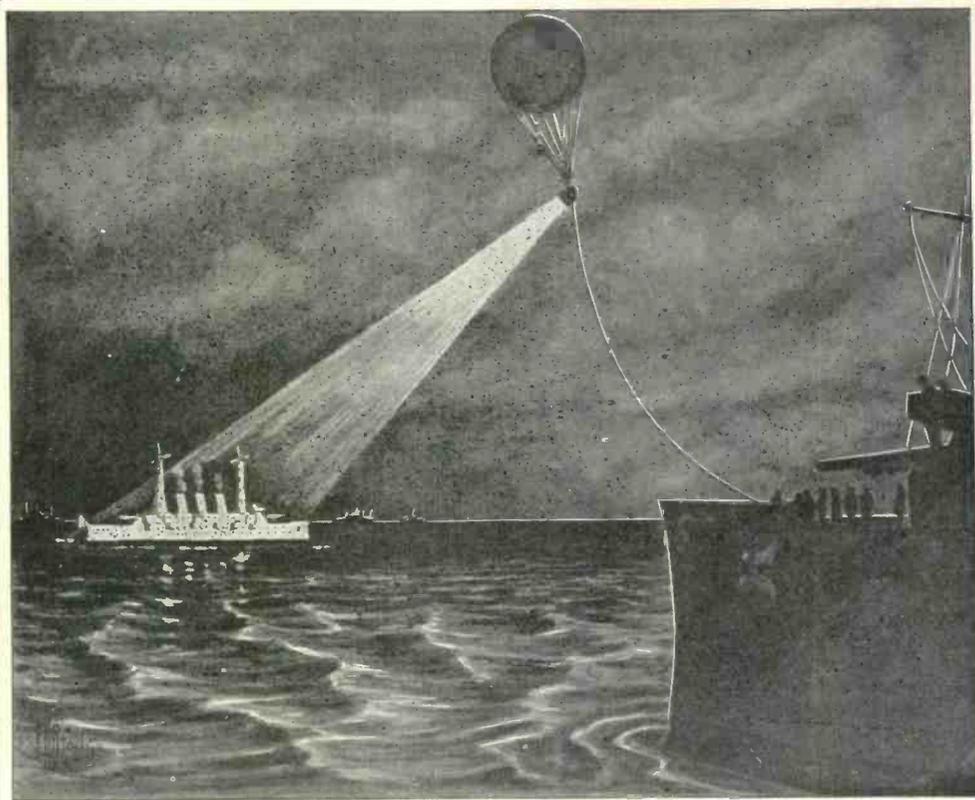


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Vol. III

MARCH, 1911

No. 11

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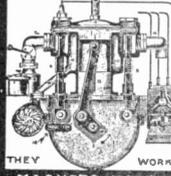
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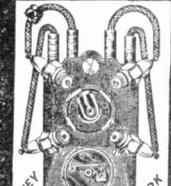
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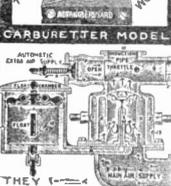
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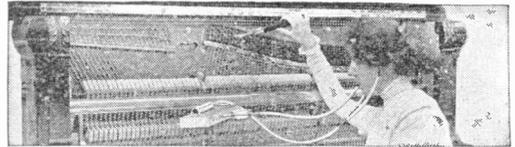


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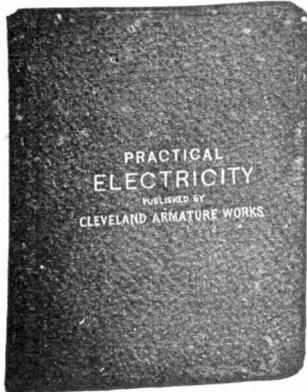
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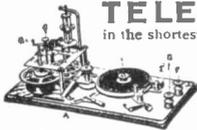
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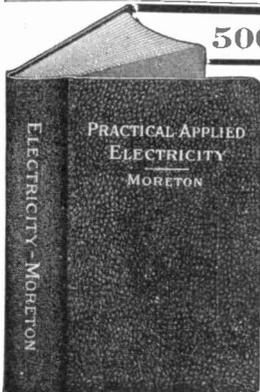
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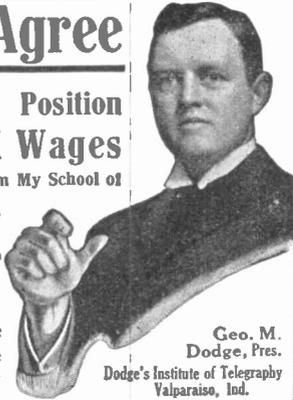
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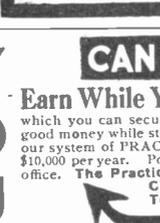
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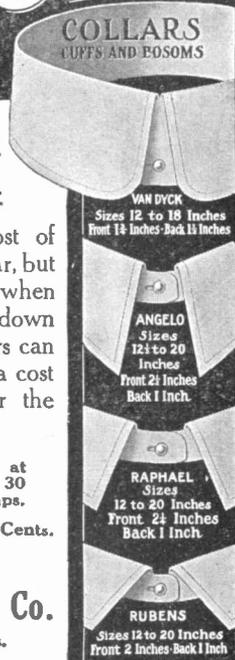
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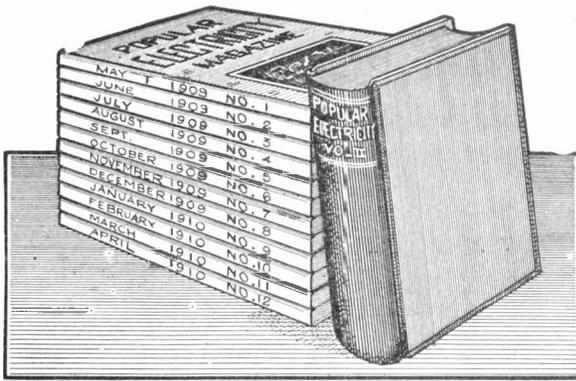
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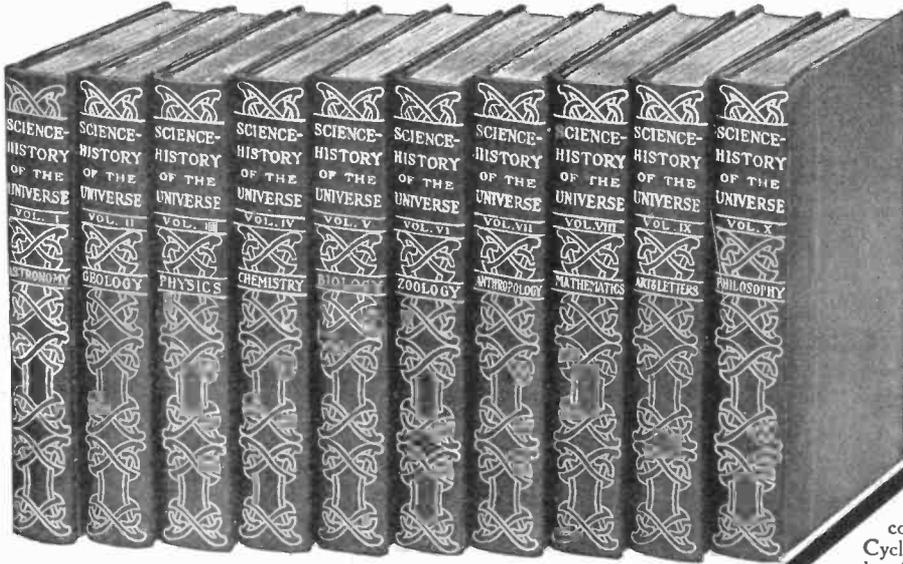
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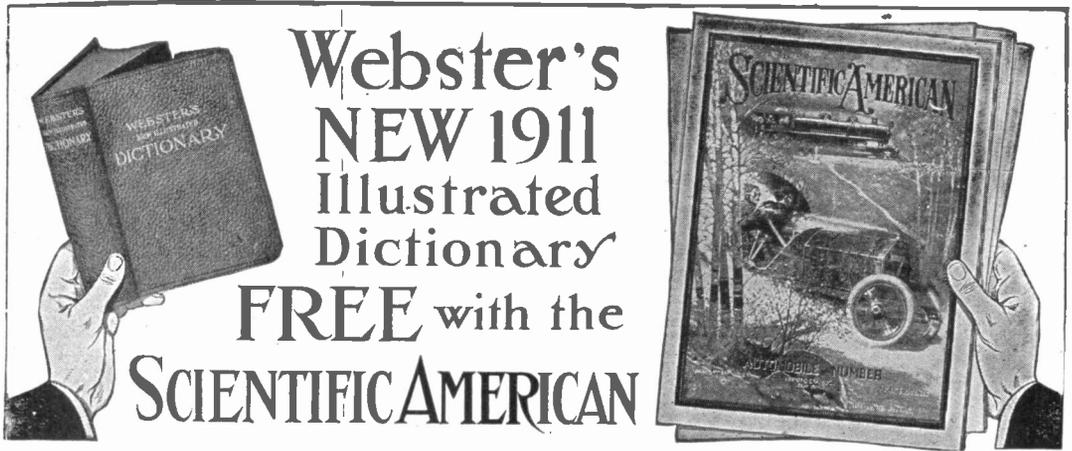
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POPULAR ELECTRICITY

IN PLAIN ENGLISH

HENRY WALTER YOUNG, Editor



Vol. III

March, 1911

No. 11

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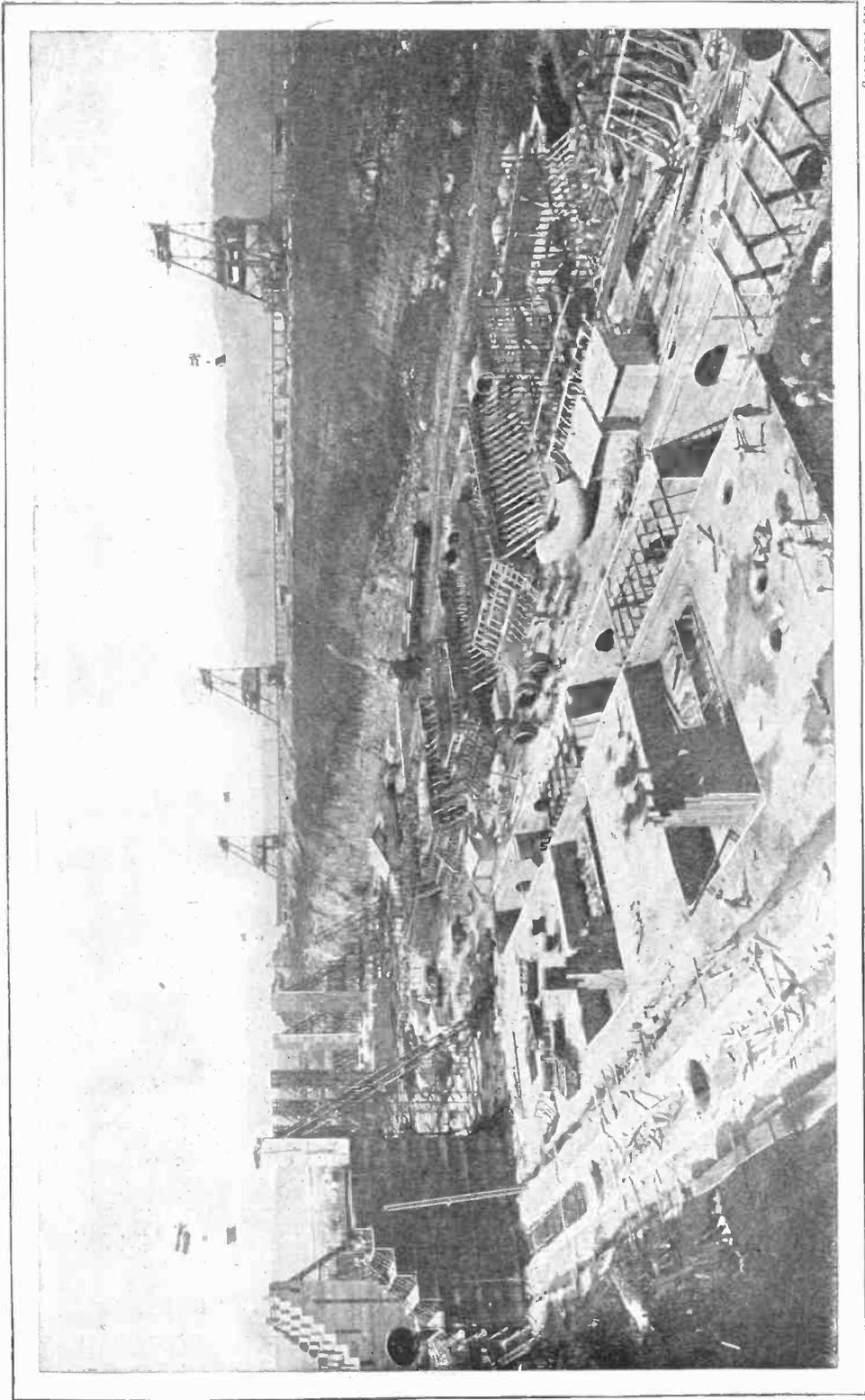
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See page 326

FIG. 8. AERIAL BUCKETS CARRY THE CONCRETE TO ITS FINAL RESTING PLACE

Popular Electricity

In Plain English

VOL. III

MARCH 1911

No. 11

Electricity as a Builder of the Gatun Locks

By EDWARD SCHILDHAUER

Mr. Schildhauer, as Electrical and Mechanical Engineer of the Isthmian Canal Commission, is to be credited with the design and execution of those methods by which electricity has been permitted to enter so largely into the accomplishment of the stupendous task which American brains have now carried well within sight of completion. Mr. Schildhauer and Mr. Ernest Eugene Lee, Assistant Electrical and Mechanical Engineer, have jointly prepared a complete detailed account of the electrical and mechanical work thus far carried out, as a thesis for their Master Degrees in Mechanical Engineering from their Alma Maters, the University of Wisconsin and Iowa State College, respectively. Although the thesis contains a wealth of valuable engineering information, it is of course, too elaborate and technical to be published in its entirety in a popular magazine. Therefore, Mr. Schildhauer has kindly consented to give to the readers the following article, based on the thesis, but in Plain English.—Editorial Note.

One of the contributory causes for the triumph of the modern, American engineer over his less fortunate French brother in the digging of the Panama Canal has been the rapid advance made in engineering and construction methods since the days of DeLesseps. It is questionable whether, even with proper management, the French, with the machinery and methods then known could have pushed the work to completion. But methods have changed in recent years and not a few of these changes have been brought about

by a knowledge of the applications of electricity.

Although electric current is used in every department of the huge undertaking in the Canal Zone, it is at the famous Gatun dam and

locks that its aid is most important in carrying on the work. There new problems came up which never before and perhaps never will again demand the attention of engineers, and nowadays when original problems arise the engineer turns almost instinctively to its magic for the ways and means for delivering him from his dilemma.

A glance at Fig. 1 will show to the reader the relative locations of the immense dam, locks and spillway and the scale on the drawing will convey to the imagination

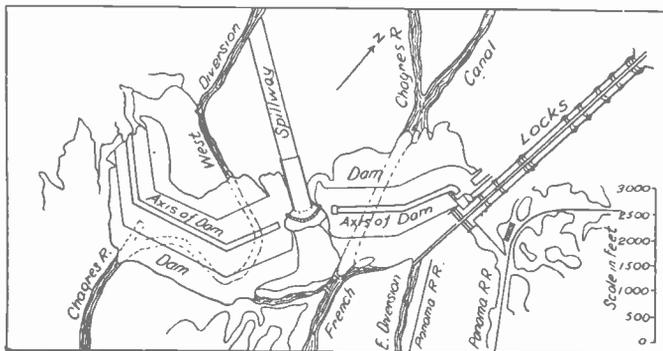


FIG. 1. SHOWING THE RELATIVE LOCATIONS OF THE GATUN DAM, LOCKS AND SPILLWAY

somewhat of an idea of the size of the task in hand. The locks, spillway and a small part of the dam are of concrete construction and it was the economical gathering

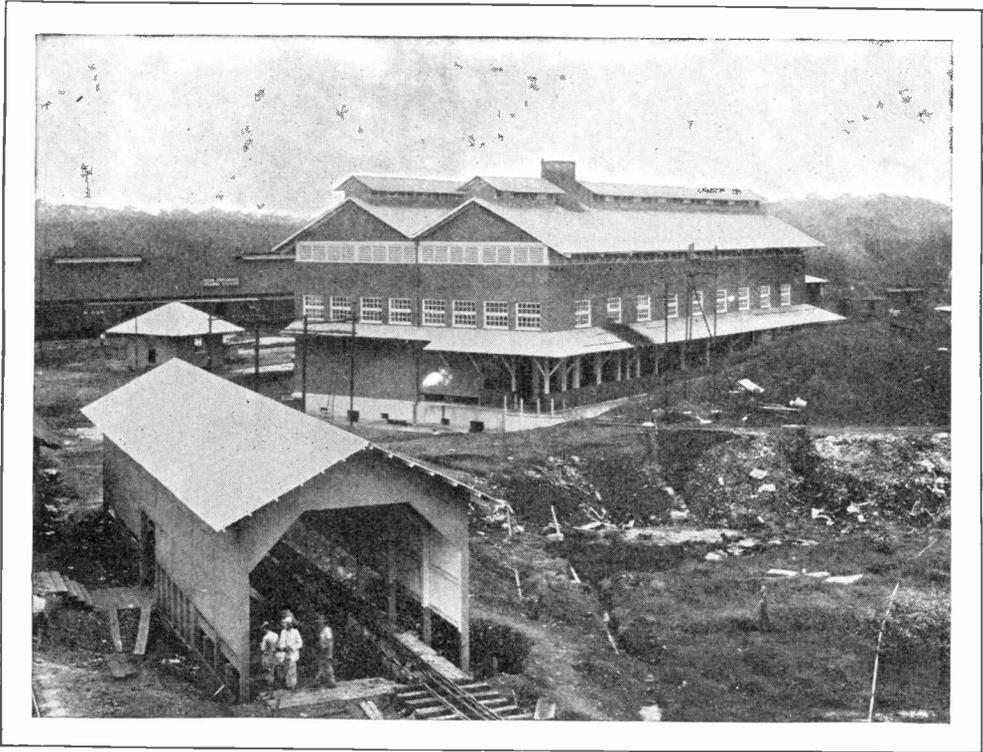


FIG. 2. ELECTRIC POWER HOUSE OF THE GATUN CONSTRUCTION PLANT

and mixing of the concrete materials and the final transportation of the concrete itself to the various parts of the work that taxed the ingenuity of all concerned, for it must be remembered that this is no ordinary job of concrete construction but involves the building of veritable mountains of artificial stone.

These things made necessary what is known as the Gatun Construction Plant, a vast industrial institution which will have been built, served its usefulness and been dismantled all in the short space of five years. Briefly, then, the object for which the Gatun construction plant was designed and built was primarily to unload, transport and mix the ingredients for concrete, and to place them, as used in the construction of the floors and walls of the lock chambers of the Gatun locks, and further, to transport the material used in the hydraulically filled portion of Gatun dam. The entire plant is essentially an electrically driven one, with the exception of the dredges and two auxiliary mixers. The system also includes the steam generating station and substation, which furnish, in addition to the current for lock and dam construction, current for various

municipal purposes in the towns of Colon and Gatun.

In the design of the construction plant nine elements were to be considered: An electrical generating plant; rock and sand unloaders; cement cranes and cement storage; automatic electric railroad; concrete mixers; electric industrial railway; concrete depositing plant; lock wall forms, and the Gatun dredging plant. These separate elements will be taken up and their operation and relation to the other elements explained.

GENERATING STATION

Although it was to have a useful existence of only five years, the electric power plant was built with every modern feature and accessory including steam turbines. Fig. 2 is an exterior view of the commodious building in which it is housed. The building is the only thing about the plant suggesting its temporary character and is quite different in appearance from the substantial brick structures which we are in the habit of seeing in the temperate zone. The interior has every appearance of the modern power station, as shown in Fig. 3. Ranged along

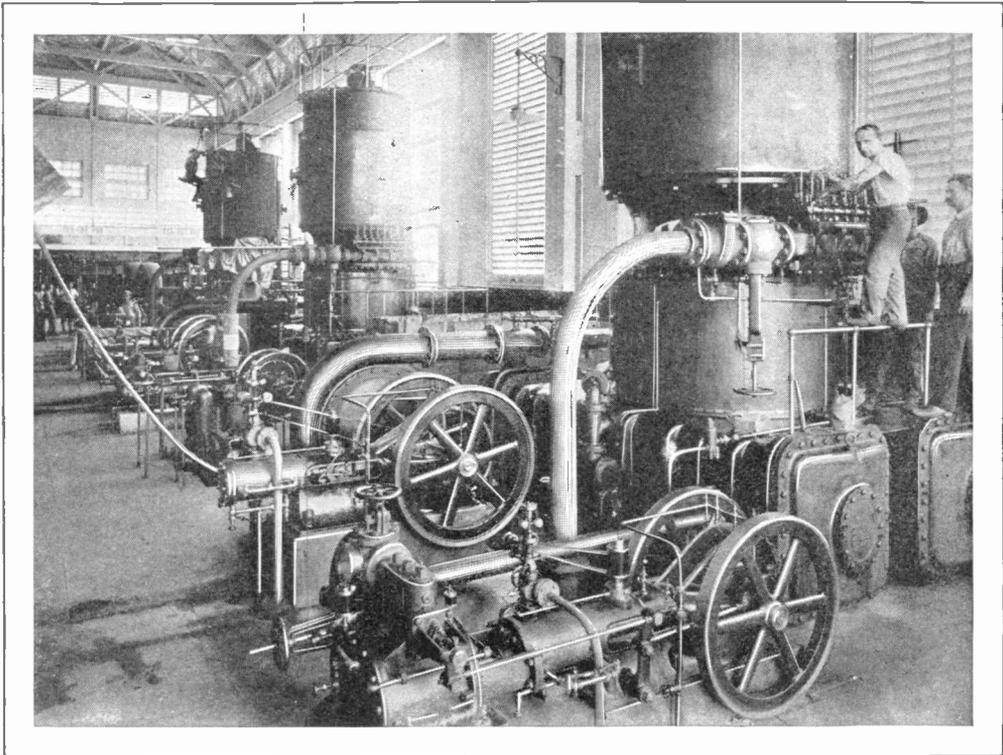


FIG. 3. THREE STEAM TURBINE GENERATORS IN THE GATUN PLANT, EACH CAPABLE OF DELIVERING 2,000 HORSEPOWER OF ELECTRICAL ENERGY

the side are the three vertical steam turbine generators of the Curtis type, each one capable of delivering 1,500 kilowatts or a little over 2,000 horsepower of electrical energy. An idea of the intricacy of the plant is obtained from Fig. 4, a view taken in April, 1909, before the concrete floor of the generator room was laid. All the maze of pipes, running in every direction, are electrical cable conduits through which the wires and cables leading to and from the generators and their auxiliary apparatus are drawn.

With this brief glimpse into the manner of generating the electrical current, let us pass on to some of its innumerable applications.

ROCK AND SAND UNLOADERS

The rock and sand which go into the making of the concrete for the giant monoliths which form the locks are brought to the site in barges. They enter a slip 600 feet from the great storage pile and then not a human hand is laid to the materials until they are in place as concrete. The slip, with its barges, and the storage pile are

parallel with each other. On the side of the slip opposite the storage pile is a double track, two rails to each track. On the opposite side of the pile is a similar double track. On these tracks are operated traveling towers with two main cables stretched between each pair of towers, which, with auxiliary cables constitutes a duplex cableway. Great grab buckets, with a capacity of two cubic yards each, operate along these main cables. With precision a bucket drops down into a barge, seizes its mouthful of rock or sand and then up and away it goes across the cable to deposit its burden on the heap of stored materials which is almost a small mountain.

The equipment is entirely electrically driven. All the operating machinery is mounted in the head towers, under the vigilance of one attendant, but remotely controlled, the operator being stationed 800 feet away on the tail tower, so as to obtain a perfect view of the barge. Hoisting and traversing motions are obtained by independent auxiliary cables, each driven by an independent motor.

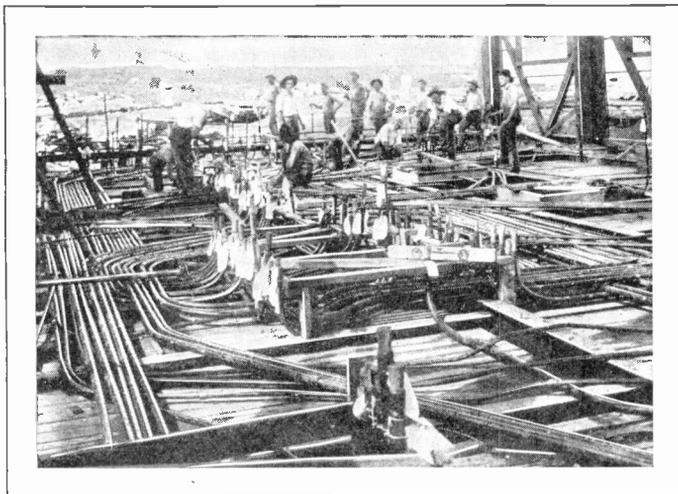


FIG. 4. SOME INTRICATE WORK IN CONSTRUCTING THE POWER PLANT—CONDUITS FOR WIRES AND CABLES

One strand of a duplex cableway is capable of unloading and transporting to the storage piles 60 yards of rock per hour, the traveling speed being 1,600 feet per minute. A single cableway is used for sand unloading and two duplex, for rocks.

That the plant may operate continuously, each main cable is illuminated at night by one eighteen-inch searchlight projector, installed on the tail tower.

The rock crushing plant is located 24 miles from Gatun at the old fort of Porto Bello, which may be remembered as one of the oldest Spanish-American forts, destroyed by Morgan, the buccaneer. During the months of November and December, severe storms occur on the Carrilbean, lasting from one to ten days, in which no rock barges can navigate. During this time the stock pile is appreciated, as this is the only source from which rock may be obtained to carry on the work.

CEMENT CRANES AND CEMENT STORAGE

The cement storage is on the side of the slip opposite the unloading tail towers. The building is a frame

structure, divided into ten bays, each one of which is equipped with a crane having a span of 47 feet and a run of about 100 feet. The roof projects beyond the face of the dock to provide protection from rain, in unloading barges, and on these cantilever roof trusses the cranes run directly over the barge. The capacity of the cement storage is about 100,000 barrels.

On the main floor of the storage and on the side opposite to the unloading dock, there are 30 cement hoppers covered with stable steel screens into which the

cement barrels or bags are emptied at the rate of 2,500 barrels per day. The charge of cement is measured by the barrel or bag in the hoppers, which have two-barrel capacity. The cement is drawn thence to cars passing under the hoppers. The empty barrels are taken by a conveyor running longitudinally with the building on the main floor and discharged a short distance from the building on a fire heap. To expedite the unloading of the cement steamers making delivery, the building is profusely illuminated, so that night

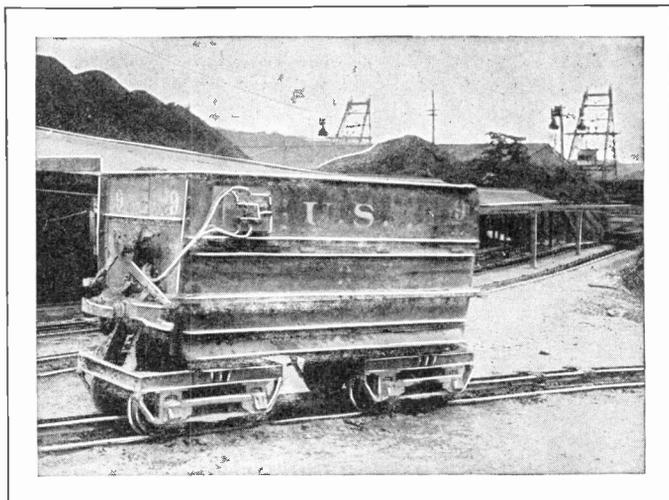


FIG. 5. AUTOMATIC ELECTRIC CARS FOR TRANSPORTING CONCRETE INGREDIENTS

work can proceed with almost as much celerity as by daylight.

We have now gathered the sand, rock and cement in their respective places of storage and all ready to be mixed into concrete for the lock walls. The next step is to convey these materials to the mixing plant and here again the recourse is had to electricity in the form of an automatic electric railroad.

AUTOMATIC ELECTRIC RAILROAD

The distance from the rock, sand and cement storage to the mixer building is over

hoppers, where all cars run on a common track. The double-looped track mentioned passes under the stone and sand storage pile through tunnels. The tracks are separated considerably for sake of greater storage capacity. The cars travel in a counter-clockwise direction, receiving first cement, then sand and rock. In the event of a blockade on one track, cars can be operated over the other. One track only is required for full plant capacity.

Fig. 5 is a view of one of the automatic electric cars. It is of the side dump type,

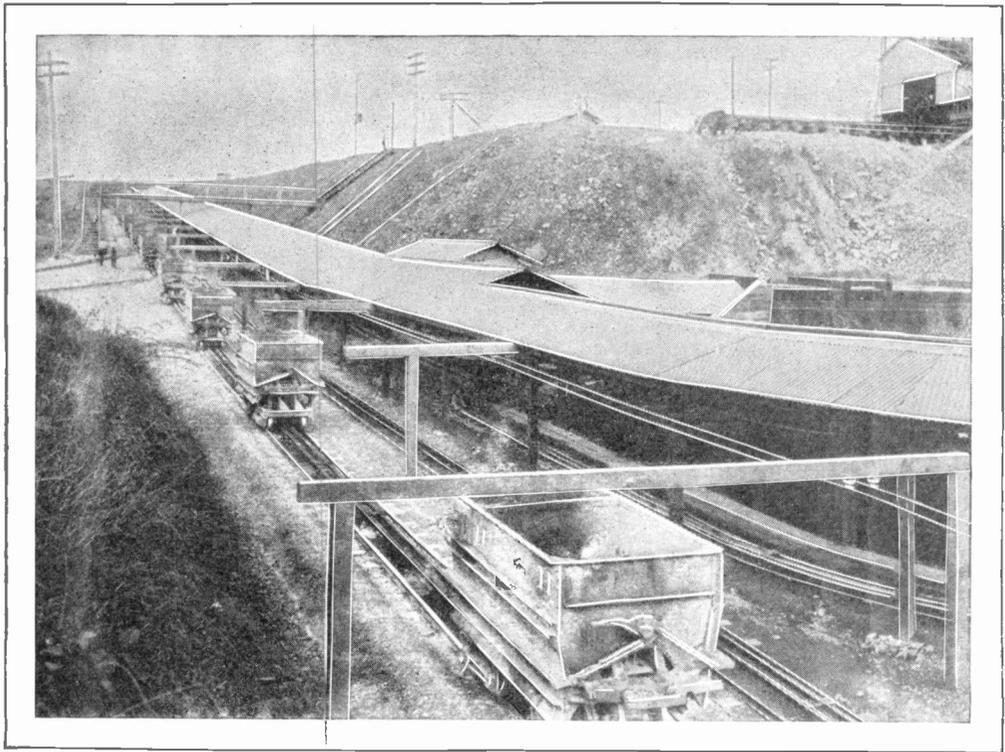


FIG. 6. AUTOMATIC CARS IN OPERATION—NO CHANCE FOR A MOTORMAN HERE

2,000 feet, and the latter is 61 feet higher. The automatic electric road transports the concrete ingredients from storage to the mixer building. The road is automatic, inasmuch as the cars run without attendants. The cars are stopped, charged and started by the attendants at the respective storages.

In a similar manner the cars are emptied after arrival at the mixer building into charging hoppers above the mixers. The track from storage to mixers and return is a closed loop, and double-tracked excepting over the mixer charging hoppers and under the cement

operated by two $7\frac{1}{2}$ -horsepower motors taking current through two third-rails located in the middle between the track rails. It is a curious sight indeed to see these little cars travel along their narrow gauge track up and down grade without motorman or attendant of any kind. On the return trip they have a steep grade to descend and curious as it may seem to the layman they are made to do work while coming down empty.

On coming down this ten percent grade, as shown in Fig. 6, the wheels of the cars turn the motors instead of the motors turning

the wheels. The motors being rotated by external power then become dynamos (for a motor and a dynamo are practically the same thing) and pump current back into the line.

The speed at which the cars travel is about 300 feet per minute and ordinarily they operate at intervals of about 50 feet.

CONCRETE MIXING PLANT

The mixing plant consists of eight 64-cubic feet capacity cubical mixers as shown in Fig. 7. The mixers are driven in sets of two, from a jack-shaft. There are four jack-shafts, which are each directly coupled to a 75-horsepower motor, and the mixers are belt driven, having a tight and loose pulley.

The material from the hoppers above is admitted to the mixers by means of a segmental valve. This valve, together with the water supply valve and dumping lever are all controlled by the attendant on the mixer floor. The quantity of water supplied is automatically measured.

The elevation of the mixers is such that the mixed material can be dumped into the buckets on the industrial railway flat cars, while on their normal track elevation. This industrial railway, a portion of which is seen in Fig. 7, makes the last long haul of the concrete to the site of its final resting place, the locks, where, for all we know, it may rest for centuries to come. The distance from the mixers to the lock cable ways may be as great as 2,000 feet in either direction, depending upon the stage of the work.

There are four tracks, each one of which will run to both ends. This amounts to a double track in each direction, and allows great freedom in the movement of trains. The general method is to run the trains in

circuit. To insure minimum maintenance of road bed and minimum work about the third rail conductor, the roadway is ballasted with crushed rock from nine to twelve inches in thickness. The trains consist of two flat cars and an electric locomotive, each flat car outgoing having a full bucket of concrete and a place to receive the empty bucket with which it is to return. The car lengths have been so designed that a train may receive two batches of concrete from the mixers at one spotting, the center to center distance of mixers and main cables on towers being equal.

Arriving at the lock the buckets of concrete are ready to be lifted from the cars and dumped at the proper place in the concrete monolith which forms the wall of the lock. This is done by what is called the concrete depositing plant, the

very last link in this chain of interesting events.

CONCRETE DEPOSITING PLANT

This plant is quite similar to the unloading cable ways at the storage yards. It consists of four duplex cable ways, that span the lock site. These spans are 800 feet in length or almost a sixth of a mile. In Fig. 8 (Frontispiece) you can see several of the buckets carrying the concrete to its last resting place and Fig. 9 is a near view as it is dropped into place. In this picture, also, is to be seen one of the immense structural steel forms, which stands vertically to the height of the wall and against which the concrete is packed.

In all, there will be a little over two million cubic yards placed in the forms for constructing the locks at Gatun. It is difficult to form a conception of the dimensions of such a mass, and a few comparisons may

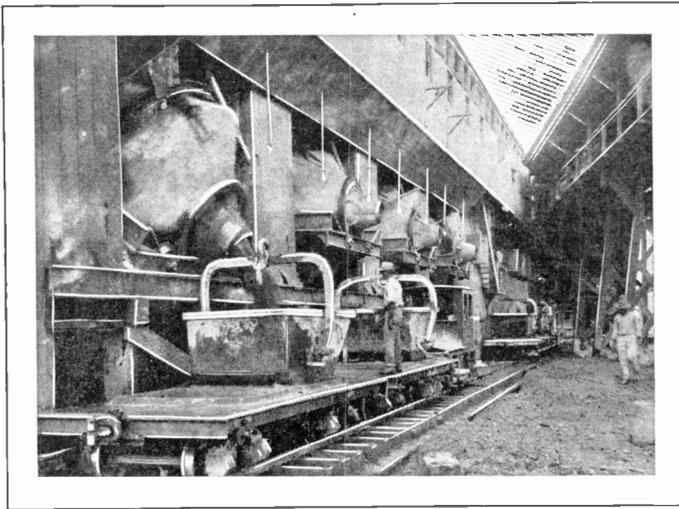


FIG. 7. THERE ARE EIGHT OF THESE CONCRETE MIXERS—64 CUBIC FEET CAPACITY EACH

give some idea of the enormity of the undertaking. If the reader will imagine standing on the far side of the corner of State and Madison Streets, Chicago, surveying one block south to Monroe Street, one block west to Dearborn Street, and an equivalent vertical height, this will form, approximately, the three dimensions of a solid cube of this mass.

Another comparison is to lay a floor about four inches thick, extending over the area included by State Street and one mile west to Halsted Street, and from Madison Street six miles south to Garfield Boulevard. This mass of concrete will also lay an ordinary sidewalk, six feet wide, from New York to San Francisco and return to Chicago.

As to the dimensions of the concrete in the locks, in Fig. 10 is shown a side wall section with its main culvert and a lateral culvert located below the floor level with numerous holes entering the lock chamber through which the water will flow when filling and emptying the locks. To get an idea of the dimensions an ordinary six story office building is shown standing on the lock floor. A standard locomotive is shown in the main culvert and other features for comparison are added.

The final element in the problem of the construction plant as mentioned in the beginning, is involved in the Gatun dam dredging plant. But as this work does not embody features of unusual interest, it will not be taken up in detail.

Now what is all this concrete work for? Why those gigantic walls? The answer is simple, for they embody the same principle as that in canal locks since remote times.

The locks, however, are very much larger than any ever built. The locks at Gatun

may be compared to a stairway of three steps with provision for gates to hold the water at predetermined levels so that the ship is lowered in three successive steps from the lake level, 85 feet above the ocean, to the level of the canal leading to the ocean. This process is reversed for ships going in the other direction. To pass a ship from the lake to the ocean level the upper lock is filled with water even with the lake level. The ship is hauled into the lock by powerful electric locomotives. The upper gate is closed and a large valve in the side culvert is

opened to pass the water from the upper lock to the middle lock. This flow continues until the levels in the two locks are the same so that the ship is at a lower level in the upper lock. The lower gate of the upper lock is opened and the electric locomotives haul the ship to the middle lock. The operations are repeated until the ship is in the canal leading to the ocean.

It is, however, in the magnitude of the work and the special devices for the operation of the gates, valves, etc., that the Gatun locks are different and more wonderful than anything in that line hitherto undertaken.

In conclusion just a word may be said

concerning the gates and their operation, which constitute a unique feature. The gates may be compared to huge doors, swinging on hinges and meeting at an angle in the center of the lock chamber. The largest gate is 65 feet long, seven feet six inches thick and 84 feet high. For comparison, the reader may stand on the seventh floor of an ordinary office building, located on a street which is 110 feet between the building lines and imagine the buildings to be the lock walls. Then suppose that this street

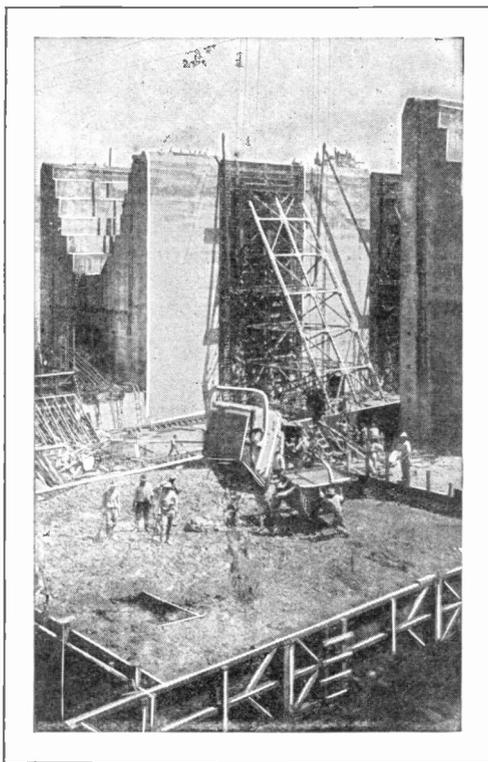


FIG. 9. DROPPING THE CONCRETE INTO PLACE

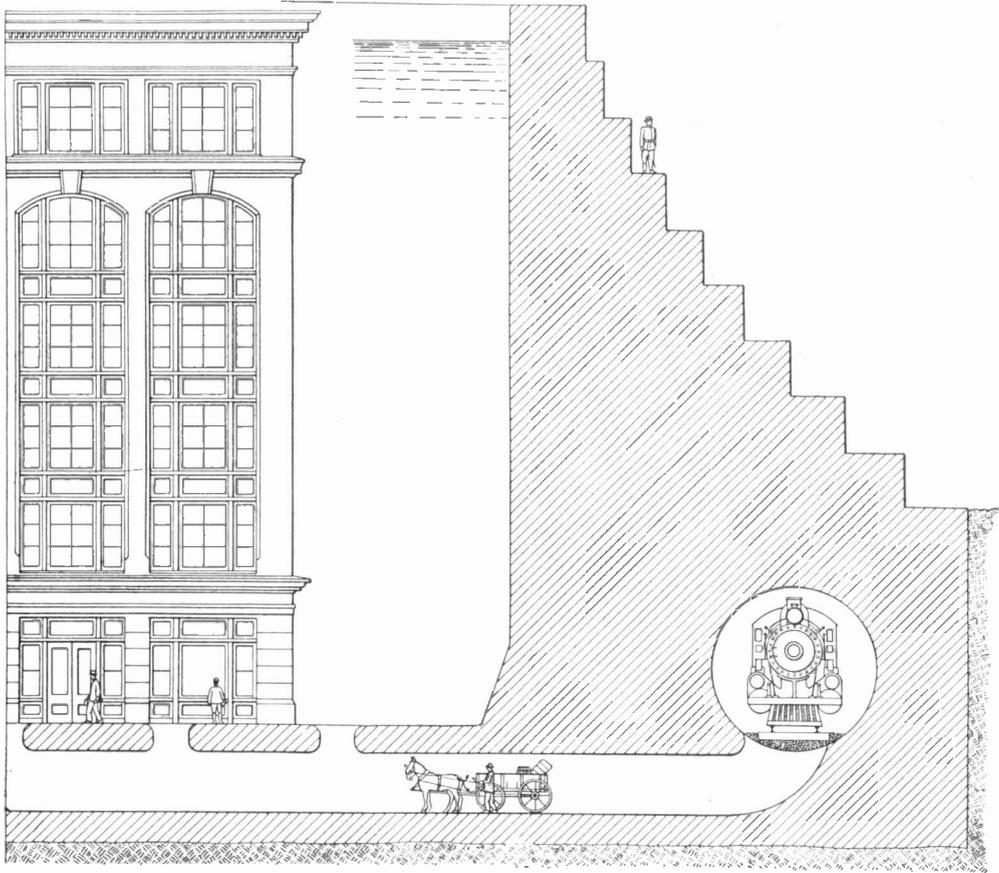


FIG. 10. THIS WILL GIVE AN IDEA OF THE SIZE OF THE LOCK WALLS. THEY ARE AS HIGH AS A SIX-STORY OFFICE BUILDING, AND THE MAIN CULVERT IN THE BASE OF EACH COULD TAKE IN A LOCOMOTIVE

were required to be closed by two huge doors weighing three million pounds in the short space of two minutes. This will convey some idea of what the machine has to accomplish.

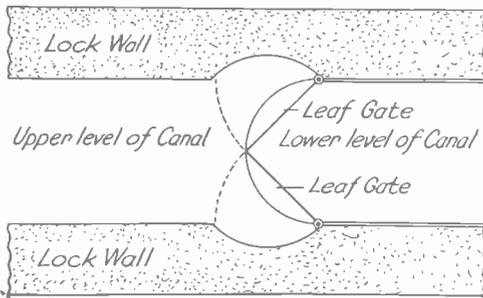


FIG. 11. PLAN VIEW, SHOWING THE PRINCIPLE OF THE LOCK GATES

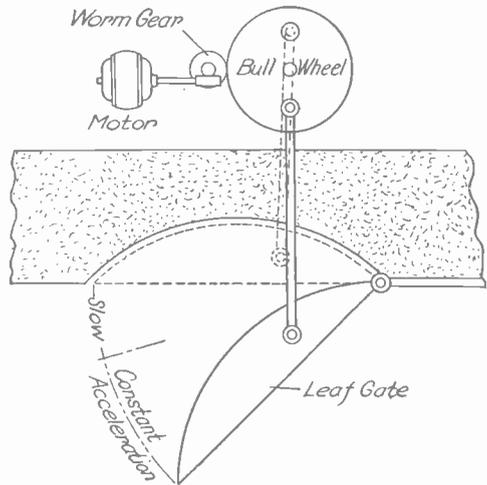


FIG. 12. METHOD OF OPERATING THE GATES

Fig. 11 is a plan view showing the principle. Normally the gates stand as shown. When water from the upper level is let out into the lower level through the culverts and a ship is passed through the locks, the two leaves are drawn back into the recesses in the side walls. This requires considerable power and is accomplished as shown in Fig. 12. A horizontal "bull" wheel is mounted as shown and revolved by an electric motor. An arm from this wheel operates one leaf of the gate. Suppose the gate is to be opened. The motor is started up and revolves the bull wheel at a constant rate. The motion of the gate is slow at first because the connecting arm is almost on a "dead center." This is as it should be for the power required to operate the gate is large when it first starts to open, and consequently the motion should be slow. As the connecting arm gets off from the dead center the speed of the gate accelerates until the pivoted arm gets around toward the opposite side of the path of travel when the speed of the gate begins to decrease. This is also a decided advantage for, as the gate begins to close into the recess in the wall, the impounded water must be given time to escape gradually or else enormous power would be required. If it were not for this ingenious arrangement, a complicated variable speed motor arrangement would be necessary at heavy cost and would not give as satisfactory results. The motors for operating the gates at each system of locks are controlled by one man from a single switch house. Here the operator sits with a little miniature lock and gates in front of him and by the simple movement of a few switches controls the movements of the great leaf gates and the other apparatus in the real lock without ever seeing them, fixing his attention entirely on the model which moves in unison.

Electricity in the Modern Theater

"We could not run this house without electricity," declared the manager of a large new theater recently. "I can scarcely enumerate the many ways in which we use electricity and we can only wonder how we ever got along without it." Not only is electricity used for the general illumination of the theater, but it is relied upon for stage effects of lighting, flame and fire, storm and crash, warmth and benignity, that are sometimes,

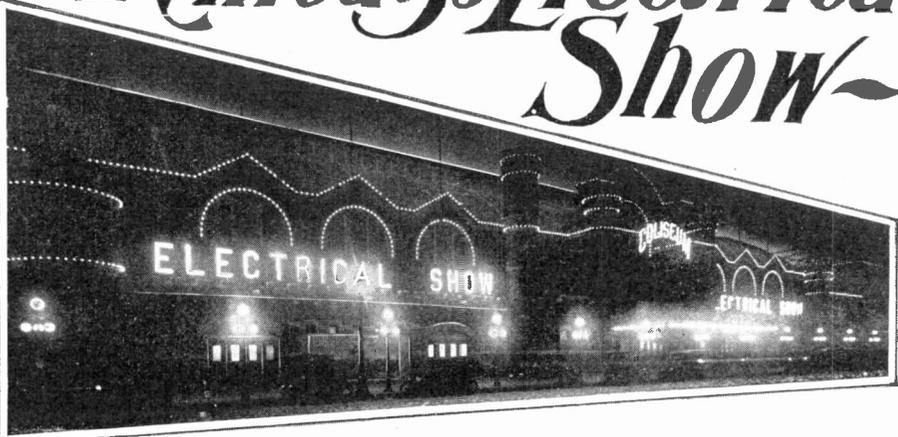
with their easy or rapid gradations, fairly marvelous. The mechanism of many important "acts" and illusions are entirely electrical; the call-boy has been superseded by electrical signals from stage manager to dressing rooms, and heating and ventilation are controlled by electrical means. Even the scrubwomen are provided with base-board attachments so that they can secure sufficient illumination."—*Electrical World*.

Aerial Searchlights

Among the most serious problems of modern naval warfare is that of lighting the enemy's vessels sufficiently at night to make them good targets. If this is done by the ship's own searchlights, the beams from the same will locate the ship carrying them, thus exposing it in turn to the enemy's shot and shell. The really desirable solution would be one that left the enemy entirely in the dark as to the location of his opponent until the devastating shots rained down upon him. For this purpose it has been suggested that the active searchlights be mounted on smaller vessels (such as torpedo boats) which would be harder to hit and not so costly to replace if sunk, but as soon as such smaller boats go some distance from the man-of-war it is difficult to communicate with them without using either lamp signals or wireless messages which may immediately be observed.

A novel substitute for this plan has just been patented in Germany by L. J. Mayer of Metz, the warlike frontier town which Germany wrested from France in 1871. Meyer proposes to mount a powerful electric searchlight in the basket of a captive balloon (see front cover) sent up from the man-of-war. Current would be supplied to the lamp through wires forming part of the cable which holds the balloon in check, while additional wires would operate magnets to rotate the searchlight. The current would not be turned on until the balloon was high in the air, hence its presence would not be suspected until the telltale beam flashes across the high sea and as the wind will usually have carried the balloon far from its master ship, the enemy could not readily judge the location of the latter. At the same time, the lamp basket itself would be too small an object to hit without an enormous waste of shots and by dropping it some distance below the gas bag the exact location of the latter would also be mere guesswork.

The Chicago Electrical Show

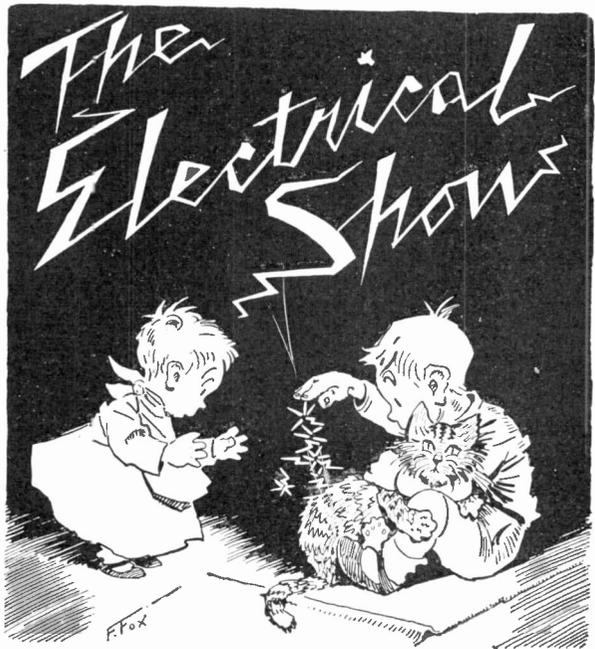


"What won't they do next!" seemed to be the opinion of the thousands that elbowed their way good-naturedly through the Chicago Coliseum during the great Electrical Show. "My but that is some heat" someone would announce confidentially to his neighbor as they stood blinking into the depths of a white hot electric furnace and trying to imagine how long a finger would last if it were stuck into a region of 3,000 degrees Fahrenheit.

"Well, what do you know about that!" was an expression you could hear from almost anyone who had striven and stretched sufficiently to bring into the line of his vision the source of a mysterious rattling and thumping—a giant electromagnet toying with a few hundred pounds of pig iron.

"I just talked to a fellow in New York, and he had the sweetest voice," giggled a High School miss to her companions as she emerged from a telephone booth where visitors were permitted to step up and hear what the human voice sounds like when coming from a thousand miles away.

"I don't care for it. Doesn't taste right, and I know it wouldn't quench the thirst in hot weather," scornfully remarked the gentleman from Milwaukee as he blew across a glass of ozonated water and let it slide neatly down his throat without the least gurgle or confusion. "It ain't got any hops in it," he concluded as he involuntarily wiped a line of imaginary foam from



IMPRESSIONS OF THE ELECTRICAL SHOW AS DEPICTED BY CARTOONIST FOX OF THE CHICAGO EVENING POST

his lips. "You are right friend," replied the demonstrator. "There are no hops, toads, microbes or other animals in this water once it is impregnated by our improved electrical process, with that wonderful and mysterious allotropic form of oxygen known as ozone." "Comes from the tropics does it? Huh! Schlitz is good enough for me," and Milwaukee hurries on to inspect nine orphaned eggs slowly hatching in an electric incubator.

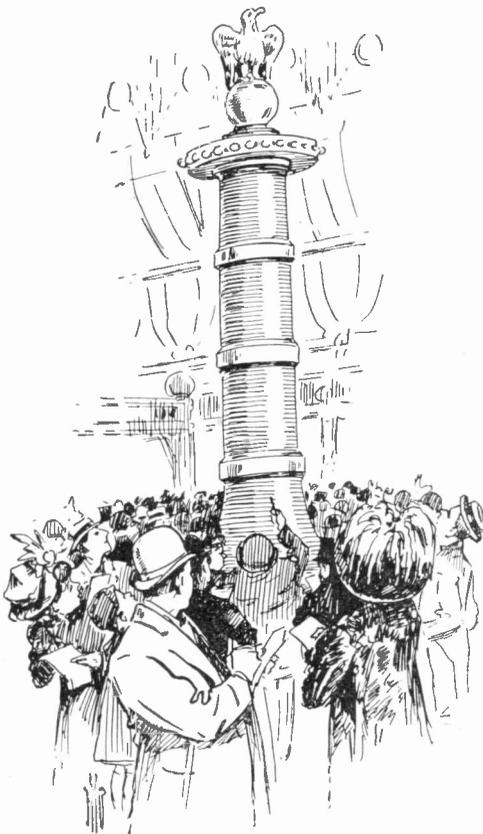
In the center of the great hall stood a pillar three times as high as a man's head and composed of a number of drums wound over their entire surface with copper wire. These drums were diabolically conceived and executed so as to embody every mathematical curve and surface dealt with by mathematicians since the days of Copernicus; including truncated cones, parabolas, circles and a few other things. Given the height of the various drums, the size of the wire and a diameter or two, the problem was to guess the total number of feet of wire so as to win an electric automobile. Some who "never were good at figgers" preferred to make a blind stab at it, one optimistic young lady thinking that seven million feet would be about right. She is doubtless doing her shopping on foot.

Others of a mathematical turn of mind set themselves squarely in the centers of traffic around the pillar and figured from an hour to an hour and a half each. Their expressions were stonelike. These last, when they had arrived at and handed in their answers immediately passed down the line and clambered into electric autos on exhibit and proceeded to familiarize themselves with the steering gear, batteries etc., so as to

be all ready for business when the final result of the contest should be made known.

Finally came some United States government inspectors and figured upon the problem. Their minds becoming confused by its complexity, and having automobiles at home anyhow, they arrived at the conclusion that the whole thing was a lottery, that it was pure guess-work, that there is no such thing as mathematics in the world—away with it!

Over in one corner was the exhibit of the Artercraft Institute at which educational work was going on, extending throughout the whole realm of electric cookery. Here was a long table, an electric kitchen cabinet and an electric washing machine to lend variety to the scenery. On the table were electric utensils of all the well known makes. Under the edge of the table were outlets from an electric circuit, for plugging on the various devices. On the floor and in the corners was food in the raw. The stage was set. Arrive, now, on the scene a group of club women to learn of electricity and spread the propaganda. They file behind the table, take up cords and plugs and at a signal the



SET THEMSELVES SQUARELY IN THE CENTERS OF TRAFFIC

"work" begins. We quote the word "work" however, for cooking with electricity as everyone knows is play and it is believed by electrical authorities that the word "work" as now applied to household activities will in the near future become obsolete.

Never was a class more interested. There were several types of outlets under the table and several styles of plugs on the cooking devices. This caused a little confusion at first. It was found out incidentally that an egg absolutely refused to fry on a General Electric stove if a Westinghouse plug was

used. Likewise a Westinghouse percolator refused to have anything to do with current through a Simplex plug. These little family differences being attended to the cooking progressed.

All this interested the throngs, particularly some fortunate men who were selected at random, or for other reasons, to come in and act as eaters.

At the corner of one of the booths anywhere from six to twenty people might be observed at any time sniffing ozone. They all took very deep breaths and then looked sadly, far away into the distance, trying to imagine "mountain air." The little machine which caused all this reminiscing was no more than eighteen inches high but it sent out a blast of air heavily impregnated with the somewhat pungent odor of this strange gas which is formed in the region of a high potential electric discharge.

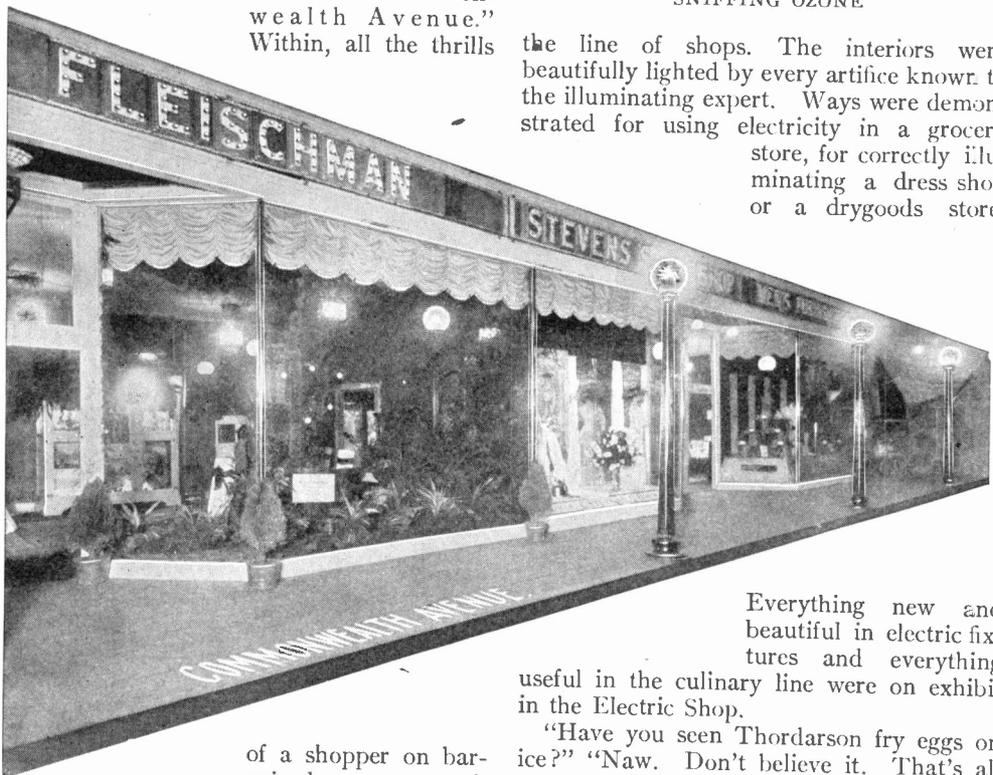
One end of the hall was taken up with a row of miniature shops and stores all facing out onto "Commonwealth Avenue." Within, all the thrills

the eye and at once plunge in absolutely without fear. Once inside, it was action every minute of the time, all the way down through



SMELLING OZONE

the line of shops. The interiors were beautifully lighted by every artifice known to the illuminating expert. Ways were demonstrated for using electricity in a grocery store, for correctly illuminating a dress shop or a drygoods store.



of a shopper on bargain day were experienced. A member of that sex which most delights in this form of battle would approach the entrance with fire in

Everything new and beautiful in electric fixtures and everything useful in the culinary line were on exhibit in the Electric Shop.

"Have you seen Thordarson fry eggs on ice?" "Naw. Don't believe it. That's all press agent talk." "Come on, and I'll show you," says the electrical engineer to his friend the bank cashier. They push their way through to the annex. The cashier wants to



INTERIOR OF THE COLISEUM DURING THE CHICAGO ELECTRICAL SHOW,
JANUARY 7-21

stop and listen to the amateur wireless fiends who are seated with ecstatic expressions, and wreathed in the flames of their resounding instruments, but his friend drags him away to the corner wherein is the Thordarson "Wireless kitchen." They line up beside the rail and watch the show. Thordarson, the "electrical wizard," presides behind a sort of long counter. At his left is the usual "assistant" who from time to time makes a mysterious pass under the table as if to scratch his ankle. This is 'not supposed to be noticed by the crowd.

"Here we have the wireless churn," says the wizard. This imposing apparatus consists of a sort of glass stein without a handle and half full of water. In the water is a metal sphere with a wire or two around it. Setting the whole thing on the top of the table the sphere revolves rapidly until set to one side when it stops as if tired.

"Wireless lamp" shouts the wizard. This time he takes up a circular coil of wire wound on the outside with tape and with an incandescent lamp connected to the center; no connections whatever to any external source.

Holding the lamp over the table it burns brightly.

"Now we will fry an egg on ice," explains the wizard. He places a frying pan on the table top and turns away for an instant. The assistant scratches his ankle and the pan aviates away ten feet.

Having secured the pan again the wizard passes down the line and lets the cashier and the electrical engineer and the rest of the crowd feel of it and of a slab of ice which he has in his hand. Both cold. Then he goes back and places the ice on the table. Then he holds the pan over the ice for a few moments. The second assistant wizard carefully selects a bunch of lard and puts it in the pan. It sizzles slightly. Second assistant then awkwardly breaks an egg in the pan. It sizzles, fries and actually smells good. All this time the pan sets on a slab of ice.

"I'll be jiggered if that doesn't get me," says the cashier. "Now tell me how he does it—you, who think you know electricity."

Says the electrical engineer, "It is done, not by what we ordinarily call wireless current; that is, high voltage, high frequency current



“NOW WE WILL FRY AN EGG ON ICE,” EXPLAINS THE WIZARD

which transmits wireless messages, but by the ordinary low voltage alternating and direct current which is used for lighting. Under that table are large transformers the cores of which form immense electro-magnets. When that assistant juggles under the table he closes a switch which sends current through the transformers. As a result the table and the wizard himself are plunged into a powerful magnetic field, which of course is not harmful to them. This field may be made alternating by sending alternating current through the transformers, in which case it rises up and dies down many times a second. Now when you place the frying pan in this field of magnetism the metal in it may be considered as a closed circuit and the fluctuating magnetic field causes electric currents to flow in the metal of the pan, though non-metallic objects such as ice, the table top, etc., are not affected. These eddy

currents as they are called (and they are developed in any solid piece of iron placed in an alternating magnetic field) quickly develop heat enough to fry the egg.

“In the same way the lamp is lighted. The coil of wire in this case is affected by the magnetism and has generated in it sufficient current to light the lamp.

“When the frying pan was made to jump off the table only direct current was used in the transformer. When the switch was closed there was a great outward surge of magnetism as the field was established around the transformer and the metallic pan was repelled by this field and whisked away.”

“Oh! I see,” said the cashier as they wended their way to the door to catch a Wabash Avenue car, casting one more look backward at the wire column where several men were still earnestly figuring.



The Coming of the Multiplex Telephone

By WILLIAM C. WARD

What bids fair to be a great advance in the telephonic art was inaugurated when Major Squier, on January 3rd of this year, gave to the people of the United States his patents on a system of multiplex telephony; that is, a system it is claimed, permitting of sending several non-interfering messages over one circuit at the same time. As has happened so many times in the past, in the case of great inventions, two men apparently were working on the same idea about the same time. Mr. Frank L. Perry of Chicago, widely known in electrical circles throughout the country, demonstrated over two years ago, to reliable witnesses, that a non-interfering voice message could be transmitted over an isolated circuit which was at the same time being employed for transmitting a to and fro conversation. It is only fair, therefore, that, following Mr. Ward's description of the Squier system, we give an account of Mr. Perry's work and the excellent proof which he has to offer establishing the fact of his independent research.—Editorial Note.

The utilization of combined wire and wireless practice, patents for which have been taken out and dedicated to the public by Major George Owen Squier, United States Army, amounts to what will prove to be the greatest stride made in electrical communication since the invention of the telephone itself. In the new system, multiplex telephony—heretofore never practical—is easily accomplished; also, any number of telephone and telegraph messages may be sent simultaneously over the same wire without any mutual interference, and one of the most important features of the invention

is the absolute elimination of the distance restriction which until now has prevented further developments in long-distance telephony.

Ever since the electromagnetic theory of light became an accepted fact, the whole range of ether waves has been looked upon as a spectrum extending from the extreme ultra-violet rays on the one hand, through the visible spectrum to the exceedingly slow oscillations that are used on submarine cables. Also use has been made of all parts, for various purposes, with the exception of two well-defined intervals; one extending



Photo by Waldon Fawcett

MAJOR SQUIER OF THE UNITED STATES ARMY, AT THE RIGHT, AND HIS ASSISTANT TALKING SIMULTANEOUSLY OVER ONE LINE WITHOUT INTERFERENCE

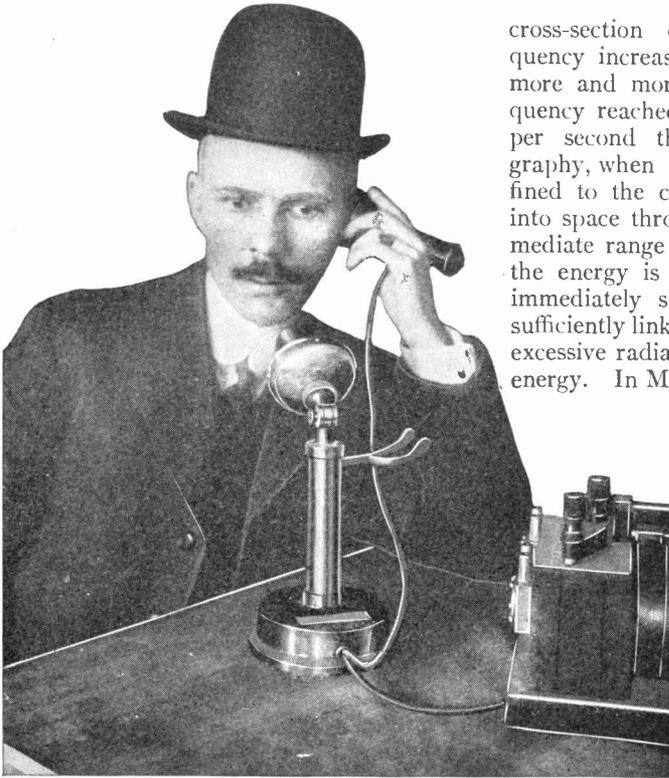


Photo by Waldon Fawcett

MAJOR SQUIER USING HIS FIRST MULTIPLEX TELEPHONE

from a frequency of about 3×10^{12} of the extreme infra-red, to 5×10^{10} , which is the shortest wave yet produced by electrical apparatus—and another interval extending from 100,000 cycles per second to 15,000 cycles per second. This latter represents a practically unexplored field which Major Squier has found by experiment to be very useful in solving the problems of multiplex telephony and telegraphy.

With such frequencies as are used in ordinary battery telephony the so-called phenomenon of "skin effect," that is, the tendency of the electric current to flow on the surface of the wire, is comparatively small, and the current fairly well distributed throughout the

cross-section of the wire. As the frequency increases, the skin effect becomes more and more pronounced until the frequency reached the realm of the millions per second that are used in radio-telegraphy, when the energy is no longer confined to the conducting wire, but radiates into space through the ether. In the intermediate range from say 20,000 to 100,000, the energy is largely carried by the ether immediately surrounding the wire, but is sufficiently linked to the conductor to prevent excessive radiation and the resultant loss of energy. In Major Squier's system, then, the loss of power due to the ohmic resistance of the conductor is eliminated by employing currents of sufficiently high frequency to be carried in the ether surrounding the wire rather than in the wire itself, and as a natural result more work can be performed at a great distance than can possibly be expected of a low-frequency conduction current.

Oscillatory currents of the frequency employed are, however, much too rapid in their periodic reversals to produce audible effects in a telephone receiver. The limits of sensitiveness of the human ear lie between frequencies of from 16

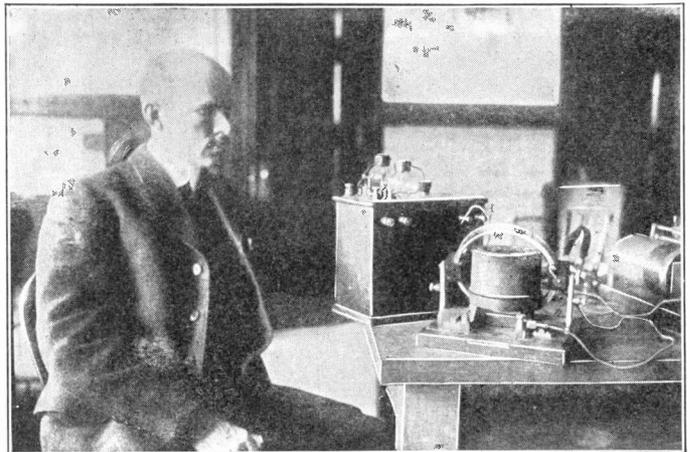


Photo by Waldon Fawcett

PRINCIPAL PARTS OF THE SQUIER MULTIPLEX TELEPHONE SYSTEM

to 20,000 cycles per second, and entirely apart from this is the fact that it is a physical impossibility for a telephone receiver diaphragm to vibrate in sympathy with any oscillations of much higher frequency than the maximum limit of audibility. For this reason Major Squier has found it necessary to employ a detector such as that now used in wireless practice to integrate the oscillations into one-dimensional effects that will cause telephone receivers to respond audibly, as they now do in ordinary battery telephone systems.

Both the sending and receiving stations are therefore connected inductively with the line wires, and a generator at the sending end is kept giving out undamped oscillations upon which voice vibrations are impressed by a microphone transmitter in the primary circuit as is now the case in the ordinary wireless telephone. At the receiving end, an inductively connected circuit with an integrating detector shunted across the telephone wires, exactly as in wireless practice, translates the messages into articulate speech. It is obvious that the number of messages that may be simultaneously transmitted over the same line wire is limited only by the number of frequencies to which oscillating circuits may be tuned, and this borders on infinity. Also it is evident that telegraph and telephone messages may be sent over the same wire at the same time, so long as the frequencies of the different sustained oscillations of which their signals are modifications are not sufficiently near together to cause interference.

One of the most important economic features of the invention is the elimination of the necessity for using a return wire in telephone circuits. This has heretofore been necessary on account of interference from earth disturbances, cross-talk from other circuits, electric railway complications and many annoyances from unknown sources. All of these outside influences, however, are of low frequency, and their elimination from the Squier system is due to the use of condensers of very small electrical dimensions, which, though imposing great impedance to slow oscillations, offer little or none to frequencies as high as 100,000 cycles per second.

Though the Duddell arc and other approved sources of sustained oscillations have been successfully used, Major Squier relies chiefly upon a generator of his own design

to supply the necessary oscillations direct. This machine, which is the power behind the throne in the new system, consists of the usual coils between which rotates an armature about one foot in diameter at a speed of 20,000 revolutions per minute. The generator gives out approximately pure sine waves corresponding to a wave-length of 1.86 miles.

In this system practically all of the generated energy is used, while in wireless telegraphy nearly all of it is wasted as the diameter of the radiated wave-sphere expands—that is the surface density of the sphere, which is expressed in terms of energy, decreases as an involved function of the radius increases.

It will be remembered that no practical use was ever made of wireless telegraphy until Marconi grounded one wire and sent out earth-guided waves. Hertz, too, noticed the performance of waves traveling along conductors. But it has remained for Major Squier to make use of wire-guided oscillations and to develop the first practical universal multiplex system.

For many years Frank L. Perry of Chicago had in his mind the idea of duplex telephony. At first it was only an idea and a vague one at that, evolved from numberless experiments in the mystifying field of vibratory electrical energy. He spent every hour of spare time at his researches in electrical wave phenomena.

Gradually the idea took form and in 1908 he was able, with crude apparatus, to do a wonderful thing in his home laboratory at 3702 Lake Avenue, Chicago. Two people talked back and forth over an isolated metallic circuit and also over an isolated grounded telephone line, using ordinary transmitters operating in connection with the ordinary receivers, and at the same time Mr. Perry with his new duplex transmitter, connected to this same line transmitted phonographic "talk" to a witness in another room; and the witness heard it, but did not hear the other two people who were conversing without interference over the line at the same time.

Then for absolute proof the witness was given the ordinary receiver connected to this same isolated single line. He held it to one ear and heard a person talk over the line with ordinary instruments. Drawing it away he held the special receiver to the other ear and

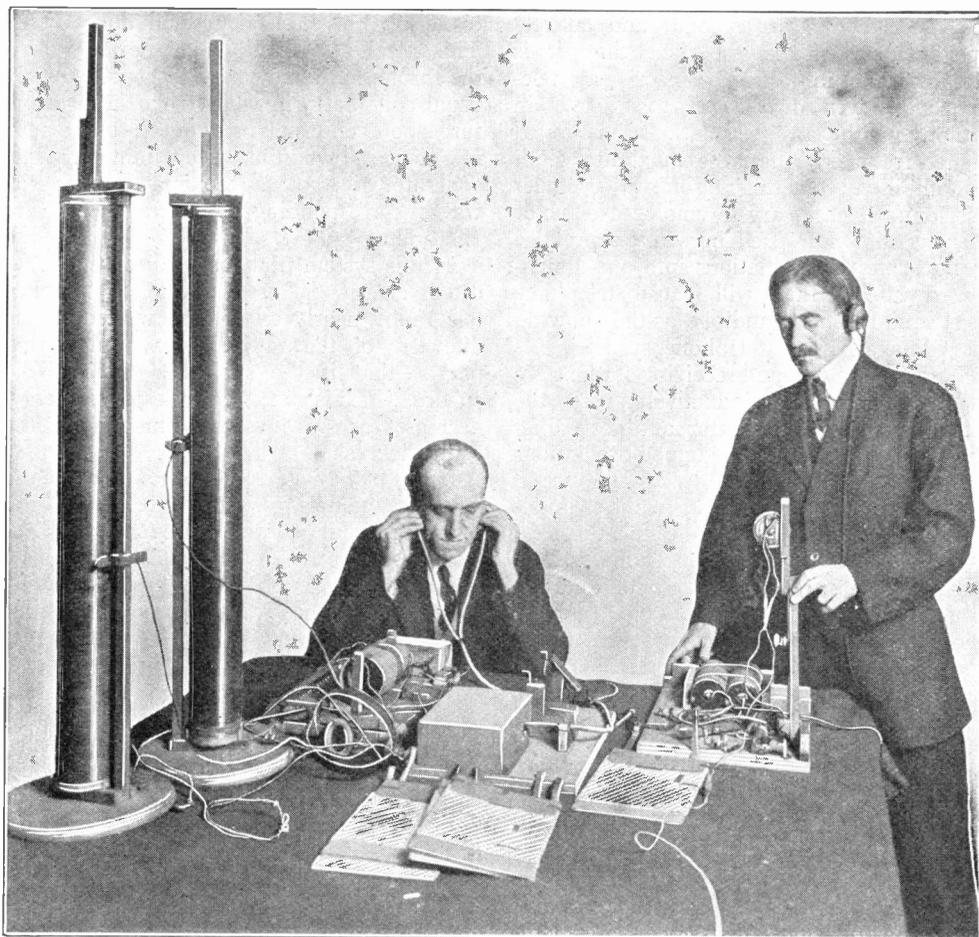


Photo by Burke & Atwell

READY FOR THE TEST—CRUDE TELEPHONE OUTFIT OF THE ORDINARY TYPE AT THE RIGHT, FOR "TO AND FRO" MESSAGES; TWO PERRY DUPLEXING RECEIVING SETS AT THE LEFT

heard only the phonographic talk with musical accompaniment. Bringing the two receivers to his two ears he heard the confusion of the two transmissions and knew beyond a doubt that the one circuit was carrying at the same time two sets of voice messages, either of which he could listen to independently, depending on which receiver he used. Duplex telephony had "arrived."

The witness on this occasion, November 4, 1908, was Mr. Bion J. Arnold, the celebrated consulting engineer and traction expert. He gave to Mr. Perry signed statements and signed a drawing verifying this important achievement.

Supplementing Mr. Arnold's testimony a signed statement was procured, after similar demonstration, from Mr. Donald M. Carter of the law firm of Parker & Carter, Chicago.

Still other men were permitted to listen to the performances of this Perry duplex telephone system, namely: Mr. B. E. Sunny, president of the Chicago Telephone Company and vice president of the American Telephone and Telegraph Company, heard a successful demonstration in October, 1909; Francis W. Parker, of the firm of Parker and Carter, and Dr. C. F. Barker, a well-known Chicago physician and surgeon, all witnessed successful tests.

Mr. Perry wisely is not telling any one just how he does it. But immediately after announcement of Major Squier's achievement came from Washington, he quickly repeated before Mr. Rufus Hatch Holbrook, associate editor of *Telephony*, his successful accomplishment. The system is essentially the same as that employed over two years ago when Mr.

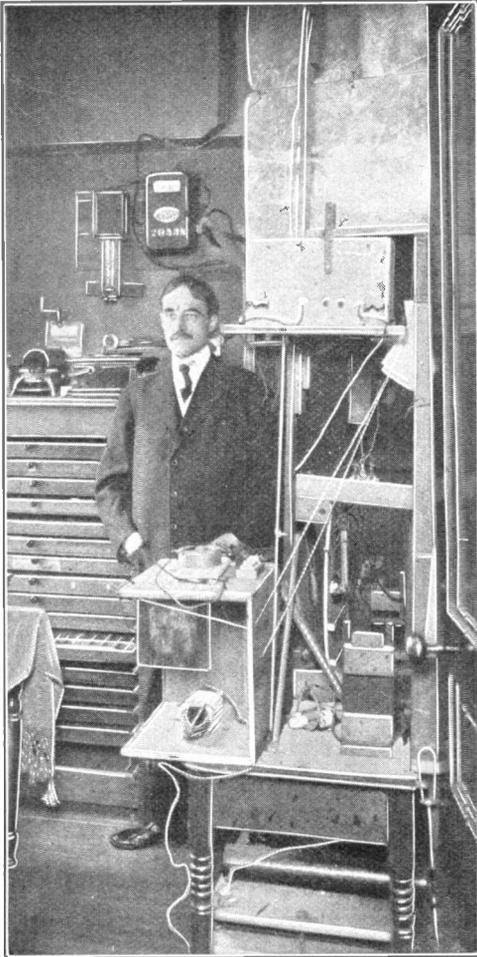


Photo by Burke & Atwell

MR. PERRY IN HIS DUPLEXING "SENDING STATION"

Perry first put the second telephonic message (voice) on the one isolated circuit that was at the same moment being used to convey back and forth the electric waves of ordinary "to and fro" telephonic conversation.

This new and additional voice message was at that time sent in only one direction, that is, to a listener. But he understood that this transmission of a second and additional telephonic message in one direction over the one circuit was enough, Mr. Perry knew, to demonstrate before creditable witnesses the discovery of duplex telephony.

With reference to the illustrations presented herewith, Mr. Perry frankly states that there are of course certain parts of the apparatus boxed up and purposely otherwise concealed; but in so far as any ordinary visiting observer

could see, the photographs herewith give a most excellent idea of the general appearance of the apparatus as it was used over two years ago, and as it was employed within a day or so after the announcement from Washington, this year.

On almost every occasion in demonstrating, he places two people at the two receiving stations in one room. With one of these persons at one of these receiving stations, a second person in another room converses. In a word, an ordinary "to and fro" telephonic conversation is carried on between these two people over a single isolated metallic circuit or an isolated single wire grounded circuit. This circuit in some cases covered a distance over surrounding roofs of a little less than a city block.

While this ordinary "to and fro" telephonic conversation is being carried on between the two persons, one at each end of the above mentioned single circuit, it has been Mr. Perry's general custom to send over this same one circuit in one direction to the other person in the receiving room, either another human voice or a phonographic reproduction of the human voice (with song and musical accompaniment.) This second human, or phonographic-human voice and music, is

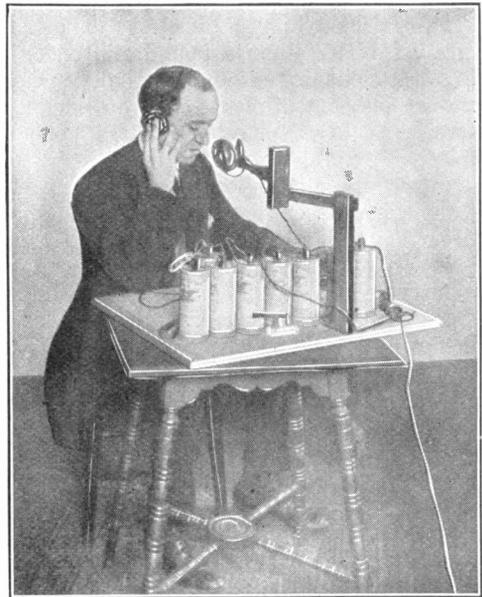


Photo by Burke & Atwell

CRUDE TELEPHONE OUTFIT OF THE ORDINARY TYPE AS USED FOR "TO AND FRO" MESSAGES

delivered into a special transmitter by phonograph in what Mr. Perry calls his "sending station" or "transmitter room." This demonstration has always been with more or less crude, hand-made apparatus.

It is here emphasized that the operation of this apparatus during these tests is such, at its perfection, that listeners cannot detect any interference between the two telephonic messages that reach either of the persons in the receiving station at the same moment over the same circuit.

Soon after making his discovery Mr. Perry became convinced that telephonic duplexing would first find its greatest utility on isolated, single metallic-circuit lines longer than those usually found within city limits. Therefore since 1908 he has been engaged in researches leading to much longer distance voice duplexing transmission.

Measuring Intensity of Illumination

It is often desirable to determine the illumination of a certain room in foot-candles. Also the architect or illuminating engineer may wish to know the illumination of a certain wall or other surface. To enable this determination to be made conveniently a device known as the "luxometer" has been put on the market by a London engineer.

It measures only 7 by $3\frac{1}{2}$ by 2 inches and weighs less than a pound and consists of a self-contained standardized lamp which throws a beam of light onto an inclined screen as in the Trotter portable photometer.

It may be stated that there is a mirror, from which the central portion of silvering has been removed, which is viewed through an eye-piece and is set at such an angle that it reflects into the eye-piece the inclined screen above mentioned. The eye therefore sees in the field of view, a small annular patch representing the inclined screen and the central portion which is cut away. Through this central portion the object of the illumination of which is to be determined is viewed. The angle made by the inclined screen with the rays of light, is variable by means of a milled head and is adjusted until the illumination of the central and outer parts of the field of view coincide on the well-known Trotter principle. The illumination of the object viewed can then be read off on a direct reading scale graduated usually from 0 to 4 foot-candles.

When it is desired to determine the intrinsic brilliancy of a surface the above procedure is followed and the same can be



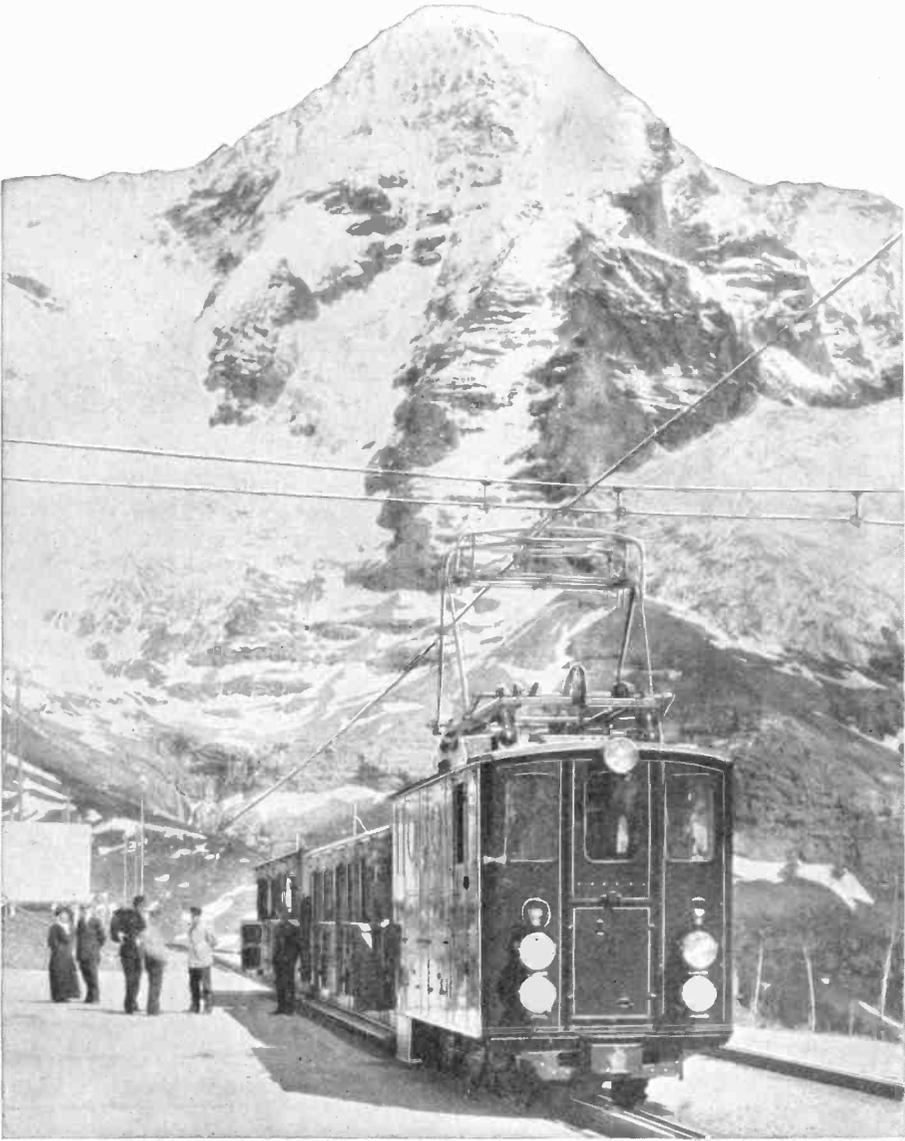
MEASURING INTENSITY OF ILLUMINATION

done by viewing a surface placed horizontally in case the horizontal illumination at any point is required.

Preserving Telegraph Poles

The Imperial German Postal Department has conducted extensive experiments with various impregnating materials to preserve the life of telegraph poles. It finds that if zinc chloride is used, the life of the pole is about twelve years; with copper sulphate, it is fourteen years; with corrosive sublimate, seventeen years; while if treated with tar oil, the pole will last 22 years.

For the year 1910 the Chicago Telephone Company reports the greatest growth in its history, the net gain in the number of telephone stations being 37,641. In the city of Chicago the total number of telephone stations connected to the exchanges of this company now amounts to nearly 240,000, and in the suburban district there is something over 60,000, giving a total of about 300,000 stations in the territory served.



AN ELECTRIC TRAIN IN THE ALPS

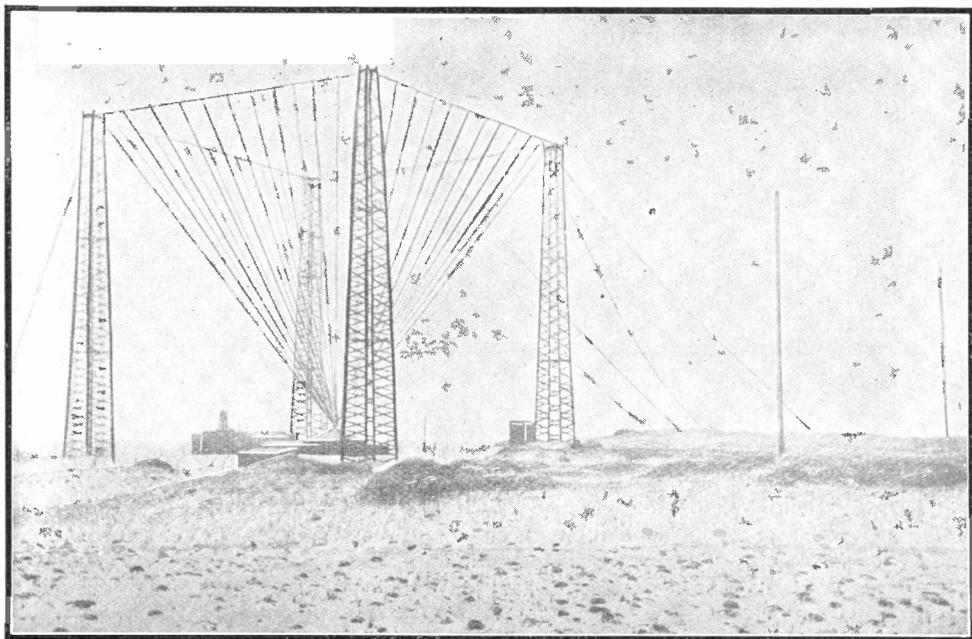
Above is a view of one of the electric trains on the famous Wengernalpbahn in Switzerland. This mountain railway is operated by direct current of 1,500 to 1,800 volts and the locomotive climbs slowly up the steep grades by means of a rack and pinion. Two cars are drawn at a load, each seating 48 passengers. A speed of about ten miles an hour is possible on the 25 per cent grade. The train is heated and lighted by electricity. By means of automatic brakes the train may be brought to rest in from $2\frac{1}{2}$ to $6\frac{1}{2}$ seconds

Journalism of the Sea

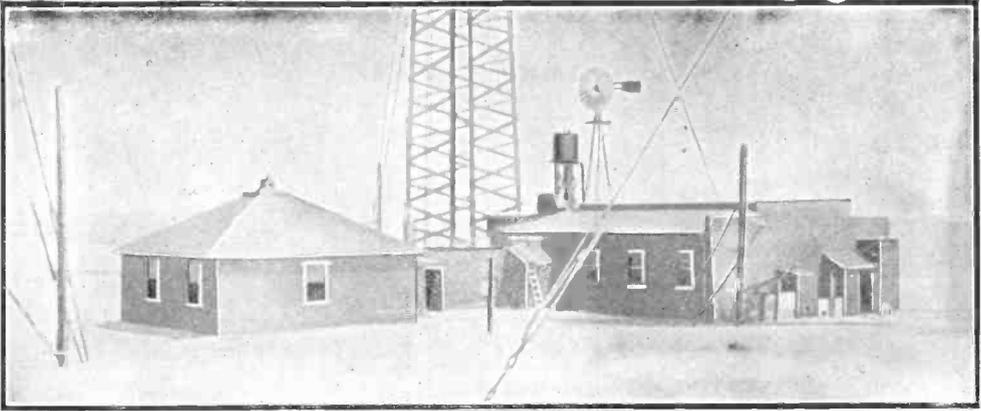
By F. M. SAMMIS

A few years ago, when a man was worn and nervous from the strain of his business, it was customary for his physician to recommend an ocean voyage for his rest and refreshment. During his trip on the water he could enjoy absolute rest from his business worries, but nowadays there is no such thing as freedom from business for the man of affairs. Each morning on his journey across the ocean he finds beside his plate at the breakfast table a newspaper printed on board containing the latest news of the day. While he may have resolved to forget entirely the things left behind, it is more than human nature can resist to leave untouched the little sheet and he is soon eagerly perusing the happenings of yesterday or glancing at the quotations of his pet stocks. There is not even the excuse that he happens not to have the change to purchase a paper, for they are distributed gratis to every passenger, for like other newspapers, they are made profitable by means of their advertising columns.

The machinery necessary to make possible the publication of a daily paper in mid-Atlantic is very much the same as that required for any of the great city newspapers, except, of course, on a much smaller scale. There is, however, one marked point of difference and that is in the manner in which the news is transmitted to the editorial room. The material for the *Atlantic Daily News* is furnished by the tremendous organization known as the Associated Press, which has a representative in every news gathering center of the earth ever on the alert for items of interest to telegraph to New York. Every day in the year at 8:30 p. m., a special dispatch is prepared at the Associated Press office in New York and telegraphed direct to the Marconi Station at South Wellfleet, Mass. From here, by means of wireless telegraphy, the news of the world at large is sent out to vessels hundreds of miles distant on the broad Atlantic. The aerial wires supported by the masts of each steamer intercept a sufficient number of the ether vibrations sent



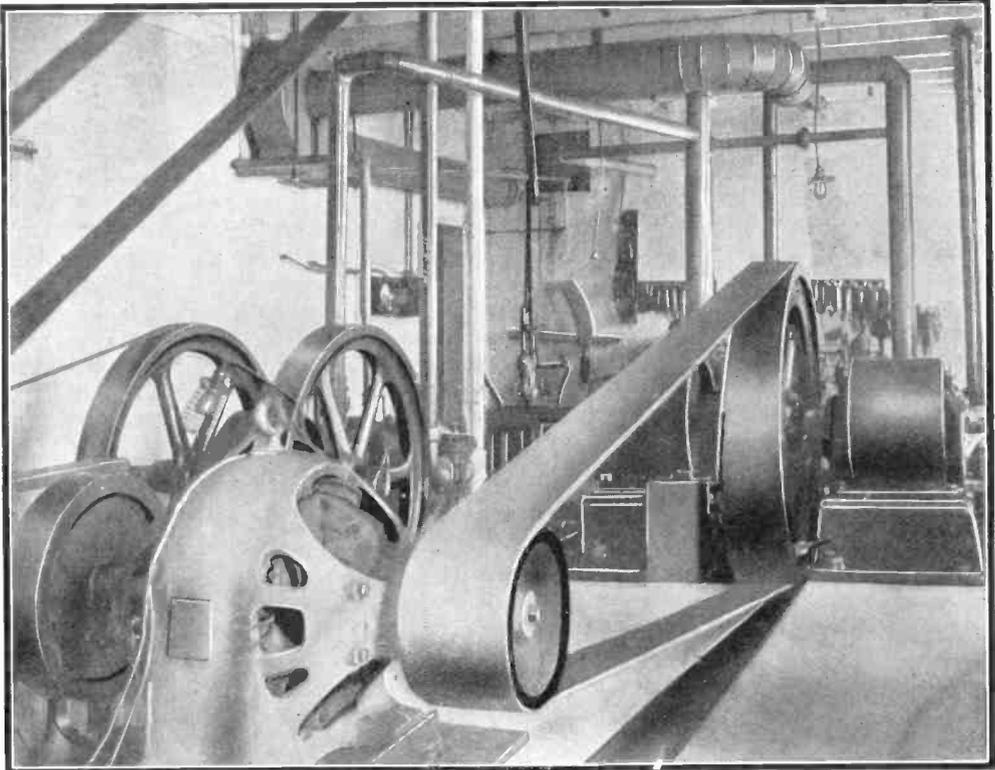
FOUR HUGE TOWERS 215 FT. HIGH SUPPORT A GREAT NETWORK OF COPPER WIRES



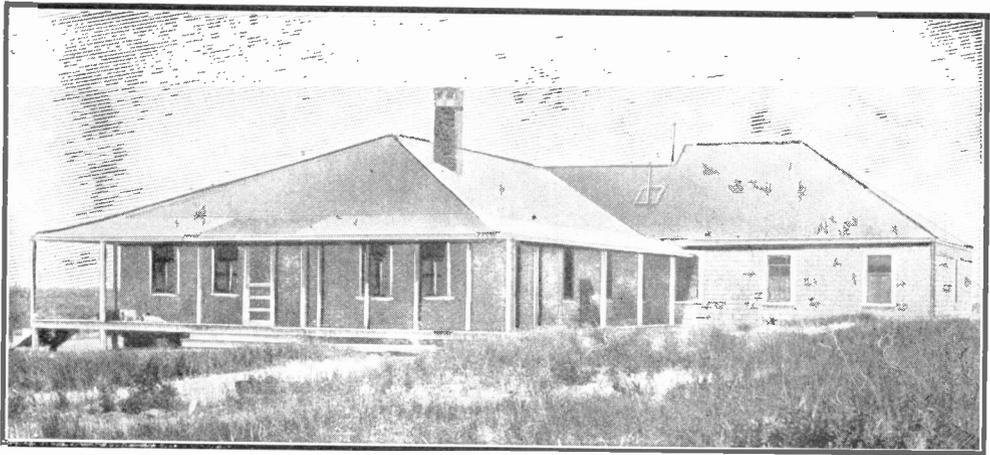
ENGINE AND TRANSMITTER HOUSE OF THE WELLFLEET STATION

out by the Cape Cod transmitter to operate the sensitive receiving apparatus, the operator records the message and in the morning the traveler finds at his place the news that has come so far and has been printed while he slept.

Perhaps, it might be interesting to know something of this station on Cape Cod, the methods by which the news is transmitted and the little company of men who form the working force. The plant is located about two miles from the railroad station at South



A POWERFUL ENGINE AND DYNAMO ARE NECESSARY TO PRODUCE THE ENERGY FOR LONG RANGE WIRELESS WORK



BUNGALOW IN WHICH THE WIRELESS OPERATORS LIVE

Wellfleet and is situated directly on a huge sand bluff that overlooks the Atlantic Ocean. There is little here but sand, the kind that stays awhile and then moves on. In fact, it is not uncommon for some of the buildings to be almost buried during a single storm. A species of coarse grass alone succeeds in drawing nourishment from the sand, and to this vegetation, Cape Cod owes its existence, for without it, the Cape would long since have been blown away.

Four huge towers, each 215 feet high, support a great network of copper wires, the lower ends of which lead into the transmitting room. These wires, when charged, set in vibration the ether for 1,500 miles around. Under the shade of these towers nestle the several buildings of the plant. A low brick structure houses the great puffing engines and humming dynamos that furnish the power necessary for the transmission of messages to great distances. Under the same roof is also located a storage battery of colossal size and a machine shop. Connected to this building by a long corridor are the transmitting and operating rooms, in which occur the wonderful display of electrical pyrotechnics that has caused the plant to be dubbed "Marconi's thunder factory."

About a thousand feet from the plant is situated the comfortable little bungalow that shelters the men employed at the station. There is a plank walk from the plant to the house and many are the tales told of trying to keep to the path on a stormy night when the ground is covered with snow and the air full of blinding sleet, or of endeavoring to reach the bungalow when there is a ferocious

wind storm blowing that drives the loose sand against the men's faces with such force as to almost bring the blood. On one occasion during a heavy storm, the manager became confused in attempting to make the passage from the house to the plant and only succeeded in reaching his destination by following the wire fence which encloses the grounds for its entire length.

The bungalow in which the men dwell is as pleasant and cozy as one could wish for. There is a large living room, furnished with comfortable chairs and couches. The walls are hung with pictures and on the tables are scattered books and magazines. Most of the men endeavor to play some musical instrument and, whatever the result may be, there are no neighbors to complain. They have an excellent phonograph and a great number of records. They had a rule that whoever was guilty of profane language had to pay a fine for each offence and this money was used to buy records; or if any of the men went to Boston for a little vacation, they were to buy a half dozen records for the privilege. Each man has a bedroom to himself, there are two guest rooms, the manager has his larger room and office and there is a very pleasant dining room.

The happy family, for it is a happy family, consists of a manager, two telegraph operators, two engineers and two old salts as riggers, a chef and steward and two dogs, Missy and Mike. The manager is the technical man and wireless engineer of the plant, in addition to his position as head of the family. The two telegraph operators take shifts in working the land lines and wireless

circuits, for the station is also used for communication with Boston shipping. The engineers stand watch alternate nights to start the main engines of the plant and to keep them running smoothly. There are also a thousand and one things for them to do during the day—some repairing, improvements to be made or experiments for the engineer at the head office in New York. The riggers keep the towers and stays in ship shape. They may be seen almost any day, perched far aloft, tightening a rope here, replacing a fouled wire of the antennæ there, putting in their time wherever it may be most needed. Painting the towers is a job that keeps them busy for many weeks at a time with extra men to help.

The chef or steward is the one man who has it in his power to make the family either happy or miserable, and misery is little known here. It requires considerable foresight and good management to keep the larder well supplied at this out of the way place and many of the provisions must needs come from Boston. With some help from the town store, the wares of local fishermen and an occasional mess of flounders caught from the bank by the men when off duty, the commissary department is kept well supplied.

The men gather for a late breakfast in the morning, for some have been up until two o'clock on duty, and then starts the business of the day. There are various tasks to engage the men during the daytime, but it is at night that the real work of the station begins. At 8:30 p. m. the operator on duty hears a call on the land wire, and he is at once busy copying on his typewriter the news dispatch from the Associated Press. He then takes his copy down to the plant and starts punching the strip. This operation is one recently added to the daily regime and is the means by which the entire news message is sent automatically in perfect Morse characters without the operator touching a key. In order to insure the receiving of the message by the ships at sea, many of which are at distances too great to ask for repetitions of certain words they may have missed, the entire news dispatch is repeated several times. In the days when the operator had to send this long message four times by means of a huge telegraph key, in addition to receiving it from New York over the land line, the news became rather a bore, especially when the hours of the morning

were small and the man's eyes heavy for sleep. The message having been punched on the paper, the strip is then wound on a reel attached to the motor-driven automatic transmitter and is then ready for the program, which starts at ten o'clock each night and continues until completed.

At 9:30 o'clock the engineer on watch hastens down from the dwelling house to the plant and starts three great flaming torches, in order to heat the ignition balls of the kerosene engines. Oil engines are used in this plant because of the high cost of coal and the difficulty of delivering it at the station. By 9:50 o'clock all is in readiness—the engines are running and the recording instruments are inspected to note whether the current value is correct. When the clock points exactly at ten, a red signal light flashes in the engine room, the operator releases the catch on the automatic transmitter and the crashing noise of the spark is immediately heard in the adjoining room. Here in the transmitting room great streams of fire a foot long are thrown out by powerful blowers and the tremendous noise of the spark, though musical, is terrifying. Very few persons have seen this plant in operation for visitors are strictly prohibited from entering upon the premises, but one may hear the high pitched note of the powerful spark for several miles, if the night be quiet or the wind favorable.

Through the windows of the station the spark has been seen for fifteen miles at sea. Viewed from the exterior, the intense white flash showing through the ground glass windows of the instrument room and the deafening crash of the spark would cause one to believe that here is the home of the evil one. In this way the great plant is calling to ships near and far and sending them the news of the day. The ships may be 1,500 miles or only 100 miles away, and unless the vessel is at the greater distance, the operator usually copies the complete dispatch correctly the first time without recourse to the repetitions that follow.

While the operator at Cape Cod is busy sending out the day's dispatch on each one of the numerous ships on the broad Atlantic there listens an attentive ear, and the ear must needs be attentive if it is to catch the message, for while the waves are tremendously powerful when released from the towers at Cape Cod, they travel equally in every direction and the amount of energy received by a ship

1,500 miles distant is infinitely small.

Between the masts of each vessel are strung horizontally several stranded copper wires about the diameter of a pencil. These wires are separated by wooden spreaders and carefully insulated by special hard rubber insulators from the masts and their attendant stays. Several vertical wires are connected at the center of the horizontal ones and these lead directly through an insulator into the wireless cabin, usually located on the upper deck.

The modern Marconi cabin aboard ship is divided into several sections. There is usually an inside companion way for the convenience of passengers and this leads into a reception room where messages may be filed for transmission. Directly adjoining this reception room is the main portion of the wireless cabin where the man on watch answers the thousand and one questions propounded to him by fair passengers, while those not so fair must content themselves with a somewhat more brief description of the wizardry of wireless.

A sample of the efficacy of explaining wireless to a passenger is well illustrated by the story of an operator who, in the days in which the received signals were recorded on a paper strip, had particularly prided himself upon an especially lucid description of the *modus operandi* of wireless telegraphy to a fair passenger. Upon thanking him for his courtesy, the lady remarked that she understood it all perfectly, but would he tell her how the paper tape reached the ships from shore without getting wet.

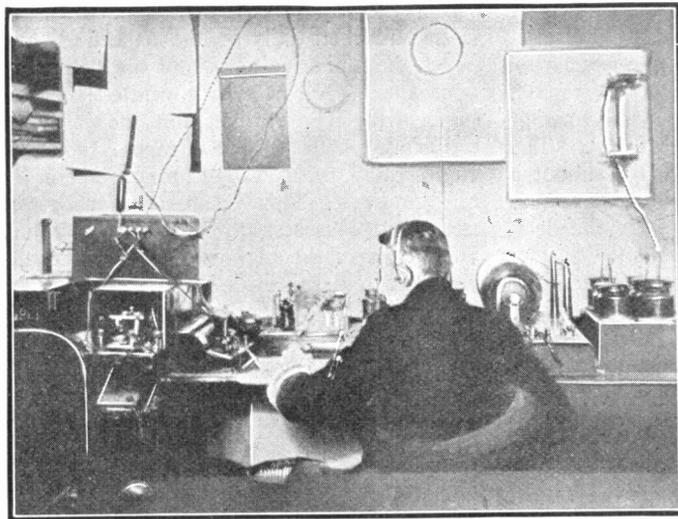
Next to the main room is the living room of the two operators and it is as comfortable a little cabin as there is on the ship. There are two berths, a writing desk, a chair or two, and in fact, all the comforts of bachelor life. At meal time the men repair to the main saloon and dine with the passengers or, if business be heavy, as it often is on the larger vessels, the meals may be served by the steward in the Marconi cabin. There are two other and much smaller rooms opening from the main cabin. The first contains the entire wireless equipment used for transmitting, while in the latter is located the receiving apparatus. Here are the special and sensitive instruments in which we are particularly interested. This room is especially constructed with sound-proof walls several inches thick and lined with cork. These more modern accommoda-

tions are in marked contrast to the quarters on the older vessels with which the operators had to content themselves. They were limited to one small room which contained the wireless apparatus and a berth. There was barely room to turn around in and, if perchance, the Marconi man was of the long variety, the chances were his feet extended under the instrument table when he turned in for a few hours sleep.

Each night, a few minutes before ten, the operator in charge shuts himself in the little sound-proof room, provides himself with pad and pencil, adjusts the pair of telephone receivers to his head and awaits the stroke of ten. Exactly on the minute, the faintest little whisper is heard in the telephones. The giant spark at Cape Cod is saying, "Good evening, ships, Good evening, ships." This spark, which was so terrifying at the station, is so weak at 1,500 miles as to be indiscernible by anyone but an operator who has become expert by long practice. These signals, though faint, are quite distinct and may be likened to the gentle purring of a contented kitten, though they are not so loud. Quite recently it has been discovered that the human ear is more sensitive to a higher musical note than that which was produced by the spark formerly in use, which was at the rate of 4,000 sparks per minute. The new musical spark has a frequency of 36,000 impulses per minute and is readable at considerably greater distances with the same power.

In the meanwhile, with receivers tightly pressed against his ears, the operator is rapidly writing down pages of news. This continues for about an hour, at the end of which time the dispatch is complete. The copy is then quickly transcribed on the typewriter and hurried down to the "editor on board" of the *Atlantic Daily News*. One of the first things required of the editor of a newspaper is the ability to write a paragraph from a single sentence and to construct a whole story from a single paragraph. This Atlantic Daily editor must likewise have the faculty of making readable articles from the abbreviated news of the telegraphic dispatch. To a novice, this message received on board, would be almost unintelligible.

When the copy is ready it is turned over to the typesetter who prepares the type in the good old way in vogue in newspaper offices before the advent of the linotype machine.



RECEIVING A WIRELESS PRESS DISPATCH ON BOARD A
TRANSATLANTIC LINER

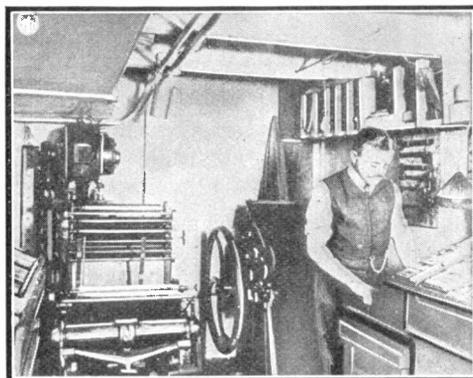
By long practice he has become very deft, and in a short time all is complete and passed over to the printer for his part of the work. The forms are rapidly adjusted to the motor-driven press and soon the copies are being taken off and folded for distribution the following morning. For the first half of their journey across the Atlantic the ships receive their news from the station at Cape Cod and the latter part of the time from the station at Poldhu in Cornwall, England.

The first wireless newspaper to be published on board a vessel crossing the Atlantic was a little sheet known as *The Transatlantic Times*. It appeared November 15, 1899, and was published on board the American line steamer *St. Paul*, enroute for England. On this voyage the *St. Paul* carried Marconi and two of his engineers, returning from America where they had been carrying on experiments with a new kind of telegraphy. The particular object of their visit had been to report the yacht races for the Associated Press and as success had crowned their efforts, they were looking for new worlds to conquer. They decided to publish a newspaper on board ship and obtained the latest news of interest from the Marconi station at the Needles. The papers were neatly printed and were sold at a dollar a copy for the benefit of the Seamen's Fund. From this small beginning, the idea gradually grew until the erection of high power stations at Cape Cod and Poldhu made

possible the constant reception of news from land and a daily issue filled with up-to-the-minute happenings.

The *Atlantic Daily News* is a paper from eight to ten pages and is printed in the form of a magazine. On the outside cover there is a copy of some famous painting, a photograph of some prominent man or an illustration of some article within. As the paper is distributed to all passengers without charge it is necessary to pay for its printing in some manner and, as is the case with other magazines and papers, this is done by

the advertising which appears in its pages. Many of the best hotels and shops have their names appearing in the *Atlantic Daily News*. There are many items of interest in the paper, news from all parts of the globe, the quotations of the stock exchange, the latest gossip of the sporting world, the abstract of the



PRINTING THE ATLANTIC DAILY NEWS

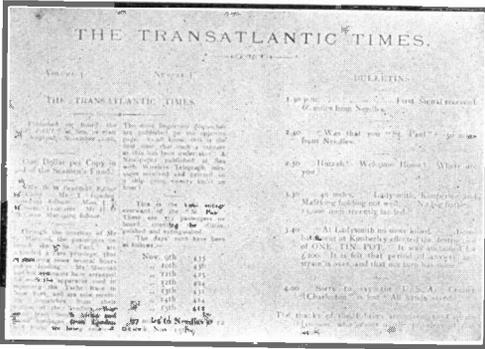
ship's log, the evening's program of music, etc. Like the great metropolitan papers, extras are sometimes issued of important news and on the bulletin board is posted election returns, etc.

The papers are most eagerly sought after by the passengers and they are scanned with absorbing interest. It is the great event of the day on shipboard and conversation turns

to the facts that have been made known by the advent of the little sheet. Of course, the barest facts are all that can appear in news dispatches that aim to send as much information as possible in as short a form as is commensurate with making sense. The whys and wherefores that brought about a certain event are talked over in the smoking room and as the passengers pace the deck for their morning constitutional.

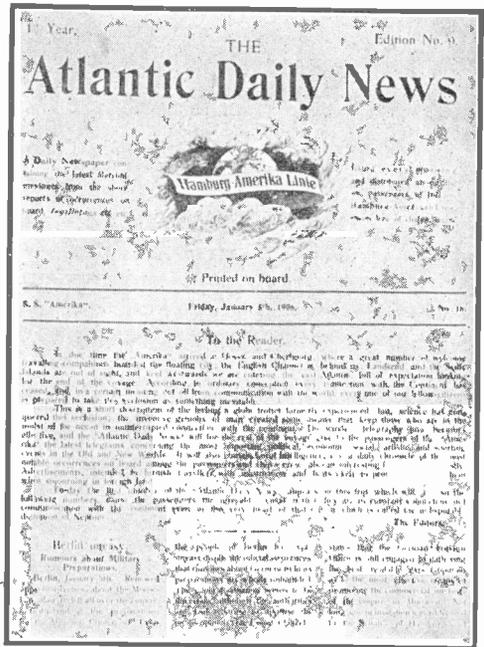
The bulletin board that is posted each day with the news of the steamer is the center of a great deal of interest and sometimes of amusement. The day's run is always noted down. Sometimes with good weather and favoring winds the vessel may have made unusually good time, or it may be, that with a head wind and other bad conditions she may not have been able to make her usual

For the last five years newspapers have been published daily on the Atlantic liners. From the individual efforts of the steamship companies, each of which printed its own paper with its own title, has developed a publication with an issue of several thousand copies daily, with a single management for all the lines. This insures uniformity of issue and increases the advertising value. Some idea of the high esteem in which advertisers hold this little newspaper may be had by the fact that for a single page as much as four or five thousand dollars per year is obtained. For certain classes of select ad-



VOLUME I, NO. I, OF THE TRANSATLANTIC TIMES—FIRST WIRELESS NEWSPAPER EVER PUBLISHED

number of knots. The names of the steamers with which the wireless operator has been in touch are noted down, with any news of importance that he may have received from any of them. The passengers scan the horizon with great interest for a sight of the wonderful icebergs or enormous school of whales that are reported as having been seen by a nearby steamer. There is a feeling of pity, not unminged with awe, when there is reported a derelict near at hand and the man on watch does not cease for a minute his close scrutiny of the waters ahead until he feels that his vessel is out of danger from these perils of the sea.



FIRST PAGE OF THE WIRELESS NEWSPAPER NOW READ ON ALL THE LARGE TRANSATLANTIC LINERS

vertising this price is not high, for this is a medium that is placed in the hands of people of means for a week and the results are well worth the price paid. Year by year the paper has grown to its present size, and in these coming days of thousand-foot liners with swimming pools and elevators, who shall say that even extras and Sunday magazine supplements may not soon be the order of the day.



The Flying Scarab and the Seventh Heaven

By RENE MANSFIELD

IV.

Click!—Kent's hand fell to his side. Both men turned about quickly. They had forgotten the girl. She was bending over Kent's camera concernedly. "Oh, I don't know what I've done, Mr. Mercury. I do hope I haven't broken anything," she cried contritely. "I was trying to operate the shutter—this is the shutter, isn't it?—and this little screw thing snapped. How careless of me!"

"Doesn't make a particle of difference," Kent assured her exuberantly, "not a particle. Nothing matters—nothing in the world. By Jove, it's wonderful—it's marvelous! You'll think I'm crazy, Miss Daphne—but you see, I've won out. I can do it—what I've been working at for years." His face was alight with the first brief glow of attainment, his eyes rested on the little indicator on the rough table.

The girl saw the unconscious twitch of his fingers, impatient to be at the work he loved—the longing in his eyes to go over each step that had led to the result he had attained.

"You will have work to do," she said at once. "I must return. It is getting late."

He insisted that he should accompany her to the Seventh Heaven. As they started up the sandy path again Butler followed them with his eyes, an odd expression on his serious face. They had gone but a little way beyond his ken, when the girl, who had kept well in the lead, paused until Kent reached her side. "Mr. Mercury," she said, with a sudden charming shyness, "will you please to go on till you reach that maple up there—then look straight west, till I—till I get there." He looked at her, puzzled.

"No turning into oak trees or laurel bushes," he warned.

"It's my shoes and stockings," she said. "I've simply got to get the sand out."

When she joined him at the big maple he noticed for the first time that she was still carrying his camera. He was quite overcome with chagrin that in the blind exuberance of his spirits he had failed to relieve her of it before.

As they reached the great green velvet throne of the Seventh Heaven she turned to him suddenly. "Thank you so much for

your kindness. You've been kinder to me than you know. I—I shan't get to the Seventh Heaven again."

Kent stared at her stupidly. "But—but, Miss Daphne——" he could think of no overwhelming reason to submit for her coming. "Oh, see here," he cried with a sudden inspiration, "aren't you at all interested in this—this discovery of mine?"

"Interested? I'm dying of curiosity! I supposed you didn't wish to——"

"If you should happen up here tomorrow I believe I can show you something that will amaze you—that will make those big eyes——"

She frowned. "I should very much like to witness any phenomena you might produce," she said with crushing formality, though her lashes flickered imperceptibly, "if you would be good enough to explain them to me."

Kent regretted that he had obtruded the little personality. He was properly contrite, and begged her to come the next day, when he would tell her himself of the discovery which would shortly be the world's property. He was immensely flattered by the parting remark she trilled back at him as the low-hanging branch swung back into place: "You really couldn't keep me away."

"Say, Kent," said Butler that night abruptly, "are you blamed sure that camera wasn't loaded?"

"What if it was?" Kent returned. But he picked up the camera from where he had laid it when he returned from the Seventh Heaven, and opened the back of it. There were no films in it. "You're crazy, Butler," he said shortly.

V.

The girl sat in the tree crotch swinging her brown shod feet nervously and twisting the end of the braid that hung over her shoulder into a great curl that shone like copper when the sunlight filtered through the leaves.

Not a sail skimmed the surface of the placid lake—not a bird winged its way across the brilliant blue of the sky. It was very warm and breathless. The girl noticed that a slim little shoot quite at the edge of the cliff where vagrant breezes might be enticed,

seemed perfectly motionless. She scanned the horizon anxiously. There was not a fleck of cloud or the shadow of a bird that might be mistaken for the Flying Scarab. She took a book from a hollow in the tree, which seemed to hold other articles, too, and began to read. She had read all of a paragraph, when suddenly she thrust the book back into the recess, slid to the ground and sat down, Turk-fashion, close to the edge of the cliff.

The white speck that she had discerned moving quickly across the sky like a tiny pilot balloon in a gust of wind, was now taking form. The girl appreciated the aptness of the name which the aeroplane had been given. It looked like a huge scarab with silken wings outspread and metal body gleaming. She remembered that to the Egyptians the scarab was the symbol of immortality. There was something fitting about that, too. In what had man's infinity been so demonstrated as in this century-old effort to touch upon the very shores of infinity?

Straight toward the Seventh Heaven the Scarab was heading. Its shadow streaked the lake with a wavering line of indigo. But instead of the aviator dipping his elevators to glide down to the clearing as the girl had expected, he shut off the rear propeller engines, and starting up the motor of the helicopter-sustainer, hovered perhaps a hundred feet above the cliff.

"Watch that little sprig," shouted Kent presently to the girl who was almost beneath him. She turned her eyes to the lone little shoot she had noticed before at the very edge of the cliff, outlined scrawny and straight against the blue of lake and sky. Every leaf seemed still. As she looked, wondering at Kent's purpose, a great butterfly poised itself for a moment and then settled on a leaf.

"Watch!" Kent called again.

She watched. And in a moment she thought a breeze must have sprung up suddenly. The leaves stirred. The gorgeous wings of the butterfly swayed. Then the girl uttered a startled little cry. As though a blight had fallen upon it from the sky, or as though an invisible hand had stripped from it in sudden fury its sturdy new leaves, the little shoot stood barren against its vivid background of blue. The butterfly lay lifeless among the fallen, shriveled leaves. The twigs and slender branches drooped, and

the whole skeleton of the shoot seemed about to crumple into nothingness.

The girl turned an awe-struck face up to the man in the Flying Scarab. She thought of stories she had read about Hindu magic and wonder-workers. She wondered if she had been hypnotized. In another moment the Scarab had descended and Kent, scarcely waiting for the wheels to strike the earth, leaped from his seat and ran to her side.

"You saw it?" he cried excitedly, "the butterfly and all—? Isn't it amazing—isn't it wonderful, girl?" The girl sat down limply on the grass.

"I tell you it will revolutionize warfare—it will revolutionize civilization. It is stupendous—it is inconceivable! Do you grasp the importance of it?" he asked her, almost roughly.

"Yes—yes, I think I do," she said faintly. "But how—the principle—the—"

Kent, succumbing to a boyish abandon of enthusiasm, flung himself on the grass beside her and explained as best he could to an unscientific mind the theory of the phenomena she had just witnessed. He drew rough diagrams for her on scraps of paper and the backs of envelopes. He outlined briefly the principles of the X-ray and also of the Hertzian waves as their activities are disclosed by the wireless telegraph. He tried to make it clear to her how he had fused the underlying elements of those two forces—how he had been able to focus etheric wave lengths into an invisible beam so powerful that all forms of life were destroyed when subjected to its rays.

"And this is only the beginning," he said. "It is like comparing a sling shot to a Gatling gun to compare what you have seen with what experiments will develop. A whole country can be devastated—a whole army cut down by this invisible force—"

"But, oh," began the girl, "what a hideous, barbarous—"

"So hideous and barbarous," he interrupted, "that the dogs of war will be kept muzzled—and kept muzzled tight. The more barbarous we make war the less we're going to have of it."

"And it is you who will tighten up the muzzle to the last notch. What a famous man you are going to be, Mr. Mercury!"

Kent smiled. He couldn't tell her that fame was already much of a bore to him.

"Not till tomorrow, anyhow," he replied. "I'm not giving it out to the press until this



"GOOD-BY, MR. MERCURY. GOOD LUCK"

afternoon. I think there are four reporters down at camp now waiting for me." He grinned boyishly. "We got ahead of 'em this trip—they were all up in the air till Butler saw fit to let them know where we were."

The girl had arisen suddenly. "I must be going on," she said hurriedly. "I have been here longer than I intended. You have been so good and patient about explaining

things to me. Good-bye, Mr. Mercury. Good luck."

"But see here—you can't go like this, you know. Can't you tell me where I may see you again—may I—won't you—"

She interrupted his stammering petition with an odd little laugh. "Mr. Kent"—he remembered afterward that she had called him Kent—"Mr. Kent, I'll let you know in the morning!"

"Really?" he exclaimed delightedly.

"Really." She traced a cross above her heart with the tip of her finger.

"I'll be here!" he assured her with enthusiasm, as she started down the little path to the road. A ripple of merry, tantalizing laughter came back to him through the dense foliage of the trees.

VI.

The next morning, when Butler sauntered into camp, having walked to the village and back for some copper wire, shaving soap, and coffee, he stopped short before Kent, who was lying before the tent smoking, and regarded him with fine scorn. "Stung!" he said briefly.

"Huh?" inquired Kent indifferently.

Butler removed a sheet of the *Daily Sun* from his pocket and thrust it beneath Kent's nose. Kent gazed down the Roman ridge of it and sat up suddenly. "How the devil—how the dev—"

Most of the front sheet of the *Sun* was devoted to an account, fully illustrated, of Kent's Discovery of Death-dealing Rays; Mystery of Disappearance Explained; Perfecting Most Notable Scientific Achievement of the Century."

There was a picture of Kent seated in the Scarab; there was another of Butler and Kent before the tent of their camp, and also a most remarkable one showing Kent at the culminating moment of achievement, standing by the table where lay his apparatus, with his hand grasping Butler's shoulder in unconcealed joy.

"Stung!" repeated Butler, emphatically. "And by a petticoat!"

Kent paid no attention to the other's disgusted remarks. He was reading the story carefully.

"By George, Butler," he cried, when he had finished, "do you know that's mighty well done—and what a scoop! Those fellows yesterday were all on the evening papers. By the way, it's kind of queer the fellows from the other morning editions didn't show up. What a scoop—Good Lord!" Then he laughed long and loud until Butler was goaded into throwing a large neat pile of quilts at him. "But, Butler," he roared, "she used my own camera—I stood around meek as Moses while she snapped to her heart's content.—Oh, Lord!—I insisted upon carefully explaining everything under the shining sun. I implored her

to permit me to demonstrate the thing—Butler, that girl's a wonder—she's a wonder, I tell you."

"I had my suspicions," remarked Butler. "If you had listened to me——"

"Oh, hang it all, Butler, what's the odds? I'm glad the girl got the scoop. By the way, I'm going back to town tomorrow. Yep. I've got a little business to transact with the *Daily Sun*."

When he strolled into the outer office of that newspaper the next afternoon the small boy behind the pink sheet behind the desk was overcome to the point of speechlessness upon recognizing the aviator.

"I wish to see the young woman who wrote that story about me yesterday," Kent repeated slowly. "No, not the editor, Miss—Miss——" he hesitated strategically.

"Mis' Dawson? Yessir. I'll fetch her right 'way, sir," the boy finally responded, darting into the inner rooms. He returned shortly to say that "She was in the library, room 403, right there, sir, yessir, thank you, sir."

Kent found the girl alone in the library room looking through the files on the high table.

"Miss Daphne," he said softly.

She raised her eyes, shadowed now by the masses of red-brown hair piled high on her head.

"Oh, Mr. Kent," she cried earnestly, giving him no opportunity to say more, "I want you to know that I *hated* doing it—how I hated doing it. There is no excuse. I know there is none. But somebody had to get it eventually. I hadn't been here very long—and I wasn't making good. My father wrote me that when he was sailing one day he noticed that somebody had set up camp just below my Seventh Heaven. I seemed to be sure at once that it was you—I don't know why. I had to make good, or lose my position. So I tracked you down. And I so nearly lost as it was. You didn't give me quite time enough"—she smiled deprecatingly—"I had to bribe father to meet the Morning men at the railroad and drive them to the Seventh Heaven by the thirty-mile route. Of course when it got too late to turn in copy for yesterday, they went back to the village, and found that the evening men had returned with the story. It was reprehensible—it was——"

"But, my dear Miss Dawson, I'm not in the least put out. I liked it, I assure you

Liked it immensely. And I want to tell you you're the aptest pupil I ever had."

Constance Dawson laughed happily.

"Oh, but you should have seen the dreadful books I had poked away in the crotch of that old tree, along with—cameras and films and things," she added, "in case of emergency."

"You can't say that I wasn't perfectly tractable," he laughed back. "Simply delighted in putting my neck in the noose—head in the lion's mouth, as it were. I hope

in view of my past amiability, Miss Dawson, you will let me call upon you tonight, where we can take the matter up in greater detail?"

The girl looked at him startled. Then she said quietly, "I'm sure we should be delighted to have you. We live at the Albermarle. I am—you know I am Dawson's wife."

Dawson? Dawson? The name seemed oddly familiar, but he couldn't quite place it. Then, suddenly, he remembered.

(The End.)

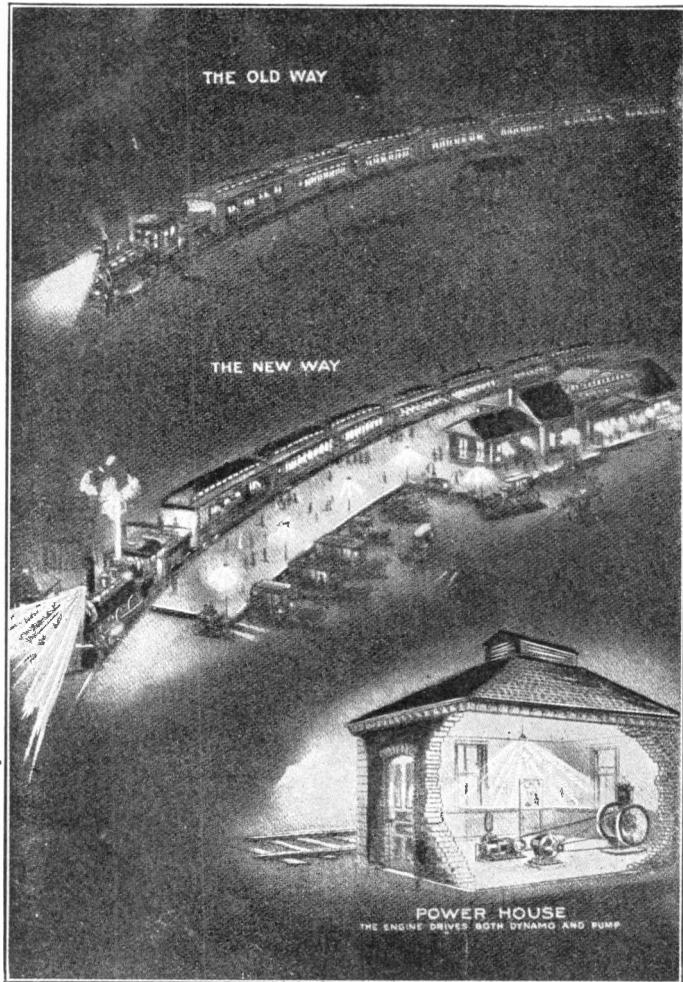
COUNTRY RAILWAY STATION LIGHTING

As indicated in the accompanying illustration the old way of lighting the railway stations and platforms in country towns was by means of kerosene lamps but since the wonderful development of the gas and gasoline engine and the tungsten lamps a more modern method is employed utilizing electricity for this service.

The new way as shown in the lower portion of the illustration consists of a power house equipped with a gasoline engine driving a dynamo as well as a water pump, the electric generator supplying electric current for lighting the depot, platform and yard, and the pump, either operated directly from the gas engine by belting or by electrical transmission, if located at a distance, the electric motor driven pump supplying all the necessary water for the station, the railway locomotive water tank and similar service.

The gasoline engine driven electric generator and pump may be started at a moment's notice and is most economical in operation, no steam being continually kept up for pumping service as when steam boilers and steam pumps are utilized for this service, the electric

lighting feature being added with very slight expense in first cost as well as maintenance.



THE OLD AND NEW WAY OF LIGHTING COUNTRY STATIONS

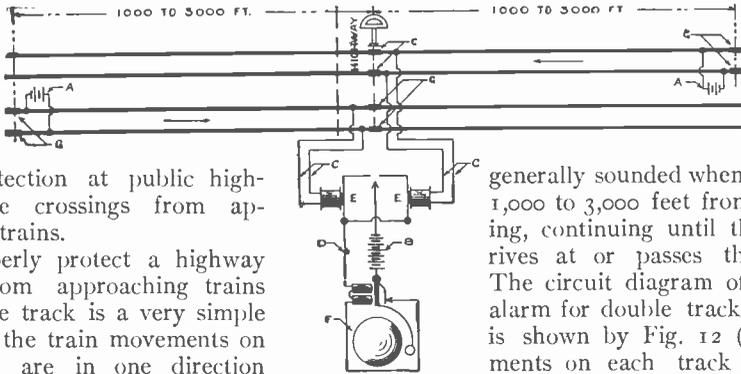
Electric Block Signaling

By SIMON DEUTSCH, E. E.

PART IV

Of the many applications of the track circuit, perhaps the simplest and still the most interesting, is its use in connection with the highway crossing alarm, a means of

only, and it therefore only requires a track circuit extending from the approaching side as far as the street crossing, no special relays or features being necessary. The alarm is



giving protection at public highway grade crossings from approaching trains.

To properly protect a highway crossing from approaching trains on a double track is a very simple matter, as the train movements on each track are in one direction

generally sounded when the train is 1,000 to 3,000 feet from the crossing, continuing until the train arrives at or passes the crossing. The circuit diagram of a crossing alarm for double track movements is shown by Fig. 12 (train movements on each track being only

FIG. 12. CROSSING ALARM CIRCUIT FOR DOUBLE TRACK MOVEMENTS

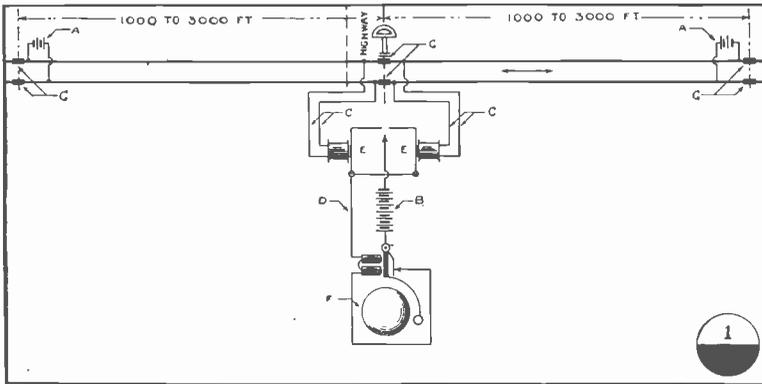


FIG. 13. CIRCUIT FOR PROTECTING CROSSING ON SINGLE TRACK

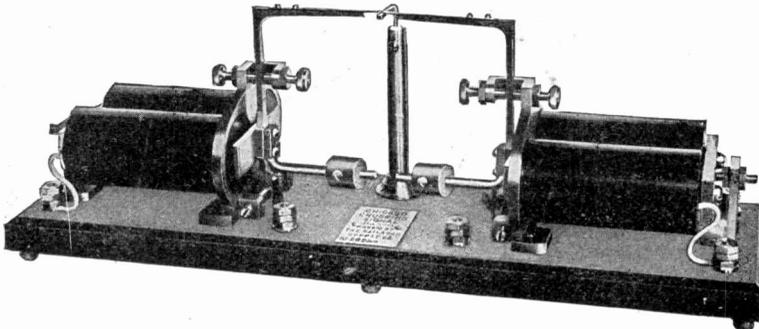


FIG. 14. AN INTERLOCKING RELAY

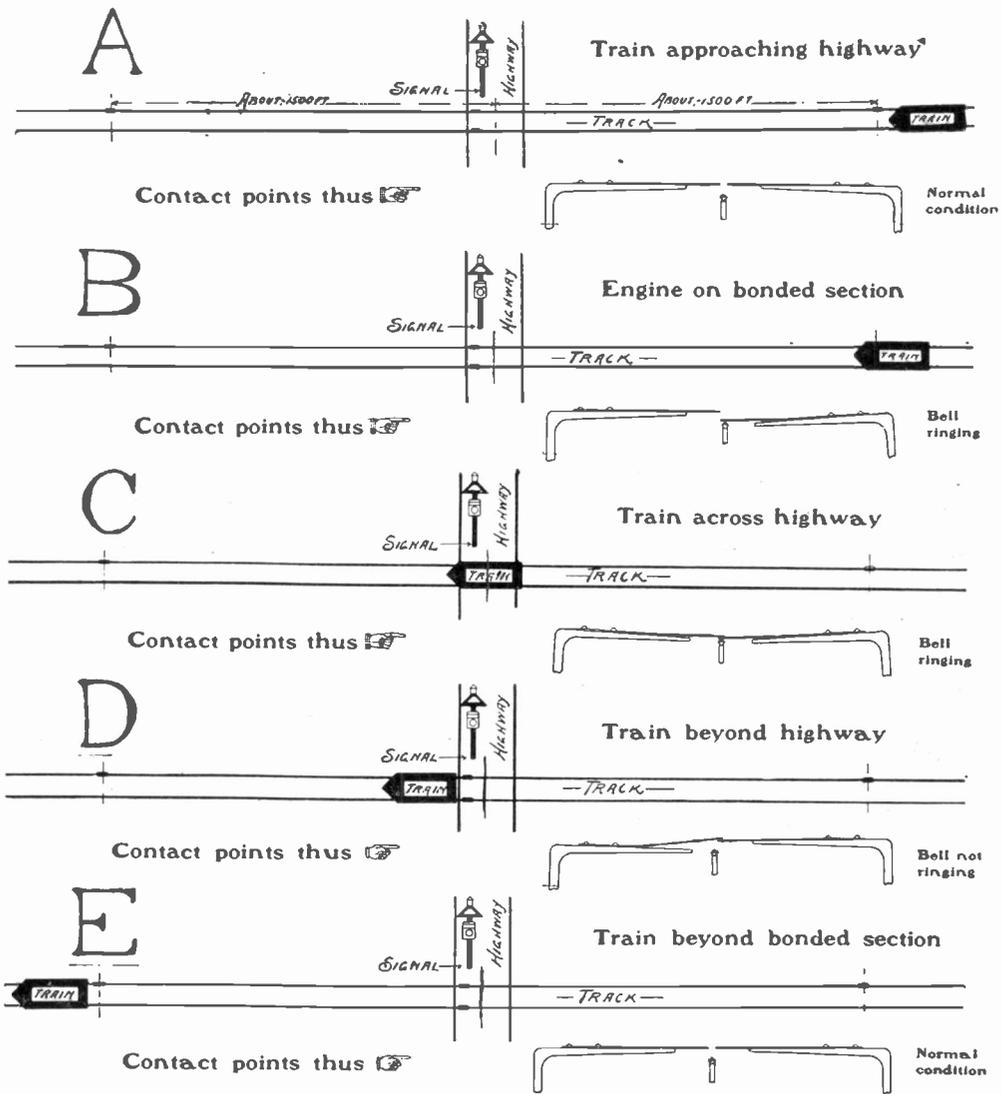


FIG. 15. SHOWING POSITIONS OF CONTACT POINTS AS A TRAIN APPROACHES AND CROSSES A HIGHWAY

in the direction indicated by arrows) and it can be readily appreciated how any ordinary electro-magnet having an armature on which is mounted a contact, can, by being de-energized when a train is on the track circuit, close a local bell circuit, and thus sound an alarm as long as the train approaches the crossing or remains on the track circuit.

From Fig. 13, which shows the circuit diagram for protecting a crossing from single track movements, it will be noted by the arrow indications, that trains operate in

both or either direction on the same stretch of track. Unless the alarm is sounded only when trains are *approaching* the crossing, the crossing alarm becomes a nuisance and menace to public safety, as an alarm sounding when a train is *receding* from a street crossing is unreliable and soon disregarded.

It therefore is necessary to provide a means of automatically silencing the bell as soon as a train has passed the crossing, regardless of the direction from which it approaches, and in addition to sound the alarm for following trains. This is accom-

plished by means of interlocking relays, a form of which is shown by Fig. 14, the method of interlocking of contact points and resulting conditions being clearly defined by Fig. 15, A to E inclusive.

From previous description of the track circuit, it will be understood how a train approaching the crossing will upon entering on the track circuit, short circuit the batteries normally energizing the relays, or electro-magnets, and through resulting contacts being made or broken, indicate its approach. By reference to circuit diagram of Fig. 13, and part A of Fig. 15, the normal condition of all parts will be noted. A train approaching the crossing, by de-energizing one side of the double coil interlocking relay, causes the contact point on its armature to assume the position shown by B, Fig. 15, thus completing the bell circuit, which is a local circuit. On reaching the crossing the train bridges both track circuits, whereupon the contact carried on the opposite armature falls on top of the first contact mentioned, corresponding to position C, Fig. 15. As soon as the train has passed by the crossing, at which point the two track circuits are separated, the first mentioned track circuit being now clear, the coil connected to same is again energized, and by drawing up its armature, the contact with the middle post, which is one side of the bell circuit, is broken, and the bell is silenced, this being shown by D, Fig. 15. As the train proceeds and passes beyond the limits of the track circuit, all conditions are again restored to normal, as indicated by E, Fig. 15.

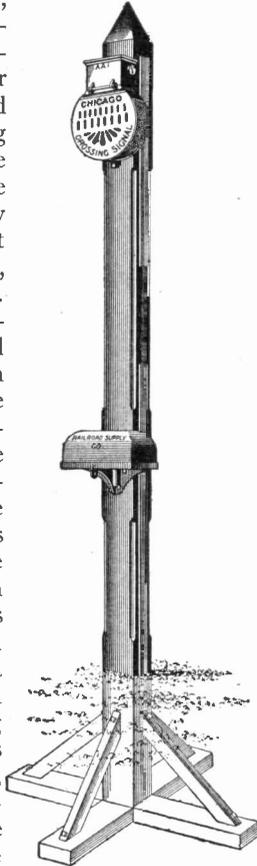


FIG. 16. CROSSING SIGNAL COMPLETE

The equipment generally placed at the street crossing consists of the bell, relay, relay box, and bell batteries, as shown by Fig. 16, which makes it a simple matter to wire up the equipment and localize all operating parts so that in case of trouble it is a simple matter to test out all parts of the local circuit or track circuit.

(To be continued)

The Cruiser

His home is not the sea, but the forests. Clad in a felt hat, heavy flannel shirt, with shoes and trousers to stand rough usage and miles of tramping through paths that have known only the redman, he is truly a "child of the forest." He carries a gun and hatchet at his belt, often using the latter to cut his way through the underbrush. His blankets, food and cooking utensils are carried in a substantial bag on his back. As he walks



THE CRUISER

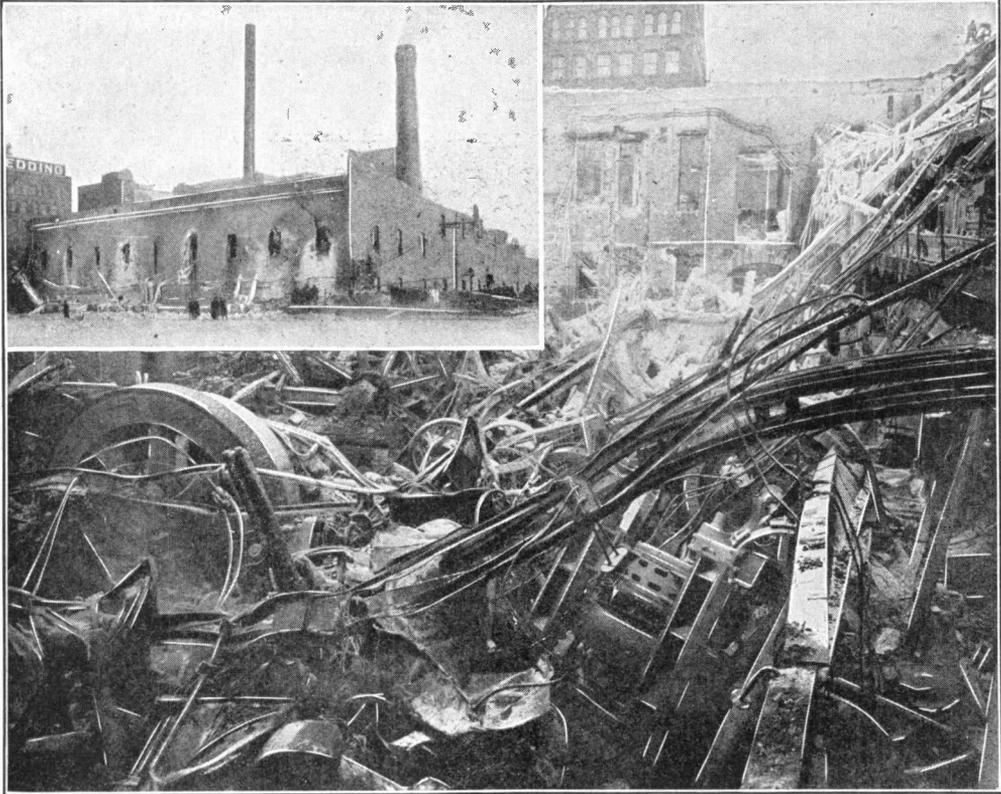
and walks his practiced eye scans tree after tree and when a certain section of timber has been carefully scrutinized, he can estimate to a nicety the number of telephone and telegraph poles as well as the amount of lumber of various kinds the section will yield.

A Demolished Power Plant

On January 6th, a tremendous explosion occurred in the plant of the Minneapolis General Electric Company, blowing out the walls and demolishing the machinery. This was followed by a fire which completed the

placed on a large truck which was stationed on the street just outside of the composing room. Wires were run into the building from these batteries and for the first time on record an electric automobile started to work in getting out a newspaper.

The five o'clock edition of the *Daily News*



RUINS OF THE MINNEAPOLIS GENERAL ELECTRIC COMPANY'S PLANT

work of destruction, as seen in the illustration. Nothing was left of the expensive generators and other electrical apparatus but a tangled mass of scrap.

An unusual incident in connection with the disaster was furnished by the efforts of the Minneapolis *Daily News* to get current for the operation of its linotype machines. When the destruction of the power house deprived the newspaper plant of current, the Studebaker Brothers Company, located directly across the street from the newspaper office, came to the rescue in a novel manner.

The power required for the linotypes was 220 volts. In 20 minutes time the Studebaker Company unloaded from its electric trucks 105 "Exide" vehicle batteries. These were

for January 6th, owed its existence to this improvised power house.

Sterilizing of Water by Ozone

The largest ozone installation yet carried out for the purification of water has just been inaugurated at St. Petersburg, at a cost of \$730,000. Receiving water from the Neva, the plant passes it through filters and then through an ozonizing apparatus, which destroys all deleterious organisms. The magnitude of the installation, which has been carried out by a German firm, clearly demonstrates the growing importance of this means of purifying water for town supply.

Electrical Men of the Times

By EDWARD SCHILDHAUER

When the Isthmian Canal Commission chooses a man to go to Panama you can safely put him down as close to 100 per cent efficient. Tested out under actual working conditions, as Electrical and Mechanical Engineer of the said Commission, Edward Schildhauer has, if anything, exceeded Government specifications. Such is the position which he now holds. How he prepared himself for its responsibilities is an interesting story.

Edward Schildhauer was born in 1872 at New Holstein, Wisconsin, a town composed entirely of German political exiles due to the wars of 1848. We first find him at the age of nine years playing a cornet in public, and for several years following he earned his living in this manner. The ability to play several musical instruments also assisted later on in paying college expenses and it is reasonable to suppose that he has made some music in the Canal Zone.

He entered the University of Wisconsin in the second semester of the class of '97 and graduated with that class, receiving the degree of Bachelor of Science in Electrical Engineering. After leaving the University he was first employed by J. G. White and Company and was engaged in electric railway work in and around Baltimore. He did not remain long in the East, however, but came to Chicago in the spring of 1898, and found employment with the Chicago Edison and Commonwealth Electric Company as draftsman. Originality in handling problems soon brought him to the position of head draftsman, then to assistant electrical and mechanical engineer of the companies, since known as the Commonwealth Edison Company. As starting engineer he tested out all

new apparatus put into service, and during his connection with the Edison interests the largest steam turbine plant in the world, the famous Fisk Street Station, was constructed. Incidental to his work in Chicago he secured numerous patents for devices in the electrical

and mechanical field which were embodied in new designs to improve the reliability of central station service. He also, with two others, formed a company in 1902 for the manufacture of high-grade insulating compounds.

It was in 1906 that Mr. Schildhauer was offered the position of Electrical and Mechanical Engineer for the Isthmian Canal Commission, which he accepted. Upon leaving the Commonwealth Edison Company, he was tendered a banquet by more than a hundred of his

fellow employees and presented with a handsome fob, suitably inscribed, showing in diamonds the number of stations and substations erected during his term of service.

In the summer of 1907 he inspected the American and Canadian Soo locks and regulating works and made tests on the large regulating gates of the Chicago Drainage Canal at Lockport. September 1, 1907, he went to the Isthmus to continue the design of all electric and mechanical work in connection with the Panama Canal. The magnitude of this work requires original methods in solving the problems.

It is impossible here even to outline the problems which confronted this young engineer and which he has solved successfully, but he has written an interesting article for POPULAR ELECTRICITY, which appears in another part of this issue, and which gives the reader a good idea of the original methods he has devised for carrying on the

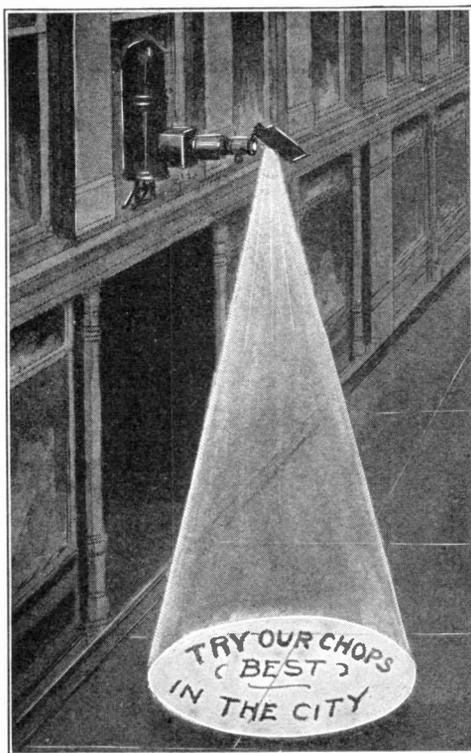


great work at the Gatun locks, though only a part of the duties which have devolved upon him. To broaden his knowledge he made an extended trip to Europe, in 1908, and inspected docks and canals in England, France, Belgium, Holland and Germany.

Mr. Schildhauer is prominent in many clubs and societies, being a member of the University Club, Panama; Strangers' Club, Colon; American Electro-Chemical Society; American Society for Testing Materials; International Society of Testing Materials; Illuminating Engineering Society; American Association for the Advancement of Science; and American Civic Alliance. Best of all he is a big, clean-cut hearty American of a type which has almost completed a task which men of other nations found impossible of accomplishment.

Sidewalk Sign

This practice of using the stone or cement walks as screens upon which an advertising



SIDEWALK SIGN

legend may be projected, first started in England where the darkening of the store windows after sundown meant darker sidewalks than we have in this country, and permitted such signs to be operated with lamps of moderate candlepower. Now the Germans to whose chemical researches we owe the intense brilliancy of our so-called flaming arc lamps, are using these high candle power lamps for sidewalk sign effects as shown in the illustration.

The arc lamp is situated inside the vertical cylinder and its rays are sent out through the horizontal projector. They are thus deflected downward by the oblique mirror.

A Plea for the Operator

When the "girlie" at "Central" says "busy," don't let yourself be worked into a fret and a sweat; don't tell her in language all freckled with fire, you think her a quite near approach to a liar. Don't paw at the carpet, and don't chew the rag, nor roar as a bull when it sees a red flag, nor tell her in voicing that paints the air red, you'll have her tin-canned ere the sun goes to bed, but murmur in sugary, marshmallow words, 'twill fall on her ear as the carol of birds, to please ring you up when the line is at rest, and she raises the party of whom you're in quest, and when she replies she will do so, just hang the receiver up gently and not with a bang. You scolding old fellow, if you had to bear but half of the hello girl's burden of care, that temper of yours would explode with a boom; 'twould scatter oath fragments all over the room. They often are cussed at and growled at by men when trying to do just the best that they can to keep service moving along without hitch, when soreheads believe them asleep at the switch, and sometimes the harsh words which fall on their ears fill their throats full of lumps and their eyes full of tears. Just do unto them as you'd have others do unto a sister of yours were she one of the crew, and you'll find that your services far better will be than if by your crossness you rattle them, see? And all of the girls will pronounce you a dear, instead of an ill-tempered, sore-headed bear. Just give it a try, and if our words lack in truth you can boot us to Brighton and back.—James Barton Adams, in the *Denver Times*.

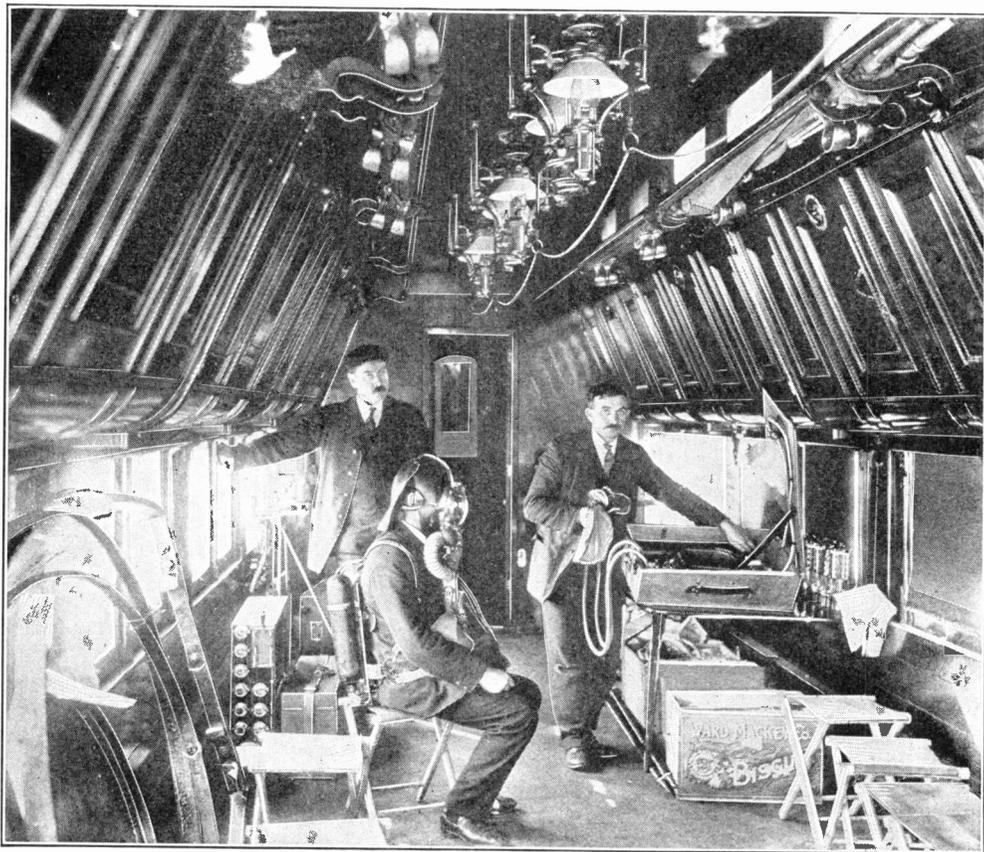
Electricity in Mine Rescue Work

By WALDON FAWCETT

Electricity is playing a most important part in the mine rescue work which is the first and foremost function of the new Bureau of Mines, the most recently organized branch of the United States Government. The Bureau of Mines which has lately been established as a part of the Department of the Interior and under the conduct of Dr.

in this country) is the kindred one of relief and rescue work following mine accidents, fires or explosions and it is to this "emergency work," for which there is such crying need, that the new Bureau has first turned its attention.

In this field the government experts are seeking to teach simultaneously all the les-



INTERIOR OF THE NEW UNITED STATES GOVERNMENT MINE RESCUE CAR

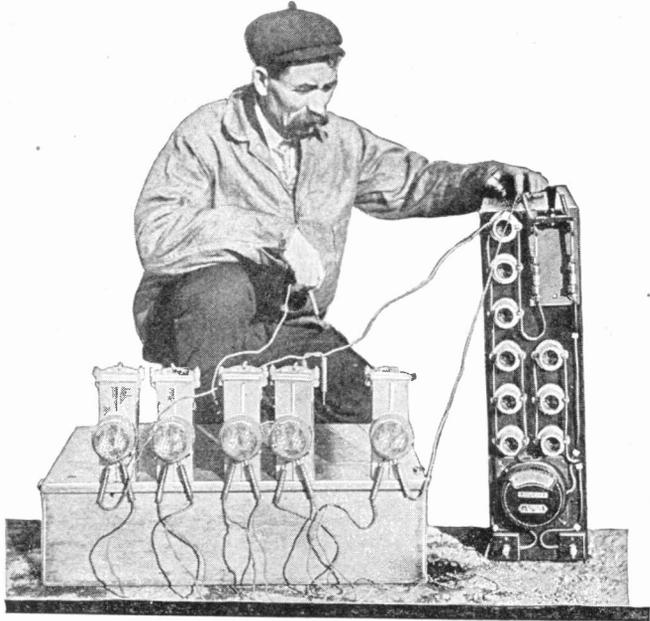
Joseph A. Holmes, as the first director of the new institution, will concern itself with the whole broad subject of mines and mining, but its especial purpose is to provide general and scientific investigations and research into the cause of mine accidents, mine explosions, etc. Bound up with this subject of mine disasters (which are nowhere in the world so numerous or so serious as

sons of the ounce of prevention and the pound of cure. As the medium of bringing about this era of better conditions there have been placed in service on the railroads of the United States a number of special cars known as Mine Rescue Cars, each carrying a carefully selected special equipment designed to meet every exigency in mine rescue work. Six of these unique cars—

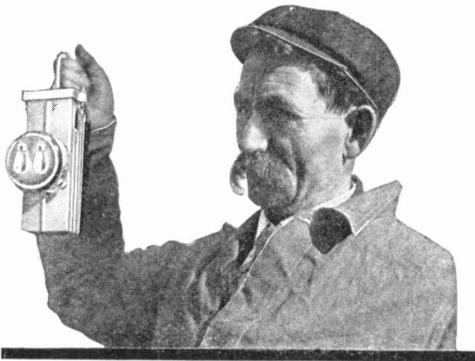
all converted Pullmans—have been placed in service this winter and the full complement of eight cars will probably be in commission before this article is printed. Each car has its headquarters in the central town or city of an extensive mining district and all the principal coal-mining regions of the country are thus brought in close touch with one or another of these portable "branch offices" of the new Bureau.

Each car, the exact duplicate of all the others in equipment, has a dual mission. Primarily it is what its name would suggest—a "first aid" car and hospital on wheels which can be rushed, literally at a moment's notice, to the scene of any mine disaster just as a wrecking train is hurried to the scene of any railroad accident. In pursuance of this purpose each car is provided with stretchers, stocked with medicines, etc., and the men who comprise the crew of each car, including a Red Cross surgeon and several men experienced in practical mine rescue work, eat and sleep

really outweighing the other in permanent value is the use of each car as a demonstrating station or school room on wheels, traversing all the steel-tracked highways of



CHARGING ELECTRIC LAMPS FOR MINE RESCUE WORK



ELECTRIC HAND LAMP USED BY RESCUE CREW

on board so that the car can leave at any hour of the day or night, waiting only for a special locomotive to be attached after the receipt of a telegraphic summons.

Secondary to the first function of a Mine Rescue Car only in a spectacular sense and

its particular district and enlightening the great mass of miners as to mine danger and mine rescue work. It is this "missionary work" which will engage the attention of the mine rescue cars all the time except in such emergencies as they are summoned to the scene of a disaster. Each car travels in accordance with a carefully arranged schedule and a stop of several days is made at each camp or mining town visited. Lectures are given in the car or in any convenient hall to the whole body of miners who are warned how to avoid danger and given advice as to what to do in any emergency. At the same time the experts on the Mine Rescue Car are training a picked body of volunteers, at each mine visited, in the whole gamut of mine rescue work and qualifying them to use the up-to-date equipment which has been invented for such purposes—equipment which the average mine operator is glad to purchase when he has men at hand who are competent to use it. It is expected that the cars now in commission will train, all told, each year about 3,000 to 4,000 men in what might be termed "advanced work" in the rescue field,

It is for this demonstration work as well as for actual rescue operations that each of the new cars carries a varied array of equipment, much of it, as has been stated, being of an electrical character. Conspicuous among the utilities are a number of portable electric lamps of a special pattern. The presence in the atmosphere of a mine of poisonous gas in a proportion even so low as five per cent will result in extinguishing the flame of not only the ordinary miner's lamp but likewise that in the latest approved form of safety lamp. Consequently the electric lamps must be depended upon to furnish the illumination for all rescue work. Indeed the lamps used by the miners (even the so-called safety lamps, which no inventor has succeeded in making thoroughly fool-proof) have been the cause of so many disasters, that some experts hope



OXYGEN HELMET IN WHICH THERE IS ALSO ENCLOSED A TELEPHONE

for a time when electrical illumination, either by means of hand lamps or lamps conveniently placed on supports, can be depended upon for all needed illumination in the underground workings.



ELECTRICALLY OPERATED "PULMOTOR" FOR MINE RESCUE WORK

There are several novel features in connection with the electric lamps on the Mine Rescue Cars. In order to conserve the current in the storage batteries the illuminating power is limited to a few candle-power, but it has the aid of a powerful reflector. Two tiny bulbs are placed side by side in each lamp. The current may be switched from one to the other in a second, but it is the intention to have one lamp burn for about four hours and the other burn for about an hour. The purpose of the dual bulbs is to have the lamp automatically give notice, so to speak, to the rescue worker using the lamp, that its supply of current for illumination is well nigh exhausted, and yet not cut off his illuminant suddenly, as would be the case with any ordinary lamp. His reserve of one hour's illumination from the second of the twin bulbs enables him to hurriedly complete the work in hand or to arrange matters for a temporary absence while a freshly charged lamp is being secured. And, by the way, the equipment of each Mine Rescue Car includes a charging outfit for charging the lamps. The outfit is portable and may be connected with any direct current. The electric lamps provided for the new cars are small but very heavy and are characterized by an almost incredible strength of construction in order to withstand the hard usage they must

sustain mid the rocks and debris of wrecked mines. At a recent test an official of the Bureau of Mines hurled one of these lamps with all his strength against a concrete pavement without breaking the heavy glass eye.

The telephone figures in the rescue outfit. There is on each car a field telephone with 2,000 feet of wire and the telephone is being made use of in the most ingenious manner in connection with the so-called oxygen helmets, eight of which, costing \$200 apiece, are included in the equipment of each car. The helmet is an air-tight, armor-like covering for the head and shoulders which enables a rescue worker to descend into mines filled with noxious fumes, just as the modern diver's suit enables its wearer to live and work under water. Inside the helmet is fastened a telephone transmitter while a receiver is attached to the ear of the rescue worker when he has donned his modern coat of mail. By means of this artery of communication a rescue worker descending into a mine after a disaster is constantly in touch with the men at the surface and can send back almost momentarily reports as to the condition of the mine, the presence of fire, the location of bodies found, etc. The telephone wire, as paid out at the mouth of the mine, is marked every fifty feet so that the men at the terminus always know just how far an advancing rescue worker has progressed in his exploration of the mine and can accurately identify the exact locality covered by any of his verbal reports.

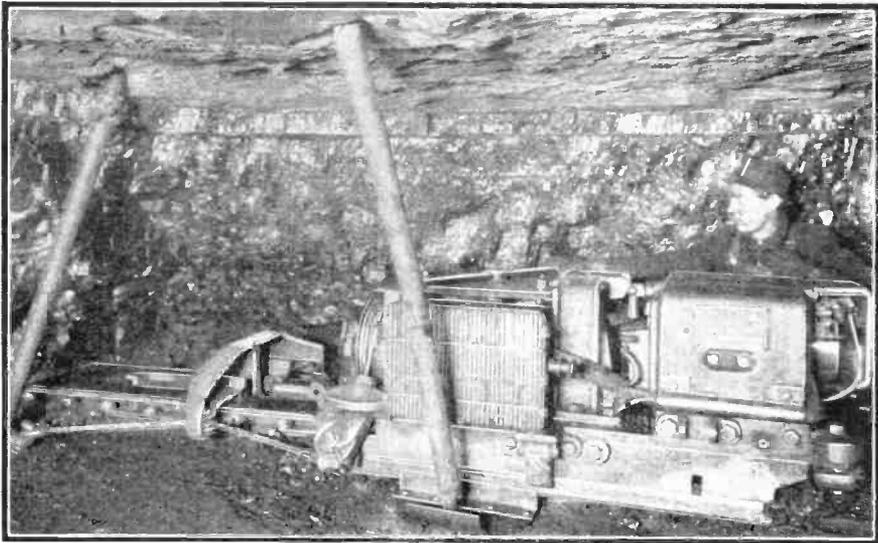
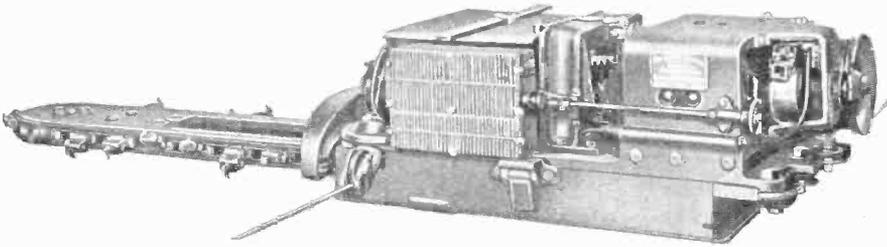
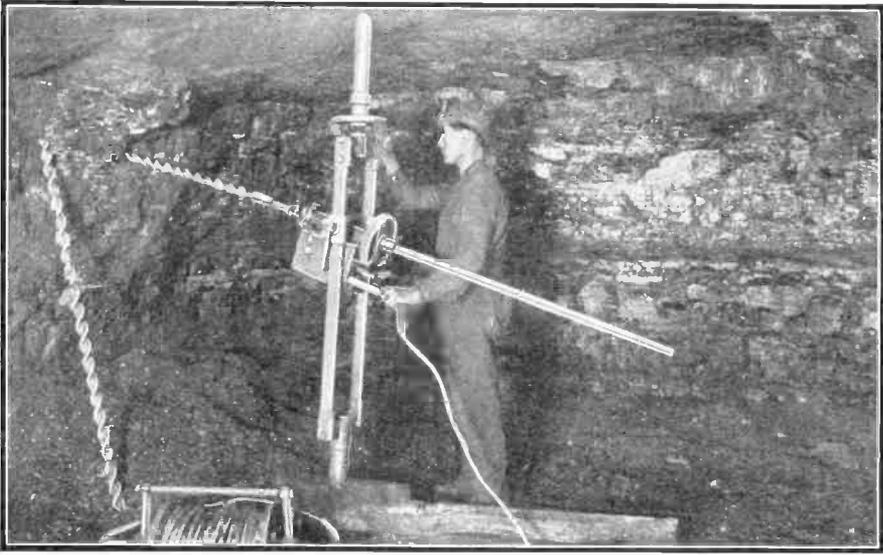
Of the electrical innovations provided for the mine rescue work, however, perhaps the most wonderful is the "Pulmoter." This is a recent German invention and the only machines yet brought to this country are the ones installed at a cost of \$800 each on the Mine Rescue Cars. The Pulmoter, which occupies a wooden case somewhat larger than the ordinary dress suit case and the motive power for which is furnished by a dry battery, embodies as the principal agents for use in mechanical resuscitation several cylinders charged with oxygen, a flexible breathing bag, a flexible tube and a hood that fits over the mouth and nostrils of the patient. The apparatus can readily be carried by one man and in actual service it is carried into the mine in order that its aid may be available the minute discovery is made of men overcome by the after-gases of

an explosion instead of it being necessary to delay to bring these imperiled men to the surface before attempting to revive them, as was the case under the old conditions, when the rescue workers had to rely largely upon exercising a victim's body in order to fan the spark of life.

The Pulmoter might almost be denominated an automatic breathing machine, its function being to draw the poisonous gases out of the lungs and to force into the lungs, in turn, the life-giving oxygen. Its marvelous efficiency is indicated by the statement sometimes made that it will "force a corpse to breathe," meaning that it will by its alternating forces of suction and pressure compel the diaphragm to move in a body in which life is absolutely extinct. Although the new type of life restorer has been in use but a short time, it has already accomplished life-saving work that is little short of miraculous. On one occasion recently it was brought into action on four men who had been in a mine for 26 hours after an explosion and who had been passed over for dead by all of the early rescuing parties. When attention was finally turned to these supposed corpses the head, arms and legs were cold, but a rescue worker thought he detected just a suggestion of warmth in one body under the arm. The Pulmoter was brought into action, and the four men are alive and well today.

The new Bureau of Mines in addition to employing electricity in its rescue work is making exhaustive investigations as to the influence of electricity in causing mine explosions. The current is being used to so rapidly increasing an extent for the operation of all sorts of coal mining machines and would be so serviceable (if thoroughly safe) for providing a permanent lighting system for underground workings, that the new department of the government is alive to the importance of determining as speedily as possible, under exactly what conditions electricity may be safely used in mines.

The Northern California Power Company maintains wireless plants at each of its hydro-electric power plants to communicate with one another and with the home office in Redding, in case the telephone lines are down or when storms make them dangerous,



SPEEDING UP COAL PRODUCTION—TOP VIEW SHOWS ELECTRICALLY OPERATED MINE DRILL AND BELOW ARE SEEN TWO VIEWS OF A MACHINE FOR UNDERCUTTING A VEIN OF COAL

Speeding Up Coal Production

How electrically operated machines are coming to displace the miners' pick is shown in the accompanying pictures more plainly than words can describe.

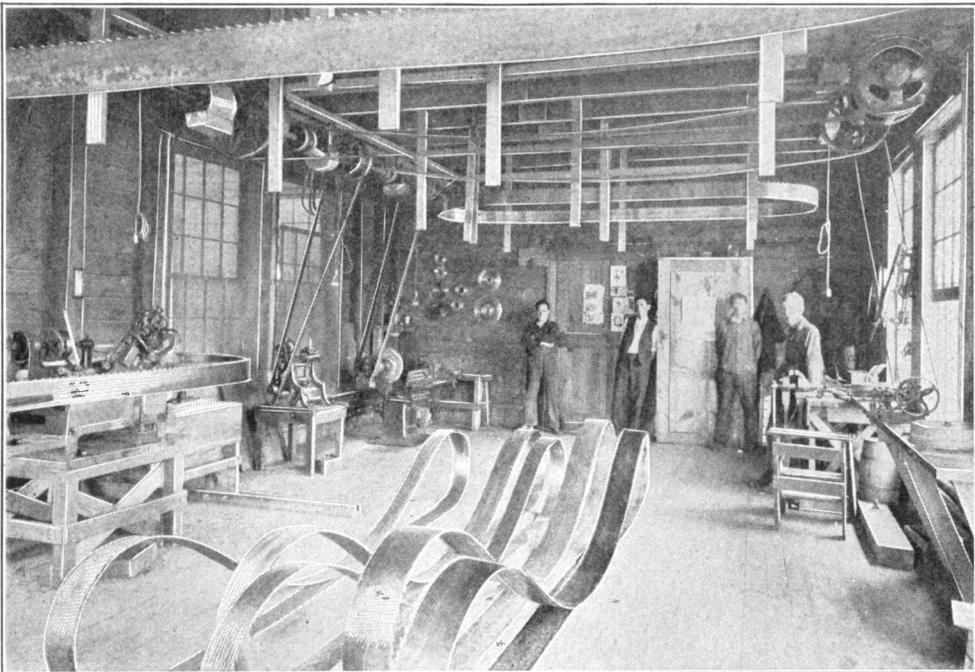
If the coal is to be loosened by blasting, the drilling in the cramped quarters is no longer done in the old-fashioned way but by an electric rotary drill. As seen in one of the cuts the drill is of the portable type, the motor and feeding apparatus being mounted in a strut held between the mine floor and roof. The drill which is driven by the motor, is a sort of auger which fairly eats its way into the coal. Such a device is set up in a few moments and unlimited power is brought to it through the flexible insulated cable from any point in the mine where the permanent wiring can be reached. This wiring then reaches up hundreds or thousands of feet to the power plant on the surface. Such long transmissions would be impracticable with compressed air or steam pipes.

Then there is another machine called a cutting machine, which will undercut a vein of coal clear across its face and to a depth of several feet. This machine moves about by its own power, being propelled by a

drum and cable. It not only feeds against the coal but cuts across from one side of the face to the other as the cable winds up on the drum. The long snout which projects out in front carries on its edge a series of traveling cutters or knives attached to a chain which is driven by a motor on the truck. These knives make what is known as a sump cut.

Electric Saw Filing

Electric power is utilized to special advantage in sharpening what are known as band saws; that is flexible steel saws that are formed like belts and travel over drive wheels and pulleys in a manner similar to belts. The electric motor is mounted on the ceiling as noted at the right, a small belt driving the scroll band saw filer on the bench below. At the extreme left will be noted an eight-inch band saw shapener while in the center may be seen a 32-inch American knife grinder and a 72-inch rip-saw sharpener all driven by the same electric motor through a counter-shaft and belt transmission. This method of group driving by a single electric motor is held to be the most economical for this class of work.



SHOP WHERE SAWS ARE FILED

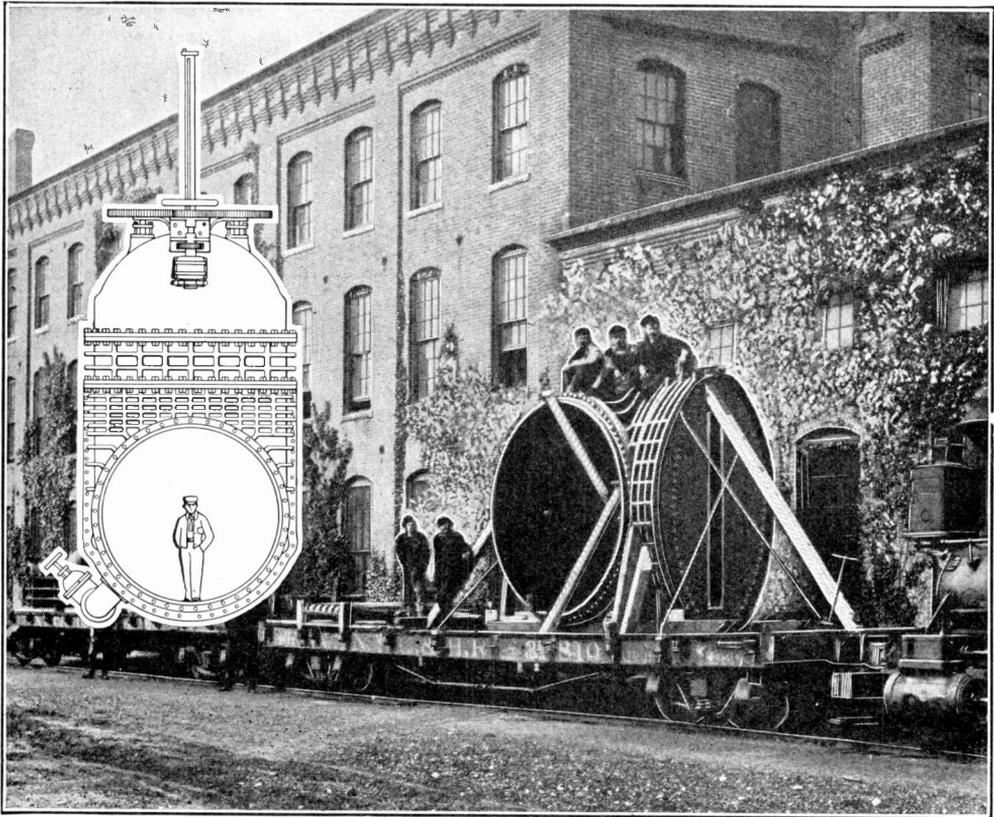
Largest Electric Valve in the World

One of the three largest gate valves ever constructed is seen, ready for shipment, in the accompanying illustration. These three nine-foot valves weigh 65 tons each and are operated by alternating current electric motors of fifteen horsepower each, three minutes being required for raising or lowering the gates which are of cast steel.

These valves are of the Chapman type

It may be stated that the body of the valve is of cast iron and the valve gate which is of steel is designed for a pressure of 60 pounds per square inch or a total load of more than half a million pounds.

The fifteen horsepower motors drive the spindles which are over twelve feet long, through gearing. These spindles for raising the gate valve have threads of two inches pitch and are two in number of Tobin bronze, $4\frac{1}{2}$ inches in diameter. There are automatic electric limit switches arranged at the top



LARGEST ELECTRIC VALVE IN THE WORLD—MAIN PART READY FOR SHIPMENT

designed to control the water-driven hydraulic turbines of 12,000 horsepower each at the Niagara Falls hydro-electric station of the Ontario Power Company. This largest electric valve in the world, only the lower part of which is shown on the car, without the controlling apparatus, is eleven feet wide and over 30 feet high when complete with controlling apparatus as shown in the line drawing.

and bottom of the gate travel so designed as to make it impossible to start the motor in the wrong direction and a unique magnetic brake is provided for instantly stopping the valve gate mechanism. In case the gate is part way open the electric motor may be started in either direction, but if the nine-ton valve gate is entirely closed the electric motor can only be started to raise the gate and vice versa.

Photographing Through the Body with X-Rays

The accompanying illustration shows the method employed in taking X-ray pictures of the interior of the body, by what is known as the compression diaphragm. The subject is held perfectly motionless in a vertical clamping device. The holder which contains the sensitive photographic plate is held against the chest. The funnel-like arrangement which is held against the back is for directing the X-rays directly through the body of the subject. The X-ray tube is the spherical, many-pronged object at the

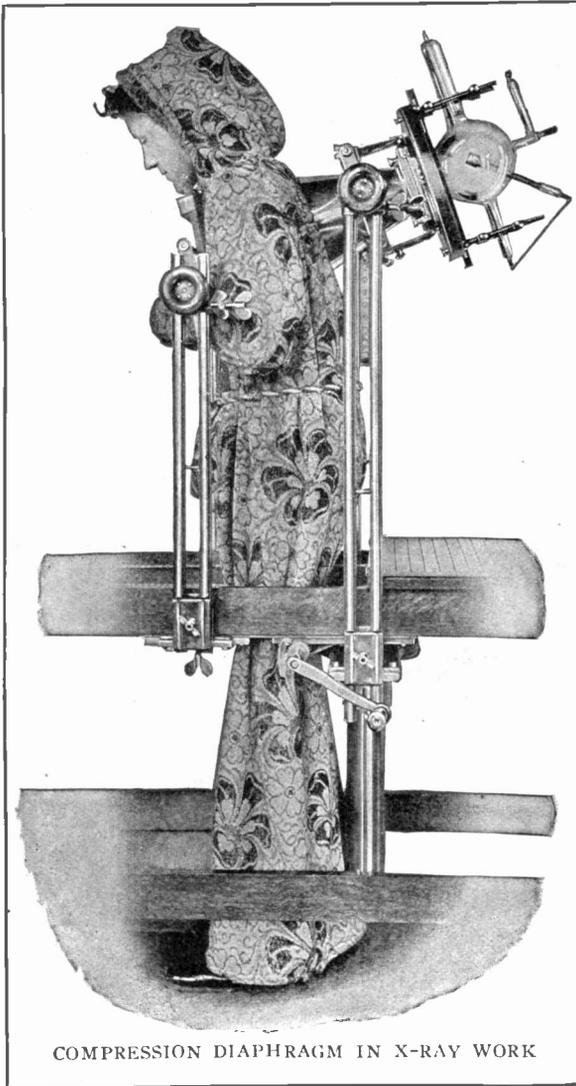
extreme right. The rays from this tube pass through the funnel, through the body and strike the photographic plate, affecting it in the usual manner. Bones, foreign objects, etc., which are more or less opaque to the rays, then cast their shadows on the plate and of course show when the negative is developed.

Portable Lamps for Military Use

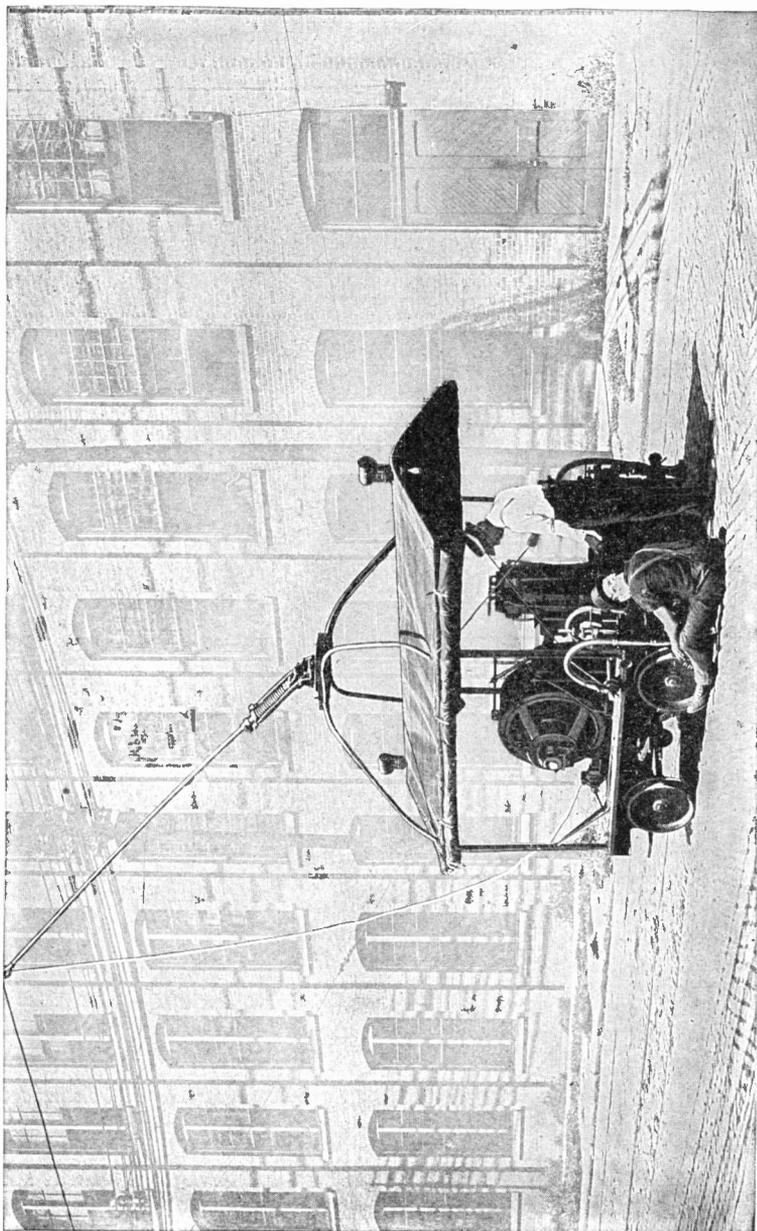
In military service officers as well as their aids have three important uses for portable lamps. First, they must be able to read the inscriptions on guide posts along the roads so as to keep their bearings, as also to light up any unexpected obstacles in the roadway. Then they must have some convenient way of lighting their maps, orders or other documents, and in consulting these they ought to have both hands free. Moreover, they should be able to light up the face of any one approaching them in the dark. But while the light should be instantly available when needed for any of these purposes, it should be turned off at other times so as not to disclose the bearer.

These requirements are all met admirably by some new German flashlight outfits built on the same principle as the common hand lamps, but carried without using the hands. Small types of these military lamp outfits have short tabs with buttonholes for attaching them to the officer's uniform, while larger ones are supported by shoulder straps. In either case the light is turned on and off by a little switch at the front of the leather case which protects the battery from the weather.

According to reports from Washington, electric locomotives will be used for towing ships through the Panama Canal locks. The locomotives will be gear-connected to the track by a middle rail cut into the form of a rack in order to obtain the requisite tractive effort. The work of installation will be done by the Canal Commission.



COMPRESSION DIAPHRAGM IN X-RAY WORK



ELECTRIC RAIL WELDING CAR IN OPERATION

Electric Rail Bonding

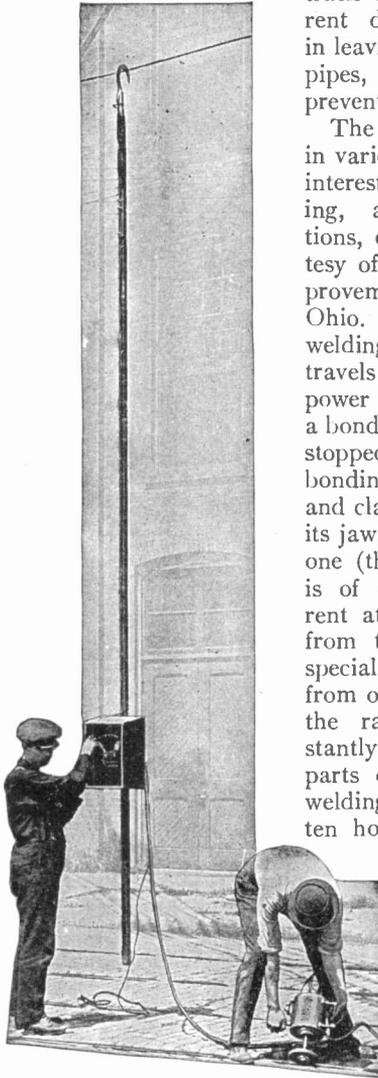
Many have no doubt wondered why it is that car motors are able to operate from a single trolley wire, having been told that two conductors are necessary to complete a circuit. The reason lies in the fact that the earth itself forms the other side of the circuit. The earth may be looked upon as a great reservoir at zero potential, and if one pole of the dynamo in the power house be connected to the earth and the other to the trolley wire the latter will be raised to high potential or voltage (550 volts in most railway systems). Then if the trolley pole is brought into contact with the wire current will travel down the pole and its connections through the car motors to earth, through the wheels of the car. The action corresponds to that of a pump (the dynamo) pumping water out of a lake into a long pipe (the trolley wire). This water flows along through the pipe perhaps several miles. There it may be tapped and the force of the water used to drive a water motor (the car motor) and from there be discharged back into the lake when its work is done.

In the case of the lake and the pump there would not be much of a flow from the motor back to the pump again, though the same water would be used over if the process were kept up long enough. In the electrical analogy, the grounded street car circuit, it is theoretically only necessary to ground one side of the car motor. In actual practice, however, better results are obtained if the track rails are made continuous and the return current led directly back to the power house through them.

To make the track rails continuous from end to end, what is known as bonding is resorted to; that is, bridging the joints in the rails by copper conductors of one type or another welded or riveted to each side of the joint. This bonding serves another purpose. By keeping the resistance of the track circuit low, so that the current does not find an advantage in leaving the rails to follow water pipes, the electrolysis of pipes is prevented.

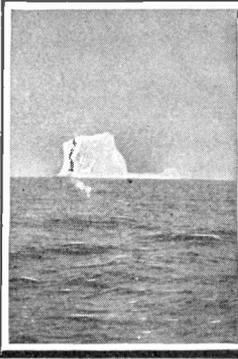
The bonds are put on the rails in various ways, one of the most interesting being by electric welding, as shown in the illustrations, obtained through the courtesy of the Electric Railway Improvement Company of Cleveland, Ohio. What is known as a welding car is used. This car travels along the tracks, obtaining power from the trolley wire. When a bond is to be made the car is stopped over the rail joint. A bonding clamp is then let down and clasps both rails and bond in its jaws. One jaw is of copper and one (that next the copper bond) is of carbon. An immense current at very low voltage, taken from the trolley wire through a special converter, is then passed from one jaw to the other through the rail and bond. Almost instantly the bond and contiguous parts of the rail are brought to welding heat, an energy of nearly ten horse power being employed, and a perfect weld is made.

Before the bonding is done, however, the surfaces must be made bright and this is accomplished by an electric grinder. This is a motor of size convenient to be handled and current for it is obtained by hooking onto the trolley wire as shown



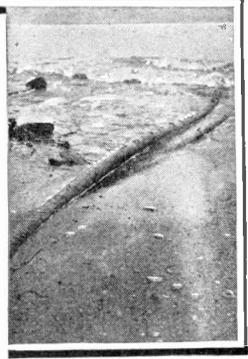
ELECTRICAL GRINDER PREPARING RAIL FOR BONDING

in the picture above. The man standing erect is working the lever of a "starting box" which controls the current to the motor operating the grinder. On the end of the motor shaft is a rapidly revolving emery wheel.



What Becomes of a Cabled Message

By FELIX J. KOCH



Perhaps nowhere, in all the world, are there more secrets bandied back and forth among disinterested listeners, than in a simple, rather neat, two-story frame building set in a little lawn, near the postoffice at North Sidney, Nova Scotia. On the outside, the structure bears simply the name of one of the great American telegraph concerns. In the lower story there is one great room filled with tables holding what seem to the layman so many telegraph instruments. You would pass it by, unheeded on your travels, were you not told of its import.

The largest part of the vital news, the movements in London stocks, and the New York markets, the cable messages to the world's great dailies and weeklies, the secret messages of kings and empires, pass from here into the waves, or, from the waves onto the long land wires.

Visitors are not relished particularly by the cable station. When they come however, and with a mission really other than curiosity, they are made welcome.

The story of the cable station can best be told in the story of a message. Messages from New York for London to come to North Sidney by telegraph. They will average ten words or less. The station here prides itself particularly on its rapid transmission of stock exchange messages, almost all of which, from the States, pass through it. In fact, most of the stock exchange business between the American and the British metropolis goes directly through here.

The New York Stock Exchange opens at ten in the morning, and if a message sent from it to the London exchange takes over two minutes for transmission, it is up to some one to explain the reason why.

Day and night they have a man standing at the North Sidney end of the wire, who

takes the message down as it is telegraphed from New York. While he is doing this, another man stands at his side and copies it, word for word, at the opposite side of the little table, onto the telegraph out-bound. From there the good word goes right through to Heart's Content in Newfoundland, and so this section of the work takes practically no time at all. Arrived at Heart's Content, in Newfoundland, another man repeats the same process, as soon as the message is received, putting it, however, onto the cable, so that in London they will be receiving the first part of the message before half of even a ten-word message is all on the wire here. And, in consequence, in less than two minutes, occasionally in one minute, the message is in London. This record time is especially adapted for the stock exchange business.

As to how the stock reports are sent one can get the story best in the words of the manager at North Sidney.

"After the stock exchange opens," he says, "we average from four to five hundred messages on its wires. We have for these messages, five cables out to Heart's Content, where there is a relay, so that we get still quicker work. When the message leaves Newfoundland, it crosses the seas, and lands at Valencia, in Ireland. From there it passes over land and to London.

If the cable be a very long one, like the one which goes direct to Ireland, it takes but slightly longer to send the message. The cabling is done much as is the sending of a Morse telegram, save that as the cable is at the highest speed necessary and requires the greatest amount of accuracy, the very best operators are stationed here. Many of these men can send from 40 to 45 words a minute, and this speed will be kept up, occasionally for an hour, without their

letting up. Stock exchange messages have the preference over others on the wires, but that simply means that they are given the fastest wires.

Cable operators require practice for perfection. Some of them will learn the work very quickly. They have some experts who have been classed as such for ten, fifteen, 20 years.

The average length of the stock exchange message is four to five words, and the price 25 cents a word to London. Other messages vary indefinitely in length. The press rate to London, from Sydney, is but a quarter of a cent a word. As a result the station will do from 50 to 70 sheets of press-work a day, at 50 words to a sheet. By a sheet is implied always, one of the familiar yellow telegraph blanks.

Occasionally a message will be affected by the earth-currents or an *aurora borealis*, no one knows just how. Any night that they can see an *aurora* at Sidney, they will find their wires affected. To overcome this effect then, they loop the two cables entering at Sidney and the operators at Heart's Content do the same, so that, instead of the two cables running as a pair of parallel strands, they now form one huge loop, touching one another, rather than the earth. Occasionally similar trouble will be met with on the land lines between Sidney and New York, sometimes delaying transmission for nearly a week.

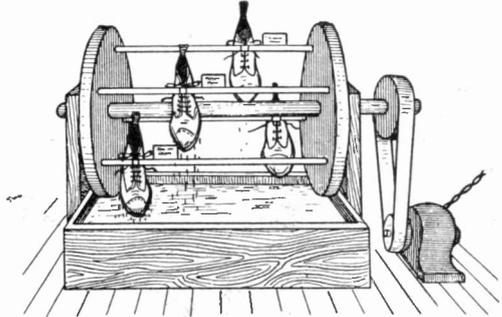
In returning a message to Sidney, it is sent the same as are the outgoing ones, using the dots and dashes. As these are taken down, in the wavy writing, the message may be kept by the automatic recorder. The transmitter uses the dots and dashes, it must be recalled, when sending his message, but the dots go into waves and streaks, as they are taken down by the recorder at the receiving end of the cable. This work, however, is done by the best operators in the company's employ, this being one of the finest of their establishments. In fact, some 50 men, including clerks, checker boys and the like, are now maintained. The station has been open at Sidney ever since the cable came, 30 odd years ago. At the time of that coming, the speed for transmission was about the same as now, though nothing was quite so hurried.

When a cable is broken between Sidney and Heart's Content, the operators are able to tell just where the break is and

about where in the water, lie the ends. The cable ship is at Halifax, but it is not long in port. Breaks are often caused by the anchors of ships catching in the cables. A ship, at such time, is supposed to cut its anchor, as it can then get damages from the company, but this they do not often do, preferring to cut the long line between the Continents. A cut of that sort occurs almost every spring. Or, again, the ice in the spring of the year, will crush the cable. Again, too, an occasional whale will injure it, or it may get on a rock, and, by wearing, be torn. Once the two ends are found, repairs can be made in a few hours. The ends have their positions marked by buoys, and are then spliced together. In fact this cable ship has become noted for its quick repairing, occasionally doing this work at Canso Station, under many eyes.

Advertising Shoe Polish

The illustration shows an ingenious home-made device, operated by a small electric motor, for advertising in show windows



ADVERTISING SHOE POLISH

that a certain oil keeps water from penetrating the leather of a shoe dressed with it. The ease with which the shoes shed the water after each immersion as the cylinder revolves is a striking argument for "dri-feet."

The kitchen at West Point has been thoroughly electrified. The food is cleaned and prepared by electricity. Electric heat cooks and bakes the meats, vegetables and pastry. Electric power does the work of cleaning the dishes, sharpening the knives and polishing the silver.

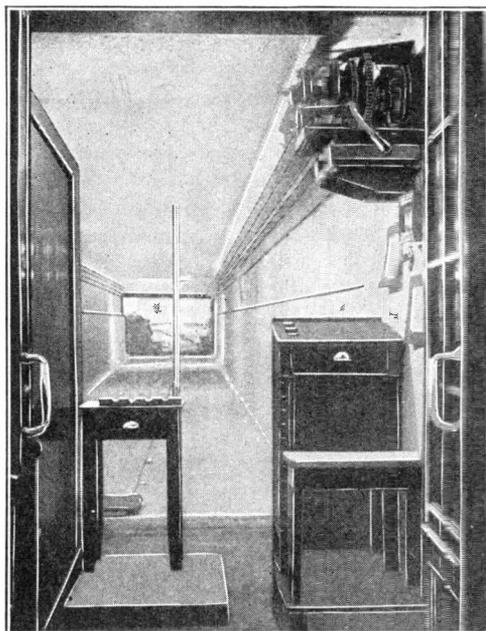
Moving Targets Electrically

When a new rifle gallery was planned for the "Landwehr" officers in Charlottenburg, Germany, it was suggested that instead of taking the recorder to the targets, the latter be brought close to the marksmen after each round of shots. This novel idea was carried out by Engineer Zickel of the Elektro-Apparatebau Company, who equipped a pair of parallel shooting galleries with a system of wire ropes for bringing the targets back to the firing end. During the firing, the targets are quietly suspended at the farther end of the gallery, fully a hundred feet off and the recorder, whose desk is beside the marksman, jots down the approximate result of each shot. After each series of from three to six shots, the recorder throws a switch on the motor above his head, thereby moving the endless cable which carries the targets and which runs over pulleys in a narrow passageway between the two parallel alleys. This starts the target back towards him, making the trip

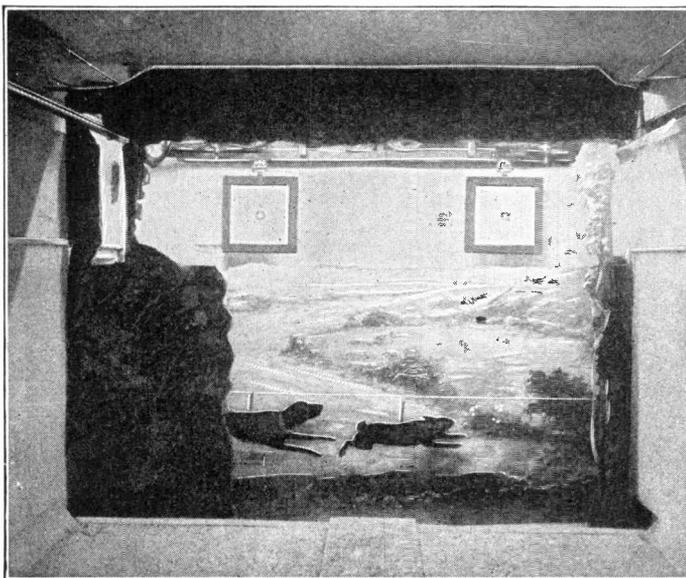
in twelve seconds and automatically stopping the motor when it reaches the recorder's side. Then the exact imprint of the shots can be noted by both the marksmen and the record keeper without the possibility of a dispute, after which the shot marks are covered with paint or pasters. When started back by a reverse throw of the switch, the motor again is stopped automatically when the targets have reached their normal position.

Instead of the bullseye targets, metal figures of game can be hung from the moving cable and this can be arranged to move the game across the end of the shooting gallery at a fair speed. In one case, such a game alley has been fitted up by the same

German firm with a double cable, allowing the operator to send the figures across the gallery in either direction. The figures used for this purpose are interchangeable so that the sportsmen never know what animal will show up next nor from what



MOTOR AND SWITCH FOR CONTROLLING TARGETS



MOVING TARGETS ELECTRICALLY OPERATED

direction it will come; but he does know that the moving figure will appear at his end of the gallery in a fraction of a minute.

The Auristophone

The auristophone is an electric hearing device for the deaf or partially deaf. It consists of a transmitter, pocket battery, and receiver, the latter being placed to the ear of the person who is hard of hearing. The grand opera Auristophone, as the name indicates, is an opera instrument and is said to give a more voluminous and full tone than the ordinary device, for the reason that the



USING THE AURISTOPHONE

receiving instrument used is of the duplex type.

It is asserted that this device enables those mildly afflicted and who ordinarily can hear music or speaking at a distance of only a few feet, to hear well in the fore part of any church, theatre or auditorium, without having wire connection with the pulpit stage or platform.

It is claimed also that the Auristophone improves the hearing by massaging the inner organs of hearing without air compression and without tiring the ear while all the ordinary trumpets and other instruments for the deaf compress the air within the auditory canal against these organs, tiring the ear and even causing severe injury.

A Recording Compass

Through the agency of delicate contacts on a compass and the communication of the corresponding electric currents to a recording stylus controlled by two magnets, an electric recording compass has been perfected by a western inventor, which promises to become indispensable to the mariner. The compass proper makes the observations automatically and communicates them through two conductors to the recording mechanism enclosed in a cabinet in the pilot house or elsewhere. The device is so designated as to produce a continuous record of the direction of the ship with relation to time; so that the direction in which a ship was moving at any hour and minute can be determined at a glance at any time thereafter from an inspection of the records produced.

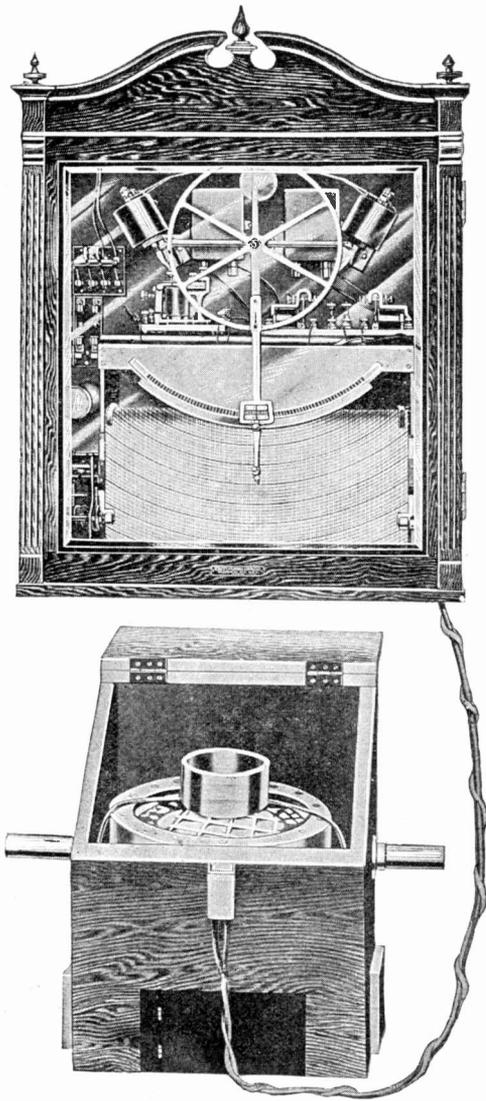
The instrument shows variations of about $2\frac{1}{2}$ degrees or a trifle less than a quarter of a point, so that if a ship is on her course and the wheelman allows the vessel to wander as much as $2\frac{1}{2}$ degrees off the course laid out the automatic mechanism will at once register the error permanently and the exact time that the deviation occurred, so that a captain by looking over the chart can discover at once whether his ship has been

working to starboard or to port, and whether his instructions have been followed.

It is also possible to secure a definite idea of the conditions encountered at sea; in a seaway, or during rough weather the record will be irregular while during calm the course indicated by the appliance will be almost a smooth line. The size of the instrument is two feet square by ten inches deep and it can be connected to any ordinary lamp socket which will give a voltage of from 100 to 125 volts.

The only attention required is the placing of a new chart on the roll every month and filling the pen about every two weeks.

The clock movement which moves the chart in the recording mechanism allows it

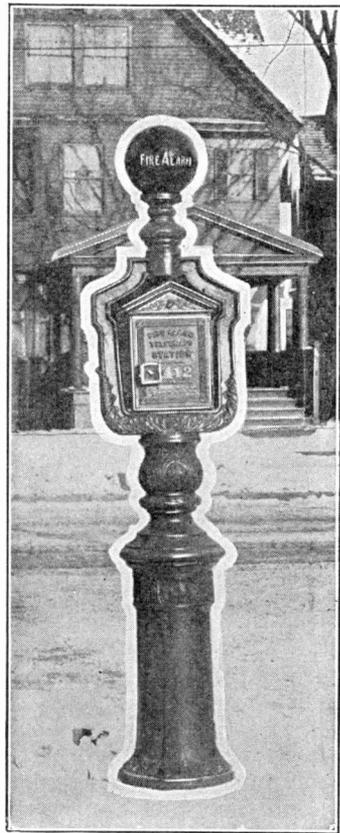


RECORDING COMPASS

to pass by the recording point $2\frac{1}{2}$ inches every hour. The clock is wound by electricity automatically and requires no attention whatever. An ingenious feature of the instrument is the circuit changer, which automatically throws the instrument on a set of batteries if the dynamo current for any reason should give out, and again switches the dynamo current in when it is again in operation. Thus the continuity of the record is maintained, and the captain can tell by a glance at the sheet whether or not the man at the wheel has been attending to business.

Where is Your Fire Alarm Box Located?

Could you tell off-hand, if asked, right where to find the fire-alarm box nearest your house? In all probability you could not, for the average person does not bear in mind the obvious things which come to his attention every day. The city of Rochester, New York, has an infallible means of directing attention to it. Upon the top of each box as in the picture is placed a red glass globe bearing the words "Fire Alarm" in large white letters. Within the globe is an incandescent lamp the wires to which run underground. In this way 300 boxes are pointed



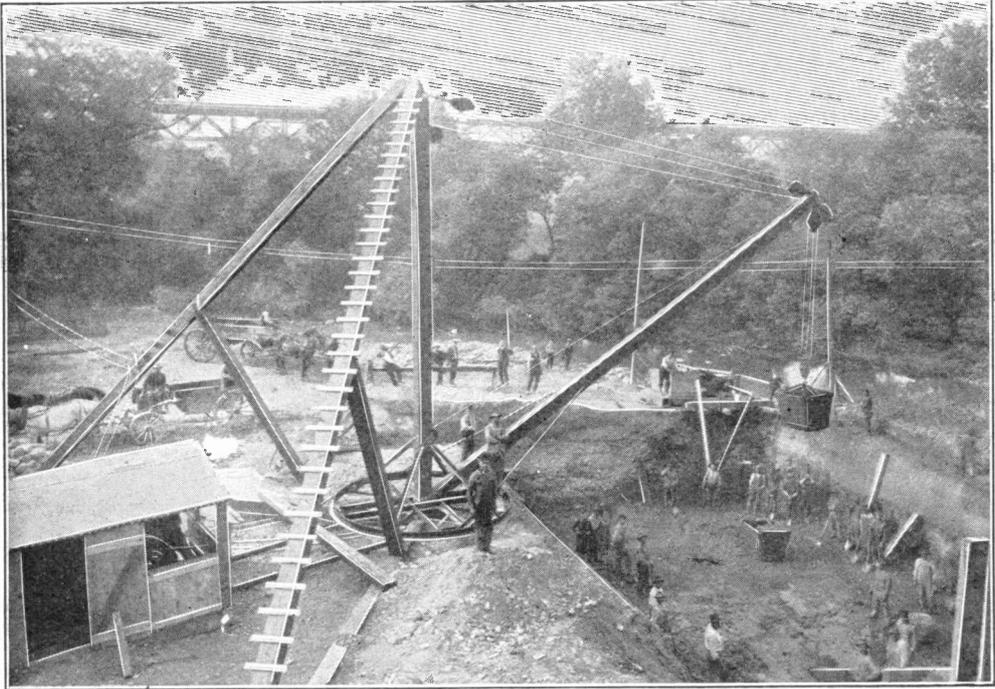
FIRE-ALARM BOX WITH LAMP INDICATOR

out. This innovation was the result of a recent fire in the city in which the man who discovered the blaze at night rushed about for some time in bewilderment trying to find a fire-alarm box.

A Convertible Electric Derrick

It is of interest to note that, in the use of electric derricks on excavation and construction work, either the guy type or the stiff leg type of derrick may be used, as best adapted to local conditions. The electric derrick shown in the accompanying illustration was specially designed to be convertible into either type, as required. This is affected by

It may be stated that this derrick is operated by an electric hoist of 20 horsepower. It has two drums, and on one end of the shaft is a special reversible winch for swinging the derrick. The other shaft carries an ordinary winch head besides the drum. In addition to the ordinary band brake, there is an automatic brake to prevent the drums from backing in the event of current being accidentally cut off while the machine is hoisting



CONVERTIBLE ELECTRIC DERRICK

the use of special interchangeable fittings, so that only a small number of extra parts is required to change the derrick for different classes of work. The machine can be adapted for use in excavating as well as for handling material. Two lines are led over the boom for operating the grab bucket. The line for the topping lift, which raises and lowers the boom, is led up to the head of the mast and thence across to the head of the boom.

This design of electric derrick was utilized in the construction of the Grand Avenue reinforced-concrete viaduct at Milwaukee, Wisconsin. The hoisting capacity is six tons and the working radius is from twelve feet to 38 feet, while the vertical lift is about 30 feet.

a load. The operating levers for the controller, the clutches and the brakes are arranged very much as in a steam hoist. The derrick is swung by means of a bull-wheel which is built of steel and is adaptable to derricks of various sizes.

Tantalum Lamps for Car Lighting

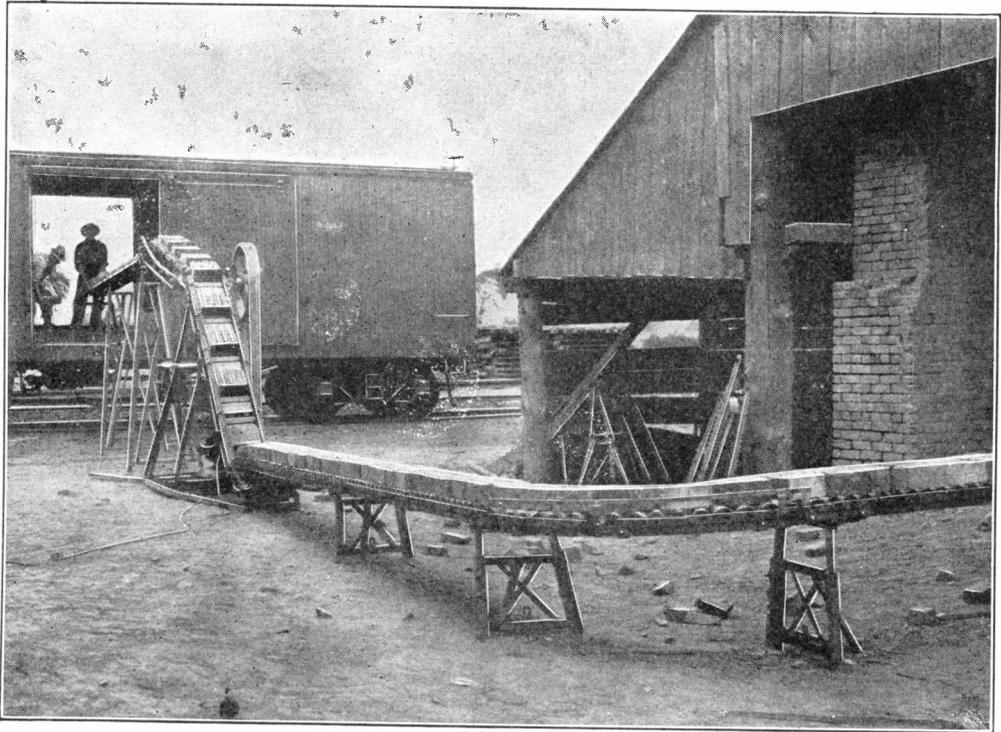
By using tantalum lamps for car-lighting, the Chicago Railway Company finds that it can save five cents a day per car. A thousand cars have been equipped with tantalum lamps, and will save the company \$18,000 a year on this basis. The company expects to equip all of its cars in this way, and effect a saving of over \$35,000 a year.

Electricity and Gravity Do the Work

The portable electric elevator noted at work in the accompanying illustration is provided with an electric motor under the hoisting equipment connected with a flexible cable for supplying the current. This electric portable elevator is utilized in connection with a gravity carrier and is a very

and scientific. Practical men in all lines of manufacturing recognized its value the moment it was brought to their attention; recognized that its chief merits lay in economy of labor, and time, the two great essentials in profitable manufacturing.

Ball bearings are used and modern gravity carriers and automatic elevators are constructed scientifically and accurately.



PORTABLE ELECTRIC CARRIER AND ELEVATOR

necessary device at this brick yard. By placing it near the loading point it receives automatically from the gravity carrier at the bottom and discharges automatically at the top to the gravity carrier above, from whence the bricks are conveyed any distance to the car and around curves if necessary. This machine automatically handles loose brick and keeps them together to their destination.

It may be stated that a decade ago little was known of the tremendous possibilities back of the idea of utilizing a natural force, such as gravity, as a means of conveying merchandise from point to point in and about factory plants. Today it is a recognized element in factory and warehouse economy; its development has been rapid

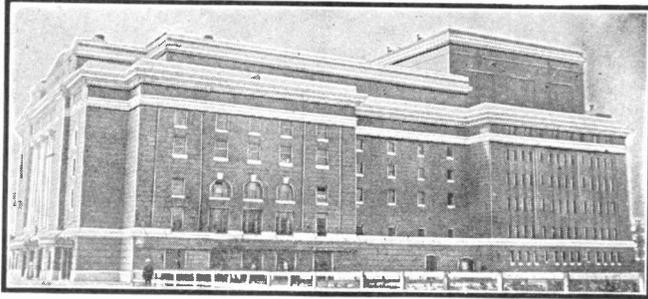
Queer Ocean Power Plant

During the fitting out of the White Star liner "Olympic," electrical energy for light and power was supplied from a tug moored alongside the larger vessel. This tug has an electrical plant with a capacity of 320 kilowatts on board, and was also fitted with a powerful steam fire pump. It is therefore both a floating electric generating station and fire station, in addition to being a tug. The "Jackal," as the tug is called, has engines of 1,500 horsepower. For the purpose of driving the electric plant the shafting connecting the propeller with the engine was uncoupled and the dynamos coupled up instead.

Producing a Grand Opera

There is one field of present-day activity where electricity has worked its miracles almost unknown to the general public. This is in the technical side of theatrical, and

public into their confidence regarding their own personalities but the shrewd business men and technical experts who provide the settings for operatic and dramatic entertain-

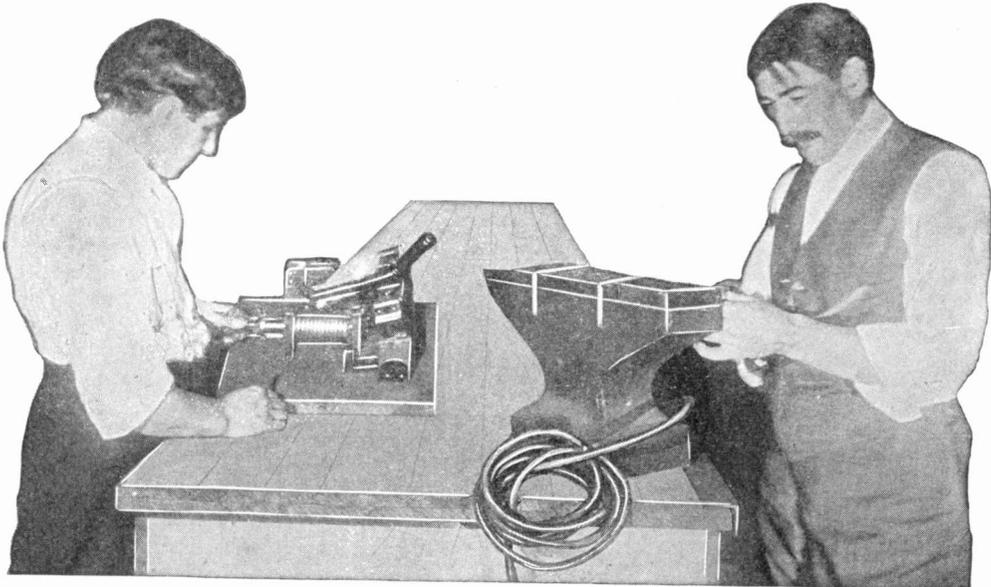


NEW HOME OF THE BOSTON GRAND OPERA

more especially grand opera productions. When one stops to consider for a moment, however, it is not altogether strange that the public should not realize the extent to which electricity has, in the last few years, revolutionized things "behind the scenes," for all that the public at large takes so lively an interest in all that goes on in the realm of music and the drama. Stage celebrities and musical stars are willing enough to take the

ments are by no means so frank. They like to preserve the traditional air of mystery in which the stage has been more or less enshrouded from time out of mind, and they like to astonish their public by glowing spectacles and sensational lighting effects without disclosing to the people "out in front" how the beauties of such illumination are obtained.

However, if you will corner the practical master of Twentieth Century stagecraft he

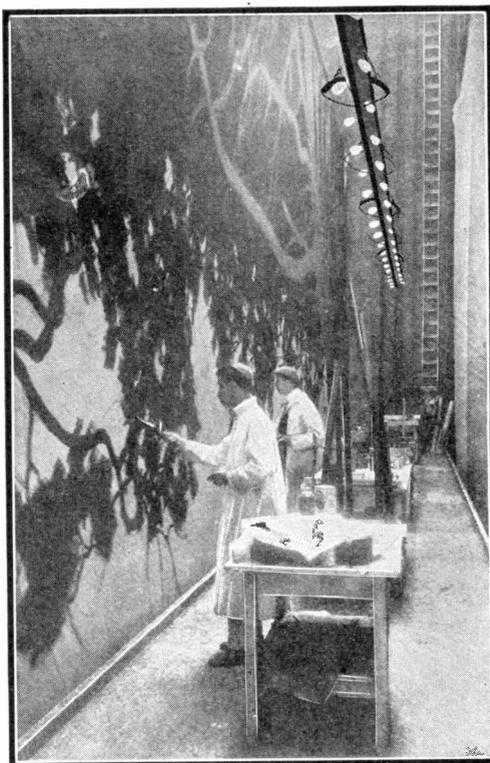


ELECTRICIANS AT WORK IN THE GRAND OPERA HOUSE—THE MAN AT THE RIGHT IS WIRING THE ELECTRIC "ANVIL" FOR USE IN THE "ANVIL CHORUS" IN "TROVATORE"

will admit that no other one factor has been so influential as electricity in rendering possible the massive stage productions of the present age and more particularly their spectacular investiture. Electricity has played its part in every branch of the entertainment field but naturally its fullest utilization has been found in grand opera—because on the one hand grand opera calls for not only elaborate but often mythical or fantastic counterfeit environment, while on the other hand the stage productions in grand opera are more extensive and more massive in every sense than in the ordinary drama.

Any layman must appreciate that the greatest service that electricity has rendered stage folk has been in illumination before and behind the footlights. It is difficult to cite a more striking transformation in any sphere of the world's work than the transition from the old days of oil lamps, slowly and laboriously extinguished when a "dark set" was required and "red fire" burned on a shovel when little Eva or Marguerite ascended to heaven, to the present facility with which an entire theatre may be plunged into darkness in the twinkling of an eye and all the tints of dawn, sunset and moonlight simulated by means of electric lights so skilfully varied in their intensity as to challenge Nature and convey to the spectators no hint of the mechanical to spoil the illusion.

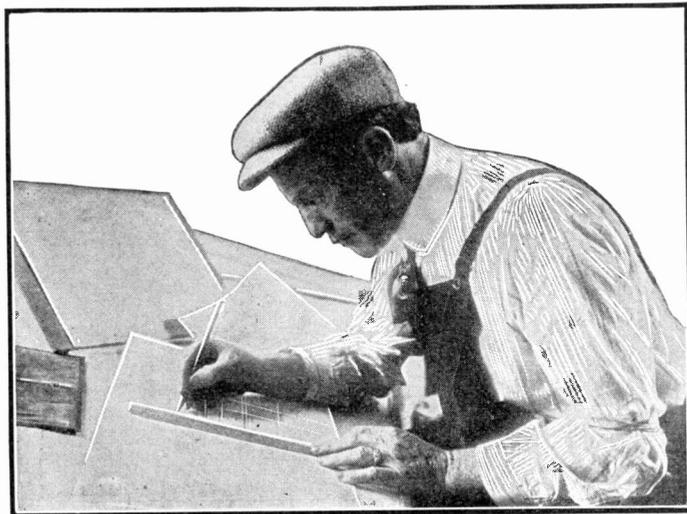
Some idea of the extent of the dependence placed upon electrical lighting at a modern



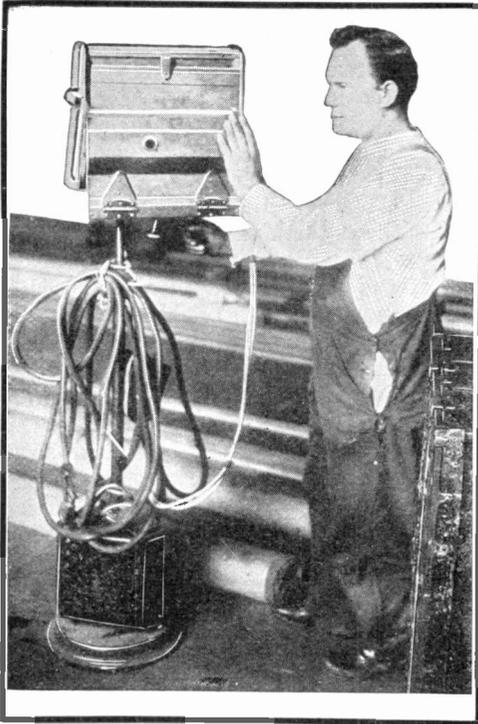
PAINTING SCENERY AT NIGHT BY ELECTRIC LIGHT

temple of grand opera may be gained if you will take, by proxy, a peep at the electrical "nerve center" in the nether regions of darkness beneath the stage of the new Boston Grand Opera House—the model opera house of the world. Here, in a long narrow apartment just wide enough to allow two or three electricians to work, is located what is claimed to be the finest switchboard of the kind in the world. It cost \$26,000 and it controls stage illuminants aggregating 5,000 incandescents and 50 arcs.

Many unusual features impress one in the equipment of this subterranean seat of electrical energy. For one thing there is a seeming excess of facilit-



PLANNING THE LAY-OUT OF ELECTRIC LIGHTS FOR THE VARIOUS SCENES OF AN OPERA



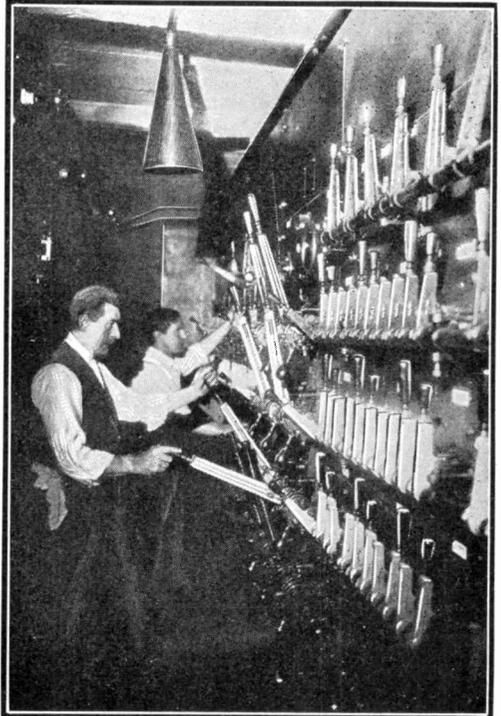
ELECTRIC SPOT LIGHT

ties for the transmission from the stage, quickly and accurately, of orders for the electricians operating the switches in the pit. This precaution is understandable however, when it is remembered that a moment's delay in switching on or off the lights may mar a "scene." Ordinarily electric bells are depended upon to transmit signals but there are also speaking tubes and finally, directly above the head of the chief electrician is a megaphone through which the stage manager in the wings overhead may shout an emergency order.

The duties of the electricians stationed before this switchboard while a production of grand opera is in progress are complicated by the fact that aside from the necessity for quick action at all times there is the circumstance that systems of lamps in a number of different colors must be controlled. For instance, the footlights and the border lights comprise not merely single rows of incandescent lamps but lines of different colored bulbs ranged side by side—red or pink to simulate dawn; yellow for sunlight; blue for moonlight, etc. In order to simplify the manipulation of these colored lights the levers of the switches on the big board are painted

in colors corresponding to the tints of the respective systems of lamps which they control. Yet another requisite of skill that confronts the men who throw the switches "below stage" is the frequent necessity for delicate manipulation in the handling of the lights. Rosy dawn must give way by the most gradual flow of light to the full glare of day, or a brilliant sunset must fade into twilight and thence to the mellow radiance of moonlight. Modern electrical science has supplied the big switchboard with all known electrical aids to such kaleidoscopic work, called "dimmers," but after all much depends on the skill and judgment of the men in front of the switch board.

The switchboard work, important as it is, is but one phase of the illuminating responsibilities incident to a grand opera production. On the stage, on specially constructed platforms elevated somewhat above the heads of the singers, maybe even in the "flies" far overhead and out in the midst of the audience in gallery or balcony, other electricians are manipulating "spot lights" and the electrical



SWITCHBOARD OF THE NEW BOSTON GRAND OPERA HOUSE, BUILT AT A COST OF \$26,000

successors of the once-familiar but now obsolete calcium light. These powerful lights designed for projection in one given direction are almost invariably arcs and the common form is that of a lamp with a strong reflector mounted upon an iron standard which is in turn rigidly supported by a heavy iron pedestal. The manipulation of these lights involves something more than the mere switching off and on at the proper moments and the ticklish task of keeping the beams centered on a "star" who will resent as a personal insult anything suggestive of a shadow. In addition there is the necessity for helping to carry out any "color scheme," such as has been mentioned in speaking of the incandescents controlled solely from the main switchboard. Only in the case of the spot lights, etc., the tintings of the scene on the stage are accomplished by means of color screens held before each arc. Or if a quick succession of rainbow tints is desired, as in the illumination of a dance, the electrician revolves before his spot light a wheel made up of panels or broad spokes of different colored glasses or other tinting mediums.

A perfectly equipped and very spacious electrical supply storehouse and workshop is an adjunct nowadays of every up-to-date grand opera house. This is the headquarters of the chief electrician and anywhere from three to a dozen assistants—dependent somewhat upon the class of productions being staged. The storehouse feature is important because an opera house must keep on hand at all times a plentiful surplus of all standard classes of supplies. There is no time to "send out and get it" when a grand opera is on. It must needs be a pretty capacious storeroom too, and well systematized because of the wide range of material required. For instance, almost as much space must be given over to red globes and blue globes and yellow lamps respectively, as is accorded the ordinary ones of clear

glass. And there are no end of electrical "properties" that may be needed only once or twice a year, but must be kept ready to hand,—for instance the anvils for "Trovatore" that give forth electrical sparks when they are struck in accompaniment to the singing of the "Anvil Chorus," and the swords of Faust and Valentine and Mephisto that strike mysterious fire in the great duel scene of "Faust."

While present-day dependence upon electricity for scenic and lighting effects in modern operatic production is perhaps paramount it constitutes only one of a long list of duties entrusted to the current in the Twentieth Century home of grand opera. "Call boys" have virtually been done away with because electric bells and flashing electric lights signal "Overture," "Fifteen Minutes," "Second Act," and all the other staple summons of stageman to every participant from the prima donna to the most humble chorus man and to the members of the orchestra as well. A complete telephone system connects every part of the realm behind the curtain. And on the scene painting bridges, in the property room and the wardrobe departments there are elaborate lighting systems that enable "rush work" at night in an emergency. The elevators for singers and scenery are electrically operated and so are the "traps" which facilitate descent below the level of the stage in certain productions. In the up-to-date opera house electricity is even employed to operate the drop curtain and the art of facial "make-up" has been greatly simplified because the stage artist may now surround his dressing room mirror with a row of electric bulbs thereby securing an illumination for his delicate decorative work that was scarcely possible in the old days of gas jets and which, if it had been practicable, would have made intolerable the temperature of the average tiny dressing room.



ELECTRIC CURRENT AT WORK

NEW DEVICES FOR APPLYING ELECTRICITY

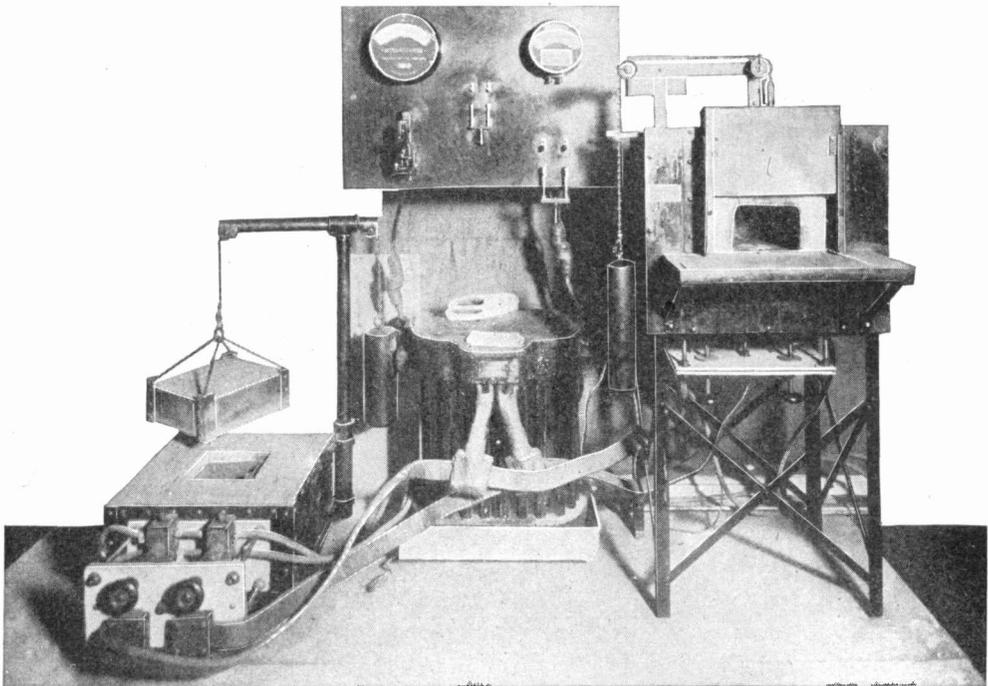
New Ideas from the Chicago Electrical Show

Furnaces for Assayers and Tool-makers

The electric arc is known to be the hottest place on earth, but it is surprising to learn that electric furnaces of the resistance type can be brought up to a temperature as high as 3,000° F. The two furnaces shown in the picture are of the Hoskins type. The one at the left is of the crucible type used by assayers. On the other side is a furnace used for tempering "high speed" steel intended for rapid cutting lathes. The crucible furnace develops in the little white hot pit a temperature of some 2,300° F. When the materials to be melted are placed in the pit,

and the cover swung over them by the little hand derrick, they melt like wax unless they are composed of some extremely refractory substance like carbon.

In the middle of the picture is the transformer which changes the current to a voltage and volume suitable for the furnaces. This current is carried through the massive flat conductors shown in the foreground to the terminals of the furnace. Imbedded in the thick, heat-resisting walls of the furnace are carbon resistance rods. When the current flows through these rods from the terminals they are heated to a white heat and the interior of the pit becomes so dazzling in its brilliancy as almost to rival the sun itself.

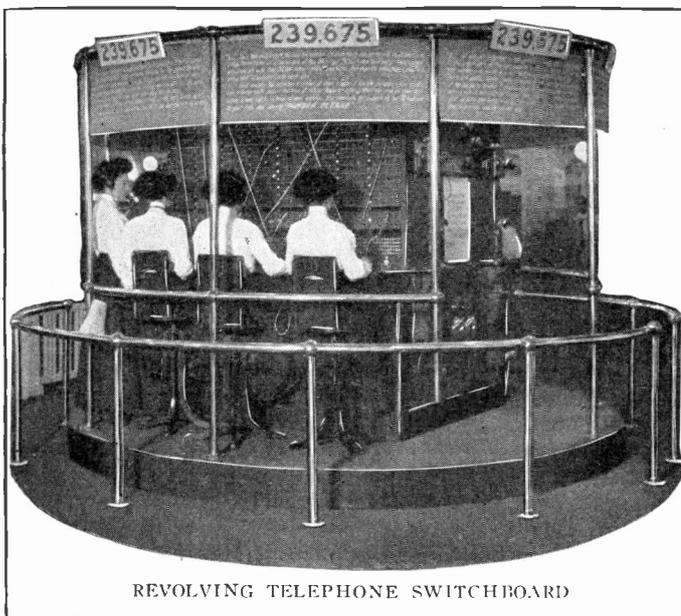


ELECTRIC FURNACES FOR ASSAYERS AND TOOL MAKERS

How Telephone Calls Are Handled

Something of the discipline and strict attention to business which must pervade a large telephone exchange in order that subscribers may be promptly taken care of was enacted in the Chicago Telephone Company exhibit at the Electrical Show. A revolving platform carried telephone switchboard panels at which six operators under two supervisors. Although no outside connections were served, "call" and "supervising" lamps were flashed automatically by mechanism back of the panels, requiring the operators to perform the same duties as are necessary when working in an exchange. The supervisor shown standing back of the operators assists in adjusting complaints and helping wherever neces-

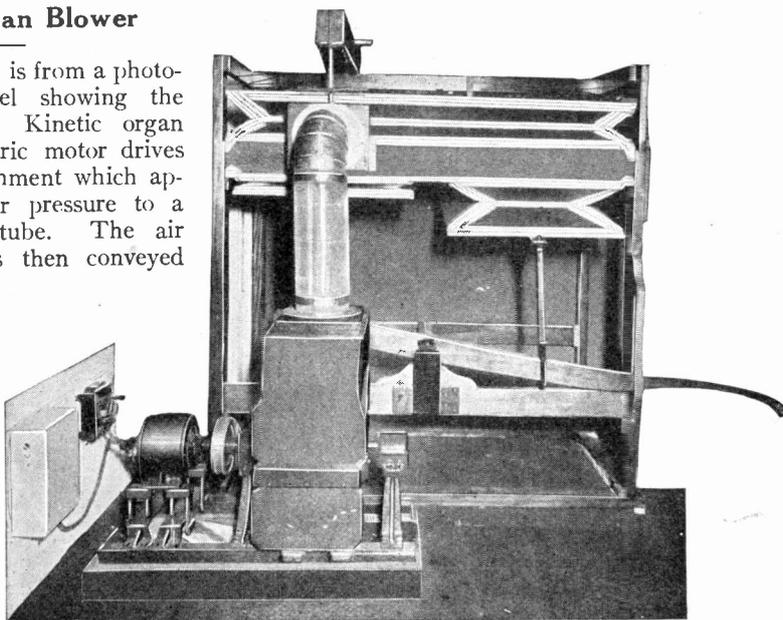
sary, leaving the operators free to attend to calls. Near this exhibit were long distance telephone booths into which one might step and find out how it seems to talk with St. Louis, Cincinnati or New York.



REVOLVING TELEPHONE SWITCHBOARD

Kinetic Organ Blower

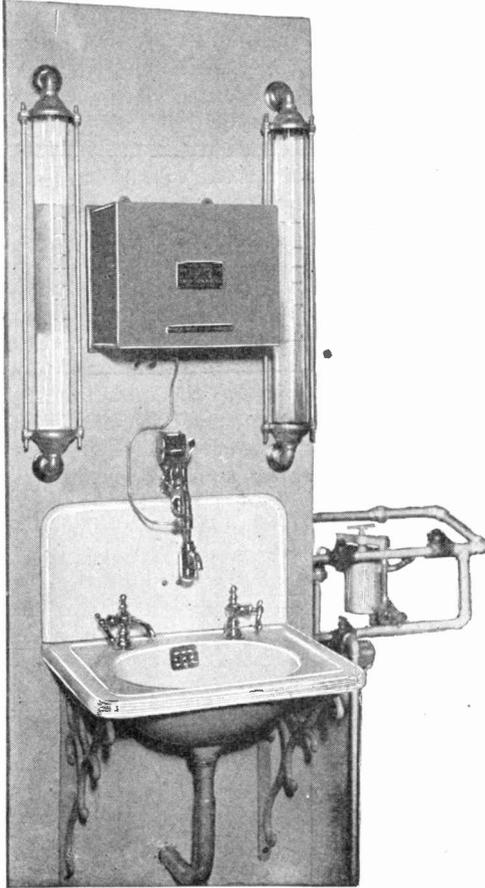
This illustration is from a photograph of a model showing the operation of the Kinetic organ blower. An electric motor drives the blowing attachment which applies a steady air pressure to a galvanized iron tube. The air under pressure, is then conveyed to a bellows which in that case acts as a sort of storage reservoir giving practically uniform pressure for delivery to the reeds. The ample and steady air supply is said to give the organist a sense of security which is thoroughly satisfying.



ILLUSTRATING THE MECHANISM OF AN ELECTRIC ORGAN BLOWER

Purifying Water with Ozone

The Ozosure water sterilizer delivers pure drinking water instantly by simply opening



WATER OZONIZING APPARATUS

the faucet. This operation closes a switch which turns current from any ordinary lighting circuit into the metal box above the wash bowl. Within this box the current is so changed as to jump across, in the form of electric sparks, between hundreds of needle points. These little sparks take oxygen from the air and unite three atoms of it into a molecule of ozone. But one of the atoms in the ozone molecule is always trying to get

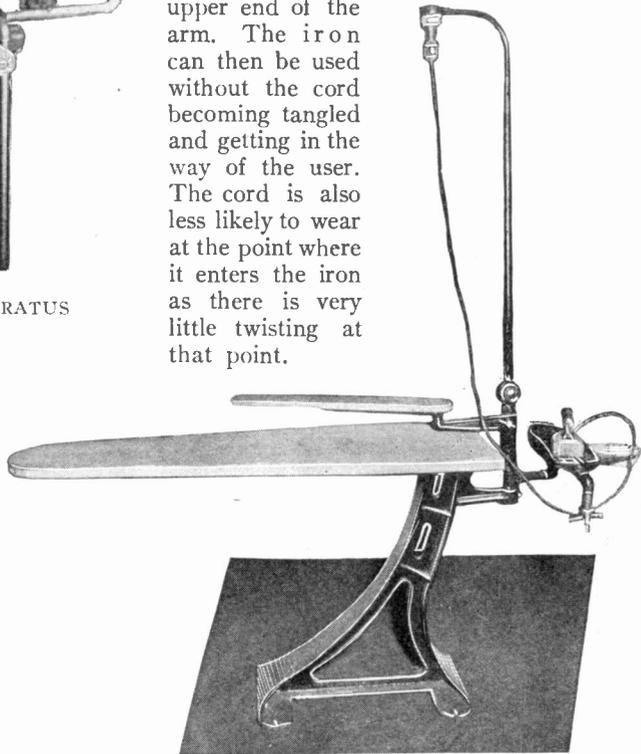
away and combine with carbon material, which forms the greater part of all microbes, consequently when the faucet is turned on and the suction draws ozone down the metal pipe from the ozone box into the mixing bulb just back of the faucet the ozone warriors literally burn up the germs and impurities.

The Mailometer

The mailometer as it is called is one of the latest electrically driven office appliances. It will seal, stamp and count 150 letters a minute and is a positive check on your postage stamp account, the specially made stamps being locked in a case and automatically recorded as they pass upon the envelopes.

Ironing Board and Cord Support

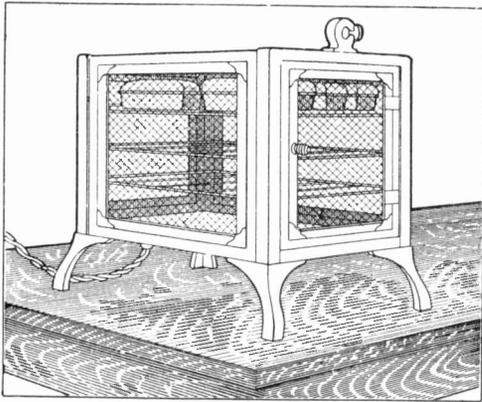
Could anything be more convenient than this ironing board with its two parts adapted for large work or sleeves and collars? At the right is a little shelf for the electric iron. A vertical arm projects well up above the board, and the cord which supplies current to the iron is attached to the receptacle in the upper end of the arm. The iron can then be used without the cord becoming tangled and getting in the way of the user. The cord is also less likely to wear at the point where it enters the iron as there is very little twisting at that point.



IRONING BOARD AND CORD SUPPORT

Watching it Bake

An oven with sides of wire glass enabled hundreds of Show visitors to witness the baking of bread by electricity. Placing eight small loaves on each shelf, in about 20 minutes the top of every loaf showed the baking

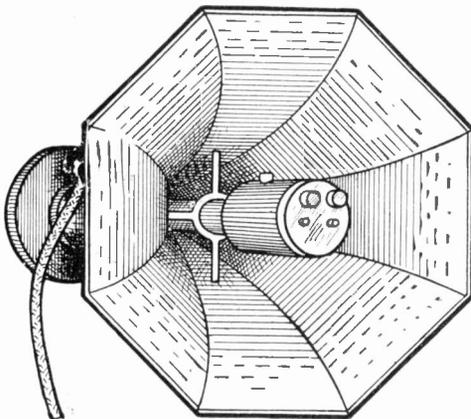


A GLASS OVEN

complete by being done to a nice rich brown. Large loaves required about 30 minutes. In the same exhibit with the Simplex glass oven a larger metal inclosed oven turned out 80 one-pound loaves at one baking which were given to charity. This oven was heated electrically to a temperature of about 350° F.

A Loud-Speaking Telephone

To speak into one transmitter and have the speaker's words conveyed to a distance and distinctly pronounced to any number of



LOUD-SPEAKING TELEPHONE

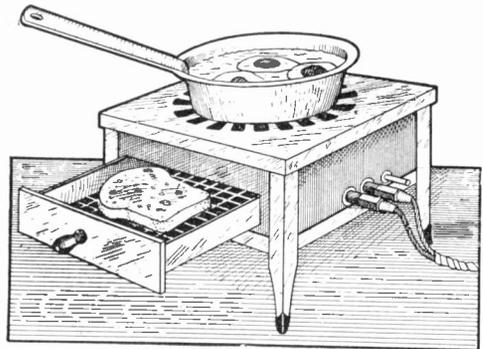
people is a possibility practically demonstrated by the Automatic Enunciator.

A telegram, we will suppose, arrives at the Coliseum for Mr. William Smith, while he is standing in the crowd within ordinary speaking distance of the enunciator. "A telegram at the information bureau for Mr. William Smith," calls out the enunciator, the funnel-shaped device illustrated, of which there are several distributed about on the wall or on convenient pillars. Mr. Smith hears the words as plainly as if a man were shouting the information, and he goes up and gets his telegram.

The enunciator may be used in hotels, clubs, factories, convention halls, theaters and in fact any place where it is necessary for one person to talk to a number of people in different locations at the same time. By installing the system in a hotel and providing enunciators for each floor the clerk will be able to find a guest if in the building by talking into a master transmitter at his desk, thus doing away with the paging system which is annoying and takes time.

Does Two Things at Once

With the Cadillac combination stove and toaster you can prepare breakfast right on the dining table, for while you are cooking

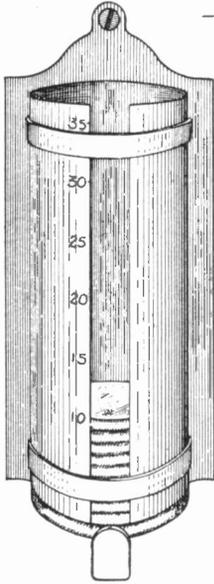


COMBINATION STOVE AND TOASTER

the eggs or chops or preparing the coffee on the top of the stove you may be making toast in the little drawer beneath the red hot coil of the grid. After the meal is ready, keep the coffee warm by switching to a lower temperature contact, there being three different heats provided for. The stove is

finished in black enamel and polished nickel and with it you can prepare a quick hot breakfast without starting the kitchen fire.

Telephone Slug Holder

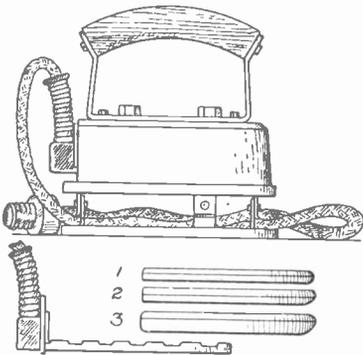


TELEPHONE SLUG HOLDER

When the telephone man calls you can tell him at once how many slugs are in the box if you use a Feurstein slug holder. Place 35 slugs in the holder at the beginning of the month and a glance at the scale on the outside at any time informs you how many remain. By pulling out a spring slide at the bottom one slug at a time is removed from the device. The holder is of polished sheet metal, a back containing screw holes serving for mounting near the telephone.

Three in One

Every housewife appreciates having a pressing iron suited in weight to the garment or cloth being pressed out, and for this reason



FLAT IRON WITH THREE WEIGHTS

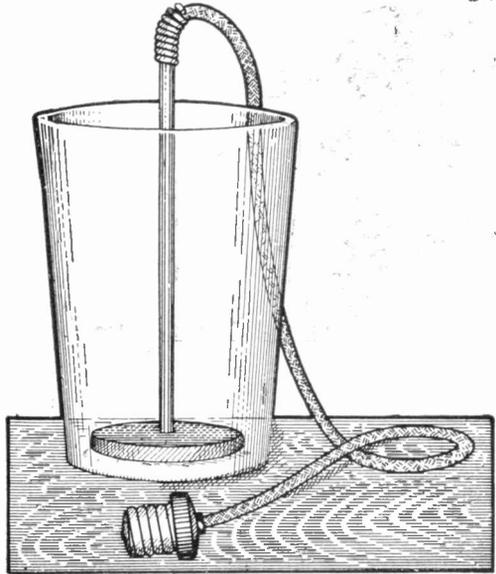
two or three irons of different weights are often a part of the laundry equipment.

The Van electric iron, however, is designed to make it serviceable in all capacities. It is so constructed as to be operated as any one

of three irons of different weights. By removing the two top screws on the rear of the iron, then loosening the two bolts at the base of the handles the heater and connection may be pulled out and weights No. 1, 2 or 3, placed on the heater making either a five, six, or seven pound iron. Another special feature is the suiting of the iron to various voltages ranging from 100 to 125 volts by changing heaters in the same manner as the weight of the iron is varied.

Boiling Water in a Glass

To get a glass of boiling water in a minute's time is very easily accomplished with the little device shown in the drawing. Inside the disk is an electric heating element to



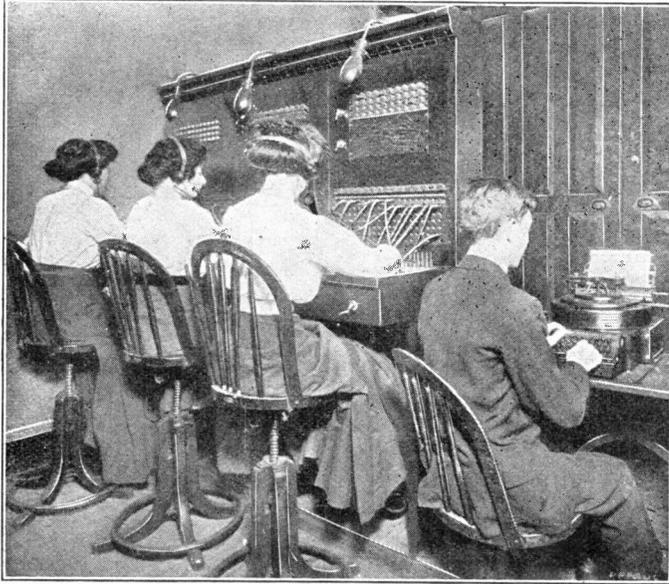
DEVICE TO BOIL A GLASS OF WATER

which current is conducted through insulated wires running down through the stem. As the current flows through the concealed wires of the heating element the disk is at once brought to a temperature sufficiently high to boil the water in a very short time. This is a very convenient device for travelers, dentists and physicians.

According to statistics quoted in *Engineering*, there are in the whole world 9,600,000 telephones, and the lines have an aggregate length of about 12,500,000 miles.

A Telegraph Typewriter

It is now possible to send a typewritten message hundreds of miles across the country and this latest triumph in the transmission of intelligence was on exhibition at the Electrical Show. It is the invention of Dr. G. A. Cardwell and does not look very much different from the ordinary typewriter.



THE TELEGRAPH TYPEWRITER AT THE RIGHT IS SENDING MESSAGES OVER TELEPHONE LINES WHILE CONVERSATIONS ARE TAKING PLACE SIMULTANEOUSLY

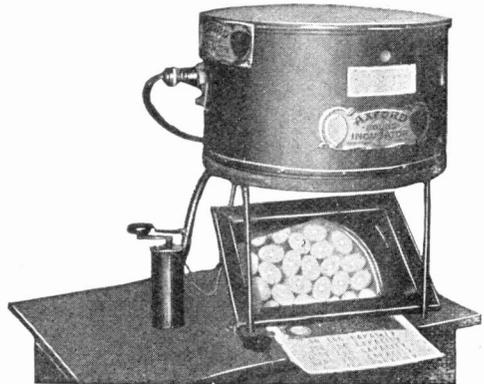
When the operator wishes to send a message he pounds it off on a keyboard like the ordinary typewriter keyboard. The act of depressing the keys sends out over the telegraph line (or even over a telephone line which is at the same time carrying telephonic messages) a series of electrical impulses. These impulses when they arrive at the receiving station operate a system of electromagnetic relays which shift a little wheel carrying raised type around so as to print each letter the instant the impulses are received. It works upon the "selected" system, each letter of the transmitting instrument sending a certain series of impulses which automatically select and print the corresponding letter at the receiving machine.

In the picture is shown a telephone switchboard of the Bell Telephone Company, in the office of the Long Island Railroad. At

the right in the picture is one of the "American" telegraph typewriters actually sending a typewritten message over the same wires that enter the switchboard and which are at the same time being used for telephonic purposes.

Electric Incubator

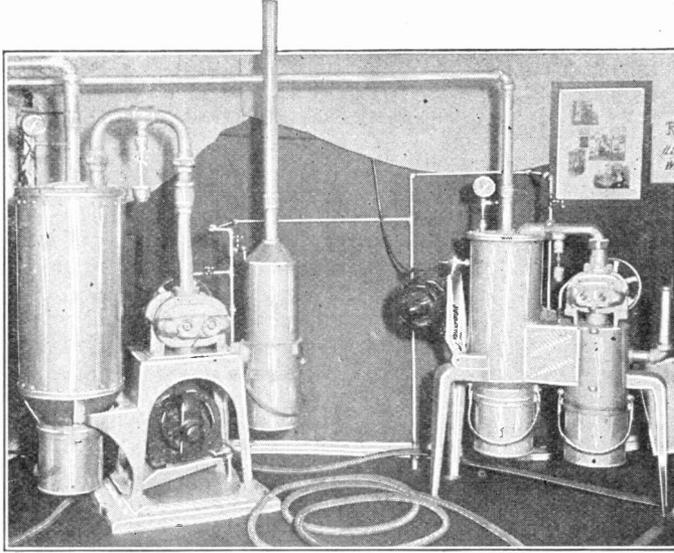
Resembling a large cheese enclosed in heat resisting material covered with leather, and mounted on legs with a mirror below to show the eggs on the glass bottom, the Axford, round, incubator exhibit attracted much attention. An incandescent lamp within furnishes the necessary heat, flashing on and off with the variation of temperature. A coiled spring thermostat like the one mounted on the dry cell on the table opens the lamp circuit when the temperature rises too high and closes it again when the heat falls below the point at which it is to remain practically constant. On account of this automatic feature the incubator needs no attention once current is turned on.



ELECTRIC INCUBATOR

Sends Dust and Dirt to the Basement

With the Houston system of cleaning, the maid takes a small roll of rubber hose, attaches one end to a wall coupling and the other to a light aluminum floor sweeper or



MOTOR AND VACUUM PUMPS LOCATED IN THE BASEMENT

other tool. Turning a switch she starts the machinery which is located in the basement, and the sweeping, cleaning and dusting begin all at the same time. By means of the special tools which may be attached to the hose, dirt and dust are sucked up from the floor, removed from the corners, picked up from off moulding and picture frames and started on a journey down a metal pipe to the basement to be deposited in a sealed metallic dirt receptacle of the vacuum cleaner. Pipes from the machine, which is operated by a motor-driven suction pump, lead to various floors where at convenient places small ornamental pipe couplings are located.

The illustration shows two equipments; one for installation in cottages and small dwellings, the other for larger buildings.

With this outfit, which may be installed in either old or new houses, the "broom and duster" method is rendered obsolete, and in addition the system insures the fact that the air which carried the germs, dust, dirt, etc., away is not again released in the room.

All Metal Washing Machine

The Apex—a washing machine entirely of metal except the wringer board—has a body somewhat cylindrical in shape on the outside but tapering at the top. It is constructed of galvanized sheeting and sus-

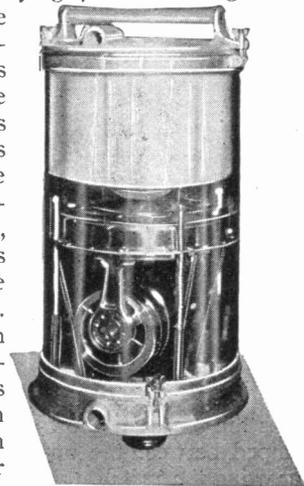
suspended at the ends on a steel frame so as to be easily rocked back and forth. On each side of the interior are four metal ribs which turn the clothes as the rocking causes them to fall from one side to the other of the enclosure. The bottom of the tub has on the inside also an inverted V, running lengthwise which helps in cleansing the clothes as they fall to the bottom. A small electric motor mounted underneath out of the way is geared to rock the tub. Adjusting a key connects the wringer to the motor and locks the tub in an upright position for running the clothes through the wringer which

is mounted directly above the tub.

Vacuum Cleaner in a Glass House

The accompanying picture will give an

idea of what the inside of a vacuum cleaner looks like—that is, one type, known as the Santo. This model is made for demonstration purposes, with glass sides instead of the usual metal case. Inside you can see the little motor which drives the diaphragm which in turn exhausts the air through a tube. The dust bag is



VACUUM CLEANER ENCLOSED IN GLASS

also contained inside of the cleaner case. This little machine, which runs without noise or vibration, operates from any electric light socket at a cost of less than two cents per hour for current.

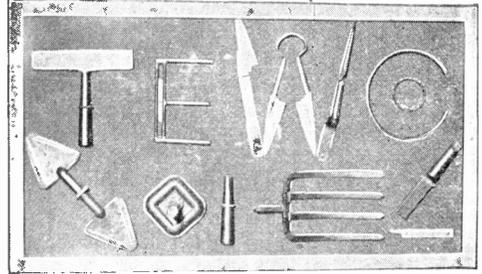
"Riveting" Without Rivets

They call it "spot welding." The machine is shown with the lever up and the two copper pins, which serve for electrodes or dies, separated. Take two pieces of sheet metal,



ELECTRIC "RIVETER"

heavy or light, lay one across the other on the lower die. Pulling the lever arm down forces the upper die down until the metal is clamped between the upper and lower dies. Throwing the switch, there is a flash and the two pieces are welded. It seems to have been done by lightning in a condensed form.



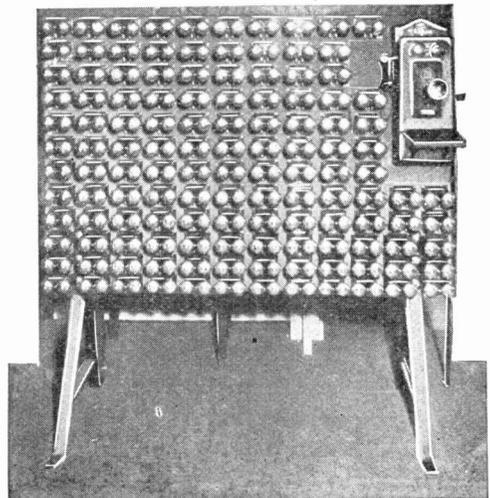
SAMPLES OF ELECTRIC WELDING

The metals are fused at a "spot" the size of a rivet and the time required to punch holes and insert rivets has been saved.

To the average man welding a bar of iron brings up visions of a dirty and grimy blacksmith shop with a leather-aproned, sooty-faced, sweaty and muscular individual swinging a sledge hammer and making a lot of noise on an anvil. But welding by electricity is more practical. The second illustration shows some of the products of electric welding.

A Modern Hercules

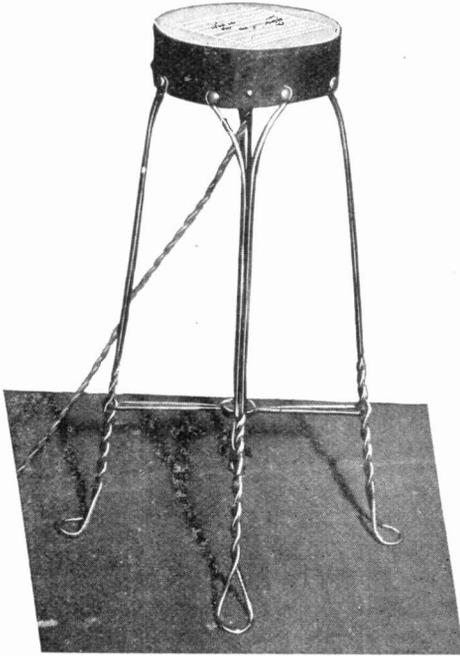
This unusual exhibit was for demonstrating the power of a telephone generator. It shows 258 gongs or 129 ringers, connected in series and all operated at once by the Hercules generator in the telephone set on the corner of the board. The gongs are so carefully toned that no discordant note is heard as 129 hammers vibrate in unison with but a slight turn of the generator crank.



ONE GENERATOR RINGS 258 GONGS

A Portable Stand Heater

An electric hot plate mounted on a neat, portable stand is one of the Hughes ideas. This is intended more particularly for hotels, restaurants and similar places where it can be brought right into the dining-room and



PORTABLE STAND HEATER

placed beside a table. It permits of the preparation of many dishes usually prepared in a chafing dish. Like the Hughes stoves and hot plates, it embodies the most simple principle, that of a number of long coils of resistance wire laid in narrow slots or depressions in the composition plate forming the top of the stand. These wires are brought to a bright red glow by the current and the heat is all transmitted to the bottom of the cooking utensil.

Keeps Tab on the Chimney

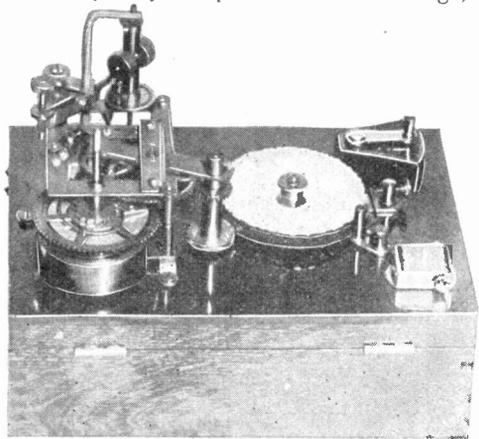
The cry is for clean cities, and to attain this it is necessary to suppress the smoke nuisance. Fulfilling the old saying, "Necessity is the mother of invention," the Hamler-Eddy smoke recorder tells the condition every hour in the day of the gases that go up the chimney in a steam plant. The recorder consists of a sheet of paper on a cylinder operated by a clock, a small nozzle with its end very close to the paper, a little motor

driven pump and some glass globes and tubes containing chemicals for removing moisture from the stack gases tested.

In operation the pump sucks in gases from the chimney, which after being freed from moisture are forced in little puffs against the paper as it moves by at a steady rate, thus allowing the carbon to be deposited in the form of a black line upon it. Every hour the cylinder drops a notch and another line is started. If little smoke is going up the chimney the paper is clean, growing darker as the smoke increases. The recorder may be installed right in the boiler room, the enclosure being of glass.

Wireless Telegraph Instructor

Every wireless operator who passed the Swedish-American exhibit at the Coliseum paused to take a message, for a sound very much like the dots and dashes heard in his head phones fell upon his ears. It was not a message of distress, but taken down read, "John quickly temporized five tow bags,"



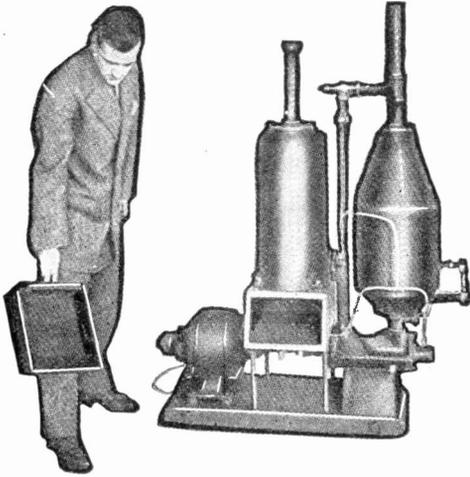
WIRELESS TELEGRAPH INSTRUCTOR

a sentence containing every letter in the alphabet except "x".

The device consists of clockwork which revolves a brass disk $3\frac{1}{2}$ inches in diameter, on the edges of which are projecting teeth shaped to sound the dots and dashes indicating different letters of the Morse code on a small buzzer. These teeth touch a contactor that closes a circuit through the buzzer and two dry cells within the case. Disks containing other sentences may be put on just as with a phonograph. The outfit is mounted on and within a neat quarter sawed oak box about 6 by 10 by $3\frac{1}{2}$ inches.

Stationary Vacuum Cleaning System

In the case of the Richmond vacuum cleaning system we have a permanent plant to be installed in the basement of a home, the same as a hot water or steam heating plant, with a piping system running up to the various rooms. Inlets to the piping are located



STATIONARY VACUUM CLEANING SYSTEM

in each room to which a hose and cleaning nozzle are connected. The motor shown in the picture operates a suction pump and the dirt and dust are drawn down through the pipes into a receptacle in the machine. When through cleaning you simply pull out a drawer and dump the dirt the same as you would ashes from a furnace.

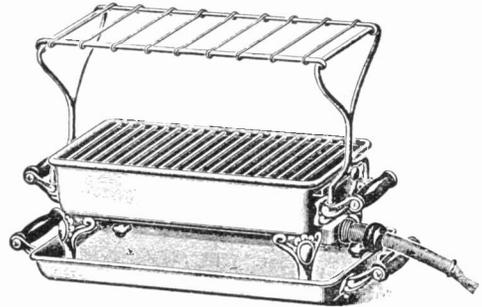
Illuminated Prismatic Glass Signs

A departure from the usual exposed lamp sign is furnished by the Flexflume glass letter sign in which the lamps and reflectors are behind the letters and within the sign. The letters are prismatic glass moulded into shape and stand out in bold relief against a black metal background. Effective in daylight, the letters are very sharp and clearly defined at night. The small number of lamps needed, ordinarily averaging one for each letter make the sign economical of current.

Combined Stove and Toaster

An entirely new principle in applying electric heat is embodied in the Pelouze toaster

and griddle. It is called the "radiant suspension" system. Insulators or other bodies of matter which absorb heat are eliminated



COMBINED STOVE AND TOASTER

in the construction of the stove, which will toast the first slice of bread in 50 seconds and the second in 45 seconds. The little wire rack above the heating element may be used for keeping the toast hot or as a plate warmer.

The Tom Thumb of Vacuum Cleaners

A ten-pound suction cleaner is one of the new comers in the field of household electric appliances. The Magic cleaner is made entirely of metal being enclosed in a strong steel and aluminum case and is mounted

on two small rubber-tired wheels. The exterior is nickel-plated and polished. By removing the dust bag and attaching a special connector the machine may be used as a blower. The usual attachments are provided for the equipment.



A TEN-POUND VACUUM CLEANER

FOR PRACTICAL ELECTRICAL WORKERS

HOW TO MAKE AND OPERATE ELECTRICAL DEVICES

Some Historical Measuring Instruments

By W. S. ANDREWS

A three-wire Edison central station with overhead system of distribution was installed in Cumberland, Md., in 1885, and the new incandescent light was so well appreciated by the citizens there that in 1887 four more dynamos were added, thus enlarging the plant to a capacity of six dynamos, three being connected in multiple on each side of the three-wire system.



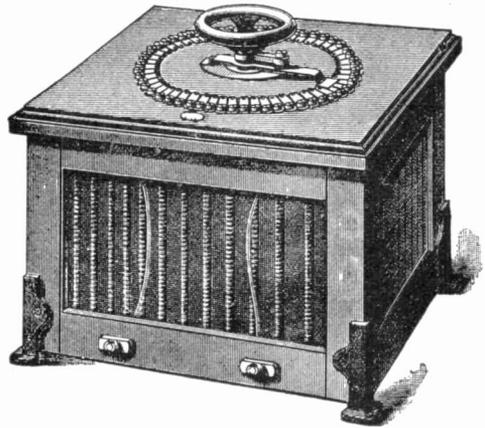
PENDULUM AMPERE
METER

The steam plant was also at the same time correspondingly increased and improved.

Soon after these additions had been made, a series of troubles were reported to the New York office of the Edison Electric Light company, principally referring to the burning out of dynamo armatures, so Mr. Edison requested the writer to visit Cumberland and make a careful inspection of the electrical plant. The Cumberland Electric Lighting Station was found in the charge of a very intelligent colored man, and on questioning him as to his method of distributing the load among the three dynamos, connected in multiple, he replied that he had been told that the passage of electricity through a wire caused it to warm up, and "*the heavier the current the hotter the wire.*" He therefore went around occasionally and *felt* the copper leads running from the dynamos to the bus bars and if one of them seemed a little warmer than the others to the touch he would reduce the load on this machine by

turning some extra resistance into its field rheostat! Under working conditions such as these who could blame the man if an overloaded armature was occasionally burnt out? On learning the above facts Mr. Edison promptly decided that when two or more dynamos were connected to run in multiple, it was highly desirable to use a current indicator in series with each machine.

No suitable instruments of this kind being on the market at that time, it became necessary to design and make them and Mr. Edison insisted that they must be simple and rugged in construction, cheap to manufacture, and easy to repair.



"FIELD REGULATOR"

The old "pendulum ampere-meter", jointly invented by Mr. Montgomery Waddell and the writer, and subsequently improved by Mr. Charles Wirt, was the result of Mr. Edison's decision, and this form of ammeter performed good service for many years.*

*The writer believes that the only location in which one of these "pendulum ampere-meters" failed to work with reasonable accuracy was a case where it was installed on the switchboard of a yacht.

When the first model of this ammeter was submitted to Mr. Edison, he approved its construction and ordered six to be made a once for Cumberland station, requesting that he should be notified after they were finished and boxed, as he wished to see them when they were ready for shipment. This procedure appeared at the time to be a little mysterious, but was subsequently explained.

The six ammeters were accordingly built and carefully packed in separate boxes ready for shipment. Mr. Edison was then notified and he soon came around to look them over. Seeing the six boxes on the floor of the testing room, he ordered them to be placed on the center table, and then to our utter amazement, he told a laborer to mount the table and *kick the boxes off onto the floor*, "and give it to 'em good and hard."

Expostulation was vain, "If they won't stand being kicked off the table, they will never reach Cumberland in working condition," he said.

After this *test* the boxes were opened, and according to the writer's recollection, the "pendulum" ammeters were found to have passed the ordeal without material injury. Mr. Edison therefore permitted them to be repacked and shipped to Cumberland. The writer also went there and connected them in circuit, after which no further complaints were heard.

This was the first three-wire Edison station in which the dynamos were furnished with individual ammeters, the ready-made *hot-wire current-indicators* previously tried by the ingenious colored attendant having proved hardly accurate enough to prevent the excessive overloading and consequent destruction of the dynamo armatures.

Aluminum Solder

A solder has been invented whereby aluminum is easily soldered. It was discovered that by combining tin, zinc and aluminum with chloride of sodium in certain proportions a new composition is formed which has many valuable properties. In making the compound these elements are fused together in the proportion of twelve parts tin, two parts zinc, and one part aluminum. One per cent chloride sodium is added to this alloy. By varying these proportions somewhat the composition formed by them may be made harder or softer according to the various uses to which

it is to be put. Sometimes a small amount of metallic antimony is added which increases its hardness without materially changing the nature of the composition.

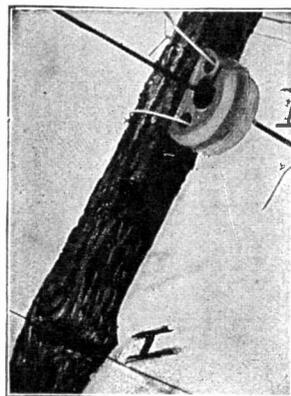
The alloy is pure white color, and is capable of receiving a high polish, which will not tarnish. It may be molded, welded, and worked in many ways. One of the valuable uses claimed for it is that it will adhere strongly to many metals, to glass, and to other substances without the use of flux and without any special preparation of the surfaces to which it is to be applied.

It may be applied by an ordinary soldering iron, but the use of copper for this purpose is not necessary.

This composition is particularly adapted to soldering aluminum, as it adheres to it strongly and is as readily applied to it as it is to other substances, such as copper and tin. Bars and wires of aluminum and other substances may be welded together by its use. Its high conductivity and the fact that it is not subject to electrolytic disturbances make it of value in soldering or welding electrical conductors of copper or aluminum or other suitable material.—*Mining and Scientific Press.*

It Helps the Trouble Man

The telephone trouble man finds plenty to do during wet, rainy weather if his lines run through wooded districts or along highways lined with shade trees. Here and there in the course of time wires will come in contact



GLASS TREE INSULATOR

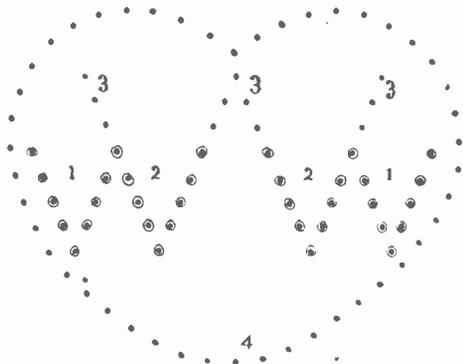
with tree branches and become grounded, or from the swaying of the limbs by the wind will wear into the bark and wood as shown at

(I) in the illustration. The Scott glass tree-insulator shown in the upper portion of the illustration is designed to get rid of many tree-ground troubles and to reduce the cost of line maintenance, as it can be applied without cutting the wires, allows the limb to move without a strain on the wire and is inexpensive.

Impressive Electrical Wedding Decoration

In this particular case the initial letter of the family name of both bride and groom chanced to be "W." The letters, "WW" were formed of four candlepower, round bulb frosted lamps wired on a background of light wood-work carved to represent a heart, as shown in the cut.

Suspended above the altar rail the entire design was thickly filled with white chrysanthemums. These were not only in keeping with the occasion but also served to obstruct the view of the unlighted lamps. The four circuits, as shown, were operated by their



WIRING FOR WEDDING DECORATIONS

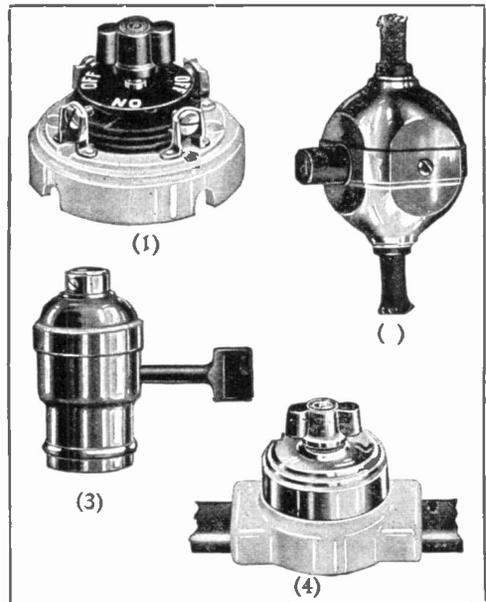
respective switches. The church being otherwise brilliantly illuminated the design was not lighted until after the wedding party's arrival.

As soon as the wedding march announced the happy couple's approach up the aisle the lamps forming the heart were lighted, and immediately upon their arrival at the altar the two small "W's" were displayed. When the words were pronounced that made them man and wife, circuit No. 1 was opened and No. 3 closed, thus making one large "W" of the two smaller ones. Inasmuch as the congregation or spectators were not prepared for this, the effect was very impressive and altogether appropriate.

Practically the same results may be obtained with the use of any two letters, it being only necessary to simultaneously extinguish the smaller letters and light the larger one. The lamps in the larger and center letter can easily be arranged not to conflict with the others, and (depending upon the designer's ingenuity) some of the lamps of the letters can be made to do double duty.

Innovations in Wiring Devices

A 600-volt snap switch is shown in Cut 1. The cut is three-eighths full size. The trouble in making a snap switch for such a high voltage, heretofore has been to prevent destructive arcs when the contact is broken. Cut (2) is a switch to be placed on a drop cord above the lamp so that you need not



reach under the lamp shade to turn off the light. Cut (3) is a socket which may be covered by a canopy through which the long key projects to turn the light on and off. Cut (4) is a switch with an insulating base for metal moulding.

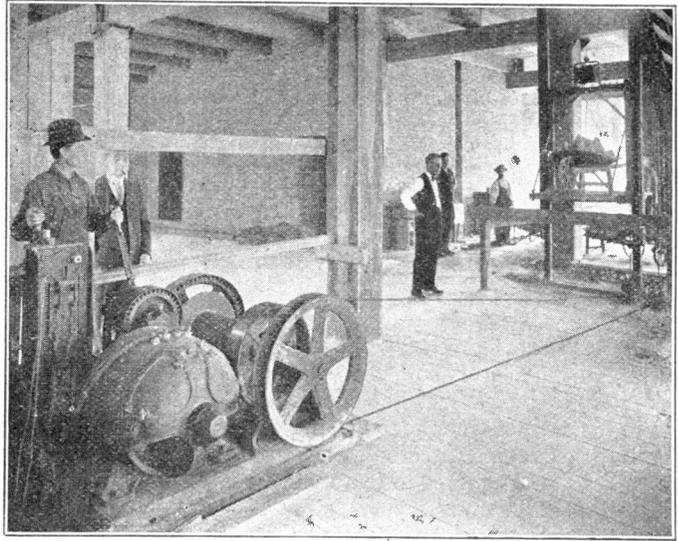
To Cut Glass

• Pass a hempen cord soaked in turpentine over the place where it is desired to cut the glass, light it and sprinkle the glass with cold water, whereupon a slight pressure will suffice to break it sharply along the line followed by the cord.

Exit the Hod Carrier

In these days of competition and close bidding the building contractor utilizes every means of systematizing work and increasing the already rapid facilities by which a skyscraper can be hurried to completion.

The accompanying illustration shows how the human hod carrier is displaced by one of electric origin which almost shoots its wheelbarrows of brick and mortar to the upper floors of the structure in less time than it takes to wheel the brick from the entrance of the building to the lift. As one lift is going up the other one comes down. In a run of eight hours 125,000 bricks have been conveyed by this apparatus to the twelfth floor of a building in process of erection.



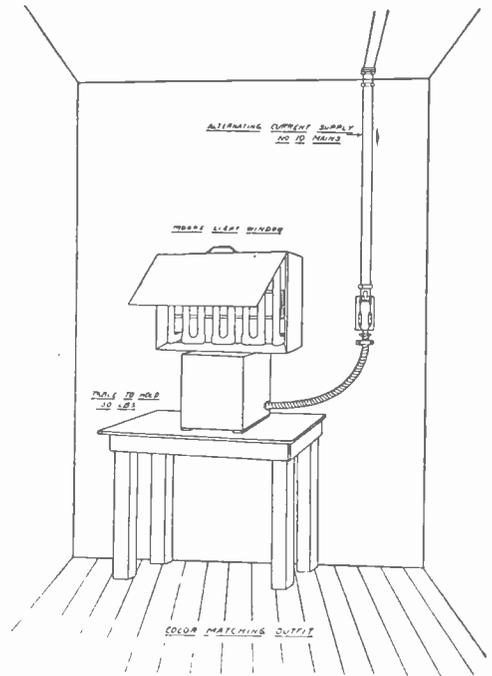
HOW ELECTRICITY DISPOSES OF THE HOD CARRIER

Moore Light for Matching Colors

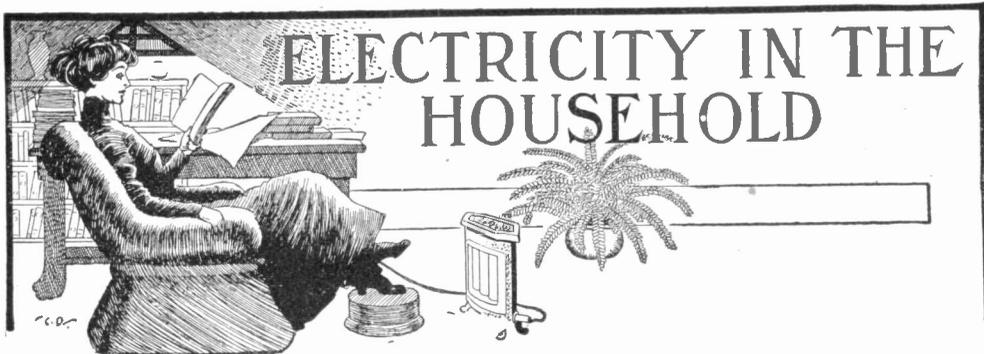
The Moore system of vacuum tube lighting, as has previously been explained in POPULAR ELECTRICITY, embodies the principle of passing an alternating electric current through highly rarified carbon dioxide gas confined in a continuous clear glass tube. The light so produced is clear white; that is, it is similar to sunlight, and it is therefore particularly valuable where color values are of great importance, as, for instance, in matching colors in dye shops, lithographic establishments, textile mills, etc., where it can be used literally to turn night into day.

To adapt the system to work of this nature the apparatus is now put up in compact unit form as shown in the drawing. The upper portion of the apparatus, known as the "window" consists of a number of vertical "Moore tubes" in a sheet metal case about the size of a suit case. The side of this case opens out at an angle to form a reflector and shade. Below the case is a transformer to change the voltage of the ordinary alternating lighting current to a value adaptable for use

in the tubes, with a leading-in cable from the service switch mounted on the wall and convenient to the hand of the operator. The transformer and tubes are mounted on a strong table located wherever convenient in the shop.



COLOR MATCHING OUTFIT

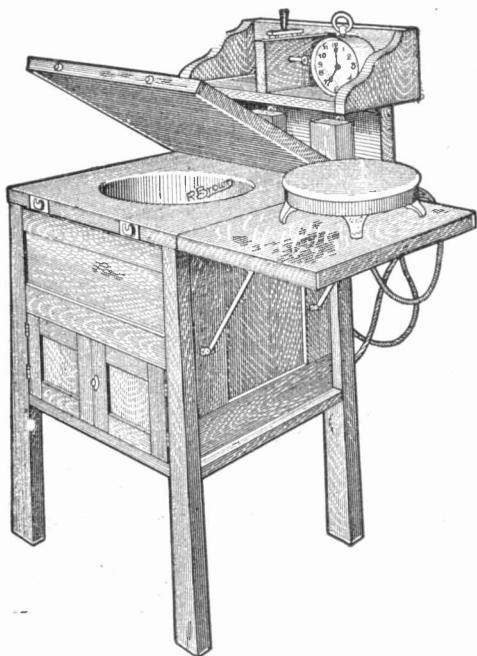


Electric and Fireless Cook Stove Combined

Those familiar with the economies of the fireless cooker will appreciate the combination of this device with the convenience and cleanliness of the electric stove.

The outside of the Hastings cabinet stove is made of finished hardwood. The

boil is known, the dish containing it is placed in the receptacle, and the cover closed. Then the alarm of the clock is set to go off in 20 minutes, a half-hour, or in such time as the case may require. Closing the switch starts the cooking. When the time is up the clock sounds the alarm and at the same time opens the switch, and the cooking then continues as in a fireless cooker. This stove enables "the lady of the house" to start the evening meal, go shopping while it is cooking and return to find it ready to serve piping hot. A drop shelf is provided on the side, while a compartment beneath the cooker permits the storage of cooking utensils.



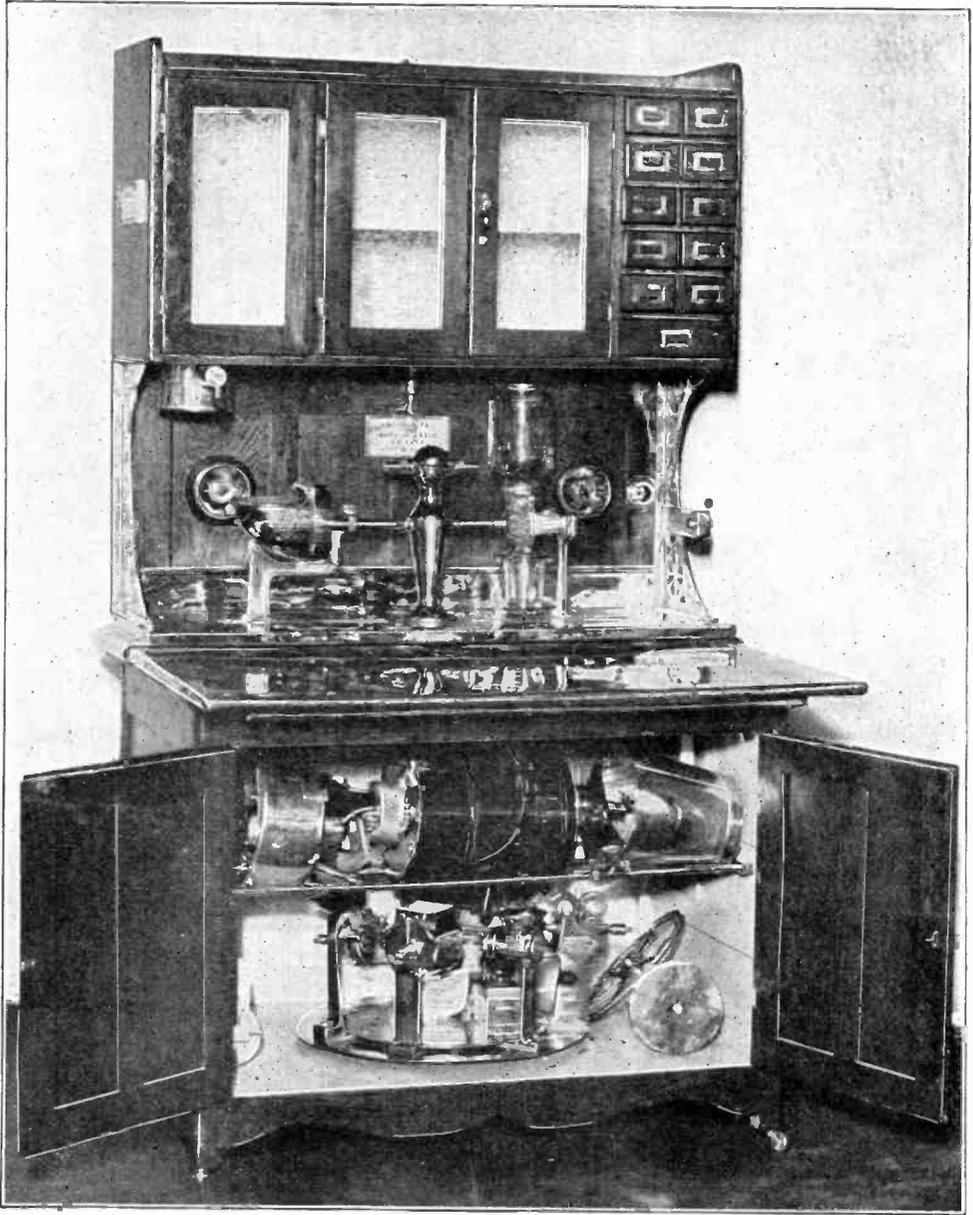
COMBINED FIRELESS COOKER AND STOVE

containing compartment is lined with non-rustable metal between which and the wood-work is a fire-proof non-heat-conducting packing, through which wires pass to the electric stove located in the bottom of the receptacle. If the length of time required to bring a certain meat or vegetable to a

A Wonderful Kitchen Cabinet

The Federal electric kitchen cabinet is designed to fill a particular need. It resembles the ordinary kitchen cabinet somewhat, but is provided at the center near the back of the table with a shaft head from which project two arms to which various utensils may be attached by setting their bases into a groove, sliding them up against the shaft arm and clamping in place. A turn of a switch on the back of the cabinet starts a small motor, and electricity does the rest. It is not necessary to stop the motor to connect or remove any one of the several devices.

The various pieces, eleven in number, which make up the cabinet are kept on racks in the cupboard under the table. There is a bread mixer large enough to mix dough for four loaves, a cake mixer which, with proper ingredients at hand, begins the preparation of most delicious angel-food cake. Then there's an egg beater, a vegetable slicer that makes a slice as thin as paper or a quarter inch thick from a potato or beet; a coffee



KITCHEN CABINET WITH ELECTRIC CONVENIENCES

grinder, a meat cutter, a potato and lemon grater, a cherry pitter, a knife sharpener, a knife polisher, and last but not least a two-quart ice cream freezer.

The cabinet is built of oak. The top of the table is of heavily nickel-plated sheet metal which is easy to clean.

By means of an extension shaft a sewing machine, dishwasher or washing machine may be operated. A flour bin and cupboard above the table add to the usefulness of this piece of electric furniture which will make the kitchen the playroom rather than the workroom of the home.

Where Art and Science Meet

By T. VERNETTE MORSE

Every housewife knows that a dainty breakfast cheerily served is a bright happy introduction to the day's work, yet there is something quite depressing in the fact that the first start towards breakfast is usually made in a kitchen where the thermometer has gone to sleep, and the cold, blustering, winter winds howl cheerlessly about the door. The woman who is able to overcome these trifles, and serenely prepare and serve breakfast in the sunny dining rooms, resolutely determines that her family shall begin

toast, the perfectly cooked eggs, the steaming hot cereal and the dainty cakes.

It is such fun to prepare these charming breakfasts that the children are anxious to assist and even "John" oftentimes finds it more interesting than the latest Washington news or stock reports. He becomes so absorbed in watching the process that he actually forgets how "Mother used to cook." Everyone feels a personal interest in preparation of a meal when electricity is used, for it so quietly and quickly does its work.



BREAKFAST DOES NOT MEAN QUANTITY, BUT QUALITY AND DAININESS

the day aright, even at the sacrifice of personal comfort.

Breakfast does not mean quantity, but it does mean quality, and daintiness. The up-to-date woman knowing this, has not been slow to abandon the cheerless morning kitchen for the new and popular electrical dining room devices which admit of preparing the breakfast at the table.

While "John" is reading the morning paper she has gently turned a switch and the breakfast is quietly preparing itself. No smoke, no oil, no gas, just the savory odor of the percolating coffee, the neatly browning

To trace the evolution and application of fuels from the original open fire place with its sturdy pots and kettles to the dainty appliances and utensils of the present is an interesting thesis in itself, but we have no time for stories, with electricity making such rapid strides and marching so jauntily right into the home.

The management of the Artcraft Institute, of which mention was made in the first chapter of this series, invited a party of club women to assist in conducting a series of "Electrical Picnics" at the recent Electrical Show in Chicago, using as a basis for these

experiments the household equipment on exhibition.

A large dining table was supplied with coffee percolators, toasters, chafing dishes, water heaters, heating disks, and other necessary appliances.

The object of these experiments was to demonstrate to these women the fact of the actual arrival of electricity, as a household necessity, and to show them that such things, for instance, as the preparation of a dainty breakfast on the dining-room table, as I have outlined above, are practical possibilities and not merely the dreams of some silver-tongued salesman of electrical apparatus.

Each day during the exhibition different groups of club women prepared and served a breakfast, luncheon or dinner, on the table, using only the electrical devices named. One of the special features was a seven-course dinner. The day Mrs. Minnie Starr Granger, president of the Federation of Illinois Women's Clubs, was guest of honor, a "Picnic Luncheon" was attractively served by the vice-presidents of the Chicago districts.

As different women were in charge of the table and menus each day, a great variety of experiments was attempted and the cooking contests grew in interest until everyone was anxious to try something new.

Washing dishes when the water is heated in a sparkling glass globe at the table becomes a pretty accomplishment, requiring as graceful handling as the serving of a cup of tea.

The writer in arranging the series of afternoon entertainments at the Electrical Show was ably assisted by the following well known women: Mrs. David W. Beggs, Mrs. Frank L. Bellows, Mrs. Freeman E. Brown, Mrs. A. P. Coon, Mrs. George E. Colby, Mrs. Frederick A. Dow, Mrs. Edward E. Ellicott, Mrs. Laura E. R. Fischer, Mrs. Frank M. Gage, Mrs. F. Albert Jones, Mrs. John F. Thompson, Mrs. Glenn Steere, Mrs. George P. Vosbrink, Miss Olive Russell Chapin, Miss Glenna Lynch, Miss Martha Matthews, and Miss Frances Thompson.

If any of this competent group of women doubted the practicability of cooking by electricity, the doubts were most satisfactorily dispelled by the success of the practical experiments, which are now being put into actual practice at the Artrcraft Institute.

We are also planning tables and cabinets especially adapted to the use of electrical appliances, for electricity demands a style of

its own in table furnishings, a style especially suited to the new epoch which is gradually opening the doorway of ideal housekeeping.

Electricity has come to stay. If it is sanely installed in the homes, without bringing with it the useless frills and furbelows, that seem destined to accompany every progressive movement, it will solve many of the problems which have hitherto confronted the housewife. It is safe, clean, and when properly used is economical. Most of the utensils are good in form, simple in construction, having no complex scheme of decoration. Consequently, they will not, in a few years, become extravagant examples of inartistic excitement and misapplied design.

Below I give a few of the breakfast menus, which can be prepared and served on the table.

BREAKFAST NO. 1.

Oranges Puffed rice and cream.
Scrambled eggs on toast.
Ladyfingers .
Coffee Tea.

BREAKFAST NO. 2.

Grapefruit
Oatmeal with cream and sugar.
Minced ham and eggs.
Buttered toast.
Cookies Coffee.

BREAKFAST NO. 3.

Grapes.
Wheatena with cream and sugar.
Buckwheat cakes, syrup.
Coffee cake. Coffee.

BREAKFAST NO. 4.

Apples.
Puffed wheat with cream and sugar.
Creamed potatoes Sausage.
Buttered toast
Oatmeal cakes Coffee.

BREAKFAST NO. 5.

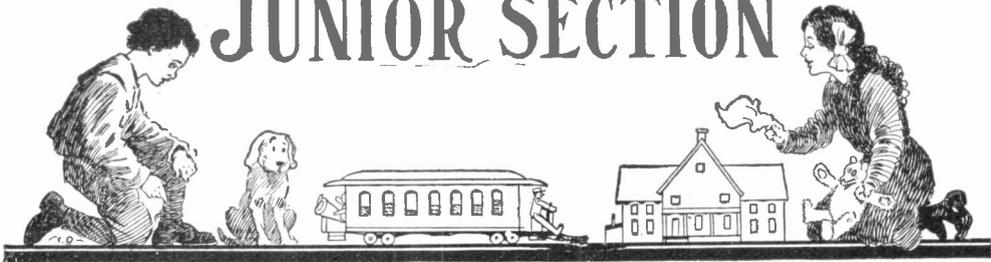
Oranges.
Oatmeal with cream and sugar.
Boiled eggs. Buttered toast.
Cup cakes. Coffee and chocolate.

BREAKFAST NO. 6.

Grapefruit
Breakfast food with cream.
Creamed codfish with poached eggs, on
buttered toast
Rolls.
Ginger drops Coffee and chocolate.

These simple breakfasts daintily prepared on the dining-room table are most attractive and save the housewife and mother many of the unnecessary steps.

JUNIOR SECTION



Construction of Small Motors and Dynamos

By CHAS. F. FRAASA

CHAPTER III.—ARMATURE CORES

Fig. 10 shows one of the armature disks. These disks are made of sheet iron, and should be turned very smooth and round. Around the periphery are a number of slots in which the armature winding is placed. The portion of iron between the slots is known as the armature tooth. In the center of the disk is a hole for a shaft.

The ratio of the diameter to the length of the armature is the same as that of the field core, after allowing for the air gap. This ratio was given in Chapter II.

In all of these small models, the armature is of the laminated type of construction, that

The dimensions of the armatures for these models should be as specified in Table II, referring to Fig. 10.

TABLE II
DATA FOR ARMATURES, REFERRING TO FIG. 10

TYPE	A	B	D	LENGTH OF CORE	NO. OF SLOTS
A	3½"	1"	½"	3½"	11
B	3½"	1"	⅝"	3½"	11
C	4¼"	1"	½"	4¼"	13
D	5"	1"	½"	5"	15

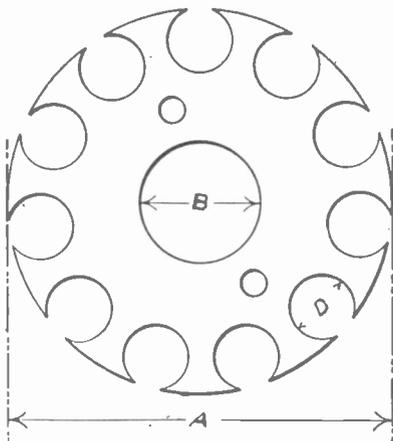


FIG. 10. ARMATURE DISK

is, composed of a great many sheets, all assembled side by side on the shaft. The simplest way to make the armature is to bolt all of the plain disks together on the shaft; but to get best results the sheets should be shellaced or enameled on one side, or better still, be separated from one another by thin sheets of paraffined tissue or other paper.

In constructing the armature, cut the two end plates, one for either end, and the sheet iron into rectangular shape, 4 by 6 inches. The stack should be 3½ inches thick when tightly clamped together, by means of bolts passed through notches in the sheets, and holes in the end-plates.

Describe a 2¾-inch circle on the end plate and drill a one-inch hole for the shaft at its center. This may seem to be a large shaft for this size motor or dynamo, but, since it is to be built on the machine, it must be of this size. Around the circumference of the 2¾-inch circle, using points on it as a center, drill eleven equally spaced (½-inch diameter) holes. The armature is now ready for turning, but the turning may be more rapidly and accurately done if the end plates and the sheets are first cut down almost to size, say 3⅝ inches in diameter, using the machine to true them up, and opening the ½-inch holes to form slots. At a radius of ⅞ inch from the center, drill two ¼-inch holes on opposite sides of the shaft through the armature. Put two ¼-inch bolts through these holes and tighten the nuts.

The next step is to prepare the boring machine for turning (Fig. 11). Make a tool-holder as before, with a piece of pipe of the same diameter as the other tool-holder, and use four lock nuts. Drill a hole through the timber of the machine bed, and through this hole put the tool-holder after having threaded

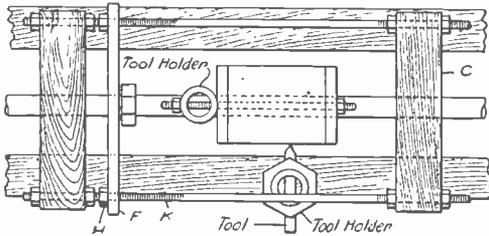


FIG. 11. BORING MACHINE ARRANGED FOR TURNING

it from end to end, and fasten it there by tightening the lock nuts on either side of the wood, as shown in Fig. 12. The pipe should be long enough to extend about two inches above the center of the shaft of the machine. Near the top, cut a slot wide enough for the tool, and putting the tool in place, clamp it between the two nuts. Now put the armature on the shaft of the machine, and fasten it to the original tool holder by means of a

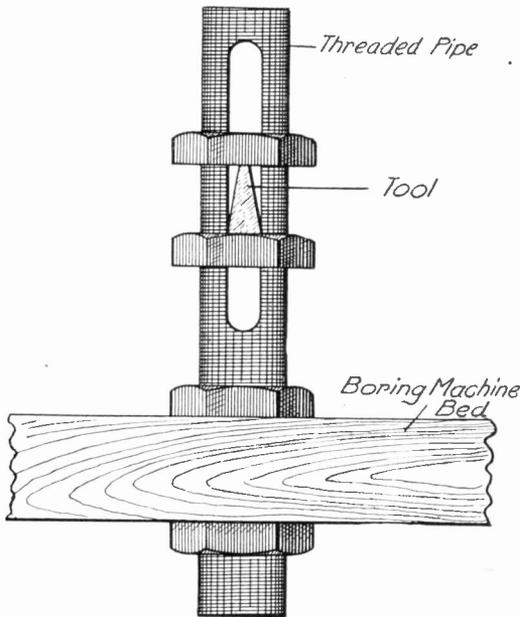


FIG. 12. TOOL HOLDER

bolt passed through one of the armature slot holes and through the slot in the tool holder. It would be better if two slots,

opposite, were connected to the tool holder in this way.

Set the tool to cut to the proper diameter if using a side tool, but if using a tool like the one shown in Fig. 11, set it to take a very light cut, drive the foot-power and feed up the work by means of the feed device. The armature will then rotate and move before the tool, and will be turned perfectly round on the shaft with its center and the center of the shaft coinciding.

After the armature is machined, it should be removed from the shaft, and the disks insulated from one another by either a coat of shellac, or enamel, on one side of each disk. The disks should then be carefully assembled on the shaft while the separating insulator is still soft, and tightly clamped together again.

(To be continued.)

Simple Galvanometer

A simple galvanometer for approximately determining the strength of electric currents may be made up as follows:

First procure a small compass mounted in a containing case about $1\frac{1}{2}$ to $1\frac{1}{2}$ inches in diameter. Now bore a hole in the center of one side of a wooden block about $2\frac{1}{2}$ inches square, of such a diameter that the compass case will fit snugly into it. This hole should be bored to such a depth that the center of the compass needle will be in the exact center of the wooden block when the needle is in place. Cut two grooves all the way round the block as shown in Fig. 1, the grooves being $\frac{1}{2}$ inch wide and $\frac{1}{2}$ inch deep. Wind in each of these slots twelve layers of No. 24 B. & S. double cotton-covered copper wire. These coils should both be wound in the same direction and the inside end of one connected to the outside end of the other which results in the current flowing around the two coils in the same direction when the remaining two terminals are connected in a circuit. The compass should, of course, be placed in a the wooden block before the wire is wound on, and it can be held in place by means of some shellac put in the bottom of the hole.

Mount the compass case in such a position with respect to the block that the needle will be at zero when it is parallel to the planes of the two coils as shown in Fig. 2.

This part of the galvanometer should now be mounted on a wooden base whose dimen-

sions correspond approximately to those given in Fig. 2. Two back-connected binding-posts may be mounted on the base that will serve as terminals for the instru-

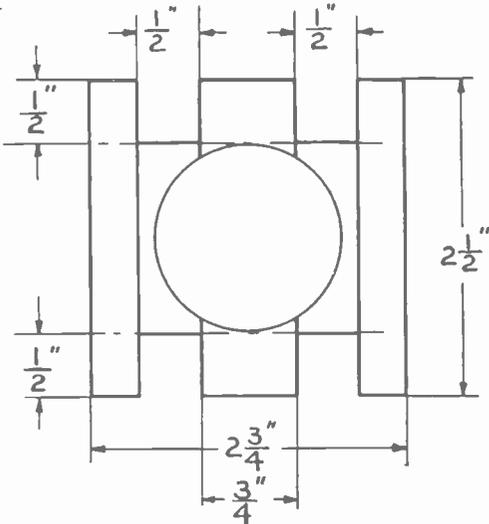


FIG. 1. MOUNTING BLOCK OF GALVANOMETER

ment and the free ends of the coils should be connected to them on the under side, the wires being placed in grooves cut in the base. The completed instrument should be

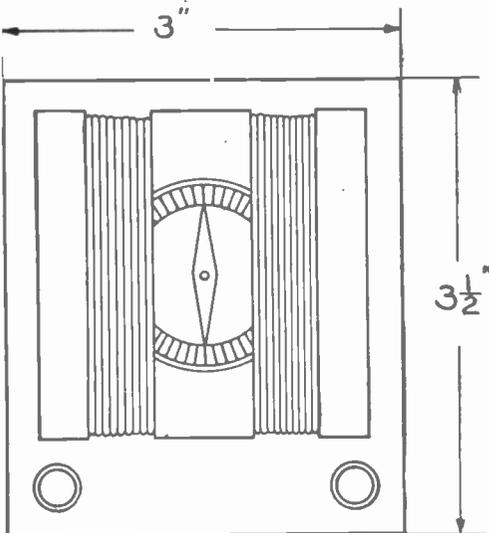


FIG. 2. ARRANGEMENT OF GALVANOMETER COILS

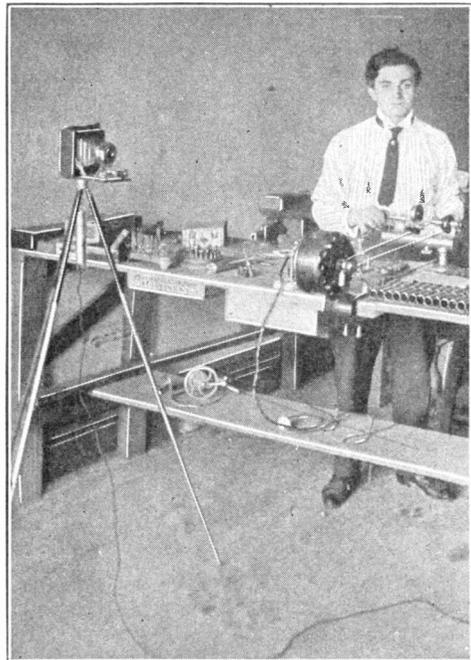
given two coats of shellac and you are ready to calibrate it, which can be done by connecting it in series with an instrument whose indications are known.

This instrument can be made to indicate the value of larger currents by winding it with larger wire and using a smaller number of turns. It can also be made to indicate small currents by decreasing the size of wire and increasing the number of turns.

Self Photography by Electricity

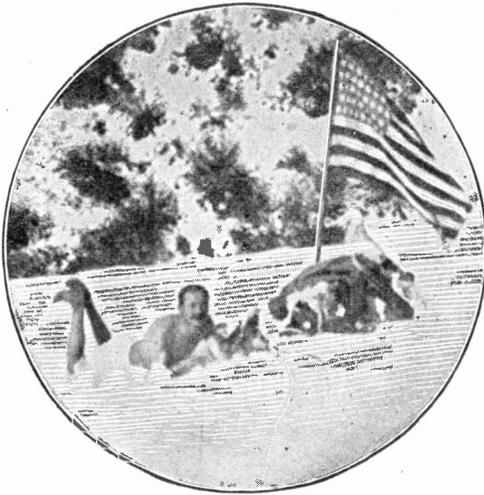
A device which enables a person to take his own photograph by means of electricity and compressed air has recently been perfected by Karl Thalhammer, a young Austrian inventor living in Los Angeles.

It consists of a metal cylinder about six inches long, which contains an air com-



ELECTRICALLY OPERATED CAMERA

pressor and an electrical mechanism for releasing the air pressure, and a small dry cell. This cylinder hangs from the tripod and is connected with the rubber air-tube that opens and closes the camera shutter. A double length of fine, insulated wire is attached to this cylinder and connects with a smaller cylinder held in the operator's hand, this cylinder containing another tiny dry cell. A slight pressure of the thumb is all that is required to electrically release the compressed air for a snap shot, or, if a time



UNUSUAL PICTURE TAKEN WITH ELECTRICALLY OPERATED CAMERA

exposure is needed, a second pressure will close the shutter.

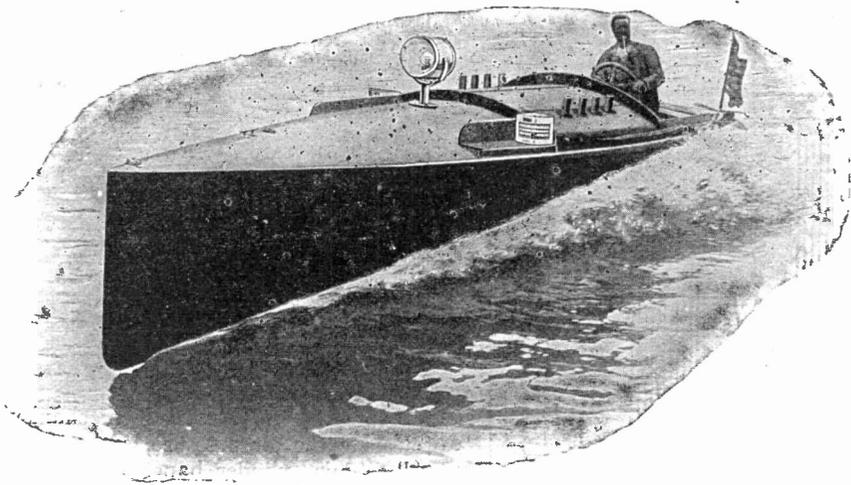
The cylinder is so small that it will not show in the hand, and the wire can be adjusted so that it will be inconspicuous.

Its greatest value is to the solitary traveler or explorer who can bring back photographic proofs that he has visited some particular place. That phase of its use is shown in the photograph herewith of Paul Reinwald, the famous mountain climber, who took this picture of himself in peculiar pose on Mount Baldy in Southern California, Christmas day, 1909.

The value of this device to the amateur photographer lies in the fact that he can include himself in a group of friends when there is no friendly stranger to "press the button."

Motor Boat Searchlight

Nosing about after dark among other craft with an expensive motor boat requires that some precaution be taken to prevent a costly accident. Compared with slow going craft the motor boat is the automobile of the water and should therefore be equipped with just as good a head light as the wheeled vehicle. The accompanying picture shows such a boat equipped with an electric search-



MOTOR BOAT SEARCHLIGHT

The operator desiring to take his own picture should first carefully adjust the camera to include the place in which he expects to pose, getting the focus upon some object on that spot, like a twig or a stone.

light. Inside the swinging reflector is a low-voltage, heavy filament tungsten lamp of from 10 to 25 candlepower. This is operated from a storage battery and sends out a surprisingly powerful beam of light.

POPULAR ELECTRICITY WIRELESS CLUB

Membership in Popular Electricity Wireless Club is made up of readers of this magazine who have constructed or are operating wireless apparatus or systems. Membership blanks will be sent upon request. This department of the magazine will be devoted to the interests of the Club, and members are invited to assist in making it as valuable and interesting as possible, by sending in descriptions and photographs of their equipments.

A High-Power Wireless Equipment

By ALFRED P. MORGAN

PART XI—DETECTORS (CONTINUED).

The moving parts of the detector are assembled as in Fig. 123. A small spiral spring is formed by wrapping some fine piano wire around a small brass rod, and placed on the shaft between the wire ring and a small brass washer $\frac{3}{8}$ inch in diameter

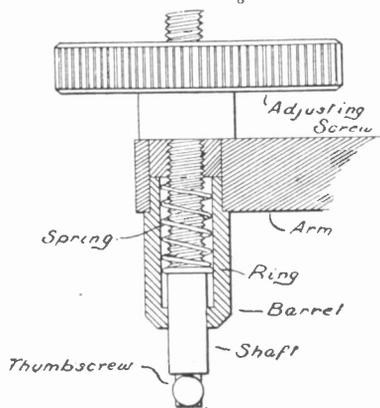


FIG. 123. MOVING PARTS OF A DETECTOR

and $\frac{3}{16}$ inch thick. The shaft passes through a hole in the centre $\frac{1}{32}$ inch in diameter. The washer as well as the "barrel" are soldered to the arm.

When the hard rubber adjusting head is turned in one direction it will raise the shaft, but when turned in the opposite direction the spring forces it down.

The brass arm is secured firmly to the hard rubber standard Fig. 124, by a brass rod which passes through the longitudinal axis of the latter. The rod is $2\frac{3}{4}$ inches long. The ends are threaded with an 8-32 die. A hexagonal nut having a similar thread is placed on the lower end. A composition

knob similar to that used on the adjusting rods of the oscillation condenser is screwed on the top. The arm is kept from moving sideways by two small brass pins which pass,

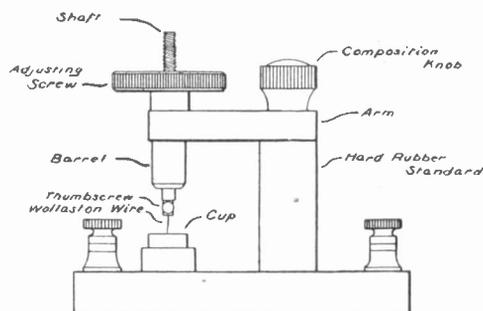


FIG. 124. COMPLETE DETECTOR

one from the arm into the standard and the other from the base into the standard.

The cup to contain the electrolyte, Fig. 125, is a piece of hard, close-grained graphite rod. The variety used for making brushes for dynamos and motors is preferable since

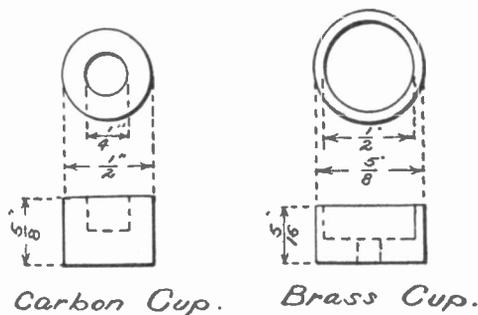


FIG. 125. THE CUP

it is non-porous. The cup is $\frac{1}{2}$ inch in diameter and $\frac{3}{8}$ inch deep. A small recess, $\frac{1}{4}$ inch in diameter and $\frac{3}{16}$ inch deep is bored in the top to contain the acid. This may seem to some to be an unusually small

This detector is especially suitable for use with carborundum crystals, it being employed for that purpose by the United Wireless Telegraph Company.

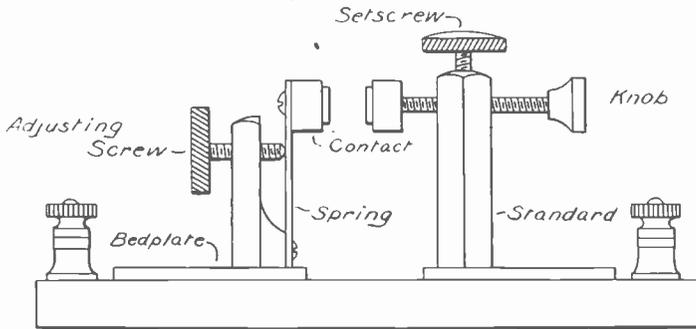


FIG. 126. MINERAL DETECTOR

amount of electrolyte. But a few drops of acid are preferable to a large quantity. The acid does not then move very easily and the detector is not so liable to be thrown out of adjustment by jolts or jars.

The carbon should fit snugly into a brass cup $\frac{3}{8}$ inch in diameter and $\frac{5}{16}$ inch deep. The recess in the top of the brass cup should be made $\frac{1}{2}$ inch in diameter and $\frac{3}{16}$ inch deep. The cup is fastened directly under

The base, Fig. 127, is a piece of polished hard rubber $2\frac{3}{4}$ by 7 by $\frac{1}{2}$ inches. The standards are made of hexagonal brass rods $\frac{5}{8}$ inch in diameter. The tallest standard is two inches high. The top is turned slightly convex to present a good appearance. It is bored and tapped to receive an 8-32 knurled thumbscrew having a head $\frac{7}{8}$ inch in diameter. The lower end is bored

and tapped to receive an 8-32 machine screw which holds it to the base. A $\frac{5}{32}$ inch hole is bored at right angles to the axis of the standard $1\frac{1}{16}$ inches from the lower end.

The smaller standard is $1\frac{1}{2}$ inches high. One face is ground away as shown by the detailed drawing in Fig. 128. A knurled brass thumbscrew, Fig. 129, $\frac{7}{8}$ inch in diameter and one inch long over all passes through the standard $1\frac{3}{16}$ inches above the lower end. The end of the thumbscrew bears against a brass spring $\frac{3}{8}$ inch wide and $1\frac{15}{16}$ inches long. The spring

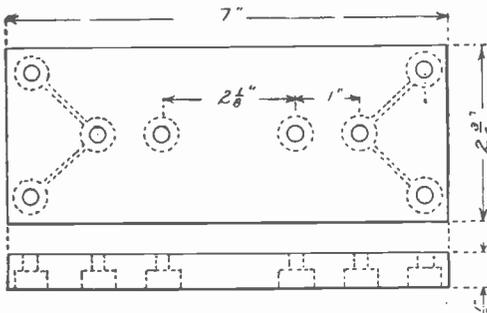


FIG. 127. BASE OF MINERAL DETECTOR

the lower end of the shaft. A small brass screw passes through the base into a threaded hole in the bottom of the centre of the cup.

Connections are established by copper wires inlaid in grooves in the under side of the base. Two of the binding posts are connected to the cup and the other two to the lower end of the rod which passes through the arm and standard.

The detector shown in Fig. 126 is illustrated for the benefit of those experimenters who for some reason or other prefer to use minerals.

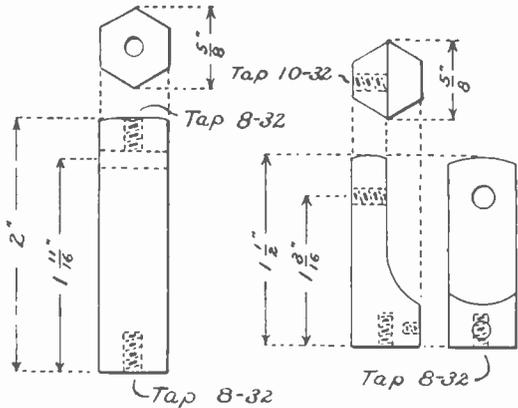


FIG. 128. DETAILS OF STANDARDS

is fastened to the standard by means of two small round headed brass screws. The lower end of the standard is bored to receive an 8-32 machine screw which holds it to the base.

The standards are mounted on a brass bed-plate which serves to make them firm and also to give the detector a more finished appearance. The bed plates are two inches long, $\frac{7}{8}$ inch wide and $\frac{1}{8}$ inch thick.

The electrodes are two circular pieces of brass, Fig. 130, $\frac{1}{2}$ inch in diameter and $\frac{3}{8}$ inch thick. They are bored and tapped to fit an 8-32 thread. One is fastened to the spring by means of a small machine screw. The other is fitted on one end of a 5-32 inch brass rod two inches long. The other end of the rod is fitted with a small composition knob. The rod passes through the hole in the largest standard.

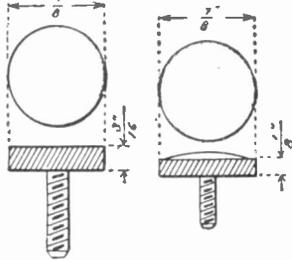


FIG. 129. THUMB SCREWS

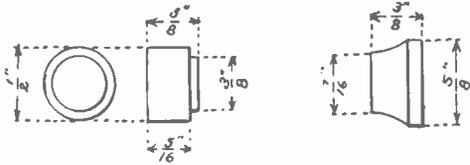


FIG. 130. BED PLATE ELECTRODE AND HANDLE

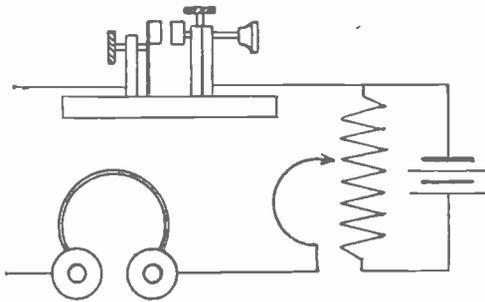


FIG. 131. DETECTOR CIRCUIT

The base is fitted with four binding posts, one near each corner, two connected to each standard. The connecting wires are inlaid in grooves in the bottom of the base. The circuit is shown in Fig. 131.

The following is a partial list of the minerals and crystals useful as wave detectors for wireless telegraphy.

Carborundum crystals are the only ones requiring a battery

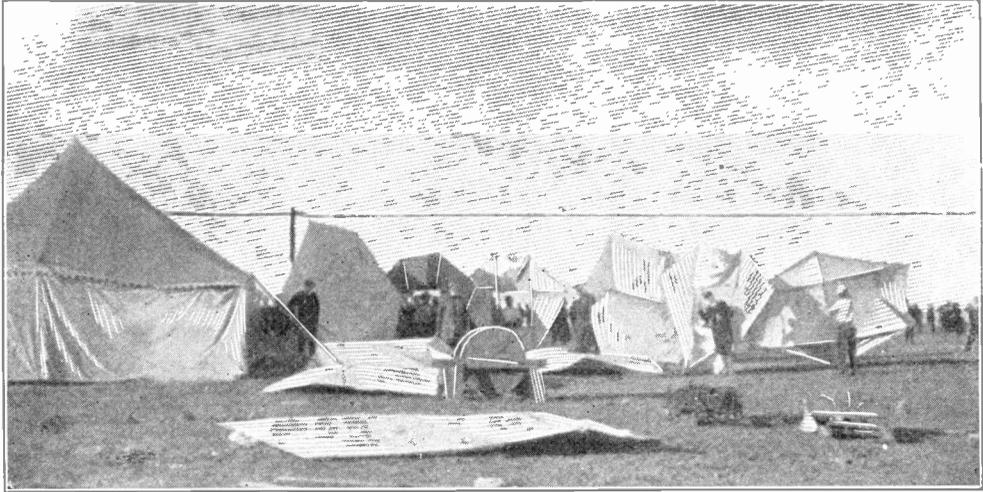
MINERAL NAME	CHEMICAL NAME
Carborundum	Silicon Carbide
Fused Silicon	Silicon
Iron Pyrites	Iron Sulphides
Copper Pyrites	Copper Sulphide
Chalcopyrites	Copper Iron Sulphide
Hessite	Telluride of Silver and Gold
Zincite	Zinc Oxide
Octahedrite	Oxide of Titanium
Stibnite	Antimony Sulphide
Galena	Lead Sulphide
Molybdenite	Molybdenum Sulphide
Zirconium	Zirconium
Niccolite	Nickel Arsenide
Domeykite	Copper Arsenide
Sphalerite	Sulphide of Zinc
Pyrrholite	Iron Sulphide
Corundum	Oxide of Aluminum and Iron.
Hematite	Iron Oxide
Cassiterite	Oxide of Tin
Siderite	Iron Carbonate
Malachite	Copper Carbonate.

(To be continued.)

Wireless at the Los Angeles Aviation Meet

At the recent aviation meet held at Los Angeles, California, the United Wireless Company installed a two K.W. station on the aviation field in order to send the daily flying news to a big Los Angeles newspaper. The installation was novel in many ways, the aerial being attached to one of the ten-foot man-carrying kites which was on exhibition at the meet. The aerial was a single No. 12 aluminum wire 300 feet long. The kite was raised 500 feet in the air and the aerial wire ran from the kite string to a tent on the field. The instruments used were of the DeForest type consisting of a loose coupler, silicon detector, 2,000-ohm phones and receiving condenser.

For sending there were used a two K.W. transformer, a condenser of the Leyden jar type consisting of 12 1/2 gallon jars, helix, anchor gap and key. The transformer was operated on a 110 volt alternating current light circuit. With this set the operator, a



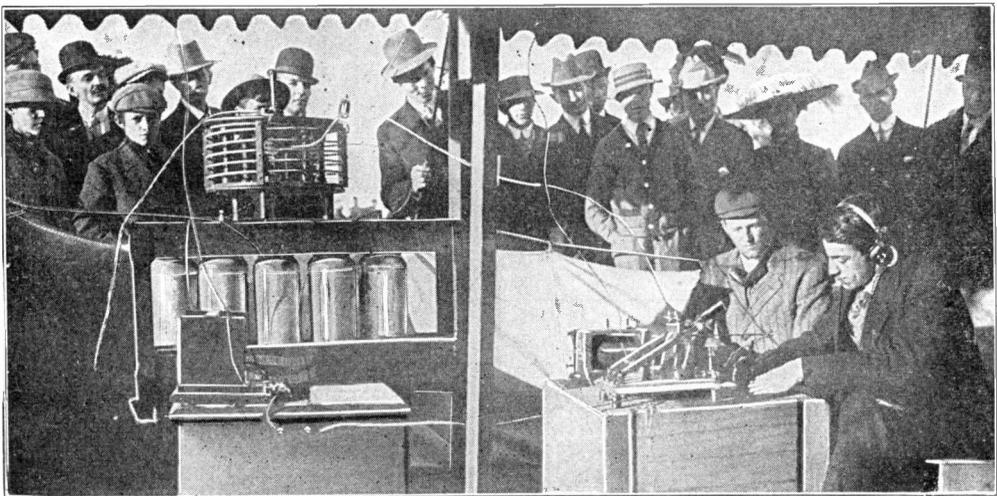
GETTING THE MAN-LIFTING KITE READY TO CARRY UP THE WIRELESS ANTENNA

Los Angeles amateur, was able to communicate with Los Angeles (P. J.), Catalina Island (P. I.), Point Loma (T. M.) the large coast steamer Yale and other ships at sea. The station which was open to the public was visited by several thousand people a day.

The United Wireless Company was to install a wireless set on one of the Wright biplanes but after the accident in which one of the Wright flyers, Arch Hoxsey was killed, the Wright manager refused to allow the instrument to be put up for fear of another accident.

Toward the last of the meet one of the Curtiss flyers, C. F. Willard, while circling the course in his machine at a 200 foot level ran into the aerial wire, bringing the kite to earth and smashing it badly. The aerial wire got tangled in his machine forcing him to descend. In landing he smashed the running gear and wing of his machine. Another kite was raised and the station resumed operation within fifteen minutes after the accident. The station was kept in operation all through the meet and transmitted and received from ten to 180 miles.

R. B. YALE.



WIRELESS OPERATOR'S TENT AT THE LOS ANGELES AVIATION MEET

Amateur Wireless at the Electrical Show

The story of the attention young men of the country are giving wireless was told at the exhibit of the Chicago Wireless Association at the Electrical Show where future Jack Binns explained to an always interested crowd the mysteries of Hertzian waves.

radius of 200 miles. With an active membership around 200, meetings are held twice a month at the Atheneum Building, 18-26 Van Buren Street, at which members discuss various phases of wireless and listen to lectures by experienced men in the field. Among the topics recently discussed were: "Wireless and Life in the United States Navy" by W. W. Holzbaur, operator in the

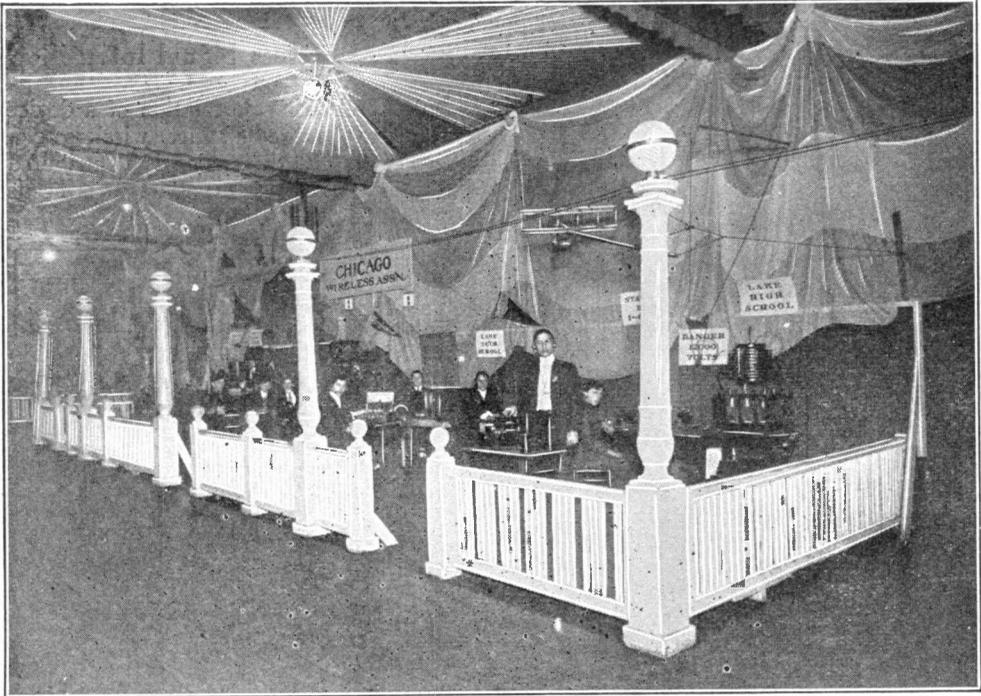


EXHIBIT OF THE CHICAGO WIRELESS ASSOCIATION AT THE ELECTRICAL SHOW

Several wireless equipments each in charge of operators demonstrated the manner of sending and receiving messages. An equipment, installed in the north balcony, as far away as the Coliseum would allow, served as a station with which the operators talked at different times. Much of the apparatus was home made, some of the devices having been built in the laboratories or shops of the school the students attend. Besides the Association apparatus the following Chicago schools were represented: Lake High, Lane Technical, Englewood and Crane Technical. Apparatus exhibited varied in capacity from $\frac{1}{4}$ K.W. to five K.W.

The Association which began as a club in 1907, has for its object the banding together of all amateurs in Chicago and within a

Navy, and "The Rotary Spark Gap." The officers of the Association are: E. Meullner, president; J. Hair, vice-president; J. Walters, Jr., secretary; C. Stone, treasurer. Applications for membership may be addressed to the Secretary, 6555 Langley Ave., Chicago.

Department Store to Install Wireless

Plans have been completed for the erection of two steel and wooden towers 125 feet high on the roof of the Wanamaker store at Broadway and Ninth Street, New York. The towers are to be used for a wireless telegraph station, which will communicate with a similar station connected with the Wanamaker store in Philadelphia,

Wireless Club Contest

The new P. E. W. C. membership list was sent out to all members on January 16th. It contains over 950 names and since January 1st, when the list was sent to the printer, a large number of new members have been added. As stated in the booklet, we believe the Club was never in a more prosperous condition. The members whose names are found in both this list and the old one have been with us since the beginning and their perseverance shows that they went into the wireless experimental work as something more than a passing fancy.

As the P. E. W. C. members have always been among the most loyal readers of the magazine we decided to make them an exceptionally good offer in the form of a subscription-getting contest, full particulars of which have been sent to each member. We have arranged this contest so that all can make their running expenses as they go along. We have also arranged so that every one who does good work can secure one of the special prizes—something that he needs every day in his experimental work. There isn't a member that cannot go out and get at least ten subscriptions before May 1st, entitling him to one of these special prizes. Probably most of you can go out and get several times ten thereby obtaining several of the "specials" and putting you well in the running for one of the grand prizes, which last are all of them worth a lot of effort.

As the contest ends April 30th, announcement of the names of the winners cannot be made in the May issue, but the announcement will be made in the June issue, although, of course, the prizes will be distributed long before that date.

And now a word in regard to your working methods: Remember, first, that those interested in wireless are not your only "prospects." Everyone is a prospective subscriber to POPULAR ELECTRICITY, because there is something in every issue to interest young and old, men and women alike. Don't forget that point; your grocer, your doctor, your dentist, your machinist friends, your favorite engineers in the power plants and pumping stations where you go to watch the machines, the blacksmith around the corner, the principal and teachers in your school, the firemen, the butcher, the storekeeper—all are interested in electricity, they will all be glad to listen to your arguments

and to take out their subscription through you.

Sample copies are valuable to you in the work and we will be glad to send them to you as often as you ask for them. Also remember that each subscription you take must be sent in on one of the blanks given you, for these blanks constitute our record on which we are to finally compute the results of each one's efforts. When you run out of blanks send for more.

A Wireless Signal Intensifier

The following description of a device for rendering more distinct wireless signals, especially faint signals, is contributed by William Greotzinger: All that is needed is

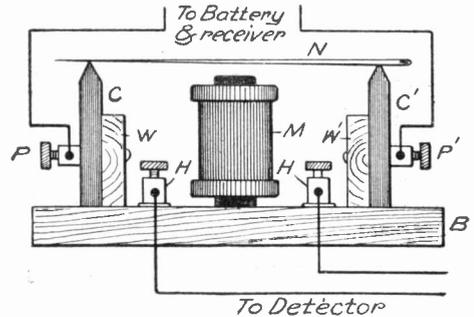


FIG. 1. SIGNAL INTENSIFIER

preferably a wireless receiving set using an electrolytic detector. Although any detector can be used, the electrolytic seems to give the best results. The intensifier or relay is shown in Fig. 1. (B) is the base and (WW') are two wooden uprights. (CC') are two carbons and are fastened to (WW') by two binding posts (PP'). The carbons must have a sharp edge on the top. (M) is an electromagnet out of an old 75-ohm single-pole telephone receiver and is fastened to the base between the two carbons, the free ends going to the binding posts (HH'). Be sure to have the carbons a very little higher than the top of the magnet core so that when the needle (N) is laid across them it almost touches the core. When a message is coming in the detector makes the magnet a little stronger, which pulls on the needle and lets more current through the contact between the carbons and the needle, thereby operating a receiver or relay.

The connections are shown in Fig. 2. The intensifier merely takes the place of the wire-

less telephone receiver, and relays a strong current on to another receiver or sensitive relay. The instruments are adjusted as usual. Mr. Greetzinger states that he has

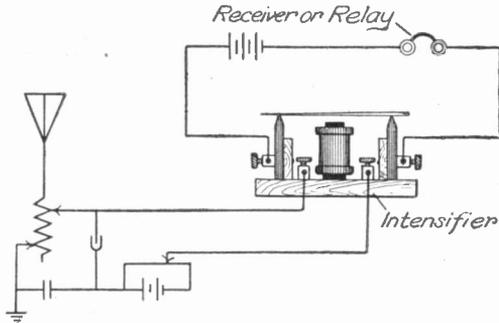


FIG. 2. CONNECTIONS OF SIGNAL INTENSIFIER

had fine results with this instrument and weak signals have been increased to fully three times as loud.

WIRELESS QUERIES

Answered A. B. Cole

Questions sent in to this department must comply with the same requirements that are specified in the case of the questions and answers on general electrical subjects. See "Questions and Answers" department.

Measuring Sending Current

Question.—Could you tell correctly when you were sending out the most amperage from an aerial by connecting an incandescent lamp in the aerial circuit?—T. R. D., Van Wert, Ohio.

Answer.—This method is fairly satisfactory, but since slight changes in the current passing through the lamp do not cause large changes in its brilliancy, and since the eye of the operator will not readily note small changes in its brilliancy because there is no standard to judge by, this method will not give as exact results as a hot wire ammeter.

Carborundum for Detector

Question.—Is the carborundum in the oil stones suitable for a detector if it is broken into small pieces?—A. A. MacC., Syracuse, N. Y.

Answer.—No, because the carborundum used in making these stones is in a powdered or granulated condition and therefore offers too high resistance. Also, these stones contain a certain amount of binding substance which is of high resistance.

Tuning Transformer

Question.—Why does the secondary of a tuning transformer slide inside the primary instead of the primary sliding inside the secondary as in a spark coil?—C. F., Little Valley, N. Y.

Answer.—These transformers generally have a sliding contact on the primary windings so that very close adjustment for any wave length can be obtained. Sufficiently close adjustment in the secondary circuit can be obtained by use of a switch and a variable condenser. The reason for the construction which you point out is that a slider can be more easily manipulated on the outside coil. The other method of construction could be used, however.

Aerial; Set Connections; Ground

Questions.—(A) Would No. 14 aluminum wire make a good aerial? (B) Please give connections for a fixed condenser having three binding posts, double slide tuning coil, potentiometer, 1,000-ohm receiver, electrolytic detector and batteries. (C) Would a pipe four feet long driven into the earth make a suitable ground for receiving?—A. H. L., Toledo, Ohio.

Answers.—(A) Yes.

(B) Referring to diagram 4, page 553, of the October, 1910, issue, the fixed condenser is shown at (C). Any one of the three binding posts may be connected to the lower slider of the tuning coil and to the earth, and either one of the other two binding posts may be connected to the detector and to the slider of the potentiometer as shown.

(C) Yes, for short distance working, that is, up to 200 or 300 miles. A longer pipe would give better results, since it might strike moist earth.

Receiving Radius

Questions.—(A) Please give receiving radius of the following outfit: Bare point electrolytic detector, 2,000-ohm phones, receiving transformer, potentiometer, variable condenser and fixed condenser. The aerial consists of four wires 60 feet high and 50 feet long. (B) Would a common tuning coil give as good results as one of the loose coupled type? (C) What instruments will increase my receiving range?—A. C., Belvidere, Ill.

Answers.—(A) About 600 miles over level land or water, receiving from high power commercial stations.

(B) A straight tuning coil will give nearly as great a receiving radius, unless there is interference, when a loose coupled tuner would give better results. This latter is nearly always the case.

(C) You would have somewhat better results with a good Perikon detector.

QUESTIONS AND ANSWERS

Use of this department is free to readers of Popular Electricity, but attention will not be given to questions which do not comply with the following rules: All questions must be written in the form of a letter addressed to the Questions and Answers Department and containing nothing for the other departments of the magazine; two-cent stamp must be enclosed for answer by mail, for space will not permit of printing all answers: the full name and address of the writer must be given.

Polarity of Compass Needle

Question.—What is the polarity of the “north-seeking” pole of a compass needle and why is it called “north-seeking”?—H. E. S., Los Gatos, Cal.

Answer.—If the north-pointing pole of a needle is attracted by magnetism near the North Pole of the earth we must infer according to the law of magnetic attraction that the earth’s magnetic North Pole and the north-pointing pole of the needle are unlike poles. If we call the magnetism at the North Pole “north” magnetism then the north-pointing pole of the needle is south magnetism. On account of confusion in this matter Sir William Thomson calls the north-pointing pole a “true south pole,” although common practice is the opposite, calling it the north pole. The French and Chinese call the north-pointing pole of a needle a south pole and the south-pointing pole a north pole. The term “north-seeking pole” seems to avoid a misunderstanding as to which end of the needle we refer.

Commutator Troubles

Questions.—(A) What is the cause of high mica on the commutator of a motor? (B) What remedy can be applied? (C) Why do carbon brushes on a motor become pitted?—F. W., Chicago.

Answers.—(A) The raising of the mica is an unusual occurrence and does not take place over the entire commutator. What really does happen, is the wearing away of the copper bars leaving the mica projecting from between. In a poor machine this wearing away is not surprising. If the commutator is allowed to continue in its roughened condition the machine will flash over from one brush to the next and will act very badly under a heavy load.

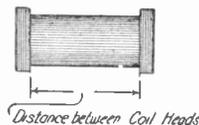
(B) One way of getting the commutator into shape is to use the motor where the load is variable. While the motor is running

light the brushes smooth up the commutator and thus counteract to a certain extent the bad results from a heavy load. A second remedy is to replace the commutator by another while a third treatment is to cut down the mica, with a narrow sharp chisel, 1-16 of an inch below the level of the bars. This last remedy is considered a good one.

(C) This may be due either to poor design or a wrong position of the brushes on the commutator. In design if the width of the brushes is not correct pitting will occur. In some cases where heavy current flows through the brushes they glow but this current is not all line current. The brushes overlap two segments of the commutator and so short circuit two coils of the armature. While in this condition if stray flux from the pole tips passes through the coils a very heavy current for the moment may be produced and glowing and pitting occur.

Distance Between Coil Heads

Question.—Referring to an induction coil, what is meant by “distance between coil heads”?—R. H. T., Greenville, S. C.



Answer.—See illustration.

Watts Per Candlepower of Filament Lamps

Questions.—(A) How many watts per candlepower does the carbon filament lamp require? (B) Tantalum? (C) Tungsten?—F. E. K., Asbury Park, N. J.

Answers.—(A) 3.5 watts.

(B) 2. watts.

(C) 1.25 watts.

Surrender and Re-Issue of Letters Patent

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

RIGHT TO SURRENDER AND OBTAIN REISSUE.—*In General.*—Whenever any patent is inoperative or invalid by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more than he had a right to claim as new, if the error has arisen by inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, the commissioner must, on the surrender of the original patent and the payment of the duty required by law, cause a new patent for the same invention, in accordance with the corrected specification, to be issued for the unexpired part of the original patent. The statute is to be construed liberally and not strictly as restraining and limiting the right.

ERRORS OR DEFECTS AUTHORIZING REISSUE.—*In General.*—A patent may be surrendered and a reissue granted only for the errors or defects specified in the statute.

INSUFFICIENT DESCRIPTION.—Where the specification of an original patent is defective for not containing a full and perfect description of the invention intended to be patented, the defect may be remedied by a reissue with a corrected specification.

ERRORS OF PATENT OFFICE.—Where the error is one of the patent office and not chargeable to the patentee, it may be corrected by a reissue.

CLAIMS TOO NARROW.—Where the claims are too narrow to cover the actual invention made and described and intended to be claimed, the defect may be cured by a reissue of the patent with broadened claims. But this can be done only where the original specification and description, including the drawings or model, sufficiently describe the actual invention, so as to show that the reissue is not in fact for a different invention, for the original and the reissued patents must both be for the same invention.

BUT MERE SUGGESTIONS IN THE ORIGINAL SPECIFICATION, DRAWINGS, OR MODEL WILL NOT BE CONSIDERED AS A PART OF THE INVENTION INTENDED TO BE COVERED BY THE ORIGINAL PATENT, UNLESS IT CAN BE SEEN FROM A COMPARISON OF THE TWO PATENTS THAT THE INVENTION WHICH THE ORIGINAL PATENT WAS INTENDED TO COVER EMBRACED THE THINGS THUS SUGGESTED OR INDICATED, AND UNLESS

the original specification indicated that those things were embraced in the invention intended to be secured by the original patent.

CLAIMS TOO BROAD.—Where the claims of a patent are too broad and include matter which the patentee had no right to claim as new, the defect may be cured by a reissue. But a reissue is rarely resorted to simply to cure excessive claims, as a simpler remedy exists by disclaimer.

CONDITIONS OF REISSUE—INVALIDITY OR INOPERATIVENESS OF PATENT.—It is only invalid or inoperative patents that may be surrendered and reissued. A valid and operative patent cannot be reissued solely for the purpose of expansion. But this must be taken with the qualification that a patent which is not valid and operative to the full extent of the actual invention described and intended to be claimed may be reissued so as to cover the real and actual invention. Such expansion, though not expressly authorized by the statute is deemed within the equity of the statute. But whether the right to such an expanded reissue of patents not wholly invalid or inoperative rests upon the statute or not, the right to and the validity of such reissues are now firmly established by the courts.

INADVERTENCE, ACCIDENT, OR MISTAKE.—A reissue is unauthorized unless the defect sought to be cured arose from inadvertence, accident or mistake.

INTENTIONAL OR FRAUDULENT DEFECTS.—Where the defect was intentional or fraudulent, it cannot be cured by a reissue.

PERSONS ENTITLED TO REISSUE.—*Where There has been No Assignment* of the patent, the sole right of surrender and reissue is vested in the patentee, or, if he is dead, in his executor or administrator.

If the Patent Has Been Assigned, the right of surrender is in the assignee. Where there has been an assignment of an undivided interest in the patent, the assignee and patentee or his legal representatives should join in the surrender. The patentee cannot, by a surrender, affect the rights of third persons to whom he has previously passed his interest in the whole or a part of the patent, without their consent. But the grantee of an exclusive territorial right or a

mere licensee, need not join in the application for a reissue.

REISSUES OF REISSUED PATENTS.—There may be more than one reissue of the same patent. Reissues are favored where the patentee is more specific or more modest in his claims.

NEW BOOKS

MOTOR TROUBLES. By E. B. Raymond. New York: McGraw-Hill Book Company. 1909. 197 pages with 98 diagrams and illustrations. Price \$1.50.

The fact that the author is an electrical engineer in the motor line for the General Electric Company makes his experience especially valuable. New apparatus from an electrical manufacturing company is expected to operate from the first without difficulty and in order to assure this, tests must be made and any troubles remedied before the apparatus leaves the factory. The titles of the four parts into which the book is divided are: Part I. The Tracing of Direct Current Motor Troubles and Their Remedies; Part II. The Tracing of Alternating Current Motor Troubles and Their Remedies; Part III. The Testing of Direct Current Machinery; Part IV. Testing Alternating Current Machinery.

FLYING MACHINES. CONSTRUCTION AND OPERATION. By W. J. Jackman, M. E., and Thos. H. Russell, A. M., M. E., with an introductory chapter by Octave Chanute, C. E. Chicago: Chas. C. Thompson Company (Not Inc.). 1910. 221 pages with 94 illustrations. Price, cloth, \$1.00. Flexible leather, \$1.50.

This book is intended to give the reader interested in aerial navigation, practical instruction in the building and operation of flying machines. It is written in a non-technical manner and tells clearly of the principles as well as of the practice of the art of aviation.

THE STORY OF GREAT INVENTIONS. By Elmer Ellsworth Burns. New York: Harper and Brothers. 1910. 246 pages with 119 illustrations. Price, \$1.25.

The purpose of this book is to tell in simple language how our great inventions came into being, to depict the life-struggles of the men who made them and in the telling of the story, to explain the working of the inventions in a

way the boy can understand. The stories are so woven together as to give to the young reader a connected view of how our great inventions have arisen out of scientific discovery on the one hand and social and economic conditions on the other. This well written romance of great inventors will appeal strongly to young readers as well as to many older ones.

THE TESLA HIGH FREQUENCY COIL, ITS CONSTRUCTION AND USES. By George F. Haller and Elmer T. Cunningham. New York: D. Van Nostrand Company. 1910. 119 pages, with 56 illustrations. Price, \$1.25.

After a careful study of a twelve-inch spark coil the authors set forth in this book much information designed to save the builder of a Tesla coil time and trouble over details. One chapter of fourteen pages, is given up to the uses of the coil for lighting vacuum tubes, Roentgen ray work, etc.

DYKE'S AUTOMOBILE ENCYCLOPEDIA. By A. L. Dyke. St. Louis, Mo.: A. L. Dyke. 1911. 497 pages with 148 pages of illustrations. Price, \$3.25 prepaid.

The book is divided into 29 parts and treats of everything apparently pertaining to the construction, repair and operation of automobiles and gasoline engines. A marked feature of the book is the inclusion of a large number of illustrations lettered and arranged to convey a clear idea of the apparatus under consideration.

ELECTRICITY EXPERIMENTALLY AND PRACTICALLY APPLIED. By Sidney W. Ashe. New York: D. Van Nostrand Company. 1910. 349 pages with 422 illustrations. Price, \$2.00.

After a concise presentation of the intimate connection between magnetism and electricity and a brief summary of the theory of direct current apparatus, the author illustrates and describes the more important types of primary and storage batteries, the action of electrolysis, the three-wire system, electrical measurements, motors, lamps and meters.

PHYSICS. By Charles R. Mann and George R. Twiss. Chicago: Scott, Foresman and Company. 1910. 417 pages with 220 illustrations. Price, \$1.15.

This book is written for use as a text book in secondary schools. It is designed to take up the subject by the "problem method," that is, by seeking to answer queries with experiments and laboratory exercises.

ON POLYPHASE SUBJECTS

Electrical Training that Brings Success

The young man who is now in a technical school preparing himself for the electrical engineering profession will do well to gain also as much knowledge of metallurgy and chemistry as his time will permit. That electrical science owes much of its progress to research work done in metallurgy is well shown by the improvements made in transformer and armature iron which takes us back to the blast furnace where the iron first starts on its preparation and in which processes both the metallurgist and chemist are concerned. Further evidence of the inter-relation of these sciences is exemplified in the production of metals of high melting point for metallic high-efficiency lamps, which offers an unlimited field of research for the electrical engineer who is thoroughly equipped with a knowledge of chemistry and metallurgy.

Heating Up a River

In the great Fisk Street Station of the Commonwealth Edison Company of Chicago the steam turbines which drive the electric generators exhaust the steam, after most of the energy is taken out of it, into huge condensers. To condense this exhaust steam quickly, water from the Chicago River is pumped into the condensers, and, after having performed its duty in condensing the steam is discharged back into the river—this time as steaming hot water.

It is surprising, even to engineers, to learn in this connection that one-tenth of all the water in the Chicago River flows through the condensers of the Fisk Street plant, and in so doing drops half a million dollars of the company's money right into the river each year, in the form of wasted heat units. But there seems to be no economical way of getting around this serious leak.

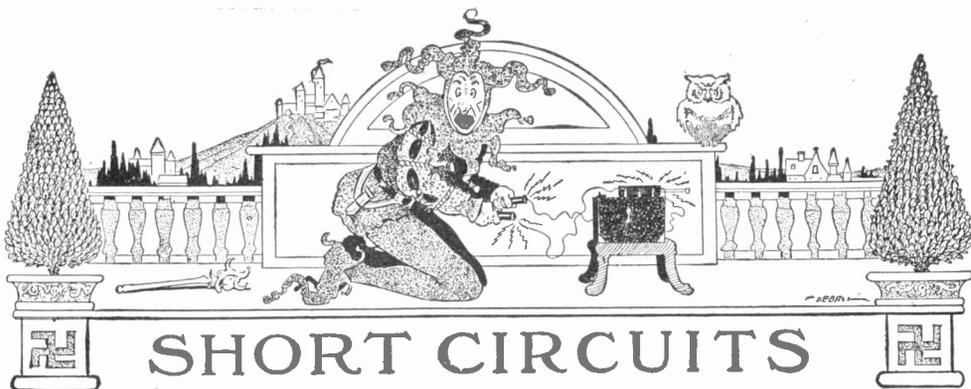
The Quarry Street Station which is situated just across the river from the Fisk Street plant, shunts five per cent of the river's flow through its condensers.

The Economy Light and Power Company, a small competitor down river from the Commonwealth stations used to have a lot of trouble in the winter with ice in the river. Since the big plants have so graciously taken to warming up the river, however, no ice trouble has occurred on the river and sanitary canal, not even as far down as the hydro-electric plant of the Sanitary District, 25 miles below.

Locating Pearls with X-Rays

The pearl fishing industry of Ceylon has long been noted as an example of the tremendous waste which too often accompanies primitive methods. Hauling the pearl oysters into boats and opening them to sort out the comparatively few containing pearls, has always meant the needless killing of hundreds of thousands of these mollusks and the polluting of both water and air through their decay.

Six years ago one of the authorities on all forms of animal life in the deep seas, Prof. Robert von Lendenfeld of the Zoological Institute at Prague, recommended the use of Roentgen rays for determining whether or not the unopened bivalves contained pearls. Now at last the suggestion has been put into practice and the unopened shells are tested at the rate of about 100 per minute on board a steamer to which they are brought partly by dragnets and partly by men in regulation divers' outfits. The X-rays readily indicate whether or not pearls are present and those containing none are thrown back into the water. Those showing the presence of small sized pearls are taken to secluded spots near the shore where they are left in the water while the pearls develop to a marketable size. Only those shells in which the X-ray radioscope shows pearls of considerable size are opened and robbed of their valuable contents, thus saving both the time of opening the many others and the ruthless slaughter of the majority of the mollusks, some of which may still secrete pearls later on.



SHORT CIRCUITS

A crowd had gathered to see the first car on a new line make its initial trip. A great deal of preparatory work seemed to be required by the motorman, and, as the people stood and watched every movement, a pessimistic old lady, to whom the idea of a car being able to move without any visible propelling power was incomprehensible, kept remarking, "It'll never go. It'll never go."

Finally everything was adjusted to the motorman's satisfaction. He turned the switch, and the car sped away down the track.

The old lady's eyes opened wide. She watched the car far a moment, and then, with amazement still written upon her features, but with firm conviction in her voice, she turned once more to the crowd and said, "It'll never stop!"

* * *

Mrs. Subbubs—Henry, that's twice you've come home and forgotten to bring the lard.

Subbubs—Yes, my love, it's so greasy it slipped my mind.

* * *

A youth from Calhoun county, Ill., which has nothing but steamboat transportation, came over to Elsberry, Mo., the other day to catch a Burlington train to St. Louis.

He had never seen a train, and when the Hannibal local came rolling in he stood there gaping, watched it hiss and steam, and finally pull out.

"I thought you was goin' to St. Louis on that train?" shouted the station agent, thrusting his head through the window.

"I was," answered the youth, "but they didn't put down no gangplank."

* * *

"What's the hardest thing about roller skating when you're learning?" asked a hesitating young man of the instructor at a rink.

"The floor," answered the attendant.

* * *

A newly-wed desired this to be inserted: "Love is the electricity that lights up the soul; marriage, the switch by which it is turned on or off."

* * *

George Ade was presiding at a banquet one night. In introducing each speaker he made some reference to the etymology of the speaker's name and pointed out some alleged definition of the name based upon an imaginary Latin or Greek derivation.

By and by the humorist himself was to speak, and another member of the party introduced him. "The next speaker will be Mr. George Ade," said the man. "Now, let us consider that word Ade. It comes from the old French source, aide, or, in modern English, aid, meaning help, assistance. It also means succor."

* * *

The young lady had been a great traveler in the West. "Been in California, Oregon, New Mexico, and Duluth, I suppose," inquired the man. "Yes, indeed, I've seen most every thing in the West," she vaunted. "Ever see the Cherokee Strip?" "N-no," with reddening face, "b-but they do almost."

A little Scottish boy was up the other day before the examiners for the Navy; the examination was *à la voce*, designed to discover signs (if any) of "general intelligence." They asked the boy what he knew about the battle of Flodden. He said, "Nothing." "What!" they said. "Don't you know anything about that battle in which the English beat the Scotch?" "Well," he said, "I know it must have been verra exceptional."

* * *

"Show me one of these old robber castles of the Rhine," commanded the tourist.

"Robber castles?" echoed the puzzled guide. "Does the gentleman mean a garage?"

* * *

St. Peter (to applicant)—What was your business when on earth?

Applicant—Editor of a newspaper.

St. Peter—Big circulation, of course?

Applicant—No, small; smallest in the country.

St. Peter—Pick out your harp.

* * *

Papa—Where have you been, James?

"Fishin'."

"Come into the woodshed and we'll have a whaling expedition."

* * *

The wild beasts gnashed their teeth and roared like a circus callopie; the gladiators shouted hoarsely; the arena was knee-deep with gore.

In the amphitheater the pleasure-seeking populace clamored tumultuously.

"More blood! More death!" they yelled ferociously. Great Caesar in his private box heard their cry and sighed.

"Would that I might grant their prayer," he muttered. "If only—" and imploringly he raised his eyes heavenward—"I could pull off an automobile cup race!"

Great Caesar wept.

For with all his boasted power he was unable to hasten the flight of time.

* * *

Little Walter was always carefully guarded against germs. The telephone was sprayed, the drinking utensils sterilized, and public conveyances and places were forbidden him.

"Father," he said one night, in a tone of desperation, "do you know what I am going to do when I grow up?"

"What?" asked his father, preparing himself for the worst.

"I'm going to eat a germ."

* * *

Earnest but Prosy Street-corner Orator—I want land reform; I want housing reform; I want educational reform; I want—

Bored Voice—Chloroform.

* * *

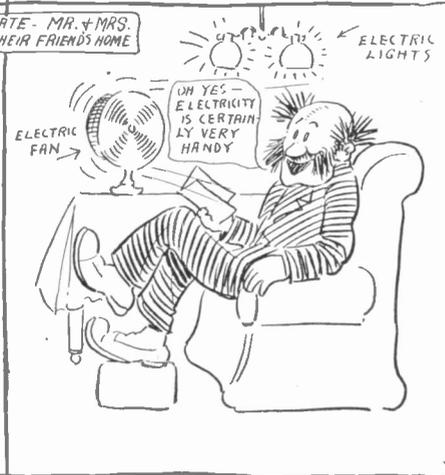
Small Girl (of twelve)—Is this a library?

Librarian—Yes.

Small Girl—I want something wicked and excitin and bad.

Librarian—I wouldn't let you have any book like that, little girl.

Small Girl—It ain't for me—I've read 'em. It's for my younger sister.



COMMON ELECTRICAL TERMS DEFINED

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

COMPOUND WOUND MOTOR.—A motor with two field windings, one in series with its external circuit and armature, the other in parallel or shunt with the armature. (See Compound Dynamo.)

CONDENSER.—A device for storing up static charges of electricity by induction. Tinfoil sheets separated by paraffine paper, mica or glass are alternately connected to two leads. These leads may be connected across a circuit, or one to a positive terminal, the other to ground. A condenser increases the capacity of a circuit. (See cut.)



CONDENSER, ADJUSTABLE.—A condenser in which the capacity may be varied as desired.

CONDENSER COATINGS.—The sheets of tinfoil or other conducting material which make the surface of the condenser able to receive and part with an electric charge. Often applied to the tinfoil of a Leyden jar.

CONDUCTANCE.—A word sometimes used instead of conductivity.

CONDUCTIVE DISCHARGE. A discharge of electricity through a conductor, as when a continuous current flows from the positive terminal through the external circuit and back to the negative terminal.

CONDUCTIVITY.—The property of a substance which allows it to pass an electric current either poorly or well. The greater the resistance of a given material the less its conductivity, therefore conductivity is often stated as the reciprocal of the resistance

or $\frac{1}{R}$. Matthiessen established a standard for finding the resistance of copper using the formula: $R = \frac{10.35 \times L}{D^2}$, R being the resistance in ohms at

68° F., L the length in feet and D the diameter of the wire in mils. It is possible to obtain copper purer than that used by Matthiessen but commercial copper falls below this standard.

CONDUCTOR.—In electricity a substance which will permit the passage of a current of electricity. Silver and copper are good conductors while glass is a poor conductor.

CONDUIT.—Ducts or piping of metal, tile, paper or other material within which are run electric wires, these ducts or pipes being made for use either in buildings or in underground work.

CONNECTOR.—Any device for joining the ends of two or more wires.

CONSEQUENT POLES.—If a bar magnet be so magnetized as to have both ends of the same polarity and the middle of opposite polarity the magnet is said to have two consequent poles.

CONSTANT CURRENT.—A current which flows continuously for some time without any variation in amperes. A series arc system is operated by a steady or constant current.

CONSTANT CURRENT ALTERNATOR.—An alternator designed to supply an unvarying current. Used on series lighting and series arc systems.

The voltage rises or falls as more lamps are added to or cut out of the circuit the current remaining constant.

CONSTANT CURRENT CIRCUIT.—A circuit in which the number of amperes remains constant without regard to the changes which may occur in its resistance.

CONSTANT CURRENT REGULATOR.—A device for maintaining constant the current from a dynamo when changes in the resistance of the external circuit are made. The Brush regulator, for example, does this by having across the field magnet coils a shunt whose resistance may be varied by an electromagnet energized by a coil through which the main current flows.

CONSTANT POTENTIAL.—The ordinary system of incandescent lighting in which the voltage is kept constant between any two wires. The current increases or diminishes according to the demand.

CONSTANT POTENTIAL REGULATOR.—An automatic device consisting of a rheostat in the shunt field circuit of a generator, the moving arm of the rheostat being operated by a solenoid in such a way as to vary the field circuit current by varying the resistance and thus keep the generator voltage constant.

CONTACT BREAKER.—A device operating either automatically or mechanically to break and make a circuit.

CONTACT POINT.—A point or pin often made of platinum against which a spring or other surface is brought to close an electric circuit. Used on coils, telegraph keys, etc.

CONTACT MAKER.—A device for making electrical contact thus sending current to instruments during a test. It usually consists of a wheel upon the rim of which at regular intervals are copper strips. Between the strips the rim may be of hard rubber or other insulation. As the wheel revolves these contacts close the circuit through a copper brush resting on the circumference of the wheel, the frequency of the contact being governed by the number of revolutions per minute of the wheel. Used in connection with tests of generator armatures.

CONTACT SERIES.—If different metals are brought in contact, a certain potential difference is developed. For example, if a piece of zinc be placed against a piece of lead the zinc is positive to the lead by .21 volt. An arrangement of substances on this basis is termed a "contact series." Volta recognized this by framing a law covering the condition.

CONTACT SPRING.—The metal spring attached to the armature of the vibrator in a bell or in an induction coil, by which the circuit is made and broken against the platinum point of the adjusting screw.

CONTINUOUS CURRENT.—Current which flows in one direction only.

CONTINUOUS RHEOSTAT.—A device for carrying current continuously up to a certain limit without changing its resistance. Used in measuring current by the fall of potential method which is based on Ohm's law transposed; $E = C \times R$.

The Man Who Made Florida

A TRUE STORY OF THE FIRST MAN OF THIS DECADE TO DEMONSTRATE THE PRACTICAL VALUE OF FLORIDA AS THE HOME OF "TEN ACRES AND LIBERTY"

By E. C. Roy

This reads like fiction but it is nothing but fact. I have traced the influences which have created the tremendous land rush to Florida, and though my opinion may be an humble one I give it to you for what it is worth.

I say without fear that the very first man to prove to the world that Florida was a spot where the man of ordinary means could be forever secure from loss of livelihood was and is Charles H. Sieg.

This man had made a minute and a careful study of the trend of the public mind. Three years ago he saw the "back-to-the-land" idea coming.

He was a man who has devoted much of his life to the manufacturing of mechanical things. He was successful and more than all else he was carefully practical.

He learned that the most essential thing in all agricultural topics was climate. He made a thorough study of crop failures, and the figures he can give to you on this subject would alarm you. He traveled much and read more. He conversed with many of the best informed men in this country on land.

Out of his own deductions there arose the determination to give Florida the test of fire. He wanted proof and proof only after a complete test.

All over this state he went. Into the swamps of the south, down upon the wet prairies bordering the Caloosahatchie he went, along the west coast and into the great districts of the middle ridge of Florida. He learned the state. He slept with the timber buyers, the land cruisers, the hunters,

the cane and corn planters, he learned of riches by nights spent with the growers of grape fruit and oranges. He fished the streams and his gun brought down the feathered treasures of the pines and palmettoes. He bathed in crystal waters during the winter months. He learned what "the out of doors" means in Florida and mentally he made a note of all these things.

When these places were as familiar to him as our own scenes are to us he began the idea that I claim has made Florida the most talked-of and read about spot in the entire world.

He purchased thirty-six thousand acres bordering beautiful Crescent Lake in St. John's County. He told of the tests he had made. He offered this land to the public at the rate of less than two good cigars a day. Financiers said: "Mr. Sieg, you cannot

make a success when you sell land at such small terms." The announcements appeared in the public press and every acre of this 36,000-acre tract was sold out in less than thirty days. He had more than 1,500 applications which could not be filled. Again he bought land. This time he had the prestige of the St. John's Park Colony behind him, and when he offered the second colony for sale, the name of which he called it was Jacksonville Heights Colony, he sold this project out in the same time that he consumed to dispose of St. John's Park. Then he began to see to the detail of the actual settlement, for Mr. Sieg is practical in everything he does. He is not a land man. The company



CHARLES H. SIEG

The man who made Florida famous as the Poor Man's Paradise

he is president of is not a land company. It does not abandon its settlers to their own resources. It builds roads, helps teach the essential lessons, operates experimental farms and sticks close to the new colonist until, like the young bird, he is ready to fly and can take care of himself. Now comes the point that I say proves this man Sieg to be the father of the Great Florida land rush. The success of these two colonies spread over this country like wildfire. The newspapers began to quote Florida topics. The doctrine of Sieg had sunk deep into the innermost recesses of the minds of the men who had influence and brains.

They knew that a land where there was the climate which could produce three crops every year, where the gentle breezes from the sea swept first in one direction and then in another over this land, was a spot where man could do three times as much with land than he could do in the great West or upon the sterile farms of the East. These financial giants who had robbed Florida of her trees and her turpentine, who had sought after the phosphate in her mines to enrich the lands of other farming sections, who had made millions in her fisheries, these men now saw that Sieg had struck the real riches of this great state and that their efforts were as nothing compared to the wealth that lay upon her fertile plains for the farmer and fruit grower.

These men came to Florida. Not in pairs but in droves. They scurried all over the state. They bought land and they copied Sieg's ideas and his arguments. They had learned that land could be sold on the easy-payment plan, so they began to advertise. In just a few brief months there was a tremendous land rush toward Florida. Almost every train headed toward the south bore some man or woman to Florida.

All this was a little over two years ago. Last fall Charles H. Sieg started his third great colony. He had by this time solved many perplexing questions and knew better

what to do and how to do those things which meant more for the comfort of his colonists. This colony he called Burbank Ocala and he located it down in that portion of Florida where the ancient Seminole Indians had lived and chose to call it "The Land of Plenty." You cannot imagine this spot unless you have been to Florida and know the charm and beauty of its pregnant interior.

This colony was located 101 miles south of Jacksonville on two railroads. In a short time, 90 days in fact, this entire tract of 65,000 acres was sold out. A railroad company, realizing the prestige and profit such a colony meant, began to build a line through its very heart from the pretty city of Ocala to the great St. John's River port, Palatka. This railroad at once made Burbank Ocala Colony a definite and fixed show-place of the

entire state. Here the colonists came by the hundreds. They came dressed in all manner of clothes. Some there were who had left the Saskatchewan and the dreary winters and the toiling days in the wheat fields; others came from the cities of the Northeast and West. Here met

for the first time the doctor and the office manager, the expert mechanic and the Yankee school teacher, and the Western farmer and the railroad engineer. They were followed by their wives and their children. In a short time their land was cleared. Their houses began to show through the beautiful pines and live oaks. They planted their crops and tilled their fields. Two towns sprang up in the short space of five brief months. Everywhere one looked there was improvement.

You should talk with some of these people if you want to know what all this means.

The work of Charles H. Sieg was bearing better and bigger fruit. His company had work to do and it did it. They made roads, built administration buildings, dug ditches so the excess rainfall of the summer would work no hardship. They put in an experimental farm. They attracted competent



DEPOT INTERLACHEN. A SMALL CITY ON THE FLORIDA-PALATKA COLONY

merchants and in every possible manner supported their colonists as far as it lay in their power to do so. This colony is now a tremendous success, and it is because of this success that Mr. Sieg has been compelled to secure additional land lying alongside of the Burbank Ocala colony to supply the demand that has been made upon him for small farms from people located in almost every section of this country, some even coming from European points.

If you would admire the other colonies which he has fathered and which are to-day eminently successful you would be wildly enthusiastic over the latest and best colony which he is colonizing now, called the Florida-Palatka Colony.

There is no spot on the North American continent where nature and man have joined together so successfully for the luxurious abode of humanity. This great colony, whose lands to-day are selling so fast as to be almost unbelievable, is located in the major part of Putnam County, though some lies in Page and Marion Counties. These three counties rank the first in the state and have repeatedly taken the blue-ribbon prizes at state fairs and exhibitions because of the excellence of the agricultural and horticultural products. Florida-Palatka Colony occupies the highest land in the state of Florida. This is an element you should have in all Florida land, for it means safety to your home and crops when the heavy rain floods the low lands, as the case often is in some portions of Florida.

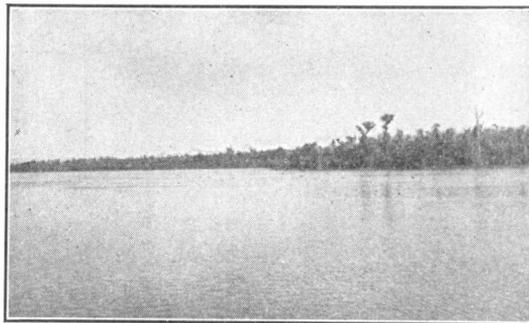
Then this great colony is located upon the very best of excellent railroads. You can get out of a Pullman car directly upon this land. The Atlantic Coast line, the Seaboard Air Line, the Florida East Coast, the Florida & Georgia Southern, and the Ocala & Northern railroads are all available for this colony's needs. You can have the very best passenger and freight service.

At one side of the colony flows the mighty St. John's River, broad as a bay and deep

enough to permit sea-going vessels to dock at Palatka, which city is but ten miles from a portion of this colony. Down this great river lies Jacksonville, the fastest-growing city in the South, if not in the Union. You may enjoy the best churches, the finest schools, the best roads and the most select society in and around this colony. You will have a superb home for health's sake, for the death-rate here is less than 7 in 1,000, a record no other state in this country can approach.

If you want to be charmed and entranced with the grandeur of sky and landscape, if you want to be thrilled by wonderful color schemes, as nature makes them, and if you wish to listen to the wild and delightful music of the wonderful mockingbird, and see the wild duck and the artful quail and turkey feeding along the beautiful waterways, then

here is the spot of spots for you to make a home. Every day of the year is a holiday for the settlers of this land. The streams are filled with the very best fishing one could wish for. The woods are teeming with squirrel, fox, rabbit and other small game, while within a few hours'



ST. JOHN'S RIVER SKIRTING FLORIDA PALATKA TRACT

ride one can yet get a proud pair of antlers and have venison for one's table. On one side of the colony flows the Ochlawaha River. This stream is without question the most romantic and picturesque in this country. No matter what manner of natural beauty you desire you will find it here. The river is swift-flowing. It is lined on either bank by gigantic pines, palmettoes, cypress, and live oak. These beautiful trees are draped with Spanish moss, just as though some master-hand at festooning had been here before one to please every sense of the artistic. The bosom of the river is one mass of fanciful colors and weird shadow-effects that travelers pronounce without an equal anywhere in the world.

The beauty of this spot is above question.

No one can look upon it and remain unmoved.

It is abject folly to attempt to describe this

beautiful region, where Mr. Sieg has selected the last and only colony perhaps he will ever be the moving spirit in. Just consider what it all means to have a home here. Not only does one enjoy the very pinnacles of nature's greatest unimproved gifts beside one's very door step; not only is your home at once a health resort and a playground for the grown-up boy and girl, but you have all around you, within a short hour or more ride, all the joys of the deep sea, the unfolding charm of the government reservation, where a giant forest will remain untouched throughout all the ages for the rambling ground of man and the wild animals and the full-noted Southern wild birds. Then, too, you have elegant cities but a short distance away where you may go and shop, or if you please, attend the opera or the theater and see the latest dramatic successes.

This sort of thing is life in all the word means and implies. To the worn-out man of the cities it is more than life; to the farmer it is all play, and he cannot comprehend it until he sees everything with his own eyes. Speaking of this question, the farmer revels in a perfect ecstasy when he learns the producing value of this great soil. Let me briefly tell you something of the soil which lies universally over the Florida-Palatka Colony.

The land you buy has a very peculiar soil. It is a rich, sandy loam underlaid by a heavy and deep clay subsoil that has the color of chocolate and is the part of the soil that holds the water that is drawn up gradually through the peculiar sandy loam by the action of the sun's rays and the needs of plant-life. This clay subsoil acts as a true and natural storehouse for moisture right at the roots of the plants and the trees, where water is needed.

The earning ability of this land is unlimited. This is the home of the three-crop farmer. It is here that now this very day the farmers and growers are working in their

fields in their shirt-sleeves. They will within a few weeks be sending their third crop to market, and this just at the time when the prices are the very highest and when the whole farming country of our Union is idle, except Florida and some of the far-distant points, like Texas and California.

There are men in these counties who earn \$1,000 per acre, and there are men who earn only \$100 per acre. The average value of all Florida crops per acre is \$125, as is shown by the state and government agricultural reports. Much depends on the man and his ability and desire to work.

The Northern men are the ones who are making \$1,000 per acre; the native and the negro are the ones who content themselves with the lesser amount.

If you desire to go in for oranges, grape-fruit, pecans and other tree products, one can reach a yield per acre that is simply astounding.

The majority of settlers are planting garden-truck, ground-fruits, etc., and the prices on these products are such as to raise a figure per acre that will satisfy almost any man or woman, for each acre produces that figure three times each year.

I have been to most all of the so-called garden spots of Florida. I have

talked with the great fruit and vegetable growers whose life work has been devoted to various sections of this state. I have visited their home and met their families. I have walked into their fields and amid their trees. These men would startle you with the statement of the profits they have earned in just a few years from just a few acres. Their bankers will tell you the same story. They own automobiles, they send their children to the best universities, they travel at home and abroad and every month of every year they are as independent of all mankind as though they received their competence from some source outside this universe.

It is folly, as I have said before, for one to attempt to tell of these things for the rea-



MR. KENNERLY RAISED 600 CRATES OF SUCH CELERY ON HALF ACRE OF ORDINARY PINE LAND NEAR FLORIDA-PALATKA COLONY

son that most people will decry your wording and will remain sceptical until they have seen the proofs with their own eyes.

If you want to know more of the great Florida-Palatka colony and of the history of the colonies Charles H. Sieg has established, you should write for his great free book called "Ten Acres and Freedom."

This book contains more than 60,000 words. It is filled from cover to cover with photographs of colony scenes. It pictures with the camera, in plain black and white, the beauties of the countryside around this great colony.

It takes you out upon the St. John's River and down the fantastic Ochlawaha River. It shows you Silver Springs and Silver Lake, the new towns born this year over the colony; it reveals farm scenes and illustrates almost every point you would wish to know simply by the use of photographic reproductions.

It goes into the statistical side of Florida and of this colony in particular. It moves along with a rhythm of fact after fact compiled from the best state, government and expert reports obtainable and it never tires and never grows dull. It is almost like a novel, for everything is new and everything is written in a common, every-day style of language that carries conviction with it.

This great book tells you the prices of those things you wish to know. It informs you all about railroad rates, both freight and passenger. It tells you of Jacksonville and the other cities of Florida. It speaks of climate and shows you the proof from the Weather Bureau, covering something like twenty years, so that you may know just how far down the thermometer goes in the winter

time and how far up it goes in the summer time. It proves to you that the North is a worse place to live in during the summer than Florida. It gives you facts that you can substantiate. It tells you of the health conditions, and how Florida has the lowest death-rate of any of our states. It describes Florida's advantages and Florida-Palatka Colony in particular from a transportation standpoint both by water and by rail. It gives you crop statistics and tells you what to plant and how to plant it, and estimates the cost of each and every transaction for you. It tells you what to do and how to do it, from the time you leave your home until you have your house built and your first crop in.

It contains all manner of testimonial proof together with the names and addresses of those colonists who have dealt with this great colonization company, and proves to you that their words are like their bonds.



HOTEL AT RODMAN—ONE OF THE TOWNS IN FLORIDA-PALATKA TRACT

This book, in my opinion, is the greatest piece of literature ever issued on any section of our country, and is another reason why Charles H. Sieg should be called "The Man Who Made Florida."

Then you will receive the monthly magazine called *The New Florida*, which tells of the development of Florida and contains the monthly news of Mr. Sieg's great colonies. This paper sells for one dollar a year, but will be sent free to any address for three months just for the coupon below.

By special provision the New South Farm and Home Company will send free to every one who sends in the coupon below all the literature above described, together with their written binding and legal guaranty to give

every one who buys a colony farm 120 days to investigate his land, and if he finds it not what he desires, or if, for any other reason, he desires to cancel his contract he need only to request his money back within the time limit of 120 days and his money will be returned. It is needless to say that Charles H. Sieg knows from experience just what to expect from such a broadcast guaranty and that he has no fears from such provision because the land will protect him and please every purchaser. Remem-

ber thousands and can prove every statement it makes, or failing to satisfy you, it agrees to return your money. This is why I say that this company, and the man at its head, is the primal force in the making of Florida the most sought-after and talked-of state in this Union.

The Price of Florida-Palatka Farms is \$30 Per Acre; Terms

\$5 down and \$5 a month for 59 months buys a 10-acre farm

\$10 down and \$10 a month for 59 months buys a 20-acre farm

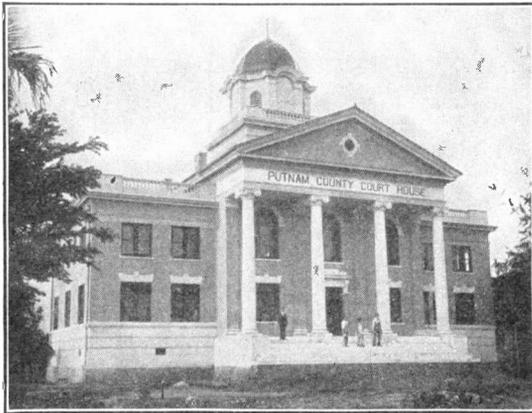
\$15 down and \$15 a month for 59 months buys a 30-acre farm

\$20 down and \$20 a month for 59 months buys a 40-acre farm

No Taxes. No Fees. No Commissions. All you have to pay is like above figures each month. We pay all taxes until you pay for your farm in full. You may have possession after the very first payment.

Every purchaser of a Florida-Palatka Colony farm will be permitted to receive every cent he has paid in, if for any reason he does not desire his farm, within 120 days from the date of his contract. This will give you ample time to make an investigation, or if you are not satisfied with the farm which has been allotted to you, you can exchange it for one entirely to your liking or know that you can receive back every cent you have paid in.

No other company in Florida makes such an offer. This company does so because it does not fear the closest scrutiny into each and every phase of its colony.



PUTNAM COUNTY COURT HOUSE, JUST BEING COMPLETED

ber you are buying land in a company that has proven its value; in one that is a community builder, and not a strict land-selling corporation. A company that has pleased

Don't delay a single day. Send in the coupon now, today, this very minute, and receive the greatest descriptive literature you have ever read. Just send the coupon below—no letter is necessary.

NEW SOUTH FARM AND HOME COMPANY

ROOM 1071, MERCHANTS LOAN AND TRUST BUILDING, CHICAGO

Please send me "Ten Acres and Freedom" and a three-months' subscription to the New Florida Magazine. Everything is sent FREE. I don't agree to buy. I only want your literature.

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City..... State.....

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Will You Try Johnson's Wood Dye and Wax at our Expense?

We'll gladly send you samples of all of Johnson's Wood Finishes—together with copy of our beautifully illustrated book by famous experts—printed in five colors—"The Proper Treatment for Floors, Woodwork and Furniture"—absolutely free. This Book tells you how to finish or refinish all woodwork, floors and furniture.

Read Free Offer Below.

Johnson's Prepared Wax

for all woodwork, floors and furniture (including pianos). Anyone can easily use Johnson's Prepared Wax over any finish or on the bare wood for that beautiful, artistic, dull finish so much in vogue. Ask your dealer for sample.



Johnson's Wood Dye

—not a varnish stain—but a deep-seated Dye which penetrates the wood and fixes a deep, rich, permanent color. Made in 14 artistic shades. Johnson's Wood Dye makes inexpensive softwoods as beautiful and artistic as expensive hard woods. Color plates and directions for use in the booklet.



Johnson's Kleen Floor

for cleaning all polished floors, stairs, and finished surfaces, keeping them in perfect condition. Apply with a cloth and rub dry—removes all stains and discolorations. After using, give the surface a coat of Johnson's Prepared Wax and the wood will look just like new.



Johnson's Under-Lac

a thin, elastic spirit finish far superior to varnish or shellac. Not thick or sticky or slow-drying like varnish—neither does it dry too quickly like shellac. Especially good on linoleums and oilcloth, bringing out the pattern and giving a finish as glossy as new. Protects from wear—makes cleaning easy. Dries hard in an hour. Gallons \$2.50—quarts 70c—pints 40c.



Free Book and Sample Offer

We have sent a liberal supply of Johnson's Wood Finishes—together with a supply of our beautiful Instruction Book by famous experts—illustrated in five colors—to all leading dealers who handle paints, for your use, free. If your dealer hasn't samples and books send us his name, and we'll send you Free—any two of the above finishes, with copy of the Book. All we ask is that you test the samples and ask your dealer to supply your future needs.



S. C. Johnson & Son, Racine, Wis.
"The Wood Finishing Authorities"

Free Coupon

For 25c Book, "The Proper Treatment for Floors, Woodwork and Furniture" FREE and two samples

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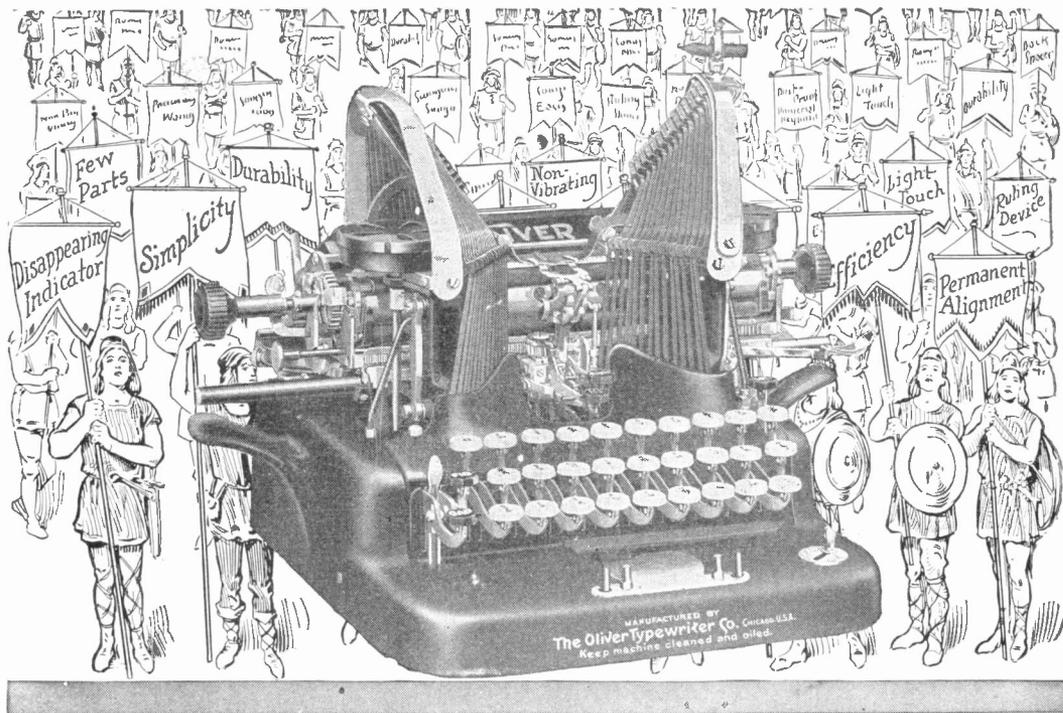
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The Oliver Typewriter, which brought about the Era of **Visible Writing**—a **revolutionary improvement**—has persistently carried the standard toward the summit of Highest Efficiency. The many brilliant innovations that have been introduced in rapid succession, overturning typewriter traditions and precedents, have kept the Typewriter world in a ferment since the Oliver entered the field.

“**Visible Writing**,” the central thought around which revolve these many startling improvements, encountered tremendous opposition from our staid, conservative rivals.

The **OLIVER** Typewriter

The Standard Visible Writer

They thought to stem the resistless tide of popular approval by condemning it as “unnecessary,” “impractical,” “visionary.” Then—one by one—these “**blind**” manufacturers ran up the flag of **surrender**.

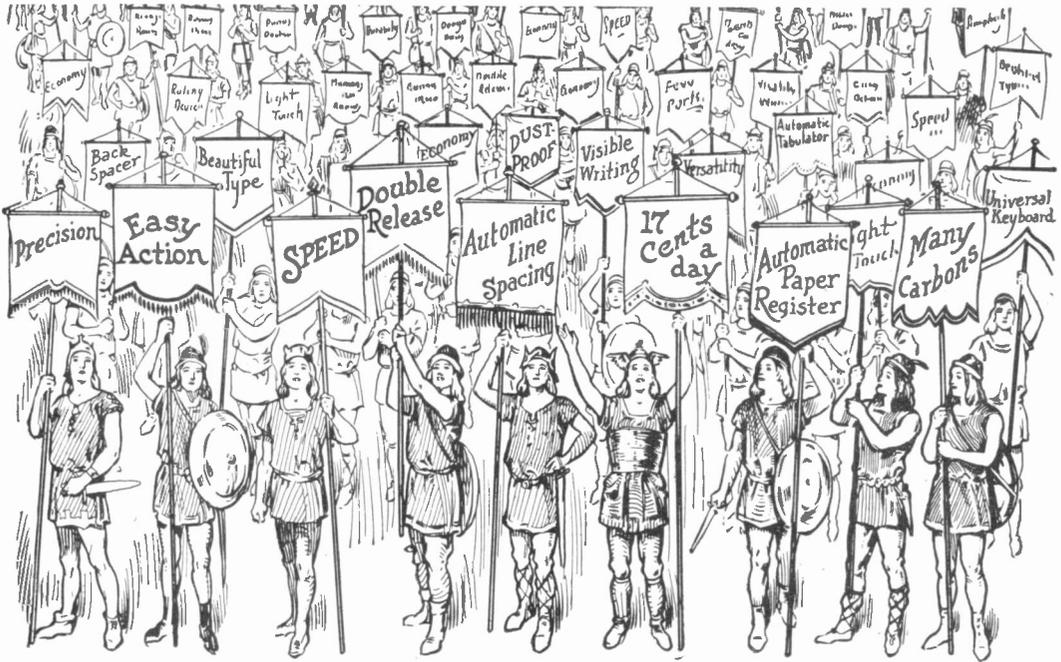
Today—all standard typewriters are “Visibles”!

Do you wonder that the Oliver has the largest sale of any typewriter in existence?

Why not buy a typewriter that has—at the Present Time—all these time-saving, result-getting innovations, rather than one that will adopt them later, when forced to change by enlightened public opinion?

The Oliver Typewriter **17-Cents-a-Day Purchase Plan** is in its way as great an innovation as was that of **Visible Writing**. It extends the **immediate** advantages of the use of **Typewriters** to thousands who must otherwise **wait**. The response of the public to this amazing offer is **phenomenal**. Sales are reaching **stupendous volume**.

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



Oliver Typewriter Features!

The abandonment of **longhand** in favor of clean, beautiful, legible **typewriting** is the next great step in human progress. **The Era of Universal Typewriting is fast becoming a reality!** The Oliver Typewriter is just as indispensable to small merchants, tradesmen, shop and factory owners as to the largest business enterprise. It's an easy way for the merchant and tradesman to **protect** himself against **misunderstandings**, because he keeps a **carbon copy** of every typewritten letter or document. The **legibility** of typewriting prevents mistakes, disputes, delays. Professional people, ministers, authors—all who have to **write**, where typewriting would be more welcome to those who **read it**, owe it to themselves to own Oliver Typewriters.

Yours for 17 Cents a Day!

This "17-Cents-a-Day" Purchase Plan makes the Oliver Typewriter as easy to own as to rent. It places the machine within easy reach of every home—every individual. A "man's cigar money"—a woman's "pin money" will buy it! Clerks on small salaries can now afford to own Oliver Typewriters. By utilizing spare moments for practice they may fit themselves for more important positions. Schoolboys and schoolgirls can buy Oliver Typewriters, just by saving their pennies.

You can buy the Oliver Typewriter on this plan at the regular catalog price—\$100. A small first payment brings the machine. Then you save 17 cents a day and pay monthly.

And the possession of an Oliver Typewriter enables you to earn money to finish paying for the machine.

Can you spend 17 Cents a Day to better advantage than in the purchase of this wonderful machine?

Write for handsome Catalog and 17-Cents-a-Day Purchase Plan. Address—Sales Department

The Oliver Typewriter Company

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Send Coupon or Letter

The Oliver Typewriter Company
643 Oliver Typewriter Bldg., Chicago

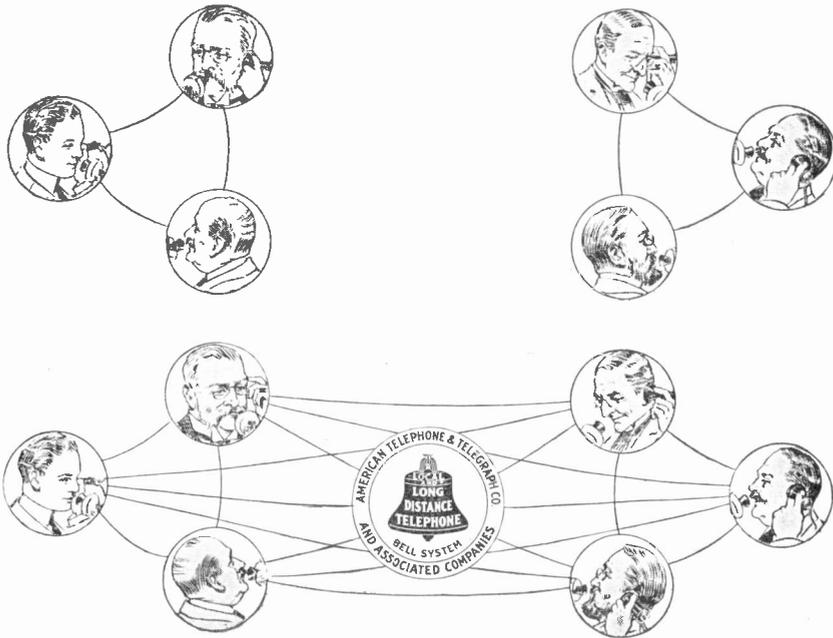
Gentlemen: Please send your Art/Catalog and details of "17-Cents-a-Day" offer on the Oliver Typewriter.

Name

Address

Occupation

Union Increases Use



When two groups of telephone subscribers are joined together the usefulness of each telephone is increased.

Take the simplest case — two groups, each with three subscribers. As separate groups there are possible only six combinations—only six lines of communication. Unite these same two groups, and instead of only six, there will be fifteen lines of communication.

No matter how the groups are located or how they are connected by exchanges, combination in-

creases the usefulness of each telephone, it multiplies traffic, it expands trade.

The increase is in accordance with the mathematical rule. If two groups of a thousand each are united, there will be a million more lines of communication.

No one subscriber can use all of these increased possibilities, but each subscriber uses some of them.

Many groups of telephone subscribers have been united in the Bell System to increase the usefulness of each telephone, and meet the public demand for universal service.

**AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES**

One Policy

One System

Universal Service

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

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¶ Advertisements in this section of Popular Electricity will cost 5 cents per word with 5% off for 3 times, 10% off for 6 times, 15% off for 9 times and 20% off for 12 times, cash with order.

¶ In order to secure the proper classification, advertisements must be in this office the first of each month preceding date of issue.

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BLERIOT MONOPLANE — GUARANTEED Flyer 25c. Antoinette Two-foot; three wheels, thrust bearing; Rubbers, Mailed K. D. 50c. Reberts, 344 Cumberland, Brooklyn, N. Y.

AVIATION DIRECTORY—QUARTERLY Industrial Number. Information and Addresses; 7 divisions, 41 classifications; Aeroplanes, Motors, Propellers, Parts and Supplies, Manufacturer, etc. 25 cents. L. M. Allison, Lawrence, Kansas.

MODEL BALLOONS AND FLYING MACHINES. How to Make Them. By J. H. Alexander. Contains complete directions for constructing models with five folding plates of working drawings, also an account of the progress of aviation. \$1.50 postpaid. Popular Electricity Book Dept.

AVIATORS—NO LIMIT TO SALARY. BEST paid profession today. Home course by correspondence. Practice on standard type Aeroplane at our Aviation Field. Write for booklet entitled "Aviation," Dept. E, Chicago School of Aviation, Chicago.

"BOY AVIATORS' SERIES," SIX THRILLING airship books for young Americans. New, exciting and absorbing. Send for Vol. 1, and you will quickly want the others. Postpaid 50c. At all bookstores. Our immense catalogue free. Hurst & Co., 395 Broadway, New York.

CURTISS, WRIGHT, BLERIOT, or SANTOS-DUMONT. Blue print drawings with complete directions for building any one of the above Aeroplane Models, 25 cents postpaid. See our quarter page advertisement. International Aeroplane Co., E628 World Building, N. Y.

AGENTS WANTED

2-TICKLE-U, 3c. STIX, STOCKTON, CAL.

See what I say under "Typewriters." ATCHISON

MONEY MAKING MAIL ORDER CIRCULARS furnished free to mailers. P. E. Walter, 35 Dean St., Brooklyn, N. Y.

"PERFECTION POCKET ADDING MACHINE—Lightning seller. Agents wanted. Cincinnati Specialty Mfg. Co., Dept. E, Cincinnati, Ohio.

MATCHES UNNECESSARY—BLITZ SPARKER instantly lights gas jets, ranges, etc. Sample quarter. V. Wesley, Aurora, Ills.

DON'T ACCEPT AN AGENCY UNTIL YOU get my samples and particulars. Money-makers. Address SAYMAN, 706 Sayman Bldg., St. Louis, Mo.

AGENTS—TO SELL THE "GEM" POCKET rule holder in every shop; new invention; just out; sell on sight. New Invention Co., Box 1008, Wilmerding, Pa.

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KEROSENE MANTLE LAMPS—AMERICA'S largest variety; repeat order quality; our burner guaranteed best on the market. Guilford Co., Seville, Ohio.

BOKARA DIAMONDS—AGENTS, EVERYONE wanted to wear and sell these Famous Gems. Big profits. Sample offer and catalog, Free. Northwestern Jewelry Co., 80 Northwestern Bldg., Chicago.

SELL EAGLE BRAND MENDING TISSUES. Greatest Labor Saving Invention. 500 per cent profit. Three samples for dime. Eagle Rubber Company, 207 East Tenth St., New York.

AGENTS—IMMENSE PROFITS. VACUUM Cleaners. Everybody delighted—must have one—Sample to workers. A postal to us should mean a fortune to you. Aerio Vacuum Co., E 2000, Cincinnati, Ohio.

AGENTS—PORTABLE FOUNTAIN BATH Apparatus. Patented Aug. 1910. Gives all kinds of baths. Money maker. Partner wanted to manage plant and mail order business, G. W. Walters, Patentee, Electric Bath Co., Findlay, O.

AGENTS MAKE BIG MONEY—BIG PAY, NO experience, no capital required. 5,000 new art specialties, photo pillow tops 25c, portraits 30c, bromides 25c. New 1911 catalog and samples free. Write. Daniel H. Ritter Co., Madison St., Chicago, Ill.

AGENTS MAKE BIG MONEY SELLING OUR new gold letters for office windows, store fronts and glass signs. Any one can put them on. Write today for a free sample and full particulars. Metallic Sign Letter Co., 400 N. Clark St., Chicago, Ill.

OUR ELECTRIC SPECIALTIES ARE EASY sellers and Agents' profits are big. Some choice territory still open. A penny postal will bring you full particulars. Send now. STANDARD ELECTRIC WORKS, 1200 Washington Ave., Racine, Wis.

BULLY! GREAT! IMMENSE!—THAT'S WHAT all our agents say after selling our attractive 1911 combination packages of soap and toilet articles with valuable premiums. 100 to 300 per cent profit. One Michigan agent made \$65 in 47 hours; another \$21 in 8 hours; another \$22.50 in 10 hours; ACT NOW—NOT TOMORROW. Davis Soap Co., 27 Union Park Court, Chicago.

AGENTS—BIGGEST MONEY-MAKER known. The new Canchester Incandescent Kerosene Lamp revolutionizes old lighting methods. Burns air, not money. Six times brighter than electricity, gas or acetylene at 1-10th cost. Burns with or without mantle. Burner fits any lamp. Saves 75 per cent oil. No trimming wicks. Showing means selling. Territory going fast. Write today. Handsome outfit furnished. Canchester Light Co., Dept. P. E., 3, Chicago.

AUTOMOBILES

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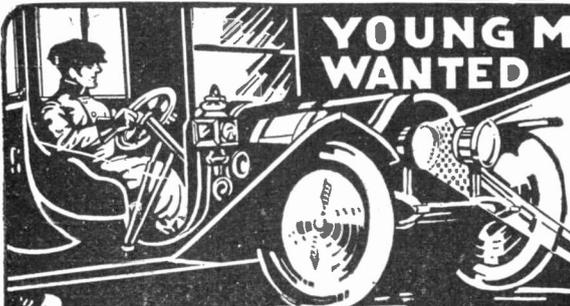
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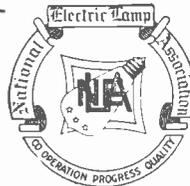
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National Electric



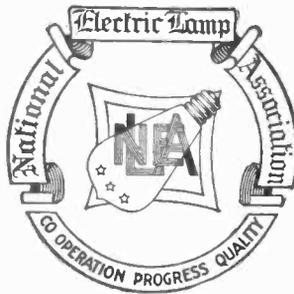
Lamp Association

CLEVELAND



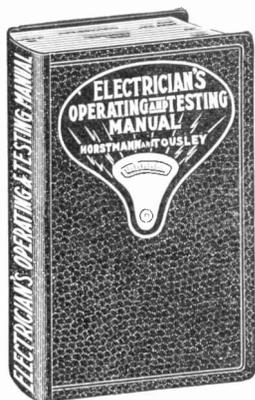
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National Electric Lamp Association
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Call upon any of them for your lamp supplies.



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| THE BANNER ELECTRIC CO.,
Youngstown, O. | THE GENERAL INC. LAMP CO.,
Cleveland, O. |
| THE BRILLIANT ELECTRIC CO.,
Cleveland, O. | THE JAEGER MINIA. LAMP
MFG. CO.,
New York City |
| BRYAN-MARSH COMPANY,
Central Falls, R. I.—Chicago, Ill. | THE MONARCH INC. LAMP CO.,
Chicago, Ill. |
| THE BUCKEYE ELECTRIC CO.
Cleveland, O. | THE WARREN ELECTRIC &
SPECIALTY CO.,
Warren, O. |
| THE BUCKEYE ELECTRIC
LAMP CO.,
City of Mexico | NEW YORK & OHIO COMPANY,
Warren, O. |
| THE CLEVELAND MINIA.
LAMP CO.,
Cleveland, O. | THE SHELBY ELECTRIC CO.,
Shelby, O. |
| THE COLONIAL ELECTRIC CO.,
Warren, O. | THE STANDARD ELECTRICAL
MFG. CO.,
Warren, O. |
| THE COLUMBIA INC. LAMP CO.
St. Louis, Mo. | THE STERLING ELECTRICAL
MFG. CO.,
Warren, O. |
| ECONOMICAL ELECTRIC
LAMP CO.,
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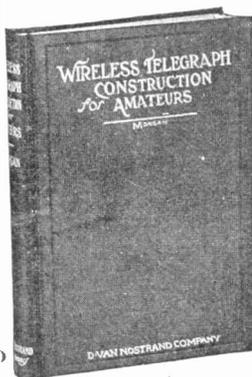
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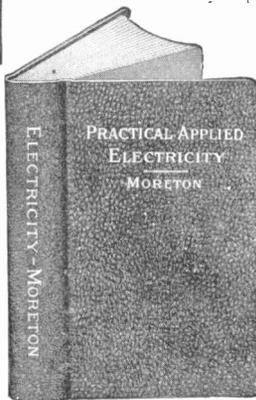


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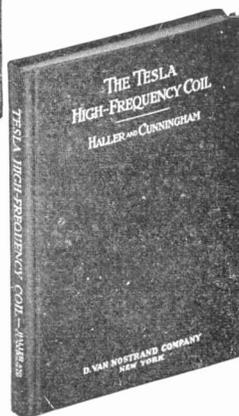
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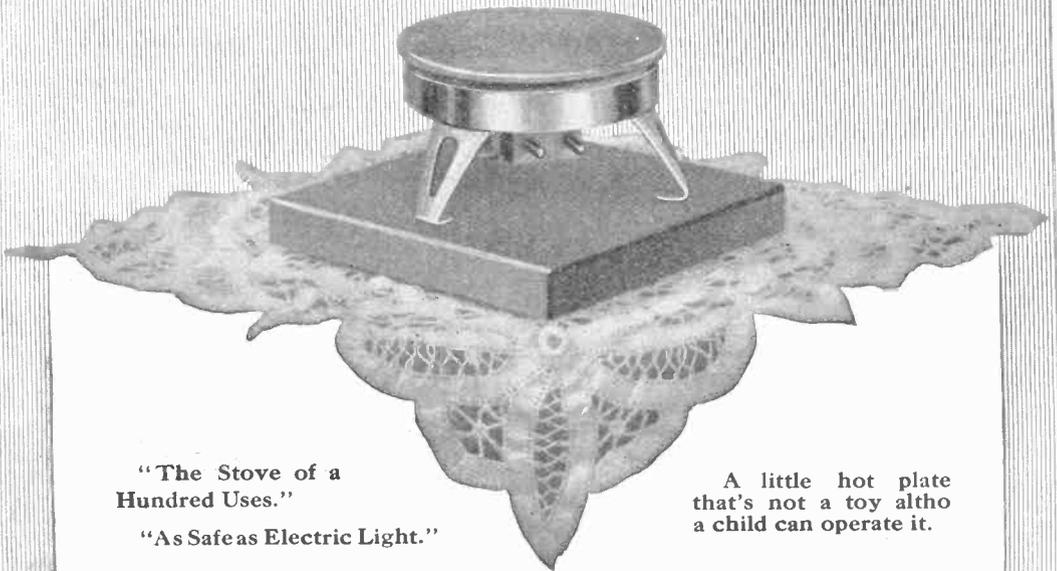
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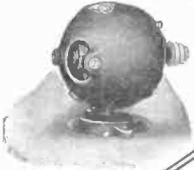
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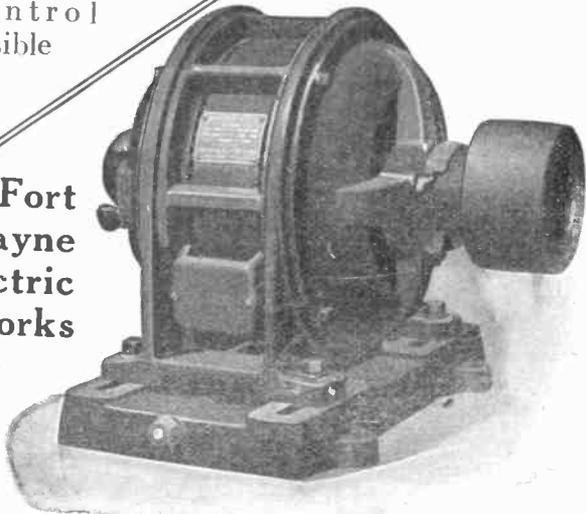
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ONE Dollar forever frees you from brooms, mops and dusters—and the backaches and drudgery they bring.

One Dollar forever stops the expense and the nuisance of Spring and Fall housecleaning.

One Dollar enables you to do, *easily*, by electricity, the *worst work* a woman has to do.

And One Dollar is the only cash outlay.

It will bring you the "RICHMOND" Suction Cleaner complete—ready for instant use.

The balance you pay for month by month out of the *actual money you save*.

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You are paying the price of a suction cleaner, *right now*—whether you have one or not.

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YOU see here the lightest and simplest suction cleaner ever designed.

1.—is the motor—not a "stock" motor, but one built expressly to operate the powerful suction fan to which it is directly connected, under

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3.—is the suction nozzle which is pushed over the surfaces to be cleaned—or to which can be attached a twelve-foot hose for high wall, drapery and upholstery cleaning.

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| 1 Book and Wall Brush | 1 Felt-Faced Floor Tool | |
| | 1 Adjustable Wall Brush | |

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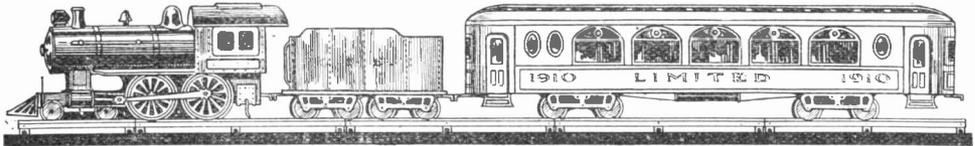
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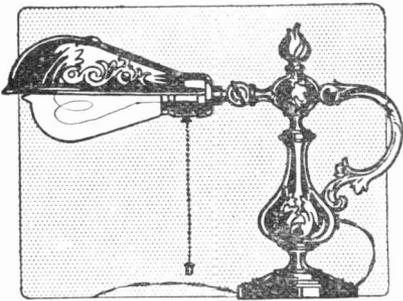
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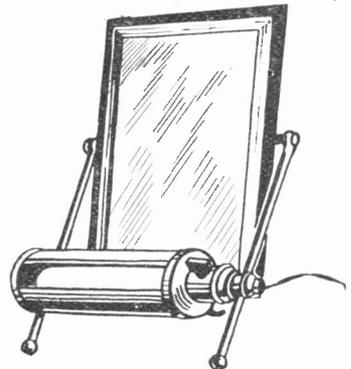
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\$1.25.

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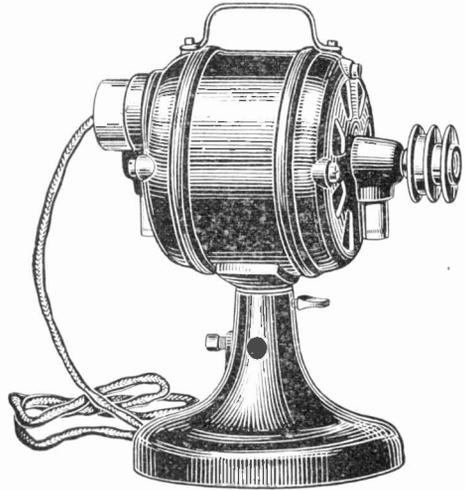
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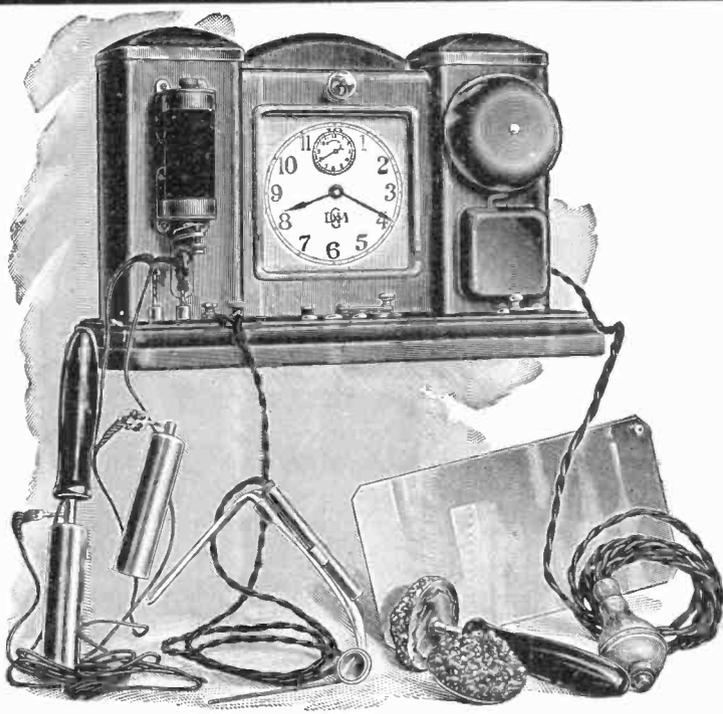
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the time*

*Electric
Alarm
Clock*

*Electric
Night
Light
by
pressing
the button*



*Electric
Call Bell*

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Bell
Alarm*

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to examine
the throat
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I am willing, of course, to send circulars to students or other young men who are as yet learners rather than buyers, because the learners of today are the buyers of tomorrow.

But the purpose of *this particular* advertisement is to secure enough inquiries from *actual users* of Electricity to warrant my company in continuing the use of this medium.

If the ad. is not repeated, it will be your fault, not mine.

THE KIMBLE MOTOR IS UNLIKE ANY OTHER MOTOR—AND BETTER

I have faith to believe that it will supplant all other forms of A. C. motors, in your lifetime and mine, because it is such a distinctive *advance* in motor design and construction, doing so many things that no other A. C. motor will do—and at *so much less cost* for power.

But; it is hard to teach old dogs new tricks, and it's the old dogs who do the buying. So I put it up to you who read this page to investigate the Kimble Motor on your own account with minds free from all preconceived notions.

Here are some of the "impossible" things the Kimble Variable Speed, Single Phase, Alternating Current Motor does:

1. Operates on Single, Two or Three-Phase circuits interchangeably.
2. Gives varying speeds (not steps merely, but every shade from 300 to 3,000 r. p. m.) without resistance coils or *any* other outside controlling device.
3. Starts, stops, reverses and changes speed (from full speed forward to full speed backward) by means of *one single lever* that is on the motor itself.
4. Starts with full load torque, and *uses* no more current in starting than is used at full load running current. In other words, a given speed consumes a given current; *half* the speed *half* the current, with none of the electricity wasted in resistance coils or other makeshifts.
5. Is the most silent, the most economical and the most nearly "fool proof" motor now on the market.
6. It makes alternating current electricity the cheapest, most efficient, most easily worked with form of electricity, superior in every way to the more popular direct current.

Have I told you too much?

Or, do you want to know still more?

Will you believe your own eyes when you see the motor *doing* all these things, and many more?

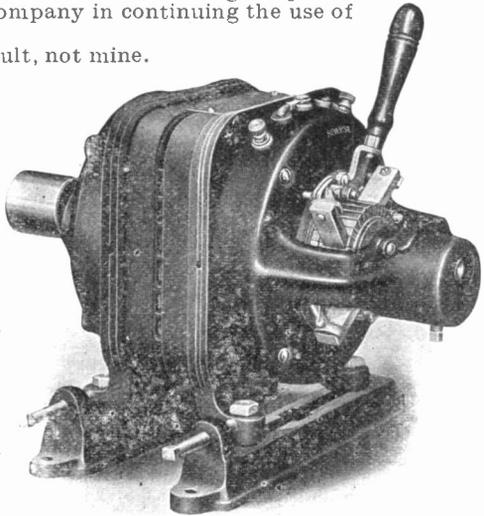
No matter: you won't have to take anything on faith; my Company embodies all its 13 claims in a *guarantee contract*, by which we agree to perform the 13 "impossible" things and keep on doing it for TWO YEARS.

Kimble Reversible Single Phase A. C. Motors are supplied in $\frac{1}{2}$ to $1\frac{1}{2}$ H. P.; 110 and 220 volts, 60 cycles. Also $\frac{1}{2}$ H. P., Non-Reversible.

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Kimble Electric Company
1119 Washington Blvd.,
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Meister Piano

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Just to prove to you the splendid worth of this MEISTER piano, let us send it to you on thirty days' free trial. It won't cost you a penny or a moment of bother. **First**, send for our beautifully illustrated MEISTER catalog and see how the Meister is made and the materials used in its construction. Read therein the testimony of delighted owners. Select the style you like and send in your order. We'll do the rest. The piano will be shipped to you promptly, freight prepaid, no matter where you live. Try it a month at our expense. You will be under no obligation until you decide to buy. Then you may take full advantage of our easy payment plan which makes it easy for any man of modest income to own this famous instrument. If you don't find it to be precisely as we have represented—if you don't regard it as the richest toned instrument you have ever heard then we'll take it back after the month's free trial and it hasn't cost you a cent.

SOLD DIRECT FROM FACTORY TO YOU.—We deal only with the people direct and sell more pianos than any other firm in the world. We are sole makers of the MEISTER piano. It is produced in our own magnificently equipped factories and sold direct from the factory to you minus the usual profits of jobber, retailer and special salesman. There is only one small profit and that is ours. We were obliged to secure extra factory facilities this year because of an enormously increased demand and we are doing the finest work in the history of piano making. This instrument is made of the very finest materials by men who have earned their way because of efficiency, and is fully guaranteed for 10 years. **WE WILL SEND THIS PIANO TO ANY HOME IN AMERICA ON THIRTY DAYS FREE TRIAL**, or any one of the other four styles, some of which are very elaborate and beautiful. If you have a son or daughter to educate nothing will prove so acceptable to them as one of these handsome richly-toned pianos. At any rate send for it and let the children try it. Let the question of buying pass until then. Send for the catalog today. A post card will bring it. **Rothschild & Company's resources are in excess of \$3,000,000.00.**

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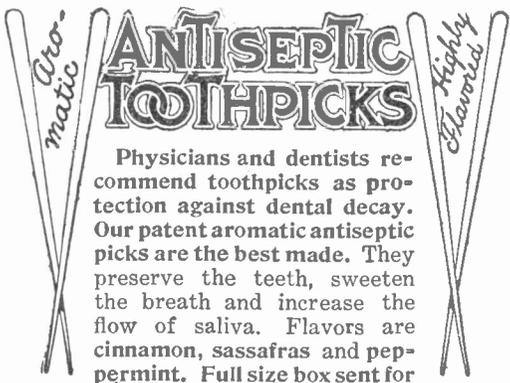
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Correspondence invited with dealers, hotel men, dentists and physicians.

We want dealers and agents everywhere. Agents are making from \$3 to \$10 a day.

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Enclosed find 15c. for which please send me one box of

300 Aromatic Antiseptic Toothpicks..... flavor.

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We are making clothes for tens of thousands of dressy young men. We save them from 30 to 50 per cent because we deal direct, and they take their own measurements. No local agents to pay.

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If you are perfectly satisfied you can pay a little each month for six months. No extra price, no interest, no security, no red tape. We simply open a charge account as we have with thousands of others.

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Send us your name and address—a postal card will do—and this whole new outfit will be mailed you free. Write us now. We will save you from \$10 to \$20 on a suit for spring and you can have six months to pay. (16)

THE CLEMENT CO.

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Dept. 83

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or locker finished in snow-white, baked everlasting enamel, inside and out. Beautiful beveled mirror door. Nickel plate brass trimmings. Steel or glass shelves.

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Hilker-Wiechers Mfg. Company
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Makers of Signal Overalls

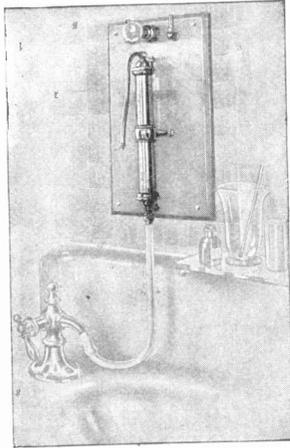


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The many uses for which the Cutler-Hammer Electric Disc Stove is adapted makes it a necessity in every household. It has a seven inch heating surface and is artistically designed, and finished in polished nickel plate.



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Useful for many purposes



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Three Quart Size
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That is PRACTICAL
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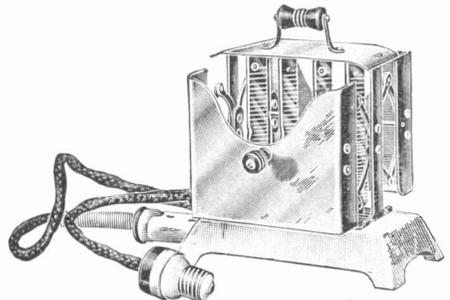
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Price with Cord and Attaching Plugs, complete, \$5.00

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Mechanical Heat Regulator.

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Not the Cheapest, But the Best.

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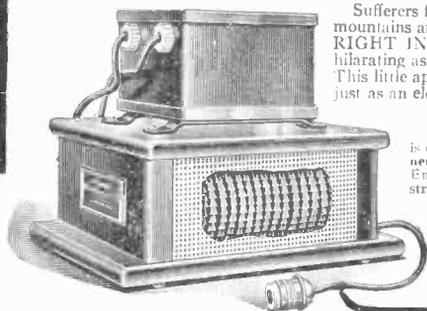
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CANADIAN TRADE SUPPLIED BY
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IT

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weighs only 20 lbs. No Jar or Vibration.
equals the highest priced machines in efficiency.
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The "Ironclad=Exide" Battery

It has the following features of superiority:

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Learn all about this new and most up-to-date Electric Vehicle Battery by securing from any of our Sales Offices a copy of the "Ironclad-Exide" Book.

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The Thor Electric Home Laundry Machine
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Hurley Machine Company
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IRONING MADE EASY

Your bed and table linen, plain clothes, flat pieces, 80 per cent of family wash, can be ironed **Easier** (no backache or tired feet), **Quicker** (in 7-5 the time), **Better**, with finish far superior to hand work, by using the

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"THE BEST IRONER"

1 1/2 ct. per hour to heat by gas or gasoline. Price within reach of all. Sizes for small homes and large; operate by hand, or small washing machine motor. Illustrated booklet sent free on request. Write for our 30 day free trial offer and nearest dealer.

American Ironing Machine Co., 25 E. Lake St., Chicago

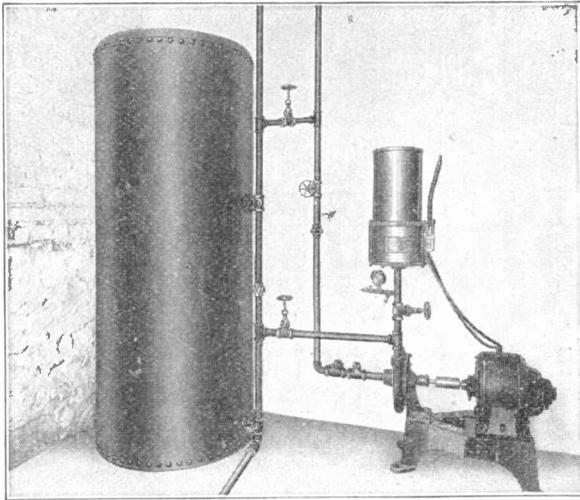
TESTED APPARATUS Means the Elimination of Faults in Your Product.

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Tests on any electrical machinery and apparatus made anywhere.
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Illumination tests made anywhere.
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“ECONOMY”

Automatic Electric Water System

will furnish an abundant supply of clean, aerated water, without the use of a roof or large storage tank.

Will stand the most severe service for long periods of time without skilled care.

Installed in basement. Consists of a pump, direct connected by an insulated flexible coupling to an electric motor, an automatic switch and a pneumatic tank.

Water is pumped into tank against air pressure. When maximum pressure is reached the automatic switch opens and stops pump. When pressure is lowered, the automatic switch closes starting pump.

Especially adapted for schools, flat buildings, suburban homes, office buildings, hotels and factories.

Tell us your needs and we will be pleased to give you detailed information.

We also manufacture:—

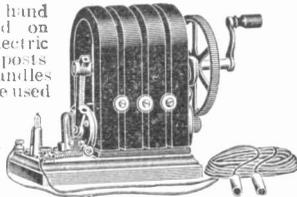
Bilge Pumps—Sewerage Ejectors—Condensation Pumps and Receivers—Cellar Drainers
Centrifugal and Triplex Pumps for all work—Hot Air Engines—Vacuum Cleaning Apparatus—Air Washers—Purifiers and Cooling Apparatus.

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A Pleasing Gift For Boys

Large powerful hand Dynamo, mounted on oak base with electric lamp, connecting posts and cord with handles for shocks. Can be used for ringing bells, lighting lamp, etc.



Something practical and durable and guaranteed to be perfect.

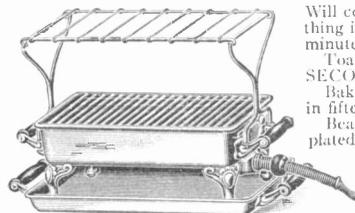
Send order today as we have a limited supply.

Special offer this month only \$3.00

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Will cook most everything in less than FIVE minutes.

Toasts in forty-five SECONDS.

Bakes Griddle Cakes in fifteen seconds.

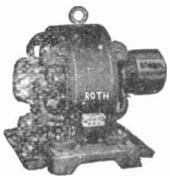
Beautifully nickle-plated throughout.

Very efficient and economical.

Price \$10.00

Send for circular of irons and heating devices. Very economical. For sale by leading dealers everywhere.

Pelouze Electric Heater Co. 232-242 E. Ohio St., CHICAGO, ILL.



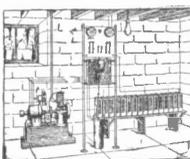
ROTH ELECTRIC MOTORS
POLISHING LATHES
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SPECIAL MACHINERY

ROTH BROS. & CO.

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ELECTRIC LIGHT AND POWER



DAY AND NIGHT SERVICE

The Junior No. 1 Equipment

Direct Connected Dynamo, Gasoline Engine Set, Complete Switchboard, 16-Cell "American" Storage Battery } \$265

The most complete, reliable equipment ever offered at this price. We want a representative in every county.

AMERICAN BATTERY COMPANY
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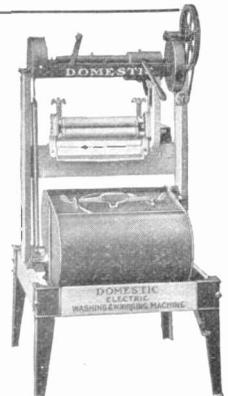
“Domestic” Electric Washer and Wringer

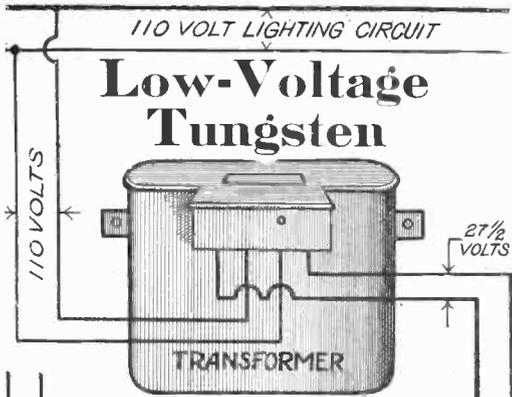
Oscillating, Self Cleaning, All Metal Tub, Reversible, Metal Frame Wringer, Positive Drive, Automatic Belt Tightener, Inclosed Working Parts. No Springs to Break.

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Domestic Equipment Co.

53 State St., Chicago





Warner's Fifty Per-cent Saving System

☐ Tungsten lamps for the ordinary 110-volt lighting current are necessarily made with long, thin filaments which are frail and liable to break.

☐ A low-voltage tungsten lamp, like the Warner Mazda lamp, has a short, thick filament which will stand any amount of jarring.

☐ The Warner system permits the use of these **efficient and economical low-voltage tungstens** in homes, stores, hotels, offices, etc.

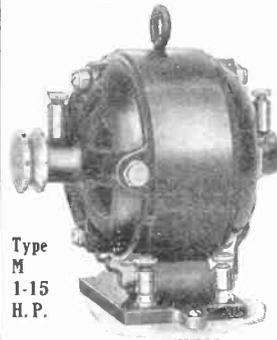
☐ It consists of a small transformer into which the 110-volt current is passed through one pair of taps and out of which current at 27 1/2 volts is obtained from another pair of taps.

☐ This transformer, together with the Warner Mazda lamps constitutes all there is to the system.

☐ It is easily installed and means plenty of clear, white light at a much reduced cost.

☐ Send for our catalogue 600-P and tell us number and kind of lamp you are using.

Warner Arc Lamp Co.
Wilton Junction, Ia.



\$3.50
FOR THIS
High Grade MOTOR

Runs on a. c. and d. c. current, 110 volts. Includes complete set of blue prints showing how to assemble. Has laminated field and armature, mica insulated commutator, 3-16 carbon brushes, bronze bearings, brass grease cups, pulley and terminals.

Type
M
1-15
H. P.

Any bright boy can get valuable experience and at the same time **STUDY MOTOR CONSTRUCTION WITH PRACTICAL WORKING MODEL**. Many interesting experiments can also be performed such as winding so that **IT WILL RUN AS A DYNAMO AND ON BATTERY CURRENT**. Hundreds of these motors sold to ambitious Electrical Students during the last sixty days. The best small motor made for operating advertising devices, mechanical toys, jewelers lathe, etc.

This motor assembled complete ready to attach to any 110-volt lamp socket, \$5.50.

Send Express or P. O. money order.

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Manufacturer Electrical Specialties

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The Dewsberry Electric Power Freezer

Will enable you to produce a better grade of ice cream at a lower price and in less time than by any other method.

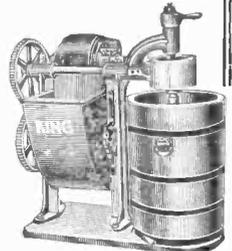
These machines are built unusually substantial and are guaranteed to give satisfaction.

Made in 20 and 40 quart sizes. The 40 quart size runs both fast and slow on A. C. current. Write today for circular.

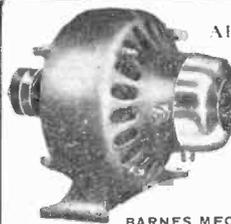
R. A. DEWSBERRY

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**1/12 AND 1/8 Direct and Alternating
Current Motors**
VARIABLE SPEED - SINGLE PHASE



**MOTORS THAT WILL
ABSOLUTELY NOT HEAT**

"The Barnes Motors" are especially adapted for Washing Machines, Vacuum Cleaners, Air Purifiers, Ventilating Devices, Coffee Mills, Meat Choppers, Printing Presses, etc., etc. —Dental and Medical work a specialty. Positively the best motor for use where motor driven work is necessary —greatest power, highest efficiency. We want Reliable Agents everywhere —write at once for prices and catalog. Let us figure on your requirements.

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This Kerosene Engine Cuts Your Expenses 75%

YOU should not even consider engines that operate on gasoline only. The rapidly rising price of gasoline, now 6 to 16 cents higher than kerosene, absolutely makes operation on this fuel too expensive. The Perfection Kerosene Engine operates on any engine fuel. When you purchase it you are on the safe side—proof against all fluctuations of the market. You can always run this engine at a great fuel saving and get the greatest amount of work done. The Perfection vaporizes its own kerosene and so makes it as efficient as gasoline—something other engines cannot do.

The Perfection is very light, portable, has only three moving parts, runs everything about the place, is lower in price than any other engine of its capacity on the market.

PERFECTION Kerosene Engine



Sent You on 15 Days Free Trial

See your dealer at once and ask him to let you have a copy of our Free ENGINE BOOK, which shows the sizes and styles of the "Perfection" and explains this very attractive offer. Your dealer will send any "perfection" engine to your farm for 15 days and let you return it if you are not satisfied. Ask him about it. If he does not carry the "Perfection" write to us and we will send you our Free Engine Book direct.

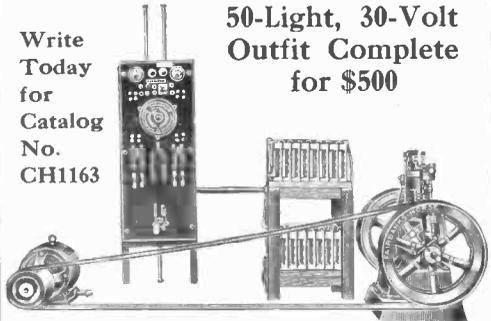
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Operate Your Own Electric Light Plant

We furnish complete outfits that will give you all the light you need for your place at surprisingly low cost. Makes a light of great brilliancy—the most convenient and healthful light known. It is restful to the eyes and does not consume the life-giving oxygen in your rooms as do lamps or gas. Same engine runs water supply system or other machinery. Absolutely safe. Will last for years at very small maintenance cost. We also make larger electric light plants up to 500 H. P. in single units.

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Outfit Complete
for \$500



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Reputable agents wanted to handle popular-priced marine engine. Absolutely guaranteed for 5 years. Thirty days' trial by the purchaser. Your money promptly refunded, without question, if you are not fully satisfied.

A sure favorite and quick seller. Big returns assured. Simplicity the keynote of construction.

Just the engine you have been looking and waiting for. Combines the good features of the best, with all the bad ones eliminated.

Fool-proof. As near perfect as anything mechanical can be produced.

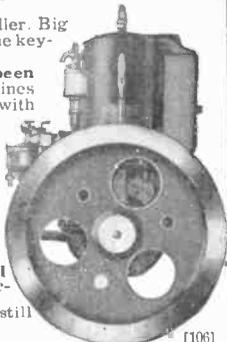
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Some very productive territory still open.

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[106]

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For Farmwork, Irrigation or Pumping, Factory use and Electric Lighting.

3 to 20 h.p.—perfectly governed—guaranteed by a responsible firm. Write for full description.

GRAY MOTOR CO., 128 Leib St., DETROIT, MICH.

Popularity

THERE'S one never-failing characteristic about the hand made

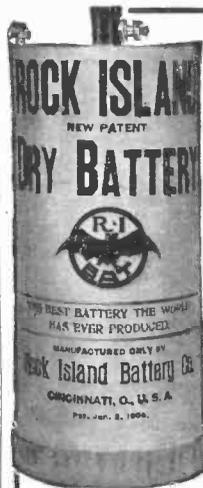
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DRY CELLS

They give the satisfactory service which holds old users and enlists new advocates.

They LAST LONGER

Proved best on every test, these batteries are good for all electrical purposes and are unsurpassed in ignition work.

PRICE 25 CENTS



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SPECIAL

WE have a quantity of perfectly good **ENAMELED WIRE** that we will sell at a sacrifice.

as standard stock, but we do recommend it for all ordinary windings and especially for **WIRELESS WORK**.

This wire was coated with enamel made according to our old formula. We don't offer it

There is a good assortment of sizes. Reservations of stock will be made in the order in which inquiries are received until stock is exhausted. **WRITE FOR PRICES ON THE SIZES YOU NEED.**

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Wireless Receivers

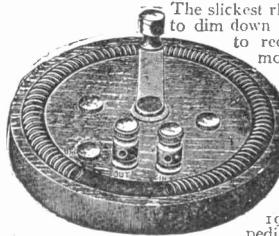
Our long experience in manufacturing all kinds of receivers for telephone use, has made us specialists in **WIRELESS RECEIVER** work. Our special magnet steel, sensitiveness of operation, durable construction, places our wireless receiver set far ahead of anything manufactured in the country.

Mention Popular Electricity when writing.

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Chicago, Ill. Brookline, Mass.

The "Electro" Rheostat Regulator (Patented)



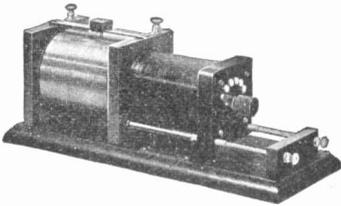
The slickest rheostat ever manufactured to dim down small incandescent lamps; to reduce the speed of small motors, to regulate current for Electro Plating work, and hundred other uses. The only rheostat that raises or cuts down current gradually. Resistance 10 ohms, carries 2 amperes. Price, prepaid, 50c. Send 4 cents postage at once for our great 106-page electrical cyclo-pedia No. 9, containing hundreds of experiments, **WIRELESS GOODS**, etc.

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"Everything for the Experimenter"

MURDOCK WIRELESS APPARATUS



DESERVEDLY

the most popular receiving transformer available at a moderate price. Distinguished by its thorough construction, its sensitiveness, its selectivity. So far superior to instruments of similar purpose and relative price, that there can be no comparison.

PRICE - \$15.00

We MANUFACTURE every requisite for complete installations of wireless telegraphy, and will be pleased to correspond with individuals or corporations contemplating its use.

Wm. J. Murdock Co.

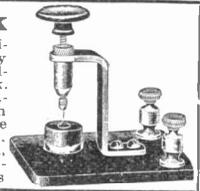
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Long Distance Work

can only be done with good and sensitive instruments. Our goods embody both these qualities. Use our Electrolytic detectors shown in cut for fine work. We are this month sending out this instrument with 2 inches of Wollaston wire prepaid for \$1.50. Send 3c for large catalogue. **FRANKLIN ELECTRIC COV. & MFG. CO., 846 Ninth Ave., New York N. Y.** Branch, Biloxi, Miss. Levey Electric Co., San Francisco, Cal., Western Agts



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World's headquarters for Dynamos, Motors, Fans, Toys, Railways, Batteries, Belts, Bells, Pocket Lamps, Telephones, House Lighting Plants, Books. If it's electric we have it. *Undersell all.* Fortune for agents. Big Catalogue 4 cents. **OHIO ELECTRIC WORKS, CLEVELAND, OHIO,**



No More "Battery Trouble"

Cease sending for the electrician to "fix that bell." Let the electric light current ring your annunciators, burglar alarms, etc. Our

"Junior" Transformer

will do it more cheaply than any other way. It uses scarcely any current, and can't be damaged by short circuits. Fireproof and durable. Price \$3, at dealers or direct from us.

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Brooklyn Wireless "Mark of Quality" Be Wise

No. 8-14 Aluminum Aerial or Helix, or No. 14-22 Enameled Wires per pound	\$0.50
No. 14-22 Bare Copper Wire per pound	.40
Stranded Galvanized Guy Wire per 100 feet, \$0.35, Turn Buckles Each	.10
"Bwaenco" Universal Mineral Detectors Adjustable (for any Mineral)	1.00
"Bwaenco" Spark-Gap Adjustable, \$0.35, Geissler-Tubes-3-inch Liquid	.20
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"Bwaenco" Tuning Coils, Double Slide, \$1.50 Single Slide	1.25
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**ENAMEL
INSULATED**



**MAGNET
WIRE**

ENAMEL WIRE is supplanting silk and cotton covered because the insulation is better, because it requires less space, because it is cheaper.

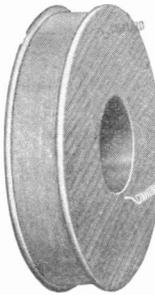
FEVAL WIRE has a dielectric strength in excess of 75 volts per .0001 inch of insulation. The evenly distributed enamel covering adheres tenaciously yet is resistant and elastic, never cracking. No change at 400° to 500° F. All sizes, Nos. 16 to 40.

MANUFACTURERS: We have an attractive contract proposal to offer covering your requirements for 12 months.

INDIVIDUALS: We will furnish small quantities for spark coils and magnets.

FEVAL ENAMEL INSULATED WIRE CO.
129 N. Curtis Street CHICAGO

SECONDARY "UNITS"



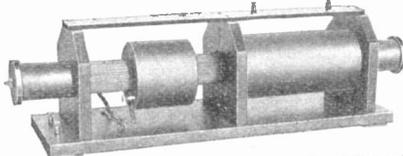
Been having trouble winding your Secondary for your Induction Coil or Transformer? Why not put your worries on our shoulders? The winding is not a WORRY to us, as we have the equipment, and winding coils is a part of our BUSINESS.

Our Secondary "UNITS" are wood spool sections wound, paraffined, etc., and all ready to connect up. You can buy a spool at a time or as many as you want, and they will cost you but little more than the wire alone.

Send 2-cent stamp for our large catalogue which tells all about it and many other things "WIRELESS" besides.

Dawson & Winger Electric Co.
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WIRELESS TRANSFORMERS



1-2 K. W.
\$30.00

Send for
Catalogue

E. S. RITCHIE & SON, 117 Cypress St., BROOKLINE, MASS.

Can You Beat This?



2000 Ohm Leather Headband Set \$4.50

I SAY YOU CAN'T

Better than anything on the market at this, and even at a higher price.

LET US PROVE IT
Receiver only, 1000 ohms, \$1.50. Postage 10c
C. BRANDES 111 Broadway, New York

WIRELESS COILS

No. 1— 1-4 in. to 1-4 in. spark	\$3.50
No. 2— 3-4 in. to 1 1-4 in. spark	4.50
No. 3— 1 1-2 in. to 2 1-2 in. spark	9.00

These high-grade guaranteed coils are not over-rated.

Send your money and coil will be shipped to you same day. Thousands of them in use.

LEMKE ELECTRIC CO., Dept. P. E., Milwaukee, Wis.

NEW WIRELESS WONDER



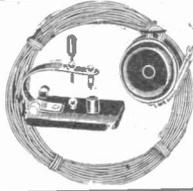
Aero-Field Receiving Outfit. Weight only 4 oz. Receives up to 75 miles. The Wireless Sensation of the Year. Consists of 1000 Ohm. receiver and attachments all assembled on regular size leather insulated head band. Price \$4.00 (not including light field aerial). A wonderful instrument at a wonderful price. Buy scouts and all requiring light outfits send 2c for description of

the Aero and catalogue. **Etheric Electric Co.,** Salesrooms and Factories, 278 Lenox Ave., cor. 124th St., 11 Barclay St., New York, N. Y.

WIRELESS APPARATUS

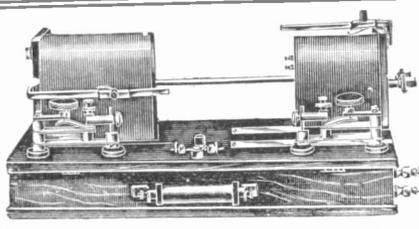
Our Wireless Goods are the best on the market, and are guaranteed to work. Our instruments are made of the finest materials, and are sold at present at a price within the reach of every experimenter. Send 2c stamp for our large catalogue which contains a full list of Wireless Instruments, Novelties and Electrical Goods, and also a great deal of Wireless information for the Wireless experimenter.

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Everybody Can Own A Wireless

We are this month offering an exceptional bargain in our new Wireless Receiving Set consisting of a combination Electrolytic & Mineral Detector, 90 Ohm Nicroed Receiver, 3 ft. silk cord, 65 ft. aluminum wire and diagrams, 300 to 500 miles guaranteed. 1 inch finest Wollaston Wire furnished. Price, \$1.40, postage 10c extra. Send stamp for catalogue. **THE HERTZIAN ELECTRIC CO.,** 3316 Avenue L, Brooklyn, N. Y.



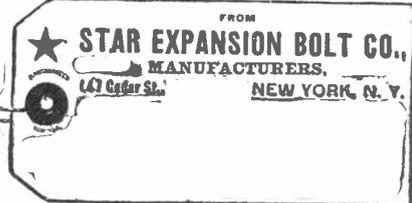
No. 6040, price - - \$40.00
Complete Set, unmounted 29.00

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The Greatest Line of Wireless and Electrical Goods Extant

Send 4c stamp (to cover postage only) for this catalog, deducting same, if desired, from first order.
One of our patrons from California voluntarily writes as follows: "I think that it is only right for me to express my appreciation to you for the receiving set No. 6040 that you supplied me with some two weeks ago. I have never seen anything that can be compared to it. I have received messages from stations sixteen hundred miles distant,—on three occasions I picked up Honolulu in the Hawaiian Islands and heard signals very clearly," etc.

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MAIL THIS AD TO US and we'll send you our FREE SAMPLE SET of STAR EXPANSION BOLTS and SEBCO SCREW ANCHORS, together with our beautifully bound seventy-page catalogue No. 10 of specialties.

Tear this ad out and MAIL IT NOW to

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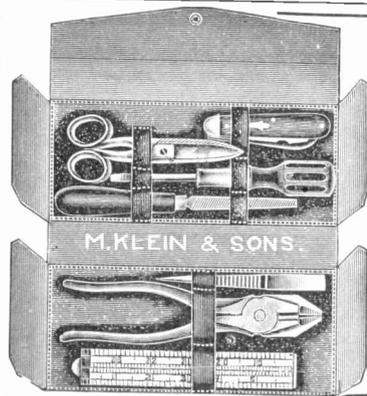
Star Hack Saw Blades



are highest in quality and lowest in price. These two features work well together. The blades which we are now turning out are the best we have ever made. You can satisfy yourself that this statement is no exaggeration by remitting to us 34c. for a sample dozen of 8-inch, or 42c. for 10-inch, or 50c. for 12-inch. Postage free.

MILLERS FALLS COMPANY

26 Warren St., New York, N. Y.



Every Tool

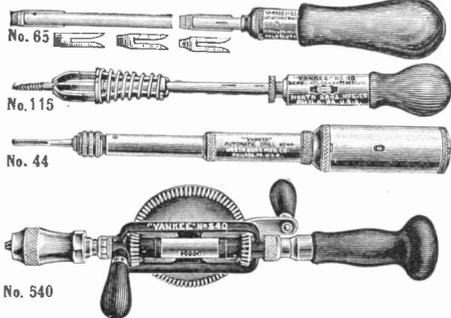
in this Kit a first necessity to Mechanic Inspector, Lineman. In sight, in place, ready for action. Write for descriptive folder on Kit No. 403H.

Mathias Klein & Sons
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YOU'LL WANT MORE "Yankee" Tools

WHEN YOU SEE THE LINE

35 STYLES 75 SIZES

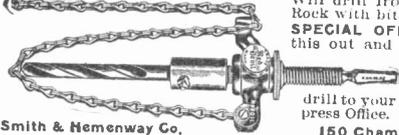


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Tells all about them. A postal brings it. Your dealer sells the "YANKEE."

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Genuine "Red Devil" Self Feeding Chain Drill



Will drill Iron, Steel or Rock with bit brace. **SPECIAL OFFER:**—Cut this out and send to us with \$1.50. We will deliver this drill to your nearest Express Office.

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We will deliver a complete heating equipment at your station at factory prices and wait for our pay while you test it during 60 days of winter weather.

The entire outfit must satisfy you or you pay nothing. Isn't this worth looking into? Could we offer such liberal terms if we didn't know that the Hess Furnace excels in service, simplicity, efficiency, economy?

We are makers—not dealers—and will save you all middlemen's profits. No room for more details here. Write today for free 48-page booklet which tells all about it.

Your name and address on a post card is sufficient.

No. 45 "Leader" Hess Steel Furnace Price \$49
Delivered East of Omaha and North of Ohio River
Type and Register Extra

HESS, 912 Tacoma Bldg., Chicago

FREE TRIAL for 6 Months

We want you to grind your tools on this perfected carborundum grinder for six months so you can find out its great value in your work. If after six months' trial you decide not to keep it, return it to us—no hard feelings, just send it back. The six months' use will have cost you nothing.

Luther Diamond Tool Grinder The Perfected Carborundum Sharpener



Mechanic's Special with Twist Drill Grinding Attachment

25 times faster than grindstones
6 times faster than emery

25 Times Faster Than Grindstones

This **Luther Grinder**—the standard of the world—with its wheels of the wonderful abrasive **carborundum**, is 25 times faster than grindstones. It cuts the hardest steel as emery does copper. One man with the Luther does the work of 20 men with any other sharpening device. Does not draw temper. No need of hard pressing—just a light touch—the hard, sharp carborundum crystals of the wheels peel off steel in tiny shavings. No water needed.

Foot and Hand Power Equipped with Sharpening Attachments

The special sharpening attachments enable anyone to do the most difficult sharpening, such as sharpening twist drills, chisels, plane bits, etc.

Luther Diamond Tool Grinders are the standard grinders of the world. In addition to their wonderful carborundum wheels, that never need dressing, they are mechanically perfect machines—machine cut spur gears—dust proof and bronze bearings—machined parts run in bath of oil.

In short, a **Luther Diamond Tool Grinder** will please you by its solid construction, and because it makes it easy to have keen edged tools without drudgery.



Hand Power Mechanic's Special with Attachment

Return This Coupon and get our 6 months Free Trial Offer

Send for our 6 months' free trial offer—we will also send you free a booklet telling the interesting story of the discovery of carborundum—how a scientist, attempting to make artificial diamonds, and fusing the elements of diamonds in an electric furnace, hot beyond the measurements of science, discovered, not the diamond, but **carborundum**—the wonderful abrasive that will scratch the diamond itself and cut steel as emery does copper.

Send coupon for our 6 months' free trial offer today.

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Please send me free and prepaid your free carborundum booklets and your six months free trial offer on the Luther Diamond Tool Grinder Mechanic's Special.

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NEW HOME INVENTION

First experience as a general or local agent, M. Stoneman, Over \$15,000 Neb. artist (address upon request) spare time orders total

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Hundreds enjoying similar prosperity. Agents breaking all records—actually getting rich. Let us refer you to 10 more whose total orders exceed \$51,000; to hundreds like O. Schelcher, Ohio (minister), whose FIRST 12 HOURS WORK SOLD 30 OUTFITS (PROFIT \$81.90)

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R. V. Zimmerman



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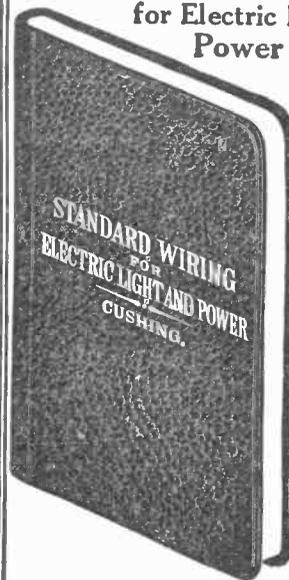
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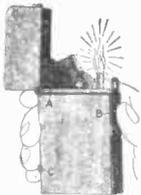
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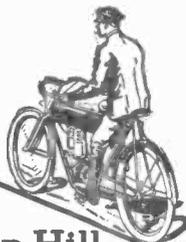
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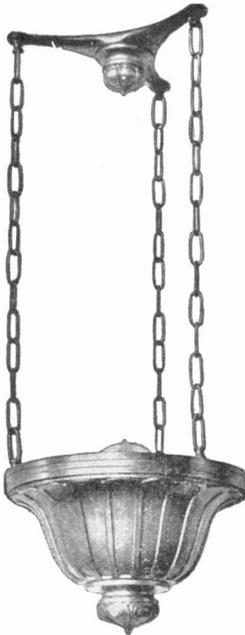
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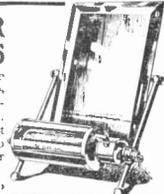
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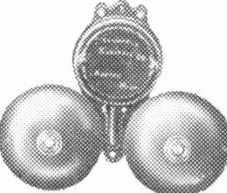
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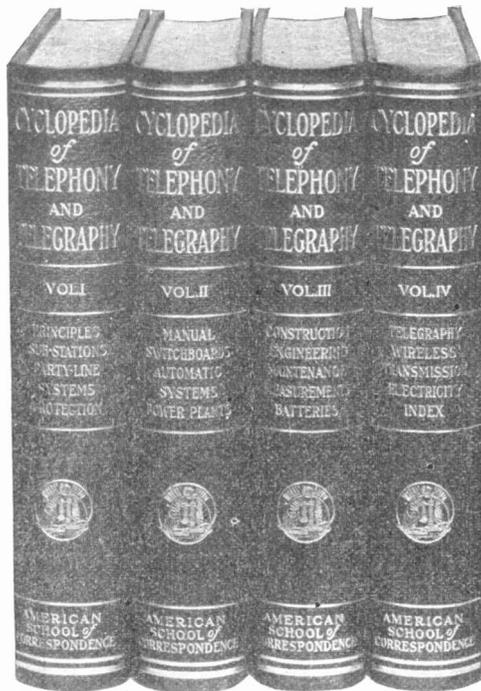
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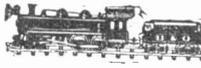
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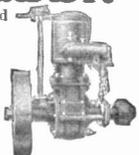
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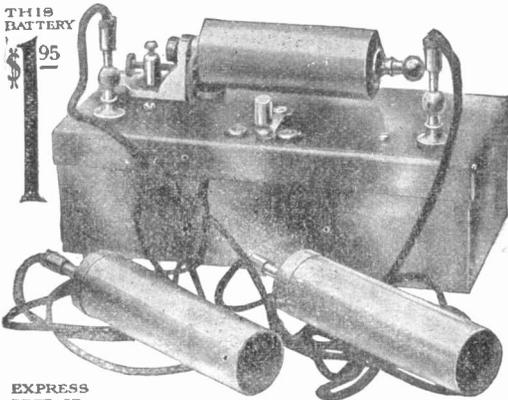
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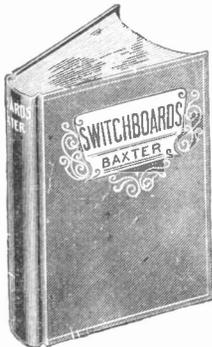
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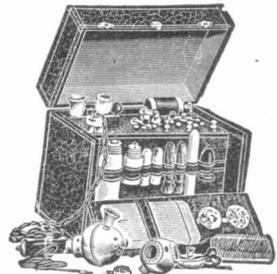
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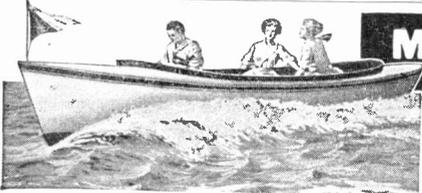
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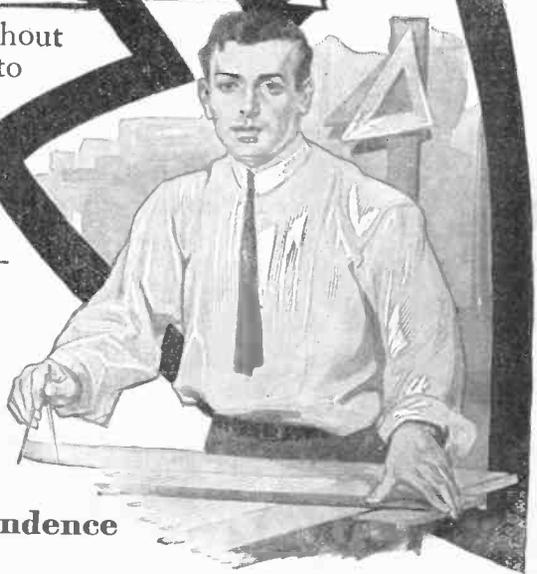
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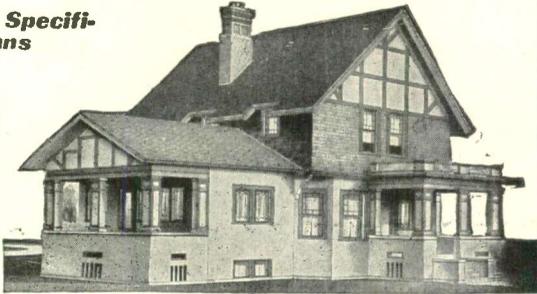
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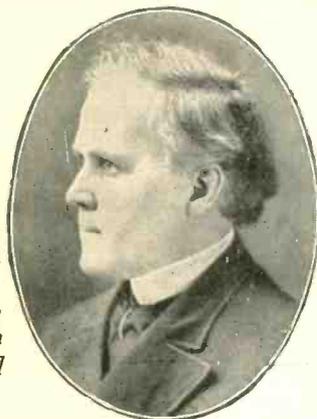
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