Popular Electricity
In Plain English

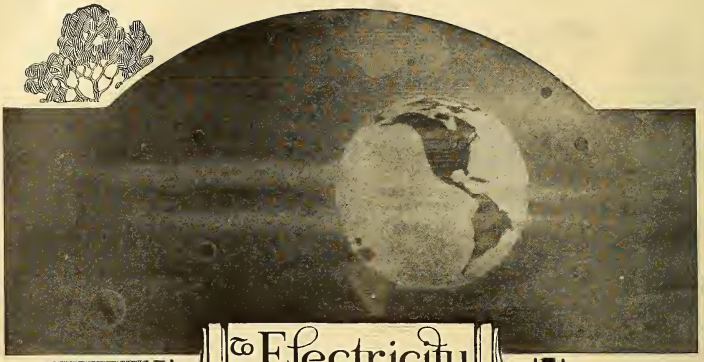
VOL. V AUGUST, 1912 No. 4

An Electrical Empire of the Future

Dwellers in the East, the South and in the great Middle West hear often of the "Empire" which is being built up beyond the slopes of the Rockies. Ordinarily they pass over the term lightly as a pet expression—a slogan, if you please, of an enthusiastic people in a new country. A few, comparatively speaking, of the millions who live in our flat lands and the aged and lowly hills of the Appalachians, which we are pleased to call mountains, cross the Great Divide and passing on through the Cascades, find in reality an empire of wonderful natural resources, of human grit and great accomplishment —and it is significant that a large percentage of them never come back. "If we can have them for one year they are ours for good," say the people of Seattle and Portland, and the casual visitor sees no reason to dispute their boast, for no doubt the climate, the rivers and the mountains, the almost tropical luxuriance of the vegetation and the activity and amazing growth of their very modern cities are already working their subtle influence upon him.

It was into this country—to Seattle—that the delegates to the National Electric Light Association made their way in June, to hold the annual convention. Some mention of this event was made in the June issue. It was a long journey for most of them. Some came on the Red Special DeLuxe and the Pink Special all the way from New York; others from Chicago on the Green Special, via the Canadian Rockies, or straight through on the Orange Special. Then there was the Purple Special from St. Louis and the Golden Poppy Special from Los Angeles and San Francisco.

To the electrical men especially did this country seem to come up to its



To Electricity

Ere the storm-clouds curled 'round an infant world,
Ere the air was cleft by a wing,
You encircled space in an endless race,
A wild, unfettered thing.
In creation's art you wrought your part,
Subject to Nature's skill;
From zone to zone, a power unknown,
Unshackled by man's will.

On a summer eve strange scenes you weave,
Where the fleecy clouds pile high;
When your lightnings shift from rift to rift,
As you play in the twilight sky.
Oh, there's grotto and wall, palace and hall,
Quaint ships on an ocean blue,
Your flashlights run like molten sun
Blent with the sea shell's hue.

But you come to our eyes in another guise,
Where motor harnesses bind;
And the ocean's wide sweep and the mountain steep
Cannot measure your worth to mankind.
Oh, the matchless speed of the winged steed,
Needing not bit nor spur,
Where the broad belts slant and the engines pant,
And the spindles reel and whir.

—RENICE RADCLIFFE

Popular Electricity
In Plain English
Henry Walter Young, Editor

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CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

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THE BUSINESS CENTER OF SEATTLE. IN THE DISTANCE IS MT. RAINIER, WHOSE ETERNAL GLACIERS FURNISH WATER SUPPLY FOR SOME OF THE HYDRO-ELECTRIC DEVELOPMENTS

name—an empire above all others in its electrical possibilities; for the glacier fed lakes high up in the mountains and the furiously running streams mean electricity without coal. In other words, current can be produced cheaply and used profusely in a manner that makes these Western cities blaze at night almost like great amusement parks.

What the citizens of Seattle did not do for the visitors was not worth doing. They consider their city a gem—an electrical one—and they like to show it to people and explain how wonderful has been its growth, and discourse upon the possibilities which the future holds. So after four strenuous days of convention work dealing with the technicalities and commercial phases of the electrical industry, the visitors were permitted to view some of the great natural sources of energy from which the city of Seattle derives the current which it uses so lavishly—being taken by special train far back up into the mountains where the great power plants are located.

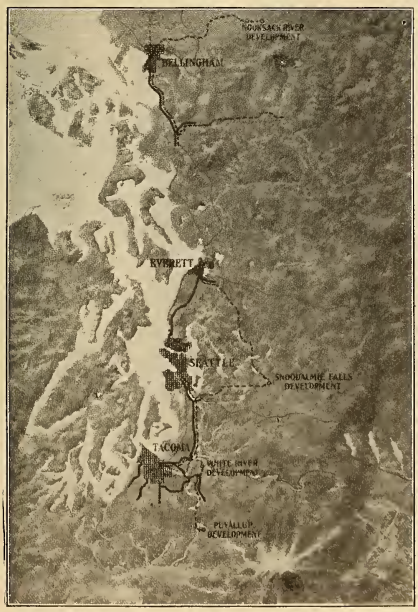
It may be said at this point that the system of The Seattle Electric Company includes railways and lighting and power facilities, serving a population of 245,000 people. There are 193 miles of track, with 550 cars, and in 1911 101,200,000 passengers were carried. Current for light or power is provided for 15,000 of the city's homes and business houses, there being 1,274 commercial arc lights, 15,178 incandescent lamps and 13,547 horsepower of motors on the system.

Three car lines reach the shore of Lake Washington on the east, where the company maintains large parks that play an important part in the outdoor life of the city. In winter as well as summer these parks are enjoyed by thousands of patrons.

Madison Park is the terminal of the Madison Street Cable Line, which pierces the center of Seattle. On the

southeastern shore of the lake, at the end of the Yesler Way Cable Line is Leschi Park, and between lies Madronna Park on the Madronna Park Line, with cable connections on James Street in the heart of the city. On the north, the Seattle electric system connects with the interurban line running 22 miles to Everett and on the south with the Puget Sound Electric Railway extending 36 miles to Tacoma. This great system and the power plants which supply it have been developed by the Stone & Webster Engineering Corporation of Boston.

To meet the demand, plants have been built and are now operating on the White River, the Puyallup, the Snoqualmie and the Noosack. The capacity of these plants is over 80,000 horsepower, or about 60 per cent. of all developed power in the district. The Noosack is as yet a separate system, to the north of Seattle, with a power plant and 40 miles of transmission lines running to Bellingham.



THE PUGET SOUND COUNTRY—SOLID LINES SHOW RAILWAYS; DOTTED, TRANSMISSION LINES

In the foot-hills of Mt. Rainier, 1,700 feet above sea level, is located the headworks of the Puyallup development. The Puyallup River rushes in a series of cascades through a deep rocky gorge to the northwest. For ten miles along the southern face of the gorge, higher and higher above the river, runs a timber flume carrying a standard gauge track for gasoline inspection cars. Through this flume the water flows evenly from the intake to a large reservoir above the power house. Then from a concrete forebay built within the reservoir, it is led several hundred feet in pipes to the brink of the gorge, where it enters four steel penstocks and drops 872 feet to the power house at the river's edge. The power house contains four units of 3,500 kw., or approximately 19,000 horsepower.

Thirty miles away, to the east of Seattle, the Snoqualmie River drops over a perpendicular cliff 270 feet high. Just above these falls are the dam and intake of the Snoqualmie development.

A low, rock filled, timber crib, part of a previous development, diverts the flow to a concrete intake leading to a tunnel, 1,000 feet long and twelve feet in diameter, cut through the rocky crest of the hill. The tunnel emerges from the hillside in a concrete forebay cut in a jutting shoulder of rock looking directly down upon the power house. Through a penstock, 470 feet in length, the water goes from the forebay down the steep hillside under a head of 284 feet.

To get the machinery and supplies for this development onto the job, a spur was run from the tracks of the Great Northern Railroad, on the south side of

SECOND AVENUE AT NIGHT—SEATTLE'S "GREAT WHITE WAY"

the Snoqualmie, to a car ferry above the falls. The standard railroad cars, loaded with equipment, were switched from the main line, ferried across the river, hoisted up one incline railway and lowered down another by electric hoists to the power house.

The present installation consists of one 10,000 horsepower Francis type turbine direct connected to a 7,000 kw. generator, but the ultimate development will have three such units and three penstocks. Power is transmitted to Seattle, Tacoma and Everett.

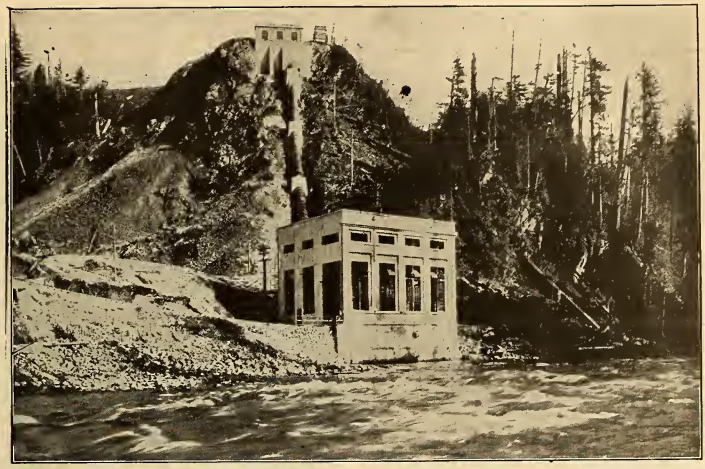
On an elevation, 24 miles southeast of Seattle, and ten miles east of Tacoma, is Lake Tapps, the main storage reservoir of the White River Development. It lies in a large, natural basin and around and beyond it is a plateau, stretching away on the east to the Cascade Mountains and the upper reaches of the White River.

A mile west of the lake this plateau begins to drop abruptly to the floor of the White River Valley, 500 feet below.

The development has taken advantage of this situation by diverting the White River at a point seven miles southeast of the lake and leading part of its waters through flumes, artificial basins, canals and natural valleys across the plateau to the lake, and thence by canal tunnel and penstocks to the power house.

The storage capacity of Lake Tapps is about 2,250,000,000 cubic feet, a reserve that gives the White River Plant the unique distinction of being able, if necessary, to operate at nearly its full present capacity of 40,000 horsepower for a month on storage alone. The plant balances the load on the entire system of developments, and, since its operation

SNOQUALMIE FALLS IN 1909, WITH A SHEER DROP OF 270 FEET, IT MADE POSSIBLE TWO GREAT PLANTS WHICH FURNISH LIGHT AND POWER TO SEATTLE



ONE OF THE PLANTS AT SNOQUALMIE. HERE THE WATER FALLS UNDER A HEAD OF 284 FEET TO THE TURBINE AT THE RIVER'S EDGE

began, the steam relay in Seattle has been practically idle.

This in brief is an outline of the water power developments of the Puget Sound District as it is known, and which supply Seattle with the greater part of its

ELECTRICAL EXHIBITION IN SEATTLE ARMORY, THE SCENE OF THE NATIONAL ELECTRIC LIGHT CONVENTION

current. Seattle maintains stoutly that it is *the* "City of Light," though there are numerous other centers that aspire to that distinction. There certainly *is* light in Seattle and lots of it, and electricity is used for power as freely as for glowing filaments. It takes power to run street cars in Seattle, for when you are not going down hill, you are climbing most discouragingly up hill—there are no level stretches. Some of these hills used to be the limit, until some one hit upon the idea of setting up huge electric driven pumps which drew water from a lake and squirted it against the hills with terrific force, washing them away, a river of mud, into the lake and making new land. To make itself big and bustling and modern in every way the city has had to fight and fight hard against some of these adversities of Nature, but in doing so has turned against Nature her own most powerful weapon—Electricity.

Electric Stimulation for Babies

Mr. T. Thorne Baker, the electrical expert connected with *The Daily Mirror,* London, who recently made some experiments in raising chickens under the influence of high frequency current, now proposes to do the same thing with babies.

"No kind of food seems to do some weakly babies any good," says Mr. Baker. "I, as recently stated in *The Daily Mirror,* propose to use an electrically charged cot, in which the baby is put to sleep for about 20 minutes at a time.

"The physician is at present experimenting on little animals, such as guinea pigs, and in a few days we shall begin with the babies."

Mr. Baker's intended experiment is to place babies near high frequency currents, which would be switched on while the child sleeps in a little bed, placed inside a special coil.

"The result," he said, "will be that while treatment is in progress the electro-magnetic vibrations will pass back and forth right through their bodies."

Up-to-Date Scrubbing

A strong man behind a scrubbing brush can do excellent work, but in these days of special attention to the relative cost of work it has been found that this is an expensive method.

The illustration shows an International electric scrubbing machine at work on

SCRUBBING THE STEPS OF THE NEW YORK LIBRARY

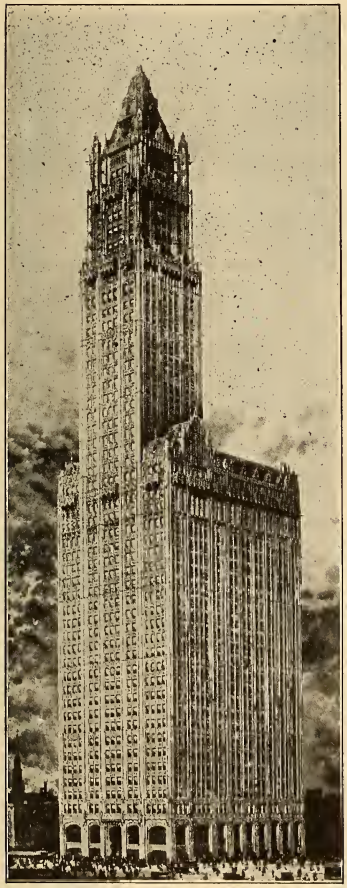
the steps of the New York Public Library. The use of the machine, which weighs only 75 pounds, results in great saving of time and labor.

Powder Exploding Box

In the article on "Some Secrets of Electrical Stagecraft," July issue, the drawing of the powder exploding box shows same with a cover in place. The box should obviously have been shown without a cover. With a cover on the explosion would be *real.* Smokeless powder should be used, as black powder would make smoke enough to cause choking and coughing in the audience.

The Woolworth Building—King of Skyscrapers

In the erection of the world's newest skyscraper, the Woolworth Building in New York, no other power than electricity is being used for operating the engines that hoist the thousands of tons of steel and other material that are being put in this 45-story, 750-foot high building. By the fall it will be completed, towering 50 feet over the Metropolitan Tower, the present king of skyscrapers.



BY FALL THIS 750 FOOT BUILDING WILL BE COMPLETED, TOWERING 50 FEET ABOVE THE METROPOLITAN TOWER, PRESENT KING OF SKYSCRAPERS

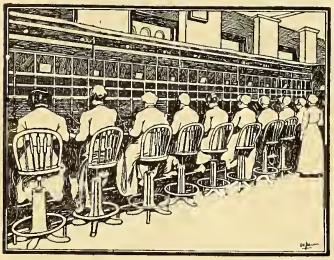
When completed there will have been put into the Woolworth Building 130,000 tons of material. There are six 80-horsepower hoisting motors and another of 40 horsepower, and when their work is completed they will have hoisted 21,000 tons of steel.

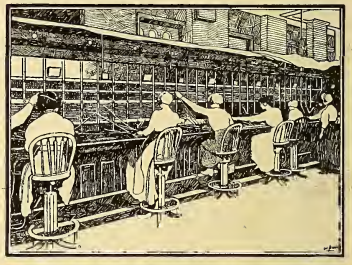
Seventeen million bricks are being used which weigh 42,500 tons, the glazed terra cotta weighs 7,500 tons and the fireproof flooring and arches weigh 32,000 tons more. All of this material is carried to the upper floors on freight elevators and hod hoists. There are ten of these elevators, operated by 40- and 50-horsepower motors. The hoisting machinery is set on one of the lower floors and a system of bell signals tells the operator when to start and stop his car. The concrete is also carried on these hoists after having been prepared in the sub-basement. Four motors of fifteen horsepower each partially mix this material. After it has been delivered to the masons on the upper floor more water is added to bring it to the right consistency. This water is carried through a temporary installation of plumbing that reaches hydrants to every floor, and is kept in circulation by two fifteen-horsepower pumps, while a third pump of 50 horsepower is required to keep the cellar dry. For the compressed air required to hammer the heads of the rivets in place air compressors of 50 and 25 horsepower are required.

Two hundred arc lights and a thousand incandescent lamps provide light for the workmen on the darkened floors. Current for the lights and motors is supplied by the New York Edison Company. There are fourteen meters on the service board and a force of six electricians keeps the wiring up to the progress.

Rush and Slack Hours in a Telephone Exchange

During the rush hours of the day's work every "position" in a great telephone exchange requires an operator.





WHAT RUSH AND SLACK HOURS MEAN IN A TELEPHONE EXCHANGE

Calls are coming in at a rapid rate, and it is as much as one girl can do to take care of the few hundred incoming lines which terminate on the board directly in front of her.

When the lull comes at the end of the day half as many operators will do, and in the middle of the night only a few are required, who walk back and forth in front of the long board making the few scattering connections. The two drawings illustrate the difference between the "rush" and the "slack" hours. In the latter case the operator takes care of a position on each side of her usual one, making a rather long reach.

The "Trouble Hunter"

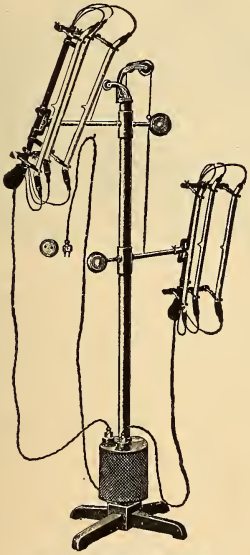
The electric "trouble hunter" is a unique apparatus used by the modern electrician for locating all sorts of aches and pains in nearly every kind of electrical device on the market. It is to the testing engineer what the stethoscope is to the doctor who makes a specialty of heart disease. It correctly diagnoses cases of short circuit, open circuit, grounds, and nearly every ailment that a piece of electrical apparatus is heir to. The appliance is easily portable and consists of a small induction coil, condenser, and batteries in a case carried on the back. Two flexible wires lead to two insulated copper terminals, and by applying these to the parts of the motor or switchboard the operator notes by the sounds in a receiver clamped to his head what the trouble is, and by a systematic search finally discovers the trouble and remedies it.

The great advantage of this device over the ordinary testing set is the fact that it requires no one to turn a magneto crank, and the entire apparatus is light and easy to carry.

EXPLORING WITH THE TROUBLE HUNTER

The Quartz Mercury Lamp in Medicine

Dreaded germs lurk in dark places. Sunlight destroys them. For those reasons health flourishes out doors while germs and disease are found in dark, dismal places. Sunlight destroys germs because it contains, besides light and heat, ultra-violet rays which have wonderful medicinal properties. These rays are destructive to animal tissue and for that reason care must be exercised in not exposing parts of the body, especially the eyes, to ultra-violet light of appreciable intensity.



QUARTZ MERCURY LAMP

It is the ultra-violet light in sunlight which tans exposed portions of the body. On exposure of the eyes to the light from a quartz mercury tube or a carbon arc without a globe intense irritation will result. This irritation does not appear until some time after the exposure, and for this reason unusual care is necessary.

All of us are familiar with the mercury vapor lamp commercially known as the Cooper-Hewitt lamp. This bluish-green light comes from the luminous vapor contained in the highly evacuated glass tube. A modification of this ordinary glass mercury-tube lamp is used for medicinal purposes. For the glass tube is substituted a clear quartz tube which is transparent to all the ultra-violet rays. Glass is opaque to these wonderful rays just as wood or metal is opaque to ordinary light.

One form of the quartz mercury-vapor lamp is shown in the figure. It is called the Uviol quartz lamp. The tubes are held on arms and the light can be concentrated on any portion of the body. Skin diseases are especially treated with satisfactory results, and by this and other apparatus, ultra-violet light is beginning to rival the wonderful X-rays and the mysterious element radium in medicinal practice.

Prospecting by Electricity

A demonstration of a system of ore finding by electricity was made at a mine in North Wales, where it was shown that a hidden vein of lead ore could be clearly located by this means.

This mine, the Telacre, is situated at Prestatyn, and for some while it had ceased operation for the reason that further working would be attended with considerable loss. The tests applied foretold the presence of ore in new places and in the deeper workings, and borings that were made corroborated the predictions of the instrument.

At another mine, at Cwmystwyth, similar success was had, a lode of lead and blende being found in an unsuspected place. The system seems to depend upon the production of electric waves which are affected by the near presence of metallic ore in the ground, the position being judged by means of that wonderful detector of delicate sounds, the telephone receiver.

The Electrical Wizard of Willis Island

Close to the Pennsylvania shore of the Delaware River, about five miles above Trenton, N. J., and two miles below the historic Washington Crossing, lies a beautiful island. Here James Willis has lived alone with Nature for the past 28 years. Here he built with his own hands the first bungalow on the river, and has equipped it from time to time with all the up-to-date conveniences of the city home.

THE ELECTRIC WIZARD OF WILLIS ISLAND AND HIS BUNGALOW

Gifted with a natural bent for scientific work, he has spent his spare moments in fitting his home with all manner of ingenious electrical contrivances, so that it is a veritable house of magic and mystery. There are in all about 150 connections, and when the switches are closed, it is almost impossible to move a muscle or touch a thing without receiving a shock or turning on the lights or ringing an alarm bell.

In all kinds of weather, winter as well as summer, Mr. Willis has lived on the island. Between April and October he entertains about 2,500 people, and his registry book shows men in all walks of life throughout the country. To visit the bungalow you go down to the Pennsylvania shore of the Delaware River and hail "Jim Willis." In a few minutes, if he is at home, he comes for you in a boat, and after a pleasant greeting rows you over to the island.

The island contains about ten acres and is densely wooded. Once there you walk up under broad spreading trees to the house. And what a cozy little place it is!

You are invited to enter. The house is only one story, but everything spells solid comfort, and as you cross the threshold into the living room you are most agreeably surprised. There are easy chairs, a large center table covered with the latest books and magazines, electric lights, a telephone, an electric heater—everything, in fact, to make life comfortable.

After you have taken it all in, the fun begins.

On each side of the room you may notice, if you are a close observer, two switchboards. One controls a 600-volt connection with a trolley line on the Pennsylvania side, which furnishes power for the lights, heater and other devices. The other controls a network of apparatus operated automatically by a system of over 100 dry cells. There are 150 connections in the house.

Mr. Willis moves a few switches, and you find you can scarcely stir or touch a thing without closing an electric circuit. Immediately the lights go on and

a gong rings. If you pick up a book, a pipe, or lift the lid of his tobacco jar, you start an alarm. You cannot sit down, move a shade, open a window, turn a door knob, or take down the broom without an electric alarm ringing. You can't even take a pin from his pin cushion, or a toothpick from its holder, nor can you even turn the water into the lavatory without the same result.

The bedroom offers more surprises. It looks like any ordinary cozy sleeping apartment, but here, too, his electrical science has been employed. When the proprietor lays himself in bed all the curtains come down with a click and the lights go out automatically, without the touching of a switch. As soon as he raises his head from the pillow in the morning the lights and window shades go up again. Every part of the house is fitted up in this manner. At night time, when the curtains are pulled down to keep outsiders from seeing in, the lights go on automatically as soon as the curtains start to lower.

The most unique and interesting piece of work in the whole place is an electrical alarm clock. Mr. Willis made this from a tomato can, a small desk clock, and part of an arm of a pair of drawing compasses.

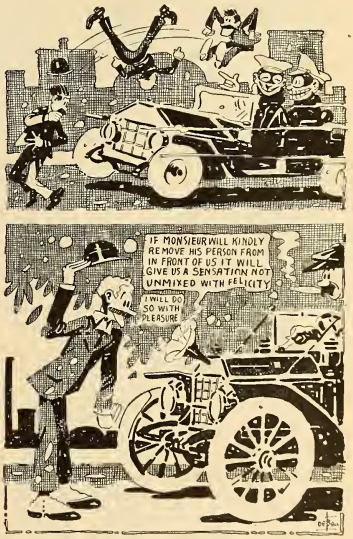
The clock is supported face up on a vertical rod. The can rests upon the face of the clock and is so attached to it that as the hour hand moves the can rotates on its axis, making one complete revolution every twelve hours. Around the surface of the can, near the top, runs a paper band, which is divided into twelve equal parts to represent the hours.

In front of the clock is a vertical hand. The compass arm may be attached to the top of the can like a clothespin. Place it above any hour mark, and when that mark gets around to the stationary hand again the compass arm touches a projecting rod, closing the electric circuit. Then the lights all go on, the shades are all automatically lifted, and a twelve-inch gong sounds loud enough to be heard across the river. It is a most efficient alarm clock.

Mr. Willis himself says the house is one of the most perfect burglar-proof structures in existence, for the very instant anything is touched this enormous gong sounds, or the lights are lit, or both, and if it is an intruder at the window, the curtains rise, showing who the miscreant is.

The Phonograph as an Automobile Alarm

A decided innovation in automobile alarms is promised through an invention patented by Joseph H. Erickson, San Francisco, Cal. The device is a phonograph so constructed that it may be attached to the front of an automobile. Spoken or musical warnings, according to the fancy of the owner, may be used. By pressing a foot lever or a push button the alarm may be repeated as often as desired.



A Lonely Cable

An emerald set in a pear-shaped lagoon, a ring of pink coral, a shimmer of white where the beach slides down to meet the chameleon sea, the tops of cocoanut palms moving gently, a jumble of low roofed houses, two windmills spinning lazily in the breeze, and beyond, the blue tropical sky reaching out to meet the vague horizons—that is Midway Island, a lonely cable station in mid-Pacific.

If you look upon the charts, you will see that it is half way between California and China, half way between Australia and Alaska. And if at the risk of inaccuracy you care to continue the alliteration you may say, half way between Vladivostok and Valparaiso. Of course Midway is the most important station on the Commercial Pacific cable. It is the place whereon rests the long arm of Electricity while reaching to connect two worlds. It is the border of the Western Empire; at the gate of the mystic Orient. It is where Yesterday going West meets Today coming East.

Here is the little hut that throbs with the news of the world—and does not care. Here are the cable operators, silent men, watching day and night the incessant swing of the Morse code. Here unreels the panorama of the world—its tragedies, its joys, its commerce, its affairs of state. From the East it turns, a kaleidoscope, the siphon recorder. And always there are men waiting to read it, to relay every dot on the last leap under the seas to the West. And from the West it comes to the little hut, faint and weak, weary with its long race, only to be caught and hurled toward the China Seas. A lonely little island, to be sure, but wonderfully important—an outpost on the borders of two empires.

Few people know it exists. Only the cable men and those who have sailed the South Seas look intelligent if you mention the word Midway. Most people think you're talking about some World's Fair. Which is to be expected.

Life at the little station is loneliness sublime. Recently Midway came into the news. People saw its name buried in a little paragraph in the newspapers. The Pacific cable had broken down. The break was at Midway. A cable ship had set sail from Seattle to repair it.

Then Midway was forgotten. In the little hut the signal began to sound. East met West again and Midway vanished from the thoughts of men. Still the siphon is swinging back and forth in the isolated hut; still the news is being caught and sent racing on under the seas.

On the Midway sands, clear white, the product of the leaching of the dead coral by the rains, the sun blazes eternally. It blazes the same, day after day—just a glaring rim that seems to run down to the sea to get cool. And on the people of the island the men and women, a score of them, the sun has left its mark—the

Station *in* Mid-Pacific

By
Edward Lyell Fox

awful mark of the tropics. It has made their faces brown and drawn, their eyes a little sunken, a little expressionless. Most of them wear thick blue goggles. Otherwise they would go blind. All variety has gone from their lives. Always the sun burns fitfully; always when the rain comes it comes at the same time; always when a breeze blows it blows from the same corner of the horizon; always when the sand, picked up along the beach by some sudden gust, whirls and dances, it does the same dance that it did yesterday, today—tomorrow, forever.

Always, Electricity, the voice that connects Midway with the outer world, talks the same way. Even when it tells of great news—perhaps of an empire being overturned—it never lifts the inflection. And so when day after day the whole world passes through a little hut, those in the hut are apt to become weary. To them it is an old story. They are like a newspaper man, growing cynical. There can be no change, in Midway.

Only four times a year is the monotony broken. Even then it's the same. The break comes on certain days in the year. Every three months the sails of a schooner appear in the lagoon. It is the supply schooner from Honolulu, bringing mail from the home, newspapers, food. Sometimes a new operator is swung over the side of the schooner. Perhaps he comes to take the place of one of those who, crazed by the monotony of the place, must return home. Perhaps he just moves in a routine of things, coming to relieve a man whose turn of service is ended. But, strange as it may sound, the cable company will tell you that they have more applications than they can fill, for berths at Midway. Every operator must sign a five years' contract, but if the solitude of the place overcomes him, there is always someone in the States eager for his post.

Only the other day I met a man who had been to Midway. From him I learned something about life on the island, some of its wild history and a place that he called "The Great Bird Park of the Pacific." He told me that the present population of the island was 23 persons. I asked him to enumerate, and he said they were the superintendent

HERE UNREELS THE PANORAMA OF THE WORLD

of the cable station and his wife, a chief operator, also married, a physician, a crew of operators and a few laborers. He also added to the list two donkeys, two cows, and two canaries. This reads like the passenger list of the Ark, but it's just a coincidence that the animals were dealt in pairs.

Then I asked him how it was that Midway came to be selected as the cable station. But before answering me he told me something about the wild history of the place. It seems that from the time men first sailed the tropical seas Midway has been a graveyard for their ships. Like all uncharted and unlighted islands, its beach is strewn with the broken bones of many sailing vessels. Just beyond the cable station one may find the remains of some Japanese junk, dry planks bleaching in the torrid sun. Further on are the signs of other wrecks, jagged spars sticking up out of the sand —the shafts of the graves.

And the island has its stories of these wrecks. There is the tale of the *Wandering Minstrel,* Swiss Family Robinson sort of a story, with Captain Walker and his family living on the island after the crew had died of scurvy. For fourteen months they lived on the fish they were able to catch, the birds they killed and such eggs and fruit as they found. Then a schooner came from Honolulu and took them off.

And there is the story of how the Pacific Mail Company, wanting a coaling station, annexed the island, naming it Midway; how the *Lackawanna,* commanded by Captain William Reynolds, landed marines, erected a shed and stored a little coal in a neat pile. For this exploit was only an object lesson for old

King Kamehameha V. This Hawaiian monarch, forgetting all that the Pacific Mail had done for him, tried to collect high revenue for a coaling station at Honolulu. So the company organized the reserve at Midway just as a blind. And seeing his country apparently about to be cut off from the regular route of travel, the old King came to terms. Today the pile of coal may still be found at Midway. But washed by the tropical rains, neglected and forgotten, it is just a pile of soft dark rock, brittle like coke, but with all the combustion gone from it.

In due time, however, the seizure by the *Lackawanna* was pronounced unconstitutional.

Then came Kalakaua, the dreamer of the South Seas, who proposed an empire of the Pacific with Hawaii at its head. Accordingly he annexed Midway and other adjacent islands, but that was all. The empire never emerged from the mists. Finally Kalakaua ceded the island to this country and Congress accepted. And so Midway basked peacefully in the sun until the *Nero* reached it during the survey for the American cable across the Pacific. That was in May of 1899. Four years later the cable was laid and Midway, the desolate speck, had become an all-important link in the electrical band around the world.

And then the man who had been there told me about the "bird park," a surprising preserve of glistening sand, coarse grass, and blue sea. He told me that from Midway, extending toward Nihoa, the nearest Hawaiian island, lies a national sea bird preserve—1,500 miles of water and sand, where the albatross dance, clumsy things, yet bending to their minuets with tropical rhythm. He told me that it was a place patroled by a revenue cutter. I think he called the boat the *Thetis*. I know he said it was busy rounding up Japanese poachers who continually invaded the preserve. He said that the park contained a number of birds beyond reckoning. He called them a million, merely as a unit of reckoning. He could have said quintillion and he wouldn't have exaggerated.

If we are to believe the superintendent, life there is very satisfactory. It always is to the man who yields to the tropics, lets the sun get into his head—becomes what Jack London calls a "Son of the Sun."

Hydro-Electric Wonders in California

By ARCHIE RICE

This is the third article of the series. The first described how a famous gold bearing river was diverted to produce hydro-electric power for the operation of huge gold dredges. The second told of the original Yuba River project and its relation to the deep gold mines of the famous Mother Lode. The fourth and last article of the series, which will appear in an early issue, will present one of the largest installations on the West Coast, with its 40 miles of flumes and ditches leading the water to its final terrific drop of 1,450 feet, or over a quarter of a mile.—Editorial Note.

CHANGING MOUNTAIN SNOWFLAKES INTO CITY LIGHTS

Fred is a portly chap, ruddy and English.

We were standing on a street corner at the top of one of San Francisco's dozen high hills.

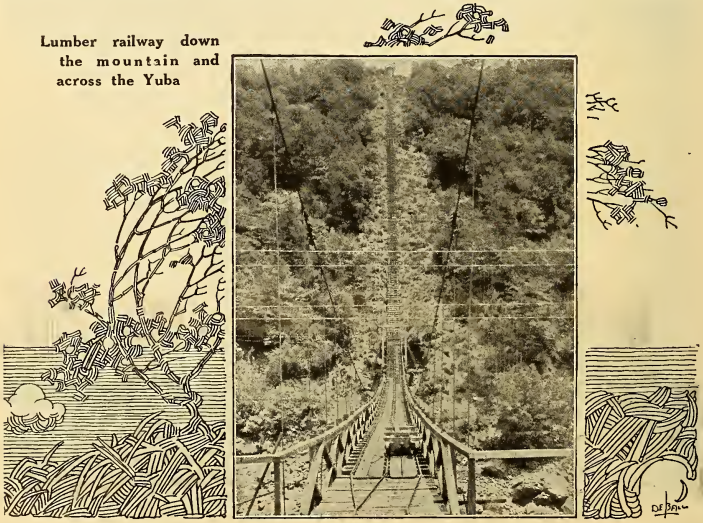
"I say, what's all that—the lights?" inquired Fred, with a forward sweep of the hand.

"That's a 20-mile stretch of cities and towns along the east side of San Francisco Bay. At the extreme left is Richmond, an oil refinery and manufacturing city of 10,000 people; then the little town of Albany; then the hillside residential city of Berkeley, with its 41,000 people, and the great state university with about 3,500 students; then the city of Oakland, with its 150,000 people, and then the quiet community of Alameda, where dwell about 20,000 people."

"But the lights?" persisted Fred; "they appear to be electric, and quite like a million of them."

"Those lights," I explained, "are made from mountain snowflakes."

"In the mountains off behind all those



Lumber railway down the mountain and across the Yuba

lights," I continued, in answer to an amazed query, "are the generating plants, converting snowflakes into incandescent lights for the coast cities."

Because he said he would like jolly well to see it done, the next forenoon we started to see the source of all this light, first by ferry across the three mile stretch of waters to the projecting Oakland pier. The ferry boat disgorged its throng of humanity, streaming forth like a dark flood that had burst through the restraining dam in three great openings. Fred and I were carried along with the current to a score of local and suburban and main line trains waiting on parallel tracks under an enormous glass roofed shed.

After towns and farms and factories had been rapidly thrust past our windows for an hour, during which Fred critically studied a copy of the *London Illustrated News,* I interrupted him in his devotions.

"See that high skeleton tower on that hill over there across the water? See those wires crossing to our side? This is the upper end of San Francisco Bay. I want you to get a good look at those wires. That is the longest aerial cable in the world. Each of those wires is a metal rope almost an inch in diameter. There are four of them. They stretch a distance of more than 6,000 feet, which is something more than a mile. The lowest one is 206 feet above the high water surface of the bay. And through three of them there is constantly flowing, day and night, electric current at a pressure of 60,000 volts. That is what carries lights to those cities you saw last night and power to all the factories we passed."

Toward evening we got off at a little town called Colfax, possibly 2,500 feet above the waters of the bay. There a tiny train was wheezing impatiently on a siding. We boarded it and the little cars rocked to the vibration of our steps. Then we wound through wooded ridges and crossed deep ravines on trestles that were like huge stilts. The front end of the train shrieked and shrieked, and the piercing notes echoed from afar, flung back by the mountain ridges and the depth of the cañons.

"Nevada City!" announced the brakeman finally, and he commenced turning down and blowing out the little oil lamps.

We were inside a hollow globe. Above us, quite near, was the curve of the sky studded with stars. About us, like a deep dish, rose the slopes of a concave town, aglitter with hundreds of electric lights.

Before five the next morning we were on the road in a mountain rig, behind two rangy horses. We passed great deep mines in the gray of early dawn, and heard the rumbling of the incessant tramp of the ore crushing stamp mills. Four thousand feet down in the earth men were still working on the night shift, toiling by electric light. The ore

End of the Flume and the final drop to the Colgate Plant

cars and the hoists and the stamp mills were moving by electric impulse.

The road went down and down for a mile and then up and up for another mile, but always down or up.

"These roads don't seem to be paved at all," he observed.

A half hour before noon we came to the top of a long wooded ridge. Far down in a ravine was another river. We unhitched the horses and left them in a shed where there was some hay.

"And now what?" ventured Fred.

"A little stroll down to the power house. It's only about a mile. But it's too steep for a wagon road."

"Look!" exclaimed Fred; "there's a bath house on the creek down there! You know, I'd like jolly well to have a bath after that dusty ride."

"You mean that long white building on the edge of the river?" I asked. "Well, that little thing is the length of a city block, and it's 40 feet wide, and full of thousands of dollars' worth of big electric generators and transformers, with sets of giant waterwheels down in the basement. It's built of solid granite and lined inside with cement and braced and girded with steel bars. That little creek you see way down there is the Yuba River. Those streams you see spurting out from the building would tear down a whole London block as if it were so much beach sand piled up by children at play.

"That cleared swath stretching off there to the left along the river is the route of one of the power lines, the one that we saw crossing that strait by the longest aerial span in the world. Your cute little bathhouse down there is a mile from here, and in it is constantly being generated nearly 20,000 electric horse-power.

"This pole right here by us carries some of that power back to help run those mines over at Nevada City and Grass Valley. There is another over to other mines. Three other high-voltage power lines extend from that plant down there. Each carries current at 60,000 volts. They start off down river along that wide cleared right-of-way. They make a beeline over ridges and across country. Men patrol them constantly to watch the wires and to guard against forest fires. One line, 61 miles long, serves the city of Sacramento, and two others extend one hundred and forty miles clear on to Oakland and spangle all the east side of San Francisco Bay with those myriad lights you saw from afar the other night."

"Nevada has sage-brush like that on those hills over there, has it not?" interrupted Fred.

"Not," I echoed. "That sage-brush you see all over those ridges is pine trees.

"That bald spot up to the left behind your little bathhouse is the clearing they made for the stables. They lead the horses and mules up and down to and from that spot night and morning. That thing that looks like a little bungalow

The Colgate Flume

off there at the left of the bathhouse is a big boarding house for the employees. They call it a hotel.

"Do you see that straight path right up the ridge directly behind the power house? That's where the pressure pipes come down. There are five heavily riveted pipes anchored to concrete blocks. Each pipe is 30 inches in diameter, or about as high as your hip. They shoot solid streams of water down from a perpendicular elevation of 702 feet. That is more than four times the height of Niagara Falls. At the bottom each huge pipe tapers down to a four inch steel nozzle. Where the water jets out it is so dense, its force is so tremendous, that you can strike the stream with a sixteen pound sledge, and the big hammer will merely rebound as though you had struck a solid steel anvil."

"Just fancy," commented Fred.

"The nozzles point out horizontally. But they are so nicely poised on a sort of hinge arrangement that they lower or raise themselves slightly as occasion demands. Ordinarily each jet strikes an undershot blow directly into the massive steel buckets that form the outer rim of the windmill like waterwheels. There are eleven of these waterwheels, and they stand upright like the wheels of a wagon. Only they are bigger than the wheels of any conveyance. Three of them are 8½ feet high, and the thrust of water whirls them at the rate of 240 revolutions a minute. Four of them lack only an inch of being six feet high, and they whirl at 360 revolutions a minute. That means that the rims of those big wheels are going at the rate of about two hundred and twenty miles an hour.

"When, suddenly, less power is used down in the cities, the nozzles deflect automatically and partly shoot clear of the buckets.

"Inside that building there are six big electric generating machines. They are practically nothing more than large magnetic coils. Revolved rapidly, they produce electric current. Each generator is a big wheel, and on each side of it, with a common shaft running through all three, is a waterwheel. The whirl of the waterwheels, like the pedals of a bicycle, revolve the middle wheel. That middle wheel is a bundle of magnets, and from its droning and whirring revolutions come the mysterious and unseen fluid force that runs mines and factories and city street cars and elevators, and spangles the rim of San Francisco Bay at night with a galaxy of surface stars.

"As it is first produced there the electric current has a force of 2,400 volts. But it is immediately passed into ponderous cylinders called transformers. Inside them it is electrically juggled till the intensity is increased to 60,000 volts. And at that high potential it is sent into the power lines to go long distances cheaply. There are 23 transformers.

"The five main power lines that extend fan-wise from that plant form a ribwork composed of 450 miles. And there is enough big copper wire in the ramifications of the system to span the American continent with a twin line between New York and San Francisco.

Typical California Distribution Station

"Very possibly, no doubt," interrupted Fred, "but you distinctly told me, old chap,

that the electric lights were made from mountain snowflakes. Quite plainly I remember you saying just that."

"Look over there where the pressure pipes start down the slope," I continued. "Do you see the point?"

"I see no point," Fred replied. And I believed him.

"Well, any way, that's the end of the flume line. That's the flume coming along the mountain side from the right. There's a little house up there. It's one of several along the line. They are occupied by the flume tenders. The flume tenders for this plant really live higher than the superintendent."

"Oh, I see the point now," exclaimed Fred, excitedly, "right across there in a sort of obtuse angle of the trails."

"Just so," I agreed. "Well, we're going over there. Then I'll show you about this snowflake business."

At the power house a double mule team and a spring wagon were waiting on telephonic orders from Nevada City to take us to the top of the ridges. We started at once.

"They built this road to get the heavy machinery down to the plant. They didn't seem to figure on anything ever coming up," I remarked, jamming on the brake and letting the span blow for the twentieth time.

"What's the name of this blooming place?" inquired Fred. It seemed to me I detected a slight petulance in his tone.

"The Colgate power plant on the Yuba River in Yuba County, California."

By three o'clock in the afternoon we had reached an abandoned lumber camp on a ridge high above the river. We hitched the team to a tree by an old cabin.

And down we started, afoot through a beautiful forest trail, winding and steep. Suddenly we almost launched ourselves upon a cabin clinging to the cliffs. By and partly under it ran a great flume, edge full with a rushing torrent of water. We were up-river seven miles above the power house.

"Now to the dam," I exclaimed, and strode gingerly off on the plank laid on cross girders and forming a hazardous pathway almost on the surface of the surging waters of the flume. The flume is half the width of an ordinary room and so deep that men and mules used to walk through it during its construction. It carries a racing flow of 12,000 miner's inches of water, going at the speed of a Marathon runner. Nothing living can fall into it and get out alive.

A mile further up we came to the dam, a solid masonry structure built across a narrow neck in the cañon. A diverting masonry wall guided the impounded waters into concrete headgates controlling the outflow into the flume.

"This water is all melted snow from the higher mountain slopes," I began, and started forward across the crest of the dam to take the upper trail.

"Will the team be quite safe till we return?" inquired Fred, standing and mopping his scarlet features.

"Why, a man followed us on horseback to drive that team right back to the power house. We're to walk down the flume. It's eight miles."

"I don't care to see where the snow comes from. I'll take your word for it, old chap. But I'm beastly hungry."

"When they built this great flume-line," I went on, "the problem was to get enough good lumber. Ten miles back on the ridges on the other side they found a tract of big timber. They set up a sawmill, got out 11,000,000 feet of lumber, and selected more than 8,000,000 feet of the very best of the cut. All of it was required in making the flume.

"They hauled it through the mountains and shot it down from the top of the last ridge. See that Jacob's ladder climbing up out of this ravine? That's where the repair lumber still comes down a steep tramway 1,275 feet and then sweeps across to our side on a steel cable bridge swung safely above the freshet water line.

"This old cañon used to resound for

months to dynamiting blasts and the noise of many workmen building flume and power-house and dam."

"Don't you ever get tired?" came from Fred, plodding doggedly behind as we strode rapidly and silently down the flume plank, ever intent on each step. "There it goes again!" he muttered, "another of those protruding nails."

Shadows were darkening the cañon.

"I'll be jolly well glad to get to bed right after supper," came from behind me.

"Right after supper at the plant we're due to climb out of the cañon, get to our team, and drive back to Nevada City tonight," I explained.

What Fred said sounded technical and irrelevant.

Two hours later, out on the mountain road, he asked, "Are you quite sure of the way? I can't see a blooming thing, it's so beastly dark."

"Keep reaching out with your left hand," I directed, "and as long as you touch the inner bank we're safe. I don't want to rim the outer edge too close and go bumping and bounding down half a mile."

"Gracious! Whatever was that? There it goes again!" gasped Fred.

"Mountain lion screaming."

"I say, old chap, this is a most dreadful adventure you've brought me out upon."

At two o'clock the next morning we stomped into the open livery stable opposite the hotel. A sleepy man emerged from somewhere to meet us and began unhitching the weary team.

"Fine mountain lion over there," he said, jerking his head to indicate where. "Couple of fellers shot it on the way to town yesterday afternoon. Eight feet three from tip to tip."

Someone sighed audibly.

A Palace Garden Electrically Decorated

The views herewith show the garder of the regal mansion of Don Teodoro de Bary, in Buenos Aires, as it appeared when electrically decorated during an occasion when the mansion was placed at the disposal of Her Highness the Infanta Doña Isabel. The illuminations were especially brilliant, making it appear like one of the gardens of which we read in fairy tales.

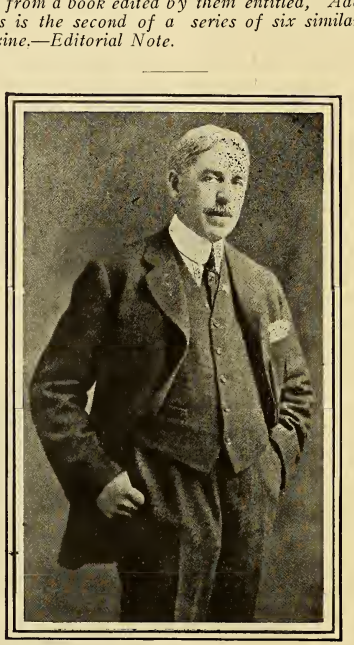
All the paths and much of the shrubbery were outlined with miniature incandescent lamps, artfully hidden among the foliage and presenting a most fascinating appearance at night.

ILLUMINATED GARDENS IN BUENOS AIRES

Advice to Freshmen

By FRANCIS C. SHENEHORN
Dean of the College of Engineering, University of Minnesota

Extracts from a lecture to the freshmen in the College of Engineering, University of Minnesota, and published through the courtesy of Waddell and Harrington, consulting engineers, from a book edited by them entitled, "Addresses to Engineering Students." This is the second of a series of six similar articles which will appear in this magazine.—Editorial Note.



Undertaking work in the College of Engineering shows courage, for only strong men knowingly enter here where the portion is man's work. No mollycoddles may hope to prosper here. You have entered a course so strenuous that success in it will call for every fiber of manliness you possess—all your pluck and endurance. You are, therefore, a body of picked men, each one of whom has the rare opportunity of completing the course and of taking up the practice of the most virile of the professions—that of engineer.

A college education is the privilege of but few men. About one man is college-bred to 800 who are not. I wish to place much stress upon the value of the chance now yours because I want you to make the most of it. You must make good, you must realize the hopes for you of those at home, you must make worth while the sacrifice made by your people for you. Do not disappoint the mother and father. Live up to what the neighbors expect of you, and graduate with honor. Do you know that out of a freshman class of men, on an average only 40 graduate while 60 drop out for one reason or another? Resolve that you are in the game to the end and that you will not quit.

Most of your schoolmates of the earlier school days are not here. The wage-earning activities of life have absorbed them. They have taken up the burden of men, but have missed your special privilege of dwelling for some years in the rare atmosphere of the academic plateau. Your special privilege is that you are becoming mentally enriched and equipped with professional training—at the expense of the state.

You must understand that while our engineers on the campus are earnest, strenuous workers for the most part, now and again men appear without the business perception to live up to their contract. For these we have a pneumatic gun into which they are gently loaded and tossed into the uttermost

realms of thin air. Do you remember the projectile which Jules Verne conceived for the trip from the earth to the moon? That had water compartments, as I recollect it, with collapsing bulkheads to absorb the starting shock. Well, our projectile has no collapsing bulkheads.

Now, I am going to give you a term to express the kind of men we desire as a product of this college. We want "thorough-breds" and I wish to tell you what a thorough-bred is as I mean it. Perhaps I can do this most quickly by telling a story. Governor Odell of New York related it. He said he was out hunting with his father one day, and they had with them an Irish setter which was a thorough-bred, and they had also a yellow dog. His father picked up the yellow dog by the nape of the neck and held it out at arm's length and the yellow dog whined piteously. He dropped it and picked up the Irish setter. The setter hung there with never a whimper. He said, "My son, that is the difference between a thorough-bred and a yellow cur." Now, what the thorough-bred had was self-control. It certainly hurt him just as much as it did the yellow cur, but he did not whimper; and self-control is the one thing that will let a man win out in life.

Now there are certain things in your college course which I wish to bring into high prominence. An engineer in his direction of the forces of nature is an expert mathematician, applying to useful ends his mathematical attainments. The backbone of the engineer is mathematics; and you men, if you are going to succeed in your college course, must get a firm grip on your mathematics, and clear up everything as you go along. To get behind in mathematics is fatal. Other courses depend on it. Your physics of the sophomore year and your mechanics which comes later require higher mathematics as a pre-requisite. If you have failed to pass or are conditioned in your mathematics, you are at a serious disadvantage; and I advise you in the strongest terms to get your mathematics right. You are building a pyramid, and in the first course of masonry lies your freshman mathematics. You cannot lay your second course of masonry until the first course is completed.

Because our profession has so recently emerged from the trades, our culture is questioned. Many people do not distinguish between a locomotive engineer and a mechanical engineer. If you are satisfied with the wages of a trade, you will not need to speak and write clearly and effectively, you do not need to study English and German or French—but you cannot graduate at Minnesota! This is not a trade school, but a professional school. You will need to do just as conscientious work in rhetoric or language as in your technical studies. We want Minnesota engineers to reach the high ranks of the profession, and not pass through life as subordinates. You will be useful men as subordinates, but there is something more useful and better. You find it hard to believe that language studies will help you as engineers, but take this on faith now and make your scholarship excellent in them. That these will count, accept as expert judgment.

First of all, keep yourself in good physical trim. You must have enough to eat. You must eat wholesome things. You cannot expect such an engine as you are to do work without the proper fuel. Then you must get the proper sleep. Do not let any fairy tales about Napoleon's capacity for work on six hours' sleep lead you to burn too much midnight oil, because the more accurate historical fact is that Napoleon needed eight hours' sleep the same as the rest of us men. You need some exercise and that has been provided for the most part, in your drill; but you ought to get out and breathe the open air some minutes or an hour daily; and you ought to absorb the sunshine into your blood and get the wind into your pulses, in order to keep yourself in the best possible condition.

If, however, you overdo this matter of physical exercise, you use up the energy which you need for proper study. Therefore, the rule for exercise is "Not in excess, just in moderation."

I am not going to say much to you young men about drinking, because I am certain it is not necessary. We business men look upon a man who drinks as a fool, as a yellow cur. The "whiskey breath" warrants discharge from a man's position in many corporations in this country and it discredits a man.

Smoking in moderation is not very bad, but for you it is not now worth while. The disadvantages are real, the advantages in good fellowship and relaxation are intangible. A man may be splendidly virile, and yet not smoke. Mollycoddles smoke cigarettes, but some strong men also smoke them. Smoking is really in the "twilight zone," between good and bad. The clear daylight is better for young men.

You must assure yourself of reasonable quiet and freedom from interruption, if you would study effectively. Form the habit of absolute attention to the task in hand. Keep parallel all the forces of your mind in the direction toward which your work tends. Be master of your study hours, and do not permit any one to interrupt you. In "Tom Brown at Oxford" I remember they had a special oak door to close when a man was at study and not to be interrupted. He was said to be "sporting the oak" and it was bad form to interrupt him then. When you have work to be done, do not hesitate so to inform your caller. Be courteous, but do not permit your study hours to be encroached upon. Be systematic. Keep your room, your books, and your papers in business-like order. Disorder in your environment will put disorder in your brain, and into your work.

I want to speak in closing of the profession of engineer. It is such a splendid profession. Its horizon is so wide. It is so modern as to be full of the spirit of youth, and yet it is as old as the pyramids. It is vibrating with new life, new applications of old laws. It is so helpful. It builds, and old earth becomes a better place. It gives to the poor ways of travel that the rich of old knew not of. It takes the brutal part away from human labor, and floods the night with light. It is creative. The engineer is a partner of the gods and the master of gravitation.

Specifications for a Good Engineer

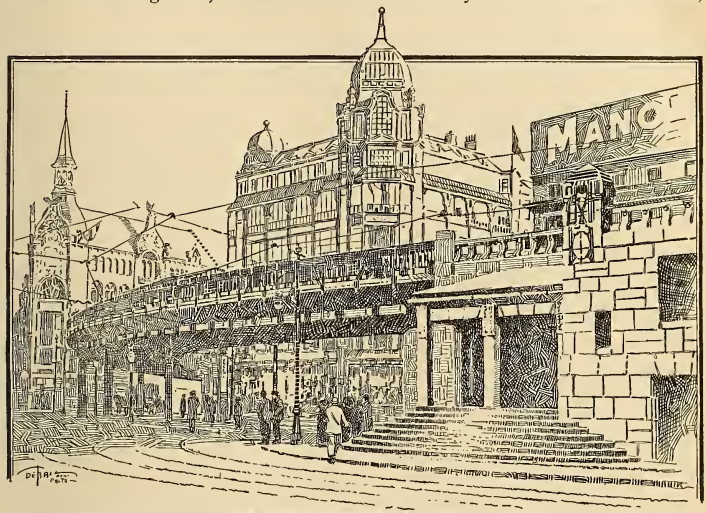
"A good engineer must be of inflexible integrity, sober, truthful, accurate, resolute, discreet, of cool and sound judgment, must have command of his temper, must have courage to resist and repel attempts of intimidation, a firmness that is proof against solicitation, flattery or improper bias of any kind, must take an interest in his work, must be energetic, quick to decide, prompt to act, must be fair and impartial as a judge on the bench, must have experience in his work and dealing with men, which implies some maturity of years, must have business habits and knowledge of accounts. Men who combine these qualities are not to be picked up every day. Still, they can be found. But they are greatly in demand, and when found they are worth their price; rather, they are beyond price and their value cannot be estimated by dollars."—*Chief Engineer Sterling's Report to the Mississippi Levee Commissioners.*

Hunts Diamond With Flashlight

A St. Louis young lady while walking through one of the parks discovered that she had lost two valuable diamond rings. She returned over the gravel walks that she had traversed and found one of the rings, but failed to find the second one. She procured an electric flashlight and waited until dark when she again resumed her search. The glint of the gem under the flashlight ray soon attracted her attention, and she reported to the police, who had been notified of her loss.

Hamburg's New Railway

While in America the elevated railway system is usually preferred and in Great Britain the underground, in the German



HAMBURG ELEVATED RAILWAY

empire they use a combination of both. Thus Berlin is the possessor of such a line which starts as an elevated in the east, goes down in the center beneath the pavement, rises up again and ends in the western suburb, Charlottenburg, as an underground railway. Now Berlin has a competitor, as very recently in the second largest city, the famous port of Hamburg, such a combination line has been opened.

The new Hamburg line is fifteen miles long, one-fourth of the whole running under the pavements. The old city is cut up by many canals, rivers and ponds, and, besides, is very hilly, therefore the line contains several miles of stone viaducts, no less than fifteen bridges and some 43 street crossings at two levels, all built at great cost.

The cars are fitted with two motors, each of 100 horsepower, an arm touching the third rail from beneath so that the latter is insulated above. Thus you may walk upon it without danger. A new block system of Siemens & Halske, of a type which has never been tried before, has been introduced. It works so perfectly that human activity is almost excluded.

As the trains operate under varying conditions, now in daylight and the next moment in tunnels, the lamps in the cars are automatically lit and extinguished when approaching and leaving a tunnel.

UNDERGROUND SECTION OF THE HAMBURG LINE

Electrical Securities

By "CONTANGO"

Something About the Price of Stocks and Bonds and Their Market Fluctuations—the Commission of Brokers and Bankers When You Buy or Sell Through Them—Explanations of Various Financial Terms and Details Given to You in Plain English

You, the investor or seeker after information concerning electrical enterprises, have already been advised in previous issues of this magazine as to the general characteristics of reputable brokers and bond houses, and by what means you can best judge their standing. In the last article great stress was placed on the time to buy and a promise of further financial details was given.

All the big and established houses have much the same rules, or customs, in their relations with their customers. Thus for example, a bond house will execute an order for a small number of bonds without charge or expense to you, so that the handling of your transactions may be retained. It will doubtless also interest you to know that when you want to sell some of your securities, supposing them to be of one of the older and well established electrical concerns, there will be a charge of something like ⅛ of one per cent or even as low as 1/16 of one per cent. For example, say one bond sells in the market at 103. Then in selling them through your broker you will be charged the small discount of ⅛ to 1/10 of one per cent, which the broker takes for making the transaction. Any good bond has a ready market. They are—bearing in mind among others the bonds of the large and well known electrical generating enterprises—just as good as cash and in a degree better because you are not so likely to spend them, i. e., realize on them once possessed, until maturity compels.

You must also understand that you can often deal direct with the company issuing them and save all charges. Of course, if the bonds have been underwritten, that is, purchased in block by some firm of bond dealers or bankers with a view to selling them out to the public as individuals, or to large corporations which invest in such securities, there will be to the purchasers the difference in the price at which the bonds in quantity were delivered to the brokers or bankers and the price set in the open market. This is the profit to the underwriters or original purchasers, but they take all the risk of floating the securities, that is selling them to the public.

You must understand clearly that the final price both for bonds and shares of stock is regulated by the public demand and confidence in them. There are many things that create demand, and it has been the purpose in these earlier articles to lead up step by step to the reasons why the public should make their demand felt. It is the confidence derived from the past record of the company, the present management and the future prospects.

This brings us to the consideration of the terms of maturity for various bonds and its connection with the price at which they sell. Some bonds are issued to the public for a short period—say ten years—others run for 30 years: the periods vary. Now the long time bond selling at a premium or above par naturally, everything else being even, has the high price over the short term bonds, for they are all issued in par denominations of $100, $500 or $1,000, as the case may be, and in proportion as they draw near maturity or the end of their term, so does the premium dwindle until in the last year they are worth for cashing-in purposes just what their face value represents, that is to say, the $100, the $500, or the $1,000, as the case may be. In the early stages when they had long periods to run they might have been quoted as high as 110.

This is a point not easily grasped at first and may be elaborated upon as fol-

lows: Suppose a company issues a $1,000 bond which matures in ten years. It is so desirable that it is worth above par, say 105. You would then pay $1,050 for the bond. The $50 premium which you pay, distributed over 10 years represents $5 a year, which you are willing to pay because of the soundness of the bond. Now suppose the same company issues another bond exactly as well secured and just as desirable, but maturing in 20 years. If the price of the 20-year bond were 105, the $50 premium you would have to pay would, when distributed over 20 years, represent only $2.50 a year, and everyone would wish to buy the 20-year bond. Therefore, to place the 20-year bond on the same market basis its price would naturally be 110. And, to put it in another way, if you buy your bond of $100 denomination at say $95 then the sooner it comes to the maturity the better for you and, therefore, the shorter its life the better in a general sense.

The price, of course, affects the yield, and it is, after all, the yield with perfect security that most interests you when looking for investment. Thus you can readily see that if you are buying high priced bonds paying five per cent nominally, that is at par, the yield to you lessens in proportion to the price you have to pay and this may bring your five per cent bond down to an annual yield to you on your investment of only 4½ per cent. It is the same if you purchased stock, for you buy at the market price, unless, as before pointed out, being a shareholder and a new issue of shares being made, you have the privilege of subscription at par.

But again understand clearly that the price for shares of stock is just like that for merchandise, and, there being no false play or manipulation, is regulated entirely by the law of supply and demand. Thus when all stocks are in a booming condition owing to the favorable business conditions, either general, or in the case of individual shares because of specific facts affecting that particular company's business, then the shares fluctuate in price up and down, following the trend of the market. Those most stable move the least except there be special causes relating to them.

For example, the demand for electrical equipment the past year or two, and this year so far, arising from the development of great central station systems, has created considerable of an upward movement in the shares of the great producing and operating companies, such as the General Electric Company, which has been doing an excellent business with orders ahead of the same period last year. These are special conditions affecting that particular industry.

Now a word or two as to some of the more generally used financial terms:

Investments: this represents the money you put in the stock or shares of companies by way of becoming part owner, or which you lend to a company as a bondholder, mortgage bondholder, or holder of debentures.

Securities: the term used very generally, but not accurately, to describe the financial offerings of any particular company. But in truth the term "securities" really relates only to bonds of the various kinds. The best way to describe a security is—any bond or preferential stock guaranteeing to its holders a *fixed return of interest* on money lent, or if you so wish to say, invested. An investment in ordinary shares or stocks, the dividends on which fluctuate, does not come within the meaning of the word securities. Moreover, securities implies something with a guaranty behind it, as in the case of an ordinary bond with either a trust deed or mortgage to cover and protect it.

Bonds: this name covers several forms of security. The ordinary bond represents money lent and the return of which is payable to bearer with the interest specified and guaranteed. But once registered the bonds cannot be delivered from hand to hand. Bonds may or may not

bear interest bearing coupons corresponding to the number of interest periods during the life of the bond. The larger issues are for the convenience of those who desire to invest in big amounts and thus do away with the multitude of coupons. Bonds are made payable as to principal within certain periods, and *maturity* is the time when they come to an end and have to be cashed in or exchanged for other bonds or securities.

Income Bonds: these are not exactly bonds, as they have no trustee deed or mortgage rights behind them, but are in reality a form of preference shares.

Mortgage Bonds: these represent the direct result of a company executing a trust deed by which it specifically mortgages its property to cover loans obtained from public subscription. It is very essential if there is the slightest doubt as to the *standing* of the company floating bonds, that the terms of the trust deed be thoroughly examined and understood.

Stock, or Shares of Stock, as it is sometimes expressed: by the general term stock is meant the capital of the company in which ownership rests. Stock may be acquired in any amounts, no matter how small, according to the specified value of each share of stock. But shares in their exact sense represent specified amounts of stock. That is the difference between the two terms, but in a general way they represent one and the same thing. It is the capital of the company and means ownership. Stock takes all the profits and losses. Bonds remain with their fixed rate of interest no matter how successful the company may be.

Dividends: these are the profits available for distribution among the owners of the capital stock of the company—the shares of stock—after all working expenses, bond and debenture interest and the like have been paid.

Fixed Charges: represent the interest to be paid before dividends can be paid.

Cumulative Dividends: is the term applied to any fixed rate of dividend on shares or stock and which becomes a debt on any company's future earnings if at any time the original and fixed amount has been unpaid wholly, or in part, over any date when it would be due.

Interest: this is the money paid on loans obtained through the sale of bonds. It is quite distinct from dividends and is paid on bonds, mortgages and the like. Interest is paid on debentures.

Debentures: are really certificates or acknowledgments of indebtedness—but a debenture is not a mortgage and, therefore, always very careful information should be obtained as to the security behind it, as it really is no more than a company's acceptance of an obligation to pay a certain sum.

Assets: this represents the property a company possesses, i. e., its lands, real estate, buildings, stock in trade, investments in marketable securities, money owing, cash on hand and the like. The physical assets are the actual property holdings with the buildings and machinery thereon, including conveyances and transportation facilities, coal and other such property.

Certificate: is the paper which testifies as to the ownership in a joint stock company.

Yield: this represents the rate the company returns on every $100 of the capital stock or on every part of a $100. It is the rate per cent after the existing price of the stock or bonds is considered.

Commission: is the fee charged by brokers on transactions involving the purchase or sale of stock or bonds.

Bear: is the name given one who sells shares for a fall in prices.

Bull: is one who buys shares for an advance in prices.

And finally the term "Contango" is an expression in use on the London Stock Exchange in particular, to designate the interest or charge exacted for the continuance of a transaction from one settlement day to another. It is a technical term used among brokers and might be likened to the continuance fee paid for continuing a case in a court of law.

Whisper Girl for Theaters

Charles Frohman, the American theatrical magnate, has introduced an innovation at his Globe Theater in London which has proven highly pleasing to patrons. A telephone operator back of the scenes takes any messages over the telephone from outside for any member of the audience or members of the company. In the former case the messages are retransmitted over a delicate "whisper phone" which is connected so that every seat in the lower part of the house can be reached. The girl is called a "whisper girl" because of the delicate transmitter she uses and from the fact that she must whisper her messages in order not to disturb the performance. The members of the company are whispered to through phones connecting with the dressing rooms. The first message the "whisper girl" received was from a man to his wife in the dress circle, stating that he was going to return home late.

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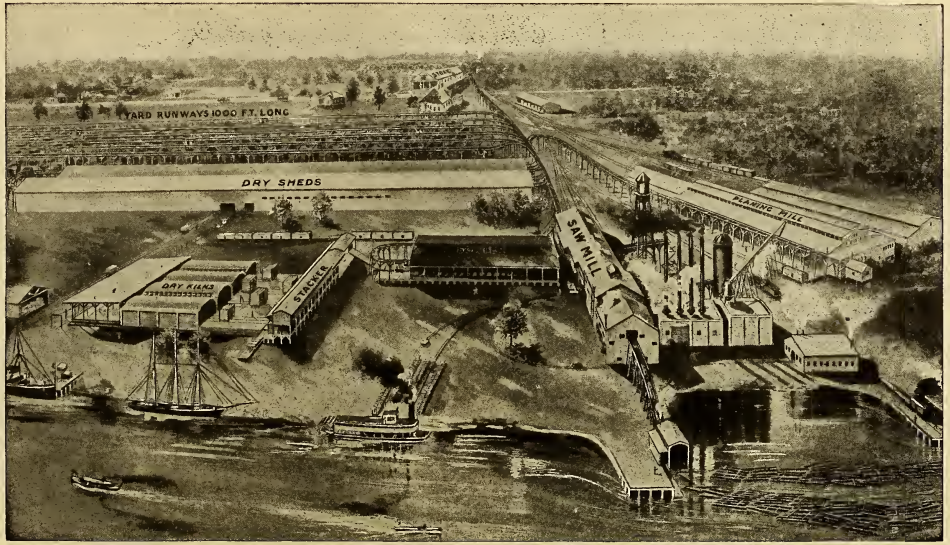
THE WHISPER GIRL OPERATOR

New Electric Welding Process

A new electric welding process which joins iron and steel quickly, safely, and with a minimum expenditure, is the result of a recent patent by a German engineer. The new process allows all of the molten welding metal to be deposited at the exact spot desired. To accomplish this the force of magnetism is used to attract the welding metal in a molten condition and flow it over the surface to be welded. It makes no difference whether the weld is being made over a workman's head or not, the melted welding fluid, which is heated by the electric current, will be attracted to the desired point and follow the lines of magnetic attraction, flattening itself out at the point of the weld.

In the process, the electric arc used is drawn between the metal to be welded and a metal electrode. This is done by using a welding clamp on the article to be welded, which is held in place by a few coils of wire around it, which magnetize it and make it stick fast to the material on which the weld is to be made. This magnetizes not only the clamp but also the welding wire which forms the metal electrode and is melted by the heat generated. As this melted metal drops from the welding wire it follows the lines of force and flows over the metal at the point to be welded. Thus the magnetism resulting from the turns of wire around the welding clamp serves a double purpose; that is, it is used to deposit the melted metal where it is needed, as well as keep the clamp firmly fixed to the article being welded.



This is a picture of the cypress mill of the F. B. Williams Company, Patterson, La., where traveling monorail electric hoists, described in the June issue, are used almost entirely to handle the lumber. The planing mill, dry shed, storage yards, sorter and loading platforms are all connected by the monorail system, totalling 5½ miles of track.

Train Struck by Lightning

So seldom are reports received of a railway train being struck by lightning that many persons suppose that special protection is afforded by the abundant metallic connection of the train with the soil through which the electricity is led away. However this may be, a fast train was some time ago struck by lightning during a violent storm in France, between Dijon and Lyons. The last car of the train was the one hit. A part of the ceiling of the corridor was smashed and the pieces fell to the floor. There was no fire and no one was hurt, and after a stop to take account of damages the train pursued its way.

A Test for Radium

All clear-yellow or greenish-yellow dirt may turn out to be a variety of earth that contains radium or radio-active minerals. A test for radio-active substances may be made as follows: A photographic plate is placed sensitive side up in a box which is made impervious to light. The ore or mineral is then placed on top of the box for a week or ten days. At the end of this time the plate should be carefully developed. If diverging rays of fog, shadows and black spots are found on the plate radio-activity may be assumed to be present. It is always advisable to make more than one test to be certain.—L. K. Hirshberg.

ENGLISH ROYALTY AT THE ALDERSHOT EXPERIMENTS

The King and Queen of England are watching recent experiments at Aldershot in connection with the use of portable wireless outfits on aeroplanes. Behind them is seen the motor car generator which supplies power for the sending equipment. The queen is looking intently at the aviator, who somewhere up in the sky is receiving the message. His Majesty takes a deep and practical interest in airmanship and all that pertains to it.

Execution by Electricity

Humane as is the electric chair for executions, compared with the old-fashioned scaffold and hangman's noose, or the bloody guillotine, still used in France, this method of executing a condemned person is not without its horrors, and experts in Boston have suggested improvements to do away with some of these. Much of the horror of it could be eliminated and the execution shortened by the placing of the electrodes on the back of the head and over the heart, instead of on the top of the head and on the left leg, as is now done, and as was done in the recent electrocution of Rev. Clarence V. T. Richeson, the murderer, at the Charlestown (Mass.) State Prison.

The current of electricity causes death by paralyzing the heart. Therefore, it is merely necessary to send the current through the heart. By placing the electrodes as above described, it would be possible to use a much lower voltage than the 1,900 volts now used. The burning of the hair and flesh on the skull, caused by the resistance to the current of the bony structure of the head, and other disagreeable phenomena, would be eliminated. Death would be practically instantaneous. Bone is a non-conductor of electricity, and in the case of a thick skulled person there must be a tremendous resistance to the current from the electrode on the top of the head.

THE ELECTRIC CHAIR IN THE CHARLESTOWN STATE PRISON

An execution by electricity in the state of Massachusetts costs $348.58. The electrician who throws the switch is paid $250; the balance goes for salary of guards, warden, chaplain, medical examiner and burial. The executioner is supposed to be unknown, and is hidden from the legal witnesses and from the prisoner's view before the black mask is adjusted by a screen. He has, however, a full view of the prisoner, and of the warden, who signals for throwing the

switch. He may wear a mask to hide his features, if necessary.

The electric chair is a solidly made wooden apparatus, with heavy leather straps for the arms, chest and legs of the prisoner. At one side is the electrode which is attached to the left leg. A head rest holds the prisoner's head firmly in position and the other electrode is strapped down to the top of his head, where a space several inches wide has previously been shaved. A black rubber mask is adjusted over the face, with eye-holes and holes for the nose and mouth.

The warden, who has personal charge of all executions, watches the rise and fall of the prisoner's breath and gives a signal to the electrician just when the exhalation comes. It is necessary for him to bend over the man in the chair to watch closely. While the warden's hand remains raised, the electrician keeps on a current of 1,900 volts. As the warden lowers his hand, the voltage is gradually decreased. This is twice repeated, the electrician leaving the current on fifteen seconds the third time. Back of the electric chair is a board with a double row of incandescent lights, which may be connected with the electrodes to test out the connections.

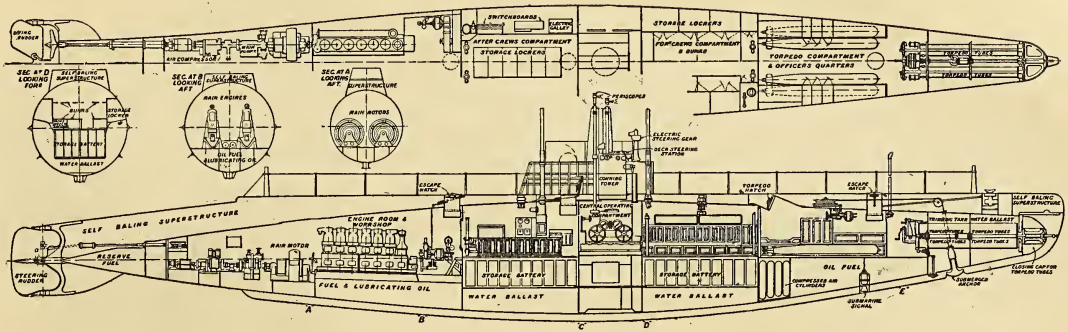
An Electric Waffle Wagon

An enterprising young Chicago man has applied electricity to his business, that of vending waffles and ice cream about the city, by having a body built upon the frame of an electric automobile. The body is painted white and is fitted with doors and windows of artistic design. Within, there is ample room for a small refrigerator and cooking apparatus, and underneath the body is a compartment for the batteries. The vehicle is driven an average of 75 miles a day and impresses one with its cleanliness, which in turn creates a desire to eat some of the products.

ELECTRIC WAFFLE WAGON

Radium in the Air

If it were not for the assurance of the almost immeasurably small quantities one might feel alarmed at the disclosure of radio-active material in the atmosphere. It was first collected by Elster and Geitel on a negatively charged wire some years ago, and was shown to consist of the active emanations both of radium and thorium. The experiments have been now repeated by Kinoshita, Nishikawa, and Ono in Tokyo with improved apparatus, and the net result of their labors is to show that either the first investigators exaggerated the amount of radio-active material present, or else that there is much less radium emanation in the air of Tokyo than in that of Chicago, Montreal, or Cambridge. The amount of the emanation is, in any case, not large enough to cause apprehension, for it is measurable only in billionths of a "curie," the unit so named after the discoverers of radium. But though the quantities are so minute that a mathematical mind is required to appreciate them, it is demonstrable that there is several thousand times as much radium in the air as thorium.



THE DETAILS OF A WHITEHEAD SUBMARINE

A partial plan view and a longitudinal section of a modern submersible torpedo boat of the Whitehead type is shown in the above drawing. It was built for the Dutch navy and modified forms of this boat are largely used by the United States and English navies.

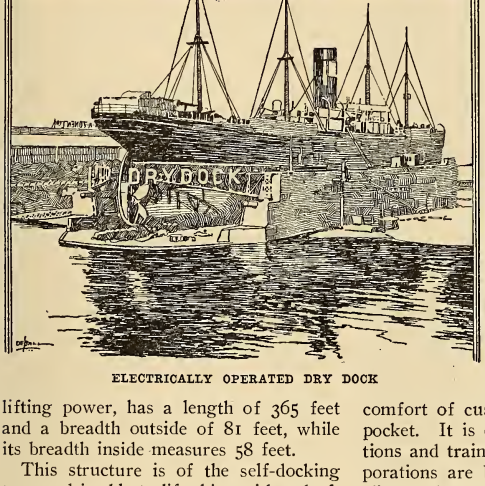
This boat is able to make a surface speed of eleven knots per hour, and at a speed of ten knots has a radius of action of 500 miles. While navigating on the surface it is propelled by a 300 horsepower Diesel engine. When it dives beneath the waves, however, the power is supplied by a storage battery, through a 300 horsepower electric motor. Submerged, a speed of seven knots per hour for five hours is obtainable. That is, it can pass from sight and not come up until it is some 40 land miles away.

In the 200 ton boats of this type there are fixed berths for twelve men. At the bow are to be seen the torpedo tubes, from which the torpedoes, with their terrific charges of guncotton, are propelled. Just over the engine room is to be seen the escape hatch through which the men can come to the surface in case of emergency.

On the occasion of its trial tests one of these boats went down 97 feet without showing any signs of deflection.

Electrically Operated Floating Dry Dock

The accompanying illustration shows an interesting Dutch floating dock, electrically equipped. It is of 4,500 tons lifting power, has a length of 365 feet and a breadth outside of 81 feet, while its breadth inside measures 58 feet.



ELECTRICALLY OPERATED DRY DOCK

This structure is of the self-docking type and is able to lift ships with a draft of maximum 20 feet. It is provided with three centrifugal pumps, each pump being driven by an electric motor supplied with current at 100 volts. These pumps are able to raise, within three hours, vessels of 8,000 register tons, which means about 4,000 tons displacement.

Good Light as an Asset

Measuring results in dollars and cents, scientific illumination is a valuable asset. It appears on the ledger as maximum office efficiency, with minimum office force; maximum factory output, with minimum of "rejects" and "seconds"; maximum satisfaction of customers, consumers, clients—every one to whom you furnish goods or service—with minimum of complaint and trouble; maximum of health and comfort for yourself, your employees, your customers, with minimum of worry, annoyance, and expense; maximum of light to use, with minimum of current to pay for.

The value of good illumination is not realized because it is so subtle. People feel it unconsciously. They avoid a store that is harshly or inadequately illuminated. They avoid harsh lighting just as they avoid noise. On the other hand, in a store where the illumination is quiet but effective they stay longer, do their shopping better and buy more without knowing why. They speak well of the store and visit it often.

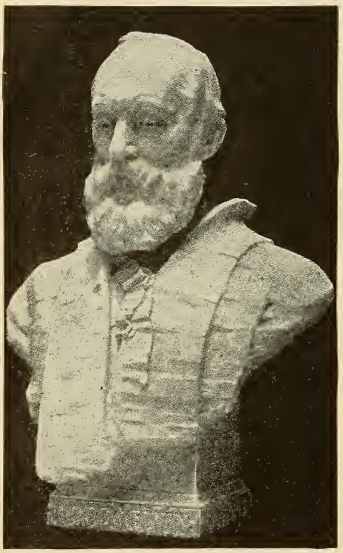
The same thing applies to restaurants and other places where the comfort of customers is money in your pocket. It is even true of railroad stations and trains; for public service corporations are becoming more and more alive to the money value of making their customers comfortable.

The cash value of good illumination in efficiency of employees cannot be overestimated. They work better and with less strain when they have just the kind of light and quantity of light suited to their work. Their eyes are better, their health is better, their heads are clearer. They don't get sick so often and stay away. The output is better, and there is certain to be more of it.—*Scientific Illumination.*

When a battery is only partially discharged it requires only a partial charge. Charging a battery that is already full is not only a waste of current, but is injurious to the battery, and care should be taken to cut off the current just as soon as the maximum charge is attained.

Presentation of Bust of Lord Kelvin

On May 16 a marble bust of Lord Kelvin was formally presented to the Institution of Electrical Engineers, Lon-



BUST OF LORD KELVIN PRESENTED TO THE INSTITUTION OF ELECTRICAL ENGINEERS

don, in accordance with the desire of Lady Kelvin. In behalf of Lady Kelvin the memorial was tendered to the Institution by Sir W. H. Preece, who was followed by Prof. S. P. Thompson upon the achievements of the great scientist. Mr. Ferranti accepted the bust on behalf of the Institution.

American Lamps Superior

Not so long ago Sir William Preece made some statements before the British Association which are calculated to disturb the equanimity of English manufacturers of electric lamps, especially since he based them upon tests made at the instance of the Engineering Standards Committee. He showed, among other things, that the British made lamp falls short of the American made lamp in efficiency, in life and in accuracy of rating. Many English lamps nominally of sixteen candlepower, purchased in open market, showed an average of only 13.2 candlepower, as against 16.2 for the American lamps. They showed also a much smaller efficiency, and their useful life was only one-fifth that of the American article.

Dr. Bell Reminisces After 35 Years

Thirty-five years ago the 25th day of last June Dr. Alexander Graham Bell placed on exhibition for the first time his telephone at the Philadelphia Centennial. At that time (1876) Dr. Bell was teaching in a school for the deaf in Boston and disliked very much to leave his work. In an address which has just been published, delivered Nov. 2, 1911, in Boston before the first meeting of the Telephone Pioneers of America, he told of these early experiences.

"So I went down to Philadelphia," said he, "growling all the time at this interruption to my professional work, and I appeared in Philadelphia on Sunday, the 25th. I was there, and trotted around after the judges at the exhibition while they examined this exhibit and that exhibit. My exhibit came last. Before they got to that it was announced that the judges were too tired to make any further examination that day and that the exhibit could be examined another day. That meant that the telephone would not be seen, for I was not going to come back on another day. I was going right back to Boston.

"And that was the way the matter stood, when suddenly there was one man among the judges who happened to remember me by sight. That was no less a person than His Majesty Dom Pedro, the Emperor of Brazil. I had shown him what we had been doing in teaching speech to the deaf in Boston, had taken

him around to the city school for the deaf and shown him the means of teaching speech, and when he saw me there he remembered me and came over and shook hands and said: 'Mr. Bell, how are the deaf mutes of Boston?' I said they were very well and told him that the next exhibit on the programme was my exhibit. 'Come along,' he said, and he took my arm and walked off with me,—and, of course, where an emperor led the way the other judges followed. And the telephone exhibit was saved.

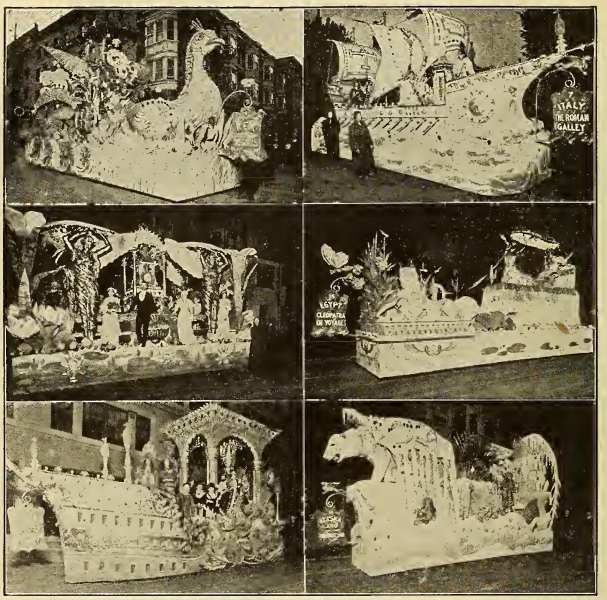
"Well, I cannot tell very much about that exhibit, although it was the pivotal point on which the whole telephone turned in those days. If I had not had that exhibition there, it is very doubtful what the condition of the telephone would be today. But the Emperor of Brazil was the first one to bring that situation about at that time. I went off to my transmitting instrument in another part of the building, and a little iron box receiver—you probably all know what it was from diagram—was placed at the ear of the emperor. I told him to hold it to his ear, and then I heard afterwards what happened. I was not present at that end of the line. I went to the other end and was reciting: 'To be or not to be, that is the question,' and so on, keeping up a continuous talk. I heard afterwards from my friend, Mr. William Hubbard, that the emperor held it up in a very indifferent way to his ear, and then suddenly started and said: 'My God! it speaks!' And he put it down; and then Sir William Thomson took it up and one after another in the crowd took it up and listened. I was in another part of the building shouting away to the membrane telephone that was the transmitter. Suddenly I heard a noise of people stamping along very heavily, approaching, and there was Dom Pedro, rushing along at a very un-emperor-like gait, followed by Sir William Thomson and a number of others, to see what I was doing at the other end. They were very much interested. But I had to go back to Boston and couldn't wait any longer. I went that very night.

"Now it so happened there, that although the judges had heard speech emitted by the steel disk armature of this receiving instrument, they were not quite convinced that it was electrically produced. Some one had whispered a suspicion that it was simply the case of the thread telegraph, the lovers' telegraph, as it was known in those days, and that the sound had been mechanically transmitted along the line from one instrument to the other. Of course, I did not know about it at that time; but when the judges asked permission to remove the apparatus from that location, I said: 'Certainly, do anything you like with it.' But I could not remain to look after it; they had to look after it themselves. My friend, Mr. William Hubbard, who had kindly come up from Boston to help me on this celebrated Sunday, the 25th of June, said he would do his best to help them out, although he was not an electrician. He knew nothing whatever about the apparatus, beyond being in my laboratory occasionally, knowing me well. But he undertook to remove the apparatus and set up the wire under the direction of the judges themselves. So they had an opportunity finally of satisfying themselves that speech had really been electrically reproduced."

Fortuny Stage Lighting

The system of stage lighting devised by Meriano Fortuny, of Venice, whereby a diffused light, very like daylight, is obtained, is most ingenious.

Fortuny uses electric arc lamps, so arranging them as to secure a reflection of their light from surfaces of cloth. The cloth for the purpose is made in broad strips, alternately light and dark, so that a dead white glare is avoided. The proportions of light and dark vary, and the cloth is arranged on rollers, controlled from in front of the stage, so that the operator can watch and change effects at will during the progress of the play. The sky backing for each scene set is arched, to further the illusion.



PORTLAND ROSE FESTIVAL

The dramatic unmasking of Rex Oregonus on the night of June 15th terminated another of Portland's famous Rose Festivals. By far the most notable feature of the evening was the electrical parade which followed a route over 5½ miles long through the heart of the city. Above are some pictures of a few of the most elaborate floats all of which were mounted on electric flat cars deriving current for their propulsion, and for lighting the thousands of lamps, from the overhead trolley. It is estimated that fully 250,000 persons viewed the pageant and all of them voted it "the best one yet."

The floats were made to represent the various countries, and also historical incidents. These were the imperial family of Russia, home life in Holland, Japan the land of cherry blossoms, a Roman galley, Alaska, Columbus' triumphal return, the Land of the Midnight Sun, the Durbar of India, and a score of others. These were all so brilliantly lighted that, as they passed along, the regular street lighting appeared to pale in comparison.

X-Ray in Studying Athletes

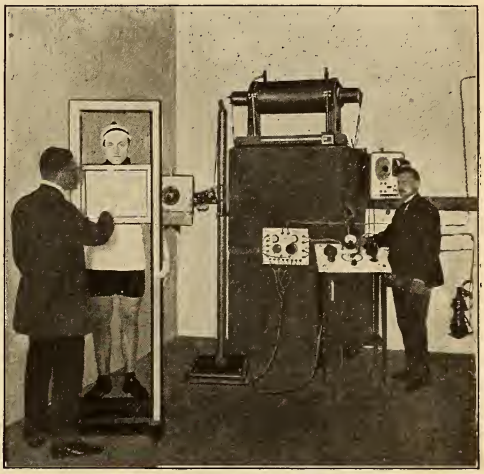
The most divergent views have so far been prevalent among medical men with regard to the effect of athletic exercises on the human organism, especially on the heart. Whereas some practitioners believe the action beneficial, others were of opinion that any continued exertion is liable to produce fatal injury, especially dilatation of the heart.

The continued strain on the sportsman's attention may result in a certain nervousness, but any fear of organic injury seems to be practically unfounded. In fact, the use of X-rays has allowed the behavior of the heart to be watched at frequent intervals during exercises, permitting observing any possible alteration. The recent six-day cycling races held at the Berlin Sporting Palace afforded an excellent opportunity of putting this method to a practical test.

While the cyclists on the wooden 66 meter race course hurried along at a lightning speed, scientific men far down in the basement of the building were busy at work investigating a problem which had long been disputed. An X-ray apparatus of special construction allowed an X-ray record to be obtained within one one-hundredth of a second. This, in connection with a new process designed by Drs. Strauss and Vogt, enabled the shape of the heart to be reproduced on the screen and to be recorded with its accurate dimensions within ten to twelve seconds.

In view of the interesting and valuable results to be expected from these experiments, all the competitors in the races willingly agreed to betake themselves after each individual performance to the X-ray laboratory in order there to have their hearts measured.

While details of the results obtained in this connection have not yet been made known, this much can be said, that the apprehensions entertained by many prominent physicians as to the weakening effects of sport on the human heart are at least exaggerated.



STUDYING AN ATHLETE WITH THE X-RAY

The Electric Swan Boat

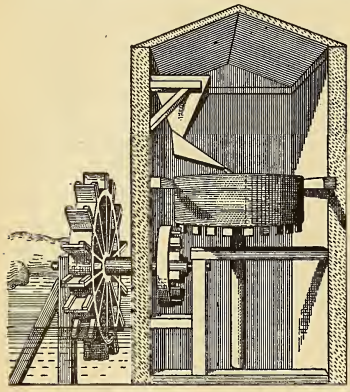
The electric swan boat, in which passengers and driver ride, has rigidly connected with it, at the bow end, a swan shaped tug containing an electric motor driving a propeller. The craft is steered by means of reins attached to the head of the swan, which turn a rudder of ordinary pattern. The driver has also close at hand a regulator, which gives him control over the machinery in the swan. The vibration of the boat is said to be much less than in one that carries its own motor.

From Ancient to Modern Water Wheels

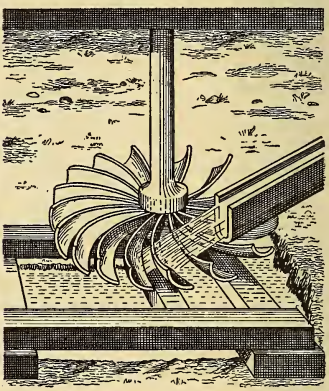
The Chinese claim the use of water wheels as far back as 1000 B. C., but at that time human labor was too cheap and human wants too simple to require any extensive use of the energy from flowing water.

The American Indian and the early settlers in the New World ground corn by placing it on a hollowed rock and then crushing it with a second stone by using muscular labor, yet back as far as 14 B. C. in Rome a crude wheel served to operate the mill stones for the grinding of corn. This form of wheel was operated by the current flow of the stream.

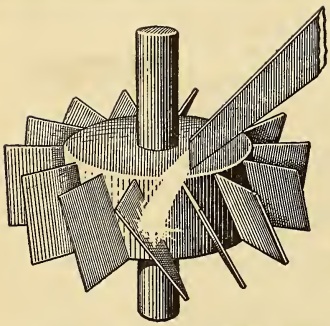
At an early but unknown time an advance over the current wheel was made by placing blades upon a vertical shaft and in such a position as to receive the energy of the water by having it strike the blades, and this type, a form of "impact wheel," forecast the modern steam turbine.



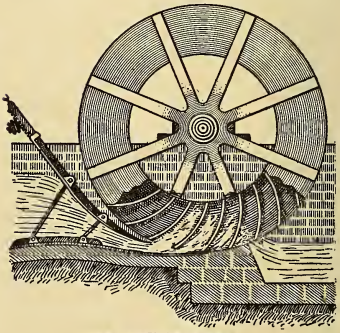
GRINDING CORN WITH A CURRENT WHEEL—ROME 14 B. C.



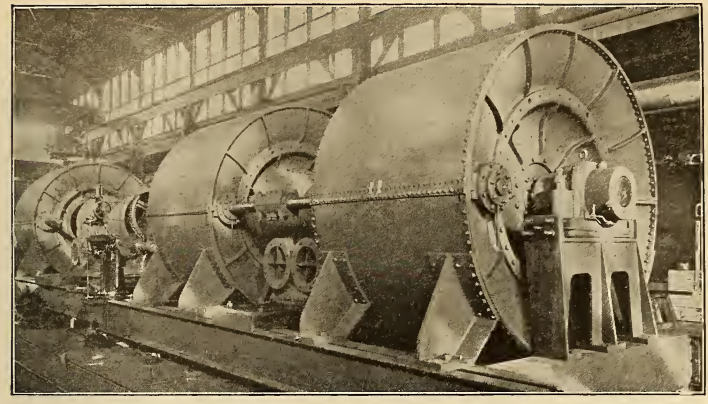
THE IMPULSE WHEEL



THE IMPACT WHEEL



THE UNDERSHOT WHEEL



A MODERN HYDRAULIC TURBINE GENERATING ELECTRICITY IN THE PLANT OF THE MADISON RIVER POWER COMPANY, MONTANA

Some 130 years ago a Swiss mathematician, Euler, began considering a curved blade to receive the water and the "impulse wheel" with spoon-shaped buckets was the result. The overshot wheel which operated from the weight of the water carried from the top of the wheel down the far side proved cumbersome and often costly, as regards the masonry work to get the water to the wheel. The undershot wheel was a decided advance in that the water was received on curved surfaces upon the underside of the wheel in such a way as to make its velocity count and the increase in efficiency over more ancient wheels was around 50 per cent.

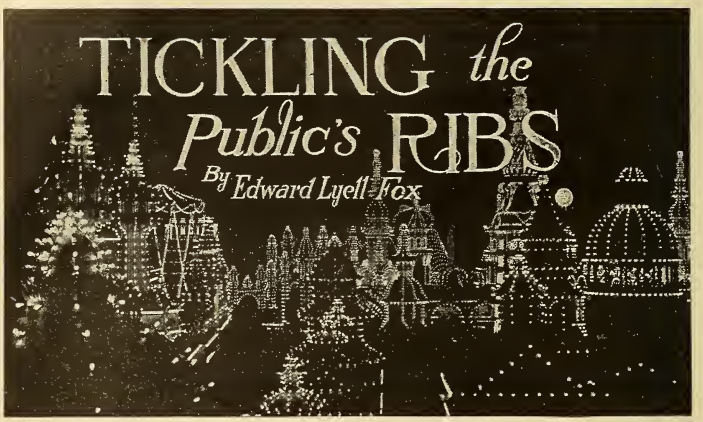
The word "turbine" seems to have been applied to a water wheel upon a vertical shaft in which the water by pressure or impulse acted upon the entire circumference of the wheel, coming either from the outside or from within and discharging accordingly.

Europe has done more than this country in the past to perfect the turbine, but of late years American builders, waking up, have designed and installed some of the best of water turbines, some very massive as indicated above.

Insulation from Seaweed

A new product, based on common seaweed, which is found in such unlimited abundance, is announced as the result of many years of experimenting in England. Many scientists have foreseen the enormous possibilities afforded by seaweed, and the material just discovered, called seagumite, bids fair to exceed all expectations, as it is of special value in all electrical industries, being a non-inflammable insulation of high dielectric strength, proof against heat, cold, oils and weather. A singular property is the increase of insulation resistance following immersion in water. The material is unaffected by dilute sulphuric acid, which makes it well adapted to storage battery jars and separators. Among associated mechanical uses, seagumite seems well adapted for motor gears, switchboard panels, switch handles, steam and gas packing, especially for high pressures. The product is also well suited to replace leather in belting.

Do not forget the comfort a fan in the kitchen may afford by exhausting the hot air and kitchen odors, to the outside, or by forcing in the cooler breezes.



Do you know that electricity has made possible Coney Island not only by night but by day? Do you know that the Borealis, flashing over it nightly, has been an important factor in its development; that the wheels of all the great amusement parks are driven by the power that is generated in dynamos? Consider that it costs $3,000 a night to light its wooden spires; that these are ablaze 140 nights a year, making the bill of $450,000. Do you know that a man with a headful of figures has computed that if all the electric bulbs of Coney Island were placed in a line 30 feet apart that they would illuminate the way from New York to San Francisco? Surely you will admit it is indeed the City of Electricity.

Paris has a carnival in Mid-Lent, but New York has one every day from the middle of May to the middle of September. Last year 20,000,000 people took part. They came from all parts of the country. Coney Island, you see, is a national show place like Yellowstone Park, like Niagara Falls. Also, the same people spent $45,000,000, according to the adding machines, and adding machines do not lie.

Unlike Gaul, all Coney is divided into four parts—Steeplechase, Luna, Dreamland and the section of general shows. These, taken one at a time, show their dependence to a remarkable extent upon electricity. Let me illustrate:

If you happen to be in Steeplechase Park some day, you may notice a blue-eyed, bristling red-moustached man whose hair, seemingly damp, gives one the impression that he is always working. He is George C. Tilyou. Tilyou, the proprietor of Steeplechase, was one of the first men to recognize the value of electricity for amusement park purposes. When he was three years old he went to live at Coney Island with his folks. School days over, he became interested in real estate and finally organized the old Surf theatre on the Bowery. Also, Tilyou ran a clean show. At that time John McKane, the political boss of Coney Island, wanted the other type of show. He could obtain graft from it. So he and Tilyou began to fight. Twice Tilyou lost all he had, but finally he won out. McKane went to the penitentiary for ballot box stuffing. And this is why Tilyou won out:

One day as he was walking along the beach he saw some youngsters playing around an upturned cart. They had rigged up a platform on its wheel and

spun this around until one of their number flew off, falling on the sand. Instantly there came to Tilyou the idea of the "Human Roulette Wheel." Using the principle of centrifugal force, he built a huge wheel of smooth wood and about it a wall of cushions. To the wheel was attached an electric motor which made the wheel revolve, accelerating at every revolution. People paid ten cents for the privilege of sitting on this wheel and finally being hurled off into the cushions. This netted Tilyou $50,000 and was the start of his successful Steeplechase Park.

Also, it is very significant that the other big attraction of the park is run by the same power. This is the "Steeplechase," from which the place took its name. One day Tilyou sat watching a merry-go-round. He looked idle but his brain was busy. On this particular merry-go-round the wooden horses moved up and down. There was a crowd waiting to ride them, but at the merry-go-round across the street, where the horses were stationary, there was nobody. The proprietor of the successful merry-go-round came to Tilyou and said:

GEORGE C. TILYOU—BUILDER OF THE NEW STEEPLECHASE

"The reason for my success is that the people want all the action they can get. They like the idea of jerking up and down as well as going round and round."

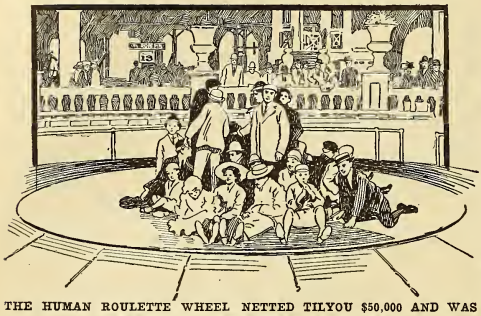
And, as the organ from the failure across the street creaked dismally, Tilyou thought.

"Why wouldn't a contrivance on which the wooden horses run a race be even more popular?"

Not being able to answer the question in the negative, Tilyou went to work on his invention. At the end of a half year he gave to Coney Island the Steeplechase. This was a loop of track, uphill and down, under bridges and over them, on which six wooden horses, operating on the principle of the cable car, raced; and it earned a fortune.

But let us walk up Surf Avenue, the aorta of the Island, until we come to Luna Park — a wonderful place of papier-mache, mountains and valleys, minarets and and towers, streets of quaint wooden pagodas. This is the place where nearly a million and a half electric light bulbs burn nightly, where the power used is enough to illuminate a city of 400,000 souls, where electricity, as an agent in producing illusions, is seen at its best.

In the beginning was Frederic Thompson, a young mining engineer of Nashville, Tenn. Every once in a while you read of Thompson failing, going into bankruptcy; but always he comes to the front again, stronger than ever. Over ten years ago he obtained the use of one of the big exposition buildings at Nashville. In it he staged his "Trip to the Moon," an illusion in which the scenery revolved downwards, giving the passengers aboard his stationary airship the impression that they were being lifted into space. Wonderful light effects were obtained by dexterous use of violet and pink shades. From Nashville he took his "Trip to the Moon" to the Pan-American Exposition, and meeting there Elmer Dundy they decided to try it on New York. On May 16, 1902, they organized Luna Park, which was named, not after the "Trip to the Moon" but after Dundy's little sister. Their big electrical illusion was the attraction, however, and at the end of the year they had realized 90 per cent on their



THE HUMAN ROULETTE WHEEL NETTED TILYOU $50,000 AND WAS THE START OF THE STEEPLECHASE PARK

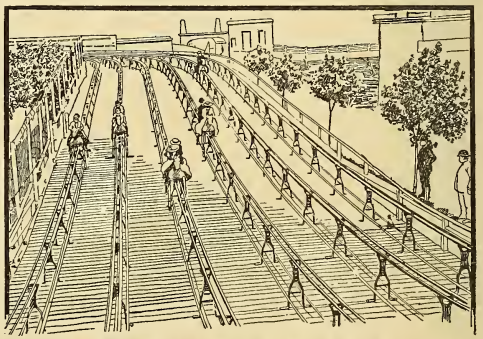
original investment of two and one-half million dollars.

From that first successful use of electricity grew the many attractions of the park.

Take the "trick walk" that one encounters shortly after entering. The planks of this spread in all directions as one moves forward, being jerked by a series of levers connected with a motor. So with the "Witching Waves"—a canvas covered surface made to undulate in a similar manner. Over this surface cars full of laughing passengers rock to and fro.

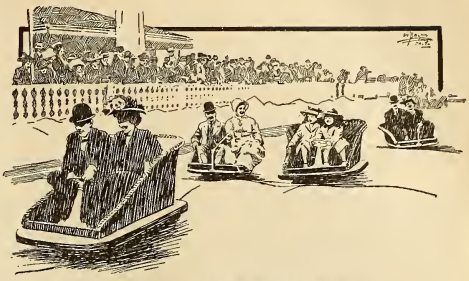
But electricity was carried to bigger things. One day Thompson thought it would be a good idea to show the public what damage could be done by a tremendous volume of water, suddenly turned loose. He spent $200,000 doing that and made as much more. He called his new attraction the "Crack of Doom." By means of powerful electric pumps he drew daily a million gallons of water from the ocean into a great reservoir. The water came, 65,000 gallons every minute, through 22-inch mains. Then the reservoir was decorated to represent a mountain and below it was built a ten foot tank at the top of which was a mining town in miniature. When the show began the audience saw the town at sunset. The lighting effects used by theatrical men were made doubly effective through Thompson's skill. Gradually the painted sky darkened into night; one by one lights began to twinkle in the little houses, scenes of riot and dissipation came into being throughout the camp—some Gomorrah of the Northwest. Then, when the orgies were at their height, a judgment in the form of a sudden deluge was visited upon the place. Behind the scenes a man pressed a button and, the reservoir opening automatically, the water came hissing and tumbling down, sweeping everything before it and tumbling the little houses in a dark surge.

It has been said of Thompson that his psychological recipe for amusement park success is "let the crowd amuse itself." He does that with his "helter-skelter," a cane slide down which people



SIX WOODEN HORSES OPERATED ON THE PRINCIPLE OF A CABLE CAR EARNED A FORTUNE

shoot amid the laughter of hundreds looking on. In nearly every other case, however, he calls upon electricity to help the crowd in the unconscious task of "amusing itself." Yes, Thompson is enamored of electricity. Last year he even went so far as to do away with the little steam railroad that ran around Luna and in its place installed an electric system. Now he has two roads, two third-rails and two double end motor cabs.



A RIDE ON THE WITCHING WAVES

So it is with Dreamland. Its great tower formerly ablaze with thousands of lights hints that electricity is the keynote of the place just as it is at the other two parts. They'd no use for steam power of any kind. They even had a Hall of Electricity, in which one could be shocked for the asking and view all sorts of great apparatus to say nothing of electrical curling irons. Then they had their big illusion like the one at Luna. Only here it was called "The Fall of Pompeii" and an electrical volcano got in its work after vari-colored electric lights have shown the city in beautiful hues. And there's "Creation" too, the only constructive show of the spectacular type. It too, however, was dependent upon electrical effects.

But let us leave these three great parks. We have seen that their success depends wholly upon electricity. Now let us visit the swarm of general attractions scattered throughout the Island. Most important among them is the Scenic Railway. Of this there are two types—the one in which the cars are motor driven, and the gravity railroad. Of course the former type is using electricity all the time. The latter, though, employs it as well. By cables the cars are carried to the top of high points, where they gain the potentiality for their wild dashes up and down and around.

Also, we find in many of the side shows up-to-date uses of electricity. There are glass palaces, of many colored lights, and stairways, their steps charged with electricity, giving the walker the sensation of countless needles entering the soles of his feet.

And because of electricity Coney Island is a success—such a success that twenty million people visit it every year, spending $2.25 apiece. The whole proposition would be regarded by a hard-headed business man as a gamble. But the splendid audacity of the showman makes a surety. In his weird city of make-believe he gives wild license to the imagination and pays cash to bear out his theories that the public wants to amuse itself in the most ridiculous manner.

Carnival at Nice

Some notable features were produced in the floats shown at the Nice Carnival, in France, this year, the floats being so made that they could be used in an electric parade following the day parade. Nearly all the floats, some of which were very elaborate and costly, were trimmed with row after row of electric light bulbs, the floats carrying powerful batteries concealed beneath the decorations. One float which attracted much attention was a satire on well-known French officials. One huge figure sat in front holding a huge imitation electric lamp, studded with small globes, his cocked hat also being studded with electric lights. A figure sitting over one wheel had half the body sticking through a picture frame, with electric lights around the edge of the frame.

Another float represented a huge fish overwhelming a small boat in which were figures holding blades aloft. Rows of lights along the gunwale of the boat and down the edges of the oarblades were lighted at night. Huge spiders with electric light eyes crawled in the sand beneath the stern of the boat.

SOME VIEWS OF THE ELECTRICAL PAGEANT AT NICE

One of the most striking floats represented King Carnival riding in his carriage drawn by a horse wearing a summer sun hat. The King wore a light studded crown and carried a light studded scepter. The dummy driver's hat was fringed with light bulbs and the carriage, shafts and harness of the horse were also covered with them. This float was drawn by six horses in white trappings.

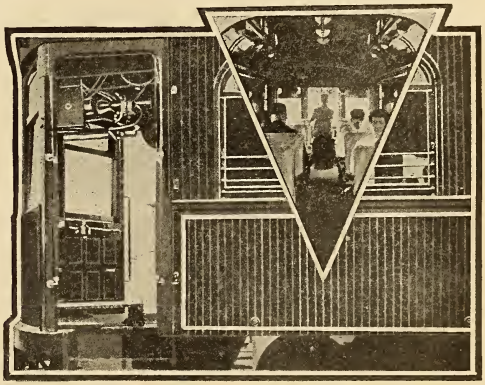
Another striking feature was a half dozen walking lamp-posts. These were hollow and contained a man hidden

within as the motive power. On the front of each was a face and a small battery at night lighted up the transparent tops. Electric lights were profusely used about the buildings along the streets and about the square, over the route of the carnival procession.

Moving Picture Theater in Trolley Car

The Pittsburgh, Harmony, Butler and Newcastle Electric Railway has put in service on its road a special car in which moving pictures are exhibited for the entertainment of its passengers during trips. Of the many schemes called into service for the entertainment of the traveling public this is certainly the most unique and marks the entrance of the moving picture into another field. The car in which the pictures are exhibited is not run regularly, but is used for the accommodation of special parties by whom it is chartered for a certain run. Being badly damaged in collision with another car, the superintendent in having it repaired installed in the rear platform a moving picture machine, with a small bench upon which the operator of the machine may stand. The machine draws its power for use in the arc light from the trolley and, although the power varies with the amount consumed by the car, there is little or no flicker.

When the pictures are to be exhibited, the screen is first lowered just back of the motorman. This is opaque, so that no light penetrates it and interferes with the motorman in his cab. The electric lights in the car are turned out, window curtains are drawn, and the car resembles a small moving picture theater.



MOVING PICTURES IN A TROLLEY CAR

Absorption in X-ray Tubes

As usually known, X-rays arise in vacuum globes called Crookes tubes, just where the rays from the cathode strike a piece of platinum, tungsten, or molybdenum, called the anti-cathode.

Roentgen rays differ from light rays in being short pulsations instead of continued waves. Hitherto, the Crookes tubes, which give X-rays, have absorbed as high as 70 per cent of these valuable rays.

Sir J. J. Thomson has just discovered that the waste and absorption of these rays really depends upon the atomic weights of the elements composing the kind of glass used. He therefore suggests that glass tubes be manufactured with elements of the lightest weight. This has been applied now practically by using a glass composed of lithium, beryllium and boron, with a combined atomic weight of 27, in place of calcium, silicon and sodium glass, whose combined weights are 92.

As a result, when these new glass tubes are used, only about fifteen or 20 per cent of the rays are lost.—L. K. Hirshberg, A. B., M. D. (Johns Hopkins).

Electrical Display Accompanying Mt. Taal Eruption

Some 37 miles south of Manila in the Philippine Islands is Bombon Lake with Volcano Island in its middle. The soil of this island is rich, but only the most courageous of the Filipino farmers cultivate it because of fear that one day Taal volcano, which has wrought destruction many times before, will again become active.

The earliest eruption is recorded by the Augustinian friars 340 years ago. "There is a volcano of fire which is wont to spit forth many and very large rocks, which are glowing, and destroy the crops of the natives," read the records. Something like eighteen times Taal has belched forth, the last disturbance occurring in January, 1911. A description of this destructive eruption and the unusual electrical phenomena accompanying it is given in the *National Geographic Magazine* by Dean C. Worcester.

"Taal continued unusually quiet until January, 1911. During the night of the 27th of that month the seismographs at the Manila Observatory commenced to register frequent disturbances, which were at first of insignificant importance, but increased rapidly in frequency and intensity. The total recorded shocks on that day numbered 26. During the 28th there were recorded 217 distinct shocks, of which 135 were microseismic, while ten were quite severe. The frequent and increasingly strong earthquakes caused much alarm at Manila, but the observatory staff was soon able to locate their epicenter in the region of Taal volcano and to assure the public that Manila was in no danger, as Taal is distant from it some 37 miles.

"Definite news that Taal was in eruption was received during the morning of January 28, in a telegram to the Director of the Bureau of Science from Mr. J. D. Ward, who conducts tourists to the volcano. Mr. Charles Martin, the government photographer, left for the scene of disturbance at three p. m., reaching the edge of Bombon Lake at eight p. m.

"He had been sent to obtain a photographic record of the phenomena of this eruption, which no one anticipated would be destructive, and he proceeded to perform his appointed task with extraordinary coolness, and with complete disregard for his personal safety. It is due to the merest chance that he is alive today.

"Early in the morning of January 29 he crossed the disturbed waters of Bombon Lake in Mr. Ward's boat and by eight o'clock had made his way to the crater rim, from which point he secured a magnificent series of photographs giving an impressive idea of the play of titanic forces which was then occurring.

"The varied phases of this imposing display tempted Mr. Martin to expose plates until his stock became practically exhausted, when he returned to Tanauan with but a single plate ready for use.

"At 1:05 on the following morning he was awakened by an extraordinarily heavy explosion, and saw an enormous column of mud rising from the crater, which was distant some eleven miles. There was a magnificent display of 'chain' lightning about the black mud cloud, and the explosion had awakened and terrified every one. Twelve minutes later there was a rain of mud at Tanauan. It was followed by a fall of fine, dry volcanic ejecta. Shortly before two o'clock the sky, which had been obscured by the black mud cloud, cleared completely.

"While Mr. Martin and his companions were still discussing the imposing phenomenon which they had witnessed, there occurred at 2:20 two terrific explosions, or I should perhaps say a double explosion, for the second report succeeded the first so quickly as almost to coincide with it, and people a little further away noted but one concussion. We now know that this explosion tore most of the floor out of the main crater of Taal volcano and hurled it skyward. A huge black cloud continued to rise for

GOVERNMENT PHOTOGRAPHER MARTIN AND GEOLOGIST PRATT ON THE EDGE OF THE CRATER OF THE TAAL VOLCANO. THE PHOTOGRAPH OF LIGHTNING FLASHES IS REDUCED TO ONE-THIRD SIZE—THEY WERE FIVE MILES FROM THE CAMERA

a long time. Its ejection was attended by a most extraordinary electrical display, which was visible for 250 miles.

"The explosion was heard over an area more than 600 miles in diameter. In the subprovince of Kalinga the wild men thought that the dynamite stored at Lubuagan by the government for use in road construction had exploded, and throughout the following day delegations from various settlements visited the town to ask if this was the case.

"Mr. Martin says that the cloud at first rose steadily, but 'soon the wind got hold of it and it spread out all over the country, leaving us in total darkness. Wet mud started to come down in Tanauan twelve minutes after the explosion.

"In Manila the shock of the explosion was so great that people leaped from their beds in terror, thinking that there had been some great catastrophe in the city. Their attention was instantly attracted by the glare of the electrical display, and many of them realized that Taal must be in full eruption. The thousands who witnessed the extraordinary sight agree that it beggared description, and few of them have even attempted to describe it. The streams of electric fluid seemed to be of extraordinary breadth.

"With the instinct of the photographer still alert, Mr. Martin exposed his one remaining plate; but, unfortunately, in the excitement of the moment he failed to realize that a flash of lightning makes its own exposure; and, fearing that the steady glare resulting from the myriad discharges would fog his plate, timed his shutter to one six-hundredth of a second, with the result here reproduced.

"When it is remembered that these flashes were taken at a distance of some five miles through a lens with a focal length of 300 millimeters, and that the photograph is here reproduced one-third size, some idea will be gained of the breadth of the discharges.

"The thousands upon thousands of people who were awakened by the final explosion in time to see the enormous column of ejecta shooting up from Taal, and to witness the extraordinary attendant electrical display, little dreamed that in the twinkling of an eye some 1,400 human beings had perished."

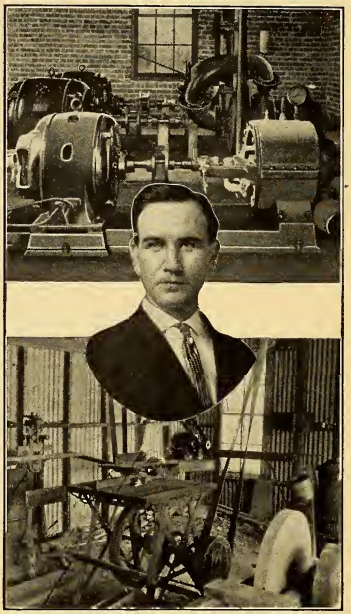
Electrifying a City

It is no small undertaking to electrify a single building, even under favorable conditions, and the man who would undertake, and carry to successful completion, the electrification of a city of 2,100 people must be energetic, resourceful, well trained.

Such a man is George Edward Johnson and the city to which he first applied his principles is Sabetha, Kan.

The lighting plant at Sabetha, when Mr. Johnson took charge, had been operating under municipal direction, and at a loss, for nine years. With a definite idea in mind and with carefully thought out plans he set about reorganizing and improving the central station service. How well he has succeeded may be appreciated from the fact that out of the total 700 houses in the place 600 are taking current and use in the aggregate 7,000 lamps in the stores, factories and houses. There are also 600 motors in use, driving every conceivable appliance for the lessening of manual labor on the farm, about the house and in the factory.

The first great work of putting the plant on an efficient and business basis was successfully accomplished at an outlay of $8,000, devoted mainly to new and modern apparatus, and the task then presented itself of building up an adequate consumer load that would tax the capacity of the machines. The most important step was, after the introduction of the electric light into a major portion of the homes and factories, the application of the electric motor to the various power uses of the city. The city itself led the way by installing a complete equipment of electric motors to drive all its pumps and furnish its entire water supply. All the water the citizens use is also obtained by electric pumps, and at the most reasonable rates.



GEORGE EDWARD JOHNSON, ELECTRIFIER OF CITIES, AND EXAMPLES OF HIS WORK IN SABETHA, KANSAS

So satisfactory was the city's venture that motors of the same type were soon installed wherever the need for power existed, and only a short time ago the last gasoline engine power plant was sold and the money used to buy an electric motor.

Mr. Johnson, having started the larger users of current in the right direction, went after the grocers, carpenters, butchers and other trades people in the city and also after the farmers in the outlying districts. It was in one of these latter campaigns the Sabetha plant secured as

a customer the entire town of Morrill. Practically all the storekeepers in Sabetha use electricity and reap the consequent advantages as do the storekeepers in the large cities.

Even the small and unpretentious carpenter shop has its motor. The one illustrated is some distance out of the city and the single phase motor is connected to the same transformer that carries the lights of a number of dwellings, but no disturbance is noticeable on these lines when the motor is started.

The next and final step in the electrification was the introduction of current devices other than lamps into the homes of the city. Mr. Johnson, with the coöperation of Mrs. Johnson, a graduate engineer, by the way, equipped their house with every modern electrical device that could be obtained, and aside from the regular use of the various appliances, gave special demonstrations of the more popular pieces, such as flat irons, fans, washing machines, curling irons, etc. It was not long before a demand was worked up for these handy household current-consuming devices.

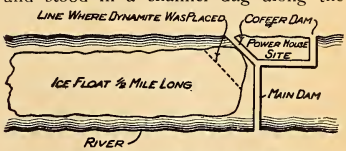
Finding that he still had some steam to spare even at the peak of the load, and that lots went to waste, exhaust pipe lines were laid, radiators bought at wholesale, and the city homes are now users of central station steam heat as well as current. There still being some exhaust steam to spare, arrangements were made to sell it to a big laundry and to an ice plant, so that they would use not only the electricity the plant made but also the steam it would have ordinarily wasted.

The Invention of the Acousticon

The Dictograph which has become so prominent in the last six months and which was described in the June issue under the title "Eavesdropping by Science" is but an adaptation of the acousticon which was invented some ten years ago by Mr. Miller Reese Hutchison, as the technical press of that period will indicate. Therefore, the statement in the above mentioned article, to the effect that the acousticon and interior telephone were invented by Mr. Turner, is an error, which we take this opportunity to correct.

Saving a Power House From the Ice

Last spring a new power house was in course of construction on the Kankakee River. It was only about half completed and the steel framework was already in and stood in a channel dug along the



HOW THE ICE TROUBLE WAS AVERTED

one side of the river to a depth of 50 feet below the water level. The water was kept out of the channel by cofferdams built all around it, as shown in the sketch.

Ice had coated the river to a depth of sixteen inches and when this began to go out a lot of trouble was experienced. One afternoon a large ice sheet, fully a half mile long and the width of the river, came down and lodged against the upstream cofferdam in such a way that the whole weight of the float rested against the dam. Smaller pieces coming down the river piled up against the large float, which gradually increased the pressure until the cofferdam began to give.

Dynamite was freely used to break up the ice by laying five or six sticks on the ice in a line and lighting the fuses with a match. This scheme, however, did not work, as they could not shoot off enough at one time.

They then decided to place a row of sticks half way across the river on the side resting against the cofferdam and shoot them all off at once by means of electric current. This was successfully accomplished and the cofferdam relieved of the enormous pressure in time to save the plant.

Electrical Colloids

By DR. LEONARD KEENE HIRSCHBERG,
A. M., M. D. (Johns Hopkins)

The introduction of the metallic colloids into medicine constitutes a new departure, the significance of which is not generally recognized.

Colloids are substances that will not pass through an animal membrane, of which gelatin, albumin, and white of egg are typical instances. Until recently this was about all that was known of them, although, as the animal organism is wholly composed of colloids, it is only by a thorough knowledge of their interaction that the reactions taking place in the human organism can be understood.

The discovery that it is possible to convert certain metals and metallic salts into the colloid state, and the careful study of these metallic colloids, however, show that they are reduced to infinitely small particles. Some idea of the minuteness of these particles can be gathered from the fact that a cubic millimeter of ordinary colloidal gold is estimated to contain 1,000,000,000 of them, and what would be considered a solution of fine particles at least twice that number. These granules are animated by what is known as Browian movement and are enabled to remain in suspension in a liquid medium almost indefinitely, their stability depending on the size of the granules, the nature of the body and of the vehicle employed. It is interesting to note that the number of granules varies according to the cube of their size, so that if their size be reduced to one-half, their number is multiplied by eight, a fact of considerable practical importance because the activity of these solutions depends upon the multiplication of these centers of activity.

There are two principal ways of producing metallic colloids, viz., chemical and physical (electrical). The chemical preparation of a colloid metal is effected by the slow reduction of a salt of the metal, as, for instance, by treating nitrate of silver with a mixture of sulphate of iron and citrate of soda. The physical method consists in passing the electric arc between electrodes of the metal to be converted into colloid, plunged into distilled water. Under these conditions the electrodes throw off an extremely fine powder which remains suspended in the liquid. The two methods of production yield widely different results, and from a therapeutical point of view I need only deal with the electric colloid metals, since only these present the necessary homogeneity, minuteness of granules, purity, and stability.

A solution of electric colloid silver (small-grained) is of a brownish-red color (the solution with larger grains has a green tinge). It diffuses light and is vaguely opalescent. For therapeutical purposes it is made stable by modifying the composition of the aqueous medium and is rendered isotonic with blood serum by the addition of sea salt. Thus prepared for use, it is known as electrargol, and is one of a series, electraurol, electroplatinol, electromercurol, etc., which all appear to possess the same properties in approximately the same degree, a fact which militates in favor of the view that it is the physical state of the substance rather than its nature that determines its effects. These colloid metals, like colloids in general, have a special electric charge, and thanks to their state of fine divisions they possess a certain catalytic power—that is to say, by their mere presence they can determine very powerful chemical action out of all proportion with the quantity of matter brought to bear. From this point of view the action of colloids resembles that of the ferments.

Although of comparatively recent introduction, the medical applications of the colloid metals are numerous and

interesting; indeed, their employment inaugurates a fresh chapter in medicine.

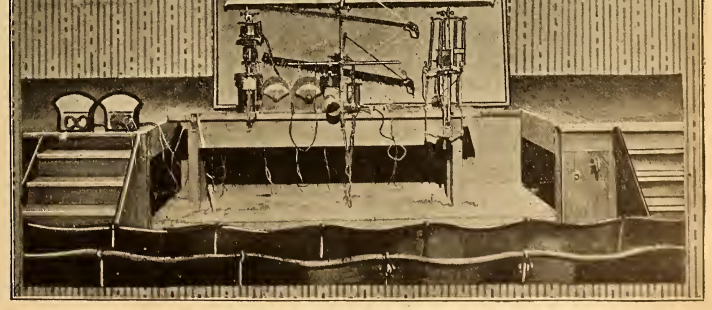
Speaking generally, the colloidal metals are especially remarkable for their beneficial action in infective states — blood poisoning by germs. This action has been shown to be due to their stimulating influence and to their destructive effects on micro-organisms and their toxins as shown by the immediate fall of temperature, and the subsidence of the constitutional symptoms of intoxication. They are employed as a rule for the sake of their constitutional effects, for which purpose an injection of from five to 20 c. c. is made into muscle or, in urgent cases, into the veins.

Even more interesting are the results obtained in acute meningitis and in epidemic cerebro-spinal meningitis. In the latter, electrargol can be employed either alone or in conjunction with the serum treatment. The injection is usually intravenous, but in severe cases it should be made directly into the spinal canal so as to obtain immediate effects.

A DISAPPEARING LABORATORY TABLE

At the Lewis Institute, Chicago, a novel means is provided for handling experimental apparatus in classes in electricity and physics. The laboratory is located in the basement under the auditorium. The lectures are delivered in the auditorium above. Under Professor Woodworth's direction a section of the front portion of the stage was arranged upon hinges so as to drop down while the front portion lays forward upon the floor. An elevator was installed which runs from the floor level of the basement up to the stage level. After the apparatus has been placed upon the elevator platform in the basement and with the hinged parts of the stage out of the way, the elevator lifts the apparatus into the auditorium and to any height convenient for demonstrating.

As shown in the illustration, the elevator platform is equipped with a regular laboratory table to which are attached connections for providing electricity, gas, air and water. The apparatus shown is that used in a lecture upon arc lamps and includes three types of arc lamps, a mercury vapor lamp and instruments for measuring voltage and current.—Clarence M. Bartelme.



A DISAPPEARING LABORATORY TABLE

The New Edison Rectifier

By W. H. MEADOWCROFT

Without question, the owner of an automobile would regard it as an ideal condition of affairs if he were able to run electric lights in his car, operate his ignition system and automatically start his machine from one common source of supply, which could be constantly renewed by him at his home without trouble and at small expense.

All this, however, is only possible by the use of storage batteries, the great drawback to the extensive use of which has been the lack of practically universal facilities for recharging. Where direct current is available this presents no difficulty at all, but the major proportion of the public electric circuits supply only alternating current, which, of course, cannot be used for charging storage batteries, except through the medium of motor-generators or rectifiers of various types.

An alternating current rectifier has been developed at the Edison Laboratory after a long and persistent series of experiments made to determine the most reliable and efficient means of charging a storage battery from an alternating current circuit. And, moreover, it has been designed to meet the needs of the average automobile owner who may be the merest tyro as regards electrical apparatus.

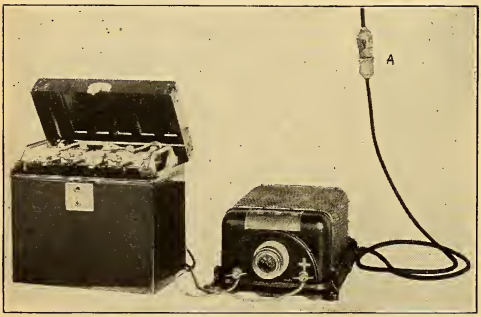


FIG. 1. THE NEW EDISON RECTIFIER

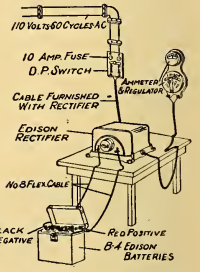


FIG 2. CONNECTIONS OF RECTIFIER

The new rectifier in theory and in fact is a simple electro-mechanical valve which allows current waves of only one polarity to pass through it from an alternating current circuit to the battery which is to be charged. It consists of an arrangement of vibrators controlled by magnets, with a capacity device in circuit. The charging current begins and ends exactly at the commencement and closing of the positive wave, hence there

is absolutely no spark when the rectifier is in operation. Edison, with his accustomed thoroughness, has been running one of these devices on a destructive test, but thus far has not succeeded in breaking it down, although it has been in operation continuously for more than 5000 hours, delivering its full load of current and requiring no stoppage for repairs or adjustment in all that time. This is equal to several years' duty in ordinary charging service for automobile use.

The method of operating it is as simple as the turning on and off of an ordinary electric light. An indicating snap switch of the usual form controls the starting and stopping of the charging current. This rectifier will run continuously, giving any desired charging rate of current within its rated capacity. There being no commutator, brushes, bearings, vacuum tubes, or special starting devices, there is no need of an expert's services to operate it or to keep it in good running condition.

Figure 1 shows a small size of Edison's rectifier connected up and charging an ignition battery of five cells of Edison storage battery. It will be seen that the connections are exceedingly simple, consisting of the usual connecting cord and plug at (A), and a charging lead running from the positive side of the charging terminals on the rectifier to the positive pole of the battery, and another lead connecting the negative terminals, as shown.

On turning the snap switch to the "on" position, the proper charging current will flow into the battery. When the charging is completed, the switch is turned to the "off" position and the battery leads are disconnected. Any battery will charge in just the same time on the Edison rectifier as though it were running on an ordinary direct current charging circuit.

A larger size of this rectifier, for 20 amperes capacity, is made for charging two sets of battery, and in this case, in order to insure correct adjustment of the charging current, a regulating rheostat and ammeter is connected in the charging circuit.

Figure 2 shows a plan of connections for this rectifier. In this instance the rectifier is connected to a wall receptacle of the ordinary type and the circuit goes through a small switch and cut-out. This makes a permanent and reliable connection, easy to install and free from accidents. With batteries of the lead-acid type, the use of a regulating rheostat and ammeter in the charging circuit is advisable.

The usefulness of this rectifier is not limited to the charging of storage batteries, as it may also be employed to furnish direct current from an alternating circuit to any electrical device connected with it. For example, it can be used to advantage to operate a direct current arc-light for the illumination of motion picture machines and stereopticons; also for operating railway signals, and telegraph and telephone apparatus.

Retouching and Printing Frame

The illustration shows an equipment for the rapid printing of post cards and developing papers. The light bracket is

RETOUCHING AND PRINTING FRAME

adjustable to any desired position, thus giving control of the light intensity. The lamp is switched on and off automatically by the release of a spring switch when the pressure board is opened or closed. For retouching, a special socket is provided, so that the light can be placed just behind the frame and reflected to the negative by a white enameled reflector.

A Self-Supported Telephone

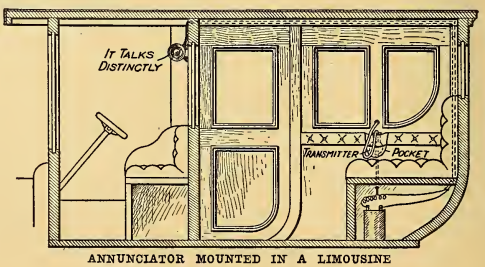
It is often a great convenience to be able to use both hands while carrying on

SELF-SUPPORTED TELEPHONE

a conversation over the telephone. The Van Akin combined transmitter and receiver permits this by having a substantial and adjustable support.

Auristophone Annunciator for Limousines

Those who are so fortunate as to own limousine cars will find the Auristophone electric, loud speaking annunciator an improvement over the old-fashioned Dutchman's pipe megaphone for giving orders to the chauffeur. The system consists of a voice receiving instrument or transmitter carried in a little pocket in convenient reach of the passenger. This is connected through a cell or two of battery with a reproducer affixed to an amplifier in the chauffeur's compartment. The chauffeur can hear the passenger's voice readily and without putting a receiver to his ear. In reality it is a loud speaking telephone and can be used for various other purposes, as in public passenger cars to announce streets, in restaurant kitchens to receive meal orders, in private homes for use between rooms, between offices as an intercommunicating telephone, etc.



ANNUNCIATOR MOUNTED IN A LIMOUSINE

Stranded Wire Tips

It is frequently convenient to have stranded wires transformed into solid terminals. Here is a special Fahnestock tip which does the trick in a simple manner. Hold the tip in a gas or candle flame, using a pair of tweezers or pliers

STRANDED WIRE TIP

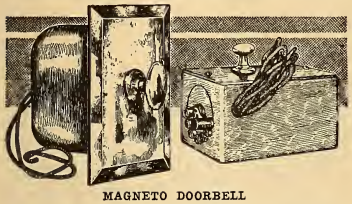
until the solder already inside it melts. When the solder melts push the end of the wire into the tip. When the solder cools, the wire will be soldered securely to the inside of the tip.

Demand in India for Electricity

In Bombay, India, according to the German consul, the new dwellings and offices are nearly all fitted with electric light and electric fans, and some also with electric lifts. Hardly less important than lighting is the demand in the bungalows for electric fans. Where electric power is available, there is in every room an electric fan attached to the ceiling, and generally there are also small portable lamps. There is also a large demand for electric machinery for power plants. Not the least important part of this demand is for the textile factories in Bombay, and it may be anticipated that in a few years most, if not all, of the larger spinning and weaving mills, at least, will be run by electric power.

A Magneto Doorbell

It is well known that the battery is the most troublesome part of a bell system. To overcome this feature a new device, recently designed, makes use of a magneto. When the knob which replaces the familiar push button is given a slight turn, current sufficient to operate the bell, which is furnished with the magneto, is generated.

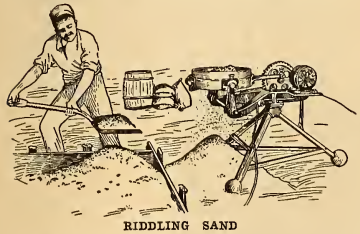


MAGNETO DOORBELL

For offices, a selective switch is provided, so that any one of a number of bells may be rung from the same magneto.

Riddling Sand by Electricity

The molding and core sands used in the foundry are prepared by sifting them through a screen or "riddle" to make all of the same consistency and to remove the coarser parts. This is usually done by hand or by pneumatically operated riddles.

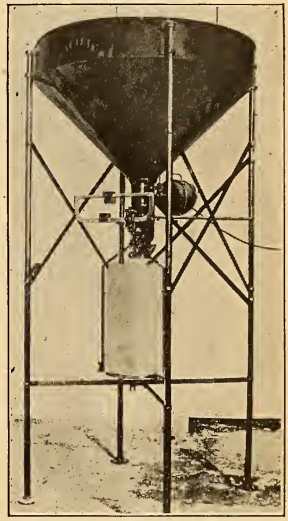


RIDDLING SAND

The illustration shows a one-third horsepower motor applied to shake the riddle. The ordinary eighteen inch foundry riddle fits the clamping device and the amount of work possible is increased 50 per cent over the old method.

Automatic Weighing Machine

Sugar refineries, wholesale groceries, canneries, candy factories, bakeries, etc., wherever large quantities of sugar are handled, have long felt the need of a practical weighing machine. Such a machine is now on the market, embodying a novel motor application. The motor drives an agitator which stirs the sugar and insures an even flow and correct weight at all times by the prevention of lumping and clogging in the hopper.



AUTOMATIC WEIGHING MACHINE

An advantage lies in the uniformity of the weighing. When the weighing beam is set at five pounds, for instance, the package is sure to contain exactly that amount—no more, no less—while with hand weighing it is next to impossible to give exactly the same uniform weight.

The Westinghouse motor is of 1/20 horsepower, applied directly to the weighing mechanism at the bottom of the hopper and is connected to the agitator by

means of a worm and gear. The motor control is effected entirely by the weighing beam.

When the weighing beam comes to a horizontal position, a switch is closed, which starts the motor; and when the required amount of sugar has passed from the receptacle, the weighing beam drops to an inclined position, thereby stopping the flow of sugar, and at the same time opening the switch and stopping the motor.

Pressing Clothes by Magnetism

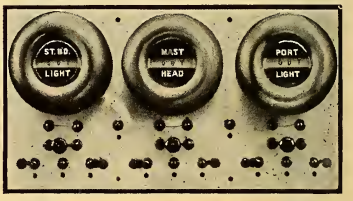
In striking contrast with the old style pressing iron is the easily operated magnet controlled iron. With the old type iron a man's full weight is often needed to properly press out the seams and edges on a newly made garment. With the magnet controlled iron the pressure may be varied from one to 8,000 pounds by a readily moved counterbalanced foot control. This lever moves an arm over contacts which energize more or fewer coils, according to the pressure which is desired.

The current consumed is equivalent to that required by two sixteen candlepower carbon lamps.

MAGNET CONTROLLED IRONS AT WORK

Ship Automatic Tell-tale System

It is not generally realized that masts, relics of the old sailing boat days, are still used on steamboats as a means for carrying signal lights. These lights, and certain others, must be kept burning during the night, and some nations have laws which require automatic devices such as are here illustrated to give warning in case these lights go out. When an automatic tell-tale is used, each signal lantern is provided with two incandescent lamps connected to this board and in turn to the lighting circuit. The regular light is thrown into circuit by the switch on the board, and should this light burn out, or the circuit controlling it become interrupted, a small light on the indicator board is thrown in, the annunciator drops from "Burning" to "Out," and the buzzer is set going. At the same time the relay provided in the instrument throws in the second or auxiliary lamp, maintaining the lantern lighted.



AUTOMATIC TELL-TALE SYSTEM

While it is desirable to replace the original or burned-out lamp as soon as possible, in the case of a storm where it would be impracticable to get at the lantern, the auxiliary light can be left burning until the other is replaced, in which case the indicator will continue to indicate that the original lamp is not lighted.

Electric Heaters in a Water Tank

Located high above the streets of New York on top of the Trinity Corporation Building and exposed to the cold winds from over the North River stands a great water tank for fire protection in

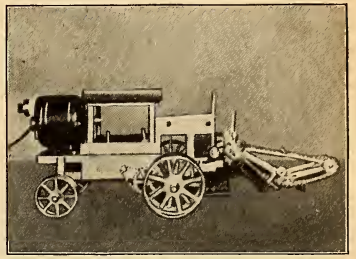
WATER TANK WHICH IS HEATED BY ELECTRICITY

the building it surmounts. This tank is connected to pipes which convey the water to sprinklers in case of fire.

To prevent the water in the tank from freezing electric heaters were installed, after much experimenting. It was found that the heaters worked most effectively when set in the eighteen-inch air chamber at the top of the tank and attached to the underside of the air-tight cover. Four heaters of 1,200 watts each were installed by electricians, with a thermostatic control.

Electric Motor Operates Model

A practical use for the small electric motor is shown in the photograph of a miniature working model of an exca-

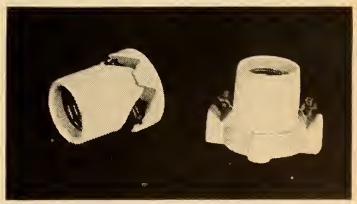


ELECTRICALLY OPERATED MODEL

vator, which is so equipped that it will display its method of operation by simply starting the motor. The advantage is obvious, as an inventor can make a much more convincing exhibition of his model to a prospective investor or financial backer when the model is adding its argument by actually operating.

A Temporary Socket

The installation and use of temporary electric decorations, no matter how cheaply accomplished, are generally costly on account of the short length of time they are used and because of material rendered unfit for further use.



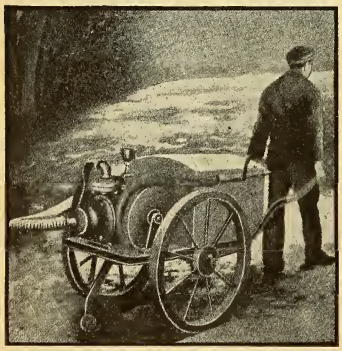
TEMPORARY SOCKET

Bryant sockets, as illustrated, having pointed set screws for connection to the circuit wires, will reduce this cost by saving the time used for splicing, taping,

etc., and making it possible to repeatedly use the same material. After the wires have been put in place, a few turns of a screwdriver, until the point of the screw punctures the insulation, completes the circuit.

Portable Pump for Fire Fighting and Irrigation

A pump direct connected to a motor and both mounted upon a two-wheeled truck is a convenience employed by German gardeners and owners of small



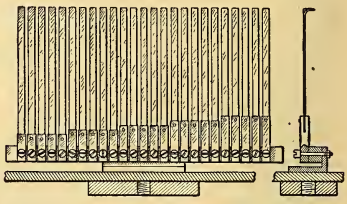
PORTABLE FIRE PUMP

farms. A reel for the hose and a holder for the nozzle are fixed upon the truck platform. The equipment, according to size, weighs from 450 to 800 pounds, and is light enough for one or two men to handle easily. It is also of service in fire fighting, being capable, if put to the test, of throwing 120 gallons of water per minute to a height of 90 feet.

Vibration Tachometer

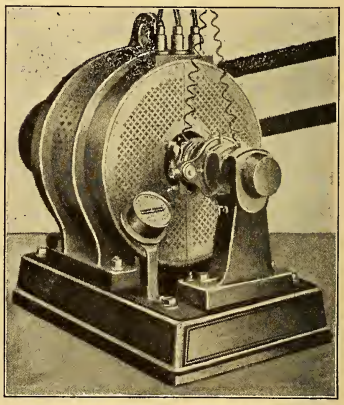
An interesting speed indicator or tachometer operated by the vibration of the machine to which it is attached is here illustrated. If a note is sung into a piano or played on another instrument, the corresponding string in the piano will vibrate sympathetically, and the same principle is followed in this instrument.

The Frahm vibration tachometer contains a number of steel springs or reeds mounted side by side as shown in Fig. 1. The reeds are made of high grade steel,



VIBRATION TACHOMETER

about .12 inch in width, and a small portion of the free end is bent at right angles and enameled white so as to be easily seen. The tachometer is affixed directly to the turbine or motor casing. The vibrations of the turbine cause the tachometer reed in resonance therewith to vibrate violently, so as to be distinguishable from the other reeds. For example, if the machine has one impulse or vibration for each revolution at 3,600 r. p. m., the particular reed would indicate which is adjusted for 3,600 vibrations per minute.



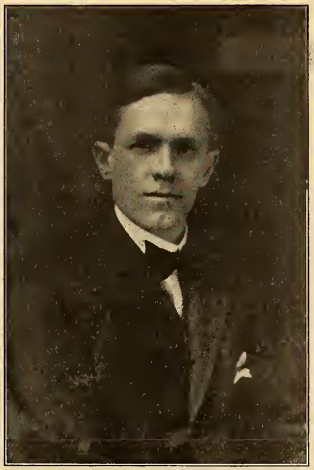
TACHOMETER IN PLACE ON MOTOR

Electrical Men of the Times

RAY PALMER

The lifting power of concentration, persistence and work are nowhere better exemplified than in that growing class of young men who are holding or reaching out for responsible positions.

Foremost among the former is Ray Palmer, appointed on March 19th of this year to the position of Chief Electrician of a city of two and one-half millions—Chicago.



Mr. Palmer was born in LaCrosse, Wisconsin, 34 years ago. His work at the University of Wisconsin was interrupted by active service in the Spanish-American war with the Third Wisconsin as sergeant of Company L, taking part in the skirmishes of Coamo and Abonida Pass in Porto Rico. He graduated from the University with the class of 1901.

His first position was with the J. G. White Company, New York City, as assistant superintendent in the installation of street lighting in Greater New York. The years 1902 to 1904 were spent in England for the same company.

Returning to this country, he was employed the following two years as electrical engineer for the old Union Traction Company in Chicago, now merged in the City Railway Company. Resigning this position in 1906, he started a consulting electrical engineer's business in Milwaukee and Chicago, which he continued up to the present appointment.

As a consulting engineer Mr. Palmer made a complete and valuable report on the water works system of Milwaukee in relation to its efficiency and the effect of electrolytic corrosion on the buried pipes. This was followed by a similar investigation of the underground metal work of Chicago, including, besides pipes of all kinds, bridges, the steel structure of buildings and all lead covered cables. In the matter of questions regarding electrolysis, Mr. Palmer is an authority. As a prominent engineer, referring to this, put it, "He eats it; just eats it."

At the present time an ordinance is pending before the Chicago City Council in conformation with Mr. Palmer's idea of the proper method of preventing electrolytic action on the underground metal work of the city and is causing a lively discussion, the principal feature being the estimated cost of preventive means.

Mr. Palmer is a member of the American Institute of Electrical Engineers, of the Western Society of Engineers, of the City Club and of the Kappa Sigma Fraternity.

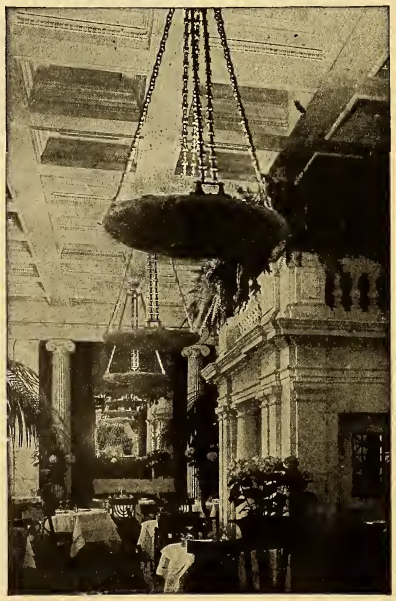
Electrical Interests of Women

EDITED BY GRACE T. HADLEY

Camellia Thea and the Modern Tea Room

The Camellia Thea is a plant that has exerted an ever increasing influence upon civilization during the past three centuries. It is a bushy shrub with beautiful white or rose colored slightly fragrant flowers, occurring either singly or in clusters. The constituents of tea are an essential oil, the caffeine or theine, producing the stimulating effect and the tannin giving astringency. Fragrance, flavor and aroma are the desirable qualities in tea. The rise in popularity of tea in England was rather slow up to the Nineteenth Century.

From the United Kingdom, which is the greatest consumer of tea, the custom of tea drinking has been rapidly growing in the chief cities of our own country. Tea rooms or places especially fitted up for the serving of afternoon tea are more and more a metropolitan feature. The environment of the "cup that cheers" is more artistic than ever known before. In many beautiful tea rooms of Chicago every afternoon one may see fashionable women taking tea. It is a great promoter of social life, and tea rooms now vie with each other in daintiness of service.



TEA ROOM IN BLACKSTONE HOTEL

On the sunrise side of the world in China and Assam, Camellia Thea develops its beautiful rose colored blooms and puts forth its fragrant buds and leaves. On this side of the world, the serving of the beverage made from the fragrant leaves demands more special tea rooms, more elaborate and expensive accessories. It has become an important afternoon social function.

Electricity

plays a most important part in the illumination of the modern tea room. Handsome electric floor standards are used and large silk shaded electric table lamps. Candles adorn the small tables with floral pink tinted shades that match the tints of Camellia Thea's blossoms. Yellow jonquils, tulips and the poet's narcissus assist in the scheme of decoration which includes subdued lights and harmonious blending of colors.

The tea table has gold decorated china plates. The tea tray contains a pot of fragrant tea, a pitcher of hot water, a jug of cream, a small dish with a slice of orange and clove bedecked lemon, while the tea biscuits or cakes are flanked with a little dish of salted almonds and candied orange peel. After a cup of tea, one dips the fingers into a bowl of water in which float perfume buds, and then one is ready for the music of the afternoon.

"I am deeply interested in the subject of electricity," said Miss Gleason, manager of one of the large tea rooms in Chicago, "and I think electric cooking is full of possibilities. When we remodel the kitchens of our tea rooms I hope the cooking may all be done on electric ranges and with electric utensils. It may be a trifle more expensive, but there is a compensating saving of labor. Then electricity is so safe and sanitary; in fact, there are so many advantages in favor of electric cooking that I can scarcely enumerate them all."

The tea room in the Blackstone Hotel, Chicago, as an example, is one of the most beautifully illuminated interiors in the world. It is an exquisite Grecian marble café. The ceiling is paneled and finished in ivory white. The fixtures consist of shallow bowls suspended by bronze chains. Each bowl contains 20 indirect lighting units, consisting of 60 watt tungsten lamps, with clear bulbs and reflectors. The bowls are hung four feet from the ceiling, there being six of them in the room. It is generally conceded by architects that pure classical architecture furnishes one of the most difficult of all problems to handle with respect to artificial lighting. The methods used in ancient Greece were so absolutely inadequate and unadaptable to modern conditions as to render them out of the question. The only alternative is an adaptation of Twentieth Century lighting units to an architecture 20 centuries old. The indirect method of illumination possesses the unquestioned advantage, while the general diffusion of the light after the manner of daylight brings out the architectural features in their proper perspective and relations.

Thermal Storage Electrical Stove

An electrical stove has been recently designed to consume electrical energy continuously at a low rate throughout the full 24-hour day and give off energy as needed quickly for cooking purposes. The energy is stored in a mass of cast iron thermally insulated from external influences by means of lampblack or powdered silica and thermally in direct contact with the cooking utensil. The cast iron mass for storing the heat is mechanically connected to a hydraulic plunger so that it may be raised at will to expose its upper surface for cooking purposes or lowered when it is desired to retain the heat. A central station can contract to furnish energy to the device without the use of a meter, the contract being on a flat rate.

Household Ozonator

The household ozonator has been designed to meet the various conditions found in residences and is ideal in detail for household use. A two-point switch provides an excellent means for controlling the quantity. In the bedroom, for instance, the device would be operated on low output, while, on the other hand, in the kitchen, where there are strong odors from cooking, the maximum output would be used for, at least, brief periods.

I was born in the Land of Sunrise centuries ago. Some say the idea of a fan originated in the palmetto leaf borne to and fro by the breeze, but the Chinese who claim to have invented me, trace my origin into the land of legends. Langsin, the daughter of an all powerful mandarin, was present at a Feast of Lanterns. Overcome with the heat, she removed her mask—a daring thing to do. She still held it near enough to screen her features, while waving it to and fro. It is said that to this caprice of a princess, the origin of a fan is due.

I Was Born in the Land of Sunrise Centuries Ago

In the beginning I was a trifle, a mere trifle, an airy thing made of bamboo, a bit of paper or silk adorned with a lily bud or a leaf. Sometimes a flight of swallows, a handful of graceful grass or a dragon fly appeared upon the paper surface. Later I was evolved more elaborately from ivory, dragon skin or oiled silk and finished with a silken cord and tassel. Little figures were sometimes wrought in silk embroidery, for silk was an ancient and highly valued material. In China I was a flat, stiff, hand screen, but finally the Japanese improved me by making me an ogi or folding fan. I then acquired a framework of sticks of the same length and thickness, with the outer stick wider and heavier. For the Japanese I soon became an emblem of life. The rivet end was the starting point, and as the rays expand, so the road of life was supposed to widen to a prosperous future, therefore I was used as a gift on important occasions. In the oriental lands I was always an indispensable weapon against the hot climate and swarms of insects, and it was not long before I became another kind of a weapon, a war fan. The Japanese sewed two thicknesses of leather together and attached an iron handle over a foot long, very strong and heavy, thus making a formidable weapon. Gold was used for the rivets of war fans, also for ornamentation, while

Then I Became a Professional Breeze Maker

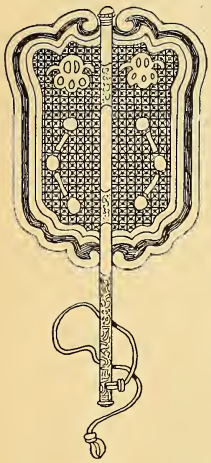
bronze embellished the metal handle.

In Egypt I was a royal emblem and signified authority, happiness and repose. The worshipful company of fan-bearers were generally persons of royal birth. Imagine with what elaborate ceremonies they escorted the stately Cleopatra, waving the semi-circular screen fan attached to a long handle. In Greece, I was made of peacock feathers, as the peacock was Juno's bird and symbolized luxury and splendor. I enhanced the great festivals of the Romans, for slaves stood behind the guests and waved fans made of peacock feathers enriched with ostrich plumes.

The Japanese Improved Me

Early in the Eighteenth Century I reached England, where I became a mere feminine accessory, but I was held in high favor and carried at court. Then I finally crossed the Atlantic and came to America. Here I settled down and developed from a mere caprice into a commercial necessity. I became more substantial in every way. The bamboo, silken paper and plumes disappeared entirely. I was made with a motor body and base finished with black enamel, with fan blades, guards and trimming in dipped and lacquered brass. My silken tassel became an attaching cord and plug and I was connected with an electric current. Then I became a professional breeze maker with a range of operation. I am useful in the home in a variety of ways. Fresh air is one of the most important factors of modern healthy living, and I freshen the air and ventilate the home. In the library, dining room and bedrooms, I am indispensable. I never get tired or fall asleep like the

punkah boys in India. The higher the mercury climbs the busier I am, for I can keep a home comfortable on days that would otherwise be unbearable. For a small cost I provide hours of cooling breeze. I am very popular in an eight-inch size where only a moderate breeze is required, and I am made both with and without an oscillatting mechanism. Recently some of my relatives have acquired two sets of blades revolving in a circle and with three running speeds. The baby six-inch fan is a favorite. Try it and be comfortable. In stores, hotels, offices, restaurants, cafés and residences, I am capable of adding greatly to individual comfort and improving the ventilation, and the question of proper ventilation is especially important these days.



I Became Another Kind of Weapon—a War Fan

Fan Facts

Air should be changed in public buildings to insure health and comfort—in large public rooms every 20 minutes—in shops, offices, halls and churches every 20 minutes. The electric fan offers a simple solution of all difficulties in the way of ventilation. It can be fixed in any position and controlled from a convenient point. It is silent and its simplicity of construction is such that it seldom gets out of order; moreover, it does its work at an extremely low cost and it can be switched on or off with the greatest ease and facility.

The electric fan must not be overlooked, for it has proved itself invaluable, with its cooling breezes in summer and its power of distributing warm air in winter, or exhausting the foul air from the room.

Exhaust fans are now extensively used in factories, public buildings and offices, also in hotels and restaurants; in fact, by all who wish to attract customers. Proprietors of such establishments realize that pure air is desirable for the comfort of patrons as well as necessary to good health.

The initial cost of an electric exhaust fan is lower than that of any other apparatus capable of moving an equal amount of air.

Oscillating fans are suitable for use in large rooms or in places where a breeze blowing steadily in one direction is not desired. In operation the fan swings slowly from side to side, so that the air current sweeps over a wide area.

The housekeeper who formerly got along with one fan now has several. She is not satisfied only to have the fan breeze to sit by when she reads or works, but requires it for the bedrooms and for the kitchen as well.

Eight-inch fans give a moderate breeze. They are light in weight, strong in construction, attractive in appearance and practically noiseless in their operation.

The Swinging Electric Breeze

Why sigh for the breeze
  That wavering blows
Thro' the trees and leafy glades?
We'll give you the breeze
  That steadily flows
From the thrust of whirling blades.

Pay dear if you will,
  And seek where you can
For breeze worth a princess' dower;
We'll give you your fill
  From a 'lectric fan
At less than a cent an hour.

A Home-Made Electric Lamp

Here is a home-made electric lamp. It is a modern, artistic electric lamp with a Princess shade and it is made out of an old oil lamp. Mrs. T., a Chicago lady, has achieved this feat of doing something that all her friends said could

HOME-MADE ELECTRIC LAMP

not be done, and they marveled that she dare attempt it. She confesses that she surprised herself, not to mention the family and a host of friends, who are making special calls to see the home-made electric lamp.

For some time the good brass standard of an old oil lamp stood about on a closet shelf. Every time she saw it, she thought it ought to be used and finally she ordered a wire frame to be made, which cost $2.25. Then came the problem of covering the frame, and all her women friends assured her that this was a most difficult bit of work and that she better not try to do it. Being a lady of resources and some skill in trimming, she decided to make an attempt to trim the wire frame.

At a large department store she purchased two bolts of rose silk binding tape to cover the wire, one yard of embroidered rose silk for the outside, and two-thirds of a yard of China silk of a lighter shade, three and a quarter yards of gold braid, and 50 inches of gold fringe. The cost of the material, including frame, came to about nine dollars. Then she worked for two days, covering the frame first with binding tape, then putting on the outer silken cover, then sewing on the gold braid and fringe, and last, but not least, putting in the lining. This was a ticklish job and demanded a good deal of ingenuity. The shade is 33 inches in circumference at the top and 50 inches at the bottom. When completed, the combination of the old brass standard with the new Princess shade was so pleasing, Mrs. T. decided to ascertain about how much such a shade would cost if purchased regularly in a store. She was amazed to find that she could not buy anything approximating her shade in appearance for less than fifty dollars.

An artistic electric lamp in a library really constitutes the center of family life in the evening. Equipped with a tungsten lamp, a beautiful Princess shade of rose silk, it becomes the final word in a scheme of home-like house furnishing, where the keynote is harmony.

A Cent's Worth of Electricity

A cent's worth of electricity at ten cents per kilowatt-hour will bring to a boil two quarts of water; run an electric broiler for six minutes; operate a twelve inch fan for two hours; will make a Welsh rarebit in an electric chafing dish; operate a sewing machine motor for three hours; will keep a four inch disk stove hot for fifteen minutes; will make four cups of coffee in an electric coffee percolator; will keep a six-pound electric flat-iron hot for fifteen minutes; will heat an electric curling iron once a day for two weeks.

Don't Neglect the Vacuum Cleaner Bag

A man who did not want a vacuum cleaner finally permitted a $125 machine to be installed in his home on trial. When it was called for by the salesman he was asked to let it remain in the house another day or so.

"I may decide to keep it," explained the gentleman.

Some time after this the salesman was worried with repeated calls to come out immediately, the vacuum cleaner was out of order; it would not work at all! The salesman was very busy and could not leave the office that day.

"Say," he remarked, "you have lived over 20 years without a vacuum cleaner and I think you can live through one more day. I can't come out until tomorrow."

The following day the salesman went out to investigate the cause of trouble. Removing the top, he discovered that the bag was packed full of dirt in a solid cake. The vacuum cleaner had been used continuously for two weeks and the bag had never been emptied once!

Mechanical Refrigeration

Perfect refrigeration means pure, wholesome food. The utilization of automatic electric refrigeration insures perfect refrigeration. Some of the advantages of such refrigeration are that it is cleanly, dry, sanitary and economical. It can be regulated so that the same temperature will be maintained in the refrigerating chamber whatever the temperature may be outside. Temperature obtained by melting ice is always variable. Automatic electric refrigeration keeps the ice box cold all the time with no drip pan or drain pipes to think about. No more tainted meat, no spoiled milk and the ice man is no more for the user of perfect refrigeration with electricity.

The Auto-electric refrigerating machine is especially well adapted for meat markets, groceries, restaurants, hotels, buffets and apartment houses. It is reliable and requires no engineer. The convenience of the automatic feature is one of the principal advantages of this type of refrigeration. You merely install the machine, connect it up, set the thermostat at the desired degree of temperature, and then it does the rest. Your worry is over. A small automatic electric machine is also made for use in private homes.

Electricity Adds to Baby's Comfort

An electric device especially designed for heating baby's bottle will be appreciated by mothers who have small children to look after. A convenient method of heating the milk quickly has long been wanted and the device shown in the accompanying photograph seems to meet all requirements.

A CONVENIENT METHOD OF HEATING MILK

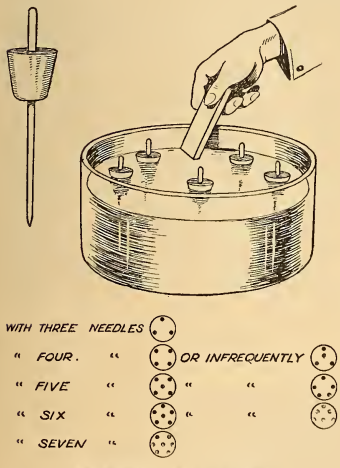
The metal container is just large enough to hold the nursing bottle and when the current is turned on will bring the liquid to the proper temperature in a few minutes. It is so small that it may be carried in a suit case or transferred from room to room.

Junior Section

An Interesting Experiment in Magnetism

A simple experiment which can be performed by any one will go far toward explaining, in a graphic way, something of the nature of molecular arrangement and action.

A small supply of ordinary sewing needles, preferably of the size referred



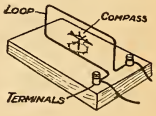
EXPERIMENT IN MAGNETISM

to as No. 6, should be magnetized so that all the points are north. Each needle should then be driven into a cork so that the eye appears just above the top of the float. The corks are then mutually repellant, and if dropped into a basin of water will attempt to get as far away from each other as possible. If the north pole of a large bar magnet be now lowered over them they will arrange themselves in geometrical figures, varying in design according to the number of corks used, as shown in the diagram.

Diagrams may be worked out for as many needles as the basin will hold, and it will be found that they will adhere to the regular arrangement except occasionally when they seem to prefer for the time being some other form, as shown in the second column of the diagram.

A Simple Ammeter

Experimenters with small motors, batteries, etc., are often at a loss to find out how much current they are using. The following apparatus will serve and give approximate results:



A small piece of hard wood 1 by 6 by 8 inches is used for a base, on which is fastened a loop of No. 6 copper wire, bent as shown, and having about two inches clearance between the top and bottom wire. A short compass needle pivoted on a needle point is free to swing over a degree scale. With the compass needle in place nearly between the wires, turn the instrument until the wire is parallel with the needle and mark this point zero on the circular scale. Current through the wire will deflect the needle. Sixteen candlepower carbon lamps which require one-half an ampere each may be used to calibrate up to 1½ amperes.—H. G. Wilson.

ONE OF THE NOBILITY AND HIS ELECTRIC AUTO

This picture was sent to us from Warwick Castle, England, through the courtesy of the Countess of Warwick, and is a photograph taken nine years ago of her son in his little electric car. He was then five years old. This miniature car illustrates the perfection which even then attended the construction of electrics. The motor is one-half horsepower and the top speed of the car is four miles an hour.

How Electricity Is Helping Me Through College

The accompanying picture illustrates one way I employ to make money to go to college. The bicycle is screwed to the floor. It is connected by a heavy cord to a small eight volt direct current dynamo which has sufficient capacity to charge small storage batteries. People of means who live around me pay me to charge their storage batteries and keep them in good order. They use them to run fans, ring bells, for electric miniature lights and for automobile ignition.—J. W. Quimby.

UNIQUE BATTERY CHARGING OUTFIT

A Model Power Plant

The accompanying picture shows a model power plant built by Henry Walter, a student at the Allentown Preparatory School, Allentown, Pa. The model represents a small 500 volt direct current station of the type operating a railway system.

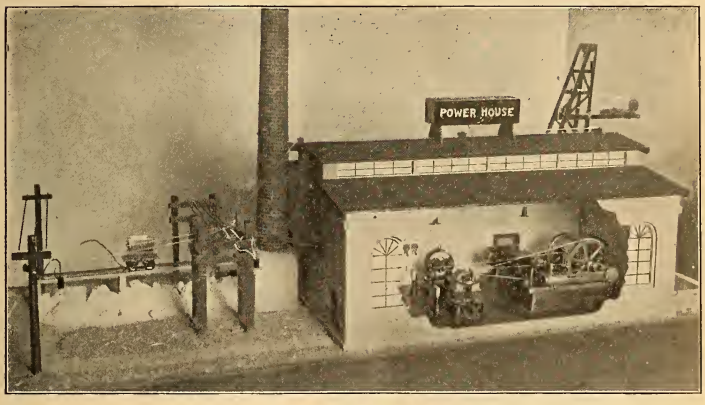
There are two generating units and a small exciter engine not shown. The dynamos are really motors, but the effect is that the engines are furnishing the power.

To the left of the dynamos are seen the equalizer and main switch stands. Only one panel of the switchboard is shown. The circuit-breakers, meters, and all the appliances of this switchboard were carved from wood.

From the ceiling are suspended two arc lamps which light the interior. There are also three arc lamps in the yard and one on the coal hoist. From the roof the words "Power House" flash forth in letters of red and green.

In the background is seen the little ash car. This car appears from behind the stack, runs to the end of its trestle, dumps, and returns, the operation being kept up as long as the current is on.

At the extreme right is shown the coal hoist. The bucket rises from the hold of a canal boat to the carriage of the hoist, runs in over the chute, then out again and down. Both the motion of the ash car and the coal hoist are automatic and continue as long as the current is supplied.



A MODEL POWER PLANT

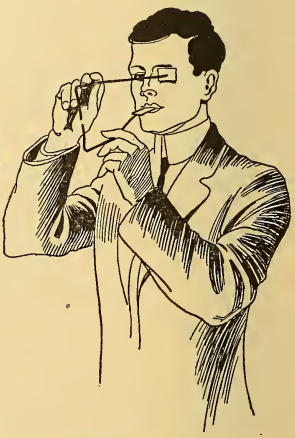
Electricity in Flames

If two copper wires are placed in a yellow, sooty flame, such as a gas burner or a candle, one above the other, say two and a half inches apart, an interesting discovery can be made. Both, of course, become black with carbon. If then they are joined to a battery of six or eight good cells in series, the black carbon or soot will change into a sort of tree or growth with a kind of trunk from which fine branches extend into the flame, as soon as the potential difference exceeds twelve volts. It is of no use whatever to raise the voltage above 25, for the beautiful phenomena are not increased or in any way augmented; nor do they become any more pronounced in excessively sooty flames. The soot must be very fine and soft, like that of a candle.

Electric Stimulation of the Senses

As long ago as the year 1830 it was known that the senses could be stimulated by means of electricity. It was found that by applying the terminals of a battery to the tongue, nose, lips, ears, etc., various sensations were experienced, although the same sensation was not always felt when the terminals were reversed.

STIMULATING HEARING



ELECTRIC VISION

Electric vision has been produced by placing tinfoil over the eyelid and connecting it to a silver plate held in the mouth. A bright flash before the closed eye was noticed on closing the circuit even without a battery in series. A dry cell can be used in the circuit without danger. Then the plate in the mouth need not be silver.

Helmholtz used twelve small cells in series with two paper covered electrodes which were soaked in salt water. One electrode was pressed against the brow while the other was held in the hand. He describes the effect as a whitish violet tone in the eye. On opening the circuit a flash was seen. Various observers note different effects. Numerous color effects are obtained by passing the current from the temple to the bridge of the nose or transversely across the eye. Electric stimulation also changes the appearance of colors when viewed while current is passing transversely through the eye, as in the last method described.

Recently sensations of light have been produced by placing the head in a changing magnetic field. A coil of wire is wound large enough to admit the head, and when an alternating voltage is impressed upon it currents are induced in the optic nerve, due to the alternating magnetic field.

Electric hearing is produced by placing the terminals of a battery of several cells

in contact with the external auditory passages, the latter having first been filled with tepid water. When the two wires were placed on the lobe of one ear or, respectively, on the ear and in the moist hand, the note "g" was heard. In many cases it is not heard.

Electric taste is produced by holding in the hand the negative wire of a battery of several cells and placing the positive wire on the tongue. A decidedly acid taste is experienced. When the connections are reversed the taste has been described as bitter, harsh, caustic, and alkaline, while others find it merely acid. It is possible that electrolysis of the saliva results and hence the acid taste; however, the acid thus set free would be neutralized by the alkaline saliva, and besides no acid has been found present. The same effect is produced when a piece of cooked meat is interposed between the tongue and the wire.

If two persons touch tongues together while each holds a terminal of a battery the one holding the positive wire tastes acid while the other tastes alkaline. This experiment was reported years ago.

Various sensations of feeling can be obtained depending on the method of applying the electric stimulus. Among the sensations described are cold, heat, cutting and burning.

Experiments on electric smell are not as satisfactory as those on the other senses. It is claimed by one experimenter that a putrid odor was experienced when the terminals of a battery were placed, respectively, on the nose and in the mouth, or on different parts of the nose.

The fact that the senses can be stimulated by means of electricity is not astonishing when it is remembered that electric currents are supposed to carry all messages to the brain.

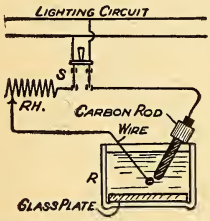
ELECTRIC TASTE


HELMHOLTZ'S EXPERIMENT

Smoke is no longer the sign of a busy manufacturing community. At the present rate of electrical development it will be but a comparatively few years until the factory from which clouds of smoke belch forth will be the exception.

Formation of Imitation Crystals

A very interesting experiment in making imitation crystals can be performed by following directions given: As shown in the diagram, the apparatus needed is an ordinary large tumbler, an electric



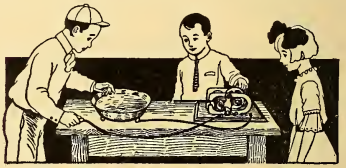
APPARATUS FOR FORMING IMITATION CRYSTALS

light carbon, small pieces of colored glass about the size of the bottom of the tumbler and a piece of bare copper wire No. 14, connected up as in the diagram. Wires from the lighting circuit are led to a small switch and then through a water rheostat (RH) to the two electrodes, consisting of the carbon rod and the copper wire.

The tumbler is nearly filled with water and a little salt added to make the solution more conductive to the current. On the bottom of the tumbler place one of the pieces of colored glass. Some friction tape or cloth should be wrapped on the upper end of the carbon rod so that it may be held in the hand. The rod and the wire are held about an inch from the bottom of the tumbler and touched together for a second. Upon drawing them apart a small distance there will be an arc formed between the carbon rod and the copper wire. This is all done under the water, as the arc can be seen through the sides of the tumbler and gives out a very brilliant green color. The arc is kept going until a small ball of hot copper formed on the end of the wire falls off. As the ball of copper touches the glass plate, the glass is heated and a small piece cracks off. As the copper cools, it clinches the small glass particle. This imbeds the colored glass in the copper and the whole looks as if a jewel were imbedded in a large shot. The different crystals can be made in the same way by using different colored glass.

Shocking Money

A dime or a quarter in the bottom of a dish of water may look like very "easy" money and is under ordinary conditions. However, with the arrangement shown in the illustration, the ease with which the coin can be picked up depends upon how much of an electric shock one can stand.



FUN WITH THE SHOCKING MACHINE

An ordinary magneto with one terminal connected to the basin, if of metal, and the other terminal held in the hand, will impart a nice little surprise to the finger tips.

How to Remember Which Is the Cathode

A good many times I have had occasion to use the words "cathode" and "anode" in my school work in physics and chemistry. I always found it rather confusing to remember which was which, until one of our professors helped me by telling how he always remembered.

He said that when he was a boy at home, they had a big cat that could open the screen door and *go out* but could not *enter* by the same door.

He always related the cat and the house, respectively, to a current of electricity and the cell or battery from which it comes. He thought of the screen door as the "cathole" where the cat went out of the house, as similar to the "cathode," where the current went out of the battery.—ALDEN GILPEN.

Advice to Prospective Wireless Operators

By JAMES M. MERCER

With the enormously rapid development of wireless telegraphy, it has been but natural that many young men should have entered this field, but in many cases without seriously considering its opportunities. A brief discussion of the advantages and disadvantages of this work, remuneration, etc., may not be amiss.

We will divide this discussion into several geographical sections, as each presents some local characteristic.

THE GREAT LAKES

The work done in this region is of a mediocre class and cannot be justly taken as a basis of comparison. Salaries are low, averaging about $35.00 per month for steamship operators, and at times very uncertain. Furthermore the operators generally are not accorded the treatment which, in view of the importance of their position aboard ship, they should have. It has been found necessary on some steamship lines to have the operator's meals served in the same mess-room with the stewards and waiters, which is of itself rather unpleasant.

The majority of steamers make short night trips, thus imposing night duty on the operator. However, this has the advantage of allowing shore leave during the part of the day not spent in sleep, which would not be feasible otherwise.

The salaries of land station operators are higher, of course, but living expenses must be taken into consideration, which is not the case aboard ship. Operators are paid on a scale based upon the amount of work done at their station, number of hours at work, day or night trick, personal ability, etc., usually from $55.00 to $70.00 per month. This work is generally entrusted to men with one or more seasons of meritorious service behind them, and is rarely given to novices.

In discussing the Great Lakes, no small consideration must be given to the fact that there are only about 8½ months of work during the season of navigation, the majority of the stations closing for the remainder of the year.

However, some men thus thrown out of employment are taken care of by the coast companies.

THE PACIFIC COAST

This section offers a limited field of employment at a fair salary. There are coast stations from Los Angeles to Seattle and several commercial stations in Alaska. Coastwise steamers ply both north and south from San Francisco and there is passenger mail service north to Alaska and south to the tropics. All these steamers are equipped with wireless apparatus. Probably the most desirable of all positions here are on the large palatial liners to the Hawaiian Islands and the Orient.

There is a good deal of work done, providing employment for quite a few operators and construction electricians and also special workmen, at a large commercial laboratory at Seattle. But this demand is amply cared for by the supply of men directly in that district, and the East or Middle West are rarely drawn upon.

THE ATLANTIC COAST

We have here four large companies doing a big business and one or two smaller ones.

Nearly every steamer entering or leaving New York carries her wireless antenna, and a good operator should experience small difficulty in securing a berth.

A United States government license is necessary for work here and in the case of steamers touching foreign ports foreign licenses are often required. These should, however, offer but little difficulty to the man who understands his business.

The average operator going to New York will no doubt secure his first position on some coastwise steamer equipped with United Wireless apparatus. This would be a good place to gain much valuable practical knowledge and should be taken advantage of before aiming higher.

The Marconi company usually wants men experienced in the use of both codes and with a successful past record. The large proportion of its operators come directly from its own training school in Great Britain.

The Marconi company of America, however, will employ operators not of its own training.

Both the Fessenden and Telefunken companies use a highly perfected type of high frequency apparatus, requiring exceptionally skilled operation. Both companies do a large amount of government contract work and only the best of men should apply to these firms for work.

The salaries on the coast vary greatly, ranging from the four pounds sterling ($20.00), paid by the Marconi company on some of its boats, to what is probably the most sought-for steamship position on the coast, a berth aboard one of the fine steamers of the United Fruit Line, paying $65.00 to $80.00 per month and expenses. These boats are equipped with Fessenden apparatus.

The land stations of the United Fruit Company's service pay up to $150.00 per month for a chief operator, other operators being paid according to their work.

The salaries for land station work for other companies on the Atlantic coast rarely exceed $75.00 per month. This practically exhausts the commercial field of this country.

A brief word now of other opportunities.

GOVERNMENT SERVICE

The only positions open to civilians come under the classified civil service laws and applicants must enter a competitive examination in which the following are made the basis of grades:

Practical experience	50%
Practical questions	20%
Spelling, penmanship, etc	30%
Total	100%

It is readily apparent from this, that unless one has a long successful record he may as well spare himself the trouble of taking this examination. These positions are usually in either the Hawaiian or Philippine Islands and pay $75.00 to $90.00 per month, generally, with quarters allowed.

Incumbents are open to advancement to the position of wireless inspector at a higher salary.

At the present time there are no government stations in the United States proper, that come under this classification, that are not directly controlled by the Naval Service and manned by bluejacket electricians.

Full information regarding the Naval Service can be obtained by applying to the Navy Department, Washington, D. C. Suffice it to say that electricians, after having reached the first class grade, are eligible for examination to the rank of Acting Chief Electrician, subject to a permanent appointment as such, and at a rate of pay of $66.00 and $77.00 per month respectively.

There is one other government service open.

THE U. S. REVENUE CUTTER SERVICE

A limited number of good positions are available in this department. Applicants must show a good record or pass an examination and are then subject to appointment as vacancies occur. Appointment is made to either of two grades—Second Class Electrician at $44.00 per month or First Class Electrician at $66.00 per month—both grades having a commuted ration allowance. Appointees are stationed aboard one of the revenue cutters. Further information can be had on application to Secretary of Treasury, Washington, D C.

IN GENERAL

Wireless work is intensely interesting and, judged from that standpoint, looks very attractive. Leaving out of consideration land station work, which is more or less routine, we might look into the life of a wireless officer aboard ship.

Primarily a good wireless man must be able to endure the strain of long continuous duty if the occasion arises necessitating it. Ordinarily a few hours in the morning, similarly in the afternoon and most of the evening are the hours spent at the key. This of course varies with any prearranged schedule. The work entails the ordinary hazards of the sea and in the event of disaster the operator must remain at his key, in spite of anything that happens, flashing out his S. O. S. call, and continuing to do so until help is brought or the dynamo fails to furnish the necessary current.

Separation from home and friends is another item. On the other hand the wireless man in the course of his career sees many strange ports and foreign peoples, makes hosts of acquaintances and leads a rather care-free existence.

PREPARATION

After due consideration of the foregoing, if a young man decides to enter this work he is confronted by the difficult problem of adequate preparation. Alluring advertisements of wireless schools are in every magazine. This, then, seems to be the only practical solution of the question: *Investigate a school thoroughly* before entering it, as your work there will bear upon your whole future.

Briefly, the essential qualifications for a good wireless school are:

(1) Instructors to be experienced practical men.

(2) Maintain a complete practical station of commercial design.

(3) Individual instruction as much as possible.

(4) Teaches both Morse and Continental codes.

Some schools assert that the Continental code is unnecessary, and that it is a waste of time to learn it. The writer, to the best of his knowledge, knows of no place in the world, with the exception of the Great Lakes of America, where the Continental telegraphy code is not used, and in many places exclusively. In fact, the Morse code is distinctly American.

One other method is open to the embryo wireless operator. Learn the codes by means of buzzer and key and then apply to the nearest wireless office for a position as messenger. By paying close attention in spare moments, the practical operation can be learned.

Eclipse of Sun Affects Wireless Transmission

During the recent solar eclipse an interesting test was undertaken between the radio station of the Royal Dock Yard in Copenhagen and the Blaavandshuk station on the coast of Jutland, so as to ascertain the effect of the eclipse upon wireless transmission. It transpired that the telegraphing became more distinct and reliable as the eclipse progressed, and that it was most distinct shortly after the culmination of the eclipse. The view that it is the effect of the solar light upon the atmosphere which is the cause of radio-telegraphy being much better at night than during the day seems thus to be confirmed.

English Boy Scouts Studying Wireless

Some of the Boy Scout troops of England are giving considerable attention to the studying and using of practical field wireless telegraphy.

EXPERIMENTING WITH WIRELESS APPARATUS

The Second Royal Eltham Troop, whose ages range from eight to seventeen years, have equipped themselves with a complete portable wireless telegraph outfit, for both sending and receiving. Under the direction of their scoutmaster they are mastering the intricacies of the Continental and Morse codes, and many of them are already making good progress. At their camp they use a portable, light, iron table, while the field workers who go out a distance of from two to five miles pack the apparatus on their backs. The field workers when out on march do not carry a table, using one of the outfit boxes for a sending table and the other for a seat. Tall bamboo poles are used to hoist the aerials.

The development of wireless telegraphy during the last three years is remarkable. In January, 1909, there were 92 wireless stations in action and 416 ships provided with wireless apparatus. In January, 1910, there were 136 land stations and 619 ships provided; in January, 1911, there were 219 land stations and 988 ships fitted with wireless apparatus.

Questions and Answers in Wireless

By A. B. COLE

(DETECTORS—CONCLUDED)

62.—*Explain a theory regarding the operation of imperfect contact detectors.*

In all these detectors the two or more active materials are in very light contact. The line of distinction between rectifying and imperfect contact detectors is not well defined. One form of the latter type consists of two carbon blocks sharpened to fine edges, which support a steel needle. This combination constitutes a microphone, and is very unstable. The slightest jar throws this detector out of adjustment. The resistance of this detector is very high, and but little current from the local battery passes through it. The high tension oscillations from the aerial are sufficient to break down this resistance and to carry the battery current through. At their cessation the resistance of the detector again becomes high and consequently the flow of battery current through it is diminished.

Another form of imperfect contact detector is the coherer, which was most fully perfected by Marconi. This was composed of a glass tube of a diameter of about $\frac{1}{8}$ inch, containing about $\frac{1}{16}$ inch of filings composed of ten per cent silver and 90 per cent nickel. One of two silver plated metal plugs which fitted the tube exactly was arranged so that it could be moved into or withdrawn from the tube, thereby exerting a greater or less pressure on the filings. The other plug was stationary. In the better coherers the air was exhausted from the tubes.

In using the coherer it was necessary to employ a mechanical device, called a decoherer, to restore the high resistance of the filings at the cessation of the waves. The coherer was used in connection with a telegraph relay and sounder. It was unreliable, but was the first practical detector of electromagnetic waves as applied to wireless telegraphy. One of the most important applications of the coherer today is for demonstration purposes, where an audible signal is desired.

A form of imperfect contact detector was invented by Solari, and is sometimes called an autocoherer. This is composed of two carbon rods inserted in a glass tube and having between them a small drop of mercury. A local battery in connection with a potentiometer is used with this detector.

A fourth form of imperfect contact detector is known as the Lodge coherer, and consists of a metal wheel which is revolved so that its periphery touches the surface of a body of mercury which is covered with a layer of oil. The high tension oscillations break down the resistance between the wheel and the mercury, which is restored by the revolution of the wheel.

63.—*Explain the tantalum detector.*

This detector consists of a cup containing mercury and a fine tantalum wire held in such a way that it may be raised or lowered into the mercury. The tantalum wire may be obtained from a tantalum lamp. This detector requires a local battery, which is connected in the same way as with an electrolytic detector. The tantalum detector reproduces strong signals loudly, but is not as sensitive as some of the crystal detectors.

64.—*Name the crystal detectors in rank of sensitiveness, assuming that the crystals used are all of the best quality.*

Ferron; perikon; carborundum; silicon; molybdenite.

65.—*Is the perikon more sensitive than the electrolytic?*

The perikon detector is considered to be about ten per cent more sensitive than

the electrolytic described in answer to question 61.

66.—*State the composition of a fusible metal suitable for holding crystals in metal cups.*

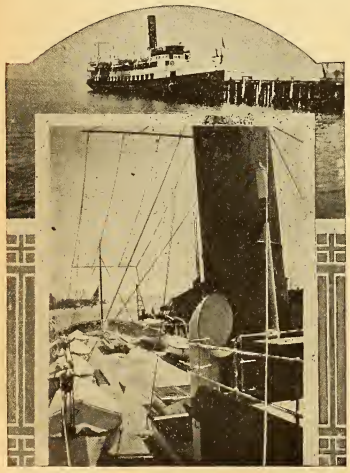
A material for this purpose should have a low melting point, since the use of solder or other compounds of comparatively high melting point is liable to decrease the sensitiveness of some of the crystals on account of the heat to which they are subjected when being fastened in the cups. One of the best alloys consists of the following:

Bismuth, 50 per cent; lead, 25 per cent; tin, 12½ per cent; cadmium, 12½ per cent.

This is known as Wood's Metal and melts at 149° F.

Novel Method of Suspending Aerial

It was found necessary to remove the masts of the steamer "Cabrillo," of San Pedro, Cal., for shortening and general overhauling, while the requirements of travel were such that it was necessary for the steamer to make its daily trip from San Pedro to Avalon, Catalina Island, thus necessitating the use of its wireless outfit. Accordingly, the plan illustrated was adopted.

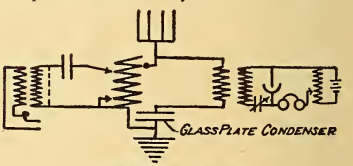


NOVEL AERIAL SUSPENSION

In order to support the aerial a small mast was placed in the stern of the boat on the upper deck and a pulley was made fast to the upper end of the smoke-stack. The aerial was suspended between them, thus raising it about 30 feet above the instruments. No difficulty was experienced in maintaining communication with this temporary installation.

"Break-in" System

The accompanying diagram shows a simple "break-in" system. The condenser is of the plate glass type. I have found a carborundum or any detector that is not affected by strong transmitting to be very satisfactory.—Geo. Uzmann.



BREAK-IN SYSTEM

Wireless in Chicago Schools

With the approval of Mrs. Ella Flagg Young, superintendent of Chicago schools, the school management committee has adopted a recommendation urging the teaching of wireless telegraphy in the public schools.

The Titanic disaster, it is said, has caused hundreds of boys in the city high schools to petition for instruction in wireless telegraphy.

The north coast and the interior of Honduras will be soon connected by wireless telegraphy. Wireless is of special value in the tropics, where line transmission is extremely difficult owing to the rank vegetation and dense forests.

Directory of Wireless Clubs

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

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

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

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

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

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

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

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

Berkshire Wireless Club.—Warren A. Ford, President; William Yarkee, Vice President; Charles Hodecker, Treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., Secretary.

Canadian Central Wireless Club.—Alexander Polson, President; Stuart Scorer, Vice President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary and Treasurer.

Cardinal Wireless Club.—K. Walthers, President; F. Dannenfelser, Vice President; Miss A. Petersen, South Division High School, Milwaukee, Wis., Secretary.

Chicago Wireless Association.—John Walters, Jr., President; E. J. Stich, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Custer Wireless Club.—Franklin Webber, President; Fred Cross, Vice President; Oakley Ashton, Treasurer; Walter Maynes, 438 Custer Ave., Los Angeles, Cal., Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reincke, 518 9th St., Fargo, N. D., Secretary.

Forest Park School Wireless Club—W. S. Robinson, Jr., President; William Crawford, R. F. D. No. 1, Springfield, Mass., Secretary.

Frontier Wireless Club.—Chas. B. Coxhead, President; John D. Camp, Vice President; Franklin J. Kidd, Jr., Treasurer; Herbert M. Graves, 458 Potomac Ave., Buffalo, N. Y., Secretary.

Gramercy Wireless Club.—James Platt, President; John Gebhart, Vice President; John Diehl, Treasurer; John Jordan, 219 East 23d St., New York, N. Y., Secretary.

Independent Wireless Transmission Co.—Starr W. Stanyan, 76 Boston Ave., West Medford, Mass., Secretary.

Northwestern Wireless Association of Chicago—Rolf Rolfson, President; H. Kunde, Treasurer; Edw. G. Egloff, 2729 Noble Ave., Chicago, Ill., Recording Secretary.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Youse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Haverhill (Mass.) Wireless Association—Riedel G. Sprague, President; Charles Farrington, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary and Treasurer.

Independence Wireless Association.—Boyce Miller, President; Ralph Elliott, Secretary; Joseph Mahan, 214 South Sixth St., Independence, Kan., Vice President.

Jonesville Wireless Association.—Frederic Wetmore, President; Webb Virmylla, Vice President; Richard Hawkins, Treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., Secretary.

Lake View Wireless Club.—E. M. Fickett, President; R. Ludwig, Treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Byd., Long Beach, Calif., Secretary.

Manchester, (N. H.) Radio Club.—Homer B. Lincoln, President; Clarence Campbell, Vice President; Elmer Cutts, Treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary.

New Haven Wireless Association.—Roy E. Wilmot, President; Arthur P. Seeley, Vice President; Russell O'Connor, 27 Vernon St., New Haven, Conn., Secretary and Treasurer.

Oakland Wireless Club.—H. Montag, President; W. L. Walker, Treasurer; W. R. Sibbert, 916 Chester St., Oakland, Calif., Secretary.

Oregon State Wireless Association.—Charles Austin, President; Joyce Kelly, Recording Secretary; Edward Murray, Sargeant-at-Arms; Clarence Bischoff, Lents, Ore., Treasurer and Corresponding Secretary.

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Coke, 263 Engleburn Ave., Peterboro, Ontario, Can., Secretary and Treasurer.

Plaza Wireless Club.—Paul Elliott, President; Myron Hanover, 156 E. 66th St., New York, N. Y., Secretary and Treasurer.

Rockland County (N. Y.) Wireless Association.—W. F. Crosby, President; Tracey Sherman, Vice President; Marquis Bryant, Secretary; Erskine Van Houten, 24 De Pew Ave., Nyack, N. Y., Corresponding Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Sacramento Wireless Signal Club.—E. Rackliff, President; J. Murray, Vice President; G. Banvard, Treasurer; W. E. Totten, 1524 "M" St., Sacramento, Calif., Secretary.

Santa Cruz Wireless Association.—Orville Johnson, President; Harold E. Sentor, 184 Walnut Ave., Santa Cruz, Calif., Secretary and Treasurer.

Southeastern Indiana Wireless Association—R. F. Vanter, President; D. C. Cox, Vice President and Treasurer; H. Hitz, Fairmont, Madison, Ind., Corresponding Secretary.

Southern Wireless Association.—B. Oppenheim, President; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Secly, Vice President and Treasurer; D. W. Martenson, Secretary; Club Rooms, 323 King St., Springfield, Mass.

Spring Hill Amateur Wireless Association.—R. D. Thiery, President; H. P. Hood, 2nd, 2 Benton Road, Somerville, Mass., Secretary and Treasurer.

St. Paul Wireless Club.—Thos. Taylor, President; L. R. Moore, Vice President; E. C. Estes, Treasurer; R. H. Milton, 217 Dayton Ave., St. Paul, Minn., Secretary.

Tri-State Wireless Association.—C. B. DeLaHunt, President; O. F. Lyons, Vice President; T. J. M. Daly, Treasurer; C. J. Cowan, Memphis, Tenn., Secretary.

Waterbury Wireless Association.—Weston Jenks, President; Alfred Upham, Treasurer; H. M. Rogers, Jr., 26 Linden St., Waterbury, Conn., Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; E. Kelly, Treasurer; H. J. Bothel, 300 Fourth Ave. E., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Canada.—W. Fowler, President; E. G. Lunn, Vice President; W. C. Schuur, Secretary and Treasurer.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillie, Vice President; Harold Satter, 309 South Ohio St., Butte, Mont., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 North Monroe St. Baltimore, Md., Secretary.

Wireless Club of the Shortridge High School.—Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., President; George R. Popp, Vice President; Bayard Brill, Treasurer; Oliver Hamilton, Secretary.

For Practical Electrical Workers

Electric Lighting Circuits

By HENRY CLOWS

The maximum incandescent lamp load permissible on any branch circuit is 660 watts. That is, wiring must be so arranged that no set of incandescent lamps requiring more than 660 watts, whether grouped on one fixture or on several fixtures or pendants, will be dependent on one cut-out. This is an

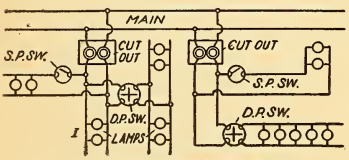
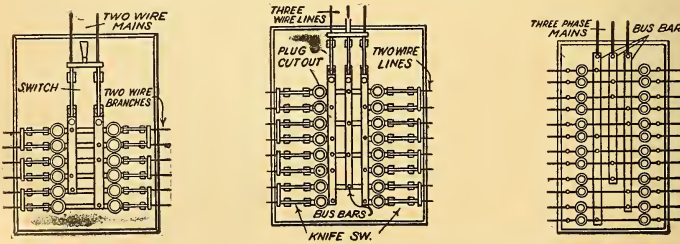


FIG. 1. LAMP CONNECTIONS

underwriters' requirement, but permission may be given in special cases by the local inspection bureau for departures from the rule.

The connection of lamps to circuits can be effected in innumerable ways, but the principles outlined in Fig. 1 are general. The lamps at (I) will burn as long as the main is alive. The other lamps are controlled by either single pole or double pole switches. Single pole switches should not be used for the control of circuits of capacities exceeding 660 watts, and three-point or three-way switches are considered the equivalent of single pole switches in this respect.

Panel box panels for two wire, three wire and three phase systems, are illustrated in Figs. 2, 3 and 4. A panel merely provides a convenient means of connecting (through fuses) the branch circuits to the mains. Switches may be used as in Fig. 2, in both the main and branch circuits, or switches may be omitted entirely, as in Fig. 4. Whether or not switches should be provided, is determined by conditions or convenience, as the only switch required on the lighting service of a building is the service switch. Fuses, however, are required to protect every branch circuit. Many satisfactory



FIGS. 2, 3 AND 4—PANELS FOR TWO WIRE, THREE WIRE AND THREE PHASE SYSTEMS

installations are in operation without switches, but switches are of great convenience for opening the circuits, for

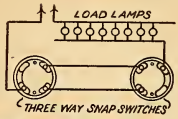


FIG. 5—CONTROLLING LAMP FROM TWO LOCATIONS

replacing fuses and for testing. Branch lighting circuits may be controlled by either flush or surface snap switches, mounted outside of the panel box.

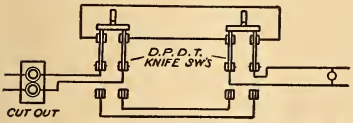


FIG. 6. TWO-LOCATION CONTROL WITH DOUBLE POLE SWITCHES

The method of controlling a group of lamps from either of two locations, with snap or flush switches, is shown in Fig. 5. Two special three-way switches, of either the flush or surface type, are required. These can be purchased. This scheme of wiring is much used for hall lights so they can be controlled from either the first or second floor.

Two-location control with double pole knife switches, is shown in Fig. 6.

The method of controlling a group of lamps from any one of more than two locations, with flush or snap switches, is shown in Fig. 7. Special switches made for the purpose are required. A three-way switch is used at each end of the

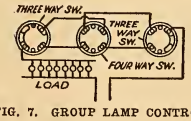


FIG. 7. GROUP LAMP CONTROL

circuit, and as many additional four-way switches are necessary as there are additional control locations. This method is also much used for wiring for hall lights.

An emergency or burglar circuit is shown in Fig. 8. This arrangement can be used where it must be possible to light certain lamps in a building from a certain location, irrespective of whether the switches normally controlling the lamps are closed or not. Closing the master

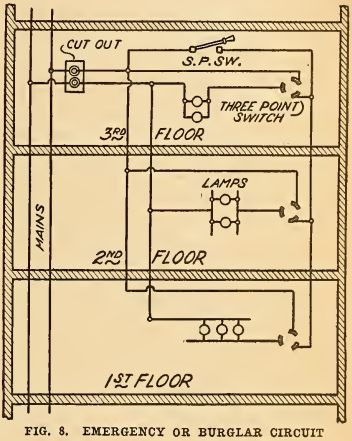


FIG. 8. EMERGENCY OR BURGLAR CIRCUIT

switch illuminates the house as might be necessary in case of fire, an invasion by burglars or other emergency.

Electrolier switches for controlling lamps in groups, as is often necessary in room lighting where there is a dome or

FIG. 9. ELECTROLIER SWITCHES

electrolier having several distinct circuits, are wired as shown in Fig. 9. Special snap switches of either the flush, pull, or surface type, are necessary. With the two-circuit switch, Fig. 9, with the switch handle in the first position all lamps are off, in the second position only those of Group 1 are on, in the third position

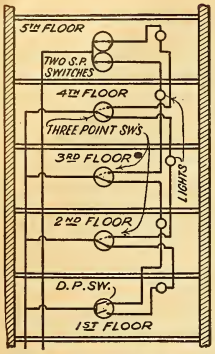


FIG. 10. CIRCUITS FOR STAIRWAY LIGHTING

those in both groups are on, in the fourth position only those in Group 2 are on. Then with the next quarter turn of the switch the first position is again assumed and all lights are extinguished. While the same principle is always used, all commercial electrolier switches are not arranged exactly as illustrated.

A circuit arrangement for stairway lighting is shown in Fig. 10, whereby one can illuminate the landing that he is on and the one above or below him as he goes up or comes down the stairs. The switch at each landing must be operated in passing. Two single pole switches are shown on the fifth floor. With these two switches the lamp on that floor can be left burning if desired.

Getting Rid of the Tie Wire

A new way to fasten electric wires to the glass insulators upon the poles is made possible by the Fay clamp insulator.

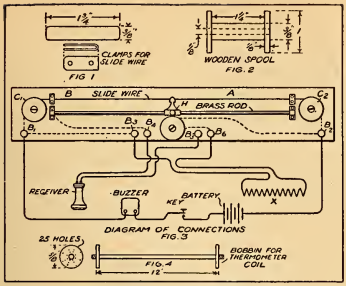
WIRE FASTENER

The clamp is of porcelain and both the insulator and wire are so made as to be installed with small loss of time, by hooking the jaws of the clamp under the insulator rim and turning the lock nut.

How to Make a Resistance Thermometer

The operation of the resistance thermometer depends upon the change in the resistance a conductor offers to the passage of a current of electricity through it, due to a change in its temperature. If the relation between the resistance of a coil of wire and its temperature is known, then its temperature may be determined at any time by simply measuring its resistance and looking up in a previously prepared table the temperature corresponding to the measured value of the resistance. The coil of wire, together with a Wheatstone bridge, would constitute a resistance thermometer, but a slide-wire bridge with a direct reading temperature scale under the wire is here described.

Obtain a hardwood board ⅞ by 7 inches and 3½ feet long, also 35 feet of No. 24 B and S gauge insulated manganin wire and 20 feet of No. 27 insulated manganin. Round the edges and corners of the board and give it several coats of shellac. Make two brass clamps, as shown in Fig. 1, from some 1/16 inch sheet brass. Next turn out three wooden spools like the one shown in Fig. 2, and shellac them. Mount the piece of No. 24 manganin wire by means of the brass clamps on the board, Fig. 3, the center of the wire being one foot from one clamp and two feet from the other, the clamps being equally spaced from the two ends of the board. The slide-wire should be one inch from the edge of the mounting board. Mount two of the wooden spools on the ends of the board as shown by (C_1) and (C_2). Provide six back-connected binding posts and mount them on the base as shown by (B_1), (B_2), (B_3), (B_4), (B_5) and (B_6) in Fig. 3. Place a piece of ⅛ or 3/16 inch brass rod on the board parallel to the slide-wire, one inch from it and ¼ inch above the surface of the board. Obtain a piece of thin brass tubing about 1¼ inch long and of such an inside



RESISTANCE THERMOMETER

diameter that it will slide along the brass rod. The sliding contact is carried by the brass tube and should be soldered to the under side of it. The lower edge of the sliding contact should be rather sharp so it will make contact with a definite point on the slide-wire. A small hard rubber handle (H) may be fastened to the tube and will aid in moving the contact along the wire.

One end of the brass rod should be connected to the binding post (B_4) by a copper wire placed in a groove on the underside of the board. Wind the free portions of the slide-wire on the two spools (C_1) and (C_2) and attach the ends to the binding posts (B_1) and (B_2), making connections on the underside of the board. Wind on the spool (R) the 20 feet of No. 27 manganin wire and connect the ends to the binding posts (B_2) and (B_6). The windings on the spools (C_1), (C_2) and (R) should be noninductive; that is, one-half of the turns should be wound around the core in one direction and the other half in the opposite direction. Connect the binding post (B_1) to (B_3) and the binding post (B_5) to (B_6) and the bridge proper is complete.

The thermometer coil is of copper wire and it, together with its leads, should have a resistance practically the same as the resistance of the coil (R) at ordinary room temperature, which is usually about 25° C. To construct the thermometer coil, proceed as follows:

Make a spool whose dimensions correspond to those given in Fig. 4. The spool should be made of some 1/8 inch sheet rubber, threaded and screwed on the threaded ends of the brass rod. Glue several layers of thin insulating cloth around the brass rod. Drill 25 small holes in each of the rubber ends and thread 25 feet of No. 40 B and S gauge, cotton-covered copper wire back and forth from end to end. Place this spool in a piece of brass tube to protect it mechanically. The tube should have a number of small holes drilled in it so that the temperature inside will always correspond to the temperature outside the tube. If this coil is to be used some distance from the bridge, leads of suitable length should be provided before calibrating, and their resistance should be comparatively low, No. 18 B and S gauge manganin wire being suitable.

A piece of heavy cardboard 3/4 inch wide should be mounted directly under the slide-wire and it should extend from clip to clip. Carefully remove the insulation from the slide-wire between the clips by means of a good sharp penknife.

To calibrate the bridge wire as a direct reading thermometer, immerse the thermometer coil in a quantity of oil placed in a metal vessel. Arrange to heat this oil, using a good mercury thermometer as a standard. Bring the oil bath to a constant temperature, say 25° C., then adjust the resistance of the thermometer coil plus its leads to such a value that a balance is obtained with the sliding contact in the center of the total slide-wire or one foot from one clip and two feet from the other. Gradually raise the temperature of the oil bath and allow it to become constant at some higher value, say 30° C. (smaller steps may be taken if desired), and make a second balance and mark the point of balance on the cardboard. Continue in this way until a maximum temperature of, say, 100° C. is reached. Lower temperatures may be obtained by immersing the vessel con-

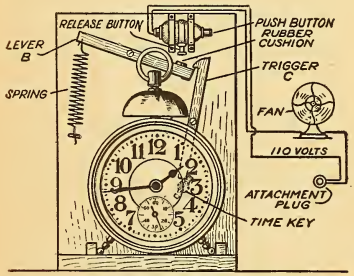
taining the oil in crushed ice or snow. Always make sure the temperature of the coil has reached a value corresponding to that indicated by the thermometer. Errors due to unequal temperatures of the oil and coil may be reduced by stirring the oil with a small paddle.

Instead of using a steady battery current, an interrupted battery current is used, it being interrupted by introducing an ordinary low resistance buzzer directly in series with the battery. The balance point is indicated by a minimum hum in the telephone receiver. A steady battery current and galvanometer may be used instead, if desired.

Turns the Fan Off

The scheme here suggested may be used to turn off the electric fan by the bedside without disturbing the sleeper, who may start the fan going when he retires.

A pendant push button switch may be obtained from any electrical supply house for 50 cents or less. To complete the

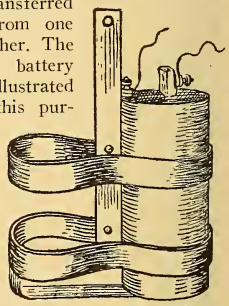


SUGGESTIONS FOR AUTOMATICALLY CONTROLLING A FAN

circuit, the button in the end of the switch is pushed, which is released upon touching the small button on the side of the switch. The lever (B) is made to hit this small button on the side of the switch, thus turning off the current at the desired time. The time key of the clock is made to push over the trigger (C), releasing the lever (B), which deals the button on the side of the switch a smart blow. The part of this lever which comes in contact with the button should have a piece of soft rubber or cork glued on to prevent noise. In winding the clock, the time key should be left so that in a quarter revolution of the key it will come in contact with the trigger (C), which on my clock allows the fan to run for about half an hour.—Wesley G. Paulson.

Battery Holder

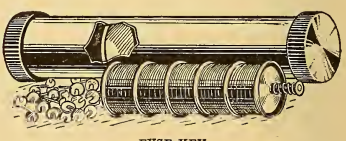
It is often convenient to have two or three dry batteries arranged so that they may be transferred altogether from one point to another. The Economy battery holder here illustrated serves for this purpose and is a skeleton holder made of ¾ inch enameled band steel. It may be hung from a nail or screw and is made to hold either two or three ordinary dry cells.



BATTERY HOLDER

Wireman's and Engineer's Fuse Kit

The house electrician or the engineer is often called upon to replace a blown

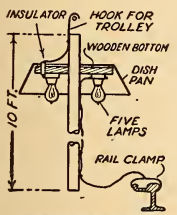


FUSE KEY

fuse. The convenience of the fuse kit here illustrated, is in such a case easily demonstrated. The case contains five sizes of fuse wire upon spools to fit the case, an assortment of links being also included.

Portable Street Light

The track gang on a street railway was working on a rush job of relaying a section of track, and as it was necessary to work all night, the question arose as how to light the tracks. As the gang was constantly moving forward, it would not pay to install arc lamps. This is how the problem was solved:



PORTABLE STREET LIGHT

Several medium sized dishpans, procured at a five and ten cent store, were fitted with wooden bottoms to which were fastened five sockets. A ten-foot pole was placed through the center of the pan bottom.

A hook of heavy copper was then attached to one end of the pole, and a wire connected it with the sockets. The sockets were connected in series to allow use of 110 volt lamps on the trolley circuit of 550 volts. The other terminal of the socket group was connected to a long wire, which in turn made connection to the rail. Thirty-two candlepower lamps were placed in the sockets.

Whenever the arrangement was moved all that was necessary was to remove the rail clamp and unhook the pole, move to the spot selected, clamp on to rail, hook on to trolley and there was plenty of light. Four of these furnished light for 50 men.—Harold L. Kessler.

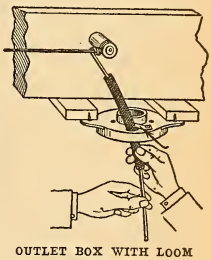
Preventing Gravity Cells From Creeping

Gravity batteries cause some inconvenience and muss by "spewing over." There are ways of preventing this, but the one I have found to be the most successful is as follows: After the battery has been made up place a layer of excelsior on top of the solution and pour in enough molten paraffin wax to completely cover.

This comes handy when the battery needs renewing, for by melting the edge of the paraffin with a blow torch it can easily be removed and replaced by again melting and allowing to cool. This cover prevents evaporation and creeping, and at the same time is porous enough to allow the gases to escape.—T. Dodd.

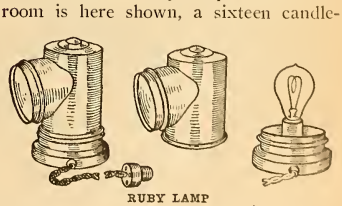
Keeps the Loom in Place

The electrician likes to leave his work in good condition for the fixture hanger. The protecting "loom" at the outlets is seldom firmly fixed on the wires. The Fancleve outlet boxes for concealed work offer something new to do this. Over each hole a flat steel spring projects slightly, so that when the conduit is in place it cannot be withdrawn from the box. The idea is to cut off enough conduit to be in the box to meet the terminal porcelain knob in the timbers, then push it through the box toward the knob. This can be done with two fingers, but would take a yoke of oxen to pull it out when once in place.


OUTLET BOX WITH LOOM HOLDER

Ruby Lamp

A convenient ruby lamp for the dark room is here shown, a sixteen candle-


RUBY LAMP

power lamp being used. The body of the lamp is of heavy tin plate and is copper oxidized.

Electricity the Silent Salesman

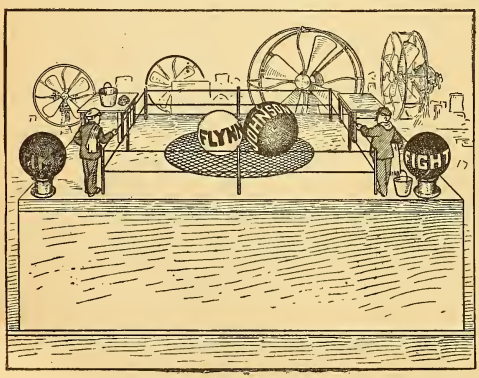
Some helpful hints on the use of electric current in getting up show window displays. The following schemes have all been used with remarkable success.

A "White Hope" Fan Display

A clever window display appealing to the "fight fan," and attracting unusual attention from everybody, is made use of to advertise electric fans.

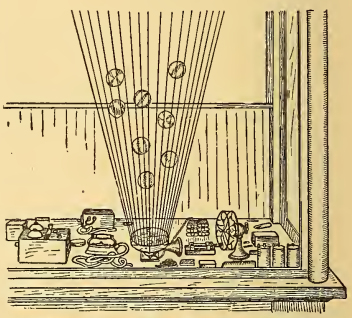
Upon a small platform a miniature ring is roped off. In opposite corners are trainers with towels, sponges and pails. An opening in the top of the box platform and within the ring is covered with wire netting. Upon this netting rest two rubber balls, one white, labeled "Flynn," the other black, marked "Johnson." At each front corner of the platform is an incandescent lamp with a ground glass globe. Upon one is printed "Fight," upon the other, "Time." Inside the box platform and directly under the ring is an electric fan arranged to blow air up through the opening and, of course, against the balls.

The device operates as follows: With the current turned on, the lamp marked "Fight" lights up, the fan runs and the black and white battlers bump each other about the ring, the air draft being regulated to a point to accomplish this. Then the "Fight" light goes out, the "Time" light is automatically turned on, the fan stops, and the balls come to rest until the "Fight" lamp again lights up.



"WHITE HOPE" FAN DISPLAY

Fan Time Display



THE BREEZE KEEPS THE AIR BAGS BOUNCING

An enterprising dealer in electrical goods has put an electric fan to good use in an attractive window display. The fan, with wire guard attached, is laid face upward on the floor of the show window, and numerous pieces of twine are fastened to the guard and to the ceiling, forming a space enclosed by twine and shaped like an inverted cone. In this space are placed four or five air-filled balloons, which, when the fan is not in operation, lie on the guard of the fan. When the current is turned on, they perform a merry game of tag in the cord cage. W. H. Dennison.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

PLACING PLATINUM WIRE IN QUARTZ TUBES

While it is an easy matter to mount platinum wires in glass, such as we find in electric lamp bulbs in order to bring the current to the filament, it is quite a problem when it comes to using the new quartz tubes which are being used for mercury vapor lamps, or other kinds of quartz vessels such as experimenters are working with. A Paris constructor, M. Berlemont, succeeds in doing this by a new method. The difficulty is that quartz melts at a very high heat, 1800° C., and expands very little under heat, while the metals melt below this point and also expand much more. He first tried to fix the wires directly in the quartz by melting, and then used other methods, such as placing glass or enamels between the wire and the quartz. However, he came back to the direct method, and is now able to fix the wire in the quartz, using a wire made of an alloy of platinum and iridium. Thus he could obtain a tight joint which would hold well even at a high heat.—*Académie des Sciences' Report.*

HOLLAND FISHING BOATS EQUIPPED WITH WIRELESS

Some of the fishing boats in the Holland ports are fitted with a simple and convenient wireless outfit, and this is a great aid to such craft, as they can send signals to shore about the results of the fishing, or can say when they are to come to port, or ask for a tow boat. The Holland boats have only one antenna, which is a copper wire stretched above the deck between two masts and a wire then leads down to the apparatus. The receiving set is in a compact box and uses a detector fitted in a watch case, also a small regulating coil and a telephone receiver, with two dry battery cells.—*Revue Electrique.*

LAMPS AS TIME-LIMIT SIGNAL TO SPEAKERS

When, a few years ago, Parliament became a recognized institution in Russia, the question of the length of speeches early engaged the attention of the framers of the new adjunct to an ancient Constitution. It was agreed that fifteen minutes was a reasonable allowance per head, and an ingenious contrivance was introduced with design to mark off the allocation. On each man's desk was fixed a red lamp fed by electricity. When the member rose to speak, the lamp lit up. At the end of a quarter of an hour it automatically went out, and simultaneously the orator, even if he were in the middle of a sentence, shut up.—*The Observer.*

WIRELESS TELEGRAPHY ON AEROPLANES

Some very good experiments on the use of wireless telegraphy with aeroplanes were made not long since at Chartres, in the region of Paris. Starting from the aerodrome, the pilot Frantz carried on board M. Rouzet, the inventor of the wireless apparatus, and made a sail of about 100 miles around the country, with 30 miles as the greatest distance from the starting point, where a small wireless outfit had been set up at the aerodrome and where several of the army officers were taking part in the trials. They could receive all the news of the aeroplane observations and the signals were very good even though the antenna wire was a short one. On the aeroplane the antenna consisted of a 100-foot wire hanging down, and the motor served to drive a small dynamo for producing the current. The dynamo and all the rest of the apparatus is especially light, and all is well enclosed so that there is no danger of electric shocks to the operator. The wire is mounted on a reel and can be rolled up in fifteen sec-

onds, and there is a safety device for cutting the wire in case the aeroplane should descend rapidly.—*Industrie Electrique.*

HOTEL WITH 200 ELECTRIC CLOCKS

A hotel with 200 electric clocks has been opened recently in Liverpool, this being the Adelphi Hotel belonging to the Midland Railway Company. It has uniform and accurate time distributed throughout the building by electrical impulse dials on the Synchronome system, all the dials being wired up and controlled by a master clock. With the exception of 40 in the service and the servants' quarters, the dials are of handsome enamel on copper and are set in elaborate brass hand-finished cases which the architect designed so as to be in harmony with the surroundings. The bedrooms have dials fixed on the wall, and what is a good point is that they run very silently so as not to disturb rest during the night.—*Electrical Review, London.*

COATING BALLOONS WITH ALUMINUM POWDER

Balloon envelopes are sometimes given a coating of aluminum powder so as to protect the rubber tissue from the bad effect of the sun's rays, and it is found that with the metal coating there is less difference in heating and cooling when the balloon passes from cloud shadow to sunlight. But the metal also has a disadvantage, as it is likely to become electrically charged when in the air, owing to atmospheric electricity. In one case, on April 22, a German spherical balloon was flying near the Harz mountains, and it took fire from an electric spark which occurred when the gas valve was opened. The spark set fire to the gas. Somewhat the same kind of an accident happened to a military captive balloon at Strassburg. It broke loose from its moorings and rose high in the air, then came down to the ground. No doubt it became highly charged with electricity during the flight, for a spark set fire to the gas as soon as the officers opened the valve. Not long ago an army balloon in Italy with metallic coating was struck by lightning, and this seems to be the only case where a captive balloon suffered in this day.—*Cosmos, Paris.*

PEAT FIELDS OF BAVARIA

Southern Bavaria has immense peat fields which can be used for running electric plants and the attention of engineers is being called to the matter; electricity could thus be had very cheaply. The peat bogs lie mainly in the neighborhood of the Danube and it is estimated that they cover an area of 500 square miles. Even supposing that only 80 per cent of this surface is worked, and that the layer is but three feet in depth, estimating a cubic yard of peat to weigh about 100 pounds this would mean no less than 50 million tons of fuel from this source. Should the peat fields be worked all the year round, power could be obtained to the extent of 700,000 horse power for the space of 50 years.—*Elektrotechnik Maschinenbau.*

INSPECTING EGGS WITH X-RAYS

Eggs are now being examined by X-rays in Denmark and England, and the new method is said to be a very good one.

A special dark room is installed in the quarters where the eggs arrive, and the apparatus consists of a closed lantern containing the electric tube for producing the rays. In the front of the lantern is a small opening of about the size of an egg, so that the rays can pass through the egg. The rays throw the shadow of the egg upon a screen placed in front. Fresh eggs are seen to be quite clear, but any defects are shown up as small spots appearing on the screen. Such eggs are put in the second class, but if the spots are too large they are rejected.—*La Nature.*

Inventions and Patents

By A. P. CONNOR

Many who have what they are satisfied is a patentable invention have a very incomplete idea of how to proceed in taking out a patent. Some, moreover, believe that all the world is waiting to steal their ideas—patent attorneys included. We have in mind one inventor in particular. He had a "revolutionary" invention but did not know what to do with it. So he wrote (address general delivery) to a publisher for the name of a reliable patent attorney. On getting the information he appeared before said attorney with witnesses and asked advice. He would not tell the attorney what the device was, or what it was for. He did tell him, however, that he, the attorney, need not hope to follow the trail of the invention for he, the inventor, moved mysteriously several times a week, taking long rides on elevated trains and dashing in and out of alleys from one boarding place to a new one. Of course, the attorney was powerless to help him in his dilemma. Now the Patent Office is to protect the inventor and it is a simple matter to get a patent on a new and meritorious device. There are a few simple rules of procedure explained in the following article, which will be concluded in the next issue.—EDITORIAL NOTE.

GENERAL

That humble legal instrument issued by the Government and known as a patent is the main cause of a great deal of our present industrial development and progress, because of the protection it affords and the encouragement it gives the inventor, and those who instituted the system which is built around it deserve great glory and credit. The patent in this country may be defined as being a legal instrument issued under the seal of the Government to the inventor satisfactorily complying with certain conditions outlined by law, and which gives the inventor a monopoly of his invention for seventeen years. The inventor may do anything he wishes with his invention; that is, he may sell it, or he may lock it away if he so choose and prevent anyone else from using it. In fact, if anyone wishes to have an adequate idea of the extent of the monopoly he has only to read the late case of Dick before the Supreme Court of the United States, which case caused quite a stir in the commercial world so recently.

A patent may be obtained by any person who has invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof, and in each case the novelty and utility must be that defined by the statute. If neither novelty nor utility are present, or if one is there and the other absent, a valid patent can not be obtained, but the matter of patentability is a difficult one to decide in many cases even under the best conditions, and it is always advisable to get the opinion of an experienced patent attorney on the subject before going to the expense of applying for a patent.

A machine in the Patent Office language is a term broad enough to include any mechanical device, as for instance a button hook, a wrench, a motor, a cotton picker, a plow, an insulator and almost any other device capable of being used in the mechanical arts. The term composition of matter embraces special substances which produce special results, such as chemical compounds and mechanical mixtures, as, for instance, dyestuffs, adhesives, explosives, paints, and multitudinous other well known classes of materials. The term manufacture is an expression which serves to classify those classes of invention which might be difficult to include in the other terms, and

serves to give a certain amount of discretion to the Commissioner of Patents in his determination of patentable objects. The term new and useful art is particularly clear to the layman but is also broad in its scope, as it includes new processes for manufacturing materials, and in the electric class would include those special systems of wiring, as in the case of duplex, diplex and other systems of telegraphy.

There are also patents granted for designs of all kinds, but these are treated differently from those already referred to, and they are given for designs of machinery, manufactures, etc., some examples of which are wall paper patterns, specially and artistically formed furniture and hardware, and other articles which are given some particular design for artistic rather than for efficiency reasons.

Trade-marks are also examined in the Patent Office and registered there, but they are intended to identify the goods of one corporation from those of all others in the same line of business. This subject, however, will not be treated of in this article.

THE APPLICATION

The application for patent usually includes a petition to the Commissioner of Patents, a specification, an oath and sheets of drawings. In addition a model is sometimes required and a power of attorney included. The petition is a communication asking the Commissioner of Patents to grant a patent to the petitioner, that is, the inventor, and includes the latter's address and other incidental matter. The power of attorney is usually placed after the petition and is signed by the inventor. The specification is divided into three main parts which are technically known as the preamble, the specification proper, and the claims. The first is a public declaration by the applicant that he has made the invention referred to. The specification proper describes the invention, its purpose and its operation in such language as will enable all those who are in the profession it refers to, fully to understand it, and where there are drawings it refers to the same, so that they will be clearly understood. Finally come the claims, which in technical and in legal language positively point out the invention, and to a very great extent control the value of the patent.

The drawings required to illustrate the invention must be made to comply with the strict rules of the Patent Office, and are usually beautiful pieces of draftsman's work when drawn by an experienced patent draftsman. The drawings have to be of a high grade character in order that the drawings will show up well in the printed publications issued by the Patent Office. The drawings are signed by the inventor or his attorney for him in the presence of two witnesses, who also attest their signatures.

The inventor must sign the specification in the presence of two or more witnesses who also attest theirs, and the inventor also takes the oath in the presence of a notary public and signs the same. The notary or whoever administers the oath to the inventor must then put his official seal on the papers in such a way as to identify the whole application papers, for which purpose the papers are in most cases ribboned together with the ends of the ribbon brought under a paper seal which receives the impression of the notary's seal.

(To be Concluded.)

NEW BOOKS

THE CINEMATOGRAPH AND NATURAL SCIENCE: By Leonard Donaldson. London: Ganes, Limited. 1912. 88 pages with 25 illustrations. Price, 66 cents.

A volume in which the author shows the value of the moving picture as an educator, serviceable in laboratories, hospitals, colleges and in public and private schools.

THE MODERN BIOSCOPE OPERATOR. London: Ganes, Limited. 1911. 181 pages with 29 illustrations. Price, 83 cents.

A book written for the moving picture operator by men who have been in the business. The subject matter is presented in a practical way.

On Polyphase Subjects

From Diamond to Coke

There has been accomplished the transformation of a diamond into a black coke-like mass. This was achieved by the action of cathode rays in a high vacuum. The diamond first became red, and then intensely white-hot, and finally, at 11,200 volts and 48 milliamperes, it disintegrated, increased considerably in volume, and assumed the appearance and consistency of coke.

The temperature at the time of disintegration was estimated to be 1,890°. Differences were observed in the spectra of the gases in the vacuum tube before and after the operation, but they were not sufficiently marked to determine with exactitude any variation in the nature of the gases.

New Discoveries Regarding Magnetic Metals

It was unknown before 1903 that alloys of non-magnetic metals could acquire permanent magnetism. The alloys of manganese, with arsenic, aluminum, bismuth, tin, antimony, and boron, become, if copper is present permanently magnetized after being in the presence of powerful electrical fields. These alloys are best made by adding the third metal to copper-manganese. Heating these alloys brings out various curious properties. If the copper-manganese is warmed as by the hand, it is not magnetizable. The moment, however, it is cooled, as by cold water, it again reacts to a magnet. This fact was announced to the London Faraday Society by Professors Hilpert and Dieckman a short time ago.

Electricity and Memory

There has been presented to the Royal Society at London a paper on the neurons cells of the brain in their relation to the faculty of memory. After stating that as with the other tissues of the body, so with the cells of the brain, evidence of lessening power and activity appears with the passage of years, there is adduced the interesting fact that the line of present investigation demonstrates that the electrical current through the brain rotates its molecules to such a degree as to produce a most noticeable physiological response in the direction of improved memory.

The Production of Hydrogen

Under the stimulus of practical science the work of the world widens and intensifies, so that there is a constant demand for better methods of producing certain substances that formerly were little used. One of these is hydrogen, for which there is a rapidly increasing demand for use with dirigible balloons, for the manufacture of tungsten lamp filaments and for processes that require the employment of the oxy-hydrogen blowpipe. Two principal processes are at present used in producing hydrogen, one being electrolytic, and depending upon a cheap supply of electric energy to decompose water; the other produces the gas by passing steam over red-hot iron. The electrolytic method has been largely developed in Germany and the other in England. But the problem of producing hydrogen cheaply on a large scale has not yet been satisfactorily solved.

"How do you feel about being on the water wagon?"

"Well, I feel better off."

* * *

Lulu—"I've never met a man who really interested me."

Mary—"What kind of a man do you want?"

Lulu—"Oh, a man who'd do things and make it necessary for me to write to the heart to heart department of some magazine for expert advice."

* * *

"Dear Clara," wrote the young man, "pardon me, but I'm getting so forgetful. I proposed to you last night, but really forgot whether you said yes or no."

"Dear Will," she replied by note, "so glad to hear from you. I know I said 'No,' to some one last night, but I had forgotten just who it was."

* * *

Physician—"From a hasty examination, I am of the opinion that you are suffering from clergyman's sore throat."

Patient—"The h—l you say!"

Physician (quickly)—"But it is quite possible that I am wrong—I will look again."

* * *

In a recent examination in machine design in a Chicago technical High School, the class was asked to define "Stress and Strain." A Chinese student made this answer:

"Stress will be happened if, when a piece of machinery gets outside of the factor of safety and then something hits it a blow, why it will break right off."

* * *

The new Swedish cook, who had come into the household during the holidays, asked of her mistress:

"Where bane your son? I not seeing hem 'round no more."

"My son," replied the mistress, pridefully. "Oh, he has gone back to Yale. I miss him dreadfully, though."

"Yas. I know yoost how you feel. My broder, he bane in yail saix times seence Tanksgaving."

* * *

"Is Mrs. Gillet a well-informed woman?"

"Well, she's on a party wire."

Said the electric light promoter to the mill stream, "I need your help." Said the mill stream to the E. L. P., "Well, I'll be dammed."

* * *

Augustus—"I'm not fond of the stage, Violet, but I hear your father on the stairs, and I think I had better go before the foot lights."

* * *

Teacher—"Appropriate means fit. Can you give me an example?"

Willie—"No, I can't; but our old cat can. She has 'em."

* * *

She—"In a way, getting married is like using the telephone."

He—"How so?"

She—"One doesn't always get the party one wants."

* * *

"Will you have anything on your face, sir, when I am through?" asked the barber.

"You might leave my nose there," answered the man in the chair.

* * *

"Money isn't everything," sighed the young man.

"Of course not," said the girl. "I know of a couple that started housekeeping nicely on tobacco coupons alone."

* * *

"Look a-here, Malvina!" cried the old man, shaking a horny finger at the bills the rural free delivery carrier had left, "mustard plasters from Josyin's, fifty cents; six teeth pulled at Dr. Pollard's, three dollars! There's three dollars and a half in one week spent for your own private pleasure. Do you think, woman, I'm made of money?"

* * *

Willie—"Pop, what are 'ancestors?'"

Father—"Well, I'm one of yours—your granddad is another."

Willie—"Oh! But why is it that folks brag about them?"

* * *

Chappie—"Electricity is wonderful. I tell you, it makes one think."

Miss Cutting—"Yes; why don't you get a battery?"


SOME ADVENTURES WITH A VACUUM CLEANER
"I DONT SEE ANY 35 DOLLARS WORTH"
"OH FATHER SEE MY NEW FEATHER! THE TAX WAS 35 DOLLARS"
SIP! - PHT
"MOTHER! COME QUICK! PIPE THE BIZARRE ORIFICE I HAVE FOUND!"
CHILD GERM
"OH FATHER COME QUICK! BRING GRANDPA & GRANDMA
MOTHER GERM
BR-BR
BZ-BR-OR
BR-BR
BR-BZ-
THE PURSUIT OF THE WICKED FLEA
(NO MAN PURSUETH)
JUST THEN SOMEONE STARTED THE MACHINE
PHT
PHT
SIP
PHT
A NEW PLACE TO LOOK FOR MISSING COLLAR BUTTONS
"OH JOHN-LOOKIT! SEE WHAT A FUNNY LOOKING MAN OUT IN THE STREET!
PSYCHE NOT
WHERE? I DONT SEE HIM"
A TIP FOR LADIES WITH TIGHT-WAD HUSBANDS
DEBALL

Common Electrical Terms Defined

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

RESISTANCE BOX.—An inclosure containing a number of resistance coils so arranged that one or all may be placed in series on the circuit. The most common application is found in the Wheatstone bridge and in the motor starting box.

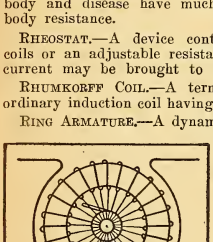
RESISTANCE COIL.—A coil of wire used to control the current in a circuit. (See Resistance Box.)

RESISTANCE OF THE HUMAN BODY.—Resistances varying from 350 to 8,000 ohms have been determined, but so much depends upon the contacts and their application that these results are not dependable. It is also asserted that moisture upon the surface of the body and disease have much to do with the body resistance.

RHEOSTAT.—A device containing resistance coils or an adjustable resistance by which the current may be brought to a fixed value.

RHUMKORFF COIL.—A term applied to the ordinary induction coil having a circuit breaker.

RING ARMATURE.—A dynamo or motor armature in which the coils are wound spirally around a ring-shaped or hollow cylindrical core. (See cut.)



Ring Armature

ROCKER.—A movable ring mounted about the commutator of a dynamo or motor and to which the brush holders are attached. By moving the rocker back and forth the brushes are given the proper position upon the commutator.

RODDING A CONDUIT.—In drawing a cable into a straight conduit a number of rods are placed in the conduit and connected together one after another end to end and crowded through until the first rod comes out at the far end. A rope is then pulled through by the rods, which are uncoupled as they are drawn out. The rope is used to haul in the cable.

ROSETTE.—A porcelain piece placed upon the ceiling from which to anchor the drop cord of a suspended incandescent lamp.

ROTOR.—In an induction motor the rotating mass of short-circuited conductors.

SAL AMMONIAC BATTERY.—See Battery, Sal Ammoniac.

SATURATED.—A liquid is saturated when it has dissolved all of a salt that it will at ordinary temperature, some of the salt remaining on the bottom of the vessel.

SECONDARY BATTERY.—A combination of a number of storage cells to form a single source of current supply.

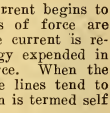
SECONDARY CURRENT.—The current induced in a second wire or coil by the current flowing in an adjacent wire or coil. The current taken from a transformer or an induction coil is secondary current.

SELENIUM.—An element resembling sulphur and tellurium. It is a conductor of electricity under certain conditions. It has the peculiar property of being highly resistant to the flow of electric current in darkness, but when light falls upon it selenium becomes a fairly good conductor.

SELF-EXCITING DYNAMO.—A dynamo in which the current for the field coils is furnished by the machine itself.

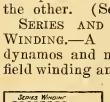
SELF INDUCTION.—When a current begins to flow in a wire, magnetic lines of force are formed about the wire and the current is retarded on account of the energy expended in building up these lines of force. When the current supply is cut off, these lines tend to prolong the current. This action is termed self induction.

SERIES.—A term used in speaking of the method of connecting up lamps or cells of battery. In batteries so connected, the zinc of one is connected to the carbon of the next. In lamps so connected the current passes through one after the other. (See cut.)



Series Connection

SERIES AND LONG SHUNT WINDING.—A winding in dynamos and motors in which there is a series field winding and also a shunt winding connected across from terminal to terminal of the machine. The shunt winding may be looked upon as a shunt to the outside circuit or as a shunt to the armature winding and series field. (See cut.)



Series and Long Shunt

SERIES AND SHORT SHUNT WINDING.—A compound winding in which the shunt winding is connected from brush to brush.

SERIES MOTOR.—A motor in which the field winding is in series with the armature winding.