POPULAR ELECTRICITY AND THE WORLD'S ADVANCE

May

Filming Crater of Vesuvius

Paris Fixes World's Time

Motion Pictures

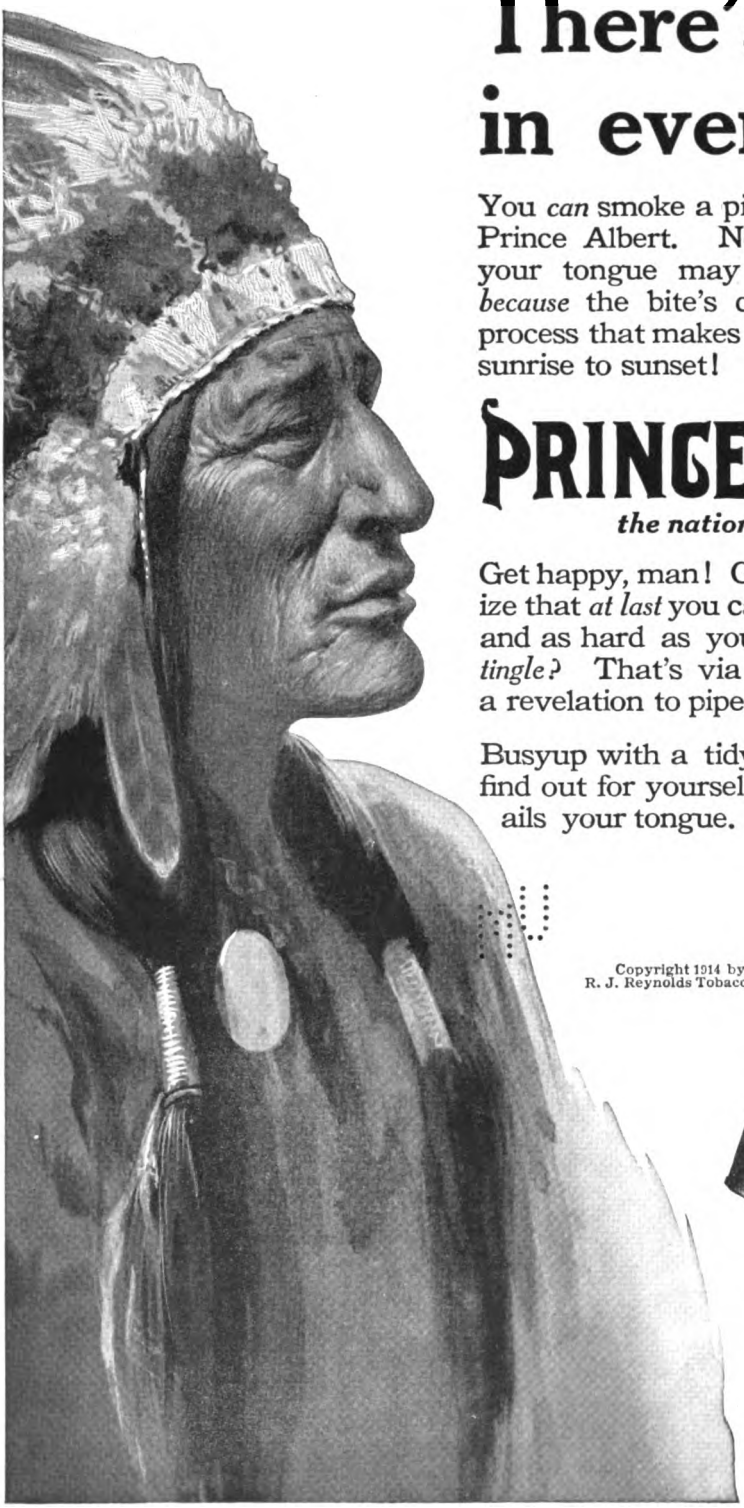
Radium's Power to Cure

Gasoline Engine Talks

World's Picture Gallery

Fireman's Shower Suit

175 Subjects and 200 Illustrations In this Issue.



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POPULAR ELECTRICITY
and the
WORLD'S ADVANCE

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Table of Contents

Continued on Page 12

Table of Contents

Continued from Page 11

For Practical Electrical Workers

Popular Electricity Wireless Club

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return with remittance at once to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

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POPULAR ELECTRICITY AND THE WORLD'S ADVANCE

VOL. VII MAY, 1914 No. 1

Unique Ceremony in Constantinople

Recently at the opening of the first electric street railway in Constantinople there occurred the ancient rite of sacrificing the lamb, as portrayed in the picture. In countries of modern civilization there is nothing with which this ceremony can be compared, excepting perhaps the breaking of a bottle of champagne over the bow of a battleship at its christening.

The Sacrifice of a Lamb Marked the Opening of the First Electric Street Railway in Constantinople

Across the tracks of the street line two young lambs were placed, and after the customary prayers of the Mohammedans they were killed on the spot; the rails were smeared with the warm blood and prayers invoking the blessings of Allah on the new line were offered. The officials watched the performance with all seriousness and they are shown here in supplication with palms up. The line runs from the Pont de Karakeny to Sirkedji in the Ottoman capital.

EXPOSITION REQUIRES 1,000 TONS OF GLASS

More than a thousand tons of glass will be used in the construction of the buildings at the Panama-Pacific International Exposition, 550 tons having already been contracted for to be used on eight of the main exhibit palaces. In the Machinery Palace alone there are 28,000 panes of glass in the facades now installed and 65,000 square feet of glass in the skylights.

Radium and Its Power to Cure

By D. WATERSON

PART I.—DIFFERENCE BETWEEN RADIUM AND X-RAYS; INSTRUMENTS USED; THE EMANATION; DOSAGE; SOME CURIOUS FACTS, ETC.

New discoveries—such as radium—have to pass through several stages before their real value can be estimated. When the sponsors are of world wide reputation, there is philosophic doubt. When the knowledge of the wonderful

A Very Recent Picture of Madam Curie in Her Laboratory. She is Firm in Her Conviction that Radium Possesses Marked Healing and Curative Properties, Especially in Cancer Cases

Dr. Louis Wickham of Paris, Discoverer, with Dr. Degrais, of Destructive Powers of Alpha and Beta Rays on Diseased Tissues

work the novelty may do has spread to the popular imagination there is unbounded enthusiasm. Then, as facts are more accurately measured, there succeeds a period of doubt and disappointment, and the true value is reached only after the most searching experiments.

Radium as a curer of disease is well on towards the fourth stage, but, unfortunately, partly from the natural desire to avoid an operation, and partly from an exaggerated estimation of the powers of radium, there is a great tendency on the part of the public to insist on what they call "trying radium," whereas its use is sometimes only in preparing the way for operation or aiding afterwards.

It is commonly supposed that the "Becquerel burn" first brought the physiologic action of radium into notice, but the burn of Henri Becquerel, caused by his carrying a tube of radium in his vest pocket, occurred in 1901, and Pierre Curie says that, in 1900, Dr. Walkhoff, of Munich, and Professor Giesel made a voluntary experiment on themselves; the latter placed and kept under his arm for two hours some bromide of barium in a celluloid case, the burn lasting three weeks.

Then, soon after, Curie experimented on himself with some chloride of barium encased in gutta percha, and produced a burn after ten hours which lasted 52 days.

Curie gives the name of Henri Danlos as the next to use radium therapeutically. This was at the Hospital St. Louis, Paris, on a case of lupus erythema.

THE DIFFERENCE BETWEEN RÖNTGEN RAY AND RADIUM TREATMENT

These are frequently confounded, and the unlearned hearing of the likeness between the X-ray and the Gamma ray decry the use of a new therapy which they say is, after all, only an old one.

But there is absolutely no identity, though they are analogous. Apart from the "emanation," which Röntgen therapy does not possess, and the special manipulation of instruments allowing radiation to be conveyed to points practically inaccessible to X-rays, radium can utilize the Alpha and Beta rays, while the analogous ones in the former treatment are unusable.

Sir William Ramsay, Physicist, Who Has Done Much to Forward Our Knowledge of Radium

Frederick Soddy, Who With Rutherford, Observed that Radium Undergoes Spontaneous Change, Slowly Turning Into Helium and Another Gas Called Radium Emanation

Further, the X-rays, though the same as the Gamma rays in their physical constitution, have far less powers of penetration. Lesions responding to radium have resisted all intervention by the X-rays.

Two German doctors, Freund and Kaminer, have recently made an interesting discovery: The blood and tissues of normal persons contain a substance which destroys tumor cells, and, where a tumor is present, this substance — a fatty acid—is lacking. Exposure of normal tissue to the X-ray destroys this substance, while radium does not, and, what is remarkable, the latter *causes the appearance of this acid in cancerous organs where it did not before exist.*

When radium was first used it was considered sufficient to apply it to the diseased part, but now the quantity of radium, its purity, distance of application, nature of screen, metal or otherwise, thickness of screen, area of exposure, and time of exposure are questions which have to be settled by the radium doctor, and they, with the physicists and chemists, are working hard to get at general solutions of the difficulty. Then there is the accurate study of the histological, chemical, nutritional and other changes undergone, say—in a cancerous case—the cells, the connective tissue cells and the blood vessels. It is evident, from a study of medical literature, that radium and X-ray radiations are sometimes liable to speed rather than retard growth, and insufficiency of knowledge concerning dosage is liable to be followed by evil results.

INSTRUMENTS USED

The radium salt is kept enclosed in a fine platinum tube about an inch long, which tube is again sometimes encased in lead, this being used because it acts as a filter, keeping back the Alpha and Beta rays, which are destructive to normal tissues, and letting the Gamma rays slip through. The tube, further screened with some soft substance, is then laid in immediate proximity to the diseased part; if necessary, it can be attached by surgical plaster. In some cases incisions are made in the diseased part and the tube embedded. Its action generally begins at once; the application lasts from one to 24 hours.

The flat varnished "applicators" of various shapes are of three sizes, each containing a carefully weighed amount of radium sulphate. The little silver tray, from one to four inches in diameter, is varnished, then the radium, mixed with varnish, is put over this and three more layers of varnish added. The instruments can be attached to holders or fitted into shields of aluminum silver, lead or rubber, according to the rays it is desired to exclude. It takes on an average five to six weeks to make an applicator. The radium varnish can also be put on linen. Tubes and little boxes can be filled with the emanation, hermetically sealed, and lent out for use to doctors.

What is known as "radium gelatine" is a sterilized solution of gelatine containing a small solution of radium salts and is applied upon wads of absorbent cotton.

The rays possessing varied powers of penetration, it is possible by using suitable screens to intercept the undesired ones. A very thin screen of paper will cut off the Alpha rays, or one of aluminum or lead the Beta rays, the thickness determining whether the "hard" or "soft" Beta rays shall pass. By interposing a lead screen of at least five or six millimeters only the Gamma rays can penetrate.

A small rodent ulcer, when limited to the skin, may be cured by a single exposure, because here a full strength applicator may be used unscreened, whereas in large or mucous ulcers different parts are treated at intervals of two to three weeks.

Dr. Louis Wickham, of Paris, found, with Dr. Degrais, that the Alpha rays destroy tissues, while the Beta and Gamma, which are hard and penetrat-

ing, affect diseased cells without causing the death of normal ones, so, in superficial cancer growths, warts, etc., where the decay of tissue causes no harmful effects, only the Alpha rays are allowed to pass through the "screen" of gold, silver, aluminum, caoutchouc, etc.

SMALL DOSES USELESS

With an inadequate quantity of radium failure is almost inevitable in cancer cure. If the radio-active doses absorbed are insufficient, the change which takes place is simply radio-active excitement; i. e., if the irridation of the whole mass is not thorough, the cells which receive the smaller doses are not killed but stimulated to increased growth in consequence of the increased blood supply which is produced. There is nothing which makes cancer spread more rapidly than great blood supply produced by inefficient use of caustics or even poultices.

With a large bombardment of radium rays from all points (the "cross-fire" plan of Wickham), the cancer cells on the border, which are the youngest and most active, are the first to succumb or are checked in their growth and so do not spread.

FACIAL DISFIGUREMENTS

Many persons, disfigured by disease on the face, who have hitherto been almost debarred from society, are rejoicing in a clean skin, for birthmarks, port wine stain, lupus and non-cancerous growths generally yield after short treatment. Dr. Louis Wickham successfully treated over a thousand cases in seven years, some inoperable sores yielding to radium after one or two treatments.

THE EMANATION

The credit of investigating the effects of radium emanation is, undoubtedly, due to Dr. S. Löwenthal, who in 1906 studied its influence, but Frederick Soddy, the English physicist, urged its use for tuberculosis in 1903. Though the introduction of 15,000 units has no effect on a healthy person, the rheumatic experience first increased pain and then relief. Whether taken by inhalation, drinking or bathing, or in an applicator, the emanation is curative or ameliorating in gout, rheumatism and the neuralgias. Löwenthal has an "emanatorium" in Brunswick; has started one in Berlin, and such places are now becoming as popular as the old-fashioned "pump rooms."

The emanation is continuously given off from aqueous solutions of radium salts. It can be collected as it escapes; drawn off through the use of the mercury pump or other means; quantitatively determined by either the Alpha or Gamma ray electroscope; brought into solution in water for internal or external use or be set free in an emanatorium (room for inhalation), also collected into applicators.

THE EMANATORIUM

At these establishments patients drink the emanation two or three times a day, then take an emanation bath and, finally, strengthen the effect by remaining for an hour or two in the "emanation parlor," breathing in the emanation. That they do become in a certain sense permeated with radio-activity is proved by tests made on the blood of animals subjected to the same treatment.

SOME CURIOUS FACTS

When the emanation is removed from the radium solution by passing a current of air through it, and the emanation is stored in a holder away from the original radium, one-half of the emanation will disappear in nearly four days and in three weeks the remaining amount is negligible.

But the radium solution has grown a fresh crop as fast as the old disappeared. After about three weeks the quantity reformed by the radium solution is a practical maximum, the same as originally obtained by dropping the solid salt into water.

The law is, that the sum total of the emanation in existence at any one time is a constant, provided, of course, that

the vessels are airtight. The emanation of thorium lasts but 58 seconds.

EMANATION DEPOSITS ON WIRES

Pierre Curie and other laboratory workers often found the disadvantages in their own bodies and on delicate instruments by the radio-active deposit of radium, but a great advance in medical treatment has been made by collecting radium emanation on metal wires which for a time are as potent as radium itself. It has been found possible with these to make curative cellular transformations to a depth of nine centimeters, and even more.

IONIZATION

"Ionizing" the air means that the positive and negative atoms composing the molecules of gases have become separated and give positive or negative ions (gr., a wanderer), this being done by an electric discharge, by X-ray or radium. A solution of soluble radium is put on linen and the linen on the diseased part. It is covered with the positive electric pole and the negative pole on the other side. The current passes slowly and the radium ion penetrates even to a depth of two to three and a half inches. The same method has been used over applications of radiferous mud.

RADIFEROUS MUD

"Mud baths," alternately extolled and derided through the centuries, are again to the fore. The radiferous mud, often used as a poultice, is obtained from the remains of the uranium ore after the extraction of pure uranium. It contains a great quantity of iron and the radio-activity is produced more by actinium than radium.

RADIO-ACTIVE SPRINGS

That which has greatly helped to restore the reputation of the old-fashioned spas was the accidental discovery by Prof. Rudolf Gottleib in 1905 of the immunity from rheumatism enjoyed by workers in the very wet pitchblende mines of Joachimsthal, and the cure of the rheumatic who came to work there. Dr. Robert Abbe, of New York, made some experiments with radio-activity on vegetable growth by exposing oat seeds to radium at various distances and then planting them. The two rows which had been nearest the radium had been killed; the third row was devitalized, but the fourth to the seventh were larger, thicker and fuller in color.

(*The concluding part of this article, in the next issue, will take up the question "Is Cancer Curable by Radium?" Also the method of obtaining radium.*)

ELECTRIFIED DRAMA SERMONS

Rev. A. T. Kempton of the Broadway Baptist Church, Cambridge, Mass., recently delivered a series of what he calls "drama sermons" in one of which he depicted a ship in danger at sea. As shown in the picture he was in the uniform of the ship's captain. A wireless set played a part in portraying the story and at the conclusion of the sermon a large anchor studded with electric lights was illuminated as a quartette sang "Will Your Anchor Hold in the Storms of Life."

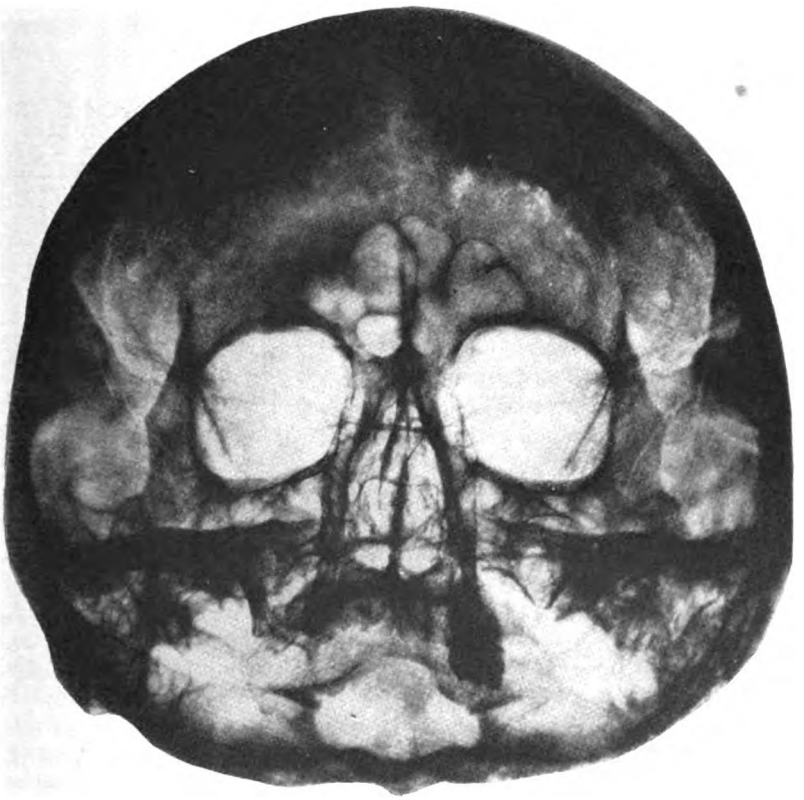
Electric Lights and Wireless Assist a Clergyman in "Drama Sermon"

A Wonderful New X-Ray Tube

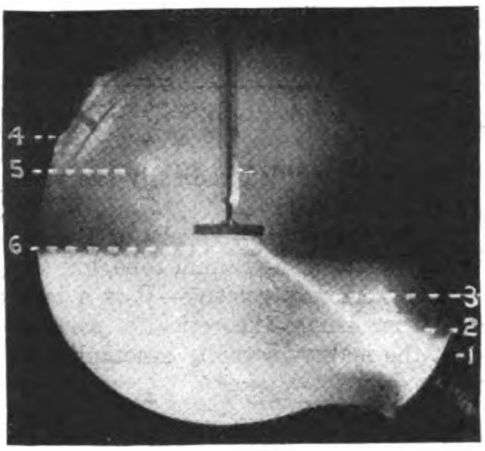
By ROBERT G. SKERRETT

The X-ray tube has made the seemingly impossible feasible since Wilhelm Konrad Röntgen discovered its phenomena nearly 20 years ago, but no small part of these achievements has been due to mere guesswork. Both the radiographer and the physician have had to feel their way, simply because they could not measure exactly the volume and the penetrative power of the rays they used. In part, this was due to the changeable character of the tube's output as it grew older in service, and, again, the quality of the vacuum inside of the globe modified radically the very nature of the X-rays.

Briefly, the layman speaks of the X-ray apparatus as a vacuum tube, but the vacuum is merely relative—it is a long way from being theoretically perfect. What the makers actually accomplish is to reduce to a limited number of microns the gas pressure within the globe. In doing this they limit by just so much the number of gaseous molecules floating about in that rarefied atmosphere. These molecules have heretofore been the prime agents considered needful in



A Positive Print Made from an X-Ray Photograph of the Human Skull and Remarkable for Its Detail and Penetration



Photograph Taken by the Light of an Ordinary X-Ray Tube Itself and Showing a Number of Things That Would Not Be Visible to the Human Eye: (1) The Cathode; (2) Luminous Glow Around the Cathode Induced by the Attack of Positively Charged Ions; (3) The Stream of Cathode Rays or Electrons Driven from the Cathode Against the Target in the Middle of the Globe; (4) The Positive Electric Terminal; (5) The Reflection on the Inner Surface of the Globe of the Heated and Luminous Cathode Opposite; (6) The Area of the X-Rays Cast in a Hemispherical Zone from the Surface of the Metal Target

An X-Ray Picture of a Piece of Wire Passing Through a Metal Ring. There is Curiously the Effect of a Shadow and the Apparent Appearance of an Ordinary Photograph

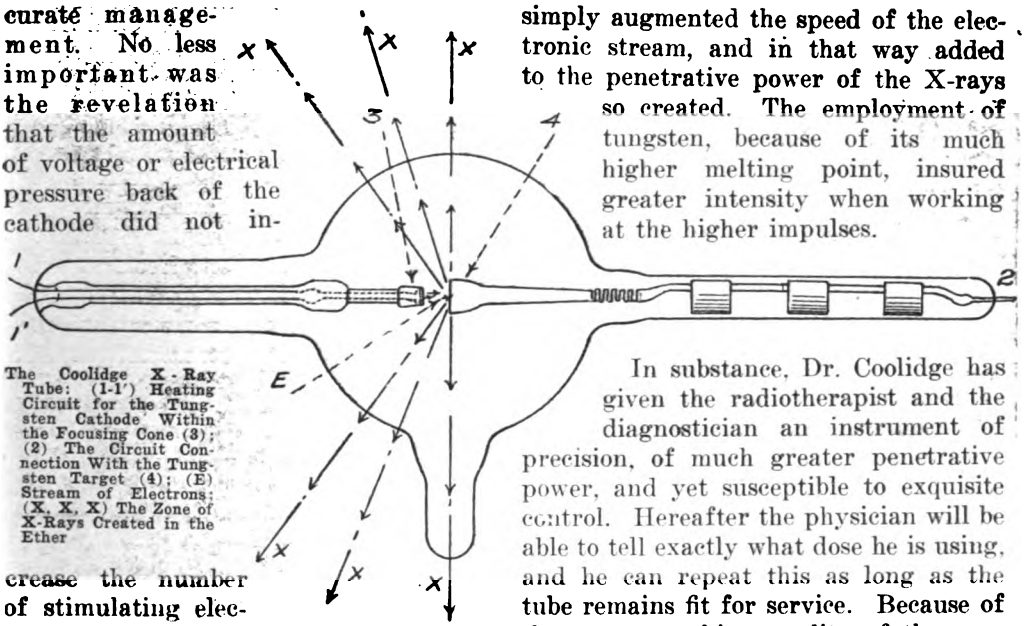
Lilies-of-the-Valley Taken by X-Ray, Illustrating That a Radiograph Is Not a Mere Shadow Picture

starting the three cornered function which takes place in a working X-ray tube. Let us make this very plain. These globules of gas are charged with positive electricity at the positive electrical terminal, known as the anode, and are projected therefrom through space against the negative terminal, called the cathode. The attack of these positive ions causes a counter discharge from the negative terminal—this discharge consists of electrons hurled violently against a metal plate lying in their path. This plate is the target. The electrons are shattered against the target, and in breaking up create waves in the enveloping ether. These waves are the X-rays which possess the peculiarly penetrating power.

The Coolidge tube produced by Dr. William D. Coolidge, of the General Electric Company, and which has aroused so much interest in the last few months, does away with the positive ion heretofore considered absolutely necessary. Dr. Coolidge employs a vacuum having a pressure of only a very small part of a single micron. Thus he uses only a twofold function in generating X-rays. His discovery is due principally to his efforts to increase the life of the X-ray tube by substituting tungsten for both of the elements—i.e., the target and the cathode. At first his tube behaved in a very unsatisfactory way, but gradually, as the cathode heated, the flow of electrons became steadier. This was the secret Nature disclosed.

He found that he did not have to have an anode to project positive ions: the mere heating of his cathode caused a flow of electrons independently, and by controlling the temperature of this negative terminal he could regulate to the greatest nicety the volume or quantity of electrons speeding toward the target. Hence, the production of resulting X-rays was subject to kindred ac-

curate management. No less important was the revelation that the amount of voltage or electrical pressure back of the cathode did not increase the number of stimulating electrons above that regulated by the temperature. The electrical pressure—like the head of water back of a faucet—simply augmented the speed of the electronic stream, and in that way added to the penetrative power of the X-rays so created. The employment of tungsten, because of its much higher melting point, insured greater intensity when working at the higher impulses.

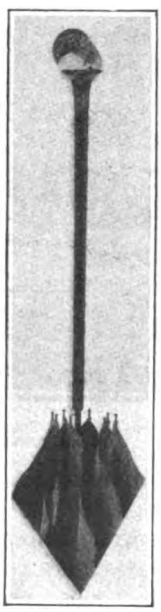


The Coolidge X-Ray Tube: (1-1') Heating Circuit for the Tungsten Cathode Within the Focusing Cone (3); (2) The Circuit Connection With the Tungsten Target (4); (E) Stream of Electrons; (X, X, X) The Zone of X-Rays Created in the Ether

In substance, Dr. Coolidge has given the radiotherapist and the diagnostician an instrument of precision, of much greater penetrative power, and yet susceptible to exquisite control. Hereafter the physician will be able to tell exactly what dose he is using, and he can repeat this as long as the tube remains fit for service. Because of the more searching quality of the rays this new tube approximates that much closer to the curative rays of radium.

WHY NOT A LAMP IN THE HANDLE?

Some clever illuminating engineer will doubtless find it profitable to devise a lighting attachment for milady's powder—puff—parasol. At least the only thing that to the mind of mere man, is lacking from this vanity handle is the light. Powder box and mirror are available at the touch of a spring. Of course they are all right as far as they go, but in the dark recesses of a taxicab a miniature light might be appreciated. The long handle offers possibilities that ought to tempt some one's inventive genius.



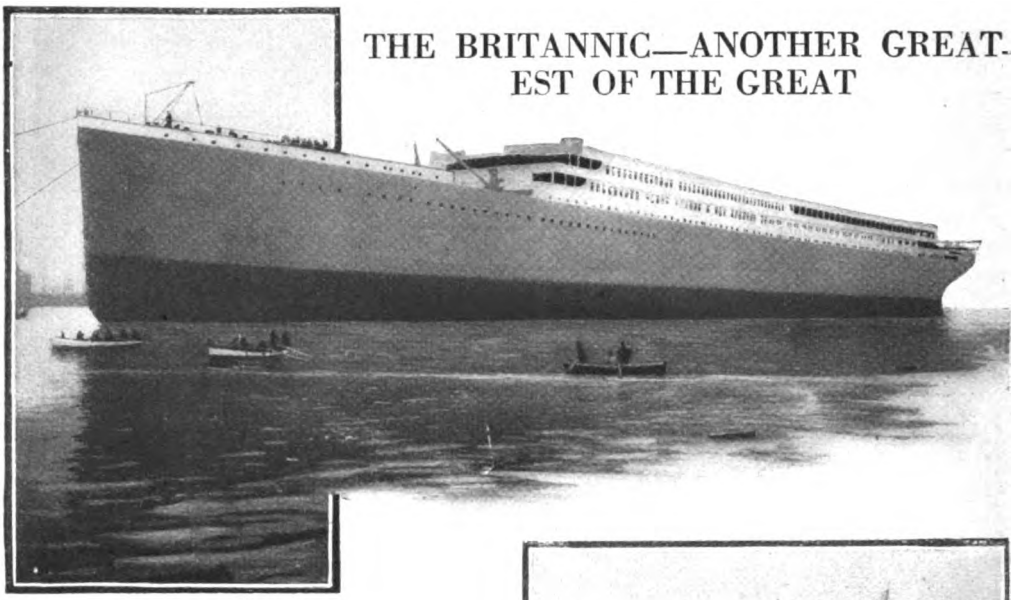
Only Light Is Lacking in This Vanity Handle

PLATINUM DUST IN GOLD PLACERS

The constantly increasing demand for platinum, especially for the manufacture of gas mantles, has led to the invention of a process of saving the fine powdery grains of this metal found in the gold placer deposits of southern Oregon and elsewhere.

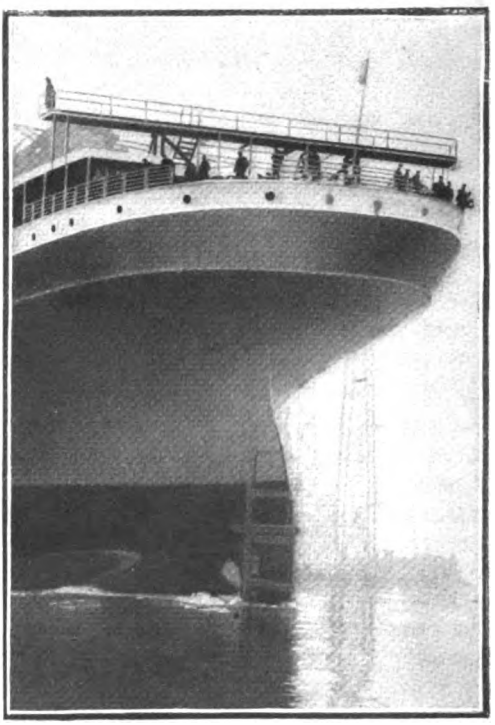
This platinum, being in a state of very fine division, almost in the form of dust, will not settle in a placer sluice so long as the water is briskly stirred. After the metal bearing water has passed over a riffle table, on which nearly all the gold settles, it is drawn more slowly over a cocoa mat riffle, on which the platinum settles, and is then collected by rinsing the mats over tanks. Formerly the platinum was all wasted, at first because its identity was not recognized, and afterward because no process was then known for saving it.

THE BRITANNIC—ANOTHER GREATEST OF THE GREAT



The ocean highways between this country and Europe are being filled with liners, each larger than its predecessors, at the rate of at least one, and sometimes three, per year.

The latest addition to this fleet is the Britannic, built in Belfast shipyards. She is about the same length as the Olympic (882½ feet), but possesses a greater beam (width) and embodies every device and convenience that past experience demands for safety and comfort. Her double bottom, which is for the most part five feet deep, is increased to six feet in that part of the liner containing the machinery, and on each side of the center line rise up six great longitudinal steel girders, which, with their cross plates, divide the double bottom space into a large number of air tight compartments and these extend above the water line. Coal bunkers occupied this space in the early days of ship building so that even with the "double skin" of the ship the danger was ever present that in case of injury to the hull below the water line, a door might be opened in the "inner skin" to a coal bunker.

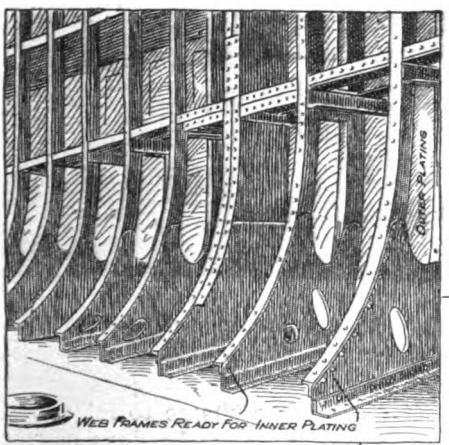


Two Views of British Liner Embodying Newest Plans of Naval Architects and Marine Engineers

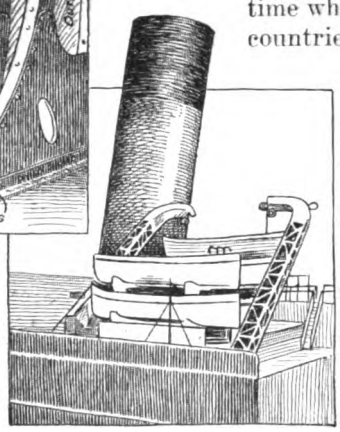
An enumeration of the features that make an ocean trip on the Britannic as convenient as if one were at home, emphasizes the extent to which electricity serves. Three electric elevators carry the passengers from deck to deck. In every first class room is an electric fan and every public room is ventilated and heated by air actuated by electric fans. Elec-

tric radiators of capacities ranging from 3,500 to 6,000 watts are installed plentifully. Electric baths, even, may be had and in the hair dressing parlors and in every stateroom are electric curling irons for the use of lady travelers.

One of the most interesting features of the Britannic is the control which the captain may exercise from the bridge 63 feet above the water line. Every possible quarter of the ship where a member of the crew may be is equipped with both a telegraph and a telephone instrument, and also from the bridge, by means of electrically controlled indicators, the captain at a glance can determine the speed of the engines, the operation of the steering gear, the position of bulkhead doors and even the five great anchors, the largest of which weighs sixteen tons, are, in case they are needed, lowered and raised in accordance with telegraphic instructions from the bridge.



Double Hull Construction Is Carried Up the Sides of the Ship to a Distance Above the Load Water Line



System of Inboard Lifeboat Davits

Sewage from the lavatories is taken care of by piping within which water is constantly circulated by electric pumps, and the hot water system is controlled in such a way that the moment a faucet is turned on, hot water may be had without waiting for cold water to leave the pipe.

The generating plant of the liner has a capacity of 1,660 kilowatts and perhaps a better idea of this is conveyed by the fact that 66,400 25 watt Mazda lamps could be lighted at one time.

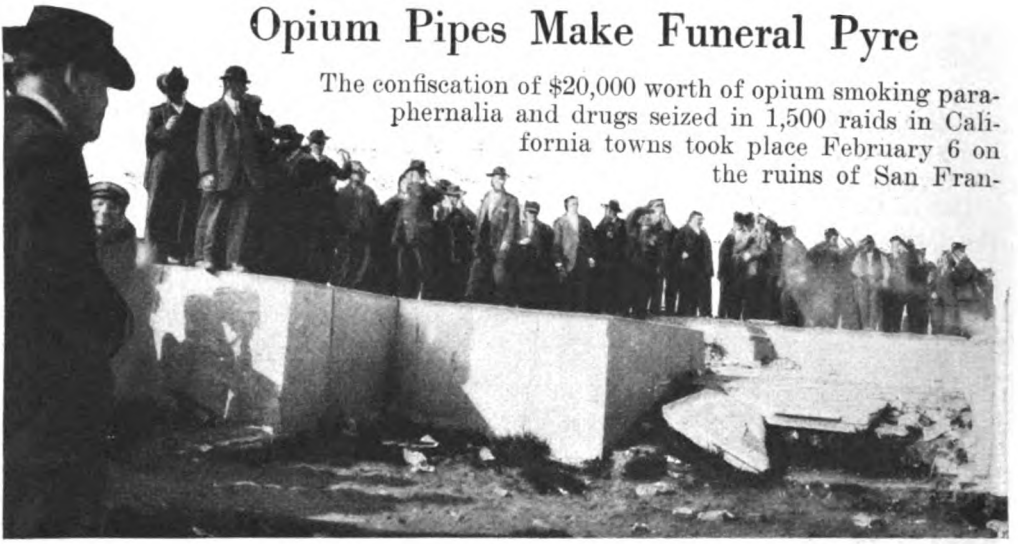
The wires for the Marconi installation are carried on the masts at a height of about 200 feet above the water when the boat is loaded. The power of the installation is such as to send messages over 2,000 miles so that the liner will be in communication during a voyage with either England or America, and for some time while in mid-ocean, with both countries.

To insure absolutely a supply of electrical energy for operating the wireless, whistle controls, boat hoisting and a certain portion of the lighting, what is called an emergency electric power station has been installed on one of the decks high above the water line. There are two generators which are used to charge a substantial storage battery set and it is this equipment that will furnish current in case of an emergency or accident and when in port.

Two reciprocating engines and one Parson type low pressure turbine, drive the three screw propellers. Twenty-nine boilers, all but five being double ended, constitute the boiler equipment and their furnaces find outlet through the four funnels which rise 180 feet from the bottom of the ship.

By a special system of rotation originated by John McLaren, Superintendent of San Francisco's Parks, every flower of the million plants of the tropical garden at the Panama-Pacific International Exposition will be in full bloom during the ten months the exposition will he open to the public.

Opium Pipes Make Funeral Pyre



The confiscation of $20,000 worth of opium smoking paraphernalia and drugs seized in 1,500 raids in California towns took place February 6 on the ruins of San Fran-

MIKE'S NOSE IS OF BRASS

It is being demonstrated to the folks of Mt. Healthy, Ohio, by Mike, the faithful old horse of the street cleaning department, that a regular nose is quite a superfluous thing.

Now if Mike had relied on his own natural nose he would have been dead long e'er this.

Mike Breathes Through a Brass Disk in His Windpipe

When Mike's nose ceased to work well, so that it seemed that Mike would die of suffocation, Joe Stoppel, his owner, said it would be a shame to let a nice horse like Mike go to the dogs merely because he hadn't the use of his nose.

So Stoppel consulted a horse doctor and the doctor told Stoppel to cease grieving, because he, the doctor, could give Mike a new nose by way of his neck.

The doctor made a hole in Mike's neck and opened the windpipe and put a tube into it. At the outer end he fixed a brass disk which may be seen in the picture.

All the air that Mike breathes goes through the disk, up the tube and down Mike's windpipe. On cold days Mike's nose emits steam just like a regular horse nose.

"And he's better'n ever now," says Stoppel. "Giddap, Mike."

A FEW ELECTRICAL TERMS EXPLAINED

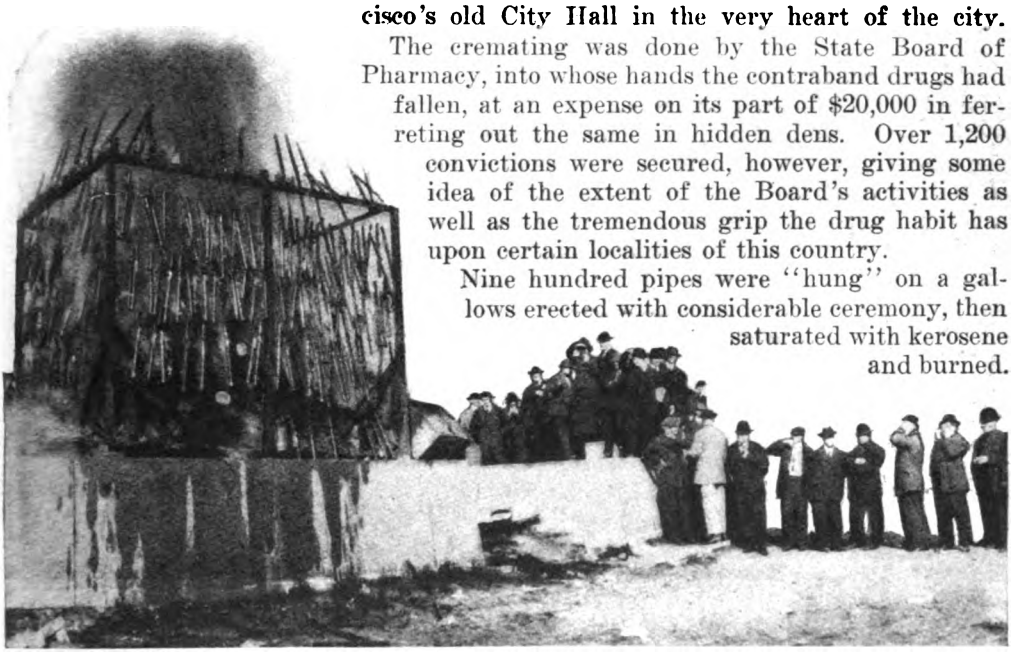
High Tension.—When Tom proposes and May hesitates.

Zero Potential.—When May says, "No."

Cross Arms.—Two meanings: The cross beams which support wires on

cisco's old City Hall in the very heart of the city. The cremating was done by the State Board of Pharmacy, into whose hands the contraband drugs had fallen, at an expense on its part of $20,000 in ferreting out the same in hidden dens. Over 1,200 convictions were secured, however, giving some idea of the extent of the Board's activities as well as the tremendous grip the drug habit has upon certain localities of this country.

Nine hundred pipes were "hung" on a gallows erected with considerable ceremony, then saturated with kerosene and burned.



telephone poles; also the soul-reading pose when lovers stand with hands on each other's shoulders. The latter definition is proper and preferred.

Dynamo (dye-no-mo').—Parting message of a jilted darkey lover as he swallows a pint of grape juice and fakes suicide.

Circuit Grounded.—When two lovers kiss while their feet are stuck in the mud.

Carefully Wired.—When her hair stays on straight.

Insulated.—When she wears a veil.

Permanent Magnet.—"A steady."

Soft Magnet.—Very spoony.

Short Circuit.—The path lovers never take when returning home.

Sparking.—An obsolete term, no longer used. Usually meant, "Trouble ahead."

Transformer.—The minister.

PERUVIAN RAPID TRANSIT

The inhabitants of Pisco, Peru, few of whom have ever seen a steam or electric car, think this "omnibus" the acme of rapid transportation. Operating on about one-half mile of track, it is the only street car of any description for hundreds of miles around and is proudly pointed out to all who visit this quaint little Peruvian town.

Rapid Transportation in a Little Peruvian Town

SPANISH ROPEWAY OVER FIVE MILES LONG

Here is a picture of a very long wire ropeway of an iron ore company operating in north Spain. The company is engaged in working the deposits of this district on a large scale. A plan was developed to send the earths to a washery erected on a hill at the coast. A careful survey was made and as a means of connection between the mine and the washery, a wire ropeway was decided upon.

A cable system was constructed consisting of a double ropeway of two parallel lines, each independent of the other. The total length of the main line is about five miles. The capacity of this wire ropeway is 1,400 ton miles per hour and it is claimed that this is by far the greatest ton mile capacity yet achieved on such a line.

Protection is afforded by a broad band underneath the cars when the line passes over a village or through a town. Electric drive is used for both sections of the main line consisting of two electric motors of 100 horsepower each.

DIAMOND SAWS

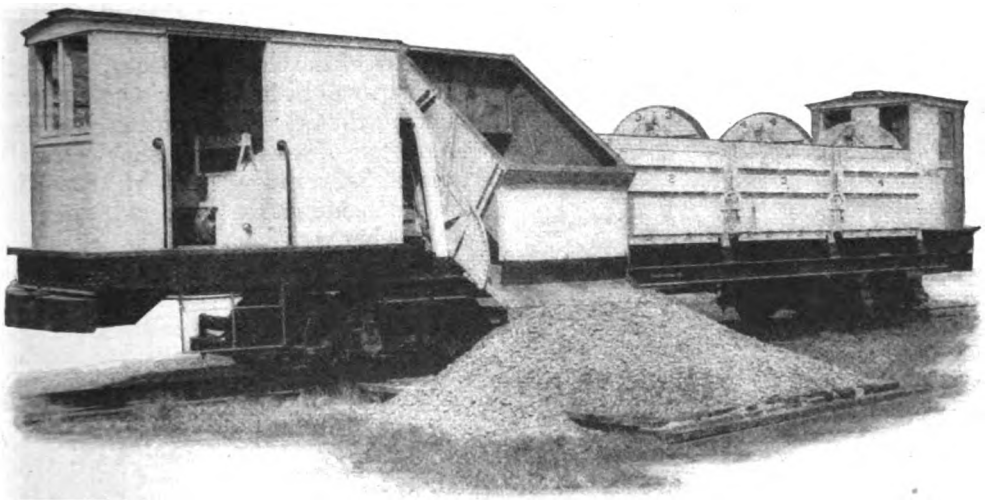
There is in use a curious diamond saw for cutting stone. The diamonds that form the cutting teeth of this saw are common crystals, worth about $2.50 a carat, and they are fixed in a steel disk about six feet in diameter, which is mounted on a spindle and revolved by electric power in the manner in which an ordinary circular saw is operated.

For sawing hard stones there are 200 diamonds in the cutting edge and the speed is 300 revolutions a minute. The saw enters the stone about one foot in that time. For soft stones the teeth are of steel, with diamonds at intervals of every five teeth, and at a speed of twelve turns a minute the saw advances a yard a minute.

This saw cuts and dresses the stone on all sides, and gives it sharp outlines, accomplishing its work at one-eighth to one-tenth the cost of hand labor.

FOUR DUMP CARS IN ONE

So unsightly had some of the old dump cars become on a certain big electric line in the State of Connecticut that the State Public Utilities Commission suggested, if possible, a more pleasing design of car. Through the united efforts of the engineers of the company and a well known firm of car builders of Springfield, Mass., the particular design of electric work car here shown has been developed. It contains four separate dumping compartments, all of which may be emptied at one time by one operation, or singly, as may be required.



Electric Work Car With Four Separate Dumping Compartments

At the present time there have been five of these cars in use in and about New Haven and Hartford, Conn., for the hauling of crushed stone. Each car has a capacity of 24 cubic yards of crushed stone, or 64,000 pounds. A separate section carries six cubic yards. With a full load on, the car has a weight of 72 tons and without a load its weight is 21 tons.

In the cab, shown in the fore part of the car, is a ten horsepower motor for dumping each load. This is done by means of cables attached to the lower corners of each compartment and running over sheaves at (3-3) and (4-4), etc., in the illustration. The time required to dump each compartment separately is less than one minute, and the entire operation of the car requires but two men, where many more were required by the old method.

THE BULGARIAN ROSE INDUSTRY

Miles and miles of rose fields in southern Bulgaria are despoiled for the extraction of the oil that forms the most important export of that part of the country. The sorts of rose trees principally cultivated for the purpose are the red Damascus and the common white rose. They are planted at a distance of seven feet from one another and require very little care.

The buds are cut before they are half opened, fifteen tons yielding about one pound of oil, the cost of which ranges from $70 to $100.

Before the war in the Balkans the largest demand for attar of roses came from Turkey.

The merchants get the exquisite perfume bottled up on the spot in tiny, hermetically closed flasks, which are afterward sold at retail.

A QUEER BOMB

A curious bomb was found recently in the hall of a New York apartment house. The machine consisted of an oil soaked box six inches by four, which contained a spring and a great piece of absorbent cotton soaked in a most peculiar liquid having neither smell nor taste.

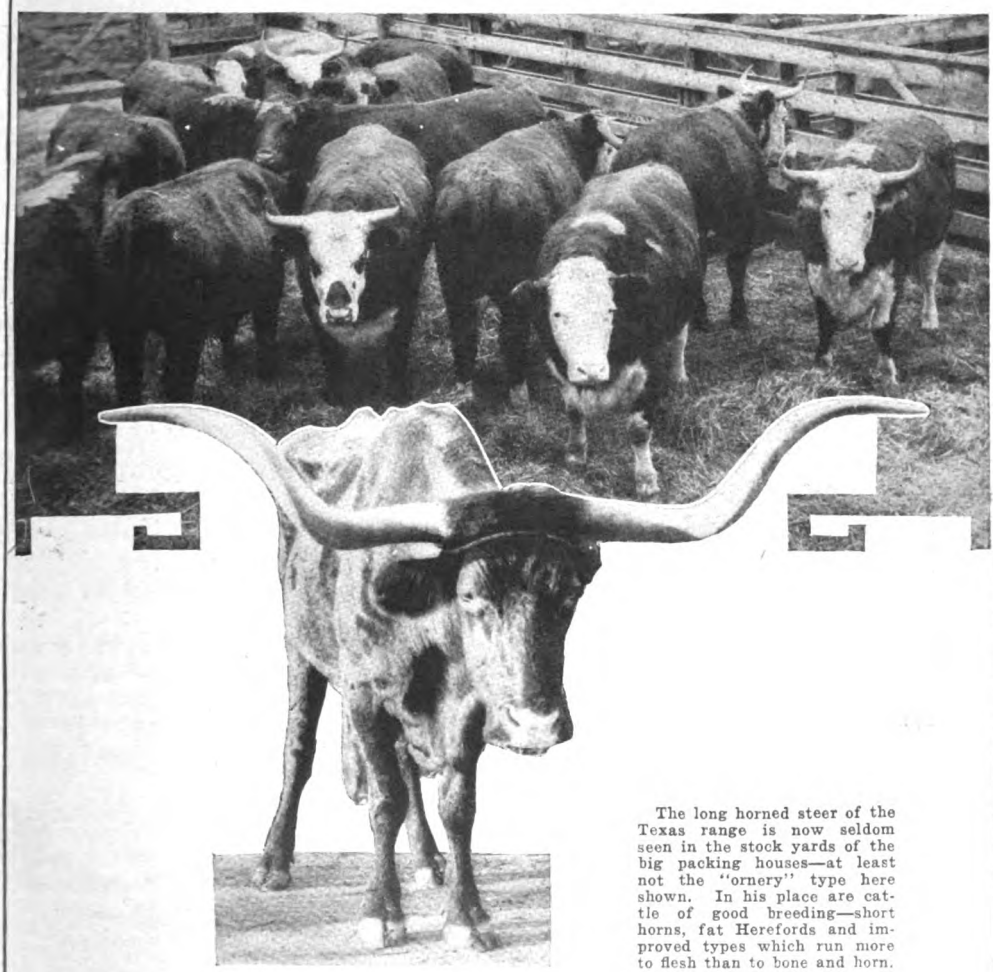
Inspector Egan, head of the Bureau of Combustibles, was of the opinion that its object was to blind rather than to kill, as the bomb might explode in an enormous flare and possibly was designed to destroy the sight of the person exposed to the flame. The Inspector, who has dissected many infernal machines, declared he had never seen one similar to this.

The Curious Bomb Found in a New York Apartment House; Supposed to Blind Rather Than Kill

THEORY OF ELECTROLYTIC DISSOCIATION

"If we insert between the poles of an electric battery a piece of rock salt or some distilled water," says Prof. Treadwell of the Polytechnic Institute of Zurich, "there will be no electric current in the circuit; a piece of fine platinum wire placed in the circuit will not be made to glow. The solid rock salt as well as the distilled water are non-conductors of electricity, they are non-electrolytes. If, however, we dissolve rock salt in distilled water and then insert the solution between the poles of the electric battery, the platinum wire will be brought to a bright glow, showing that the salt solution is a good conductor of electricity, an electrolyte. It is thereby proved that by dissolving the non-conducting rock salt in non-conducting water, an essential change of the former has taken place. The same observation is made with all acids, bases and salts. In an anhydrous state they are non-electrolytes, while in aqueous solution they are electrolytes.

"According to the theory proposed by Arrhenius in 1887, all electrolytes are partially decomposed in aqueous solution into electrically charged atoms or atom groups called ions; and the extent of this dissociation increases with dilution. For every degree of dilution there exists a certain state of equilibrium between the ions and undissociated molecules."



The long horned steer of the Texas range is now seldom seen in the stock yards of the big packing houses—at least not the "ornery" type here shown. In his place are cattle of good breeding—short horns, fat Herefords and improved types which run more to flesh than to bone and horn.

William Schwab, a conductor on the Sacramento Division of the Southern Pacific, who came 3,000 miles to New York to receive the E. H. Harriman memorial bronze medal.

William Sproule, president of the Southern Pacific, who received the silver medal.

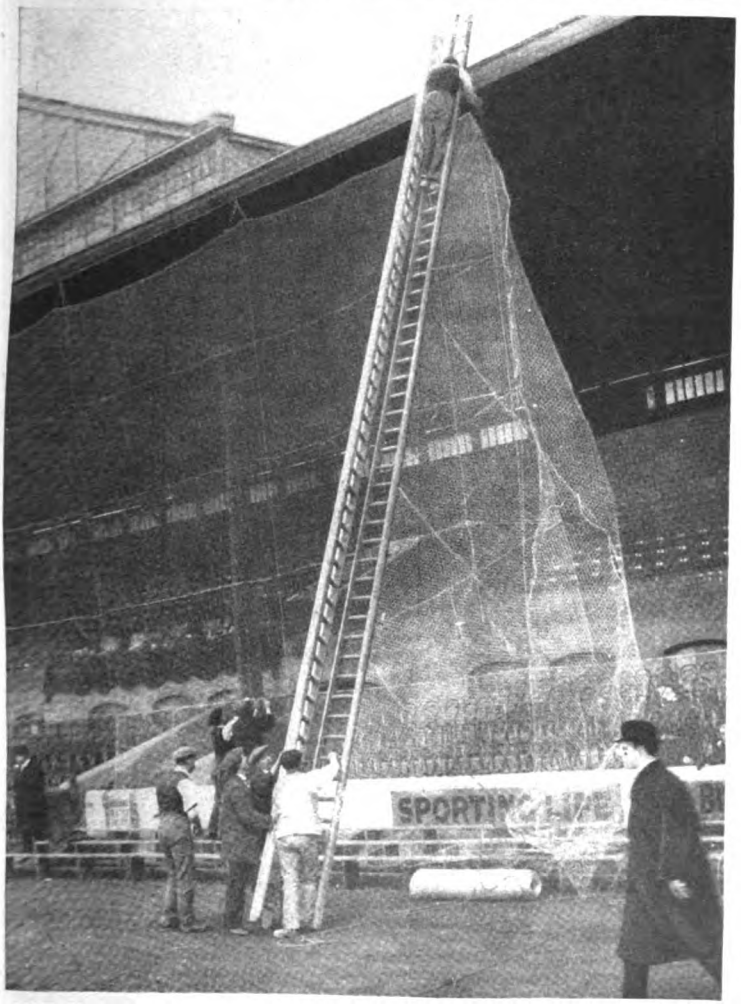
The E. H. Harriman Memorial Medals were awarded in New York on Saturday evening, March 14th, in the studio of A. A. Anderson, the millionaire artist. A railroad president and a conductor on his road stood side by side and received the medals from the hand of Mrs. E. H. Harriman, widow of the late railroad magnate, as a reward for their services to humanity in making safer the great Southern Pacific Railroad system.

Julius Kruttschnitt, who received the gold medal for the Southern Pacific R. R.

The purpose of the Harriman medals is to encourage a greater striving for safety and the conversation of human life by American steam railroads. They are to be awarded annually to the road making the best record in accident prevention and industrial hygiene affecting the public and its own employees. The gold medal is awarded to the railroad company itself, a replica in silver to the member of the operating department of that road who has done the most to bring safe conditions about and a replica in bronze to the employee of the winning road who has been most conspicuous in the promotion of safety.

In his speech of presentation, Arthur Williams, president of the American Museum of Safety, called attention to the fact that not a single passenger's life had been lost on the Southern Pacific in the last five years. Julius Kruttschnitt, chairman of the Executive Committee of the Southern Pacific, received the gold medal for the Company. He said that during the year ending June 30, 1913, the company's locomotives in passenger, freight and work service ran 59,738,000 miles, enough to girdle the world once every 3½ hours, nearly seven times in a day and 46 times in a week. With so great a movement the liability to accident is very great, yet 41,783,000 passengers were carried the inconceivably great aggregate distance of 1,756,482,000 miles. Furthermore, it was done for the four years preceding with the same immunity.

The King of England chatting with Ambassador Page in the grand stand, surrounded by members of the American Colony in London, during the baseball match between the Giants and the White Sox at Stanford Bridge, Feb. 26th.



Putting up nets for the protection of the public just before the above mentioned game.

Photos by Paul Thompson, N. Y.

This picture shows a general view of the hairdressers' academy in London. A hairdressing competition took place in this academy recently in the west end. The members vie with each other in making up coiffures of false hair so intermixed with natural hair that detection becomes impossible and the result becomes the prevailing fashion for the next few months.

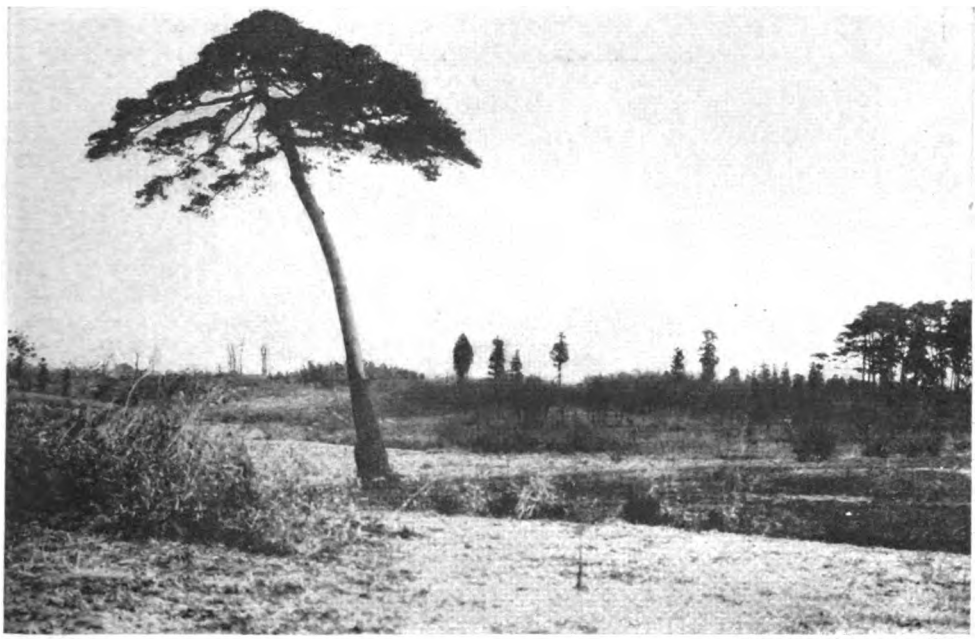
Paul Thompson, N. Y.

International News Service, N. Y.

Miss Helen Keller, at left, "listening" by touch on throat, lips and nose to words of Mrs. Anne Sullivan Macy, her teacher and companion for 27 years.

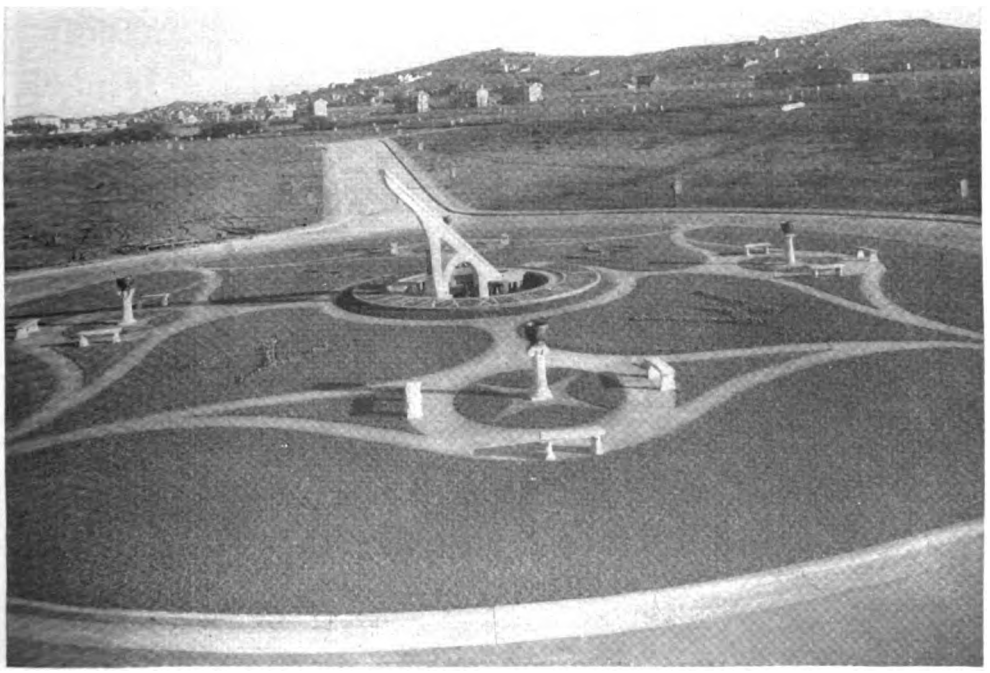
Here is a group of five coiffures that were selected as showing the best workmanship in the above competition.

Paul Thompson, N, Y.



International News Service, N. Y.

The site selected by the government of Japan for the shrine to the late emperor Meiji. After long discussion, it was finally decided to erect it in the vicinity of Tokyo. The shrine, which will probably cost several million dollars, will doubtless become one of the favorite holy places of the empire.



J. L. Wright, Revere, Mass.

Largest sun dial in the world, recently erected in Ingleside Park, San Francisco, 150 feet from tip to tip

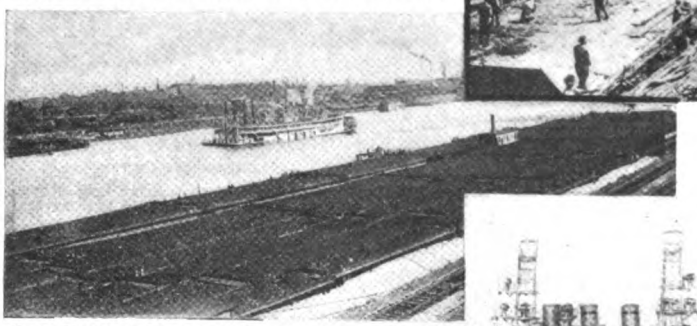
Jim Wray, the veteran Australian sculler, who has been turning out winning crews at Harvard for the last six years, has just signed a contract to continue as head coach at Cambridge for the next three years.

International News Service, N. Y.

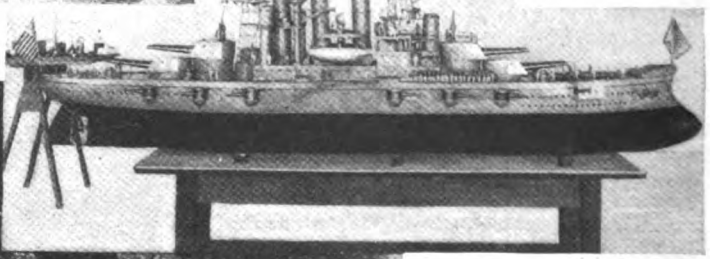
Weaving a mattress of willow boughs which is to be sunk to the bottom of the Mississippi River to prevent the current from cutting a new channel.

R. H. Moulton, Chicago

This is just one section in Pool No. 1 of one of the huge Pittsburgh coal fleets and contains 13,000,000 bushels. How much power this means if converted into steam and how much electric current it would produce, how many engines it would drive!

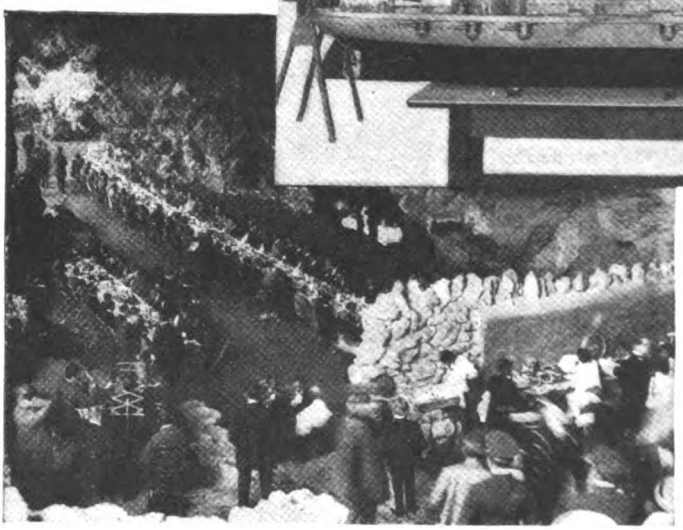


Boston Photo News Company, Boston



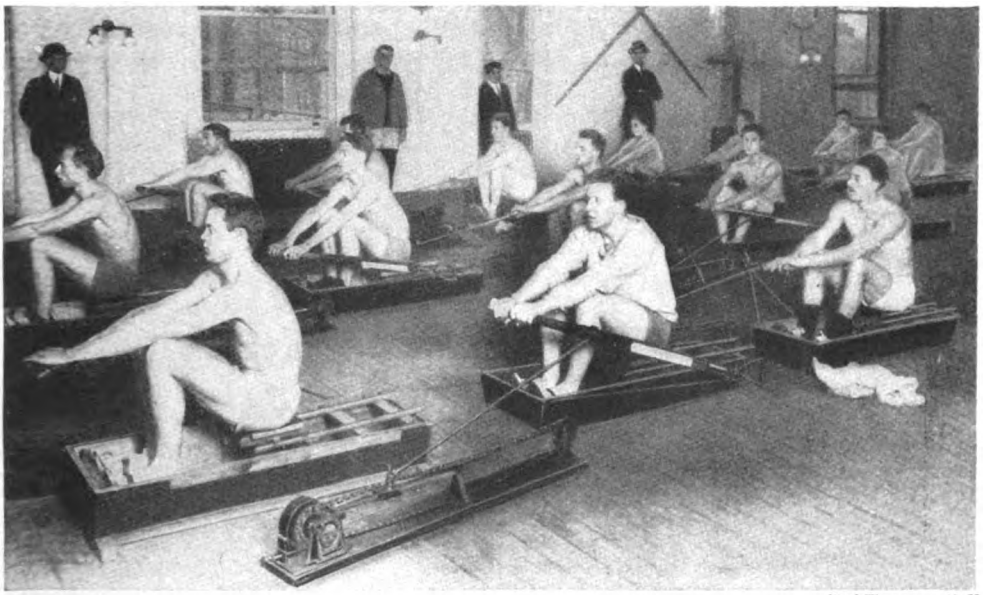
International News Service, N. Y.

This miniature battleship is a mechanical marvel built by Samuel Orkin, a young Boston inventor, which he will soon demonstrate to the secretary of the navy. At a recent demonstration in New York, Mr. Orkin set several screws and then stepped away from the model. A tiny band played the American Patrol, flags were raised and while the little manikins moved about the decks, the ship weighed anchor and the screws revolved. With the firing of the first shot, the sailors went below and the decks were cleared for action.



International News Service, N. Y.

Mexican officials entertaining Japanese officers after their arrival in Mexico. This gathering took place in a large cave.

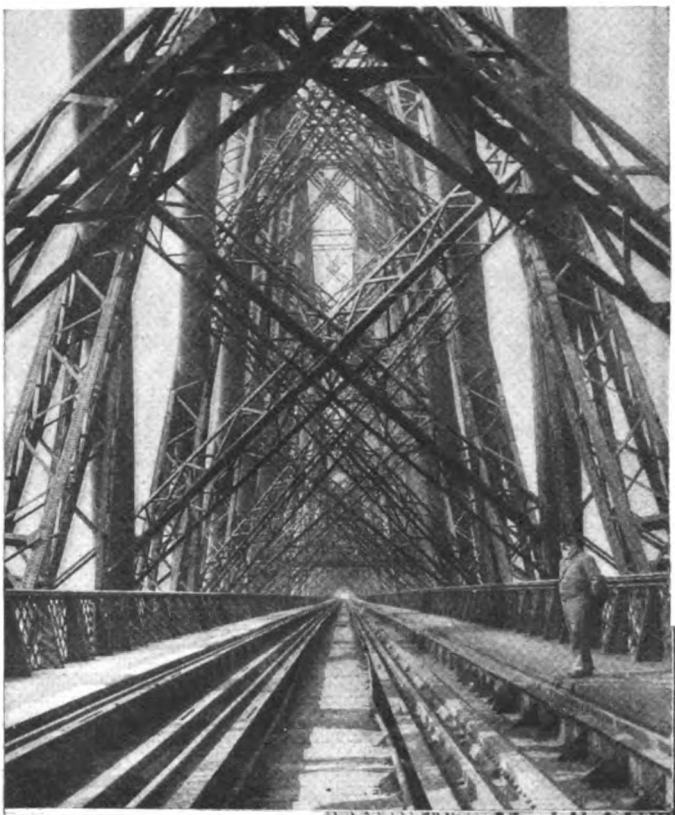


Paul Thompson, N. Y.

Columbia "varsity" crew practising at the Columbia University gymnasium on rowing machines.

Underwood & Underwood, N. Y.

View in the famous Reach factory in Philadelphia, where, under the direction of A. J. Reach, the spherical little "pills" are made without which there would be no ball games, no ball teams and no National, American or Federal Leagues. As much skill is required in making a baseball as in the adjustment of a fine watch, for the weight must be evenly distributed.



Looking lengthwise through two of the World's greatest bridges—The Forth Bridge, Scotland (upper) and the Brooklyn Suspension Bridge (lower.) These pictures illustrate very strikingly the difference between the truss and suspension types of construction.

Photos Copyrighted by Underwood & Underwood, N. Y.

American Press Association, N. Y.

Giant tubers grown by student farmer in Douglas County, Wash. C. V. Ogee here shown won the prize for both quality and size of potatoes.

Paul Thompson, N. Y.

Architect's plan for the Pan-American States Association Building which is to be 51 stories high, to cost $12,500,000, to stand on Broadway, Eighth Avenue, 57th and 58th streets, New York City. Hudson Maxim is the president of the Association.

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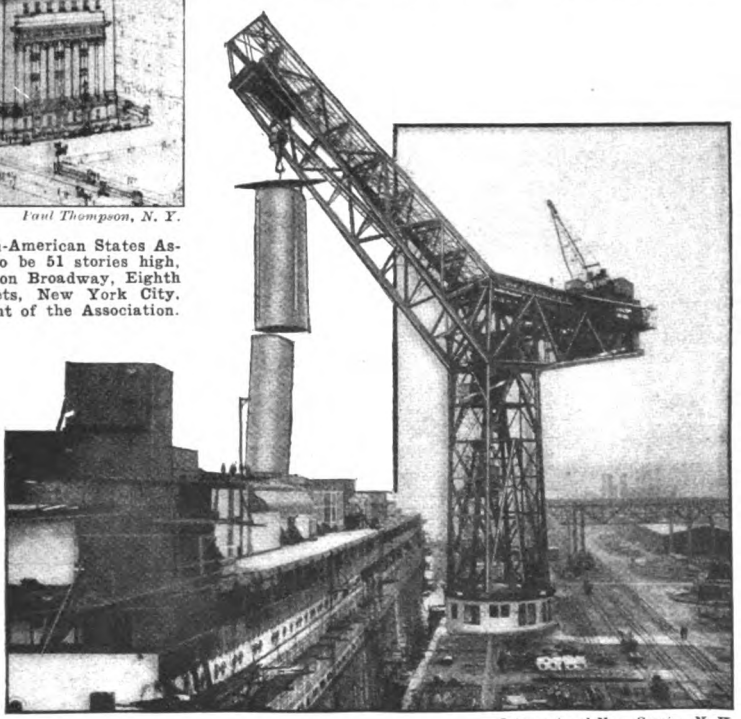
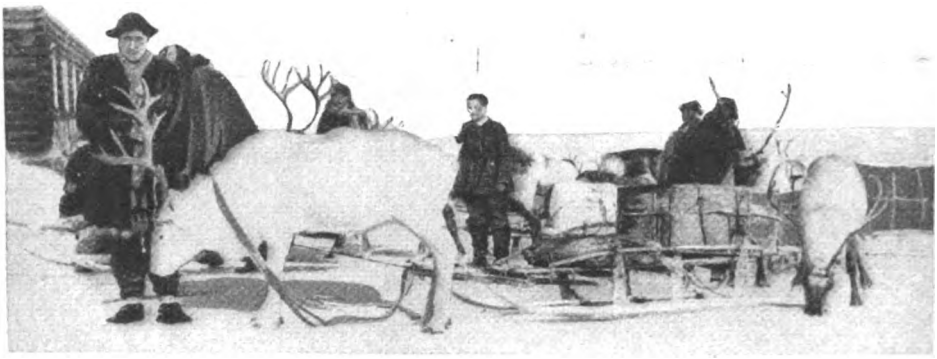
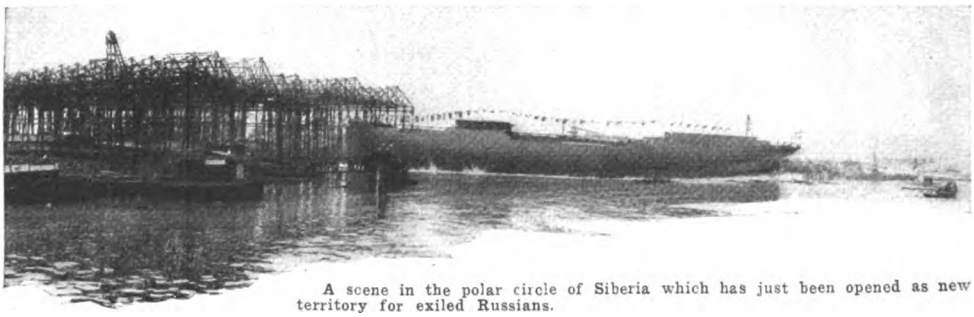
How imported goods are carried from custom house; railway along street in Guayaquil, Ecuador.



International News Service, N. Y.

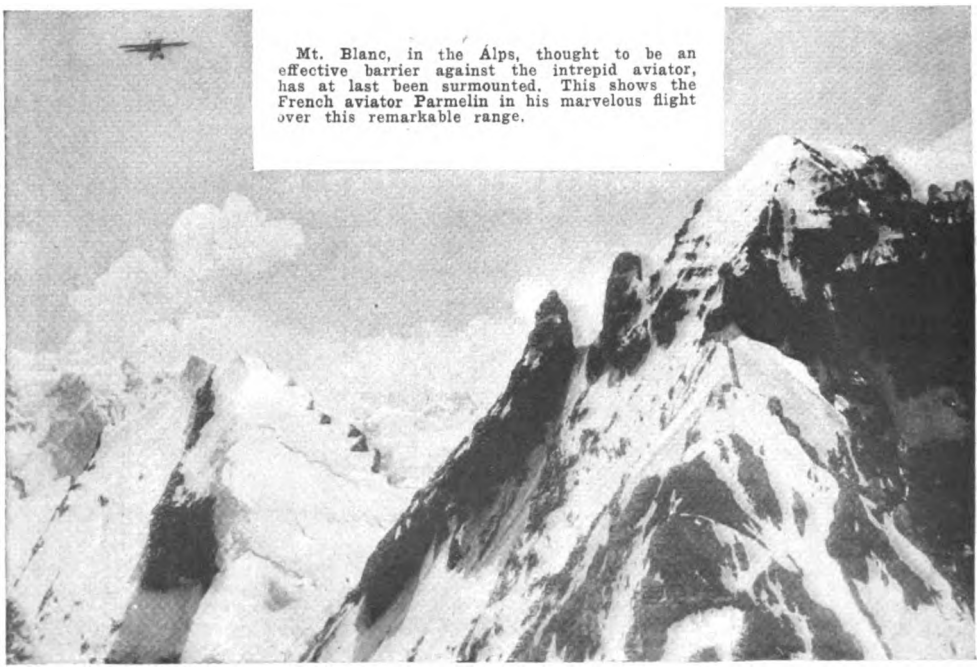
The greatest derrick in the world, used to place the sections of the smokestack on the giant liner Vaterland.





A scene in the polar circle of Siberia which has just been opened as new territory for exiled Russians.

The largest American built oil tanker slid from the ways of the Union Iron Works, San Francisco, Feb. 11, 1914. It was built in five months and five days at a cost of $800,000.

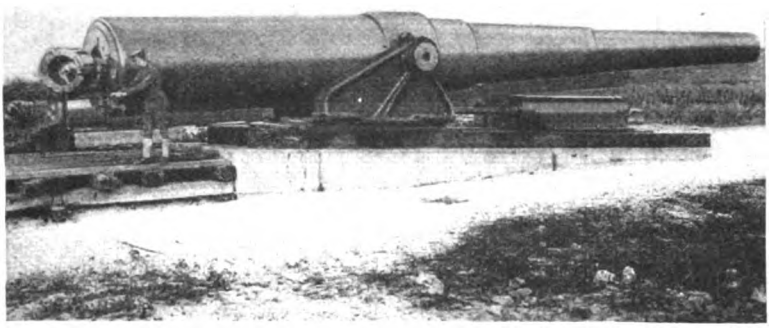


Mt. Blanc, in the Alps, thought to be an effective barrier against the intrepid aviator, has at last been surmounted. This shows the French aviator Parmelin in his marvelous flight over this remarkable range.

The auto log hauler is being used extensively by Maine lumbermen. The machine weighs ten tons and each car carries about four horse loads.

International News Service, N. Y.

Here is the biggest gun in the world designed to guard the Panama Canal. The range of this gun is 21 miles. If smokeless powder is used, 580 pounds will be required for a single charge. The gun is 49 feet in length, caliber sixteen inches.



R. H. Moulton, Chicago

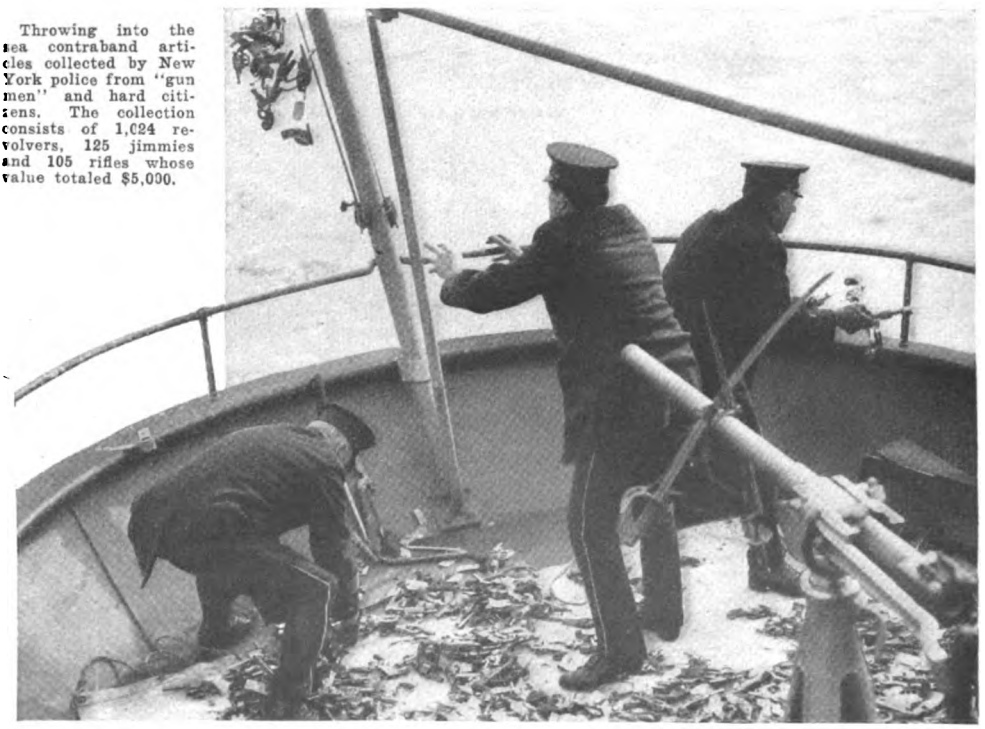
C. A. Osier, Seattle

Prominent business men of Seattle, Wash., while on a recent excursion to Bend, Ore., were surprised by a very realistic encounter with masked highwaymen, but the outlaws proved to be the citizens of Bend, who took this unique method of welcoming their guests.

Underwood & Underwood, N. Y.

An English vessel aground on the Mediterranean coast between Algiers and Bougie. That waves sometimes reach to the masthead as related in the yarns of sailors is here demonstrated to be true.

Throwing into the sea contraband articles collected by New York police from "gun men" and hard citizens. The collection consists of 1,024 revolvers, 125 jimmies and 105 rifles whose value totaled $5,000.



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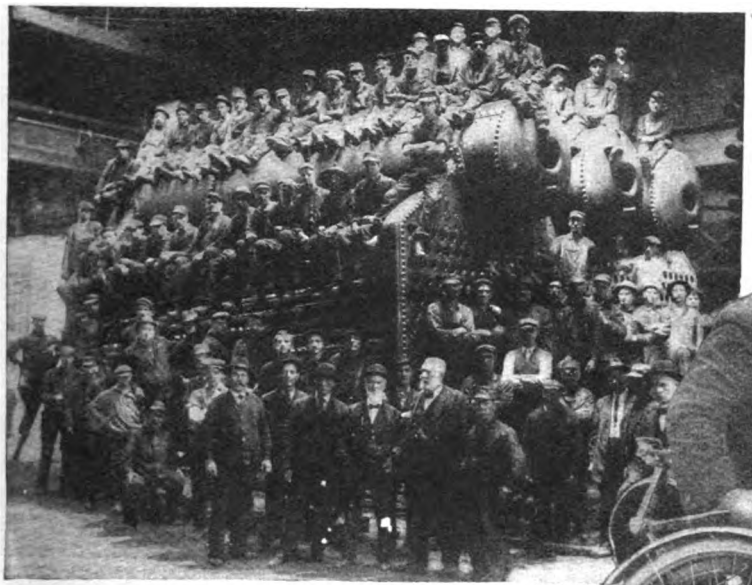


Frank W. Lane, San Francisco

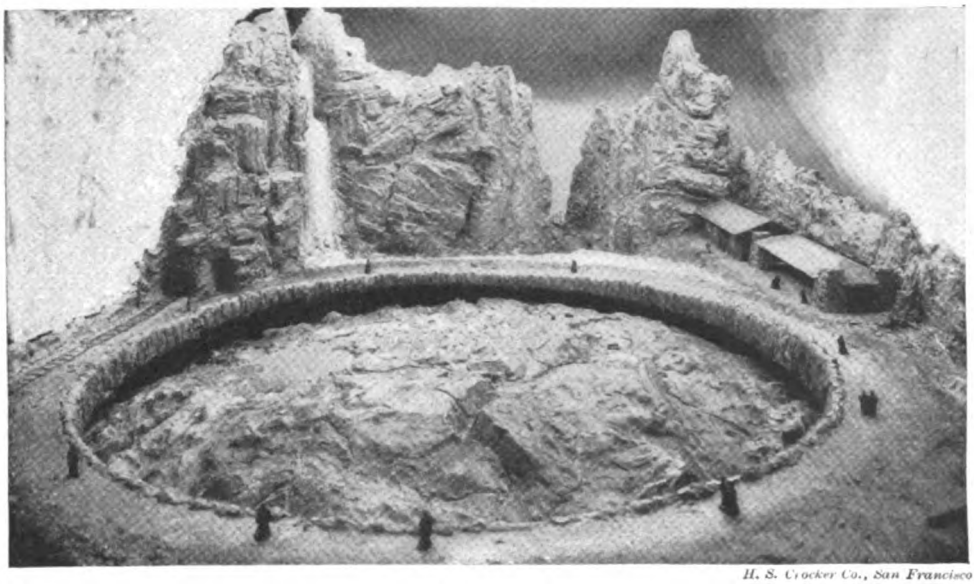
One of the largest boilers in the world built by E. Heller Company for a big copper company to receive waste heat from the largest reverberatory copper furnace in the world. This boiler contains two miles of pipe.

This bicycle can be folded and put into a leather case in five minutes and everything about the wheel can be taken apart. "It is fine for tourists," declares John Robinson, an Englishman who will have it patented in England and America.

J. R. Schmidt, Cincinnati

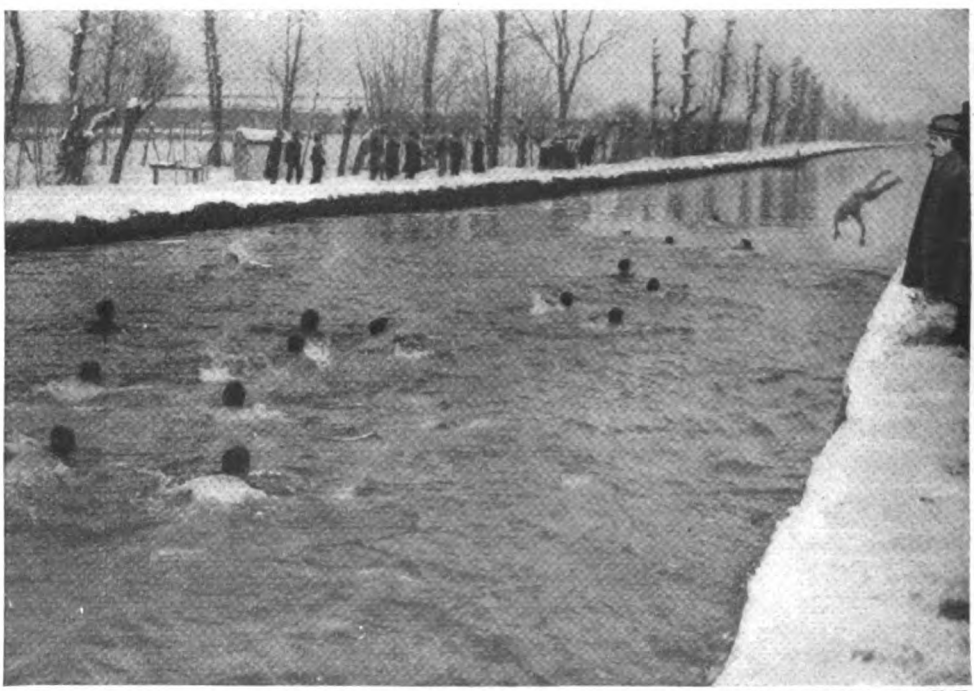
This original device has been installed in the kindergarten class of a Cincinnati public school to develop weak chests and arms of anemic children. The youngsters travel around the 20-foot circle on the floor by means of muscular power.

J. R. Schmidt, Cincinnati



H. S. Crocker Co., San Francisco

The illusion of great distances, depths and heights is produced in the Yellowstone Park exhibit at the Panama-Pacific International Exposition, by every device of the showman. Various means are used to create the effect, and the ensemble is a wonderfully exact reproduction of the original.



Underwood & Underwood, N. Y.

The picture shows a remarkable scene of Italians swimming in icy waters in Milan, Italy. This section had unusually severe weather last winter, but in spite of the cold a large number of men took daily out-door swims while hundreds of spectators enjoyed the unusual sight.

International News Service, N. Y.

Air bags connected with a beam used as substitutes for boats by soliders of a Vienna regiment.

International News Service, N. Y.

Field practice of the Vienna regiment—building a bridge.

Typical Albanian children in front of a typical Albanian home.

The ancient fortifications of Durazzo.

Selling steers in the open market.

Albania, the new nation born as a result of the Balkan War, has many interesting but little known places with which the public is not acquainted. The new nation consists of several hundred small villages hidden away in the mountains, and two cities: Vallona, the capital, and Durazzo, a seaport town. The ruler is Prince Weid, who was elected by the European nations.

Photos by Underwood & Underwood, N. Y.

The open-air market of Durazzo.

The Savage Arms

By LESLIE G. SHANNON

PROLOGUE

I pulled the lap of my sleeping bag down tightly and pushed my feet deeper into its warm fur. Then I rested for a moment and listened to the uncanny c-r-a-a-c-k of the frost in the brittle limbs of the snow-pedestaled trees.

Slowly the influence of a grateful warmth heavily leaded my eyelids with an overpowering drowsiness, and easily I gave way beneath it. When it seemed as if all things were merging into a floating mist, startled and gasping I suddenly returned to furtive consciousness. For tearing and shattering the quiet of the mysterious forest aisles thousands of vagrant echoes hurled themselves into being, pursuing the first quick, sharp lash of a rifle's discharge.

Again and again it came, until the great clear dome of the heavens seemed to resound with the clamor. Then, with every sense alert, I crept out of my bag. Thonging my snowshoes securely into place and grasping my rifle, I skirted the boundary of glittering moonlit pine. For a moment, now, silence had returned, with all the dull weight which the lonely Arctic seemed to breed. But I knew that somewhere not far distant lurked the enigmatical agency whose crooking finger had released the battery of echoes which had pulled me out of the depths of my slumber.

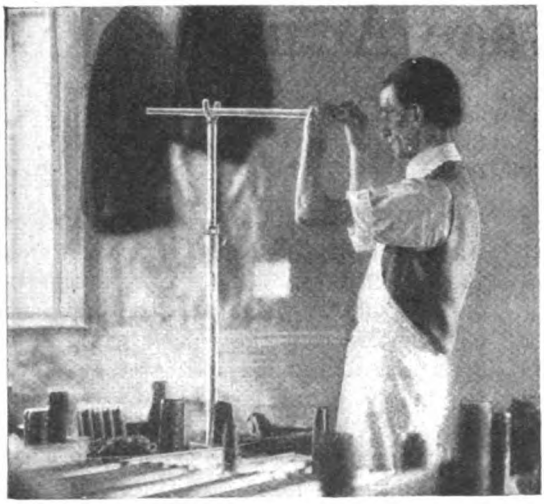
As I crunched along, my stretching shadow waving eerily before me, there suddenly came from the low pineland at my right a long, dreary, rolling cry. Once again the mad turmoil of echoes responded, and I could feel a sucking chill creep slowly up my backbone and stand my hair on end. It was the howl of a timber wolf—the big, brave scavenger of the Northland.

I entered the lengthy shadows of the woodland, sloping easily along towards the point of the compass from which the cry had sounded. As I cautiously crept on my way, another whip like lash of rifle fire sent the echoes again into frenzy, and then all was quiet, save for the snapping in the depths of the frost-bitten shrubbery.

I hastened my pace a trifle, snowshoes brushing the light fall into a cloud as I passed along. Abruptly and without warning the treeland ceased and I found myself on the edge of an open clearing, bright as noonday under the rays of the Arctic moon.

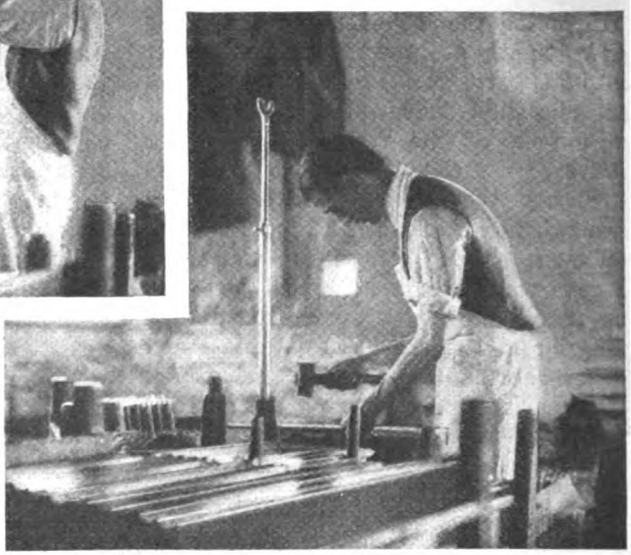
For a moment I stood, rubbing my eyes and gazing uncertainly at the spectacle which I saw before me. Lying in the midst of fantastically shaped ice pools of scarlet, the forms of a dozen or more great timber wolves were slowly stiffening in death. Not a sign of a human could I discover until I had crunched my way in and out amongst the bodies of the slain beasts. Then it was that I found the shattered, half buried stock of a heavy hunting rifle, its magazine empty, and as I examined it closely, these words, which appeared on its wood—"Savage Arms"—seared their lines into the far depths of my memory, allowing me vividly to recall even at this moment the heavy quiet of the somber, northern woods, the circle of snow pedestaled pines glittering beneath the winter moon, the grotesquely frozen bodies strewn about the stretch of the narrow clearing, and the clean cut series of human footprints which led unfalteringly into the dense shadows of the pine boundary.

It is not difficult to determine why, in the heart of the American boy, the



Looking Through the Barrel at a Window, His Trained Eye Discovered the Most Insignificant Crook

Seventeen years ago the first rifle built by this company was placed upon the market. The factory at that time employed only about fifteen men, but all were specialists in each particular operation required for a rifle's development and perfection.



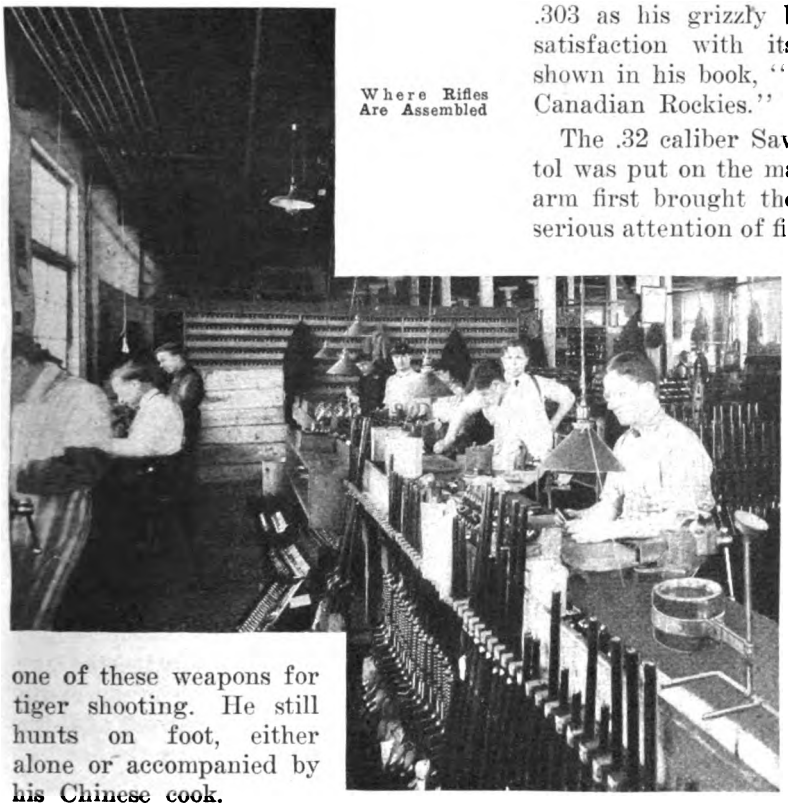
Then He Would Drop the Barrel to the Bench and Tap It with a Wooden Mallet

rifle has always retained a distinctive place as the premier weapon of romance. The rifle is, in truth, the American's weapon. He has an inherited, instinctive dislike for a smoothbore. If we are a nation of riflemen today, it is not because the nation needs us for its defense, not from military ardor, but for the reason that every American boy is trailing in the footsteps of a long, lanky figure, clad in homespun and leather, across his shoulder the long rifle that never missed. This man of the woods, the plains and the mountains, iron like, lean, aggressive, unafraid, with a weapon as deadly as death, is still marching on, and following him are all the youth of America who know American tradition. Hence we are a nation of rifllemen, who shoot the arm for its own sake.

Located just on the outskirts of the beautiful city of Utica, in the heart of New York's historic Mohawk Valley, is the plant where are made the guns and ammunition which bear the name of "Savage," a name which they have carried from Indian jungles to ice-bound trails of the great North.

Experts in firearms will tell you that the first radical improvement in the industry came from the plant of the Savage company.

Although many other companies had long been in the field, the experimental work of weapon perfecting seemed to have lapsed to a decided standstill. This inertia was shortly and rudely broken by the first product from the new factory—the famous .303 caliber rifle. This rifle has been used all over the world on all sorts of big game. In the hands of a number of African hunters, among whom Mr. Harry Storey is perhaps the most prominent, it has killed elephants and the greatest beasts Africa has to offer. The Rev. H. R. Caldwell, of Frankfort, N. Y., a prominent American missionary in China, has killed with this rifle more than eleven Asiatic tigers, and is using at the present time

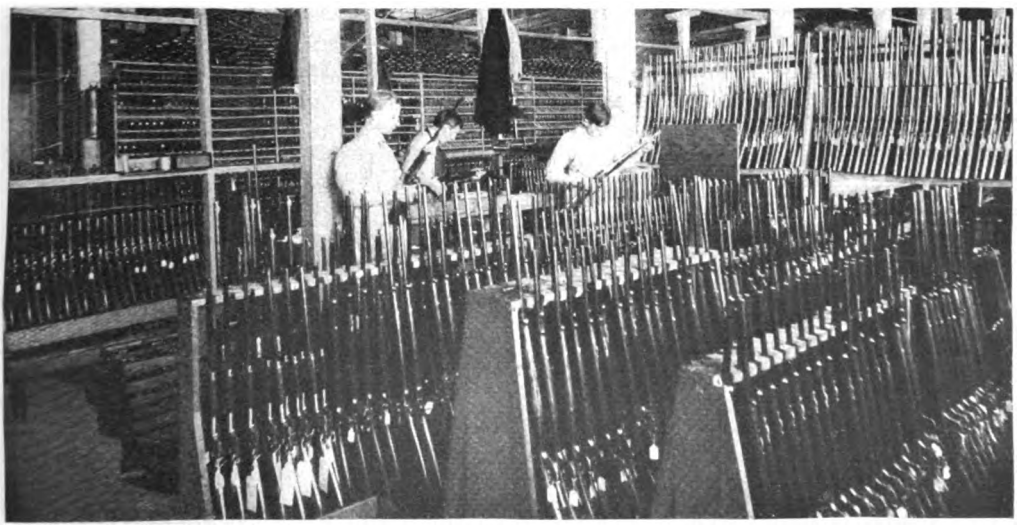


Where Rifles Are Assembled

one of these weapons for tiger shooting. He still hunts on foot, either alone or accompanied by his Chinese cook.

Dr. W. T. Hornaday, the greatest living naturalist and the director of the Bronx Zoological Park, uses this same .303 as his grizzly bear rifle, and his satisfaction with its performance is shown in his book, "Camp Fires in the Canadian Rockies."

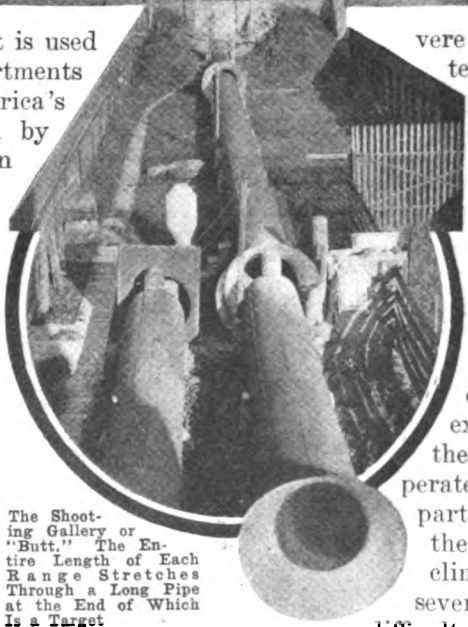
The .32 caliber Savage automatic pistol was put on the market in 1909. This arm first brought the automatic to the serious attention of firearms authorities. Detective William J. Burns, the hero of the McNamara dynamiting trials, carries this pistol for protection. The celebrated William A. Pinkerton took it with him when he visited the Coronation at the invitation of the London police. The Hon. W. Morgan Shuster, former Treasurer-General of Persia, during the latter part of his stay in that country, equipped himself and his party with this



In the Final Testing Department Where the Mechanism of the Guns Is Carefully Scrutinized and Tried Out

automatic pistol. It is used by the police departments of many of America's greatest cities, and by the famous Dominion Police of Canada.

Following this, came a wonderful .22 caliber high power rifle — the Imp—an object of admiration and wonder to rifleman and hunter. It was the first American sporting rifle to handle a cartridge of high concentration, and it has upset all previously conceived theories as to rifles and their performance. It drives a vicious little pointed soft nose bullet at the tremendous velocity of 2,800 feet per second, 100 feet per second faster than the new Springfield U. S. Army rifle. The wonderful work of this arm in penetrating half-inch steel boiler plate and also in blowing out a cavity in lead the size of a grapefruit has been supplemented by its work on American game fields during the last two years. In that time it has in numbers of instances killed, with a single shot each, individuals of all the largest and most dangerous of American big game.



The Shooting Gallery or "Butt," The Entire Length of Each Range Stretches Through a Long Pipe at the End of Which Is a Target

As the latest development, perhaps, comes the .380 caliber pistol. This arm has the same mechanism as the .32 caliber automatic, but it is considerably more powerful and slightly more accurate. Before this pistol was placed on the market, a model was sent for test to the Panama Canal Zone Police Department, which was conducting a very severe series of competitive tests to determine the selection of a service pistol for the force. The requirements of a pistol for the use of this police department are very much more severe than for the work of any other police force in the world, owing to the small size of the force, the great extent of the Canal work, the large number of desperate characters from all parts of the world which the work has attracted, the climate, which is especially severe on firearms, and the difficulty of handling the natives. As a result of these tests the "Savage" was selected as the official weapon.

With my guide, one of the officials of the company, I passed out onto the lower floor of the plant, where the first of the wonderful operations which a gun goes through in the making is started. In this department are tons of twelve foot lengths of special high grade barrel steel, which are cut into sections by automatic machinery and sent to the barrel department for completion. Here also are thousands of feet of black walnut lumber for the stocks and forearms.

As we passed through the barrel department I noticed a workman carrying a gun barrel through a curious operation. Upon the bench in front of him was placed a slight upright bar of steel with a double tined head. He would lay the uncompleted gun barrel between the two forks, bring it to a horizontal position and peer through its length towards a window, which I saw was of ground

In Testing an Automatic Pistol It Is Fired Off-hand Exactly as It Would Be in Use

glass. Then he would drop the barrel to the bench and tap it two or three times with a small wooden mallet. I inquired regarding the work which this man was doing.

"That is what we call barrel straightening," I was informed, "and it is one of the most important operations in the plant. When a gun barrel reaches the barrel straightener it is his duty to gauge, by means of his eye alone, whether or not it is perfectly straight and true.

What the Vicious, Steel Jacketed Bullet of the New .22 Caliber Will Do to a Steel Plate ⅝ Inch Thick

The man who is working before you at that bench is Fred A. Schneider, one of nine employed in that profession in the United States, and he has had years of experience. By looking through the gun barrel at a ground glass window, this window bisected by a thin steel rod into two parts, the shadow thrown by this rod into the gun barrel will enable his

But the Rifles Are Discharged from a Rest

trained eye to immediately discover the most insignificant crook in the barrel, and by a couple of light taps with his mallet he can straighten it. When a barrel leaves his hands it is in perfect alignment and ready for the stock."

In the barrel department the barrels are given the twist, or rifling.

After the guns are assembled they pass through an inspection department, where they are inspected for finish and smooth working qualities. They are then taken to the rifle range in the basement, where they are sighted and tested for accuracy.

"This range, or 'shooting-butt,'" my guide explained, "consists of a number of targets, which you will notice are

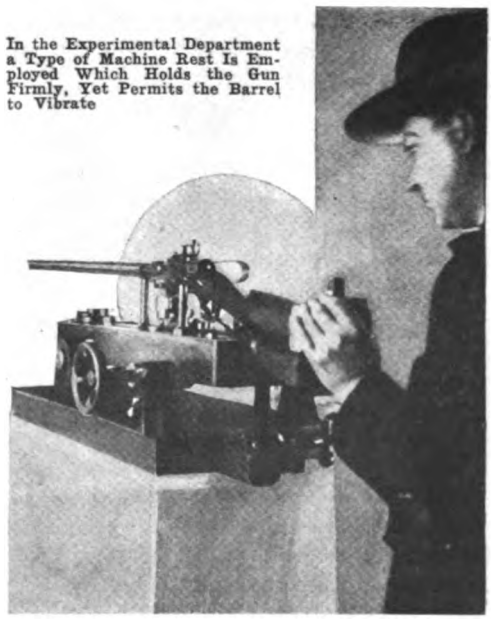
placed at various distances, each immediately opposite a firing window. In this window the operator stands when he is carrying on the test of any particular arm. The entire length of each range stretches through a large pipe, at the end of which a target is placed. This gives to the marksman in the shooting butt a long, clear range with an excellently lighted target at the end.

"The men employed in the shooting butt are expert riflemen, and they give each arm a rigid test. Pistols are fired just exactly as they would be in actual use, but the rifles in the ordinary tests are rested when discharged. In this shooting butt we use up hundreds of thousands of rounds of ammunition in a year's time, and you can see the wholesale use to which it is put by looking into the bins in which we store it in this room."

The bins which I examined were two or three feet deep and were filled with loose cartridges of all calibers.

In a small outhouse used for experimental purposes I was shown an instrument known as the Chronograph, and the engineer who accompanied me explained that it was used to determine the velocity of rifle bullets when discharged from various gun models. In his own words:

The Chronograph, an Electrical Apparatus Used by All the Leading Manufacturers to Measure the Velocity of a Bullet



In the Experimental Department a Type of Machine Rest Is Employed Which Holds the Gun Firmly, Yet Permits the Barrel to Vibrate

"This Chronograph is of the electro-magnet gravity type and is most commonly used today by all of the leading manufacturers. The system was invented by Captain Balange, an officer of the French army, and we make use of it as follows: Two electro-magnets are employed and two separate electric circuits. One magnet is mounted higher than the other. The higher one supports a long bar, and the lower one supports a weight when both circuits are closed. The wires of the uppermost magnet pass in front of the muzzle of the gun. The wires of the lower magnet are connected with the target. At the moment of firing the bullet, when emerging from the muzzle of the gun, breaks the circuit of the magnet supporting the long bar. Thus the magnet becomes demagnetized and the bar drops. When the projectile strikes the target the other circuit is broken, thus demagnetizing the lower magnet, which in turn drops the weight. This weight then releases a spring-pressed knife, which in turn makes a mark upon the bar. The distance the rod has dropped between the breaking of the two electric circuits is then measured, and as the

law of gravity never varies, the time of flight of the projectile from the muzzle of the gun to the target is easily computed."

Another apparatus which I also found interesting was known as the "Machine Rest." This instrument is used to hold a gun barrel in experimental tests for accuracy.

"This is a type of machine rest that we think most practical in our experimental work," said the engineer, after I had examined it, "and this is because it leaves the gun barrel absolutely free, giving results which will be practically the same as those of service conditions.

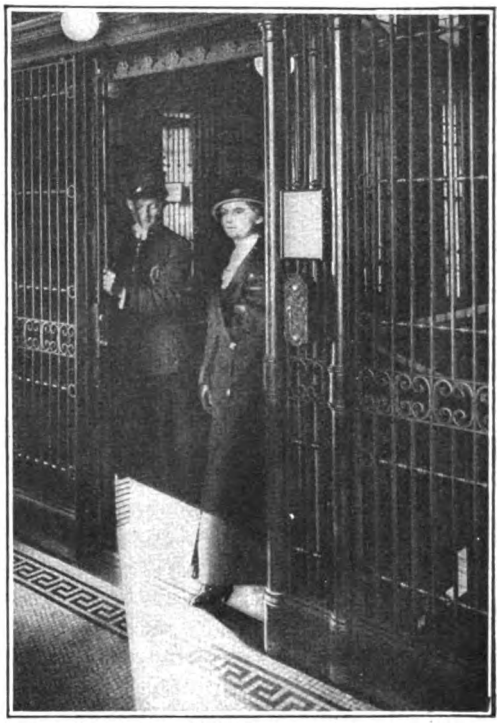
"A machine of this type holds the rifle firmly by the receiver and stock, leaving the barrel free to vibrate as it would in the hands of a shooter when firing. As the rifle is always in the same position for each shot, the error of different aim, light, etc., is eliminated. The machine may be adjusted vertically as well as horizontally. Means are also provided to permit the arm to recoil as in service conditions. The machine rest does not increase the accuracy of the arm tested, but its purpose is simply to eliminate the error of the human eye as well as the error in holding and pulling. We only use it at this plant in experimental work."

A cartridge plant is conducted in connection with the factory, in which cartridges are made for all stock guns, thus enabling the company to make positive guarantee of its own rifles with its own ammunition.

When the company started its primitive factory in the old days it gave employment to about fifteen men. This force has gradually been increased in order to meet the heavy demand for its arms, until at present over 900 people are employed in all its various departments. No less than eighteen trades are represented among the workmen, who hail from every section of the United States.

WATCH YOUR STEP

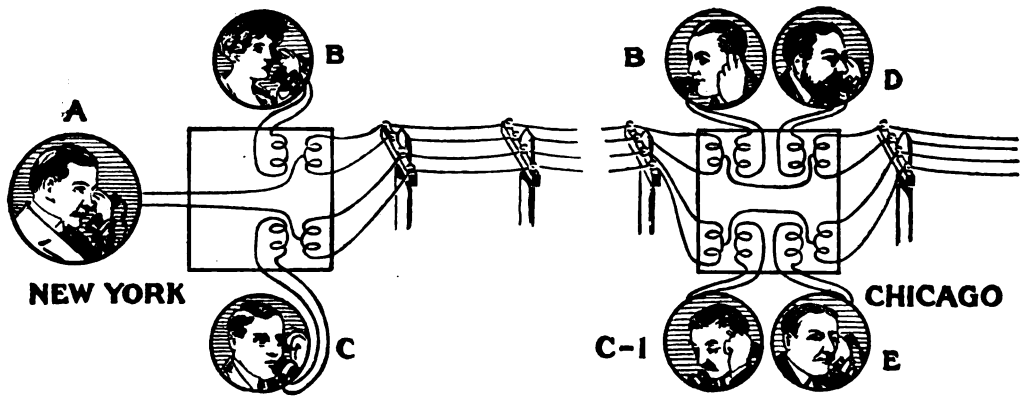
The Moore illuminator for elevator doors automatically flashes when the car comes to a stop, before the door is opened. If the elevator is stopped a little above or below the floor landing the light shows the passenger the uneven step.



Novel Illuminator for Elevator Doors Which Shows the Passenger on Uneven Step

When the operator's controller is thrown in position to stop the car the light is instantly flashed on. The casing at the door near the floor contains an electric lamp and a reflector directing the rays to the floor.

Charles P. Steinmetz, consulting engineer of the General Electric Co., has been invited to act as honorary president of the International Electrical Congress, to be held at San Francisco in 1915. E. B. Rosa, of the Bureau of Standards, Washington, D. C., will be honorary secretary.



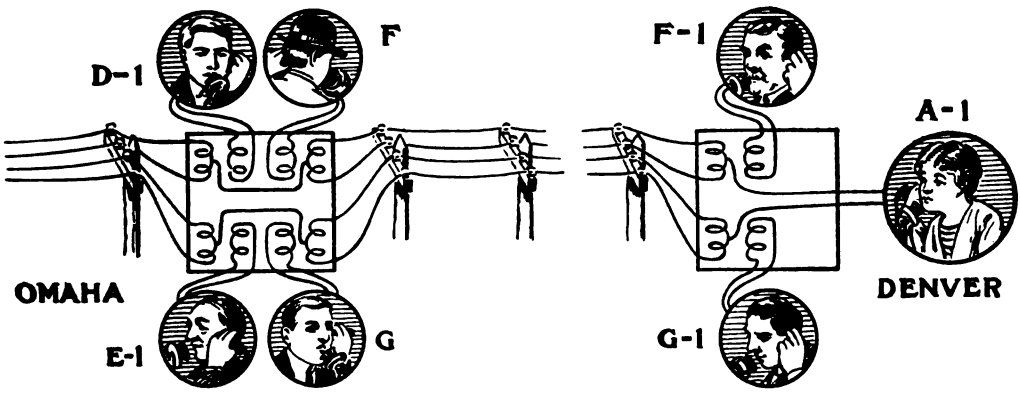
Talking From New York to Denver

The telephone is in such common use at the present day that it is looked upon simply as a telephone, without any thought as to the problems which are met or the difficulties which have been overcome by the telephone engineers.

Long distance telephone conversation is the most interesting. Since a little over two years ago it has been possible to talk from New York to Denver, a distance of 2,011 miles. At present a line is under construction from Denver to San Francisco, an additional distance of 1,360 miles, which, when completed, will give transcontinental service. It is remarkable that one is able to talk a distance of over 2,000 miles, conversation being carried on easily and distinctly, but the wonderful part is that while this conversation is going on between New York and Denver other conversations over the same wires, four in number, are occurring between intermediate cities without any interference whatsoever. Moreover, many telegraph messages are being sent at the same time over these same four wires with as great rapidity and reliability as if separate wires were used, and without interfering with the many telephone conversations.

The telephone circuits starting from New York extend to Chicago, a distance of 933 miles by the pole line, to Omaha, 496 miles, and to Denver, 582 miles. When the through connections are made by the girls in the telephone central exchanges and two persons are conversing between Denver and New York over the "phantom circuit," two other conversations can be carried on between New York and Chicago, two more between Chicago and Omaha and two between Omaha and Denver, making a total of seven conversations. On these same four wires, due to the highly developed stage of the art, two telegraph messages, one in either direction, on each of the wires can be sent. That is, between New York and Chicago four telegraph messages can be sent from New York to Chicago and simultaneously four messages can be sent in the reverse direction. The same arrangement can be obtained between Chicago and Omaha and between Omaha and Denver. Here then is a circuit of four wires over which it is possible to have all at one time seven telephone conversations and 24 telegraph messages without any interference one with the other.

The accompanying illustration shows diagrammatically what is taking place: (A) is talking to (A-1) between New York and Denver, the conversation passing over what is known as the "phantom circuit," which includes all four wires, while (B) is talking to (B-1), (C) to



(C-1), etc., over "trunks," each trunk consisting of a pair of wires, between the intermediate cities. This phantom circuit is not a new circuit but one which utilizes with some modifications the four wires which are already strung on the pole line.

Each telephone central office is represented in the illustration by a square. Within each office are repeating coils, shown by the double coils, which are connected into the circuits. The telephones are not connected directly to the trunk lines, the conversations having to pass through these transformers, which are provided with a middle connection. To establish the phantom circuit between New York and Denver the telephone operators connect the middle points of the incoming and outgoing repeating coils in each of the telephone exchanges together so that a through circuit is established.

The conversation starting at (A) passes over four wires in the form of electrical waves to Chicago, through the Chicago exchange over two wires, from Chicago to Omaha over four wires, and so on to Denver,. where it is heard at (A-1). It is by the discovery of this phantom connection whereby four wires are used for transmitting a conversation, that it is possible to extend the range of the telephone from a distance of 1,000 miles to a distance, as in this case, of over 2,000 miles.

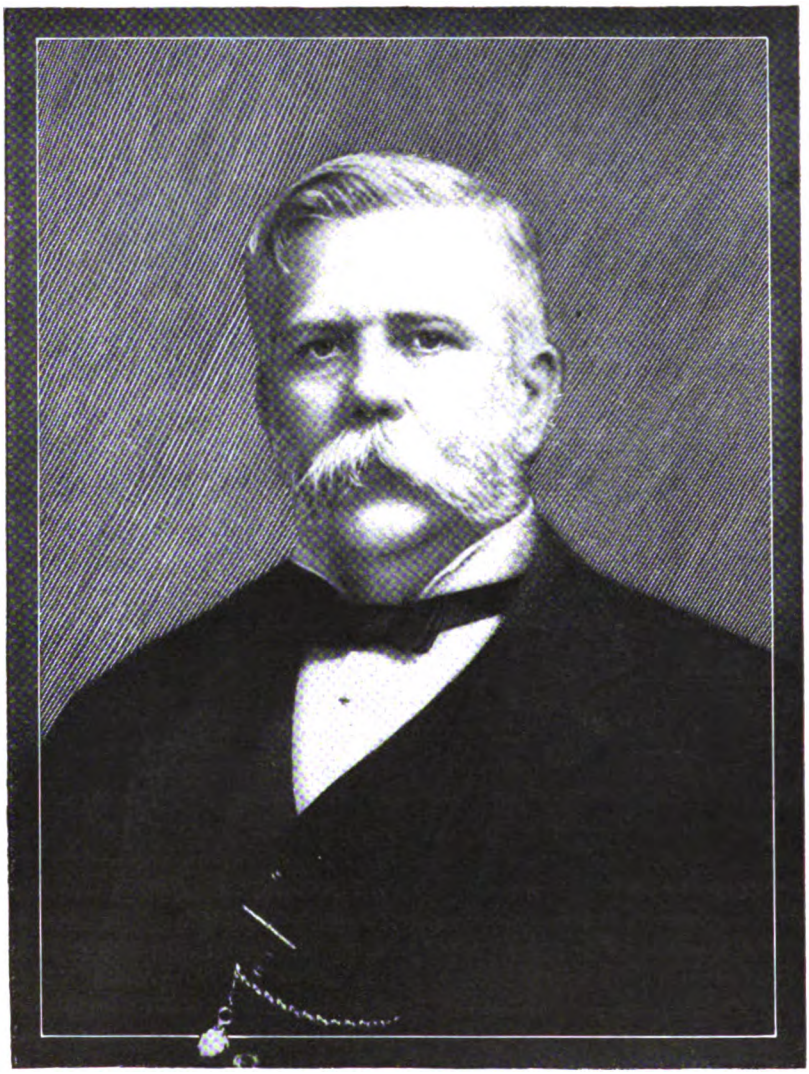
WHY NOT PUT A SWITCH IN THE BATHROOM?

"Maybe there is a lot for women to learn about electricity," said Mrs. F., an up-to-date housewife, "but we women certainly know where we would like to have the switches in our homes. Take this house, for example: it is well wired compared with many others. We can switch on the light in the hall upstairs before we go up, or if we are up, we can turn on the lights in the front hall downstairs before we descend. We have central fixtures in the parlor and dining room and side-wall brackets, also the bedrooms are provided pretty well with brackets, but look at the bathroom!

"There is a small central fixture and so high no one but my husband can reach it. If I go into the bathroom at dusk, I paw the air in a vain attempt to locate the fixture or light a match to aid in finding the fixture and then, finally stand on a stool to turn on a light.

"Now, whoever wired this house might have put in a switch or lowered the central fixture so it could be reached with ease. If we stay here long, it would be necessary to put a pull chain on the bathroom light, but I prefer to have the switches installed where they will be convenient. Electric energy should always be under perfect control."

George Westinghouse



George Westinghouse, the famous inventor and engineer, died of heart disease at his New York City residence on Thursday, March 12th. On the following Saturday, the day of the funeral, 50,000 men, on whom were dependent 150,000 other persons,—they were men in all parts of the United States, in Canada, employed by the great Westinghouse Electric Co. Ltd., London, by the Westinghouse Metallfaden Gluhlampenfabrik of Vienna—each and every one of them laid down his task to do honor to the great organizer. The inventor of the air brake was buried while the machinery stood idle in a dozen factories in America and Europe.

He was born at Central Bridge, Schoharie County, N. Y., on the 6th of October, 1846; his parents were George

and Emeline Vedder Westinghouse. The father's ancestors came from Germany and settled in Massachusetts and Vermont before the Revolution; the mother's were Dutch-English.

In June, 1863, though barely seventeen, he enlisted in the Twelfth New York National Guard. After two reinlistments he was honorably discharged August 1, 1865. On his return he entered Union College, where he remained until the close of his sophomore year, and, obedient to his impulse toward experiment, abandoned his classical studies and entered upon active life to find a wider scope for his inventive genius.

Going to Troy one day, a delay caused by a collision between two freight trains suggested to Mr. Westinghouse the idea that a brake under the control of an engineer might have prevented the accident. His first thought was an automatic brake attached to the couplers, which was unsuccessful. This was followed by steam, which proved also to be unsatisfactory because by the time it reached the brake from the engineer's cab it lost its power.

At this point Fate seems to have entered his life. In the pages of a magazine he had subscribed to, through the solicitation of a young girl, he saw an account of the use of compressed air in digging the Mont Cenis Tunnel, 3,000 feet under ground. Instantly the inventor saw the light. He began to think over the matter, and, after much further study and investigation, the use of compressed air further impressed itself on him. The first patent was issued April 13, 1869, and the Westinghouse Air Brake Company was formed on the 20th of July following.

Soon after this he invented the "automatic" feature of the brake which overcame the imperfections in the first form, and removed the danger from the parting of trains on steep grades. In 1886 he invented the "quick-action" brake, the improvement being made in what is known as the "triple-valve." By this valve it became practicable to apply all brakes on the train of 50 freight cars in two seconds.

About 1880 Mr. Westinghouse became interested in the operation of railway signals and switches by compressed air, and soon after there was developed and patented the system now manufactured by The Union Switch & Signal Company; the "pneumatic interlocking switch and signal apparatus," whereby all the signals and switches are operated from a given point, using compressed air as the motive power, and electricity to bring that power into operation.

In 1886 the Westinghouse Electric Company was formed for the manufacture of lamps and electric lighting apparatus, Mr. Westinghouse having become interested in the subject. The business rapidly developed and in 1889 and 1890 this company absorbed the United States Electric Company and the Consolidated Electric Light Company. In 1891 all these properties were reorganized into the Westinghouse Electric & Manufacturing Company, which owns extensive works at East Pittsburgh, employing over 22,000 people.

In 1892 Mr. Westinghouse secured for the Electric Company the contract for the electrical equipment of the World's Fair at Chicago, and in 1893 the contract for the large generators at Niagara Falls, both of which marked epochs in the progress of the electrical industry.

Mr. Westinghouse rendered an invaluable service to the electrical development of the world when, in spite of the opposition and ridicule with which his alternating current system met, he remained steadfast in his belief that this class of high-tension transmission would make distant electrical distribution possible. This system his engineers developed, and incidentally in this connection secured Nicola Tesla, 1887, who invented the alternating current induction motor.

The world today, lighted by distant waterfalls and central stations, now rec-

ognizes its debt to Mr. Westinghouse's foresight and perseverance.

Chance has had no place in the success of this man. It has been due to his foresight, courage and technical skill. As with his first invention, the air brake, the different kinds of apparatus have been developed to answer actual needs, in some cases acknowledged generally, and in others foreseen by him with remarkable prevision. When the apparatus had passed the experimental state and was ready for commercial exploitation, he established factories which are themselves models, and which show the sane anticipation of great future development.

Owing to his many achievements in mechanics, electricity, steam and gas, his name was known the world over, and he had many honorable distinctions conferred upon him for his achievements and in recognition of the services he rendered the various branches of engineering. His alma mater, Union College of Schenectady, conferred upon him the degree of doctor of philosophy. He was decorated with the order of the Legion of Honor, with the order of the Royal Crown of Italy, with the order of Leopold of Belgium. He was the second recipient of the John Fritz medal. Added to these is a long list of other honors and medals conferred upon him in all parts of the world.

Mr. Westinghouse was married August 8, 1867, at Brooklyn, N. Y., to Marguerite Franklin Walker. They had one son, George, who is a graduate of Yale, recently married to the Honorable Evelyn Violet Brocklebank. His wife and son survive him.

New York's Newest Power Station

By LESLIE G. SHANNON

On January 31 last a most important step in the growing public demand for electricity in New York City was marked by the formal opening of the new $6,000,000 generating station of the United Electric Light and Power Company, situated at West 201st Street, between the Harlem River and Sherman Creek.

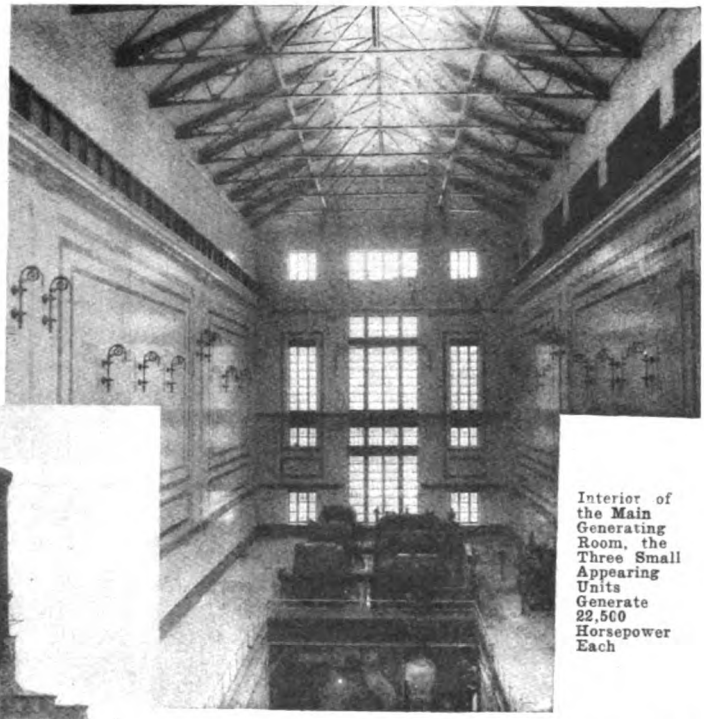
This station, calculated to supply alternating current exclusively, is housed in a fireproof structure of steel and red brick, with terra cotta and granite trimmings. It has four huge stacks, each measuring 22 feet in diameter and 325 feet in height, which are a little higher than the towers of Manhattan Bridge.

"The depth of the Harlem River is ample at all tides for 500 and 600 ton coal and ash barges," remarked the engineer who was escorting me on my inspection tour up the long stairway which led to the roof. "Our coal is hoisted in 1½ ton buckets from the barges to the receiving hoppers, a distance of 170 feet. It then passes through a crusher and is dumped into coal cars, each holding three tons. After every car is filled it is weighed, the cable grip tightened and the car started on its journey over the bridge and around the bunkers, hauled by an endless, constantly moving, steel cable. It is dumped into the proper bunker where it hits a movable tripping plate.

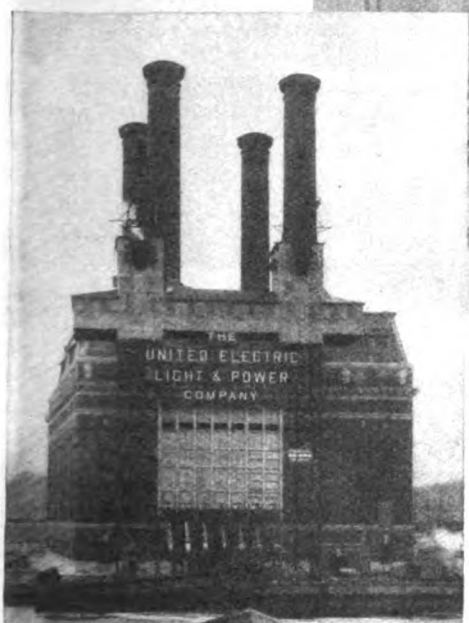
"We have figured that from the time a car is started on its journey until it returns ready to be filled again, 4½ minutes are required and the car has traveled a distance of over one-third of a mile. Everything in the coal tower is electrically driven except the hoist, and this, as you will see, is driven by reciprocating engines.

"Each of the coal towers is capable of handling 150 tons an hour for short periods," went on the engineer, as we

watched the line of cars rise from the surface of the creek. "Our coal bunkers have a capacity of 13,500 tons, and you will note they are concrete lined and of a shape to obviate level surfaces where coal can lie indefinitely and so help toward spontaneous combustion. The coal drops by gravity through chutes to hoppers at the front of the boilers. A combined valve and pusher in each chute controls the flow of coal."

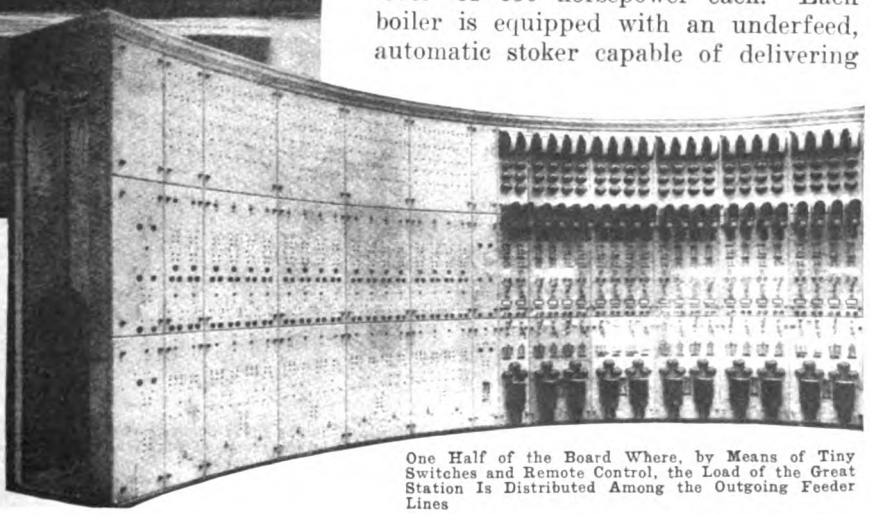


Interior of the Main Generating Room, the Three Small Appearing Units Generate 22,500 Horsepower Each

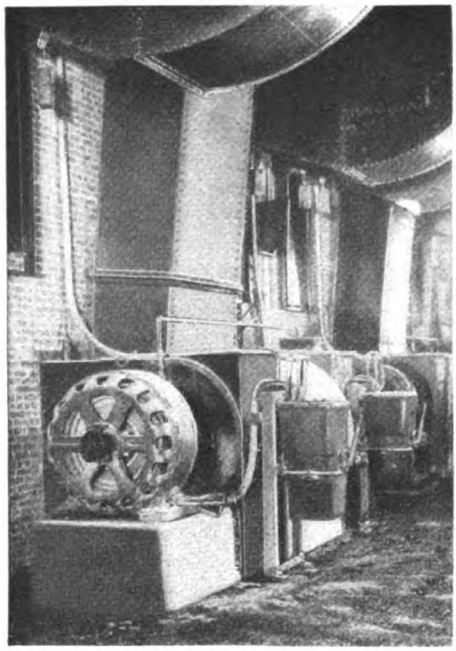


Exterior of the Plant from the Harlem River

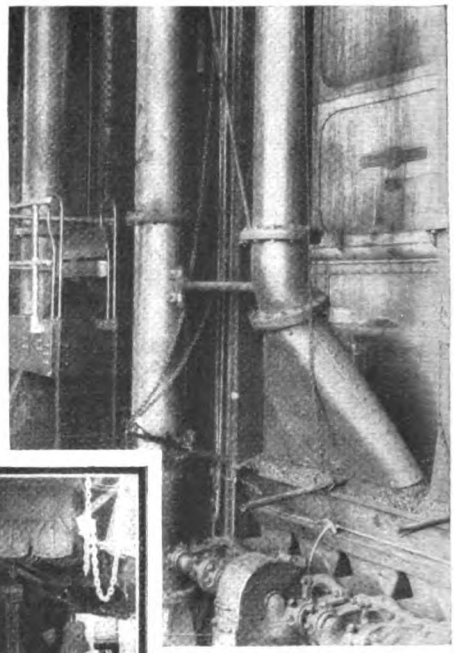
Descending to the level of the fireroom floor we came to the boiler room. The plant is designed for 72 boilers and 32 of them are now installed—all on this level—of 650 horsepower each. Each boiler is equipped with an underfeed, automatic stoker capable of delivering



One Half of the Board Where, by Means of Tiny Switches and Remote Control, the Load of the Great Station Is Distributed Among the Outgoing Feeder Lines

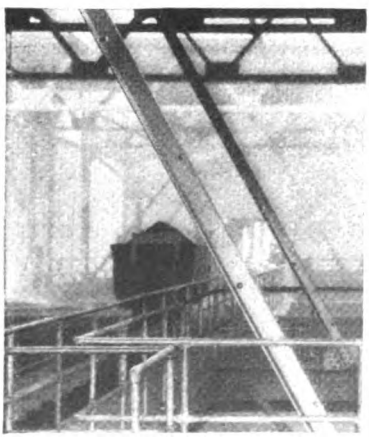


Electrically Driven Fan Blowers Which Send a Constant Blast of Cooling Air to the Generators

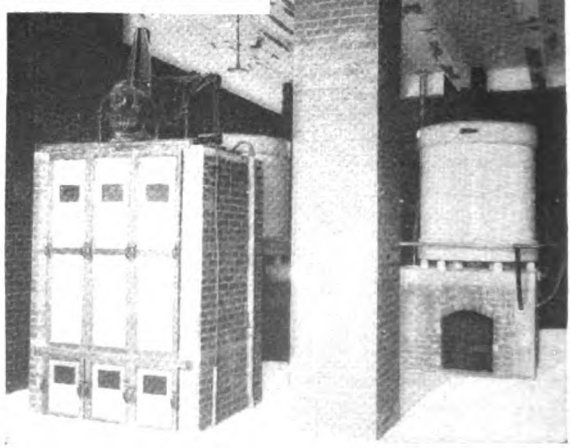


Front of One of the Boilers Showing How the Coal Is Led Down Until Within the Clutches of the Automatic Stoker

Ash Train on Its Way to the Skip Hoist—Part of the System Which Will Handle 60 to 70 Tons of Wet Ashes an Hour



In the Dim Light Above the Coal Bunkers a Laden Car Trundles Along a Track, Without a Soul Aboard



Enclosed in the Brick Compartment Is One of the Oil Switches Operated by the Motor on Top, Which in Turn Is Controlled from a Far Away Switchboard

and burning under the boiler about 2½ tons of coal per hour, and which with proper handling will so completely burn the coal that a minimum of smoke is produced.

The ashes are dumped at intervals into hoppers, where they are cooled by streams of water and finally dumped into cars in the ash cellar. The cars are hauled by electric locomotives receiving current from an overhead trolley rail. I followed my guide out from between the furnace batteries and he pointed out an odd looking motor car with a pair of heavy arms resting against the trolley rail. It seemed to be of a double truck mine type, and was equipped with two five horsepower motors.

"These ash trains discharge the ashes," he went on, "into the hopper of a double skip hoist, which in turn hoists them up over the marginal sheet into the concrete pocket which forms part of the coal tower. They are taken away at intervals in barges. This ash system will handle 70 tons of wet ashes an hour."

We passed into the main operating room. This room is lined throughout with white enameled brick, paneled with green, and is lighted by 30 bronze brackets, each containing a 500 watt Mazda.

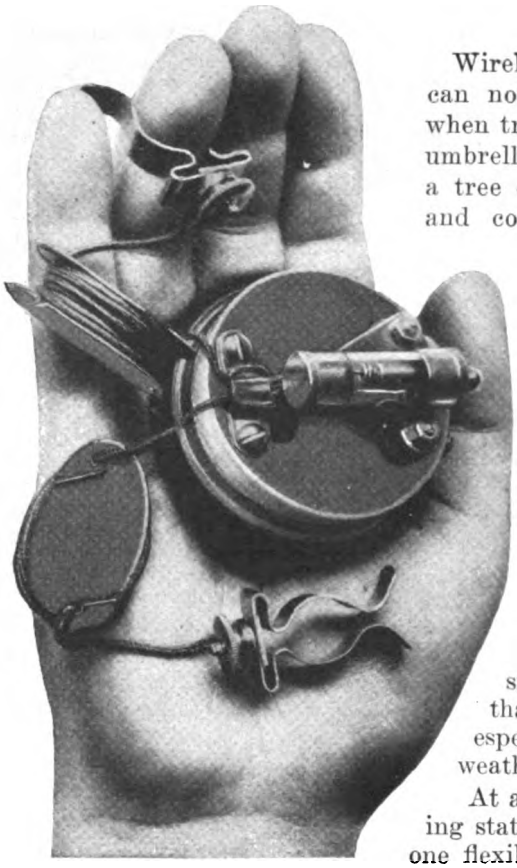
"This scheme of illumination is so complete," commented the engineer, "that there is no need for any special lighting around the turbines, except over each gauge board. In this room there are at present three Westinghouse Parsons double flow turbines of 22,500 horsepower each, each turbine coupled directly to a 15,000 kilowatt generator."

I was told that the plant is designed for eight of these units. These machines, it seems, have a guaranteed economy which is at least equal to anything of their size made in this country. They run at 1,875 revolutions per minute and generate current at 8,000 volts. The generators are cooled by screened air taken from a specially designed corridor running the full width of the building, the air being forced through the generators and discharged into another corridor, which discharges the air at the opposite end of the building from which it was brought in. None of the air is taken from or discharged into the main operating room.

On the third gallery with a rounded front of swinging glass doors overhanging the main operating room is the high tension control board. In this room is centered the control of the operation of the station. This room is carpeted with cork tile, is trimmed with marble and is illuminated by four semi-direct lighting globes. The control boards themselves are built of marble and are sectors of circles so that the operator's desk is in the center.

The operator's desk in the middle of the room is of metal, mahogany grained. It is equipped with a telephone and a telautograph to the exciter board. On the rear of the desk are the emergency signal apparatus from the system operator, the boiler signal apparatus and a load equalizer.

"This is a new instrument in power house equipment," I was informed, "and it is designed to keep the load between the turbines divided equally or in predetermined proportions. The boiler signal also has several new features. When the operator wants to indicate to the boiler room that a certain number of boilers is to be required to carry the load expected in the next few minutes he inserts a perforated card in the instrument and throws down a lever. This lights an illuminated number in the boiler room, stamps on a tape the time and the number sent, and starts a whistle blowing in the boiler room. This whistle continues to blow until the boiler room man throws in a switch indicating that he has received the signal. This return signal also causes the time to be stamped on the tape, so that after the complete signalling operation the tape record will show the number sent, the time it was sent, and the time the boiler room man acknowledged it."



The Complete Ondophone Can be Held in the Palm of the Hand

THE ONDOPHONE

Wireless time signals from the Eiffel Tower can now be heard many miles from Paris, when traveling on the road on a bicycle, or an umbrella will also serve as an antenna. Even a tree can be used by planting a knife in it and connecting up with the tree and the ground. All this is done by the ingenious little Ondophone and it is so small that the entire wireless outfit can be held in the hand or stowed in the vest pocket. No other apparatus than the combination detector and telephone is needed to take signals as far away as 250 miles.

The Ondophone uses a mineral detector which is easily adjusted and does not need a battery or tuning coil. The little device which is shown here is quite complete in itself. Now that such a simple and inexpensive outfit is brought out, it is expected that it will be largely used by the public, especially as the Tower is now sending out weather signals as well as time signals.

At a closer range of 30 miles from the sending station, an open umbrella can be used with one flexible wire attached to it by a clip while the second clip lies on the ground.

TELEPHONE INSTALLATION ON A STREET CAR

The street cars which run in one of the suburbs of Frankfort, Germany, in a region where there are no telephone stations, are provided with a telephone placed in a booth near the entry. When the conductor wishes to communicate with the office of the company he can do so by putting the trolley pole in contact with the neighboring telephone wires, and by means of a special connection bringing the instrument in the car into the circuit. This system has been found to be so satisfactory that it is being installed in other localities where there are no telephone stations.

PASSING SHOWER CALLS FOR 800 TONS OF COAL

People take so much for granted nowadays. When clouds descend and floods come, be it morning or afternoon, they advance confidently to the switchboard and demand light. Generally they get it. No one ever looks for a shortage in supply of the popular commodity, electricity, or expects anything to interfere with its instant appearance at the touch of a switch. Therefore, it is of interest to know that a recent single downpour in New York caused the burning of 800 additional tons of coal to provide sufficient current to meet the city's demand—to live up to the "Readiness to Serve" ideal.

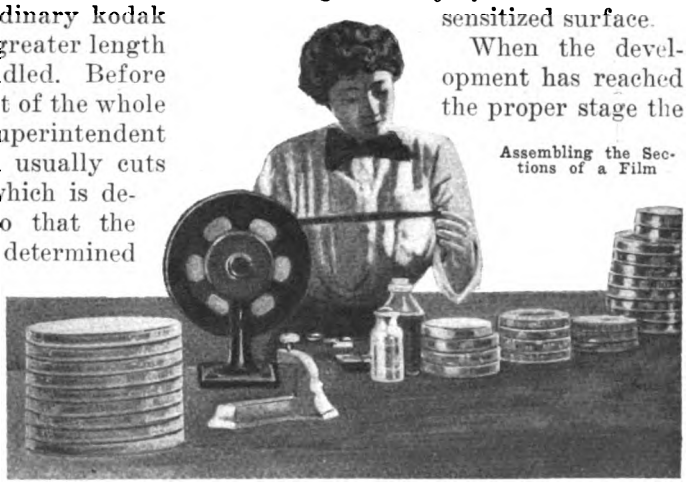
What Happens to the Scenario

The film which is originally exposed in the camera is the negative film and from it are printed the hundreds of positive films which are used in the projectors in the theaters. This article of the series explains the development of the negative film.

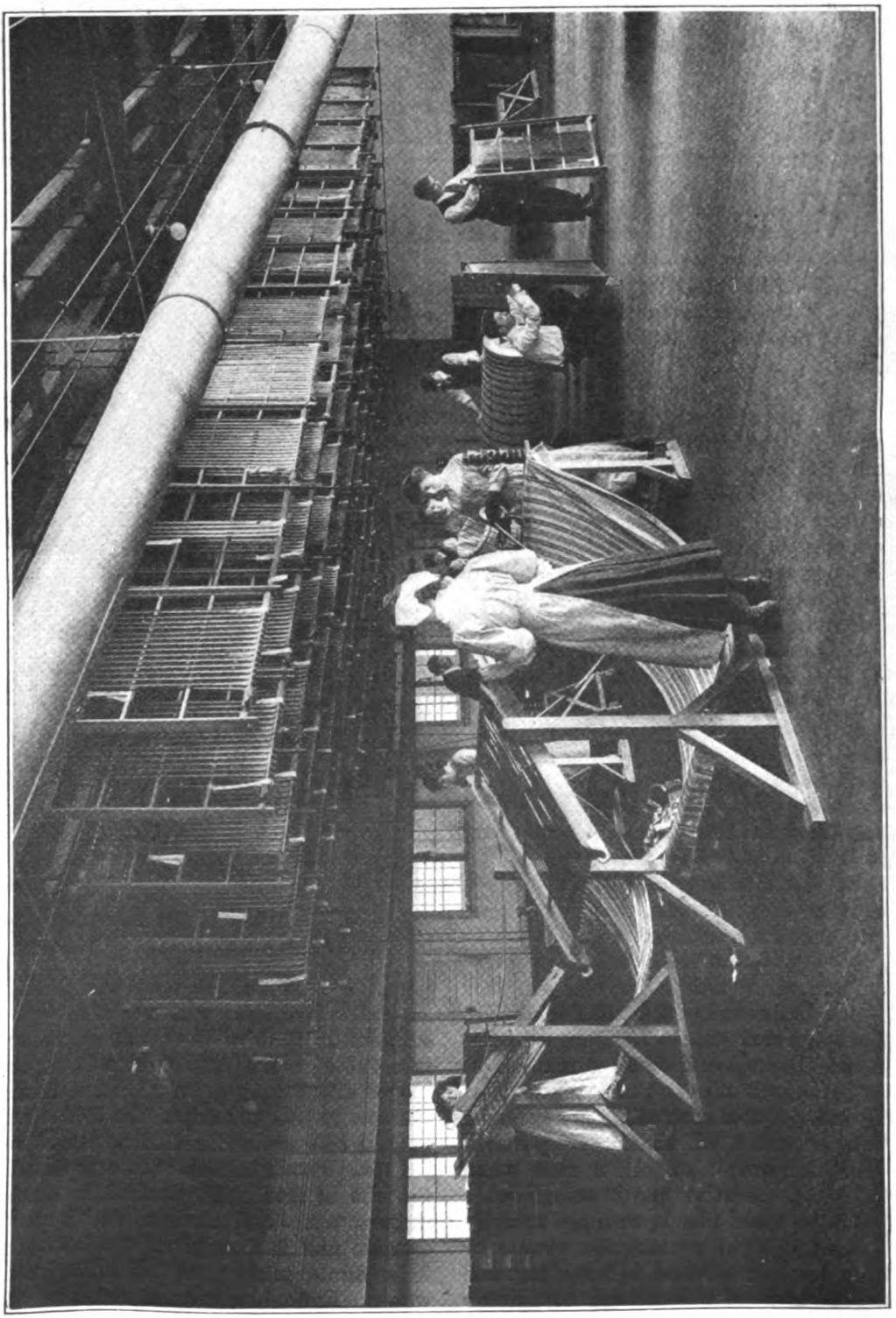
The picture having been taken in short 200 foot film lengths, the cameraman delivers the negative to the developing department, where it is developed and fixed much after the fashion adopted in developing ordinary kodak films, except that a much greater length of negative has to be handled. Before beginning the development of the whole roll of negative film, the superintendent of the development room usually cuts off a few inches of film which is developed independently, so that the proper treatment may be determined without endangering the entire reel. Owing to the fact that different scenes in a thousand foot film subject are taken under varying light conditions and on different days, some portions of the film are almost certain to be over exposed, while others are apt to be under exposed. Each separate scene has, accordingly, to be developed in such a manner as to bring out all its parts to the best advantage, and each scene is developed independently of the other portions which adjoin it on either side when the whole negative film is assembled.

The exposed film is wrapped spirally around a light rectangular frame or rack for convenience in handling and is then dipped into a tank containing the developing solution. By handling the film on a rack or frame the whole can be easily managed by the employes in the developing room and there is little danger of injury to the delicate sensitized surface.

When the development has reached the proper stage the negative is placed in the fixing bath where it is treated with sodium hyposulphite until all of the active emulsion is reduced to the point where it is no longer affected by light. In the fixing bath as in the developer the 200 foot lengths of film are handled on racks or frames. Fixing having been completed, the film is thoroughly washed in clear water to remove all traces of the "hypo" solution and is then given a final bath in a dilute solution of glycerine and water. Enough glycerine remains on



Assembling the Sections of a Film



The Room in Which the Strips of Film Are Dried and Hung on Racks

the film, even after it has been dried, to absorb sufficient moisture to keep the film in a soft and pliable condition.

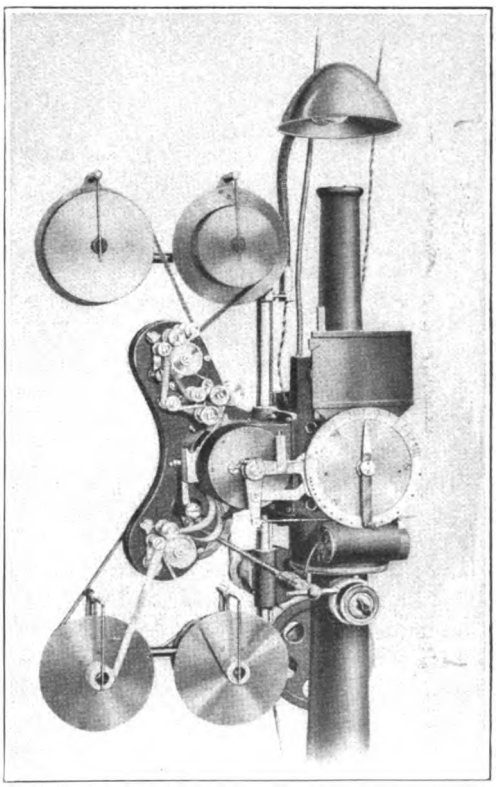
Coming out of the glycerine and water bath the negative film is taken to the drying rooms, where it is wound upon huge drums or spindles, which are then revolved before a current of warm air. The motion of the drums removes all excess drops of water which may be clinging to the back of the film and the hot air dries the emulsion side. The negative film is now ready for the insertion of subtitles and printing.

Subtitles are made by various methods in different manufacturing plants. In some factories the letters which form the words of the titles and subtitles are small letters such as are sometimes seen attached to store windows to form a sign, and these are arranged in proper order upon a black velvet topped table to spell out the title desired. A motion picture camera suspended above the table and pointing down toward the letters is then operated and several feet of title taken.

In other studios the titles are lettered with black paint upon a white cardboard surface, which is then set up before a motion picture camera and photographed under a strong light, while in still other plants the letters are painted in white on a black background and then photographed as above. Upon the completion of the photographing of the titles or subtitles, the negative film is treated the same as was done with the film on which the action of the story was recorded.

The negative being finally ready for printing, it is taken to the darkened room in which the printing machines are installed and put into a film box corresponding in appearance to the film box on a projection machine. From this film box the strip of negative film is threaded down through the gate of the printing machine, the emulsion side of the negative being brought into contact with the sensitized side of the unexposed positive film, which is also threaded through the machine from a second film box, in which the spool of positive unexposed film is held.

When passing through the "gate," or what corresponds to the shutter of the picture camera, the negative film is



Detail View of the Machine Which Prints the Positive Films, Which Are Used in the Projectors, from the Original Negative Film

exposed to a brilliant light, in such a manner that the light passes through the negative and onto the positive film. The image outlined on the sensitized positive creates a picture which is the reverse of that on the negative; in other words, all of the light portions of the negative are dark on the finished positive and vice versa. Artificial light is always used in printing, as it is

The Developing Tanks

then possible to maintain an absolutely uniform illumination on the film and, at the same time, much easier to control than sunlight.

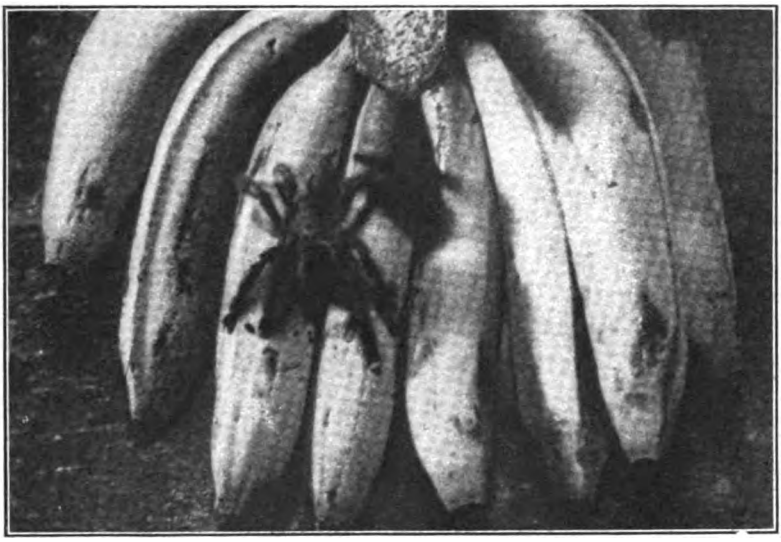
Printing machines are of two classes, the "step by step" machine and the "continuous" kind, the difference lying in the method by which the film is fed through the machine. In both machines the rolls of negative and positive film are pressed, emulsion sides together, and fed at a uniform speed past the printing light. After printing, the two strips of film separate, the negative film being wound on one reel, while the positive film, now ready to be developed, goes into another take-up box.

The "step by step" machine is operated somewhat after the fashion of the camera, as the film is printed one picture or "frame" at a time, the film being jerked ahead the width of one picture or "frame" during the interval that the light is cut off. A framing device on the machine enables the operator to adjust the film with regard to the sprockets of the feed mechanism, which feed into the sprocket holes cut in the edges of the film stock. Another device also permits the adjustment of the rate of feed and regulates the quantity of the light, so that negatives of varying densities can be properly printed.

The "continuous" machine feeds the negative and positive films straight past the light, without the intermittent motion of the machine described in the paragraph above, and consequently is capable of printing more film in a given period of time, though it is not, as a rule, as accurate in the spacing and exposure of the pictures as the intermittent machine.

(Next month's article will describe the development of the positive film, the tinting of it for "moonlight," "firelight" and such effects and the exchange system by which the films are marketed.)

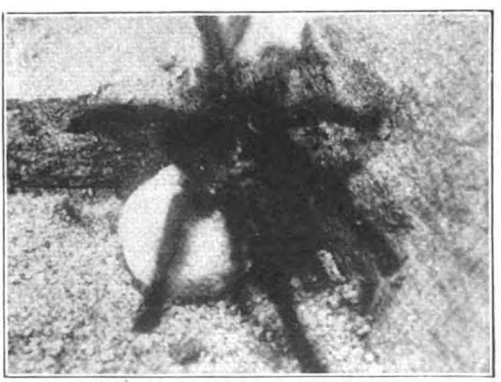
Curious Traits of "The Hunting Spiders"



Frequently These Poisonous Spiders Come North Hidden in Bunches of Bananas

One of the recent Pathe educational releases bore the above title and was prepared and filmed under the direction of R. L. Ditmars, curator of reptiles for the New York Zoological Society. Among the spiders shown is the vicious tarantula of South America, which kills small birds, reptiles and insects. It belongs to the group of hunting spiders which spin no web but stalk their prey. Its lair is a tunnel of leaves bound by the creature's silk. The cocoon is nearly as large as a hen's eggs and holds the spider's eggs. It is carefully guarded by the female in the shelter of rocks or heavy vegetation. It contains about 200 pearl like eggs, which require about six weeks for incubation. Frequently these poisonous spiders come north, hidden in bunches of bananas, and a ship is rarely unloaded without the discovery of one or two tarantulas. Another large tarantula shown in the film inhabits Texas. It has short legs, a heavier body and shorter hair than the tropical species. Savage and alert, it neither courts nor avoids an attack. Still another of the interesting spiders shown is the Mygales, or trapdoor spider of California, which dwells in the sterile regions. The doors of their burrows are covered and hinged with silk. The creature holds the door shut by hooking a claw in the silken lining.

The Lycosa, or wolf spider, which is common in the eastern part of the United States, is also shown. It hides under stones in damp places and is an extremely alert and savage hunter. The cocoon of this spider is also shown. The female drags around the heavy cocoon and also carries its young with her for a full two weeks. The Dolomedes, or



The Cocoon Is Carefully Guarded by the Female in the Shelter of the Rocks

nursery spider, is pictured in close-up views. This is the insect which is so often seen on bodies of fresh water.

FILMING A VOLCANO

QUITE recently Frederick Burlingham climbed down into the heart of the burning crater of Vesuvius and, at a depth of 1,200 feet, stayed for 20 minutes to take moving pictures of the interior of the volcano. Upon returning to London he told of his experience in detail.

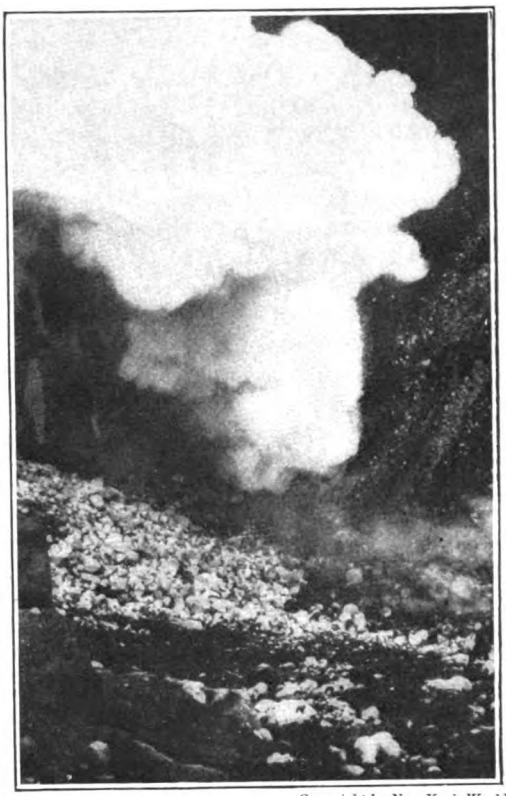
Burlingham was accompanied by two Italians, who volunteered to help him, as he failed to secure any co-operation from the Vesuvius Observatory. "They were very nice about it," Mr. Burlingham told the London reporter, "but absolutely refused to give any official recognition of what they termed foolhardiness, as they considered the volcano was entirely too active to make a descent even comparatively safe.

"However, I was determined to go down, so I secured the services of a fine young Italian, who was game for any kind of an adventure, and for four days we studied the crater together, looking for a new way down, but finally concluded the only possible one was the one followed by the observatory professor, who made a descent last year. It is called the Via Malladra and, while very steep, can be negotiated by means of ropes. We had to carry 55 pounds of luggage with us and the worst part of the descent was the first 500 feet. There

were three dangerous precipices to avoid and the surface was terribly loose."

Just as Mr. Burlingham and his assistant thought that the worst was over they were suddenly confronted by the most deadly danger. The volcano suddenly increased in activity and the smoke and fumes entirely enveloped them. They clung to the rope for over 20 minutes, uncertain whether to proceed or retreat. Eventually they decided to go on, and at the depth of 1,000 feet reached a broad plateau. This was as far as anyone had previously penetrated.

The Italian was willing to go on as far as Mr. Burlingham would lead the way, but thought the hand camera was enough to carry. "I replied that if I did take the hand camera," continued the adventurer, "I would soon have to take a back seat, for within a few months' time someone would go me one better. So down we went with all the luggage—the whole moving picture paraphernalia. It was a 200 foot climb. No living man will ever get lower. We reached the very lip of the central tunnel, which Professor Malladra calculates to be two miles long, with a temperature some distance down of 600° C. The tunnel, which is about 50 feet across, was belching fumes of many colors and the lava was making the queerest kind of a noise, something between a big blast furnace and a tea kettle. Where we were there was no daylight at all, but there was plenty of light for the camera to work by, for the great columns of vapor reflected the light from the pit of fire.



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Interior of the Crater of Vesuvius

Mr. Burlingham and his assistant remained in the pit for fully 20 minutes, taking films which are said to have developed remarkably well. Then the slow and even more dangerous upward climb began. The sulphur fumes and clouds of hydrochloric acid gases became so troublesome and dangerous that the two men were obliged to cover their mouths and noses with cloth, in order to avoid being instantly suffocated. The activity of the volcano increased so that Mrs. Burlingham and the other Italian who held the rope were in great anxiety

as to the fate of the two within the crater.

The ascent took two hours and the whole time consumed in the trip was four hours. Two thousand feet of film was obtained, which will be controlled by the British and Colonial Kinematograph Company. Mr. Burlingham is an American who has become famous for his daring as a camera man for the motion pictures. Last year he climbed Mont Blanc and the Matterhorn for the same purpose. On the latter expedition he and his wife, who is always his companion, had a narrow escape from death.

It is expected that these pictures of the great interior cone of the most famous volcano in the world will soon be shown in the United States.

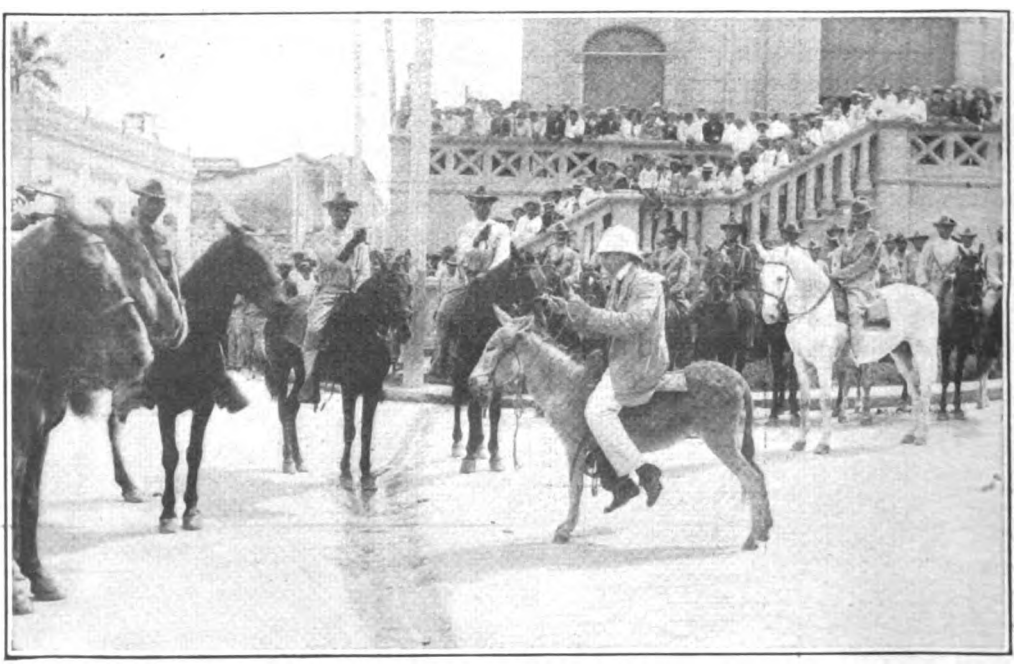
"SOLDIERS OF FORTUNE"

The All Star Film Corporation recently completed the filming of Richard Harding Davis' thrilling story of "Soldiers of Fortune," in which the well known player, Dustin Farnum, appeared in the leading role. The pictures were taken in and about Santiago, Cuba, which is close to the spot where the scenes of the story are actually laid. Mr. Davis himself accompanied the players and directors to Cuba and from time to time assisted in staging the scenes, suggesting changes in the scenario which would tend to make the story still more interesting and enjoyable, and otherwise aiding in the filming of his own story.

The accompanying illustration shows the interruption of the American Consul's escape, which forms one of the thrilling moments of the picture. It was taken in the plaza of Santiago, Cuba, where this scene was filmed.

FILMS TO CURE STUTTERING

A recent press dispatch from Paris asserts that a new method of curing stuttering by means of the cinematograph has been described to the Academy of Science. Dr. Marage, who devised it, has found that stutterers can be rapidly cured if their mouthings of words are shown to them on the film.



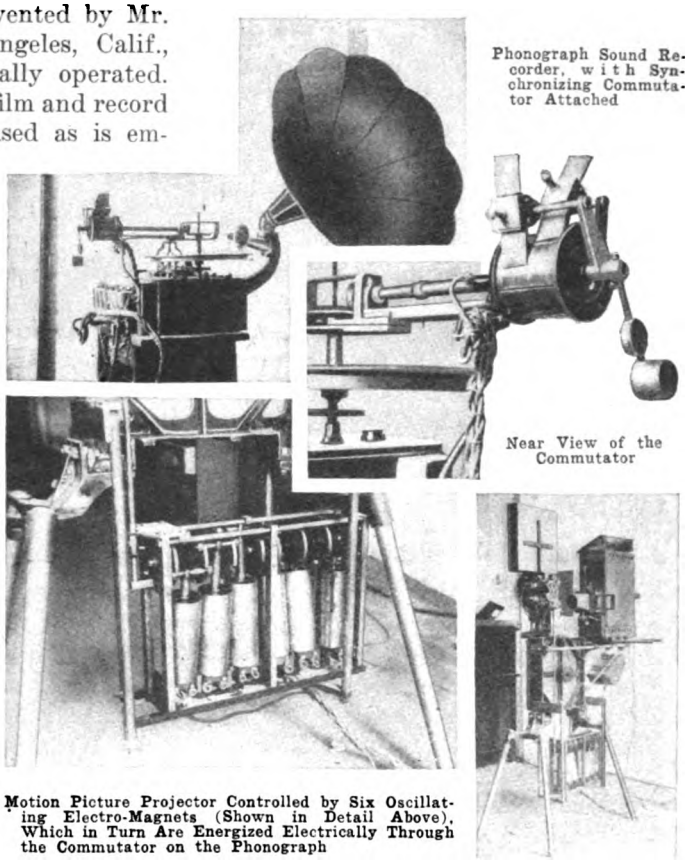
One of the Thrilling Moments of the Picture

ANOTHER ATTEMPT AT TALKING PICTURES

Among the various systems seeking to accomplish synchronism of the phonograph and motion picture, in other words, to produce talking motion pictures, is that recently invented by Mr. O. E. Kellum of Los Angeles, Calif., which is entirely electrically operated. During the making of the film and record the same mechanism is used as is employed when the record and film are being reproduced.

The pin which runs through the center of the phonograph disk is made extra strong and has a small bevel gear at its upper end. This pin is connected, by a corresponding bevel gear, to a horizontal rotating rod, the opposite end of which forms the axis for a commutator. The commutator, which is shown in one of the accompanying illustrations, is made up of six separate parts, the object being to form a make-and-break circuit. This commutator, which is equipped with six condensers so as to keep it from sparking, is identical in action to that of rotary devices used to operate animated electric signs.

From the commutator the electric current is run to either the camera or the projecting machine, but for illustration we will take the projector, by means of a cable, which may be of any desired length and which is attached to a series of six oscillating electro-magnets. Within each of these magnets is a piston rod or plunger, the top end of which is connected with a horizontal driving shaft, which in turn is fastened, by a series of bevel gears, to the apparatus which propels the projector. The bottoms of these magnets are heavily charged and constitute a reciprocating solenoid motor. Each one of these magnets is connected with one of the sections of the commutator, so that when one division of the commutator is being pressed upon by the brushes its corresponding magnet is energized and the piston of that magnet is quickly drawn to the bottom. In truth, for every revolution of the six throw crank shaft, the commutator turns once around and each magnet is brought once into operation. By this apparatus it is impossible for the projector to go faster or slower than the commutator, which is regulated by the speed of the phonograph. If the phonograph slows down the commutator does not revolve so fast and, consequently, there is a comparative slowing down of the picture machine. If its speed is increased there



Phonograph Sound Recorder, with Synchronizing Commutator Attached

Near View of the Commutator

Motion Picture Projector Controlled by Six Oscillating Electro-Magnets (Shown in Detail Above), Which in Turn Are Energized Electrically Through the Commutator on the Phonograph

is a corresponding quickening of pace.

Practically the same operation is used during the making of the pictures and records. The blank record is placed on the phonograph and an unexposed section of film is placed in the camera. There is a common starting point, and once the machines have been started they need no attention until the scene is finished.

When the machine is stopped, which may be done at any time, resuming operation again from a standing start, the magnet corresponding with the section of the commutator upon which the brushes are pressing, is magnetized and forms a positive stop. The camera is run by a smaller set of oscillating magnets than is used for the projecting machine. The inventor asserts that both studio and outdoor pictures may be made with this machine with equally good effect.

A CHEAP AND PRACTICABLE PICTURE SCREEN

A moving picture screen made of wall paper, a plain white paper, is giving an Indianapolis moving picture theater owner better results than any he has ever used, and the cost is slight. The paper should be laid free of seams. It takes a skilled workman to do this, but it can be done in such a way as to make practically a seamless job.

Upon the paper must go a coat of shellac. It is essential that the shellac be brushed upon the paper quickly. The average screen is nine by twelve feet. To get the shellac upon this surface rapidly enough, two workmen are essential. The importance of getting the shellac on rapidly is that it must not have dried before the next coat is applied. Inasmuch as shellac dries rapidly the necessity for speed becomes apparent.

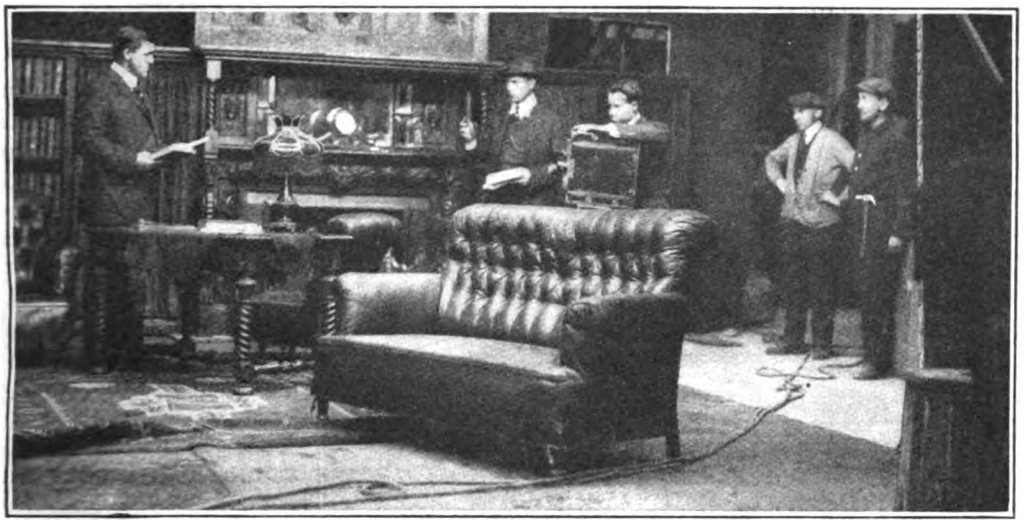
Over the shellac goes the finishing coat of aluminum paint. This gives the screen the silver finish which is recognized as best for film reproduction. The cost of a screen made in this way need not be in excess of $25. Where the back wall of the theater is used the cost is very much diminished. When the aluminum surface becomes dark, as it inevitably will from floating dust, it can be resurfaced at a cost of 80 cents for the paint, plus the cost of labor.

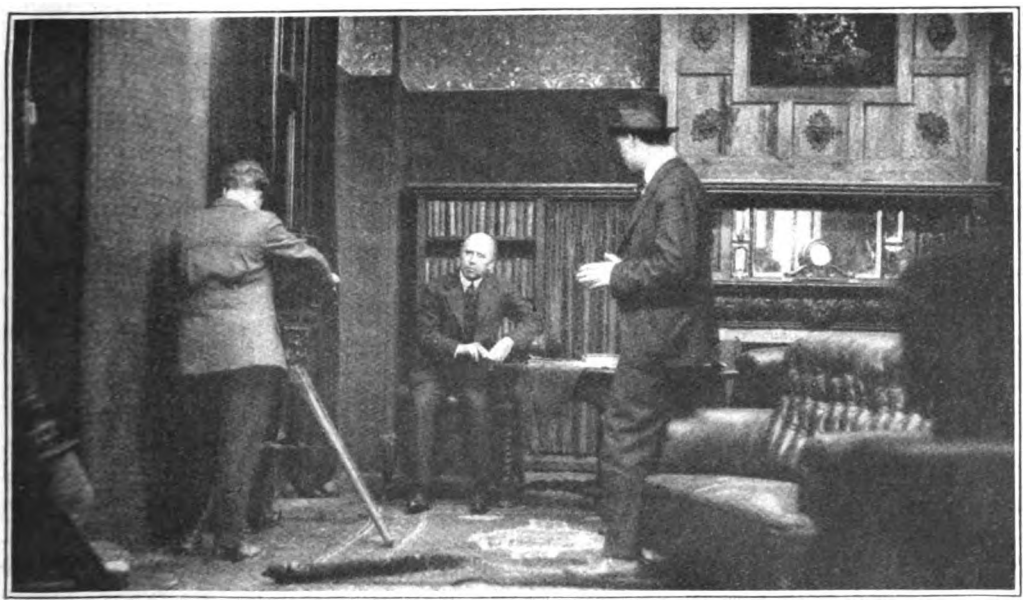
Some variation on this idea, possibly a betterment of it, is by the original use of linoleum instead of paper. This gives a screen of more toughness and body. Another advantage is that linoleum can be obtained in widths to provide a seamless background for the finish. The greater cost of linoleum is overcome very largely by the fact that it dispenses with the services of a paper hanger.

TO STAR OR NOT TO STAR

Margaret Gibson, one of the leading women of the Vitagraph studios, permanently located in Santa Monica, Cal., is confronted with a serious problem; whether it is better to pursue fame through the medium of the pictures or continue on a large scale with her commercial business, which is a most unique one.

In four years Miss Gibson has built up a big mail order business in Japanese kimonas and jewelry. At first it was merely a woman's fondness for these wares and soon she became an authority. Then she commenced making selections for her friends, until her fame spread, and now she has many well known society leaders among her clients. Different Japanese firms send their American traveling salesmen to visit Miss Gibson with their samples, but this work, together with her playing in the films, has proved rather trying on the little lady. Her preference is for the screen, so it appears that the pictures will continue to claim her, and her clientele will have to look elsewhere when seeking advice on Japanese materials.





MAKING FILMS OF FAMOUS AUTHORS

In as much as many of our modern story writers are not only producing books to enthrall countless thousands, but are also writing scenarios and plots for motion picture plays, it is becoming quite the fashion to film these literary idols so that their enthusiastic followers may see them at their work, in their summer homes, roughing it—anywhere, in fact, that the camera catches them. Of the two pictures here reproduced the upper one shows Rex Beach posing before the motion picture camera. In the lower one the camera man is busy grinding out a pictorial record of George Barr McCutcheon. Both of these are specially posed scenes in motion picture studios and the subjects are evidently being admonished to look pleasant, with the usual result.

An Entire Village Street Was Erected and Destroyed

First the Village Grocery and a Blacksmith Shop Topple Over

A Dwelling House and Post-office Are Wrecked

Finally, the Church with Its Tower Wavers

WRECKING A CITY FOR THE PICTURES

When the picture fades on the screen and you have witnessed the five reel production entitled "Through Fire to Fortune," or "The Sunken City," which was made at the Lubin studios, you will undoubtedly leave the theater wondering if there remains any calamity or catastrophe too gigantic for the film manufacturer to reproduce in pictures, and in a manner so natural that you can scarcely detect the make-believe.

As the title, "The Sunken City," may suggest, the picture is based upon a catastrophe in a Pennsylvania mining village, where a cave-in in the underground workings of the mine causes the whole little village to sink into the ground. In the Lubin studio yard, at an enormous outlay of time, money and labor, an entire street in the mining village has been erected before the camera. It is lined on either side by stores, shops, homes and a church—all carefully built-up structures and not mere painted canvases—and then, in less than five minutes, this is all destroyed before our very eyes by what appears to be a cave-in of truly gigantic proportions.

First the village grocery store, then a black-

smith shop, next a dwelling house, and, finally, the church, with its lofty spire, waver, topple, and sink into the ground. Where the busy street, teeming with activity, had stood but a moment earlier is now nothing but a mass of *debris.* As night falls over the scene the ruins catch fire from the conflagration raging in the mine shaft just outside the village and flames destroy what little remains of the once proud village.

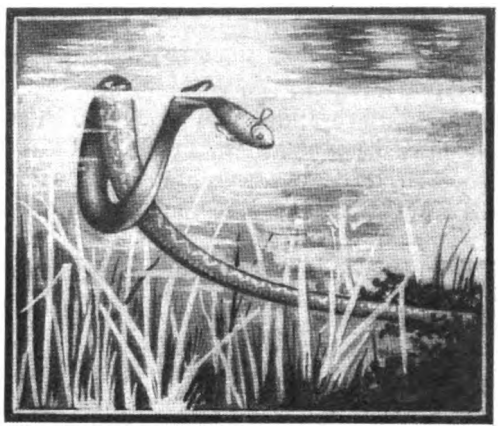
In reality, of course, days must have elapsed between the taking of the various stages of the cave-in, and what we are witnessing on the screen in a few short moments really took days to accomplish. Infinite patience and extreme care had to be used in effecting the various changes in order to preserve the illusion of continual change. So carefully was the destruction of the city accomplished, however, that at no stage does it appear jerky or abrupt. It all seems natural and real.

Previous to the awe-inspiring scene in which the city is destroyed you are shown the interior of a coal mine in full operation and the discovery of oil by one of the workmen. The candle in his hat, falling into the black fluid, sets the oil afire and the screen reflects a scene of grandeur and yet of terror as the imprisoned miners rush this way and that in seeking for an exit from the mine.

The hero of the story is one of the men imprisoned in the underground workings and his escape is cut off by a cave-in in one of the galleries of the mine. From the other side of this cave-in we then witness the work of the rescue crew, behold them push through to him a long section of pipe by means of which he is given water, food, and allowed to hear the voices of his rescuers as they dig towards him. In other parts of the mine, men with smoke helmets and pulmotors aid in bringing out the imprisoned men and restoring them to consciousness.

HOW SNAKES SWALLOW FISH

A snake, when it attempts to eat a fish, must swallow the latter head first, on account of the fins. If the fish is



Fish Lifted from Water by Snake and Turned

caught by the tail or crosswise of the body it must first be deftly lifted out of water and turned as disclosed by this section of a remarkable film, made by an English camera man—Will Day.

WOMEN RULE CITY OF "MOVIES"

Universal City, California, is perhaps the most unique city in the world, in that it is ruled by women, that moving picture players are the sole residents and everything can and is utilized for the making of moving pictures.

It is situated in the hills of the San Fernando Valley, near Los Angeles. Less than a year ago it consisted of a cook house and two outdoor stages. This unique center of moving picture players has a woman mayor and a woman chief of police. Lois Weber, one of the few successful women producers of moving pictures, is mayor, while Laura Oakley represents the police arm of the law.

A street in Universal City is a capital reminder of the typical early time Western city. One of its interesting features is that everything in it can be and is utilized, at one time or other, in the making of films.

FILM SHOWS FOR PRISONERS

Motion pictures as a method for entertaining and morally benefiting the prisoners in a number of state penitentiaries and reform schools have been found exceedingly helpful. In some of the institutions the picture show is held out as a reward for good conduct and only such prisoners are allowed to enjoy the show as have been above a certain grade of conduct during a certain period, while in others all the prisoners are permitted to view the pictures, whether they have been on good behavior or not.

Men who have been confined behind prison bars for scores of years have seen on the motion picture screen for the first time such things as aeroplanes, automobiles, electric trolley cars, elevated railroads, and modern battleships, besides such events as are shown in the various animated weeklies depicting the world's events. Wardens and superintendents of the various institutions are almost unanimous in their praise of the pictures and their assertions that the films do much toward educating and developing the unfortunates in their care. Prisoners are inspired to lead better lives, and to become honest and thrifty following their release, as a result of the prison film shows.

One of the most noteworthy of the prison entertainment halls is shown in the accompanying illustration of the "chapel" at the Washington State Penitentiary, located at Walla Walla, Washington. Aside from the opera chairs and scenery it cost the taxpayers $17,427, but the board of control, in its last report, claims that, aside from the items named, the building is worth $22,500, the taxpayers having been saved more than $5,000 by the use of convict labor in its construction.

Motion Picture Entertainments Are Given to Convicts in the Chapel—Note Sentry Boxes Decked with Flags

Superintendent Henry Drum states that four reels of film generally comprise a program and that the pictures selected are usually of an instructive or wholesomely entertaining nature. The pictures are shown every alternate weekly entertainment and are open to all of the inmates, who seem very much to enjoy them.

When the convicts are assembled in the theater an armed guard climbs a ladder

and enters a protected room from which his gun can reach any seat in the theater should any of the convicts start trouble. There are two of these guard chambers which can be seen in the illustration showing the interior of the chapel, one on each side of the stage partially covered by draped flags.

Warden John E. Hoyle of San Quentin prison in California states that a motion picture machine has recently been donated to his institution and will be regularly used when the new prison is completed.

Henry Wolfer, warden of the Minnesota State Penitentiary, located at Stillwater, Minn., writes:

"We have had moving pictures by outside companies on certain occasions at the State Prison. We consider such entertainments wholesome and educative, and as soon as our new prison is completed we expect to arrange for a full equipment, so as to provide the best moving pictures that can be obtained."

Warden Edmund M. Allen of the Illinois State Penitentiary at Joliet, in reply to a letter on the subject of prison entertainment says:

"We have, for some months past, been giving the inmates of this institution the benefit of motion picture entertainments. These entertainments are given about twice a month for the benefit of all the inmates. We endeavor to secure a high grade of picture, wholesome and entertaining, giving the inmates an opportunity of indulging in a healthful, hearty laugh. The pictures are shown in the chapel connected with the institution, on week days and are not opened to the public."

Edward J. Fogarty, warden of the Indiana State Prison at Michigan City, Indiana, writes:

"We have had few picture shows here, for we do not give regular exhibits. The last show we had was that magnificent set of reels, 'From the Manger to the Cross.' It was donated to us by the owners of the rights for Indiana. All the prisoners see the pictures when they are exhibited, and the regular church building (our chapel is a church building) was used in which to show them."

R. V. Clark, superintendent of the Nebraska State Industrial School for Boys, at Kearney, Neb., in his reply, declares: "We furnish motion pictures for the boys of our institution every Friday night. We try to get films which are appropriate to be shown to the boys of this school and we feel that the plan is a good one. We try to get scenic, industrial, dramatic and educational films."

ANOTHER HOME PROJECTION MACHINE

Projection machines suitable for use in the home or by amateurs have long been a growing need, and occasionally one hears of a new type being perfected and offered for sale, but, strange to say, none of these devices seems to prove as efficient when put into actual use in the home as the rosy prophecy of its inventor might lead one to believe would be the case. Within the past few weeks the Eclair company of France and America has announced a new device of this kind which is called the Kineclair, to be offered in the American market, which may be a solution of the problem.

The new machine uses standard film, a feature which is of marked advantage. It measures ten inches wide by fourteen inches long and weighs but seventeen pounds, and complete with the carrying case weighs but 19¼ pounds. It can, therefore, be carried with ease from place to place by salesmen wishing to demonstrate their goods on the screen, traveling lecturers and for demonstrating purposes of all kinds.

The mechanism of the machine is contained within a dust proof casing and is built entirely on the plan of the highest class professional projectors. No previous knowledge of the working of projection machines is necessary in order to correctly thread the film through the Kineclair and, most pleasing of all, by

simply placing the crank handle on another shaft the working of the intermittent movement is so changed as to enable the viewing of each and every picture of the film for any length of time desired—in other words it actually transforms the moving picture into separate stereopticon pictures.

MEXICAN PICTURES STILL COMING

Scarcely a week passes at the New York offices of the Mutual Film Corporation without the receipt of anywhere from one to five thousand feet of negative from the camera men who are "at the front" in Mexico. The early films received were such "close up" studies of the men and battles described in the daily press at about the same time that the public found them not only interesting and entertaining, but gradually came to realize that they were historically accurate, pictures of events actually transpiring and not in any sense "faked" or "staged" scenes. The later reels and those which are still being received have therefore been eagerly awaited, and Washington officialdom has been particularly interested in obtaining views of the actual events taking place in Mexico.

The illustration presented on this page shows the chances which the fearless camera men took in obtaining the pictures, for the motion picture photographer can be seen busily turning the crank of his camera on the roof of the building in the background, while just a little in front of him the cannons roar and men drop as the shells of the enemy burst in the vicinity.

Showing a Camera Man in Action in Mexico

This remarkable "still" picture was taken during an early morning battle in a little Mexican village where a company of Villa's men were surprised by a much larger force of federals. A half hour following the taking of the above picture the Villa force was compelled to evacuate the village, and with them on the retreat went this same Mutual camera man.

Inquiring Rufus

By CHAS. K. THEOBALD

Rufus Washington Sanders, the engineer's dinner boy, swallowed the one remaining scrap of homemade bread with which he had previously mopped the last plate spotlessly clean, then wiped his mouth with the back of his hand and heaved a regretful little sigh as he returned the empty dishes to the dinner basket. Then he set the basket aside and strolled over to the big 500 horsepower engine which he had observed the engineer gravely inspecting.

"Sumpin wrong wid de injine, Mr. Price?"

The engineer brought the speed of the huge flywheel to very nearly the point of stopping and closely followed with his eye a bad looking place in the yard wide belt as it slowly passed him.

"I don't like that belt, Rufus," he complained, his trained ear alert to catch the slightest unfamiliar sound as he cautiously gave the engine her steam again.

" 'Tain't gwiner bus', is it?" And Rufus, backing off a step or two, mentally counted the exact number of steps in the shortest unobstructed path between himself and the power house door.

Price consulted his watch. "I hope not," he said. "By careful nursing, the old belt ought to hold until two o'clock, when the steam fitter has promised me the other engine again."

Rufus breathed a little easier, though he eyed the swishing belt doubtfully as he sat down on a waste can near the engine.

"Mr. Price," he said irrelevantly as the engineer took a seat on a chair, "I'se been a-watchin' how dem street kyar motormans works de crank on de front of dey kyars, an' I notices dat de furder dey turns de handle de faster de kyar runs. But my 'ticular obsahvations has been dat, when de kyar am a-runnin' at a right smaht gait and de 'lectrissty quits a-comin' all of a suddint—like it do sometimes when I hear folks say 'Dar now, de power's off!' —de motorman am mighty quick to turn de crank all de way back agin. What make him do dat, Mr. Price, and

"I'se been a-watchin' how dem street kyar motormans works de crank in de front of dey kyars"

how come dat crank make de kyar go jess like de motorman wants it to?"

"The iron clad box with a crank on it, on the front of the car, is called a controller," the enginer explained. "It contains a rotary switch, or combination of switches, which, when the motorman turns the handle, gradually distributes electricity to the car motors."

"Den dar's more'n one motor on a street kyar?"

"There are two—one on each side of the bottom of the car. When making full speed they develop about 60 horsepower apiece, and, since their operation requires large quantities of current, it must be supplied to them a little at a time. To explain why this is necessary, I'll ask you a question, Rufus:

Suppose this big engine were motionless and I should suddenly let into the cylinder a full supply of steam—what do you think would happen?"

Rufus grinned. "I don't think nothin' 'bout it, Mr. Price. Dat injine'd jess natu'lly bus' herself wide open tryin' to git stahted in er hurry."

"Move up to the head of the class," Price laughed. "And something similar would happen to a large electric motor if it were to receive a full charge of current at one time. Now I'll tell you what happens under the car when the motorman turns the controller handle— Hang that belt! I'll have to shut down a few minutes and take a look at it."

There was nothing unusual happening to the belt, so far as Rufus could see, but nevertheless he was ten feet away and ready to go farther before Price could reach for the throttle to shut down the engine.

No sooner had the big flywheel come to a stop than the telephone set up an incessant ringing.

"Mus' I answer de 'phone, Mr. Price?"

"No, let it alone," the engineer ordered, without looking up from his examination of the belt. "Every motor user in town wants to know how soon we'll get started again. You couldn't talk to them if you tried. Let 'em ring —and wait."

The delay was of short duration and soon the plant was in full operation again.

"You was talkin' 'bout de street kyar motors, Mr. Price?" This reminder from Rufus, as he approached the engine again and took his former position on the waste can, brought the engineer from a troubled study of the bothersome belt. He resumed his talk:

"Besides the two motors, there are also under the car a number of resistance coils which are designed to resist a too rapid flow of current. Compared to the gradual opening of a steam engine's throttle valve, these coils, at the first movement of the controller handle, admit a small amount of current to the motors."

"Uh-huh," Rufus averred. "Dem existence coils holds back some 'lectrissty and lets de motors git jess ernuff to staht 'em off kinder easy like."

"Exactly. And furthermore, at this first movement of the controller handle the electric connections are such that the small supply of current thus admitted to the motors divides its pressure between them, thus running them at

Very suddenly reminded that he had overstayed his time at the plant

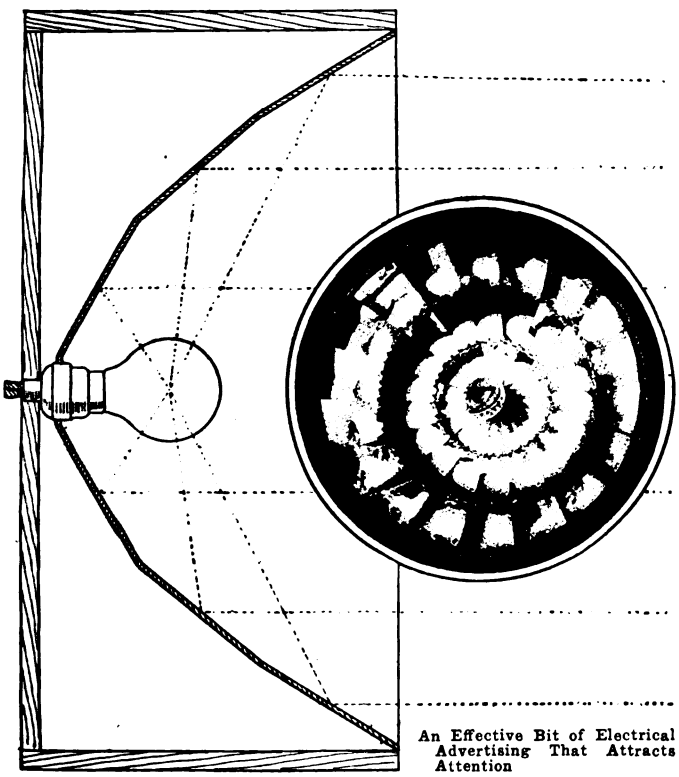
very low speed. Then, as the motorman moves the handle a little farther, the resistance coils are gradually cut out, admitting more current to the motors and running them faster. But as yet, this added pressure is still divided between the motors, now driving them at half speed. Another move of the controller handle cuts one motor out entirely and connects the other directly between the trolley wire and the rail, giving it full pressure and driving it at full speed. And the last notch of the controller handle makes a like connection with the first motor, which, because of the speed it has attained while running idle in its gearing, is now prepared to receive without injury a full supply of current.

"And now, Rufus," the engineer concluded, seeming to doubt whether the boy had thoroughly understood him, "I

haven't used any words too big for you, have I?"

Rufus looked up with the air of one whose intelligence has been insulted; then his ivory teeth showed in striking contrast against their ebony hued background as he affected a disdainful little smile.

" 'Scusin' de pernunciation of dem persistence coils," he said by way of displaying his own vocabulary, "de 'lucidation of your subjic' am puffickly 'splainable to my understandin'. I also com'prends de necess'ty of de motorman turnin' his 'troller handle back in a hurry when de power leaves de trolley all of a suddint. Cuz if he didn't Mr. Price, and de 'lectrissty'd come back right quick and git into dem motors all to once, dey'd bus' open jess as sho' as——"



An Effective Bit of Electrical Advertising That Attracts Attention

And just at this juncture, as if to emphasize his words, the big belt snapped in two within two feet of Rufus' head. Like a huge whip twirled by a giant it popped its longer end in the air and then, on its downward plunge to the wheel-pit, spent its fury against the side-wall window with one resounding crash of glass and sash.

Only that much did Rufus stay to see —being suddenly reminded that he had overstayed his time at the plant. Five minutes later—and a quarter of a mile removed—he was at home.

OPTICIAN'S WINKING EYE SIGN

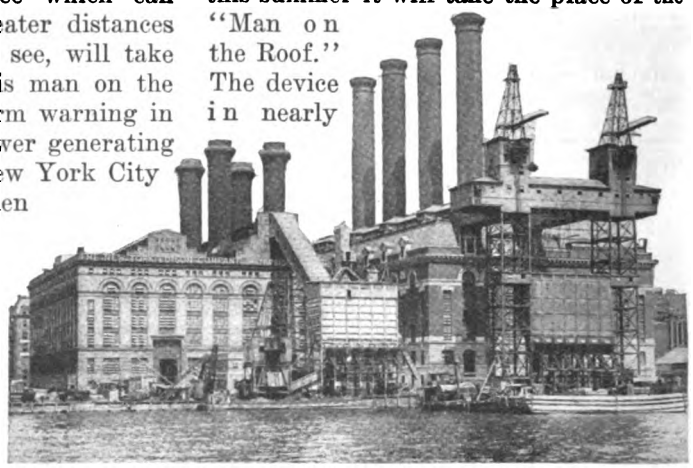
A striking bit of electrical advertising is obtained in a Massachusetts optician's shop by the installation of a single incandescent lamp of sixteen candlepower rating in the focal center of a series of plane mirrors, as shown in the accompanying photograph. The mirrors are assembled so as to form chords between points on a parabolic surface, (54 being employed), with an outside diameter of 24 inches. The central lamp is frosted, the bulb being painted to represent a human eyeball. The circuit is automatically opened and closed to produce a winking effect.

More than 25,000 cubic yards of rich soil was towed from Collinsville, on the Sacramento River, to the site of the Panama-Pacific International Exposition at San Francisco to be used in the tropical garden, which will form the setting for the great exhibit palaces. This loam, heaped up, would make a mountain one-half mile high and 100 feet square at top and base.

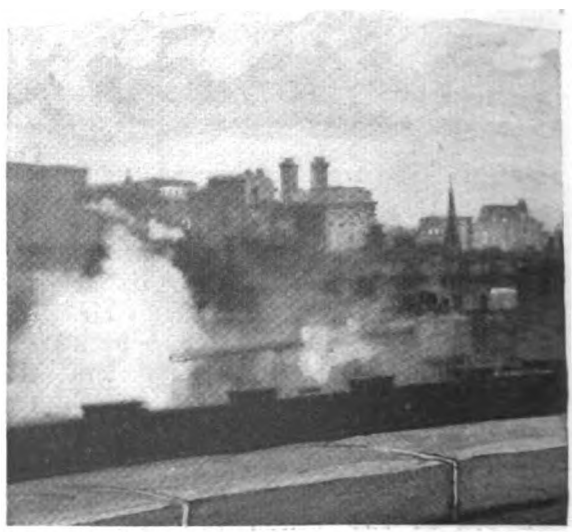
"The Man on the Roof" Superseded

"The Man on the Roof," who is known from the Battery to Kingsbridge, for the vigilant watch which he keeps for storms, will soon be out of his job. A new mechanical device which can sense a storm at far greater distances than the human eye can see, will take his place. For years this man on the roof has sounded the storm warning in the third-million horsepower generating station which supplies New York City with electric light. When he sights an approaching storm he gives the warning in the chief operator's office and immediately several of the huge boilers that are always held in reserve with their fires banked, are immediately gotten under way, and the big 20,000 kilowatt generators started to receive the coming load. So, when the storm throws its mantle of darkness over the city, all is in readiness at Waterside, as the generating station is called, to take care of the city's additional demand for electric light. Sometimes the load jumps from less than 100,000 kilowatts to more than 150,000 kilowatts within the short space of fifteen to twenty minutes. Naturally, if the generating station were unprepared to meet this great increase, it would be serious, so, within two or three minutes after the storm warning has been sounded, the station is prepared to meet the greatest possible demand.

The new device which will supersede the "Man on the Roof," is the invention of Mr. W. H. Lawrence, Superintendent of Waterside Station. Mr. Lawrence conducted a number of experiments last summer with his device, to prove its reliability and efficiency, and they were so successful that this summer it will take the place of the "Man on the Roof." The device in nearly all respects resembles the wireless telegraph apparatus. An aerial will be strung between the tall smoke stacks and will connect with the registering device, which will be located in the chief operator's office. The registering device is



Waterside Station of the New York Edison Company at 38th and 40th Streets, on the East River



The "Man on the Roof" at Waterside—A Storm is Rising in the Northwest

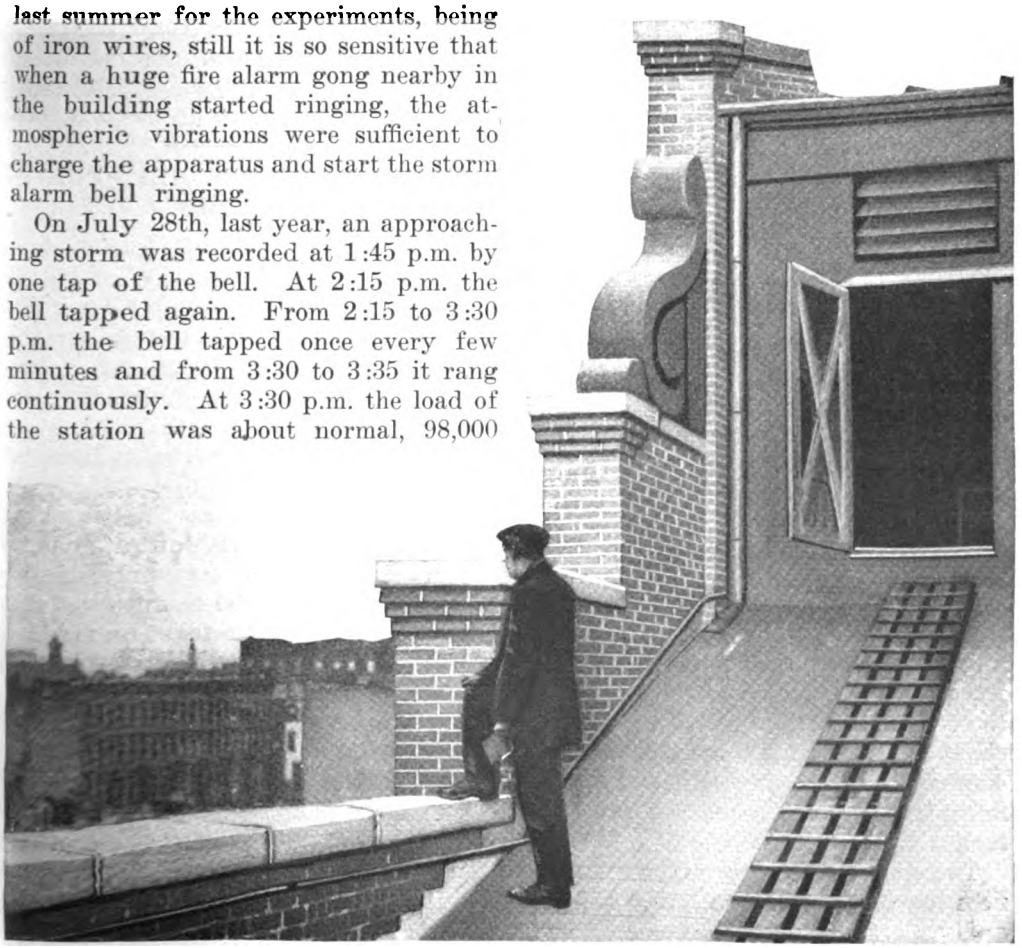
contained in a small box, less than a foot square. It differs from the wireless apparatus in that there is a big spark gap for the purpose of shutting out wireless waves, in which there is not enough energy to jump it.

Any atmospheric disturbance whatsoever charges this aerial line and creates a circuit in the apparatus, jumping the spark gap. In completing the circuit, the current taps a bell. The frequency with which the bell is tapped indicates the proximity of the storm. It is particularly acute for thunder storms, although even a gale of wind will charge it up, though it takes longer for wind to charge it than it does for an approaching thunder storm. Although only a crude form of aerial was constructed last summer for the experiments, being of iron wires, still it is so sensitive that when a huge fire alarm gong nearby in the building started ringing, the atmospheric vibrations were sufficient to charge the apparatus and start the storm alarm bell ringing.

On July 28th, last year, an approaching storm was recorded at 1:45 p.m. by one tap of the bell. At 2:15 p.m. the bell tapped again. From 2:15 to 3:30 p.m. the bell tapped once every few minutes and from 3:30 to 3:35 it rang continuously. At 3:30 p.m. the load of the station was about normal, 98,000 kilowatts, but at 4:10 p.m., when the storm broke and the city was shrouded in darkness, the load soared to 140,000 kilowatts.

PRIVATE WIRE OVER 5,000 MILES LONG

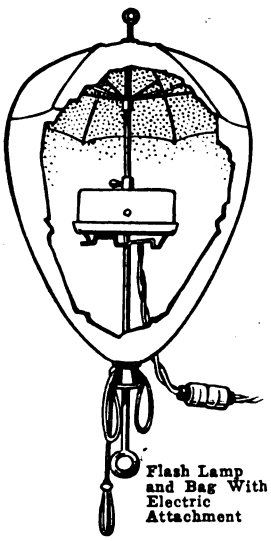
One of the members of the Montreal Stock Exchange, the firm of McDougall & Cowans, with head office in Montreal, and with branch offices in Halifax, St. John, N. B., Quebec, Ottawa, Winnipeg and Vancouver, on the morning of February 16 completed the last stretch of its private wire from the Pacific to the Atlantic coast. By extending this wire from Quebec to Halifax, McDougall & Cowans have now what is claimed to be the longest private wire in existence.



This line of wire as completed is 5,073 miles long, and serves the public in cities the combined total population of which is 1,233,018.

FLASH LAMP AND BAG

Many people have been suddenly and unexpectedly photographed in public places without understanding just how it is done. The flashlight which explodes with such blinding effect is concealed within the bag, which you had previously noted, made balloon shaped and of fireproof material with a collapsible umbrella frame at top. There is a shirr string at bottom, which, after pan is loaded, is closed tightly around a spool attachment, making the bag airtight and allowing no smoke to escape. Either an electric or a paper cap igniting device is used. With the electric attachment any number of lamps may be connected and fired all at once, using the ordinary lighting current.



Flash Lamp and Bag With Electric Attachment

ELECTRIC VAPOR INHALER

The electric vapor inhaler creates from the healing oils and antiseptics, such as menthol, oil of pine and thymol, a thin, warm vapor which gives the essence of these remedies. The soothing, healing effect is apparent at once. A pleasant odor and agreeable sensation of breathing a sweeter and cleaner air are the immediate effects of this device.

To create the ideal thin vapor, it was necessary to apply to the liquid a steady and moderate heat. This was done by a series of fine wires wound around the bottle of liquid. The inhaler is so arranged that the vapor is automatically mixed with air in just the right proportions. The amount of electricity consumed is so small it can hardly be measured.

Ingenious Device for Vaporizing by Electric Heat, Oils and Medicines

With the current on for 24 hours, scarcely one penny's worth of electricity would be expended.

ELECTRIC DEVICES HELPFUL IN A STUDIO

Miss T., a teacher of singing in a large city of the Middle West, has a very pretty studio. Gradually it has been equipped with an electric portable lamp, a small piano lamp, an electric fan for use on hot days, and then the busy teacher happened to think of an electric toaster and convenient little hot plate.

"So now," said Miss T., "it is not necessary for me to rush out at noon for my luncheon as I did formerly; if I am busy and have only 30 minutes between lessons I simply make toast on my electric toaster and brew a cup of tea on the hot plate, and with jam or marmalade I make a light luncheon for myself. I find the electric devices very convenient and they are so clean and nice. There is no soot or smoke or odor of any kind, just a little heat where I want it and when I want it, and behold, my luncheon is ready at a moment's notice."

MOTOR-OMNIBUS DRILL

Margaret Hallam, in the London Daily Mirror, advocates a motor-omnibus drill for women for the purpose of learning to alight from moving vehicles. The writer states that coach builders have so constructed the motor-omnibus that the only way to alight is by standing on the small foot board with your back to the approaching traffic and dropping down on your left foot. It would be wise therefore to practice these exercises, as they may save you cutting an undignified figure in the mud.

American women often experience difficulties getting on and off street cars, owing to high steps, and doubtless these same exercises may appeal to them in the way of developing agility, poise and precision.

FRANKLIN 100 YEARS AHEAD OF HOUSEWIVES

Every section of American and British endeavor and development is joining hands in the coming Anglo-American Exposition, to be held in London. W. M. Mordey, of the British Institution of Electrical Engineers, says of his section of the work:

"It is very fitting, I think, that the electrical engineers of America and this country should join together in showing one another and in showing the world what they have been doing in developing the branch of engineering which has not only progressed but has had its whole birth and life within the one hundred years, the century which this exhibition is intended to cover.

"We owe much to America. We have to go back further than one hundred years to find when our debt began. It began in connection with roast turkey, and I am sure you will agree it is appropriate I should mention the fact that in 1748 that marvelous man, Benjamin Franklin, actually killed a turkey by an electric spark, roasted it by an electric jack over a fire that was lighted by an electric spark. That was the first contribution of American electrical science to the industry that was to become so great.

"You will remember that Franklin's next contribution was to prove the identity of the electric spark and of lightning. Then there was a long pause. It was in 1813 that Davy erected on Burlington House the first arc lamp.

"Then there was another gap, and it is a rather curious thing regarding the two great early contributors to this science and industry that Franklin should have been a printer's apprentice and Faraday a bookbinder's apprentice. It was in 1831 that Faraday practically laid the foundation of the whole modern science of electrical engineering."

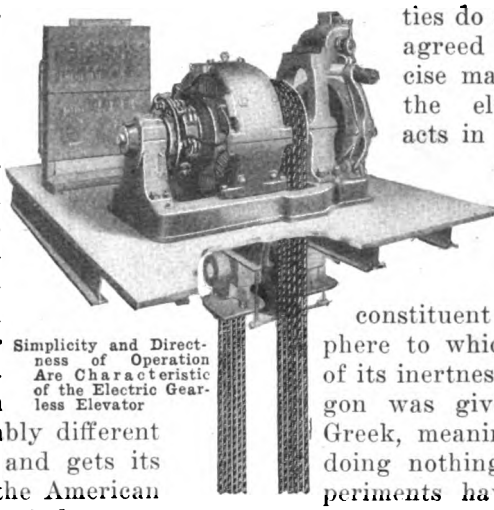
Twenty-three Elevators in a Single Building, Each Like a Bucket Hung in a Well

ELEVATORS TO CARRY 30,000 PEOPLE DAILY

Chicago will soon have ready for occupancy what is declared to be the most complete office building in America. The Continental and Commercial Bank Building covers an entire block and while a city ordinance does not permit a structure of 40 or 50 stories, this 21 story building in point of area, magnificence and service will be the most modern of its kind in use exclusively for banking and office purposes. It covers a ground area 323 by 166 feet.

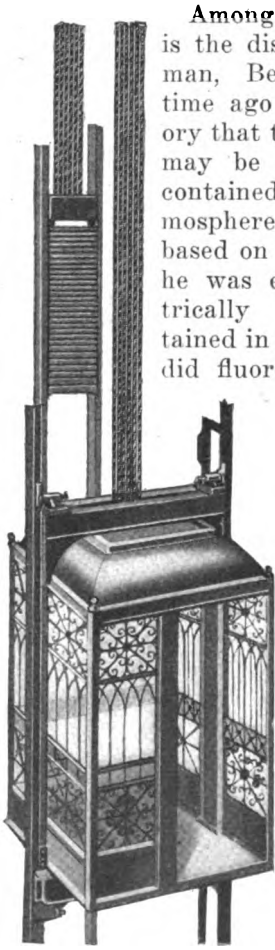
In the basement there will be a 600 ton, safety deposit vault of nickel steel, armor plate encased in two feet of solid concrete and closed by two doors weighing 45 tons. The Continental and Commercial National Bank, the second largest institution of its kind in the United States, will occupy the second and third floors and portions of three more. The remaining space will be given to offices, an interior light court 154 by 54½ feet of white enameled brick extending from the fifth to the twenty-first floor, giving all interior offices ample light. The exterior of the building is of granite and

terra cotta; the interior is of Mexican mahogany and white marble. The feature of the building, however, which will save time for the 30,000 people who, it is estimated, will daily transact business there, will be the 23 electric, gearless, passenger elevators. These will run at a speed of 600 feet per minute. The traction system of elevator operation here installed is considerably different from the geared variety and gets its name from the fact that the American wire rope cables do not wind up on the driving sheave but adhere to it. This adhesion is accomplished by continuing the cables from the sheave on around an idler, then again around the driving sheave, thus forming a complete loop around both and down to the counterweights. The shaft of the driving sheave is the extended motor shaft, all intermediate gearing being done away with.



Simplicity and Directness of Operation Are Characteristic of the Electric Gearless Elevator

An important safety feature of the system is an oil cushion buffer on each counterweight and one under each car, capable of bringing the car to rest from full speed without discomfort to passengers. It should be mentioned also in connection with the elevator equipment that two private passenger elevators automatically operated by push buttons will enable bank officials to go from floor to floor.

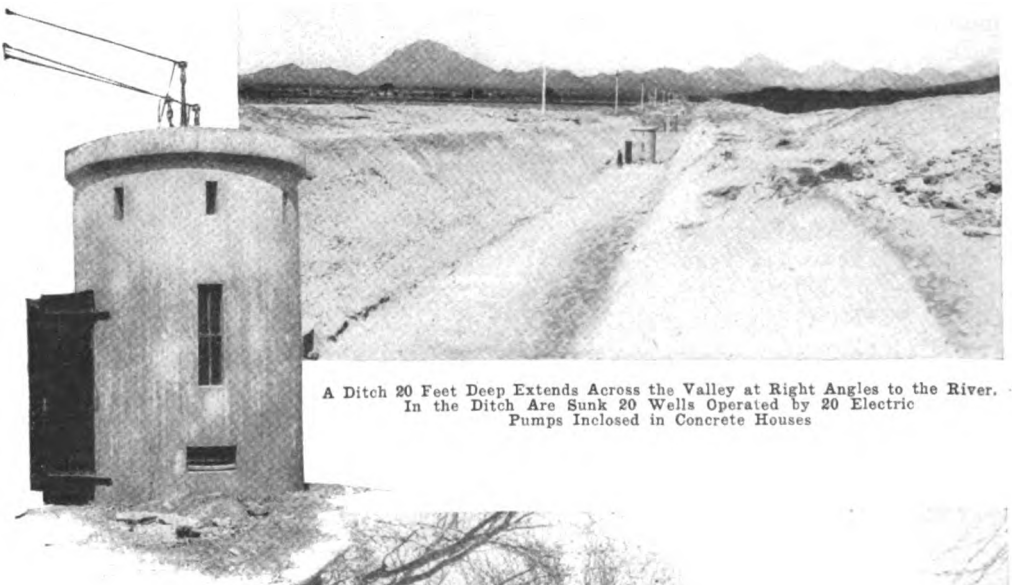


ARGON AND THE AURORA BOREALIS

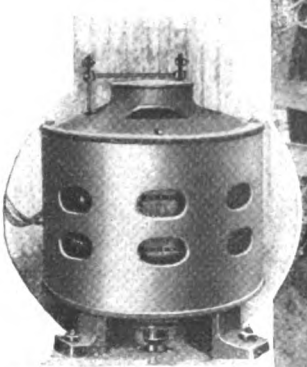
It has been a long recognized fact that the phenomenon of the "Northern Lights," or Aurora Borealis, is due to electric action producing luminosity in the upper regions of the atmosphere, perhaps 75 miles or more above the earth, where the density of the air is exceedingly slight. But the authorities do not seem to be agreed as to the precise manner in which the electric energy acts in producing this phenomenon.

Since the discovery, some years ago, of the constituent of the atmosphere to which, on account of its inertness, the name argon was given (argon, in Greek, meaning "lazy, idle, doing nothing"), many experiments have been made by chemists to determine the properties of the element.

Among the experimenters is the distinguished Frenchman, Bethelot, who some time ago advanced the theory that the Northern Lights may be due to the argon contained in the upper atmosphere. This theory is based on the fact that, while he was experimenting electrically with argon contained in a test tube, a splendid fluorescence was developed, the light of which, as tested by the spectroscope, resembled that of the Aurora Borealis. It is thought that argon, or some element associated with it, may, under the influence of electric currents developed in the high regions of the air, produce a fluorescent combination, giving rise to the lights.



A Ditch 20 Feet Deep Extends Across the Valley at Right Angles to the River. In the Ditch Are Sunk 20 Wells Operated by 20 Electric Pumps Inclosed in Concrete Houses



The Motor Is Vertically Connected to the Pump

Concrete Lined Ditches Have Great Capacity, with no Loss by Seepage

Barley Field in the Santa Cruz Valley in Arizona

RECLAIMING A DESERT WITH AN UNDERGROUND RIVER

Twenty electric motors running 20 centrifugal pumps are irrigating 10,000 acres in the Santa Cruz Valley in Arizona. These pumps, with the aid of gravity, are bringing an underground river to the surface with the least expenditure of power.

Only during a few months of the year does the Santa Cruz have enough water in it to be called a river. At other times the water flows many feet below the surface. How to raise this water cheaply and utilize it for irrigation was the problem.

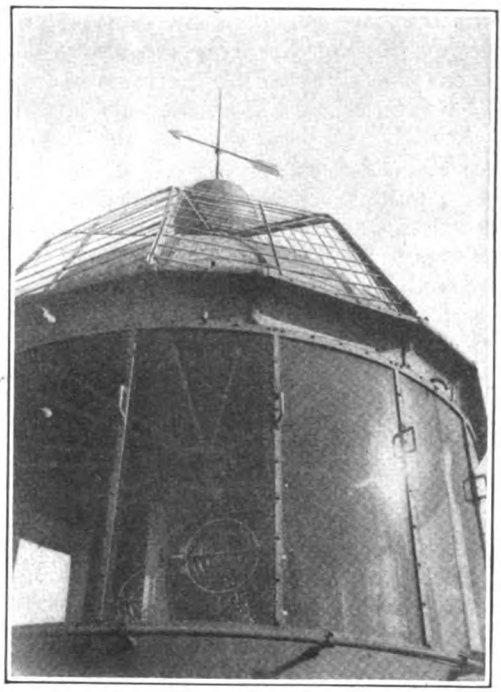
After first determining the amount and extent of the underflow, a ditch 20 feet deep was dug to the water level extending across the valley at right angles to the river. At intervals of 200 feet wells were sunk into the underflow. Each well was fitted with a centrifugal pump vertically connected to a fifteen horsepower electric motor enclosed in a concrete house. Each well was connected to a concrete conduit from two to three feet in diameter running the entire length of the ditch.

The water is pumped into this conduit, the actual lift being only a few feet when the water table is at its lowest point. At certain times of the year the underflow rises high enough for the water to flow into the collecting conduit without pumping. This conduit carries the water by gravity from both sides of the valley to a central point. Here it turns at right angles and runs underground down the valley. The water flows by gravity, but on a gentle grade, until the natural slope of the valley allows the water to be brought to the surface. From here it is carried in concrete lined ditches to the awaiting fields.

The Borneo Islands boast a telegraph line constructed of mahogany and ebony poles. This is no doubt the most valuable telegraph line in existence.

BIRD PERCHES ON LIGHTHOUSES

It is well known that the powerful beams from lighthouses and lightships are responsible for the slaughter of hundreds of thousands of feathered immigrants. Under certain conditions of weather, according to one authority, a lighthouse becomes a veritable shambles, and he adds that those who have not witnessed a "bird-night" at a light



Bird Perches on the Famous Terschelling Lighthouse

station cannot form any conception of the appalling loss of life that takes place.

There appears to be some difference of opinion as to the primary cause of the tragedy. Some naturalists maintain that the birds are dazed by the glare and strike the lantern with such force as to be maimed or stunned. A Dutch professor, on the other hand, holds that the majority are merely attracted, mothlike, to the light, and that they circle about it for hours until, from sheer exhaustion, they fall and perish; or, again, they are deluded

into the belief that morning has arrived, and with it the end of their journey, and that they fly about seeking the desired alighting place. The professor accordingly devised a series of perches which could be attached to the lantern itself without interfering with its illuminating power and by arrangement with the Dutch lighthouse authorities, he fixed these, about three years ago, at the Terschelling light, on the Frisian Islands. As our picture shows, the perches are ladder like devices placed round the platform and on the roof, as much as possible within view of the light, which by the way is of 30,000,000 candlepower. There are also other perches lower down on the structure and not shown in the picture. Since these perches were erected the mortality of birds during the migratory season has not exceeded a hundred, whereas previously thousands used to perish in a single night. On a dark night, says the professor, every perch is occupied, the birds clinging to them in clusters to the number of quite ten thousand, providing, as may be imagined, a remarkable spectacle.

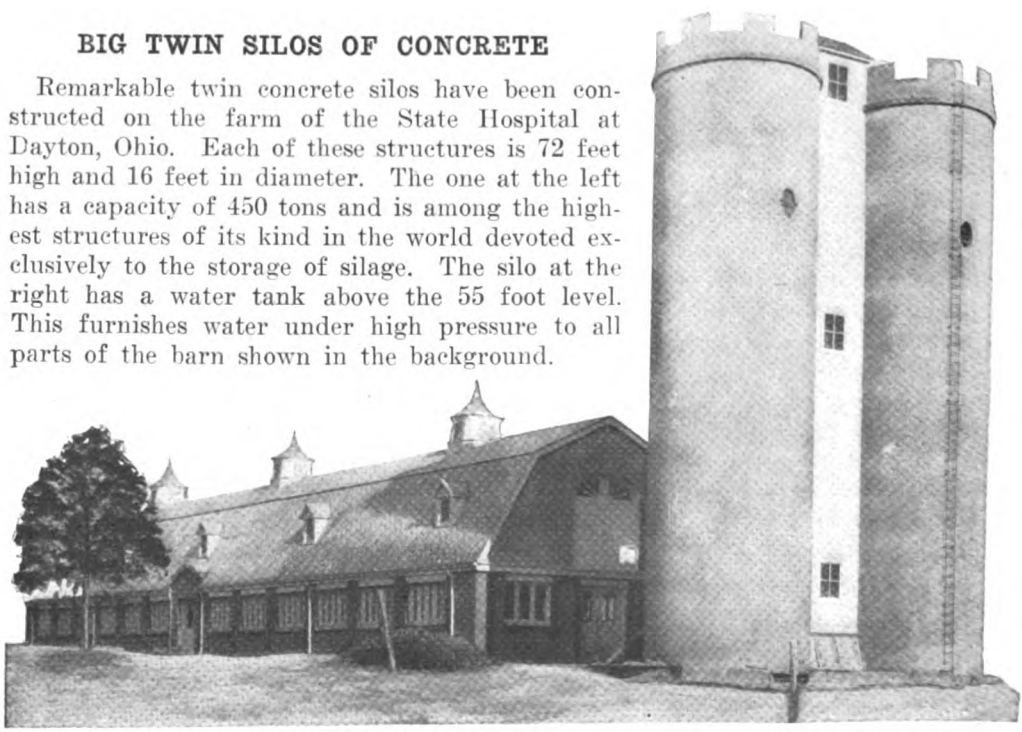
MONUMENT BENT BY THE SUN

Solid as it is, the Washington Monument at the national capital cannot resist the heat of the sun, poured on its southern side on a midsummer's day, without a slight bending of the gigantic shaft, which is rendered perceptible by means of a copper wire 174 feet long hanging in the center of the structure and carrying a plummet suspended in a vessel of water.

At noon in summer the apex of the monument, 555 feet above the ground, is shifted, by expansion of the stone, a few hundredths of an inch toward the north. High winds cause perceptible motions of the plummet, and in still weather delicate vibrations of the crust of the earth, otherwise unperceived, are registered by it.

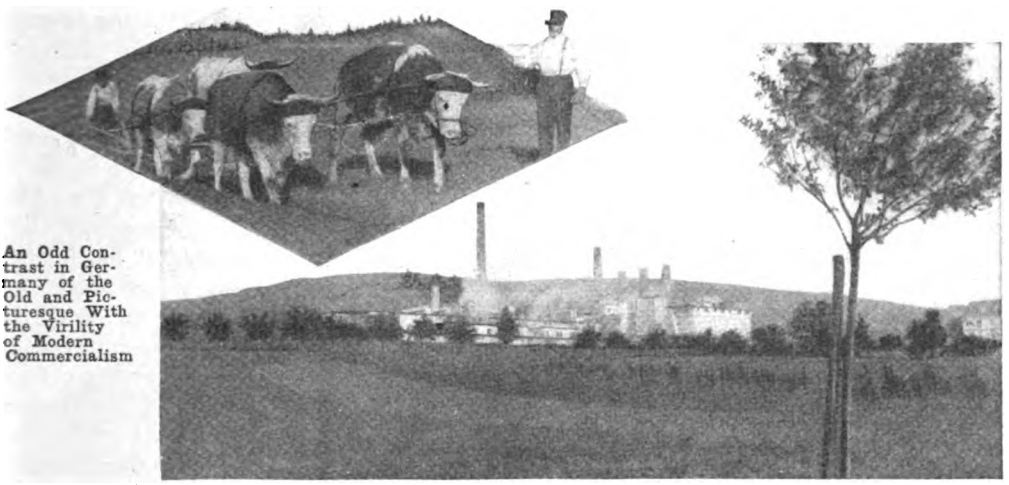
BIG TWIN SILOS OF CONCRETE

Remarkable twin concrete silos have been constructed on the farm of the State Hospital at Dayton, Ohio. Each of these structures is 72 feet high and 16 feet in diameter. The one at the left has a capacity of 450 tons and is among the highest structures of its kind in the world devoted exclusively to the storage of silage. The silo at the right has a water tank above the 55 foot level. This furnishes water under high pressure to all parts of the barn shown in the background.



THE OLD AND THE NEW IN NECKAR VALLEY

The dividing line between tradition and modernness is sharply defined in Neckar Valley, Germany. As you wend your way along the excellent road towards Heidelberg in your high powered automobile, you may pass a peasant in picturesque native attire—a costume unchanged through generations. You may see quaint little milkmaids, dressed as they have dressed for a hundred unvarying years; while on an adjacent farm your attention to the beauties of the valley may be rudely diverted by the mercenary whir of an electric milking machine. Or again, as the accompanying photographs depict, as you pass a span of oxen laboring at a rustic plow, in the distance you may focus your eyes upon the spectral towers of a mammoth Portland cement plant.



An Odd Contrast in Germany of the Old and Picturesque With the Virility of Modern Commercialism

It is a contrast which exemplifies the Germany of today: the presence of the old, the beautiful and the picturesque together with the virility of the progressive and commercial. The combination is strictly a mosaic—not a blend—and will remain so until the passing of one or the other faction.

COLOR COMBINATIONS

A Swiss ribbon manufacturer, who claims to be able to distinguish some 2,700 different shades, has gathered some interesting information with reference to combinations of colors.

It appears that black combines well with almost all colors, except those which are so lacking in brightness as to be too nearly like it. Black and pale pink, yellow, green, red, lavender, and even rather dark shades of blue, clear brown, and green, are excellent combinations.

Brown combines well with yellow, gold and bronze, if it is the shade of brown that has brightness. It is effective also with black and with certain tones of green. A chocolate-and-milk brown combines well with old rose and the dull shades of pink.

Very dark green is effective when brightened by linings of narrow trimming of pale blue. A medium shade of green unites well with old pink. Brownish greens look well with bronze and copper color.

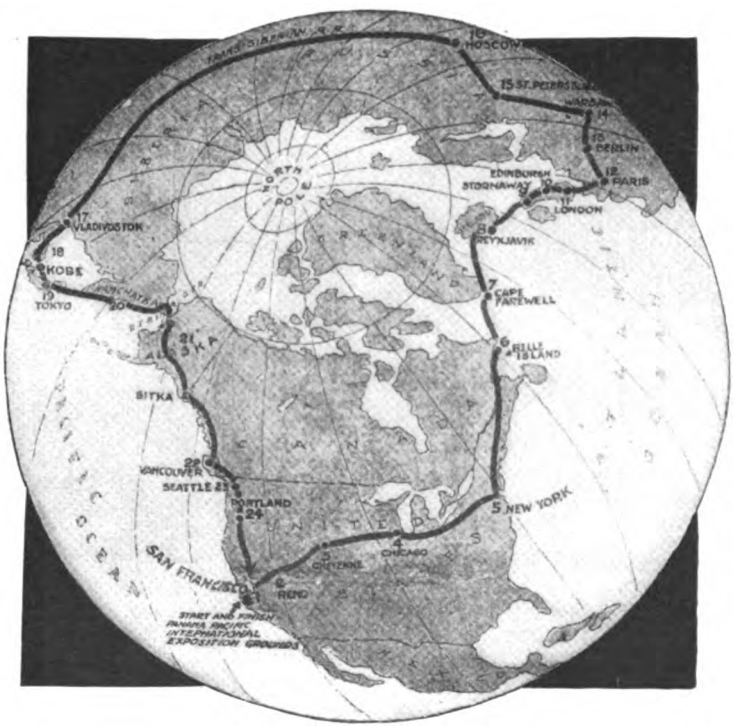
Dark blue may be heightened by lines of bright, rich red, by lines of old rose or of clear yellow. Blue of the "electric" and "cadet" varieties is best combined with black or with figured silks in which the same shade predominates.

SUBMARINE VOLCANIC ERUPTION

On the night of the 28th of August last, a submarine volcanic eruption was observed by the crews of vessels cruising in the Caspian Sea, near the islands of Svinoi and Glinyani. During fifteen minutes a high column of fire streamed up from the surface of the water.

Finally the flames were extinguished and during an hour afterwards dense smoke, apparently coming from the surface of the water, was visible. On the 24th of June, 1860, about eleven o'clock at night occurred an eruption of fire which was visible at Baku and at the mouth of the Koura River, 60 miles distant. The port of Baku was illuminated to such an extent that all the vessels in the harbor could be seen. It seems probable, says Cosmos, that these phenomena may be occasioned by eruptions of burning naphtha or hydro carbon gases, similar to the mud-volcanoes of Sassuolo, or the salt marshes of Paterno at the foot of Mt. Etna in Sicily, or the Colombian volcanoes of Humboldt, rather than to volcanoes, properly so called.

'ROUND THE WORLD AIR ROUTE



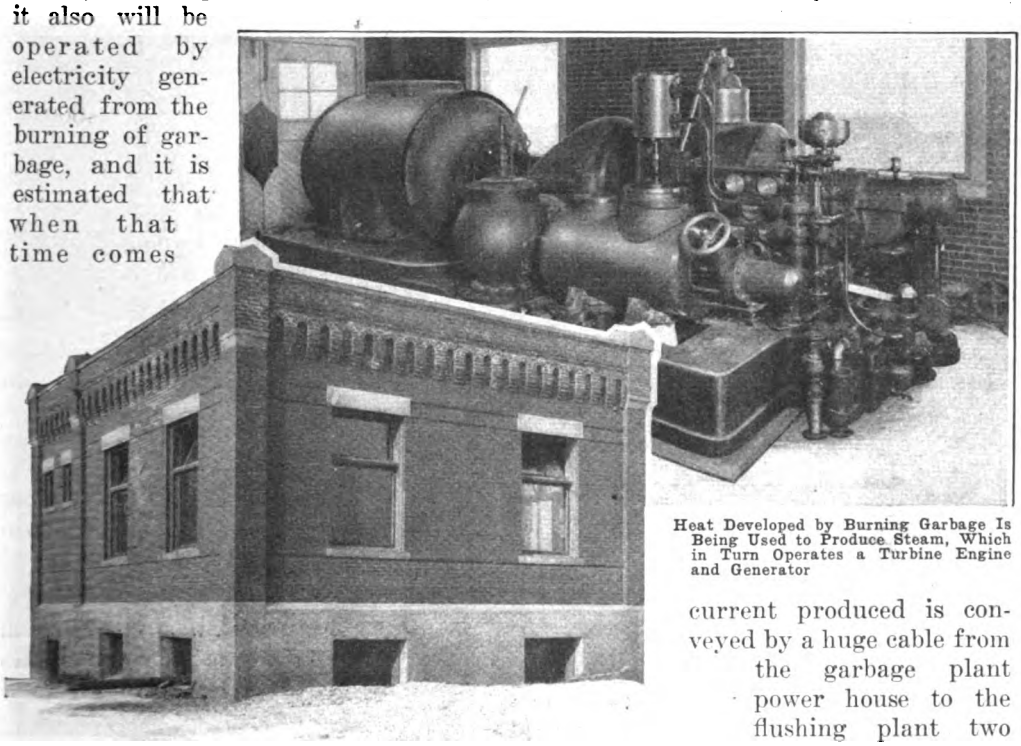
Unique Map of Proposed Air Route Covering 22,760 Miles

Plans for the airship flight around the world, proposed by the Panama Pacific Exposition officials, who have already subscribed $300,000 towards the $1,000,000 prize which is to be offered, are now actually under way. Already a local committee has been appointed to work up national interest in the big prize fund and to co-operate with bodies from seventeen other countries, representing altogether 400 organizations. The proposed air route shown in the map covers a distance of 22,760 miles. The start is to be made at the Panama-Pacific Exposition grounds, San Francisco, Cal., and the various cities at which all entrants will have to stop are indicated on the map.

The committee to take charge of the funds for the $1,000,000 prize consists of Rodman Wanamaker, Cornelius Vanderbilt, Ogden Mills Reid, Clarence H. Mackay, George J. Gould, Frank A. Munsey, James Gordon Bennett, Cortlandt Field Bishop, Alan R. Hawley, Robert J. Collier, Harold F. McCormick, Orville Wright, Glenn Curtiss, Ralph Pulitzer, Vincent Astor and Lieutenant Colonel Samuel Reber

MILWAUKEE'S GARBAGE ELECTRIC PLANT

Transformed into electricity, the garbage of the city of Milwaukee is being used to operate the flushing plant by which nearly half a billion gallons of water is pumped daily from the lake through the flushing tunnel into the Milwaukee river to keep it clean and free from odors. On the completion of the Kinnickinnic River flushing tunnel, now in process of construction, it also will be operated by electricity generated from the burning of garbage, and it is estimated that when that time comes the destruction of useless garbage will mean a financial profit to the city of Milwaukee instead of an expense.



Heat Developed by Burning Garbage Is Being Used to Produce Steam, Which in Turn Operates a Turbine Engine and Generator

To the city engineering department is due the credit for working out the plan by which the heat developed by the incineration of the garbage is being used to produce steam. This steam operates a turbine engine and generator and the electricity produced is conducted across the city to operate the pumps of the flushing plant.

Five thousand tons of garbage are destroyed daily in the incineration plant by the Herin system. It is destroyed absolutely, for housewives are required to put only destructible waste into the garbage cans from which it is collected several times a week. The incineration plant is operated practically without use of other fuel. The plant is situated on Jones Island at the entrance to the city harbor and within a mile of the business district of the city. The electric current produced is conveyed by a huge cable from the garbage plant power house to the flushing plant two miles away.

The destruction of the river's natural current by the dredging of the river bed to allow the lake steamships to go up the river to the docks of manufacturing plants located on the upper Milwaukee, two miles or more from the harbor, necessitates the artificial flow provided by the flushing plant and the pump is taxed to its utmost in the summer time.

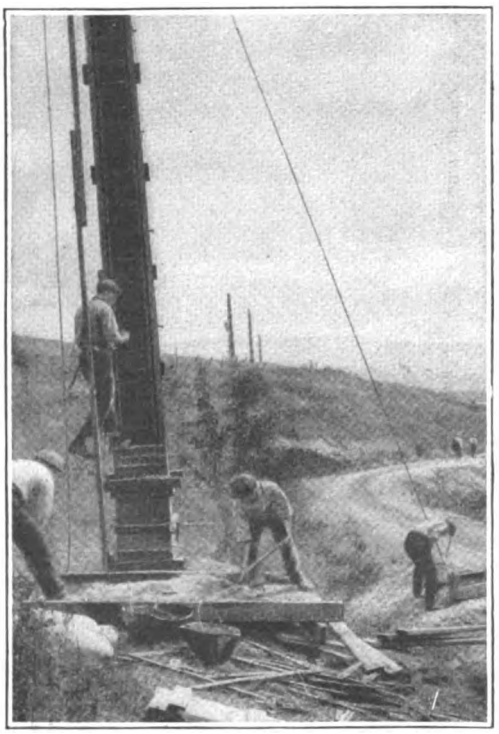
The power plant at the incineration works cost $40,000, the cable and con-

duits between the power and flushing plants an additional $20,000 and the installation of the electric machinery at the flushing plant $40,000, making the entire cost of the electrification of the flushing plant and garbage plant about $100,000.

Under the Milwaukee accounting system, the flushing tunnel plant must pay for the power purchased. But it is estimated that current can be furnished at a rate low enough to reduce this item of expense for the flushing plant several thousand dollars and still pay interest, operating expense and liberal depreciation on the incineration power plant.

CONCRETE TRANSMISSION LINE POLES

These pictures show stages in the construction of a line of reinforced concrete poles carrying power wires for the operation of the enormous locks and gates in the $101,000,000 New York State barge canal from Buffalo to Albany.



Portable Mixing Plant and Light Apparatus Used in Construction of Transmission Line Poles

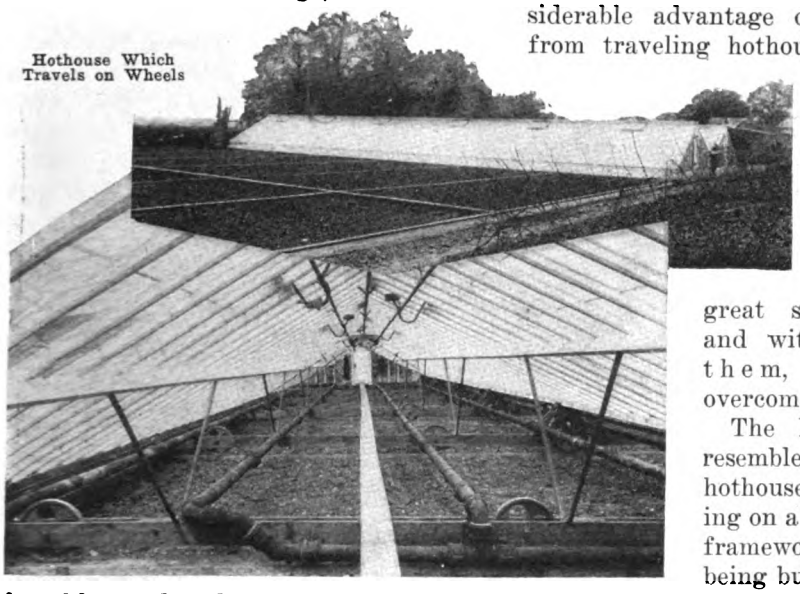
The poles were constructed in place in a vertical position on account of their size and the rough nature of the country, which prohibited cartage and the erection of finished poles molded in a special factory.

Poles Were Constructed in Place in a Vertical Position

Note the portable mixing plant and the light apparatus used. When the pole is completed the miniature mixer is picked up, together with the little scuttles, boards and cement sacks, loaded upon a wagon and away the workers go to begin construction of the next pole in the line.

AN AGED COUPLE CONVINCED

A couple moved from their farm to a nearby New England village. They rented a modern cottage, with a comfortable yard and a large garden, near the edge of the town, determined to spend the rest of their days in ease and comfort.



Hothouse Which Travels on Wheels

The house they rented was wired for electric lights—but they did not use them. Truth to tell they were afraid of electricity and, anyway, they continued to burn the old fashioned oil lamps until their son came up from Boston on a visit. It took the son a long time to convince his father and mother that electricity in the house is not akin to lightning, that it is perfectly harmless. He finally persuaded them to use the electric lights for one month as an experiment. It is quite needless to say that the aged parents were delighted with the new lamps. It was far safer for them to snap on and off the lights in the various rooms than it was to carry an oil lamp. There is no fumbling for matches in the dark, no groping for the lamps. Much to their surprise the bill for the month's electricity was only about a dollar. Since then they use electric lamps every night.

TRAVELING HOTHOUSES

It has occurred to a prominent English gardener, Mr. A. Pullen-Burry, of Sompting, near Worthing, that considerable advantage could be derived from traveling hothouses, by covering in succession a number of plots of land planted in advance. The only difficulty met with in this connection, viz: that of moving great structures bodily and without racking them, was successfully overcome.

The house outwardly resembles an ordinary hothouse, but for its resting on a strong pitch pine framework, instead of being built on walls. This framework is carried on large wheels running on concrete walls a few inches above the ground. These walls run the whole length of the set of plots to be covered in succession in the course of a year.

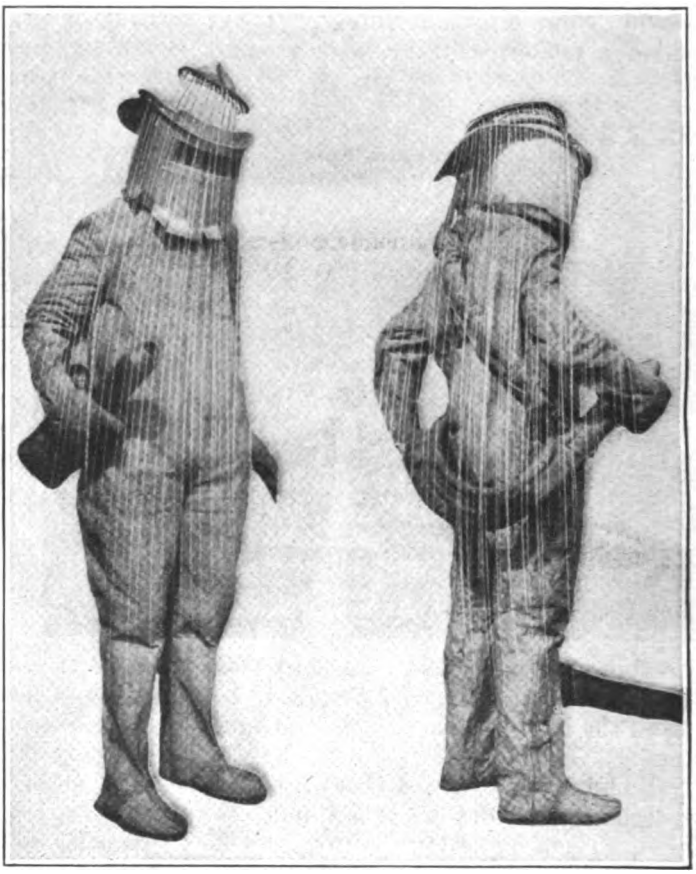
Parallel to the outside walls there are intermediate walls at intervals of about sixteen feet. On each wall run five wheels, the central one of each set being the driving wheel. The outside walls have iron rails embedded in them, whereas, the intermediate ones are plain concrete walls, smoothed down with cement at the top.

The boiler for the heating system is installed just outside in one corner of the house, so as to travel along with the latter on one of the outside rails. Horizontal wheels, arranged at each corner so as to run along the sides of the rails, serve to keep the house, while in motion, quite square. Moreover, the gearing is so designed that the two ends of the house will start simultaneously, thus counteracting effectually any tendency to torsion.

Shower Bath Suit for Firemen

You can stand right in the fire with this new uniform on and not even feel warm. In fact, after standing in the intense flames of a coal-oil and wood fire for five minutes, Martin Panier, the inventor, said he didn't feel as warm as on a hot July day.

The reason of all this is that you are enveloped from head to foot in cooling streams of water and the intense heat hasn't even a chance to heat up the water. To secure these conditions the suit is made of a double thickness of fireproofed canvas, and between the two layers of suiting there is sewed at the neck a perforated ring through which tiny streams of water are continually showering down in between the two layers of suiting. This water finds outlets at the finger tips and at the soles of the shoes, so that it doesn't even have a chance to get hot. A perforated ring also encircles the helmet, showering streams down over the helmet and suit from the outside like a shower bath.



Firemen Protected by Water Curtains

The new invention is designed for firemen and hardly adds 25 pounds to their weight, hence the uniform does not weigh more than the usual rubber uniform of the firemen. The water supply is obtained from the regular line of hose through a one-half inch hose connection. This small hose also manipulates a water motor of light weight which is a part of the special section of regulation hose. The water motor pumps fresh air into the helmet through another half inch hose, so that the fireman is abundantly supplied with fresh air at all times.

This new uniform was tested out in Cincinnati recently, and while the fireman stood in the center of a fierce fire of wood, coal-oil and shavings, spectators could not get closer than 20 feet to the flames, so intense was the heat. The man remained in the flames five minutes and played the streaming hose about him.

"The scientific importance of giving a name to the quantity which we call kinetic energy seems to have been first recognized by Leibnitz, who gave to the product of the mass by the square of the velocity the name of *Vis Viva*."

ILLUMINATION OF SUN PARLORS

Since sun parlors have become an artistic addition to the modern home, their illumination is important and the indirect light seems best suited to bring out the beauty and fitness of the furnishings. The handsome bowl of the fixture is often hung with trailing vines which harmonize with the palms and posies in urns and create a feeling of comfort and repose.

Decorative Effects Are Brought Out to Perfection by the Indirect Lighting

The ivory lattice work, the wicker chairs, the table of Chinese grass, the rich rug and silken hangings are much enhanced by the soft glow of reflected light and every corner of the sun parlor is available for reading or card playing. Beauty and utility are combined in this ideal method of illumination.

PHOTOGRAPH PRINTING IN NATURAL COLORS

Science has worked to the advantage of amateurs, and all those interested in photography, and it is now possible to print on paper in colors as produced on the different color screen positives, such as Autochrome, Omnicolor, Dioptichrome and Thames-color plates.

Although the above named color plates are the most important subjects for printing, a large number of other subjects are available, such as three color glass and film positives, hand colored lantern slides, transparent paper and glass paintings, window transparencies, colored plans and drawings of architects and engineers, upon tracing paper. Highly colored pictures, lithographs, etc., upon ordinary paper, if not too thick, may be rendered transparent by rubbing with oil at the back and then printed from.

Pressed flowers and leaves, butterflies and other highly colored objects, which are easily pressed flat upon the glass, may also be printed from with advantage upon paper.

All color pictures having a portion of gray, mixed with their colors, are naturally less brilliant in color when viewed by reflected light (upon paper, etc.) than when viewed as transparencies. On this account, positives with strong and brilliant colors are more suitable to print from than those with soft and delicate color tints, as the paper prints always lose some of the color intensity of the original.

The plates should not exhibit too great a contrast of light and shade, otherwise, as in ordinary black and white photography, the lighter parts of the plate will be printed out long before the darker portions are sufficiently printed. It is well, on this account, to take precaution before exposing the plate, of having the subject of the photograph as evenly illuminated as possible.

It is best to retouch the colored plate, which corresponds exactly to the retouching in ordinary black and white photography, only in this case it refers

almost exclusively to increasing the intensity of individual color areas. This retouching may be easily done by any amateur. As the colors are already given by the plate, it is only necessary to brush over the parts of the plate where the colors are too weak in the corresponding tone, until sufficiently deep in color.

Suitable dye solutions may be obtained which are specially selected for this purpose, and cannot be replaced by other colors.

In general, the printing process with color paper is the same as that of all ordinary daylight printing-out papers.

The plate is laid in the printing frame, film side up, as usual, and the color paper is laid upon it, with the dark sensitive surface downward. The printing frame is then closed and placed out in the daylight. The printing should be done in strong daylight; for a normal positive it requires about two hours in sunlight and correspondingly long in diffused light. In the northern climate, during the winter months, it is advisable only to print in direct sunlight, and even then no filter is necessary, as the sunlight is so weak as to require six to eight hours to print from an Autochrome. The best results are obtained under white clouds but unfortunately this kind of illumination seldom lasts long enough. Very good results are obtained when the printing is commenced in good diffused light, and continuing for several hours, then finished in sunlight for about one hour.

In printing in strong sunlight, there is a great danger of the plate becoming overheated, and the plates being destroyed, a black and white positive resulting. The printing must therefore be carefully looked after, and the plate not exposed longer than a quarter of an hour at a time to midsummer sun. In order to absorb the heat rays it is well to use a printing frame with a sheet of plate glass ten to fifteen millimeters thick. This thick plate glass serves also the purpose of absorbing largely the injurious ultra violet rays of the sun. When the plate has become too hot, the printing frame should be placed in the shade to cool down, and this may be hastened by the application of a wet sponge or such like device.

There will shortly be placed upon the market special printing frames, having plate glass sheets fifteen millimeters thick, and a convenient arrangement above the frame for inserting the light filters about to be described. A second patented printing frame will also be placed upon the market, enabling finished prints to be obtained in about one quarter of the time otherwise required in the sun.

In damp weather, or if the paper has been kept in a damp place, it is advisable to warm the sensitive paper over a gas flame or fire before placing it on the positive, otherwise the paper may stick to the plate during printing and tear away a portion of the surface when taking the print off.

If the surface of the plate feels damp or sticky, it is well to warm the positive and the paper.

It is necessary to use light filters which are adjusted to the character of the light employed for printing, in order to compensate for the variations in the quality of daylight. There will shortly be on the market two different light filters for this purpose, in two grades, one of them to be used when printing under strong diffused light, or in weak sunlight, the other in strong sunlight. In very strong sunlight, and especially in southern climates, it may be necessary to employ both of these light filters.

The fixing process is absolutely different from the process employed in black and white photography, and under no conditions may the ordinary fixing baths be used in fixing the prints on color paper. A special fixing bath must be obtained for this paper, with full directions as to the operating. For-

tunately, however, although the process is a German one, the materials necessary are handled by at least one importer, making them available to the amateur who wishes to take up this interesting work.

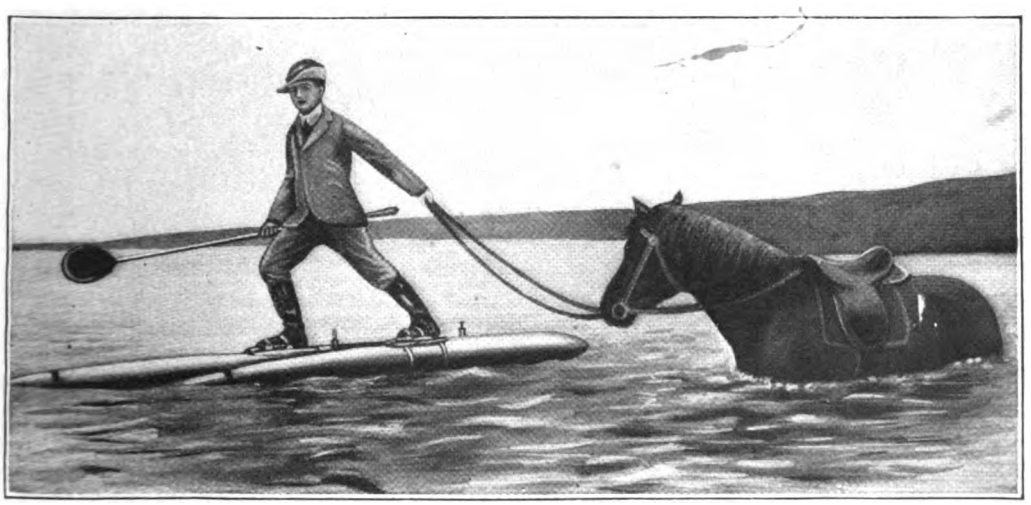
SELLING LAND BY SEARCHLIGHT

To sell real estate by the use of a powerful electric searchlight is one of the latest fads introduced by a real estate company of Los Angeles, Calif. The residents of that part of Southern California have become accustomed to seeing the brilliant rays of this remarkable light flashing over the sky and in and around clouds. The light has over 8,500,000 candlepower and throws its glare a distance of 32 miles. With the exception of the wonderful light on Mt. Lowe, it is the largest in Southern California.

The light is run every evening from 7 until 9 o'clock. In addition to attracting the attention of people to Culver City, the lamp is used to sell real estate at night. From its location, on a three-story building at the center of the city, its glare may be turned upon any lot or section of lots and "night selling" has become a regular practice.

WHEN VAPOR IS DRY

It is a popular misconception that aqueous vapor and ice are wet. They are in themselves dry, and become wet only when they turn to water. "So dry is aqueous vapor that it will dry any moist object that it comes in contact with," states an eminent authority, Mr. M. Mott-Smith. Superheated steam, before it condenses, is a dry gas. Ice feels wet if the temperature of the hand is sufficient to melt it; as ice it is dry.



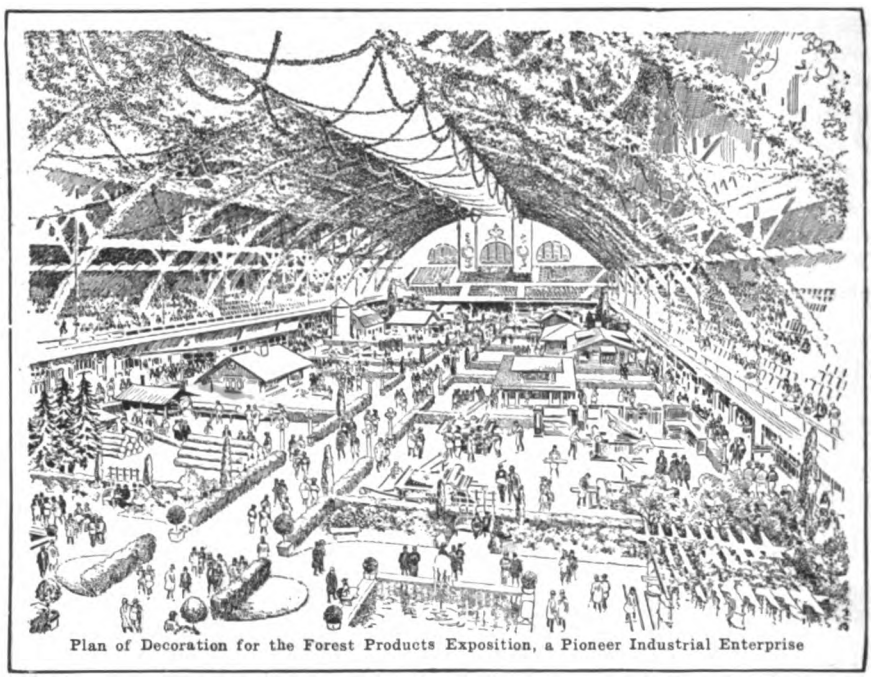
WATER SKATING IN GERMANY

A new sport called "water skating" is coming out in Germany, the skates being of light canvas covered rubber and inflated with air. Propelling is done by pushing on a pedal, which works four "fins" placed underneath, such paddles being designed so as to work only one way. A simple canoe paddle serves for steering, and a soldier even does this with the butt end of his gun. The pictures show what can be done with the new skates, and they are likely to be of great use in the army for crossing streams. The outfit is folded up in small size and carried on the back.

FOREST PRODUCTS EXPOSITION

The Forest Products Exposition, a pioneer industrial enterprise, is shaping itself definitely for successful presentation at the Coliseum in Chicago April 30 to May 9. It will be an impressive demonstration of the wood industry of America, setting forth the utility and wide range of possibilities of wood as a basic material and commodity. The Forest Service of the U. S. Department of Agriculture is assembling an exhibit that will doubtless be the most interesting display of its kind ever given. The woodworking machinery people are polishing up the machines which in their operations will show the last degree of efficiency and mechanical advancement. Both large and small concerns are preparing for an active demonstration of the value and merits of their wares and specialties.

The moving picture exhibit in connection with the exhibition will contain wonderfully accurate views of activities in every branch of the wood industry. The Canadian lumber and wood manufacturing interests are manifesting a keen interest in the coming exposition, and local lumber representatives are making elaborate preparations for the entertainment of visiting hosts.



Plan of Decoration for the Forest Products Exposition, a Pioneer Industrial Enterprise

INTERESTING PAINTS

Paints are serving many useful purposes. For protection, for decoration, for hiding something, for preserving, for decorating, etc. A protective paint is "Efcalin," protective in so far that it announces as soon as a machine or part of it is in danger of becoming too hot. This paint is of a light red color and changes to dark red at about 50° C. to brown red at 70° C., to nearly black at 85° C. Applied to such parts of machinery which are liable to run hot, thereby causing a breakdown or other serious troubles, even fire, it will prove very effective in preventing such costly accidents. The change of the color is so prominent that it will be noticed in time, so that serious damage is avoided. Bearings, generators, motors, etc., are some examples where it might be ap-

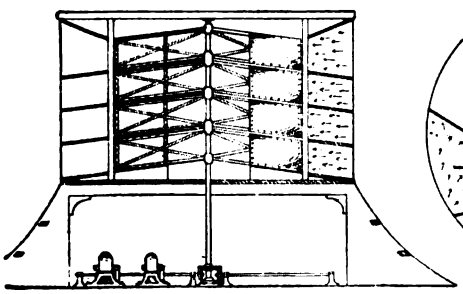
plied to advantage. The most interesting point is, however, that the paint after the part which had become hot is cooled, will regain its original color of light red. On this account it will last practically indefinitely.

Another paint, "Alacorin," also has protective properties, but serving nevertheless an entirely different purpose. It protects against the heat of the sun. It is applied to roofs of workshops, factories, halls, etc., and reflects the heat rays of the sun in such a manner that the rooms covered by those roofs will be kept cooler by about fifteen to 30° F. What this means for the workingman working in factories under glass, slate, corrugated iron, or similar roofs in the hot summer days is clear. The paint is of a light blue color so that, if applied to glass roofs, it will not interfere with the light. It is, of course, especially adapted to glass and metal roofs, on which it is sprayed in a thin layer. It is not necessary to remove it for the winter time.

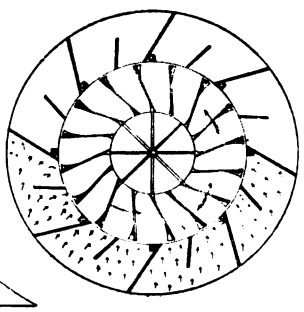
A Turbine Windmill

A new type of windmill based on the principle of a steam turbine, has been designed by Mr. L D. Parker, an architect of Portland, Ore. There is a vertical

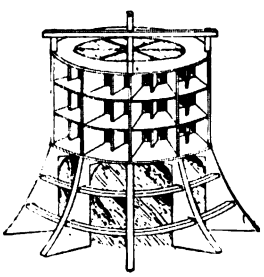
increasing its power. The maximum amount of wind will be made useful by this arrangement, giving not only a high efficiency but also a comparatively large surface ex-



Sectional View



Plan of Wheel and Housing



Perspective View

rotating shaft on which vanes are arranged which will drive the shaft in one direction. The wind is caught by means of specially arranged funnel like entrances, which deflect it in such a way that no matter from which direction it is blowing the rotation of the shaft will remain the same.

The wind entering the funnel entrances and striking the blades will be compressed to a certain extent, thus posed to the action of the wind. The vertical shaft transmits the high power by means of bevel gears to a horizontal shafting, driving dynamos, pumps or other machinery. The housing is constructed of reinforced concrete so that no hurricane is able to wreck it.

The designer has built such a mill on a small scale and found that it works entirely as predicted; larger ones are contemplated.

Broadway and Canal Street as it Looked at the End of the Revolution—the Old Stone Bridge and the Old Stone Tavern

New York's Subway in a Buried Stream Bed

By ARTHUR MILLER

Photographs by the New York Edison Company

Fifty-five feet below street level and 50 feet below water level, under the crossing point of two of New York City's busiest streets, an engineering feat as startling and as difficult in its way as the Panama canal construction is being accomplished. Down underneath the planked street more than 600 horsepower in electric motors are waging a continuous fight against water and quicksand. Twenty million gallons of water are being pumped out of this hole every day. This represents one-fifth of the entire water supply of Manhattan Island; clear sparkling spring water, just as good as New York City is spending millions of dollars to bring all the way from the Catskill Mountains—going to waste.

A hundred years or more ago Manhattan Island was covered with a multitude of ponds, swamps and creeks, which have since vanished as completely as if they had never existed. These primeval streams and water courses have been filled in and their flow checked and diverted. Although not apparent now, they still exist, and but for the armor of masonry, millions of tons, which covers the Island, the old streams and ponds would find their wonted level.

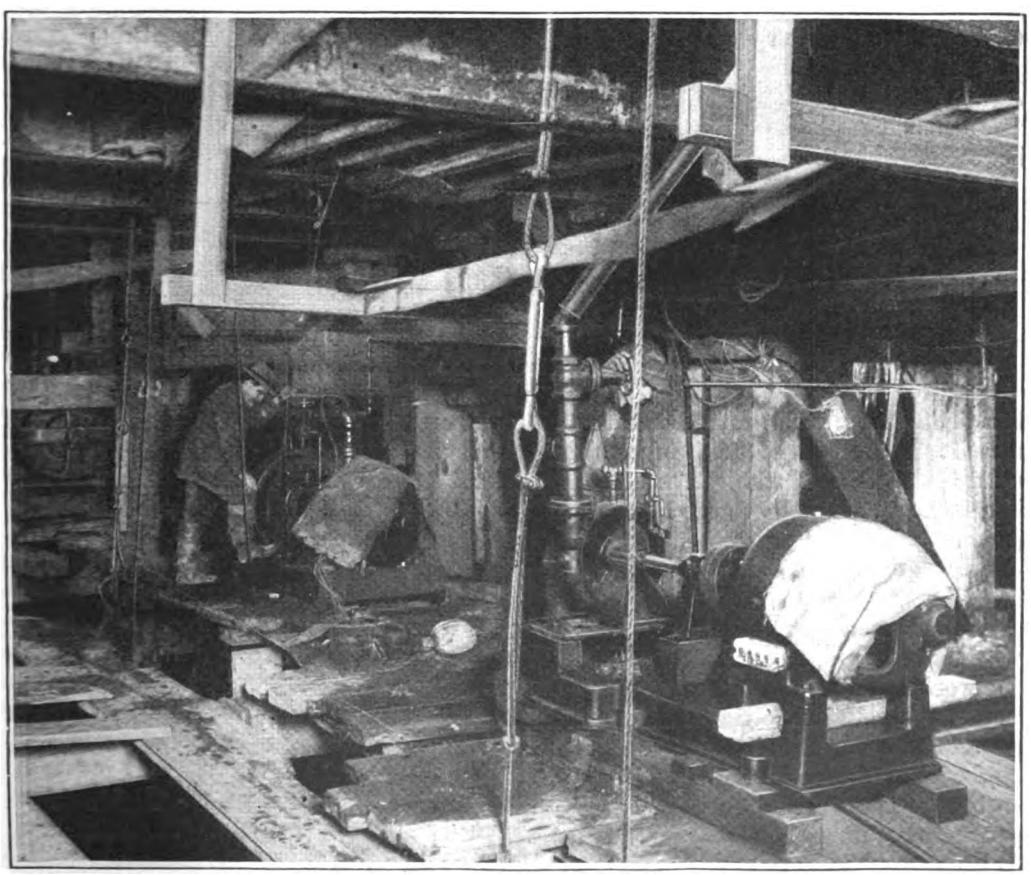
While it has been possible to hold these streams in bondage below the surface, the engineers have been reminded of their existence and felt their force when the necessity came to dig subways. One of the most difficult problems which has confronted the engineers in building the new Broadway subway is the little section, just two blocks long, at Canal street. This is the lowest point on Manhattan Island and lies below water level. Beneath the Broadway subway, cutting it at right angles, and lying full within

the old stream bed, is the route of the Canal Street subway, also now in course of construction.

Engineers knew of the existence of this primeval stream below Canal Street, and for a long time it was difficult to secure bids on this particular section. But the work was finally started in August, 1912, and will be completed three years from that time, at a cost of more than a million dollars. It covers just two short city blocks, from a point a trifle north of Walker Street, crossing Canal Street to a point just north of Howard Street.

Down in the misty light of the hole, as the men call it, the pumps' incessant drone, and the dripping of water mingle with the muffled rumble from the street above. Dark forms move in and out among the shadows of the timbers and around the yellow glow of the incandescents. The pumps are mighty centrifugal mechanisms of the Worthington type and Lawrence type. The motors which drive these pumps range from 25 to 75 horsepower. The pumps count the hours by thousands of gallons of water, until the hours spin into days and weeks and months, with never a pause or a stop, day or night. Perhaps at the end of three months a pump will need to be repacked and is stopped ten minutes for the process; then it whirls on again. Should, by any unfortunate chance, all of these pumps decide to go on strike, the hole would in an hour become an inky, and debris-floating lake.

Directly under the crossing of Canal Street and Broadway there is a clear



Three of the Motors and Pumps that Are Lifting 20,000,000 Gallons of Water a Day Out of the Old Canal

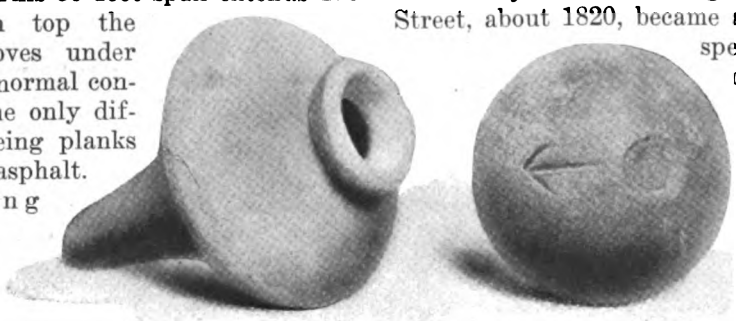
The Shaft in Broadway and Canal Street, Looking North on Broadway

made it possible to get through the quicksands. As the work progressed downward strainers were sunk into the ground. These strainers are large cylinders of perforated iron, being about three feet in diameter and from ten feet to fifteen feet long, open at the top. The object of the strainers is to prevent sand and gravel getting into the pumping lines. In each strainer is suspended the end of a pumping line.

Reverting just a little into the history of this locality, when it was finally filled in and graded, Canal Street, about 1820, became a highly respectable residential thoroughfare; the little canal in the center was crossed at intervals by foot bridges with walks and shade trees on both sides.

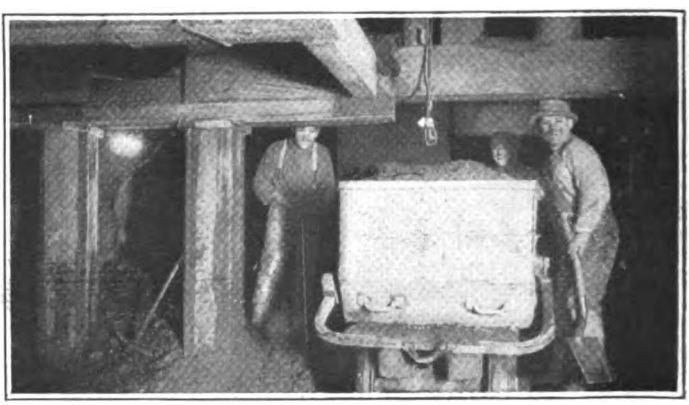
span of 50 feet, bridged over by steel girders. This 50 foot span extends 150 feet. On top the traffic moves under perfectly normal conditions, the only difference being planks instead of asphalt.

Standing beside the motors down underneath the street one can see 40 feet below thousands of gallons of water bubbling up through the gravel and sparkling under the glow of the electric lights.



British Cannon Ball and Old Dutch Ornament Found in the Excavations. The Broad Arrow on the Former Was a British Mark on all Supplies and Ammunition.

As soon as enough headway could be gained after the work was started sand points were sunk into the ground to a depth of 150 feet with strainers at the bottom. These started pumping immediately. This somewhat checked the rushing waters and

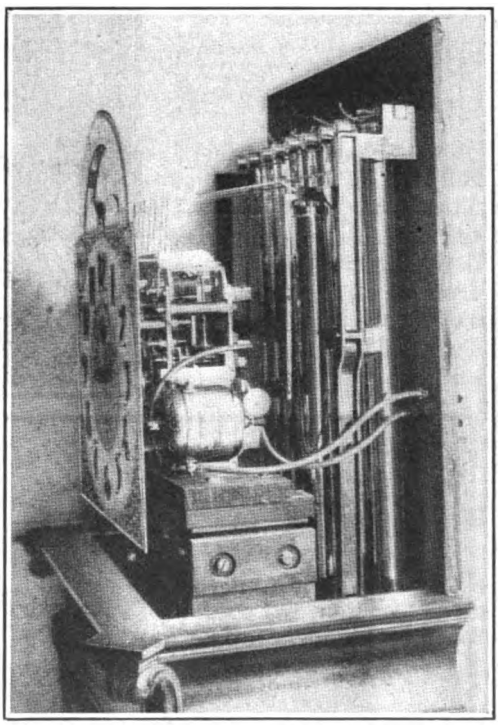


Where Electric Lights Glow 50 Feet Below Water Level

The original stream or water course was maintained for drainage purposes, leading from Center Street to the North River. Haswell, in his "Reminiscences of an Octogenarian," tells how, whenever it became necessary to clean the bottom of the canal, prisoners from Bellevue were employed, the vicious being restricted by an iron ball and chain secured to one or both of their legs. This fact from history accounts for the discovery in the present excavation of a British cannon ball identified as such by the chiseled "broad arrow," the mark used by the British upon their stores and ammunition during the Revolution. Without a doubt this cannon ball dates back to the British occupation of New York, being used 40 or 50 years later to restrain some Bellevue convict from escaping while he was employed in the gang which cleaned out the canal. The proof of the latter assumption is based on the fact that in one side of the cannon ball has been drilled a hole which was obviously for fastening one end of the chain, the other end of which was secured to the prisoner's shackle.

MOTOR WINDS THE HALL CLOCK

It is well known among clockmakers that chime clocks follow a general rule of winding, necessitating the use of three weights, one to drive the time train, weighing approximately twelve pounds, one to drive the hour strike mechanisms, weighing fifteen pounds, and a third attached to the quarter hour stroke train, weighing from 35 to 45 pounds. These weights have heretofore been wound by hand. There is now, however, a new clock, electrically operated, the power required being furnished by a lighting circuit connection with a 1-30 horsepower motor. This motor is geared to the time train by a worm, which train in turn drives the two striking trains, the motor raising the single weight which now does duty for three. It is also found that the utilization of the single weight has greatly lessened the general complication of chime clock mechanism and that the power is equal to, if not greater than, that attained under the old system.



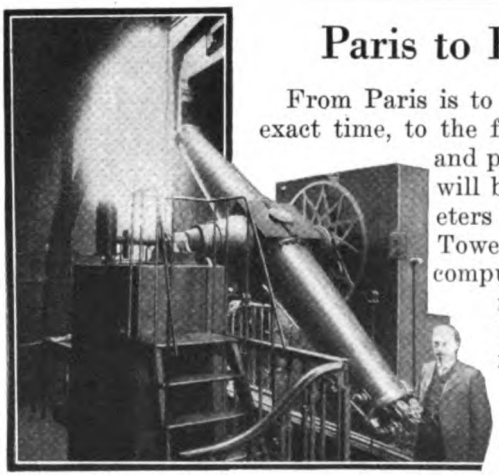
New Clock Electrically Operated, the Power Being Furnished from the Lighting Circuit

All connections to the motor are made in armored conduit. The use of the motor is intermittent in the strictest sense of the word, running but 1 1-2 minutes every 24 hours, the opening and closing of the circuit being accomplished by a switch of the commutator type connected indirectly with the time gears. When the weight is fully wound there is an additional reserve of energy stored sufficient to operate the clock for 24 hours.

Paris to Fix the World's Time

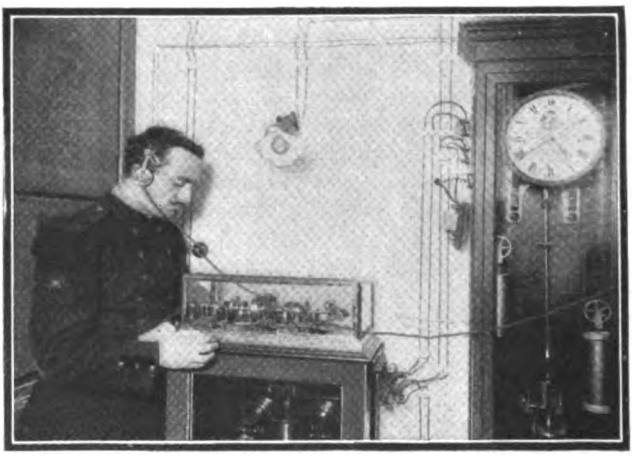
From Paris is to speed, each day, round the world, the exact time, to the fraction of a second. Every telegraph and postoffice and all the navies of the world will be able to set their clocks and chronometers by the signals flashed from the Eiffel Tower by radio-telegraph. The time will be computed, as heretofore, from the Greenwich meridian—such is the decision of the international conference on time signals, which recently sat in Paris.

A commission has been appointed which will have charge of the work of serving the world with time signals.



Mr. Jules Chatelut With His Great Meridian Instrument Which Determines Time With a Micrometer and Automatic Register of a New Type. The Movements of the Stars Are Registered Automatically With the Aid of a Corrected Chronometer. These Movements Permit of Correcting the Length of Swing of the Pendulums of the Clocks

It will be known practically as the International Time Bureau, which will transmit the signal thrice daily by wireless flashes from the radio-telegraph station on the Eiffel Tower. The scientific work will be done by the Paris

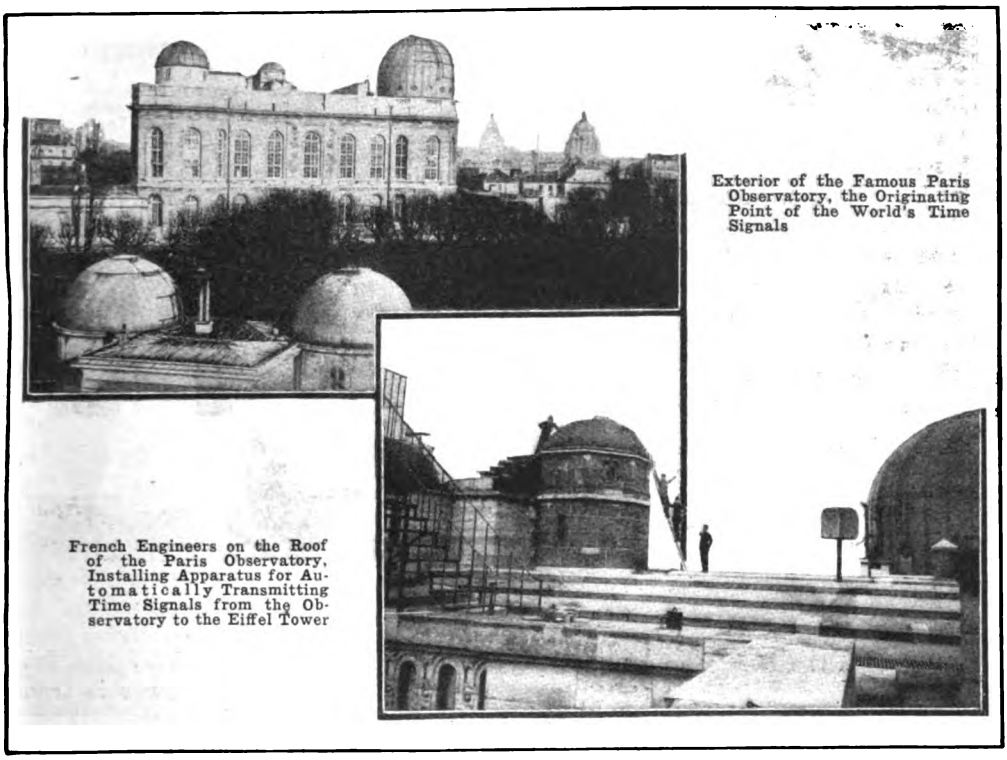


Paris Observatory Official Listener Who Listens to the Movements of the Balances in the Clocks Regulated by the Pendulums After Correct Time Has Been Transmitted

Operator Brilli at the Automatic Apparatus Which Opens and Closes the Signal Circuit

Observatory, which will synchronize the automatic time signalling device in the wireless station at the Eiffel Tower. No hand sending devices will be used, as the sending apparatus will be connected directly with the time clock in the Observatory, especially designed for this work.

Wireless time transmission will prove of great value throughout the civilized world, especially on board ship for charting purposes.



Exterior of the Famous Paris Observatory, the Originating Point of the World's Time Signals

French Engineers on the Roof of the Paris Observatory, Installing Apparatus for Automatically Transmitting Time Signals from the Observatory to the Eiffel Tower

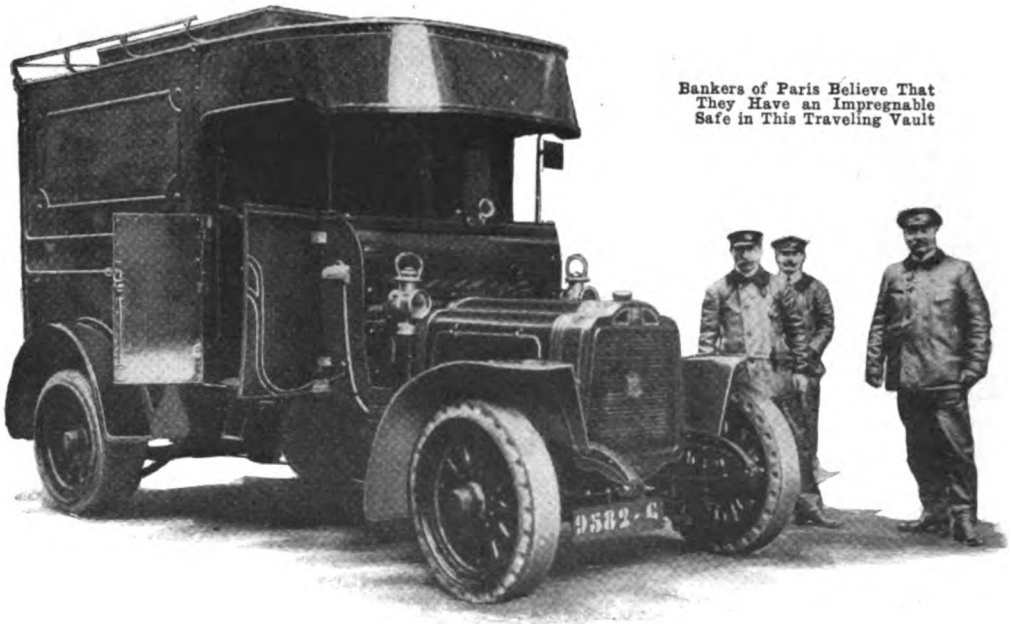
"LOST ARTS"

In an address to the American Chemical Society Dr. W. D. Richardson discussed interestingly the question whether there are, in reality, any "lost arts," such as many authorities have so eloquently written and spoken of. Dr. Richardson's conclusion was that these things should be relegated to "the same mythological museum which holds the lost Atlantis."

The authority quoted sees no great wonder of mechanical skill in the Pyramids of Egypt. The Egyptians had not even developed the movable pulley. They depended simply on man power multiplied many thousand times. Dr. Richardson dismisses the legend that the ancients knew how to harden copper better than modern metallurgists. Their skill in ceramics depended only on the accident of having suitable materials, and not on any forgotten art. The ancient glasses were only translucent and often opaque. Transparent glass, especially in large sheets, is a modern production. Their famous dyes were no better than chemists produce today, and perhaps not so good. In the matter of cement, that which is now made "will probably outlive any similar material which the world has seen."

CURIOUS HEAT TRANSFERENCE

It was through a workman in the Observatory at Toulon that, not so long ago, attention was called to a singular phenomenon. A bar of iron is taken by the end and the other end is plunged into a fire, heating it strongly, but not so much that the hand cannot retain its hold. The heated end is then plunged into a pail of cold water. Immediately the other end becomes so hot that it is impossible to hold it. This phenomenon, familiar to workmen in iron, is ascribed by them to some repellent action they suppose the sudden cold exerts upon the heat contained in the iron.



Bankers of Paris Believe That They Have an Impregnable Safe in This Traveling Vault

A SAFE ON WHEELS

So frequent have been the hold-ups in Paris of bank messengers and bank custodians that the banking firms have adopted this veritable safe on wheels as an extra precaution against hold-ups in future. The entire car is closed with the single exception of the driver's seat.

The traveling vault is mounted on a high powered truck and bankers believe that they have now an impregnable safe which may be sent safely through the streets.

AUTOMOBILE DUST

It has been usual to explain the dust raising properties of automobiles as due to "suction" by the tires. Further study of the problem by some authorities seems to show that there is no such suction, but that the dust and fine particles from the road are thrown up by a combined flicking and kicking action of the tires.

The flick arises from the rapid recovery of form by the tire as it is released from pressure at the bearing point, and the kick is imparted by the driving wheels when more power is transmitted through them than the adhesion between tire and road warrants. The eddying currents in the wake of the flying car serve to whirl the loosened dust high in the air.

AEROPLANE VAN

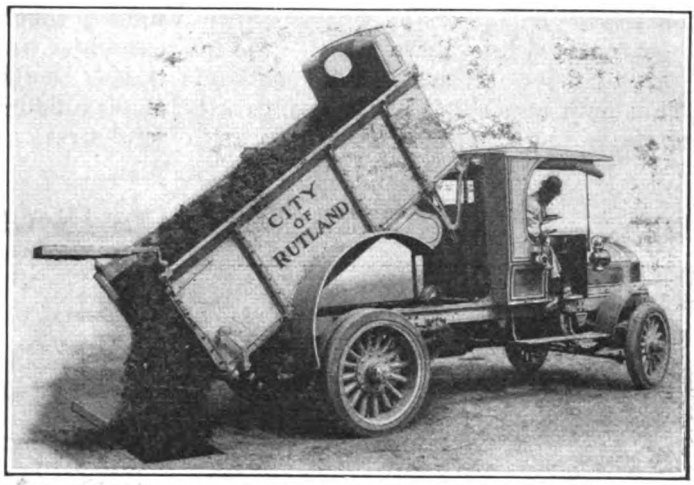
One of the features at the recent Aero Show in Paris was the French army aeroplane outfit consisting of a power car drawing as a trailer an aeroplane

Power Car Drawing an Aeroplane Van

van for the flying machine. In the field, this would be accompanied by another power car drawing a trailer containing a complete repair shop.

AUTOMATIC DUMP TRUCK

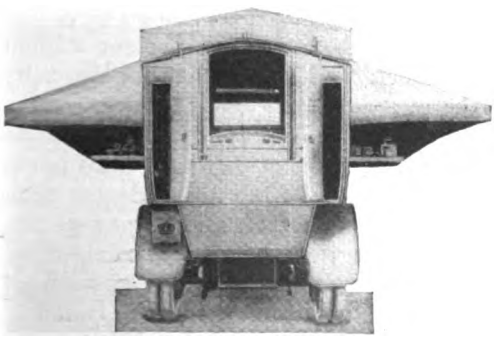
The power dump truck, on which the body of the truck is raised by a shaft geared to the main engine drive, is one of the greatest labor and time saving devices used in connection with motor truck work. A 7½ ton automatic dump truck owned by the city of Rutland, Vt., has, according to Mayor Percival W. Clement, moved 114 tons of crushed stone per day at a total cost of $5.00, replacing twelve teams, which cost $4.00 per day each, a saving to the city of $43.00 over horse equipment, quite a significant amount.



This Automatic Dump Truck Saves the City of Rutland, Vt., $43.00 per Day Over Horse Equipment

KAISER DESIGNS A MOTOR KITCHEN

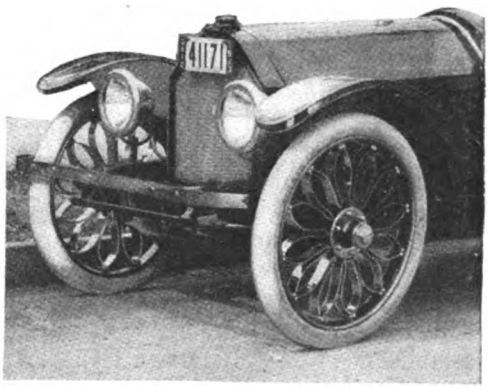
An automobile kitchen has been designed by the Emperor of Germany for use in his army. The interior of the machine is completely equipped with electric cooking utensils and appliances which have the great advantage of being safe and convenient. On the sides of this unique machine are folding counters from which food is distributed to the soldiers and over the counters are awnings.



Portable Motor Kitchen Which Uses Electric Cooking Utensils to Great Advantage

SPRING SPOKE AUTO WHEEL

An automobile wheel which will not need an air filled tire is sought; in technical language, a resilient wheel.



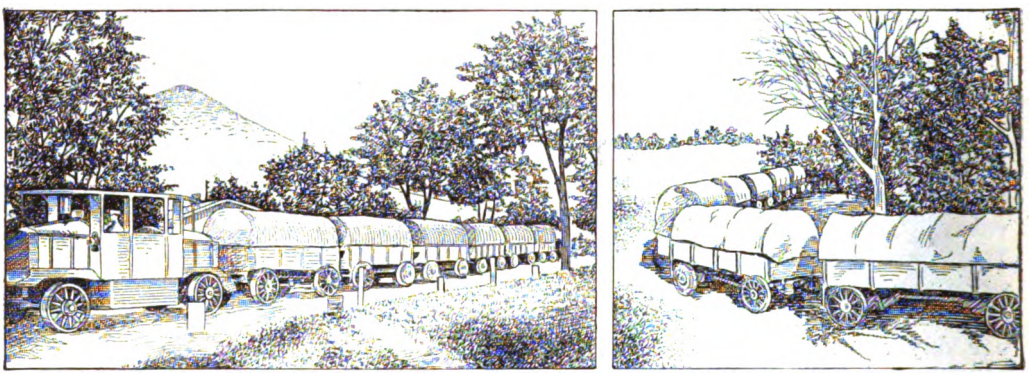
Resilient Wheel Affording Complete Comfort with Solid Tires

The Ideal steel wheel claims the distinction of having met this requirement so completely that it affords the same comfort when used with a solid tire that is obtained from inflated tires.

The illustration shows the general plan of the wheel—a number of flat spring spokes symmetrically arranged around the wheel between the hub and the rim. Each spring is curved and the springs are set in pairs with the concave faces toward each other. With the weight upon the axle, the springs

on the lower side of the wheel tend to bow apart while those on the upper part of the wheel are drawn together. Thus both upper and lower springs assist in taking from the axle and car any sudden roughness that the wheel may encounter in the road. While the illustration shows the wheel equipped with an air inflated tire tests were made with solid tires.

MOTOR ROAD TRAINS IN GERMANY



Motor Truck Transportation in Germany Promises to Replace Short Railroad Lines

In Germany there are numerous short lines of railroad that require more capital in proportion to their receipts than the longer lines. In general they pay from two per cent up and manage to pay their running expenses, but there are some that do not pay expenses and are constantly demanding more capital. As the government is expected to furnish this capital, the question has become a burning one in the Kaiser's realm. Out of it has grown renewed activity for the establishment of motor truck transportation to replace short railroad lines, either electric or gasoline, with the odds in favor of the electric, or the combination of electric and gasoline.

But in solving the question the use of trailer wagons must be considered. The trailers are connected with the motor and may consist of several, as was demonstrated in the practical experiment made by Chief Engineer W. A. Th. Muller, of the railroad department, which is represented in the drawing herewith.

It was discovered that there is no difficulty in making a curve with a train of numerous trailers and that every individual wagon would follow its leader and that all of them move in the general direction of the motor containing the power. In this way it was easy to haul 36 tons of freight distributed among six trailers. On smooth street haulage the capacity reaches 55 tons.

It has been found by actual experience that the ordinary motor truck was too cumbersome for light freight or passenger traffic and the new motors have been considerably reduced in weight without interfering with their hauling capacity, the question being one of power.

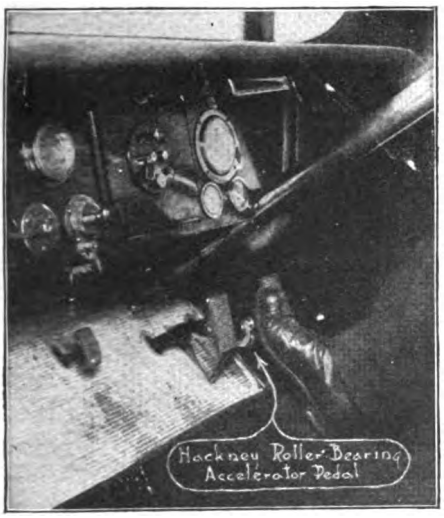
This method of transportation promises to spread everywhere throughout Germany, where the railroads are under government control, and it may be that the new system of motor truck transportation will come under government control as being for the public benefit.

The ideal store window first attracts the attention of passers-by and then holds it. At night both objects are attained by the efficiency of the illumination.

ROLLER-BEARING ACCELERATOR PEDAL

Leslie S. Hackney, an inventor of St. Paul, Minn., has perfected a simple roller-bearing accelerator which is one of the important inventions of the year to motorists.

Attached to the foot pedal of any car, regardless of make, the accelerator is designed to give a perfectly even flow

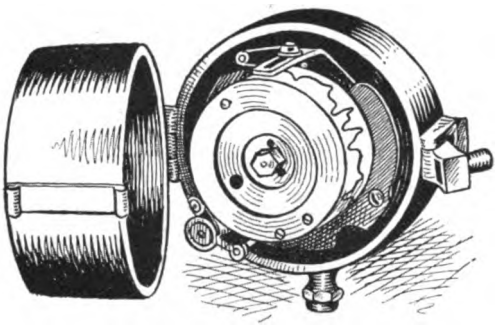


Eliminates the Necessity for the Hand Throttle

of gasolene and practically eliminate the necessity for the hand throttle. It gives the driver more complete control, enabling him to increase or decrease his speed more quickly and more gradually.

THE RECORDOGRAF

The Recordograf, a tape recorder, is an instrument which can be attached to any vehicle, motor driven or horse drawn, and accurately records on a tape: The time of starting the day's work; the time of its finish; the distance covered during the day and between any given periods; every stop made during the day, the time each stop was made and its duration; the various speeds attained, and the speed at which the vehicle was going at any moment.

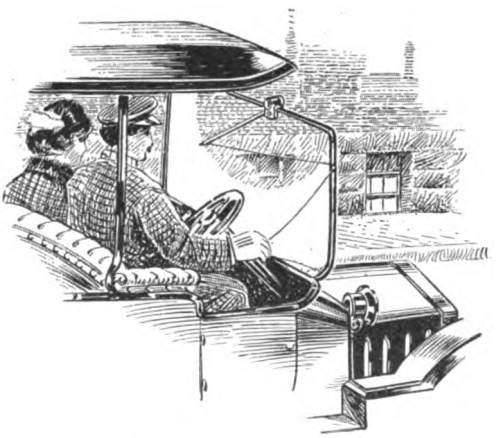


A Remarkable Little Tape Recorder

When vehicles are equipped with these wonderful instruments, their owner can be as certain of their movements as though he had driven the vehicle himself. The registration being mechanical is positive and therefore cannot err.

WIND SHIELD CLEANER

A stormy weather convenience—the Gabriel cleaner—is fastened to the upper edge of the wind shield frame and its arm is drawn by a cord over the glass.

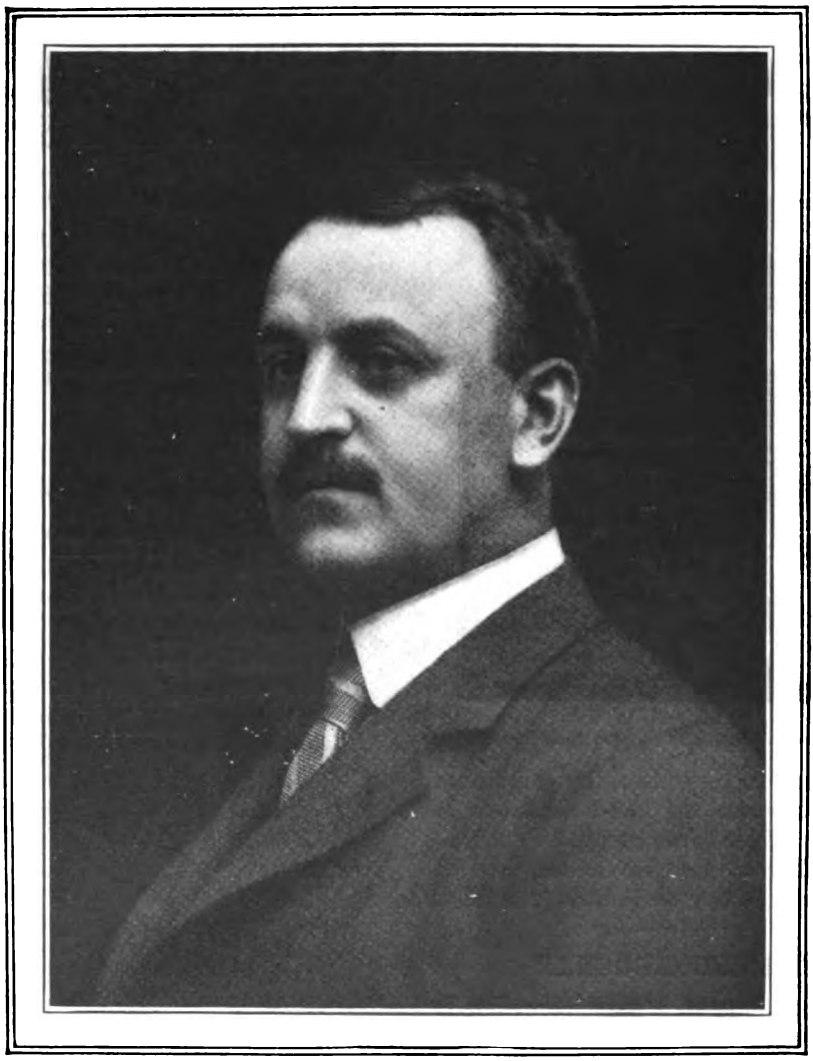


Wind Shield Cleaner

This movement removes rain, mist or snow from a half circular space on the glass directly in front of the driver. The arm then returns by spring tension to a position along the upper section of the frame and remains there out of the line of sight.

Electrical Men of the Times

THOMAS EUGENE MITTEN



The telegrapher's key has again and again asserted its magic influence as a stepping stone to success in the railroad world and while authoritatively it is stated that 90 per cent of the officials of the railroad today began as "knights of the key," the story of a man who rose from telegrapher to electric traction expert is doubly interesting. Born in Brighton, Sussex, England, 49 years ago, while still a boy he came to this country with his parents and at nineteen years of age found leisure between the joint jobs of acting as station agent and telegraph operator at the little town of Wyndham, Ind., to listen to the ticking of the ever present railroad station clock and to formulate

some plans to be attempted when opportunity should offer.

The next 20 years found Thomas Eugene Mitten slowly but surely forging ahead as he went from one position to another on different railroads until in 1890 he became general superintendent of the Denver, Lakewood and Golden.

At that time the electric railway was in its infancy and it offered a big field with problems that men like Mitten foresee and delight in not only tackling but solving. In 1893, therefore, we find Mr. Mitten assistant superintendent of the street railway system of Milwaukee for a short time and then general superintendent, in which position his tact and executive ability were displayed in bringing a strike upon the system to successful arbitration and in placing the system on a profitable operating basis.

A short time previous to the Pan-American Exposition at Buffalo he was made general superintendent of the International Railway Company and here again Mr. Mitten demonstrated his resourcefulness in handling the great crowd of visitors and as a recognition of his success he was appointed general manager.

In 1905 he was called to Chicago to become president of the Chicago City Railway Company. Buffalo interests were so loath to part with his services entirely that he was elected vice president of the Buffalo system that he might still direct its business policies.

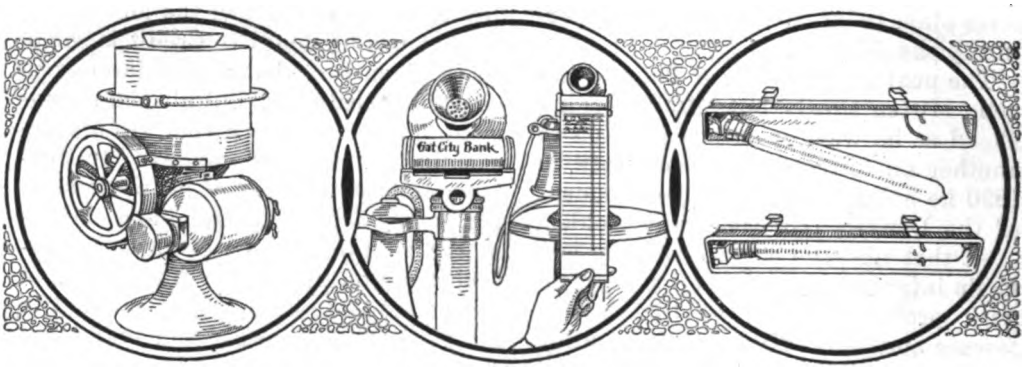
After the work of rehabilitation had been completed for the Chicago City Railway Company and notwithstanding efforts to retain him, he resigned in 1911 and was elected to the chairmanship of the executive committee of the Philadelphia Rapid Transit Company, his efforts now being devoted to these interests and to the Buffalo company, though interspersed with duties as a director and officer in other important corporations.

In the last analysis men's measure of any man is contained in the answer to: "What has he done?" Credit is sometimes given for what a man intends to do or has tried to do, but ultimate judgment hinges on the actual results accomplished. By this standard Mr. Mitten stands at the head of his profession, for he has achieved unqualified success in the administrations of three important traction systems. Entrenched in the belief that the public is entitled to good street railway service, that labor should be properly recompensed and that the owners of the road are entitled to the integrity of their investment and a reasonable return on the capital, free from political harassment and chicanery, he has so managed the properties in his care as to earn the respect, good will and co-operation of all interests concerned, including the public, the city authorities, employes and security holders.

TOOTHLESS SAWS

The employment of high speed revolving disks of mild steel for cutting hard steel is common enough, but the process always excites the wonder of the layman.

The disks are preferably made of boiler plate quality and are about a quarter of an inch thick. They revolve with a peripheral speed of as much as 20,000 feet a minute. One of these disks will cut through a heavy channel section of hard steel, 12 by 6¾ inches, in fifteen seconds. It appears to act by local fusion. The very high speed causes thousands of inches of surface to impinge in rapid succession on the metal undercut, so that its temperature at the point of contact becomes very high, although the disk, owing to its large surface area, remains relatively cool. All its frictional energy is concentrated on an extremely small area of contact. The work is done so quickly that the heat has no time to spread in the metal undercut, and the sides of the cut portion are only a little warmed.



Paring Machine With Friction Disk | Convenient Device for Telephone | Mazda Tubular Lamp

NEW WAYS OF USING ELECTRICITY

VEGETABLE PARING MACHINE

The American paring machine removes by friction the outer skin of potatoes, turnips, carrots, parsnips, etc., and turns them out perfectly peeled, smooth and clean and ready for use.

The machine is built in accordance with U. S. Navy specifications and is driven by an enclosed water-tight motor rated at one horsepower. It is adapted for hotels, hospitals, sanitariums and shipboard use. Forty pounds of potatoes can be placed at one time in the hopper. The height of the machine is 49 inches and it requires very little floor space, the base being nineteen inches in diameter.

To operate, start the motor, turn on the water, empty into the cylinder sufficient potatoes (not washed or assorted) to almost fill it up.

The friction disk will cause the contents to form a rotary motion and come in contact with the diverter fastened to the cylinder, which will immediately cause the return of the potatoes to the center of the disk, from where they are again taken to the side of the cylinder, and so the movement repeats itself. By gentle friction and rubbing contact with the disk the outer skins only are being removed without tearing, pounding or bruising the vegetable in any way. Water is constantly sprayed over them, which thoroughly washes and cleanses them and also carries off the parings, dirt, etc., through the waste outlet.

When the vegetables are sufficiently pared, open the door without stopping the machine and it will empty the vegetables into the receptacle placed to catch them.

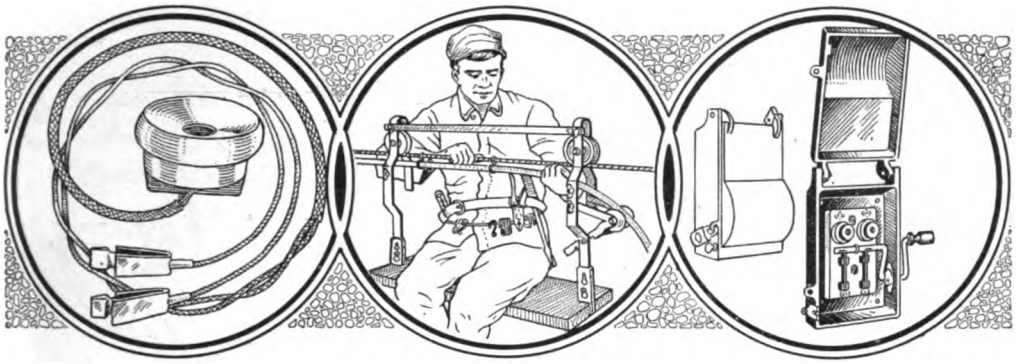
TELEPHONE LIST ON MINIATURE CURTAIN

A convenient device for listing names and numbers most frequently called on the telephone is a cloth curtain which like a wall map is enclosed in a case when not in use. The curtain is rolled up on a spring roller like a window shade and is attachable to any telephone by merely removing and replacing the mouthpiece.

FOR LIGHTING THE SHOW CASE

It is authoritatively stated that in the past three years department and dry goods stores have increased by three times the use of show case lighting.

A recently designed show case unit employs a Mazda tubular lamp one inch in diameter and twelve inches long. The lamp is made in two wattages—25 and 40. The reflector is of brass with an aluminum interior finish and is



Pocket Testing Phone

Car Permits Wireman to Easily Repair Aerial Cables

Ironclad Entrance Switch

shaped to fit the upper front part of the show case. The unit is installed by raising the glass top of the show case and supporting the reflector from the upper edge of the front glass by two brass brackets and then lowering the top.

POCKET TESTING 'PHONE

The pocket 'phone is designed principally for the use of troublemen and installers of common battery plants. It is said to be a good transmitter, when used as a transmitter, and a perfect receiver, when used as a receiver. It is constructed to talk over long distance with as much volume as any transmitter and it is said to receive equally well. It may be carried in the pocket.

As a test receiver on a common battery, it is a complete telephone minus a bell. It is much easier to carry than a combination set and is declared to be less liable to breakage because it goes into a man's pocket and does not have to be carried partially exposed, or on a strap, where it is likely to swing against a pole or fall and break. Cords and clips are furnished with the pocket phone.

IRON CLAD FUSED SWITCH

The application of the conduit principle to include the switch and cut-out is made in the construction of the Detroit ironclad entrance switch.

The switch and its fuses are enclosed in a cast iron box and the cover is locked by a padlock through lugs on the lower edge of the box.

The switch is operated from the outside of the box by a detachable handle which indicates the position of the interior mechanism when it is placed on the operating shaft.

By an ingenious spring device these switches are made with a positive make, quick break action. This device automatically opens the circuit if good contact is not made when the switch is thrown "on." There is no possibility of the switch opening accidentally, however, when good contact is made.

The switches are made for either open link or Edison plug fuses.

CAR FOR HANGING AERIAL CABLES

The Aero car permits the wireman to sit comfortably at his work while hanging or repairing aerial lead cables.

The car is fitted with two corrugated wheels so that it may be moved along the messenger wire over cable hooks or hangers. It is of steel, except the seat and pick up roller, which are of wood. The weight is only twenty pounds. A brace bar across the back of the car is adjustable to suit the workman and the seat may also be suspended closer to or further from the messenger wire. The pick up attachment makes it easy for the workman to attach the hooks much faster than when obliged to hold the

Eliminates the Dazzle of a Strong Light

Automatic Electric Cooker

Facilitates the Cleaning of Bowl and Lamp

cable. One man, placing the car and tools on a motorcycle, can go miles into the country to repair a cable, which otherwise would necessitate two men and a wagon.

ADJUSTABLE AUTO LIGHT

The Nodaz headlight for automobiles eliminates the dazzle of a strong light and was invented to satisfy the conflicting demands of the motor car driver and the city authorities. By pressing a button two pairs of translucent shutters close over the light in the reflector, but let through a strong mellow light. When required, as in the country, by pressing the button again, the full concentrated beam of the headlight is released.

COOK THE ELECTRICAL WAY

The housewife can place in the oven of the Denver electric cooker what she wishes prepared for dinner, such as a roast, vegetables, a pudding or baked apples, all in separate closed vessels in the one oven, the odor of one never contaminating the others. She then sets the clock for the time she wishes the electric current off, and goes out, assured that at the time set the current will be automatically shut off, thus saving her dinner from burning, the heat thus generated and retained in the oven keeping the dinner warm until she returns home several hours later.

The body of the cooker is made of seasoned hard wood, built in cabinet style and trimmed with nickel plated hardware. The oven is of aluminum, which does not tarnish and is easily kept clean. The outer lining of the oven is sheet iron. Between the two linings is packed a substance which is a non-conductor of heat or cold, thus making it possible to retain the heat in the oven for hours. Within the cooker and at one end is placed an incandescent lamp, indicating whether the power is off or on. In the oven are two heat units, the lower one being stationary, while the upper unit is adjustable and can be used for frying, toasting or preparing a light meal.

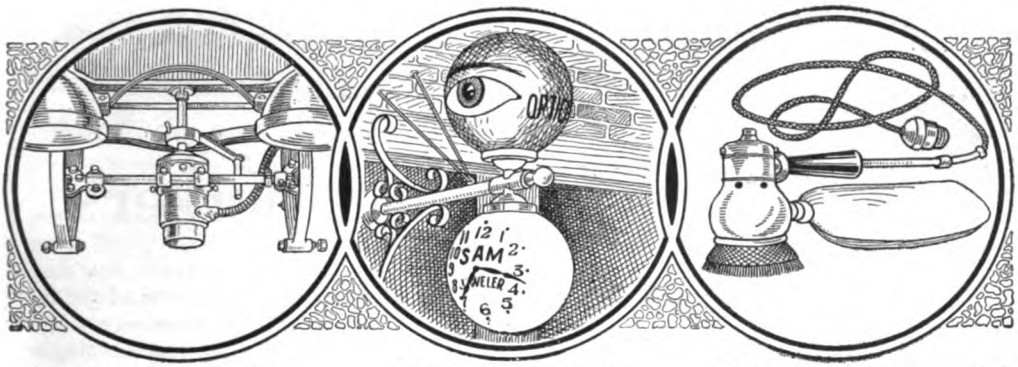
The oven is made large enough to do cooking for an ordinary family. Mounted upon ball bearing rollers, the cooker can be placed or moved anywhere.

DESIGNED FOR CONVENIENCE IN CLEANING

The bowl of the Multi-Lux fixture for indirect lighting is arranged to facilitate the cleaning of the bowl and lamp.

To the socket cover are attached brass plated steel suspension rods for the bowl. By detaching the rods the bowl can be easily swung on the other one or two and in this position it can be cleaned without danger of being dropped.

Another convenience is provided in a spring cap which snaps on or off and catches the dirt which may collect at the bottom of the bowl.



Electric Starter Designed for Attachment to Any Automobile

New Electric Flashing Sign

Hand Vacuum Cleaner that is Light and Compact

ELECTRIC STARTER FOR ANY CAR

Someone has called the Ide starter for an automobile an "electro-mechanical man." Anyway, it cranks an engine just as one would by hand, only faster. It pushes in the starting crank, spins the engine and kicks out just as the hand crank does.

This starter is designed for attachment to any automobile. It has a type of universal fixture for clamping it to the car frame in front of the radiator and uses the regular form of starting crank and clutch. Its position is in front of the radiator and the wires from the storage battery are brought to the motor through flexible metal tubing.

Another very important feature is offered with the starter. If by mischance one neglects the battery until it is discharged too far to crank the car, simply unscrew the little hand wheel on the left hand side of the car, swing the starter out and crank by hand, then swing the starter back in place again.

JEWELER AND OPTICIAN'S SIGN

A new electric flashing sign for the jeweler and optician embodies two large round globes, eighteen inches in diameter, made of extra heavy glass and able to withstand ordinary abuse. The lamps in the clock globe, which is made of opaque glass, burn steadily, illuminating the entire store front. The eye globe is flesh colored and has two colored eyes on the inside, crystal glass on the outside and can be cleaned without fear of affecting the interior. The light within flashes on and off automatically, giving the appearance of a winking eye.

The sign is furnished complete, as shown, but not lettered, with a steel bracket supporting the globes 30 inches from the building, two galvanized chains, screws, bolts, etc., ready to hang.

HAND VACUUM CLEANER

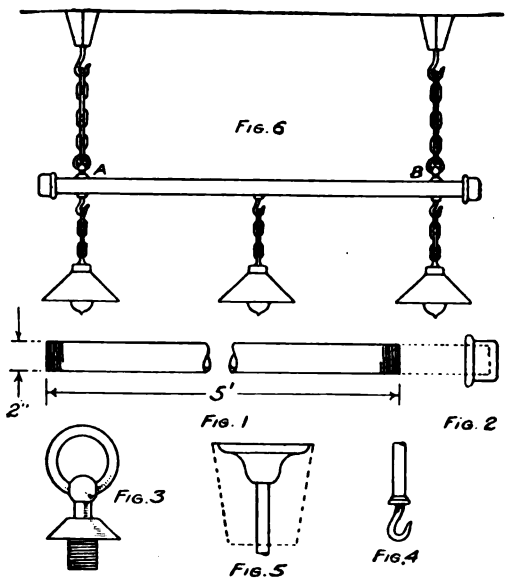
An electric vacuum cleaner so compact and light that it can be readily manipulated with one hand is offered in the Dumore cleaner. Reference to the illustration shows the position of the dust-proof bag, which is not so large as to be cumbersome. The cleaner is of special use in caring for the upholstery in electric vehicles and also finds wide application in hotels, barber shops, Pullman cars, etc.

An unusual application of the cleaner is in grooming horses and cattle, a curry comb or brush attachment being provided, the dust, dirt and dandruff being sucked into the bag to be carried from the stable.

Although wireless apparatus was not fully developed until 1909, it is estimated that over 5,000 lives have been saved by its use.

ODD THREE LIGHT FIXTURE.

Being called upon to design an electrolier that would offer a good appearance and be cheap, to furnish light for pool tables, bowling alleys, etc., I procured a piece of old iron pipe two inches in diameter and five feet long, Fig. 1, and cut threads on both ends to screw on a cap,

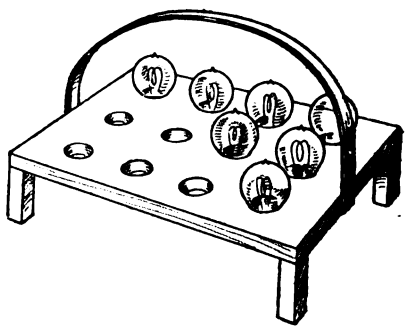


Light Fixture from Chain and Pipe

Fig. 2, then cut two holes in the pipe to receive two plugs with a ring in them, Fig. 3, to which was attached a piece of common trace chain. Two hooks, Fig. 4, were screwed into short ⅜ nipples. A hole was drilled for the wire to pass into the large pipe at each of the points (A) and (B). The ⅜ nipple was screwed into the crowfoot, Fig. 5, on the ceiling. If the two hangers are so spaced that they come under the floor timbers, use lag screws for hooks. The trace chains were about eighteen inches long. The canopies were made out of sheet iron such as stove pipes are made of. Three holes on the under side of the pipe were next tapped out for three screw hooks to support the sockets. The lower chains are smaller and at the end is a ⅜ nipple, which is screwed into the socket. Fig. 6 gives an idea of how the electrolier looks when completed. This makes not only an odd fixture, but is cheap. Give the pipe two or three coats of air drying black Japan.—GEORGE MACLEAN.

CARRIER FOR INCANDESCENT LAMPS

A very simple and practical device for the carrying of incandescent lamps can be constructed as described. Such a device will save many broken lamps. First secure a piece of soft board 24 by 12 inches. Bore a number of 1½ inch holes in it to suit the number of lamps you wish to carry. The lamps are inserted base downward in the holes. Nail a small strip of wood three inches long under each corner of the board. This keeps the lamps in position when the carrier rests on anything. A handle is made to carry it



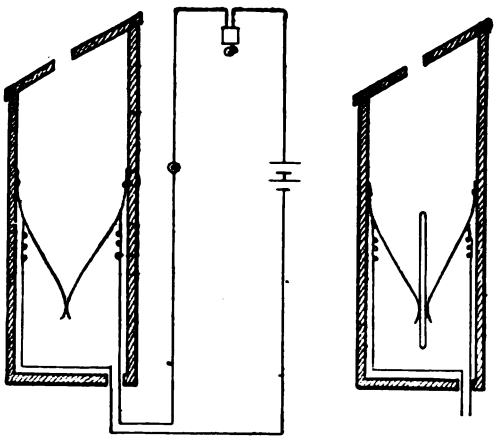
Lamp Carrier

around by bending a strip of sheet iron in the shape of a semicircle and fastening it to the board over the top.—STANLEY RADCLIFFE.

Ground wires for metal mouldings must be of copper at least No. 10 B. and S. gauge.

SIMPLE LETTER BOX ALARM

Various schemes have been devised for an electric letter box with alarm to show when letters are placed in it. One of the simplest is the following and by its use one is able to see without opening it whether any letters have been dropped into the box. Fix two metal spring plates inside the box so as to keep them slightly in contact at the lower ends and connect them up with two cells of battery, a button and an electric bell. Pressing the button at any time, the bell will ring should the letter box be empty, but is silent



Arrangement of Letter Box Alarm

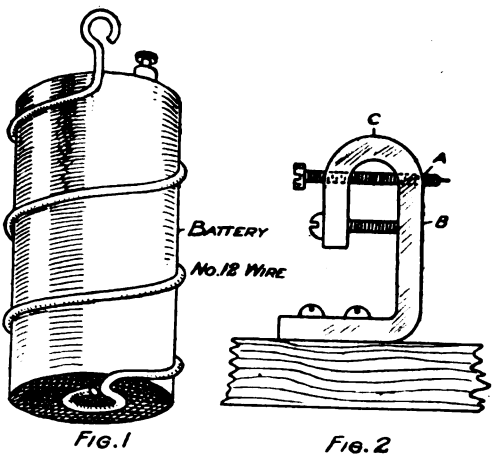
in case mail forces the plates out of contact. Such plates may be of thin sheet spring brass. In a metallic letter box, wood or cardboard may be used to insulate the plates from the metal.

KINKS FOR THE EXPERIMENTER

The following suggestions, culled from experience, may prove useful to experimenters.

It is often desirable to locate a dry cell where no shelf is available. By bending a length of No. 12 galvanized iron wire, as shown in Fig. 1, a most substantial and easily supported hanger may be constructed.

In the construction of homemade spark coils, bells, etc., difficulty is often experienced in securing a vibrator that is easily adjusted and at the same time capable of retaining its position when once regulated. The illustration, Fig. 2, shows a post of simple design that will accomplish this and which costs practically nothing. (C) is a heavy ½ inch piece of strip brass bent as shown and threaded at (A) and (B) for 8-32 machine screws, which can be obtained from an old dry cell. When the vi-



Battery Holder—Vibrator Adjustment

brator is once regulated, two turns of the set screw will render the adjustment permanent.

RINGING ELECTRIC BELLS WITH CLOCK

The clock that is to control a system of bells to be rung at regular intervals, as in a school, may be any kind that has an escapement wheel that rotates about once in a minute. An eight day clock with a half-second pendulum is to be

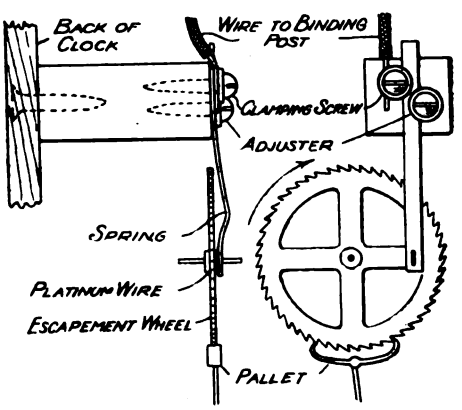


Fig. 1. Contact on Clock Escapement

preferred. A piece of platinum wire from an old electric light bulb can be used to make a contact point on the escapement wheel. This wire can be wound around the end of a spoke of the wheel, or around the rim between two teeth, if the pall of the escapement will have

enough clearance from the wire. The platinum should project about 1/32 of an inch from the side of the wheel.

A block of wood about one inch square should be cut long enough so that when fastened to the back of the clock the end will be even with the escapement, as shown in Fig. 1. A piece of watch spring about ⅛ of an inch wide or less and about two inches long should be bent as shown. The contact end should be ground smooth and bright so that a good connection will be made and so as not to wear away the platinum point. The spring should be clamped to the block by a screw and washer. A wire should be run from this screw to a binding post on the back or top of the clock. Another screw and washer is used for adjusting the spring so that it will just barely touch the wheel point. Too much tension on the spring will stop the clock. A small piece of wire or a pin fastened under the spring near the edge of the block will cause the tip of the spring to be thrown away from the wheel when the screw is forced in, as may be seen from the sketch. If this contact is properly made and adjusted, there will be little need of any further attention to this part.

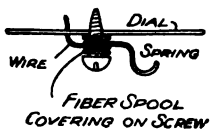


Fig. 2. Contact for Dial

The contacts on the dial of the clock should be made of short pieces of wide clock spring with edges and face ground smooth and bright. These should be fastened to the dial, but insulated from it, Fig. 2, by the use of screws and pieces of mica or fiber. These contacts should be connected together on the back of the dial by insulated wire, and connected to a second binding post on the top or back of the clock. The dial should be insulated from the mechanism so that a person could not be shocked when winding the clock.

The tip of the minute hand should be notched on both sides so that a small piece of platinum or silver wire will be held securely when twisted around it. The end of the hand should be bent so that this tip will rub lightly on the dial and will make contact with the springs without touching the hour hand. These pieces of spring should be just long enough to allow the minute hand to pass over them in one minute, or, if it may be desirable to ring two bells at one minute intervals, these springs should be somewhat longer. The escapement wheel should complete the circuit while the minute hand is on the spring, but the circuit will be broken before the wheel makes another revolution.

The clock is connected to the electric lighting circuit in series with three carbon filament lamps and a switch, as shown in Fig. 3. Of course, all wires in this circuit should be well insulated so as to conform with the requirements of the electrical inspectors.

Small buzzers are much better than bells and are cheaper. If they are fastened to the door casing they will give a signal loud enough to be easily heard in any part of a large room.

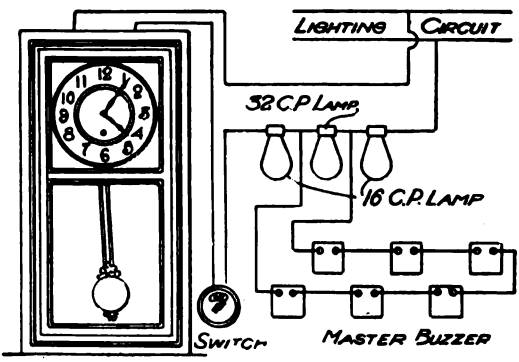


Fig. 3. Connection Diagram

These buzzers must be placed in series with each other, but the contacts in all the buzzers except one should be short circuited and the armature adjusted to vibrate in unison with this master vibrator when direct current is used. If the lighting circuit is alternating current, all contacts should be short circuited.

The buzzer circuit should be connected to the terminals of the middle lamp. If these wires should accidentally become grounded on the lighting line there would always be one lamp in the circuit, so that no serious damage could result. One 50 watt carbon lamp on each side and an 80 watt lamp between them will give sufficient current to operate ten or twelve buzzers.

The writer has had a system of this kind in operation for the last six months and has not had a "case of trouble" from any source. —L. A. Barrack.

Except in the case of stage pocket and border circuits the same conduit should not contain more than four two wire, or three three wire circuits of the same system, unless by special permission, and should never contain circuits of different systems.

A Gasoline Engine Talk

By FRANK H. TESKEY

While this article may slightly interest, it will not particularly benefit the man who owns a motor car or boat and is fortunate enough to have some one to "look after" it. But the man who owns—or contemplates owning—a gasoline engine and is under the necessity of operating it himself, should be able to obtain enough useful information to repay him amply for the time spent in the perusal of this brief sketch, the author of which has been a "trouble man" for a number of years.

By "gasoline engine" is meant anything which consumes gasoline in the production of power. No matter whether it is a "six-sixty" in an automobile or a "one-one" in a canoe, the principle is the same with a few minor variations.

So many people whose occupations do not require that they be of a mechanical turn, use the gasoline engine in one form or another for business or pleasure, that it is scarcely to be wondered at that some of them have trouble. No doubt on more than one occasion when this much maligned source of power has been under discussion, the reader has heard some one exclaim: "I wouldn't ride a hundred yards in a gasoline launch." This person has probably been obliged to row home at some time or other and will remain sore to the end of his days. Yet I venture to say that if there were as many amateurs operating steam engines there would be nearly —if not quite—as much trouble.

The gasoline engine may be divided into two classes—the two cycle and the four cycle. These in turn may be again divided into those using the jump spark and those using the make-and-break or touch system of ignition.

The four cycle engine is built with one, two, four and six cylinders, while the two cycle is built with one, two and three cylinders. The chief point of difference is that while an explosion occurs in each cylinder of the two cycle every revolution, the four cycle receives only one explosion per cylinder every second revolution.

In the automobile, stationary and portable types, the four cycle is used almost exclusively. In the marine branch the two classes seem to be pretty evenly divided, particularly in the smaller sizes up to, say, ten or twelve horsepower. This gain on the part of the two cycle machine seems due to two reasons: Having no valves or gears the two cycle costs a trifle less, and owing to the same reason, appears to the uninitiated to be easier to operate. In reality the one type is no more difficult to operate than the other.

The second, and perhaps more important reason, lies in the mistaken idea that the two

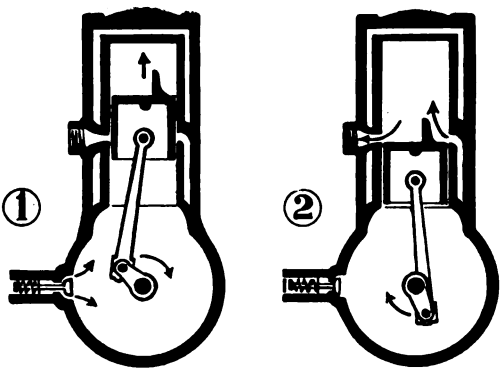


Fig. 1. Operation of Two Cycle Engine

cycle engine—having twice the number of explosions—will have double the power, the size of the cylinders being equal. While it may develop more power, this is effectually offset by the extravagant and wasteful manner in which it consumes fuel. To prove this it is only necessary to study the working principles of the two engines. The carburetor, which distributes gasoline and air in the correct proportions, connects with the base in the two cycle engine, Fig. 1. The intake and exhaust ports are situated opposite each other and just above the piston when it is at the bottom of its stroke. When an explosion occurs, the piston, driven downward, compresses the gas in the base of the engine and causes it to rush up through the intake port into the cylinder.

On top of the piston, directly in front of the intake port, is a projection which acts as a splasher, shooting the gas upward and preventing it from escaping through the exhaust port. As the cylinder is filled with fresh gas, the exhaust, or burnt gas, is crowded downward and makes its escape

through the proper port. Then the piston, ascending, compresses the gas in the cylinder and at the same time draws a fresh charge from the carburetor into the base. When the piston reaches the top of its stroke another explosion occurs, and so on.

Now, if the exhaust port is left open long enough to permit all of the burnt gas to escape, some of the fresh gas will also get away; while, if the port is closed early enough to prevent this, a certain amount of the burnt gas will remain in the cylinder, diminishing the force of the following explosion.

Another very bad feature of this engine is the necessity of compression in the base as well as in the cylinder. After a time the bearings will become worn to such an extent that the bushings will have to be replaced in order to obtain anything like satisfactory results from the engine.

The four cycle engine, Fig. 2, has two valves—one exhaust and one intake—for each cylinder. These valves are operated by a cam shaft the speed of which is reduced by means of a pair of gears to one-half that of the main or crank shaft.

The timer, which, as its name would imply, regulates the time at which the spark occurs, is also placed on this shaft.

When the piston attains its lowest point after an explosion, the exhaust valve opens and the piston, ascending, forces out the burnt gas. Reaching the top, the exhaust valve is closed and the intake opens and the piston, traveling downward again, draws in a fresh supply of gas. When, both valves being closed, the piston makes its second ascent it compresses nothing but absolutely pure gas which when exploded will yield the greatest possible amount of power.

An acquaintance of mine owns two sister boats, each equipped with a two cylinder, ten horsepower engine, one a two cycle and the other a four cycle. This man claims that his four cycle machine will accomplish the same amount of work on 75 per cent of the fuel consumed by the two cycle.

Such a saving is well worth considering when purchasing an engine. A few dollars in first cost is soon forgotten, but waste of fuel is a grievance which continues as long as the engine lasts.

While the use of either the jump or the touch system of ignition is largely a matter of taste, the jump spark is undoubtedly the best, especially in connection with engines of more than one cylinder. The use of the touch spark on these machines involves the use of too many small parts which are exposed to a continuous wear and tear.

Troubles and Their Causes

I think I may say without any exaggeration that 75 per cent of all gasoline engine troubles are due, not to the fault of the engine,

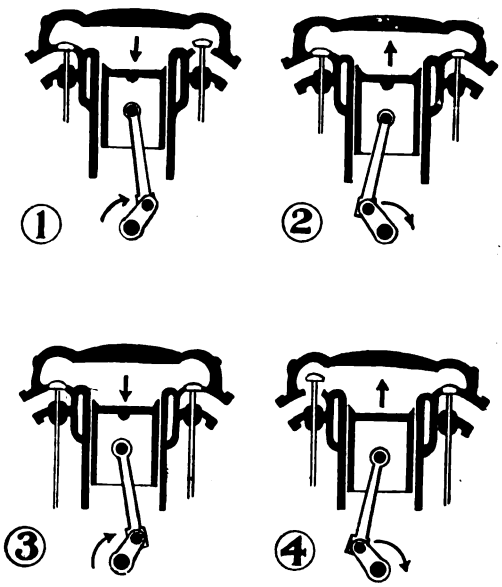


Fig. 2. How Four Cycle Engine Operates

but to the ignorance or carelessness—and ignorance is often the direct cause of carelessness—of the operator.

Anyone who has the slightest "mechanical bent," combined with the same amount of common sense, should have very little trouble with a gasoline engine. Still, the gasoline engine is by no means trouble proof, and when you hear anyone say, "My engine has never given me five minutes' trouble," it is pretty safe to bet on one of two things: Either he has not owned the engine more than a week, or he is the biggest liar in his county.

The nearest to a perfect season's run that I personally know of was made by a fisherman of my home town. He has used a gasoline engine for the last eight years, and last season he escaped without a stop until the middle of October. Then one day he started out to "lift" and not a hundred yards from the dock his engine stopped dead. Seeing

nothing the matter, he tried to crank it and found that by exerting all his strength he could not even move it. Paddling ashore he took the machine apart and discovered that a small piece had broken off one of the cylinder rings and worked in between the ring and the piston, jamming it in the cylinder. Fortunately it did no further damage and five hours later the man was on his way again, finishing the season without another stop.

Except, as in the case just mentioned, when something is actually broken, engine troubles are almost invariably due to the spark or the gasoline. Nine times out of ten it is the former.

At the first sign of trouble see—or rather feel, for sight is of little use in this instance—if all the binding screws are tight. Owing to the constant vibration of the engine they sometimes work loose. A loose screw has been known to cause hours of needless cranking.

Few manufacturers will tell you before you purchase an engine that you will need a dynamo and storage battery, but the fact remains that you will. Go to some one who uses these and ask him why he does not use batteries. He will probably tell you they "kept him poor" replacing them. Many engine owners spend half—and some all—of the price of a dynamo in replacing batteries before they "get wise." Then, after all this useless expenditure for which they have nothing to show, they find they must have this equipment.

While some magnetos cost more than engines, you can obtain one which will answer nicely for from $10 to $20. If you do this you will always be under the necessity of using batteries to start on, as the magneto will not charge a storage battery.

A good dynamo costs from $25 to $40 and a storage battery $10 and up, depending on the size. If you feel that you cannot afford both, buy the dynamo and use batteries for starting until you are able to purchase a storage battery.

When you have these you have taken a long step towards the elimination of future troubles and will, with reasonable care, be through buying for years to come. Of course you can obtain this equipment at much lower prices than those mentioned here; but it seldom pays to risk sacrificing quality for a small saving in first cost.

When Buying an Engine

If I were buying an engine tomorrow there are two things I would insist on: One of these, and one which, considering its advantages is surprisingly rare, is a taper bored flywheel, with a nut to keep it in place, Fig. 3. This style of flywheel will always remain tight and yet can be removed with the greatest ease.

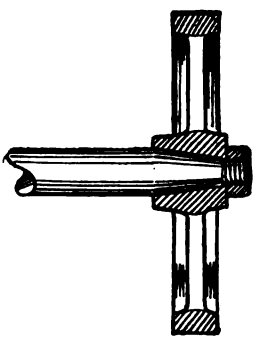


Fig. 3. Taper Bored Flywheel

Compare this with the trouble experienced in taking off a flywheel having a straight hole and a key. If it is to remain tight it must be pressed or driven to place and then keyed. When you wish to take it off, the head of the key will probably break off. There is, then, nothing to do but drill the key out, and when this is done it is still no small matter to get the wheel off.

The other point is the accessibility of the cranks. In many engines the hand holes are very small and some of the two cycle machines have none at all. No matter how good the material, the cranks need taking up occasionally and the prospect of having to take the whole engine apart to do it is—well, not pleasing.

Although a good looking engine is desirable and a good oiling system essential, do not allow a lot of nickelplated ornaments and nicely polished brass oil cups to blind you in regard to the lack of other necessary good points. Quality is not always apparent on the face of a thing, as an acquaintance of mine is able to testify. In choosing between two engines which were so much alike that it would have been almost impossible to tell one from the other after removing the names of the manufacturers, he chose the one which was $25 less in price.

After he had paid for it and had it installed in his boat, the after bearing ran hot in a few minutes. The flange couplings had not been faced off after having been keyed in place. The rest of the engine was built in the same slipshod manner, and at the end of two years he practically gave it away in disgust.

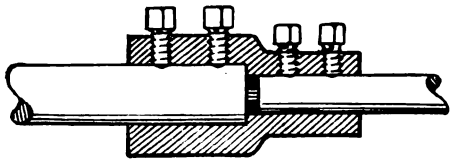


Fig. 4. Earmark of Cheap Engine

Two of the earmarks of the cheap engine—or the one which should be cheap—which can be detected at a glance are the muff or sleeve coupling, Fig. 4, and the use of set screws where keys are necessary.

The Fault of the Man

Many people, upon the refusal of an engine to start, will persistently crank it by the hour. This is simply a waste of time and muscle. When an engine will not go after three or four trials there is something wrong and the sooner one starts to look for it the sooner it will be found.

Not long ago a man sent for me to look over his engine, after working at it himself for three hours, during which time he had taken it apart and found nothing wrong. Now anyone who knows anything at all about an engine should know that there is nothing inside to get out of order unless something breaks and in this event you will be notified automatically.

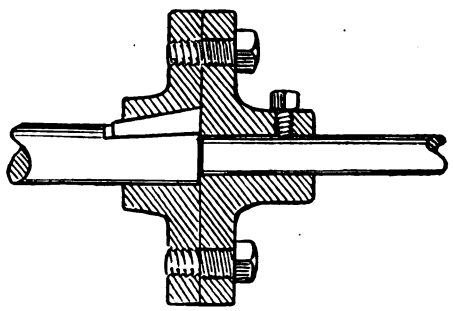
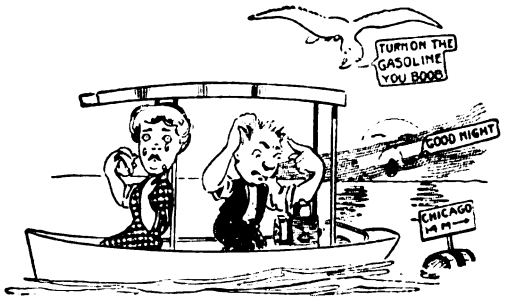


Fig. 5. Set Screws Instead of Keys

Upon being primed the engine would run a few revolutions and then stop. Although there seemed to be gasoline in the carburetor I grew suspicious and began using my eyes. In about two minutes I found the gasoline shut off just outside the tank. The owner had shut it off for some purpose and had forgotten all about it. The engine now worked all right without a load, but as soon as the clutch was thrown in it would stall instantly. I picked up a wrench, and paying no attention to his protestations that he had "taken it all apart and everything was all right," proceeded to remove the cylinder head. It was a two cycle engine and as I suspected he had put the piston in with the splasher in front of the exhaust port instead of in front of the intake.

Do you think this will be a lesson to him?



"Gasoline Was Shut Off"

It will not! The next time his engine "balks" he will tear it all to pieces again. He is one of those fellows whose mistakes do not benefit them in the least. There is some excuse for the man who makes a mistake; but the man who makes the same mistake time after time is a hopeless case. Men of this stamp should have nothing to do with anything the mechanism of which is finer than that of a rowboat or a wheelbarrow.

Mark the Pieces

If owing to any reason you must take your engine apart it is a good plan—and one which applies to any other piece of machinery—to mark every piece as you take it off. It is all very well to say, "Oh, I'll remember which way this goes on," but when with a dozen or more pieces scattered here and there, you commence to put things together again you will be obliged to admit that after all you have rather a poor memory.

A small center punch (which you can obtain at any hardware store for a quarter) is the very thing for making witness marks. When kept sharp it will make a small but distinct mark which can be readily found.

I have in my kit a dozen pairs of tags made of pieces of sheet brass about an inch long by half an inch wide. With a small hole at one end and a number on the other, I find they save me considerable time where there are a number of wires to be taken off. When I remove a wire I slip a tag on it and the tag bearing the corresponding number on the binding screw. While this takes sec-

onds at the time it saves minutes afterwards.

Anyone may make a set of these little trouble savers; strips of tin will do as well as brass, and in the absence of a set of steel figures, center punch marks will answer all practical purposes.

Overfeeding

Another practice which causes much trouble is the feeding of too much gasoline in proportion to the amount of air used. One of the sure symptoms of this trouble is the occasional lagging of the engine as if it were about to stop. This is often accompanied by a slight knock or pound similar to that produced by a slack crosshead pin. Many people will laugh at this idea but it is the straight, honest fact.

Did you ever notice your engine, when turning up very slowly, running with a "long leg and a short one?" I mean that the exhaust sounded something like this: "Chug-a-chug, chug-a-chug." This is another sure sign of the "too much gas" trouble. An engine, no matter how slowly it is running, will, if properly fed, produce a steady, regular "chug-chug-chug-chug"—without a break.

When the average man finds his engine lagging he will give it more gasoline. This will probably produce the peculiar pound I have mentioned and will, if continued, flood the engine to such an extent that if it finishes the run will prevent it from starting easily again.

Remember that it takes money to buy gasoline, but air is free to all. If you will try feeding less gasoline I think you will find the result satisfactory as to the working of your engine—and incidentally—less of a strain on your pocketbook.

Meet Trouble Half Way

The saying, "Never cross a bridge till you come to it," is followed to the letter by too many engine owners. So long as things go well they seem quite satisfied with the rather meager knowledge that an engine develops power through the consumption of gasoline exploded by an electric spark. Then when trouble overtakes them—and this usually happens miles from any place where assistance may be had—they are absolutely helpless.

If you own an engine and do not thoroughly understand the working principles of it, go to a repair man or some owner having plenty of experience and have him explain the "whys and wherefores" of every bolt, nut and screw.

Do not be so parsimonious as to expect him to furnish this information without charge. You would hardly have the "nerve" to ask a doctor or a lawyer for free advice. Like these, his knowledge was obtained at the ex-

"Willing to Practice on Another Man's Engine"

pense of much time spent in study. A dollar or two invested in this way in the beginning will save you many dollars in the future, to say nothing of inconvenience and loss of time.

Another thing: There is a class of would-be benefactors who though not knowing any more than the law allows are perfectly willing to gain experience by practicing on another man's engine. This particular brand of assistance is often of a rather negative nature and is an expensive luxury in which you cannot afford to indulge.

Some Helpful Don'ts

The frequency with which the amateur operator ignores the following apparently superfluous "Don'ts" is an excellent excuse for their appearance here:

Don't use a two foot monkey wrench to tighten a half-inch set screw.

Don't forget that oil, even at a dollar a gallon, is less expensive than a new engine.

Don't crank the engine when the fuel tank is empty; it is a useless waste of muscle.

Don't forget to turn on the switch, or if you do not, don't "cuss" when the engine refuses to start.

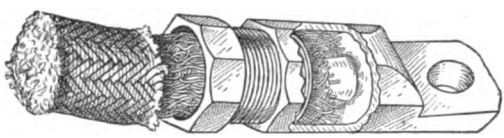
Don't touch the spark plug when the switch is on; the consequences are sudden and rather unpleasant.

Don't forget that you can do more damage with a hammer in ten seconds than can be repaired in a whole day.

Don't lose your temper, for while a club may be a very persuasive instrument in the case of a balky horse, it is strangely unavailing when applied to an engine.

SOLDERLESS JOINT.

The illustration shows the design of a solderless joint for connecting stranded wires to terminals, such as lugs, or to each other. The threaded portion is placed on the bare stranded wire end close up to the insulation, and the



Joint Partly Put Together

lug part is then turned on. The interior of the lug has a projecting point that turns into the center of the bundle of strands, making an electrically as well as a mechanically secure joint.

SOIL RESISTANCE

The resistance of the soil varies greatly with temperature within the ordinary range encountered in practice. Even at about freezing temperatures the resistance will be several times that at summer temperatures. This not only has an important bearing upon the magnitude of the electrolysis trouble that may occur at different seasons, but also indicates that where practicable, voltage surveys should not be made when extremely low temperatures prevail.

TESTING TELEPHONE TRANSMITTERS

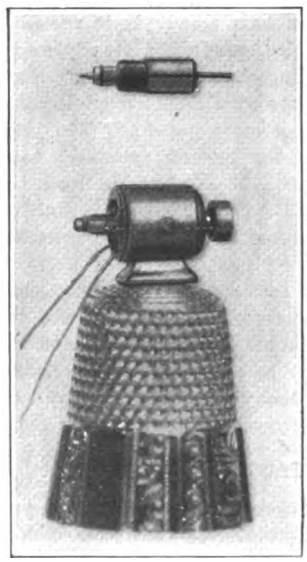
Telephone transmitters are tested to determine how long they will efficiently give service and how this is done is told in a recent issue of the *Western Electric News*.

The transmitters are connected on a common battery substation circuit and mounted in a sound proof box. Telephone receivers attached to phonographs are mounted directly in front of the transmitter. The phonograph is arranged so that for a short period of time the transmitter is spoken into and then for a like period the transmitter is given a rest. After each talking period the transmitters are automatically jarred to give them the wear sustained by removing and replacing the receiver on the hook. The operation of the phonograph carriage also opens and closes the circuits of the transmitters.

IS THIS THE SMALLEST MOTOR?

Ivan T. Nedland, Hillsboro, N. D., sends the accompanying photograph and a letter as follows: "On page 467 of the September, 1913, issue of POPULAR ELECTRICITY AND THE WORLD'S ADVANCE is an article describing 'The Smallest Dynamo.'

"Enclosed you will find a photograph of a motor I have just completed. This motor is a little less than one-half as large as 'The Smallest Dynamo.' The photograph shows the complete motor standing on a No. 11 thimble. The top picture shows the complete armature. This is bipolar and series wound. The armature and commutator have six slots and segments. Everything is built on the same order as on large motors. The commutator is insulated from the shaft with fibre and the segments are insulated with mica. The commutator is screwed together the same as the large ones, no glue being used. The diameter of commutator is 1/10 inch and of the armature 14/100 inch. The dimensions of the motor are: Height, 11/32 inch, length over all, 9/16 inch; width, 19/64 inch; diameter of pulley, 5/32 inch. The complete motor weighs 34 grains. The motor operates with a hum resembling the buzz of a mosquito. It runs on the smallest vest pocket searchlight battery."



Motor on No. 11 Thimble

Design for a Small Induction Motor

By CHAS. F. FRAASA, Jr.

PART II

Center and mount a 4⅞ inch piece of ⅝ inch machine clear through steel in the lathe. Both ends are turned down to ⅜ inch in diameter, the end (A), Fig. 5, for a distance of 1¾ inches and the other end (B) for a distance of 1⅛ inches. The center (C) is turned down to ½ inch in diameter and threaded twelve threads per inch for a distance of ⅜ inch on

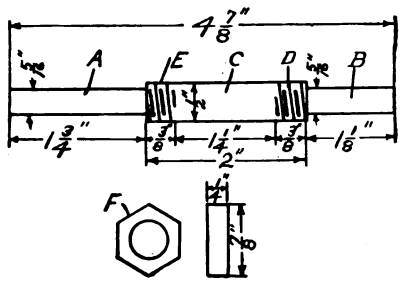


Fig. 5. Rotor Shaft

ends (D) and (E). Fig. 5 gives the finished dimensions of the shaft. The core is to be mounted on the center portion of the shaft, clamped between two nuts (F). The nut is drilled out $\frac{13}{32}$ and tapped ½ inch, twelve threads per inch.

For the rotor core, cut enough disks 3½ inches in diameter to make a stack 1¼ inches thick. Cut two 3½ inch disks from some ⅛ inch copper and clamp the rotor disks down on the drill press between them. Drill a ½ inch hole through the center of the stack, and clamp the rotor on the shaft very tightly between the two nuts (A) and (B), Fig. 6. Mount the shaft betweeen the lathe centers again and inscribe a 2⅝ inch circle on the copper disc. This circle should be divided into seventeen equal parts each of which locates a slot for the rotor bars. Center punch these points and drill seventeen ¼ inch holes through the core and copper disks. Fig. 6 dimensions the finished core. In the core as it is now, the holes are not so close to the periphery; there is still a little material around it to be turned off. This could be turned off now, but it is best to turn it off after the bars have been secured in the rotor, as this will swell it and necessitate another cut over the periphery of the core.

For the bars (C), Fig. 6, cut seventeen pieces of No. 3 copper wire, each 1¾ inches long. It is not necessary to insulate the rotor bars, but it is preferable to do so as this gives direction to the currents in the rotor. The insulation of the bars consists of a piece of tough bond paper wrapped around them and secured with shellac. The insulation covers only the center portion of the bar over a distance of about 1¼ inches. The ends should be scraped clean so as to make good contact with the copper disks to which they are soldered. Put the bars in the holes in the rotor and with a light hammer rivet the ends tight in the copper disks. The bars should then be soldered to the copper disks with a blunt soldering iron, holding it over the end long enough to heat it and cause the solder to flow freely and make a good electrical connection between the bars and the disks.

The rotor should then be mounted in the lathe and turned down to three inches in diameter and the copper end rings faced off with a light cut, removing the surplus solder.

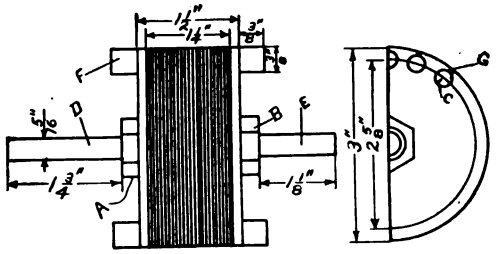


Fig. 6. Rotor Core on Shaft

The ends of the shaft (D) and (E), Fig. 6, should be turned down to $\frac{5}{16}$ inch in diameter. Two fans (F) are added to each end of the rotor core by soldering them to the end rings. These fans cause a circulation of air in the machine which helps keep down the operating temperature. The slots which contain the rotor bars should be opened by a hack saw cut (G). When the rotor is completed, it should be carefully balanced.

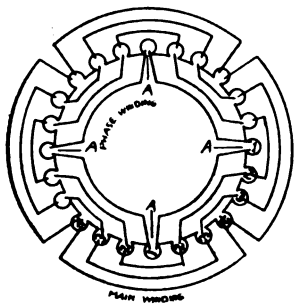


Fig. 7. Stator Winding

The insulation of the stator slots consists of a piece of empire cloth with a piece of tough wrapping paper to protect the cloth from the walls of the slots. The insulation should be long enough to project on each end of the slots for ¼ inch. It would be well to shellac the surface of the paper and the empire cloth to stick the two together before placing in the slot.

Fig. 7 gives a diagram of the winding. The main winding consisting of four poles, 2½ coils per pole is wound first. Each coil contains 94 turns of No. 23 enameled wire making a total of 235 turns per pole. Enameled wire must be used, as the proper number of turns cannot possibly be put in the slots if cotton covered wire is used.

The slots (A) spaced 90 degrees apart around the stator will be the centers of the poles. Referring to Fig. 7, number this slot (1), the two adjacent slots (2), the next slots adjacent to these (3), and finally the next slots (4). The main coils of each pole start in slots (2), in which 94 turns are wound, continue in slots (3) also containing 94 turns and expand further into slots (4), which contain only half as many or 47 turns. The slots (4) contain a half coil from adjacent poles. Where the succeeding coils overlap on the ends of the core, separate them by two layers of empire cloth. When the coils are wound, tie the three coils of each pole together in the center with a piece of friction tape.

The phase winding consists of 2½ coils per pole of 30 turns per coil of No. 28 enameled wire, making a total of 75 per pole. The phase winding starts with 30 turns in slots (3) on top of the main winding, expands to slots (2) which also contain 30 turns, finally expanding to slots (1) containing one-half coil or fifteen turns. The diagram, Fig. 7, will be useful for reference while winding the stator.

If all the coils are wound in the same direction, there will be less confusion when making the connections between the coils. The winding of each pole though divided into 2½ coils is continuous. The terminals of each pole winding should have a six inch piece of fixture wire, or lamp cord soldered to them for connection leads.

The device which automatically cuts out the phase or starting coils when the rotor has attained speed is illustrated in Fig. 8. This consists of two brass contactors (A), which revolve with the rotor about two contact segments (B). The contactors are held in contact with the segments by means of the springs (C). The two contact segments (B) are connected in series with the phase winding. When the rotor has attained a certain speed, the centrifugal force of the contactors pulls them away from the segments, opening the starting coil circuit.

The contactor is dimensioned at (D), Fig. 9. The material is ⅛ inch sheet brass. Be careful to get the proper curvature on the edge which is in contact with the contact segments and to make the slots of such size that the contactor will slide freely on the rods which support it. The rod is dimensioned in detail at (A), Fig. 9. Two nuts (B) are provided to retain the contactor. These nuts are soldered in position when the contactor has been adjusted in position. They should not be too close or they will prevent free motion of the contactor.

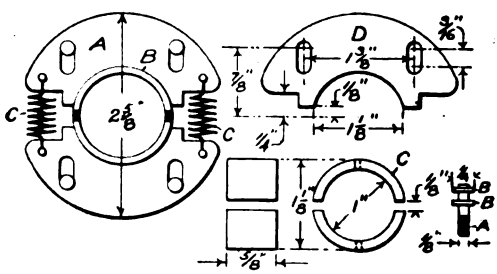


Fig. 8. Brass Contactors. Fig. 9. Contact Segments

The segments (D) are cut from some one inch internal diameter brass pipe, or cut and bent from some ⅛ inch sheet brass. A ¼ inch hole is drilled in the center of each segment for a screw which holds it in place on the inside hub of the housing. The segments should be insulated from the housing hub by means of wrapping paper or fibre wrapped on to a thickness of ⅛ inch. Then mount the segments in place by means of a ⅛ inch machine screw driven through the segment and into a hole previously tapped in the bearing hub. A fibre washer should be placed about the screw to insulate it from the contact with

the segment. The screw should not make contact with the segment, as the hole in the segment was drilled ¼ inch in diameter. Be sure to test both segments for grounds, as a short circuit between them would throw a dead short circuit upon the line upon starting.

The spring (C) which holds the contactors together is made of No. 22 spring wire wound upon a ⅛ inch mandrel. The spring measures when normal, about ⅜ inch from end to end of the convolutions.

Fig. 10 illustrates the connections of the stator windings. If all the coils are wound in the same direction, the proper connection may be effected by connecting the beginning of the first coil to be beginning of the second and the end of the second to the end of the third and so on around the core. The terminal leads of each set of coils will then be either the beginning or end leads of the first and last coils, depending upon which was started with. By connecting the coils in this way, they would produce alternate north and south poles if direct current were circulating in them.

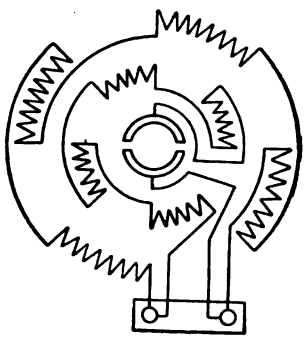


Fig. 10. Connections of the Stator Windings

In the diagram, it will be seen that the phase coils are connected in series with the two segments of the self starting device. The leads of both sets of coils are brought out to two terminal binding posts, one lead of the main winding and one lead of the phase winding being connected to each post. To reverse the direction of rotation, the starting leads are simply reversed.

The machined parts are assembled as in Fig. 11 which is a section through the parts of the machine showing the location of each part. When the machine is started up it will run at practically 1800 r. p. m. Under load the speed will drop to somewhere about 1730 r. p. m.

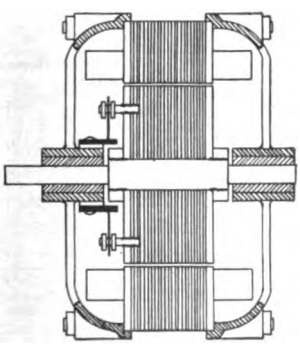


Fig. 11. Cross Section of Assembled Motor

The self starting device should be adjusted when the machine is first tried out. The contactors should open the circuit at full load speed, or at about 1730 r. p. m. If they open the circuit at a higher speed, the contactors are too light and weight should be added to them in the form of drops of solder. If the circuit is opened too soon, it is evident that the spring is not strong enough and a spring made of heavier brass wire should be used.

(END)

"TREE WIRE" ON TELEPHONE LINES

The illustration shows a method of carrying a copper line wire through a tree with the use of what is known as "tree wire." On account of the very high cost of this kind of wire and the unsatisfactory results which arise from its use through trees, the method should be employed only after all efforts to properly trim the trees, or to otherwise secure the proper clearance have failed. The insulated wire should extend only about five feet beyond the tree on either side and, while weatherproof wire may be used for subscribers' circuits, circular loom tree wire should be used for toll lines.—GEORGE M. PETERSEN.

Tree Wire

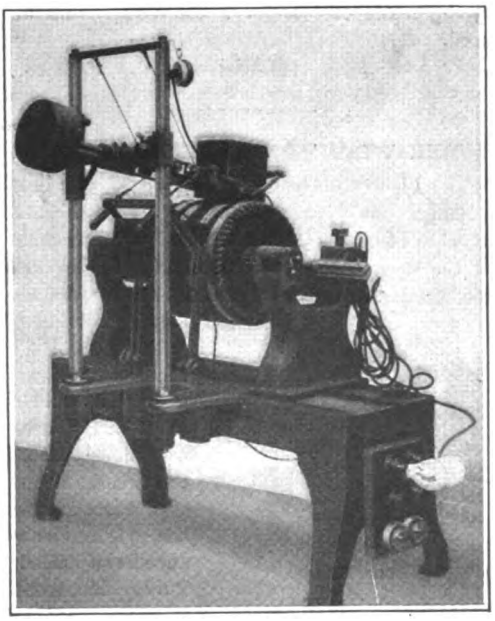
CURRENT REQUIRED FOR ELECTROPLATING

The German magazine *Zeitschrift fur Schwackstromtechnic* gives the following table of the tension and intensity of current required for the different kinds of electroplating. The figures are the result of a number of carefully conducted experiments.

	Tension, Volts.	Intensity. Amperes per sq. Foot.
Silvering	.5 to 1	2.3 to 3.2
Gilding on brass or copper	2.0 to 2.5	4.6
On iron and steel	2.5 to 3.0	6.5
On zinc	3.5 to 3.7	13.9
Copper plating	3.0 to 4.0	4.6
Zinc plating	2.5	11.0 to 14.0
Tin plating	2.0 to 2.5	4.2 to 5.5

TESTING ARMATURE COILS

A great cause of trouble in electric dynamos and motors comes from short circuits in coils, that is, from accidental contact between adjacent turns or layers of wire beneath the outer wrapping of insulating material. These short circuits are hard to detect before the coils are put into use, and afterwards there comes a breakdown which lays up the machine for repairs; for instance, an entire armature may be burned out. Testing completed armatures presents a rather hard problem, but a new tester on the market is claimed to solve it in the best way. Laid upon an adjustable support, the armature has placed over it an instrument containing an inductor, a detector and a telephone. The inductor receives battery or other current and serves to induce currents in the armature coil immediately beneath its poles. Should there be an internal short circuit in that coil, a current flows which by means of the detector, causes a loud noise that cannot be mistaken in the telephone receiver. No wire connections need be made to the armature under test and it is moved slowly around so that all the coils pass under the device in turn. Defective coils are thus marked to be repaired and the test can be very quickly made.



Armature Tester

The illustration shows the fairly large armatures which may be tested with the device.

MAGIC MONEY

This illusion employs the same principle as that of the old street fair trick of "the statue turning to life," where the spectators looked in wonder upon the marble image which gradually changes into a beautiful woman.

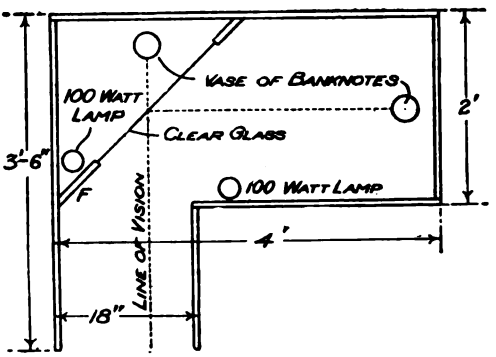


Fig. 1. Arrangement of Illusion Apparatus

In the "magic money" illusion, which best serves its purpose as a show window attraction, a vase of natural flowers slowly becomes apparently a bouquet of genuine United States bank notes. When the transformation is complete, the operation is reversed, the money melting away and the flowers reappearing as before. There is no human agency present to manipulate the trick and the performance is continuous.

A little study of the accompanying sketch will expose the trick. The drawing, Fig 1, represents the bottom of an L shaped box, whose dimensions are roughly given. The box is about three feet high and is supported in the show window on a height with the observer's line of vision, the opening in the short leg of the L being close to the window front.

The entire interior of the box is lined with black cloth and a pane of clear glass, about three feet square, is placed upright in one corner at an angle of about 45 degrees. A wooden strip (F), six inches wide (also black) serves

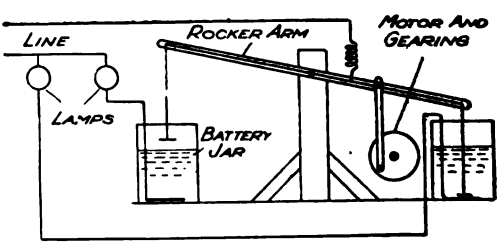


Fig. 2. Motor and Controlling Device

as a frame for one edge of the glass and shields the incandescent lamp behind it. A white vase holding a bouquet of flowers is placed as shown behind the glass. A similar vase, overflowing with United States banknotes, is placed in the long L of the box in the position shown, both vases being elevated to exactly the same height. Two 100 watt tungsten lamps are connected in circuit with an automatic dimmer—located in the basement or otherwise out of sight—which alternately dims and brightens each light.

This dimmer consists in the main of two battery jars partly filled with water, which serve as separate resistances for each lamp. A small motor with low speed gearing operates a rocker arm, on each end of which a copper terminal is made to dip back and forth into the jars. Both terminals on the arm are connected to one side of the lighting circuit and a copper plate in the bottom of each jar connects with each lamp, the other connections being made as shown. As the rocker arm stands in the sketch, Fig. 2, one lamp is burning and the other is extinguished.

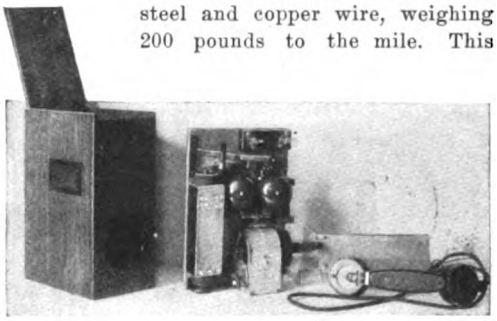
When the lamp nearest the glass is lighted, the observer, looking into the short L, sees the vase of flowers only, the other vase and lamp being out of view. When the lighted lamp begins to dim, the other lamp in the long L begins to brighten, and the glass, due to the black background behind it, serves as a mirror. The reflection of the vase of bank notes gradually merges in the line of vision with the vase of flowers shown by the dotted lines. When the change is complete, the operation reverses, the money and the flowers appearing to change places every few minutes.—C. K. THEOBALD.

ARMY FIELD AND CAMP TELEPHONE

The United States Army's new field and camp telephone is of very light weight, has an exceedingly small and efficient magneto and a small call bell, the whole outfit weighing less than eight pounds. For use with a moving body of troops, the telephone set may be carried strapped over the shoulder of a Signal Corps man and a handle is also provided to move the set about in camp.

When a military camp is established, dependence for communication is placed temporarily upon "combat lines" or emergency telephone lines—involving the use of buzzer telephone sets and field wires laid on the ground. Under the new order of things, however, if a camp is to be occupied for longer than a day the emergency phone will be succeeded by a telephone system using this new set.

Twenty of these sets will be assigned to each division of our army, and with them will go 20 miles of especially strong steel and copper wire, weighing 200 pounds to the mile. This

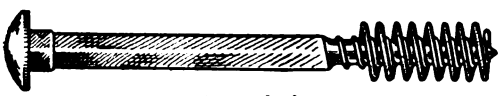


Army Telephone Set

wire can be strung on lances or other supports, but the latest practice calls for the burial of the wire, it being provided with an insulation to withstand such usage. The invention makes use of the cartridge form of battery and the micro-telephone with receiver and transmitter in one piece.

SCREW ANCHORS FOR CONCRETE POLES

The use of concrete for telegraph and telephone poles requires a means of securing to them, pole steps and cross arms without weakening the structure. The accompanying illustration shows one device known as a screw anchor well adapted for this purpose. A metal



Screw Anchor

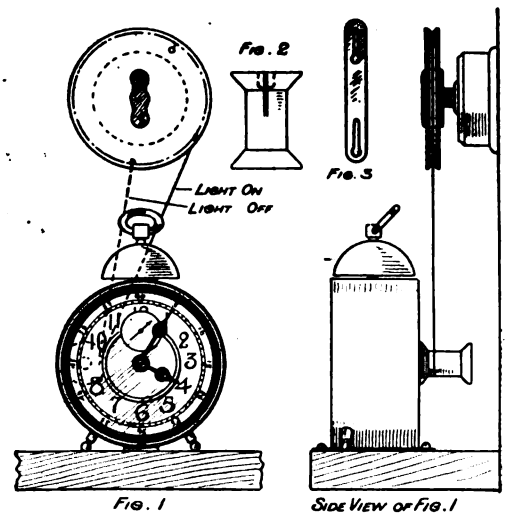
helix, fitting the cross arm bolt to be anchored, is placed on the bolt and the two together are embedded in the concrete while soft. After the concrete has hardened, the bolt is unscrewed to permit the removal of the forms in which the pole was cast. Pole steps are secured in place in the same manner.

Rigid supporting of wires in open work requires under ordinary conditions, where wiring along flat surfaces, supports at least every four and one-half feet. If the wires are liable to be disturbed, the distance between supports should be shortened.

A TIME SWITCH

This is a simple attachment to be used in connection with a common alarm clock to make a practical time switch on any circuit controlled by a snap switch without tampering with the switch or wires.

Cut a disk 3½ inches in diameter from ⅜ inch hard wood and file a small groove around the circumference. Drill a ⅛ inch hole through the center and one on each



Details of Time Switch

side, slightly overlapping the center one, then trim it out to fit tightly over the switch handle.

The winding drum, Fig. 2, is a thread spool slotted and reamed out until it fits tightly over the alarm winding key.

Fig. 3 is a metal strip to be soldered to the bottom of the clock to hold it firmly to the floor or shelf.

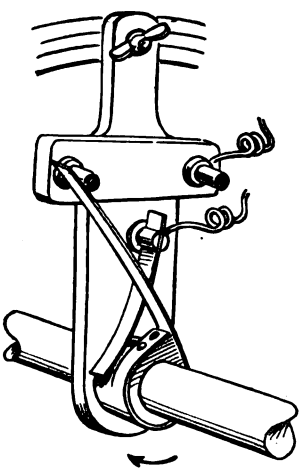
To adjust, set the clock on the shelf and lock by sliding the slots under two screw heads. Fasten a piece of shade cord to the spool and push it on the alarm key, after winding this up. Turn on the switch and push the disk over the handle. Take the free end of the cord and fasten at a point ½ inch to the right of a vertical line drawn through the disk.

The writer has had a device like this in use every night for the last nine months on a stiff ten ampere switch, and it has never failed as yet to operate satisfactorily and takes the place of a very much more expensive outfit.—J. P. ROACH, JR.

IGNITION BY FRICTIONAL MACHINE

Having had trouble with battery and coil ignition on a single cylinder, stationary motor which I use in my workshop to furnish power for the lathe, drill press, grindstone, etc., I decided to replace the battery with a more dependable source of ignition current. Stored away with a number of other pieces of experimental apparatus, I had a very simple frictional electric machine, and it struck me that the device when in condition gave a spark with practically the same characteristics as the high tension magneto spark. I began to experiment with the machine in an endeavor to fit it for the purpose in hand and the results have exceeded my expectations.

A fiber arm was mounted on the half time shaft in such a manner that it could be rotated through an arc suitable to accommodate the spark to any position between full retard and full advance, and means were provided to hold the lever at the point set. Fastened to the half time shaft so that it would rotate with it was a fiber carrier in form somewhat similar to a cam and to which the flexible steel spring was fastened. This carrier was turned with a boss on the side facing the fiber arm and a brass ferrule or contact ring was driven on and connected to the spring by means of a short piece of wire. A brass brush supported by means of a post on the arm made contact with this ring, serving to conduct the current from the electric machine to the spring.



Contractor for Ignition Circuit

Up above on the arm were mounted two pins or posts. The first one was the stop pin which served to retard the progress of the spring. It was so mounted that when the spring — a straightened piece of clock mainspring — first brought up against it, the length of the spring was half an inch greater than the distance from the post to the other end of the spring on the carrier. Naturally, with

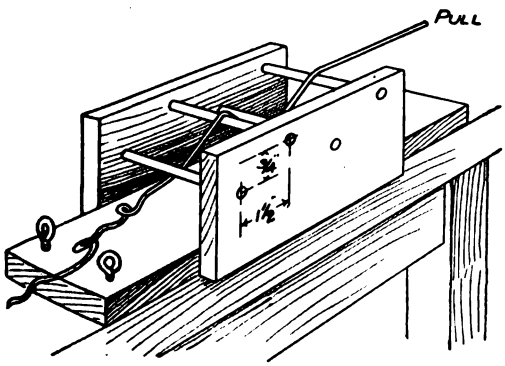
this condition, the spring would lag behind the shaft every time it touched this pin, until it was flexed enough for the end to slip past, when to make up for the lost time it would increase speed and bring up sharply against the contact pin. This latter was connected directly to the spark plug so that when the spring hit it the circuit was established and the spark jumped the gap in the combustion chamber.

I found that it was not advisable to rotate the plate of the electric machine too fast since the potential was enough to produce too large a spark. I also found that very much better results were obtained when a Leyden jar was used with the machine. In this connection, I might add that the condenser made starting quite easy, for it was simply necessary to give the plates a couple of quick turns by means of the hand crank, slipping the belt, of course, when the energy stored in the jar was sufficient to produce the first good spark, irrespective of the speed of the machine.—J. NAVEMAN.

WIRE STRAIGHTENER

Several hundred feet of wire from step-down transformers was laid away "because it would take too long to straighten the bends in it."

To put the wire in shape to use again, I made the device shown. By drawing the wire through it, the wire was straightened without



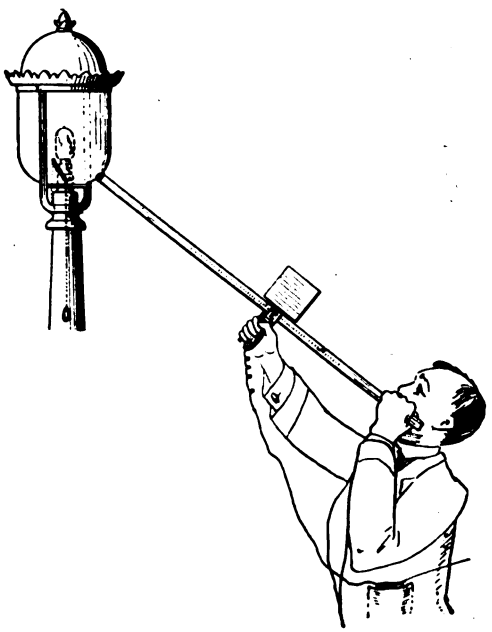
Wire Straightener

injury to the insulation and used in rewinding transformers. The dimensions given may be altered to suit different sizes of wire. In fixing up some silk covered wire, I substituted spools on shafts for dowels.—D. B. TEMPLETON.

LAMP INSPECTOR'S PHOTOMETER

A "hand photometer," so made up that it can be carried by a lamp inspector and used with scarcely any preliminary preparation to ascertain the candlepower of a light source, is the subject of a patent issued to Herbert E. Ives, Mount Airy, Pa.

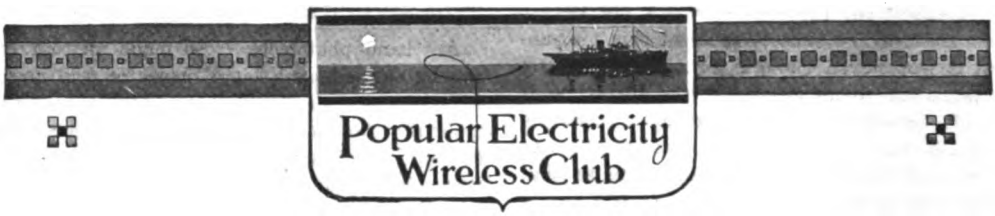
The illustration shows how the device is held while taking measurements. Within the box is a battery lamp for comparison with the light source examined. Pressure of a lever



Taking Measurements With Photometer

on the handle of the box closes the circuit of the battery lamp and also permits the moving of the box along the rod. When the operator releases the handle, the battery lamp goes out, the photometer box is locked in place and the scale reading may be taken at his convenience. Of course the device is intended for use at night and away from surrounding artificial light.

Dry cells never should be connected with accumulators; the effect of the arrangement might be expected at first to light lamps to unusual brilliancy. Very quickly, however, the dry cells will become exhausted and they then will act as a powerful resistance to the passage of current from the storage battery to the lamps.



When the Wireless Set Refuses to Work

By PHILIP E. EDELMAN

"Why won't my set work?" is a question often asked by the beginner as well as by the older amateur. Like the automobile owner who took his whole engine apart only to find that the trouble was merely a disconnected wire, an operator will frequently look everywhere except the right little place, to find the difficulty.

The writer has come across enthusiasts who have a one kilowatt transformer coupled to a 75 foot aerial which is brought in on a single No. 14 lead-in wire and they wonder why they were not tearing up the ether hundreds of miles away. Others with a ground on insulated fixtures question why a five kilowatt station a few miles away "comes in so faint." There are others who had been doing about everything from sending practically all of their power down a rain pipe instead of up the aerial, to receiving on their lead-in wires alone, their aerial being effectively insulated from the lead-in either by an unsoldered aluminum joint or by a broken insulated wire.

It seems well therefore to mention a few of the common causes for failures, which may suggest the remedy to readers who have similar problems.

Probably a majority of the difficulties arise from a misconception or ignorance of the fundamental principles involved; for example, (1) the use of a single wire for a lead-in from an aerial composed of six such wires, (2) the use of too small or too large a condenser for the transmitting circuit, (3) faulty insulation or design of instruments, such as using a helix or oscillation transformer for a ½ kilowatt set which has No. 14 wire for its primary. Information concerning the fundamentals of radio telegraphy is so easily obtained from books that one should aim to know the main principles of each part of the station.

"I get a good spark, but cannot radiate any energy." Probable causes are a broken conductor in the aerial circuit, an overheated gap, too short or too long a gap, a poor or practically no ground connection, enormous resistance due to loose contact, a broken wire, dry earth connection, a broken condenser plate, punctured insulation, too much or too little primary or secondary inductance or both, causing a lack of resonance, a broken aerial insulator, grounded lead-in wire, coupling too loose, or again, the values of capacity, inductance, frequency, voltage or resistance, may be such as to prevent free radiation. Occasionally an aerial will really radiate, the apparent failure being due to a burned out hot wire ammeter, which is used as an indicator. The proper relation of the values for the capacity, inductance, resistance, voltage, amperage, frequency, and the coupling used are fundamental and any variation will cause some degree of loss or failure. Total failure is generally due to a definite leakage caused by a breakdown in the circuits.

"I am using one kilowatt of power but cannot reach a friend fifteen miles away." The cause may be one already given, but in a case in mind the difficulty was due to the use of too small an aerial, a poor ground and very poor tuning.

"I cannot get a good spark discharge." This is often due to the use of too small electrodes, too much power for the size of the gap, lack of cooling, too short a gap, a leaking or broken condenser; or again, it may be due to the use of long connecting wires of small cross section, such as were found in

one particular case where the connecting wires were heated hot.

"I cannot get my set down to 200 meters and radiate enough energy to affect my hot wire meter." A variety of causes may include the use of too large a condenser, an inductance consisting of a coil of too great diameter, a poor design of oscillation trans-

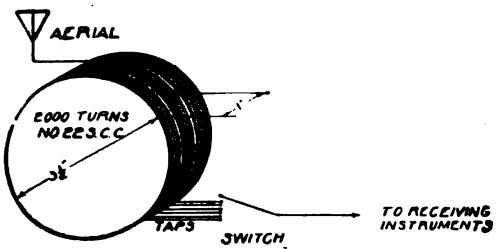


Fig. 1. Loading Coil

former, too long wires for connections, loose contacts of the clips, or connecting wires of too small a cross section. In many cases, an inductance coil of the cylinder type will give better results with a smaller diameter, say six inches, or less and a large conductor, say No. 0 to 4, than is ordinarily used. The aim should be to use a condenser and inductance which will allow at least one complete turn of the inductance to be included in the primary 200 meter circuit. A pancake type of oscillation transformer embodying this principle of small diameter and large conducting surface is also suitable.

"I can hear NAX clearly, why cannot I get Arlington?" The usual reason for this is that a small station has insufficient wire in use to attain the necessary high wave length. It is a simple matter to construct a large loading coil, Fig. 1, with taps, to bring a small set up to the longest wave length now in general use.

"There is an arc light on our corner, that just roars into the 'phones, making receiving very difficult." This and similar line interference can be eliminated by the well known loop aerial circuit and a good variable condenser shunt to the ground, Fig. 2, in which (A) is the looped aerial; (L), the loading coil; (Sw), a switch to cut out (L); (LC), a loose coupler; (D), a detector; (VC), a variable condenser; (T), head phones; (G), ground; (1), a small inductance coil and (2), a high inductance coil. Use receiving instruments as usual. The shunt through the small inductance (1), the high inductance (2), and (VC_2) is adjusted until disturbance is eliminated.

"A station 150 miles from here formerly came in very strong, but now I can barely hear it." It was found that the station mentioned had changed its wave length, but the cause might have been poor contact of the sliders or coupler switches or a non-sensitive detector. Often, after some months, a conductor used in the circuits will become grounded or broken.

"My set tests out fine with a buzzer, but I cannot get even static." This failure is due to a poor ground or no ground, or a grounded aerial, or a broken lead-in, or a broken wire in the primary inductance (usually near the binding posts), or it may be merely a case requiring intelligent tuning.

"I am operating a ship station using a motor generator set, but I have to connect a battery across the fields to get the generator started." This often happens with small generators because of a loss of magnetism due to a variety of causes, such as a faulty connection, the iron used in construction, etc.

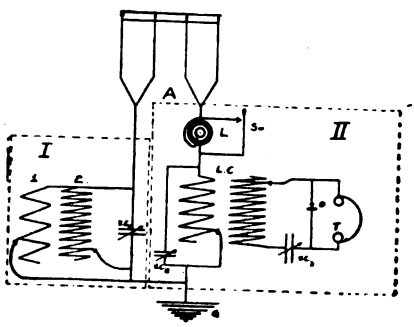


Fig. 2. Loop Aerial and Loading Coil

A few dry cells are generally sufficient to supply the starting energizing current, after which the fields build up rapidly.

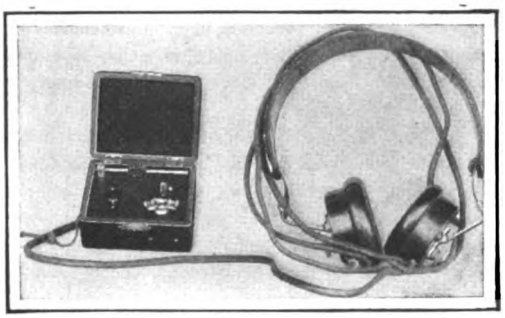
A government operator recently told the writer that there are now a large number of operators who cannot get down to the bottom of things and fix a break of the general class mentioned above; they are code operators rather than radio operators; they are helpless in an emergency in which a man who can make repairs is prepared and on the job.

The loose coupler is in general favor at the present time, as with it and condensers, a wide variety of tuning and coupling is possible.

MINIATURE WIRELESS RECEIVING SET

The accompanying illustration shows a remarkably compact, yet complete wireless receiving set which was designed and constructed by an amateur of Long Beach, Calif.

The outside dimensions of the case are 3⅛



Receiving Set

by 2⅛ by 2⅝ inches and within this case are mounted a fixed condenser, a loading coil, a loose coupler and a silicon detector. The entire outfit is neatly constructed of hard rubber and mahogany.

The instruments have been in daily use for some months, messages often being copied from the Point Arguello Naval Station, about 150 miles away, showing that this miniature set is a practical as well as a novel one.

HINTS TO WIRELESS AMATEUR

A map of the locality in which the amateur is situated, divided into zones by means of red ink circles of varying radii drawn around his town, will prove very convenient for computing the distances over which received messages have traveled.

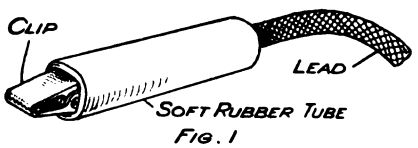


FIG. 1

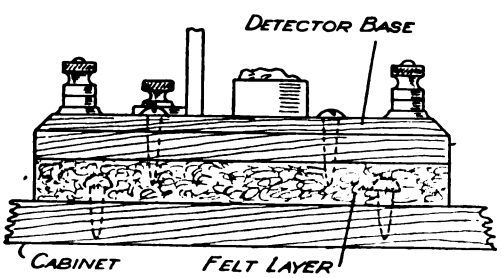


FIG. 2

Fig. 1. Insulated Clip. Fig. 2. Detector Base of Felt

Large glass beads or rubber tubing slipped over bare high tension leads will lessen the liability of unpleasant shocks.

A strip of felt fastened to the bottom edge of a loose coupler secondary will aid smooth and accurate adjustment.

Several of the helix clips sold are good so far as gripping the wire is concerned, but to put it mildly, are rather inconvenient to adjust while sending. Fig. 1 shows an effective way of insulating such clips.

There are few contrivances that will do more to preserve the amateur's temper than a ½ inch detector subbase made by fastening a heavy layer of felt to the cabinet and attaching the detector as shown in Fig. 2. Using this arrangement, little adjustment of the detector will be required except for receiving very distant stations.

Spongy, soft rubber erasers, such as are used for cleaning mechanical drawings, will do a great deal to absorb vibration when placed under the corners of receiving cabinets.—S. R. WARD.

RADIO OPERATOR SUSPENDED

The Department of Commerce, Radio Service, has suspended for a period of thirty days the license of a radio operator who had indulged in unnecessary and unauthorized radio conversation and used profane and obscene language by radio. This is the second case where an operator's license has been suspended by the department because of not complying with the requirements of the law.

FIXING BOUNDARY LINE BY WIRELESS

In the survey now being conducted to fix the boundary line between Peru and Brazil, the wireless is being employed to determine the position of the markers—galvanized iron—placed along the frontier. By chronometers, the time of which is corrected by star observation with the astrolobe, a recently invented French instrument, and wireless messages flashed between the two points at which the chronometers are located, the difference in time of the two places is found, and from this the longitude and finally the distance between the two places. The latitude is found from observation of the stars.

A Stranded Wire Aerial

A very efficient aerial can be made of stranded wire by the amateur provided he is willing to spend a few hours of time. Of course, solid aluminum and copper wires can be used, but they do not make as efficient or as neat aerials, as the stranded wires have greater surface and they hang better and do not kink. By the method here given the wireless man can make his own stranded wire at less than 50 per cent of the cost of purchased stranded conductor.

The aerial considered is the inverted L type and gives good results, as it has a longer wave length than a T aerial of the same dimensions and this has advantages in receiving. The dimensions are perhaps not as great as some might wish, but this aerial can be put up in a comparatively small place at a moderate ex-

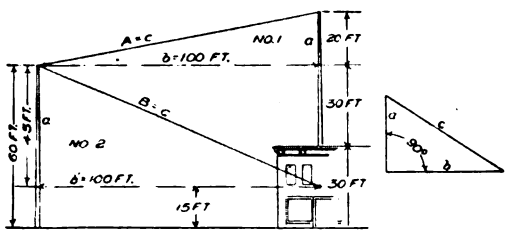


Fig. 1. Finding Distances. Fig. 2. Right Angle Triangle

pense. The work can all be done by one person with the exception of the pole erecting, which requires about four men. For sending, the natural wave length can be cut down by the insertion of a large capacity condenser in series with the ground.

Suppose we have a 50 foot pole on a 30 foot house, with a 60 foot pole in the rear yard 100 feet from the house pole, Fig. 1. The distance (b') is also 100 feet, this being the distance from the rear pole plus the distance in through the wall to the operating table.

First find the distances (A) and (B). In a right angled triangle, Fig. 2, $C^2 = a^2 + b^2$. (Square of the hypotenuse is equal to the sum of the squares of the other two sides.) Therefore in the triangle, No. 1:

$c = \sqrt{c^2} = \sqrt{a^2+b^2} = A.$

Substituting,

$A = \sqrt{20^2+100^2} = \sqrt{400+10{,}000} = \sqrt{10{,}400}.$

$A = 102$ feet.

In triangle No. 2:

$c' = \sqrt{c'^2} = \sqrt{a'^2+b'^2} = B.$

$B = \sqrt{45^2+100^2} = \sqrt{2{,}025+10{,}000} = \sqrt{12{,}025}.$

$B = 109$ feet.

In wires of this length there is a certain amount of sag, so allow an extra five feet in 100, giving (A) as 107 feet and (B) as 114 feet. Also when twisted the wires will shorten slightly. Seven strands of wire are required for each conductor, and as there are four conductors, there are needed 28 strands 109 feet long, or 3,052 feet plus 28 strands each 114 feet long or 3,192 feet, equal to 6,244 feet altogether. No. 22 B. & S. gauge bare copper wire runs about 514 feet to the pound, so that there are needed 12½ pounds, which can be bought at about 25 cents per pound, making our aerial wire cost us $3.13. Stranded wire would cost, for the same aerial—(4 by 114) plus (4 by 109) equals 456 plus 436 equals 892 feet—at 90 cents per hundred feet, $8.03, from which, subtracting $3.13, gives a saving of $4.90.

The only tools needed are a small hand drill, a hammer, a few long nails and a pair of wire-cutting pliers. An ordinary bit brace may be used in place of the hand drill, but it is much slower to work with. Put a small piece of pipe or iron rod about a foot long through the hole in the wire spool so that it can turn easily. Then drive the two nails in the fence 114 feet apart so they can be used to fasten the wire and, taking hold of one end of the rod through the spool, walk back and forth from one nail to the other, fastening the wire at each end until you have seven lengths 114 feet long between the nails. Then cut one end of all seven wires free from one nail and place the ends in the hand drill chuck and turn, twisting the wires together to form a cable. Do not twist any tighter than necessary to hold the wires together. Do this to the four 114 foot lengths and then to the 109 foot lengths. Then again fasten the four 114 foot conductors to the nail about 20 feet from one end and, placing the ends in the drill chucks, twist the wires to form one lead-in cable.

I have found poles made from the sticks used by awning companies to roll up large awnings on to be very good masts. These poles are made of lumber of semi-circular cross section measuring 2½ inches in diameter. This kind of a pole is as neat in appearance as an

iron pole, but must be guyed about every fifteen feet and should not be used over 75 feet high. A good wire for guy wire is stranded iron wire clothes line a trifle over an eighth of an inch thick. Before erecting, put a length of sash cord, equal to twice the length of the pole, through a heavy glass awning ring fastened to the top of the pole.

Spreaders may be made of solid two inch pieces of wood ten feet long, but as they are

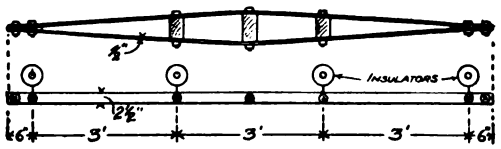


Fig. 3. Spreader Construction

very heavy it is better to build them up from thinner wood, following the plan shown.

The material required for each consists of two pieces of wood (fir) 10 feet by 2½ by ½ inch; one piece of wood 1½ feet by 2½ by 2 inches. Cut from the 1½ feet by 2½ by 2 inch piece the following: Two blocks, 2 by 2 by 2½ inches; four blocks, 1½ by 2 by 2½ inches; four blocks, 1 by 2 by 2½ inches. Five of these blocks are used on one spreader and five on the other. Some ¼ inch stove bolts of the following lengths will be needed: Two 3½ inch; four 3 inch; eight 2½ inch. Nails can be used in place of the stove bolts, but the bolts are preferable. With this material construct two spreaders like Fig. 3. Fasten the

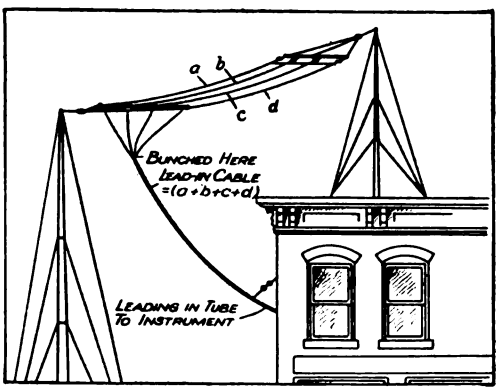


Fig. 4. Arrangement of Lead-in

spreaders to the sash cord on the poles by means of a piece of wire clothes line which has an insulator in it on each side. Then fasten four insulators to each spreader, beginning six inches from each end and spacing as indicated, Fig. 3.

Attach the four 109 foot lengths of stranded wire to the spreaders and solder the four ends of the 114 foot conductor to the four wires of the antennæ on the spreader on the rear pole; then haul the wires to the top of the poles and bring the lead-in through the wall tube to the instruments. Any of the standard, wall tube lead-ins are good or one may be made of a fifteen inch tubular insulator run through a fiber tube about an inch in outside diameter and a half inch inside. It is also a good idea to have two insulators in series swung from the wall to attach the lead-in to, so as to take any undue strain off the lead-in tube, Fig. 4.

This makes a very efficient aerial, but the best aerial will give poor results if used with

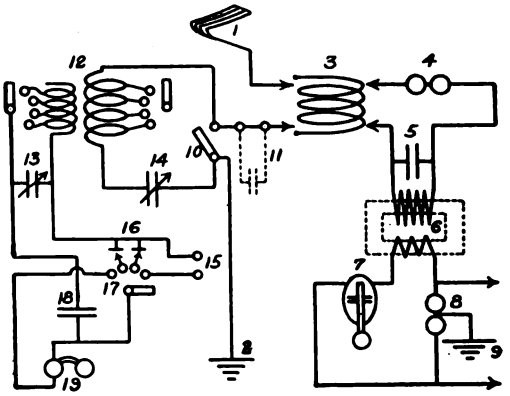


Fig. 5. Hook-up in which (1) is aerial, (2) ground, (3) helix, (4) spark gap, (5) glass plate condenser, (6) transformer, (7) key, (8) lamps in series, ground between (9) ground, (10) s. p. switch shut while sending, (11) condenser here if desired, (12) tuner, (13) variable condenser, (14) variable condenser, (15) posts for extra detectors, (16) detectors, (17) shunt for telephone receivers, (18) fixed condenser of .002 mfd. capacity, (19) phones of from 2000 to 3000 ohms. Switch No. 10 is closed when sending and detector switch should shunt the phones. This does away with an anchor gap which causes as high as ¼ ampere loss in radiation on the small sets and it is simpler than an antenna switch.

a poor ground. Most books and writers say to use a No. 4 wire, but anyone who has tried to make a joint with this size of wire will agree that it is easier said than done. An excellent ground may be made of about nine or ten No. 14 bare wires twisted together. No. 14 bare wire runs about 75 feet to the pound. This kind of conductor can be joined to a ground plate or water pipe more easily than a heavier, solid conductor.

Lastly, it is suggested that a ½ inch brass tape, or its equivalent in surface be used to connect up the oscillation transformer or helix. Conductors may be used, made as were the antennæ. For flexible leads to the oscillation transformer, build up a set of cords from about 40 No. 26 s. c. c. wires and then run them

through a piece of rubber tubing. Wire for connecting up the spark gap, condenser, etc., may be made of ten strand No. 16 enameled wire, which is as good as brass tape and makes a better appearance.

With an aerial and ground like the one described, the aerial, however, being only 68 feet high at the highest point and 51 feet at the lower pole, the writer has heard and copied radio messages coming from a distance of 2,200 miles.

The hook-up used by the writer is shown in Fig. 6, while a more simple one is illustrated in Fig. 5.

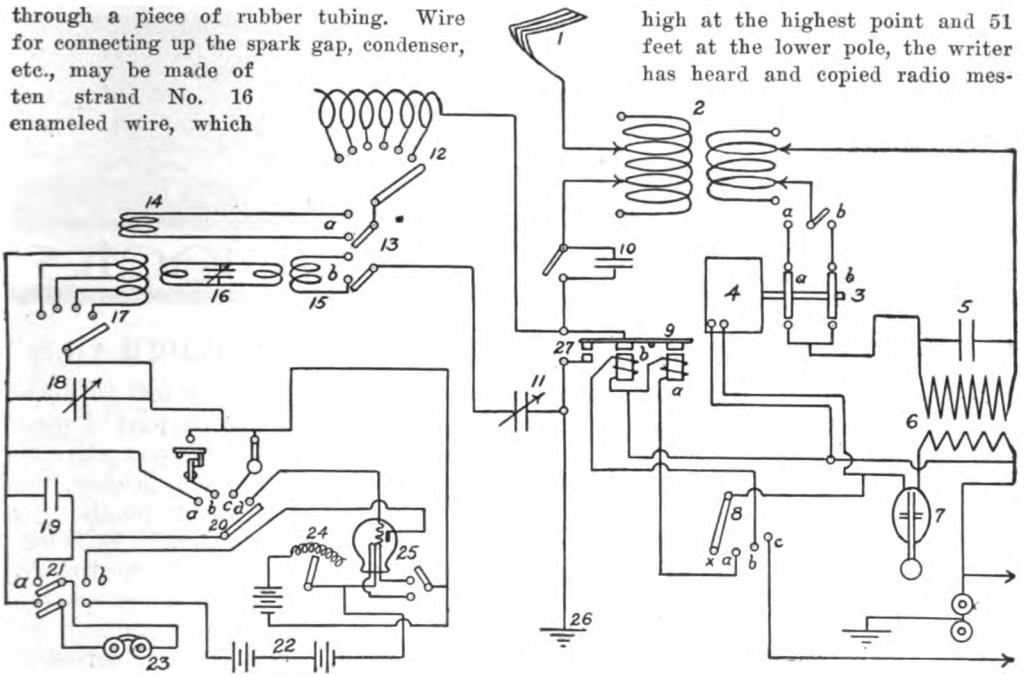


Fig. 6. Hook-up use by writer in which (1) is aerial, (2) oscillation transformer, (3) rotary gap consisting of two discs, one eighteen point and one 24 point. (4) Emerson 3600 r.p.m. induction motor, (5) glass plate condenser, (6) closed core, magnetic leakage transformer, (7) key, (8) switch which traveling from (X) to (C) first energizes magnet (a) throwing contacts (27) apart, then energizes magnet (b) closing the anchor gaps and when on contact (c) starts motor (4) on gap, (9) armature for automatic anchor gaps, (10) series condenser used when sending to conform to wireless law, (11) variable condenser of .004 mfd. in ground, (12) loading coil for receiving set, (13) d. p. d. t. Keystone switch for throwing either "standby" coil (a) or tuning coil (b) in, (14) standby primary for listening in, (15) tuning primary, (16) intermediate consisting of two ball secondaries, one operating within a secondary (17) and primary (14) and the other within primary coil (15) and connected in shunt and shunted in turn by a variable of .004 mfd., (17) tuning secondary—four taps shunted, (18) variable condenser of .0008 mfd. capacity, (19) fixed mica condenser of .002 mfds., (20) detector switch on (a) shunts phones when sending, on (b) throws in perikon detector, on (c) connects ferron detector and on (d) uses audion detector, (21) d. p. d. t. switch for throwing phones on circuit (a) when using crystal detectors and on (b) for audion, (22) eighteen volt flashlight batteries on audion, (23) 3000 ohm 'phones, (24) rheostat for audion filament regulation, (25) audion bulb, (26) ground, (27) knife contacts of anchor gaps.

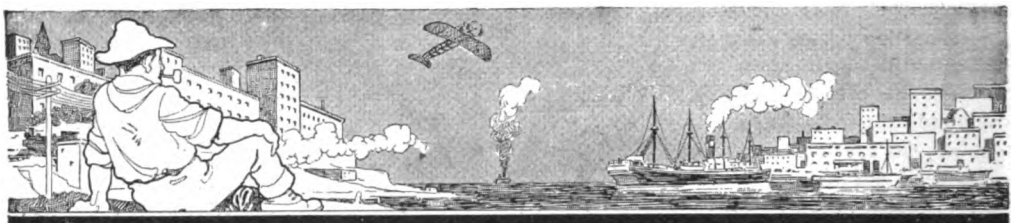
OPERATORS' OATH OF SECRECY

Under date of Jan. 30 the Bureau of Navigation, Washington, D. C., sent out the following letter addressed to radio inspectors and examining officers:

"It has come to the attention of the Bureau that several operators holding operators' licenses under the Act of August 13, 1912, have not taken the oath of secrecy, as required by the International Radiotelegraphic Convention and the Department of Commerce Regulations.

"The attention of licensed operators should be invited to the fact that the license is not valid until the oath of secrecy has been executed. Radio inspectors may recommend the suspension of the licenses of operators in cases where oaths of secrecy have not been taken. Where practicable, radio inspectors or examining officers should not affix signatures to the licenses until the oaths have been properly executed.

"The attention of radio operators holding licenses should also be invited to the service record on the back of the form. Operators should make every effort to have the service record properly filled in by their employers, as the record will be an important factor in determining whether or not an applicant will be re-examined for a renewal of license, and in determining whether an applicant is eligible to take the examination for the 'Extra Grade' license."



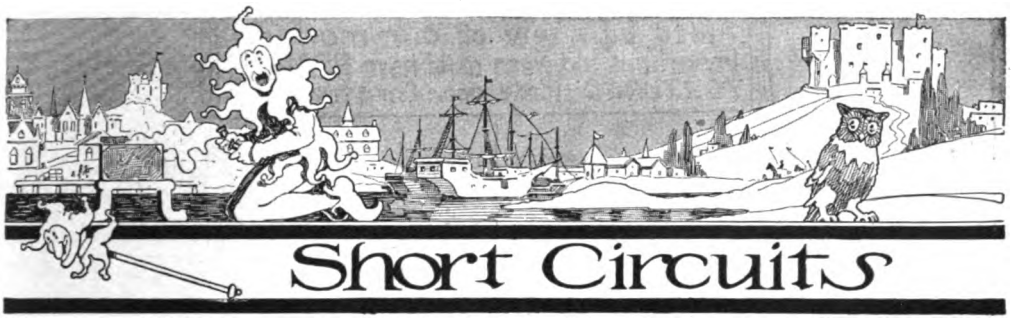
On Polyphase Subjects

NO WONDER "ELECTRICS" GROW MORE POPULAR

Electric vehicles, both pleasure and commercial, have made their real advancement in a period of approximately ten years; and by far the greater part of their rise in popularity is a matter of the last five years. Some of the reasons why the electric truck and delivery wagon are demonstrating that to them belongs the problem of city hauling, and why the relative number of electric cars on the city boulevards is so fast increasing, are set forth in a paper read by Mr. F. E. Whitney before the Electric Vehicle Association of America at its monthly meeting in New York, February 24th. He finds, for instance, that in the last ten years the weight of the battery has been reduced 30 per cent, while its life has been increased from 50 to 150 per cent and its capacity 25 per cent. In the same period of time the cost of tires has been reduced 50 per cent and their life is now twice as long as it was a decade ago. In the matter of mechanical parts, such as transmission, gearing, bearings, etc., life has been increased 100 to 500 per cent, weight reduced 30 to 50 per cent and efficiency increased 50 per cent. And, lastly, in that time the rates charged for electric current with which to charge the battery have, in general, been reduced from 50 to 75 per cent.

SOME LIGHT ON THE RADIUM DISCUSSION

New discoveries must pass through several stages before their real value can be estimated. Even when the sponsors are of world wide reputation, there is, at first, philosophic doubt. When the knowledge of the wonderful work the novelty may do has spread to the popular imagination, there is unbounded enthusiasm. Then, as facts are more accurately measured, there succeeds a period of doubt and disappointment, and, finally, the true value of the discovery is reached after the most searching experiment. That radium is well on in the fourth stage of its development is the belief expressed in an article upon "Radium and Its Power to Cure," by D. Waterson, which appears elsewhere in this issue, and which will conclude next month with a fair and conservative opinion as to the efficacy of radium for the cure of cancer. The second part of the article will also go into the matter of the production of radium-bearing ores in this country and the manufacturing processes necessary in redeeming the precious salts from the rock called carnotite. Unusual interest has been aroused of late in the subject of radium, partly on account of some extraordinary claims that have been made concerning its curative properties, giving rise to a spirited discussion in the scientific and lay press, and partly on account of a controversy which has arisen over the exportation of radium from this country, and in which the government has had some voice. The author seems to be perfectly fair in treating these various phases of the question, and the article is one meriting careful attention.



There was a very determined look in her eye as she marched into the optician's shop.

"I want a pair of glasses immediately," she said. "Good strong ones."

"Good strong ones?"

"Yes. I was out in the country yesterday, and I made a very painful blunder."

"Indeed! Mistook a stranger for a friend?"

"No; a bee for a blackberry."

* * *

Teacher—"Now, children, can you tell me what are the national flowers of England?"

Class—"Roses."

Teacher—"And France?"

Class—"Lilies."

Teacher—"And Spain?"

(Silence for a minute—then small voice at back of the schoolroom.)

"Bullrushes, ma'am."

* * *

"How is your Shakespearean Club getting on?"

"Splendidly. We learned two new steps last week."

* * *

An enterprising young florist, in order to increase his trade, displayed this sign in his window:

"We give a packet of flower seeds with every plant."

His competitor across the street promptly sought to meet the competition by placing in his window the following announcement:

"We give the earth with every plant."

* * *

A young man who had prolonged his call on his sweetheart was surprised when a window in an upper story was raised as he left the house and the voice of the mistress called:

"Leave an extra quart this morning, please!"

School Teacher—"Richard, do you know what happens to boys who use bad language when they are playing marbles?"

Richard—"Should think I do! They grow up and play golf!"

* * *

Turning to the newspaper man who was his passenger, the aviator exclaimed:

"It's all off; the propeller is broken, and we are doomed to fall 6,000 feet!"

"Great guns!" cried the reporter. "I hope we don't fall into the water. I can't swim a stroke!"

* * *

"Help, help! I can't thwim and my wife ith drowning." "Why don't you walk out with her then? You don't appear to be out of your depth." "Yeth I am. I'm thanding on her."

* * *

This is the story of an incident that recently happened to an agent out in Kansas, on the Frisco system. It seems that a drummer running to catch his train at Piedmont dropped his pocketbook at the station, and after missing it, wired back to Agent Byrd to look out for it and hold for a few days till he returned. Mr. Byrd found the "roll" and held as per message, placing it securely in the company's safe. In about a week the drummer stopped off at that point and asked about his money. Mr. Byrd got it for him, and after the stranger counted it over, asked him if it was all there yet. The drummer replied: "Sure, de money is all here, but vere is de interest?"

* * *

The drug clerk stepped forward to wait on her. She trained her guileless eyes upon him and said: "I wish you would give me a sponge bath, please." He looked puzzled, then frankly said, "Do you prefer hot or cold water, miss?" She fled—and got her bath sponge next door.