Popular Electricity
In Plain English

VOL. V. JANUARY, 1913 No. 9

Where a Quart of Water Equals a Horse Power of Electricity

BY GEORGE F. WORTS

To the lay mind, hydro-electric service would seem highly difficult if not actually impossible in a section of the country where the thermometer, during the winter months, often registers 30 and 35 degrees below zero and, so it is said, the first flake of snow remains until spring; curious though ample proof of the severity of the winters.

However, so hydro-electric authorities assert, such contingencies as might be expected to result from the above conditions are avoided by the use of large reservoirs with an aggregate capacity sufficient to supply the generators throughout the winter.

The turbines furnishing electricity to Duluth, Minn., and her subsidiaries are actuated through a water head of 375 feet—the greatest head of water commercially available east of the Rocky Mountains. From this fall it is estimated that a quart of water per second at the water gate will furnish one horse power of energy in Duluth. A secondary, or auxiliary system, of 70 feet still remains to be developed; making a total available head of 445 feet, over twice the distance of the fall of Niagara's waters, although the grandeur of Niagara is lacking.

Five years ago, the largest water turbine then in existence was installed in the Great Northern Power Company's plant on the St. Louis River at Thompson, Minn., thirteen miles from Duluth; today 40,000 horse power is available, while at least double that still remains to be harnessed.

The great reservoir at Thompson has a capacity more than enough to supply the customers' wants during the extreme winter season.

Leaving the reservoir, the water flows through a canal two miles in length and from there is carried a distance of one mile by three pipe lines constructed of California red wood. These conduits, which are each seven feet in diameter—large enough to drive a horse and buggy through—deliver the water to the blades of the turbines in the power house located on the lower level of the river.

A unique feature of the installation just before the water arrives at this point, is a standpipe, the function of which deserves comment. The standpipe is a mammoth concrete and steel affair, rearing to a great height—several feet above the level of the reservoir—and is directly connected to the conduit lines.

In order to understand the function of this standpipe, let us consider one phase of the use of electric power which has assisted materially in placing Duluth next in rank to New York City in the number of tons of freight entering and leaving annually and which has a particular bearing upon the subject in hand.

Here alternating current was first applied to unloading apparatus.

THE PROBLEM OF TRANSPORTING HEAVY ELECTRICAL APPARATUS TO PLACES WHERE NEEDED IS A HARD ONE WHEN THE PLACE OF INSTALLATION IS AWAY FROM A RAILROAD. THE ILLUSTRATION SHOWS THE FRAME CASTING OF A 700 HORSE POWER MOTOR BEING HAULED A DISTANCE OF FOUR MILES FROM THE RAILROAD TO THE PLANT OF A BRITISH COLUMBIA COPPER MINING COMPANY. THE WEIGHT OF THE CASTING IS 34,000 POUNDS. NO WHEELS AVAILABLE COULD SUPPORT THE WEIGHT SO IT WAS HAULED ON RUNNERS AND AT A TIME WHEN SNOW WAS ON THE GROUND

POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. V | January, 1913 | No. 9

CONTENTS

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ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS

No additional copies will be sent after expiration of subscription except upon renewal.

Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.

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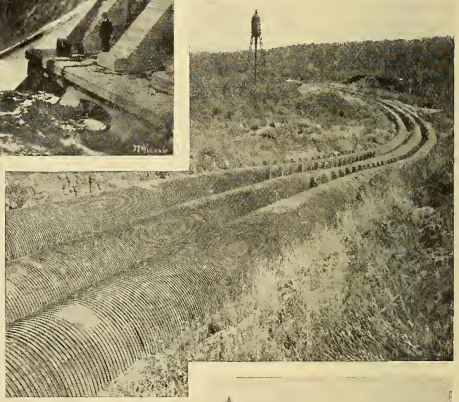
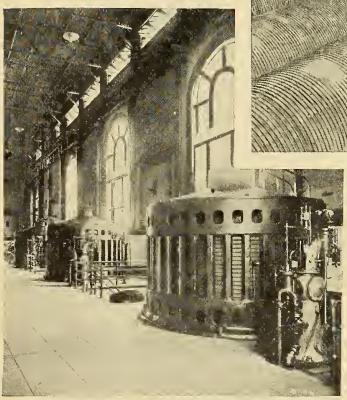
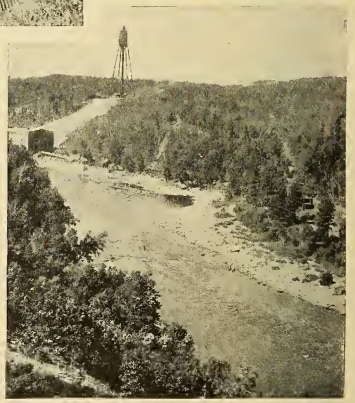






VIEW OF THE GREAT NORTHERN POWER COMPANY'S DEVELOPMENT ON THE ST. LOUIS RIVER, THOMPSON, MINN.

At the largest coal docks 1,000,000 tons are unloaded yearly, a sharp contrast to the 200,000 tons of five years ago. Huge electric motors at these docks will oftentimes throw an instantaneous load on the line of 8,000 horsepower. Consequently the line is drained and the prime mover—the water in the conduits at Thompson—is seriously taxed. At this juncture the mission of the standpipe becomes evident.

The natural tendency of water is to seek a common level. Manifestly the surface of the water in the standpipe is equal to that in the reservoir, thereby developing the same pressure as the 375 feet of normal head. When the sudden load of 8,000 horse power is thrust upon the great, vibrant transformers at Du-

luth, back over the threads of copper upon the quiet spinning turbines, the pipes cannot supply water fast enough and the reserve power of the standpipe is automatically tapped. When the load diminishes, the tank again fills to a level corresponding to that of the dam.

Between the standpipe and the turbines are automatically actuated valves to regulate the flow of water to the wheels.

From the low-humming generators, the current is stepped up in transformers to 33,000 volts and transmitted by a steel tower line thirteen miles to the distributing station at Duluth. Here the current is stepped down for local consumption and delivered to "wholesalers" in modified forms in Duluth, and also to Superior, Wis., via submarine cable under the St. Louis River where it emerges to join the sparkling, emerald waters of Lake Superior.

A point of interest worthy of mention in passing, is the method used to cool the immense transformers here employed to lower the voltage of the current. The coils of copper wire encircling the heavy iron core, constantly impressed by the tremendous current, would soon heat to redness if some adequate steps for cooling them were not taken. Hundreds of gallons of a special oil are circulated through the windings and piped out to cooling tanks from which it returns to complete the cycle. The old method of cooling consisted of pumping water through coils of pipe submerged in the oil. The new method was given its initial commercial trial in the Duluth station and has since been adopted extensively elsewhere.

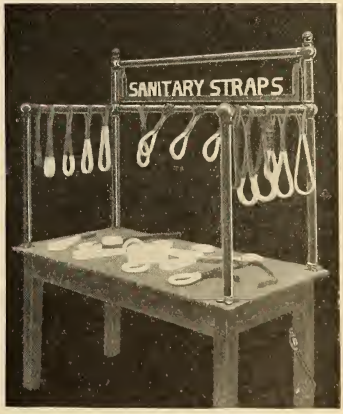
Why the rates for current are so low in these parts—lower, even, than at Niagara where there is no competition whatsoever—has the following interesting explanation:

Previous to the advent of the Great Northern Power Company, all large manufacturers using electric current were compelled to generate it themselves by private power units. The Great Northern Company's rates then, in order to be attractive were necessarily lower than the bare cost of similar production in the private units—not taking into consideration overhead, interest, etc.

Electricity is used entirely in pumping the municipal water supply and in nearly all mechanical processes where electricity and steam compete, the countless advantages of the former are rapidly gaining it supremacy in this flourishing city of the Northwest.

Sanitary Strap for Street Cars

In this age of improved sanitary conditions, nothing escapes the eye and microscope of the bacteriologist and in this scrutiny the street car strap has not been overlooked. While the strap hanger



AN EXHIBIT OF SANITARY STREET CAR STRAPS

grips the strap his hand comes in contact with millions of bacteria, so health departments tell us. But along with this discovery comes the Rico sanitary strap. Bacteria cannot make a home upon it for its surface is of polished enamel and therefore readily cleaned and kept clean. The strap is made to cover old straps or to replace entirely the old leather type.

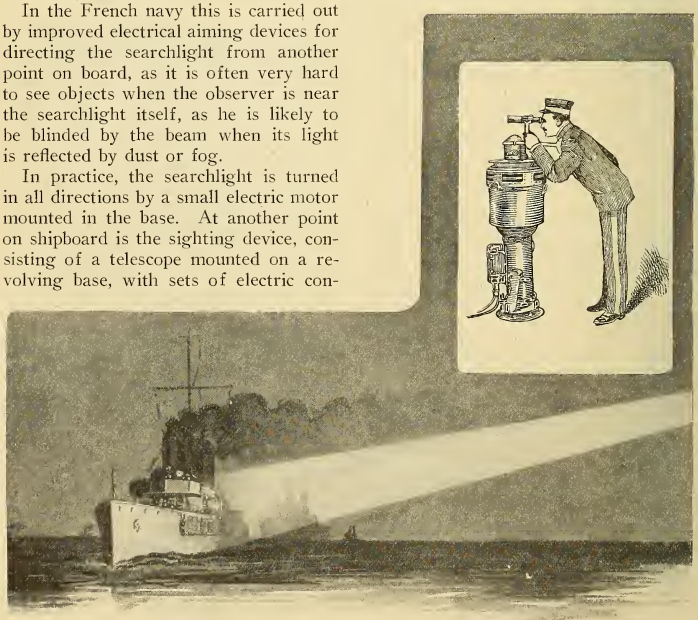
Searchlight Aiming Device

It is true that a battleship is protected against the approach of torpedo boats by exploring the sea with the searchlight in all directions, but the light also shows the position of the vessel to the enemy and serves to attract the torpedo boats. For this reason it is now the rule to use a masked light and to turn on the beam just at the moment when the searchlight has been pointed to an object at sea. In this way the beam does not risk being directed upon another vessel of the home fleet so as to reveal its presence to the enemy, and in general the idea is to keep the beam from sweeping over the field of operations and to unmask it only when it is actually needed.

In the French navy this is carried out by improved electrical aiming devices for directing the searchlight from another point on board, as it is often very hard to see objects when the observer is near the searchlight itself, as he is likely to be blinded by the beam when its light is reflected by dust or fog.

In practice, the searchlight is turned in all directions by a small electric motor mounted in the base. At another point on shipboard is the sighting device, consisting of a telescope mounted on a revolving base, with sets of electric contacts placed so that inclining the telescope or revolving the base will send different electric currents in the circuits which run to the searchlight. The device is so adjusted that any movement of the telescope gives exactly the same movement to the searchlight, and then the light can be unmasked by an electric shutter so as to send the beam in the proper direction.

Often the position of the enemy can be distinguished in the night, and the sighting is first done by the telescope, then the searchlight is thrown on at the time when it is thought fit. By the present method the operator thus has complete control of the light.



Light of the Firefly

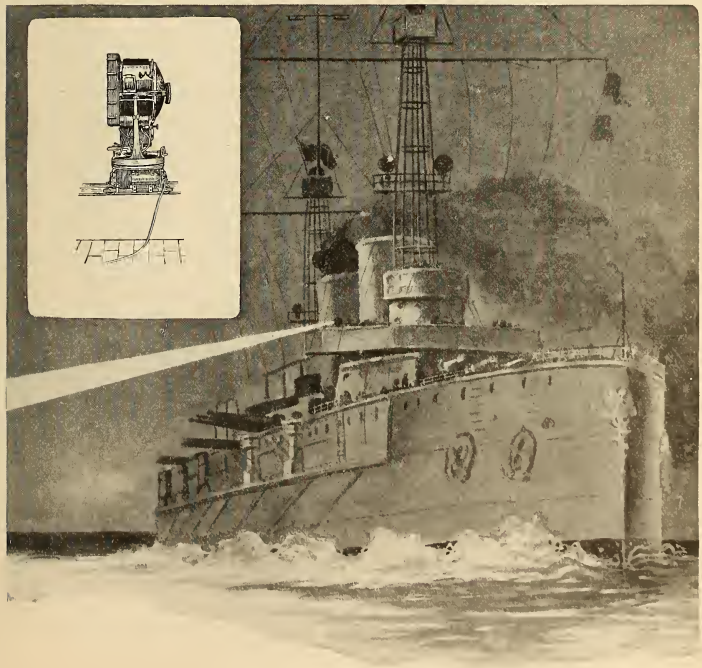
Recently some measurements have been made on the brightness of the light of the firefly. This of course is not the first time that scientists have turned their attention to this interesting insect commonly known as the "lightning bug." Men have tried for years to wrest the secret of light production from the firefly, but so far have been unsuccessful.

Even though we do not know how the light is made it is of interest to learn just how much area of the brightness of the firefly's body would be required to give sufficient light to replace a tungsten lamp in an ordinary room. The measurements indicate that if one-fifth of the ceiling area in an ordinary room was closely covered with glowing fireflies the resulting illumination would be sufficient for ordinary activities. We have everything but the secret!

Lightning and Petroleum

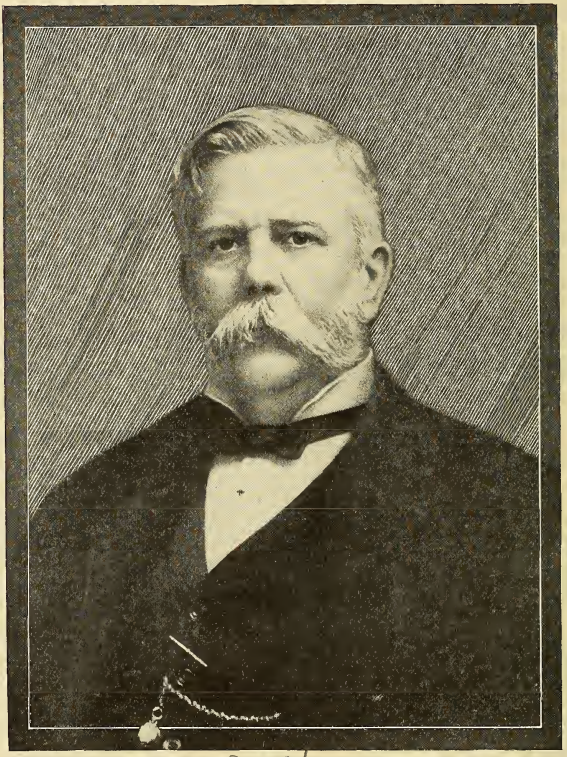
For four months certain of the petroleum wells at Boryslaw, Galicia, fired by a violent thunder storm, burned like torch flames 40 to 50 feet in height.

It is said that no less than five wells are struck by lightning every year at Boryslaw, the cause being ascribed to the obligatory use of sheet iron coverings for all the installations. The iron surfaces communicate with the system of metallic tubes, thus forming, during a thunder storm, a sort of Leyden jar, which provokes lightning strokes.



A Matter of Achievement

By H. Bedford-Jones

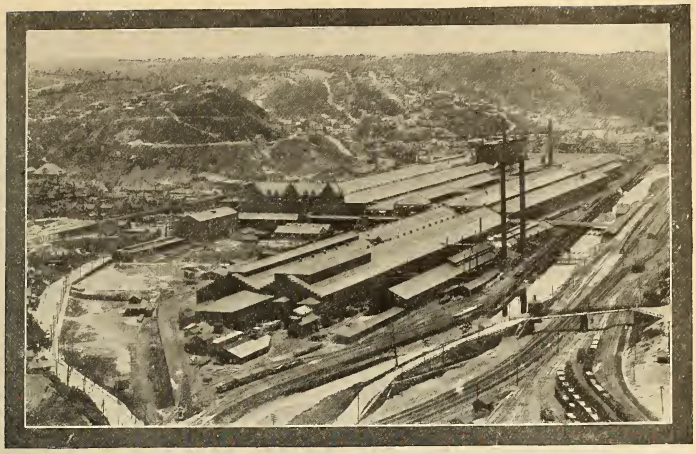


GEORGE WESTINGHOUSE

Up at the Press Club of Chicago we have some enjoyable evenings. Once in a while a few very noted men will drift together from the ends of the country and will remodel this sorry scheme of things to their hearts' desire. The remarkable part of it is that they can command an audience!

Men like Opie Read, Will Comfort, Captain Jack, Jay Cairns—all more or less literary—ever gather hearers unto themselves. Their causeries are worth while, because such men stand for achievement, not for time wasted.

Time killers are usually proud of the fact that they have nothing to be



WORKS OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, ONE OF THE GROUP OF WESTINGHOUSE INTERESTS CENTERED IN THE VICINITY OF PITTSBURGH

proud of. Men who have achieved things in the world, interest the world. Industries which have achieved things, also interest the world. The imitators of a man mark his worth in the world's esteem. The imitators of an industry mark its worth in the world's bankbook. Only big things can be imitated. Smaller things are copied.

When George Westinghouse began to use the alternating current for electric lighting, his business grew with amazing rapidity. Today you can follow the Turtle Creek valley, just outside Pittsburgh, for five miles and meet new Westinghouse factories all the way. Each is a distinct entity, a company separate in itself; but each was founded by the genius of this single man. His products are too big to be copied; they can only be imitated, these days.

The name of Westinghouse stands for achievement. After all, a coat of arms counts for very little unless you win it yourself. Perspiration is the blazonry of success.

When I got off the train at the Westinghouse Electric and Manufacturing Company factory, I found myself standing on a huge bridge. This seemed to lead into a smoke-maze of buildings, but as I walked along it proved to have various side vents, opening on this or that factory; the end of it proved to be my goal. And I had thought I was coming to a mere electric works!

As I passed along I could look down into the yards and see machines whose very names I knew not, waiting for shipment. Electric tram cars—storage battery cars, I found later—pushed about, loaded to the guards. Rows of electric locomotives stood ready to go forth. In and out of the buildings ran trains, while the ivy faced brick buildings themselves stretched thin and dark down beside the railroad tracks, offering little promise of the marvels of achievement which they contained. Then I had come to the shops at last.

"There are four rows of girls working here," said my guide as we passed through one of the divisions. "Lined up, they make pretty near an even mile."

"Why, how long is this shop?" I asked in surprise.

"A third of a mile. But wait till you hit the locomotive section. *That's* something like a shop!"

And it was. It was hard to believe that this was a single building where steadily progressive work was performed from end to end. For here, as in some other large factories, the work is based on a system of progression. Each piece goes forward, never backward, gaining a little at each step and ending in the shipping room, a factory in itself.

I was surprised both at finding the large number of women and girls at work in these shops, and at their high standard of intelligence and quality. It seems that the company has found that the female of the species works better than the male, especially on coil wrapping and such work as requires rather delicate handling. Here is an interesting point for other manufacturers, in that working men are apt to tire of their work—it grows monotonous to them and toward the end of the day is in consequence liable to a drop in quality. With women, on the other hand, this is not the case. They remain at a constant level of quality, and keep up to the average output which is required in piece work as well.

But to return to the locomotive shop. Standing at one end of this, it was nearly impossible to see to the other end—almost a solid half mile of enginery under construction and tests, small and large cranes moving massive cast steel from point to point, and the whole forming a study of the application of electricity to machinery in the mass.

The engine room, which furnishes power for the entire plant, is a model power house. Here are all turbine engines, whose capacity of 12,000 horsepower is ample for its needs. Each of the two engine rooms is controlled by a huge eighteen panel switchboard of blue marble. At the time I visited the plant, it was also under the inspection of a number of consulting chemists from the world over. One of these, a Russian, standing near me, was gazing at the switchboard with interest and delight. At length he suggested that the meters should be installed behind the switchboard, out of sight, instead of on its face.

"But why?" asked the puzzled engineer. "That would make us go clear around to read them!"

"Yes," returned the chemist with simple earnestness, "but just think how they spoil the looks of that beautiful marble!"

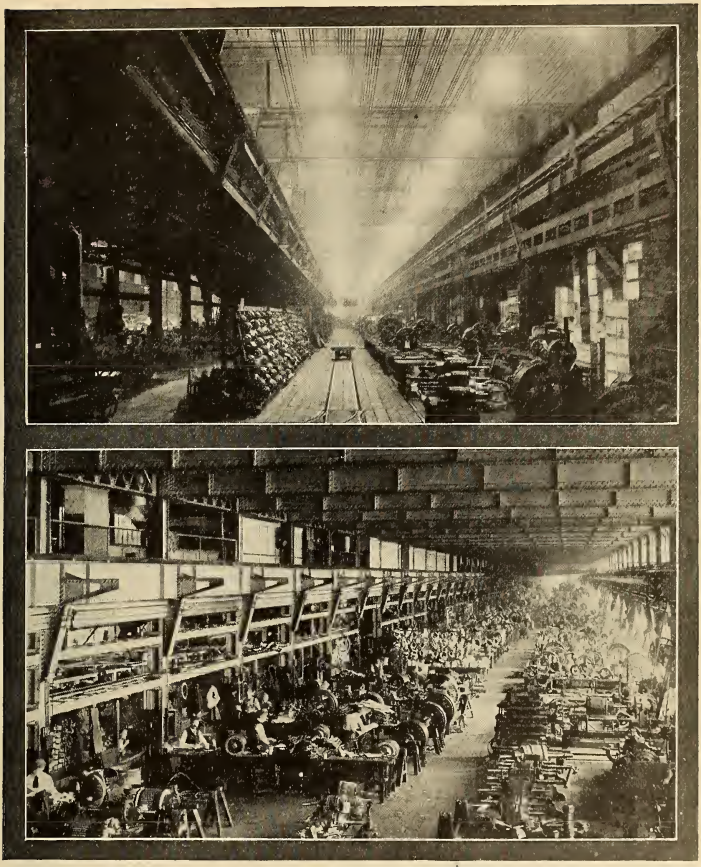
I forget what the engineer said to that.

And yet in some factories such a remark would not be considered inapt. I know of one place where the "beauty shop," as the men call the office corps, might even follow it out.

A rather remarkable point which I observed all through this factory was its striving for better and quicker results. for the elimination of all useless effort. For example, the catalogs and circulars sent out to customers and district sales offices and dealers are composed of separate leaflets, and I took for granted that putting them together in the loose binders involved quite a large force. But I found that it was all done by four girls and a table.

The table is far more important than the girls. It revolves on an axis, being driven by a belt from an electric motor. It has two speeds and may be stopped from any point about its edge. About the table are piled the loose leaflets in consecutive order. As the table revolves the girls simply pick up one leaflet from each pile and place them together in order. This not only eliminates the old method of walking from table to table and so wasting much time and effort, but it does away with about twelve girls, while the regular speed of the table keeps the girls working at a uniform average rate and so prevents any loafing on the job.

In the same way the pay-roll system here is unique, having been evolved after many trials and experiments. The usual factory has pay days every day in the week, for the different sections, the em-



THE UPPER ONE OF THESE SHOPS IS DEVOTED ENTIRELY TO THE BUILDING OF SMALL MOTORS. IN THE LOWER ONE THE WINDING OF ARMATURES PROGRESSES—LITERALLY THOUSANDS OF THE ARMATURES ON THE BENCHES

ployees keeping the pay department busy all the time. But here the 14,000 shop workers are all paid off in fifteen minutes, on a single day. Just before the whistle blows a long belt is unrolled on the floor in each section. This belt is stationary and has numbered squares, from one onwards. Each employee of the section has a number and takes the corresponding place on the belt.

When the whistle signals they go forward to the ticket window and the paymaster simply hands out the envelopes in consecutive order. There is no time

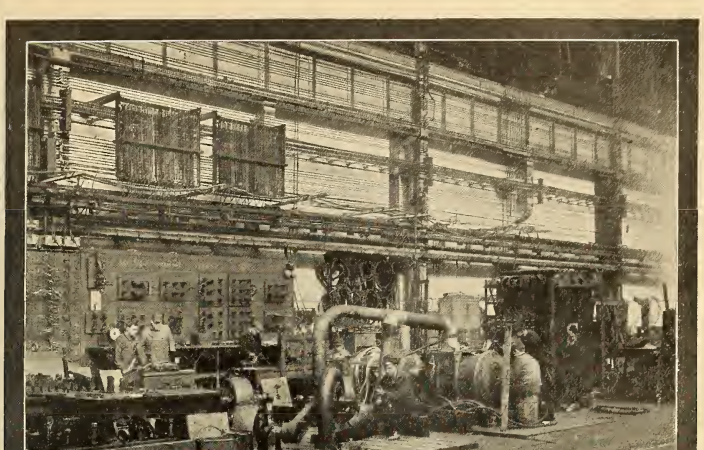
lost hunting for names and numbers—it is simply a matter of handing out the envelopes as fast as they can be received.

With the exception of a few buildings, all the works here are under one consecutive roof, and the various machines are expressions of the most recent advancement in the electrical art. The rectifiers for charging batteries are made amid blue flame and mercury and while each occupies a space only four feet by 20 inches, they are of remarkable interest. This type performs the essential operation of changing the usual alternating current to the direct current requisite for charging batteries.

The rectifier consists of a sealed glass bulb filled with mercury vapor. This is provided with three electrodes, two of graphite or similar material, and the other of mercury. The alternating current voltage is applied to the two solid electrodes and the central point of an auto transformer. The mercury vapor allows the current to pass from the solid electrodes into it but prevents a reverse flow. The result is a continuous current from this mercury vapor tube out into the circuit and back again. This current is made up of the two halves of the alternating current wave, passing alternately from the solid electrodes into the mercury, and then out as direct current.

But a distinctive Westinghouse product, made at no other place in the world, and of singular interest, is the reduction gear for steam turbines. This, while not distinctly electrical, has nevertheless a wonderful part in turbines, and is attractive to all electricians. Some form of gear to work between a marine turbine and the propeller it drives was for a long time considered impossible. But to make full use of the possibilities of the steam turbine such a gear was necessary, for a propeller cannot be driven

A VIEW IN THE ELECTRIC LOCOMOTIVE SHOP—A SOLID HALF MILE OF ENGINERY UNDER CONSTRUCTION AND TESTS. HERE ARE BUILT SOME OF THE LARGEST LOCOMOTIVES IN THE WORLD



A SECTION OF THE TESTING DEPARTMENT. WHEN A PIECE OF APPARATUS HAS ASSIMILATED THE TRIAL DOSES OF CURRENT HERE PROVIDED IT IS NOT LIKELY TO FALL DOWN IN SERVICE

at turbine revolution speed, for in the Westinghouse turbine—the Parsons type—this speed is several thousands of revolutions a minute.

Balanced helical gears in solid bearings were used for small horsepower, but for high power this proved impractical owing to the excessive tooth pressure and wear of the bearings. To overcome the various difficulties, a reduction gear is now manufactured by the Westinghouse Machine Company, just over the bridge from the electric factory.

Here I saw the tremendous pinions in place, working a reduction in revolutions at ratios of from four to one to seven to one, while still higher reduction may easily be obtained. The reduction gear is provided with a floating frame, which supports the pinion. This frame is carried on three pistons, each of which floats on a cushion of oil. This permits the frames to oscillate in a vertical plane and to maintain automatically a uniform distribution of tooth pressures.

Not far from these gears, which are now manufactured on the spot, was set up the original device, made from special forgings by German companies. While this was primarily devised for marine practice, it has also been adopted for driving direct current generators, which in order to avoid commutation troubles must be driven at relatively low speed. It is also applicable to driving pumps and shafting, so that the future holds great possibilities for this wonderful machine control. Nor is there any waste here from loss, an official test of a 6,000 horsepower set having shown an efficiency of 98.5 per cent.

But let us leave the shops and visit the Westinghouse Club, an institution provided for the men of all the Westinghouse companies in general. This is a finer place than many a city club I have

seen. The light, low rooms are tastefully furnished and decorated, and as regards club equipment everything is here; the gymnasium is a magnificent one, well equipped, well lighted,—and well used. In fact it was all so fine that I thought it must be for the officers of the company alone. But my guide showed me the rules, and pointed to the literally nominal dues, and I said no more. This club has but taken advantage of an excellent chance to aid the Westinghouse men both physically and mentally, and in this it seems to have won the cooperation of the men themselves, which is the great thing.

But I was forced to return to the works at length. Here in one section were some fifteen electric locomotives under construction for the Southern Pacific lines. These were to be operated either at 600 or 1200 volts and were designed for freight work, the Southern Pacific being engaged in electrifying certain of its coast lines. By the time this article reaches you, these locomotives will be at work—clear across the continent.

A notable point about some of these engines is that they can be operated by direct or alternating current. This was a special feature, for usually the electric locomotive is made either for the one type or the other.

In another of these long distance shops, running dim into the far end, were piles of smaller motors, such as are here applied to machinery in all its phases. Overhead on each side of the central halls, worked men, women and girls at the smaller details and piece work. This is one thing which the electric motor makes possible. In the old style machine shops the mass of workers had to be kept distinct from the machinery production, owing to the roar and blast of noise and the unhygienic air conditions. But in these shops there was none of this, none of the pallid cheeks and tired faces which one so often observes. All were healthy, cheerful, and busy.

I was surprised to find that the average girl at her machine or her hand work makes by her unskilled labor as much as the average trained girl can make in the more usual women's trades. And surely it is much better to work here among the hills, away from the city grind and roar, where the pay is graded to the amount of work done, than to slave all day long over the typewriter for a weekly pittance! True it is that the piece worker falls into a regular output and often turns out no more than the average required of her, yet none the less there is an excitement about such work, a stimulus which proceeds from getting paid by your work instead of by your time.

Here, as in other places, the old line shaft drive for machinery has given place to individual motor drive. It is only natural that electrical factories should be the first to make use of this system of their own manufacture, but others have wakened up to it the world over. Every machine, tool and motor turned out here is figured down to the last detail of its future work. The rating of the motor is based on its future need, as is the type and arrangement of the controller.

But not only the larger phases of electrical life are born here. The Westinghouse electric heating apparatus is made in other shops, all part of the main body. This apparatus is of all ranges and sizes and is applicable to all trades and industries. This is a newer field and one of unlimited possibility, giving room to many competent companies today. Yet in the course of time these will be eliminated, as is the way of all business, and the consumption will return to the one or two producers whose goods shall win the favor and reliance of the public.

Educational work among the employes is an important feature of the place as the visitor sees it. Besides the club's educational work, here at East Pittsburgh the technical night school offers at very small expense an opportunity to study the basis of shop work and even of engineering. It is open to all, and enables them to secure both the theory and the

practice of their work, so interwoven that the student learns quickly to apply his studies to his daily shop work. Given these fundamentals of mathematics and engineering, it is possible for the average worker to build his own career along any desired line.

The training may be general and not specific if desired. Besides the general night school work, there are special classes. The apprentice system puts a boy to work for four years and pays him well while he is learning practical electricity. He is not only given the technical training necessary to make him a good workman, but is given a general education as well. The young man who is a graduate of a technical college may enter as an apprentice and in two years, by working in all different parts of the works, become a practical electrical engineer. At present there are about 250 such apprentices at work.

But following out the general Westinghouse idea of striking to the roots of things and achieving something, there are other courses for supposedly finished men. When a college graduate finishes his two year final course here, if he wishes to go on the road he is given a six months specialized sales course. This course gives him an idea of "the latest" in salesmanship and applies his mechanical learning to actual practice.

I mentioned before the remarkable system employed in handling details by these associated companies. In writing this series of articles I came into contact more or less with many publicity men, and looked into their systems of work out of pure curiosity on the subject. It was surprising to me to find that, considering the enormous value to any general manufacturing company of its publicity department, this was very seldom reduced to scientific business methods. In one place the publicity man made no reports, chose his own subjects, and was under no governance whatsoever. In others, the value of publicity was ruined through carelessness and inattention to details. But here the publicity department is as systematized as is any other section of the shops. The total cost of each press notice and article, printed on the place, is known before it is sent out. No—hands off! This article is nothing of the kind!

An extremely interesting building is the print shop. Here are printed the catalogs, circulars and forms for the district sales offices and dealers. Here are the latest type setting machines. I saw every form of press from hand to cylinder. Over in one corner were special presses, getting out certain ruled and punched kinds of paper to be used as graphic meter records. Seven artists are employed on various work in their own lines—illustrating publications. This is one of the busiest little printing houses the visitor will find in a long time; but more than this, it turns out fine work—work that is artistic to the last detail. Here are immense piles of stock, material of all kinds from paper to pencils, intended for distribution among the various offices and branches. It is this great amount of work which justifies the establishment of a private plant like this, for on quick work there is a large saving in time, while the presses can be kept going on forms and letterheads always.

The relief department of the company is noteworthy. Doctor Charles A. Lauffer has achieved a national reputation in the resuscitation of supposedly dead persons, whether the injury is electrical or otherwise. The employes of the company are trained in this work and are rendered thoroughly conversant with Dr. Lauffer's method.

All of this is much more than business. We used to say "Where there's smoke there's fire." But that was before Pittsburgh was. Now we say "Where there's smoke there's achievement." When you go through this plant you realize that great undertakings have made the name of Westinghouse famous; not because they have been attempted, but because they have been *achieved*.

SAVING the FUR SEAL MOTHER

Theodore Roosevelt, in his message to Congress on December 4, 1906, said: "The destruction of the Pribilof Islands fur seals by pelagic sealing still continues. . . . . In case we are compelled to abandon the hope of making arrangements with other governments to put an end to the hideous cruelty now incident to pelagic sealing, it will be a question for your serious consideration how far we shall continue to protect and maintain the seal herd on land with the result of continuing such a practice, and whether it is not better to end the practice by exterminating the herd ourselves in the most humane way possible."

In 1874 Congress directed that the approximate number of fur seals upon the Pribilof Islands be ascertained and the report placed the number at 4,700,000. In August, 1906, the entire herd upon these

islands was less than 180,000 and this together with the reports of the cruelties practiced in pelagic sealing brought forth the prompt and vigorous action at this time of Mr. Roosevelt. And since, up to the present time, the United States has sought to protect from extermination its fur seal fisheries and to this end has tried out any available and feasible means suggested.

It is the female seal that must be kept from harm and however ruthless or hardened or eager the seal hunter may be, his desire for gold is the thing that he seeks to satisfy. Destroy the value of the pelt of the mother and mark her so this may be known and she will be passed by even though her "white-coated pup" is batted over the head and stripped.

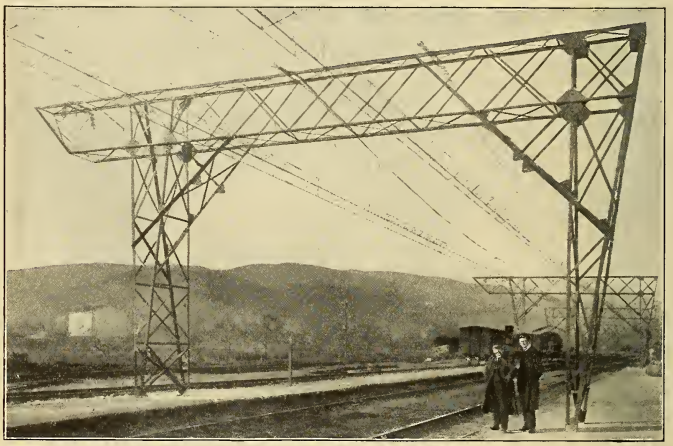
And to put this mark upon the female —the mother—the surgeon's electric cauterizing wire has been used by the United States authorities with success. She is branded—her shining fur and hide is made valueless by the application of a platinum wire heated to whiteness by current supplied by a dynamo driven by a gasoline engine. By moving this wire once over the animal's body, the hair and fur are virtually mowed away. A second sweeping of the wire across the now exposed surface destroys the cells so that no more fur can grow there and the mothers in a herd are readily distinguished.

But how will this affect "pelagic sealing?" The habits of the herds of the Pribilof Islands will answer this. Early in May the bulls of the herd coming from the warm waters farther south along the Pacific coast take their places upon the boulder-strewn beaches and rocky slopes awaiting the arrival of the females who come during the month of June. Here the baby seals are born and fed by the mothers until November when mothers and "pups" (the latter swim at the age of six weeks) start south for the winter. And it is during this winter migration that the mother may owe her life to the mark left by the electric branding wire, for sealing vessels haunt the waters through which the herd goes south. The seals are frequently found sleeping on the

surface of the water. The sealing vessel sights them. Boats are lowered, the hunters put off to the windward of their prey. The spearman stands in the bow of the boat, the shaft is thrown, the animal tired out and then the poor brute is drawn aboard to be ruthlessly killed with a club.

In the water the female cannot be distinguished and the hunter kills every animal found. Branded, the scarred surface is visible. Killing the female seal when going northward in the Spring means also the destruction of her unborn offspring. Killing the female in the months of August and September while still on the islands means the death by starvation of the young seals still under the mother's care. In 1896 alone over 16,000 young seals were found dead from starvation on the Pribilof Islands.

And this is pelagic sealing, against the wholesale barbarity and destructiveness of which the United States is seeking methods and looking to electricity as a possible means.

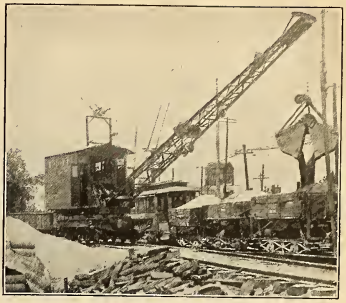


OVERHEAD CONSTRUCTION IN FRANCE

Those accustomed to the ordinary types of overhead line construction of electric railways in this country, the trolley wire being simply supported by a cross suspension from poles on each side of the track, or even to our so-called catenary construction, but slightly more complex, will gaze with wonder upon this view of some overhead work built by a French interurban railway. The line is known as the Chemins de fer du Midi and the construction is designed after the Vedovelli-Priestley system. The heavy steel towers, the three wires, triangular trolley conductors, suspended from the towers by catenary cables, the intricate bracing in every imaginable way remind one of a half-completed suspension bridge. We might almost suppose that the overhead work would carry the cars themselves, instead of simply supplying a smooth contact for the gracefully designed, sliding trolley bows which they use in that country in place of our ordinary trolley wheel.

Power Crane in Gravel Handling

The ease with which large quantities of sand or gravel may be handled by electric power is demonstrated in the accompanying illustration. The Browning crane runs upon an eight wheel truck with the machinery enclosed in a steel house. The boom is 38 feet long, making it possible to cover an area of sixteen square rods, for the crane is so constructed that it can rotate in a complete circle. Equipped with the grab bucket no labor is required except that of the operator. The lifting capacity of the crane varies from three to fifteen tons, depending upon how far from the truck the weight is located.

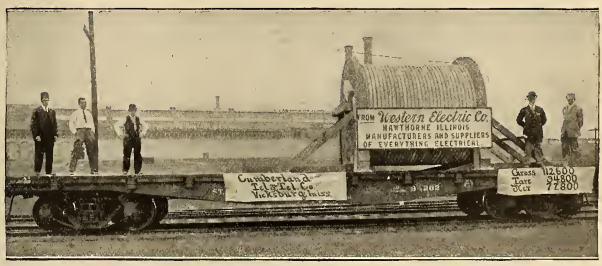


POWER CRANE AT WORK

Record-Breaking Reel of Wire

This is an age of record breaking. We have record-breaking buildings, each new one exceeding older ones in height; there are new ocean steamships breaking size and time records and there have been new world's records made in athletic contests.

A record-breaking reel of wire is shown in the accompanying picture. This is the largest reel of duplex armored submarine cable ever turned out at the Hawthorne works of the Western Electric Company. Something of its size and length may be vaguely conveyed by the following facts: It contains 26 pairs of No 13 gauge copper conductor and is only 180 feet short of being a mile long. To manufacture the cable there were required over 1,000 pounds of paper, 15,000 pounds of lead, 47,000 pounds of wire and 7,500 pounds of miscellaneous material. The gross weight of the reel with its blocking was 56 tons.



THE LARGEST REEL OF WIRE EVER SHIPPED

The cable has been laid across the Mississippi River below Vicksburg, for toll line purposes.

For heating various kinds of baths, electricity is invaluable. By means of a portable electric hot air cabinet the luxury of a Turkish bath can be enjoyed readily and cheaply. The sand bath and ordinary water bath are heated by means of coils electrically heated and immersed in water or sand.

Finish for Electric Fixtures

Every one is familiar with the standard finish and color of electric fixtures, but knows little about the process in general of the finishing. Each manufacturer has a certain finish which he gives a name, but the most common finishes in general use are: polished brass, brushed brass, dead black, nickel, mottled and oxidized brass. All finishes are used in residences and small stores, but in large public buildings, dead black, nickel, mottled and oxidized brass give better service. If brushed brass is exposed to dirt as in public buildings, it will soon become dirty and have to be removed and taken to the finishing works to be restored to its natural color.

Polished brass will not hold its color as well as brushed brass. To polish brass is simply to rub it up to the desired degree, then lacquer. The surface is very smooth, while the surface of the brushed brass is rough, thus giving the lacquer a better surface to cling to than the polished brass.

The finish known as dead black is produced by making the surface of the brass rough, then spraying it with black lacquer. The mottled finish is made by first polishing to the desired degree, then rubbing with Scotch stone and water, with a gyrotary motion. The oxidized finish is secured by immersing in a bath of chemicals until the desired color is obtained. The principal chemicals used are nitrate of iron, hyposulphite of soda and water.

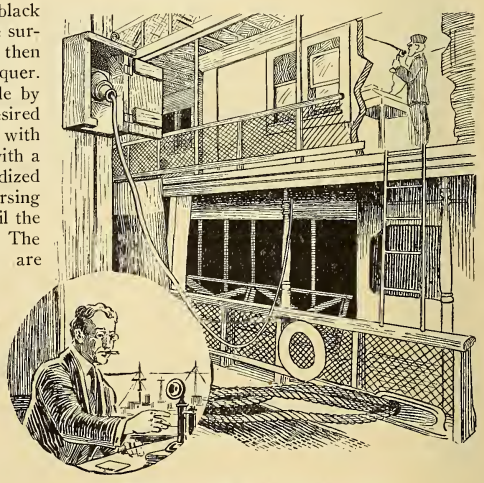
After lacquering, the surface of the fixture is kept from oxidizing. To help the lacquer perform its duty, the fixture is baked, which also improves its appearance.

Other finishes not in general use are antique and rich gilt. The former is a little darker than brushed brass, while the latter takes on the appearance of gold.

Telephone Service to Docked Vessels

Although we cannot as yet telephone between New York and London, the New York Telephone Company has done the next best thing to transatlantic service by equipping a number of steamers with facilities permitting connection to the city telephone system. Both the Cunard Line and the Hudson Navigation Company have this convenience for their passengers, and the illustration shows the manner in which it is used. The wires from the land telephone line terminate in what are known as "jacks" in the weatherproof box on the pier.

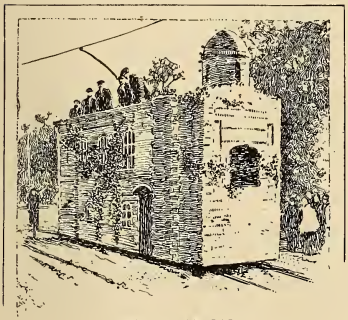
As soon as the steamer is docked a flexible cable connected to jacks on the pier and in the boat is immediately put in place. Business may be transacted and good-bys said up to a moment before the boat leaves.



TELEPHONE IN USE ON A DOCKED VESSEL

A Castle on a Trolley

One of the unusual features in connection with "Shopping week" in Colchester, England, was an electric railway car covered over to represent an old castle. This



THE CASTLE CAR

attracted a great deal of attention as it traversed the various lines of the city, especially at night when it was brilliantly lighted with incandescent lamps.

Freak Ordinance

The Philadelphia Rapid Transit Company recently received a letter proposing that the ordinance printed below should be passed by the Common Council of that city. A copy of the "ordinance" also was sent Mayor Blankenburg, a director of the company ex officio. Some clauses of the joke ordinance follow:

"Section 1. Be it ordained that from and after the date of the passage of this ordinance all the cars of the Philadelphia Rapid Transit Company shall make alternate stops at the near and far sides of all street crossings as shall be further directed in the following sections:

"Section 2. For the time intervening between the odd and even hours all cars shall stop on the near side and from the even to the odd hour cars will stop on the far side.

"Section 3. When the near-side stop is made all male passengers will enter the car by the front entrance and leave by the rear exit. All female passengers will use the rear entrance and the front exit at this time. When the far-side stop is made all passengers will enter the car by the rear entrance and leave by the front exit. All female passengers will use the front entrance and rear exit at this tume.

"Section 4. Children will be allowed only at the hour corresponding to their ages. For example, a child of five years may ride from 5 to 6 o'clock, a child of twelve years from 12 to 1 o'clock, and at no other time.

"Section 6. And it is further ordained that nothing in this ordinance or any section thereof shall be so construed as to require or enforce the payment of fare, either in cash, its equivalent, or any substitute therefor, to the Philadelphia Rapid Transit Company by any passenger of either sex or any age if it can possibly be avoided by said passenger, and any act, endeavor or effort on the part of any official, agent, employee or representative of the company to demand, force, coerce, extort, compel, exact, claim, cajole, solicit, entreat, induce, beg, beseech, supplicate, request, petition, require, ask, desire, obtain, take, collect or recieve the payment of fare shall be deemed a violation of this section and ordinance."

Pearl Lightning

Doctor W. J. S. Lockyer has collected some interesting accounts of the phenomenon known as beaded, or pearl, lightning. Several engineers in California not long since saw lightning discharges, which struck the earth, and left beautiful strings of fire beads in their course, that remained visible for perhaps a quarter of a second. "There seemed," the report states, "to be a bead of fire at every angle in the course of the spark." Other observers have noted beads of lightning which remained visible for at least a second.

The Hippodrome and its Electrical Stage Effects

BY ARTHUR VOEGTLIN

In telling of the striking results electricity has permitted me to secure and of the many time and labor saving devices in the mechanical department of the stage which electricity has permitted me to employ, I must first, to make the story quite clear, tell something about the unique nature of that monstrous playhouse in New York which we call the Hippodrome, and particularly about its stage. Such facts serve to illustrate the added importance of electricity to the proper presentation of our productions. Without it they would be impossible.

The Hippodrome is the largest playhouse in the world. In construction, equipment and conduct it is single of its kind. It represents an outlay of $2,350,000. Five thousand two hundred persons find comfortable accommodations in its capacious body.

The proscenium is 98 by 37 feet, while the total width of the stage is 200 feet between walls and it has a depth of about 120 feet from the foot lights. These are amazing figures when compared with other theaters. The proscenium of the average stage is about 35 by 30 feet and the average stage from 25 to 40 feet deep. The back drop curtain of the Hippodrome is 85 feet by 212. The ordinary playhouse curtain is no more than 24 by 35 feet. From these figures it can be readily judged that lighting effects which would be very satisfactory in the ordinary theater would be most unsatisfactory in the Hippodrome.

To produce our electrical results we are obliged to work along entirely original lines. We cannot copy because we would not gain the same results. Every electrical effect must be worked on a gigantic scale. To describe the difference between our electrical equipment and that of other theaters, let us start with the foot lights. We have 600 of these lights of 32 candlepower each. In most theaters there is only a single row of foot lights. Our foot lights are arranged in a double row. Moreover, the average theater has only about 70 foot lights of sixteen candlepower each. Think of the difference. For our border light effects we use 3,800 60 watt tungsten lights, while the average theater only uses about 500 six-

ANNAPOLIS SCENE AT THE HIPPODROME. THE AFTERNOON SUNLIGHT EFFECT IS THE BEST OF ITS KIND EVER SHOWN ON A STAGE

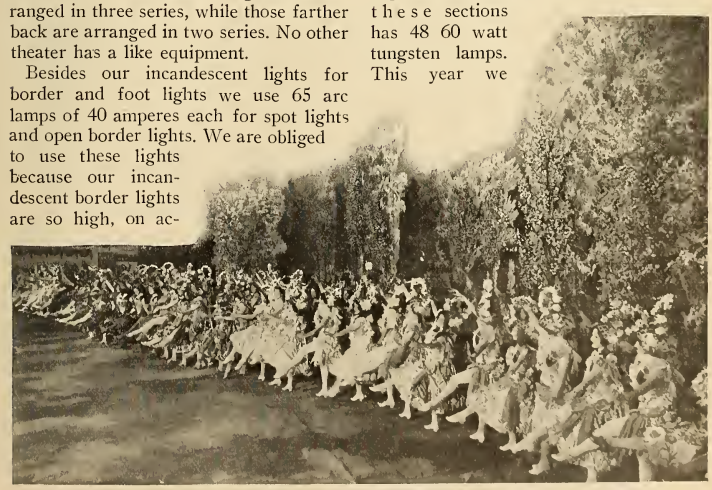
ARTHUR VOEGTLIN, INVENTOR AND DESIGNER OF THE NEW YORK HIPPODROME

teen candlepower lights for the same purpose. Our front border lights are arranged in three series, while those farther back are arranged in two series. No other theater has a like equipment.

Besides our incandescent lights for border and foot lights we use 65 arc lamps of 40 amperes each for spot lights and open border lights. We are obliged to use these lights because our incandescent border lights are so high, on account of the height of the stage, that it is necessary at times to use the more powerful lamps for proper effects. For border lighting, 22 of these lamps are arranged on a bridge which is operated by six men. For full scene effects these lamps are most useful.

On each side of the stage are located what we call our effect lights. These are situated in a gallery 30 feet from the stage. Ten lights altogether are used, five on each side, requiring 40 amperes each. With these lights we produce many marvelous electrical effects, simulating sunshine and shadow, fire effects, water effects and a thousand other electrical effects which amaze the Hippodrome audiences, and even to many expert electricians seem really wonderful.

Besides the results produced by the effect lamps, we depend greatly upon our strip lights for ground effects. These lights are in four colors—red, white, blue and green—and it is marvelous how they light up any small scene. We have four rows of these lights and there are eight separate sections to each row. Each of these sections has 48 60 watt tungsten lamps. This year we



BALLET OF THE FLOWERS, SHOWING MARVELOUS LIGHT AND SHADOW EFFECTS

have been able to operate these strips to better advantage than ever before by hanging them on a battan which, when not in use, is hoisted by electrical power into the flies. By this electrical arrangement we have been able to save the work of fifteen men. These lights are now operated by simply turning a switch when the lights are lowered into the position desired and all that is then necessary is for stage hands to lift them from the battan and connect them with the power which is at hand. Several men can do this work well and rapidly.

Apart from the strip lights we have instituted this year ten front lights requiring 40 amperes each. These lights are situated in the center of the front row of the family circle and are equipped with very powerful reflectors. By the aid of gelatin films we can change the lights to any colors desired. These front lights take the place of the old fashioned calciums, a light which has always been an annoyance and worry to every producer. The visitor to the Hippodrome for the first time is always impressed with our wonderful simulation of sunlight, moonlight, sunset and sunrise. No other stage in the world shows these varied light effects so satisfactorily reproduced. We have been able, by the use of our effect lamps to create a picture, a real atmosphere of the outdoors so perfect that the spectators are instinctively carried to the location we are endeavoring to picture. Of course the size of our stage helps vastly in this effect but after all this would amount to nothing if the proper employment of electrical effects was lacking.

It takes us frequently weeks to work out these results. This work is all practically done in the summer time. After the Hippodrome is closed for the season we begin immediately on our next year's production. The scene is set and then we start to work out the proper light effects for it.

One of the most satisfactory results which electricity has enabled us to arrive at is the instantaneous "black-out." The present production at the Hippodrome, entitled "Under Many Flags," is shown in three acts, but between these acts there are a number of scenes which are in reality separate acts, requiring an entire change of most elaborate stage settings.

In many theaters it would still be necessary to lower the curtain to change for these scenes, but by the use of the instantaneous black-out we only lower the curtain twice during the entire performance and this is only done because we desire to break the show and give the audience slight intermissions to think about it. We could readily produce the show from beginning to end without raising or lowering the curtain. Some day we may.

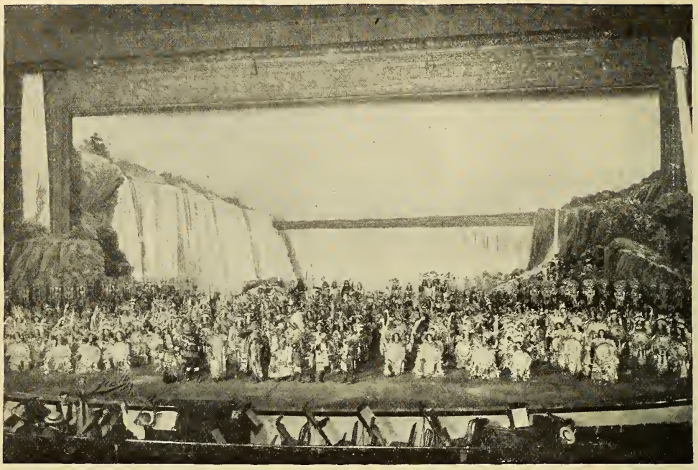
The stage manager of a few years ago would have found this impossible in the proper presentation of a performance of the magnitude of that which we are now presenting at the Hippodrome. It has taken us a long time properly to work out this instantaneous black-out, but now it is so perfect in operation that the spectators, even in the first row of the orchestra, are unable to see one thing that is going on upon the stage, which of course adds greatly to the height of the effect when the lights are again instantaneously switched on.

All our electrical effects are dependent upon the proper manipulation of our switchboard. This is situated in a gallery to the right of the stage. It is arranged on the A. B. C. system of four colors of red, white, blue and green and is regulated by 160 dimmers. Three men, every one an expert in stage lighting, operate this switchboard. Each dimmer has sixteen different steps. Thus we are enabled to get any shade of light we desire. Besides the dimmers there is a main gang switch which instantly throws every light on the stage on or off. This is used for the instantaneous black-out.

In connection with the switchboard we have this year introduced a real novelty, a loud talking telephone; in other words, a telephone with what might be described

A SCENE ON THE COAST OF BRITTANY

THE ELECTRIC LIGHTING OF THE BACK DROPS IS SO REALISTIC THAT THE AUDIENCE IS TRANSPORTED IN THOUGHT TO THE HIGHLANDS



NIAGARA FALLS AS PICTURED A FEW YEARS AGO AT THE HIPPODROME. THE FALLS WERE NOTHING BUT PAINTED CANVAS, BUT SO INGENIOUSLY LIGHTED THAT THE EFFECT OF A TREMENDOUS VOLUME OF FALLING WATER WAS SUCCESSFULLY IMITATED

as a megaphone horn. The voice from this can be heard for 30 feet. Thus, if as the producer, I do not think that the lighting of any scene is just right, all I have to do is to step to a telephone to the rear of the auditorium and quietly tell the men at the switchboard where they are in error. They can hear what I have to say without having to interrupt their work to go to the telephone, and can quickly correct the defects. This loud talking telephone is an invention of our own, but I look for its introduction in many theaters before long, as it is a wonderful time saver.

For our alternating current we have a separate switchboard. This alternating current we use for water effects, the lighting of diminutive scenes, etc. Another electrical device which we have at the Hippodrome and which is not to be found at any other theater in the world, is shown in two hoisting machines, located one on each side of the stage. One is operated by a five and one by a three horsepower motor. These hoisting machines are most valuable for lifting heavy scenery, also big drops and anything that hangs. Any other theater has to have stage hands and fly men to do this burdensome lifting. By their use we save the work of at least 12 men, as it is only necessary to have two men to operate them. Besides, we save a vast amount of time in stage setting which is important in preventing our black-out from becoming tiresome to the audience. Now they wonder how we accomplish these changes so quickly. The answer is by electricity.

Running around the stage to the rear is an electric crane. By the use of this crane any kind of heavy machinery can be shifted from one part of the stage to another and it saves the work of from six to eight men. It is also useful in some of our stage effects. For instance, this year an airship we use in our piece floats gracefully across the stage along one of the tracks of this electrical crane.

Practically all our lifting on the stage

is done by electrical power. We have a number of different power motors. A 50 horsepower motor raises and lowers the stage and the water tank, the asbestos curtain and strip lights. Heavy pieces of scenery are also moved off the stage by motor power. In the tornado scene in this year's production, most of the scenery is removed in this way and the effect of buildings falling down and being blown away is most realistic.

At the Hippodrome we have an immense grass mat which covers the stage and weighs three tons. Before we employed electrical power to move our stage properties, it used to take 65 men to bring this mat up from under the stage, while now it is done by an electrical hoist run by one man, the power being furnished by a five horsepower motor.

One of the best and most startling electric light effects produced in our present show occurs at the end of the first scene which pictures the lawn of the White House. After the stage has been lit with brilliant sunlight, darkness gradually sets in until finally a very beautiful sunset effect is produced with the charming light of the afterglow. Then gradually the light fades until darkness sets in. Then at the proper moment the instantaneous black-out is used and the stage is shrouded in utter darkness. In an incredibly short time the stage is reset and the lights again go up instantaneously on our second scene, the parade grounds of the naval academy at Annapolis. In this scene the stage is flooded with a glorious volume of mid-afternoon sunlight. It took us a long time to work out this exceedingly contrasty light effect, but that the audience appreciates it is illustrated by the applause which the lighting of the Annapolis scene always brings forth.

Another very startling electrical effect is produced during the tornado. It occurs in scene ten, part two. Following the tornado comes a prairie fire. This fire is most realistic but it is entirely produced by the combination of our electric lighting, yet the audience sees the flames leaping up and flickering in the wind just as they would when a real fire occurs during a heavy wind storm.

Weed Burners on Electric Railways

The work of hundreds of Mexican laborers on the tracks of the Pacific Electric Railroad in California is now being done by a weed burning device that eliminates the hard work with mattocks and hoes. This extensive trolley system which

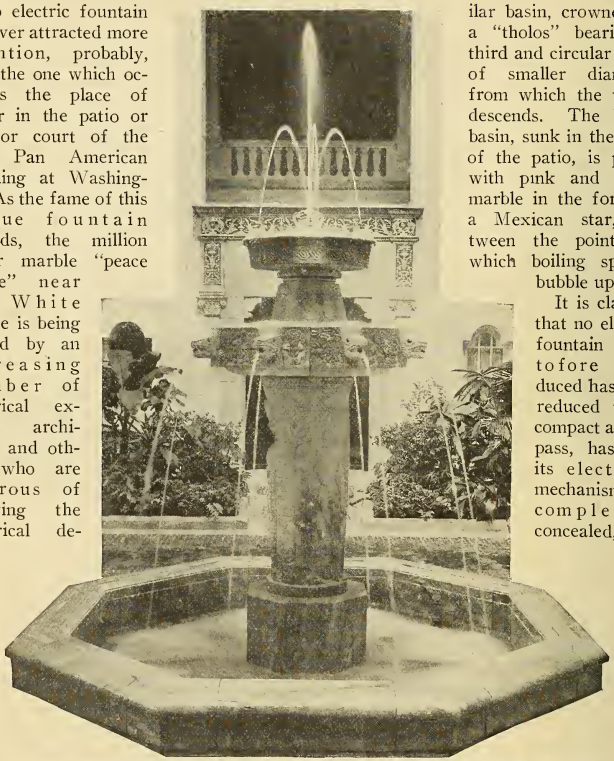
WEED BURNER AT WORK

centers in Los Angeles has hundreds of miles of track which must be kept free of weeds and the new invention is attached to an electric locomotive, and, together with an oil tank and water car, is hauled over the line at the rate of about ten miles an hour. Green weeds and dry are destroyed alike by this device, and the cost is but a fraction of the former expense, only about 80 cents for a mile strip about 20 feet wide.

The invention is the work of E. E. Allen, a Los Angeles inventor, who has experimented for years with weed burning devices using crude oil as the fuel. The crude oil is brought into contact with live steam by this system, forming a gas emitted under the car and ignited, burning the weeds to the roots and destroying all seeds that are cast on the right of way. The heat is so intense that the bottom of the car and the extended side wings are covered with metal, which in turn is protected by a coating of cement.

FOUNTAIN OF THE "PEACE PALACE" AT WASHINGTON

No electric fountain has ever attracted more attention, probably, than the one which occupies the place of honor in the patio or interior court of the new Pan American Building at Washington. As the fame of this unique fountain spreads, the million dollar marble "peace palace" near the White House is being visited by an increasing number of electrical experts, architects, and others who are desirous of studying the electrical details of the fountain in order to embody some of the ideas in fountains to be placed in public buildings and in private mansions.



ARTISTIC ELECTRIC FOUNTAIN DESIGNED BY MRS. HARRY PAYNE WHITNEY FOR THE PAN-AMERICAN UNION

This marble fountain at the home donated by Andrew Carnegie to the Pan American Union was modeled and executed by Mrs. Harry Payne Whitney, nee Gertrude Vanderbilt, and consists of a pillar rising from the midst of an octagonal basin and supporting a smaller similar basin, crowned by a "tholos" bearing a third and circular basin of smaller diameter from which the water descends. The lower basin, sunk in the floor of the patio, is paved with pink and white marble in the form of a Mexican star, between the points of which boiling springs bubble up.

It is claimed that no electric fountain heretofore produced has been reduced to so compact a compass, has had its electrical mechanism so completely concealed, nor has had this mechanism so ingeniously combined with the sculpture.

Electricity is employed for the illumination of the basins of the fountain and to give glow to the jeweled eyes in the feathered serpents' heads that surround one of the basins, but the main utilization of the magic current is for illuminating in changing colors the streams and sprays that ascend in varying form and volume from the upper basin. The

fountain is capable of producing twelve different water combinations or shapes and for illuminating these there are available sixteen colors and tints. Both the colors and the changes of water are controlled at a specially constructed switchboard, which is in the form of a keyboard desk.

The main utilization of the fountain is on ceremonial occasions, and at such times its electrical illuminating facilities are employed to produce successively the national colors of the 21 republics of the three Americas. These color effects are produced to the accompaniment of the rendition of the national anthems of the various republics by the United States Marine Band, stationed in the patio, and the musical director and the chief electrician have so perfected their co-operative work (electric signal buttons insuring accurate unity of action) that they are now enabled to produce the 21 distinctive color combinations, each with its appropriate incidental music, in a total elapsed interval of seventeen minutes.

BESMIRCHING THE SKIES

Had our great American novelist, W. D. Howells, seen the above illustration in time, he might have added another interesting page to his fascinating "Letters from Altruria." Well might his visitor from Mars have asked: "What are you doing? Are you blackening the the skies and obscuring the daylight in order that you may pay for more artificial light?" Of course the native American (or European, for that matter) would indignantly have denied that this was the case, and yet there would have been the usual implied germ of truth which makes Howell's report of the Altrurian's questionings such delightful reading.

The fact is that in the earlier decades of our modern industrial development we so accustomed ourselves to smoke belching from the stacks of our factories that we have grown not only to tolerate the nuisance but even to pride ourselves on it. So when our impressionists wish to depict a group of typical manufacturing plants, they top them off with the soot and smoke supposedly emitted from their chimneys. To them, smoke is still an index of industry—which goes to show how sadly artists usually lag behind the progress of their time.

But the progressive man or woman knows that a smoking chimney is a sign of either imperfection or undevelopment; that rapid transit is now typified not by the soot-hurling steam locomotive but by its cleanly electric successor, and that the modernizing of electric power distribution has involved a minimizing of smoke. Like the puffing and snorting of the old types of engines the belching of smoke is only a survival of methods which are fast becoming obsolete. The smokeless factory with the almost inaudible purring of its electric motors may not lend itself so readily to the artistic conceptions of those unfamiliar with the real progress of our times, but it represents the industrial status of the more enlightened sections and our artist friends must learn to acknowledge it as doing so.

Curious Fact as to Lightning

It is a curious fact that, sitting in a dark room at night, an electrical storm coming on, the observer of electrical phenomena will be unable to determine from which of the points of the compass a blinding flash of lightning proceeds, even though the room in which he sits possess four windows to the four points of the compass. This statement applies, of course, in the event that the window shades be lowered sufficiently, that the possible bolt may escape the eye. The roll of thunder will be the first intimation the observer has of the storm direction.

This fact is especially noticeable when the rain has begun to fall heavily, and when the raindrops have, in a sense, become reflectors of the light, giving the effect of sheet lightning. At such a time, when the skies seem sheets of flame, one may observe how this reflected light penetrates to every corner of a room with a brilliancy not outdone by sunlight.

Sunlight, coming in direct rays into a room, leaves its shadow spots; the reflected light of the lightning stroke leaves the ceiling and the floor equally illuminated.

A Paint Train

The electrification of portions of some of the steam railroads of the country has brought up some unique problems in connection with the maintenance and painting of the large amount of overhead structure necessary to carry all the overhead trolley wires. The New York, New Haven and Hartford Railroad has solved this problem in a very simple manner by building paint trains with cars built with platforms which can be raised or lowered by means of winches. The train is run under a section of superstructure needing painting and the men are hoisted right up to the overhead wires and bridges.

A paint train ordinarily consists of five bridge cars, a paint car and an engine. The crew consists of 32 painters.

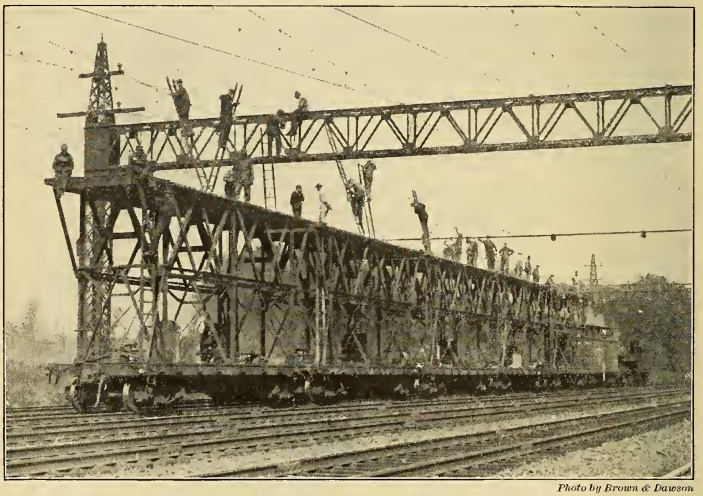


Photo by Brown & Dawson

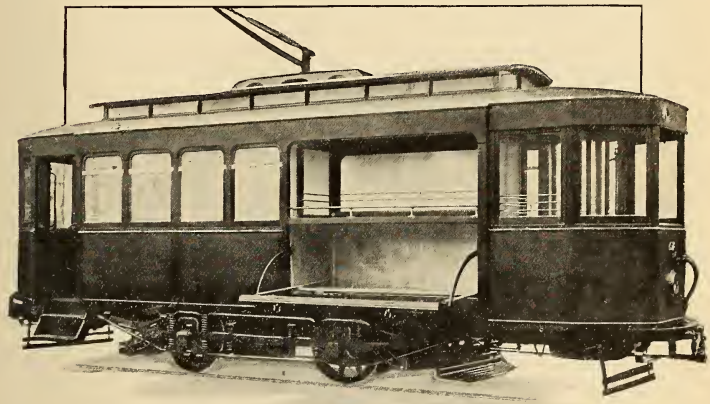
A PAINT TRAIN ON THE ELECTRIFIED PORTION OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

A Funeral Car in France

The Compagnie des Chemins de fer Nogentais, an electric railway company operating near Paris, has placed in operation a special funeral car for use between Vincennes and the Nouveau cemetery.

The funeral car has several compartments for the use of the bearers, the funeral director and mourners, the casket being placed in a compartment near the front. Additional cars are also provided in the funeral train each carrying 50 to 60 persons.

To facilitate the removal of the casket, one of the side panels of the car drops down and outward to form a platform on which the casket may be easily rolled out.



A FUNERAL CAR ON AN ELECTRIC INTERURBAN RAILWAY NEAR PARIS

Nursery Noise Indicator

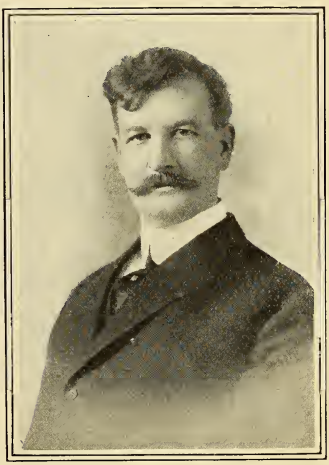
Are the children all sleeping soundly? Every night brings that same question to untold thousands of homes in which mothers are glad to have their little ones in a children's room, yet half worried at not having them close by. In such cases, what is the anxious mother to do? Must she keep the hall doors open both from her chamber and from the nursery, thereby allowing all the noises of the house to disturb the occupants of both rooms? Or shall she tiptoe occasionally to the children's room to see if all is quiet there? In either case, the mother's sleep would be considerably broken.

Here again, an electrician has come to the rescue with a simple solution which ought to bring added comfort to thousands of homes. He places a telephone transmitter with its battery on a shelf in the nursery, high enough to be well out of reach of the children, and runs wires from it to a receiver hung beside the mother's bed. During the day, a switch at the receiver cuts off the telephone circuit so that no sounds will be carried by it from the nursery. But at night, the switch is turned on and the mother can at once settle down to a sound sleep, knowing that if a child should cough or become restless, she would immediately hear it, even though the hall doors to the various rooms are tightly closed.

The Value of English to the Technical Man

BY JOHN LYLE HARRINGTON, CONSULTING ENGINEER

Extracts from address delivered in 1907 by Mr. Harrington to the Technological Society of Kansas City, the Engineering Society of the University of Missouri and the Civil Engineering Society of the University of Kansas, 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 seventh of a series of similar articles by prominent educators and business men, which will be especially interesting to boys and young men who contemplate following the engineering profession.—Editorial Note.



You will recall Sam Weller's remark regarding Mr. Nupkins' eloquence that "his ideas come out so fast they knock each other's heads off and you can't tell what he is driving at." Like any other instrument, the value of language is in direct proportion to our knowledge of it and our skill in its use. If we understand it fully and use it skillfully, it will serve our purpose well, but if we are novices and bunglers only disappointment will result.

Language, though it will not supply the place of thought, is a most essential instrument to every man. To him who is without important thought to express, it is not a very valuable tool. The laborer does not require it in handling the pick and shovel; it is only in his social relations that he has much need for speech. It is not important that the stoker speak fluently, or that the mechanic be an able orator or writer. But as we proceed from the lower to the higher and more intellectual occupations, the need and the value of knowledge and command of language will be found to increase rapidly.

The technical man; that is, the engineer, the architect, and the applied scientist of every kind, finds a sound, accurate knowledge of the language essential to him in every part of his work. A wide and precise knowledge of words is required in his reading as well as in his general writing; in his business and professional conversations even more than in those of a social nature. But, in the preparation and interpretation of technical correspondence, specifications, and contracts, the use of perfect language reaches the highest degree of importance.

You may say that it is absurd to state that men who have graduated from any college cannot spell correctly, but many of them cannot. S-e-d, said, p-e-a-r, pier are extreme, but true examples. It is very common to find misspelled words in letters written by young engineers. They consider such errors of no material consequence, because they are not technical errors. The mind has been so fixed upon the scientific work during the course of study and while the early experience is being acquired, that such matters as lan-

guage and culture seem to be of little importance. But the recipient of the letter generally takes a different view of the matter, for he justly considers the writer something of an ignoramus.

There are technically educated men who say "I have saw," "I seen," and "I done;" and there are men in high places who require no further proof of the speaker's deep ignorance, not only of English but of technical matters as well. One who is thus ignorant of the language finds social progress substantially impossible. This may seem a trivial matter and foreign to our purpose, but it is not. Matters of very large importance are often settled by favor, and favor frequently follows social position. Other things being equal, almost any one will show his friend the preference in business or professional matters. It is even common to stretch a point in favor of a friend.

Language has large weight in classifying a man, infinitely more than manner or dress. It exhibits his breeding and indicates his social status. I do not mean that it shows whether he belongs to the so-called "smart set," but whether he is of the educated, cultured class, whether you would care to entertain him at all, and, if so, whether you would send him to your less or more select club, or whether you may extend the extreme courtesy of inviting him to your home. This may appear at first glance to be of small consequence, but great things often result from associations quickly formed.

There are many vocations in which it is not essential that a man be cultured and intelligent; but the technical professions are not among them. Nothing so surely marks a man's secret habits of thought, his real character, as the little tricks of speech which are exhibited when his mind is upon the matter rather than the manner of his speech. If his thought be habitually coarse, crude, or brutal, his speech will make the fact manifest at times; and the speech of a moment frequently produces a permanent and vital effect.

But the preparation of reports, specifications and contracts is the most particular and momentous task the technical man has to perform. A misused word, a phrase whose meaning is ambiguous, a paragraph that is confused, or the omission of a direction or a precaution, may result in great damage to both the client and the technical man. It is not enough to be careful in a general way. Every word, every phrase, every sentence has a direct bearing on the work governed by the documents. I have known the presence in a contract of a single word of equivocal meaning to cost one of the parties many thousands of dollars, though when the contract was drawn there was no question regarding the intent of the parties to it. Probably the majority of the civil law suits are caused not by trickery or deceit or dishonesty, but by the use of ambiguous words and phrases, bad ordering of the matter, incompleteness, and other faults in the language of the correspondence, specifications, and contracts. There is no more certain way for the engineer to protect his own and his client's interests than to prepare all documents in accordance with the best English usage as well as with technical skill; and there is no surer way to lay the foundation for trouble and financial loss than to neglect the character of his language.

Very few railway specifications for complicated structures are so well written that a contractor cannot comply with them to the letter, yet give the company construction far inferior to what the writer of the specifications intended, and thereby gain for himself material advantage.

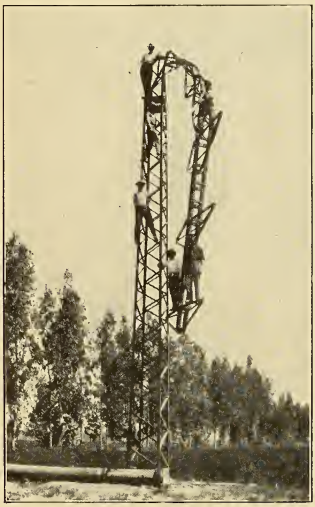
The lawyers and the courts are kept busy rectifying the blunders of other professional men who do ill what they are paid to do well. I know of one contractor who has grown gray in the business of constructing buildings, who has never completed a contract without a lawsuit, and who has never lost a lawsuit. This speaks ill for the work of the architects under whom he worked, yet they

are probably no worse than their fellows. If it were not good policy to be reasonably honest, many another contractor might easily approach his record.

A thorough study of one or two good books which treat each phase of the study of English, the reading of literature of the best classes, and reasonable watchfulness over one's every-day writing and conversation will inevitably result in habitually correct use of the English language.

Collapse of a Steel Transmission Tower

An unusually severe wind storm was responsible for the destruction of a number of steel power line towers on a line being constructed in Southern California.



THE STEEL TRANSMISSION TOWER HUNG LIKE AN OVER-WEIGHTED SAPLING

By a strange freak one of the towers was bent and twisted in the middle and the top hung over half way to the ground like an over-weighted sapling. A number of line men climbed on the steel frame work to have their pictures taken with the wreck, and also to show the comparative size of the pole.

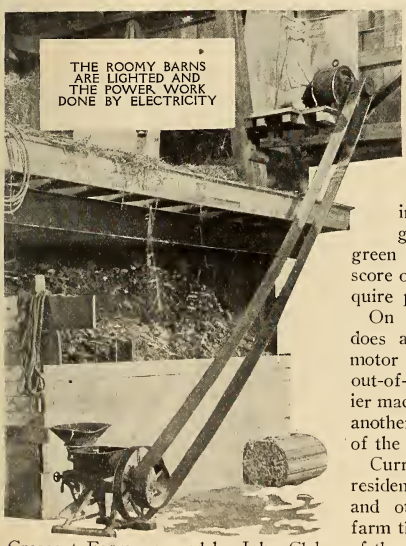
Traveling Spot Light in a German Theatre

At the New Court Theater in Stuttgart, Germany, extensive use of flaming

SPOT LIGHT OPERATED FAR ABOVE THE STAGE

arc lamps is made above the stage, which make possible particularly artistic lighting effects. Below the first machinery, gallery rails have been mounted from which traveling carriages have been suspended, each carrying a flaming arc spot light and its operator. The movement of these carriages backward and forward enables the stage to be flooded with light at any point without difficulty and without encumbering the gallery with spot light apparatus.

ELECTRICITY AT CRESCENT FARMS



THE ROOMY BARNS ARE LIGHTED AND THE POWER WORK DONE BY ELECTRICITY

Crescent Farms, owned by John Clelland of Scranton, Pa., are located at Mt. Cobb, near Scranton, and are devoted to the raising of fine stock, principally. Great roomy barns are built to house the stock and these are lighted electrically.

Practical farmers know well the amount of work connected with even the item of preparing the rations for animals, particularly when this is done in a scientific manner. Aside from the threshing, the corn and feed must be ground, roots and straw cut up, green feed prepared for the silo and a score of other things necessary which require power.

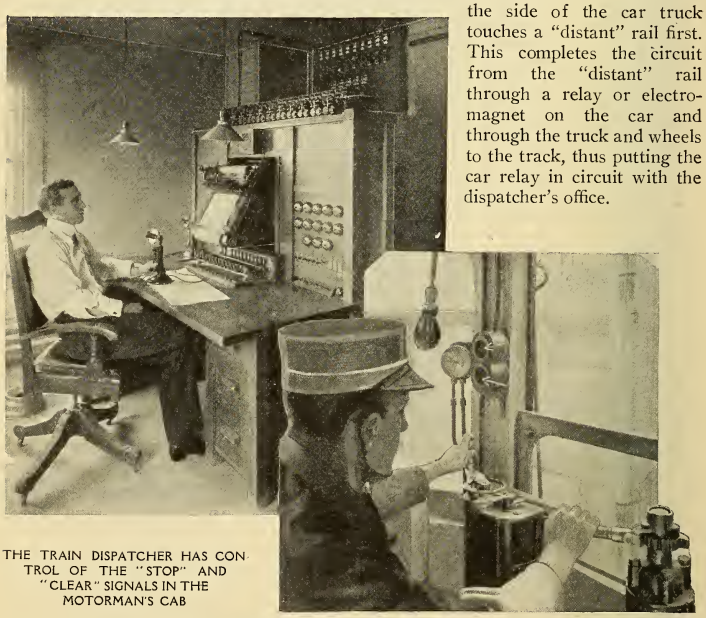
On Mr. Clelland's farm electricity does all this work, one Westinghouse motor of five horsepower, located in an out-of-the-way corner, running the heavier machinery and doing the pumping, and another of two horsepower taking care of the dairy apparatus.

Current is also used in the owner's residence for washing, ironing, sewing and other household duties. On the farm there are about 100 tungsten lamps of the wire type. These are in the barn, the greenhouse, the hennery, the three houses of the help and the large residence of the owner.

All the electrical apparatus was installed about three years ago; a farm boy has been able to give it all the attention it has needed.

Signaling Between Dispatcher and Motorman

A new electrical signal system by means of which the dispatcher is in communication with the motorman in his cab is in operation upon the Indianapolis and Cincinnati Traction Company's lines.



THE TRAIN DISPATCHER HAS CONTROL OF THE "STOP" AND "CLEAR" SIGNALS IN THE MOTORMAN'S CAB

With the Simmen system, running orders go directly to the motorman and not to him through intermediate persons.

At each siding along the line are placed three sections of contact rail. Each piece is 72 feet long and resembles a third rail when in position. One length of rail is placed beside the track opposite the siding switch and the other two rails are placed 2,000 feet distant in opposite directions from the siding. The rail at the siding is called the "home" rail, the other two are termed "distant" rails. These three third rails are connected by a single wire along a pole line direct to the dispatcher's office. When a car passes them, a contact shoe attached to the side of the car truck touches a "distant" rail first. This completes the circuit from the "distant" rail through a relay or electromagnet on the car and through the truck and wheels to the track, thus putting the car relay in circuit with the dispatcher's office.

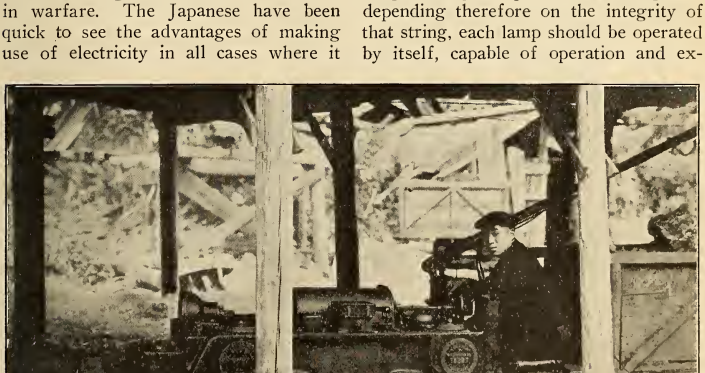
The car relay controls a red and a green light in front of the motorman, indicated by the arrows in the picture, and also a bell. The current for these is furnished by a battery on the car. In front of the dispatcher are switches corresponding to each siding. When a car reaches a rail 2,000 feet from the siding the dispatcher throws the current on or off this third rail circuit which energizes or disenergizes the car relay and lights the proper lamp for "stop" or

"clear," at the same time ringing the bell in the cab. Another feature of the system is the train record sheet which is constantly made in the dispatcher's office. This sheet is a roll of paper moved by clockwork and divided up into time divisions and "blocks." When a train enters a block, needles are actuated that punch the sheet so that the running time of the train is recorded and also the time of entering and leaving the block.

American Equipment in Japanese Mines

Japan's progress in the last 25 years has been along industrial lines as well as in warfare. The Japanese have been quick to see the advantages of making use of electricity in all cases where it is applicable, and the United States has received a large quantity of orders for electrical apparatus and equipment.

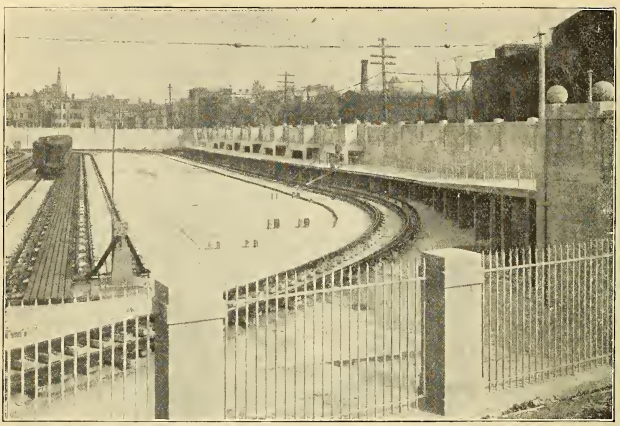
The cut shows a very modern American made electric mine locomotive emerging with a train of coal from the Sorachi Mine of the Hakkaido Tanko Company, located in northern Japan. All employes of the mine are Japanese and the entire electrical equipment is operated by them with great success.



MINE LOCOMOTIVE AND ITS JAPANESE OPERATOR

Edison's Principles Still Followed

Mr. Edison, in conceiving his system of incandescent lighting, started out with certain broad fundamental ideas. He started out with the idea of not merely inventing this or that piece of apparatus but a complete operating system commercially as well as technically. His idea was that in contradistinction to the system then existing for arc lamps, which was known as the series system, with the lamps strung like pearls on a string, and depending therefore on the integrity of that string, each lamp should be operated by itself, capable of operation and extinction, and that all the units of the system, beginning with the engine, the boiler, the dynamos—every part of the system—should be laid out on the same broad comprehensive plan. These fundamentals laid the foundation for the success of the parallel system of distribution as we now have it, 30 years later.



THE HARVARD STADIUM STATION

A new station of the Boston-Cambridge subway system has just been put into use for passengers bound to and from football games and other events at the Harvard Stadium. Until this station was completed people attending the football games at the Stadium, sometimes 35,000 to 40,000, were obliged to "hoof it" to the Harvard Square terminus of the Cambridge subway or take surface cars by a roundabout route. The Stadium station is designed to handle an enormous traffic in a very few moments. There are seven entrances with ticket booths, and three or four trains can be loaded at once from the concrete platform.

The Evaporation of Metals

The evaporation of metals is conducted upon a large scale only close to the surface of the sun, where the hardest metals exist only as clouds of glowing vapor. On a very small scale, however, metals can be evaporated in a beautiful manner. A current of electricity passing between electrodes, through a vacuum tube, supplies the means.

If a piece of platinum is used for the negative electrical pole, the passage of the current drives off some of the molecules of the platinum, which afterward condense on the inside of the glass tube, forming a mirror like deposit.

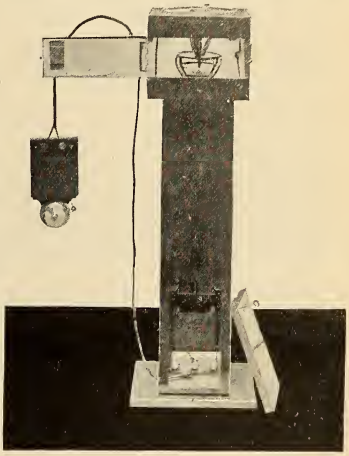
The manner in which this action takes place is most interesting. To understand it, the layman must recollect that the change of any substance from the solid to the liquid, and from the liquid to the vaporous condition, is accomplished by imparting greater and greater velocity to the molecules of which it is composed. If the molecules of a liquid fly too far they will get beyond the molecular attraction of the liquid mass and escape into the atmosphere, or the free space around them, in which case they are said to have evaporated.

The ordinary way in which to increase the motion of molecules, or, in other words, to produce evaporation, such as changing water into steam or vapor, is by the application of heat. Heat is simply a form of molecular motion. But the electric current, streaming from one metal pole to the other, also affects the molecules of which the pole is composed, and by stimulating their motion, drives them beyond the sphere of attraction of the metal, whereupon they fly off until they come into contact with the surrounding glass.

In this way have been evaporated various metals, including that very hard substance, iridium, of which the points of gold pens are made. Gold and silver are very easily evaporated in this manner, while aluminum can hardly be evaporated.

An Electrical Steering Sentry

A novel English electrical steering sentry of the Heath type is constructed at the Hezzanith observatory works at Crayford, England. This instrument automatically gives warning to the officer on watch and in the captain's cabin when the vessel deviates from the course



INSTRUMENT WHICH AUTOMATICALLY GIVES WARNING TO THE OFFICER ON WATCH

set. The amount of deviation from the course before the warning is given may be regulated from 2° to 30° as desired. When the vessel is just off her course and the limit set, the warning bell rings intermittently, but should she deviate considerably from the course the bell rings incessantly.

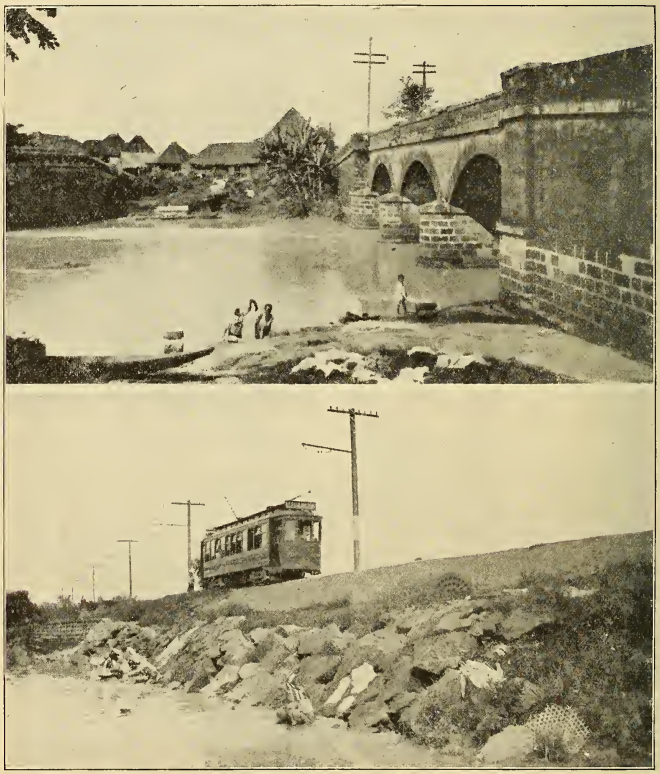
The officer on watch has very often other duties to attend to besides that of checking the steering, all of which take a certain amount of time, during which time the man at the wheel is solely responsible for the steering and has to be trusted.

With the electric sentry in use the officer is at all times aware whether or not the course is being made.

Electric Washing Machines Needed in the Philippines

BY T. JEFFERSON FOX

Since American occupation of the Philippine Islands, now about fourteen years, considerable progress has been made in almost every direction by the Filipinos in employing modern methods in their various callings, but the primitive and very crude manner of washing clothes which has obtained in the islands for the



LAVANDERAS OF THE PHILIPPINES WASHING CLOTHES BY PRIMITIVE METHODS UNDER THE VERY WHEELS OF THE MODERN TROLLEY CAR

past 250 years or more still prevails today. The writer has been in the islands since 1899 and has never seen any one here using a washing machine.

With the exception of a few Chinese laundrymen, who are to be found in almost every country, and two steam laundries, one of which is Government owned and operated, in Manila, a city of 250,000 inhabitants, all laundering is done by Filipino "lavanderas" and "lavanderos," the former being women and the latter men, and about as many of the men follow this pursuit for a living as women. Usually the entire family assist in washing, and it is all done, with the exceptions made above, as shown in the illustration, on the banks of rivers and small streams. The small boy in the upper picture has just brought the garment over his head with all his might against the rock, and it shows the woman in the act of beating the garment against the rock. They wet and soap the clothes (using soap locally manufactured by Chinamen), placing the garments, one at a time, on a rock. Then they take a large club or stick, when available, and beat the garments, and when they have no stick or club they simply take the garments in their hands and beat them with all their might against the rocks until they are in a fair condition of cleanliness.

They use the club more frequently in beating the clothes, which process is extremely hard on the garments; in fact, after a few washings they are unfit for further service and the local tailor is resorted to for a new outfit. Most all the men in the islands wear either white or khaki, averaging about $3.00 per suit consisting of coat and trousers and they do not mind the wear and tear in laundering so much, as they have grown accustomed to it, but it is very different with women's wearing apparel, such as lingeries, laces and linens, etc., and the "lavanderas" are continually reprimanded for the rough usage the garments receive. The native then assures the owner that it will not be done any more, but it is always repeated until there is nothing left of the garments to wash, the "lavandera," by way of consolation, saying, *"patiencia, Señora, no tengo culpa,"* which means in English, "patience, Madam, I am not to blame."

While it is not practicable to use electric washing machines altogether in the islands, still there are about 12,000 European families in Manila, Cebu and Iloilo that could use the electric machine, as current is available in those cities. Electric plants will also soon be established in many other towns in the islands, some now in the course of construction, the population ranging from 20,000 to 60,000 in each, and containing from 1,000 to 3,000 Europeans.

It is readily believed, however, that in a very short time many of the Filipinos, especially those within the city limits where electric current is available, could be induced to adopt the electric machine and ironer if only some live and energetic party would take the trouble properly to demonstrate the merits of these useful and much needed articles to them.

First School for Telephone Operators

In 1902 the New York Telephone Company started a school, the first of its kind in the world, for the education of telephone girls. This school is hidden amid ranges of skyscrapers, but 17,000 girls discovered it in the course of the year. It is a most particular and exclusive school. It accepts fewer than 2,000 of these girls, and rejects over 15,000. Not more than one girl in eight can measure up to its standard; and it cheerfully refuses as many students in a year as would make three Yales or Harvards.

The school is unique, too, in the fact that it charges no fees, pays every student five dollars a week, and then provides her with a job when she graduates. But it demands that every girl shall be in good health, quick-handed, clear-voiced, and with a certain poise and alertness of manner. — *History of the Telephone.*

The Hot Air Douche

The electric hot air douche, consisting of a motor, fan and heater combined, has many uses to which the thoughtful person may apply it, and the fact that it is so light that it can be manipulated with one hand adds to its convenience.

The accompanying illustration suggests its serviceability for drying the hair, warming garments or bath towels, drying gloves after they have been washed, drying Fido's coat after the bath, taking the soreness out of a rheumatic arm, treating the face, warming the bed, and recurling ostrich feathers; and the practical person will multiply the uses enumerated above.

Mouse Ties Up Street Car System

Of all the vagaries of the electric current one of the most curious is reported by the *Portland Carman*. Early one morning the system of the Portland Railway Light and Power Company experienced a bad shutdown. Electricians with expert knowledge were called in to analyze the situation but apparently of no avail.

Finally the trouble was traced to Knott sub-station. Here Operator Abbott was unable to find the cause except that an oil switch was on fire. By cutting the switch entirely clear from the rest of the system, the service was resumed in about ten minutes.

During the shutdown all of the arc circuits feeding out of the Jefferson and Knott sub-stations were dead, and railway service running out of Alder substation in the very heart of the city was at a standstill. After much trouble and spending a great deal of time in trying to solve the problem, it was found that an inquisitive mouse had crawled onto an oil switch at the Knott station and thus formed an electric connection between an 11,000 volt terminal and the concrete work, permitting the high voltage to jump to the ground.

The mouse when found had only his forelegs burned off. The current which

passed through his body should have shriveled him up into a speck of dust. In some manner he must have escaped the withering effects of electrocution, but just the same he made it up in trouble for the electricians and patrons of the company.

The Conductor's Transformation

Uniforms are distasteful to the majority of men who have to wear them during working hours. A conductor on an interurban line has found a way by which he can wear what to the ordinary observer is the usual uniform of the company. At the end of the run he removes

THE CONDUCTOR'S TRANSFORMATION

his brass buttons, which are merely hollow brass covers with slots cut in their backs so that they easily slip on and over the usual buttons on men's clothes. He then replaces his cap with a hat of the latest style and is transformed into a prosperous looking business man in a broadcloth navy blue suit, as per the artist's conception shown above.

Electrical Resistances at Very Low Temperatures

It is well known that with the materials commonly used for electrical conductors, the resistance varies with the temperature of the conductor, and as the temperature rises the resistance also increases, though not always in the same proportion. It may, however, not be so well known that there is a theory among scientific men that if we could reach the absolute zero of temperature (—273° C.), then the resistance of a conductor would disappear entirely. This consideration may be purely theoretical, but it is none the less interesting in view of the fact that the Dutch scientist, M. H. Kamerlingh Onnes, who in 1908 succeeded in liquifying the rare gas helium at a temperature of 4.6° above the absolute zero, has been making experiments on the electrical resistance of mercury at these low temperatures.

In a communication recently made to the Dutch Academy of Sciences, Onnes states that by allowing helium to boil in a partial vacuum measured by a height of one centimeter of mercury, which is equal to the one seventy-sixth part of an atmosphere or about one-fifth of a pound per square inch, he has been able to reach a temperature only 3° C. above the absolute zero. At this temperature he made the surprising discovery that the electrical resistance of mercury is only the one ten-millionth part of its resistance at 0° C.

The possibilities opened up by this discovery are of course tremendous. For instance, if a coil of very fine wire in which the electrical resistance was very greatly reduced by lowering its temperature, should be charged with a powerful current, it would be possible to create a magnetic field of an intensity greater than any hitherto dreamed of.

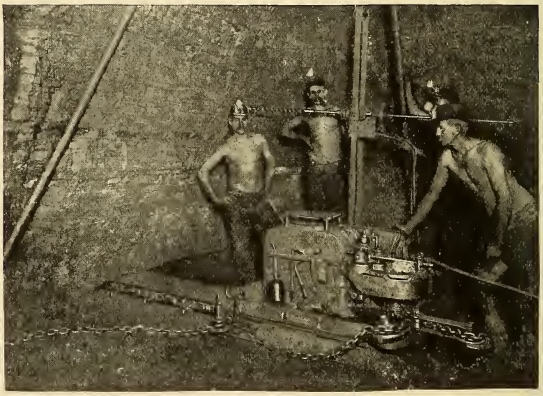
The results of the experiments also lead to the belief that the idea that electrical resistance disappears at the absolute zero of temperature, may be, and probably is, correct.

Coal Mining Machines in Australia

The use of mining machines has almost entirely replaced mining by hand pick in foreign mines as well as in those in this country. By "hand mining" is now meant, ordinarily, drilling holes in the working face of the coal seam, inserting explosives and blasting the coal out from the straight face of the seam by the mere force of the powder. This is a very dangerous practice, and one which is responsible for many of the serious accidents which are so often reported.

Mining machines are of two patterns: one operated by compressed air, which makes a wedge shaped cut underneath the coal similar to that made by the hand miner with a pick; the other, operated by electricity, sometimes by compressed air, makes a cut four to six inches high and from 3½ to 6½ feet deep, parallel with the floor at the bottom of the coal seam. This cut may be seen behind the front of the machine in the accompanying picture which shows a Sullivan coal cutting machine in a coal mine in Queensland, Australia.

In mining coal with this machine, it is first brought into the room or working place mounted on its self propelling carriage or trunk. It is then dragged to either the right or left hand side of the room under its own power, by means of the feed chain shown in the picture. It is then started feeding under the coal, until the full length of the cutter bar is reached. The jacks, or supports, are then reset, so that the feed chain is stretched across the entire face of the room. The machine cuts across the face, making a continuous undercut or mining, without being withdrawn from the coal until the opposite side of the room is reached.



SCENE IN AN AUSTRALIAN MINE—THE UNDERCUTTING IS DONE BY SHARP BITS ON AN ENDLESS CHAIN. IN THE BACKGROUND IS AN AUGER DRILL MAKING BLAST HOLES

The cutting is done by sharp bits, or cutters, seen in the foreground of the picture. These run on an endless chain on sprocket wheels, one at each end of the cutter bar, and are driven by an electric motor through gearing.

The horsepower of this machine is 30. The picture shows the machine partly withdrawn from the coal, presumably to cut around a ball of sulphur, or some other impurity.

In the background of the picture is

shown an electric auger drill, with which the blast holes are drilled in the face of the coal, after it has been undercut. When coal has been mined in this way, it is necessary to put in only three holes in a working place, one in the center and one on each rib, and a dozen or fifteen pounds of powder is ample to break down the entire face.

Storage Battery Cars in Trains

A marked step in the development of electric railway operation has been taken by the Unidos Habana, an electric railway company in Cuba. It will operate storage battery trains such as the one shown in the picture, which was taken during a recent try-out from New. York City to Long Beach, L. I. Single storage battery cars of this type, built by the Federal Storage Battery Company, have been successfully operated in a number of cities in this country. But never before had the operation of trains of these cars been attempted.

A large element in the success of the operations of the trains is the special direct current Diehl motors used on the cars, all the motors being coupled together electrically by a clever system of multiple unit control handled by a single motorman. The batteries on the cars are of the Edison type, 200 cells being located under the seats in each car.

TRAIN OF STORAGE BATTERY CARS OF A TYPE WHICH WILL BE OPERATED IN CUBA

Curious Case of Electric Shock

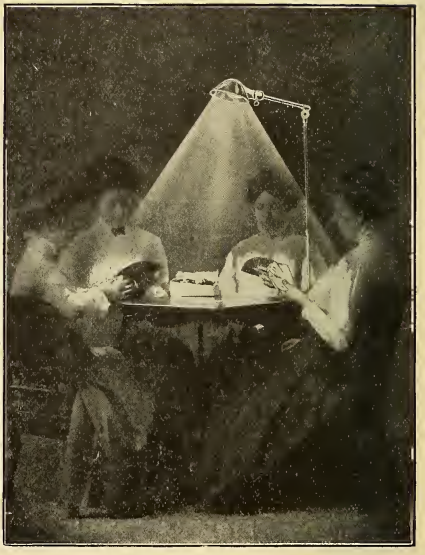
An interesting case of electric shock without fatal effects was presented before the Academy of Medicine of Cincinnati by Dr. Merril Ricketts recently. The victim was Walter Still, one of a number of men engaged in dismantling a water tower on Price Hill, a suburb of the Queen City.

Some months ago the man was engaged in rigging a derrick, and in some manner his head came in contact with an electric wire charged to a potential 35,000 volts. This voltage was impressed directly upon his body, from the crown of his head to the soles of his feet. Still was rendered unconscious and hurled a distance of 30 feet. The only evidence of his injury, however, is a hole in each of his feet, and these are healing rapidly.

Portable Floor Light

A portable floor light is so convenient in the home that it may almost be classed among the necessities. At card parties, sewing parties, as a reading light, piano light and in many other ways it adds to pleasure and convenience. The Morse light shown in this picture has a six foot telescopic upright, with a one foot arm that can be swung or tilted in any direction. No thumb screws are needed to control the adjustment. It thus can be adjusted to any height, or to any position in a second. It is made also with flexible instead of stiff arm.

The upright is of brass with a brass socket and shade to match. The base is of iron covered with spun brass. It is also furnished in other finishes, such as polished or old brass, verde, bronze or gun metal.



Electric Circus-Museum Train

An electric special or traveling side show has been inaugurated by the Alabama Southern Railroad. It is made up of a train with specially constructed cars equipped with all sorts of electrical devices, like washing machines, cookers, floor scrubbers, cleaners, pumps, irons, toasters, automatic kitchens, tables, rarebit tureens, candy machines, and the like. Direct connected motor driven outfits such as coffee mills, bone grinders, meat choppers, shoe shiners, hat cleaners, sewing machines, windmills, water filters, house pumps, are in two of the cars.

Still other cars—the train is transported from village to village by a gasoline electric locomotive with a storage battery equipment—were fitted out as a fully equipped electrical department store with cash arrangements on electric switches, electric cash registers, counters, lighting arrangements, push buttons, electrical timing devices, electrical shelves, show cases, stairways and card systems. Even an electric typewriter and adding machine was there.

The car that interested the children most was an electric toy shop and play room. Here an electric Santa Claus bowed and handed out picture cards, beneath an electrically trimmed Christmas tree. An electric fountain spouted in an electric garden, where an electric railroad, with semaphores, telegraphy, telephone, wireless, and other electrical novelties were busily doing their expected work. An electric trolley system vied with several small aeroplanes and electric automobiles in picking up and letting out electrically manipulated figures.

In another car, a moving picture and marionette show was given. Electrically manipulated lay artists sang by means of a graphophone run by electricity and were accompanied by an electric piano, banjo and 'cello. The moving pictures

showed in an amusing way the wonders of modern applications of electricity.

Movable Laboratory for Air Surveys

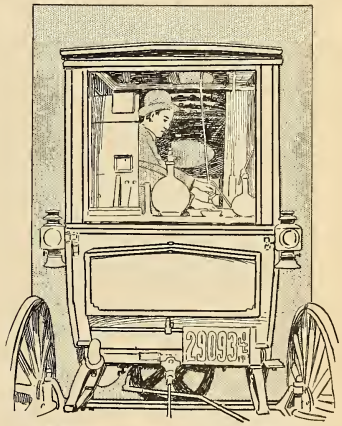
The effects of atmospheric pollution in public halls are pretty well defined and it is not a difficult operation to analyze the atmosphere of a laboratory in which the various devices are permanently installed, or to which samples of air in bottles may be taken, but the problem of testing the atmosphere of a great city, in the many parts of the city and with the use of sufficient volumes of air to insure average conditions at the point investigated, and to determine accurately those constituents existing in minute quantities in the air, is a problem that has been most uniquely worked out by Mr. William Hoskins of Chicago in a portable laboratory containing apparatus for the express purpose of conducting air analyses at many different points.

An automobile delivery wagon with a closed body was secured and the car is operated by the ordinary two cylinder engine. The runs cover about eight hours and are made during the day and at night. In designing the arrangement of the apparatus, account had to be taken of the fact of transporting glass bottles and flasks over rough streets, so the wagon was fitted with shelves and each flask is held firmly in its place by a tiny strap. A storage battery, an electric motor, and a pressure pump are the essential features of the portable wagon.

The air is drawn in through a specially devised filter so controlled by a weather vane that it always turns the filtering surface towards the direction from which the wind is coming. The filter waylays all dust, soot and carbon particles, then it goes through a series of flasks and absorbing solutions. The amount of carbon dioxide and other chemical constituents is determined in this way.

The electric motor operated by a storage battery is connected with a pressure pump, thus drawing the air through a specially arranged filter and then through the various absorbing solutions. The amount of carbon dioxide is determined every hour and a half throughout the test and the total quantities of sulphur compounds, nitrites, ammonia and chlorine are also determined. A barometer, hygrometer, a wind gauge and other apparatus are carried and frequent determinations of the meteorological conditions of the atmosphere are recorded.

The dust collected in the cotton filter



AIR SURVEY LABORATORY ON WHEELS

is weighed and a microscopic examination is made to determine the nature of the material collected and photo-micrographs are made.

There is scarcely a period of electrical development, starting with the early days when Edison was but a stripling, that has not felt his influence. Follow his progress through the patent records of the world. In the telegraph business, the telephone business or the electric light and power business, it will be found that in each one he has greatly distinguished himself, and has probably effected at least three-quarters of the electrical development of our time by the product of his mind.

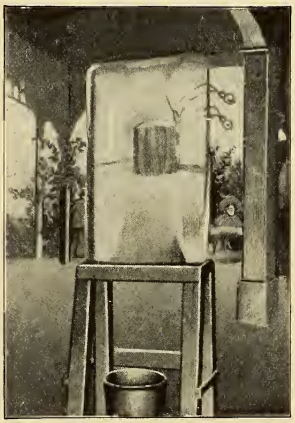
Lightning Rods to Protect Threshing Machines

Threshing machines out in Republic County, Kansas, were equipped during the threshing season with lightning rods as a protection to the machines during the fierce electric storms so frequent in that time of year. It is said that lightning destroys more machines than all other causes combined.

Storage Battery in a Cake of Ice

A storage battery actually doing work while frozen into the center of a solid cake of ice was the novel sight which met the eyes of visitors to the recent automobile show in St. Louis.

The Leutwiler battery which underwent this unique test was first lowered into a tank of water and remained there 40 hours while the water was slowly

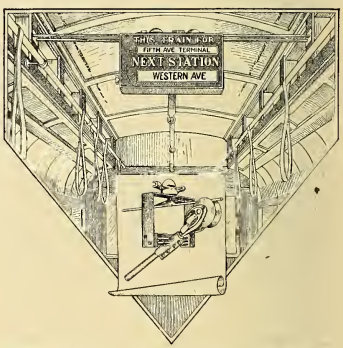


STORAGE BATTERY IN A CAKE OF ICE

congealed into a solid cake of ice. Then the lamps were connected to wires left projecting. These wires were not even insulated, to the surprise of most of the observers, demonstrating the fact that ice is a very good insulator. Otherwise a heavy current would have passed from wire to wire through the ice and practically short circuited the battery.

Street Indicator for Electric Cars

The street car passenger who is anxious to get off at the right street and whose confidence in the guard or conductor has been sometime rudely shaken by being carried by his destination on a



STREET INDICATOR IN A CAR AND THE TROLLEY BRUSHES WHICH OPERATE IT

stormy night may now sit back unperturbed and read the next station or street upon an indicator in the car. Not only that but the point to which the car goes is also shown. One of these indicators is shown installed in a car.

To operate the indicator automatically a brass collar on the trolley pole carries current through a wire in the center of the pole whenever the pole passes metal brushes placed at proper intervals along the line as shown in the illustration. The manual method of operation is to have two push buttons, one to run the machine in one direction and one to run it in the other, placed within reach of the conductor, who then pushes the proper button upon leaving each station which causes the machine to display the name of the next street or station.

Vibrating the Whole Body

The vibration of the street car and the railway passenger coach has upon many people the effect of an opiate—a sleepy, soothing feeling is experienced. Whether or not this has anything to do with the invention of the vibrating chair the same principle is observed.

AN ORDINARY VIBRATOR IS CLAMPED TO A CHAIR

The accompanying picture illustrates the application of vibration to the whole body by attaching a White Cross electric vibrator by a clamp to a chair. The vibrator is the same as is used in massaging the face or body. Those who have tried the vibrating chair treatment assert that it stimulates the circulation, induces sleep and imparts a natural healthy tone to the system.

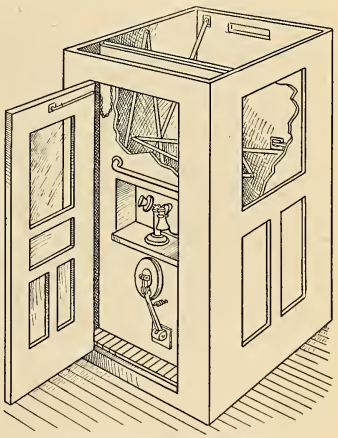
New York public service commissioners are the best paid in the country; they receive $15,000 per year each. South Dakota commissioners receive least of all, their salaries being $1,500 a year. Members of the other 45 state commissions and one federal commission receive between $1,900 and $10,000 per year. These commissions have in the aggregate no less than 156 members.

Ventilated Telephone Booth

William Douglas Carter of Quincy, Illinois, recently received a patent upon an invention to effect a change of air in a telephone booth after each occupancy.

The general plan is indicated in the illustration in which a sort of "fan door" is shown, the roof and part of the side of the booth being cut away in the drawing for the sake of clearness.

A person entering the booth pushes the fan door inward, thereby causing fresh air to flow into the booth through the open entrance door, and the air in the



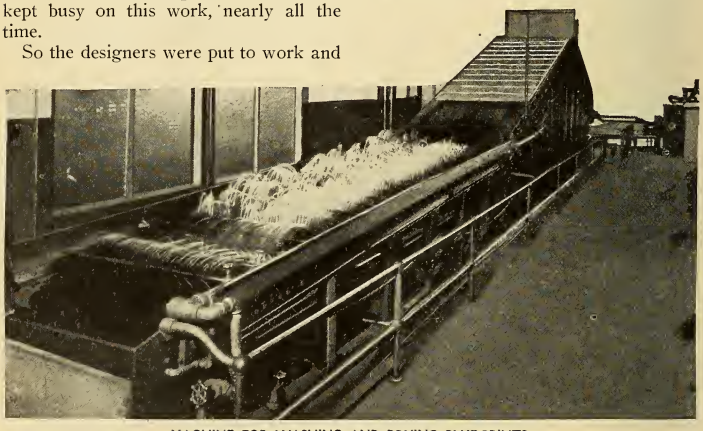
VENTILATED TELEPHONE BOOTH

booth to flow out through an opening in the back of the booth. As the fan door is pushed inward the entrance door is nearly closed by a chain. A dead center spring forces the fan door against the back of the booth and a stopper closes the air opening in the back of the booth. The folding stool may then be pulled down and the telephone used. When the user opens the entrance door to leave, the chain pulls the fan door forward forcing out dead air and admitting fresh air behind it.

A Blue-Print Machine

A certain large manufacturing plant employs a special corps of designers, architects and draftsmen, while its own school for draftsmen and designers turns out a great number of blue prints. Some time ago this concern began figuring on the time consumed in washing and drying these blue prints. The manager who did the investigating found that out of the crew of ten photographers, four were kept busy on this work, nearly all the time.

So the designers were put to work and



MACHINE FOR WASHING AND DRYING BLUE-PRINTS

the machine shown in the illustration was finally produced. It consists of little more than a series of rollers and pipes. The blue print sheet is fed between the rollers, which are continuous, and as it goes down the line the sprinklers (shown at work in the picture) develop and wash it thoroughly. The blue print then passes on to other rollers, which squeeze it uniformly, and rid it of water, finally passing it on through a heating section, and bringing it out dry and ready for use at the other end. The affair works automatically and is run entirely by electricity. It requires almost no time or attention, and turns out thousands of blue prints each year perfectly.

The Golden Arc Light

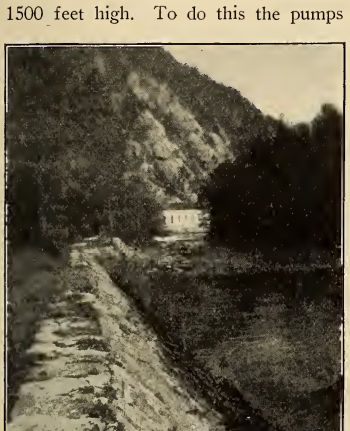
In place of the pure white glare—cold and unkind in its whiteness—of the usual form of arc light, a still more glaring radiance, but of a soft and pleasing golden color, is now frequently seen, produced by what is familiarly called the flaming arc.

The golden color of this light is due to a peculiar preparation of the carbon pencils, which are said to contain the salts of various somewhat rare minerals; but the exact constituents are not revealed by the manufacturers.

The golden arc light gives a curious spectrum quite unlike the continuous band afforded by ordinary carbons, which is very similar to that of daylight. The spectrum yielded by the new carbons is discontinuous, and consists of a number of brilliant strips separated by spaces of darkness. The red, orange, and green are especially conspicuous, while blue and the colors beyond it are scarcely represented. The carbons have the disadvantage of giving a somewhat unsteady light, and for this reason they are used principally for outdoor work.

Adding Charm to the Picture

On the Areuse River in the Canton of Neuchatel, Switzerland, there is located a pumping station which supplies water to a town on the farther side of a mountain 1500 feet high. To do this the pumps



A LITTLE SWISS PLANT THAT ADDS THE FINISHING TOUCH TO A MOUNTAIN SCENE

must force the water up through the pipe against the enormous pressure of 825 pounds to the square inch. Ordinarily this is done by waterpower turbines in the riverside plant shown in the picture, but when the water is low in the river two electric pumps in the plant help out with the work, the motors taking their supply of current from a nearby power station.

The Swiss, as a people, have an eye for the artistic, especially as their mountains and rivers and lakes form a picture gallery for the whole world, and they are very careful never to mar any of their natural scenic attractions. When a power station or any other plant of this nature is set among their hills and mountains you may be sure it will enhance rather than detract from the picture. Not the least interesting feature about this little plant, therefore, is its admirable setting, and whether intentionally or by accident it has been made to add the finishing touch to a charming mountain view.

Puppies Appreciate Warming Pad

A rather odd use of an electric heating pad was made in a western kennel. A litter of puppies came into the world while the thermometer hung around the freezing point. To make the newcomers comfortable they were placed in a clothes basket along with a heating pad set to operate at the first degree of heat, and they snuggled down to the source of warmth with a frank display of puppy satisfaction.

PUPPY SATISFACTION

When a University Holds Open House

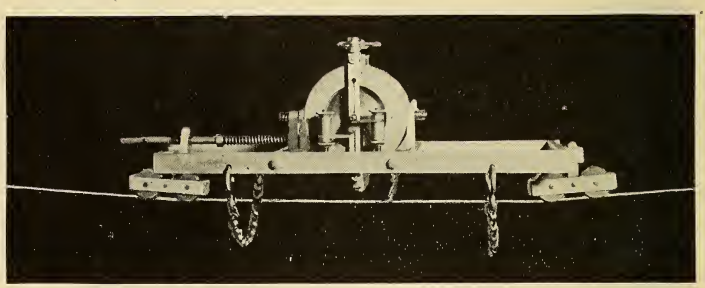
BY D. L. GEYER

If we should happen to be in Champaign, Ill., some evening in January, we might be startled to see high above the tops of all the buildings, an enormous kite and sign, sharply outlined by the rays of a distant searchlight. In large letters the sign reads "Attend the Student Electrical Show Tonight."

Should we follow the crowd out through the streets of the college town toward that searchlight we would come at length to the dimly looming buildings of the University of Illinois, to the closely packed group forming the College of Engineering, and finally to the large structure devoted especially to the study of electricity. And here we would find ourselves at an electrical exposition given by the student body of a university—an exposition whose evening throngs of "town and gown" are increased to the very limit of the building's capacity by trainloads from the neighboring cities on either side. At the exposition this year, in the early part of February, many of the features of last year's exposition, here described, will be embodied, and likewise many new ones.

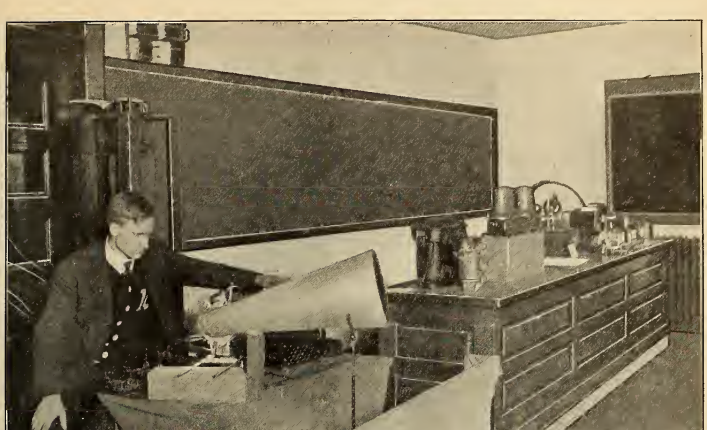
Every other year, we learn, the seniors of the Electrical Engineering Society plan a set of "stunts" or demonstrations that shall illustrate some of the more practical and simple applications of the theories they are learning, and then, without any assistance from the faculty whatever, manage it for better or worse in their own way.

When our eyes have become accustomed to the brilliant and many colored lights shooting across the large laboratory, we see a series of picturesque booths set about in pleasant irregularity, each containing an operator who is busy in explaining some piece of apparatus to the crowd which continually pushes in about him. Here at the left is what looks like a moving picture show. Yes, a film is running off and is illustrating each step gone through with in the ordinary production of electricity. Every detail of the process is shown, from the coal bunkers to the Mazda lamp, and an accompanying explanation by phonograph makes all of them clear even to a layman.



A GYROSCOPE CAR; IT CANNOT BE DISLODGED EVEN BY SWINGING THE CABLE

Now here a little farther on is a "stunt" that reminds one of sleight-of-hand. The magician is lighting lamps merely by touching them with the tips of his fingers. The booth is marked "High Frequency Exhibit," and an assistant is explaining that a strong current



A VOICE IN A DISTANT ROOM, SPEAKING OR SINGING INTO AN ARC LAMP CIRCUIT, IS REPRODUCED AT THE FUNNEL—AN EXPERIMENT UNUSUALLY FASCINATING

is being passed through the seeming magician's body, but because it is alternating at a frequency of hundreds of thousands cycles per second it is harmless to him. Harmless it plainly must be, yet it is powerful enough to cause the lamp he touches to glow finely.

But what is this crowd in the center? With a good deal of merriment they are watching the operation of a model nursery. This illustrates, perhaps, a typical night's events. At first all in the booth is dark, an electric alarm goes off, an electric lamp lights up, and an electric fire starts burning and heats a bottle of milk. An electric motor rocks the baby's cradle, "jumps" the baby-jumper, and even operates an automatic slipper-spanker.

We stroll on past those booths which seem to contain demonstrations of an especially technical nature. Of these there are several, and around them are numerous faculty people and upper-class students absorbed in discussion of some of the fundamental principles here involved. But it is those exhibits of a less intricate kind which seem to draw the attention of all except these few specialists.

Here is a sign "Apples, Take One." But obviously this was devised by some undignified freshman and not by the aforesaid absorbed graduates. For as we reach in to "take one" from the tub of water in which they are floating—what a jerk and a tingling shoots up one's arm. We release that apple with a quick impulsive gesture of disdain.

This very large booth over here in the corner is the model kitchen. Shining with polished nickelware and burnished copper, it seems to hold every conceivable cooking device from chafing dishes to coffee grinders, and from corn poppers to complete kitchen cabinets. And the utensils are not here merely to be looked at, but are showing what they can actually do, with ten very pretty co-eds to hand out the delicacies.

Heated Glove for Auto Drivers

The matter of keeping the motorist's hands warm while driving the car in winter has given rise to more than one patent, some of these applying to methods of heating the steering wheel itself. However, the most practicable method, in the light of experience, seems to consist in heating the glove itself by means of resistance wires imbedded in the material of the inner glove, after the manner of the ordinary electric heating pad. The illustration shows such a glove and its application.

The current is drawn from the storage battery with which most cars are provided, either for ignition or lighting purposes, or, in an electric car, from the regular battery. The amount required is about equal to that taken by a six candlepower side or tail lamp. Flexible conducting wires are brought up from the two terminals of the battery and connected, one to each of two metal plates placed at the proper points on the rim of the steering wheel. The resistance wires in the glove terminate in the metal buttons shown on the glove, one on the thumb and two on the palm at the base of one of the fingers. As the driver grasps the wheel, these glove terminals come at the right position to connect with the two terminal plates on the wheel and the circuit through the glove is connected in this way.

It is pointed out that the wire used in these gloves is not only very pliable, but is placed in the gloves in such a way as to avoid all short bends, making them very durable, and also surprisingly flexible. It is claimed that in case it does break, the inner glove can be easily replaced in a few seconds at a low cost.

Electrically Heated Baptismal Fount

There is a church in Northern Michigan where there has been difficulty in maintaining a sufficiently high temperature of the water in the fount in which those that profess the faith are baptized, so that the ceremony could be conducted with comfort to the convert.

ELECTRICALLY HEATED AUTO GLOVE

The problem was effectively solved, however, by installing an immersion electric heater in the basin.

A heater of the copper clad immersion type was selected. With a heater of this type, the resistor, which by being heated by the passage of the electric current imparts heat to the water, is entirely enclosed and hermetically sealed in a copper jacket so that it can be thrust into the liquid. Obviously, all of the heat generated in the heater must pass into the water; hence the arrangement is very efficient. There can be no waste of energy, as all energy entering the heater as electricity passes into the water in the form of heat.

A short time prior to the time that the

baptismal fount is to be used, the sexton closes the switch that connects the immersion heater to the electric lighting mains. The water is comfortably warm when the service commences.—CHARLES D. CARREY.

Cut Glass Electrolier and Vase

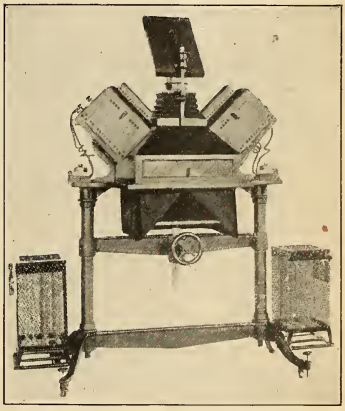
Cut glass in the presence of electric light always produces a brilliant, not to say, dazzling effect. A combination electrolier and vase in which this effect is prominent is presented in the accompanying illustration. The base and arms are of white metal silver plated. The vase at the center is detachable for cleaning and refilling. The electrolier is 21 inches high and is equipped with pull sockets, cord and plug.

COMBINATION ELECTROLIER AND VASE

There is one telephone for every fourth person in Stockholm, Sweden, including children and servants, the highest number per capita in the world.

Projecting Images of Opaque Objects

While opaque projection is not new its successful application to the projection of large objects has only recently been made possible by the modern development of electrical apparatus. The Balopticon, as it is called, will not only project upon the screen clear images of small machines and other solid objects but also full page illustrations from large magazines, or photographs and engravings of any size up to 20 inches square. In educational work, too, lie some of its greatest possibilities for service as it is especially suitable for projecting large embroyos and anatomical specimens. All subjects are clearly shown in their natural form and coloring in greatly enlarged images, conveying a certain sense of the true relation of the parts projected.



LANTERN FOR PROJECTING OPAQUE OBJECTS

In order to reach the attainment of such a wide scope of service this apparatus was constructed with an opening for objects measuring 20 inches square. To cover this wide area with sufficient illumination to the very edges was the first problem to be solved. This was successfully accomplished by mounting two large

90° arc lamps in light tight houses at a suitable angle to the object table to cover the exposed area with the cones of light, and without the use of condensers.

After obtaining the maximum amount of illumination for the area to be covered, the next problem to meet was to utilize this light for obtaining the most efficient image possible. To this end a high grade photographic anastigmatic lens was employed—of 19¾ inch focus and 47/16 inch diameter. This is a lens of unusual covering power for its speed and proves no less effective in projection than in photography.

There is a mirror required above the projection lens to direct the image toward the screen, since the objects are held in a horizontal position because of their size and weight. This also serves an important purpose as a reversing mirror, so that objects, illustrations and printed matter are shown on the screen in their true position.

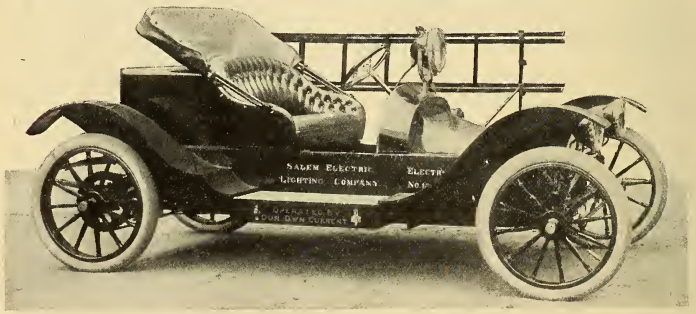
Electric Car for Maintenance and Lamp Trimming

The central station company which advertises electricity for power and lighting purposes and which uses other than electrically propelled vehicles for lamp delivery, repair and maintenance purposes, loses an opportunity for profitable advertising, for above all, it would appear to the consumer that the company itself should use its own product. In the illustration is shown a Bailey electric runabout equipped for arc light trimming and repairs. Space for globes, electrodes and other parts is obtained by using the running board boxes and the large box behind. It is capable of running 100 miles, at an average of 20 miles per hour, on one charge of the new Edison storage battery at a cost of 1.4 cents per mile with current at five cents per kilowatt-hour. The motor and control apparatus is placed under the hood which is so designed that it offers the least possible resistance to the wind.

Electric Railway Without a Trolley

There operates out of Minneapolis, Minn., one of the most novel and interesting railroad systems in the world. This system is owned by the Minneapolis, St. Paul, Rochester and Dubuque Electric Traction Company. At present, the road operates between the southern limits of the city of Minneapolis and Northfield, Minn., a distance of 38 miles, but by next summer it expects to operate 40 miles additional.

The novelty of its construction and operation lies mainly in the fact that it is operated by gas-electric motor cars for power. No trolley wire or third rail is used. Power is developed first by a gas engine on each motor car. This power



AN ELECTRIC LIGHT COMPANY'S MAINTENANCE CAR

GAS-ELECTRIC CAR RUNNING OUT OF MINNEAPOLIS

is used to drive a dynamo, which in turn furnishes electric current to operate the car motors. Each motor car therefore carries its own independent power plant and electric system.

During the coldest months of the winter of 1911 and 1912, when all steam and electric cars in the state of Minnesota were forced to operate far behind regular train schedule time, this line ran smoothly and promptly, a train schedule never being missed. This remarkable record was due in the main to the fact that during the heavy snow storms and extremely cold weather, no roaring fires had to be kept up, as in steam locomotive operation. There were no steam pipes to freeze up or burst, no water tanks to freeze, no trouble at coaling stations, no heavy counterbalances on the wheels to break rails in cold weather and cause delay and accidents, no fires to be cleaned or flues to blow out. Neither were there any overhead trolley wires to sleet over and break nor power house to break down.

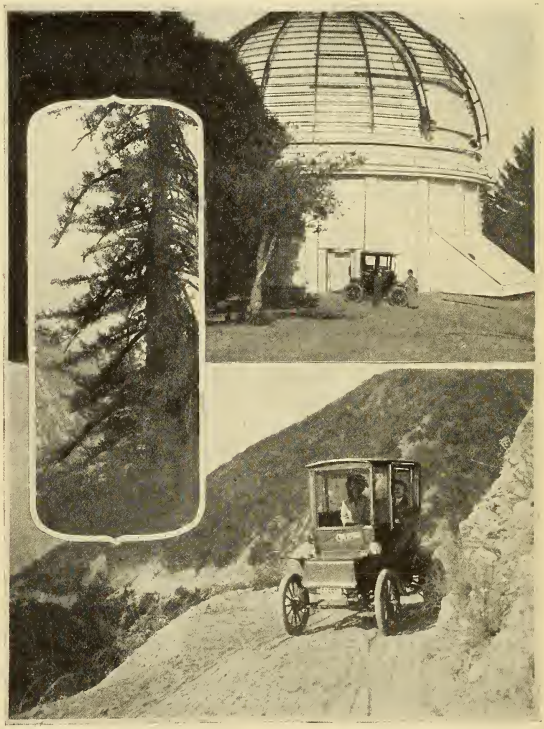
The method of control and power application is essentially the same as that of an ordinary electric car but has an additional advantage in that the dynamo voltage is varied by the controller to produce speed changes of the motors, thus providing a smooth and rapid acceleration without loss of power. The engine is entirely enclosed, eliminating all wear from dust and dirt. On down grades it is possible to lower the speed of the engine and still maintain the desired car speed, thus reducing the wear on the engine bearings. The radiators, located as they are on the roof, are protected from damage by flying stones, etc. The entire power plant in the gas-electric motor car is within easy reach of the operator.

Loud Speaking Telephone at Ball Games

Loud speaking telephones are promised as first aids to the baseball fan next year. These telephones will be placed in various parts of the grandstand, the transmitting system being in the press box. The telephones will announce each batter as he steps to the plate. They will also serve to call doctors and other spectators to the public telephone to receive messages. This baseball adjunct will be of real benefit, if it is not abused. It could easily be abused by a continual dinning into the ears of the fans of calls for promoters, politicians, and other modest self-advertisers.—*Electrical Record.*

Mountaineering in an Electric

A short time ago the toll road up Mount Wilson above Pasadena, Calif., was improved so as to be available for motor cars, but as the grades are nowhere less than ten per cent and range as high as eighteen per cent, the trip has been attempted by none but experienced drivers of gasoline cars. There are nine and a half miles of this road, a steady uphill pull, with exceedingly sharp curves,



THE OBSERVATORY ON THE SUMMIT OF MT. WHITNEY AND THE LITTLE ELECTRIC THAT CLIMBED UP TO IT

a straight drop on the down side and a corresponding cliff on the upper side. It is certainly the last road on earth that one would consider suitable for an electric coupé.

Yet such a car made the run to the summit of Mount Whitney in October of this year. It is the property of Mrs. Volney Beardsley, a Los Angeles woman, who has previously used it for her shopping or social calls—a little Columbus electric coupé.

From the garage in Los Angeles to the foot of the grade is a distance of 22 miles and this part of the trip was made over the smooth boulevards in an hour and a half. The start was made from the toll house at the foot of the mountain at ten minutes past ten, and with two passengers the car began the ascent, very soon encountering grades that ranged from fourteen to eighteen per cent.

After a run of 2½ miles over a road of this character the car was stopped for the purpose of taking pictures, and it was found that they had been 26 minutes on the way. The batteries and motors were tested for heating and were found to be only slightly warm.

From Schneider's Camp the grades became steadily worse and the curves were difficult; wheel tracks showing that cars of longer wheel base had been forced to back and start afresh to negotiate the abrupt turns.

At nine miles from the toll house the car was taking 75 amperes at 56 volts, and the driver was beginning to feel a trifle worried as to whether they would pull through. He cheered himself with the reflection that there was only half a mile more to make, gritted his teeth and went to it, and at half past twelve drove up in front of the Mount Wilson Inn on the summit. Here again the motor and batteries were tested for heating and found to be perfectly satisfactory, having a temperature of not more than 95 degrees.

Dinner was enjoyed at the Inn and then came a little run around the plateau on the mountain top, a beautiful park-like area, overgrown with tall pines. Here are built the little bungalows that serve as sleeping rooms for the guests of the hotel and the astronomers of the Solar Observatory. The car was drawn up before the solar tower and the big white dome of the observatory to be photographed.

The view from this summit, which has an altitude of 5895 feet, is magnificent. In fact, it is one of the finest mountain trips in the world, more than 30 towns being visible from the Inn.

The return trip began at three o'clock and if the climb was an extreme test for motor and batteries, the descent was no less severe on the brakes. However, they held back the 2800 pound car without heating and the nine and a half miles of the down hill slide was accomplished with no great difficulty. After this, the little electric sped back to Los Angeles, an additional 22 miles, on its own power, completing one of the most remarkable trips ever undertaken by an electric car.

Electrolytic Copper Refining in Norway

For several months a company at Aamdal, Norway, has been successfully extracting copper from the crude ore by an electrolytic process invented by Victor Hybinethe, a Norwegian engineer who has patented the process in Europe and the United States. The Aamdal works have proved so successful that plans are now under way for increasing the output to three tons of metallic copper per day.

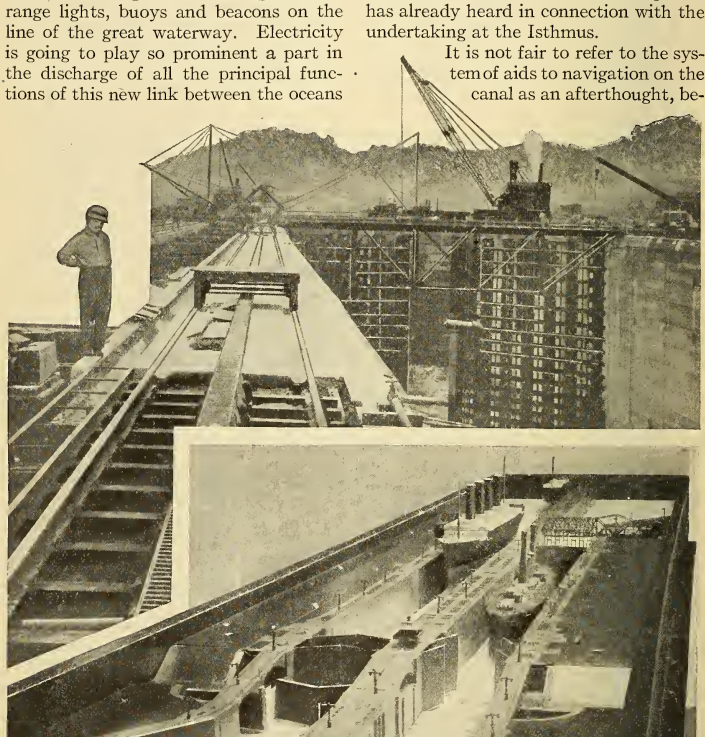
The treatment, which is done at the mine and thus results in enormous shipping economies, consists in leaching the crushed ore with a solution of sulphuric acid which dissolves out the copper. A strong current of electricity is then passed through this solution and the pure copper is precipitated. The new process will mean a great deal to the copper industry of Norway.

Aids to Navigation on the Panama Canal

BY WALDON FAWCETT

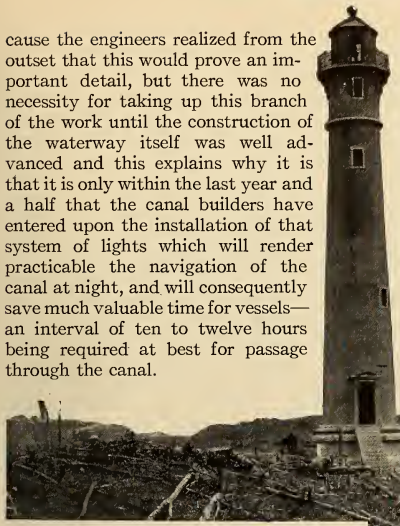
One of the newest utilizations of electricity in connection with the Panama Canal project is as the illuminant for the aids to navigation—the lighthouses, range lights, buoys and beacons on the line of the great waterway. Electricity is going to play so prominent a part in the discharge of all the principal functions of this new link between the oceans that the big ditch might almost be denominated the "electric canal," and now one more sphere of electrical influence has been added to those of which the public has already heard in connection with the undertaking at the Isthmus.

It is not fair to refer to the system of aids to navigation on the canal as an afterthought, be-



THE UPPER VIEW SHOWS PEDRO MIGUEL LOCK AND THE RACK TRACK WHICH WILL CARRY THE ELECTRIC TOWING LOCOMOTIVES. BELOW IS THE MODEL LOCK WHICH WILL OPERATE IN UNISON WITH THE REAL LOCK, FOR THE GUIDANCE OF THE MAN WHO CONTROLS THE LOCK GATES

cause the engineers realized from the outset that this would prove an important detail, but there was no necessity for taking up this branch of the work until the construction of the waterway itself was well advanced and this explains why it is that it is only within the last year and a half that the canal builders have entered upon the installation of that system of lights which will render practicable the navigation of the canal at night, and will consequently save much valuable time for vessels—an interval of ten to twelve hours being required at best for passage through the canal.

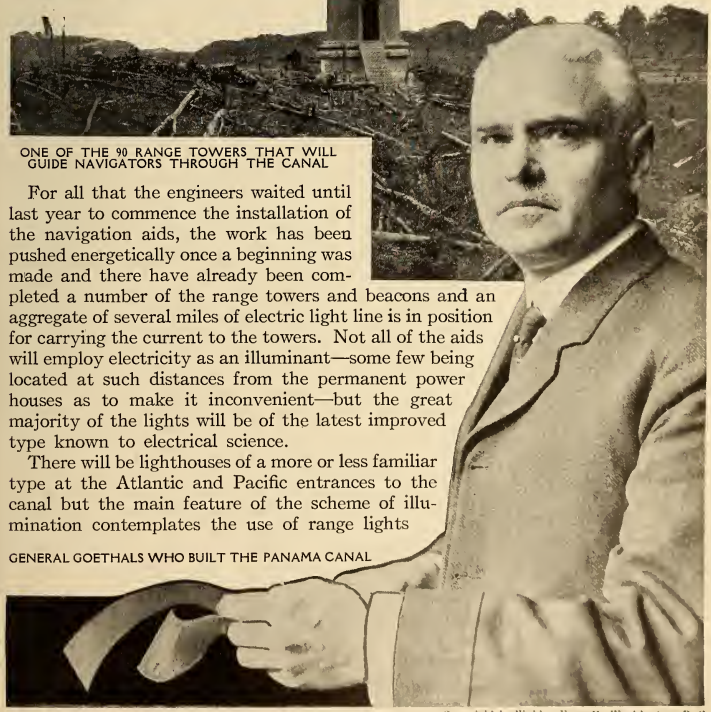


ONE OF THE 90 RANGE TOWERS THAT WILL GUIDE NAVIGATORS THROUGH THE CANAL

For all that the engineers waited until last year to commence the installation of the navigation aids, the work has been pushed energetically once a beginning was made and there have already been completed a number of the range towers and beacons and an aggregate of several miles of electric light line is in position for carrying the current to the towers. Not all of the aids will employ electricity as an illuminant—some few being located at such distances from the permanent power houses as to make it inconvenient—but the great majority of the lights will be of the latest improved type known to electrical science.

There will be lighthouses of a more or less familiar type at the Atlantic and Pacific entrances to the canal but the main feature of the scheme of illumination contemplates the use of range lights and of side lights, spaced about one mile apart, to mark each side of the channel. The range lights, will, however, be omitted in the Culebra Cut, where the use of such aids is hardly practicable.

All the lighted beacons are of reinforced concrete and the undertaking at Panama will therefore constitute the most severe test yet made of the serviceability of concrete for lighthouse construction as well as of the value of electricity as an illuminant. There will be, all told, about 90 tower beacons ranging in height from 29 to 74 feet. The more elaborate structures are being pro-



GENERAL GOETHALS WHO BUILT THE PANAMA CANAL

Copyright by Waldon Fawcett, Washington, D. C.

vided at the Gatun locks and dam and in the Atlantic and Pacific divisions of the canal, where these beacons will be located close to the sailing lines of the vessels passing through the canal. Simpler structures will be placed in Gatun Lake where the beacons will be under less close observation.

The electric lights in the towers will be of from 2,500 to 15,000 candle power according to the length of the "range." The most powerful lights will be in the sea channel and will be visible from twelve to eighteen miles. In addition to the powerful range lights there will be a number of beacons of 900 candle power each. It will be necessary, of course, that the various range lights, all of which will be plain white lights, shall be invested with distinctive characteristics in each instance in order to enable identification by the mariners on passing vessels. This will be accomplished by a system of flashes, different in the case of each tower.

As the canal locks at Panama approach completion, visitors to the Isthmus are more and more deeply impressed with the fact that the crowning marvel of the canal is to be found in the electrically operated gates of the various locks. The lock gates are steel structures seven feet thick, 65 feet long and from 47 to 82 feet high. They weigh from 300 to 600 tons each and the 92 leaves required for the entire canal will have a combined weight of more than 57,000 tons. Electricity, generated by water turbines from the head created by Gatun Lake will operate the gates and also the valves controlling the culverts, by means of which the lock chambers are filled and emptied.

The gates may be compared to huge doors swinging on hinges and meeting at an angle in the center of the lock chamber. They will be moved from the closed position to the opened position, back into recesses in the side walls, by means of powerful electric motors. The motors for each system of locks will be controlled by one man from a single switch house. Here the operator will sit with a miniature of the lock and gates before him, this miniature operating in exact synchronism with the real system quite a distance away, and by the movement of a few simple switches he will control the movements of the great leaf gates and other apparatus at the lock.

Paralleling in interest the use of the magic current for operating the lock gates will be the employment of electric locomotives for towing ships into and out of the locks. No vessel will be permitted to enter or leave any lock chamber under her own power, and, as a rule, at least four of the big electric locomotives will be assigned to each vessel. Two locomotives, one running on each lock wall ahead of the vessel, will pull the craft while two other locomotives in similar positions opposite one another on the walls but in the rear of the ship will aid in keeping the craft centered in the lock and will also serve as a brake to bring the boat to rest when she is entirely within the lock chamber. The electric locomotives will run on cog rails on the tops of the lock walls and not only will there be two towing tracks for each flight of locks—one on the side and one on the middle wall—but there will be one return track on each side wall and a third return track, common to both of the twin locks by reason of its location on the middle wall. All of these electric tracks will run continuously the entire length of the respective flights of locks and will extend some distance on the guide approach walls so that the electric locomotives will have ample latitude of action in manipulating their unwieldy tows.

When the Pearl Street Station was started in New York in 1882 it cost the public 1.1 cents to burn a sixteen candle power carbon incandescent lamp for one hour. It now costs a maximum of only two-tenths of a cent or less than one-fifth of the original cost, to obtain a equivalent illumination of even better quality, or if the current be purchased in large quantities, one-twentieth of the original price.

Manila's New Hotel

In the new Manila Hotel, a magnificent concrete structure seven stories high the first passenger elevator in that part of the world has been installed, and it

NEW MANILA HOTEL CONTAINING THE FIRST ELECTRIC PASSENGER ELEVATOR IN THE PHILIPPINE

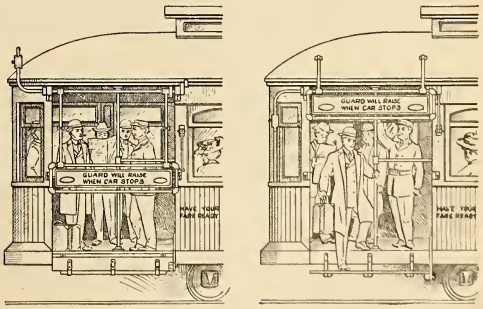
is operated by electricity. In fact, "juice" plays a decidedly prominent part in the equipment of the new hostelry. The several hundred rooms in the building, nearly all of which have private baths, are lighted by electricity, and all the grills kitchens, the laundry, and bar rooms have the latest electrical appliances. In the towers on the spacious roof gardens are located what are locally known as the aeroplane cafes, and these are lighted by electricity.

A beautiful system of sunken gardens will surround the building, and when open air fêtes are on, as is often the case in the tropics, arc lamps will be brought into use. The rooms also have inter-communicating telephones and a thoroughly reliable call-bell service. No better electrical equipment can be found anywhere, which speaks well for the electrical progress in our far-off island possessions.

Street Car Safety Device

Broken arms, broken legs, bruises and sometimes more serious injuries happen to street car passengers who alight or board the car before it stops, and there are always some on every trip who are willing to take a chance.

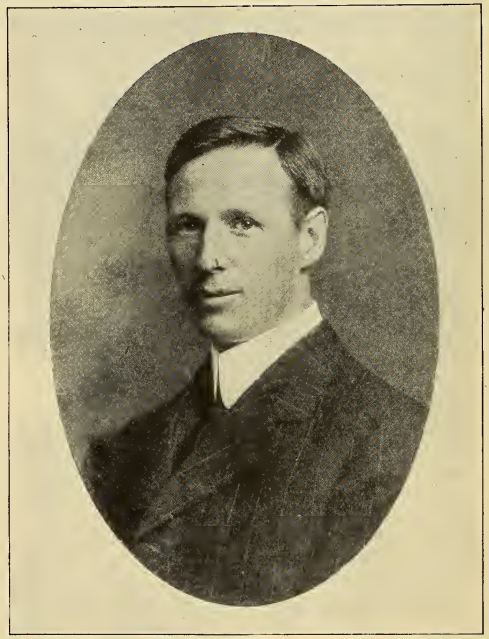
While doors operated by the conductor when the car stops are in service in some cities, the safety guard with folding step is a new device to accomplish the same purpose. The guard, supported by hinged metal work, extends across the entrance when the car is in motion and is raised by the conductor when the car stops. It may be made to work in connection with an adjustable step.



A DOOR GUARD FOR STREET CARS

Electrical Men of the Times

ROBERT F. PACK



Biographies of prominent men make little if any mention of the silent partner —the woman—who in no small measure molds for success or failure the future of her mate. But the story of Robert F. Pack, the new general manager of the Minneapolis General Electric Company, Minneapolis, Minn., would be very incomplete without mention of his accomplished helpmate and three beautiful children, a boy aged seven, and two girls of five and three. A noted sociologist gives as one of the rules for a successful career, "There should always be a center upon which, outside of working hours, an individual's interest is concentrated," and to Mr. Pack this center is his family.

Mr. Pack was born in England 38 years ago and was educated for the British Navy. Abandoning the idea, however, and believing opportunities for a young man to be better in America than in England he came to Canada in 1889 and two years later accepted the position of office boy with the Toronto Electric Light Company. It soon became evident,

however, that there was much more than office boy material in the lad and he was promoted, becoming in turn chief accountant, comptroller, secretary, and then general manager.

As manager Mr. Pack was held in high esteem by those under his supervision and this feeling of the employees was obtained by contact, for he made it a point to get acquainted with every man as far as possible. The one thing, however, more than another for which he is remembered in Toronto is for both preaching and practicing that there should be a progressive management of public utility companies—that is, a "square deal" for the people and a fair return on capital invested, with generous treatment of employees. Mr. Pack firmly believes that this policy will solve most of the troubles of public service corporations. When he became general manager, the newspapers of the city, owing to the operation of a municipal plant, were decidedly antagonistic. Within a short time, however, this attitude was entirely changed and when leaving for his present position he could count everybody as a friend from the mayor down.

Mr. Pack's policies received a most favorable approval from Adam Beck, Minister of Power and Chairman of the Ontario Hydro-electric Commission. Mr. Beck asserted that instead of being allowed to leave Canada Mr. Pack should have been chosen to manage this great hydro-electric project.

During his management of the Toronto company the employees were organized into a strong company section of the National Electric Light Association, thus starting the movement in Canada. He also brought about the affiliation of the Canadian Electrical Association with the National Electric Light Association. Upon the occasion of his leaving Toronto to accept his present position he was presented with a handsome silver loving cup by the heads of departments of the Toronto Electric Light Company.

Mr. Pack served as President of the Canadian Electrical Association and is ex-officio member of the executive committee of the National Electric Light Association. He is an Associate Member of the American Institute of Electrical Engineers, also a member of the Engineers' Club, the Albany Club, the Arts and Letters Club, and the Royal Canadian Club, all of Toronto.

Long Run of an Electric Car

It is sometimes stated that electric cars are only adapted for short runs, and are not practical for bad roads. Although electrics are most frequently used for city and suburban service, yet the run recently made by a Borland-Grannis electric from Chicago to Milwaukee on a single charge of its Hycap-Exide battery proves that the electric car will give long mileage and can be satisfactorily operated under adverse weather and road conditions.

The car covered the 104 miles from Chicago to Milwaukee, and for 54 miles of this distance the route was over muddy country roads.

Measuring Wind Velocity

Recently an electrical method for the determination of wind velocity has been proposed. Copper wire changes its electrical resistance as the temperature is varied. This is true of many metals. Alloys of metals have been produced which do not change perceptibly in their resistivity when their temperature is varied. Notable among these alloys is manganin. If two wires consisting of these materials, copper and manganin, are placed in the open air and at the same time are connected as two arms in the well known Wheatstone bridge, their relative change in resistance can be measured. Due to the cooling effect of the wind the bridge is "unbalanced" and this amount of unbalance can be determined once for all in terms of wind velocity. The cooling effect of the wind increases with its velocity.

A Plant in the Bush Land

One of the subscribers to this magazine, Mr. H. O. Johnson, an old time sailor but now a farmer in New Zealand, is located on 500 acres of bush land, rich in possibilities but most tenacious and tough when it comes to the matter of

A FARM ELECTRIC PLANT IN NEW ZEALAND

clearing away the great stumps and logs which are left from the primeval forests. He has this to say concerning the use of electricity there:

"I must confess that I am a novice at electricity and take the magazine to enlighten myself, being too old to go through all the theory attached to it. But I see immense possibilities here as this is a mountainous country and great quantities of water power going to waste. This country is ruled by theoretical Solomons, which generally means practical dunces. The country is almost asleep as far as electricity is concerned."

He is of the opinion that electric current ultimately is going to aid the farmers there to a great extent, for most of them have water power on their property, and he is planning now to put such a plant into operation on his farm. Some of the farmers have already made a start in this direction as will be noted from the picture which he sends us.

This little power plant is on a New Zealand back country farm and is used to supply light, heat and power, and the expense of running it is practically nothing. The water from a little stream up the valley is brought in a flume along the hillside, then dropped through a pipe to the paddle wheel shown in front of the building. This wheel is geared to a pulley which drives the electric generator.

The White Way and the Chickens

We are now advised of the riotous living of chickens in Oklahoma, made possible through the medium of a brilliantly lighted thoroughfare. It seems that every night the fowls in a particular location in Oklahoma City leave their premises and congregate under one of the big electric lights. Also drawn to the vicinity of the electric lamp are innumerable grasshoppers, the chickens feasting with glee upon the toothsome bugs.

The attraction proves so alluring to the chickens that their owner experiences considerable difficulty in driving them back to roost. It is stated that sometimes the chickens remain up all night, going back to roost about daylight, the effect being that they are drowsy the following day and the hens do not lay.

The owner of the chickens blames a dissipated old rooster for the demoralization of his flock. He says the rooster was out late one night and discovered the grasshoppers. He gallantly called the hens and they left the roost to answer. Since then the hens have waited each night for the light to be turned on and the feast it brings to them.—*Good Lighting.*

FARM LIGHTS AND FARM MOTORS

AN IDEAL FARM HOME AT NIGHT

Three sources of supply make it possible for the farmer to obtain electric current. In many instances transmission lines from the city plant run along the highways and can be tapped. Again there is in the vicinity a stream which can be dammed at little expense, and, with the present development of the water wheel, be made to operate a dynamo of sufficient capacity to supply two or three farms.

But should neither of these means be available, the gas engine is, and it can be direct connected to the dynamo. With this equipment and a set of storage batteries no farm, however distant from the city, need be without electric light, heat and power. The gas engine plant is comparatively inexpensive to install, and can be operated at extremely low cost both in the matter of fuel and in attention required. For example, a Gray equipment here illustrated will run for ten or twelve hours generating electricity at an extremely low cost for fuel, which may be either gasoline, alcohol, distillate or kerosene (coal oil).

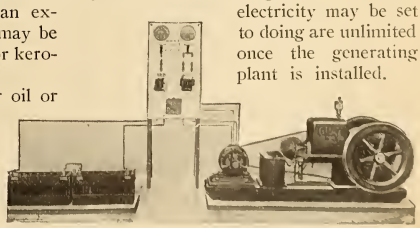
A twelve or fifteen horsepower oil or gasoline engine operating at full load will require about one pint of oil (kerosene) per horsepower per hour. A six horsepower engine will run at full load on one quart of oil per horsepower per hour.

The first appreciation of such a simply operated plant is found in the use of lights, at the turn of a switch, in the cellar, closets, barn and other formerly dark places. Its next advantage will be felt in the laundry, where it does the washing and where it makes possible the use of the electric pressing iron.

In the repair shop—and nearly every farm has one—an electric motor can be used to turn the grindstone, operate a lathe, run a saw, etc.

The creamery is another place where electric power can do its full share, for the cream separator, the churn, the pump and the butter worker can all be operated by electric drive.

About the barn and granaries electricity may be made to unload the grain and deposit it in bins, handle hay, cut fodder, shell corn, fill the silo, milk the cows, and so on. In fact the things on the farm that electricity may be set to doing are unlimited once the generating plant is installed.



TYPICAL FARM ELECTRIC PLANT

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

The Blue Bird

The quest of the blue bird, a being perfect, elusive and infinitely to be desired is the subject of many old French fairy tales. In the play by this name the blue bird represents happiness. Maeterlinck wrote it as a Christmas pantomime, but it is full of symbolism. On the surface it is simple, a fairy play for young people. Grown-ups somewhat familiar with the mysticism of Maeterlinck might well exclaim: "How deep!" It typifies the experiences of the subconscious mind.

LIGHT, TIME AND NIGHT

Tyltyl and Mytyl are put to bed by mummy Tyl in the wood cutter's cottage. With the entrance of the fairy Berylune, the most wonderful things happen. Flame dashes out of the fireplace, water comes from the old fashioned hydrant in the form of a beautiful maiden, bread, milk and sugar come forth in amazing guise. The dog and the cat and all the common things with which the children are most familiar acquire a soul and become animated. The two children with their odd companions set out at the fairy's command to seek the blue bird. To young people the fairy is simply a fairy; to grown-ups Berylune may typify society; and society's child is sick—for what? Happiness, for something it has not and knows not how to obtain. Society in the world in the quest of new ideals of life and happiness sets in motion a dynamic force. Possibly grown-ups read something of the philosophy of the subconscious between the lines of a play that is so simple on the surface.

Tyltyl and Mytyl first visit the fairy Berylune's palace, then they go to the Land of Memory where they visit gaffer and granny Tyl and their little brothers and sisters who were once alive. They all have supper together. Gaffer Tyl sits at the head of the table with all the Tyl children about the table, while granny brings from the cottage a large lamp, which she places in the center of the table, and immediately the lamp lights up. After Tyltyl and Mytyl depart, gaffer, granny and the other Tyl children bend lower and lower until they relapse once more into the silence of death. The stage gradually darkens until nothing can be

seen except the light of the lamp in the center of the table, and then suddenly that goes out of itself, at least, apparently.

Throughout the play electricity is an important factor. Thirty-nine arc lamps and fourteen stereopticon machines are used for the many illusions and all of these are carried by the company; also they carry their own switchboard, with a much larger switch than that found in any theater they play. An electric signal box is used to signal cues to front light man (up in the gallery) and to the various parts of the stage and theater from which the lighting effects are worked. A special man is carried for the express purpose of operating the signal box. The electrical apparatus for staging the Blue Bird is very complicated, having been arranged and built for the great revolving stage of the New Theatre in New York, on which two scenes could be set up and prepared while another was being played. Thus no time was lost in changes. A local staff of electricians is engaged in addition to the regular staff when the play is presented in other cities which have not the same facilities as the famous metropolitan theater.

WATER AND FIRE NEUTRALIZE EACH OTHER

Edison's Twentieth Century House

by W. H. Meadowcroft

To those who are acquainted with Edison's way of doing things, it will be quite natural to assume that any country residence to which the above title could be applied would represent the latest in modern progress so far as comforts, conveniences and the absence of domestic drudgery are concerned.

The world undoubtedly regards the incandescent light and its system of operation as the great central invention in all of Edison's numerous and wonderful achievements. His original ideas, when he was working them out more than a generation ago, were centered on producing a system that should be capable of *universal* application; and although his immediate energies were then bent on central station lighting in large cities, he has always felt that our country cousins would in time come into their own in the enjoyment of comforts and conveniences similar to those which are available to the dwellers in large cities.

With the development of the storage battery and small gasoline engine in later years, this condition has been realized and it is now possible to introduce electric current into isolated country houses, no matter how remote they may be from a central station source of supply.

As this involves the operation of a gasoline engine, dynamo and storage batteries, it naturally follows that such an equipment must be greatly simplified, as the average householder cannot be presumed to possess technical or engineering ability. With the completion of his nickel-iron storage battery and its successful use in the hands of non-technical persons, Edison concluded that his plans for the universal use of electric current for light, heat and power could now be carried to fulfillment.

He had made his battery practically "fool proof." All it needed was to be charged and discharged and given a little clean water occasionally. The only other

necessities were a reliable gas engine, dynamo and an automatic regulator of the voltage. Such a combination could then be put into the hands of any householder whose only instructions would be to start the engine every second or third day, let it run a certain number of hours and then stop it. By so doing, the storage batteries would be charged and electric current would be available in the house or grounds wherever and whenever desired.

Such was the ideal combination planned by Edison. He therefore instructed his engineers to work it out accordingly and to hire a house in the vicinity, furnish it and install a complete plant to demonstrate the practicability of his ideas. "And make it a Twentieth Century house," said he, "with a plant that can be operated by a boy."

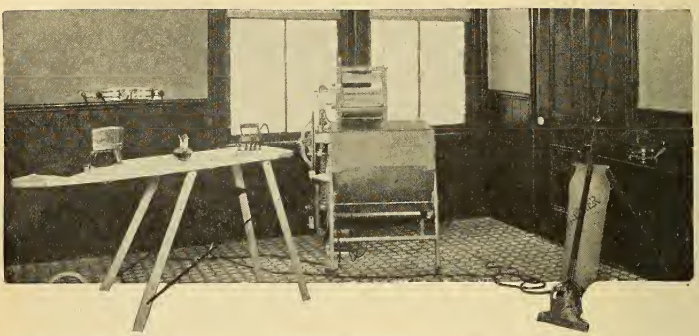
The troubles of his engineers then began. The storage battery was all right and there was an abundance of simple and efficient dynamos to be had, but the first difficulty encountered was to get a good gasoline engine. One after another was installed, tested and found to be lacking in some essential particular. Either they would not regulate closely or did not develop the rated horsepower. After a vast amount of testing and experiment, however, the right engines were at last secured.

The next difficulty arose over the matter of automatic voltage regulation. Edison's instructions were to preserve the highest efficiency and to this end he directed the use of tungsten lamps. While these are very efficient, it is well known that they will not stand much increase of voltage over their rating. Consequently, it was necessary to have a regulator which would automatically keep the voltage of the line constant, no matter if the battery was being charged or discharged at full or partial load. No such regulator was to be had in the market, and the matter was referred to Edison.

DINING ROOM AND COZY CORNER, SHOWING ALSO THE NEW EDISON DISK PHONOGRAPH

Just at this time he was about to attend the Byllesby banquet at Chicago, and said he would figure on it while he was away. He was as good as his word, and on returning presented quite a number of sketches showing many different plans for such a device. From these a thoroughly efficient and practical regulator was developed, and it has been put into use and standardized.

The last link in the chain having been forged, the initial demonstrating plant was installed in a typical country residence that had been rented in Honeysuckle Avenue, Llewellyn Park, West Orange, N. J., a short distance from the Edison laboratory. The interior of the house was painted, papered, decorated, handsomely



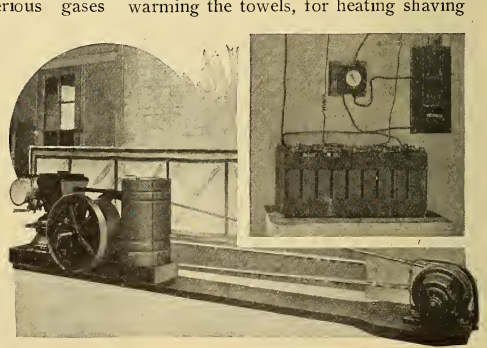
WASHING, IRONING AND VACUUM CLEANING APPARATUS—VERY ESSENTIAL IN THE TWENTIETH CENTURY HOUSE

furnished and wired throughout for electrict lights, and with special service receptacles for fans, motors and other electrical devices.

The generating plant was installed in one of the stable rooms in a building near the house. This plant consists of a four horsepower gasoline engine and a 1¾ kw. dynamo, and near the latter is located a small switchboard upon which is mounted only a main switch, an underload cutout and an ammeter. No voltmeter is necessary. It was deemed desirable to place the battery in the house, and as the Edison storage battery gives off no noxious fumes or deleterious gases 27 cells of type A4 (150 ampere hours) were installed in the basement, and in close proximity were placed the voltage regulator and an ampere hour meter.

The distribution of lights in the house has been so planned as to produce the most effective illumination possible; 64 20-watt Mazda lamps are employed in the entire installation and these are placed in center drops and brackets, according to the requirements of the various rooms. The bedrooms are equipped not only with the usual side lights but there are also reading lamps for the bedside and, in addition, electric heating pads for warming the bed, together with electric foot warmers. Each room also has its electric fan for use in hot weather and milady's special requirements are provided for in devices for heating curling irons by electricity. The baby has not been forgotten, for there is also an electric device to warm its food and thus save some weary steps for sleepy parents.

The bathrooms are also up to date in their equipment of electric devices for warming the towels, for heating shaving



HEART OF THE SYSTEM—GENERATING PLANT AND STORAGE BATTERY

water and for sterilizing tooth brushes, besides apparatus for obtaining electric massage.

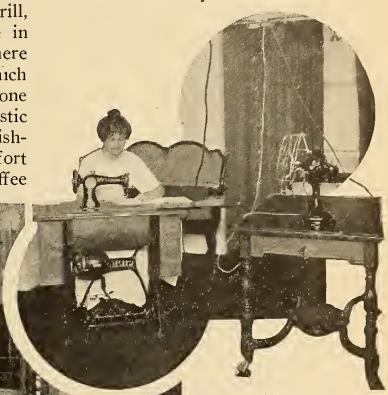
The cooking of meals and serving them piping hot is provided for by the installation in the kitchen of an electric grill, a broiler and a small electric stove in addition to the regular coal range. There is also an electric refrigerator which makes its own ice and a lightener of one of the most dreaded items of domestic drudgery in the shape of an electric dishwasher. Electricity adds to the comfort of the dining room also with its coffee

THE BEDROOM IS PROVIDED WITH A HEATING PAD AND A FOOT STOVE

percolator, toaster, chafing dish and egg boiler, all operated by the same current.

In the laundry, the clothes are washed by an electric washing machine, after which they are wrung out by an electric wringer and ironed with electric irons. Domestic labor is further lightened with an electric vacuum cleaner which can be used in any part of the house. It is almost unnecessary to say that there is a full equipment of electric bells and telephones and the temperature of each room is automatically controlled in cold weather.

If the busy man finds himself unable to finish the day's work at his office, he may dictate letters or instructions to his clerks into the Edison dictating machine which is placed in the library. He can carry the cylinders to his place of business the next day for transcription, and thus start the day's work with a mind



SEWING ROOM CONVENIENCES

clear of unfinished detail.

Entertainment has not been overlooked. In the billiard room there is a home kinetoscope for projecting motion pictures and in the drawing room there is one of the new disk phonographs—both of these described in the November issue of this magazine.

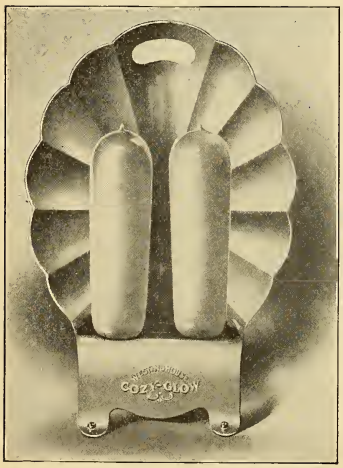
While a few gallons of gasoline transformed into electricity through the medium of engine, dynamo and storage battery is the basis of most of these marvels of Twentieth Century comfort and convenience, it is, after all, the perfect storage battery that really makes them possible and practical because of its simplicity and dependability.

No longer need the suburban dweller envy his city cousin the electrical delights and conveniences of the large city, for they are all at his command. Not only that, but another serious problem is solved, that of keeping the young folks

at home nights. A cheerful, bright home with plenty of amusement of a healthy kind will surely lessen outside allurements to young people. Again, the difficulty of retaining domestic servants is reduced to a minimum by the lessening of domestic drudgery and the increasing of cleanly surroundings with less labor.

The Cozy-Glow

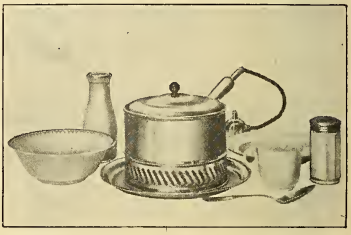
Every one appreciates the grateful heat and cheerful glow of the luminous electric radiator, the modern open fireplace. It is so very useful wherever a small amount of heat is desired quickly. The Cozy-Glow is especially desirable for the sick room, nursery and cozy corners, on account of the glow from the luminous heating units. Its cheerful glow acts like a tonic in the sick room. Children can play around it with absolute safety. It gives off no fumes and requires no chimney. It can be moved about the house as desired or put into the fireplace the same as a gas log.



A NEW DESIGN FOR LUMINOUS RADIATORS

Electric Saute Pan

The electric saute pan is a universal cooking utensil, designed to take the place, in a large measure, of the regular cooking stove in the kitchen. It will boil, fry, bake or roast, and is especially suitable for frying in deep fat. It is a utensil that is much appreciated by the up-to-date housekeeper for use in preparing special dishes without interference with the cook.



ELECTRIC SAUTE PAN

It is made of nickel plated steel and has a cooking compartment formed of heavily tinned copper welded to the frame. The heater is hermetically sealed in the bottom of the cooking compartment. There are three heats controlled by an indicating snap switch.

The Dream of Elias Howe

It is by no means uninteresting to know that Elias Howe, the Perseus of our compulsory needlework dragon, was taught in a dream how to make the sewing machine effective. The needle was where his invention hitched, and every experiment that he could devise had failed. One night he fancied himself in a vision pursued by a crowd of mischievous sprites, all brandishing needles and prodding therewith the poor inventor. Suddenly he observed that these needles all had an eye pierced near the point, and in a moment he understood that this was how to solve the difficulty.

A still further release from the drudgery of sewing, which was not dreamed of by Howe, is obtained through the electric sewing machine motor that makes sewing a real pleasure. By a light pressure on the treadle, the machine is operated at any desired speed. The material needs only to be guided and the sewing is quickly and easily done.

Dressing the Hair

It used to be considered the proper thing to follow fashion blindly, whether the prevailing styles were becoming or not. But nowadays clever women are realizing more and more that it is a

THE FLUFFY, WAVY EFFECT SO MUCH DESIRED

detriment to their appearance to follow styles that are unbecoming. Nothing makes a woman more unattractive than an unbecoming style of dressing the hair.

There is one style of coiffure that becomes nearly every woman, and that is the soft, fluffy, wavy effect. However, this effect is often difficult to achieve without the aid of a competent hair dresser or without proper appliances.

Electrocurl will produce any effect desired, from a soft, fluffy, natural appearance to a beautiful wave. This appliance gives continuous and uniform heat. It does not scorch or burn the hair. It also abolishes lamps, alcohol heaters and other dangerous and clumsy appliances.

Especial care should be taken in the selection of brushes and combs, the latter being very important. If a comb does not run smoothly through the hair, it should not be used at all. It was a custom in old times for maids to rub the heads of their mistresses with an old silk handkerchief. The excellent effects on the hair of electricity in silk was also experienced by old-time ladies who slept in silken caps.

Effects of Artificial Light on Hangings

The color of paper hangings and tapestries is far from being a minor factor in the degree of light that prevails in a room, and is very closely related to the economic use of artificial illumination also.

Recent investigations reveal the fact that the absorption of light depends, in the first instance, on the color of the hangings, and therefore on the same color when the walls are painted with it too. Naturally the most favorable effect of color in this regard is afforded by the white hangings and paints, but even these absorb 50 per cent of the light falling upon them, while the other 50 per cent radiates back into the room.

Following these in the effect of light come the yellow hangings, which radiate 45 per cent. The next in order are the bright greens, from which 40 per cent of the light striking them is thrown back. Dark green and red hangings exercise precisely the same influence; they radiate fifteen per cent.

Junior Section

Midnight Ride of 48-Ton Generator

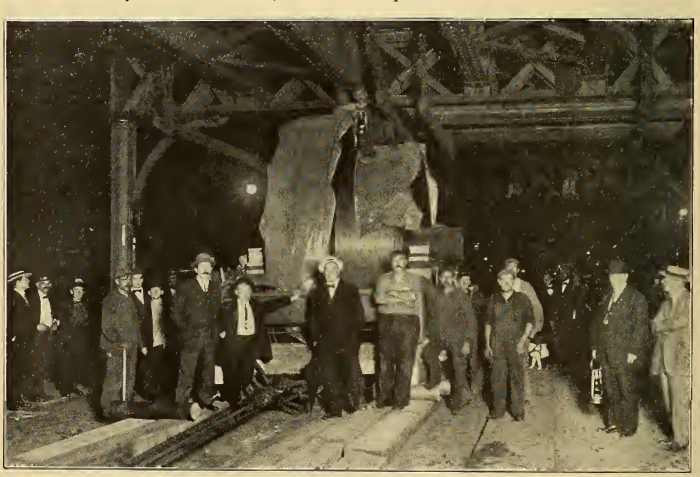
Men who know what is best for generators, and incidentally what is best for the welfare of the residents of a great city like New York, hesitate to permit generators on the street in the daytime. That is why the little trip of the 5,000 kilowatt generator that is now being installed in the Edison station at Fifty-third Street was begun at the hour of one o'clock one morning a short time ago.

Although the entire trip covered a very short distance—not more than a few hundred yards—the tortoise-like pace at which it traveled caused it to be on the move until nine o'clock the next morning.

When it was decided that the streets were sufficiently clear of traffic, which was some time after midnight, cables were attached to the huge generator, and a series of eight inch rollers placed under it.

Then began the slow journey toward the Fifty-third Street Station. Inch by inch it moved ahead as the winch on board a five ton truck was started, and with the aid of rollers its slow journey was finally completed.

At one point it appeared as if the generator would experience some difficulties in making its journey, for it was thought that the elevated structures would not afford it clearance enough to pass under and on its way. By careful measurement it was found that there were a few inches to spare.

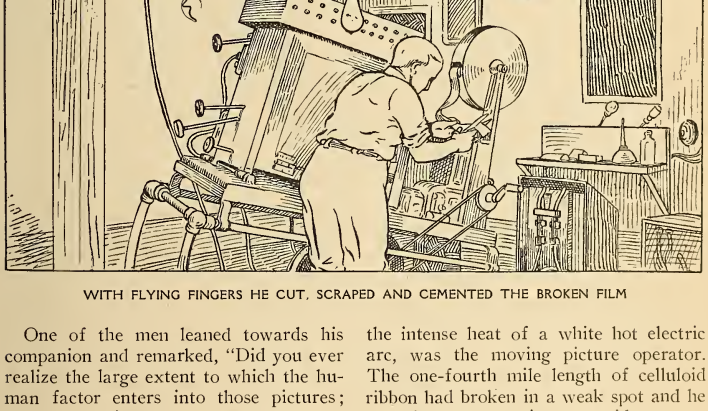


ON THE WAY ACROSS TOWN

THE MAN BEHIND THE "MOVIES"

The two business men stepped briskly down the aisle of the little theater and sank into the comfortable seats to participate in their daily noon hour indulgence—the moving picture show.

The brilliant stream of pictures against the screen depicted the inevitable "Cowboy and Indian" fracas with the usual number of hair-breadth escapes, horse races, pistol fights and hold-ups.



WITH FLYING FINGERS HE CUT, SCRAPED AND CEMENTED THE BROKEN FILM

One of the men leaned towards his companion and remarked, "Did you ever realize the large extent to which the human factor enters into those pictures; just how daring and reckless the actors will sometimes become to make a picture successful?"

His friend nodded in agreement and the two once more concentrated their gaze upon the active scene before them.

Suddenly the picture stopped. The piano player promptly commenced to thrump out a popular "rag" to allay the immediate signs of discontent which arose among the audience. The business men discussed the circumstance as "poor management," "incompetent operating," and used a number of equally expressive terms giving vent to their feelings. They had forgotten, or rather, neglected to realize that their remarks of the moment previous were particularly applicable to the case in hand, for in no place in the making and showing of moving picture films is the "human factor" so ever present and prominent as in the reproducing end.

In a galvanized metal cage, built in the back wall of the theater, sweating under the intense heat of a white hot electric arc, was the moving picture operator. The one-fourth mile length of celluloid ribbon had broken in a weak spot and he was, in a systematic yet rapid manner, repairing the break. The deviation of a one one-hundredth of an inch in matching the ends would have resulted in more serious trouble later on.

With flying fingers, he cut, scraped and cemented the broken film.

In the house an impatient audience commenced to grumble—to echo the sentiment expressed in the words of the two business men. A further delay meant their noon hour wasted.

With a sharp click, as the clamp swung in place over the perforated ribbon and the loud hiss of the arc steadied into a

musical humming, the wonders of western American scenery and activity were again unfolded before the absorbed gaze of the little audience.

In the narrow confines of his sweltering hot room, the patient operator turned the handle of the machine with unvarying regularity. Plainly speaking, it is "up" to him to reproduce with as great fidelity as he possibly can, the actions of the people in the pictures. He must gauge the speed of the film correctly so that the actions are normal. He must manipulate the blinding arc so that the resultant beam of light is concentrated to the highest possible degree—directly upon the little hole through which flutters the perforated ribbon of celluloid; this insures a bright clear picture. He must take more than conscientious interest in the delicate machine.

In the advent of a breakdown for any reason or other he is held accountable by a frankly critical public for a repair measured in seconds. At such moments, and only then, does the great horde of nickel theater goers ever give the "man behind the movies" a passing thought.

Giraffo Telephonia

Professor Burbank may be able to develop a seedless tomato or a tasteless prune, but he must share scientific honors with Maintenance Superintendent V. Ray, who discovered an old skeleton of a prehistoric animal, the "Giraffo Telephonia," which when rejuvenated may by a proper amount of training be taught to locate bullet holes in aerial cables and clear crossed wires in Chicago.

Our naturalist photographer, who never by any chance misses getting the picture of any rare species that may cross his path, followed this specimen the other day and actually caught the trainer Halberg putting it through a little cable trouble drill. Repairmen who care to learn to ride this fractious beast should file their applications early.

It seems strange, but it is nevertheless

GIRAFFO TELEPHONIA

a fact, that fourteen years ago this identical specimen traveled the streets of Chicago, and stranger still the Park Commissioners at that time gave orders to the Park Police not to allow either this machine or automobiles to drive through the parks on account of frightening horses. How times are changed! It is now nearly up to the point where horses will not be permitted to appear on boulevards for fear of frightening timid chauffeurs.—*Bell Telephone News.*

Cylindrical Lightning

What appears to be a well attested instance of lightning in the form of a cylinder is reported from Italy. At seven o'clock in the evening, at Rome, there was a brilliant discharge of lightning over the city, a glowing cylinder twelve inches long and $\frac{3}{8}$ inch in diameter issuing from a wall at the point of attachment of a telephone wire. It passed horizontally over the table containing the telephone, and between two persons seated close together, and then went out

of an open door. A few seconds later an explosion was heard. None of the persons present felt any effect from the presence of the cylinder, which was silvery white, with a slightly bluish or violet tinge, and no noise or odor was detected during its presence, which lasted only a few seconds. The cylinder did not change its form.

Telling the Time at Night

Did you ever wake up, reach for your watch under the pillow and find that it was two hours earlier than you thought, and then because of your exertion fail to go to sleep again? Did you ever try to stay awake to hear the clock strike the hour and find that your next conscious thought was that you had somehow fallen asleep and overslept?

AN ENLARGED REFLECTION OF THE CLOCK FACE IS CAST UPON THE CEILING

Some of these crimes against peaceful slumber are overcome by the electric ceiling clock here illustrated. Besides the clock there are reflectors, a battery and a small Mazda light. By pressing a push button attached to the end of a flexible cord the dial of the clock is lighted in such a way that the reflector throws a picture of the dial, hands and all, in light and shadow upon the ceiling of the room. The projected picture is about two feet in diameter.

Birds and the Wireless

The view has been expressed in certain quarters that the behavior of birds, especially of gulls, in the neighborhood of wireless stations, indicates that the wireless waves interfere with the instinctive knowledge of direction which birds possess. In this connection attention has been invited to the unusual losses in homer pigeons since the advent of wireless telegraphy.

The sense of direction in birds has always been a mystery. The swallow does not guide itself by the stars, as the sailor does, for flight is more often made by day than by night. Nor does the bird make use of landmarks, so far as can be ascertained, since the flight is frequently led by the young. This "sixth sense" affords, therefore, some means of determining direction through a medium unknown to man. The flights of homer pigeons are less wonderful, except in the matter of speed, than the flights of the wild bird; yet they, too, have the migrant's gift and can travel wide seas as the season dictates.

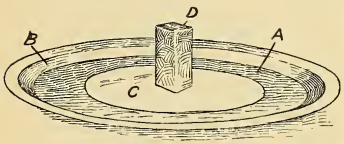
Of the traveling instinct and the sense of direction in birds, a plausible explanation is the theory that they and other animals have what has been called "the electric sense," in other words, they are, so

to speak in touch with the ether, that mysterious medium that conveys wireless messages. If the birds are so attuned, it is not difficult to imagine that the course of the earth, the incidence of the seasons and the movements of light convey to bird senses curious and certain intelligence. Upon the presumption, therefore, that living creatures can feel what the Marconi receivers record, it is easy to understand the confusion in a bird's instinctive sensations, and how these abrupt vibrations from the stations would war with the creature's previous electric experience.

To Make an Electrophorus

This instrument consists of two parts —a cake of sealing wax (A) cast in a round pie plate (B) and a round disk of tin (C) with a piece of sealing wax (D) as an insulated handle.

Place the sealing wax in the pie plate, and warm until it covers the plate uniformly. Cut from another pie plate a circular piece of tin smaller in diameter than the cake of sealing wax. Stick to this disk at the center a piece of sealing wax as a handle.



THE ELECTROPHORUS

To use the electrophorus, the sealing wax is rubbed with a warm piece of woolen cloth. The disk is then placed upon the cake, touched momentarily with the hand, then removed. The disk will be found to be charged sufficiently to yield sparks when brought near the fingers or hand. The tin disk may be charged many times before the sealing wax need be again rubbed.—Spenser M. Gowdy.

A California Rain Maker

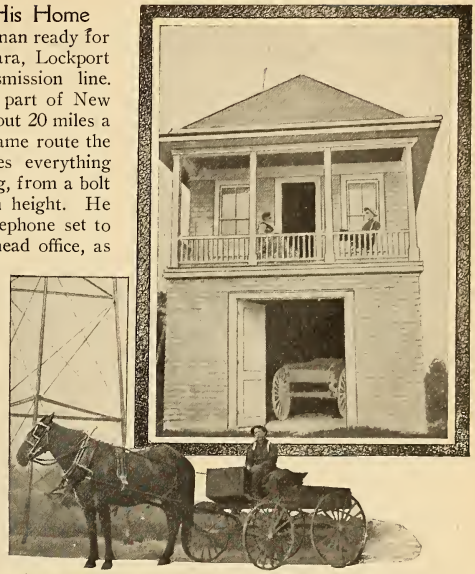
A device to cause the precipitation of moisture is being experimented with in Hyde Park, California, an electrically operated blower being used to force chemicals into the air through a huge upright tube. This is a steel pipe resembling a factory smokestack, and the top of it is 60 feet from the ground. At the base is the blower and a device for inserting the chemicals. The composition of the latter is the inventor's secret, and it is carefully guarded, together with all details of operation, by a high board fence and a padlocked gate. The tests are made at night in order to still more effectually balk curiosity. The results so far have not proved that the secret of "rain making" has been solved. The photograph shows all of the details which the camera is permitted to record, namely the steel pipe, the stockade, the power line, and pole transformer.


HEADQUARTERS OF A CALIFORNIA RAIN MAKER

Line Patrolman and His Home

This view shows a patrolman ready for his daily trip on the Niagara, Lockport and Ontario power transmission line. This line is in the western part of New York State. He travels about 20 miles a day and returns over the same route the following day. He carries everything that can be used in repairing, from a bolt to an insulator five feet in height. He also carries a lineman's telephone set to use in telephoning to the head office, as the company has its own telephone line. Along the line is a fine road bed, which enables the patrolman to travel near the line at all times. Part of one of the transmission line towers is seen at the left. These carry the three power cables.

One of the patrolman's houses is shown in the picture. He stays here one night and in one farther down the line the next. These houses are complete in every way. Each has its own bath, kitchen and dining room. There is a cozy sleeping room in the rear. The dining room is used as a loafing room. A well which is drilled at the rear of the house supplies fresh water. There is a barn and wagon shed in connection, forming the lower floor of the building.



A LINE PATROLMAN, AND THE COZY HOME IN WHICH HE LIVES

Commended for Telephone Enunciation

Recently a firm employed a new man in its office. He was called upon to transact considerable business with a neighboring concern over the telephone. A few days after his arrival one of the officers of the company met one from the other concern and was immediately asked about the new man. Upon inquiring the reason for this special interest, he was told: "His voice is as clear as a bell over the telephone and every word he utters can be understood perfectly." The person who made this comment talks daily with many people over the telephone, both local and long distance, but this one man's voice was the only one which was particularly noticeable to him, his interest being directed to it by the clear, pleasant enunciation.

The Wizard Lead Pencil

To make this requires some care, but it will furnish lots of fun. The things necessary are a lead pencil, with rather thick lead, and a sewing needle. Magnetize the needle, split the lead pencil along the glued joint, take out part of the lead near the end which is not sharpened, insert the needle and glue the parts together again. When this is carefully done the needle will not show. Tacks and other small articles can be attracted and held to the end of the pencil.

Flasher Display at Fire Chiefs' Meet

In front of the Albany Hotel, Denver, during the annual convention of the International Association of Fire Engineers, composed of the fire chiefs of the United States and Canada, stood an unusual

electric sign. A fireman was depicted as playing a stream of water upon the hotel building.

The production, created by the Denver Gas and Electric Light Company, used 1,500 lamps. A flasher gave a realistic effect to the illusion of water shooting from the hose nozzle, the fireman's helmet was outlined with red lamps and his body and the hose were shown by clear glass globes.

Novel Use of Electric Current

An interesting use of electricity was recently demonstrated in England, where a wooden bridge was cut down by means of electrically heated wires. The bridge had been condemned and was to be replaced by a structure of steel supported on the old masonry piers and abutments.

Three weeks was allowed in which to dismantle the woodwork, but it proved impossible to accomplish the work in so short a time without the use of dynamite or fire, which undoubtedly would have injured the masonry. Finally an old electrician proposed to destroy the bridge by the use of electricity. Each span of the bridge contained 27 planks, and it was proposed to cut them so that they would drop into the water simultaneously, clear of the piers. The structure was wired and sufficient current was employed to bring the wires to a cherry red. An hour and 40 minutes after the current was applied the first span was cut and fell into the water.

Five Hundred Fifty Volt Fishing

The fish and game warden of Tippecanoe County, Ind., was much exercised during the past fishing season over the large quantities of fish offered by the dealers of Lafayette. Seines and nets he felt quite sure were not in use in his territory. Seeking for a time in vain he suddenly came one day upon a lone fisherman seated at the end of an interurban railway bridge and beside the angler lay a huge pile of fish. From time to time the fisherman indulged in the queer pro-

FROM TIME TO TIME THE FISHERMAN INDULGED IN A QUEER PROCEEDING

ceeding of striking his fishing pole against the trolley wire. Dead fish came to the surface following this action. Investigation showed that an insulated wire ran down the fish pole and dipped into the water under the bridge. The 500 volt contact with the trolley served to electrocute all fish near the wire.

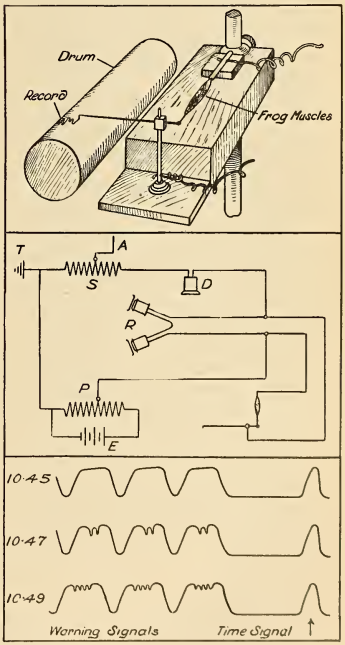
Wireless Signals Registered by Frog Muscles

M. Lefeuvre, professor of physiology in the medical school at Rennes, France, has recently described an apparatus by means of which radiotelegraphic signals may be registered on a revolving drum through the agency of a bit of frog muscle. The following observations on this subject are set forth by *La Nature:*

Every one knows of the galvanoscopic frog's leg, utilized since the time of Galvani by physiologists to study the electrical excitation of the nerves. This is simply a frog's leg from which the skin has been removed, cut off just above the knee and containing a part of the sciatic nerve. If the nerve is placed in an electrical circuit, the passage of a current causes the excitation of the nerve and the contraction of the muscle. If it is desired to register these movements, a lever can be attached to the extremity of the leg and a tracing point at the other end of the lever will give a series of curves which will correspond exactly to the movements of the muscle. The tracing point rests lightly upon a piece of smoked paper, and the apparatus is arranged so that the cylinder on which the paper is pasted is turned at a uniform rate by means of clockwork.

In applying this device to the reception of wireless messages M. Lefeuvre has employed a receiving station as shown in the diagram of connections. The aerial wire (A) is in contact with a tuning coil (S) which is also connected with an electrolytic detector (D). This detector is also in circuit with two telephone receivers (R), in series, each one of which has a resistance of 4000 ohms. The receivers are in connection with a potentiometer (P) placed in the circuit of an ammonium chloride battery of three elements (E) which communicates with the earth at (T). It is therefore an ordinary radiotelegraphic receiving station.

The frog's leg is simply an addition, and the two metallic wires leading to the nerve act as a shunt on the telephone receivers. The excitation of the nerve is



WIRELESS TIME SIGNALS REGISTERED BY FROG MUSCLES

due to the self-induction currents which have their origin in the coils of the receivers, and which are momentarily more powerful than the weak current impulse of the original wireless waves. In other words the receiver coils act somewhat after the manner of a "kick coil" used in gas lighting circuits to force a heavy spark across the gap.

Such an arrangement has enabled Dr. Lefeuvre, at Rennes, 210 miles from Paris, to receive and register the time signals sent out by the Eiffel Tower Station. The diagram of curves represents the registration of the signals at 10.45, 10.47 and 10.49. The muscle, responding to each excitation of the nerve, has transmitted the movement to the smoked paper on the revolving drum, which appears as a series of curves. The upper diagram shows very clearly the warning signals which correspond to the rhythm of the sending apparatus (twelve to fifteen per second). Then, after a moment's delay, comes the time signal. In the second diagram are seen the two small impulses within the waves of the warning signals, and in the third these small beats are increased to four. It will be seen that each time signal has the same form; consequently the only means of distinguishing them is by some difference in the warning signals.

The time elapsing between the emission of the wave and the registration of it by this means is about the one hundredth part of a second, that being the time which it has been calculated is required for the contraction of the muscle. Thus it will be seen that this method of registration is almost perfect, as the time consumed by the passage of the wave through the air is so small as to be inappreciable.

It is interesting to draw attention to this device because of its ingenuity. Of course it is scarcely to be expected that in practical working much use can be made of the frog's leg, as it loses its sensibility so quickly and consequently must be frequently renewed.

Wireless Unit Time in Germany

Germany will be the first country in the world to adopt wireless controlled clocks—these clocks to give uniform time all over the empire with a precision of one one-thousandth of a second. Norway, Sweden and Denmark have also secured the rights to the system and will follow shortly. A central station has been almost finished near the town of Fulda, Germany, and one standard clock located there will operate thousands of electrical clocks in every town and village of the empire by means of electric waves.

The central station in Fulda consists of one building, containing three standard clocks. Not far from the building is a tower about 330 feet high, carrying the sending antennæ. The central clock winds itself up automatically every minute, sending at the same time a wireless wave by means of the sending antennæ to all the receiving antennæ in the country. At the same time the minute hands of the receiving clocks of the system advance by one minute.

Each receiving clock has its antennæ on the roof of the house fastened to a special pole, or any number of clocks in a building, block or village can be connected with only one receiving antennæ by means of electric wire. Such clocks can be worked to a distance of about 800 miles from the central station.

Post offices, railway stations, etc., in Germany will be the first provided with the unit time and great interest is already shown by the public in general, the more, as the rent of the clocks is only $4.50 a year.

The new installation is of high strategic value besides, as the wireless apparatus all over the country can be made use of for military and telegraphic purposes.

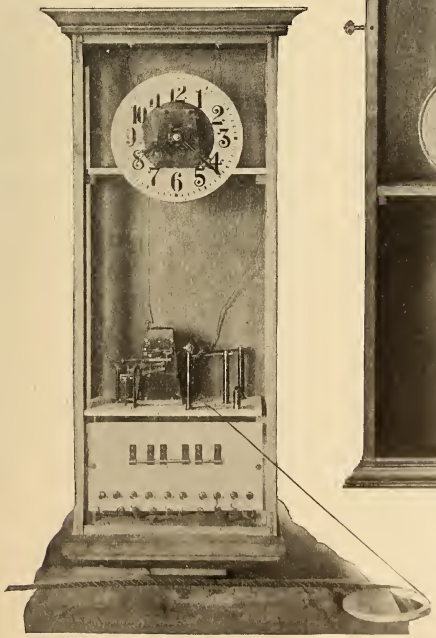
The inventor of this system is a German engineer, Mr. Schneider, the American rights to the patent being controlled by Alfred Graefe of Stapleton, Staten Island, N. Y.

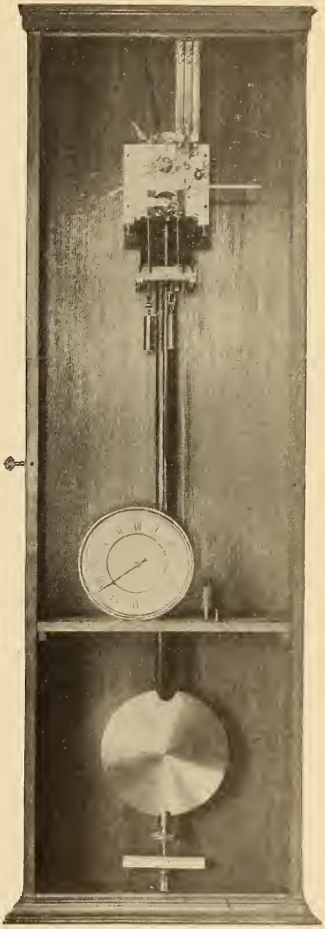
Wireless for Submarines

Recent experiments have demonstrated that it is possible to communicate with submarine craft from wireless stations on shore for a distance of 50 miles or more, and also to send wireless messages from submarines to the land stations.

The original experiments were unsatisfactory as regards the sending of messages from the submerged vessels, but it is now thought that these can be sent most successfully by means of a device attached to the submarine that will permit the raising and lowering of masts and a gaff above and below the surface of the water. These masts can be lowered to the upper deck when not in use.

Perfectly watertight connections permit the wires to enter the deck and pass down into the hull.





ABOVE IS THE SENDING CLOCK AND AT THE LEFT THE RECEIVING CLOCK OF THE WIRELESS UNIT TIME SYSTEM

Formalities to be Observed in Connection with the New Wireless Law

BY PHILIP E. EDELMAN

In the last two issues, suggestions for making amateur apparatus to comply with the requirements of the act of August 13, 1912, were given, together with a discussion of the provisions and effect of the new law. The present article, however, is concerned with further details and particularly with the steps necessary in order to obtain a license. The Department of Commerce and Labor has formed certain rules which must be complied with, and it is important that every experimenter should understand his rights and how to comply with the formalities.

The act took effect on December 13, 1912, slightly later than previously stated, and the regulations will be enforced by the Secretary of Commerce and Labor through collectors of customs, radio inspectors, and other officers of the government. Administrative districts have been established with offices at the custom houses of the ports named. These offices are located at Boston, Mass., New York, N. Y., Baltimore, Md., Savannah, Ga., New Orleans, La., San Francisco, Cal., Seattle, Wash., Cleveland, Ohio, and Chicago, Ill. Communications regarding licenses should be addressed to the radio inspectors at one of these custom houses or to the Commissioner of Navigation, Department of Commerce and Labor, Washington, D. C.

It is again pointed out that the act does not apply to stations for receiving only and which are not equipped for sending, nor to stations which are for transmission exclusively between points in the same state so that stations in other states are not interfered with, or to transmitting apparatus which does not interfere with the reception of interstate radiograms. If your station complies with the above limitations it is exempt from license, but if you are in doubt write the facts clearly and briefly to the Commissioner of Navigation, Washington, D. C., before applying for a license. If your apparatus is strong enough to transmit into a neighboring state or if it interferes with a local receiving station which receives from another state, it must be licensed.

Classifications have been made for the purpose of administration. The two main divisions are the coast stations and the inland stations. The coast stations are to receive the first attention, and attention will be given to the inland stations after the important coast stations have been attended to by the officials. Amateurs in inland states are asked to be patient, as licenses can not be issued to them until later. It is important, however, that your application should be made for a license at once and the officials will not take steps toward imposing penalties if it is impossible to act in your case before the law takes effect. With this exception, licenses are required before Dec. 13, 1912.

Both land and coast stations are divided into eight classes, five of which may concern experimenters and amateurs. Most of the readers will undoubtedly have their stations included under the class of *General Amateur Stations,* i. e., those restricted to a transmitting wave length of 200 meters and a transformer input of one kw. *Technical and Training School Stations* will be licensed in a separate class. If your station is located within five nautical miles of a naval or military station it is classified as a *Restricted Amateur Station,* and such stations are limited to a power imput of one-half kw. for transmission at a wave length not exceeding 200 meters. A few readers may be concerned with the other two classes, *Experiment Stations* for the purpose of research, and *Special Amateur Stations* with the privilege of using long wave lengths and large power. Special

qualifications must be given, however, and a convincing reason presented if such a license is to be obtained.

In addition to a license for your station it is necessary to have an operating or personal license. All licensed stations must be under the supervision or in charge of a licensed person or persons while in use and operation. Of the three classes of operators, two may concern the experimenter.

The most important is that of an *amateur operator*. Before applying for a license the amateur is expected to read and understand the essential parts of the Berlin Radiotelegraphic Convention and sections 3, 4, 5, and 7 of the act of August 13, 1912. Copies of these two publications may be secured for this purpose from the radio inspectors or by addressing the Commissoner of Navigation. (Be sure to state that you want them for this purpose, as they are not intended for public distribution.) The regulations prepared by the Department of Commerce and Labor state: "The Department recognizes that radio communication offers a wholesome form of instructive recreation for amateurs. At the same time, its use for this purpose must observe strictly the rights of others to the uninterrupted use of apparatus for important public and commercial purposes. The Department will not knowingly issue a license to an amateur who does not recognize and will not obey this principle." In addition to this prerequisite, it is necessary that an applicant be a citizen of the United States or Porto Rico or a company with similar qualifications.

Amateur operators are classified into two grades. To get a *first grade* license, the applicant must have a sufficient knowledge of the adjustment and operation of the apparatus, and of the regulations of the International Convention and acts of Congress in so far as they relate to interference with other radio communication and impose certain duties on all grades of operators. It is unnecessary to remember the other portions of these documents and a reading will serve to show the vital passages. The readers are advised to check off such passages for reference and study. The applicant must be able to transmit and receive in Continental Morse, but there is no speed limitation. The readers should aim to attain a speed of at least ten words a minute even though there is no prescribed regulation in this respect. In order to receive a first grade license the applicant is required to take an examination. A *second grade* license is the same as a first grade one except that it is issued where an applicant can not be examined or until he can be examined. Information regarding the officer to apply to as well as the place of examination should be asked for at the time when you apply for a license. Those who are unable to attend the examinations may be examined at home later, when the radio inspector makes a trip into their locality. If you are able to satisfy the examining officer or radio inspector that you are qualified to hold a license and will conform to its obligations and if further you can give reason for not presenting yourself for examination (as remote location from examining place, etc.) an actual examination may be waived.

Technical operators are classified into *experiment* and *instruction* grades. In either case a commercial first grade license is a requisite and must be indorsed by the Secretary of Commerce and Labor. Details will be found in the Regulations Governing Radio Communication issued by the Department of Commerce and Labor, Bureau of Navigation. (A part of this article is abridged from that document.)

The license provides for the taking of an oath before a notary public. This oath is for the preservation of secrecy of messages and need not scare the younger readers. A notary public or officer authorized to administer oaths may be found in every locality and in most cases the formality will be done for you gratis, "just to encourage you." The usual fee for a notary is not over 50 cents.

If you are not clear as to the exact procedure for your particular case, address the radio inspector, if there is one near to you, or else address the Commissioner of Navigation. The first thing to do is to write for Forms No. 756 and 757. These forms are self explanatory and should be filled in as directed thereon. Further forms will be sent to you after the filled in forms have been received at the office from which you obtained them. It will also be well to inquire, at the same time, as to the place of examination, and other points which are pertinent and on which you are doubtful. A request for copies of the act of August 13, 1912, and of the Berlin International Radiotelegraphic Convention, together with a copy of the Regulations Governing Radio Communication should also be made at the same time. As the time is short, readers are advised to do the foregoing and file their applications for licenses without delay. One of the forms asks for the approximate transmitting range. It will be safe to state this according to the rule of ten watts to the mile. Thus a one-fourth kw. station (250 watts) should be considered as having a range of 25 miles as a maximum, a one-half kw. 50 miles and so on. The other items of location, date, etc., will be understood without further comment. In sending in your forms, it is advisable to state whether or not you have read the act of August 13, 1912, and the International Convention provisions, as the regulations specifically state that amateurs who have read these documents will receive attention before those who have not. A license will probably be issued in about a month after the application is in. The readers are advised to fill out the blank forms carefully and to adhere to the formalities in order to avoid delay. Needless to say, the general observation given in the Regulations Governing Radio Communication should be considered. Copies of letters to the officers or Bureau of Navigation should be kept for reference.

Questions and Answers in Wireless

BY A. B. COLE

TUNING COILS (Continued.)

89. *How may the insulation of silk or cotton covered wires be removed to allow contact between the sliders and the wire?*

One of the best ways to do this is to heat an old file or a soldering iron and pass it along the wire coil where the insulation is to be removed. The insulation will be charred by the heat, and may then be removed by means of a stiff brush.

90. *Give dimensions of a good straight coil tuner.*

Diameter of core, two inches; length of winding, ten inches; size of wire, No. 20; insulation of wire, enamel; weight of wire, one-half pound.

If bare wire is used the length of the coil should be increased to fourteen inches, and the space between adjacent convolutions should be not greater than the diameter of a No. 14 wire.

91. *Give diagram of connections for single slide tuner, crystal detector and telephone receivers.*

See Fig. 25.

92. *What advantage has a double slide tuning coil over one having a single slide?*

Referring to Figs. 25 and 26, it will be seen that in the case of the single slide tuner, the aerial-ground circuit is common to that of the detector, since the detector is included in series with this circuit. In the case of the double slide tuner, the circuit involving the detector and the condenser is almost independent of the aerial-ground circuit, since the former circuit is connected to sliders, and since therefore its inductance and capacity can be varied almost independently.

The double slide tuner has, therefore, the advantage that the inductance and capacity of the aerial-ground and of the detector-condenser circuits can be varied

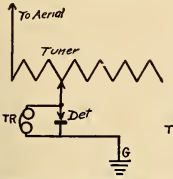


FIG. 25. CONNECTIONS OF SINGLE SLIDE TUNING COIL

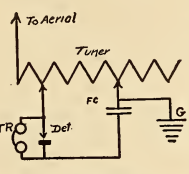


FIG. 26. CONNECTIONS OF DOUBLE SLIDE TUNING COIL

almost independently, and for this reason better tuning results.

93. *What advantage has the three slide tuning coil over one having two slides?*

Figure 27, a diagram of connections for a three slide tuner, shows that the inductance and capacity of the two circuits mentioned in answer to question 92 can be varied still more independently

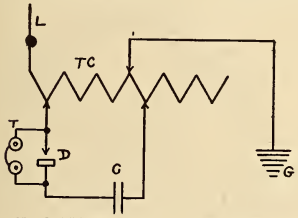


FIG. 27. CONNECTIONS OF THREE SLIDE TUNER

than is possible with a two slide tuner. Consequently very close tuning can be accomplished with a three slide tuning coil. By the use of this type of tuner the author is able to hear stations sending with a one-inch coil at a distance of one mile and at the same time to eliminate completely two high power commercial stations at a distance of fourteen miles.

94. *What advantage has a tuning coil using switches instead of sliders?*

At the point of contact between a slider and the wire of the tuning coil there is always a certain amount of resistance. The use of switches in place of the sliders will greatly decrease this resistance.

The use of switches has the disadvantage, however, that contact cannot be made with every turn of wire. The use of a variable condenser offsets this disadvantage to a considerable extent, however, and we have obtained very good results with a tuner of this type. Figure 28 shows the method of connecting the switches of a double contact tuner. The switch points should be connected to points of the wire not more than ten turns apart.

95. *What is a transformer tuner?*

A transformer tuner is one having two

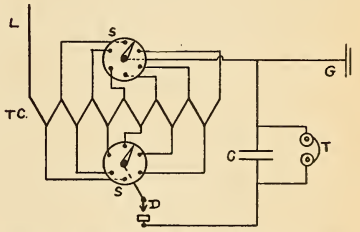


FIG. 28. CONNECTIONS OF DOUBLE POINT TUNER

layers of wire. This type of tuning coil is also known under the names receiving transformer, variable coupling tuner, loose coupled tuning coil and loose coupler.

The type generally designated as a receiving transformer has a primary and a secondary winding, so arranged that the secondary slides inside the primary. Figure 29 illustrates this tuning coil. The primary is provided with one slider, and variation of the inductance of the secondary is accomplished by means of a switch.

96. *Give dimensions of a good transformer tuner.*

Primary—4½ inches long, four inches in diameter, wound with one layer of No. 18 bare copper wire; secondary—four inches long, 3¾ inches outside

diameter, wound with one layer of No. 28 double cotton covered magnet wire.

The primary is provided with one sliding contact, and variation of the number of turns of the secondary is accomplished by means of a six point switch. The secondary is arranged to slide within the

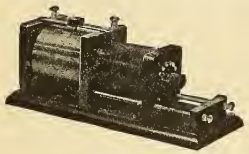


FIG. 29. VARIABLE COUPLING TUNING COIL

primary and can be moved out of it to a distance of seven inches.

97. *Compare the possible results to be obtained with a transformer tuner with those to be obtained with the three slide type.*

In the three slide tuner the aerial-ground circuit and the detector circuit are almost independent but are included in the same wire. In the transformer tuner these two circuits are entirely independent, as the distance between them may be varied at will. The transformer tuner is therefore more selective, which is an advantage under some conditions.

The signals from a distant station are necessarily weak, and unless the receiving station using a transformer tuner were exactly on the tune of the transmitting station it is doubtful that the signals would be heard. While the three slide tuner is not quite so selective, we believe that it is in many ways equal or superior to a transformer tuner.

98. *In a transformer tuner having a slide on the primary, how is it possible to make connection with any turn of the secondary wire when the secondary is entirely within the primary?*

It will be found that in nearly all cases when the secondary is in this position it will not be necessary to vary the number of turns in use within the primary, and any variation which might be of assistance can be obtained by the use of a variable condenser in series with the secondary and the detector.

99. *What advantage has stranded wire over solid wire in the construction of tuning coils?*

Stranded wire offers less resistance to high frequency currents than does solid wire. Since it is desirable to reduce all resistances in the apparatus to a minimum, the use of the former wire helps to increase efficiency.

100. *What is a variometer?*

This instrument (Fig. 30) consists of two coils of insulated wire, suspended in the same plane, and so arranged that the angle between them may be varied from zero degrees to 180 degrees. The variometer is therefore a transformer tuner in which the mutual inductance may be regulated by varying the angle between the two windings.

In one type of variometer the windings are not electrically connected. One end of the outer coil, which acts as the pri-

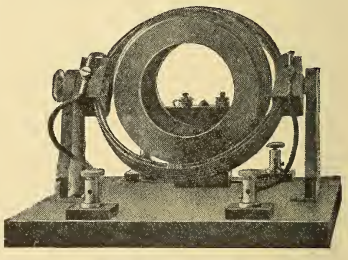


FIG. 30. VARIOMETER

mary, is connected to the aerial, and the other end is connected to the ground. One end of the inner coil, which acts as the secondary, is connected to the detector, the other terminal of which is connected to the condenser, which may be of either the fixed or variable type, preferably the latter. The other end of the secondary coil is connected to the remaining terminal of the condenser. If the variometer will not respond to sufficiently long wave lengths, a single slide

tuning coil may be connected in series with its primary and the aerial.

In the second form of variometer both coils are wound in the same direction, and the outer terminal of the outer coil is connected to the outer terminal of the inner coil. The detector may be connected either in series with the variometer and the ground, as in the case of a single slide tuning coil, or across either of the windings in series with a variable condenser.

A few moments' reflection will show that when the plane of the inner coil coincides with that of the outer coil the inductance of the entire instrument will be minimum, since the coils will act magnetically against each other. When the inner coil is moved through an angle of 90 degrees from this position the inductance of the instrument will be increased, until when the angle has become 180 degrees, the inductance will be maximum. It will therefore be observed that a wide range of inductance can be obtained with this instrument.

The variometer gives very satisfactory results as a tuning coil, especially in stations receiving from transmitters emitting undamped waves, as very sharp tuning is possible.

101. *Give dimensions of a good variometer.*

Outside core—cardboard, six inches in diameter; inside core—cardboard, five inches in diameter; both tubes or cores two inches wide. Each core is wound with one even layer of No. 24 enameled wire for a distance of ¾ inch from one end. Then a space ½ inch wide is left, continuing the wire to the other side of this space, and the balance of ¾ inch is wound with one even layer of the wire as before. About 90 feet of wire will be needed for the inner coil and 110 feet for the outer coil.

102. *What is an interference preventer?*

One type of interference preventer consists of two tuning coils, detector and two variable condensers connected as shown in Fig. 31. The tuning coils may be either both of the double slide type or both of the loose coupled type. A combination of the double slide tuner and a loose coupled tuner can also be used.

Adjustment is made to ground the energy received from the interfering station by moving the ground slide of one

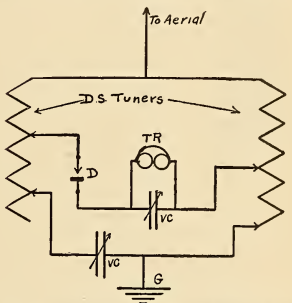


FIG. 31. CONNECTIONS OF INTERFERENCE PREVENTER

tuner. The other slide of this tuner and the sliders of the other tuner are then adjusted for the wave length of the desired station.

103. *What is a pancake tuner?*

A pancake tuner consists of two spiral windings of insulated copper ribbon which are movable with respect to each other in a manner similar to that employed in the ordinary receiving transformer. The sliding contacts are arranged to make connection with any turn of the ribbon. The action of this tuner is similar to that of the receiving transformer.

104. *What is the purpose of a helix?*

The helix is a transmitting tuning coil and is used for the same general purpose as a receiving tuning coil, to vary the wave lengths of the various circuits to which it is connected, by varying their inductances.

A helix may be of the close or loose coupled type. The former has one winding and the latter two. A close coupled helix (Fig. 32) may be either a true

helix in form or may be wound in a spiral in one plane. The former type has the advantage that every turn has the same inductance and the insulation between turns is greater. The latter helix is more compact, but the outer turns have a greater inductance than the inner ones, which is a disadvantage, especially when there are two or more circuits used.

FIG. 32. CLOSE COUPLED HELIX

The loose coupled helix finds its main application in systems emitting undamped waves, since in the ordinary systems of the present time the loss of energy due to the distance between the windings is too great for practical purposes.

105. *Give dimensions for a helix to be used with coils giving up to four inch sparks and transformers up to ½ kw. capacity.*

Diameter of winding—eight inches; number of turns—10; size of wire—No. 8; kind of wire—copper or aluminum distance between turns—1⅜ inches.

A helix for larger transformers up to two kw. may have a diameter of ten inches and be wound with No. 6 or 4 copper wire, all other dimensions remaining the same.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published quarterly. 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.

Arkansas Wireless Association.—G. A. Rauch, President; Edward Vaughn, 2622 State St., Little Rock, Ark., Secretary and Treasurer.

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 Scoren, Vice President; Benj. Lazarus, P. O. Box 1115, Winnepeg, Manitoba, Can., Secretary and Treasurer.

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

Chester Hill Wireless Club.—Waller Morgan, President; Richard D. Zucker, 46 Clinton Place, Mt. Vernon, N. Y., Secretary and Treasurer.

Chicago Wireless Association.—F. V. W. ReQua, President; S. W. Wooster, Vice President; C. Stone, Treasurer; F. D. Northland, Secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., Corresponding Secretary.

Coatesville Radio Telegraphy Association.—Charles Mellin, President; Ira Laird, Vice President; Raymond C. Newlin, Treasurer; Geo. H. Newlin, 326 Charles St., Coatesville, Pa., Secretary.

Colorado Wireless Association.—William Cawley, President; Thomas Ekren, Vice President; W. F. Lapham, 1545 Milwaukee St., Denver, Colo., Secretary-Treasurer.

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

De Kalb Radio-Transmission Association.—Bruce Lundberg, President; Walter Bergendorf, Vice President; De Esten Snow, Treasurer; Bayard Clark, 205 Augusta Ave., De Kalb, Ill., Secretary.

Electro Mechanical Association of Columbus, Ohio.—Howard Meyer, President; Robert Poole, Vice President; Stephen Davis, Treasurer; John Dolby, 512 W. State St., Columbus, Ohio, Secretary.

Fargo Wireless Association.—Kenneth Hance, President; John Bathrick, Vice President; Earl C. Reineke, 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.—Franklin J. Kidd, Jr., President; A. Donald Allerbury, 1034 Elmwood Ave., Buffalo, N. Y., Secretary-Treasurer.

Fruitvale Wireless Club.— Jos. C. Brewer, President; Abner Scoville, Vice President; Alwin Karner, 1612 35th St., Oakland, Calif., Secretary.

Geneva Wireless Club.—Charles B. Hartman, President; Charles Smith, Vice President; Benjamin Merry, Treasurer; Henry B. Graves, Jr., 448 Castle St., Geneva, N. Y., Secretary.

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

Granby High School Electricity Club.—Harold Taylor, President; Stuart Bliss, Vice President; Eastman Smith, Granby, Mass., Secretary-Treasurer.

Greenfield Wireless Association.—Edward M. Wolfe, President and Corresponding Secretary, 4125 Haldane St., Pittsburgh, Pa.

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.

Harriman Wireless Association.—Oswald L. Fillmore, President; Everett R. Parish, 801 Clinton St., Harriman, Tenn., Secretary.

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

Hobart Wireless Association.—Asa Bullock, President; Charles Clifford, Hobart, Ind., Secretary.

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

Independent Wireless Transmission Co.—Harlan A. Eveleth, 72 Gray St., Arlington, Mass., Secretary.

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

Killington Radio Club of Rutland, Vermont.—John L. Copps, President; Howard Crane, Vice President; W. R. Canty, Rutland, Vt., Secretary.

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

Lane Technical High School Club.—B. C. Lizenby, President; C. I. Gringrich, Vice President; C. H. Stone, Treasurer; J. Simon, Secretary; R. R. Traub, Lane Technical High School, Chicago, Ill., Corresponding Secretary.

Lexington Aerogram Company.—Roger H. Preston, President; Francis Dean, Vice President; Charles Young, 5 Warren St., Lexington, Mass., Secretary.

Long Beach Radio Research Club.—Bernard Williams, 555 E. Seaside Bvd., 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.

Minneapolis Wireless Club.—P. D. Gage, President; John L. Ewart, Minneapolis, Kans., 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.

New Thomson Wireless Club.—T. Frank Edwards, President; C. D. Fitzgerald, Vice President; Edward M. Fleming, care the New Thomson, Kane, Pa., Secretary.

Non-interference Wireless Association of America.—Melville S. Starr, President; Albert E. Snow, Treasurer; Gerald E. Travis, 1062 Saratoga St., East Boston, Secretary.

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

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

Oklahoma State Wireless Association.—T. E. Reid, President; G. O. Sutton, Vice President; Ralph Jones, Box 1448, Muskogee, Okla., Secretary and Treasurer.

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

Peterboro Wireless Club.—G. B. Powell, President; C. V. Miller, Vice President; E. W. Oke, 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.

Pueblo Wireless Club.—L. R. Finke, President; B. C. Howe, Treasurer; K. G. Hermann, 100 Board of Trade, Pueblo, Colo., Secretary.

Radio-Signal Club of Chicago.—W. E. White, President; G. C. Schade, Vice President; F. H. McCarthy, 2113 Washington Bvd., Chicago, Ill., Secretary and Treasurer.

Rockland County Radio Wireless Association.—M. V. Bryant, President; H. I. Sprott, Treasurer; P. Haeselbarth, Nyak, N. Y., 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.

Seneca Electrical Club.—Neil A. Stillman, President; Maurice P. Whitney, Vice President; Harold Server, Treasurer; Howard Donnelly, R. F. D. 1, Geneva, N. Y., Secretary.

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. Seely, 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.—E. C. Estes, President; W. P. Husby, Vice President; T. J. Taylor, Treasurer; L. R. Moore, 1911 Ashland 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.—Arthur E. Hapeman, President; Walter Lowell, Treasurer; H. M. Rogers, Jr., 65 Elizabeth St., Waterbury, Conn., Secretary.

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

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

Wireless Association of Fort Wayne.—Adolph Rose, 1326 E. Wayne St., Fort Wayne, Ind., President and Secretary.

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

Wireless Association of Savannah.—P. C. Bangs, President; A. A. Funk, Vice President; H. Jenkins, Treasurer; L. H. Cole, Cor. Liberty and Price Sts., Savannah, Ga., Secretary.

Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garrit, Treasurer; Winters Jones, 728 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.

Y. M. C. A. Wireless Club of Williamsport, Pa.—Lewis Holtzinger, President; Christian Cupp, Vice President; Robert Templeman, Treasurer; Lester Lighton, 211 W. 4th St., Williamsport, Pa., Secretary.

Zanesville Wireless Association.—Charles S. Shryock, President; Rudolph C. Kamphausen, 105 South Seventh St., Zanesville, Ohio, Secretary-Treasurer.

For Practical Electrical Workers

Construction of a 50 Watt Dynamo

BY CHARLES F. FRAASA

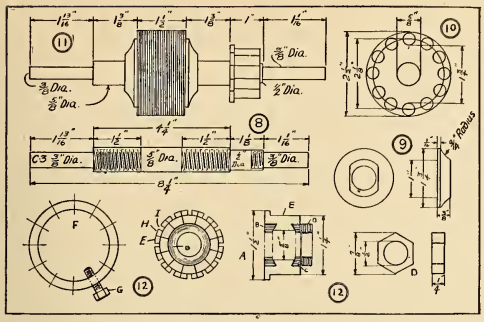
PART II.—ARMATURE, COMMUTATOR, BRUSHES, FIELD AND ARMATURE WINDINGS, ETC.

The construction of the armature and shaft, Figs. 8, 9, 10 and 11, is as follows: center an 8¼ inch piece of ⅝ inch steel rod, and turn down the ends for a distance of 2 3/16 inches from one end and 1 13/16 inches on the other end to a diameter of ½ inch. Thread the center portion for a distance of 1½ inches from each end, eleven threads per inch, as shown in Fig. 8. Then from some iron or steel, turn two pieces as dimensioned in Fig. 9. The central hole is bored ½ inch in diameter, and threaded with a ⅝ inch eleven thread tap.

Cut up enough 2¾ inch pieces of No. 27 gauge sheet steel to make a stack 1¼ inches thick when compressed. Clamp them to a drill press and drill a ⅝ inch hole through the center. Put the disks on the shaft and turn on the nuts, Fig. 9. Locate the twelve equally spaced slots, Fig. 12, and center punch. These slots are drilled with a ⅜ inch drill. When the holes are drilled put some ⅜ inch dowels or iron bolts through them and mounting the shaft between the lathe centers turn down the core to 2½ inches in diameter. The slots are then cut open with a hack saw, two or three blades being mounted in the frame to secure the right width of slot opening.

While the core and shaft are still in the lathe turn down the ends of the shaft to the dimensions given in Fig. 8, and thread the ½ inch portion twelve threads per inch for the commutator lock nut. The assembled armature should then appear as in Fig. 11.

The commutator (A), Fig. 12, is composed of a number of copper segments insulated by mica and held together by the two iron rings (B) and (C) and a lock nut (D). The segments (E) are made from a copper casting, or, better, a copper forging about 1¾ inches in diameter and one inch long. The copper forging is chucked and rough turned to within 1/16 inch of the required size, and then the circumference is divided into twelve equal parts. The hole through the center should be bored to ½ inch in diameter. Mount the copper ring on a mandrel, and with a thin screw slotting tool, cut along the division marks to within 1/16 inch of cutting through. From some sheet mica, split twelve sheets as thick as the slitting saw which cut the slots in the commutator and insert them in the slots. Use a micrometer in this operation if available. If the mica is too thick scale it off to the right thickness. Each piece of mica as inserted should be dipped in shellac. Mount the commutator on the mandrel again, and turn off the projecting mica. Turn up a ring of iron (F), Fig. 12, 1¾ inches internal diameter and 2¼ inches in external diameter. Drill twelve equally spaced holes around the circumference of this ring with a No. 29 drill, and tap with a 3/16 inch



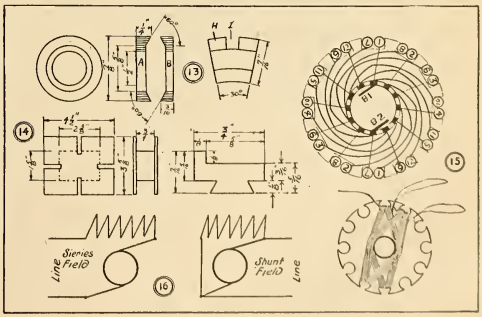
ARMATURE, SHAFT AND COMMUTATOR

24 thread tap. Into these holes screw twelve 3/16 inch screws (G), and when the commutator is dry, put the ring over it and turn the screws down tightly. The ring may then be chucked in the lathe for boring the inside and turning the ends of the commutator. After the 1/16 inch of metal remaining around the hole has been bored away, the screws should be tightened up before the boring and turning is completed.

The rings (A) and (B), Fig. 13, and the nut (D), Fig. 12, are turned from iron. The nut is bored 25/64 inch in diameter, and tapped twelve threads per inch with a ¼ inch tap.

Scale off some mica very thin and cover the surfaces of the rings (A) and (B), Fig. 13, which touch the commutator using a liberal amount of thin shellac. When they are dry, put the ring (A) on the shaft up against the shoulder, and wrap a piece of mica about ½ inch wide on the shaft, varnishing it well with shellac. Then put the commutator on and the other ring (B), and screw up the nut (C). Test the commutator for grounds with test leads connected in series with a 110 volt lamp. If a ground is found between the commutator and the shaft, the insulation is faulty and should be improved. Direct the flame of a blow pot on the commutator to bake it. The shellac will boil out and the screws and the nut should be turned up tighter. When the shellac is baked out, remove the ring and turn down the outside of the commutator. The raised ring (H), Fig. 12, around the commutator is for the connections. Twelve slots (I) about ⅛ inch deep should be cut in this ring, one in the center of each segment.

The brushes are composed of several leaves of thin spring copper or brass soldered together at one end. For the two ampere machine use two leaves of No. 24, ½ inch wide, and for the five ampere machine, four leaves. The brushes are mounted in slots cut in the brush holder studs (C), Fig. 3 (Part I.) Nut (D), Fig. 3, binds the brush in place. To vary the tension of the brushes, loosen nut (E), and rotate the stud un-



ARMATURE AND FIELD COIL WINDINGS

til the brush bears on the commutator with the proper tension and tighten up the nut (E) again. The slot in the brush holder stud should be wide enough to receive the brush. The leads to the brushes connect to the terminals (G), to which they are soldered. These terminals are placed between the two nuts (H) and (I). The end of the brush should be filed or ground to fit the curvature of the commutator. When mounting the brush holder studs, wrap a piece of 1/32 inch fiber around the stud where it goes through the hole in the brush holder, and put a fiber washer under the nuts (E) and (H).

The field coils are wound in the form, Fig. 14, and bent to the curvature of the field magnet by clamping between two blocks turned to the same curvature as the inside of the field ring. When the coil has been wound, slip a string through the four saw slots in the form and tie the coil tightly. Remove the coil from the form and dip in thin shellac and bake well in an oven, then wind a layer or two of tape over the whole coil. The terminals of each coil should be soldered to flexible lamp cord for connection leads.

The shunt windings are as follows: 25 volts two amperes, 1714 turns, 857 per pole of No. 25 d.c.c.; ten volts five amperes, 686 turns, 343 per pole of No. 21 d.c.c.

The series windings are: 25 volts two amperes, 344 turns, 172 per pole of No. 18 d.c.c.; ten volts five amperes, 138 turns, 69 per pole of No. 14 d.c.c.

Wind both coils in the same direction, and the connections will be made more convenient.

The slots and the armature will have to be insulated before winding. On each side of the armature wrap several layers of shellacked paper or muslin, for a distance of about one inch. Cut a number of disks of insulation about three inches in diameter, and glue them to the heads of the armature with thin shellac. When this dries, trim the insulation off around the periphery and from over the slot ends. Twelve pieces of 1/32 inch fiber should then be folded, and inserted in the slots. These troughs should stick out on the ends of the armature for about 1/8 inch, so that the winding will have no possible chance to be cut by the core.

The shunt armature windings are 25 volts two amperes, 72 turns No. 23 per slot, 36 per coil; ten volts five amperes, 28 turns No. 19 per slot, fourteen per coil. The series windings are: 25 volts two amperes, 90 turns of No. 24 per slot, 45 per coil; and ten volts five amperes, 36 turns per slot of No. 20, eighteen per coil, all double cotton covered magnet wire.

Fig. 15 illustrates the armature winding. Two coils are wound in each slot, making a total of twelve coils. The coils may be wound each from a separate piece of wire, but when wound this way, some confusion of ends results, making the connections to the commutator rather confusing to the beginner. A better method is to wind each slot half full and leave out a loop at the slot before winding the next coil. The coils are wound in slots diametrically opposite, coil 1 being wound in slots 1 and 7; coil 2 in slots 2 and 8; coil 3 in slots 3 and 9; coil 4 in slots 4 and 10; coil 5 in slots 5 and 11; coil 6 in slots 6 and 12; coil 7 in slots 7 and 1; coil 8 in slots 8 and 2; coil 9 in slots 9 and 3; coil 10 in slots 10 and 4; coil 11 in slots 11 and 5; coil 12 in slots 12 and 6. The slots will then be found to contain the conductors of two coils, and there will be twelve loops sticking out from the sides of the slots. Test for grounds, and apply a liberal coat of shellac. The winding must be carefully done, to get the correct number of turns in each slot. If there is any space left in the top of the slot, put a wooden strip in it to prevent the wires pulling out when the armature is running, or wedge a thin strip of fiber or wood in the saw cuts which open the slots, and shellac well.

The whole armature should then be baked.

The connections to the commutator are simple. Each loop is brought straight out from the slot to the commutator segment, and soldered in the slot provided for it.

When the armature is wound and connected, we are ready to assemble the dynamo. It will be noted that the field coils are wound large enough to go over the pole piece tips. The core should be built up with fiber or paper and wrapped with tape to the inside dimensions of the field coil. Secure a thin piece of fiber to the inside of the field ring around the core to insulate the field ring from the coil. Then slip the field coils in place and connect the end of the one coil to the end of the other. When the current flows through the field coils, it will flow in opposite directions around the poles, making one a north pole and the other a south pole.

The connections of the armature and field for series and shunt excitation are shown in Fig. 16. In the series field the total armature current flows through the field while in the shunt only a fraction of the armature current flows through the field, since it is a comparatively high resistance connected in shunt with the armature. The terminal binding posts are turned from brass and should be insulated from the field casting by a fiber bushing, and fiber washers.

An inch pulley having a one inch crowned face is recommended, though a grooved pulley and a ⅜ inch round belt may be used.

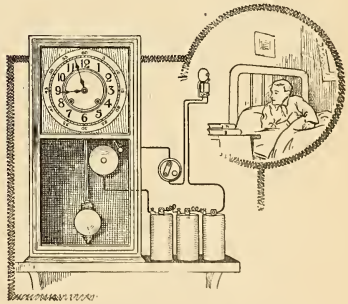
When starting the dynamo for the first time, the fields should be magnetized by a battery. The cast steel field magnet will then retain sufficient magnetism to enable it to start generating. It would be best to try it first as a motor to see if all connections are properly made. There will then be a residual magnetism in the field casting and it will not be necessary to magnetize it. If it runs as a motor, try it as a dynamo. The brushes should be somewhere between the tips of the pole pieces on opposite sides of the commutator. With a voltmeter in circuit, speed the machine up to its rated speed and shift the brushes back and forth until a position of highest voltage and least sparkling is found. This will be the running position of the brushes when running as a dynamo.

With the machine running as a dynamo the brushes are always given a little lead in the direction of rotation, but when running as a motor they should be given a little lead in the opposite direction.

To Make Bell Strike the Hours

It was necessary that I arrange to have a bell at a distance from a clock strike the hours at the same time as the clock.

The gong of the clock was connected to one wire and the hammer to another. These two wires were attached to bat-



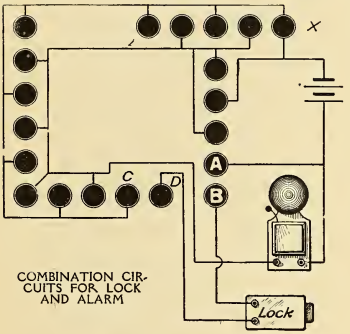
BELL THAT STRIKES THE HOURS

teries and run to the distant bell as shown. As the gong of the clock was insulated by being mounted on the wooden back, the hammer closed the circuit with each stroke. A single stroke bell is best but a vibrating bell may be used.—J. B. Wood.

Tool Chest Lock and Alarm

As a safeguard against thieving an ingenious mechanic has equipped his tool chest with a combination electric lock and alarm.

An electric door opener, such as is now employed to open doors from remote points, is fitted to the lid of the chest and



COMBINATION CIRCUITS FOR LOCK AND ALARM

serves as a lock. With this device, when bought from the dealer, is also furnished a stiff spring, designed to fit into the jamb of the door. This does the duty of forcing the door open when the electric lock, or door opener, is operated. In the present case the spring is attached to the chest and exerts an upward pressure against the lid.

On the lid of the chest the designer's initials are formed with brass upholstering nails placed about an eighth of an inch apart. These are connected—on their points on the inside of the lid—in a dry battery circuit with the lock and a bell, as shown in the illustration. A circular hole, protected by small iron bars, is made in the back of the chest near the bell, to convey the alarm more clearly. Brass hinges connect the wires where the current is carried across the lid from the battery in the chest.

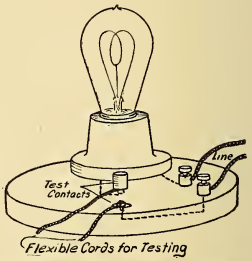
Closing points (A) and (B) and points (C) and (D) releases the lock, while the spring raises the lid automatically. But closing any other two adjacent points rings the bell. A finger ring, a key or any other metal objects handy are used to make the connections.

In the event of the battery's becoming inactive from constant use or other causes, thereby rendering the system inoperative, temporary connections to open the chest, may be made with another battery on points (A) and (X).—Chas. K. Theobald.

Ground and Short Circuit Tester

The following arrangement I use for testing motors, fixtures, flat irons, etc., for short circuits and grounds.

Referring to the illustration, fasten a receptacle, as shown, upon a common five inch fixture block, leaving space also for line and testing terminals. Connect as indicated. The "test contacts" are placed



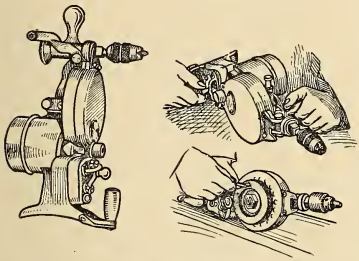
GROUND AND SHORT CIRCUIT TESTER

so that in putting the center contact of a lamp base upon one test contact, the screw shell will come in contact with the other, thus lighting both the test lamp and the lamp to be tested if the latter is in good condition. Fuses may be tested on the same contacts. In my shop I have fastened the whole outfit to a window casing and attached flexible cords to the test contacts for testing fixtures and for looking for grounds. A two candlepower lamp is sufficient in the receptacle.

E. M. Goodenough.

New Portable Electric Drill

The Temco electric hand drill satisfies the electrical engineer in that it is provided with a motor that will run on either alternating or direct current. The frame of the drill is made of aluminum, making it light to handle. Another



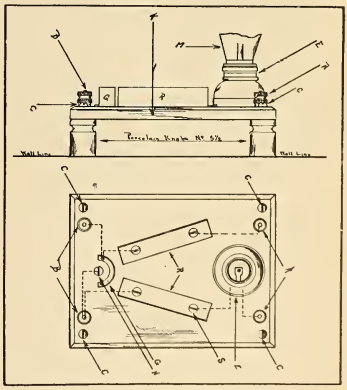
A PORTABLE DRILL WITH GRINDER ATTACHMENT

feature is that when it is desired to tighten the chuck, the drill spindle is broken over, falling into jaws on the main frame, thus preventing the spindle from turning. The drill is perfectly balanced between the handles, making it easy to hold to the work. A fourth striking innovation in its construction is the emery wheel attachment driven by the intermediate gear shaft which extends through the case. This wheel is convenient for sharpening drills.

Fuse and Trouble Tester

Considerable money is wasted by current users through good fuses being thrown away because of no place to test them to see whether they are good or not. This device also comes in handy for testing trouble in electric flat irons, curling irons, fans, small motors, etc.

The base is made from slate and is ½ by 6 by 8 inches in size. It is mounted on the wall by means of four supporting screws (C) and four porcelain knobs that keep it the right distance away from the wall. At one end is mounted the brass shell receptacle (E) to take the test lamp (M), which is an ordinary carbon filament 110 volt lamp. Two brass strips (R), made by cutting a piece of ¾ inch square casing in two pieces, are mounted on the base by means of brass machine screws. These slides are about four inches long and will test all enclosed fuses from six amperes up to 600 amperes. The small circular part (G) is made from the screw base of a socket or receptacle cut in two and mounted with brass machine screws. The center contact (H) is a brass machine screw. This part will test all sizes of plug fuses up to 30 amperes. The line is connected at the binding posts marked (A) and the wiring of the device is shown by the dotted lines. You can readily see that by placing a good fuse across the metal slides the light will burn. The lower binding posts (B) are for connecting testing terminals. These terminals can be made from two pieces of lamp cord about four feet long, with a



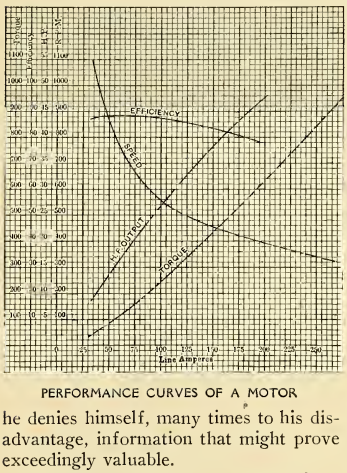
FUSE AND TROUBLE TESTER

piece of No. 14 or 12 insulated wire fastened to the end to add stiffness and to act as a handle.

The cost of making one of the testers should not exceed 75 cents.

How to Read Motor Performance Curves

Every person who owns, or ever expects to own or have charge of an electric motor should be able to read motor performance curves. These tell the whole story of the motor's capabilities and limitations at almost a glance to those who can read curves—but to the average person, and even to many engaged in electrical pursuits, a performance curve drawing looks something like a railroad map and there his information ends. Consequently



PERFORMANCE CURVES OF A MOTOR

he denies himself, many times to his disadvantage, information that might prove exceedingly valuable.

Nowadays, more than ever before, motors are sold on their "curves." It is not enough to simply say a motor has 25 horsepower capacity, because a 25 horsepower motor might mean several things. For instance, it can mean that the motor's momentary maximum output is 25 horsepower; or that its output is 25 horsepower at rated voltage for one-half hour, or maybe for one or two hours or continuously. It is true that electrical associations have laid down rules, but each motor manufacturer, nevertheless, rates motors according to his own ideas.

The result is that electrical engineers and all experienced motor buyers now demand curves showing the actual performance of the motor under all conditions of service. A motor performance curve drawing shows the exact output in horsepower for all speeds, the amount of current or amperes it consumes for any horsepower or speed within its capacity, the torque or turning power developed, and the efficiency, under all conditions.

The curves here shown give the performance of a direct current motor rated by its manufacturer at 20 horsepower. Each curve on the drawing is read between the ampere scale across the bottom, and its own scale along the side. In the drawing, "Torque" means pounds pull exerted at one foot radius (from the shaft); "H.P." means horsepower; "R.P.M." means revolutions of the shaft per minute; "Efficiency" means per cent of current or amperes converted into useful work.

To find the operating characteristics of this motor, locate the point where, at its normal rating, 20 horsepower, the "H.P. Output" curve intersects the 20 H.P. horizontal line. This point, it is seen, is on the 75 ampere vertical line (scale across bottom of drawing); at 20 horsepower then, the motor takes 75 amperes of current. The other characteristics are indicated by the different curves at the points where they intersect the 75 ampere line. Thus, by following the 75 ampere line down to the "Torque" line, it is seen by referring to the side scale, that the torque developed is 160 pounds; similarly its "Speed" is found to be 660 r. p. m. and its "Efficiency" a trifle over 88 per cent.

Now as another example assume that it is desired to know the conditions if this same motor was put to 25 horsepower service. By the same method we see that to do this extra work, it will consume 93 amperes; develops 220 pounds of torque, but the speed is reduced to 580 r. p. m., and the efficiency is now under 88 per cent.

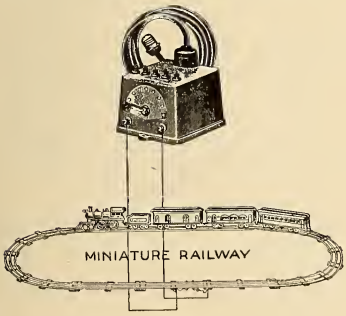
The drawing shows that this motor can develop as high as 49 horsepower (end of "H.P. Output" curve), but this is inadvisable, for while the torque is then over 600 pounds, the speed is only 420 r. p. m., and the efficiency drops way down to 78 per cent.

The rated output of the motor is, therefore, somewhat arbitrary. Any high grade motor has considerable range of power to take care of overloads. The momentary overload capacity should be about three times the rated capacity, so it is of great importance to know just what the motor can stand and what change will result in the speed, and how the overload affects the torque, the efficiency, and the current taken from the supply circuit.

By following this explanation, the performance curve of any motor can be intelligently read by anyone.

Variable Low Voltage Transformer

The transformer that will give low voltages from a 110 volt circuit finds a wide service in ringing electric bells, operating electric toys, running small motors, etc.,

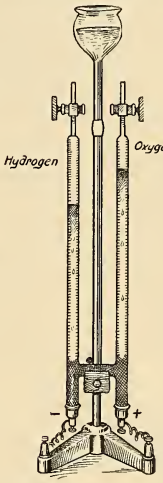


ONE OF THE USES OF THE LOW VOLTAGE TRANSFORMER

and at the same time takes so little current that it is hardly noticeable on the wattmeter. The accompanying illustration shows a Goettman transformer which is provided with a regulation switch by which voltages from seven to twelve may be obtained in one-volt steps by moving the switch from one contact point to the next. Transformers of this type are also made having a range from 2½ volts to 28½ volts.

Electrolysis of Water

Water may be separated into the two gases oxygen and hydrogen by the application of electricity. Laboratory apparatus for this purpose is here shown, although much more crude apparatus of glass is sometimes used. A heavy metal base supports the glass tubing.



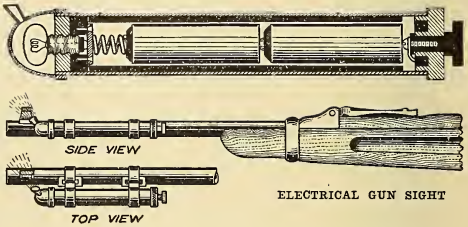
APPARATUS FOR WATER ELECTROLYSIS

When current is applied the positive terminal gives off oxygen while the negative terminal gives off hydrogen. The volume of the gases are in the proportion of two of hydrogen to one of oxygen, which corresponds to the chemical symbol for water, H_2O. At the top of each tube a valve for releasing the gas is provided. A rubber tube may be attached to the end of either tube and led into a test tube filled with water and inverted in a dish of water and gas collected for testing.

Water made slightly acid with sulphuric acid decomposes with the application of three volts. Careful experiments show that pure water really begins to separate into its gases at 1.08 volts. One ampere hour will free 12.8 cubic inches of oxygen and 16.3 cubic inches of hydrogen.

An Illuminated Gun Sight

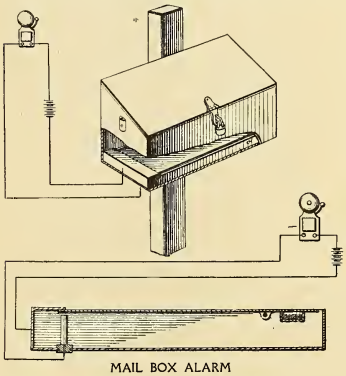
For the aid of hunters shooting in the dark, an electric lamp and battery have been so designed as to permit their being strapped to the gun barrel as shown. Light is projected upon the gun sight by a funnel shaped cover for the lamp so that the light is carefully screened from the object shot at. It is claimed that if the outline of the animal can be discovered, accurate shooting can be done with the illuminated sight.



ELECTRICAL GUN SIGHT

Mail Box Alarm

Monroe W. Grindle, of Santa Rosa, Cal., may doze in his chair or finish the milking and yet be notified the moment the rural mail carrier drops a letter or paper into the mail box. The device upon which he has secured a patent consists of a tilting bottom in the box in the form of a lever slightly weighted at one end and provided with an electric contact under the other. A postal card dropped into the box will cause the tilting bottom to swing down and close the bell circuit.


MAIL BOX ALARM

An Ingenious Safety Device

In these days of complicated mechanical apparatus designed to further comfort and to protect property, it is interesting to know that one electrical expert at least has reached the conclusion that to accomplish to a great extent the protection mentioned, the simplest means are the best.

As a protection against burglary, fire and flood, an electrical engineer in New York has devised a simple contrivance consisting of four screws, two strips of brass, a screw-eye, and a piece of cotton or string, applied to a hallway, window, etc., with the necessary wires and battery. The operation of this apparatus is as follows:

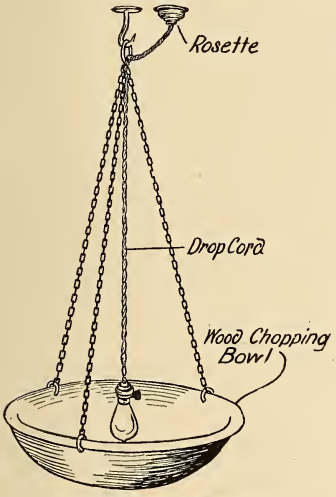
First tie the cotton securely to the screw-eye, draw taut across the opening to be protected, and attach it to the spring hook in such a manner that the cotton holds the spring away from the back screw and the front strip of brass. Then turn on the switch and thereby connect the necessary electrical apparatus to the spring circuit.

If a burglar should enter, he presses against the cotton and draws the spring against the front contact, sending in his own alarm. If a water pipe should burst, the cotton becomes wet and shrinks, pulling over the contact and making an alarm. In case of fire, even in its incipient stages, the cotton is consumed. The spring then falls back to its original position and makes contact with the back screw, which is also connected with the electrical circuit.

The system may be somewhat elaborated so that it will give separate alarms for fire or burglar or flood by arranging the spring to work as the armature of a two-point relay. Further, the scheme is applicable either to closed or open circuits.

Chopping Bowl Reflector

Enamel the inside surface of an ordinary chopping bowl white and make the outside to harmonize with the decorations of the room in which it is to be used. For suspension, chains of whatever design is desired may be fastened at three

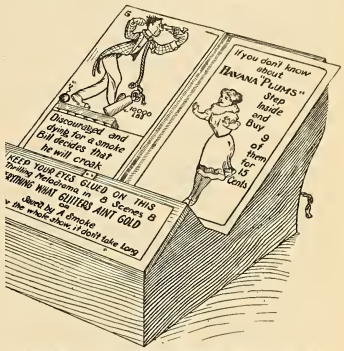


CHOPPING BOWL REFLECTOR

equidistant parts of the rim, as shown, and the free ends connected to a large ring which also serves as a ceiling fastener. A large hook screwed into the ceiling near the drop light completes the outfit. The drop light hangs vertically in the center of the chains and the cord is long enough to allow it to be screened from view by the sides of the bowl.—H. G. Wilson.

Book of Mystery

This is the name of a window advertising attraction. The device consists of a multiple card arrangement built in book form and having 22 pages, 8½ by 14 inches. The leaves are turned automat-

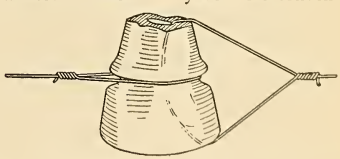


MULTIPLE CARD ARRANGEMENT BUILT IN BOOK FORM

ically and slowly enough so that each page may be read. An electric motor concealed in the oak cabinet furnishes the power.

Emergency Strain Insulator

One of the chief requirements of a "trouble shooter" on line work is that he be ingenious enough to get along with whatever material may be most conven-



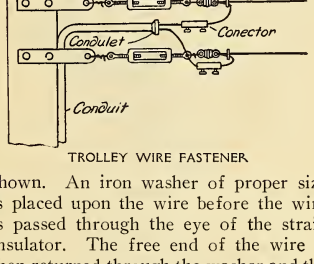
EMERGENCY STRAIN INSULATOR

ient when quick repair work is necessary. An instance of this kind happened a short time ago, in which strain insulators were necessary to finish the job. As there were plenty of glass petticoat insulators but no strain insulators to be had, it was a simple matter, when thought of, to knock

the top off a glass insulator, thus allowing the pin hole to extend all the way through. This afforded a very satisfactory substitute for a strain insulator.—H. G. Wilson.

A Trolley Wire Fastener

In large steel mills the continuous operation of machinery is of paramount importance, and speed in making repairs the chief requisite. A quick means for securing trolley wires on crane runways is



TROLLEY WIRE FASTENER.

shown. An iron washer of proper size is placed upon the wire before the wire is passed through the eye of the strain insulator. The free end of the wire is then returned through the washer and the end bent back on itself. The feed wires are then fastened by connectors, the whole operation requiring but a small amount of time.

Improved Carbon Holder for Moving Picture Machine

A picture machine operator requested me to make him some carbon holders more durable than the ones of cast brass. I suggested cold rolled steel, though doubting its worth (comparatively) because of its lower conductivity. However, they were made and tried out and

CARBON HOLDER.

were found to take no more current than the brass ones and instead of lasting three weeks they are evidently permanent, as the high heat has little or no effect on them and at that heat they are not brittle as is brass. The dimensions are all given on the drawing. Also an improved terminal is shown which carries the point of connection outside of the machine where it is easy to work while the arc is burning.—D. A. Hampson.

Removal of Oil from Condenser Water

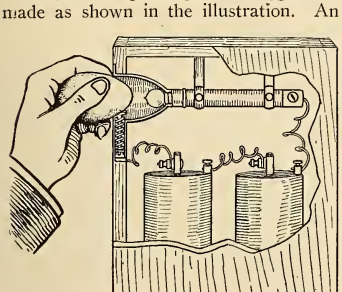
The condenser water from reciprocating engines when jet condensers are used contains some of the oil used in lubrication of the cylinders. This water is generally used again for steaming and the oil in it causes serious boiler troubles especially in the water tube type of boilers. With moderate lubrication this oil may amount to five grains per gallon.

Filtration and settling will not remove it because the oil and water form a very stable emulsion. One sample observed stood for three years with no sign of settling. All the known methods for removal of this oil make use of the fact that metallic hydroxides entangle or cover these tiny globules in such a way that they coagulate and settle out. Filtration will remove this coagulum. One method is to add aluminum sulphate and caustic soda which produces aluminum hydroxide, an insoluble compound capable of coagulating the oil drops.

The electric method, however, is simpler. The condenser water is passed through a long cell containing a large number of pairs of iron electrodes, between which the water is electrolyzed. Hydroxide of iron is formed at the anodes, and it promptly drags down with it all the oil globules in an insoluble mass which is then easily filtered off. The oil particles move with the electric current by attraction and this also helps in removing them from the water.—Harry N. Holmes.

Portable Egg Tester

A small electric flash lamp contained in a reflector is the basis of a patent recently issued to William D. Bixler of Fort Worth, Tex., upon a portable egg tester made as shown in the illustration. An

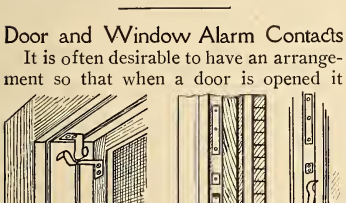


PORTABLE EGG TESTER

egg is lightly crowded into the opening of the reflector and this action closes a spring contact that completes the circuit of the lamp and two dry cells which furnish the current. The reflector causes a strong illumination of the egg's interior which decides its future.

Door and Window Alarm Contacts

It is often desirable to have an arrangement so that when a door is opened it

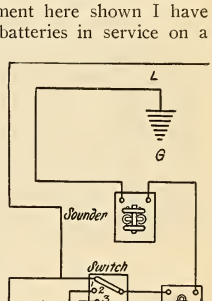


ALARM CONTACTS

will ring a bell at some convenient point. With brass strips bent and attached to the casing and screen door as shown, good and workable contacts are formed. I adapted the same idea to windows, the arrangement of the brass strips being shown in the illustration. Through the short contact point the bell will ring when the window is raised a little from the bottom or lowered slightly from the top. The second or long strip may be spaced any distance from the short one, this distance being governed by how much, after the first alarm, it is desired to raise the window without ringing the bell again. Two dry cells are sufficient.—W. Hall Moss.

Open Circuit Telegraph Line

The arrangement here shown I have found to save batteries in service on a telegraph line. Place the movable contact of the switch on point No. 1 when the instruments are not in use. The batteries are then out of circuit and the sounder is connected to line and ground so that the other station may call. When both stations are working place the switch contact on point No. 2, thus assisting the other station with only part of the battery. When calling use point No. 3; that is, all the battery.—W. Hall Moss.



OPEN CIRCUIT TELEGRAPH

Knife Blade as Eye Magnet

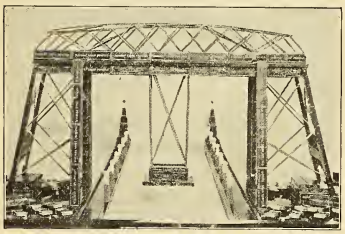
Unscrew the cap and remove the diaphragm of an ordinary telephone receiver. Gently stroke the knife blade on one of the magnets of the receiver (be sure to use the same pole all the time). I have used a blade so magnetized to remove particles of iron and steel from the eye.—Milton H. Shoenberg.

ELECTRICITY THE SILENT SALESMAN

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

The Aerial Bridge in Miniature

One of the most unique features of Duluth scenery, and one of which the city is very proud, is the aerial bridge that stands astride the government canal. It is a ferry bridge and consists of a platform, called the "car," suspended at the end of long girders, which is made by electric power to travel along the



MINIATURE AERIAL BRIDGE

tracks raised high over the water. This platform, though it looks small in comparison with the structure as a whole, will carry four teams and over 100 passengers at once. It is said to be the only thing of the kind in America, and the only one abroad is in France.

A firm of Duluth stationers specialize in a pencil made particularly for them, named "Aerial Lead Pencil." From these pencils and their boxes they have constructed an extremely clever window display, "The Aerial Bridge in Miniature."

The frame of the bridge and the canal piers are made of "Aerial" boxes; so is the car. The girders and stringers are of the pencils. The lamps stand along the piers and the two lighthouses at the ends are bunches of pencils, each group being surmounted by a tiny electric light globe. The globes on the pier lamps are white, those on the lighthouses are red, and at night all are shining brightly.

The miniature car is moved by means of a cord that passes round and round through the two rows of boxes spanning the canal; the cord is equipped with a mechanical device which will catch the car at one side of the canal, carry it slowly along and release it at the other side. The car stops for a moment, then it is caught again and slowly carried back across the canal. The cables which pass from the wheels at the sides of the car to the cord above are in imitation of the ones on the real bridge; they revolve slowly while the car is in motion, but have nothing to do with the progress of the car. The power is supplied by a small motor in the basement.

The background is a great sheet of stiff paper, curved toward the back of the window. It is painted in water colors to represent distant lake and sky. Far out on the lake can be seen boats, full steam on. The water in the canal and about the piers is of the paper.

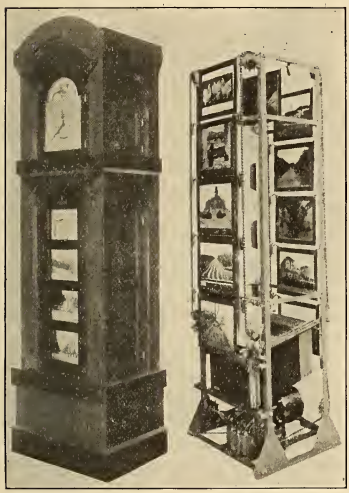
Electric Advertising in Clock Case

An attractive method of displaying advertising is the device of a Los Angeles inventor. It is in the form of a handsome clock in a tall case, the upper portion of which contains the timekeeper, while the lower part holds the mechanism which displays illuminated photographs on glass slides. Both the lighting and the mechanical operation are electric. A motor of 1/20 horsepower runs the mechanism at a cost of about five cents a day. It contains four Mazda lamps, one behind each of the four photos displayed at a time, and one behind the dial.

By an ingenious device, the 60 plates which it contains are shifted at ten second

intervals in the front of the case. The upper plate moves back, the three others move up and a fourth fills the lower space. This gives a total display of 40 seconds to each plate.

Only high class advertising is accepted by the holders of this patent, such as accurately colored photos with a few



INSIDE AND OUTSIDE OF AN ADVERTISING CLOCK

words of text, as the object is to make the scenic clock so attractive that it will be welcome in the lobby of a first class hotel or other public building.

"Save a Dollar" Window

Demonstrate to the average person how he can save money and you have his interest, especially if the demonstration is made with real money.

This side of human nature is made use of by a shoe store in a window display. "Save a dollar" is the slogan used and this is emphasized by a safe set in the window into which from a supporting cabinet below passes a belt made of one

A NEVER ENDING STREAM OF MONEY

dollar bills. A pile of paper money is also placed in the window. A concealed electric motor moves the apparently never ending stream of money and the window is a center of attraction.

Advertisement on Lamp Globe

A large translucent glass globe containing an incandescent electric lamp and having on its exterior an advertisement is being widely used in show windows.

LAMP GLOBE ADVERTISEMENT

Besides presenting the advertisement in a way that cannot be disregarded, the globe fills the window with a subdued light.

Hat Cleaner's Advertisement

In a western city a thrifty hat cleaner draws the attention of the passing crowd to his small but efficient establishment by whirling a couple of hats on the outside of his display window, as shown in the drawing. Auxiliary shafts and belting

HAT CLEANER'S ADVERTISEMENT

reach these from the rotary polishing block he is at work upon, and the energy used in rotating them is almost nil, not to mention the fact that a further saving is made by operating them simultaneously with the polishing block. The ever ready electric motor attends to the trick.

Fly Chaser for the Baker's Window

The baker's show window is usually an interesting one, but during the summer months much of its attractiveness is lost by the necessary protection of the goods from flies by wire screening. To overcome this, one manufacturer of good things placed an oscillating fan high up in the window corner, and fastened long streamers of brightly colored cloth above it. As the fluctuating breeze caught the streamers it alternately lowered and raised them over the goods, and, as it

FLY CHASER OPERATED BY A FAN

were, pointed long fingers to the protected eatables as well as served as an additional protection against flies.

The Anti-Window-Steamer

Storekeepers fully realize how detrimental a steamy window is to their trade. Passers-by do not see the goods displayed, so that naturally they do not stop, and many chances for sales are lost in this way.

A convenient little device is being used in London and other places to prevent this, and is known as the anti-window-steamer. It consists of a small electric motor and air blower, which forces through a suitable flat nozzle, which may be ornamental in design, a current of cold air over the whole surface of the window so that it is impossible for any moisture to settle on the glass. This prevents a mist or what is commonly known as "sweating."

Blower and tube can be kept quite out of sight and only the small nozzle lies near the window. Another point is that damp air does not settle upon the goods themselves, which would often spoil them in time.

Electro-Chemistry and Promises it Holds Forth

BY DANIEL M. GROSH

Discoveries and advancements in chemistry during the past decade have been greatly dependent upon and assisted by the science of electricity, without the aid of which those industries dependent upon the higher temperatures would have been unable to reach their present state of perfection. Among the industries so developed by the electrical furnace may be mentioned the manufacture of calcium carbide, artificial graphite, carborundum, the extraction of aluminum and other refractory metals, the manufacture of phosphorus, artificial precious gems, and many others, aside from those sub-industries dependent upon the above products. Those industries such as the extraction and fixation of nitrogen are really more dependent upon the electrical end of the proposition than upon the chemical end, especially when exploited commercially.

The important part taken by the professions of both electricity and chemistry in the many industries, so far created by either or both, is but an iota compared to the demands that will be made upon the new profession of electro-chemistry, and the great work of the future is already cut out for the electro-chemical engineer, not only in the way of new discoveries and the building up of new industries, but also in the elimination of waste, conservation of energy, utilization of by-products, economy of resources and reduction of cost of production.

The next few years will see every so-called waste product turned into a source of revenue, and the waste from saw mills, paper mills, furnaces, mines, refineries and factories, which formerly taxed the owners by their accumulation and littered the face of nature, will have passed into the pockets of the owners by the genius of the electro-chemist.

The electrical furnace is responsible for the electro-metallurgical developments and the use of the current as a source of heat has in itself, apart from any other action of the electrical current, produced most amazing results. For the exploitation of the electrical furnace the world is indebted chiefly to Prof. Moissan though even before the beginning of his great work, other investigators had done much; it is his 200 contributions of new substances and methods that constitute the bulk of electro-chemical knowledge. He was the first to realize that the arc light could be used for other purposes than that of heating all out doors, and the temperature so produced of 3500° C. is limited to this point only because it is the boiling point of the carbon electrodes, and out of its withering heat the new industries and the new chemistry has arisen.

Moissan and his methods have demonstrated that nearly every metal has its carbide, though calcium carbide is the most familar to all. For illustration we will take aluminum carbide, made by heating kaolin and carbon. It leaves the furnace a mass of beautiful yellow crystals which are to all intents useless. After years it was found that this Al_4C_3, being heated with aluminum oxide, yields the pure aluminum and carbonic acid, and this meant a new method of extraction of great value. Again, another peculiarity of aluminum carbide is its slow reaction with water to produce methane or marsh gas. Now natural gas is almost methane and its origin has always been a mystery. It seems possible, however, that the abundance of aluminum compounds in the earth, with the consequent high temperature and pressure, might result in aluminum carbide and its decomposition by water into natural gas. Again, some carbides yield petroleum on treatment with water. These instances show some of the possibilities waiting the electro-chemist to de-

velop. The other carbides may also be found to yield possibilities equal to those of aluminum carbide, so long discarded.

The opportunities of the investigator evolving new industries and new utilities by means of the rarer earths is most promising, as even until a few years ago many of the rarer earths were positively unknown to the chemist except by name. The few that have been used so far have created new industries, while a wondrous field of activity remains in those not at present utilized.

Many processes now conducted by the use of chemicals alone may be improved and revolutionized by the application of the electrical element. The possibilities of printing direct from type or plates, without the use of press or ink, by the use of chemicals and electricity, is very likely to be developed commercially, as well as a new photographic art analogous to positive printing direct without the use of a negative. The mercerizing of cotton may be improved by an electro-chemical process, as well as a combined process for treating cotton in order to make it take dyes without the injurious use of mordants. Why could not an electro-chemical process be invented for making and purifying wood pulp, instead of the purely chemical process in which half of the wood is wasted in securing the pulp? An electro-chemical process of procuring the flax fibers could be invented to take the place of the one that has been used since flax was first planted, which consists in soaking the fibers in stagnant water until they rot apart. These are but a few opportunities out of the hundreds that exist in the field of cellulose alone, any one of which means a fortune.

Certain chemicals will be found to have new properties, now unknown and unsuspected, when they are experimented with electrically, as is exemplified in the X-ray and mercury vapor light. The great achievements have been made in the past by using electricity as the energy or the helper, and when the investigator reverses the process, it will be found that the results will be so marvelous and astounding that any idea the imagination might conceive as a prophecy will perhaps turn out feasible.

May it not be proven that the reason that silver and lead or copper and gold are always found together is that there is an electro-chemical disintegration and synthesis from the baser to the more precious metal, assisted by or combined with radio-activity. The furnace has created such marvelous products that even disintegration of the elements does not seem improbable or impossible.

The examples of physical and chemical catalysis even without the aid of electricity per se, or as a means of energy or power, show that untold treasures lie beneath the sod of this field. Truthfully, we do not know the cause of this mysterious influence which a catalyzing agent exerts, but great industries are the result and greater ones are awaiting the investigator.

Every industry has its door open and each new industry started creates new conditions that must be provided for and studied by trained men, and for each individual plant or factory the laboratory will be the prime requisite. There are many vitally important problems to be solved which can only be done by the trained expert.

Windows Artificially Lighted

A western moving picture house has produced a very pretty effect in its auditorium. There are windows which appear to be exposed to daylight but are artificially lighted. There are buildings adjoining the theater which would shut out the daylight and the apparent windows are simply boxes covered with colored window glass. Back of these windows are small incandescent lamps in the outer frame of the case. The lamps give the window the effect of outdoor light and greatly add to the appearance of the room when lighted between performances. This idea may be used in stores which are always dark.

Electrical Securities

BY "CONTANGO"

It would seem a good idea at the beginning of the year to draw attention to certain selected electrical undertakings, giving some particulars as to their location, operating area, ownership or connections, capital stock and securities outstanding. The facts presented will not necessarily be the same as to each example, but given rather with a view to bringing out different aspects. In no sense will any special recommendation be made, other than what may be gathered from applying the explanations and principles laid down in former articles.

It must not be forgotten that the really important points are the character of the management and the identity of the interests with which this or that particular company is connected. Where possible the system or chain of companies of which any of those mentioned may be a part will be indicated. It will also be made perfectly clear that in the majority of cases the parent or controlling company will probably furnish the best opportunity. Thus to show a system of control, take the American Light and Traction Company of New York; this company controls the Detroit City Gas Co., Detroit, Mich.; the Western Gas Co., New York; Grand Rapids Gas Light Co., Grand Rapids, Mich.; Madison Gas and Electric Co., Madison, Wis.; St. Joseph Gas Co., St. Joseph, Mo.; Southern Light and Traction Co., Jersey City, N. J.; St. Paul Gas Light Co., St. Paul, Minn.; Binghamton Gas Works, Binghampton, N. Y.; Consolidated Gas Company of N. J., Long Branch, N. J.; Muskegon Traction and Lighting Co., Muskegon, Mich., and the St. Croix Power Company of Somerset, Wis. The common stock of this parent company is very valuable and is not mentioned here as a present opportunity for purchase, as will be presently explained, but more to illustrate very forcibly the great opportunity presented to the original subscribers to the stock, an opportunity which may be equaled any year and which knocks to-day at the door of those interested in the better class of electrical securities.

It may be stated at once that the common stock of the American Light and Traction Company has been selling, during the latter part of 1912, at prices ranging from 430 to 435. As a matter of fact the price of the stock has advanced over 150 points during 1912 in spite of the fact that, at the beginning of the year before that the company voluntarily reduced rates in the most important territory in which it operates.

Now it is not suggested that there is any opportunity in buying the stock of this company at the present price, but it is suggested that it gives a brilliant example of the success attained by a well managed holding company, and that in the further examples given in the following pages will be found opportunities for purchasing stock of other holding companies at a low figure where in due course and indeed comparative short order results are likely to be equally good. Examples even of prospective share subscription opportunities will be given and the chances indicated.

But apart from purchase of stock the actual securities or bonds as you have been instructed to call them, of the American Light and Traction Company are to be bought from time to time at a comparatively low figure and are "just as good" to the purchaser, in so far as the security behind them is concerned, as a government bond, with a far higher rate of interest and therefore much better income to the purchaser.

To further illustrate this point only from another aspect, that of a lower price with a seemingly assured future wherein opportunity by immediate purchase may

be found, let the case of the Cities Service Company be mentioned. This undertaking, really part of the well known Henry L. Doherty system, operating and financing engineers, controls the Spokane Gas and Fuel Co., Spokane, Wash.; the Denver Gas and Electric Company, Denver, Col., and the Empire District Electric Co., Joplin and Carthage, Mo. The company has an authorized capital of $50,000,000 of which there is outstanding $13,669,475. The report of the Company for the year ended August 31, 1912, shows gross earnings of $1,132,528 and net of $1,053,225. In that period the company paid $579,251 in preferred stock dividends and $194,739 on the common stock outstanding, leaving a surplus of $299,235. This added to the previous surplus made a total surplus of $481,277. The year's earnings that might be applied to payments on the common stock after both dividends were paid were equal to 8.89 per cent. The common stock on which four per cent is paid at the present time sold up to 122 per share during 1912. It may be stated that the substantial reason for the premium on the par shares of that stock rests in the belief that there will be extra dividends over and above those that have been definitely agreed upon for the ensuing year.

Or again, take the example of H. M. Byllesby and company property—the Standard Gas and Electric Company—controlling seventeen companies mainly in Arkansas, California, Colorado, Minnesota, Oklahoma, Washington and Oregon. July 31, 1912, the number of gas consumers served by this company was 105,232 with 104,372 electric customers. The common stock authorized amounts to $15,000,000 with $9,343,150 outstanding par value $50. The preferred stock authorized is $30,000,000 with $10,977,950 outstanding, par value of $50. The preferred stock pays dividends at the rate of eight per cent quarterly. The amount of bonds authorized is $30,000,000 of which $10,300,000 is outstanding. The following exhibit of the Company as of August 31, 1912, is of decided interest.

Common Stock	$ 9,343,150
Preferred Stock	10,977,950
Bonds	10,300,000

The actual earnings and expenses for the twelve months ended August 31, 1912, are reported as follows:

Gross Earnings	$2,113,432.28
Expenses and Taxes	34,503.88
Net Earnings	$2,078,928.40

Calculating annual dividends and interest deductions based on the total bonds and preferred stock outstanding as shown above, the results would appear as follows:

Net Earnings	$2,078,928.40
Annual Interest on Bonds.	618,000.00
Net Profits	1,460,928.40
Annual Dividends on Preferred	878,236.00
Balance	$582,692.40

However, as the total preferred stock and bonds now issued were not all outstanding for that full period, the actual deductions for interest and dividends were considerably less, therefore, the actual balance applicable to common stock dividends was in reality larger, being $786,722.17. The total accumulated surplus August 31, 1912, was $1,079,532.35.

This shows the condition of a really standard organization whose securities may be had at a reasonable figure and doubtless will show good future profit to investors.

Or take the case of a company just being formed, the securities of which will be offered to the public this year: The Appalachian Power Company. This company was organized under the laws of Virginia in May, 1911, for the purpose of developing the water power of the New River and distributing it by

electrical transmission to southern Virginia and southern West Virginia.

The company has acquired the electrical properties, including electric lighting, railway and power systems in the towns of Bluefield, Pocahontas, Bramwell, Welch, Keystone, Pulaski, Wytheville and Marion; all within 60 miles of the development on New River; also five separate power sites on New River in Carroll and Pulaski Counties, Virginia aggregating a total fall of 225 feet, capable of developing a total of 75,000 horsepower.

The Appalachian Power Company first mortgage five per cent sinking fund gold bonds are secured by a first mortgage upon all of the property and franchises now owned or hereafter to be acquired. The estimated earnings from the utilities operated and the present closed contracts are in excess of $500,000. The estimated earnings for the year as of January 1, 1915, are as follows:

Gross Earnings	$750,000
Operating Expenses	239,000
Net Earnings	$511,000
Annual Charges:	
Interest on $5,450,000 of bonds at five per cent	272,500
Balance	$238,500

The net earnings are almost twice the bond interest charges.

Having thus given illustrations of various forms of electrical undertakings it is the intention next month to give a list of selected companies with very brief but pertinent details in regard to them.

Bonds—the Ideal Investment

In the old common law sense of the word a bond signified an obligation to perform an act and in the event of the failure to do so, there was provision for the forfeit of something or property to compensate for the subsequent damage. This is true of investment bonds, which are secured by a lien against the property which would be forfeited in case the obligations were not met. The return of the principal sum at a definite date and the regular payment of interest at a fixed rate are set forth in special agreements in the bond, which also usually provides penalties in case the agreements are not carried out.

An ideal investment must have the quality of convertibility. That is to say, it should be of such character and in such form as to permit of ready sale for cash if this is desired, or to be used as collateral for a loan at a bank in case the investor needs to borrow money quickly.

In this time of public improvements and general business projects on a huge scale requiring very large sums of capital, money is borrowed for such projects in large amounts. At the same time, in order that these loans may be available to all owners of money, large and small, a big loan or bond issue is divided into smaller parts and one of these parts is known as a bond. For example: an issue for one million dollars may be divided into one thousand parts, or bonds of $1,000 denomination each; or perhaps 2,000 bonds of $500 each, or even and better still 10,000 bonds of $100 each.

Coupons are the small ticket-like divisions attached to a bond. The reading matter on such coupons states that so many dollars of interest on the bond for year or half-year or quarter-year will be due on a certain date and will be paid at the place mentioned. When these coupons fall due, the owner of the bond clips them off and presents them for payment. If he is at some distance from the place mentioned he may collect his interest by mail, or deposit the coupons in his bank for collection. Some bonds do not have coupons; these are known as fully registered bonds. Instead of presenting coupons for collection the owner of the bonds receives his interest by check without any action on his part. To register a bond the purchaser has it sent to the agent of the maker of the bond so that

he may be recorded as its owner. Bonds may be registered in two ways. In the case of a fully registered bond both principal and interest are payable only to the person who has been recorded as its owner. Thus a "fully registered bond" may be said to be "registered as to principal and interest." When a bond is registered "as to principal only" it carries interest coupons which are collected in the usual way.

On the face of a bond there is printed the date it will fall due, or be paid off. This date is its maturity.

The rate of interest to be paid is stated in the bond, and also the time when the interest will fall due, whether every three months, every six months or yearly. This rate is paid until the bond matures or is redeemed under its optional provision. The usual interest payment is semi-annual; thus the owner of a bond bearing five per cent interest payable semi-annually, January 1 and July 1 will receive on each of those dates a half-year's interest on his bond; if the denomination of the bond is $1,000, that is face value, he will receive $25 on January 1 and $25 on July 1.

The price of a bond means the amount for which it is sold, and like the price of any commodity depends upon market conditions existing at the time. Naturally other things being equal, a five per cent bond will bring a higher price than a four per cent. But if the security behind the four per cent be considered much greater than that behind the five then the four per cent bond's price may be higher.

To quote a prominent authority—an official of one of the best known bond houses in the country—"When a man wishes to avoid risk in his investment he has in mind three important requisites:

"First: Security, or the safety of the principal invested.

"Second: Ready convertibility into cash in case a change of investment be desired, or ready money needed.

"Third: As high a rate of interest as can be obtained without sacrificing either steadiness of income or safety of principal."

The bond of the well managed and progressive electrical undertakings furnishes all three requisites and in the growing market of the day gives ample security for necessary loans.

SCIENCE EXTRACTS FROM FOREIGN JOURNALS

6,500 Telephones in Pekin.—The use of the telephone at Pekin is an instance of the way in which China is entering the field of progress. Persons who were acquainted with this country 20 years ago, and still more, those who traveled there half a century ago, will be no doubt surprised to learn that the telephone is now being used to a considerable extent at Pekin. The government is building telephone exchanges on the latest principles and there are already upward of 6,500 subscribers listed. Of these, about 3,000 are in the Chinese and the Tartar quarters.—*Cosmos, Paris.*

The Time Signals of Greenwich.—The Greenwich Observatory is now receiving wireless time signals from the continent, now that it has installed an aerial and a receiving apparatus and such signals are now regularly recorded by instruments morning and evening, which is a new departure for Greenwich, as hitherto in these matters it has found it more usual to give than to receive. At 10:44 a. m. a series of Morse V's is heard as the warning calls from the Eiffel Tower and lasts with a series of T's for 55 seconds. Then at a quarter to eleven, the first "time signal" comes. Silence for one minute; then more warning calls, and the Eiffel clock strikes 10:47 a. m. It finishes with 10:49 a. m., and the mean of these time signals is the adopted time. These, however, are not the only signals from the continent, and there is another series received from the Norddeich station in Germany. Like the Eiffel Tower signals these also begin with tuning V's. The Eiffel Tower tuning signals resemble the crumpling of tissue paper, but those from Norddeich are more like the squealing of a rabbit. In all there are six groups of five signals each received from the German station. So far the chief points are the great accuracy of the wireless signals and the ease with which they can be observed. They are certainly worth the confidence of navigators. Paris may be considered as 200 miles and Norddeich as 270 miles from Greenwich.—*Observatory, London.*

Tunnel Under the English Channel.—France may be connected with England by a tunnel under the Channel at no very distant date according to the project which is being discussed a present. Following this, it is now proposed to build an electric railroad line through the tunnel. Mr. W. Rose Smith is promoting this movement, and the main idea is to construct an electric railroad from London to Dover, then crossing the Channel through the tunnel to Calais, then running the line directly to Paris. In this way the trip could be made by express trains from London to Paris in a few hours. He states that French capitalists will be approached so as to promote the enterprise in that country for designing and building the Paris-Calais section as well as the French part of the Channel tunnel. It would take about five years to build the tunnel and he estimates the cost of this work to be about $25,000,000.—*London Electrician.*

A Telephone Repeater.— Inventors have been seeking for some time for a telephone relay which will act to strengthen the weak currents received and send them anew upon the line and this will be one of the most valuable inventions, should a suitable relay or repeater be found. It is claimed that telephone relays which have appeared up to the present are not of the best and are difficult to operate in practice. A German engineer, R. von Lieben, has now invented a telephone relay which is of novel character, seeing that it makes use of a cathode or X-ray tube as the principal

working part. What would appear to give confidence in the new method is that several of the leading electrical firms are said to have taken up the idea and are now engaged in experiments in the laboratory with very good results. The working of the new relay is claimed to be regular and this makes it superior to what has been heretofore brought out. Should this be true we are likely to see much longer distances realized by telephone than before.—*Elektrotech Zeitschrift, Berlin.*

Searchlights that Float in Mercury.—The new lighthouse boat which is the second of the kind to be put into use at the port of Havre, is intended to show the landing places at Havre and on the bay of the Seine which enters the Channel at this place. Ship owners have come to prefer signals which are placed not as before upon the obstacles themselves but at a distance in front of these and wish to have some of the lighthouses replaced by suitable vessels. The present boat is fitted with a well designed electric system and uses a powerful lamp composed of twelve Nernst burner rods, these being placed around a circle so as to light all the horizon. To keep the lamp level during the boat's movement, it is mounted in a mercury bath by means of a float, the bath itself being held on the usual ship's compass type of support. Thus it is found that the lamp holds very steady.—*Cosmos, Paris.*

Device to Suppress Undesirable Telephone Noises.—A Swedish engineer has invented a simple device to suppress noises in the telephone so as to be able to hear more clearly. It consists of a variable resistance which acts to suppress the induced currents to a great extent. The resistance is made up of two water columns connected together and also with the ground, the other end being connected to the telephone wires. It is coupled on to the subscriber's apparatus at each end of the line and the subscriber is able to operate it, doing this by moving a conductor within the liquid so as to regulate the resistance. He adjusts so that the sound is deadened to the greatest extent. This regulation is needed for each case owing to the fact that the noises caused by induction in the lines vary with the state of the weather, so that a frequent adjustment needs to be made, but this is very quickly done by the use of a sliding piece. Trials of the device were made not long ago on the telephone line between Westeras and Traangfors, this line having been almost put out of use by the great noise, and it was found that the noises were suppressed to a remarkable extent.—*Electricien, Paris.*

Highest Telephone Station in the World.—It appears that the highest telephone station in the world is that of the meteorological observatory on the top of Monte Rosa, at a height of 15,450 ft. Since the station is only occupied for a short period each year, the poles carrying the telephone line are removed at the end of each season and then re-erected when this is required. It is striking to see that the unusual conditions of weather which are met with in the mountain region do not hinder but really favor the working of the telephone line. Short poles are used and at the center of each span the wire touches the snow, but as the snow is quite dry it is a good insulator and no leakage troubles are found. Indeed, the final section of the line from the Col du Lys to the peak is simply laid across the snow without using any other support. Where the poles are used, to prevent any breakage of the wire owing to movements of the glacier, the line is carried through rings on the poles and is not attached fast to the insulators. The line crosses two valleys each about 3,300 feet wide and naturally they must be crossed by a single span. But the depth of the ravines is so great that the sag of the wires is of no importance.—*London Electrician.*

Subways for Constantinople.— It is to be hoped that electrical operations at Constantinople will not be interfered with by the present war as there are several important projects on hand. It is announced that an electric subway is to be built in order to connect some of the principal districts of the city, according to the plans which are being drawn up. In spite of the present critical period, the Ministerial Council found time to settle in favor of the Deutsche Bank on behalf of a group of German, French and Belgian financiers the question of the franchise for the new metropolitan subway and the project is sanctioned which calls for the subway and electric line from Taxim to Bajadiz, this representing an outlay of $75,000,000, so that it will be seen that the undertaking is an extensive one. The same syndicate already controls the city tramways which are being changed over to electric traction and about thirteen miles of new lines are in construction.—*London Electrical Review.*

Arc Carbons Made From Tar.—The John Okissons firm of Stockholm has succeeded in separating carbon from tar and it is now possible to make electric light carbons with this material. The black color of tar is in fact due to the finely divided carbon which it contains and this forms a large percentage, being about one-fourth the weight of the whole. As the liquid tar has about the same density as the solid carbon, the minute particles of carbon remain suspended in this way. By the new process the carbon can be separated from the liquid part and this latter takes the shape of a dense and transparent golden-brown liquid. What is remarkable is that the carbon has physical properties of an entirely different kind from lampblack. When compressed in molds it is found to make very good carbons for arc lamps or for electric furnace use. Carbon crucibles can also be made in this way.—*Electrician, Paris.*

Increasing the Sound of a Telephone. A novel method of increasing the sound in a telephone is to heat up the transmitter and it is claimed that surprising results can be obtained in this way. M. Petersen, a Danish engineer of Nyköbing, applies heat to the microphone transmitter so that the air becomes rarefied and consequently has a different action on the microphone, as he claims, and speech is much louder than before. Prof. Hannover of the Danish state experimental establishment took up the matter and made a number of researches showing that the effect is well marked. Then the apparatus was tested on a telephone line between Nyköbing and Copenhagen and speech was so loud at the receiving end that it could still be heard when the receiver was laid on the table and the persons stood off at some distance. It appears, however, that the idea is not a new one, as a heated microphone was used before this by the Paris telegraph engineer, Germain, with good results.—*Elektrotech Zeitschrift, Berlin.*

Memorial to Phillips of the Titanic. The memorial at Godalwing, England, to John George Phillips, the wireless operator of the Titanic, is to take the form of a cloister, with a small garden enclosed by it and with seats sheltered from the weather. This is a memorial in which the committee shows its good taste, being useful as well as attractive, especially as the farther wall is to consist of an arcade through which there will be a view of fields and wooded hills. The committee seems to be aware of the obvious fact that a memorial should not be forgotten as soon as it is set up, so here the cloister will be used and not ignored and as long as it is used it will be associated with the name and story of Phillips. The successful completion of the scheme, however, depends on whether the necessary funds can be raised, but it is hoped to secure these by the international subscription list which is now open.—*London Times (daily).*

Ozone for Sterilizing Barrels.—During the last few years the use of ozone produced by electric apparatus has reached a great industrial importance on account of its property of destroying germ life and especially for sterilizing of liquids. Even now a certain number of cities, military quarters, hospitals and large schools are using it with success for water purifying and the next step will be to apply it for wines, cider or beer. But such a method is very difficult to carry out and the problem has not yet been solved. However an important advance is made in the use of ozone for giving a thorough purifying to the barrels or other vessels and this is especially useful in the brewery industry where the barrels must be cleaned very quickly to meet the demands. Dr. Monfang's process consists in passing ozone gas through the barrels after a rapid washing, and this for about 30 seconds, or else ozonized water can be used. Then the barrel is washed with a small quantity of sterilized water and the result is found to be excellent from a germ-destroying point of view. The electric apparatus needed for producing the ozone is of a simple kind and is easily used in practice.—*Revue Scientifique, Paris.*

NEW BOOKS

Electric Lighting. By William S. Franklin. New York: The Macmillan Company. 1912. 295 pages with 199 illustrations. Price, $2.50.

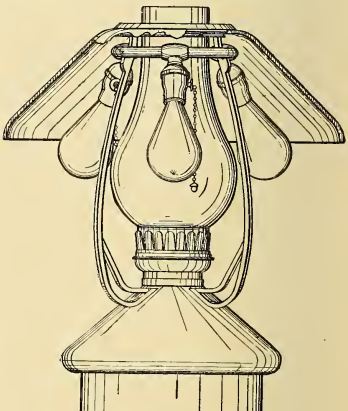
In the preparation of this book especial attention has been given to the principles which underlie operating engineering. The subject is given careful attention from station to lamp.

The Modern Gasoline Automobile. By Victor W. Page. Chicago: Norman W. Henley Publishing Company. 667 pages with 380 illustrations. Price, $2.50.

The author believes a treatise upon the motor vehicle should not assume that the reader has a knowledge of mechanics. This work is wide in scope, discussing principles of both construction and operation of vehicles propelled by internal combustion motors and is designed to be of practical value to motorists.

Combination Electric and Oil Lamp

A novel arrangement for converting an oil lamp into an electric light support is here shown. Standards secured to the font support a shade and below this are projections upon each standard which



COMBINATION ELECTRIC AND OIL LAMP

support a ring containing wires and carrying electric lamps.

The device has been patented by Philip J. Handel, Meriden, Connecticut.

How Electric Ware is Constructed

In changing electricity to heat there is no combustion, consequently there is no flame. The heat is obtained by the resistance opposed to an electric current passing through ribbons of special metal. These ribbons are sealed in the appliance and the current is conducted into them through insulated conductors. There is less danger of fire or damage through overheating in the electric utensil than in the use of any other method of direct heating.

On Polyphase Subjects

"Everyone hears better with one ear than with the other," theorizes a Chicago "hello girl." And yet if you notice you will see that in 999 cases out of 1,000 the person at the phone places the receiver to the the left ear. It is because the receiver is hung on that side of the instrument. The wire is always long enough so that the receiver can be held to the right ear, but this never seems to occur to the 'party.'

Which is Your Telephone Ear?

"He may be half deaf in his left ear and may be perfectly sound of hearing with the right, but this makes no difference. There he sits and fumes and struggles and perspires, trying to find out what the person on the other end of the line is trying to say, and all the time he is merely delaying the game by making his 'tin ear' do the work. I'm thinking of putting up a sign here over the booths, 'Are you right or left eared? Find out before calling your number.'"

An interesting if not startling fact in connection with the production of coal in the United States, according to the United States Geological Survey, is that in each successive decade the output is practically doubled. If the production of bituminous coal alone were considered, the record for the last 50 years would show an increase somewhat in excess of this ratio. The increase in the production of anthracite has been much less rapid on account of the limited area of the fields, the conditions under which the industry is carried on and the restriction of the prepared sizes to domestic consumption. It has been estimated that the output of anthracite will reach 100,000,000 long tons annually before it begins to decline. The average annual production from 1896 to 1905 was 283,240,275 short tons; the average production from 1906 to 1911, inclusive, was 461,499,260 short tons, showing an increase of 178,258,985 short tons, or 63 per cent.

Coal Output Doubles Every Ten Years

The electric fan may be used the year round, yet in some instances it may be stored away during cold weather. In such cases it is well to preserve the lasting qualities and efficiency of the fan by observing certain things in getting it ready to be placed on the shelf.

Storing the Electric Fan

After having unscrewed the connecting plug at the end of the flexible cord which conducts current to the fan from the lighting socket, place the fan on a table and wipe it thoroughly with a dry cloth or dry cotton waste. Go over the whole fan carefully removing all dust. Next unscrew the caps of the oil cups which are at each end of the armature shaft and fill them with good lubricating oil. Replace the caps and wind the flexible cord around the base of the fan.

To cover the fan place a large, heavy, paper bag over it, tying the neck of the bag tightly around the base of the fan, and it is ready to be set away.

When the bag is removed the next season the fan will be in good condition and ready to run. An electric fan thus protected during the winter and oiled two or three times during the summer should give satisfactory service for many years.

Teacher — What is velocity, Johnny?

Johnny — Velocity is what a fellow lets go of a wasp with.

* * *

"Is you gwine to let dat mewel do as he please?" asked Uncle Ephraim's wife. "Wha's you' will power?"

"My will power's all right," he answered. "You jest want ter come out hyar an' measure dis here mewal's won't power."

* * *

It is said that a young man, while attending the La Crosse, Wis., fair, dodged an auto and had just got out of the way when a motorcycle whizzed by, barely missing him in its meteoric flight. "Golly," he remarked, "I didn't know the darned thing had a colt!"

* * *

"What's the matter with Briggs?"

"He was getting shaved by a lady barber when a mouse ran across the floor."

* * *

Teacher — Johnny, what would you do if another boy called you a story teller?

Johnny (aged six) — To my face?

Teacher — Yes.

Johnny — About how big a boy?

* * *

"Why did you strike the deceased on the head with an oar after he had rocked the boat and fallen out?"

"Because he knew how to swim."

* * *

The female suffrage orator stood upon her platform and looked over the sea of faces.

"Where would man be to-day were it not for woman?" she inquired.

She paused a moment as she gazed around the hall.

"Again I repeat," she said, "where would man be to-day were it not for woman?"

"In the Garden of Eden," answered a male voice from the rear.

* * *

Potash — Cohen can nefer make a goot goluf blayer.

Perlmutter — For vy not?

Potash — He nefer hollers fore — always he yells dree ninedy-eight.

A prominent bridge player went to her doctor before taking an ocean trip and asked: "Doctor, I want to ward off seasickness on this trip so that I can play bridge and enjoy myself. Now, some of my friends say I should eat all I want and others say I shouldn't eat a thing. Which should I do?"

"Well, ma'am," replied the doctor, thoughtfully, "it's only a question of whether you prefer to discard from strength or weakness."

* * *

The garage keeper's little daughter never had happened to see a dachshund before.

"Look, papa!" she exclaimed. "See what a long wheel base that dog's got!"

* * *

First Motorist—What is the name of this big cemetery we are passing?

Second Motorist—That's not a cemetery, my dear boy; those are milestones.

* * *

Old Gentleman—Now, kiddies, do you want me to have a game of romps with you? Eh?

Youngster—Oh, no! We're playing at Indians, and you're no use. You're scalped already!

* * *

Uncle Jack—I understand the angels brought you a little brother last night.

Small Bobby (pityingly)—You'd better come over to school to-morrow and join our class in sex hygiene.

* * *

Interlocutor—That's right, go ahead and tell all you know. It won't take long.

End Man—Yassah, I guess I might as well tell all we bofe know—it won't take any longah, yah, yah, yah!

* * *

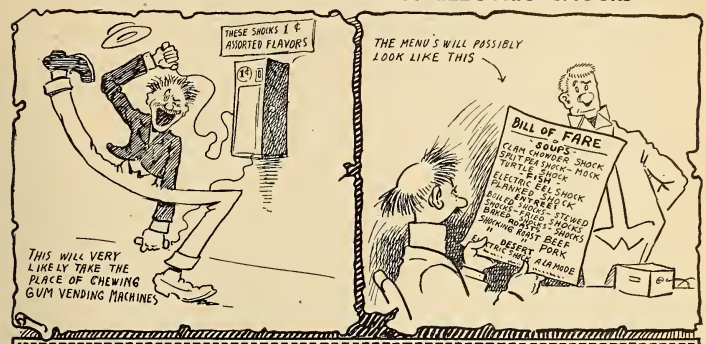
Georgia Lawyer (to colored prisoner)—Well, Ras, so you want me to defend you. Have you any money?

Rastus—No; but I'se got a mule and a few chickens, and a hog or two.

Lawyer—Those will do very nicely. Now, let's see; what do they accuse you of stealing?

Rastus—Oh, a mule and a few chickens and a hog or two.

THE LATEST SCIENTIFIC IDEA IS THAT THE MAN OF THE FUTURE WILL GIVE UP BEEFSTEAKS AND OTHER FOODS AND NOURISH HIMSELF WITH ELECTRIC SHOCKS

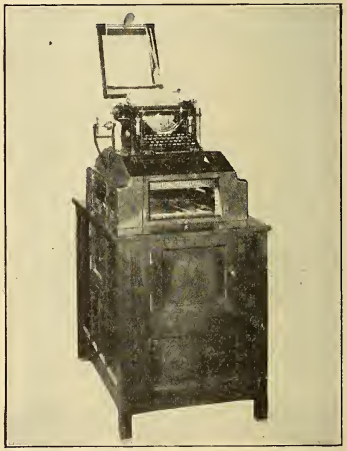


Automatic Typewriter

A machine operated by electricity that will write as many real typewritten letters each day as can be written in the same time on six machines is here shown.

The "filled in" circular letter is too often consigned to the waste basket unread. The letter in which every word is actually typewritten receives attention. Hence the field for such a machine as described.

The equipment consists of the operator and cabinet, a perforator, an automatic letterhead feeding device and an Underwood typewriter. The letter is first written upon the perforator which is operated like an ordinary typewriter. The perforator punches holes in a sheet of paper, each perforation corresponding to a letter on the typewriter keyboard. Then, somewhat similar to the perforated rolls of the player piano, this roll is placed in position in the "operator" as it is called, a one-tenth horsepower electric motor is started and the operator turns out real typewritten copies of the letter perforated on the roll. Completing the machine is a mechanism for automatically placing letterheads in the typewriter. This mechanism takes a letterhead from a holder at exactly the right moment, drops it into the typewriter and brings it at the same time into proper registration with the date line. When the supply of letterheads is exhausted the motor is shut off automatically.

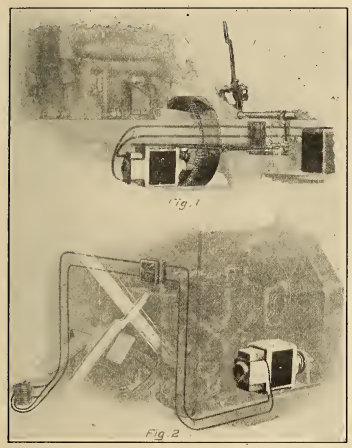


THE OPERATOR, SHOWING THE LETTER HEAD FEED MECHANISM

THE PERFORATOR

Automobile Self-Starter

An electric self-starter used as standard equipment on Haynes motor cars consists of two separate but correlated elements, the generator and cutout, Fig. 1, and the battery, self-starting motor and lamp system, Fig. 2. The twelve volt generator is mounted on the right side of the motor and is driven from the right



AUTOMOBILE SELF-STARTER

cam shaft. It is wired to a cutout on the dash, which alike automatically prevents overcharge of the battery and leakage of current from thence to the generator armature at slow speeds. The battery which is carried on the left running board is of 100 ampere hours capacity. Five lamps are supplied from this battery.

The starting motor which is supplied from the same battery has, like the generator, but two connections. It is geared to the flywheel by means of teeth cut in the latter's periphery, a sliding gear on a short idler shaft geared direct to the motor armature meshing with these teeth. The starting motor is mounted on the left side of the engine, forward of the flywheel and beneath the frame. The control of the sliding gear is accomplished by means of the gear shaft lever. A quick forward thrust on the lever throws the sliding gear into mesh with the teeth on the flywheel, thus starting the motor. The lever is automatically returned to neutral upon the response of the engine.

New Kind of Insulating Glove

Rubber for insulating gloves was naturally tried at the very outset. But rubber as a glove material has never proved very satisfactory. While it has high resistance to puncture by the current it does not wear well against such abrasion as a working glove always receives, while it causes sweating with consequent discomfort and slipperiness of the hands.

From the standpoint of durability, of course, leather has always been recognized as the ideal material for linemen's gloves; but how to render it sufficiently

INSULATING GLOVE

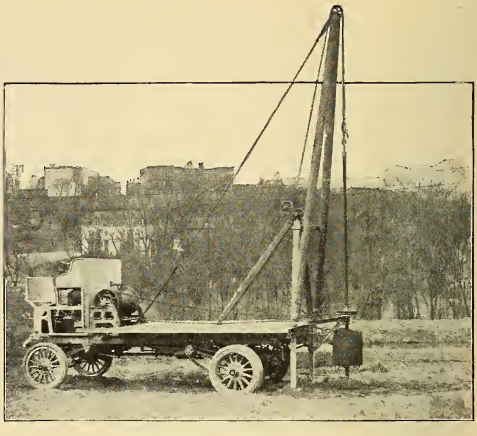
resistant to high voltage currents became a question which for years was a puzzle to tanners and scientific experts.

Now, however, success is announced in producing a leather, called Rezistol, which has not only unusual wearing qualities but also a very high degree of resistance. The gloves made from this leather bear the same name and are now on the market.

Very thorough resistance tests have been made on these gloves and they indicate that what is a new and very valuable insulating material for other purposes has been discovered.

Brain versus Brawn

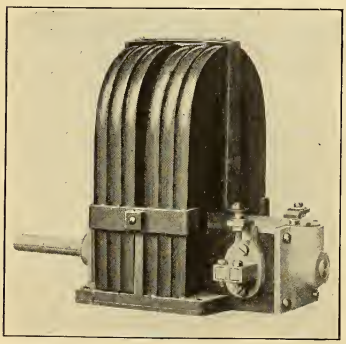
The digging and setting of telephone and electric light poles usually requires the services of nine men and a foreman at an average cost of about $42 per day for the erection of ten poles. With the apparatus illustrated, which can be used both as a derrick and a power driven pole hole digger, the setting of 20 poles per day with the services of five men is a fair average. The truck is gasoline driven with the transmission gearing arranged to operate either the windlass or the truck.



POWER DRIVEN POLE HOLE DIGGER

Electric Speed Indicator

The desirability of knowing the speed of vehicle, machinery, or shafting at any time, is something that is now generally understood in every branch of industrial work. The electric speed indicator here illustrated consists of a Holtzer-Cabot magneto generator, a form of small dynamo, and used in conjunction with a Westinghouse measuring instrument. The magneto is attached to a pulley or shaft of the apparatus the speed of which is to be measured, and since the voltage of the magneto generator is proportional to its speed, the meter which is properly calibrated indicates the speed directly at any time. When operating at 1,000 revolutions per minute; the magneto generates 25 volts so that the meter may be calibrated for any unit, as revolutions per minute, cycles per second, percentage fast or slow, or feet per minute.



MAGNETO WHICH OPERATES A SPEED INDICATOR

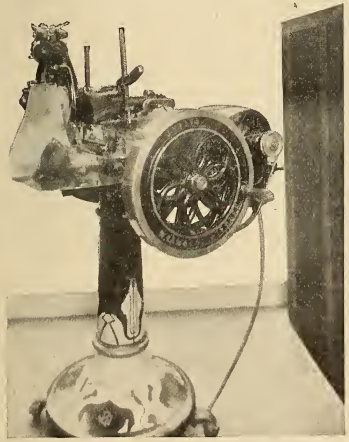
On account of the ease with which these indicators may be adapted to the many types of machinery, they find a wide field of application. The meter may be mounted some little distance from the magneto generator, so that it is possible to locate a number of the meters in one place, for those in charge to note the efficiency of the work in the various departments at any time. In connection with newspaper presses, the application is to note the number of copies being printed at any time or the total number of an edition.

A comparatively new use of speed indicator is for determining the speed of

trains or electric cars. The indicator may be attached to the axle and, if the meter is adjusted to prevent jar, this will give excellent results.

Meat Slicing Machine for Butchers

The V. B. P. slicer, as it is named, is used to slice dried beef, bacon, boiled ham and all kinds of boneless meats, producing a perfect slice of uniform thickness all the way through. A change in thickness can be made in a second by a single adjustment. Anyone who has ever had to remove rind from bacon knows how difficult it is to do it without waste. An attachment on this machine removes rinds at the same time that the slicing is done. One motion on the slicer



ELECTRICALLY OPERATED MEAT SLICER

simultaneously removes the rind and does the slicing, resulting in a saving of time and meat. It is a great time saver for the butcher.

The knife is a finely tempered disk with a razorlike edge which is maintained by a patented automatic sharpener. The work of sharpening requires only a few seconds. To prevent any accidental contact with this sharp knife, an efficient knifeguard is provided, which affords protection to the operator and renders the machine safer to handle than the butcher's knife.

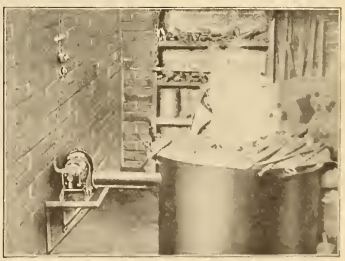
The sanitary features have not been overlooked and close examination will reveal no crack or crevice of the machine where small particles of meat or dirt can lodge.

The machine has a normal capacity of approximately 50 slices per minute, though this can be varied to values either below or slightly above if desired, though the higher speeds are not recommended. Sixteen different thicknesses of slices are provided for by single adjustment which may readily be made by the operator. The motive power of the machine is a one-half horsepower Westinghouse motor.

A Forge Blower

The blacksmith who uses only a single fire may still profitably use electric current in connection with the blower. A small motor taking no more current than the ordinary incandescent lamp may be used in conjunction with a small centrifugal blower and arranged as shown in the illustration. No levers, belts or gears are required.

It is maintained that the electric forge-blowers are of high mechanical efficiency and hence have small current consumption. They are also quiet running, while the "howl" of the ordinary blower is



FORGE BLOWER

almost unbearable. At the same time they provide a larger volume of air at ample pressure and produce quick and hot fires because of perfect combustion of fuel in the fire bed.

Pressing-Iron Economy

Many people forget when comparing ironing by electricity with the old way that three-quarters of the heat that

THE GAS STOVE WASTES HEAT IN ALL DIRECTIONS

HEAT IS GENERATED WHERE IT IS NEEDED IN AN ELECTRIC IRON

should go into the old type of iron escapes from the stove into the air. Graphically this waste is presented to the eye in the illustration, and in hot weather is emphasized more thoroughly when either the cook stove or gas stove used for heating the iron brings the temperature of the room to an uncomfortable point.

With the Princess electric iron the heat is made within the iron, exactly at the point needed, with no loss of heat, no heating of the rooms, no walking between board and stove.

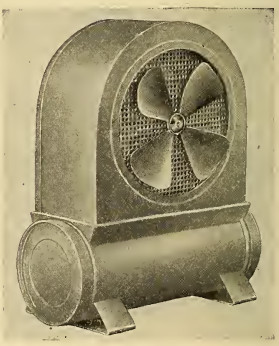
The heating element is constructed of Nichrome ribbon wire wound on mica and sealed between sheets of the same material. It lies inside flat on the face of the iron, applying the heat where needed. Three minutes after turning on the current the iron is ready for use. The handle is large, is shaped to fit the hand and has an ebonized finish. The cord is detachable at the iron by a simple pull of the free hand. The plug making this connection is encased in metal and when attached is held firmly in place by a metal sleeve, removing all strain from the terminals.

Electric Perfumer and Disinfector

Have you ever stood among the pines in their native forest after a rain storm and noticed how cool, clean and refreshing is the air?

Would you like to sit in your own home or office and breathe the same "forestized" air, or enjoy the same privilege when you go to the cafe, hotel, club, lodge room and similar places of assembly?

The accompanying illustration shows a device designed for bringing about this



ELECTRIC PERFUMER AND DISINFECTOR

pleasant state—the Glendale electric perfumer and disinfector. The fan, obtaining power from a dry battery contained in the base, is surrounded by a perforated metal receptacle containing a wick which

can be saturated with any desired perfume, the odor from which is emitted immediately upon turning on the current. Oil of pine needles, lilac water and menthol, formaldehyde and spirits of cologne are some of the liquids used.

Kerosene Torch

The gasoline torch has gradually become a luxury on account of the increasing the price of gasoline. Inventors have

KEROSENE TORCH MUCH USED IN RAILWAY WORK

therefore turned their attention to the production of a torch that will operate effectively, using kerosene.

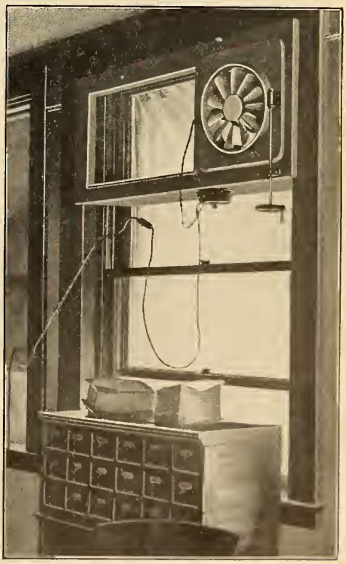
The Hauck heater, in a large size, is shown in the illustration. This tool is used by electric railways in rail bonding, brazing and in other heavy work. It consists of a seamless steel tank, equipped with hand air pump, pressure gauge, twelve feet of oil hose, a patented burner which can be used with kerosene oil as fuel, with a pressure on the tank of from 25 to 50 pounds. The flame is steady, giving intense heat, without smoke or smell.

Small hand torches operating on the same principle are also made.

An Office Ventilator

This office ventilating fan is designed to be placed in the top sashes of windows or in transoms and at slight expense. It includes a 12½ inch Ventura fan with a cast iron housing. The fan is driven by a motor which is adapted to run from a connection to the light socket.

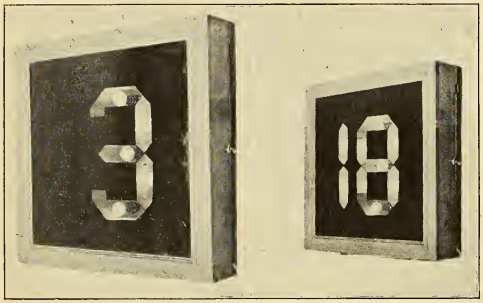
An ingenious reversing mechanism makes it possible to discharge the air straight ahead, upward toward the ceiling, downward toward the floor or at any intermediate point. Pure, invigorating air introduced under slight pressure can be supplied at will without direct draft or directly onto occupants. A simple turn of the hand wheel, seen in the illustration, reverses the outfit so that it exhausts from the room, thus providing for absolute ventilation by complete air change.



OFFICE VENTILATOR

New System of Electric Number Signs

The new Mickelwright number indicator, an English idea, is intended to show illuminated numbers by electric lamps in a much more economical way than usual, as it uses but ten lamps for each figure. Supposing a single figure, which gives any number from 1 to 9; this requires only eleven wires to be connected from the sign to the controlling switch. Usually a figure display is made up of a much greater number of lamps and the wiring is more expensive. One of the single figure indicators is illustrated and it is made up of small metal reflectors containing the lamps, the whole being enclosed as usual in a box with a colored glass panel in front in red or green glass. In another view is the two figure pattern with the figure 1 on the left and the variable figure from 0 to 9 on the right, so arranged as to show the figure 8; 19, 13, 12 or any other number of two figures can be shown by properly switching the lamps.



NEW ELECTRIC NUMBLR SIGNS

In this case only twelve lamps are used for the whole. Such indicators are useful in music halls or moving picture theaters to show the program numbers, in public dance halls, also in restaurants for orchestra numbers. Railroads use them to show train numbers, and they are also employed by omnibus and tramway lines. The small cost of these indicators will probably favor their more extensive use.

General Utility of the Modern Searchlight

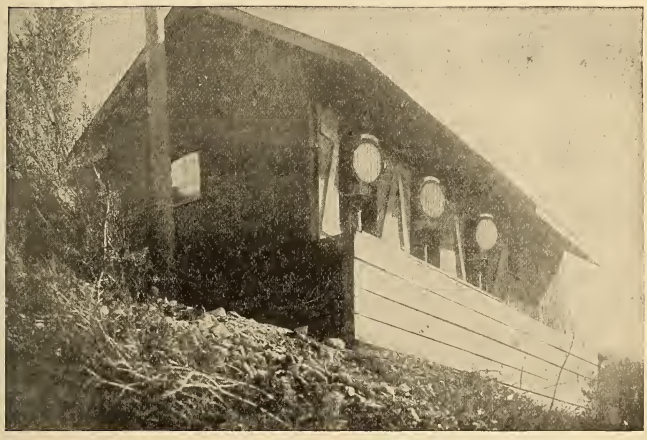
Prominent among the industrial applications which have lately proved the utility and worth of the searchlight projector may be mentioned the installation at the mine of the Telluride Company, at Telluride, Colorado. Here, five lights ranging in size from nine to eighteen inches have been used with success

STEAM SHOVELS WORKING BY SEARCHLIGHT—UTAH COPPER COMPANY

for illuminating cars, workings and approaches to the mines, as well as to facilitate night work, to guard the trails and roads to the mines and mills and the approaches to the power plant.

The Utah Copper Company's mine in Bingham Canyon, Utah, was originally worked as a placer gold camp, then as a ground silver lead proposition and has finally developed into the largest low grade copper mine of its type in the world. In 1906, the work of mining with steam shovels was commenced. The terraces extend outside the canyon for a distance of 1,500 feet.

It is obvious that economical management of an industry of such magnitude requires its operation by night as well as by day. The problem of adequate night illumination, however, was one not easily solved. Electric lights, either arc or incandescent, as ordinarily installed for illuminating purposes, proved impossible because the ore and low grade porphyry is broken from the terraces by blasting before loading into the cars. Arc and incandescent lamps were so frequently shattered by blasting, and by falling and flying rocks that they were found impracticable. In the fall of 1909 three eighteen inch searchlights were installed in a house on the opposite side of the canyon, distant about 1200 feet from the workings, and have been in successful operation ever since. During the loading period the shovel is "picked up" by the searchlight, which follows it during its movements.



BATTERY OF THREE, EIGHTEEN-INCH SEARCHLIGHTS AT THE STEAM SHOVEL WORKINGS OF THE UTAH COPPER COMPANY

Photographs of the novel use of searchlights as depicted in the accompanying illustrations were obtained through the courtesy of the General Electric Company.

"When Benjamin Franklin wandered into the limelight with a loaf of bread tucked under his arm, he never could have dreamed that the mysterious electricity he was to bring to earth with his little kite would one day be made to mix dough and bake the bread, but that is what has happened."

A Regulating Socket

The Wirt regulating socket is nothing more or less than a little rheostat for dimming lamps or regulating the current to small motors as, for instance, those used in connection with massage vibrators. It is constructed with a thick brass shell with threads at one end for screwing into the lamp socket and interior threads at the other for receiving a lamp or a plug from the motor. Resistance wires are contained in this shell. Adjustment is made by turning the milled fiber ring shown in the illustration; turning it one way causes the light to grow dim or the motor to run slow. Turning it in the opposite direction has the opposite effect.

REGULATING SOCKET

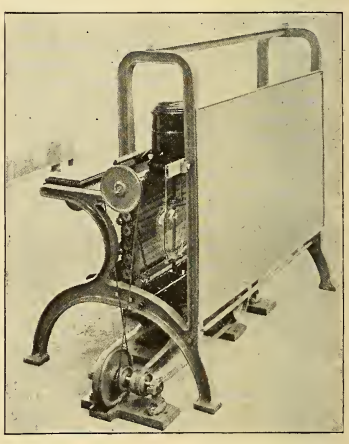
For the Man who Shaves Himself

The man who shaves himself appreciates a light that can be properly arranged with reference to his face and the mirror. The device shown in the illustration is made to meet this need. On account of its unique construction the lamp and mirror may be conveniently adjusted. In case one desires to sit down while shaving, the lamp and mirror are made up to set on a table or stand.

SHAVING MIRROR AND LIGHT

English Blue-Print Machine

The accompanying illustration represents an improved English model of continuous blue printing machine. It will copy tracings of any length in one piece, while small tracings can be fed into the machine one after another and side by side, thus saving the time occupied in loading and unloading a printing frame and reducing the cost of paper.



BLUE-PRINTING MACHINE WITH TRAVELING ARC LAMP

The floor space occupied is small and the simplicity in construction and simplicity in working are most desirable. The tracing and sensitized material can be fed into machines at table height while all operations, viz., the feeding in of tracing and sensitized material and the taking out of copies, can be performed without stopping the machines.

The single arc lamp travels backwards and forwards across the view plate.