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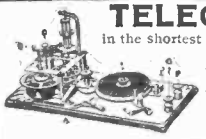

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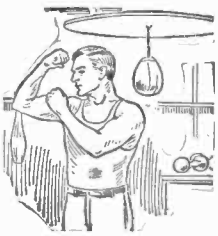

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and develop a memory that will increase your efficiency and productiveness generally. Thousands of successful men and women can tell you what my memory course has done for them. Some can tell you how they owe their present efficiency and success solely to this course. Others naturally bright, can tell you how my course of study increased the value of their natural powers—brought them to present success.

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It is certainly gratifying to receive a report like the following from one of my scholars, who says: "In the brief time of five months you have made me an entirely new man. While I was lacking in faith in my ability and compelled to work in a mill nine years, through your instruction I have been able to quit that work and am engaged at present, as a salesman with great success."

From Mill To Salesmanship

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Prof. Henry Dickson, Principal

Dickson School of Memory

929 Auditorium Building Chicago

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You've pitied the little girl who forgot her piece.

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POPULAR ELECTRICITY MAGAZINE

In Plain English

HENRY WALTER YOUNG, Editor

Vol. VI June, 1913 No. 2

CONTENTS

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READY TO SUPPLY THE LIGHTS FOR A WEDDING IN KARACHI, INDIA, WHERE THERE IS NO REGULAR ELECTRIC SERVICE AND THESE PORTABLE OUTFITS ARE MUCH IN DEMAND

Popular Electricity Magazine
In Plain English

VOL. VI. JUNE, 1913 No. 2

Lights for Indian Aristocracy

In the vicinity of Karachi, India, there is no central power plant and electric light is still more or less of a novelty. Some of the richer class maintain small plants of their own, but when they deem this too costly, and when they want electric light for weddings and other important occasions, they go out and hire it.

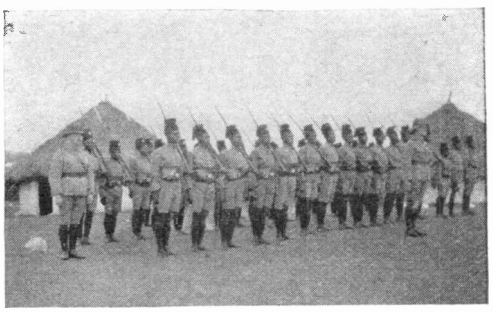
The Eastern Electric and Trading Company, the only firm in those parts dealing in electrical apparatus, maintains a complete generating set with all fittings and accessories, ready to send out at a moment's notice. On the opposite page is a picture of this plant fitted up at a recent wedding and surrounded by the engineering staff that usually does service with the set.

The Secret of Electric Fishes

There are about 50 species of fish known to possess electrical organs capable of imparting a shock. A special study of some of them has been made by Professor McKendrick, of Glasgow University, with the purpose of ascertaining the source of their peculiar power. He finds that the electricity is generated in specialized organs, which are either modified muscles or modified glands, structures which in all animals manifest electric properties. In economy of production these electric organs are said far to surpass anything yet contrived by man, just as the light of the glowworm excels in a similar sense our best efforts to produce cheap illumination. In each case there is another of Nature's secrets yet to be discovered.

African Native Police

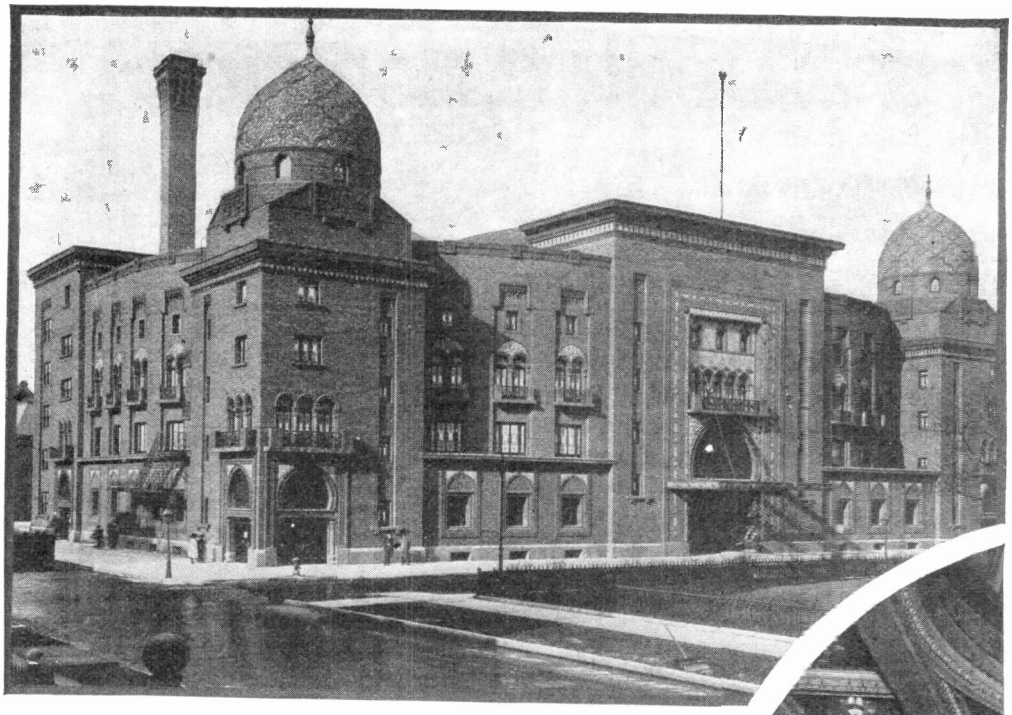
Until the introduction of electric torches into police circles in East Africa, the native constabulary were severely handicapped in their night work. They had to use old-fashioned oil lamps of the London police variety—very unsatisfactory and obsolete. But now the native police have all been issued electric

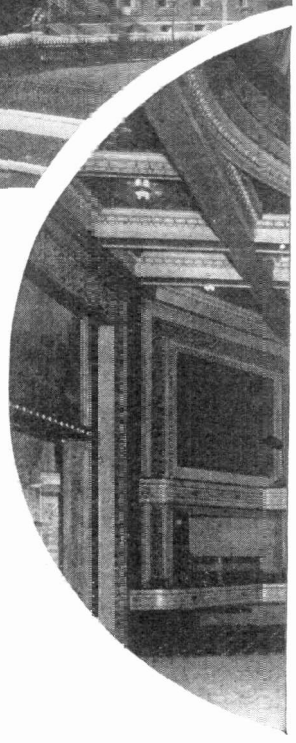


A SQUAD OF AFRICAN POLICEMEN

torches and have been able to give better service in consequence. As the villages are very badly lighted, in most cases with poor oil lamps at long intervals, the police were obliged to make the best of a very bad job, and it is surprising that there were not more crimes committed without detection.

The policemen are enabled to signal to each other at night by this means, for many of them have been taught to use the Morse code with the lamps. Of course this is a great benefit to the police service and to the public.





Medinah Temple, Scene of the N. E. L. A. Convention

The largest body of its kind, the National Electric Light Association, will hold its 1913 Convention, June 2 to 6, in Chicago's newest and largest assembly place, Medinah Temple, home of the Ancient Order of the Nobles of the Mystic Shrine. This building faces Cass Street and extends from Ohio Street to Ontario Street. It is of fireproof construction. The mosque is designed in pure Arabic style of architecture and decoration. A rich exterior polychrome effect is produced by a blending of mottle brown, cream, red and blue. The two domes rest on a structural steel framework.

The auditorium seats 5,200 and the stage measures 70 by 75 feet. The acoustics of the place are perfect. From any of the most distant balcony seats one can distinguish between the sound of a penny and that of a dime dropped from the hand of a person at any point upon the floor of the stage.

There are 150,000 Shriners in the world to-day and of this number 11,000 hold their meetings in Medinah Temple. The membership of the N. E. L. A. is 12,400 so that ample accommodations are afforded within the structure, and spacious parlors and smoking rooms are provided on various floors.

From the center of the great dome in the Auditorium is suspended a massive electrolier whose beauty of design and color when illuminated holds the observer spellbound. The Temple lighting equip-

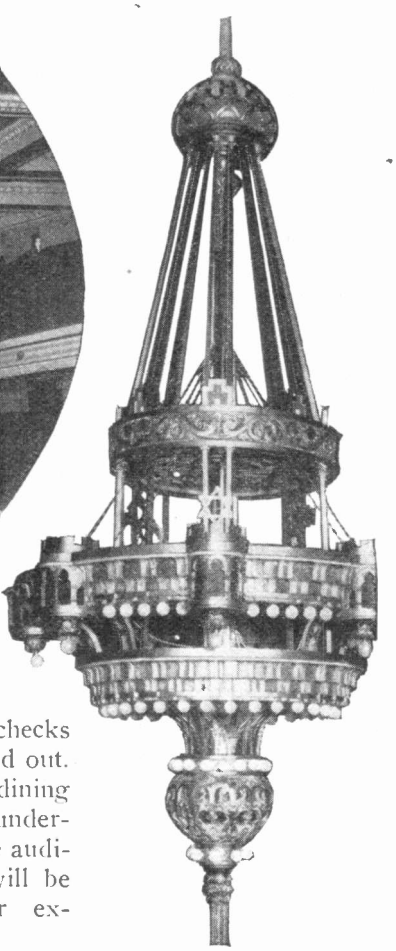
ment includes four 25 ampere spotlights, sixteen 150 watt tungsten lamps, 176 of 25 watts, 1,076 of 40 watts, 130 of 50 watts and 20 of 100 watts. Everything that could be delegated to electric power was provided for by the architects, Huehl and Schmid of Chicago.

The emergency lights are entirely independent of the main lighting service. A plan of each part of the lighting circuit reposes on the electrician's desk, so that should any light or group of lights fail, the exact cut-out box, fuses and switches can be located in an instant. In the motor equipment is a ten horsepower turbine vacuum cleaner, 32 openings being distributed about for hose attachment. The sewerage and ventilation systems are likewise taken care of by electric power. In summer electric fans force the air through a water spray to remove the dust and then through cooling chambers; in winter the washed air passes through warming coils. At every other seat in the auditorium is the terminus of a ventilating pipe.

An automatic fire pump equipment is installed and its 50 horsepower motor is arranged also to raise the twelve ton steel, stage curtain which, with its backing, is nine inches in thickness. Including the dumb waiter and elevator motors there are eighteen motors in the building, totaling 212 horsepower.

The use of electricity for one's convenience begins with the checking of coat and hat. Each set of racks is provided with an incandescent lamp. When a set is hung full of wraps the light is turned out. The checkers thus lose no time in looking for vacant racks and can keep busy until the 10,000 checks are passed out.

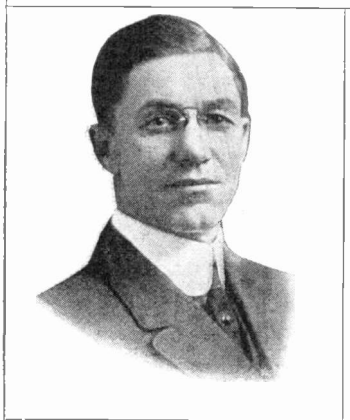
The dining room underneath the auditorium will be used for exhibits.



The Society for Electrical Development

By J. M. WAKEMAN, General Manager

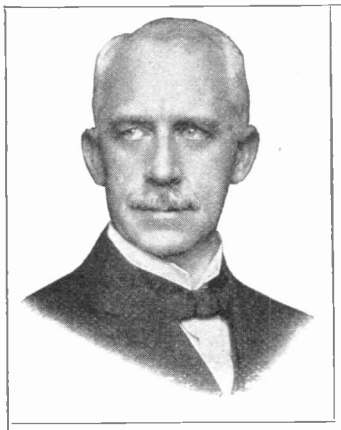
A number of men gathered in the Engineers' Club in New York were discussing the recent conference of The Society for Electrical Development. ¶"There is a novelty about an entire industry combining for the education and benefit of the general public," said one. "That is what interested me most. While all the interests represented at the meetings realize that the electrical industry as a whole, and their own particular interests, will be benefited by the work of the Society, the greatest benefit will accrue to the public." ¶Various interesting plans had been submitted at this conference in New York, including advertising campaigns, traveling electrical shows, moving pictures, attractive window displays, popular lectures, committees to co-operate with other societies and a school for training salesmen. ¶Very few people realize that electricity is the one thing which has steadily decreased in cost to the consumer during the last fourteen years, which is the period covering the marked increased cost of living. The public is only just learning that electricity is no longer a luxury, that it is something which everyone can afford to use better than he can afford to do without. All the little electrical conveniences which go to make the home attractive and comfortable, though inexpensive to the user, are yet an important factor in keeping the central station load even, and, in consequence, the more electricity is used the easier becomes the problem of the central station, and the cheaper can current be supplied. ¶If the Society succeeds in carrying out its plans, every home in the United States, which makes any claim to elegance or even comfort, will be equipped with so many electrical conveniences that people will wonder how they ever got along without them.



The Jovian Order

By F. E. WATTS, Reigning Jupiter of the Jovian Order

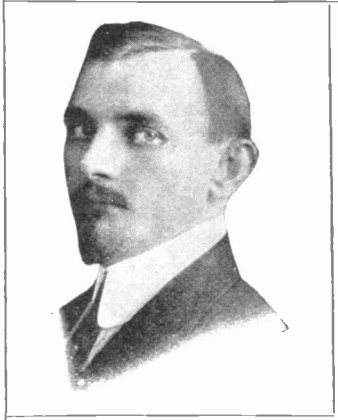
The purpose of the Jovian Order is briefly set forth in the following language: "The object of this Order is the cultivation of the spirit of fraternity and good fellowship from which may be evolved practical plans of commercial co-operation for the promotion and popularization of electricity in the world's work." ¶The necessity and value of establishing harmonious relations among men engaged in the electrical business in any locality is being more generally recognized to-day than ever before. The growth and development of any city electrically will depend largely upon the development of such happy relations. This condition the Jovian Order is attempting to bring about by means of Electrical Leagues in various cities. We believe that before men can co-operate to practical advantage, they must first "get together" on a friendly basis where each is ready to "give and take." ¶When the spirit of co-operation—the desire to co-operate—has been instilled into men, the first bridge has been crossed on the highway of co-operative effort, and the way is paved for serious practical work which has for its purpose the development and growth of the electrical business. ¶The recognition of the possibilities of such an organization in the electrical field is rapidly growing and this accounts largely for the great increase, during the past few years, in the membership of the Jovian Order. ¶It cannot be doubted that this Order, with over 10,000 members working earnestly to exemplify its object, and with the active support of men prominently identified with the industry, will have a powerful influence for good upon the development of the electrical business to its fullest extent.



The Electric Railway Situation

By GEORGE H. HARRIES, President American Electric Railway Association

The electric railway "situation" to-day is for the most part financial. With respect to efficiency and economy of operation there are few shortcomings, and these, wherever practicable, are being remedied; but the most successful management is unable to deal in any other than temporary fashion with propositions that involve the raising of new capital. ¶There has been great increase in the cost of material and labor; oppressively exalted taxation has become common; the multiplicity of transfers continues to diminish revenue; lines have been unfairly and even forcibly extended; equipment and service requirements are more and more exacting—the former being subject to public whims as baseless and as changeable as those of fashion. ¶And while construction and operating costs have climbed steadily and rapidly and the length of ride has been arbitrarily extended the fare has at best remained constant and at worst has suffered heavy discount. ¶Much effort has been and is now being expended on definitely establishing the proper rate; the conclusion naturally differing as population, fixed charges, tax demands and operating requirements vary. ¶What changes of fare will be permitted by popular opinion is wholly problematical but until there are increases in the now unprofitable communities (probably by the adoption of the zone system) there will be growing difficulty in securing the new capital without which there can be no extensions or any real betterments. ¶These facts are now being sown broadcast. How long will it be before the country understands and appreciates "the electric railway situation?"



Agricultural Engineering

By FRANK KOESTER, Consulting Engineer

The rapidly increasing use of electricity in agriculture is one of the most important developments now taking place in this country. The benefits which will result will not alone affect the farmer, but, greatly increasing the agricultural output, will be of vast consequence to the city dweller. ¶A motor of even diminutive size does the work of a man at far less expense, while larger units economically supplant farm draft animals, whose consumption of farm produce is of itself an enormous item. Thus in supplanting labor, electricity has a most profound effect upon agriculture since agriculture demands a great amount of labor as compared with the skill involved. ¶The use of electricity for light, heat and power, it being the only medium so adaptable, means far more than the mere saving and convenience, for it has the effect of making hours of labor on the farm uniform and so reduces the drudgery that farm life becomes sufficiently attractive to stay the drift to the cities. ¶The electrification of farms is being greatly stimulated by the practice of central station companies in running feed branches to the farms from their main transmission systems; and by a greater attention to the subject on the part of consulting engineers who are placed to the best advantage to advise the farmer of the kind of machinery and equipment which will give him the most economical results. ¶Electric farming is long past the experimental stage, and the farmer to-day who is not alive to its advantages is losing money. Even if he is not within the reach of a central station supply, it is a wise policy and one widely followed to install his own electric generating plant.

Welfare Work

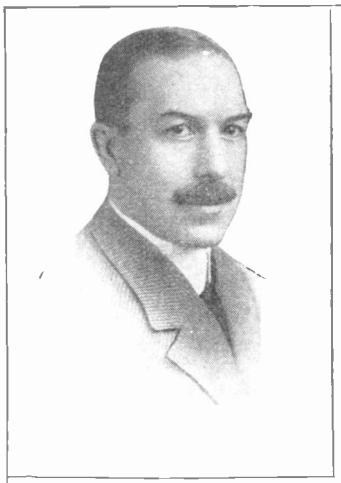
By ARTHUR WILLIAMS, General Inspector New York Edison Company

The National Electric Light Association takes the position that it is the duty of all employers to provide for their workers reasonable hours, good occupational conditions and recognition for satisfactory personal effort. This conviction arises not only from a sense of justice, but also from the knowledge that this is sound commercial policy. Time was when effort of this sort was set down to Quixotism or sentimentality, but to-day it is accepted business dogma that to make an organization thoroughly effective those connected with it must receive just consideration. ¶Through the past several years the Public Policy Committee of the Association has given careful consideration to various methods of eliminating friction between employers and employed. The results of this study were summarized in its 1911 report, which it is believed has had material influence upon the attitude of employers in many different lines of industry toward their employees. "The cost of accidents inherent to our industry," said this report, "should fall not upon the individual employee, but upon the industry as a whole." The same document also urged the provision of sickness, insurance and death benefits, and the institution when possible of employees' savings funds and of profit sharing. The establishment of service annuities—as distinct from pensions—was also strongly advocated, it being felt that years of faithful service should go toward insuring an employee against privation in old age. ¶Some of the plans recommended in this report had previously been adopted by Member-Companies, and others have since been put in practice. It speaks well for the electrical industry that it has been a leader, not a follower, in a definite progressive plan of relationship with labor which seems to be receiving world-wide interest and approbation in every department of human endeavor.

Electrical Shops and the Public

By GEORGE B. JOHNSON, Manager of the Electric Shop, Chicago

It was considerably less than ten years ago that the flatiron was about the only electrical household convenience. No one would think of starting a store or shop with only electric irons. To-day in the larger cities you will find, very likely in the shopping district, a well-appointed shop devoted solely to electrical devices; and the electric iron is only one among hundreds of household utensils, beautiful lighting fixtures, heaters, laundry appliances, vacuum cleaners, electro-vibratory equipment and the like. And these shops, as well as special departments of similar kind in the great general retail establishments, and the display and sales rooms of the central stations themselves, are well patronized—for people have learned that there is now such a thing as "electrical shopping" and commonly recognized places in which to do it. The time was that to select anything electrical seemed to the layman to involve some engineering knowledge and experience too deep for him. Now he heads very confidently for the electrical store and buys anything he wants from a battery to a stationary refrigerating plant and converses knowingly of watts consumption. ¶All this is but indicative of the popularity of electric current consuming devices. Nowadays those who operate central stations and believe in pushing the sale of electricity realize that it is very essential not only to sell electricity, but also to assist the public to a realization of the exceeding usefulness and convenience of such articles, and the electric shop is the logical outcome of this broad policy.



Electric Clubs

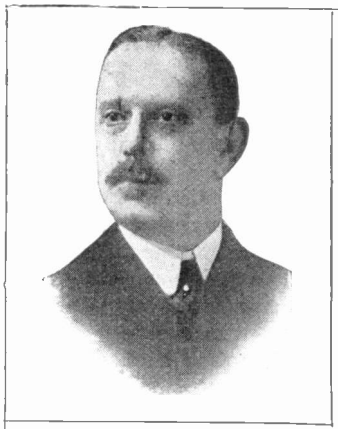
By GEORGE C. KEECH, President Chicago Electric Club

Apart from the technical societies which furnish valuable scientific data to the electrical industry are the Electric Clubs. In each of our 30 foremost cities is an association called the Electric Club, the Electric League or the Jovian Club with a membership of 200 to 700 composed of electrical men. The object of these clubs as usually announced in their constitutions is the advancement of the social and commercial interests of their members. They do not have permanent quarters with the usual club accommodations but meet once a week at a suitable location for luncheon, listen to a speaker of prominence on a popular subject, discuss affairs of mutual interest and get better acquainted. ¶The membership comprises the real men in the industry, presidents and managers of the central stations, supply houses, manufacturing plants, telephone companies and contracting firms, and the young man of ambition who realizes the importance of his acquaintance with these men of experience. ¶At a recent meeting of the Chicago Electric Club, Charles G. Dawes, ex-Comptroller of Currency referred to a quotation of ex-senator Hoar in which the latter stated that he measured a man by the time he spent with his business associates outside of business hours. Here is the great advantage of the electric club — the young men informally at the table with the older, absorbing information of value and interest, and the older men learning who will be the future leaders in the industry. That these clubs accomplish their purposes is established by the fact that the old members retain their interest and the memberships are rapidly increasing.

Electrical Advertising

By J. C. McQUISTON, Manager Westinghouse Department of Publicity

Electricity is a popular subject in the abstract, but the concrete substance is so shrouded in mystery that its introduction to the public is handicapped and must be secured by preaching and teaching its application. The interest must first be secured through the devices themselves and then follow with the wonderful properties of electricity which are capable of so many applications that tend to make life more worth living. ¶Success in electrical advertising depends on the co-operation of the interests involved. The national advertising is often done for the benefit of the local dealer, the manufacturer depending for his profit on the increase of sales through him. Domestic applicances in particular must be described in popular terms so that "he who runs may read," and the mediums selected accordingly. ¶The ever-increasing popular use of moving pictures has naturally led to their adoption for educational purposes, which has been rapidly followed by their use as advertising mediums; in which field the electrical companies, as usual, were among the first. Films showing a human interest story of increased domestic happiness, through the use of electrical devices in the home, have proved to be very effective, especially when used in clubs, societies, lodges and similar organizations. The advent of the kinetophone will doubtless lead to its adoption also as a means of disseminating ideas as to the uses of electrical apparatus. ¶Not the least important form of electrical advertising is that of window dressing. A well-dressed window displaying electrical ware in an attractive manner with the name of each device properly displayed thereon cannot fail to secure the favorable attention of the prospective buyer, which is one of the fundamentals of salesmanship.



Growing Popularity of Electric Vehicles

By W. H. BLOOD, Jr., Stone and Webster

Ten years ago a man who owned an electric vehicle was looked upon with pity and was considered as having in his possession an expensive toy. To-day the easiest way for a woman to excite the envy of an entire community is to purchase an electric coupé. ¶Ten years ago what few electric trucks were in operation would hardly propel themselves and their radius of activity was limited to a very few miles. To-day they carry loads of one, three or five tons and make from 40 to 60 miles per day, replacing several pairs of horses. The economy of the electric truck compels progressive merchants to purchase them in lots of from ten to 100. ¶This wonderful advance in popularity is perfectly natural and is not due to the glittering advertisements of vendors of electric cars but to actual performances. What car can compare with the electric coupé in cleanliness, comfort and simplicity? Not even the newest of the self-starting gas cars, where one has to push a button or two, throw a clutch, then adjust gasoline and spark and shift the gears two or three times. With the electric car one simply throws the speed lever and is off. ¶Another great argument in favor of electric transportation is found in the fact that the cost of electricity has during the past few years gradually been reduced by successive stages from 20 cents per kilowatt-hour, until now large users are able to get their electric energy for three cents, and in some cases even as low as two cents. During this time the cost of gasoline has steadily risen from fifteen cents a gallon to eighteen cents, stopping only a few weeks at 20 cents and is now generally quoted at 25 cents, with a good prospect of a still further rise in price.

Electric Signs

By JAMES M. GILCHRIST, Secretary Federal Sign System (Electric)

Aside from the big, spectacular, display sign with its wonderful flashing effects, there is another class of large electrical signs which has been slow in starting but is now rapidly growing in favor. These are the large signs which progressive manufacturers are putting on their factory buildings and roofs. Every large factory near a traveled road or a railroad has an undeveloped advertising power which the owners have been slow to realize. At a comparatively small expenditure for original sign installation and electricity, an advertising medium of great value is created. Such a sign as this supplements in a very forceful way a magazine or newspaper campaign, as it locates the advertiser in the mind of the prospective customer and makes his establishment an actuality instead of only a name. ¶The city slogan or city name sign is another type which is becoming considerably used. The average city has a commercial association or board of trade which is keenly alive to the desirability of attracting new industries and these associations are learning that a well lighted sign near a railroad station announcing the name of the city, especially if it is supported by a number of factory signs, will go a long way toward impressing the traveler with the characteristics of the city and its people. ¶With the great increase in the number of moderate sized door and window signs has come the problem of municipal regulations to govern their use so as to prevent abuse and secure the safety of the public. The tendency is almost without exception to sane, reasonable regulation with adequate inspection, and the authorities have universally the support and assistance of progressive central station companies and responsible sign builders in forwarding such a policy.

Modern Tendencies in the Illuminating Field

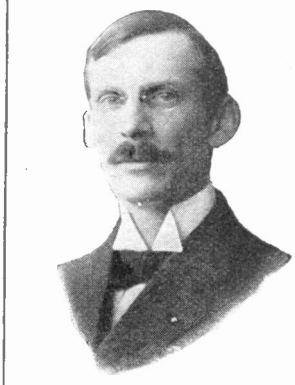
By M. LUCKIESH, Physical Laboratory, National Electric Lamp Association

For several years after the birth of illuminating engineering as a distinct art and science, little besides the purely engineering features of a lighting installation, such as watts per square foot of floor area and the efficiency of light sources, was considered. Lately, however, has come an awakening to the fact that illumination is not merely an engineering problem—that proper lighting results only through the co-operation of the ophthalmologist, the architect, the decorator, the fixture designer and the engineer. ¶The ophthalmologist demands that light sources be kept out of the normal field of view and that their intrinsic brightness be reduced. These requirements are usually satisfied by hanging the units high and equipping the sources with diffusing glassware or protecting shades, or by resorting to indirect lighting. Polished surfaces, such as glazed paper, are being condemned. By lowering the intrinsic brightness of the light units this evil is somewhat reduced. The engineer now specifies the position of outlets. Here the architect must co-operate early in the design of a building. The fixture designer must produce fixtures to harmonize with the style of decoration. The decorator requires light of proper direction and color value to obtain a satisfactory appearance of the finished interior. Here a tendency toward the use of tinted light is evident. ¶Many of these desirable features cannot be obtained except at the expense of utilization efficiency. This fact and the tendency toward higher values of general illumination demand high efficiency methods of light production. ¶The chief tendency in the illumination field is, then, toward the recognition of the complexity of the problems in lighting and toward the full realization that complete success is the culmination of proper co-operation of all interests.

The Central Station and the Consumer

By E. L. CALLAHAN, Manager New Business Dept., H. M. Byllesby & Company

When speaking broadly in considering the business of making, distributing and selling electricity, I do not like the term "Central Station." The American people want and *will have service.* The more proper and expressive term for the central station, or any concern whose business it is to administer to the public in the way that the electric light, gas, telephone or telegraph company does, is "*service company.*" ¶The old-time feeling on the part of the people was that the electric service company had a luxury to sell at fancy prices; subsequently the feeling changed to one of uncertainity as to whether or not the company really meant that it did desire to *serve* the public and the people individually with what was recognized as a necessity to comfortable living. ¶To-day the public *knows* that the service companies have spent and are spending huge sums of money in order to bring their service up to the highest standard of perfection, to be sold at the lowest possible price consistent with good management, and that it is the desire of such companies to bring the service to the consumer's door—yes, his reading lamp, electric iron or motor—and through the efforts of the service company's experts the consumer may obtain the requisite light, heat or power in the most satisfactory manner. ¶The consumer, appreciating this real and essential service rendered, will lend his support as occasion may arise to protect the interests of the company to the extent of making it possible to continue to improve its service under good management—in fact the value of the service sold to the consumer depends largely upon the degree of co-operation that exists between the producer and consumer.



Advertising Goods Electrical

By FRANK H. GALE, Advertising Manager, General Electric Company

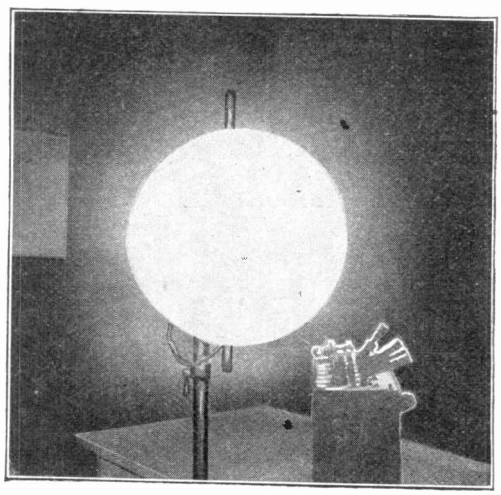
Long, long ago it was written by "Poor Richard, His Almanac," that "one day is worth two to-morrows. And this truism was never more trite and applicable than in the advertising of goods electrical. ¶A nation-wide advertising campaign, be it ever so carefully planned and cleverly executed, must signally fail of its true purpose if it has not the hearty and timely co-operation of every firm who retails that manufacturer's wares. ¶An extensive advertising campaign in the national magazines and periodicals is always more or less educational. Electricity may be as old as the Pleiades, but, at the same time, it is all very new and strange to the average person. Through the medium of popular publications the electrical manufacturer can tell millions of readers what electricity will do in the home, office or shop— that it will give the best and cheapest artificial light, the cleanest and safest heat and the most flexible and convenient power. All this is quite possible with judicious advertising, but it remains for the local dealer to sell the goods. *He must co-operate, and at the right moment.* ¶When such a national advertising campaign awakens public interest the wise dealer immediately takes advantage of the situation by displaying the advertised wares in his show window. He also advertises them in the local newspapers and has in readiness a good supply of posters, booklets and other "follow-up" literature. ¶True co-operation between manufacturer and dealer in advertising brings prompt and sure results.

Ball Room Moonlight Effect

Ball rooms and dance halls are frequently equipped with electric lights arranged to produce beautiful effects during the dance numbers by throwing the lights or various combinations on and off. The accompanying picture shows an arrangement that I use to produce a moonlight effect. Behind a large opalescent globe is placed an arc light. On ordinary direct current this affords enough and diffused light to illuminate a large hall and makes a capital moonlight.—PAUL CLOKE.

Sailed off with City's Light Plant

According to reports, the electric light plant which has supplied the town of Ocos, Guatemala, for the last four years, is about to weigh anchor and put out to sea. Four years ago a steamer of the Kosmos line, while making a voyage to San Francisco from European ports, was carried into shoal water near Ocos by a tidal wave, but rested on an even keel with undamaged machinery. An enterprising Guatemalan is said to have run wire from the ship to the shore and made effective use of the ship's generating plant to supply the local community. A Philadelphia salvage company has succeeded in refloating the ship, however, and oil lamps will probably come into fashion again in Ocos.

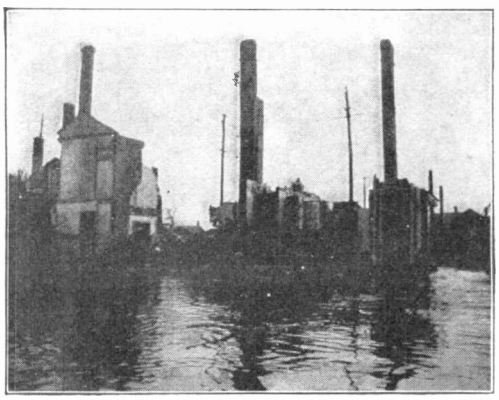


AN ARTIFICIAL MOON

The Story of Dayton

By T. W. CARROLL
Division Traffic Superintendent, Western Union Telegraph Company

The Dayton flood as I saw it was more terrible than the San Francisco disaster because in the latter city a very large portion of the residential district was not affected and the people could escape from the burning district. They saw the fire coming. In Dayton a very large portion of the residential section was overtaken by the water before the people had a chance to get out. The current was described to me by a real estate man who was rescued in water up to his neck, as reminding him of Rapids in Niagara River. Houses were carried for blocks, freight houses torn down, large type, heavily loaded, freight cars were swept away and big oil tanks, 20 feet in diameter and as high, were carried for miles and placed in the main thoroughfares down town.



UTTER DESOLATION

I went down there, primarily, to put the Western Union Telegraph Company in Dayton back on the map, for it is one of our main trunk line centers with five trunk lines east and north and four south and west.

At nine o'clock Tuesday morning, March 25th, the employees who arrived at the main office attempted to leave when the water rose to three feet but the force of it against the doors was so great that they were unable to open them. They escaped by a back window and climbed a telegraph pole to the second story. Then a fire started in a drug house near and they were obliged to climb, again, to the third story and from there to the roof and work away from the fire, finally landing a block away on the roof of a building, where 179 people were marooned until Thursday night. They hooked a crate of cabbage as it floated along, a crate of whisky and a crate of candy, the only food they had until taken off on Thursday evening in small boats. When rescued they all started to dance. One young fellow said he did not know anything about dancing, but that he danced that "joy dance" just as good as any of them.

In our office we had three clocks at different heights. The first clock stopped at 10:15 when the water reached the pendulum. The next clock, a little over two feet higher up on the wall, stopped at 11:27, showing the rise of the water to have been about two feet an hour.

The first telegraph office into Dayton was at Wolf Creek, two miles west of the city hall, on the Pennsylvania road. That office was opened at eleven o'clock on Wednesday. That was the first equipment we had. On Wednesday afternoon we succeeded in opening at Miami City. The same evening we got in touch with the Cash Register station on the C. L. & N. from Cincinnati and operators were sent by special train from Cincinnati to the Cash Register station, from Indianapolis to Miami City, and from Toledo with instructions to get into East Dayton and open an office there. The latter crew succeeded in opening a telegraph office on Thursday, the 27th, at noon.

The water receded, and on Saturday,

THE MANNER IN WHICH MANY RESCUES WERE EFFECTED

the 29th, by special permission of Adjutant-General Wood, we were authorized to take possession of two rooms on the second floor of the Beckle House, one-half block from our old office, and that night, by special order, we were permitted to light the first lamp in Dayton in four days. By midnight on the 29th, R. W. Whitehead, division plant superintendent had eighteen wires working in to the Beckle House, with a total force of 35 operators divided up between the Beckle House, the Cash Register, Miami City and the East Fifth Street Bell Telephone Exchange, and Dayton was again in touch with the world. To accomplish this much, we went to the outskirts and tested wires in all directions and then we used emergency cable over houses, along the sides of buildings, any way to get a line.

The town was placed under martial law. It was a most unusual experience to go out at night without any light except that on the automobile, and hear a voice out of the darkness command "Halt!" And it was necessary to stop or be shot right there, for looters had made this rigid order necessary. A sentinel in the street would suddenly loom up before the automobile light. First you would see only his shoes, and then gradually a soldier with his gun trained on you. We were obliged to carry for three nights, two men of the National Guard in order to make speed in looking after what lines we had succeeded in establishing.

The immense accumulation of telegraph inquiries from the outside world, Tuesday, Wednesday and part of Thursday were sent to Indianapolis, Cincinnati and Columbus, and from there as soon as possible hastened by train, electric car and automobile to the flooded city. We delivered under the direction of Assistant General Manager Cook, between Saturday morning, the 29th, and Monday noon, the 31st, over 10,000 telegrams in various ways—by personal calls at the addresses, special delivery, automobiles, motorcycles, and by using the United States mail to the outlying residential sections. We pressed into service, through the kindness of Mr. Patterson, a motorcycle squad. We put out

bulletins and told people where to come for their telegrams. When the postoffice opened, many registered their names there.

People filed telegrams with us with the address and signature and no text at all. Some filed telegrams with the address and the text but no signature. Others filed messages with just the text and signature. They would come into the office and drop their telegrams and say, "Send this as soon as you can," rush out, and of course there was nothing for us to do but to file the intended message. Those that contained an address and signature, we sent along with an explanation, so that their folks could see that they had really sent a telegram although they said absolutely nothing.

Hunger for a time was forgotten. The four men that I sent in from Indianapolis by Union City and Arcanum, were without food at Wolf Creek for 24 hours until supplies sent in from Richmond reached them. Operators at the Beckle House were without fire, and were obliged to go fourteen hours without food because of the difficulties in obtaining transportation facilities to carry it between the Cash Register and the Beckle House.

J. H. Patterson of the Cash Register Company, did wonderful work. From his carpenter shop he turned out a boat every six minutes. He took care of 7,000 people, fed, clothed and gave them medical attention. He organized a corps of physicians, kept all his employees on salary and turned them over to relief work.

The flood treated rich and poor alike. Some of the most beautiful homes are totally destroyed. In the residential district west of the river, one man failed to heed the warning to put out all the lights. The force of the water weakened the gas mains in his house, permitting the gas to escape, and in the storm of Tuesday night, that house blew up and set fire to houses on either side and five were destroyed. During this time, a heavy electric storm was raging, it was raining, houses were burning and all around cries for help were heard. Many cried and no one heard them. That is the story of Dayton, 'Help! Help!' all night long. It was the snow of Wednesday night that saved what is left of Dayton. It settled down over all the buildings and prevented flying, burning embers from getting at the roofs.

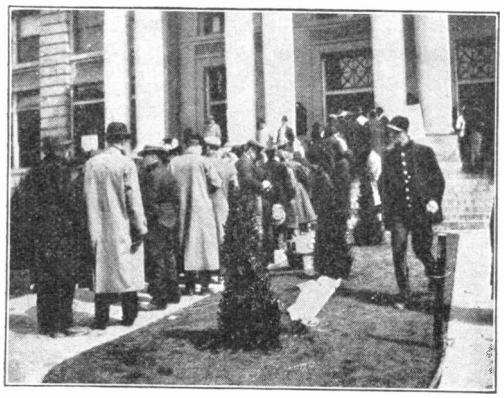
It is remarkable what people did. One young fellow took off all the doors inside his house, made a raft out of them, then took a music cabinet and screwed that down to the doors to put his baby in. He sawed a hole in the back end of his house so that if the water got too high, they could float out without any trouble. They came out all right.

I saw one fellow who had his new barn cut in two by a floating house, but the waters landed three barns in his back yard, so he had three and a half barns after the flood.

In scores of houses holes were cut in the roof. People had been forced from one floor to another and finally were obliged to cut holes from the inside to get out on the roof. I picked up two girls who, imprisoned in the attic by the rising waters, were obliged to batter a hole through the roof with frying pans to save themselves. Later I picked up a mother and four children who had been marooned in an attic from Thursday to Saturday. The oldest was seven, the youngest, two years. The mother was sent to the hospital and the children were sent out to the Cash Register Company's hospital to be taken care of.

On Main St. a blind woman was put out on the roof at nine o'clock on Tuesday and was there until twelve o'clock on Wednesday, all through the big storm of Tuesday night, with a blanket over her shoulders and protected only by an umbrella which had been left with her. They asked her what she had been thinking of all that time, and she answered, "I have been praying to God."

We found another woman who had been trapped in her kitchen. The rush-



THE BREAD LINE. THE FLOOD TREATED RICH AND POOR ALIKE

ing water would not permit her to open a door to a stairway going upstairs. She had taken a carving knife and had a hole almost large enough to get through carved in the door when the knife broke, and we found her body in the kitchen. She left a note upon the wall, stating that her husband was getting a divorce from her in Pasadena, Cal., and to advise him that it would not be necessary.

A furniture store building in one instance was so torn to pieces that a fine parade of furniture was seen following the current down Second Street. In another instance a heavy timber tore a hole in the wall of a garage, forced the front doors open and a procession of automobiles without occupants was carried down the street. Telephones were scattered everywhere. It means practically a new equipment in the residential sections. One thousand two hundred and fifty horses were carried off the street up to Friday. A layer of mud from ten inches to two feet thick, according to the action of the water, was left everywhere. Money was of no value. There was no place to spend it.

It is a pitiful story—one of suffering and exposure. I took into the car at Riverdale two girls that were visiting from Kansas City. They were obliged to saw their way out through the attic roof in order to get above the water and out on the roof. All one of these girls had to protect her from the cold was her morning gown and slippers and these had to do her up to the day we took them to the Cash Register company for food and clothing.

Whenever we had room in our automobile, we would carry refugees, and they would tell their stories, and from a cry of help as the water receded the appeal changed to one of anxious search for relatives, friends and neighbors.

Anxiously, almost hysterically, the world waited for news of the disaster. How this news was gathered and the obstacles and hardships which the reporters encountered makes one of the thrilling stories of newspaper history.

At 9:25 a. m., Tuesday, March 25th, our operator at Dayton, Ohio, reported "flood" and said "Good-bye," and at the same time the Associated Press operator reported "high water," and immediately Dayton was cut off from the world by the water reaching the switchboard connections. The news spread rapidly and seven minutes later Superintendent Cowles, of the Associated Press, had started Chris. D. Hagerty for Dayton via Indianapolis, and at the same time, Dwight F. Loughborough, via Toledo, and also two men from Cincinnati.

Hagerty reached Indianapolis that evening and was marooned several hours by the flood in the White River at that

THE HANDSOME STEELE HIGH SCHOOL BADLY DEMOLISHED

point, but finally succeeded in working his way on a supply train as far as Richmond and used an automobile from Richmond to Dayton, arriving at the temporary Western Union office at Wolf Creek in West Dayton at noon, Wednesday; later on, moving his headquarters to the Cash Register office.

Loughborough reached Toledo, but the railroad company would not sell him a ticket for the relief train which was about to leave, and in order to get aboard he was obliged to offer his services and handle supplies from Toledo to North Dayton, including the five mile transfer made by the Second Regiment and the supply train at West Liberty. While working en route, he gathered some valuable information regarding the conditions in the flooded district and found time to start his story, which he completed and filed at the Western Union office at the Cash Register Company, Dayton, after traveling across the city in a boat.

Arthur J. Peglar of the *Chicago American* tried the Toledo route and like the others was denied a ticket and attempted to ride the relief train, but was discovered by the captain of the National Guards and ordered off. Not to be outdone by his rival and more fortunate correspondents who had secured permission to ride on the relief train, he found a telephone wire O.K. from Toledo to Xenia, sixteen miles east of Dayton, and got hold of the local newspaper editor.

UNDER MILITARY RULE

IN THE WAKE OF THE FLOOD

The latter had just returned from the Dayton district in an automobile and was primed with the general conditions, and Peglar proceeded to pump him dry and gave to the world a true story of the Dayton situation and at the same time cleaned up the correspondents on the relief train who were, it is said, responsible for his being ordered from it.

After filing his story, Peglar secured authority to ride on the next relief train and went into the flooded district via Springfield.

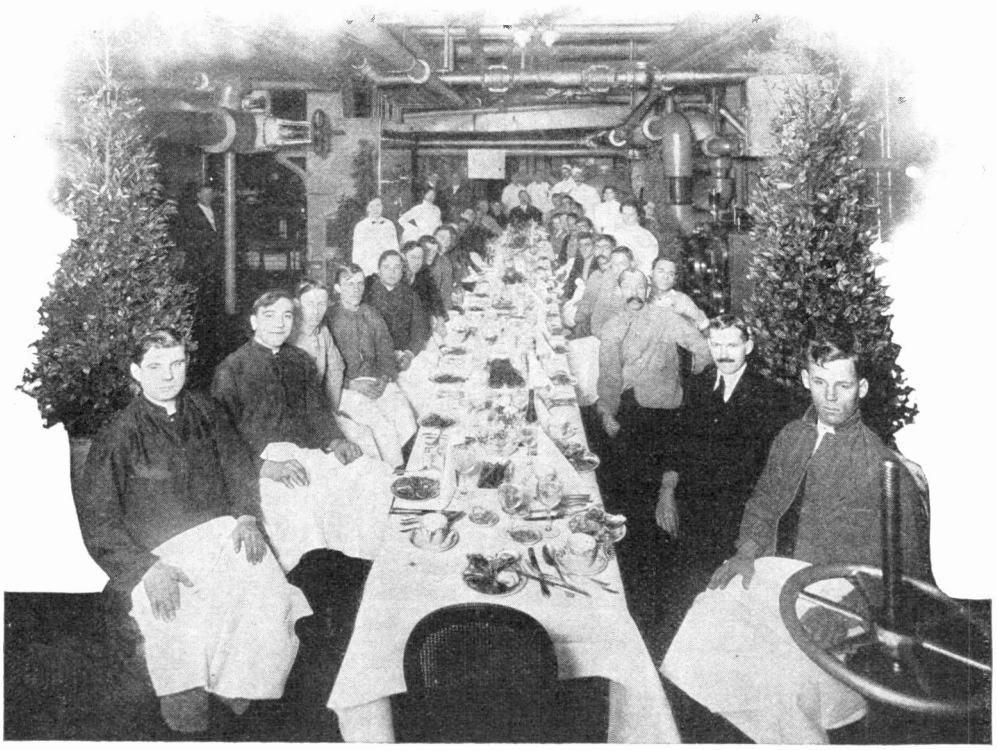
Hagerty and Peglar require no introduction to the public. They have represented the press associations in the wars in the far East in recent years, also in the Spanish-American War in the Philippine Islands and Cuba. They have been entertained by presidents and royalty, know human nature and the trails of the world, and never fail to "get there" when ordered on a "special."

The *New York World* was represented by Earl Harding, the *Herald* by W. A. Willis and the *Times* by Sturtevant.

After the water had receded, and it was possible to move around in the flooded district, these men were obliged to walk miles through darkened streets piled high with *débris*, with mud knee deep, halted every few steps by a guard and surrounded by tottering walls and buildings, to file the news for their respective papers.

On March 29th, when a passageway

had been cleared through one or two of the main thoroughfares, President Patterson of the Cash Register an chairman of the relief committees, realizing the value of the telegraph in getting news to and from the outside world, assigned a special car to the Western Union Company and through the courtesy of Captain Bowers and Lieutenant Soleather of the Second Regiment, Artificer Thomas and Chaplain Atkinson, the latter a Presbyterian minister of Marysville, Ohio, acted as our guides, very materially facilitating the work of distributing and collecting the important telegrams and press matter filed at the various relief stations.

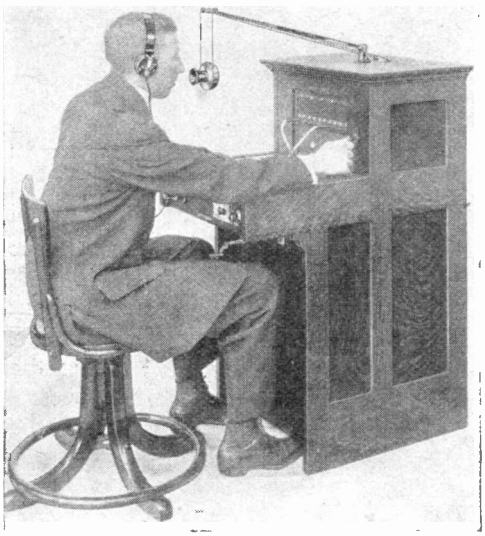


BANQUET IN AN ENGINE ROOM

This picture was taken on a national holiday, down in the engine room of a big Chicago hotel, where every man must be "on the job." The hotel management desiring that its engine room force share in the festivities of the day, laid the tables spread with good things in these odd surroundings which seemed to whet the appetites of the banqueters. While there was no orchestra to partially drown the sound of jokes and laughter yet this was in part compensated for by what is music to the ear of the engineer — the humming of well-cared-for machinery.

Code Ringing for Private Telephone

In a large clothing establishment in Rochester, N. Y., the private branch telephone exchange was an important feature included in the plans of the new plant. The telephone in each department, which could be interconnected with any other telephone in the plant by the operator through the switchboard, was not all that was required. The executives in the organization were required to be at any place that their duties might take them at any time during the working day. The bother and inconvenience of having to inform the switchboard operator as to their whereabouts would not be tolerated so it required some practical scheme to solve the problem and simplify the condition. The result was the invention of a simple but thoroughly reliable code call and general alarm telephone system as a feature of the regular private exchange switchboard.



COMMON TYPE OF PRIVATE EXCHANGE SWITCHBOARD EASILY FITTED WITH THE NEW CODE CALL KEY

The Stromberg-Carlson Telephone Manufacturing Company perfected this system which simply means, in a general way, an arrangement of the wiring of the connecting apparatus on the switchboard so that the operator can connect any number of telephones in the plant and code ring the telephone bells simultaneously in every telephone in the system.

The general manager may receive an important communication any time from a customer demanding a short time delivery of a large order of goods. He immediately decides to save time and get quick action by calling all his department foremen together for a conference. The switchboard operator is advised of this fact so she instantly sets up the connections for calling every department by telephone by a code signal at the same time. The foreman, no matter where he is in the building, hears the general manager's call signal and immediately reports to his office in less time than it would take to call up half the number of departments in consecutive order as fast as the connection could be made and the right man brought to his telephone located in his department.

This same scheme is used by different manufacturers to alarm workmen of fire; to notify all departments to shut down their machines and to call the superintendent or the general manager, who may be on a tour of inspection through the factory, to the nearest telephone regardless of where he happens to be at the time he is wanted.

No auxiliary apparatus or additional circuit wiring is required. To ring simultaneously 50 regular telephones throughout a manufacturing establishment takes more energy than to ring one, so in this system it is necessary to have ringing machines of the magneto type in the telephone system's power plant. These machines are direct connected to either a direct current or alternating current motor as may be required and they are made in three sizes having outputs of fifteen watts, which will be suitable for ringing a maximum of 50 telephone bells; 20 watts for 75 bells and 25 watts for 100 bells, etc.

The Problem Answerers

By H. Bedford-Jones

MAIL MEETING — A GATHERING OF DEPARTMENTAL HEADS

The old Norsemen were wise in their day and generation. "There is little luck in finishing another man's starting," says the old Sagaman. "But both evil and foolish it is for a man to let loose that which he is not able to control."

That axiom has come down to us of to-day through every branch of life. "Don't start anything you can't finish!" is our own equivalent, and to finish "another man's starting" is no great credit winner. It is easy, once given the idea, the foundation, to build and raise from that foundation to completion; but it is very hard to find the initiative, the primal energy that will start a thing off with a swing and keep it going steadily to the end.

These two problems of start and control run through all the ways of life. They form the greatest problems of writer, architect, shopkeeper and electrician alike. With the majority of men they are abstract problems that are theoretical rather than actual, problems of the mind and will rather than of the hand and eye. But when it comes to the electrician we find them problems that are concrete and vital, for the electrician deals with a concrete, tremendous force that is an actual *thing,* and in the solving of the problems of start and control lie much of the secret of his success. The answer to these, his problems, is found in Milwaukee, and goes thence to the uttermost ends of the earth.

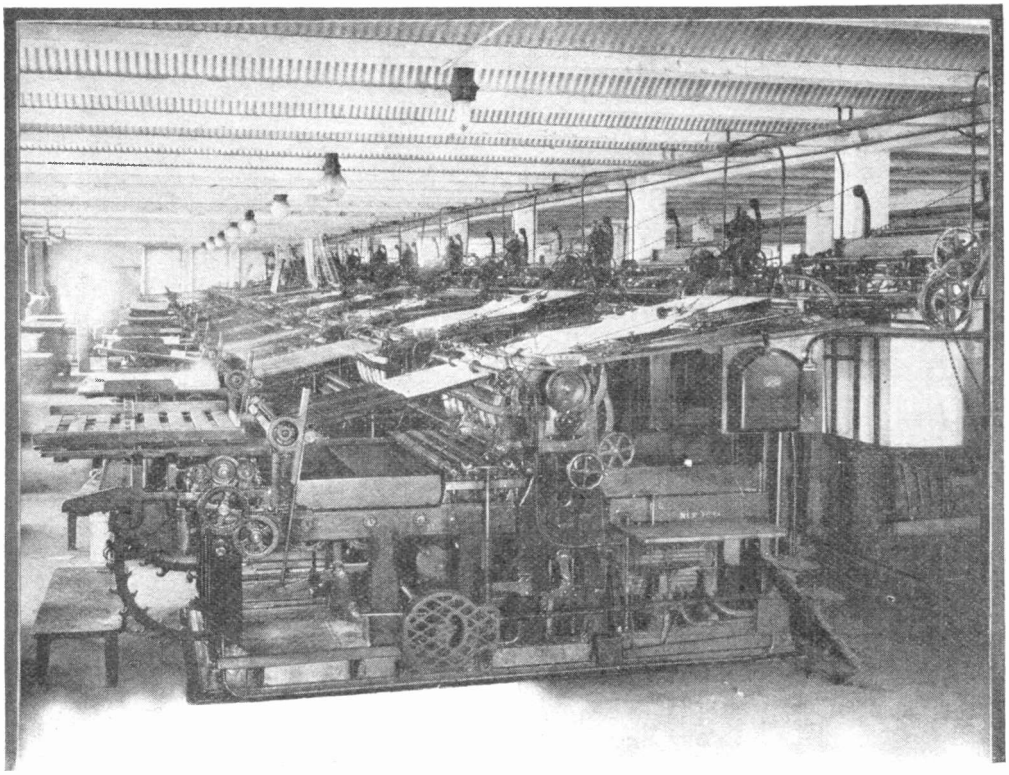
A half-dozen men are grouped about a table that is littered with papers. From a heap of new-opened letters the man at the left picks up one.

"Blank theater, Denver, must handle 50 circuits and has no stage space for switchboard. Suggestions?"

"I'll take it over," speaks up one. "Same problem we had with the Hippodrome in New York. No use discussing that."

"All right. Here's a power station in Tampa. Must have guaranteed tonnage per hour in coal and ash skip, a hoisting speed of 300 feet per minute, automatic stops, automatic reversal with total over-travel of 30 inches under average load of a ton."

Then ensues a discussion. About this table are gathered the departmental heads of the Cutler-Hammer Manufacturing Company of Milwaukee. The



A ROW OF FLAT BED PRINTING PRESSES, ALL OF WHICH RESPOND WITH MORE THAN HUMAN PRECISION TO ELECTRICAL CONTROL

morning's mail has come in and the daily gathering is taking place. Problem after problem is discussed by the experts in every line, masters of starting and control. To their knowledge comes tribute from all points; a hotel wants a simply controlled dumb-waiter service, a cathedral wants organ or light controlled at a certain point, a railroad station wants ventilating fans and mail conveyors handled by a turn of a finger. Therefore they come to Milwaukee for plans—and they get them. These half-dozen men are there to solve problems, to invent things, to build special controls.

It is not a mammoth company, but it does magnificent things. My guide showed me a small metal box with a number of projecting buttons.

"This will control the largest printing press made," he said. "Suppose there is a break in the paper, which runs at the rate of a thousand feet a minute. The operator presses the button and crawls in to fix things, and that press can be started at no other point; thus it is absolutely fool-proof, and from this button he can control the whole machinery."

This factory is at first sight a machine shop. The watchword of the company is *service*, and it will build practically anything that will give the service desired. As I went through the shops, I noticed that the men drilling the slate or marble blocks for switchboards used sometimes six individual drills.

"Would it not be cheaper to combine those six and push the block under all at once?" I asked.

My guide smiled. "Yes, if we made only one pattern. But we may make a dozen different patterns in a day. We standardize to some extent, but lots of

people want some special wrinkle, some peculiar device, and we aim to give people what they want if it can be done."

One of the first places I visited was the museum, which conveyed very little until my glance fell on the steering gear of a ship. I wondered what connection that had with electricity—and I found out.

This was the first electrical steering gear built for a warship. It was found that the prejudice of an old-time pilot against steering by handle or button was insuperable; so the usual steering gear was installed with the switch inside. During the trial trip the helmsman watched the installing expert guide the battleship by a turn of the finger, and leaned against the rail for support.

"Good gosh! Kin that monkey-wrench thing buck them rollers an' head her up like that?" he asked weakly. The expert explained. "Well," replied the pilot with conviction, "I'll be double-dinged if I ever set foot in a pilot house again!"

His ultimate actions are not recorded, but the Cutler-Hammer people have driven romance from the pilot house of warship, ocean liner and even lake boat. Here in one corner three men were assembling a special controller for the "battle circuit" of a cruiser, the hidden lights that are used in time of war; while beside it stood the controller for the usual lighting circuit.

"The warship of to-day is becoming a thing of electricity, not of men and guns merely," explained my guide. "Instead of capstan-bar and chantey while the sailors 'blow the man down,' an electrician throws in this switch and the 300 horsepower windlass attends to the anchor. This one, a turret switch, moves the turrets; this controls the ammunition hoists, and so it goes from stem to stern. Even for the range finders up in the basket masts we build special controls that signal the gun crews."

For reason of the special equipment built here, which often is never duplicated, much of the work must be done by hand. Here in one room a boy was winding resistance units with wire, testing it for resistance as he went on, while behind him were racks of wire of all kinds to be used as needed in special work. But perhaps the most interesting of the standardized products are the theater dimmers.

Very unusual problems are met with and answered in the installation of these theater lighting machines, for space is always at a premium in theaters. The dimmer plates themselves consist of a soapstone base. In the immense warehouse one may see these piled high, together with slate and marble slabs and other raw material, but when the construction is begun, the boring over, the filling and finishing completed, one can see little of the original gray stone left. The plates are filled with resistance wires, which are curved, snakelike, by special machines, and these wires are covered with a cement composition. The plates when set up are each controlled by a single lever; these levers, in turn, by a master-lever for each set—which enables a single operator to control the whole.

Now, this is all very well for an ordinary theater, but the New York Hippodrome is extraordinary, presenting a good sample of the problems solved by C-H methods and men. No space could be allowed on the great stage of this theater, and a conventional switchboard to handle the hundred circuits, many of 200 or 300 ampere capacity, was absolutely out of the question. So, the stage being impossible, the experts went up into the flies and set there a little pilot board. From this are handled the 90 triple pole, solenoid switches which make and break the lighting circuits of the whole immense stage.

We stopped before a tiny switchboard, or more properly, pilot board, that was being built for a double organ—organ and echo organ. It was difficult to

realize that by a movement of his thumb the organist could control every range of sound, from throbbing diapason to piping flute, on both organs!

Many of the remarkable results obtained in special cases come from the policy of the company—service. This implies co-operation. If a salesman has a problem put up to him, he may be perfectly well able to solve it in time; but he knows that a similar problem may have been worked out at one of those "mail meetings." So he writes in to the higher experts and obtains the solution in the shortest time possible—which is service. He gets a good deal more credit than if he had taken a week to think out the answer himself.

There is little red tape in this factory. Each foreman is an expert and is king of his domain. He is there for results, not ways. The experimental room is open to each expert, suggestions are always considered and tried out and men who years ago left the company still send in ideas and inventions for trial or use. There is sincere good fellowship throughout, and at the yearly dinner every trace of friction is brought out openly and cleared away.

I entered a room occupied by a number of boys and clerks and found that this was the repair department. All very well; but when I heard that each of these boys had *carte blanche* over the requisition rooms, that was another matter altogether.

"Do you mean that whatever they order they get, without checking or reference?"

"Absolutely," smiled my guide. "We have no time to bother with red tape. Records of each piece are kept, but this room attends to repairs, and whatever these boys order, they get. It's up to them to deliver the goods, literally and figuratively."

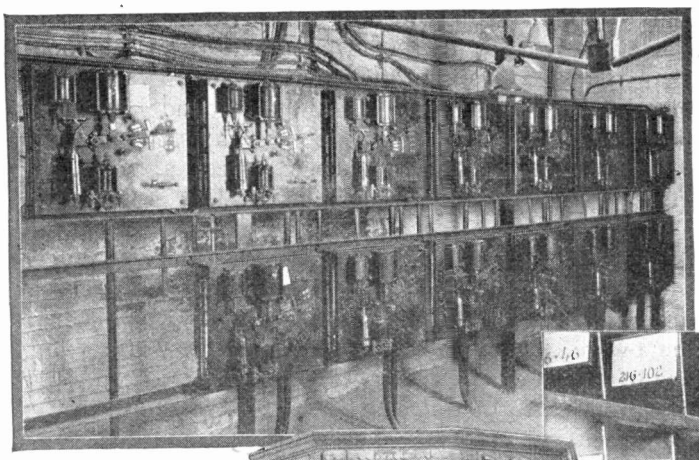
Anyone can give 57 reasons for using red tape; the C-H people give but one for not using it—"we haven't time." It is a business of petty details, in the main, which means that there is no room for a man who reaches for his boot straps every time he wants a raise. He has to be a self-starter and he has to finish what he begins; control, like charity, commences strictly at home.

The specialty department is the starting end of this factory—or rather, the push-button end. It is a very complete little concern in itself and is concerned with the small work—which is, as always, the most distinctive work. This department supplies the button, the other departments provide the push.

Now, pendent switches and push buttons are little things, but they are highly essential to the whole, and many of the processes used here are novel and very interesting. The porcelain is not porcelain, but a composition, into which many of the parts are molded; and when these are made into switches, the specialty department has to save all the time possible. So it gets busy and invents things.

The C-H push-button contains very tiny but very essential springs and each spring must be bent and caught around in a circle. This is a three machine process. The wire is automatically wound, cramped and shot forward. As it touches the opposite wall of a gap, it creates a circuit which sends a knife through it on the instant; thus it automatically measures and cuts itself at the rate of 13,000 springs per day, none of which deviates more than a quarter turn in length. It then goes to another machine which thrusts up the last turns on each end of the length of spring. At the third machine, a deft-fingered operator catches the ends together and the circle of spring is complete.

And here a word on the operators. Boys, girls and men alike, all are deft beyond the ordinary. They have to be. Whether their work is automatic or for special order, so much must be hand done that co-operation of brain, eye and hand must be instantaneous, and it is. Here as elsewhere it has been found that women or girls are better machine



A ROW OF FAN CONTROLLERS INSTALLED IN THE NEW YORK COUNTY COURT HOUSE

operators than men, as they are more careful and less sensible to the monotony of the work. Patience was ever woman's virtue, but is no longer its own reward, in such case.

The specialty department is full of interesting machines. One turns out long brass push buttons, turning a brass rod into buttons with four processes in one circular sweep. There are screw-driver tables, at some of which the pressing down of the instrument makes a circuit and puts it in motion. At others the screw-drivers are stationary, the screws and molds are pressed on them and the work is done upside down, as it were.

One very ingenious contrivance I have not seen in use elsewhere, though that may have been my fault. This is an oil saver. About ten per cent of the oil thrown on the rods which go to make the parts is used up; the rest goes into the shavings of metal. These shavings and scraps are collected and put into the "washer," which is set revolving. By centrifugal energy the oil is shot through a screen and drips into a huge bucket beneath, thus effecting a goodly saving.

In one corner of the shops are large vaults, fireproof. Here, each night, the special machinery and tools are placed, for if lost they could hardly be duplicated. One of these vaults contains $50,000 worth of such material each night; more, the vaults serve as storerooms while the material is not in use.

SENTRY BOX TYPE OF TOOL RACK

BINS FOR SMALL PARTS, SHOWING THE TIME SAVING CARD SYSTEM

While on my rounds, I noticed that each workman had a tag bearing his number. Inquiring after this, I was shown a neat little "sentry-box," with a boy in charge, while outside and in it was hung and drawered and festooned with tools. So many special tools and general tools are required that it is im-

practicable for each man to have a separate supply; wherefore these "sentry-boxes" are stationed around the place, and whenever a man requires certain tools he hands the boy his tag, which takes the place of the tool drawn out. This gives a check upon everything in use and everyone knows just where the tools can be found if needed in a hurry.

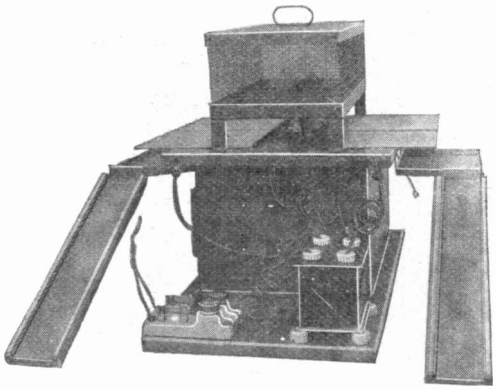
One other most necessary and striking parts of the plant is the stockroom, or rather rooms, for each department has its own. Where some of the work is standardized but for the most part special, a complete stockroom is an essential. One of these rooms contains 18,000 parts and in all there must be at least 40,000—largely small things in great number. Keeping track of these and keeping the stock filled up would be a hard job elsewhere, but there is system here. Each part-bin is carded with a number, and the back of the card is a record form. Whoever lowers a bin by a large requisition turns the card around; the stock keeper passes on his rounds, sees the large painted number gone, orders a new supply of the part in question, enters order and date on the back of the card, and returns it to place. Thus the stock is kept in shape.

That is but one of the numerous short cuts installed here. All is brought down to as simple a basis as possible, and all is efficient. The tests are especially rigid here, of course, where so much is made to fill a special need; on some of the small parts, for example, such as push-buttons, special machines give in two days a test equivalent to five years of service.

Best of all, most of these men who are doing things have grown up with the company. They are men who know each other and their work intimately, who are masters of service. It is easy to serve but it is hard to give service; and when you find Class A service given in the cause of starting and control, be assured that you have found a thing from which you can learn much.

Another Rat Trap

Among the various methods for getting rid of rats, the most interesting is a sort of electric chair, so to speak. The device electrocutes them, swiftly removing the dead animals and automatically adjusting itself to receive other victims.



INCLINE PLANE LEADS TO THE RAT'S DEATH CHAMBER

Upon the top of the trap is a cage in which may be kept a few live rats to serve as decoys, or in place of this, tempting bait is used. The rat outside walks up a runway, of which there are two, and upon a pair of metal trap doors. The weight of the animal tilts these and the rat rolls down, his body forming a bridge between the doors. This completes an electric circuit and the rat is killed in from five to ten seconds. The tilting of the doors is also sufficient to drop the body into a drawer in the lower part of the trap.

Ordering Meal by Electric Dial

The suggestion has been made by an electrician that a dial similar to those employed in the automatic telephones be placed on the table in restaurants and the plan worked out to order a meal with it. If one desires a cup of coffee turn dial No. 1; if pumpkin pie is desired, No. 13 might be used, etc. With everything numbered on the bill of fare, a few numbers would suffice by combination to order a large number of eatables.

AFRICAN

By

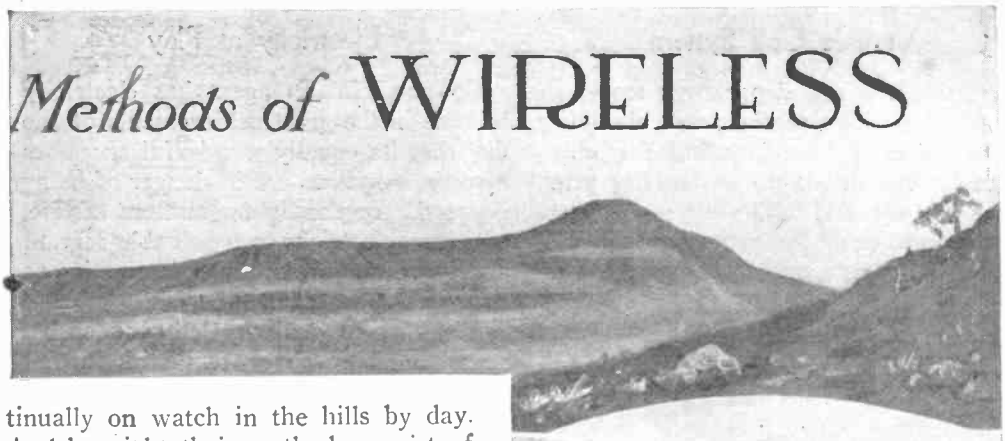
W. ROBERT FORAN

It may be a revelation to many people to know that the savages of the interior of Africa have a wireless system of their own. They use no wires or electric batteries, sending or receiving. But long before Marconi perfected his system of wireless telegraphy, the savages had been accustomed to sending and receiving messages by a method which was to them as old as time. I have known of cases where the news of an event which had occurred fully a hundred miles away was known by the natives for hundreds of miles around just as swiftly as if the telegraph line had clicked the news to the various government stations.

One day I stumbled upon the secret. The women of the tribes are the wireless instruments. They go upon the hilltops and shrilly call the news out. Their voices carry enormous distances, for years of wilderness life have taught them how to cover incredible distances with their voices. Other women take up the tale until everyone within a radius of a hundred miles or more knows the story in a few minutes.

At times it is very disconcerting, this native wireless system. In many punitive expeditions against erring tribes the news of the movements of the troops has been made known with unfailing swiftness and accuracy, thus defeating the objects of the expedition. The women are con-

Methods of WIRELESS



tinually on watch in the hills by day. And by night their methods consist of fires, which of course render only a skeletonized service of news. But the day service of news bulletins, that by word of mouth, is as full as is needed.

I had one remarkable experience of the accuracy of this wireless system. I was away on a hunting and exploring trip round the extinct volcano of Elgon on the Uganda-East African borders. It so happened that in my absence from my headquarters the governor of the colony had arrived to inspect my province. He had telegraphed out to Mumias, a post some 115 miles from where I was, orders for me to come in at once. The official in command at Mumias had failed to connect with me by runner as it afterwards turned out. But I got the news that the governor was in Kisumu, my headquarters station, less than 24 hours after he had arrived there, and a couple of hours later I heard that native runners were searching for me. I guessed the reason.

This news had been forwarded by means of the native voice-wireless—truly a wireless system—and reached me before the telegraph message and runners could have done. Some natives picked up the calls of the women and passed it on to a chief near at hand to my camp and one of my native policemen picked up the message in transmission; in other words, tapped the wires.

In a couple of hours I was making forced marches back to Kisumu. On arrival the governor asked me if I had received his message by telegraph and I replied in the negative. He was puzzled for a moment and asked how I knew he wanted me. When I had explained, he was overcome with astonishment for he had not known of the natives' advanced system of news despatching. In fact few men in Africa are aware of it.

Survey has been made for the location of towers to carry the electrical transmission line which will follow the relocated line of the Panama Railroad from Cristobal to Balboa, connecting terminal substations at those points. The line will be fed normally from the Gatun hydro-electric station, and will be tied into the permanent steam-generating station at Miraflores. Energy will be transmitted along this line at 44,000 volts.

Vehicle Call System

At theaters and department stores in large cities upon matinée and shopping days the curb attendant has far more than he can attend to in looking after vehicle calls and alighting passengers. A needed means for relieving this condition is here shown in the operation of

VEHICLE CALL SYSTEM

the Edwards vehicle call system. The interesting part of the system is the annunciator contained in a steel weatherproof case over the main entrance. Figures are mounted upon five faced cylinders each upon a vertical shaft. The attendant by switches may cause any combination of figures within the limits of the system to appear together illuminated by an incandescent lamp within. Matters are handled about as follows: An automobile draws up to the curb and stops; an attendant is at hand to open the door and assist the passengers to alight, at the same time presenting them a card bearing a number, a duplicate of which is given to the chauffeur who then drives away to await the appearing on the annunciator of the number he holds. The passengers go into the store, theater or club, and later return and present their number card, which number is immediately displayed on the annunciator and a bell or whistle sounded.

Electricity at Play

So powerful an agent has electricity become in the great achievements of the day that its equally wonderful successes along minor lines are in danger of being eclipsed. In the lighter matters of life, however, electricity is a valuable servant and its results are often as fascinating as they are wonderful.

The dish of ordinary jelly hidden beneath a silver cover and still further shaded by a skilful arrangement of flowers, cannot fail to be a brilliant object when the cover is suddenly removed and the transparent jelly is disclosed to view, bright, glowing, ablaze at its very center, where an electric light is ingeniously placed so that its rays shine through the jelly in every direction.

More wonderful still was a table ornament once displayed by Edison. It was an aquarium containing goldfish, every one of which was a living light. The tiny fishes were all ablaze within and their delicate bodies showed clearly the details of their anatomy. Each had been induced to swallow a tiny electric lamp connected with a battery by two hair-like wires passing out of its mouth.

Jewels and flowers for personal adornment can be lighted by means of very small secondary batteries and walking sticks may be made startlingly brilliant. That great American institution, the rocking chair, has also come under the spell of electricity. An American inventor has patented one that calls for no exertion of the part of the ease-seeking occupant. It moves by electricity and affords him the additional advantage, if he so desires, of gentle currents of electricity when he grasps the metal handles or places his bare feet on metal pedals.

The attraction that light exercises over fish has led the Prince of Monaco, who in his deep-sea soundings in the Mediterranean observed that the movement of an incandescent light in the water never failed to draw the fish to itself, to design a fish trap lined with incandescent lights.

This, while it replenished the ship's larder, also brought to light many of the finny tribes new to science.

The ball of light beneath the water is the deadliest lure ever employed by fishermen. When the handle of the battery is pressed the light fills the water with a glow that makes distinct every object near it.

From far and near the fish can be seen trooping up to this curious thing which has appeared among them, and their movements while under the spell of the light afford a most interesting study. The only danger is that the lure may prove too effective. Its general adoption might have the same result, with respect to certain species of fish, that the repeating rifle has had with the once countless buffaloes of the prairies.

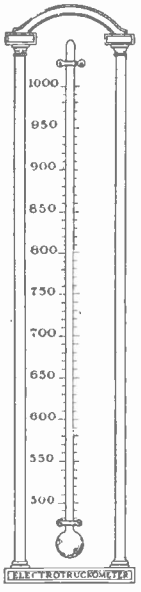
Stop Signal for a Store

"The semaphore is a trade winner," declared the proprietor of the Los Angeles store where it is installed. "Many a customer has stopped at the unfamiliar sight of a semaphore on a store front, and entered to ask questions, usually making a purchase before leaving. Others watch the flashing light, the rising and falling arm, and then drop in with such a remark as 'Well, I saw your stop signal, and followed it.' It is inexpensive to install. One of my clerks originated the idea and constructed the upright and arm from pine boards, and a sign painter did the lettering at small cost. The operation of a small motor keeps the arm in motion and the cost of power and the light behind the colored panes is very slight compared to the results."

THE SEMAPHORE

The Electrotruckometer

As a convenient method of indicating the rapid increase in the use of the electric truck and delivery wagon by Chicago merchants, there has been invented by the local manager of the Philadelphia Storage Battery Company, Mr. D. C. Arlington, 516 The Rookery, a very simple instrument which he has christened the "Chicago Electrotrucksalesometer."



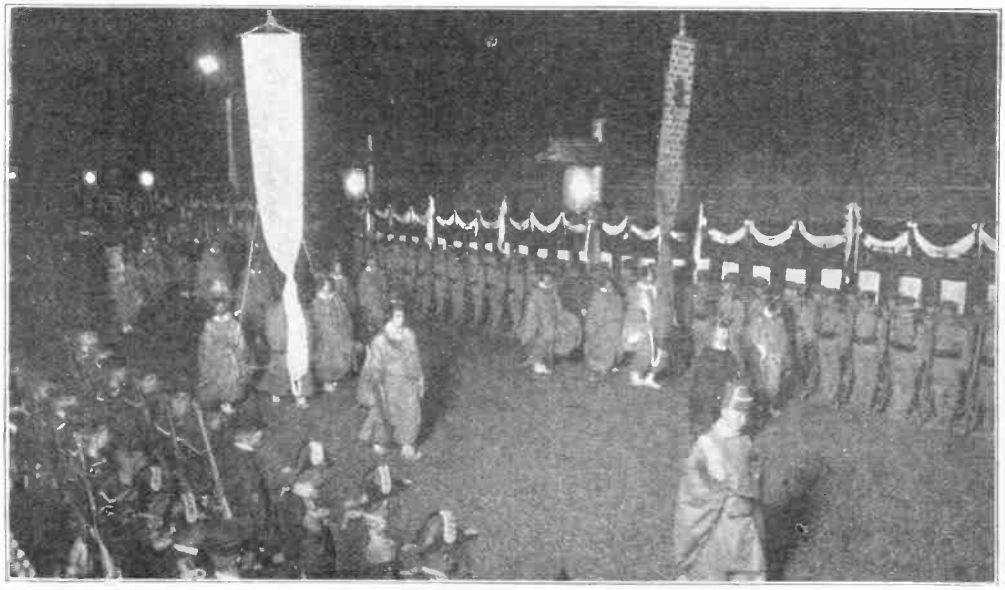
As described by the inventor, this instrument consists of an outline of a barometer printed upon a piece of Bristol board, a red pencil and one human being, preferably a male electric truck manufacturer's agent or representative whose chief interest and aim in life is to sell, or promote the sale of, electric vehicles of the commercial type.

This instrument shows for the first of January, 1913, that 523 electric trucks were in service and on order in Chicago. At the present writing, March 12, there are 603 electric trucks in service and on order, showing a considerable increase since the first of the year. The first of January, 1912, there were probably not over 270 electric trucks in Chicago. It will be seen that an increase of approximately 100 per cent was made in 1912.

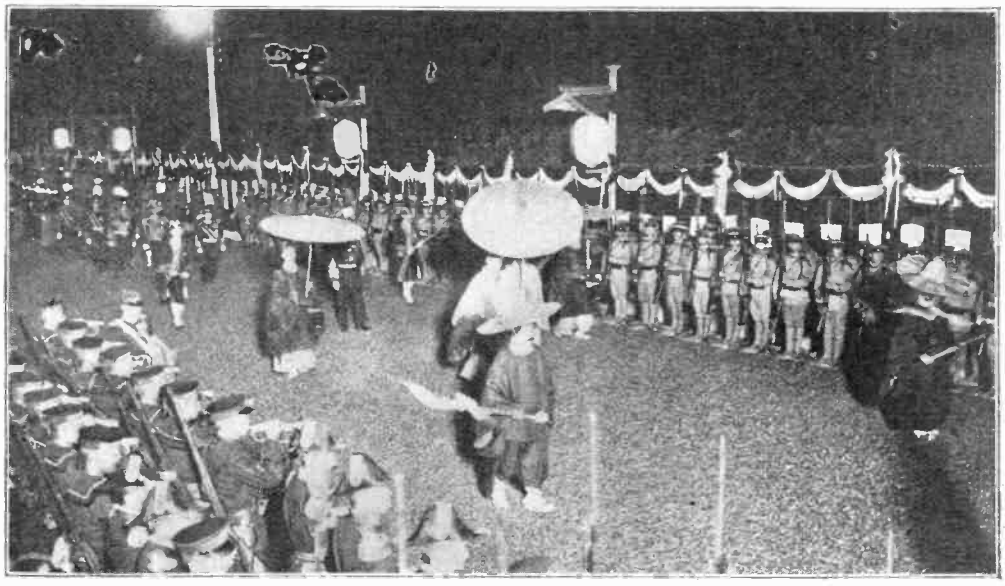
Referring to cut of instrument: the number 1000 will be found at the top of the scale. It is expected that by the end of 1913, fully this number of electric machines of the commercial type will be either in service or on order.

Photographs of the Mikado's

These illustrations show what can be done in the photographic line by means of fixed electric lights outdoors. The photographs were taken at midnight, at which time the Mikado's funeral was held, from a special stand erected by the Tokio police for newspaper photographers. This stand had a screen in front of it, and the photographers worked in the dark, making their exposures wholly by the light of



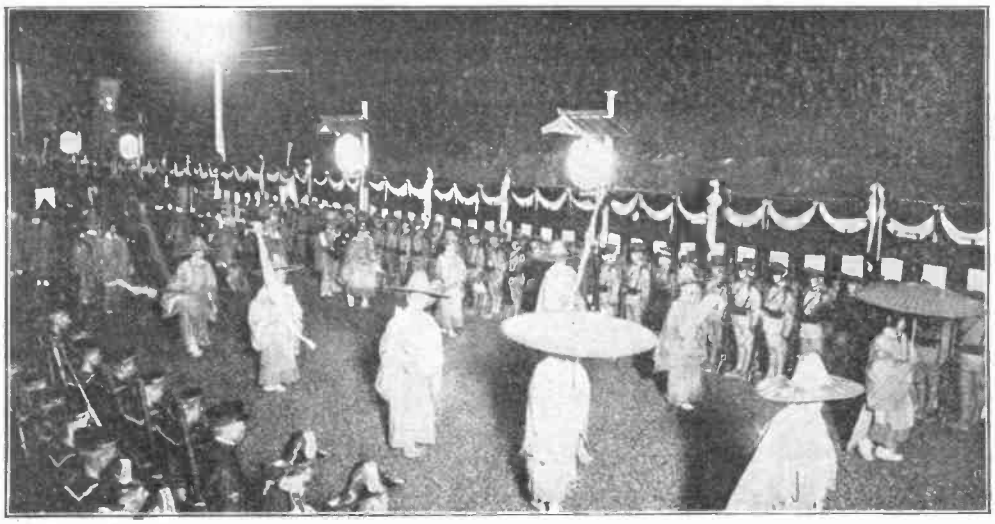
BEARERS OF THE "SUN" BANNER



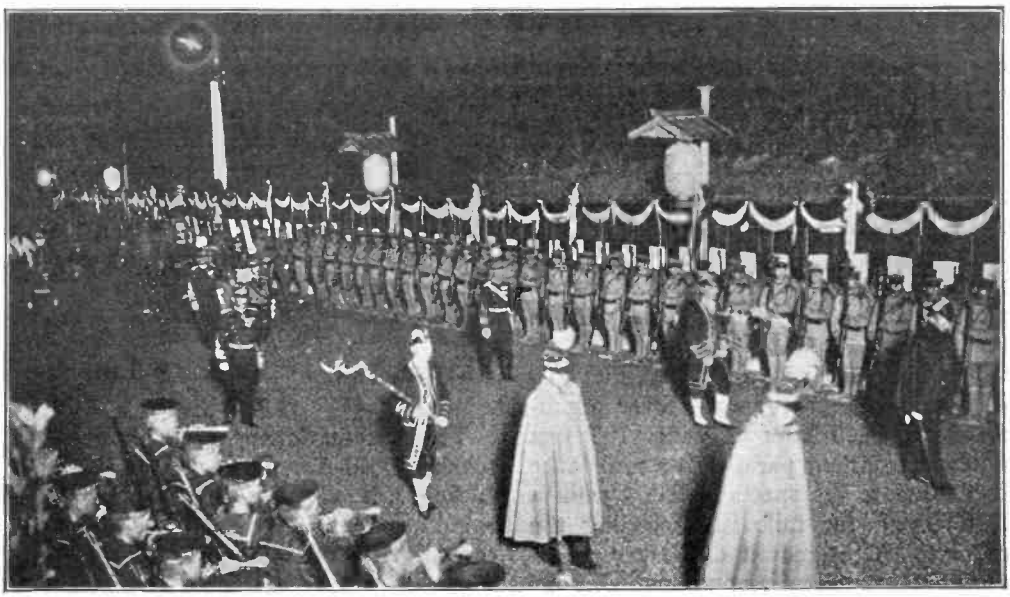
PRINCE FUSHIMI IN ANCIENT CEREMONIAL DRESS, UNDER THE FORWARD UMBRELLA

Funeral by Electric Light

the powerful arc lamps which lined the road from the Imperial Palace at Tokio to the parade ground at Aoyarna. The white spots are ancient Japanese lanterns in which powerful electric lamps were suspended. The scenes during the procession from the Imperial Palace to the parade ground at Aoyarna were impressive in the extreme, interest being intensified by the striking nature of the costumes, which presented a mixture of modern uniforms and ancient ceremonial dresses.



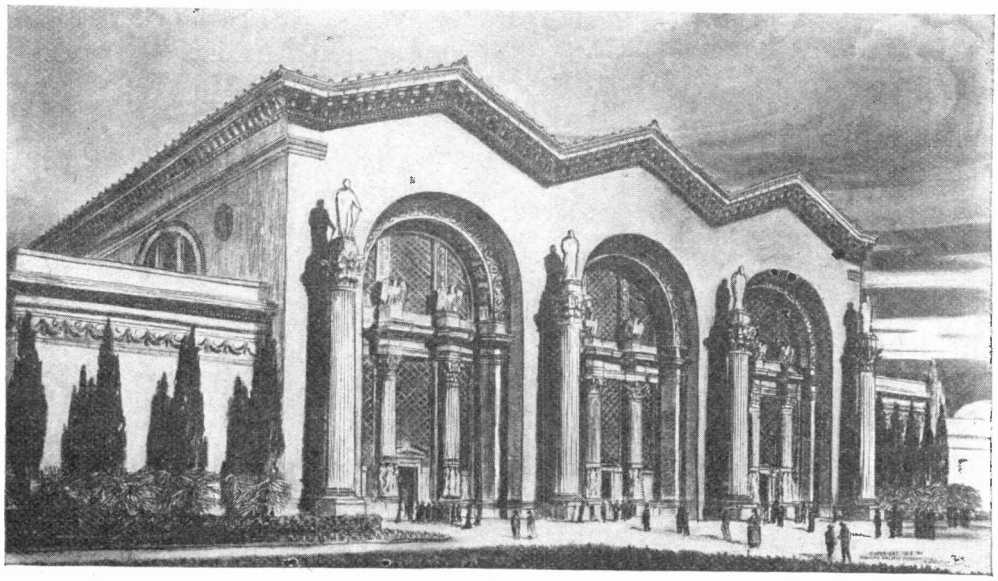
BOWS AND ARROWS CARRIED IN THE PROCESSION. THESE WERE BURIED WITH THE EMPEROR



PRINCE KANIN, WHO REPRESENTED THE NEW MIKADO IN THE PROCESSION

Machinery Hall at the Panama-Pacific Exposition

The home of the greater electrical exhibits at the Panama-Pacific Exposition at San Francisco will be an imposing palace of huge proportions known as Machinery Hall. The engineering fields of mechanics and electricity have become so correlated in these modern times that segregation of their products has been considered impractical, and so this great edifice, whose architecture by Clarence Ward recalls historical periods of Italian and Spanish renaissance, has been designed to accommodate replicas of the multitudes of mechanical and electrical appliances by which the world's work is facilitated.



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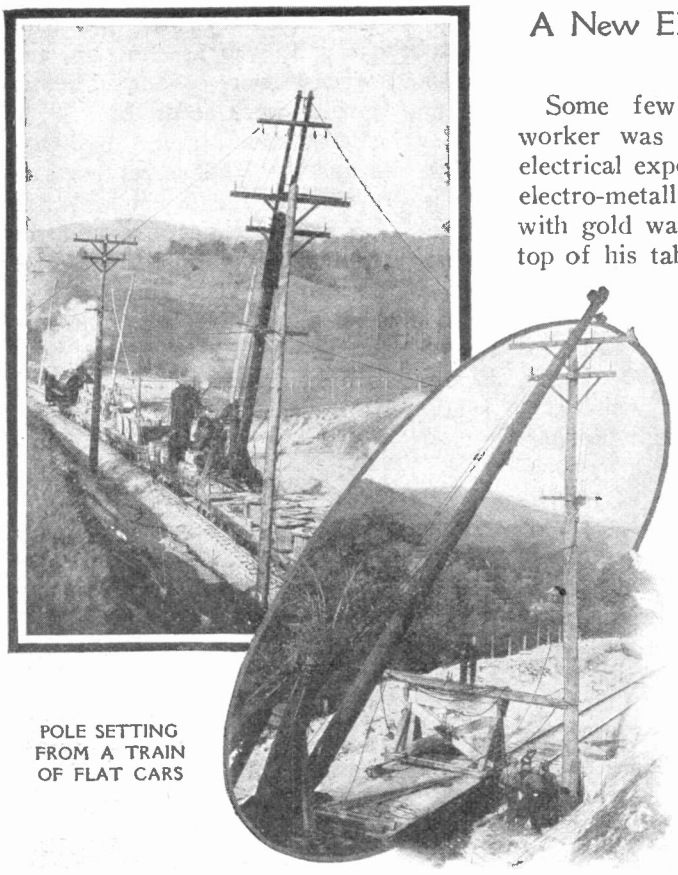
MACHINERY HALL AS IT WILL APPEAR AT THE PANAMA-PACIFIC EXPOSITION—WHERE THE GREAT ELECTRICAL EXHIBITS WILL BE SHOWN

The impressive array of exhibits will be found collected beneath three gigantic naves, each 80 feet wide, 100 feet high and running parallel for a distance of 1000 feet. A spectator must walk a distance of one mile in encircling the building. The amount of timber entering its construction is appalling. Nearly 8,000,000 feet will be used, enough to floor over 64 city blocks or 200 acres.

On the first day of this year fully 100,000 people left the residence districts of the city to witness the first turning of the soil for this exhibit palace. It was a mellow day and all seemed to augur well for the exposition. The throngs were joyous, for work of real magnitude—the realization of their dream city—was beginning. Indeed, the "rubbing of Aladdin's lamp" had almost immediate effect. Fleets of coastwise lumber steamers soon sailed in through the Golden Gate and unloaded their burdens "right in the front yard," so to speak, for Machinery Hall is close to the water's edge.

Erecting a Transmission Line by Train

The accompanying pictures show a scheme used for setting poles along a trolley line at Westfield, Mass. The equipment consists of a locomotive, reel car, derrick car and pole locating car. The reel car is a platform car, on which is bolted a heavy reel stand, holding the



POLE SETTING FROM A TRAIN OF FLAT CARS

six reels, with one mile of wire per reel. The derrick car carries a heavy derrick with a 50 foot boom for pole setting and a 20 foot extension to this for wire stringing. The extension piece carries on its outer end a cross arm holding six single blocks through which the wires pass directly from the reels.

The pole locating car, shown in the lower picture, is a flat car to which is bolted a wooden frame carrying an adjustable arm for accurately locating each pole. The poles are 50 feet in length, setting eight feet in the ground, each carrying an eleven foot four pin arm and a nine foot two pin arm besides the feeder, telephone and trolley. With this equipment the work is completed at once by the lineman placing the insulators and tying the wires to them.

A New Electro-Chemical Printing Process

Some few years ago a laboratory worker was engaged in making some electrical experiments in which a certain electro-metallurgical action in connection with gold was the object in view. The top of his table was of tin and a moist piece of paper rested on it. The wires of his battery were lying on the paper. In taking a gold coin from his pocket it fell on the paper and to prevent its falling on the floor he placed his hand upon it. It so happened that the coin touched one of the bare wires while the other wire laid on the tin. When he removed the coin, to his surprise its image was impressed as clearly on the paper as though it had been inked and an impression taken.

The same results were apparent whether gold, silver, copper or bronze coins were used. In this fortunate accident was born a new process which, it may be imagined, may some day revolutionize the greatest and most important industry in the world—that of printing. At any rate the discovery is worthy of careful development.

In the course of further investigation of this peculiar phenomenon it was found that all that was necessary to form an imprint from metal was a clear contact, regardless of the pressure used, the strength of the current governing the density of the imprint and to secure the best results the negative pole should be connected with the type or plate. As the imprint is of a brownish cast it is necessary to treat the paper with a certain common chemical to acquire a jet black imprint.

A press designed for the purpose of

utilizing this wonderful process is similar to the regular printing press as used at present, but about half the size, dispensing with all inking rollers, founts and ducts. The main parts are large rollers of metal sheathed with zinc and insulated, to which the positive contacts are connected, and another roller containing the plates to be printed from, with a negative contact. This is essentially the make-up of the machine.

The question of printing in colors has been solved by the use of various chemicals, oxidizable by electricity, which are impregnated in the cellulose paper during its manufacture, and the use of various metals in the imprint roller. A yellow color is given by zinc, brass gives a red and copper a blue, and all the other metals, tin, gold, silver, iron, platinum, aluminum and others singly or in alloy, will produce distinctive colors with unvarying certainty, in electrical action with certain chemicals.

At the same time the question presents itself, if cellulose in the form of paper can be colored superficially by electrochemical means, why cannot the same substance in the form of fabrics or textiles be dyed or colored by the same method. The inventor claims that textiles can be printed by this process and it seems that but a small step intervenes between this and dyeing completely.

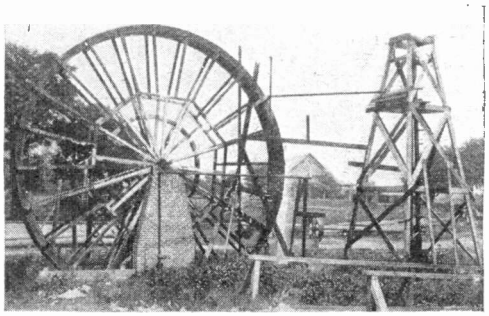
Another great industrial problem has been simplified by this discovery. Printing inks as used on paper are impossible to remove completely when being repulped and consequently paper once printed on can never be used again for the same purpose and can only be converted into packing paper or for similar uses. By using the new process all waste paper can be made over into printing paper, as there is no deposit of ink on it, and a method of electrolysis bleaches the pulp like new.

Much chemical experimenting was necessary in perfecting the process as the use of the proper chemicals is most important, and to make it of commercial value it was necessary that chemicals must be cheap as well as effective, and thousands of tests were conducted before the final results were secured.

The chemicals and formulas used constitute the valuable and secret portions of the process, but the principle of the process has many applications and the investigator has many opportunities to apply it to various undertakings, as well as to develop those other latent properties of cellulose which have already been brought to light or are already utilized. —DANIEL M. GROSH.

Artesian Well Power Plant

Artesian, flowing, or spouting wells are widely used for irrigation in the West and for general water supplies in various parts of the country, but seldom is a single well made to serve such a variety



ARTESIAN POWER PLANT IN GEORGIA

of purposes as the one shown in the picture, through its operation of an electric plant.

The unique well and plant are located on a farm near Midville, Georgia. The well has a sufficient water pressure to generate enough electricity to supply the house and barn with light, with power for the running of a farm mill, feed chopper, lathe and other farm appliances such as are generally operated by progressive farmers with small gasoline engine plants, besides a clothes washer and several other labor saving devices for the house.

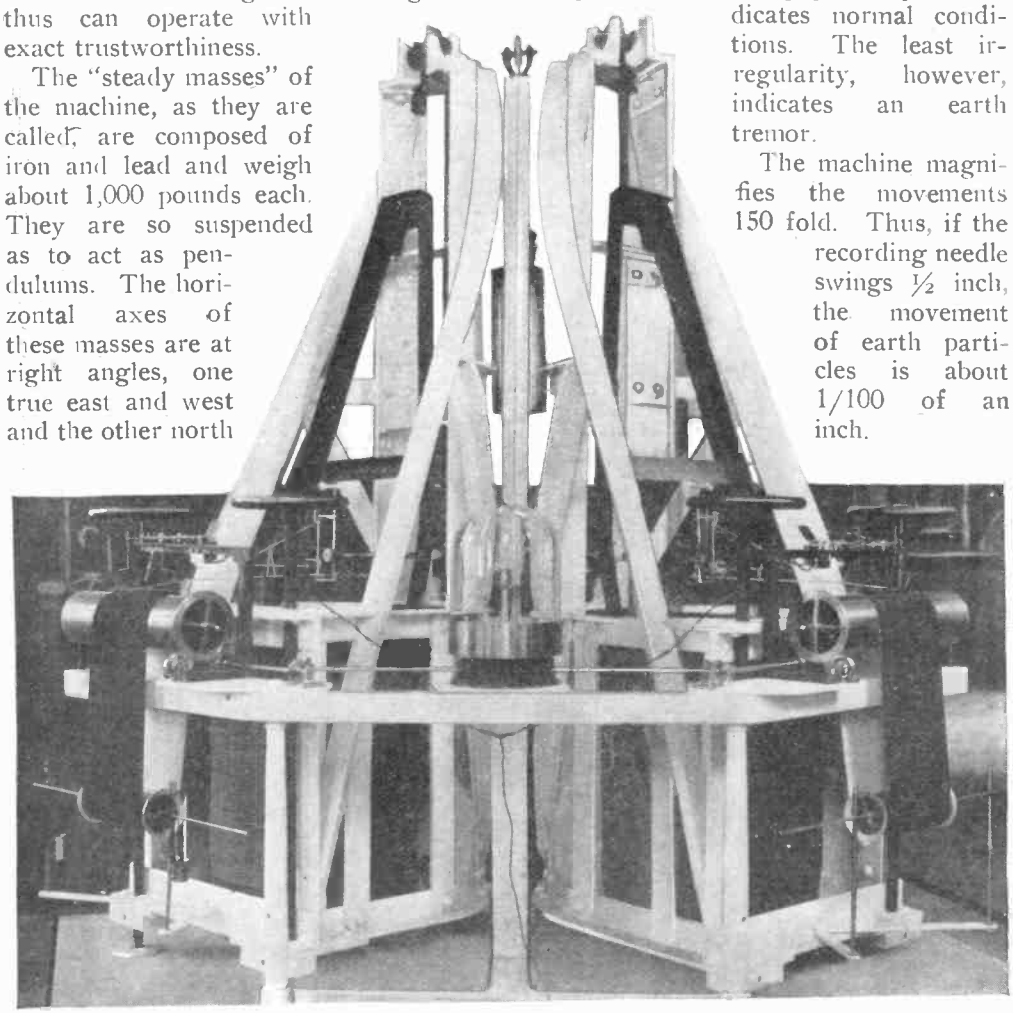
The World's Largest Seismograph

The largest seismograph, or earthquake detector, is located in New York and has recently accomplished the amazing feat of noting undulations clear from Alaska, 3,100 miles distant. So subtle and delicate are the notations that this seismograph records even the effects of heavy winds upon the earth, also the pounding of the breakers of the ocean. It rests upon a cement base, which in turn is fastened unshakably to the solid rock. The structure is so arranged that it is absolutely free from contact with the great building and thus can operate with exact trustworthiness.

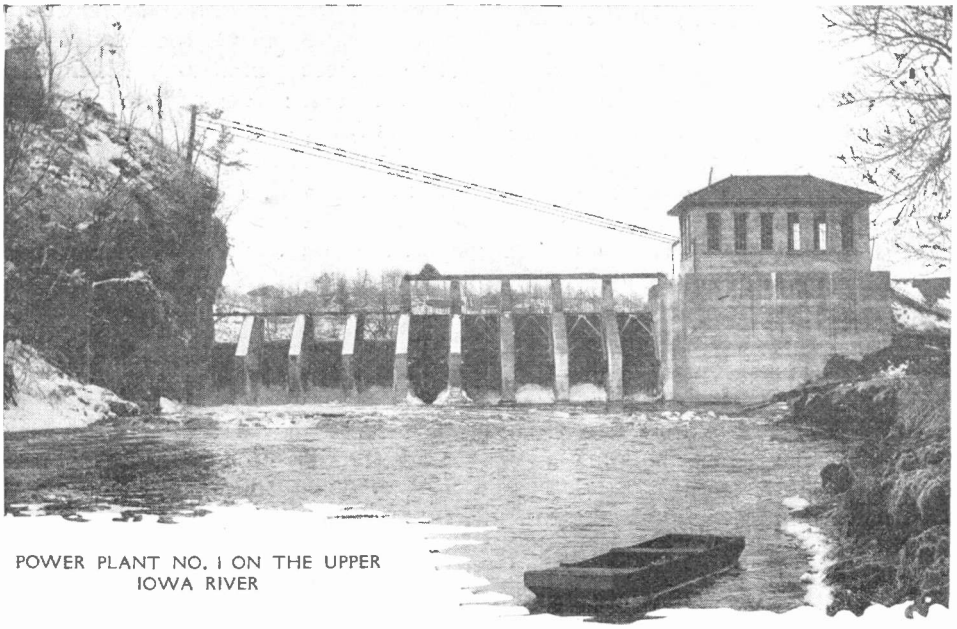
The "steady masses" of the machine, as they are called, are composed of iron and lead and weigh about 1,000 pounds each. They are so suspended as to act as pendulums. The horizontal axes of these masses are at right angles, one true east and west and the other north and south. The least tremor of the earth of course effects the relative positions of these pendulums, which hang freely, and the rest of the apparatus which is fixed to the earth.

In the matter of operating the recording needle which traces the earth's fluctuations on a moving strip of smoked paper, the fine work of the electro-magnet comes into play. Every minute this needle is raised from the paper by the force of the magnet. The time the needle is down is sufficient for it to make a mark about 1/30 of an inch in length. When these marks are in a perfectly straight line on both paper strips, it indicates normal conditions. The least irregularity, however, indicates an earth tremor.

The machine magnifies the movements 150 fold. Thus, if the recording needle swings ½ inch, the movement of earth particles is about 1/100 of an inch.



THE WORLD'S LARGEST SEISMOGRAPH



POWER PLANT NO. 1 ON THE UPPER IOWA RIVER

Putting the Small River to Work

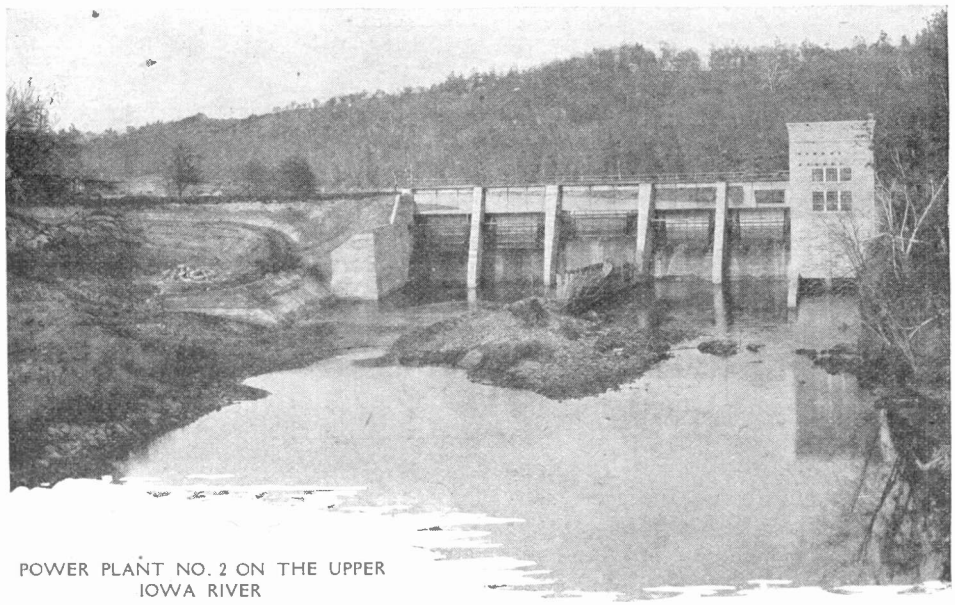
By FLORENCE L. CLARK

The topography of Iowa is generally believed to be flat or slightly rolling. This is true of most of the state but in the northeastern part a sort of island in the glacial drift, deeply cut by streams flowing from the highlands to the Mississippi, makes a rugged break in the otherwise regular surface. The bluffs in this section are from 300 to 500 feet high and of massive limestone capped with deep black loam. Many springs bubble out of the limestone, creating creeks which run together to form the picturesque Upper Iowa River. From earliest times the clear waters and wooded hills of this little river have been a favored haunt of the sportsman and even to-day the region immediately adjoining is still so much Nature's own that a den of wolves can now and then be unearthed.

Just back from these hills, however, undulate far and wide highly developed farm lands. Their owners are among the most prosperous of Iowa's most prosperous farmers. Land sells as high as $250 an acre. The big red barn, the modern home, the cement floored stable and the garage feature the landscape. Just one thing, electric light and power, was needed to give the latest progressive touch to rural conditions. The little Upper Iowa, so long but an idle pleasure stream, is now in the harness and hard at work providing this one lacking feature.

Near the town of Decorah, named for the famous old Winnebago chief who with his braves used to hunt and fish through the region, the waters of the Upper Iowa ripple quite noisily down to join the Mississippi, falling five to eight feet to the mile. At one place in early geologic times a limestone ridge, cracked off and undermined by the wash of the river, toppled over, forming an ideal dam site. In 1908 the site was discovered by Iowa capital and a hydro-electric power plant was installed.

The construction was attended with difficulties. Violent floods, causing a big

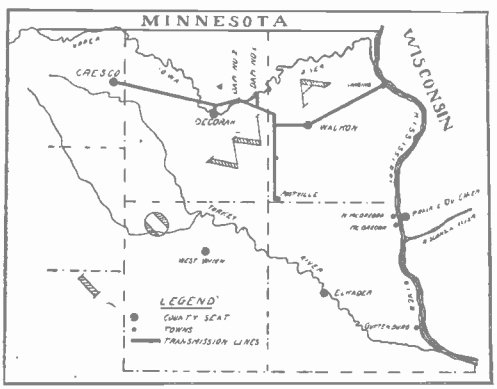


POWER PLANT NO. 2 ON THE UPPER IOWA RIVER

rise in the Upper Iowa within a few hours, are liable to occur at most any season of the year. Such a flood came after the preliminary work on the dam was in place and swept everything before it. Undaunted, a new start was made and the work carried to successful completion. Five Taintor gates, ten feet wide and 20 feet high, operated by an electric hoist and two spillways, one 40 feet and the other 100 feet wide, control these flood waters. The operator at danger times keeps his ear close to the telephone and at the first warning lowers the water in the pond. The dam, with an effective head of 27 feet when the pond is full, is the highest in Iowa, barring the great structure at Keokuk.

Sufficient electricity was generated by the plant to supply quite an area. The demand for the current grew as the plant tested out a success and last year the company found it feasible to enlarge its capacity by putting in a second dam and power plant just above the pond formed by the first. The work was completed in January and interesting developments are rapidly following. From an engineering standpoint the two plants together form probably the most complete small hydro-electric development in the Central States. From a practical point of view the system is unique.

The transmission lines have been strung on 30 foot cedar poles along the public roads and private right-of-way through the fields for 77 miles. Over



THE REGION COVERED BY POWER SERVICE FROM THE UPPER IOWA RIVER

these lines the current is now flowing up from the Upper Iowa into three counties in the northeastern part of the state. On the way it is supplying the five leading towns, Decorah, Postville, Cresco, Waukon and Lansing, with both light and power. Iron mines near Waukon, button

factories at Lansing, clay works at Postville and several minor industries are using the current and further manufacturing development is indicated.

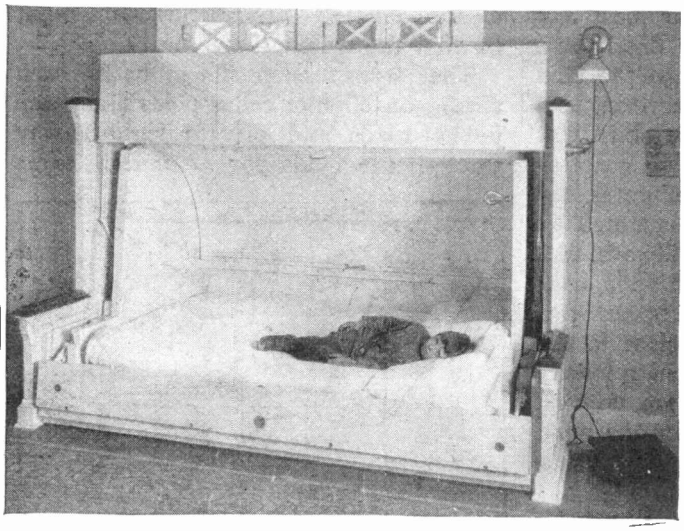
Between these larger towns quite a number of villages too small to support a steam plant are supplied with electricity. The best and most significant feature of the system, however, is the bringing of electricity into rural life. Several hundred farms are adjacent to the lines. All that is necessary for a farmer to do is to pay for a transformer, lightning arrester and the wiring and then at the same rate as town customers he may light barns and house and install motors to pump the water, grind the feed, separate the cream, do the family washing and a score of other things. New as the system is, already quite a number of farmers have taken advantge of the great convenience which has been brought to their doors and eventually several hundred will be using the current.

Larger Telephone Cables

The extraordinary increase in the number of the telephone wires and the difficulty of obtaining additional space underground in many places have emphasized the importance of utilizing every underground duct to its fullest capacity. This could only be accomplished through improvements in cables. Six hundred pairs of wires have been the largest number which it has heretofore been practicable to employ. Experiments were completed last year by the Bell Company and specifications prepared for a new type of cable providing 900 pairs, or 1,800 wires, in the space which was formerly required for 600 pairs. This will result not only in great economies in the use of cables, but also in large economies in the construction and utilization of conduits.

Electric Lighted Folding Bed

For reading after retiring, an electric light is installed over the head of a novel folding bed devised by a Los Angeles inventor. The reason for its necessity is that when the bed is in use, a canopy is brought down over the front of the couch, shutting out the light from the room, so the familiar reading light of the Pullman berth is installed for the benefit of nocturnal readers.



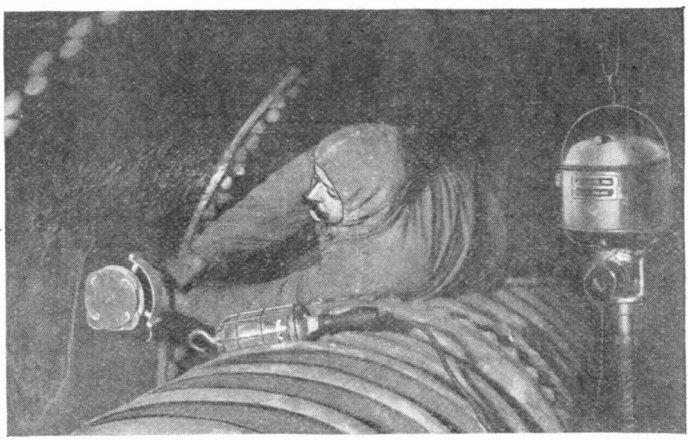
ELECTRICALLY LIGHTED FOLDING BED

The idea is very ingenious. When the occupant has retired the canopy (the curved back portion shown in the picture) is swung down over the front of the bed and draws up in its place at the rear a screen so that the outer air is admitted to the sleeping quarters, while the air from within the apartment is excluded. The screen opens directly upon a very small porch, just large enough to take about half the bed; a miniature sleeping porch, in fact.

By day, the canopy swings down outside, making a weatherproof wall, while inside of the room the various parts fold back and form a settee.

Removing Boiler Scale

A rapidly revolving electric tool is now coming into use for cleaning the inside of boilers and removing the scale, and one of the latest kind, of English make, is illustrated. An electric motor is connected by a flexible shaft to an ingenious cleaning device consisting of a flat metal drum provided at three or more points with steel cutter wheels loosely mounted upon pins. When the drum is made to rotate by starting the motor, the steel wheels which are similar in appearance to milling cutters, fly outward by centrifugal force and give a hammering and tearing action on the surface to be cleaned with no less than 8,000 strokes a minute. Much quicker work is thus done, as may be imagined, than with any kind of hand tools.



REMOVING BOILER SCALE

Government Standard Specifications for Electric Vehicles

The United States government will follow a new plan in contracting for the electric vehicles which will be built for the various branches of the federal establishment during the fiscal year 1914; that is, the twelve months beginning July 1, 1913, and ending June 30, 1914. The new plan is a decided innovation in that it contemplates the placing through one central authority of orders for all of Uncle Sam's new electric automobiles instead of the old plan whereby each of the executive departments has dealt direct with the manufacturers of electrics.

Yet more significant is the fact that under this new scheme contracts for trucks and other electric vehicles will be let under standard or uniform specifications. Standardization is just now so important an issue in the electrical world, as it is in the mechanical, that there will naturally be interest in this governmental policy which must be interpreted as a move in the direction of standardization, But, even aside from this, there will be curiosity in electrical circles regarding these supposedly model specifications which embody the ideas of the chief experts in the government service, including the electrical authorities at the United States Bureau of Standards.

This systematic method of making government purchases of electric vehicles and extra parts originated with the General Supply Committee, a comparatively new federal institution, the purpose of which is to bring about system in all government purchases and to secure the lowest possible prices by buying in quantity—co-operative buying by all the departments of the government, it might be denominated. The plan is designed to work out in this wise: Early in the spring, the specifications are sent out and bids invited from manufacturers. In due course these bids are received and opened and then the experts of the committee devote some weeks to detailed comparisons of the propositions made. Tests of material are conducted when it is deemed advisable and visits may even be made to the factories to complete investigations.

The verdict of the supply committee

on all proposals is supposed to be announced by the middle of June. But it does not follow that contracts for cars will be entered into at once. That is one of the stipulations made to bidders—that proposals shall not require immediate acceptance, but will be open for the period of one year.

The general specifications stipulate that the underframe of every truck shall be entirely of steel and that all wheels must be of the artillery or equally substantial type. Solid tires are demanded. It is indicated that motor trucks of the electric storage battery type should preferably be equipped with a single motor of rugged construction, driving the car through a countershaft and chains. Each truck must be equipped with a series-wound motor fully inclosed; the armature shaft must revolve on ball bearings and be geared to the countershaft by means of an inclosed silent chain; and the motor must be so suspended from the frame as to maintain absolute alignment with the countershaft throughout the range of the chain adjustment. The controller must be of the continuous torque type, having at least three speeds forward and two reverse. It is stipulated that it shall be operated by means of a single lever so arranged that the reverse cannot be thrown in by mistake and that on the off position of the controller the battery shall be in series for charging. All the wiring must be carried in conduit or must be thoroughly protected, waterproofed and secured to the underframe entirely independent of the body.

Each builder of electric vehicles who aspires to include the government among his customers will be expected to fill out a schedule of data under which information is asked in answer to no less than 55 different questions, embracing everything from the carrying capacity of the vehicle, expressed in pounds, to the size of the chains. Especially does Uncle Sam desire information as to the mileage guaranteed on one battery charge on a hard level road, with the rated load; and as to the battery, its type, size, number of cells, weight and location. Every competing manufacturer of electrics will be asked to state the guaranteed number of miles of actual service (to be determined by the odometer readings) which will be obtained before the battery has reduced below 80 per cent of its original ampere-hour capacity. This is rather an important requirement because the government is asking that the capacity of the battery at the completion of the stated mileage shall be determined by a test at the nominal discharge rate and standard temperature and that, on the basis of the showing made, the guaranty above mentioned shall contemplate a cash rebate proportionate to the excellence of performance.

The new purchase plan, as thus far perfected, contemplates the making of contracts under the standard specifications for four different classes of electric vehicles; namely, an electric motor wagon (primarily for mail purposes) of 1,000 pounds capacity and electric motor trucks of capacities respectively of 1,500, 2,000 and 3,000 pounds.

By Wire and Air

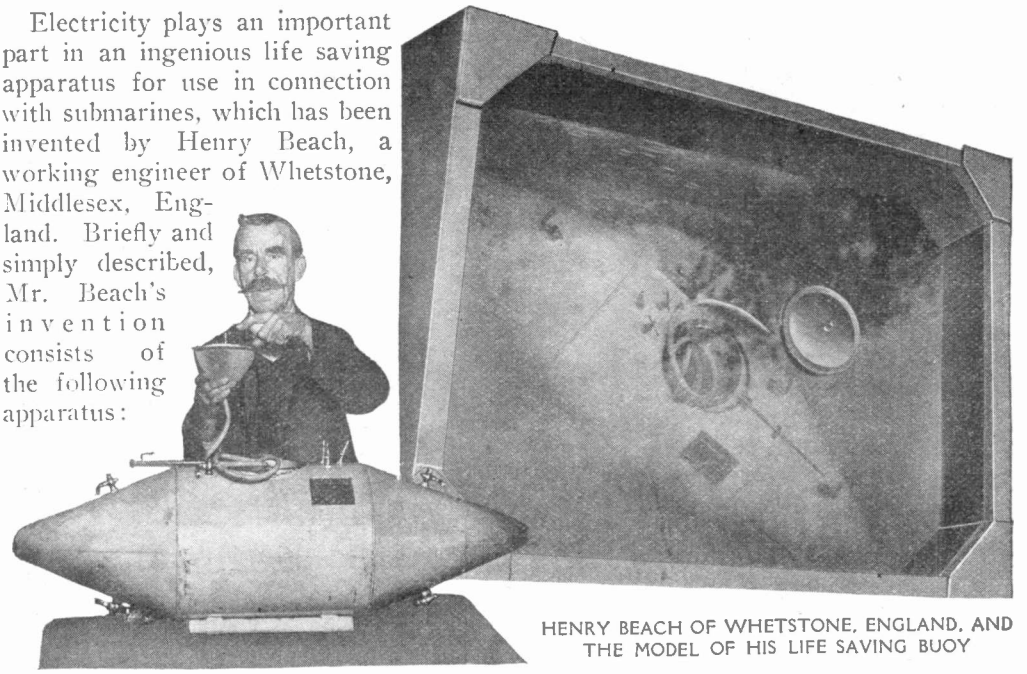
A New England man reports an accidental experiment in the velocity of sound. He had gone to his telephone and just as he put the receiver to his ear had heard the click of another telephone. Another receiver had been removed and the line was open.

Then he heard through the telephone the shriek of a locomotive whistle, and a few seconds later the sound came through the open window in the usual way. Looking up he saw a locomotive half a mile away, passing the house of a friend.

The mystery was solved. The telephone that was open was that at the distant house and the sound of the whistle had come, through its transformation into an electric current, quicker than it had traveled through the air.

LIFE SAVING DEVICE FOR SUBMARINES

Electricity plays an important part in an ingenious life saving apparatus for use in connection with submarines, which has been invented by Henry Beach, a working engineer of Whetstone, Middlesex, England. Briefly and simply described, Mr. Beach's invention consists of the following apparatus:



HENRY BEACH OF WHETSTONE, ENGLAND, AND THE MODEL OF HIS LIFE SAVING BUOY

A well six feet across and 3½ feet deep is cut into the deck of the submarine near the conning tower and inside this is a watertight buoy, to which is attached a length of armored hose, including three strands of cable. The other end of this hose passes through the bottom of the well into the interior of the submarine and establishes communication with the buoy.

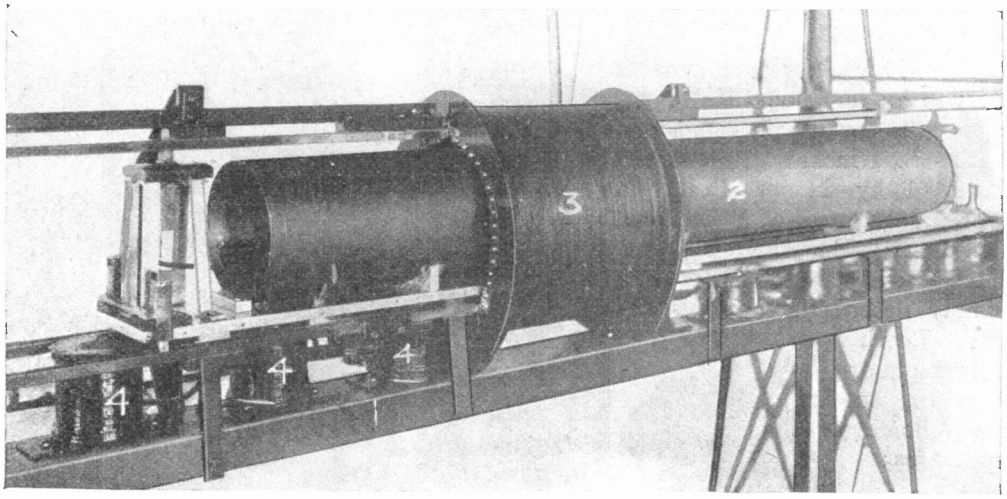
In the event of a collision this buoy, with a lifting power of four tons, is released automatically and floats to the surface, carrying with it the hose. The parent ship cruising around in the vicinity of the disaster, will keep a lookout for the buoy, which makes its presence known almost immediately by the ringing of an electric gong during the day, or lighting a powerful electric light at night.

On reaching the buoy the rescuers immediately couple one of the very powerful air pumps carried by all these vessels to a valve on top of the buoy and air is pumped down through the hose, through which telephonic communication is also established. Then, by a series of valves, air is pumped into one or more of the compartments of the sunken submarine with such force as to empty the vessel of water in about half a minute, thus enabling it to come to the surface.

Electricity Versus Smoke

A parliamentary committee in England has collected some important facts concerning the saving of coal and the suppression of smoke in London which could be effected by the generation of all the electric power used in the metropolis in a few large stations, with very tall chimneys.

It has been estimated that about 6,000,000 tons of coal per year could be thus saved, together with an immense reduction of the quantity of smoke poured into the city air. It is also estimated that from these stations current could be cheaply supplied for cooking and other domestic purposes, thus eliminating another great source of smoke.

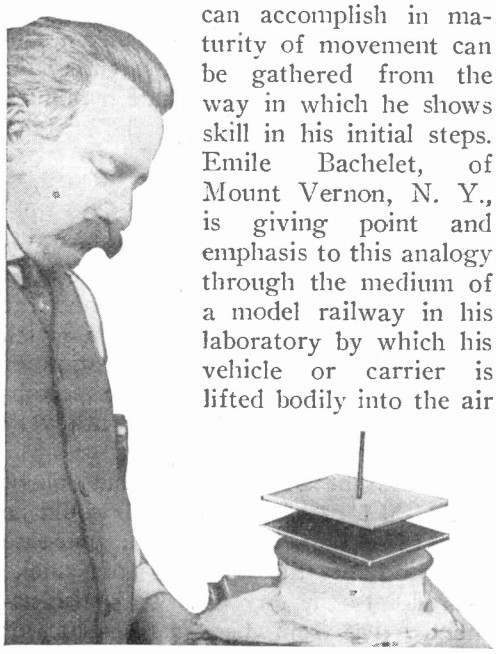


GENERAL FEATURES OF THE LEVITATED SYSTEM: (1) ALUMINUM BED-PLATE; (2) IRON BODY OF CAR; (3) SOLENOID WHICH DRAWS THE CAR FORWARD; (4) LEVITATING MAGNETS

Bachelet Levitated Railway Car

By ROBERT G. SKERRETT

Man must learn to walk before he can run, but a pretty good idea of what he can accomplish in maturity of movement can be gathered from the way in which he shows skill in his initial steps. Emile Bachelet, of Mount Vernon, N. Y., is giving point and emphasis to this analogy through the medium of a model railway in his laboratory by which his vehicle or carrier is lifted bodily into the air and thus free from substantial support, as we understand the phrase, is able to be impelled through space—in this way eliminating the problem of wheel loads and the friction of revolving trucks and axles. This sounds a bit uncanny, but the levitation of the carrier is an accomplished fact plain to the eye of the most exacting doubter, and the drawing of the vehicle through the air is effected in a no less convincing manner. Mr. Bachelet is applying in a new manner certain magnetic forces which have been known for many years but which, heretofore, have been considered principally in the light of an electrical curiosity and of interest essentially as a laboratory spectacle. The magnetic force used by Mr. Bachelet is applied through the agency of what are commonly known as Foucault or "eddy" currents, and they have been considered more troublesome than helpful. Mr. Bachelet withdraws this "undesirable" from the limbo of the electrician and invests it with the dignity of promising usefulness.

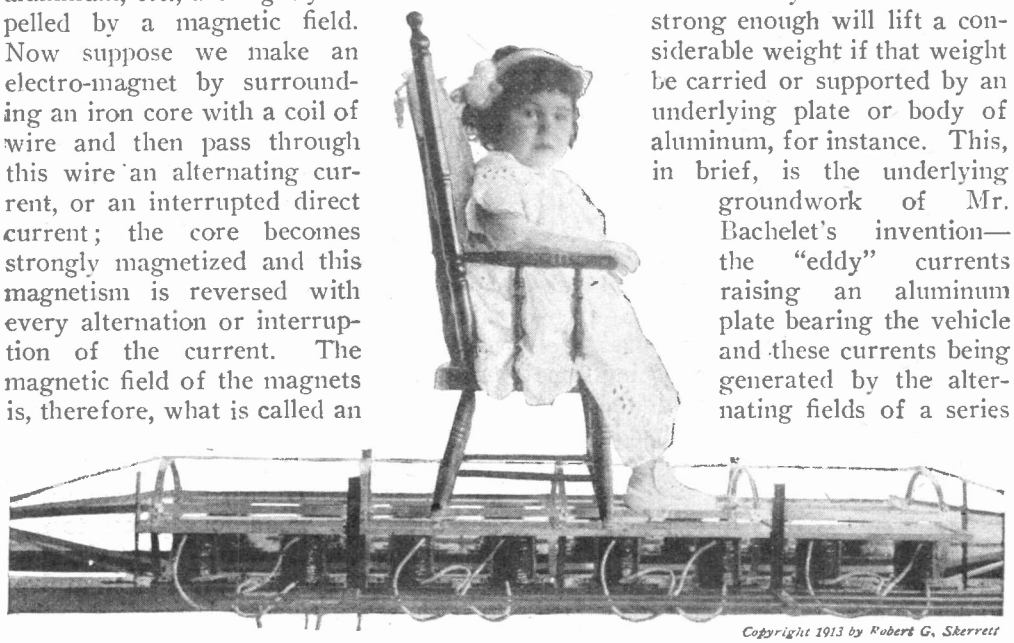


AN EXCITED ELECTRO-MAGNET LEVITATING A SHEET OF BRASS AND A SHEET OF ALUMINUM

The principle of operation of this in-

teresting railway may be briefly explained as follow:

Certain substances called magnetic, such as iron, are attracted to a magnet. Certain other substances, called non-magnetic, are in no way affected by a magnetic field. A third class, called paramagnetic, such as copper, silver, gold, aluminum, etc., are slightly repelled by a magnetic field. Now suppose we make an electro-magnet by surrounding an iron core with a coil of wire and then pass through this wire an alternating current, or an interrupted direct current; the core becomes strongly magnetized and this magnetism is reversed with every alternation or interruption of the current. The magnetic field of the magnets is, therefore, what is called an alternating one continually reversing in polarity.



Copyright 1913 by Robert G. Skerrett

THE LEVITATING FRAME WEIGHS ONLY EIGHTEEN POUNDS, YET IT EASILY SUPPORTED THE CHILD. ITS TOTAL CAPACITY IS 65 POUNDS

Now if we place a non-magnetic substance in this field it is of course not affected. If we place a magnetic substance in the field it is attracted to the core and held there. But when a paramagnetic substance is placed in the field a strange thing occurs; it is repelled or levitated by the field. The reason for this is the fact that the alternating field of magnetism induces electric currents to flow in the paramagnetic substance. They are called eddy currents. These little currents set up magnetic fields of their own—invisible lines of force which oppose the field of the main magnet and tend to push away from it. The tendency then is to carry the paramagnetic substance out of the field.

It is true that eddy currents are also produced in the same manner in magnetic substances such as iron but their effect is overcome in that case by the natural magnetism which tends to draw the iron to the magnet.

The eddy currents when strong enough will lift a considerable weight if that weight be carried or supported by an underlying plate or body of aluminum, for instance. This, in brief, is the underlying groundwork of Mr. Bachelet's invention—the "eddy" currents raising an aluminum plate bearing the vehicle and these currents being generated by the alternating fields of a series of magnets along the track. Upon this cushion of invisible streamlines the carrier rests while supporting several times its own weight by way of load. The carrier will be held at different heights above the magnets depending upon the force of the current fed into the coils, but all that is really necessary to be practicable is to lift the vehicle just clear of any contact, thus economizing electric current.

The strength of the magnetic force, with any exciting current, would depend upon the frequency with which that current was interrupted in its flow to the windings of the coils. Mr. Bachelet has developed a novel interrupter for this very purpose and by its employment in

connection with his coils, he is able to multiply his "eddy" currents to a strength three times as great as they would otherwise be for a given measure of electrical feed.

In his demonstrating apparatus, the carriage or shell of aluminum weighs eighteen pounds and it bears a dead load of 65 pounds. With a given alternating current, the vehicle is held in the air a quarter of an inch above the coils, and by doubling the force of the current the car is lifted three times higher. For practical purposes this additional rise is not necessary, but, as an indication of the forces developed, it is exceedingly impressive.

When the car or carrier is in action, it is so arranged that it automatically excites the levitating coils in groups—energizing the group just ahead in advance of entrance into that zone of influence and simultaneously cutting out the coils which have just been left behind. In this manner current from the dynamos is economized.

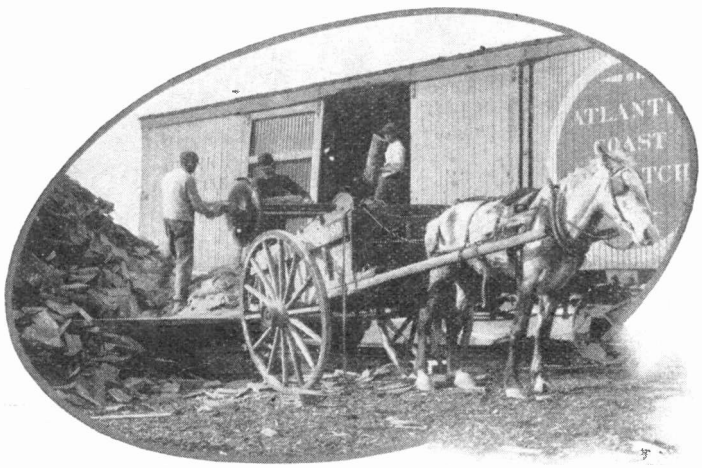
The horizontal movement of his cars Mr. Bachelet obtains by means of solenoids—virtually electro-magnets of another form—which, when energized by an electric current, exert a strong pulling or attractive force. These solenoids are successively energized by the forward movement of the car. It is necessary, that each solenoid shall be deenergized at the proper instant lest it tend to hold the vehicle in its magnetic grip. The carrier is, in fact, drawn forward by means of a series of magnetic pulls and then carried onward to the zone of influence of the next solenoid by inertia—the succeeding solenoid again accelerating the car's speed by fresh attractive impulse.

Mr. Bachelet makes no claim to having reduced the fruit of his years of experimenting to a state where his invention can be installed immediately as a practical rival to the ordinary railway for freight or passenger service. The details of a commercial line have not yet been worked out for the Bachelet system, but the demonstrating apparatus and the model plant furnish abundant food for serious reflection.

Portable Wood Sawing Outfit

This portable electric equipment is owned by a wood dealer who receives his wood in railway cars and delivers it by cart in small lots. A portion of the carload which is shipped in long lengths is cut up as unloaded and piled into the cart for immediate delivery to his customers.

The saw and motor occupy a space 3 by 6 feet. The motor is direct connected to the saw so there is no waste power. It is stated that the machine will saw a cord of wood four pieces to the stick using one kilowatt-hour of electricity which at the usual price is from five to seven cents. Current is supplied to the motor through a cable which is connected with the nearest outlet point on the electric service lines.



FIVE TO SEVEN CENTS' WORTH OF CURRENT WILL SAW A CORD OF WOOD

Art in the Suburbs

Evidence of the general trend towards the aesthetic side in street lighting is here illustrated in the novel fixture in-

NOVEL AND ARTISTIC LIGHTING FIXTURE

stalled at the Kenilworth (Ill.) depot of the Chicago and Milwaukee Interurban Railway.

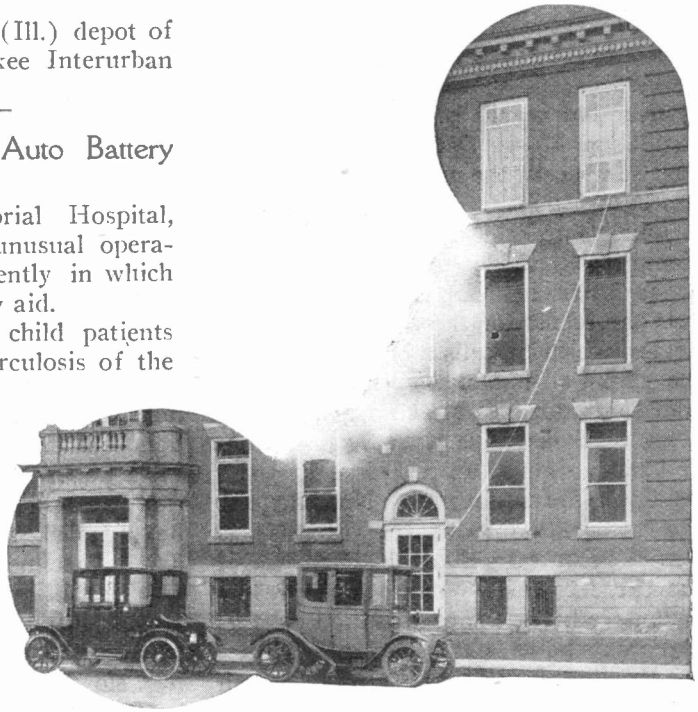
Surgical Operation by Auto Battery Power

The Children's Memorial Hospital, Chicago, witnessed two unusual operations in bone surgery recently in which electricity was a necessary aid.

Two of the hospital's child patients were suffering from tuberculosis of the spine. The front of the spine had been eaten away in each case and the operations were such that only five have ever been performed in Chicago. Dr. Fred Albee of New York City devised the method and was present as an aid to Dr. E. W. Ryerson, the head of the hospital.

That the operation may be performed without loss of time, a small circular saw driven by an electric motor is employed. When Dr. Albee arrived from New York City it was made known that his instruments operated on direct current. The hospital lighting was alternating current. On being called by telephone the manufacturers of the Borland electric car hurried a car to the hospital, a pair of wires were run from the third story window of the hospital and connected to the car's battery. In a few minutes the tiny saw began to cut away a strip of bone one-half inch wide, one-quarter inch thick, and about six inches long from the first patient's leg, this being then transferred to the front of the spine thereby strengthening and straightening it in the manner necessary to healthy growth. Both operations were pronounced successful.

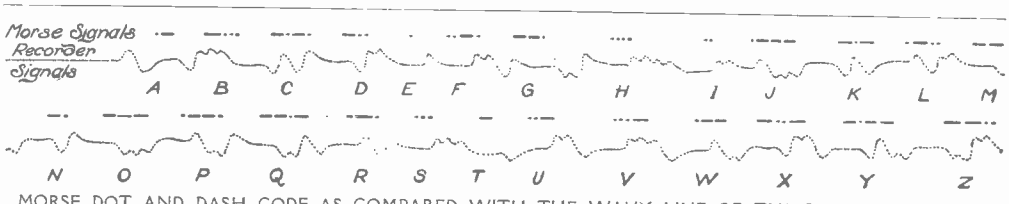
At least two places within the Arctic Circle have received the electric light. Hammerfest and Tromso.



ODD WAY OF SUPPLYING CURRENT FOR A SURGICAL OPERATION

MORSE CODE FOR SEA CABLES

Since the first transatlantic cable was laid in 1858, submarine cable engineers have dreamed of sending messages over their lines by means of the Morse code. Experiments were made with all sorts of apparatus but the only one that gave any satisfaction was the siphon recorder which recorded a message by means of wavy lines on a strip of paper. This was a slow and laborious way of getting word from the other side of the ocean, even though some of the operators grew to be expert readers and could repeat a message as the tape unrolled before their eyes with as much ease as though it were written in longhand. There was a limit to the speed which such a method developed. What was wanted was some system that would permit the use of a regulation Morse sounder. Within the past few weeks the answer to the puzzle has been found.



MORSE DOT AND DASH CODE AS COMPARED WITH THE WAVY LINE OF THE SIPHON RECORDER

John Gott, chief electrician of the Commercial Cable Company since its organization in 1884, is the man who gets the credit for the solution. By his device, which he calls a battery reverser, the circuits that bring power to the transatlantic cables are so arranged that a message can be sent in the usual dot and dash signals on a Morse key and read on a Morse sounder. No change in the voltage is necessary. Neither is there any difference in the actual use of the current which operates the present siphon recorder. The adoption of this invention holds out great possibilities for the increased flexibility of telegraph service. It allows for the linking together of land lines and cables, in series or alternately.

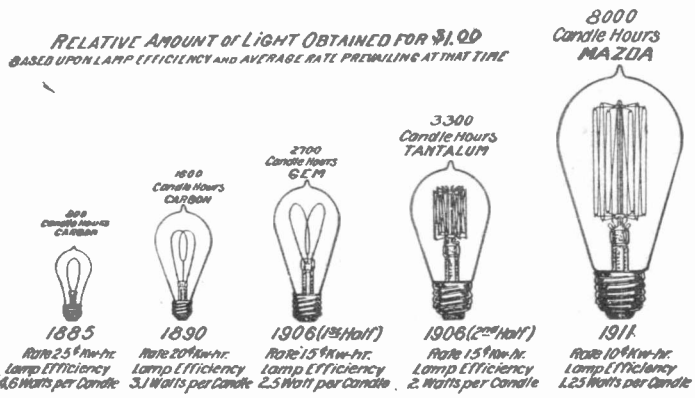
The details of Mr. Gott's device for rearranging the circuits have not been given great publicity yet. The Commercial Cable Company believes in it though to the extent of taking out patents for it in every country in the world and in a recent report said:

"This invention surpasses anything that has been added to the submarine cables since Sir William Thomson and Cromwell Varley first made the practical operation of long distance submarine cable possible 55 years ago."

That means that John Gott takes an enviable place among the very small group of men who have improved submarine cable transmission. He ranks now with the late Charles Cuttriss, inventor of the vibrator and the late T. J. Wilmot, who with Cuttriss invented the automatic transmitters. There is more honor for him in comparison with the long list of men who have failed. Even Thomas Edison came to grief in his attempt to send the Morse code by cable. He experimented with a 1,000 mile cable coiled in a huge tank. The dots and dashes were to be transcribed on a paper tape and he was confident that it would work. At the first dot that he signaled, the tape began to unroll. The inked impression of that "dot" was just 28 feet long. He didn't try to send a dash. It remained for John Gott to conquer the obstacles of a current working slowly through the cable on the ocean floor.

Cost of Electric Light Going Down

While the price of almost every commodity has been steadily climbing, that of light has gone down. This is especially true of light produced by the incandescent lamp. In 1885, $1.00 would purchase 1,600 candle hours of light so produced. In 1906, by treatment in the electric furnace, a further advance in the efficiency of the carbon filaments was obtained enabling one to purchase 2,700 candle hours for a dollar. In the same year carbon filaments began to give way to those of tantalum, thus increasing the light purpurchasing power of $1.00 to 3,300 candle hours. To-day we can buy for $1.00, 8,000 candle hours of light generated by the drawn tungsten filament lamp. It is an interesting fact that light from the ordinary candle as sold to-day for 25 cents per dozen, costs approximately 2/10 cent per candle hour, while an equal amount of light from a tungsten filament incandescent lamp, with power at ten cents per kilowatt hour, costs approximately 1/100 cent, or, in other words, lighting by candle costs 20 times as much as lighting by electricity.



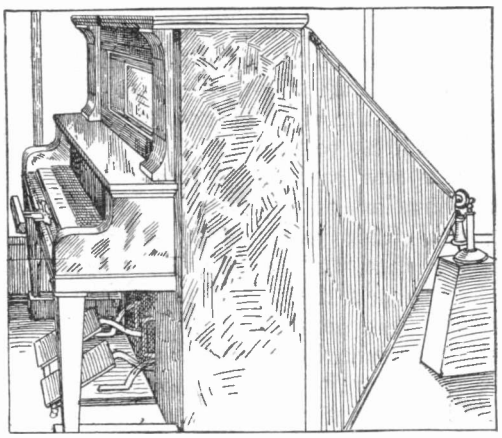
COMPARISON OF ELECTRIC LIGHTING COSTS BETWEEN 1885 AND 1911

Player-Piano Furnishes Music by Telephone

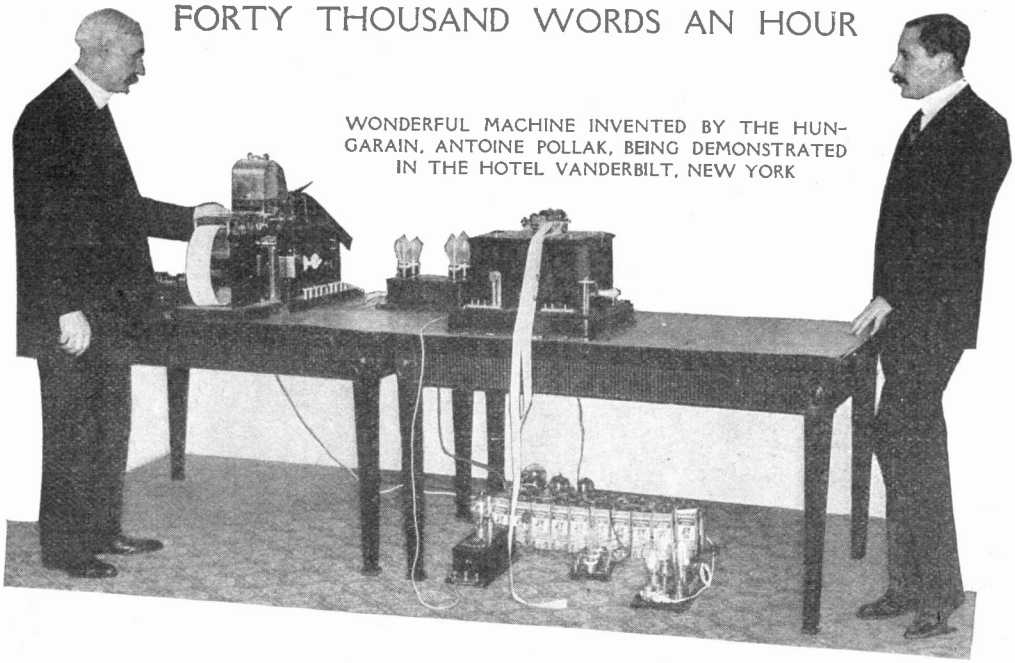
A brand new idea for transmitting piano music over the telephone and also an excellent advertising scheme was put into operation recently by J. E. Butler, of the Butler Music Company, Marion, Ind.

A large box board funnel was attached to the rear of a player-piano with the small end connecting with the transmitter of a telephone. At first the arrangement attracted a crowd to the window in which it was located but later the company began to receive telephone calls from persons anxious to hear the music and the result is that the telephone and piano are in service from early morning until late at night.

Mr. Butler said: "The telephone manager here was pleased to connect an extra line for our use for the advertising he received from the plan. We advertised in the papers that through the courtesy of the telephone company we had a telephone connected to one of our high grade player-pianos and would be pleased to have anyone call over the special line and hear their favorite selection. Two or three evenings we have one of our men here and the telephone girl calls up party lines to have them listen.


METHOD OF DIRECTING THE SOUND WAVES INTO THE TRANSMITTER

FORTY THOUSAND WORDS AN HOUR



WONDERFUL MACHINE INVENTED BY THE HUNGARAIN, ANTOINE POLLAK, BEING DEMONSTRATED IN THE HOTEL VANDERBILT, NEW YORK

Antoine Pollak, a Hungarian, is the inventor of a machine that will telegraph 40,000 words an hour. Associated with him during ten years of labor to bring the machine to a success was the late Joseph Virag, a fellow countryman. Virag lived to see the accomplishment of his part of the plan in the completed machine, but not the recognition of its merits. These have been marked by the conferring upon Pollak of the Wahrmann Foundation Prize of 2,000 francs by the Hungarian Academy of Sciences in Budapest and by the grant of the French Government to the inventor of the right to use its telephone wires for his tests.

This new rapid telegraph system is a combination of electricity and photography. The machine is many times larger than the usual equipment of a telegrapher's desk, but its operation is much less complicated. In fact an operator who is far from being an expert can develop amazing speed.

There are three parts to the Pollak-Virag station outfit. First comes the perforating machine. This is equipped with a universal keyboard similar to that of a typewriter. The message is "typed" off on this, but instead of the letters being recorded, a roll of paper like that in a stock-ticker receives various perforations for each one, a combination of openwork dots and dashes. This machine is separate from the rest and therefore in the case of a long message it would be possible to have several operators at work simultaneously preparing portions of it. This tape is then placed in the automatic transmitter, feeding from a cylinder, and the perforations cause current impulses of varying strength to pass over the wires.

The most wonderful part of the machine is the receiver. Here it is that photography aided by electricity plays its part in the final stage of the message. The electric currents pulsing over the wires act on membranes which in turn react on a small mirror. In this mirror is reflected the light from an electric lamp. The mirror intensifies this to a single spot and projects it on a band of photographic paper 2¾ inches wide which passes steadily through the light

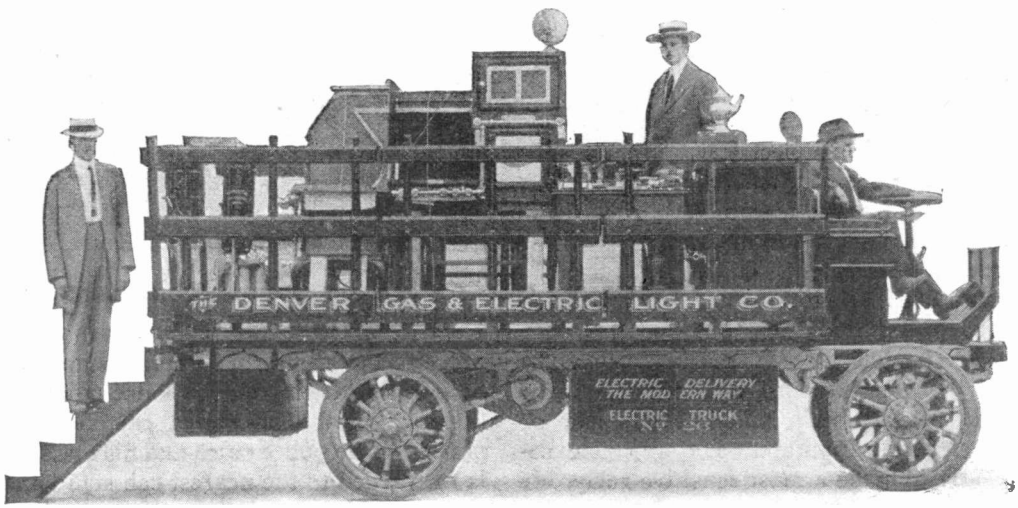
spot as the message comes in. The mirror rests on a fixed point and the membranes give it both a vertical and horizontal motion so that the spotlight plays back and forth and up and down as the electrical impulses direct. By combining these two motions, the light becomes a veritable pencil, writing in Latin characters on the sensitized strip the words of the original message.

The paper then passes, still automatically, into a developing and fixing bath, and emerges with the message standing out clear and distinct as though written in India ink with a firm hand. Were a copy not needed for office record, this slip might be delivered at once without further trouble. Note how much of that valuable commodity, time, has been conserved.

This photo-electric telegrapher has just been brought to the United States for demonstration. In its first test here, before an audience of newspaper and magazine men, Mr. Pollak sent several messages through to completion. One of them containing 225 words took only 19 seconds to pass through all the processes in the transmitter and receiver and appear again in writing. It is the inventor's hope to secure a hearing from the United States government and also from the telegraph and telephone companies. For the transmission of long messages of official import or for newspaper service the Pollak-Virag system would be invaluable. In fact, France has already seen the possibilities and has given the inventor every chance to prove the worth of the device.

A Traveling Show Room

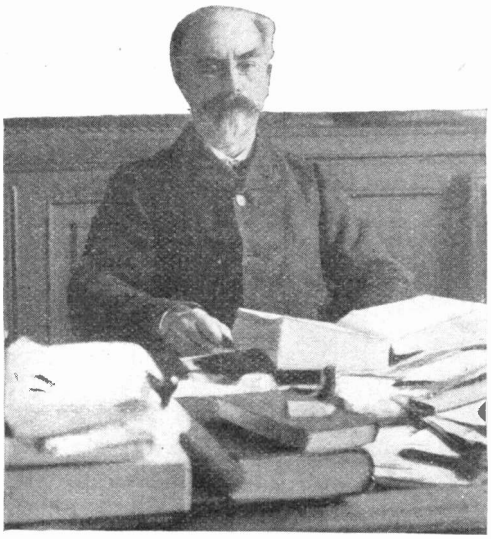
The accompanying picture shows a demonstration electric truck in the service of the Denver Gas and Electric Company of Denver, Colo. This truck carries a complete equipment of electrical devices that are adaptable to household utility. The truck with its salesmen passes through the residence sections where the men make house to house demonstration of various electrical heating, cooking and motor equipments. It creates a great deal of public interest by its daily work and is a means not only of educating the public to the advantages of electric household utensils, but also gradually adds a central station day load by the sale of current consuming apparatus.



A SHOW ROOM ON WHEELS, USED IN DENVER

Professor Lippmann of the Sorbonne

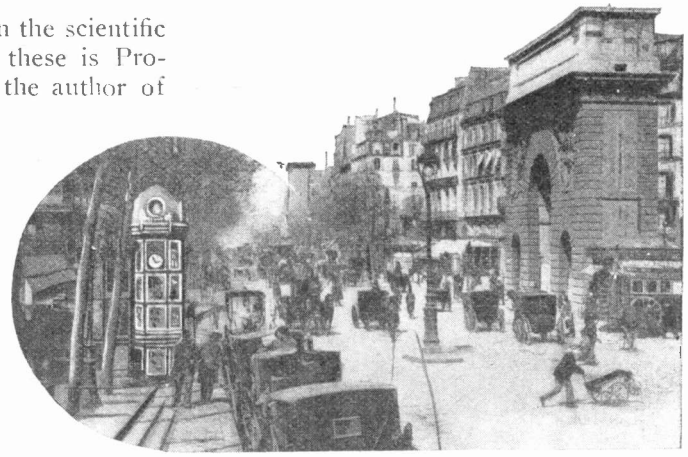
The central institution of the Paris University, the Sorbonne, owes much of its prestige to its professors, many of whom are leading figures in the scientific world. Prominent among these is Professor Lippmann. He is the author of many brilliant discoveries in the electrical and also in other branches of the physical field. His best known work is in the domain of color photography in which he was a pioneer, but not less interesting are his electrical investigations. For instance, his electro-capillary instrument for electric measurement is a marvel of scientific skill. In recognition of his work he has already carried off nearly all the honors which it is possible for a scientist to obtain and is a member of the French Institute. He was able recently to make a most sensitive relay. He finds what was not known before, that simply using a moistened contact for the current will allow the making of an electric contact with a very much weaker current than usual, so that signals can now be given with a very minute current. This idea may prove very valuable in the future.



PROFESSOR LIPPMANN

Calling a Cab in Paris

Parisians call up a cab in a very convenient way, owing to a system which has lately been organized by the city department. Along the boulevards and main streets are stationed small kiosks. One is shown on the left side of the picture taken in Boulevard St. Martin. These kiosks have been in use for many years past and serve several purposes: first, as a station for a police officer who is on guard at this point; then as a center of a cab stand, so that the cabs are under the surveillance of the policeman. All the kiosks carry pneumatic clocks which connect with the underground compressed air pipes and these clocks are quite a convenience. The kiosks are made still more useful by being connected by wires with the central police office. If a person wishes to call a cab, he telephones to the police office and his message is forwarded to the nearest cab stand and the guard at the kiosk notifies a cab to proceed to the given point.



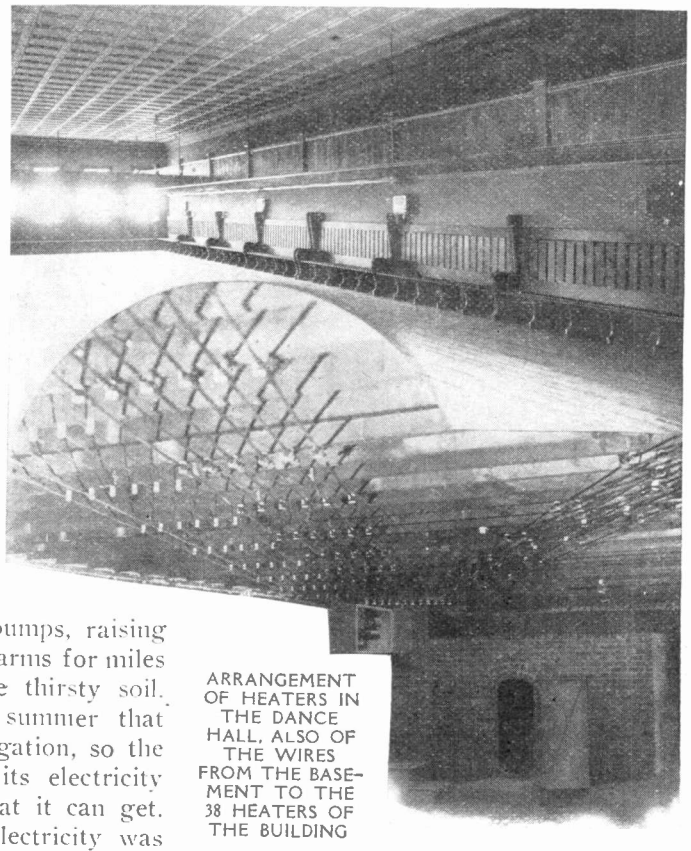
TELEPHONE CALLS FOR CABS ARE SENT THROUGH THE POLICE STATION TO THE NEAREST KIOSK

Business Block Electrically Heated

Twin Falls, Idaho, has, it is said, the largest business block ever heated entirely by electricity. It was planned so to heat the building in view of the low rate quoted during the winter by the Twin Falls Water Power Company. This company generates 20,000 electrical horse power from the Great Shoshone Falls on the Snake River four miles from the town. During the summer months this power is utilized to run pumps, raising water from deep wells on farms for miles around and irrigating the thirsty soil.

It is only during the summer that power is required for irrigation, so the company is glad to sell its electricity during the winter for what it can get. This is the reason that electricity was chosen for heating the Rice-Smith Building. The rate agreed upon in the heating contract was less than one eighth cent per kilowatt-hour.

The heating installation consists of 38 independent heating elements placed at intervals through the building. These heaters take electricity to the extent of 100 kilowatts or about 130 horsepower.



ARRANGEMENT OF HEATERS IN THE DANCE HALL, ALSO OF THE WIRES FROM THE BASEMENT TO THE 38 HEATERS OF THE BUILDING

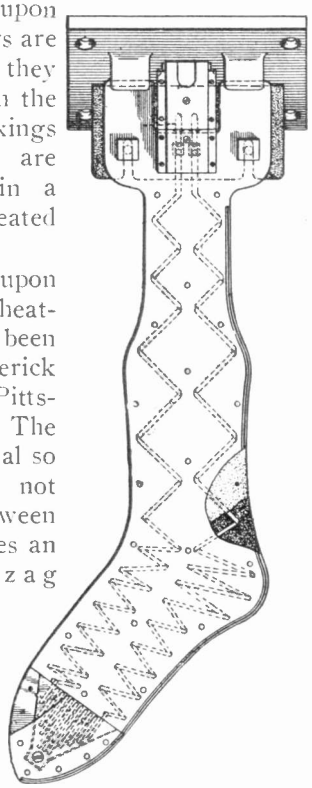
The building contains, besides offices and stores, a large dance hall. It was opened for a New Year's dance before the windows were all in place. The thermometer had registered ten above zero for days before and the entire building was thoroughly chilled when the electric heaters were turned on, but the temparature was sufficiently high for comfort.

American Time Signals the Best

English men of science freely admit that the system of telegraphic time signals adopted at the Naval Observatory in Washington is much to be preferred to that in use at Greenwich for supplying Great Britain with standard time. At Greenwich a single signal is sent out at noon, whereas at Washington a series of signals is used, beginning five minutes before noon. During these five minutes every tick of the observatory clock is electrically transmitted, except the 29th second of each minute, the last five seconds of the first four minutes, and the last ten seconds of the fifth minute. After this final ten seconds' break the noon signal is given. In this manner the middle of each minute is clearly indicated, and yet more clearly the instant of noon. The length of the series facilitates the regulation of clocks.

Electrically Heated Hosiery Form

Up to the present time it has been the practice of hosiery manufactures to use wooden forms upon which stockings are drawn after they come wet from the dyes. The stockings on the forms are then placed in a drying box heated by steam.



ELECTRICALLY HEATED HOSIERY FORM

A patent upon an electrically heated form has been issued to Frederick M. Vogel, Pittsfield, Mass. The form is of metal so that dyes do not stain it. Between the metal plates an insulated zigzag heating conductor is placed. At the heel and toe the unit is arranged to give off the most heat. More rapid work at a lower cost is expected by the use of this device.

A Monkey's Escapade

A newspaper of Durban, South Africa, relates the following incident which occured in the Durban corporation electric power station.

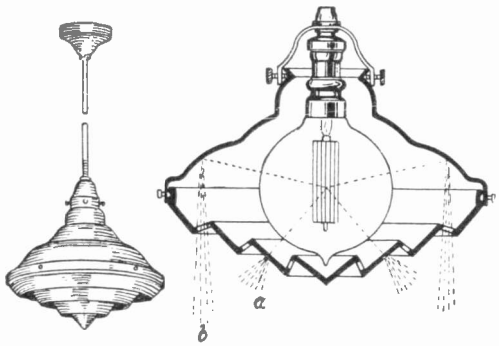
"The electric power station staff received a fright on Monday night, when a pet monkey, finding that he was not appreciated at home, looked in and tendered his services to the engineer-in-charge, but got a greater fright still—at least, the staff hope he did.

"It seems that Jacko, on entering the building, took his appointment for granted and set off on a tour of inspection of the machinery. Fearful lest his lack of technical skill would result in trouble, the men in the station gave chase. There was an exciting five minutes and the new hand, not appreciating the attention paid him, took refuge in the recesses of some high tension electrical switch-gear compartments and—vanished in a column of smoke, doing the disappearing trick even more effectively than ever Nicola managed it.

"It was only by the greatest of good luck that the holocaust did not cause an interruption in the electrical supply of the town, and the staff in their gratitude, gave the remains a solemn burial, and the site of the grave will be pointed out to the monkey's owner if he cares to call at the power station."

The New Indra Electric Light Fitting

The new Indra electric light fitting is claimed to give a brilliant light without eye strain by the use of a new principle of scientific distribution with no loss of light. It is a combination of a specially designed upper reflector and a lower stepped plate or distributor. The upper reflector is of opal glass or it can be of aluminium, where all the light is wanted below. The lower plate is made up of parts of clear and frosted glass, most of the light being reflected through the clear glass rings while the source of light cannot be seen.

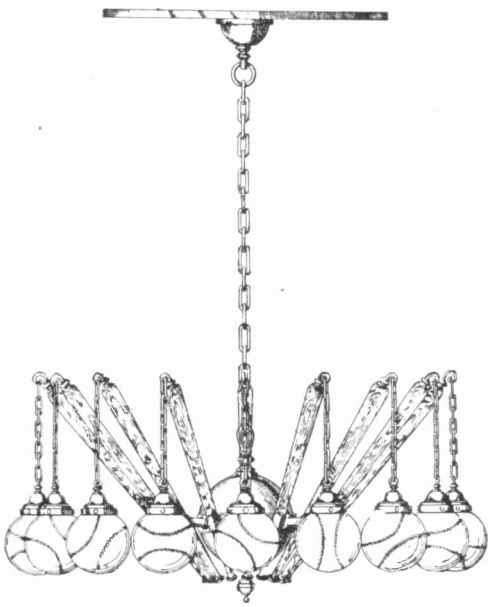


LIGHT FITTING EMBODYING A NEW PRINCIPLE OF DISTRIBUTION

As is well known, most of the rays from metallic filament lamps go out at right angles to the filament and these rays strike the reflector and are sent down through the clear glass parts (b). The rays (a) strike the lower part direct, and go through the frosted parts, thus being diffused. In this way a brilliant light is given without causing a strain on the eye such as a bare lamp would give and practically all the light is thrown downward. Tests show that this light is much greater than that from an ordinary lamp and reflector.

Electrolier for Ball Park Entrance

The entrance to Ebbets Field, the home of the Brooklyn Ball Club, is to be illuminated by an appropriate electric



BASEBALL ELECTROLIER

light fixture which will hang from the ceiling in the center of the rotunda. The fixture is supported by heavy brass links from the ceiling and each light globe, of which there are sixteen, is suspended from the end of a baseball bat. The bats are of sheet brass and are constructed in all details to match the size of the bats used by the National League. The globes enclosing tungsten lamps are of opal glass decorated with seams and stitches to conform to the appearance of the standard baseball. The entire fixture weighs 400 pounds.

Warming Pad for Brooding Chickens

The use of electrical apparatus is becoming more and more general every day. Not so much because the electrician is finding new work that it can do, but rather because the consumer is coming to the electrician with such demands as this: "Mr. Grout, I am tired of that oil lamp in my brooder. I want you to put an electric one in for me."

"Mr. Jones, if I put an electric lamp in that brooder and you get some cloth against it, you will have a fire or else it will get so hot that it will cook those chickens before they are really old enough to fry."

"Grout, I want to use electricity in that brooder; it's up to you to tell me how to do it. You usually find some way to fix my electrical wiring so that it suits me."

Grout, thinking aloud. "If I wind a coil and put it in there, it will cost a lot and then it may not give just the right amount of heat without a lot of experimenting. Mr. Jones, why don't you try one of these small electric heating pads. Here is one that is called an electric hot water bottle. It has a thermostat in it, preventing overheating, and it sells for $2.25."

"That's just what I want. I can put that in myself. I'll put it right inside the brooder with some cloth between it and the chickens, the cloth low enough to just touch the backs of the chickens."

Jones has used that heating pad for two years and it has not cost him as much to run it as did the oil lamp, he told me when he came in yesterday to get another pad to put in a second brooder that he will use this year.—ROBERT C. GROUT.

TO HELP THE THE TRACK

WARM CURRENTS FLOW TOWARD THE ICEBERG

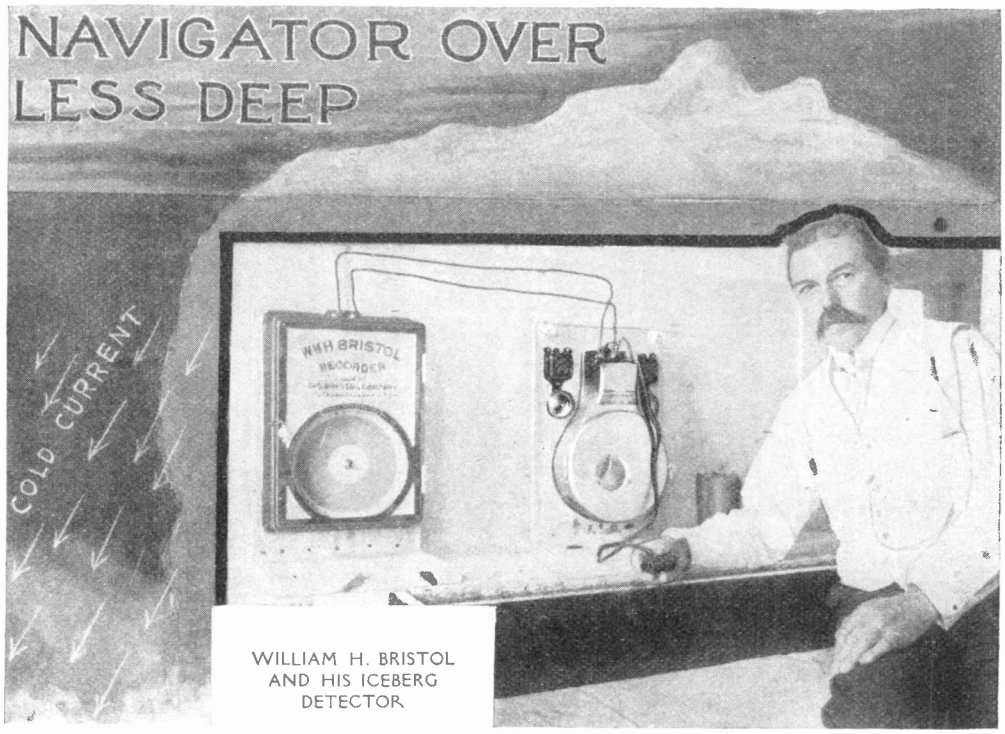
By ROBERT G. SKERRETT

Professor Howard T. Barnes has shown that icebergs affect the temperature of the surrounding sea for miles away. He has proved conclusively that an iceberg actually seems to warm the surface water rather than to chill it, as seafarers have imagined heretofore. This is rather astounding but the reasons for it are simple. The frigid body sets up currents which sink into the ocean and thereby induce other and surface currents which bring toward the ice the warmer waters.

Now comes Professor William H. Bristol with an apparatus by which the navigator may have these temperature changes given to him automatically so far as they mark the approach to menacing ice and his cunning device is designed to do this in a number of ways, so that the man on the bridge cannot escape the warning signals. This is a far better method than the custom hitherto prevailing of dipping up a bucketful of surface water from time to time and leaving the temperature taking more often than otherwise to a deckhand.

Professor Bristol's instrument is an exceedingly cunning adaptation of what is known to physicists as the thermo-electric couple. This, in short, is fundamentally but two wires of dissimilar metals joined together at one end and open like a hairpin at the other. To the latter is connected the wiring of an electric circuit. A current of electricity is induced merely by heating or suddenly chilling the point of juncture of the two unlike metals. Of course, the current of the thermo-electric couple is a weak one, but this can be considerably increased by combining a number of couples. An arrangement of this sort is termed a thermopile and it is this that Professor Bristol places in contact with the sea water. This current continues to flow until the entire thermopile has acquired the same temperature, when it ceases and is not again induced until affected by a sudden change of temperature. To increase this interval of operation, the remoter ends of the couples are insulated and during this period of "lag" the bells and the lights give warning. It is possible to so adjust this "lag" that it will suit the speed of the ship and so make the duration of the alarm signals a fitting one.

The electric current produced by the thermopile is a comparatively weak one, but it is strong enough to operate certain switches in the chart house and these in their turn make and break the circuit of a strong local relay. This relay actuates a recording pen, the flashlights and alarm bells. The thermopile

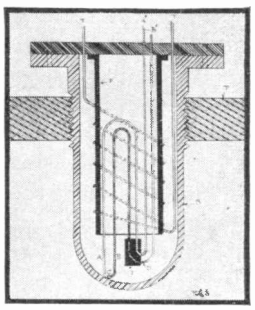


WILLIAM H. BRISTOL AND HIS ICEBERG DETECTOR

merely serves to take the message from the sea—the relay executes it, as it were.

If the thermopile in contact with the sea water be chilled suddenly, the induced current flows in one direction; if warmed abruptly the current flows oppositely. In this manner are obtained the effects of a positive and negative current and the different audible and visible signals are called into service while the hills and valleys are traced as a curve upon the smoked dial by the recording pen. The wide swing of the curve on the dial is the guide for the navigator. The dial revolves with the hours of the clock. The navigator interprets these records in combination with his geographical position and the known normal conditions of the sea at the particular season in question.

The bell signals and the flashlights are distinctive. One bell is high pitched and the other low. One light is red and the other is green. The shrill bell sounds and the red light flashes simultaneously when the temperature change means danger, and the other signals operate when the condition is the contrary. The admirable feature of the apparatus is that the navigator can be called to heed in a manner which is sure to reach him. He need not bother about watching the recording dial.



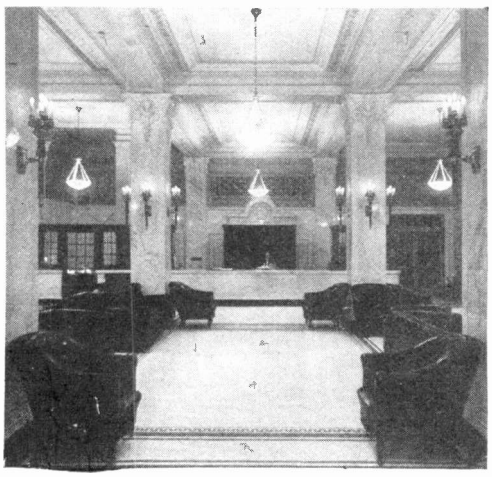
THE THERMO-COUPLE

What the seafarer needs is a reliable instrument that he knows is always in working order. Professor Bristol places about his tell-tale thermopile a little coil of wire which can be heated by a separate current controlled from the bridge by a push button. This heat is sufficient to excite the apparatus when it is in working order and to cause the proper signals to be given. This test can be made at any moment, and assures the navigator that the detector is on duty.

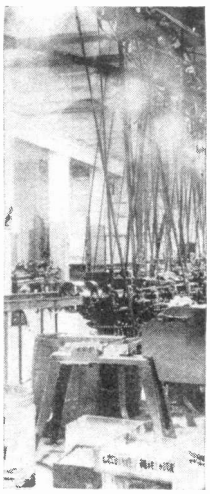
Intelligent Use of Artificial Light

By L. C. PORTER

INDIRECT LIGHTING



SEMI-INDIRECT LIGHTING



DIRECT LIGHTING

Vision is one of the most valuable of our senses, and the most delicate, the eye being in fact a part of the brain itself, yet, strange as it may seem, the eye has been one of the last organs to be given scientific help in this age of engineering. Long ago rules were enforced in our factories regarding the employees' safety. Artificial illumination, however, was allowed to be furnished in any haphazard way or amount. This condition of affairs is now under investigation and much is being done to remedy it.

Considerable prejudice has to be overcome because lighting has been neglected for so long that those in authority do not always see the necessity for a change. It is a more or less common belief that electric light is "hard on the eyes." For this reason many people prefer an oil lamp for reading, rather than the intense light of an electric lamp. The electric lamp, however, giving a light more nearly aproaching daylight, may be more beneficial to the eye than the light from the yellow flame of an oil lamp, provided the electric light is properly applied.

In many houses electrically lighted there are no portable electric lamps. The existing fixtures are placed in positions requiring the least trouble and expense to the builder, regardless of the use to which the lamps are to be put, resulting in considerable glare. With the older illuminants, such as oil or the open flame gas, the intrinsic brilliancy or candlepower per square inch of light emitting surface is so low that when allowed to shine directly in one's eyes the liability to permanent injury is small. On the other hand the modern incandescent lamp is so bright that if it is not properly shaded it may cause considerable discomfort.

If a bright light is directly in the line of vision of a reader the pupil of his eye will grow very small, shutting out considerable of this bright light. When he looks at the print of a book which is nowhere near as bright as the light itself, the eye is strained in trying to decipher the relatively dim print, often producing headache and other accompanying disorders. It is perfectly possible to see

more clearly with an eight than with a 32 candlepower lamp, provided the former is properly shaded and the latter is not. To demonstrate this, place a 32 candlepower, clear globe lamp between your eyes and a book, move away until you determine the greatest distance at which you can read the print. Then replace the 32 candlepower with an eight candlepower lamp having an opaque shade back of it to keep the light out of your eyes, but throwing it on the book. Note how much farther away you can stand and still read the print. When you have again determined the maximum distance at which the print is legible, keep your eyes on the print while some one quickly removes the shade from the eight candlepower lamp, and notice how quickly the print becomes blurred.

There are, to-day, many shades and reflectors on the market for various illuminants. Some of these obtain primarily, efficiency, delivering the maximum amount of light where it is most needed; some produce artistic effects, little attention being paid to efficiency. The great majority, however, come between these two extremes. They redirect the light generated so as to place it where it will be of greatest service and at the same time shade the light to reduce glare.

The improvement obtained by the application of the proper reflector is easily demonstrated: Hang up a bare sixteen candlepower lamp, three feet above an object to be viewed; beside it, but separated from it by a piece of black cloth, hang a similar light equipped with the proper reflector; and the difference in illumination of the object is very noticeable.

The question of what is the proper reflector is one which is answered largely by the conditions to be met. There are many reflectors made for various uses; some throw the light out over large areas. Such are said to have an extensive distribution, and are used for lighting large rooms with low ceilings. Others spread the light over a smaller area, and are called "intensive." These are used for places having a fairly high ceiling. The third type, known as "focusing," throws a very strong light over a small area and is used for such work as lighting store windows, etc. Even after the type of reflector for a certain purpose has been determined, there are various ways in which it may be applied. The location, type, etc., of the lighting units, i. e., lamp and reflector, can be varied to a large extent, thus producing different systems of lighting.

The use of lamps overhead, either bare or equipped with reflectors which throw the light directly down, is called "direct illumination." If, on the other hand, as is not infrequently done, the reflectors are inverted so as to throw the light up on the ceiling, which in turn, reflects it down, we have what is known as the "indirect." If, however, translucent reflectors are used, so that some of the light is thrown up and some comes directly down through the reflector, we have what is known as the "semi-indirect" system. The advantage of either the indirect or semi-indirect method is that the light, by striking the relatively rough ceiling, is broken up and thoroughly diffused, thus tending to eliminate sharp shadows and to produce soft, even illumination. Probably the semi-indirect fixture lends itself more readily to artistic designs.

After the question of eliminating glare and placing the light where it is needed is taken care of, the question of efficiency is to be considered. An illuminant will generate a definite total flux or amount of light. Under certain conditions a large percentage of this flux may be available for use. Under others, it may be wasted. If, for example, we have a light in a room having light colored walls and ceiling, much more of the light will be reflected onto the table tops where it is to be used, than will be the case if the walls and ceiling are dark. For this reason indirect and semi-indirect methods are not good where the walls and ceiling

are dark. In some instances redecorating will increase the effective illumination considerably, thus raising the efficiency of the lighting system.

It is evident that after the proper amount of light and method of application has been determined, the choice of illuminating apparatus which will produce these results at the lowest cost is of great importance. The lighting companies, recognizing that the better satisfaction their illuminant gives the greater will be the demand for it, maintain engineering departments for the use of their customers. Tell your lighting company of your conditions and they will be glad to make you a gratis recommendation as to the type of lighting that will best meet your requirements. It also frequently happens that they will sell reflectors for their lamps at nearly cost.

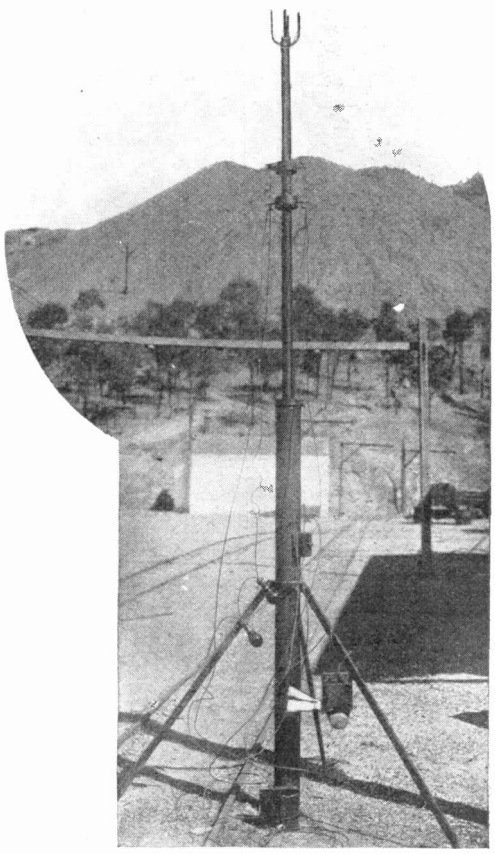
The direction from which light comes plays a large part in the appearance of the object lighted. Many beautiful pieces of architecture when lighted from above lose their design entirely when the light comes from below. This is largely due to the changing of the shadows. A striking demonstration of this is easily made: Place a plaster cast or other object having other than a flat surface in a booth made of black cloth; by lighting it with a lamp held first on one side, then on the other, then above and then below, a remarkable change in its appearance will be brought about. Architects are beginning to realize these facts and so to design their friezes and so to arrange their lighting, that their work will appear equally well either by daylight or under artificial illumination at night.

Electric Flatiron Protects Automobile Engine

A recent English electrical paper reports that an ordinary electric flatiron was called into playing a new rôle by the resourcefulness of an automobile driver. Being obliged to leave his car in an unheated garage over night with the radiator and the cooling system of the car full of water during a spell of cold weather, the driver connected the electric flatiron to the lighting circuit and placed it under the car bonnet, where it served to protect the engine from freezing of the water.

Mine Alarm

The four prongs at the top of the metal tripod are placed in contact with the mine roof which is in danger of falling. Any movement of the roof, after the device is set, presses the prongs and closes two pairs of contacts attached to the two cylinders near the top, causing lamps to glow and bells to ring as a warning.



ALARM WHICH TELLS WHEN A MINE ROOF IS SETTLING

Facial Expression Produced by Electrical Excitation

Underneath the skin of the face lie the muscles, the contraction of which causes the different facial expressions. The emotions, such as anger, hate and joy, affect these muscles and cause them to contract and expand. In fact, each strong emotion has its own particular muscle. For example, the superciliary muscle influenced by pain will contract and draw the eyebrows inward and upward, giving the face a look of sorrow, so it is called the muscle of pain. So, also, we have the muscle of laughter, of weeping bitterly, of lasciviousness, etc. Mingled emotions, of course, affect two or more muscles.

FIG. 1. EFFECT OF CONTRACTING THE "MUSCLE OF LAUGHTER"

These facts were not always so clearly understood by artists and anatomists. Duchenne helped to make an exact science out of this imperfectly understood subject. He was the first man to approach it in a really scientific manner.

Wishing to note and photograph the effect or facial expression resulting from the contraction of each muscle *singly* he was at first at a loss for a subject to experiment upon. He knew that by placing two electric needles on the course of a muscle he could make it contract. Yet this operation was so painful to the subject as to render it obviously impossible. He next experimented on the dead body of an executed criminal a short time after death. This proved unsatisfactory. At last Duchenne had the good fortune to discover the ideal subject for his purpose in the person of an old pensioner who had anæsthesia of the face, the skin of which was insensible to the most painful excitation. Electricity could be applied to the skin without any manifest pain, yet causing the muscle beneath to contract as desired. To quote from Dural's artistic anatomy—"He could, therefore, cause this or that muscle to contract alone and could excite, for example, the great zygomatic, giving to the face the expression of laughter without the subject having any idea of what his physiognomy reflected; his face by the action of the electricity was laughing while his thoughts might be indifferent or fixed on sad recollections; on the other hand, for example, by the contraction of the superciliary muscle his countenance might express the most acute pain while his thoughts might be borne away by gay and pleasant ideas." Duchenne's work, illustrated by his remarkable photographs, was adopted by the French School of Fine Arts as a part of its course in anatomy.

The two pen sketches were drawn from reproductions of Duchenne's photographs of the old pensioner. Fig. 1 shows the effect of contracting the great zygomatic muscle (muscle of laughter), which is attached to the cheek bone and extends downward and is inserted near the angle of the mouth.

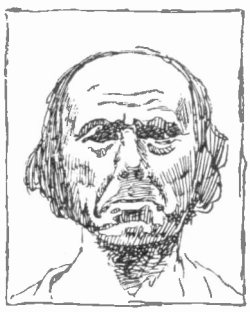


FIG. 2. EFFECT OF CONTRACTING THE "MUSCLE OF CONTEMPT"

Fig. 2 shows the effect of contracting the triangular muscle of the lips—the muscle of contempt.

A possible cause of the breakage of incandescent lamp filaments in either inside or outside automobile lamps is looseness of the bulbs in their sockets which allows them to rattle about with every vibration of the car without interrupting the flow of current.

Friends in Time of Need

"After trudging a mile and a half over the wreckage we reached the power house at eight o'clock. There wasn't a soul in sight, and everything was covered with mud. Mud, mud, mud and slime a foot thick was over the generators, the switchboards, the motors, the engines, and a line of dirt showed where the water had reached the operating room thirteen feet above the floor level.

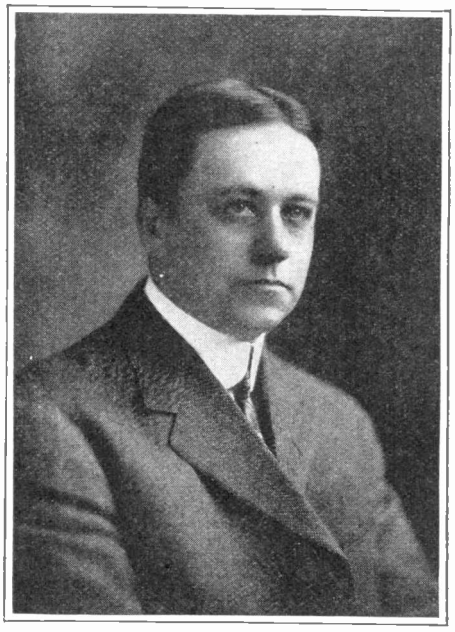
"High up on the main steam line extended a walkway, and there, the only living thing in sight, perched a dog.

"Onions! The place was filled with them. They were thicker in the mud than raisins in a raisin cake. Twelve feet above the floor on a generator frame there were two crates full of sprouting red onions while the whole top of the switchboard was lined with them. The dog was chewing one when we arrived and from that we named him Onions.

"But the place was an awful sight—sickening and discouraging. The mud nearly reached our knees and in some places water still stood a foot deep on the floor. After a good look at the boiler room, still filled with water, we got out to hunt our friends, so we could start the task of clearing the wreckage and muck and get things going. This was no small task, and it took nearly 30 hours before the work of drying out could be started."

In these words, John W. Lieb, Jr., vice-president of the New York Edison Company described the generating plant of the Dayton Power and Light Company as he found it the day after the water had receded from the streets of the city. He, with Samuel G. Rhodes, superintendent of arc lighting in New York, had rushed to Dayton at the first word of the danger to the local lighting company, and in the work of reconstruction that started at once they played prominent parts in the emergency organization.

Almost as difficult as the task of rebuilding the plant was their trip across Ohio into Dayton, for they were held up by wrecked railroads, military rules, and roads that were almost impassable. It took 24 hours to make the 200 mile trip

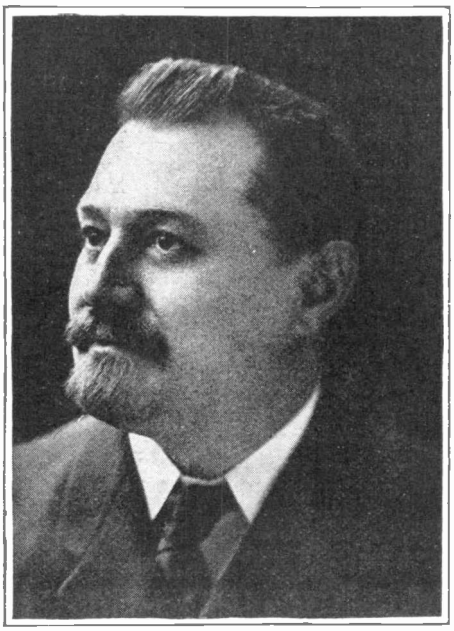


FRANK M. TAIT, PRESIDENT OF THE DAYTON POWER AND LIGHT COMPANY

from Cleveland, and part of the way they rode beside the boiler of a lurching locomotive, part of the way in a one-car special, part of the way on foot, 20 miles or so by automobile, and they finished the journey on a troop train, on the first morning that the streets of Dayton had been free of water. Then began their tramp across the town to the power plant.

Within an hour after the arrival of the New York men, the employees of the Dayton company began to assemble for the task they knew confronted them. They had come without being called and the only reason they had not assembled sooner was the fact that most of them had been marooned in their homes. This had been the fate of their president,

Frank M. Tait, who for two days had been a prisoner on the second floor of his home. Grave fears had been felt by all those connected with the electrical industry for his safety, for he is known throughout the country and is the president of the National Electric Light



JOHN W. LIEB, JR., VICE PRESIDENT OF THE NEW YORK EDISON COMPANY, WHO HEADED THE EASTERN CONTINGENT OF THE EMERGENCY ENGINEERING FORCE THAT WAS RUSHED TO THE AID OF STRICKEN DAYTON

Association. With these men came others who had been prisoners in the plant while the water covered everything. They told of having kept alive on the fruit that floated in from a neighboring market and the rain they had caught in their hats. They had been freed that morning and had only been home long enough to make sure their families were safe.

The task was started at once but it was soon found that it was more than the men of Dayton could handle alone and a call was sent to Chicago and New York for help. Eight men responded from Chicago. They arrived the next morning (Saturday) in charge of John C. Manley, and on Monday sixteen men from New York had augmented the emergency force.

Every effort was concentrated on the Fourth Street plant where the equipment consisted of a 1750 kilowatt and a 2250 kilowatt Allis-Chalmers steam turbine, an 800 kilowatt direct current generator and a duplex compound drive engine operating two 200 kilowatt generators. This small machine was tackled first because it could be repaired most quickly. By Saturday night there was steam in the plant and the generator was placed in operation, running on short circuit to dry out its conductors.

In the meantime the street lighting men were putting every effort in the establishment of a temporary system. They found tungsten lamps in the plant storeroom, stripped a flooded warehouse of its arc lights, and secured some of their wiring and cables by ripping out building installations. The poles and street fixtures were down, but they hung their lamps on cable ways that stretched from housetop to housetop across the intersections of the busiest streets and on Sunday afternoon the current was turned into the street circuits. Fifteen lamps had been placed in the business sections and they made it possible for the relief squads to keep at the work after dark. They put an effectual stop to the ghouls too, for these robbers of the dead had already appeared in the city.

During all this work of reconstruction no word had been received as to the welfare of the electricians, except the one call for help that had been sent through Chicago. The first announcement came on April 1st in the shape of the following telegram from Mr. Lieb:

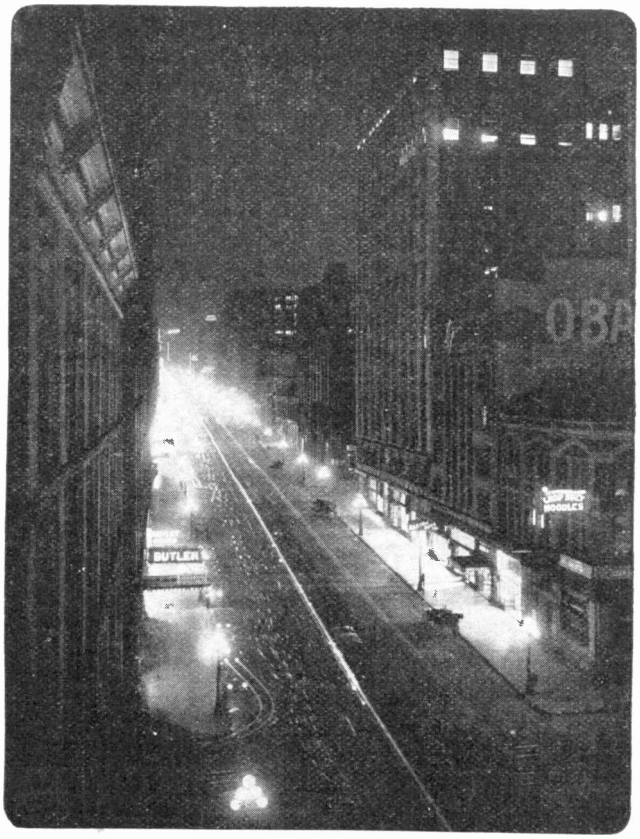
"Tait family well. Had close call. Water up to second floor of house. Were isolated two days. First engine started last night. Some street lights tonight."

A Photograph That Tells a Story

Some remarkable photographs have been taken lately of brilliantly lighted thoroughfares in the larger cities of the world. To get sharp, well defined pictures in the face of dazzling lights and all sorts of moving traffic is no insignificant task.

The accompanying reproduction of a photograph of an uptown street in Seattle has many points of interest aside from the sharply defined buildings and other objects. It embodies a complete short study of the effect of lights in a time exposure of the kind.

It will be noted at the distant end of the street the illumination is pronounced. This is caused by the full glare from the lights of automobiles and trolley cars showing squarely into the lens. The result on the print is one solid halo. The streaks of light in the foreground are made by automobiles traveling toward the camera. The heavier dots in the streak were caused by the cars slowing down in speed, thus giving the lights more time to penetrate the photographic plate. The straight line of lights was made by on-coming trolley cars. In the lower left hand corner of the picture, just beyond the second cluster light, an automobile was standing when the exposure was begun. Before it was finished the car moved off, describing a pretty semicircle, and leaving a telltale track.



A STUDY OF ELECTRIC ILLUMINATION IN PHOTOGRAPHY

Remarkable Truck Performance

The tale of one electric truck's efficiency as a carrier of coal is interesting. In one month it hauled a total of 435 tons of coal—an average of 18.3 tons a day. Its biggest day's work was the transportation of 22.1 tons.

This truck was in service 229 hours, but was engaged in hauling only 126 hours, the remainder of the period having been consumed in loading and unloading. In 119 trips it traveled a total of 1,005 miles. In a single day it covered 63 miles, making seven trips.

As the weather is likely to be at its worst when coal delivery is most needed, it is clear that the electric has proved its superiority under the most unfavorable conditions.

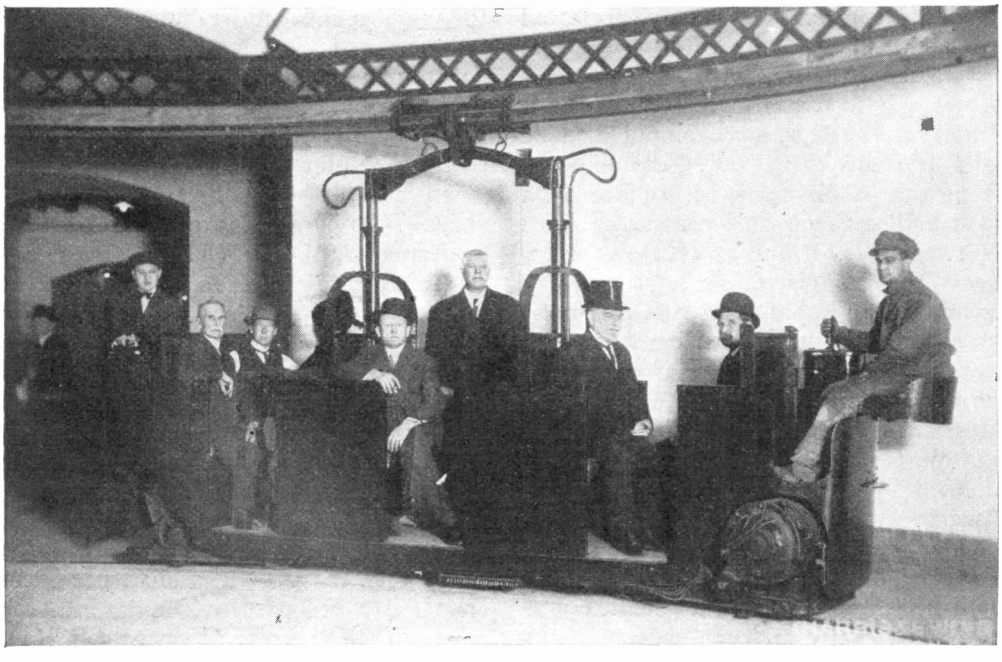
Mono-Rail System at the U. S. Capitol

The superintendent of the United States Capitol, Mr. Elliott Woods, has been puzzled ever since the completion of the Capitol subway several years ago to find a suitable system of electric transportation. There are in reality two subways, each somewhat over 700 feet in length and connecting the Capitol with the Senate and the House of Representatives Office Buildings, respectively, the one located north of the Capitol and the other south of the white domed structure.

Officials at the Capitol hoped that they had met the exceptional requirements which confronted them when they installed in the subway between the main building and the Senate annex a service by specially designed electric automobiles. These electric vehicles have given a fairly good account of themselves during the year or two they have been in operation but they were not quite as dependable as could be desired. Then Superintendent Woods hit upon the idea of the utilization of the mono-rail system.

The type of car in use on the mono-rail system is fifteen feet seven inches in length by three feet three inches in width and is of all steel construction. A wooden floor is laid on the steel framework and the seats are upholstered in red leather. The car is designed to accommodate twelve passengers in six seats of a capacity of two passengers each.

The overhead construction is secured to the ceiling of the subway and the type of the trolley equipment is the two conductor soft steel rail with sliding contact. The weight of the car being carried by wheels underneath, running on a single rail, the car is kept from tipping over by the two vertical plungers connecting with the trolley arrangement overhead. The plungers have vertical play which compensates for differences in distance between the overhead and the traction rail.



UNIQUE MONO-RAIL CAR IN THE CAPITOL SUBWAY. THE PASSENGER WITH THE SILK HAT IS SENATOR JAMES A. O'GORMAN OF NEW YORK

Protection from Lightning

To the Editor of Popular Electricity Magazine:

Through the *Literary Digest* the writer's attention has been called to the article in your February issue on the subject of "Investigating Lightning," by Mr. Waldon Fawcett.

With your permission he would like to make a further contribution on this topic and is prompted to do so for two reasons: first, because he has been interested in this subject for over 20 years; secondly, on account of the enormous fire losses which the secretary of the National Fire Protection Association of Boston, Mass., Mr. Franklin H. Wentworth, last week explained here at a banquet amounted annually to $250,000,000, of which he stated $150,000,000 could be saved. He further explained that of course all these sums must be paid by the people carrying insurance.

Many people try to protect their homes by paying from $100 to $250 or more for a system of lightning conductors and consider themselves perfectly protected because they see a wire with prongs projecting above the roof of their house. This wire is only then a fair protection when it is well connected by a continuous metallic path into the earth and there exposed by means of an enlarged surface to a good and unchangeable connection with moist earth (not sand or clay). In other cases (broken circuit or poor and dry ground, changeable with the seasons) the conductor on the roof does not prevent the electric discharge from setting fire to the house, but on the contrary invites and coaxes the lightning to do so.

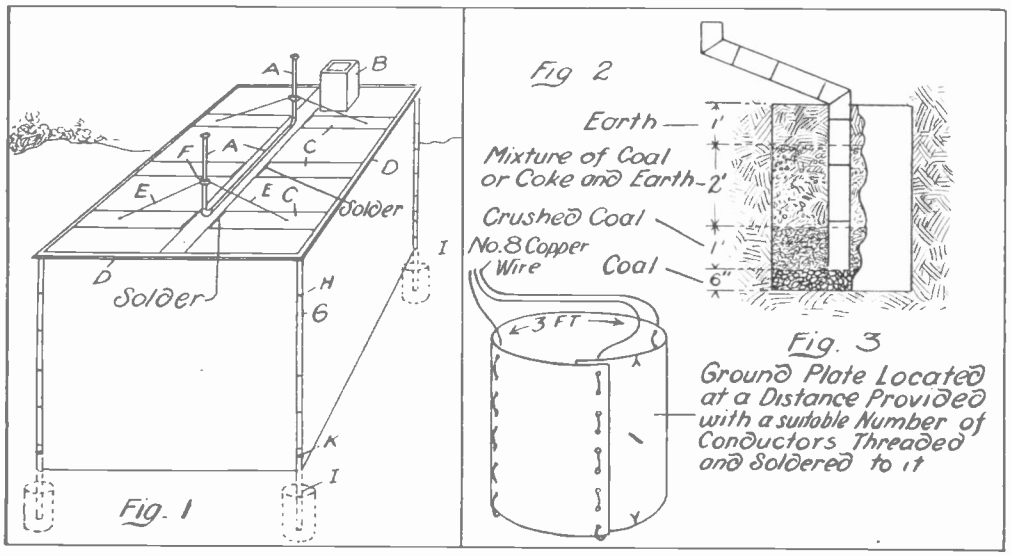
It must be admitted that a home surrounded by a conducting screen or encased in a network of wires, as Professor Henry says, will be pretty safe should a discharge of the most violent type fall upon it. However, such a complex system is too costly and not necessary. In fact a very simple system can afford great protection.

To be brief, it consists of a few strips of metal, as outlined below, and some gas pipe (unless copper strip or wire can be readily secured) in connection with the rain conductors. I will refer directly to the sketches.

Fig. 1 shows the outline of a barn in perspective. This is shown for convenience as a flat roof structure. (A) is a heavily galvanized iron pipe made of three pieces of ½ or ¾ inch gas pipe connected with L pieces to form the figure U. The upright parts should be three or four feet higher than the highest point on the roof, in this case the chimney (B). The tops of the pipes are closed by means of galvanized caps or taper plugs and after being closed are dipped, as also the L joints, into melted solder to insure a good continuous outer surface. Strips of zinc (C), heavily galvanized iron or copper from six inches to twelve inches wide are *soldered* at their extreme ends to the gutters or eaves troughs (D) and where they cross each other.

The length of the horizontal conductor (A) depends on the dimensions of the building and may terminate a yard or so from the front and rear walls. The tubing is held in position by brass, copper or heavily galvanized iron stays (E) soldered at (F) to the upright tubes (A). The braces (E) must be anchored on the strips (C) by staples or connected by soldering or both. (These strips are unnecessary if the roof is of sheet metal.)

The rain conductors for the building should be of heavy galvanized iron and soldered to the eaves troughs. Similarly section (H) should be soldered at the connecting joints. The rain conductors should extend directly into the ground, but to prevent an early rusting away it is advisable to cut the conductor off one foot above the ground and to use sheet copper for the part extending into the ground. The sheet copper tubes (I) serve as rain conductors and as ground terminal, and should extend some six



A SIMPLE AND EFFECTIVE METHOD OF LIGHTNING PROTECTION

feet into the ground. At the juncture (K) the copper tubes should be soldered to the rain conductors (G). These copper tubes (above ground) as well as the conductors on the roof should be painted or given a coat of tar, except the extreme ends or caps of conductors (A).

The dirt should be removed around the copper tubing (I) making a hole about the size of a water barrel. This space is filled with a mixture of coal, crushed coke and earth, starting with a layer of ordinary coal six or eight inches below the end of the copper pipe (I) and filling up the hole, bringing the mixture in close contact with the pipe by tamping. Where the rain carried through the conductors would affect the building it may be imperative to place them further from the house by a few feet. The self-explanatory Fig. 2 will answer for this case.

Figure 3 shows a ground plate bent from a sheet of 1/32 inch copper 1 by 3 feet with wires threaded through nail punched holes. This ground plate may be inserted in a hole as described above, with the mixture inside and surrounding it, at some distance from the house or placed in a well or some place that can be kept moist. The wires are brought from the plate and soldered to the rain conductors in such a manner that they cannot readily be damaged mechanically.

While it is fascinating to see laboratory experiments with high potential currents of 400,000 volts and over acting on insulating strata like glass, such as the writer was privileged to witness and much useful information of the action may be gathered therefrom, yet a far more striking and practical lesson may be had if perchance one visits the laboratory of "Dame Nature" which also fell to the luck of the writer.

It was in Columbus, Ohio, he believes, some fifteen years ago. He stopped at the best and newest hotel in town (name forgotten): the lobby had walls of white marble slabs, the floor white square tiling. Everything was clean, neat and substantial. On the top of the flat sheet metal covered roof was a flagpole some forty feet long, some six inches in diameter at the bottom, tapering upward and capped with a gilded ball about eight inches in diameter. The six or eight story building was of brick with a massive stone front, as far as the writer can

now remember. Shortly after dinner one day—it was a hot summer afternoon—a very severe thunderstorm broke out over the city and after it had lasted some ten to fifteen minutes an exceptionally bright lightning bolt flashed through the air followed immediately by a terrific crash of thunder. A few seconds later the top of the flagstaff, a piece four feet long, crashed to the ground. The writer, who had not felt any shock nor heard the familiar crackling noise from electric light or telephone wires frequently noticed on such occasions, ran into the street and looked to the roof of the house. The whole flagstaff was gone. He returned to the hotel and notified the manager, who had been busy in his office, of what had happened and asked the privilege of investigating with him the amount of damage done. Inspection of the rooms on the top floor disclosed no trace of lightning and no damage. Climbing to the roof it was found that the building had no lightning rod nor was it especially provided with any system of wiring for its protection. This, of course, made a closer investigation so much the more interesting.

The flagpole was provided with stays as shown in sketch (Fig. 1) and anchored on the tin roof which formed one conductor with the eaves troughs and the rain conductors which extended straight into the ground through the large slabs of the pavement—a construction of conductors entirely in accordance with the theory and experiences for rapidly discharging oscillatory currents of high frequency into the ground which was kept moist automatically by the rain from the roof.

That the full charge of the lightning bolt was received by the flagstaff and carried off without further damage to the building or its contents will readily be understood when it is learned further that half an hour later a couple of men brought the rest of the flagstaff to the hotel which they had picked up two or three blocks away.

Hoping this information may be of help to some of your readers, I remain,

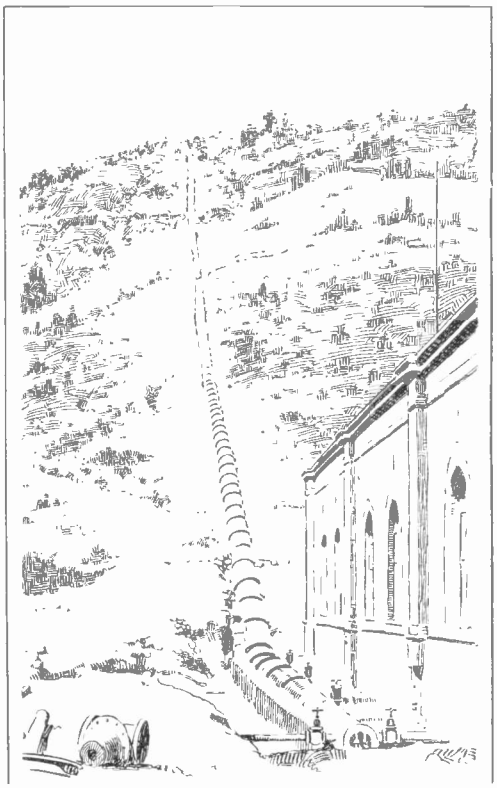
Very truly yours,

LUDWIG GUTMANN.

St. Louis, Mo., March 12, 1913.

Capturing a Mexican Mountain Stream

A small but constant flowing mountain stream in northern Mexico has been



A MOUNTAIN STREAM IS CONDUCTED THROUGH A 30 INCH PIPE TO THE HYDRO-ELECTRIC PLANT

literally captured and put to useful work generating electric current for use in silver mining operations in the vicinity. The stream, which originally flowed down the south slope of a foothill, is now conducted through a 30 inch pipe down the east slope to a hydro-electric plant, while the original bed of the stream from the place it was intercepted is now dry. The plant has two turbo-type generators.

Keeping the Lines Up in Central Africa

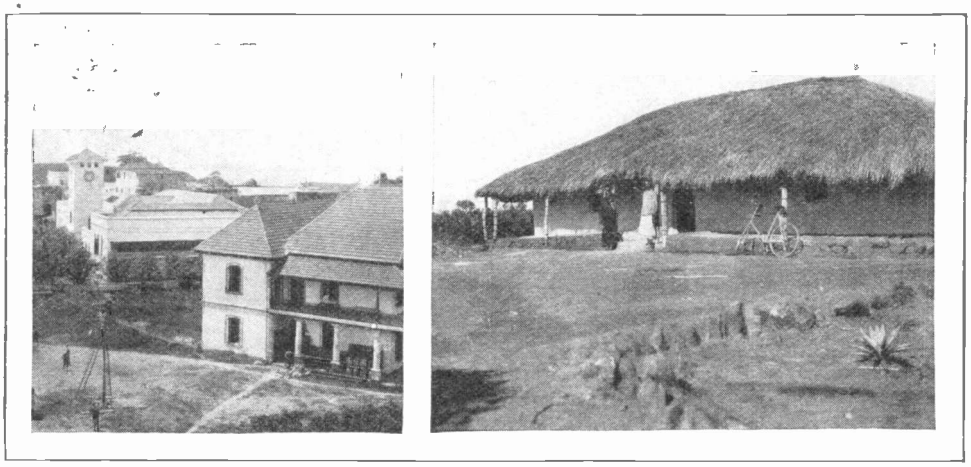
It is a never ending source of wonderment to the traveler in Africa what odd means the government has used in maintaining an efficient telegraph and telephone service. In my journeyings through Central Africa I often came across telegraph poles which were nothing more nor less than trees cut down and transplanted. The wires had been strung on them and they made excellent standards if somewhat unique ones. Frequently the trees had again taken root and were sprouting.

While traveling down the Nile through Uganda I often came across angle iron standards of telegraph lines which had been knocked down by some herd of journeying elephants who had paused to scratch their backs against them. In some cases the poles had been twisted in all manner of shapes by elephant or rhinoceroses who had not waited to pass around them. Particularly was this the case in the Akuma Forest and near Wadelai. An elephant has no respect for the telegraph service, and it is no infrequent thing for the line to be reported down or interrupted simply owing to the unwelcome attentions of these beasts.

At one place in Uganda the iron telegraph poles are the sole means of marking the native path between two stations. They have been set in a perfectly straight line for over 150 miles. In fact without them it would be very difficult to find one's way across country. They are the milestones of Central Africa, the sign posts, as well as the source of news being transmitted.

The telegraph lines are kept in repair by natives, who have been trained to the work and have quickly become very efficient. These linemen live in their native villages at frequent intervals along the line and go out immediately to repair the line when there is anything wrong with the service.

In some parts of Uganda telephone lines and a native hut serve as a telephone booth where one can stop and ring up the nearest station and without charge. There are no nickel-in-the-slot 'phones, but a free service provided by government.—W. Robert Foran.



ONE OF THE CENTERS OF THE CENTRAL AFRICA TELEPHONE SYSTEM

A UGANDA WAYSIDE TELEPHONE STATION

Electric advertising signs and electric vacuum cleaners are rarely found in Spain. Of the first named, few are used except in three or four of the largest cities. Occasionally a theater has its name outlined with electric lights.

Ste. Anne de Beaupre, the "Miracle Church"

Ste. Anne de Beaupre, and old-fashioned and undisturbed little village nestling against the Laurentian hills of Quebec Province, is the second greatest "cure resort" in the world. The celebrated Lourdes in France, which Zola touched upon with none too friendly regard, has probably a longer line of annual pilgrimages, but Ste. Anne's in Canada draws to its gates tens of thousands of crippled men and women and children, to whom the chance of a miracle is absolutely their last hope on earth. How this strange and impressive institution, so unmodern in its origin and almost medieval in appearance, has seized upon electricity as a legitimate part of its equipment is one of the most unique stories in the writer's experience.

It is well to explain that the installation of electrical power has nothing to do directly with the healing of the sick. Its only function is to render more impressive the elaborate ceremonies within the church of Ste. Anne and in the great gardens about which the cortège of worshipers daily wend their way to the slow rhythm of a Catholic prayer. Possibly some churchmen of a century ago might dispute the wisdom of replacing candles with electrical bulbs, but the priests at Ste. Anne's, with whom the writer often talked, defended the innovation as being consistent with the traditions and ideals of religious services. At all events, the old-fashioned scheme of illuminations at this essentially old-fashioned village will never be restored. If supernatural "manifestations" are to be granted to the thousands of cripples praying morning, noon and night at the shrines, the presence of electric wires, it is argued, will not materially interfere.

One night as I strolled down the village roadway, boarded from side to side and banked by garishly painted bazaars and filigreed verandas like the comic opera streets of the theatre curtain, I found myself at the gate of a wooded garden and at the farther side loomed the church of Ste. Anne. Around the edge of the enclosure ran a wide promenade trampled into adamant by the feet of an unnumbered procession of yearly worshipers. At the doors of the church I found myself caught in a sudden flood of outcoming pilgrims at whose head marched three acolytes in their robes, bearing crosses of gold and silver, upon their shoulders. Turning to one side I surveyed this solemn army of humanity gathered for weeks or months from every corner of the globe. Some of them had been at Lourdes and failed to meet a cure. Some had come from California, Mexico, Alaska, Russia, and not a few had marched on foot scores of miles to reach this land of promise. Over their heads, deep in the recesses of the columned church, I saw a statue of Ste. Anne, the mother of Mary, raised high above the congregation and sculptured in gold. To this symbol more than five million cripples and abandoned sick have looked for pity in the many years it has stood there.

Every suggestion of the building was of an architecture long survived. The ceilings were matted gray with age and the smoke of incense. But about the whole figure of Ste. Anne was drawn an ellipse of tiny incandescent globes—a surrender to the picturesqueness of Twentieth Century electricity. The dazzle of the lamps against the golden surface raised a curious contrast to the yellow flicker of the long candles that devotees had strung about the base, as tributes of their faith. The candles kept harmony with the quaint atmosphere, the monotone of the preacher in the lofty pulpit, the subdued beauty of the choral music coming from a distant chamber. But light is light and electricity is better light. So it won the day against tradition.

The procession, fifteen deep, was now well along the wide path of the gardens.

Each pilgrim held a lighted candle protected by a cone of crimson paper from accidental injury of his closely packed neighbors. The effect was to cast upward on the thousands of faces a thousand shafts of light softened into a shadowy pink; the rest of the figures was obliterated in the darkness of the night. As the queer array of sad-faced people plodded along, some in invalids' chairs, some in their parent's arms, I saw a long arrow of the whitest light leap across the garden from the far corner and fall about another golden figure of Ste. Anne standing a hundred feet high upon the central tower of the church; it was nothing more or less than a powerful spotlight—another innovation which the church authorities brought into use to heighten the religious effect of their daily ceremonies. By its use the concourse of pilgrims were enabled to keep in view during their march the One to whom their piteous prayers were addressed with such sincerity. I understand that the spotlight idea was combated by some of the clergy but finally won its way. The picture of the garden

Photos by courtesy of the Canadian Pacific Railway

THE "MIRACLE CHURCH" OF STE. ANNE DE BEAUPRE. IN THIS OLD AND CELEBRATED SHRINE UTILITY HAS WON THE DAY OVER TRADITION—IT HAS BEEN "ELECTRIFIED"

on a summer's night with the glowing gold of the statue vignetted like a vision from the clouds, the curé in the center of the quadrangle leading the prayers, the moving masses about the edges singing softly in broken meter—nothing in after years can dispel its quaintness, not even the thought of its volts and ampers.—ROBSON BLACK.

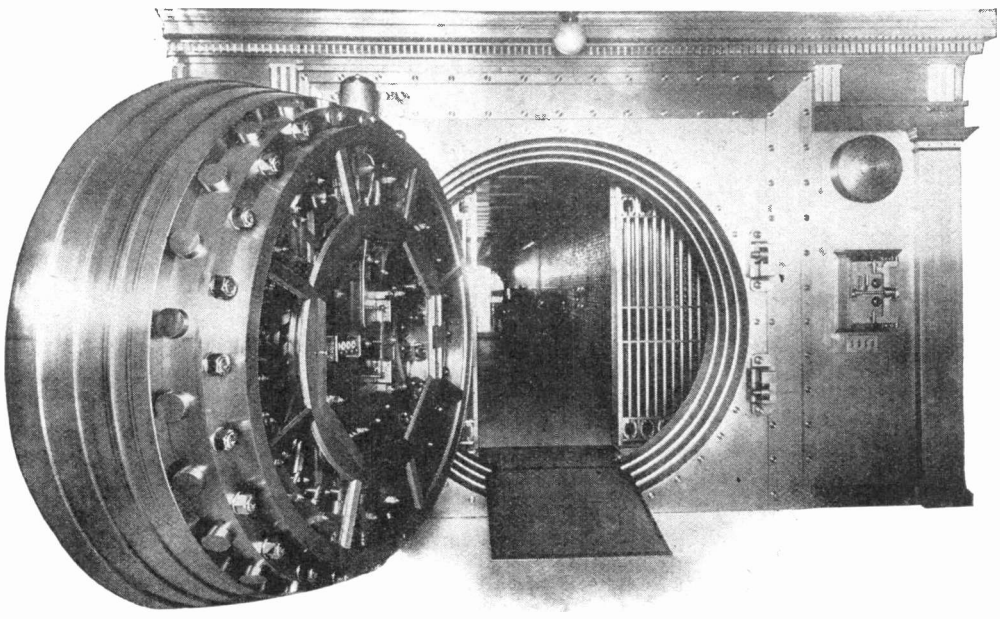
A Mammoth Electrically Timed Door

One of the largest safety deposit doors in the world, and a door in which the most burglar-baffling ideas have been utilized, has just been erected by the Globe Savings Bank of Los Angeles, Cal. The door, with the casing, weighs a trifle over 80,000 pounds, the door itself balancing the beam at more than 34 tons. It is composed entirely of the finest chrome steel.

Around the edge of the door and constituting a large portion of the "locking" apparatus is a series of 25 bolts, each of these being five inches in diameter and the entire 25 having an aggregate weight of one ton. These bolts shoot out from the center of the door into the casing when the door is closed.

This door is controlled entirely by electricity, having four small electrical time dials and being equipped with a series of four electrical burglar alarms, two of which are stationed at the sides of the vault door, one being situated on the street in front of the building and the other being set at the police headquarters of the city. There is a system of blind combinations and it is claimed that the door is drill proof. Those in charge declare that to wreck this door would mean that the entire thirteen story building would be destroyed.

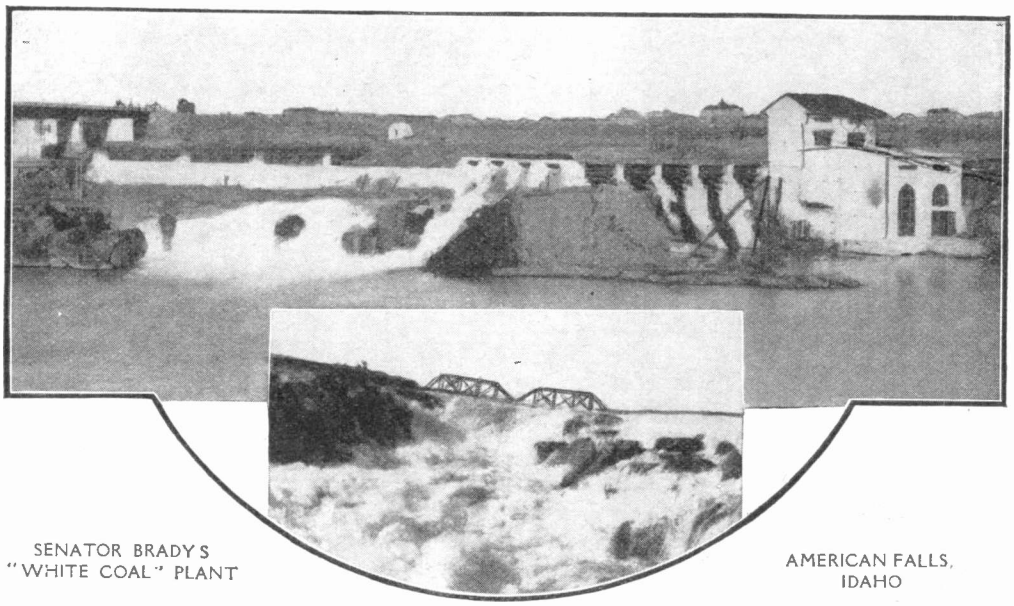
This entire vault is electrically protected. The walls are 38 inches thick, there being fourteen inches of concrete and steel and 24 inches of honeycomb steel boxes. The floor is 36 inches thick, while the ceiling has a thickness of 48 inches. At intervals of four inches through this mass of steel and concrete are electric wires which lead to the burglar alarms.



THE DOOR ALONE WEIGHS MORE THAN 34 TONS

Another White Coal City

Senator Brady's recent transaction in selling his white coal mine, American Falls, to the Kuhns of Pittsburg for $2,000,000 recalls to our minds a certain famous real estate deal which happened a few years back when all of the country west of the Mississippi River and east of the main range of the Rocky Mountains was bought by a certain shrewd and cautious buyer, a veritable Yankee bargainer, for the sum of $15,000,000. Considering that $15,000,000 would not purchase the undeveloped water powers of the Snake River alone and that the $2,500 which Congress once refused President Jefferson to explore the great territory, then considered a bad buy, could soon be sunk in merely staking claims on these water powers, Uncle Sam's reputation as a close bargainer should be completely restored.



SENATOR BRADY'S "WHITE COAL" PLANT

AMERICAN FALLS, IDAHO

The new plant at American Falls, Idaho, is unique among most plants in that the electrical energy will find a large summer market furnishing power to the gigantic pumps that are used to lift water to irrigate the Carey Act lands. As the irrigation season opens about April 1 and closes about October 20, a like amount of electrical current that finds a market during the summer period for pumping water must be used in some other way during the winter period. There is seldom interference with the great hydro-electric plants in Idaho streams on account of ice. The turbines are kept going with no additional cost except for supervision and lubricating oil through the winter period. Hence large quantities of this electrical current during the winter period are sold and very cheaply for heating purposes. In some districts of Idaho the power companies make a flat rate for heating a home with a given number of rooms through the fall, winter and spring period. Estimates are made upon the cubic contents of the rooms and character of construction of building.

There are now a good many chimneyless homes in Idaho. For seven years Senator Brady has had no fire in his house at Pocatello, either for cooking or heating. Electricity cooks, churns, washes, irons, runs the ice cream freez-

er, washes the dishes and furnishes the heat and light. The rich man's luxury will now be the poor man's economy and the servant question is solved.

Flash Lamp in Opera Glass Box

Music lovers often like to follow the score during the opera and are unable to do so when the house is in darkness.

OPERA GLASS BOX WITH ELECTRIC LAMP

For their benefit an opera glass box has been designed that has a tiny electric lamp and battery in the bottom. The lamp is at one end of the box and by pressing a button enough light is given to read the libretto.

Peat collecting by electrical machines is the latest method to be carried out in Germany. The whole machine is mounted to run upon a broad and heavy beam laid down on the ground of the peat bog, and an electric motor drives it.

Fountain with Electrolier

While the "bubbling fountain" without insanitary drinking cups was hailed as a decided advance over the old style, the invention of a Michigan designer of street fountains has removed the one objection to the ordinary "bubbler." He has made it as readily available to children as to adults by placing the "bubbler" on the end of a tube.

AN ARTISTIC BUBBLING FOUNTAIN

However, the most advanced feature of the design is the electrolier at the top which may serve by the use of a globe of distinctive color to mark the location of the fountain in the evening and provide proper illumination around it.

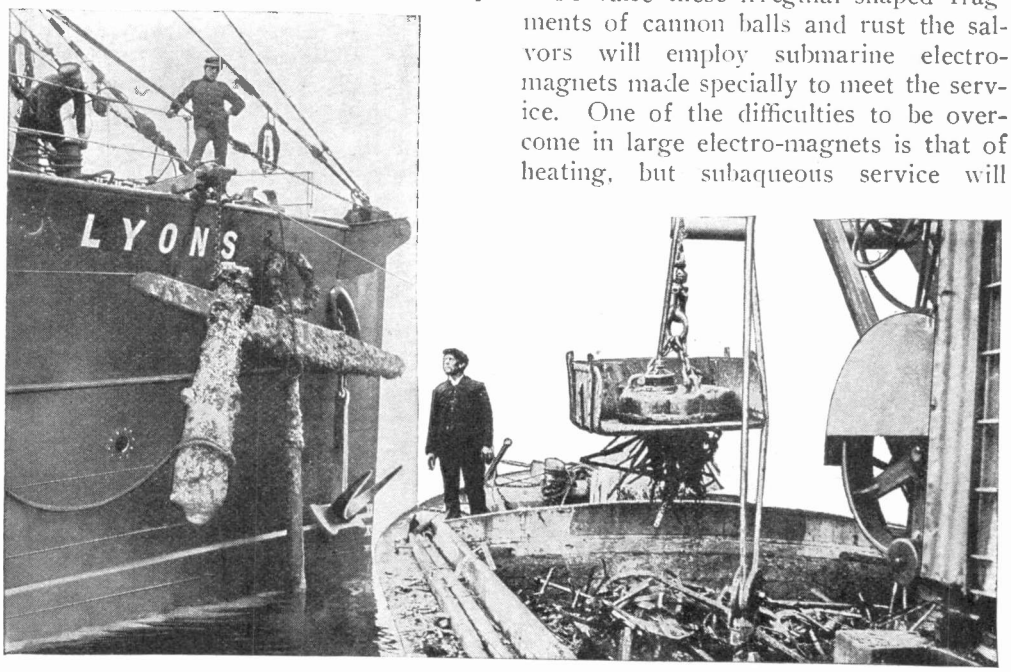
Treasure Hunting with Electro-Magnets

The adaptability of the electro-magnet to recovering iron and steel submerged in water has been demonstrated many times of late when salvage work has been carried on in this manner, notably in Regents Canal Basin, London. These results have fired the imaginations of certain treasure hunters, and that is the story we wish to tell now.

Lest you may have forgotten it, the British frigate "La Lutine," reputed to have had aboard bullion and specie to the value of $6,000,000, foundered upon the coast of Holland—near the entrance to the Zuider Zee—in October of 1799. In the summer of 1858, wreckers recovered in a few days from the battered stern of that ship more than $150,000, and that exploit has fired successive and intermit-

tent salvage expeditions ever since. Unfortunately none of the later ones have reclaimed enough of the gold and silver to meet expenses, and some of them did not even find the hulk.

After two years' work, the National Salvage Association of London has not only uncovered the remnants of the hulk of the frigate but has pretty conclusively proved that any treasure remaining on the present site is probably buried under a mound of cannon balls that have become bound rigidly together by iron rust. A bit of that rust, brought up by accident and just before the salvors were about to abandon the hunt as hopless, contained grains of gold and the impress of a rectangular object. This turned out to agree in dimensions with a bar of gold in Amsterdam which was recovered from the wreck a good many years ago.



THE OLD WAY OF RAISING IRON FROM THE DEEP COMPARED WITH THE MODERN LIFTING MAGNET

Last year the divers tried to shatter the iron mass by using dynamite in a crude way, but their efforts were unproductive.

Now, however, they intend to go at that obstacle in an approved fashion: first, to break it up, and then to lift the pieces aboard the salvage steamer "Lyons" to make sure of getting any of the bars of bullion that may be mixed with the rust and the cannon balls. They expect, though, to find most of the treasure grouped below the enveloping heap of iron.

To raise these irregular-shaped fragments of cannon balls and rust the salvors will employ submarine electro-magnets made specially to meet the service. One of the difficulties to be overcome in large electro-magnets is that of heating, but subaqueous service will greatly reduce this drawback, because the enveloping water will tend to keep the lifters cool.

Perhaps you will wonder, just the same, why these magnets may otherwise be superior for this particular duty, and in brief we may say because of the time saved during operations. This is of the utmost importance in this undertaking, because the North Sea is a fickle body of water and it does not permit wreckers to work except at intervals, and even then perhaps only for a day or a few hours at a time. By using these magnets to clear away the obstruction without requiring that the divers attach ropes or chains to each piece, the entire task may

be completed in a short while after the mound of shot and rust has been properly fractured. Some idea of the weather uncertainties of those waters can be gathered from the fact that in 1911, when the salvors did the bulk of their excavating, they were able to work about 800 hours during eight months of the year, while in 1912 they could anchor the "Lyons" over the site of the wreck and pursue their efforts under water for a cumulative period of less than 300 hours.

Theater Exit Light Fixture

One of the most stringent municipal regulations in force in large cities for the protection of theater patrons is

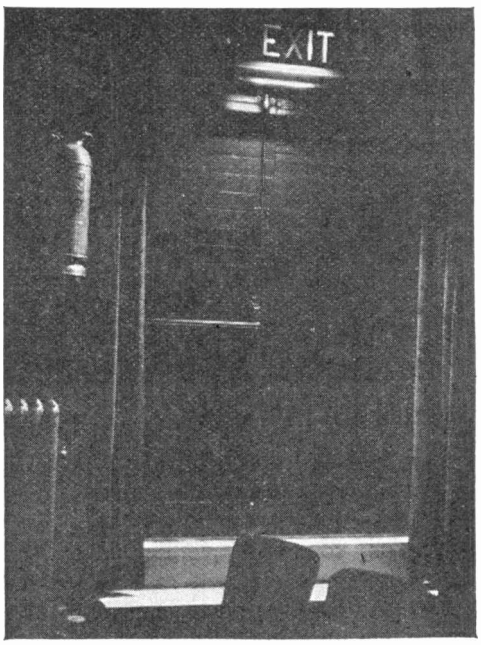


PHOTO TAKEN WITH EXIT ILLUMINATION ONLY

that requiring the exits to be plainly marked and illuminated.

The illustration shows a special fixture for this purpose which so distributes the light as to illuminate the threshold, the lock and the fire extinguisher. The word "EXIT" is arranged on the front face to be displayed in white letters.

Electrical Action on Cement and Re-enforced Concrete

In 1908 a Frenchman, Monsieur A. Knudson, published the results of a number of experiments which he had made on the effect of the action of the electric current on cement and reënforced concrete. Whether there were errors in the reports sent out or whether they were intentionally misrepresented is not known, but the fact remains that a considerable amount of discussion was aroused at the time among engineers and others interested in the matter; some writers even going so far as to say that a mass of concrete, after being subjected for a period of time to the action of the electric current would suffer disintegration to such an extent that it would be possible to cut it with a knife! Since then the question seems to have been undecided, and it is only recently that information has been available which, for the present at least, will allay any uneasiness which may exist in the minds of technical men on this point.

A short time ago a German technical journal, *Die Bauwelt*, made an inquiry among concrete experts throughout Germany for the purpose of discovering what had been their experience in this respect. The data gathered covered practically every kind of concrete structure in use in Germany at the present time, and in not a single instance was any report made which would indicate dangerous effects from the action of the current. Even in the case of waterworks, which would be especially liable to injury on account of their exposed situation and the probability of electrolytic action, there was no report of any damage.

In the case of reënforced concrete, however, it had been found that where a mass of iron had been in such a position with regard to the current as to form a positive electrode, the iron was coated with rust and the concrete in the neighborhood was fissured. That the fissures

were due to the accumulation of rust on the electrode was proven by the fact that when the iron was replaced by brass, no rust, of course, being formed, the fissuring ceased.

Other experiments have shown that the continued action of an electric current has the effect of drying the concrete, and so diminishing its resistance to crushing, except in the case of concrete which has been well tamped, in which this effect was not observable. These results, however, are from experiments which were made under conditions very much exaggerated in comparison with those of actual practice.

The result of the inquiry is that there is not the slightest cause for alarm in the case of reënforced structures as at present built.

Electric Oven for Bakers

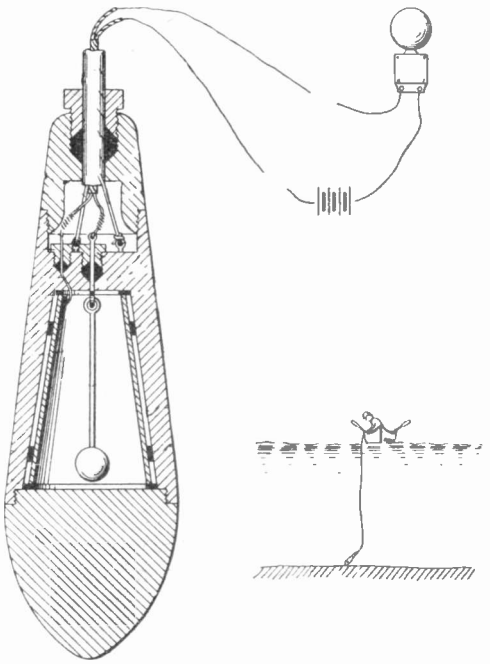
The large electric oven shown in the illustration was specially constructed for use in baking fruit cake, gingerbread,

OVEN FOR BAKING FRUIT CAKE

etc., where it is necessary to have the heat well regulated to secure the best results. The oven has ten compartments, each of which is controlled by a separate switch so that any or all compartments can be used. The entire oven is lined with asbestos to retain the heat; the exact temperature is indicated by pyrometer gauges placed above the switchboard.

Sounding Device

A sounding device which will ring an electric bell when it comes in contact



SOUNDING DEVICE

with the bottom of a river or body of water is the invention of Donald B. Ferguson, Aurora, Minn.

Within the bell shaped, weighted body is a hollow interior shaped like a frustum of a cone, the wall of which is lined with metal and connected to one wire of the cable for lowering the plumb. From the top of the frustum is suspended a metal tongue or clapper connected to the other wire of the plumb cable. When the plumb strikes bottom, as shown in the small picture, it tips and the tongue strikes the metal wall, closing the circuit and ringing a bell which is, of course, connected with a battery attached to the upper end of the cable.

Heroes of the Flooded Shaft

By ROBSON BLACK

Now this is a tale of plain fact, without a heroine, without a third act. It tells how three electrical workers who are living at this moment went in a punt down through a raging torrent that choked a power company's tunnel along the mighty cliff that holds up the weight of Niagara Falls. It tells how three men with three boxes of dynamite groped their way in pitch blackness through a circular chamber swirling with water in order to blast out ten tons of rock lodged unexpectedly in the tunnel's "spout." They failed. And then what? A few days later they did what mortal men have done neither before nor since: they climbed up the face of Niagara Falls *from the outside*, crawled under the curtain of water that leaps out from the giant cliffs and placed a charge of dynamite in the mouth of the tunnel. That time they were successful. The channel was cleared without the loss of a life.

The Toronto Niagara Power Company had spent millions on an elaborate system of power houses. One of the engineering necessities was to provide an escape for the water used in the development wheels and it was decided that a tunnel should be constructed from the company's plant some distance above the falls, opening out under the Horseshoe Falls at a point 150 feet beneath the upper surface. Here the water coming from the turbines would be thrown into the descending torrent.

After months of anxious labor, boring foot by foot through the solid rock, the drills so changed their tune that the engineers knew the face of the precipice was a few feet distant. Working with caution—for such an experiment with the Falls of Niagara had never been tried before—a few more feet were chipped from the intervening wall. The unexpected happened. An aperture appeared at the top of the tunnel. Dense clouds of spray packed through the hole from without, and the workers knew in an instant that their wits were now to combat the ugly ingenuity of Niagara. A dash was made for the inner channel and though the water rose nearly to their waists all reached safety. Desperate to save the costly undertaking of many months, the superintendent decided to beat the Falls with electric pumps. He stopped them, out of pity. Then came the call for three volunteers to which John Davis, "Shorty" Minor and "Mike" Abbott responded.

When the trio entered a punt in the tunnel with a full load of dynamite they found their curious journey to be far more hazardous than anticipated. The waters had risen until only about three feet remained between the top edge of the punt and the rough hewn roof of the tunnel. Ballast was taken aboard and by lying on their backs they were able to press the punt forward foot by foot. It was now utterly dark, with no noise other than the sucking of small whirlpools and the dull boom of the mighty Niagara that hurdled above and before them. But the punt was nearing its destination and with a final shove the prow struck against the thin partition of granite. Onto a narrow ledge the volunteers scrambled, dragged their dynamite beside them and then commenced their hair raising search. Within ten minutes they had scrambled through the hole in the partition against a gale of spray and flooding water and now stood within perhaps the most remarkable chamber in the whole world. Within reach of an arm descended in stupendous masses the curtain of Niagara which with every vicious eddy of wind cast back heavy sheets of spray against the cliff to which the workers clung for dear life. At their feet loomed the misty depths into which plunges the overflow of four lakes

hour after hour. Above them flicked and flashed the black torrent at the brink of the fall.

Cautiously and without haste they placed the heavy charges of explosive, attached their reels of copper wire and crawling once more through the hole into the channel took their places in the punt for the return voyage. When the watchers at the mouth of the shaft had about despaired of the outcome the nose of the punt jutted into view and a shout of congratulation was given as the volunteers stepped ashore.

After the explosion the undaunted crew once more essayed the task of reporting the state of the tunnel mouth. Again the ballasted punt was shoved through the narrow band of vacant space hundreds of feet to the far end. They found a disappointing sight. Instead of blowing the boulders out the dynamite had merely dislodged fresh chunks of rock which now lay heaped at the opening.

Back went the punt to report the unfortunate result. Half way to safety the water crept above the edges, filled the overweighted shell and sent it to the bottom in a couple of seconds. Swimming for their lives—shouting encouragement to one another as they scrambled for an instant's rest onto a rocky ledge touched in the dark—the escape from death was avoided only by a persistent struggle.

The engineers responsible for the production of a workable plant turned to a novel and much more hazardous scheme to rid the costly tunnel of its impediment. This was to send a group of men roped together like Alpine tourists *to climb up the face of Niagara Falls from the outside.*

To all who have set eyes upon the beauties and terrors of Niagara such a suggestion may sound mere madness. It was, however, a fairly practicable idea. The great curtain of water that drops from the brink of the precipice into the pool of mists that appears to rest on the bottom of the planet is swept from five to fifteen feet out from the face of the cliff by the force of the river's current. By the action of years a sloping mass of boulders has gradually become lodged higher and higher against the wall behind this curtain so that from certain points a daring man might crawl half way up the cliff. The most fatal of many grave dangers attendant upon such a piece of hardihood was that by a change of wind the sheet of waterfall should be pressed backward into the cliff and crush the adventurers beneath its enormous weight.

"ALL THIS TIME WE WERE ADVANCING LITERALLY UNDER NIAGARA FALLS"

Davis, Minor and Abbott, led by Beverley R. Value, the superintendent, again stepped into the breach. Once the job of clearing the tunnel was started,

said they, it was "up to" them to see it carried out. Tying themselves together with a long, stout rope and donning oilskin suits and rubber boots, they descended into the Cave of the Winds, (familiar to tourists), which is an artificial channel carved some hundred feet beneath the falls with smaller channels running at right angles to the face of the mountain. At the farthest opening the men climbed over the guard rail and were lowered one by one about 50 feet to the point where the broken boulders lay against the precipice. There they shouldered their packages of dynamite and copper wire, cast off the rope that held them to their friends in the Cave of the Winds and started the perilous journey. I give the story in the words of one of the men who recounted it to me:

"Although we were dressed in oilskins, oil hats and rubber boots we were quickly drenched to the bones by gusts of spray that tumbled on our heads and backs like pails of buckshot. So great became the force of these gusts that we could stand upright no longer and crawled from boulder to boulder on our hands and knees. All this time we were advancing, *literally under Niagara Falls,* for the cataract was falling over and slightly beyond us, now and then giving us an extra heavy swish of water as the winds in the gorge blew direct against the face of the fall.

"We were walking about a hundred feet up from the pool, bracing ourselves against the pile of rocks. It was, at first, an almost impossible task to make steady progress. So we kept some distance apart for safety's sake in the event of one having a tumble, and by taking our medicine patiently at every downpour sent our way, we finally reached the ledge directly under the tunnel's mouth. It was a matter of a few minutes to place the dynamite and wires where they would hit the blockade to best advantage.

"We rested a few minutes and commenced the return journey. Bad as the approach had been, the going back was infinitely worse. The adverse winds had practically isolated us by walls of water and indeed at one time the prospect was good for a 24 hour stay on the edge of an ugly cavern.

"During a lull we were enabled to make another start. Having to drag the pair of copper wires with us made the trip much more difficult, but we held on and gained foot after foot, sometimes slipping, often bringing blood, until the sight of the Cave of the Winds peeped through the abnormal mists. Exhaustion was slowing down our steps, and a fearful hunger increased the discomfort, for the adventure had taken the best part of a day. I remember some one throwing us a rope and we snatched at it with a sudden return of energy.

"Lifted safely into the cave, the superintendent touched the copper wires. A far-off roar, that sounded even above the boom of the Falls—and we turned to face a messenger who had been waiting at the telephone for instant news of the water level in the tunnel. 'It is rapidly lowering," said he, and all of us knew that the blockade had been broken by the blast."

Glasgow's Navigation School

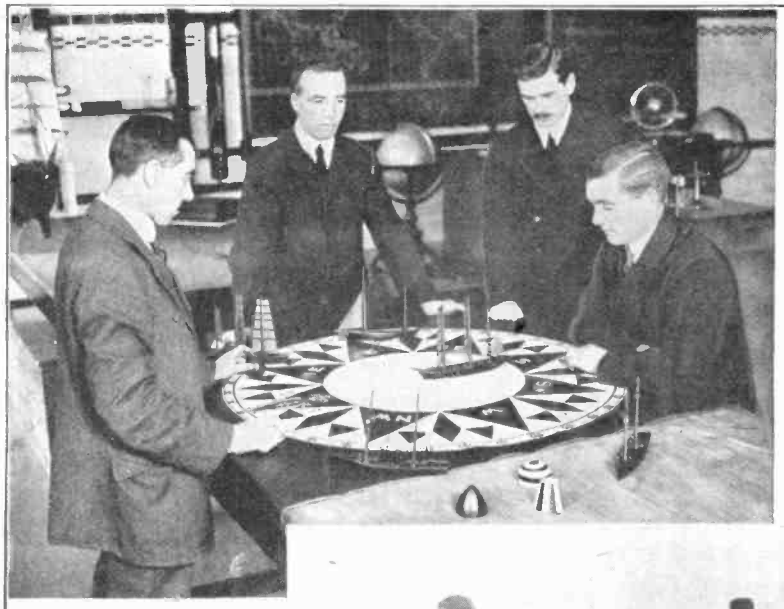
Electricity and the magnetic phenomena of the earth figure in the efforts of the city of Glasgow, Scotland, to officer the British mercantile marine. Glasgow's navigation school at the Royal Technical College is the most perfectly equipped institution of its kind in the world.

The authorities of this school purchased not long ago the steam yacht Vivid from the Royal Navy, in order that the work learned indoors during the winter may be put to practical use during the summer months. In addition to the regular courses in seamanship, which include instruction in the rigging and handling of sailing ships, instruction is given in the Board of Trade regulations for pre-

venting collisions at sea; theory and practice of all forms of electrical and other signaling apparatus, wireless telegraphy, electric steering apparatus and the handling of floating electric plants of all kinds; the magnetic pole and the effect of electrical currents upon the compass; taking observations; adjustments of the ship's compass by means of a device called the deviascope, and in fact all electrical problems that have to do with navigation or the handling of a ship of any sort.

"Electrifying" the Boardwalk Wheel Chair

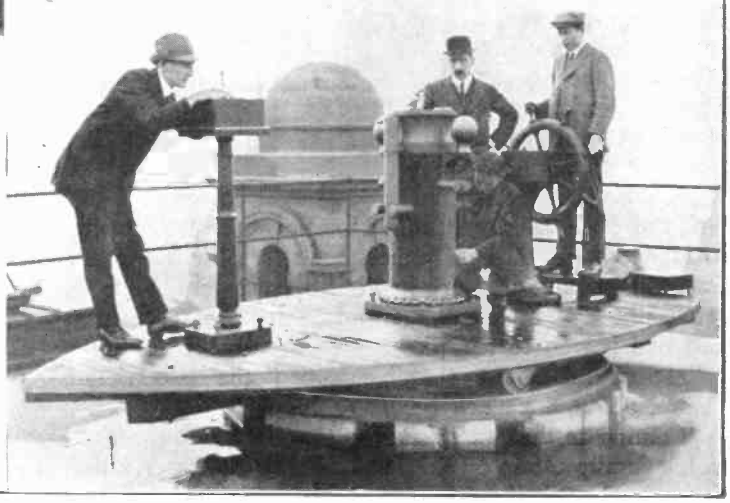
The boardwalk wheel chair seems to be the newest application of electricity to recreation. A young couple wintering at Palm Beach, Florida, recently appeared on the boardwalk in the first equipage of this kind. It looks in every respect like its predecessor, the old-fashioned Atlantic City wheel chair, except that it is operated by electricity instead of by a porter.



DEMONSTRATION OF THE BOARD OF TRADE REGULATIONS FOR PREVENTING COLLISIONS AT SEA

TAKING OBSERVATIONS WITH A SEXTANT

CAPTAIN BROWN SHOWING STUDENTS HOW TO ADJUST A SHIP'S COMPASS



The White

"These are great times," exulted the Electrician to his friend the Old Fogy, "With machine guns and other instruments of war we certainly are going some in the fighting game!"

"Yes," agreed the Old Fogy, as he adjusted his glasses, "but do you know that, before such things were dreamed of, an entire nation was conquered with a magnet and a little black box?"

And the Electrician confessed, "No!"

"You have heard, no doubt," the Old Fogy rambled on, "of the marvelous inventions of Robert Houdin, the great French conjurer, a man who did great things with electricity when Alexander Graham Bell was an infant. Houdin applied electricity to many of his magical experiments, and delighted the Parisian public for years in his little theater. When he retired he was the most favored performer of his day, and had bowed to the plaudits of royalty!"

"Heard all about that," snapped the Electrician. "What about the black box?"

"Coming to that, boy; coming to that. Houdin retired to his family estate on the left banks of the river Loire, near St. Gervais, hoping to end his days in peace. But after a year or so there came to him, through a military friend, a request from the French government that he go to Algiers. In his memoirs, translated into English some years before his death, he says that the Marabouts of that country, a sort of medicine men and wonder-working priests, controlled the masses and incited them to intermittent revolts against the French by their tricks. These tricks, he

Man's Magic

By Charles F. Oursler

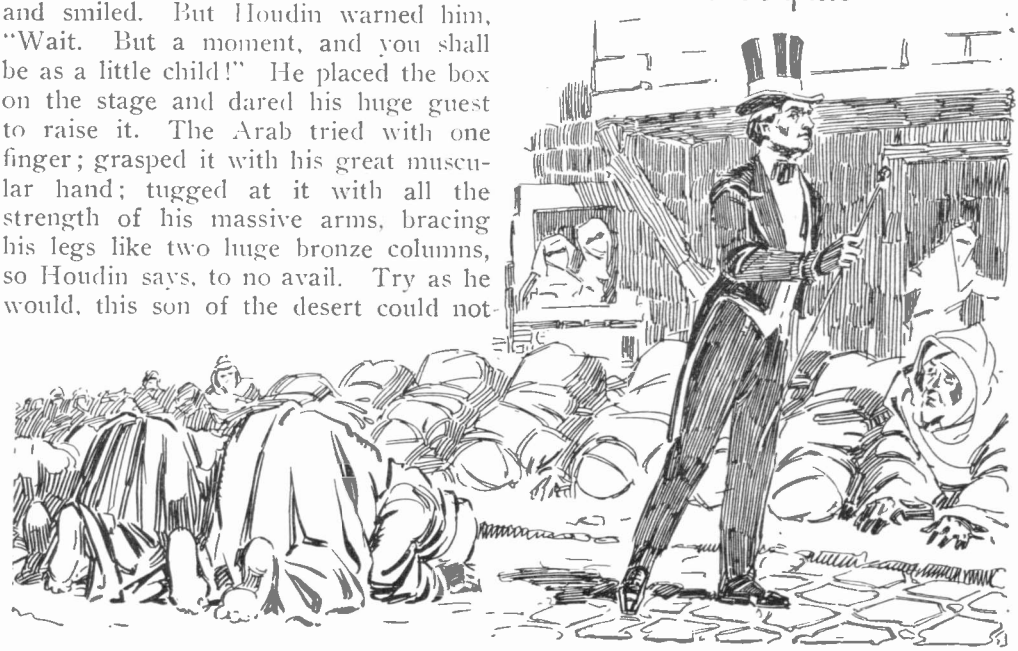
-and caught the bullet unharmed

assures us, were of the simplest and most primitive type. It was the hope of the government that Houdin, by his mysteries, could demonstrate that the white conquerer's magic was superior. And Houdin did it."

"With the little black box and the magnet?"

"Yes. His recital of his performance in Algiers is exceedingly interesting. Some of the most distinguished natives were there. Houdin showed them all sorts of things; allowed himself to be shot at, and caught the bullet unharmed, and many other such feats. But his *piece de resistance* undoubtedly was his box. He called for a strong man to come on the stage, and a giant responded. Houdin toyed with him a moment, bantered with him about his strength, and asked him if he could lift his little black box. Disdainfully, the Arab lifted it and smiled. But Houdin warned him, "Wait. But a moment, and you shall be as a little child!" He placed the box on the stage and dared his huge guest to raise it. The Arab tried with one finger; grasped it with his great muscular hand; tugged at it with all the strength of his massive arms, bracing his legs like two huge bronze columns, so Houdin says, to no avail. Try as he would, this son of the desert could not stir that little box from its place. For a breathing spell, he released his grip for a moment, then went at it again. And while the awestricken audience panted in amazement, he suddenly writhed in acutest agony, and sank groveling to the stage. The current coursing through him had galvanized him into misery. Then Houdin gave a signal; the current from the electro-magnet beneath the stage was turned off, and the Arab fell back groaning. He lifted himself to his feet, and, hiding the face in his cloak, crept away to blush

The conqueror's conquest was complete—



unseen. The little black box had conquered."

"And—?" inquired the Electrician.

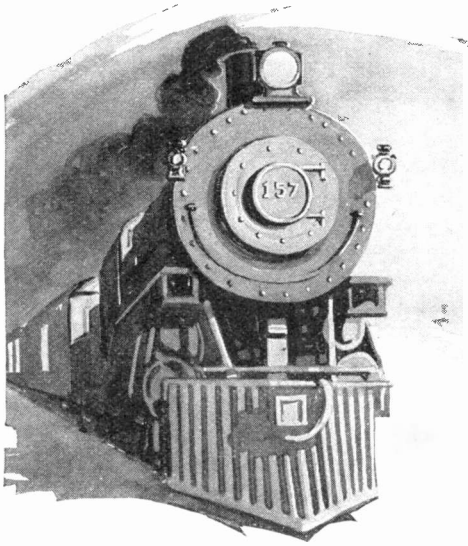
"And," replied the Old Fogy, "Houdin was triumphant. The country had seen him shot at by a man who said he wished to kill; had seen him rob a giant of his strength. No Marabout had ever done that. No Marabout with primitive tricks could convince them that any revolt of theirs could prevail against the white man and his magic: his electricity. The conqueror's conquest was complete."

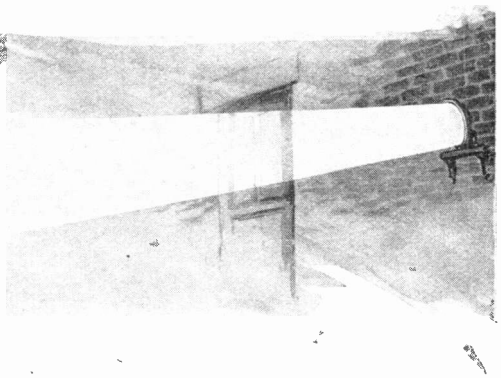
Making the Desert to Blossom

A vivid object lesson in the value of electricity to the rancher in arid southwestern lands is shown in this picture of the flow of water forced by an electrical pumping plant. The photograph was taken in Santee in the El Cajon Valley, near San Diego, and shows a flow of 200 inches on alfalfa land. This water is pumped from the San Diego River and raised 35 feet by means of a centrifugal pump. In transforming the desert into green fields, water means wealth; therefore the electric power that brings the water rightly spells dollars.

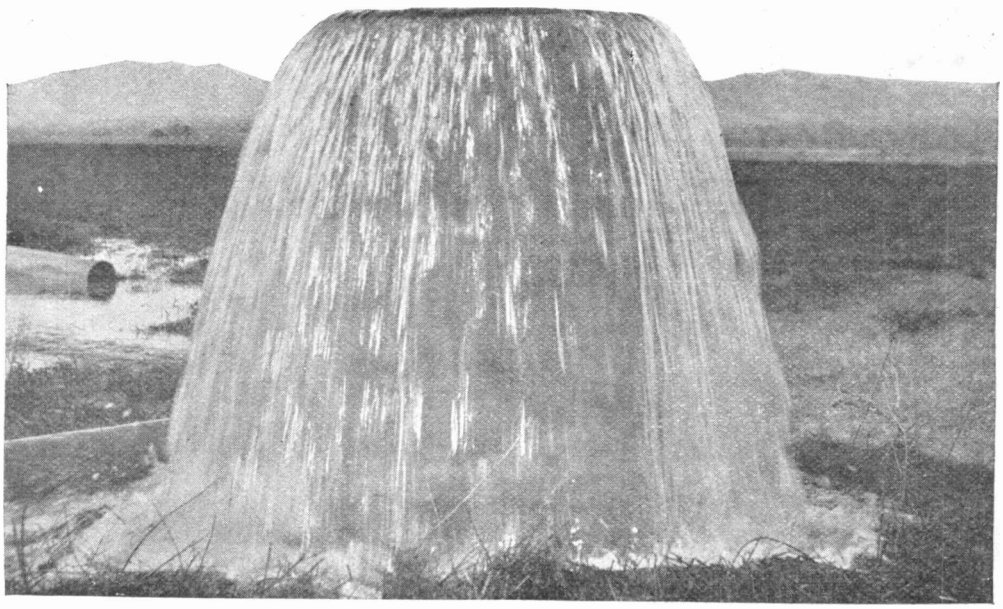
Searchlight for Viewing Locomotive Numbers

An electric searchlight is attached to the side of an interlocking tower on one of the eastern railroads for the purpose of enabling the operator to read the numbers of the locomotives at night. The searchlight consists of a 100 watt, carbon filament, 110 volt lamp placed within a ten-inch parabolic reflector. It is supported by a bracket bolted to the side of the building at a height of about eight feet above the rails. The reflector is





placed in such a position that the rays of light are projected normally across the tracks. The operator controls the lamp by means of a switch placed in the



EXPRESSIVE OF THE POWER OF AN ELECTRIC PUMP

upper room of the tower. The current is turned on at dark and the lamp is kept lighted all night, permitting the numbers to be easily read as the locomotives pass at high rates of speed.

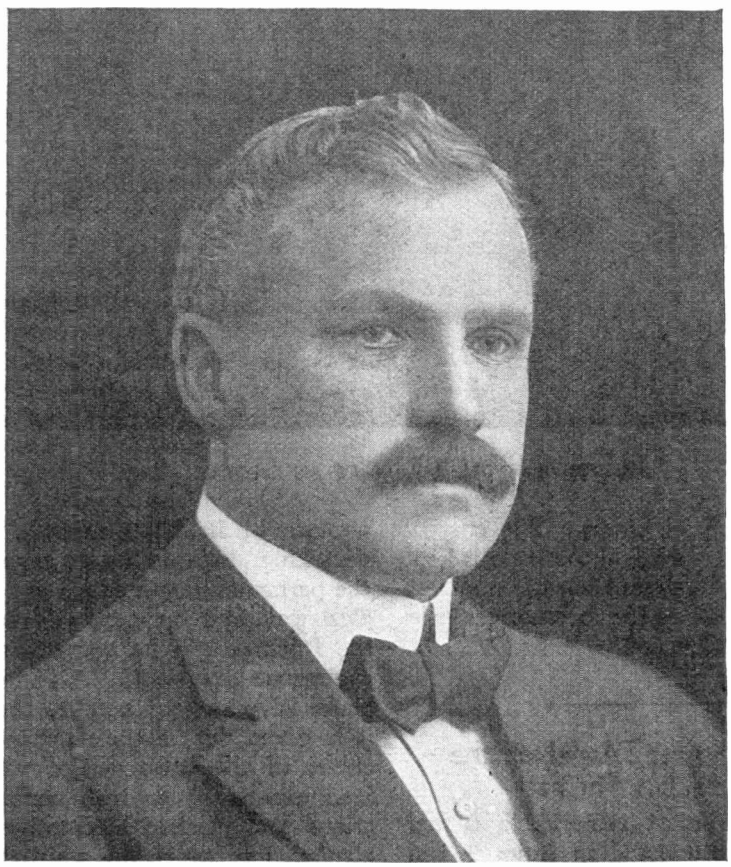
Kicking Horse Tunnel of the Canadian Pacific

One of the most remarkable tunnel projects ever attempted in America has been announced by the Canadian Pacific Railway Company of Canada, and involves almost a complete supersedence of steam by electricity. In order to reduce the length of its mountain tracks in western Canada by five miles and to do away with many miles of dangerous snowsheds, the company will spend no less than fourteen million dollars to bore a tunnel through Kicking Horse Pass of the Rocky Mountains. It will be sixteen miles long, four miles longer than the famous Simplon tunnel in the Alps, and will take seven years to build. Its eastern portal will be in Alberta, and the western in British Columbia. The undertaking, both in its construction and the permanent equipment, will be largely electrical and new power sources in the Rockies will be tapped in order to commence the work. While detailed plans have not, of course, been issued, it is given out that electric power machines of the latest design will be utilized exclusively in the tunneling operations and electric locomotives will be employed to carry the trains from side to side.

This improvement, with many others under way and proposed, will make the Canadian Pacific main line 300 miles shorter than any other transcontinental line. The company proposes to have three and probably four main lines to the Pacific Coast, the first by the present main line, the second by a new cut-off, via Souris in Manitoba, the third through Edmonton and thus by one of the northern passes to a northern Pacific port. It is the aim of the company to eliminate "crossing" the Rockies altogether as far as freight business is concerned.

Electrical Men of the Times

JAMES M. WAKEMAN



James M. Wakeman came to this country from England, in 1886. When he arrived in the land of his adoption he knew just one man, who told him what hotel to stop at and then dropped out of sight—useful but somewhat limited in his information and assistance. Since that time, however, Mr. Wakeman has not been slow in making friends to take the place of the one who had disappeared. Those who know say that he has now a speaking acquaintance with about 20,000 men in the electrical industry alone.

From now on the public is going to hear a great deal of the Society for Electrical Development, organized a short time ago by representatives from electric light and power companies, the great electrical manufacturers, contractors and supply dealers, architects and others variously interested in the electrical business. The object of this society is to bring to the people through various channels accurate, instructive and at the same time interesting information concerning the most up-to-the-minute subject to-day

—electricity. This is a movement of great importance and it is well to know that Mr. Wakeman is the man who is actively directing it, as general manager of the Society.

He was selected for this important position because of his knowledge of men and ability to find the "point of contact," to use an advertising expression, which will bring home to people of all classes and interests the ideas and information which it is the desire of the Society to promulgate. In addition to a natural ability in this line he is further fitted by experience to carry on the work.

In 1892 Mr. Wakeman entered the advertising field and was for some years western manager of the *American Machinist* and *Railway Locomotive Engineering*, during which time he resided in Cleveland and Chicago. Then he went to New York and was one of the incorporators of the McGraw Publishing Company in 1899, of which corporation he was vice-president and general manager for eleven years. During ten of these years he was president and general manager of *The Electrical World and Engineer*, and was also at one time acting president of the *Engineering and Mining Journal*. While vice-president of the McGraw Publishing Company he held the position of vice-president of the *Electrical Railway Journal*, *American Electrician* and *Engineering Record*. For two years he was on the board of directors of *Success* magazine and was on the board of directors of the American Press Association for nine years, during which period he served one year as vice-president and one year as president of the association. In addition to this, in 1906 he held the office of Supreme Apollo of the Jovian Order and is furthermore a member of a number of electrical and engineering societies, clubs and associations, including the American Institute of Electrical Engineers, Engineers' Club of New York, etc.

It is to be seen, then, that as far as experience in the publication field, both technical and general, is concerned he could not be better fitted, and this experience, coupled with his wide acquaintance and ability to see and grasp the elements of "human appeal" in electricity, are going to make him valuable to the Society in its education campaign.

If one may include hobbies in this brief sketch it might be said that Mr. Wakeman's chief hobby is traveling. He has done this nearly all his life in connection with business and as a recreation. In the course of these travels he has covered pretty thoroughly the United States and Canada from the Atlantic to the Pacific, has become familiar with nearly all the chief European cities.

Ancient Burying Vaults Lighted by Modern Lamps

The catacombs of St. Calixtus, near Rome, were not long ago illuminated with thousands of electric lamps, filling the gloomy vaults and passages with a bright light, whose effect, as it fell upon the rows of bones and skeletons, is described as being startling and almost uncanny. The use of electric lights in the catacombs is perhaps the most unique example of modern practical science brought face to face with antiquity. This, however, would be exceeded by the introduction of the electric light in the galleries of the great pyramids of Egypt. It is reported that the Egyptian government is considering this.

Telephone Figures

According to the 1912 report of the American Telephone and Telegraph Company, the Bell toll lines of the United States now reach 70,000 places. The total mileage of wire for exchange and toll service was 14,610,813. The daily average of toll connections was about 738,000 and exchange connections about 25,572,000. This reaches the enormous figure of nearly eight and one-half billion connections in the year.

Electrical Interests of Women

EDITED BY GRACE T. HADLEY

Household Science at the University of Toronto

In a recent interview reported in an eastern magazine Mr. Edison says: "Women do not take enough pains with their cooking; it is not even treated as an art, when as a matter of fact it should be practiced as a science. All cooking should be done over an electric range. Current used in cooking should be accurately measured by an automatic instrument attached to the stove, and the number of heat units expended should at all times be indicated upon a dial that the cook can see. Cooking cannot be learned in the average home any more than mechanical engineering can be learned in the average home. Cooking can be successfully taught only in a great chemical laboratory such as a good cooking school is."

In this connection it is eminently gratifying to note that Mr. Edison's ideas are being most successfully carried out in the Lillian Massey Laboratory of Household Science at the University of Toronto. The following description of the institution and its work was furnished by Miss Annie Lewisa Laird, associate professor of household science at this university.

The Household Science Building of the University of Toronto, which was formally opened on the evening of January 28th, is the gift of Mrs. J. M. Treble to the university. It is a handsome building of cut stone and has been very carefully planned so as to provide all the necessary equipment for instruction and research work in the various branches of household science.

The building has a frontage of about 184 feet. It is built about three sides of an open court, the wings extending about 106 feet. The basement continues around the four sides, the swimming pool occupying the fourth side. The pool is about 46 by 20 feet and is a most attractive one with direct light from above on the water. The gymnasium extends through two floors—the basement and first floor—and will accommodate from 40 to 50 students at a time. It is finished throughout in fumed quarter-cut oak and is splendidly equipped.

The first floor of the building is devoted to the library and museum, the faculty room, the student's common room, the large lecture hall, a household art room and offices.

The second floor of the building is devoted to food work. There are five food laboratories where 100 students may at the same time study foods and their preparation. The attempt has been made to make these laboratories as sanitary as possible. The floors are of terrazzo, the walls up to the tops of the doors glazed tile, and the rest of the walls and ceiling a cement which gives a very hard finish, and according to the contractor can be hosed down. It has been planned to use coal, gas and electricity in the laboratories, and it is hoped to very shortly have an electric stove which will work automatically and which can be depended on for accurate experimental work in temperatures.

To be complete, the scientific study of food must be applied and lead up to the

LILLIAN MASSEY LABORATORY OF HOUSEHOLD SCIENCE, UNIVERSITY OF TORONTO

actual preparation of not only a single dish but of meals and in connection with this part of the work a large dining room has been provided where class instruction may be given. But for the individual student a small apartment of kitchen, pantry and dining room has been planned where she prepares day meals under home conditions. To facilitate the work with large classes, this suite of small rooms has been repeated on the third floor, and adjoining these suites rooms have been provided in which some of the staff and the students who are working in the home suites may live in the building.

In the north wing on the third floor there are two household management laboratories with vitreous tile floors and tiled walls as on the second floor. The experimental work in these laboratories includes a study of cleansing agents, the treatment of woods and metals, the action of various reagents on textile fibers, the economic value of different textiles, etc. The laundry, where practical application is made of the knowledge gained with respect to the cleaning of textiles, is fitted with the necessary tubs, steam boiler, steam dryer, ironing stove, ordinary, gas and electric irons, etc. The home nursing room is also in this wing.

The south wing of the third floor is devoted to food chemistry and contains the office of this department, a lecture room and two laboratories which provide accommodation for over 50 students to work at one time. In one laboratory special provision has been made for advanced students to do research work. There are also two private laboratories, one for the members of the staff in food chemistry and the other for the household science staff.

Realizing that we are influenced to a considerable extent by our surroundings there has been a definite aim in planning the appointments of the entire building to make everything not only durable and convenient for the work to be done but at the same time artistic and such that the building will have an uplifting and elevating effect upon those who come to it day after day.

Household Fans

The first sultry summer days cause the housewife to get out that modern breeze maker, the electric fan; of course she has one stored away on the closet shelf; if not, she begins to look longingly at fans in the shop windows and mentally calculate how she can best dispense with some adornment and obtain what has become almost an absolute necessity in the modern home.

Electric fans in the home drive out the close, sultry air and bring in the freshness of outdoors. More and more it is being realized that fresh air is one of the important factors of healthy living. Air should be changed with frequency to insure health and comfort. Electric fans are the best and surest means of changing air in the household. Equipped with a three speed switch, any range from a gentle movement to a hard blow of air may be had; they are smooth-running, quiet and clean; they make the home delightfully cool on hot days. In the kitchen they may be used to drive out cooking odors; in the dining room they may be combined with the center piece and maintain a mildly exhilarating breeze over the dining table; in the living room they will keep an entire family comfortable; in the bed-room, on hot nights, an electric fan enables one to rest and sleep.

The new type of twelve inch, six blade oscillating fan in dull copper, with close mesh guard is especially suitable for the home where there are small children.

In the illustration, the little girl is very evidently enjoying a delightful summer breeze, so much so that she has insisted upon Pussy enjoying it too; she is sure Pussy must be warm in her furry coat, so the four-footed playmate must have some of the breeze. Pussy likes it but is a bit puzzled as to the source of the agreeable sensation, and no doubt contemplates taking summer quarters somewhere in the vicinity of the electric fan.

ENJOYING A DELIGHTFUL SUMMER BREEZE

Dust on Lamps Absorbs Light

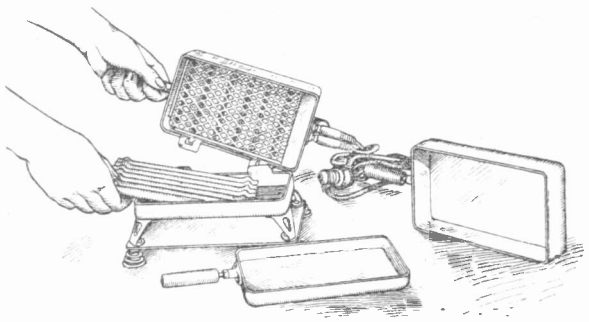
A lady in Cleveland awakened to the fact that her rooms were apparently much darker and less cheerful than they had been at the beginning of the dark winter season—that is to say, just after the fall house cleaning. The change from light to darkness had been so slow as to be imperceptible, but she was sure that it had come.

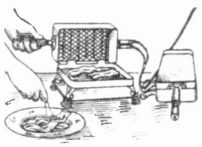
She looked at the room and looked at the lamps and concluded to work the reformation in the lamps.

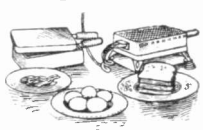
She brought a damp cloth, carefully removed the shades from the lamps, and while the lamps were still lighted she removed every vestige of dust from the bulbs. She washed or thoroughly dusted each shade before replacing it and then compared the light in the room with what it had formerly been. She was very much pleased with the result and the next day carried out her bright idea on every lamp in the house.

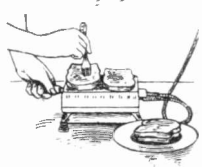
AN IDEAL WEDDING GIFT

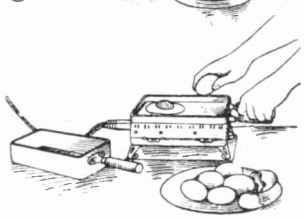
The day after the wedding Mr. and Mrs. Burton went to housekeeping. They decided with great wisdom to enjoy the honeymoon in their own home. They had a five room apartment furnished simply but in good taste and all their wedding gifts were pretty and practical. Mrs. Winsome, the bride's sister, had stipulated that her gift was not to be opened until the morning after and then it was to go into immediate service; so with eager fingers the little bride brought out the original package while Bud clipped the string and pried off one end. Then Mrs. Bud drew out a parcel all neatly done up in tissue paper, then another and still another, as there were three compartments in the package.











"A radiant grill!" cried Mrs. Bud delightedly, "an electric convenience! But fancy taking one's cookstove out of a tissue paper parcel," and she laughed joyously, with all the exuberance of happy youth.

"A very useful and appropriate gift," commented Bud who was immensely interested.

"A fryer, a broiler, a toaster, a boiler," continued the little bride taking up the different parts of the grill. "Could anything be more complete for table cooking?"

"It will save a lot of work," said Bud, busily connecting up the device to a nearby electric light socket.

"How quickly it heats up," cried Mrs. Bud. "See how the coils glow! And the beauty of it is that I can stay right here and prepare the breakfast at table."

"You see," said Bud examining the grill, "the heaters consist of a horizontal series of open radiant coils of calorite which glow instantly upon inserting the two little plugs on the pins."

"How much you know!" exclaimed Mrs. Bud admiringly.

"Well, a fellow who is in the automobile business and handling electrics has to know a thing or two," remarked Bud with becoming modesty. "You know the new slogan, 'If it's modern, it's electrical! Wasn't it great luck that I got the agency for that new electric? Of course I'm not the head of the business yet, but—"

"You're climbing up!" completed Mrs. Bud.

"Now let's get breakfast on the new grill. I've got the bacon and I'll put it to broil beneath the coils. And here is the bread all ready to be toasted on the top of the stove."

"When the toast is done I'll drop a couple of eggs into this shallow pan and by the time we finish our fruit, the bacon and eggs will be ready," said Bud.

"Or if you want some wheat cakes," suggested Mrs. Bud, "I can invert the pan and cook them on top and we can have them after the bacon and eggs are cooked."

"Well, here is your breakfast all nice and hot and the coffee has percolated," exclaimed the little housewife enthusiastically. "How does everything taste and do you think you will like my cooking?"

"I never tasted anything better in all my life," said Bud with the fervency of a newly-wed.

"Thank you," and Mrs. Bud smiled and blushed. "Perhaps it is the grill as well as my skill. You know these modern devices are solving the cooking problems so easily for young married folks like us. Electricity does away with so much of the sordidness of cooking, but these electrical devices make cooking really a dainty art."

"Well," said Bud, "I'm sure we can testify that the radiant grill is an ideal wedding gift!"

Cooking an Art

The human animal feminine trusts to instinct to teach her how to rule a house and guide her young. The human animal masculine believes that Providence arranges these things and that scientific cookery, sanitation and all that are the fad of a small school of cranks.

Cooking is a craft, remember, in that it requires manual dexterity; a profession, in that it requires highly trained service; a science, in that it involves wide, deep and exact knowledge; and beyond all these it is an art—the highest form of human activity—in that it is open to the direct inspiration of genius; is a form of expression.—*Helen Campbell in Household Economics.*

New Kitchen Pleases Mrs. Wilson

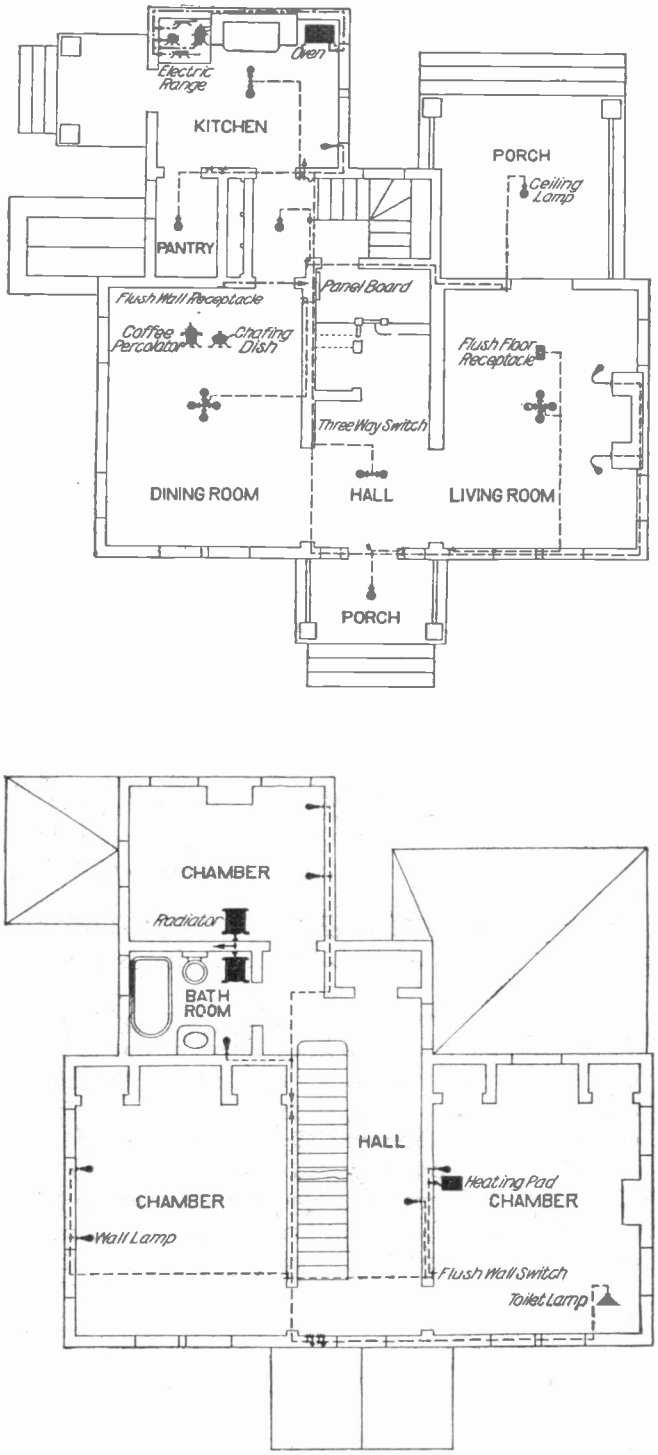
Mrs. Wilson likes to preside over her own kitchen. She is delighted with the kitchen at the White House and hopes to find time to slip in occasionally to concoct something to please the family. She finds in this new kitchen of hers every modern convenience and electrical contrivance for culinary purposes.

Wiring Plans for the Home

Good lighting is the primary consideration for wiring a home and it is here that electric service shows its most attractive aspect and accomplishes perhaps its most desirable purpose. Generally speaking, each room will have its own particular lighting requirements demanding individual attention in regard to the number, size and location of the lighting units; in the living room the requirements for illumination will be quite severe, since in the average home it is the one room most occupied during the evenings. It is therefore well to have several side wall outlets for wall brackets, a ceiling outlet for a central fixture or shower, and two or more baseboard receptacles to provide connection for electroliers, piano lamps and heating devices.

The ceiling and side wall lights can be most conveniently controlled by a side wall switch placed beside a door through which entry is most often made. It is well to make proper provision for switching on a part or all of the lamps in the room, so that it may be either dimly or brightly lighted, as desired.

In the dining room the illumination is most effective if provided from a central ceiling shower so that ample light is thrown on the table directly beneath. This may be supplemented by side wall fixtures, if the size of the room demands them. The kitchen should be the most brilliantly illuminated of any room in the house. The number of lights which should be provided will depend entirely on its size. A fixture in the center of the room is usually capable of providing ample general illumination, but in many cases, the illumination should be re-enforced by wall brackets over the sink and beside the range. Usually the pantry is well taken care of by a single unit placed at such a height that the resulting illumination of the shelves will be adequate and sufficient.



PLANS FOR A HOUSE COSTING LESS THAN $5,000, IN WHICH THE WIRING CIRCUITS HAVE BEEN PROPERLY ARRANGED TO GIVE OUTLETS AND SWITCHES IN THE RIGHT LOCATIONS

An important feature relating to the introduction of heating devices is the arrangement of the various electric circuits. There are three general plans for wiring houses for electric heating devices, which differ chiefly in relative costs of installation. The first includes the most complete system, made up of separate heater circuits to the bathroom, sewing room, dining room, all radiating from a single location and measured on a separate meter from that employed for the regular lighting service.

The second class of wiring combines the use of lighting circuits with a separately metered, heavier wired circuit from which current can be drawn for the operation of the larger cooking utensils at least in the kitchen and laundry.

The third and simplest plan makes use of lighting circuits provided with proper outlets at various points throughout the house.

A plan for a house costing less than $5,000 is herewith presented and it is easily seen that for the simplest and least expensive system of wiring for heating devices, only the lighting circuit need be used.

If possible, the heating circuit to the kitchen should be installed, for in every home electricity is bound to become a source of heat energy for domestic purposes. The cost of such a circuit when the light wiring is being done is nominal. But if the expenditure incident

to such a heating circuit is out of proporton to the total cost for electric wiring, at least extra receptacles should be installed on the lighting circuit.

Little Annoyances That Electricity Saves

A year ago Mrs. Gilford did not have any electrical conveniences in her home.

In April of last spring she had her house wired and she is sure that she has saved herself enough small annoyances to fully repay her for everything spent or done in connection with the wiring. She has had a good trial of every phase of it during the summer and the winter and has noticed many things that appeal to her simply as a housekeeper.

She has been pleased with the absence of burnt matches scattered here and there over the various rooms. Although apparently a very small matter, to her it is quite a relief that she does not have them to look at nor to pick up.

She notices that after the long lighting hours of the winter she has no soiled places on the walls or ceilings. She does not even have to consider papering this spring.

She has not had the disagreeable odor emanating from an open flame light and filling the room.

Since pressing the button brings the light she does not have to leave a light in every room in the house simply so that it will be there when she comes in again.

She likes the dim light which she leaves all night in the hall and bathroom without fear of any mishap.

She has not carried a candle to closets, or cellar, or attic since the installation of the "push-the-button" lights.

The other electrical conveniences which the year has brought have not been small. She has had summer coolness and winter warmth. An electric fan, an electric iron and electric breakfasts are all the year round comforts which Mrs. Gilford has enjoyed. "I don't do my housework," she says, "I merely give directions to my servant—Electricity."

Chautauqua Society Uses Electric Service

"Wild Cat Springs," a private picnic ground rented by the Chautauqua Association of Hamilton, Ill., in its earlier years, is just at the city limits and half a mile from the electric service lines. The Association contracted for a hundred lights for the ten days' program and the electric light company carried its wires this extra distance to accommodate the Chautauqua patrons only.

Campers from town and country establish a semi-circle of tents about the big canvas at a comfortable distance for privacy. Oil lamps are dangerous in tents exposed to strong draughts and they are a nuisance to care for to people accustomed to electric lights in their homes. All night service is provided and for a small rental any tenter can have an electric lamp in his little cloth house.

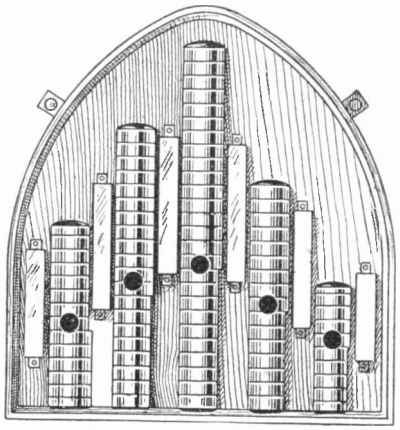
One enterprising lady brought her electric disk stove along and attached it to the lamp socket and used electricity for making coffee and frying bacon and eggs.

Farmers, attending at night with their families in carriages or autos, seem to appreciate having electric lights about the hitching grounds and on the winding road through the grove to the gates.

Electricity afforded comfort to the campers in yet another way, for the telephone company ran extra wires out to the park and installed an instrument for public use in a central location. Thus the housekeepers could order groceries from the stores a mile away and the storekeepers delivered the orders. The assortment of messages that went over these wires covered all the business questions of the men campers as well as the domestic errands of their wives and the calls for the doctor.

Tubular Dinner Chimes

The tubular dinner chimes are made of bell metal tubes, slotted and finished in brass with gold lacquer; between the tubes are cast bronze music plates inscribed with the notes to be played on the chimes. The tubes and plates are mounted on oak backs, so that they may



DINNER CHIMES

be laid down flat or hung on the wall as desired. They were originally designed to be played by hand with a padded mallet, but they may be attached to any clock by concealed wires and played automatically at any given hour by means of electricity.

These chimes are exquisite in tone and are very appropriate for the modern artistic home. They have been very popular as wedding gifts and are much prized by army officers of the the various nations on account of the bugle call, reveille and military calls which may be played upon them.

Practical Wedding Gifts

Not long ago the members of a department of a large store, in the throes of choosing a wedding gift for a fellow worker, went to the young man and desired some hint of what he would most like to receive for the money collected. For answer he brought them the next day a catalogue of electrical appliances with the ones which "he and his" most preferred, plainly marked. The best feature about electrical appliances for wedding gifts is that you can give beautiful and useful things at a cost within your means.

Increasing Food Efficiency

Dr. Kraft of Weisser Hirsch, near Dresden, in a speech before the Physiotherapy Congress at Berlin, said it would be well to extend instruction in the preparation of food to housewives. He declared that vegetables especially lost a tremendous portion of their nourishing qualities when they were prepared in the usual German fashion. Dr. Kraft asserted that mankind's knowledge of foodstuffs was only fragmentary and that the method of estimating value in calories was "useless and bungling."

In the section for electrotherapy, Dr. Bergonie of Bordeaux discussed the action of high frequency electric currents on metabolism. He said that the efficiency of food was much increased by these currents, as 70 per cent of the food which passed through the body undigested could be taken up by the tissues when the currents were applied. The currents also destroyed certain microbes, particularly those of malaria.

This same scientist has advanced the theory that applications of electricity could be made to supply the place of food to a certain extent. By the application of electricity it was his claim that the human body is able to make up for a part of the alimentation of the system by furnishing a large amount of heat to the body, instead of producing the heat from food materials which need to be consumed or indeed burned in the system. The doctor considers that the time is not far distant when all troubles due to insufficient nutrition will disappear under a series of electrical treatments by high frequency currents.

"Impressionism in the kitchen simply means indigestion."

My Native Servant First Meets with Electricity

By W. ROBERT FORAN

On the completion of my journey down the Nile I landed in Cairo, bringing with me my faithful native servant, Sefu bin Mohamed, who had been my valet for six years. On arrival at Shepheard's Hotel I instructed him to take my baggage up to my room and unpack it while I sent off a couple of cablegrams. I showed him the electric elevator and told him to go up to my rooms on the fourth floor in it. He entered the elevator without any suspicion and I thought no more of it.

In half an hour or less I went up to my apartment and found him standing in the middle of the room with my baggage still unpacked.

"What in the name of thunder is the meaning of this, Sefu?" I asked him angrily. "I thought I told you to unpack my baggage and prepare my bath."

"Yes, master, you did."

"Then why the dickens didn't you do as I told you to do?"

"Please, Master, I'm frightened!"

I looked at him in surprise, for I could think of nothing which could have frightened him so thoroughly that he had failed to do my bidding. Then it was that I noticed he was yellow and shaking like an aspen leaf.

"Frightened at what?" I asked in surprise.

"Master put me in a room and it went 'shush!'" he threw his hands up into the air and made a hissing noise through his closed but chattering teeth.

And then it was that I remembered he had never before ridden in an elevator. Of course I roared with laughter at him, while he looked suitably ashamed of himself.

At great pains I explained to him the use of the electric elevator and how it saved one's legs many a weary climb up and down stairs. Finally a great light seemed to dawn upon him and he began to grin sheepishly.

"I see, master. It is the white man's magic and not a devil room."

"That's right, Sefu. Now get my baggage unpacked and look alive about it."

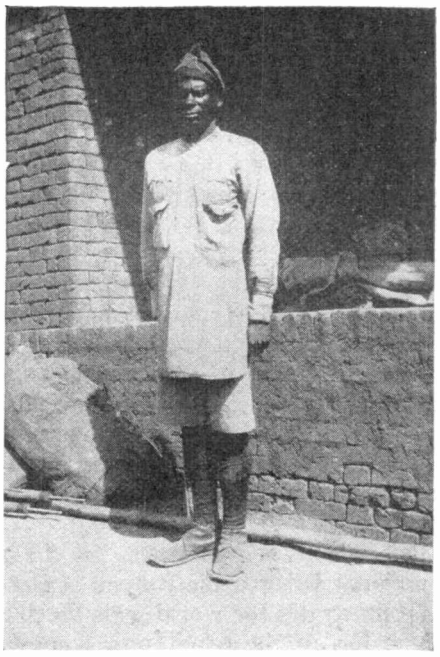
Nothing more was said about the matter for several days and I had almost forgotten the incident when one day I had occassion to send Sefu down to the hotel lobby with a cablegram for dispatch. He returned so quickly that on his reappearance I expressed my surprise at his celerity.

"Oh!" he remarked carelessly, "I went in the up-and-down room."

Afterwards I discovered that he had spent all his spare time ringing for the elevator and riding up and down in it. He now treated the matter as if it was nothing out of the ordinary. Yet, I should have liked to have heard what he told his friends about it on his return to East Africa.

But this was not Sefu's first experience with the white man's electrical genius.

Some years before this incident I had the telephone connected from my house



MY VALET, SEFU BIN MOHAMED

to the police station at Kisumu on the Victoria Nyanza. One day Sefu saw me talking through it to one of my Indian inspectors of police. He watched and listened for some time, and finally went away without saying anything. That night at dinner he asked me who was the new God that I was talking to on the wall.

"God, a new God! what on earth do you mean?" I shouted in surprise.

"Master was talking this afternoon to the box on the wall when I brought him his tea." Sefu was very positive.

A great light broke upon me, for I remembered that he had seen me telephoning.

"That was no God I was talking to, Sefu, but to Inspector Harnam Singh at the police station."

"Talking to Harnam Singh at the police station!" he laughed incredulously.

"Why, yes." I answered. "Come! and you, too, shall talk to him."

I led the way into my living room and called up the police station.

"Hullo! Harnam Singh! Hold the wire a moment." I held out the receiver to Sefu who placed it at his ear as I had done. "Now, Sefu, talk to Harnam Singh and he will answer you."

Sefu looked at the box with contempt and, with a most bored air as if I had to be humored, began to talk.

"Harnam Singh, hullo! How are you to-day?" he began glibly. And then a sudden change came over his face. His superior air vanished and he looked frightened. I, too, heard Harnam Singh's voice come back to him over the wire. Then with a yell he dropped the receiver and ran as fast as his legs would carry him out of the room.

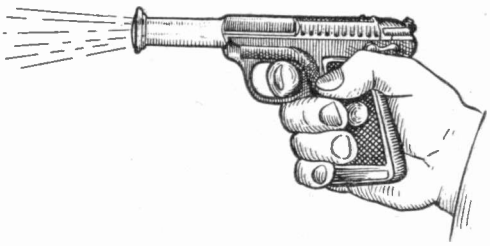
It was some time before I could persuade him to come back, for he was convinced that I had a devil concealed somewhere in the box on the wall. Finally I persuaded him to try again and explained to him as simply as I could what the instrument was.

When he finally came to realize what a great talking machine the telephone was he could hardly be persuaded to leave it alone.

Sefu is firmly convinced now that the white men are great magicians and that they know everything and *then some.*

Pistol Shaped Flashlight

The latest novelty in the flashlight line is this device in the form of an automatic pistol body. The handle serves to



A NOVELTY POCKET LIGHT

carry the battery while at the end of the barrel is a battery lamp and reflector. The trigger is the switch by which the light is controlled.

The Romance of Telegraphy

Few persons realize the importance of the work of the International Telegraphic Conferences held from time to time. These conferences discuss and amicably arrange every point of every sort relating to the exchange of telegraphic communication between all parts of the earth.

The International Conference meets about every five years; but there exists all the time at Berne the International Telegraphic Bureau, which the conferences direct. The bureau in Switzerland is the nerve center of the world's telegraphs. It is the court of arbitration and the medium of amicable arrangement of all the difficulties that arise in the way of the free interchange of telegraphic correspondence between all parts of the globe. It is, as some one has aptly described it, a prosaic business office full of infinite poetry.

"Berne," as the bureau is known in every telegraph office in the world, is in closer touch with the world than are all the world's rulers and statesmen.

If the contending forces in the Balkans cut the wires, or storms or earthquakes or any other catastrophes interrupt the free flow of the world's telegraphic correspondence, "Berne" is the first to know of it, and "Berne" notifies every telegraph in the world, and immediately sets to work to contrive how best the break may be bridged.

The first duty of every nation is to notify "Berne" of any interruption or alteration in its telegraphic arrangements. The first duty of "Berne" is to notify every other nation. "Berne" is the center of everything telegraphic, and "CQ," in the nomenclature of telegraphy is the circumference of everything.

A message from anywhere addressed "Berne" finds its way by the quickest route and ahead of every other message to the International Bureau and a message from Berne addressed simply "CQ," finds its way ahead of every other message to every telegraph office in the wide world.

Every city has its recognized code. New York is "NY," London is "LN," Suez is "SZ," Montevideo is "MV." A message sent from Berne addressed simply "IQ," would quickly find its way to Iquique, far away on the east coast of South America.

But "CQ" means "all stations," and a message from Berne, telling, perhaps, of an interruption to West Indian cables, or of the stoppage of cipher telegrams to Turkey because of the war, would be passed from one station and government and cable company to another, until it reached every telegraph office in the world.

This is only a minor duty of the International Telegraphic Bureau at Berne, but it illustrates the world-wide touch the bureau has of the telegraphic communication of the world. And what Berne does in this detail it also does in every other detail affecting telegraphic correspondence. For Berne is very much more than a mere information bureau. It is an international clearing house and arbitration tribunal. It was created in 1868, as "a central office to collect, arrange, and publish information of all kinds relating to international telegraphy; to circulate requests for modifications of tariffs and service regulations, to give notice of changes adopted, and generally to study all subjects and execute all work entrusted to it in the interest of international telegraphy."

Everything relating to the internal telegraph service of the various countries is communicated to Berne, and so to one another; every improvement any country may introduce, all alterations of tariff, opening of new lines and closing of old ones, information as to experiments in improved telegraphy—even the times during which offices are open for business.

As showing the minuteness of detail with which Berne deals, it is interesting to note that Berne says that "between all

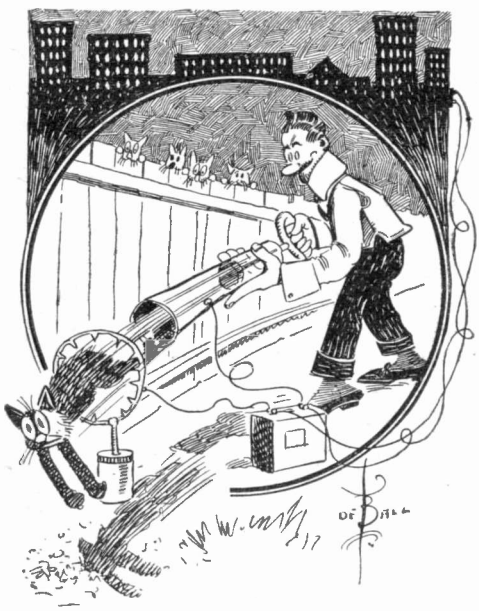
offices of different states the signal for closing is given by the office belonging to the state whose capital is situated furthest West." This trifling rule illustrates vividly how Berne settles a very possible international quarrel between a Persian operator who may want to hurry home to see his sweetheart and a Russian telegrapher who, at the usual hour of closing, has still on hand a message from a prosaic London merchant ordering a bale of something, by next steamer, from his Parsee agent in Bombay.

Cat Power

We do not exactly credit this report from Brooklyn, but give it here in case someone wishes to experiment.

There is no need of going to New London to prove that a cat can give off electricity from its back; right here in Brooklyn it has been demonstrated.

A block on Macon Street was infested with cats. The back fences were topped with a board about four inches wide and this boardwalk was used by the cats as a promenade and concert stage.



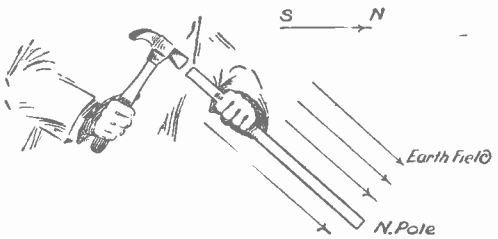
A GLASS TUBE LARGE ENOUGH TO PUSH A CAT THROUGH

An electrician put a glass tube large enough to push a cat into, and with a puff of compressed air pussy was shot out of the other end. The resultant electricity was wired to a storage battery. Each family wishing electric light had to furnnish its own cats.

This furnished light for the block and destroyed the "yows."—*N. Y. Sun.*

Interesting Experiment in Magnetism

One of the simplest yet most puzzling experiments in magnetism can be performed with a rod of machine steel held in the earth's magnetic field. It is well known that it is difficult to free



HOLD THE ROD OF IRON IN THE EARTH'S FIELD

iron completely of magnetism. That is, it is almost impossible completely to demagnetize it. For this experiment a piece of very soft machine steel is desirable.

If a small compass needle is brought near one end the north seeking pole will be found to be either attracted or repelled. At the other end the reverse condition will obtain. Hold the rod of iron in the earth's field whose general direction is north and south and strike one end with a hammer. The end of the rod which is pointed north will become a north pole. If the rod is reversed and a blow struck on the end with the hammer the magnetism in the rod will be found reversed.

As the earth's field is not parallel with the surface of the earth better results will be obtained if the rod is pointed at the earth at an angle of say 60°, care being exercised to keep the rod in a general north and south direction.

Experimental 200 Meter Wave Sets

By PHILIP E. EDELMAN

PART 4

It is well known that the length of the spark gap in the condenser circuit is governed by the potential at the terminals, so that it must be decreased as the charging potential is decreased, the other conditions being constant. It will be understood, too, that the purpose of the spark gap is to allow the condenser to discharge only when it is properly charged. The gap must prevent a discharge before the condenser is properly charged and at the same time it must aid the discharge after the proper point has been reached. It is further known that the resistance of the spark gap is one of the main factors which causes damping of the oscillations and the loss of energy in the form of heat. With these points in mind, then, we may readily follow this brief account of spark gaps in a 200 meter circuit.

Considering first the relation between the charging voltage, length of spark gap and the spark frequency for the particular type of apparatus described in this article, there are several interesting points to be noted. By referring to Fig. 7, which is a simplified and approximate diagram to show these relations, the straight line ($O^v O^v$) represents the zero line in the charging of the primary condenser, while any distance at right angles to this line represents the charging voltage at a particular instant during the cycle. It will be understood that although the time taken in the direction indicated is very small, the diagram shows the general relation with sufficient accuracy for our purposes. Starting at (O), zero potential, the voltage at the secondary terminals of the charging transformer begins its cycle, the voltage increasing with the time so that the curve is traced from (O) in the direction of the arrow marks. Thus, in the present case, the voltage will have reached 7,000 volts, at (a), when the time has reached the point (1), starting from (O). The voltage then increases until the maximum point is reached at (M), or in this case 14,000 volts. The curve from (O) to (M) represents ¼ of the cycle of the

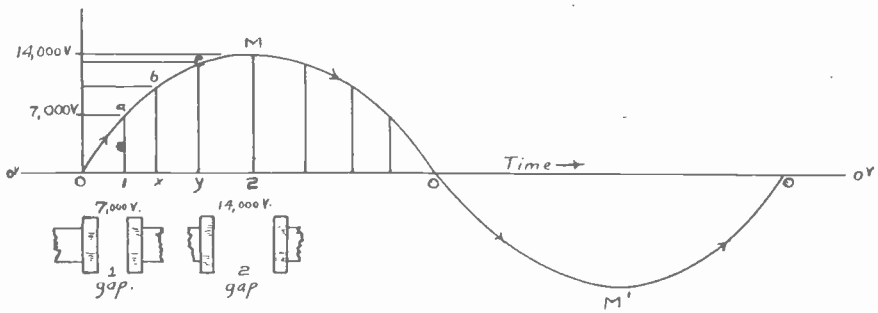


FIG. 7. DIAGRAM SHOWING THE RELATIONS BETWEEN CHARGING VOLTAGE, LENGTH OF SPARK GAP AND FREQUENCY

charging voltage. The next quarter cycle is (M) to (O), the time continually advancing, and the voltage decreasing down to zero again. After this point has been reached the remaining half of the cycle continues in substanially the same manner but in the reverse direction, as indicated by (O M^1 O), the time continually advancing.

Now, if the transmitting circuit is adjusted so that a spark occurs in the spark gap just after the point (M) has been reached, and again just after the point (M^1)' has been reached, there will be two spark discharges corresponding to the one cycle of the charging voltage. There are thus at least two spark discharges for every cycle in the charging voltage. Assuming that the charging transformer has a potential of 14,000 volts at the secondary terminals, we will get these two discharges when the length of the gap is adjusted so that the accumulated charge of the condenser cannot discharge through the gap until the point (M) has been reached. But to do this for the case taken, the gap must be approximately one inch in length, as indicated by gap (2) of the diagram. When this is done, it is evident that the long gap has considerable undesired resistance, and, too, the spark rate is relatively low. Further, the dimensions of the condenser necessary for this case of resonance are such that the method is not well suited to a 200 meter circuit. This will be apparent when it is remembered that we are trying to keep the capacity used small in order to allow sufficient inductance in the primary circuit to insure a good coupling with the antenna circuit.

If, then, we shorten the gap in this case so that a discharge will occur at 7,000 volts—gap (1) shortened to one-half the length of gap (2)—the condenser will only be charging while the voltage and time increases from (O) to (a) before the first spark passes, which means that a smaller condenser capacity must be used in order to allow a proper charge to accumulate in the shorter time. This is just what is desired for a 200 meter circuit, using a transformer to charge the condenser. But since the voltage is still increasing, it is evident that a condenser discharged at the point (a) cannot remain discharged long, for the rising voltage charges it again. Now these conditions are working against each other. The rising voltage continually tends to charge the condenser, after the first discharge, while the gap itself is adjusted so that the condenser discharges almost as soon as it is charged. The voltage still rising, again charges the condenser, which in turn discharges through the gap after a very small space of time, and, as shown in the curve, these discharges may occur at points corresponding to (a), (b), (c), and so on, until the charging potential is no longer high enough to charge the condenser to the sparking potential controlled by the length of the gap. A similar operation, not indicated in the curve, occurs during the lower half of the charging voltage cycle. It is thus evident that such an arrangement will give a large number of discharges or a high spark rate instead of the two discharges of the previous case, provided that the gap itself will permit this rapid charging and discharging.

While an ordinary non-cooled or semi-cooled spark gap will serve well for use with spark coils and even with a transformer, for a brief time, it is unsuited for the circuit under consideration, because its resistance is broken down by the heating, thus affording such a good conductivity that the condenser cannot be charged and discharged in the manner just outlined. By cooling the gap so that it affords a high resistance while the condenser is charging and a low resistance while the condenser is discharging at the high rate desired, we may attain the case of resonance just noted.

SERIES GAP

A compact form of the series gap suited for this purpose is illustrated in

Fig. 8. The essential features in the design are, first, a uniform length for the several gaps between good conductors, and, second, a large cooling surface for the electrodes. The electrodes are turned out from copper or brass sheet to a diameter of three inches and a thickness of ⅛ inch. A distance is then marked at the center for the electrode surface (a), and the metal is cut away for a depth of 1/16 inch to form an electrode with a flange, as shown. The diameter (a) should be about ¼ inch for every 100 watts used, i. e., ⅝ inch for ¼ kilowatt and about one inch for ½ kilowatt. When assembled, the gap will comprise a series of gaps 1/16 inch long with a hooked air space, as shown. The electrodes are spaced apart by means of hard rubber washers. These washers are cut from a polished sheet of uniform thickness of ¼ inch and are made ⅜ inch square, with one end rounded to fit the outer circumference of the flange. The depth of the air space formed (b and c) will then depend on the diameter of the electrode surface (a) and in any case up to ½ kilowatt will be sufficient. It is well to bore a few holes in each electrode surface, as shown in the top view. These face holes may be 3/32 inch in diameter and tend to prevent uneven wear. The last two electrodes may be plain disks and leads made up of two or three thicknesses of ½ inch or ⅝ inch brass ribbon should be soldered to them for terminals. The assembled gap should be mounted between clamps or a screw pressure, so that the whole may be clamped together securely. The number of electrodes to use is best determined by trial and will depend on the charging voltage used. Thus the ¼ kilowatt condenser charged at 7,000 volts will require a smaller number (three or four) than a ½ kilowatt condenser of the same capacity charged at 10,000 volts (five or six).

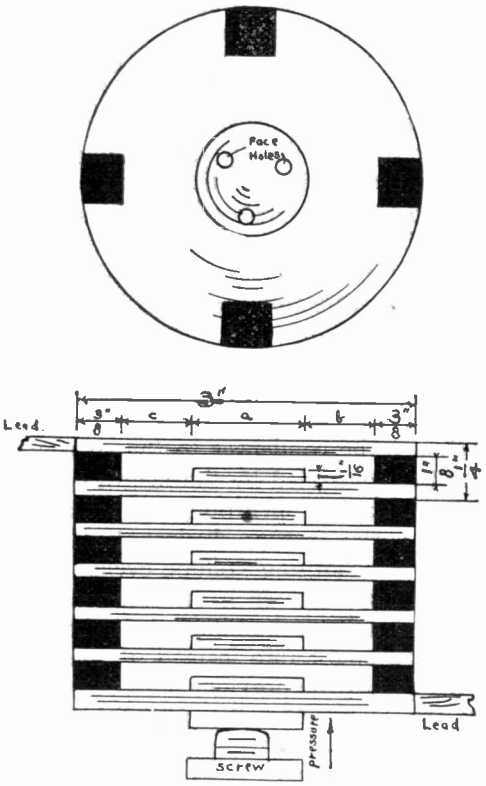


FIG. 8. COMPACT FORM OF SERIES GAP

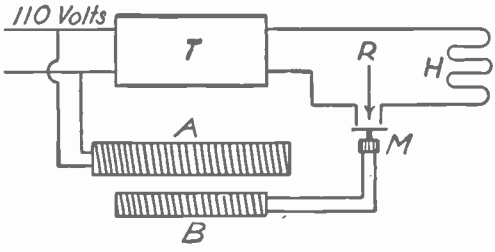
It is seen, then, that this particular design takes care of the increase in power by an increase in the total cooling surface, first, by increasing the size of the electrodes, and, second, but not directly, by increasing the number of electrodes used. A machinist can be found to turn out the plates if no lathe is available, and if time permits it is well to bore a series of ⅛ inch or 3/16 inch holes in the flange part of the electrode to provide additional cooling surface. Indeed, as long as the essential features are preserved the design may be varied.

When once adjusted this form of gap requires little attention until the plates become worn through use, in which case they may be replaced with new ones, or if not badly worn the whole set may be polished with emery cloth. This gap cannot be used continuously unless a small fan or some form of blower is used to circulate a fresh supply of air in between the plates. The gap is preferably mounted in a dust-proof case provided with air openings.

(To be continued.)

Operation of Rotary Spark Gap Motor

Below is a diagram for those who have small battery motors and wish to use them for a rotary spark gap on a 110 volt circuit without injury to the



ROTARY GAP CONNECTIONS

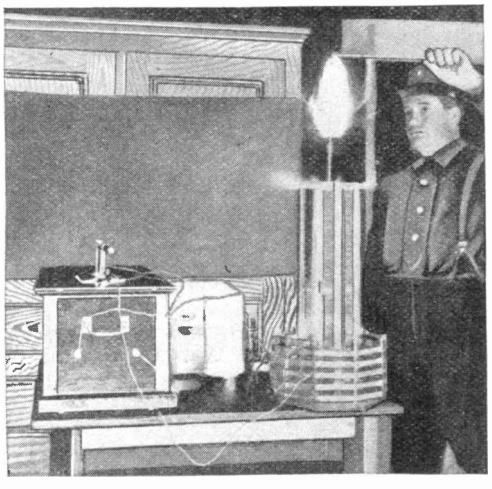
motor or without having to insulate the stud wheel from the motor shaft.

(T) is the transformer, (H) is the helix, (R) is the rotary gap, (M) is the motor, (A) is a regular open core primary 2¼ by 20 inches wound with two layers of No. 12 d. c. c. magnet wire. (B) acts as a secondary, has a core 1 by 12 inches and is wound with two layers of No. 12 d. c. c. magnet wire.

When current is sent through (A), a secondary current is set up in (B), producing a low voltage but heavy amperage, thereby operating the motor. The two coils being separated will prevent the high tension current at the spark gap from passing back through the motor and into the primary circuit. Any degree of regulation can be had by simply moving (B) toward or away from (A) but they must not touch. A piece of glass may be placed between them, or they may be wrapped in empire cloth. A better regulation can not be had than with the coils. The writer used this arrangement on a transformer taking 25 amperes at 110 volts and producing 50,000 volts and the resonator gave a 30 inch spark.

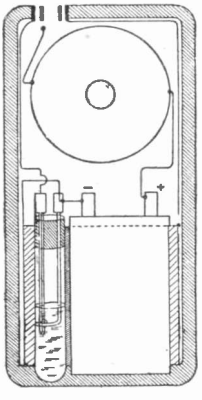
Coil (B) could be made smaller but it works better at the size given. Coil (C) could be made smaller but it would then take more current.

This arrangement can be used on any alternating current lighting circuit. It is cheaper than batteries, is perfectly steady and gives wide control of motor speed.— S. E. Horton.


EXPERIMENT, USING THE ROTARY GAP

A Pocket Receiving Set

The "radio-pocket" is a compact little French apparatus for taking wireless messages, and is designed especially for amateurs at Paris or elsewhere in France who wish to receive the time signals from the Eiffel Tower. It measures only 3 by 6 inches, so that it can be readily carried in the pocket.



POCKET SET

It contains an electrolytic detector, a three volt battery of two cells, condensers and a special telephone receiver. All that is needed is to connect one of the terminals to the antenna and the other to the ground. In dwellings, a wire can be run to any large metal piece such as a balcony, radiator or piping and the like, provided this is not connected direct to ground by metal parts.

Tufts College Wireless Station

Members of the Tufts College Wireless Society, constituting a class in wireless research at the engineering school of Tufts College, Medford, Mass., have completed the installation of a new wireless station on College Hill, which is said to be the most powerful station maintained by any college or school.

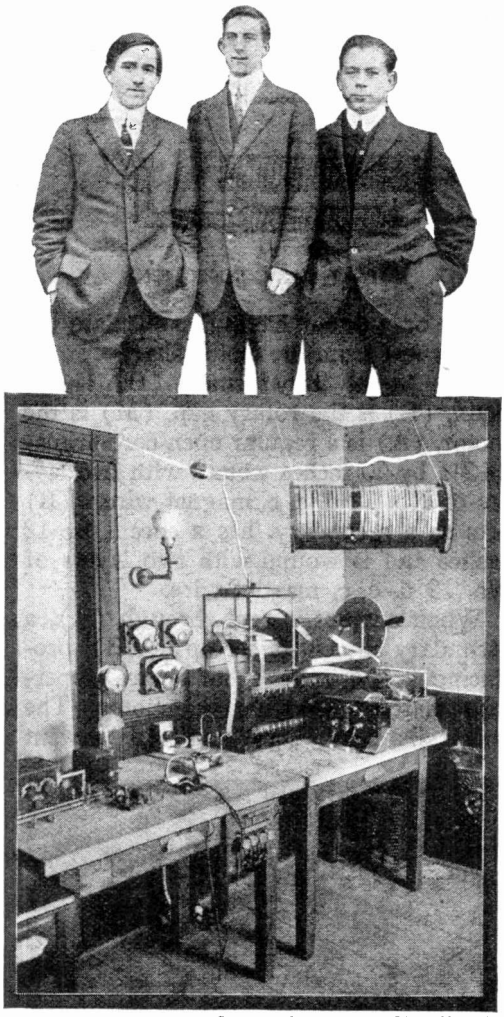
With the new apparatus installed, the Tufts operators are able to send messages, under favorable conditions, more than 1,000 miles and to receive them from twice that distance. While the work of the Tufts Wireless Society is purely voluntary, work in wireless research is being carried on and Acting President Hooper is planning to give a course in wireless study as an elective during the present half-year.

The apparatus was given to the Tufts Wireless Society by an anonymous friend. The station has been located in Paige Hall, on the crest of College Hill, the antennæ stretching from the chimneys of Paige Hall over to Miner Hall, a distance of 225 feet. Over 1,000 feet of wire were used in making the antennæ. The station apparatus includes the latest model commercial, high-voltage transformer, rated at two kilowatts and capable of stepping 110 volts up to 15,000 volts. A synchronous rotating spark driven by a one-eighth horsepower motor is used to set up the Hertzian waves and to discharge the condenser.

In connection with this gap will be used an inductive-coupled oscillation transformer, which is so constructed that great changes in the wave length and character of the wave are possible at the will of the operator.

The synchronous rotating spark gap is a distinct feature of the sending apparatus, since by its means a characteristic and musical note is produced, so that stations will soon learn to recognize Tufts messages before the signal letters are even understood.

The receiving station is equally well equipped. It includes the latest type of inductive tuner, variable condensers, loading coils, a combination of pyron and perikon detectors and a pair of extremely sensitive high resistance wireless receivers.



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APPARATUS OF THE TUFTS COLLEGE WIRELESS STATION. ABOVE—FROM LEFT TO RIGHT—JOSEPH A. PRENTISS, TREASURER, HAROLD I. POWER, PRESIDENT, AND LEON W. PETERSON OF THE TUFTS COLLEGE WIRELESS SOCIETY

The Tufts College Wireless Society came into existence in 1910, but not until the next year were the members able to secure any apparatus. Then Prof. Harry G. Chase of Tufts, captain of

the Mass. National Guard Signal Corps, secured the loan of a portable field wireless set from the state militia and a series of complete tests were made, the result being sent, by request, to the Signal Corps authorities in Washington. A year ago the society was formally organized with Harold J. Power of Everett as president. In 1905, when as a young boy he completed his little receiving set, there was only one other amateur station in New England. He continued to widen his knowledge of wireless and in the summer of 1907 became wireless operator on the steamer Yale. Later he was on the steamer Harvard, the Florizel of the Red Cross Line and Col. John Jacob Astor's yacht Noma, as wireless operator. Last summer he was chief wireless operator on the St. Louis, of the American Line.

Joseph A. Prentiss, treasurer of the society, first became interested in 1908, when he erected an aerial on the roof of his home in Belmont. He made a carbon coherer and other crude instruments used by amateurs then. Since then he has been improving his home aparatus until now he has a fine type of a small station. Last June he passed the government examinations for licensed first-class operators, passing with a high mark. He has never undertaken commercial work, but last summer he was chief wireless operator in the Massachusetts Signal Corps under Capt. Harry Chase.

Privacy for Wireless

Experiments are being made between wireless stations at League Island Navy Yard, Philadelphia and Cape Henlopen, with an instrument said to exclude all stations except the proper one. If the invention is successful it will eliminate the difficulty now experienced by interference from outside stations.

The manner in which the instrument is said to operate is by "tuning" to a certain pitch; similar to the tuning of musical instruments. The receiving set is adjusted to a certain number of vibrations, and can only be reached when the correct number of vibrations are applied from the sending instrument.

The invention is said to be very simple, requiring but slight change to the instruments now in use and the addition of several extra parts. The tuning of the instrument is accomplished by a system of reduction coils through which the electrical current increases or decreases the vibrations. These can be produced at the rate of many thousands a minute, and are gauged by a contrivance which by a simple twist can be set to reach any desired station. A dial attached enables the operator to tell if the proper call has been made to the station wanted.

A government operator at one of the coast stations is the inventor. His name is being withheld until the apparatus is perfected.

Giant Antenna for Wireless

To speak of a wireless antenna fifteen miles long and containing 150 miles of wire would appear to be somewhat fanatic, but a project of this kind is being considered quite seriously in France and it is not as hard to carry out as may seem at first thought. The project is due to one of the state telegraph engineers, M. Bouthillon and it will allow making scientific and practical observations of far-reaching importance in wireless telegraphy. As to cost it should be said that it will not mean any great outlay, not more than $5,000, it is estimated. The antenna is to be made up of ten wires stretched horizontally, each wire being fifteen miles long and the best place for running it is no doubt the picturesque ridge of Grande Chartreuse, the antenna to run on the top of five mountain chains with a greatest height of about 6,000 feet above the sea level. As the distance between the mountains is not over three miles, the wires can easily be run across in a long span, and as the valleys are very deep

the wires would not touch ground, but would clear it by 1,500 feet at least.

The object of an antenna of this kind is to study the use of long wave lengths for wireless work, such waves being several hundred miles long with a frequency of 1,000 per second.

Construction of a Quenched Spark Gap

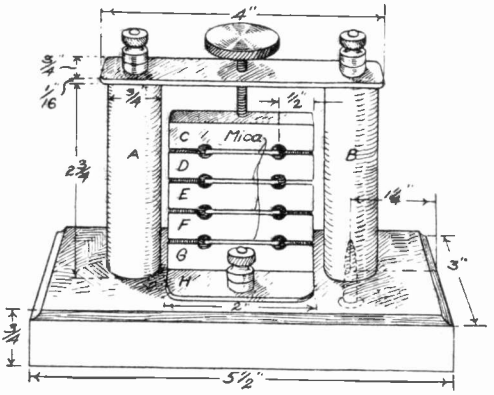
The quenched or series type gap here described has been used in connection with the 200 watt transformer described in the April, 1913, issue of POPULAR ELECTRICITY MAGAZINE. Other operators state that they can easily tune out when this gap is used and also that the pitch of the spark is exceedingly clear. A sixteen candlepower lamp placed in the ærial circuit will light up to full brilliancy when this gap is used.

The materials required are: A hardwood base 5½ by 3 by ¾ inch, an aluminum rod ten inches long and ⅜ inch square, a round fiber rod ¾ inch in diameter and 5½ inches long, a strip of brass 1/16 by ¾ by 4 inches, a thin piece of brass 1½ by 2 inches and a small quantity of mica.

Bore two 3/16 inch holes in the wooden base 1½ inches from the side and 1¼ inches from the ends. Also bore one 3/16 inch hole ¾ inch from the edge and 2¾ inches from the end of the base. Cut the fiber rod into two pieces 2¾ inches long and drill one end of each to receive 8/32 inch binding posts and drill holes in the lower ends to admit ordinary wood screws. These fiber rods are to act as standards as shown in the accompanying cut. The brass strip ¾ by 1/16 by 4 inches has two 3/16 inch holes bored ⅜ inch from each end and ⅜ inch from the side to admit the binding posts as shown. A hole is tapped for an 8/32 thread two inches from the end of the brass strip. This is to admit the thumbscrew.

To build the gap the aluminum rod is cut into two inch lengths. Two pieces are taken at a time and placed side by side in the vise. On the line between the pieces and ½ inch from each end of the rods a 3/16 inch hole is bored. These rods (C, D, E, F, G) form the gaps.

After the base, standards and brass strip with thumbscrew have been put together assemble the gap. The thin piece of brass (H) 1½ by 2 inches is punched one inch from the end and ⅜ inch from the side to receive the lower binding post.

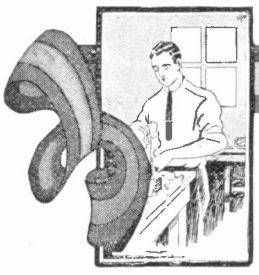


QUENCHED SPARK GAP

The lowest aluminum rod (G) is placed on this lower brass plate, a strip of mica ⅝ inch wide and long enough to reach from the center of one of the holes to the center of the other hole when the rods are arranged is placed on the top of the aluminum rod. The next rod (F) is placed on top of this, and so on with the remaining rods. In this manner the gap is built up and clamped by the thumbscrew.

The gap is connected as usual in the closed oscillating circuit. The mica used is about .01 to .02 inch thick. This gap overcomes to a large extent the demerits of the ordinary gap and there are no rapidly rotating parts as in a rotary gap. A greater number of gaps may be placed in series for a larger transformer.—ALEX POLSON.

The world's largest wireless station is projected for Wales, where convenient mountains will enable the antennæ to be erected 2,800 feet above sea level.



For Practical Electrical Workers

Elementary Electricity for Practical Workers

By W. T. RYAN

Chapter III—Electrical and Magnetic Units

The study of electrical engineering must be based upon accurate conceptions of fundamental electrical and magnetic quantities. It is therefore necessary to have a working knowledge of the units.

Our English system of units has been much criticized, but it is in use at the present time and probably will remain for some time,—therefore we must make use of the system whether we like it or not.

In Philadelphia, on September 24, 1884, Lord Kelvin said: "I look upon our English system of units as a wickedly brain-destroying piece of bondage under which we suffer. I say this seriously. I do not think anyone knows how seriously I speak of it."

It is very easy for me to say that we ought to discard our English system of units and adopt the metric. If I were a great manufacturing company, however and had tens of thousands of dollars invested in molds, patterns, etc., all based on the English system, I probably would not be in much of a hurry to change. However, some of the large manufacturing companies are giving the matter serious consideration, and a drawing is occasionally seen on which the dimensions are given both in inches and in centimeters. It is not at all improbable that in time the change will be made. In the American Institute of Electrical Engineers' Proceedings both systems are now used.

In this discussion I propose to start from the bottom and come up, therefore I will first classify the units:

- **Fundamental units**
  - Length—centimeter
  - Mass—gram
  - Time—second
- **Secondary units**
  - Area—square centimeter
  - Volume—cubic centimeter
  - Velocity—one cm. per sec.
  - Acceleration—one cm. per sec.
  - Force—dyne
  - Work—erg
  - Power—erg per sec.
  - Heat—calory
- **Magnetic units**
  - Unit pole—no name
  - Density—gauss
  - Flux—maxwell
  - Magnetizing force—gilbert
  - Reluctance—oersted
  - Permeability—no name
- **Electrical units**
  - **Electrostatic** (based on the force exerted between 2 quantities).
    - Unit quantity—no name
    - Unit current—no name
    - Unit potential—no name
    - Unit specific inductive capacity—no name
  - **Electromagnetic** (based on the force exerted between a magnetic pole and a current of electricity).
    - Absolute
      - Unit current—no name
      - Unit quantity—no name
      - Unit potential—no name
      - Unit resistence—no name
      - Unit energy—erg
      - Unit power—erg per sec.
      - Unit capacity—no name
      - Unit inductance—no name
    - Practical
      - Unit current—ampere
      - Unit quantity—coulomb
      - Unit potential—volt
      - Unit resistence—ohm
      - Unit capacity—farad
      - Unit energy—joule
      - Unit power—watt
      - Unit inductance—henry
    - Legal
      - Ohm—mercury column
      - Volt—standard cell
      - Ampere—silver voltameter

I shall not stop to discuss the fundamental or secondary units. You all have a working conception of what a centimeter, a gram, a second, a square centimeter, a cubic centimeter, etc., are. We will pass on then to the magnetic units.

MAGNETIC UNITS

Unit Magnetic Pole: If two magnetic poles whose strengths are M and M' respectively, are placed at a distance d, it has been determined over and over again, experimentally, that the force, F, with which they act upon each other is:

$$F = \frac{MM'}{d^2}$$

If F is one dyne, if M and M' are equal and is d is one centimeter, than M and M' are each unit magnetic poles.

A *unit magnetic pole* may therefore be defined as a pole of such strength that it will exert a force of one dyne on a similar pole at a distance of one centimeter. No name has been adopted for this unit.

Unit Density: The unit of magnetic density is the *gauss,* and is simply one line of force per square centimeter.

The term "line of force" is used in two senses. It means the lines along which magnetic attractions and repulsions take place and is also used as a unit to measure the strength of the magnetic field. If, for example, the intensity of the field is such that it will exert a force of one dyne on a unit magnetic pole, we say the intensity is one line of force per square centimeter.

Unit Flux: In place of the term "line of force," the word *maxwell* has been adopted. Unit of magnetic flux is therefore the maxwell, and is simply one line of force. The physicist usually says gausses or maxwells. The majority of engineers still use the terms "lines of force per square centimeter, or per square inch."

Unit Magnetizing Force: This unit is named the *gilbert* and is equal to $1 \div 0.4\pi$ ampere turns ($\pi = 3.1416$). A gilbert would therefore correspond to 0.7958 ampere turns. Most engineers still use the term ampere turns. It is more convenient for the purposes of design.

Unit Reluctance: The reluctance of a magnetic circuit varies directly as its length, inversely as its area and inversely as the permeability of material of the circuit. (The permeability of air is unity.) The reluctance of a cubic centimeter of air is taken as unity and is called one *oersted.*

ELECTRICAL UNITS

Sometimes one is confused by the fact that there are two distinct systems of electrical units, one called the electro-static system and the other the electro-magnetic system. The electro-magnetic system is further subdivided into the absolute, the practical and the legal units.

In the electro-static system we define first in order unit quantity, whereas in the electro-magnetic system we start with unit current.

ELECTRO-STATIC UNITS

Unit Quantity: Unit quantity is that quantity of electricity that will act on another similar quantity at a distance of one centimeter with a force of one dyne. It has not been assigned any name.

Unit Current: The heating of the filament of a lamp, the power exerted by an electric motor, the breaking up of liquids into their constituents and many other phenomena are said to be due to the effects of an electric current. This electricity is essentially the same as static or frictional electricity. If a glass is rubbed with silk it is charged positively. If a resin rod is rubbed with fur it is charged negatively. If we connect them by a metal rod they neutralize and a current of electricity flows, which is just the same as the current which flows from a battery. In the case of static electricity, however, there is simply a sudden momentary rush, known as the discharge, and it is stretching a point to call it an

electric current. In this system we define unit current as that current which conveys unit quantity past a given point on a conductor in one second. It has no name and inasmuch as the discharge usually lasts only a fraction of a thousandth of a second it can hardly be considered an electric current.

Unit Potential: Unit potential is that electricity moving force or electromotive force (e. m. f.) which exists between two points or charged bodies when one erg of work is done in moving unit quantity from one point to another.

Unit Specific Inductive Capacity: The specific inductive capacity of a substance is the ratio between the capacity of a condenser having that substance as a dielectric and one having dry air at a temperature of 0° C. and a barometric pressure of 76 centimeters.

ELECTRO-MAGNETIC UNITS.

In this system, which is of course the one in which we are particularly interested, we define, first, unit current. To measure current, we make use of its magnetic or electrolytic strength. We say one current is twice as strong as another when it exerts double the force on a magnetic needle, or deposits twice as much silver from a certain solution as another under the same conditions.

Unit Current: Unit current is that current which when flowing along a wire one centimeter in length, bent into the form of a circular arc of one centimeter radius, acts with a force of one dyne on a unit magnetic pole placed at the center. Practically, we would, of course, consider a large circular piece of wire several cms. long and several cms. in diameter and then measure the effect on a pole at the center that would have some size to it, but still would have negligibly small dimensions as compared to the diameter of the conductor. This unit is too large for commercial purposes, hence we divide it by ten and then call it an *ampere*.

It is evident that the above unit could not easily be exactly produced. Therefore the legal ampere is defined as the current which will deposit 0.00118 grams of silver per second from a solution of fifteen parts by weight of silver nitrate and 85 parts by weight of water, under certain conditions, and as per a very elaborate set of specifications, recommended by the International Electrical Congress and legalized by the United States Congress.

Unit Quantity: Unit quantity is that quantity of electricity which in one second passes any section of a conductor in which unit current is flowing. When the current is one ampere, the quantity which passes in one second is one *coulomb*. It is also one-tenth of the absolute unit. It represents a definite quantity of electricity, just as the gallon represents a definite quantity of water. The analogy to amperes would be *gallons per second.*

Unit Potential: Unit difference of potential exists between two points when the work done against the electrical forces in moving unit quantity from one point to the other is one erg. This unit is found to be one hundred million times too small for commercial purposes, hence we multiply it by ten to the eighth power and call it a *volt.*

The legal volt is defined as a certain fraction of the voltage of a certain standard cell, made according to an elaborate set of specifications recommended by the International Electrical Congress, and legalized by an act of Congress.

Unit Resistance: Unit resistance is possessed by that conductor through which unit current will flow when unit e. m. f. is applied to its ends. One billion times this gives us a unit of convenient size for practical purposes. We call it an *ohm*. The legal ohm is defined as the resistance offered by a column of mercury at the temperature of melting ice, of one millimeter cross-section, and 106.3 centimeters long, as per specifications, etc.

The legal ampere as reproduced in a silver voltameter is seldom used as a

fundamental standard any more. Practically all high grade laboratories maintain standard cells and standard resistances as their court of last resort in case exceedingly accurate calibrations are required. The ampere is taken as the quotient of the volt and the ohm.

Unit Energy: The absolute unit of electrical energy is that represented by the flow of unit current for one second through a conductor of unit resistance. It is called an *erg*. Ten million ergs is a *joule* and represents the work done by the flow for one second of one ampere through a conductor whose resistance is one ohm. An erg is also the work required to raise one gram, one centimeter against the force of gravity. The joules are equal to the product of volts and coulombs and since the coulombs are equal to the product of amperes and seconds, it follows that:

$$J = E\ I\ t$$

where J equals electrical energy in joules; I equals current in amperes; t equals time in seconds.

Since from Ohm's law E equals IR where R is resistance in ohms,

$$J = I^2\ R\ t \text{ joules},$$

or,

$$J = 10^7 I^2\ R\ t \text{ ergs}.$$

Even the joule is too small a unit for commercial use. The most common unit is the *kilowatt-hour* which represents 3,600,000 joules or 36,000,000,000,000 ergs. Sometimes the term *horsepower-hour* which is equal to *550 foot lbs. per second,* and to 0.746 kilowatt-hours is used.

Unit of Power: The absolute unit of power is the erg per second. The practical unit is the watt and is equal to a joule per second. Therefore it follows that,

$$W = E\ I = I^2\ R$$

where W equals power in watts.

The power of a generator is usually expressed in kilowatts, whereas the power of a steam engine, or other prime mover and of motors is usually given in horsepower.

Joule found that the heat which is generated by doing 778 foot-pounds of work is equivalent to the heat required to raise the temperature of one pound of water one degree Fahrenheit, when at its maximum density, or when its temperature is approximately 39° F. This quantity of heat is called a British thermal unit (B. T. U.). Since 778 foot-pounds is equal to one B. T. U., since 550 foot-pounds per second equals a horsepower and since a horsepower equals 746 watts, we have established the relationship between electrical, mechanical and heat energy.

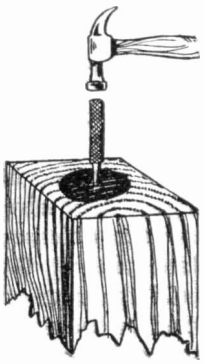
Unit Capacity: Unit capacity exists in a condenser when a unit quantity per unit of applied e. m. f. is stored in the dielectric separating the plates. When considering alternating current circuits it is usually defined as follows: A circuit has unit capacity when unit current flows into the dielectric per unit rate of change of the applied e. m. f. One billion times this unit is called a *farad*. The farad is too large for most practical purposes, so we generally use the *microfarad*, (one-millionth of a farad).

Unit Inductance: A changing current in a circuit produces an e. m. f. When we make or break a direct current circuit an e. m. f. is produced, while the current is rising from zero to its normal value or vice versa. This e. m. f. is in opposition to the applied potential, therefore it takes some time for the current to reach its normal value after the switch is closed or to die out after it is opened. Once the current has become established the effect is, of course, nil.

An alternating current is changing all the time, therefore this induced e. m. f. is present all the time. The absolute unit of inductance is possessed in that circuit in which the rate of change of one unit of current per second produces unit e. m. f. One billion of these units is called a *henry*. A circuit in which a change of one ampere per second will induce one volt has one henry inductance.

(To be continued.)

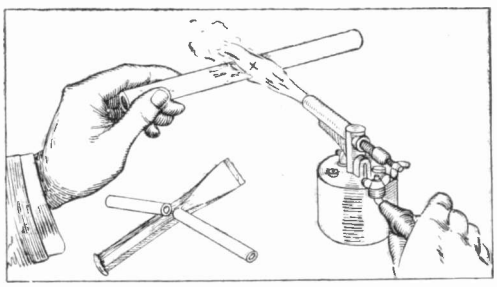
Punching Armature Laminations



To make holes in armature laminations or other pieces of sheet metal, place the metal upon a block of wood, the grain of which is cut so as to pound directly at the end of the grain. Use a flat ended punch, and strike a sharp, quick blow with a fairly heavy iron. In this way a clean-cuthole will be made, while if a sharp-pointed punch is employed, the metal will be pushed aside instead of being punched, and leave a ragged edge inside the hole.

Breaking a Porcelain Tube at the Point Desired

No doubt numerous electricians who have tried to break or cut a porcelain tube to a desired length, have noticed the great difficulty they have met in doing so. A convenient method of overcoming this difficulty is within the reach of all simply by using one of the principal instruments the electrician usually carries along—the "blow-torch" or alcohol torch.



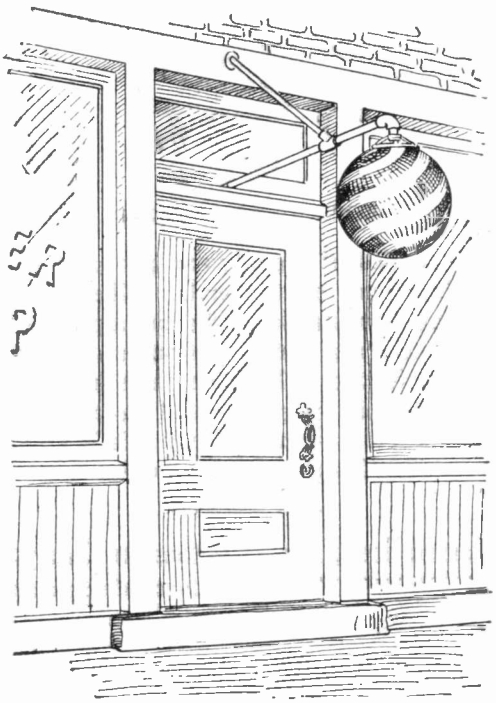
METHOD OF BREAKING PORCELAIN TUBE

After marking the tube at the length or proper size desired, the tube is then revolved in either one or both hands; meanwhile the electrician blows a steady pointed flame of fire upon the point marked. The more evenly the tube is held to the mark while turning it, the finer and more perfectly even will be the break.

After the constant application of the flame of from 40 to 60 seconds, the tube should be suddenly dipped into water. Now taking the tube by the largest end from the point of annealment and tapping it against the hammer, pliers, or any hard instrument at the point where the flame encountered the tube, it will break sharply and evenly at the point desired.—T. J. NEWLIN.

Barber's Door Light and Sign

In a small southern Illinois town a barber had no available space on which to place a pole, so he had an electric fixture

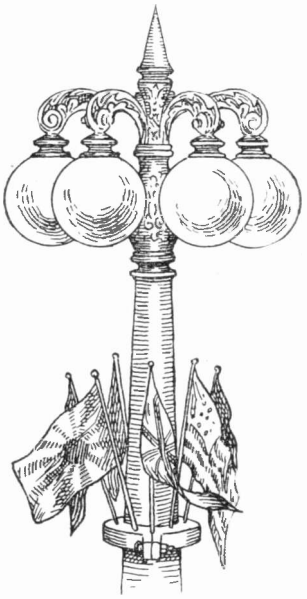


BARBERS' DOOR LIGHT AND SIGN

carrying an unusually large glass globe placed over his shop entrance. This was painted with the barbers' colors, the substitute proving even more effective than the usual trade sign.

Decorating a Lamp Post

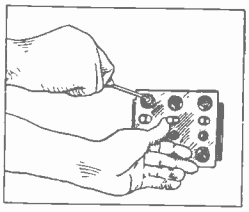
During a convention in Chicago of distinguished scientists from all over the world, the electric lamp posts along Michigan Avenue were decorated with flags. To do this without too much expense, two



LAMP POST DECORATIONS

half circles of wood were cut with extending ears at the ends. These two half circles were clamped about a post and a thumb screw and nut through a hole in each pair of ears held the circle in place. Around this ring of wood holes were bored, into which the flagstaffs bearing flags of different nations were set.

Frame Installing Switches in Gangs

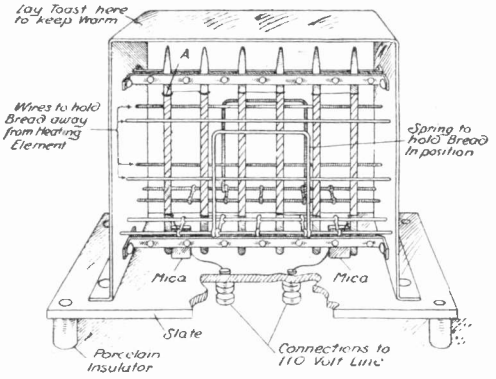


GANG SWITCH FRAME

Every electrician appreciates the work connected with the installation of several push button switches in a gang box. The Perkins steel adjusting frame serves to make the spacing and aligning of such switches comparatively easy as shown in the illustration. A three gang frame can be used for any number of switches and insures accurate work.

How to Build an Electric Toaster

The construction of an upright toaster is shown on the accompanying sketch. The heating element, which consists of fifteen feet of No. 25 gauge Calido wire, is wound around five or six ordinary slate pencils. To facilitate winding the resistance wire and to hold the wire on one pencil, until it is wound on the next, a small piece of No. 20 gauge bare copper wire is twisted around each end of each pencil, as shown. The heating wire



HOME MADE TOASTER

is then twisted around the projecting part of the copper wire (A) which will hold it and then wound around the pencil. This would not be necessary if the resistance wire were not wound in one piece. If a separate piece of wire were wound on each pencil and then the wires connected together, it would be difficult and troublesome to make good, permanent conducting joints between the pencils. Although Calido wire does not appreciably oxidize, still in time it does oxidize enough to increase the resistance at the joints unless they are tightly and permanently made.

When the toaster is first connected and the slate pencils begin to heat, they will crack and rattle in surprising fashion, but as soon as they become heated thoroughly the noise will cease. The

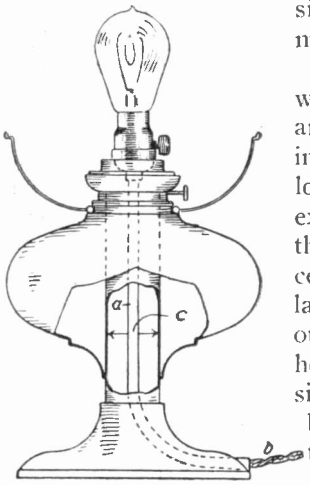
pencils can be heated up to the point of incandescence without breaking.

The other points of design are left to the builder. One way to mount the pencils is between two sheet iron strips as shown, with a small bolt or rivet between each two pencils to firmly clamp them in place.

Fifteen feet of No. 25 Calido wire will be found about right for 110 volts either direct or alternating current. If more heat is desired, unwind three or four turns from one of the end pencils, and cut this off, shortening the heating element that much. This will reduce the resistance, allowing more current to flow through the heating element, raising its temperature. On the other hand, if it becomes too hot, splice on five or six inches more of the Calido wire.—WESLEY G. PAULSON.

Desk Lamps

The lamp described, I made from an old Rayo oil lamp, but any oil lamp of similar design may be used.



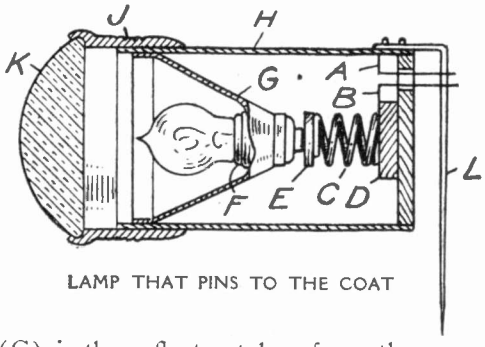
ELECTRIC DESK LAMP MADE FROM AN OLD OIL LAMP

Remove the wick and the top and secure a ¼ inch rubber tube long enough to extend down through the center of the lamp body and out through a hole made in the side near the bottom. Allow the tube to project ¼ inch. Pull through this tube the cord of a socket and fit the tube up close to the socket. Then fit the socket as shown into the open part of the lamp, and put a plug on the cord for attaching to the circuit. The cost is about 60 cents. —C. M. PFENNING.

Cap or Coat Battery Lamp

In working in dark attics and basements I have used the arrangement shown in the drawing.

(H) is the end of an ordinary tubular flashlight removed from the tube and fitted to the wooden piece (M).



LAMP THAT PINS TO THE COAT

(G) is the reflector taken from the same light, while (K) is the lens and (F) a 2½ volt tungsten lamp, mounted exactly as in the flashlight.

In the center of the piece (M) a spring (C) or a metal clip is mounted to make contact with the base of the lamp. A piece of twin cord about four feet long is connected to the spring or clip on one side and the metal cage (H) on the other. These are led to a small pocket battery. A piece of brass wire (L) is bent to form a substantial pin, and soldered on, for attachment to the coat or cap.—J. S. BLAIR, JR.

Charging a Dry Cell

A dry cell that is exhausted may to a certain extent be "doctored up" so as to be of some further use, if its internal resistance has not increased, by charging with a direct current of ½ ampere. This is the current consumed by a 110 volt sixteen candlepower carbon lamp.

Connect the positive terminal of the charging circuit with the positive pole of the dry cell and the negative lead to the negative terminal, placing the lamp in series with the cell. Only a small part of the energy put into the cell in this way can be taken out.

How to Build a ⅛ Horsepower Motor Without Castings

By W. A. ROBERTSON

This machine is designed for a Manchester laminated field and a slotted drum armature to operate on 100 to 110 volts, or can be wound to run from a battery.

Referring to the drawing, Fig. 1, the field frame may be composed of convenient thicknesses of sheet wrought iron, say ¼ inch, as shown in Fig. 3, or it may be made of ¼ inch iron at the outside and about No. 24 gauge sheet iron between.

Make a templet of the field as shown in Fig. 1 about 1/16 inch larger than the drawing, which is actual size to allow for filing. After a templet is made mark and drill the two ¼ inch holes, then clamp the templet to the sheet iron and mark with a scriber a number of plates, which when drawn together solid will be two inches thick, this being the thickness of the field.

After the plates are cut out and the two ¼ inch holes drilled, assemble and rivet the plates up solid. Then drill the 3/16 inch holes and rivet them up also. Now take the top and bottom part of the field and file them up to size and mark and bore the 1¼ inch holes for the field cores 5⅜ inches between centers. Be sure to have them correctly spaced.

Take two pieces of wrought iron 1½ inch in diameter and 4¼ inches long, center and turn them to the size shown in the sectional view in Fig. 1. Make a good tight fit and rivet the two cores to the bottom part of the frame. The top part of the frame can be secured by two 3/16 inch pins fastened through the frame and core.

After the field frame is secured you can bore out the core for the armature to 2 5/16 inches in diameter; then mark and drill the ⅜ inch tap holes 3¼ inches between centers and tap the holes for the bearing stud shown in Fig. 5. Also drill the ¼ inch tap holes for the holding down lugs shown in Fig. 2.

When the field frame has been filed and the holes drilled and tapped, make four bearing studs out of machine steel as shown in Fig. 5 and screw them to the field frame as shown in Fig. 2.

To make the bearing frames take two pieces ⅛ inch sheet brass and drill and cut out to the size shown in Fig. 8 to fit on the bearing studs. The center hole for the bearing may be drilled ⅝ inch and filed out afterward when adjusting the bearings on the armature. The bearings are made of two pieces of ⅝ inch brass rod and are drilled out to the size of the shaft which is ⅜ inch in diameter.

Make the shaft of machine steel as shown in Fig. 4, then turn up the part to size for the armature disks, leaving the finishing of the bearings and commutator till the armature disks are secured on the shaft as the shaft may spring.

To make the armature take two pieces of sheet wrought iron and cut out a little larger than shown in Fig. 6. Drill one piece to fit on the shaft up to the shoulder and tap the other piece so it will screw tight on the threaded part of the shaft, Fig. 4 (B). Then cut out enough disks of sheet wrought iron (about No. 24 gauge) to make up the thickness of the armature which is 2¼ inches when finished. When the two end pieces and the disks are cut out, clamp them together with a bolt and nut and anneal them by placing them in a fire until they become cherry red, then let cool off in ashes or slack lime. When the armature disks are cool slip them on the shaft and fasten so they will not turn or move when turning off the armature. Place the shaft in the lathe and see that it runs

true; if not, straighten it and turn off the armature to 2¼ inches in diameter and 2¼ inches long; also turn up the shaft for the commutator and bearings. Before removing the armature make a recess for the binding wires around it ¼ inch wide and 1/32 inch deep. Remove the armature from the lathe and mark off the twelve slots 9/32 inch wide and 7/32 inch deep as shown in Fig. 6. You can cut out the slots by sawing them near the marks with a fine hack saw, then take a small, sharp cold chisel and chip out the slots, then make a small gig out of a piece of brass or iron 9/32 by 7/32 by 2¼ inches and file out the slots to fit the gig.

When the armature is done wrap a piece of paper on the outside and place it in the armature opening of the field, then slip the bearings on the shaft through the holes in the bearing frame. If the holes in the bearing frame should be out of line, file them out to fit the bearings. When the bearings are in their place solder them to the frame, building the solder well up as shown in Fig. 2. Now remove the paper from the armature and see that the armature revolves freely in the bearings and field. If all is correct remove the bearings and place them on a mandrel, turn off the solder and drill oil holes as shown in Fig. 2.

To make the commutator place a piece of one inch brass pipe on a mandrel. Make it ⅞ inch long and champ off the end about 60 degrees; divide the circumference into twelve equal parts. Center these parts and drill twelve ⅛ inch tap holes for pins to which to connect the ends of the armature wires. Screw in the pins and turn them off as shown in Fig. 7, to 1½ inch diameter; then make a saw cut in the ends of the pins for the wires. With a fine saw cut the twelve segments through between the pins. The hub is made from two pieces of ½ inch fibre turned to fit the bore of the brass pipe as shown in Fig. 7. Now take twelve strips of mica the thickness of the saw cut and place one between the segments of the commutator bars, then on the fibre hubs, slip the hubs on the shaft, screw them up tight, as shown in Fig. 2, then with a fine cut turn up the commutator as in Fig. 7.

For the brush holder take a piece of ½ inch fibre, drill and cut it to size as shown in Fig. 10.

The brass brush studs, Fig. 9, for holding the carbon brushes is made out of two pieces of ½ inch brass rod. Turn one end down to ⅜ inch in diameter and ⅝ inch long, then square the rest of the stud up to ⅜ inch. Take a piece of 1/32 inch sheet brass as shown in Fig. 9, fold it over a piece of ⅜ inch square iron, then fasten it to the end of the stud by two small pins, and solder. Make the springs and screws as shown. The carbon brushes are made out of a piece of carbon ⅜ inch square and one inch long. The brush holder is placed on the outside of the bearing, Fig. 2.

To insulate the field coils, make two spools, Fig. 1, by wrapping a piece of 1/32 inch fibre around the cores. Glue two washers of ⅛ inch fiber in place and after they are set they can be removed for winding.

To wind the field spools make a piece of wood the same size and length as the field core, also two wooden flanges to prevent the flanges on the spools from spreading. One flange is made fast to the wooden core and the other is screwed to the wooden core so it can be removed when winding the spools. Drill a small hole diametrically through the fibre flange, letting it come out at the core, then place one end of the wire through the hole in the flange and wind on each spool 3,600 turns of No. 27 B. & S. gauge, s. c. c. copper magnet wire. It will take 120 turns and 30 layers. Be sure to have the same quantity of wire on each spool. The spools are wound to produce consequent poles, north at the top and south at the bottom, or vice versa. The work can be done in the lathe, with a little care. Shellac each layer lightly.

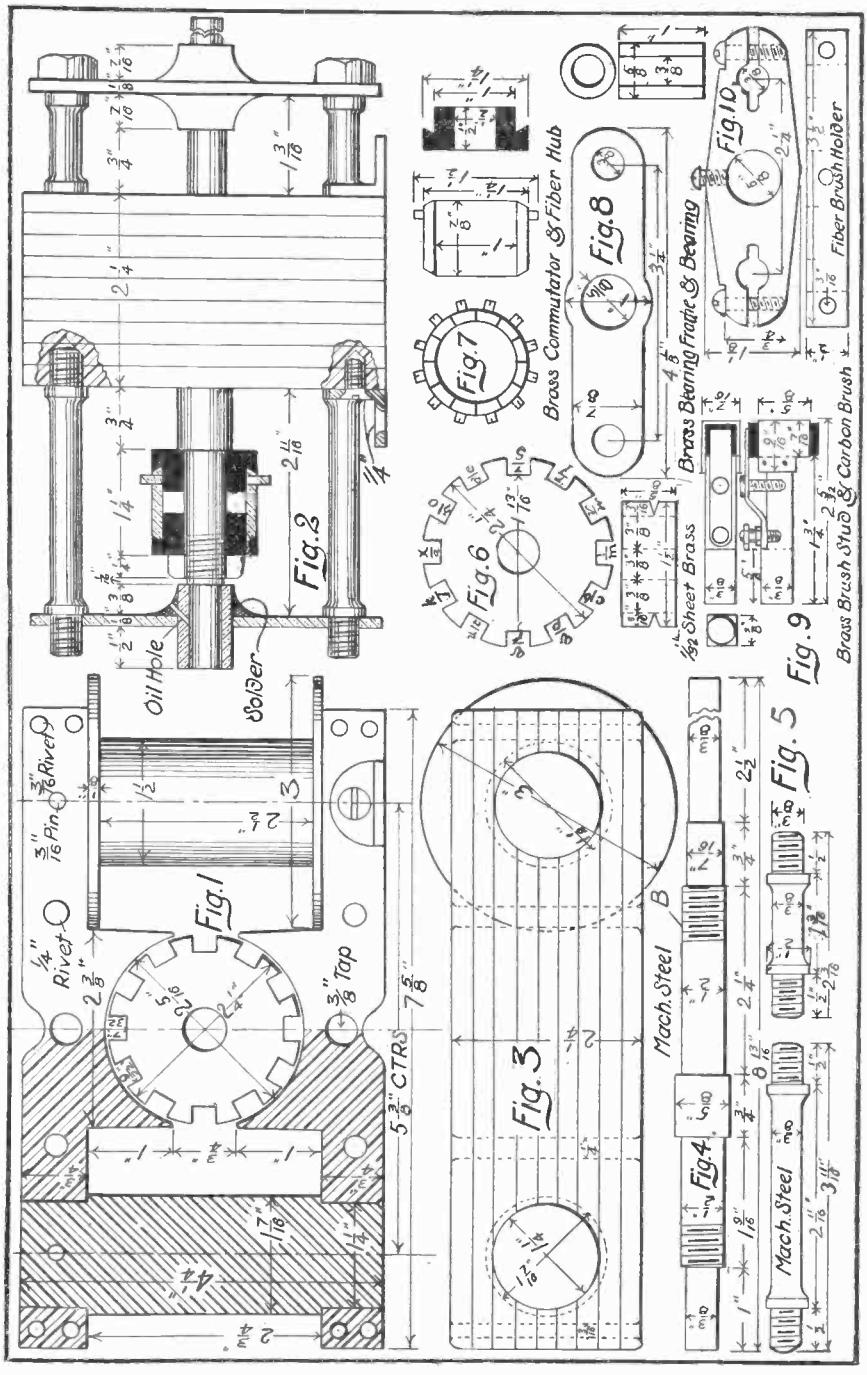


Fig.1
Fig.2
Fig.3
Fig.4
Fig.5
Fig.6
Fig.7
Fig.8
Fig.9
Fig.10
Oil Hole
Solder
Mach. Steel
Brass Commutator & Fiber Hub
Brass Bearing Frame & Bearing
Brass Brush Stud & Carbon Brush
Fiber Brush Holder
1/32 Sheet Brass

To insulate the armature cover the shaft next to the armature with 1/32 inch sheet fiber ¾ inch wide. Make two 1/16 inch fiber washers 2¼ inches in diameter, slip them on the ends of the shaft and glue them to the ends of the armature. After the glue has set cut out the slots. Make twelve channel pieces out of 1/32 inch sheet fiber and glue them into the slots and to the fiber washers; when set trim off with a sharp knife and be sure to have all the iron covered.

To wind the armature take a piece of tape and place it on the starting end of the wire for a mark, make the end fast by taking a turn round one of the teeth and start to wind from (a) to (b), Fig. 6. Wind on 40 turns (ten turns and four layers) of No. 26 B. & S. gauge s. c. c. copper magnet wire and shellac each layer. After the 40 turns are wound take the finishing end and twist it to the starting end temporarily then start winding at (c) marking the starting end of the wire in the same way and wind from (c) to (d) the same number of turns and twist the ends together. Continue winding until the twelve slots are filled, which will make 960 conductors. The winding is done in the two slots not exactly diametrically opposite, but one short of a half diameter as shown by the letters in Fig. 6.

To connect up the conductor to the commutator segments, take the starting end of each section in succession and join it to the finishing end of the next or adjacent section. The conductors are now soldered in the saw cuts in the pins of the commutator segments. Place a strip of mica ¼ inch wide around the recess in the armature and wind tightly No. 24 gauge copper or brass wire in the recess over the mica and solder it in place.

The motor may be placed on a wood stand one inch thick and 7 by 10 inches and fastened by wood screw to the lugs on the motor. The field coils in series are connected in shunt around the armature.

Construction of an Electric Whistle

Procure a piece of iron pipe having the dimensions indicated in Fig. 1. Draw a line around the pipe 15/16 inch from one end. Space four points equidistant on this line and drill through with a No. 25 drill. With a No. 43 drill make two holes opposite each other in the edge of the pipe and thread with a 4/36 tap.

Fig. 2 is a piece of iron 3/16 inch thick and 1⅞ inches in diameter. Using a No. 33 drill make four ¼ inch deep holes equally spaced as indicated and thread with a 6/32 tap. Drill four holes through this same piece of iron as indicated.

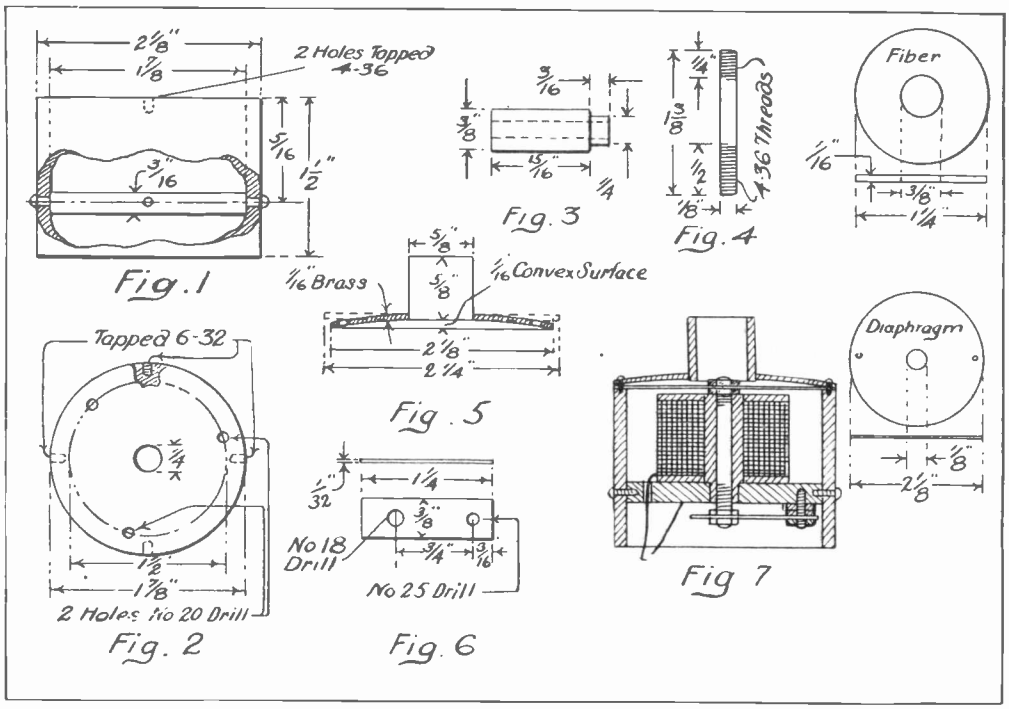
Fig. 3 is a piece of cold rolled steel drilled through the center with a No. 20 drill and turned to the dimensions indicated.

Now from a sheet of 1/16 inch fiber cut two pieces 1¼ inches in diameter. Drill a ⅜ inch hole through the center of each and make a spool by gluing to the large part of the steel rod (Fig. 3). Insulate the spool core and wind the spool full of No. 36 enameled wire.

Fig. 4 is a brass rod 1⅜ inches long and prepared as shown. A diaphragm made of 1/64 sheet iron and 2⅛ inches in diameter is held on the ¼ inch threaded end of the rod by two round iron nuts ½ inch in diameter and 1/16 inch thick.

The cover (Fig. 5), is made of 1/16 inch brass. It should have a convex surface of 1/16 inch as indicated. A ⅝ inch hole is drilled in the center and a brass tube soldered into it. The tube is ⅝ inch long and ⅝ inch outside diameter.

Two holes are drilled opposite each other through the cover and through the diaphragm with No. 31 drill to coincide with the two in the edge of the cylinder (Fig. 1). A stiff steel spring (Fig. 6) 1/32 inch thick, ⅜ inch wide, and 1¼ inches long, is required. Two holes should be drilled in it: one 3/16 inch from the end with a No. 25 drill and the



DETAILS OF THE ELECTRIC WHISTLE

other ¾ of an inch from the first with a No. 18 drill.

Put the circular block (Fig. 2) in the cylinder and screw fast with 6/32 screws. Now put the spool in the cylinder so that the extra ¼ inch which has been turned down, will fit snugly in the circular block. The smallest hole in the spring is screwed fast to the only tapped hole in the bottom of the circular block. Put two washers between the spring and block before screwing fast so as to have a tension. Slide the brass rod to which the diaphragm is attached through the coil and through the spring and fasten on the bottom with 4/36 nuts. One serves to lock the other.

Increasing and diminishing the tension on the spring regulates the tone of the whistle.

The cover is finally fastened on with two 4/36 screws that pass through the cover and diaphragm and screw into the top rim of the whistle.

Operate the whistle on alternating current.

For the Fixture and Switchboard Man

Having to wire a very difficult fixture recently, I found that a short piece of chain such as is used on Hubbell pull sockets made an excellent device for fishing the wire through, as it is very flexible and will follow any bend, including a right angle and is still stiff enough to admit of a certain amount of crowding.

In setting up a new power panel I was short of black cap bolts and could not obtain them readily. I found that by heating the ordinary bright cap bolt to a dull red in the flame of a gasoline torch, dipping it in asphaltum paint, then burning the paint off and rubbing with a cloth while it was still warm, that I obtained a black finish equal to the bolts supplied by the manufacturer. By letting the bolt become cold before rubbing with a cloth, the finish will be glossy and rubbing while warm will give a dull finish.—A READER.

Electrical Securities

By "CONTANGO"

Further Consideration of the Income Account

NET EARNINGS

Now as to "Net Earnings;" these really represent the balance remaining after operating expenses and taxes have been taken care of. It may be clearly understood, however, that we are now dealing only with the income account, for, after the net earnings shall have been established, of course the fixed charges will have to be taken care of, and then, and then only, any balance shown may be applied to dividends and the like, if such earning power has been demonstrated. These points have already been taken up in considering the balance sheet. What is now under consideration is a company's actual income account. To start the income account report with a statement of net earnings is not good policy, for the simple reason that it usually means concealment of the volume of business done and also concealment of the ratio of expenses to that business. It must also always be kept in mind that there are other sources of income, which indeed may be considered under the head of:

OTHER INCOME

This usually comprises investments in the securities of other corporations and, in so far as a holding company of electrical securities is concerned, is a decidedly important point to keep in mind. In such case the character of the bonds and stocks on which this other income depends should be most carefully considered. Included in "Other Income" are interest on bank balances and rentals. This item in the income account added to the, otherwise, net earnings gives the "Net Corporate Income." This total of the income account represents the amount from which the fixed charges are to be deducted. It is, in short, the amount that must be applied to meeting those fixed charges, and should there be anything over and above when such have been paid, then that amount may be used to meeting dividend declarations, and, even prior to dividends, other charges against the company.

FIXED CHARGES

"Fixed Charges" represents the payments a corporation must meet, as agreed on by prior contract, before any real profits are shown. The chief thing to be first considered in regard to fixed charges is the amount of interest that has to be paid on outstanding notes and bonds.

"Sinking Funds," that is to say, sums set aside regularly out of earnings to take care of outstanding securities by taking them up when due or buying them in—rents, guarantees and all charges of a like kind which are fixed or form an obligation fixed and agreed on—compose the other main items of fixed charges.

The difference between what a company earns and what it has to pay in the way of fixed charges is most important, for it represents the degree of safety or security—the actual margin of safety—and this is probably the most important point to be considered in determining *the real value* of a corporation's securities. The term securities is used in the broad sense; that is, meaning both stocks and bonds.

THE REAL VALUE OF SECURITIES

It may be given in a very few words: The company which can earn little more than its fixed charges is not very far from a receivership.

When a company's statements show that the proportion of its fixed charges to the available earnings to meet them is, year by year, decreasing, any securities it may have given to the public become increasingly valuable. One can perhaps

best express the position by saying that the company earning its fixed charges several times over is obviously in a much better position than one just about meeting them.

NET PROFITS

These belong to the owners of the property; the owners of the common stock, or shares, and even before them, to the preferred stock holders. Net profits usually take the form of dividends. From time to time the different classes of stock holdings have been explained and discussed in this magazine by "Contango." There may be just the common or ordinary stock; there may be preferred, first preferred and second preferred, and so on. The first preferred stock is not the ownership. It is somewhat in the position of a fixed charge, but instead of having a mortgage behind it, has to await its dividends as they are earned, but receives them before anything is paid on the common shares, or shares of stock; before anything is paid, that is, to the actual owners of the property. It is not a fixed charge, because it has to take its turn, first it is true, but after the regular obligations have been met.

The common stock takes as high a rate of dividends—payments on it—as the financial condition of the company will permit after the payments on the preferred stock, should there be any, have been taken care of.

In determining the earning power of a company the investor had best look over the figures of the particular company for several years back. This examination of annual reports will give the average and show very clearly, if they are honest and conform to the law, whether or not that company is progressing or dropping behind.

Watered Stock

This is a much misunderstood term. It is usually considered as meaning something quite undesirable and more or less fraudulent, though as a matter of fact it is often necessary to have a certain amount of water in any company's capitalization.

But before discussing this point let the proper definition of the term "watered stock" be made.

"Water" in the stock of any corporation's capitalization primarily means stock issued without any tangible or physical assets behind such stock; that is, assets to cover or protect it, but to illustrate: a company may have a represented stock capitalization of, say, $10.000,000, and in distributing this for public subscription there will be promoter's fees on the promotion and underwriting for the banking houses, brokers and energetic men who do things and actually make the project possible. This is legitimate to a reasonable amount; when it is excessive it is not. In certain commercial undertakings "good will" is capitalized at an enormous figure, but it is an intangible asset in reality and from the banker's standpoint cannot be considered.

The greatest financial authorities in the world consider that every company must of necessity have a certain amount of so-called water in its stock flotations, but only to a very limited degree. And this is true, for bankers and brokers who promote and float or underwrite projects are doing it as a business proposition, and must have a margin of profit, which takes the form of a bonus of stock. This is usually called "water."

But the point is that it is essential that issues of stock made be kept to the bounds of a company's growth and there should ultimately be dollar for dollar in the form of tangible assets behind it.

On the other hand it must be remembered that where water always remains water the organization is at a tremendous disadvantage and the public imposed on. For example, not long ago a company was organized with the huge capital of $60,000,000, based almost entirely on good-

will of the business, there being scarcely any tangible assets or physical property. The shares when first put out were offered at $86,50, giving a total market value of $51,900,000. The same shares are selling to-day at $29.50 a share, or a total of less than $18,000,000 for the outstanding stock. And this is because there was nothing behind that huge capitalization.

Water and real values do not mix. "Watered stock" finally gravitates to its true level irrespective of any strong financial backing it may have or may have had.

Common Stock Voting Trust Certificates

These are sometimes advertised in particular instances as a bonus on subscriptions to, say, cumulative preferred stocks, or maybe as a bonus on the purchase of bonds. By bonus you must understand the idea of something thrown in extra as a premium, or sop, to put it bluntly.

The common stock voting trust certificates participate in the net earnings of a company—that is to say, in the net profits to the owners of the company—after fixed charges, and dividends on preferred shares, if there are any, have been paid; but the voting capacity is limited to a limited trusteeship. The voting capacity indicating ownership is not vested in the individual owner of the certificates, but in the trustees designated by the holders of the ordinary common stock—the real owners of the property in point of fact.

It must be remembered, however, that the ordinary common stock of some of the greatest corporations in the United States is, in so far as voting is concerned, vested in trustees, notably the New York Central Railway Company. It was mainly by reason of the fact that he controlled as trustee for stockholders their votes and also their confidence, reposed in him for that purpose, that the late Mr. John P. Morgan enjoyed the enormous financial power he possessed in the later years of his wonderful life.

Former Comptroller of the Currency "Boosts" Public Utility Corporation Securities

As the guest of honor at a luncheon given by the Electric Club of Chicago a short time ago, former Comptroller of the Currency Charles G. Dawes had a good deal to say about the value of public utility or service corporation securities. He suggested that inasmuch as the business grew right along with the growth in population, even ahead of it, the value of electrical public utility securities was much greater than even choice city real estate investments, which came ultimately to a practically fixed valuation and which might even go backward, according to change in fashion or popularity of location. Not so with the investment in the stocks or bonds of companies furnishing utilities always used and needed by the public—these could but enhance in value with the growth in population and steady expansion of their business. All of which seems like good, common, horse sense, although it roused considerable discussion and criticism among Chicago real estate dealers.

Proper Purchasing of Bonds

What the individual investor has uppermost in his thoughts when purchasing bonds is, first, safety of the principal, and, second, a good income yield. But many investors, in a declining bond market, seeing a drop in the price of their bonds below what they cost them, are easily perturbed, lose sight of the consideration that led them to make their purchases and are induced to sacrifice their securities, though nothing may have occurred to impair the intrinsic value or reduce their income from those bonds. That is a wrong and pernicious theory to follow, because inevitably it leads to losses which the exercise of a little sound judgment could have avoided.

The investor should realize that when he has purchased the bonds of a substan-

tial company they will be paid off 100 cents on the dollar; therefore where bonds are intelligently purchased there is not the loss of even a cent in principal. The investor should also appreciate the fact that until the bonds become due the fixed interest will be paid promptly. An investment in good bonds held in hand is in point of fact a good income for a man's savings or surplus, though the bond holdings may often with advantage be changed from time to time to meet market conditions.

Tricking the Investor

Whenever an investor receives a letter from a broker who is not a member of any exchange in good standing offering to lend money on speculative stocks not listed, or offering to accept such stocks as collateral for the purchase of additional shares of stock, he should watch out, for a trap is surely being laid for him.

Brokers are not making loans on collateral which the banks themselves consider undesirable. They have quite another plan and that, too, a scheming one. In fact, in the majority of cases brokers who show such "charitable" instincts as to lend money on unlisted and extremely speculative issues of stocks or bonds have neither financial standing nor any spare cash whatever.

What they do with such stock, once they get it, is to sell it in the open market for what they can get the moment the certificates are in their possession, on the very sure theory that the so-called security will fall in price. Then when the borrower closes his loan or his transaction, if he has transferred his shares to buy other stock, the broker goes into the open market again and repurchases the stock at, of course, a much less price than that for which he sold it and thus closes the deal on his unwitting customer.

It often happens, too, that the victim of such manipulations cannot get his stock back. This is the bucket shop practice in a new guise; this lending of money on wild-cat stocks or using them as collateral for general purposes. It also very aptly illustrates the general value of listed stocks and bonds as compared with those not so listed—though there are, of course, various valuable unlisted securities—and also the position and standing of regular brokers, members of leading stock exchanges such as Chicago and New York, and those who are not.

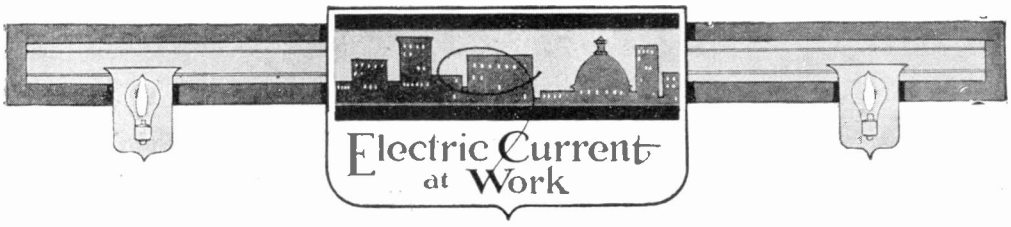
The "Listing" of Stocks and Bonds

Listing means the manner in which they are presented to the public legitimately and through regular and honest financial channels.

Thus the requirements of the New York Stock Exchange are very exacting as to the financial statement of a company's position, far more so than the Chicago Stock Exchange. But it is rather a question of the influence and power of the bankers and brokers underwriting and putting out the issues of stocks or bonds, as to where they may be listed.

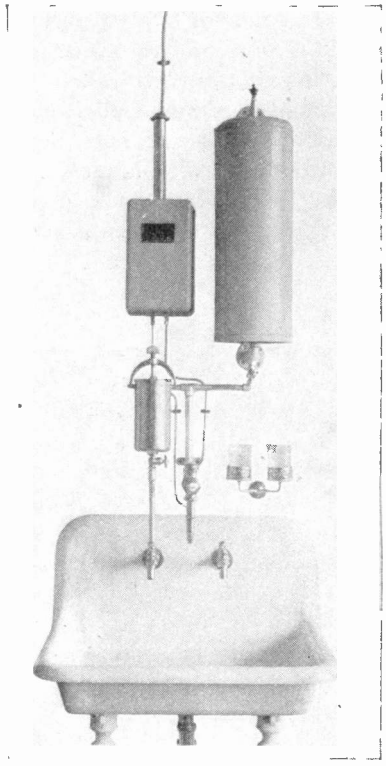
It is not necessary at this time to go into the safeguards insisted on by both the New York and Chicago stock exchanges in regard to the stocks and securities listed with them. Suffice it to say that such listing is considered a guarantee of the financial integrity of the proposition, although the question of "water" or lack of it in the particular issue listed has not, so far, been specifically adjusted—except that the New York Stock Exchange is becoming more and more exacting as to statements of actual assets presented for its inspection.

Listed stocks and bonds represent those which are regularly dealt with and on which quotations are daily made on the regular stock exchanges of the country. For the reasons given above regularly listed stocks in general, though not always, have a far stronger intrinsic and financial strategic position than those dealt in privately, or "on the curb;" that is to say by brokers without official connection with, but yet more or less recognized by the official stock exchanges.



Ozone Water Sterilizer

Ozone, which is oxygen in highly concentrated form, is Nature's own favorite method of attaining absolute sterilization, and its application to the purification of water has been perfected by Seigfried



OZONE WATER STERILIZER

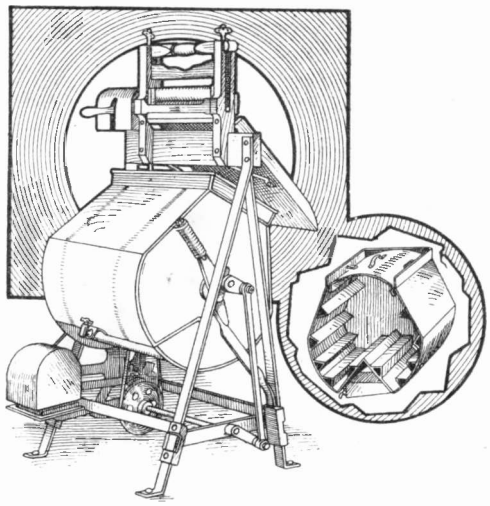
Held, an Austrian scientist, whose patents embody an interesting equipment for supplying sterile drinking water in homes and offices.

His apparatus here illustrated is arranged as follows:

A connection is made from a fitting back of the cold water faucet or from any cold water supply to a stone filter which removes the dirt from the water and prepares it for purification. A pipe leads from the filter to a galvanized steel compression tank. The outlet from this is at the sterilizer faucet, placed at a convenient height above the sink for the filling of water bottles and other receptacles. Connection is made from the house lighting circuit to a step-up transformer producing 5,500 volts and from the generator through an aluminum tube to the sterilizer faucet. A second tube from the generator to the mixing compartment of the faucet conducts the ozone. The opening of the faucet automatically closes the electric circuit and produces a high frequency discharge from the transformer in the generator box. At the same time the suction caused by the water running through the faucet draws a powerful discharge of ozone from the generator and intimately mixes it with the water. The mixer is constructed so that the water is sprayed at the outlet of the tube which conducts the gas from the generator.

All-Metal Washing Machine

The Apex washing machine is made entirely of metal, except the wringer board. The bottom of the tub is cylindrical, while the sides taper up to the cover. This metal tub is suspended on a steel frame and is rocked back and forth by a motor placed on the framework below. The rocking action moves the clothes within from side to side, and in so doing they are brought against the metal ribs on each side of the enclosure and also worked over the inverted V at

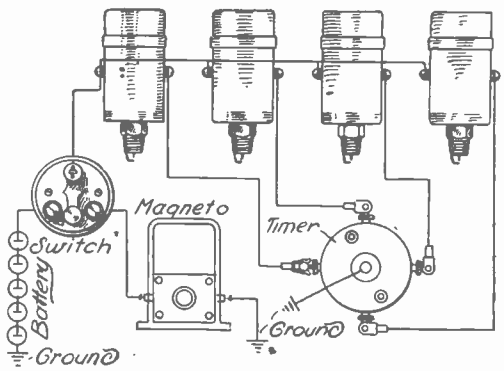


AN ALL-METAL WASHING MACHINE

the bottom, forcing the water and suds through the clothes. A convenient lever enables the operator to lock the tub and run the wringer. An important feature on the wringer is the release, which will instantly allow the rolls to open in case the operators hands are caught.

Combination Spark Plug and Coil

The spark plug and coil are usually separate devices in the outfit of a combustion engine. The Connecticut plug coil, however, combines the two, and



CONNECTIONS OF COMBINATION SPARK PLUG AND COIL

with this unique combination offers a jump spark coil protected from dampness and water, and suitable for motorboat engines.

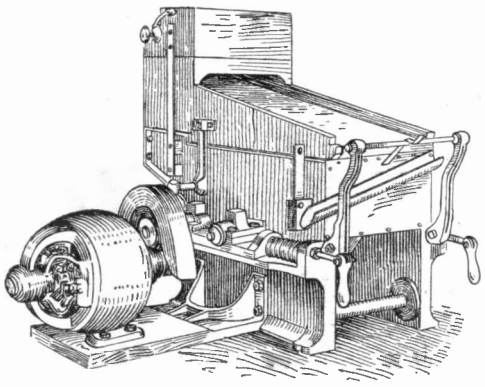
The plug is attached to a threaded brass flange molded into the coil case. On the coil top is mounted the vibrator, which is housed under a gun-metal cover.

Referring to the cut, there are just two primary wires, one from the battery to the plug coil, the other, generally a short wire, from the coil to the tuner. It is evident that there are no high-tension wires to offer leakage of current.

Oat Crusher

The feed bill of the man who keeps five, ten, or more horses can be materially reduced and the animals kept in better flesh by the use of an oat crusher to prepare this part of the horses' fare, is the assertion of those who have tried it.

The machine shown will clean and crush 2,200 pounds of oats per hour, enough to feed 125 horses eighteen pounds per day. The crushed oats retain their original moisture when pre-

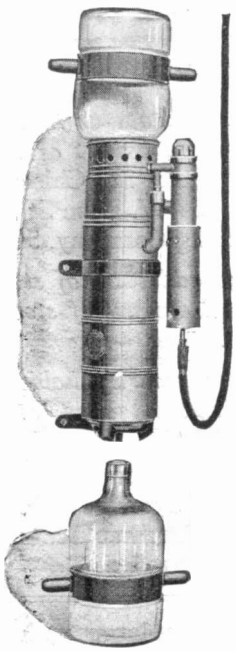


MACHINE FOR CRUSHING OATS

pared as used, and are more completely and readily digested and the looks and condition of the animals are better with less feeding. It is claimed that a fifteen per cent saving is made over the old way of feeding whole oats, which, if a horse were accustomed to a diet of eighteen pounds of whole oats per day, would amount to about 30 bushels a year using crushed oats. The crusher is operated by electric motor power which is, therefore, easily applied and shut off.

Safe Drinking Water

Although electricity is used in the Forbes water sterilizer its purpose is not as an electrocuting agent of germs but for generating heat. The heating member shown attached to the larger cylinder consists of a small resistance enclosed in a copper tube and this tube is submerged or surrounded by the water to be boiled. The action of boiling causes the water to rise and flow into the sterilized water compartment but not until it has been sufficiently heated to destroy any disease organisms it may contain. This method of sterilizing the water does not impair the taste and the apparatus will purify two gallons of water per hour at a cost of 2¼ cents with current at ten cents a kilowatt hour.



WATER STERILIZER

NEW BOOKS

ESSENTIALS OF ELECTRICITY. By W. H. Timbie. New York: John Wiley & Sons. 1913. 263 pages with 223 illustrations. Price, $1.25.

This book gives the underlying facts and laws of good electrical practice. It is written both for class use and self instruction and is put out in pocket size as a reference for the "man on the job."

DESIGN OF ELECTRICAL MACHINERY. By William T. Ryan. New York: John Wiley & Sons. 1913. Vols. I, II and III. 102, 119 and 129 pages respectively with numerous illustrations. Price, $1.50 per volume.

Vol. I contains what the author believes will be of the most service to the student who is just entering upon his experience as a designer. It covers the design of direct current dynamos and motors with illustrative designs for two machines.

Vol. II contains information obtained very largely from manufacturing companies upon the design of transformers. Designs for twelve different transformers are given.

Vol. III treats of the building of alternating current generators, synchronous motors and rotary converters. Special attention is given to the arrangement of the work with regard to the order of the process of carrying out the calculations.

LIGHT, PHOTOMETRY AND ILLUMINATION. By William Edward Barrows. New York: McGraw-Hill Book Company. 327 pages with 196 illustrations. Price, $3.00.

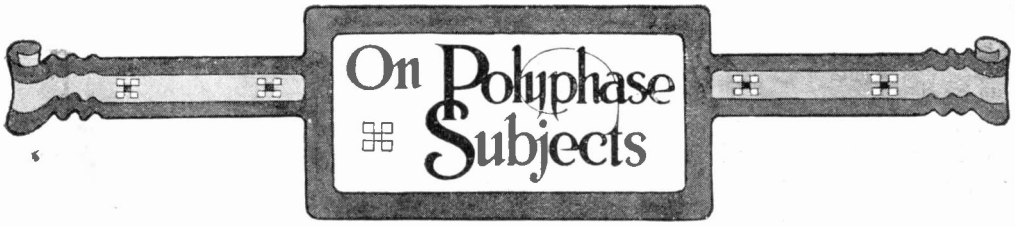
This book is designed as a text in illuminating engineering and as a reference for the practicing engineer. It is the outgrowth of sets of notes written and compiled by the author for use in his classes at the Armour Institute of Technology and of his previous book "Electrical Illuminating Engineering." Eminent authorities on different phases of the subject have been freely consulted.

ELECTRICAL METERS. By Cyril M. Jansky. New York: McGraw-Hill Book Company. 1913. 360 pages with 273 illustrations. Price, $2.50.

This work is invaluable to the man who tests and repairs any kind of an electrical measuring instrument. It can be understood by the average man who may want information which will enable him thoroughly to understand and handle such instruments.

ALTERNATING CURRENTS SIMPLIFIED. By Elmer E. Burns. Chicago: Joseph G. Branch Publishing Company. 1912. 187 pages with 101 illustrations. Price, $1.50.

The author seeks to present an explanation of the principles of alternating current machinery, rather than a description of the various types of machines, and to do this in a manner that will interest both the novice and the experienced electrician.



Popular Electricity Magazine's Sworn Statement

Statement of ownership, management, etc., of Popular Electricity Magazine, published monthly at Chicago, Ill., required by act of August 24, 1912.

Editor—Henry Walter Young, 54 W. Lake St., Chicago.

Business Manager—F. W. Harvey, Jr., 54 W. Lake St., Chicago.

Publisher—Popular Electricity Publishing Company, 54 W. Lake St., Chicago.

Owners: (If a corporation, give names and addresses of stockholders holding one per cent or more of total amount of stock.)

E. J. Doyle, 54 W. Lake St., Chicago.

Known bond holders, mortgagees, and other security holders, holding one per cent or more of total amount of bonds, mortgages, or other securities.

None.

(SIGNED) F. W. HARVEY, JR., Business Manager.

Sworn and subscribed before me this 21st day of March, 1913.

(SEAL.) RICHARD MUELLER, Notary Public.

(My commission expires May 25, 1915.)

Where Immense Energy Lies

In an address before the Institution of Electrical Engineers at Glasgow on the unknown energy contained in the chemical elements and the prospect of making it available, Dr. Soddy said that the forces at our disposal compared with those exhibited when an atom suffers change are of a different and lower order of magnitude. Suppose, he said, that a way could be found in which uranium, which disintegrates to the extent of a thousand-millionth part annually, could be made to disintegrate completely in the course of a year; then from one gram of uranium 1,000,000,000 calories of heat could be evolved, which, converted into electric energy, would suffice to keep a 32 candlepower lamp burning continuously through the year. By the expenditure of about one ton of uranium, costing less than $5,000, more energy would be derived than is supplied by all the electric supply stations of London put together.

Fiery Cross at Mariners' Guide

The largest illuminated cross in the world will soon flash its beams over Lake Ontario from the dome of St. Augustine's Seminary situated on a picturesque bluff some miles out of Toronto, Canada. Its light will be seen for more than 70 miles and one of its purposes is to guide mariners in times of storm. The cross will be 500 feet above the level of the lake and the illuminated portion will be sixteen feet high with a crosspiece of nine feet. Eighty lamps of high candlepower, 40 on its east face and 40 on the west, will outline the design.

Other crosses of larger dimensions are established at a score of points along the St. Lawrence River by the habitant farmers and fishermen but none of these symbols is illuminated. The custom is not by any means an innovation on the part of the Roman Catholic Church which in the most remote monasteries of the Alps or Andes and along the coasts of foreign seas have erected guiding lights.

"Man in Taxicab Commits Suicide."—Headline.

The meter should be placed where the passenger cannot see it.

* * *

"Hey, waiter, I want to order a steak. There's none on the bill of fare."

"We are not serving steak to-day, sir. You see, we have a new cook and he has not as yet arranged for his bond."

* * *

HE (nervously)—"Margaret, there's been something trembling on my lips for months and months."

SHE—"Yes, so I see. Why don't you shave it off?"

* * *

PROF. WISER—"What effect does the moon have upon the tide?"

SWEET CO-ED—"None! It affects only the untied."

* * *

"Look here, now, Harold," said a father to his little son, who was naughty, "if you don't say your prayers you won't go to Heaven."

"I don't want to go to Heaven," sobbed the boy; "I want to go with you and mother."

* * *

A country school teacher was cashing her monthly check at the bank. The teller apologized for the filthy condition of the bills, saying, "I hope you're not afraid of microbes." "Not a bit of it," the schoolmarm replied. "I'm sure no microbes could live on my salary."

* * *

An Irishman walking along a road beside a golf links was struck between the shoulders by a golf ball.

"Are you hurt?" asked the player. "Why didn't you get out of the way?"

"An' why should I get out of the way?" asked Pat. "I didn't know there were any assassins around here."

"But I called 'fore,' that is a sign for you to get out of the way."

"Oh, it is, is it?" said Pat. "Well, thin, whin I say 'foive' it is a sign that you are going to get hit on the nose. 'Foive.'"

"I always wear it," she explains, "when I have had a quarrel with my husband."

"But why do you call it a quarrel dress?"

"Because it is the only gown I have that doesn't button in the back. Consequently I don't have to call on the old grouch to help me."

* * *

Tommy's mamma—"Why aren't you a good boy like Willie Bjones?"

Tommy—"Huh! It's easy enough for him to be good. He's sick most of the time."

* * *

Mrs. O'Hara—"Its the iligant job me man has now, Mrs. McClune. 'Tis a night watchman he is."

Mrs. McClune—"An' why do ye like that better than the other, Mrs. O'Hara?"

Mrs. O'Hara—"Why, sure, he sleeps all day, and that saves his board; and he works all night, and that saves his lodging."

* * *

Two Irishmen were working on the roof of a building one day, when one made a misstep and fell to the ground. The other leaned over and called: "Are yez dead or alive, Mike?"

"O'im alive," said Mike, feebly.

"Sure you're such a liar Oi don't know whether to belave yez or not."

"Well, then, Oi must be dead," said Mike, "for yez would never dare to call me a liar if Oi wor aloive."

* * *

The lovely girl descended to the parlor to find the family pet ensconced upon the knee of the young man caller, her curly head nestled comfortably against his shoulder.

"Why, Mabel," the young lady exclaimed, "aren't you ashamed of yourself! Get right down."

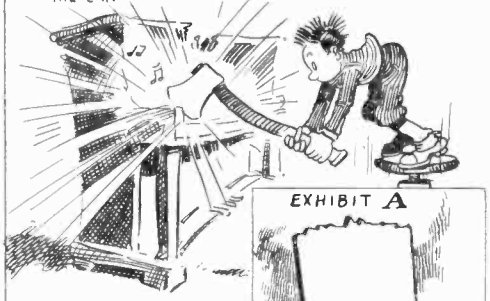
"Sha'n't do it," retorted the child. "*I got here first.*"

* * *

"What do I want with a wife?" snorted Bachelor Bockwedder, on reading an old maid's reasons for not wanting a husband. "I have a game rooster that is vain about his fine feathers, a goat that chews the rag, an aeroplane that gets me up in the air and an automobile that keeps me all the time broke!"

A PAGE FOR BOYS

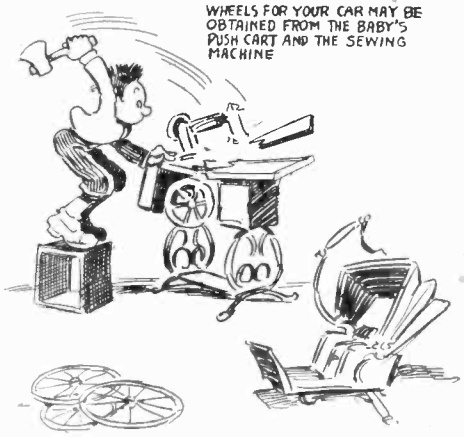
HOW TO MAKE AN ELECTRIC STREET CAR —— FIRST, SOMETIME WHEN FATHER AND MOTHER ARE NOT AT HOME, TAKE AN AX AND CHOP UP THE PIANO. THE WOOD IS TO BE USED FOR THE BODY OF THE CAR



SAVE ONE OF THE PIECES - ONE ABOUT 12 INCHES SQUARE. THIS IS TO BE INSERTED IN THE SEAT OF THE TROUSERS

1

WHEELS FOR YOUR CAR MAY BE OBTAINED FROM THE BABY'S PUSH CART AND THE SEWING MACHINE



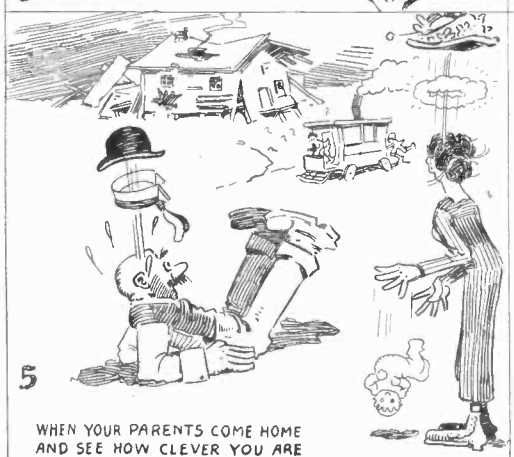
2

FRAMED PICTURES WILL FURNISH THE GLASS FOR YOUR CAR WINDOWS.

3

OF COURSE YOU WILL NEED LIGHTING FIXTURES. THEN ALL YOU HAVE TO DO IS PUT IT TOGETHER. IF YOU NEED ANY ADDITIONAL MATERIAL PRY IT OFF THE HOUSE

4



5

WHEN YOUR PARENTS COME HOME AND SEE HOW CLEVER YOU ARE THEY WILL BE MUCH SURPRISED

WHEN YOUR FATHER GETS THROUGH WITH YOU THE PIECE OF WOOD (SEE EXHIBIT A - FIRST PICTURE) WILL LOOK LIKE THIS

IT MAY BE USED AS KINDLING WOOD OR TOOTH PICKS

6

IF WE ARE NOT STOPPED BY THE STATE LEGISLATURE MAYBE NEXT MONTH WE WILL SHOW YOU HOW TO BUILD AN ELECTRIC BATTLESHIP

N. E. L. A. Convention

CHICAGO, ILLINOIS

June 2, 3, 4, 5, 6

Chicago Hotels

At the left is the New Medinah Temple where the convention will be held. 10 minutes walk, 3 minutes by car, from **Chicago's Great Hotel Center.** Now is the time to make your reservation.

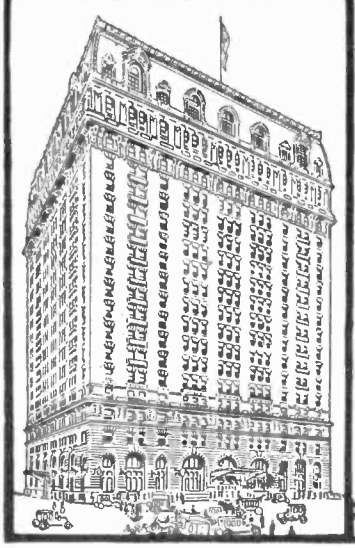
NATIONAL ELECTRIC LIGHT ASSOCIATION

Hotel La Salle

Chicago's Finest Hotel

Delegates and visitors to the NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION will find HOTEL LA SALLE the most conveniently located hotel in Chicago. It is but ten minutes walk from the convention headquarters; it is within easy reach of all Railway Terminals, but far enough away to be free from the noise and smoke of switching trains.

Although the city will be crowded with convention visitors the rates of HOTEL LA SALLE will not be increased.



RATES:

One Person:	*Per Day*
Room with detached bath	$2 to $3
Room with private bath	$3 to $5

Two Persons:	*Per Day*
Room with detached bath	$3 to $5
Room with private bath	$5 to $8

Two Connecting Rooms with Bath:	*Per Day*
Two Persons	$5 to $ 8
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All rooms at $5 or more are same price for one or two persons.

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PREFERRED STOCK, 6% CUMULATIVE . .	10,000,000.00
COMMON STOCK (5% DIVIDEND PAID) . .	31,998,750.00

INCOME ACCOUNT

Years Ending December 31	Gross Revenue	Maintenance	Oper. Expenses and Taxes	Net Earnings	Interest	Balance
1907....	$11,342,140.08	$1,057,163.03	$5,169,065.60	$5,115,911.45	$2,854,264,06	$2,261,647.39
1908....	12,657,304.80	1,219,492.31	5,573,226.94	5,864,585.55	3,021,721.67	2,842,863.88
1909....	13,491,288.16	1,210,505.62	6,321,070.27	5,959,712.27	2,988,521.70	2,971,190.57
1910....	14,044,595.91	1,243,859.24	6,677,481.76	6,123,254.91	3,006,256.16	3,116,998.75
1911....	14,604,609.30	1,398,404.03	6,815,667.94	6,390,537.33	3,254,133.27	3,136,404.06
*1912....	14,744,658.96	1,085,959.18	7,345,602.02	6,313,090.79	3,568,943.53	2,744,147.26

*Rates to consumers reduced voluntarily by more than $1,000,000 during 1912.

STATEMENT OF CONSUMERS

183,271 CONSUMERS . . .	DECEMBER 31, 1907
199,909 CONSUMERS . . .	DECEMBER 31, 1908
218,252 CONSUMERS . . .	DECEMBER 31, 1909
244,325 CONSUMERS . . .	DECEMBER 31, 1910
287,106 CONSUMERS . . .	DECEMBER 31, 1911
320,870 CONSUMERS . . .	DECEMBER 31, 1912

33,764 Consumers Added During the Year Ended December 31, 1912.

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HENRY E. BOTHIN, President Judson Manufacturing Company, Oakland
JOHN A. BRITTON, Vice President and General Manager
W. H. CROCKER, President Crocker National Bank, San Francisco
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JOHN S. DRUM, President Savings Union Bank and Trust Company, San Francisco
D. H. FOOTE, Secretary
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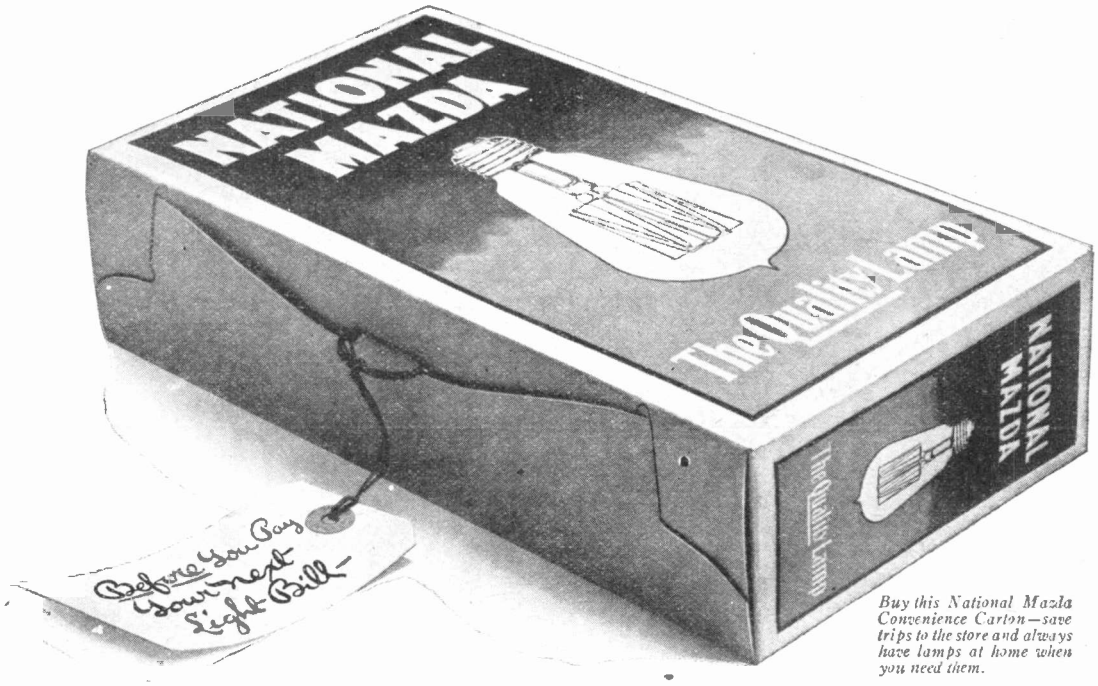
GEORGE K. WEEKS, Vice President N. W. Halsey & Co., San Francisco



Buy this National Mazda Convenience Carton—save trips to the store and always have lamps at home when you need them.

Buy Better Lamps in This Carton

INSIDE the blue walls of this Convenience Carton are five new National Mazda Lamps—the improved kind that give three times as much light as carbon lamps at the same cost—the rugged kind that put daylight into the New York Subway. Get a full carton from your electric store before you pay your next light bill; replace carbon lamps with National Mazda Lamps and you triple your light without increasing your expense.

When You Clean House

YOU can't get the full benefits of a clean house without proper light. Renovation isn't complete until you have relamped every socket with National Mazda lamps from attic to cellar. If you move, select a wired house and put National Mazda lamps in every socket. They make better light and better light makes better homes. If your house isn't wired it should be equipped for National Mazda lamps while you are cleaning. The cost is small. Send for our free booklet on House Wiring.

Put a National Mazda Lamp in Every Socket

BEFORE you pay your next light bill, put a National Mazda lamp in every socket; in addition to tripling the lighting power of electricity they give a better quality of light—whiter, more like daylight, more beautiful, more pleasant in every way. Holophane globes and reflectors will still further increase the charm of your home lighting.

How to Know National Mazda Lamps

A glance will show you the difference between efficient National Mazda lamps and the old fashioned, wasteful carbon lamp. Note the inside construction as shown on the carton at the top of this page.

When you buy lamps look for the blue carton illustrated here. See that each lamp has the words "National Mazda" etched on the bulb and that one of the labels at the bottom of this page is pasted on it. Each of these labels is a guaranty of National Quality.

Where to Buy National Mazda Lamps

The Electric Stores in your city sell National Mazda lamps five lamp blue convenience carton; or you can get them from your Lighting Company. They are made in all sizes for every purpose. They burn in any position.

Buy the National Mazda Convenience Carton and save trips to the store. It will provide extra lamps for emergencies.

We have free literature on all phases of proper illumination. Send for the volume you need: 1—Homes. 2—Office and Public Buildings. 3—Shops and Factories. 4—Stores. 5—Trains. 6—Automobiles. 7—Street Cars.

For Literature or further information address

NATIONAL QUALITY LAMP DIVISION

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Any of these labels is a guaranty of National Quality

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Direct action, quick results, freedom from complications—that's what every executive wants in his business, and that's the secret of the simple efficiency and increasing popularity of *Stromberg-Carlson* Private Telephone System.

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Manufacturers of over 2,000,000 Telephones and 8,000 Telephone Exchanges.

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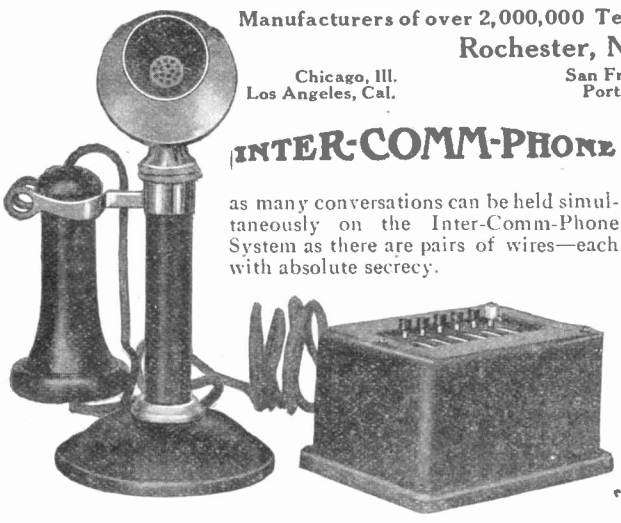

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as many conversations can be held simultaneously on the Inter-Comm-Phone System as there are pairs of wires—each with absolute secrecy.

Code No. 905—6 station desk set. Other sizes, 12, 22 and 32 station capacities. Several styles

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(Address nearest office)

Please send me details of a *Stromberg-Carlson* System that you think will be best adapted to my business.

My name .....

My address .....

Number of desk Phones desired .....

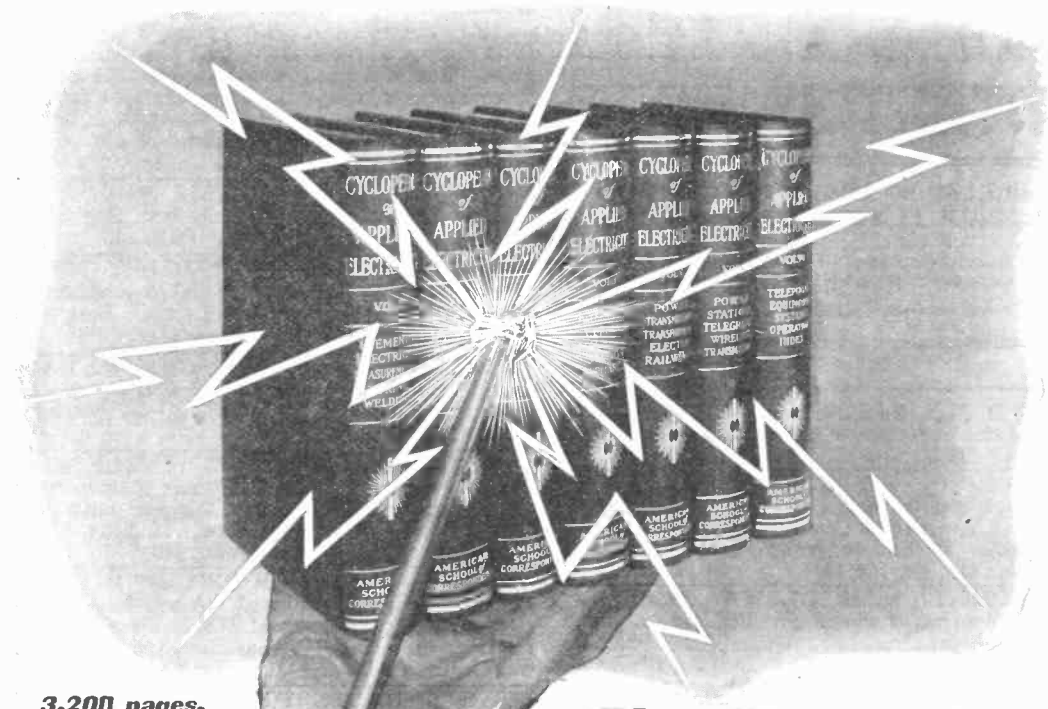
Number of Wall Phones desired .....

Approximate distance between stations in feet .....

.....

General purposes for which the System is to be used .....

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.



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As the magician of old performed miracles with the aid of his magic wand, so does the magician of today—the electrician—achieve most wonderful results with a power as mysterious and invisible as that which came from the wand of the sorcerer. The field of Electricity is limitless—new uses for this great force are discovered daily and large salaries are paid to those who know how to handle it. Prepare yourself, then, to become a big man in this field; learn from these books all that is necessary for you to know. If a beginner, you can soon fit yourself to make your start in this fascinating work at a good salary. If a worker, engineer or expert, you can add to your knowledge and put yourself in line for a better job at bigger pay.

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SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

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LOOK HERE! SELL BERMA STARCH Enamel, greatest repeater and business builder. Perfumes clothes; lasting Oriental odor. 100% profit; samples free. Berma Co., 140 Nassau St., New York.

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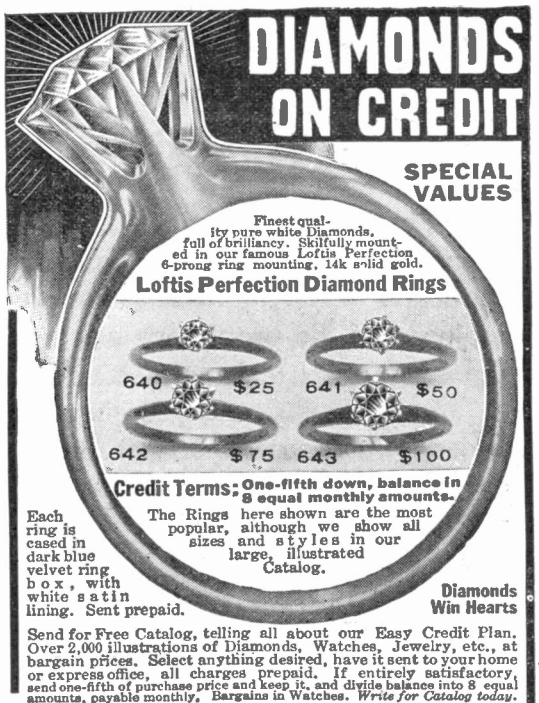

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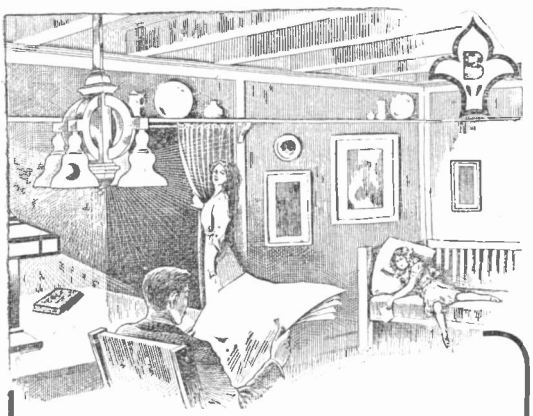

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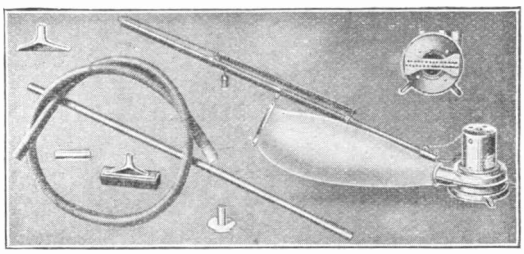

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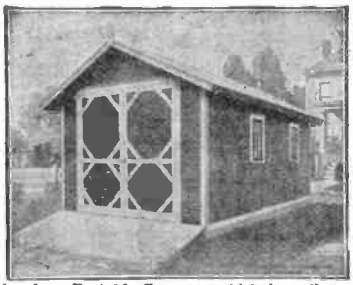

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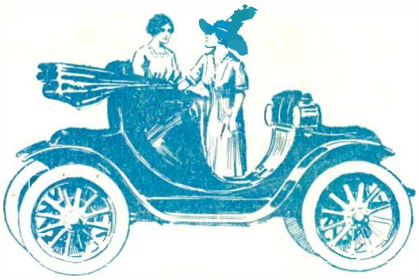

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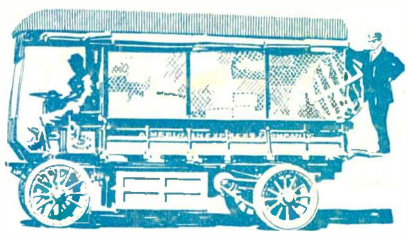

Electric Trucks

are used by the biggest businesses in America because experience has *proved* their reliability, economy and efficiency. Electric Trucks will reduce your haulage cost—widen your delivery area and advertise your business.

?

Why do 58 concerns operate an aggregate of 2,292 Electrics valued at $8,000,000?

Why did a single salesman sell just $19,000 less than a million dollars' worth of Electric Trucks last year?

Why are there over 5,000 Electric Pleasure Vehicles in use in Chicago alone?

Why has Denver one Electric Pleasure Vehicle for every two hundred and seventeen people?

Because the Electric is the silent, dependable, dignified, simple, economical and logical vehicle for city and suburban use.

Interesting literature sent gladly upon request. *Write today.*

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON NEW YORK, 124 W. 42nd St. CHICAGO