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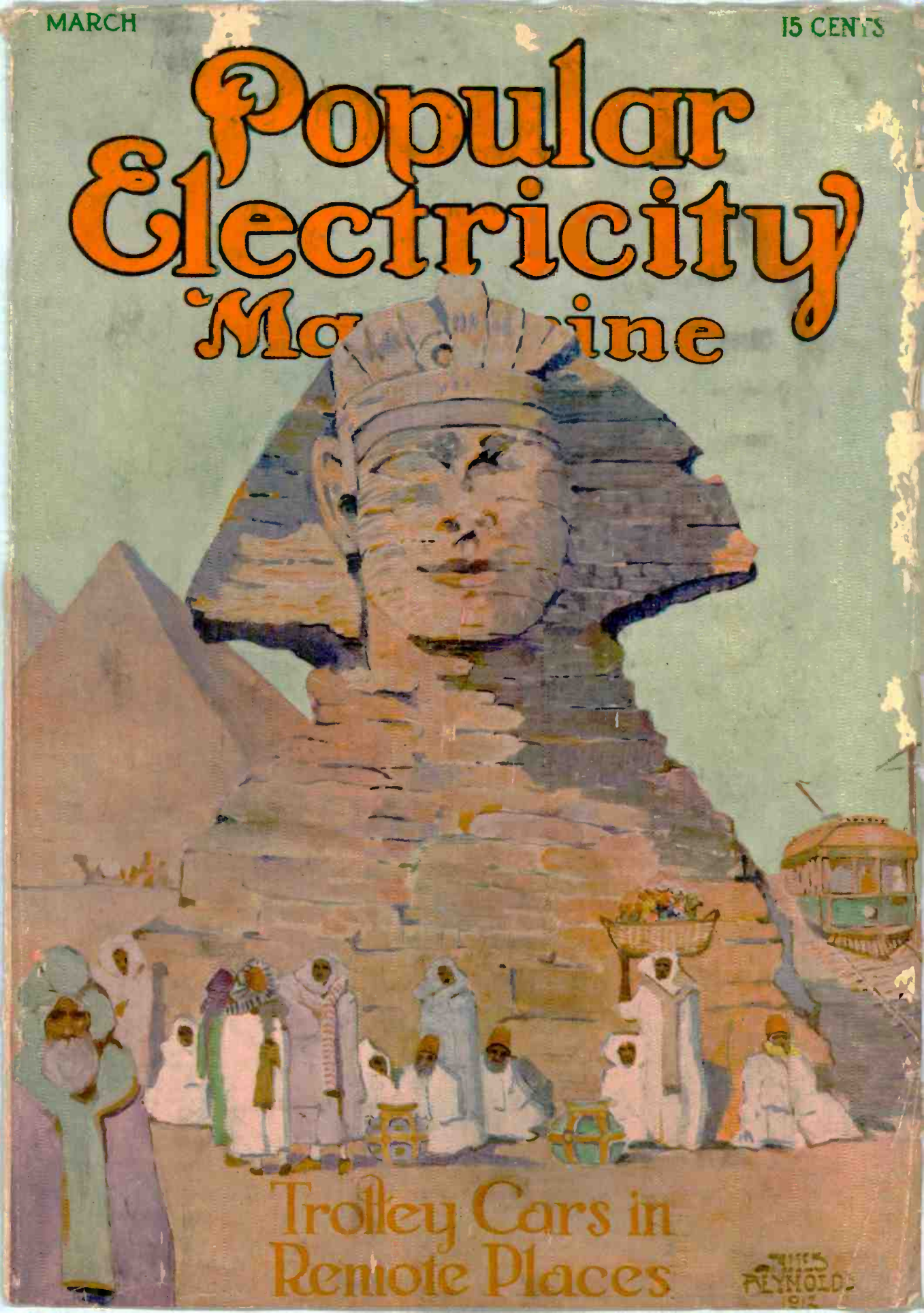
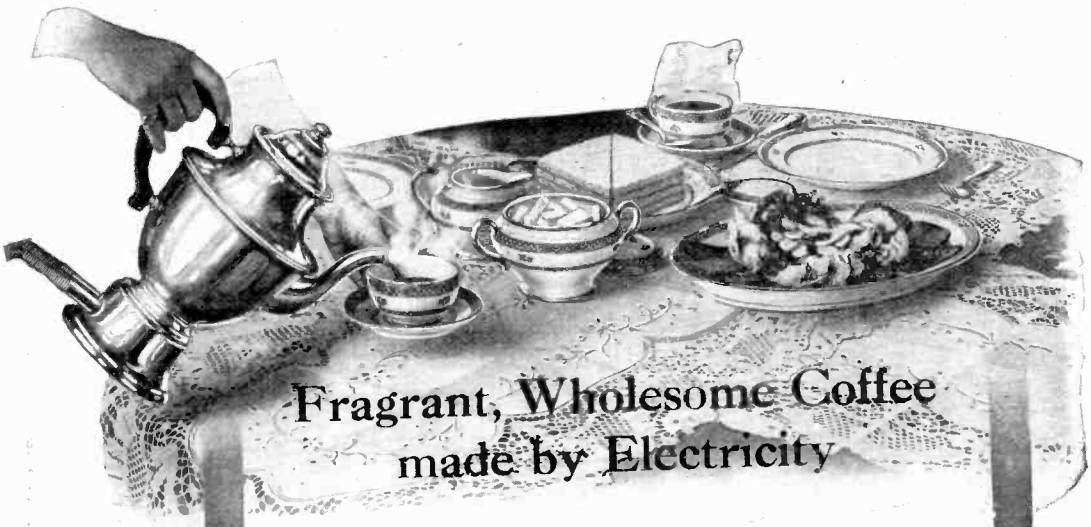


Trolley Cars in Remote Places



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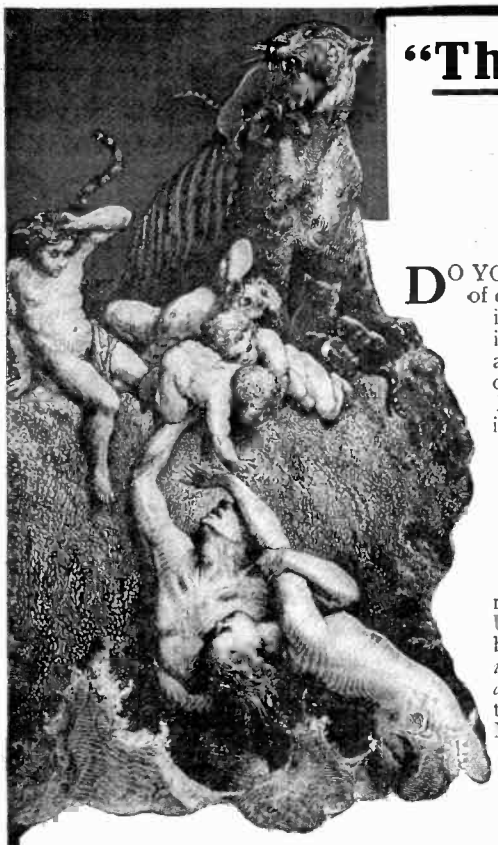

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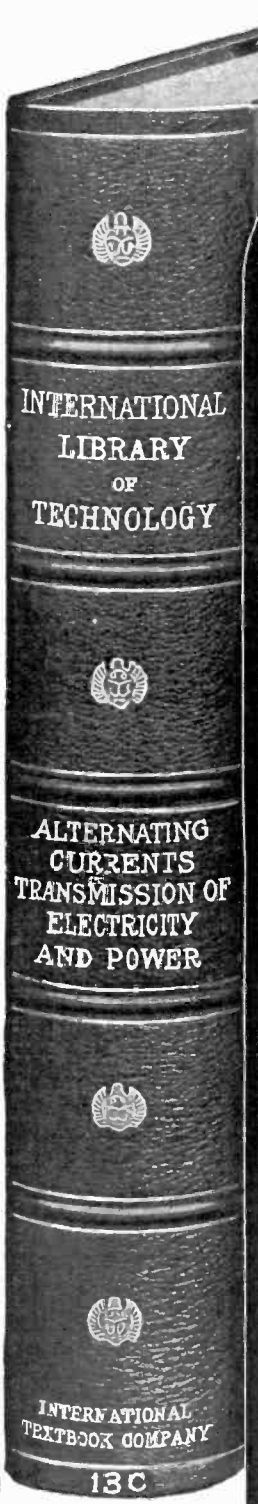

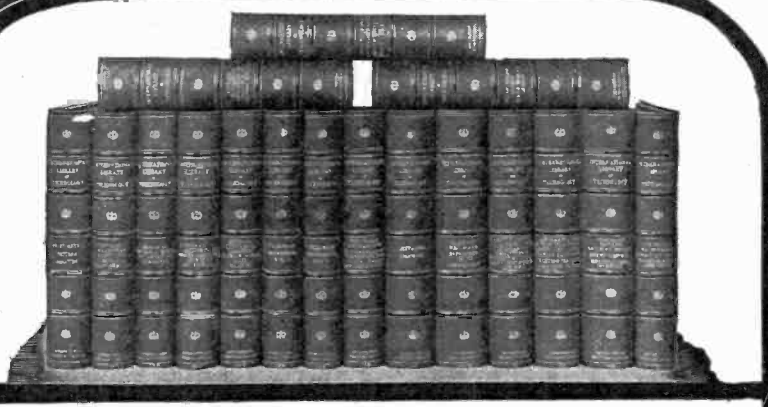

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POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | March, 1913 | No. 11

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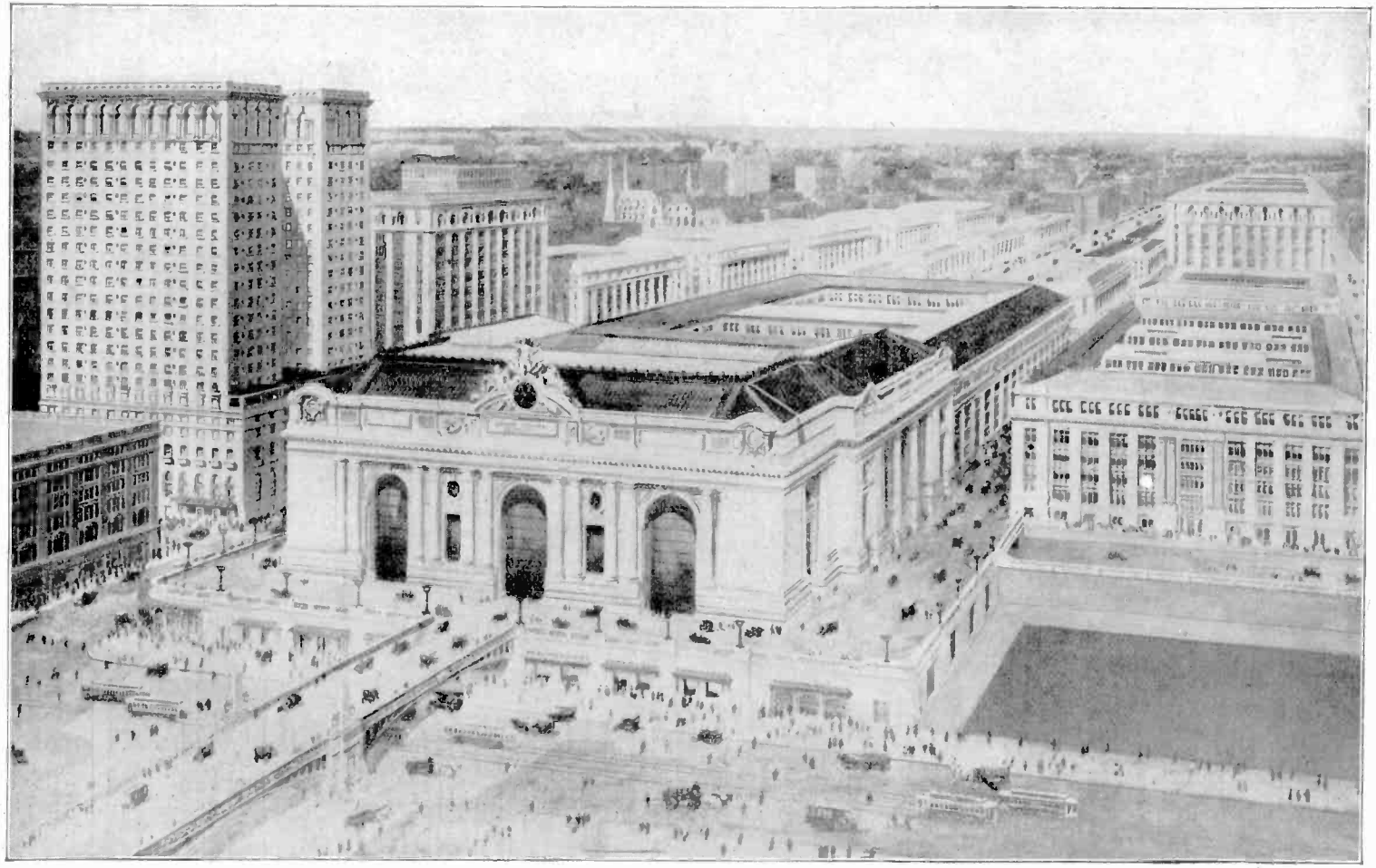


THE GRAND CENTRAL STATION NEW YORK AND ITS SURROUNDINGS—FROM THE ARCHITECT'S DRAWING

Popular Electricity Magazine In Plain English

VOL. V. MARCH, 1913 No. 11

New York's Grand Central Terminal

By FRANK PARKER STOCKBRIDGE

Why not call New York's new Grand Central terminal the "Electric Station?" There is everything to justify it. There is not another railroad terminal in the world, and the Grand Central is the very latest and finest of its kind, where electricity is put to so many uses. Electricity was but an infant in the old Grand Central station nine years ago. Since then it has grown into the giant that dominates everything, does everything. From snaking the heavy trains in and out to washing the dishes in the kitchen, electricity does it all. Gas has been eliminated entirely, even for the purposes of cooking. The current has been made to do many new and novel things in such an eminently practical way that the telling of them is worth while.

Electricity starts to work away down under the terminal, where a "sump" pump automatically removes such water as may collect below the sewer line.

The incoming and outgoing trains are drawn by electric locomotives. All the switches and signals are operated electrically, and the signals are lighted by the same current.

Announcement of the departure and arrival of trains is made at 30 different points through the new application of an old principle in electricity.

Drinking water for the terminal is purified by a jump spark.

Freight elevators, baggage trucks, fans, ventilators and the usual office equipment are all electric. So are the clocks.

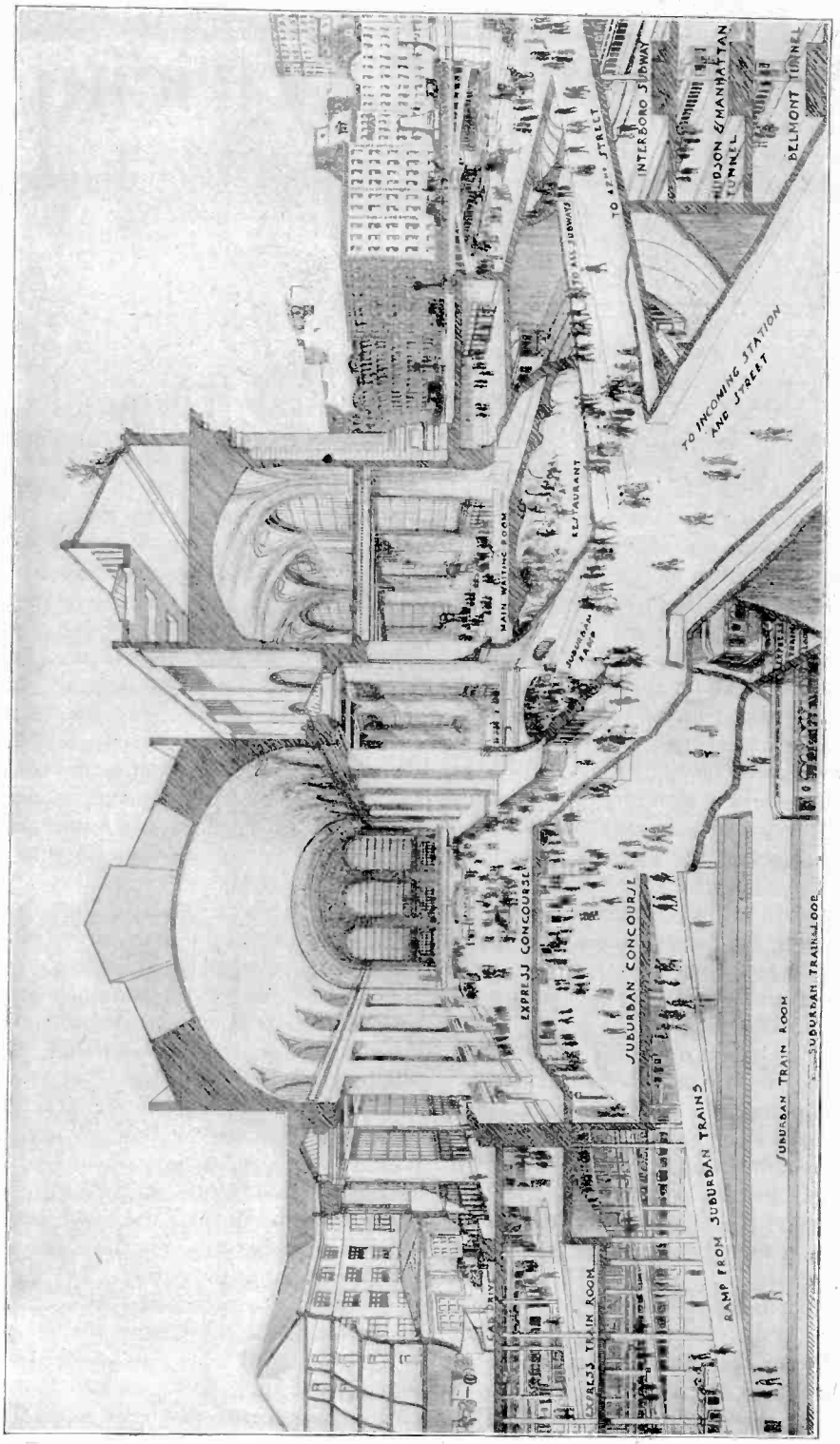
The electric current is used in copying blue prints and its helps to test concrete.

Incandescent and flaming arc lamps furnish the light.

An electric pump forces hot water through the radiators that heat the buildings. Cars standing on the tracks are heated by steam during the winter, but in case of emergency they can be heated by electricity as well.

During the better part of the year the current that does the many and manifold things about the terminal is generated at Port Morris, the main station. Current at 11,000 volts is carried from that point down to the substation at Fiftieth Street, where the alternating current is transformed by rotary converters to a direct current. A second method of obtaining power is by generating the current with steam driven turbines at Fiftieth Street. This is done during the cold months, when the exhaust from the turbines is used for heating purposes.

Probably the most interesting feature of the electrical equipment to the layman is the manner in which the departure and arrival of trains is announced throughout every part of the terminal reserved for the use of patrons of the road. Many



A SECTIONAL VIEW OF NEW YORK'S GRAND CENTRAL TERMINAL

of those who have followed the directions of the voice seemingly coming from the wall are under the impression that the contrivance is a combination of telephone and megaphone. It is neither, but something different from anything in use for the same purpose anywhere else in the world. The marvelous results obtained by the operation of the announcer are achieved through the new application of an old principle in electricity.

The announcer consists, first, of a mouthpiece similar in appearance to the ordinary telephone transmitter. But it differs vastly from the telephone transmitter in the important particular that it contains no induction coil. The transmitter also is unlike anything else of the kind in he fact that it is surrounded by a water jacket, through which a tiny stream of cold water flows constantly, cooling the carbon, which would otherwise become packed with the heat of the heavy current employed for operation. The transmitter is cooled in the same way in which the cylinders of an internal combustion engine are kept from heating.

This cooling of the carbon in the transmitter is made necessary by the fact that a current of 110 volts is used in operating the announcer. The ordinary telephone requires only a small fraction of this amount of voltage, and the current passing through it is correspondingly small. But it is through the employment of the heavy voltage that the remarkable results are obtained. The voltage is so equalized and the circuits so balanced on the Wheatstone principle that the sound of the human voice is intensified many times. And there is no limit to the number of points to which wires may be run for the transmission of sound from the central point.

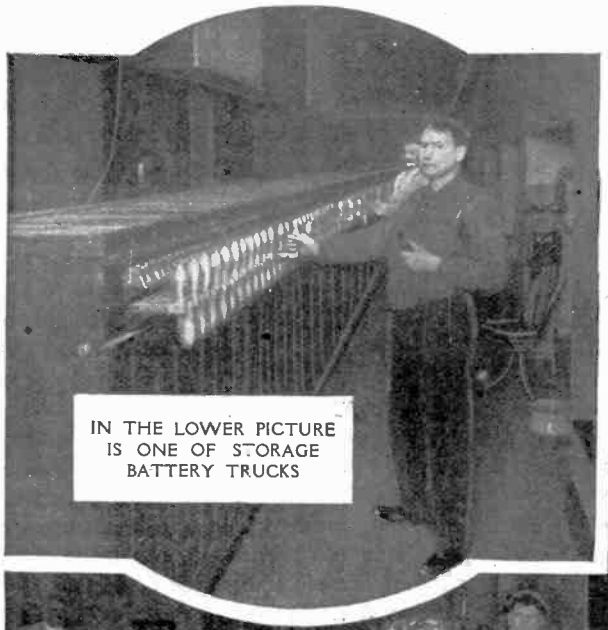
In the main waiting room of the terminal, in the smoking room, in the room reserved for women and on the concourses a series of horns, all resembling the phonograph horn, are in position against the walls. These horns are connected with the central station. When the operator is ready to announce the departure of trains he simply steps to the transmitter and speaks into it in an ordinary tone. Simultaneously there is heard throughout the terminal a giant voice telling all about the trains that are about to depart. Some 30 horns are in use at the present time and more will be added as necessity requires.

What is of almost equal interest is the manner in which the drinking water distributed through the terminal and offices of the company is purified. Not only is the water plant run by electricity, but every impurity in the water is killed absolutely by the employment of an electric spark. The layman would say, after seeing the plant in operation, that the water was so purified and vitalized by means of the electric spark that its properties as a life giving fluid were vastly enhanced.

The water purifying plant is situated on the fourth floor of the main office building. Ordinary city water enters through a main feed pipe and runs to a pressure tank. Thence it is forced through sixteen stone filters fastened to the rear wall. From these filters the water goes to the purifying outfit. The contractors who are erecting the terminal, and whose operation extend all over the country, say it is the first water purifying plant of its kind they have ever installed.

Actual purification of the water is accomplished when the current is turned on in a series of cells, somewhat longer and of about the same diameter of the ordinary dry battery. The cells are set up in batteries of twelve each and there are three such batteries in operation, the whole being enclosed in a wooden box with a door in front. Inside of each cell there are two electrodes, set far enough apart to produce a jump spark. Ten thousand volts are used to make the spark, though the amperage is very low.

When the door of the box is opened the pungent odor of ozone assails the nostrils. It is this ozone, created by the



THE BRAIN OF THE ELECTRICAL, INTERLOCKING SIGNAL SYSTEM. THE HUNDREDS OF SIGNALS ARE HERE CONTROLLED, EACH BY ITS INDIVIDUAL LEVER

THE DIRECTOR OF SWITCHING AND SIGNAL TOWERS SITS IN AN OFFICE OF THE TERMINAL YARDS WITH A TRACK INDICATOR IN FRONT OF HIM

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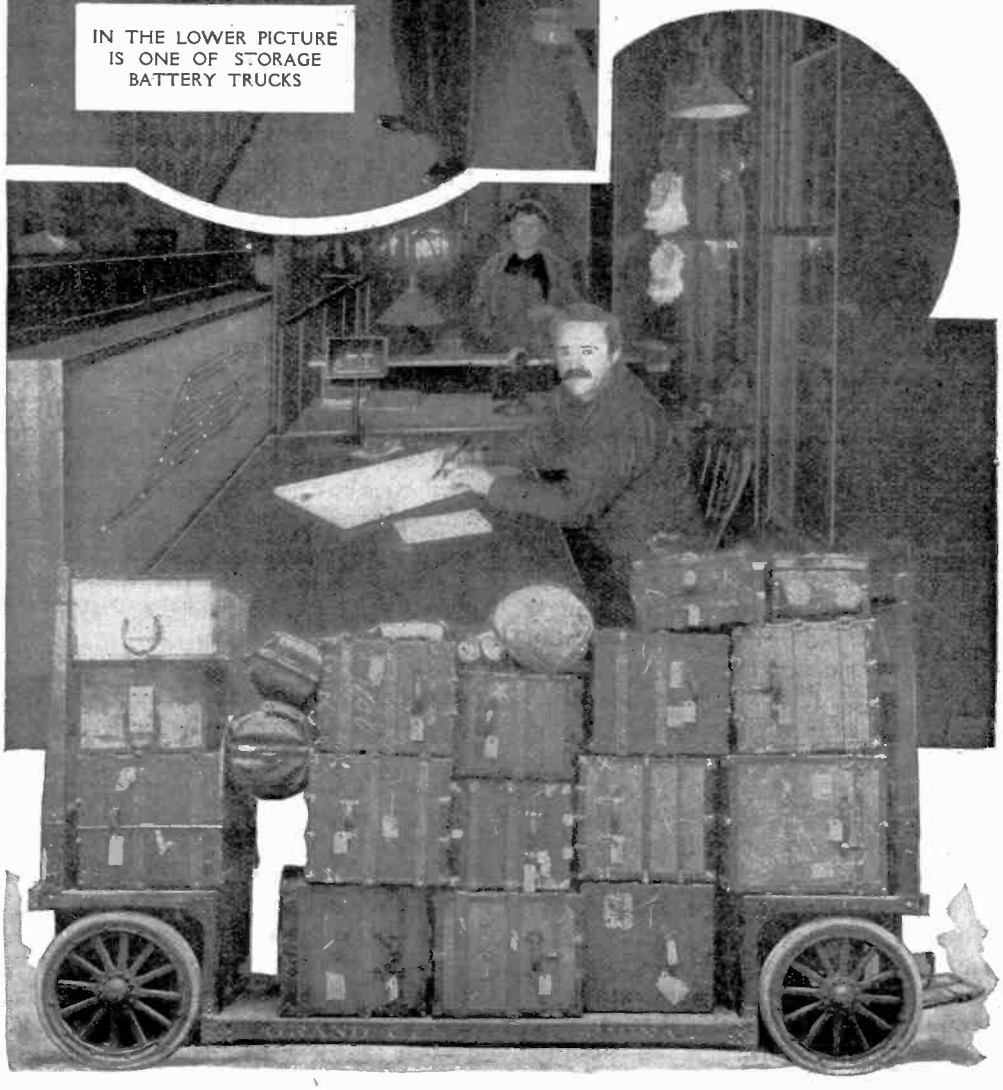
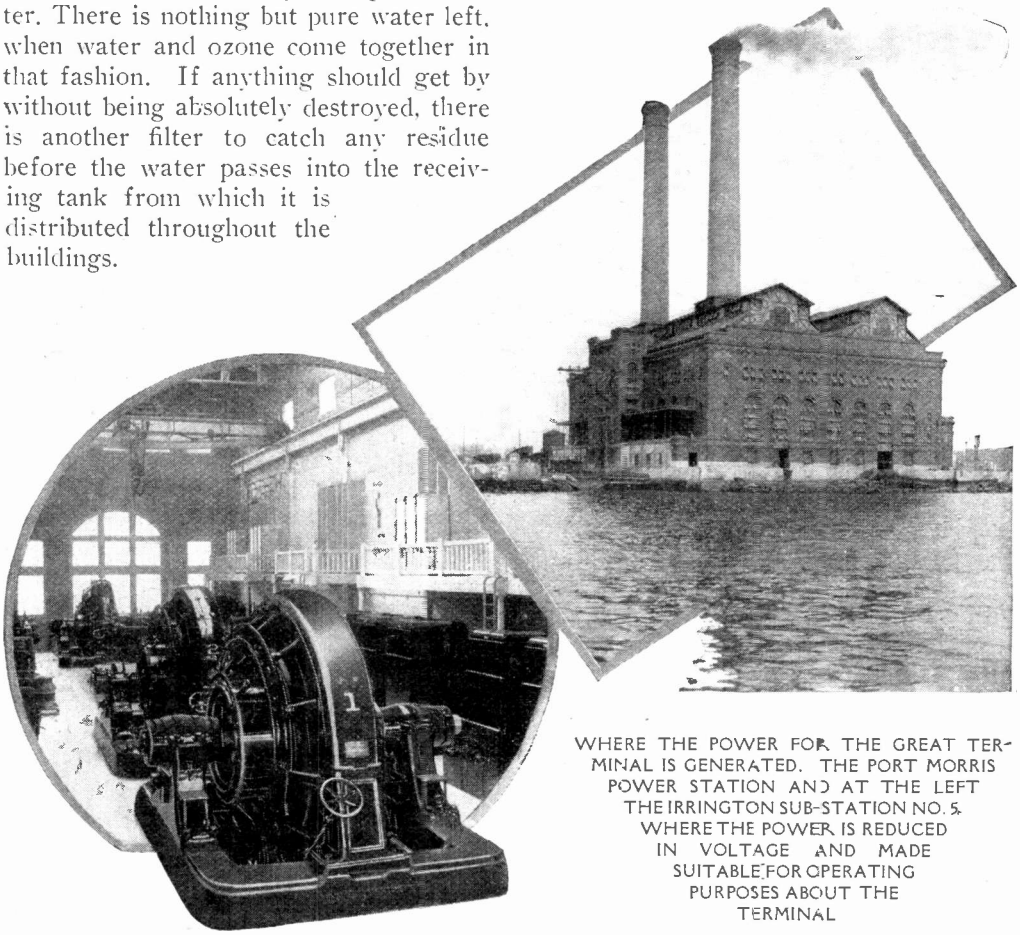


spark, that does the trick of killing the impurities in the water. The box is connected with three injectors through which the water passes, and as the water rushes along enough ozone is drawn into it to accomplish the purification, which is done by the ozone killing all organic matter. There is nothing but pure water left, when water and ozone come together in that fashion. If anything should get by without being absolutely destroyed, there is another filter to catch any residue before the water passes into the receiving tank from which it is distributed throughout the buildings.



WHERE THE POWER FOR THE GREAT TERMINAL IS GENERATED. THE PORT MORRIS POWER STATION AND AT THE LEFT THE IRRINGTON SUB-STATION NO. 5, WHERE THE POWER IS REDUCED IN VOLTAGE AND MADE SUITABLE FOR OPERATING PURPOSES ABOUT THE TERMINAL

The tank to which the pure water finally finds its way looks for all the world like a huge icebox, which it is, in a sense. A 20 ton refrigerating outfit of the single expansion type completes the work of preparing the water for consumption. The refrigerator is run by a motor and the supply of water is regulated, as the whole plant is controlled, by electric devices that work automatically. If the supply of water gets below a normal point an electric impulse is started which automatically throws a switch which starts up the machinery. When the supply gets beyond the normal the same switch shuts off the machinery. The pipes in the tank are covered with ice and frost. The purified water, being forced through the buildings under pressure, passes through the tank many times.

But the novel uses of electricity in the new terminal do not end with the features already referred to. An odd trick was the substitution of storage batteries for the operation of electric bells and buzzers instead of employing the usual dry batteries. Dry batteries scattered about the offices were an eyesore to the officers of the company and so two large

storage batteries were installed on the fourth floor. The batteries are charged by two rotary converters. From these batteries also power is obtained to keep the clocks runing regularly and properly.

Electricity is even employed to test the concrete used in the construction work both in the terminal and all along the road. A "cement laboratory" is in operation in the main office building, where different combinations of cement and sand are tested before the proportions of each that shall be used for different purposes are decided on. A small motor is used to shake fine sieves through which cement is passed before being mixed with sand. The fineness of these may be judged from the fact that in some of the screens there are 10,000 holes to the square inch. For a man to stand and shake a screen like that would cost too much money. The little motor does the work economically and right.

In the same laboratory electricity is utilized to heat ovens in which the briquettes of sand and cement are baked or steamed. Both dry heat and steam heat are employed to prepare the briquettes for the pressure test to which they are subjected later. The current furnishes the heat that makes the steam.

Near the cement laboratory is located the blue print shop, where electricity is again the important factor in operation. Blue prints, of which there are many new ones every day, are copied on a slow moving roller of some eighteen inches diameter that is turned by an electric motor. The original blue print prepared by the architect is placed in the printing machine with a sheet of copying paper beneath it. The roller carries both close to arc lights of 1,000 candlepower each and the trick is done after the copy has been given a bath in a solution that fixes the lines on the prepared copy paper.

In the commissary department, where much of the cooking is done for the dining cars on through trains, electricity is employed exclusively. There are electric ovens where meats and fowls are roasted, electric ranges on which many things are cooked. The humble griddles are heated in the same way and finally ice cream is frozen in great electric refrigerators. An electric dish washer cleans the crockery and kitchen utensils.

The baggage trucks used in the terminal carry two tons each and are driven by storage batteries of twelve cells each, making 24 volts to each cell. They scoot around with big piles of baggage, doing swiftly and quietly what many men would be required to do in a much longer interval of time.

Truly, the new Grand Central terminal, when it is finally completed a year hence, might well be termed the "electric station."

Tantalum

Tantalum, that curious substance of which more or less use is made in the construction of filaments for electric lamps, is pure white and as hard as the best steel. When hot, it can be rolled, hammered and drawn out into wire. Its tensile strength exceeds that of steel. For lamp filaments it is drawn into wire hardly more than one five-hundredth of an inch in diameter. Its electrical resistance is much less than that of carbon, so that the filaments have to be much longer than the ordinary carbon filaments when they are used with the usual 110 volt lamps.

Tantalum melts at 2,300° C. Tungsten melts at 3,030° C. Like tantalum, it has a much lower resistance than does carbon.

In connection with tantalum deposits, there is reported the finding of a new mineral in the gold washings of the Ural Mountains. Analysis shows that it consists of 98.5 per cent tantalum, 1.5 per cent niobium, and .001 per cent manganese. It may therefore be regarded as consisting practically of native tantalum. The mineral occurs in very minute quantities, and is apparently an isolated formation.

Electric Frost Prevention

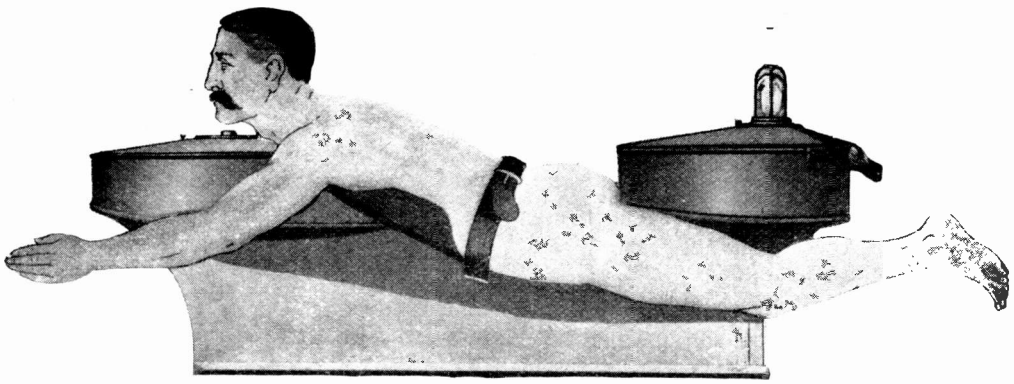
An electric heater for the protection of orange groves from frost is being tried out in the groves about Riverside, California, this winter

The device is being used on a small scale to cover sixteen trees in the belt which was affected by frost last year. Overhead wires have been strung above the trees and connections made with the heaters. The current will be turned on when required and careful observations made with thermometers to test the difference in temperature. Of course it is understood that in frost prevention it is not the rise in temperature alone that makes the difference, but the circulation or agitation of the air which a comparatively slight inequality of temperature can cause. It is stated that the value of this device promises to be so great that free current has been provided for the experiment by the Board of Public Utilities.

Another way in which electricity helps the orange grower is by the use of a complete telephone system around the Pomona, California, citrus groves. This telephone connects the homes of the growers with numerous stations among the orange groves which are visited at frequent intervals during the winter nights by a motorcycle rider who observes the thermometers at various points and promptly telephones the owner's house when any particular area is threatened by frost. By the use of the motorcycle patrol and the telephone, it is possible for the orange growers to receive a warning in time to start the smudges, or pots of burning oil under the trees, and thus prevent the great damage that a single freezing night could do.

Novel Life Raft

The picture indicates the construction of a form of an individual lifeboat or life raft and its method of operation. It is equipped with an electric light as noted in the rear and a compass in front. It was devised by Philipp Lentz of Berlin-Lichterfelde and measures 1½ meters in length. It is so designed that the user may have free use of his arms and legs for propelling the apparatus and can readily steer the craft by the aid of the compass.



AN INDIVIDUAL LIFEBOAT OR RAFT WITH ELECTRIC BEACON

He is fastened to the device by a single strap over his back which he can easily reach. The intermittent electric light is intended to aid in his rescue by showing the location of the apparatus in the dark.

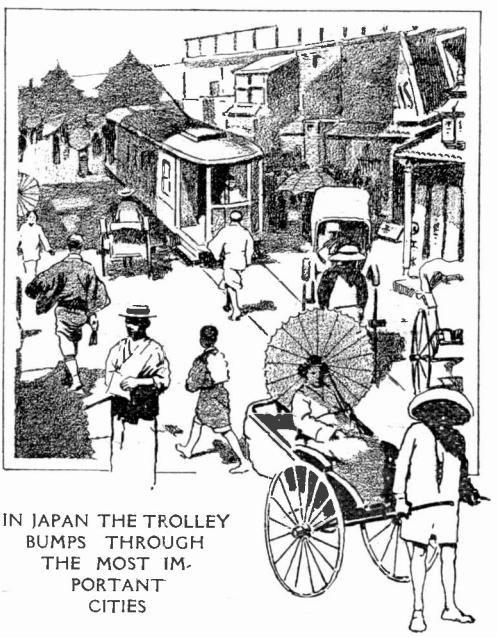
The signal electric light consists of a ten candlepower tungsten lamp operated by a storage battery. A small electric motor is provided which automatically switches the electric light into circuit for two seconds with a pause of four seconds between the flashes.

Building the Trolley in the

You know that Oolong tea comes from Formosa. But do you know that there are 400 miles of electric railways in operation and under construction throughout the island? Do you know that primitive Formosa through the invasion of the trolley has become up to date, bustling, commercial? Let us see how the change came about:

The smoke was still drifting from Japanese guns; China was still groaning from its ill-fated war, when the little men of Nippon turned their faces toward Formosa. They knew the island was rich. They knew that these riches could not be obtained until the head-hunters had been driven away. So the Japanese landed their brown faced soldiers and drove the native bandits back into the mountains. Also, being able to shoot very straight they kept them there. The first obstacle out of the way, the Japanese conceived the idea of laying a system of electric railways over the island. So they began to build, using Keelung, the capital, as a center and tapping the remote corners of Formosa. The plan was to establish an electric service between the great sugar and camphor districts, the rapidly growing bamboo pulp factories and the natural outlet for commerce.

For a while the Japanese had a hard time building their line. No sooner had they raised trolley poles and put cars in operation than the head-hunters sneaked down. By night they came, excited with the plan of an old chief. A renegade Englishman had given it to him. And the plan was to cripple traffic by cutting down the poles. As the story goes the savages cut the poles but with them brought down a "live wire." Now even a savage's skin isn't tough enough to stand a "live wire." And after the chief had seen ten of the strongest warriors fall to the ground electrocuted, he concluded that it would be a good thing not to cut down any more trolley poles.



IN JAPAN THE TROLLEY BUMPS THROUGH THE MOST IMPORTANT CITIES

And in a similar manner the trolley has sought the remote places of the earth, so let us follow the story more or less geographically.

Unlike Formosa the impetus for the trolley in Hawaii came from the West. In the Island Beautiful, Formosa, the Japanese were the builders. In Hawaii they were Americans. To-day Honolulu has a very up-to-date electric system. One of

Remote Places of the Earth

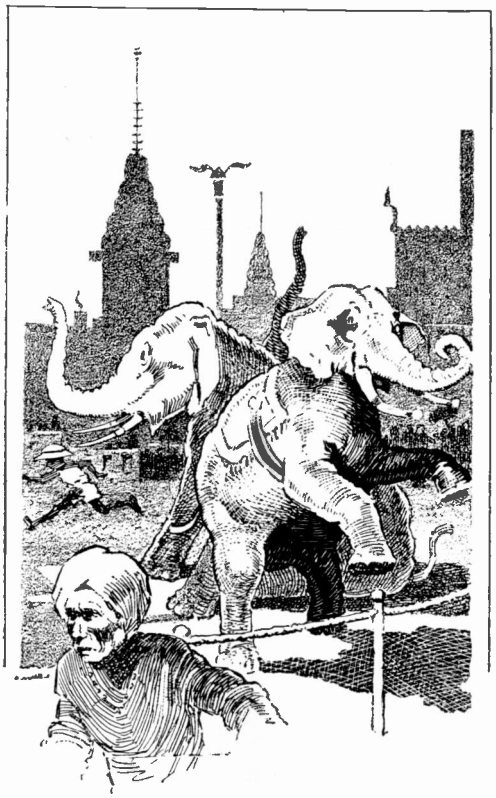
its branches winds out of the town curving and climbing until it reaches the crest of the Punch Bowl, 500 feet above the sea. Not only is it popular with tourists but the residents favor it as well; and by residents I mean the natives as well as the foreign born. For the natives are very easy going, indolent, dreamy. They hail such effortless transportation as the trolley car as a gift from the God of the volcano Kileiu.

In the Philippines the story of the trolley is the story of a hard construction fight. As soon as Spain had been defeated an American engineering company sent its forces to the islands and built the Manila Electric Railroad. They found things very unsettled. The Philippines, more backward than Cuba, were stagnant so far as modern engineering went. An old system had to be torn down. Not only did the indifference of the people have to be overcome but certain climatic conditions presented serious obstacles. No sooner had the engineers begun work than they found that heavy dampness corroded the rails. Overcoming this by generous coatings of asphaltum paint they faced another difficulty. White ants were destroying the wooden ties. So the ants' party was spoiled by covering the rails with jodelite. That took away their appetite. Then it was found that the familiar tubular steel trolley poles were rapidly rusted in the Philippine air. Poles of native wood had to be substituted.

Then, shut out from the ties, the ants began eating the cars. So ordinary wood was dispensed with. Expensive teak had to be employed. And worst of all, the construction and excavating was done by the natives, whose habits make it necessary for the man employing them to watch closely.

No sooner had the Manila Electric Railroad begun to pay wages than the natives disappeared. As soon as they had a little money they quit their jobs and gambled. Those who remained used the luncheon hour to get into games. Their earnings paid for excitement instead of food. So the builders stationed lunchmen along the line, sold excellent and very tempting food at low prices—and won. To-day the Manila Electric Railroad has about 40 miles of track. Some of it runs through the suburbs, which means through a jungle. Here malaria and snakes lie on either side of the rails. Re-

THE CHINAMAN NEVER USES A WHEELBARROW BUT INSISTS ON A WICKER BASKET



FEARED THAT THE NOISE OF THE MOTORS MIGHT DISTURB THE CALM OF THE SACRED ELEPHANTS

pair work is costly. Yet since 1905 the line has been running continuously and at a profit. The native admires it chiefly for one thing—it enables him to reach the race track near Manila quickly.

Of course you would expect well equipped lines in progressive Australia. There are excellent systems at Melbourne, Perth and Kalgoorlie. Indeed the trolley has ever penetrated far-off Auckland. New Zealanders are as familiar with it as New Yorkers. This sounds stranger if you take a map of the world and see where Auckland is—one might call it the edge of the earth over which the doubters believed Columbus would fall.

But going up the Pacific we again meet the Japanese, the same busy trolley promoters who turned Formosa from a paradise of head-hunters into a paradise of money chasers.

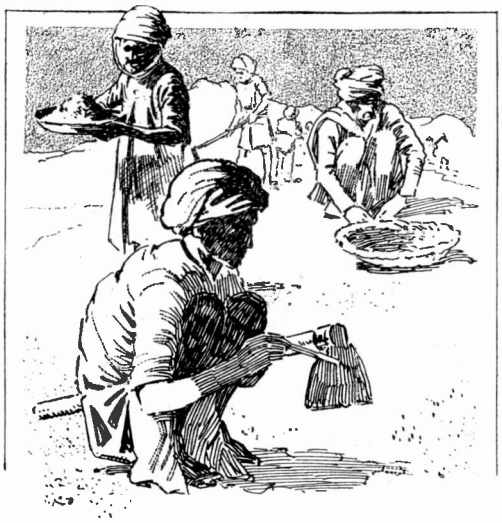
In Japan the electric trolley hums through most of the important cities. It has forced the "ricksha" from the more traveled highways. It has robbed the native atmosphere of ancient charm and local color. Still it has facilitated transportation, helped bring the Empire up to date; helped the Japanese to make money faster, which is his second ambition. The first, as you know, is to make his empire the greatest of the world.

By way of emphasizing her up-to-dateness, her desire to hold her own in an age of mechanical progress, Japan has built an electric railway in Dalmy, that seaport of southern Manchuria torn from the grip of the Russian bear. Before Japan brought the trolley, Dalmy lived in another century. But Japan is no respecter of another country's traditions. For ages Corea, hermit of the Asiatic, resisted every innovation from the western world. Then flushed with her victory over Russia, Japan pushed some of the innovations down the throat of the ancient nation. To-day Corea has a trolley, running out of Chemulpo. It is planned to extend the tracks 25 miles inland to the ancient capital of Seoul. Of course, this is being done very much against the will of Corea. But what is the will of a dead kingdom? Still one cannot help wondering what the natives think of electricity, of the unseen force that speeds rattling cars over the dusty roads where once only shuffling coolies and lazy ponies toiled.

Even China has surrendered to electricity. Many of her large seaports are now networks of trolley track. Not so long ago conservative Hankow agreed to spend $20,000,000 on new and electrified transportation. Lines are being built everywhere. Still the natives persist in using the most primitive implements in carrying on the work. Often a trolley line in China must cross shaky ground, rice paddies, marshes. Piling must be done. Still you rarely see a modern pile driver in China. What you do see is a

yellow faced coolie setting the pile into position, gripping it with big bamboo poles and strapping these poles together. Then other coolies, chattering excitedly, cling to the outstretched bamboo and by sheer weight force the pile into the mud. Then they hammer aided by a big stone, held firmly between two timbers. Also in carting away dirt the Chinaman never uses a wheelbarrow. He insists upon his inefficient wicker basket. Another difficulty that trolley constructors had to fight in China is superstition. I mean a particular superstition. It is called "Feng-Shui." Now that is Chinese for what might be translated into "the symmetry of local topography." That is to say the Chinaman believes that the earth depends upon a balance. If he imagines a particular locality is not balanced properly he builds pagodas to establish the proper poise. And if he thinks the ground is balanced properly he is careful to place his house in such a position so as not to destroy the balance. Also he observes it in burying his dead so that they

THE ROYAL HEAD OF THE LAND ORDERED THAT THE POLICE WEAR TROUSERS



HINDUS USING GRUBBING HOES AND CARRYING THE DIRT AWAY IN BOWLS

may enjoy repose without the earth teetering and bothering them. It isn't good for a foreigner to ignore that superstition.

Once a party of American engineers plotted the survey of their trolley in such a way that it threatened the local "Feng-Shui." The American gunboat that came to their rescue arrived just in time.

The trolley has even invaded the Malay peninsula. Here the chief difficulty is in furnishing accommodations for the various classes. Of course caste rules in the Orient. The lower class natives have welcomed the trolley lines. Still they have yet to adjust themselves to new habits which the new transportation demands. When a native travels he invariably carries excess baggage. A farmer bears heavily laden baskets or balances vegetables, poultry and pigs from a long bamboo pole. Of course the natives insist upon carrying all their truck into the trolley cars—which is embarassing.

Siam was one of the first of the eastern countries to encourage the trolley. About eight years ago some American high in the favor of the White Elephant obtained a concession for a trolley line in Bankok. Previously bullock carts furnished transportation for those who did not

walk or ride in the boats of the muddy Meinam and its canal like tributaries. It was some time before the Americans dared begin work. The natives feared that the noise of the motors might disturb the calm of the sacred elephants. These objections overcome, the road was built.

Even then it innocently caused trouble. Up to that time the native police had dressed very simply. They wore a cloth around their waist, a hat and a smile. This wasn't considered in keeping with an electric railroad. So the royal head of the land ordered that the police wear trousers. The trousers came, were put on and so amused the people that great crowds gathered, blocking traffic on the electric line and causing unheard of excitement. The next day the trousers were removed and the police and the electric cars moved freely.

It would be easy to go on and tell how the motor invaded Bombay, how they dug 44 miles of track with Hindus using grubbing hoes and carrying away the dirt in bowls. It would be interesting to know how ancient Bagdad is building its electric line; how a trolley now runs from Cairo to the ruins of Heliopolis with the gray pyramids looking on; how they no longer close the gates at sundown in the Holy City of Jerusalem; how a trolley line is going where only camels and donkeys went before. To some the clanging of a gong, the whirr of the motor near those sacred walls may be a desecration. But the trolley has become a part of the Holy Land. Pilgrims are now using its cars to explore the streets of the Holy City. Modernity has pushed out the traditional archaism of Jerusalem.

The trolley has gone through South Africa from Cape Town to Camps Bay, and they broke the road through heavy rock, laid their tracks 800 feet above the sea and provided a wonderful view of Table Bay. The black natives became enamored of it, sold anything to get the necessary fare for a ride in one of the wonderful cars.

There is the story of Durban in Natal. Here they have an electric line owned by the municipality—a line that conducts a street car parcels delivery, carrying small packages at a very moderate rate. We have, therefore, something to learn from Durban.

And there is the tale of a thousand miles of trolley track in remote parts of Russia. Down in the small town of the Baltic provinces it has provided transportation for the poor. Farther north it has brought the people of the wheat districts closer one to the other.

You would think that the limit had been reached but you don't know the persistence of electricity. For centuries old Popocatepetl has lifted its peak two miles into the heavens. The Mexicans are proud of it. Its summit is far above the snow line. But soon an English syndicate will lay the tracks of a trolley up its slopes, climb them as easily as the trolley climbed Vesuvius, bring to the volcano top what it has never felt before —the mighty pulsing of electricity high above the snows.

So far has the trolley spread—penetrated the remote places.

Radium in Yellowstone Park

Recent investigations at the Yellowstone Park hot springs show that the travertin of the ancient terraces contains little radium as compared with that found in the terraces of later formation. The reason is thought to lie in the fact that the hot water has separated the radium from the uranium in the rocks and deposited it in the terraces where it gradually decays and disappears when not replaced by fresh supplies from beneath.

Certain of the travertin terraces are overlain by glacial boulders and it is thought that this fact affords a means of estimating the date of the last glacial invasion of the region of the Yellowstone Park. Assuming a uniform action of the springs, they make this date 20.000 years ago.

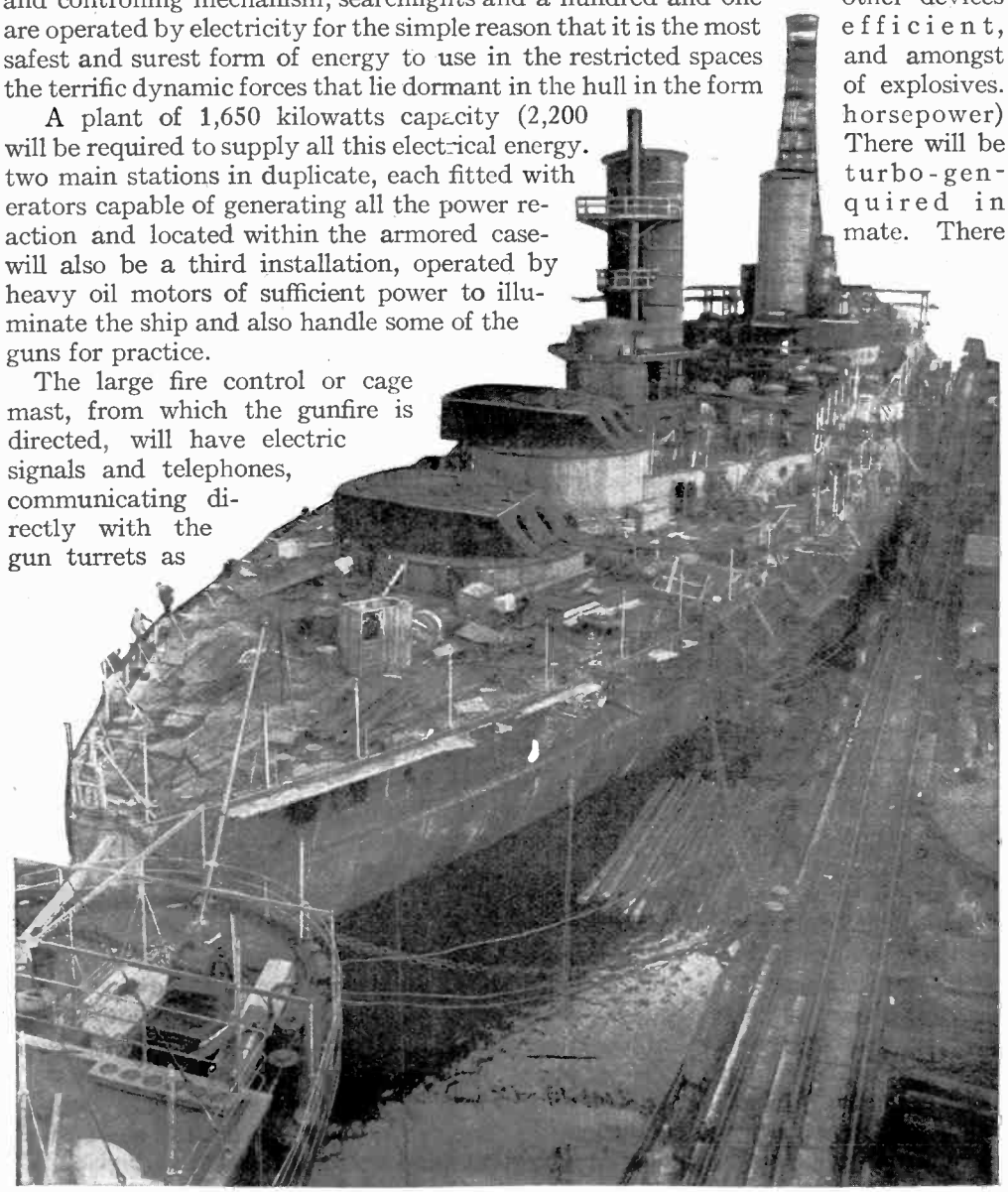
RIVADAVIA—THE GREAT ARGENTINE BATTLESHIP

A new record for size and power of armament of battleships is made every few months. For a fleeting moment this record is held by the Rivadavia, the new Argentine battleship now almost completed at the Fore River Works, Quincy, Mass. It will be turned over to the Argentine government complete in every respect down to dishes, table linen and silver and the piano in the officers' quarters.

Twenty-seven thousand tons is the displacement of this monster fighting machine, and throughout its vast bulk the workings of electricity are found in all phases of its intricate organization. The lights, signals, telephones, ammunition hoists, gun firing and controlling mechanism, searchlights and a hundred and one other devices are operated by electricity for the simple reason that it is the most efficient, safest and surest form of energy to use in the restricted spaces and amongst the terrific dynamic forces that lie dormant in the hull in the form of explosives.

A plant of 1,650 kilowatts capacity (2,200 horsepower) will be required to supply all this electrical energy. There will be two main stations in duplicate, each fitted with turbo-generators capable of generating all the power required in reaction and located within the armored case-mate. There will also be a third installation, operated by heavy oil motors of sufficient power to illuminate the ship and also handle some of the guns for practice.

The large fire control or cage mast, from which the gunfire is directed, will have electric signals and telephones, communicating directly with the gun turrets as



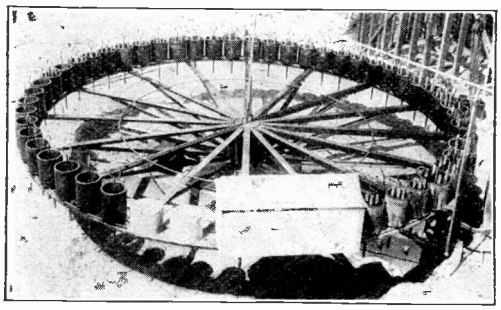
well as with the engine room and other parts of the ship. Intercommunicating telephones are everywhere, and there will be submarine signal apparatus.

Below the waterline the ship will be protected with a double bottom transverse and longitudinal bulkheads, dividing the vessel into watertight compartments, fitted with electrically driven centrifugal pumps.

In the work of building this ship, hoisting the huge parts into place, giant electric cranes, one of them the largest on the Atlantic coast, if not in the country, were used.

Concrete Poles Molded in Sections

A device here shown and on the market will do much it is claimed to simplify the erection of concrete poles for transmission and telephone lines besides making possible the transportation of poles in sections to points away from railroads.



MACHINE FOR MOLDING CONCRETE POLE SECTIONS

A wheel like, iron structure carries a series of molds of different sizes to the number of 54 upon its periphery. In the molds are formed concrete pole sections nine inches long varying in diameter from seven to eleven inches. In erecting poles these sections are placed one upon the other, those of lesser diameter being used as the top of the pole is approached. Through four holes in every section steel rods are passed to hold the built up pole together. Poles may be lengthened or shortened at any time by adding or taking away sections.

An Electrical Fancy

The following is a free translation of a sketch in a Parisian paper wherein is neatly satirized the astonishing progress of electrical science. This sketch pictures Edison in his laboratory, hearing the news of a declaration of war between the United States and Great Britain. A young man, his assistant, rushes in, pale and out of breath and exclaims:

"War is declared! It is terrible!"

"Ah," says Edison. "War is declared, eh? And where is the British Army at this moment?"

"Embarking, sir."

"Embarking where?"

"At Liverpool."

"At Liverpool—yes. Now, my friend, would you please join the ends of those two wires hanging there against the wall? That's right. Now bring them to me. Good! And be kind enough to press the button."

The assistant, wondering and half-amused, presses the button.

"Very well," says the inventor. "Now do you know what is taking place at Liverpool?"

"The British Army is embarking, sir."

The inventor pulls out his watch and glances at the time. "There is no British Army," he says, coolly.

"What!" exclaims the assistant.

"When you touched that button you destroyed it."

"This is frightful!"

"It is not frightful—it is science. Now every time that a British expedition embarks at any port, come and tell me—tell me at once. Ten seconds afterwards, such an expedition will simply be out of existence, that is all."

"There doesn't seem to be any reason why America should be afraid of its enemies after this, sir."

"I am inclined to share your views," says Edison smiling slightly. "But in order to avert any future trouble, I think it would be best to destroy England altogether."

"To—to destroy England, sir?"

"Kindly touch button number four there."

The assistant touches it. The inventor counts ten.

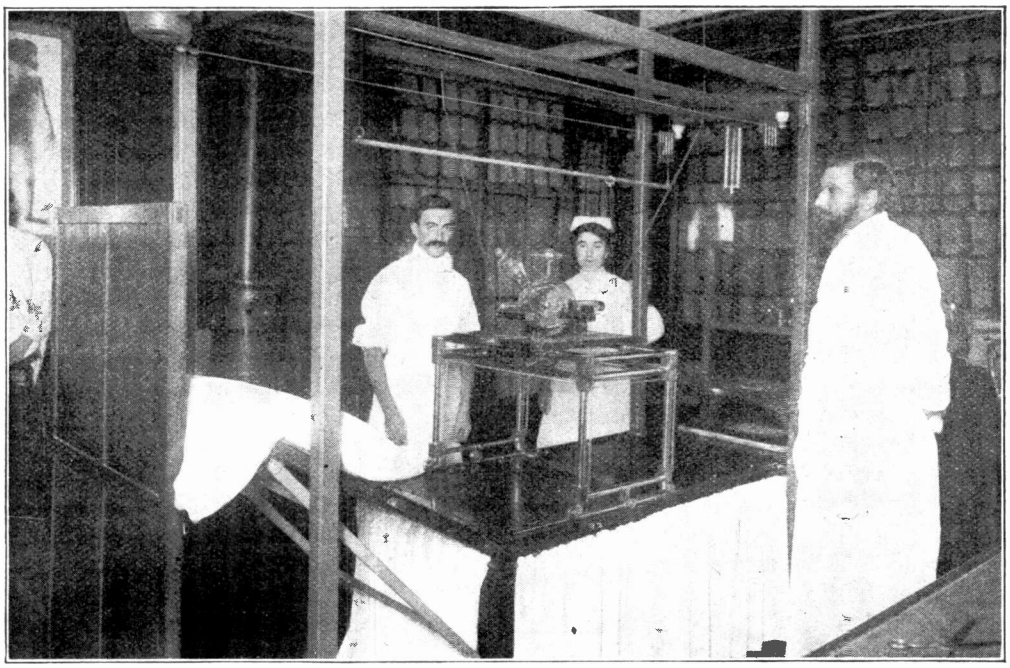
"—eight, nine, ten—it is all over. There is no more England!".

"Oh! Oh!" exclaims the young man.

"Now we may proceed quietly with our work," says the great man. "And if we should ever be at war with any other nation, you have only to notify me. I have an electric button connecting with every foreign country which will destroy it when pressed. In ten minutes I could destroy every country in the world, the United States included. Be careful, now, that you don't touch any of those buttons accidentally—you might do a lot of damage!"

Dr. Infroit's Radiographic Laboratory

Dr. Infroit, the Paris scientist, for 29 years head of the laboratory at Salpetriere is henceforth to devote himself exclusively to experiments with radium, and has constructed for himself a radiographic laboratory in which to perform his experiments. It is dangerous work that this scientist has undertaken, and sooner or later it may mean his death. He has already felt its effects. Radium, it is well known, when one is exposed to its rays constantly in experimental work, creates a skin disease which gradually penetrates the flesh until the affected member has to be amputated to save the rest of the body. This wonderful mineral, which has such curative powers, can also be very destructive at times. Dr. Infroit first lost a finger. Then a hand was amputated. He was attacked by the disease back in 1908. But since then he has never faltered in his work. He did not stop his experiments even until his hand was healed. Now he has decided to give up his entire time, and perhaps his life to experiments in the cause of humanity and scientific knowledge. The illustration shows him in his radiographic laboratory with two assistants.



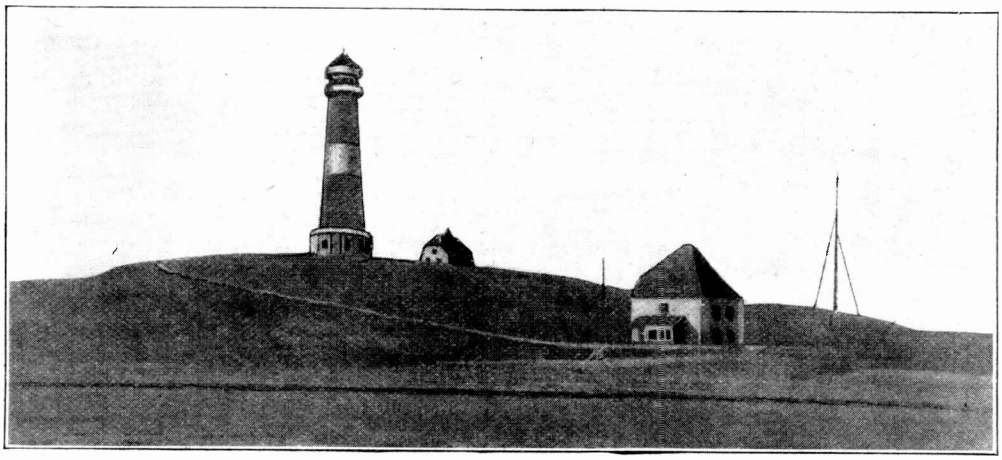
DR. INFROIT IN HIS RADIOGRAPH LABORATORY

Hornum Lighthouse

One of the finest of the world's electrically equipped lighthouses stands on the coast of Germany. The tower of the Hornum lighthouse is of steel and from it shine two electric lights with a third light for range purposes in a secondary structure half a mile distant.

Inside the main tower are installed on the ground floor duplicate twelve horse-power Diesel engines direct connected to duplicate generators. This plant is used to charge a battery of 100 storage cells on the floor above and is accomplished in six hours. The battery will then run the three lights for ten hours.

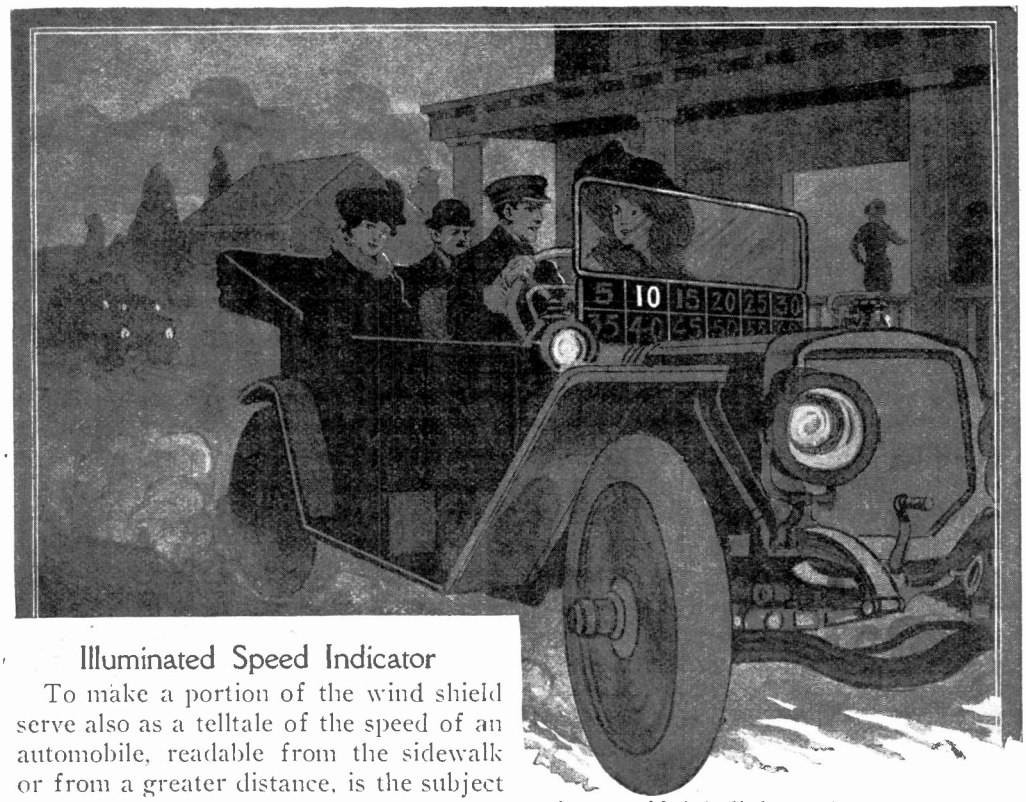
The floor above the battery is fitted up as a bedroom, and the floor above this is the watch room with a telltale switchboard and a telephone to the engine room and keeper's dwelling. There is also an automatic device by which the generating set on the ground floor can be stopped either from the watch room or battery room. Above the watch room the secondary light shines from the main tower, the rear light of the range, the front light being about half a mile away. The front and rear lights each consist of two 150 candlepower incandescent electric lamps, the one in service and the second directly behind (not in service). In case the service lamp should be broken the current automatically (by the short circuit caused by the broken lamp) turns the table on which the two lamps are mounted and throws the spare one into focus and lights it. The main light in the tower is an arc lamp. The difference between this lamp and the ordinary arc lamp is in the arrangement of the carbons. The positive carbon is horizontal while the negative carbon is placed in an inclined position to the positive, the two forming an angle of 70 degrees. For the lighting effect only the crater of the positive carbon is taken into consideration. The positive crater is clear of the negative carbon entirely, so that the total amount of light given out may radiate. Automatic mechanism in the form of shutters cuts off the light in groups of two flashes alternating with groups of four flashes repeating again in 30 seconds.



HORNUM LIGHTHOUSE

Economy of Electric Ware

Electric ware is not only convenient, sanitary and safe, but is economical as well. The electric toaster stove requires 500 watts or one-half kilowatt. If the rate is ten cents per unit or kilowatt hour, you can cook on the toaster stove a full hour for five cents. The electric heating pad consumes 55 watts.



Illuminated Speed Indicator

To make a portion of the wind shield serve also as a telltale of the speed of an automobile, readable from the sidewalk or from a greater distance, is the subject of a patent issued to Forest Lee Cantrall, Ivy, Calif.

The lower part of the shield proper consists of compartments upon the glass front on which are numbers in successively increasing values beginning with five. In each compartment is an electric lamp backed by a reflector. Under the needle of the speedometer are electrical contacts so arranged that as the needle moves over the scale to indicate the speed these contacts are closed one at a time through a battery thus lighting up the proper lamp and displaying the number showing the speed.

Mineralized Carbon Lamp Electrodes

Arc lamps with mineralized carbons have been in use for some time in France and are believed to be more efficient than any other lamp yet invented; that is, they give more light per unit of energy consumed. As they yield a spectrum more nearly like that of the sun than other artificial lights, they may prove valuable in many ways where other lights are unsatisfactory.

They have had, however, a serious disadvantage, as the vapors from the burning carbon have been found to condense on the interior of the globe and thus obstruct the radiation of the light. This has been recently overcome by the adoption of a double, closed globe, such that one part is used for the glowing carbons while the other part acts as a condensing chamber. With this arrangement it is found that the formation of the gases is lessened on account of the limited air supply, and what does form is condensed in the lower chamber. The fumes are principally fluoride of calcium and nitrous vapors resulting from the direct combination, at the temperature of the arc, of the nitrogen and oxygen of the air. These vapors are more abundant in lamps with mineralized carbons than in ordinary lamps, on account of the higher temperature of the arc.

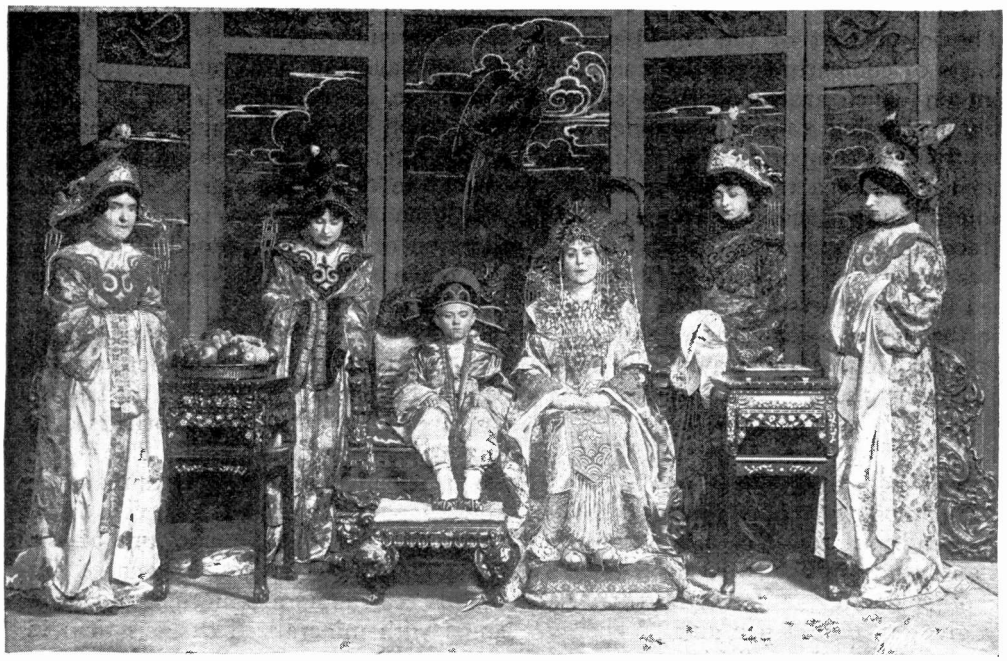
The Daughter

By EDWARD

Through the curtain there percolated low rumblings, explosions, a confusing sound as of many bodies moving, gruff heralds of battle. Then there came a pause, a lull in the firing, absolute silence as if the voice of destruction were taking breath for some greater effort yet to come.

In the darkened theater people began to show uneasiness. One heard whisperings, shifting of feet. The audience, strangely affected by this unseen disaster, waited nervously for the curtain to rise. And then of a sudden it shot up, curled its soft folds into the flies, exposed a dimly lighted stage and on it a grim picture. There behind the footlights lay the battlements of Nankin—red battlements with the dead and dying of the Ming army strewn about them. Now in the black reaches of the sky one saw flashes of fire, splitting forks of yellow and red, heard shells burst filling the air with their terrible crashing. Then the wall began to fall in, great blocks of stone tumbling down upon the stage pinning men as they fell. And the din continued, the bursting shells, the rattle of musketry, the waving of signal fires.

How long this lasted I cannot say. All sense of time had gone. Only could one think of the falling battlements, the thunder of cannon, the spreading smoke, the cries of the soldiers of Ming. And then The Daughter of Heaven, empress of a lost dynasty, a little woman armored in gold, in allegiance for whom her loyal subjects had risen in revolt,



VIOLA ALLEN AS THE DAUGHTER OF HEAVEN, AND HER ATTENDANTS AT THE MING THRONE

# of Heaven

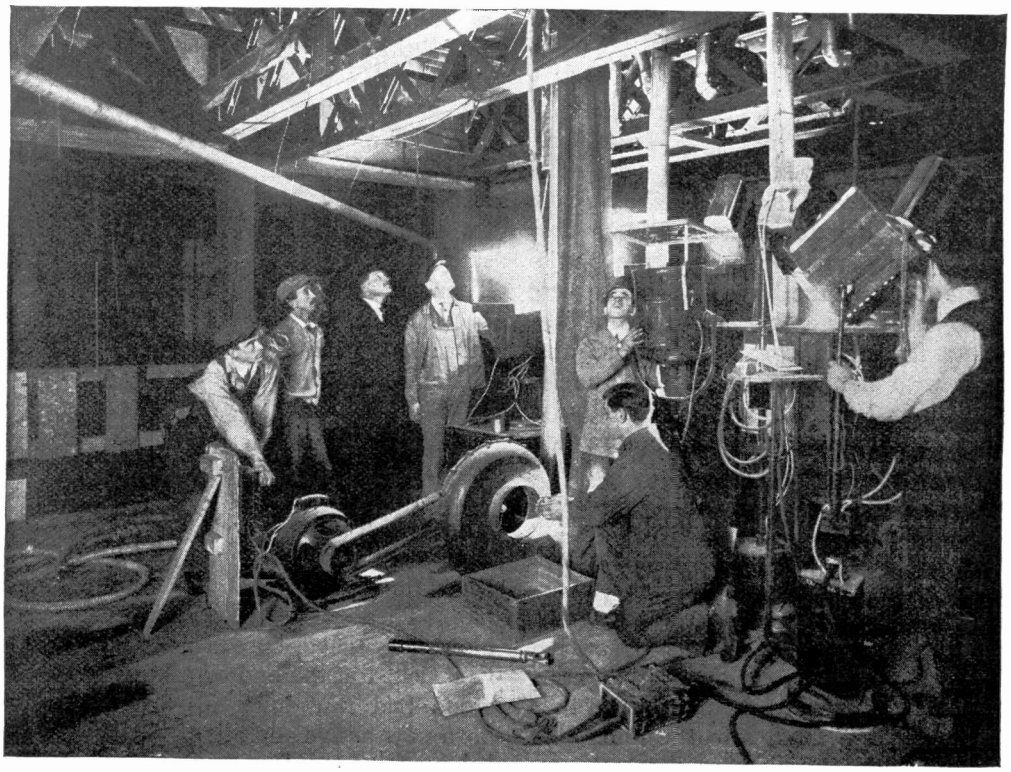
LYELL FOX

crossed the stage. I saw her pick up a torch and hold it overhead. Her soldiers had gathered around her. The day was lost. The Manchus were carrying all before them. Soon they would come swarming over the battlements. And the loyal Mings were pleading of her a last dispensation, begging a favor. She, their Empress, must light with her own hands the funeral pyre upon which they would all burn. They prostrated themselves before her.

And then I noticed a great pile of logs off in a corner of the stage over at the end of the wall. They looked like railroad ties piled up beside a track. Silently The Daughter of Heaven approached them. I saw her torch ignite, suddenly bursting into flame. I saw her thrust it deftly among the logs, lighting them all with swift precision. And then she tossed the torch into the middle of the pyre and escaping by a secret passage that ran under the city, left the scene. So much for the little woman in the armor of gold.

Now a puff of grayish smoke issued from between the stacked logs. Then it thickened, more and more of it, darker and darker until it swirled and eddied in an ecstasy of destruction. Through it one caught a glow of red, faintly visible. Then the glow brightened, spread and spread until it licked at the end of a huge block of wood and ran down it—fire, suddenly born now active and alive. Brighter and brighter it glared, encompassing all until the pyre had become a roaring car-

WHEN THE FORBIDDING RED LIGHT PLAYS OVER THE PAVILION AT NANKIN



A PECULIAR GROUPING OF PIPES, REFLECTORS, FANS, MOTORS AND LIGHTS—THE "FIRE" MACHINE

nage, red with fire, gray with smoke. It hissed, it crackled, it moaned. And into the hell of it I saw the soldiers of Ming, one by one fling themselves upon the logs and lie still. The curtain fell.

It was to discover the illusion, to spoil the effect that the scene had for me that I went to the Century Theater the next afternoon. I was to see the big scene of The Daughter of Heaven from a viewpoint that would forever spoil for me the illusions of the theater. And so I invaded that magic land of behind the scenes, was conducted through many mysterious passages and finally found myself standing in a cellar sort of a room such as one finds in an empty warehouse. Just below a trap in the stage it was and as I passed through a little door I saw before me a peculiar grouping of pipes, reflectors, electric fans, motors and lights.

I learned that the peculiar machine was most intricate. The pipes were for smoke. At the bottom of each was placed a chemical smoke pot that subsequently made grayish clouds issue from the pyre above. I saw a big circular piece of amber gelatine which when played upon by the powerful electric light would produce the color of fire. I saw thick silken brushes, imitations of feathers, orange colored, hanging like the plumes of some huge hat. I saw powerful bellows that driven by large electric motors would send the feathers swirling around, bright in the glare of the pyre—bellows that created the impression of whirling fire. And these motors made the smoke eddy too. Everything depended upon them. Even the gusts of confetti that thrown into the air, were caught in the breeze of six electric fans and made to whirl round and round like flying sparks—even they relied upon the big motors.

And that was the fire-colored light, whirling feathers and confetti, smoke pipes and pots, bellows, fans, a motor. And it came to me how surprisingly it all depended upon electricity.

My guide's name was Bierwald, "Bennie" they called him. I met him at the Tyler offices up in the Century Theater. As you may know it is the firm of George Tyler & Co., that produced The Daughter of Heaven; also The Garden of Allah which last year opened a new era in impressionistic staging. And Bierwald is their master electrician—an artist in lights, a painter who paints with candlepower instead of with a palette and brush.

I was fortunate in having him as my guide. He took a delight in explaining the illusions he had created. It seemed as if I were a little boy, and he, an old man grinning and saturnine, was saying over and over—

"There isn't any Santa Claus! There isn't any Santa Claus!"

It began before the first curtain had risen. The stage was set for a scene called "A Chinese Love Song." It had no bearing on the plot. It was just a picture that created a mood. I saw the soft landscape of a river dancing in moonlight of a glowing oriental sky rich in purple, of fireflies twinkling in the foliage of a wood. It was very vague, dim, indistinct; yet surprisingly beautiful.

That was because the picture was soft. There were no stiff wing pieces. The audience gazed upon it through a curtain of gauze and even the moonlit water was different. I was going to ask Bierwald about it, when there came from just behind me a low whirring, the subdued sound of machinery. I turned and saw a "Kinemacolor" apparatus. On the drop it was creating an actual picture of water in moonlight—a greenish, yellow flow that brought out the rare quality of the scene.

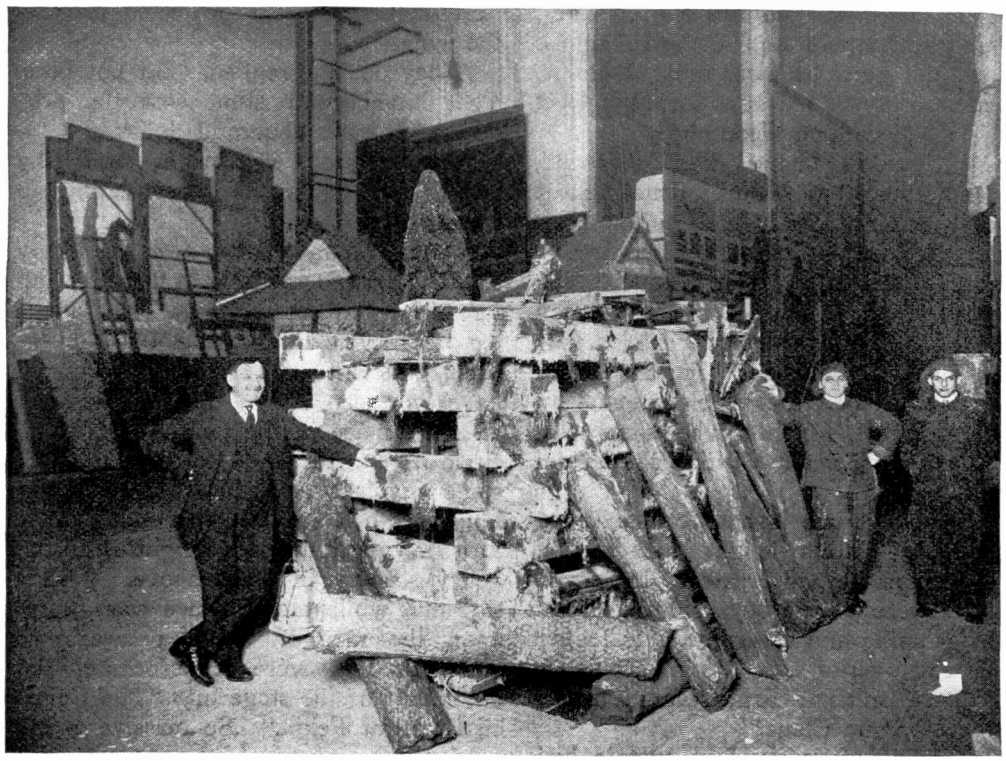
"I thought they always did moonlight and water by a stiff magic lantern sort of an arrangement," I said to Bierwald. "I thought they just projected it from the wings."

"They do," he replied, "but not here. That kinemacolor stunt cost the producers an extra thousand dollars."

And that, too, was made possible by electricity. I saw the wires leading to the machine.

We hadn't walked two feet before my foot caught in something in the floor and I realized that not only was The Daughter of Heaven different but the Century itself was different from any theater I have ever seen. My foot had caught in an open space in the floor—a complete circle as I afterwards found. For the stage revolves and that was the slot. Underneath it are the great motors that turn it—turn it and the weight of all the heavy scenery in place above. And I saw that while the audience was gazing upon the moonlit water a swarm of scene shifters were transforming the other half of the stage into "The Council Room at Pekin." So massive is the production, so intricate the scenery, that only on a revolving stage could it be done full justice. Without the arrangement whereby one set can be put in place while the other is being played upon the delay between acts would be so long that the audience would become restless—maybe bored.

Three stories under the ground we followed a staircase and there saw the huge switchboards that control all the lights in the house, the huge motors and the engine room. Then when I felt as if I had been through some huge power plant Bierwald led me up an exceedingly narrow spiral staircase, told me to go ahead and hung back himself. The next moment I found myself in a queer little compartment, its ceiling so low that one had to stand half crouched. I saw a man seated before a little shelf on which were many electric switches. He smiled and whispered for me to look around over my shoulder. I did and was astonished to find myself gazing into the face of a big Chinaman!



THE FUNERAL PYRE—STANDING BESIDE IT, IN THE FOREGROUND, IS BIERWALD, THE STAGE MAGICIAN

I was under the stage, in a little depression, just behind the footlights, in an open trap that was screened from the audience by the footlight reflectors. And here, I learned, sat the man who painted in the picture with the colors that Bierwald had devised. He was at the master switchboard from which every lighting effect is made. In every other theater this board is located in the wings. Here it is in midstage where its occupant can view his picture perfectly with no strained or inaccurate view so often caused by the angle of the wings.

By the time we got back to the wings the stage hands were finishing their work on the battlements of Nankin—the same as we first saw at the opening of this article. I saw the torch that the Empress had ignited. At the end was a cluster of tiny glass bulbs painted red. She had lighted them by pressing an electric button on the handle. Not even the smallest of properties could escape this dominance of electricity.

Over at the left of the stage the director of the battle took his seat in the "prompt entrance." Near him swarmed the Chinese soldiers—real jabbering Chinamen obtained from New York's Chinatown and demanding four times the pay of the ordinary "supe." But having seen the battle from in front, from below, I asked Bierwald to take me behind the back drop—a black square lighted from the wings with a reddish glow.

Here we found a number of batteries strewn about. We saw men kneeling beside them ready to press the buttons that would send a flash of electricity up through the long vinelike black wires and explode the bombs. Held in glass faced boxes, these were fastened to the drop. Then Bierwald told me that the bombs were different from the ordinary.

He said they were placed in boxes, one side of which was ground glass. On the glass was painted the picture of a bomb bursting. Behind it were the magnesium bombs exploded by the electric wires. So was a very wonderful effect created, an actual explosion heard—a picture of what a real bomb looks like, revealed to the audience.

And when I began to wonder if some uncanny electrical forces were not pushing in the battlements and tumbling their *papier maché* blocks on the stage, Bierwald overwhelmed me by explaining the last scene of the play.

It is the throne room at Pekin. The Daughter of Heaven, slowly dying from the poison she had taken, is sitting on the throne of the hated Manchus. The Emperor—the lover from whom tradition had parted her—is waiting below with his nobles. At the sight of her dead, the emperor lights the great jars filled with incense and burns a funeral farewell. Instantly the electric blower gets busy under the stage and forcing a cloud of perfumed smoke through a pipe empties it out into the jar and sends it drifting lazily into the air. And the curtain falls with the Tsin emperor and his nobles prostrating themselves before the pale and still Empress of the Mings.

As it has begun so has the drama ended with its significant effect, electrical.

Afterwards Bierwald took me up into his workshop and told me the secret.

"Our whole system of stage lighting," he said, "is new. It is new because it is impressionistic and creates moods. It is the method we began with the 'Garden of Allah' and which we are carrying out here on a larger scale. We colored scenes for instance, harsh red, a color that may not be in Nature. We did it so the audience would feel the sense of disaster.

"We colored a moonlight scene with a strange greenish tone just to produce in the minds of the audience the spirit of the play. We use a peculiar purple in the last act to give intense emotion, grief. We do this to 'get over' the spirit of the play. It may not be true to Nature but we contend that to create moods, to hold people's minds by the psychology of color, by their skillful variations is a vastly bigger, more important and more intelligent thing than to set a stage with real doors, real Turkish rugs, real lamps, and all the other clutter of the school they call realistic!"

White and Black Coal

The French call the power derived from waterfalls *houille blanche*—"white coal;" and a singular combination of the power derived from white and black coal has been effected at Etupes, in eastern France. At that point electric conductors coming from the coal mines of Ronchamp, eighteen miles north of Etupes, meet similar conductors coming from the waterfalls of Le Refrain, 24 miles south of Etupes. The current derived from the mines is of 30,000 volts, and that from the waterfalls of from 30,000 to 50,000 volts. At Etupes the power is combined in a large plant, provided with transformers and distributors and sent out to run shops, light lamps and so forth. It is estimated that ultimately this alliance of white and black coal will furnish 50,000 horsepower.

Rathenau Medal

Dr. Emil Ratheneau, a lifelong friend of Mr. Edison and head of the Allgemeine Elektricitäts Gesellschaft (General Electric Company of Germany), has placed a medal in the hands of the American Museum of Safety, New York, to be given each year for the best device for safeguarding life in the electrical industry. The medal, which goes this year to Mr. Edison, bears upon one side a picture of Dr. Ratheneau and the words "Emil Ratheneau, 70 years old, Dec. 11, 1908," in commemoration of which the medal was founded. The other side bears four German words meaning "for merit and fidelity."

"Eating Electricity"

An Interview with Prof. Bergonie, Discoverer of the Worth of High Frequency Current as a Body Builder

By FRANK L HALSEY

When my chief in London cabled me, his Paris correspondent, "See Prof. Bergonie, Bordeaux, eats electricity," I was, to say the least, a trifle startled. A man who eats electricity, indeed! Was he then some son of Jove who for the mere pleasure of it nibbled at his father's thunderbolts—lunched off the lightning? My vision conjured up a man of great build, of god-like stature as the ancients imagined it, while the train bore me on toward the town that held the marvelous personage. Bordeaux is a far cry from Mount Olympus and so when set down in its streets, I felt that perhaps after all it was no semi-immortal whom I was to visit, but a scientist.

Such a man did I actually find Prof. Bergonie, seated in his office-laboratory, somewhat taciturn but keen as one of his own electric sparks. There was nothing of the immortal about him; he was a man of average size and with no particularly distinguishing feature, a man whom you would pass on the street without a thought of what was stirring behind the rather broad and high forehead. Is this the man who derives nourishment from the lightning, I asked myself. I set about to learn how, and why.

Prof. Bergonie was courteous. "You are a journalist, Mr. Halsey? Ah yes. And you want to know how I 'eat electricity'? That is rather obscure; it does not at all convey the purpose of my recent discovery. That purpose is to supply the body with a great quantity of heat without overtaxing the digestive organs which Nature designed to serve that function. In the first excitement of the newspaper world when I made known my method of supplying this heat, it was stated—you will pardon me—with not unusual exaggeration that I had discovered how to do away with food entirely, furnishing by means of electricity all the nutritive benefits derived from animal and vegetable matter. That is simple nonsense. Following that line of thought—their own, mind you, not mine—the journalists made me say that an electric current of 1,000 volts is equal in food value to a porterhouse steak. Think what my confrères in the Academy of Science must have thought of me to see that statement apparently emanating from me."

The professor broke off his narrative to rise and pace about in some excitement; finally he halted before my chair.

"What I told the Academy" he resumed, "was that diathermy, the method of applying a current of low tension and high frequency as discovered by Prof. D'Arsonval could be made to partly supplant food, by supplying the body with a great quantity of heat. The daily food of a normal person furnishes about 3,000 calories, the calorie being the unit of heat. By applying D'Arsonval's current with an intensity of from two to three amperes and at a voltage of from 1,000 to 2,000 about 1,000 calories an hour can be supplied.

"The current traverses the body without provoking the least pain. Imagine what that will mean to those whose digestive organs are out of order and who still are in need of their daily heat supply. A man cannot force his stomach and the supplementary digestive tracts beyond a certain point. If for any reason those organs are incapable of furnishing the necessary amount of calories, he loses weight and his case is diagnosed as one of malnutrition. He may be drugged into some semblance of a normal condition but the action of the medicines is quite as likely to merely shift the seat of his

trouble. That is where the electrical applications solve the problem."

"But, Professor," I interjected, "can you give me a proof, a concrete example of the good to be derived from your method?"

"Most certainly I can. At first I had experimented with the applications upon myself, but being in a normal condition at the time I could not be positive of any good that accrued to me from them. Possibly I felt improved to some slight extent but I could have laid it as well to atmospheric exhilaration as to the electricity. Therefore I sought among my medical friends for word of a patient who would be willing to gain possible relief and no harm from the experiments. I was fortunate. A man living here in Bordeaux had sought aid from a physician. He was of average height but when stripped was thin almost to the point of emaciation. What was more he continued to lose weight and naturally was in a weakened condition. He declared that his appetite was good and that he ate large quantities of meat but he always felt very cold. When sent to me he had scarcely strength enough to walk.

"Here was the very subject I desired. I began the applications at once. Each one lasted 40 minutes, during which time the patient absorbed 1,700 calories. You will understand that this was an extreme case and therefore called for a lower amperage and higher voltage than I would usually recommend. At the end of the series of treatments I was rejoiced to see that the patient's weight had increased considerably and that he had far more energy. Moreover, he was eating far less than when he came to me. Is not that a proof that to a large extent electricity can replace food."

Prof. Bergonie smiled.

"I am not trying to urge the elimination of all food and the replacing of soup, meat and vegetables by a purée of amperes and a filet of volts," he declared, "for in that case I would be flying for my life before a horde of enraged market men. It is an impossible thought that electricity can ever fulfill all the functions of food but I will say this in all seriousness: the time is not very far distant, in fact we will both probably live to see it, when all troubles arising from insufficient food, the disorders of metabolism, will disappear before a reasonable application of the high frequency current."

I left Prof. Bergonie with the pleasant impression of a man who knows he is on the right track toward being of help to humanity and rejoices that he can ease the ailments of troubled humanity. In view of his ideas, though, could I resist the thought that his background of working tables with battery jars and generators on them might be a prophecy of the dining tables of the future?

Canadian Farmers use Niagara Power

The farmers in the central sections of Ontario, Canada, have joined hands with the Hydro-Electric Power Commission to solve their rural difficulties in a rough but effective way. In one county the commission has commenced the construction of a trunk line, but the farmers will build the branches under expert supervision. The swamps will yield the poles and the farmers will haul them out and do the digging and erection. Upon such a coöperative contract the rural communities have entered with eagerness and some of the farms will be equipped with electrical power by the beginning of next summer.

An instance of how the propaganda has taken hold is the extension of a dairy farm near Beaverton to accommodate 210 cows, all of which will be milked by electricity. The owner milks 75 by that method at present and his neighbors are preparing to discard the old hired man arrangement as quickly as the government can bring them the condensed energy of Niagara Falls.

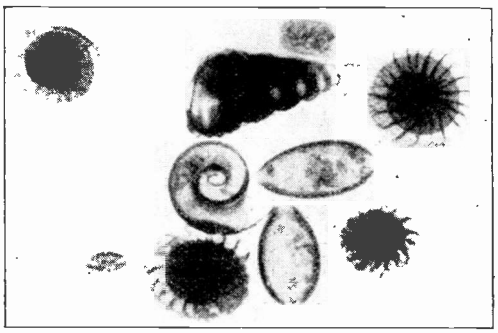
The Hydro-Electric Commission of

Ontario was organized on application of a hundred or more municipalities and financed with public money. The commission undertakes the construction of all transmission lines throughout the province, while the municipalities are responsible for construction and distribution within their own borders; in other words the commission is the wholesaler and the towns and cities the retailers. Recent legislation has placed in the hands of the commission almost autocratic powers of control over the municipalities, such as their rates of charge, the standardizing of equipment, the disposal of surplus profits and other points whereby the efficiency of the commission shall not be jeopardized by carelessness or incompetence of local bodies.

Microradiographs

M. Pierre Goby's new X-ray method is likely to work a revolution in microscopic work, as this is the first time that the rays have been applied so as to show up the internal structure of minute specimens, although we are familiar with the results which are obtained with ordinary sized objects. He uses a special electric apparatus for producing the X-rays, and combines this with microscope devices in such a way that the rays show the otherwise invisible parts within the minute objects. It would be difficult and in the majority of cases impossible to see the structure in any other way.

FROM A MICRORADIOGRAPH OF THE FORE AND REAR MEMBERS OF A SMALL LIZARD



A PINCH OF SAND FROM THE SEASHORE CONTAINS MINUTE SHELLS. A MICRORADIOGRAPH SHOWS THE REMAINS OF LIVING ANIMALS

As an example, take a pinch of fine sand from the seashore. Putting it under the microscope we often find that it is made up of very minute shells which could not be detected by the eye. But M. Goby's apparatus now allows us to go farther and see the inside structure of the shells or other remains of living animals and he even discovers new species in this way where naturalists could not detect any difference from a simple outside examination of the specimens. The structure of the objects often reveals a regular design which is very attractive.

Not only can the X-rays be used with microscopic specimens, but even small animal specimens can be examined by magnifying them, say up to 20 diameters. For instance, we illustrate some of the parts of a very small lizard from the south of France, and it would be hard to observe these by the ordinary X-ray method. Now the parts, such as the minute bones and other details, are very distinct. The inventor is working on his apparatus at Grasse, France, and promises a more complete description later.

Courtesy of The Illustrated London News

THE REVEALING RAY

This picture from a sketch by a newspaper correspondent with the Turkish Army, vividly portrays victorious Turkish infantry, preceded by the revealing ray of a powerful searchlight, entering the village of Papas Burgas at midnight, on Nov. 17 of last year just as the Bulgarian forces were withdrawing. After the day's battle had silenced the Bulgarian batteries, the Turks secretly placed a searchlight on a hill overlooking the town and at midnight as it flashed down upon the startled village the ghostly, unheard-of scene here depicted took place.

THE FAMOUS AERIAL ELECTRIC CABLEWAY IN THE TYROL IN WHICH SIXTEEN PEOPLE MAY RIDE AT ONCE FROM ONE STATION TO ANOTHER 2700 FEET HIGHER UP

How the Swiss Exploit Their Scenery

By FRANK C. PERKINS

It is said that many of the Swiss people who love their mountains and enjoy the beauty and grandeur of the Alpine scenery regard with disfavor the commercialization of these things as exemplified by the scaling of mountains by trolley cars, building mountain hotels and stretching great lines of aerial cableway among the giant precipices. They cannot be blamed for taking this view of the matter, but at the same time they should remember that these modern facilities for travel—brought about very largely by electric power from the glacier fed lakes —enable tens of thousands of people to view the wonders of the Alps who could not do so if it were only possible with the aid of Alpinestock and hobnailed shoes.

After all it is the tumbled peaks, the stupendous distances, the great, silent masses of ice in glittering splendor lying so peacefully miles and miles away up in the air that grip one. A hotel or two, a few hundred yards of track or even a grotesque, cable-slung car in the foreground is of small consequence. It is a simple matter to change one's point of view a little to cut out of sight these man made contrivances and then again gaze at crag piled upon crag, as elemental in their grandeur as the day they were tossed up from the level.

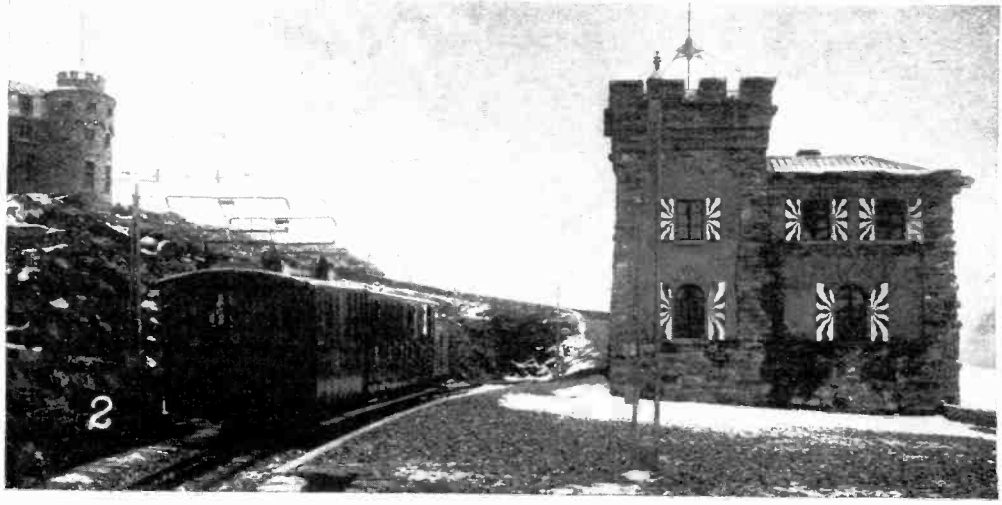
Frequently in the past these pages have contained descriptions and illustrations of the great work which is being done in "electrifying the Alps." But the story is one which does not grow stale so long as pictures of these regions can be presented. To picture the Matterhorn, the Jungfrau or the great Grindelwald glacier hardly needs excuse though they have been seen and studied many times before. And it is pleasurable at the same time to look forward to the day when either the government or private enterprise shall make our own Rockies, perhaps as splendid in every way, just as accessible as the Swiss Alps. It is scarcely fitting that to tread great glaciers and be inspired by snow capped peaks so many of the people of this country should first go through a period of seasickness to view other people's scenery.

One way the Swiss have of making mountain climbing easy and attractive to visitors is shown on the opposite page. This is a famous aerial electric cableway in the Tyrol. Sixteen people may ride in the car at one time. From the lower station you are drawn up by a hauling cable, winding over huge drums driven by motors, and step out at the other station over 2,700 feet higher up. And all through the journey you view the most entrancing scenes at the same time that you are thus easily overcoming the most difficult bit of mountain climbing in the region, if you were to attempt it afoot.

Over on the next page (No. 3) is a more distant view of a similar cableway, at a point on the Wetterhorn on the way up to the Grindelwald glacier. The little station to which the car is ascending is known as the Station Enge. But the highest cableway in all Switzerland provides tourists with easy access to the top of the Vigiljoch. The difference in level between the two stations is 3,800 feet and the total length along the incline considerably over a mile.

The famous Jungfrau, a favorite with tourists, is now much more accessible, by means of the electric railway which winds gradually up to the Station Eisiner 10,273 feet above sea level. View No. 1 shows a section of this interesting railway.

The Zermatt-Gornergratt mountain railway carries passengers a long way up the lonely Matterhorn. View No. 2 shows one of the rustic stations erected at intervals along this line. So artistic is its conception and so in harmony with its surroundings that one cannot believe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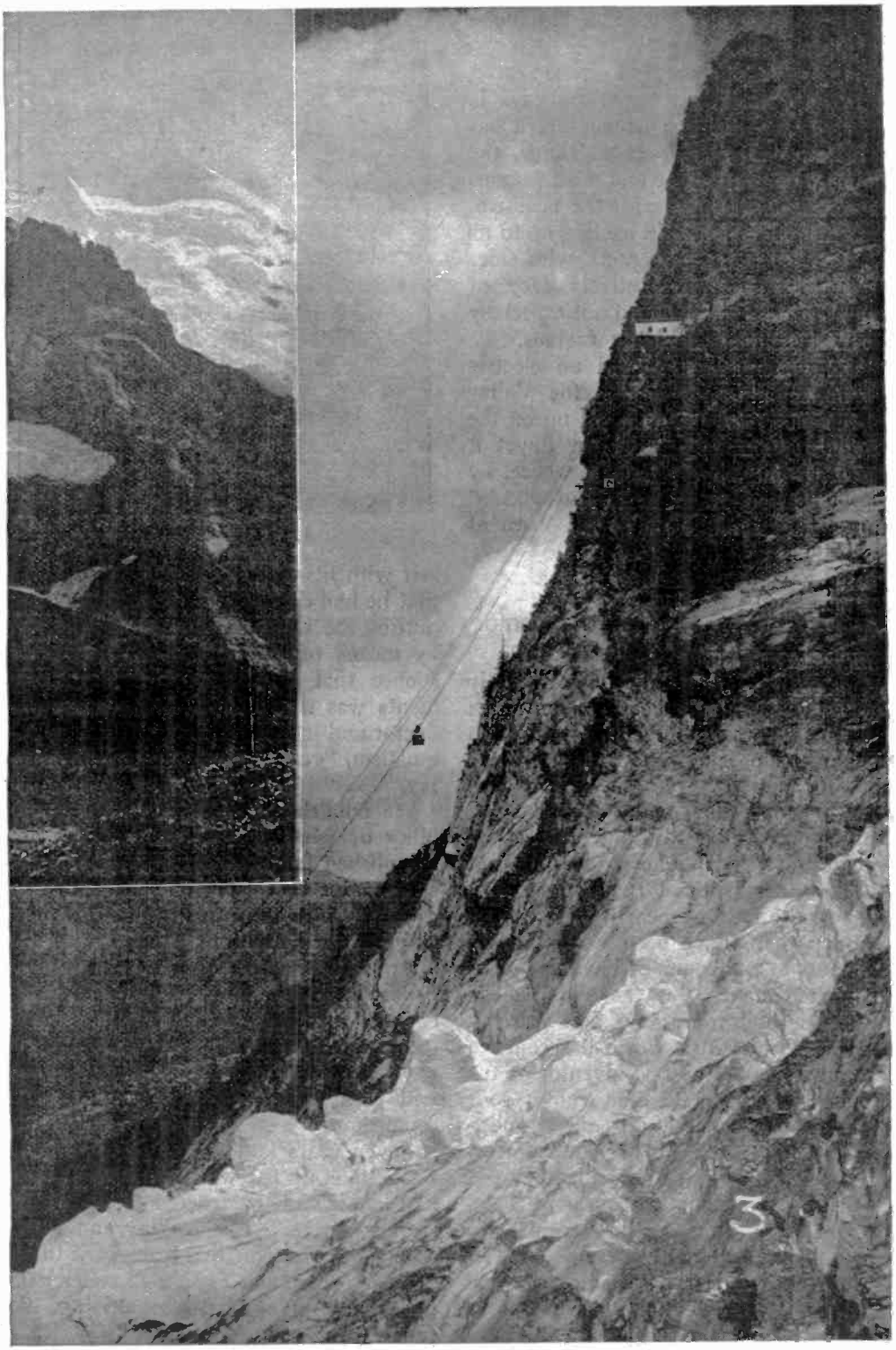


seriously that it is any great blot upon the natural scenery.

With the development of electric cable, rack and pinion and aerial railways in Switzerland, attention of engineers has been directed towards Mont Blanc, the highest peak in Europe and most famous in the Alpine ranges, with the beautiful valley of the Chamounix leading up to its base. On both French and Swiss sides Mont Blanc is comparatively easy of ascent toward the base and not especially abrupt even in the higher regions.

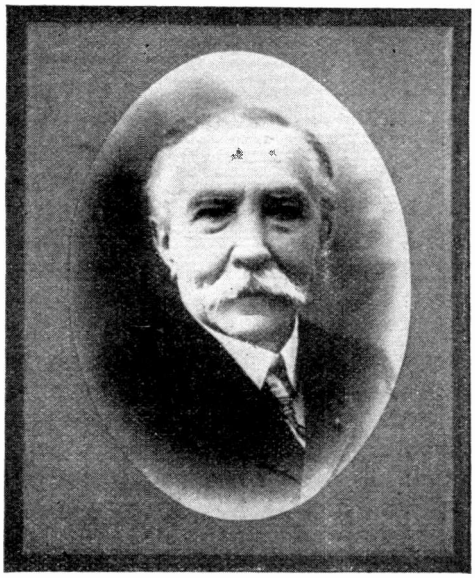
There has been installed an electric rack and pinion road from the Valley of Fayet and Chamounix well up on the side of the mountain. From Fayet it ascends to St. Gervais, from where, by an incline road on a grade of sixteen degrees, it reaches the Col de Vova at an altitude of 5,500 feet.

Charles Bourseul—French Inventor of the Telephone

Le Petit Journal of Paris recently commented upon the death of a French inventor, Charles Bourseul, who died in comparative obscurity, yet who had more title to national recognition by the French people than many recipients of the Legion of Honor. Bourseul was the inventor of a telephone antedating that of Alexander Graham Bell.

As in the case of nearly all great inventions there have been a number of claimants to the honor of having invented the telephone. But, as with Edison and the incandescent lamp, and Marconi and the wireless, the world has come to recognize in Bell the real inventor of the telephone, for he is the man who made it a practicable possibility. Still it is interesting to read of this French claimant.

It was in 1854 that Bourseul, employed in the department of Posts and Telegraphs, asked the French government to take and use his discovery. His superiors did not understand it, and regarded him as crack brained, a man who fooled away his time instead of occupying himself with his work. He told the officials that he had discovered a means of transmitting the human voice a long distance by means of electricity. The only response that he obtained to his statements was that he had better consult a doctor and in an equivalent French colloquialism, "get rid of the bats in his belfry."



CHARLES BOURSEUL

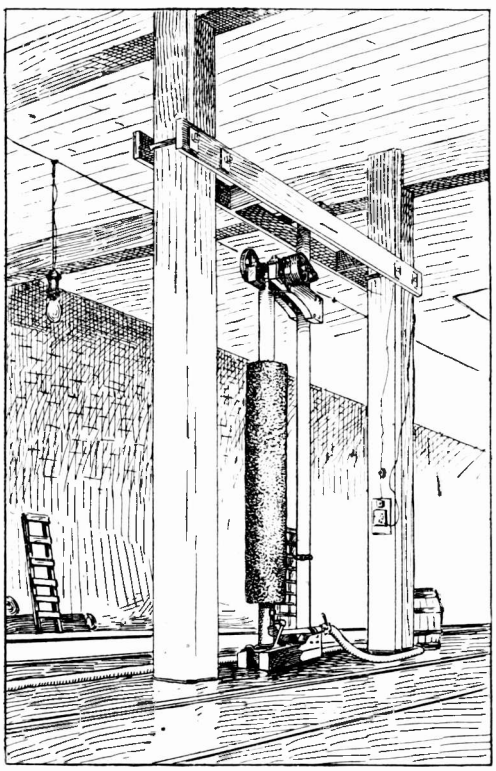
He published his belief in the possibility of what has now become an accomplished fact in the following words:

"Imagine that a person speaks near to a plate which is of such flexibility that none of the vibrations of the voice are lost; imagine also that this plate establishes and interrupts successively the communication with a voltaic pile; under these circumstances it will be possible to have at a distance another plate which will make the same vibrations at the same time."

Seven years later, in 1851, a German, Reiss, took up the work where Bourseul had left it and constructed the first telephone. In 1876 Elisha Gray and Prof. Alexander Graham Bell brought it to its present perfection, Prof. Bell, after long litigation winning final recognition as the practical inventor.

Washing Cars by Electric Power

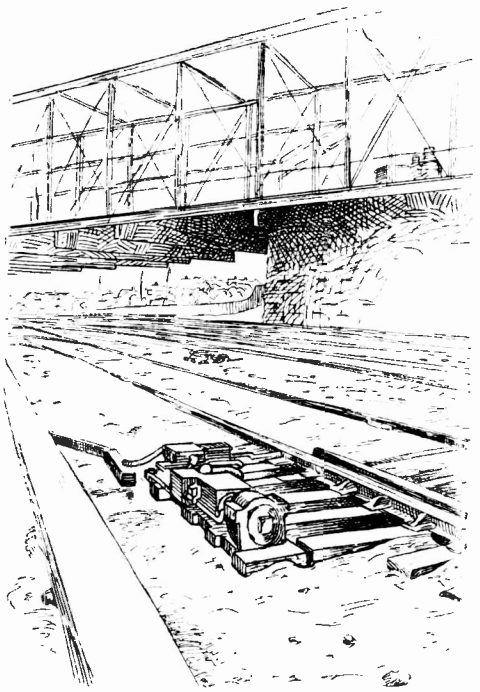
A convenient method of washing the sides of electric box cars is in use in the Seattle, Wash., Electric Railway Company's shops. As shown in the accompanying drawing, the washing apparatus consists of a vertical cylindrical brush piped with water from the shop mains, and driven by a small electric motor mounted on two cross timbers at the top. A car is washed by running it upon a track at the side of the revolving brush, the brush being swung against the windows and panels while a stream of water passes through the space between the bristles. The largest semi-convertible car can be washed in this way in a few moments, and the company obtains a decided saving in labor compared with the old method of hand washing with pole type brushes.



MACHINE FOR SCRUBBING CAR SIDES AND WINDOWS

Electric Motors in Track Switching

Electricity is rapidly gaining ground in the latest railroad work in connection with the movement of track switches. It



MOTOR OPERATED TRACK SWITCH

is free from the troubles encountered in forcing compressed air through hundreds of yards of pipe. In cold weather especially, electricity saves time at points of congested traffic.

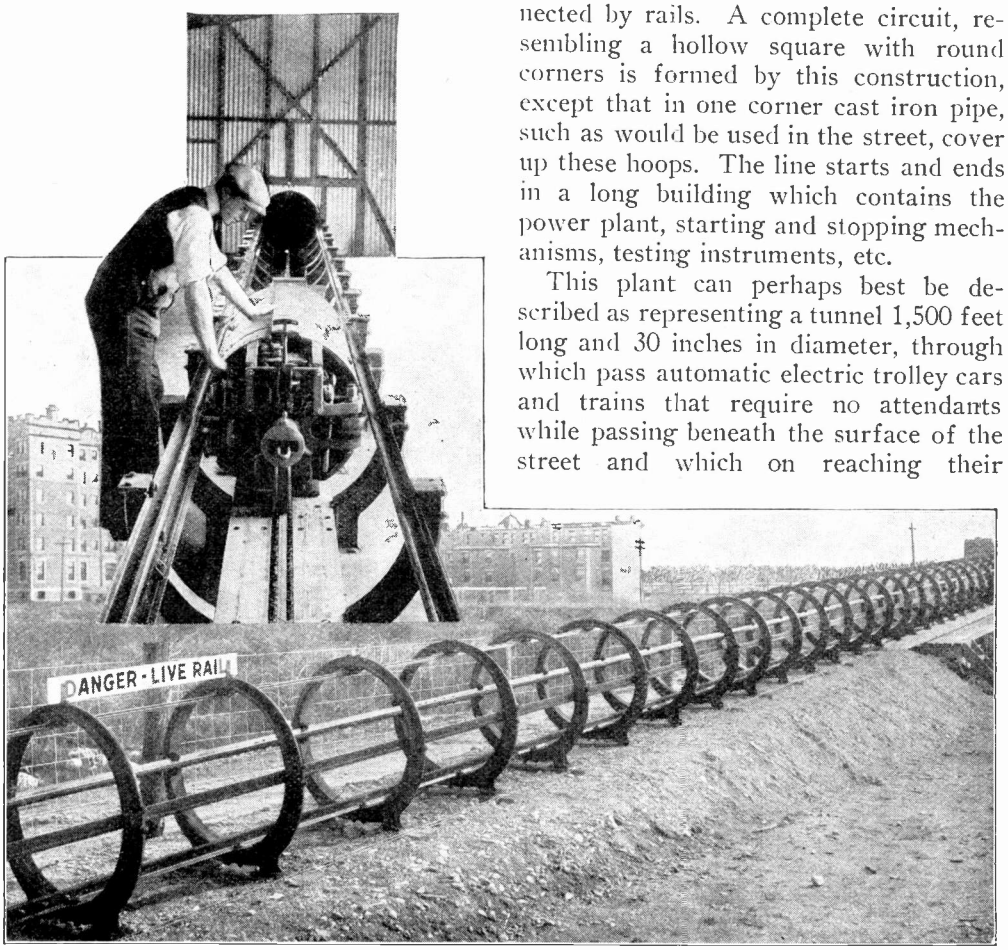
In a typical installation on the Boston & Albany Railroad at Allston, Mass., shown in the accompanying illustration, the motors are located with the switch operating mechanism in the depressed space between tracks and are supplied with electric current from the local central station service. The apparatus works well in the snowy weather of a New England winter. The operator in the switch tower simply pushes the button or pulls a small lever; this starts the motor, which may be made to run in either direction, and the latter opens or closes the switch as the case may be.

Underground Transportation for Parcel Post

The establishment of the Parcel Post in the United States creates many new problems for the post office department to solve. One of the most important of these is that of transporting this bulky mail in the large cities between the main post offices and railroad depots. The rational solution of this problem as worked out by practical post office officials is to connect the more important post offices and depots by tunnels and to thus transport this volume of mail underground.

A system designed to solve this problem is now being demonstrated in Cambridge, near Massachusetts Ave. and the Charles River, and in the rear of Riverbank Court. This system has been installed by the American Pneumatic Service Company. This Cambridge demonstration plant greatly resembles a small scenic railroad; not so small at that, since it is approximately 1,500 feet long. This resemblance is due to trestle work which has been installed in order to provide on this flat river front grades and curves such as would be necessary in actual construction beneath the streets. On this trestle work, and running along the ground from it, is a continuous row of cast iron hoops, which in turn are connected by rails. A complete circuit, resembling a hollow square with round corners is formed by this construction, except that in one corner cast iron pipe, such as would be used in the street, cover up these hoops. The line starts and ends in a long building which contains the power plant, starting and stopping mechanisms, testing instruments, etc.

This plant can perhaps best be described as representing a tunnel 1,500 feet long and 30 inches in diameter, through which pass automatic electric trolley cars and trains that require no attendants while passing beneath the surface of the street and which on reaching their



SECTION OF THE TUBE FRAME OF THE ELECTRIC MAIL CARRIER ABOVE, THE OPERATOR IS ABOUT TO START A CAR BY PULLING THE CONTACTOR AGAINST THE LIVE RAIL

proper station automatically come to a stop. The diameter of this tunnel, 30 inches, is just the height of an ordinary table. A workman could, if necessary, to make repairs, crawl into such a tunnel. The system can, however, be of any diameter. It is designed in particular to cover the field up to a size tunnel in which it would be possible to have motormen on the trolley cars.

The first striking point about the system is that it is automatic, for after the trolley car is once started it needs no further attention either to keep it going or to stop it at its proper station. The second point that immediately impresses you is that this is a mono-rail system; in other words, the trolley car runs on a single rail instead of on two as is the case with most railroads. In addition to this single rail, there is a guide rail on each side of the tunnel to keep the trolley car from tipping over, and a trolley rail on top which acts as a trolley wire and brings the electric power to the car.

The proposed method of building this tunnel is also interesting, as well as most simple. It is expected, with the 30 inches diameter tunnel at least, that in most instances it will consist of ordinary 30 inch cast iron water pipe laid in an open trench. Inside this pipe will be fastened the rails upon which the cars and trains will travel. It is believed that this form of construction will prove very simple and in addition will give a strong and permanent tunnel. Ordinarily two such pipes would be laid in order to give service in both directions as on a double track railroad.

The trolley car is a very substantial looking vehicle. It is about seven feet long and its inside, which is protected by a cover, would easily take in a small man or a boy. It is designed to carry four pouches of mail. The car is shaped something like a torpedo and has bumpers at each end. The motor is outside, although the gears running from it to the driving wheels are enclosed. The car has a sliding trolley contactor. The car also has a reversing switch which permits it to be sent in either direction and a mechanism for moving the car under its own power, but at very slow speed while it is in stations or on sidings.

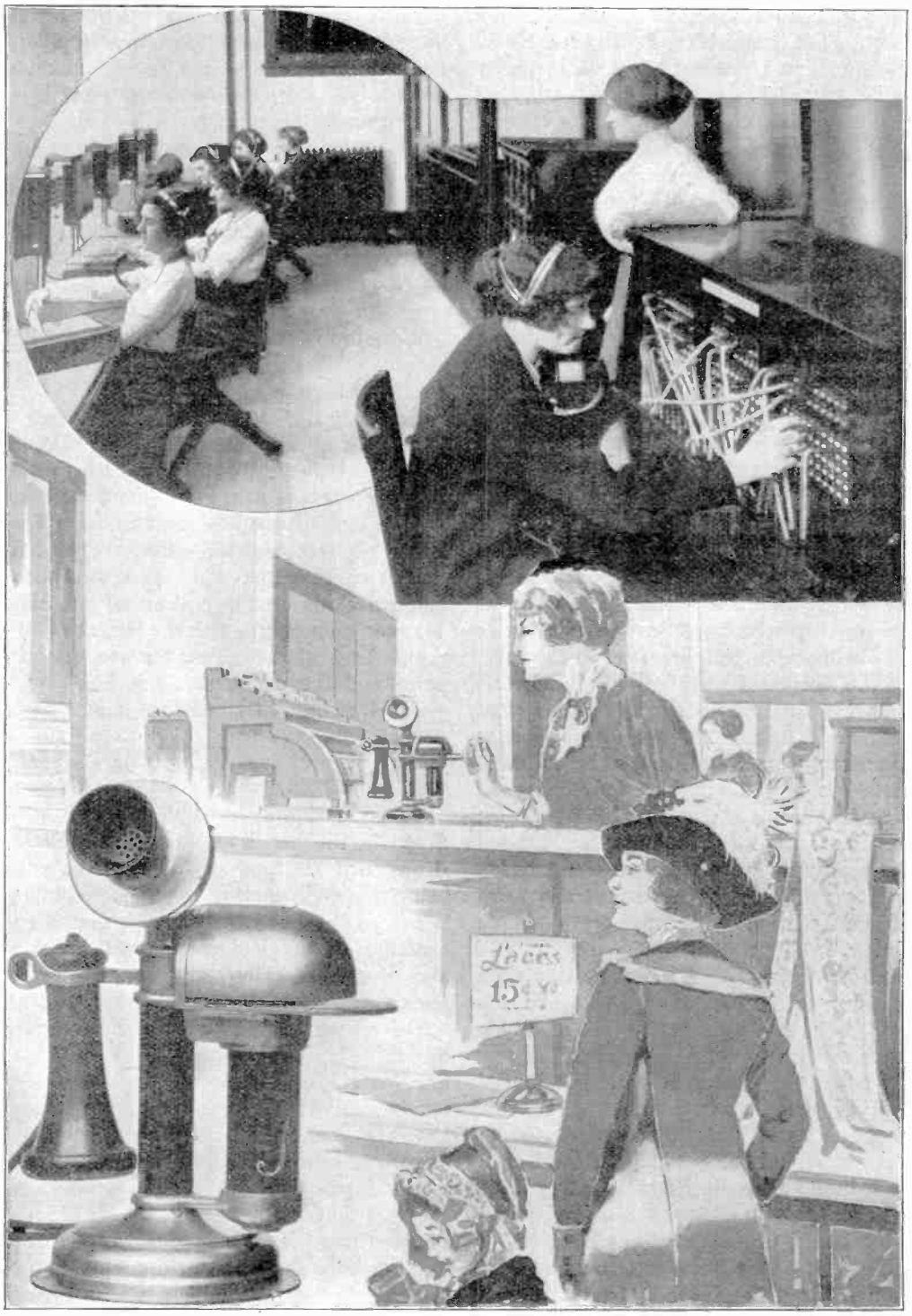
The motor is of a special design and is the most important part of the car. It is so wound that is has practically a constant speed at all loads and when going up and down grades. This characteristic is, of course, necessary to prevent cars overtaking each other while in the tunnel. The motor is started by a switch which automatically releases itself when the car reaches a certain speed.

Stopping the car by itself, and without the aid of an attendant, is a very simple process. It is similar to that used on the roller coasters seen at amusement resorts. At the end of the line and perhaps for 30 or 40 feet wooden skids are placed just above the mono-rail. There are also wooden skids on the bottom of the car. The car comes into the station, the current is lead off the trolley bar at a certain point and the car strikes the skids and gradually and easily comes to rest.

The Electricity of Drops of Water

When a liquid jet divides itself into drops in the air, it is known that these drops are charged positively, the air being charged negatively. This effect has been used by Lord Kelvin as a means of creating electrical charges; it is utilized also for measuring atmospheric electricity.

Dr. von Bernalak, of the University of Heidelberg, in an article in *Annalen der Physik*, gives us opinion that this production of electrical charges is intimately connected with the formation of drops infinitely small which accompany the principal drops. He establishes the fact that if the number of these secondary drops is increased so as to produce rapidly the large primary drops at the outlet of a tube which has its lower end enlarged, the total amount of the charge is considerably augmented.



THE TELEPHONE CREDIT CHECK SYSTEM IN OPERATION

A Telephone Credit Check System

In large department stores where goods are sold on credit, a system is necessary for checking the credit standing of customers at the time of the purchase. A system for this purpose was recently installed in the new Rothschild department store, Chicago. The two requisites, speed and accuracy, are attained by means of telephones placed at wrapping desks throughout the store. These telephones are fitted with a special electrical stamp controlled by a separate circuit which permits an o. k. from the credit office being printed on the inserted sales slip. In the credit department is located a switchboard controlled by an operator who switches the calls received to the girl handling the particular section of the alphabet in which a customer's name is located. The credit files in the form of card indexes are conveniently located in front of each girl and to each is assigned one of the six divisions. For example, girl No. 1 has charge of all calls from A to D, etc.

CURB STREET LIGHTS AND HOUSE NUMBERS

If a customer, S, desires to have a purchase charged to her account, the cashier-inspector at the station where the goods are bought inserts a sales slip under the little hood attached to the telephone standard, calls for authorization clerk No. 5, hangs up her receiver and resumes her duties.

In the credit room the operator switches the call to clerk No. 5 and a lamp is lighted in the board at her desk, which indicates that a credit is ready to be passed upon. The lamp remains lighted until the call is answered. Clerk No. 5 then calls the inspector, who gives the name and address of the customer and the amount of sale. The inspector then hangs up the receiver. Referring to her cards, clerk No. 5 ascertains the customer's credit standing and if found satisfactory presses a key which prints an o. k. on the sales slip which was inserted in the instrument down at the sales counter. If there is a question about charge, the customer is asked to call at the office of the credit manager, where it can be properly adjusted.

Street Lights Along the Curb

A plan to aid in finding house numbers at night and at the same time to illuminate the street by throwing the light from the curb directly over the surface of the roadway is here illustrated.

Within a metal hood open upon the side towards the street is an incandescent lamp. The hood is secured to the cement curbing by bolts embedded in it. The interior of the hood is lined with a reflecting material and upon the base of the hood facing the street is a beveled edge for the street number. The hood is arranged so that the lamp is locked in. The lights may be replaced in a staggered position as shown affording a light free from shadows at the street surface. The idea is patented by Thomas S. Brown, Hemet, Cal.

In Recognition of Faithful Friends

The homeless cat, the stray dog and the injured horse have received a recognition of their devotion to humanity in the opening of a hospital for them at East Twenty-fourth Street and Avenue A, New York City.

The hospital, which is a three story building, was built by the Society for Prevention of Cruelty to Animals, is provided with everything necessary to care for its patients, including even a roof garden for their exercise, and affords an example of the modern applications of electricity.

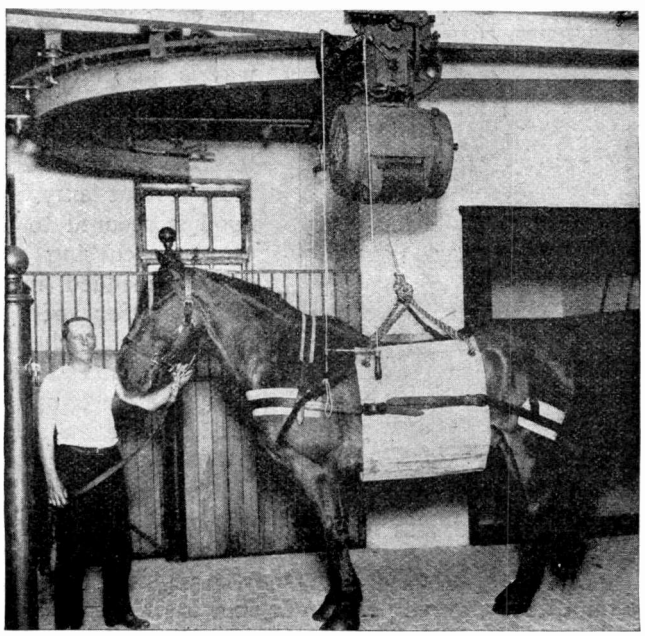
According to the *Edison Monthly*, a sick or injured horse is brought to the hospital in a specially built ambulance. An electric elevator conveys ambulance and horse to an upper floor where an electric one-ton hoist upon an electric trolley lifts the animal clear of the floor if need be and conveys it to the operating room. A $1,200 operating table with adjusting mechanism enables the surgeon to place the horse in any desired position. This room is lighted by 44 electric lights and contains operating tables for handling dogs and cats.

CONVALESCING UNDER THE ELECTRIC BLANKET

Cats and dogs are kept each in neat clean cages properly lighted by electricity and even provided with electric warming pads where needed. A place is also arranged in which to keep dogs suspected of rabies.

In the horse ward are box stalls, all lighted by electricity, and also a "threshing stall" with sixteen inches of peat moss on the concrete floor where a horse suffering from colic may be confined.

As in hospitals for human beings, there is a contagious ward, with electric lights shaded to protect the eyes of the dumb patients from the effects of the glare.

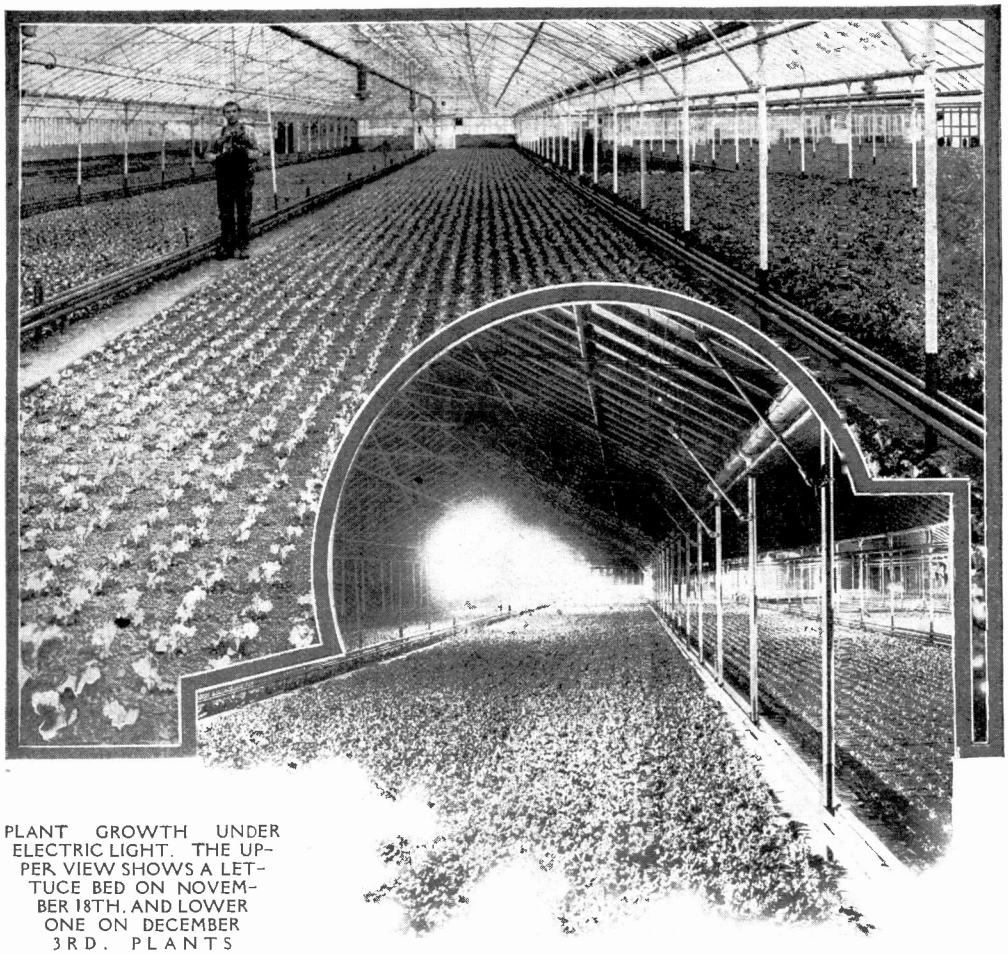


FROM ELEVATOR TO OPERATING ROOM BY TROLLEY

Piecing Out Daylight to Hasten Plant Growth

Experiments have been made at the Cornell (N. Y.) Experimental Station, at the West Virginia Station and by W. W. Rawson, a well known vegetable grower of Boston, to determine whether electric light, either arc or incandescent, can be advantageously used upon lettuce to piece out the sunlight in midwinter, and the accompanying pictures show the interior of the Walla Walla Hothouse Vegetable Company, Walla Walla, Wash., where excellent results are also being attained. A partial view of six flaming arcs can be seen in the daylight picture.

Regarding results Mr. F. E. Mojonnier of the company says, "The daylight picture shows in the foreground a bed of lettuce transplanted a week before this picture was taken. The night picture shows the same bed of lettuce taken from almost the same spot sixteen days after the first picture. During this period the lights were turned on continuously at night and the great growth secured must be attributed to the effect of the light, as from my experience it is impossible to make such a growth in winter in that time when the days are short and often



PLANT GROWTH UNDER ELECTRIC LIGHT. THE UPPER VIEW SHOWS A LETTUCE BED ON NOVEMBER 18TH, AND LOWER ONE ON DECEMBER 3RD. PLANTS GROW DAY AND NIGHT

dark, without the aid of the lights. We also installed," says Mr. Mojonnier, "sixteen 500 candlepower Mazda lamps in another part of the houses to test the relative merit of the two systems. While lettuce grows rapidly under the influence of the Mazda lamps it is inclined to be more spindling and light weight than that grown under the flaming arcs. We account in part for this by the considerable quantity of carbonic gas thrown from the arcs which is absent in the Mazda installation. This gas is a food for vegetation and is promptly taken up."

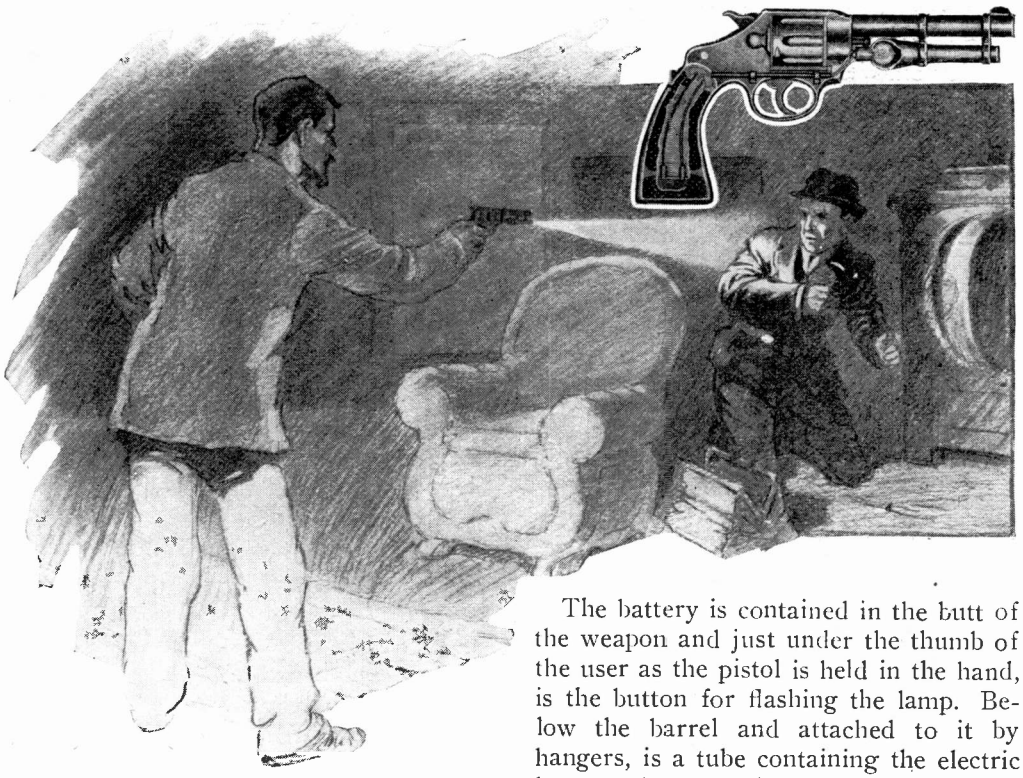
Referring to the other experiments, Mr. Rawson saves a week upon each of his three winter crops by the use of three ordinary street arc lamps hung over a house 370 by 33 feet. At Cornell the effects upon lettuce have been marked in all tests and the gains in maturity have been as much as two weeks.

Revealing Power of Light

It has been pointed out that not only the direction and intensity of light, but its color, must be considered in estimating its power to reveal fine details. Experiment shows that most persons are shortsighted for blue and violet light. When patterns are illuminated alternately with red, green and blue light, it is found that for ease of seeing minute details, blue and green light are preferable to green for short distances, but that at greater distances red light gives the best results.

Searchlight Attachment for Pistol

A lighting attachment for a pistol, consisting of a battery, electric lamp and a push button for controlling the light, has been patented by Clifford A. Lewis of Portland, Oregon.

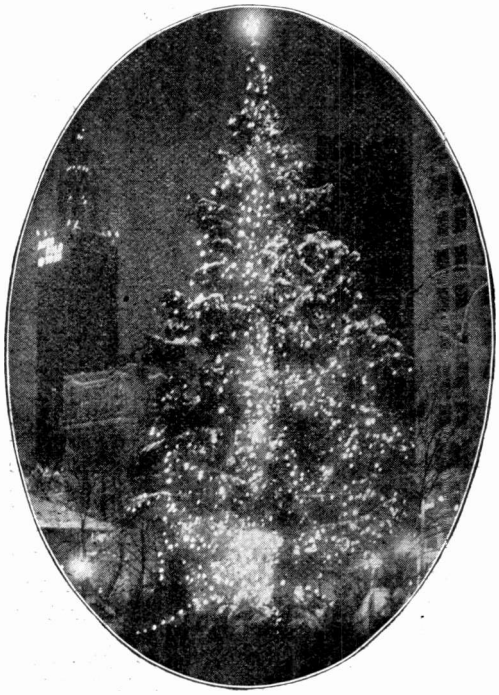


THE PISTOL SEARCHLIGHT AND ITS EVIDENT ADVANTAGE

The battery is contained in the butt of the weapon and just under the thumb of the user as the pistol is held in the hand, is the button for flashing the lamp. Below the barrel and attached to it by hangers, is a tube containing the electric lamp and a lens for directing the rays of light.

The Tree of Light

With a tree and a carol, the Christmas spirit was revived in New York, and thousands of dwellers in that busy city where sentiment is supposed to lie dormant paused in their hustle and bustle



AN OUTDOOR CHRISTMAS TREE

to gaze at a thing of beauty that blazed against a background of park elms and tall buildings. It was the "tree of light," conceived in the mind of one who would provide cheer for those in whom the spirit of Christmas might need awakening and all the holiday week it gleamed in the darkened park.

The outdoor Christmas tree was a gift in every sense. The tree, a 60 foot balsam, was presented by the Adirondack Club, its transportation was donated by the railroad company, it was erected by an interested New Yorker, the wiring was a gift and the illumination was provided by the lighting company. Even the soloists, the choral societies, and the band gave their services free.

Late in the afternoon of Christmas Eve the "tree of light" was ready. Long before the appointed hour, Madison Square Park was thronged. People had come from all over the city and hundreds paused on their way home. There were shoppers with their arms filled with bundles and tired girls who had waited upon them, but they all stood patiently until the trumpeters sounded the fanfare from Parsifal. High at the top of the evergreen appeared the faint glow of a star, symbolical of the Star of Bethlehem of 2000 years ago. Slowly, as its message seemed borne upon the great throng, it gained in brilliancy until at last it burst forth in all its glory. For several minutes it ruled the darkness, and then the great tree seemed to spring to life as cluster after cluster of vari-colored globes shed their radiance from the branches.

At first the crowd stood in awed silence, then a burst of applause swept over the throng and as the choir burst into "Holy Night," the carol was taken up until a thousand voices were united with those of the singers on the platform. The program continued until one o'clock, when the lights were turned off. Each succeeding evening until New Year's, the tree gleamed from dusk till midnight.

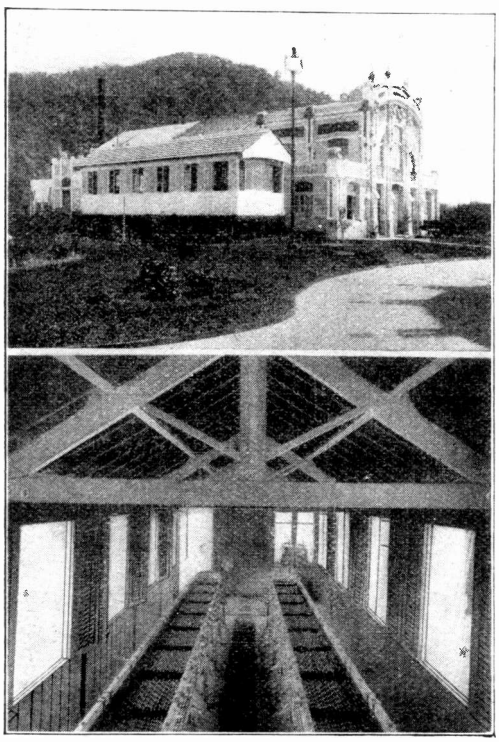
An Electro-Sanitation Plant in Brazil

A remarkable electro-sanitation plant has been in use in the city of Santos, Brazil, for about one year and is reported to be highly efficient and economical in operation. The building has a beautiful parklike surrounding and the power house which stands beside it is of an ornate architecture that resembles that of an amusement pavilion or exposition hall. In reality the sanitation plant is used to render the sewage of the city odorless and innocuous and it accomplishes its purpose so admirably that there is not the slightest nuisance involved in its operation. Although one half million gallons of raw sewage flow through this build-

ing daily in open troughs there is no odor perceptible. This is because of the instantaneous action of the electrolytic treatment which it receives, a process that deoderizes it instantly.

The operation is simple and the apparatus is not expensive to install. The main features are two uncovered troughs containing a series of electrodes, metal plates set on edge with about ¾ inch space between the anodes and cathodes. The proper wiring is connected from the sides of the troughs and the power is obtained from the adjacent power house.

An electric current of from two to three volts and from 700 to 800 amperes is maintained and the electrolysis not only



ELECTRO-SANITATION PLANT IN THE CITY OF SANTOS, BRAZIL

destroys all offensive odor but kills all disease germs, including the typhoid bacteria. The fertilizing properties of the liquid are not diminished by this process, which suggests an enormously profitable method of soil renewal.

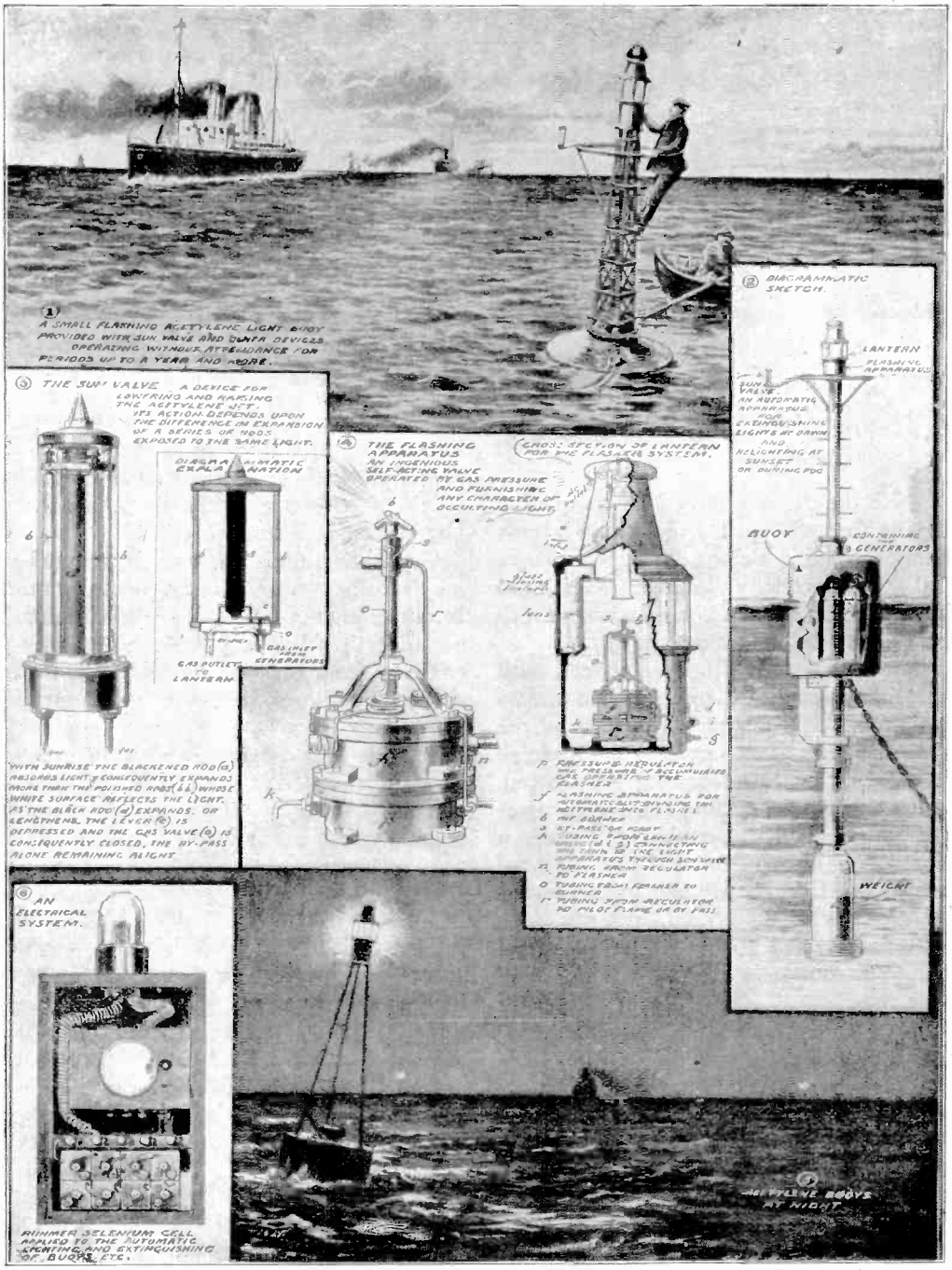
The cost of this plant was about $10,000 and the cost of operation is very slight, about $10 or less per million gallons treated. The only labor required is the inspection of the electrical apparatus and the cleaning of the plates by reversing the current a few times a day.

The Sun as Lightbuoy Tender

It is announced that a feature of the Panama Canal will be a number of acetylene lighted buoys marking the channel entrance, and these will be extinguished by the sun rising in the morning and automatically lighted when the sun goes down and darkness comes on.

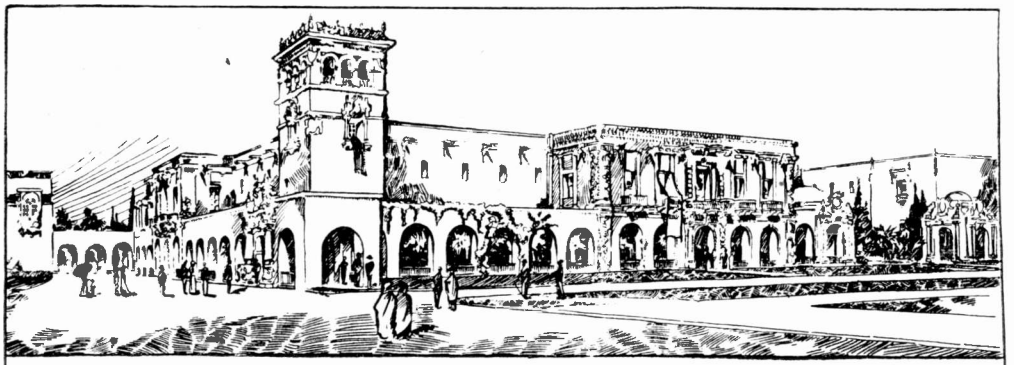
There are two systems proposed as shown in the illustration. One is that of Gustaf Dalen, the Swedish physicist. This is mechanical. Briefly, the warmth of the sun at dawn, falling on a rod which rests on a lever, expands that rod and so moves the lever which closes the gas valve. At night the rod, getting cooler, contracts, and so opens the valve and lets the gas pass, to be lit by a small jet always left burning. The rod can be adjusted according to the temperature conditions of any country.

The other system proposed, which is electrical, is that of Ernest Ruhmer. It was briefly described in the March 1912 issue of this magazine. It depends upon the substance selenium for its operation. Selenium has the property of being highly resistant to the flow of electric current when in the dark but becomes a good conductor under the influence of light. It is placed in a battery circuit in the buoy in such a manner that when the sun rises and strikes the selenium cell current flows through the circuit and operates an electro-magnetic device which turns off the gas. When darkness comes the selenium becomes highly resistant, cuts off the flow of current, and, the electro-magnet being released, the gas flows again and is lighted by a small permanent jet as in the case of the Dalen system.



By Courtesy of the Illustrated London News

TWO TYPES OF ACETYLENE BUOYS PROPOSED TO MARK THE ENTRANCE TO THE PANAMA CANAL. BOTH ARE CONTROLLED BY THE LIGHT OF THE SUN—ONE BY AN ELECTRICAL DEVICE EMBODYING THE SELENIUM CELL



ELECTRICITY BVILDING

Electricity Building at Panama-California Exposition

With the expectation of its completion by the first of April, 1913, there is now being erected in Balboa Park, San Diego, Cal., the Electricity Building which is to be a part of the Panama-California exposition to be held there in 1915.

The structure is 250 by 300 feet, with balconies here and there and with towers which will be covered with vines by the time the exposition opens. The Spanish colonial style of architecture is followed, and, in fact, the building is modeled after the palace which Comte de Heras, a Spanish nobleman, erected for his own use in the City of Mexico in the seventeenth century.

It is planned to have the electrical building contain an exhibit which will give the history of the use of electricity from the beginning of its adaptation to man's use down to date. As far as possible every electrical discovery and every instrument or device which has been developed will be shown, the progress from the beginning being shown year by year in regular sequence. As a result of this every visitor to the building will obtain a comprehensive idea of the multifold uses to which man has put electricity.

The latest models of electric vehicles and boats will be shown, along with all kinds of electric motors, lighting, heating and medical apparatus. Upon the exterior the building is to be a study in lights at night and is expected to far surpass even the famous electric tower which was such a feature at the Pan-American Exposition in Buffalo in 1901.

Great progress is being made, it may be incidentally stated, in the preparations for the Panama-California Exposition at San Diego, which is to be distinct in every way from the world's fair to be held at San Francisco the same year. It is planned to open the gates on January 1st, 1915 and to keep the exposition going until the end of the year. This arrangement is possible by reason of the equable climate which San Diego enjoys.

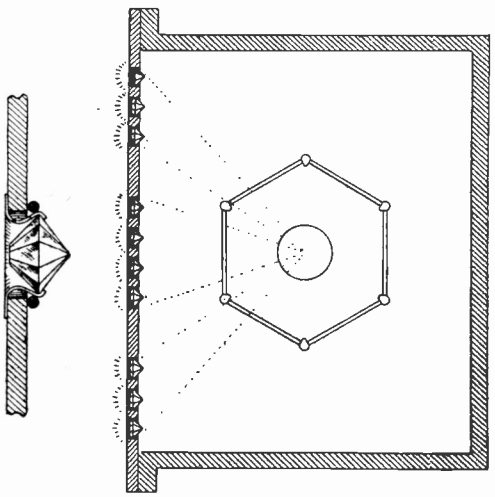
The Diamond Electric Sign

The "Diamond" electric sign is the latest French idea in this line and it uses letters made up of cut glass pieces cut like gems. When different colored light is thrown through the clear glass pieces, it makes them glow and sparkle like so many diamonds, and the effect is a striking one. The method of working is very clear. On the front board the cut glass gems are set in holes so as to make up the letters, clear glass being used in all cases so as to allow different colored light to pass.

Back of the board is a revolving drum with translucent glass faces, each face being of a different color, and inside the drum are incandescent lamps placed

along a row. When the drum revolves, the colors are thrown upon the glass gems in varied fashion, so that the gems appear to flash with a changing glow and thus produce a flaming effect which is very striking.

A small motor or clockwork rotates the drum, and the inventors point to the use of a low current for lighting the few lamps employed, so that a good sign can be had at a low cost for current, this being much less than where the letters are made up of lamps. If need be, the



THE DIAMOND ELECTRIC SIGN

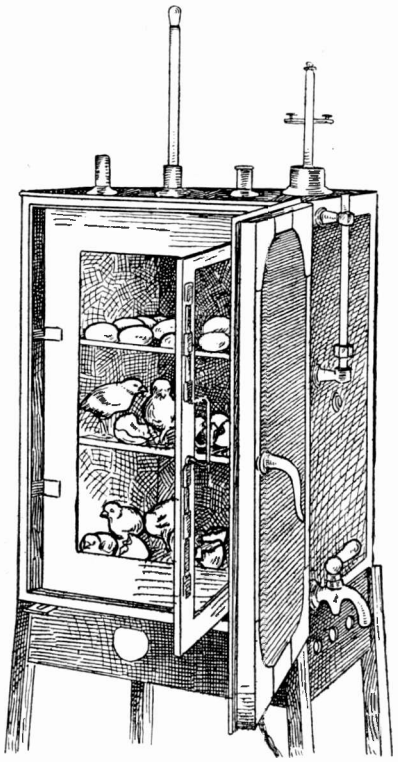
sign can be put out and lighted at intervals, by the revolving device. Even in daytime the sun strikes on the diamond faces and gives a very brilliant effect.

Electric Incubator and Brooder

An electric incubator and brooder which is finding much favor in Germany is described in *Mitteilungen* the publication of the Berliner Elekricitäts-Werke. With this incubator it is possible to approach very closely the results of natural incubation, and thus reach a very favorable result (80 per cent) in the hatching of chickens from artificially incubated eggs.

The heat produced by an electric current is made in this apparatus to regulate itself to a fraction of a degree. In this way a pratically uniform hatching temperature is maintained, which is seldom reached by other artificial methods. This incubator requires no attention beyond the daily turning and airing of the eggs. As a consequence of the automatic heat regulation by the shutting off of the current when the desired temperature is attained, the consumption of electricity is reduced to a minimum, and since the energy is calculated according to power and heating charges, the expense is very small.

The brooder, like the incubator, is built on the principle of making the most economical use of the heat of the current, thereby keeping down the cost of operation. In combination with an electric

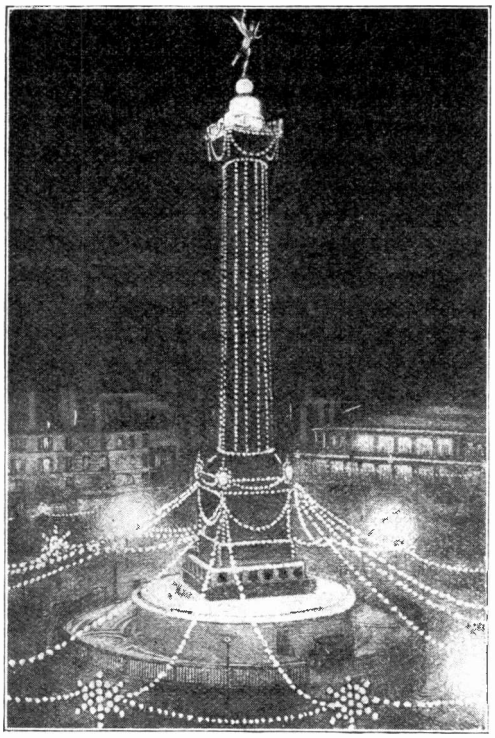


BROODER AND INCUBATOR BUILT TO MAKE THE MOST ECONOMICAL USE OF HEAT

lamp the brooder keeps the chickens comfortable and warm and consequently a very large per cent of those hatched can be reared, whether in winter or spring.

Lighting the Bastile Column

The 14th of July is the French independence day, and corresponds in idea with our own Fourth of July. This date commemorates the taking of the Bastile

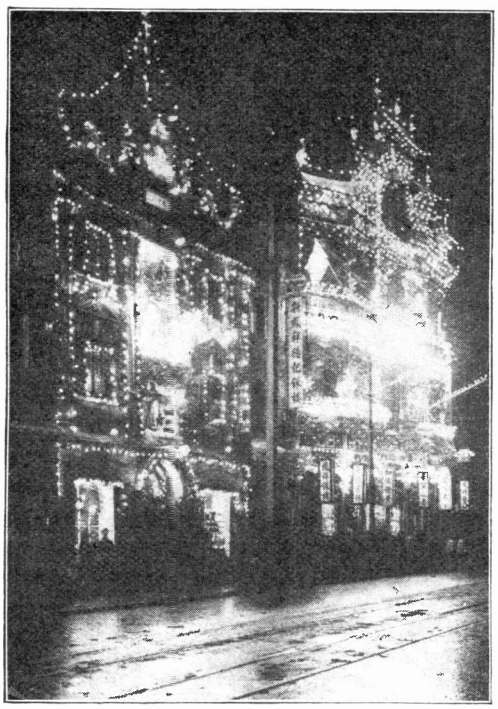


THE FAMOUS BASTILE COLUMN AT NIGHT

during the Revolution and it is also a time of general merrymaking in the streets of Paris, especially at night when the open air balls in the public squares and the illuminations all over town make an attractive scene. Electric illumination naturally heightens the effect, such as the lighting of the famous Bastile column which the photograph shows. On the top of the column the figure of Victory, which appears to be small, but is in reality of colossal size, is brilliantly lighted up by the lamps placed around the platform and the decoration is made up of long rows of lamps running from top to bottom, together with numerous garlands. On the whole this is one of the most interesting examples of electric illumination to be seen in the city.

Electric Advertising in Shanghai

Shanghai, the commercial metropolis of China, has seen such changes in the few months which have intervened since the conservative Chinese empire was changed into a modern republic that it is difficult to realize what the city was a year ago. Space forbids a description of these changes, and indeed this page is not the fitting vehicle therefor, but all those interested in electrical science and its application to modern commercial needs will be interested to learn that John Chinaman, emerging from his Rip Van Winkle slumbers, bids fair to rank with,



VIEW IN SHANGHAI—THE CHINESE IDEA OF ILLUMINATED BUILDING FRONTS

if not excel, the most up-to-date nations of the world in connection with the adaptation of electricity to this form of advertising.

Shanghai has a foreign population of over 13,000. In the international and French Settlements there are 300,000 Chinese, and in the Chinese city itself about 540,000. The total trade of the port for the year 1911 amounted to $153,000,000 in gold, and thus it will be readily understood what the possibilities are for the retail trader.

The Nanking Road, leading from the business section to the residential district, is the principal foreign thoroughfare. For eighteen out of the 24 hours it is thronged with pedestrians—of all nationalities, but principally Chinese—and vehicular traffic. All the principal shops are congregated there, among which are the silversmiths' stores. Three of these places have recently been rebuilt, and have been fitted up in the most elegant and up-to-date manner in order to display their wares to the best advantage.

Not content with internal decoration, the exteriors have been decked, regardless of expense, in a manner which would appear strange to people of other lands, as can be judged from the accompanying picture.

The photograph here reproduced shows the premises of two dealers, in another part of the same road, illuminated. The more pretentious of the two has 2,000 sixteen candlepower electric lights, the other 1,500. These are worked in among the fantastic decorations, some of them of an allegorical nature and operated by clockwork.

Questioned as to whether the results warranted such an expenditure, the enterprising proprietor of one of the stores remarked, "Maskee how much he cost. Can catchee plenty tlade so fashion."

Needless to say, the nightly display attracts crowds of Celestials, who stand open mouthed and dumb watching the free show, obstructing the traffic, and affording the pickpockets an easy mode of livelihood.

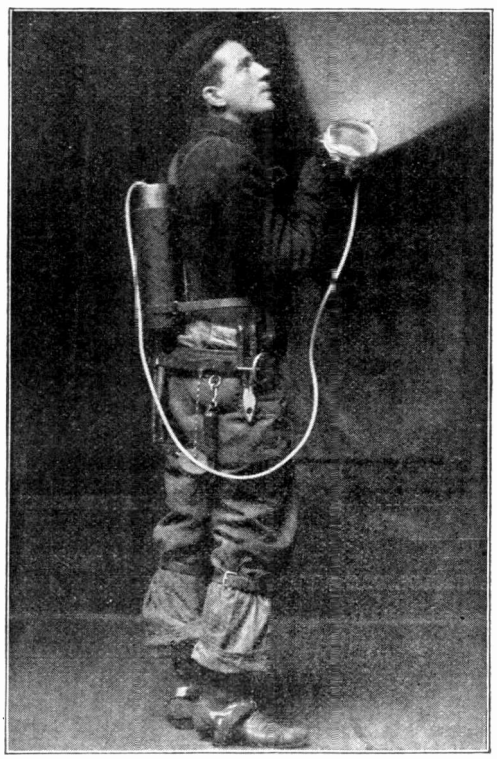
It is stated that the illuminations will be continued indefinitely although the cost is heavy even for a single night.

Troubleman's Portable Searchlight

A portable light that will enable the troubleman to examine the wires on a transmission line at night means quicker location of trouble.

The portable searchlight here shown is fed from a tank with gas at 250 pounds pressure, the tank being carried on the back of the troubleman. The lamp will burn for 70 hours on one charge of gas.

It is possible with this light to see clearly the wires at the top of the highest poles. It furnishes sufficient light from the



TROUBLEMAN WITH A SEARCHLIGHT

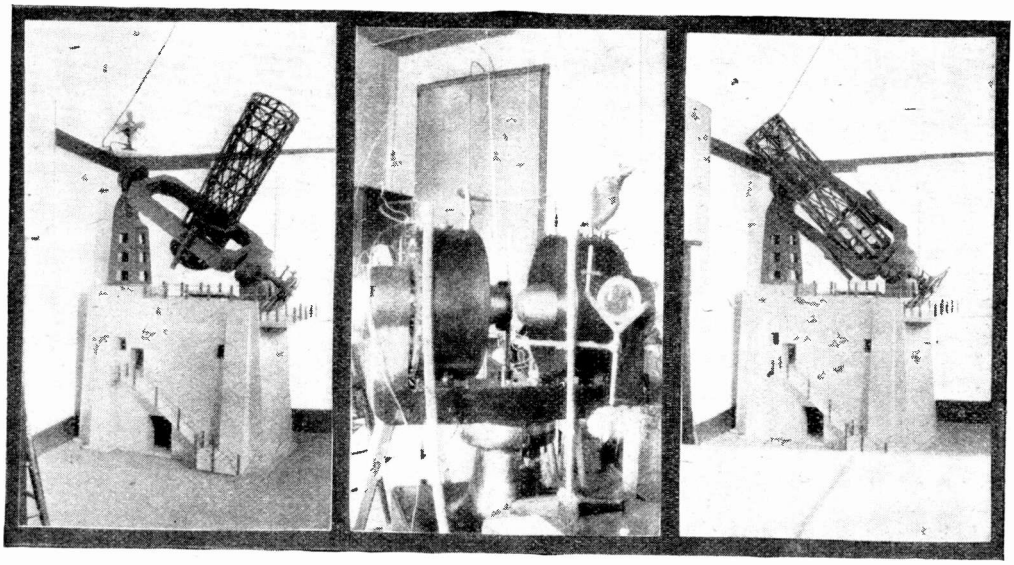
ground for the re-fusing of transformers and the replacing and repairing of lines at once, no matter how dark and stormy the night, with the minimum amount of danger to the man doing the work. As a very large percentage of line troubles occur at night the value of this outfit can be readily appreciated.

Mount Wilson Observatory

Electricity is one of the most important auxiliaries in the work of the modern astronomer and the range of its applications in this field is nothing less than surprising. The Mount Wilson Solar Observatory, in southern California, is one of the most noted installations of this kind in the world, and the accompanying photographs show two or three applications of special interest. The largest telescope on Mt. Wilson is a 60 inch reflector, and when this was hauled up the mountain in parts a few years ago a gasoline-electric truck had to be impressed into service and an old, ten mile trail 30 inches wide rebuilt into a ten foot roadway.

The observatory is planning to erect a 100 inch telescope on the mountain, and this is to be the largest glass of its kind in the world. Recently it was discovered that the glass being ground for this purpose in the Pasadena laboratory of the institution was not flawless and many months of hard and delicate work came to naught. Arrangements have been made for the manufacture of a new mirror, and when the telescope is completed and set up in its new home on the summit of the mountain, it will be capable of being turned at many angles by small motors responsive to the hand of the observer. The great tube's range of motion is shown in the accompanying view of a model frame which the mechanicians of the observatory staff have prepared in studying the possible mountings of the instrument.

The observatory maintains an important laboratory in the city of Pasadena where exhaustive experiments are carried on in the comparison of phenomena noted in the heavens with the results of spectroscopic and other observations made within doors. The accompanying view shows one of the most powerful electro-magnets in the world in use in this laboratory, the magnet being built in two parts and water cooled. When fully excited the coils of this magnet absorb about sixteen kilowatts or about 20 horsepower of electrical energy. By its use many of the conditions of the solar magnetic field have been simulated.

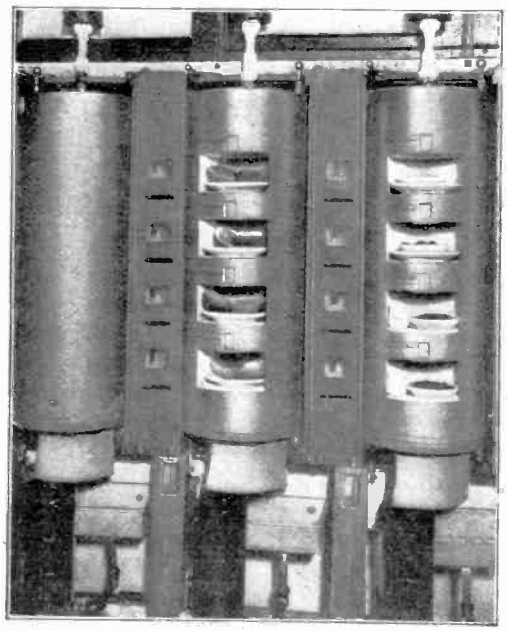


TWO VIEWS OF A MODEL OF A 100 INCH TELESCOPE MOUNTING.—MOUNT WILSON OBSERVATORY. IN THE CENTER IS A GIANT ELECTRO-MAGNET IN THE OBSERVATORY LABORATORY. FOR STUDY RELATING TO THE SOLAR MAGNETIC FIELD

Money-in-the-Slot Restaurant

Mr. Edison predicts automatic or money-in-the-slot stores and the "Automat Lunch" at 1557-63 Broadway, New York, which now feeds 10,000 people daily, goes far towards verifying his prophetic vision.

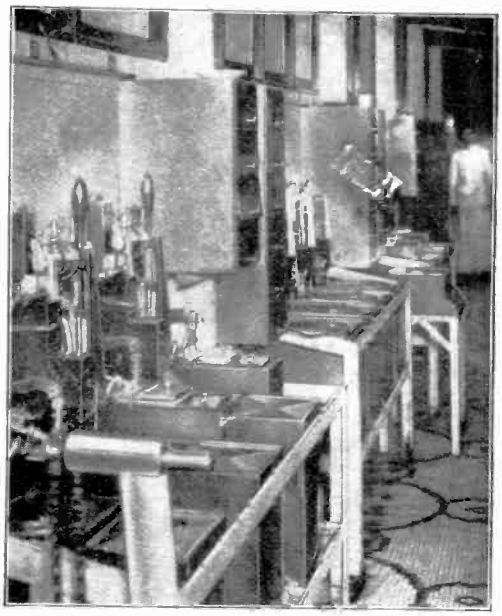
Passing under a big electric sign and through a doorway surrounded by a $6,000 stained glass window, mechanical coin devices in connection with drums and enclosures that contain foods and drinks to suit any palate are found. Hunger



COOLING CABINET FOR FOOD PREPARED AND READY TO SERVE

may be appeased by inserting a coin of proper value and either turning a knob or pulling a lever. Through glass windows the customer can inspect the food he is to pay for.

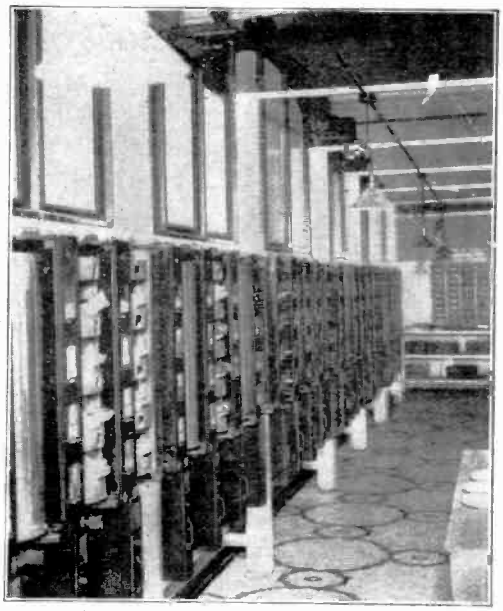
The drums containing the ice cream are kept chilled by a surrounding jacket through which cold brine circulates. Hot machines circulate hot water through a jacket. Ten hot and cold liquid machines containing orders of tea, coffee, milk, buttermilk, etc., are operated by electric



HOT AND COLD LIQUID MACHINE OPERATED ON THE COIN-IN-THE-SLOT PRINCIPLE

pumps which measure the proper amount at each helping. Even the cream is poured into the cup before the coffee.

Three motor driven ice machines in the



REAR OF THE FOOD CABINET FROM WHICH THE DISHES COME FORTH WHEN A COIN IS DROPPED IN THE SLOT

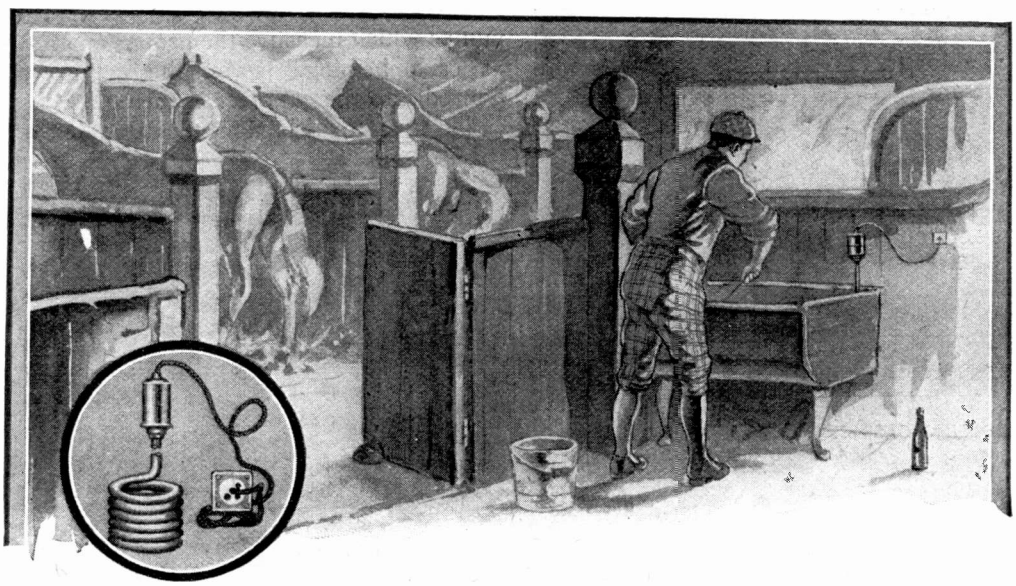
basement constitute the refrigerating plant and two electrically operated dish washing machines on the top floor take care of the soiled dishes sent up by an electric conveyor. Tungsten lamps are used for lighting and 22 electric fans provide ventilation.

Although the tile floor, ornamental columns and glistening machines are inviting, there are those who are still a bit shy and these may find beneath the main floor a room where 240 people may be served in the old "Order, please" way.

Warm Meals for the Horse

In the cold, windy days of winter, the horse is called upon to face the sleet and storm, and this faithful beast appreciates a warm supper after such a day's work as much as does his driver.

In the preparation of this feed the electric heater comes into convenient service as most livery and boarding stables are lighted by electricity. The American heater suitable for this purpose consists of a metal coil within which is contained the heater wire. The coil may be set into a pail or trough of feed and water and a connection by a length of flexible cord and a plug made with the nearest light outlet. In two or three minutes' time the feed is warm and is far better for the horse than an ice cold supper.



THE ELECTRIC HEATER IS A VALUABLE ADDITION TO THE STABLE EQUIPMENT

Automatic Compasses for Ships

There is a form of compass that automatically registers the route followed by a ship. It is a matter of practical experience in navigation that the steersman often varies from the course set for him in advance, and sometimes the final effects of these variations may become serious. The Heit compass preserves a record of all the departures made by the ship from the set course from one end of the voyage to the other, and this record may be consulted at any time. The compass is connected with an electric apparatus in such a way that once every minute the angle made by the ship's course with the magnetic meridian is recorded by means of an electric contact.

The records are made on a moving roll of paper, whose motion is so timed that the hour and minute of the contact are

automatically indicated. Thus the ship's captain has continually before his eyes a chart of the course he has traversed.

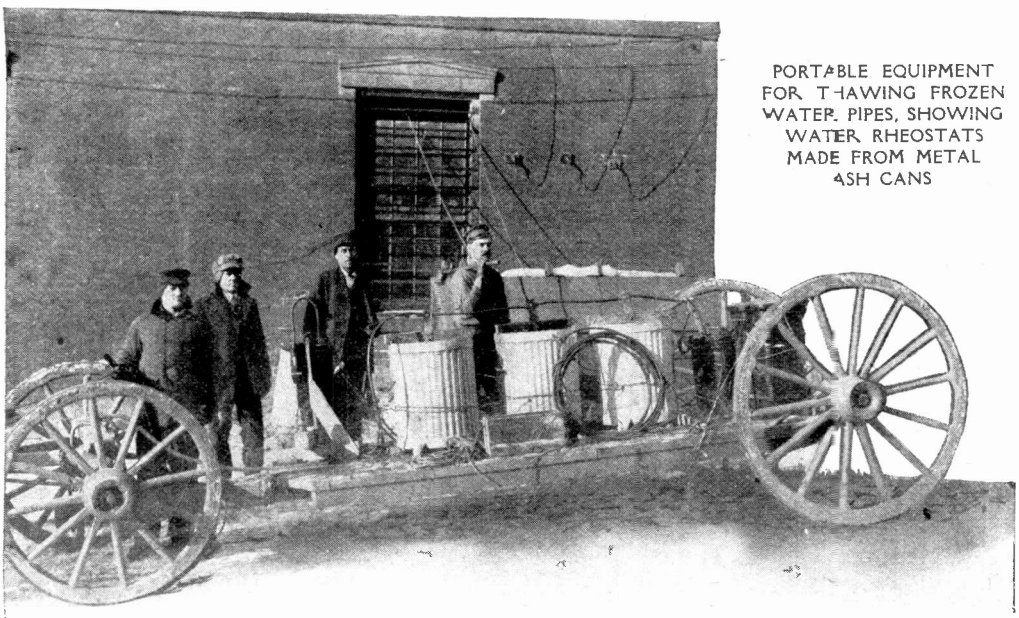
Economical Lighting in a Pumping Plant

An inexpensive method of providing electric lighting is employed in a large pumping station in the East. The plant contains two steam driven pumps of 11,000,000 gallons combined daily capacity, but no small engines. To avoid the inconvenience of installing the latter a fifteen inch Pelton water wheel was purchased and direct coupled to a small dynamo. The water wheel is operated on about 100 pounds pressure per square inch taken from the pumping mains and after the water passes through the wheel it is returned to the station well so that none is wasted. The city reservoir provides sufficient head to run the unit even when the main pumping engines are shut down.

About ninety 40 watt tantalum incandescent lamps are supplied from the unit, the full load each night being about 75 lamps. The equipment requires practically no attention, and the cost of operation is trifling in comparison with the expense of purchasing current or of running and maintaining a steam or oil engine set for illumination service.

Thawing Frozen Water Pipes

A portable emergency electrical equipment for thawing out frozen water pipes was made at Fort Leavenworth Army Post last winter and used successfully all winter. After several frozen pipes had to be uncovered the apparatus shown mounted upon the wagon was used. There are two transformers which were connected to the nearest high voltage pole line through fuses. Current through the piping, which was connected to the 110 volt side of the transformers, was regulated by water rheostats made from large metal ash cans.



PORTABLE EQUIPMENT FOR THAWING FROZEN WATER PIPES, SHOWING WATER RHEOSTATS MADE FROM METAL ASH CANS

The most stubborn case in ¾ inch pipes required thirteen minutes and 127 amperes to thaw out. A two inch pipe took 34 minutes and 327 amperes. In all cases the pipes became smoking hot.

From Ingot to Wire

By H. Bedford-Jones

Americans have learned the lesson that many heads are better than one. Instead of one man putting all his energy into a whole factory system, many men concentrate each on his own department. All important questions now-a-days are settled by committees—not by single individuals.

Sixty years ago there was a canal at Worcester, Mass. The railroad came and the canal went out of business. But it is still of use in the world. Its bed serves as a dipping tank for the American Steel & Wire Company; its water serves to cool the steel and iron of the mills. Each night the mill workers go home along what was once the towpath. Such is the evolution of business in theory and practice. One-man-power would never have harnessed that canal; it would have been too busy harnessing details.

The one hundred and two acres of the Worcester mills in actual use are under various heads. Each of the north, central and south works is a mammoth industry in itself. I had seen cable works and steel mills before, but when I left the general offices and started out to inspect things, I was amazed. Here I encountered the primeval industry, the giant at the bottom of the refined factories higher up in the scale. Here I found men who really worked by the sweat of their brows, and added to it all the other sources of perspiration possible. In the annealing room, standing on the floor gratings, watching the men shifting huge cranes of metal from baths of cleansing acid into annealers and heating ovens, my thoughts went back to Dante. But they did not stop there. They went a good deal farther back than Dante before I got through.

There is a tremendous fascination about copper, the shimmering red-gold metal of many hues. The workmen felt it just as much as I did. I stood looking at the piles of copper wire fresh from the annealers, and the foreman came over holding up a coil admiringly.

"Ain't she a peach, eh?" he exclaimed. "You ought to see her when the ovens are opened!"

I did, and it certainly was beautiful. Outside, in the yard, were row upon row, car upon car, of dull gray coils from the rod mill. These went into the acid baths and came out from the washing gleaming rose-pink. They went into the annealers and came out gold-red, more beautiful than gold—"Mary Garden copper" we called it. It was quite a compliment to Mary, not to the copper.

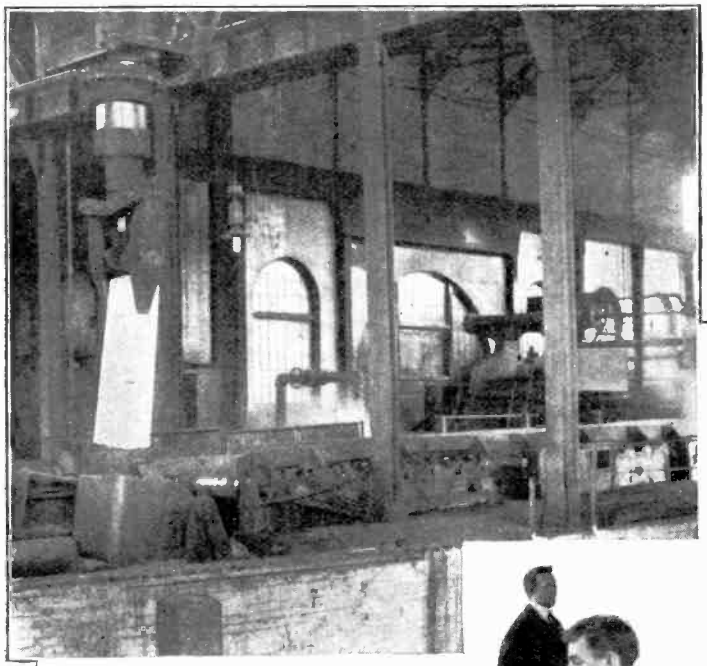
Softened and rendered ductile by the annealing, the coils of wire, both steel and copper, go to the drawing rooms. Here they are drawn smaller and smaller, to go back time after time to the annealing rooms. Rigid specifications demand rigid care and supervision. If the wire is drawn to a greater tension than its ductile capacity will permit it is ruined. Often it is annealed half a dozen times in process, to remove the internal strains produced by drawing.

The beauty of copper wire is by no means an end in itself. It is a means to an end. In the annealing process unless properly manipulated, scale is very apt to form and any oxidization would seriously impair the efficacy of the future product. The metal, while at the high temperature necessary for proper annealing, if kept from all contact with the air will come out as bright as if just polished.

The wire goes to the drawing rooms in various sizes, and the exact specifications must be known beforehand. This latter statement applies all through the whole establishment. The exact use and speci-

fications of the future completed product are known before it goes to the factory. This is borne in mind through every process and for this reason the Worcester plant specializes in special products.

drum. Speech is impossible here. The roaring of the machinery and the dull rumble of whirring wheels is hardly observable until you attempt to talk. Then you notice it. And what a variety of



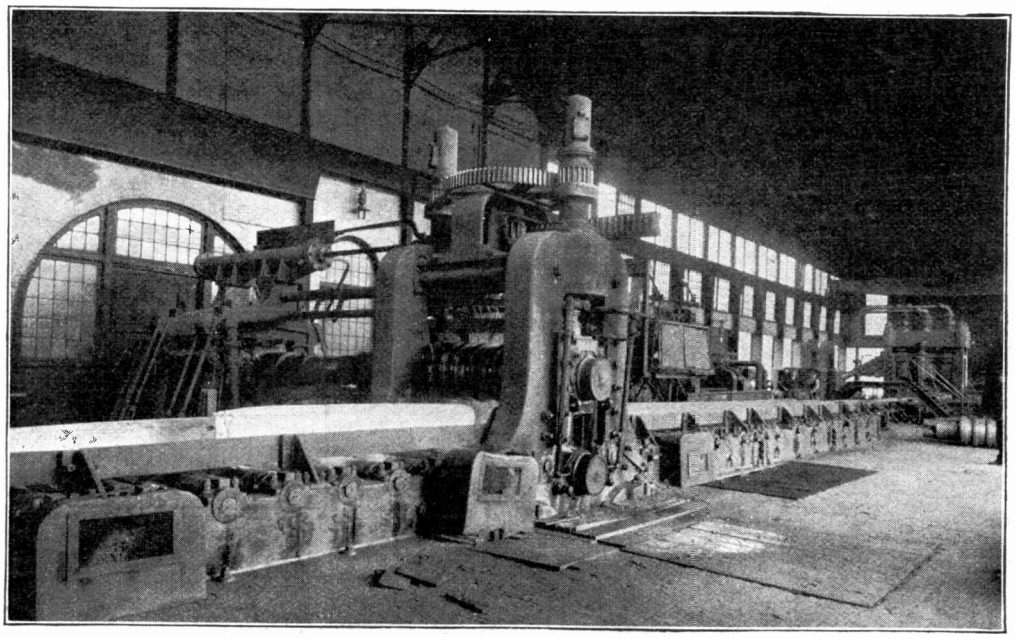
THE TITANIC FINGER FOLLOWS US WITH UNERRING SPEED, BEARING A WHITE-HOT INGOT

THE LABORATORIES ARE ESSENTIAL FEATURES OF THE PLANT AND ARE OF NO LITTLE INTEREST TO THE VISITOR

A coil of wire may be given a few drafts, or it may be given many, both making the same size in the end; but the physical characteristics of the two finished wires will be entirely dissimilar.

I followed on after the coils, each one growing longer and finer, from drum to

noises there are in different parts of the plant! Stepping out of the blooming mill into the engine room, you are tempted to think that all noise has been left behind. Then you find that instead of the crash and plunge of tons of white-hot metal there is a simple, silent burr of



THE BEGINNING OF A WIRE—RECEIVING SIDE OF A BLOOMING MILL

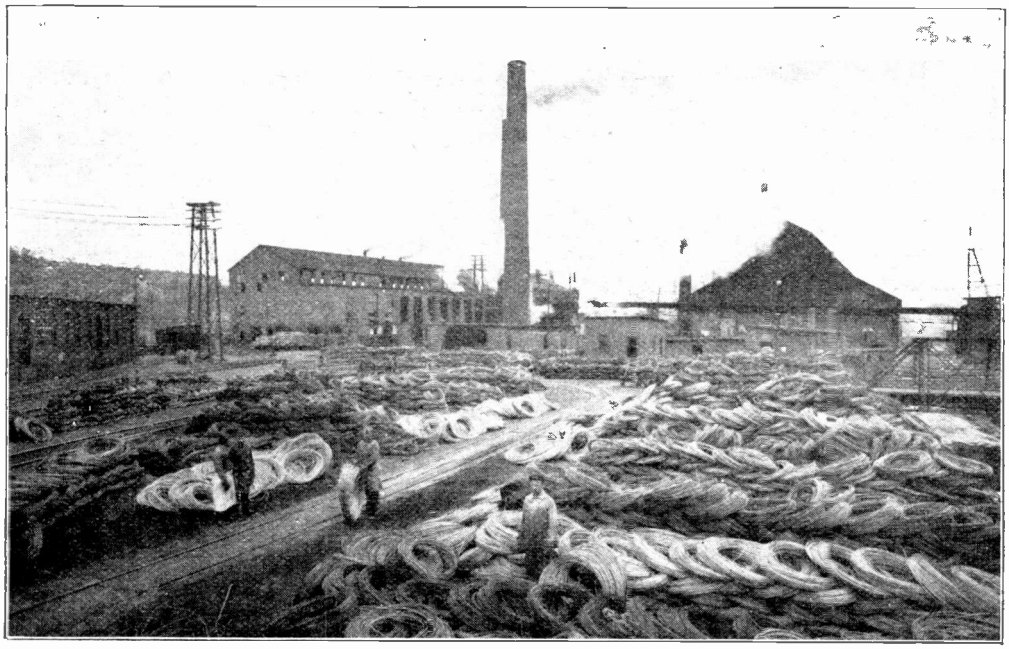
engines here which renders all other sound mute. Fortunately, the wire process needed but little oral explanation. Smaller and smaller grew the wire, longer and longer, until at last it came to the diamond dies. And before my eyes was worked a miracle.

Three-fifths of a mile of copper wire was fed into the machine. The wire traveled at the rate of 500 feet a minute, but was rolled up at the end over five times as fast as it was unrolled at the start. In fact, the three-fifths mile became three and one-tenth miles, going through nine drafts in this single machine, from roll to roll, in less than half an hour. Its diameter began with .0641 inch and finished at .0285 inch. Three thousand feet were made into 16,000 feet.

The diamond centers of these dies are marvelous pieces of microscopic work which must be able to stand the steady rush of heavy work and the wear and jar of constantly passing wire, while remaining absolutely perfect. They wear out in time, of course; as the holes in the diamonds become larger, the die is passed on to the next larger wire and replaced by a new one made in the shops. Each diamond center is bored, then firmly bedded in nickel, which in turn is centered in the brass die. Then the microscopic hole is finally bored and rounded, to the size of a wire that is almost a copper hair.

This is a Titan among factories. There is far more in its bounds, it seems to the visitor, than in other plants of equal acreage. As a steel and copper plant it is enormous. As a wire producer it is enormous. As a spring mill, a cable works, an insulating plant, a railroad system—in each detail it is enormous. In the south works alone there are nineteen miles of railroad tracks. The amount of material on hand must run up into the millions at each inventory; its monetary value is probably far greater than most people would suppose, owing to the great costliness of the materials—rubber, copper, silk and all the rest.

But let it not be imagined that here is copper only. Copper wire plays but a very small part in the whole general scheme of things. The making of steel



THERE IS A TREMENDOUS FASCINATION ABOUT COPPER, THE SHIMMERING RED-GOLD METAL OF MANY HUES

is always a mammoth project: here, it is a humanly interesting one. As one of my guides pointed out, it is entirely analagous to human life itself. From the scrap heap it goes through various formative processes, is turned out to perform its work in the world, and in course of time returns to the scrap heap. And this scrap heap is a wonder.

As I stood and gazed up at it, while the overhead crane and the giant electro-magnet carried tons of metal from place to place, I could pick out nearly everything from swords to ploughshares in the pile before me. Here were parts of battleship armor, cog-wheels from shops and machines, farm machinery, garden tools, automobile scrap, car couplers—everything which is manufactured from certain grades of iron comes back here to the scrap heap from the Hebraic hands of the city. This is a morgue of dead ambitions, a charnel house of genius. All of these scraps, from big to little, were products of human brains and energies, once vital and in their turn energizing the world.

But the electro-magnet takes hold on them, their individuality gone, and shifts them on to cars for another reincarnation, tons of them at a time. This giant magnet works like nothing so much as a dry sponge picking up drops of water. A man could do it with his fingers, a drop at a time; but as the sponge is pressed down the water runs to it and all is over. Tons of this scrap were lifted by the single magnet; as it went up and over the ground the iron scraps ran to it, stood on end to greet it, and were finally carried on and away by it until they were absorbed in the general mass.

The steel furnaces are terrific—great masses of metal and fire brick lost in the dull steel rafters above, surrounded by smoke whorls and smudge in which move the figures of puny men, impotent yet all-potent, handling everything by a switch here, a lever there. The coruscating steel is poured into the ingot moulds, car after car of them which move on in endless procession. One of these furnaces is significant. It is electric—it does away with fuel. Rather, it makes

steel out of the energy of falling water, for it is run by hydro-electric current, the three electrodes heating and purifying all. In days to come the electric furnace may do away with the fuel problem, in factory and in home, and we of today are witnessing the beginnings of a new era, over the horizon of which we can as yet but dimly see.

But the ingots are cooling, and we must go on. Stripped of the moulds, each ingot weighs two tons or more. The cars take them into the blooming mill, and here the ingots are carried about, tossed and played with, like the jackstraws of a child. All about us are white hot furnace pits. Overhead travel giant cranes, between each a prehensile finger tip that folds up into itself uncannily, grotesquely. Very carefully but with exceeding speed the long finger shoots down and grips a red hot two-ton ingot. Over us it whirls and then down into a glowing pit where the ingot is dropped for greater heating. Then the finger delicately cools its nails in water before lifting more, so we go upstairs to watch the next operation.

Before we can reach the top the titanic finger follows us with unerring speed, bearing a white hot ingot. This it deposits in a holder, and the play of the gods is begun. The mighty mass of steel is tossed about hither and thither on a line of rollers and upshooting hands that grip and whirl it, until it travels down to us and enters the presses.

These are controlled by four men on a platform above. The glowing ingot is pulled forward and back through the rolls, and we seek a reason for the action. Half a dozen times this is repeated, the ingot undergoing no appreciable change; but suddenly we notice that the metal is longer, thinner. Then the rolls clamp down and as the white hot end appears one can see it crumple up and come through, half its former size.

The metal resists this, twisting, quivering and curling in a frantic effort to get away from those unfaltering rolls and omnipresent hands of steel. But those hands show no mercy, the rolls bear it ever onward, and soon the luminant metal has become a giant's jackstraw which is tossed around and whirled back and forth until it is drawn into a seemingly thin rail of red hot steel.

Then down the trackway to the lesser rolls, where it is finally cut up into four-foot lengths called billets. These lengths are pushed on to the cars and loaded mechanically—and we emerge into the blessed free air once more, thanking fate that it is not our lot to lose the blue sky and the winds of heaven for the dim rafters of the blooming mill.

The steel billets are taken to the rod mills and reheated and rerolled. Now one begins to see that wire comprises much more than a mere strand of metal. It may be of all shapes, all sizes. Wire is shipped out to be brass coated and rolled into tubular steel for beds; other wire is shaped, sectionally, like a star. This goes to watch and clock makers, is cut off into narrow slices, and these become the cogwheels in our cheap timepieces. Wire is not all cylindrical by any means. Trolley wire, for instance, is grooved in various ways and shapes; and there are turned out over 500 different shapes of wire, used for every purpose under heaven.

So onward goes the stubby billet of steel. As the size of the rod or wire decreases the speed at which it travels increases, until in the end the four-foot billet has become a quarter of an inch thick and a quarter mile long. Then it is coiled, still red hot, over drums and passed on to the next room, where it is loaded on cars to be held until the wire mills are ready for it.

But within my given limits of space it is impossible to amply describe this immense place. It has so many ramifications, there are so many special products and special processes employed, that this entire issue could be filled with a mere generalized description of the place.

One of the interesting features is the

utilization of the by-products. In various European countries hot slag is blown into thin threads of cottony material, and this is later woven into a cloth-like substance which being a non-conductor of heat is used for many purposes. But here the hot slag is thrown into cold water, and the resultant explosion leaves it in the form of a powder which is ground and used extensively in the making of cement. Another by-product is sulphate of iron, of which thousands of tons a year are sent out. The various acid cleaning solutions become charged with this, and it is carefully saved, being used as a weed exterminator and water purifier.

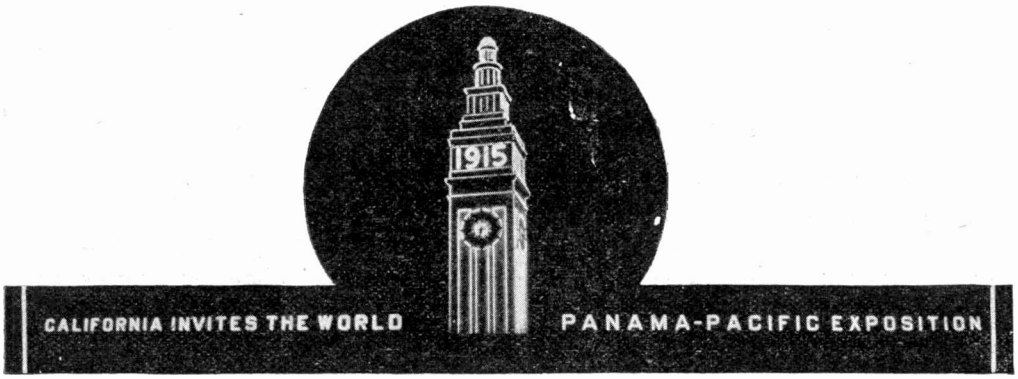
The insulation of the wires and cables is extremely interesting. In other articles I have described the stranding of a cable and the braid insulation, placed on the wire by braiding machines and thousands of flying shuttles. Besides this, the rubber insulation is also made here at Worcester. There are two methods of doing this.

The rubber is sent through the rollers, or calenders, as they are called, and comes out in thin strips of rubber sheeting. This is then wrapped about the wire by means of special machines, which leaves a thin seam along the entire length. Later, the vulcanizing process, which develops the characteristics of the rubber and gives it life, does to the insulated wire essentially what the heating process does to steel. The second method is to press the rubber tightly about the wire, just as lead is pressed about a cable, in a complete sheathing. The completed wire of the first process shows no trace of a seam after the vulcanizing, which effectually welds the whole.

A very elaborate equipment is in use for tinning and galvanizing wire. Copper conductors are often tinned, and telegraph wire is nearly always galvanized. The absolute perfection demanded by trade specifications makes a corresponding perfection necessary in the making. The principle of this process is the passing a wire through an acid tank which cleanses it, then through a vat to wash off the acid, then through a flux and lastly into the molten tin or zinc. It is easy to make the metal adhere to the surface as a whole, but it is hard to cover the wire with a uniform thickness of bright metal which will neither crack nor peel, and the resultant machinery and operations are ingenious and interesting in the extreme.

Naturally the laboratories are essential features of the plant, and are of no little interest to the visitor. Here small models and samples of all kinds may be made, which could not possibly be turned out of the huge shop machines. For example, I saw a few inches of a sample sub-ocean cable—strand after strand of steel wires and saturated insulations, enclosing the all-essential core in its heart; and beside this lay a bit of the first Atlantic cable—primitive, if you like, but none the less an epoch maker in the world's progress.

This is the American Steel & Wire Company, in an infinitesimal degree. There are many places about it I have not visited, there were mills and shops I had not even time to go through, or the space in which to describe them. And all this is the labor of men in the mass. Every trifling detail of the whole place has been worked out by some unnamed man or men, and involves a dozen other more trifling details which had first to be worked out. Component work is marvellous in itself; individual work is marvellous as showing the strength of an individual. But the individual work, however great or far reaching, must surround itself with other individuals and become mass work if it is to meet with success. That is why great men surround themselves with greater men. That is why American business will stand in the forefront of world progress for ages to come.



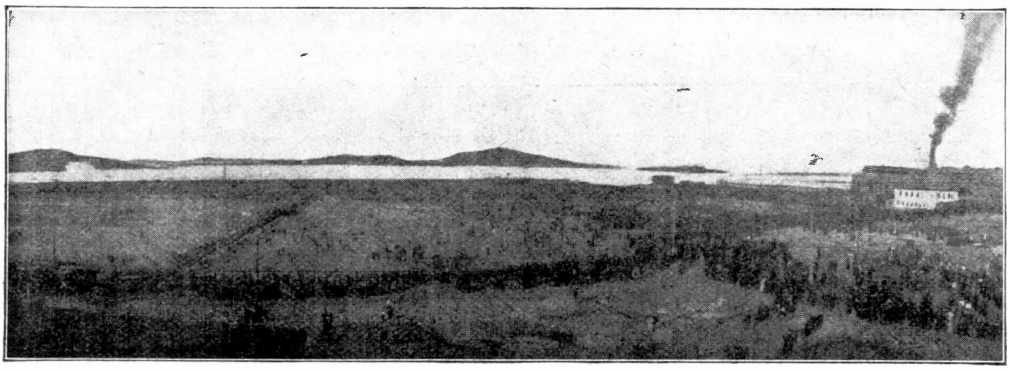
THE GREAT WELCOME SIGN ON THE UNION FERRY BUILDING. IT IS 600 FEET FROM END TO END. THE TOWER ABOVE CONTAINS OVER 4,000 LAMPS

Construction of the 1915 Exposition Begun

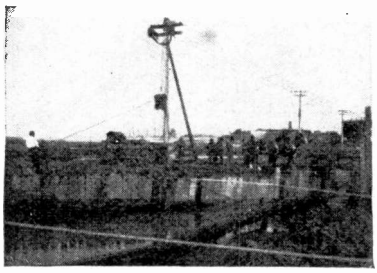
By RUSH KIRBY

That group of enterprising citizens known as the Exposition Company has carried the development of the Panama-Pacific Exposition to such a point that general preparedness is an accomplishment of the past. Actual construction has begun. In fact, the first building, one of the minor affairs of the great structures contemplated, is now occupied by exposition organizations such as the Police Department, Commander of the Guards, Emergency Hospital, etc. Daily, scenes of construction are now witnessed which effectively dispell all fear of the undertaking becoming a sluggish enterprise, and weekly, one might almost say, foreign envoys arrive and select sites for pavilions and exhibits. Experts say San Francisco is a whole year ahead of previous expositions in preparation. General plans for fourteen principal exhibit palaces are ready. The contract is let for grading the site of Machinery Hall, the largest edifice to be constructed, and bids for its construction are called for. The contracts for grading the railway yards and for the improvement of Fulton Basin the contemplated yacht harbor—are also let. Twenty-two foreign nations have accepted invitation to participate, while five have their flags flying over sites chosen and dedicated for their edifices. Nineteen states likewise have their colors flying over chosen locations. Eight hundred leading exhibitors of the world have applied for space, which is some seven hundred over those of similar periods. Two thousand concessions have filed application—something unprecedented. And all this before active campaign has begun.

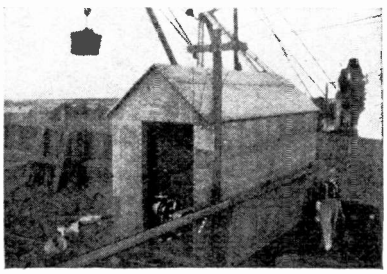
Persons not directly connected with the exposition work see but little of the vast amount of activity engaged in by the Exposition Company. It is a casual stroll over the great area about to blossom into a fairyland that opens the eyes of the visitor. Indeed, the evidences of unequaled spirit and progress are not only convincing but their magnitude is so impressive that one enthusiastically wishes San Francisco God speed and good luck and experiences a yearning to join in. And through it all again, as the eye sweeps over the scene, there is observed stretching across the sky line, extending from the forest of houses on the hills, over the site and down to the water's edge, a line of tall poles whose cross-arms bear power transmission wires, for, be it known, the services of electricity have become imperative and today this line conveys the first electric power to be employed on the fair grounds.



BREAKING GROUND FOR MACHINERY HALL, THE LARGEST BUILDING TO BE ERECTED AT THE 1915 EXPOSITION. THE STRUCTURE WILL EXTEND FROM THE CENTER OF THE MASS OF PEOPLE ALMOST TO THE WATER'S EDGE. IT WILL CONTAIN 8,000,000 FEET OF LUMBER, ENOUGH TO FLOOR 200 ACRES, OR 64 CITY BLOCKS. A PERSON WILL TRAVEL A DISTANCE OF ONE MILE IN WALKING AROUND IT, AND TWO MILES OF DECORATIVE CORNICES WILL BE USED IN ORNAMENTING IT

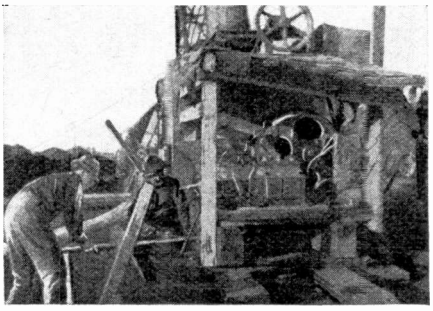


BRINGING THE FIRST ELECTRIC CURRENT INTO THE FAIR GROUNDS



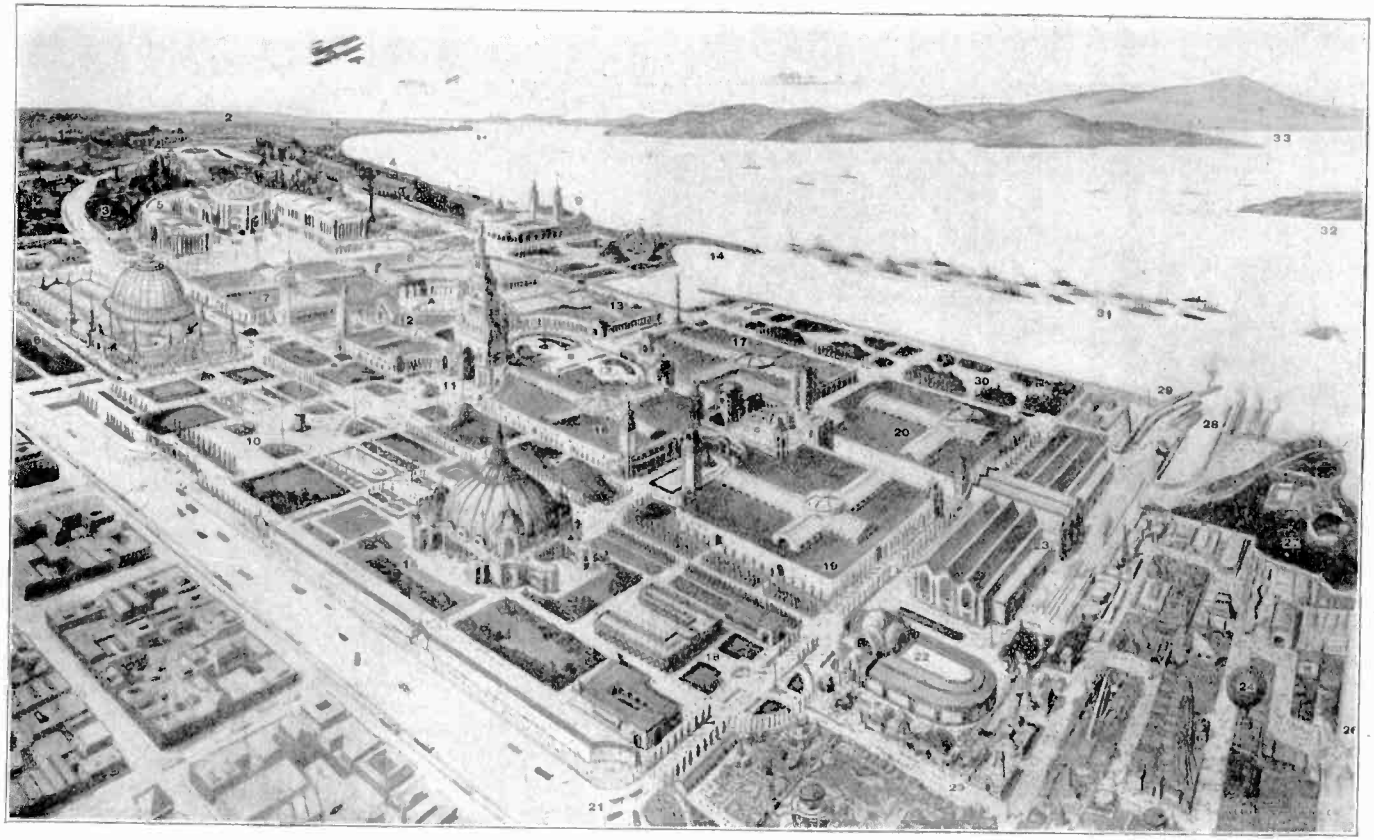
FIRST MOTOR TO OPERATE ON THE GROUNDS. PUMP HOUSE ON A FILL NEAR THE WATER'S EDGE

A trivial event may seem the installation of this transmission line with its transformers and motors, yet when, on Thursday evening, November 14, 1912, as the setting sun slowly sank out in the great sea of red, the electrician at the pumphouse down on the fill near the shoreline "plugged in the juice" on a ten horsepower motor and started the whir and hum so familiar to mortals who frequent the electrical world, he put into operation the forerunner of the vast amount of that mystic energy that will ere long be raising beam to pinnacle, recording the vigil of the nightwatch and toiling day by day on a most ambitious undertaking.



MOTOR OPERATED CONCRETE MIXER BEGINNING THE SEWER WORK

Passing at twilight into the heart of the city and down to the foot of Market Street where the great Union Ferry Building rears its tall tower, we observe that not only does the traveler just entering the portals of the city, but the busy San Franciscan himself pause and gaze upward to watch the tall pinnacle flash into light as the hours of illumination are begun. It is then that the eyes fall upon the dazzling white numerals above the great clock and cause the ob-



BIRDSEYE VIEW OF THE PANAMA-PACIFIC INTERNATIONAL EXPOSITION

To be held in San Francisco, California, February 20th to December 4th, 1915.—Drawn from the official diagrams and plans

1—Foreign Governments Building. 2—Live Stock Exhibit. 3—U. S. Government Building. 4—State Buildings. 5—Fine Arts Building. 6—Horticulture Building. 7—Education Building. 8—Food Products Building. 9—California Counties Building. 10—Grand Main Entrance. 11—Grand Central Tower. 12—Liberal Arts Building. 13—Agriculture Building. 14—Yacht Harbor. 15—Festival Hall. 16—Manufactures Building. 17—Transportation Building. 18—P. P. I. E. Service Building. 19—Varied Industries Building. 20—Mining and Metalurgy Building. 21—Fillmore St. Entrance. 22—Motor Transportation Building. 23—Machinery Building. 24—Joy City. 45 Acres of Concessions. 25—The Joy Way. Zig-Zag Street through the Concessions. 26—Van Ness Ave. Entrance. 27—Fort Mason. 28—Transport Docks. 29—Ferry Boat Landing. 30—Grand Marine View Esplanade. 31—Warship Anchorage. 32—Alcatraz Is. U. S. Military Prison. 33—Mt. Tamalpais—The Most Scenic One Day R. R. Trip in the World. 34—Fort Winfield Scott guarding the Golden Gate. 35—Presidio. U. S. Military Reservation. a—West Court of Four Seasons. b—Central Grand Court. c—Festival East Court.

server to forget the world and its cares and behold visions of the coming wonders of the exposition.

The illumination of the tower on the ferry building, combined with that of the structural steel invitation at its base extending for some 600 feet along the roof and built of eight foot letters, is part of an extensive plan to give publicity to the coming exposition, though this building throughout is controlled solely by the State Harbor Commission. In this decorative achievement is seen vividly the powerful and far reaching effect electricity has in the art of exploitation. Some 4200 eight and sixteen candlepower lamps are set in the lines of the tower alone. The numerals comprising the "1915," placed both on the land and bay sides, burn in tungsten white and stand out beautifully, showing well the advantage of tungsten over carbon in lamp filaments. Only 60 watt lamps were used here. The hour-points on the dial of the huge clock are set with sixteen candlepower carbon ruby lamps. The voltage maintained throughout the system is 120.

The great sign conveying California's invitation to the world faces the bay and all the transbay region wherein lie the cities of Oakland, Berkeley, Alameda and Richmond, from which direction travelers come and go in their visits to the city. On clear nights, this invitation and tower, when illuminated, can be observed 20 to 50 miles away, though the letters become indistinguishable at about 20. The entire combination undoubtedly constitutes the largest steel electric sign in the world.

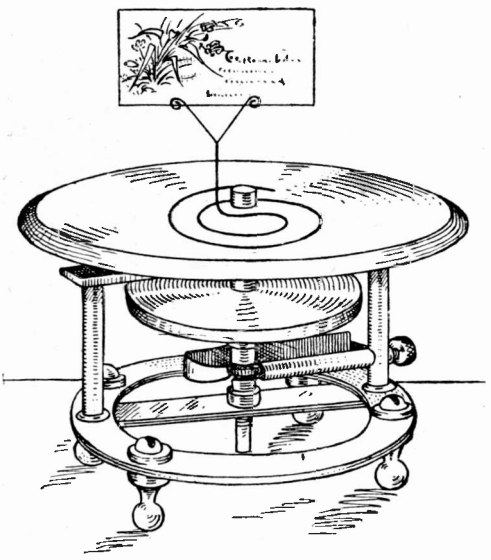
Radiation from Potassium

It is possible, judging from the experiments of Mons. E. Henriot, that potassium should be added to the short list of substances known to possess the property of radio-activity. The observed amount of radiation is small, but Mons. Henriot thinks that it is not due to the presence of traces of some of the recognized radio-active substances, but must arise from the potassium itself or from some unknown body associated with it.

The Rotating Spiral

A curious movement can be obtained by the use of a small rotating bar magnet. The end of the small magnet runs up for a short distance above a table and below is a clockwork or other device which rotates the magnet as a shaft. A small motor can also be used. On the table is placed a spiral of iron wire and this is kept drawn against the magnet, but as the magnet revolves, the spiral also sets up a movement which acts about like a gear movement between these two pieces, since the magnet always adheres to the spiral so as to keep on driving it.

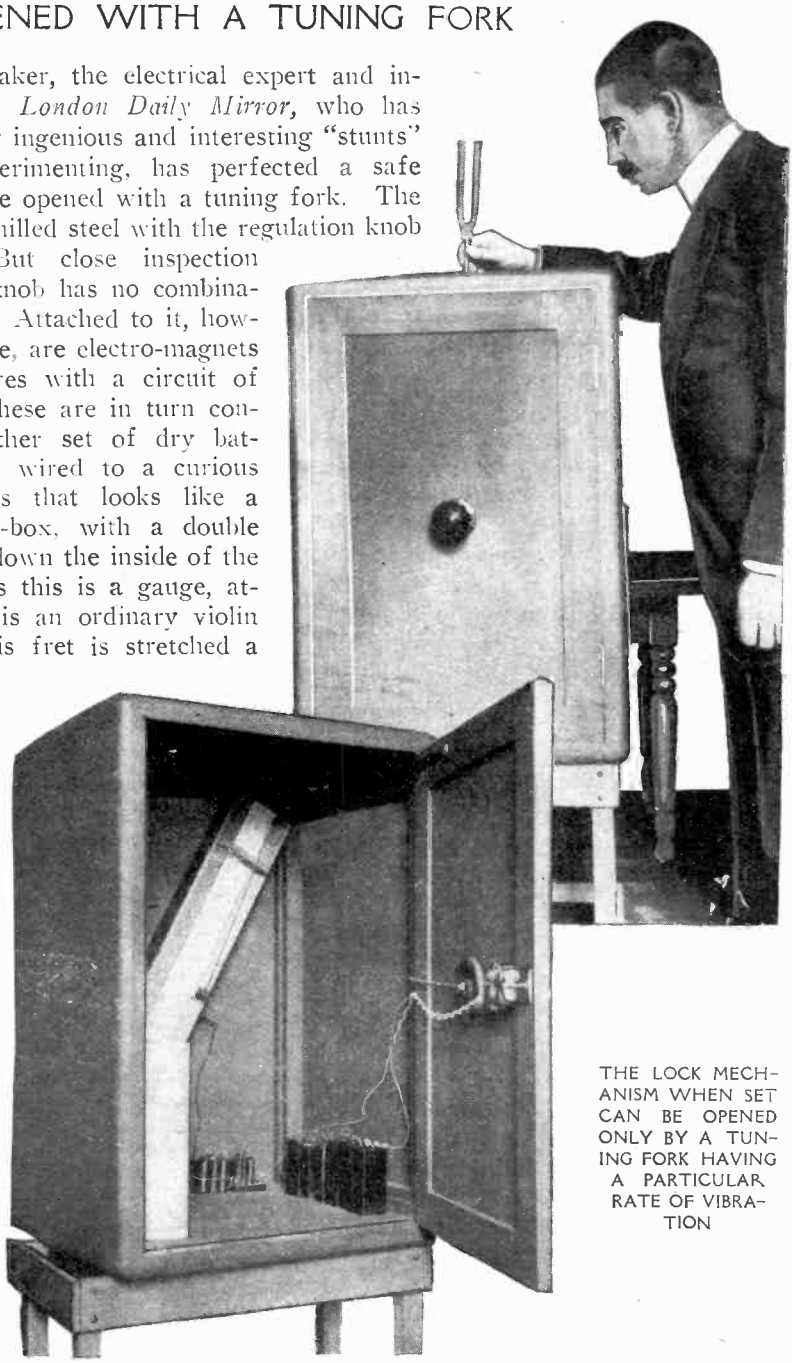
When at the end of the spiral, the magnet does not let go, but passes around to the outside of the wire, so that the motion keeps up without stopping as long as the magnet revolves. It is an easy matter to curve the end of the wire so as to make it take an upright position, and a card can be mounted on it. The card now keeps up a continual motion and will serve very well for use in a show window owing to the curious effect it produces.



ROTATING SPIRAL

SAFE OPENED WITH A TUNING FORK

Mr. Thorne Baker, the electrical expert and investigator of the *London Daily Mirror,* who has done some highly ingenious and interesting "stunts" in electrical experimenting, has perfected a safe which can only be opened with a tuning fork. The safe is made of chilled steel with the regulation knob on the door. But close inspection shows that this knob has no combination or timelock. Attached to it, however, on the inside, are electro-magnets connected by wires with a circuit of dry batteries. These are in turn connected with another set of dry batteries, which are wired to a curious looking apparatus that looks like a carpenter's mitre-box, with a double row of numbers down the inside of the channel. Across this is a gauge, attached to which is an ordinary violin bridge. Over this fret is stretched a music wire of metal, drawn taut to a binding post and passing through this to form a coil below it and outside the tuning box and thence down into the dry batteries.



THE LOCK MECHANISM WHEN SET CAN BE OPENED ONLY BY A TUNING FORK HAVING A PARTICULAR RATE OF VIBRATION

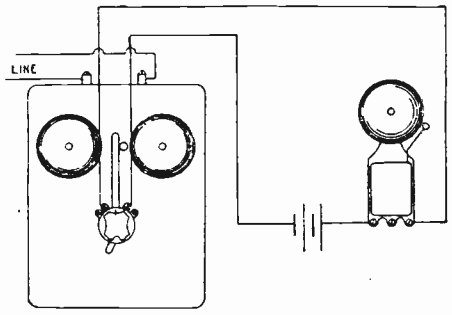
This mitre box is really a musical scale, set by numbers so that the tone can be gauged up or down by two's as may be desired, to meet the needs of a new combination, or a new tuning fork, if it is desired to thus change the combination or opening note. The music wire, which may be a guitar, banjo or violin string, is selected and gauged to synchronize with the tuning fork used. When the tuning fork is struck and placed to the top of the safe, the wire inside catches the vibration from the fork and vibrates in sympathy. This vibration passes through the bind-

ing post into the outside coil and thence down into the small circuit of dry batteries, mechanically closing this circuit. An electric current is thus started which passes on and is made to close the larger circuit of dry batteries which starts a stronger current moving. This stronger current acts through wires directly on the electromagnets that throw the bolts of the concealed lock. Once these are thrown, the door may be pulled open.

After the tuning fork and wire are set to the same gauge, no other tuning fork will have any effect whatever upon the lock. As no two tuning forks are exactly alike in pitch, it is obvious that only one tuning fork in the world could open the safe, once it is closed and locked, and only the person possessing the fork could have access to the safe. However, once it is opened, it can be reset to accord with another tuning fork, whereupon the original one is useless.

Telephone Extension Bell

It is frequently the case that the telephone bell cannot be heard at all required locations, an extension bell often being necessary. A simple and an easily installed extension device on the market is here illustrated. The circuit closer is



EXTENSION BELL

placed just below the bells on the telephone box and so adjusted that when the bell rings, its hammer will move the circuit closer lever that in turn releases a contact maker which closes the local circuit of the extension bell.

Measuring Temperature from a Distance

Electrical pryrometers are now coming into industrial use in all kinds of processes, for instance in annealing or hardening furnaces, pottery and cement kilns, enameling ovens, glass works, also for use in finding the heat of furnace gases or steam, or liquid baths. In fact we might enumerate endless uses for them.

The Cambridge Scientific Instrument Works bring out several interesting kinds of pyrometers. One kind uses a thermo-electric couple mounted inside a protecting tube of porcelain or the like, for inserting it where it is needed. Wires lead to an indicating instrument which gives the amount of current, that is, the number of degrees of heat. In a second type the tube contains an electric resistance wire carrying a small current from a battery and connected to a measuring device. As the wire increases in resistance under heat, each heat gives a different current, so that the instrument either indicates or records the degrees of heat in the furnace.

An interesting apparatus works on the Féry principal. Here an open tube with a thermo-couple stands on a tripod near the mouth of the furnace so as to receive the heat rays. The readings are made on a separate instrument, as before. In the upper illustration (see next page) is a Féry pyrometer used at the Sèvres porcelain works near Paris. All these instruments allow of finding the temperature very accurately, and upon this often depends the success of many kinds of industrial processes.

In the lower illustration is shown a pyrometer designed by Charles Burton Thwing. The operator stands at a distance from the furnace door and points a tube at the opening. Inside the tube is a thermo-couple which is affected by the radiated heat. A current is formed in the couple, which is in proportion to the temperature to which the parts are subjected.

USING A PYROMETER OF THE FERY TYPE TO TAKE THE TEMPERATURE OF THE INTERIOR OF A PORCELAIN KILN

PORTABLE RADIATION PYROMETER DESIGNED BY CHARLES BURTON THWING—DETERMINING THE TEMPERATURE IN AN OPEN HEARTH STEEL FURNACE

Police Call System

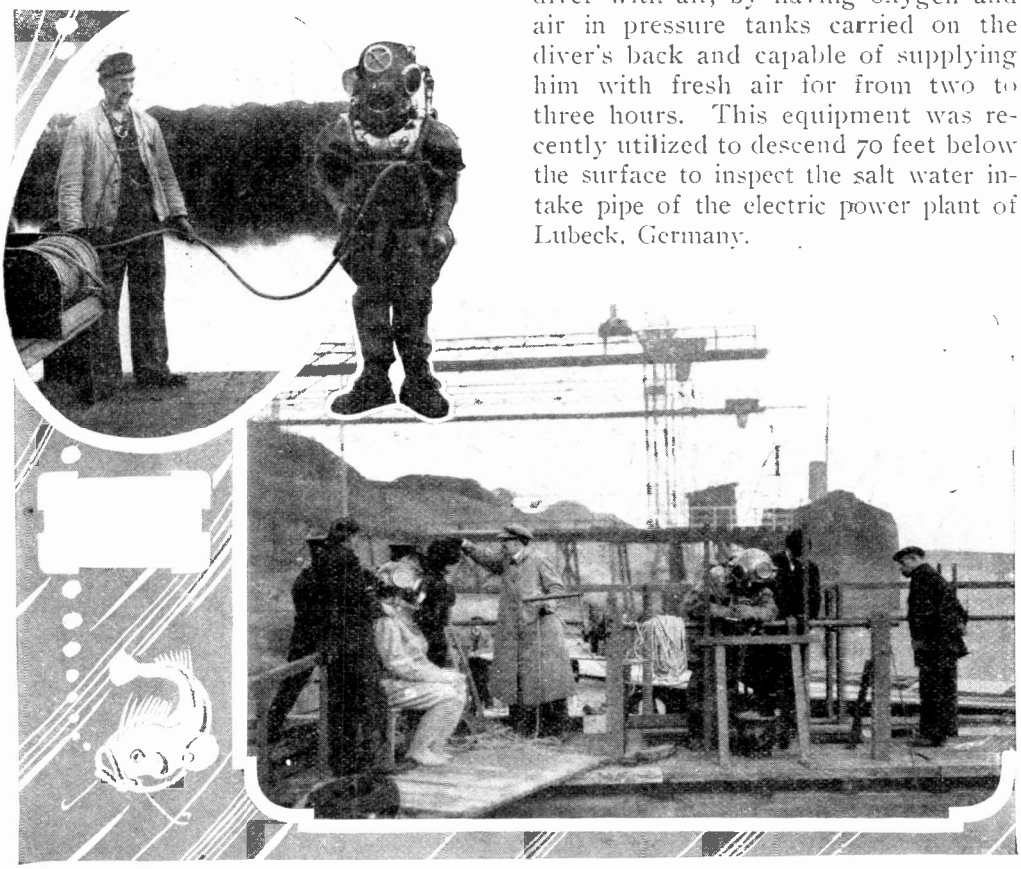
A police call system in operation at Bismarck, N. D., while very simple in make-up is found thoroughly practical and worthy of adoption by small cities.

An electric light circuit is strung throughout that portion of the business and residence districts within the patrol limits. At various corners incandescent lamps are mounted in conspicuous places, mostly on electric light and telephone poles, both of which by the way are impressed into service to carry the circuit.

Current is led to this circuit from either a switch in the police station or from a pendent switch which hangs just above the operator's head in the local telephone exchange. It can be readily seen that by these means a call for police gets prompt attention as the operator can push the button in the pendent switch in an instant and then inform the chief of police of the location, and the patrolman seeing the lights flash on immediately calls headquarters or if near by goes there at once with little loss of time.

Diver's Outfit Equipped with Telephone

The diver in the picture is rigged out in a diving apparatus equipped with a telephone so that at all times he is in communication with his assistants. The apparatus does away with a tube and pump for supplying the diver with air, by having oxygen and air in pressure tanks carried on the diver's back and capable of supplying him with fresh air for from two to three hours. This equipment was recently utilized to descend 70 feet below the surface to inspect the salt water intake pipe of the electric power plant of Lubeck, Germany.



DIVER WITH DRAGER'S SELF CONTAINED APPARATUS PREPARING TO INSPECT THE SALT WATER INTAKE OF THE POWER PLANT AT LUBECK, GERMANY

Public Entertaining Revolutionized

By ROBERT GRAU

The great slump that has taken place in the patronage of the playhouses in the country has been such that few of the men, who still tempt Fate with the production of plays, longer regard the situation with equanimity and the spectacle is now on view of the most important of these producers being intimately associated with the motion picture industry. Not only is Daniel Frohman extensively interested in the film industry but his more celebrated brother, Charles, has announced his entrance into the field of the silent drama.

DANIEL FROHMAN, THE FAMOUS THEATRICAL PRODUCER, IS NOW ALSO INTIMATELY ASSOCIATED WITH THE MOVING PICTURE INDUSTRY

In the next two months perhaps the two largest theatrical and vaudeville corporations are to adopt a mode of procedure in the conduct of the hundreds of playhouses they control that is likely to thoroughly revolutionize the field of the theater and change the theatrical map from coast to coast.

The two corporations are the John Cort Amusement Company, which owns, leases or controls 200 playhouses west of Chicago and the United Booking Offices of New York, which with its allies represents 90 per cent of the vaudeville theaters of high grade in the United States and Canada.

It is not that these two representatives of vast amusement interests are to creat an upheaval by a change of policy that is causing so much excitement on New York's "Rialto," for thousands of players and singers have been reconciled to the tremendous encroachment resulting from the amazing vogue of the photo-play. What has been feared and in some instances prophesied is that the day is near when the distinctly theatrical managers will tire of paying prodigious salaries to actors in the flesh and that they will welcome any genuine solution of the problems confronting them.

The writer, in a previous article, ventured to prophesy that within two years the talking picture would come forth in a manner that would constitute the greatest menace to the older methods of public entertaining yet recorded (and the playhouse has had to withstand many encroachments); but what worries the thespians who congregate on the "Rialto" is not so much that the talking picture is to be revealed in its latest and perfected form, but that the men who control half of the amusement output in America are to substitute for players and singers in the flesh in their theaters the

ADOLPH ZUKOR, WHO, IN CONJUNCTION WITH FROHMAN, HAS INTRODUCED THE WORLD'S GREATEST PLAYERS TO THE FIELD OF THE PHOTO PLAY

two nearest methods of synchronization by which operas, plays and spectacles will be reproduced on the screen precisely as seen and heard in theaters and opera houses, but with science simulating voice, action and color.

These two managerial interests have not acted without deliberation in this momentous procedure. Many serious conferences have been had and such vital issues as "the increased cost of living" and "reduced prices of admission" as well as "reduced salaries" were discussed from every angle. Final action was taken by both of the big concerns only when coöperation was denied by the players who alone could have prevented the upheaval by accepting lower salaries. And now comes the vital part.

John Cort and his associates have secured the exclusive rights for the Kitsee talking pictures, which are operated on wholly different lines from all previous efforts at synchronization. At the public or rather semi-public exhibition given in New York this remarkable device was voted perfect. The modus operandi has not been made public.

The United Booking Offices have effected an arrangement with Thomas Alva Edison for the exhibition exclusively, in its theaters, of the Edison speaking pictures on which the Wizard of Menlo Park has been working for many years.

When asked what he thought of the talking picture at the time of a demonstration (January 3, 1913) Mr. Edison spoke thus:

"Is it perfect? By no means, nothing that I know of is perfect; every man needs a doctor once in a while to fix him up, so anything I may invent would not be equal to a human being.

"But the way now is clear to the presentation of plays, musical comedies, operas, spectacles and other modes of public entertainment through the kinetophone; moreover it is now possible to duplicate what we call the two dollar show for five cents.

"The poor man, with a family of six, has my sympathy. He earns $2.75 a day and he can't pay the regular theater prices, and there are 1,000 such men to the man who can afford to go to the modern opera house or any other high grade playhouse. We are already near perfection, and the time is near when the whole thing that is aimed at will be accomplished, and the people of Podunk will be able to see as good plays and operas for five and ten cents as the metropolitan playgoer can see at any price. The best of literature and the best of music and drama now can be presented to the poorest persons

MARCUS LOEW, OWNER OF 30 MOVING PICTURE THEATERS IN OR NEAR NEW YORK; UNKNOWN SIX YEARS AGO, AND NOW A MULTI-MILLIONAIRE

all over the world and simultaneously.

"I have been working and thinking of this invention for 34 years. I took it up now and then and dropped it temporarily, and now, with the aid of one of the men in my plant here, we have reached a stage where we are satisfied of the ultimate outcome."

With existing conditions as they are it is not unlikely that public entertaining is about to witness an upheaval. None who have observed the vast improvement which has characterized the progress of the motion picture in its appeal to the public will need to be convinced of the importance of the new era which will be ushered in when all of the above named parties inaugurate what is to be called, so I understand, "The Theatre of Science."

"Talking Movies," Edison's Newest Invention

Thomas A. Edison tells of his Kinetophone, which produces words and sounds in synchronism with Moving Pictures

By E. LESLIE GILLIAMS

For several years the great electrical wizard has been promising the "talking movies." If anyone else had been working on it the public would have been sceptical as to a satisfactory result. But the American people have faith in Edison's accomplishing the seeming impossible, and he has never disappointed them. The present invention is his newest proof of his ability to "make good." There is only one imaginable class of people who will not thank the inventor for his latest marvel. They are the barn storming actors. For their resentment there is good reason, for it is readily imagined that in a short time there will be no more barn stormers because no one will be willing to pay for second class acting when the foremost stars are performing before the machine and can be seen and heard for a dime.

But one person can properly tell about the kinetophone. That is the inventor himself. He was found at the Edison plant in West Orange, N. J.

"Mr. Edison is upstairs in the laboratory," said Miller Hutchison, his chief engineer and personal assistant, as he led the way.

It is three flights to the "insomnia ward," as Edison's workshop is called. The wizard of electricity was ready for questions, and he discussed his ambition freely. Now and then, as he talked, his gray eyes lit up and he rubbed his silvered hair enthusiastically.

"What does your new invention do?" he was asked.

"It delivers at the exact instant of occurrence on the film any sound made at the moment such action took place. Every word uttered by the actors is recorded and delivered in time with the action; the creaking of a gate, a whistle, the noise of hoof beats, even the click of cocking a revolver, comes apparently from the screen and in unison with the motion."

"How is it done?"

"Well, it never could have been worked out without the aid of electricity. The phonograph, which is placed behind the screen, is wired to the picture machine, which may be a hundred yards away. By electrical control the speed of the talking part acts as a brake on the film, so that neither can get ahead of the other. There are special records which run as long as the film lasts. Other records can be made to come into place successively, and the performance may be carried out through a whole play. Whole operas will be rendered and the films can even be colored by hand.

"Small towns whose yearly taxes would not pay for three performances of the Metropolitan Opera Company can see and hear the greatest stars in the world for ten cents. And it will pay because of the volume of business.

"Actors will have to leave the legitimate stage to work for the 'movies' in order to get any money. This is all the better for them. They can live in one place all the year round; thus they will be able to lead a normal home life. I can see nothing in the future but big studios, centralized perhaps in New York, employing all the actors all the year round and at a better figure than they now get.

"We want democracy in our amusements. It is safe to say that only one out of every 50 persons in the United States has any real right to spend the price asked for a theater ticket. What chance has the working man for amusement whose income is from two to three dollars a day? No chance at all."

"How long did it take to work out the plan for talking motion pictures?" was asked.

"Thirty-seven years," replied Edison slowly. "It is all of that time since I made a motion picture show inside a box, by dropping a succession of drawings rapidly.

"I have thought of the talking movies and wrote of my ambition ever since. I would take the thing up and work at it for a time, drop it for several years, and then take it up again. I got the device prefected to a certain extent and then one of the men in my plant here worked it out still further.

"The great difficulties in the development of the kinetophone have been twofold. First, there was the obstacle of having the voice and the picture synchronize. Second, there was the difficulty of having a phonograph that would record the voices of the actors on different parts of the stage.

"The question of synchronism has been solved by the invention of a device that keeps the pictures to the fraction of a second in time with the words or music. The second has been solved by the invention of a delicate instrument that catches the voices of the players on different parts of the stage. The recording needle is more delicate than that formerly used and it catches the words of the player without recording the echo that formerly gave much trouble and made the voice vague.

"In making a talking picture, the actor performs exactly as he does upon the dramatic stage and his every word and action are simultaneously recorded. The action is taken in the usual method of sixteen pictures per second on the negative film, from which the finished positives are printed. The sound is taken on a large cylinder of soft wax, from which the commercial records are molded of indestructible material.

"The strangest thing of all," explained Edison, laughingly, "is that the players become embarrassed at the combination of a phonograph and motion picture camera. It is hard for them to get used to them.

"When the play is reproduced the projector of the pictures is separated from the phonograph. One is at the rear of the hall, the other behind the canvas in the front of the hall. Both are connected by electric wires, however, and the synchronizer is attached to the projector.

"The point is that the man who runs the projector cannot, even if he wishes to, turn the pictures on faster than the words. An electrical device prevents that. He may slow down too much, but an indicator immediately shows the fact to him."

The writer was invited by Mr. Edison to witness an exhibition of the invention in the perfectly equipped little theater attached to the Edison plant. First when the pictures were turned on a lecturer appeared who bowed, but there was not a sound until he opened his mouth.

Then the words flowed forth appar-

ently from the picture. Behind the canvas, however, was a megaphone attached to the phonograph, from which the words really came. Behind the spectators was the projector for the reel of pictures.

The lecturer explained the intricacies of the invention. To show the actual synchronizing of time and action he dashed a plate to the floor. It appeared so real it made one of the spectators sitting in the front row jump in dismay. The lecturer played a bugle, and the swelling of his cheeks kept perfect time with the sound. He blew a police whistle, called in dogs which barked loudly, adding still more to the effect of action and sound. A violinist played a melody, and then a young woman sang, and to the ordinary observer the synchronism was perfect.

Part of a light opera was given next. A scene from "The Chimes of Normandy" was presented with lightness and delicacy of tone and music and vivid acting. That was followed by a song from "Il Trovatore." Then the quarrel between Brutus and Cassius in "Julius Caesar" was acted in a way that showed the actors and the synchronizer on the Kinetophone followed Shakespeare's advice of suiting "the action to the word."

The quarrel is so thrilling, that any lover of Shakespeare can find himself holding onto his seat entirely oblivious to the fact that only a man made machine is portraying the fierce anger of the Roman officer.

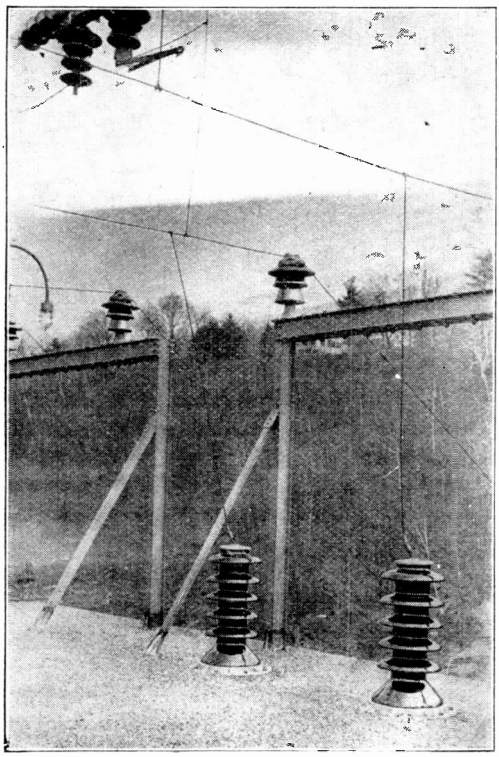
To light comedy the kinetophone turned next, giving a short sketch called "The Politician," with slang, rough vocies and gayety, showing still other phases of the new invention. Again the spectators were able to judge how the voices of the players were reproduced in keeping with their actions. The last reel showed "Dick, the Highwayman." It was full of action, daring and shooting, but at no time was there any apparent difference between the gestures and the voices.

It was observed, however, that the players apparently made an unusual effort to speak distinctly. M. R. Hutchison, Edison's chief engineer, said, however, that the phonograph catches words less distinctly articulated and that the gestures had been emphasized to prove the synchronism of the gestures and the words.

In all of these pictures the spectator was impressed by not only the perfect synchronism, but the remarkable illusion. When the actors were up-stage and walked down-stage, their voices increased in volume and in proportion to their photographed figures, and seemed to come from the right or left of the stage, as they were situated. The strange part is that one ceased to think of the phonograph and kinetoscope and his entire attention is held by the action of the piece, and he enjoys every thrill exactly as he would in a theater.

High Tension Roof Wiring

The increasing use of electric power transmission at potentials of from 60,000 to 100,000 volts has necessitated great improvements in the design of generating plants and substations, as the circuits of such installations literally carry chained lightning. The accompanying illustration shows the care which is now taken in building plants of this kind to provide for the proper mechanical support and thorough insulation of the incoming and outgoing line conductors. In the case shown, which is the roof of one of the Deerfield River plants of the New England Power Company, the 60,000 volt lines are dead-ended at strain insulators fastened into the wall of the station and from these dead-ends taps are taken as shown, to high tension insulators mounted on angle irons with latticed cross bracing to provide a firm support under heavy wind conditions. Horizontal leads are then run across the top of the roof at a height well above the head of the tallest man, and taps are



HIGH TENSION ROOF WIRING

made from these horizontals to disconnecting switches, lightning arresters and to the transformers in the station below through five-part insulating bushings. The size of these bushings, their wide spacing, and the protection of the legs of the standards supporting the insulators all emphasize the extraordinary care which must be taken to give the safest and best quality of service when dealing with such high potentials.

Why Tungsten Lamps Are Better Than Carbon Ones

The amount and quality of light emitted by a hot piece of metal or any other substance depends on the temperature, therefore the hotter it is the better will be its light giving qualities. We can make either kind of filament get as hot as we wish by making it of the proper size and length, for a given voltage. But the carbon filament will evaporate like a piece of camphor if it gets much over 1800 degrees, whereas the tungsten filaments will not evaporate until they are hot enough to melt. The evaporated carbon will collect on the inner surface of the globes and spoil the lamps by blackening them, and the blackened surfaces will weaken the light. The tungsten lamps will therefore work at a higher temperature than the carbon and will give more light for the same amount of electric energy, because of the fact that at very high temperatures the energy wasted in heat is less than at low temperatures.

To make this last point clear we must remember that light and heat are similar forms of energy; that is, they are merely wave motion of the ether. The difference between light and heat is that the light is heat vibrations that are rapid enough to be perceived by the eye. The slowest heat vibrations that can be seen give us the impression of red; the fastest ones give the impression of violet. Each color corresponds to a different speed of heat vibration beginning with red, thus: red, orange, yellow, green, blue, violet.

White light is a mixture of all the colors and its quality depends on the relative amounts of each. Carbon lamps, being colder than tungsten, have too little blue and violet in proportion to the red and yellow, hence the yellow appearance.

Also the proportion of the total visible heat radiation (light) to the invisible (heat) is less for the colder carbon filament than for the tungsten because we see that the higher frequencies (faster vibrations) disappear first, as the filament becomes cold. Suppose we start at white heat and gradually cool the filament. At first it gives off some light, say five per cent, and a great deal of heat. The heat we consider wasted since we want a light and not a heater. When it is

cooled to red heat it gives off much less heat but what it does give is all wasted energy since the small amount of red light is useless. The carbon filament may not give off any more heat than the tungsten, but the light it gives would be less and hence it is more wasteful. A red-hot horse shoe would not give off as much light as a white-hot nail but it might give off more heat, and require more coal to heat it.

There is another advantage of the tungsten lamps, which is that they will give better light on circuits where the pressure or voltage is not steady. If the pressure of a 110 volt circuit falls to 100 for any reason the carbon lamps will become so dim as to be almost useless, while the tungstens are scarcely affected at all. This is due to the fact that carbon has a higher electrical resistance when cold than when hot and when the temperature falls because of the weak pressure the resistance increases so that the current is greatly weakened. Tungsten, however, is a better conductor when cold than when hot and when the temperature falls because of the weakened pressure the resistance will become less and will therefore tend to keep the amount of current flow constant in spite of the diminished pressure.

Classes in Pulmotor Practice

Much is heard these days of the pulmotor, which has rendered such marked service in saving the lives of persons overcome by gas. A great many of the electric lighting companies in the larger cities now give free "pulmotor service," after witnessing the successful results attending the initial experiments in this direction last spring, by the Commonwealth Edison Company of Chicago.

A CLASS IN PULMOTOR PRACTICE

Originally the idea of an electric light company keeping such a device on hand was to render first aid in cases of electric shock, but these cases are few and far between as compared with cases of as-

phyxiation and we find the electric light companies in a very humanitarian way assuming the burden of rendering first aid to gas victims.

A thousand men in New York have been trained in the use of the pulmotor. The men are the workers in the electrical construction, the operating and the distribution departments of The New York Edison Company and their familiarity with the use of this mechanical life saver is due to the fact that special classes for their instruction have been held since late in October.

First the men who install electrical apparatus in the stations were taught, then the men who are in charge of the generating apparatus and finally the men who work on high tension cables of the distribution system were taught. Twelve men constituted a class and they met at all hours of the day. Some assembled in the early morning, some later in the day and some in the evening—it depended on the shift in which the men worked, for it was the desire of the company to reach them during the working hours rather than call them together in their own time.

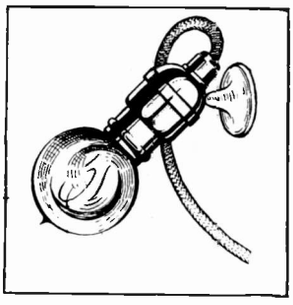
Three company physicians had charge of the instruction, which included not only the use of the pulmotor but of one of the older methods of artificial respiration; that is, by the application of pressure to the back. After the men had been told under what circumstances the application of artificial respiration was proper—that is, in cases of electric shock, gas poisoning, suffocation from smoke and apparent drowning—they were shown and given practical instruction in the Schaeffer prone pressure method.

The mechanism of the pulmotor was then explained, the men being told how to ascertain the amount of oxygen remaining in the cylinder and how to replace an exhausted for a full tank, after which the instructor showed the machine on an unconscious man. After this demonstration the class paired off for practical work, one man acting as the victim while the other put the machine in operation.

The introduction of the pulmotor in New York followed the Electrical Exposition of last October, when two victims of illuminating gas were resuscitated. There are now machines in every sub-station and the Waterside generating stations of the Edison company as well as in several hospitals.

Suction Cup Fixture Holder

An electric fixture to which is attached a little rubber suction cup that can be pressed against a window, a mirror or against any other smooth surface and by atmospheric pressure holds the fixture in position is a recent useful novelty on the market. With the Hand-E-Lite fixture is twelve feet of silk cord. The device is so small that it can be stowed away in the traveler's smallest handbag ready for service in a moment's time.



FIXTURE HOLDER

Electric Drilling in the Oil Fields

The use of electricity in the oil fields has recently been tried out on the property of the Midway Pacific Company and has been proven a success. Well No. 2 was put down by electric power at a saving of $5,000 over the cost of drilling No. 1 on the same property, which was done by the old method.

There was a great economy in time as well and in every way the experiment proved that electric power in the California oil fields has a great future.

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electrical contracting business was anything but a holiday affair. There was very little standardization of methods, no co-operative effort and most of the contractors went around with chips on their shoulders—and there was chaos. Finally some of the more far-sighted ones saw that if the business was to prosper, singleness of interest would have to be the rule instead of the cut-throat methods then frequent. So a small group of them, not over 30, assembled and formed the National Electrical Contractors' Association. This was some twelve years ago. Its force began to be felt immediately. Out of it came such co-operative benefits as the

the electrical contractor. The electrical contractor as a rule is a poor business man and his accounts are recorded usually in a loose leaf book carried in his hip pocket. When a job is finished he has no accurate way of checking up to ascertain how much it has cost him and if he has done the work at a loss he has no method of determining where the trouble is.

One of the things Mr. Freeman desires most to accomplish during his presidency is that of placing in the hands of every association contractor a system of bookkeeping applicable to this industry and so simple that the contractor will have no difficulty in checking up.

Electrical Men of the Times

ERNEST FREEMAN

One of the stories he delights to tell illustrating the co-operative and friendly spirit engendered among the members has to do with a contractor in a large city in Texas. This contractor was new at the business. At best his resources were small and he had bought a large bill of goods on consignment, returnable in six months if not sold. The six months rolled around and most of the goods were still in his store. He had done very little business, creditors were insistent, and he was very down in the mouth. Finally came the sheriff and closed him up and took away his fixtures which were to have been returned.

His extremity became known to the other electrical contractors in the city—fellow members with him in the Contractors' Association. Immediately they formed a pool and staked him, so to speak. They got his fixtures back and opened his store and furnished him some ready money to tide him over. All these brother contractors turned over to him one job of work each, which they had secured for themselves—enough in all to keep him busy for a considerable time—and even lent him men to do the work. He is now one of the most prosperous contractors in that city.

Before the formation of the Association his fate would have been a different one. And it is this very spirit of live and let live, of co-operation instead of elimination, that Mr. Freeman loves in his association, and which he has been so instrumental in bringing about.

On entering Mr. Freeman's offices one is impressed with the quiet, systematic handling of business and this quiet, systematic way is characteristic of the man himself. If he is making a speech he talks slowly and seems to measure each word; but every single word he "gets over," to use the venacular of the stage. While made to feel perfectly at home, the interviewer's "Tell me something about yourself" is met by a smile and a suggestion that friends and other sources must be appealed to if one is to find out how this brown eyed man of medium height and quiet personality has won success.

Telephones in the Vatican

The Vatican has had a telephone system since some time after the present Pope came into power. He is a most progressive man and believes in the adoption of facilities to expedite the enormous business of the Vatican. This telephone system is not only an interior system, but has connection with the outer world by a trunk line or two.

TELEPHONE SWITCHBOARD IN THE VATICAN, IN CHARGE OF A UNIFORMED ATTENDANT

While the Pope does not often use

the system himself, since his secretaries attend to details of Vatican business for him, it is used many times a day on his official business, to transmit his instructions to the various church dignitaries, some of whom reside at the Vatican and many others outside. It can be connected with the long distance lines of Rome and thus with those of the other European cities having telephonic communication with Rome. The picture herewith shows the private exchange telephone switchboard in the Vatican in charge of a uniformed operator.

Missoula's Lane of Light

"There are cities with a greater number of similar lights in use; there are cities which have spent thousands for a more artistic arrangement of ornamental posts and clusters, but there is no city that has a district of equal size so well lighted." So says *The Missoulian* of Missoula, Montana.

There are no confusing shadows, no dark corners, and the beauty of the window displays is greatly enhanced by the light from the new lamps. The illumination from without has made it possible for many merchants to reduce the number of lamps within and has been the means of effecting considerable saving to them in this manner.

The accompanying picture of the city's main thoroughfare at night speaks forcefully of the street illumination. Luminous arc (magnetite) lamps set upon brackets eighteen feet above the street are used. The brackets are attached to steel poles set opposite each other on the street, and spaced 100 feet apart along the curb.

Small expense was incurred by the city in connection with the installation owing to the liberal manner with which the matter was handled by Mr. W. A. Clark of the Missoula Light and Water Company. Missoula is the first city west of the Mississippi to adopt these lamps. The first town in which they were used was New Haven, Conn. At present there are ten installations in different parts of the United States, and a large number of towns are considering their use.

NIGHT SCENE IN MISSOULA, MONTANA

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

A Lesson in Values

Mrs. Fitzgerrell, radiant and successful, awaited her husband in their well furnished dining room; when he appeared, she rang for the maid to serve the bouillon. Then facing him across the spotless table, she proceeded eagerly to demand:

"Have you heard the news?"

"What news?" inquired her husband leisurely.

"I was elected president of the Suffrage Society at the meeting today," was the proud announcement.

"Then I presume you are going in for votes for women and that sort of thing."

"Exactly!" exclaimed Mrs. Fitzgerrell.

"Is suffrage taking precedence over bridge and teas and becoming fashionable?"

"Indeed it is among thoughtful women. It is in the very air and even frivolous women are beginning to wake up."

"I don't see why women want to vote," began Mr. Fitzgerrell, helping his wife to a choice bit of rare beef. "Don't I provide well for you? Don't I give you the best of everything?"

"Yes, you are a dear, but we women want to be real citizens. We have had a great deal of experience in practical housekeeping within the four walls of our homes and now we want to have a hand in municipal housekeeping."

"Well, we business men are so busy tending to our own affairs we have been in the habit of letting the politicians run things."

"That's just the point. Property owners and business men do not take sufficient interest in municipal affairs. You are all too busy making money. You say things about the grafters, pay the graft and keep right on making money."

"But I don't see how it's going to help if women mix up in such matters."

"To illustrate," began Mrs. Fitzgerrell judicially, "there is the initiative, the referendum and the recall which should be in operation now in practical politics. I have practiced the recall for some time in the administration of my home affairs."

"I don't think I quite understand."

"When you voters put a man in office he is elected for a certain length of time and no matter how crude or how inefficient he may prove to be, or how much positive damage he may do in municipal affairs, there he stays until his term expires. Could anything be more foolish or more wasteful?"

"I admit your point. What is your plan?"

"Well, when I employ a maid who proves to be inefficient, I put into effect the recall. If she begins to break up the dishes, I do not let her continue to break up my best china for two whole years, I recall her at once and dismiss her."

"And do the dishes yourself?" inquired Mr. Fitzgerrell quizzically.

"No," returned his wife calmly and serenely, "I get an electric dishwasher and save my chinaware."

Mr. Fitzgerrell laughed in his hearty, wholesome way.

"Would you suggest an electric dish-washer for municipal management?"

"No," returned Mrs. Fitzgerrell brightly, "but I would apply electrical efficiency to practical politics. Instead of doing the municipal housekeeping in the clumsy, cumbersome way it has been done, we up-to-date women would introduce the principle of efficiency in civic affairs. The slogan of the modern housewife is, 'efficiency, economy of operation and values.'"

"Values!" repeated Mr. Fitzgerrell vaguely.

"GREAT SCOTT! BUT I'VE HAD A GREAT LESSON IN VALUES"

"Yes, women have always been the great conservers of social values. All men do is combine and recombine the elements they find and sometimes the combinations they make are bad, while women have always been accustomed to give things time, place and form values."

"You have a habit, Marian, of sometimes getting beyond my depth," observed Mr. Fitzgerrell. "You know I am just a plain everyday banker, and not accustomed to sounding the subtleties of psychology or chemistry."

Br-r-r-r-r! buzzed the front door bell. The maid entered promptly with a folded paper in hand which she gave to Mr. Fitzgerrell.

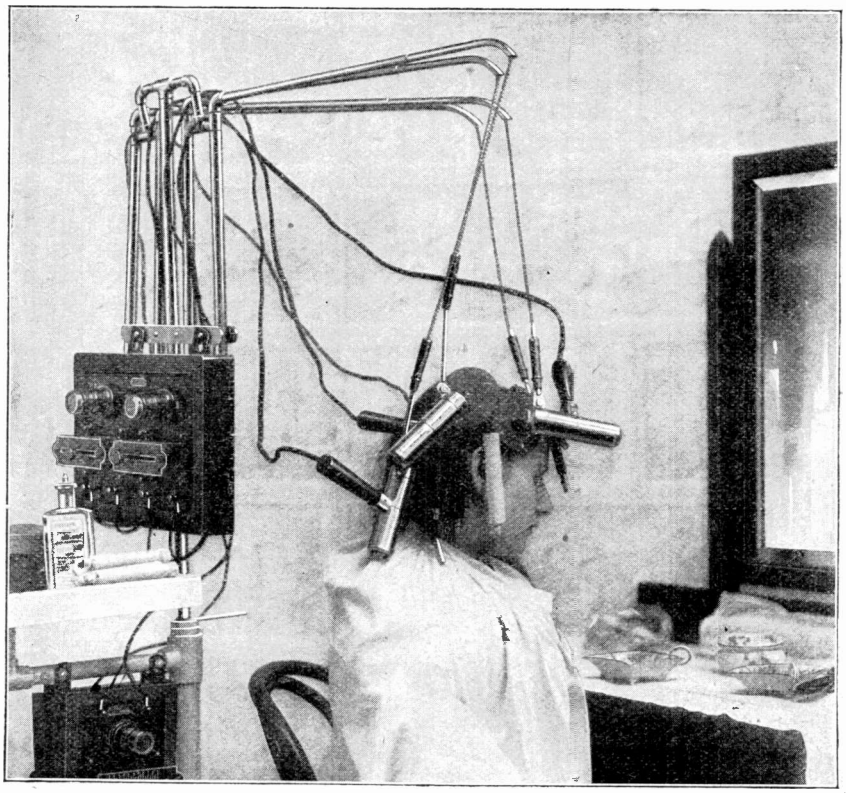
"Great Scott!" exclaimed that gentleman in startled tones.

"What is it dear?" enquired his wife sweetly.

"It's the bill for the electric dish-washer," remarked the head of the house weakly. "You've saved your china, Marian, but—"

"But what?" said his brilliant wife.

"Oh, nothing, it's all right, but I've had a great lesson in values and of course that's worth something."



FOUR HEATER OUTFIT FOR HAIRDRESSING ESTABLISHMENTS

The Permanent Hair Waver

"What would you do with hair like this?" The question was asked by a comely young woman, who possessed a clear complexion, hazel eyes, good features and a tendency to make the most of her talents and her natural charms, but her hair was her despair. It was irregular in length and hung down in lanky locks about her eyes. Every morning with a hot curling iron she gave these locks a few twists on the curler and pinned them up out of her eyes, but by nightfall they hung disconsolately downward without a vestige of curl in them, hence her despairing inquiry, "What would you do with hair like this?"

"Well," remarked the friendly visitor, "I would have such hair put into a permanent wave."

"A permanent wave," said the young woman, "why what is that?"

"The permanent wave is a new patent process of changing straight hair into natural wavy hair by electrical and chemical process of recent discovery. It is the invention of an eminent specialist formerly of Paris and Germany. It is well known in Europe where it has delighted many women, but women on this

side are quite mystified as to its action.

"To explain simply, just picture a strand of hair as a horn tube. Children's hair and naturally curly hair have tiny pores leading from the surface into the interior of the tube or central channel of the strand of hair. These tiny pores become clogged by a fungus growth as the years pass and with the closing of the pores opening into the central channel, the hair becomes lank and straight, losing its charm and becoming difficult to dress becomingly. The permanent hair waver produces the wave or curls of any style by opening these tiny pores, by removing the fungus growth from the affected straight hair, cleansing it and giving to it the beautiful texture as well as other advantages of natural wavy hair. When once waved, the hair remains so until it grows out from the roots."

Exorbitant prices are obtained by doing this work and the demand has been greatly in excess of the supply of skilled operators who have learned to do it. It is possible for a skilled operator and assistant to wave two heads of hair a day, which would mean an income of something like sixty dollars a day. This can be done at the lady's own home providing there is electricity available, so that it is not really necessary to have an establishment to do the work.

The hair must first be shampooed and it is advisable to have this done the day before the waving is done. After arranging the outfit so that everything is convenient for use, the work is begun by dividing off a portion of the hair beginning in front and tying close to the roots with the tying cord. A strand of hair is wound very tightly around the curler beginning at the end that is tied and the winding must be perfectly flat and smooth. Tie the thread after the entire curl is wound and it is ready for the application of the chemical. The strand of hair is then covered with a

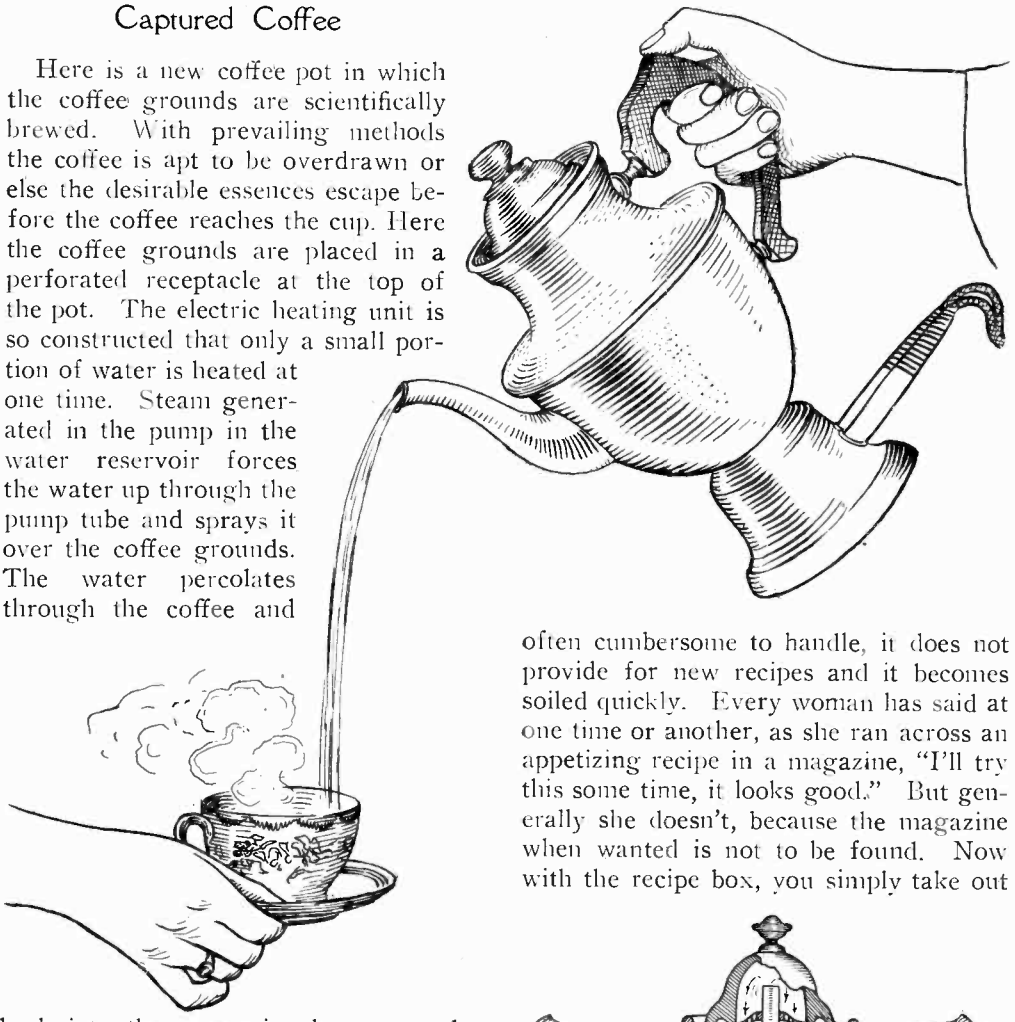
A SMALL OUTFIT IS MADE FOR HOME USE

strip of gauze that protects the hair from the powder after the chemical has dried. A flannel strip moistened with the chemical is wound over the strand above the gauze. It is now ready for the asbestos tube which is slipped over the strand. A shield protects the scalp from the heater. The electric current is then turned on until steam appears from the ends of the heater. This heat creates a vacuum and the suction combined with chemical action draws from the hair the particles that close the cells. By this process the hair is transformed from straight hair into a naturally wavy condition. Hair that is naturally wavy is free from cell clogging fungus growth and if hair that has been subjected to this treatment should become straight, all that is necessary to restore the wave is a good shampoo. Such hair is not affected or straightened by rain, moisture, or shampoo. It is claimed that the process is a benefit to the hair.

A complete outfit for giving this wave at home consists of two electric controllers, heaters, curlers, tubes, chemical and other accessories.

Captured Coffee

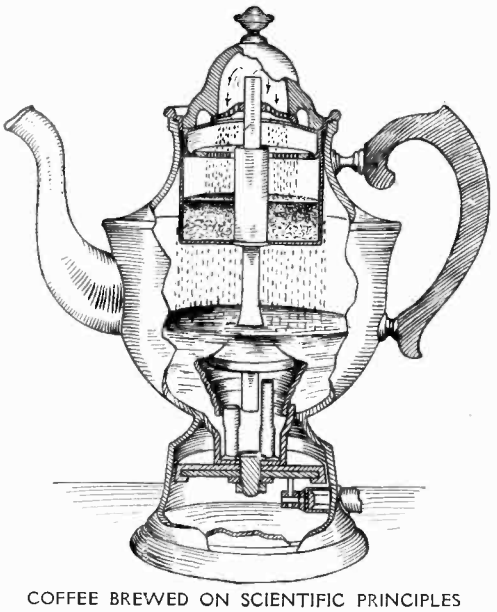
Here is a new coffee pot in which the coffee grounds are scientifically brewed. With prevailing methods the coffee is apt to be overdrawn or else the desirable essences escape before the coffee reaches the cup. Here the coffee grounds are placed in a perforated receptacle at the top of the pot. The electric heating unit is so constructed that only a small portion of water is heated at one time. Steam generated in the pump in the water reservoir forces the water up through the pump tube and sprays it over the coffee grounds. The water percolates through the coffee and back into the reservoir, the process being continuous. The little pump inside this pot is constructed on the same scientific principle as a city pumping station.



The aromatic, volatile essences do not escape but are captured, producing a delicious beverage.

Recipe Box Aid to Housewife

The recipe box is a quick and convenient system to take care of cooking recipes. Each recipe is on a separate card filed behind appropriate guides. New recipes may be added at any time. Every woman who has used the ordinary cook book has realized its limitations. It is often cumbersome to handle, it does not provide for new recipes and it becomes soiled quickly. Every woman has said at one time or another, as she ran across an appetizing recipe in a magazine, "I'll try this some time, it looks good." But generally she doesn't, because the magazine when wanted is not to be found. Now with the recipe box, you simply take out



COFFEE BREWED ON SCIENTIFIC PRINCIPLES

a blank card, paste the recipe on one side, make any notations you wish on the other side and file in the box.

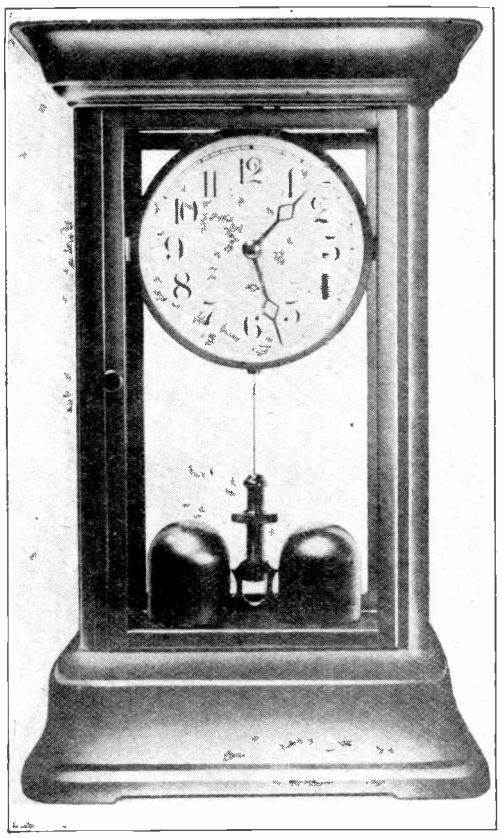
There are the hundred-and-one household helps which are encountered in the day's reading. Some are valuable and should be preserved. With the recipe box at hand it is only necessary to clip the article, paste it on a card and file it behind the proper guide in the box. The recipe cards are unique in that they give the ingredients in one column, the quantity in the next column and remarks occupy the third space. In the ordinary cook book the ingredients, quantities and directions are all run together and it is often difficult to differentiate one from the other.

Clock That Needs No Winding

For years many inventors have tried to produce a practical and ornamental electric clock for the home; one which would not need to be wound and would yet be so simple in its mechanism that it could be produced at a price within the reach of all.

A new clock said to fulfill these requirements is sold under the trade name of the "Never-Wind." The case is of polished brass, heavily gilded and lacquered, 9½ inches high, 6 inches wide and 5½ inches deep. The clock operates without springs, weights or wires or any outside connections, the motive power being an ordinary flashlight, dry battery concealed in the base. The cost of the battery is 25 cents and as the battery runs the clock six months or more, a cent a week for battery power saves the trouble of winding the clock.

From the battery in the base, two small wires run in one of the hollow posts at side of clock, one from the carbon and one from the zinc contacts of the battery, these wires connecting, one with an electro-magnet and one with the pendulum wire at very top of clock movement. The pendulum weights do not swing to and fro as in an ordinary clock but revolve first about one and a half turns to the right and then to the left. On the pendulum wire is a platinum contact pin, which by the action of the pendulum is brought into contact with a platinum plate, thus completing the electric circuit, pulling up the armature at bottom of the magnets which in turn works a pawl on the ratchet wheel

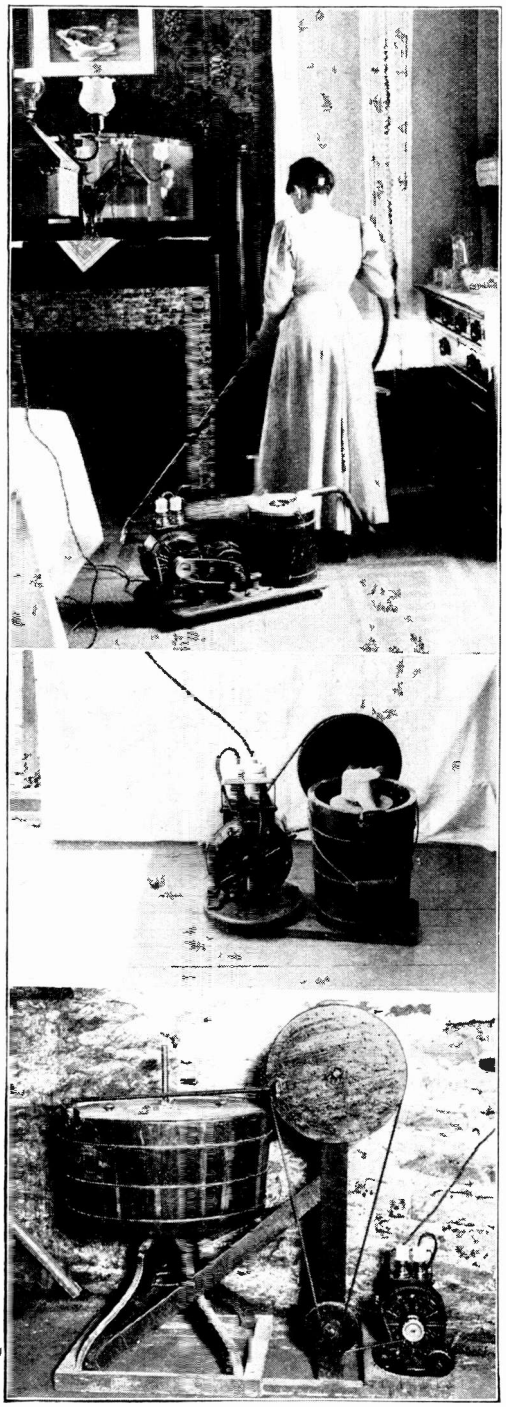


CLOCK OPERATED BY DRY BATTERIES

and thus the minute and hour hands are operated.

A regulating nut just above the pendulum weights can be turned to the right for "fast" or to the left for "slow," in this way shortening or lengthening the twist of the pendulum wire, which in turn regulates the time of the clock.

It is amazingly simple and needs only to be seen to be appreciated, especially by all women who forget to wind their clocks or watches.



SOME OF THE USES OF A SMALL MOTOR IN THE HOME

A Versatile Small Motor

Mrs. Deemer, a Pennsylvania woman, has solved the servant problem in a very unique and efficient way by letting a small motor do her hard work. It is true, of course, that many women have a motor driven washing machine, or a motor driven vacuum cleaner, but usually the motor does just one thing and no other. Mrs. Deemer's, however, has seven distinct duties. It runs a vacuum cleaner, a washing machine, a grinding wheel, a polishing wheel, a ventilating fan, a sewing machine and an ice cream freezer. Current is taken from the nearest lamp socket and the motor is started by simply turning the switch.

To operate the vacuum cleaner, the motor, which by the way doesn't weigh much more than a flat iron, is clamped to a small platform and belted to the vacuum cleaner pump, which with the dust receptacle is also mounted on the platform. The platform has casters and rolls around very easily. With this outfit it is easy work to get the dust out of the rugs, tufted furniture, portieres, mattresses and corners hard to get at with a broom.

In a similar way the motor is attached to the washing machine. On wash day the motor is started, and while the family is at breakfast the first tubful is being washed; the second is put through while the dishes are being washed. No attention is needed except to put in and take out the clothes.

For polishing silver a chuck is screwed on the extended shaft of the motor, a cloth wheel is slipped on and it takes just a few minutes to polish all the silverware. By substituting an emery wheel the kitchen knives, choppers and the like are kept in good usable condition.

A fan wheel can also be attached to the shaft and used to circulate the air in the summer and to distribute the furnace heat throughout a room in the winter.

By transferring the motor to the sew-

ing machine all the hard part of sewing, the treadling, is eliminated. A small idler pulley permanently attached to the motor (shown in the illustrations) is connected by a small chain to the treadle. The belt is run from the motor pulley, over the idler pulley and around the machine hand wheel. By pressing on the treadle the belt is tightened and the machine starts. The speed of the machine is controlled by the pressure on the treadle from a stitch at a time to as fast as desired.

Lastly, the motor turns the ice cream freezer. This was originally hand operated but the crank was replaced by a homemade wooden wheel grooved for a belt. To make ice cream electrically takes about five minutes against two or three times as long by the tiresome hand method; consequently homemade ice cream is almost an everyday occurrence.

It was very easy to apply this motor to so many useful duties and it seems strange that there are so few instances of this kind. It is rated at 1/6 horsepower and costs about two cents an hour to run.

Electricity as an Invigorator

A certain person was ill and on the verge of collapse. She was sure that she could not live through the day, and it was to be a busy day. It was impossible for her to get away to the Springs, but there was hope in an electric bath treatment. There were some very fine baths in the city where she lived, and she resolved to try them when she was about ready to drop from exhaustion.

First she was placed in an electric light cabinet for fifteen minutes, then she was hustled into a tub of warm water with electric currents vibrating through it. "Now, you are going to feel this in your shoulders," said the attendant, and she felt it. "Now you are going to feel this up and down your spine." She felt it. There was a merry little sizzling song on the switchboard and the lifegiving currents pulsed through the warm water. Then came an excellent salt rub and an exhilarating pine needle shower, and the healing process was complete. The sick one was well. "How do you feel?" inquired the attendant, poking her head into the rest room an hour later. "Fine," exclaimed the patient; "I think I'm about well and I'm as hungry as a bear."

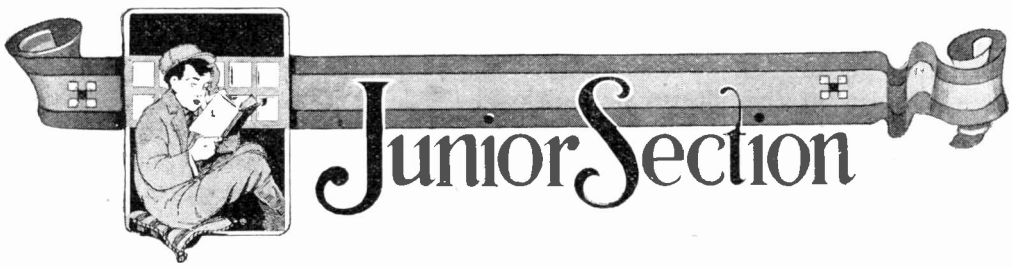
Mechanical and electrical therapy are coming into more and more use in treating ailments, and the results obtained are such as to cause the greatest hopes for the future of this kind of treatment. In this field electricity has no competitor, for the science itself is built on electricity.

Thoughts for Housewives

When women are free from the barbarities of present methods of housekeeping—the market basket, the kitchen utensils, the scrubbing brush gone from every house; electricity everywhere spreading warmth and life, they will still be forced to do a certain amount of work. This cannot be avoided even by the help of the most perfect apparatus or by cooperative methods, provided the house is not to be replaced by the barracks.—*Ellen Key.*

Wherever a true wife comes, home is always around her. The stars may be over her head—the glow worm in the night-cold grass may be the fire at her foot, but home is where she is; and for a noble woman it stretches far around her, better than houses ceiled with cedar or painted with vermilion, shedding its quiet light for those who else are homeless.—*Ruskin.*

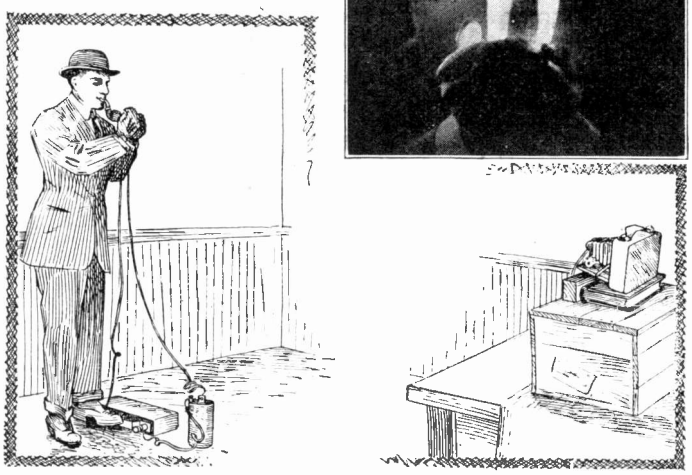
You talk of the fire of genius. Many a blessed woman who dies unsung and unremembered has given out more of the real vital heat that keeps the life in human souls, without a spark flitting through her humble chimney to tell the world about it, than would set a dozen theories smoking or a hundred odes simmering in the brains of so many men of genius.—*Oliver Wendell Holmes.*



To Take Your Photograph.

With an ordinary camera and the apparatus described, one may take his own picture in a darkened room and obtain fairly artistic results. The flash part of the equipment requires a 3½ volt battery, a 3½ volt tungsten lamp, fourteen feet of flexible wire to make connections, two battery binding posts, a strip of copper or brass ½ by 4 inches and a block of wood. Drill a hole in the strip the same size as the binding post screw and about ½ inch from the end, then connect up the wooden block as shown with the switch in series with one of the wires running to the lamp.

To take your own picture, place the camera on a table and focus it upon some object that is about the same height as your shoulders and the right distance away. Leave the camera setting in this position and turn out the lights as the room should be dark. Now open the shutter of the camera, place the lamp in your hands, using them as a reflector and when you have about the right position press your foot against the spring switch. This will light the lamp and in turn light up your face. The exposure may be about 30 or 40 seconds at the end of which the foot releases the spring contact. Before turning on the light close the camera shutter. A few trials will settle the time question. Photographs taken in this manner do not have the startled expression characteristic of flashlight pictures.



METHOD OF TAKING ONE'S OWN PHOTOGRAPH, AND THE RESULT

The Power of a Meteor

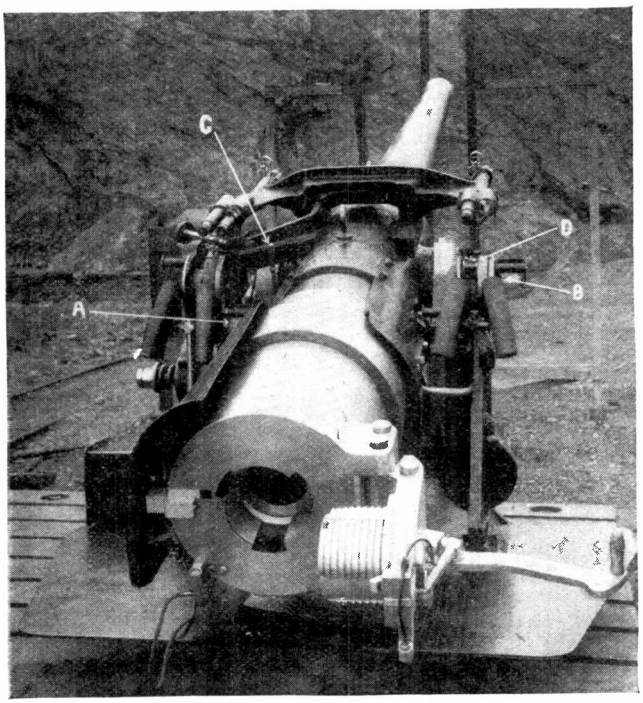
A most curious observation of the effects produced by a meteor at sea was once made a part of a government report.

Some years ago, the captain of the British steamship "Nerano," when a little more than 200 miles southeast of Cape Clear, during a voyage from Baltimore to Havre, saw a meteor that appeared to pass close to his ship.

An observation of the North Star taken soon after the appearance of the meteor showed a surprising result. The

direction of the ship's compass needle had been changed no less than eleven degrees. Before the meteor passed, the needle had pointed about five degrees 30 minutes west of true north, but now it pointed five degrees 30 minutes east of north.

That the meteor had caused the change was indicated by the fact that within 24 hours the needle returned to its former position, moving slowly back about eleven degrees toward the west.

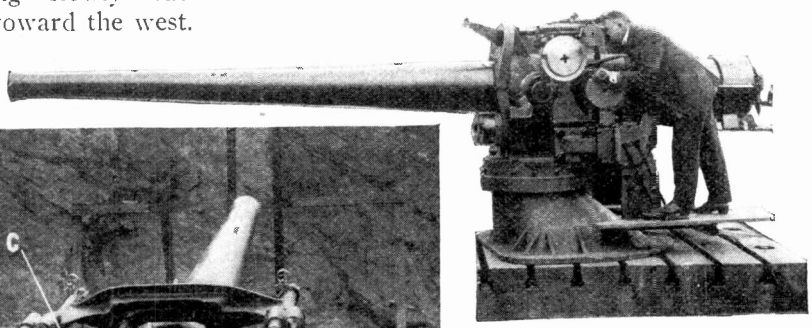


HEAVY ORDNANCE WHICH IS MANIPULATED AND FIRED BY ELECTRICITY

Equally great effects have been produced upon ships' compasses by lightning, but in such cases the bolts have actually struck the ship. The meteor seen by the "Xerano" did not touch that vessel and while no estimate of its actual distance was made, it was probably considerable, since the report contains no record of its having been observed to fall into the sea.

Aiming and Firing a Heavy Gun

Comparatively heavy ordnance, that is, guns as large as four and six inch bore, are aimed and fired in much the same manner as the lighter guns, by aiming directly through the telescopic sights from a position at the breach of the gun. But of course the piece is much too heavy to swing and depress readily by hand, so



the work is done by motors and electricity also is used for the actual firing. In the four inch pedestal rifle shown the operator is in position at the variable speed gear mechanism. His left hand rests on the lever (A) controlling the electrically operated pointing mechanism. At (B) is the trigger for electric firing. At (C) is a handle used for percussion firing, which may be used if necessity demands. At (D) is the circuit closer putting the electric firing parts in readiness for action upon pulling lever (B).

Strange Electric Storm

One night in February, in south latitude 33 degrees, west longitude 38 degrees, the sailing vessel Ville-du-Havre encountered a most remarkable electric storm. The rain fell in torrents, and the ship appeared to be electrified, the mastheads flaming like giant candles. Strange

lights traveled over the rigging, and after every flash of lightning a part of the vessel which had been newly painted remained for several seconds glowing with phosphorescence. The lightning, which was very frequent, instead of displaying itself in zigzag lines, took the form of flying bombs, which exploded with outbursts of light that illuminated the whole sky. Before and after the more violent explosions of thunder fierce gusts of wind swept the ship. This terrifying experience lasted for five hours with no respite.

An Archimedes Tower

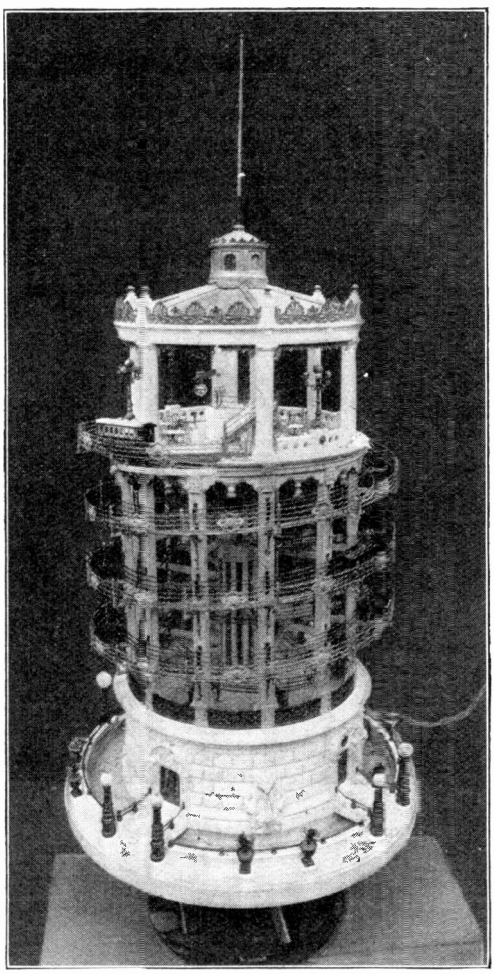
John B. Daleo, a young Italian sculptor, residing at 228 Degraw street, Brooklyn, N. Y., has constructed a remarkable electric tower, which he has named after the gifted Sicilian, Archimedes. He has so designated it because it is built on the plan of what is known as the Archimedes screw.

The tower measures six feet six inches from base to tip of flagpole and is at once artistic and ingenious. Electricity is employed for propelling the cars, for lighting and for running the water wheels.

In the upper part of the tower is a restaurant, at the entrance to which the car stops. All the electric wires are hidden in the construction, making accidents therefrom impossible. The cars and lighting require 190 volts. Thirty-six tungsten lamps, corresponding to the light of 216 candles, are used for illumination.

The base of the tower, constructed of wood, is 40 inches in diameter. There are four entrances to the building, which are led up to by a flight of steps. The fountains at the side of the doors spout water into a pool, where small fish might be kept. The candelabra in front of each door give the proper light. Eight decorative vases are placed around the base. The bottom of the tower is made of plaster composition, the inside of which contains the electrical apparatus.

The railway structure is of wood and casting metal. At the bottom is the platform station for the loading and unloading of the cars. The electric car starts from the station and runs on the outside track to the restaurant at the top, remaining here but a second or so, and then starting on the return journey, taking the inside track, which connects with the outside one at the bottom. (This railway is an ingenious piece of work.) When a car stops at the upper station, another is at the lower platform. Both cars are in



ARCHIMEDES TOWER

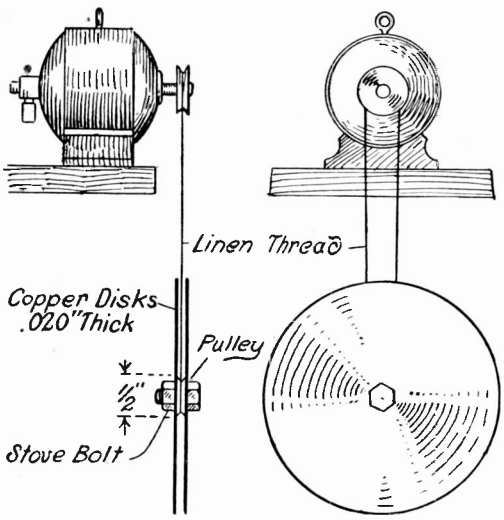
motion at one time, controlled by a separate motor. A fence is built for the safety of the passengers, with a broad walk on the inner side of the railway. The third-rail system is used.

Certainly Mr. Daleo has shown considerable genius in constructing the tower, but the question naturally arises—of what practical use is it? In his opinion, it might serve as a model for a large building at some seaside resort, utilizing the base as a theater and the upper part as a restaurant. One can easily imagine that a building constructed after this model, brilliantly lighted by electricity, with the cars ascending and descending on the winding tracks, with the music floating out on the upper air and with the chance of dining in the cool breezes hundreds of feet from the ground, would attract great throngs and could be made to be a paying investment.

Odd Static Generator

The outfit here illustrated I accidentally discovered will generate static electricity.

Upon a shelf or the edge of a table fasten a small motor that will run at a



STATIC GENERATOR

speed of about 3,000 revolutions per minute. On the shaft of the motor there should be a small grooved brass pulley. Provide a second pulley about ¾ inch in diameter and a small stove bolt that just fits the hole in it. From thin sheet copper cut two disks exactly alike, and six inches in diameter. Drill a hole in each disk of the same size as the hole in the pulley, and fasten the disks, one on each side of the pulley with the stove bolt as shown. Now make a belt of heavy linen thread. Place the thread over the pulley on the motor and set the disks' pulley upon the loop, thus leaving the disks suspended in the air. Start the motor, give the disks a turn and as soon as they come up to speed, they will act as a gyroscope and keep balanced. Take a piece of copper conductor in the hand and bring the metal near the disks. A ¾ inch spark can be taken off. An incandescent lamp held near the disks will glow with a weird blue light.— E. H. SAMEN.

Short Circuits Produced by Birds

Birds perched on or flying between the wires of a high tension system often cause a short circuit which may result in considerable damage at the central station and also in the electrocution of the bird. This occurs, however, only with birds having a considerable spread of wing; but with these it happens so often that in certain regions the total destruction of birds of large wing area is likely to result.

A case of this kind occurred recently in Germany, caused by a panic in a flock of starlings on the appearance of a hawk. Several of the birds and the hawk were caught between the high tension coils and the insulators in such a way that the high tension cable was grounded; but as the ground wire of the tower carrying the insulators and the transformer had become a bad conductor as the result of dry weather, the high tension current passed by the low tension circuit line to the earth at the same point, occasioning damage and fires in the homes of the consumers, as well as interupting the light service. The intensity of the current arising from the short circuit formed by the birds was not at any time great enough to put into action the automatic apparatus at the station.

And Their Friend's Were Led to It

A dingy little confectionery and tobacco store has stood for years in the center of the ghetto district, Pittsburgh. Nobody remembers just how long it has endured. Many grown-ups have been youthful patrons. From time to time it has changed hands, and with the last change it came

THE STREET WAS HALF FULL OF SHOUTING YOUNGSTERS

into possession of a young man, who introduced some innovations, among them a modern penny-in-the-slot scale.

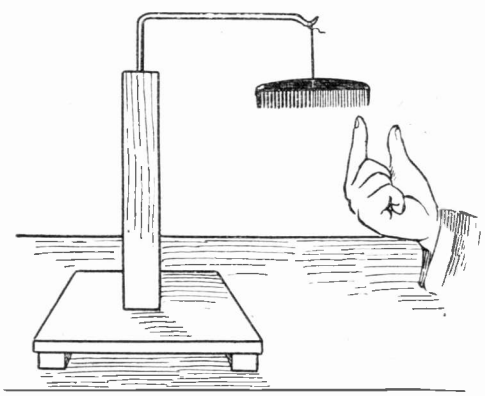
From the first the scale seemed to become the center of attraction for the youthful population, who tried to work it without the assistance of pennies. The storekeeper soon realized that unless something was done the destruction of the scale was imminent.

An old high tension magneto in the back cellar offered an inspiration. Forthwith it was installed behind the counter. One terminal was grounded. A concealed wire was run from the other terminal to the metal body of the scale. The scale was propped up from the damp bricks on some dry blocks of wood dipped in melted parrafin.

Very shortly, some youngsters approached and commenced playing with the scale as usual. The storekeeper hied himself back of the counter and gave the magneto a vigorous turn. The kids got the surprise of their lives. Undaunted, however, they touched the scales a second time, receiving another shock. The storekeeper saw them make off up the street at a run and inwardly exulted but he was a poor student of kid nature. In a few minutes the original kids returned with three more. The newcomers were led up to the scales, experienced a shock, wondered a moment, and then "beat it" up the street to find some new victims. In a short time the street was literally half full of shouting youngsters fighting for a chance at the scales. About this time, the storekeeper decided that electricity might be very efficacious for some purposes but here was a case where it was a signal failure.

Controlling Finger

Electrify a rubber comb by rubbing it briskly with dry flannel. Suspend it as shown by a silk thread previously at-



COMB THAT TURNS UNDER THE INFLUENCE OF AN ELECTRICAL CHARGE

tached to it. When a finger is held under it the comb will follow the finger, turning round and round as the hand moves.

Fishing Up a Cable

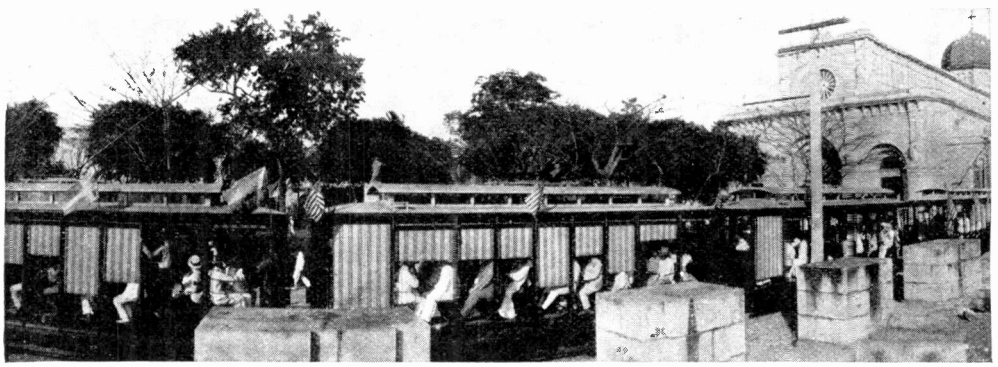
A copper wire, coated with gutta-percha, was, in the year 1850, laid under the channel between England and France. Messages were sent from coast to coast, and men of science and capitalists in both countries were congratulating one another upon this triumph, when one morning, soon after the completion of the great work, communication suddenly ceased.

That morning, it appears, a French fisherman of Boulogne was going out in his boat. A British seaman, who at the moment had nothing to do, was seated on a coil of rope on the dock, looking out over the sea and meditating as he smoked his pipe. The Frenchman invited the Britisher to join him in his little expedition for fish.

Away went the two, bearing to the northward along the coast before a light breeze, until they finally brought up off Cape Grisnez.

Here the Frenchman let down his trawl and fished up among other curiosities of the deep the submarine cable before mentioned. Both he and his British friend were, to say the least, surprised. To the fisherman it seemed a species of seaweed; to the Britisher a form of petrified marine monster. The latter, handing his friend a heavy knife, the Frenchman forthwith cut off a small portion of the cable and let the end go.

The two bore their prize to Boulogne, where it was exhibited by them as a specimen of rare seaweed with its center filled with gold! Meanwhile the telegraphers at each end of the cable sat gazing in dismay at their useless instruments.



HANDLING A CARNIVAL CROWD IN MANILA

Handling the annual carnival crowd in Manila requires a lot of forethought on the part of the schedule expert of the street railway system. In the Walled City the streets are so narrow that they accommodate but a single track and the operation of cars to avoid congestion becomes a fine art when traffic is unusually heavy. Often a dozen cars get so close together in creeping through the narrow thoroughfares that they resemble a train of trolleys. All the rolling stock is bedecked in flags during fiesta days and from the large variety displayed one knows that the holiday is an international one, rather than a celebration purely for Americans. For instance, the British don't care to fly the Union Jack along side the Stars and Stripes on the Fourth of July and Spaniards keep the Red and Yellow of Spain in the dark on Occupation Day.

Experimental 200 Meter Wave Sets

By PHILIP E. EDELMAN

PART I

The wireless law practically limits all amateur experimenters to 200 meter wave sets. Although this limitation means that the design and size of the apparatus must conform to certain requirements, it will not be a difficult matter to establish a good 200 meter experimental station.

The purpose of the present article is to give specific data for experimental 200 meter sets which comply with the law and it aims to present the matter so that the readers can establish the stations without calculating the circuits and dimensions. The construction and use of the series condenser will be taken up first because there are many readers who already have outfits, and who do not wish to go to great expense to comply with the law. The series condenser will enable them to make their old outfits comply with the law in most cases at very little expense. The remainder of the chapter will consider sets which use a short aerial. The object is to give definite data for particular sets rather than general data for any desired case.

THE SERIES CONDENSER.

It is a well known fact that the wave length depends upon the capacity and the inductance in a given circuit. Now in most of the old outfits the value of the capacity and the inductance is too large to comply with the law because the aerial is too large. At the same time, the large aerial is an advantage for long distance receiving, and as there is no restriction on the receiving wave length, it is very desirable to keep the old aerial as it is.

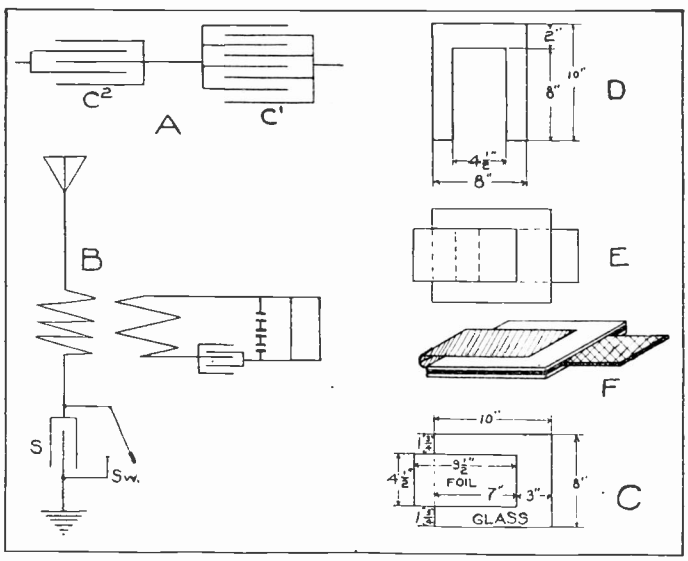


FIG. 1

When the large aerial is the main item which keeps the value of the circuit too high to comply with the law, a small condenser can be inserted in the aerial circuit to keep the wave length within the limit. In this case, the large aerial may be used as it is, for receiving purposes.

The series condenser arrangement

operates on the principle that the combined capacity of two condensers which are connected in series (A, Fig. 1) is less than the capacity of the smaller condenser. Thus if the capacity of the condenser (C^1) may be represented by ten units and the capacity of (C^2) by two units, the combined capacity of (C^1) and (C^2) in series is less than two units. The antenna itself may be considered as the larger condenser because it consists essentially of conductors forming a capacity with the earth, the air serving as the dielectric.

The arrangement is shown at (B) Fig. 1. The aerial proper corresponds to (C^1) in (A) and the series condenser (S) corresponds to (C^2). The switch (Sw) is useful when automatic or break arrangements are used, as the series condenser is not desired for the receiving circuit. It may be omitted, and in any case the switch is always left open when transmitting. It will be understood that the series condenser makes the capacity of the secondary circuit less and consequently lowers the wave length. The aerial system can thus be operated at less than the natural wave length and this new wave length can be limited to 200 meters by the use of the proper size of condenser. The size for this condenser is best determined by trial, using either of two methods, as follows:

1. *Hot Wire Ammeter.* The primary circuit having been fixed at 200 meters, (See "How to Comply with the New Wireless Law," November and December issues), connect the series condenser in the antenna circuit. Pressing the key, and having a hot wire meter in circuit, adjust the inductance in the secondary circuit until a maximum reading is obtained. Now vary the capacity of the series condenser and repeat, continuing until the maximum reading is obtained. Note the connections and the capacity used for future reference.

2. *Wave Meter.* If you have a wave meter, it will only be necessary to measure the wave length of the secondary circuit with the series condenser connected in. Vary the capacity of the series condenser until a 200 meter wave length is obtained with a desired amount of inductance in the circuit. This may be checked with the hot wire meter to insure the maximum radiation.

Construction of the Series Condenser. The condenser for use with the average aerial will not need a very large capacity. The conditions vary so much in each case that a variable condenser is the most desirable form. The condenser which is described is of such dimensions that it will work well with a large percentage of the average old outfits, and if found too small or large it can readily be altered.

Obtain two identical pieces of ordinary window glass 8 by 10 inches. Coat one side only of each piece, with heavy tin foil or copper sheet as shown at (C), Fig. 1, taking care to make the foil smooth and space as shown. The 2½-inch extension of the foil is for connection. Give each plate a coat of shellac on all surfaces. Now cut out a piece of 1/32 inch fiber sheeting to the dimension and shape shown at (D), Fig. 1. Obtain also a piece of brass or copper sheet cut to the dimensions of 4½ by 8½ inches and smooth off the edges with a file. Now shellac the fiber piecee to the two glass plates so that the blank faces are next to the fiber and the foil surfaces are on the outside. The two plates will then be fastened together with the fiber between them, so that the extensions of the tin foil are at the back and the open part of the U shaped fiber is at the opposite end. This will be clear by referring to (E) and (F), Fig. 1, which are the plan and isometric views of the assembled condenser. The brass sheet is then placed in the recess thus formed so that it can be moved back and forth, thus varying the capacity. The condenser should be mounted so that it is well insulated and heavy flexible conductors should be soldered to both the foil coatings and the brass sheet. The assembled

condenser should be mounted in a vertical position if possible.

Condensers for larger sets can be constructed in the same manner, using thicker glass, larger dimensions and having the fiber cut larger than the glass plates, to form a flange. The capacity for use with medium sizes of aerials may be larger than for larger aerials. There is a practical limit which will soon be found by experiment. It is well to start with all of the capacity and then to reduce the capacity by pulling out the brass plate until the desired position is found.

SHORT AERIALS.

In the remainder of this chapter, we will be concerned particularly with 200 meter sets operating with short aerials. As has already been pointed out in this chapter, the total length of the aerial should not exceed 120 feet. Inasmuch as lead-ins

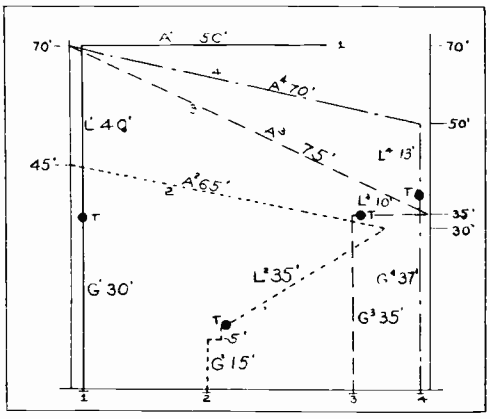


FIG. 2

and ground wires must be counted in the length of the aerial, the aerial proper can not very well exceed 75 feet in length. This will be clear from Fig. 2, in which four cases are shown. The aerials in this illustration are indicated by the numerals (1), (2), (3) and (4) and are shown as simple distinct lines to indicate the length and arrangement of the parts. Thus, (A^1) 50 feet means that the aerial (1) proper is 50 feet long. (L^2) 35 feet means that the lead-in of aerial (2) is 35 feet. And (G^3) 35 feet means that the distance from the instruments to the ground is 35 feet for aerial (3). The black circles (T) indicate the positions of the sending instruments.

Aerial (1) indicates a horizontal aerial 50 feet long and suspended 70 feet high. In order to use such a high aerial, it is necessary to make it this length, and to have the ground lead and lead-in substantially in a straight line, if the total length is to be kept within the limit.

The aerial (2) is 45 feet high at one end, 30 feet at the other, and is 65 feet long. The lead-in is 35 feet and the instruments are about seventeen feet up from the ground. It will be noted that a bend is indicated in the ground lead, which amounts to about five feet extra. This is a typical case and usually occurs when the water pipes are used for grounding.

Coming now to aerial (3) we see how a 75 foot aerial can be used with a short lead taken from the lower end, to keep within the limit. In this case, the instruments are 35 feet from the ground so that the ground wire must be substantially straight. Aerial (4) needs no special comment, and shows how an aerial 70 feet long may be used if the leads are made substantially straight.

Whatever modification a particular case may require, the total length should be kept within the 120 foot limit. To take a special case, suppose that it is possible to have two aerial supports, one of which is 61 feet high and the other 39 feet. Suppose it is found that the instruments can be located in a room 27 feet up from the ground and situated near the 39 foot aerial support. This case might readily occur in the average city.

A suitable arrangement complying with these limitations is shown in Fig. 3. Here the aerial proper comprises four conductors 75 feet long of No. 12 copper, or seven strand phosphor bronze wire, spaced two feet apart on the spreaders. The supports can be poles as indicated or extensions on buildings, trees, or other arrangements, it being understood that

the aerial is well insulated. The lead-in consists of four wires of the same capacity as the aerial wires, eighteen feet long and in the form of a rat tail. Each wire is fastened and soldered to one of the antenna wires. The instruments are again indicated by (T) and the ground lead is run straight to a good ground. In this illustration the antenna conductors are shown, turned out of their plane, in order to make

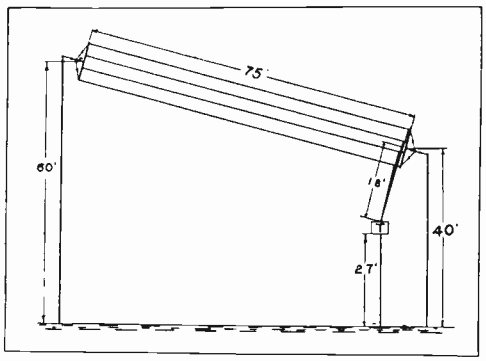


FIG. 3

their appearance clear. It will be noted that the height of the antenna from center to center is 60 feet at one end and 40 feet at the other on account of the slant of the supporting ropes. The fact that a pole is 60 feet high does not always mean that the antenna will be 60 feet high, as is shown in this case.

It should not be difficult to arrange a short aerial to meet the particular conditions for any case. When a larger aerial is already in use, a short aerial can be erected as described, for use with the transmitter only. In such a case it is preferably located at a right angle to the larger aerial. The use of the series condenser, as described, makes the erection of such a short aerial unnecessary. Simple aerials with direct leads are to be preferred for short wave lengths because they aid efficient radiation and sharp tuning at the low wave length. An aerial which takes all sorts of twists and bends should be avoided.

GROUND CONNECTIONS.

With a low wave length, a good ground becomes even more important than heretofore. It is not considered necessary to go into the details of the various forms of grounds other than to point out the need for good connections. Make the ground lead as short and direct as possible. Remember that every foot saved in this part of the aerial can be put to use in the antenna and that every foot wasted means another limitation to the wave length, which can be alloted to the remainder of the circuit. Every twist and turn should be avoided if possible. If connection is made to the water pipes, be sure that it is a connection, and solder it well. Remember too that it will not aid your effort to secure a short wave length to have your ground circuit run through all of the house pipes before it reaches the ground. The use of wire smaller than No. 8 B. & S. is not desirable. It is not good policy to choke off the energy by the use of small ground leads.

(To be continued.)

Receiving Stations on the Ground

At the little town of Neuchateau in the Vosges, France, the signals from the Eiffel Tower at Paris, 250 miles away, have been heard by means of horizontal wires placed close to the ground. One of these arrangements consists of a grill formed of nine wires of galvanized iron, five millimeters in diameter and about 65 feet in length, stretched horizontally four inches apart at a distance of three feet above the earth. The extremities of the wires are soldered to two transverse wires and the collector connects with the instruments on the ground floor of the house. When this arrangement is replaced by a metallic grill, the signals are still heard, but not so well. Another receiving station has for antennæ a strip of wire netting of large mesh, 160 feet long and three feet wide, supported at about 20 inches above the earth.

Nine New Wireless Stations for Canada

An announcement has just been received to the effect that the Marconi Wireless Telegraph Company, of Canada, has entered into an agreement with the Canadian Government for nine additional stations in the Great Lakes regions.

The Canadian Marconi Company is to receive an annual subsidy of $31,500 for their operation and maintenance over a period of nineteen years.

Washington Greets Honolulu

The long distance record is broken and wireless telegraphy has achieved another advance. On Sunday evening, December 8th, the new station at Arlington succeeded in getting in communication with Honolulu, nearly 6000 miles away!

C. F. Elwell, chief engineer of the Federal Telegraph Company, was operating at Arlington Station, near Washington, D. C., which has recently been erected by the Government. He had just succeeded in exchanging messages with San Francisco, and was carrying on this 3500 mile aerial conversation, when suddenly he was astounded to hear signals coming from the station at Honolulu.

Completely surprised and hardly believing his senses, Elwell immediately grasped the sending key and flashed the following message to the San Francisco operator:

"Call Honolulu and tell him to listen, for we get him fine. ELWELL."

The operator at San Francisco did so at once; and as soon as he advised Elwell that Honolulu was ready, the latter flung these words into space:

"This is C. F. Elwell at Arlington near Washington. How do you get us. We get you!"

Immediately on dispatching this message Elwell pressed the receivers to his ears, and breathlessly awaited a response. Very soon he caught the faint tick of an incoming signal, and while rather inclined toward the feeling that what he hoped for was impossible, he commenced to tune his instruments until finally the sounds came in quite steady and clear; and he experienced the amazement and delight to hear the following from far off Hawaii:

"If this is surely Arlington I hear you O. K., but I can't believe it. This is S. B. Maddams. Give C. F. Elwell my regards and tell him that we launched a yacht here today, named the C. F. Elwell. You come pretty good. Go ahead and give O. K."

For a moment Elwell stood still, full of wonder at the remarkable thing that had just taken place; then he again seized the sending key and flashed these words in reply:

"S. B. Maddams, Honolulu: Thanks Maddams. Will be at 2, our time, tomorrow with Chicago and Kansas City. Good night. C. F. ELWELL."

Thus was achieved a success for the Government's new wireless station at Arlington that was hardly anticipated when this immense structure was projected.

The news of this great accomplishment was immediately sent to all the stations of the Federal Telegraph Company in various parts of the United States. When H. P. Veeder of San Francisco, who is secretary and treasurer of the company, heard of this he immediately communicated direct with Honolulu to verify the announcement from the East. Operator Maddams at Honolulu at once forwarded him an answer, in which he recited the details of this memorable event and added that the messages from Washington "came clear and fairly loud."

This notable feat marks another great record in the wireless transmission of messages, and more firmly establishes this wonderful art as a necessary adjunct of our civilization.—W. ZACHERT.

THE UNIVERSAL HOUR

The International Time Conference which was held in Paris in October last has agreed to the acceptance of Greenwich time as the basis upon which the proposed international time signals are to be sent out. Since March, 1911, French legal time has been that of the meridian of Greenwich; previous to that it had been the mean astronomical time at the meridian of Paris. The difference is 9 minutes and 21 seconds. Consequently, Greenwich time will be given from the following wireless stations, if the recommendations of the conference are carried out, at the hours indicated, on and after July 1, when they are expected to be ready for this service:

Paris—10 a. m. and midnight; Mogadiscio (Italian Somali)—4 a. m.; San Fernando (Brazil)—2 a. m. and 4 p. m.; Arlington (U. S.)—3 a. m. and 5 p. m.; Norddeich (Germany)—12 m. and 10 p. m.; Massua (Red Sea)—6 p. m.; San Francisco—8 p. m.

The signals will be given according to the code shown by the diagram, beginning two minutes before the hour:

From 57 minutes to 57 minutes 50 seconds—warning signals; from 57 minutes 55 seconds to 60 minutes—time signals.

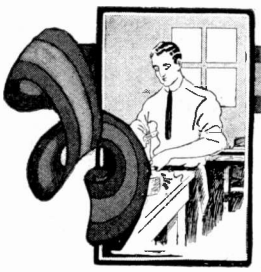
The advantage of this system to all ships carrying wireless apparatus will be apparent. Now a ship's officer must depend upon the accuracy of his chronometer in determining his location; the chronometer may not have been compared with standard time for days or even weeks, and an error of a fraction of a minute will falsify this reckoning by miles. With the new system he will never be out of range of some time signal for more than a few days at a time. It is thought that these signals may also

TIME SIGNAL CODE

be used to give warning of the location of icebergs, and it is proposed to extend our present knowledge of meteorology by the exchange of weather reports between the different stations. The conference also appointed a commission to arrange for an organization for the scientific study of the Hertzian waves in their relation to the surrounding media.

The Increased Cost of Living in France

La Revue Electrique gives in a recent number a calculation by which it comes to the conclusion that the law passed in March last year, making Greenwich time the legal time for the whole country, has increased the lighting expenses of every household in France by about 1%. Without considering the accuracy of this figure, it is very evident that the cost of electric light, kerosene and candles will be increased somewhat when people stay up o'nights ten minutes longer than they have been doing, as will undoubtedly be the result of putting back the clock ten minutes, seeing that all household and business affairs are regulated, consciously or unconsciously, by the clock.



For Practical Electrical Workers

Telephone Wiring

By GEO. MADISON

Telephone wires run in pairs, the wires of which are designated as "tip and ring," "odd and even" or "line and test." The tip wire is usually the darker insulated of the two. The idea of having differently colored insulation on the two wires of a pair is to simplify the location of a case of trouble, inasmuch as the wires if cut must be spliced back exactly as they were. In outside wires and in inside wires outside of cables, the wires are designated by the use of a silk thread which runs through the insulation on one wire and not on the other.

The ring wire should always be fastened to the right hand binding post in all telephone terminals, except instrument terminals, and the tip wire should be fastened to the left hand post. If, however, a single row of posts is mounted vertically, then the even numbered posts counting from the top down should be the ring side while the odd numbered posts become the tip side. If the connecting blocks are mounted horizontally and numbered from left to right the lower posts become the tip side, but if the blocks are numbered from right to left the upper binding posts become the tip. Like wires should always be spliced or bridged to like wires and reversals of the circuit thereby avoided.

All wires should pass through the entering rings and through the proper hole in the terminal box before being connected to the terminal. The insulation should be removed and the wires scraped clean, care being exercised that the wire be not nicked. Wires should be made fast with one complete turn around the binding post in the direction in which the nut tightens and the ends should not lap. The distance from the binding post to the insulation on the wire should not be less than 1-16 nor more than ⅛ of an inch. The binding post nuts should be tightened with a regular binding post wrench and not with pliers, shears, etc.

When connecting a wire to a binding post having only one washer between the nuts, the first wire should be placed under the washer, the second over the washer and a third wire may be attached by placing it under the washer and alongside of the first wire, but the wires must lie flat and not lap each other. When the binding post has two washers between the nuts, the first wire should be placed between the washers, the second under the lower washer, while the third wire is placed above the upper washer.

When splicing outside insulated wire, the splice should be made by the use of a copper sleeve. The insulation should be removed for about four inches from the ends of the wire, the wire scraped nice and clean and inserted into the sleeve so that the insulation is tight against it, as in Fig. 1.

Table 1 compiled for the use of the New York Telephone Company, gives the proper size of sleeve to be used, the number of half turns to be given and whether or not the splice is to be taped. All splices in twisted pairs should be

staggered so that the ends of the joints will miss each other by at least six inches.

The splices in inside wires may be made by either twisting the wires into a Western Union joint and soldering or by means of a copper sleeve. In places where a flame might be dangerous the twisted joint may be tightly wrapped with tinfoil instead of soldering. In splicing a twisted pair, care should be taken to have the strain equally divided between the wires and this is accomplished by keeping both wires exactly the same length. Inside wires should not be spliced between the instrument and picture molding or baseboard in new work, and should never be spliced under floors, in damp places, or in terminal boxes. When the wires are spliced in a shop or storeroom, the wires should be twisted and soldered together.

When making a twisted joint on inside wires the insulation should be removed for about four inches from the ends of the wires without nicking them, and the wire scraped clean. A joint of eight half turns should be made and the wire then given eight half turns around the insulation, after which the ends should be trimmed close and pressed into the insulation. The wire should not be exposed for over an inch, after the splice is made, and the joint should be soldered and covered with two layers of pure rubber tape and two layers of friction tape, Fig. 2.

TABLE I.—SPLICING.

Sleeve, B. & S. Guage	Length	Size and Kind of Wire Spliced	No. of ½ Turns	Taped
6	6¾	Connecting No. 8 B. W. G. bare wire	7	No.
6	6⅜	Dead ending No. 8 B. W. G. bare wire (½ sleeve)	3	No.
10/12	4¾	Connecting No. 12 & 14 N. B. S. bare wire	8	No.
10/14	3	Connecting No. 12 N. B. S. bare to No. 14 B. & S. two pair wire	5	No.
10/18	3	Connecting No. 12 N. B. S. bare to No. 18 B. & S. two pair wire	5	No.
16/18	3	Connecting single No. 12 B. & S. covered to No. 18 B. & S. two pair wire	5	Yes.
12	4½	Connecting No. 14 N. B. S. bare wire	8	No.
12	2¼	Dead ending No. 14 N. B, S. bare (½ sleeve)	3	No.
14/14	3	Connecting No. 14 N. B. S. bare to No. 14 B. & S. two pair wire	5	No.
14/18	3	Connecting No. 14 N. B. S. bare to No. 18 B. & S. two pair wire	5	No.
14	3	Connecting No. 14 B. & S. two pair to No. 14 B. & S. two pair wire	5	Yes.
14/16	3	Connecting No. 14 B. & S. two pair to No. 16 B. & S. leading in	5	Yes.
14/18	3	Connecting No. 14 B. & S. two pair to No. 18 B. & S. two pair wire	5	Yes.
18/19	1½	Connecting No. 18 B. & S. two pair to No. 19 B. & S. two pair inside	2	Yes.
19/19	1½	Connecting No. 19 B. & S. inside to No. 19 B. & S. inside	2	Yes.
10	4¾	Connecting No. 12 N. B. S. bare wire (½ sleeve)	8	No.
10	2⅜	Dead ending No. 12 N. B. S. bare wire	3	No.

Fig. 3 shows the correct method of splicing a twisted pair to bare line wires on a terminal pole.

When one pair of wires is to be bridged to another, as in Fig. 4, the slot in the base of the connector is slipped over the main line wire and the bridging wire connected in the manner described for fastening a wire to a binding post. If a second No. 18 B. & S. twisted pair wire is to be bridged at the same point it should be placed above the top washer. Additional connections may be made by using two washers, Fig. 4.

A general method of running inside wires is as follows: The inside wire should be run as inconspicuously as possible and should never come in contact with finely finished walls and woodwork,

pipes or electric conduit. It is quite common, however, to have provisions made for the telephone wires at the time the building or house is constructed. These

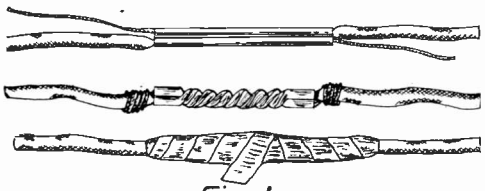


Fig. 1

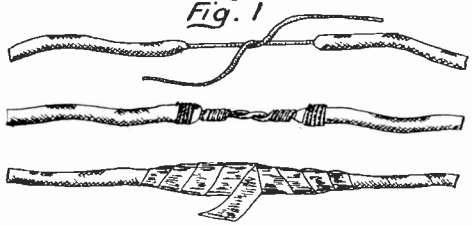


Fig 2

provisions usually take the form of some sort of conduit, often similar to regular electric conduit, or a molding, or a combination of both conduit and molding. The former method is best and as there are often no special wiring facilities provided, we will consider that the building has none, in which event the wires should preferably follow the picture molding, or, if no molding is available, the wires could be fastened to the baseboard but the woodwork should not be damaged. Wires should never be run along chair rails as there they would be directly exposed to mechanical injury.

The greatest damage done in inside wiring is in boring holes through walls or ceilings and extreme care should be used when doing this class of work in order to avoid interference with sliding doors, windows, etc., as well as to avoid damage to the opposite side of the partition or wall.

When the instrument is located on a desk which stands out from the wall, the wires should be brought out under the floor if possible, but if the wire must be laid on top of the floor it should be covered with a molding so as to avoid not only damage to the wire but also the possibility of accidents from tripping over it. A small coil of slack wire should be left behind the desk or table, so that it may be moved without breaking the wires. It is often required that the wires be run under rugs, carpets, etc., and special treatment is necessary in nearly every case, but one thing holds good for all jobs in which carpets play a part, and that is never to cut holes in rugs or carpets in order to bring the wires through, but bring them through by separating the threads at the seam by means of a sharp pointed lead pencil or a sharp piece of wood.

Inside wires may be fastened with furniture nails, cleats, double pointed tacks, tie wires, clamps, or rings. Furniture nails may be used for fastening wires to woodwork and plaster walls using the shorter ½ inch for hardwood and the longer one inch for softwood and plaster. Nails and tacks should never be used for outside wiring on metal walls, around window sills or in other damp places and when used on interior work should not be spaced more than twelve

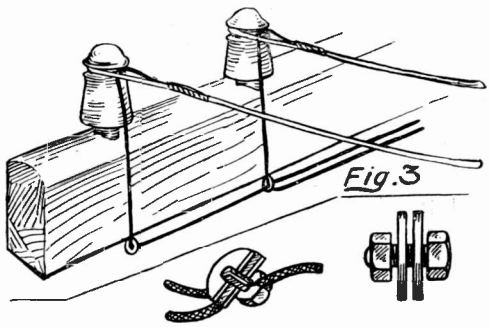


Fig.3

Fig.4

inches apart except when the wires are run in molding, when the nails may be spaced eighteen inches apart. When rounding inside corners the nails should be placed ½ inch on either side and the wire bent back into place in the corner. Two pairs of wires may be fastened by one nail, as shown in Fig. 5.

When fastening wires around window

sills, to metal or to damp walls, a two or three wire cleat should always be used. A cleat should always be used to fasten wires near the binding posts, as shown in Fig. 6.

Double pointed tacks may be used for

Fig. 5

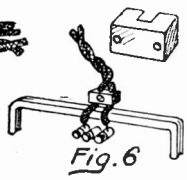


Fig. 6

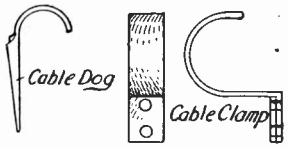


Fig. 7

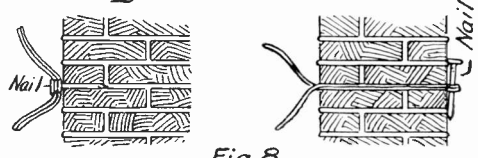


Fig. 8

fastening a single wire and sometimes for a twisted pair, but when used in connection with the latter both wires should never be placed under one tack.

When lead covered switchboard cable or inside wire taped in the form of a cable is used, it should be fastened with clamps as shown in Fig. 7, or by annealed iron wire and cut nails, Fig. 8. If cable clamps are used Table II will be of assistance in determining the size of the clamp, screw and anchor to be used.

TABLE II.—FOR 22 GAUGE SWITCHBOARD LEAD COVERED CABLE.

Prs.	Diam. in Ins.	Size Clamp	Size Anchor	Size Screw
5	3/8	00000	No. 10, 3/4 in.	No. 10, 1 in.
10	15/32	0000	" 10, 3/4 "	" 10, 1 "
15	1/2	000	" 10, 3/4 "	" 10, 1 "
20	9/16	00	" 10, 3/4 "	" 10, 1 "
25	5/8	0	" 14, 1 "	" 14, 1 1/2 "
30	11/16	1	" 14, 1 "	" 14, 1 1/2 "
40	3/4	1	" 14, 1 "	" 14, 1 1/2 "
50	13/16	1	" 14, 1 "	" 14, 1 1/2 "
60	29/32	2A	" 14, 1 "	" 14, 1 1/2 "
75	1	2	" 14, 1 "	" 14, 1 1/2 "
100	1 1/8	2	" 14, 1 "	" 14, 1 1/2 "
150	1 11/32	3	" 14, 1 1/2 "	" 14, 2 "
200	1 1/2	3	" 14, 1 1/2 "	" 14, 2 "

When running several pairs of wires in light or air shafts, loft buildings, cellars, factories, stables, etc., where their appearance is not objectionable, rings may be used.

When inside wiring comes in contact with pipes or passes through floors or plaster walls, and whenever necessary to protect against mechanical injury, the wires should be well taped. Tape may also be used to change the color of the insulation on the wires and make it harmonize with the color scheme of the walls and molding with which it comes in contact. Cloth tape in various colors may be used for this class of work.

When entering a building with No. 18 wire a 3/8 inch hole should be bored for one pair of wires, a 1/2 inch hole for two pairs of wires and a 5/8 inch hole for three pairs of wires. These holes should be well reamed out and slant downward from the inside. In brick buildings the wires are generally led in through the frames of windows or doors and it is preferable to locate them at the top of the frame rather than below. In frame buildings, the holes should be bored through the wood apron under the window sill or through the outside base immediately above the foundation walls. The wires should pass through the hole without untwisting, binding or kinking

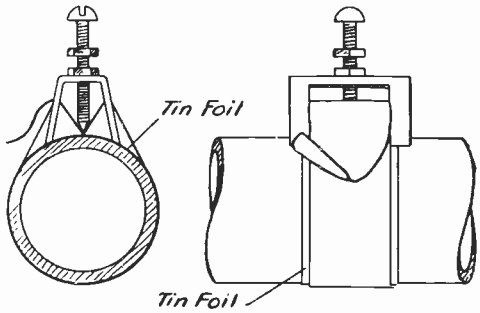


Fig. 9

and at the point of entrance they should be wrapped with friction tape for a distance of about two inches and in such a manner as to form a conical wrapping about the wire and having a diameter in the center a little larger than the hole and tapering each way. The wire should be drawn into the hole until this wrapping

enters and completely plugs up the opening. The wires should then be fastened below the hole and as close as possible to it.

Ground connections for party line bells, battery feeders, etc., may be made to water pipes, cable sheaths, gas pipes or to a buried ground, the preference

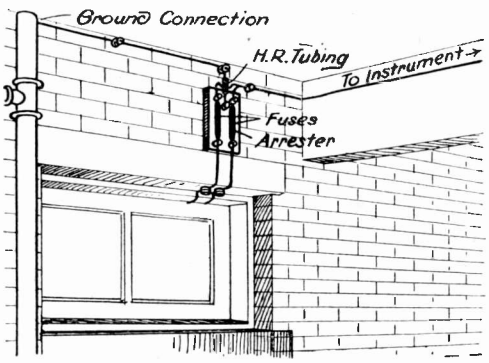


Fig. 10

being given in the order named. Steam, hot water or sprinkler pipes should never be used for grounds. All grounds should be made as near to the point of entrance to the building as possible and all attachments should be made in an accessible place and so located that the wires will not be disturbed. When attaching to a gas pipe the connection should be made on the street side of the meter. The best practice for attaching wires to pipes, cables, etc., is to file up the surface if an iron pipe, scrape a cable sheath and sandpaper a galvanized pipe, then wrap the pipe or cable with tinfoil. A ground clamp, Fig. 9, is then attached and, if the connection is exposed to the weather, the entire device is taped.

Wires must not come nearer than two inches to any light or power wires in a building unless separated by some continuous non-conductor such as porcelain tubing or approved flexible tubing.

When the telephone wires run in proximity to high voltage electrical circuits the separation should not be less than one foot. If absolutely impossible to obtain this separation between the two circuits, the telephone wires should be enclosed in an approved insulating tubing and the greatest clearance possible secured between the two circuits, but under no circumstances should the covering of the high voltage circuit and the insulating tubing on the telephone wires touch each other. The insulating tubing should project six inches on each side of the high voltage conductor and should be securely taped at each end.

When protectors are used they should be placed within the building and as near the entrance of the line wires as possible, allowance being made for an easily accessible ground and for convenience in inspecting and repairing. The protector should be at least six inches from probable contact with curtains, shades or other inflammable material and should be securely fastened to the support with its fuses vertical and so that the line

Fig. 11

wires may connect directly to the binding posts. The protector should be mounted so that the binding posts are either at the top or at the bottom but the micas should always be placed with the notched side down. The protector should never be placed in a show window, on vibrating partitions, or on damp walls. Fig. 10 shows the usual installation of a protector on the inside of the cellar wall over a window. It is sometimes impracticable to place the protector within the building, in which case it should be

mounted in a cast iron waterproof box as shown in Fig. 11. Fig. 12 shows the position of the protector in the box. This box should be located on the outside of the building in a position accessible for inspection and repairs and as near as possible to the point of entrance. When protected lines enter a building they should enter in the same manner as given in the early part of this article for unprotected lines, but the holes should be bored 2½ inches apart and bushed with insulating bushings, usually made of porcelain.

The ground wire should be No. 16 B. & S. insulated wire, which should be attached to the post on the protector marked "G" and should be run as straight as possible from the protector to the ground, using a two piece porcelain knob as shown in Fig. 13. In places where these knobs would be unsightly the ground wire may be run on "peanut" cleats as shown in Fig. 14. The knobs and cleats should be placed not more than four feet apart and when passing through walls or floors the ground wire should be run through circular loom or insulating tubing. When installing party line instruments a triple conductor wire should be run between the protector and instrument so as to provide a ground wire for the bell.

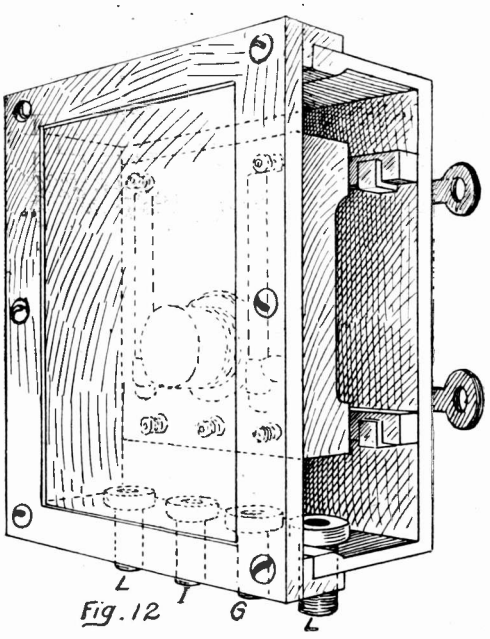


Fig. 12

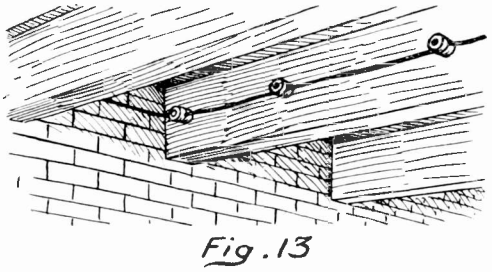


Fig. 13

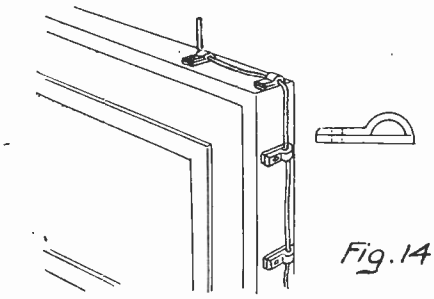


Fig. 14

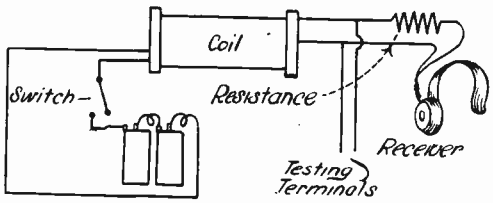
The outer covering of the switchboard cable should be carefully removed only as far as necessary to permit of properly forming the cable without damaging the insulation or conductors. The strippers of unfilled cable and one inch of the outer covering should be immersed in hot standard beeswax compound for three minutes and the surplus wax allowed to drip off before cooling. Standard beeswax is a composition composed of half beeswax and half paraffine.

For cotton covered cable the butt should be wrapped with waxed twine for ½ inch over the strippers, starting at the end of the outer covering. The twine should be wrapped back on itself and extended a distance of ½ inch back of the starting point. One end of the twine should be pulled in under the wrapping and the other or long end should be used for sewing the form. After cables have been formed up and sewed they should be shellacked and baked until all moisture is expelled.

Fault Finder

The fault finder here described will give good service in testing knob and tube work, conduit systems and fixtures, for grounds, short circuits, etc.

Make a hardwood box 10 by 8 by 3½ inches having a hinged cover with latch



FAULT FINDER

or lock. Purchase a small induction coil (one giving a 1-32 inch spark is large enough), four binding posts, eleven ounces of No. 36 enameled copper magnet wire, a small battery switch, a head receiver and cord and two testing terminal wires.

The next step is to mount the articles in and on the box. The two batteries should be securely fastened in the box by wrapping them with strong wire, then securing the wire to the back of the box with wood screws. The coil should be placed where adjustment will not be difficult. The No. 36 magnet wire wound on a piece of fiber should provide resistance for the receiver and be connected to the apparatus as shown in the diagram. The four binding posts are installed on the box to serve as testing and receiver cord terminals.

In testing for a short circuit a humming sound will be detected in the telephone receiver. Should the coil or wire being tested be of higher resistance than the resistance in series with the receiver the apparatus will prove useless. If the test is being made for an open, the rule should be reversed; that is, the noise in the receivers will be detected upon locating the defective coil. In testing for a ground, apply the rule for detecting a short.

By placing a leather handle on the instrument it may be easily carried from place to place. Take care that it receives no jars as this will make necessary the adjusting of the vibrator on the coil, but if a lock nut is placed on the stationary portion of the vibrator this trouble will be eliminated.—P. M. EAMES.

Why Shunt Motors Speed Up

Most repair men are familiar with the fact that a weakened field or a decreased number of armature coils will result in increased armature speed but the reason of this phenomenon may not be so generally known. First let us state certain facts that are more or less self-evident, or that follow directly from Ohm's law. The current through any circuit is equal to the effective voltage divided by the resistance, the effective voltage being the applied voltage less any opposing voltage that may be present. Also the torque or twisting force of a motor is proportional to the armature current, which in the case of a motor will be the difference between the line voltage and the motor voltage divided by the armature resistance. This last point will become clear if we consider the fact that the motor is essentially the same as a generator and will generate a voltage proportional to its speed and field strength. Therefore the effective voltage is not the line voltage but the difference between it and this counter electro-motive force, as it is called.

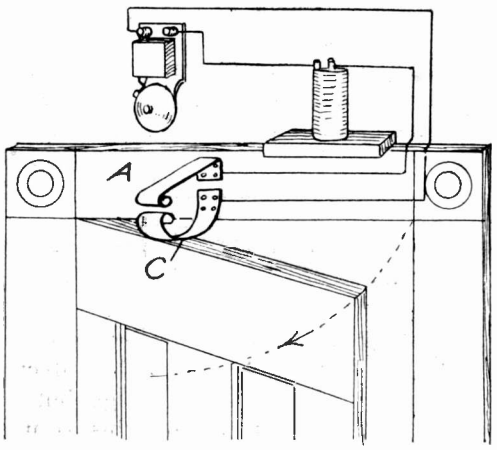
Bearing these facts in mind let us consider the probable effect of a weakened field. Since the motor voltage or counter e. m. f. depends on the field strength the former will be reduced and the difference between it and the line voltage will become greater. As this difference is the effective voltage tending to send a current through the armature the current will be increased and the torque will also be increased. Thus we see that weakening the field indirectly tends to increase the torque and speed also, since increased torque will naturally cause increased speed.

The increased speed will partly compensate the weakened field and raise the motor voltage almost to its original value, so that the motor will strike a balance at a slightly higher speed than the original one. Since the motor voltage depends on the number of coils this same phenomenon attends the cutting out of armature coils.—T. G. SEIDELL.

Office Bell

In offices of doctors and dentists where there is no attendant and in other rooms where the noise of machinery prevents the opening of the door from being heard, a bell connection as in the following description may be used.

Two pieces of tin (A) and (C) are



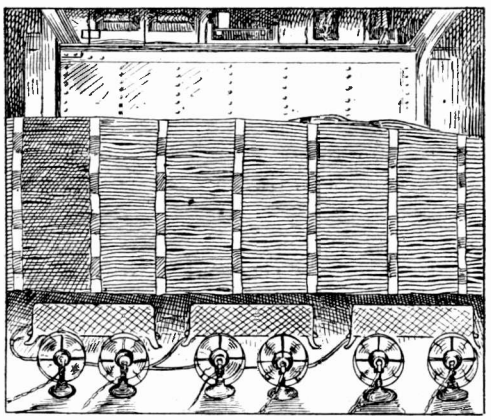
DOOR CONTACT FOR OFFICE BELL

fastened by nails or screws to the door frame and under each is secured the bare end of a bell wire, which connects as shown to a bell and battery. The tin strips may be an inch wide and five or six inches long. Brass may be used in place of tin if desired.

By shaping the strips as indicated, the top of the door strikes the lower tin closing the circuit for only a moment. As the door opens farther, the strips spring apart breaking the circuit automatically. —W. H. ALBRIGHT.

Drying Telephone Cables

During a recent fire in a telephone exchange the water thrown saturated the cables at the back of the switchboard. To dry these out electric car heaters

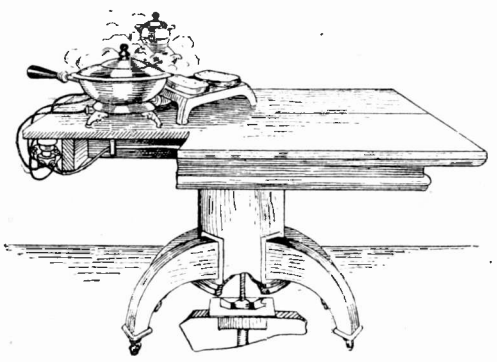


ONE WAY OF DRYING TELEPHONE CABLES

were borrowed from the car company and the heat generated by them blown upon the cables by electric fans as shown. This was considered to be the only feasible means, as great care had to be exercised to prevent the melting of the paraffin used in the cable insulation.

Dining Table Outlets

In these days of numerous electrical cooking devices, such as percolators, toasters, etc., designed for use on the dining table, it is often a question of where to obtain the necessary circuit



ARRANGEMENT OF TABLE OUTLETS

connection, when several devices are used at the same time. Unsightly cord runs are objectionable.

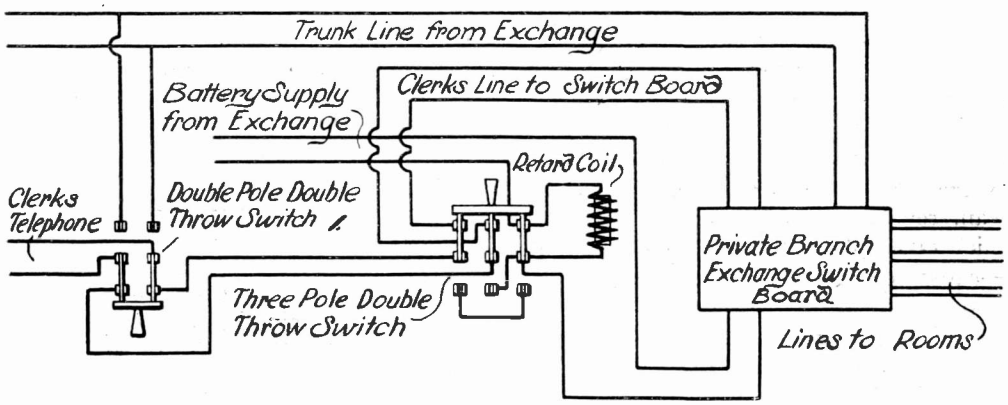
In one case convenience was found in the following manner: In the center of the dining room floor under the table a flush wall plug receptacle was fitted and connected to a circuit run on the basement ceiling from the service. From this receptacle a No. 14 reinforced portable cord equipped with a plug and long enough to allow for the extension of the table was passed through the hollow center leg and then to a 600 watt, wall socket located under the table edge. Into the wall socket was screwed a three outlet fixture for the reception of the heater circuit plugs. When cleaning is done or the table moved the floor cord and plug are pulled out through a slit in the carpet.

Hotel Clerk's Private Exchange Board

In a hotel having a private branch exchange using direct current telephones, i. e., transmitter and receiver in series, the switchboard is located behind the cigar counter entirely across the lobby from the clerk's desk.

When the operator leaves at night she turns on the night alarm and throws the three pole, double throw switch shown in the accompanying diagram, which allows sufficient current to flow through the clerk's instrument to enable him to ascertain the wants of any guest who may call him after that time. He can see the switchboard from his location and if it is the trunk line from the city exchange which is flashing he throws the double pole, double throw switch shown and places himself directly on the trunk.

Of course if one guest desires to talk to another or to a party in the exchange the clerk must go and put up the connection, but as a majority of the calls are for ice water or of that nature he saves many unnecessary steps.—MAURICE E. YOUNG.



CIRCUITS OF THE TELEPHONE CLERK'S PRIVATE EXCHANGE BOARD

How Brass for Fixtures is Made

A young man, newly employed as clerk in the office of a brass mill, remarked to a fellow clerk, "I see invoices for the copper, zinc and other stuff, but where do they buy the brass?"

While this may be an exceptional case, yet the general idea of brass, outside of manufacturers and dealers in it, is rather vague. The two most important products of this industry are sheet brass and tubing.

The brass industry had its inception about a century ago in and around Waterbury, Conn. Dame Fashion gave rise to the need of button shops, for the gentlemen of that day were adorned with bright metal buttons on coats and buckles on shoes, and Yankee shrewdness and

energy answered the demand with little mills along the streams that abounded in this section, for manufacturing them. And from that beginning the value of the brass industry's output has reached a total of $200,000,000 annually.

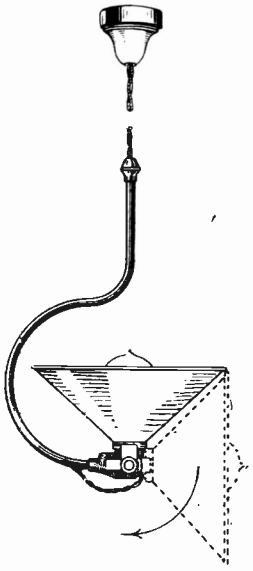
Brass is an alloy of copper and zinc in certain proportions, about two parts copper to one of zinc being the alloy most used for sheet brass. The metal is melted in crucibles carrying about 200 pounds. First, the copper is placed in the crucibles; when this has reached a fluid state a flux is added, which in casting shop vernacular "cleans the metal." The melted copper is then covered with a layer of charcoal, to prevent oxidation, by keeping the air from contact with the molten metal—the carbon in the charcoal also acting as a reducing agent. The zinc is next added. After the alloy has been well puddled it is poured into a mould to solidify. If the solid mass shows no imperfections it is sent to the rolling mill, annealed in a furnace in 5,000 pound lots and is then ready for the break-down rolls, two chilled iron rolls 20 inches in diameter and weighing twelve tons. Here, to use a crude illustration it is rolled out as the pie maker rolls crust.

After each annealing the metal is placed in a bath of oil of vitriol (about six per cent) and water and "pickled" clean, removing the surface oxidization which takes place during annealing. By repeated rollings the sheet is reduced to whatever gauge is desired, and after being cleaned in sawdust is inspected and slit to the necessary width, and shipped in coils of about 80 pounds each to be manufactured into the many forms for which brass is used, such as lamp bodies, electrical and gas fixtures, etc.

The tubes used in chandelier work are usually brazed tubes, and are made from sheet brass cut in strips and formed up into tubes, the edges being brazed together in a specially constructed furnace. They are then drawn in a steel die and triblet until the desired diameter and gauge is reached.—*The Fixtureman.*

Combined Direct and Indirect Fixture

A British company has placed upon the market a combined fixture for converting a pendant lamp with a shade into an indirect lighting unit when desired. A tube for the flexible current conducting cord, a grip for holding the lamp by its shade ring and a swivel permitting the lamp and shade to be turned to any position between an upward reflection of the light and a direct downward illumination make up the fixture.

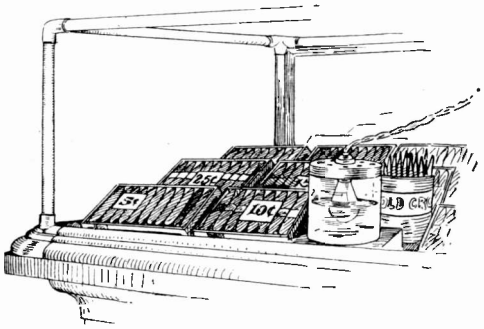


COMBINATION FIXTURE

Tobacco Jar Humidor

A one pound glass tobacco jar may be converted into a practical humidor.

Drill six or eight ⅜ inch holes in the metal top of the jar away from the center and in a circle preferably. At the center cut out a hole large enough to allow a lamp socket to be passed part way through as shown. With the jar two-thirds full of water when the cover and lamp are put in place the heat from the lamp will cause evaporation.



HUMIDOR MADE FROM AN INCANDESCENT LAMP

ELECTRICITY THE SILENT SALESMAN

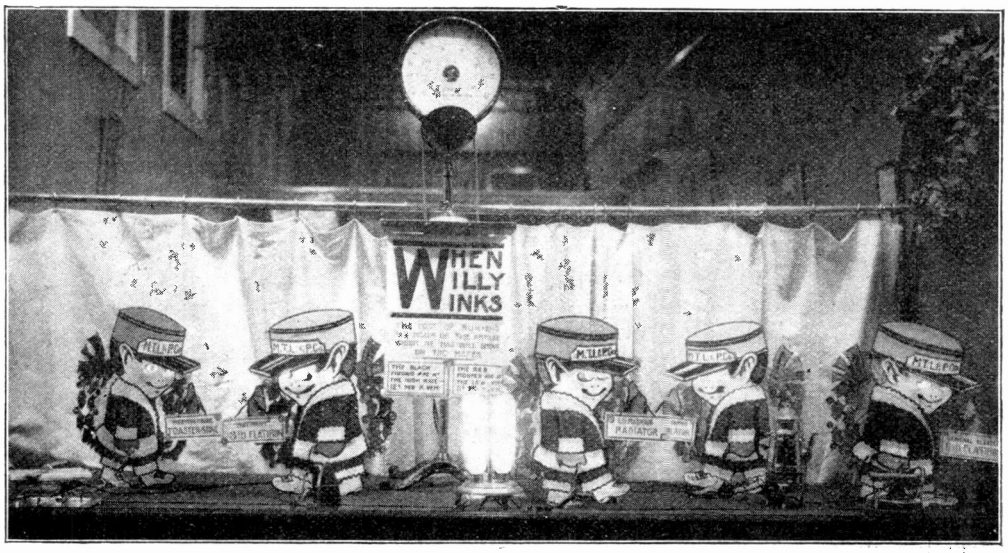
Some Helpful Hints on the use of Electric Current in getting up Show Window Displays. The following schemes have all been used with remarkable success

The "Winking Willies"

An attention attractor that is as unique as it is ingenious is that which has been installed in one of the show windows of the Manchester, N. H., Traction, Light and Power company. It is distinguished by five "winking willies," who succeed in drawing attention of a great many every day to the merits of the various articles which the commercial department of the company has to offer for sale.

The picture accompanying this shows the window in question and its winkers. The sign, "When Willy Winks," the diminutive messenger boys and their flirting oculars, are the distinctive features. The Willies are labeled "M. T. L. & P." and each presides over some article of electric usefulness. These latter are connected with a Donkin cent-hour meter, so called, and with a simple rotary flasher designed and built by the company's electricians and operated in such a manner that every twelve seconds a different article is connected with the meter.

The articles are varied from time to time, but at the time the photograph was taken they were electric toasters, electric flatirons, twin glower, luminous radiator, percolators, etc. As the apparatus connects each article with the cent-hour meter the young man who has it in charge winks in a very pronounced manner in the general direction of the article and simultaneously, on the broad dial of the meter, appears the price in cents per hour at both high and low rates, the charges the traction company makes for furnishing the current to operate it. The connections are so arranged that the current required to operate the winkers does not pass through the meter.



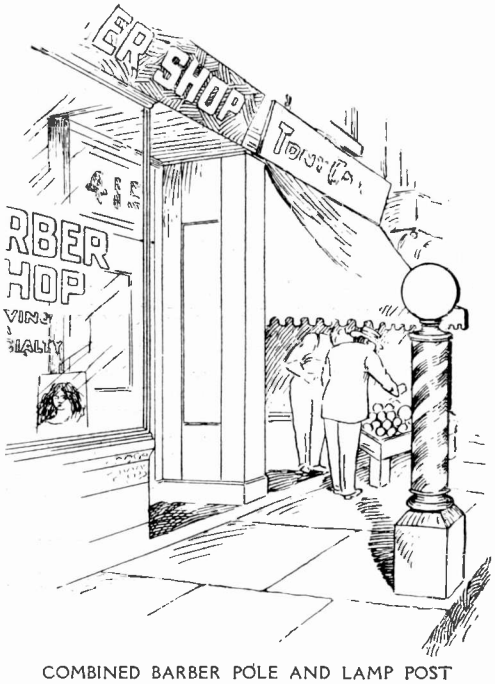
THE "WINKING WILLIES"

On the face of the meter the low rates, six cents per kilowatt hour, are indicated in red figures, while the high rate, twelve cents, is shown in black. Attention is called to the fact, by means of signs,

that the greater number of Manchester residences are drawing current at the low rate.

Barber Pole as a Lamp Post

A Springfield (Ill.) barber utilizes his barber pole as a pillar to support a light to illuminate the sidewalk in front of his shop. The pole is set on the outer edge



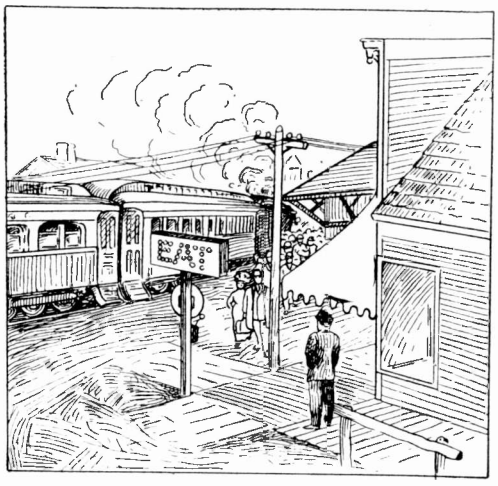
COMBINED BARBER POLE AND LAMP POST

of the walk and is surmounted by a large ground glass globe covering an ordinary incandescent lamp. Wires are run up the center of the post from the basement lighting circuit.

Double Appeal for Customers

An Enid, Okla., restaurant man whose place of business is close to the railroad station uses electricity in two ways upon the outside to call the attention of travelers. Even a blind man can find the place unassisted.

Directly underneath and on the same pole that supports the illuminated sign "EAT," is installed a bell of gong like proportions. Upon the arrival of a train the bell circuit is closed with the



RESTAURANT ADVERTISING

result that there are few who do not know that the restaurateur is ready to supply internal needs.

Advertising in Waste Space

In the majority of cases there is an unused space of eighteen to 24 inches beneath the usual store window. A Springfield merchant made advertising space out of this by substituting a translucent glass panel for the wooden one. With his name and wares printed thereon and three incandescent lamps tapped off the basement circuit placed behind, he had a cheap but very effective sign well within the range of vision of pedestrians.

A GOOD PLACE FOR AN ELECTIC SIGN

Electrical Securities

By "CONTANGO"

It is the intention in this article to give additional illustrations of companies, the stock and bonds of which, one or the other, are well worth your consideration and whose statements bring out particular points mentioned in former articles.

AMERICAN PUBLIC UTILITIES COMPANY.

This company is under the active management of Kelsey, Brewer and Company, engineers and operators of public utility properties, Grand Rapids, Michigan. It controls through stock ownership the following subsidiary companies: Merchants Public Utilities Co., Indianapolis, Ind.; Peoples Light & Heat Co., Indianapolis, Ind.; Elkhart Gas & Fuel Co., Elkhart, Ind.; Valparaiso Lighting Co., Valparaiso, Ind.; Utah Gas & Coke Co., Salt Lake City, Utah; Boise Gas Light & Coke Co., Boise, Idaho; Winona Gas Light & Coke Co., Winona, Minn.; Minnesota-Wisconsin Power Corporation; LaCrosse Gas & Electric Co., LaCrosse, Wis.; Albion Gas Light Co., Albion, Mich.; Holland City Gas Co., Holland, Mich.; Jackson Light & Traction Co., Jackson, Miss. The total population, 1910, of the cities served by this company is given as 471,451 compared with 332,920 for the year 1900. This is an increase of 41 per cent and very aptly brings out the inherent strength of the public utility situation in the ever growing demands of an ever increasing population.

CAPITALIZATION

	Issued	Authorized
Bonds, Thirty-year 5% Collateral Trust	$ 839,000	$20,000,000
Preferred Stock, 6% Cumulative	3,914,000	20,000,000
Common Stock	2,995,000	20,000,000

A conservative estimate, based on previous earnings and a thorough knowledge of the communities served and the operating conditions under which the service is rendered, indicates the following earnings for the present year.

EARNINGS

Gross earnings of all Properties		$2,192,453.31
Operating Expenses, including Taxes and Insurance	$1,140,075.72	
Interest on Underlying Securities	528,475.00	1,668,550.72
Earnings accruing to American Public Utilities Co		523,902.59
Earnings Derived from Working Capital		48,000.00
Gross Earnings American Public Utilities Co		571,902.59
Deduct Interest on $839,000 Collateral Trust Bonds		41,950.00
		529,952.59
Deduct 6% Dividend on Preferred Stock		234,840.00
Earnings on Common Stock less $75,000 thereof held by Trustee for future Corporate purposes		295,112.59
Per cent Earnings on Common Stock		10.1%

The earnings accruing to the American Public Utilities Company are two and one-quarter times the amount required to pay six per cent upon the company's preferred stock. In a recent offer of $2,200,000 six per cent cumulative preferred stock and $770,000 common stock, $1,000 par value preferred and $350 value common stock were allotted to the $1,000 subscription. At the beginning of the year American Public Utilities common was quoted 64 to 67½ and the preferred at 78 to 80.

REPUBLIC RAILWAY AND LIGHT COMPANY.

The Republic Railway and Light Company was incorporated in June of last

year in New Jersey and has acquired over 90 per cent of the outstanding stocks of 27 minor companies. The company operates (under satisfactory franchises) about 150 miles of electric railway lines and three electric light and power plants, also three gas plants. In all a population of over 200,000 is served, the increase in this population since 1900 being 64 per cent.

CAPITALIZATION

	Authorized	Issued
Preferred Stock, 6% Cumulative	10,000,000	$5,200,000
Common Stock	7,500,000	6,360,000

The Republic Railway and Light Company has no bonded indebtedness. But the subsidiaries have outstanding bonds amounting to $10,148,000.

The subjoined shows the consolidated statement of earnings for the subsidiary companies for the nine months of the fiscal year ended September 30, 1911, with comparative earnings of the same companies in 1910:

EARNINGS

	1911.	1910.	Increase
Gross	$1,705,105	$1,623,172	5.05%
Operating Expenses	975,839	945,118	3.25%
Net	729,266	678,054	7.55%

The surplus earnings over operating expenses and interest requirements for the three years ended December 31, 1910, and conservatively estimated figures for the following three years have been as follows:

Year	Surplus	Year	Estimated Surplus
1908	$163,156	1911	$488,128
1909	375,916	1912	562,633
1910	445,688	1913	641,883

Regular six per cent dividends are being paid on the preferred stock, the present earnings averaging one and one-half times the amount required for the preferred dividend. The preferred has been quoted at 81 to 82¼, which gives a yield on the purchase at that price of 7.29 per cent. The common is quoted at 25 to 27.

As is the case with other consolidated holding and operating companies, savings and economies are expected by reason of the saving in the cost of power production, better distribution of the power load, double tracking of congested lines, improvement in buildings, standardization of equipment, greater efficiency of employes and the like.

COMMONWEALTH POWER, RAILWAY AND LIGHT COMPANY.

This company was incorporated in February, 1910, with no bonded indebtedness except such as remains upon the individual properties. Through its constituent companies it owns and operates, in the State of Michigan, street railway properties in Grand Rapids, Saginaw and Bay City, together with an interurban line connecting the two last named points and having a total trackage of 121 miles; the gas properties in Jackson, Kalamazoo, Pontiac, Flint, Saginaw and Bay City; the electric light and power companies in Grand Rapids, Muskegon, Lansing, Kalamazoo, Battle Creek, Jackson, Pontiac, Flint, Saginaw, Bay City, Charlotte, Owosso, Corunna, Big Rapids, Albion, Cadillac and many smaller towns; the water business in Cadillac.

The company also controls valuable hydro-electric plants upon the Muskegon, Kalamazoo and Grand rivers; undeveloped waterpowers capable of an installation capacity of 65,000 horsepower on the Au Sable River, and large undeveloped waterpowers on the Muskegon River. The total population served is about 500,000.

CAPITAL

Preferred Stock (6% Cumulative) authorized and issued	$ 6,000,000
Common Stock	12,000,000

Shares $100 par. Preferred dividends payable February 1, May 1, August 1, and November 1.

Figures available showing the combined earnings of the Commonwealth Power, Railway and Light Company and its constituent companies for the eleven months ended November 30, 1912, and the final estimates for 1912 are as follows:

EARNINGS STATEMENT

For eleven months ended November 30, 1912, and estimated for twelve months ended December 31, 1912, with the percent increase over corresponding eleven and twelve months of preceding year, respectively:

	11 Months	Per Cent Increase	12 Months (est.)	Per Cent Increase
Gross Earnings	$5,739,477.26	15.50	$6,289,998.35	15.18
Operating Expenses	3,024,405.78	16.33	3,311,916.02	15.61
Net Earnings	2,715,071.48	14.60	2,978,082.33	14.72
Fixed Charges (see note)	1,688,232.60	19.67	1,827,409.30	19.44
Net Profits	1,026,838.88	7.13	1,150,673.03	7.94
Dividend Preferred Stock	330,000.00	...	360,000.00	...
Balance: Available for replacements and dividends on Common Stock	696,838.88	10.88	790,673.03	12.00

NOTE.—Fixed charges include dividends on outstanding preferred stocks of constituent companies in addition to taxes and interest.

The final estimated figures for 1912 are well within the results shown the year previous. The preferred stock was quoted at 89 to 90 at the close of 1912 which shows a yield of 6.59 per cent. The common stock is quoted at 67 to 68.

It may be mentioned here that the president of this company is Anton G. Hodenpyl of Hodenpyl, Walbridge and Company, the New York bankers. Mr. Hodenpyl was formerly secretary of the Michigan Trust Company of Grand Rapids, Michigan and is decidedly familiar with conditions in the territory served.

EASTERN PENNSYLVANIA POWER COMPANY

The Eastern Pennsylvania Power Company does all the commercial electric light and power business in and about Easton and Bangor, Pa., and Philipsburg and Dover, N. J., serving a population of about 92,000. Through ownership of all the capital stock, the Easton Pennsylvania Power Company controls the Easton Gas Works which does all the gas business of Easton and Philipsburg.

CAPITAL

Capital Stock: (Shares $100 par)	Authorized	Outstanding
Preferred, 7% cumulative	$1,000,000	$ 550,000
Common	3,500,000	2,900,000
Funded Debt:		
First and Refunding Mortgage 5's, due 1939	4,000,000	1,880,000
Easton Power Company 5's, due 1940	120,000	120,000
Bernards Electric Company 5's, due 1971	125,000	125,000
Five Year 6% Notes due 1917, secured by Mortgage	1,500,000	1,000,000

The issue of five year six per cent notes is a direct obligation of the Eastern Pennsylvania Power Company and is secured by a joint mortgage of the Eastern Pennsylvania Power Company and the Easton Gas Works upon all the electric lighting and power and gas properties of these companies in the State of Pennsylvania and further secured by $140,000 mortgage bonds on the gas properties in New Jersey.

H. M. Byllesby and Company, consulting engineers, estimated that on December 31, 1912, the company would be on an annual net earning basis of over $320,000.

EARNINGS

	1910	1911
Gross Earnings, from all sources	$472,394.65	$519,726.61
Operating Expenses, including taxes, maintenance, rentals, and interest on Bernard's Electric 5's	287,366.24	314,066.64
Net Earnings	$185,028.41	$205,659.97
Add saving that will be effected in operating expenses through consolidation (report of H. M. Byllesby & Co.)		44,000.00
Total Net Earnings		$249,659.97
Interest Deductions: Bonds, $2,000,000 at 5%		100,000.00
Surplus		$149,000.00
5-Year 6% Construction and Purchase Money Notes $1,000,000 at 6%		60,000.00
Surplus		$ 89,000.00

List of Selected Bonds showing Income Yield

Under the above heading, from month to month, a list of carefully selected securities will be given showing the approximate income yield. In this connection it is to be remembered that the income yield depends upon the price that is paid for the bond, and, as in the case of commodities, bond prices fluctuate according to the laws of supply and demand and to the quality or worth of the security in the opinion of the buying public. For instance, if a bond of a face value of $1,000 and paying six per cent interest can be bought in the market at 98, or, in other words, for $980, the income yield to the purchaser will not be six per cent but a little over 6.1 per cent. That is, a year's interest on the bond is $60. If it is bought for $980, the income will be $60÷980=6.1 per cent. Correspondingly, if the bond is bought above par, say 102, the income yield in that case will be $60÷1020=5.88 per cent.

In compiling the list below, the income yields given are perforce those determined by the market prices of the bonds at the time of writing, which is somewhat earlier than the date at which the magazine reaches its readers. But as the market price on stable securities such as these fluctuates very little the table is sufficiently accurate to enable the prospective purchaser to make his selection intelligently.

Bonds to Yield 4.50% to 5%

California Gas and Electric Company, San Francisco, Cal. General mortgage and collateral trust 5% bonds. Mature 1933. ($1,000.) Yield about 4.78

Cleveland Electric Illuminating Co., Cleveland, Ohio. First and refunding 5% bonds. Mature 1939. ($500.) Yield about 4.85

Commonwealth Edison Company, Chicago, Ill. First mortgage 5% bonds. Mature 1943. ($1,000.) Yield about 4.90

Edison Electric Illuminating Co., Brooklyn, N. Y. Consolidated 5% bonds. Mature 1995. ($1,000.) Yield about 4.50

Edison Electric Co., Los Angeles, Cal. First and refunding gold 5% bonds. Mature 1922. Yield about 4.75

Milwaukee Light, Heat & Traction Co., Milwaukee, Wis. First mortgage 5% gold bonds. Mature 1929. ($1,000.) Yield about 4.80

Milwaukee Electric Railway & Light Co., Milwaukee, Wis. Refunding and extension gold 4½% bonds. Mature 1931. ($1,000.) Yield about 4.95

Minneapolis General Electric Co., Minneapolis, Minn. First 5% bonds. Mature 1934. ($1,000.) Yield about 4.85

Muskogee Gas & Electric Co., Muskogee, Okla. First and refunding gold 5% bonds. Mature 1926. ($1,000.) Yield about 4.90

New York Gas & Electric Light, Heat & Power Co., New York City. First mortgage 5% bonds. Mature 1948. ($1,000.) Yield about 4.90

Pacific Elec. Ry. Co., Los Angeles, Cal. First gold 5% bonds. Mature 1942. ($1,000.) Yield about 4.75

Portland General Electric Co., Portland, Ore. First gold 5% bonds. Mature 1935. ($1,000.) Yield about 4.85

Rochester Railway & Light Co., Rochester, N. Y. Consolidated mortgage gold 5% bonds. Mature 1954. ($500.) Yield about 4.90

Scranton Electric Co., Scranton, Pa. First and refunding gold 5% bonds. Mature 1937. ($1,000.) Yield about 4.78

Washington Water Power Co., Spokane, Wash. First and refunding gold 5% bonds. Mature 1959. ($1,000.) Yield about 4.90

Union Electric Light & Power Co., St. Louis, Mo. First mortgage gold 5% bonds. Mature 1932. ($1,000.) Yield about 4.85

Bonds to Yield 5% to 5.50%

Asheville Power and Light Co., Asheville, N. C. Gold 5% bonds. Mature 1942. ($1,000.) Yield about 5.20

Buffalo General Electric Co., Buffalo, N. Y. First mortgage 5% bonds. Mature 1939. ($100.) Yield about 5.00

Buffalo & Niagara Falls Elec. Light & Power Co., Buffalo, N. Y. First 5% bonds. Mature 1942. ($500.) Yield about 5.00

Burlington Railway & Light Co., Burlington, Vt. First 5% bonds. Mature 1932. ($1,000.) Yield about 5.30

California Gas & Electric Corporation, San Francisco, Cal. Unifying and refunding gold 5% bonds. Mature 1937. ($1,000.) Yield about 5.25

Colorado Springs Light, Heat & Power Co., Colorado Springs, Colo. First and refunding gold 5% bonds. Mature 1919. ($100.) Yield about 5.10

Danville Street Railway & Light Co., Danville, Ill. Refunding mortgage gold 5 bonds%. Mature 1925. ($1,000.) Yield about 5.00

Denver City Tramway Co., Denver, Colo. First consolidated gold 5% bonds. Mature 1933. Yield about 5.00

Denver Gas & Electric Co., Denver, Colo. General (now first) mortgage 5% sinking fund gold bonds. Mature 1949. ($100.) Yield about 5.00

Eastern Pennsylvania Power Co., Easton, Pa. First and refunding gold 5% bonds. Mature 1939. ($500.) Yield about 5.25

Illinois Northern Utilities Co., Chicago, Ill. First and refunding 5% gold bonds. Mature 1957. ($1,000.) Yield about 5.30

Indiana Railways & Light Co., Indianapolis, Ind. First and refunding 5% bonds. Mature 1943. ($500.) Yield about 5.40

Kankakee Gas & Elec. Co., Kankakee, Ill. First and refunding mortgage 5% sinking fund gold bonds. Mature 1930. ($100.) Yield about 5.10

Los Angeles Gas & Electric Corp., Los Angeles, Cal. First and refunding gold 5% bonds. Mature 1939. ($1,000.) Yield about 5.07

Niagara Falls Power Co., Niagara Falls, N. Y. First Mortgage 5% bonds. Mature 1932. ($500.) Yield about 5.00

Northern California Power Co., San Francisco, Cal. Refunding and consolidated gold 5% bonds. Mature 1948. ($1,000.) Yield about 5.34

Oklahoma Railway Co., Oklahoma City, Okla. First and refunding gold 5% bonds. Mature 1941. ($1,000.) Yield about 5.37

Oklahoma Gas & Electric Co., Oklahoma City, Okla. First gold 5% bonds. Mature 1929. ($1,000.) Yield about 5.07

Pacific Light & Power Corp., Los Angeles, Cal. Collateral trust 6% bonds. Mature 1915. ($1,000.) Yield about 5.25

Pacific Light & Power Corp., Los Angeles, Cal. First and refunding mortgage 5% sinking fund gold bonds. Mature 1951. ($1,000.) Yield about 5.45

Pacific Light & Power Corp., Los Angeles, Cal. First gold 5% bonds. Mature 1942. ($1,000.) Yield about 5.00

Pacific Power & Light Co., New York City. First and refunding (now first) 5% bonds. Mature 1930. ($1,000.) Yield about 5.44

Port Huron Light & Power Co., Port Huron, Mich. First mortgage gold 5% bonds. Mature 1921. ($1,000.) Yield about 5.00

Portland Electric Co., Portland Me., First mortgage 5% bonds. Mature 1926. ($1,000.) Yield about 5.00

Portland Gas & Coke Co., Portland, Ore. First and refunding 5% bonds. Mature 1940. ($1,000.) Yield about 5.05

Portland Ry., Light & Power Co., Portland, Ore. First and refunding mortgage 5% sinking fund gold bonds. Mature 1942. ($100.) Yield about 5.25

Portsmouth (N. H.) Gas Company. Portsmouth, N. H. Refunding (now first) 5% gold bonds. Mature 1931. ($500.) Yield about 5.05

Public Service Company of Northern Illinois, Chicago, Ill. First and refunding gold 5% bonds. Mature 1956. ($1,000.) Yield about 5.13

Buying Stocks and Bonds on the Installment Plan

Most of the Stock Exchange brokers or investment bankers who have adopted the partial payment plan for the purchase of securities for customers using the installment plan, follow much the same system. When the intending buyer wishes to buy on the installment or part payment method he is required to pay as follows:

On a $1,000 high grade bond, $100.

On a $1,000 bond that is considered speculative, $200.

On stocks selling at $150 or upwards, one-third to one-half the full amount of the purchase price.

On stocks selling at $50 to $100, $20 per $100 share.

On stocks selling below $50 per share, $15 per share.

If a would-be purchaser of ten shares

of say Union Pacific wished to buy stock on the partial payment plan, an initial cash payment of $500 would be required. The balance on all stock bought this way would have to be paid for in regular monthly payments, usually $3 to $5 per month for each share of the stock so purchased.

The buyer of the ten Union Pacific shares would pay $30 to $50 per month and if he bought at $175 per share, for 10 shares, and paid $500 down, the balance due would be $1,250. This if paid off at the rate of $50 monthly would be all paid for in two years and one month. The dividends on the stock would meet the interest payments, and perhaps a little more so that the stock would be free and clear at the end of the period named.

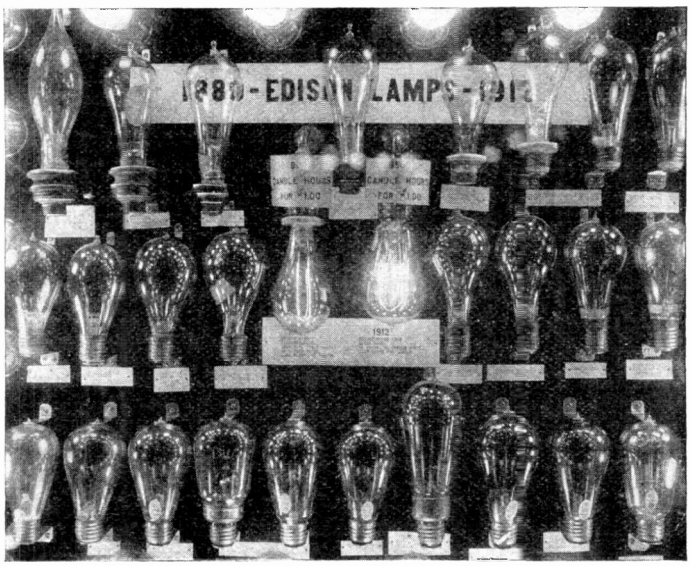
Altogether the buying of stocks and bonds by paying part of the purchase price down and the balance in one, two or three years or longer, is much the same as paying for a house in installments.

When considering the price of bonds it must not be forgotten that if the owner of bonds has reason to think that they, having advanced in price from the figure he originally gave for them, have reached as high as they are likely to go it will be the part of wisdom on his part to dispose of them at the profit and then reinvest his money in lower priced bonds, perhaps of later issue and on newer propositions, that are equally well secured and just as safe.

By following this plan he will be getting a better income or yield from them with, at the same time, the prospect of enhancement in the value of his property through an advance in their price.

Unique Lamp Exhibit

One of the interesting exhibits at the recent Electrical Exposition in New York, was that of the General Electric Company showing a collection of the various substances used by Edison in his search for a satisfactory filament. Another collection shown in the illustration, showed the development of the lamp itself, from those of 1880 to the high efficiency lamp in use at the present day. Among the lamps there was the old hand made bulb, with the bamboo filament, in which the vacuum was produced with a hand pump, and others of the early '80's with their wooden or plaster bases. Then were shown the various lamps that had been manufactured during the past 30 years; among them the gem, the tantalum, the pressed tungsten filament and the latest type of drawn wire Mazda. In 1881 only 30,000 lamps were manufactured while in 1910 the output was 80,000,000. The lamps of 30 years ago consumed 4.66 watts per candlepower as compared with the 1.17 watts consumed by the latest type of tungsten.



UNIQUE LAMP EXHIBIT

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

London Railway Electrification.—The London and Northwestern railway as well as other railroad lines which are so extensively used in the suburbs of London are now to be equipped for running electric trains. This is a very extensive undertaking, and for the lines owned by one company alone the length of railroad to be fitted out for electric operating is about 80 miles. Passengers will now be able to travel between the city and suburbs under much better conditions than before, and it has long been desired to replace the steam trains by electric trains. Direct current on the 600 volt third rail system is to be used here, and the plans call for a power station of large size which will cover a seventeen acre site near the electric line and will be laid out so that it can be readily increased in the future. Steam turbines will be mounted in the station and they will supply high voltage current upon a power line which runs to a number of substations located along the railroad line so as to be able to supply this latter. Each of the electric cars will carry four motors and the trains will be made up of motor cars and trailers.—*The Electrician, London.*

Palace of Light at Ghent.—The Palace of Light is to be one of the original features of the Ghent Exposition of 1913. What is desired is to have the electrical exhibits laid out so that they will be displayed with a better effect than has usually been done at exhibitions. In fact the exhibits are rarely open at night, and during the day the lighting effects are not well brought out, seeing that daylight interferes with this. The new plans are quite original, and call for a vast space which is to be entirely closed, so that it is dark even during the day. But night will be turned into day by the brilliant arc lights, also incandescent and mercury vapor lamps, as well as the new Moore tubes and neon tubes which will be placed all around the hall. A very attractive effect is given by Geissler tubes of many hues which will be set in constant movement by electric motors.—*L'Electricien, Paris.*

Ordnance Manufacturing in Russia.—A large part of the ordnance the Russian army and navy is made at the large works of Motovilika, in the Perm district and within a recent date the works is engaged in putting in quite a number of electric motors so as to take the place of steam engines. To run the motors there is erected a good sized electric plant with 300 horsepower steam engines and dynamos and also a 400 horsepower Diesel oil engine set working on crude oil from the Russian wells. Besides, there will soon be installed a 1,200 horsepower Brown-Boveri steam turbine group of Swiss make. Throughout the shops are motors to the number of 2,450 at the present time, also eighteen traveling electric cranes of fifteen to 90 tons lift. The extensive shops are lighted by 6,450 incandescent lamps and 100 arcs. In the foundry is now running an electric furnace of considerable size which is proving very useful for this kind of work. The nickel plating shop is laid out on a large scale, and here are plated 25,000 projectiles a month.—*Revue Electrique, Paris.*

Low Aerials for Wireless.—M. E. Rothe finds that he can receive wireless messages from quite a long distance by the use of an aerial wire running along not far from the ground, so that this will be easier to mount than upon a pole. For instance at Nancy in the east of France he picked up signals from the Eiffel Tower and also from several German posts, with an 80 foot wire stretched at less than eight feet from the ground. In

later experiments at St. Dié, he used a copper wire run along on small stakes six inches high, the wire being attached without care as to having it insulated, and it even touched the grass at times. The shortest length he used was 50 feet and the wire was connected to buried water piping, using a self induction coil between. With a detector telephone and battery set, he could easily hear the Eiffel Tower signals. The garden in this case is entirely surrounded by an iron fence more than three feet high, but this did not appear to have a bad effect.—*Journal Academie des Sciences, Paris.*

Bearded Grain Draws Electricity from the Air.—Prof. Lemstrom, of the Helsingfors University, shows that bearded grain such as wheat acts in a hitherto unexpected way in order to draw in electricity from the air, and thus it serves as a veritable lightning rod. This produces a pronounced beneficent effect upon the wheat plant, seeing that the grain, at least and no doubt the other parts of the plant, are constantly in a a bath of electricity, and it is now well known that this acts to further the growth of plants to quite a considerable extent. Thus the yield of grain or vegetables is found to increase, according to experiments which have been made in various places. In Europe, farmers have hitherto preferred wheat which is not of the bearded variety for various reasons, although the latter is hardier in growth and produces more grain, as is well known. Now Prof. Lemstrom seems to prove that this superiority is due to the electric currents from the atmosphere. This is another point to be added to the knowledge we are now gaining on the subject of "electro-cultivation," as it is called.—*La Nature, Paris.*

Radium and Plant Growth.—It has already been observed that radium has the effect of increasing the growth of plants, and the new experiments made by J. Stoklasa throw new light upon this interesting field of study. Other workers used radium minerals or salts, but he makes use of the radium bearing mineral waters of Joachimsthal, taking the water directly from the springs each day and before it loses its effect. He shows that when grains are placed in this water, they grow at a surprisingly rapid rate; for instance, using barley grains, at eight days' growth the results were quite striking, for the roots were two inches long and the stalk three inches, while in ordinary water the roots showed but a quarter of an inch and the stalk only half an inch. Other plants gave equally good results. Grain also sprouts much quicker, as for instance it took only 24 to 36 hours for it to sprout when in the radium water and as long as 56 to 120 hours otherwise. Other equally surprising results come from the weight of the plants. After 40 days' growth, the weight for ten stalks of the same plant was over four times as much by the radium treatment.—*Journal Academie des Sciences, Paris.*

New Telegraph Recorder.—At the recent exhibition of new apparatus held in London by the Physical Society, Mr. S. G. Brown spoke of a new recorder for receiving telegraph messages over long lines and especially ocean cables. The current is very weak in such cases, and the signals are usually received in the siphon recorder, as the current is not strong enough to work another kind of device. Mr. Brown magnifies the current by the use of a new relay of his design. As usual, the current comes into a suspended coil which swings under the action of the current, but instead of using the siphon for ink signal record on the end of the arm attached to the coil, he uses a very ingenious method which consists of a pair of minature thermo-electric couples mounted on the arm. The two couples lie midway between two small spirit lamps, so that when the coil is not working, the ends of the thermo-couples are equally heated. When the coil moves

one of the couples comes nearer the flame, and these are now unequally heated so as to give rise to a current. What is remarkable is that this current is nearly 30 times as great as the telegraph current, so that it can be used to work other recording devices for the signals.—*The Electrician, London.*

Sending Colored Photograhps Over the Wire.—A scheme for sending photographs over the wire in their natural colors is devised by an Italian engineer, Q. Marino. As the apparatus is not made as yet, it is too soon to say whether it will work in practice, but the idea appears to be an attractive one, at any rate. Each point on the original color photograph, or even a natural object, is made to pass before an opening so that the light from this point is decomposed by a prism into the seven colors, in the case of white light, or into a less number. Each color falls on a separate selenium cell whose office is to send current over the line so that the cell having, for instance, red light upon it, will produce red at the other end. This is done by having the cells send a vibratory current which is tuned so as to work with tuned Poulsen arc lights at the receiving end. Without going into details, the selenium cell sends current in such way that the corresponding arc light operates and throws light through a red screen on to an autochrome photographic plate. Thus the red color spot at the sending end gives a red light spot at the receiving end and so on for all the different colors of the photograph.—*Genie Civil, Paris.*

Keeping Tab on an Electric Wagon

A convenient application of recording watt-hour meters is made in the electric wagon service of the Lowell, Mass., Electric Light Corporation, which is one of the most carefully handled services of its kind in New England. The power wagons shown are equipped with a Sangamo watt-hour meter calibrated between 60 and 115 volts, in addition to an ampere-hour meter, and by these instruments the company keeps a close record of the energy consumption of the machine in various classes of service, as well as the condition of the battery with respect to charge and discharge. The meters are mounted on the dashboard directly in front of the driver's steering wheel.

NEW BOOKS

LESSONS IN WIRELESS TELEGRAPHY. By Cole and Morgan. Newark, N. J.: Cole and Morgan. 1912. 62 pages with 59 illustrations. Price, 25 cents.

There are 30 lessons, arranged as far as possible in logical sequence, giving a systematic elementary course in the principles of wireless telegraph apparatus and the electrical laws upon which it depends.

WIRELESS TELEGRAPHY AND TELEPHONY SIMPLY EXPLAINED. By Alfred P. Morgan. New York: Norman W. Henley Publishing Company. 148 pages with 156 illustrations. Price, $1.00.

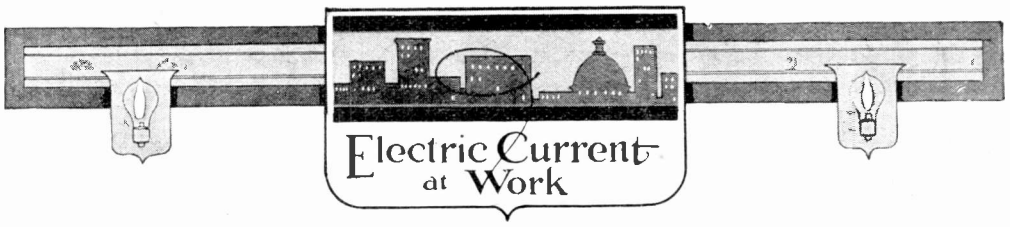
The book furnishes a comprehensive explanation in simple language of the theory and practice of wireless telegraphy and telephony and explains as far as possible the importance of its position today and the possibilities of tomorrow.

SAW FILING AND MANAGEMENT OF SAWS. By Robert Grimshaw. New York: Norman W. Henley Publishing Co. 1912. 129 pages with 106 illustrations. Price, $1.00.

This book is designed as a practical aid to those who use saws for any purpose. While, as its title implies, it treats principally of saw filing, it also goes into the questions of gumming, spring setting and swaging.

GASOLINE ENGINE TROUBLE CHART. By Victor W. Page. New York: The Norman W. Henley Publishing Company. Price, 25 cents.

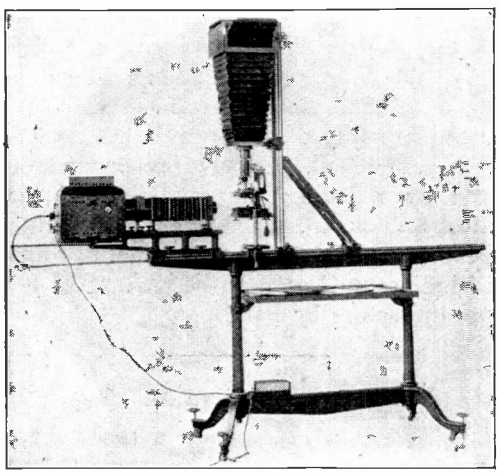
A chart 25 by 38 inches showing a sectional view of a typical four cylinder, four cycle, gasoline engine and a tabulation of troubles, causes, symptoms and remedies to aid in clearing up any engine trouble.



Photographing Microscopic Objects

Tiny organisms or bits of mineral have been studied up to now by placing them upon a piece of glass called a "slide" and then slipping this glass into a holder under a microscope.

The electric photomicrographic apparatus, as it is called, changes all this



APPARATUS FOR PHOTOGRAPHING MICROSCOPIC OBJECTS

by taking a picture of the slide, using the microscope in doing so and giving us an enlarged picture of what we see if we look into the microscope itself.

The device consists of a camera, an ordinary microscope and either an arc lamp or a Nernst lamp enclosed in a lamp house and fitted with lenses for illuminating the slide during the picture taking. The equipment is fitted to a lathe like table with adjusting devices for accurate work. The camera may be placed in a vertical position and the microscope slide used to hold minerals and opaque objects while they are photographed.

By removing the camera and microscope from the stand the remaining apparatus may be used as a stereopticon.

A Revolutionary Improvement in Plate Printing

Plate printing, that is, printing from engraved steel plates, is likely to be revolutionized as the result of an experiment now in progress by the United States government. Until recently it was held by all experts in this, the highest branch of the printing art, that impressions of the first quality could be obtained from steel plates only by means of hand work and the use of a hand power press that has shown little modification in design from the original type of printing press devised by the Italian inventors centuries ago. It is this demand for manual labor unaided that Uncle Sam is now challenging by the unique experiment lately undertaken.

The old style plate press has been retained but the old wheel which the plate printer had to revolve in order to bring to bear the pressure needed for each impression has been supplanted. In its place there has been installed an electric motor which supplies energy for the printing operation and brings to bear each successive sheet of paper upon the inked steel surface with all that precision and evenness attained by the hand impression and which are essential for the transfer to the paper of all the exquisite details of lines and shading. The electric manipulation of the roll of the press not only minimizes labor but results in an appreciable saving of time.

The national government has worked out this problem in order to simplify the

task of printing our currency but it is expected that the discovery will be taken advantage of by commercial houses in all parts of the country that are engaged in the production of any of the classes of work to which the new scheme will be applicable. Uncle Sam is disposed to let

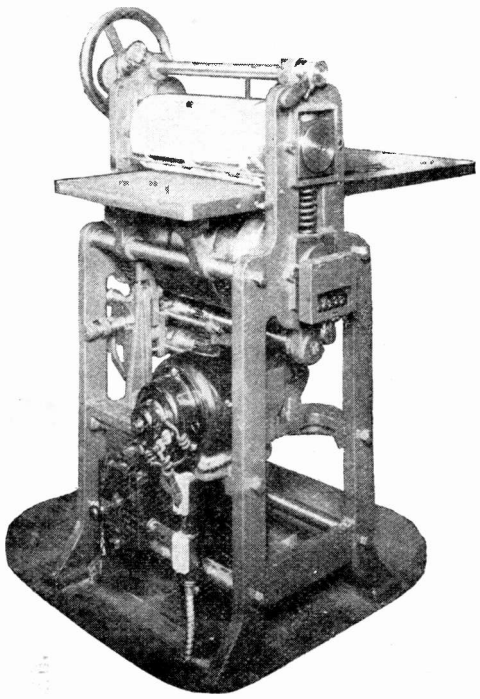


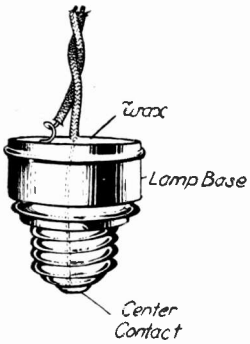
PLATE PRINTING PRESS MOTOR DRIVEN

all such interested persons into the secrets of the special type of motor which the experts designed for this work.

A specially wound armature on the motor, in conjunction with a controller of original design, results in the press starting slowly and gradually increasing speed until the roll reaches and engages the printing plate. Maximum speed is maintained during the passage of the roll across the engraved plate and then there is a gradual decrease in speed to an automatic stop. When it is explained that one second is the total elapsed time required for this operation from the time the current is turned on by means of footpedal control until the roller has mechanically come to rest it will be appreciated that careful calculation has been made and when it is stated that this operation will be repeated more than 100 times an hour during eight or sixteen hours per day it can be realized that severe exactions are placed upon the motor.

Tests already made show that motor drive will increase the speed of a plate press at least ten per cent. The average skilled operative of a hand press prints about 110 sheets per hour whereas a speed of 121 sheets per hour has been recorded by the electrically operated press under favorable conditions and a record of 100 sheets in 35 minutes has been made in a spurt. The aid of the magic current does not reduce this highly specialized form of printing to the level of the mechanical because now, as formerly, the inking of the plate, which is done by hand, determines in great measure the quality of the product but, as has been explained, it increases production and by relieving the operative of the most arduous manual labor allows him to devote greater care to the exacting duty of inking and rubbing the surface of the printing plate by hand.

Emergency Extension Plug

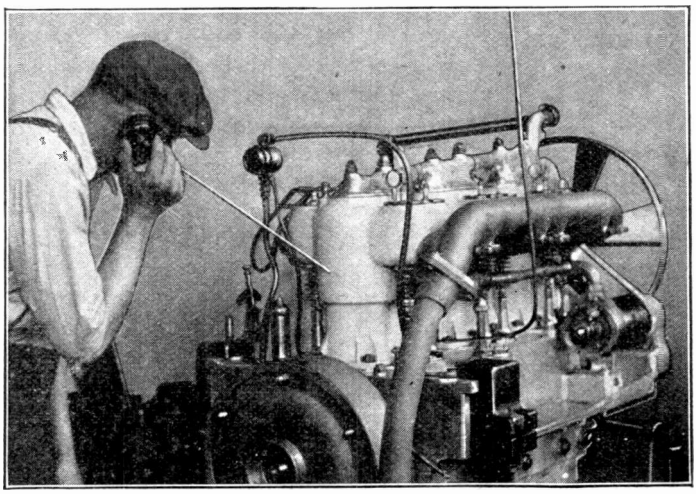


EXTENSION PLUG

In a case where a plug could not be obtained in time for use on an extension light I made a plug from a tungsten lamp base in the following manner: The two wires of an ordinary drop cord were soldered one to the center contact and the other to the screw shell of a tungsten lamp, the whole interior being then filled with sealing wax. A socket connected to the other end completed the extension which was used until a regular plug could be delivered.—H. G. Wilson.

Stethoscope to Detect "Valve Slap"

There is no marked similarity between the physician's office of a life insurance company and the engine testing room of a motor car factory, yet they have points in common. Among the tests given in each place is that of the stethoscope.



LISTENING FOR VALVE SLAP

The physician uses it to detect irregularities of the heart—the mechanic to discover any unevenness of operation inthe motor.

While serving the same purpose as the stethoscope, the instrument used in the high grade motor car factories is slightly different in appearance. It consists of a steel rod made of three separate pieces combined with a regulation telephone receiver. By placing the end of the rod against the side of a motor it is possible to locate the source of the smallest disturbance. The lightest of "valve slaps" or knocks in the engine are thus noted, allowing the correction of any fault before mounting the motor on a chassis. The road testers carry similar instruments as an extra precaution against the possibility of a car being turned over to the sales department with a faulty motor.

The accompanying photograph shows a workman testing a six cylinder motor for interior trouble.

Automatic Electric Generator for Country Homes

There has lately been put on the market in France an electro-generative outfit which seems to have overcome some of the difficulties of small lighting equipments by means which are both simple and ingenious. When the motor is supplied with its combustible, lubricating oil and cooling water, the apparatus furnishes automatically the current necessary for lighting or other purposes on the turning of a switch.

The arrangement consists of a small gasoline or benzine engine attached by a belt to a dynamo, a tank for the combustible and another for the cooling water, a battery of a small number of elements acting as an accumulator and a starting rheostat. The whole is mounted on a pair of I beams, and is so light that it can be moved around very easily.

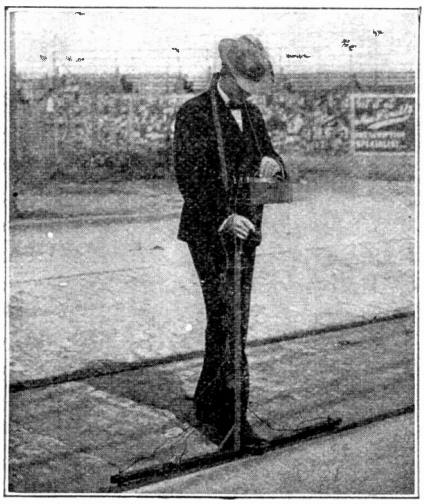
The apparatus being connected with the wiring system of the house, a switch is closed which discharges the current of the accumulators upon the circuit thus opened; this current is sufficient to supply, for a time, three or four lamps without the help of the engine. But if another switch is closed and the current becomes insufficient for doing the work in hand the dynamo, acting as a motor, is connected. This moves with increasing speed, carrying with it the engine, until the latter begins to work of itself. The dynamo is then driven by the engine and produces current to feed the lamps and to re-charge the accumulators.

If at any moment the charge diminishes to a point where it does not exceed the capacity of the accumulators, the dynamo stops and the accumulators are dis-

charged upon the line. Each time that the accumulator charge is lowered below its normal voltage, even if there are no lamps lighted, the apparatus is automatically set in motion to re-charge the accumulators. All these maneuvers are effected by the movements of an electromagnetic relay on the switchboard.

The Bond Tester

The current which leaves the trolley wire through the trolley pole passes through the car motor and then must return to the power house along the rails of the tracks if no return wire is provided. For this reason each rail is connected to the next by a good heavy wire which is called a "rail bond." This bond



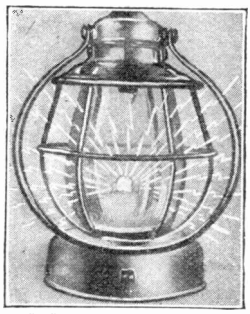
BOND TESTER

or connecting wire between the rails must be at all times in good condition and to determine this men called "bond testers" travel along the tracks and make tests where the rail ends meet.

Without going into detail the tester shown in the picture equipped with a Roller outfit works about as follows: The inverted T shaped wooden bar is placed on the rails under test. It has three saw blade contacts which are connected by flexible conductors to the portable galvanometer swung from his neck. Since current from cars is always flowing along the tracks some of it will flow by way of the contacts through the galvanometer and deflect the needle, but just how much will depend upon the condition of the bond wire.

Electric Lantern

An electric lantern designed by a locomotive engineer and following the lines of a Pullman conductor's lantern is being placed on the market by a Chicago firm.



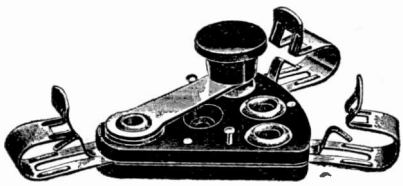
ELECTRIC LANTERN

The body of the Jenks lantern is made of brass heavily nickel plated and weighs 2¼ pounds. In the base is a three cell dry battery which supplies current to an incandescent lamp. When the lantern is lifted by the bail the lamp lights up. By dropping the bail on one side the light is turned out, while dropping the bail to the other side keeps the light burning.

The lantern does away with the use of oil and the cleaning of smoky chimneys and it cannot be blown out by wind.

Battery Switch

This switch is designed for service upon battery and magneto circuits. The Fahnestock spring binding posts make it appeal to experimenters on account of the



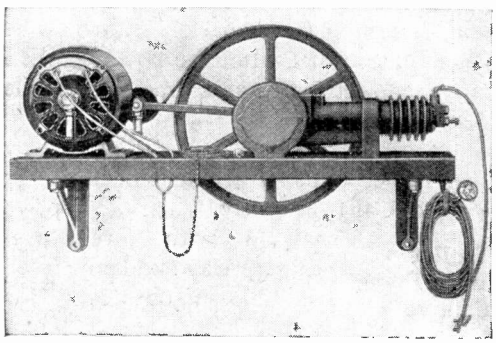
BATTERY SWITCH

ease and quickness with which wires are connected and disconnected.

Automobile Tire Pump

Considering the amount of hard work this pump can save, its low cost of operation is surprising, since at ordinary rates for electricity it will operate for less than one cent an hour. The cost of filling a tire is therefore insignificant.

The operating parts of the Vaile-Kimes pump, which is operated by a



TIRE PUMP

small Westinghouse motor, are enclosed in an oil tight, dust proof casing, so that practically no attention is required.

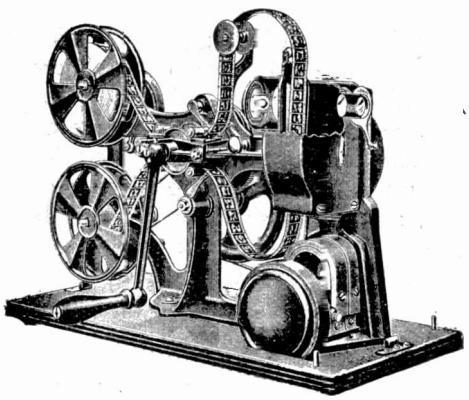
A pressure gauge registering up to 150 pounds is provided as part of the outfit. The automobile owner is, therefore, able to maintain his tires at the proper pressure, which adds greatly to their life. It is impossible for oil to get into the tire through this pump, so that rotting from this cause is prevented.

Moving Pictures by Incandescent Lamp

Much enjoyment as well as instruction can be had during winter evenings by the use of the new moving picture machines of small size, and these are coming into service in Paris and other cities for use in the family circle. It may seem strange that the metallic filament electric lamp is responsible for a great deal of this progress in making a simple and inexpensive machine. As soon as it was found that the lamps would flash up and die out much quicker than the ordinary carbon filament lamp, inventors set to work to make a machine in which the lamp would flash up at one-tenth of a second, that is, making a separate flash just as each picture passed before it. This brilliant flash sends a strong light through the picture film just at the moment it is needed, then the light goes out while the film is passing on.

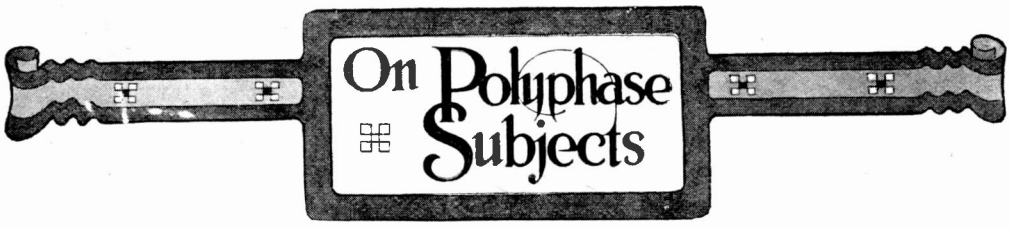
Before this a revolving shutter was needed to stop off the light while the pictures were being changed.

The new Pathé machine is here illustrated. It uses non-combustible film of smaller size than usual, and at the factory there is a special camera apparatus for reproducing the standard films in this small size. The film will be seen passing in front of the small electric lamp, the light being concentrated by reflector and lens. A magneto supplies the current and an extra brilliant light is given at each impulse by the use of a much higher current than the lamp is made for. This uses up the lamp very quickly, but it costs but little, and one lamp lasts for about ten hours. Even with this small appara-



MOVING P CTURE MACHINE OPERATED BY INCANDESCENT LAMP

tus and using an incandescent lamp which would give but two candlepower usually, the picture appears in an excellent light on a screen three feet square, which is very good for use in an ordinary room. For schools the new machine will prove excellent.



A New Electric Vapor Lamp

The cadmium vapor lamp which has just been invented by a German physician, M. Wolfke, gives a white light. Every one knows the mercury vapor lamp: it has the advantage of being very economical from the point of view of current consumption, but the green coloration of its light limits its usefulness very considerably. M. Wolfke, after having tried a great number of metals and alloys, seems to have solved the problem by an amalgam of cadmium with a small quantity of mercury. Cadmium has the following properties which make it very suitable for this purpose: its temperature of vaporization in a vacuum is low (450° C.); it does not attack glass; its spectrum contains red radiations. Pure cadmium used in a lamp gives a red light; with the addition of from three to ten per cent of mercury it produces a very satisfactory white light. Here seems to be an interesting question for inventors and electricians. If a mercury vapor lamp gives a green light, and a cadmium lamp a red light, and a combination of the two in certain proportions gives a white light, then how shall a blue or yellow light be produced, if such should be desired?

Steam, Electricity and Coal

For a time, during the transition from steam to electricity on the Southport Branch of the Lancashire and Yorkshire Railway, it was necessary to run steam trains between the electrical trains, at the same speed. This afforded an opportunity to compare the coal consumption of the locomotives with that of the power house supplying the electric trains. It was found that the six wheeled, coupled tank engines consumed 80 pounds of coal per train mile for express trains, and 100 pounds for accommodation trains. The consumption of coal at the power station for the electrical trains was 49 pounds per train mile.

Trolley Wire Frees Captive Balloon

A rather unusual accident occurred at Venice, Calif., recently, when the captive balloon with three passengers was suddenly freed and blown out over the ocean.

The balloon had just risen to the end of its cable when a freakish wind caught the big bag and forced it towards the ground. The steel cable came in contact with a trolley wire and the electric current burned it in two almost instantly. The balloon floated upward and for an hour and a half drifted about in the air sometimes near the land and sometimes far out over the water. About four miles from the San Pedro breakwater the pilot finally noticed some boats beneath him and, descending, they were rescued.

The International Candle

Something over three years ago a new unit of electric illumination, called the "international candle," was adopted by France, England and the United States. The American standard candle was thereby reduced one and six-tenths per cent in order to make it uniform with the English candle and the Bougie Decimale of France. The value of the Hefner, the German unit, is nine-tenths that of the international candle.

The French visitor to Gelligaer showed some alarm at the prospect of passing a savage looking dog that stood in the way, barking furiously.

"It's all right," said his host. "Don't you know the proverb, 'Barking dogs don't bite?'"

"Ah, yes," said the Frenchman, "I know ze proverbe, you know ze proverbe, but ze question is, does ze dog know ze proverbe?"

* * *

A traveler in Indiana noticed that a farmer was having trouble with his horse. It would start, go slowly for a short distance and then stop again. Finally the traveler approached and asked, solicitously: "Is your horse sick?"

"Not as I knows of."

"Is he balky?"

"No. But he is so danged 'fraid I'll say whoa and he won't hear me, that he stops every once in a while to listen."

* * *

"God bless mama and papa, and God bless Harrigan," said little George, aged four years, as he knelt beside his mother for his evening prayer.

"Why, George," said his mother, "who is Harrigan?"

"That's me," he replied.

* * *

"You are rather a small boy to be earning five dollars a week."

"I suppose I am," he replied. "I know I'm small for my age, but to tell the truth, since I've worked here I've been so busy I haven't had time to grow."

He got the "raise."

* * *

Some years ago a prominent man went into the business of raising hogs. Friends congratulated him on his success, as his breeds were certainly fine. "Hogs!" replied he contemptuously. "Why, these people never knew what a big hog was till I came here!" And he wondered why they laughed.

* * *

Teacher—"Johnny, what is a skeleton?"

Johnny—"Please, ma'am, it's a man with his insides out, and his outsides off."

Subbubs had taken Chumleigh home to dine. Everything went well until they were seated at the dinner table, when Willie Subbubs remarked, "Why, pa, this is roast beef!"

"Well," said his father, "what of it?"

"Why, I heard you tell ma at breakfast that you were going to bring a mutton head home for dinner this evening."

* * *

"Why do you use paint?" asked a violinist of his daughter.

"For the same reason that you use resin, papa."

"How is that?"

"Why, to help me draw my beau."

* * *

Not long ago Bishop Greer recounted some amusing replies to examination questions given by Chinese students. The first of them is evidence how rapidly the sporting instinct is spreading. In answer to the question, "What are the five great races of mankind?" one student replied: "The hundred yards, the hurdles, the quarter mile, the mile and the three miles."

* * *

"It is the duty of everyone to make at least one person happy during the week," said a Sunday school teacher.

"Now, have you done so Johnny?"

"Yes," said Johnny, promptly.

"That's right. What did you do?"

"I went to see my aunt, and she's always happy when I go home!"

* * *

"So you advertised for your lost purse, pretending that the person who found it was recognized?"

"Yes."

"How did the bluff work?"

"Didn't work at all. Next day this ad appeared in the same paper: 'The recognized gentleman who picked up the purse on Boylston street requests the loser to call at his house.'"

* * *

"That lawyer of mine has a nerve."

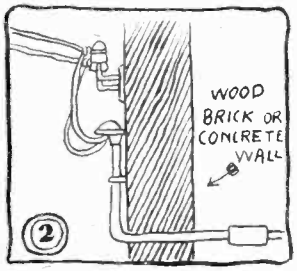
"Why so?"

"Listen to this item in his bill: 'For waking up in the night and thinking over your case, $5.'"

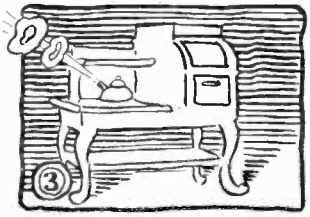
THE ELECTRICAL HOUSE THAT JACK BUILT

THIS IS THE HOUSE THAT JACK BUILT

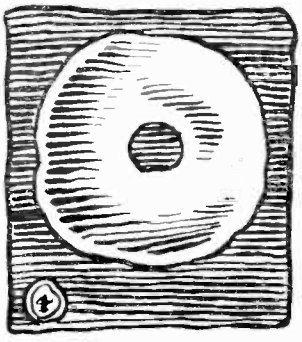
THESE ARE THE WIRES THAT WIRED THE HOUSE THAT JACK BUILT



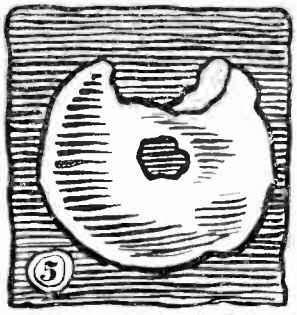
THIS IS THE ELECTRIC RANGE THAT J.'S WIFE BOUGHT AND ATTACHED TO THE ENDS OF TWO OF THE WIRES THAT WIRED THE H. THAT J. BUILT



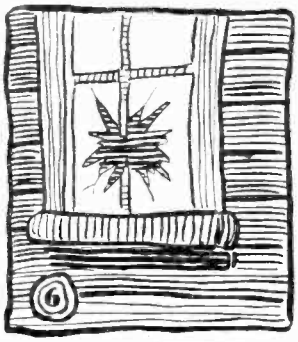
THIS IS THE SINKER ALL FORLORN THAT J.S WIFE COOKED UPON THE RANGE ATTACHED TO THE ENDS OF TWO OF THE WIRES THAT WIRED THE H. THAT J. BUILT



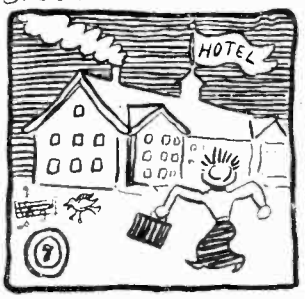
THIS IS THE BITE ALL TATTERED & TORN J. TOOK FROM THE SINKER ALL FORLORN THAT WAS COOKED ON THE RANGE ATTACHED TO THE WIRES THAT WIRED THE H. THAT J. BUILT



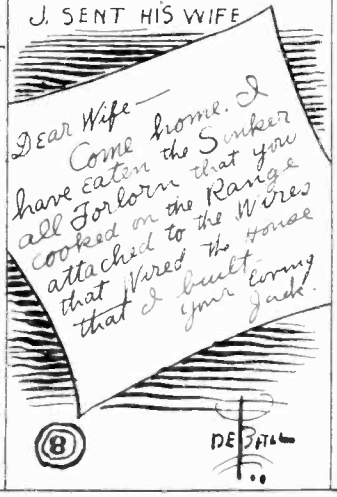
THIS IS THE WINDOW OUT OF WHICH J. HEAVED THE SINKER ALL FORLORN THAT WAS COOKED ON THE RANGE ATTACHED TO THE WIRES THAT WIRED THE H. THAT J. BUILT



THIS IS THE HOUSE IN RENO WHERE J.'S WIFE WENT WHEN HE CAST AWAY THE BEAUTIFUL SINKER ALL FORLORN THAT WAS COOKED ON THE RANGE ATTACHED TO THE WIRES THAT WIRED THE H. THAT J. BUILT



THIS IS THE LETTER J. SENT HIS WIFE



SO SHE CAME BACK AND THEY LIVED HAPPILY AND PROSPERED — AND SHE COOKS NO MORE SINKERS ALL FORLORN UPON THE RANGE ETC.

Intelligent Industry Insures Independence

By FRANKLIN O. KING

The Man Who tries to Kill an Elephant with a Pop-Gun is on a Par with the Person who would plan to Pulverize a Peanut with a Pile-Driver. Both may be Terribly in Earnest, but Neither has a Correct Idea of the Eternal Fitness of Things. Fools Spoil their Tools when they try to Reap Results without Rules. Like the Horse on the Treadmill—They are Walking Fast, but not Getting Anywhere, in Particular. The Untrained Man, with only Brute-Strength to commend Him, is up against a Hard Proposition in this Day and Age of *Specialized Supremacy*.

In other Words, the Man who Knows How to do one or two things *well*, has most Everybody else "*On the hummer*," when it comes to Competition. Emerson said:—"The Man who Makes the best Mouse-trap will find a Beaten Path to his Door, even though he Live in the Midst of a Forest." I am not so Sure about the quotation, but it simply bristles with Truth, like Quills on the Ridge-pole of a Fretful Porcupine. The Man with the Hoe would make more "dough" if he used *Modern Methods* to Sow and to Reap.

The Business Man makes the Best Farmer, because he Applies Business Principles to Buying and Selling, as well as to Growing his Crops. His Creed is Simply to make a Two-Dollar Bill grow where only a "One-Spot" grew before, and with all Due Respect to the Yokel who is Merely Multiplying Blades of Grass, I think the Business Farmer has the Bulge.

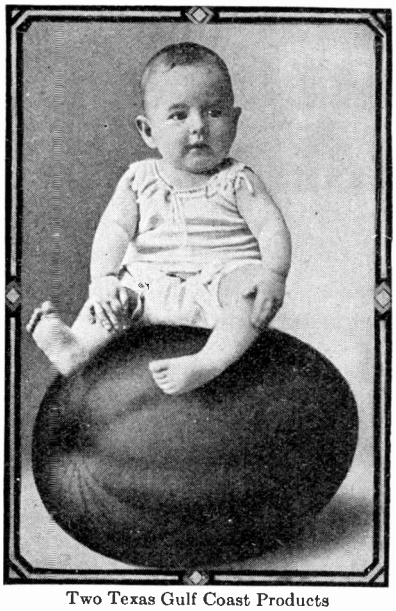
The Mechanic, the School-teacher, the Doctor, the Lawyer and the Day-laborer are all "Business Men," when it comes Right Down to it—"Even as You and I." Most of Them have had Training in the "School of Hard Knocks," and Know How to Listen when "Money Talks." It only requires the Application of Brains in Order to make the Earth most Anywhere Bloom with Life.

Ben Franklin said:—"He who by the Plow would Thrive, Himself must either Hold or Drive." The Man who is Really in Earnest will *absolutely make good* on a Small Farm, if he will only Put his Shoulder to the Wheel, and stay "Put." **Work Wins**—It Always Wins, but **Industry** and **Intelligence** are **Irresistible** and **Invincible.**

Since Investigating Conditions in the Rain Belt of Gulf Coast Texas, I have no Fear of Old Age or Poverty, because I Know I can Take Up a Few Acres down there and be *Absolutely Independent*. I am Firmly Convinced that with *Average Intelligence* and *Average Industry*, any Man who is now Working His Head off in the North to make a *Bare Living*, where they Snatch one Crop between Snow-Storms and Blizzards, can soon Lay up a Nice Bank Account in the **Winter Garden of America.** Come to the *Land of Least Resistance*, where You can Grow Three Big Money-Making Crops a Year on the Same Soil and Without a Dollar's Worth of Expense for Irrigation or Fertilization.

I believe you could save Twenty-Five Cents a Day if You Tried. I know you would Try if you Realized that our Growers of Figs, Strawberries and Early Vegetables clear a net profit of $300 to $500 an Acre. Men have Realized more than $1,000 an Acre growing Oranges in our Country. Remember that our Early Vegetables get to Northern Markets in Mid-Winter and Early Spring, when they command Top Prices.

One German Truck Grower on adjoining lands last spring realized nearly $500 from three-fourths of an acre of Strawberries. You could do as well if you only Tried, and on a Ten-Acre Tract **Find Financial Freedom.**



Two Texas Gulf Coast Products

The Biggest Price paid for a car of watermelons on the Houston Market last year was $140. The car was shipped by the Danbury Fruit and Truck Growers' Association.

We are situated within convenient shipping distance of Three Good Railroads and in addition to this have the inestimable Advantages of Water Transportation through the Splendid Harbors of Galveston and Velasco, so that our Freight Rates are Cut Practically in Half. The Climate is Extremely Healthful and Superior to that of California or Florida—Winter or Summer—owing to the Constant Gulf Breeze.

Our Contract Embodies Life and Accident Insurance, and should You Die or become totally disabled, Your family, or any one else You name, will get the Farm without the Payment of Another Penny. If you should be Dissatisfied, we will Absolutely Refund your Money, as per the Terms of our Guarantee.

Write for our Free Book, which contains nearly 100 Photographs of Growing Crops, etc. Fill Out the Blank Space below with your Name and Address, plainly written, and mail it to the Texas-Gulf Realty Company, 1383 Peoples Gas Bldg., Chicago, Ill. Read it Carefully, then use your own Good Judgment.

Please send me your book, "Independence With Ten Acres."

CLASSIFIED ADVERTISEMENTS

THE COST OF ADVERTISING IN THIS SECTION IS 5 CENTS PER WORD

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

Forms for the April issue close March 1st.

AERONAUTICS

MAKE AN AEROPLANE OUT OF YOUR bicycle for $6.00. Drawings 30c. Thomas Hofmeister, Overlea, Md.

ARE YOU LOOKING FOR ROTATING planes on a flyer? Get the model plans and explanations of my "Circle Aeroplane" for 25c. It's a sure winner. C. R. Zickler, Route No. 29, Yonkers, N. Y.

TWO FOOT MODEL AEROPLANES, BLERiot, Antoinette, Demoiselle, $1.00 each. Curtiss, Farman, Wright, $2.00 each, in knock-down form with blueprint and instructions for building, postpaid. Yale Mfg. Co., D5, Newark, N. J.

COMPLETE PLAN, DRAWN TO SCALE, with concise Instructions for building a 3-foot Nieuport Monoplane, 25c. Other Plans: Bleriot, 15c, Wright, 25c, Curtiss, 35c, "Cecil Peoli" Champion Racer, 25c. Set of five, $1.00. 40 pp. Model Supply Catalog, 5c. IDEAL AEROPLANE CO., 86B West Broadway, New York.

AGENTS WANTED

AGENTS, RENEW OLD DRY BATTERIES; complete instructions, 25c, guaranteed. Clark, 1613 North 13th, Philadelphia.

NEW $$$, BIG BARGAIN FOUNTAIN PEN. Sample 25c; five for $1.00 postpaid. Johnson Co., 112 Viola St., St. Paul, Minn.

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

SHOW CARD AGENTS ARE MAKING MONey in bunches. Catalog free. Popular Show Card Co., Dept. C. H., 1235 Michigan Ave., Chicago.

GET POSTED WHERE TO BUY EVERYthing the Mail Dealer or Agent needs. Our new Directory is just off the press. Tells you where to buy from first hands about two thousand different articles. It will save you many dollars. Price $1.00 postpaid. Hardware Electric Supply Co., 56 Charlotte St., Buffalo, N. Y.

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

SEE DISPLAY AD, PAGE 63. DOUD LIGHTing Co., Chicago.

AGENTS—YOU CAN SELL ADDING MAchines at $1.00 and $3.50. Big Profits. B. Bassett, 5921 Indiana Ave., Chicago.

AGENTS WANTED

PERFECTION POCKET ADDING MAchine—Lightning seller; agents wanted. Cincinnati Specialty Co., Dept. E, Cincinnati, Ohio.

AGENTS:—MY TWELVE MONEYMAKERS bring repeat orders. Easy selling plans. Big profits. G. Rolfe, 923 N. Alder, Philadelphia, Pa.

AGENTS WANTED TO SELL ARTICLE which can be used in every home and schoolhouse. Non-Draft Ventilator Co., Frankfort, Ind.

190% PROFIT. HOUSEHOLD NECESSITY "IS" New "Will" Sell itself, 20c. package—proposition 10c. John Hellwig, 49½ Clinton St., Albany, N. Y.

DISTRICT MANAGERS—PEERLESS POLisher—an ingenious, indispensable article; wonderful seller, producing $200 to $500 monthly. Forslund Sales Agency, Superior, Wisconsin.

A DOZEN NEWLY PATENTED ELECTRIcal devices, all quick sellers; 32-page catalogue; exclusive territory. PRESTO ELECTRIC COMPANY, 325 Geary, San Francisco.

$100.00 TO $300.00 INVESTED IN OUR NEW Ball gum vending machines will turn your spare time into big money. May make you independent. Universal Mfg. Co., Box 18, Columbus, Ohio.

AGENTS SELL PALS CHANGEABLE SCARF Pin; make $30 weekly, send stamp for FREE sample. Pals Manufacturing Company, 25 East 14th Street, N. Y. City.

WONDERFUL INVENTION JUST OUT, makes what was drudgery, "just fun." Sells for $3.00. Agent pockets half. Big demand. Illustrated circular. Tarbox Coy, Haverhill, Mass.

AGENTS—OUR "HOME LAUNDRY TRIO" are winners. Greatest time and labor savers. Money Makers. Write for attractive proposition—To-day. Leibman, Lefferts Ave., Richmond Hill, N. Y.

SELL AND INSTALL OUR NO-BATTERY Electric Bells at big profit. $5 to $10 a day. Expert knowledge not necessary. We can help you start a big profitable business. Write for terms. Searles Electric Co., 1155C Monadnock Block, Chicago.

AGENTS—TO SELL THE NEWEST ELECtric appliance on the market; sold everywhere there is electricity, in the home and office; liberal profits; sales-driving sample, weighs a pound, no experience or knowledge of electricity required; it shows how to use one light instead of two and get the same results; sells for $3.50 and saves the purchaser an investment of $25. Write for particulars. THE HANDY LIGHT CO., 25 Handy Light Block, Cincinnati, Ohio.

500 PER CENT PROFIT—YOUR OPPORtunity. Act how. Buyers everywhere for our U. S. Fire Extinguisher. Low Cost; fast seller; sure profits; exclusive territory. District managers wanted. United Mfg. Co., 1027 Jefferson, Toledo, O.

AGENTS—WOULD YOU TAKE A STEADY job where you can clear $20 to $30 weekly and work up to yearly profits of $3,000 or more? My line is snappy household goods. Quick sellers! Get busy with postal asking particulars. E. M. Davis, B16 Davis Blk., Chicago.

BOOKS AND PERIODICALS

CLASSY BOOKS — STAMP BRINGS CATALogue. Paul Duff, 2713 N. Mozart St., Chicago.

"RHYMES OF DAVID." RACY, RARE, true to nature. One dollar. Fetter Book Co., Robinson, Md.

THREE LITTLE BOOKS FOR LADIES, postpaid, in plain cover, for 25c. (Tell what you want to know.) O. K. Pub. Co., Decatur, Ill.

HOW TO MAKE DYNAMO—BOOK TELLS how, and Digest, one year, 25c. Digest, Grand Rapids, Mich.

SECOND-HAND BOOKS, HALF-PRICES ON every subject. New 25 per cent discount. Books bought. Catalogue 544 post free. Foyle, 121 Charing Cross Rd., London, England.

NO MORE DEAD ENGINES, OR WALKS back to town. New discovery guaranteed. Instruction booklet 25c. Thomas Mfg. Co. Star Theater Building, Des Moines, Iowa.

WONDERFUL BOOK ON HYPNOTISM, personal magnetism, magnetic healing and occult science sent free to anyone. Send your address today. M. D. Betts, Sta. 129, Jackson, Mich.

THE MARRIAGE GUIDE, TELLS RARE things you should know before and after marriage. 276 pages of valuable information. Price $1.00. J. F. Sheridan, 417 E. 151st St., New York.

SEND 12c FOR "SEXUAL PHILOSOPHY," clearest, best, most instructive sex manual published. Actually teaches, not merely argues. Write today. "Health-Wealth" Publishing House, 85 Bennington St., Lawrence, Mass.

"THE GUARDIANS OF THE COLUMBIA." Just published, describes the beautiful Pacific Coast scenery, with maps and 210 illustrations (eight in colors) size 7x10½ inches. Cloth binding. $1.66 postpaid. Circular for 2c. N. B. Pearson, 340 East 45th St., S. Portland, Ore.

ELECTRICITY. JUST WHAT YOU HAVE been looking for. Our Modern Blue Print Chart Method of Electrical Wiring Diagrams. Thoroughly explained so that you can easily understand them. All kinds of Bell Wiring, Annunciators, Telephones, House Wiring, Conduit, Theatre, Isolated Plants, Dynamos, Transformers, Arc Lights, Special Treatise on Motor Wiring. Write now for information. ELECTRICAL WIRING DIAGRAM CO., Box B 173, Altoona, Pa.

"WIRING A HOUSE," BY H. PRATT, shows a house already built; tells you just how to start about wiring it; where to begin; what wire to use; how to run it according to insurance rules; in fact, all the information necessary for wiring a house and shop. Postpaid, 25c. Popular Electricity Book Department.

BUSINESS OPPORTUNITIES

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

MAIL ORDER BUSINESS. ONE DIME FOR four plans and you're started. E. Dunne, 7631 Sangamon St., Chicago.

JUST OFF THE PRESS! TWENTY SUCCESSful money-making plans. All sure money-getters by mail, 50 cents. No stamps. B. W. Nettlebeck Falls City, Nebraska.

BUSINESS OPPORTUNITIES

WE HAVE ONE OF THE GREATEST PROPositions on the market to-day for the live agent. Catalogue free. Main Specialty Co., Desk 218, Williamsport, Pa.

FREE! MONEY-MAKING PLAN. JUST send a self-addressed envelope with a 1c stamp attached for postage. Frank Cote, Box 1, Saco, Maine.

EARN MONEY WRITING MOTION PICture Plays; Big Demand. Complete legitimate instructions 10c. Hester, 651 Northampton, Easton, Pa.

BE A MANUFACTURER! BIG PROFITS. Easily done. Your kitchen will serve as a factory. Sample formula, lists and plans 10c. The Anjo Company, A497, Galesburg, Ill.

CONDUCT PAYING MAIL ORDER BUSIness from your home: $5.00 Starts business, complete course $1, particulars FREE. Box 115, Brooklyn, N. Y.

START A GOOD PAYING BUSINESS OF your own during your spare time. The "KEY" will tell you how. Price 10c. L. J. Mathewson, Waubay, S. Dak.

PATENTS BRING WEALTH. WRITE FOR proof and book which tells the kind that pay. Your idea may make your fortune. Alexander Wedderburn, Atty., Dept. M, Washington, D. C.

MAIL ORDER BUSINESS IN IT'S TRUE light, 100 testimonial letters, and particulars how you may obtain on loan, advertised mail order "instructions" and plans, sent on request. Library Division 46, "MAIL ORDER NEWS," FISHKILL, N. Y.

WE FURNISH YOU CAPITAL TO RUN profitable business of your own. Become our local representative and sell high-grade custom-made shirts, also guaranteed sweaters, underwear, hosiery and neckties, direct to homes. Write, Steadfast Mills, Department 21, Cohoes, N. Y.

IF I START YOU MAKING $50 to $200 monthly utilizing spare time evenings will you pay me $50 in six months time for my services? Remember I GUARANTEE success under forfeiture of my fee. If interested enclose ten cents (to keep out triflers) for full instructions. Address V. K. Leinmiller, 1013 Olive St., Philadelphia, Pennsylvania.

EARN GOOD PAY SENDING US NAMES and addresses. Particulars 8 stamps. Princess Perfume Co., 506 East Utica St., Buffalo, N. Y.

EARN $10 TO $15 A WEEK AND HOLD your position besides. No canvassing. We, as manufacturers of patented just-in-season specialties, have new easy Mail Order Plans to keep factories busy. We furnish everything. Large profits. Small capital. Experience unnecessary. If you are one of the want-to-go-ahead kind, write for our most modern (copyrighted) plans. Sworn statement. J. M. Pease Mfg. Co., 550 Pease Bldg., Main St., Buffalo, N. Y.

WE START YOU IN BUSINESS, FURNISHing everything; men and women, $30.00 to $200.00 weekly operating our ORIGINAL "New System Specialty Candy Factories;" home or small room anywhere. Opportunity lifetime; booklet free. H. RAGSDALE CO., East Orange, N. J.

FOR SALE OR EXCHANGE

FELT PENNANTS, ALL COLLEGES, 40c. each. Larger sizes 50c. Harold Hartzman, Moline, Ill.

FENCEPOSTS AND POLES OF RED MOUNtain cedar—all sizes. Write for price list. Mott & Berg, Cedar Hill Farm, Cocolalla, Idaho.

FOR SALE—ELECTRIC STREET CAR tracks, bridge and switch; any reasonable offer accepted. Fred Loos, 249 Lelia St., Pittsburgh, Pa.

40,000 POUNDS LEAF TOBACCO FOR SALE. Mail stamps for samples to Anton Wavrin, Franklin, Ky.

HOUSE ROBBED? PROTECT YOURS. Burglar alarm, best on market, 35c. "Juron," J-1400 Noble St., Chicago, Ill.

FOR SALE OR EXCHANGE—ELECTRIC Vibrator slightly used. Cost $35.00. E. M. Rider, Central Village, Conn.

200 BONA FIDE NAMES OF GOOD BUYERS secured by campaign advertising in Popular Electricity, $2.00., T. J. Newlin, Denver, Colo.

EXTRA LARGE BULL ELK HEAD, 13 points; one 20 point Moose head. Fine specimens. Reuben Sayler, 497 So. Broadway, Dayton, Ohio.

TATTOOING SUPPLIES, MACHINES $2.50. To advertise, 6 colored designs 15c price list free. F. Barber, 1019 Vine St., Cincinnati, Ohio.

SALE—COMPLETE I. C. S. STEAM ELECtric course (cost $106.00). Cheap if taken at once. Lawrence Gates, Winnebago, Minn.

TATTOO MACHINE, INK, AND DIRECtions, 50c silver. Electric Machines, Supplies. Rebec Mfg. Co., Cedar Rapids, Iowa.

GUARANTEED RAZOR AND SELF-HONing Strop. Two Dollars. Money returned if unsatisfactory. J. Regan, Twenty-second St., East Orange, N. J.

REMOVE THAT STAIN! INK, FRUIT, coffee, rust, grease, etc., quickly removed. Will not injure fabric. Sample prepaid, 30c. Otto, Box 83, Elizabeth, N. J.

INK PILLS THE BEST FOR LOADING fountain pens. No soiled fingers. Put contents of pill in pen, add cold water and write on. 10 cents a box. Schuck, 133 Meserole St., Brooklyn, N. Y.

MAKE YOUR AUTO PUMP WATER, SAW wood, etc., by using QUICK DETACHABLE PULLEY. Clamps on rear wheel. Postal brings illustrated circular with prices. SIMPLEX CO., 5002 Victor Building, Washington, D. C.

ELECTRIC COOKING STOVES WITH CORD AND plug ready to use $1. Big money attaching these to percolators, chafing dishes, etc. Neville, Broadway 256th Street, N. Y.

BOYS—WE HAVE WHAT YOU NEED, small Power Plants for Shop or House. Enclose stamp for circular. Modern Supply Co., Dept. B., Connellsville, Pa.

300 PER CENT PROFIT ON GLIDING casters, noiseless, won't scratch floors; save carpets, rugs and furniture; child can attach; sell many sets, homes, hotels, restaurants, everybody buys; from 15c to 25c a set, cost 4c. Samples etc., 10c. Gliding Caster Co., Willows, Calif.

FOR SALE OR EXCHANGE

FOR SALE—ADVANCE 1911 MINNEAPOLIS two-speed Motorcycle, with Thor four-motor, Purdy Exhaust Whistle. In perfect condition, $125.00. Gus. A. Anderson, Sauk Centre, Minn.

FOR SALE OR EXCHANGE—VALUABLE coin collection. Lewis Pendleton, Dodge City, Kansas.

QUICK SHAVE WITHOUT A RAZOR WITH Razorine the new shaving powder, just rub on, wash off and you have a smooth face. Once used, always used. Box of five shaves 25c postpaid. Clyde Fahrney, Lock Box 157, Waynesboro, Pa.

FOR SALE. ONE 12" SCHEIDEL WESTERN induction coil, with single point interrupter, rectifier, etc. Suitable for wireless or X-ray work. First money order for $50 gets outfit. The Pope Sanatorium, 115 W. Chestnut, Louisville, Ky.

FOR SALE—PATENT ON NURSING BOTtle holders; something entirely new. Recommended by all physicians who have seen it in use. Francis H. Escherich, 1917 K St., N. W., Washington, D. C.

FORMULAS

THERE ARE ONLY THREE GOOD FORMUlas for recharging dry batteries. All three for 10c (silver). Box 126. Winfield, Kans.

TESTED FORMULAS. HAIR REMOVER, Hair Restorer and Hair Grower, all for 25c. Ellis, 18 John St., Newark, N. J.

START A FORMULA BUSINESS, MAKE $50.00 weekly. 50c. brings complete instructions and 25 best formulas. Parker, Dept. F., Box 28, Columbia, Tenn.

DRY CELL BATTERIES RENEWED FOR one cent each. Two guaranteed formulas 15 cents each or both for 25 cents. Both formulas are entirely different. L. M. Kachel & Co., Whitewater, Wisconsin.

GAMES AND AMUSEMENTS

MAGIC POCKET TRICK, 10c. ISRAEL, 440E, East 146th St., New York.

105 TRICKS, 25c WITH THREE CATALOGS. Klein, 1193 Broadway, N. Y.

PLAYS, VAUDEVILLE SKETCHES, MONOlogues, Dialogues, Speakers, Minstrel Material, Jokes, Recitations, Tableaux, Drills, Entertainments, Make-up Goods. Large Catalog Free. T. S. Denison & Co., Dept. 26, Chicago.

EVERYBODY'S TALKING ABOUT PRESIdent, the new card game. The most interesting game of Science and Humor ever published. Printed so they may be used as ordinary playing cards. You'll enjoy it immensely. 50c per deck prepaid. Dealers write President Card Co., Detroit, Mich.

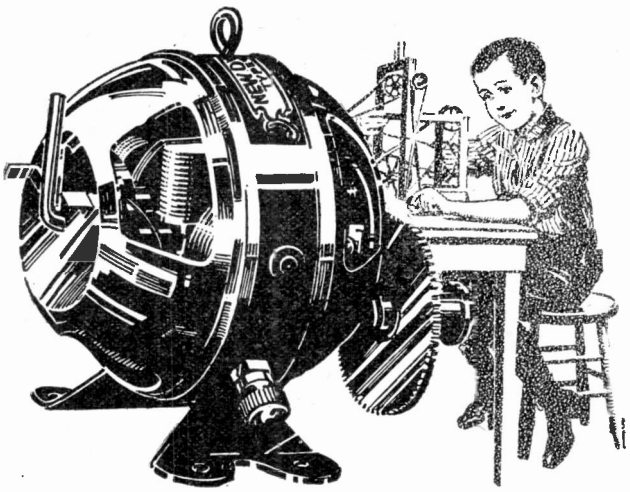
INSTRUCTION

LEARN AUCTIONEERING BY CORREspondence. P. O. Box 72 A, Attica, Indiana.

THE MASTERY OF WORDS. HOW TO command the right word. Invaluable. Write E. D. Snow, 8 Main, Hornell, N. Y.

OLD DRY BATTERIES MADE NEW AT A cost of 1c each. Instructions 15c. Lotton, Waverly St., Buffalo, N. Y.

FOR INGENIOUS BOYS



FOR MECHANICAL TOYS

SPECIAL SALE *of* BATTERY MOTORS

THESE miniature battery motors will give any boy or girl a whole lot of pleasure and instruction. They are sturdy little affairs and on one or two dry cells will develop a speed of 3500 revolutions per minute. There is a type for every purpose; will operate all sorts of mechanical toys—lathes, planes, jig-saws, windmills, etc. These miniature motors are substantially constructed and will give good service. We have only a few of each type of motor, as noted below:

		Were	Now
23	Type C (Semi-Enclosed, snap switch)	$1.50	$ .90
23	Type D " " reversible	2.00	1.20
6	Type E " " snap switch, 2 speed .	2.00	1.20
15	Type F " " 2 speed, reversible . .	2.50	1.50
14	Type G (Fan Motor, semi-enclosed, snap switch) .	2.50	1.50

The above prices are NET, that is, purchases will be sent express charges collect

Act Quickly to Secure These Bargains

Select the motor you want and send us your money order for the amount of your purchases. But you should send in the coupon ***at once*** as there are only a few of these left at these bargain prices. Be sure to write plainly, telling which type wanted, how many and the price.

ELECTRIC SHOP

CHICAGO

Michigan and Jackson Boulevards

Send me following described motors per your special sale offer in Popular Electricity.

type_____, price $_____

type_____, price $_____

Name_____

Address_____

Danger Lurks in Hidden Dust —Safeguard Your Family!

A *clean-looking* house may still be *insanitary*. That's the danger of sweeping with a broom. Shoes collect dried sputum from sidewalks and deposit its dust on rugs and carpets. You can't see it, perhaps. But it's *there*. Then comes sweeping day. Your broom fills the air with invisible, germ-laden dust. It finds its way into your lungs—into your food—settles on the floor where playing children stir it up again and become infected. The *broom* is even more dangerous than the *fly*.

Federal Vacuum Cleaner

Sucks Up All the Germ-Laden Dust

No dirt too heavy—no dust too light and invisible to escape the FEDERAL Vacuum Cleaner. Its powerful suction searches every thread and fibre of rugs and carpets—clothing and drapery. Yet it can't injure the most delicate fabric. From the innermost depths of thick, heavy padding, the powerful FEDERAL sucks out the dust and germ-laden air—making upholstery, pillows and mattresses as sweet and clean as new.

The FEDERAL is the Guaranteed Cleaner

But don't think that just any vacuum cleaner will do this. Some really do no more than a carpet sweeper. They pick up the *surface* dust —the *visible* dirt—but not the hidden, germ-laden dust. The Federal, which has no parts to wear out, like a *fan* device, a *bellows* or a *diaphragm*, creates a tremendously powerful suction. Constant use increases, not decreases, its power. The Federal is the machine that has stood the test of time.

The Powerful Rotary Pump

The Rotary Pump in the FEDERAL revolves steadily in one direction—like a powerful turbine engine on an ocean liner. It creates a suction impossible with a fan or bellows type of cleaner. Its working parts are few—simple—easy of access. No valves to work loose—no gears to rattle —no piston to pound up and down—no bellows to wear out—just a powerful, substantial pump and a motor—both revolving in one direction—steadily, silently, without jar or jerk.

SEND FOR ILLUSTRATED BOOKLET

"Purity in the Home"

The Federal is not a cheap machine—price, $125—but it is the ***most economical*** cleaner to buy. We will gladly tell you why in our illustrated booklet, "Purity in the Home," No. 1453. Use the coupon ***now***.

Vacuum Cleaner Department

Federal Sign System (Electric)

Lake & Desplaines Sts., Chicago

SIGN, TEAR OFF AND MAIL

Federal Sign System
(Electric)
Lake & Desplaines Streets, Chicago, Ill.

Kindly send me your illustrated booklet, No. 1453, entitled, "Purity in the Home." It is understood that this places me under no obligations.

Name .....

Address .....

City .....

It will pay to Read These Advertisements

Because they are small you should not pass them over. The good things in life are worth looking for and many of the smaller advertisers have worthy products which they can sell you although many of them are not in a position to buy large space to tell their story. We bespeak your patronage for these advertisers.

POPULAR ELECTRICITY MAGAZINE

Small Ad Department

It will pay to Read These Advertisements

Because they are small you should not pass them over. The good things in life are worth looking for and many of the smaller advertisers have worthy products which they can sell you although many of them are not in a position to buy large space to tell their story. We bespeak your patronage for these advertisers.

POPULAR ELECTRICITY MAGAZINE

Small Ad Department

ONE DOLLAR A MONTH
Buys a Standard Typewriter

Your choice, Remington, Oliver, Smith Premier, L. C. Smith or Underwood. Prices lower than other cash prices. Perfect machines only. Guaranteed.

Typewriter Installment Co.
Dept. 9., 180 N. Dearborn St. Chicago

I will send as long as they last my **25c. Book**

STRONG ARMS
For 10c in stamps or Coin.

Illustrated with 20 full page halftone cuts, showing exercises that will quickly **develop, beautify, and gain great strength, in your shoulders, arms, and hands,** without any apparatus.

PROF. ANTHONY BARKER
1298 Barker Bldg. 110 West 42d Street, New York

Guaranteed Non-Magnetic

This watch, a handsome **stem wind and set, thin model, dust proof** time piece, will **positively withstand all magnetic attractions.** Tested to 2000 Volts. Guaranteed accurate. Money back if not as represented. Approved by all electrical engineers. Price only $5.00. Delivery FREE

Great Bargains in Diamonds and Jewelry of all kinds

E. KIRCHBERG, 134 NORTH STATE ST., CHICAGO

WHITE VALLEY GEMS
IMPORTED from FRANCE
SEE THEM BEFORE PAYING!

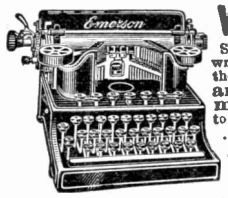
These gems are chemical white sapphires—**LOOK** like **Diamonds.** Stand acid and fire diamond tests. So hard they easily scratch a file and **will cut glass.** Brilliancy guaranteed 25 years. All mounted in 14k **solid gold diamond mountings.** Will send you any style ring, pin or stud for examination—all charges prepaid—**no money in advance.** Write today for free illustrated booklet, special prices and ring measure.

WHITE VALLEY GEM CO., 742 Saks Bldg., Indianapolis, Ind.

BILLIARDS
AT HOME

Have your own Burrowes Billiard and Pool Table. A few cents per day will buy it. No special billiard room needed. Write for particulars.

THE E. T. BURROWES CO. 126 Free St., Portland, Me.



WOULD YOU

Show this wholly visible Typewriter to your friends and let them see wherein **it excels any $100 Typewriter made,** if we would send one to you **Free of One Cent of Cost** for you to keep forever as **your own?** Then on a postal card, or in a letter to us, simply say: Mail particulars.

EMERSON TYPEWRITER CO. Box 512, Woodstock, Illinois.

Money in This

Print your own cards, circulars, book newspaper. PRESS $5, larger $18, Rotary $60. All easy, rules sent. Print for others, big profit. Write factory for press catalog, TYPE, cards, paper, etc.

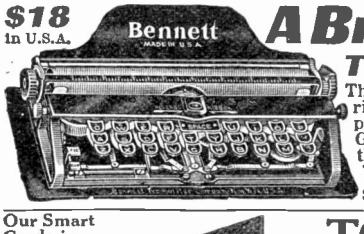
THE PRESS CO., Meriden, Conn.

ADDING MACHINE
MULTIPLIES—SUBTRACTS
For General Office or Personal Desk Use
Over 60,000 in use
Mostly sold through recommendation
Purchase through your Stationer
If he will not supply you, send remittance to us. We guarantee every machine — money refunded if not satisfactory within 10 days.

P. CANCHER A. A. M. CO. 819 Broadway N.Y.

LIVE AGENTS WANTED

$18 in U.S.A.



A Brand New Typewriter for $18

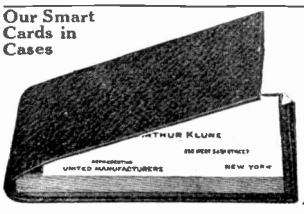
That does work equal to any $100 machine

That's what you get in this unique, wonderful little typewriter, so small it can be carried in pocket or grip, with every modern improvement. Standard keyboard 84 characters. **Use It 10 Days Free**

Get out letters, orders, records, etc., on train, in office, at home, everywhere—see the neat, rapid work the ***Bennett*** does—we know you'll decide to keep the machine. Write for catalog and ***free trial*** offer. *Foreign Address: 75 Cannon St., London, E. C.*

Splendid chance for agents. ***A Visible Bennett Typewriter Co., 366 Broadway, New York***

Our Smart Cards in Cases



TO THE END OF TIME

You will be judged by your acts. If you prefer not to be misjudged send in a **PEERLESS Patent Book Form Card** Its smooth edges; its genuine elegance will tell the character of man you are. Nothing else like it. Used by the men who care for appearances and who command big pay. It ought to be used by you.

Send today for sample tab of engraved cards, and get get right, in the card line.

The JOHN B. WIGGINS COMPANY, *Sole Manufacturers*
Engravers, Die Embossers, Plate Printers. 85-88 East Adams Street, Chicago

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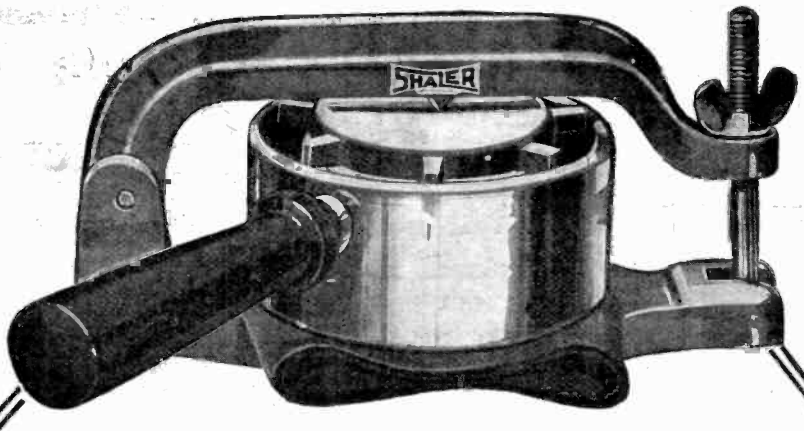
For our Mutual Advantage mention Popular Electricity when writing to Advertisers.



YOU can make better tube repairs at home than those you've been paying 50c apiece for. For the price of a very few vulcanized repairs you can get this complete vulcanizer that will eliminate forever the delay and expense of tire repairing. Carry it with your car and be ready for a quick emergency repair.

Only $2.00 for This Shaler Vulcanizer

Isn't it worth this small sum to know that you are prepared to make a permanent tire repair at any time—on the road or at home?

The Vul-Kit is the only inexpensive vulcanizer that vulcanizes tube repairs perfectly, because the patent Shaler method of generating the fuel, gasoline, into gas, maintains the temperature long enough to cure the rubber clear through.

Fill the puncture with raw rubber, the generator with gasoline, clamp vulcanizer on tire and light it—and the Vul-Kit does the job exactly right.

VULCANIZER REPAIR KIT
$2.00

Note the handle for moving vulcanizer while hot—the clamp that adapts heater to tire, insuring smooth repairs—asbestos pad inlaid in tube plate to prevent pinching tube—all exclusive Shaler features.

Furnished complete with repair material and instructions. Nickel plated, will last a lifetime.

Free—A Valuable Book About Tires

Send coupon today for complete description and receive a complimentary copy of the famous book "Care and Repair of Tires. It's full of valuable repair kinks and descriptions of tire-saving appliances.

C. A. SHALER CO.

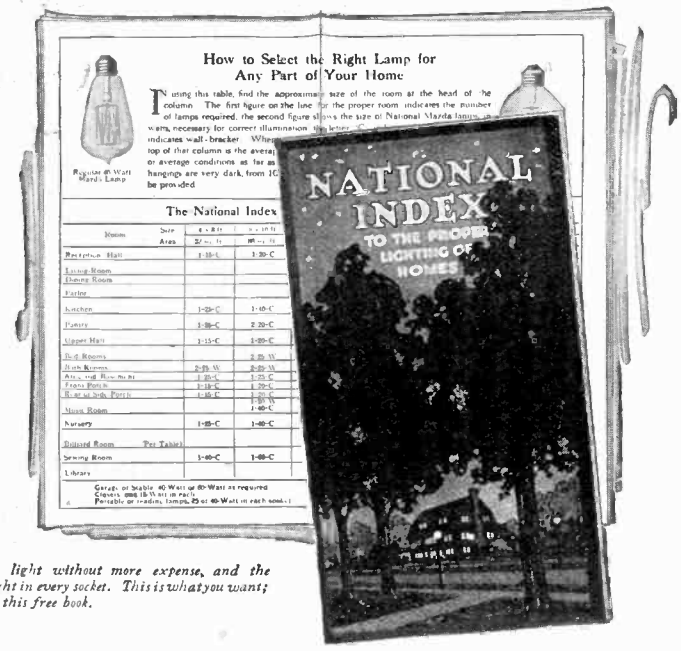
452 Tenth St. WAUPUN, WIS.

Makers of the Famous Shaler Electric Vulcanizers

Name.....

Address.....

C. A. SHALER CO.,
452 10th Street
WAUPUN,
WIS.



More light without more expense, and the right light in every socket. This is what you want; send for this free book.

How to Select the Right Lamp for Any Part of Your Home

Buy electric lamps to fit your rooms. Don't guess, when this book will show you at a glance the right size and kind of lamp for every socket from cellar to attic, from closet to garage. Correct Lighting is as important in your home as in your office, factory or store. Every user of incandescent lamps should send for a copy of this book—free.

NATIONAL MAZDA

THE QUALITY LAMP

This new lamp is as rugged as a carbon lamp and gives three times as much light at the same cost. It burns in any position, uses any current, fits any socket, and is made in all sizes for the home. It is used in trains and automobiles because it is strong. It has given electric lighting to the smallest homes and improved the illumination of the finest residences, stores, offices, factories. It is the most efficient incandescent lamp for homes, because it turns all the available current into light. Carbon lamps waste two-thirds of the current in heat.

Buy lamps in this blue carton

National Mazda lamps are sold by Lighting Companies and thousands of electrical dealers in this blue carton containing five lamps. If you buy single lamps, see that they come from this blue National Carton,—your guaranty of the highest quality and greater efficiency.

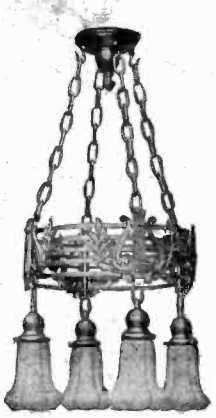
NATIONAL QUALITY LAMP DIVISION

of General Electric Co.

For booklet or further information address
National Mazda Sales Dept., 4411 Hough Avenue, Cleveland

Every National Mazda lamp bears one of the labels shown in this border—a guaranty of National Quality.

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



Beardslee Lighting Fixtures

In beauty of design and finish, Beardslee trade-marked lighting fixtures can not be surpassed. No detail is too small to have the careful attention of expert workmen. Designs are worked out with minute fidelity. All parts are carefully fitted.

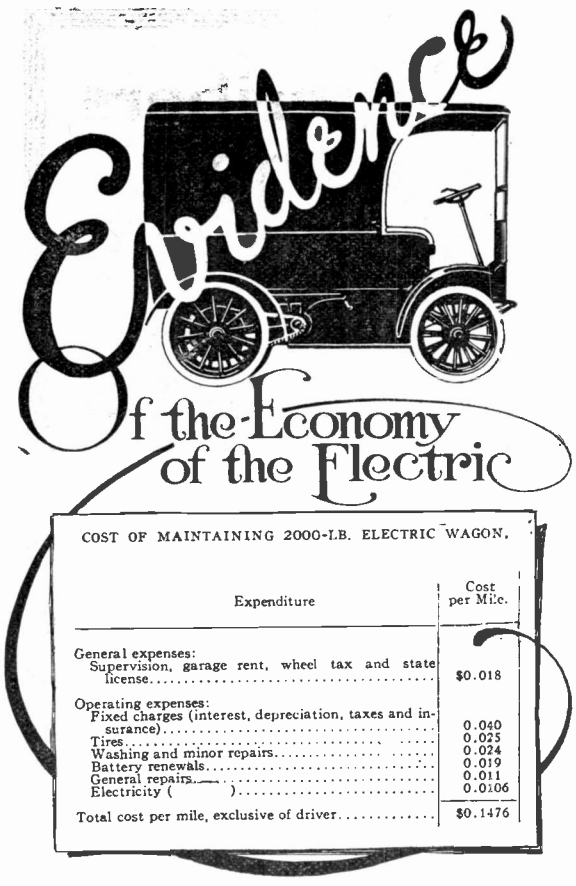
The wide variety of Beardslee designs includes patterns suitable for every building, whatever its use and style of architecture. These designs are derived from authentic sources and are true to the school or period to which they belong.

When you build or remodel, give your personal attention to selection of fixtures. Specify the use of "B" trade-marked lighting fixtures throughout—they will add to the beauty and selling value, and are an insurance against dissatisfaction.

Write for our new booklet, "Light and Art in the Home." We shall be glad to mail you a complimentary copy. Illustrates and describes many designs suitable for residences.

Beardslee Chandelier Mfg. Co.

227 South Clinton Street, CHICAGO



COST OF MAINTAINING 2000-LB. ELECTRIC WAGON.

Expenditure	Cost per Mile.
General expenses:	
Supervision, garage rent, wheel tax and state license	$0.018
Operating expenses:	
Fixed charges (interest, depreciation, taxes and insurance)	0.040
Tires	0.025
Washing and minor repairs	0.024
Battery renewals	0.019
General repairs	0.011
Electricity ( )	0.0106
Total cost per mile, exclusive of driver	$0.1476

65 Miles in a Single Day

In 33 days a 1-ton Electric made 1490 miles and 950 stops for the Patterson Transfer Company of Memphis, Tenn. At times the mileage stood as high as 65 miles for a ***single day's run,*** all of which was accomplished ***without a single mishap.***

A Year of Real Service

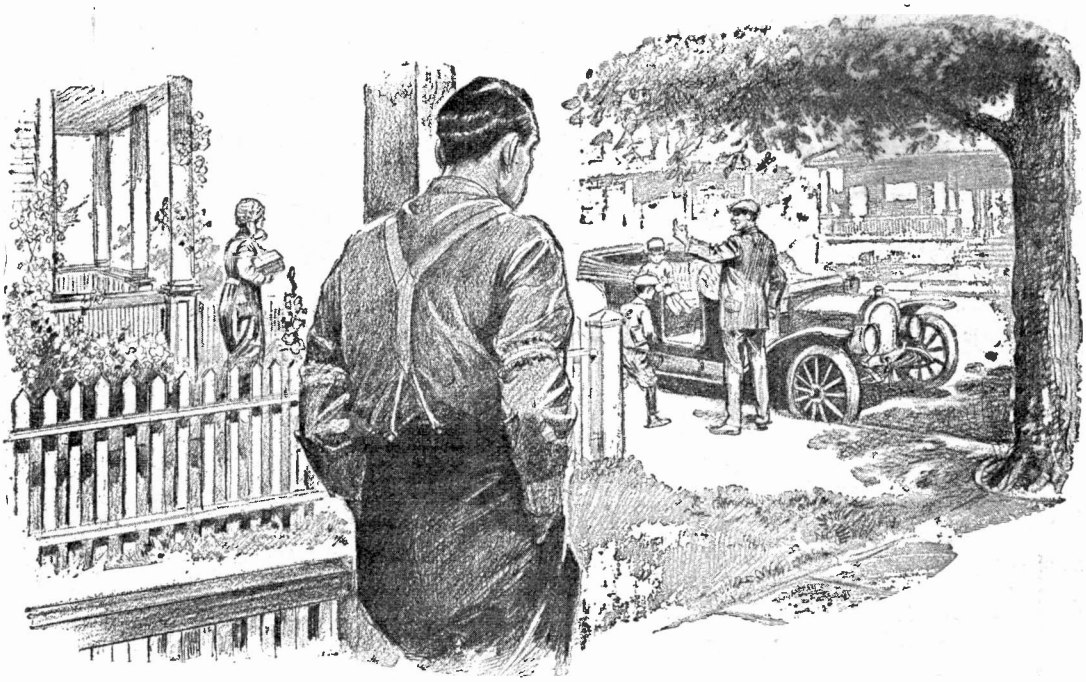
In one year a 1-ton Electric in the service of L. L. Gilbert Baking Company of New Haven, Conn., covered over 11,000 miles—an average of 35 miles a day—and ***never missed a trip.***

The Electric Invites Investigation

The Electric is the car of swift, silent and economical service for you. Don't put off investigation any longer. Write us now for interesting literature, sent gratis gladly.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON **NEW YORK: 124 W. 42nd ST.** **CHICAGO**



Don't envy the trained man—be one

No use envying the man who has made good. Don't think he got where he is because he had a "pull." A "pull" doesn't amount to much unless you can deliver the goods, and the best "pull" in the world is **training.**

Just make up your mind today—**right now**—that you are going to be **a trained** man—that you are going to get the money and hold a good job. **You can do it.** The **American School of Correspondence** will show you how. This great school, with its sixty-five complete courses in **Engineering, Business and Law,** can soon give you the training necessary to become a successful man—a man who will be envied as you, perhaps, now envy the men above you.

Your Opportunity Coupon

Check the course you want and mail the coupon now

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." Pop. Elec. 3-13.

....Electrical Engineering	....Lawyer
....Elec. Light & Power Supt.	....Bookkeeper
....Electrical Wireman	....Stenographer
....Telephone Expert	....Private Secretary
....Architect	....Accountant
....Building Contractor	....Cost Accountant
....Architectural Draftsman	....Cert'd Public Acc'nt
....Structural Engineer	....Auditor
....Concrete Engineer	....Business Manager
....Civil Engineer	....Fire Ins. Inspector
....Surveyor	....Fire Ins. Adjuster
....Mechanical Engineer	....Fire Ins. Expert
....Mechanical Draftsman	....Moving Picture Op'r
....Steam Engineer	....Sanitary Engineer
....Stationery Engineer	....Reclamation Eng'r
....Gas Engine Engineer	....Textile Boss
....Automobile Mechanician	....College Preparatory

NAME .....

ADDRESS .....

How the American School Will Give You the Training You Need

The **American School of Correspondence** was established fifteen years ago for the benefit of ambitious men and women everywhere. This school makes it possible for you to obtain the education and training you need without leaving home or giving up your work. It will bring a practical college course to you right in your own home.

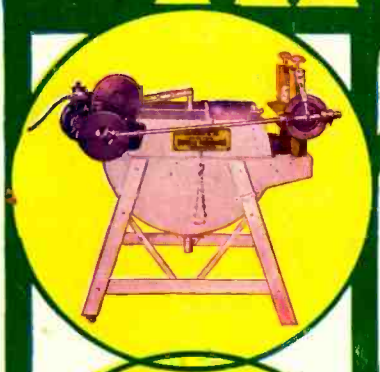
No matter where you live, the **American School** will train you in any branch of **Engineering, Business and Law,** or prepare you for entrance into any resident college. Remember: no need of your leaving home or giving up your present job.

Write the **American School** now, while the subject of making more money is on your mind. State how far you went in the public schools, what you are doing now, and what you would like to be. Your case will receive special attention.

The **American School** will tell you the best and quickest way to better your condition and get more money. Check the coupon and mail it now. Don't let this matter drag another day. Another year might slip by and find you at the same old job and prospects for a raise very slim.

American School of Correspondence
CHICAGO, U. S. A.

WORLD'S WONDROUS WASHERS



DIETZ ELECTRIC

Double Rub-board Home Laundry Machine. World's finest machine—mechanically, in design, finish and all around washing and wringing ability. With hot water and good soap, washes a very dirty lot of clothes in 8 minutes. Capacity, 16 shirts

RETAIL PRICE **$95.00** F.O.B. FACTORY

QUEEN CITY ELECTRIC

A Particular Washer For Particular People. Neat, compact, simple, convenient, unquestioned washing ability, reversible wringer, cypress tub, all gears fully enclosed. Castings white (baked) enameled, to prevent rust. The washer for medium sized families. Capacity, 10 shirts.

RETAIL PRICE **$55.00** F.O.B. FACTORY

QUEEN CITY SPRINGLESS - GEARLESS

An Excellent Example of Present Day Tendency to build machines so well designed that they will run indefinitely without repairs. 90% of trouble with water power washers is caused by the springs, operating valves. Twenty pounds pressure is sufficient. Capacity 10 shirts

RETAIL PRICE **$16.50** F.O.B. FACTORY

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THE JOHN DIETZ MFG. CO.

CINCINNATI