Popular Electricity In Plain English

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# Edison as a Manufacturer

By H. Bedford-Jones

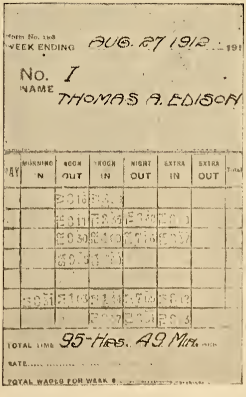
To dream dreams is very easy. To materialize the dreams of others is very easy. But he is the really great man who can turn his own dreams into hard, practical *power.*

The average inventor thinks his executive ability is one hundred plus. Give him a chance to prove it and he is apt to send out the S. O. S. call. But a few dreamers have been able to switch the surplus energy of their mind batteries into making good in a practical way. And the greatest of these is Edison.

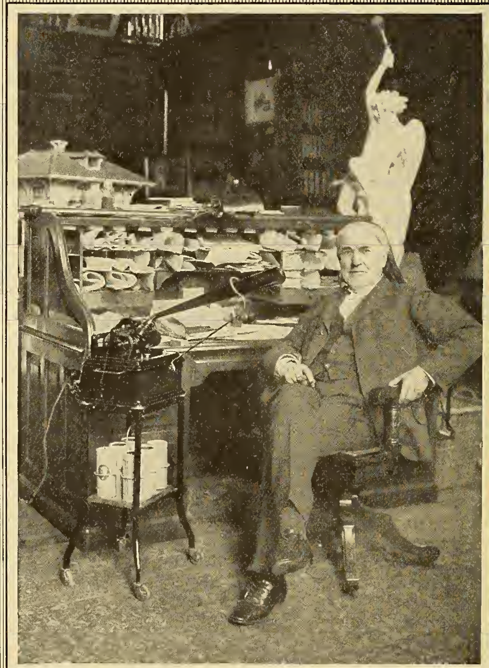
Thomas Alva Edison is the representative of the highest type of American business man. This type is a composite of inventive, salesmanship and executive ability. Class B men must specialize in details. The Class A man specializes in the handling of men. Orange, N. J., is chock full of both detail-handlers and men-handlers.

The keynote of the Class A business man of today was formulated years back by one Dave Crockett. "Be sure you're right, then go ahead." Dave did not say "Be sure you think you're right," as a good many people imagine. You can easily think you're right, but *being* right is often a harder job than the going ahead. Being right is the principle which has placed Edison in the van of American manufacturers.

The Thomas A. Edison Company is the focal point of a dozen immense organizations. Each separate company is a direct product, not only of "The Old Man's" invention, but of his executive ability. One wonders at his ingenuity; one is appalled at his tremendous power of management. Outside the gate of the Thomas A. Edison, Inc., plant are listed the Edison Manufacturing Company, the Edison Phonograph Works, the New Jersey Patent Company, the Edison Storage Battery Company, the Edison Portland Cement Company, the Motion Pictures Patent Company, and as many more companies.


WEEK ENDING AUG. 27 1912 191
No. 1
NAME THOMAS A. EDISON
DAY | MORNING IN | NOON OUT | NOON IN | NIGHT OUT | EXTRA IN | EXTRA OUT | TOTAL
TOTAL TIME 95-HRS. 49 MIN.
RATE
TOTAL WAGES FOR WEEK $

EDISON'S TIME CARD. NOTE THE TIME IN ONE WEEK—OVER 95 HOURS



MAHOGANY DESKS ARE CONSPICUOUS BY THEIR ABSENCE AROUND THE EDISON OFFICES. THE ONLY FINELY FURNISHED OFFICE IN THE PLACE IS THE LIBRARY OF MR. EDISON, AND "HE'S ONLY THERE WHEN HE SIGNS CHECKS" AS HIS MEN SAY

# POPULAR ELECTRICITY MAGAZINE

**In Plain English**

**HENRY WALTER YOUNG, Editor**

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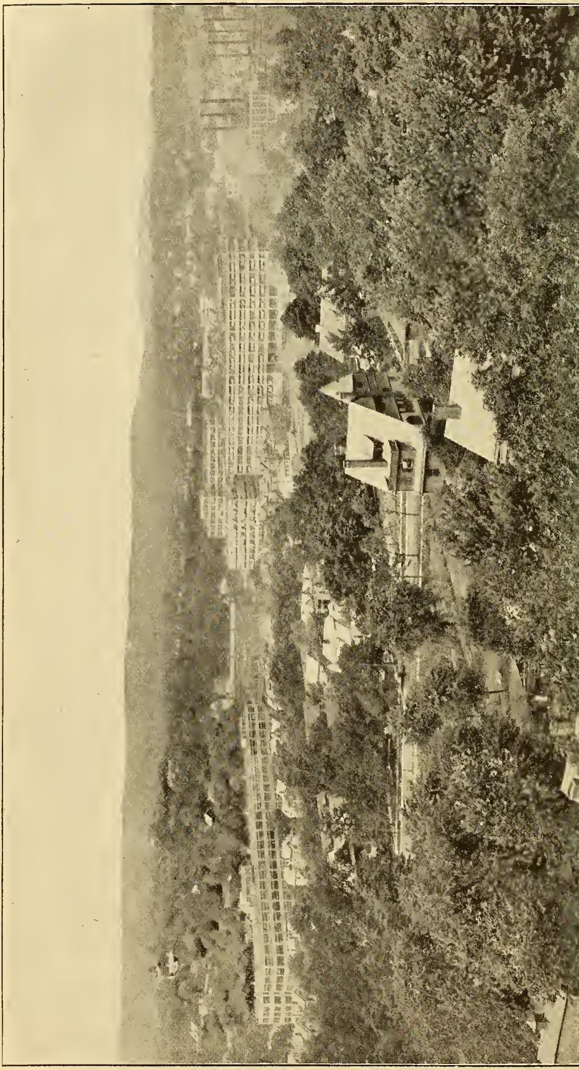


Storage Battery Works — Laboratory — Executive Offices — Cylinder and Disk Record Factory — Phonograph and Motion Picture Works — Concrete Cabinet Works — Small Motor and Rectifier Factory — Power Plant

FACTORIES, LABORATORIES AND OFFICES OF THOMAS A. EDISON, INC., ORANGE, N. J.

The dreams and the organizations of Edison are realized at Orange—a group of solid gray concrete buildings interspersed with others of red. Here is no usual type of factory. The two great facts which impress the visitor are first, lack of stability, and second, solidity. This is like no other factory in the world. The place reflects its master genius. The lesser genii must use their brains—and keep moving toward a fixed end which is continually placed farther on.

The average manufacturer mistakes stability for solidity. Edison never stands still, nor do his works. No product of his ever reaches perfection. "Be sure you're right," he says. Time after time some product seems ready for the market, only to be recalled for more improvements, more slight changes which will affect it in the years to come. The result is that through its very lack of stability this greatest of factories is imposing in its solidity. Nothing is a crime here save negligence.

More and more was this impressed on me as I went through the great shops and heard how problem after problem had been solved. On the famous storage battery, 50,000 distinct experiments were made and tabulated. Edison products contain nothing, can be associated with nothing, unless that thing is *right,* in every sense of the word. Just now Edison is working on a light delivery wagon, carrying a 20 volt motor, with a battery of sixteen 300 ampere-hour cells, running 45 miles per charge. Near Orange is a fifteen mile road, the worst in the country. A wagon good for 50,000 miles on an ordinary road goes to pieces after 250 miles of this one. Edison's wagon must run 2,000 miles continuously on this road—without a single accident. So far half a dozen wagons have been built in vain, and some $35,000 expended; the work may not be half done, but in the end a wagon will stand the test—and then have to stand a harder one. Then, perhaps, Edison will be satisfied and the world will have a new product.

But this, you say, is inventing, not manufacturing! Wrong. Mr. Edison knows how to invent, and applies the knowledge to manufacturing methods. Like most master minds of business, he invariably picks out the obvious things which others overlook.

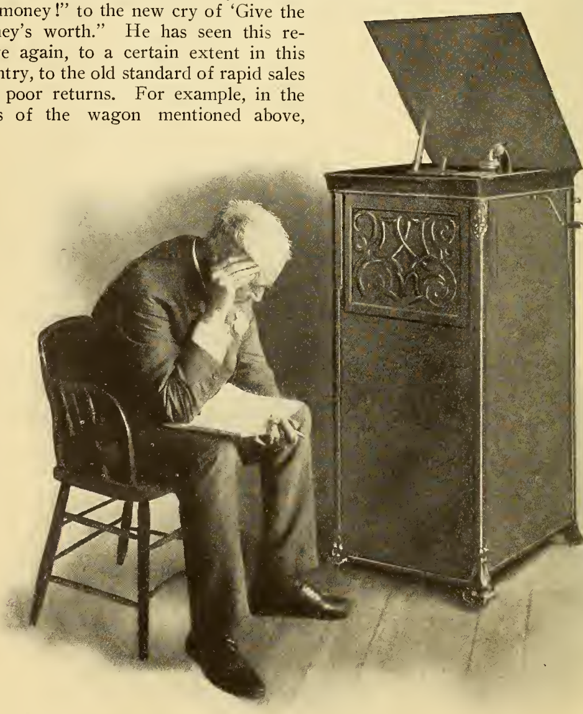
I was asking him about the patent reform question, on which a committee of Congress is now working.

"Simple," he said quickly and positively, with that manner of his which leaves no loophole for argument. "At present the burden of proof rests on the patentee. Make it rest on the infringer and the problem is solved. In other words, instead of making me prove that my patent has been infringed, make the other fellow prove that my patent has not been infringed. It is simpler, would avoid the endless lawsuits and the burden of proof would lie where it belongs. If the other fellow's patent is worth anything he would be spending his money to some purpose. If it is an infringement, the real inventor should not have to pay good money to prove it. This, moreover, would protect the penniless inventor from having his patents stolen. At present he cannot help himself unless he has the money to put up for legal costs."

It is these obvious things which are so hard to see. It is always easy for us to see just beyond our noses; we are blind to what lies under our noses. Mr. Edison went on to say that the greatest fault with the present patent situation lay in its method of settlement.

"It is fair neither to the inventors nor to the judiciary," he declared, "that an involved and intricate mechanical or electrical case should be decided by judges and juries who are not trained mechanicians or electricians. Yet such cases are decided every day by such men. It would be far better to let such things go before trained experts. The government employs these experts in other lines; why not in this? And a sufficient salary would place them above the temptation of bribery."

The world, in a way, has long been unfair to Edison, in not giving him credit for all his achievements. His ability as an executive has been overshadowed by his ability as an inventor. His power of salesmanship has been lost in the world's view of the "wizard." In his lifetime he has seen the evolution and devolution of business standards. He has seen the gradual change from the old cry of "Get the money!" to the new cry of 'Give the money's worth." He has seen this revolve again, to a certain extent in this country, to the old standard of rapid sales and poor returns. For example, in the tests of the wagon mentioned above, various motors from many of the largest American shops were tried and tested thoroughly. Invariably these motors were lacking in practical efficiency, and at length he had to build one himself. This is a startling statement, but it is true. And yet, from the day he became a manufacturer, Edison has maintained one watchword for all his men, in each of his shops. "Negligence is crime. Give



MR. EDISON IN CHARACTERISTIC ATTITUDE WHEN TESTING RECORDS

*(From a photograph taken especially for Popular Electricity Magazine.)*

**Note the book in which he jots down various comments on quality, volume, surface or "scratch," and criticisms of voice and accompaniment. Some of these are interesting and amusing. One in particular reads: "The manner in which the accompaniment has burst forth in the introduction, compared with the thin, piping voice of the singer, is like announcing the singing mouse by roaring cannon."**

a dollar's value for a dollar!" And in the effort to do this, he has had to give several dollar's value for a dollar—but it pays.

We were sitting before the new Edison disk machine, listening to the finest phonographic records ever evolved, when Mr. Edison touched on this point—Edison the manufacturer, not Edison the inventor. At one side an expert was inspecting record molds through a microscope, going over each inch of the three miles the needle travels, searching for blowholes or other defects. I heard how the reproducers had been tested for three years, how 2,500 combinations had been tried before the perfect one was found.

"And this absolute perfection," I asked, "does it pay in the end? Will not the rapidity of modern improvement cause it to go out of date quickly? Surely an earlier one of those 2,500 combinations was practically as good as this final one."

"Not on your life," came the almost savage reply. "I am not building for a day. The trouble with some American manufacturers is just that very point. They cater to the passing whim. I haven't finished with those records for that instrument yet; when I have, they will be perfect in every way. As it is, they are indestructible—as good five years hence as they are right now. We won't know the ultimate limits of that storage battery for years to come; it hasn't been invented long enough. But I do know it will show full rated capacity at the end of four years and am guaranteeing it. It pays to make things slowly, but to make them right. Over in Europe they do this much more than we do. It is one of the fundamentals of business success—not measured by success standards of today, but by those of a century hence. There are no 'seconds' or 'thirds' going out of my shops. Nothing but firsts, first, last and all the time."

Isn't that a mighty good "gospel of efficiency?" Thoroughness to the last detail is the watchword in Orange. Edison rejects absolutely everything which is not proved exact to the last fraction of an inch. He attends to details himself, suggests new machines, sees that they are made as he wishes, watches the tests himself. It is the greatest ambition of every employé in his shops to have a bit of "new work" approved by the "Old Man." Soon after this article appears the new phonograph will be on the market. The final records for that machine are now being tested individually by Mr. Edison himself. He listens to each one and accepts or rejects it with an ear for minute flaws not only in the construction but in the music. Many of our most "popular" and famous singers have been rejected by him. His singers must be up to his standard of efficiency; he cares nothing for the whims of today.

"People may think some of those people are great singers," he chuckled, as we listened to a marvelous but hitherto unknown soprano, "but they can't fool my phonograph! I've got 'em!" And he has. One famous violinist made a number of records, and Edison quietly rejected them one after the other. The artist was highly indignant and demanded his reasons.

"Aren't good enough for me," came the reply. "Bad music. Hear those harmonics? They don't sound in the concert hall, but when they come out of that hole, they do."

The artist listened, admitted there was a fault, and was at a loss to account for it. So Mr. Edison took the violin and placed the strings under a high power microscope. He was looking for the reason and he found it. The almost indefinable harmonics were produced by the strings which had been worn perfectly flat by the bow. This accidental discovery not only surprised the artist, but the manufacturer himself. It was never hitherto known that violin strings are worn to an exact flatness, even when comparatively fresh.

A month or two after you read this look for the new catalogue of the Edison disk records. The first 500 of these rec-

ONE OF EDISON'S LATEST GIFTS TO THE WORLD—THE KINETOSCOPE FOR THE HOME. EACH FILM CARRIES THREE SERIES OF PICTURES

ords will have been made by Mr. Edison personally, and put through the final tests by him. He has personally supervised the catalog itself, together with the artists represented. His agents throughout the world have been reporting on singers, famous or not, and sending records of the voices. Each voice met with the acid Edison test of quality. Each record on the catalog is approved by the keenest and most critical ear in the world. And with it all, hundreds of experiments have been personally conducted and countless details thought out every day.

The shops, of course, are under military discipline. No one can enter or leave without a pass. The visitor is surprised when he enters one of the offices of the departmental managers or chiefs. In all other such establishments are elaborate suites of private offices and passing guardians are found in proceeding from one luxurious room to another. One can hardly believe that none of these adjuncts exist here. There is no ostentatious display, no useless room. Mahogany desks are conspicuous by their absence. The only finely furnished office in the place is the library of Mr. Edison, and "he's only there when he signs checks," as his men say.

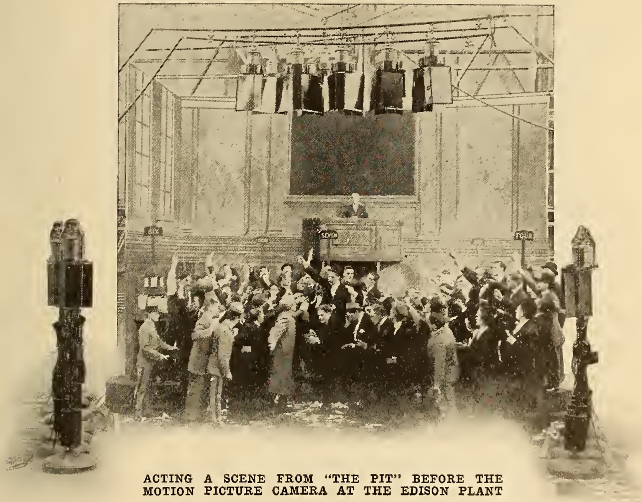
The reason for this? It is two-fold. First, the managers and department chiefs are men like Edison himself—practical workmen who spend more time in the shops than at the desk. Like all Class A business men, he surrounds himself with the best men procurable, men who, under anyone else, would be more remarkable than their masters. Many of them are almost as full of inventions as Edison himself. One of these, talking with Mr. Edison and me at 1 a. m., in the laboratory, began writing steadily for some time. He finished, and handed the pad to Mr. Edison. The latter read it, signed as a witness, objected to a minor detail—and his opinion was promptly overruled. In that few moments was born a new invention; within the next few years it will have been tested to the breaking point, and may then go to the market or the scrap heap.

The second reason for the lack of fine offices is more involved. At the same time it has more to do with Edison the manufacturer. I came upon it by chance through asking the master genius a question aimed at his executive knowledge of his shops.

"In such a combination of industries," I asked, "is there not a danger point reached by your producers and non-producers? In other words does the overhead expense, red tape, and lost motion result in a higher manufacturing cost than where the business is smaller?"

"Exactly." "The Old Man" reached down for his tobacco meditatively, his eyes wrinkling. "But not here. The overhead expense, in which I would include the office force and other non-producers, is always on the jump. But so are your producers. One jumps ahead and catches up with the other, then the other takes a jump ahead, and so on. You simply must keep the two balanced. A small manufacturer is liable to disaster unless he can do this. He is apt to make the mistake of crowding his warehouse full, then shutting down his shop and selling his stuff. He doesn't build for tomorrow. The bigger your business, the less your overhead expense should be in proportion to your amount of production. Should be, mind—not *is*. Such a theoretical condition is nearly always impossible in practice.

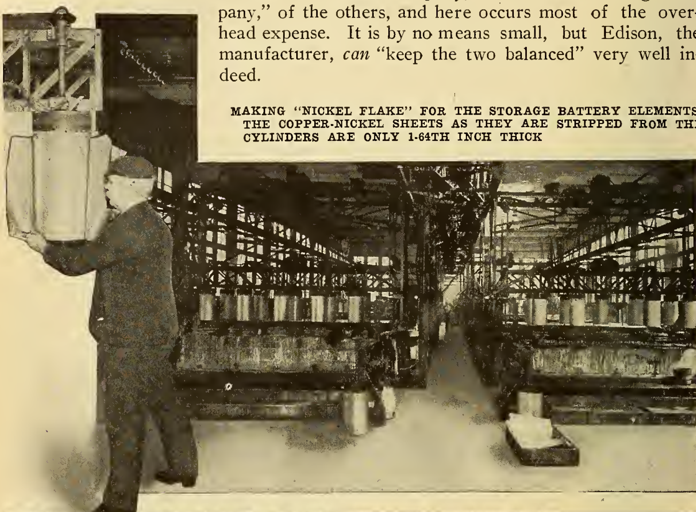
"Most folks want things to look well. I want results. For a good many years after I started in business I worked on the 'two hook' method. I had two hooks along side my desk. On one hook I stuck all bills payable, on the other all bills receivable. Then I had a checkbook to tell me how much I had in the bank. Those were all the books I needed. The more space you give to your non-producers the less you have for your producers. Floor-space is valuable."



ACTING A SCENE FROM "THE PIT" BEFORE THE MOTION PICTURE CAMERA AT THE EDISON PLANT

Of course, the "two hook" method has not lasted to the present day, but the office forces here are small, considering the size of the industry, and are located centrally. The Thomas A. Edison Company, Inc., is the "holding company," of the others, and here occurs most of the overhead expense. It is by no means small, but Edison, the manufacturer, *can* "keep the two balanced" very well indeed.

MAKING "NICKEL FLAKE" FOR THE STORAGE BATTERY ELEMENTS. THE COPPER-NICKEL SHEETS AS THEY ARE STRIPPED FROM THE CYLINDERS ARE ONLY 1-64TH INCH THICK



ONE END OF THE FORMING ROOM IN THE STORAGE BATTERY PLANT. NO EXHAUST FANS OR VENTILATORS HERE SINCE THE GASES FROM THE EDISON CELLS ARE ODORLESS AND HARMLESS

Here I ventured timidly into politics—very carefully, for I knew nothing whatever of Edison's views on the subject.

"You have a combination of interests here yourself," I put forth, "and I would like to know how you view the question. Should eggs be unscrambled?"

"That depends on just how rotten the eggs are," came the answer. "I think a business combination should be regulated, not busted; or rather that its prices should be regulated. But not from the top. The only sound way to regulate prices is from the bottom upwards, not from the top downwards, as is advocated generally. In fact, it would be mighty hard to regulate prices from the top, with any efficiency, and you can't regulate them very far from the bottom. But you can regulate them *at* the bottom. My plan would be to take the average cost of production of any given product, figured from the mean cost of differing localities and methods used, and on this average cost to base the *minimum* selling price of the product itself. Let competition, in other words, figure on the maximum price, but let regulation figure on the minimum price. It is not the maximum price which kills a firm, but the minimum. Such a plan would effectually prevent destructive price cutting, which has sent so many concerns to the wall. An average minimum price, giving a fair profit to all, is the only fair regulation. To try to regulate it from the top is folly; it is like giving a man headache powders for sore feet—and would have about the same result."

On the subject of taxation Mr. Edison was equally stringent in his views. Some little time since, a number of men in France put up a proposition to him by which they were to manufacture certain of his products in that country. Over there the government taxes the stock of firms and companies, and in order to get around it, what is known as "founder's shares" are issued. This was carefully explained to Mr. Edison and the number of founder's shares to be given him was just being discussed when he cut the subject short with a negative decision. His reasons for this were simple.

"Did they touch any company of mine? I guess not! Why, it was a straight fraud game—cutting the government out of its lawful taxes! Too dirty to touch my hands, anyhow. No, sir, I believe in paying taxes fairly and squarely. If I'm living under the laws I intend to keep them—not keep the letter of the law only, either. If I don't want to obey them I'll get out. I want to be able to look every dollar I possess squarely in the face, and not have to blush when I do it."

As is well known, Mr. Edison himself works for days at a stretch, and many of his helpers do likewise. At these times he will take a nap on a work bench, and when he is "on the job" you can find more than one bench or table occupied by recumbent forms. Each group of assistants is working on some campaign, and the last finished of these and the most interesting to visitors is the model "suburban home."

This is a house in the Park near the factories. The house was rented and fully furnished, and was then equipped with the lighting system which can be installed at moderate cost in any home. Here may be seen electrical devices of every imaginable description. These are operated by a small group of cells in the basement and a small engine outside the house proper. The entire affair exhibits the salesmanship of Edison the manufacturer to a remarkable degree.

The single group of cells can be installed in any farmhouse and can be recharged by the engine, which need run only some seven hours per week. This is Edison's latest gift, a gift to the farmer, bringing within his reach the greatest attainments of civilization. By means of this he may operate everything from a washing machine to a foot warmer by his own power. Here may be seen the kinetoscope for the home—a complete moving picture machine which bears on each film reel *three* series of pictures, reversible at will, and which is probably the finest educational factor ever placed on the market.

But even the kinetoscope reflects the lack of stability I mentioned above—as well as the solidity. Complete as it is, it may be touched upon at any time and re-made, minute changes added which the average person would never see, but which in the end will render it a thing unimprovable. For ten years Mr. Edison dropped all work on his phonograph, while perfecting the storage battery. Then he began his recently finished "campaign," worked steadily on it for three years, and today the instrument is perfect as never before — solidity through very lack of stability.

A word on this machine may be of interest. It is founded on the simple principle that sound waves lose their tone and volume by taking a zigzag course from reproducer to vent, as in other machines; while by eliminating these side thrusts and substituting for them a rising and falling motion, the tone and volume is retained. With this machine all scratching is absolutely nil—but it required 2500 experiments on the diaphragm alone.

The shafts and bushings of the instrument are ground and gauged to within one-fifth of a thousandth of an inch. Each machine is tested, almost incredibly, and is furnished with an automatic stop which will check the record at any given point. The records themselves play from four to eight minutes—in itself a tremendous achievement.

A FEW OF THE EDISON MEDALS. IT IS SAID THERE ARE SEVERAL QUARTS MORE PUT AWAY SOMEWHERE

One of the most interesting of Mr. Edison's late inventions is in use in the model house referred to above. This is an automatic voltage regulator which controls the pressure on all the lamps in a building. It can be placed anywhere in the basement, requiring no attention whatever, renders it possible to run the lamps while charging the home battery, and prevents burning out of lamps from voltage fluctuation.

This machine is operated by a solenoid, which opens and closes the circuit on a motor. This motor (through a worm drive) operates an arm which travels through a series of steps. This arm makes contact on the steps, cutting out and cutting in resistance according to the number of lamps or appliances in use, controlling a current of 30 volts to each. This invention was planned by Mr. Edison while on a train from Chicago. He brought 50 sketches into the shops and directed them to be worked out. One or two of them seemed better than the others, but each one was carefully tested until the final result reached perfection.

The atmosphere of the whole giant factory breathes *work*. Every such place has an atmosphere of its own, and this at Orange reflects that of its maker. There is no regard for appearances, only for results. Nothing is stationary; you may hear pianos in the laboratory or see scenario settings in the storage battery yard. Today there are 100 men at work on a certain part of the storage battery. When this article appears there will be only three men—but new machines. Eighteen months ago the output of batteries was 700 a week; when this article appears the output will be 1800 a week. So it goes throughout all the Edison factories. You realize that they are in truth, factories, and that there is a factor behind them, a man of dynamic energy, whose personality is injected into and through them all ceaselessly, and whose message is drilled into man and machine alike, not for today, but for a century hence—"Be sure you're *right*. Then go ahead."

## FIRST QUARTZ LAMP INSTALLATION IN THIS COUNTRY

The accompanying picture is from a night photograph of the first installation of Cooper-Hewitt, quartz-tube, mercury-arc lamps for street lighting in America. The scene of the picture is Randolph Street, Chicago, between Fifth Avenue and La Salle Street.

QUARTZ LAMP INSTALLATION IN CHICAGO—THE FIRST IN THIS COUNTRY

The lamps are arranged to illuminate a block length, or 320 feet of street. The street width is 80 feet from building line to building line, and six quartz-tube lamps are staggered, three on one side of the street and three on the other. The lamps are 40 feet above the sidewalk and are suspended eight feet from the building, the height resulting in an entire absence of glare.

The distinctness of the two automobiles standing at the curb shows the excellence of the illumination, for the photograph was taken by the light of the six lamps, four of which appear in the picture. It is easy to read the ordinary newspaper anywhere in the block and all doorways and entrances are well lighted. Although the light is of a greenish color, there are enough yellow and orange rays so that we get away from the marked effect of the ordinary mercury-vapor lamp.

The quartz lamp, while based upon the same fundamental principle as the ordinary mercury vapor lamp, differs from the latter. Both lamps use the vapor of mercury as the luminous body. The mercury-vapor lamp holds the mercury in a long lead glass tube while the quartz lamp has a short tube of pure, fused quartz or silica.

The property of the quartz tube to

withstand a very high temperature makes it possible to have this tube short and the "trimming" consists in renewing a tube which is quite infrequent compared to the attention required by a carbon arc lamp. Each lamp takes 3.5 amperes on 220 volts direct current. Four amperes are required by the 110 volt type. The installation shown operates on 220 volts.

## Paris Fire Fighters

Since the Paris fire department reorganized its service of fire engines and other automobile cars, it now ranks among the best equipped in Europe in this respect. While the cars are of the gasoline automobile type, some of them also carry electric motors which aid in operating them. For instance the new hook and ladder turntable automobile is fitted with an electric motor for carrying out part of the movement of the ladder. This automobile represents the latest idea of the kind. On the rear of the truck is a revolving turntable which carries a ladder so that no other support is needed in order to extend the ladder up to 80 feet in the air, to reach the windows of high buildings. A hand movement rotates the platform and also sets the ladder at any given slope, but a 25 horse power electric motor is used to slide out the four sections of the ladder by means of steel cable and pulleys and it can be fully run out within 20 seconds.

What is novel is that the ladder sections slide in again by their own weight, and now the motor is run backwards as a dynamo with the current absorbed by resistance coils, so as to work as an electric brake and ease up the movement of the ladder.

The gasoline motor of the car serves to drive a small dynamo which gives current for the electric motor and also for an arc searchlight.

There is also shown the salvage automobile, of which there are a number in use, and they are mainly used for protecting against water. They carry a great number of heavy tarpaulins, besides all kinds of salvage devices. On the car is also a small dynamo, which gives current for a portable searchlight.

GASOLENE - ELECTRIC FIRE TRUCKS OF PARIS

## Static Electricity Fogs Films

On some of the moving picture films obtained by Captain F. E. Kleinschmidt, of the Carnegie Museum expedition to Alaska and Siberia, peculiar and recurring fog marks were observed and for a time challenged explanation. Finally it was discovered that in the intense, dry cold of the Arctic climate static electricity was generated on the rapidly moving film and this, in discharging between metal points caused the fog marks.

ELECTRIC FURNACE USED BY PROFESSOR MOISSAN IN MAKING DIAMONDS

## Prof. Moissan's Furnace

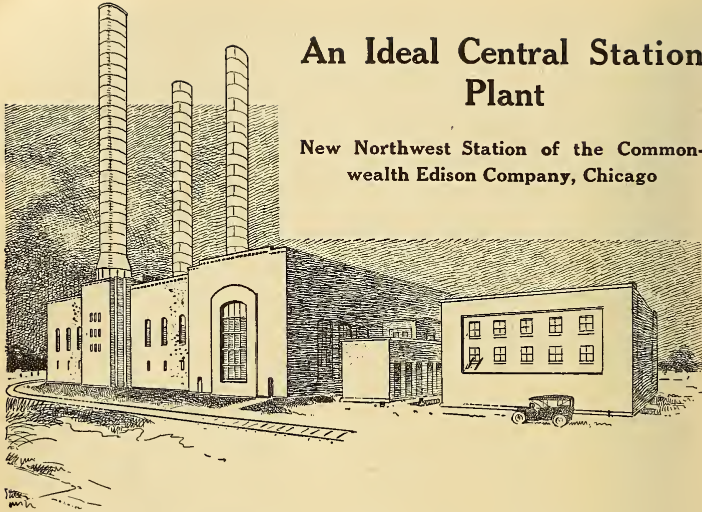
The accompanying view shows the Moissan electric furnace which is in use in the laboratories of the Paris University, and owing to the extremely high heat which it affords, metals and other substances can be melted with ease and even the most refractory ones. Some of the metals or compounds are even given off as vapor and can be thus put through experiments of different kinds. A furnace of this kind was used some years ago in the remarkable work done by the late Prof. Moissan in the production of diamonds, and he actually succeeded in making miniature diamonds in this way. As the method is very difficult and requires great skill, it has not been taken up of late, but the furnace is used for other work.

## Lighting the Track Ahead

If you were to get up close to the locomotive whose headlight throws a beam of light such a surprisingly long distance down the track at night, you would likely see an equipment similar to that shown in the illustration. The headlight itself is a powerful arc lamp with a suitable reflector. Nestled down upon the front of the locomotive and indicated by the arrow is a small steam turbine direct connected to a direct current generator. The whole outfit is enclosed in a substantial iron casing. The set, rated at one kilowatt, is ample to supply current to the headlight and takes high pressure steam direct from the boiler of the locomotive.

THE ARROW SHOWS THE LOCATION OF THE LIGHTING GENERATOR ON THE LOCOMOTIVE

# An Ideal Central Station Plant



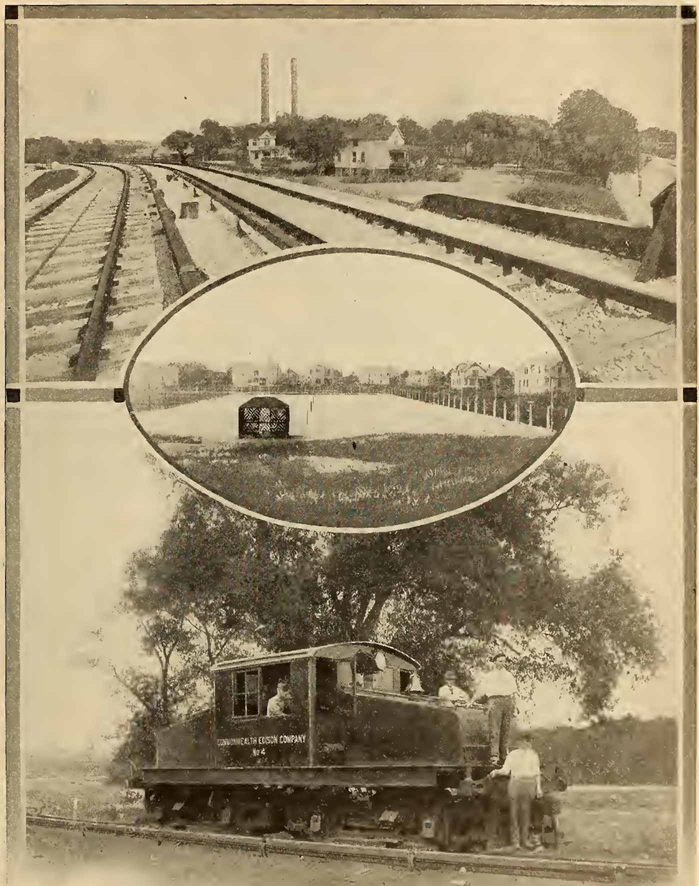
**New Northwest Station of the Commonwealth Edison Company, Chicago**

Take the Elston Avenue car from the "Loop" district of Chicago and go away out into the Nor' Nor' west part of the city, across the northern branch of the Chicago River—that branch which is now another part of the drainage channel—and you will come in due time to the entrance gates of what promises to be the greatest and certainly one of the best laid out electric generating plants in the country. It is at present, it is true, only in an initial or embryonic stage but the lines mapped out for future development are good.

Verbena, gladioli, roses, nasturtiums, asters and shrubs and young growing trees of all kinds, not forgetting smooth and well laid lawns are not usually associated with manufacturing plants so far as Chicago is concerned. But it is quite different with this huge new generating station of the Commonwealth Edison Company, called the Northwest Station. The utilitarian while just as marked and projected on even stronger lines of efficiency is softened so far as externals are concerned by tasteful and well planned environment.

Suppose one takes the most westerly entrance to the property which comprises 109 acres, the way will be along pleasant gravel paths bordered with well set out flower beds, in late summer and early autumn gay with all the brilliant favorites of that season. Looking due west it will be seen that the grounds are cut by the high embankment of the company's own electric third rail line connecting with the Chicago and Northwestern Railway at this point. This little internal electric railway is quite scenic, in that it wanders in and around the grounds with the river to the east, while to the north is considerable well treed meadow land. There are also very prosaic and large coal storage yards. The third rail system in use is of the under-contact type so that all interference from ice or snow is avoided and the rail is boxed as to the top with a wooden covering.

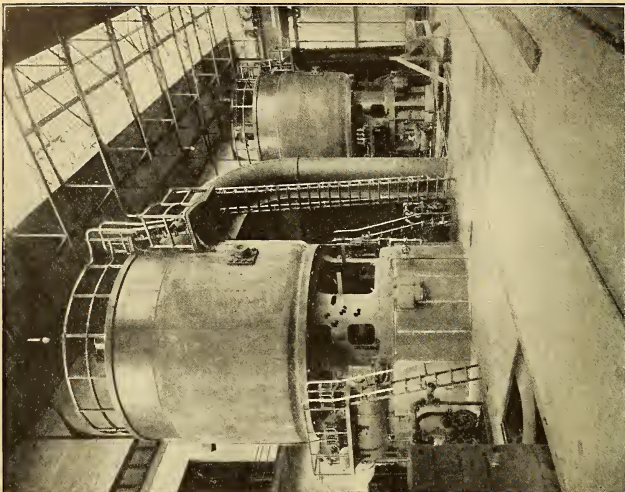
The locomotives used are of the same type as those used on the New York



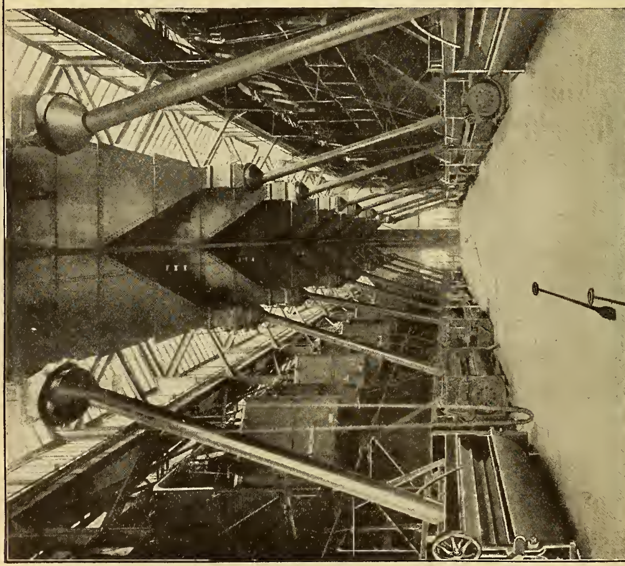

The Great Stacks of the Northwest Station Loom Up in the Distance Over Gardens, Lawns and Shrubbery, All on the Company's Property—a Tasteful and Well Planned Environment. In the Foreground Is a Portion of the Private Third Rail Track System.

Tennis Courts for Northwest Station Employees. Surrounding These Are Employees' Cottages

One of the Third Rail Locomotives Which Does the Coal Hauling on 4½ Miles of Private Track



Two Immense Steam Turbo-Generator Units of 26,000 Horse-power Now Installed in the Northwest Station.



Boiler Room in Northwest Station Showing Overhead Coal Bunkers With Coal Chutes Leading Down to the Automatic Stokers

Central railroad. Each is of 60 tons weight and can haul eight cars of 71 tons.

In all there are 4½ miles of track consisting of switch sidings for hauling the company's coal from the main line of the Chicago and Northwestern Railway Company, and these electric locomotives do the work.

On the west side of the embankment mentioned are the beginnings of various buildings and the excellent gravel tennis courts used by the company's employees, where during the season regular tournaments are held, much enjoyed by the Commonwealth Edison Company players. It may be noted that at various of the company's stations and substations the surrounding lawns have been laid out for courts.

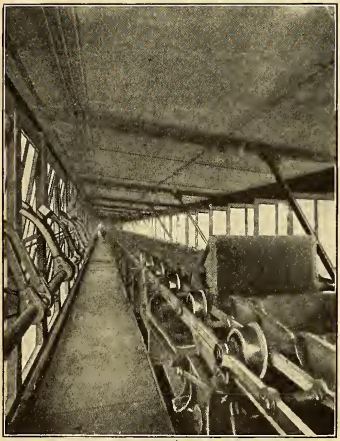
Keeping to the east side of the embankment and along the pleasant walks just mentioned, the first building one meets with is the cottage devoted to a restaurant for private use of the heads of departments at the works. Then as one approaches the plant proper there is another cottage used by the staff of the resident engineer. These offices are well fitted up and equipped, including, of course, telephone communication over the company's private wire with the executive offices in West Adams Street. Meals are served in the restaurant at a cost of 25 cents to employees.

As may be readily expected the approaches to the main building from the western side are more or less through a network of third rail tracks marked "Dangerous" over which one passes only at regular crossings where the connection ceases. The main building itself, in so far as it is completed, is a huge structure of steel covered with vitrified paving brick lined with white glazed brick and having a tessellated pavement. It contains at this time in operation two units of 26,000 horsepower each, classed among the largest turbo-generators ever built and of the very latest design and construction.

There is also floor room in this building for two additional units of the same capacity. Overhead, running from end to end, is a splendid 110 ton Morgan crane used for putting the machinery in place and moving any piece necessary. A broad iron staircase takes one up into a gallery from which one passes into the boiler room. Here we see the automatic stoker at its best. Rather different in design from those in service at the Fisk and Quarry Street plants—the hoppers run down with huge tubes automatically feeding the fires and being themselves fed from the coal cars below, which are run directly in on the third rail tracks and from which the coal is lifted by big electrically operated shovels or buckets —just as you see the steam shovel at work excavating for track laying on any railway, only this is all done by electricity.

To give this process of handling coal, which is most interesting, a little more in detail, there are in the boiler house basement, running centrally beneath each two rows of boilers, four railway tracks. The two outer tracks are directly below the ash bunkers, the inner tracks being for loaded coal cars. A traveling coal handling crane with grab-bucket spans these two tracks, but hopper bottom cars discharge directly into coal receiving hoppers beneath the rails, holding 74 tons for each boiler. Below these hoppers runs another space with a track on which is a large traveling coal crusher spanning a 34 by 36 inch bucket conveyor. The latter encircles vertically the entire double boiler section, discharging into overhead coal bunkers. The latter hold 63 tons for each boiler. The station bunkers thus have a capacity of nearly 1,400 tons for each unit of ten boilers. The heating surface of each boiler is 5,600 square feet. The steam pressure is approximately 250 pounds. The steel stacks—one to each set of ten boilers—which may be seen for miles away rise 250 feet above the boiler room floor, which in turn is 21 feet higher than the floor of the turbine room. In the basement of the boiler room there is also installed the machinery for the oiling system.

The space in the grounds allowed for coal storage is sufficient for 250,000 tons when all the plans are completed. At present there is always on hand 10,000 tons, with a capacity for 20,000, for the two units now in operation.



One of the Coal Conveyors of the Northwest Station

The vast amount of ashes derived from the great consumption of coal is either sold for a mere song, or to a certain extent given to the railway company for hauling it away.

A word as to the condensing water for the station. It enters a crib intake at the river's edge, flowing through a concrete tunnel of 90 square feet rectangular cross section into the station and out again at a different point. The circulation equals 210,000 gallons per hour per unit.

The other two buildings so far erected are the transformer and switch houses. From out these run at present sixteen transmission lines, serving a territory of about 40 square miles.

It is the ultimate purpose to have a twin station with a total capacity of approximately 320,000 horsepower, but that will not be for several years to come. The first station when completed will have a capacity of approximately 160,000 horsepower.

All around for miles a practically new and most thriving part of Chicago is springing up. Go due north and you find yourself in a very large and new residence district, the creation of the last five years and growing month by month at an enormous rate, while south and west and east there is a steady growth in manufacturing enterprises.

It is readily understood then, that the electrical needs of Chicago's ever growing population will be come vaster and vaster as years go by and when electrification of terminals and practically universal use of electricity has come to pass, even the supply generated by this huge station, when completed, will have become a matter of comparative insignificance.

Ground for this station was broken in October 1910. The two units described were put into active operation in August of this year. There are now 70 employees and every care has been taken to provide ample convenience for the physical comfort and general welfare of the operating force. When the right of way was acquired a good many dwellings were acquired with it—cottages which have since been improved and repaired and leased to employees.

And as one turns away from this breezy new part of Chicago, all a matter of the last few years, and looking back sees a gardener at work raking his flower beds and planting his grass seed for lawns right up to the walls of the main building one realizes that this is a new age indeed, and that big, fine, well equipped, business institutions must have big, fine surroundings, conveniences and comforts for the humblest as well as the highest of the workers within their gates.

## Mill Mountain Incline

Roanoke, Virginia, is built at the foot of an imposing hill 900 feet higher than the city, and with 25 acres of beautiful forest on its summit. On account of its inaccesibility, as the average grade is 50 per cent, the city derived no pleasure from this unusual advantage, until about two years ago, when $40,000 was raised among the public spirited business men and Mill Mountain Incline,

MILL MOUNTAIN INCLINE

Incorporated, was organized to build the incline and convert the mountain into a park. The plans were immediately executed and the park has been enjoyed by the public two seasons.

The incline, which is 2200 feet long, has a double track with a car running each way. These cars are connected by two cables, one carrying the weight of the car and the other slightly slack for emergency. These cables pass around drums at the top of the incline. The drums are operated by electric motors. When one car is ascending the other is descending, so if the cars are about equally loaded the weight of the one descending will raise the other, thus only requiring the electric power for the start.

The operating cost of the incline is about $500 a month, but as during the season an average of 600 people a month visit the top, each paying 25 cents for the round trip, the investment is not only an example of civic pride and progressiveness, but a good financial proposition.

## Loud Speaking Telephone for the Home

An interesting adaptation of the loud speaking telephone for household use is made by a French manufacturer. The transmitter and receiver are contained in a little box which may be placed on a table or stand, and which is surmounted by a vase for flowers or some little comic head or other attractive, ornamental de-

VARIOUS FORMS ADAPTED TO THE TRANSMITTER AND RECEIVER OF A HOUSEHOLD LOUD SPEAKING TELEPHONE

sign. By pressing a button on the side of the case the mistress can signal servants in any other room in the house where a similar instrument is located. Then she gives her orders in an ordinary tone of voice. She can also overhear anything that is said in the distant room.

## Shooting at Moving Pictures

The very newest idea for shooting galleries is to have the marksman shoot at moving pictures, both to test his accuracy in firing at moving objects and his judgment of distance, both of which are brought out almost as well as by shooting in the open. James Paterson of London, England, is the inventor of the device.

Figure 1 shows the marksman at the shooting stand in the act of firing at the motion picture on the screen before him. At the left is the lantern which projects the picture. In the picture on the screen a scout is in the act of firing at the observer. This scout may advance, retreat into the distance, run sidewise, hide behind trees, etc., according to the nature of the moving picture film, and he forms just as hard an object to hit as if he were a man actually running out there in the woods.

The screen upon which the picture is thrown is made of paper or cloth so as to form no obstacle for the bullet. Right behind the screen is the real target, although the marksman does not see it. This target is about the size of the scout in the picture and it is made up, as shown in Fig. 2, of a number of movable concave members having plungers in the rear which make electrical contact and work an annunciator up at the stand when a hit is made—indicating in this way what part of the scout or moving creature has been hit.

Finally an arrangement is provided to move this target indicator around in the rear of the screen so as to follow the moving figure about wherever it may go. This is done by mounting the target on suitable wires or cords, giving it a lateral, vertical and rearward movement at the will of the operator who controls it from out in front. To enable the operator to follow the movements of the, to him, invisible target the three arrows near the margins of the picture are so connected to the system of cords as to indicate to him the position of the target—all he has to do is to watch the arrows and keep them all pointing at the moving object on the screen.

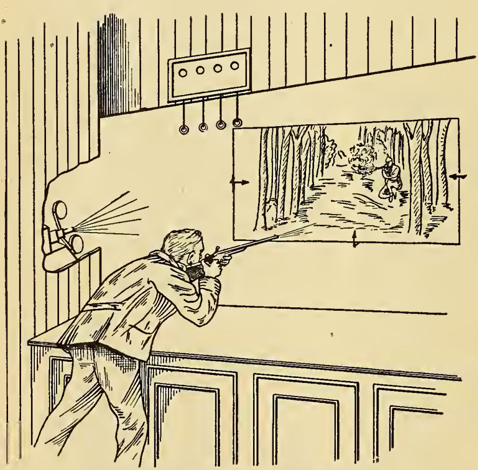


FIG. 1. SHOOTING AT MOVING PICTURES

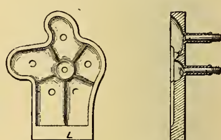


FIG. 2. CONTACT MAKER FOR THE TARGET

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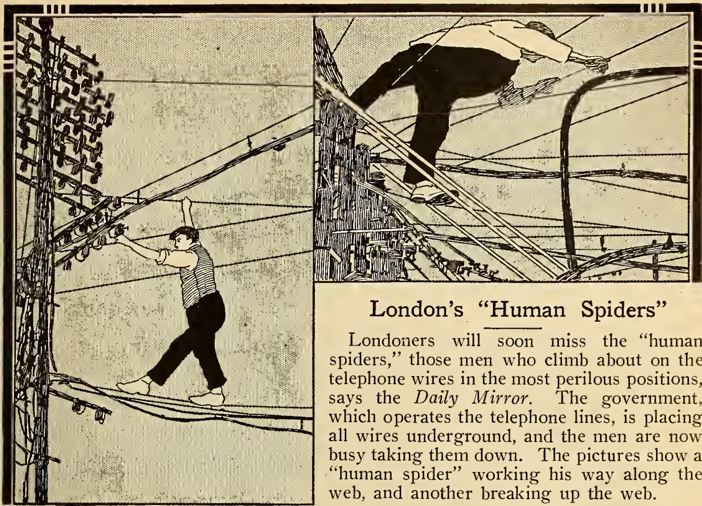
Electric energy with which to operate machinery in nearly all the mines surrounding Johannesburg, South Africa, will be generated by a station that, the specifications indicate, will be probably one of the two largest in the world.



## London's "Human Spiders"

Londoners will soon miss the "human spiders," those men who climb about on the telephone wires in the most perilous positions, says the *Daily Mirror*. The government, which operates the telephone lines, is placing all wires underground, and the men are now busy taking them down. The pictures show a "human spider" working his way along the web, and another breaking up the web.

## Electric Heating in Sweden

According to the director of the Gottenborg, Sweden, municipal gas and electric power station, the experiments carried on in Gottenborg last winter prove that it is practicable to use electricity for general heating purposes, and formal notice is now being given to the effect that the city is prepared to dispose of a certain amount of electrical energy for this purpose.

Since the current for heating can be supplied only between certain hours in the night, it is necessary to have the heat stored in accumulators of some sort to prolong it into the day. For this purpose the ordinary Swedish tile stoves are used, as well as specially constructed accumulators made of pot stone or similar heat resisting material.

In the 22 experiments arrangements were made for heating 86 rooms, 55 ordinary tile stoves being fitted with the necessary apparatus, averaging 1.42 kilowatts, and nineteen smaller stoves with an average of 1.72 kilowatts each. In the experiments 87,473 kilowatts were consumed. The results were found to be rather different in different apartments, much depending on the arrangement of the different heating devices. In seven of the experiments the cost of the energy consumed amounted to three öre (öre = $0.00268) per kilowatt, while in five instances it was between two and three öre and in ten cases less than two öre per kilowatt.

The director of the municipal plant informs the city council that, as a result of the experiments, he is convinced that heating living apartments by means of electricity is economically feasible at a price of three öre per kilowatt, provided proper arrangements are made for installation and storing. At his suggestion the price to the consumer has been fixed per kilowatt year, with an additional price per kilowatt hour to prevent wasting of the current.

# Efficient Plan for Canvassing Election Returns

**By CHARLES F. BOWEN, State Editor of The Manchester, N. H., Union**

To any daily newspaper of large circulation, election night presents the following problem for solution:

Given a certain number of towns in the state, how can the election returns be canvassed promptly, accurately and thoroughly and with the lowest possible outlay of money in gaining the result desired?

The *Manchester Union* is an unique paper in that it is one of the very few which have an entire state to cover, not only in the way of news gathering but in the way of furnishing news to subscribers. It is therefore a matter of prime importance that the election be canvassed thoroughly and promptly for the morning edition of the day after election.

Now, in New Hampshire there are nearly 290 towns and some of them are set down in the heart of wildernesses. Others have no telephone connection and some, so small that but two votes were cast in September primaries, this year, cannot tell in advance whether there will be an election or not.

A great deal of money could be wasted in covering New Hampshire's towns, for instance by having each correspondent (the *Union* has one in every town), telephone or telegraph into the office at Manchester the results that day or night. This would be prohibitive in cost and would not be feasible because of the failure of some of the less energetic correspondents to get the returns in promptly.

POLITICAL ROOM AT THE NEW HAMPSHIRE "UNION" OFFICE, SEPTEMBER 3, 1912. GATHERING RETURNS FROM THE BIENNIAL PRIMARY ELECTIONS

The plan devised by the writer and used with great success is dependent upon telephone toll centers. From an inspection of the telephone map of New Hampshire, shown herewith, it is seen that the entire state is dotted with centers from which radiate in all directions local telephone lines to smaller towns or smaller toll centers. As a general thing the correspondents at these centers are better than at smaller places because the places are usually bigger, busier and more newsy. As far as is possible, then, the returns are handled from toll centers, the reporter at those places being assigned all the towns for which his is the center. It is thus possible to get the number of reporters at work on the returns down to 55 and still get all of the 290 towns.

The reporters collect from the places assigned them and then file the entire collection via telegraph or telephone. A great many dollars in toll bills are thus saved. It is also more convenient for the office to handle the returns in this way, for it is possible to so instruct the 55 reporters in the manner of making up the dispatches that the copy will require but little editing at the office, whereas 290 messages would likely enough be all different and give a great deal of trouble in arrangement.

The accompanying picture, taken especially for Popular Electricity Magazine, shows the political room at a dull primary election, Sept. 3d. At the general election of November four times as many men will be engaged. In tabulating the vote, the data from the reporters goes first to the "governor man," so called, who takes off the vote cast for governor and checks it. It then goes to the assistant who handles the councilor vote in the several districts, next to the "senator man," and so on down to register of deeds and register of probate. Most of the telephoning is done in other parts of the building where the calling of numbers and repeating of votes will not disturb the computers. When a vote is nearly complete adding machines are set to work to determine the totals. To supplement these printed blanks with stamped-addressed envelopes are sent to every town clerk with request to mail them to the *Union* promptly when he determines the vote cast.

In making up the assignments of towns, access was had to a regular telephone tariff book, such as every chief operator has. This book gives the toll center for every town and city and affords a ready means of dividing up the state. This system of working by tele-

SHOWING TELEPHONE TOLL CENTERS AND GENERAL DISTRIBUTION PLAN

phone and telegraph has proven the most satisfactory yet used and has certainly been the most economical, for in many cases where towns seem near enough by airline where measured on the ordinary map, it is found that they are connected to totally different toll centers and that telephone connection between them is very expensive.

## Light for Sultan of Lahej

One of the recent purchases made at Cairo, Egypt, by the Sultan of Lahej is a dynamo for generating light in his palace at Lahej, an Arabian town eighteen miles northwest of Aden. A large number of electric lamps, wires and other fixtures have also been purchased.

# Electrical Invention and a Larger Patent Office

By WALDON FAWCETT

There is a strong prospect that after years of waiting and ever increasing need, the inventors of the United States are at last to enjoy the benefits of a new and larger Patent Office. Every man who has at any time in recent years essayed to take out a patent on any child of his brain can appreciate how the interests of the whole inventive community will be served by improved facilities for the governmental handling of patent applications.

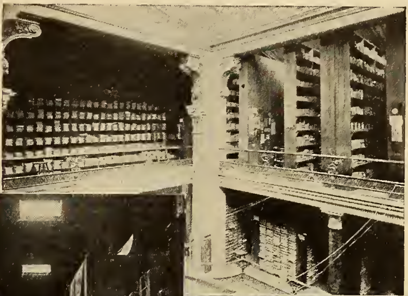
President Taft's Economy and Efficiency Commission Just Appointed to Investigate the U. S. Patent Office. Left to Right—Dr. W. F. Willoughby, Harvey S. Chase, Dr. F. A. Cleveland (Chairman), Prof. Frank H. Goodnow, Judge W. W. Warwick, M. O. Chance

Edward B. Moore, U. S. Commissioner of Patents

In the expectation of the persons best qualified to judge a new and enlarged United States Patent Office, such as it is now proposed to erect, would be synonymous with a number of separate and distinct blessings for inventors as a class. To mention only a few it may be cited that the facilities of the modernized institution would expedite the examination of applications and the issuance of patents. Adequate record and filing equipment would facilitate the work of inventors and others who desire to consult the archives of the Patent Office and who are hopelessly handicapped by the present congested conditions. Museum space would be provided for the display of some of the nation's most interesting relics—the original patent models of notable inventions, including a number of early electrical inventions.

jeopardy include not only the original papers in all patent cases, but also all records of deeds of assignment of titles to inventions. The latter are of the greatest value in determining the ownership of valuable inventions. Just imagine, for instance, the confusion that would follow the destruction of the deeds of assignment in the electrical field where so many of the most valuable patents have been transferred. And as though the menace of fire were not sufficient the present Patent Office holds another bugbear through the

**A Typical Corner in the U. S. Patent Office**



**The Unfortunate Fate of Valuable Models of Patents—Stored in a Damp Basement**

**The "Search Room" Where Inventors Consult Files of the Patent Office—Somewhat Crowded**

After all, however, perhaps the most potent argument in favor of a new Patent Office is found in the dangers that beset the secret archives of the office, which if destroyed could never be replaced and the loss of which would work untold damage to the commercial and inventive interests of the country. The present Patent Office structure is not fireproof and every nook and cranny of it is piled high with tons upon tons of inflammable matter comprising these valuable papers. The documents thus in present necessity of storing some records in the basement of the overcrowded building. Indeed, only recently many tons of valuable papers were removed from the basement in a rotted condition, owing to the dampness.

Thomas A. Edison and other workers for the broad cause of invention have pushed energetically during the past few years the agitation for a new Patent Office and an improvement of the entire patent system. The delay in providing a new building has been particularly inexplainable to many persons because the Patent Office is one of the few institutions of our government that is self supporting. More than that, the surplus of receipts over expenditures now amounts to more than $7,000,000 and it is argued that some if not all of this sum should be used to furnish larger and better quarters with modern facilities for the force, which would then be in a position to accomplish the best possible results in the work for which the inventive public pays the total cost.

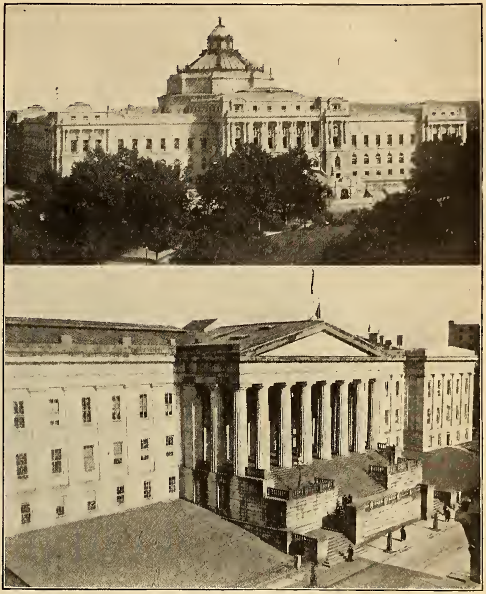
But, as has been said, the dreams of a millennium in the patent situation appear to be on the eve of realization. Such has been the pressure of public sentiment that both of the leading political parties have declared in favor of a revision of the patent laws at the next session of Congress with a view to improving conditions in general, and with the specific object of so increasing the rigidity of Patent Office examinations as virtually to prevent the issuance of patents except for real inventions. By thus strengthening the validity of patents, a United States patent will become a more valuable asset for the inventor. He will not be confronted, as at present, with a prospect of prolonged and costly litigation to determine his patent rights, and this dependability of the government guaranty on an invention is expected to do much to stimulate invention and industry.

At the last session of Congress the sum of $10,000 was appropriated to enable the President's Commission on Economy and Efficiency to thoroughly investigate the United States Patent Office as to methods, personnel, equipment and building, and it is expected that the findings and recommendations of this board of business experts will serve as a guide in the rehabilitation that is now in prospect. The most promising proposal for a new Patent Office contemplates the erection of a monumental building on Capitol Hill, facing the United States Capitol. The new Patent Office would, in that event, be architecturally a companion structure to the beautiful Library of Congress and would be erected on an adjoining site. Such an arrangement would be eminently fitting as it would bring into close relation the two governmental institutions which were fostered by the same clause of the Constitution and which are kindred in purpose. Furthermore, the proximity of the structures would greatly facilitate the researches of inventors and others who may desire to consult books and records in the Congressional Library as well as in the scientific and technical library of the Patent Office.

The provision of a new Patent Office and the adoption of an improved administrative and examining system would hold greater significance for no class of inventors and producers more than for the devotees of electricity. The explanation is found in the fact that applications for electrical patents are especially numerous and, as a rule, require particularly thorough and detailed examination. Furthermore, the present quarters of the electrical examining divisions of the Patent Office—located on the ground floor and poorly lighted—offer exceptional opportunities for improvement. And finally, this overhauling of the patent system comes at a most opportune time for electrical interests, for such has been the recent increase of inventive activity in the electrical arts that the need for added facilities for the examination of patent applications in this field is well nigh imperative.

The importance of electrical science in the operations of the Patent Office is eloquently attested by the fact that there are four divisions of the institution devoted to the examination of electrical inventions, whereas no other industry in the whole range of human activities is represented by more than a single division in the Patent Office. This apportionment of responsibility, or specialization, in the examination of electrical inventions has been a development of the past quarter of a century. Prior to that time all electrical inventions of whatever character were passed upon in one division. This original division, known as Electrical Division A, continues in existence but its scope is now restricted to telegraphy and telephony.

In the year 1886 Electrical Division B was created and has jurisdiction over the subjects of generation and motive power. Then in 1902 there was further subdivision of the interests of inventors working with the magic current by the creation of Electrical Division C, which concerns itself with conductors, electric lighting and general applications. The fourth division in the group is that of Electric Railways and Signaling and, as may be surmised from the name, is a highly important one. Even this elaboration of Uncle Sam's machinery for passing judgment upon electrical patents would not suffice to keep pace with electrical progress had not the Patent Office in recent years adopted the policy of not burdening the examiners in the electrical divisions with inventions in which only a minor or supplementary use is made of electric power. One of the veteran electrical experts tells, for instance, of an experience of the early days when he, wholly ignorant as to the process of manufacture involved, was called upon to examine a huge machine for manufacturing horse shoe nails simply because one minor operation in connection with the feeding of the raw material was performed by electricity. There is no such "lost motion" in the Patent Office in this day and age. A newly invented machine, destined to be operated by electric motor, does not require any attention from the electrical examiners unless the motor represents an innovation in some form.



**At the Bottom Is the Present Patent Office Building and Above Is the Congressional Library, Which May Be Taken as a Pattern in Constructing the New Patent Office**

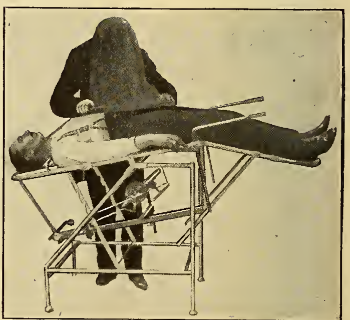
But for all that the Federal experts are thus concentrating their attention upon distinctly new achievement in the electrical field, the activity in the electrical inventive field in recent years has been such that the facilities of all the electrical examining divisions are sorely taxed, and in no section of the Patent Office is the need of larger quarters and better equipment felt more keenly. It seems as though a trend of development had been delegated to congest each of the several divisions. The marvelous evolution of wireless telegraphy and wireless telephony has provided Division A with heavy new responsibilities. In the case of Division B there is the same story to tell owing to the new theories and practice with reference to motors and transmission, the increase in polyphase work, the introduction of electric starting devices for automobiles, and the present activity of invention in the field of electric elevators, the aim and object in this latter field being to attain greater safety and greater speed. In Division C the appearance of mercury vapor lighting, the tungsten lamp, etc., may be cited as indicative of multiplied duties for the examiners and every reader will realize instinctively that much study and research has been required to enable men to sit as arbiters in that complex inventive field which embraces electric railways and signaling—a sphere in which the past decade has witnessed the appearance of many new factors, revolutionary in influence.

Generally speaking, the examination of electrical inventions at the Patent Office involves more tedious and painstaking work than is required in almost any other branch. In many mechanical fields it is possible to pass upon inventions by merely consulting the drawings submitted, but in the case of most electrical inventions it is necessary to also refer in detail to the specifications furnished. The electrical examiners are also called upon to consider an undue proportion of what are known as "paper inventions," that is electrical inventions which have never been tried out in practice and which in a large number of instances are not patentable. Visionaries with schemes of the "perpetual motion" class are also more or less heavy contributors to the grist of applications for electrical patents.

An interesting side light upon electrical invention is found in the increasing proportion of the whole number of electrical patents granted which now go to inventors employed on a salary or other basis by the large electrical corporations. Such firms are no longer open to the suspicion that they seek to steal the ideas of a resourceful employee. On the contrary they encourage employees in all branches of the industry to submit inventive ideas, rewarding them liberally when the proposed inventions prove serviceable.

## Novel X-Ray Apparatus

A new X-ray apparatus, which the engraving represents, has been brought out in Paris in order to carry out surgical work for the army in the field. The operating table is entirely metallic except the upper part, and can be adjusted to take all positions. Underneath the table



X-RAY APPARATUS WHICH CAN BE USED IN A FULL LIGHTED ROOM

is a cross bar carrying an X-ray bulb which can be slid along and adjusted, and this allows the surgeon to inspect by using the rays at the same time that he is operating, so that he works more surely and quickly. It is now an easy matter to find the exact position of bullets in the body by means of the new Ducretet and Roger apparatus, and one of the new points is the use of a dark box with cloth which covers the operator's head so that he can see the X-ray shadow on the screen while in a full lighted room, and darkness is no longer needed. This gives the advantage of allowing other work to go on at the same time.

## Quartz Working

Since it takes an exceedingly high temperature to melt quartz, so as to make it up into tubes or vessels, it is only within the last few years that the proper methods have been found for doing this. On the Continent, practically all of the quartz vessels come from Germany, and they are a great aid where substances need to be heated to a high point where glass would melt.

FINISHING QUARTZ TUBES AND SOME OF THE PRODUCTS

M. Billon Daguerre is now using an electric furnace of his designing by which he hopes to start the new industry in France, and he is now turning out tubes and many shapes of vessels.

Pieces of the transparent rock crystal are put into a crucible and then this is exposed to the powerful heat of the electric arc so that at a certain heat the quartz begins to soften. Then the operator takes out a piece and continues the heating by the oxy-hydrogen blowpipe so as to make up the quartz into a thin rod. By winding this around in spiral and then melting together, he can fashion a tube or a vessel of any usual shape and even some complicated ones, but this process requires a special skill on the part of the workman.

The quartz is not entirely melted in the electric furnace, but is only softened, as this method is found to be the best.

Quartz thermometers are the latest achievement, and they can be used to register high heats where glass would melt. Tubes for mercury vapor lamps are also made in this way.

## Street Car Efficiency in Germany

Vice Consul General Roger C. Tredwell, of Dresden, states that the city authorities who control the street car service of Dresden have put in force a system which greatly increases the efficiency of their lines. By their plan it is possible for a stranger to make immediate use of the street railways without either speaking a foreign language or having any of the advance knowledge that is needed in getting about by street car in many cities of Europe and America.

Each of the eighteen car lines is known by number instead of by name, as this makes possible the system of public indexing which is in vogue here. Cars belonging to lines of even numbers are painted red, odd numbers yellow. The number is placed conspicuously on each car, together with the general route, which is indicated by side signs.

Every car carries a conveniently placed piece of glossed cardboard, on one side of which is a route map of all the car lines, together with their numbers, and on the reverse a map showing the various numbered zones into which the city is divided.

The terminals of each line are indicated by signs inside the cars, by which passengers may tell the direction in which they are traveling. As a means of advertisement each car is furnished with a clock and a daily newspaper.

In order to expedite the service cars stop only at specified places, all of which are marked by red signs attached to lamp posts. These often occur in the middle of a block where the stopping of a car will interfere least with the traffic. The lamp globes show bands of red which make them easily seen at night; and the zones in which they are found are indicated on the posts by bands of white paint, one for each zone. These assist passengers in estimating the correct fare, which is charged according to the zone system. Small white signs project over these bands, showing the numbers of the car lines passing there and the names and directions of the terminals of each line. At the principal railway stations and at other important centers illuminated index signs have been placed for the convenience of strangers. Every street corner is conspicuously labeled in blue with the name of the street and the numbers of the houses included in each block.

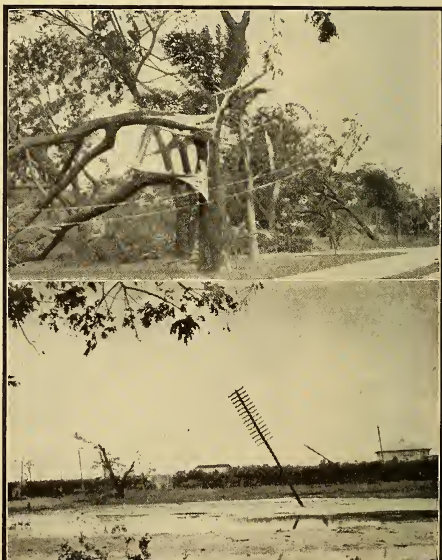
## WHY CONDUITS ARE NECESSARY IN THE PHILIPPINES

The cable, telegraph, and telephone companies of the Philippines, especially in the city of Manila, have found the use of underground conduits especially desirable, not so much because of looks and as a means of avoiding accidents, but for a maximum of safety to transmission lines.

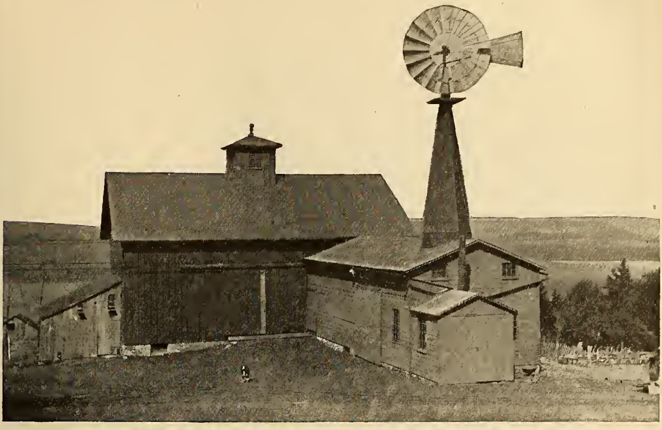
The typhoon reigns as storm king in the Philippines, and some storm king he is, too. Our cyclones and tornadoes are back numbers compared to a typhoon, and the electric pole line that can successfully withstand the onslaught of a full grown typhoon has yet to be built. American electrical engineers after having their systems completely disabled by typhoons soon realized that conduits were the only solution of the problem.

If the wind itself does not succeed in blowing down pole lines, falling trees and the homes of the peasantry, sailing through the air on the installment plan, never fail to carry the lines to the ground, snapping wires and poles.

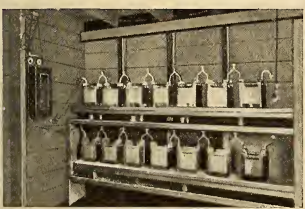
The transmission lines of the trolley system are reenforced to withstand the force of the typhoons, but in some of the worst storms occurring since American occupation the street car system has more than once been paralyzed, fortunately, though, not for lengthy intervals, owing to the efficiency of the company's management.



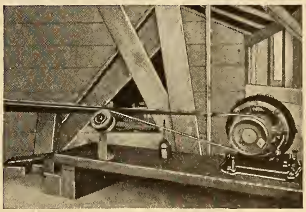
THE RESULTS OF A TYPHOON



LIGHTING PLANT ON THE FARM OF J. F. FORREST, POYNETTE, WISCONSIN



FARM STORAGE BATTERY



FARM DYNAMO

## WINDMILL FARM LIGHTING PLANT

The question as to whether or not a windmill is a satisfactory source of power for operating a farm electric plant is difficult to answer. Windmill manufacturers say it is not, and they have done a lot of experimenting along that line. The wind is too erratic, they say, and the difficulties to be overcome in designing the right control devices and in building a satisfactory storage battery to stand up under the arduous duty it has to perform have so far prevented a standardized equipment of this type from being put on the market.

On the other hand, instances have been cited where a plant of this kind has been put into successful operation, using the standard type of storage battery with a cut-in arrangement permitting it to be charged by a windmill driven dynamo. One such is the plant of J. F. Forrest, of Poynette, Wis., which is briefly described in a paper by Mr. Putnam A. Bates, consulting engineer of New York, and presented at the annual convention of the American Institute of Electrical Engineers, held in Boston last June. We quote from this paper as follows:

"In this instance, a small dynamo (six amperes, 35 volts at 450 revolutions per minute) is belted to the vertical shaft of a windmill. As the mill speed is not constant, an automatic cut-in is introduced in the electric circuit between the dynamo and the storage battery, from which the lighting current is taken, the charging of this battery being the sole duty of the dynamo.

"This plant develops current for 24 fifteen watt 25 volt tungsten lamps. Its whole cost was $250, exclusive of transportation, but including windmill, dynamo, storage battery, automatic cut-in, wire, porcelain insulators, sockets, switches and tungsten lamps. The owner did the complete wiring and arranging of the lights and switches. The two years of successful operation and the cleverness of the lighting scheme, which embodies several two-way and three-way switches for distant control of both exterior and interior lights, is certainly an indication that Mr. Forrest, who runs a farm of some hundred or more acres, has done for himself what many other farmers may also do by a little planning and some interesting labor."

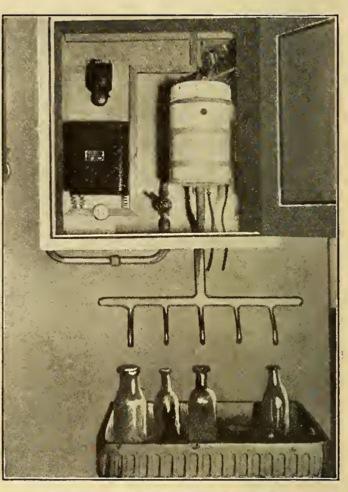
## Electric Propulsion for Lake Boat

An order has been placed by the Montreal Transportation Company with John Reid & Company for an electrically propelled vessel for lake traffic. The vessel will be of 2,400 tons and 300 horsepower.

The engine will be of the Diesel type and will drive an alternating current generator whose power will be applied to large induction motors connected to the propeller shaft, which will have a speed of about 80 revolutions per minute. Control will be had by means of switches mounted on the bridge.

## French Water Sterilizer

Ever since Prof. V. Henri, of Paris, and others found that the ultra-violet rays from the mercury vapor lamp will kill microbes instantly, it was desired to adopt this very useful method for practical appliances. The water sterilizer made by the Société Internationale is of great interest, as any household, public school or the like can use it when electric current is at hand. The apparatus is

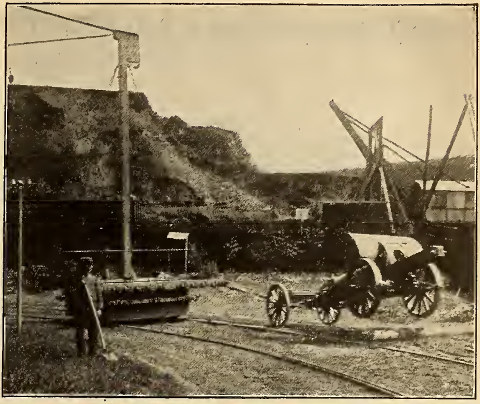


ELECTRIC WATER STERILIZER

simply connected on the water mains and the current brought to the mercury vapor lamp which is inside the water tank. All that is needed is to turn the water tap, when there is given a regular flow of very pure water, quite free from any germ life.

Authorities on questions of health advise the public to wash with water of this kind all food, such as salads, fruits and the like, which are to be consumed raw, as it is well known that many epidemics arise and spread through lack of such precautions. The apparatus avoids the use of boiled water with its flat taste.

## Testing Gun Carriages at the Krupp Works



A STRENUOUS TEST FOR GUN CARRIAGES

At the great artillery works of the Krupp Company at Essen, Germany, a circular electric track is laid out in order to give a test upon field cannon or ammunition wagons. Upon the track runs an electric car, and the cannon are attached to it so as to be drawn around the track and put through many kinds of endurance tests. A circular ring for drawing the cannon lies on the outside of the electric track, and it is paved in some parts and in others represents country roads of different kinds, such as are met with in real practice. The electric car is much better than horses, as it can make high speeds so as to put the cannon through a severe strain.

## Electricity Creator and Destroyer

The human body is a good conductor of electricity in the same way that the air is a poor conductor. But the body is composed of such a number of substances that it is evident some of its parts must be good conductors and others bad. Those which are good in such a case convey the current easily, those that are not so good either convey the current with resistance or refuse to convey it at all. These two factors respectively are considered in the use of electricity for purposes of medicine and electricity for purposes of execution. The electric current that the doctor gives in his private office for the soothing of pain is the same electricity that is given in the death chamber of Sing Sing, only there is more of it in the latter case.

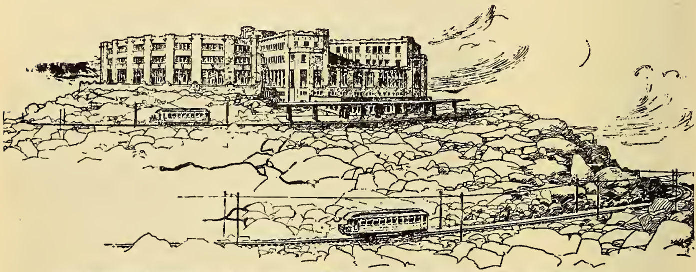
Among the substances in the human body which are good conductors of electricity is salt, chloride of sodium. This compound is what is called an electrolyte —that is, it really breaks up into its simple parts when the electric current is passed through, and under certain conditions of the body this is of value. For some conditions of malignant growths the use of the direct current is of help in assisting a cure, the acids and alkalies set free by the current helping the molecules of the tissue of the body to build themselves up again.

When, however, the current is so strong that the substances in the body which are good conductors of electricity are not enough to carry the current, it stands to reason that the force makes its way at any cost, so thoroughly disrupting the resisting tissues that death ensues. It is the realization of this which makes electricity in medicine something to be used with the utmost caution and only by the hands of the most expert. Modern science is advancing daily in the understanding of the relation of electricity to life, but so far, our knowledge is very incomplete.

DR. L. K. HIRSHBERG.

# Circular Railway Up Mount Washington

By LIVINGSTON WRIGHT



CIRCULAR RAILWAY AS IT WILL APPEAR AT THE TOP OF MT. WASHINGTON

The most unique electric railway in the country will be that recently surveyed for Mt. Washington. This novel railway is only part of a huge improvement project for providing this famous mountain with the most up-to-date summer resort appointments. An outlay of over $1,500,000 is to be expended upon the railway, power plant and, at the summit, upon a magnificent new hotel, which is to be erected. It will be the only hostelry in the world that can boast of having a mountain top sticking through its floor!

The new electric road will supplant the celebrated "cog wheel" railway, which ran its first train up the mountain in 1869 and cost $150,000. The new line will be about 20 miles in length and will circle the mountain 2½ times before it reaches the summit.

The present railroad (Boston & Maine) from Fabyans to the base, a distance of seven miles, will be electrified. From here, the new line will have a station at Bretton Woods, where the Mt. Washington and Mount Pleasant hotels are. Then, turning to the left the line passes Lake Carolyn and the Bretton Woods golf links, along the rocky gorge of the Amoonusuc. The southern peaks of the Presidential range are seen at the right—Monroe, Franklin, Pleasant, Clinton, Jackson and Webster. Mt. Washington is supported on the left by Clay and Jefferson. The line climbing higher reaches the base, 1,000 feet above Fabyan and Bretton Woods.

At the base the new electric railway up the mountain begins. It starts at exactly right angles to the present line and at several points runs directly away from the summit of the mountain.

On the west slope of Mt. Jefferson, the new route presented extreme difficulties, making it necessary to put in two switchbacks. In a direct line from Jefferson Notch to the highest point to which the railway runs is a distance of less than a mile and a half, but by the new line it is six miles long. After the road passes over itself, it runs back toward Base Station, but always climbing higher. At the first switchback, there is in front a sheer drop of a thousand feet. It can be realized that as a scenic purveyor, this new electric line is going to give passengers the value of their money. Every ingenuity that could be devised for doubling and twisting and careering in order to enable tourists to "see it all" has surely been taken advantage of.

Coming in sight of the Lakes of the Clouds, the road makes an abrupt turn to the left, beginning the circling of the summit and giving a wonderful view down into Truckerman's Ravine. Climbing higher, it runs above the Alpine Garden and unfolds views toward North Conway, Lake Winnepesaukee and Portland. Making a turn to the left the road doubles back and crosses the carriage road, looking down into the Great Gulf with Spaulding Lake about 1,200 feet below. Again in crossing the old cog road the electric line completes a circuit of the summit but makes another complete turn and comes to an end in front of the new hotel, having run two and a half times around the top of Mt. Washington.

Unique among hotels will be this hostelry on the highest peak of New England. Every room will be an outside room and there will be 100 of them. In planning it the most unusual features have been incorporated. The architect who planned the new hotel had had years of experience in this particular specialty of mountain resorts, having, among others, incorporated many new features in the Yellowstone Park hotels. Accordingly, one special aim was to secure ample accommodation both for those who would stay at the summit but a few hours and for those who would spend the night. Thus, a dining-room to seat over 400 will be one of the features.

The observatory of the hotel, 150 feet in diameter and with glass sides, will be located on the very highest tip of the mountain and a picturesque feature will be in having the tip of the mountain itself protrude through the floor so that one may stand on the summit and view the horizon for 312 degrees of the circle.

On completion of the new electric line, the venerable "cog wheel" will be abandoned.

The pumping station at the base to supply the summit with water is already completed, as is the pipe line to the summit. This plant is unusual in that the water is pumped in one stage or lift from base to summit, an altitude of 3,700 feet, and the pressure consequently is tremendous.

The power plant which will generate the electricity to keep this vast enterprise of railway, hotel and subsidiary plants in operation will be located on the Amoonusuc river at the base.

Electric cars will start at Fabyans and run through to the summit without change in less than two hours.

## An Electric Heater for the Table

The very convenient little electric radiator illustrated is made by a Paris firm, and it may often come into use where only a small amount of heat is needed. The new radiators of this type make use of an electric resistance of a very fine metal wire disposed in the form of a grid, and the wire takes but a small current but

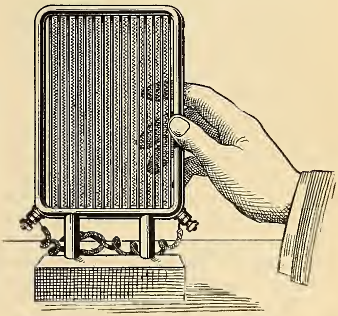


TABLE OR DESK HEATER

at the same time gives out a good amount of heat.

The small radiator which here is represented is designed to be placed on an office desk or a table and in such cases it will be useful to many persons who have cold hands, even in rooms which are otherwise heated. A good warmth is thus secured without obliging them to change their place. Larger sizes of radiators on the same principle are also made.

# Sir Joseph Beecham Comments on English Electrical Affairs

*Sometime ago we sent letters to our foreign subscribers, who represent almost every civilized country, asking them to write to us in return, telling something of themselves and of the electrical conditions in their locality. Among letters so far received is one from Sir Joseph Beecham of Ewanville, Huyton, near Liverpool, England. Sir Joseph gives some interesting facts concerning the municipality of St. Helens, of which he is mayor—particularly the electrical undertakings—and the following is quoted from his letter.—Editorial Note.*

"You ask me to tell you something about myself and my surroundings. My business is the manufacture of an article well known in your city and country. The business is carried on at St. Helens (six miles from here), of which city I am mayor for the third time.

"It will probably be of interest if I give you some particulars as to how the city is governed. It is divided into nine wards, each ward returning three councillors, who are elected by the people for three years, one retiring each year. These elections take place on November 1st. Each ward is also represented by one alderman (someone who has had considerable experience in municipal work) who is elected by the councillors, and usually for a term of six years. This brings the total number of the council up to 36 members. Once a month the whole of the council meet, when the minutes of the various committees are brought up for confirmation and discussion. At this meeting the mayor presides.

"The city owns its own water, gas and electricity, also other undertakings. These and other departments such as health, parks, highways, finance, etc., are each managed by specially appointed committees of the council under the direction of a chairman. I am chairman of the electricity committee. Only the permanent officials are paid, everyone else giving his time and services free, the desire being to obtain good local government.

"A description of our electricity undertaking will, no doubt, interest you more than anything else, so I will give you a brief outline of what has been done.

"Our population is about 97,000. The electricity committee was formed in 1895, and I have been the chairman since November 1899. In 1896 the installation at our lighting and power station consisted of Lancashire boilers and two Ferranti steam alternators supplying single phase energy at 2000 volts. Very shortly afterwards, the council decided to construct tramways, and, when the question of the enlargement of the power station came up for discussion, it was decided to erect an entirely new station on a fresh site, putting in plant for generating continuous current, and scrapping the old plant. St. Helens is a scattered city, and, as the demand for power grew from the more distant manufacturers, it was decided in 1909 to install an extra high tension, three phase alternating plant at 6000 volts, 50 cycles, which is transformed to 230 volts for lighting and to 400 volts for power.

"In April last year a 100 kilowatt Westinghouse turbo-alternator was put down, and this has since been working very satisfactorily. As the business further increased, it was decided to put in a further 2000 kilowatt turbo-alternator, and this was started at the beginning of the present month.

"We have in the station rotary converters of a total capacity of 1000 kilowatts, thus enabling us to use energy from these machines for tramways, lighting, etc.


SIR JOSEPH BEECHAM'S HOME AT EWANVILLE, HUYTON

"Our sales during the past year amounted to 5,000,000 units (kilowatt hours).

"Our charges are 3½d. (seven cents) per unit for lighting, and one penny (two cents) per unit for power, with discounts up to 40 per cent, depending upon the amount of energy taken and the load factor. There is no charge made for loan of meters.

"Our cost of production has been brought down to .54 of a penny (just over one cent) per unit. Next year ending March 31st, now that the new turbo-alternator is running, we hope to bring the cost below one cent.

"I might add that I put in a plant for lighting my house here in 1886. The installation was one of 50 volts, the dynamo being driven by an eight horsepower gas engine, which charged the battery in the daytime. A few years ago I was able to obtain current from an outside source, and I have done so since. This is 100 volts alternating, and, as I have an organ in the house, it is necessary to use a motor-generator for blowing same.

"The price I am charged for current by the firm which supplies my house is eight cents per kilowatt hour for lighting and two cents for power and heating, irrespective of quantity.

"You ask if I am an American. I am not, being a native of this country. At the same time, I know your country very well indeed, having crossed the Atlantic 52 times, and the continent of America four times. I have been several times in Chicago, my first visit being in 1879, when I stayed at what was then one of the principal hotels, namely, the Grand Pacific. I have visited the city a number of times since.

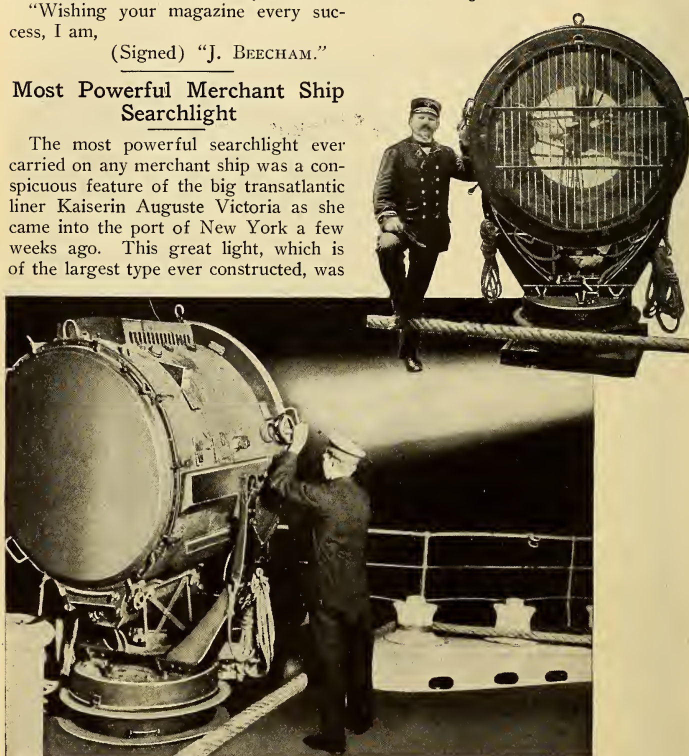
"You will probably wonder how I became acquainted with your magazine. It was at an Electrical Exhibition in Madison Square Garden, New York, in October, 1910, where I subscribed for it. I think it is an excellent magazine, the name is very appropriate and the various articles are written in a manner that appeals to the vast majority of people who wish to be interested in such subjects, but usually find them written in language full of technical terms suitable only to the experienced electrical engineer. I have shown several copies to our electrical engineer, who informs me that he has read them with great interest. There is no doubt that such a magazine is bound to become more increasingly popular as it becomes more widely known.

"Wishing your magazine every success, I am,

(Signed) "J. BEECHAM."

## Most Powerful Merchant Ship Searchlight

The most powerful searchlight ever carried on any merchant ship was a conspicuous feature of the big transatlantic liner Kaiserin Auguste Victoria as she came into the port of New York a few weeks ago. This great light, which is of the largest type ever constructed, was carried on that trip thoroughly to test it out on sea and entering harbors, after which the same type of lamp will be installed on all the big ships of the line. It threw a beam of light of 80,000 candlepower. On approaching port the light was turned on the Scotland Lightship, rendering the name of the ship clearly visible at a distance of several miles. The great light is effective for seven miles across the open sea and when thrown upon the clouds is clearly visible for a distance of 30 miles.



THE GREAT SEARCHLIGHT OF THE KAISERIN AUGUSTE VICTORIA

The searchlight was carried on the bow of the ship on this the trial voyage, but it will later be installed in the lookout, high up on the mainmast where it can be quickly swung to any angle. It is of the type used heretofore only on the largest dreadnaught battleships. The lens is 42 inches in diameter. It is operated on a

110 volt circuit and consumes 13,000 watts or over seventeen horse power of electrical energy. In actual tests at sea the rays pierced fogs and distinguishable distant objects at every point of the horizon.

## What Is Electricity?

Some years ago, says Mr. John S. Bleecher, in the *Public Service Journal,* when I was instructing motormen in the art of operating street cars, I thought it would be a good plan to prepare a set of questions as a sort of examination for them to pass before approving their instruction as complete, and at the top of the list I put a test question, believing that the kind of an answer I got to this question would indicate the kind of a man I was dealing with.

The question, which even scientists cannot answer, was "What is electricity?" I received many and different answers, displaying originality and inventive genius. Sometimes a man would be frightened by the first question and fall down on the entire list. Such a man I knew was not the proper material for facing emergencies which arose on the front end of a street car. Other men would become discouraged because they did not know just how to answer the question and some would give very interesting and illuminating answers.

One said that "electricity was a kilowatt, and that a kilowatt was a little green bug." Another, "electricity is hot stuff." There is one answer that I did not get but which I believe is the best answer of all, and that is *"electricity is efficiency."*

## A Greenback Laundry

During "Made in Chicago" week in that city a prominent home laundry machine company made its display and salesrooms well worth a visit, by laundering real money.

A Thor electric washing machine and an electrically operated and heated mangler did the work. From the National Bank of the Republic $5,000 in soiled bills varying in denomination from $1 to $20 was obtained. These bills were placed in the washing machine just like so many small articles, and after being washed were wrung out. Each bill was then ironed by the mangler, which left the money dry and clean and fit to be passed again.

REAL MONEY WASHED AND MADE USABLE WITH AN ELECTRIC WASHING MACHINE

## Ice Harvesting on the Farm

The views herewith present an ice carrying machine driven by electricity on the farm of Dr. Schuyler S. Wheeler. It is described in a paper read by Mr. Putnam A. Bates, consulting engineer of New York, before the annual convention of the American Institute of Electrical Engineers, held in Boston last June. In his paper Mr. Bates quotes from Mr. Wheeler as follows:

"The outfit was eminently practical and satisfactory in every way, and enabled me to fill my house with about 200 tons of ice, using five men and no teams. Previously it has been the custom to employ four to six teams four to five days in addition to these men."

When the bridge was fully elevated, 2.5 horsepower was required, current for which was supplied from the private generating plant ordinarily used for lighting and small power devices.

ICE HARVESTING MACHINERY OF THE MODERN FARMER

## Saving Lamp Carbon Stubs

Under every carbon arc lamp for street or park lighting will usually be found short pieces of carbon that the trimmer has thrown away. In Germany these stubs of carbon are used. After being taken from the lamp they are squared off on a motor driven grinding wheel and are then cemented to a new carbon. This repaired carbon is placed in the lamp with the stub end at the arc so that the old carbon is thus entirely used.

# Electricity in the Control of Fireworks Displays

Pyrotechnic art with the aid of electricity has reached such perfection that it is possible to produce immense and prolonged pictures of fire as great stage settings in the light of which actors portray the daily life and struggles of the people of a period.

Of these productions the most familar, the most stupendous and at the same time the one in which extreme care must be exercised in installing the electrical system is the production based upon Bulwer Lytton's great novel, "Last Days of Pompeii."

In Pain's presentation of this spectacle the electrical circuits are sixteen in number. It is mystifying to behold a building burst into flames when no one is near, and though the answer is "electricity" this does not explain the devices concealed behind burning Pompeii.

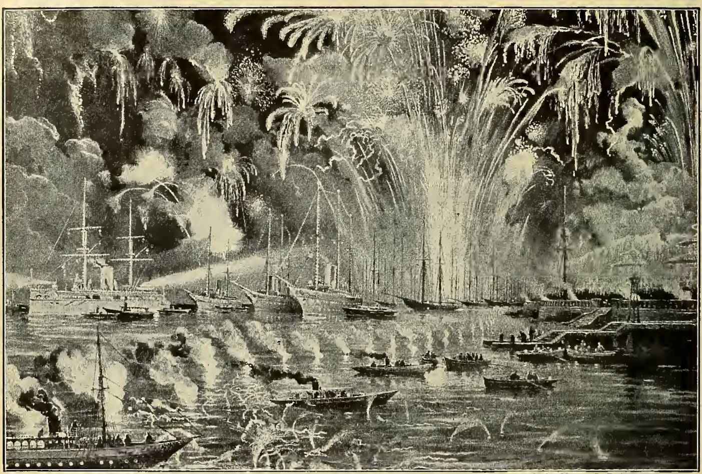
Back behind the Temple of Isis and Mount Vesuvius is a flat keyboard upon which is a circle of brass knobs. At the center of this circle is fastened one end of an arm so that the outer end may be moved at will over any of the knobs. Wires run from different parts of the painted city to this keyboard. One of each pair of wires is connected upon the under side of a knob and the other is connected to the movable arm. Beneath the keyboard is an electric battery.

In witnessing the production you remember the conclusion of the day's festivities, the march to Arbaces' palace, then to the Temple of Isis where the multitude all kneel save one, Glaucus, the Christian. Then follows the command of Arbaces that Glaucus should kneel. Glaucus refuses and the terrible combat before the altar is interrupted by signs of an eruption from Mount Vesuvius. Lightning flashes about the mountain and the crater spits fire.

Just here the operator at the keyboard has moved the arm around to a knob and made contact. Current speeds over the wires and the powder at the crater of the volcano is ignited. Another move of the lever and a long fuse hung upon a framework back of the mountain is set off. Along this fuse at intervals are charges of powder suspended like so many lamps along a wire. The fuse burns to the first charge. There is a flash and those "out in front" see lightning play about the mountain. As the fuse burns on, one after another of the "flashes" explodes, imitating nature's lightning. There are explosions in one place, then in another as the eruption becomes more violent—and the operator plays the arm about the mystic keyboard.

The buildings begin to fall in every direction, and the walls of the city crumble. It is a thrilling and realistic sight when viewed from the front, but back amid the falling buildings and lightning flashes it is wildly exciting.

The tongues of flame, the blinding smoke, the terrific explosions, all originate in very small firing caps or detonators as they are called, in which electricity heats a tiny bit of platinum wire laid in powder. Great care must be given the making of the firing caps or detonators else the current of electricity will not ignite the powder. The cap is a shell about one-fourth of an inch in diameter. It is filled with meal powder, somewhat similar to gunpowder, and a circular piece of tin that fits inside the shell is placed above the powder. There are two holes in the circular tin and an insulated copper wire passes through each into the powder. These wires are connected within by a small platinum wire. The upper half of the cap is filled with melted sulphur which hardens. When the cap is used it is attached to the fuse of the piece it is to ignite and by wires to the keyboard. When the arm presses the proper knob on the keyboard current enters by the copper wire,



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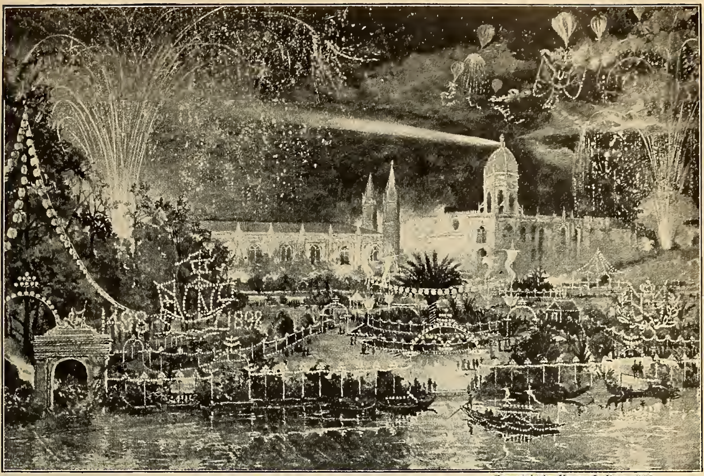
THE ROYAL YACHT SQUADRON REGATTA AT COWES

*Copyright by Henry J. Pain, 1905*

AT THE LOUISIANA PURCHASE EXPOSITION



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JARDINI JERONYMOS, LISBON, 1898. CELEBRATING THE 400TH ANNIVERSARY OF THE DISCOVERY OF INDIA

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DISPLAY AT DUSSELDORF, GERMANY

heats the platinum, sets fire to the meal powder and ignites the fuse.

It is by means of this little contrivance, powder and electricity, that the town of Pompeii is utterly destroyed night after night before wondering audiences and such gorgeous displays as those illustrated made possible.

## Dictating Letters by Telephone

In one of the large New York dry goods stores all correspondence is dictated through the telephone.

Ten stenographers are employed in the conduct of the store's correspondence. These stenographers perform their duties in one large room. In this room, a specially designed table has been installed which is provided with five typewriting positions on each side, the typewriting machines being placed about eight inches below the surface of the table. A ten-inch panel extends down the center of the table and on this panel, immediately in front of each stenographer's position, an annunciating drop and a spring jack are installed. Each of the ten typewriting positions is equipped with a breast transmitter and a head receiver terminating in a plug. The spring jack circuits connect to a 40 line standard sub-switchboard which is located at the head of the stenographers' table.

STENOGRAPHERS WRITING FROM DICTATION OVER THE TELEPHONE

With the equipment now installed, when the services of a stenographer are desired, the party wishing to give dictation merely lifts his receiver and says "Stenographer, please." His extension station to the main house switchboard is immediately connected by a tie line to the sub-switchboard in the stenographers' room. The operator answering the sub-switchboard glances down the stenographers' table, connects to the stenographer who is least occupied, and who immediately plugs into the spring jack with her head receiver and breast transmitter. This equipment permits both hands to be free and the stenographer can either take the dictation in shorthand or write it direct on the machine.—*The Telephone Review.*

## The Location of Electric Heaters

Turn electric heaters upside down if you wish, or fasten them on the wall, they operate as well in one position as in another. The idea of placing the means for heating rooms, etc., on the floor is one which has become so deep-rooted that when electrical heating devices were first designed for practical use, they were made so that they also occupied floor space. But this space is valuable in some places, as was the experience of a street car company which grew so rapidly that the waiting rooms soon became too small.

The electric heaters in these rooms were spaced about four feet apart on the floor all around the room and projected about eight inches from the wall. This space was saved by placing the heaters about nine feet above the floor on the walls with very good results as to heat.

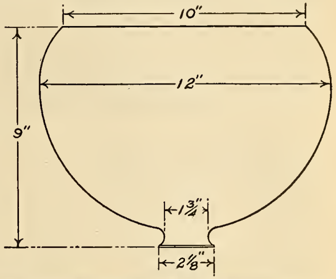
# Destroying the Browntail and Gypsy Moths

Although the work has not attracted a great deal of attention outside of New England, it is nevertheless a fact that the United States Department of Agriculture has been expending about $100,000 annually in New Hampshire in an heroic effort to exterminate the dread browntail and gypsy moth pests. In addition, the legislatures of New Hampshire and Massachusetts have set aside smaller sums to help on the work. Both pests continue to advance over an everwidening area, so that it will not be long before other states which now neglect the opportunity of warding off trouble will find themselves engaged in the same battle.

The widest variety of devices for killing off the pests have been put into service. One of the most successful of these was the so-called Hannigan "moth pot," which consisted in the essence of a flaring pot and a quantity of burning crude oil. At first these were set upon the ground in commons and other open places but later they were hung from the mast arms of street lamps, the best location being found to be about three feet back from the arc lamp, measured along the mast arm, and three feet below. Even at this distance, however, the heavy black smoke from the smudge soiled the arm and was in several ways disagreeable.

The Manchester Traction, Light and Power Company had meanwhile been experimenting with an arc lamp arrangement to accomplish the same ends as the moth pots and the accompanying drawing shows the type of globe which was finally adopted after considerable experimenting. It is used on General Electric 72 volt, 7½ ampere, series alternating arc lamps, fitted with clear glass inner globes. From the drawing the glass workers manufactured a mold and from this 605 of the special globes were cast. By the terms of the contract, the electric light company was to cart these globes to the lamps, put them on, take away and store the regular globes, empty the globes daily, keep track of the quantity caught and, at the end of the moths' flight, replace the old globes and store the special globes until the next year.

The globes were put on with the cut away part up, so that the moths fluttering around the light would fall into the bowl. The first gathering was made July 8. The flight, which usually continues about eight days, this year lasted fifteen




ARC LAMP BOWL USED IN ELECTROCUTING MOTHS

days. Between July 8 and July 23, there were collected from the globes 107 5/16 bushels within the city and 12 7/16 bushels from the globes placed at two of the summer resorts.

Two different quarts were counted, one moth at a time, and it was found that there were just about 1,600 moths to a quart. Of these about two-thirds were females. This fact could easily be determined from the moths as taken from the globes, but careful observations were made of those which thickly encrusted the street lamp poles, trees, sides of buildings, etc., and gave good evidence that this percentage was accurate enough for all purposes. In a bushel there were, of course, 51,200 moths, according to these figures, or 5,494,400 in all. If 60 per cent were females, the figure would be 3,296,640. In a year the development resulting from the eggs deposited by each female would be about 400, so that if the quantity mentioned had not been destroyed in the electric light globes, they would have produced in excess of 1,318,656,000 other moths to get busy on the trees in 1913. Adding to this figure the number that would be developed by the females captured at the two summer resorts, Lake Massabesic and Pine Island Park, the total of 1,474,560,000 is reached, a truly astounding figure.

In collecting the moths from the globes, the lamp trimmer simply placed his hand over the opening at the bottom, removed the globe and dumped the contents after measurement into a two-bushel bag of close woven goods. Measuring was done by means of a ten quart flaring pail, suitably marked on the sides. The condition of the employees who attended to this job was shocking, as they were covered with rash from their toes to the top of their heads. Some of them found it necessary to bathe in creoline of strong yellow soap baths five or six times a day.

When thrown loosely in, such a globe as that shown would hold about 10½ quarts of moths. However, after a globe got about half filled the moths seemed to stew from the heat of the lamp, so that about half way through, the heap would be wet and at bottom "muddy." Several of the inner globes gave way under the confinement of the heat and were badly distorted and discolored. Sometimes the globes would be so full that the moths would be heaped up and on most of the heavy catch days they were almost full to the brim. From the globes the moths were taken to one of the generating stations where they were thrown into the furnaces and burned.

The theory upon which the device works is that the globes shall be cut off at such a height that the moths can easily fly inside but be unable conveniently to fly out. The shape shown was found to be best when used with the regulation type of obtuse angled reflectors. Examination of the moths when taken from the globes showed them not to be badly burned, except occasionally on the head. Death seemed to have resulted from general suffocation from the intense heat or from impact against the walls of the death chamber.

The mold is now at the glass factory and any public service corporation or municipality can obtain the special globes at the same price as the regular type, as the mold has been placed on file.

## Linking the Links of the Long Distance 'Phone

By Felix J. Koch.

Taking Cincinnati as a sort of central point for the country, they told me, last August, that the farthest one could talk by long distance telephone to the east, was to Portland, Me. There isn't direct communication to Halifax, because the traffic hasn't so far seemed to warrant it. The longest "talk" in the country at present is New York to Denver, just a little trifle of 2000 miles. It will cost you $7.75 for three minutes talking from the Queen City to Denver, and $2.75 for each minute additional. New York to Denver is about twelve dollars. To the south, you can talk to New Orleans and Gulf points; to the north Michigan and Montreal.

Two thousand miles though is today about the limit of transmission. Were the telephone rates as low as the telegraph rates what a "gab fest" the United States would enjoy!

Most of the heavy trunk lines, one of the superintendents of construction work told me, are now done as far as the present development of the country warrants. One of the last to be completed was that from Topeka to Denver. Meanwhile the country is dotted with the construction camps of the crews that are putting up the connecting links of the great system —cross lines and branch lines. On a heavy line, there will be about 100 men to a camp, and this camp is then split up into three sections. That is done because the line is likewise built in sections, instead of starting at one end and working directly toward the other.

Of course what constitutes a camp and how its men may be "fixed" depends largely on its location. Material is shipped in usually from two or three central points. As a rule a car is loaded up and sent out. Whether it be a heavy winter or a short winter affects both the work and the men, and also the degree of rush to the work.

But there is a chapter of the story to be told even before we come to the camps. Two or three men drive or motor through the country and decide on the route for the line. Following them come surveyors, engineers who stake out the exact location. Two or three men will work together at this sort of thing.

Close on their heels come the men who check up, who determine the size of the line and the nature of the poles. Often, looking at it from their still more practical view point, they are forced to change the route selected by the others, particularly where this crosses ravines and the like, and where heavier poles are required than on one long, steady line.

CAMPING OUT WITH A TELEPHONE CREW IS LIVELY AND PICTURESQUE TO SAY THE LEAST

Camping out with a telephone crew is the jolliest sort of work for some young electrician, even though the work is hard. In the far west they still have a wagon outfit which is taken right along with them—four sleeping wagons, a kitchen and an eating tent. Throughout the South and in part of the mid-west negroes are employed on the work, and life around their camp is lively and picturesque to say the least.

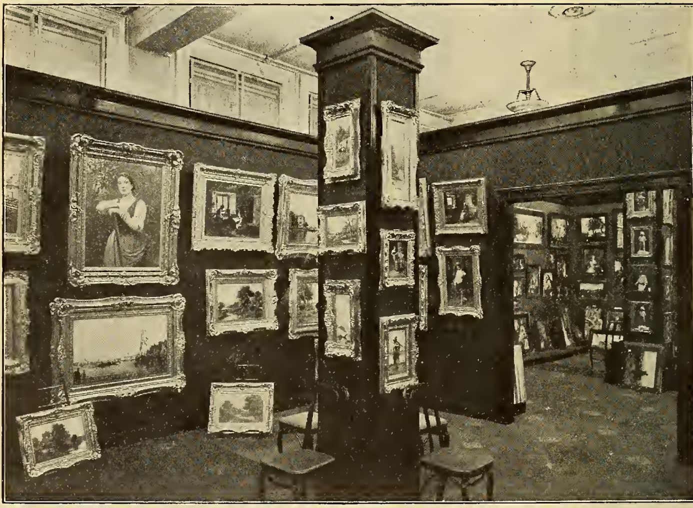
Where work is apt to take some time the innate want of a home by man will lead the men often to desert the tent and erect shanties, tar-papered over. In these they eat, drink and sleep when not busy upon the work of construction. As a matter of fact, the camp is apt to preempt all the best woods and groves, and there beneath the trees, men swing in their hammocks or thrum the mandolin on sultry Sunday afternoons.

It takes all manner of men to build a telephone line, and from the high priced supervisor or chief of construction, who occupies a tent by himself, the social scale of the camp will descend to the picanniny who is water boy, errand boy and general factotum. Men of these lower ranks are happy go lucky as the gipsies into whose nomadry they have fallen.

Ramble on through the camp, you're only one of many visitors, for the country folk for miles about drive in for a look on the Sabbath. Knowing the engineer's purse to be long and his chances at spending limited, country boys bring in their fattest poultry and dispose of it in short order. Village electricians come out for a talk with the engineer, and while comparatively little electric current is used in telephony, the amount of general electrical information they imbibe from the city engineer is indeed much.

One of the tents serves as horse shed, and outside a huge triangle is hung to serve as general call. In Alaska similar triangles are hung from posts at the street corners in order to summon folk to a fire. Then there is the mess tent and off to one side, sometimes at a little distance, a house may even be rented as temporary headquarters. Mornings the cook sounds the breakfast call and a hungry crowd turns out. Then they work till noon, then eat, then work again till dusk.

Little by little they are building the line of the telephone—on and on and on. The local engineer tells me we'll be able to talk from coast to coast in 1915. Next it will be Edmonton to Mexico City, I suppose.



SHOWING THE EFFECT OF INDIRECT ILLUMINATION IN AN ART GALLERY

## Picture Lighting Without Glare

Diffused light, light free from glare, light that does not cause bright rays to be reflected into the eyes, is the kind of illumination most suitable for art galleries, stores, hospitals and offices. Particularly in the art gallery it is the soft shadowless light that gives exceptional results, and these results seem to be most readily obtained by indirect lighting.

The accompanying picture is from a photograph taken at night, the gallery being illuminated by the Alexalite indirect lighting system.

A nonbreakable light diffusing bowl of metal, finished in white enamel, is suspended from the stem of a ceiling fixture which holds but a single lamp. The fixture stem is made in one length only, so that the diffuser is eighteen inches from the ceiling. The three chain suspension permits the bowl to be readily cleaned by unhooking one chain, allowing the bowl to hang by the other two. The candlepower of the lamp to be used is determined by the size of the bowl and the light required. The diffusers are made in styles to suit the surroundings, though the white enamel type is most frequently chosen.

## Illumination of Niagara Falls

It is confidently expected that within another year the Falls of Niagara will be illuminated with electricity and that the power of this illumination will be the greatest of any illuminating project in the world. Once, for a few weeks in 1907, the Falls were illuminated, and it was a sight that will never be forgotten by those who gazed with wonder on the mighty waters. Plans now under consideration provide for an illumination four times as great as this temporary illumination.

The plan which has in view the permanent illumination of the Falls of Niagara contemplates two large and powerful batteries of projectors, one to be known as the "Gorge" battery and the other as the "Hill" battery. The Gorge battery will be composed of 20 30-inch projectors, together with suitable apparatus for transforming and distributing the electric current. This battery is to be placed in a niche in the face of the cliff opposite the foot of Goat Island, where its rays of light can play on the face of the American and Canadian waterfalls as well as upon the "bridal veil" that pours over the precipice between Luna and Goat Islands. This battery will also be able to bathe the gorge below the falls in a flood of light. The niche in which lights will be placed will be ten feet high, twelve feet long and twelve feet deep. It will be protected by a set of roller doors to protect the machines and the operators from spray, the lights operating through glass panels when necessary.

The Hill battery will be composed of twelve 60-inch projectors located on the elevation west of the Queen Victoria Niagara Falls park and near the transformer house of the Ontario Power Company. These lights will play upon the upper rapids and the upper stretches of the river and at the same time be converged with the rays from the Gorge battery, intensifying the effect upon the Falls and gorge scenery. W. d'A. Ryan, the illuminating engineer whose plans for the illumination have been practically adopted, declared recently that he had every reason to believe that the project will be carried through during the coming year, and that the Falls will be illuminated by the first of July, next year.

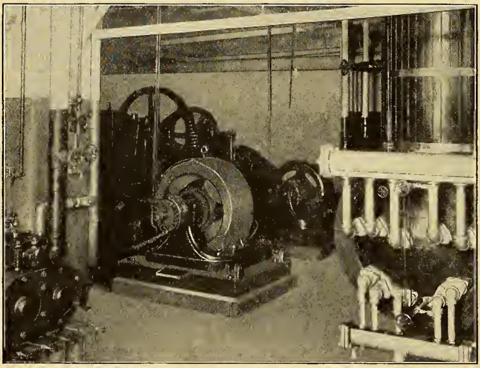
## Electric Thermometers

The measurement of temperature by electric means is called electric pyrometry. Such perfection in this respect has been attained that, it is claimed, such measurement is applicable from near the absolute zero—some 490° F. below the ordinary zero—to a temperature of melting platinum, more than 3,000° F. above zero.

Among the methods of measuring temperature by electrical means may be mentioned that which depends on the increase of electric resistance of a pure metal with increase of temperature. Another method depends on the production of an electro-motive force in a circuit of two metals when one junction is kept at a constant temperature and the other is heated to the temperature which it is desired to measure. Many electric pyrometers give a continuous record of the temperature on a revolving drum.

## A Cold Storage Plant for Furs

With the coming of summer our grandmothers stored away their furs and winter garments in a way that might now provoke a smile, but was the best method known until a few years ago. Grandfather's tobacco pouch was raided and between each layer of fur a liberal sprinkling of tobacco leaves was showered with here and there a moth ball. Today artificial refrigeration, at an Arctic temperature, has been found to be a destroyer of the germs and insects that our grandmothers had not the facilities to combat.



ELECTRICALLY OPERATED REFRIGERATING PLANT FOR THE COLD STORAGE OF FURS

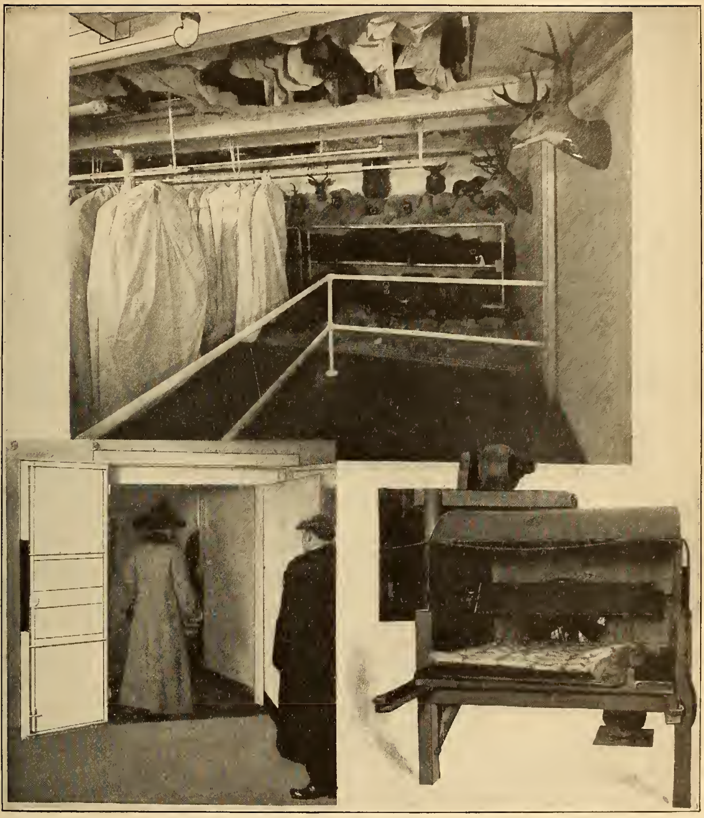
One of the largest fur storage plants in the country, that of Marshall Field & Company, Chicago, has been doubled in capacity within the last five years because of the popularity and efficiency of this method of keeping furs through the summer. Electricity has much to do in this plant as will be seen from the following description.

As the furs are received they are properly tagged so as to be quickly located when wanted. They then go to the cleaning department where a motor driven fur beater and compressed air assist other processes in making them perfectly clean. They are now placed on suitable hangers to keep them in shape and enclosed in fabric bags, ready to be hung in long tiers upon metal rods in the vaults.

The vaults are open to the public and visitors are conducted through them by an attendant. Stepping past the first doorway, a chill is felt in the air, although one is not yet inside the vault. Heavy fur coats or long warm capes are now put on, for in passing through the next doorway the temperature will drop from 70 or 80 degrees of the outside air to twelve below freezing.

Inside the vault, the walls of which are of concrete, cork and steel, a strange sight is beheld. Along the walls are metal shelves filled with rugs, and here and there an animal head with open jaws and gleaming eyes. Furs from every furbearing animal are here — furs from the cinnamon bear and the grizzly, from the mountain lion and the tiger, from the wolf, the mink and the sea otter; furs ranging in value from the inexpensive pieces to those worth thousands. Over to the left in this cold, clean, white place are long rows of coats encased in fabric bags. These coats, however, are not all of fur, for silk opera wraps and garments of delicate texture are also stored in this way. In the darkness and the cold, new luster seems to come back to the fur and the danger of moisture to either fur or silk is entirely overcome.

Above the floor of the vault are row upon row of white, iron rods upon which hang muffs, boas and every product of the furrier's art. There are in all, four stories in the vault, reached by metal stairways and landings. At the



INTERIOR OF THE FUR STORAGE VAULT

ENTERING THE VAULT

ELECTRIC FUR BEATER

top a chilly breeze blows into one's face, for the ventilating pipes enter the vault near the ceiling. In another part of the building an electric motor is forcing a freezing liquid through pipes. A powerful electric fan is blowing 17,000 cubic feet of air about these pipes every minute and the air thus chilled is circulated throughout the vault. At the bottom of the room are ducts through which the air leaves.

The vault described is but one of four. Placed one upon the other they would form the equivalent of a ten story building 30 by 30 feet—an immense refrigerator holding furs during the summer of a value totaling millions of dollars.

# A Black Art Entertainment

By T. J. NEWLIN

When you gaze at an incandescent lamp steadily for a few seconds and then look at any other object or even up into the sky an exact imprint of the shape and size of the filament will be seen before your eyes, no matter where you look nor how many times you wink and blink in order to cast the annoying


FIG. 1. PROSCENIUM STRIP WITH REFLECTORS

haze from your vision, until it finally passes off from the over stimulated nerve fibers.

This phenomenon is what opticians term "scotomy." It means a dark spot on the visual field. "Absolute scotomy" is a condition wherein the perception of light is entirely absent. Both conditions are the result of a "retinal fatigue;" that is to say, the constant stimulation of the light has caused an insensitiveness for that part of the retina previously occupied by the brilliant, dazzling electric filament.

In dealing with black art the electrician will do well to remember that you sim-

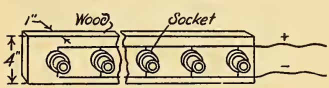



FIG. 2. WOOD SLAT LIGHTING STRIP

ply cannot gaze into the darkness, when an electric pocket-light is suddenly flashed into your eyes, and see anything beyond the lamp. When a "hold-up" or a burglar orders you to throw up your hands, from behind a flashlight, ten to one up they go, for he has the drop on you, or at least you think he has, for as far as you know (not being able to see beyond his flashlamp) he has his gun pointed right at you. On the contrary he may not even have a pistol, but be only bluffing it out, but you somehow or other don't care to prove it or investigate further.

With this little prelude the electrician will all the better understand the idea which is to be carried out in wiring up the parlor, the church or small stage for a few hours' mysterious entertainment in "Black Art," for it is electricity and the laws of light or optics that practically make the illusion feasible.

In order to produce black art the electrician must secure three or four long reflectors say about ten or twelve feet long or build them to fit the shape of

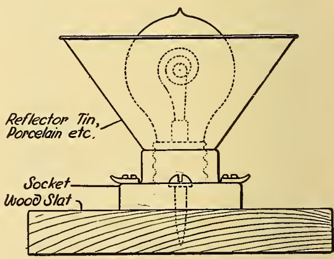



FIG. 3. LAMP REFLECTOR FOR SLAT STRIP

the front opening of the stage or proscenium as it is called in stagedom. Lamp sockets are properly fastened in this reflector and set from ten to twelve inches apart (see Fig. 1). Or a reflector can be made and wired up as shown in Fig. 2.

In the latter case, as in Fig. 2, build a long slat of wood of the dimensions shown, to conform to the opening of the stage front or platform which has been built for the purpose. Set lamps on this slat, spaced as aforementioned, and have the lamps wired in multiple. It is well to have them all controlled by a double pole knife switch set at some position convenient to the operator. On each lamp (if slat style is used) a reflector must be placed as shown in Fig. 3, and both lamp and reflector set to face the audience. The importance of this reflector is to create a glare in the eyes of the audience and simultaneously prevent any light escaping backward into the stage proper, in which case the observers may inadvertently discover the nature faking electrician, and thus spoil the whole illusion. Fig. 4 shows the effect of the glare as seen from the "front."

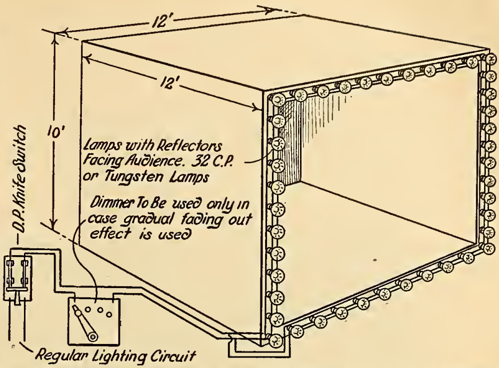


FIG. 4. ARRANGEMENT OF THE BOXLIKE STAGE TO THROW A GLARE OF LIGHT IN THE FACES OF THE AUDIENCE

A nice size for a stage to produce black art is ten feet high and twelve feet wide, but the electrician will do well to judge the illuminating capacity of his light in proportion to dimensions in all cases. The depth of the stage should be anywhere from eight to ten feet, extending backward from the proscenium or light frame. Everything inside of this box-like affair should be either painted dead black, if made of wood, or lined or covered with a dead black cloth so as to reflect no light from within.

When the performer is working on the stage producing the illusions the electrician will see that every other light in the house except his glare frame is turned down exceedingly low by a resistance or dimmer or else entirely switched off, as any outside light is liable to spoil all of the intended illusions.

I will now explain the other essential accessories necessary to carry out successfully the black art illusions. To begin with it requires two performers, the one who stands out front and acts as the magician and the one who is inside of the box or stage and acts as his imp of darkness. The magician is dressed entirely in white, either a flannel or white duck suit, including a white cap. The imp is dressed entirely in black, or he can wear his ordinary black clothes, but he must have a black bag placed over his head.

This black bag is made of some gauze-like material such as cheese cloth or lining which allows the black operator to peer through the cloth while he is working and see everything on the stage and out into the audience. Yet the people in the audience cannot see him on account of the glare of the electric light in their eyes. Anyone who has stood outside and gazed into a lighted room has noticed how easy it is to see the people inside and yet how difficult it is for them to look out into the darkness and see or recognize anyone. While these conditions are actually reversed, the similarity of the conditions remain the same. Even though the imp comes out to the very front of the stage beside the white operator it is exceedingly difficult to see him. But he must be very careful not to pass before the white operator or magician or his whole outline will be discovered, on account of the white background thus formed.

In the performance of black art the magician stands out near the front of the stage and by a few passes of his wand causes women to appear and disappear at will, pitchers to spring forth from the darkness while goblets actually rise up in the air to pour their contents in the pitcher or the pitcher to pour its contents back again and vice versa.

Most any trick of this nature can be performed; but nothing in the line of candles or fire tricks can be executed, as the light would show up the imp and the stage settings.

The stage is set for a performance the same as on the regular stage. The table with the pitcher and goblets are all there, the only difference being that each pitcher, goblet, or wineglass is covered over with a black cloth the same as that worn by the imp. If a woman is to be made to appear she also is covered with the black cloth which is suddenly withdrawn at the psychological moment.

FIG. 5. THE IMP AND THE BLACK BAG

The "props" used to produce black art, and which are to be visible to the audience, are usually made of wood and painted a decided white. In fact several coats should be used to insure perfect whiteness, as it will allow the figures they are made to represent to stand out more distinctly when uncovered by the imp at the cue. The objects or props are usually sawed out of $\frac{7}{8}$ inch or one inch boards or cut out of tin or sheet iron sometimes and made in the form of pitchers, goblets, oil cans, clocks or anything you wish to bring forth, and painted as explained above. After being set on the table they are covered with the black cloth as aforementioned and are ready for the performance.

In performing the trick the magician dressed in white gives his "spiel" to the audience, telling them of the great mystery he has discovered, informing them he has been in consultation with his Satanic Majesty and will endeavor to please the audience by causing a woman to appear and disappear before their very eyes or make rabbits or cats come forth and pitchers to pour their contents into glasses and the glasses to dump their contents back or cause birds to fly in the air and go back and forth to their perches, etc.

Everything being in readiness he makes a few passes with his magic wand and behold a most beautiful woman appears. (See Fig. 5.)

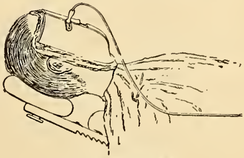
The magician has the woman walk forth to the front of the stage where the audience can see her, then has her return to her place, where she in turn is made to disappear at his command.

In order to perform these tricks the magician goes through a lot of his usual passes and at the finish he utters the magical words such as: ·Presto! Change! Pass! Appear! etc. The imp who is standing behind, unseen in his black robe, suddenly jerks off the black cloth thereby revealing to the gaping audience the beautiful creature all smiles or the inanimate objects whichever the case may be. When he wishes the object to disappear he utters the reverse words: Presto! Begone! Pass! and lo and behold, there is nothing seen. Of course in this instance the word "Pass" is the cue word at which the imp quickly covers the object with the black cloth causing it to become invisible.

If for instance the magician wishes the pitcher to appear he simply gives the command—off comes the black cloth quickly and there you are. The goblets are now made to appear and he actually makes them lift up in the air, turn and pour their contents into the pitcher. Or if in the form of a bird it is made to fly and perform all kinds of stunts in the air. Of course our imp in black simply stands behind these objects and manipulates them as intelligently to life as possible or carries them from one point to another, pulling off black cloths here and putting them on there, causing the objects to appear and disappear at the apparent will of the magician and much to the surprise and amusement of the audience.

## Electric Heater for Face Steaming

An electric heating pad so shaped as to fit the contour of the face is the invention of Alfred P. Blenkner and Bert Z. Smith of Mountain Home, Idaho.



FACE HEATER

The device is adaptable for use in barber shops, massage parlors and the like.

A wet towel is first applied to the face and then the heater laid on over this, generating steam. The heater has double walls, the heating elements being located between the walls. Moreover the heater is adjustable in size and its arrangement such that an air chamber is formed between it and the face, giving a more even distribution of heat.

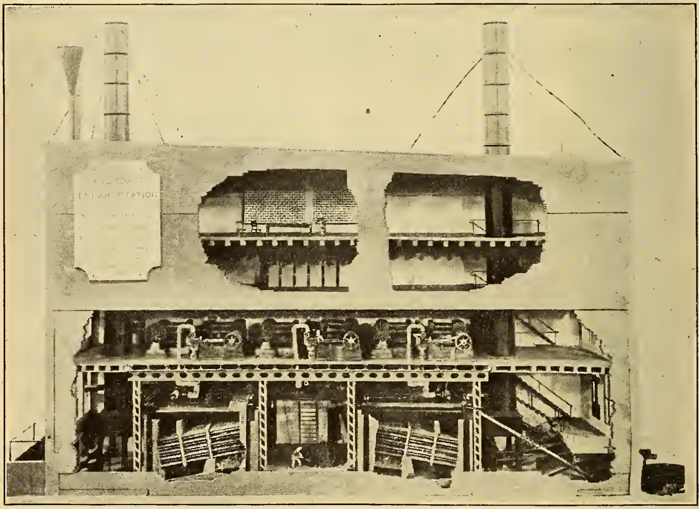
## Electricity and Coal

Certain of the statements made by Professor de Ferranti, in an address before the Institution of Electrical Engineers in London recently, may occasion surprise to those who are not familiar with the facts dealt with by him. For instance, he has pointed out that, taking all the uses for coal into consideration, we are getting, in the form of useful work, much less than ten per cent. of the energy contained in the coal. Moreover, by the present methods, nearly the whole of the valuable by-products of the coal, consisting principally of fixed nitrogen, is dissipated. The suggested remedy is to convert the whole of the coal which is used for heat and power into electric energy, to be distributed over the country from as few central stations as possible, the process of conversion to be performed under strict scientific supervision.

# Thirtieth Anniversary of Electric Lighting in New York

By NORMAN MAUL

Through a period of but 30 years is threaded the entire history of commercial incandescent lighting. There are people today who, with hardly a thought of those former days, push a button to flood their rooms with light. Yet the chances are that some of these same people were among the throngs that curiously visited Edison's house on 65th Avenue, New York City, where the first electric lights were burning.



THE OLD PEARL STREET STATION, LONG SINCE DISMANTLED AND SOLD, IS PERPETUATED IN A MODEL WHICH SHOWS ITS ENTIRE INTERIOR ARRANGEMENT

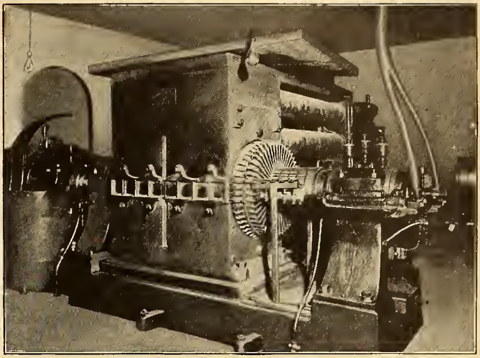
That was in the early '80's, and from that time until the industry had proclaimed itself and was recognized for its true worth many of the chapters of its history are written around New York.

The New York of 1912, with its skyscrapers, subways, trolley cars, automobiles, and lights, realizing full well that without electricity it could not be, has just commemorated the beginning of it all. It is doing honor to those whose genius, strength and courage wrought this change from dark buildings, congested streets, horse cars and all the old institutions that have been cast into the discard during these 30 years.

The fourth of September, 1912, was the 30th anniversary of the actual beginning of central station service in New York, for on that day in 1882, current generated by a single dynamo, was sent through a system of underground cables to some 400 lights, and a new industry had come into being.

On that memorable day the generating

plant consisted of a reconstructed brick building at 257 Pearl Street in which had been set up six generating units of the "Jumbo" type. Each of these was rated at about 125 horsepower and was driven by steam from boilers in the basement. The distribution system consisted of fifteen miles of underground cables in a territory bounded by Wall, Spruce and Nassau Streets and extending to the East River. The lamps numbered about 400 on that first day, but they shortly increased to 5,000 on the premises of about 200 customers.



THE ONLY ONE OF THE ORIGINAL "JUMBO" EDISON DYNAMOS THAT ESCAPED THE FIRE OF 1890

Today the generating apparatus of the New York Edison Company is housed in two Bastile like structures that cover two city blocks and the power is rated at that of 700,000 horses; the fifteen miles of cables have extended until now they number 1,300 and reach almost every street in the city and the power sent through them lights five and a quarter million lamps, 40,000 arc lights and drives nearly 400,000 horsepower in motors, while 159,000 meters are required to measure off the current as it flows through the wires.

The lighting company at first was known as the Edison Electric Illuminating Company. It was the New York licensee of the Edison Electric Light Company which held all of the Edison lighting patents, and the New York Edison Company of today is the direct successor of the original illuminating company.

The old Pearl Street station continued in service until January 2, 1890, when fire destroyed the building, wiping out practically the entire equipment. Some of the apparatus was saved, but all the Jumbos with but one exception were lost. The survivor, No. 6, stood near a window, and firemen fighting the flames from the elevated structure that passed the building were able to keep a stream of water on the dynamo and thus hold the fire in check. It was four days before operations could be resumed in that building, but the interruption of service only lasted a few hours, the Liberty Street annex taking up the load. By placing certain restrictions on the use of current all the customers were enabled to have enough light to meet their needs, and this tided the crisis until new apparatus could be installed.

At this time the demands for lighting in the uptown sections had led to the extension of service and generating stations had been opened in three other parts of the city. With the Pearl Street station they made the number of electric power plants in New York four. The old station had been outgrown, however. In 1895 after the new Duane-Pearl Street station had been opened, the old one was dismantled and the building sold. Old No. 6 having yielded to machines of greater power (the youngest of which, with a rating of 30,000 horsepower, has been in service about a year) was placed on the pension roll and is now treasured by the New York Edison Company.

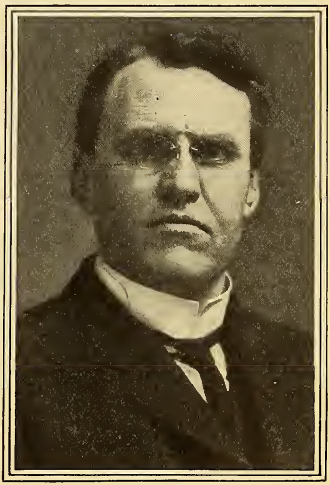
With the exception of this fire, and one other interruption, whose aggregate was less than twelve hours, Edison service in New York has been continuous, a remarkable fulfillment of the inventor's prophecy on the opening day "that the service would go on forever unless stopped by an earthquake."

The original Edison plan called for the generation of current at as many as 36 independent stations south of Fifty-Ninth Street, each with its own steam boiler equipment. However, with the use of the high tension system of transmission which began on Nov. 3, 1898, it became possible to concentrate all the generating apparatus in one locality, and to operate at various parts of the city, not the steam generating stations at first planned, but sub-stations all connected with the central station by high tension cables.

# The Making of an Engineer

**By M. J. RIGGS, C. E., Superintendent of the Toledo Branch of the American Bridge Company**

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



When you look over the field and note what is being done and what is still to be done in the way of taking the forces and materials of Nature and converting and using them to supply the world's needs, to build up society and to help along our best progress and development, you will find that there is plenty of work to be done, and that the engineer is the man who can and should lead and direct the doing of it; and let me say here that for the doing of this work the engineer receives ample reward. From the financial standpoint the efficient and capable engineer receives as much compensation, perhaps, as he would in any other profession or business. His best pay, however, comes from the work itself. There is a great satisfaction in doing things, and the successful accomplishment of any engineering work is a pleasure.

In these days the engineer is the man who is turning the world upside down, and I know of nothing finer or more satisfactory than the building of a Brooklyn bridge, the building and equipment of a modern rapid transit railway system such as the one in New York City, or the putting into successful operation the large steel mills of the Carnegie Steel Company at Homestead, Pa.

If the engineer is to carry on successfully this great work, he must be a first class man, he must be honest. He deals with forces and principles which are unvarying and which of themselves tend to make him honest. He must be honest to himself and to his work. Any violation of these well known laws of Nature will certainly make itself known and result in expense and disaster. He must be honest with his client or employer, since he is put in trust of great interests, both financial and material, and if he is to have the confidence of those for whom he works, he can only have it by strict integrity and attention to business.

There is probably no place in any profession or business for the dishonest man, but of all the professions of which I know, that of engineering has the least room for such men. On the whole, I believe engineers as a class are usually honorable. I have known a few of the opposite kind, and have never known one to succeed and maintain any position whatever.

The engineer must be energetic. His work is to get things done. He receives his pay and holds his position because men with means want to invest it with the idea for prompt returns. There certainly is no place in the engineering world for the lazy man. It is not, how long will it take? but how quickly can it be done, and how well—not how little can be accomplished to-day? but how much—not halfway service, but the very best that is in one.

The engineer must be a man of broad view. He has large things to do in every part of his work, large undertakings to be carried out, large investments of capital to be properly expended; and no small man can do these large things well. For this reason, I think his training at school should not be narrowed down to a specialty, but that he should have a broad culture, one that will help him in these lines and make him fit to do what he must do in life if he is to succeed.

The engineer must keep up with the times; he should not be lazy mentally; he ought to keep fully posted as to what is being done in a general way along engineering lines, and he should have a much better and more intimate knowledge of his own particular line. This he can do by keeping his eyes open and always being quick and ready to adopt any methods which may be better than his own. He should take and read carefully three or four of the leading engineering papers which are published and which are doing an excellent work for the engineering profession. He should belong to the local and national societies of engineers in his line, and should keep in touch with brother engineers, which his membership makes possible.

Lastly, the engineer should be a good man. The qualities which I have outlined necessarily make him a man of power, of strength, and of influence, not only with the men with whom he works, but also in the community in which he lives. These qualities cannot but make him a leader both in social and public life.

A man with all this inherent strength has no business to lessen it and curtail his usefulness and influence by not being a man of good morals, and by not using this strength to build up and help other men. There is no reason why the engineer should be blind on the moral side and every reason why he should be the opposite. I have little patience with the cob pipe, cigarette smoking, beer drinking engineer, and I believe no one else has, and I also believe that the brightest man cannot succeed in the engineering profession who is not also a good man and who is not letting his influence for right be felt by his associates, friends, and neighbors.

## Foreign Delegates at American Conventions

One of the great features of international relationship to-day is the extent to which congresses are held from time to time in practically every branch of work affected by modern civilization. It is perhaps in scientific fields that these meetings are more numerous than in any other except, perhaps, medicine and economics; and just at the present time arrangements are being made for a huge international electrical congress in San Francisco in 1915.

Last June the National Electric Light Association held its annual meeting at Seattle. It was largely attended by representatives from the British provinces on the Pacific slope. This convention has attracted a good deal of attention in England, and in a recent issue of the *London Times* the suggestion was put forward that it would be a good thing to send over a representative party of delegates to such meetings. This is the first proposition of the kind for sustained attendance at such gatherings from the other side.

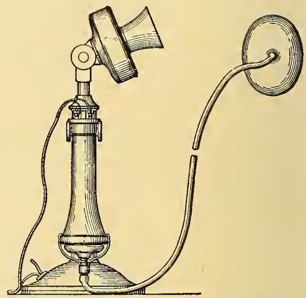
It is a notorious fact that in such matters England falls lamentably behind Germany, whose representatives are always scouring this country for electrical novelties of importance. The *Times* says:

"The growing body of opinion in the British industry in support of the so-called 'forward policy' of the Institution of Electrical Engineers will perhaps in the near future justify a proposal to send over a representative party of delegates to American conventions. The mere reading of newspaper reports cannot convey the psychological effect of these great conferences, and three weeks devoted to one of the Eastern cities for this purpose would be of greater benefit than a decade of municipal electric association Congresses."

It will be an interesting development if such conventions in the future are, therefore, attended annually by experts who have come over to report on the rapid advances in central station work in the United States.

## Telephone Attachment

An odd telephone attachment is presented by a patent recently issued to William A. Schmely of Pittsburg, Pa. A cup shaped member fits closely over the earpiece of the telephone receiver, and



EAR ATTACHMENT FOR TELEPHONE RECEIVER

attached to the cup is a flexible tube provided with an earpiece which fits lightly over the ear of the listener, without the necessity of holding it in place. When the receiver is slightly raised from the hook or laid upon the table, sounds issuing from it are carried to the ear through the tube. This leaves both hands free to make notations during a conversation; or, in case some time is required to bring the distant party to the telephone, the caller may go on about his work and listen at the same time.

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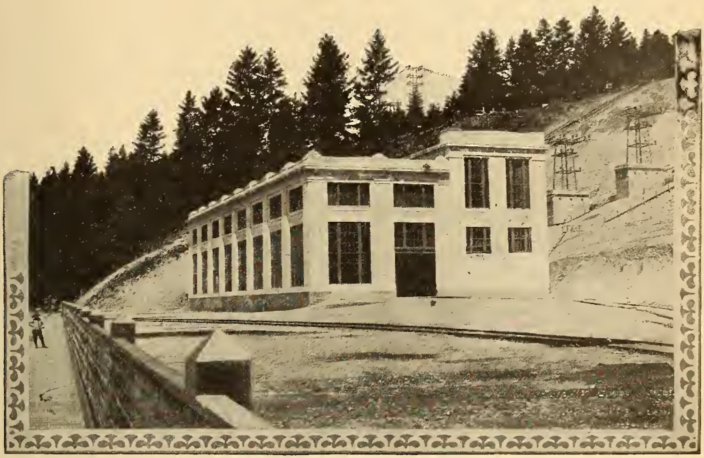
Niagara Falls is now known as the greatest center of electro-chemical manufacture in the world. The dreams of chemists have become everyday facts. Air and earth are separated into their constituent elements and the products put into neat packages for sale at low prices.

## Glaciers Transformed into Electrical Energy

From frozen energy in icy glaciers to electrical energy leaping over the wires at 6,600 volts is the story of the Lake Tapps hydro-electric plant at Dieringer, Washington. White river is fed by the glaciers of Mount Tacoma. Lake Tapps and several lakes, together with masonry dams, will make the total water storage of this project amount to 2,250,000,000 cubic feet, a reserve so great that the widest fluctuations recorded in the flow of the White river would be of no consequence in the operation of the power plant. By canal and tunnel the water is carried through a ridge to the brow of the hill and dropped through the penstocks to the power house at the level of the river 440 feet below. The whole development stretches over fourteen miles of country, much of which is wild and heavily timbered.



The power station is of reinforced concrete, 204 feet long and 82 feet wide. It is remarkable for the fact that the water wheels are said to be the largest horizontal pressure turbines yet built. They are two in number and are rated at 20,000 horsepower each. The outgoing transmission lines aggregate about 10½ miles and are laid out so they connect with the earlier transmission lines of the Seattle-Tacoma Power Company and the Puget Sound Power Company at three points, one near the powerhouse, one at the town of Bluffs on the Seattle-Tacoma interurban line and the third at Sumner.

## Telephones in Jerusalem

The latest bit of enterprise in the Holy Land is the beginning of a telephone system over the city of Jerusalem. For the first time in all its long history, the Holy City hears the tinkle of the telephone bell. The new court house at Jerusalem has been connected with the old serai, and the system is to be extended until first all official points, and then business houses and residences are supplied with telephones.—*Telephony.*

## Electric Current Rates Defined

In the report of the rate research committee of the National Electric Light Association are embodied the definitions of the various methods now employed of charging for electric service. All service cannot be charged for on the same basis, with equity to both the company and the consumer. Obviously, also, the same method of charging cannot be employed by different companies where the services rendered are widely different. As so many different kinds of rates are employed to fit various conditions, they have become somewhat mystifying to the public, and perhaps these definitions will help to make the terms clear.

*Flat Rate:* The term "flat rate" is applicable to any method of charge for electric service which is based on the consumer's installation of energy consuming devices or on a fixed sum per consumer. Meters are not used.

*Demand Rate:* The term "demand rate" is applicable to any method of charge for electric service which is based on the maximum demand during a given period of time. The demand is expressed in such units as kilowatts or horsepower. Maximum demand indicators or graphic meters are used.

*Meter Rate:* The term "meter rate" is applicable to any method of charge for electric service which is based on the amount used. This amount is expressed in units, as kilowatt hours of electricity. Integrating meters or graphic meters are used.

*Consumer's Output Rate:* The term "consumer's output rate" is applicable to any method of charge for electric service based on the consumer's output. The unit of the consumer's output may, for example, be a gallon of water pumped, a barrel of flour, or a ton of ice made.

*Two-Charge Rate:* The term "two-charge rate" is applicable to any method of charge for electric service in which the price per unit of metered electric energy for each bill period is based upon both the actual or assumed quantity of electric energy consumed and the actual or assumed capacity or demand of the installation.

*Three-Charge* Rate: The term "three-charge rate" is applicable to any method of charge for electric service in which the charge made to the consumer for each bill period consists of (a) a sum based upon the quantity of electric energy consumed, (b) a sum based upon the actual or assumed capacity or demand of the installation, (c) a charge per consumer.

*Straight Line:* The term "straight line," as used in connection with and as applied to any method of charge, indicates that the price charged per unit is constant, *i. e.*, does not vary on account of any increased or decreased number of units. The total sum to be charged is obtained by multiplying the total number of units by the price per unit.

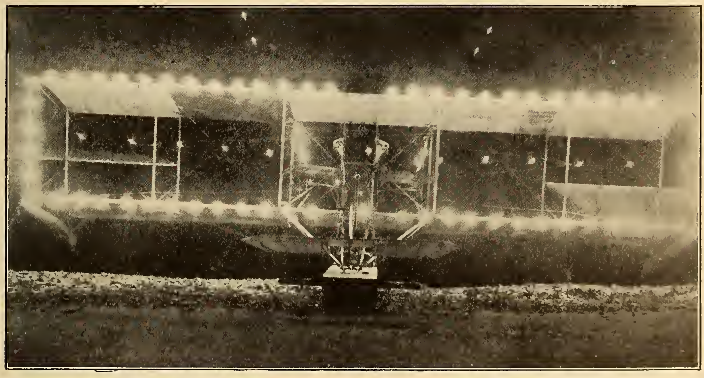
*Block:* The term "block," as used in connection with and as applied to any method of charge, indicates that a certain specified price per unit is charged for all or any part of a block of such units, and reduced prices per unit are charged for all or any part of succeeding blocks of the same or a different number of such units, each such reduced price per unit applying only to a particular block or portion thereof. The total sum to be charged is obtained by multiplying the number of units in the first block by the price per unit for that block and adding thereto the number of units in the second block times the price per unit for that block, and so on until the sum of the units falling within the different blocks equals the number of units to be charged for.

*Step:* The term "step," as used in connection with and as applied to any method of charge, indicates that a certain specified price per unit is charged for all or any part of a specified number of units, with reductions in the price per unit based upon increases in the number of units according to a given schedule. The total sum to be charged is obtained by multiplying the total number of units by the price applying for this number of units, or by the primary price, and deducting the discount applying for this number of units.

These definitions were originally suggested by the Second Public Service District Committee on Gas and Electric Schedules, New York State, and were finally adopted at a joint meeting of that committee and the rate research committee. They have furthermore been approved by the Committee on Terminology.

## Electrically Illuminated Waterplane

One of the spectacular features of the annual regatta at Cowes, England, which was graced by the presence of the King and Queen of England and other royalty, including the King and Queen of Spain, as well as many other notables, was an electrically illuminated "waterplane," as the English call it, or hydro-aeroplane. The frame of the machine was studded with incandescent light bulbs, while a row on either side of the engine and a row along the wire struts that hold the planes rigid, were all connected up with the plane lights in one circuit. The lights strung along the wires looked as though they were suspended in midair. A powerful little dynamo operated by the engine of the aeroplane proper furnished the current. As the great machine sailed through the air, over land and sea, soaring high above the Royal Yacht Club, it was a remarkable sight.



ILLUMINATED AEROPLANE

## Canal Boats Propelled by Electricity

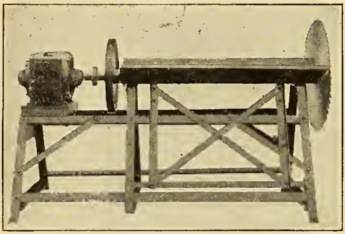
All canal boats negotiating the St. Lawrence River and Welland Canals are expected soon to be fully equipped with electric motors. The electrical supplies and equipments as well as a number of new canal boats, are being fitted out by British concerns. The vessels will be of the usual Canadian canal dimensions and form, with a deadweight capacity of 2,400 tons gross on a draught of fourteen feet.

The machinery will consist of two 300 horsepower high speed Diesel engines, each with its own alternating current generator. The motor deriving current from this generator will rotate the propellers at about 80 revolutions per minute as compared with 400 revolutions of the Diesel engines.

# Electric Current at Work

## Electric Wood Sawing Machine

Now that winter is coming on and cordwood is to be sawed up into fuel length those who contract for this kind of work will be interested in the electric motor driven sawing outfit developed by Fred. W. Walter, of Norfolk, Va.



ELECTRICALLY DRIVEN WOOD SAW

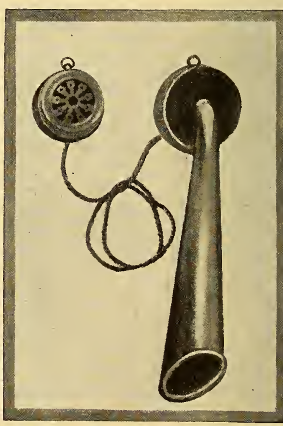
This machine will saw a cord of wood, four pieces to the stick, with one kilowatt-hour of electricity; which at the usual price is about seven cents. This is lower than any other method by from 25 to 50 per cent and cheaper than firing a boiler with free fuel.

The motor is of five horsepower, which has been found to be ample power for the heaviest work and equivalent to a 7½ or ten horsepower motor connected in the usual way. The saw is driven at 1,800 revolutions per minute, which has been found to give excellent satisfaction. The motor is insulated from the frame so that there is no possibility of the operator getting a shock.

The machine is equipped with a fused starting switch mounted on the side of motor, so that operator may stop or start saw without leaving the machine. It may be mounted on wheels and moved anywhere about the yard (current being supplied by portable cable), which in many cases will effect sufficient saving in labor alone to pay for the machine in one season.

## Telephone for Motor Cars

One very good use for loud speaking telephones is upon automobiles for transmitting orders to the driver from the inside of the car. A French firm makes a very neat little set of the kind, and the transmitter takes the shape of a small ornamental box somewhat like a watch. It is hung up on a hook inside the car,



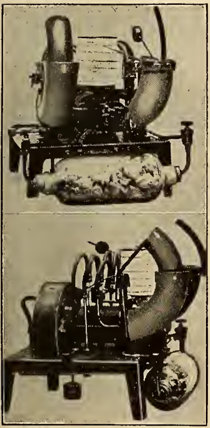
MOTOR CAR TELEPHONE

and on the outside is a trumpet attached to a telephone receiver of the loud speaking kind, this being placed just behind the driver. A small wood box for the necessary dry batteries can be stowed in the car box.

In order to speak to the driver the small transmitter is unhooked and a button on the side of the watch case is pressed, then the person speaks in the natural tone of voice.

## Furnace Gas Analyzer

The Poulenc firm of Paris have brought out a very convenient electric device for analyzing and registering the quality of furnace gases, and it is likely to prove of value in many kinds of plants, since it shows what is going on in the furnaces and whether any fuel is being wasted. A small electric motor drives the whole device, and a number of automatic operations are carried out.



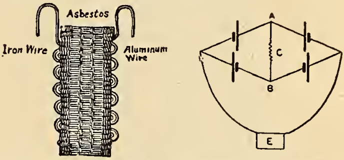
TWO VIEWS OF THE NEW FURNACE GAS ANALYZER

A gas pump in the shape of a rotating cylinder draws in the furnace gas, and then it passes into a measure, which is a curved cylindrical gas holder, rising out of a water bath so as to measure off just 100 cubic centimeters of gas. Then it stops, and the gas is sent by automatic valves into a glass absorbing chamber with pumice stone wet with potash for absorbing the carbonic acid, or with other chemical compounds for absorbing the oxygen, as the case may be. From here, the remaining gas goes to a second gas holder and causes it to rise, but if any gas has been absorbed, this holder will rise to a less degree. This operation makes a dot with a pen on a recording drum. Thus the amount of oxygen, for instance, in any given furnace gas is recorded at regular intervals, taking in a sample at each interval, recording, and expelling to make room for a new one. At the end of the day a permanent record is thus had. The instrument is the invention of W. C. Brenot.

## Rectifying Nets

A simple and ingenious device for converting alternating current to direct has been introduced, in the shape of "rectifying nets," by Messrs. C. Schniewindt, Neuenrade, Westphalia, Germany.

These nets are placed in glass jars filled with water, in each of which is




RECTIFYING NETS AND MANNER OF CONNECTING

placed a small quantity of bicarbonate of soda, which are afterwards connected up like cells. The special nets are composed of iron and aluminum wires woven with asbestos.

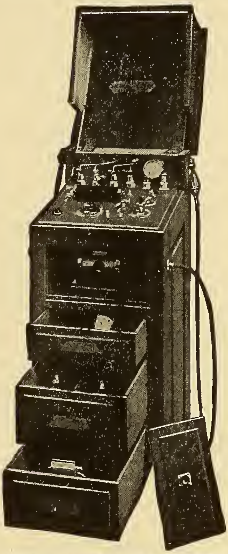
Only that current impulse of an alternating current, up to 100 volts, will be transmitted for which the iron wires are the positive electrodes, so that half of the rectified alternating current is obtained in the circuit as direct current.

By connecting the cells as in the diagram, in which the short dashes represent the aluminum wires, and the long dashes the iron electrodes, it is possible to obtain between the points (A) and (B) a direct current of 75 per cent efficiency, the heating of the electrolyte accounting for the deficiency. (E) represents the source of supply, and (C), the consuming circuit.

These "rectifying nets" can be used for charging batteries from a. c. circuits.

## Physician's Electric Cabinet

Every physician knows the value of many forms of electrical apparatus in therapeutics, but also realizes that the



PHYSICIAN'S ELECTRIC CABINET

purchase of each one would involve a large investment of money and expensive storage space.

These difficulties are, however, overcome in the Seibert-Welch cabinet illustrated herewith. This device provides, among many other conveniences, a vacuum apparatus, a hot air douche, compressed air without the use of a tank and vibration upon an entirely new principle. It weighs less than 100 pounds, but places the physician in a position to take care of patients himself whom he would otherwise be compelled to send elsewhere.

The vibration, so essential in modern therapeutics, is obtained by causing air to pulsate against a thin disk or diaphragm at the rate of about 5000 times a minute. This action is claimed to resemble nature more nearly than does any other device.

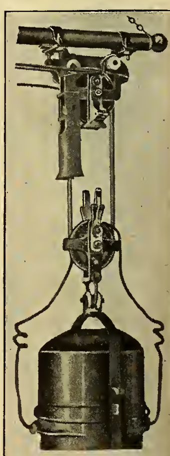
The compressed air and the vacuum obtained are produced by means of a unique fan or blower attached to a 1-10th horsepower Westinghouse motor operating at 1700 revolutions per minute.

Among other electric functions performed by this device are the furnishing of what is known to the medical profession as galvanic, foradic and diagnostic lamp currents when used on 100 volt direct current circuits and sinusoidal, instead of galvanic, current when used on a 110 volt alternating current circuit. The latter can then be furnished through a rectifier.

The cabinet complete with its accessories is made by the Siebert-Welch Company of Columbus, Ohio, and the electric motor for operating the air pump is made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

## Cut-Out Hanger for Arc Lamp

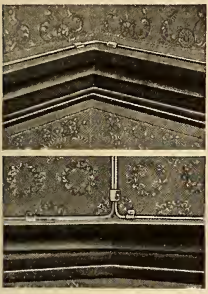
An ingenious arrangement on the hanger of an arc lamp for doing away with the usual slack loops and enabling the trimmer to lower the disconnected lamp to within reach is here illustrated. The line wires connect to the hanger terminals, while on the lamp are two conductor clips that open or close the circuit according as the lamp is lowered or drawn to place. From these clips wires run into the lamp.



ARC LAMP PROTECTED WITH CUT-OUT HANGER

## The Stannos Wiring System

Although the cost of electric light has been steadily reduced in recent years, and in spite of the introduction of the high efficiency metallized filament lamps, there are still many using gas or oil, unable to take advantage of the reduced cost of electric light because of the relatively high cost of wiring their homes. This situation drew the attention of the Committee on Residence Business, of the National Electric Light Association, and this committee suggested for consideration a system of wiring used extensively in Europe, known as the Stannos system.


HOW STANNOS WIRES ARE RUN

The component parts of this relatively cheap method of wiring are the Stannos wires and Kalkos conduits which may be used separately or in combination.

Stannos wires consist of single or stranded tinned copper conductors, insulated with pure and vulcanized India rubber (or Unvol, which contains no sulphur) taped and then surrounded by a closely compressed sheet of tinned copper, the whole being rendered homogeneous by a special process, and tested with a pressure of 1,000 volts. They are in effect, small copper tubes which contain the electric light wires, without any air spaces between where moisture can collect. Owing to their small diameter they are particularly suitable for wiring on the surface in situations where value is attached to neat appearance, while if sunk below the plaster they necessitate the minimum of cutting away. Stannos wires are stocked in coils of about 55 yards, and to facilitate erection these coils may be mounted on drums supplied specially for the purpose.

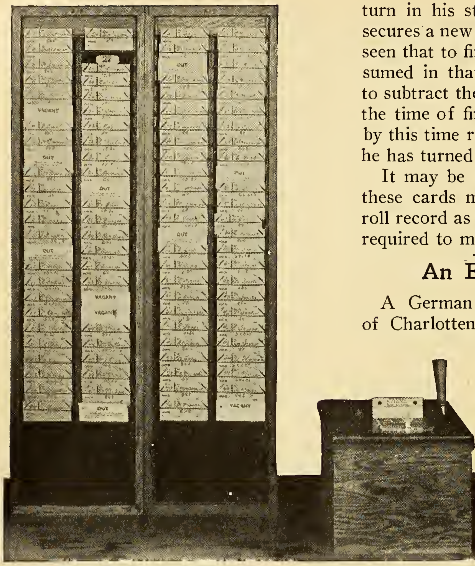

STANNOS WIRES—ONE, TWO AND MULTI-STRAND

For the purpose of obtaining the electrical continuity legally required for a metal cased wiring system (and which is not obtained reliably by steel conduit), Continuity fixtures are mounted on the walls or ceilings at the joint, switch, plug, and light points. The wires are clamped to these plates, which are then covered by the wooded blocks supplied for the purpose, on which standard switches, etc., are mounted. In the case of joints a steel cover takes the place of the wooden block, but where something neater than this arrangement is required, special Stannos watertight boxes are employed. Where the job is required to be watertight throughout, Kalkos boxes provided with adapters for Stannos wires are used for joints, switches, plugs and light points, or the joints may be made in the Stannos junction boxes referred to.

## The Periodograph

Each article put out by a factory represents a certain net value in labor and material. It has been possible to find the cost of the material in each article manufactured with comparative ease. But the cost of the labor involved is more difficult to estimate. To fill this need a system of devices, termed Periodographs, which owes its practicability largely to the electric current used in its operation, has been devised.

The system consists of a master clock and any number of time stamping devices or Periodographs which may be installed at convenient intervals throughout the facory. The master clock makes contacts through notches in a disk ten times each hour and through a system of wires operates the dials of the Periodographs located in different parts of the



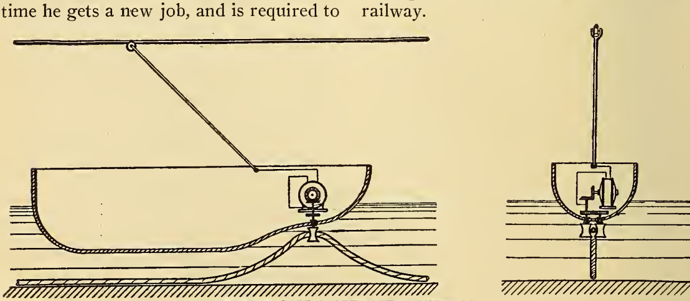
THE PERIODOGRAPH

manufacturing plant. These are so controlled by electro-magnets that their time indicator is moved up every tenth hour and if a card is placed therein and pressure applied to a projecting lever a record of the time will be stamped in ink on the card in hours and tenths of hours. If each workman is given a new card each time he gets a new job, and is required to turn in his stamped old card before he secures a new job and new card, it will be seen that to find the amount of time consumed in that work it is just necessary to subtract the time of commencing from the time of finishing the work as shown by this time recording device on the card he has turned in.

It may be seen readily from this that these cards may also be used as a pay roll record as well as a check on the time required to make each article.

## An Electric Tugboat

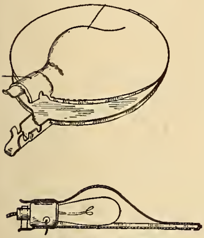
A German inventor, George Meyer, of Charlottenburg, has patented a system of tug propulsion for use on canals. A heavy steel cable is laid in the bottom of the canal and is grasped by two friction wheels depending from two vertical shafts on the boat. These shafts are driven by an electric motor as shown in the drawing, current for the motor being derived from an overhead trolley wire, one being strung over the canal in the line of each of the two paths of travel. In this system, as in the ordinary street car, only one trolley wire is used, the current returning to the source of power through the steel cable in the same manner that it returns through the track rails of a surface railway.



ELECTRICALLY OPERATED TUGBOAT

## Incandescent Lamp as a Heating Element

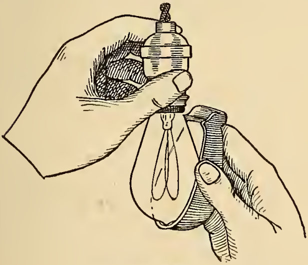
A substitute for hot water bottles is presented by a new type of electric heater invented by Elizabeth C. Donaldson of Detroit, Mich. Two complementary sections of the casing are hinged together as shown in the figure, so as to close down tightly over the base of an incandescent lamp. The walls of the casing absorb the heat from the lamp which is then imparted to the body from the broad under surface. The casing sections are formed of thin metallic disks.



LAMP HEATED PAD

## Adjustable Reflector

In the Magna reflector is a simple inexpensive device for directing the light of an individual incandescent lamp to the place required. It is a pear shaped piece of metal covered with baked enamel, white inside and dark green outside. In position it covers slightly over half of the lamp bulb, is revolvable about the lamp and can be quickly removed or put on. The reflector is made to fit a sixteen candlepower carbon filament lamp or a 25 watt tungsten lamp.

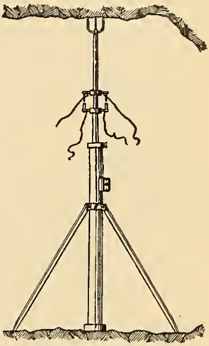


ADJUSTABLE REFLECTOR

## Mine Alarm

Ofttimes a "creep" or a movement of the roof in a mine precedes a cave-in. An electric alarm which will give warning is the subject of a patent issued to Henry W. Lee and George H. Weedman, Mount Morgan, Queensland, Australia.

A pair of pipes are arranged upon a tripod. The upper pipe is provided with forks at the top which are adjusted against the roof. This pipe slides into a second pipe and rests against a spring. Contacts arranged as illustrated are closed on the two wires of an electric circuit and bells are rung if the roof moves after the device is set.



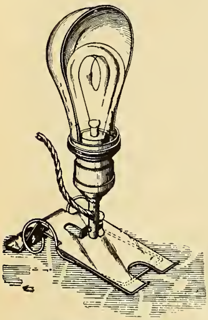
MINE ALARM

## Wireless Picture Sending

A young Italian inventor, Bernochi, of Turin, has just succeeded in sending drawings, handwriting and the like by a new wireless telegraph device which has thus far been tried with good success at 100 miles distance between the wireless stations of Turin and Milan, which were placed at his disposal by the Minister of War. It can be adapted to any kind of wireless plant and gives absolutely secret transmission. A point which is well worked out is the synchronous running of the sending and receiving cylinders which operate on the principle of phonograph cylinders by suitable mechanism. In many cases the records on the receiver cylinder were quite clear.

## Adaptable Lamp Stand

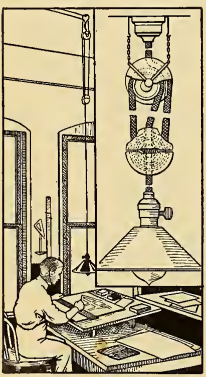
A lamp stand so constructed that it may be attached to the edge of a desk or table, hang evenly against a wall or rest on a flat surface is the subject of a patent issued to John T. Powers, St. Louis, Mo. An adjustable lamp shade may be used in connection with the stand, the shade being revolvable and mounted on the lamp socket.



ADJUSTABLE LAMP STAND

## Magna Lamp Adjuster

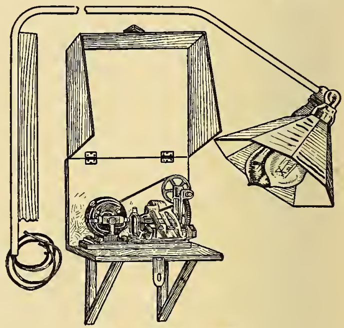
The Magna adjuster illustrated is readily attached to any flexible cord drop light so that it may be raised or lowered and automatically held at any desired height. The device operates on the double pulley tackle principle. The stationary pulley is held by two chains from the ceiling. The lower ball shaped member acts as a counterbalance to the lamp and shade. The adjuster is manufactured in white or dark brown glazed porcelain with nickeled parts with sufficient weights for the counterbalance to hold in place a socket, lamp and shade.



MAGNA LAMP ADJUSTER

## Effective Night Billboard Lighting

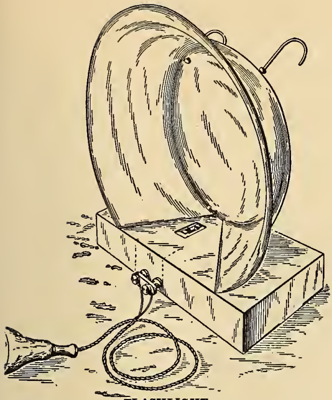
An apparatus for making an illuminated billboard more attractive by color changing effects is embodied in the Reynolds reflector. This contains lamps of two or three different colors, as may be desired, and a small motor driven flasher outfit, making it possible to change the color of the illumination from white to pink to red, etc., and back to white again. The effect upon the average billboard painted in colors is sufficient to cause a person to read it whether he really wants to or not.



BILLBOARD LIGHT

## Electrically Controlled Flashlight Device

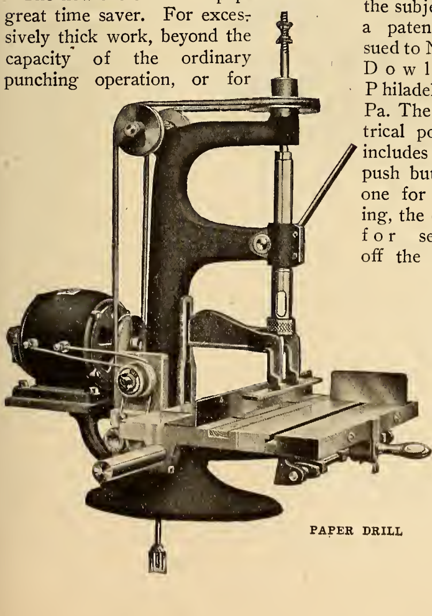
The illustration shows a portable igniting device for flashlights. A basin-like reflector is mounted upon the base which is arranged to contain batteries. One feature of the device is the removable plug upon which metallic filament lamp wire is preferably to be used as this wire has been found to give a large flash and to ignite all parts of a charge of powder practically simultaneously. A push button and cord enable the operator to ignite the powder from any distance, depending upon the length of the cord. A patent upon the invention has been issued to William Bale, Tooting, England,



FLASHLIGHT

## Paper Drill with Adjustable Table

The new motor driven paper drill is a great time saver. For excessively thick work, beyond the capacity of the ordinary punching operation, or for holes far from the sheet edge, this machine will be found very valuable and will do work not heretofore done satisfactorily. It is especially adapted for railroad tariffs, telephone directories, order blanks, calendar cards and similar work.

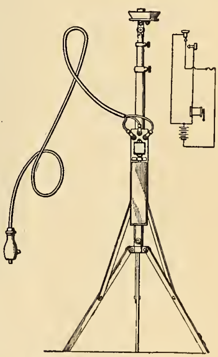


PAPER DRILL

The drills are hollow, insuring clean holes, the capacity varying from one sheet to two inches in thickness. The table is readily adjusted by automatic stops; the clamping device is operated by the foot, leaving both hands free to control the work.

## Portable Flashlight Apparatus

A portable, telescoping, foldable flashlight apparatus so made that it may be quickly set up without disarranging circuit connections for employing electric current to fire the powder is the subject of a patent issued to North Dowling, Philadelphia, Pa. The electrical portion includes two push buttons, one for testing, the other for setting off the powder; a battery, and a powder container in the bottom of which are small binding posts. Across these is secured a piece of fuse metal which the current heats and fires the powder covering it. A diagram of the testing and firing circuit is shown.



PORTABLE FLASHLIGHT

# Electrical Men of the Times

## VICTOR H. TOUSLEY

Good judgment, rare executive ability, congeniality, and being absolutely "on the square," are some of the prime requisites a municipal electrical inspector should have. The subject of this sketch is the happy possessor of all these traits and in exercising them finds himself, at the end of eleven years of service in one department, at its head, directing 45 men engaged in the inspection of wiring.

Victor H. Tousley, chief electrical inspector of the city of Chicago, is exceptionally fitted for the position he holds through the qualifications noted, and is also possessed of technical knowledge and a habit of careful performance of work that the public appreciates, and to which is due the commendable work of the men in his department.

Mr. Tousley is a Wisconsin boy, born in Fond du Lac, 37 years ago. While still a youth, he came to Chicago, was a student in the grammar schools and in the Englewood High School. After finishing the electrical engineering course at the Armour Institute of Technology, he entered the employment of the city of Chicago, doing night work upon the street lighting system.

In 1901 he entered the department of which he is now the head, the Bureau of Electrical Inspection, and at the end of seven years became assistant chief inspector. Three years later, 1910, he was made chief inspector.

Chicago's Electrical Department has charge of municipal lighting, fire alarms, the police telegraph system and the inspection of both outside and inside electric wiring. Inspections last year numbered 77,000. The apparatus subject to the bureau's supervision includes 5,000,000 incandescent lamps, 6,000 electric signs, 50,000 arc lamps and 300,000 horsepower in motors.

There are few men who have given the National Electrical Code more careful study than Mr. Tousley, and were you to enter his office in the City Hall and ask for the Code requirements upon a certain kind of electrical construction, he would doubtless hand you the Code and, while referring you to pages and rules by number, quote the needed information without bothering himself with printed pages.

To the field of electrical literature Mr. Tousley has given five books, in collaboration with Henry C. Horstman, bearing upon construction work and the care and operation of electrical devices. These are: "Electrical Wiring and Construction," "Modern Wiring Diagrams," "The Electrician's Operating and Testing Manual," "Modern Electrical Construction" and "Modern Illumination," the last being just off the press.

Mr. Tousley has been president of the Western Association of Electrical Inspectors. In the revision of the National Electrical Code he was a member of the electrical committee of the National Fire Protection Association.

## Electricity as an Aid to Health

That the modern house of the near future will be equipped with electrical apparatus which will, without the inmates knowing it, keep them constantly charged with electricity, thereby warding off many of the ills and aches that flesh has hitherto been heir to, is the prediction made by Dr. John P. Sutherland, dean of the Boston University School of Medicine.

"The use of the high frequency current," says Dr. Sutherland, "does not obtain so widely as might be expected, and physicians in this country have not, for one reason or another, taken it up. To my mind, however, it is of greater value than is generally recognized.

"It has been my experience that the apparatus is of value especially in the non-infectious diseases, such as rheumatism, nervous indigestion, headaches, general debility and the various other ailments, most of them chronic, which we have much difficulty in classifying, as well as treating. These ailments arise from what is known as auto-intoxication. These diseases may, in fact, be called chemical, as opposed to biological—that is, arising from germs.

"The human body is a laboratory in which are constantly occurring a number of chemical changes. For instance, when starch is taken into the stomach it is changed first into dextrine, then into glucose, and finally into sugar before it can finally be assimilated by the blood.

"This is an example of the chemical changes which are constantly occurring in the human system. These chemical changes are closely related and interrelated. In fact, it may be said that in the human body there is always a chain of chemical changes occurring. Now, provided any one of the links of one of these chains is broken—that is, if any one of the functions becomes out of order—we get a condition which probably brings on some ailment or other.

"Although the effect of the high frequency current and of electricity in general upon the human body is not altogether understood, it is safe to say that it has a decided effect upon these chemical processes. The current stimulates the action of the various excretory organs, enabling them to pass off the waste matters, and this is one of the most important functions of the healthy body.

"The body absorbs electricity from the high frequency currents, it may be said for the sake of illustration, in a manner not unlike that in which the storage battery receives its charge from a generator.

"In the future there will probably be a more extensive use of this form of high frequency current. Possibly it is preferable for a patient to be under the influence of the machine at a distance, even though the effect be slighter during a given length of time, than for him to take direct hold of the metal terminal of the machine.

"Much, then, has been done with the high frequency current, and much is still left to do. The man who perhaps deserves the most credit for providing this apparatus is Mr. Earle L. Ovington, now an aviator, who first opened the field for the high frequency apparatus.

"In the future it may become customary to sleep in an atmosphere charged with high frequency waves, just as we now recognize that it is beneficial to sleep in a room in which there is plenty of fresh air."

## Illuminating the Thermometer

In winter months porchlights are seldom used for any purpose other than for a moment or so in illuminating the steps leading therefrom and a very practical use for it, is for the illumination of the thermometer on the porch. This is readily accomplished by using an extension lamp connected to the porchlight socket and hung in place near the thermometer.

It is a decided luxury in the dark midwinter mornings to turn on the light from inside and read the outside temperature, without going out into the cold, so as to dress accordingly.

# Electrical Interests of Women

**EDITED BY GRACE T. HADLEY**

## Electrical Shops and Shopping

Electrical shops where electric heating and cooking apparatus is sold are a comparatively new development in the field of electrical industry. They are most attractive, and the wares exhibited for sale are unusual and unique. Purchasers often have to be convinced that electric heating apparatus is efficient and practical, but once convinced, a good customer is the best advertisement. The first cost of the apparatus often seems excessive, but its durability must be taken into consideration, and the scientific skill necessary for its proper construction. Electric heating and cooking apparatus is notable for the sanitary conditions its use promotes, the cleanliness it maintains, the flexibility it offers, and the safety it insures.

THE MODERN ELECTRICAL SHOP IS INTERESTING, EVEN FASCINATING

Shopping in one of these modern electrical shops is both interesting and fascinating. The former industries of the kitchen, done so tiresomely by hand, are now combined in one modern piece of apparatus such as the electric kitchen cabinet, which has devices for grinding coffee, beating eggs, paring potatoes, mixing bread, freezing cream, all done by means of cunningly contrived motor driven appliances. The electric portable power table is smaller and more compact than the kitchen cabinet, but offers the same variety of devices, which all help to solve the servant problem.

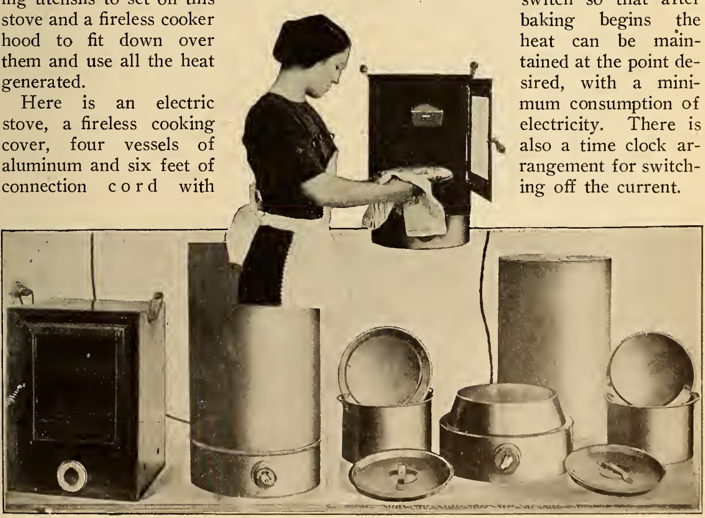
In the new electrical shops, neat, tidy maids demonstrate the use of the various devices, while competent salesmen explain the efficiency, value and practicability of the electrical merchandise.

## Quad Electric Stove and Fireless Cooker

Electricity is the ideal heat generator. It is absolutely uniform in its intensity and it is always under control, that is, it can be turned on or off at will. The fireless cooker is the ideal means of using heat for cooking, first, because it uses all the heat that is generated, and second, because it does the work without constant watching. A glance at the equipment herewith illustrated will show a device that utilizes all of these advantages. Just a round base in which is contained an electric stove to generate the heat, cooking utensils to set on this stove and a fireless cooker hood to fit down over them and use all the heat generated.

Here is an electric stove, a fireless cooking cover, four vessels of aluminum and six feet of connection cord with socket, plug and three heat switch. It is a cook that never frets, worries or complains and is never too tired to get an extra meal. Getting breakfast is an easy task indeed with this outfit. Oatmeal, for instance, can be put in at bedtime and taken out thoroughly cooked in the morning. When the cooker hood is removed, the electric stove will still be warm. Switch on the current just a few minutes and a pot of coffee may be boiled or bread may be toasted and eggs fried right on the stove plate.

In this device the oven fits down tightly over the heating surface of the electric stove. The walls of the oven being insulated, all the heat is retained and used. And through the glass door, the progress of the baking may be watched without exposing the food to sudden drafts. The shelves are removable so that space can be made for the largest roast or three dishes can be cooked at the same time. The stove for the oven is supplied with a three heat switch so that after baking begins the heat can be maintained at the point desired, with a minimum consumption of electricity. There is also a time clock arrangement for switching off the current.



THE NEW QUAD ELECTRIC FIRELESS COOKER


**(1) Mrs. Harry L. Keats and daughter Mildred of Portland, Oregon, in their car which took first prize in the Rose Festival Parade. (2) Mrs. C. Y. Kenworthy (driving), member of the Electric Automobile Club of New York, just returning from a 45 mile spin. (3) Mrs. Clarence Udell Townsend of Seattle, Wash., a prominent woman who is devoted to the use of her electric car.**

The woman who is socially busy is enabled, by the aid of the electric motor, to cover just about three times the amount of territory in comfort that was formerly accomplished with effort and fatigue. She does not have to depend upon a chauffeur. She can wear her smartest and daintiest frock and it will not become soiled. She does not have to strain her voice to carry on a conversa-


**(4) Mrs. John H. Hannan, a social favorite of New York, just leaving for a shopping trip from her home on Fifth avenue. (5) Mrs. William Howard Taft, first lady of the land, who drives an electric car and is one of its most ardent advocates. (6) The Misses von Brunberg of Berlin in their electric. Incidentally this shows a type of electric runabout not frequently seen in this country.**

tion with her companion because there is no noise. All these things appeal to a woman, and there isn't a woman who ever rode in an electric motor car but hopes that some day she can guide her own car down the boulevard or through the parks.

It is difficult to overestimate the value of the electric car from the health standpoint. That it is a wonderful stimulant to vitality and a cure for nerve troubles is a certainty; physicians invariably speak in the highest terms of the beneficial results derived from the use of the electric motor.

The ozone which is driven into the lungs by riding in a motor car at a fair rate of speed is a specific cure for insomnia and other nervous troubles. Sanity and level-headedness, together with healthy living, have come to those who have found it possible to live a good share of the time in their cars.

The woman whose social duties are many and make a great demand upon her vitality should take a spin in her electric car as often as she can possibly do so, no matter how short the spin may be. Motoring is most effective in breaking up stagnation of mind and body and sending a healthy vibration through the system.

Women of social and intellectual prominence in every state and every city are taking to the electric, and indeed it is in a great measure to women that the remarkable development of this type of vehicle is due.

## The First Thanksgiving Week

Progress has been so rapid that present achievements seem almost incredible. Today the electric current furnishes illumination and also provides innumerable means of lightening labor and making life more enjoyable. A quaint book of colonial life gives a picture of the first Thanksgiving week in bleak Plymouth in the year 1621, when "the four women of the colony, with the help of one servant and a few young maidekins, had to prepare and cook food for 120 hungry men, 91 of them being Indians with an unbounded capacity for gluttonous gorging unsurpassed by any other race. Doubtless the deer and possibly the great turkeys were roasted in the open air. The picture of that Thanksgiving Day, the block house with its few cannon, the Pilgrim men in buff breeches, red waistcoats and green or sad-colored mandillions; the great company of Indians, gay in holiday paint and feathers and fur, the few sad, overworked, homesick women in worn and simple gowns with plain coifs and kerchiefs, and the pathetic handful of little children, form a keen contrast to the prosperous, cheerful Thanksgivings of a century later." It was in this same year that Governor Bradford wrote, "beside water foule ther was a great store of wild turkies." Later on the supplies in the larder of the early colonists included such dainties as samp or hominy, eels with herbs, joll of salmon, honey, curds and cream, "pumpion pye" and fish and cranberries were plentiful.

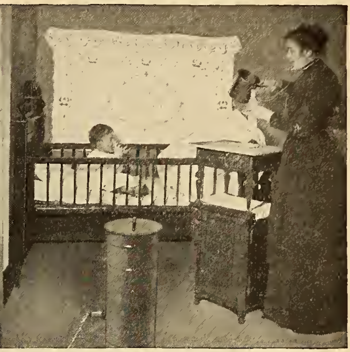
The chief means of illumination in those early homes was the glow from the kitchen fireplace, supplemented by a few flickering, sputtering tallow candles. Now the modern Thanksgiving table may be beautifully decorated with chandeliers or candelabra containing tiny electric opalescent globes and illuminated garlands.

## Electricity in German Homes

While the United States has been a world leader in much electrical development work, such as the manufacture of arc lamps, incandescent lamps and telephones, still when it comes to the practical application of electric power to the small farm and the small home, Germany is in the lead. There are several reasons for this: the average farm in Germany is small, and the farmer must practice intensive cultivation; then, too, these farms are often quite near some town with an electric light plant from which electric current may be purchased.

A plan adopted abroad is to install a rural central station to supply a number of farms, country homes and rural industries. In Germany, as many as 100 to 150 consumers are supplied with electric energy from one of the numerous rural central stations. Thus it follows naturally that the German hausfrau finds the electric current a handy helper in


DOMESTIC MOTOR IN THE GERMAN KITCHEN


MILK WARMER AND ELECTRIC HEATER


ELECTRIC COOKING AND IRONING IN A GERMAN WORKINGMAN'S HOME

the performance of household duties. In a family of modest means, where there are several children and much work, the electric flatiron eliminates the drudgery of ironing and makes it a less tiresome task. The mother has more time and strength for other duties.

Considering that she has five meals to prepare in twelve hours, electricity becomes a most efficient aid. The first breakfast is served between seven and nine in the morning, and consists of coffee with or without rolls; between ten-thirty and eleven, there is a second breakfast or simple luncheon of sandwiches, sausage or eggs, with wine or beer. In the middle class household, dinner or mittagessen is served between one and two o'clock. Soup is an essential and a skilled hausfrau will see that the same kind of soup does not appear too often. Hot dishes are also necessary and a good deal of care is bestowed upon the preparation of vegetables. Fruits and conserves are used as a dessert. At four in the afternoon, coffee and cake are served, while at eight o'clock supper must be ready, and a very substantial meal it is, with cold meats both fresh and cured, fish salads and the heavy but very nutritious rye bread with tea or beer.

Among some of the middle class families several old customs are observed at table, as when the guests take their seats a genial "May you dine well!" is spoken, and at the end of the repast, "Blessing on the meal!" followed by handshaking and mutual good words of cheer.

Electric utensils, the milk warmer and a cylindrical electric heating stove, are often to be found in humble homes, and the household motor for polishing the silverware and for sharpening knives. All these handy appliances are in daily use in many middle class homes in Germany and make increased comfort in the small German home.

# Electric Cooking in a Modern Hotel

"Electricity is far better than gas for cooking purposes," said Mr. Frank Cucco, chef of one of the leading hotels in Chicago. He ought to know since he is a culinary artist presiding over a fine, modern electric range in the grill room of the Hotel La Salle. This room is open to the public during the winter season and is very popular, since every bit of food served is cooked to order. There are no "ready to serve" specials. In front of the electric range is a counter equipped at both ends with a plate glass refrigerator wherein are displayed samples of the fish, game and poultry. Large glass bowls filled with water show live brook trout to the best advantage and offer a potent appeal to the most fastidious appetite. Prospective diners whet their appetite first by taking a look at the toothsome edibles on display and then select whatever appears most appetizing.

An artist in domestic science once remarked that every dish that comes to the table should make the mouth water merely to look at it, so in this grill room samples are displayed most temptingly and a hungry patron makes a prompt selection: "Chef, broil that trout for me," or "Chef, I like the looks of that lobster," and in a trice the bonny brook trout or the baby lobster is on the electric iron and comes to the table well calculated to make an epicure's mouth water.

"Electricity is safe, clean and has many advantages," declares the chef. "An entire Thanksgiving dinner may be prepared upon the electric range with ease and comfort." In proof of this statement, he offers the following menu:

THANKSGIVING DINNER.

Canape Admiral

Celery Olives Radishes

Pureé of oysters à la Wilson Crackers

English sole in electric iron
Maitre d'hotel butter
Potato Sarah Bernhardt

York ham glacé au champagné
Brussels sprouts saute with chestnuts
Grill sweet potatoes

Pineapple sherbet

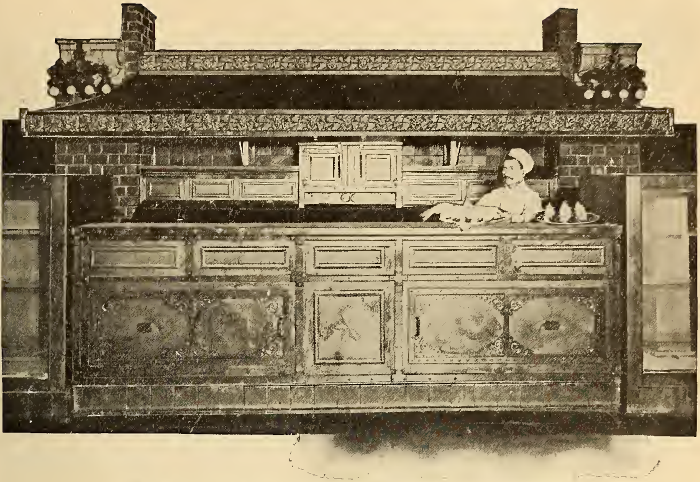
Fresh mushrooms Surcloche

Roast turkey, cranberry sauce
Celery à la Moille
Salad de Season

Pumpkin pie Plum pudding
Bombé Surprise Petite Four
Macedoine de fruit, Maraschino

Assorted Cheese

Coffee Crackers



THE HOTEL LA SALLE ELECTRIC GRILL—CHEF CUCCO PRESIDING

The modern electric range is a marvel in its way, with seven large cooking compartments, three double broilers, one each for fish, meat and fowl, two compartments for toasting and two electrically heated plates for the pots of soup. There are a couple of warming ovens above the broilers where plates are heated and the order is served piping hot. A magnificent tile embroidered hood surmounts the whole range and beneath this are a number of electric lights so that the illumination is efficient and satisfactory.

## Triscuits Baked by Electricity

The power from Niagara Falls is not only utilized to make candy, chewing gum, chemicals, flour, ice and pure fruit preserves, but the baking of triscuits is done by electricity in a plant near the falls. Triscuits are made of whole wheat shredded eighteen layers deep and subjected to pressure before they are baked. The shredding machines consist of pairs of rollers and a cutting and panning device. Each pair of rolls consists of a steel roller with lines or corrugations cut upon its surface; rolling against a smooth roller the kernel of wheat is caught between the two and rolled out into a long shred, which drops upon an endless belt. These electrically driven shredding machines are marvels of ingenuity and by their continuous operation light porous shreds in threadlike form are deposited on the traveling belt the width of the finished biscuit.

The triscuit factory resembles a huge conservatory with its 844 windows and 30,000 panes of glass.

## For the Toast Stove

Use the toaster stove plate turned upside down to form a tray.

Fry the bacon first; then draw the bacon to one side of the tray, and put in the liver cut in thin slices and rolled in flour and peppered. Cook the liver until brown; turn frequently. Serve a slice of bacon with each piece of liver.

# Junior Section

## Buff Cochins and the Battery

By EVERETT E. LOWRY

In view of the many and intricate applications of electricity the following account is not calculated to stagger the wizards, in fact, it may be regarded by some as a trivial, if not an undignified application of the king of energies. To such, however, as have had to cope with the headstrong hen, when that moulting grandame of the barn yard has decided to set at the wrong time, there may arise a sense of satisfaction to learn that a speedy and permanent cure has at last been discovered for this insane resolution.

THERE IS LITTLE USE ARGUING WITH A SETTING HEN

Speaking of chickens in a general way, it must be admitted that they are quite a nuisance—especially to the neighbors. There is nothing a chicken more thoroughly enjoys than scratching its initials and leaving Bertillon marks among the fresh growing things of a neighbor's garden, thereby keeping alive family feuds and provoking party fence altercations without end. They eat their heads off, are hard to catch when company stays for dinner, and through some secret understanding refuse to lay when eggs are 40 cents a dozen, but they have their good points.

There is little use, however, arguing with a setting hen, or pointing out the fact that she hasn't an egg to her name. She is deaf to reason, although you boost her off the nest a dozen times a day and present her with prickly pears and hot door knobs as foot warmers.

I recently spent a few weeks in a small Indiana town where nearly everybody raised chickens. A family in this town that didn't carry a side line of poultry was hardly regarded as "keeping house." For example, Mr. Brown, my neighbor on the right, was secretly vain over a bevy of Rhode Island Reds, the widow Green on the corner had for years been a victim of the Plymouth Rock habit, while Mr. Blue, who occupies the old mansion situated on the crest of the broad sweep of lawn across the way, had, after careful consideration, pinned his faith to the Buff Cochin, and it was a pleasant sight in the late afternoon to see the entire herd marshalled out on the lawn for an hour's recreation before dusk.

TAUGHT THEM TO EAT FROM THE HUMAN HAND

Of course the Blues were a little foolish over their chickens, teaching them to eat from the human hand and perform before company, so it was with a decided shock that Mrs. Blue discovered, while in the role of Lady Bountiful one morning, that three of her most trusted charges had gone on strike without even a bean in the treasury.

Realizing, after a brief, but one-sided battle, that it would require the services of a hired man to thwart the will of these stalwart fowls, she was about to give up in despair when her son Lebert came to her rescue.

Lebert is sixteen years of age, of an inventive turn of mind, with a penchant for electrical experiments, and it was no time before he had rigged up an appliance that he felt sure would have a stimulating effect upon anything from a hen to a balky horse. The device was simplicity itself, consisting merely of two flat pieces of metal encased in damp cloths, and connected by wires to a spark coil transmitting the genial current from seven batteries.

I happened to be one of the judges selected to witness the experiment (the family having decided to receive returns by telephone), and being somewhat in awe of an invisible force, approached the fatal spot with some hesitation. We found Lebert already on the grounds with the shining eyes of a genius about to prove an invention, and while the committee stood back at a respectful distance he adjusted the plates and made a final examination to be sure no hitch should mar the performance.

When the disgruntled old hen had crept back on the nest, planting a gnarled claw on either plate, she was given an opportunity to state why sentence should not be executed, but remained sullen to the last, and at a given signal the current was switched on.

So far as I know the Cochin has never taken any medals in athletics, and to judge from the stolid expression assumed by this fowl, the acrobatic achievements that followed were wholly unpremeditated. Be that as it may, this bird person suddenly decided that to "set" any

SHE SUDDENLY MOUNTED SKYWARD

longer would be the height of foolishness and an utter waste of valuable time. With one long-drawn-out squawk she mounted swiftly skyward, turned a double back flip-flop, and came down in the nest again all spraddled out with one foot planted squarely on either plate. Lebert promptly gave her the other barrel, and with an-

SCATTERED THE JUDGES RIGHT AND LEFT

other mighty whoop she was again in air, but this time, by rowing hard with the left wing and reversing with the right, she managed to avoid the nest in her descent, and went thumping off down the lot, scattering judges right and left and startling the neighbors with her squawks.

For fifteen minutes there followed a tumult in the barnyard fit to rival a Bull Moose convention, and for the rest of the day this foiled and mystified fowl stood ready to jump four feet in whichever direction she happened to be pointed if a cob chanced to turn under her foot.

The cure was next applied to the other two recalcitrants with the result that each in turn tried to break the standing high jump record. As for returning to the nest again, at last accounts all three hens were still taking their meals standing and seemed too nervous to remain still long enough to do any good. They now spend the days among the jimson weeds in the lower lot, dodging the falling leaves and staring hard at the hen house, first with one eye and then the other.

## As an American Boy Sees Switzerland

Readers of the Junior Section will no doubt be interested in a letter received from Roland Richardson, an Ohio boy, who is living at present in Switzerland, and we quote here the major portion of his letter as follows:

"I have only seen one steam power plant since I have been here, about five miles from Neuchatel. Down the lake a little there is a gorge and in that gorge there are three high tension power plants (the Swiss call them "Usine Electrique"). One sends electricity to Neuchatel at a pressure of 25,000 volts, another to LaChaux de Fonds at the same pressure and I don't know where the other one goes. They are all run by water power coming from a mountain called Boudry and you can see these immense steel pipes coming down the side of the mountain. The pipes are about three feet in diameter and two of those pipes run eight dynamos of about 200 K. W. each. In all the cities big and little they have electric lights and use electricity for power. There are transmission lines all over Switzerland and where they run near a little village they tap the wires to transform it down to 110 volts and use it.

We left Neuchatel for three weeks for a little place called Loeche Les Bains which is right down in the mountains. In this little town of about 650 inhabitants there are two small power houses and I want to tell you how they get their power. There is a little brook that is fed by a glacier that runs through the town, and about one-fourth of a mile up the stream from the town they dropped some rocks about half way across the stream. I say they dropped them because it isn't a dam; it's just a few big boulders in the water which kind of side tracked a little of the water into a ditch which ran along a little ways and then into a pipe about eighteen inches in diameter and then down about 200 feet, not straight down, but on an incline into a little house. I got inquisitive and hung around a little and stuck my head in the door when a big Swiss man called to me to come in and so I did. In there I saw the end of the pipe connected up with a little turbine about waist high and that to a dynamo of about five K. W. capacity and a belt wheel in the middle to connect another dynamo to the turbine if necessary. Then in another room there were 84 cells of storage battery, each cell bubbling and letting off such a smell that I couldn't stay in as long as I wanted to. And here this one man was in charge of this plant and all he had to do was to turn a few switches and read a paper while the water did all the work.

Then there is another one that is still more easily tended to. There is a little stream not more than one foot wide in places and not more than two feet any place that runs along until it gets to a place where it runs into a cement tank about six by three by four feet large and at the bottom of that a pipe running down a hill and into a house. I could only look into the window of this one because there was no attendant, but I saw all there was to see. The pipe was connected to another turbine and that to a dynamo of about 30 K. W. capacity, and it was humming away there at about 800 revolutions per minute with no one to look after it even. And those two power plants light this little town which is mostly hotels, and they use up a lot of juice. They all have Osram lamps over here. Even the oldest, most run down houses that the poorest people live in have electric lights because current is so cheap; it only costs $2.00 per year for a 16 candlepower lamp.

I am an American and I lived in the Southern part of Ohio all my life and I have taken Popular Electricity for three years. One year I just bought it by the copy and another year a boy named Joe Hark and I took it together. The town I came from is named Glendale and this boy Joe Hark and I did all the electric jobs in town and made a good deal of money. We put in door bells, fixed electric lights and everything along those lines.

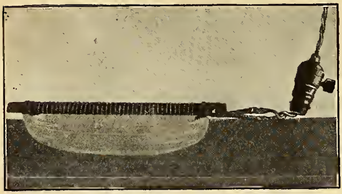
We once, with three other boys, had a telegraph line that was 1½ miles long. We put our telegraph wire on the railroad poles, the electric light poles, the telephone poles and also on the street car poles. We did not mean any harm by it, but before long we had five big rich companies after us and that put an end to our telegraphing. We took to doing the jobs in town and now my pal in Glendale is getting along O. K. and is installing electric fans and telephones just like an expert. I tried to get a job over here, but everything works on the apprentice plan over here and I would have to learn as an apprentice for three years, besides paying 300 francs. As we only expect to stay here for three years and I want to learn all I can in the way of languages, etc., I couldn't accept the position.

In reference to Popular Electricity Magazine I really don't think I could be happy without it, for I can't wait until the end of the month comes to get it and then I don't like anybody to bother me until I have finished reading it. I read it from beginning to end, advertisements and all, and wish it was twice as long and came every week, so you see I have nothing to say against it and lots to say for it.

## Electric Fly Killer

Millis Knickerbocker of New Lenox, Will County, Ill., has invented a new way of killing flies. He says it beats the swatter or sticky fly paper ali to pieces. He simply shocks the flies with electricity. It is a very simple method according to Mr. Knickerbocker; all the fly has to do is to get in the circuit and it is all off with him.

The fly killer is made of a round grooved piece of wood eighteen inches long wound with German silver wire, the

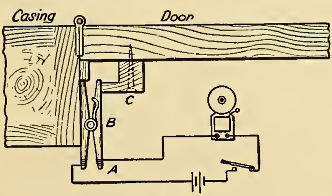


ELECTRIC FLY KILLER

two wires from the lighting circuit being wound in parallel spirals. The ends of the wires at the top of the coils connect with the electric wires in the lamp socket while at the other end of the coils the wires are cut off at even length and not connected. The wire bound roll is placed over a small tin trough or glass bowl filled with water, into which the flies fall, for as soon as a fly touches two wires a connection is made and the victim is quickly electrocuted and falls into the water. No current goes to waste as none is used until a connection is made.

## Door Alarm

A switch which causes the alarm to sound when the door is opened can be made with a spring clothespin (B) fastened by one leg to the sash of the doorway. The upper ends of the pins are




DOOR ALARM

first wound with enough bare bell wire to make a good contact when the pin is closed. The wire from (A) must be coiled to allow for the movement of the pin. An L-shaped piece of wood (C) is fastened to the door to break the contact when the door is closed, as shown in the illustration. CARL T. EBER.

## Fairyland Discovered

Fairyland! That wonderful region of fancy and childhood dreams has been found at last—found in the soft glow of 10,000 electric light bulbs twinkling through branches of trees and out of leafy bowers—found by nearly 4000 gleeful little boys and girls—and by the photographer, for of course it was necessary to have the picture man on hand to record the great event on his plates or grown-ups might doubt the success of the children's exploits just as they do discoverers of poles.

Strange to tell, it is in the very midst of a great big noisy city full of five millions of people. It is in Central Park, famous for its natural beauty and charming scenery. That is where the children of New York's 42 playgrounds found fairyland on the evening of August 3rd.

The sheepfold, a rolling green meadow of eleven acres, in the heart of Central Park at about Seventieth Street between the Mall and the West Drive, is the exact place where fairyland was discovered. It was the greatest children's pageant ever staged and was witnessed by an audience estimated at 50,000. The fete was arranged and carried out by William J. Lee, Supervisor of Recreation, and his assistant, Miss Mary J. McKenna. The Recreation Bureau is conducted under the Department of Parks, of which Charles B. Stover is Commissioner. Preparations for the pageant extended over a month, 5000 yards of cheesecloth being made into the costumes which the children wore. More than an acre of the sheep meadow was transformed into a stage and roped off. At 6:30 p. m. the pageant of all nations began to arrive, represented by specially costumed delegations from the various municipal playgrounds. Then followed dancing, frolicking and disporting of clowns while the search for fairyland was going on. At length the children becoming weary ranged themselves in a huge semicircle on the green. At 7:30 with a blare of trumpets the King and

Queen of Fairyland appeared in a golden chariot drawn with ribbons by 50 little fairies.

It was at this moment that the most wonderful part of the program—in fact the climax—was reached. The growing dusk and the shadows were making details indistinct when suddenly, simultaneous with the appearance of the King and Queen, the trees surrounding the meadow were transformed into a witchery of varicolored lights. There were 10,000 of them—all eight candle power. They twinkled even from the tops of the tallest trees surrounding the meadow and wrought a fantastic tracery in the dark foliage. The beauty of the scene—the children seated on the green, speechless in their amazement, the lights, the falling dusk—is hard to describe.

A great sign, 21 feet long and three feet high, composed of 129 electric lights spelled out "FAIRYLAND" at one end of the green. There was a giant Maypole, too, the like of which was never before seen. On this glowed 1500 colored bulbs, running in streamers from the top to surrounding points on the green.

There are perhaps a few who realize the difficulties which attend planting an electrical display of this extent in the center of a big park. A force of skilled specialists in this line of work started in four days before the staging of the event.

FAIRYLAND

## Electric Lighting in Arabia

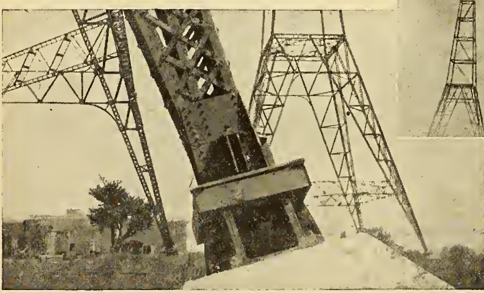
The installation of a 500 lamp electric lighting plant in the palace of the Sultan of Oman, at Maskat, Arabia, has just been completed by N. S. Bayanker. This is the first instance of the operation of any sort of electric machinery in this country. Mr. Bayanker has also secured permission to operate a commercial lighting and power plant and will proceed to erect the same at once, his intention being to use two 30 kilowatt dynamos capable of supplying current for 6000 lamps. One set of machines will be run at night and the other during the day, principally for the purpose of driving fans which, on account of the great heat and the difficulty of securing energetic punkah pullers, are much needed. Power will be furnished by oil engines and direct current will be used.

Popular Electricity Wireless Club

# A World Wireless System for Uncle Sam's Navy

By BERTRAND SHERBURNE

The tallest wireless towers in the world, belonging to the first station of a series of seven, which will cover all of that portion of the world which is visited by ships of the United States navy, are about completed at Arlington, Va., across the Potomac river from the city of Washington. The largest of these towers is 600 feet in height, and it is expected that wireless stations in Ireland and Germany will be within its radius. This station is the controlling station for an ocean embracing system for the United States navy which will be so comprehensive that, when completed, it will put all of the vessels of the American navy in constant touch with one another and the Navy Department at Washington.



TOWERS OF THE NEW GOVERNMENT STATION AT ARLINGTON, VA.

Coupled with the stations of the commercial wireless companies, this system will cover the entire globe. The other six stations are to be located in the following places: Panama Canal Zone; in the vicinity of the great United States naval base, recently opened at Pearl Harbor, Hawaiian Islands; on the Pacific coast, probably not far from San Francisco; island of Guam; island of Tutuila (American Samoa); somewhere on the island of Luzon, Philippine Islands.

The immense strategic importance of this plan is at once apparent when it is considered that it will permit of the issuance of orders direct from the Navy Department at Washington to any United States war vessel. It will make possible the mobilization of the entire United States naval fighting strength in any part of the world as fast as each vessel can steam to the point selected.

The station at Arlington will be the controlling station. Construction work on this station was begun some time last summer, and it is expected that everything will be in running order by the first of November of this year. The general plan consists of three towers—one 600 feet in height and two 450 feet in height, with connecting antennæ and a station building with full transmitting and receiving equipment.

The towers are arranged in the form of an isosceles triangle, the apex pointing west, and the base running due north and south. The base of the triangle is about 352 feet and the legs 392 feet. The towers are of structural steel, with latticed legs, rectangular in section. The smaller towers are 120 feet square and the larger one 150 feet square. Each tower leg is insulated from the ground by a marble slab which rests on a large steel casting, from which bolts pass up through the slab to the steel base of the leg, being insulated from the latter by marble washers. Each slab is designed for an insulating resistance of 150 volts.

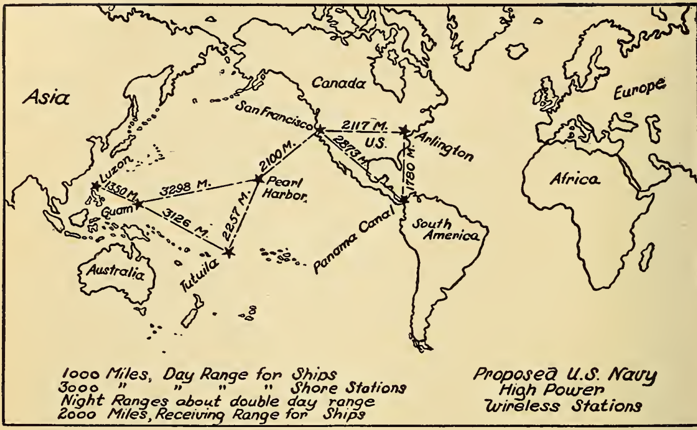
The station house is about 158 feet long and 46 feet greatest width. It is two stories in height. The first floor space is divided into a receiving room, two laboratories, power room, two office rooms, living room, kitchen and store room. The second floor is devoted to bedroom and dormitory space and bath room. The flat roof has a high coping, and is intended to be accessible for observation purposes. From it a fine view is afforded of the Potomac river, Anacostia Heights, and the city of Washington.

The transmitting antennæ consist of three sections, stretching between the three towers in the form of an isosceles triangle. The sections are composed of two groups of wires each. Each group is provided with 88 foot spreaders, and the wires are spaced at intervals of four feet. The transmitting aerial is brought down midway between the two smaller towers to the station building, making a T of this section. A lightning switch is interposed between the aerial and the section entering the transmitter room. The latter enters in the center of a rectangular piece of plate glass, six feet square and one inch thick, which provides ample insulation. The grounding system is very elaborate, being in three sections, one in the form of a gridiron, covering the entire space beneath the building and also a portion of the surrounding ground area, the other two spreading out from each side of the building in the form of a fan. In all, about 60,000 feet of wire is buried.

The receiving antennæ are 20 feet above the transmitting antennæ. The former are to be made up of from one to ten wires, the number to be experimentally determined after installation. The aerials from the receiving antennæ lead down to a lightning switch, and thence through the insulating plate to the receiving room, as in the case of the transmitting wires.

Two different types of receivers will be used, one type for short wave lengths and one for long wave lengths. The receiving room is a sound proof apartment in the center of the building. The walls are made of extra thickness, and are deadened so as effectually to prevent the entrance of external noises. The only means of communication provided the receiving operator other than his radio apparatus is a telautograph which leads to an operator in the adjoining office.

This other operator will be provided with a telephone instrument connecting direct with the Navy Department at Washington, a telephone switchboard for the building and for local calls, and a telegraph sounder and key, connecting with the Postal and Western Union of-




fices, thus permitting the direct transmission of all messages immediately to the land wires.

The transmitter for the station is a 100 kilowatt, 500 cycle generator, direct connected to a synchronous rotary spark gap. This generator is belt driven from a 200 horse power, three phase, synchronous motor, current for which is supplied from the wires of the Potomac Electric Power Company. Current is taken at 6600 volts, 25 cycles, three phase, and transformed down to the 110 volt current with which the motor is driven. About 175 kilowatts are required to drive this motor. It is proposed at some later date to install an oil or gasoline engine, as an additional source of power.

In addition to this high power equipment, there will be various machines for testing purposes, some of which are as follows:

The engine room has been planned to provide for future expansion. The two large testing laboratories will be fully equipped with the latest apparatus. There are two large storage battery rooms.

The dormitory on the second floor of the station will accommodate 24 men, and laundry and kitchen equipment are complete. One of the interesting features contemplated will be the use of two rooms as a wireless museum, in which old and out of date radio apparatus will be on exhibition.

Wireless apparatus for the primary set was furnished by the National Electric Signalling Company, formerly the old Fessenden Company. Contract for the structural work was awarded to the Baltimore Bridge Company and taken over by the Carnegie Steel Company at the time of the recent absorption of the former company by the Carnegie concern.

Officials of the Navy Department believe that this station will have a continuous day and night range of 3000 miles, and that a day communication between this station and the Marconi station at Clifden, Ireland, can be maintained, while the night range is expected to include points as far as Nauen, Germany.

With the seven stations to which reference was made above, it is expected that the Navy Department will be independent of the cable service, and that it will be possible for all United States war vessels to keep in constant touch with each other and with the home office.

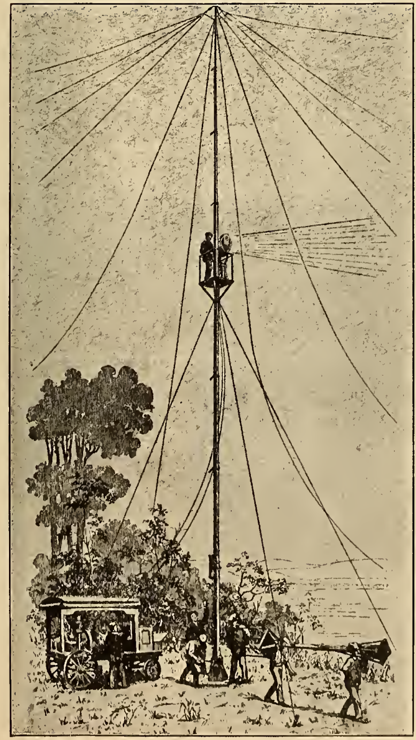
## Field Mast for Wireless and Searchlights

The Komet mast is a recent German invention and it can be put to quite a number of uses. When not in use it occupies but a small space, but can be extended so as to reach a considerable height, and this is readily done either by a hand crank or by a small electric motor.

The mast is made up of a number of iron tube sections and these are telescoped by an improved method so that when the sections are slid out, each one is firmly locked in place to make a solid joint. When fully extended, the mast can be stayed by guy wires running to the ground.

In connection with electrical work the Komet mast serves for wireless telegraphy and is very convenient for field use. A searchlight can also be mounted on it so as to explore the surrounding country.

Again, temporary electric lighting of construction work and the like can be very well done by using the masts as arc lamp poles. The mast is well adapted for use with a wireless automobile outfit or again with an automobile electric plant for searchlight use, and it will be valuable in military work in this connection. Many other uses can be found for it. One type of mast is fitted with a small electric motor in the base so that by simply closing a switch the whole mast is slid out within a few minutes, and it can be run in again in the same way. The usual height of the mast is about 100 feet.



THE "COMET" COLLAPSIBLE MAST WHEN RAISED

## Proposed Atlantic Weather Bureau

Professor Moore, head of the Meteorological Office, Washington, proposes that a median line shall be established through the North Atlantic, and all ships fitted with wireless apparatus, sailing on either side of it, will be required to take a daily weather observation. The idea is that vessels on the eastward half of the ocean should relay these reports to London and Paris, and those westward of the line to Washington. By a close comparison of the messages it will be possible to estimate the track and speed of storms, to make up a weather chart.

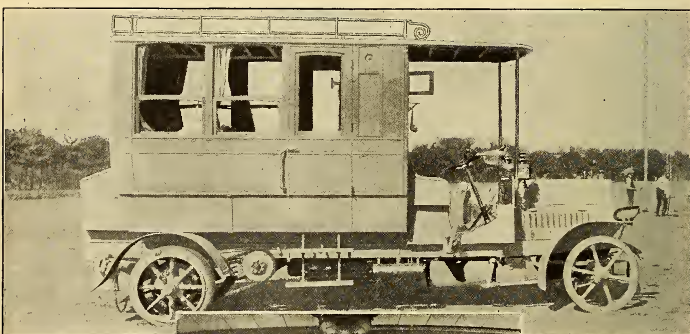
## A German Wireless Motor Car

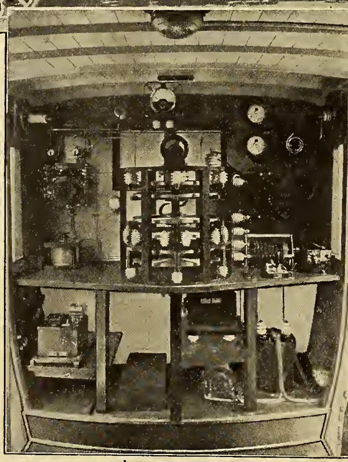
BY OUR BERLIN CORRESPONDENT

The German wireless telegraph company (Telefunken Company) has brought out an automobile wireless station intended to supplement the ordinary transportable military post. Its range is about the same as that of transportable military stations, being between 125 and 155 miles on the level with an antenna mast 80 feet high. Six to eight men, inclusive of the driver, who are transported on the motor car itself, suffice for the operation, the wireless post being put up in working order in 15 to 20 minutes.

In designing the motor car, the Neue Automobile Gesellschaft made a special point of insuring great reliability and high speed. A four cylinder motor of 30 horsepower normal output is used for driving the car and the wireless generator. The body of the car is designed as a limousine, containing the wireless apparatus and the seats for the staff. Its interior is lighted by incandescent lamps fed from a small storage battery, an oil lamp being provided as reserve.

The table on which the apparatus is arranged in a straightforward and readily accessible manner is installed on the front wall, the measuring instruments being fixed to this wall. A window allowing a direct communication with the driver through a speaking tube is likewise arranged in the front wall. On the rear wall is provided a seat for three men, and in the middle on both sides are two officers' seats. The electrical machinery, which is fitted into the chassis below the floor, is readily accessible through doors in the latter. The antennæ, reserve material, and dynamo are arranged





A GERMAN WIRELESS MOTOR CAR

in a fire box at the rear, which is accessible from the inside as well as the outside. All the machinery and apparatus are so fitted into the car that every part is readily accessible, easy to control and immediately ready for operation. In order to pass from traveling to wireless operation it is only required to erect and connect up the antenna system, and for the sake of transmission, to switch the motor coupling into the generator set.

The generator, which can be coupled to the gasoline motor by means of the switchgear, is a high frequency, single phase machine, devoid of collectors and slip rings. Its output is two kilowatts.

The wireless equipment is installed on an apparatus table at the front wall of the car, and partly on the front wall itself. On the right side is seen the sender and on the left side the receiver. Below the table are arranged the condenser and the transformer of the sender, as well as two boxes for tools and reserve materials, respectively. All connection wires are plainly visible, laid out bare on insulators and screwed to the apparatus.

The sender is operated by opening and closing the alternating current circuit by means of an ordinary key. A hot wire ammeter and voltmeter have been provided for measuring the current intensity and tension in this circuit.

The primary vibratory circuit comprises the spark gap, the condensers and the self-induction coil. The spark gap is a series damping spark gap with metal electrodes, which are arranged in an insulated frame. The condensers consist of tinfoil with paraffin paper insulation, fitted into a wooden case; brass terminals are provided at the outside of the case for connecting up the conductor. The self-induction coil is wound from flat copper bands and comprises plug connections for adjusting some given fixed wave lengths. Inside the range of 600 to 1,600 meters any four fixed waves are readily adjusted for by means of a few manipulations.

The antenna circuit is adjusted to the wave length of the primary by means of a set of six antenna extension coils inserted into the antenna and provided with connections for the various wave lengths. The coils are made from flat copper bands.

In order to allow an accurate tuning to be obtained between the antenna and the exciter circuit, the second coil is wound in a direction opposite to the remainder and is movable in a vertical direction, thus altering within narrow limits the mutual induction of the two coils.

After plugging the desired wave length into the exciter circuit and antenna, the movable coil is approached to the stationary coil situated above it, or removed from this coil, until the hot wire ammeter inserted into the antenna shows a maximum deflection. An accurate tuning between the two sender circuits has thus been obtained.

## Frenchman Invents New Detector

It is stated that a French inventor has succeeded in dispensing with all the outer wires and antennæ in a receiving wireless telegraph system by producing a detector which is far in advance of all others in sensitiveness. The inventor is M. Duroquier, and he made experiments before different persons with his apparatus, hearing messages which came from all quarters. The most valuable discovery is a substance which is far more sensitive than any now in use for receiving the waves, and he thus makes a detector which cannot get out of order and is mounted in a small base of 6 by 4 inches. With an ordinary telephone he heard messages from other countries, even as far off as Ireland, Gibraltar, and other places, and could read the Marconi news bulletin sent out to vessels. All this was done without an antenna and nothing but the detector, the "finding coil" and the head receiver.—*London Electrical Review.*

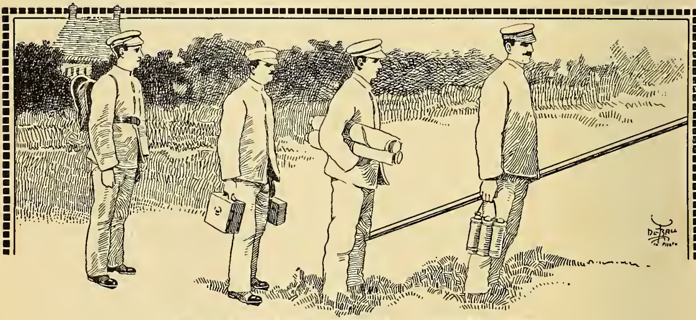
## Great Brazilian Wireless System

A new record for the establishment of a cross country wireless system, has been made by South America republics. Lima, Peru, and Para, Brazil, formerly completely isolated from each other, have recently been hooked up by a German wireless company. The height of the mountains between the two stations is nearly 20,000 feet.

## Knapsack Wireless Outfit

The new Marconi knapsack wireless outfit is one which will often be useful in army work, and it can be used for signalling where a heavy plant could not be employed. It has about a ten mile range, and the whole outfit is carried in knapsacks strapped to the backs of the soldiers, the complete set being carried by four men, each with a 20 to 30 pound load. The first man takes the mast and the battery, the second the wire gauze network which is unrolled out upon the ground to serve as an earth connection, while the third man has the transmitter and receiver. The aerial gear is contained in the fourth knapsack. An aluminum tube mast about 30 feet high acts to hold umbrella wires going down to ground pegs.

Separate flat boxes contain the transmitter and the receiver, the latter having a carborundum detector and four dry cells. No tuning coil is needed owing to the very short wave length which is used in this case and this is widely different from what other posts use so that there is no trouble from interference.



KNAPSACK WIRELESS OUTFIT READY FOR THE MARCH

## Wireless Antenna for Balloons

A German inventor, H. Mosler, has been engaged on the question of wireless telegraphy from spherical balloons or airships, and makes some improvements in the method of mounting the aerial wire around the body of the balloon. As before, he encircles the balloon by throwing a loop of wire over it so that the two ends of the wire come down into the basket, but instead of attaching the wire to the network, he first mounts the wire upon a band of stout canvas and then fixes the band to the balloon network in a suitable way. One advantage is that there is no danger that the wire will cause damage to the balloon by cutting it. Again, he mounts the wire loop not directly over the middle, but towards one side of the balloon, so that the wires come into the basket on one side and are far away from the gas valve so that there is less danger of setting fire to the gas by sparks. The antenna is completed by a wire which hangs down from the basket. —*Elektrotechnische Zeitschrift, Berlin.*

# How to Comply with the New Wireless Law

**Standard Experimental Equipment in Accordance with Regulations**

By PHILLIP E. EDELMAN

As a direct result of considerable agitation, pro and con, wise and foolish, a wireless bill has at last been enacted into law. The bill (S. 6412) was passed by the Senate on May 7th, by the House on August 9th, and signed by President Taft on August 17th. It goes into effect after 90 days, or November 17th, 1912.

There is no cause for alarm, however, because the bill, while defining the rights of experimenters or amateurs, does not deny, curb, or otherwise prohibit experimental stations, *provided* that the simple defined limits are observed. The portions of the act which directly concern the experimenter, boiled down to their briefest forms are:

1. The law recognizes the experimenter, gives him rights, and a license will be issued without cost upon application to the Secretary of Commerce and Labor, *provided* that,

2. The experimenter does not use a wave length over 200 meters long for transmission nor a greater power, in either a coil or transformer, than one K. W. if he is farther than five nautical miles away from a government station, or not more than ½ K. W. if he is within five nautical miles of a government station.

3. However, experimenters having apparatus which is not powerful enough to transmit farther than the boundaries of the State in which the station is located, *need not* take out a license unless they desire to do so. For instance, a station located in the heart of Texas need not take out a license provided that stations in other states cannot receive the messages which it sends. Experimenters living near the border of another State, however, will have to obtain a license or else use very weak power.

4. It *is not* necessary to have a license for a receiving station only, *provided* that you do not receive messages from another state. The inter-state feature is particularly emphasized in the bill.

5. While the experimenter is limited to the low wave length and power, the Secretary of Commerce and Labor has considerable latitude, and while he cannot refuse to license stations complying with the act, he can waive the provisions in special cases. Permission may be had upon proper application,, showing why additional power and wave length are desired, to use a high wave length or power.

6. The experimenters must use sharp and pure waves. This means that the stations must be very sharply tuned.

7. The operator must preserve the secrecy of all messages sent or received upon penalty of forfeiting his license.

8. The penalty for sending a false message of any kind, will be a fine up to $1,000 or imprisonment up to two years, or both.

9. The penalty for sending out a false distress signal will be a fine up to $2,500 or imprisonment for five years or both.

10. The operation of wireless instruments for either sending or receiving, except as before stated, without a license, will be punishable by a fine of not more than $500 and the forfeiture of the apparatus.

These are the main requirements of the law as far as the experimenter is concerned. The Secretary of Commerce and Labor will very likely have directions and information ready within a short time. A copy of the bill can probably be had from your congressman. Mr. E. T. Chamberlain, the Commissioner of Navigation, will very likely have charge of the matter. Under date of August 13, 1912, he advises the writer that the matter of licensing the stations has not yet been determined. He states, "It is probable, however, that it will be carried out either through wireless inspectors or collectors of customs. No fee will be charged for the license."

The license, being free, is even advantageous to experimenters. All that is necessary and required is that the simple provisions be strictly adhered to. In fact, Richard Roe, Jr., who may only be thirteen years old or so, may well feel proud of the certificate, and the title "Licensed Operator." Manufacturers of experimental apparatus and supply houses need feel no alarm as the interest in the matter will not lag on account of this act. Experimenters, however, must abandon hit and miss apparatus and either adopt or revise their present apparatus to conform to the requirements. The object of the present article is to show how this may be done.

GENERAL PRINCIPLES.

The first item to receive attention is the matter of the low wave length and power. While this low wave length will eliminate the interference between com mercial and private stations, the interference between the private stations themselves will not be materially improved even when sharply tuned apparatus is used. The low wave lengths are more difficult to manipulate for selective purposes than the longer wave lengths. The experimenter, then, must use an even increased amount of skill in working with his apparatus. When a number of stations are all working at approximately a 200 meter wave length, it will be practically impossible to greatly lower the wave length, and the use of a higher wave length to escape from interference is restricted to the commercial installations. Where interference of this nature is very bad a system of time will have to be provided so that every station may have a chance. Stations in isolated parts of the country where there are few if any other stations may continue as before without particular concern over the act. The low wave length necessitates the use of the low power because the larger power transformers and coils require a condenser of a size which prevents the use of a low wave length. This is an advantage in many respects as experimenters are, or have been, in the habit of using too much power for their purposes. The use of a low wave length, however, restricts the transmitting range considerably, because the low wave lengths are subject to much more absorption. This effect will be particularly marked during the summer months, and particularly when the station is in the vicinity of considerable foliage, hills or other irregularities of the earth.

With good tuning, however, a small station can be made to give equal or even greater results than a large powered station poorly tuned. The experimenter can easily expect a range of one mile for every ten watts provided the distance is not over 50 miles or so, but greater distances, or even this maximum distance, are not to be expected with short wave lengths when the natural conditions are favorable to absorption. Then, too, the use of short wave lengths makes the "tuning out" of natural disturbances such as static more difficult, since the latter are best eliminated on the short wave side of the circuit. The writer believes that the standard 200 meter wave length will operate most efficiently with stations up to ½ K. W., as although a greater range may be expected by a one K. W. station properly tuned, the increase will be far from a direct proportion. We shall now consider the several parts for a standard 200 meter station in some detail, assuming that the reader has some previous knowledge of the relations, principles and construction of wireless apparatus.*

*For a detailed account giving the construction and operation of standard apparatus in accordance with the new law the reader is referred to "Experimental Wireless Stations," soon to be published by the author. See also, back numbers of this magazine.

### AERIALS.

An aerial to coöperate with a 200 meter set must not have an effective length of over 120 or 125 feet. As the effective length includes the lead-ins and ground-lead if of appreciable length, the height for a standard aerial cannot very well exceed 60 feet. The effective length of an aerial is the total distance from the instruments to the aerial proper, plus the length of the aerial itself. The actual length of the aerial itself cannot therefore exceed 75 feet. The flat top type will perhaps be best to adopt for the purpose of standardization, the T type being preferred. A directive aerial is also desirable. The short length can be compensated for to a certain extent by the use of a large capacity. This is accomplished by using a greater number of antenna wires, and while the capacity does not increase in a direct ratio, this method is effective. The capacity, however, must not be greater than the given set can stand. Using a No. 12 copper wire as a standard for the aerial conductor, three strands should be provided for all stations up to 100 watts. (Figure a 1" coil at 100 watts) and an additional conductor should be provided for each additional 100 watts. The wires should be spaced at least two feet apart, all joints should be soldered, and the aerial supports should be preferably of the same height, i. e., 50 or 60 feet at both ends. Such an aerial will be nicely proportioned, have sufficient capacity, and have very little resistance. The large capacity is an advantage in that the transmitted energy is more intense, provided of course that the remainder of the station is balanced accordingly. It is important that the aerial be well insulated, as leakage cannot be afforded.

The lead-in should have an equal carrying capacity to correspond with the capacity of the aerial. Thus if the aerial has four strands of No. 12 wire spaced two feet apart, the lead-in should consist of four strands of No. 12 wire twisted together and connected to the aerial wires. The lead-in should be very short and direct as this is an important factor in securing sharp tuning. It should be very well insulated, particularly at the point where it enters the operating room. The effective length of an aerial should be made 0.6 of the wave length. Thus for a wave length of 200 meters, the effective length should be 120 feet. This is obtained from a simple calculation which need not be repeated here. When the aerial is 75 feet long, the lead-in can not be over 45 feet long, and must even be less when the ground wire leading to the water pipes or other ground, is of appreciable length. The aerial must be shortened or other equalization made if this does not fit in your particular case. This leaves a margin of some 40 or 50 meters for tuning purposes, preferably using a standard helix or oscillation transformer.

This aerial may be used for both sending and receiving in short wave lengths, a longer aerial being desirable for receiving alone. The experimenter is not limited as to the receiving wave length which he may employ, and for this reason a duplex aerial arrangement is desirable. Those having large aerials at the present time can leave same for receiving purposes only, erecting a shorter aerial for transmitting purposes. It is always desirable to make the second aerial so that the least energy will be absorbed by the large receiving aerial. This is best accomplished by placing the transmitting aerial at right angles to the receiving aerial, and well insulated from it. There is one other method of securing a low wave length by the use of series capacity, which will be taken up later.

### THE TRANSFORMER OR SPARK COIL.

It will be understood that the use of a good ground is essential to the success of a wireless station, so this item will not be considered. The matter of the power to use is worthy of attention. If a spark coil is used, standardization is not as easy as with a transformer, as the proper capacity to use for a given coil is much more difficult to determine. A transformer is to be preferred for this and other reasons. Now it will be understood that the source of power, the frequency, and the secondary discharge voltage of the transformer, determine the capacity of the transmitting condenser, and that this condenser in turn determines the wave length of the primary or condenser circuit for efficiency, which in turn determines the transmitting wave length of the station. The transformer and condenser must therefor receive attention first. They form the heart of the transmitting station. A one K. W. transformer requires a larger condenser, other conditions remaining the same, than a ½ K. W. station. This means that for a standard 200 meter wave length, less inductance can be used in the primary or condenser circuit with a one K. W. set than with a ½ K. W. set, since the product of the capacity and the inductance of the circuit determines the wave length. Now a one K. W. set can have only very little inductance in circuit if the 200 meter wave is to be retained with an efficient condenser for the transformer, which means practically that a one K. W. set will not operate with as great efficiency, other conditions remaining the same, as a ½ K. W. set will with a wave length of 200 meters. Of course if efficiency is of secondary importance, the one K. W. set will transmit farther when adjusted to resonance than the ½ K. W. set in most cases. One of the regulations of the bill requires that all stations use *only sufficient power* to transmit the business at hand to the desired station, so that excessive power is really unnecessary for the average station. Nearly every experiment which can be carried on in the art, with the possible exception of absorption tests, can be carried on with power of ½ K. W. or less.

### CAPACITY REQUIRED FOR GIVEN SET.

In this and other calculations to be given, there is nothing difficult or which is not within the limitations of every reader. The formulas have been simplified so that little more than simple arithmetic is required. The amount of capacity needed for the transmitting condenser depends on three things, as follows:

1. The power in watts supplied to the condenser.
2. The frequency or number of sparks per second.
3. The secondary discharge voltage.

Now with a transformer the power in kilowatts (1,000 watts=1 K. W.) supplied to the condenser may be represented by P. With an ordinary spark gap and the proper capacity, properly adjusted, the condenser charges to a sparking potential once each half cycle. (The natural spark rate is thus twice the natural frequency, as 120 times per second if the primary frequency is 60 cycles, etc.) Now when the condenser and spark gap are arranged so that the condenser is charged to a sparking potential once each half cycle, the power (P) in kilowatts is equal

to $\frac{nCV^2}{1{,}000}$ in which n represents the frequency (as 60 to 25 cycles), C the capacity of the condenser in farads, V the potential in volts to which the condenser is charged at the time the spark begins.

This formula is readily simplified to the following form, which we will use hereafter:

$$C = \frac{1{,}000 \times \text{Power in K. W.,}}{nV^2}$$

the letters representing the same items as before.

Now when the power, the number of cycles per second, and the voltage to which the condenser is to be charged are known, the required capacity can easily be found from this formula. It will be evident that the higher the frequency, the less will be the needed capacity, so that for the same output a smaller capacity may be used for 60 cycles than for 25 cycles, and so on. For larger power stations it is an advantage to use a higher frequency. To illustrate the use of the formula:

Suppose that the station has been determined and found to have a range of 25 miles, using a ¼ K. W. transformer, operated on a lighting circuit, primary voltage 110, frequency 60 cycles, secondary voltage 20,000. Substituting these values in the formula we get—

$$C = \frac{1{,}000 \times \frac{1}{4}}{60 \times 20{,}000 \times 20{,}000} = \frac{1{,}000 \times .25}{60 \times 400{,}000{,}000} = \frac{.25}{24{,}000{,}000} = .0000000105 \text{ farad (approximately).}$$

On account of the large unit represented by a farad, wireless capacities are invariably calculated in microfarads, a microfarad being one 1,000,000th of a farad. Therefore, to change the result to microfarads, the answer is multiplied by 1,000,000, giving a result in this case of .0105 microfarad.

The calculation is really very simple and is sufficiently accurate for all experimental purposes. We shall see how a condenser is built to secure a desired capacity a little later.

On acount of the lack of uniformity in spark coils now on the market it is difficult to determine the proper capacity to use beforehand. The following table will be found sufficiently accurate for the average coil.

Table of capacities required for condenser when spark coils are used:

| Length of Sparks in inches | Capacity in Microfarads. |
|---|---|
| ¼ | .001 |
| ½ | .002 |
| 1 | .004 |
| 2 | .008 |
| 3 | .012 |
| 4 | .016 |

These values are approximate and will vary according to the coil used.

A more satisfactory method when spark coils are employed is to use a variable step by step condenser in which the capacity of each plate is known. This capacity may be found from a formula which will be given a little later.

It will be obvious from the foregoing formula that when a low potential is used, the capacity must be relatively large, and that if a high potential is used the capacity will be correspondingly small. In practice the transformer used generally has a potential of from 15,000 volts for ¼ and ½ K. W. to perhaps 30,000 or more for the larger sizes. There is no material gain in the amount of dielectric material whether or not a high or low voltage is employed since a corresponding increase in thickness for the dielectric is necessary to withstand the higher voltage without a breakdown. An increase in frequency then is the only factor which materially affects the size of a given condenser.

In estimating the voltage to substitute in the formula, it is customary to allow 15,000 volts to the centimeter of spark length, one inch being 2.54 centimeters, since this is a fair value for a heated and ionized spark gap.

Now, with the condenser and transformer decided upon, the inductance for the primary or condenser circuit is the next item to work out. As will presently be shown, the wave length of the condenser circuit is varied by the amount of capacity and inductance in the circuit, and since the capacity is preferably a fixed value (wireless apparatus manufacturers generally supply a fixed condenser of the proper dimensions to begin with), the amount of inductance used will decide the wave length, in most cases. Before proceeding further, the method of determining the wave length must be understood. This involves only simple mathematics and can easily be mastered by a careful reading, together with the working of a few problems, if it is not already familiar to the readers.

### CALCULATION OF WAVE LENGTH.

Wave length is expressed in the metric system as a certain number of meters long. Now, feet can easily be changed into meters by dividing the number of feet by 3.281 (one meter being 39.37 inches). If we had a universal system of measurement this constant translation would be saved.

The formula for wave length is:

Wave length $(\lambda) = v \times 2\pi\sqrt{LC}$, $(\lambda)$ being a symbol for wave length, v the velocity of light in meters or 3x 100000000 meters in one second, L the inductance in henrys, and C the capacity in farads. $\pi = 3.1416$.

Wave length=300,000,000x2x3.1416$\sqrt{L \times C}$=1,884,960,000 times the square root of the product of L and C, or 1,884.96 times the square root of the product of L and C, expresed in microhenrys and microfarads, respectively. (.000001 farad being one microfarad, and .000001 henry being one microhenry.)

Now for a given wave length, the product of L and C will be a *constant quantity* so that if the capacity C is large, L will be correspondingly small, or if the inductance L is large, C will be small. The quantity (LC) varies as the square of the wave length so that if the wave length is to be doubled (LC) must be four times as great, and so on.

It will be noted from the formula that there are three items to be filled in by numerical quantities. If any two are known, the value for the other one may be readily found. Thus, if a wave length of 200 meters is desired with the use of the .0105 microfarad condenser already calculated for the ¼ K. W. set taken as an illustration, the necessary inductance can readily be found. Or if both the inductance and capacity are known, the wave length is readily determined. In order to still further simplify the formula so that it will not be necessary to extract the square root of (LC) it may be expressed,

$$\left[\frac{\text{Wave length}}{1{,}884{,}960{,}000}\right]^2 = L \times C \text{ (expressed in}$$

henrys and farads respectively. It might be well to jot down or memorize this formula as it is used repeatedly.

Using this formula for the case at hand, and expressing L and C directly in microhenrys and microfarads respectively,

$$\left[\frac{200}{1{,}884.96}\right]^2 = L \times .0105.$$

$$(.1061)^2 = L \times .0105.$$

.011257=Lx.0105 for the case at hand, that is,

$$L = \frac{.011257}{C} = \frac{.011257}{.0105} = 1.072 \text{ microhen-}$$

rys approximately, that is, to obtain a wave length of 200 meters when the inductance is an unknown quantity and the capacity is .0105 microfarads, the formula gives 1.072 microhenrys as the proper amount of inductance.

When the wave length is fixed at 200 meters, the formula may be greatly simplified to LxC=.011257.

*This article will be concluded in the next issue, giving directions for calculating transmitting condenser, inductance, standard helix and spark gap.*—Editorial note.

## Directory of Wireless Clubs

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Waterbury Wireless Association.—Arthur E. Hapeman, President; Walter Lowell, Treasurer; H. M. Rogers, Jr., 65 Elizabeth St., Waterbury, Conn., Secretary.

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

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

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

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

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

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

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

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

# For Practical Electrical Workers

## Wiring in Damp Places

By C. B. DAVIS

In wiring in damp places such as in dye-houses, stables and breweries, wires should be rubber insulated, and separated by knobs at least one inch from the surface wired over. Solid knobs are preferable to split ones, because there is more liability of current leakage to the screw of a split knob. They should be separated by at least 2½ inches for voltages up to 300 and four inches for voltages up to 600. Greater separations are preferable. Conductors on side walls should be protected preferably with well painted wooden boxing, but conduit can be used. Moulding is not permitted in damp locations. Sockets and other fittings in such places should be designed to withstand moisture.

Where conductors cross damp pipes they should be carried over rather than under, so that drippings will not strike the wires. Porcelain tubes, securely taped to the conductors, should be placed on the conductors over the point where they cross.

Sockets for damp places should be of porcelain or hard rubber, or composition weatherproof, or, as they are sometimes called, "waterproof," Fig. 1. Unless made up on fixtures they should be hung by separate stranded, rubber insulated wires, not smaller than No. 14 B. & S. gauge, which should preferably be twisted together when the pendant is over three feet long. The leads furnished in weatherproof sockets are six or eight inches long, but longer ones can be supplied on special order. The socket leads should be soldered direct to the circuit wired but supported independently of them. Fig. 2 shows a short drop and Fig. 3 a long one; both figures illustrate the method of using cleats to remove the stress from the line conductors. Waterproof sockets are always keyless. Porcelain sockets are easily broken; hence, although their use is not formally approved by the underwriters, brass-shell sockets thoroughly taped and coated with waterproof paint are sometimes used. Where not liable to be broken, porcelain or composition sockets are the best.

Receptacles for damp places are shown in Fig. 4. They are especially designed to withstand moisture, but should always be supported on porcelain knobs. The rubber insulated leads extend six or eight inches from the body. The leads should be soldered directly to the line wires and the joint well taped and compounded.

Wiring troughs are sometimes used in damp places, Fig. 5. The troughs protect the conductors from drippings, but not from water that condenses on them out of the atmosphere. In assembling wiring troughs, abutting edges should be coated with tar or with thick waterproof paint. Screws smeared with paint should be used to hold the pieces together and the screw heads should be painted. A wiring trough in addition to keeping drippings from the conductors, constitutes a mechanical protection for the conductors. The wiring trough serves the same purpose as a running board in this respect.

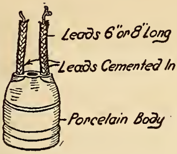
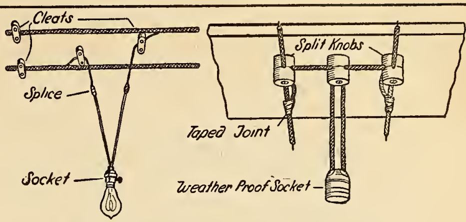
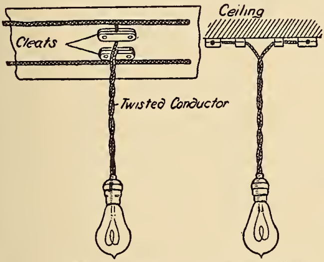



Fig. 1




Two Cleat Support Split Knob Support

Fig. 2




Side Elevation End Elevation

Fig. 3

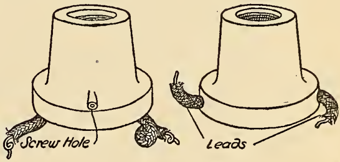



Fig. 4

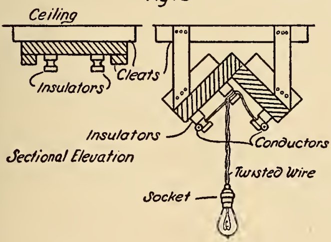



Fig. 5

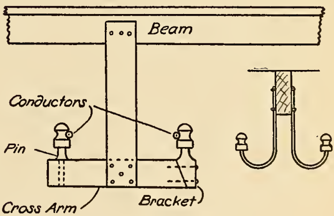



Fig. 6

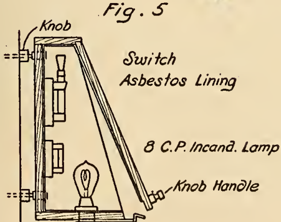



Fig. 8

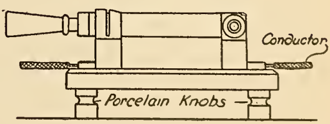



Fig. 7

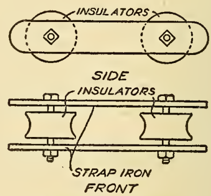
Porcelain or glass, petticoat insulators probably form the best support for wiring in damp places. These are the same insulators that are used on out-of-door pole lines. There is apt to be considerable electrical leakage in damp places with ordinary knobs and cleats, and the long creepage distance provided by petticoat insulators constitutes good protection against this. The insulators are supported on thoroughly painted wooden pins or brackets, which are held by small cross arms or on metal brackets, Fig. 6. In no case should the insulator be mounted up-side-down. Glass or porcelain knobs, mounted on a small cross-arm, are sometimes used instead of insulators, but are not as good from an insulation standpoint. The advantage of mounting them on the arm is that an ample separation from the surface wired over is thus provided. The cross-arm support should be thoroughly painted with a waterproof paint or tar.

Joints and splices in damp places must be soldered with great care and should be thoroughly taped. A thorough painting of the tape wrapping, with a waterproof compound, asphaltum or tar, will protect against the entrance of moisture. Splices should be avoided in damp places, but where necessary, they should be located at some distance from a point of support, because the insulation resistance of the insulation around a splice is less than that of an unimpaired equal length of wire.

Switches and fuses for wiring in damp locations should, if possible, be located outside of the damp room and in a dry place. Where it is impossible to locate them outside they should be mounted within a box the inside of which can be kept dry, or on porcelain knobs, Fig. 7. Cabinets thoroughly treated with waterproof compound are preferable to metal ones. A switch-and-fuse cabinet similar to that of Fig. 8 can be made of ⅞ inch stock. It is lined with well painted asbestos board and mounted away from the damp wall on porcelain knobs.

## Strain Insulators

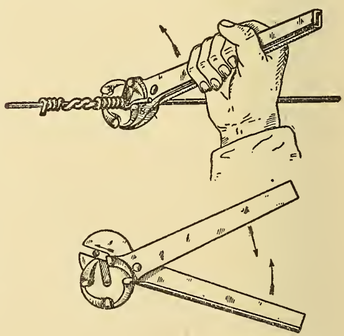
The illustration shows an easily made insulator for use on antenna and guy wires of an amateur wireless station. Place two No. 15 porcelain knobs between two strips of ⅛ by 1¼ inch strap iron. Drill ½ inch holes in the ends of the straps and use ⅜ by 2 inch bolts through these to hold the porcelain knobs.



STRAIN INSULATOR

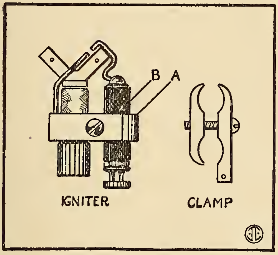
## Tool for Forming Wire Joints

The accompanying illustration presents the idea, embodied in a patent issued to Abraham B. Probasco, Turtle Creek, Ohio, of a tool for completing the joint between two wires after their ends have been partially engaged. Teeth upon the sides of the hub catch the wire ends after the tool is placed upon the wire as in the lower illustration.


FORMING A WIRE JOINT

## Lighter for Auto Gas Headlights

A device for lighting gas headlights on an automobile is shown in the accompanying illustration. A clamp (A) holds a hard rubber insulator (B) to the burner. A gap is formed by leading a copper wire from the clamp, and a




LIGHTER FOR GAS HEADLIGHTS

wire from the rod through (B), to a point over a hole in the burner. The gap is about 1/16 inch. Wires from a spark plug circuit are connected to each burner, the circuit being under control from a switch on the dashboard. By turning on the gas and closing the switch for an instant the headlights are lighted. —JESSE JAY.

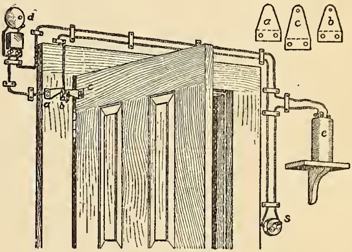
## Capacity of a Lifting Magnet

Heretofore the practice of handling furnace pig iron with electro-magnets has been limited by the quantity that could be lifted under the ordinary plan of picking the iron from the ground. When the pigs lie flat, only a relatively small number adhere to the magnet. Now, however, at the Maryland Steel Works, outside of Baltimore, they are testing the value of their magnets on stocks of pigs which stand in a bunch vertically erect.

Thus a greater number of pieces on end make direct contact with the magnet pole pieces and a corresponding increase in the lifting power of the magnet follows. A magnet formerly able only to heave 1,000 pounds heavenwards, now easily lifts 2,000 pounds of pigs "standing on their tiptoes" as the workmen say.

## Open Door Alarm

A good open door alarm may be made as follows: Provide two pieces of stiff brass (a) and (c) cut in the shape shown and bent at a right angle on the dotted line. Provide also a piece of spring brass (b) cut as indicated and




OPEN DOOR ALARM

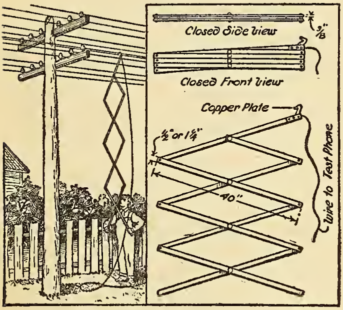
bent at a right angle on the dotted line. Referring to the illustration, set (a) and (b) on the casing, bending the tongues on each so they touch. Set (c) upon the door. Connect (b) and (c) by a chain or wire of such length that when the door is closed (b) is pulled away from (a), breaking the tip contact. The rest of the wiring may be done as shown, placing a switch at (s) to open the circuit when it is not desired to have the alarm operate.—OLE B. RITCHEY.

## Show Case Signs

Among the latest store devices are small illuminated signs having ground glass slidable fronts, on which is printed information regarding the special articles for sale. The fronts may be replaced with others for the sale of different goods. An eight candlepower lamp is sufficient to give the necessary effect, and the design is such that they add to the attraction of the show cases on which they are usually placed.

## Collapsible Contact Maker

In making tests on telegraph, telephone and trolley wires contact must be made at times with a wire that cannot be conveniently reached. To do this and to avoid the necessity of climbing poles in many cases, J. A. Lopez, one of our Cuban subscribers, uses an ingenious collapsible contact maker of his own design, as shown in the sketch.



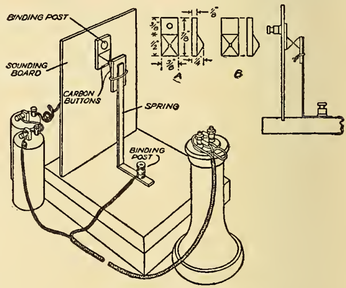

COLLAPSIBLE CONTACT MAKER

It is made up of a number of wooden bars riveted together as shown. By closing the two end ones, as if closing the handles of a pair of shears, the collapsible frame is projected up a distance corresponding to the number of bars used. On the upper end is a copper hook carrying the test wire. This is hooked over the line.

## To Make a Simple One-Way Telephone

Out of white pine make a base 4 by 5 by 1 inch thick and bevel the edges. Cut a groove in the top at one end, as shown, 3½ by ⅛ by ⅛ inch. Make a sounding board of white pine ⅛ by 3½ by 5½ inches long and glue it into the groove so that it stands perpendicular to the base. Shellac the whole thing.

Take the carbon from a wornout dry cell and make two pieces, shaping as indicated by (A) and (B). Drill a 3/16 inch hole through the flat part of (A) and a 3/16 inch hole ¾ of an inch from the top of the sounding board. Fasten (A) to the board by means of a battery binding post. Then take (B) and bind it by means of a copper wire to a thin brass spring 5½ inches long and ¼ inch wide, bent as shown. Now adjust the two carbon blocks so that the two points touch lightly. Connect up as indicated, using two dry cells and a 75 ohm receiver. The receiver cord may be made 50 or 60 feet long for experimenting. If a person speaks, sings or whistles against the back of the sounding board, the sound will be distinctly heard in the receiver, even though the receiver be 50 feet away. The ticking of a watch laid on the base of the device can be plainly heard. A person walking across the floor disturbs the contacts sufficiently to be heard.



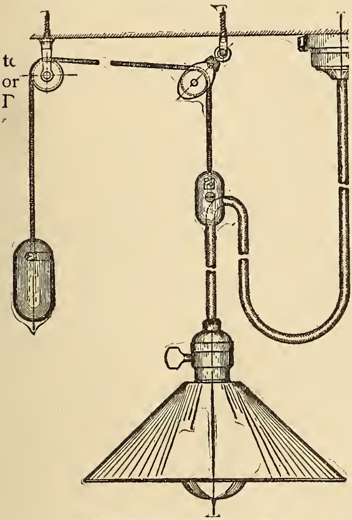

ONE-WAY TELEPHONE

## Supporting Open Wiring in Concrete Buildings

A method of supporting open wiring in concrete buildings is here shown. A round groove of ⅜ inch radius is cast in the faces of the beams, by having ¾ inch half round moulding nailed in the forms. Wrought iron yokes are bent to fit the grooves as shown, and ½ inch bolts clamp them in position. Although moulding is shown supported in the illustration, wooden blocks can be bolted

## Drop Light Counter-Balance

The Simplex counter-balance here illustrated serves to regulate the height of an incandescent with little trouble. A two part insulating clamp secures the conductor and is held by a suspending



DROP LIGHT COUNTER-BALANCE

cord which passes over a swivel and a fixed pulley on the ceiling, then down to the weight. The lamp drops straight from the clamp as it would from any rosette.

## Keeping the Motorman Warm

An interurban car company, realizing the possibility of accidents which might occur if the motorman was uncomfortably cold, which would naturally result in his paying more attention to keeping himself warm than to the correct operation of the train, uses a portable electric heater of sufficient size to keep the cab warm at all temperatures.

Receptacles connected to the current supply are placed in both ends of the car, so that the motorman can use the heater, no matter which end of the car is being used for the front.

## Conveniences in House Wiring

To wire a house so that each room is provided with lights is not all there is to a "good job" of wiring. There are numerous little things that count for convenience and comfort that should not be overlooked in such an installation. Some of these conveniences which add little to the cost are here noted.

Locate a wall switch or two just inside the front door so that it can be reached at once on entering. One of these switches should turn on the light in the hall, and the other, a three-way, should control the porch light. The other three-way switch for the porch light may be located outside beside the doorway to turn this light on or off when entering or leaving the house.

Clothes closets are dark places. A low candlepower lamp should be installed in each at the ceiling and controlled by automatic door switches which turn the light on when the closet door is opened and turn it off when the door is closed.

Place the switch that controls the cellar lights at the head of the stairs so that the cellar lights may be used to illuminate the stairway when entering the cellar. Beside this switch may be placed a small red lamp to remind that the lights are to be turned off on coming upstairs.

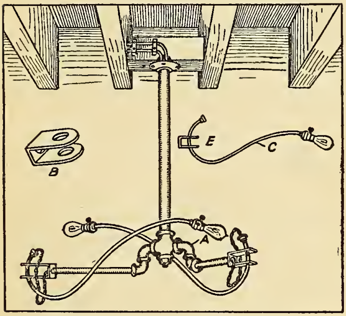
Baseboard or wall receptacles for attachment plugs for the piano lamp, the lamp on the table at the side of the room and for the electric luminous radiator should not be foregotten.

Economy and comfort require a turn-down or Hylo lamp in bathrooms and halls and also for the bedroom in case of sickness.

In the dining room and kitchen, receptacles for operating an electric toaster and a coffee percolator in either room should not be overlooked, while a special circuit for the electric pressing iron should be provided.

## Adjustable Work Bench Fixture

To make a two-light bench fixture, cut and thread a piece of 1¼-inch pipe about 2½ feet shorter than the distance between the ceiling and the top of the work bench. Connect a 1¼ by ½ inch cross at one end and from the ½ inch openings at




ADJUSTABLE WORK BENCH FIXTURE

each side insert two els (male and female) loosely connected together, as shown at (A).

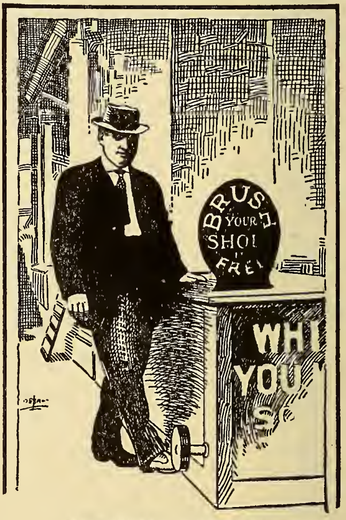
Next, attach two-foot lengths of ½ inch pipe and on the free ends fasten, with lock nuts, U-shaped pieces of strap iron, as shown at (B), which have had holes slightly larger than the outside diameter of ¼ inch pipe bored near the ends and opposite each other.

Pieces of ¼ inch pipe 3½ feet long are bent in the curve shown at (C), and after being inserted in the U-shaped pieces have couplings attached to the upper ends. Two lengths of No. 14 insulated wire may be used in the large pipe to which at the T is soldered and taped double twisted lighting cord, which is left long enough to pull into the fixture arms, allowing about twelve inches of slack cord for adjustment at (D).

After wiring and attaching lamp sockets, insert a 1¼ inch plug at the bottom of the vertical pipe and secure the pipe to a threaded flange at the ceiling, allowing an opening for attaching lighting circuit wires. Have fittings loose enough at (A) to allow arms to swing. Conduit and condulets may be used in place of gas pipe if desired. W. R. REYNOLDS.

## A Trade Winning Shoe Brush

Using the power applied to his electrical shoe repair machinery, a tradesman in a Western city has placed an electrically operated shoe brush in front of his place of business, which brings him profits in the shape of new and friendly customers. A belt transmission and a shaft that projects through the front wall of his shop were all the additions he had



SHOE BRUSH FOR PASSERS-BY

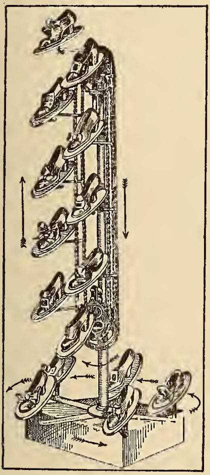
to make to his outfit, and as the machinery is in use all the time, there is no additional cost for power. The circular brush is revolving all the time from the end of the shaft, and is placed at a convenient height for shoe brushing—just high enough from the pavement for the passer-by to bring his footwear in contact with it and remove the dust. A sign calls attention to it and states that its use is free. It is a trade winner.

# Electricity the Silent Salesman

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

## Miniature Elevator Displays Shoes

The device here shown, manufactured by The Newman Manufacturing Company, is designed to be placed at the center of a window display. Operating like an elevator and furnished power by a small electric motor it brings to view one after another the shoes placed upon it. The device is finished in oxidized copper, and is also built to exhibit jewelry and other goods.

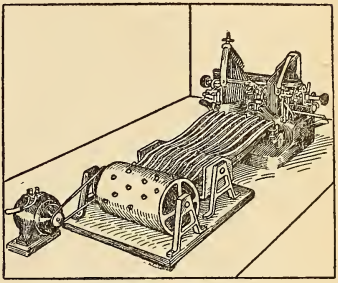


DISPLAYING SHOES ON AN ELEVATOR

## Testing a Typewriter in a Window

A large typewriter manufacturing firm which prides itself upon the fact that every typewriter sent out is first put through severe tests to find any weaknesses shows a testing machine operating a typewriter in the window of its offices.

The device consists of a cylinder upon which are projecting teeth. When this cylinder is turned these teeth, one after another, strike the keys of a sort of lever keyboard. Each lever operated in turn a key upon the typewriter. The machine

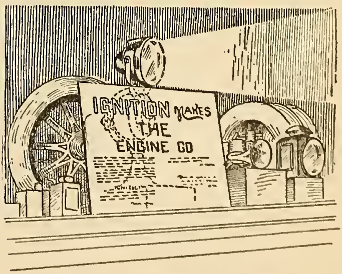


TYPEWRITER UNDER TEST

tests the speed capacity of each typewriter and at the same time the wearing parts are brought down to their proper bearings. Any flaws are almost sure to be detected, as the testing device can be speeded up to a point faster than fingers can move or eyes can see. The equipment is run by electric power, and is a strong advertisement of the durability of the machine.

## Moving Headlight as Window Attraction

Remove the blades and guard from an oscillating fan motor. Fasten an electric automobile headlight by means of two brass uprights to the case of



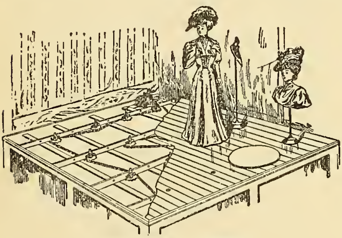

MOVING HEADLIGHT ATTRACTION

the fan at (A) with the same screws that held the guard. When the motor is started and the lamp lighted, the latter will swing to and fro catching the eyes of passers-by.

To hide the motor, place a neat and attractive sign as shown.

## Invisible Multiple Rotary for Windows

The illustration shows how a number of stands, forms or round platforms may be made to revolve, some in one direction, some in another. Upon the floor of the window is built a light, four inch high platform within which are sprockets



ROTARY WINDOW DISPLAY

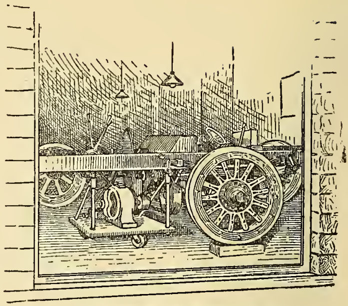
and bicycle chain. A small motor furnishes the motive power and with this concealed the entire mechanism which imparts motion to the window display is invisible.

The device is a regularly manufactured article and is known as the Newman multiple rotary.

## Demonstrating Gasoline Auto Trucks

Insurance companies charge a higher rate for buildings storing gasoline automobiles than when electrics only are housed because of the presence of gasoline.

To get rid of this extra premium on his truck display rooms, an agent obtained a platform about four feet square and mounted it on wheels. He placed thereon a small motor starting-box and switch with the necessary length of port-

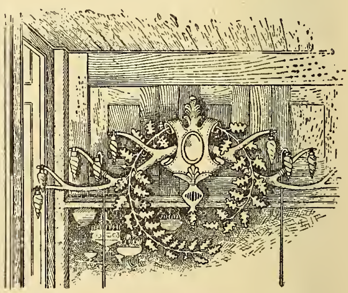


AUTO TRUCK DEMONSTRATION

able cable. When it was necessary to show the operation of truck engines, he rolled the platform under the car and connected the motor to the engine flywheel with a small belt.

## Trophy Fixture

Up to a very short time ago, trophies of the chase were used for decorative purposes alone; but with the advent of artistic electroliers they have been made useful as well as ornamental by fitting them up for fixtures of miniature lamps. In this way they may be made into at-



TROPHY FIXTURE

tractive window displays for jewelry stores and similar places of business.

The illustration shows one of such being used for a combined hall light and ornament.

# The Magnet

By GEO. FREDERIC STRATTON

According to Chinese lore, the magnet with its real and imaginary mystical properties has puzzled and served the world for 45 centuries; a legend coming down from those past ages that a certain emperor of the country possessed a wheel marked with the four cardinal points, which he used for directing the operations of his army during foggy weather.

It was not, however, until the approach of the Christian era that any authentic records were made of this wonderful, natural magnetic force; and these are mingled with strange and imaginative stories. Strabo, the Greek philosopher, and evidently the Jules Verne of his day, wrote an account of a chimerical correspondence between two friends by the help of a certain lodestone which had such virtue in it that, if it touched two separate needles, when one of those needles so touched began to move, the other—though at never so great a distance—moved at the same time in the same manner.

He tells us that these friends, being each of them possessed of one of these needles, made a kind of dial plate, inscribing it with the letters of the alphabet. Then they fixed one of the needles on each of these plates in such a manner that it could move around without impediment, so as to touch any of the four and twenty letters. Upon their separating from one another into distant countries, they agreed to withdraw themselves, punctually, into their closets at a certain hour of the day and converse with one another across a whole continent. And by means of this invention they did afterwards convey their thoughts to each other in an instant, over cities, mountains, seas or deserts.

This yarn was written 31 B. C. and is worthy of more than passing notice as being strangely prophetic of the recent wireless telegraph inventions.

Lucretius (55 B. C.) in a poetical dissertation on the lodestone, gives a clear description of its actions.

"Oft from the magnet, too, the steel
recedes,
Repelled by turns and reattracted
close."

In the Fifth Century record is made of its general use by Chinese mariners and, in the following 500 years it must have been extensively adopted by navigators in European waters, for Abbot Nickham (1157 A. D.) writes:

"Among other stores of a shippe there must be a needle hung upon a thread, which will vibrate, oscillate and turn until the point looks to the north, and the sailors will thus know how to direct their course when the pole star is concealed through the troublous state of the atmosphere."

And, in a quaint poem written by Guyot de Provins in 1208, the compass is thus described:

"An ugly stone and brown,
To which iron joins itself willingly,
They have. They attend to where it
points
After they have applied a needle to it.
And they lay the latter on a straw
And put it simply in the water
Where the straw makes it float.
Then the point turns direct
To the star with such certainty
That no man will ever doubt it,
Nor will it ever go wrong."

This straw supported needle was superseded in 1269 by the invention of Petrius Peregrinus, an officer of the engineering corps of the French army. He placed the needle upon a pivot and surrounded it with a graduated circle showing all the points of the compass.

Peregrinus was a very talented man. He wrote the first practical disquisition on the lodestone and its applications, and he invented a clever and ingenious magnetic motor, undoubtedly the first device of the kind ever conceived in the brain of man.

No further improvement of the mariner's compass, or advancement in the knowledge of its correct use, is recorded until we come to Dr. Gilbert's masterly and exhaustive ten volume treatise on the subject—"De Magnete"—published in 1600.

Dr. Gilbert was physician to Queen Elizabeth, and was accorded a prolonged audience in order to read portions of his work to her Majesty and, although the petulant and self willed queen exclaimed at the close of the reading: "Ods rot! but I know not what it all means!" she did not fail to reward and honor the eminent lecturer.

The doctor deserved more appreciative understanding of his efforts for, in his introduction, he says that he "desired not to veil things in pedantic terminology." And he succeeded admirably; his work being characterized as one of the clearest and most lucid philosophical treatises of the Middle Ages.

Poets have ever delighted in using the lodestone and the needle as emblems of constancy, affection and love; but the needle is, alas! like love, easily and frequently deviated, and blind faith in its constancy has caused untold disaster and misery.

In the early centuries of its use, the shipwrecks and loss of life due to errors and idiosyncrasies of the compass must have been appalling, but although these variations were observed no effort was made to investigate the causes, they being attributed to evil spirits, sorcery and witchcraft. Even today the ship compass, with its perfect detail of construction, requires unceasing watchfulness and adjustment.

One of Captain Cook's men, Wales—an astronomer—was the first to look, scientifically, for the causes of so many disastrous errors, and he soon found them in the ship, herself. Anchors, chain cables and iron of any description were first observed to have an effect upon the susceptible needle, diverting it from its duty. The British naval authorities took immediate and active steps to place their war vessels in a more trustworthy condition.

But in those early days scientific truths travelled slowly, and it was many years before shipowners and shipmasters were thoroughly and universally imbued with the necessity of correcting and adjusting their compasses at frequent intervals. If it was necessary or convenient to coil a few fathoms of anchor-chain on the ship's quarter, or to stow a freight of hardware in the vicinity, no thought was given to the compass. The ship might go off her course several points and miss her port, or strike bottom; the skipper would damn everybody and everything except the true cause.

With the advent of polar expeditions another disturbing cause was discovered. It had always been supposed that the attraction for the needle was a gigantic deposit of lodestone at the north pole; but the explorer Kane, first determined that the north pole was by no means the magnetic pole. And later explorers and scientists have also discovered that there are two magnetic poles—one, N.N.W. of Hudson Bay; the other—far less in strength—in Siberia, the exact location of which is not, as yet, defined.

By this time shipbuilders had become thoroughly alive to the necessity for watchfulness of the compass. The instrument was carefully adjusted and corrected after all fittings and stores had been put on board, and a much greater reliability ensued. But with the advent of the iron ship new and mysterious actions of the needle commenced, and for awhile captains were kept at the top notch of anxiety over the correctness of their courses.

In order to understand this clearly it is necessary to call attention to the fact that if a bar of iron be laid pointing north and south, and hammered, it will acquire more or less magnetic qualities, varying according to the number of blows struck, also according to the quality of the iron—whether hard or soft.

When an iron or steel ship is built, some plates or beams must, necessarily, be in a position bearing north and south, and will surely become magnetized from the shock and vibration of the riveting. Of course the proximity of large masses of magnetized iron to the compass has an enormous influence, but it can be and is corrected by compensating devices.

It has also been found that, when the vessel proceeds on her voyage, the buffeting of the waves and the vibration of the engines will induce further magnetism; and as the direction of the vessel is changed, so does the polarity become changed, and the compass is, accordingly, again bewildered and demoralized.

On a course running east and west—as from Liverpool to New York and return—this deviation of the compass is often as much as four degrees one way or the other, according as the ship is proceeding easterly or westerly. Devices are now employed in all ship's compasses by which they may be instantly corrected, but constant watchfulness and testing are still imperative.

Magnets are made by rubbing a piece of iron against lodestone—a mineral substance which is found over the entire globe. They can also be made, as before stated, by simply hammering any bar of steel or iron while it is pointed due north. If the metal is soft it will quickly lose its magnetism; if hard it becomes a permanent magnet.

The commercial manufacture of magnets, however, is now entirely by electricity. A coil of wire is provided, into which the iron or steel of any desired shape is inserted; a strong current of electricity is switched on, and in a moment the rod is magnetized. As in other processes, if the iron is hard a permanent magnet is the result; if the metal is soft its magnetism leaves it the moment the current is cut off. It is this peculiar property of soft iron, of instantly becoming magnetized and demagnetized, which makes the electro-magnet; and the electro-magnet is the inward soul—if so strong a metaphor may be used—of the great light and power generator of the present day. But that is another story.

## Getting Ready for the Opportunity

Mr. George A. Damon, Dean of Throop Polytechnic Institute, Pasadena, Cal., desiring to secure information regarding the things the technical man must "stand for" in order to be successful in Southern California, addressed a list of questions to 70 of the most successful men engaged in technical occupations in that part of the state.

Three of the questions were:

"What do you think of a 'technical college education'?"

"What is the best way to get 'practical experience'?"

"If you were a young man starting all over again what would you do?"

Five answers to the first question from as many different men were:

"Good foundation for practical experience."

"A very necessary training for a man expecting to follow any line of engineering or control work."

"The higher positions of life especially in the present day and age, require technical training which is easier attained in college than elsewhere. Without such training a man usually comes to the sticking point beyond which an employer cannot advance him even though he has other splendid qualifications. He cannot see his problem completely and his vision is narrow. He is limited to his own experience and has no precedent to follow."

"The young man who has it, has an immense advantage over his competitors."

"College training gives to a workman the best tool in his chest but does not guarantee success. Some of our pioneers can hew out a better timber with an axe than many an architect can make with a full set of modern tools."

Four answers to the second question were:

"There is only one way—don overalls, and go to it."

"Don't be afraid of getting hands and clothes dirty. Take any kind of a job where construction or operating work is actually done under regular working conditions."

"Association with construction work during vacations, and frequent changes in position during the period when salary is not the prime requisite for one's existence."

"Work at your profession for a year, if possible, between the preparatory school and college. Then work at it summers during college. If the work eliminates you, you are eliminated while still a student and will not become a graduate who made a failure."

Four replies to the last question were:

"Educate myself along the above lines (mining, hydraulic, electrical and mechanical engineering), besides acquiring a thorough knowledge of Spanish language, as I believe the great things accomplished in the next generation will be in the republics south of us."

"Work at my profession before and during the college course. If I could only get four years of a college course I would not take it all at one school, whether the diploma were lost thereby or not."

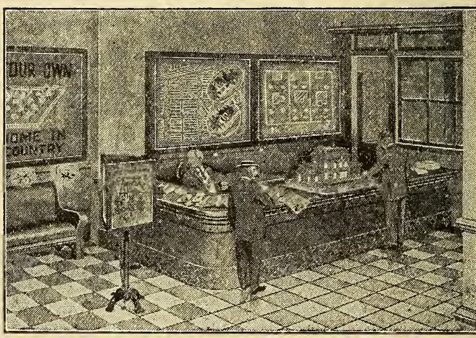
"Get the best technical college education available, work during the vacation periods for nothing, with the best man in my line, and when through with college work, would still work for practically nothing with large firms for several years, until feeling sure of myself. After this I would change my policies entirely and work for small firms, asking for high wages, forming my own opinions about the way my work should be done and following these out. Then I would carefully study myself and my work, see if I were really earning my money."

"Take more time for preparation and not begin to 'specialize' too soon."

## Utilizing an Out-of-the-Way Corner for Effective Display Space

A real estate firm advertising the advantages of living in the western suburbs of Chicago occupies an out-of-the-way corner of the terminal station which is used by the trains running through this district, and has changed it into the most attractive office space in the depot by means of a few well disposed electric lamps. These are placed in trough-like enclosures and mounted so that they shine through six by ten inch ground glass signs on which are painted in natural colors the plats of ground for sale, the rivers and trees on the property and the firm's name in bold lettering.

For advertising the sale of individual houses, smaller signs of the same mate-




ATTRACTIVE SCHEME OF A REAL ESTATE OFFICE rial with each house painted thereon are used, and mounted one above the other on the three sides of a slowly revolving triangular frame, also illuminated by electric lamps placed inside the triangle.

## Dr. Eyde's Work in Electrical Production of Nitrogen

BY DR. LEONARD KEENE HIRSHBERG

Ten years ago Dr. Samuel Eyde of Christiania, Norway, was a struggling engineer, one of a family of electrochemical engineers. Now he is rated one of the wealthiest men in Norway.

Dr. Eyde came to this country to deliver a lecture before the Eighth International Congress of Applied Chemistry. He has delivered the lecture only once in the past, before the Royal Society of London in 1909. He lectures only once in three years, and that fact, no doubt, adds to the great enthusiasm with which he is greeted by other chemists.

He tells the story of his life work with a series of lantern slides, and ends the showing with pictures of the four great nitrogen transforming plants now under his control, which have a capacity of 200,000 horsepower, and send out yearly 80,000 tons of nitrate of lime for use in fertilizers, 10,000 tons of nitrate of ammonia for use in explosives, 10,000 tons of nitrate of soda for use in coloring industries, and thousands of tons of other compounds of nitrogen. Having shown all this, including pictures of the complete chemical process from the harnessing of the air to the shipping of the finished products, Dr. Eyde, in optimistic mood, tells how Norway was prepared to furnish his chemical company with 150,000 additional horsepower almost free of charge, and how his country, independent as to all international controversy and politics, would ultimately furnish all the armies and navies of the world with the greatest agency for universal peace—gunpowder.

The secret of extracting nitrogen from the air was known ten years ago, Dr. Eyde explained in the preliminary part of his lecture, though the method in vogue was not a practical one. Sir William Ramsay of London and the well known American chemist, Charles S. Bradley, both of whom were in the audience, were complimented by Dr. Eyde for their advanced experimentation. Mr. Bradley, it was recalled, attempted to build up a great industry at Niagara Falls, but found it too expensive to make his electrical current.

On one of the numerous fjords in lower Norway the present nitrous compound industry had its start back in 1903. Dr. Eyde was both the structural and the chemical engineer of the project. His first plant was at the little town of Frognerkilens, and there he could develop only 25 horsepower from the waterfall. He increased this power year by year, always moving his plant to meet the better water facilities, until, in 1907, he had developed 42,000 horsepower. His employees had grown in number during those years from four in 1903 to 125 in 1907.

Then the Bank of Paris and other European banks became interested in Dr. Eyde's plans and within the next few years invested millions of dollars in harnessing waterfalls, diverting whole streams through mountains, building tunnels, towers and complete villages for the workmen.

The electricity is consumed in electric arcs over which free air is passed. Nitrogen oxide is thus formed, and this, with the addition of oxygen, is converted into nitrogen dioxide. The addition of water makes the nitric acid which is used as the working basis of the commercial compounds of nitrogen.

"It is very simple," declared Dr. Eyde, "if only you have the means. And see what this industry represents. For instance, it has been taken for granted that an unlimited supply of ammunition is always to be had. As a matter of fact, this is not so. With all her strength, England could be put out of commission simply by cutting off her nitrates from Chile, the essential ingredients of explosives. The nitrate of ammonia which we produce from air, moreover, is very pure, and, according to the tests of the British navy, prolongs the life of the heavy guns, the purity of the product reducing the heat of the discharge.

# Electrical Securities

By "CONTANGO"

**An Explanation of Hydro-Electric Power and Its Development—Examples of Some of the Large Results Obtained—Acquisition of Water Power Rights and the Widespread Interest Excited Therein—Private Enterprise Mainly Responsible for Their Economical Use—Enormous Amount of Energy Still Conserved in Sites Located in Forest Lands—Value of the Securities of Companies Dealing in This Cheap Form of Power—Transmission Lines of the Future.**

What is hydro-electric power?

Briefly, it is the electric power or current produced, or generated, by the use of waterwheels.

A water power site is said to be capable of developing so many horsepower, the term horsepower representing the energy required to lift 550 pounds one foot in one second, or, as usually expressed, 550 foot-pound-seconds. In electricity this unit of power becomes the kilowatt, that is to say, a thousand watts. The kilowatt is equal to about 1⅓ horsepower. A kilowatt of electricity used for an hour is called kilowatt hour, which is the basis on which electric companies sell their energy.

After electricity is developed by the use of water power it is passed to near or distant points by the use of transmission lines, of which more will be said later on, as the future development of the transmission lines has much to do with the value of electrical securities created by hydro-electric companies.

The first development in the generation of electricity by water power and the transmitting it long distances occurred in California. The progress was rapid. From small plants sending the power a few miles at a relatively low voltage, there came in rapid succession the building of larger and larger plants with longer transmission lines and higher voltages. The system has now spread all over the world, and while the largest plants in the world are to be found elsewhere than in California, yet the development in that state has kept abreast of the progress made elsewhere.

At the time when the electric development commenced in California the vast oil fields had not been discovered, and California was without fuel. Coal in any considerable quantities had never been discovered and that which was used had to to be imported at a high cost. Hence the necessity for some cheap form of power was the mother of the invention of the hydro-electric plant.

Mr. J. D. Galloway, member of the American Society of Civil Engineers, attributes the peculiar formation of the Sierra Nevadas as another reason for the beginning and progress of hydro-electric development in California. The mountains range from a summit elevation of about 8,000 feet in the northern to over 14,000 feet in the southern part of the state. Geologically they are of recent formation. In many parts a recent lava cap, several thousand feet thick and many miles wide, covers older formations. The rain and snowfall in the mountains ranges from 20 inches to over 100 inches. In some places the snowfall is over 30 feet and it remains well on into late summer. The result is that numerous rivers flow down the slopes of the mountains into the two collecting rivers, the Sacramento and the San Joaquin. These branch rivers have cut deep canyons into the relatively soft lava cover from 1,000 feet to 3,000 feet average depth. The canyon of the Tuolumne River is at one place over 4,000 feet deep and less than two miles wide at the top. The descent of the rivers is swift, ranging from 100 to 150 feet fall per mile. This means a torrent of water dropping in successive falls and cascades.

Then last, but not least, is the presence of numerous large cities situated in huge fertile valleys far below near sea level, and two of the largest cities in the whole country right on the seacoast.

Such then was the situation—high mountains with heavy precipitation at high altitudes offering the power.

Having illustrated conditions in California, which have to a certain extent been duplicated as to most points in other parts of the country, one can remind the reader that at the water power site the first step is always the formation of a dam by which the water may be controlled and headed up into a greater source of energy.

Now, before passing to available water power sites, it may be well to mention some of the very large ones now in full use as generating sources of hydro-electric power. The two greatest producing centers in the world are the Falls of Niagara and the Victoria Falls on the Zambesi River, South Africa. The rights at Niagara have all long since been acquired by American and Canadian companies which form a monopoly. There is between three and four million horsepower capable of development there and, up to the present, transmission lines have been carried, by one of the companies, to points about 150 miles away. The giant plant at the Victoria Falls Power Company, in South Africa, is said to be the largest in the world, is at this time supplying the entire "Rand" with electrical energy and it too, has an absolute monopoly over practically all that part of South Africa.

Other well known hydro-electric power developments in this country are the United States Government works at Roosevelt, Ariz., the large plants on the Tennessee and Cumberland rivers, the Oregon City plant on the Willamette near Portland, the Seattle Electric Company's plant near Seattle, Wash., the Central Colorado Power Company's plant with 430 miles of transmission lines, the plant at Spokane, Wash., the plant at Joliet, Ill., on the Desplaines River, the Lockport plant of the Chicago Sanitary District near Chicago and others too numerous to mention in various parts of the Atlantic Coast and New England States.

There are many electric systems in different parts of the country which have acquired water power sites without having developed them so far. In fact, it may be stated with some show of authority that almost all the open water power sites have been acquired by the great electrical interests.

There are, roughly, 12,000,000 horsepower capable of hydro-electric development in the national forests alone. Probably half of this amount is now under the control of the United States. That half will have a minimum value when marketable of at least $600,000,000, or over a billion dollars worth of marketable value for the water power still existent in the national forests. Just now a question being agitated considerably is: To what extent can the control of additional power sites be secured by acquiring national forest lands under the guise of homestead settlement, in many instances very small tracts of arable land along mountain streams being sufficient? It is stated that though many of these tracts are unquestionably suitable for agriculture, their opening to settlement could have but one result, namely, speculative entries for their future value for the development of hydro-electric power. As soon as a legal title to such entries could be transferred they would be acquired by power companies. This has been done in the past in many parts of the west through homestead and preëmption entries and mineral locations.

Such power sites furthermore, as has been already suggested, are not necessarily acquired by power companies for immediate development and use. In many instances the sole purpose is to control undeveloped power and prevent its passing into the hands of possible competitors. These sites will be held, as others are being now, until the market permits the development and sale of electric energy without affecting the prices paid by consumers.

Having thus shown what is the general situation in regard to hydro-electric power at this time, it must be made clear that the final value of stock and bonds issued by such hydro-electric companies and systems greatly depend on the future service derived from the lines of transmission. No less a financial authority than the president of the National City Bank, of New York City, has had this to say: "The utilization of the great water powers which are now being so rapidly developed will tend toward a combined management covering large areas. The progress that is being made in long distance transmission is of the greatest importance in this direction. Indeed, if a layman might venture an opinion, it would be that the next era of distinct development in the electric lighting field will come as a result of the progress that the technical experts will make in long distance transmission." This does not conflict with the opinion of Herr Rathenau, of Berlin, "the electrical emperor of Germany," who expressed himself some years ago to the effect that in "concentration of the areas of distribution" would be found the next great electrical development of the times—meaning that he saw no reason why there should be more than one distributing system within a radius of 50 miles. Therefore, what as to lines of transmission at the present time?

One cannot do better here than quote a few words from a paper read in May of this year by C. A. Keller before a branch meeting of the National Electric Light Association. "Our great national problem of the conservation of energy, as well as the inevitable struggle of industry for cheaper power, will find their solutions in the transmission line—the ultimate scarcity of fuel will finally drive civilization southward, and here again the transmission line will come to the rescue by delivering to industry energy developed at the great water plants of the North. This can only be accomplished by transmission lines operating at considerably higher voltages than at present." And he might have added, very considerably lower cost. Here are some of the important long distance transmission lines operating at 60,000 volts or over:

Central Colorado Power Co., 100,000 volts—450 miles of transmission lines.

Great Falls Water Power and Townsite Co., Montana, 102,000 volts—135 miles of transmission lines.

Ontario Power Company, 60,000 volts —200 miles of transmission lines.

Washington Water Power Company, Spokane, Wash., 60,000 volts—260 miles of transmission lines.

Copper is used almost exclusively for these transmission lines. There are in places aluminum lines, especially for long spans. There is also braided copper in steel sheath.

You, being interested in investment in electrical securities, will be wise to give close attention to the hydro-electric power developments of the day, for in the march of progress, you will find there a great opportunity. Just now, this manner of abundant and cheap power is very much a matter of country, nay world wide, interest and you will do well to watch events closely, and be ready to take advantage of some of these adequately managed hydro-electric opportunities.

# SCIENCE EXTRACTS FROM FOREIGN JOURNALS

## NEW WAY OF USING RADIUM

An interesting method for using radium for different kinds of work is now employed in Europe. Seeing that glass or aluminum vessels containing radium have the drawback of shutting off a good part of the useful rays given out from this substance, M. Lieber employs a special method for covering surfaces with radium so as to make what may be called an active screen. To do this he dissolves or mixes the radium compound so as to be able to spread it upon a celluloid backing in the shape of a disk or plate. A celluloid rod can also be coated in the same way. After drying, the layer of radium is covered with a coating of collodion, which dries quickly and then gives a good protective layer. It also allows a good part of the radium rays to pass. What is known as "radium gelatine" is also used for a number of purposes, and at present it is employed for medical use. It consists of a sterilized solution of gelatine containing a small quantity of radium salt. When the ordinary means fail, the radium gelatine is injected into parts of the body or it can be applied upon wads of absorbent cotton.—*Les Inventions Illustrées, Paris.*

## ELECTRIC HEATERS FOR CHURCH PEWS

Electric heating is carried out in the St. Sebaldus church in Nuremburg, Germany on a most improved plan, the heaters being installed in the shape of foot warmers, which run along under each pew, and the result is said to be excellent. The outside electric mains come in to half a dozen or more connection boxes lying under the floor and from here wires branch out to each of the pews and on the pew is a switch so as to be able to cut out each heater independently. The electric heater consists of a four inch iron pipe laid along at a short distance from the floor and in front of the seat so that the feet can be placed upon the heater. A foot support in the shape of an iron plate runs along just over the heater tube so that there is no direct contact made with the latter. Inside the tube is the electric heater proper, which consists of resistance wire wound on a central metal core, being insulated with glass supports. The foot bench acts as a flap and is hinged to the back of the pew following and has feet in front, so that it can be folded up when it is desired to inspect or clean the heater. The St. Sebaldus church is a large one and has 1,200 seating places, with 1,800 feet total length of pews.—*Elektrotechnischer Zeitschrift, Berlin.*

## ST. ELMO'S FIRE

The curious electrical phenomenon, known as St. Elmo's fire, was observed on a trolley wire of the Louvre-Vincennes line at Paris by M. Vaudequin, and he says that there was a continuous flame like brush all along 100 feet of the wire and about 20 inches high. This lasted for more than half a minute and had a pale green color which could be very well seen on account of the dark clouds which were back of it. It is well known that such effects are electrical discharges which take place during stormy weather and have the appearance of flames or brush discharges, such as are given with electrical apparatus, for instance, when approaching the finger to a static machine. The St. Elmo's fire is often seen on the masts of ships and in Paris it is noticed on the spire of Notre Dame. Sometimes the effect is remarkable, such as was seen at the Pic du Midi Observatory in France. Here the spectacle which occurred at night was a striking one, as all the lightning rods, stay wires and a 200 foot length of wireless telegraph antenna, the metal roofs and even the weathercock were covered in part or altogether by flames or discharges reaching eight inches in height and there were seen brilliant stars of a small size upon the metal. The whole southern half of the observatory seemed to be in flames, while the northern half remained in complete darkness. After a quarter of an hour the storm abated, and the St. Elmo's fire disappeared altogether.—*La Nature, Paris.*

## NEW WAY OF MAKING QUARTZ TUBE LAMPS

A Paris constructor, M. Berlemont, uses a new method for making quartz tube mercury vapor lamps which makes them much more reliable. These lamps are now coming into use for water purifying purposes, and are made with a quartz tube instead of glass, so as to allow the microbe destroying ultra-violet rays to pass through. But these lamps are noticed to run down with time and become useless, so that this is likely to hinder the use of the lamps unless a remedy is found. Air enters the tube by degrees and combines with the mercury, and again there is deposited a black layer on the tube like that seen in an incandescent lamp. Before this, the current was taken into the quartz tube by conical ground stoppers of the non-expansion metal known as "invar." This metal expands scarcely any and thus does not work loose with the heat. Ground stoppers are used, as it is impossible to fuse the current wires in the quartz as is done with glass. However, it is found that air will enter around the stoppers, even in spite of great care, so that the inventor now uses an alloy of platinum and iridium, and by combining properly he obtains an alloy which melts at the same heat as the quartz. In this way he is able to fuse the wires directly in the quartz tube when making the lamp. He claims that by covering the wire with platinum in a certain way, it will not work loose under the action of heat, so that this drawback is remedied and there is also no black deposit in the lamp. —*La Nature, Paris.*

## HUMAN COMPASS

While we cannot vouch for the truth of the statement made by a Paris journal that the human body may be made to act like a compass and place itself due north and south, the idea is an interesting one and is said to be not difficult to prove by an actual trial. Take a wide plank as long as the person's body, insert at the middle point a sewing thimble or other suitable hollow metal piece, placing the whole upon a metal pivot fixed in the ground and about 20 inches high, so that the board can turn about easily. The person lies upon the board, with the arms laid next the body. It is claimed that the board will then turn about and finally take a position which is just north and south. Thus we have what might be called a "human compass."—*Soleil* (daily), *Paris.*

## ELECTRIC TIMING AT THE OLYMPIC GAMES

At the Olympic games at Stockholm there was used a novel electric method for timing the runners in some of the races, so as to get the exact time made by the winner, and also to decide who crossed the line first, even when the difference was very small. The starter gave the signal by firing a pistol and this was connected by electric wires with two stop watches and these commenced to run for taking the time. The start and finish were at the same point, and across the track a light string was stretched between poles and the string was also connected with the stop watches for stopping them. The first comer broke the string when crossing the line so that the watches were stopped and the exact time between start and finish could be seen. Breaking the string also served to work an electric device for the shutter of a camera which was mounted just on the finish line and above the judges' stand, so that the photographer had an image of the winner when crossing the finish line. This method is very useful in settling all disputes.—*La Nature, Paris.*

## TELEPHONES PER CAPITA IN SCANDINAVIAN COUNTRIES

It has often been stated that Sweden is in the lead among European countries as to the number of telephones which are in use with relation to the number of inhabitants, especially in Stockholm, where the public uses telephones very largely. Denmark is also not far behind, and the same state of affairs is found at Copenhagen. The recent telephone figures bring out the number of telephones per 1,000 inhabitants which are in use in some of the large cities. In Stockholm this number is no less than 191.5 telephones per 1,000 persons, and Copenhagen follows this with 96.5 telephones. Next comes New York with 85.5 subscribers per 1,000, then Christiania with 68.9, Helsingfors with 59.5, which is the same figure as for Berlin, then come Paris and London with only 27.4 subscribers. In several of the above cases it will be seen that the Scandinavian region is in the lead.—*Zeitschr für Schwachstr.*

## INTERNATIONAL CONGRESS OF ELECTRO-CULTURE

The French Moto-Culture Association, whose headquarters are at Paris, is now organizing an international congress of electro-culture as well as a concourse and exposition of all kinds of motor devices applied to agriculture, to be held at Rheims from the 19th to the 27th of October. The congress will deal with the influence of electricity on the growth of plants, such as the effects of atmospheric electricity upon the soil and upon the sprouting or general growth of crops of different kinds, also the effect upon microbes and insects. Electric treatment of plant diseases will be another feature, also electric forcing of plant growth, influence of electric light on plants and flowers and the like. The second part of the program relates to exhibitions of electric or other motors as applied on the farm for all kinds of work.—*Revue Scientifique, Paris.*

## GASOLINE-ELECTRIC OMNIBUSES IN LONDON

A number of the new Tilling-Stevens electric automobiles are beginning to run in London and others are now in use in Liverpool, and they appear to be having considerable success. Each automobile carries a miniature electric plant and this can also be made use of to supply current, as for instance, for electric welding or for operating searchlights, and the cars are used in this way at present. The motor is of the four-cylinder gasoline type and gives 90 horsepower, having a dynamo mounted on the same shaft. On the car is an electric motor which receives the current from the dynamo. This motor drives the rear axle by a set of gearing, and as the current from the dynamo passes through a controller, the driver can easily vary the current and so run the electric motor at different speeds to operate the car. A certain number of the new cars are now in public use in London and they are well patronized by the public. In spite of their seeming complication, they are easily handled, and a noteworthy point is the economy of running which they show when compared with the usual gasoline omnibus. The same type of omnibus is coming into use on the continent, and a number of them have also been built for India.—*Electricien, London.*

## LONG DISTANCE WIRELESS RECORD FROM PERSIA

It is somewhat surprising that a long distance wireless record should be obtained by a station in Persia. This country seems like a bit of the old world dumped down into modernity, though the statement may not be cheering to those who are lovers of the land of "the Lion and the Sun." This isolated country is being hemmed in on the north and east by Russia and India, and possesses a coast line which commands only a byway to the Arabian Gulf. Lack of good roads is another point, and most of these are mere caravan tracks so that means of connection with the outer world are scanty and unreliable. Wireless telegraphy is now coming in to help matters.

The operator in charge of the Marconi Jask station was recently able to cover a remarkably long distance, his messages being received by an operator on the ocean liner "Mantua," which was then off the Port of Melbourne, Australia, a distance of 6,249 nautical miles. It is only possible to account for this long distance by some exceptional conditions of the atmosphere or other physical conditions which prevailed at the time. The operator on the "Mantua" heard Jask as clearly as if the stations were only 100 miles apart.—*Marconigraph, London.*

## MAP MAKING WITH THE AID OF WIRELESS

Map making is one of the new uses to which wireless telegraphy is being put, and this is likely to become an important feature before long, especially in the colonies or newly-developed regions where surveying work is difficult to carry out. At the Eiffel Tower plant in Paris experiments showed that the exact difference in longitude could be found by sending time signals by wireless. For instance, if it is two o'clock in Paris and the time at a second station at this moment is three o'clock, there is one hour difference between these points, and as the difference in latitude corresponds exactly to this, it is figured at once and we have the latitude of the second point with reference to Paris. This is due to the fact that the two time values are instantaneous, as the waves take no appreciable time to travel. The King of Belgium is now taking steps to apply the method in the Congo region in Africa, and it is said that a map can be laid out within two years, where it would take about ten years to do the work by ordinary surveys. A commission is now engaged in applying the wireless method to fixing the frontier between the French and the German possessions in the Congo region.—*Frankf. Zeitung, Frankfort.*

## NEW BOOKS

Modern Illumination—Theory and Practice. Horstman and Tousley, Chicago. Frederick J. Drake & Company. 265 pages with 42 illustrations. Price, $2.00.

This work takes up the subject from the view-point of the practical workman, and is serviceable not only to electricians, but to architects, superintendents and managers of commercial or industrial establishments.

Toll Telephone Practice. By Thiess and Joy. New York: D. Van Nostrand Company. 1912. 410 pages with 271 illustrations. Price, $3.50.

Like many other fields in the electrical industry, the art of telephony has advanced to a point where it must be divided into various subjects and have these treated separately in order to be presented in a volume of reasonable length. The book noted covers the field indicated exhaustively and is written for the engineer, the student and for those whose training has been practical.

Shop Mathematics. By Earle B. Norris and Kenneth G. Smith. New York: McGraw-Hill Book Company. 1912. 180 pages with 86 illustrations. Price, $1.50.

The aim of this book is to teach the fundamental principles of mathematics to shop men, using familiar terms and processes, and giving such applications to shop problems as will maintain the interest of the student and develop in him an ability to apply the mathematical and scientific principles to his every-day problems of the shop. This volume (Part I, Shop Arithmetic) presents the first half of the instruction papers in Shop Mathematics, as developed and used by the Extension Division of the University of Wisconsin.

Drafting Instruments and How to Use Them. By Ralph F. Windoes, South Haven, Mich. 1912. 48 pages with 88 illustrations. Price, cloth, 75 cents; paper, 50 cents.

A book written for students beginning the study of mechanical drawing. Besides treating of instruments used, a chapter is devoted to blueprinting and tracing.

# On Polyphase Subjects

The leading article in this issue—"Edison as a Manufacturer"—emphasizes a phase of the man's many sided personality not very widely appreciated by the public, which has come into the habit of loving and honoring him more as a great inventor and philosopher. But Edison the manufacturer, assisted by very able men with whom, through his keen insight into human nature, he has been able to surround himself, has also built up a great industrial organization at Orange, N. J. He is a thorough business man and a good portion of the long hours he spends every day at the plant is given up to the management and even to directing details of the numerous manufacturing units which are linked together under the name "Thomas A. Edison, Inc."

**Edison Among the Great Manufacturers**

The author of the article, Mr. H. Bedford-Jones, visited the plant at Orange and conversed with Mr. Edison concerning this phase of his work. The results of this interview and his close observation of the wonderfully interesting and diversified processes of manufacture there represented he has set forth in a pleasing style.

This is the first of a series of articles by the same author which will present some of the very interesting features in connection with great manufacturing institutions in the electrical field. When you place a telephone receiver to your ear and listen to the voice of a friend far away, you would perhaps like to know something of the greatest telephone manufacturing establishment in the world, which builds telephones and intricate switchboards not only for this country but for China, for Russia, for France—wherever, in fact, the human voice pulsates over wires. When you see a mighty waterfall harnessed, or listen to the song of a 20,000 horsepower turbo-generator, you would like to know where those great machines came into existence. As you turn the current into a little wire heating element that then cooks your dinner or curls your hair, you wonder, also, where these modern devices come from.

The articles will answer some of these questions which have come to your mind. Not every great plant can be described nor can one one-hundredth of the marvels in each be dwelt upon, but at least some very interesting bird's-eye views will be presented of the leading institutions in the various branches of the electrical industry.

It has been ascertained that the rare atmospheric gas, neon, readily becomes luminous under the influence of electric waves, and it is suggested that the property may afford a means of visually reading wireless telegraph messages. Experimentation with a tube of neon during an Atlantic voyage in July showed that the gas glowed beautifully in response to the waves sent out from the wireless apparatus of the ship, but that the received waves were apparently too weak to affect it sensibly. Further experiment may result in the discovery of a means of utilizing this property of neon as a detector of received signals. At present it is employed to measure the length of electric waves sent out.

**Neon and Electric Waves**

# Short Circuits

Dr. Marcus Herz, of Berlin, once said to a patient who read medical books diligently in order to prescribe for himself:

"Be careful, my friend. Some day you'll die of a misprint."

* * *

"Hello, Jack," called out little Harry, "is Tommy in the house?"

"Course he is. Don't you see his shirt on the line?"

* * *

The other day a young woman teacher took eight of her pupils through a museum of natural history.

"Well, my boy, where did you go with your teacher this afternoon?" asked the mother of one of them on his return. With joyous promptness he answered:

"She took us to a dead circus."

* * *

He passed the sugar-bowl to a shy young girl of about fifteen, sitting across the table, saying, "Sweets to the sweet, you know;" whereat the little miss handed him the plate of crackers, remarking, "Crackers to the cracked."

* * *

The residents of a neighborhood in Harlem were surprised the other morning when on their way to the subway station they noticed this sign hanging in the window of an undertaker's establishment:

"Why walk around in misery when you can be comfortably buried for $35?"

* * *

A teacher wishing to emphasize the importance of the ocean cable in binding together the nations of the earth, inquired of her class:

"What one thing unites more people than anything else in the world?"

The unhesitating reply of a pupil was, "Getting married."

* * *

He danced a waltz with the wife of his host. The lady spoke with an especially broad accent, and she ran somewhat to flesh. When they had finished the round of the floor she was panting in a repressed and well-bred way.

"Shall we try another whirl?" inquired the Chicago man, eagerly.

"Not now," she smiled, "I'm so dawnced out."

"Not by a long shot," said the Chicagoan with emphasis. "You're far from being darned stout. In fact, you're put together better than any little girl I've seen yet."

* * *

He had dropped a nickel in the slot of a telephone pay station and stood patiently waiting. He was full to the brim. He read the instructions and took down the receiver.

"Number?" asked central.

"Fife centsch."

"What do you want?"

"Sen Sen."

* * *

Doubtless that Vermont widow meant well when she erected a monument to her late husband bearing the inscription: "Rest in peace until we meet again."

* * *

A man called up a big office on the telephone and got a saucy greeting from an office boy while asking the man who he was and what he wanted.

"Oh, I'm only the president of your company," the man answered, "so you needn't be polite to me; but please do be to others."

* * *

Two farmers of Kansas were discussing a recent cyclone. "Was your barn damaged any?" asked Si. "Wal, I dunno; I ain't found that barn yet."

* * *

"Do you think telephone operation can be classed as a profession?"

"Well, it certainly is a calling."

* * *

Three strangers were in the Pullman smoker, when one of them turned to another and asked:

"H-How f-f-f-far is it t-t-too P-P-P-Pittsburgh?"

The man addressed made no reply, but got up and left the car. The stutterer then turned to the third man, who gave him the information.

A few moments afterward the third man met the one who had left the car and said:

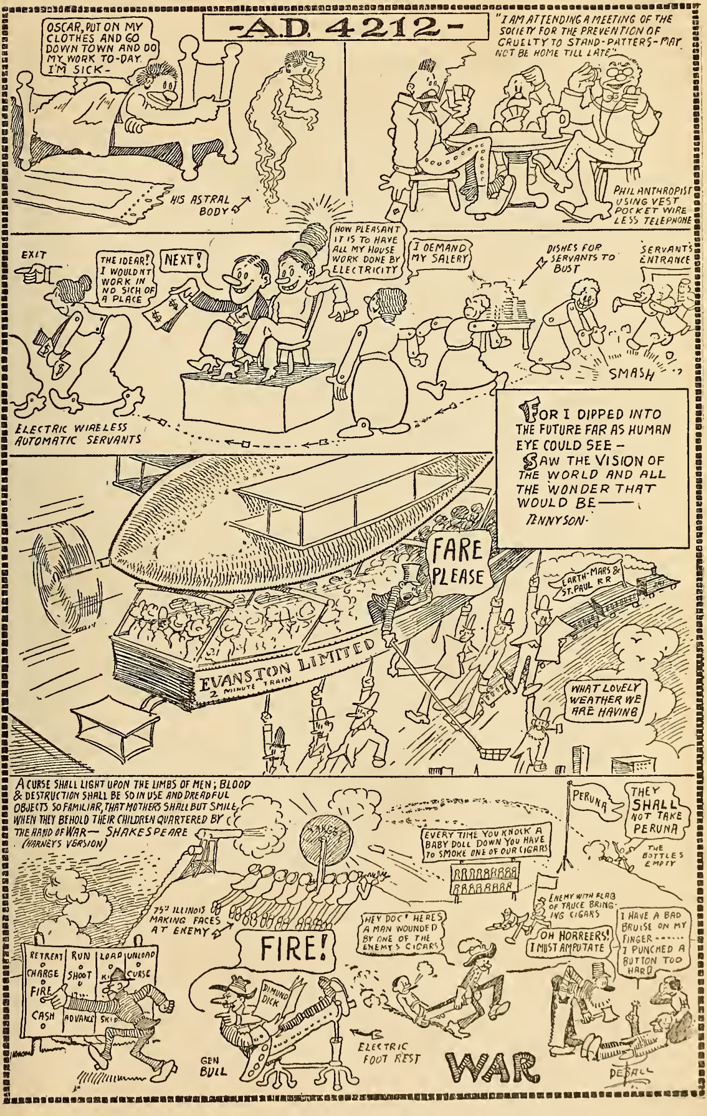
"See here! Why did you go out without answering, when that man asked you a civil question?"

"D-D-Do you think I w-w-wanted to g-g-get m-my head knocked off?" was the answer.

* * *

"What are you doing with that parrot?"

Stammerer: "I'm j-j-just t-t-t-eaching him to sp-sp-speak."


-A.D. 4212-
OSCAR, PUT ON MY CLOTHES AND GO DOWN TOWN AND DO MY WORK TO-DAY. I'M SICK-
HIS ASTRAL BODY
"I AM ATTENDING A MEETING OF THE SOCIETY FOR THE PREVENTION OF CRUELTY TO STAND-PATTERS-MAY NOT BE HOME TILL LATE"
PHILANTHROPIST USING VEST POCKET WIRELESS TELEPHONE
EXIT
THE IDEAR! I WOULDNT WORK IN NO SICH OF A PLACE
NEXT!
HOW PLEASANT IT IS TO HAVE ALL MY HOUSE WORK DONE BY ELECTRICITY
I DEMAND MY SALERY
DISHES FOR SERVANTS TO BUST
SERVANTS ENTRANCE
SMASH
ELECTRIC WIRELESS AUTOMATIC SERVANTS
FOR I DIPPED INTO THE FUTURE FAR AS HUMAN EYE COULD SEE - SAW THE VISION OF THE WORLD AND ALL THE WONDER THAT WOULD BE—
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FARE PLEASE
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2 MINUTE TRAIN
WHAT LOVELY WEATHER WE ARE HAVING
A CURSE SHALL LIGHT UPON THE LIMBS OF MEN; BLOOD & DESTRUCTION SHALL BE SO IN USE AND DREADFUL OBJECTS SO FAMILIAR, THAT MOTHERS SHALL BUT SMILE, WHEN THEY BEHOLD THEIR CHILDREN QUARTERED BY THE HAND OF WAR— SHAKESPEARE (HARNEYS VERSION)
PERUNA
THEY SHALL NOT TAKE PERUNA
THE BOTTLES EMPTY
EVERY TIME YOU KNOCK A BABY DOLL DOWN YOU HAVE TO SMOKE ONE OF OUR CIGARS
75TH ILLINOIS MAKING FACES AT ENEMY
ENEMY WITH FLAG OF TRUCE BRINGING CIGARS
HEY DOC' HERES A MAN WOUNDED BY ONE OF THE ENEMY'S CIGARS
OH HORREERS! I MUST AMPUTATE
I HAVE A BAD BRUISE ON MY FINGER------ I PUNCHED A BUTTON TOO HARD
FIRE!
RETREAT RUN LOAD UNLOAD
CHARGE SHOOT CURSE
FIRE
CASH ADVANCE SKIP
DIMUND DICK
ELECTRIC FOOT REST
GEN BULL
WAR
DEBALL

# Common Electrical Terms Defined

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

TURBO-GENERATOR.—An electric generator coupled to a high speed steam turbine. In some machines the common shaft is vertical and in others horizontal.

TWIN CONDUCTOR.—A cable of electrical conductors in which two wires insulated from each other are carried. (See cut.)

**Twin Conductor**

UNIPHASE ALTERNATOR.—An electric generator which produces single phase alternating current. Sometimes called a "uniphaser."

UNIVERSAL DETECTOR.—A wireless detector so constructed that it may be operated as an electrolytic, tantalum, peroxide of lead, silicon, carborundum, or as any of the crystal detectors.

UNIVERSAL DISCHARGER.—See Discharger.

V.—Sometimes used as an abbreviation for volt.

VERTICAL MAIN.—In the wiring of a building for electric light and power the conductors running vertically from floor to floor. Called also risers.

VIBRATING BELL.—A bell that rings while the circuit is closed and having a circuit-breaker operated by its own motion.

VOLT.—The unit of electromotive force. If a source of electricity capable of furnishing an electromotive force of one volt is connected to a circuit of one ohm resistance a current of one ampere will flow. The nearest and most familiar approximate standard is a Daniell cell which gives an electromotive force of 1.07 volts.

VOLTAGE.—The electric pressure of a circuit expressed in volts. When this term is applied to lamps, however, it means the voltage of the system upon which the lamp is designed to burn.

VOLTAIC ARC.—See Arc, Voltaic.

VOLTAMETER.—An electrolytic cell arranged to measure the quantity of electricity that has passed through it in a given time. If two plates of copper be placed in sulphate of copper and a current of electricity be passed through from one plate to the other the anode plate will slowly dissolve and the kathode plate will receive the copper deposit lost by the anode. One ampere will deposit 1.174 grams of copper per hour. In 1879 Edison proposed a copper voltameter to measure current supplied to houses for electric lights.

VOLTA'S BATTERY.—See Battery, Volta's.

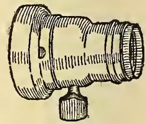
VOLLMETER.—An instrument used for measuring the potential or electric pressure.

VULCANITE.—A variety of vulcanized rubber used for insulation purposes in electrical construction. Sometimes referred to as ebonite, when black. A more common name is hard rubber.

W.—An abbreviation for watt.

WALL BOX.—An iron or steel box required by the National Electrical Code to be set in a wall or partition to hold a flush switch or plug receptacle.

WALL SOCKET.—A socket designed to be placed upon the wall to hold an incandescent lamp. (See cut.)



**Wall Socket**

WATT.—The unit of electric power. The $\frac{1}{746}$ of a horsepower.

WATT-HOUR.—The term used to indicate the steady expenditure of one watt of electrical energy during a period of one hour.

WATTMETER.—An instrument for measuring in watt-hours the electrical energy passing through it. (See Watt-hour.)

WAVE LENGTH.—Used in wireless telegraphy to designate the distance between two adjacent points at which the electrical strain in the ether is at its maximum in the same direction. A rough analogy to wave length in ether may be made by dropping a float regularly into a pool of water. Waves will be produced, the distance (wave length) between their crests being in accordance with the rapidity of the oscillation of the float.

WIMHURST MACHINE.—A type of static machine having two oppositely rotating plates of glass on which are pasted sectors of tinfoil. These sectors on the two plates react one upon the other, becoming charged with electricity which is taken off by collecting combs of metal.

WINDAGE.—The air gap between the armature windings and the pole pieces in a dynamo is sometimes so called.

WIRELESS TELEGRAPHY.—A method of electrical communication between two stations without the use of a metallic circuit. The principle of wireless communication as specified in Marconi's patents is the production and detection of electro-magnetic waves, the ether being the transmitting medium.

WORK.—When a force acts upon a body and moves it this force does work, it acts against a resistance and produces motion. The common unit of work is the foot-pound. If a weight of one pound be lifted one foot, a foot-pound of work has been done. Foot-pounds equals pounds-force times feet displacement.