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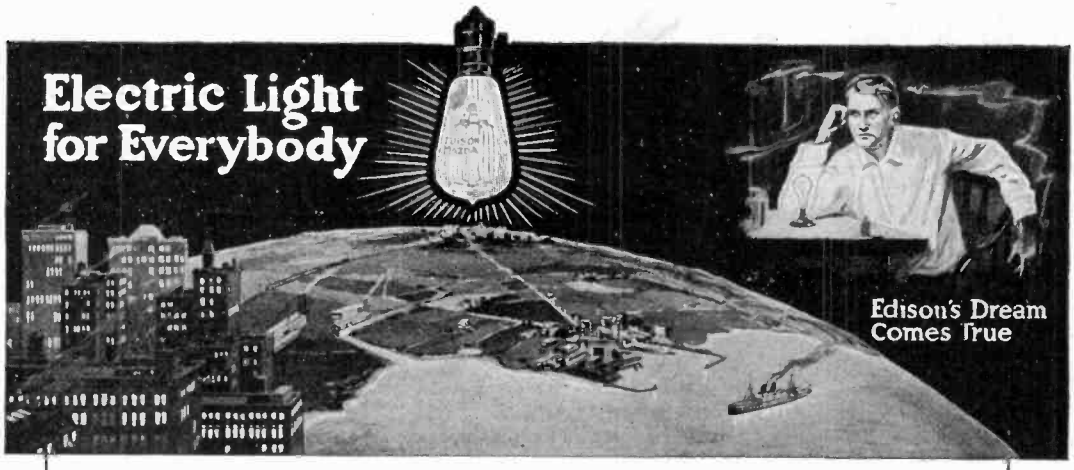

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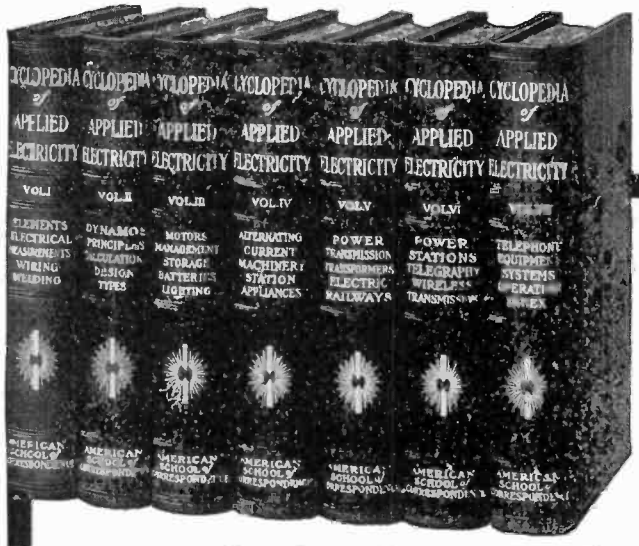

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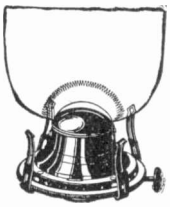

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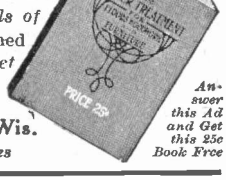

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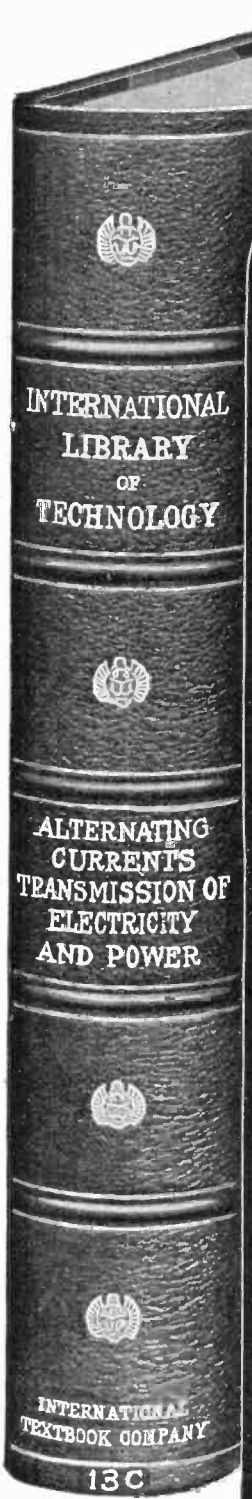

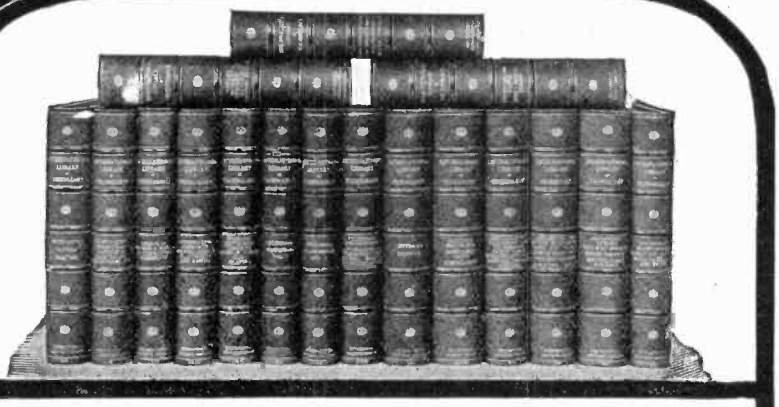

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POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | September, 1912 | No. 5

CONTENTS

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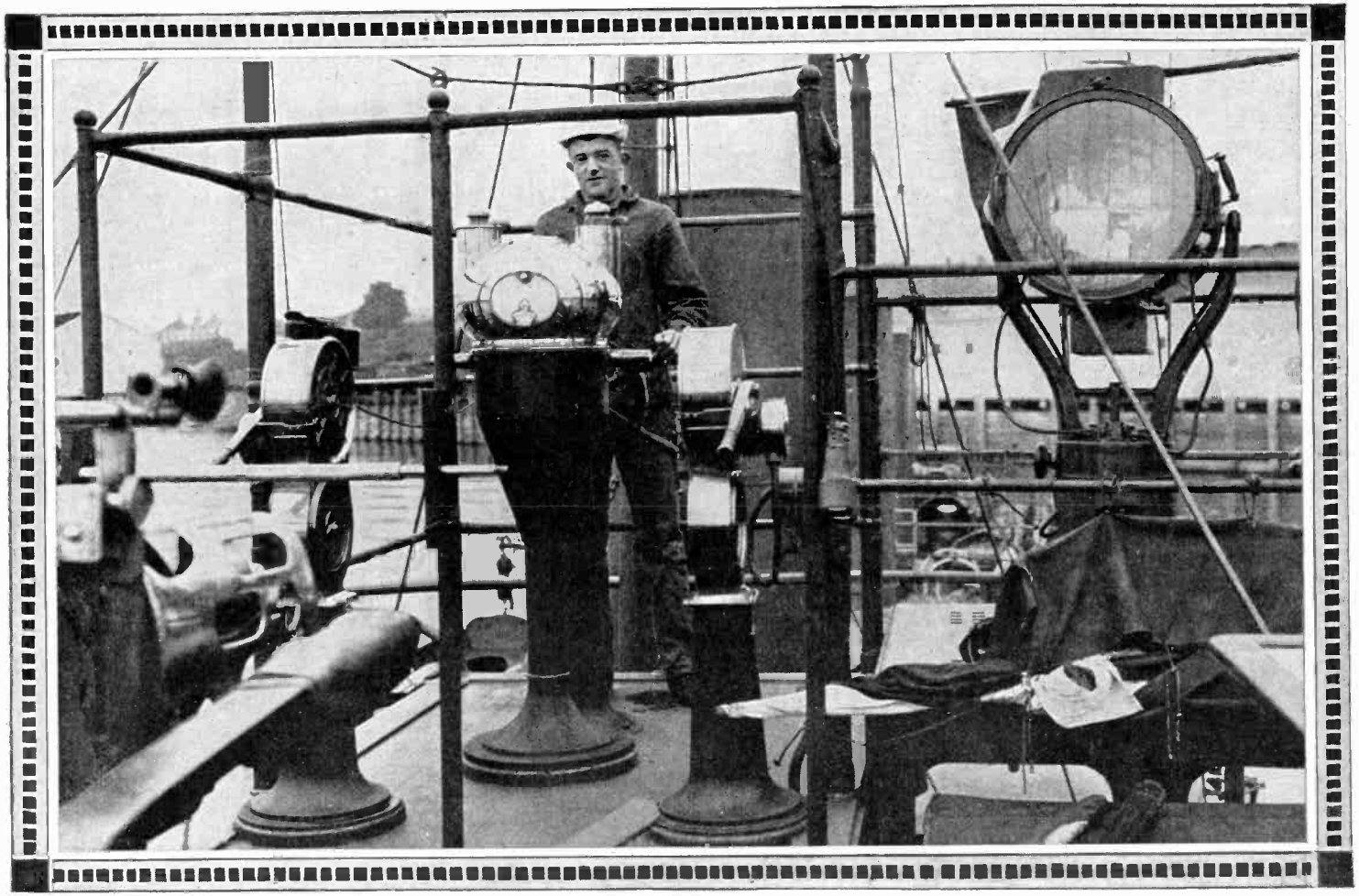
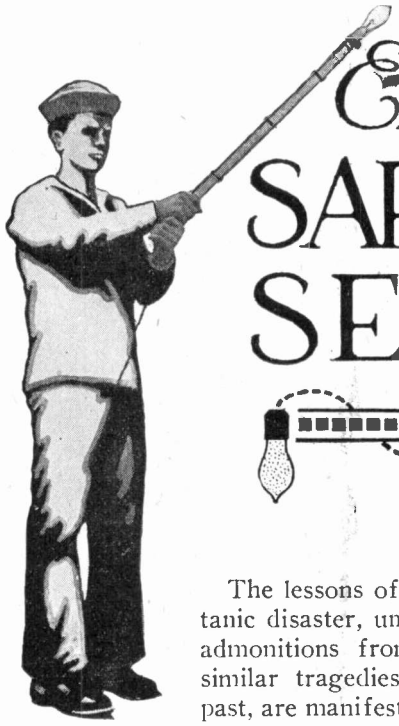


THE ELECTRICAL EYES OF THE SHIP—SEARCHLIGHT SIGNALLING APPARATUS ON BOARD A WARSHIP

Popular Electricity
In Plain English

VOL. V SEPTEMBER, 1912 No. 5

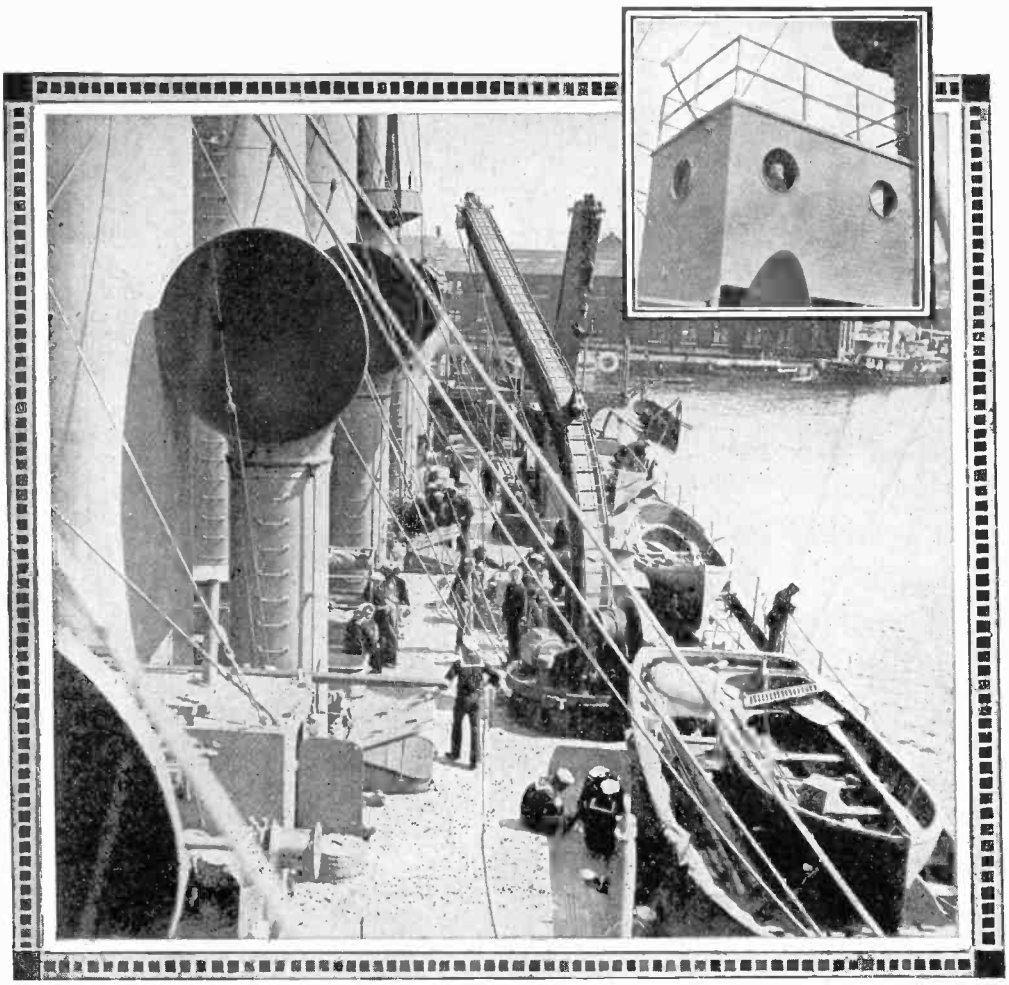


Electricity's Part in SAFEGUARDING SEA-TRAVEL

By WALDON FAWCETT

The lessons of the Titanic disaster, unlike the admonitions from some similar tragedies in the past, are manifestly to be taken to heart. Already we find that the United States Government has acted in the premises. Congress is engaged in stiffening the legislative requirements with reference to the safeguarding of human life at sea; Germany, Great Britain, and other maritime powers are coöperating to standardize the equipment of the merchant marine, and the shipbuilders and vessel owners themselves appear, to be in earnest in an effort to remedy the defects disclosed by the recent catastrophe. However, the deeper the investigation into the subject, the more apparent it becomes that electricity is the force which must be most heavily depended upon to minimize the dangers of navigation.

One utilization of electricity which will certainly be dictated by the costly experience of the Titanic involves the placing of powerful electric searchlights on all large passenger-carrying vessels in the oceanic trade. Indeed, it seems inexplainable and inexcusable that this has not been done before. For years past the searchlights have been considered indispensable on the warships of the American and foreign navies, and they have likewise been used with excellent effect on many steamers on our Great Lakes and on rivers such as the Hudson. To be sure, it is admitted—as per the argument of some of the unprogressive old-timers—that searchlights on ocean liners would be of little aid in a fog, but the Titanic disaster proves that the fog is not



DECK OF A WARSHIP SHOWING DISPOSITION OF LIFEBOATS, WHICH ARE LAUNCHED WITH ELECTRIC CRANES. ABOVE IS THE TYPICAL WIRELESS CABIN

the only menace of the ocean, although perhaps the most dreaded one. A powerful searchlight will, with its finger of light, point out objects from three to five miles distant, and such illumination could not fail to be of the greatest assistance to a vessel when passing through an ice field.

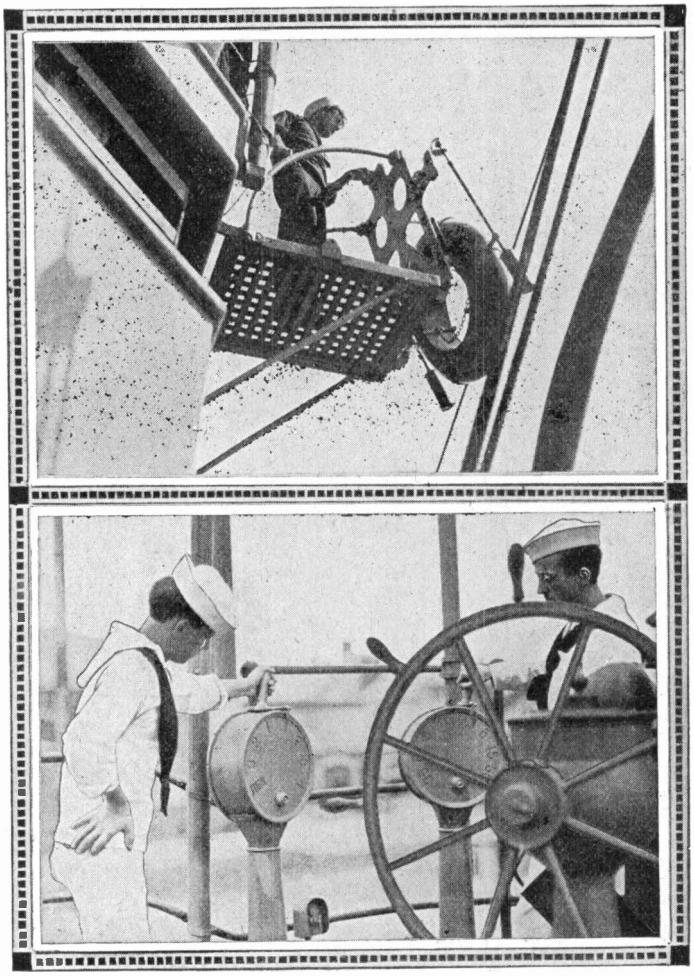
The Titanic disaster but added, of course, to the overwhelming mass of evidence as to the value of wireless telegraphy in the field of navigation. It disclosed, however, opportunities for improvement in the system of operation that were not emphasized by the Republic incident or any of the other dramas of the high seas in which the wireless has had part. One of the newly disclosed needs, quickly reflected by legislation introduced in Congress, was for a continuous wireless service on shipboard,—that is, the employment on each passenger carrying ship of a sufficient number of wireless operators to enable one operator to be on duty at all times to give and respond to warning messages and appeals for help. There is also demand for the installation on ocean liners of more powerful wireless apparatus, having a greater radius of communication than obtains in the case of some of the wireless sets now in service. And, finally, there is much

insistence upon an auxiliary electric power supply, independent of the ship's main electric power plant.

This latter emergency equipment would, naturally, find one of its chief functions in supplying current for the wireless, but there are other considerations which make it desirable for each ship to have surplus electrical resources. The danger of panic, the problems of distributing life belts, the loading of life boats and every other incident of an accident at sea is intensified or complicated if the electric lights are cut off. One of the requirements, then, that has grown out of the Titanic's last moments of darkness is for an auxiliary plant that will supply current for lighting after the regular plant has been put out of commission from any cause, or the operatives have been driven from their posts by fire or by water entering the compartment containing the electrical machinery.

Yet another increased dependency upon electricity is for better and more comprehensive alarm systems on shipboard. It seems to be pretty well established by the evidence that in the Titanic disaster many persons were lost —or, at least, never had a chance for their lives —because no effective general alarm was sounded. Although some of the large trans-Atlantic liners have rather comprehensive alarm systems none of them have installations as elaborate or as efficient as those to be found on our most modern battleships, and which might be copied in some respects most advantageously. The time will probably come when every stateroom aboard ship will be provided with an alarm bell which can be sounded from a common point and which may be used to arouse passengers at night, just as such alarm bells are placed in many modern hotel rooms to enable the sounding of "early rising" calls from the hotel office in accordance with the requests of guests.

Of the services performed by electricity incident to safeguarding life at sea, there is none more important, perhaps,



ABOVE IS SHOWN THE ELECTRICALLY ILLUMINATED LIFE BUOY READY TO BE RELEASED. BELOW IS THE ELECTRICAL SIGNALLING APPARATUS FOR COMMUNICATING BETWEEN WHEEL AND ENGINE ROOM.

than the operation of the watertight bulkhead doors which may be operated individually or collectively from the bridge of the vessel. In this connection it may be mentioned that there has lately been inaugurated an agitation in favor of making these doors smaller in order that they may be more easily operated. In the latest approved system of electrically operated bulkhead doors an electric bell sounds in each compartment that is to be closed for some seconds before the doors close, in order to allow time for the egress of any persons who may be in the compartments. Electric indicators in the chart house or on the bridge also indicate at all times just which doors are closed and which are open.

GENERAL ALARM PHONE ON DECK FOR FIRE AND DANGER SIGNALS

USING THE ARDOIS ELECTRICAL SYSTEM OF SIGNALLING

Fire on shipboard, the dread of the

oldtime mariner, has been robbed of its terrors in a dual sense by the introduction of electricity. For one thing, the use of electricity for illuminating purposes aboard all vessels of any pretensions has greatly decreased the danger from fire. Secondly, fire, if it does occur, is much more quickly detected and more effectually combated, thanks to the magic current. In all parts of the modern ship are located electric thermostats which, when the temperature rises to a point that indicates the presence of fire, automatically sound electric fire alarms and summon the crew from their quarters. Electric fans likewise play their part in preventing fires by aiding in the ventilation of the coal bunkers, thus reducing the danger of spontaneous combustion, etc.

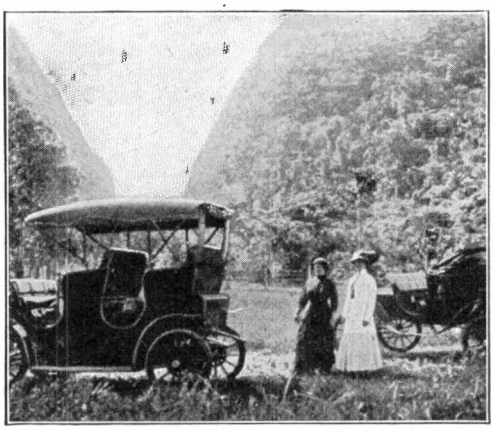
Supplementing the wireless as a means of communication are a number of other electrical signalling systems which are valuable for the interchange of messages at comparatively close range. Most of these are designed for use at night, and they include the semaphore, the electric torch, which makes use of the wig-wag system; the Ardois system, and the electric "blinker" light.

The interior telephone system of the modern ship is an important adjunct of safe navigation, but it may be remarked that the telephones on shipboard are a very different proposition from those with which the average "land lubber" is familiar, since it is necessary to provide on vessels instruments that will transmit and deliver an exceptional volume of sound, owing to the amount of noise (of machinery in operation, etc.) which must be overcome.

Engine room and other telegraphs which annihilate the distance between the bridge and the power plant in the bowels of the ship are likewise important assets in behalf of the cause of safety at sea. Electricity is now utilized to release the life buoys which are cast into the sea when the cry "man overboard" is heard —it being possible under present arrangements to release four or six such buoys simultaneously from the bridge—and it is predicted that the time will come when electricity will also be depended upon to a considerable extent for the launching of life boats. This important task is, under present conditions, dependent largely upon the human equation, and the human equation is always uncertain in an emergency, so that this constitutes to some extent the weakest link in the chain of marine safeguards. Also, if inventive genius in the field of electrical science could but provide a means of exploring fogs and of indicating the proximity of icebergs, the goal of safety at sea would seem to have been reached.

Extremes Meet in the Antipodes

An American lady residing in Manila, P. I., sent her Waverley victoria-phaeton up to Montalban, Province of Rizal, Luzon, for her own use during a fort-



TWO ELECTRICS IN THE PROVINCE OF RIZAL, LUZON

night's visit at that beautiful mountain resort.

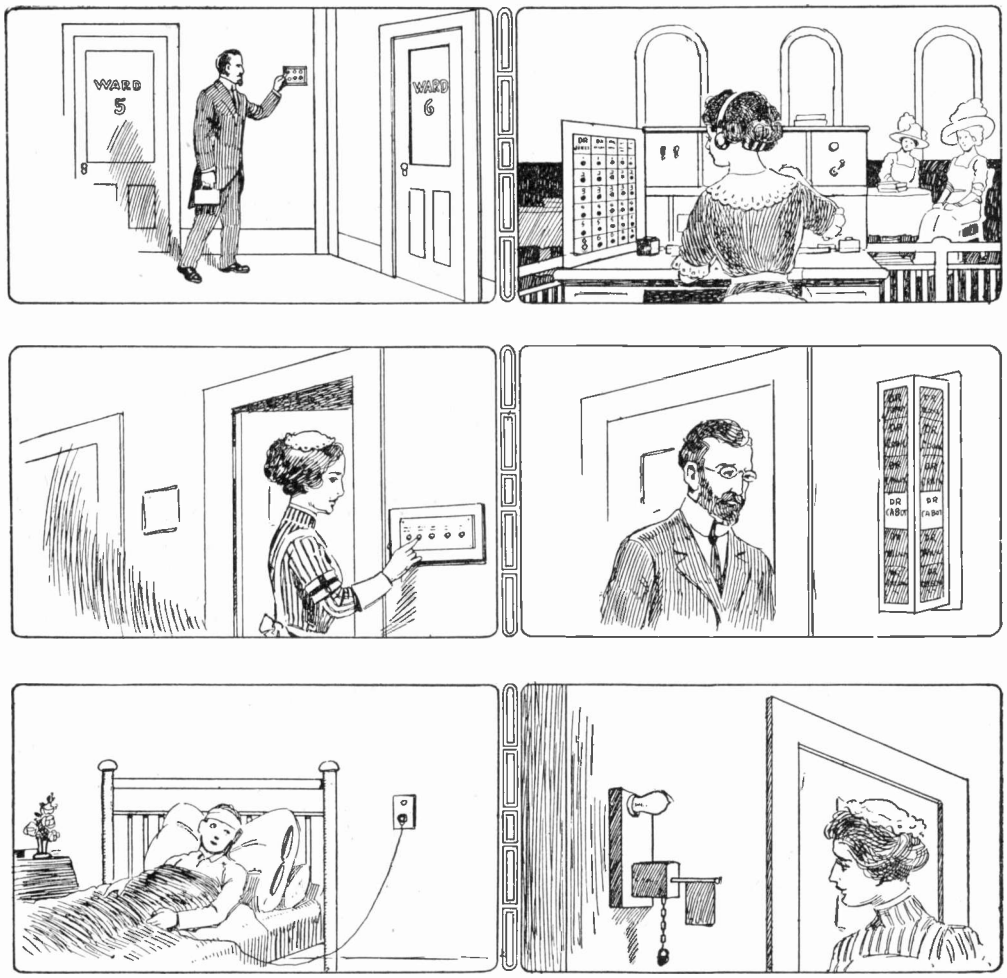
Going for a drive with a friend the day after her arrival, she was surprised and interested to meet another Silent Waverley on a beautiful mountain roadway near the town. On investigation it proved to be a model 60 Waverley surrey, selected by its owner for the sake of its solid construction and large seating capacity.

Hospital Signal Systems

Those engaged in the care of the sick know that prompt response to sudden calls is imperative. In this field electricity has been made to do service by means of signal systems which keep doctors, internes, and nurses in touch with each other and with the patients.

while the drop which shows where he was goes back to place. Should this physician be needed, a nurse telephones the operator, who then calls the doctor.

The doctor may be called also in another way. The nurse presses the button under his name in the nearest button plate in the corridor. This causes the doctor's lamp to light in each lamp an-



HOSPITAL SIGNAL SYSTEM

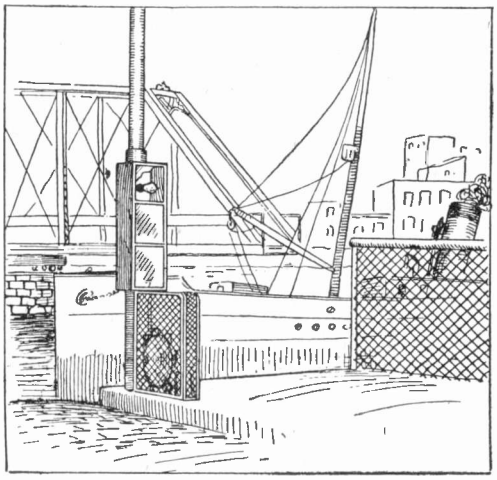
The illustrations show how some of the Holtzer-Cabot hospital signal apparatus operates. A doctor, about to enter a ward, will, in passing a button plate, press his button. This causes a drop on the annunciator at the telephone operator's desk to fall, showing where he is, nunciator in every corridor of the hospital, and the doctor's drop falls on the telephone operator's board, indicating the point where he is needed. The doctor, noting that the lamp indicator has a call for him, telephones the operator and is told where to go.

Should a patient wish to call the nurse, he presses a calling button on the end of a cord from a wall plate to his bed. A drop corresponding to it shows on the nurses' annunciator, the semaphore outside the door of that particular ward or room drops into an exposed position, and the lamp on it lights up. A bell on the nurses' annunciator also rings as long as the patient is pressing the calling button. The semaphore outside the door remains down and the drop in the annunciator exposed, until the nurse answering the call arrives at the door of the ward or room. She pulls the chain and resets the semaphore. At the bedside of the patient she pushes the resetting button, and this restores the drop in the nurses' annunciator and puts out the light.

A Combination Danger Signal

Numerous accidents, resulting in loss of life, have occurred at swing and draw bridges, during the past few years, chiefly owing to the high rate of speed at which automobiles may be driven and with a consequent inability to stop within the necessary distance to prevent the car from plunging to destruction over the abutments.

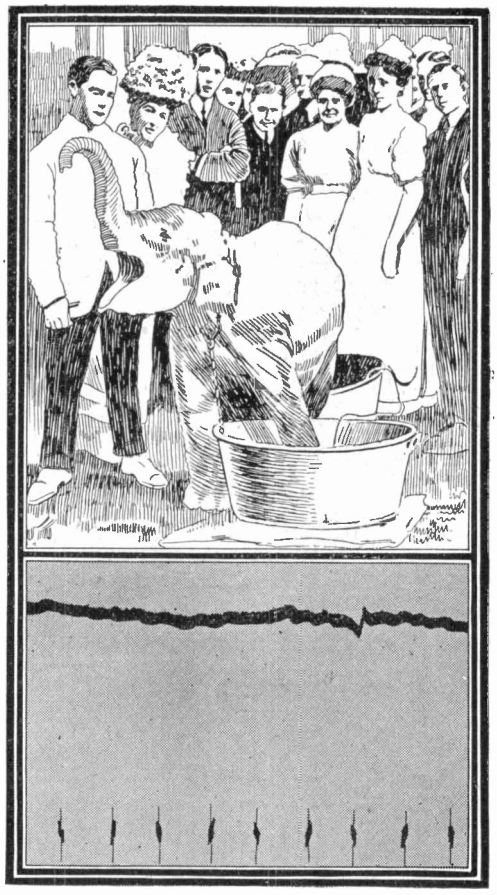
In addition to policemen stationed at its bridges, Chicago has installed a series of red lights and a loud sounding electric bell. Both of these signals operate when the bridge is opened, so that two of the senses, seeing and hearing, are warned of danger when the driver is approaching draw.



DRAWBRIDGE SIGNAL

Baby Jumbo's Heart Beats

"Baby Jumbo," a young elephant owned by an enterprising London newspaper, recently had his heart beats recorded at a hospital. He placed two feet in basins of salt water in which were the terminals of an electric circuit so connected as to make possible a graphic record of the pulsations of his circulatory system. A record of one of the experiments is shown in the lower picture by the wavy line.



HAVING HIS HEART BEATS RECORDED

The Ideal Insulator

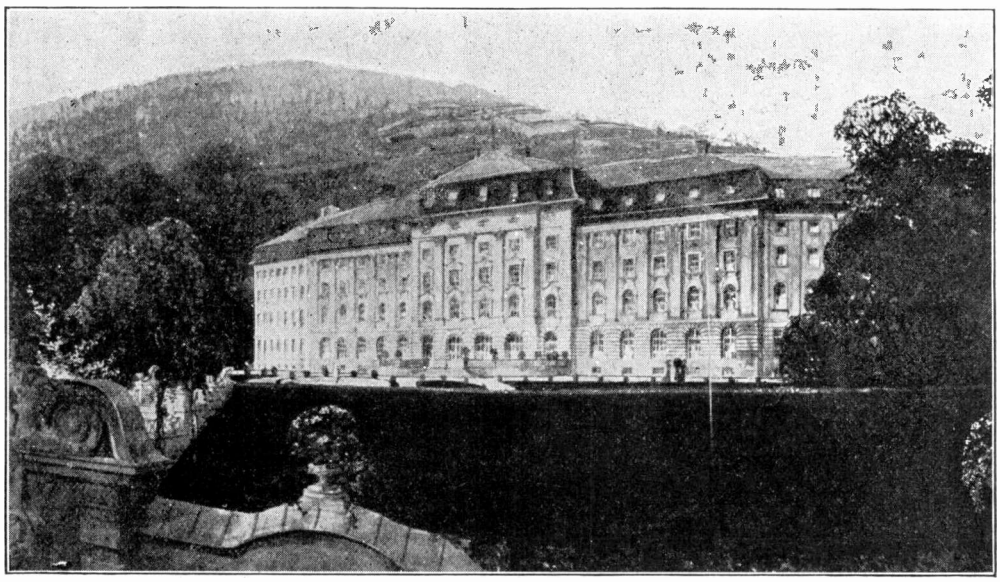
The highest electrical conductivity has hitherto been found always associated with the greatest purity of such metals as copper, silver, aluminum, and iron. These metals are ductile, easily worked, and also conduct heat well. Soft copper, where its tensile stress is not excessive, as in dynamo construction, is also a valuable conductor. In the case of exposed wires, however, it is necessary to use hard drawn copper, even at a loss of two per cent in electric conductivity.

Insulating materials which are enduring, resistant to exposure, strong and available for manipulation, are rare. Glass is too brittle for heat, cold, and mechanical stresses. The properties of insulators really indicate that electrons have difficulty in jumping from atom to atom. Unfortunately, this often is a concomitant of brittleness. This same defect of handling electrons from one atom to another explains why most insulators are heat conductors. This shows a remarkable similarity between substances classified as thermally and electrically conductive.

It is not yet known upon what conditions within a material its insulating capability depends. Both physical and chemical changes play a part in the making of insulators. It is therefore within the realms of reason to expect some time an insulator that will be durable, unweatherable, noncombustible, elastic, pliable, workable, germ proof, moisture proof, thermal proof and cheap.—Dr. Leonard Keene Hirschberg.

Hotel for Radium Bathers

St. Joachimsthal, the radium town of the world, in northwestern Bohemia, became famous soon after the discovery of this mineral by Professor and Madame Curie. Immediately following the knowledge of the curative properties of radium, a large hotel-sanatorium, here shown, was built in the town. The building is capable of housing 400 people, while an annex containing 50 rooms provides additional accommodations. Every means for bathing in the radium carrying waters is afforded, which, with the elevation of 2,100 feet above the sea level, makes it a much sought resort. The sanatorium rooms are provided with hot and cold water and a telephone. There



HOTEL IN ST. JOACHIMSTHAL, THE RADIUM TOWN

is an open air dining room, a billiard parlor, music room, reading and writing room, winter flower garden, stenographers to care for correspondence, and postoffice and telegraph facilities.

The Electrical Directory

A street corner directory which operates by electricity is the invention of a Los Angeles man, who expects to place it on the busiest corners of the city and in hotels and railroad stations. The device looks like a large letter box,

STREET CORNER DIRECTORY

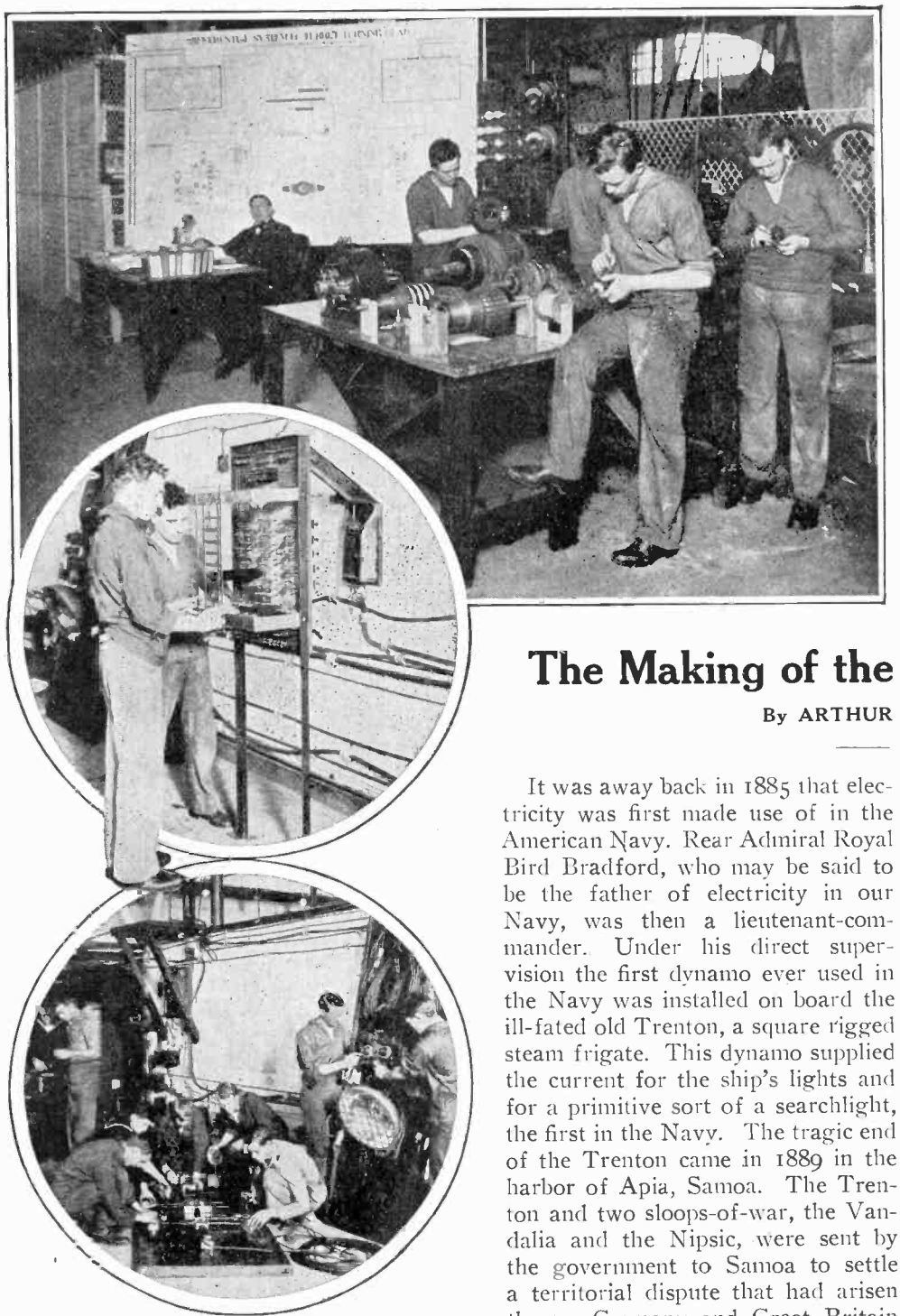
is of metal and is 34 inches high, 24 inches wide and ten inches deep. A square of glass measuring 21 inches is set in the front of the box, and behind it is displayed a tape of equal width on which is printed a business directory. The tape is reeled on drums above and below the glass and is divided into 21 sections, each containing a list of all the firms engaged in certain lines of business. A row of push buttons on the lower part of the device is labeled with a corresponding list, as, "dry goods," "groceries," etc., and by pressing one of these buttons the reels unwind until the desired section is brought into view. Current from the commercial lines is used for operating and lighting the device.

Besides a complete business directory (in which names are inserted free), there is space for display advertising, and this will pay cost of operation and the owner's profit, as each machine contains 8,800 square inches which should sell at a good price to local merchants. In addition to the regular directory feature, the device will give information of value to tourists and strangers in the city, regarding car lines, amusements, hotels, etc. No charge will be made to the public for its use.

Mine Mules and the Trolley Wire

Mine locomotives ordinarily operate at 250 or 550 volts on the trolley system, the rail being used as the return circuit. The trolley wire is strung well to one side of the entry (usually several inches outside the rail) in order to safeguard the passers-by. In many cases the entries are not more than six feet high, sometimes less than that, and a 500 volt trolley wire is not a comfortable thing to have near one's head in a dimly lighted passage with a very uneven floor, especially when rapid movement is occasionally required in dodging passing cars.

Mules, which in some mines are used for "gathering" (drawing the loaded cars from the rooms to the electric haulage track), are very sensitive to electric shock and in low entries their long ears are a source of annoyance; to the mules for obvious reasons and to the mine owner because a good mule costs over $200. When mules are worked around an overhead trolley a sort of hood or cap is placed over their long ears and tied down on their necks so as to reduce to a minimum the chances for contact with the electric circuit. A mule that has received an electric shock is (if he survives) very restive near the trolley wire and uses all his intelligence to avoid it.

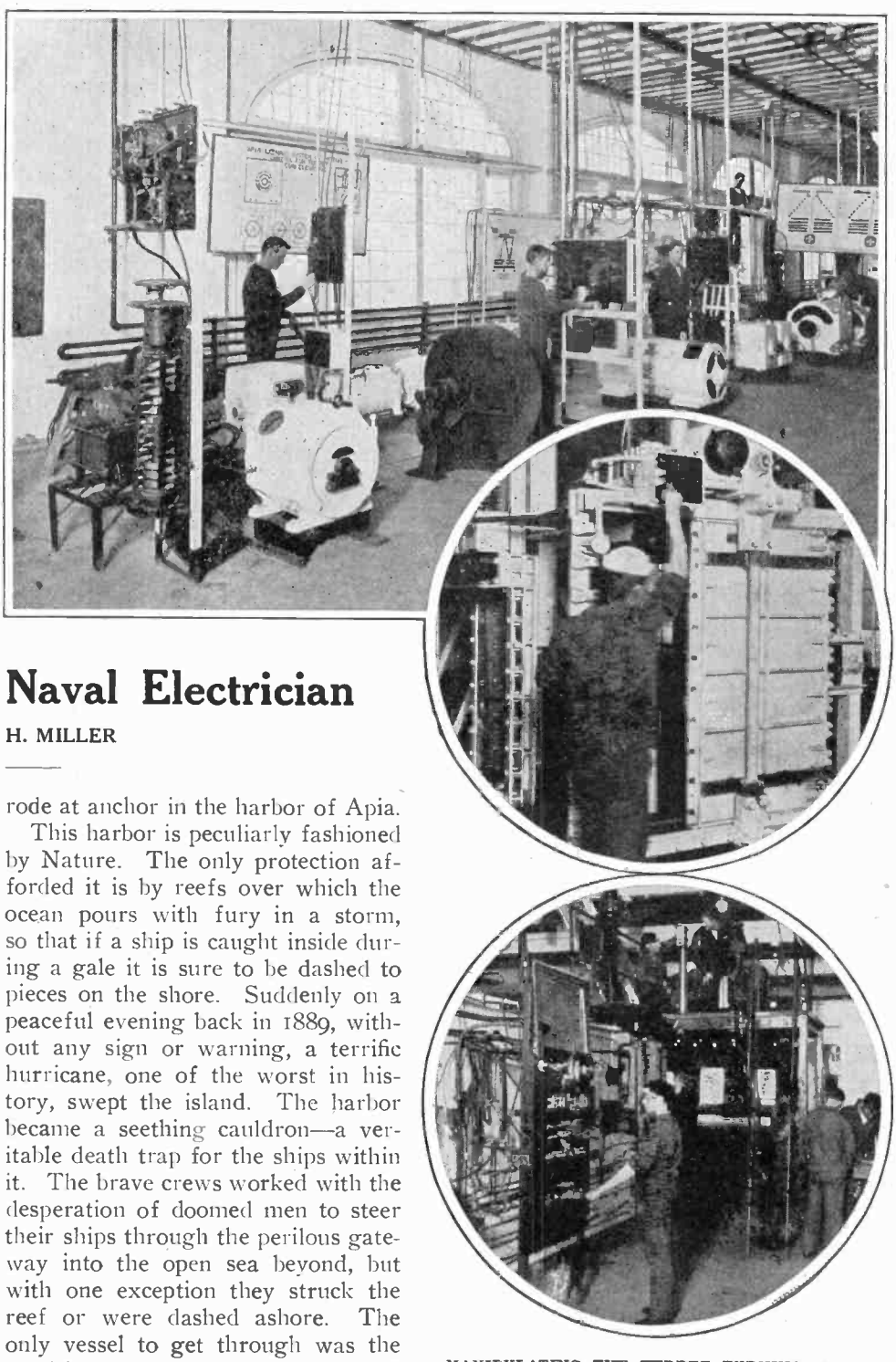


WINDING ARMATURES AND OTHER EXPERIMENTAL WORK IN THE BROOKLYN NAVY YARD SCHOOL

The Making of the

By ARTHUR

It was away back in 1885 that electricity was first made use of in the American Navy. Rear Admiral Royal Bird Bradford, who may be said to be the father of electricity in our Navy, was then a lieutenant-commander. Under his direct supervision the first dynamo ever used in the Navy was installed on board the ill-fated old Trenton, a square rigged steam frigate. This dynamo supplied the current for the ship's lights and for a primitive sort of a searchlight, the first in the Navy. The tragic end of the Trenton came in 1889 in the harbor of Apia, Samoa. The Trenton and two sloops-of-war, the Vandalia and the Nipsic, were sent by the government to Samoa to settle a territorial dispute that had arisen there. Germany and Great Britain also sent ships, so that the pride of the strongest navies of the world



MANIPULATING THE TURRET TURNING, WATER TIGHT DOOR AND SIGNAL APPARATUS

Naval Electrician

H. MILLER

rode at anchor in the harbor of Apia.

This harbor is peculiarly fashioned by Nature. The only protection afforded it is by reefs over which the ocean pours with fury in a storm, so that if a ship is caught inside during a gale it is sure to be dashed to pieces on the shore. Suddenly on a peaceful evening back in 1889, without any sign or warning, a terrific hurricane, one of the worst in history, swept the island. The harbor became a seething cauldron—a veritable death trap for the ships within it. The brave crews worked with the desperation of doomed men to steer their ships through the perilous gateway into the open sea beyond, but with one exception they struck the reef or were dashed ashore. The only vessel to get through was the British sloop-of-war Calliope, and as she passed the floundering Tren-

OFFICERS AND INSTRUCTORS OF THE ELECTRICAL CLASS—AT THE RIGHT, SITTING, IS COMMANDER GEORGE F. COOPER AND BESIDE HIM IS GUNNER E. STUART TUCKER, ASSISTANT

ton on her way to sea the Trenton band struck up "God Save the Queen," the Calliope's band replying with "Star Spangled Banner." The sailors of both ships manned the rails and cheered. The Trenton and the Vandalia were wrecked on the reef and the Nipsic went ashore.

Rear Admiral Bradford was made Chief of the Bureau of Equipment in 1897, and he bent his best efforts toward opening up the wonderful future he saw for electricity in the Navy. Up to that time there were no electricians in the Navy. Electricity was used on some of the ships, but was considered more of a luxury than a necessity. Dynamos were then operated by gunners' mates, who were graduates of the seaman gunner's class.

In 1898 Assistant Secretary of the Navy Theodore Roosevelt issued a general order creating a rating for electricians and in the same year the electrical school, at the Brooklyn Navy Yard, had its inception. It now ranks as one of the leading institutions of its kind in the world. The demand for electricians in the Navy has increased so rapidly that it is all the school can do to meet it. On the modern battleship electricity swings the great turrets, lights the entire vessel, including the searchlights and Ardois signals, operates the wireless, does the ventilating, runs the pumps, cooks, opens or closes the water tight doors, sews and does many other things besides.

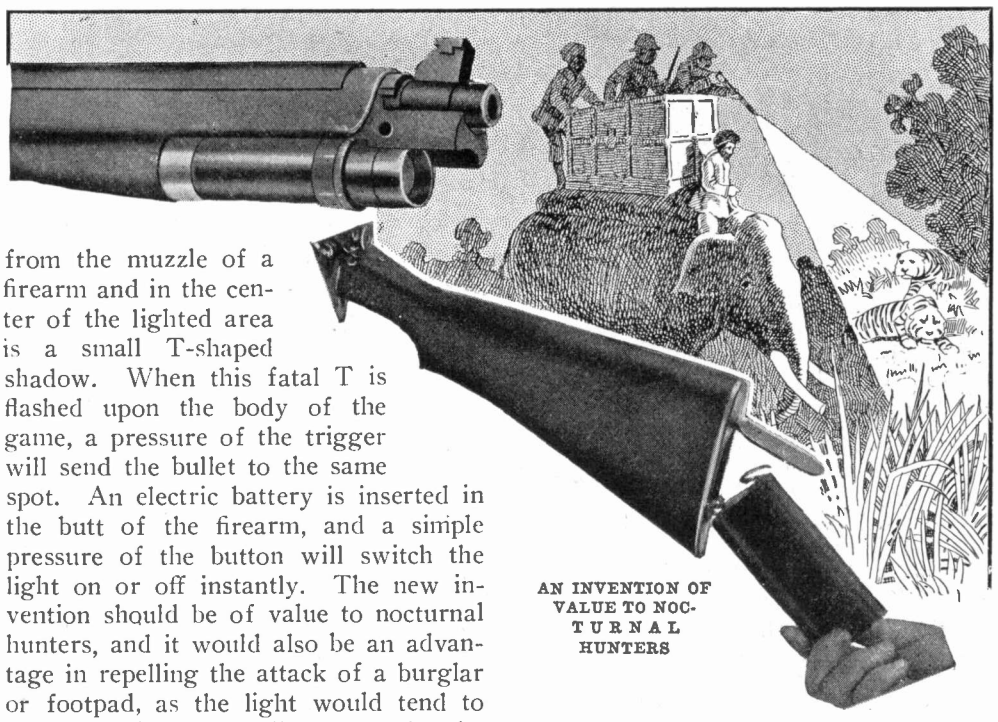
The electrical generating apparatus of the ships which last October assembled in the Hudson River had a combined power of 19,470,000 watts or 26,000 horsepower, which is capable of lifting 429,000 tons a foot a minute. In other words, it can lift all at once fourteen superdreadnaughts, such as the Florida, over the Metropolitan tower in less than twelve hours. These figures are based on an estimate compiled by a prominent Navy official who was present at that greatest mobilization of battleships in the history of the world.

The generating apparatus of the various ships varies, of course, very greatly with the size of the vessels. The superdreadnaughts carry an equipment of four 300 kilowatt generators, equivalent to upwards of 1,608 horsepower. This is in addition to the emergency apparatus. In the crews of these latest terrors of the deep are from 35 to 40 skilled electricians.

Supervising and operating all this electrical machinery requires skill of a high order and the teaching in the naval schools must be thorough. The pictures herewith are calculated to show the kind of practical work which an electrician of the Navy must go through with before he is fitted to take his place.

A Searchlight for the Rifle

A searchlight which enables a marksman to aim accurately at night has been devised by an Englishman, Mr. Morrison Bourke. It consists of a flashlight which sends a bright pencil of illumination from the muzzle of a firearm and in the center of the lighted area is a small T-shaped shadow. When this fatal T is flashed upon the body of the game, a pressure of the trigger will send the bullet to the same spot. An electric battery is inserted in the butt of the firearm, and a simple pressure of the button will switch the light on or off instantly. The new invention should be of value to nocturnal hunters, and it would also be an advantage in repelling the attack of a burglar or footpad, as the light would tend to disconcert him, as well as to make the aim quite certain.



AN INVENTION OF VALUE TO NOCTURNAL HUNTERS

The device, as noted in the picture, is very compact and does not interfere in the least with the operation or cleaning of the weapon.

Coal Mines Turned Into Gas Retorts

At the opening of the Smoke Abatement Exhibition in London last spring, Sir William Ramsay referred to the ideal state of things that would exist if we had gas retorts in the mines, adding that there was nothing, so far as he could see, to prevent a borehole from being put down until the coal substratum was reached, concentric tubes being used to set the coal on fire by electricity. Air would be blown down to enable the coal to burn as a preliminary operation. Sir William elaborated his idea thus: "When sufficient heat has been engendered, the amount of air sent down can be restricted. Coal with plenty of air gives carbon dioxide. When partially burned it gives carbon monoxide, which is used for gas engines. If steam were blown in, it would give a mixture of hydrogen and carbonic oxide, or water gas, which also is used frequently in gas engines.

"Bring gas engines to the mouth of your pit or borehole, and produce your power there. You would thus save 30 per cent of the energy of the coal available, as against 15 per cent available in fuel engines.

"That energy might be transformed into electricity at the mouth of the borehole and you could distribute it throughout the country, wherever you like. In this way you would get electricity available for lighting and heating, your railways would be worked by electricity, and the only fuel you would require would be oil for ships."

Rules Recommended by Resuscitation Committee

Following are the rules which have been recommended by the Commission on Resuscitation from Electric Shock representing the American Medical Association, the National Electric Light Association and the American Institute of Electrical Engineers:

FOLLOW THESE INSTRUCTIONS EVEN IF VICTIM APPEARS DEAD

I. IMMEDIATELY BREAK THE CIRCUIT

With a single quick motion, free the victim from the current. Use any *dry non-conductor* (clothing, rope, board) to move either the victim or the wire. Beware of using metal or any moist material. While freeing the victim from the live conductor have every effort also made to shut off the current quickly.

FIGURE 1—INSPIRATION; PRESSURE OFF

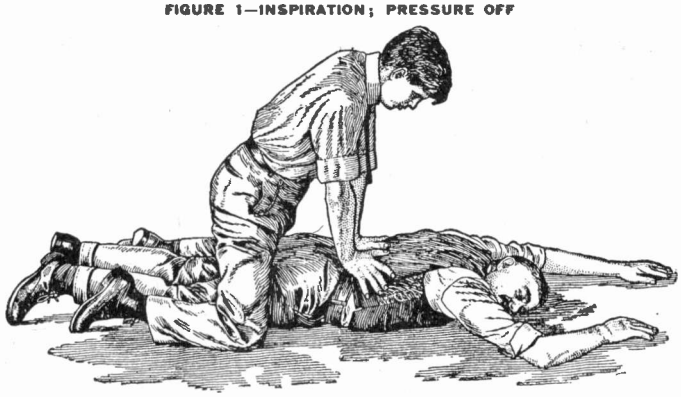


FIGURE 2—EXPIRATION; PRESSURE ON

II. INSTANTLY ATTEND TO THE VICTIM'S BREATHING

1. As soon as the victim is clear of the conductor, rapidly feel with your finger in his mouth and throat and remove any foreign body (tobacco, false teeth, etc.). Then *begin artificial respiration at once.* Do not stop to loosen the victim's clothing now; *every moment of delay is serious.* Proceed as follows:

(a) Lay the subject on his belly, with arms extended as straight forward as possible and with face to one side, so that nose and mouth are free for breathing (see Fig. 1). Let an assistant draw forward the subject's tongue.

(b) Kneel straddling the subject's thighs, and facing his head; rest the palms of your hands on the loins (on the muscles of the small of the back), with fingers spread over the lowest ribs, as in Fig. 1.

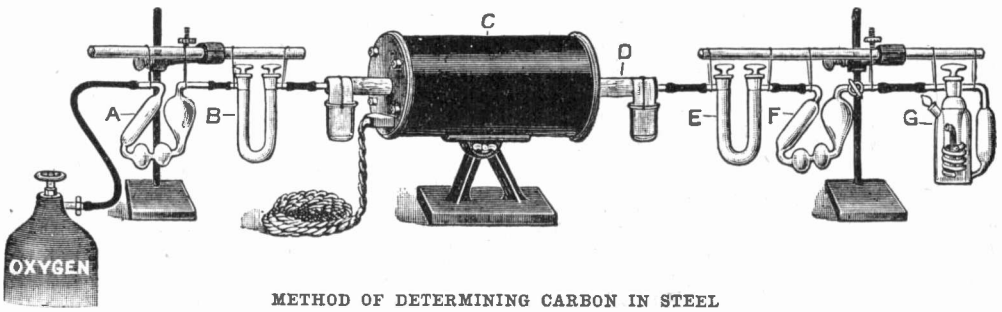
(c) With arms held straight, swing forward slowly so that the weight of your body is gradually, but *not violently,* brought to bear upon the subject (see Fig. 2). This act should take from two to three seconds. Immediately swing backward so as to remove the pressure, thus returning to the position shown in Fig. 1.

(d) Repeat deliberately twelve to fifteen times a minute the swinging forward and back — a complete respiration in four or five seconds.

(e) As soon as this artificial respiration has been started, and while it is being continued, an assistant should loosen any tight clothing about the

subject's neck, chest or waist.

2. Continue the artificial respiration (if necessary, at least an hour), *without interruption,* until natural breathing is restored, or until a physician arrives. If natural breathing stops after being restored, use artificial respiration again.



METHOD OF DETERMINING CARBON IN STEEL

3. *Do not give any liquid by mouth until the subject is fully conscious.*

4. Give the subject fresh air, but keep him warm.

III. SEND FOR NEAREST DOCTOR AS SOON AS ACCIDENT IS DISCOVERED

The Great Proctor Theater Sign In New York

At Proctor's One Hundred and Twenty-fifth Theatre, in New York, the Fourth of July was celebrated by the lighting of one of the largest electric theatre signs in the world, the same being a gigantic "P" with the letters of the word "Proctor" running down the stem. The total height of the sign is 90 feet and the height over the roof is 67 feet, with the width over the roof, 30 feet.

For those technically inclined it may be added that the sign required 50,000 feet of circuit wires to connect 262 separate circuits. Four thousand lamps and fifteen tons of iron were used in the construction, the letters inside the stem of the "P" being four feet six inches high. The cost of the whole affair was over $10,000, and the sign can be seen for many miles around in Jersey, the Bronx and Long Island.

Combustion Train Determines Carbon in Steel

A modern apparatus is here shown as used in steel works laboratories for the determination of the amount of carbon in steel. Drillings from samples of iron or steel are placed in a combustion boat which is in turn placed inside of the combustion tube in small electric furnace (C).

Oxygen is then introduced into this tube, having been first purified by running through the bulbs (A) and (B), which contain caustic potash solution for removing carbon dioxide and calcium chloride for the purpose of absorbing all moisture.

The temperature maintained in the furnace is about 1,750° F. The steel drillings are burned in the oxygen and the carbon uniting with the oxygen forms carbon dioxide (CO_2).

As the gas emerges from the tube it passes through some granulated zinc into tube (E) where traces of sulphur are removed; then through bulb (F), which is filled with sulphuric acid to remove moisture. Tube (G) is a specially designed double bulb filled with granulated caustic potash on the inside and caustic potash solution on the outside. This caustic potash absorbs all of the carbon dioxide.

The bulb having been formerly weighed is now weighed again and by calculating the weight of the sample and the difference in weight of the bulb before and after the combustion, the amount of carbon in the steel is determined.

Bringing Water to New York from the Catskills

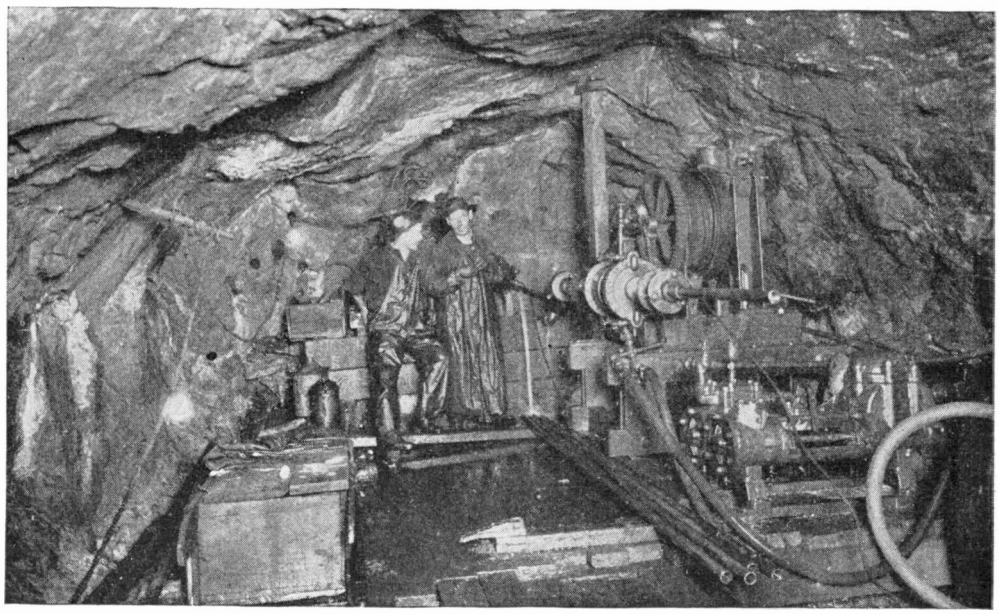
By EDWARD LYELL FOX

Under the very feet of the city, hundreds of feet below the pavement, through solid rock the great tube is boring its way; nearly eighteen miles from a point beyond the city limits, down through the outlying borough of the Bronx, under the Harlem River, through the maze of subways and sewers in Manhattan and thence under the East River to Brooklyn—an engineering feat the like of which has never been attempted before. And it's going to cost $25,000,000 before the water from the new Catskills sheds goes churning through it—pure, wholesome water from the mountains, 500,000,000 gallons a day, that New York must have to drink. But consider now that this great project is possible only because of electricity.

As an engineering proposition it would be impossible were it necessary to use steam engines, steam pipe or compressed air lines instead of the electro-pneumatic apparatus and other mechanical appliances driven by electric power. The limited space, the demand for speed, the necessity of compactness make it imperative that the smaller yet more efficient electrical apparatus be used. And for the same reasons the great tunnel must be lighted by electricity by thousands of tiny bulbs that burn steadily and brightly. These are not my opinions, they are the opinions of engineers.

MAYOR GAYNOR OF NEW YORK TOUCHING THE SWITCH WHICH WILL BLAST THE REMAINING SECTION OF ROCK BETWEEN THE EAST AND WEST HEADINGS OF THE HUDSON RIVER DIVISION. WITH HIM ARE COMMISSIONERS CHADWICK, GALVIN AND STRAUSS, AND POLICE COMMISSIONER WALDO.

The passerby at Broadway and Twenty-fourth Street, noticing temporary small buildings of rough wood, remarks casually: "Tearing up the streets again"—and walks on. For days I passed this same place, said about the same thing—if I happened to be with anybody—and walked on. Then came a day when a young engineer was my companion and as the planking reared into sight above the pavements he asked: "Been over there?"



A SOUND GATHERED HARSHLY INTO THE CLATTER OF DRILLS—THE SNARLING CONTACT OF STEEL ON ROCK

Upon being answered in the negative, he said:

"Well, it's time you went. Come on!"

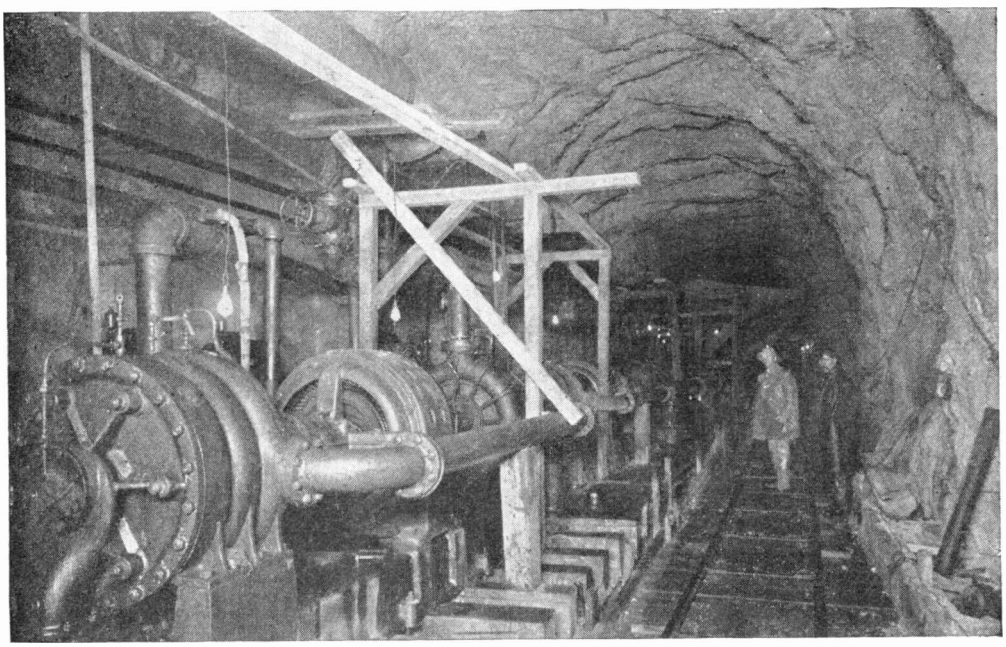
Later he was dumfounded to learn that I didn't know the rough structures to be the head of one of the most important shafts along the line of the tunnel. At a gate in the tall fence he met another engineer, a friend luckily, and our descent into the tunnel was arranged.

I've never been down into a mine but my guide saying the shaft was like one he used to enter in Idaho, I believed him. You could have believed anything of that place. Down, down we went, the dampness growing about us, unpleasant odors thickening, and a faint rumbling becoming more and more sonorous. Then we stepped from a ladder into what appeared to be a shelf in the rock and saw below us the confusion of tunnel building. And what confusion it appeared at first sight! Men lurched through the darkness, bending their heavy bodies to the weight of tools and apparatus. Over them lights burned balefully, casting an unhealthy yellow glow on their heavy features. Like specters of another world they passed, silhouetted a moment against the yellowish glare, darkening into shadow and vanishing.

We moved along the ledge and behind an overhanging rock. I noticed the strings of wires about me, bearing light from one end of the job to the other. My companion told me that the regular city power was tapped by every job. Then I saw two rows of rails, yellow, too, in that uncanny light, cast down among the shadows, like worms spread out on their backs. And from afar there came

a rattling, a sound of wheels turning, of men breathing heavily and stumbling. Then more "muckers" appeared, lurching along like the dripping car they were pushing.

The engineer beckoned; I followed him further along the ledge, walking until it seemed as if the air was growing darker, the light dimmer. I touched my forehead—it was damp like the rocks beside the men. And as we walked, a impudent jingle in that clamor. Then a foreman hastened to a wooden post, jerking down the receiver from a telephone. Blocks away at the other end of the job another foreman was calling him and for a minute they talked, deciding something about the work, that had there been no telephone might have wasted fully half an hour by trips back and forth. Then my friend called attention to the electric pumps, stiff with the



ELECTRIC PUMPS, STIFF WITH THE POTENTIALITY OF POWER, WAITING IN THE SHADOW FOR A MOMENT OF NEED

sound, faintly audible at first, gathered harshly into the clatter of drills—the snarling contact of steel and rock.

Then I learned that the drills were electro-pneumatic and that the tangle of pipes were the feeds that came from an apparatus above. But as we stood watching the drillers, I noticed that there was a certain orderliness to the confusion. Each vague form was performing his task—mucker, driller, Boss—was but a unit in the unseen machine that untiringly, relentlessly was eating its way through eighteen miles of rock.

Suddenly there sounded about the confusion of it all the jingle of a bell—an potentiality of power, waiting in the shadows for a moment of need.

There are 24 of these shafts strung along the path of the bore—the eighteen mile path from above the city limits to the borough of Brooklyn. And all of them are vibrating with the power of the electric current. For the most part they're in the public parks—St. Nicholas, Morningside, Central, Bryant, Fort Green—that the route passes under, and at street intersections. As the park drives are lighted by electricity, the supply is available there, too. From the bottom of these shafts, the sections of the tunnel are being driven in two direc-

tions. Thus the sections from adjacent shafts upon meeting will form the continuous tunnel, that will bring a river of drinking water through to New York daily.

"No doubt," my companion began, "you noticed the completion of the tunnel under the Hudson River above West Point. It is 1,100 feet below sea level and was the last physical difficulty between the Ashokan reservoir and the city line at Yonkers. At Yonkers the water is held by the Hill View reservoir. This, a distributing station 295 feet above sea level, will feed the tunnel that we just left."

Now let us see some of the problems that had to be overcome before a stroke of work was done and the peril that daily menaces the workers, sometimes 200, sometimes 700 feet underground.

"When the problem of how to distribute Catskill's daily supply of 500,000,000 gallons of water first came up," one of the general superintendent's engineers told me, "the ways of solution were seen to be only two. One was to carry the supply in metal pipes laid in the streets close to the surface; the other was to build a tunnel through rock. The cost of the first plan was tremendous. Incidentally it would have made little use of electrical apparatus. It was estimated at $47,000,000. Thirty-two 48 inch pipes or sixteen 66 inch pipes would have been necessary to transport the daily flow and deliver it at the desired elevations.

"On the other hand the tunnel plan was estimated to cost $10,224,000. That was in 1905. Since that another estimate was made placing the expenditure at $25,000,000. This is not a great price to pay when one considers that the tunnel will distribute half a billion gallons of water a day in the simplest and safest manner that man has ever devised. The tunnel, about large enough to permit a subway train to pass through it, is being excavated at from sixteen to eighteen feet in diameter. Being lined all around by a foot of concrete, however, the finished bore will be on the average two feet less. Located from 200 to 740 feet below the street level, the tunnel will be lower than any subway, even tiers of subways, that New York may build. The principal reason for this great depth is that the engineers wanted to bore through solid rock. They figured it easy with electrical apparatus. All sewers, gas, water mains, ducts and other tunnels will always be above it. It is all very easy when you consider it as one great plan.

Mayor of Wheeling in His Decorated Electric

Mayor Charles C. Schmidt, of Wheeling, W. Va., was in a recent floral parade in his home town. The decorated auto-

MAYOR IN A DECORATED ELECTRIC AUTO

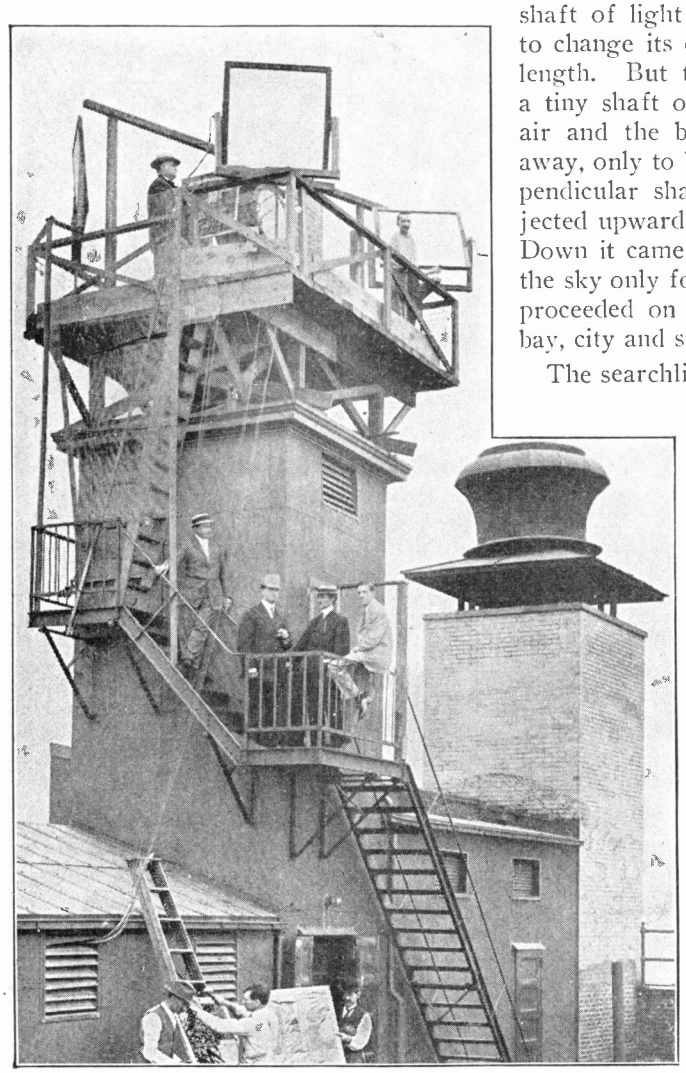
mobile in which he is seated is a Silent Waverley Electric.

Though the Mayor is an aggressive figure in the local politics of his community, it will be seen that his natural instincts incline to peace, since the dove of peace is the principal emblem on the car.

Novel Searchlight Advertising in Baltimore

National Democratic Convention visitors and all Baltimoreans out on the street after dark were familiar with the brilliant, startling, ever-changing searchlight effects, in white light and in color, that were flashed nightly from the top of the new Fidelity Building.

In these novel effects first came the huge majestic fantailed beam of pure white light that flashed out over Baltimore city, the bay and the distant suburbs. With movement for all the world like the arm of an immense giant, this big solid white beam radiated outward and, with the Fidelity Building as a centre, marked, once a minute, its wonder-circle about the city.



SEARCHLIGHT WITH NOVEL PROJECTOR

Then something happened. Suddenly the big beam was seen to change as it swept along. Now it quivered with the rapidly changing, vibrating color. Red and green, orange, pink and yellow and back again to white. All these had their turn and still the big beam swept on. But this was not all. Again, the great shaft of light was seen, chameleon-like, to change its color throughout its entire length. But this time it broke in two, a tiny shaft of light darted up into the air and the big horizontal beam faded away, only to be replaced by a great perpendicular shaft of changing light projected upward into the sky at the zenith. Down it came again. It had been up in the sky only for an instant, when it again proceeded on its long journey over the bay, city and suburbs.

The searchlight proper which had been courteously placed at the disposal of The Fidelity Trust Company of Baltimore by the Consolidated Gas, Electric Light & Power Company, was mounted as shown in the picture in the center of a supporting platform. This platform surmounted one of the elevator houses on top of the building. The searchlight thus found a setting on one of the highest points in Baltimore.

The apparatus in its entirety consisted of the supporting platform, the searchlight proper, a motor in the base of the searchlight for revolving it, four large light oscillators, or projectors, and the coloring apparatus.

The searchlight proper had a diameter of 24 inches, i. e., it threw a beam of light 24 inches in diameter. The motor in the base of the searchlight was run by the same source of current that fed the light. But it was started and stopped without in any way interfering with the light itself. The angle of the beam of light was easily adjusted by hand and the lamp locked into position by a thumb nut.

A glance at the picture will reveal that the projectors are located one at each of the four corners of the platform railing. Each projector, or oscillator, is carried by a supporting frame of peculiar construction. These frames are so built that any one or all of the four projector oscillators may be set at any angle desired relative to the beam of light. Or, any or all the oscillators may be revolved on the bearings and at the same instant be swung about.

Directly over the center of the searchlight is hung the horizontally revolving color mechanism. This device produces and varies the four colors in the beam.

Assume, for instance, that the searchlight makes one turn, horizontally, about the horizon per minute and that the projectors are set stationary and at a right angle. With the apparatus thus arranged the big white beam would first sweep along horizontally until it struck the first projector-oscillator. It would now begin to split and part of the beam would dart up perpendicularly into the sky. In a moment the entire beam would be, literally, "up in the air." Then a portion splits off and darts out horizontally, only to be followed in an instant by the full white beam, which then proceeds on its way to the next projector.

With the searchlight thus working automatically in connection with the inclined projectors, the operator now rotates his color mechanism. Instantly the beam, whether horizontal, split or perpendicular, becomes alive with scintillating varying color.

Further, if the operator so desires, any or all of the projectors may be oscillated so as to throw the beam, as it travels over them, backwards and forwards across the heavens; or any projector may be rotated with the searchlight stationary so as to throw or swing beam after beam, so to speak, in quick succession across the sky and down on to buildings, etc. Or the beam, filled with one color or full of scintillating color, may be turned on to the street to illuminate processions, floats, etc.

This novel searchlight apparatus was designed by Frank L. Perry, of the executive staff of the Fidelity Trust Company.

An Insidious Loss that Invites Attack

"The whole electrical industry is now tied to the silicon-iron alloy." So remarked Mr. W. R. Whitney in an address before the National Electric Light Association. "The highest grade transformers make use of an alloy of about four per cent silicon. Silicon itself is derived from the reduction of sand by carbon in an electric furnace and is now made in large quantities at Niagara Falls. Its effect on iron is to greatly increase the resistivity, which in turn reduces that part of the core loss due to eddy currents induced in the iron, and its presence also reduces the energy lost in the magnetic hysteresis.

"If the cores of the transformers sold by the General Electric Company last year had all contained the high grade common iron, as used to be the case, instead of the silicon alloy now largely used, the additional loss, when they were all operating, would correspond to about $15,000 per day at the ten cent rate.

"This insidious type of loss will always be an object of attack by the experimenter, because it seems absolutely unnecessary. No one knows that a magnetic hysteresis *must* exist; we simply know that it *does* exist, and moreover, that it is being continually reduced by discovery. I call it an insidious loss because it is going on all the time and doing no good."

Some Secrets of Electrical Stagecraft

By T. J. NEWLIN

PART V

PRODUCING A RAINBOW BY THE SCIENCE OF OPTICS

The rainbow effect is produced by the laws of optics, so to make it clearer to the average reader I will give a short illustration of how it is accomplished by the rays of light being acted upon by

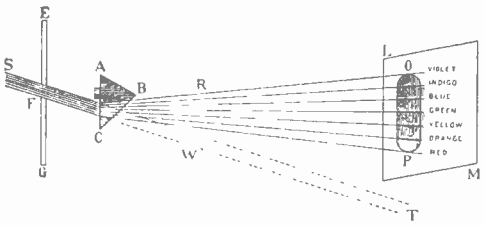


FIG. 25. SEPARATION OF A RAY OF SUNLIGHT INTO THE PRIMARY COLORS BY MEANS OF A PRISM.

lenses interposed in front of the sciopticon, a lamp used on the stage to produce any effect in Nature, such as moving clouds, streaked lightning, moon rise, water ripple, etc.

SEPARATING THE SEVEN COLORS FROM THE WHITE LIGHT OF THE SUN

As almost everyone is aware, all white light contains seven primary colors. By causing white rays of light to pass through a prism they are separated into seven colors, which are known by their position in the spectrum, viz.: red, orange, yellow, green, blue, indigo and violet, as shown in Fig. 25.

Let (S), Fig. 25, be the impinging beam of light and (WT) its path, if not intercepted by the prism (ABC). The beam of light (S) passes through the hole in the shutter (EG) and impinges on, or strikes the prism, which acts the same as a ray of light passing from a rarer to a denser medium and bends the light toward its base, which disperses the light according to the refrangibility of the color, red being bent the least, while the other colors in their respective order are bent to a greater and greater degree until the violet is reached, which undergoes the greatest refraction or bending of all.

On the cardboard (LM), the colors are shown as dispersed by the prism. In other words, the spectrum (OP) is shown with the proper position of the colors. In the sciopticon attachment a slot (S), Fig. 26, is made in the plate in front of the condensing lens (LL_1), allowing the light to emerge through same and strike the prisms (PP_1), which disperses the projected rays upon the back drop on the stage in the form of an encircling rainbow, thereby bringing out the seven colors of the rainbow, or the solar spectrum, apparently true to Nature.

THE WONDERFUL, FASCINATING SCIOPTICON

To my friends, Mr. Joseph Menchen and Messrs. Kleigel Bros., I am indebted for the privilege of using the views of the sciopticon and its various uses. In Fig. 27 are shown two views of one of these sciopticons, with Mr. Menchen holding in his hands a disk that revolves in front of an arc light and carries the

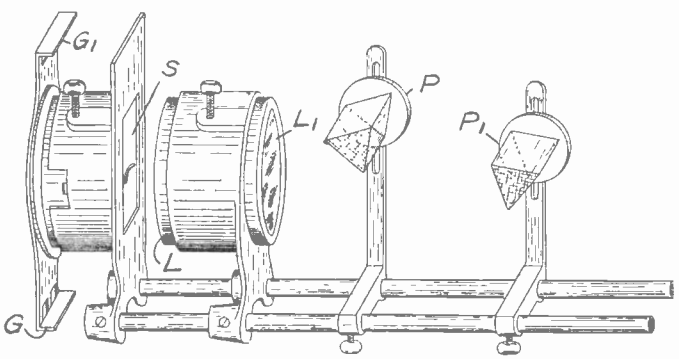


FIG. 26. PRISM ATTACHMENTS ON THE SCIOPTICON

painted scenes which are projected on the stage by means of a battery of lenses. The tortuous wavings and windings in the glass or mica, which are so indented as to cause a jumping up and down of the rays of light while being thrown upon the "drop," cause the fire effect. The plate or disk is usually artistically painted in colors to represent the flames, bending from red to yellow. The particular plate which the operator is holding in his hands is designed to produce the cyclone effect. To remove the disk, all that is necessary is to loosen the thumb nuts. At the right in the picture is shown the operating mechanism, particularly the speed clock (S), which is wound up by a key and is the motive power for all these effects.

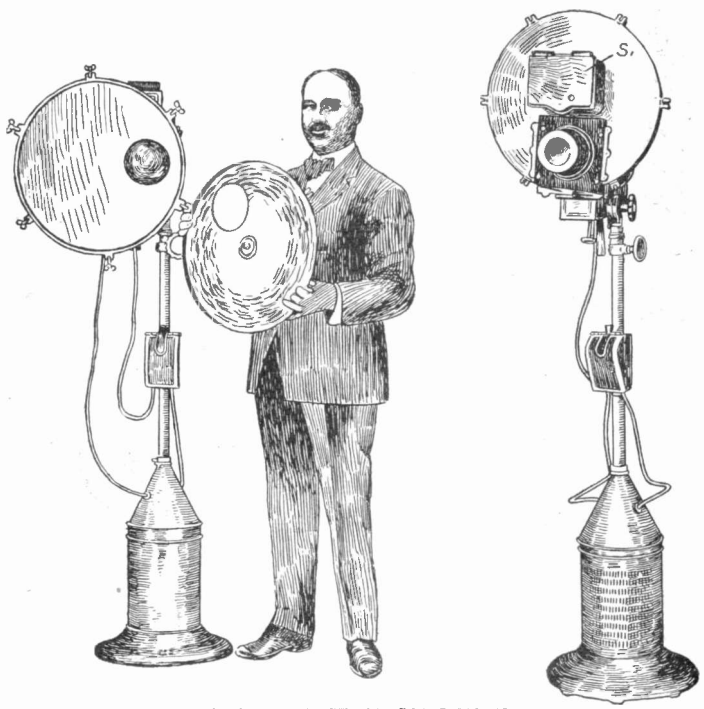


FIG. 27. THE STAGE SCIOPTICON

THE "WOMAN IN THE MOON"

That there is a woman in the moon can be proved by the most natural fact that if there was not the man would not be there. In the illustration, Fig. 28, they both are shown pointing earthward. The instrument below, which has just been described, throws the picture on the screen in the same manner as the magic lantern.

We will now digress for a moment from the strictly theatrical illusions to those of much greater scope which are produced in special buildings set aside for the purpose at expositions, large amusement parks, etc.

"UNDER AND OVER THE SEA"

Figure 29 illustrates the largest type of moving panoramic sciopticon machines ever built. These machines were first built for "Under and Over the Sea," at the World's Fair, St. Louis, and a "Trip to Mars," at the White City, Chicago. They are by far the finest and largest machines in the world today. The same type of machine was used in Mr. Menchen's production of "Hades to Paradise by Airship." The great disk shows the imaginary designs which are supposed to exist in and between the planets. This is used in the new production of "War in the Clouds." The plate in this machine is 60 inches in diameter and the aluminum box itself weighs about 220 pounds. The plate glass disk weighs 100 pounds, and it takes 30 gallons of solution to develop one plate. The above explanation is to show the enormous size in comparison with other machines. The lantern slide which the operator is holding is the standard 3¼ inch lantern slide used in all projecting machines. You can therefore judge the enormous size of these disks.

THE ELECTRICAL DISSOLVING EFFECT WHICH PRODUCES ILLUSION

Dissolving effects can be produced

FIG. 28. THAT THERE IS A WOMAN IN THE MOON CAN BE PROVED BY A NATURAL FACT

only by the use of two or more lanterns at once as shown in Fig. 30. The lanterns must stand at such an angle in reference to each other that the disk of light on the screen shall be so perfectly registered that it appears to come from one light only. If more lanterns are used they may be placed above or between the others, tipping them so that they, too, will register their disk of light on the screen with the others. A slide placed in each lantern will be projected equally and two or three views will be jumbled together on the screen. Mechanical contrivances known as dissolvers are placed on the lanterns, by which the light in each lantern may be controlled at will. The light being cut off from one lantern only one view will appear on the screen (being shown alone it will of course be perfect). The light being cut off from the picture on the screen and simultaneously turned onto the view in the other lantern, will cause the first picture to disappear and the second one to come on the screen, and while the light is being manipulated the first appears to dissolve and fade away until nothing is left of it, and the new picture comes out clear and distinct.

The use of the third lantern is to project lightning, rain, snow and other effects in conjunction with the scenery from one of the other lanterns. The fourth is for flying objects such as birds and butterflies when they fly in opposite directions.

VALUE OF ELECTRICAL EFFECTS

Great tragedians lay important stress upon their scenery, stage settings and electrical effects. No actor of prominence will, even for the sake of financial gain, place insignificance upon these essential adjuncts. The greatest actors of the present day engage only the most clever and experienced stage managers to see to the minute details of the stage

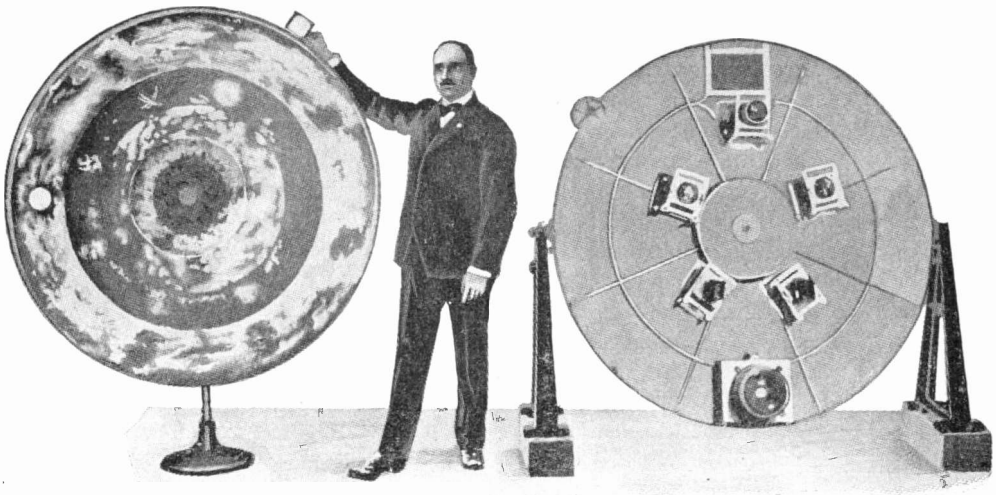


FIG. 29. THE LARGEST TYPE OF MOVING PANORAMIC SCIOPTICON

settings for their respective plays. Expensive auxiliaries they would fain dispense with were it not to their advantage in playing upon the psychological and sentimental feelings of their audience. Richard Mansfield and Sir Henry Irving, the foremost tragedians of the two hemispheres, are said to have claimed that the greater part of their success and prestige depended upon the infinite attention and detail they gave to their scenic and electrical effects. From this the reader can readily glean the fact that the expert stage electrician as well as the actor must play his part well.

THE BAD STAGE MANAGER

A bad stage manager or a well dressed, dandy "know-it-all" is a thing to be deplored. Not only does he get "in bad" with the star, but he becomes the laughing stock of the whole stage crew by his infinitesimal knowledge of stagecraft. His importance quickly drops below par the very moment the boys get wise to the fact that he is a rookey. Then it puts them all on their guard, for it is a foregone conclusion that he is going to make things ten times harder for them, even if he does get off without "crabbin' de show."

STEALING CURTAIN CALLS

There are few stars who do not attempt to steal curtain calls, especially on a Monday night. The reporters are there then. Of course the paper next day must tell of their success, so the "curtain-gag" is worked overtime. The star will have her stage manager trip the curtain again and again while she bows and salaams, while the poor men in the fly gallery are developing their muscles and tearing and blistering their hands in their effort to help the star to "make good." Of course, if the curtain happens to be of plush, and on the draw order, the flymen get a rest. In this case the stage manager and assistant stand at the opening and pull on the curtain to make the audience think that it is going to see the star, while she may be 30 feet away in her dressing room. If the manager can thus scheme on the audience and bring forth the applause, the star is sent for and she, smiling, has stolen a dozen more curtain calls than she deserves. Nevertheless, she usually actually believes there were still more coming to her. This is part of the stage manager's duty, for she must be petted, and if she were not then the business manager would be looking up a new one who would steal these curtain calls. Oftentimes the audience, seeing the apparent swing of the curtain, believes the star is coming out to bow again when it is only the stage manager jollying them along.

There is nothing that makes an audience sit up and take notice as quickly as the simple throwing on of the house lights. In case of fire this is the stage electrician's first duty. If any disturbance should occur, this is his first action, or should there be catcalls he must be equal to the occasion, and a bright light will dispel disorder as quickly as a bluecoat's appearance will break up a fight. But such extraordinary conditions are not always necessary. Sometimes, when the star goes too far in wanting curtain

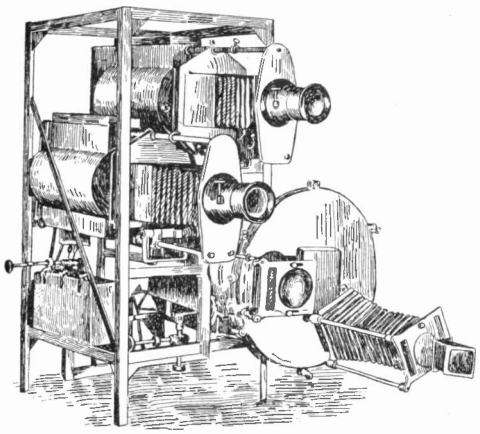


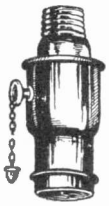
FIG. 30. LANTERN FOR DISSOLVING EFFECTS

calls, the stage electrician gets the wrong cue, or his hand slips, and he accidentally throws in the house light switch, which instantly cuts off this little petty thievery. Oh, yes, his position may be in jeopardy, but he is oftentimes thinking of his family waiting patiently for his homecoming.

A Pull Chain Adapter

Although the pull-chain sockets are undoubtedly much more convenient than those of the key type, still their substitution is rather expensive when the old ones have to be discarded.

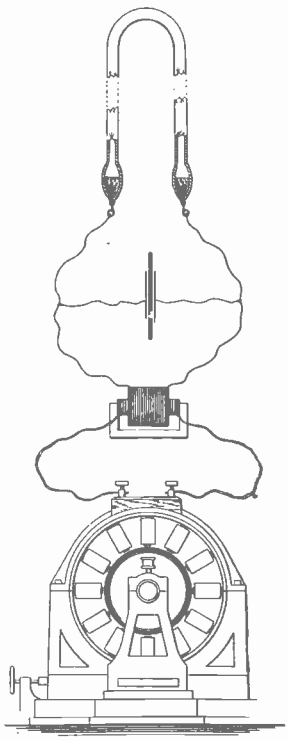
The Hubbel pull socket with lamp base attachment is so designed that any one can make the change by merely screwing the base into the ordinary key or keyless socket.



ADAPTER

Novel Tube Lamp

Vapors of mercury, sodium, iodin and some other metals each produce a light with colors peculiar to itself when electric current is passed through them. It is well known also that a wire leading into a rarified atmosphere becomes heated although the same sized wire will conduct the current under ordinary conditions without heating. Upon these facts is based a lamp patent issued recently to Peter Cooper Hewitt, of New York City.



COOPER HEWITT'S NEW LAMP

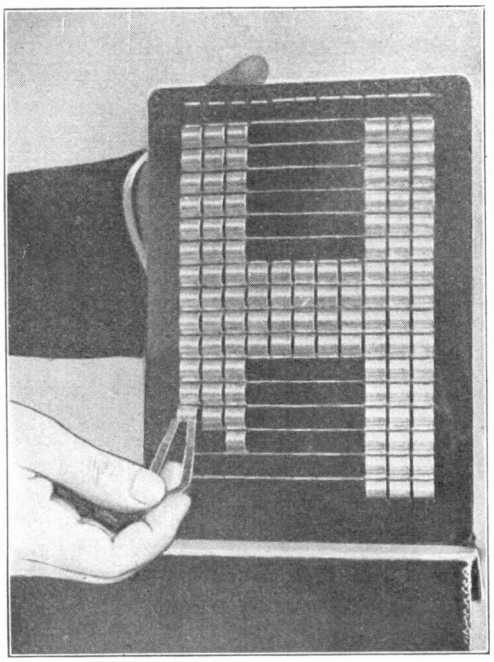
The lamp used to illustrate the patent is a U-shaped tube, inverted, containing the liquid metal, at the ends which hold sealed-in electrodes. The light will operate on from 500 to 5,000 volts alternating current, depending on the length of the tube and the quantity of light to be produced. A condenser connected as shown improves the quality of the light. If mercury is used in the tube, the temperature during operation is about 300° C. "I have also found that the combination of two or more tubes, each giving light of a different color, is advantageous," says Mr. Hewitt.

There are at present installed in the United States and Canada approximately 80,000 electric signs, containing about 8,000,000 electric lamps.

An Electrical "Spelling" Machine

A New York concern has recently placed on the market an ingenious electrical "spelling" machine, applicable not only to certain commercial fields, but even to kindergarten work.

The simplest form of the machine is



SIMPLE FORM OF "SPELLING" MACHINE FOR KINDERGARTENS

shown in the accompanying illustration, and is the one used for kindergarten purposes. It consists of an oblong sheet of metal pierced with slits as shown. In each slit is inserted a curved strip of tin, silvered to distinguish it from the sheet frame. Normally these tin strips are out of sight behind the frame, but may be drawn out by means of a magnet. By drawing the magnet down over the frame, letters and characters may be formed as seen in the picture. Although the form just described is attaining a wide popularity for educational purposes, there are other and wider fields for use of the same principle.

Perhaps the greatest commercial application of the principle lies in the electric daylight sign. The main frame is posted up in a conspicuous place and may be of any size desired, the tin movable strips being ready to spell out the letters of the sign. The strips are then turned out into view — not by a hand magnet as in the case of the kindergarten device, but by an ingenious arrangement of electro-magnets and electrical circuits running to a special typewriter keyboard arranged for closing the circuits to operate the sign. One step further in this idea is to have the typewriter keys fitted with dies suitable for perforating a paper strip and then run this strip through a special machine for operating the sign, electrical contact for the various circuits being made through the perforations. In this way an operator is only required to perforate the strips which, afterwards, by an automatic machine, may be made to operate the sign.

Such a sign, operated direct from the keyboard, might be used to advantage in connection with a railroad station or other public bulletin board.

Washington Monument's Lightning Rods

The Washington Monument is held by many to have an ideal installation of correct lightning conductors. The apex of the monument is an aluminum pyramid, from which eight half-inch copper rods extend down to the base of the stone pyramid, forming the top of the structure. At that point they bend inward through the masonry and pass down the interior of the shaft. The eight conductors are all connected on the outside of the pyramid by a heavy rod, and they are all gold plated. Two hundred platinum tipped points, connected with the conductors and all pointing skyward, cover the pyramid. The conductors connect directly with the tops of four iron columns which support the stairway and elevator.

At the base of the monument the iron columns are connected by copper conductors with the bottom of a well 20 feet below the foundation of the shaft.

The Pathfinders of the Wires

BY WALDON FAWCET

RECENT statistics would seem to prove that the vocation of the electric lineman is becoming relatively less perilous than it was a few years ago. The stringing of electric wires goes on apace in all parts of the country—the linemen pushing farther and farther into the deserts, the forests, the mountainous regions and other virgin fields that await this great civilizing influence—yet for all this increase in the amount of field work and increase in the number of linemen employed there is a steady decrease, pro rata, in the number of fatal or serious accidents.

A tremendous reduction in the risks of the work was brought about with the introduction of the shorter poles which are in vogue today. Almost all our readers can remember, probably, when a telephone or telegraph pole less than 40 feet in length was almost unheard of, 50 feet being the more common. Nowadays the 25 foot pole may be said to be standard unless tree conditions necessitate the carrying of lines at unusual height. Finally, the tendency to adopt the underground system in most of our large cities has helped the average lineman's chances of longevity by relieving him of much of the work which in the old days had to be carried on from poles or housetops amid a perfect network of wires.

But for all that the present day lineman may discharge his responsibilities with less danger to life and limb, he must even yet face far more risks than the private in almost any other division of the industrial army. And this brings to mind the fact that the linemen past and present have had all too little credit for the very important part they have played in the advancement of electrical science. What the prospectors are to the mining industry, what the track layers are to railroad construction and what the pioneers of the trans-Mississippi region

were to modern farming interests these pathfinders of the wires have been to the conquest of the magic current.

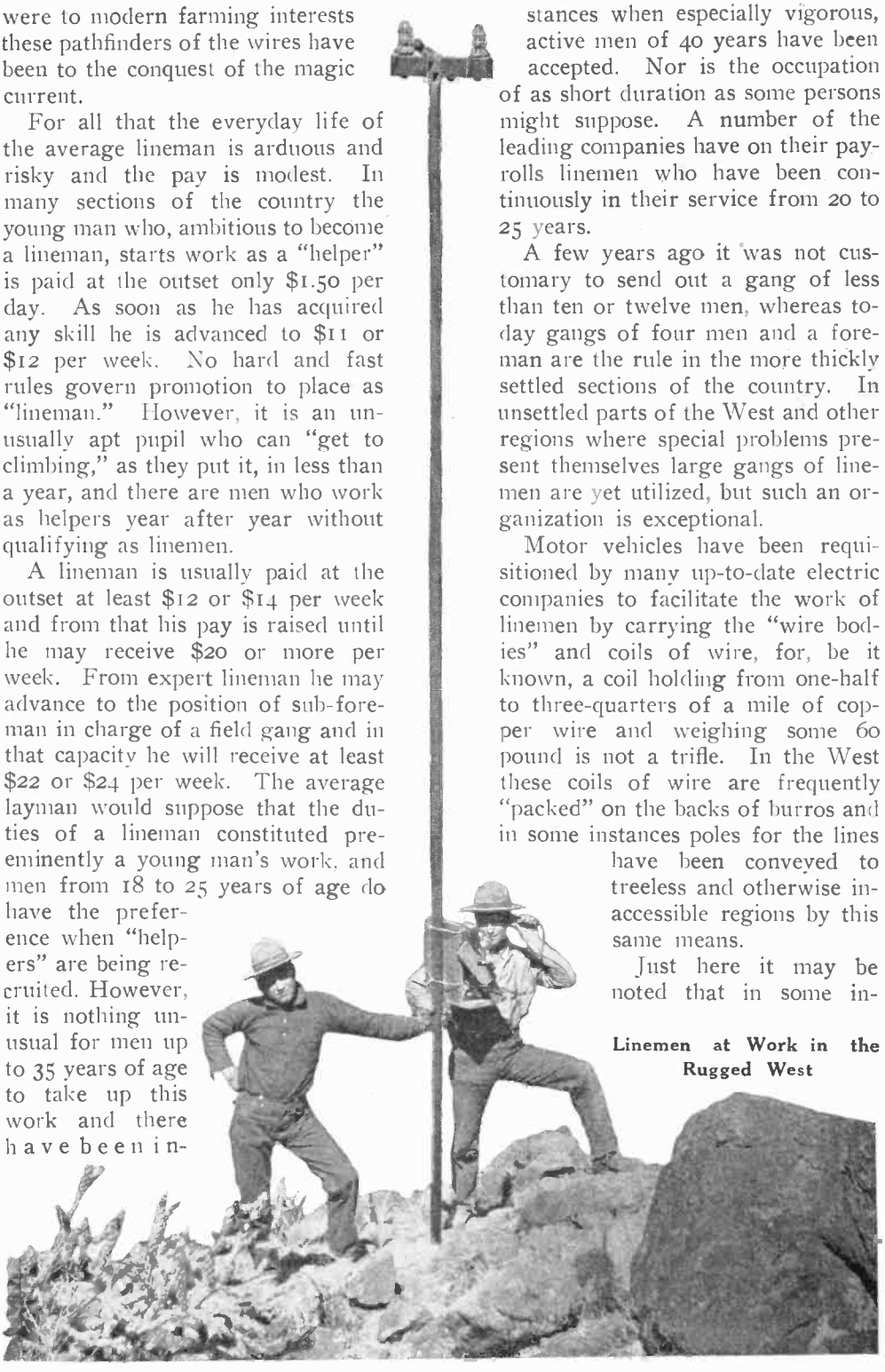
For all that the everyday life of the average lineman is arduous and risky and the pay is modest. In many sections of the country the young man who, ambitious to become a lineman, starts work as a "helper" is paid at the outset only $1.50 per day. As soon as he has acquired any skill he is advanced to $11 or $12 per week. No hard and fast rules govern promotion to place as "lineman." However, it is an unusually apt pupil who can "get to climbing," as they put it, in less than a year, and there are men who work as helpers year after year without qualifying as linemen.

A lineman is usually paid at the outset at least $12 or $14 per week and from that his pay is raised until he may receive $20 or more per week. From expert lineman he may advance to the position of sub-foreman in charge of a field gang and in that capacity he will receive at least $22 or $24 per week. The average layman would suppose that the duties of a lineman constituted preeminently a young man's work, and men from 18 to 25 years of age do have the preference when "helpers" are being recruited. However, it is nothing unusual for men up to 35 years of age to take up this work and there have been instances when especially vigorous, active men of 40 years have been accepted. Nor is the occupation of as short duration as some persons might suppose. A number of the leading companies have on their payrolls linemen who have been continuously in their service from 20 to 25 years.

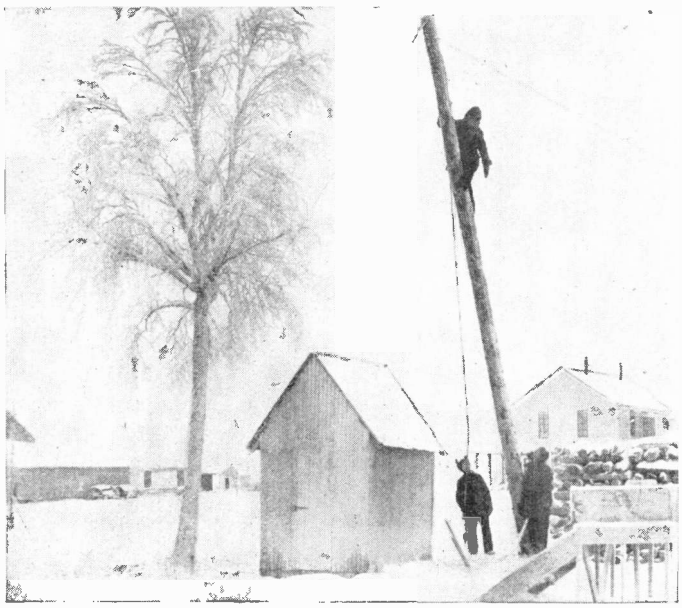
A few years ago it was not customary to send out a gang of less than ten or twelve men, whereas today gangs of four men and a foreman are the rule in the more thickly settled sections of the country. In unsettled parts of the West and other regions where special problems present themselves large gangs of linemen are yet utilized, but such an organization is exceptional.

Motor vehicles have been requisitioned by many up-to-date electric companies to facilitate the work of linemen by carrying the "wire bodies" and coils of wire, for, be it known, a coil holding from one-half to three-quarters of a mile of copper wire and weighing some 60 pound is not a trifle. In the West these coils of wire are frequently "packed" on the backs of burros and in some instances poles for the lines have been conveyed to treeless and otherwise inaccessible regions by this same means.

Just here it may be noted that in some in-



Linemen at Work in the Rugged West



Locating a Line in Mountain Regions. Building a Line in the Dead of Winter

stances linemen stringing communicative lines in rocky, mountainous regions in the West have utilized the hollow iron poles. Holes have been drilled in the solid rock, the pole put in place and then concrete poured in to fill the depression and hold the pole in place.

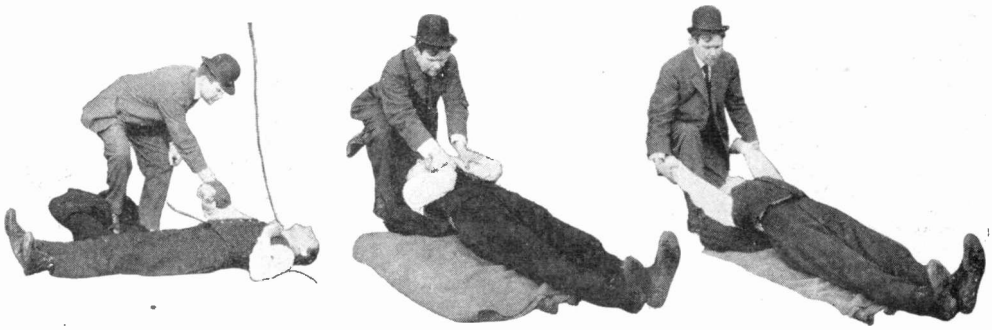
In wire work use is also being made of motorcycles, particularly by the "combination men." These combination men, or "trouble shooters," as they have been dubbed in the slang of the trade, are a distinctive class of linemen. They derive the name "combination men" from the fact that they each can serve in the dual role of "inside" and "outside" men; that is, they can undertake any responsibility from stringing wire to installing an instrument and they are usually sent out when trouble of any kind has interrupted communication on a telephone or telegraph line.

Speaking of trouble on the electric power and communication lines it may be noted that mishaps, particularly those due to the ravages of the elements, afford the linemen their greatest opportunities for rapid and efficient work. Such emergencies also necessitate that exposure which makes frost bites the heritage of almost every lineman. A company may have anywhere from a dozen to a hundred linemen on its roll and yet the force is liable to prove inadequate to the speedy repair of the havoc wrought by a tornado, a blizzard or a severe visitation of sleet. Happily for the electrical companies such tantrums on the part of Nature are seldom country-wide in scope and usually the companies in an afflicted district can "borrow" linemen temporarily from kindred concerns in other communities.

A change that has come about in recent years has to do with the accepted plan of lodging and boarding electric linemen when absent from home on field work. Formerly all nomadic gangs carried camp outfits and pitched camp in localities convenient to their work. This method is yet followed in the more sparsely settled regions and under cir-

cumstances where a large force is engaged in stringing new trunk lines, but in the more thickly settled regions which are traversed by established wire systems the companies have made arrangements at conveniently located farmhouses for board and lodging for the linemen who may be sent out. Under this plan a lone lineman or a small gang can at short notice get board for a day or a month as the exigencies may happen to dictate.

Another "wrinkle" in this field is the provision of a "first aid" cabinet for each gang of linemen and the instruction of the men in its use so that they will be qualified to employ emergency relief measures in behalf of any comrade who may fall from a pole or sustain an electric shock.



Methods of Resuscitation That Must Sometimes Be Employed

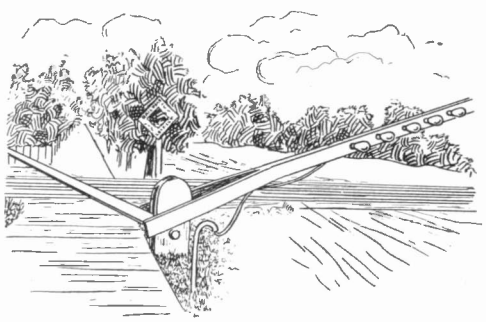
Electric Farm Lighting

The farmer of today has increased his standard of living. He demands many of the conveniences enjoyed by his brothers of the city. Most of these conveniences, which 20 years ago were looked upon as luxuries, are today considered bare necessities. The proper and efficient lighting of the farm home and farm buildings is one of them. We have but to note the introduction of the gasoline engine and the telephone in farming communities. Fifteen years ago both of these modern conveniences were looked upon by the farmer as luxuries. The modern farm electric light system marks another epoch of progress. It should be classified with the gasoline engine, telephone, and cream separator as a genuine farm convenience and labor saving device.

All of these have been given to the farmer during the past decade, and all have contributed to his comfort and general welfare. The modern farm electric lighting system, more than any other contrivance designed for lighting purposes, possesses all the features which should commend a lighting system to the farmer. —*Farm, Stock and Home.*

Lamps on Crossing Gate

A suburban electric railway indicates its crossings by five incandescent lamps mounted on each half of the "gate." The lighted lamps show the crossing at night



LIGHTED CROSSING GATE

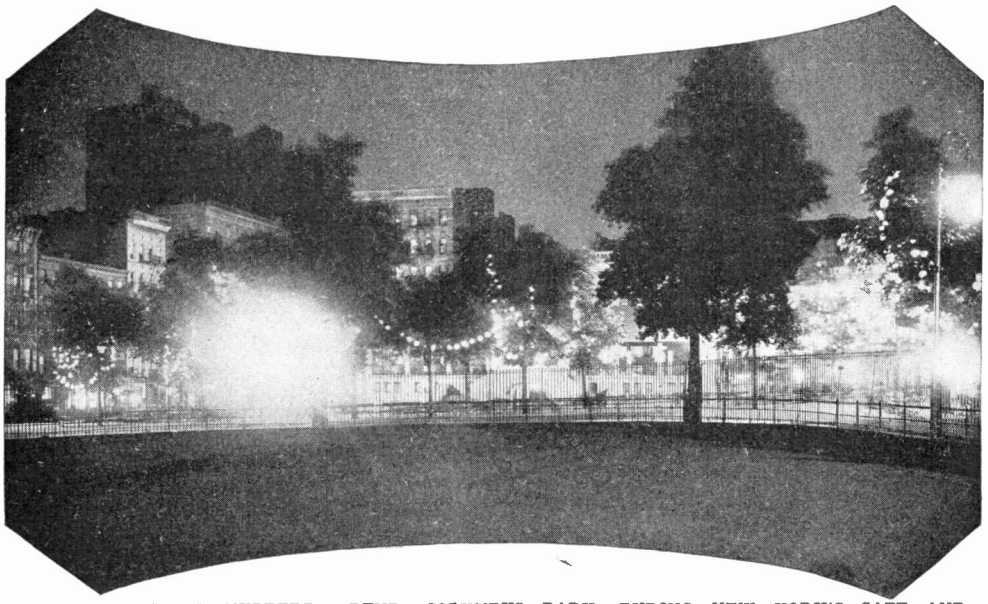
whether the gates are open or closed. Current is obtained by a wire from the third rail through an underground conduit.

New York's Electrical Fourth

When that dear old American patriot, John Adams, second President of the United States, wrote to his wife that the Fourth of July "will be celebrated by succeeding generations as the great anniversary festival" and that "it ought to be solemnized by pomp and parade, with shows, games, sports, guns, bells, bonfires and illuminations from one end of the continent to the other," it was quite impossible for him to foresee the terrible toll that would be exacted by modern fireworks, and it seems hardly fair to blame him, as some do, for the wrong start in the way of celebrating. His opinion today would probably be quite different.

President Adams, however, was not altogether wrong, for he struck a keynote when he said "illuminations." After all, there is only one way of celebrating at night and that is to dispel the darkness with electric light.

The electrical Fourth of July as it now stands is a thing of beauty as well as of safety. Many colored lights, arranged in artistic designs, flash out in rare impressiveness their messages of patriotism. Residences, statuary, bridges and other edifices, as well as the trees in the parks, can be strung with lights or outlined in red, white and blue, in such a manner as to bring forth unrestrained admiration. And they are permanent objects on which the eye may gaze, drinking in all of the beauty, while on the other hand the fireworks are of but a moment's duration—just a transitory gleam, and gone.

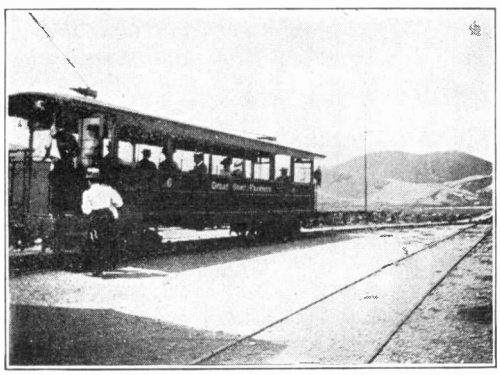


ILLUMINATIONS AT MULBERRY BEND, COLUMBUS PARK, DURING NEW YORK'S SAFE AND SANE FOURTH

In New York City this year fourteen public parks and squares were illuminated by special electrical effects. Six thousand electric light bulbs of eight candlepower each were used in lighting the City Hall and City Hall Park. The famous old pile glowed like a palace in Arabian Nights set in the midst of an enchanted garden. Festoons of electric lights hidden in Japanese lanterns were strung from tree to tree all through the park. A similar plan of decoration was carried out on Borough Hall in the Bronx, the current for the three night illumination of these two buildings, together with the wiring, being supplied free by the Edison Company. Nearly 100,000 incandescent bulbs were used in the illuminations throughout the city.

Electricity Conquers the Welsh Orme

Possibly you are not exactly familiar with the Ormes. There are the Great Orme and the Small Orme and they form the background to Llandudno, the world famous seaside resort of Wales. For time immemorial every visitor



TODAY YOU CLIMB THE ORME BY TROLLEY

climbed them; but today—well, today you go by electric car.

On the long white car one hears as much English spoken as Welsh; folk are discussing what they shall order when they reach the great restaurant at the top.

You remark how there are practically no Welsh left wearing national costume, as you survey your colleagues in the car.

Splendid residences, the most of them built of a grey concrete, are all about you. Advertisements of coaching tours punctuate open vistas. By the track, walls of a grey stone begin rising, though passengers are able to look over these. Above their zone come gardens of chestnuts.

Presently we stop at a series of buildings, before which we dismount to change cars for the summit. It is rather picturesque here, in the rolling upland, walking 'cross the stony fields, bare save for the low grass blades, and occasionally divided into sections by fences of rocks. Behind us, lesser ridges rise in the mist; ahead is the track, with two cable ropes at its center and trolley wires stretched above to poles at the sides. On and away, one sees these stretching, across the barren hills, winding, but yet making a gradual ascent.

As the ride is continued up mountain, somehow it makes one think of the trip up Mt. Lowe. It is cool and you almost envy three ladies you see climbing the Orme by a footpath. Finally you come to the end of the journey at the great Orme Hotel. Mountain meadows invite you to stroll, or to rest, as do most in the gravel of their slopes. It's windy and cool and delightful and one gets a fine view of the sea. That though is an old, old story,—one not quite so interesting, to Welshmen at least, as that electricity has conquered the Orme.

An Old-Time Mine Signal

The simplest form of mine signal was not operated by electricity. It was installed in a slope mine where the bottom was over a mile distant from the hoist house. The signal consisted of a bell located in the hoist house and a single wire attached to the bell and leading down the slope to the bottom or parting 7,000 feet away. The cars were hauled from the face of the parting by electric locomotives and from the parting to the surface the cars were pulled up the slope by the hoist. When the trip was ready to be taken, the engineer was signaled by pulling the wire above referred to until the bell rang. One can imagine the friction and lost motion incident to the operation of such a device. The united efforts of several men were usually necessary to send a signal from the parting, and they say that sometimes it was necessary to hitch a mule to the wire in order to operate the signal. Nowadays telephones are used in many mines for such service, and their use is increasing. The telephone instruments are designed especially for underground service, and are enclosed in an iron box designed to be moisture proof.

Hydro-Electric Wonders in California

By ARCHIE RICE

This is the fourth and last paper of the series. The others showed types of progressive developments from California's remarkable natural water power. Each bore upon some specific phase of industrial life directly benefited by the application of cheap electric power sent long distances. In this article is presented one of the largest installations—one on the west coast. It has about 40 miles of flumes and ditches leading a diverted riverflow to where it can be dropped from a perpendicular height 1,450 feet to drive impulse wheels. This energy is sent off over hills and across valleys to work deep mines, irrigate orchard lands, pump out inundated delta districts of great agricultural richness, run big cement works, propel electric cars, light cities and supply power to half a hundred other industries throughout a territory the size of Ohio.—Editorial Note.

THE FAMOUS ELECTRA PLANT

It came about that I took a manufacturer with me to see a great hydro-electric plant back in California's mountains, 50 miles or so to the northward of the Yosemite. Toward the end of our long railroad trip from San Francisco that day I pulled a notebook from my pocket and opened it at some figures. The figures caught the eye of the manufacturer and engaged his attention.

"Do you know," I began, "that California has the greatest hydro-electric possibilities of any part of the world? I'll tell you why.

"Wherever you find a steep river there is someone's chance to divert the water by an easy gradient and then produce an artificial fall from a considerable height.

"The source of the Mississippi is only 1,500 feet higher than its mouth. The average gradient of its flow is only about seven inches to the mile. The Ohio drops only 700 feet in its thousand mile course. But there are more than a dozen rivers in California that drop from fourteen to 300 feet to the mile. Most of them are very much steeper than that back in the mountains. Where such a river is flanked by slopes and ridges, then there are chances to lay out diverting ditches.

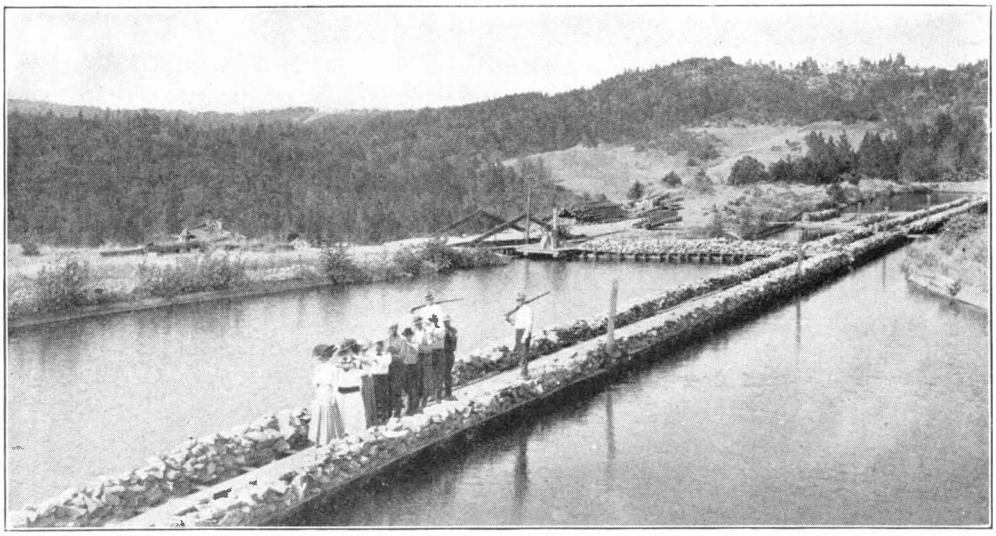
"Now, just scan these figures:

River	Miles Long	Feet Descent	Foot-drop to Mile
Eastern—			
Mississippi	2,300	1,500	.6
Ohio	1,000	700	.7
Missouri	2,340	4,000	1.7
Connecticut	375	2,000	5.3
Kennebeck	150	1,000	6.6
Rio Grande	1,800	12,000	6.6
Hudson	300	4,300	14.3
California—			
Calaveras	68	1,000	14.6
Sacramento	400	7,000	17.5
Feather	136	4,678	34.4
Tuolumne	155	8,000	51.6
Stanislaus	113	8,000	70.8
American	118	8,500	72.0
Yuba	90	6,700	74.4
Cosumnes	93	7,500	80.3

"At the next stop we'll leave this little train. Then we'll go three miles by stage to the old mining town of Jackson. It is in Amador County.

"From Jackson a private mule team will take us eight miles to a place on the Mokelumne River. There you'll see a whale of a power plant. We'll arrive just in time for supper.

"But tomorrow we'll put in a day seeing the whole enterprise—the river, the diverting ditches and flumes, the saw-mill making lumber for the flumes, the storage reservoirs, the pressure pipes coming down a steep mountain side, the tramway up and down that mountain and the machinery of the splendid great plant itself, where 28,100 electric horsepower is constantly generated. It is sent through all this rich old mining district and out to the valleys and to half a hundred city industries. It even goes to cement works on the seacoast near Santa Cruz, 140 miles from the mountain plant. And it supplies all the electric lights on the campus at Stanford University."



THREE-ACRE FOREBAY RESERVOIR ABOVE THE ELECTRA POWER PLANT. THE WATER ENTERS HERE AFTER TRAVERSING 20 MILES OF MOUNTAIN SLOPES AND RIDGES FROM THE RIVER DAM

After supper at the club house, prepared by Ah Charlie, the most famous Chinese cook in the mountains of California, we sat in a great group on the broad, vine-covered veranda overlooking a beautiful lawn. Electric lights made grounds and surrounding buildings like some summer resort in the moonlight.

Unceasingly rose the hoarse groaning hum of the generators down in the power house. We strolled over to the long building, escorted by the superintendent.

"Let me have your watches," said he, holding his own and extending a hand for ours. The manufacturer looked at me. I nodded an approval meant only for his inquiring glance.

"We'll leave them here till we come out," remarked the superintendent. "These generators magnetize the steel of the works and play the deuce with a watch's accuracy."

The manufacturer was still cautiously peering at the ponderous wheels when I left. We were due to start for the sawmill at three the next morning. But he didn't know it then.

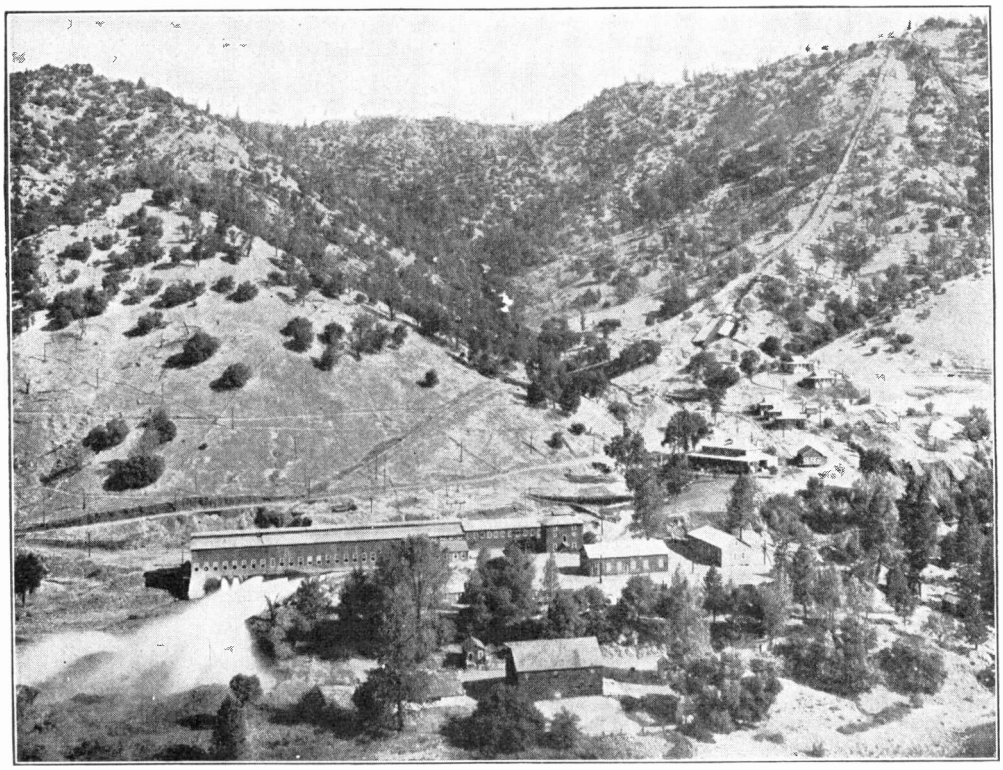
To the southward from famous Lake Tahoe is Alpine County. It is part of the ridgepole of the Sierras between California and Nevada. Terraced high along its western slope are natural basins filled with melted snow water. There are four in one group. They range in area from 120 to 340 acres. They are from 20 to 60 feet deep, and they are at an elevation of between 5,700 and 8,200 feet above sea level. That group is called the Blue Lakes.

These lakes of high mountain snows are 80 miles up in the Sierras back of the Electra power plant. Artificial canals connect them. By opening headgates any amount of water desired can be let into the upper channels of the Mokelumne River to increase its flow. During the six months' rainless season, when the water in California's mountain streams gradually decreases, an auxiliary supply becomes necessary for the big power plants.

For 50 miles the artificially stored snow water flows down the regular mountain channel of the Mokelumne. Then a ditch and flume system tap the river at a dam and lead the diverted flow winding along the corrugated ridges a distance of 20 miles to the top of the hill back of the Electra power house. In those 20 miles the Mokelumne River has dropped more than 1,600 feet. But the ditch has come along by an almost level gradient and saved up energy for a final perpendicular fall of 1,450 feet to

the impulse wheels;—that is, a plunge more than eight times as high as Niagara Falls.

Blue Lakes and two other storage reservoirs connected with the system comprise an area of 950 acres and store an aggregate of 1,080,000,000 cubic feet of water. This is to supplement the river's normal flow and guard absolutely against the shortage of any long dry season.



THE ELECTRA POWER PLANT IN THE CANON OF THE MOKELUMNE RIVER. DOWN THE STEEP PIPE LINE AT THE REAR THE WATER TAKES THE FINAL PLUNGE FROM AN ELEVATION OF NEARLY 1,500 FEET

Like most of California's hydro developments, the Electra plant was evolved from small beginnings. In the early '90's, when the world was beginning to see possibilities in the transmission of hydro-electric power, there came to California a scion of a royal family of ancient Poland. Tall, slender, esthetic looking, socially prominent, young Prince Andrea Poniatowski did not look the part of a big promoter. But he went up into that Mokelumne mining country and used his eyes and ears. He saw many abandoned mines along the river. And he decided that, if combined for economical operation, they could be made to pay. While he was quietly buying them up he also cast an eye upon the Blue Lakes water system, used since 1871 for bringing water to the mining towns of Jackson, Sutter Creek and Amador City. Why not buy up the water company, too? Then a big drop could be created from some point along the ditch and a hydro-electric plant established to supply power to his combination of mines.

With the capitalistic backing he was able to attract to his scheme, he made all this come true. But the first plant was only a little affair. It was three miles down-stream from the present Electra power house.

The idea grew as he studied it. By 1898 mammoth plans were afoot for the

production of enormous power. Every detail was handled with minute scrutiny and study. Famous engineers were engaged.

So sure were the promoters that they would not fail that they set about building solidly and with infinite care. They took four years for the work. Electrical manufacturers in Massachusetts proposed the then amazing idea of operating the power lines at 50,000 volts and at a saving. The current was to be carried to Oakland on San Francisco Bay. Special machinery was accordingly made.

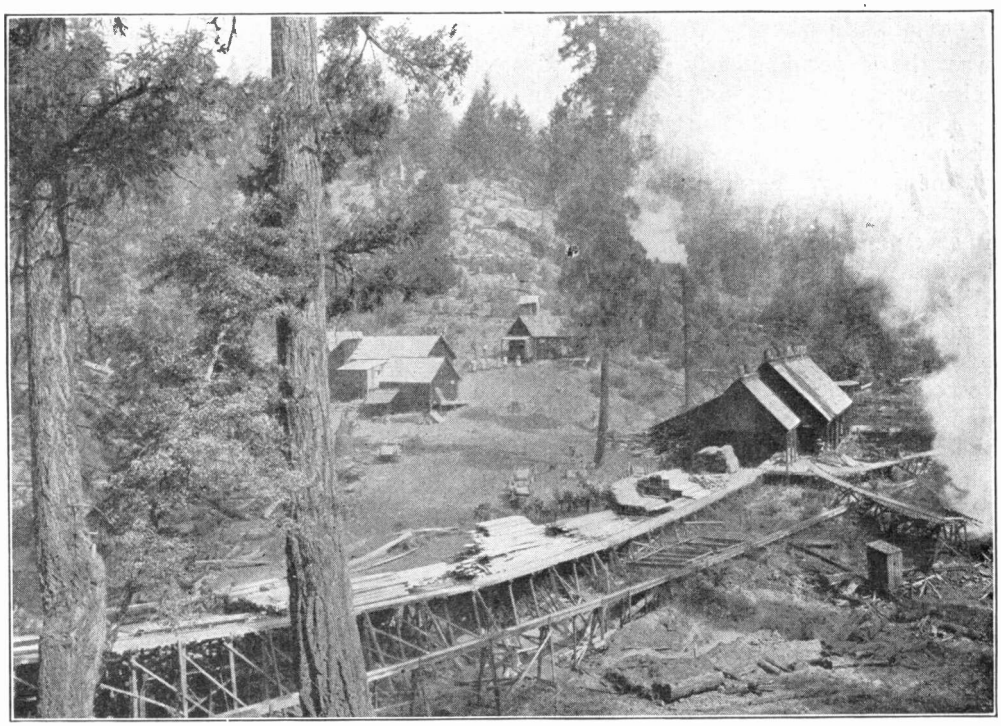
Four construction camps, each with from 100 to 300 workmen, were established back in the mountains to repair and enlarge the aqueducts and prepare for the great new plant.

The builders confidently made contracts in advance, guaranteeing to deliver so much power to different distant customers at a certain date. And they were not disappointed.

But before the Electra plant was actually producing energy in 1902 a rival installation, the great Colgate installation on the Yuba River, was sending its current across the Sacramento Valley into Oakland.

All the hydro-electric plants described in this series of articles, along with ten others, are now combined into one interconnecting system, feeding into a great comprehensive network of wires and distributing through some 200 local electric stations. The area that this system covers is three-fifths the size of New York State. It embraces two-thirds of California's entire population. The historic plants that have appeared in this series are really types in what is now the largest hydro-electric enterprise in all the world.

"It's plain idiocy to start anywhere at 3 o'clock in the morning," complained the manufacturer. But we had him up and out on the great arcade porch.



HERE IN THE REMOTE SIERRA FOREST ARE HARVESTED LOGS AND LUMBER TO REPAIR THE FLUME OF THE ELECTRA POWER PLANT

The same electric lights were everywhere. The same droning hum came insistently from the power house. The clear vault of heaven canopied the cañon and shone with brilliants.

"I'll take you to the tramway," said the superintendent. "They've led the mules up the trail an hour ago. There's a wagon at the top, sent round 20 miles by a road that goes out of Jackson and along the ridges."

"How about breakfast or a little coffee?" suggested the manufacturer.

"You get breakfast at the sawmill," was the superintendent's reply. "I've telephoned you're coming."

A brilliant constellation glowed where the mountain touches the sky. "Lights at the forebay," explained the superintendent. "The tram'll snake you up there in seven minutes. It's 2,400 feet."

The manufacturer perched on the cleats below me on the long open toboggan. The superintendent pressed an electric bell. A warning ring came back in response. The car jerked, jerked again, and then went steadily up and up out of the cañon. We sat like lonely spectators on a narrow slice of bleachers starting mysteriously for the moon and looking down rather regretfully upon the retreating joys of earth and an Ah Charlie breakfast.

'Way up it jerked again. "I wonder what's the tensile strength of that cable," commented the manufacturer. There was anxiety in the tone.

The mule team was waiting. And on and on we drove through a sparse forest. And then through a mile of sputtering and crackling and pyrotechnic acreage where a forest fire had passed and left the road a distinct pale streak across an undulating blackened carpet flecked with glowing sparks.

We came finally to a long descent so steep that the collars pulled out to the mules' ears and the animals struggled back desperately trying to keep the rig from overrunning them.

We skidded down into an actual road at last. And on we drove through forest ravines. Then suddenly the panorama of a little settlement in a clearing opened before us. There was a shrieking saw at the mill, a loud welcoming honkey-honkey-honkey of a mule on a big lumber wagon, and the peculiar squealing noise of log cars sailing round the curves of the gravity road from the timber section farther up the ridges.

We had arrived at the Tiger Creek sawmill. It was nine o'clock, and we had driven 30 miles before breakfast.

There in a primeval province of bears and rattlesnakes they were cutting timber and making lumber for the annual repair of the many miles of flumes to the power house and from the forebay reservoir on through the hills to supply water to the great mines at Jackson, Sutter Creek and Amador City.

Waiting for the slow lumber teams to get a long start, we followed them down to the head dam in the Mokelumne River.

There the lumber is piled high. It waits for telephonic orders for certain amounts and sizes to be dumped into the canal and floated down to auxiliary piles along the course.

The whole vast electric system is covered intimately by a comprehensive private telephone service from the cities to the far-off snow water lakes high in the mountains.

When we got back to the top of the ridge and onto the toboggan tramway, hours later, we were models done in red clay.

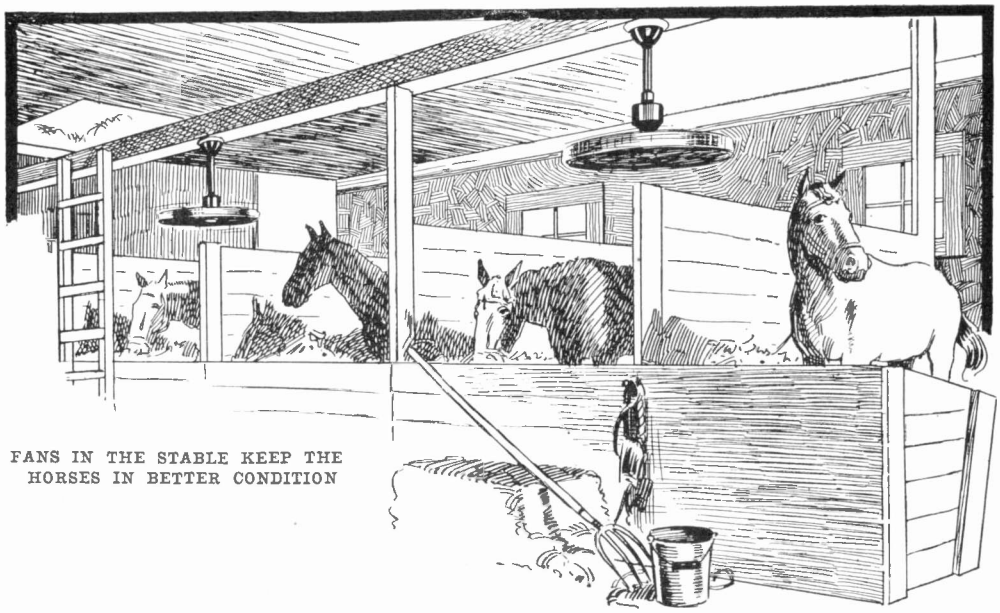
The dust of those forest roads is finer than flour. It covered us with the thickness of a woolen blanket. Our eyelashes were red dough; our hair and eyebrows brushes full of cayenne pepper.

"Sixty miles in this kind of up-and-down country is a little too much riding for one day," complained the manufacturer, as he limped stiffly to a place on the tram.

"The Blue Lakes are 50 or 60 miles beyond where we went, eh? Well, there's a whole lot in California I'd rather read about and see photographs of than punish myself going to see."

Keeps Horses Cool and Comfortable

The owner of a large livery stable in an Indiana city has found the installation of electric fans for keeping the stable cool and free from flies a paying proposition. The expense for power is more than justified by the comfort to the horses during the extremely hot weather. Instead of standing up to fight flies, the horses are able to lie down without being pestered by flies, do a harder day's work, and keep in better condition.



FANS IN THE STABLE KEEP THE HORSES IN BETTER CONDITION

Death From an Improvised Electric Needle

A very peculiar case of accidental death came to light recently in Pittsburgh. Charles Beab, chef at the Union Station Restaurant, was found dead in his room with an improvised electric needle stuck into his back. As he was a sufferer from rheumatism, it was quite evident that he had attempted to get relief from an electro-medical apparatus of his own devising. He had taken a ten foot length of lamp cord and attached one end to one terminal of the light socket. The many fine wires of the other end of the cord he had fanned out as a surface electrode to hold on his chest. Another wire for the other terminal of the socket carried at the outer end a sharp needle, which he had thrust into his back. In this way the full force of the current had passed through his body. Although only the ordinary lighting voltage was present, it was sufficient under these conditions to cause death.

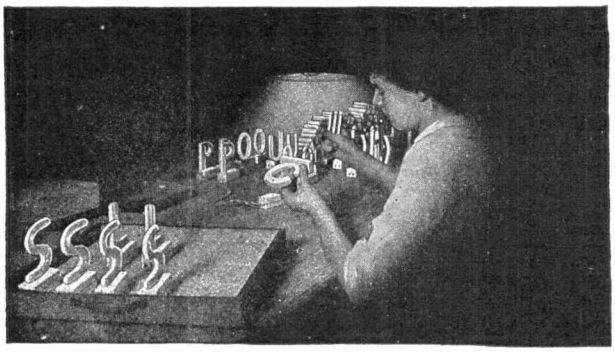
Complexity of Telephone Field

"No one man knows all the details now," said Theodore N. Vail. "Several days ago I was walking through a telephone exchange, and I saw something new. I asked Mr. Carty to explain it. He is our chief engineer; but he did not understand it. We called the manager. He didn't know, and called his assistant. He didn't know, and called the local engineer, who was able to tell us what it was."

Either a voltmeter or hydrometer may be used to determine when a battery is fully charged, but preferably both methods should be employed, one as a check on the other.

Miniature Lamp Letter Sign

No circus side-show of a decade ago was complete without its marvelous Bohemian glass blowers, who, on their plush draped pedestals, did all manner of things with variously colored glass. It is somewhat with the same feeling of wonder and interest that one watches the marvelously delicate processes in the fac-



WIRING AND CONNECTING THE BASES

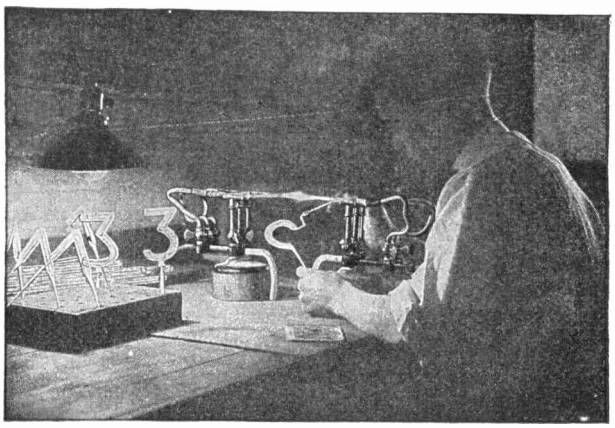
tory where are made the Federal alphabet letters, an electrical product of the glass blower's skill. Each letter is actually a tubular incandescent lamp in the shape of a letter, with a special base which slopes into the frame or fixture holding the sign, connecting by its terminals with the circuit that lights the lamps.

Skilled glass blowers bend and shape the letter, according to patterns, leaving attached to the letter short, glass stems through which the air is finally exhausted. They work in semi-darkness, as a bright light makes it impossible to see the tip of the almost colorless but intensely hot flames that are focused on one point from the two sets of triple blowpipes operated by compressed air.

The letters are then taken to the sealers who seal into the wall of the letter the tiny carbon filaments or "beads." These beads consist of a small hairpin shaped platinum wire embedded in a glass bead with the tiny carbon filament cemented to the ends of the wire.

The glass is heated to softness where the filament is to be, a small hole made, and the filament inserted and the glass bead fused into the wall of the letter. This must be absolutely air tight and is constantly tested by blowing through the glass tube attached to the letter. A good sealer can finish 80 letters or more in one day.

The letters are then sent to another operator who connects these platinum wire terminals in series by fusing copper wire along the outside of the letter. At this stage, the letters are fused by their glass stems on a "fork," a glass tube with 25 branches, each connecting the air chamber in the letter with the central stem. They are then taken to the mercury vacuum pumps and the air ex-



GLASS BLOWER MAKING THE LETTERS

hausted, with the letters subjected to heat and with the current turned on the filaments, an operation requiring anywhere from 20 minutes to two hours, during which any slight leak that may develop means starting all over again.

The letters are taken off the forks by heating each stem with a tiny flame until the glass softens and fills the opening and the letter is pulled off before the glass hardens.

The letters are then "backed," the wiring on the backs being covered with a white composition which is moulded by hand on each letter, protecting the wiring and making a white reflecting surface. The letters are then mounted on the square porcelain bases, which are really interconnecting push plugs through which the current flows from each letter to the next. If a letter is broken this base carries the current so that all other letters are lighted.

Electrical Warmers for Baby Cribs

There has been devised for use in the children's ward of the Presbyterian Hospital, Philadelphia, an electrical crib warmer that has been found to be less costly and less troublesome and more effective than hot water bottles. This electrical contrivance, which is contained between asbestos coverings, is made to extend over the whole bottom of the crib, but so arranged as to give the greatest degree of warmth at the feet.

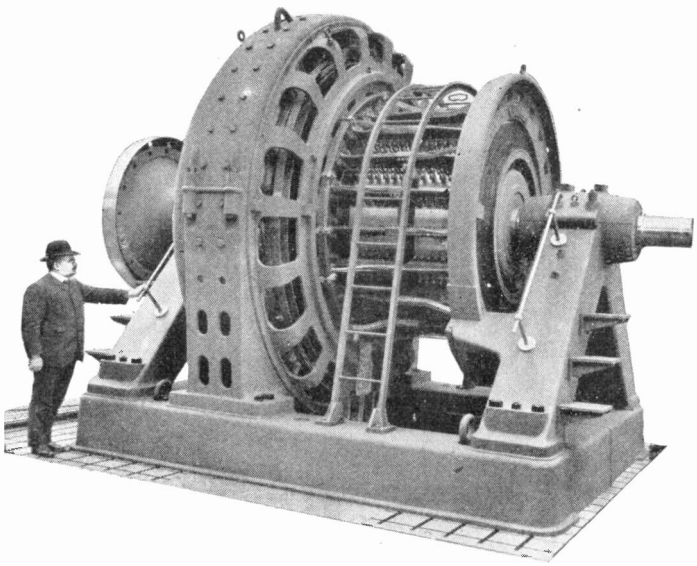
The heat of the entire warmer can be regulated by switches and it can be kept constant at any stage of the day or night. Electricity is supplied through a flexible cable from the house current.

Evil Lighted Into Harmless Gayety

From an ethical point, ornamental street lighting systems are of value because they decrease the possibilities for successful commission of crime, and so transform the thoroughfare after dark that loafing and hoodlumism are impossible and the acts of the recklessly disposed of both sexes, of whatever age, are literally lighted out of evil into harmless gayety and amusement. The thoroughly lighted street cannot be made the theater of wrongdoing.

The Largest Direct Current Dynamo

The Iluminium Industrie, Ltd., of Neuhausen, Germany, has had constructed two of the largest direct current dynamos ever built. They are to be used for electro-chemical purposes, and were built by the Oerlikon Machine Works. One of these machines is shown in the picture, and, judging by the stature of the man, must stand at least fifteen feet high.



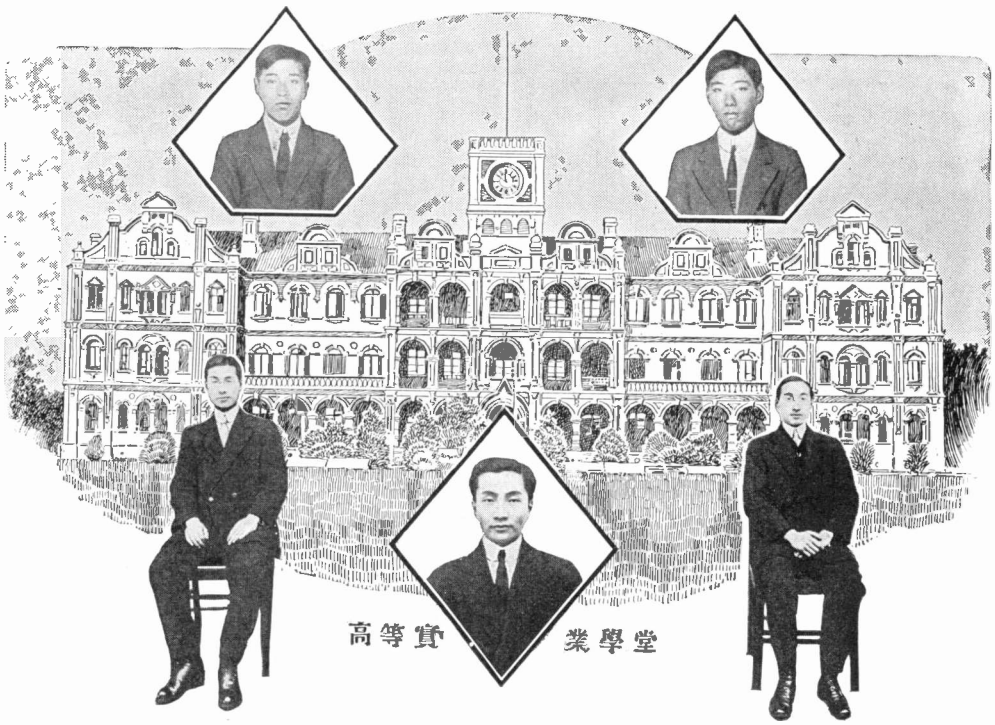
THE LARGEST DIRECT CURRENT DYNAMO

At the right is seen the huge commutator, almost as large as the main part of the machine. A curved ladder passing up over the commutator is necessary for the attendant when adjusting the brushes.

It requires 3,850 horsepower of energy to drive this generator when it is delivering its normal full load output of current. Seven thousand eight hundred amperes of current at a pressure of 340 volts represents its regular duty as a current producer. This is enough to light about 50,000 sixteen candlepower lamps.

Chinese Students Study American Telephone Methods

It has been a common thing during the last fifteen or 20 years for the Japanese government to send students to pursue a course of studies in the colleges and apprenticeship courses in the manufacturing establishments of the United States. This policy has been beneficial to Japan as a nation, as evidenced by their achievements in recent years. Probably owing to the fact that large bodies move slowly, China, however, has not, until a very short while ago, seen fit to take advantage of these opportunities for those of her young men who wished to embark upon professional careers.



MAIN BUILDING OF NANYANG UNIVERSITY IN CHINA AND FIVE OF ITS GRADUATES WHO ARE AT PRESENT TAKING A PRACTICAL COURSE IN TELEPHONY IN ONE OF OUR GREAT MANUFACTURING PLANTS

A new era, however, is dawning in the Celestial land. Political upheavals have taken place and the desire for progress has expressed itself emphatically. As early as 1911 the Government Technical College at Shanghai, or Nanyang University, as it is now known, decided to send a number of the young men of its graduating class in electrical engineering to this country. Partly because these young men expressed a preference for telephone work, and partly because of a belief that this phase of the electrical industry will develop first and fastest in the next few years in China, the first five men to open the way chose telephone engineering, and their university selected the Western Electric Company, Hawthorne, Ill., as the place for training. Here they will study the manufacture, distribution and engineering side of the telephone industry.

In July, 1911, Chu Fu I, Long Kuo

Tsan and Swan Pao Kien left China for America, and were followed a little later by Frank P. Dunn and Ngo Chung. The last two remained, as explained in their letter, which follows, to help make China a republic, both serving in the revolutionary army.

While interviewing Mr. Dunn and Mr. Chung at the Western Electric shops, a representative of POPULAR ELECTRICITY MAGAZINE met with a surprise in listening to the very good English in which these men expressed themselves. This, however, was explained by the fact that at the Nanyang University the engineering books used are in the English language.

A NANYANG UNIVERSITY TEAM

These young men will return to their native land after completing their work here and will doubtless be heard from in the telephone field.

Herewith is printed, as received, a letter written by request by Messrs. Dunn and Chung to readers of POPULAR ELECTRICITY MAGAZINE, telling something of themselves and their country:

"Permit us, first of all, to give you a little idea about the history of our University, that has undergone several changes in name. Up to 1904 it was known as Nanyang College, which name, we presume, is better known over this country as well as in European countries even now. Between 1905 and greater part of 1911, being under direct control of and supported financially by the Board of Post and Communication of the late government, it received the name 'Imperial Polytechnic College,' and though the organization changed a little, the activities of the faculty remained as strong. In the October last, when the city Shanghai, where the college is situated, as well as the whole of province Kiang Su, were taken by republicans, the name Nanyang University was given to it, under the management of Mr. W. C. Tong, one of the presidents devoted to the progress of the college. The only change was the separation of the college from the said Board at Peking. Courses of law, political science, and medicine were then planned to be added to the electrical railroad and marine engineering courses, which are in parallel.

"Towards the idea to take electrical engineering as course of our study, we knew that the application of the electricity by different discoveries and inventions has become one of the most important and interesting subjects in the industry of today. There is plenty room yet for one to distinguish himself by discovering new theories and inventing new systems and devices which are the best hope of a student in the electrical line.

We learned that the telephone engineering is one of the most important electrical industries of today and will find better opportunity in our country than it is here. Our college year was 1911. Being kept back by the revolution, we

helped the republicans with our engineering knowledge in our respective towns. Never before in the history of any country in the world has met with such a successful yet bloodless revolution as has the Chinese revolution. The beauty of it has been that we made the so-called 'baby emperor' abdicate by allowing three million dollars annually as pension in order to avoid the bloodshed of the war. During the revolution uttermost care had been taken to protect the foreigners from danger as well as their personal properties, and fortunately no one of such case had ever reported. Dr. Sun Yat Sen was made provisional president and later he resigned with a recommendation to put Mr. Yuen Shi Kai in front, which the people agreed. This was in the February, 1912. Our work in the revolution is thus accomplished. Devoted to straightening up the country, the new government sent us abroad.

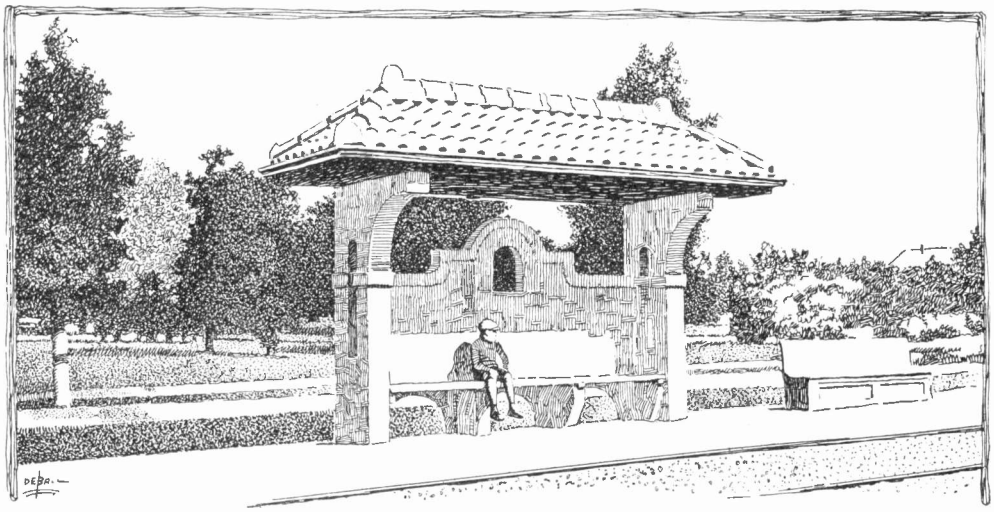
"Since our entry in the Western Electric Company we are quite interested in our work and under the systematic and efficient instructions we are quite sure that in course of time we shall probably be the pioneers in China.

"Trusting this will give you a fair idea of who we are and why we join the telephone engineering course here, we remain Yours cordially,

"N. CHUNG,
"F. B. DUNN."

ARTISTIC REST STATIONS IN PASADENA

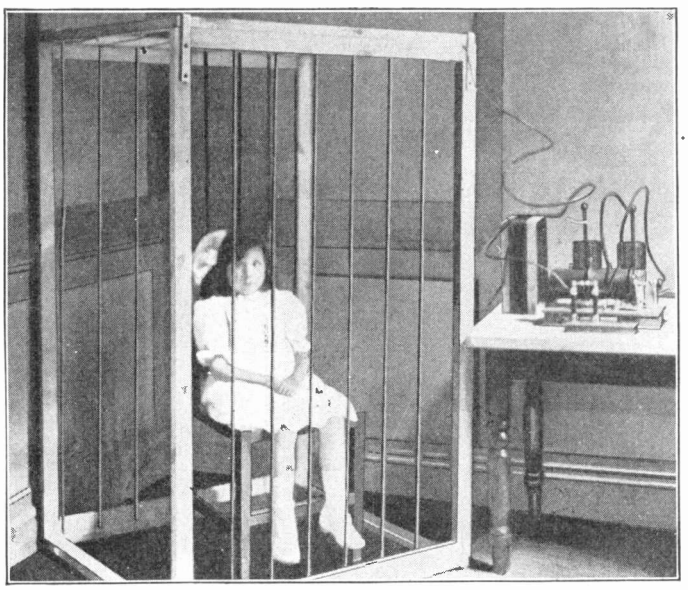
No more does the wornout street car from the '80s serve as a resting place for street car patrons in Pasadena, Cal., and the rough and ready benches provided for the same purpose by local advertisers and inscribed with advice about pills or "gent's furnishings"—all these must go. Such makeshift waiting places for street car patrons are now being replaced by concrete structures of Mission design with red tiled roofs. The Pacific Electric Railway Company has a real interest in Pasadena, and will add to its popularity by these structures, which ornament the beautiful neighborhood through which its line passes. It is "good business" in the highest sense to make improvements which appeal to the good will of the community in which a firm or corporation operates.



STREET CAR PATRONS IN PASADENA APPRECIATE THESE ARTISTIC REST STATIONS

Electrical Treatment of Children

In the August issue mention was made of certain experiments in the stimulation of the growth of babies by means of high frequency currents. These were made by Mr. T. Thorne Baker, who frequently performs more or less spectacular "stunts" of this nature for his paper, *The Daily Mirror* of London. We now have a photograph and some further details of this interesting work to present.



CHILD IN AN ELECTRIFIED CAGE

The experiments have been conducted in some cases with his own little daughter of five, Yvonne Baker. These experiments, says Mr. Baker, are the first of their kind, and he now expects shortly, in conjunction with a medical man, to start treating the first of the babies who really need the treatment—babies who are thin, anemic and underweight.

Seated in a grim looking cage surrounded with wires, little Yvonne Baker underwent for five minutes recently the high-frequency, electro-magnetic treatment, and at the same time "sat" for her photograph. One's imagination was stimulated by the wire cage, the crackling blue sparks from the giant coil, the sense of mystery and unknown power which the apparatus radiated. What would an old-fashioned mother have thought could she have seen this modern method of strengthening babies?

Little Yvonne, after the experiment, gave her impressions to the photographer. While she was in the cage her father put in a helium vacuum tube, and it glowed brightly, showing the electrified atmosphere. "I felt lovely all the time," said Yvonne. "It made me feel very happy. I should have liked to go to sleep there, it was so comfortable. I love having 'lectric currents." Really she felt nothing at all, but she imagined all this.

There is no pain or danger in the treatment. The babies will be placed in a cot in the wired in cage for ten minutes each day. The doctor will weigh them and carefully report upon their progress. In the cage electro-magnetic waves are set up in the ether, these waves moving in all directions hundreds of thousands of times a second. "Laboratory experiments have shown me," says Mr. Baker, "that these currents improve the circulation of the blood and therefore increase the vitality of the infant under treatment."

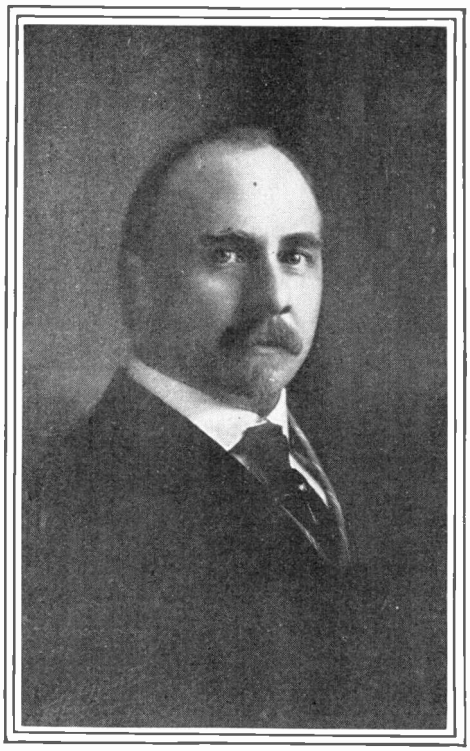
Outdoor Electric Advertising

No other form of outdoor advertising is at present so free from criticism and antagonism from esthetic reform organizations as electric advertising. On civic grounds electric advertising is generally recognized as highly desirable. It is the one advertising medium which at the same time serves a distinct commercial service and renders a distinct public service in lighting the thoroughfare.

College Training of Electrical Engineers

By A. C. SCOTT, President of the Scott Engineering Company

Extracts from "Addresses to Engineering Students," edited by Waddell and Harrington, consulting engineers. This is the third of a series of similar articles by prominent educators and business men, which will be especially interesting to boys and young men who contemplate following the engineering profession.—Editorial Note.



Lord Kelvin said that the first object of an education is "to enable a man to live," and the second, "to assist other men to live." The truthfulness of this statement is nowhere more apparent than when considered with respect to the engineer of the present time; to him is due, more than to any other, the great improvements in communication, transportation, illumination, and sanitation, which so manifestly assist other men to live. Moreover, it must be admitted that the phenomenal advance made in electrical engineering within the past few years has brought comforts and luxuries to the public at large never before considered possible.

It has been well said that "the recent rapid development of the electrical industry owes its vitality to the engineering school. Its graduates have done the designing, constructing, operating, and directing which have made possible the rapid progress and wise extension in the use of electricity."

Granting that this is true, the questions of vital interest and importance at present are:

Does the average university or college technical school properly prepare its students for their life work as engineers?

Does the sequence of courses taught, and do the methods of teaching afford the maximum opportunity for the student, when viewed from a common meeting point of the psychological and pedagogical standards within the college, and the practical or operating standards outside it?

Such questions as these, or something akin to them, have of late been the source of voluminous and no doubt profitable discussion, although a digest of papers recently published appears to show that no common ground of agreement has yet been reached.

A few years ago the manufacturers and heads of corporations gave the college graduate but little encouragement, because they did not appreciate the value of concentrated theory; the probable reason why today they are saying, "Give us technically educated men," and are filling vacancies in their factories and systems with college men, is on the one hand that the college is constantly endeavoring to improve methods of instruc-

tion, including such practical testing and laboratory work as will be more in line with their requirements, and on the other, the manufacturer or corporation manager is becoming educated to recognize the importance of sound theoretical training.

The most potent criticisms by large manufacturers and property managers of their college graduate employees, at the present time, appears to be that they lack a certain kind of human common sense, and that they do not know how to adapt themselves to new conditions, or to adjust their personalities to the wishes of their superiors; that they lack most decidedly the ability to direct men, and are loath to assume responsibility which requires originality or initiative on their part.

To meet such deficiencies, several of the large concerns have established special apprenticeship courses, and it has recently been shown that with one large company, of those who finished the apprenticeship course, 50 per cent are now with the company, and the others are with operating or electrical supply companies, or are acting as consulting engineers or instructors.

The apprenticeship course attests the validity of the criticism, but there are grades of adverse criticism, and it appears that the sort presented is the best, for the following reason: A student passes from three or four years of cramming, memorizing effort, in the high school. During the first two years of his college course he is likely to go on memorizing as in the high school, and does not really learn how to study or concentrate his mind on the work before him until some time during the junior year, or possibly the senior year. As a matter of fact, it appears that there is not sufficient time for him to obtain a knowledge of the fundamental principles underlying a broad education in engineering, and at the same time carry on work involving much originality, or the direction of men. Therefore, the criticism of the manufacturers in general of college graduates is what one familiar with professional college work might expect. There appears to be no doubt, however, in the minds of all that fundamental principles of mathematics, mechanics, physics, chemistry, English, foreign languages and political science are a necessary part of the engineering graduate's proper training, as well as the more specialized subjects of engineering.

I am thoroughly of the opinion, therefore, that the average technical college does not properly prepare students for their future work as electrical engineers. The chief reason is that an attempt is made to complete subjects in a four-year course which, if properly taught, would require fully six years. It is no wonder the student does not develop the spirit of original research—he has no time to do anything but attend lectures in the morning and laboratory practice in the afternoon for six days per week, and even at that pace does not properly cover the ground. The electrical engineer must be more of an all-round engineer than any other; he must not only have the fundamental knowledge of theoretical and applied electricity, but in addition must be reasonably familiar with much of civil, steam, hydraulic and gas engineering.

With the ever-increasing additions to the present great store of technical knowledge, I have no hesitancy in expressing my belief that the institutions that are in the lead with a five or six year technical course will readily find better positions for graduates than will the others. It certainly appears reasonable that in an institution having well-equipped laboratories and a corps of competent instructors, it is possible for the student during the one or two extra years to do much more for himself than would be possible in the same time after leaving at the end of a four year course with what amounts to a too hastily swallowed dose of everything taken; this is evidenced not infrequently by cases of acute mental indigestion and, as complained of

by the manufacturers, an utter lack of originality, judgment, or logic in meeting shop requirements.

The longer course gives the student time for some attention to athletics, social functions, perusal of current engineering literature, a better training in culture subjects, and a much more thorough training in theoretical and applied engineering, than a four year course. My view of the situation, considering the best interests of the students, is that any college offering technical courses leading to an electrical engineering degree should require the equivalent of a five year course to obtain the B. S. degree in electrical engineering, with the further provision that the E. E. degree be allowed for an additional year of study involving a thesis covering original research work; maintaining the standard entrance requirements as at present and the same for all students.

So far as laboratory courses are concerned, I believe it to be possible to meet the criticisms of employers of students to some extent. In some of the engineering laboratories the students have nearly all connections made for them, and their chief duty one and all in a test is to read instruments and record their readings. I think that is the limit of poor laboratory instruction. The student regards it as a special dispensation at the time, but if he is required to direct a shop test later on, he will no doubt act as though devoid of "human common sense." He does not know what to do, much less how to direct others. The laboratory course that will most nearly meet the adverse criticism of employers today is the one wherein the students are required to make all machine and instrument connections, and also that requires some one of the members of a section to act as director of the test at every period, and be responsible to a reasonable extent for the use of machines and instruments. This arrangement is not intended to relieve the instructor from his duties in the least; on the contrary, it may add something to them, for the student whose turn it may be to direct the test should confer with him beforehand in order to be sure that he understands the test completely, and also to learn what instruments are available for the test.

It is only by actually directing men that one learns how to do it, and if the students gain some practice in this way in the laboratory they may be less criticised after entering practical work.

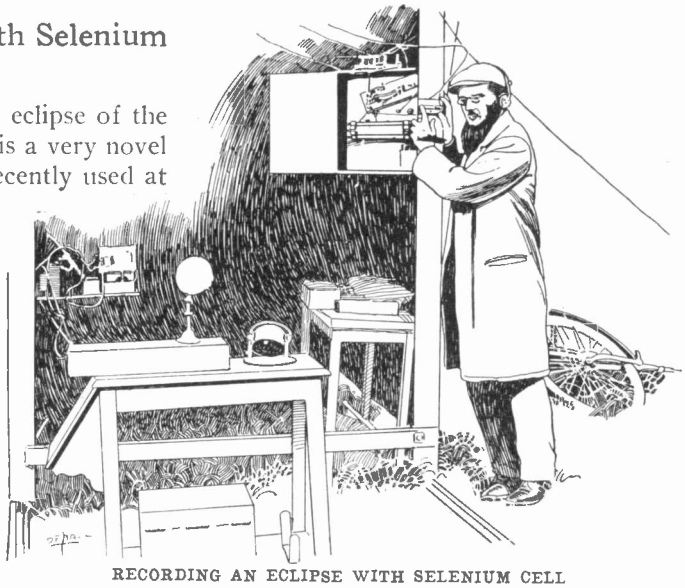
Unique Electric Sign

The huge bell of green glass shown in this illustration is a duplicate on a large scale of the bronze Mission bells which have been set up at frequent intervals on the highway which links the old Spanish missions in California, a popular automobile road known as El Camino Real, or the King's Highway. As these signs are so frequent as to be well known landmarks, a Santa Barbara garage has adopted the emblem as its advertising sign, thus securing a large amount of free advertising. The garage is on the road to the Santa Barbara Mission and so the electric sign takes its place in line with the familiar roadmarks.

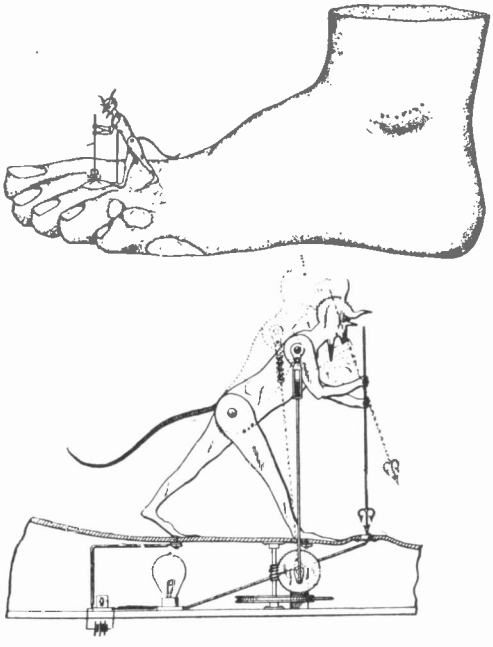
BELL SIGN OF A SANTA BARBARA GARAGE

Recording Eclipse with Selenium Cell

Taking the effect of the eclipse of the sun by means of selenium is a very novel method which M. Ancel recently used at Paris. Seeing that more or less current will pass through a selenium cell according to the amount of light falling upon it, he applied the idea by throwing the sun's rays upon a very sensitive cell and measuring the effect of the light by recording electrical instruments. This he was able to carry out with good success in the suburbs, where he had erected a shelter tent in the middle of the fields. In front of the tent was a mirror moved by clockwork, so that it followed the sun exactly and kept its light thrown upon the selenium cell, this being placed on a table at the front of the tent. Inside was set up the electric recording apparatus and batteries. The recorder worked upon a moving paper band and traced a line showing the strength of the light.



RECORDING AN ECLIPSE WITH SELENIUM CELL



HOW ONE MIGHT SUPPOSE THE STING OF A CORN IS PRODUCED

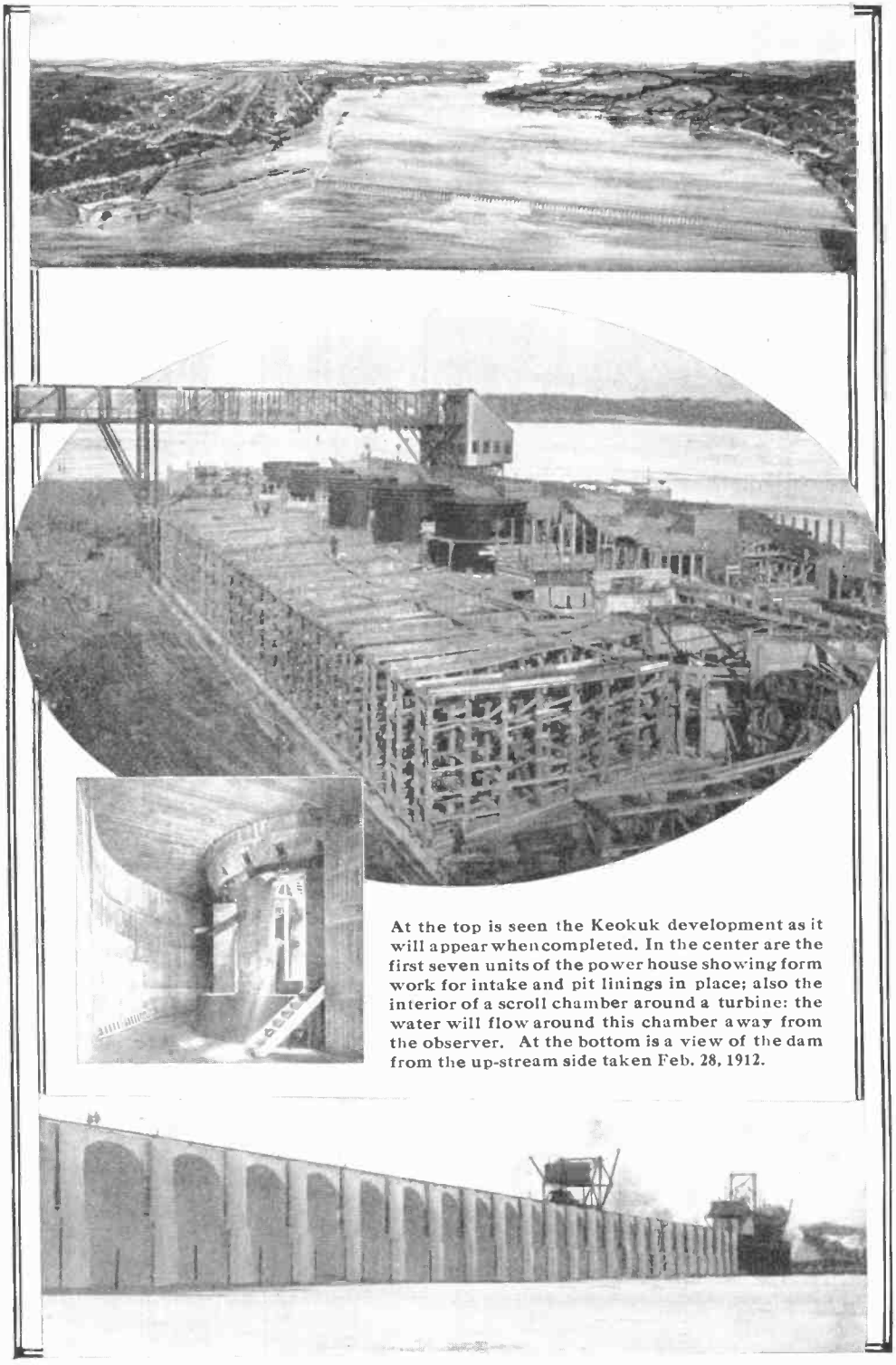
Corn Cure Advertising Device

An unusual advertising device for calling attention to a corn cure is the subject of a patent issued to John Jay Lepper, Milwaukee, Wis.

A hollow member representing a person's foot is surmounted by a moving figure representing his Satanic Majesty. In his hand is a spear. With great regularity he brings the point of the spear down upon an offending corn, when, upon withdrawing it, an electric spark is produced between the corn and the spear point. Within the foot form is a small motor and a lamp.

Boron in Cast Copper

Recently a step of great importance has been made in the casting of copper. It was formerly impossible to obtain a cast copper having the density and electrical conductivity of the drawn pure copper. Now, through the use of boron, copper may be cast of high conductivity, high density and freedom from blowholes.



At the top is seen the Keokuk development as it will appear when completed. In the center are the first seven units of the power house showing form work for intake and pit linings in place; also the interior of a scroll chamber around a turbine: the water will flow around this chamber away from the observer. At the bottom is a view of the dam from the up-stream side taken Feb. 28, 1912.

Immense Generators of the Keokuk Plant

The largest power house in the world, where will be wrested from the "Father of Waters" the largest single conservation of energy ever harnessed, will be installed ultimately 30 immense vertical waterwheel type alternating current generators that rank as mammoths among machines for generating electric current. These generators will be placed in the hydro-electric power house at Keokuk, Ia. When completed this building will measure 1,750 feet long by 123 feet wide by 133 feet high above the foundations, and the plant will develop with the final entire installation over 300,000 horsepower. This gigantic concentration of energy is to reach out and wrestle with the machinery, lighting and traffic of towns and cities within a zone of 150 miles or more from Keokuk.

ONE OF THE KEOKUK GENERATORS WHICH MEASURES 30 FEET IN DIAMETER AND WEIGHS OVER 600,000 POUNDS

In the March issue of this magazine an article of some length treated of this immense project. Some later pictures have been received, however, showing the present stage of the development, which are reproduced on the opposite page. Also, a little additional information concerning the gigantic dynamos or generators will be of interest.

The initial installation of electric generating units, built by the General Electric Company, will include fifteen alternators direct connected to the same number of vertical hydraulic reaction turbines of the single runner type, which will occupy the north half of the power station. Each turbine and generator will form an independent unit. Each wheel, mounted on a vertical shaft 25 inches in diameter, in a spiral chamber 21 feet three inches in diameter and molded in the concrete substructure, will operate at a constant speed of 57.7 revolutions per minute and will have a normal capacity of 10,000 horsepower.

The generators are to be installed on top the wheel pits directly over the turbines and will be direct connected to the vertical wheel shafts by forged steel flanged couplings.

The rotors of the generators operating at slow speed accounts in a measure for the great size of the machines at their rated capacity, as will readily be understood by engineers. The generators measure 32 feet in diameter by twelve feet high, and the total weight of each machine is over 600,000 pounds. Fifteen to 20 freight cars are required to transport one complete generator when dismantled, the shipping weight of which is nearly 700,000 pounds. About 400 cars and 25 locomotives will be needed to haul the shipment of the entire equipment of electrical apparatus for the first half of the installation. These cars and locomotives all coupled together would form a train 4¾ miles long.

Notwithstanding the moderate speed of the generator rotor, owing to its great diameter the peripheral velocity is relatively high. Should a fly crawl in onto the outside of the rotor and it start suddenly, he would be whirled around at

the rate of 52½ miles per hour, provided he could hang on. Walking on the ceiling is an everyday occupation for the fly, but hanging on a merry-go-round where the centrifugal force tending to throw him off would amount to nearly 500 pounds is not usually included in the fly's stock of legerdemain. He might as well try to carry a fat man on his back.

Ohio Electric Light Association

Ohio has been called the "Mother of Presidents," so many of the nation's executives have come from this state. Ohio never does things by halves and the Ohio Electric Light Association convention at Cedar Point, July 16 to 19, was a sample of some of the state's energy active in the electrical field.

The membership is made up of men connected with the electric light and power plants, large and small, scattered over the state. This year they elected as their president Mr. J. C. Martin, of Wilmington, Ohio, to succeed Mr. W. C. Anderson, of Canton.

Only twelve years after the first commercial central station was built in Appleton, Wis., in 1882, the Ohio association was formed, making it easily a pioneer among the many strong state associations which grew up later. No small portion of its success has been due to its secretary-treasurer, Mr. D. L. Gaskill, who has held the position for many years.

That the farmer can make profitable use of electricity was evidenced in one paper, "Electricity in Rural Districts," by J. C. Matthieu, of the Dayton Light and Power Company.

"The possibilities of electricity on the farm have not as yet been scratched," says Mr. Matthieu. "The farmer is one of the first to adopt modern practice if he is but shown. Irrigation is destined to become one of the most important, if not the most important, economic factors of the country; water, when and where you want it, will act as a governor regulating that great machine—the farm.

"In the state of Ohio there are an innumerable number of truck farms where success depends a great deal upon the amount of rain that falls each month and at the proper time. Truck garden crops demand even distribution of from one to five inches of water per month. Rainfall estimated over six months for a period of 28 years throughout Ohio is approximately 3¼ inches per month, an excess precipitation often following a period of drought and vice versa.

"Experience has shown a crop increase of from 25 to 100 per cent with plentiful

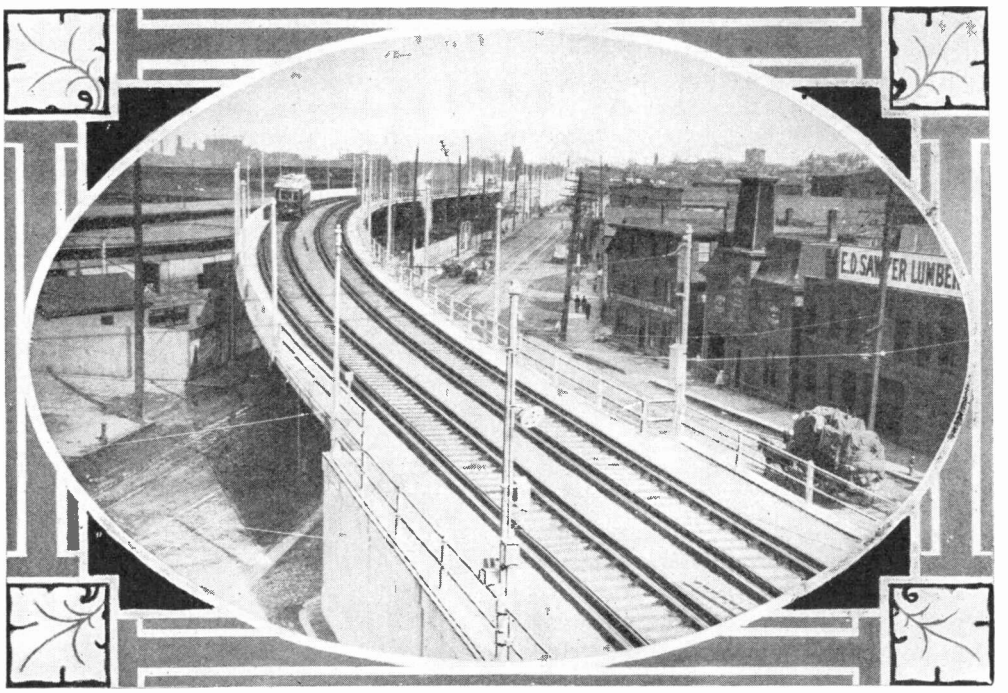
D. L. GASKILL

wetting of the ground at plant setting and regularly applied irrigation of two or three inches of water per week in one to three applications, depending upon the weather and rainfall.

"In some instances motors are used to increase circulation of the water in heating pipes in greenhouses, thereby saving the coal bill. The very fact that the pump can be left without an attendant, running at any hour of the day, is what appeals to the farmer. And he can use a portable motor upon feed grinders, hay presses, silage grinders, threshing machine, corn shellers, etc.

Surface Cars on an Elevated Line

There has recently been opened in Boston another section of the fast growing rapid transit system of the city, under the control of the Boston Elevated Railway Company. This is the East Cambridge elevated extension, which is a double tracked elevated structure for surface cars only, the cars being specially built heavy steel conveyances of the familiar trolley type, with sliding end doors controlled from either end, and having concrete floors. This line extends from Lechmere Square, East Cambridge, through the West End of Boston to the North Station, where it connects with the elevated and subway systems.



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BOSTON'S NEW ELEVATED TROLLEY LINE—CHARLES STREET CURVE—SHOWING CONCRETE VIADUCT IN DISTANCE

It was built under the direction of George A. Kimball, chief engineer of elevated and subway construction, by the Boston Elevated Company. It is 1.18 miles in length and has 2.51 miles of single track. It crosses the Charles River on an ornamental concrete viaduct about 1,700 feet long, said to be the longest concrete bridge in the country. Near the Boston end is a Strauss trunnion bascule drawbridge, electrically operated.

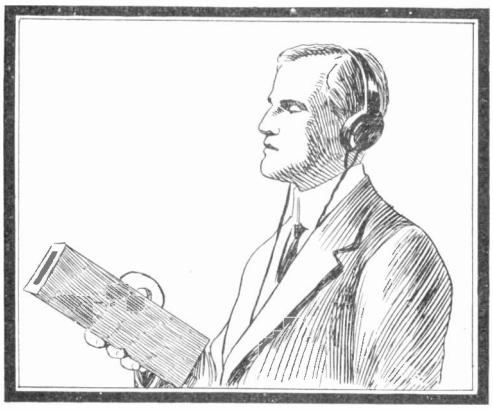
By means of automatic interlocking devices, steel bumpers are raised from between the rails of each track, eliminating danger from the car approaching an open draw. The bridge, therefore, cannot be raised unless signals are set at danger and bumpers are raised to protective positions. Except for the portion over the river, this elevated trolley structure has a concrete floor and the track, of 85 pound A. S. C. E. tee rail, is laid in rock ballast. The cost, exclusive of power, cars, etc., was $3,500,000.

One very interesting feature of the viaduct structure is the huge hinge that is embedded at the base of every arch where the span rests upon the pier. Fully five feet wide and nearly six feet tall, these hinges are intended to take up the motion of expansion and contraction of the huge

mass of reinforced concrete in each arch. That these are the hardest hinges to move that have ever been conceived may be seen from the fact that the steel pin which joins the two leaves of the hinge can support 2,000,000 pounds and this weight is necessary to move the hinge a half inch.

Scientists Listen to Light's Noises

Great interest has been aroused in scientific circles by the exhibition at the optical convention held recently in South



PROF. D'ALBE'S APPARATUS

Kensington of the octophone, an instrument which makes light audible. It is the invention of Prof. E. E. Fournier d'Albe, B. Sc., M. R. I. A., lecturer on physics at the University of Birmingham, formerly secretary of the Dublin Society for Psychical Research.

The octophone is a cameralike box from which come two wires with highly sensitive receivers at the ends. If you are blindfolded and place the receivers to your ears and a piece of blotting paper is placed between the box and an arc lamp you hear a ticking or grating sound —in fact, you "hear" the shadow passing. On a moonlight night one may hear the moon, while the sun makes a tremendous noise like a cataract.

The octophone can locate the light of stars invisible through the telescope.

A stone blind young man stood with the receivers to his ears. Between him and the windows people passed at intervals. He always detected their passing, exclaiming, "That's a man!" Walking with the instrument, he always found a window by the noise caused by the light, although he lives in perfect darkness.

Prof. d'Albe hopes his discovery can be greatly utilized for the benefit of the totally blind.—Dr. Leonard Keene Hirschberg.

Flies Avoid Fan Breeze

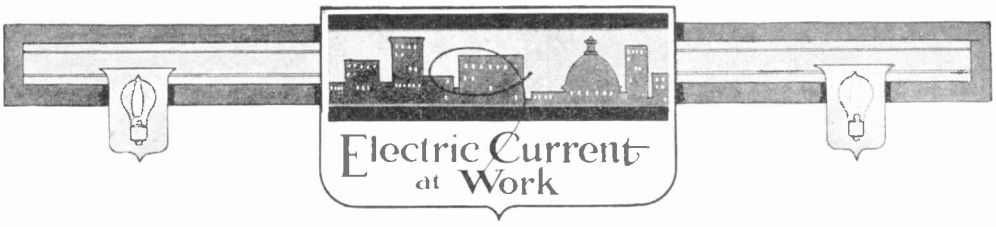
The electric ceiling can be recommended without qualification as a substitute for a screen door. Flies plainly show their dislike for the breeze from a fan, and this has led bakeries, restaurants and candy stores to appropriate the

FANS KEEP OUT THE FLIES

idea. One very serviceable place to install the fan is at the ceiling of the entrance to the store.

Electric Line Up Mt. Washington

Plans have been completed by the Boston & Maine Railroad for a unique summer hotel to be erected on the summit of Mount Washington, and to be reached by a scenic electric railway almost 20 miles long, which will circle the mountain 2½ times.



The Electro-Magnet a Veritable Aladdin's Lamp

By GEO. J. KIRCHGASSER

In the early part of the nineteenth century—1820, to be more exact—it was discovered that a bar or rod of iron could be magnetized by passing an electric current through a coil or spiral of wire surrounding the bar or rod. This results in an electro-magnet, developments of which are responsible for our great industrial advances. The electro-magnet is the basis of modern electrical industry. Electrical investigators in all branches have produced marvels since the discovery of the electro-magnet.

Morse made all of us kin when he adapted the electro-magnet to the telegraph. Bell made whispering galleries of the country by adapting another form of electro-magnet to produce the telephone. When you go calling an electro-magnet, actuated by the small push button, announces your coming.

The electric telegraph consists simply of an electro-magnet placed at a receiving station, the iron bar core of which is attracted, making a clicking noise each time a small hand switch or key is closed at a sending station. The clicks of the iron core, translated by the Morse code, transmit the message.

The dynamo or generator which produces the electric current for the lighting of our homes, offices, stores, etc., and the motors for operating our streets cars and the machines of our factories, consists essentially of two electro-magnets, the rotating armature and the stationary field poles being usually built of sheet steel or iron around which insulated wires or conductors are placed.

As late as the year 1895 the prospect of adapting the motor widely for industrial purposes seemed slight. At that time it would have been ridiculous to predict its almost universal present day application. An electro-magnet, a very small one, was again mainly responsible for making the motor generally applicable. Before Mr. Harry H. Blades invented the adaption of the "no-voltage release electro-magnet" with the starting rheostat of the motor all sorts of dangers were concerned with every motor installation. They were liable to burn out, to run away and to fly to pieces.

The design of Mr. Blades, which is adapted universally now, is illustrated in Fig. 1. Here the electro-magnet referred to is seen at the right side and consists of a spool wound with a coil of small wire. This winding is connected in circuit with the wires which carry current to the field coils of the motor and when current passes through it the iron pieces seen at the ends of the spool become strong magnets. The handle at the left is for starting the motor gradually, as it passes over the contact buttons. In its extreme right or "full on" position the electro-magnet grasps and holds the lever against the action of a spring. As long as everything is all right and current flowing to the motor the electro-magnet holds the lever in the "full on" position. If the current is accidentally cut off the

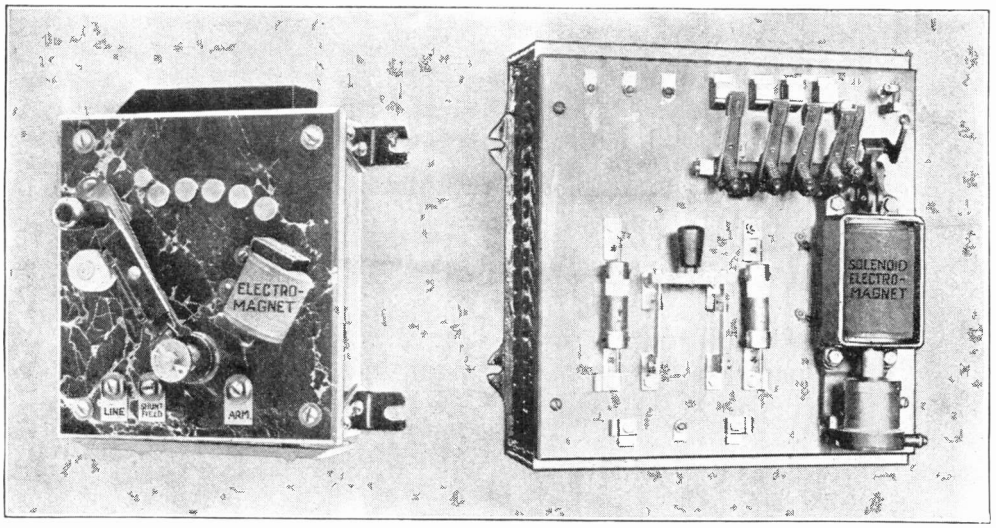


FIG. 1. ELECTRO-MAGNET ON A MOTOR STARTER

FIG. 2. THIS ELECTRO-MAGNET AUTOMATICALLY OPERATES THE MOTOR STARTER

electro-magnet is de-energized and lets go of the lever, which flies back to the "off" position. Then, when the current comes on to the line again the motor will not start until the lever is thrown over by an attendant slowly, from button to button, so as not to allow a rush of current through the motor and burn it out. This device, small as it may seem, has meant more to the application of motor drive than anything else.

Besides its use on the simple hand operated motor starters, the electro-magnet has been adapted in various designs to all kinds of motor controlling devices. Fig. 2 shows an automatic motor starter or self-starter, the principal feature of which is the electro-magnet mounted on the right side. Small wires which control the current to the electro-magnet can be carried to any or several points, and permit, by simply pushing a button or closing a small switch, of starting the motor from a distant place. This is called remote control. The magnet pulls up its iron core, which is retarded by an air dash-pot in this case, and closes the successive fingers at the top of the panel and brings the motor from rest to full speed. If the current supply is interrupted the magnetized core drops down and opens the finger contacts.

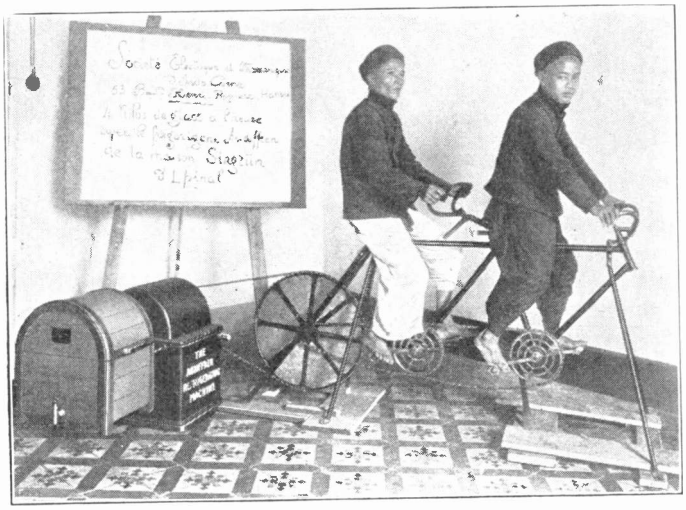
The high speed electric elevators required in our tall buildings are possible only through the agency of the electro-magnet. The elevator car is not started, speeded up and stopped directly by the operator's switch, but by a series of electro-magnetically operated switches located on the elevator controller near the motor. The operator's switch carries the current to the magnetic switches and they handle the main currents.

The adaption of the electro-magnet permits of the high speed, easily controlled printing press. The controller may be located on the wall, and push button stations permit of starting, speeding up, slowing down, stopping, etc., at the will of the operator. These stations simply close or open small circuits which energize or de-energize the electro-magnets or electro-magnetic switches of the controller which govern the action of the motor driving the press.

The above examples of applications are only a few out of a multitude, but these show that the electro-magnet responds to the various purposes for which the electrical engineer wishes to use it. It is not only necessary to the dynamos and motors, but is the basis of the entire industry of motor controllers—it has been a veritable Aladdin's Lamp.

Audiffren Refrigerating Machine

The Audiffren refrigerating machine operates on the compression system, using sulphur dioxide as the refrigerating agent. It consists of two globes joined



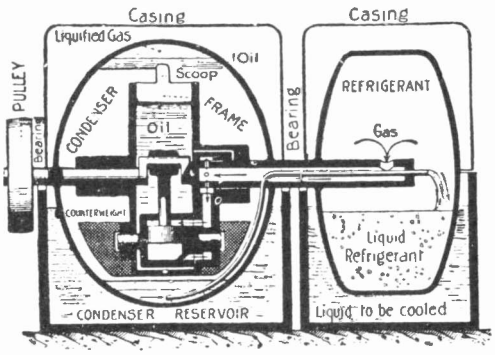
METHOD OF OPERATION IN INDIA WHERE ELECTRICITY IS NOT ALWAYS AVAILABLE

by a hollow shaft which carries on its extension a pulley or crank. Its external appearance is that of a dumb-bell. There are no joints, valves, gauges or stuffing boxes, and its operation is simplicity itself. It is only necessary to place the machine in its bearings, fill the condenser and refrigerator tanks with water and apply the power, in order to have at will, within a few minutes, cold air, cooled water or ice.

A pump, the compressor, receives and compresses a liquefiable gas, in this case sulphur dioxide, and discharges it into the condenser, where liquefaction takes place, the metallic container being cooled by the water in which it is partly immersed. The resulting liquid passes through the hollow shaft into the refrigerator, where it expands again into a gas and is ready for its return to the compressor. The circulation of the volatile liquid continues in a closed cycle from the condenser to the refrigerating side and return indefinitely. One of the most novel features of this machine consists in making the compressor operate in the atmosphere which it compresses, inside of a condenser hermetically sealed.

An electric motor is the most practical and convenient means of supplying the power and is used where it is available. In India, where electric power is not everywhere available, the machine is connected by chain to a tandem bicycle operated by coolies. The particular machine set up in India is used to make ice for drinking water and for table purposes. This application of the Audiffren refrigerating machine in the Orient is merely an extension of the activities of the punkah boy and his fan.

When the Audiffren machines are applied to domestic refrigeration in other countries, they are mounted directly on top of the refrigerator, and brine is used in the cold tank instead of

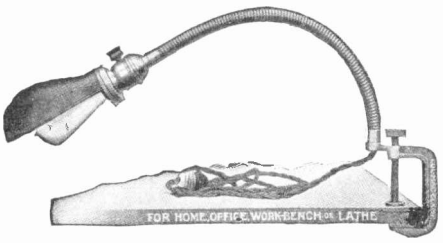


SHOWING THE ACTION OF THE AUDRIFFEN REFRIGERATOR

water. Connections are made from the brine tank down to the cooling surfaces placed in the ice box. In this way the refrigerator is cooled by clean, dry, pure air and the disagreeable slime, which is bound to collect from even the best ice, is avoided.

Flexible Lamp Arm

A handy lamp holder for the garage, work bench, lathe, etc., is here shown. A flexible arm is attached to a bronze

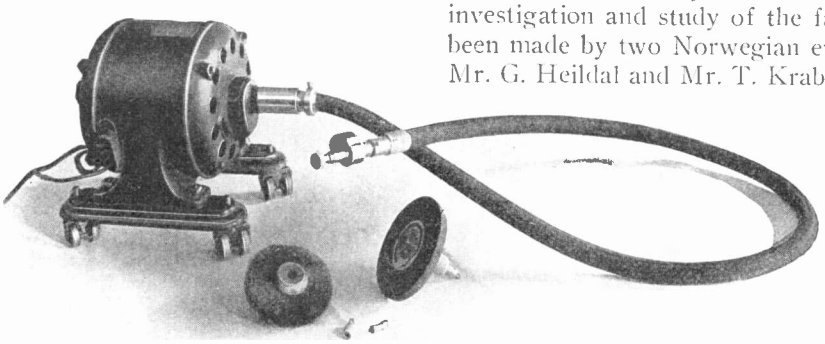


FLEXIBLE LAMP ARM

clamp that makes it possible to fasten the whole outfit to a bench, table or any material over which the three inch jaw of the clamp will fit. From the plug the cord passes through the interior of the arm up to the lamp.

Portable Polishing and Grinding Motor

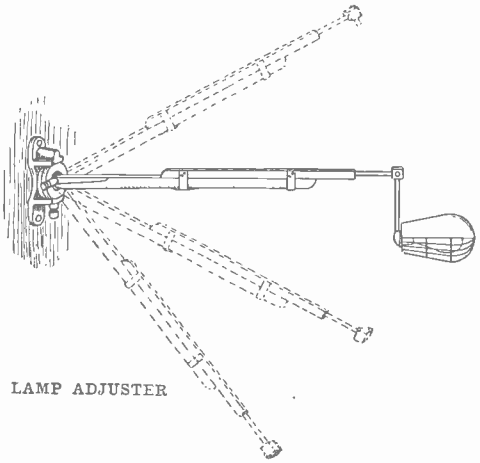
In the grinding and polishing of metal, the electric motor enters as a strong competitor of the hand method, especially if close, careful but rapid work must be done. The accompanying illustration shows a one-half horsepower motor equipped with a flexible shaft upon which may be placed a buffer, a small emery wheel or any similar polishing or grinding device. The flexible shaft makes it possible to keep the material worked upon stationary. The motor runs at 1,750 revolutions per minute.



PORTABLE POLISHING AND GRINDING MOTOR

Lamp Adjuster

This illustration shows the Universal lamp adjuster designed to be fastened to the wall or ceiling at the point where a movable light is required. The arm is of polished hard wood and the trimmings



LAMP ADJUSTER

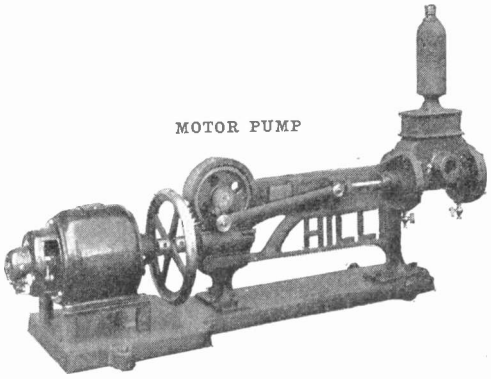
are aluminum finished. A reflector and wire guard make the adjuster very serviceable in the shop or factory.

Water Power of Iceland

According to the Icelandic paper *Thödviljinn*, a company has recently been formed for utilizing practically all the available waterpower in Iceland, aggregating 250,000 horsepower. A thorough investigation and study of the falls have been made by two Norwegian engineers, Mr. G. Heildal and Mr. T. Krabbe. The name of the company is the Iceland Waterfalls Company, Ltd. The president is Mr. Sam. Johnson, Christiania, Norway.

Reciprocating Motor Pump

A novel form of electric house pump is shown in the accompanying illustration operated by a small electric motor

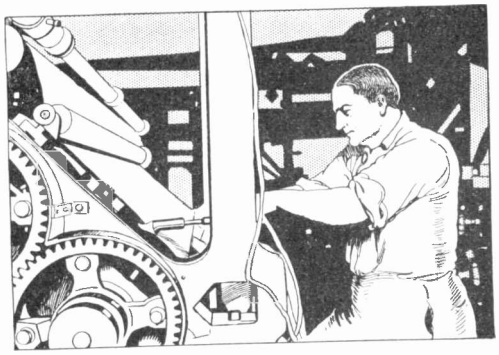


MOTOR PUMP

of a semi-enclosed, direct current type developing ¼ horsepower. A piston pump is utilized with a connecting rod operated by the armature shaft of the electric motor through a transmission of worm gearing.

The Electric Felting Tool

When a newspaper is being printed, the paper is run on the press over a strip of muslin, and beneath the muslin is a felt "blanket." In a short time the constant pressure of the inked metal wears down the felt, leaving in the center, at the ends of the metal, a ridge of felt, which corresponds to the unprinted margin at the center of the newspaper, where it is folded. If this narrow strip of felt, or "bolster," as it is called, is not kept down to the level of the blanket the paper will crease or even break at the margin.



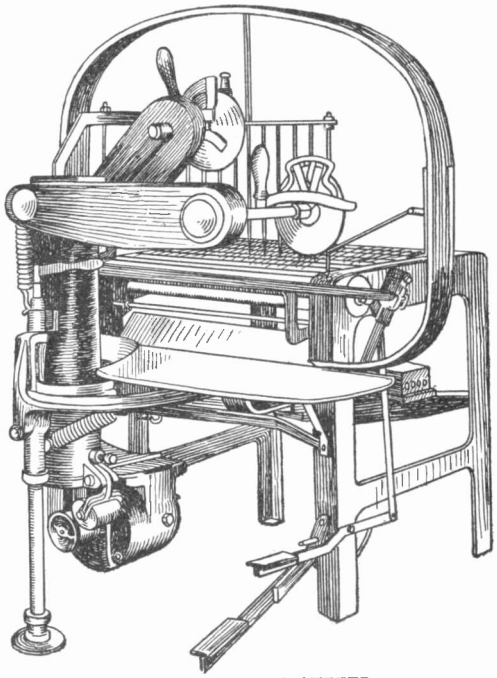
USING THE FELTING TOOL

Before the electric felting tool was put on the market it was necessary to scrape the bolster or burn it down with an ordinary soldering iron. By either method the process was a slow and laborious one, sometimes requiring a man on each side of the cylinder.

In cases where the Vulcan tool has been adopted it is said that very few minutes are needed for burning the bolster with the new iron, and that, as it may be kept at an even temperature, it has not the destructive effects of the old soldering iron or scraping knife.

Electric Meat Cutter

The machine illustrated is a motor driven meat cutter made to slice up beef loins and rounds into nice, even steaks.



ELECTRIC MEAT CUTTER

It works rapidly and takes the place of the knife and saw in the retailing of all sliced meat. It is operated by a one horsepower motor, and its working parts are made of nickel plated steel.

An Electric Scrubbing Machine

An interesting machine has just been patented by E. J. Stewart, an attendant at the Vanderbilt Clinic in New York. It is an automatic electric scrubbing machine which supplies water to the floor, scrubs it and takes up the dirty water as the apparatus is pushed forward or backward.

ELECTRIC SCRUBBING MACHINE

The machine has a tank holding about five gallons of water, which is poured into it through the funnel on top. It then runs from the lower corner through a valve to a sprinkling pipe in front of a revolving brush, the flow being regulated by a lever on the handle. Under the tank is a small electric motor (¼ horsepower) which turns the brush at a speed of about 400 revolutions a minute. The brush is seven inches in diameter, so its bristles travel about 700 feet a minute, sweeping up the water into detachable receptacles.

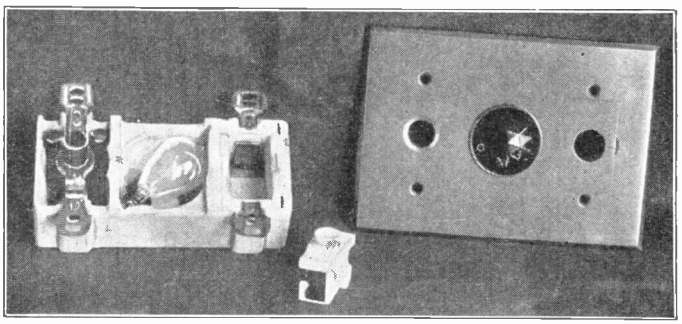
By a simple system of gears the brush can be adjusted so as to press lightly or strongly against the floor, and thus can be used effectively until it is worn out.

The machine works the same in either direction, thus obviating the necessity of turning it around. When the wall has been reached, all that is necessary is to swing the handle over. This reverses the action of the motor and of the brush and shuts off the water on one side and turns it on on the other. This keeps the bristles straight.

Telltale Lamp for Heaters and Irons

Because the electric heater or iron gives out no light or flame we may sometimes forget to turn off the current. It is therefore desirable to have between the heater or pressing iron and the switch an incandescent lamp of low candlepower to show at a glance whether or not the current is on.

This idea is carried out in the Bryant combination receptacle, which contains a push button switch, a place to put in the heater plug, and between the two a pocket in the porcelain in which an incandescent lamp is held by clips. This all sets back flush in an iron box in the wall just over the ironing board or

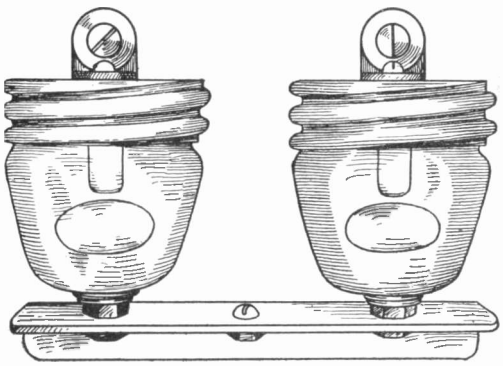


LAMP INDICATOR FOR ELECTRIC HEATER CIRCUITS

heater, and is covered by a neat brass plate with a red glass bull's eye over the telltale lamp.

Mercury Lightning Arrester

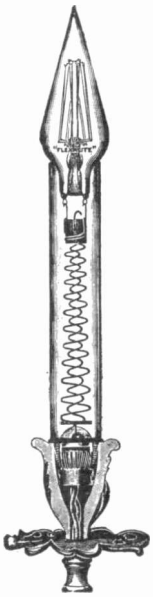
This odd looking mechanism is a lightning arrester designed for service upon telephone circuits. A heavy glass cup is secured by a machine screw to an aluminum base which is connected to ground. Over the head of this screw in the base of the cup mercury is placed. A substantial screw cap or cover serves as a means for connecting to the line wires, while from the center of the cover a carbon post projects down to a point close to the mercury. When the line is struck by lightning the high voltage tends to draw the mercury up to the carbon post, closing the air gap and completing the circuit to earth. The mercury remains in contact with the carbon until the discharge has passed and then drops back to its normal position, restoring the air gap and ready for another stroke.



MERCURY LIGHTNING ARRESTER

The Flexalite Candle

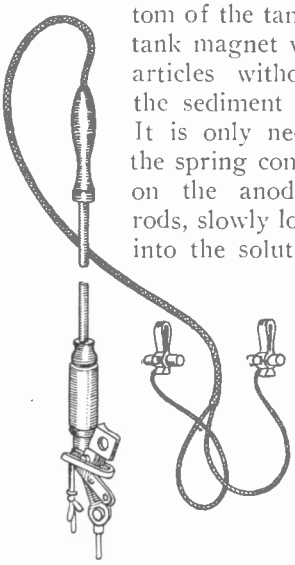
Although a very attractive illumination is given by an electric candle, there are many drawbacks to the use of this kind of light, and one of the chief objections is the difficulty of having a good fit of the candle into the socket. Again, it is liable to break in ordinary household work, and where the candle and electric lamp are all in one piece, the whole is made useless when the lamp burns out. In England the Sun Electric Company makes what is called the Flexalite candle and it overcomes these drawbacks. The fitting has a small lamp separate from the candle tube, so that a new lamp can be put in. The base is made with a spring plug so that it will fit into any candle holder. One of the main points which will appeal to householders is that the spring base prevents accidents when dusting is being done, as the spring makes the candle bend over, and it comes back again in the straight position so that no breaking is feared. Another point is that it faithfully reproduces the graduating transparency of the candle.



FLEXALITE CANDLE

Plater's Tank Magnet

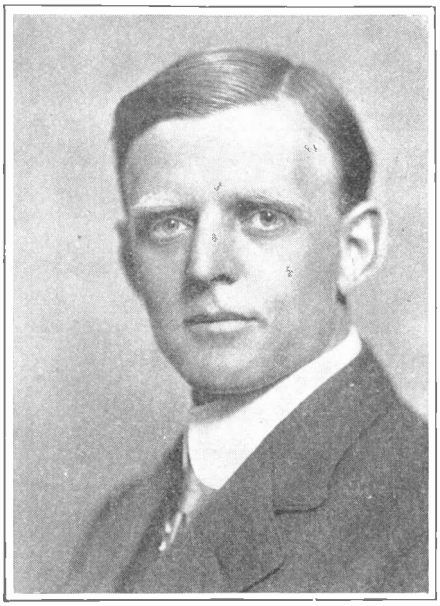
Every plater knows the annoyance caused when articles are lost at the bottom of the tank. The plater's tank magnet will recover lost articles without stirring up the sediment in the solution. It is only necessary to snap the spring connectors in place on the anode and cathode rods, slowly lower the magnet into the solution and recover the lost piece or pieces, then gently withdraw the magnet. Work in the process of plating is not disturbed. Magnets are made up in three styles to suit the three voltages common in plating shops.



Electrical Men of the Times

WALDO ARNOLD LAYMAN

That a good newspaper man will make a good engineering executive is shown by the career of Waldo Arnold Layman, vice president and manager of the Wagner Electric Manufacturing Company, of St. Louis. Mr. Layman's newspaper activities began while he was still in the sophomore class of the Terre Haute (Ind.) high school, from which he graduated in 1887, at the age of eighteen. There he established a monthly paper for the school, running it as a private enterprise until graduation time.



His connection with this high school journal resulted in an invitation to devote a summer vacation, between junior and senior high school years, to work as a member of the editorial staff of the Terre Haute *Daily Express*. This he accepted and served through the summer vacation as a reporter. The work of that summer resulted in an offer immediately after graduation of a permanent position on the editorial staff of the *Express*, as assistant to the city editor, and in that capacity Mr. Layman served from about June, 1887, to September, 1888.

Following this, Mr. Layman accepted the position of editor of a weekly family paper in Terre Haute, called the *Saturday Evening Mail*. This was one of the successful family weeklies in that section of the country and had a wide circulation. Mr. Layman remained there until he decided to enter Rose Polytechnic Institute, having been influenced to do so by Dr. T. C. Mendenhall, with whom he enjoyed a delightful acquaintance. The latter became much interested in Mr. Layman and agreed to make special arrangements for him by which he was permitted to continue his outside newspaper work.

Accordingly, he made arrangements to enter Rose Polytechnic Institute in September, 1888, continuing his direction of the *Saturday Evening Mail* at the same time for about two years, until the ownership of the paper changed. Then he resumed his relations with the Terre Haute *Daily Express* and continued to act as a contributor to that journal until about the middle of his senior year at college, giving up at that time so as to finish up the heavy work of his last college year. His newspaper work thus enabled him to make a fairly comfortable income for about three and a half years of his college course.

While at Rose Institute, Mr. Layman, with his pronounced newspaper inclinations, established a monthly college paper and was its editor during his whole four year term. He was also active in athletics throughout the course, taking a prominent part in the Institute's baseball programme. He was a member of the Rose Polytechnic track team, and held the Indiana 100 yard dash college championship for two years, the standing high jump record for three years and the run-

ning high jump record also for three years.

A year college book called "*The Modulus*" was also established by Mr. Layman while at Rose Polytechnic, and he was the editor of the first volume. Both this book and the other publication known as "*The Rose Technic*" have since been continued regularly as Rose publications.

Mr. Layman graduated from the Institute in 1892, with the degree of B. S., receiving a later degree of M. S. in 1894, and still later degree of E. E. in 1899.

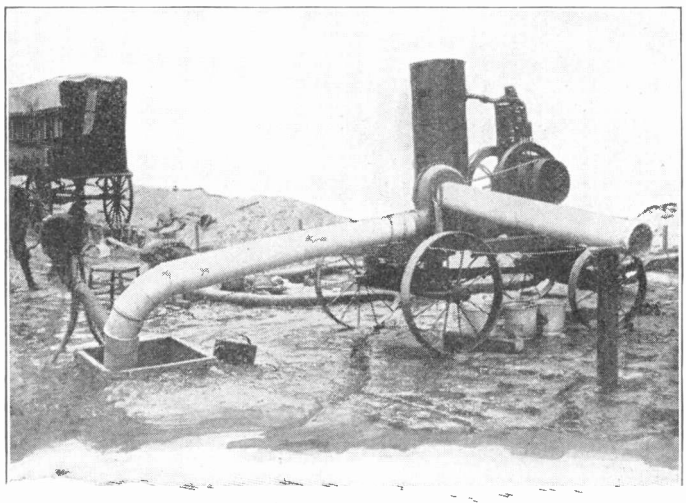
In 1892, shortly after graduation, he entered the employ of the Wagner Electric Manufacturing Company as a utility man in testing and drafting work. He made all the drawings for the Wagner company's first line of transformers and direct current motors, and became identified with all the work leading up to the development of a successful form of single phase motor. In 1894 he became assistant superintendent of the company, and still later, in 1898, he was given the position of assistant general manager. In 1900 he became treasurer of the company, and two years later was made general manager in addition. This twofold position he filled until 1908, when he was made first vice president and general manager.

His engineering work for the company for the last ten years has consisted chiefly in passing judgment on detail engineering work and in looking up new lines of engineering work. He has had full charge of the financial, engineering and manufacturing interests of the business since 1902. The entire Wagner organization is, at the present time, made up of men of his selection, including all the outside selling organization, with the exception of Mr. John Mustard, of the Philadelphia office. Mr. Mustard was out of the service of the company for one year, but was induced to return through Mr. Layman's instrumentality after he assumed the management of the business.

Providing Pure Air in Telephone Vault

Illuminating gas from leaky mains sometimes offers a serious handicap to doing repair or extension work in street telephone vaults. In one instance in Chicago recently fourteen men were affected and one rendered unconscious, a "pulmoter" (described in the May issue of POPULAR ELECTRICITY MAGAZINE) from the Commonwealth Edison Company being called upon to render assistance.

In seeking to remedy the trouble, hand forge blowers were tried without success. Finally an exhaust blower capable of handling 350 cubic feet of air per minute was mounted with a gasoline engine upon a truck. Sheet iron pipe was run into the vault and by this means a steady and plentiful supply of air was obtained.



PUMPING GAS FROM CABLE VAULTS

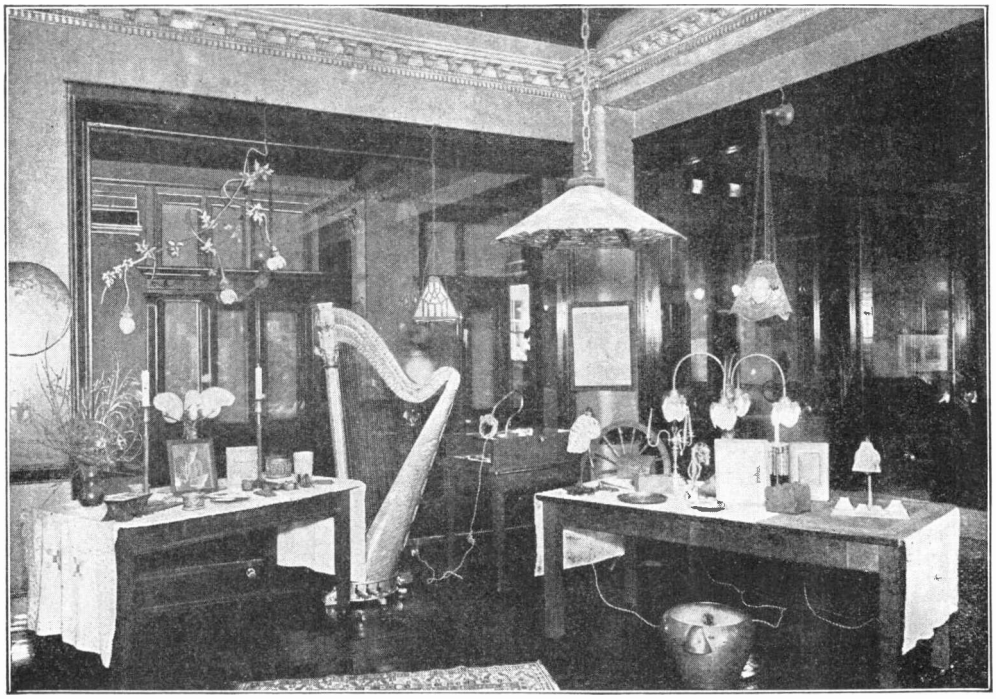
Electrical Interests of Women

EDITED BY GRACE T. HADLEY

A Woman's Artistic Work

The artistic and unusual work of Miss Leonide Lavaron, of Chicago, is attracting much attention. This French-American goldsmith has made many successful experiments in chemical processes, especially in the treatment of copper, one of the first metals used by mankind. There is scarcely a branch of human industry where copper is not an important factor. The "Lavaron copper" is noted for its color-play and iridescent surface. It was only natural that in working with the antique metal Miss Lavaron should study the classic urns, bowls and Pompeiian lamps of another age, in order to discover their structural principles, but she has evolved artistic new lamps which meet every modern need.

While traveling on the Pacific coast she one day picked up some sea shells, beautiful derelicts of the ocean. Holding them between the sun and her eye, this artist gratified her great love of color by studying the soft luster of the rainbow tinted light filtering through the shells. An idea occurred to her. Why not utilize the shells as globes in lamps made of Lavaron copper with an electric bulb as a miniature sun? Thus with the light which is so akin to sunlight, the



THE STUDIO OF MISS LAVARON, WHO DOES SOME WONDERFUL WORK WITH SHELLS

iridescent beauty of the shells might be produced at will. Upon returning home, she polished a few shells and made her first shell globe lamp, which proved so successful that she began to import shells in quantities from Japan and the Pacific Islands.

Nature having furnished the idea for these lamps, the artist was careful to preserve the idea of life and growth in working out new effects in electric lamps. The first essential of any lamp is practical use and the Lavaron lamps afford excellent illumination in unique form; but they are wonderfully picturesque and often embody a deep sea motif, as for example, the lamp christened "Whispering of the Deep," in which a suggestion of life is most skillfully given to seaweed masses of copper forming the standard with globes of pearly tinted shells. A single trumpet conch fitted with a tungsten lamp and equipped with a copper standard makes a cozy corner lamp or furnishes sufficient light for a den.

Miss Lavaron has worked out a most charming effect in illumination in a vine-like fixture of copper and chitons for a conservatory or to be suspended across a glass door. The motif of the vine is the flowering maple with twisted copper stems, realistic leaves and tinted shells for the miniature lamp globes.

The Lavaron electric lamps show a decided departure from the conventional lamps and a return to Nature as the source of structural forms as these are revealed in the plant, the lily cluster or tangled seaweed. Miss Lavaron's combination of opalescent shells with copper and the tungsten lamp result in creations of exquisite color and luminosity.

The "House Electric" in Baltimore, Md., equipped at a cost of $10,000 by the Consolidated Gas & Electric Company, has a tea room where tea, cake and sandwiches are served free every afternoon from three to five, to ladies and customers.

An Illuminated Ice Box

Every user of an ice box will be interested in a refrigerator that not only embodies cold storage wisdom, but electric illumination. In the ice box illustrated by the accompanying cut an electric push button on the outside instantly illuminates the interior of the box. This

ILLUMINATED ICE BOX

has the advantage of lighting up dark corners and revealing at once the whereabouts of the butter or meat. When it was formerly necessary to illuminate the entire kitchen or pantry in order to see into the refrigerator, with this improved ice box it is only necessary to press a button and, behold, a flood of illumination just where it is wanted. This refrigerator is provided with an air flue at each end of ice chamber, affording a special system of circulation that prevents a pocket of foul air at top of provision chamber and gives a dry, cold atmosphere in every part of the storage compartment. This system of sanitation provides a hot water flushing device in connection with a syphon floor trap. Electric lamps inside the ice box connected with the push button switch provide the much needed illumination.

A Glimpse Into Japanese Home Life

The adoption of western civilization and the application of science to modern Japanese life have been well termed the "Occidentalization" of Japan. The appliances of western industrial invention have worked admirably in Japanese hands and excellent results have been attained in those crafts in which the nation was already skilled. It was merely the turning of old abilities into new and larger channels. While Tokyo, Yokohama, Nagoya and many other cities and towns are now illuminated by electric lights, and street cars are propelled by the electric current, still Japanese home life is about as simple and primitive as in past ages.

JAPANESE WOMEN ON WASH DAY

The Japanese women still take their tea on the floor, kneel on their kneeling cushions, use ivory chop sticks and pursue their simple pleasures. A Japanese kitchen bears little resemblance to one of our American kitchens, perhaps because we require a great deal more in our way of living. The Japanese are noted for their ability to live without much furniture or impedimenta of any kind and with a small amount of clothing.

Lafcadio Hearn, that wonderful interpreter of Japanese life, well expresses the whole matter when he says: "How intolerable may seem to the mind of the artist or poet those countless restrictions which once ruled this fairy world and shaped the soul of it, he cannot but admire and love their best results, the simplicity of old custom, the amiability of manners, the daintiness of habits, the delicate tact displayed in pleasure-giving, the strange power of presenting outwardly, under any circumstances, only the best and brightest aspects of character."

Japan is a country blessed with rainfall. The Japanese Alps constitute a region lying west of Mount Fujiyama drained by the Oigawa River, which flows south, emptying into the ocean after a lively race down a precipitous valley. With such steep slopes and such a heavy rainfall, there is abundant water power and the development of electrical industry is so fast in Japan that the home manufacturers of generators cannot keep pace with it. The importation of electrical goods is increasing at about 50 per cent per year and the United States obtains the bulk of the trade.

Of 46 electric light companies in Japan, 22 have water as a motive

A JAPANESE TEA PARTY

power, while four have water and steam.

The Hakone hydroelectric plant transmits electrical energy a distance of 36 miles to the city of Yokohama. The plant does not compare with the Katsura-Kawa in size, but it involved the trial introduction of modern steel towers and the use of apparatus and materials of domestic manufacture. The Tokyo Electric Light Company was established in

POSSIBLY THEY BELIEVE THE SIMPLE KITCHEN WITH ITS FEW UTENSILS FAR AHEAD OF FIRELESS COOKERS AND ELECTRIC RANGES

1883 and acquired a new power plant on the Katsura in 1906, but with the increasing demand for electric lighting the company has found even the present large hydroelectric plant insufficient to meet its requirements and has decided to secure a second source for hydroelectric power.

In view of the electrical developments in Japan, one cannot help but notice that women seem to have been thus far left pretty much out of it, perhaps, for all we know, by their own choice. It is possible that to their notion the old well and the portable tubs in the open air constitute an ideal laundry, while the simple kitchen with its few utensils is ahead of any electric fireless cooker of the western world.

Chemistry and Household Science

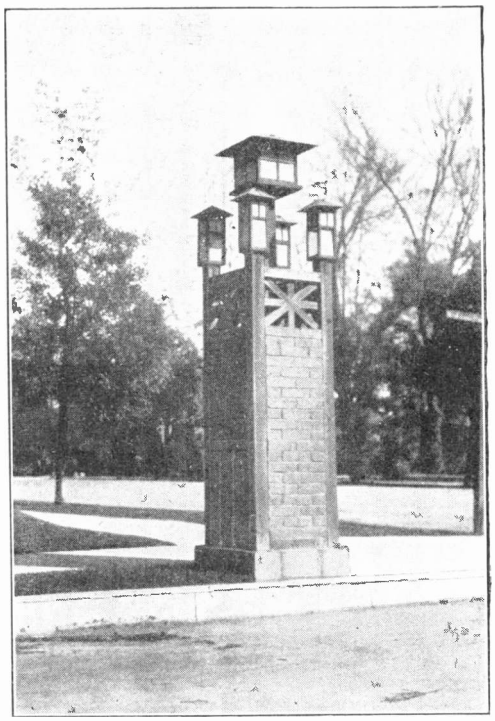
During a recent convention of the National Educational Association a professor from a college in Quebec emphasized the need of careful study of the household arts in the light of modern science. He declared that girls should have some definite correlated knowledge of the chemistry of foods, of cleaning and combustion. He said they should know something of the chemical action underlying the fermentation of fruit, the charring of sugar, the souring of milk, the electrolysis of water, the tarnishing of silver and the necessity for prompt polishing. To illustrate how unrelated some of these subjects may remain in the mind of the modern girl he told the story of a brilliant young woman who specialized in chemistry and took a year of graduate work in Germany. Then instead of teaching she finally married and the professor upon meeting her one day remarked how very useful she must now find her knowledge of chemistry in cooking and housekeeping.

"Oh," exclaimed the young matron, radiantly, "when I'm cooking I never think of chemistry!"

Too many housewives never think of chemistry, nor of the food values in the preparation of meals for the family. Happily, some of the new cook books remedy this matter by embodying in the recipes not only the how, but the why, and such books have a real scientific value.

Mission Street Light Fixtures

Electroliers for street lighting, formed of timbers and masonry, are in use in a high class residential district in Los Angeles, where they harmonize with the artistic homes. Realizing that the ordinary cast iron lamp posts would clash



MISSION STREET LIGHTING UNIT

with the surrounding architecture, the property owners had this exclusive form of lighting structure designed for their vicinity, and the result is most pleasing. The post is set on a concrete foundation and built up of dull red bricks enclosed in unpainted timbers. A simple design of woodwork surmounts the masonry and supports five bronze lamps, one at each corner and a larger one in the center. The whole design is of the popular "Mission" style.

Woman and the Electric Motor

There are many reasons why the electric motor is especially adapted to the use of women, one of the chief of which is the fact that there is no complicated machinery. About all a woman has to learn is to handle the controller and steer her car. She does not have to think of the power at all. She does not need a chauffeur, a fact which in many instances weighs heavily with the woman purchaser, for the cost of the employment of a driver may be beyond her resources.

When a woman becomes the owner of an electric car, the first thing to learn is how to steer it. It is well to select an open space for this, and the larger the better. Here she can practice turning around, backing, etc., all of which must be learned thoroughly before she attempts to drive on city streets or where traffic is congested. The ease of control is such, however, that the most congested traffic can be traversed with comparative ease, after a little experience has been gained.

The application of the brake and the movement of the controlling lever is next in order as a lesson. The controlling lever gives the different speeds, both forward and backward. On account of the interlocking devices with which every electric car is equipped there is no fear of mistake, as it is a matter of just simply progression from one to another, or reverse.

In driving her car the woman should realize that the battery has limitations and ought not to be worked down to

AS A MEANS OF AMUSEMENT, RELAXATION AND PLEASURE, THE ELECTRIC CAR IS AN ESPECIALLY FINE PRODUCT OF MODERN CIVILIZATION

the last evidence of energy, as the battery needs a certain amount of energy and a certain quantity before it will operate the motor. Though the pressure be the maximum, if it were not renewed it would not accomplish much, and so the battery must have a substantial reserve before it can be expected to do its best. It will be found by observation that the meters give accurate readings of the conditions which exist, and these will indicate what can be done and what had best not be undertaken.

The woman operator should have a practical knowledge of the construction of the motor, the wiring, etc., as this will enable her to overcome difficulties. The troubles experienced by the motorist are more a matter of the owners than the cars. If the operator has the ability to ascertain the difficulty and to remedy it at once, there will be but little to contend with. Necessity is the mother of invention, and the woman who can study out and solve the conditions which may from time to time arise is the one who will develop into the expert and successful driver.

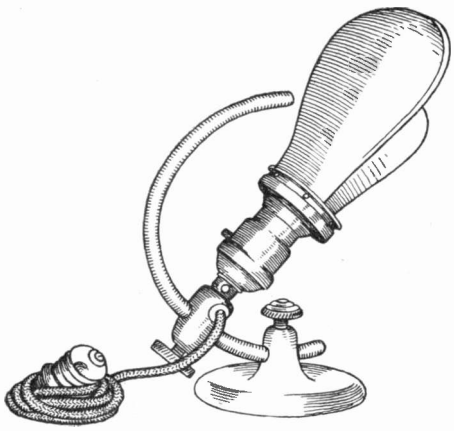
Taken purely as a means of amusement, relaxation and pleasure, the electric car is an especially fine product of modern civilization. By its use, those good gentlemen of the medical profession will find less necessity for sending patients to swell the receipts of some cure, resort or retreat. There never was, and never will be, such a remedy for the tired, overworked human body as the pure, fresh air.—MRS. A. SHERMAN HITCHCOCK.

Mountain Breezes by Wire

What is more delightful on a hot summer's day than cool mountain breezes, gentle, invigorating breezes that fan away your worries, rest your tired body and put action into your veins? You can have the comfort of such breezes every hot day without going to the mountains. While "Old Sol" is driving people to seek relief in the hills, you can sit in your home and, by merely turning a switch, have breezes delivered to you instantly by wire.

The Port-A-Lite

The Port-A-Lite is the handiest light ever made. It is compact, convenient and practical. It can hang on the wall. It can be converted into a desk light or a table lamp. It can be taken apart in a



THE PORT-A-LITE

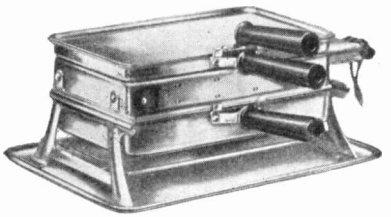
minute and packed in a small box and carried in a grip when traveling. It is used extensively by tourists and travelers who want a light where they want it. This little lamp has ten different adjustments and can be used either in the home or the office.

Electric Cooking Reduces Shrinkage

That in a nine pound leg of mutton as much as 1½ pounds of meat may be saved by cooking in an electric oven, as compared with cooking the same joint by coal or by gas, may be easily demonstrated upon trial. There is a shrinkage of from 25 to 35 per cent in the weight of meat cooked by coal or gas, while the same kind of animal food cooked to the same degree by electricity loses only ten to fifteen per cent of its original weight. Therefore, even if gas or coal cost nothing, it is cheaper to use the electric cooker, since there is a third less loss, compared with cooking by gas or coal.

El Grillo

Electric cooking offers the widest field for localized electric heat. Instead of a good proportion of the heat going up the chimney or into the room, the heat is concentrated in the place where it is wanted and most needed. When the heat is not needed the current can be turned



EL GRILLO ELECTRIC STOVE

off and no waste occurs. Another good point is that the heat can be obtained at a moment's notice, and the cooking apparatus is portable and can be moved from room to room as is convenient.

El Grillo is a new electric stove that will do the cooking for a small family, quickly and economically. At breakfast time, broiled bacon and fried eggs, or sausage and griddle cakes, or shirred eggs and toast, any two of them may be ready in less than five minutes from the time the electricity is turned on. At luncheon time the glowing multi-cooker provides hot dainty foods so quickly. For dinner, broiled chops and hashed brown potatoes may be prepared in a few minutes. The double boiler for rice or cereals, the tea pot or coffee pot or even the cheery corn popper can be used with efficiency on El Grillo. The device includes a deep dish, a medium dish and a griddle. All are used interchangeably above or below the coils. Each has an always cool handle.

The El Grillo dishes are all made of pressed steel with nicely rounded corners, nickeled and polished. Not only are electric utensils cleanly and convenient but they are a real adornment to the table. No dirt accumulates on such utensils on account of combustion and therefore washing up afterwards is not such a disagreeable process.

Emancipated

"The very first time I ever used an electric iron," exclaimed a mother and a home maker, "I felt emancipated! Now I can press a waist or iron a bonnet string without incurring the ire of the maid by asking her to stop her work and do it for me. I shall never forget my feeling of delight when I discovered that I could iron a waist with so little trouble and without having to descend to the laundry to do it. Electricity is a great thing for the home maker who has only one maid-of-all-work."

Electricity Enhances Jewels

According to the Marquis de Castellane, the French women of fashion are wearing hair of gold. Tiny luminous balls are arranged in the hair. They are so small that they are scarcely visible to the naked eye. These are lighted by a miniature electric battery placed in the corsage or bodice. A tiny button is pressed and the hair is illuminated. If a tiara of diamonds be worn the lights properly placed make a most dazzling effect. Earrings also carry one or two little luminous globes behind the jewel.

Just Plain Mothers

At a recent reception where there was a mingling of writers, art teachers and specialists, two ladies after being presented to a writer laughingly remarked: "You know we are not specialists in anything. We are just plain mothers."

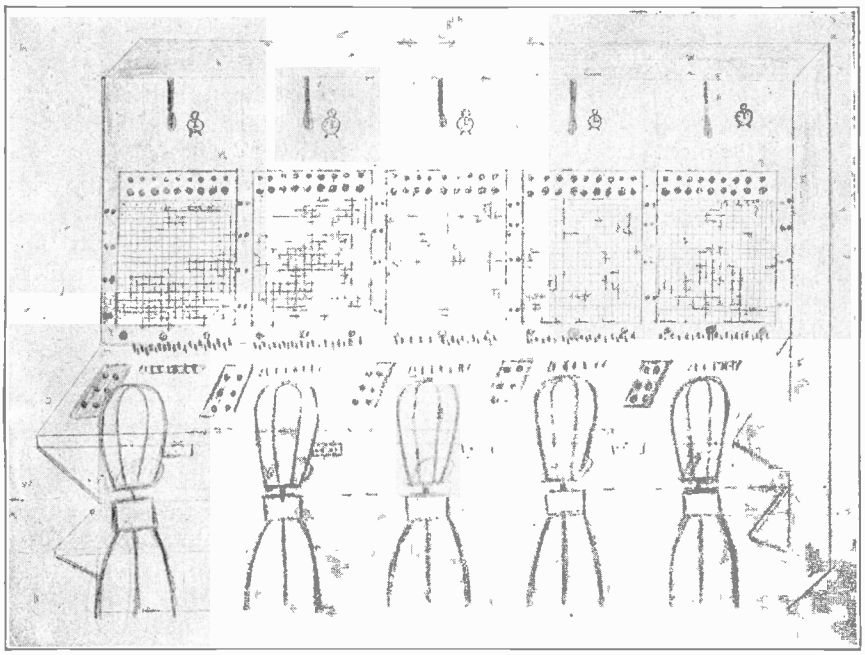
A woman who has been well trained in home activities ought to be a more efficient worker in the great civic and social enterprises, for the home is the national civic unit. Into the home pour all the products of the world—food, clothing, books, furnishings and utensils. The latter differ so much from the old-fashioned pots and pans, especially the modern electric cooking utensils, which are the very newest products to pour into the modern home and are daily demonstrating their value, especially to just plain mothers.

Deaf Children Visit Telephone Exchange

Eight pupils of the Chicago Training School for the Deaf, with their teacher, Mrs. A. F. Smith, recently visited the Wabash Avenue exchange of the Chicago Telephone Company. These children are not allowed to talk on their hands in the old way, nor to use pencil and paper in communicating, but are limited to the use of the face muscles and vocal organs only.

The children were taken up on the roof of the exchange, where they saw the great wireless installation on the Heisen Building across the street, and were much impressed with the idea that wireless telegrams could be sent from these masts for hundreds of miles.

When their teacher imparted any information to them, they immediately explained it over to her, as they had been trained to do, to show that they understood—a sort of "repeated message" system of instruction.



TELEPHONE SWITCHBOARD DRAWN FROM MEMORY BY DEAF AND DUMB CHILD

In the operating room they learned the difference between an A board and a B board, as well as the use of the special positions. Mrs. Smith asked a little eight-year-old if he knew what a hospital was for. He said, "To cure sick people." "What do you suppose," she continued, "this hospital switchboard is for?" "To call the doctor quick," he replied.

One boy asked to see the girl that worked the fastest, and one boy of ten asked how many calls all the girls could handle in a day.

They showed marked politeness in talking with their hosts, but in "talking" with each other they were often impatient and would resort to violent facial distortions and grimaces. Their teacher would coach them to speak more distinctly by touching their throats or lips, indicating the unruly members.

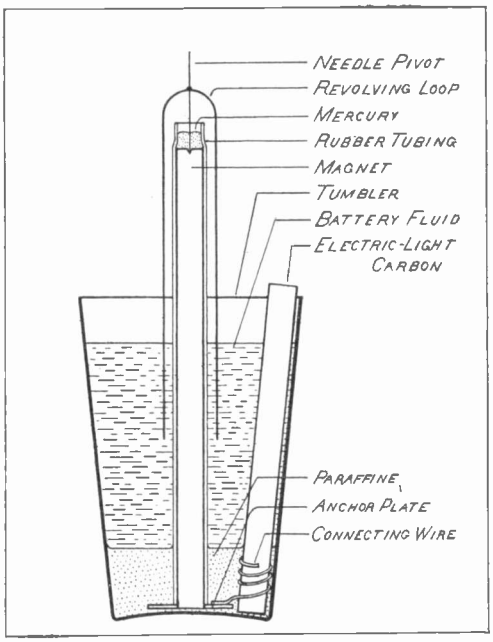
These children could understand practically all that was being said in their presence, even reading the faces of the operators and repeating what the girls said into their transmitters. The children were given colored marking plugs and were delighted with the play of colors of the switchboard lamps.

The next day after their visit they wrote polite letters in neat penmanship to Chief Operator Elizabeth V. Goggins, thanking her for her kindness, and mentioning things that had interested them. Several of them drew from memory sketches of the things they had seen and got as many details right as any normal grown person would do under similar circumstances. Among the letters was one which referred to the telephone receiver as a "listening handle."

Electro-Magnetic Rotation Experiment

In 1821 Dr. Michael Faraday discovered that a metallic conductor carrying an electric current and placed within the influence of a magnetic pole would exhibit a strong tendency to move across the lines of force of the magnetic field. An easy experimental demonstration of this historic phenomenon, interesting because it illustrates the vital principle of the modern electric motor, may be made with the simple apparatus here described.

A permanent magnet of ⅜ inch round steel eight inches long is fixed upright in the center of a tall glass tumbler by



ELECTRO-MAGNETIC ROTATION EXPERIMENT

means of paraffine melted and poured into the tumbler to a depth of about one inch. To give the magnet a firm fixture in the wax it is provided with an anchoring plate made by soldering a centrally apertured disk of thick sheet brass onto the magnet's lower end. The magnet is covered over its whole length with a piece of closely fitting rubber tubing which extends about half an inch above the magnet's top to form a small chamber for containing a small quantity of mercury.

A strip of thick sheet zinc ⅜ inch wide and ten inches long, shaped into U form, has soldered through the middle of its bend a stout sewing needle, whose point, projecting downward through the mercury, rests in a small indentation made with a center punch in the top of the magnet before tempering. The limbs of the zinc loop which hang down alongside the magnet are made to approach the latter as closely as possible without rubbing as the loop turns on its pivot.

A piece of electric light carbon placed as shown within the tumbler has its

lower end wired beneath the paraffin into electrical communication with the lower end of the magnet. Bichromate battery fluid poured into the tumbler until its upper surface is slightly above the center of the magnet, and immersing the ends of the zinc loop to a depth of about an inch, completes the apparatus.

It will be seen that the combination constitutes a galvanic cell, a part of whose closed circuit—the zinc loop—is freely movable. Under these conditions the loop sets up a rapid rotation about the magnet in a direction depending upon which pole has been placed uppermost.

Static Electric Top

The continuous action electric top here described furnishes an interesting demonstration of static electric attraction and repulsion.

The top is a disk of stiff mica 4⅝ inches in diameter mounted between two small buttons of wood or vulcanite upon a slender axis made from a piece of steel knitting needle. The pointed lower end

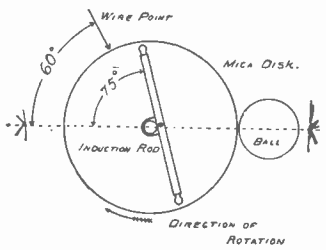
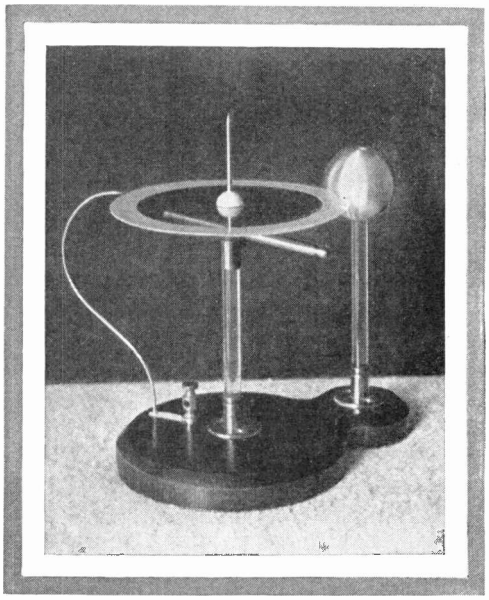


DIAGRAM OF STATIC TOP

projects 2-16 of an inch below the disk and rests in a small indentation worked with the point of a file in the upper end of the vertical glass standard made from a piece of druggist's acid rod. To give the disk a finished appearance, a broad band of red insulating varnish made by dissolving red sealing wax in alcohol is applied to the disk's circumference.

At the edge of the disk and as close to it as possible without touching is a 1½ inch polished brass or aluminum ball carried by a second support of glass. Rising from the base of the instrument at the left is a curved brass discharge wire arranged so that its pointed upper end approaches the disk's edge very closely from a horizontal direction, at a



STATIC ELECTRIC TOP

place about one third the circumference of the disk from the ball.

Beneath the disk, attached by a small brass fixture to the glass stem near its top and on the side nearest the ball, is a polished metallic induction bar with rounded ends, made of ¼ inch round brass rod. This rod is 4⅝ inches long and is so placed that its upper surface is about ⅝ of an inch below the disk. The angular position of the induction rod and wire discharge point relative to the ball is important. The most effective arrangement is that shown in the diagram, in which the wire point and induction rod make angles respectively of 60 and 75 degrees with an imaginary line drawn through the centers of disk and ball.

In operating, the insulated ball is connected to the negative pole of a static machine—that pole which gives the brush effect on its collecting combs—the positive pole being joined to the discharge wire through the binding post on the base. The disk, held in position for a

few seconds with the fingers placed lightly upon the upper end of its axis, immediately begins a swift rotation, when the finger may be removed and the top will spin at a high speed. That position of the disk at the discharge wire receives along its edge and adjacent surface positive electrification, causing repulsion from the point with simultaneous attraction from the negatively excited ball. Rotation ensues, the charged sections of the mica arriving at the ball, giving to it positive electricity and receiving negative in a hissing stream of minute sparks. These parts are impelled forward by the similarly charged ball, until within the attracting influence of the positive wire when the cycle is repeated.

The precise nature of the influence exerted by the brass rod below the disk is somewhat obscure. Through some inductive process its presence seems to effect a certain needed balancing of the acting forces; without it the top indulges in violent gyrations and soon tumbles off. —H. B. DAILEY.

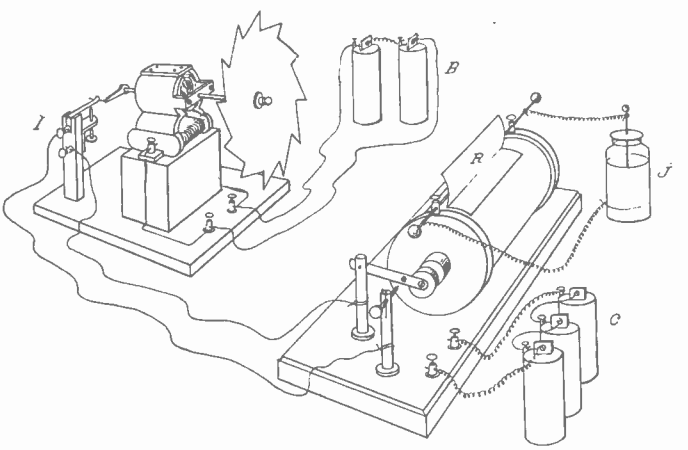
The Magic Buzz Saw

The singular spectacle of a circular saw really revolving at full speed, but having every appearance of being absolutely at rest, with all its teeth distinctly visible, is one easy of demonstration by anyone having an induction coil and a small electric motor. The figure shows the arrangement of apparatus for this experiment.

A rather coarse toothed buzz saw six or eight inches in diameter, cut out of thin sheet iron is mounted upon the spindle of a small motor, driven by the battery (B). A separate battery (C) operates the induction coil, whose regular circuit-breaker is thrown out of action by moving the contact screw permanently out of contact with the vibrator spring. Wires are attached to the interrupter posts and led to the binding screws of an independent interrupter (I), in the rear of the saw motor and actuated by it. This interrupter consists of a short piece of watch spring mounted at the top of a stiff wooden post attached to the motor base. The spring which is provided with a platinum contact bears slightly against a platinum pointed adjustable screw placed just below it.

The motor shaft, which will have to be made especially for the purpose, is prolonged, terminating in a short crank which engages the end of the spring, lifting it out of contact and breaking the primary circuit of the induction coil once for each revolution of the saw.

It is evident that with such an arrangement the occurrence of the light flashes from the secondary of the coil must exactly synchronize with the revolution of the motor, the result being that in a darkened room, owing to the instantaneous character of the perfectly timed intermittent illumination, the swiftly moving saw appears to stand perfectly still with every tooth and mark upon its surface as plainly visible as if it were actually at rest. The fine print of a scrap of newspaper pasted upon its face may be easily read with the saw running at 2,000 revolutions per minute.



THE MAGIC BUZZ SAW

To prove to the spectator that it is really in motion and not at rest as it seems, small raw potatoes may be readily sliced with it; and it is indeed a novel sight to see such objects drop in two when held apparently *between* the seemingly stationary teeth.

A small Leyden jar (J), with its inner and outer coats connected as shown with the secondary terminals of the coil, adds greatly to the brightness of the illumination, which is still further assisted by the white paper reflector (R). The front face of the saw may with advantage be painted white.

In working up this experiment the light from a Geissler tube was first tried, but was found inferior to that of the naked spark, owing to the phosphorescence of the glass, which, lasting a brief time after the passage of each discharge, interferes materially with the clearness of the effect by impairing the instantaneous nature of the light flashes.

An Electric Weather Vane

By KARL KOCH

Procure a piece of board ½ inch thick and about six inches square or, if to be finished round, 5½ inches in diameter. Center it and draw a circle 2¼ inches in diameter. Divide this circle into eight parts. These are for the different poles and the magnets will border this circle.

The magnet coils are made of ⅜ inch stock, soft Norway pine, one inch long. Eight of these are necessary. In one end of each core drill a hole ⅜ inch deep with a No. 28 drill and thread it with an 8-32 tap.

The spools are made as follows: Procure a sheet of 1/16 inch fiber or tough cardboard and cut out sixteen circles ⅞ inch in diameter. Drill a ⅜ inch hole in the center of these and glue one to each end of the core with iron glue. When dry wind two turns of paraffine paper around the core and wind the spool full of No. 22 or 23 B. and S. gauge double cotton covered wire; be sure you wind all in the same direction relatively to the holes in the cores.

A small right angle is made of 1/16 inch brass for each core to fasten the spool to the base, of dimension, as in Fig. 1. In the side, ¾ inch long, is drilled a hole with a No. 17 drill, 5/16 inch from the end; this is to fasten the angle to the core with an 8-32 screw. The other half inch of the angle passes under the spool and a hole is drilled in it for any convenient wood screw. A small groove is scooped in the wood for the angle to rest in.

The pivot for the dial hand is made as in Fig. 2. A brass rod is turned down to the dimension shown and the small end threaded for a 2-64 thread within 1/32 inch of the shoulder; the rest of the rod is cut with a 10-24 thread.

Drill a hole with a No. 6 drill in the center of the base, slide the pivot through here with a 10-24 adjusting nut on each side of the base; this is for an easy method to centralize the dial hand; otherwise it will have a tendency to draw upward or downward and thereby increase friction.

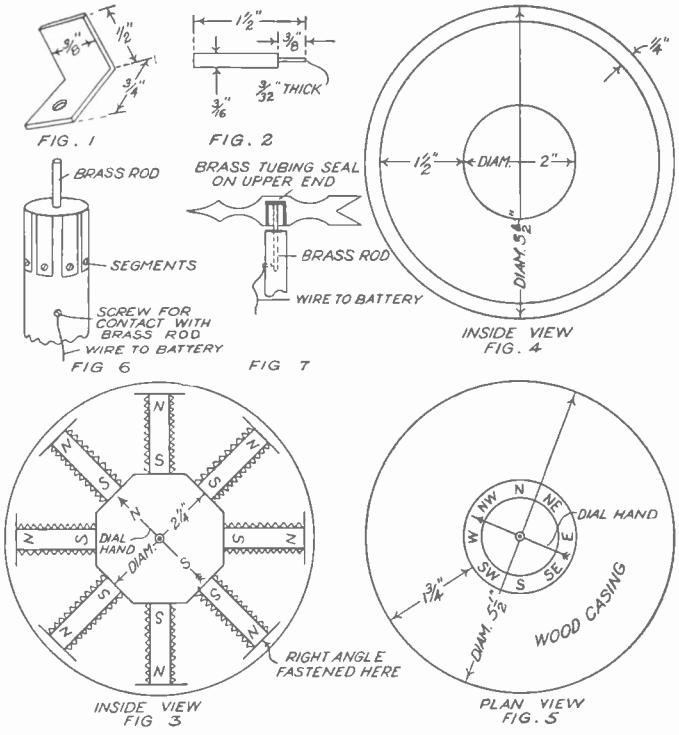
The dial hand may be made out of an old saw blade 1/32 inch thick, although thinner would be better. It should be 1/16 inch wide (except where it is to be pivoted, which portion should be ⅛ inch wide) and two inches long, pivoted to a dead center, hardened and magnetized. It makes no difference what the polarity of the pointer is, as will be shown.

The dial hand or pointer is drilled as close as possible on a dead center with a No. 42 drill, so that it will rest on the shoulder of the pivot rod. Two 2-64 nuts will serve to lock the position of pointer. The instrument now assumes

the form seen in Fig. 3. The dial hand swings clear of the magnets by an eighth of an inch.

A wood covering for the instrument is seen in Fig. 4. A circular block of wood 5½ inches in diameter and 1¼ inches thick is bored one inch deep to a diameter of five inches. A hole two inches in diameter is continued on clear through the center, to allow a view of the dial and hand. The instrument finished is seen in Fig. 5.

The vane may be made of wood and painted in the desired color. The rear end should present the greatest surface to the wind.



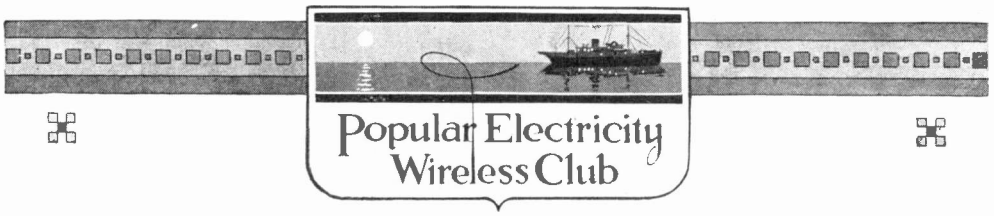
SHOWING THE CONSTRUCTION OF THE ELECTRIC WEATHER VANE

Fig. 6 shows the segments of the commutator fashioned out of 1/16 inch brass and fastened to a piece of broom handle. The brass rod that protrudes from the handle is 1/16 inch longer than the tubing that fits in the vane so that the vane can ride around on it and at the same time make contact with the tube as shown in Fig. 7. The upper end of the tube is closed by soldering a piece of circular brass on it.

A brush is fashioned out of 1/64 inch bronze and fastened to the side of the vane with two screws that make contact with the tubing and incidentally hold the tubing in place. The brush should make good contact with the segments.

The beginning wires of all the magnets are connected together and run to one pole of the battery and the other terminal wires of the magnets are run respectively to each segment. If the vane points, say, in a southern direction and the brush is on the left-hand side of the vane, the segment due east will have to be connected to the magnet that will cause the dial hand to register south. If, instead of the hand pointing south, it points north, change the direction of the current; this will change the polarity of the magnets. The brass rod is connected to the other pole of the battery.

A dial may be made to suit one's fancy. Three gravity cells will keep it "on the job" continually.



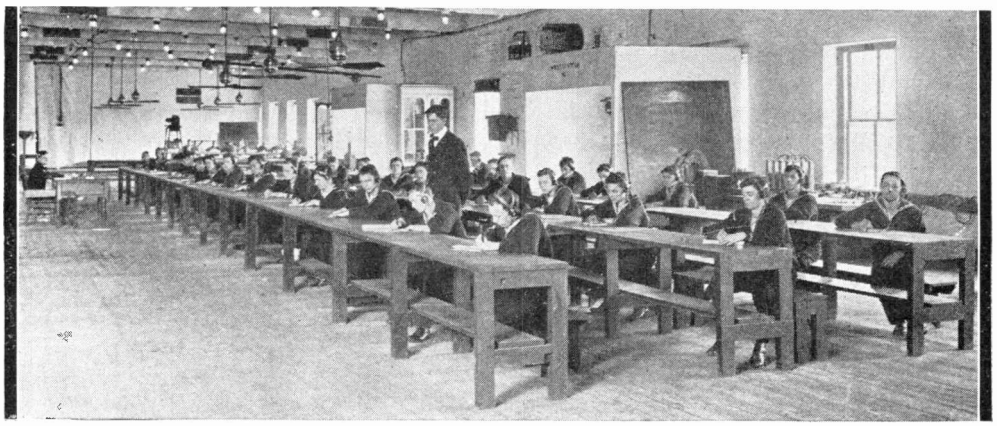
How Uncle Sam Trains His Sailors in Wireless

How to provide the vast number of ships in the Navy with men expert in the construction and operation of nautical wireless apparatus was one of the many perplexing problems which confronted Uncle Sam.

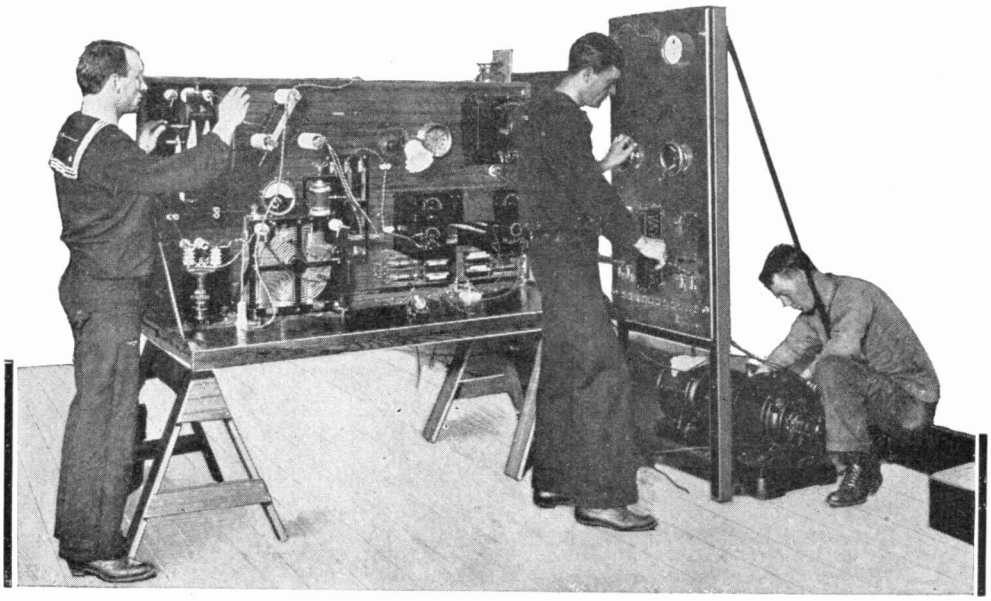
When wireless was invented the powers of the world at once realized its wonderful usefulness in their navies. The United States was among the first to adopt it and all of the vessels were ordered equipped. As a result there arose a very great and widespread need for wireless men. So Uncle Sam set about establishing a school of instruction in wireless at the Brooklyn Navy Yard. This is the first institution of its kind in the United States. There are now on an average 160 men in the class, in charge of Commander George Cooper, while under Commander Cooper is a corps of ten instructors.

The students are enlisted men, who have had experience in the dynamo room on board of a battleship and civilian electricians who have enlisted in the Navy for the purpose of taking the course and entering the naval electrical field. In the wireless classroom are three long tables running almost the entire length of the big hall. The students sit at their places along these tables with head receivers on and take down the messages sent by an operator at the master key. At the foremost table the messages come in rapidly and at the next table slower, while at the rear table, which is for the beginners, there is a pause after each letter of the code, to give the student time to recognize it.

The men graduate from the rear table forward as they acquire speed in receiving. The messages received at these tables do not come through the air and



INSTRUCTION IN WIRELESS OPERATING AT THE BROOKLYN NAVY YARD



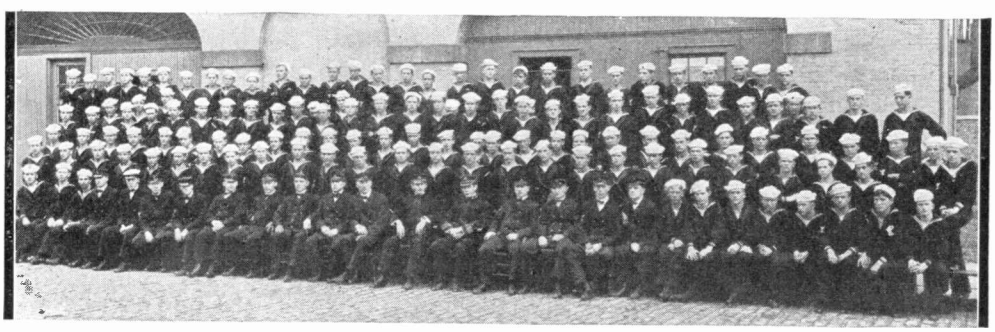
U. S. NAVAL STUDENTS STUDYING WIRELESS APPARATUS THROUGH ACTUAL OPERATION.

over an aerial, but instead are transmitted by wires from the master key to the head receivers and in every respect, particularly in the sound, are a perfect imitation of a real wireless message. In case a student shows himself particularly gifted and easily receives the messages at the rate at which they come in at the first table, he is put in a booth by himself and receives real wireless messages coming in on the Navy Yard aerial.

The course covers a period of 22 weeks and embraces complete courses in wireless, theory, lighting and interior communication of a battleship, dynamos and motors, engine construction and mechanics. The students are classed as landsmen-electricians and are quartered on the receiving ship Hancock, which was the old Arizona, one of the first trans-Atlantic liners, purchased by the Army for a transport during the Spanish-American War. It was later turned over to the Navy as a receiving ship.

Radio-Telegraphy in Time Regulation

There has for some time been considered the possibility of employing signals sent by wireless telegraphy to correct the time of chronometers and clocks. Not so long ago a practical test was made between two great transatlantic steam-



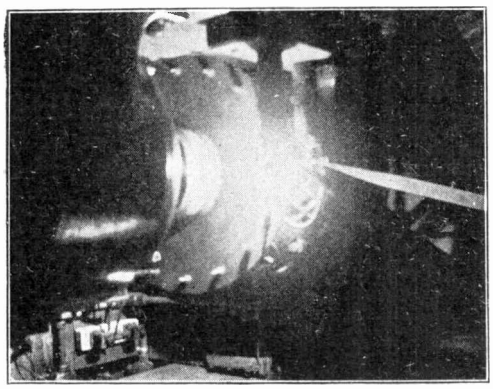
U. S. NAVY ELECTRICAL CLASS OF 1912—BROOKLYN NAVY YARD

ships in mid-ocean, which thus exchanged their chronometer times. One was found a few seconds in error.

Claude and Ferrie have reported to the Paris Academy of Sciences the results of their experiments with wireless time signals between Paris and Montsouris, showing that the method is capable of furnishing comparisons within a limit of error of less than one one-hundredth of a second.

Photograph of a Rotary Spark Discharger

The photograph here shown was made while the sending spark was discharging at the rotary spark discharger used in the five k. w. Marconi wireless station on



FROM A PHOTOGRAPH OF A ROTARY SPARK

the Wanamaker Store, Philadelphia, Pa. The discharged disk was running at the rate of 1,800 revolutions per minute and the diameter of the revolving stud circle being eighteen inches, the studs were traveling at the rate of 9,483 feet per minute, or 110 miles per hour. A time exposure was made and yet the revolving studs and their shadows are plainly shown in the photograph as though they were standing still. The reason for this is that the spark took place only at the instant when the moving stud passed the stationary studs, and the operating room being dark, the disk and revolving studs were illuminated only when in exactly the same position each time a spark took place. This effect may also be observed without the use of a camera by darkening any wireless room where a rotary discharger is used. At some stations the studs, instead of appearing to stand still, will jump backward and forward. The cause of this is that the studs are not evenly spaced and therefore not always in the same position when the spark takes place, the effect being somewhat similar to a moving picture when the film runs off the roller, causing the shutter to cut off the light at the wrong time and the picture to jump up and down.

Wireless to Stop Trains

The new wireless system of controlling trains was tested recently at Stratford-on-Avon, in England. As a passenger train, almost empty, was passing through the Midland Junction Railway Station, Professor Silvanus P. Thompson, the well-known electrical scientist, standing on the platform and acting as an amateur signalman, pressed an electric button and brought the train to a standstill in well under 300 yards.

An electric wire lay embedded in the ground, the brake-van of the train was fitted with a receiving apparatus, and the button which Professor Thompson pressed sent a warning along the embedded wire which caught up the train and was attracted through the intervening air waves and caught by the receiver in the brake-van.

The immediate result was that the air brake was automatically acted upon.

In the words of the discoverer of this new system of train controlling, Mr. H. von Kramer, a young Birmingham scientist, "the train stopped and a hooter attached to the van sounded."

Popularly, the system is known as the Ralophone, and besides stopping a train by pressing a button, the 200 or so railway experts and scientists who saw the tests say that all sorts of other wonders can be accomplished. For instance, in experiments that followed, a fast train following a slow one on the same line was pulled up automatically by wireless.

Questions and Answers in Wireless

By A. B. COLE

POTENTIOMETERS.

67.—Describe the construction of a potentiometer.

A potentiometer consists of a resistance rod or coil, across the ends of which the battery is connected. A sliding contact touching the resistance element is provided so that more or less resistance may be placed in circuit at will.

68.—Describe the operation of a potentiometer.

Referring to Fig. 22, (R) is the resistance rod generally used, (B) the

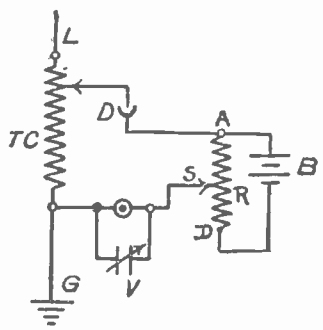


FIG. 22. POTENTIOMETER CONNECTIONS

battery of two or three dry or wet cells, and (S) the sliding contact. The voltage across the entire rod (R) is that of the battery, and that across the circuit connected to (A) and (S) is directly proportional to the distance (A-S). If, therefore, the voltage of the battery is three, and (S) is at the center of the rod, the voltage across (A-S) will be 1½. If distance (A-S) is one-third that of (D-A) the voltage across (A-S) will be one volt. This rule applies only if the current flowing through the detector circuit connected to (S) and (A) is small compared to the current flowing through rod (R).

From the above it will be seen that the voltage across the detector circuit can be closely regulated. For the high resistance element a carbon rod is sometimes employed, but the diameter must be so small that the rod is liable to break. Another type of potentiometer uses a hard rubber rod wound with enameled German silver wire as a resistance element.

69.—What should be the resistance of the resistance rod?

A resistance of 200 ohms is quite sufficient for ordinary use, for with such a resistance the voltage across the detector can be regulated to a small fraction of a volt.

70.—What is the difference between an inductive and a non-inductive potentiometer?

In an inductive potentiometer the resistance rod has inductance, so that any high frequency currents which would otherwise pass through it will be choked back. In the non-inductive potentiometers there is no inductance in the resistance element. The type employing the German silver coil on the hard rubber rod is an inductive potentiometer, and the type using a carbon resistance rod is non-inductive.

71.—It is claimed by some that the non-inductive type of potentiometer gives better results than the inductive type. Is this so?

A non-inductive potentiometer will respond somewhat more readily to sudden changes in the resistance of the detector, whereas there is a certain lag to the response of the inductive type. On the other hand, consideration of Fig. 22 will show that the potentiometer offers a path in shunt with the detector, and unless some precaution is taken part of the energy which should affect the detector will take the path through the potentiometer, thereby reducing the receiving range of the station. If an inductive potentiometer is used, the convolutions of wire retard the passage of

high frequency currents through them, and consequently nearly all will pass through the detector, doing useful work.

RECEIVERS

72.—Describe the most commonly used types of permanent magnets of a telephone receiver.

In wireless telegraphy the watch case types of receivers are most generally employed for the sake of lightness and convenience. The ordinary forms of permanent magnets are illustrated in Figs. 23 and 24. In Fig. 23 (P) represents the permanent magnet, which is composed of several laminations placed one above the other, and (N) and (S) are the poles produced by the magnets. The bobbins of wire are wound on poles (N) and (S).

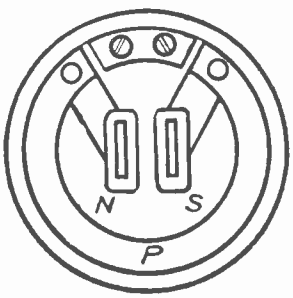


FIG. 23. TELEPHONE MAGNETS

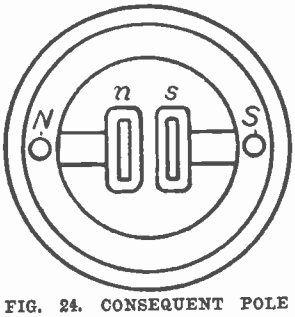


FIG. 24. CONSEQUENT POLE TYPE RECEIVER

Fig. 24 represents a permanent magnet, composed of laminations, of the "consequent pole" type, and this type is composed of an unbroken ring of steel, so magnetized that the poles are formed at (N) and (S), and in consequence (n) and (s), within the bobbins, are north and south poles, respectively.

The "single pole" receiver consists of a core of soft iron wound with wire, and set in a steel shell, the center of the iron core being placed directly beneath the center of the diaphragm. It will be understood, therefore, that this type of receiver is really a double pole instrument, for the iron core is one pole, and the part of the steel shell upon which the diaphragm rests is the other pole.

73.—Describe the action of a telephone receiver.

From the above discussion it will be seen that the bobbins wound with wire are placed around the effective poles of the permanent magnets. These bobbins are so wound that when one is a north pole the other is a south pole while the current is passing through them in one direction. When the direction of flow of the current is reversed, however, the polarity of the bobbins will be reversed. Therefore, while current is flowing in one direction the bobbins will strengthen the permanent magnets, thereby drawing the diaphragm down and producing a sound, and when the direction of flow is reversed the bobbins will weaken the pull of the permanent magnets on the diaphragm, and this will allow it to assume a more nearly flat position than it had when there was no current flowing and the permanent magnets drew it down a short distance. As soon as the flow of current ceases, the diaphragm is again drawn a short distance toward the permanent magnets.

It will, therefore, be understood that the effect of the permanent magnets is to increase the sensitiveness of the receiver, for with their aid the bobbins exert a greater influence while the current flows in one direction, and a less attractive influence when it flows in the opposite direction, and consequently a louder sound is produced when the same current flows through the bobbins.

For these reasons it is important that wireless receivers have powerful permanent or "field" magnets.

74.—How thick should the diaphragm of a wireless receiver be?

The proper thickness of the diaphragm of a receiver depends on its diameter, the distance between it and the field magnets and upon the strength of these magnets. If the diaphragm is made too thin, the field magnets will draw it down upon them, and if too thick they will not be able to cause sufficient movement to produce a sensi-

tive receiver. Most manufacturers of sensitive receivers have worked out carefully the proper thickness for their receivers, and we cannot recommend to the experimenter the substituting of a diaphragm of different thickness or an attempt to grind down the case of the receiver, for having considerably less experience than the maker of the receiver, the results will be very doubtful.

75.—*What effect has the winding on the bobbins in regard to the sensitive qualities of the receiver?*

Since the movement of the diaphragm depends largely on the combined effect of the bobbins and the field magnets, this winding is very important. The strength of the bobbins is directly dependent on the number of ampere turns of wire, and since the number of amperes is small, being only a fraction of an ampere, the number of turns or convolutions of wire must be large.

The general method of rating wireless receivers is by the resistance, because this is the simplest way to rate them. It must not be decided, however, that two receivers of the same resistance are equally sensitive, for very few manufacturers make identical receivers.

In making low priced receivers some makers have wound the bobbins with German silver wire and a high resistance was easily obtained in this way. Since German silver wire has a much higher resistance than copper wire, the number of turns of wire used by this method was correspondingly smaller, and the results obtained with such receivers were not satisfactory.

That Condenser Formula

On page 285 of the July issue we gave a formula for ascertaining the capacity of condensers. In the printing of the formula a grievous error was made. Instead of Dx10x10 for the denominator, as stated, it should have been $Dx10^{10}$, which of course makes a vast difference in the result. In using the formula, when C, the capacity, is found it means microfarads.

New Wireless Call-Letters

The recent changes in the wireless call-letters of American merchant vessels have resulted in some confusion to amateurs, many not understanding the reason for this action.

The United States has joined the international wireless agreement, and, as a result of this, the Bureau of Navigation has been systematizing the call-letters of American ships, subject, of course, to the approval of the international bureau at Berne, Switzerland.

Under the new arrangement each call will consist of three letters. The call-letters of American ships on the Pacific coast will begin with W, while Atlantic coast vessels have been assigned the series beginning with K.

As far as practicable the same second letter has been assigned to vessels of the same line, while the third letter of each call will be distinctive.

American naval vessels will continue to use the series beginning with N.

Directory of Wireless Clubs

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

Aerogram Club.—J. Stedman, President; A. Hayward Carr, Chairman Board of Directors; Albert S. Hayward, Treasurer; Donald P. Thurston, Secretary; Walter B. Clarke, 17 May St., Newport, R. I., Corresponding Secretary.

Aerograph Club of Richmond, Ind.—H. J. Trueblood, President; Richard Gatzek, Vice President; James Pardieck, 320 South 8th St., Richmond, Ind., Secretary.

Aero Wireless Club.—A. Garland, President; W. Ladley, Vice President; D. Beard, Napa, Calif., Secretary and Treasurer.

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

Alpha Wireless Association.—L. L. Martin, President; F. A. Schaeffer, Vice President; G. F. Girton, Box 57, Valparaiso, Ind., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—D. F. Crawford, President; L. Beebe, Vice President; C. Wright, Treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., Secretary.

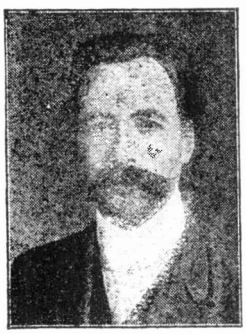
Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice President; L. Reid, Treasurer; Benj. Merry, 148 William St., Geneva, N. Y., Secretary.

Electric Wiring

English and American Practice Compared

By FRANK BROADBENT, M. I. E. E.

In preparing this article for POPULAR ELECTRICITY MAGAZINE, *Mr. Broadbent has endeavored to present without technicalities and by pictures some of the differences between English and American electrical apparatus and practice. Mr. Broadbent has been in electrical work in England for twenty-six years, is the author of "Chats on Electricity." He is also Examiner to the City and Guilds of London Institute in Electric Lighting and Wireman's Work, Consulting Engineer to the Illustrated London News and Sketch, etc.—Editorial Note.*



FRANK BROADBENT

Those who have closely followed the development of installation practice in England since the early eighties must have noticed what, for want of a more appropriate term, I might call a process of circular evolution. By this I mean that we started with certain types of apparatus which gradually evolved into other and quite different types, and these again have evolved into types which are very similar in principle to those with which we started.

Take for example the switch. The first switches used both for switchboards and for small circuits were of the knife-blade type, somewhat after the style of that shown in Fig. 1. This was not a very suitable form for ordinary use in a house, as it was difficult to enclose it neatly. Placed on its side, however, a single pole knife switch can be enclosed, the handle passing through a slot in the cover. This type formed a link between the true knife pattern and the rotary pattern. The latter did not quite correspond to what in America is known as a "snap" switch, as the handle was turned half a turn forward to switch the current on, and was turned backwards to switch it off. The American "snap" switch is always turned in one direction. For many years this semi-rotary type of switch was used almost exclusively for both small and large currents, but we have now reverted to an improved form of quick break knife switch—known as the "tumbler" switch. For small currents such as lighting circuits the tumbler switch is almost the only type of switch used in England.

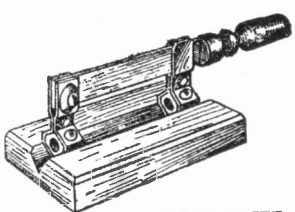


FIG. 1. SINGLE-POLE KNIFE BLADE SWITCH

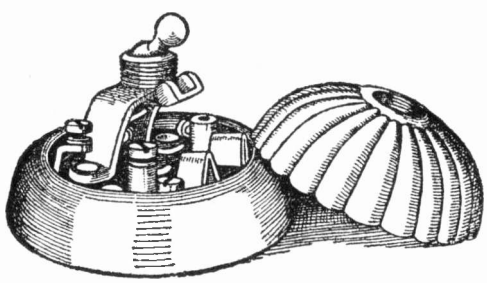


FIG. 2. "TUMBLER" SWITCH

This, as is seen from Fig. 2, is a modification of the knife switch. For switchboard work the type of switch now used bears a much closer resemblance to the original knife switch, Fig. 3. For large isolated switches, such as are used to control main circuits or motors, a similar type of switch is used, generally enclosed in a cast iron box with the operating handle outside as in Fig. 4.

For factory and workshop use enclosed

switches are preferred, and on circuits carrying pressures of 250 volts and over they are practically compulsory in order to comply with the requirements of the English Home Office. There is very little work done in factories and workshops at pressures below 200 volts. The usual pressures are 220 for lighting and 440 to 500 for motors. Hence there is very little demand for an open switch of the type shown in Fig. 5. Such a switch as is here shown would not be passed by the English Home Office inspectors on 250-volt circuits (direct current) or 125 volts (alternating) because it is possible for a man to receive a shock in the ordinary handling of the switch. Serious and, I believe, fatal accidents have occurred with switches of this kind by reason of the operator's hand coming in contact with the live fixing screws or nuts on the insulating bar when grasping the switch handle. When a switch of this type is permitted it is important to connect it up in such a way that the knives are "dead" when the switch is off, that is to say, the "live" end of the circuit must not be connected to the knife or pivot but to the isolated contacts at the top of the switch. I have known considerable trouble to result from a neglect of this precaution.

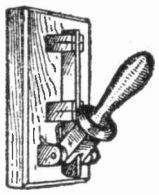


FIG. 3. KNIFE SWITCH

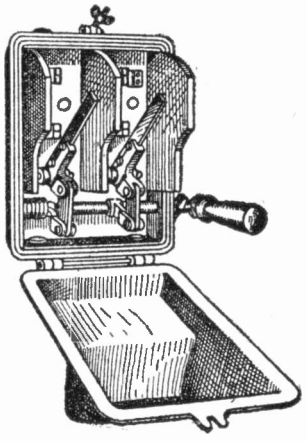


FIG. 4. ENCLOSED SWITCH WITH HANDLE OUTSIDE

Another very important accessory in electric wiring work is the safety fuse. When a considerable resistance is interposed in any portion of the electric circuit, the heat produced therein is practically proportional to the resistance interposed. It is this principle which is made use of in electric lamps, radiators, cookers and the like. If we use a substance which has a very high resistance for a small mass of material, such for instance as the filament of an incandescent lamp, we produce a white heat which is made use of for illumination. The principle of electric heating is also made use of for the protection of electric circuits by means of what in England is called the "safety fuse." This consists generally of a short piece of fusible metal, having a very small section as compared with the section of the conductor which it is intended to protect. In its simplest and oldest form the safety fuse consists of a short length of lead and tin wire for attaching to terminals as shown in Fig. 6 (a). This is generally called an open type fuse link, and when this is connected in a circuit the link will get hot and melt, thus cutting off the current if the latter should exceed a certain predetermined value. The current at which any wire will melt can be accurately calculated, and the calculations have been carefully verified by experiment. We have here what may appear

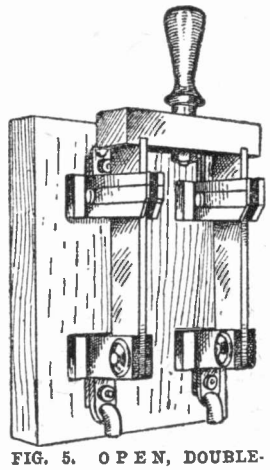


FIG. 5. OPEN, DOUBLE-POLE KNIFE SWITCH.

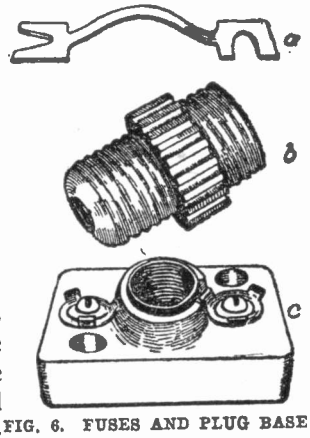


FIG. 6. FUSES AND PLUG BASE

to be a paradox, namely, that the heating property of the electric current is made use of to protect electric cables from overheating.

Fuses, like switches, have passed through various stages of evolution and there is just the possibility that we in England shall return to the original American screw socket pattern. The open type fuse link shown in Fig. 6 (a), while it is quite suitable to protect low voltage circuits, is not so suitable for high pressures and for large currents, as the spark or arc formed when the fuse melts may in itself prove a source of danger. Another disadvantage of this type of fuse link is that there is nothing to prevent a person replacing it with a larger fuse or with a piece of hard metal, such as iron or copper wire, which would not melt in the event of a dangerous current passing. It is not an uncommon thing for hairpins, or any odd piece of wire that may be available, to be used in place of fuses of this kind, and when this is done the function of the fuse is entirely destroyed.

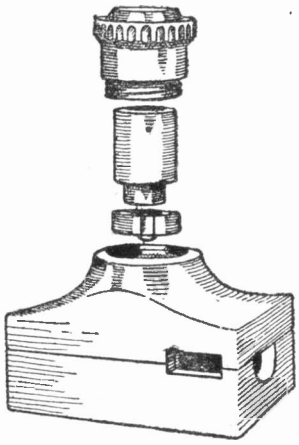


FIG. 7. "ZED" AND "DIAL" FUSE

In America the type of fuse called the Edison screw pattern has been used for many years, and years ago was used in England also. In this case the fuse link is enclosed in a screwed plug, as shown in Fig. 6 (b), this plug being adapted to screw into a base, Fig. 6 (c). When screwed home the current can pass from the contact at the point of the screw, through the enclosed fuse, and out through the threaded tube which forms the other contact. The plugs are standardized to carry certain currents, and cannot be so easily tampered with as the open type fuse link. This type of fuse has never been very popular in England, and up to quite recently was only used on installations containing American machinery, such for instance as some of the tube railways. Latterly, however, improved designs have been brought out known as the "Zed" and "Dial" fuses, Fig. 7, in which the fusible link is contained in a sort of cartridge which can be easily replaced by a nontechnical person.

When a very excessive current passes, such as is caused by what we electricians call a "short circuit," a fuse may explode with a report like a pistol. This kind of thing is more likely to occur on motor circuits than on lamp circuits, and to prevent it various devices are adopted all based more or less on the principle of smothering the spark or arc which occurs when the fuse suddenly melts and breaks the circuit. There is a sort of electrical inertia, particularly in circuits supplying motors, which tends to make the current flash over across the contacts when the fuse melts, and it is to prevent this flashing over that the smothering or damping devices have been adopted. One of the commonest of these devices is to enclose the fuse link in a fiber tube containing very fine sand or powder. The ends of the tube are capped with metal terminals to which the fuse wire is connected and

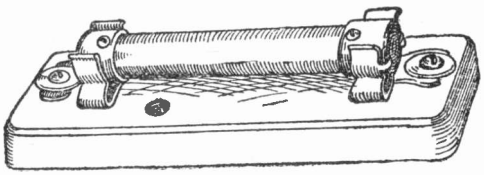


FIG. 8. CARTRIDGE FUSE

the whole is fixed into contact clips on a porcelain base, Fig. 8. Fuses of this type are known under the general term of "cartridge" fuses, and while I believe they originated in England, they are probably used more generally in America than in England. The objection to all

these cartridge fuses is that they are very easily abused and rendered useless for their purpose. When once they have performed their useful function of breaking the circuit, they are frequently refitted with a thicker and harder wire, when they are of no further protection to the circuit and only serve to give a false sense of security. It is to overcome this objection that the "Zed" and "Dial" cartridge fuses have been designed. In these types it is essential to use the proper cartridge refills supplied by the makers.

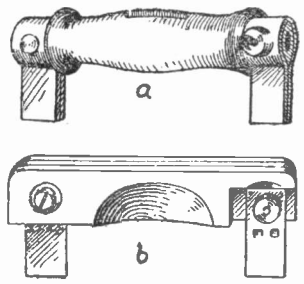


FIG. 9. PORCELAIN BRIDGE TYPE FUSES

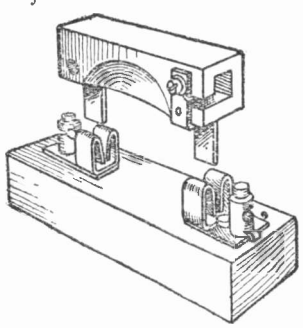


FIG. 10. SOLID BRIDGE TYPE FUSE

For small lighting circuits the commonest form of fuse used in England—so common as to be practically the only type used—is the porcelain bridge type. The "bridge" is sometimes tubular as in Fig. 9 (a),

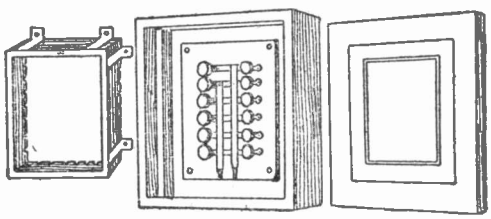


FIG. 11. AMERICAN PANEL BOARD AND CABINET

when the fuse wire is threaded through the open tube and connected to the end caps; but is more often of the solid bridge type as in Fig. 9 (b) and Fig. 10, in which type the fuse wire is exposed. The tubular pattern is, however, used for larger circuits carrying comparatively heavy currents of, say, ten amperes and over.

The fuses are always enclosed in some way and are generally grouped in a distribution box at a central point from which the branch circuits radiate. The English "distribution fuse box" is the equivalent of the American "cabinet" or panel board. The comparison between the two is shown in Figs. 11 and 12.

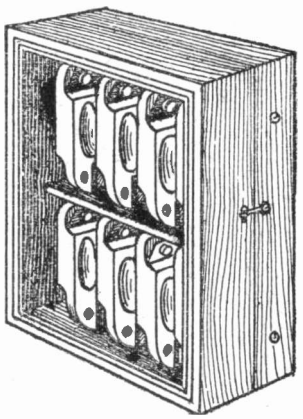
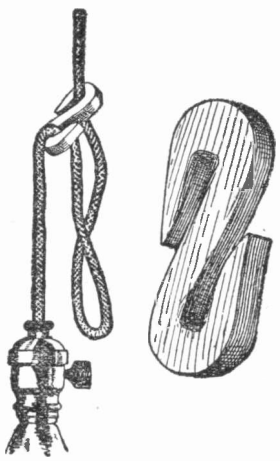


FIG. 12. ENGLISH DISTRIBUTION FUSE BOX

(To be concluded)

Cord Adjuster

A convenient cord adjuster used in a woodworking shop is here illustrated. A piece of ¼ inch hard wood is sawed into the shape shown with the edges where



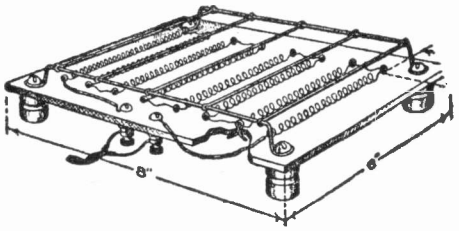
CORD ADJUSTER

the cord rests rounded off. This adjuster may be used on reinforced cord, but not upon ordinary drop cord.—W. R. REYNOLDS.

An Electric Toaster

The heating element is mounted on a piece of roofing slate 6 by 8 inches. Make holes as shown in the slate by drilling or chipping with a sharp punch.

For 110 volt service, cut off twelve feet of No. 28 Calido heater wire. In making the heating element for the



HOME-MADE TOASTER

toaster, wind the Calido wire around a piece of ⅜ inch steel rod, the latter being slipped out after the wire is wound, leaving a wire helix ⅜ inch in diameter and two or more feet in length, the latter depending upon how closely the turns are wound on the rod. The rod is simply used as a form on which to wind the wire. The Calido wire will retain its shape after the rod is withdrawn, if wound tightly and closely. In applying the heating element to the slate, the total number of turns in the helix should be counted or approximated and divided into eighths, so as to give about the same number of turns in each element.

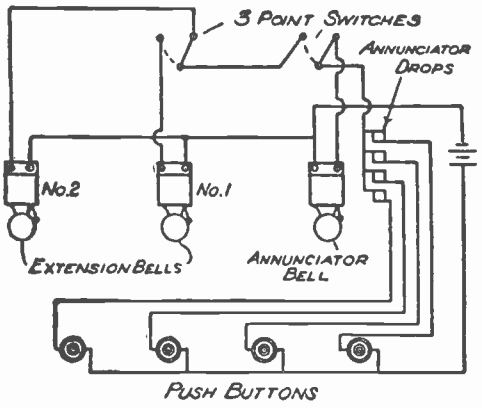
Cut sixteen pieces of No. 20 bare copper wire, ¾ inch long, and fashion into cotter pins for holding the heating element to the slate. The heating element is held in the eye of the cotter pin, and then the latter is slipped through the hole in the slate. Porcelain insulators for supports and binding posts for the ends of the heater wire are shown. For a bread rack, bend two pieces of No. 16 bare copper wire into the shape shown. The bolts holding the insulators to the slate slip through the loops in the ends of these pieces of wire. Attach five cross wires to these two side wires. Place the toaster upon an asbestos mat and connect up by cord and plug.

WESLEY G. PAULSON.

Extension Bells for Annunciator

The writer recently had occasion to install a four point annunciator in a residence where many night calls had to be answered, and it was desired to have an extension bell from the annunciator in two servants' rooms, arranged so that one week one servant would answer the bell, and the next week the other servant would answer. It was also desired to have only one bell ring at a time and still have the annunciator show who the call was from.

A three point switch was placed at the annunciator, so as to cut out the annunciator bell and cut in the extension bell, and another three point switch was



WIRING OF EXTENSION BELLS

placed in one of the servants' rooms, which would cut out one extension bell and cut in the other one. The accompanying diagram will show the necessary connections to follow to carry out this arrangement.—CHAS. OLSSON.

Division Bell by "Wire"

"A certain Conservative club" in London is electrically connected with the division bell in the House of Commons, and members have found the arrangement most convenient.

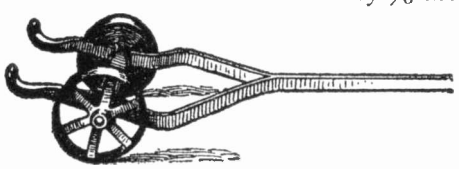
But Mr. Denman, the Liberal member for Carlisle, considers that it gives a party advantage to unpaired Unionist members, and he intends to ask the First

Commissioner of Works if he will terminate the connection.

The division bell rings in a number of members' private residences, including those of Mr. McKenna, Mr. Trevelyan and others within a certain radius of the Speaker's chair.

Truck for Handling Armatures

In electric railway shops it is necessary to handle heavy armatures. The accompanying illustration shows a truck used for this purpose. The wheels are thirteen inches in diameter on a 1⅞ inch shaft. The frame is made of 2 by ⅝ inch



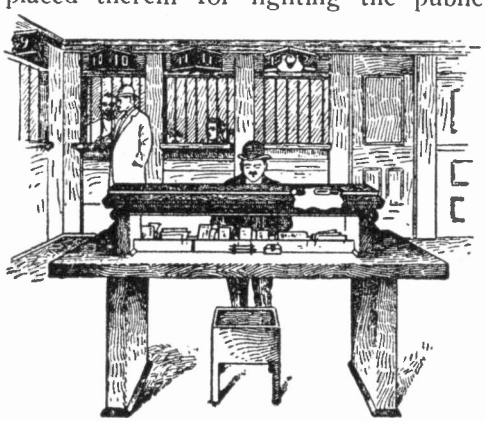
ARMATURE TRUCK

iron. The prongs of the frame are curved and spaced far enough apart so that they can be run under the armature shaft at each end. From the wheel shaft to the prong ends is eleven inches. The handle may be seven or eight feet long to secure good leverage.

Bank Lighting Hints

The economy of concentrating electric light upon the required object or place is coming into evidence more every day.

A Chicago bank uses an artistic, dull brass, trough reflector and tubular lamps placed therein for lighting the public



ILLUMINATING THE PUBLIC WRITING DESK

writing desks on its main floor. The result is absence of shadows, no matter in what position the writer may be standing, and reduced current consumption with more efficient illumination.

Another convenience appreciated by the patrons is the illuminated numbers on the bank cages. These numbers are so placed and designed that they may be easily seen from any part of the floor.

High Furnace Temperatures

In the working of metals we now have the electric vacuum furnace, which carries us several hundred degrees higher than before. Beyond this, for many purposes, there is the furnace or crucible which, operating in hydrogen or in nitrogen and heated by a coil of tungsten or molybdenum wire, lets us melt practically anything. At present this type of furnace is limited only by the material of which the crucibles are made, and can easily be carried up to a temperature at which all the well known refractories much too easily melt. When one reflects that our industries have always depended on what could be done below a temperature of about 1,600° C.; that our porcelain mixtures, as well as our alloys, our metallurgical processes and all our applications of heat have been influenced by this upper limit, we look forward with interest to the effects which may be produced by making available a temperature at least 500 degrees higher in the next few years. Fundamentally new results ought to be anticipated.

Receiver Casings of Metal

For years the custom has prevailed of manufacturing the casing of telephone receivers of hard rubber or similar insulating material. Now, however, Mr. W. W. Dean, of Ohio, has designed a receiver of metal shell, the parts of which are made from sheet metal. Auxiliary metal rings are inserted at the point where the cap screws onto the shell. The end of the shell is reduced in size so as to slip within the external rings.

Atmospheric Electricity

In spite of the knowledge already gained the actual cause of the electrification of the atmosphere is, as yet, problematic. The causes can be friction in air currents, volcanic emission of charged

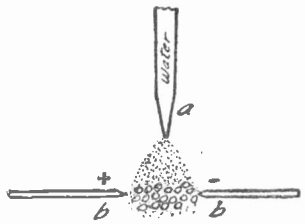


FIG. 1. SIMPLE EXPERIMENT, SHOWING FORMATION OF RAIN DROPS

gases, chemical activity, induction, ultra-violet light from the sun, and the bombardment of our outer atmosphere by electrified particles or electrons emitted by the sun and sent forth through space at tremendous velocities. The two causes last mentioned are of extreme interest because they are of recent origin.

Ultra-violet rays (sometimes called photo-chemical) are emitted by the sun in large quantities. Very little of this radiation reaches the surface of the earth because it is absorbed by the air. When absorbed it ionizes the air; that is, it breaks up the gases into ions of positive and negative charges. It can easily be shown that water vapor more readily condenses on the negative particles and therefore these might be carried to earth, leaving the air positively charged. The air is, however, sometimes negative with respect to earth. This can be explained by the phenomenon of electrostatic induction and accounted for in various ways.

The other method depends on the fact that hot bodies emit electrically charged particles. Thus the sun is supposed to send forth charged bodies consisting perhaps merely of electrons of electricity. These particles encounter no matter while traversing the boundless interplanetary space and are not absorbed or stopped until reaching our atmosphere.

Clouds are of course masses of very fine particles of water. When the air is charged it may be assumed that each tiny drop has a certain charge. As these drops coalesce and form larger drops it is a simple mathematical calculation to show that the potential of the large drop is greater than that of the small drops combined. This may account for the large difference of potential which suddenly breaks down the gap between cloud and earth. On the other hand, a simple experiment shown in Fig. 1 may be performed to show that the drop may be formed by the lightning discharge instead of vice versa. A fine spray of water is formed by the nozzle (A). A spark gap (bb) is placed in the spray and connected to a source of high electric potential. When a discharge passes between the points, the tiny particles of water coalesce and form large drops. It is thus seen that a lightning flash may be either the cause or effect of the formation of rain

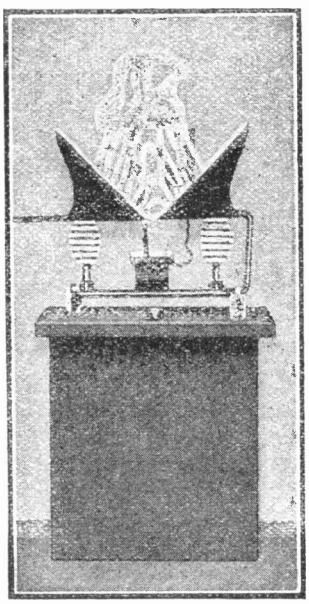


FIG. 2. DISCHARGE OF A LIGHTNING ARRESTER

drops. It is a matter of common experience that a heavy downpour of rain follows a lightning discharge, but owing to the much greater velocity of light than that of the falling drops it is impossible to determine which is the cause or effect.

The properties of a lightning discharge

are well known. It is oscillatory as is that from a condenser and its frequency is a million or more oscillations per second. Knowing this, it is useless to use solid conductors for lightning rods because an alternating current of high frequency does not flow in the middle of the conductor but confines itself to the portion near the outside. In other words, the resistance of a certain solid wire is much greater for high frequency current than for ordinary current. This "skin effect" becomes so important that the difference in conductivity of various metals becomes negligible and a galvanized iron pipe is a far better conductor of lightning than a solid copper wire of equal metallic cross-sectional area, but much smaller surface area.

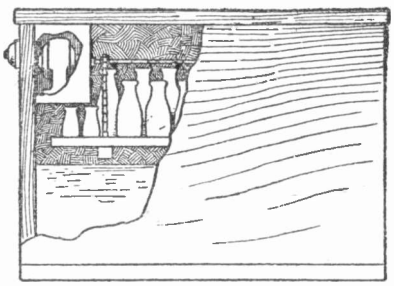
Owing to the high frequency of lightning current a few turns of wire offer a tremendous "choking" effect. This is taken advantage of in making lightning arresters for the terminals of telephone, telegraph and electric lines. A few turns of wire are connected into each outgoing wire just beyond the generator, telephone or other apparatus to be protected. Between this coil and the ground there are a number of spark gaps in series which ordinarily do not permit the current to flow across. If lightning strikes the line it meets great resistance in the coil and therefore jumps across the gaps to the ground.

There are many types of arresters, but they all contain the principle—an easy path to the ground for the high frequency discharge. Fig. 2 shows one form of arrester in action.

For the Milkman

A patent has been issued to Wm. M. Watson, Fallsington, Pa., upon a device for raising and lowering milk bottles in the milkman's cold water boxes used to chill the milk.

The apparatus consists of a rack, connected to small rods at the top of the ice box by chains or straps. These rods are connected to a small motor which when started will raise the rack and bottles above the water, allowing them to drain, still keeping them in the cold of the ice box. When the time comes for



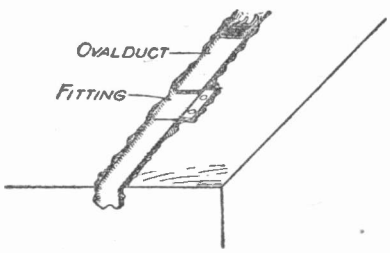
COOLING MILK BOTTLES

loading, they can be placed in the boxes and then in the wagon, entirely dry, yet cold, and the milkman has not suffered with cold fingers from picking several dozen bottles out of ice water by hand.

For the Electrician in Fireproof Buildings

In rearranging lighting circuits in fireproof buildings having partitions, walls and ceilings of plaster upon tile, the wireman has a new helper in the way of Ovalduct.

The insurance inspector does not like to have the tile injured and a groove chis-



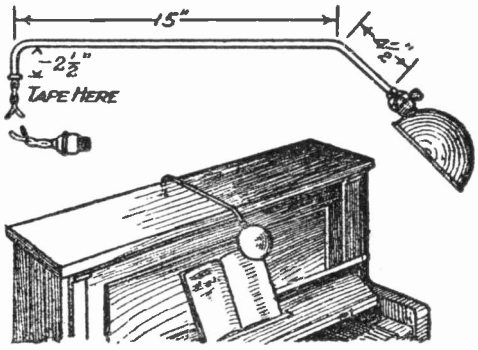
OVALDUCT

eled in the plaster is not deep enough to allow a conduit to be laid in, so lead covered wire has been used.

Ovalduct is piping like conduit, but is purposely elliptical in shape to lay next to the tile and be covered by plaster after the wires are in and the job done, thus satisfying both insurance man and building inspector.

A Piano Lamp

Procure a ¼ inch brass tube 24 inches long and thread one end to fit a standard socket. Wire the tube and socket, using three feet of fixture wire. Bend the tubing as shown in the illustration to lay

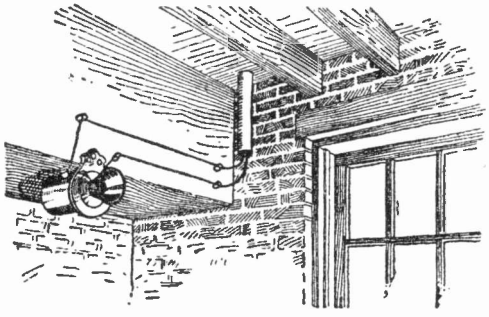


PIANO LAMP

over the top of the piano so that with a metal shade upon the lamp the leaves of music can be readily turned. Solder lamp cord with plug to the fixture wire, staggering the joints, and tape with rubber and friction tape. An eight candle-power lamp is bright enough to use.—ANTON PERTLE.

Automobile Horn for Factory Signal

Asked to install some sort of signaling device in a five story factory where steam was not used and where it was necessary



AUTOMOBILE HORN FOR FACTORY SIGNAL

to let the employes know when the machinery would be started or stopped, I made use of a Mesco automobile horn. The horn was installed on the third floor, near the stairway, and connected with the batteries and a push button in the office. The signals could be heard all over the building. The company recently moved to a place where it occupied two floors. The building had practically soundproof doors. I then installed a horn at the ceiling upon each floor, connecting the two horns in parallel.—CHARLES HORTON.

Farming by Electricity Demonstrated

Farming by electricity, as demonstrated at Beachville, Ontario, on June 25, by the Hydro-Electric Power Commission, is less than a chemical formula and more than a theory. It is a practical application of electricity as a motive power to the various branches of farming where labor is required. The demonstration was two-fold. It was the first effort of the commission to show the farmer at closer range just what the Ontario cheap power movement means to him. To the people of Beachville it was the tangible beginning of the participation of that village in the power scheme under the most recent legislation by the Ontario house.

Hon. Adam Beck took advantage of the occasion to make the announcement that the commission is about to order two portable threshing outfits, which will tour the country this fall to give demonstrations of the use of the power for this and other heavy farm work, such as corn cutting and plowing, where, say, 25 horsepower would be required.

The cost of such an equipment, Mr. Beck explained, would be about $1,000 less than the present threshing outfit; it would stand four times the service, and require no expert for maintenance. A meter would measure the quantity of power used, and the farms would be billed by the municipality.

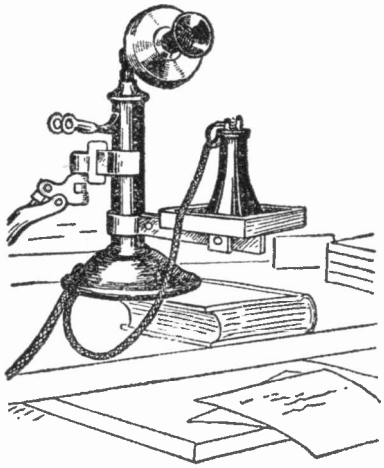
This announcement evoked universal interest, but equally practical was the statement that a supply of two horsepower of electricity would suffice for house lighting, milking, dairying, feed

cutting, cooking and the various incidental occupations where power in some form or other is required.

This demonstration, which started late in the afternoon, attracted some 1,500 people. Farmers from all sections drove in, anxious to see and to learn. While the demonstration was designed, from a farmer's standpoint, to bring the comfort, convenience and economy of electricity close to him in a practical way, many of the appliances displayed are familiar in city houses. The storage cooker, which is heated by electricity to 250 degrees Fahrenheit, and then shut off, holding its heat for hours, was put to some severe cooking tests. Chopping machines, feed and corn cutters and cream separators gave evidence of great labor saving possibilities. A center of interest was an automatic pump brought by Mr. Beck from Germany. It is operated by a one-sixth horsepower motor.

Tray for Telephone Receiver

There are few who haven't knocked the telephone receiver from the desk with



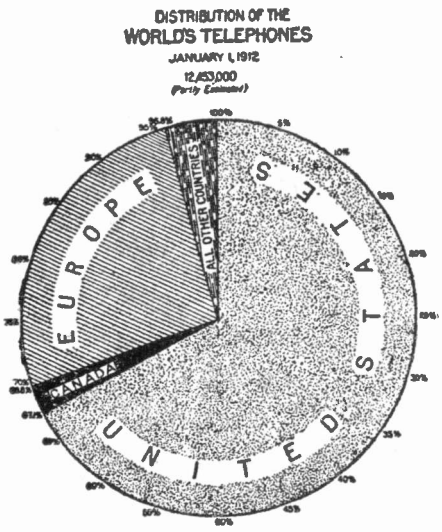
TRAY FOR TELEPHONE RECEIVER

the elbow when about to resume a conversation after looking up some needed information. I have found the small homemade wooden tray fastened to the standard of the telephone by a clamp a most convenient holder for the receiver at such times.—H. G. WILSON.

The World's Telephones

According to a recently published report of the American Telephone and Telegraph Company, it is estimated that on January 1, 1912, there were 12,453,000 telephones in use. The total length of telephone wires was 29,566,000 miles. At that date the world's investment in telephones is placed at $1,729,000,000. The accompanying diagram, which is reproduced from the above report, shows the distribution of the world's telephones, of which 67.1 per cent are in the United States.

It is worthy of note that during the year 1911 the great United States railway systems have made rapid advances



toward the general use of the telephone for train despatching. Since the introduction of the use of the telephone for that purpose, over 200 of the United States railroads have adopted that system. In fact the telephone has supplanted the telegraph on over 50,000 miles of railroad, which is over 20 per cent of the total railroad mileage of the country. A careful estimate places the miles of wire used by railroad companies for train dispatching at 120,000, and the corresponding number of telephones at 10,000.

Electricity the Silent Salesman

Some helpful hints on the use of electric current in getting up show window displays. The following schemes have all been used with remarkable success.

Garden Hose Display

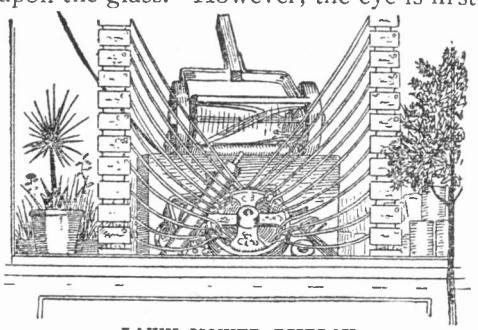
Two pillars built up of garden hose represent one dealer's method of calling attention to his stock. Between the pillars is set a searchlight upon the glass

CALLING ATTENTION TO GARDEN HOSE

of which is painted a picture of a gardener carrying several coils of hose over his shoulder and a plant in his hand. This picture in colors is made prominent by the rays from the light.

Grass Cutting Advertisement

The virtues of a lawn mower are presented in the window of a seed firm by means of parts of the mower, from each of which ribbons are run to cards pasted upon the glass. However, the eye is first

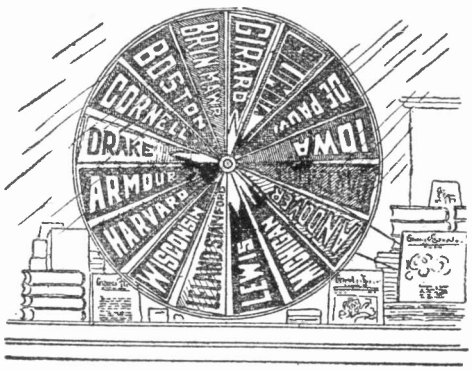


LAWN MOWER DISPLAY

attracted to the exhibit by an assembled mower. A small electric motor by running friction wheels, operates the machine.

Wheel of Flags

A store near a large university makes a specialty of college flags. In the window is a wheel of light wood seven or eight feet in diameter, with bearings at



WHEEL OF FLAGS

the hub. From the circumference of the wheel to the center are stretched flags of various colleges. On the shaft of the wheel is a pulley connected by a light belt to a concealed motor which operates this wheel of flags.

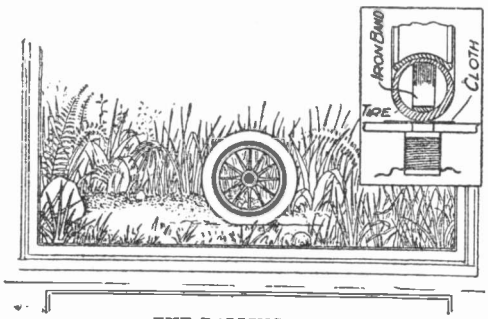
The Rolling Auto Tire

Nothing will so quickly attract the attention of passers-by as some mechanism whose operation borders on the mysterious. An apparently simple device of this nature is being used to advertise automobile tires.

The whole length of a large window is backed with an artistic arrangement of palm leaves and shrubbery. Just in front of the shrubbery is left a narrow space about six inches wide, covered with ordinary blue overall cloth. At each end of this narrow path are placed two large stones and between them, without any apparent means of support or power, rolls an ordinary automobile tire.

The secret of the device lies in a system of electro-magnets arranged at inter-

vals of about two inches and concealed beneath the path. These attract a band of iron placed inside the tread of the



THE ROLLING TIRE

tire. The poles of the magnets terminate in innocent looking heads which appear merely to hold the cloth in place. By contacts controlled by a concealed motor the coil of one magnet after another is energized, rolling the wheel back and forth.—STUART R. WARD.

Demonstrates Safety Razor Blade Sharpener

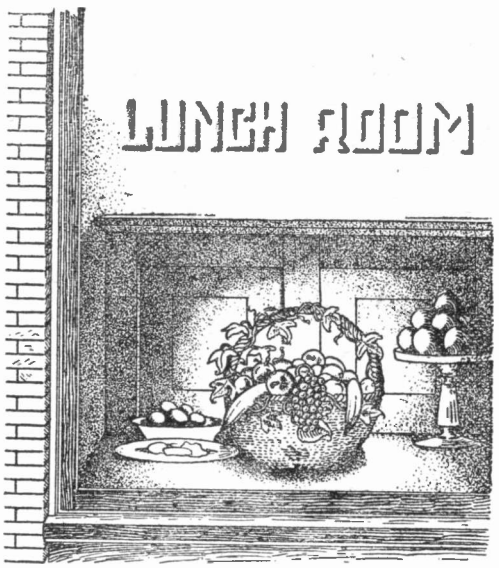
The use of safety razors has brought out numerous devices for sharpening the blades. A show window display calling attention to one of these mechanisms is here shown.

SAFETY RAZOR DISPLAY

The right hand which turns the device is operated by a small motor inside the case, as is also the "twirler" on top.

A Basket of Glowing Fruit

An enterprising Chicago restaurant owner is using for his show window a large basket containing sockets into



LUNCH ROOM ATTRACTION

which are screwed bulbs representing a large variety of fruit, so placed and arranged as to form an appetizing as well as an artistic imitation of a basket of fruit.

Emphasizing Window Displays

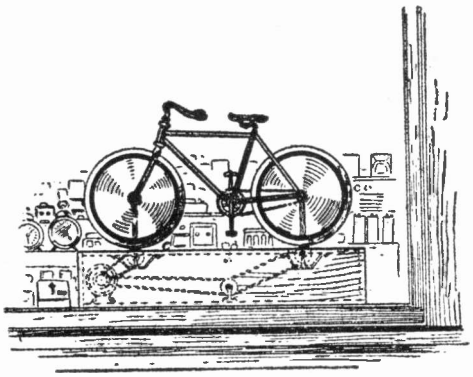
A clever method of calling special attention to certain items in his show windows is being used by a prominent dry goods merchant at Cleveland, a man who long ago learned the advantage of adopting tungsten lamps with suitably shaped reflectors for lighting his window displays. Although well pleased with the resulting window illumination, he found that the lighting made all of the goods show up equally well. What puzzled him was how to call special attention to certain items in the window without marring the artistic effect by unsightly signs.

This he has now done by placing additional tungsten lamps in the windows, with reflectors concentrating the light from each on a certain article. These added lamps have colored bulbs and are turned on and off at short intervals by little flashers. Consequently, the man or woman looking into the nicely arranged and brightly lighted window suddenly sees a table spread turn pink; then a morris chair near the other end of the window changes from brown to green in its tints, and so on.

Watch the Wheels Go Round

That an ordinary bicycle should attract attention as a window display would seem unusual, yet arranged as shown in the illustration it proves a drawing card.

The machine is mounted upon an elon-

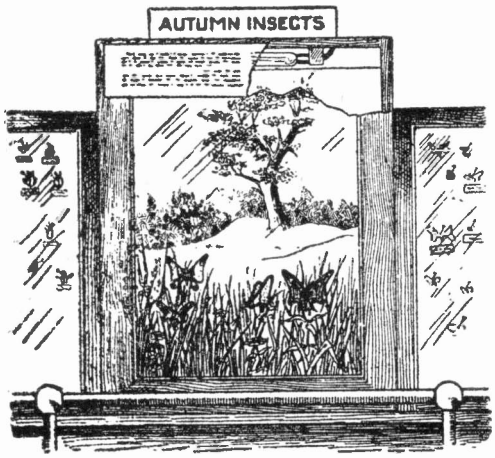


MOVING BICYCLE DISPLAY

gated box through the cover of which are two grooved wheels, each touching the rubber tire upon a bicycle wheel. A concealed electric motor turns the driving wheels, causing the bicycle wheels to spin around.

Butterfly Exhibit

In a portion of a museum devoted to insects, electric light is used to bring out the beauty of the butterfly specimens. A glass case with its sides and back holds a picture, in natural colors, of flowers and distant woods. In the foreground artificial grasses and flowers are placed, and upon these are the butterflies. The

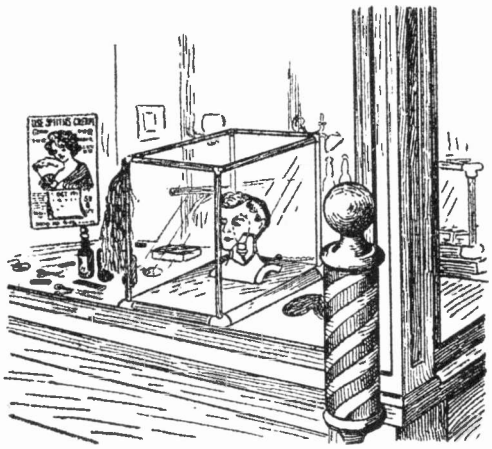


BUTTERFLY EXHIBIT

richness of the scene is heightened by light from incandescent lamps hidden from view in the upper front part of the cabinet.

Wig Advertising

A wig manufacturer attracts attention to his show window by placing within a wax head wearing a wig a low candle-



WIG ADVERTISING

power incandescent lamp. The light gives a live glow to the wax figure and, according to the manufacturer, helps sell his goods.

On and after June 1, 1913, New York City wiring rules will prohibit the use of wooden molding for enclosing electric wires.

Electrical Securities

By "CONTANGO"

In this and the succeeding article a brief review of the past ten years or so will be given, containing some extraordinary facts and figures concerning what has been done, is being accomplished and is likely to be achieved in the future.

It is not the purpose here to give a long list of figures or dry-as-dust details that nobody will read, but rather to show some pertinent facts and illuminative illustrations as to just what has been accomplished in, say, the last ten years, and, to use a homely phrase, show "what is doing" and what will be done in the world of electrical finance.

One might make the statement right here that now over, and considerably over, $2,000,000,000 is invested in one way or another in the lighting and power development of an electrical character in the United States.

It would be just as well to quote here the words said in 1909 by the president of the National City Bank of New York, itself one of the greatest, if not the greatest, of financial institutions in the world. For he spoke then from the fore-knowledge of an individual trained to watch the best possible opportunities for his customers and indeed all those people who, being not afraid to part with their money, are alive to good and certain returns on it. Moreover, the facts have more than borne out his words. Let us see.

In 1909, to quote Mr. Vanderlip: "The eleven or twelve hundred million dollars which are today invested in electric lighting and power plants form an investment that is divided between some eight or ten thousand separate companies. That in itself is one of the important reasons why we find such a small number of electric light securities in the bond lists of the great stock exchanges. The average cost per plant, as given in the census report, was about $140,000, in 1902; in 1907 the average cost per plant was a little over $200,000. We had a situation then in which there was a great number of small individual plants unrelated in management or incorporate in organization."

Now, we will for the moment leave Mr. Vanderlip's remarks to themselves to suggest that in the three years past since he uttered them, there must have been an additional investment of rather over $900,000,000, and in proportion as this great sum of money has been put forth, just so has the tendency been to decrease the number of small plants, consolidate them into large ones and increase the cost per plant.

To quote Mr. Vanderlip once more: "We have seen the electric lighting business grow more rapidly than any other form of industrial activity. A business that will double in five years, as the electric lighting business has done, has in it a vitality that is, of course, bound to carry it to enormous proportions. The great development in the use of electric power offers a field of growth that seems likely to be quite as rapid as has been the development in the illuminating field."

Again, it is wise to interrupt Mr. Vanderlip's utterances of 1909 to tell you that this development in the field of power, about which he speaks, has been far, far greater than he ever anticipated. To conclude his salient and brilliant remarks:

"Given intelligent technical management, conservative accounting that embraces ample charges for renewals and depreciation, fair rates that do not offer a field for legislative attack, I see no reason why sums in the most ample supply should not be found to absorb all the securities of this kind that it is necessary to create. If, added to these elements, there are corporate combinations,

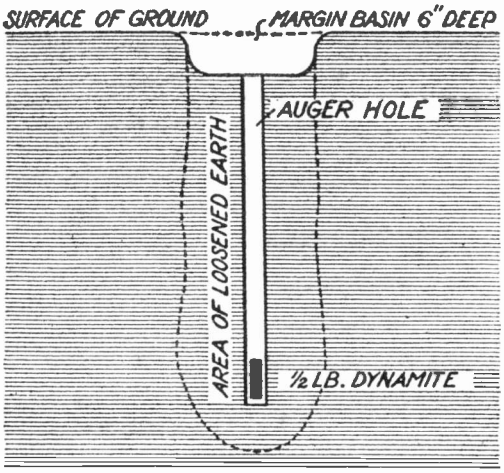
pose here, but startling figures and facts are: We had the intention to supply in detail the figures of electrical financial development in the United States during the past decade, but they were found to be too voluminous, too all embracing, for even a small portion of many articles; they would demand a volume all for themselves. But we can give some figures relating to that parent company mentioned which has its headquarters in the greatest electrical center of the world, and here they are: Speaking at the celebration of the twenty-fifth anniversary of the inception of this company, the Commonwealth Edison Company of Chicago, in June last, the president observed that in 1889 the income from light, power and railway was $105,700; in 1899, $1,792,700, and in 1911, $13,902,300. In 1893 this company had 4,100 customers; in 1899 it had 13,300 customers; in 1911 the number of customers was 157,115. What more need be said?

But you who live in the midst of such things have been told bit by bit what values are, how they are derived, why they are so termed. Therefore, after giving you all this information with the expressed willingness to give more, you must accept the homely dictum of saying surely "It's up to you."

Digging Pole Holes with Dynamite

Experiments made by the Marion (Ind.) Electric Light Company with dynamite for opening pole holes in frozen ground indicate, says the *Electrical World,* that the explosive reduces the excavation cost from $1.75 to about 35 cents per pole, besides enabling one gang to dig sixteen to eighteen holes a day.

In preparing for the dynamite a little basin six inches deep and the size of the hole is first opened at the surface of the ground to prevent the explosive action from spreading. Then with an auger a two inch hole is bored to the desired depth of the excavation, and into this hole is dropped a half-pound stick of

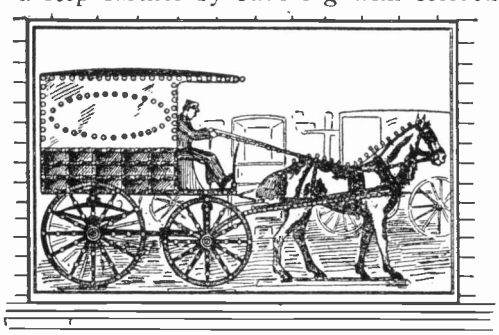


METHOD OF DIGGING POLE HOLES

dynamite, about sixteen cents' worth. The resulting explosion shatters the ground about the auger hole, loosening the frozen earth at the surface up to the margin of the basin first cut. This loosened earth in the hole can then be "spooned" out easily and the hole is ready for the pole. In making preliminary tests in frozen ground it was necessary to set off two half-pound charges at different depths for each pole, but with unfrozen ground one 16-cent charge was enough.

Attractive Wagon Display

Usually wagons resplendent with new paint and varnish, in the show rooms of the manufacturers, are considered to be attractive enough, but one company goes a step farther by outlining with colored



WAGON DISPLAY

lights a lifelike exhibit of a horse, wagon and driver and placing the outfit in a window bordered with similar lights.

Inventions and Patents

By A. P. CONNER

II.—THE PATENT OFFICE PROCEDURE

The next important step is the filing of the application in the Patent Office, which includes the payment of the preliminary government fee of $15. This preliminary fee must be paid in advance, as the Patent Office cannot accept the application until it is. If there are no informalities of serious consequence, the application is then sent to the classification division, which assigns it to the examining division to which it belongs. When its turn comes the examiner to whom it is assigned takes it up and examines it and particularly its claims to determine its patentability. An extensive search is made through the Patent Office records, which include all the domestic patents and those of foreign countries, together with catalogues, text books and all other sources of information which might serve to show all that has been done in the way of invention. This is in order to safeguard against the allowance of a patent that might be declared invalid. It is ridiculous to imagine that the Government will allow a double patent for the same invention, under the present system, especially if the difference between them is only a slight mechanical one, although many lay people seem to think otherwise. In order to obtain a patent in the United States at the present time the inventor must show that his invention is fully within the terms of the law and has merit. This is further emphasized by the fact that the examiners are men of high technical and legal training and fully capable of seeing through any schemes that might be perpetrated for the purpose of getting a patent without deserving it.

When the examiner discovers a reference which conflicts with the applicant's claims, he officially notifies the applicant or his attorney, who then suitably amends them until the case is placed into condition for allowance. When the application is allowed it is passed to another division which then sends out an official notice of allowance to the inventor, and notifies him that on payment of the final fee of $20 his patent will be granted and passed to issue. Six months after the date of allowance are given the inventor, in which to pay the final fee, so that he may be able to do it, no matter how humble his circumstances. After paying the final fee the inventor receives a copy of the patent specially printed for, and provided with the Patent Office seal and at the same time a number of the patents are printed so that the public may obtain copies of it. These copies of patents cost five cents each. At the same time a synopsis of the patent is printed in the Official Gazette of the Patent Office, which costs ten cents a number and which is issued weekly on Tuesday.

If the examiner thinks an invention is unpatentable, he so notifies the inventor or his attorney, and gives him an opportunity to prove otherwise, and then if he still is unconvinced, he rejects the application. If the inventor is not satisfied with the examiner's decision he has the right to appeal to a special board of examiners selected for that purpose, and if they do not reverse the opinion of the examiner, a further right to appeal to the Commissioner himself is given, and from thence to the Court of Appeals of the District of Columbia. This gives the inventor all the opportunities necessary to get the protection he seeks, provided he is not satisfied with that given him in the Patent Office.

If two or more independent inventors happen to make independent application for a patent covering the same invention at the same time, and each invention is deemed patentable, an "Interference" is declared, which is in short a proceeding to determine who is the first inventor of the invention. When this is found out

a patent is granted to the person who is the first inventor.

There are many technicalities which arise in the procedure of the Patent Office, which while important cannot be referred to in an article of this kind, particularly as their meaning would not be clear to the reader unless he had the actual practice and experience to assist him, but there are several important principles which should be known by all, for instance, only the inventor can make application for patent, and in case of death his administrator, and the patent will be issued in his name. If others wish to have their names appear in a patent, they must obtain an interest in the same, and have said interest recorded at or before the time the final fee is paid into the Patent Office; in which case it will definitely appear that they are assignees of the patent, together with the interest they have in it, on its face. Where anyone has obtained an interest in a patent, he should see that it is duly recorded in the Patent Office, as such action on his part will in most cases be the only proof he can offer to the courts that will be considered, in case it is necessary that he should do so. However, if the applicant is guided by a competent patent attorney he will be fully advised in all these matters, so that his interests will be protected.

SELECTING A PATENT ATTORNEY

The selection of a patent attorney is too important a matter to be lightly considered, so that a few words of suggestion seem advisable. It must be remembered that many inventions are worth tens of thousands of dollars if properly protected, and sometimes millions. As this is so the inventor should use as much caution in selecting his patent attorney as he would in selecting a trustee to take care of an estate of that value. If the patent is once passed to issue it is almost impossible to get additional protection on the invention than that already provided for in the claims in the same. If same are drawn with a lack of care and skill it means a loss to the inventor, for which he cannot get redress, because he is presumed to use proper care in the selection of his attorney. Every particular case has to be considered by itself, but the following general rules may assist the reader in this matter. If the inventor has an invention developed on electrical lines, he should choose an attorney who has had particular training along these lines, or who has specialized in the same, because their technical scope is far beyond that which an ordinary patent attorney is able to efficiently deal with. Usually any of the attorneys who have been employed by any of the large electrical corporations, such as the General Electric Company, Westinghouse Company, etc., and those in Washington who may be well known as experts in this line are particularly desirable for this class of invention.

It must also be kept in mind by those who wish to sell their patents that the name of a reliable patent attorney counts for a great deal in the consideration that it will receive at the hands of the patent experts of the corporations with whom they communicate. If the name of an attorney of high class prestige appears on the papers of an application, it assures those who are to be buyers of the invention that proper care and prosecution has been given it and that no further investigations on that part are necessary.

THE COST OF A PATENT

The cost of patenting an invention varies with the circumstances, but those of a simple nature cost in all about $70 to $100, which is divided somewhat as follows: The preliminary government fee of $15; the cost of each sheet of drawings, $5; the final fee of $20 for the government, and $35 (up) for the attorney's fees. However, conditions may vary these figures, but they form a good general basis as to what they are. In conclusion it may be said that the time for patenting really meritorious inventions was never better than the present, especially if same have some important feature that cuts down the cost of operation of the device, or its cost of manu-

facture, particularly if there is keen competition in the use of the machine.

COMMERCIALIZING THE PATENT

There are two ways in which a profit may be made out of a patent. The first and quickest is selling the same outright to a buyer, and the other is in the manufacture or marketing of the device by the inventor himself. The latter is oftentimes the most profitable but slowest in the point of realization. In selling the patent to a corporation two general methods are ordinarily pursued. One is to pay a cash price to the inventor and thereby settle the matter forever as far as he is concerned, and the other is to pay him a certain amount on every article embodying his invention manufactured, which is called the royalty basis, and is often the most equitable for all concerned. But the great doctrine of success in the production of inventions is very aptly expressed in a motto commonly used by Thomas A. Edison, which is "Everything comes to him who hustles while he waits."

NEW BOOKS

THE PROGRESS OF PHYSICS. By Arthur Schuster. London: Cambridge University Press (New York: G. P. Putnam's Sons). 1911. 159 pages. Price, $1.25.

A series of four lectures delivered to the University of Calcutta, India, March, 1908, and revised to bring the subjects to their position at the present time, such as The Theory of the Atom, Elastic Solid Theory of Light, Roentgen Rays, Terrestrial Magnetism, Atmospheric Electricity, Gravitation and Identity of Molecules of the Same Kind.

ELECTRIC METERMAN'S HANDBOOK. By the National Electric Light Association, New York. 900 pages with 750 illustrations. Price to members, $2.00; to non-members, $3.00.

This book should be of value to all company and individual members who are interested in the measurement and sale of electricity, as it contains practically all authoritative information required by any one in charge of the operation of electric meters, from the standpoint of the executive, the installation, or the testing department, and for the guidance of civic commissions.

PLANS AND SPECIFICATIONS FOR WIRELESS TELEGRAPH SETS. Part I. By A. Fredrick Collins. New York: Spon and Chamberlain. 1912. 47 pages with 37 illustrations. Price, 25 cents.

The purpose of this booklet is to describe and illustrate two different sized wireless telegraph sets, so that anyone having a little knowledge of electricity can successfully make them. A set for experimental work is described and also a one to five mile set.

THE BIOSCOPE ELECTRICIAN'S HANDBOOK. By James W. Barber. London: Ganes, Limited. 1911. 47 pages with 27 illustrations. Price, 27 cents.

The author says, "It is hoped that this book weighing not much more than an ounce will afford the operator a ton of information."

AEROPLANE DESIGNING FOR AMATEURS. By Victor Lougheed. Chicago. Reilly & Britton Company. 161 pages, with 82 illustrations.

Taking exception to the plea that the principles of aeroplane design are too uncertain, the author seeks to present a treatise in which the laws of aviation shall be presented in the manner accorded any other branch of engineering. Among the chapters are: The Wing in the Air, Equilibrium and Control, The Design of the Machine.

WIRELESS TELEGRAPHY AND TELEPHONY. By C. I. Hoppough. Valparaiso (Ind.): C. M. Dodge. 1912. 227 pages with 149 illustrations. Price, $1.50.

A treatise in which is set forth in as understandable a manner as possible a few of the fundamental principles of wireless telegraphy, accompanying these by applications to the solution of practical problems which arise daily.

TELEPHONE TROUBLES AND HOW TO FIND THEM. By W. H. Hyde. Milwaukee: W. H. Hyde & Company. 1912. 56 pages with 22 illustrations. Price, 25 cents.

An endeavor to present telephone construction, troubles and remedies in plain language in a compact reference book. One chapter is devoted to Phantom Cir cuits and How to Install Them.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

ELECTRICAL DEMONSTRATION FOR FRENCH FARMERS

France is not behindhand in the use of modern electric devices on the farm. Not long ago there was held an exhibition at Amiens which was intended to promote interest in the subject throughout the region, and one of the interesting points was a model farm with nearly everything run by electricity. Here were to be seen electric kneaders, different kinds of grinders or crushers, also washing devices for farm products, root cutters and straw cutters and breakers for hard substances. Other farm implements were electric threshing machines, wood saws, cider mills, also a freezing plant and others of the like. In this way it was shown that all the farming operations could be done in the very best way with as little hand work as possible and naturally the operations are much cleaner and the health is likely to suffer less. The electric devices would thus make farming a pleasure.—*Journal (Daily), Paris.*

WIRELESS ON FERRY BOATS

Passengers now make the trip from the Continent to Norway and Sweden without leaving the railroad cars, as these are taken across in large ferries. Wireless telegraphy is now to be used so as to keep up connection with the shore, and the ferry service between Sassnitz, Germany, and Trelleborg in Sweden will be the first to use it. On the German side is a wireless station with two 120 foot masts, and on the other coast is an iron tower of 130 foot height with an antenna of umbrella form. The German ferry boats "Preussen" and "Deutschland" are fitted with wireless outfits of a suitable kind. The new service is likely to be very useful, for not only are the two shore posts able to send messages about trains which may be late, or the arrival of freight trains and the like, but the ferry is also in connection with the shore and can have all the needed information. It can also signal about fog or ice and notify the shore posts of any delays which are due to this cause. In one case the boat met with ice and had to change its course and was then lost in the fog. It was able to find its bearings by means of wireless and soon after that it came in to the port of Sassnitz.—*Revue Scientifique, Paris.*

GYROSCOPE EXHIBIT

At a recent meeting of the Royal Society in London there were exhibited a number of electrical gyroscopes by Drs. Gray and Burnside. The larger ones had electric motors of the Gramme ring type and were suspended from frames or otherwise fitted for demonstration purposes. A striking use was offered in a gyroscope mounted on a bicycle saddle and fitted with a yoke or cross bar connecting to the handles. The gyroscope acted to steady the bicycle and gave an automatic control when moving forward. If the machine tended to fall on one side or the other, the effect on the handle bars gave the needed impulse to check up this movement and bring the machine back to the upright position, so that the bicycle was self righting.—*Engineering, London.*

ELECTRICAL RAILROAD SIGNAL

The idea of using the passing train to work a railroad signal is not a new one, but none of the pedal devices or the like which have been proposed seem to work in practice. A new electric method is used in a German apparatus which was built some time ago. It makes use of the slight sinking of the rail when the train passes. The idea is a simple one and consists in the use of two metal chambers filled with mercury, but one chamber or

cylinder having 1,500 times the surface of the other. The large chamber is used so that the rail acts to press down on the mercury in the large chamber and the least movement of the rail causes a considerable rise of mercury in the small one, just as in a hydraulic press worked backwards. When the mercury rises, it acts on a suitable device so as to close a switch and put on an electric current, either continuously as long as the train passes, or during the passage of each wheel. The new apparatus is ingenious and simple, and the moving parts are substantial and will not suffer damage.—*Revue Scientifique, Paris.*

DAMMING THE HISTORIC RHONE

A few years ago it was considered almost an Utopian idea to bring power from the Rhone river to Paris, as the distance is no less than 300 miles. However, the progress in electrical work has been so great that the project is meeting with much favor and is now almost on the point of being approved officially. The power plant will be by far the largest on the continent, as it will give 300,000 horsepower, and at the present rates for current this means a yearly revenue of nearly $30,000,000. Such an amount of power can be represented by 6,000 trains of coal of 400 tons each. The dam will be across the Rhone at a point not far from Geneva where the river flows out of Lake Leman. At Genissat the river follows a veritable cañon, and the dam will be over 300 feet in height and the same width at the base, and it will cost $2,000,000 alone. This will back the water up in a vast lake of fourteen miles length, submerging three villages. At the dam will be erected a turbine electric plant with turbines of 20,000 horsepower capacity. From the station will be run power lines to Paris, and it will operate at 150,000 volts, very likely.

There will be used four different pole lines, so that a local accident will not cut off the current. In this way the city of Paris will receive a large supply of current for lighting or for electric traction and other purposes.—*Revue Scientifique, Paris.*

RADIUM RAYS FROM GAS MANTLES

Although the rays which are known as radium rays are given off to a greater degree by preparations of radium, there are other substances which also give the rays to a less extent, as is well known. Mr. Edgar Senior brings out the fact that the ordinary gas mantle contains quite an amount of oxide of thorium, which is one of the ray producing bodies, and he makes the rays act on a photographic plate so as to give an impression or print of the threads of the mantle. Some of the gas mantles are nearly all made up of the thorium oxide, so that they will give quite a marked effect, and an amateur can easily repeat the experiment. All that is needed is to wrap a photographic plate in thin paper, and on the paper is laid a flat piece of the gas mantle so that it can act on the gelatine side of the plate through the paper. The whole is put in a tin box and this is placed in a closed cupboard. At the end of three weeks the plate is developed, and the woven threads of the mantle are very clearly seen upon it.—*Cosmos, Paris.*

INTERNATIONAL WIRELESS CONGRESS

The International Wireless Telegraphy Congress held at London on June 4 presents much of interest, and all the leading nations were represented by delegates. Three of the questions discussed are specially important just now, one of these being the organizing of the wireless time signal service, and another, the question of messages between fixed stations. A third matter which now needs to be regulated is that of wireless apparatus on aeroplanes or airships. The time service for vessels is in use by France, America, Germany and Italy, but the Eiffel Tower and the Nauen post in Germany, for in-

stance, interfere with one another, so that some rules are needed in order to have the service working properly. Now that airships and aeroplanes are beginning to use wireless apparatus, there is need for special rules as to this point, and also some standards for apparatus should be fixed upon. The last congress thus proved of benefit in taking steps toward the regulation of some of these questions. —*Matin, Paris.*

DANISH PROFESSOR'S NEW BATTERY

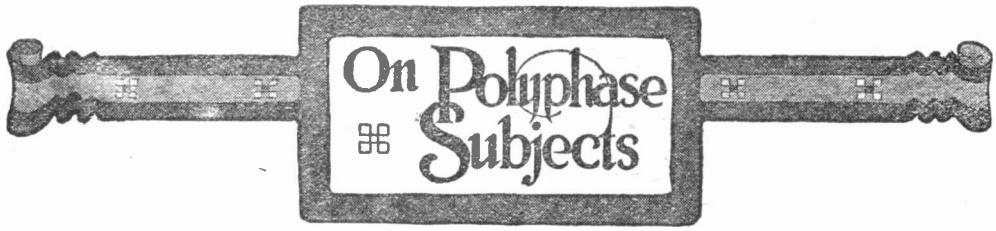
Professor Hannover, who is an eminent Danish scientist and at the head of the Copenhagen Polytechnic Academy, has just devised a new type of storage battery cell, and it is claimed to have the lightest weight for a given power which has been yet found. For an equal size and weight, the new cell gives five times as much current as an ordinary storage cell with lead plates. The essential point about Prof. Hannover's cell is that it uses a porous alloy of lead which is obtained by a special process, and to this he gives the name of "porous metal." In this way the lead plates of the battery have millions of pores of microscopic size, so that the yield of the battery is increased in proportion to its weight. He considers that his new cell will be of great service in all the cases when a light weight battery is needed, as, for instance, upon airships and aeroplanes, as well as on submarines, also for the lighting of railroad trains.—*L'Electricien, Paris.*

FRENCH DE-TINNING PROCESS

Capsules for bottles are usually made of sheet lead having a very thin coating of tin on one or both sides so that the tin will give the bright appearance which is noticed. But as tin is an expensive metal, inventors are looking for a good means of separating it from the lead so that it can be used over again. The tin recovered from old capsules would thus represent a considerable value. A Paris engineer, A. Nodon, is using an electric method for recovering the tin. He dissolves it off the lead in an electric bath, as a purely chemical bath would also dissolve the lead and is much harder to work. He puts the waste capsules in perforated boxes and places these in a tank with plates of lead on the other side, after the battery principle, using a suitable solution. Then he passes a current in the tank between the lead plates and the metal of the capsules so that after a time all the tin is dissolved off. The tin remains in the solution and it can easily be extracted by chemical means. The lead part of the capsules is then ready to be melted up and used over again, so that both the tin and the lead are recovered.—*Cosmos, Paris.*

THE "OCEANIC LETTER"

Experiments are being made on one of the Hamburg ocean liners with a method of combining wireless telegraph and postal service so as to give the public the benefit of what they call the "oceanic letter." The message is written by a passenger on board an outward-bound steamer and is intended for a person on the continent. It is given to the wireless operator on board, and when he is able to make connection with a steamer going in the opposite direction he sends the wireless message, with the proper instructions. The message is taken down on a special telegraph blank and when the vessel arrives at port the telegram is turned into the ordinary mail and thus arrives at its destination. Experiments were made on board the steamer "Cape Arcona" of Hamburg, and it was found that sometimes the messages gained eight or even fourteen days over letters sent by the usual postal method. The price is $1.20 for a 30-word message, and this is much lower than for over-sea wireless messages, the rate being 24 cents a word. It is thought that the present idea would be a most useful one and could be followed according to an international agreement, and no doubt lower rates could be made.—*La Nature, Paris.*



Vail Gift to Boston "Tech" Library

A library of 30,000 volumes on electricity and electrical engineering, valued at $100,000, has been presented to the Massachusetts Institute of Technology by Theodore N. Vail, president of the American Telegraph and Telephone Company. The library was collected by the late George Edward Dering, and is considered to be the most complete of its kind in existence.

Cheap Fuel of the Bad Lands

The Bad Lands of North Dakota embrace miles upon miles of the most wretched landscape on the face of the globe. Desolate hills and miniature mountains of cinder-shot clay stretch away in all directions, absolutely barren and waterless except during a few favored months in the spring. It looks as if at some time the whole country was a bubbling clay pot. Indeed, this is one theory for the curious formations, for the whole land is underlaid with lignite coal, which is supposed to have been on fire at one time until water from the rivers got in and the whole face of the earth blew up.

There are still vast quantities of this lignite cropping out into sight on most of the hills. It has high heating value as long as it is moist, but as soon as it dries out it rapidly disintegrates; therefore, it is unsuitable for shipment. There it lies, of use only locally where it can be mined and burned during the winter, when moist.

Robert H. Fernald, consulting engineer of the Bureau on Gas Producer Practice, in a recent paper has something to say along the line of utilizing these coal products, and some quotations from the paper are here given.

"Investigations into the possibility of generating producer gas for power purposes in a commercial way from the various mineral fuels of the country have been carried on for some time by the United States Government. These investigations have been associated with steaming, briquetting, coking, and other tests, all of which supplemented an examination into the nature, extent, and distribution of the fuels used.

"Many States of the West that have no good coal are also greatly benefited by the investigations, which have shown the adaptability of the gas producer for the utilization of low grade coal, lignite, peat, etc.

"In States in which deposits of low grade coal, lignite, and peat are found, the present cost of power, as developed in steam plants with coal that has been shipped a considerable distance, can be materially reduced by placing producer plants at the mines or bogs, so as to utilize these low grade fuels without cost of shipment by generating electric current which can be easily transmitted to desired points within a wide radius.

"It was found that the low grade lignite of North Dakota developed as much power when converted into producer gas as did the best West Virginia bituminous coals burned under the steam boiler."

In view of these facts, it is not unreasonable to suppose that some future day will see the Bad Lands a center of electrical activities and industrial enterprises built up around this source of cheap power.

"What's the matter with your wife? She's all broken up lately."

"She got a terrible jar."

"What has happened?"

"Why, she was assisting at a rummage sale, took off her new hat and somebody sold it for 35 cents."

* * *

"I know he's a darling, but I'm afraid it's no use. My husband doesn't like dogs."

"You buy 'im, lydy. You can get another husband, but you won't git another dorg like 'im."

* * *

A writer at the Chicago convention declares that one colored delegate told him that he had been able to pay off the debt on his church since his arrival in the city. This reminds one of the old couplet:

I stole dem breeches but it wa'n't no sin,
I stole dem breeches to get baptize in.

* * *

A teacher was discussing the subject of political parties at school one day. When he had gotten through he asked:

"How many Republicans have we?" Some raised hands. Then he asked. "How many Democrats?" Some raised hands. Among those was Helen, who had just said she was Republican.

The teacher said: "Why, Helen, you cannot be both Republican and Democrat."

Helen said: "Yes, sir. My father is a Republican and my mother a Democrat."

* * *

Stella.—"Does she live from hand to mouth?"

Bella.—"No, from ear to mouth."

* * *

"Why did you give your parrot away? The poor bird meant nothing by its profanity."

"I could stand its profanity, but it was learning to imitate my neighbor's rusty lawnmower."

* * *

A Matter of Names.—"What is the difference between *pomme de terre* and potato?"

"About two dollars."

* * *

"Why are you so sore on that eminent millionaire? He has done some good things."

"I was one of them."

Sibyl.—"When Steve proposed to me he acted like a fish out of water."

Maud.—"Why shouldn't he? He knew he was caught."

* * *

"You're working very hard today, Jake, me son," said a friend to a bricklayer's laborer. "How many hods of mortar have ye carried up that ladder since startin' time?"

"Hush, me lad," said Jake, with a wink. "I'm foolin' the boss. I've carried the same hodful up and down all day, and he thinks I'm working!"

* * *

"Think I'll go to the ball game today."

"All right. Is there a telephone at the grounds?"

"There's one near there. Why?"

"If the home team loses I want you to telephone me, so that I can take the children and go over to mother's until you get your temper back."

* * *

The home of a negro kalsominer in Pittsburgh bears the following original, though much to the point sign:

"GOIN OUT WHITEWASHING DONE IN HERE."

* * *

Judge.—"Why didn't you stop beating him when he cried 'Enough'?"

Sambo.—"W'ye, ye see, sah, dat nigger is sich a liah, ye can't nevah beliebe 'im."

* * *

"How did he manage to escape from the penitentiary? I thought it was well-nigh impossible."

"Well, he figured it out on scientific lines. Somebody smuggled him a pair of trunks, and after he got outside everybody thought he was running a Marathon."

* * *

A keen student of human nature must have written the following:

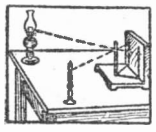
"When you see a young man sailing down the street shortly after midnight with his collar crumpled, you can make up your mind that there's a young girl crawling upstairs not far distant, with her shoes under her arm and an extinguished lamp in her hand.


JOHN! I HEAR BURGLARS! GET UP!— THE MATCHES ARE ON THE DRESSER
ILL GET A MATCH AND LIGHT THE GAS.
1
JOHN! IF YOU SEE THE WHITE OF HIS EYE - SHOOT HIM!
BERTHY, I CANT FIND THE MATCHES
2
FEEL ON THE DRESSER I TOLD YOU
BERTHY- WHERE'S THEM MATCHES?
3
HELP! HELP! HELP
LOOK OUT! IT'S A WILD ANIMAL!
BANG!
BANG!
BANG!
BANG!
4
YOU HAVE SHOT MY NEW SWITCH·
HERE HE IS-DONT BE AFRAID-HE IS DEAD
THEN-THEY MADE A — LIGHT
5
HELLO! IS THIS THE LANDLORD? IF YOO DONT PUT IN ELECTRIC LIGHTS AT ONCE I MOVE- SEE?-ALL THE TIME I'M GETTING IN TROUBLE OVER THEM BUM GAS LIGHTS
NEXT MORNING
6

Common Electrical Terms Defined

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

SHADOW PHOTOMETER.—A photometer for measuring the intensity of light cast by two sources of light by comparing the shadows of the same object cast by the two lights at the same time. (See cut.)



Shadow Photometer

SHELLAC.—A resin obtained by gathering the sap which comes out of punctures of the bark of certain Asiatic trees. Made into a solution with alcohol it is used as an electric insulator, being applied like a varnish.

SHORT CIRCUIT.—If two wires of opposite polarity are connected together with very low resistance or none at all between, a very heavy current according to Ohm's law, $C = \frac{E}{R}$, will flow, as R is practically zero.

SHUNT.—A branch circuit taken off the main circuit and returning to it farther on. Through this branch part of the current flows, the remainder flowing in the main circuit.

SHUNT WINDING.—A term applied to a dynamo or motor in which the two ends of the field windings are connected to the brushes or to the machine terminals. The field windings are then in shunt or parallel with the external circuit.

SILVER BATH.—An electro-plating solution for depositing silver. One formula is as follows: Water, ten parts; potassium cyanide, five parts; metallic silver, 2½ parts, all by weight.

SKIAGRAPH.—A shadow picture taken upon a photographic plate by means of the X-rays.

SKIN EFFECT.—Currents which change direction often are carried by the outer layers of the conductor. This greater density of alternating currents near the surface is called the skin effect.

SMASHING POINT.—After a carbon incandescent lamp has burned 500 or 600 hours its candlepower falls off from 15 to 20 per cent so that for the light given the current consumed is too much. For this type of lamp, therefore, it is a saving to "smash" it or in other words replace it at the end of its economical service.

SOLENOID.—A coil of wire of cylindrical shape in which the length of the cylinder is more than its diameter.

SOUNDER.—An instrument used in telegraphy. It consists of an electro-magnet and an armature attached to an oscillating bar and so adjusted by screws that a sound is produced, whenever the magnets are energized, by the bar striking a second adjusting screw. By means of it the dots and dashes of the telegraph code are received and read.

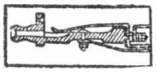
SPARK ARRESTER.—A wire screen fitting about the carbons of an arc lamp globe at the top to prevent hot pieces of carbon from escaping.

SPARK COIL.—A device consisting of a coil of wire wound about a core of soft iron wire and connected to a low voltage source. If such a coil is connected to a battery and the circuit closed and opened a spark depending upon the source of current and the size of the coil will be produced.

SPARK GAP.—The space between the knobs or points upon a static machine, coil or other electrical apparatus across which a spark is designed to pass.

SPARKING.—Used in referring to the sparks between the commutator segments and brushes of a dynamo or motor.

SPRING JACK.—A telephone switchboard device consisting of a cylindrical opening behind which are arranged one or more spring contacts. When a plug is inserted in the jack, contacts on the plug press against the springs in the jack, and thus a circuit is completed through the cord attached to the plug. (See cut.)



Spring Jack

STANDARD CANDLE.—See Candle, Standard.

STARTING BOX.—A term applied to the adjustable resistance, used in starting a motor, to control the current until the motor has developed enough counter e.m.f. to take the place of the resistance.

STATOR.—The stationary part of an induction motor. This portion carries the coils into which is sent the driving current.

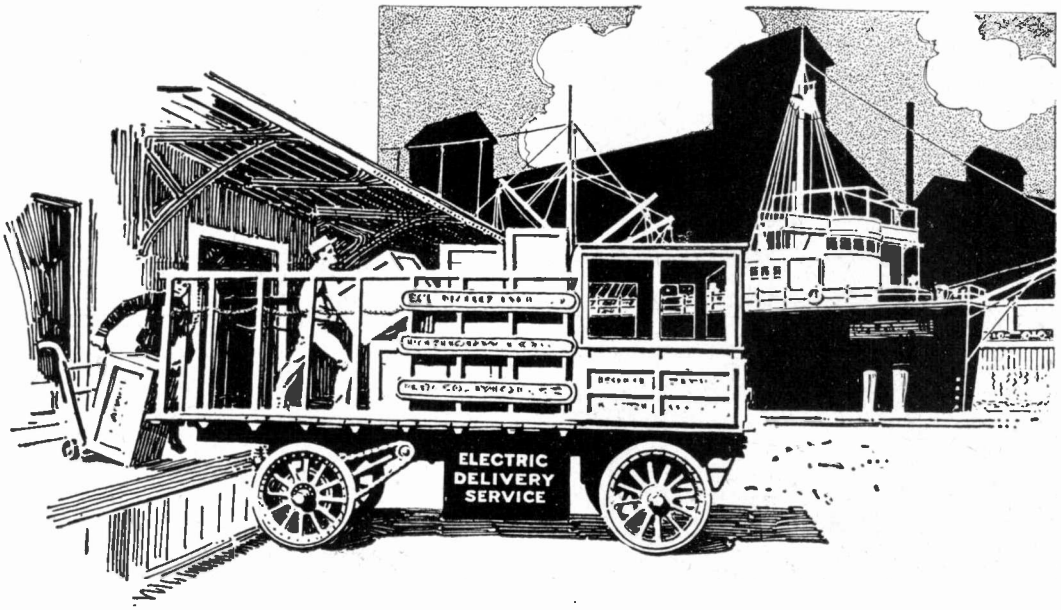
STATIC BREEZE.—A continuous spark discharge from a static machine. A person receiving treatment with such a current is seated upon an insulated platform attached to one pole of the machine while a metallic crown connected to the other pole is suspended one or two feet above the head.

STATIC ELECTRICITY.—A rather indefinite term applied to electricity not in the form of steadily flowing current. The kind formed on an electrophorus, on a glass rod rubbed with a woolen cloth, or on a static machine.

STEP-DOWN.—Used in connection with a transformer to indicate that the alternating current supplied to it is lowered in voltage in passing through it.

STEP-UP.—The reverse of step-down. (See Step-down.)

STORAGE BATTERY.—A number of separate storage cells connected to form a single source of electric energy.



Reduce Your Haulage Cost

ELECTRIC Commercial Vehicles are less expensive to operate than any other type of vehicle—and the cost is on the *decrease*. The operating cost of other types of vehicles is gradually *increasing*.

Electric Commercial Vehicles do not consume power when not in operation—they can be started and stopped almost instantly. There is no dangerous, time-wasting cranking—no shifting of gears—no back-firing.

The perfect simplicity of mechanical parts means fewer repairs, less attention — eliminates the need for elaborate repair tools. The perfect ease of control allows any intelligent horse driver to run an Electric—no need to school a chauffeur into learning new routes.

With Electric Vehicles there is no risk of fire or explosion—you can keep them anywhere without affecting your insurance. You can run them on wharves, etc., where other types of motor cars are barred. The Electric Vehicle will do far more for you than any other type and at less expense.

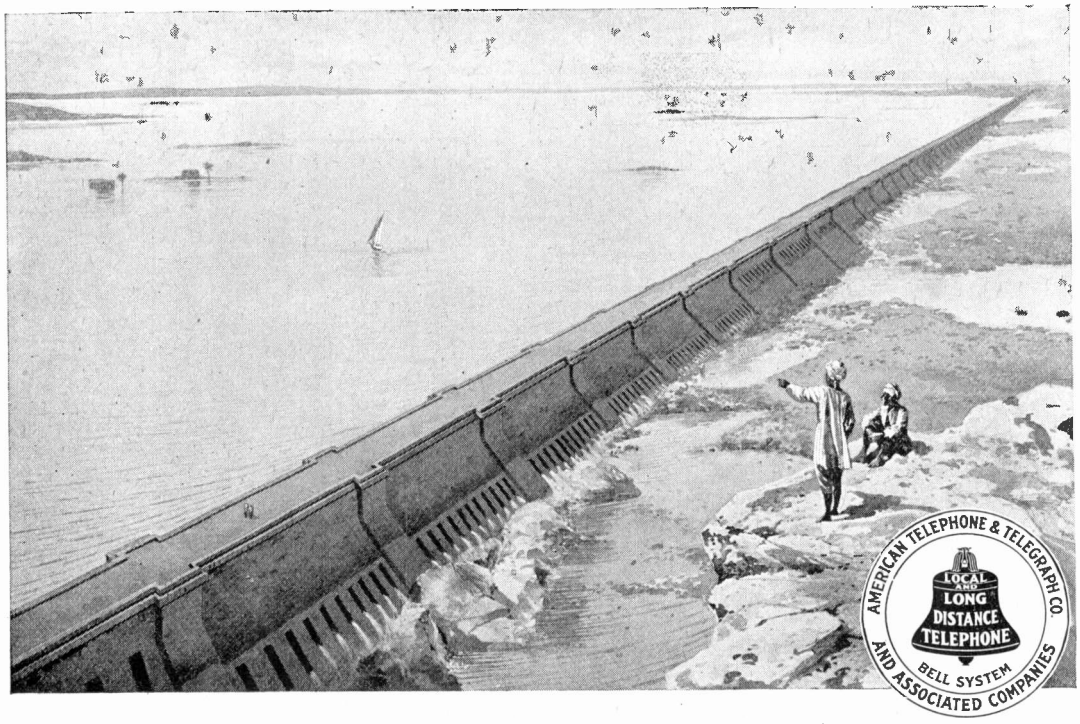
The Information Bureau of this Association will gladly send interesting literature about Electric Commercial Vehicles. Write today.

Public interest and private advantage both favor the Electric

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON NEW YORK, 124 W. 42nd St. CHICAGO

[5]



Assuan Dam, part of the Nile system, one of the greatest engineering projects of its kind.

The Nile System—The Bell System

For thousands of years Egypt wrestled with the problem of making the Nile a dependable source of material prosperity.

But only in the last decade was the Nile's flood stored up and a reservoir established from which all the people of the Nile region may draw the life-giving water all the time.

Primitive makeshifts have been superseded by intelligent engineering methods. Success has been the result of a comprehensive plan and a definite policy, dealing with the problem as a whole and adapting the Nile to the needs of all the people.

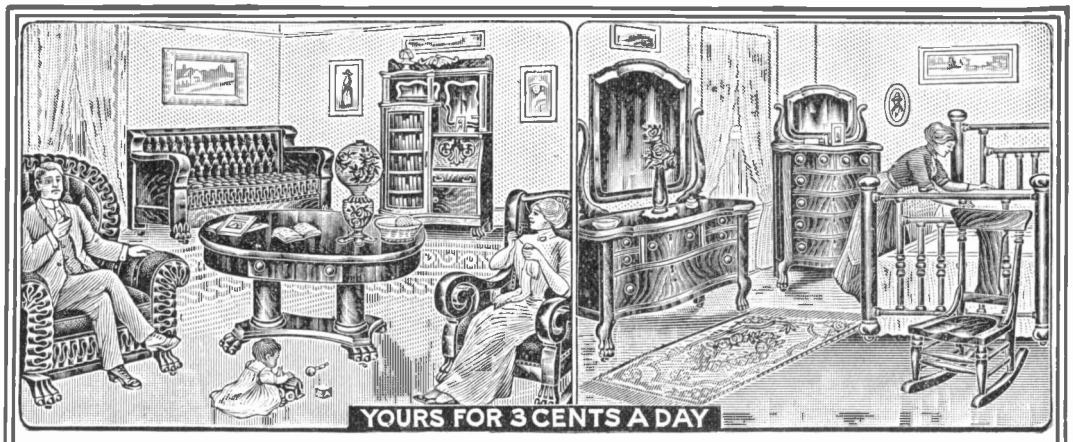
To provide efficient telephone service in this country, the same fundamental principle has to be recognized. The entire country must be considered within the scope of one system, intelligently guided by one policy.

It is the aim of the Bell System to afford universal service in the interest of all the people and amply sufficient for their business and social needs.

Because they are connected and working together, each of the 7,000,000 telephones in the Bell System is an integral part of the service which provides the most efficient means of instantaneous communication.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

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



Good for One Dollar

Here is an offer which means a dollar to you, if you simply write at once.

Simply send us the coupon for the splendid Fall Issue of our Home Lovers' Bargain Book.

The book is entirely free. It is a mammoth book, picturing 4,528 of our latest bargains in everything for the home.

Many of the pictures are in actual colors—all are big and clear. They show all the new ideas in

Furniture	**Silverware**
Stoves	**Chinaware**
Carpets	**Kitchen Cabinets**
Rugs	**Sewing Machines**
Draperies	**Washing Machines**
Lamps	**Baby Cabs, etc.**

Here are thousands of such things, in every style, shown in a single book.

We want you to see it before you do any fall buying, so we make this remarkable offer:

Write for the book before October 1, and we will send with it a Dollar Certificate.

It will be good as the cash for $1 as part of the first payment on any order for $20 or over.

It will be good for 50 cents as part of the first payment on any $10 to $19.99 order.

We will pay this much toward anything you buy, just to get a prompt reply.

But this offer is only for immediate inquiries. It will never be made again.

All the Best Things in Life Yours for 3 Cents a Day

Long-Time Credit

We sell all these things on a new kind of credit—on open charge account.

There is no interest, no security, no red tape or publicity. We trust home lovers, poor or rich, for anything they need.

We send things on 30 days' trial. You may keep them a month before deciding to buy. Anything not wanted may be returned, and we pay freight both ways.

What you keep can be paid for a little each month, at the rate of a few cents per day. The average customer takes a year to pay.

We have furnished in this way over a million homes. Many of those homes had very small incomes. But they have beautiful things, just because we let them pay in this easy way.

You are welcome to the same arrangement.

Save Up to 50 Per Cent

Our prices run from 30 to 50 per cent below store prices. This is proved by actual comparison, made in 20 cities. We save this for you by buying up bargain lots. We get the overstocks. We buy when makers must have cash.

We buy more furnishings than a thousand retail stores combined. And we sell direct. We sell on credit exactly as low as for cash. Thus we guarantee to save you up to 50 per cent, under any other house in America. Where the saving doesn't suit you, goods can be returned.

Send This Coupon Before October 1

To get the Dollar Certificate you must mail this coupon before October 1. Send it today.

This mammoth Home Lovers' Bargain Book will then be mailed free to you, with its 4,528 pictures. Also the Dollar Certificate. You will be astonished at the prices quoted on pretty things you want.

Spiegel, May, Stern Co.

1159 W. 35th Street, Chicago.

SPIEGEL, MAY, STERN CO.
1159 W. 35th Street, Chicago

Mail me without charge your

- ☐ Fall Bargain Book.
- ☐ Fall Stove Catalog.
- ☐ Fall Jewelry Book.

Also the Dollar Certificate.

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(241)

Your Evening at Home

is all the more enjoyable under the subdued restful light of

NATIONAL QUALITY MAZDA LAMPS

They give you three times the light of the old type lamp for the same current consumption—a soft, white, brilliant light by which you can read for hours without straining your eyes.

National Quality Mazda Lamps are manufactured by the following works, which comprise the

NATIONAL QUALITY LAMP DIVISION

OF GENERAL ELECTRIC CO.

Cleveland.
SIXTH CITY.

Banner Electric Works, Youngstown, Ohio.
Brilliant Electric Works, 401 Electric Bldg., Cleveland, Ohio.
Bryan-Marsh Electric Works, 431 S. Dearborn St., Chicago, Ill.
Bryan-Marsh Electric Works, 521 Mill St., Central Falls, R. I.
The Buckeye Electric Works, 714 B. of L. E. Bldg., Cleveland, Ohio.
Colonial Electric Works, Warren, Ohio.
The Columbia Inc. Lamp Works, 507 Equitable Bldg., 6th and Locust Sts., St. Louis, Mo.
Elux Miniature Lamp Works, New York City.
Federal Miniature Lamp Works, 812 Hippodrome Bldg., Cleveland, Ohio.
The Fostoria Inc. Lamp Works, Fostoria, Ohio.
General Inc. Lamp Works, 214-225 Electric Bldg., Cleveland, Ohio.
Monarch Inc. Lamp Works, 431 S. Dearborn St., Chicago, Ill.
Packard Lamp Works, Warren, Ohio.
The Peerless Lamp Works, Warren, Ohio.
Shelby Lamp Works, Shelby, Ohio.
Standard Electric Works, Warren, Ohio.
The Sterling Electric Lamp Works, Warren, Ohio.
Sunbeam Inc. Lamp Works, 500 S. Clinton St., Chicago, Ill.
463 West St., New York, N. Y.

New Strength
Vigor-Power-Health for You

Don't suffer any longer. Don't try to stand an ache or pain, ***stop it!*** Don't neglect the ***little*** ills—unless they are attended to they lead to ***serious*** things. Even if you have a chronic disease—one that you have been told is ***incurable***—*don't give up hope!* The greatest natural curative force in the world is now at ***your*** command.

VIBRATION Banishes Disease as the Sun Banishes Mist

VIBRATION is nature's own remedy. It sets your nerves a-tingling—your blood dashing through every vein and artery—it removes the ***cause!*** VIBRATION makes you feel refreshed and invigorated from the ***very first treatment.*** The

White Cross Electric Vibrator

begins where doctors stop. Hundreds of people who have been given up by specialists as incurable now say that they are well and happy through the aid of this marvelous invention. What the **White Cross Vibrator** has done for others it may do for ***you.*** No matter where you live or what your trouble is, you owe it to yourself to find out all about this ***wonder of the 20th century.*** Even if you are perfectly well now, you should investigate anyway! You cannot tell when the dread hand of disease will seize upon you or one of your loved ones. ***Be ready! Post yourself!*** Don't let disease get ahead of you. ***Take the first step yourself!***

Vibrating Chair With the **White Cross Electric Vibrator** and a simple attachment you can transform any chair you have in your home into a vibrating chair.

FREE TRIAL We will send you the **White Cross Electric Vibrator** on absolute free trial! We will give you an actual demonstration of its merits without charging you one penny. Feel its marvelous power for yourself. Feel how it drives out disease.

What This White Cross Electric Vibrator Will Do For YOU!

A few minute's use of the White Cross Electric Vibrator each day will aid in putting you in better health than you have known for years. Drugs may relieve, but they seldom cure. The White Cross Vibrator attacks the cause. When the cause is removed the disease is gone forever. The White Cross Electric Vibrator gives you not only Vibration but Galvanic and Faradic electricity as well. It is not only an ELECTRIC MASSAGE VIBRATOR but also a COMPLETE ELECTRIC MEDICAL OUTFIT. **Here is the way it acts** on a few of the most common chronic and acute diseases:

Headache—from whatever cause, can be almost instantly relieved by the White Cross Vibrator. However, headache is usually only a symptom of some other trouble. Find the cause, then use the Vibrator.

Catarrh—Clogged nostrils relieved after a few minutes' treatment. Discharge grows gradually less. Time for complete relief varies only with the foothold which the disease has obtained. (Common "cold-in-the-head" or coryza can frequently be relieved in one treatment.)

Insomnia—A short treatment with the Vibrator and in the Vibration Chair just before retiring should bring a good night's sleep even in the most long-standing cases.

Indigestion—This common disorder yields readily to Vibration. DYSPEPSIA, which is only CHRONIC indigestion, is more stubborn, but great relief almost always results in a surprisingly short time.

Rheumatism—is caused by congested condition resulting in inflammation and a deposit of uric acid. The worst case of rheumatism can be quickly relieved by the application of Vibration and Electricity.

Here are a few of the other diseases which have been treated successfully by Vibration and electricity: Asthma, Neuralgia, Earache, Weak Eyes, Nervous Debility, Constipation, Heart Trouble, Weakness, Deafness, Stomach Trouble, Skin Diseases, Scalp Diseases, Lumbago.

The Genuine Swedish Movement

You do not have to go to expensive Specialists or to a Sanitarium to get the genuine Swedish Movement. With a White Cross Vibrator you can give yourself the same treatment without cost

This Valuable Book Now Sent *FREE*

The famous book **"Health and Beauty"** will be sent to you absolutely free for just your name and address. No matter **who** you are or how **well** you are—**you need this book!** It tells all about the human body in health and disease so plainly, so clearly, that anyone can understand. It tells you how, with the aid of the **White Cross Electric Vibrator you can treat yourself** without the aid of drugs.

Sign the Coupon

and get this free book **today!** It will open the door of a new world to you. It preaches the gospel of health and hope. Thousands have been benefited by its teachings—why not you? **Send for the free book which explains all. Send the coupon today—NOW.**

Lindstrom, Smith Co.
Desk 1406
218 S. Wabash Ave.
CHICAGO, ILL.

Sign and Mail This Coupon Today

FREE BOOK COUPON

Lindstrom, Smith Co.
Desk 1406 218 S. Wabash Av., Chicago

Gentlemen: Please send me free and without obligation on my part, your Free Book "Health and Beauty" and full explanation of Special Limited Offer on the WHITE CROSS ELECTRIC VIBRATOR.

Name .....

Address .....

CLASSIFIED ADVERTISEMENTS

The cost of advertising in this section is 5 cts. per word.

All Discounts Will Be Discontinued After June 1st, 1912

Remittance must accompany order, or advertisement will not be inserted.

Forms for the October issue close September 1st.

AERONAUTICS

WONDERFUL AEROPLANE PUZZLE, 10C silver. Fred Fulgora. Box 356B North Diamond Station, Pittsburgh, Pa.

COMPLETE PLANS DRAWN TO SCALE, accompanied by clear, concise building instructions: WRIGHT 3 ft. Biplane, 25c; BLERIOT 3 ft. Monoplane, 15c; "CECIL PEOLI" Champion Racer (official record 1,691 feet), 25c; "IDEAL" three foot Racer (new), 15c. Send 5c for most complete 40 pp. illustrated catalog, including rules for contests. IDEAL AEROPLANE & SUPPLY CO., 86B West Broadway, NEW YORK.

AGENTS WANTED

AGENTS TO REPRESENT MANUFACturer. Lotton, Waverly St., Buffalo, N. Y.

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

SMALLEST ALARM CLOCK 10c POSTPAID. W. H. Garner, B-119 South LaFayette St., Evansville, Ind.

SEND TWO DIMES FOR 6 MONTHS' SUBscription. Good Ideas Magazine, 146 Marcy Ave., Brooklyn, N. Y.

AGENTS, TRY OUR UP-TO-THE-MINUTE window letters. None "just as good." Slann Sign System, 1579 St. Antoine, Detroit, Mich.

AGENTS ARE MAKING $5.00 PER DAY selling patented article; every man buys; big profits. Sample 25c (silver). Waltham, 146 Marcy Ave., Brooklyn, N. Y.

AGENTS ARE MAKING MONEY SELLING our HIGH GRADE AUTO speciality. Every Auto owner buys. Particulars free. Locust Supply Co., Box 71, Midvale, Utah.

AGENTS—NEW FIBER HOME BROOM; costs same as good broom; outlasts four; sold only by agents. Guaranteed. HILKER MOP CO., 1204 Grand Ave., Chicago.

HA! HA! LAUGH AND LET THE DIMES roll in. Article sells like wildfire. Sample (silver) dime. Tepper's Novelty, 146 Marcy Ave., Brooklyn, N. Y.

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

AGENTS WANTED—SELL RICH LOOKING imported 36 x 68 rugs, $1 each. R. H. Carter, Milan, Tenn., sold 115 in four days; his profits, $57. You can do as well. Write for sample offer and unique selling plan; exlusive territory. R. Condon, Rug Importer, Stonington, Maine.

AGENTS WANTED

WANTED — DISTRIBUTORS OF ADVERtising matter everywhere. American Distributor, 101 Mount Pleasant, Pennsylvania.

PERFECTION POCKET ADDING MAchine—Lightning seller; agents wanted. Cincinnati Specialty Mfg. Co., Dept. E, Cincinnati, Ohio.

YALE AUTOMATIC ADDING MACHINE. All parts made of steel, nickel plated and warranted accurate, $1.00 prepaid. Yale Mfg. Co., Dept. D2, Newark, N. J.

AGENTS, AGENTS—OUR NEW "PERFECT Dust Beater" Sells on sight; big profits. Sample 35c; postage 10c. Eureka Specialty Co., 118 Gazette Ave., Lexington, Ky.

MAIL ORDER MEN: GET QUICK CASH returns. We manufacture and distribute new specialties. Start high class M. O. Business. Small capital. Copyrighted prospectus free. No scheme. Box 6235, Pittsburg, Kans.

LIVE AGENTS ARE COINING MONEY with our outfit, which doubles the life of auto tires. Write W. C. Overton, Box 321, Station A, Dallas, Tex.

AGENTS, STREET MEN, $20 WEEKLY, combination key—ring, seven tools in one. Lightning seller. Sample, 10c. Arthur Beers, Bradley Beach, N. J.

AGENTS—EVERY SMOKER WANTS, AND buys on sight, our self-lighting, windproof cigar Lighter. You can make big money selling them. No talking. Sells itself. RATHBUN M. CO., Indianapolis, Ind.

AGENTS WILL ADD A SUBSTANTIAL amount to their income by handling our great novelty, "Personal Photo Stamps." The Patina Co., 146 Lansdowne Ave., Toronto, Canada.

NEW LINE POLISHES AND CLEANERS. Needed for business and home use. Large income for town and county agents everywhere. Standard Specialties, 314 E. 44th St., New York.

$3,000 YEARLY IN YOUR BACK YARD! No poultry, trucking, ginseng, mushroom dope. New industry you never heard of. Current "Square Tips" explains with further particulars. Price 10c. W. W. Stanton, Liberty, Ind.

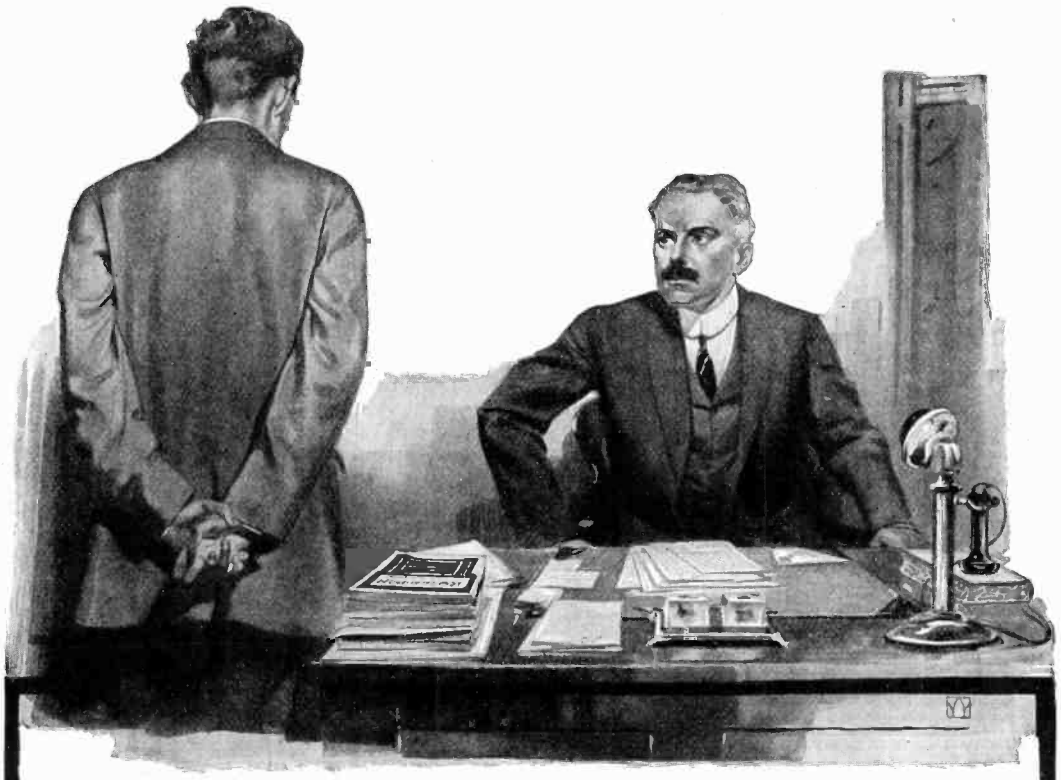
AGENTS—PORTRAITS 35C, FRAMES 15C, Sheet Pictures 1c. Stereoscopes 25c. Views 1c. 30 days' credit. Samples and catalog free. Consolidated Portrait Co., Dept. 1406, 1027 W. Adams St., Chicago.

HUSTLERS WANTED—YOU CAN MAKE from $4.50 to $9.00 daily selling Sanitary Ideal Mail Boxes. New Idea; Patented. Valuable Premiums. Write today. C. Findly, 5923 Bertha Ave., St. Louis, Mo.

BOKARA DIAMONDS—AGENTS, EVERYone, to wear and sell our famous bokara diamonds. Write for sample offer and catalogue free. Northwestern Jewelry Co., 1123 Wilson Ave., Chicago.

WE WANT ONE SELLING AGENT IN each town to represent the MAGIC Electric Suction Cleaner. This is a high grade proposition for high grade men only—that's really worth while investigating. Rosenfield Manufacturing Co., 14 Abingdon Square, New York City.

(Continued on Page 32.)



The Importance of Training

Here is a man who was in line for a better job, but, like the great majority, had not been training himself to "fill the shoes" of the man above him; he always thought that if the time ever came he could just bluff it through—special training wasn't necessary. There's where he made *his* mistake, and there's where you will make *your* mistake if you are not a trained man. The boss had only to ask a few questions to find that the man did not know anything about the other fellow's work; that he had been wasting his time instead of improving it—that he was just one of the fellows who get into a rut and stick because he didn't have sense enough to plan for the future.

The time to plan is right now; the opportunity will come when you are ready

Don't think, as this man did, that it is simply a matter of absorbing knowledge and as a matter of course promotion will follow. Don't argue with yourself "There's no opportunity here—no incentive to do better work—I have gone as high as I can in this firm—I know as much as the boss and don't see why I can't get the money."

If the opportunity for advancement is not right ahead of you with your own firm, then it *is* with another. There is always an opportunity—always a chance for a better job, for better pay—yes, just the job you have often wished you had—but mere wishing will never get you anywhere; you *must* get the training.

The American School of Correspondence was founded to help just such men as you. It is one of the largest educational institutions in the world. If you will write and tell us what you want to be, how much of an education you already have, and how much time each day you are willing to devote to bettering your condition, we will send you, absolutely free of charge, our complete bulletin describing sixty-five courses of study. We will tell you how you can pay for the course you want by the week or by the month. We will do everything we can to get you started right.

If anyone offered you $500 for two hours overtime every day for a year, you would jump at the chance, wouldn't you? Two hours study every day for the next year or two will mean more than $500—it may mean $1,000; that depends entirely upon yourself.

The American School does not employ agents or collectors to bother you in your home or at your work. It brings a complete college course to you in your own home, and all work is carried on privately and quietly, strictly by correspondence.

Won't you check, fill in, and mail the coupon?

Opportunity Coupon

American School of Correspondence, Chicago, U. S. A.

Please send me your Bulletin and advise me how I can qualify for the position marked "X." P. E. 9-12.

.....Automobile Operator	.....Lawyer
.....Draftsman	.....Fire Ins. Engineer
.....Architect	.....Telephone Expert
.....Building Contractor	.....Moving Picture Op'r
.....Structural Engineer	.....Bookkeeper
.....Civil Engineer	.....Stenographer
.....Electrical Engineer	.....Accountant
.....Elec. Light & Power Supt.	.....Cost Accountant
.....Master Mechanic	.....Cert'f'd Public Acc'nt
.....Sanitary Engineer	.....Auditor
.....Steam Engineer	.....Business Manager
.....Reclamation Engineer	.....College Preparatory

NAME .....

ADDRESS.....

AMERICAN SCHOOL OF CORRESPONDENCE

CHICAGO, U. S. A.

The New Electric Lamp for You

HERE is the Electric Lamp that everyone has long been waiting for—the Port-A-Lite. Adjustable to practically any position, the Port-A-Lite makes ***one*** light answer the purpose of several ordinary electric lights. Can be used anywhere an electric light socket is available—in any part of the home—in the office, factory or store. It throws the light just where you need it — saves the eyes by eliminating eye-strain. Easily taken apart and re-assembled—ideal for traveling or as a bed light.

Used as a Wall Fixture

The Port-A-Lite may be easily and quickly converted into a useful wall fixture — just attach to any convenient hook. Ideal for shaving or for use in milady's boudoir—gives a clear, steady, concentrated light — put up and taken down without trouble.

Ideal Light for the Piano

The Port-A-Lite gives the best illumination for the piano. It throws the light right on the music and keyboard, leaving the eyes in restful shadow. Felt pad on base protects polish of your instrument.

Convenient in the Office

Any business man will appreciate the Port-A-Lite on his desk. It can be adjusted to any desired position so easily —and the light is always just where you want it. Handy also for the artist, draftsman, jeweler, etc.

As a Study Lamp at Home

Children, and older folks, too, who use their eyes for studying or reading will appreciate the Port-A-Lite. It is far more useful than any other lighting fixture — no hurtful glare on the eyes—makes fine print easy to read.

The Port-A-Lite

Sent express prepaid on receipt of price

We will send you a Port-A-Lite express prepaid, equipped complete with reflector shade, silk connecting cord and felt covered base. Price, with polished nickel or brush brass finish, $4.40; polished silver, $6.40. Specify the name, "Port-A-Lite," and finish desired, when ordering. Write **today.**

ELECTRIC SHOP

Michigan and Jackson Blvds.

CHICAGO

Home-Made Electricity

From Your Lighting Circuit

For Automobile Lighting

THE WAGNER RECTIFIER will charge your battery at home. Electric lights so supplied are cheaper to operate than gas or oil lamps.

Convert your gas and oil lamps to electric, easily and cheaply. Any wire-man can wire your car.

Write for Bulletin 933.

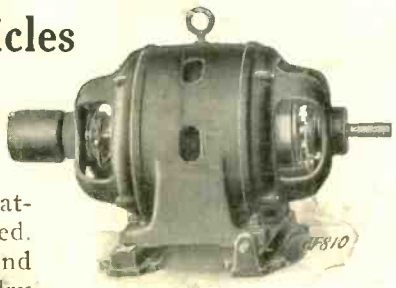
Wagner Rectifier

Home-Made Electricity

From Your Lighting Circuit

For Charging Electric Vehicles

THE WAGNER CONVERTER will charge your car at home. The simplest and cheapest charging outfit yet devised. Will work on any alternating current circuit. No expert required. Can be used as a power motor, too, and will operate your tire pumps, laundry machinery, buffing machine, etc.



Wagner Converter

Write for Bulletin 973.

Wagner Quality

Wagner Electric Manufacturing Company, Saint Louis