other machine, sucks it into the dust collector bag, from which it can be easily removed. It is the combination of the strong suction together with the patented agitating brush that makes the Arnold quicker and much more efficient than any other machine.

¶ The Arnold Electric Cleaner can be operated from any electric lamp socket, and never costs more than 1 cent per hour to operate anywhere. The machine will work on either direct or alternating current.

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Up-to-date Electrical Dealers and Central Stations all over the country are already carrying a stock of Arnold Electric Cleaners. Ask the manager of your light plant, or inquire at any electrical dealer about the Arnold. If they haven't one on hand, they will be glad to get one for you on our liberal Free Trial Offer. If you prefer, you can write direct to us. Send today for further interesting information of this wonderful little machine, and our exceptional Free Trial Offer.

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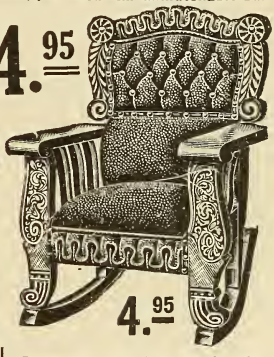

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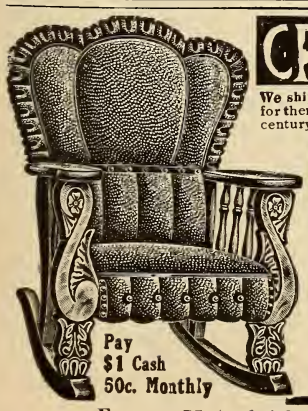

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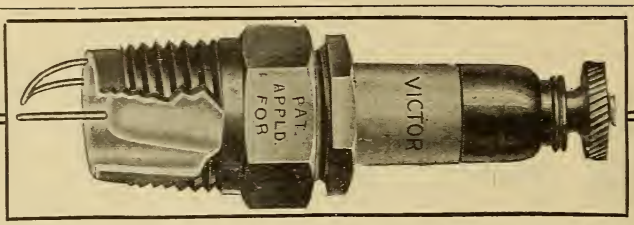

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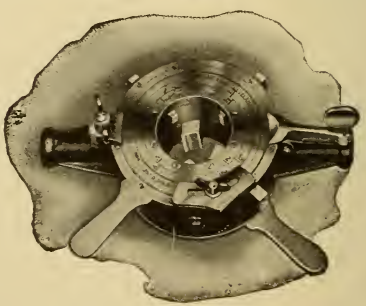

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The 1900 Motor Washer

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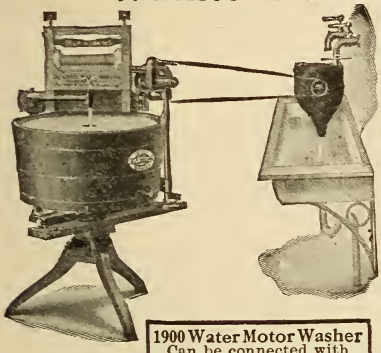

1900 Water Motor Washer
Can be connected with any water tap instantly

Handles heavy blankets or dainty laces.

The outfit consists of the famous 1900 Washer with either Electric Motor or Water Motor. You turn on the power as easily as you turn on the light, and back and forth goes the tub, washing the clothes for dear life. And it's all so simple and easy that overseeing its work is mere child's play.

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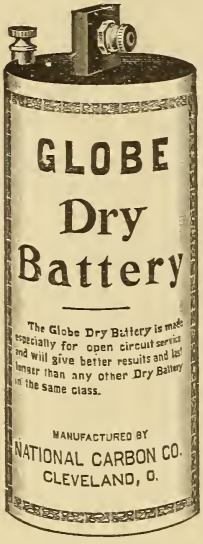

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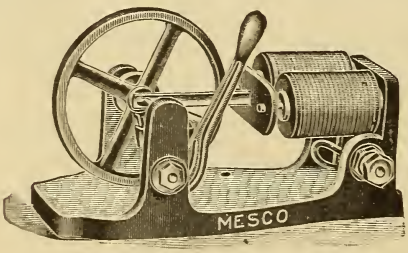

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Trade Word	Catalogue No.	List Price	Postage
Ablicumer	403 K, with tools, each, net	$5.00	25c
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No. 403 K

Genuine leather case, contains a selection of Klein tools such as have been found particularly desirable by Electricians and wire men on switchboard and telephone work. It is of convenient pocket book style, with firm metallic clasp and measures 4x9 inches. It contains the following tools: 1 single blade electrician's knife, 1-5 inch Klein side cutting pliers, 1-5 inch Klein oblique pliers, 1-6 inch Klein long nose side cutting pliers, 1-3 1-2 inch blade screw driver and 1 pair 5-in. N.P. electrician's snips.

NOTE—The pliers are plain black finish, if nickel plated pliers are wanted add 25 cents net, each, for plating. Case furnished either russet or black color. **Send 3c. stamps for 65-page Catalogue.**

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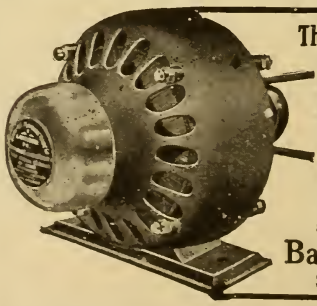

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1-12 and 1-8 H.P.

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

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POWER PERSONAL INFLUENCE. Your Latent Forces and How to Use Them. 130 pages. (Price 25c) and 50 POST CARDS (no two alike) for 35c. Booklet FREE. Address SELF-CULTURE SOCIETY, B. E., 1945 Estes Ave., Rogers Park, Ill.

A Hot Point Electric Iron is simple, safe, economical and such a comfort

ANY CHILD can use the **Hot Point Electric Iron,** because it is perfectly safe and simple. One end of the flexible cord attaches to any light fixture in the house. On the other end is a switch plug.

To heat the iron, simply push the switch plug in. And to cool it, take the plug out.

Putting in and taking out the plug controls the amount of electric current carried into the iron, and regulates the temperature.

Shortly after the plug is inserted the iron is hot. From then on you will not need current more than half the time.

The regular household iron weighs 6 lbs. but you never have to **lift** it—no carrying it from stove to board, and when not in use simply tip it up on the broad end. The stand is attached.

The heat all goes into the ironing. Hence, you iron in perfect comfort. You need no holder. Take it to any room, too; or out onto the porch.

Approved by the National Board of Fire Underwriters

The Hot Point **Automatic** Iron cannot be over-heated. Therefore it cannot possibly start a fire. If you forget to pull out the switch plug the automatic device does it for you. It is controlled by the temperature of the iron; is positive and certain. The **Automatic** Iron simply **cannot** get hot enough to do any damage.

The Hot Point **Standard** Iron is exactly the same as the **Automatic** except the automatic control. Someone must think to pull out the switch plug, just as someone must think to turn off your electric lights.

And the same is true of every electric iron in the world, of whatever name, except only the Hot Point **Automatic.** Where the iron will be used intelligently, the **Standard** will answer every purpose, and there is little fire risk.

PACIFIC ELECTRIC HEATING CO.

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Central Station Managers and Dealers

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You Should Have One

Every electric-lighted home in America should have its **Hot Point Electric Iron.**

It will save the housewife hours of time and a world of worry and discomfort. It will keep the servant satisfied and save her time.

Costs only a few cents to do the weekly ironing. Will last for many years. Rarely gives any trouble and that point is covered by

Our Binding Guarantee

This guarantee is good until January, 1911. It is printed right on the box. If you have any trouble the Lighting Company or Dealer will make your iron as good as new.

Order a Hot Point Iron

There is no other electric iron so sturdy and strong, so simple and safe, as our STANDARD Model.

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Therefore when you go to your Lighting Company or Dealer ask to see the HOT POINT IRON. If they do not have it, order direct.

We ship you one to any part of the United States at the regular retail price of $5.00 for a 4, 5 or 6-lb. STANDARD, or $6.00 for a 6-lb. AUTOMATIC. We prepay the express charges.

Be sure to give voltage. If uncertain, call up your Lighting Company.

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Please send me further particulars about Hot Point Electric Irons.
Send me, charges prepaid, 1 Standard Hot Point Iron, $5.00
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(Draw pencil through the one not wanted)
Enclosed is check in payment of same.

Name_____

Street_____ Voltage_____

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I enquired about it of_____

Federal Shaving Mirror

Furnishes perfect light for Shaving or Massaging in any part of the room at any time of day or night.

The Federal Shaving and Massage Mirror is a combination of mirror, electric light and special reflector. Throws all of the light on the face just below the eyes. Both mirror and reflector can be adjusted as desired. Price, complete with lamp and cord, express prepaid, **$3.95.**

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Write at once.

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For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

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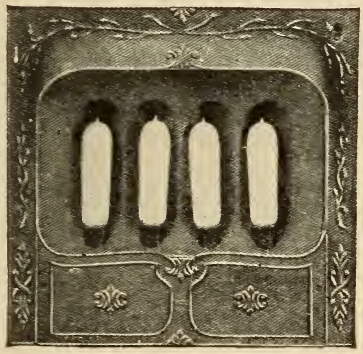

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All the advantages of the Fuel or Gas Grate without any of the drawbacks, and at less cost.

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I am so **absolutely certain** of the successful outcome of the Antol Treatment that I fearlessly

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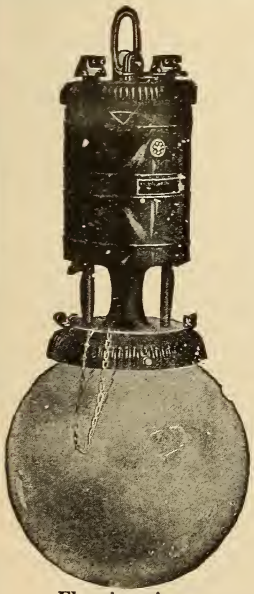
write for my **Free Booklet** on the Curious Manifestations produced by Light, Medium, and heavy Drinking; study therein your own particular symptoms, **and send for a bottle of Antol.**

Clip this notice out, for future reference, but **write now** for my Free Booklet. Address, **JOHN C. EARL,**
Antol Laboratories, 661 Gates Avenue, Montclair, N. J., U. S. A.



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Intense Light

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

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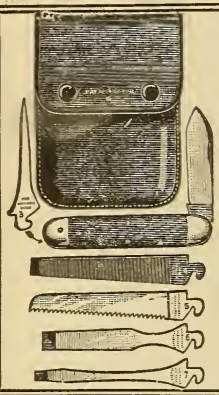
Address



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Any Tool firmly attached or detached to the Pocket Knife in a second.

Sent postpaid on receipt of price $2.25

Use it five days and if not satisfactory return it and we will refund your money.

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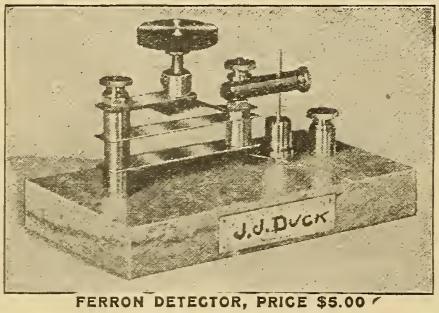
Attention Wireless Operators



FERRON DETECTOR, PRICE $5.00

This is the **Celebrated Ferron Detector**, with a **proven and demonstrated range** of over 1400 miles. Acknowledged by a great many professional operators to be one of the three most sensitive detectors yet invented, and equalled by none selling for $5.00. It needs no **acid, batteries or potentiometer,** which means at least $2.00 saved. It is not injuriously affected by the strongest signals and remains adjusted for weeks! It is most beautifully finished. The base is of finely polished Italian marble; the metal parts are beautifully nickel-plated.

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"Responder (Ferron detector) is a peach. With it I copied the "City of Memphis," 765 miles; B. N. Boston, 850 miles; New York, N. Y., 1056 miles; and also Manhattan Beach while lying at the dock. How is that for long distances and over land too?" The above is but one of many testimonials we can show in support of our claims.

Receiving set with a proven range between 500 and 600 miles, $12.75
" " " " " " 800 " 1000 " 19.00
" " " " " " 1000 " 1200 " 29.00

Send **3c stamp** for our NEW BIG CATALOG OF ANYTHING ELECTRICAL. 40 pages of wireless instruments alone.

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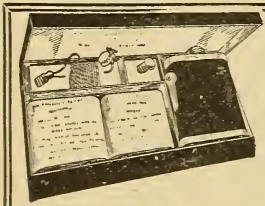

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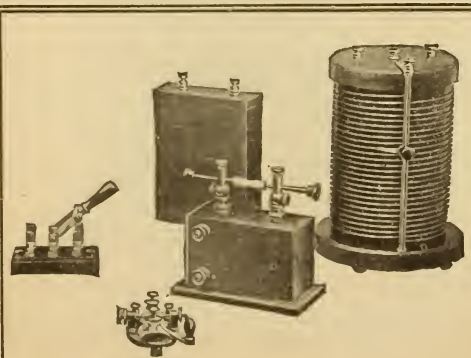

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Our Complete Transmitting Set, working from 3 to 5 miles under varying conditions, with good aerial.

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Prices of other sets on application

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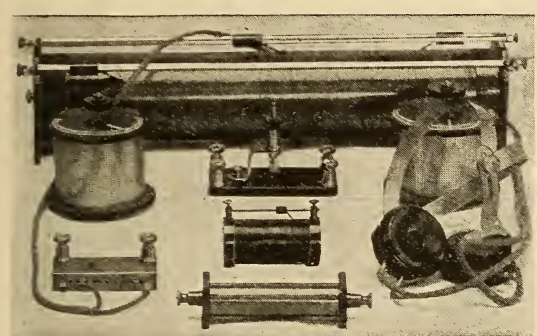
For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

Wireless Apparatus



This month we wish to call attention to our "Tri-mount Professional Set," Type C, as shown above.

3-slide Coil, high inductance	$5.50
2 Adjustable Air Capacities	8.50
Universal Detector Stand	4.50
Potentiometer	2.50
3000 Ohm Telephones with Headband, seven-foot cord, six-phone Block	8.50
Special "Tri-mount" Switch (not shown)	3.50
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Our price (delivered)	**$30.00**

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See our advertisements in previous numbers.

The Tri-Mount Wireless Supply Co.
R. A. CHANDLER, Manager
13B Irving Street BOSTON, MASS.

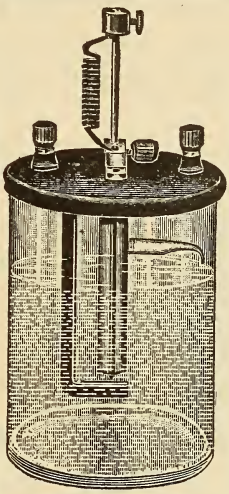

FIG. 2

FIG. 3

THE GERNSBACK ELECTROLYTIC INTERRUPTER

has been declared to be the most efficient interrupter of modern times. This interrupter has been described in the August issue of Popular Electricity, page 245, where particulars may be found. Figure No. 2 shows spark obtained of a 2″ coil on a 6 volt battery. Figure No. 3 of the same coil on 110 volts with the Gernsback interrupter. A **FLAME** one quarter inch thick is obtained such as you never saw before. Efficiency of coil is increased fully 500%. No resistance necessary, hook up the interrupter in series with the coil and 110 volts for operation. Coils from ¼″ up to 12″ spark length are used successfully with the new interrupter. Price complete $2.50. Send two cent stamp for our wonderful 120 page electrical cyclopedia containing immense quantity of information especially **WIRELESS.**

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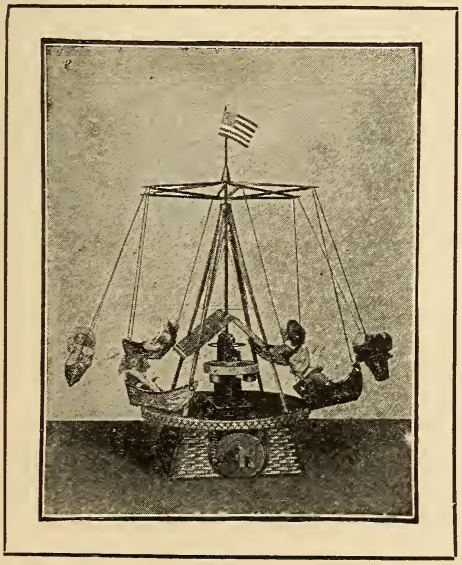

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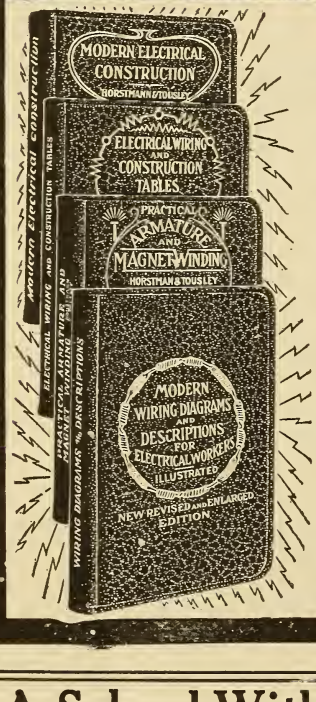

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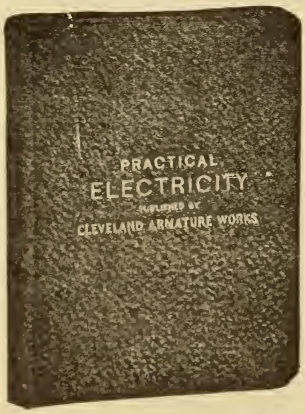

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XII—Armature Reaction.
XIII—Sparking.
XIV—Winding of Dynamos and Motors.
XV—Proper Method of Connecting Dynamos and Motors—Self Excitation.
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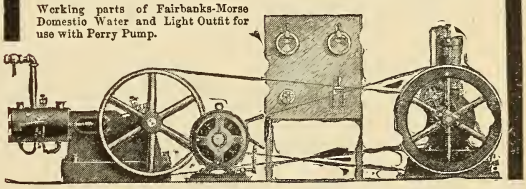

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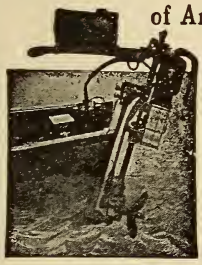

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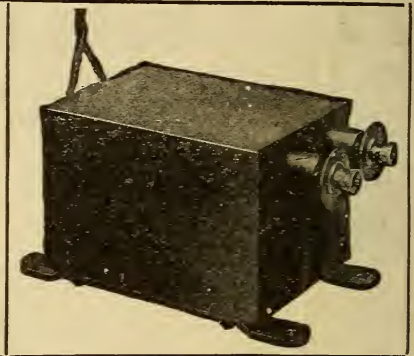

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ELECTRIC MOTOR

— Sent prepaid to any address for 35c —

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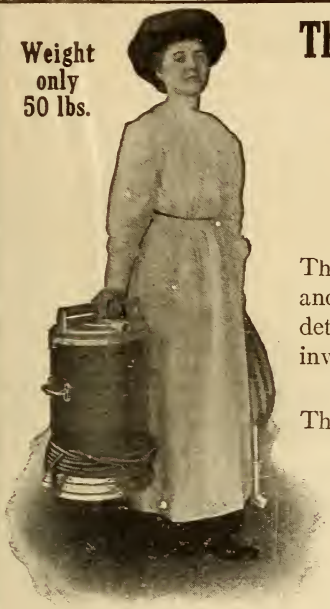


The Santo Vacuum Cleaner

The Mark of Perfection

IS BACKED BY

A Guaranty that MEANS SOMETHING

The Santo Electric Vacuum Cleaner was invented, developed, and perfected in our own factory, by our own workmen. Every detail of its construction is original with us. The title to this invention is therefore vested in us.

Like all articles of superior merit the Santo has its imitators. The Santo is the **original** round, portable cleaner. It can not be approached in efficiency, durability or completeness, by any other cleaner at any price.

Sold Under a Guaranty Bond

Instead of the verbal promises given with most cleaners and which are seldom worth anything, we give you a guaranty bond bearing our corporate seal and signature.

We agree and guarantee to replace without cost to you any parts proving defective in material or workmanship at any time, whether it be in one year, five years, or longer.

This guaranty means something. It insures you against loss and protects you in your right to use the Santo.

The Santo has been perfected after an experience of over 15 years and at an experimental cost of over $50,000. It is perfect—the final in vacuum cleaners, you can not buy more in a portable vacuum cleaner, even at five times the price.

Our cleaner is built as perfectly and of as fine material as the most expensive automobile. No tin, paper mache or other flimsy material enters into its construction. No wood except the hardwood top handle.

As a result of our experience we have determined the efficiency absolutely necessary to do perfect cleaning. Our standard as embodied in the Santo is as follows:

It will produce a maximum vacuum of 7 to 8 inches Mercury standard.

It has a calculated displacement of 25 to 30 cubic feet free air per minute.

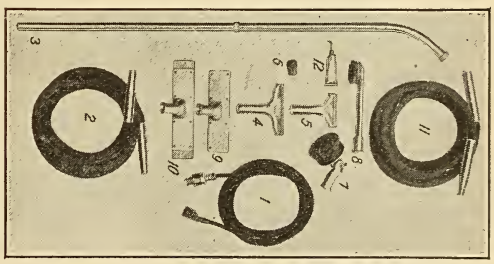
It may be operated continuously without stalling or overheating.

It does not require special heavy fuses, and will not endanger your wiring.

It is strictly within the limits set by Insurance Underwriters, viz., electrical consumption of not more than 200 Watts when operated at its full capacity.

Any electric cleaner having LESS efficiency than the Santo will utterly fail to meet your requirements.

The highest grade polished aluminum equipment ever furnished with a vacuum cleaner—nothing more to buy.



1—Electric cable for connecting cleaner to lamp socket.
2—Mercerized braid-covered vacuum hose.
3—Hollow renovator handle.
4—6-inch nozzle for thoroughly cleaning carpets, rugs, etc.
5—4-inch nozzle for portieres, upholstery, clothing, etc.
6—Rubber nozzle for tufted upholstery, corners, etc.
7—Wall brush, for walls, ceilings, mouldings, etc.
8—Book brush, for cleaning books, hats, furs, etc.
9—10-inch wood face nozzle for light and rapid sweeping.
10—12-inch nozzle, felt-faced, for sweeping floors.
11—Mercerized braid-covered blowing hose for drying hair, airing bedding, etc.
12—Tube of lubricant which eliminates greasy oil can.

The Santo cleans everything without removal. It makes your home spotlessly clean and dustless.

SANTO HAND POWER CLEANER

This little machine is a **real vacuum cleaner,** equipped with a powerful rotary pump which runs at a speed of 600 revolutions per minute. It is driven by a fly wheel. It does twice as much work as any other hand power cleaner and is the easiest to operate. Beautifully finished and weighs less than 30 lbs. Worth $50.00 but sells for $35.00.

BOOKLET FREE—The "Dustless Home" describes both our cleaners in detail. It is handsomely illustrated, interesting—complete. Your name on a postal brings it.—**Write today.**

KELLER MANUFACTURING CO., Dept. 3E, Philadelphia, Pa.

W. P. PRESSINGER CO., Dept. 3E, 1 W. 34th Street, New York City, Gen. Agt. for Mich., N. Y., New Eng. and N. J., north of Trenton.

CHAS. STRADER & CO., Dept. 3E, Gen. Western Distributer, Drawer 816. Chicago.

COOK WITH ELECTRIC LIGHT

Simplest Cooker or Cooking Device in the world. Just turn on your current from your Electric Light socket and start your meal.

The Thermo Electric Cooker is the latest improvement in Electrical Cooking Devices. You can cook your meals with the greatest convenience, no matter what you have to cook—it cooks anything—any place where Electric Light is available—there your stove is. No Heating up your house—no odor—no watching to see if anything burns. It will bake, roast, stew, boil; in fact, the Thermo Electric Cooker will do anything a stove does and do it better.

The Thermo is made in six styles, Price $9.00 and up. Descriptive Circular and Price List mailed free on request.

Central Stations and Electrical Supply Dealers, write at once for special price.

THE THERMO ELECTRIC MFG. CO., Dept. E **Toledo, Ohio**

WIRELESS TELEGRAPH RECEIVERS

Our Wireless Telegraph Receivers are perfect in every respect, combining **CLEAR CUT,** resonant talking with delicacy of operation essential for successful wireless work. Perfection in mechanical detail and in quality of material produces efficiency. **WE KNOW** that we have this perfection. A test will convince you.

Double head type complete with five foot of green cord and nickel plated German Silver Head Band.

1000 Ohm, per pair, as shown in cut.....$5.25
1500 Ohm, " " " " " " 6.00
2000 Ohm, " " " " " " 6.75
3000 Ohm, " " " " " " 7.75

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We desire to call your particular attention to the fact that the receiver case is **NOT METAL.** Metal case receivers are not suitable for Wireless work.

Receiving Sets complete less Telephone Receiver, **$10.00.** Detectors only **$3 00.** Double slide tuning coil, **$4.00.** All metal parts nickel plated and Black Composition Rubber.

Send for circular and catalogue W.

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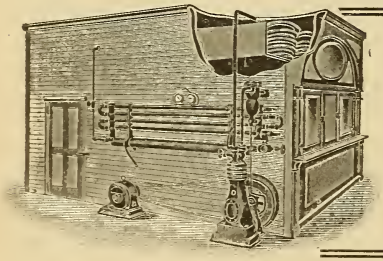

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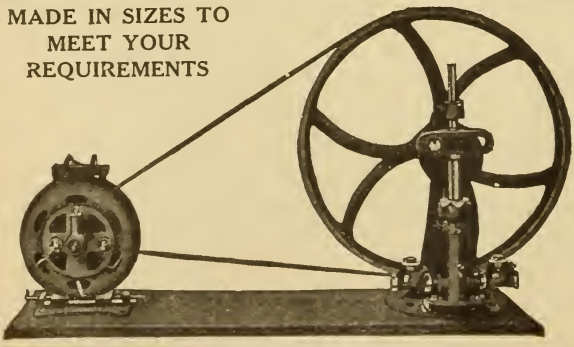
Where Electric Current is available you can have your own **ICE PLANT.** We are the originators of Electrical Ice and Refrigerating Machinery, for all purposes. Hotels, Stores, Buildings, Apartment Houses, etc. Installers of all kinds of Ice Machinery and Refrigerating Machines in any size up to 50 tons daily capacity.

We want to show you how to make your own ice with the Electric Current you have available.

Our years of experience is worth something to you. You can have it free for the asking.

Larsen-Baker Ice Machine Co.
1905 Nicholas Street **OMAHA, NEBR.**

MADE IN SIZES TO MEET YOUR REQUIREMENTS



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Electrical Driven House Pumps

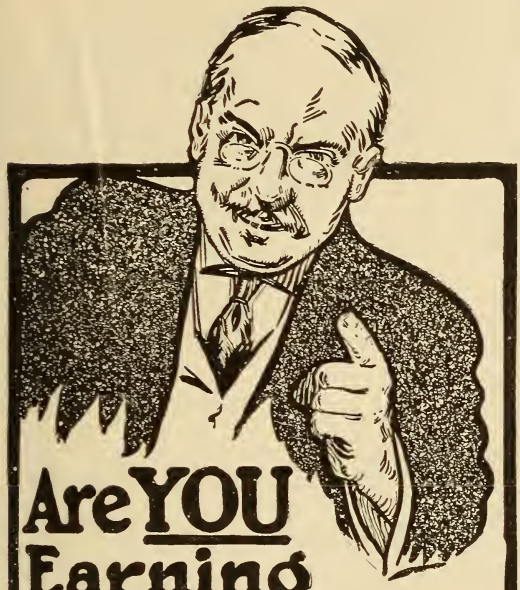
Are very highly recommended for use wherever electricity is available. The Motor can also be used to operate the Washing Machine, the Wringer, the Sewing Machine, the Ice Cream Freezer, the Food Chopper and numerous other household duties.

Fully Guaranteed.

Write today for our **New Bulletin,** No. 101, and obtain our reasonable prices.

JARVIS, 910 River Street, LANSING, MICH.

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.



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Thousands of Traveling Salesmen earn two to three times that much, besides all their expenses. Over 600,000 employed in the United States and Canada. Many famous and wealthy men, such as Marshall Field, the great dry goods merchant, Ex-Gov. Frank S. Black of New York, John W. Gates, multi-millionaire stock broker, Ex-Postmaster General John Wanamaker, the great merchant of New York and Philadelphia, and scores of others got their start selling goods on the road.

Salesmanship is the most fascinating, independent well paid profession in the world, and the demand for good salesmen always exceeds the supply. There is always a good position open for a man who can sell goods.

He is the most sought after and highly paid man in the commercial world, because he is the business-producing and money-making part of the concern and his earning capacity is unlimited. Many of them earn from $5,000 to $20,000 a year and all expenses.

Why not be a producer yourself! Get out of the non-producing class. You can never talk an increase in salary to your employer until you can show him where you are making money for him.

In a few short weeks without interfering with your present position or employment we can teach you by mail to become a first-class Traveling Salesman, **a producer**, and assist you to get a good position besides. We maintain the largest

Free Employment Bureau

in the world for the exclusive use of our graduates.

We are constantly in touch with Employers of Salesmen everywhere, and receive calls for Salesmen from thousands of firms, and are placing our graduates in good paying positions every day. There will be thousands of good openings this Fall and Winter, and now is the time to prepare for one of them. Don't let the fact that you have had no former experience in Salesmanship prevent you from writing us. We have placed hundreds of men who have never had a days' experience in good positions where they earn from $100 to $500 a month, and all expenses. We can help you in the same way we have them. If you are already a salesman we can help you to become a better one.

Your opportunity is here. Grasp it today by sending for our free booklet, "A Knight of the Grip." Every phase of the salesman's life is pictured therein and it contains interesting stories of the success of hundreds of our graduates who are now earning from two to ten times what they formerly did. Write our nearest office for it today.

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Investors—small or large—should inform themselves on Irrigation Bonds.

These bonds are secured by liens on the most fertile farm lands in America. The value of the security is in many instances four times the loan. The first year's crop often sells for more than the loan—sometimes by several times over.

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The bonds pay six per cent—a higher rate than one can obtain on any other large class of bonds equally well secured.

The bonds are for $100, $500 and $1,000, so one may invest either little or much.

These are ideal bonds, and they have become the most popular bonds that we handle.

We are the largest dealers in Reclamation Bonds. In the past 15 years we have sold 70 separate issues, without a dollar of loss to any investor.

Now we have written a book based on all this experience, and the book is free. Please send this coupon today for it, for you owe to yourself a knowledge of the facts.

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(Established 1893)

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Gentlemen:—Please send me your new Bond Book, "The World's Greatest Industry."

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Portable
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Cleaner

Excels Them All

You cannot afford to experiment with poorly built or inefficient apparatus; you want

A MACHINE, NOT A TOY

The Thurman can be operated by a child, costs only a few cents per day. Will keep everything in your home clean.

The Thurman is made by the oldest and largest manufacturers of vacuum cleaning machinery in the world—and builders of the **"The Thurman III," a hand power vacuum cleaner,** that can be

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Write for full particulars

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The only official recognized school for the teaching of

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For AUTOMOBILISTS AND MACHINISTS

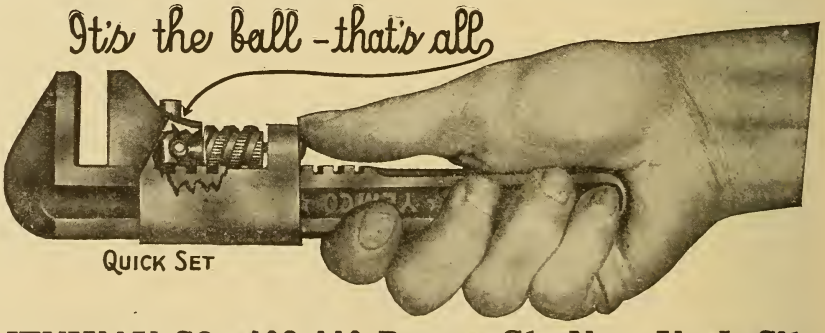
Easily operated with ONE HAND.

Strongest and best Automatic Wrench on the market.

Made from best steel drop forgings — hardended and tempered.

How it works:— Press button as illustrated and jaw will slide to nut to be gripped—holding to that point until released.

From your dealer or mailed postpaid for $1.



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Means the elimination of faults in your Product by RIGID TESTS.

Shrewd manufacturers do not jeopardize their trade by shipping half-developed goods. **Careful purchasers** buy subject to specifications and tests.

We are the medium for satisfactory dealings. We make all manner of electrical and photometrical tests and furnish you with exact and dependable data.

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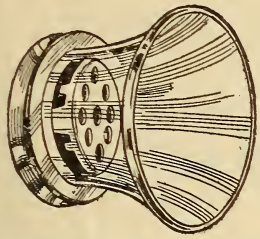

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Glass Telephone Mouthpiece

Universal Attachment Fits Any Phone

Is a sanitary device made of clear crystal glass and is rapidly replacing the rubber mouthpiece, which is an ideal breeding place for all sorts of germs. Endorsed by prominent bacteriologists, health departments and telephone companies throughout the country.

The glass part can be instantly removed for cleaning and as quickly readjusted.

It is less liable to breakage than the rubber mouthpiece, and positively gives better telephone transmission.

For office, store, and the home.

Equip your phone now and take no more chances of contracting disease.

Sent prepaid to any address in the United States for 25c each in stamps or coin.

Light is the greatest destroyer of germ life.

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The Acme School of Drawing, 4917 S St., Kalamazoo, Michigan.

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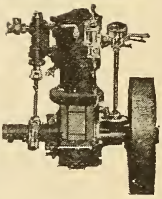
Don't Row, Sail or Paddle

this summer—install a 2 H. P. Perfection Engine in your 18-foot canoe, row boat or launch and enjoy yourself. Will take you anywhere—reliable—reversible—no cranking—starts on 1-4 turn of fly wheel—clean, economical—handsome enameled finish baked on. Easy to install—simplest in construction and operation—



2 H P $29 FOR BARE ENGINE
Complete Engine - $35
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positively greatest engine value known.

Our large volume makes possible these extraordinary low prices. Prompt shipment. Order at once. Enjoy your "Perfection" this summer.

The Caille Perfection Motor Co., 1315 2nd Ave., Detroit *CATALOG FREE*

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Write for the Burlington Watch Co.'s great book of Anti-Trust Facts—and our offer now made **direct** on our **finest** watch at the identical price the **wholesale** jeweler must pay.

The Burlington Special Watch—the **anti-trust** watch—the consumer can get this watch **direct** while this offer lasts at our smashing no-trust prices—the world's master-piece of watch manufacture at exactly the price that the wholesale jeweler must pay.

Watch Book—Anti-Trust Facts Sent FREE

While we do not say that there is an illegal watch trust, this book explains how prices have been boosted and "contracts" made to hold up prices in America on the same goods that are sold cheap in England. This book explains where the dealer's profit comes in while selling the products of the gigantic factories. The free coupon will bring our anti-trust offer and one watch. **Fill out and sign the coupon.**

Just sign and mail the coupon; no letter is necessary

BURLINGTON WATCH COMPANY
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BURLINGTON WATCH COMPANY, Dept. 1407, Millard Station, CHICAGO, ILL.
Gentlemen: Without any obligations, please send me free, prepaid, your anti-trust watch book and your present direct offer on your finest watches.

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Don't fail to send this coupon; do it today, right now.

150,000 People—

Attended the ELECTRICAL SHOW at Chicago Last Year

THIS throng was made up of people interested in the development of electricity; particularly from the consumer's standpoint.

The development of this marvelous force together with the great strides made in the manufacture of electrical accessories used in the home, in the office, in the factory and on the farm, has made it vitally important that the manufacturer of electrical accessories, the jobber and the supply house should be interested and support the Electrical Show which takes place in Chicago next year.

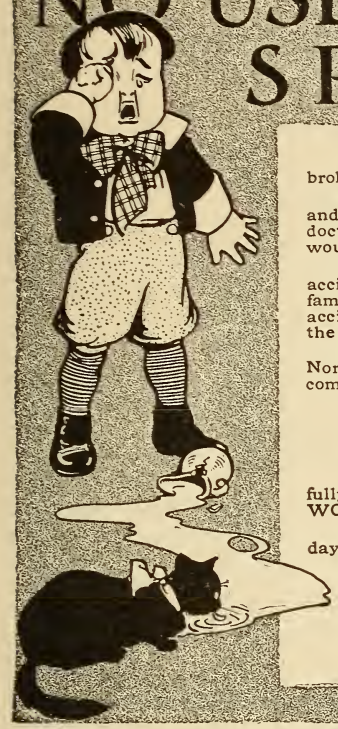
It is the general opinion that all who have exhibited at this show have received benefits which they could never have secured in any other way. The public has become interested in the exploitation of their products to the extent that the demand made upon the manufacturer to supply the consumer of electric current has been greater than ever before.

The location for exhibitors in the Coliseum is a vital point in the success of their exhibit. By reserving space considerably ahead of time you will be able to secure your desired position in the hall.

Electrical Trades Exposition Company

Monadnock Block :: :: CHICAGO, ILLINOIS

NO USE CRYING OVER SPILLED MILK



Accidents will happen. Crying won't help pick up the milk or mend the broken jug; but a little forethought will insure you money to buy more.

Suppose you should drop with an elevator tomorrow, or fall from a street car, and be picked up with a broken leg? Where would you get the money for the doctor and the landlord and the grocer? Not out of your pay envelope, for you wouldn't be earning any pay for a while.

NOW IS THE TIME to insure yourself against possible accident. When the accident has happened it will be too late. It is your duty to provide for your family—by working for them while you are able, by insuring yourself against an accident that might disable you. Nothing will help you to get well so quick as the thought that **you have paid the bills in advance.**

The TECHNICAL WORLD MAGAZINE, by special arrangement with the North American Accident Insurance Company, one of the oldest and best known companies in the country, will give you a

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The Magazine will insure you against **dull** days, the policy against **dark** days; both together will make your life longer, happier, better worth living. Write today for a sample policy giving all details; or, better yet, mail the $1.50 today.

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CHICAGO, U. S. A.

Protect Your Tungsten Lamps with a

Tungsten Life-Saver

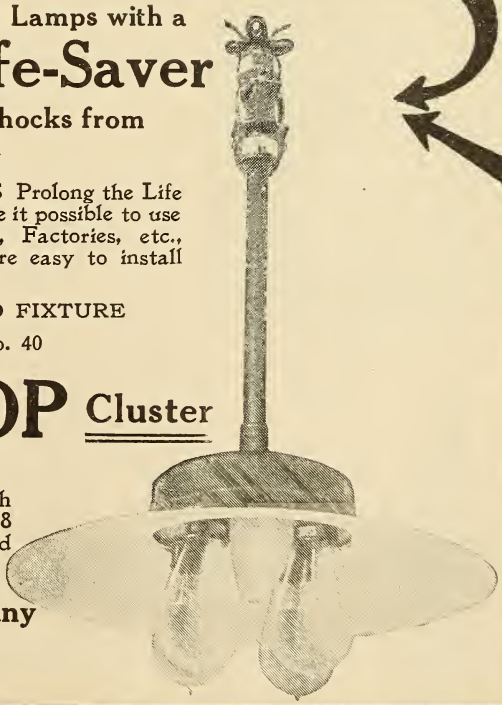
Prevents injurious Shocks from Vibration

TUNGSTEN LIFE-SAVERS Prolong the Life of Tungsten Lamps, and make it possible to use Tungsten Lamps in Shops, Factories, etc., where there is vibration. Are easy to install and require no repairs.

FIT ANY STANDARD FIXTURE

BULLETIN No. 40

Tungsten SHOP Cluster



An inexpensive cluster made of steel, with plain black finish, equipped with an 18 inch steel, porcelain enameled shade and Tungsten Life-Saver.

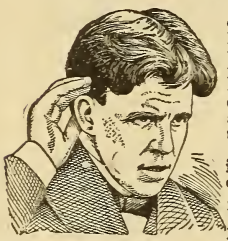
BULLETIN No. 42

American Arc Lamp Company
Specialties Department
Manufacturers
Kalamazoo, Michigan

Deaf Persons Can Now Hear

Wonderful Invention Has Delivered Thousands from the Handicap of Deafness.

Don't think you have to worry along if you can't hear well. Every deaf person is at a hopeless disadvantage, deprived of social pleasure, barred from active business. Any dullness of hearing is a constant mortification.



But now this misery is unnecessary. Every deaf person can hear as well as ever before by simply wearing a pair of

WILSON'S EAR DRUMS

A wonderful little device that fits into the ears without the slightest discomfort. Invisible when inserted—so tiny, so perfect, that you forget you are wearing them. And the effect is magical.

This marvelous invention was perfected by Mr. Geo. H Wilson, after years of suffering from hopeless deafness. They enabled him to hear perfectly. And this miracle has been repeated for 200 000 persons.

Send today for a book written by Mr. Wilson that tells the whole story—gives hundreds of letters from grateful users. This priceless book is FREE for your name on a postal. Just ask for Mr. Wilson's book. It will come by return mail. Address **Wilson Ear Drum Co., 442 Todd Bldg., Louisville, Ky.** (2)

IF YOU WANT

A reliable electrical reference book of convenient size—one that you can depend on, that will be instantly accessible when you want it, that will give you just the information desired, in language you can understand—

YOU SHOULD GET

The Handy Electrical Dictionary

This practical popular little volume is designed to meet the needs of beginners in electricity and at the same time furnish a compact, authentic ready reference for electrical workers and experts. It contains 224

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Order now—no one interested in electricity should be without it

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Taking the Motosphere Treatment

MARVELOUS CURES IN INDIGESTION, NERVOUS PROSTRATION, INSOMNIA, LA GRIPPE, RHEUMATISM, GOUT, SCIATICA, and COMPLAINTS ARISING FROM CONGESTION or SLUGGISH CIRCULATION.

The Motosphere is a new invention that changes electricity back to the original lines of force and concentrates them over the vital organs. Scientific, yet simple—it is vital energy concentrated; the essence of nerve force that revitalizes the blood and enables the system to throw off disease. Does not cost one cent unless it absolutely cures.

Send for booklet of testimonials and particulars.

The Motosphere Mfg. Co.

31 East 27th St., Dept. E, **New York City**

Hair Grows

When properly nourished. Our VACUUM CAP used a few minutes each day draws the blood to the hair roots. The blood is nature's nourishment and when properly supplied, it promotes hair growth, stops falling hair, and dandruff disappears. Our cap is used by Physicians, and men who know it to be the Scientific method of promoting "Hair Growth." We send our Vacuum Cap on 60 days' free trial. Write for our booklet on "Hair and its Growth" testimonials, and application blanks, sent sealed in a plain envelope free.

The Modern Vacuum Cap Co.

480 Barclay Block **Denver, Colo.**

Price $12.00 AT FACTORY

SAVE ROOM

Most convenient and practical low-priced Typewriter Stand on the market. Made of selected Oak, fine golden finish, 44 in. long, 24 in. wide; Pedestal 30 in. high; 3 drawers and extension slide; Paper Cabinet with shelves 14x8x1½ in.; Cabinet has roll curtain front and copy holder. Order from dealer if he has it or will get it; otherwise from us. Do not accept a substitute; no other Typewriter Stand is "just as good."

We also make School, Church and Opera Seats, Lodge Furniture.

Quality Excellent

Ask for Catalog by Number Only.

No. 219—Office Desks, Chairs, Files, Book Cases, etc.
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E. H. STAFFORD MFG. CO., 242 Adams St., Chicago, Ill.

Explicit instructions about making wireless instruments in **"HOW TO CONSTRUCT A PRACTICAL WIRELESS TELEGRAF"**, with illustrations, diagrams and fine copy of the Code, suitable for framing. Price 25c, complete. **CHICAGO WIRELESS SUPPLY CO.**, Room 52g, Auditorium Office Bldg., Chicago.

Special

Discounts on Highest

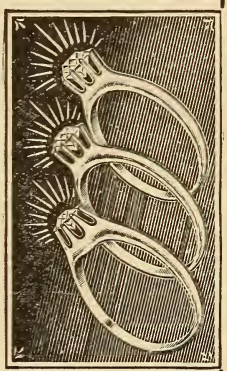
grade diamonds, the finest, pure white gems; also jewelry, cut glass, silver, etc.

WRITE for special discount sheet and price list (together with the complete Marshall catalog). The house of Geo. E. Marshall is known for its first quality goods and our special discounts on rarest values may surprise you. Write now.

Marshall's

"F" Grade—

"F" irst and finest grade—diamonds are gems of the rarest beauty — — perfect in cut and color, pure white; of dazzling brilliancy. Not one jeweler in ten ever carries in stock a diamond equal to the Marshall "F" irst grade; and the jeweler's so-called first grade is generally about equal to Marshall's second or even third grade.



HERE are shown three stones of rare beauty, all "F" grade solitaires—prices $76, $46 and $28. We allow terms of $7.60, $4.60 or **$2.80 a month** respectively. **Or for all cash, 8% off.** *Any diamond shipped prepaid on approval—not one cent in advance, nothing to pay unless completely satisfied AFTER full examination.*

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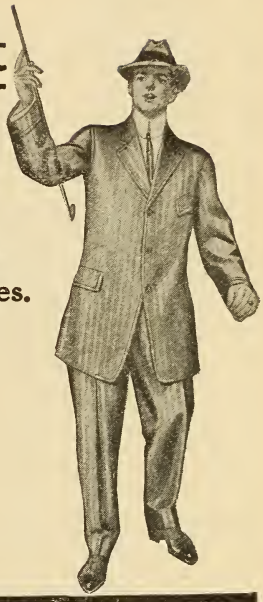

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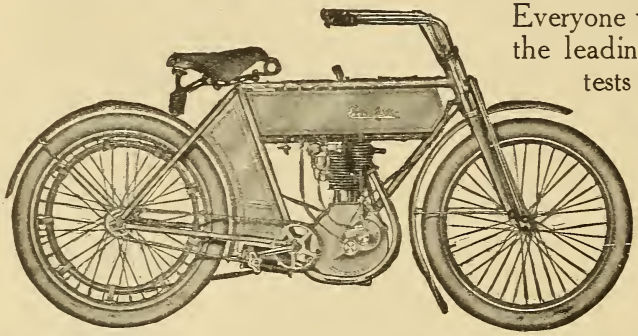

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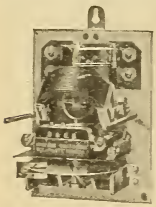

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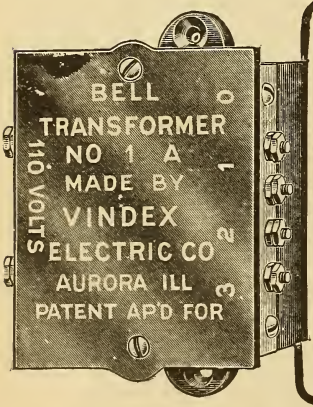

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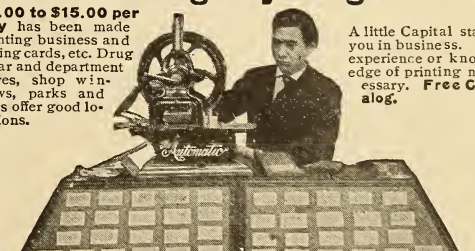

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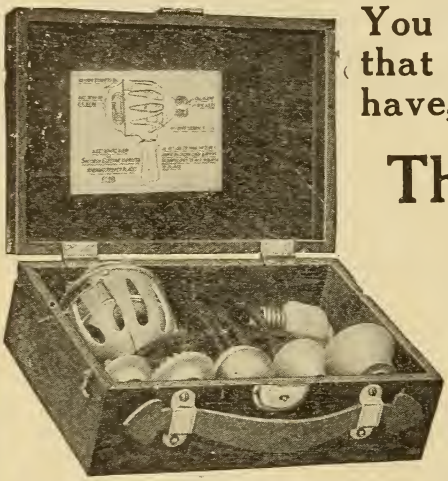

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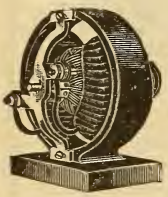

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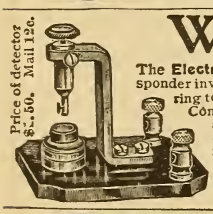

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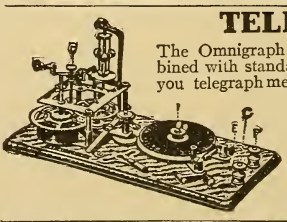

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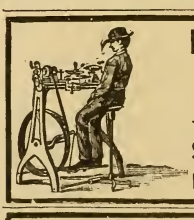

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Power and Turret Lathes, Planers, Sharpners, and Drill Presses.

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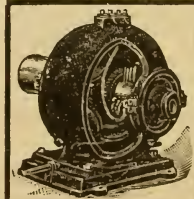
OUR WIRELESS COILS are fully guaranteed—money back if not satisfactory. The one and one-quarter inch spark, $5.00, is equal to, if not better than, any other coil at the price, but the two inch coil, $7.75, far surpasses anything now offered in this line at anywheres near the price. These coils are not overrated as to spark length as many other coils are. The spark is fat and is most efficient for Wireless work. We will gladly ship C.O.D. if desired. Send today for circulars describing these and many other Wireless instruments, both amateur and professional.

INTERNATIONAL WIRELESS CO., Dept. E., LIMA, OHIO



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POLISHING LATHES
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SPECIAL MACHINERY

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THE RADIO TELEPHONE HOLDER

IS INDISPENSABLE

in the Home or in the Office

The **Radio** is a positive boon to every one who has a telephone—either in the office or the home. It is adaptable to any make of telephone and can be fastened to roll or flat topped desk — to table —wall or floor. It keeps the desk or table clear, the telephone up, out of the way. Its flexible construction permits the telephone to be used from any angle and any position — sitting or standing — anywhere within a radius of four feet. The slightest touch will move it up, down, sideways or in a complete circle.

The Radio is simple and strong and remarkably handsome. Anyone can install it in five minutes without disturbing either the telephone cords or the wiring. The suspension joint is ball-bearing — insuring ease of motion. All parts are malleable and non-breakable. It is beautifully finished in fine enamel and oxidized copper.

How the Radio Works

The telephone can be used in a standing position by a person of any height.

It permits a child to use the telephone with perfect ease.

Sitting or standing, you can adjust the telephone to exactly the position desired.

It permits telephoning in a recumbant position from any angle.

In the dining room—permits telephoning at the table. Not in use is up—out of the way.

Price, $3.50

It is never in the way but always ready for instant use sitting or standing.

It permits you to adjust the telephone to your position.

Your caller on the opposite side of desk can telephone without either of you getting up.

It permits one telephone to serve three or more people perfectly.

The telephone can be tilted at any angle. Released it resumes its normal—vertical position.

Sent on Ten Days Trial

The price of the Radio Telephone Holder is $3.50—but a small part of its real worth. Send us the price today and we will send you the biggest convenience ever offered to telephone users. Try it ten days—and if not more than pleased—tell us so and we will give you your money back.

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Long Distance, Local, Rural Party Line, Hotel, Portable and Inter-communicating Telephones, Switchboards and Complete Systems. Electrical Supplies of every description. Buy from manufacturers direct and save two or three profits.

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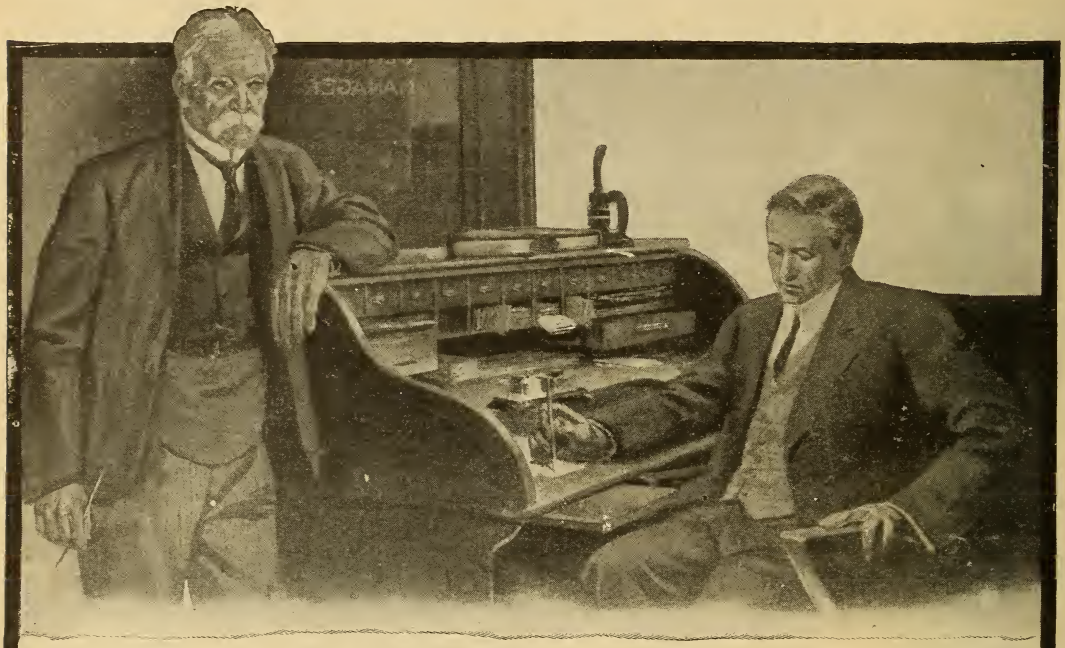

A FAILURE AT FIFTY

¶ Out of a job at fifty—is the fate of the untrained man. Business requires not only natural ability but special training.

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¶ The American School of Correspondence can fit **you** for congenial, well paid positions in your early years, and make your services valuable in your old age. Training only can compensate for the energy of youth.

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

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....Certified Public Acc'nt	....Sanitary Engineer
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set the same high standard in the commercial world. They prepare for the best paid business positions; they are prepared by practical business men who have "made good" by practising what they preach; they are planned to meet the needs of both the young man who is just starting in, and the older man who has almost "arrived."

¶ Get your training now, while you have the time and energy for study. Mail the coupon today.

American School of Correspondence

Chicago, U. S. A.

$800

Buys the Material Needed to Build This Home!

Price Includes Blue Prints; Architect's Specifications; Full Details; Working Plans and Itemized List of Material.

OUR HOUSE DESIGN No. 131

Here is a handsome Colonial residence of eight rooms, bath, pantry and numerous closets. It is 28 feet square, not including porches; full two stories high, and provided with every modern labor-saving convenience. Every detail has been carefully worked out, so that the finished product shows a happy blending of the useful with the ornamental. If you intend to build it will pay you to investigate our offer. This house will please you. You will enjoy it while you use it, and when you are through with it you can easily sell it at a good profit.

We Save You Big Money on Lumber and Building Material!

The Chicago House Wrecking Co. is the largest concern in the world devoted to the sale of Lumber, Plumbing, Heating Apparatus and Building Material direct to the consumer. No one else can make you an offer like the one shown above. We propose to furnish you everything needed for the construction of this building except Plumbing, Heating and Masonry material. Write for exact details of what we furnish. It will be in accordance with our specifications, which are so clear that there will be no possible misunderstanding.

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We have everything needed in Building Material for a building of any sort. Lumber, Sash, Doors, Millwork, Structural iron, Pipe, Valves and Fittings, Steel and Prepared Roofing. We also have Machinery, Hardware, Furniture, Household Goods, Office Fixtures, Wire Fencing—in fact, anything required to build or equip. Everything for the Home, the Office, the Factory or the Field. Send us your carpenter's or contractor's bill for our low estimate. We will prove our ability to save you money. WRITE US TODAY, giving a complete list of everything you need.

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We publish a handsome, illustrated book containing designs of Cottages, Bungalows, Barns, Houses, etc. We can furnish the material complete for any of these designs. This book is mailed free to those who correctly fill in the coupon below. Even if you have no immediate intention of building, we advise that you obtain a copy of our FREE BOOK OF PLANS. It's a valuable book.

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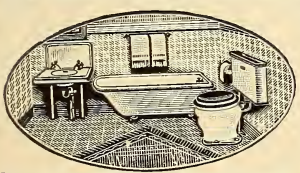
This company has a capital stock and surplus of over $1,000,000.00. We guarantee absolute satisfaction in every detail. If you buy any material from us not as represented, we will take it back at our freight expense and return your money. We recognize the virtue of a satisfied customer. We will in every instance "Make Good." Thousands of satisfied customers prove this. We refer you to any bank or banker anywhere. Look us up in the Mercantile Agencies, Ask any Express Company. Write to the publisher of this publication. Our responsibility is unquestioned.

High Grade Bathroom Outfits!



Price of this Bathroom Outfit, $37.50

Strictly new and as good as anyone sells. We have everything needed in Plumbing Material. Our prices mean a saving to you of 30 to 60 per cent. We can easily prove it if you will give us a chance.

Here is an illustration of a bathroom outfit we are selling at $37.50. Your plumber would ask you about $60.00 for this same outfit. This is a positive fact. It's only one of ten other complete outfits that we are offering at prices ranging from $25.00 to $100.00. Our catalog describes them in detail. You need the book if you want to keep posted on up-to-date business methods. Get our prices on Pipe and Fittings. Write us today.

Hot Water Heating Plants!

We furnish new complete hot water heating outfits at half the usual prices. Our proposition includes all necessary plans, specifications, blue prints and detailed instructions; so that any ordinary mechanic handy with the use of tools can easily install it. You can't go wrong when you deal with us. We stand back of every sale. You send us today a sketch of your building and we will make you a proposition to furnish you a complete steam or hot water heating outfit.

We also have hot air furnaces. Our booklet on heating plants tells every feature of the heating question. We can quote radiators & heaters separately. Whether you buy from us or not it is a valuable book for you to own. Write us today.

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Modern Air Pressure Water Supply Systems at prices ranging from $48.00 to $200.00. They are strictly new, first-class and complete in every detail. It makes no difference whether you live in the country, you can enjoy every city comfort at little expense. Why not investigate this? We are ready to furnish you with all facts free of charge. All material fully guaranteed. We also have a complete stock of Pipe, Valves and Fittings at 40 to 60 per cent. saving. Gasoline Engines at low prices.

Chicago House Wrecking Co., 35th & Iron Sts., Chicago.

Clothes Receive Gentler Handling in the

Thor-Electric

Than in Any Other Washer Made.

WHY?

The clothes are put in a wooden drum, in water heated in, and by the washer. This drum revolves a number of times in one direction, then reverses automatically, and continues this process until stopped.

The clothes in the drum are carried on a cleat or shelf—then dropped and the operation repeats.

All this time the hot suds are pouring through every mesh. They cannot be rubbed, squeezed, stretched, pounded, pulled or abraided in the slightest degree. 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 stretch or 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.*** This is an exclusive feature of the Thor-Electric.

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 your wife, housemaid, washwoman, 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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