

POPULAR ELECTRICITY

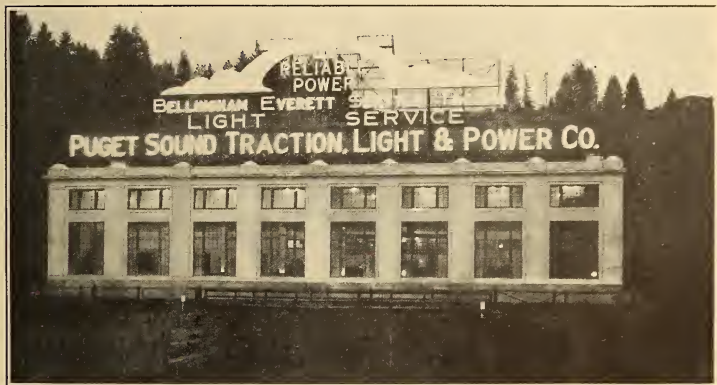
AND THE

WORLD'S ADVANCE

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THE "BEST" SIGN OF THE PUGET SOUND

In plain view of passing transcontinental trains of several great railroads is to be seen the handsome and unique electric sign of the great White River power plant, located 28 miles from Seattle and 13 miles from Tacoma, Wash., which is owned by the Puget Sound Traction, Light and Power Company.

It was agreed that considerable advertising value would be derived from an electric sign on top of the station. Suggestions were requested from the employees of the company for a suitable design for such a sign. From the many designs submitted, one by W. H. Gordanier, superintendent of the plant, was selected. The original arrangement of the names of the towns was in geographical order

from south to north, reading "Tacoma, Seattle, Everett, Bellingham."

It is stated that Engineer A. W. Leonard suggested arranging the names of the towns in geographical order from north to south, so that the first letter of each city would spell the word "Best" upon cutting out all of the other letters in the name of each city, and finally, after the flashing operation, leaving the sign to read: "Reliable power, best light, service."

The waterfall, as well as the boiling effect of the water at the bottom of the falls, is very realistic and beautiful.

It is of interest to note that the sign is 200 feet long and 54 feet high, contains 96 letters, the largest of which is eight

feet high. The sign is supported by eighteen tons of steel framework and carries 4000 30 watt carbon lamps and requires 120 kilowatts for its operation.

The sign is being greatly admired, and it is generally conceded to be the most magnificent electric sign on the Pacific Coast.

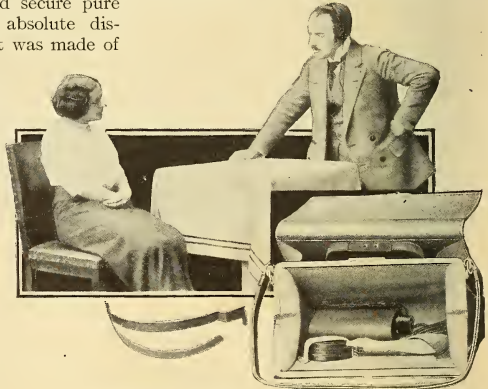
THE PHONOPHORUS—LATEST AID TO THE DEAF

Attempts have frequently been made to design, on the telephone principle, some apparatus enabling those partly deaf to hear more distinctly. The latest instrument of this type has been developed by the famous German firm of Siemens & Halske, who have attempted in particular to obviate the crackling or hissing noises in the receiver and secure pure sound transmission and absolute distinctness. A special point was made of giving the new apparatus, or "Phonophorus," as it is called, a form as convenient and inconspicuous as possible, so as to facilitate its use.

All the different types of Phonophorus brought

contact. All apparatus also comprises a folding head gear.

The apparatus for moderately intense sound reproduction comprises a simple microphone and single receiver, the former being fitted with a small hook by means of which it can be hung up from a button or loop of the user's clothes. The



The Phonophorus and Method of Its Application



Small Set in a Lady's Hand Bag

out by the firm comprise the following parts: A microphone or sound catcher, a receiver for sound reproduction and a battery of dry cells for supplying the current conductors (silk covered wires and contact plugs affording a connection between the several parts). Provision has been made to prevent any mistake in arranging the connections. The receiver, moreover, comprises a current interrupter; when permanently out of use, it is disconnected by lifting the battery

has been reduced to minimum dimensions and is readily carried in the pocket, its life being 50 to 60 hours. Supposing the apparatus to be used on an average one and a half to two hours a day, the source of current will suffice for one to one and a half months. The apparatus is kept in a flexible leather case resembling a pocketbook.

The apparatus for sound reproduction of medium intensity is supplied in two forms, for ladies and gentlemen re-



Using the Phonophorus at a Board Meeting

spectively, both comprising a double microphone and one or two receivers. The microphone and battery are each switched in by means of a plug. The battery is somewhat more substantial than in connection with the former type. The apparatus for ladies' use has been made specially inconspicuous, all parts being carried in a handy black morocco bag of the usual form, into the rear wall of which the double microphone is permanently fitted. Its apertures for sound receiving are spanned over with black cloth, thus damping somewhat the intensity of sounds and preventing the microphone from being clogged with dust. The apparatus intended for gentlemen is carried in a leather bag of pocketbook form.

The apparatus for extra strong sound reproduction comprises a fourfold microphone and two receivers fixed to the headgear, one of which is provided with an interrupter. The fourfold microphone is generally fitted into the bottom of a leather coated box, resembling a

small photographic camera, but can be removed and installed upright or hung up from a hook. When out of use, the outside openings of the microphone are completely covered by a double folding leather cap.

The contact plug comprises a sliding resistance allowing the sound intensity to be adjusted to the most convenient figure, which is the more important as the hearing of deaf persons is subject to certain fluctuations.

The Phonophorus enables those hard of hearing to carry on a conversation simultaneously with several persons, the talkers' voices being caught by the microphone from all directions and even at a distance. This does away with the necessity of raising the voice or approaching the interlocutor.

Persons equipped with the apparatus will be able to attend meetings and conferences, to listen to dramatic performances and concerts, in short, to have their normal share of life's duties and enjoyments.

Passing Ships Through the Canal

Practical Operation of the World's Greatest Electrical Control System at Panama

By J. M. C. HAMPSON

"They who possess the High-way to the East have the Possession of the World."—OLD ARABIC

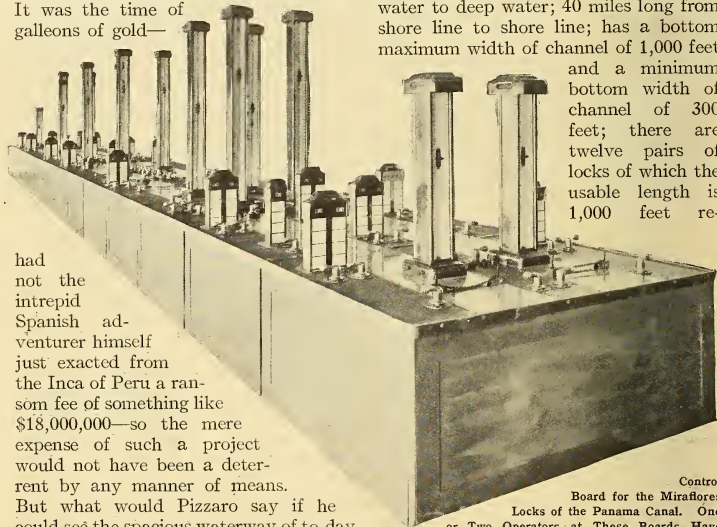
When Pizarro, native of Spain, citizen of Panama and conqueror of Peru, crossed the Isthmus in his expeditions against the Incas he suggested to the then king of Spain the possibilities of a small ship-way. That was in the late Fifteenth and early part of the Sixteenth centuries. It was the time of galleons of gold—

had not the intrepid Spanish adventurer himself just exacted from the Inca of Peru a ransom fee of something like \$18,000,000—so the mere expense of such a project would not have been a deterrent by any manner of means. But what would Pizarro say if he could see the spacious waterway of to-day with its splendid harbor works at either end, grim lines of most modern fortifications, and most wonderful of all, the centralized electrical control system for the locks, vessel towing, lighting and every form of power for the entire canal and in all its works?

The canal itself has been written about so often and described so thoroughly in the daily press and magazines throughout the entire world that it is not the intention here to go over the ground

again. The object now is to present some fairly intimate and entertaining account of the system of electric operation and of the great centralized electrical control by which everything is done and run. Of the canal itself, suffice it to say once more that it is 50 miles long from deep water to deep water; 40 miles long from shore line to shore line; has a bottom maximum width of channel of 1,000 feet

and a minimum bottom width of channel of 300 feet; there are twelve pairs of locks of which the usable length is 1,000 feet re-



Control Board for the Miraflores Locks of the Panama Canal. One or Two Operators at These Boards Have Absolute Control of the Passage of a Ship through the Locks. By Electrical Control Levers They Let the Water from One Chamber into Another, Swing the Immense Gates, Raise and Lower Guard Chains; and all the Time They Watch the Indicators

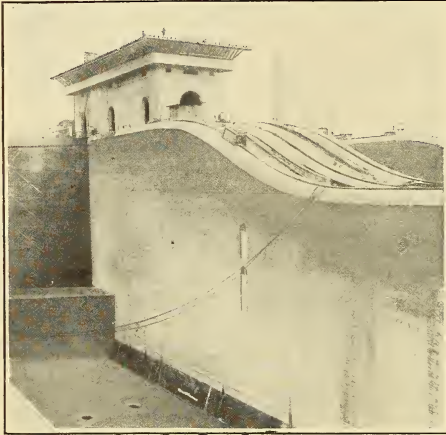
spectively with a width of 100 feet each; the Gatun lake area to the dam, of which the lift up is 85 feet, extends to 164 square miles; the channel depth of the Gatun Lake ranges from 45 to 85 feet and the depth of water in the famous Culebra Cut channel is 45 feet. As to the amount of excavation work and other such



BY COURTESY OF THE ILLUSTRATED LONDON NEWS
 This Birds-eye View of the Canal Zone Gives a Very Comprehensive Idea of the Canal Itself and the Great Locks and Cuts through Which the Commerce of All Nations Will Soon be Passing.

statistics, that need not be repeated here. The whole affair is so stupendous when it comes to the digging part of it that the mind can hardly grasp it. But it may be added that the average time

for passage of boats through the canal is set at twelve hours with three hours for the passage of the locks. Finally the estimated cost of the canal is set at \$375,000,000.



Control House, Center Wall, Upper Lock, Gatun. Note the Towing Track Incline between the Upper and Lower Levels. Electric Locomotives Running on This Track Will Tow the Ships Through the Locks

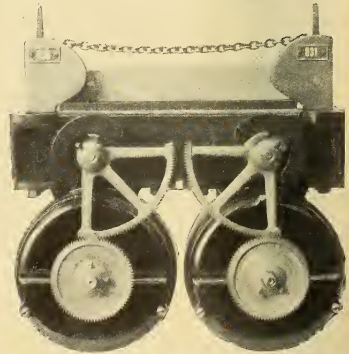
Now as to the phenomenal centralized control system for the Panama Canal locks, docks, and works there is a great deal that arouses a very lively interest and also presents an excellent opportunity for much valuable instruction in the electrical development of the day. The interest results mainly from the immensity of the canal project itself and the instruction from a consideration of the methods employed to insure the passage of even the largest ships afloat across the Isthmus with speed and safety. The complete operation of the canal locks, terminals and auxiliary equipment utilizes electricity in every department with the present exception of the Panama Railroad, the electrification of which is under contemplation.

Let it be said at the outset that the plans for the entire electric generating, lock controlling and distribution system for operating the Panama Canal were prepared under the supervision of Mr. Edward Schildhauer, electrical and mechanical engineer, Isthmian Canal Commission, and formerly with the Common-

wealth Edison Company of Chicago, assisted by a staff of able electrical engineers, including Mr. C. B. Larzelere, who was closely identified with the lock control problems, and Mr. W. R. McCann who was more particularly concerned with the generation and distribution of the power. That these plans and specifications as worked out contain every safeguard that expert engineers can suggest goes without saying.

GENERATION AND DISTRIBUTION PLANTS

It must be understood that the main generating stations of the canal are at the Gatun Dam at the Atlantic end and Miraflores at the Pacific end of the lake. There is also a smaller station at Pedro Miguel at the end of the Culebra Cut. To get the idea clearly into the mind's eye: after coming in from the Atlantic Ocean by Colon through Limon Bay the canal is lifted at Gatun by a



Mechanism of the Index on the Control Board which Shows the Operator the Position of the Chain Fender, which will Prevent a Heavy Ship from Ramming into and Injuring the Gates

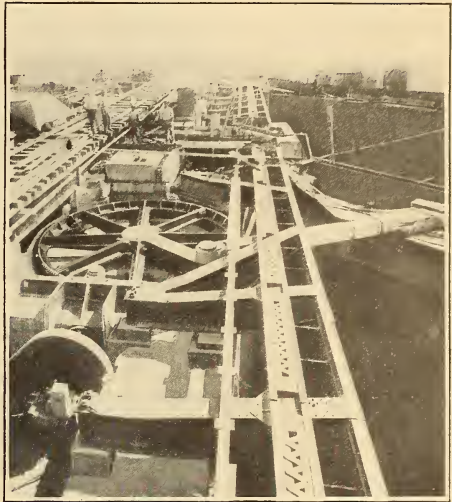
series of three locks to the summit level 85 feet up; it then goes through Gatun Lake and the Culebra Cut to Pedro Miguel where the lock lowers it 30½ feet to a lake ending at Miraflores at which point in a series of two locks it is lowered the remaining 54⅔ feet to the sea level of the Pacific Ocean. There is by the way a tide of 2½ feet on the Atlantic side and a tide of 21 feet on the Pacific side.

Without going into the technical details of the transmission, transformation and distribution systems which bring the current to points where it can be utilized in the various operations, it may be briefly stated that some 90,000 horsepower from the hydroelectric power plant at Gatun Dam

and 60,000 horse power from the emergency turbo-generator plant at Miraflores is instantly available in any quantities desired all along the line of operations, made possible by a double bus and switch arrangement absolutely flexible in its arrangement and insuring, as far as the skill of modern engineering permits, absolute continuity of



An Electrically Operated 50 Foot Float-Well Index



Miter Gate Moving Machine in Gatun Upper Locks. The Great Thrust Lever Seen on the Right, Moved by Electric Motor, Operates the Big "Bull Wheel" and This in Turn Moves One of the Leaves of the Gate

operation. The actual work of moving gates, operating valves, fender chains, etc., is of course done by motors under remote control, as will be explained later.

To give an idea of the number and sizes of the motors to be controlled in operating the lock machinery, the table is interesting.

There are many motors not included below, as, for instance, those for the spillway gates, for the hand rails on the mitering gates of the locks and for the sump (that is, lock draining) pumps.

Machines and Operation	Motors each Machine and H. P.	Number of Motors			Total	Total Horse Power
		Gatun	Ped. M.	Mira.		
Miter gate, moving, each leaf	1-25	40	24	28	92	2300
Miter gate, miter forcing	1-7	20	12	14	46	322
Fender chain, main pump	1-70	16	16	16	48	3360
Fender chain, operating valve	1 ½	16	16	16	48	24
Rising stem gate valve	1-40	56	24	36	116	4640
Cylindrical valve	1-7	60	20	40	120	840
Guard valve	1-25	6	6	6	18	450
Auxiliary culvert valve	1-7	4	4	4	12	84
Totals		218	122	160	500	12020

LOCATION AND OPERATION OF LOCK
MACHINERY

For the purpose of operation the machinery was placed below the coping of the lock walls, thus affording a clear space for maneuvering ships and also protecting the apparatus from the weather without erecting numerous houses.

The mitering gates consist of two massive leaves pivoted on the lock walls which operate independently of each other. A pair of gates is located where each change of level in the canal occurs and divides the locks into 1,000 feet long chambers. In addition to these gates at the lake and ocean ends are duplicate pairs of gates used as guard gates. To handle the vessels of various sizes with the minimum use of water, mitering gates

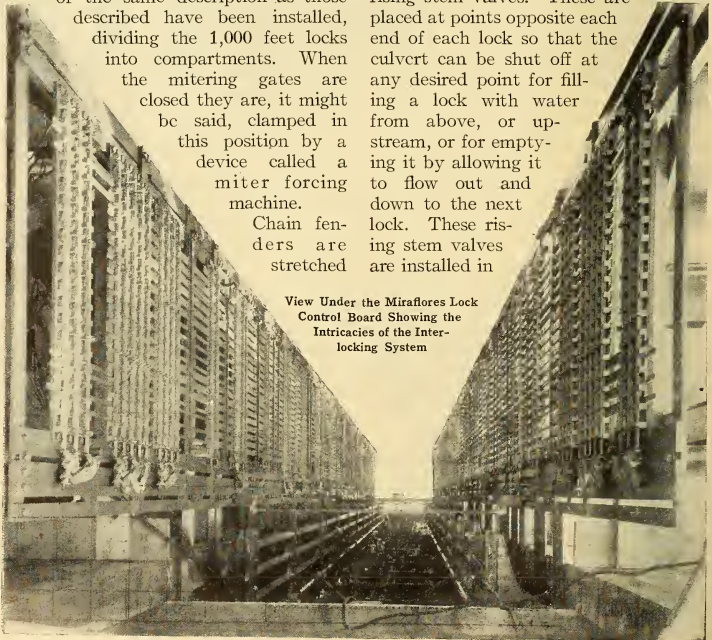
of the same description as those described have been installed, dividing the 1,000 feet locks into compartments. When the mitering gates are closed they are, it might be said, clamped in this position by a device called a miter forcing machine.

Chain fenders are stretched

across the canal in front of all mitering gates which can be exposed to the upper lock level and also in front of the guard gates at the lower end. These chains are maintained in a taut position when the gates behind are closed and are lowered when the gates are opened for the passage of a ship. The chains are raised and lowered by a method very much the same as that followed in the working of hydraulic elevators, with the additional features that if a ship approaches the gates at a dangerous speed and rams into the chain, the chain is paid out in such a way as to gradually stop the boat before it reaches the gates.

The filling and emptying of the locks is accomplished by three culverts, one in the middle wall and one in each side wall, the flow of the water being controlled by rising stem valves. These are placed at points opposite each end of each lock so that the culvert can be shut off at any desired point for filling a lock with water from above, or upstream, or for emptying it by allowing it to flow out and down to the next lock. These rising stem valves are installed in

View Under the Miraflores Lock
Control Board Showing the
Intricacies of the Inter-
locking System



pairs and there are duplicates of each pair. At the upper end of each set of locks, there are two valves in the side walls for regulating the height of the water between the upper gate and the upper guard gate.

REASONS FOR USING THE CONTROL SYSTEM ADOPTED

As the flight of locks at Gatun, for example, extends for a length of approximately 6,200 feet, and the principal operating machines are distributed over a distance of about 4,000 feet, it can be readily seen that a system of central mechanical transmission for the control of the works and machines would not only be exceedingly cumbersome but well-nigh impossible; and to control separately and locally would mean a large operating force of men distributed practically along the full length of the locks which has proved to be the invariable case in the past before such a wonderful system as that in use on the Panama Canal was devised. Moreover, such a force would be difficult to co-ordinate into an efficient operating unit. The situation therefore resolved itself into the centralized electrical control, which reduces the number of operators, operating expense and liability to accidents. To accomplish this system of control, a control board for each lock was constructed which permits of all the control switches at each particular point being interlocked, thus minimizing if not entirely preventing the errors of human manipulation.

The control boards are installed in



Edward Schildhauer, Electrical and Mechanical Engineer, Isthmian Canal Commission, to whose Ingenuity and Resourcefulness is Due One of the Most Wonderful Electrical Operating and Control Systems ever Devised

control houses located on the middle walls at points which afford the best view of the locks, although this view is not in the least the main source of information as to the position of the gates or other apparatus for all the control boards are provided with electrical indicators. The control boards are, in reality, approximately operating miniatures of the locks themselves, and are arranged with indicating devices which will always show the position of valves, lock gates, chains and water levels in the various lock chambers; and with the exception of such machines as need only an "open" or "closed" indication, the indi-

cators will register synchronously with the movement of the lock machinery. The indicators on the Panama control boards were developed especially for the undertaking, and show accurately and synchronously every movement of the machinery to which they are connected whether in the extremes of travel or at any intermediate point.

The water level indicators on the control boards are exceedingly accurate and have been set up with much detail into which it is not necessary to go here. The specifications covering the water level indication required an accuracy of 1/20 of a foot or of 1/10 of one per cent in actual water level. For water level indication, wells 36 inches square set in the lock walls, with communication to the lock by a small opening at the bottom to

lessen the effect of surges, contain a welded steel box float, 30 inches square by nine inches deep. A non-slipping phosphor bronze belt transmits the movement of the float to a sheave fitted with pins on the transmitter mechanism, the pins in their turn registering with holes punched in the belt. These indications are then transmitted electrically to the respective indicators on the control board.

The position of the miter forcing machine which clamps the mitring gates is not given by synchronous indicators, but its open and closed positions are shown by red and green lights and by a mechanical indicator on the control board representing the machine.

INTERLOCKING SYSTEM

The interlocking system is very effective and is arranged with a view to making it necessary for the operator to manipulate the handles of the control switches in a certain order and also to prevent interference with each other on the part of operators in control of the different channels. The control switches are provided with interlocks placed in two vertical racks upon each edge of the control board and some distance below. The interlocks prevent the chain fender described before from being lowered until the adjacent mitring gates have been opened; they also prevent the gates being opened until the chain is in raised position. Or again, by this same means, the miter forcing machine cannot be operated to lock the ends of the gates until they are actually closed. In the same way the rising stem valves of the side wall, next above or below a miter gate must be closed while the miter forcing machine is open. This means that the valves either above or below the gate must remain closed until the gate itself is closed, thus preventing the operator from creating a current of water around the gates while they are open, or being moved in the opening or closing.

This wonderful interlocking system

prevents carelessness, jams and blunders of any description. It also controls the compartment locks by means of which waste of water is prevented when a small vessel is being passed through.

Such in brief is a general description of the central controlling works of the Panama Canal, all electrically operated, and for the successful installment of the electrical system of which too much praise and credit cannot be paid Mr. Edward Schildhauer and his associates and to the General Electric Company which built the machinery.

SPECIAL CLIMATIC REQUIREMENTS

It may be added that to withstand the humid atmosphere of the Isthmus, every insulated part, such as solenoid, relay, circuit breaker and other coils was impregnated with non-hygroscopic compounds. All small parts were made either of brass, copper Monel metal, bronze or of sherardized iron or steel. Mica or treated asbestos lumber were used largely in place of fiber or wood. A few statistics, by way of conclusion, may not be out of order.

The combined weight of the centralized control boards for Gatun, Pedro Miguel and Miraflores is about 39 tons. In their construction there is employed more than $2\frac{1}{4}$ miles of interlocking rod; about six million feet of control leads—made up in five and eight conductor cables; 732 indicator motors and 464 control switches.

PRISONERS TO USE TELEPHONES

A new telephone system is being installed in the Western Penitentiary by Warden John Francies. Scattered all through the prison yard, in the shops and on the front lawn are weatherproof telephone boxes. Instead of the men at work going for tools, they call from one of these boxes and the articles are sent to them. Three boxes have been placed on the outside for the men who take care of the lawn and grounds. In case a call is from the office, a light shows on the boxes.



Plowing a Trench between Baltimore and Washington

LAYING LONG-DISTANCE WIRES UNDERGROUND

After the severe sleet storm of March 4, 1909, which completely cut off Washington, D. C., from the outside world during President Taft's inauguration, steps were taken, says "*The Transmitter*," to make this isolation of the nation's capital never again possible by even the worst weather conditions.

Already telephone and telegraph cables had been laid in underground conduit from New York to Philadelphia and thence to Wilmington. From Wilmington to Washington is 94 miles and in digging the long ditch the plow was employed to loosen the soil and save the men the labor of picking. The accompanying picture shows a mule and a horse hitched up tandem to a ditch plow. The mule was always placed in the lead because he worked more intelligently.

Creosoted wood pipe was placed in the ditch to contain the cable, which is made up of 74 pairs of various sizes. Over these wires it is possible to carry on 99 telephone conversations and to send 296 telegraph messages all at the same time.

"GOLD-FILLED"

The term "gold-filled" has misled many persons. They hold the idea that in, say, the case of a "gold-filled" watch, the metal is in some mysterious way impregnated with gold. As a matter of fact, gold filling consists in the employment of two sheets of gold between which is placed a section of solder heated base metal.

This metallic sandwich is now heated and pressed so that the three parts are welded into a homogeneous whole, with the gold outside.

EMPEROR OF JAPAN HAS ADVANCED IDEAS

Contrary to the precedents established by the former emperors of Japan, the present ruler, Yoshihito, is entirely modern in all of his ideas relating to his home. The present Emperor has equipped the Imperial Palace throughout with electric lights; he takes a decided interest in amateur photography, and has shown modern tendencies in many other ways.

SOME INTERESTING LIGHTHOUSES

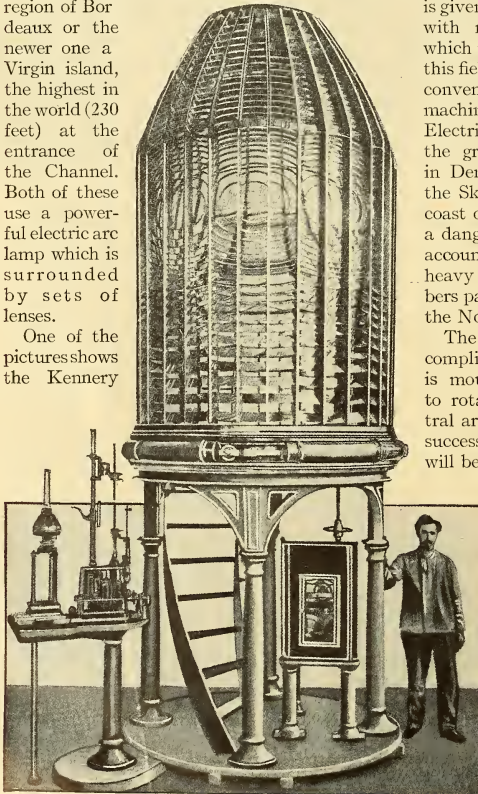
Some of the modern lighthouses which have been erected along the coast in France and other countries have now been brought to such perfection that they will send a beam for 50 or 60 miles out at sea, and in a few of the largest lighthouses this beam gives as much as three billion candlepower; for instance, in the La Coubre lighthouse erected on the Atlantic in the region of Bordeaux or the newer one a Virgin island, the highest in the world (230 feet) at the entrance of the Channel. Both of these use a powerful electric arc lamp which is surrounded by sets of lenses.

One of the pictures shows the Kennerly

light in India, indicating the method of mounting the great lenses around the central light. The table carrying the lenses is made to revolve bodily by means of a suitable motor device, so that in each revolution there are sent several beams; that is, one from each lens, and mariners know from the speed and the number of flashes what lighthouse they are approaching. In this case the light is given by an incandescent mantle with reflector, using oil vapor, which is a rival of electric light in this field, especially where it is not convenient to set up electric machines for giving the current. Electric light is, however, used in the great Hantsholm lighthouse in Denmark which is situated in the Skager Rak at the northwest coast of Jutland, this point being a dangerous one for mariners on account of bad weather, and heavy seas. Ships in great numbers pass this point in going from the North to the Baltic Sea.

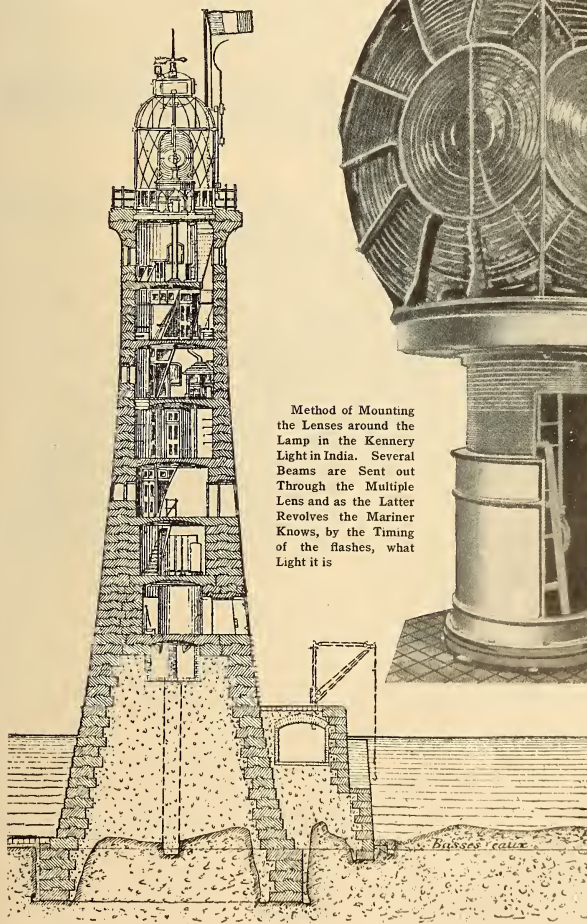
The set of lenses is quite a complicated one, and the whole is mounted on a platform so as to rotate bodily around the central arc lamp and thus produce a succession of flashes. At one side

will be seen the powerful arc lamp with its regulating mechanism, which is here removed from its position inside the lenses. It is naturally a difficult matter to rotate such a heavy body as the platform with the lenses. Here it is mounted on a set of rollers so as to turn around, but in other cases the problem is



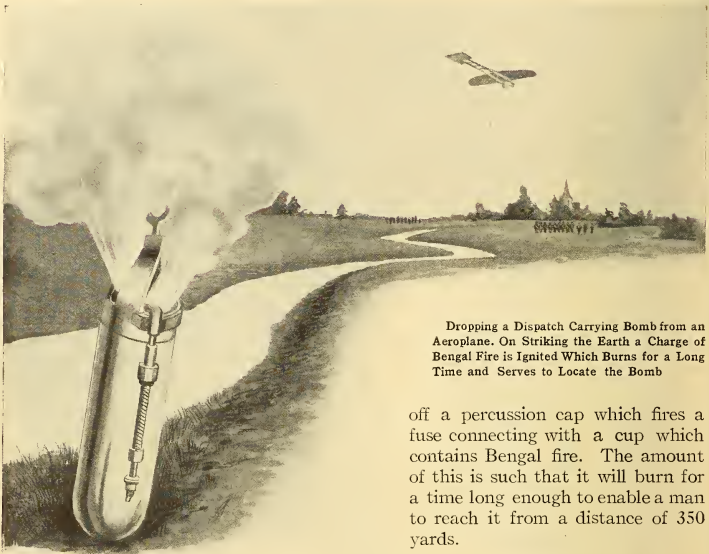
Lantern of the Hantsholm Light in Denmark in which the Lamp is an Electric Arc

solved by using a ring shaped float under the table and this is made to float in a circular mercury trough so that the mercury takes all the weight of the table and allows it to turn with very little friction.



Method of Mounting the Lenses around the Lamp in the Kennery Light in India. Several Beams are Sent out Through the Multiple Lens and as the Latter Revolves the Mariner Knows, by the Timing of the flashes, what Light it is

Showing the Interior Construction of the Beachy Head Lighthouse in England and the Arrangement of the Lenses



Dropping a Dispatch Carrying Bomb from an Aeroplane. On Striking the Earth a Charge of Bengal Fire is Ignited Which Burns for a Long Time and Serves to Locate the Bomb

off a percussion cap which fires a fuse connecting with a cup which contains Bengal fire. The amount of this is such that it will burn for a time long enough to enable a man to reach it from a distance of 350 yards.

A DISPATCH CARRYING BOMB

A French aviator, M. Fugairon, has just invented a device for providing rapid communication between an airship and the army to which it belongs. The name bomb, however, although it indicates the shape and appearance of the dispatch bearing projectile, is somewhat misleading, as the so-called "bomb" or aero-tube is perfectly harmless. It consists of a shell of aluminum having one end filled with lead, the purpose of which is to cause it to fall always with its point to the earth. Two partitions are fitted within the shell, one immediately above the lead and the other at the upper end, the latter being capped by a cover of special design. There is thus formed a watertight chamber into which the dispatch is pushed. Through the point projects a spindle which, by means of various levers and springs, is made to set

PROTECTION FROM X-RAY BURNS

It is well known that persons who are constantly using the X-rays, or even those undergoing protracted treatment by this method, are subject to so-called burns which are sometimes very serious, especially when the internal tissues are attacked. In a recent note to the French Academy of Sciences, M. Maxine Menard describes a screen and a glove, which when used together have been found to give protection both to the patient and to the operator. The screen is composed of three panels filled on the inside with sheet lead of not less than four millimeters (a little more than an eighth of an inch) in thickness. The panels are fitted on a base in such a way as to form an open triangle, inside of which is placed the subject to be examined, as well as the Crookes tube. The central panel is divided into three parts—the fluorescent screen, a movable

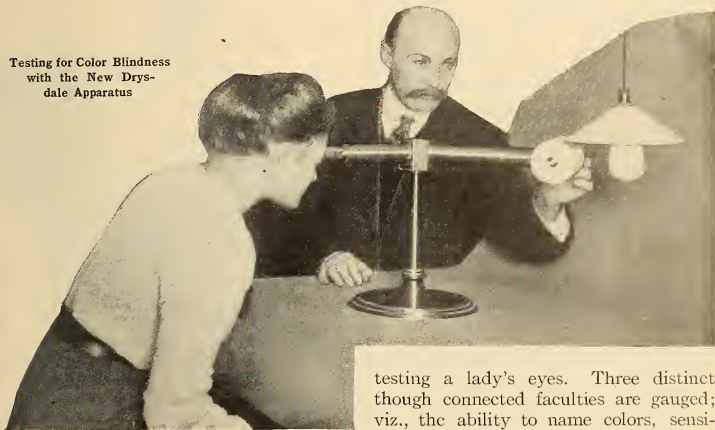
lead screen, and a fixed lead screen. The movement of the fluorescent screen is effected by means of counterweights. Similarly the movable leaden screen may be moved with the fluorescent screen or separated from it.

The gloves are made of rubber tissue into the material of which are incorporated the salts of some heavy metal—lead being as satisfactory as any. The material of the gloves should have a thickness of four millimeters, and should contain a

spectrum and a pure white light in addition. The white and colored lights are definitely separated by an angle of the prism, and the color patches can each be changed from red through to violet by turning a milled edge. The illumination can be delicately graded, and, automatically, this instrument will discover where the color sense of the eye is faulty. Dr. Drysdale calls his instrument the Chromoptometer.

The photograph shows Dr. Drysdale

Testing for Color Blindness
with the New Drysdale
Apparatus



sufficient quantity of the salts to make each square centimeter weigh not less than one and eight tenths grams, which is about four tenths of an ounce per square inch. Equipped in this way both operator and patient are perfectly protected against the strongest rays.

A TEST FOR COLOR BLINDNESS

An instrument to be welcomed by mariners, engine drivers and all who have to deal with colors, has been invented by Dr. C. V. Drysdale, of London, England. The instrument consists of a bent tube midway in which is placed a prism, which refracts the colors of the

testing a lady's eyes. Three distinct though connected faculties are gauged; viz., the ability to name colors, sensitiveness to various colors and the power of discrimination between nearly similar colors.

LOSS OF THE SENSE OF COLOR

The human eye, although trained to distinguish colors, may, by want of use, forget how to distinguish them. The unique experience of Dr. Hartley, a Fellow of the Royal Society, London, establishes the fact that color can be forgotten, as well as learned, by human sight.

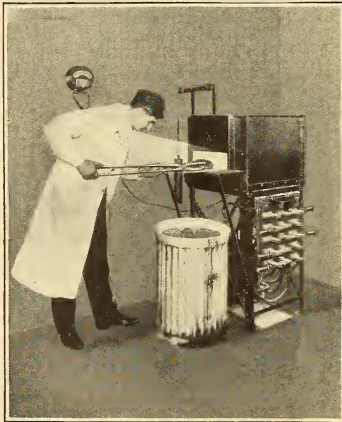
This gentleman, in order to save the sight of one, perhaps of both eyes, when one was injured, voluntarily immured himself in a room made totally dark, for several months. The fortitude that

enabled him to adopt this course, and the ingenuity whereby he preserved his health and faculties in this, the most mentally and physically depressing of all forms of imprisonment, are sufficiently remarkable; but Doctor Hartley also kept an accurate record of his impressions when he at last looked again upon the light, after the supreme moment when he satisfied himself that he was not blind.

He found that in the nine months' darkness, his eyes had lost all sense of color. The world was black, white, and gray. His eyes had also lost the sense of distance. His brain interpreted the picture wrongly. His hand did not touch the object meant to be grasped. Practice soon remedied the last induced defect of sight. Experiments with skeins of variously colored wools in the presence of one who had normal color vision restored the first.

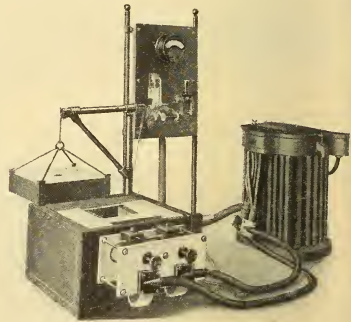
PRODUCING HIGH TEMPERATURES

The electric furnace makes the production and utilization of very high



Electric Furnace for Experimental Work, Giving a Temperature of 2000° F.

temperatures as easy as the operation of an electric motor. The illustrations show two types, the one at which the operator is at work being capable of giving a temperature of 2000° F., while in the other, used for very high melting temperatures and experimental work, a temperature of 3600° F. is obtainable. By way of comparison it may be stated that



For Very High Temperature Work this Furnace Provides a Temperature of 3600° F.

the temperature of the crater of an arc lamp is approximately 6300° F. and the melting point of platinum is considered to be 3200° F.

In the furnace shown in operation, the heating conductors are heavy nickel-chromium wire having the shape of a hair pin. These are placed entirely around the top, sides and bottom of the furnace chamber, which is lined with special fire brick, the closed end of the "hair pins" being at the front of the furnace and electrical connection being made when the units are thrust in place. In the very high temperature furnace two piles of flat carbon plates are employed, one pile on each side of the chamber.

The application of the electric furnace covers many fields, such as enameling watch dials, hardening steel, tempering tools and dies, aiding in food analysis in laboratories, testing minerals at mines, etc.



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The Japanese make very good use of their waterways which are crowded with boat loads of merchandise. This picture shows the Thiba Canal, Tokyo.



PHOTO FROM F. P. MANN, PARIS, FRANCE

Coasting down the mountain sides of Switzerland is thrilling sport. All need to lean far inward when negotiating a sharp turn.



PHOTO BY THE AMERICAN PRESS ASSOCIATION, N. Y.

When other people shiver in overcoats there are always some hardy ones who will take a dip in the ocean even in mid-winter. These young ladies are warming up with the medicine ball after a December plunge, at Brighton Beach, Long Island.



PHOTO BY UNDERWOOD & UNDERWOOD

One of the most successful life saving suits for use at sea is that invented by a Mr. Raschke, who recently demonstrated it by jumping overboard from a vessel on the Thames River, right in the shadow of the House of Parliament, London, England, to prove how easily the wearer of one of these suits can keep afloat. The suit is of specially made goods, which is put over a belt around the body. A cap protects the head and ears. To assist in getting about in the water, a paddle, which can be taken to pieces in a second, and put into working order in the same length of time, is carried.

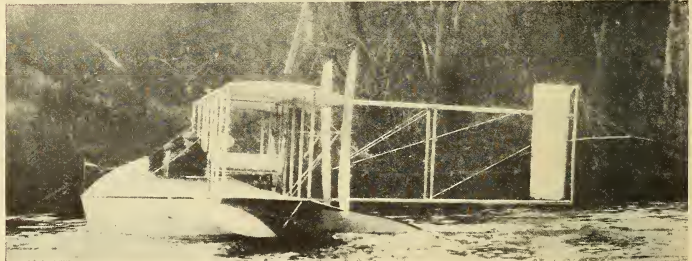


PHOTO BY PAUL THOMPSON, N. Y.

Hydro-aeroboot, just perfected by Orville Wright. It is an improvement over the hydro-aeroplane, since it is capable of attaining great speed on the surface of the water and rising into the air all within a distance of less than 200 feet. The boat is modeled somewhat after the shape of a whale.

Engine No. 26 of the C. B. C. R. R. grew tired of hauling freight trains. Left in the yards at Huntington, Ind., the engine started itself, apparently, ran off the end of a spur, crossed Jefferson Street, and backed into Wm. Maynes' grocery. Its tender dropped into the basement while its nose was poked across sidewalk.



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Joe Tinker signing up with the Federal League. On his left is Charles Weeghman, president of the Chicago Federals, and on his right, W. M. Walker. By the laws of organized baseball, Tinker is the property of the Brooklyn Nationals. His desertion to a league outside the fold is expected to participate a bitter baseball war.



PHOTO BY THE INTERNATIONAL NEWS SERVICE, N. Y.

Hugo C. Gibson, the well known automobile engineer, has brought out a novel two wheeled vehicle called the "Autoped," resembling a huge roller skate. It is driven by a small gasoline engine, and the whole device weighs 40 pounds.



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Interior of the hall in Calumet, Mich., scene of the fatal panic which resulted from the false alarm of fire — taken shortly after the disaster.



PHOTO BY C. VEIGA, PUNTA ARENAS, PATAGONIA

Branding a steer on a ranch in Patagonia, a few miles north of Punta Arenas, the southernmost city in the world. This beef can be shipped to the United States and sold, at a profit, cheaper than domestic beef. Beef from this cold country keeps much better than that from warm climates; Panamanian beef, for instance, must be eaten the day it is killed.

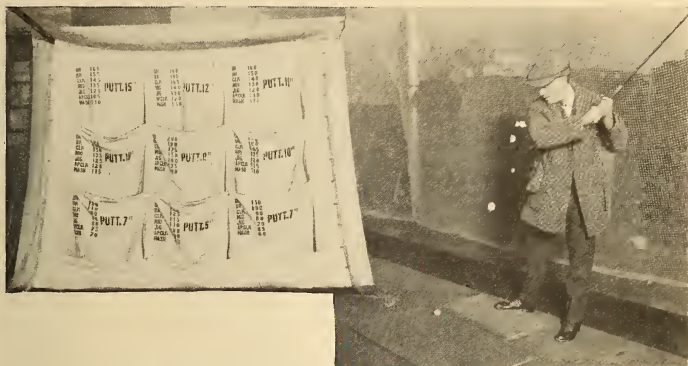


PHOTO BY THE INTERNATIONAL NEWS SERVICE, N. Y.

In-door golf is a sport rapidly gaining favor at the big athletic clubs. This group shows a player driving and also the odd curtain hung at the back of the cage. The ball striking in certain sections of this curtain denotes a certain length and direction of drive, if it had been in the open.



PHOTO BY BAKER, HONOLULU, HAWAII

Tree moulds of Hawaii. Ages ago the lava flowing from Kilauea surrounded the coconut palms to a height of many feet. The stream of lava flowing on left a large amount stuck to the trees. This cooled into moulds, which later partially disintegrated and became covered with the foliage of growing vegetation like giant toadstools covered with verdure.

Dr. Stephen Smith, vice-president of the New York State Board of Charities; president of the National Conference on Race Betterment and a prominent figure at the meeting in Battle Creek, Mich., Jan. 8-12, 1914. He is hale and active at 92.



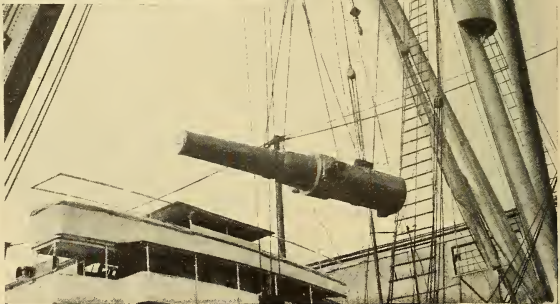
PHOTO BY HINTON GILMORE, BATTLE CREEK, MICH.



Miss Lucy Powcock, holder of the woman's single scull championship of England, is now teaching the women students of the University of Washington, Seattle, how to row the Eton-stroke.

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Steamer Cristobel in dock at New York loading guns for Panama Canal defense. The guns average about sixteen tons each.



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The Solomon Island Gourd or Gauda Bean is as fine to eat as asparagus. It grows to a height of six feet under proper climatic conditions.

PHOTO BY B. F. DAVIS, WINTER GARDEN, FLA.



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Among ferries and boats the world over none is more novel than that used frequently on the Upper Tigris River in Turkey — nothing but an inflated sheep skin, upon which the Turk floats upon the water in safety and comfort.



Members of the St. George Field Club playing soccer football on Manhattan Field, New York, on Christmas day, when two picked teams played their first match game. The girls furnished the spectators with plenty of excitement by their speedy playing and battled through two fifteen minute halves to a 1 to 1 tie.



A new telephone cable has been laid between England and Ireland at a cost of \$380,000.



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A partial view of the shore front at Sea Bright, N. J., after the furious waves, during the storm of Jan. 3d and 4th, had battered the homes of the wealthy as well as the homes of the humble fisherfolk into kindling wood. The wreckage strewn on the shore is all that remains of the once celebrated Octagon Hotel, the foremost of the hostelries there. The damage at Sea Bright amounted to about \$2,000,000.



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A view of the five submarines at anchor at the new concrete docks at Colon, waiting to pass through the canal to the Pacific entrance. These submarines arrived recently from Guantanamo, Cuba. They came down under their own power, accompanied by a collier and the Monitor "Montauk." The submarines will be used in the defense of the Pacific entrance to the canal. This is the first time on record that submarines have made such a long sea voyage.

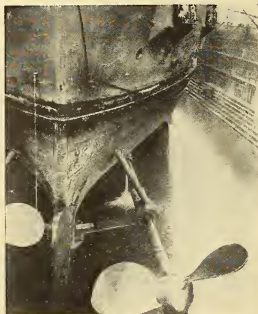


PHOTO BY THE INTERNATIONAL NEWS SERVICE, N. Y.

Disabled U. S. Battleship, Vermont, in drydock, showing the starboard propeller extending about fifteen feet further than the port propeller. This caused a bad leak, at the point where the water is here shown running out, resulting in a hurried wireless call for help.

This tunnel borer eats its way through rock like a giant mechanical mole. A huge steel engine, eighteen feet long is equipped with fifteen powerful rock cutting pneumatic hammers which strike 1,000 blows per minute, with 25 pound hammers. It goes tearing through a rock like an excited terrier digging his way under the corner of a rodent infested barn. A revolving disk, eight feet in diameter, carries the hammers up to the surface attacked and keeps them up to their work. The machine is so constructed that the cutting tools work only when they are up against the rock, each tool being cut off automatically when its share of the work is done, allowing those with harder work to do to catch up.

PHOTO BY UNDERWOOD & UNDERWOOD, N. Y.

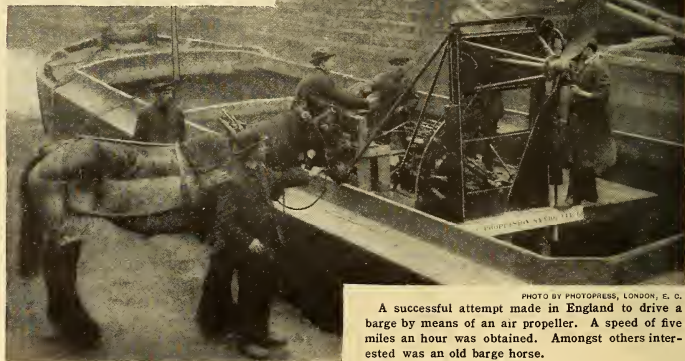
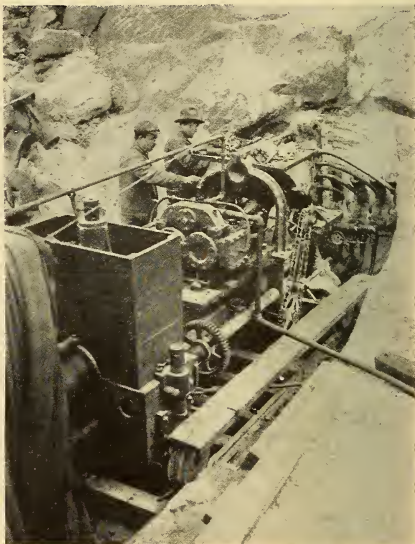


PHOTO BY PHOTOPRESS, LONDON, E. O.

A successful attempt made in England to drive a barge by means of an air propeller. A speed of five miles an hour was obtained. Amongst others interested was an old barge horse.

Lord Lytton, grandson of the novelist Bulwer Lytton, one of the finest international skaters at Wengen, England.



PHOTO BY THE INTERNATIONAL NEWS SERVICE, N. Y.

Have you a pocket in your skirt? They are all the go now. This young woman who advocates it declares she got the idea from her small brother.



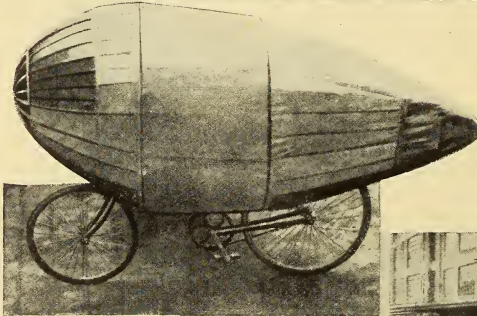
PHOTO BY PAUL THOMPSON, N. Y.

Mayor John P. Mitchell of New York throwing in the switch to fire the blast for breaking away the last barrier in the Ashokan aqueduct. This picture was taken 470 feet below the surface.

Irwin Maxwell Gregg and Grace Margaret Knoll, the first couple to be married under Wisconsin's eugenic law which requires that every man and woman entering matrimony must have a physician's certificate of good health. Mr. Gregg is a director at the Milwaukee Y. M. C. A. and his wife is an all-round athlete.



PHOTO BY THE INTERNATIONAL NEWS SERVICE, N. Y.



Bicycle with wind shield in which Berthet, the French racing cyclist, was able to cover five-eighths of a mile in 1 m. 7 sec.

Crowd applying for jobs at the Ford plant in Detroit, Mich., after the company had announced an increase of wages to practically double the usual amount. Showing Woodward Ave. packed for a block.





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Gen. Natera and Gen. Ortega, rebel chiefs who figured in the storming of Ojinaga, conferring with Agent Gray, who carried a message from Major McNamee, officer in charge of the United States border patrol, regarding firing on American border.



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Nothing is left undone to prevent spread of small-pox along the United States border, from the Mexican refugees. Even the babies are vaccinated.



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"Al" Jennings, the ex-bandit and train robber, now seeking to be governor of Oklahoma on the Democratic ticket. He says: "I'm going to be governor of my state and I'm going to show that an ex-train robber can 'come back.'"



PHOTO BY THE INTERNATIONAL NEWS SERVICE, N. Y.

Trehawke Davies, first woman to loop the loop in an aeroplane.



First photograph of Aviator Beachey looping the loop, over the San Francisco Fair Grounds on Jan. 4th. It was taken by E. Carl Wallen, in Christofferson's machine. By the time the latter had reached the proper altitude, Beachey had made six of his loops but Wallen managed to snap him on the seventh and last loop.

PHOTO BY THE INTERNATIONAL NEWS SERVICE, N. Y.

THE CURSE OF THE MAÑANA HABIT

BY GEO. F. WORTS



It has truthfully been said that the unconscious motto of every Central American is, "Never do to-day what you can put off until to-morrow." However, instead of wasting so much perfectly good breath on so many utterly idle words, he merely extracts the thought, and says, "*Mañana*" which means simply, to-morrow. And every Central American town is a living, glaring example of the *Mañana* habit. It is not necessary to consider the poorly paved street, the dirty, naked child playing in the gutter or the universally depressed currency

system. A mere observation of the inevitably indolent and listless attitude of every member of the populace on one encounter is ample evidence to carry complete conviction of the disastrous consequences of generations of practice of the habit.

Yet you may stroll down a street of any typical village of Mexico, Guatemala, Salvador, Honduras or Costa Rica, and your gaze must almost invariably seek that only conflicting element in an otherwise ideal picture of tropical beauty —electric wires on ungainly poles.

In the Shadow of the Muttering Izalco; a Hydroelectric Plant on the Banks of the Rio Grande (Salvador)



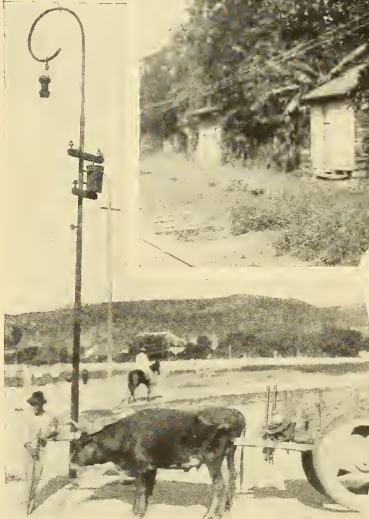
Quaint Little Electric Plants are Springing up in Constantly Increasing Numbers. This One in Tlacotepec, Mexico, is Typical

Of course they are not strung with the geometric nicety or the carefully insulated and insurance inspected neatness of the wires of Chicago, New York or San

Francisco; for they zigzag lazily along the

thatched hut you would find that they really convey as much usefulness — at least we will say as much relative usefulness — as the imposing, carefully hidden bus bars of a \$300 a month swagger apartment.

The only Disturbing Element in an Otherwise Tropical Picture—Electric Wires. They Zigzag Along the Streets and Sag Wearily Through the Rank, Fetid Jungles



Sometimes the Streets are Illuminated by the Sputtering, Metropolitan Glare of Arc Lamps

streets, sag wearily through rank, fetid jungles, careen drunkenly around bushes of banana trees and coco palms and typify at each new and amusing vista the slipshod character and nature of the people who make use of them. Still, they perform their duty. If you were to follow the ragged, rusty, sagging wires until they entered, uninsulated, the side of some palmetto



Electric Washing Machines are Not in Wide Use in Central America

It is hardly necessary to mention that such late developments as the electric washing machine, the electric flatiron or the electric percolator have not come into

widely accepted use; and I will admit that I have not met a single *señorita* who confessed to the use of an electric curler. But the immutable fact remains that to at least *one* better and greater money saving use the electric light was never put.

In the rainy season — a period of the year comparable to the American winter — it is impossible to keep clothing properly aired and dried by natural means. In an unbelievably short time it becomes moldy and rots. For the purpose of keeping a closet full of clothes absolutely dry, nothing was ever invented to surpass a constantly burning electric lamp bulb. The Central Americans were quick to realize this fact, and as a consequence you will find, even in the homes of many of the poorer class, one or two electric lights installed.

Even in those places where the machete serves a twofold purpose, a means of defense and an agricultural implement; where plebian automatically becomes patrician through the ownership of a sewing machine; where the face of an "Americano" is so rarely seen as to deserve excited comment,—in such places as these has electricity entered, and by all apparent signs it has come to stay.

No up-to-date plaza dares boast of other illumination than electrical, which means, happily, that it is no longer necessary for you to trust to the uncertain, untruthful light of the flickering oil lamp to recognize your *señorita* as she passes in the sluggish stream of Latinic beauty. Nor do lurking idlers' stiletos as of yore spell the old fear to the nocturnal traveler in those more progressive places where the streets have become illuminated by the sputtering, metropolitan glare of arcs — even though they may have been resurrected from the junk heap of some American city.

Cheap electricity is often merely a matter of geography. The volcanic peaks of the southern Sierras pierce the unhealthy lowlands of Central America. From their lofty sources, innumerable mountain

streams pour forth the power of the snowflake to constantly increasing numbers of quaint little hydro-electric stations located in the foothills. American, English, French or German genius installs fool-proof dynamos; cheap labor suffices to attend to them. Result: cheap electricity. Sonsonate, Salvador, supplies a typical illustration.

On the banks of the Rio Grande (you must remember there are scores of Rio Grandes on this earth), in the shadow of the glowering and ever rumbling Izalco, which once, so it is related, inundated the countryside with lava and ashes, is located the homely shack containing the lusty little turbo-generators which supply Sonsonate with power. There is nothing particularly striking in this statement or in the appearance or presence of the generator building except possibly the amusing thought that its wheels may turn only when the irrigation ditch which it taps is not being used for agricultural purposes. Luckily, Salvadorian farmers do not labor during the night, so that Sonsonate is aglow of evenings as a general rule.

STEAM FOR THE SOIL

For some time certain growers of tomatoes, cucumbers, and similar vegetables for the London market have been injecting steam into the soil with a view to destroying certain insects and slugs. It is reported that the plan works very well for that purpose, but the operation brought to light an unexpected fact; namely, that the soil thus treated increased greatly in fertility, so greatly, in fact, that the ordinary amount of manure cannot be used afterward.

This effect has been explained as being due to the sterilization produced by the steam, which kills the phagocytes or protozoa which in ordinary circumstances keep down the number of bacteria in the soil whose operations are beneficent in turning organic nitrogen into a form suitable for plant food.

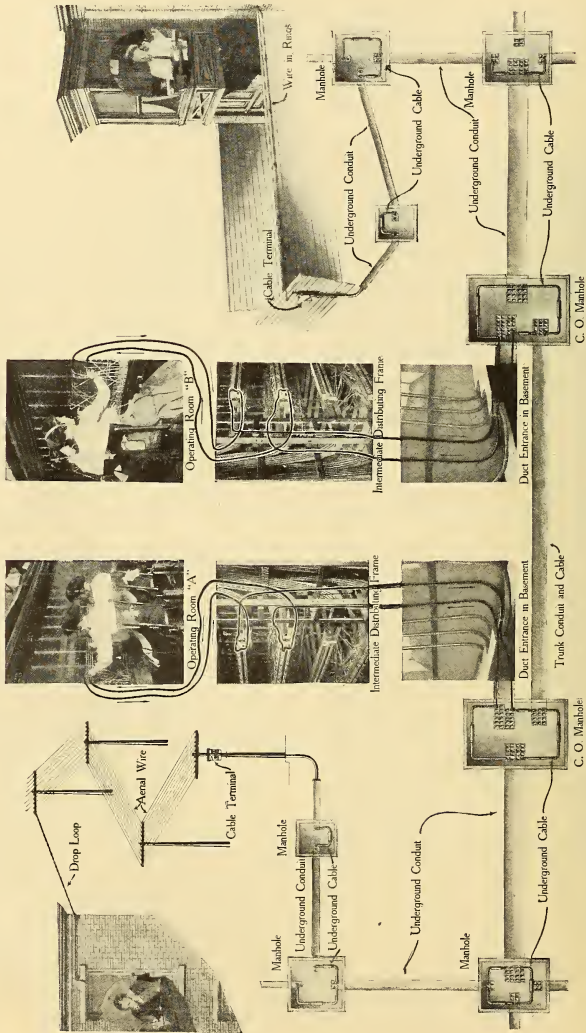


CHART ILLUSTRATING THE PATH OF A TELEPHONE CALL. NOT ALL THE INTRICACIES OF THE SYSTEM ARE SHOWN BUT BY TRACING THE LINE WITH A PENCIL THE GENERAL COURSE OF THE CALL CAN BE FOLLOWED

ROAD OF A TELEPHONE CALL

The chart shown on the opposite page was primarily intended for the information of telephone employees, but it is so simple and so clear that it is entirely intelligible to the lay reader. After tracing the path of a telephone call in any city system of a size sufficient to make trunking necessary; after considering that the line shown is but one of a network of thousands which in the exchanges are woven into almost solid masses; when it is remembered that the chart shows the general path only and leaves out of consideration all the hundred and one delicate relays, induction coils, keys, signal lamps, etc., it is difficult to comprehend why more messages do not go astray as they pulsate through this labyrinth.

This chart, first elaborated by the *Telephone News* and later reproduced by the *Transmitter*, through whose courtesy the plate was obtained, shows the man at the left calling the woman at the right. The calling circuit connecting the two switchboards is not shown in the chart.

It will be noted that two types of service distribution are indicated — the aerial and the interior block wiring. The main underground conduit (sometimes termed the backbone) and the smaller ducts in "laterals" serving the immediate neighborhood are both indicated. Cable terminals, manholes (both central office and other types), ring wiring, splicing and duct entrances are also shown.

THE MYSTERIOUS FERRYBOAT

German ingenuity is a matter of proverb. Here is a ferryboat used in crossing the Elbe, near Dresden. There are no oars, no poles, no engine, and there is no power used on shore. Yet the boat skims rapidly back and forth, from shore to shore, and with no apparent effort whatever.

The principle of its operation is as simple

as it is ingenious. A hundred odd feet upstream, parallel to the path taken by the ferryboat, a heavy steel cable is suspended from bank to bank and several feet below the surface of the water. Along the cable slides a pulley. From the pulley another cable extends to the boat. The current is rather swift — perhaps five miles per hour.



Ferryboat without Sails or Engine

From one bank, the boatman pushes off. With a swing of the rudder he heads the boat upstream. But the force of the current tightens the line between the boat and the cable, and it commences to pick up speed for the opposite shore. All that is required of the boatman now is to hold the rudder "hard over" so that the bow of the boat points slightly upstream.

These conflicting forces push the boat across. Quite obviously, on the return voyage, he puts the rudder "hard over" in the opposite direction, and the same result is gained, and he beats up against the stream in the same way that a sailboat beats up against the wind.

STEREOSCOPIC VIEWS OF SURGICAL OPERATIONS

There is not a surgeon worthy the name nor a student of surgery who would not travel miles to see an operation performed by such master surgeons as the Mayos, J. B. Murphy or F. H. Albee, famous the world over because of their skill.

A truly wonderful application of photography, the stereoscope and proper light—the device being called the “Stereo-Clinic”—enables the cross-roads surgeon or the foreign medical missionary to bring to his help from ten to 50 consecutive steps in the technique of an operation as performed by such noted surgeons as these.

The accompanying illustration shows the outfit in use, with one of a set of pictures in the stereoscope holder. A lamp and reflector properly illuminate the views.

The physician sits in his office and

has before him a lecture on an operation which he wishes to study. As he reads the lecture he follows, step by step, the whole operation with as much satisfaction as if standing at the operating table. While a suspension of an actual operation at any point might be dangerous, the Stereo-Clinic permits the examination of any particular step by the physician as long as he likes.

The noted surgeon Hugh H. Young says, “If anyone studies the stereos made of my operation he will see more than he can by witnessing the operation itself.”

GERMAN PROCESS FOR MAKING TUNGSTEN FILAMENTS

In a German technical journal, M. Ruff describes the manufacture of tungsten filaments for incandescent lamps. Metallic tungsten is obtained generally in the form of a very fine powder which is difficult to agglomerate, and when this agglom-



The “Stereo-Clinic.” A New Method of Studying Operations of Great Surgeons, Step by Step



Stereoscopic View Showing a Step in an Operation for Tendon Transplantation. The Skilled Hand Seen at Work is That of the Famous Surgeon, Robert Jones F. R. C. S., Liverpool, England

eration is effected the metal has not sufficient ductility to admit of drawing. To transform the powder of tungsten, which must be nearly pure, into a filament sufficiently supple and resistant, the following process is used.

The metallic powder is first strongly compressed in a steel mold and given the form of a bar, which, however, is very fragile and which must be first strengthened by annealing. This is done in a tubular furnace at very high temperature, the heating being carried on in a blast of hydrogen. The bars are then submitted to vitrification at a temperature of 2850° C. in an electric furnace, on coming out of which they have a crystalline appearance. The bar has then sufficient resistance to be drawn by hammering, which is done by a special machine striking very rapidly until the thickness is about three hundredths of an inch. It is then put into a wire-drawing machine in which it passes through a tube of decreasing diameter, and then through the diamond edged jaws of the wire drawer, both tube and jaws being heated by a continuous supply of gas. After passing through this ma-

chine about a hundred times it has finally a thickness of 25 thousandths of a millimeter, and after being again annealed in a current of hydrogen to remove the coating of oxide, it is ready for the lamps.

ANGLO-AMERICAN EXPOSITION IN LONDON

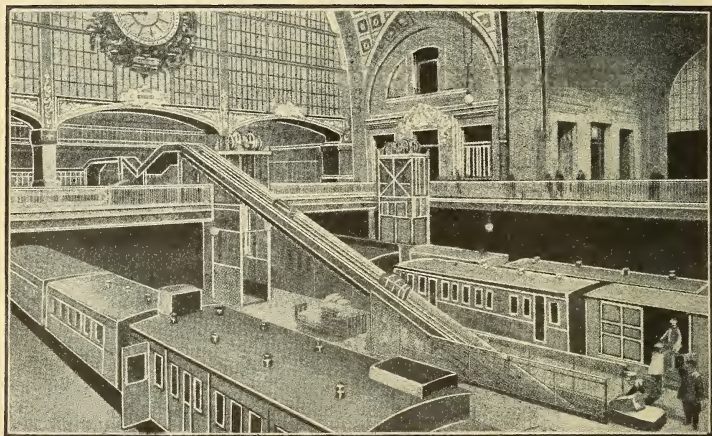
The object of the Anglo-American Exposition which is to be opened in London next May is to celebrate in a fitting manner the 100 years of peace and progress between the English speaking peoples since the Treaty of Ghent in 1814. The exposition will be held at Shepherd's Bush, London, where transportation facilities for handling as many as 1,000,000 people a day exist, and will demonstrate in a practical manner the progress which has been made by the American and British peoples in every branch of civilization during that century. A hundred years of the history of the two nations—their famous statesmen, authors, artists, inventors, philanthropists financiers, merchants, manufacturers and others, men and women who have helped in the

advancement of civilization and in making each nation what it is to-day—will be represented with such objects of historical interest as are associated with them and their times. The fruits of the intellect and genius of the people of both nations will be presented, showing in practical ways the advancement in navigation; in railway transportation; in electricity, electric and hydraulic power, coal-gas and electric light; in art; in every form of endeavor in point of fact.

The buildings proper, which stand in grounds of 100 acres or so, were completed long ago and comprise the Exposition Palaces, the Fine Art Palace, the

Congress Hall, the Great Stadium, the largest in the world, with a seating capacity for 100,000 people, American and British restaurants, a Garden Club destined to be one of the most exclusive of *rendezvous* in all London and all manner of amusement booths and theaters in a separate part of the grounds.

The list of vice-presidents and members of the various general committees comprises nearly all the best known men in America and the British Isles. The American headquarters are: American Executive Offices, Anglo-American Exposition, Woolworth Building, New York City.



HANDLING BAGGAGE IN A PARIS STATION

In the Orsay railroad depot in Paris is now installed a well designed electric system for handling baggage. At this depot the tracks lie on the lower level and the baggage needs to be elevated to the upper level which is on a level with the street. An original method is used here, which consists of an endless belt conveyor formed of heavy canvas running on rollers and driven by an electric motor, and as the belt runs at high speed it serves amply to take care of all the baggage from the incoming trains, so that as fast as the men unload the trunks and parcels these are taken up to the second floor. The speed of handling depends only upon the rate of unloading the cars.

Along the train platform are placed a number of chutes and the men have only to drop a trunk into a chute from whence it is picked up by the belt underneath and then carried to the second floor.

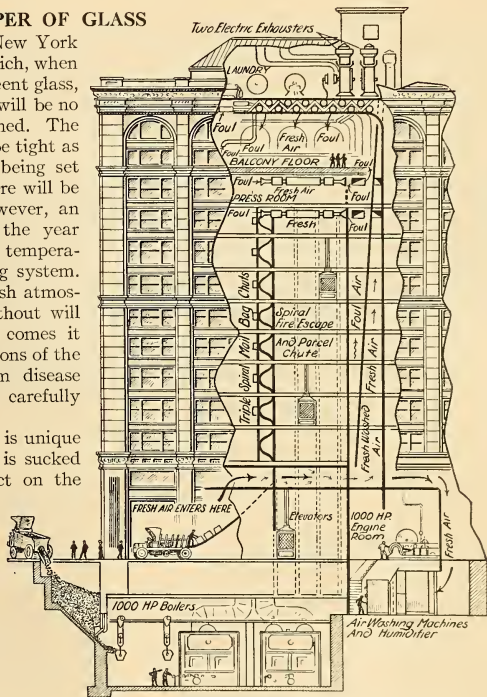
A SEALED SKYSCRAPER OF GLASS

The latest wonder in New York is a sealed skyscraper, which, when completed, will be 78 per cent glass, yet in the building there will be no windows that may be opened. The entire twelve stories will be tight as a drum, the glass walls being set in steel frame work. There will be plenty of ventilation, however, an abundance of fresh air the year round supplied at an even temperature by a new ventilating system.

In cold weather the fresh atmosphere sucked in from without will be heated; when summer comes it will be cooled. At all seasons of the year it will be free from disease breeding germs, being carefully purified.

The ventilation system is unique in its thoroughness. Air is sucked in through a special duct on the second floor, because air at this altitude has been found to be less impure than at greater heights. The air passes through a "shower" chamber where the impurities are washed out of it after the manner of a rain shower, and it is then forced into another

chamber, where it is sucked through the blinding sheets of a high pressure shower. Thus purified and vitalized, the air passes through cooling chambers into a huge flue reaching to the top of the building. This flue is divided into two sections of wedge shaped design. The purified air is sucked up through the wedge that has its base below and the bad air is sucked out through the wedge that has its base above on the roof, where powerful motor fans are stationed for this purpose. At each floor there are inlets with ducts which guide the fresh air into the interiors under regulated pressure, whereas the foul air is sucked out under the ceiling through ducts connecting with the main flue. Thus a con-



General Scheme of the Sealed Skyscraper

stant supply of washed and healthful air is being forced into the building without creating drafts, while the foul air developing within rises to the ceiling and is sucked out of the building. This system obviates the use of windows, which only let in draft and noise and dirt.

Independent of the air supply there will be a hot water heating system insuring in the coldest days of winter a constant, healthful temperature and no humidity.

The power plant will be all that an engineer could possibly wish for. More than \$300,000 will be expended on it. The engineer will have a large office, also specially ventilated, and the engine room force will have lavatories for their own

use. There is a fire escape system for the men below, so that they can run out into a fireproof shaft 40 feet below the basement and reach the street without going through the building.

As the building is to be used for publishing purposes, the ink used on the presses will be piped from specially designed tank wagons stopping in the basement into receptacles feeding the presses on the floors above. Compressed air forces a column of ink, 250 feet high, to feed the busy presses without lost motion or the touch of human hand. This system of "forced draft" ink feed is entirely new. It is believed it will save the waste inseparable from ink delivery in cans and also save the labor cost of handling them.

There will be ordinary mail chutes in the front of the building and in the center there will be an enormous triple mail bag chute winding like a spiral from top to basement. This chute will be seven feet in diameter and of all steel construction. The mail bags for each floor will be fed to it through apertures that close automatically and the bags will slide down into mail wagons standing in the basement. This scheme saves an enormous amount of handling, especially in the publishing business. In case of fire this chute is the most effective fire escape that could possibly be installed. In addition, there is a fireproof shaft, built out of cement and iron within the building and in this shaft there are double escape ladders of the usual type.

This "loft building de luxe" will cost \$1,500,000, and it will be the only building in New York built entirely of steel and glass. On the roof will be a sun parlor for the women employees, where they may take their noon rest amid the most cheerful and attractive surroundings.

As smoking will not be allowed in the building, another glass house will be put up on the roof for patrons of the fragrant weed. On the roof also will be found a steam laundry, perfectly equipped in

every particular. In the laundry all the uniform overalls worn by the employees in the building will be washed, as well as towels and other necessary linen.

The offices will be fitted with rubber floors, noiseless typewriters and dictaphones, while the absence of windows to let in street noises, and the replacement of office boys by automatic carriers, will make the interior noiseless. There will be no need for "hustling" about as all actions requiring speed will be done by machines. There will be no lost motion, no repetition.

This newest wonder of New York is being constructed by John A. Hill to house the plant of the Hill Publishing Company. It has grown out of an idea. One by one schemes to promote office efficiency have occurred to Mr. Hill and he installed them in his present quarters, until the point was reached when to carry out these ideas to their proper conclusion and also to put to use many new ones, a new building was needed. It is now well under way and will be ready for use early next summer.

CHART WILL OUTWIT THE MAGNETIC POLE

A "magnetic chart" has been prepared for Hudson Bay by the Canadian Naval Service Department which is expected to solve one of the worst difficulties of navigating in the far northern sea. The ordinary compass is of little use in Hudson Bay owing to the proximity of the magnetic pole. Its vagaries are such that the best compass can scarcely be relied upon, and indeed skilled mariners depend largely upon other means when in these waters. There is even one point in the Bay where the little needle refuses to work and swings aimlessly upon its pivot. The new chart will show exactly the positions in the Bay where the compass "kicks up," so that a captain will no longer be worried when his needle dips or swerves suddenly, but can ascertain his position by that very phenomenon and keep his ship in the safety zone.



Barge Loads of Clam Shells on the Upper Mississippi. Each Barge Carries 100 Tons, Worth About Eight or Ten Thousand Dollars

Fathering the Button Business

In 1890 there was not a fresh water pearl button manufactured in the United States. Now nearly 60 per cent of all the buttons made and used this side of the Atlantic, including pearl, vegetable ivory, metal, cloth and other kinds, are made from the shells of fresh water clams.

Before the establishment of the fresh water pearl button industry, we imported from one million to several million gross annually from Europe. In 1898 the Austrian Consul-General wrote, "The pearl button industry of Austro-Hungary, which in former years occupied a prominent place among the flourishing industries of the monarchy, has dwindled of late to such an insignificant figure that pearl buttons can no longer be regarded as one of the principal articles of export to the United States. This may be attributed to the development of the industry in the United States."

Since the Consul-General wrote the above, exportation from the United States to Europe has succeeded importation.

These changes have come about be-

cause of the initiative of one man, J. H. Boepple. Among Mississippi river folks he is known as the "father of the button business." Twenty-five years ago Mr. Boepple came to Muscatine, Ia., from Hamburg, Germany. He had been a pearl button maker in the old country. At Muscatine he found the banks of the Mississippi river literally piled with the same kind of mussel shells from which pearl buttons had been cut in Germany and other European countries for a half-century. He learned that the clam beds all along the upper reaches of the Mississippi were no less extensive than they were near Muscatine and that not one of the billions of shells had ever been made to produce a penny.

Naturally he dreamed dreams. Also he took home some of the shells and made buttons out of them. With them as evidence in hand he endeavored to interest capital in the development of the great unexploited resource. At first he met with no encouragement and the full amount of ridicule generally accorded the man who would do something different

from his neighbors, yet he went on making buttons and talking to every one who would listen to him. Ultimately he succeeded in organizing a company with a small capital and established a button factory at Muscatine equipped like the factories of Europe. The concern was a success and from that small beginning of 20 years ago has sprung into full being the splendid industry of to-day.

Muscatine with some 40 button factories has become the pearl button center of the world. The Mississippi River is lined with factories all the way along, from Red Wing, Minn., to Louisiana, Mo. New York, New Jersey — in fact, nineteen different states, now have all the way from 20 to 25 button factories. Thousands of men and women are employed in them. Other thousands make up a great army of clam diggers who live from April to November each year on the waters of the Mississippi, Ohio, Arkansas, White, Red, Cumberland, Tennessee, Illinois and a score of other rivers in the Middle West. Their equipment is a big flat boat and two bars made out of gas pipe and supplied with several dozen dangling crowfoot hooks. These hooks are dragged over the beds where the mussels are lying open. No sooner do the hooks touch them than they shut up tight and hold on for dear life.

The shells are freed of the flesh of the clams by boiling them in large tanks on shore. They are then sorted into the different varieties and thrown into bins to await the arrival of the shell boat with its big barges in tow. These barges hold a hundred tons of shells and often four of them are towed at a time. Since the lumber and rafting business has declined on the Upper Mississippi shells have taken rank as the most important class of freight carried by the river boats. The high priced ones, the niggerheads and yellow backed sand shells, have brought \$40 a ton this season. The less valuable ones, such as muckets, have sold at an average of \$20.

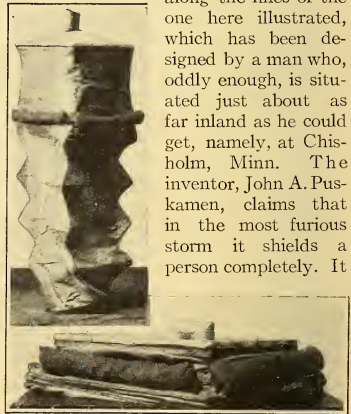
The presence of pearls in the river

mussels has given wonderful popularity to the clam digging business. Mississippi River pearls have sold as high as \$6,000. Indeed, the pearl is the direct cause of the rapid development of the shell and button industry. The clammer is first of all not a shell gatherer but a pearl hunter. He sells his shells for his daily bread but always he dreams of the day when it shall be his turn to find a pearl of great price.

A LIFE PRESERVER THAT PRESERVES

Those of inventive mind have no doubt thought of some time designing a life preserver which should be unsinkable, capable of carrying food and water, etc. Perhaps their ideas have been

along the lines of the one here illustrated, which has been designed by a man who, oddly enough, is situated just about as far inland as he could get, namely, at Chisholm, Minn. The inventor, John A. Pus-kamen, claims that in the most furious storm it shields a person completely. It



Life Preserver in Which a Person is Completely Enclosed

is collapsible and can be let down into the sea in the shortest possible time and is carried away from the side of a ship without danger. This life saving apparatus will carry one adult and one child together and is held to be a most practical device. It has an automatic air valve and is made of cork and canvas with a weight at the bottom.

AN ODD SHIPWRECK

A shipwreck occurred recently, right in New York harbor, under peculiar conditions, peculiar inasmuch as there was no storm or no collision. The unfortunate craft was the *Zulia* of the Red Line. She was at dock, loading for Caracas, Venezuela. A huge piece of shafting, weighing 3,600 pounds and enclosed in a wooden crate, had been slung up by the crane, and when over the ship's hold it suddenly shifted its position, broke thorough the end of the crate and then plunged like a plummet down through the cargo of apples, flour, etc., through the bottom of the ship, and finally brought up in the mud at the bottom of the harbor.

With great difficulty, by the aid of pontoons and powerful pumps of a wrecking crew, the ship was prevented from sinking on the spot, and the hole was finally plugged. But in getting out into choppy water on the way to dry dock, the plug loosened and the ship sank so suddenly that the crew barely escaped with their lives.

and tongue to enable the pupil to pronounce correctly the difficult French vowels and diphthongs. Then the student, by means of a hand mirror, puts



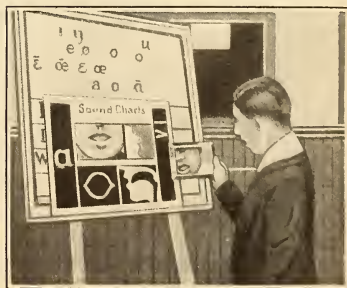
Showing How the Steel Shaft Plunged Through the Bottom of the Ship

his lips, tongue and teeth in the proper positions to make the various sounds, as indicated on the chart.

The method has proved very successful, and it has been found that after one school year — ten months — of study, consisting of six hours per week, the pupils have thoroughly mastered the French pronunciation and still retain it even after the long summer vacation. On the other hand the ordinary schoolboy who

TEACHING PRONUNCIATION BY MEANS OF A MIRROR

Anyone who has attempted to acquire a knowledge of the French language, or in fact any new language, will appreciate the difficulties of the boys in the grade schools when beginning the study of a foreign tongue. In England, every boy in the grammar schools begins to learn French at about ten or eleven years of age. A teacher in the Tottenham (London) Grammar School has hit upon the idea of preparing a series of sound charts which show by means of pictures and diagrams the correct positions of the lips



Holding a Mirror Before Him, the Boy places his Lips in the Position Shown by the Chart

has not been taught by the "mirror method" usually has, after his four years of grammar school, a pronunciation which leaves him absolutely unintelligible to the average Frenchman.

UNIVERSAL MAIL EXCHANGER

The Universal mail exchanging devise, now undergoing a try-out at several stations on the line of the Southern Pacific Railroad north of Los Angeles, is made entirely of steel and rests on a solid concrete foundation. The crane is surmounted by a pair of circular hooks, or horns, a projecting arm and a counterweight —

a steel carriage which carries a rigid arm similar to the one on the station crane.

Preparatory to making the exchange, the mail clerk on the car hangs the pouch through the sling, places the sling on the rigid arm, rolls the arm to a position just without the car door, where it is automatically latched, and goes on about any other business he has. A catcher hook, similar to the one on the station crane, which is attached to the side of the car, will have been set in position by the same motion that placed the rigid arm and pouch.

The exchange is automatic and simultaneous. At the instant of exchange, the



Ready to Deliver a
Bag to the Train

Universal Mail Exchanger Taking a Mail Bag

After the Train Has
Passed

all hinged so as to rock away from the train after the exchange is made.

The projecting arm carries a sling or bail in which the out-going pouch is hung and clamped. The step ladder shown in the illustration pivots toward the track, being held to the right slope by a chain hanging from the cradle. The horns, pointing in opposite directions, overlap and are jointed about four feet back from the point to permit of the disengaged point being turned back toward the crane.

Mail cars are equipped with a special arrangement consisting of an overhead track running crosswise of the car opposite the doors and on this track operates

sling of the discharged pouch catches on the circular horn of the crane, and in sliding around it, loses its momentum and comes to rest at the crane, the combined weight of the pouch and counterweight rocking the entire upper portion to the position shown. The pouch is taken aboard the train in like manner, the impact causing the release of a clamp and the car part of the device rolls along the overhead track and deposits the pouch well within the car.

The train making the exchange illustrated in the photograph, was traveling at the rate of about 50 miles per hour. Tests have been made with the speed of the train at 60 miles per hour.

FAITHFUL SERVICE

In these days of industrial activity, and scenes of social interest, when dissensions between different elements of society are of frequent occurrence, it is peculiarly refreshing to see one who has pursued the even tenor of his way undisturbed by the clamor about him.

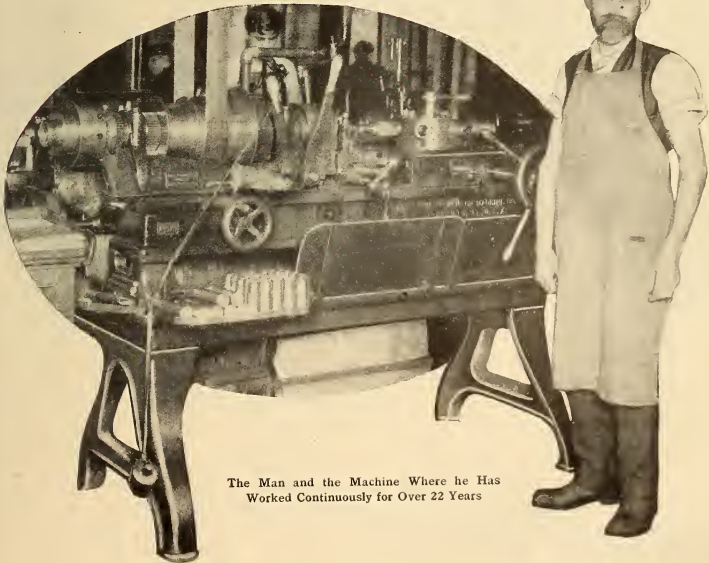
In the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company is a man who has worked constantly at one machine for over 22 years, and furthermore holds the remarkable record of having been late to work in the morning only once during this period of years.

The man possessing this record is Mr. Charles Heisler, who was born in Guttenberg, Germany, in 1864 and came to this country in 1881. After working in several different machine shops he secured employment at his present place in April, 1891.

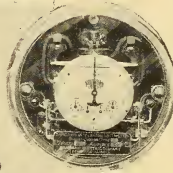
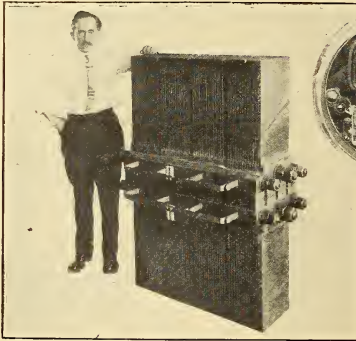
The young machinist was assigned to work on a two-inch, turret lathe and has operated it continuously ever since. This constancy in his daily work is entirely his own choosing as Mr. Heisler has on several occasions been offered work on other machines and of a more modern design, necessitating less labor to operate, but he has consistently refused, preferring, like the shoemaker, to stick to his last.

METERING NIAGARA'S POWER

The largest direct current load in the world, recorded on a single meter, is carried by the plant of the Hydraulic Power Company at Niagara Falls, N. Y., which also generates an almost equally as great a load of alternating current. The watt-hour meter in question measures



The Man and the Machine Where he Has Worked Continuously for Over 22 Years



Sangamo Watt-hour Meter and its 60,000 Ampere Shunt, Used in Measuring the Largest D. C. Load Ever Measured by One Meter

a load of approximately 318,864,000 kilowatt hours per year. If this were to be paid for at the rate of ten cents per kilowatt hour, a conservative average of the cost of electricity to the average householder, the bill would amount to \$31,886,400 per year. (Of course the users of this enormous load do not pay ten cents per kilowatt hour.)

It is comparatively easy to measure large volumes of alternating current, for the instruments are then connected to transformers. But in the case of direct current this cannot be done for technical reasons. It is necessary, therefore, in measuring direct current to construct a "shunt," or, in other words, a sort of by-path, in which the meter is inserted, through which a small but definite percentage of the current is allowed to flow. In that way the total amount of current flowing is calculated. In the picture herewith is shown the Sangamo meter and its 60,000 ampere shunt, the largest in the world. A load of 40,000 kilowatts, over 53,000 horsepower, has at certain periods been measured by this single meter and its shunt.

GRANITE AS FERTILIZER

All farmers, but especially those in certain parts of New England, know that granite boulders are not good in tilled

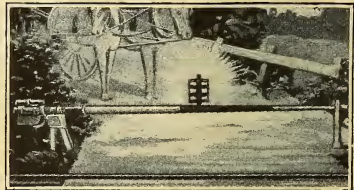
land. Yet, according to conclusions that have been drawn by government experts from certain experiments, powdered granite may prove a valuable fertilizer.

Granite contains potash, and potash is so good for land that the United States imports potash salts from Germany at about 100 dollars a ton. The imported salts contain only twice as much potash per ton as certain granites which, it is

thought, may be ground at a cost of three dollars a ton.

LIGHT FOR GRADE CROSSINGS

In France as well as other countries the grade crossing in the country districts is closed by a single pole gate on each side of the track, and these gates are worked from the guard house. At present there



Crossing Light

is hung only an oil lantern on the gate, and this does not give light enough to avoid accidents, for the light does not carry to any great distance. In view of the bad accidents which have occurred within recent times in France, the authorities are taking steps to oblige the railroad companies to give better protection at the grade crossings. An excellent method is the electric light device shown here, and the lamps are mounted on the middle part of the gate, being thrown on automatically when the gate descends.



ELECTRIC "FLASHERS" IN FILMS

Electric signs have at last appeared in motion pictures.

A recent Edison release, entitled "Stanton's Last Fling," was the means of the electric "flasher" making its debut on the picture screens of the country, and it probably won't be long until still more elaborate ones are shown.

in the office for the revolver which is shown in his hand.

Before taking his life he raises the shade to take one last look at the city of his birth, and it is then that the surprising view of the electric "flasher" is given. The brightly lighted words, "For the Holiday Go To the Continent," attract his attention and he resolves upon act-



Scene Filmed in a Studio in which the Flashing Sign Appears for the First Time as Part of the Equipment for a Setting

The illustration which accompanies this article shows the sign as it appears on the screen, for the audience sees it only through the office window through which the young man is looking. It is first shown in broad daylight and, later on in the story, Stanton returns to his office at night, discovers that his partner has appropriated all the funds and that he (Stanton) is financially ruined. He determines to end everything and hunts

ing on the suggestion instead of committing suicide.

Careful study of the picture will, of course, reveal the fact that the view of the city is but a carefully painted "backdrop," and the sign was operated by switching on and off several powerful electric lights located just back of the sign, but the result as seen in the picture is extremely novel and absolutely realistic.

What Happens to the Scenario

Nothing arouses more interest and comment than the so-called "trick picture." From the point of view of the scenario writer, as well as that of the theater patron, this series would not be complete without some explanation as to the methods employed in obtaining the mysterious effects so often seen on the film. Not all can be told, of course, for the methods are often carefully guarded secrets. But here are a few.

In all the realm of motion pictures there is probably no more fascinating department than that of the trick picture, both from the standpoint of the director's ingenuity in working out new methods of accomplishing seeming impossibilities, and from the standpoint of the spectator in witnessing new marvels of the camera's art.

In a general way there are three methods of obtaining illusions by means of the camera: first, by periodically starting and stopping the camera in such a way that certain acts are performed by the players or the objects being filmed, during the time that the camera is stopped; second, by reversing the routine on certain portions of the film in relation to the remaining portions of the same film; and third, by making two or more superimposed impressions on a single film.

To be sure every film manufacturer has his own peculiar methods of taking trick pictures, and almost every director in the employ of every manufacturer, but practically all of them depend primarily upon one of the three methods mentioned above, or upon the use of faked scenery and dummy figures.

Films in which toy animals, tiny



In Which the Mystery is Removed from the "Magic Coffee Pot"

jointed dolls or animated cartoons are shown furnish the best examples of the first class of trick work mentioned, for in these views "stop" pictures are used almost exclusively. Tools are made to apparently perform their functions without human aid and the toy animals go through a regular circus performance, the



The "Cannon Ball Limited" is Wrecked with No Loss of Life

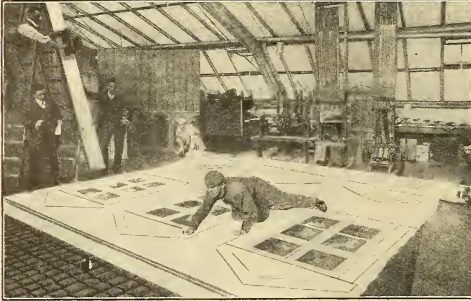
position of whatever tool or animal is used being changed a fraction of an inch while the shutter of the camera is closed, so that in the succeeding picture it is clearly observed to have moved. Combining a whole series of such views one obtains action of a most surprising sort.

Infinite time and patience is necessary for the filming of such pictures, as, if the toy or animal is moved one-sixteenth of an inch between pictures it will require sixteen separate exposures of the camera and sixteen separate changes of position of the toy or animal to show one inch of real movement, and at the ordinary rate of projection but one second of time to flash this movement on the screen.

A film called "The Magic Coffee Pot," popular some years ago, is an excellent example of the method used. Cords or strings of infinite fineness were attached to the coffee pot, and the man shown in the illustration with elaborate carefulness moved the pot a fraction of an inch at a time, a picture being taken between each minute movement of the strings. In the finished picture the magic coffee pot appeared to raise itself slowly from an

upright position on the table and tip itself over the coffee cup, when a stream of coffee ran from its mouth into the cup. Once the cup was filled the pot slowly righted itself and sank back into its original position. Lumps of sugar then chased themselves across the table, climbed up the side of the coffee cup and tumbled in. The sugar was operated in a similar manner and each minute movement was filmed, one picture at a time.

The method by which dummies are substituted for real players in some hair raising scenes is practically the same. The players carry out the action called for by the scenario until the climax is reached, when the director calls "Hold it!" and all the players stand rigidly in position without moving a muscle. Then a dummy, constructed to exactly resemble some leading player, is substituted for the living man and when the camera is again started the audience is fooled into thinking that it is still looking at the living player. The dummy is then thrown over the cliff, drops from a lofty height, or is run over by an automobile, and the instant the apparently impossible feat is



Crawling up the Side of a Building as it is Really Done in a Motion Picture Studio

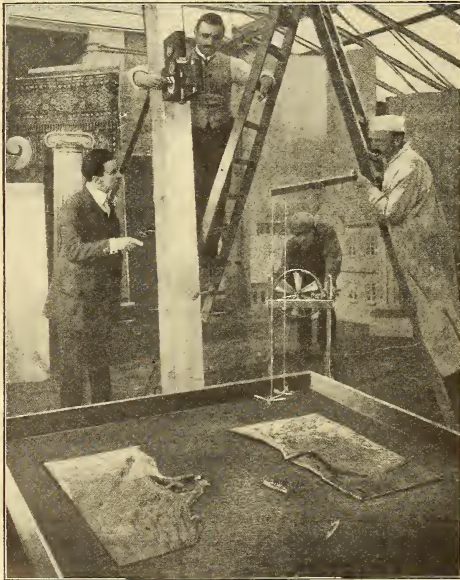
accomplished the director again calls "Hold it!" and the real player again takes his place in the picture, arranging his

posed to accomplish in the pictures, for almost every day one reads of some player being really hurt while attempting

body to exactly correspond with the position of the dummy. The camera is then started again and the action proceeds as usual, though probably three out of every four persons in the audience are astonished at the death defying deeds of the photoplayer.

It must not be imagined that players never take their lives in their hands, or never perform the feats they are supposed to accomplish in the pictures, for almost every day one reads of some player being really hurt while attempting some unusually hazardous piece of "business." But as a rule, when one sees an apparently impossible action on the screen it is pretty safe to assume that you have been fooled by a dummy, for so cleverly are these dummies constructed, and so quick is the substitution, that even the man who looks at pictures several hours each day is often deceived into thinking that a real player has risked his life to make a sensation.

The second type of picture mentioned—that in which the usual routine of things is reversed—is best illustrated by the films in which smoke floats down a chimney, divers come flying out of the surf and land on a dock, running backwards out of the picture, or objects leap from the floor onto a table. This type of picture is usually made



Taking a Trick Aviation Picture. The Toy Aeroplanes Suspended above a Tank of Real Water, in Which Miniature Battleships are Afloat, are Ready to Drop Bombs Down upon the Ships. An Electric Fan at One Corner of the Tank Causes the "Waves" to Roll in Realistic Fashion

by either a reversing crank on the camera being used, or by turning the camera upside down, though in some studios it is accomplished by a special printing machine, which feeds the negative film in a direction opposite to that of the positive during the process of printing, so that the relation of one portion of the film is reversed in regard to the portion which immediately precedes it.

What really happened in the action of such a picture was that the smoke came up out of the chimney, the divers ran down the dock and leaped into the water and the objects fell off the table onto the floor, but owing to the wizardry of the camera the action is just reversed when you see it on the screen.

The third type of trick picture—that in which superimposed impressions are made on the one strip of film—is the most common of all tricks and is best illustrated by the so-called “ghost” or “vision” scenes, in which a character in the play seats himself before a fireplace and dreams of some incident in his past life, or a soldier on the battle field gazes off into the distance and sees visions of the loved ones at home.

Such pictures are obtained, as a rule, by double printing with two negatives on a single strip of positive film. Two separate scenes are really taken by the camera, one being the large scene in which the characters are appearing when they see the ghost or vision, and the other showing only the ghost or vision itself. When the last scene is printed against the dark background of the first scene, it appears on the screen as a thin, vaporous impression that strongly suggests the ordinary idea of a “ghost,” and owing to the fact that the furniture or furnishings of the room shown in the first scene, or



A Terrible Automobile Tragedy Performed on a Three Foot Stage with a Toy Automobile. The Car has just Rolled Down a Cliff and They are Drawing It Back to Repeat the Operation

the outdoor background against which it was taken, shows dimly through the outlines of the ghost, as if it were transparent, is the illusion heightened.

Practically the same effect can be obtained by taking first the original scene or background against which the characters in the play move about, then rethreading the film in the camera and winding it through to the point at which the ghost is to appear. Then the whole of the stage is darkened, except that small portion in which the ghost is to appear, and the diaphragm of the camera is slowly opened as the film flashes past the lens, so that the ghost gradually gains in strength until the diaphragm is fully open and the full illumination is obtained, which of course gives the audience the impression that the ghost has slowly materialized out of thin air. After the ghost has acted out the part required of it, the diaphragm is slowly closed, the camera being operated the while, and the ghost gradually fades away.

Substitution of small scale models for the actual subject has been followed in ordinary photography and in the making of novelty postcards, etc., for so long that its application to the motion picture need scarcely be discussed. Instead, reference to several of the accompanying illustrations will clearly show how some apparently impossible wrecks, automo-

bile accidents, and scenes amid the clouds are taken in the picture studios.

Here again it is well to say that more and more frequently the real thing is being shown instead of the small scale substitute, for the film manufacturer is becoming a realist in every sense of the word and real trains are being wrecked, real automobiles go over the cliffs, and real aeroplanes are employed, in carrying out thrilling and spectacular scenes for the pictures.

Scenes in which comedy characters perform the most unexpected and impossible feats are not as common as they once were, though one occasionally sees excellent examples of this type of trick work. Perhaps you recall one of those pictures of a few years ago in which a chase scene was ended by the pursued running up the side of a house, thus eluding his pursuers. What really happened was that a carefully painted house on a canvas "drop" was laid out on the studio floor, the camera was suspended at a little height above the floor, lens pointed downward, and then the character who was to make the sensational climb got down on his hands and knees and scrambled across the painted surface of the house. When the film was developed and printed it appeared just as you saw it on the screen and the man seemed to actually run up the side of a house.

You may also recall the tiny figures of dancers which appeared unexpectedly on table tops in the presence of a "full-sized" audience and proceeded to perform their graceful evolutions. This feat was accomplished by posing the "audience" in the immediate foreground, while the dancers appeared back far enough from the camera to reduce their figures to the right size, and they danced on a stage exactly level with the table top. The black stage, or dark background against which the whole picture was taken, showed no connecting lines between the players and the figures that looked as though they were on the top of the table, and due to this lack of

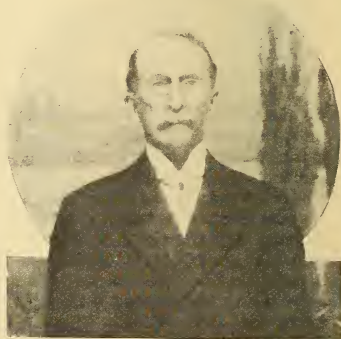
perspective the dancers appeared to be in a direct line with the figures in the foreground. By filming different parts of a scene at different distances from the camera many other and similar illusions can be accomplished.

When pictures are taken slowly and projected at the ordinary rate the action of the picture seems greatly accelerated. Reducing the shutter opening of the camera and turning the handle slowly, or by using the "trick" handle on the camera, chases, speeding trains, rapidly running automobiles, etc., can be made to speed up to a wonderful degree, and a comedian acrobat, who is really moving very slowly, can be made to fairly fly across the screen and out of sight.

The next installment of this series will contain some more concerning the subject of trick pictures, also the beginning of a discussion of the methods employed in developing the films, printing, etc.

FILMS FOR THE DEAF

As yet the only absolutely perfect talking motion picture is that which speaks through the sign language of the deaf and dumb. There is no variance with speech and action, for both evolve motion without sound. Consequently the



Dr. Gallaudet, Originator of the Talking Pictures for the Deaf

synchronism is harmonious—the keynote of the talking picture. However, one must be acquainted with this silent language, in order not to distort these movements before the camera.

The Gallaudet College of Washington, D. C., has filmed a series of lectures on literary and historical subjects for distribution among the deaf and dumb institutions. The most recent of these appears in the form of a photoplay, depicting the life story of Dr. Gallaudet. The

scene opens with the great educator in his childhood home receiving his first lesson in kindness to insects and deaf mutes, gradually leading up to his determination to establish an institute for deaf mutes, told in a series of meditations. The philanthropist is followed in his travels of disappointments and encouragements through England and France, ending with the founding of the college that bears his name in the national capital—the realization of his early dreams.

The "leaders" of this speak in the sign language, explaining the scenes to follow.



Scene in the Photoplay of the Life of Dr. Gallaudet

This film, which is at once scientific, educational, and entertaining, promises to become very popular in institutions for the deaf and dumb.

In photographing the leaders of this photoplay, great care had to be exercised, so as not to lose a movement of finger, hand or arm, or to blur these gestures and combinations. Such a fault would destroy the sense and create misunderstanding, just as a leader in the ordinary photoplay that is run off the screen too quickly or is ambiguously expressed hampers the full appreciation of the story.

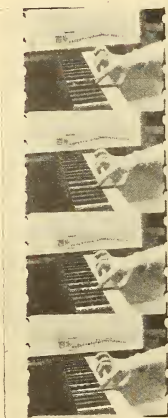
LANDS BIG CONTRACT

The Panama Pacific International Exposition to be held in San Francisco in 1915 is to be indelibly recorded in motion pictures. A contract appointing Pathé Frères as official cinematographers of the exposition was recently closed by the terms of which the Pathé company is granted the sole and exclusive right to make motion pictures in black and white, in colors, and also talking motion pictures within the exposition grounds from the date of the signing of the contract to and including 30 days after the exposition closes.

Competition for this appointment was naturally keen and cash offers ranging from \$10,000 to \$50,000, together with substantial royalties on the gross receipts from the exhibition of the films, were made the exposition officials, but the Pathé Company was granted the concession without the payment of any cash bonus, due to the fact that the officials believed that none of the other bidders could give the pictures the world distribution that they were assured of receiving under the contract with Pathé Company.

PIANO TEACHING BY MOTION PICTURES

BY WILLARD HOWE



Marie von Unschuld, Austrian concert pianist and president of the von Unschuld University of Music of Washington, D. C.

The pictures graphically show the primary position of the hand and fingers, exercises for various finger movements, the means of developing flexibility, agility and brilliancy, various touches, scale practices and movements for securing force and power. There are exhibitions of triads, octaves, arpeggios, the trill, wrist movements and others. The presentation of a few tricks for the concert pianist shows short cuts for effects that assist the public performer.

A portion of the film is taken up with the playing of the "Cookoo" and "Berceuse" of Iljinsky by Madeleine, the four-year-old daughter of Mme. von Unschuld. This graphically exhibits what may be accomplished by the beginner by the Unschuld method. The ease with which the little tot performs can not help but call forth the admiration of the spectators.

These pictures so clearly bring out the finger, hand, and wrist movements that one can readily imitate them by a careful and repeated study of the film. This

forms an effective means of studying the piano, mounting to the dignity of personal teaching. This is the first time the motion picture has been employed in demonstrating the technique of the piano for students and it promises to fill a want in the present age of condensed education in limited time. As a daily exhibition before a class of piano pupils, this film is very instructive and helpful.

The exposition of the Unschuld piano method through the eye of the animated camera adds another triumph to the motion picture industry which has proved itself endless in expounding various fields of endeavors. Now that so high an art has been taught by means of screen



Madam Marie von Unschuld

lessons, others of equal importance will doubtless be presented to the public in a similar manner.

In speaking to Mme. von Unschuld on this new departure, she said, "The eye is the most receptive organ and the widespread exhibition of motion pictures has

quiekened the power of this sense. One must be up-to-date in this age and must meet the demands of the times. The motion pictures have been employed in various educational fields and I conceived the idea some time ago of teaching the piano by the screen. After much thought I have been able to present the fundamental principles of piano technique. Americans are impatient for quick results and have almost a mania for short cuts, both of which are offered in my film. Another feature is that the study of the piano is presented entertainingly."

THE FILM THAT TALKS

A box of whirring wheels, with a strange circular air pump below, is part of the hidden mechanism which will, when it is working, probably double the attendance at the moving picture shows and give to the film the one thing it has hitherto lacked in perfected form—speech.

This machine when set to work at an exhibition performance a few weeks ago appeared just like the ordinary moving picture machine. No pictures, however, showed up, but from a great megaphone there came voice sounds, and later the strains of a band. The rays of light pouring from the projector were suddenly cut off. The sounds as suddenly ceased. A moment later the light began to play again and the speech was resumed at the exact syllable where it was cut off.

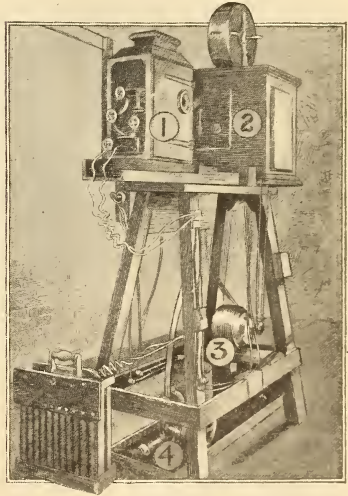
The inventor, Mr. Eugene Lauste, thus explains how his marvelous machine works: First to record the sounds for a moving picture play all about the scenery there are scattered microphones—little telephone receivers. They are hidden among the flowers, on a table near to which the heroine, say, is speaking. In a garden scene they may be hidden among the bushes.

Each separate microphone has a radius of nearly 40 feet, and is so sensitive that it can easily record and transmit the sound of a match being struck.

The next process—the photography of

sound waves by means of light—is a highly technical one, but is well known to scientists. It can be summed up, however, in the statement that the shorter or longer sound waves, can be made to trace visible waves of ever-varying contour on a moving, sensitive film with which the microphones are electrically connected. Eventually this film will do the double work of recording simultaneously pictures and sounds.

A special film, double the width of the ordinary film, is used. The left half, when the film is complete, bears the ordinary series of instantaneous photo-



Apparatus for Projecting the Talking Film

graphs. On the right half you can see a jagged wave line, each twist of which records a separate inflection of sound.

The sounds which the film has caught are reproduced by the projecting apparatus about as follows: The rays of light from the projector pierce the sound side of the film, afterwards passing through a special screen, Mr. Lauste's own invention. This is composed of tiny bars of a

substance not yet disclosed. These bars are so small that the eye can only just perceive them. The action of the rays on them is to make them swell to an infinitesimal degree, so that they touch—if the rays are strong enough. When these little bars touch an electrical impulse is communicated to the sound-reproducing apparatus similar to a telephone receiver and provided with a megaphone. According, then, to whether the light rays permitted to pass by the jagged line on the sound film are powerful enough to cause

the bars to touch for a short or a long period, the tone of the sound wave, as reproduced, varies faithfully with every intonation which originally acted to make the wavy line on the film.

These electrical sound waves sent out by the screen also open or shut tiny valves. As these valves open a current of air from a pump passes through and catches and intensifies the sound made by the electric wave. The increased sound is then transmitted through the megaphone to the audience.

BUFFALO BILL FILMS TO BE READY SOON



The Struggle to Death Between Buffalo Bill and Yellow Hand

Perchance you recall "Johnny" Baker, he who used to shoot the glass balls in Buffalo Bill's tented arena while riding his horse at a full gallop. Within the past few months Mr. Baker has been undergoing a new experience, for he has been in charge of the hundreds of Indians engaged in the filming of the chief battles in the career of Buffalo Bill. The pictures were taken by Director Theodore Wharton of the Essanay Film Manufacturing Company and under the supervision and permission of the Department of War and the Department of the Interior.

Within a few weeks it is expected some 10,000 feet of this historical film will begin a tour of the country, playing only the largest theaters in the largest cities. Every effort was made to have the

pictures historically accurate and through the help and co-operation of the government and the war department, such notables as Generals Miles, Mause, Baldwin, Lee and King, Col. Cody, Major Burke and Col. Sickles went out to Nebraska to take part in the battle scenes and, by their advice and help, aid in making the pictures accord with history.

Though over 26,000 feet of film has been exposed, it is expected scarcely more than 10,000 feet of it will be used, in which will be shown the events leading up to and the details of the Battle of the Missions, and the battles of Wounded Knee, War Bonnet and Summit Springs, the pictures practically covering the War of the Messiah, which lasted from 1890 to 1891.



From Left to Right: "Johnny" Baker (Buffalo Bill's Aid for Many Years); Mrs. Day; Chief Short Bull; Mrs. Short Bull; Vernon Day, Chicago manager of Essanay Company. Mr. Baker and Mrs. Day are Seen Wearing the "Ghost Shirt and Robe"

Chief Short Bull, who was a representative of the Sioux tribe, when chiefs from all the various tribes in the region assembled to greet the Great Spirit or Messiah at a designated meeting place is one of the chief characters participating in the film. Upon his return to his tribe Short Bull declared he had seen and talked with the Messiah and had been commanded to equip each member of his tribe with a "ghost shirt" or robe, which many of the Indians thought bullet proof, though made of only ordinary white cloth. Short Bull insists to this day that he only told his followers the shirts were "like those worn by the Messiah" and had been blessed by him, though officers who fought in that campaign against the Indians are inclined to believe that the crafty old Indian warrior told his people the shirts were bullet proof and so led them to begin the uprising, following the "Ghost Dance."

Chief Short Bull himself superintended the construction of the "ghost shirts" and robes worn in the pictures and two of them are shown in one of the illustrations, one being worn by Johnny Baker and the other by Mrs. Vernon Day, wife of the Essanay's Chicago manager.

One of the most thrilling hand to hand combats in the production is the reproduction of the famous duel to the death between Col. Cody and the Indian impersonating Chief Yellow Hand of the Cheyenne tribe. As Buffalo Bill himself tells the story, Yellow Hand and he met at a time when the Indians were becoming restless and uneasy and the Indian chief, seeing that Cody was mounted and believing him afraid to engage in a hand-to-hand fight, dared him to dismount and fight out the question of the supremacy of the whites and the redskins as man to man. Yellow Hand is alleged to have agreed that, if defeated, he would lead

his followers back to the reservation, so Cody believed he had a fair chance to settle the incipient uprising there and then.

Armed only with his bowie knife, as opposed to the Indian's tomahawk, Buffalo Bill leaped down from his horse and grappled with Yellow Hand. The men fought, pushed, slashed and wrestled at the very edge of a steep cliff, and at last the strength and endurance of the white man began to tell, for Yellow Hand was pushed slowly backward. The fight ended with Cody the victor and, true to the promise of their chief, the band of Cheyennes gave up their plan for warfare against the whites and went resignedly back to their reservation, their chief having been beaten at his own game. Later, however, they avenged the defeat

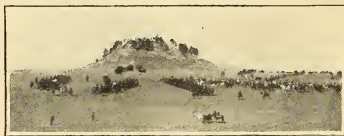


The Beginning of the Battle of Wounded Knee, in Which Over 1,250 Participants are Shown

“Pathé Weeklies” was to be greatly enlarged and thrown on a screen by representatives of the government in their effort to learn just who were the ring leaders in a recent battle in Colorado between strikers and their foes.

The bit of film in question was taken by Victor Miller, one of Pathé's cameramen, who had been sent to “cover” the labor troubles for his employers, and he managed to get his camera in such a position that he caught every face of those engaged in battle on each side, and although bullets were falling thick about him he remained on duty, getting every detail of the stirring scene. Undoubtedly when the bit of film is thrown, many times enlarged, on a screen, acquaintances will be able to easily recognize those taking part in the struggle.

Still more recently a Boston court room was darkened and a motion picture show was given as a vital part of the defense of the United Shoe Machinery Company in the dissolution suit instituted by the government on the ground that the company has effected an unlawful monopoly. The films were employed to illustrate the operation of the machines in the plant of the company and to familiarize the jurors with the mechanical processes involved. The exhibition lasted 40 minutes and during the showing of the pictures the president of the company, who is one of the defendants in the suit, explained the apparatus being shown.



Porcupine Butte Where the Troops Met Big Foot's Band, Seven Miles from the Spot Where the Battle of Wounded Knee was Fought. Note Director Wharton and His Camera Man in the Left Foreground of the Picture

of Yellow Hand many times over. The whole of this historical incident is acted out before the camera and is said to be most thrilling.

FILMS AS EVIDENCE

It is becoming more and more common for motion pictures to play a large part in the world's affairs outside their usual field of entertainment. Not many weeks ago the daily newspapers of the country contained a story to the effect that a strip of film taken from one of the



A Comparison of Costumes in the Old Fashioned Minuet and the Modern Dance

OLD FASHIONS AND THE NEW

One of the most interesting of recent Kinemacolor releases is the one in which fashions of the olden time are contrasted, side by side, with those of 1914. This series of fashion pictures was produced at the suggestion and under the direction of Mrs. A. Leist of the Kinemacolor Company and they vary from the mode of dress worn by tiny tots, both boys and girls, to that of grown-ups, both men and women.

Kiddies in beruffled long dress and pantalettes play beside old fashioned cradles, while bob-haired tots in French frocks fondle woolly lambs or ride wild rocking horses. The grown-ups of the olden times trip the stately minuet, while the modern grown-ups whirl through all the variations of the tango. The interest in the comparisons of the fashions of yesteryear with those of today is further increased by the fact that Kinemacolor brings out all the fabrics

in their true colors and in all their varying shades.

REMARKABLE CAMERA WORK

Those who puzzle over and marvel at such photographic wonders as double and triple exposures on one plate or piece of film will be still further puzzled and astonished when they see a recent Universal release entitled "The Return of the Twins' Double."

In one scene of this remarkable production, by Director Francis Ford, a double exposed "vision" is seen in a triple exposure—in other words five separate exposures are made on the same piece of film, thus permitting the same player to appear five separate and distinct times on the screen at once. This is believed to be the record to date for remarkable camera work, though other directors will probably attempt to go even this feat "one better."

TELEPHONE INDUSTRY SHOWN IN FILMS

Motion pictures are rapidly becoming a factor of importance in electrical advertising, for, by means of the animated pictures, effects previously unseen can be displayed upon the screen and publicity of an absolutely novel kind



Laying a Submarine Cable

obtained at a comparatively low cost in proportion to its benefits.

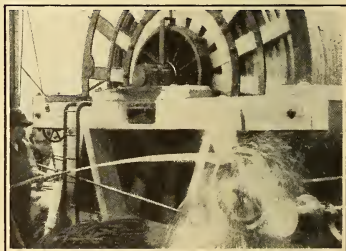
The Pathé Company recently completed a full reel of pictures, which it has entitled "Spinners of Speech," which deals entirely with the telephone industry. The various steps in establishing a telephone connection between a Colorado mine and a New York hotel are shown in combination with a map of the United States. The progress of the call through each toll district is shown by an advancing band of light upon the map; the handling of the switchboards in the connection at Denver, Chicago, Buffalo and New York is displayed in realistic fashion and finally when the conversation has begun it is shown in full sized views upon the screen and also demonstrated by miniature motion pictures on the map.

Through subtitles the public is informed of the millions of dollars' worth of plant that is tied up in such a conversation and before the film ends the audience has obtained an excellent idea of the methods of cable laying, splicing

and intricate practical tests which are eye openers to the layman. Wherever it has been shown the picture calls forth tremendous applause showing the intense interest with which the subject had been watched.

That eager desire of the average American to "learn how it works," to "watch the wheels go round," is keenly stimulated by such applications of the motion picture and it would indeed be trite to point out the influence of such film subjects in popularizing electrical service of all kinds.

The possibilities along this line in connection with the exhibition of the steps taken in filling a telephone service application, for example, are at once evident. The appearance of the prospect at the office of the central station, his signing of the contract, the machinery set in



Unwinding Cable from an Immense Drum

motion to serve him, system diagrams in elementary form and the actual operation of the plant, the work of line and inside construction forces, and finally, the comforts and low cost of the service can all be set forth effectively. Here is a field in which the imagination can be used to help the development of the industry, and undoubtedly interesting results will be obtained along these lines in the near future.

MOST PHOTOGRAPHED CHILD IN THE WORLD

Marie Eline, better known as "The Thanhouser Kid," but who is now playing juvenile leads in the Princess brand of films, lays claim to being the most photographed child in the world and apparently her claim is based upon facts and figures. Marie is only eleven years old, and not much larger than a child of eight. She began her stage career with Guy Bates Post in "The Bridge." Later she was with Fanny Ward in "Van Allen's Wife," with Nora Bayes and Jack Norworth as cap-

tain of the Kiddies in "The Jolly Bachelors" and in a featured rôle in "The Fatal Wedding."

A little over three years ago she became the first member of the stock company formed by the Thanhouser Film Corporation and since that time has appeared in over 150 reels of pictures. Since there



Some Sections of the Film, "Spinners of Speech," Giving an Idea of the Immensity and Intricacy of Modern Telephone Plant Construction. The Map is Made to Show Graphically the Various Steps in Completing a Telephone Connection Between a New York Hotel and a Colorado Mine

are sixteen pictures to every foot and 1000 feet to every reel it appears that she has been photographed more than two million times.

SOME GRIFFITH ANECDOTES

The recent announcement that D. W. Griffith, considered the world's greatest director of motion pictures, had left the Biograph Company to assume charge of the Reliance studio of the Mutual Film Corporation, brought out many interesting little anecdotes and stories of this director and the methods he used in getting his players to do what he wished.

As the public generally knows, Mr. Griffith was the man who "discovered" such present day stars as "Little Mary" Pickford, Arthur Johnson, Florence Lawrence and Blanche Sweet. The famous director's ability to "make people act" falls little short of real genius and he will go to almost any lengths to get an actor to give him the effect the scene demands.

It is said that in the early days of Mary Pickford's career, when she was engaged to her present husband, Owen Moore, who was working with her in Mr. Griffith's company, the noted director would accuse her fiancé of lack of intelligence until Mary would lose her temper. Then Griffith would turn quickly to the camera man and whisper "Go ahead, grind!" The result was always an exhibition of "temperament" on the part of "Little Mary" that exactly fitted the character she was then portraying.

Among the early trials of little Mae Marsh was the playing of a strongly emotional rôle, in which she was required to show a high degree of sudden fright. The transition from perfect tranquility to terrible alarm had to be made almost instantaneously and Miss Marsh could not seem to perform the difficult feat of acting perfectly enough to suit her exacting director. Mr. Griffith was seen giving secret instructions to a property man and then the scene was started over again with the camera faithfully record-

ing the action. This time Miss Marsh had no difficulty in getting the effect required, for, at the proper moment, a double barreled shotgun was fired off behind the scenery, within a few feet of her head, and her exhibition of sudden fright was all that could be desired.

THE "SERIES" PICTURE

Serial or continued stories have long been a feature of the popular magazines but the film maker is now beginning to adopt the idea for his pictures and the continued story in motion pictures is already an accomplished fact. Edison's "What Happened to Mary," which ran through a period of many months on the picture screens of the country at the same time it was appearing as a serial story in a largely circulated woman's magazine, proved conclusively that the idea was feasible, and was immediately followed up by a series of pictures and stories entitled "Who Will Marry Mary?"

At present the Edison Company has several new series of pictures under way, among them being "The Chronicles of Cleek," which is a series of mystery stories; "Dolly of the Dailies," a continued newspaper story in which Mary Fuller, heroine of "What Happened to Mary" and "Who Will Marry Mary?" is featured; "Wood B. Wedd," a comic series featuring William Wadsworth, and "The Adventures of Octavius," in which an extremely amusing comic detective solves some baffling mysteries.

The Selig Polyscope Company has begun and will continue for several months more a bi-weekly story called "The Adventures of Kathlyn" which was written by Harold MacGrath and which features a number of the famous Selig wild animals and Miss Kathlyn Williams, the intrepid star who performs with them. The pictures are released simultaneously with the publication by a score or more of Sunday newspapers of the MacGrath novel upon which the pictures are founded.

Hydro-Electric Plant at the Wisconsin Dells



Ruins of the Dell House on the Wisconsin River above Kilbourn, Built in 1837



The Main Street of Delton, Wis., One of the Towns that "Moved Away"

That historic waterway, the Wisconsin River, which nearly 250 years ago floated the canoes of the early Jesuit explorers, Joliet and Marquette, as they pushed their way to the Mississippi, and which in subsequent generations has served in turn as a highway for the fur trader, the logger and the rafter as these latter brought the stores of the northern pineries and laid them at the door of a growing section of the country, now continues its service to man by spinning the huge turbines of the great hydro-electric plant which has been built at Kilbourn in the heart of the celebrated "Wisconsin Dells" region. Nearly two million dollars has been expended in this enterprise which furnishes 10,000 horsepower for commercial purposes.

Kilbourn is situated midway between what are known as the upper and lower Dells—a stretch of some ten miles where the river cuts its way through a soft sandstone formation which has been worn by the rushing waters into innumerable grotesque and fantastic shapes and produced a rugged beauty which makes this region an objective point for thousands of summer tourists. Just below

the town a 350 foot dam has been thrown across the river and a spacious power house erected in which are installed four hydraulic generators of the horizontal type. Each generator delivers 2,500 horsepower under an eighteen foot head of water.

The power that is here generated is carried to Watertown—a distance of 65 miles—on a system of skeleton towers. The wires carry 50,000 voltage which will be increased in the near future some 50 per cent. At Watertown the current is "stepped down" and turned into the lines of a Milwaukee corporation. Much of it is used for traction purposes; the balance is sold for general commercial uses in Wisconsin's metropolis—something over a hundred miles from the point where it is generated.

One result of building the Kilbourn dam has been to raise the river level some eighteen to 20 feet for a distance of several miles above the town. This has destroyed some of the beauty of the Dells and obliterated many of the old landmarks and other points of interest. One such which happily has been spared is the picturesque ruin of the old Dell House



A View of the Power Plant and Dam of the Southern Wisconsin Power Company at Kilbourn, Wis. The Lower Picture shows "The Narrows" of the Wisconsin River above Kilbourn, a Part of the Famous Dells Called the "Navy Yard" Because of the Resemblance of the Rocks to the Prows of Battleships



just south of the narrows—a point where the river runs through a gorge only 52 feet wide. The Dell House, which was built in 1837, is said to have been the first permanent white man's habitation in Wisconsin west of the river. In its earlier days it was a trading post with the Indians and later it became a notorious tavern from which many a riverman and traveler has mysteriously disappeared. At one time it was the headquarters of a gang of counterfeiters.

The town of Kilbourn owes its existence to fortuitous circumstances. Back in the '50's when the railroad was projected through this region it was expected that it would bridge the Wisconsin river at Newport some five miles below the present crossing. Newport was a thriving community and together with the neighboring village of Delton mustered in excess of 1,000 inhabitants. An offer from

General Kilbourn, of Milwaukee, of a right of way and money for a bridge induced the railroad to cross the river at its present location. The town of Kilbourn was born and Newport and Delton received their death stroke. The latter still retains a struggling foothold upon the map but Newport has disappeared—its houses, with two or three exceptions, having been torn down or moved away.

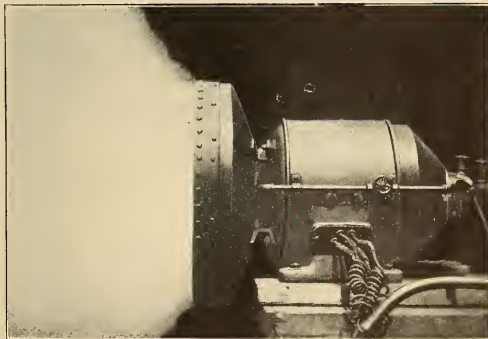
CONSTRUCTING BUILDINGS ON STILTS

The Canadian Pacific Railway Company is undertaking a stupendous task in the lofty Selkirk Mountains of the Rocky range in British Columbia by building a tunnel through five miles of almost solid rock, the job requiring 500 men over a period of four years. A peculiarity of the contractors' plans is

that the residential quarters for the army of men who will live all that time in an isolated region must be of remarkably heavy construction to resist the fall of snow which runs as high as 25 and 30 feet in depth, causing enormous pressure. Were the buildings placed on the ground level, they would be completely covered with snow and ice in midwinter, so that they will have to be built on stilts at a considerable height from the ground to keep the doors and windows accessible. The most urgent reason for the tunnel's construction is to overcome twelve miles of winding railway that represents a stupendous winter problem through the dangers of snow slides and the inefficiency of snow sheds.

SAFEGUARDING MINERS WITH ARTIFICIAL FOG

Following the discovery by experts of the United States Bureau of Mines that



Machine for Making Artificial Fog

one-fourth of all explosions and resultant losses of life, in coal mines were due to the presence of coal dust hanging suspended in the atmosphere, an artificial fog making machine, designed to remedy the evil, has been placed upon the market. This machine is known as a humidifier and its function is to introduce into the

mine sufficient moisture, in the form of vapor, to absorb and precipitate the curtain of deadly dust. The "fog machine" here pictured is operated by an electric motor and will discharge into a mine shaft every hour 1.65 gallons of water which is vaporized by centrifugal action.

THE MAKING OF "RICE-PAPER"

It is difficult to explain why the paper forming the wrappers for cigarettes should be called "rice-paper," since it has nothing whatever to do with rice. On the contrary, it is made sometimes from the membranes of the bread-fruit tree, or, more usually, from the "trimmings" of flax and hemp.

This paper is of extreme lightness, so light, indeed, that to make up an ounce of it there are required five hundred sheets. Since they are perfectly combustible, they give off a minimum of smoke. Before being rolled with tobacco they are analyzed to ascertain whether they are free from deleterious material and contain nothing but the purest paper fiber. None save "new" material is made and this is thoroughly purified. Chopped by machinery into minute particles, they are thoroughly mixed by a revolving fan and then reduced to a dust. This dust is placed in a solution of lime and soda. After remaining in this solution for some time in order that all foreign substances may

be eliminated, it undergoes a washing process, the water being of the purest sort from artesian wells sunk especially for the purpose.

The next step is to roll the pulp into paper. At first it shows a grayish tinge, the pure white of the finished product being obtained by an electric process

which, in bleaching it, also removes any impurities that may have escaped the bath.

The industry is practically a French monopoly, the Austrian and Italian papers attaining a sale insignificant in proportion.

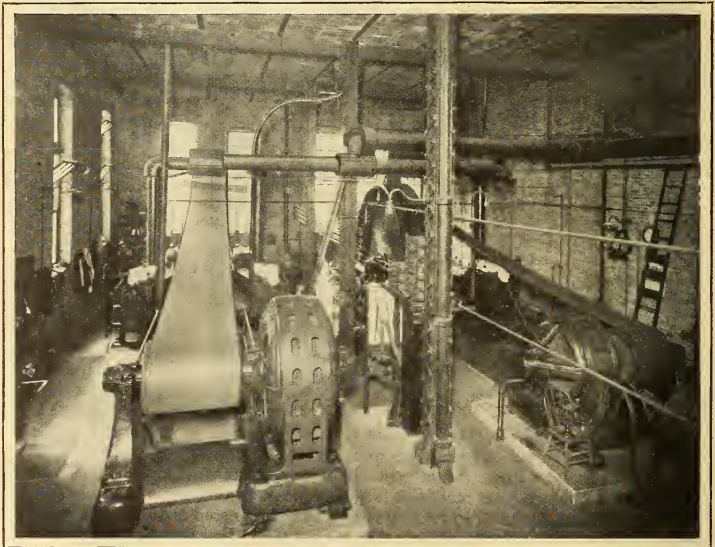
ELECTRICAL REFRIGERATION

Most of the progressive hotels and meat markets in the large cities now use electric refrigerating outfits in place of the unhygienic, inconvenient and comparatively expensive natural ice. The convenience of not having to order and receive many tons of wet and dirty ice at all seasons of the year is very great. Another advantage is the even temperature which is maintained, in which the meat keeps better and longer.

In hotels one of the features of this kind of equipment is the system of cooling

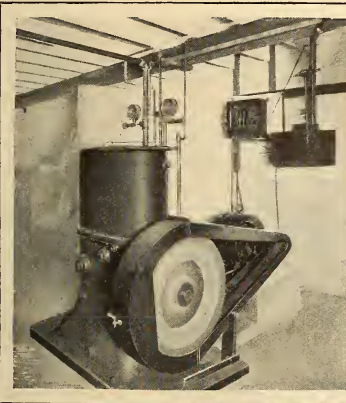
the drinking water which is piped to every room. This usually consists of a large tank in which are coils of pipe through which cold brine from the electric refrigerating apparatus is passed. As fast as the water is drawn from the tank more flows in from the city pressure. In meat markets not only are the large storage refrigerators kept cold, but the refrigeration is extended by piping to the show cases, brine coils being generally used. This insures the finest sanitary conditions, as flies and other insects never alight on the contents when the doors are opened because of the chilly atmosphere which they feel at some distance from the meat and to which they are very sensitive.

Where ice must be used, then artificial ice by all means, because of its purity and cleanliness. Its making is now an exact science, thanks to the electric motor.



This Illustration Shows the Refrigerating Plant of One of the Largest Ice Making Concerns in Chicago. The Source of Power Here, as in Most Up-to-Date Plants, is the Electric Motor

Refrigerating machinery needs constant attention and maintenance and the less time the man in charge has to devote to the driving equipment, the better the condition in which he can keep the cooling devices. It must also be remembered that cooling plants usually run 24 hours a day, and that a failure may involve the loss of con-



This Small Electric Refrigerating Plant Supplies the "Cold" for the Meat in the Picture Above

Interior of a Modern Market. The Absence of Dirt, the Compactness and Simplicity Scarcely Call for Comment



An Idea of the Immense Amount of Meat that is Kept in One Large Market

siderable money through the spoiling of perishable goods. The question of the greatest importance, therefore, is continuity of operation and this phase of the subject overshadows even the efficiency of the complete system. The

use of electricity absolutely provides this continuity.

The illustrations given here show the equipment used in the best and most modern meat markets and artificial ice plants in the country.

The Test Car

BY GEORGE AUSTIN BARNES

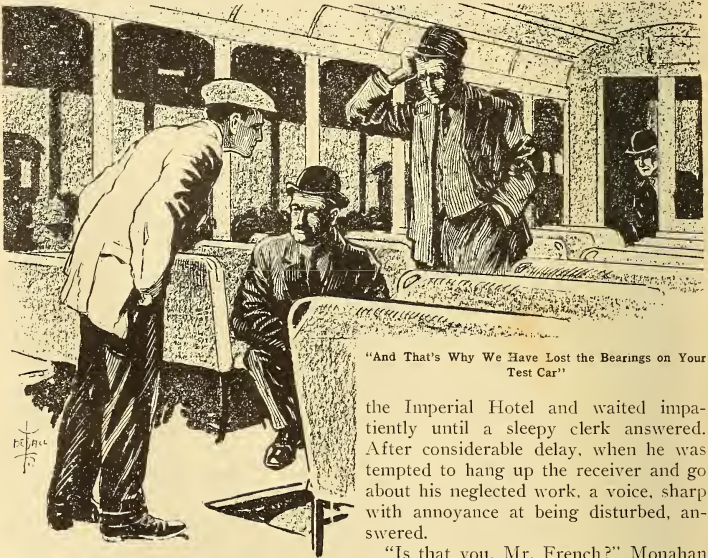
(Concluded)

Monahan laughed to himself as he went about his work. He laughed again as he sat in the office looking at the magazines, but he did not seem in a hurry to return to the barn.

When he again came to Number 30, he climbed unhesitatingly aboard and flashed his electric searchlight over every spot of the interior, but everything

"Oh, ho! And that's the game, is it? Well, well! You knew what you were talking about when you said she wouldn't run cool, didn't you?"

He left the car and hurriedly completed his round. When he entered the office he seated himself at Russell's desk and opened the telephone directory. When he found the number he called



"And That's Why We Have Lost the Bearings on Your Test Car"

seemed all right. Suddenly his gaze was attracted by a spot on the floor beside the trap over the motors—a little heap of dust that glittered hardly when the light struck it. He rubbed a pinch of it between his fingers wonderingly, a puzzled frown on his face. Then he whistled softly.

the Imperial Hotel and waited impatiently until a sleepy clerk answered. After considerable delay, when he was tempted to hang up the receiver and go about his neglected work, a voice, sharp with annoyance at being disturbed, answered.

"Is that you, Mr. French?" Monahan inquired excitedly.

"Yes, it's me. But who in blazes are you, and what do you want at this time of night," came French's irritated reply.

"It's Monahan. At the car barn. Be here at five o'clock sharp."

"Monahan! Well, what do you want of me at that ungodly hour?"

"It's the test car, Mr. French. She'll fail if you're not here. I can't tell you what's wrong now; I've got to make my rounds. But be here sure. And bring Russell with you if you have to drag him."

Heedless of French's insistent questions, Monahan hung up the receiver and hurried from the office. As he closed the door, he heard the prolonged whir of the telephone bell, but he only grinned.

"Ring away," he chuckled. "You'll be here all right. There's nothing like curiosity to make a fellow be on time."

It lacked a number of minutes of five o'clock when he heard an owl car stop in front of the barn and a moment later the office door was shaken loudly. He completed his tour of the shops before he answered the summons. Then he refused to open the door, but addressed his visitor from an opened window.

"I can't let you in; it's against the rules. But I'm glad you got here early."

"What is wrong?" French demanded. "Of course it's all right about your rules, and I don't want to get in; but I do want to know why you hauled me out here when I should be in bed."

Monahan told briefly of what he had seen, and his suspicions.

"Take my advice, Mr. French, and get the old man out here before you look at the car. You want him here, so you can prove there's no shananiganing on your part. Jacques has done you dirt, but you'll have to prove it to the old man."

"I guess you're right, Monahan," French said thoughtfully. "When does he get here?"

"Not until seven-thirty, and the car is ordered out at five-thirty. But there's a telephone in the drug-store across the street."

"All right; I'll get busy."

It was five-fifteen when the telephone in the office rang. Monahan answered it and Russell's voice peremptorily bade him call the starter. When that em-

ployee re-entered the barn ten minutes later, the crew was already on Thirty, but he ordered them onto another car.

"The boss says Thirty is to wait until he comes down, and we're not to move or board her until he comes."

Monahan punched the time clock for the last time and put on his hat and coat, but loitered around the barn, talking to the different crews. He was minded to see the matter through. He waited half an hour before Russell dropped off an incoming car and hurried across the yard. French met him at the street, and together they entered the barn and marched straight to Number 30 and climbed aboard.

When Monahan tiptoed onto the platform they had the trap up and were lifting the cups out of the grease receptacles on top of the motors. Russell drew out the waste and flashed the electric bulb against the armature bearings, and then looked at French in amazement.

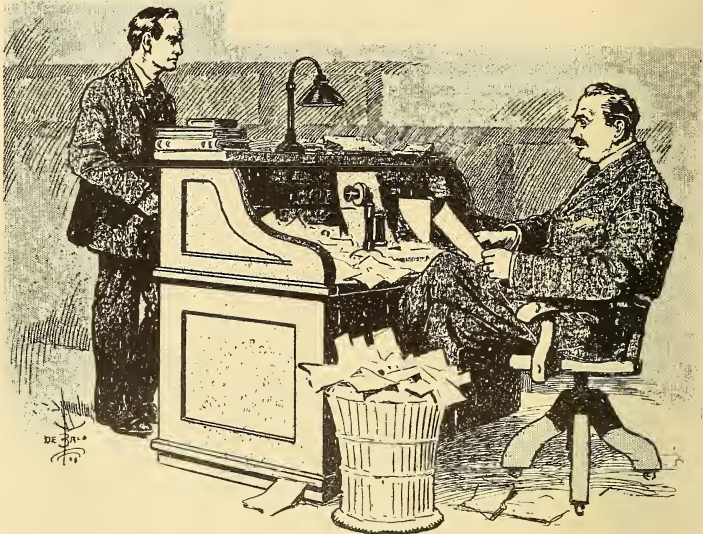
"Well, if that don't beat hell! And that's why we have lost the bearings on your test cars. Jacques told me yesterday there was no use monkeying with your oil; that it cost us more in bearings than you could guarantee to save us in oil and he wanted to go back to the dope we had been using. The salesman is a particular friend of his, but he claimed the oil was cheaper than yours and just as good. And here he's been slipping in at night, drawing your cups and waste and dumping emery powder on the bearings and setting your cups back. No wonder the machines went down."

Suddenly he leaped to his feet and started toward the door.

"Burdick!" he shouted to the starter. "Tell Jacques to come here at once."

"He hasn't come in yet, Mr. Russell," Burdick replied. "I'll tell him when he shows up."

But Monahan knew Jacques would never again show up on the City & Suburban Line. He had seen the master mechanic's shifty face appear for a moment at the rear door and noted the



"I Have Given Your Job to Another Man"

look of surprise and alarm that twisted his sharp features as he turned and ran down the back street.

A few days later Monahan received from the motor builders the bulletins French had promised. There followed a week in which he snatched many happy minutes in Russell's office, between his rounds of the barns, studying the cuts of different types of motors. As he passed the machines on the floors in the winding room and shops, he looked at them with growing comprehension, and yet with appreciation of his ignorance. But he was not discouraged; a new vision of knowledge and usefulness had opened to him.

"Just wait until I get that book, and I'll show you. I'll know all about you then," he exulted.

At the end of ten days, as he crossed the tracks on his way to work, the starter called to him.

"The old man wants to see you in his office. Guess it's the blue envelope for yours," he grinned.

Monahan entered the superintendent's office inwardly apprehensive, but outwardly calm. Russell whirled in his chair.

"French tells me you discovered the trick Jacques was playing on us."

"Yes, sir."

"Jacques had been jumping on you that afternoon, hadn't he?"

"Yes, sir," Monahan replied quietly. Then he added more quickly, "Don't get the idea I was sore at Jacques, Mr. Russell. It was the cars. I hated to see them come limpin' in that way."

"French tells me you want to learn something about this business," Russell said, after he had looked at Monahan unwinkingly for a few moments.

"Yes, sir, I do."

"Well, why don't you?" the superintendent inquired bluntly.

"I am. And I'm going to know more about it before long," Monahan said confidently.

"We'll see about that," Russell replied coldly. "I have given your job to another man. You'll show him around to-night."

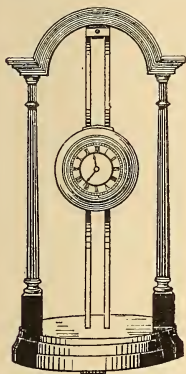
Monahan stared at him, a sickening sensation at the pit of his stomach, as he saw his air castles dissolve. Without his job, how could he learn about the motors; and not knowing about

them, how could he hope to get another job?

"You will report to the shop foreman tomorrow at noon," Russell continued. "I am going to give you a chance, Monahan, because I believe you can make good. You will get only the consideration you earn. It's up to you whether I advance you beyond a roustabout's job. You will find the new watchman waiting for you in the other room. Good-night."

A GRAVITY CLOCK

The gravity clock, as its name indicates, is operated by the force of gravity.



The Clock Itself is the Weight

Unlike other clocks, it has no springs; the usual motor force being replaced by the weight of the timepiece itself, which slides between two vertical pillars. The mechanism being perfectly adjusted to the weight, the descent proceeds with absolute regularity and precision. It requires seven days to complete the distance from the highest point to the lowest, so that all the care it requires is to raise it once a week.

Having no springs, which are affected by temperature, nor complicated mechanism to become deranged, this clock never varies in consequence of change of weather and needs no attention beyond the weekly necessary adjustment.

It is a French invention, manufactured in Paris.

IVORY—REAL AND FALSE

The supply of ivory is never equal to the demand. Hence it is that the ingenuity of man is constantly being exercised to provide good, serviceable substitutes for the real thing. The imitations and substitutes are sometimes so excellent that it is difficult to distinguish them from the genuine ivory. To the expert, however, it is an easy matter to tell the real from the counterfeit. Genuine ivory, being a modification of dentine, shows in transverse sections lines of varying shades running in arcs and forming minute lozenge shaped spaces. These markings, which exist in every portion of any transverse section, enable the expert to recognize true ivory as distinct from every other kind of tooth substance, and from bone and all fictitious "ivories."

A very curious form of imitation ivory of the vegetable sort is that which is the product of a plant called the *Phytelphas macrocarpa*, native to South America. This is said more completely to resemble real ivory than the majority of the animal substitutes. The fruit of this palm like plant is of great size, almost as large as a man's head, and it contains numerous nuts somewhat smaller than hen's eggs.

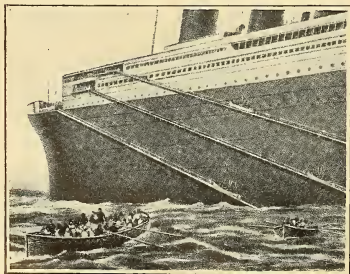
The kernels of these, commercially known as "Corozo nuts," furnish the vegetable ivory so widely used in the manufacture of buttons and trinkets.

It appears that but a small proportion of the ivory of Ceylon, India, Burma, Cochin-China, and the Eastern Archipelago, ever reaches Europe or America. By far the greater part of the ivory sold in the Occidental markets is African, and it is brought from the interior by almost every route proceeding to the coast. African ivory has superior density and whiteness and is the sort most highly esteemed by manufacturers. From time to time they express great anxiety lest the present slaughter of the animals should produce a downright ivory famine.

Other animals than elephants furnish ivory, the walrus, the hippopotamus, and the sperm whale, to say nothing of other creatures possessing teeth or tusks of sufficiently large size and great density to be employed for the many purposes for which real ivory is used. A small quantity of true ivory, of, however, a very brittle sort, is obtained from the fossil beds of Siberia. This is obtained from the tusks of extinct mammoths found in the frozen soil.

NEW IDEA FOR THE LAUNCHING OF LIFEBOATS

Since the Titanic disaster a number of new ideas for the launching of lifeboats have been patented. One inventor proposes to equip ships with inclined planes reaching from the level of the deck along the ship's side to the



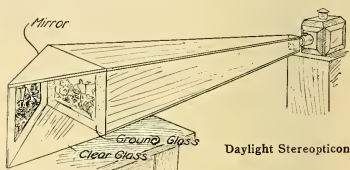
Unique Method of Launching Lifeboats

level of the water. The lifeboats are to be pushed along the deck on rails until they reach a lever arrangement which automatically starts them down the inclined planes.

DAYLIGHT STEREOPTICON PICTURES

The showing of postal lantern pictures in daylight may be accomplished by the arrangement here shown.

A funnel like box is made of $\frac{1}{4}$ inch lumber and fitted with a ground glass at



the large end, the lantern being placed with the projector just inside the box at the opposite end. A large mirror is placed at an angle with the ground glass and the picture caught upon the ground glass appears quite distinctly in the mirror. The spectator looks through the "clear glass" into the mirror in the interior the box.

The idea is being tried out for possible use in refreshment parlors and cafés where it is not desired to have the room dark.—W. F. MURPHY.

HOW CHIPPED GLASS IS MADE

Sheets of glass covered with a shell-like raised pattern are employed for screens, electric light fixtures and other purposes. This chipped glass, for the pattern is often really chipped out of the surface, involves a process that is quite interesting.

The sheet of glass to be treated is placed under a sand blast in order to give it a grain. This ground surface is next treated with a solution of good glue and

the glass is placed in a drying room on a rack, where it remains for some hours. Next the sheets of glass are removed to the chipping room, where they are placed on edge back to back, with the coated surfaces outward. This room is heated by steam coils, and when the heat is turned on the glue attains its utmost degree of desiccation and curls off the glass in pieces from the size of a dime to that of a silver dollar, but it adheres so closely to the glass that, in its effort to get free, it tears pieces off the surface, the result being a beautiful pattern.

A WIRELESS "ANTI-SPOONING" DEVICE

The chief electrician at one of the Naval radio stations on the Atlantic Coast recently installed an effective device for discouraging summer flirtations on a bench overlooking the sea in front of the station. The plant was provided with an auxiliary aerial and a No. 24 cotton covered wire was run from one of the aerial leads down the back of the seat and wrapped around the bench. The inductive voltage produced when the sending key in the station was depressed was just sharp enough to make the undesired guests feel as though they were being pricked by needles, and the arrangement was immediately effective in ridding the place of visitors.

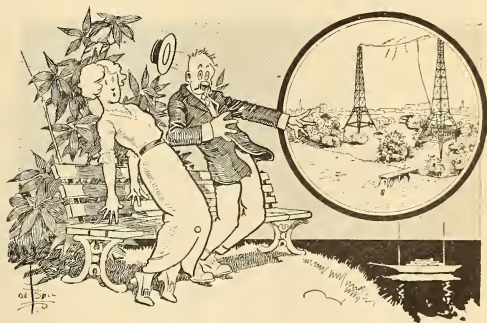
MAKING OIL FROM PENGUINS

The island of Macquarie lies about half way between the southern coast of Australia and the Antarctic continent. It is uninhabited, but serves as a breeding ground for millions of penguins. Recently the government of Tasmania has leased the island to a company which has gone into the business of manu-

facturing penguin oil, which is produced by digesting the bodies of the birds in huge cauldrons or boilers, in which the pressure of steam is kept at about 20 pounds. The oil is thus brought to the surface and then drawn off. It is then put into barrels and shipped to Australia and New Zealand, where it finds a ready market.

EFFECT OF THE GLASS GLOBE OVER INCANDESCENT LAMPS

A German scientist, M. G. Sunden, has been making experiments upon in-



candescent lamps with metallic filament in order to discover the effect of the globe of ground or opal glass which is commonly placed over these lamps when used for street lighting. He describes the results of his experiments in the *Elektrotechnic Zeitschrift*. He has established the fact that lamps in air at a temperature of 200° C. last only 40 hours under given conditions, whereas the same lamps burning in air at a temperature of 20° C., under the same conditions of lighting, last 4,000 hours. The explanation seems to be that when the bulb of the lamp is highly heated the vacuum inside becomes impaired, probably on account of the glass becoming porous. It would therefore appear to be undesirable to surround incandescent lamps of great luminous intensity with a globe, which would increase the temperature.



Most Wonderful Railway in the World

Of all the great tributary arms of the main railroad artery through Africa—the Cape-to-Cairo Railway—none is so marvellous as the famed Uganda Railroad. Never before in the world's history, perhaps, has a railroad been built under greater disadvantages, under graver perils to the builders, or with more unique results. Its history is one long romance of inconceivable terrors and adventures, of heavy death tolls, of terrible dangers and difficulties overcome and of results which have far exceeded even the most sanguine expectations of those who conceived it.

Steadily the line is being extended to meet the development of the country and to push forward to join hands with the nearly completed Cape-to-Cairo Railroad. Only a few months ago the Uganda Railroad was extended, and is now in working order, from Jinja at the Ripon Falls to Kakindu, and this extension is being carried still further north. Another extension has been completed to Fort Hall at the foot of Mount Kenya, 60 odd miles from Nairobi, to open up the agricultural lands of the plains; another has been made by private enterprise from Machakos to Lake Magadi. Other extensions are in course of construction or contemplated and in a few more years there will be a veritable network of railways throughout the vast "Dark Continent."

The first rails were laid down in 1893 and the main line of the Uganda Railroad was finally completed in 1901. The final length on completion was 584 miles with a meter gauge throughout, and the cost amounted to \$27,000,000—or \$15,800,000 more than the original estimate although shorter than at first designed by some 73 miles. The average cost per mile amounted to the appalling figure of \$46,233.

It must also be remembered that the

engineers had a most difficult country to traverse—a country broken up by deep gorges and ravines, while at times they crossed vast waterless plains of mimosa and acacia scrub—and furthermore had to carry the line to an altitude of 8,350 feet above the sea level. Even those ignorant of railroad engineering can readily understand what a tremendous task in itself this was. In some parts the railroad has an up-grade of 40 feet to the mile. In the first 276 miles it actually climbs 5,180 feet, of which 3,350 feet is climbed in 173 miles.

But not only for its engineering is the Uganda Railway celebrated; its scenery, especially in the highlands and forests, is superb; and its game in the wild state along the railroad tracks is the most unique sight in the world. Where else can you see big game in their thousands within a few feet of an on-rushing train, not only gazelle and antelope but also everything from giraffe, lion, rhinoceri downwards? Only the mammoth elephant has been driven back by the snorting iron steed of advancing civilization.

The natives in their wild state, unhampered by Mother Grundy, rush to the railway depots to meet the train, or idly watch it as it races past their plantations or grazing cattle. You can sit in comfort in your railroad coach and see unharnessed Africa in its native and primitive state.

Lord Kelvin could sometimes make sly jokes. For instance, when the great English physicist Joule, who was one of Kelvin's staunch friends, was visiting his lordship's workshop, he came across a large coil of piano wire and asked for what this was to be used. When Kelvin replied that it was for sounding, Joule asked: "What note?" "The deep C," said Kelvin slyly as it was for taking soundings in the ocean.



A Train on the Uganda Railway. Notice the Seat on the Pilot of the Engine



Masai Runner Who Covered 128 Miles in Two Days



Through the Juniper Forest



A Railway Station on the Uganda Railway



A Cutting in Mombasa, the Start of the Railway

THE HOME OF SANDALWOOD

A perfume well deserving its vogue is from sandalwood, the finest wood coming from the Indian province of Mysore. Here in a belt 240 by sixteen miles grows

seven eighths of the world's supply. This wood, used for cremation on funeral pyres, and for boxes, fans, etc., and medicines, has been known from the most ancient times.

A Light Which Beats Daylight

BY E. L. ELLIOTT

"As clear as daylight" is a common expression for the highest degree of distinctness, or visibility. In this, as in many other cases, however, science has beaten Nature at her own game. There is an electric lamp which gives out its light from incandescent mercury vapor, the rays of which enable the eye to see very fine details on small objects with greater clearness than in broad daylight. The full explanation of this involves the peculiar structure of the eye as well as the theory of light, which are too technical to be set forth here.

The above fact, however, is well established and renders such light particularly valuable for many industrial purposes. For example, in the weaving of silk it is not uncommon for the warp of the goods to contain from 120,000 to 150,000 separate threads, every one of which must be kept under close observation by the weaver. Not infrequently these threads are black which increases the difficulty of seeing them. It would seem as if nothing but microscopic vision would be able to follow such minute details. In this work the effect of the bluish green light of the mercury vapor lamp has been found practically to surpass daylight. Although manufacturers are not given to substituting a light which cost money for the free light of the sun, the operatives in weaving rooms will pull down the shades and turn on the lamps whenever the opportunity arises. The remarkable thing is that this work, which requires the keenest possible vision, can actually be carried on better by artificial light than by daylight.

Another application of the same principle is found in the use of light of this quality to detect minute cracks or flaws in metal, such as forgings or castings. In such cases it shows the existence of defects that would be passed over even

by the best daylight. A curious result of this same effect was found to practically unfit the light for one industrial purpose, namely, the finishing work on patent leather shoes; it showed up cracks and defects with such increased sharpness that shoes were rejected by the inspectors as defective which appeared fully up to standard in ordinary light. So that there is at least one case in which artificial light has proven "too good for daily use."

We generally think of white as being one definite color, but in the industries white is a term which covers a score of different shades. Some of the most important articles of commerce are graded by their shade of white, and the manufacturing processes regulated accordingly. Among the most important of these are sugar and flour. Raw sugar is a brown substance, while the perfectly refined product is pure white, its whiteness being due to the same cause as the whiteness of snow, both being made up of small crystals which are themselves transparent. Any impurity in the refined sugar will show itself by changing the white from perfect purity to some shade containing more or less yellow. To detect the smallest departure from the pure white color, plates of the crystallized sugar one inch thick are examined by looking through them toward a mercury vapor lamp. If there is the slightest tinge of yellow it will be brought out by the bluish green light, which allows of much quicker work as well as more accurate results than could be obtained by sunlight.

Another use of this light for the same purpose is in assorting the ivory strips which are used on piano keys. The color of the ivory varies from the outside to the center of the tusk to such an extent that the manufacturers sort it into sixteen different shades. While each shade is

as good as the other for use, it is necessary that only one shade be used on the same keyboard. Formerly this work of sorting could be done only when there was bright daylight. With the light of the mercury vapor lamp, however, it was found, as in the case of sugar inspections, that the grading could be done without any limitation as to the season, time of day, or the condition of the weather.

Light of this quality has a way of showing up grease spots, stains, and discolorations of all kinds with relentless accuracy. This has been turned to a practical account in the inspection of woven fabrics. In a plush mill it was found that the work of inspection could be carried on four times as fast and with far greater precision by mercury vapor light than by the daylight under which they had previously worked.

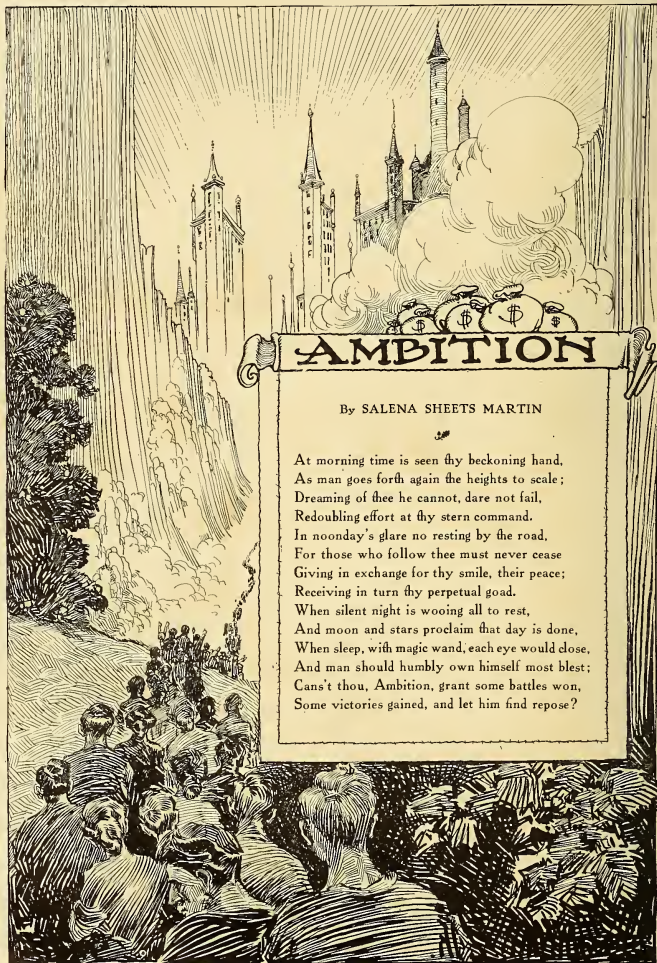
This property of the light in revealing spots and stains is still further heightened by the process of photography, and is utilized in detecting erasures and alterations on checks and documents on which money values are written. Dr. Wood, of Johns Hopkins University, recently detected a fraud of this nature where careful microscopic examination had entirely failed. "Twenty-four dollars" had been raised to read "twenty-four hundred dollars," the change being made by erasing the word "dollars" and the line following it by means of a chemical ink eradicator and writing in the words "hundred dollars." A photograph taken by mercury vapor light showed a distinct stain after the words "twenty-four," proving the use of the chemical erasing fluid, although there was no evidence of stain as seen by ordinary light.

Speaking of photography brings to mind the fact that the mercury vapor lamp is so rich in the actinic rays that it affords a complete substitute for daylight for not only copying and photographic printing processes, but for the highest class portrait photography in the

studio. It possesses, however, the great advantage of being capable of arrangement in a very portable form, so that instead of the sitter having to be arranged to suit the light, the light is adjusted to suit the subject. It has also the further advantage of being invariable in its actinic power, so that there is no guessing at the time of exposure to allow for the time of day, or the condition of the natural light. Furthermore, it permits a photographic studio to be located on a ground floor, or in any room of sufficient size, instead of limiting it to the top floor and skylight.

The latest form of the mercury vapor lamp uses a short tube of pure quartz instead of the long tube of glass. The quartz allows the ultra violet rays, in which the mercury arc, as the electricians call it, is very rich, to pass through. As these rays are irritating to the eyes they are screened off when the light is used for ordinary purposes by the simple expedient of surrounding the tube with a globe of ordinary glass, which is almost opaque to rays of this kind. The ultra violet rays are invisible themselves, or more accurately speaking, do not have the power of rendering ordinary objects visible. Under certain conditions, they produce an effect called fluorescence, by which some substances are caused to glow when exposed to the rays and are thus made visible.

This fact has been put to practical account in the assortment of zinc ores. One of the principle ores of zinc is the silicate, which is of a grayish color exactly similar in tint to the rock in which it is found, which is known as calcite. So far as the eye can detect by daylight the two minerals look exactly the same; but when the ultra violet rays from the quartz mercury vapor lamp are thrown upon them the zinc ore assumes a beautiful, deep, turquoise blue color, while the calcite remains gray. The separation can thus be made by any unskilled workman possessed of ordinary eyesight.



AMBITION

By SALENA SHEETS MARTIN

At morning time is seen thy beckoning hand,
As man goes forth again the heights to scale;
Dreaming of thee he cannot, dare not fail,
Redoubling effort at thy stern command.
In noonday's glare no resting by the road,
For those who follow thee must never cease
Giving in exchange for thy smile, their peace;
Receiving in turn thy perpetual goad.
When silent night is wooing all to rest,
And moon and stars proclaim that day is done,
When sleep, with magic wand, each eye would close,
And man should humbly own himself most blest;
Cans't thou, Ambition, grant some battles won,
Some victories gained, and let him find repose?

LAUREN STOUT.



After two or three years of planning and preparation, Uncle Sam's chief electrical experts have lately taken possession of a new seat of research work that is claimed to be pre-eminently the finest electrical laboratory in the world. This structure, which, with its equipment represents an investment of more than one third of a million dollars, is the newest member of the notable group of buildings comprising the home of the National Bureau of Standards.

That the federal testers of electrical current and fixers of electrical standards finally have facilities that enable them to carry on all phases of their study and exploration under one roof, and in environment especially suitable, is a matter for congratulation to the entire electrical world. For, be it known, the service which the Bureau of Standards performs in testing the electrical equipment and supplies purchased by the United States government is completely overshadowed by the disinterested investigations it prosecutes for the benefit of the commercial side of the electrical industry—the engineers, the scientists, the manufacturers, the public service corporations and, indirectly for the “ultimate consumers,” who are sometimes lost sight of as though it were not they who, in the end, foot the bills.

The officials feel that they have obtained for the \$200,000 expended a building that in quantity and quality is the equal of any structure of equal cost provided for a private corporation.

In order to adapt the building to the special purpose for which it was designed all sorts of “freak” requirements entered into the specifications. For instance, in the generator room in the basement there is an ingenious arrangement which permits generators to be supported independently of the building on special foundations detached on all sides from the other concrete substructure. Then again under the room for testing standard cells (in order to determine legal standard voltage) there has been provided a vault which descends into the sub-basement of the building and which is designed to grant maximum immunity from disturbing influences. Yet another exemplification of the unusual is found in certain rooms in the construction of which only manganese steel beams were used because of non-magnetic considerations. Even the roof of the new laboratory building has been specially arranged with reference to radio-telegraph work and certain experiments which it is planned to carry on there.

The effect of the provision of this new clearing house for electrical knowledge will be to provide the 50 physicists and laboratory workers who are engaged in the task at the expense of the government with working quarters approximating in the aggregate about $2\frac{1}{2}$ times the space which has heretofore been at their disposal. Of the \$150,000 worth of equipment which has been installed in the new building only a portion is new, the remainder having been removed from the

other laboratories where this electrical research was previously carried on. Prominent among the new acquisitions are half a dozen transformers which have been installed in a special high voltage building 22 by 40 feet in size, erected "down the hill" from the main electrical laboratory in order to isolate this somewhat dangerous branch of the work. Two of the transformers in this high voltage laboratory are of 100,000 volts capacity and cost Uncle Sam \$3,000; two others are rated at 25,000 volts and the remaining two are of 6,000 volts capacity.

In lieu of a power plant of its own the new electrical laboratory receives energy in various forms transmitted through a tunnel from a power house some hundreds of feet distant. Through this subway six feet wide by ten feet in height pass mains carrying hot air, live steam, exhaust steam, hot water, ice water, water at ordinary temperature, gas, electric currents, brine water, compressed air, etc.

As an interesting side light on the relations of the National Bureau of Standards with the electrical industry it may be worth while to note that one of the motor-generator sets was specially constructed for the government by a leading American electrical company which undertook the task for a contract price of \$6,000. As it turned out, this undertaking for which the contracting firm had neither precedents nor patterns cost the concern \$8,000 but the loss of \$2,000 was cheerfully assumed as an expression of the company's appreciation of what Uncle Sam's electrical experts are doing on behalf of the industry at large.

On the basement floor is the storage battery room where about 700 storage battery cells are installed for purposes of test. One end of the basement is given over to a suite of rooms devoted to absolute electrical measurements—research with reference to the fundamental units of length, mass and time. Here also is the precision weighing room and a brick pier absolutely independent of the

building and its foundations has been provided as a base for the Bureau's precision balance, an instrument so delicate that it records in fractions up to one one-hundred-millionth. The operations that take place in the precision weighing room must be watched through a window, for so delicate is the weighing mechanism that its action would be affected by the heat given off by the body of a man were a human operative permitted in the little enclosure.

Three rooms on the first floor of the new building are occupied by the magnetic laboratory which is carrying on an important work in testing the magnetic properties of iron for industrial purposes. An interesting activity now in progress is that which seeks to detect by magnetic means the flaws in railroad rails such as are in use by steam and electric roads—the flaws to which have been attributed so many recent railroad accidents. One of the practical achievements of this division of electrical work at the Bureau has had to do with the measurement of commercial steel for electrical purposes. Thanks to its aid steel in the trade has been so standardized that it is now possible for a purchaser in the open market to be reasonably sure that his specifications have been fulfilled, something that was impossible ten years ago.

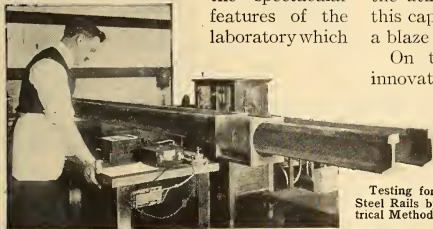
On the first floor also is the standard resistance room where are located the twelve coils, the average of which at a given temperature gives the standard ohm or unit of resistance. Here are in use extremely sensitive galvanometers which compare resistance to one part in 4,000,000. Near by is the heavy current room and the electric instrument testing rooms for testing the various types of instruments which the Twentieth Century electrical engineer uses in his work.

A tier of rooms on the second floor of the laboratory building are assigned to inductance and capacity and here is carried on a work in testing instruments and furnishing standards which is of the greatest value to the long distance tele-

phone and telegraph interests. Adjacent is the electrolysis section of the laboratory. This is a distinctly new adjunct of this versatile institution and has been established to carry out the orders of congress that a thorough and searching investigation shall be made into the whole subject of electrolysis—a probe that was ordered, of course, because of the recent disclosures of the effect of stray electric currents upon pipes, building foundations, etc., particularly in the larger American cities.

At the north end of the third floor of the building is the "light test room," one of

the spectacular features of the laboratory which



Testing for Flaws in Steel Rails by an Electrical Method

caution of picking a number of lamps at random and sending them to this light test room to be actually burned out. In the course of a year more than 5,000 lamps come to this room for "life tests" that will convince the federal sharps that such bulbs actually give the proper amount of light; that they do not require too much current to yield this illumination and that they have in each instance the requisite life of approximately 1,000 hours. In the light test room are sockets for 2,500 lamps ranged on eight huge racks and, as may be surmised, it needs the utilization of but a small portion of this capacity to render the room literally a blaze of light.

On the third floor also is another innovation which was created simultaneously with the occupancy of the new building. This is the radium laboratory which

has come into existence because the government has heeded the



The Lamp Room where 5000 Lamps a Year are Burned Out in Life Tests



Installation for Photometric Work

never fails to impress visitors. The United States government uses more than one million electric lamps a year and although these lamps are manufactured under rigid specifications enforced by government inspectors stationed at the factories, Uncle Sam adopts the further pre-

Making Experiments in Magnetism



pleas of American hospitals and other institutions which are not sure that in their purchases of radium they have received what they ordered and paid for. The radium laboratory has acquired three samples of radium, costing respectively \$400, \$600 and \$1,500 and it is hoped that ere long this court of last resort in weights and measures and standards will be enabled to tell the purchasing public what is what with reference to this superlatively expensive commodity.

GREAT STRENGTH OF INSECTS

An Englishman has made many experiments with various insects, such as



A Bluebottle Fly Draws 170 Times its Own Weight

caterpillars, fleas, butterflies and flies, which show how extraordinarily strong these insects are.

A bluebottle fly weighing $\frac{1}{28}$ of an ounce was hitched by a thread to a tiny wagon and drew a total weight of a little over six ounces, or practically 170 times its own weight. A caterpillar harnessed in a similar manner, pulled 25 times its own weight.

A strong man with a like equipment of large size can at most move but ten times his own weight.

WOULD YOU HAVE BEEN AFRAID?

An amusing incident occurred several months ago in an Iowa town, which well illustrates the popular ignorance of all things electrical. During a severe snow storm a live wire of the city's lighting system broke and the two ends fell to the ground. Before the damage was discovered, a team was killed because the driver could not see ahead through the storm. While the repairmen called were fixing the line, a piece of wire about ten

feet long was cut from the broken line and thrown far to one side. Several bystanders who had collected to watch the repair work, became speculative about this fully disconnected piece of wire. Finally one of them, pointing to the discarded wire lying at a distance in the snow, asked the electrician, "Mr. ——— would it hurt anything if we touched that wire now?" He seemed to regard electricity as some kind of an evil spirit that never left a wire, regardless of its condition. Possibly he was planning on acquiring the wire later for repairing his chicken fence but wished to avoid taking any chances.

WOODEN RUSSIA

The name "Wooden Russia" is the popular one given to that vast forest area of Russia in Europe, which covers 464,568,000 acres, or 36 per cent of the entire area of the country. Yet some fear is felt that the country may be deforested through the carelessness of private owners, and the Imperial government is considering steps for the protection of the forests. In Russia houses built of any other material than wood are almost unknown outside the cities, and wood constitutes the principal fuel.

METAL CORK

There is being used in the construction of European airships a so-called "metal cork." This is said to be of greater lightness than aluminum. Its surface is of a brilliant grayish whiteness and emits rays similar to those of unpolished aluminum.

The composition of this "metal cork," according to reports from Paris, is as follows: 99.30 parts of magnesium, with the addition of aluminum, zinc and iron.

DRINKING GLASS MADE OF ICE

A drinking glass made of ice is the latest French novelty. It not only serves for cooling the liquids which are placed

than the glass of an ordinary tumbler. But the new glass is much lighter than the usual ones.



Drinking Glass of Ice and the Mold in which it is Made

in it, but is also excellent in the way of hygiene, for in this way everyone has a fresh glass. Besides, the glasses are frozen from sterilized water. They are made in a mold which consists of an inner porcelain core and an outer metallic vessel, leaving a small space between the two for a thin layer of water, so that putting the mold in a suitable freezer, the water soon becomes frozen, then the mold is removed and dipped in hot water, which loosens up the outer vessel so that it can be taken off.

It only remains to withdraw the porcelain core, and this leaves a perfect drinking glass shaped like the usual tumbler. Such glasses can be kept in an ice-box for any length of time until they are needed, and when used for drinking, a paper mold or holder is fitted on at the lower part so that the glass can be held in the hand. By the new process the ice can be frozen very thin and is in fact not much thicker

KING SOLOMON'S MINES

Rhodesia, as is well known, possesses considerable deposits of gold. The ancients mined in this district, which lies between the Zambesi and Limpopo rivers, and carried away enormous quantities of the precious metal.

It has been suggested that Rhodesia is the ancient land of Ophir, the country of the mysterious "King Solomon's Mines," but by most authorities this theory is strongly combated. The ancient gold workings are the basis of modern operations. For every ten square miles of Rhodesia, it is stated, there was one ancient mine; that is, there are 75,000 old workings, which means that stupendous wealth was dug from the earth in the old days. Much of this must have gone to the north and east; it was, it is pointed out, the gold from which the crown of the Queen of Sheba was wrought and that which went to fill the coffers of Solomon.

The experts assure us that the ancient smelting places are still easy of recognition. They are, it is said, "sunk into the floor." The furnace blowpipes are made of the finest granite powder cement and the nozzles of the blowpipes are covered with splashes of gold. The linings of the holes are covered with specks of gold. When the first lining became worn by the heat a fresh lining of cement of an excellent quality, which has outlasted time, was smeared round on top of the old lining. It is said that one can take an old lining, split off the layers with a knife and find gold splashes in abundance.

The tools of the ancient workers so far discovered include a small soapstone hammer and burnishing stones of water worn rock, to which gold still adheres. There are evidences that the ancients conducted an extensive industry in the manufacture of gold ornaments and utensils.



THE COMBINATION-PHONE EXTENSION

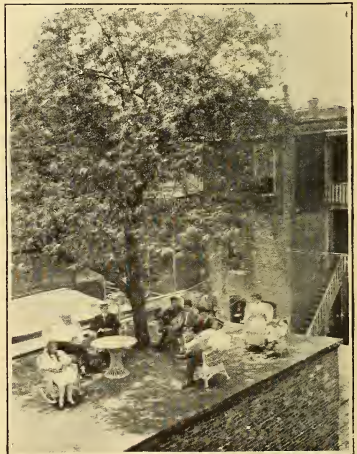
The ordinary wall telephone set must "stay where it is put"; the desk set is only slightly more flexible. Suppose, then, you want a perfect working, easily handled telephone that can be put in any room in the house, or extended, by running a little wire, so as to be available in the outbuildings on the farm, in the departments of a factory or store, etc.? Such a telephone comes in handy when installed by the bed, for use in case of night calls, inasmuch as you do not have to get up and go to the regular telephone.

The above requirements are filled by the combination-phone extension, as it is called. With it you can telephone while lying in bed, reclining in your easy chair—in fact, in any position—just as effectively and far more conveniently and comfortably than if you had to stand up to a wall-type telephone or bend down over an extension desk set.

The combination transmitter and receiver weighs scarcely more than the ordinary receiver alone. With the receiver to the ear, the transmitter automatically assumes the proper position for most convenient speech. The hook-switch or "triplet" is a compact little box, that fits on the wall or can be concealed under the overhanging edge of the table. It is easily connected to the regular party line telephone and requires no expert electrician to install it.

AN ODD ROOF GARDEN

About 50 years ago Chicago was nicknamed the "Garden City," probably from the fact that most people had gardens and the city abounded in trees. That this instinct with its magic words of "woodman, spare that tree" still lives in the hearts of its citizens can readily be seen by the accompanying photograph. A Chicagoan who was about to erect a building had a large tree growing on the



House Built around a Tree, Making a Comfortable Roof Garden

The Business Man, when Indigposed or when an Important Call Comes at Night, is in Ready Communication with His Place of Business



spot and not wishing to destroy it he conceived the scheme of erecting the building around the tree and now has an ideal roof garden for his family and friends.

CURIOUS FACTS ABOUT CRYSTALS

It has been pointed out that there exists a wonderful resemblance between crystalline growth and the growth of animals and plants, especially with reference to the powers of healing and repairing injuries.

If some of the lowest and simplest forms of animal life are torn asunder, they are not killed, but each separate part grows into a perfect animal form. In plants this power is much more completely developed, while crystals possess it to an amazing degree. It has been shown that a crystal that has been injured will, under certain circumstances, suspend its growth over the remainder of the surface until the injured part has been repaired. Yet there is no real life in the crystal, but simply a force that causes its particles to arrange themselves in geometric forms.

Some crystals, it is believed, have had their growth suspended during millions of years, after which enormous lapses of time the growth has been renewed.

In one respect, it appears, therefore, crystals possess a great advantage over human beings — they are able to renew their youth. This is not because they have discovered a counterpart of the marvelous fountain that Ponce de Leon

so vainly sought, but because the forces of crystallization are able to renew their action even after the greater part of a crystal has been destroyed through age or accident.

When the discovery of liquid crystals was announced some 20 years ago, many men of science were very skeptical on the subject, and thought that some error must have been made by the discoverer, Professor Lehmann. It was pointed out that the very name "liquid crystals," was self-contradictory. Later, the discoverer continued and extended the study of these crystals, the genuineness of which he seems to have established, although the molecular structure of the peculiar liquids experimented with is not clearly understood. The facts appear to be that certain chemical liquids at particular temperatures exhibit the characteristic crystalline properties of double refraction and dichroism. But the slightest disturbing force deforms them.

CEMENTATION STEEL

"Cementation" steel is of the high carbon variety, but it contains more sulphur and less manganese than ordinary tool steel. The cementation steel is so dense that it remains unresolved under the microscope with a magnification of 1,200 to 1,600 diameters, although that of open hearth, crucible and Bessemer steel can be resolved with a magnification of 100. Its elastic limit is said to be very high and its ultimate tensile strength 80,000 pounds per square inch.



The Castle of Sir Henry Pellatt, in Toronto, Built at a Cost of \$1,500,000

At a cost of over one and a half millions of dollars Sir Henry Pellatt, a Toronto, Canada, financial magnate, has practically completed what architects claim is the most remarkable "home" in all America. While filled from top-most tower to bottom most wine cellar with features that bewilder any observer ordinarily acquainted with the plans of magnificent homes, perhaps the most striking feature of all is that a castle modeled in the most minute details after the baronial halls of the Tudor period should "knuckle down" so thoroughly to modern electrical requirements as Electrical Engineer William B. Boyd has skilfully made it to do.

For instance, there are no less than 5,000 electric lights in the building, and the wiring in connection with them is 750,000 feet in length. Every light is controlled from one automatic board, and from five different positions in the building it is possible to turn on all the lights in the house and grounds — one of these posi-

tions being Sir Henry's bedroom. More than 100 rooms, some of them of immense proportions are contained in the building, and every one of them has a telephone, the automatic system being used and intercommunicating throughout. An electric elevator runs through the building from cellar to roof.

Now to escape a moment from such exceedingly modern phrases as electric wiring, it is well to bring in the secret staircase — yes, a *bona fide* "hidden passage" through the building from the owner's bedroom to his private office on the lower floor. But even in discussing the mysterious passage, we revert to electricity, for it is an electric button which releases a huge and innocent looking panel, thrusts it into a recess, and discloses a curving stairway through which only the master of the mansion is supposed to go. If a secret passage in this day of apartment houses, why not a ghost? Possibly this piece of equipment will be arranged after a while.

Then the organ — electrical too; and it cost \$75,000. The consol, or operating keyboard, stands at a distance from the pipes and operates the air through electrical control. Musicians state that this will be one of the finest instruments in the country.

It is interesting to get hold of some of the unordinary facts regarding this beautiful structure, remembering always that wherever there is a possibility of the application of electricity neither money nor skill have stood in the way of installation. Some of the rooms are of more than palatial proportions. The great hall, for instance, is 80 feet square by 70 feet high; this will be solidly paneled in oak, heavily carved. In the dining room it will be possible to banquet 100 guests. This room is being finished in Circassian walnut in latter Eighteenth Century style. The library, which is carried out in French walnut with a very fine Seventeenth Century ceiling in a magnificent canopied style, will be lighted by means of enormous lanterns enclosing electric lights. The library is 80 by 27 feet. The drawing room is in shape a remarkable circular bay and is 70 by 60 feet. From

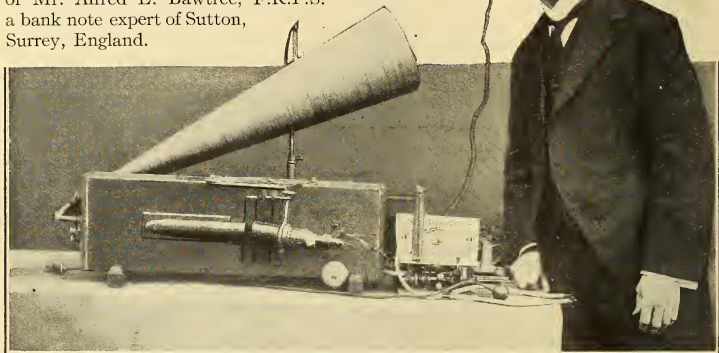
the great hall the grand staircase, which is to be of oak and carved with great richness, leads by means of a fine flight to a wide landing, which forms a lounge and from which the grand staircase branches right and left to the second floor. There are eight sets of guest rooms arranged on a scale of true magnificence, each at least 40 feet square and with bathrooms built from rare marbles. In the basement are bowling alleys, billiard rooms, a shooting gallery 165 feet long, and a swimming pool of marble graduated in depth from four and a half to eight feet, provided with an abundance of hot and cold water that can be turned on, or drained off with extraordinary rapidity. In addition there will be a Turkish bath, laundry, and refrigerating room. The kitchen contains a massive range suitable for roasting an ox whole, and upon its equipment the electrical inventor has lavished his best ingenuities. The castle will, of course, have provision for its own electric power supply, although its normal requirements will be drawn from the common sources in the city.



The Stables of the Tudor Castle. Here Electricity Does Much of the Work Formerly Entrusted to Human Hands. Reached by a Subterranean Passage from the Castle

MONEY THAT ACTUALLY TALKS

An electrically operated machine which will make specially designed bank notes and call out their value, and thus check-mate the forger, is the ingenious invention of Mr. Alfred E. Bawtree, F.R.P.S., a bank note expert of Sutton, Surrey, England.



By Listening at the Mouth of the Funnel the Bank Note Can be Heard Calling out its Value

Mr. Bawtree has been conducting several experiments for three years. His apparatus is something like a small talking machine, through which, between two metal rollers, the bank notes are passed. Connected to the apparatus are two cartubes, through which the bank note, it is claimed, can be heard calling out its value. Put as simply as possible, this is the idea and system of the invention: The "sound form" of two words like "five pounds" or "ten pounds" is first photographed by an ingenious process onto a film. A "picture" of "five pounds" is a jagged, zigzag line of varying thickness, which is about the length, or is made to be about the length, of a bank note.

By a photo-mechanical process this jagged line—which is really a little record of the words spoken—is cut on a zinc plate, and from this mould a steel cutting knife of the required shape and design is obtained.

When a bank note is passed through the rollers of the "reproducer," these

edges act like the surface of an ordinary record. "With this machine," said the inventor, "people can safeguard themselves against receiving forged notes. I claim that it would be practically impossible for a forger to imitate the serrated edge of a note which 'talks.'"

DREDGING TORONTO'S NEW HARBOR

To dredge out and rebuild the harbor at Toronto, Canada, on which nearly \$20,000,000 is being spent, the Canadian-Stewart Company, which has contracted to do the work, will make an innovation by displacing steam in all operations and doing the work with eight thousand horse power of electricity. The contract is so large that machinery of special design is being built in Europe for the purpose, and three dredges, claimed to be the largest in the world, will be brought across the Atlantic and run by electric power. The dredging work alone will take fully five years.



“PORCUPINE” STOPS SMUGGLERS

All sorts of devices are adopted by smugglers on the Franco-Belgian frontier and a continual battle of wits is waged between the customs officials and the law-breakers. The latter have frequent recourse to automobiles in their sudden dashes and the officials have devised what they call a “porcupine,” a kind of spiked chain which they draw across the road in front of any automobile in case the driver refuses to stop when signaled. A puncture is certain to follow an attempt to drive over it.

AUTOMOBILE SLED ATTACHMENT

A novel and interesting type of sled attachment for automobiles has been designed and constructed at New London, Wis., by H. H. Rohlf. By means of it the automobile may be operated during the winter season as a sleigh, by replacing the ordinary running gear with the sled attachment.

The front steering wheels are replaced by a pair of simple runners and the tires are removed from the rear wheels, a special driving mechanism being attached, together with a novel design of runners. Provision is made for raising the drivers to any desired position, from the seat, by means of a tank and pump. The lowering of the drive wheels is accomplished by the use of a valve, which may be opened to allow the liquid to return

to the tank or closed to hold the drivers in any position.

The car shown in the illustration provided with this sled attachment is equipped with an eighthorsepower engine, which is said to handle the car without difficulty, even on bare ground.



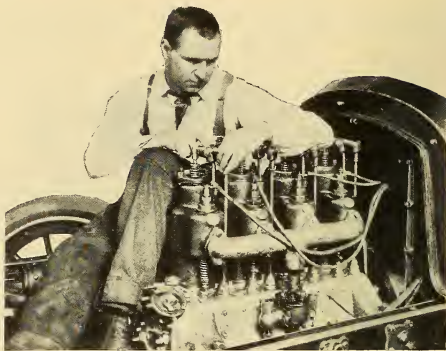
Sled Attachment for the Ordinary Automobile

BLIND AUTOMOBILE REPAIRER

On January first, Ray Fortney was graduated from a Cincinnati automobile repair school as the first expert, blind mechanic. He can repair an automobile from beginning to end perfectly and he does it by his sense of touch. He "sees" with his fingers. He is super-sensitive, made extremely so from his long training as an expert in repairing pianos at which he earned a living for some five years or more.

Just why Fortney gave up the piano repair business and entered the school for automobile repairing can be explained, for there is a much better future in the automobile repair business and it won't be very long now until people will be buying automobiles as they do pianos, so he wants to be right there and ready to gather in some of the repair work on those automobiles.

Fortney does a lot of the repair work on automobiles brought to the school for that purpose. He can assemble the delicate mechanism to perfection, never missing the placing of any of the many little parts to the engine. The carburetor is "tuned" up to perfection and with his fingers he goes over every little part of



Blind Automobile Repairer at Work

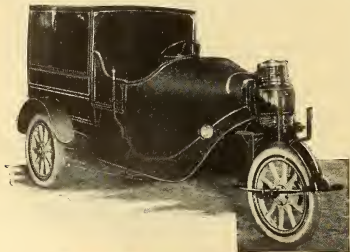
the machine and can tell instantly if all parts are in proper position.

THREE WHEELED ELECTRIC DELIVERY CAR

Something quite new in the way of delivery cars was introduced in New York during the recent holiday rush season. A large department store utilized a three-wheel electric to deliver small packages to hotel guests.

The new vehicle, which marks a distinct change in department store delivery methods, was imported from Germany for the purpose of taking hotel deliveries out of the hands of the wagons assigned to the general city work. It met with a marked success, for the principal New York hotels are centered about Times Square, and Stern Brothers' new store is only a block away.

These three wheelers derive their driving energy from a 20 cell, nine plate battery carried under the driver's seat. The motor is mounted over the driving wheel and power is transmitted to the wheel by means of a geared shaft. The cars are of 500 pounds capacity, have a speed of twelve miles an hour, and a range of 35 miles is claimed.

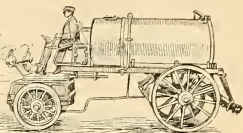
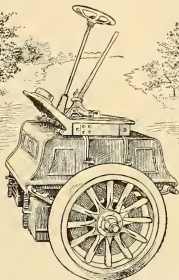
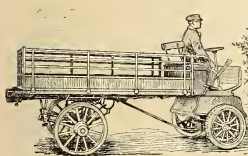


Three Wheeled Delivery Car

APPLYING MOTORS TO ORDINARY WAGONS

The problem of applying electricity as a motive power to ordinary wagons has

easily, yet when properly inflated, the two parts possess the strength and power of a one piece tire. This makes it possible to replace either part, carcass or tread,



A Storage Battery Operated Truck which Can be put in Place of the Forward Truck of Any Vehicle

been solved in a rather ingenious manner in France by the use of the "Fram" front truck. It has battery and motor combined in a most compact shape together with the two wheels, and the device can be fitted at once onto an ordinary wagon so as to simply replace the forward truck. A light, sheet iron box mounted on the wheels contains the storage battery and two electric motors which drive the wheels by gearing, so that there is no complicated mechanism. Steering and all operations of handling the wagon become quite easy.

in a few moments, anywhere, and means that practically a new tire can be obtained, if needed, at about half the usual cost.

The tread is held firmly to the carcass by the inflation of the tire. A secret construction that gives the edges of the tread an unstretchable bead solves the problem of the necessary grip, and keeps the components safe from invasion by water or dirt. It is worthy of note that no mechanical fastenings of any kind are necessary. This means there is nothing to impair the resiliency of the tire, or add extra weight.

TIRE WITH DETACHABLE TREAD

The latest innovation in pneumatic tires consists of a regular tire carcass, and a detachable tread. When the tire is deflated, the tread can be removed



Detachable Tire Tread

ELECTRIC TRUCKS ECONOMIZE SPACE

In a paper by Dr. E. E. Pratt, read before the convention of the Electric Vehicle Association of America, it is pointed out that a single horse delivery wagon has an overall length of about eighteen feet and occupies 90 square feet of area. To house this one horse vehicle demands 114 square feet of ground space. The business motor vehicle, which, on the average, could do as much work as two of the one horse delivery wagons, has an overall length of about 10½ feet, or a total of 60 square feet of area, whether on the street or in the garage. Here is a saving of valuable street space of practically 33⅓ per cent and approximately 60 per cent for storage. For larger capacity

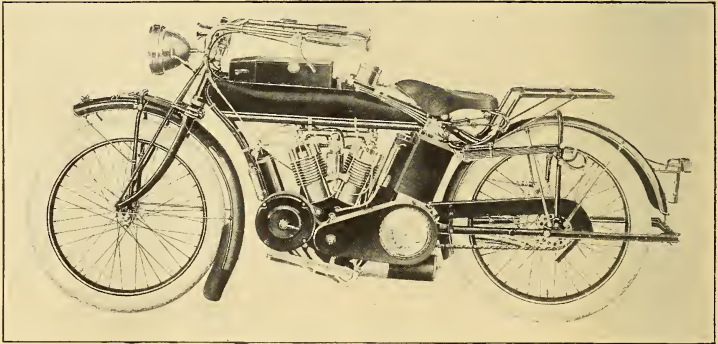
vehicles the comparison is more startling. A five ton horse truck needs 25 feet on a street, or a space of 200 square feet. The stabling of one of these horse equipments represents 281 square feet. A five ton motor truck of equal capacity and doing as much work, in some cases, as a half dozen two horse teams, takes up only 176 square feet on the street or in the garage.

MOTORCYCLES NOW ELECTRICALLY EQUIPPED

Modern motorcycles lack few of the refinements of up-to-date automobiles

equipped throughout, for starting, lights, ignition and horn, is, perhaps, hardly surprising in view of the remarkable advances made in perfecting these machines generally.

The starter motor is of $1\frac{1}{2}$ horsepower, using direct current at twelve volts, is entirely enclosed and weighs 25 pounds. To speak of it technically, it is a motor-generator and operates either as a motor or a generator. An enclosed roller chain direct from the gasoline engine runs it as a generator and when the motorcycle speed reaches twelve miles an hour, a magnetic regulator cuts in the batteries

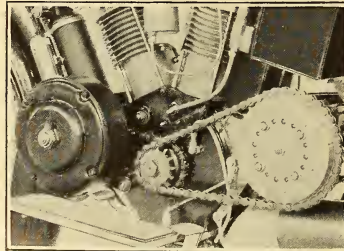


1914 Model Motorcycle Electrically Equipped Throughout Like the Best Automobiles

in the way of accessories, and that a prominent manufacturer should come out with a 1914 model electrically

which are then being charged. This regulator also controls the current to the batteries so that they will not heat from excessive charging.

As a starting device the motor-generator operates as a motor by merely throwing a switch. The batteries provide current also for electric lights, a horn, and for ignition.



Electric Starter and Engine Drive

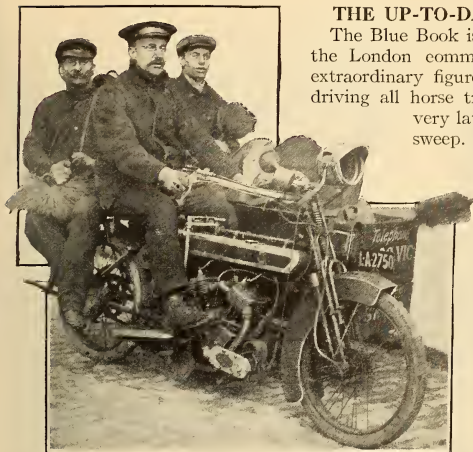
LICENSE ELECTRICS ONLY

The police department of Berlin, Germany, has refused to issue any more licenses to gasoline driven cabs on account of their menace to the public health. In the future licenses to operate on the public streets will be issued to electric cabs only.

THE UP-TO-DATE CHIMNEY SWEEP

The Blue Book issued at the close of 1913 by the London commissioner of police shows in extraordinary figures how the motor vehicle is driving all horse traffic from the streets. The very latest innovation is the familiar sweep.

The motor horn now takes the place of the horrible street cry of the old days. This modern knight of the chimney goes about plying his trade by means of a motorcycle with side car attachment capable of carrying all the paraphernalia incident to the trade. The picture shows one of the many such machines now to be seen in the streets of London in the early hours of the day.

**CANAL BOATS TOWED BY MOTOR TRUCK**

That an automobile truck can be used successfully in towing canal boats has been demonstrated at Schenectady, N. Y. Seven hundred and thirty-one tons is the load represented by these three boats in the picture, and the truck not only had no difficulty in handling them, but, half an hour later hauled a total weight of 1249 tons in the shape of five loaded boats.

The remarkable part of this demonstration was that there was no load on the truck at the time, aside from a few hundred pounds of humanity, and the truck was therefore capable of exerting only one third of its maximum pull without slipping its wheels. The truck towed the barges at a speed of four miles an hour, which would seem to indicate

the elimination of mules in the near future, less time consumed for goods in transit and a corresponding lowering of freight rates. It is stated that the experi-



Electric Truck Towing Three Canal Boats, Representing a Load of 731 Tons

ment in Schenectady has proven that this motor truck is capable of hauling as many ton miles of freight per day as could be handled by approximately 45 to 60 mules.

THE PASSING



A Table
Lamp of
Measured
Tone and
Measured
Space.



Electricity as the Perfect Artificial Light for
Displaying Flowers



ELECTRICAL SHOW.



The Only Light which
Brings out Every Tracery
in Quaker Lace



A Tulip Bulb in the
Modern Way

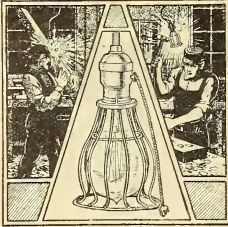


Where Cigarettes are
Made. Electric Light is
Ideal for This Exacting
Work

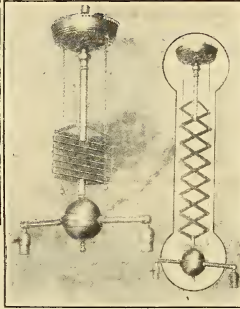


This Year
Municipal
Christmas
Trees Were
Quite the Fashion and This
Picture Shows
Chicago's Tree
as it Appeared
in Grant Park
During Christ-
mas Week

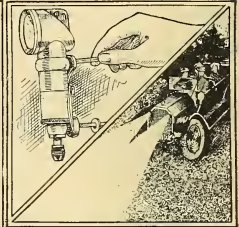
PHOTO BY GERLACH,
CHICAGO



Lamp Guard with Flared Bottom so that it can be Set Down on the Work Bench.



Extensible Fixture



Glareless Automobile Lamp Devised by Bleriot the Aviator.

NEW WAYS OF USING ELECTRICITY

FLARED BOTTOM LAMP GUARD

A factory owner remarked, "Putting guards on lamps is like putting money in the bank."

The accompanying illustration shows a Hubbell guard in which the steel wires are electrically welded, giving smoothness as well as strength at the joints. The flared bottom gives it firm foundation for standing on moving machinery and assembling benches. The side wires have sufficient bulge to allow removal of burned-out lamps without disturbing the guard. The bottom extends below the end of the lamp and insures protection whether hanging or standing.

NOVEL ELECTRIC LIGHT FIXTURE

There has recently been developed an interesting electric light fixture shown in the accompanying illustrations. The fixture may be raised and lowered somewhat as was the old fashioned kerosene lamp hung over the dining room table, the picture showing this new fixture in both the closed and extended position.

This novelty is intended for use over a library or dining table or over a writing desk. It can be attached to a single light or to a two, three or four light chandelier.

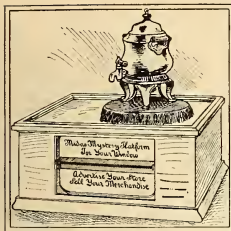
It is not necessary to discard entirely the old chandelier as the extension can be attached to this, and is neat in appearance. As is to be seen, the extension is designed on the principle of lazy tongs. The light can be brought close to the table or desk or raised up entirely out of the way and no special attention is necessary to lock it in position.

GLARELESS AUTOMOBILE LAMP

Bleriot, the famous French aviator and automobile designer, recently said: "It is more important to see the ditch at 60 feet than the obstacle a mile away."

The Roffy lamp here shown is constructed to illuminate the road near the car without blinding glare. The light from a tungsten bulb passes through two condensing lenses and upon a French mirror, then through a projection lens to the road.

The upper ray of the beam never rises higher than the top of the radiator, or about $4\frac{1}{2}$ feet from the ground, so cannot glare into the faces of oncoming auto drivers or pedestrians. The bottom of the lamp is enclosed in a glass tube which permits sufficient light to emerge to act as a side signal. Thus, a pair of lamps



Midas Mystery

perform the functions of two sidelights and two headlights. When the car is left in standing position, the two globes may be connected in series and reduce the current consumption from four amperes per lamp to two amperes for the two. This reduces the light from the lenses but permits sufficient light to act as sidelights.

MIDAS MYSTERY PLATFORM

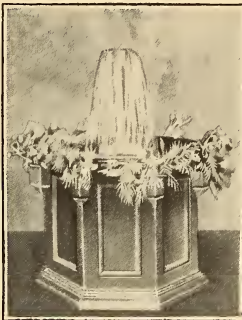
The Midas Mystery Platform is one of the latest display window advertising novelties placed on the market. It consists of an ebony case, the top of which is formed by a mirror. On this mirror rests a velvet pad or "platform" which carries the article to be advertised.

The platform moves about on top of the mirror in a most mysterious fashion, there being apparently no means whereby this motion could be caused as every part of the unbroken mirror surface can be seen at one time or another. In this way the observer's attention is drawn directly to the article being advertised.

How is it done? Frankly, we don't know, as the manufacturer won't tell us. The only hint he drops is that a $\frac{1}{2}$ horsepower Westinghouse motor is at the bottom of the mystery.

RAINBOW FOUNTAIN

The Rainbow Fountain tells its story in its name. Pressing a button puts the



Rainbow Fountain

fountain in action, and an automatic light projector produces weird changes and blending of colors every few seconds upon the spray.

Five gallons of water kept in circulation by an electric pump are forced into a vaporized spray and then drained into a metal tank below. Continuous aeration of the spray keeps it pure so that the same water may be used for a month.

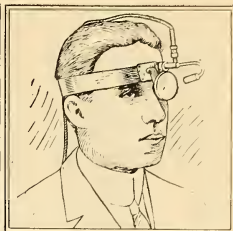
The decorative purposes to which the Rainbow Fountain may be adapted are many. A small niche can be cut out of any wall, the bowl inserted and the operating mechanism concealed, without using the metal base. In out-of-the-way corners of ballrooms it would not only cool the atmosphere but perfume the entire room and as a center-piece for the table it makes an artistic display for state or formal dinners. An ordinary electric light socket supplies ample current.

HEAD LAMP FOR SURGEON AND DENTIST

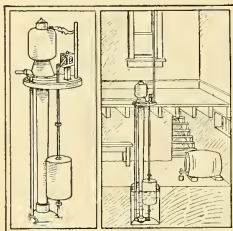
When the physician is ready to perform an operation or the dentist to work on the cavity of a tooth, he must have sufficient light.

To furnish a light that may be moved about without using the hands, the Aemi head light was placed on the market.

A mirror located over one eye receives the rays from a small but bright battery lamp held in a receptacle at the end of



Head Lamp



Cellar Drainer

a curved stem. The mirror is shaped to reflect and concentrate these rays at a point from ten to eighteen inches in front of the operator—on the part being treated or operated upon. The head light is much used in operating on eyes, mastoids, tonsils, etc., and can be connected through a resistance, when a battery is not employed, to the ordinary lighting circuit.

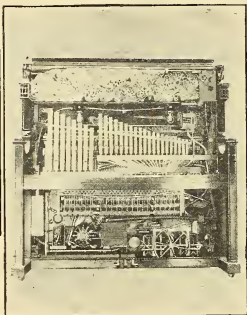
ELECTRIC CELLAR DRAINER

Wet cellars or basements may be kept dry with the automatic electric cellar drainer illustrated herewith. This device is a practical drainer at a moderate price suitable for private residences, apartments, elevator pits, etc.

It consists of a centrifugal pump direct connected to a vertical motor. The pump is installed in a three foot well into which the seepage drains, the motor and control apparatus being at the floor level, accessible for inspection and out of the way of dampness.

A float plays between two stops on a vertical rod. When water in the well rises sufficiently to cause the float to press against the upper stop, the motor is started and continues in operation until the water level is lowered so that the float presses the lower stop, when the current is cut off. The seepage is thus taken care of without attention, except an occasional inspection.

To install the pump it is necessary to



Motor Driven Piano

provide a well three feet deep, place the pump and make electrical connections. It is operated direct from the electric lighting circuit.

MOTOR DRIVEN PIANO

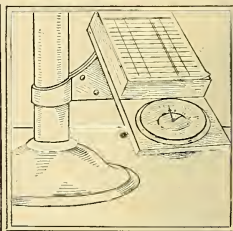
The motor driven coin operated piano is a source of amusement to patrons and of profit to proprietors of cafés, clubs, moving picture theaters, etc. The illustration shows a typical high grade instrument and its interesting interior.

The power is supplied by a small motor of special type for this service, being quiet in operation and requiring almost no attention. The motor drives an air pump, which supplies air for operating the keys and also for a stand of flute pipes.

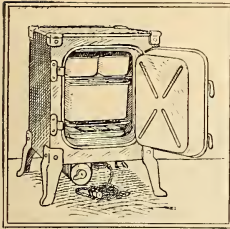
The music roll, which is contained in the upper part of the piano, is endless and will play from fifteen to 20 tunes, so that the piano has quite a repertoire with one filling.

AUTOMATIC TEMPERATURE REGULATOR

The Honeywell temperature regulator will automatically keep the rooms of a home or building at any desired temperature, by opening and closing the dampers and drafts of the furnace when the house temperature rises or falls a degree or two above or below the temperature wanted. It keeps the fire under control so that



Temperature Regulator



Fireless Cooker

there is no overheating, no underheating, no waste of fuel and no trudging up and down cellar to adjust dampers, which is tiresome and annoying.

The regulator is made in both clock and plain patterns. The clock pattern is more desirable as the thermostat may be set back for a lower temperature and at any predetermined time the clock will automatically readjust to this. Thus the temperature may be kept lower at night when the family is away and be automatically raised to normal in the morning.

The equipment comes ready to install.

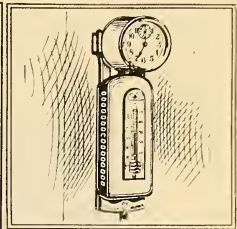
NEW FIRELESS COOKER

The El Cooko is one of the newest cooking devices. It is an electric oven employing the fireless cooker type of construction. It roasts, bakes, boils, steams and stews anything any oven will prepare.

The cooker is substantial and attractive in appearance. The outer case is of 27 gauge, blued steel, and the legs and trimmings are of polished nickel. The inner lining is of pure aluminum in one piece. The door is aluminum lined. The equipment consists of one seven quart aluminum dish with cover and two aluminum bread pans or vegetable dishes of three pints capacity each. Connecting cord and plug and instruction book accompany each cooker. The manufacturer guarantees the cooker for five years.



Water Heater



Tollometer

WATER HEATER OF NEW DESIGN

The heater illustrated is of new design, has a capacity of three quarts and because of its low consumption of current, 660 watts, can be attached to any lighting circuit.

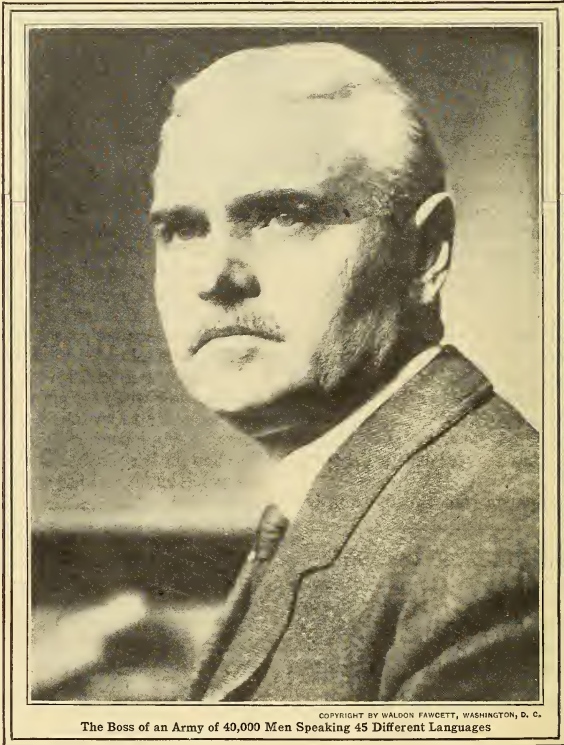
To guard against waste of current a pilot lamp is mounted in the base under a ruby glass lens and serves as a signal light to show when the current is on and as a reminder to switch it off when the heater is no longer required. A flush switch in the base facilitates the operation of turning on and off the current.

THE TOLLOMETER

The Tollometer enables the telephone subscriber to check the company's charges for long distance service. It is a simple affair which can be attached to any telephone or to the side of one's desk, or simply placed on the desk. It consists of a framework containing the timing mechanism and dial, which is graduated into minutes and seconds. By pressing a lever the mechanism is started. In case of interruption pressure on the same lever causes an instant stop. A third pressure starts again the timing device from the point at which it was stopped. This operation can be continued until the end of the call, when the exact number of minutes and seconds consumed is shown on the dial. By pressing the lever at the right-hand side of the Tollometer the hands of the clock are set to zero.

Electrical Men of the Times

COL. GEORGE W. GOETHALS



Many men have, in the history of the electrical business, "just grown" into positions of prominence in the industry, but it is safe to say that there is no more conspicuous example of such gradual, almost unconscious enrollment among the electrical men of the times than is afforded by the experience of Col. George Washington Goethals, creator of the electrified Panama Canal.

Few would have considered Goethals eligible, in the days before he went to Panama, to the title of "electrical man" and yet this virile member of the U. S. Army Engineer Corps who has so often been referred to as a human dynamo had, throughout his entire professional career, had more or less to do with the magic current. For more than three decades, or, in fact, ever since his graduation from

the U. S. Military Academy, Goethals had been constructing irrigation works in the West and building coast defenses in the East. And it goes without saying that there is infinitely delicate electrical work in connection with coast defense construction, our military posts being absolutely dependent for success in operation upon their electrical nerves. On top of all this Col. Goethals served as instructor of engineering at West Point—a detail that assuredly had its electrical side.

Yet despite all this he went to Panama with no "big things," electrically speaking, to his credit.

One factor which placed upon Col. Goethals's shoulders broadened electrical responsibilities was the progress of the construction of the canal to a point where, by reason of the creation of the great Gatun dam, means were at hand for the generation of vast electric power. A second contributor to the new status was found in arranging for a permanent operating plant for the big waterway. This contingency pushed the canal builder into the rôle of originator in electrical practice. He hints that he might have been appalled by the prospect had he allowed himself to look into the future.

Col. Goethals looks the part of an electrical "man of affairs." The grueling work in the tropics has aged him. His hair is whiter than it was half a decade ago, and the blue eyes that look out in startling contrast from a face of deep bronze tint have a judicial expression that does not obliterate the light of instinctive kindness which is one of the secrets of his success in handling men. Col. Goethals is boss of an army of 40,000 men speaking 45 different languages and is confronted with all those problems which arise when men are toiling far from home. He is a fighter when occasion demands—a quality which all men admire—and he is given to maintaining a certain measure of military discipline. But he is never obtrusive in his military ideals, for he has not donned a uniform since he went to Panama except

it has been on some most formal occasion.

Another secret of Col. Goethals's success is in giving every man credit for what he does. Just ask any of the engineers who have invented or developed any of the unusual installations at the Isthmus; for instance, the ingenious control board for manipulating the lock machinery at Gatun. Further, any man in the 40,000 can go directly to Col. Goethals with any grievance or appeal. Every Sunday morning he sits as judge in a confidential, unofficial court. No red tape bars admission and every man's plaint is heard in private. Furthermore, the conscientious employee who comes to report waste or graft can be absolutely sure that he will be protected. The outcome of it is that the "old man" has an intimacy of relation with his co-workers that is not enjoyed by many an employer. That Col. Goethals has no belief in frills is evidenced by the plain, barracks-like office which constitutes his working quarters.

As this is written this man of 55 is busy with other electrical problems—the electrical operation of the permanent machine shops at Balboa; the electrification of the Panama Railroad (a masterful project now in the air); the electrical illumination of the employee's quarters for the permanent force, and the providing of current for powerful searchlights to be mounted at the entrances to the canal. Over 6,000 Americans now in the Canal Zone would like to be retained in permanent positions. Col. Goethals must pick from this number no more than 1,000 men. The final muster at Panama will show a prize electrical corps. He is the man "on the job" at Panama, and thanks to his yellow motor car—which the workmen designate as the "yellow peril" or the "brain wagon"—he exercises in this big undertaking that close personal supervision for which he has been known ever since the days when he began his career as a canal builder by superintending the construction of the Mussel Shoals Canal on the Tennessee.



Electrical Interests of Women



EDITED BY GRACE T. HADLEY

THE DAINTY WAY TO KEEP HOUSE

Cooking with electricity means cooking with all the drudgery left out. You may cook at the table with ease in attractive utensils from which you serve the food direct. There is no other way of getting up meals that is at once so simple, so dainty, as the lamp socket way of cooking. The saving in time and trouble is self-evident.

Perhaps the greatest advantage of electric service in the home is the opportunity it affords for electric housekeeping. From the same lamp socket that provides light, you may connect a table range or an electric grill and thus the fixture of the dining room may be utilized for light cooking. Here, with a combination electric grill, small steaks may be broiled, eggs fried or bread toasted. Delicious coffee may be made in the electric coffee percolator.

There is almost no limit now to the comfort cooking that may be done with the electric utensils. The modern lady of the home knows and others are finding out how the little glowing coils radiate cheer at the breakfast, luncheon or tea table; and how efficiently, quickly and silently the modern devices operate without smoke, flame or fumes.

Cooking with Electricity Means
Cooking with All the Drudgery
Left Out

Of course you can live without these little labor savers, but why should you? You could use kerosene lamps — but do you?

A PLEASANT TASK NOW

“Any housewife who has used electric utensils knows something about their convenience and cleanliness,” said a suburban lady recently, “but it is their portability that appeals to me. To illustrate, I used to think I had to do my ironing in the kitchen because the gas stove was there and the irons had to be heated on the stove, but now, since I have used the electric iron to do my ironing, I find that





"I Ironed all the Morning in My Bedroom"

I can iron to better advantage up in the bedroom and that it is not necessary to spend the whole day in the kitchen."

"Well, that is certainly a good idea," remarked the visitor from the city. "I really think you manage well with your work."

"Having put out all of my maids," laughed the suburban lady, "I was obliged to do something, so I now have two electric servants that are indispensable, my electric iron and my vacuum cleaner. They are always at my service, take up little room and with them I am able to get along without a maid. One day I thought to myself,—

"'Why should I drudge down in the kitchen all of the time?' and I immediately carried my folding ironing board upstairs and of course it was no trouble to take up the electric iron. Before my husband left for his work he carried up the basket of clean clothes, so I ironed all morning up in my bedroom and if I got tired I could lie down a few moments and rest. I found it a nice change from the kitchen, for although my kitchen is clean I do not care to spend most of the

time there, even on ironing days. With my portable electric iron I can work where I please."

THE BOUDOIR

Every woman knows how tiresome and annoying it is to stand and hold a curling iron in a gas flame. Then the soot or smudge must be removed before the tongs can be used. These disagreeable features are entirely eliminated by the use of an electric curling iron heater. While one pair of tongs is in use, another pair may be heating and when the tongs are removed from the heater, the current is automatically cut off thus the expense of operation is slight.

In the modern boudoir, a central ceiling fixture should be installed with two



Disagreeable Features of Soot and Smudge are Eliminated

or more sidewall brackets to provide proper illumination for the dressing table, chiffonier and bedside. Also one or more baseboard receptacles should be placed for the connection of portable lamps, electric fans, vacuum cleaner and other electrical conveniences.

COOKING, THE WORLD OVER



(1) The Modern Electrical Way. (2) Soldiers Doing Outdoor Cooking in Africa. (3) Cooking in Winter Quarters in Ellesmere Land

(4) Prehistoric Bakery—a Hole in the Ground.
 (5) Cooking Over a Hot Geyser in New Zealand



Since the sacred rage of hunger first seized upon primeval man, many and varied have been the attempts to prepare his food. In the beginning, man ate flesh raw as some primitive tribes do yet, but with the discovery of fire, cooking became the fashion. Holes were dug in the earth and crude ovens created and later vessels of clay were constructed.

Cooking has always been "a burning question" until the advent of electric heat. Electricity as a safe, clean and easily controlled heat source offers numerous advantages over the ancient primitive methods, as illustrated in the accompanying photographs.

To cookery we owe well ordered states
Assembling men in dear society,
 declares a Greek epic poet and he traces the successive stages of civilization to man's culinary development, avowing that the culinary art has been the mainspring of civilization.



(6) Breakfast in a Typical Navajo Home. (7) Native Women in South America. (8) Bread Making in the Court of a Syrian Home

MODERN AIR CLEANING

Pure air is a necessity that our modern ways of living have made almost a luxury. It is a necessity in the home because more than anything else it produces robust health. The purity of the air depends upon two things: the absence of disease germs and injurious gases and the presence of an abundant supply of fresh oxygen.

Time was when a bug could "live swell" in a rug, but with the modern air cleaning system no dust, germs or microbes can withstand the artificial cyclone created by a suction cleaner, a veritable little cyclone that absorbs dust and dirt into pipes constructed for the purpose.

The machine itself is installed down in the basement. It does not have to be carried about from room to room or from floor to floor. You simply press an electric button and the machine does the rest. It is about five feet high and two feet in diameter, equipped with an iron tank in the top of which is the secret of the process, a motor and a fan. The whirling fan moves the air. It makes 3,500 revolutions a minute and is so constructed that it gives the air current a spiral movement like that of a cyclone.

This powerful centrifugal fan is on ball bearings and runs in an oil bath. The machine has run for 2,400 hours



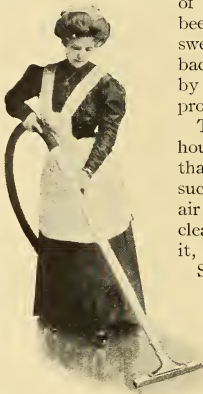
Cleaning Radiator

without oiling or adjustment; being built like a watch it runs like a watch. None of the machinery is in sight.

Sweeping and dusting have been very crude and primitive operations, comparable only with the old time methods of cookery. The old method has been to distribute the dust by sweeping and then when it settled back onto the furniture, wipe it off by hand, a tiresome, never ending process.

There is only one way to keep the house clean and wholesome and that is to pick up the dirt by the suction cleaner, take out the stale air entirely and permit the pure, clean air from outdoors to replace it, thus insuring cleanliness.

Spring house cleaning has lost its terrors and most of its miseries, for with the modern air cleaning system, rugs, furs, curtains, carpets, walls, draperies, mattresses, all can be cleaned and purified at the very minimum of cost and labor. The modern woman no longer wants to be worried with the deadlift of work that is downright drudgery, but she wants to get it done in the modern way and have time to attend her clubs and use her brain in considering how best to beautify the city in which she lives. First she cleans her own home in the best and most scientific way and then she considers the health and municipal problems of her own home city.



Carpet Cleaning



Fur
Cleaning
by
Vacuum
Process



Experimental Kitchen in Kansas City in Which Some Valuable Data in Reference to Electric Cooking were Obtained

ELECTRIC COOKING IN ACTUAL PRACTICE

Housewives would all prefer cooking by electricity if it were not for the cost, but in most instances they do not know what the actual cost is. The recent tests in Kansas City, Kansas, furnish the needed information. This enterprising city owns an electric light plant and is endeavoring to force coal dealers and natural gas companies to reasonable prices.

To do so the city offers housewives the low rate of three cents per kilowatt hour. This was not sufficient to develop electric cooking so the next move was to give a municipal exhibition of electric cooking devices at the city hall. Experts from various companies demonstrated their appliances, one of the professors from the state university lectured on the subject and the local commissioner of water and light explained the plans of the light plant.

As a final touch several electric cookers were distributed among the patrons of the

municipal plant and practical tests covering a week were made. There was no effort to select experienced operators but average American families were given the apparatus and asked to proceed with their usual cooking. At first the housewives did not expect much from the trial but they soon grew enthusiastic in praise of electric cooking.

Three types of cookers were used:

(1) Open heaters, dishes or plates. These are suited to frying, boiling or heating the same as a gas hot-plate. They produce the quickest results but are the most expensive type of electric cooker as may be seen from the data.

(2) Ovens, containing heating plates or disks, mostly enclosed but not airtight, as is the case in the third class. These utensils are used for baking, roasting and cooking of pastry. The results are quick but not as expensive as open plates, for the heat generated is retained to a marked degree.

(3) Enclosed cookers containing heating elements so constructed as to be practically air-tight, allowing very little heat generated in its interior to escape.

The results obtained showed that No. 1 is the best for frying, No. 2 the best for pastry and No. 3 the cheapest of all. The ideal cooker appeared to be a combination of all three types with two open plates, one medium sized oven and one enclosed cooker of about two or three compartments. For economy the meals should be planned so that the airtight cooker may be used the greater part of the time.

Following are some of the results obtained with the three types of electric cookers:

OPEN PLATES

Frying half pound steak.....	\$0.007
Breakfast of four eggs, fried, four slices bacon and two quarts of water boiled	.02
Breakfast for four persons—twelve pieces fried mush, six medium potatoes fried, four eggs fried, one and a half quarts coffee and one gallon of water to boiling.....	.06
Dinner—Nine medium potatoes, three fourths pound veal steak, one can corn, one quart water for tea, one gallon boiling water.....	.07

SEMI-ENCLOSED OVENS

Baked six large potatoes.....	.012
Four-pound roast and six large potatoes baked.....	.03

It is to be noted that the cost of cooking with this type is less than with the open plate.

AIR-TIGHT COOKERS

Four-pound roast, six large potatoes and one quart tea.....	\$0.015
Boiled dinner—One small head cabbage, three pounds ham, boiling piece, twelve medium potatoes.....	.015
Two-pound steak, one quart spaghetti, twelve potatoes.....	.027
Three-pound pork roast, six large sweet potatoes, can corn, warmed one pound of fruit pudding.....	.027

In addition it may be stated that one family of three persons cooked one week on the open plate type for 73 cents but



Bread Fresh from the Electric Oven

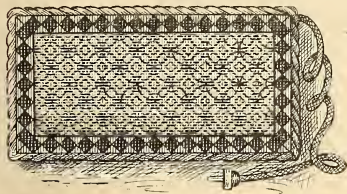
with the air-tight cooker another family managed for one week (less one meal) on 19½ cents. It is interesting to compare this with the advertised statement of a company in Indianapolis selling 55 cent gas that a dinner for an average family can be cooked with gas for three cents. Evidently not much difference at those prices but of course few cities are as fortunate as Kansas City in having electricity at three cents per kilowatt hour. Twice that is common, yet even at a higher rate many people will prefer to cook with electricity.

LORD KELVIN AT CAMBRIDGE

Lord Kelvin entered Cambridge when he was just seventeen years of age but was well prepared to enter the great university. It is amusing to read some of the inquiries of the great philosopher in his first letter to his sister after settling down in his rooms at Cambridge. He asked if when making coffee, he should put the coffee in before or after the water is boiling and also whether he should keep it boiling after the water is put in.

ELECTRIC FOOT WARMER RUG

If you would live long, keep your head cool and your feet warm. Here is an electric foot warmer rug that will help you to do this. It is the very thing for an electric automobile on chilly mornings.



Foot Warmer Rug

It is heated from the batteries in the car that average 80 volts but it can be made for any voltage.

This foot warmer rug is a warm floor covering in the shape of a Wilton carpet rug, 15 by 27 inches and is neatly bound around the edge. In the home it may be connected to any lamp socket and heated to a suitable temperature for the benefit of elderly people. It may be used any place where there is a possibility of cold feet, in the home, office, on board ship or wherever there is electric current available. The current required will cost about one cent per hour.

NUTRITIVE VALUE OF FOODS

Foods owe their value to their efficiency in supplying warmth to the body, energy and the necessary material for building up the different parts of the body during the period of growth, and for replacing those portions which are destroyed in the process of living. They are also valued because of their power to appeal to the appetite and of their adaptability to the bodily needs under certain conditions. The money value depends on the abundance of the supply of any food to meet these demands of the human body.

In speaking of the adulteration of foods, Mr. Newman, commissioner of the Illinois State Food Commission, in a lecture

before the Domestic Arts and Science School of Chicago, said: "We keep out the bad foods and we see that the manufacturers label their goods, but the purchaser should read the labels and insist upon genuine goods from the honest dealers who disdain adulteration of their products." In proof of his statement, he showed a jar of genuine raspberry jam manufactured by a firm famous the world over for their products, then he showed another jar of cheap raspberry jam which contained no fruit whatever, but the ingredients consisted of agar-agar, artificial flavor, artificial color, phosphoric acid and clover seeds.

It has been found that a Japanese sea weed, agar-agar, affords a substitute gelatine basis, and this has been used to a great extent by those engaged in making a cheap adulterated jam or jelly, as one pint of the sea weed combined with nineteen ounces of water makes a gelatine basis, which is then artificially flavored and colored: and other ingredients being added, such as phosphoric acid and clover seeds, a purely artificial product is thus put forth having no nutritive value whatever. When these ingredients appear upon a label, the purchaser who takes the time to read will doubtless decline to accept the cheap substitute.

It is possible, however, for a dealer to comply with the law and yet fool his customers, as illustrated by a grocer selling so-called olive oil. It was nothing but cotton seed oil and was so stated upon the label, in English, but, the balance of the label being in Yiddish and the customers being Yiddish unable to read the English, they were under the impression they were getting olive oil.

"It is up to the consumer to study the labels on all foods purchased," said Mr. Newman, "and the careful housewife will do this more and more; if she pays for good olive oil she is entitled to get it and not a cheap substitute. She can always demand the product of an honest dealer and insist upon having honest goods."



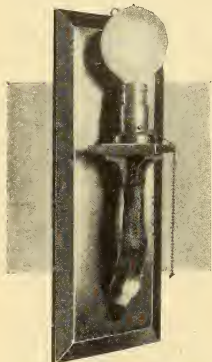
For Practical Electrical Workers

HUNTER'S DEN FIXTURE

A very attractive lighting fixture for the sportsman's home is here shown and it can be made from the hoof and part of the leg of a deer. The leg is cut off about two inches below the knee joint, and soaked in a solution of arsenic, alum and water, which preserves the hide and acts as a moth preventative.

It is then bent to shape and allowed to dry and harden, after which the marrow is burned from the inside of leg bone.

A four inch square of quarter sawed oak wood $\frac{3}{8}$ inch thick is fitted onto the leg by means of four small brackets also of quarter sawed oak. Each bracket is attached to the leg by means of a small brass screw at the



Fixture Made from Hunt Trophy

lower end of the bracket. Through the center of the wooden square a hole is cut just large enough for the leg bone to fit into, thereby serving to hold this square firmly.

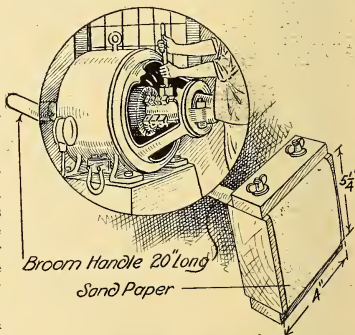
The light socket, which is of the pull chain variety, is attached to the wooden square by small screws. The leg is fastened to a panel of quarter sawed oak 18 by 6 by $\frac{3}{4}$ inch by means of two screws, one of which enters from the back of this panel into the hoof, the other entering from the back of panel and into one corner of the wooden square which holds the light socket. The current wire runs from the light socket along the under side of the wooden square and through a small hole bored in the panel.

The wooden parts may be stained a mission

shade, or to match the woodwork of the room in which the fixture is fastened and are then varnished or waxed as desired. The hoof is sandpapered and varnished. The light bulb may be either of the large round frosted variety, or a small bulb inside of a larger globe.

COMMUTATOR CLEANING BLOCK

A simple and very useful commutator cleaning block may be made of three pieces of wood, two bolts and a piece of a broom handle. The broom handle is fitted into the block and the block drilled for two holes, as shown, taking $\frac{1}{4}$ inch bolts five inches long. The slotted heads may be countersunk in one of the strips of wood and thumb nuts are used at the threaded end of the



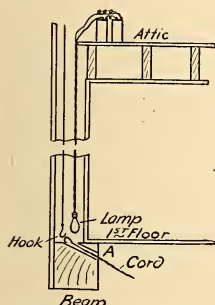
Commutator Cleaning Block

bolts. The block may be hollowed out to conform to the arc of the commutator, but if the block is not made too wide, that is not necessary.

The handle being about 22 inches long gives a chance to apply necessary pressure to handle the block and move it across the surface. It is a much better method than holding the sandpaper under the fingers or holding it to a block held in the hand.

LIGHTING PARTITION INTERIOR

Being called upon to "fish" a length of flexible conduit from the attic of a cottage to the basement, I found the way blocked by a heavy wooden sill, and it being difficult to "tunnel" through the beam, I decided to tackle the job as shown in the illustration, making a rather sharp turn.



Dropping Lamp down Partition

The rest was easy. By dropping a fishhook, I was able to make the haul with ease and dispatch. — J. W. TIERNEY.

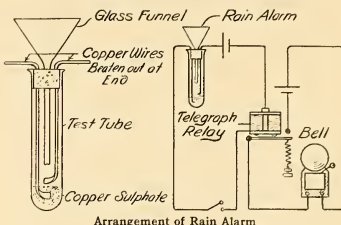
RAIN ALARM

I sleep with the windows of my bedroom wide open and to make sure that I awake and close them in case of a storm I devised a rain alarm which wakes me as soon as it begins to rain.

Outside my window is a small glass test tube which is filled to a depth of about $\frac{1}{4}$ to $\frac{1}{2}$ inch with finely powdered copper sulphate. In this is a strip of copper made by beating out the end of a rather heavy gauge copper wire. Above the copper sulphate and hanging just clear of it is another strip of copper made in the same manner as the first strip and also connected to a copper wire; both strips are held in place by passing the wire supporting them through a closely fitting cork placed in the mouth of the test tube as shown in the figure. A hole in the cork allows for the admission of a glass funnel the mouth of which was about two inches or more in diameter. The wires are connected to a battery and a telegraph relay; the relay controlling an electric bell circuit as shown in the wiring diagram.

The operation of this alarm is as follows: The rain falling in the glass funnel flows into the test tube and dissolves some of the copper sul-

phate. In a short space of time, the solution rises high enough to make connection between

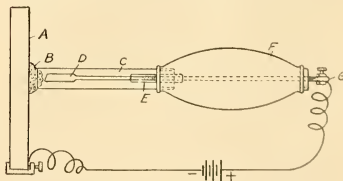


Arrangement of Rain Alarm

the two copper strips, thus operating the relay which in turn closes the bell circuit. It is, of course, necessary to have a switch in the relay circuit which can be thrown off when the windows are closed. After the alarm has been used it is necessary, to again have it ready for use, to remove the solution from the test tube and put a charge of dry copper sulphate in the tube. —ARTHUR JOVESHOFF.

HANDY ELECTROPLATING APPARATUS

The illustration shows a very simple electroplating apparatus which can be made at home. The piece to be plated (A) is connected to the negative pole of a battery, from the positive pole of which a conductor (G) carries the current to the anode (D). The rubber bulb (F) is filled with the electrolytic bath, that is, the liquid containing the plating metal in solution, which can be squirted through the small tube (E) into the larger tube (C). The smaller tube passes through a cork in the end of the larger, which



Electroplating Apparatus

also serves to give support to the mouth of the bulb. The amount of the liquid pressed out must be sufficient to keep the sponge (B) moist. Care must be taken to clean carefully the parts to be plated before beginning. — Translated from *L'Electricien* by J. H. Blakey.

Elementary Electricity for Practical Workers

By W. T. RYAN

CHAPTER XII.—STORAGE BATTERIES

As practical electrical workers it is of importance to understand thoroughly the care and operation of storage batteries, therefore this chapter will be devoted to this subject.

The chemistry of the lead storage cell is somewhat complicated and physicists are not entirely agreed upon what actually takes place. The commonly accepted theory is as follows: When the cell is thoroughly charged the positive plate is covered with lead peroxide (PbO_2), while the negative plate is covered with spongy metallic lead (Pb). During discharge, the lead at the negative plate unites with the sulphuric acid (H_2SO_4) forming lead sulphate ($PbSO_4$) and

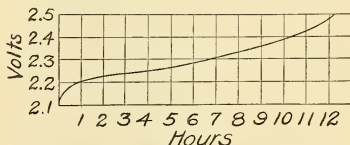


Fig. 80. Typical Charging Curve

setting hydrogen (H) free. At the positive plate the lead peroxide (PbO_2) unites with the hydrogen set free from the negative plate and forms a lower oxide (PbO) and water; this lower oxide then unites with sulphuric acid and forms lead sulphate ($PbSO_4$) and water (H_2O). As the cell becomes discharged, the acid thus unites with the plates and water is formed so that the density or specific gravity of the electrolyte falls off as the cell is discharged. When the cell is charged by the passage of current in the opposite direction, the above processes are reversed. The voltage should not be allowed to fall below about 1.8 volts per cell, as the lead sulphate is liable to change into an insoluble form, which reduces the capacity of the cell. The cell is then said to be "sulphated." Care must be taken, therefore, not to allow the battery to become discharged too far. When the cell is being charged the necessary voltage rises from 2.2 to 2.5 to 2.65 volts per cell. Figs. 80 and 81 are typical charging and discharging curves.

When the cell is fully charged, the further application of current breaks up the water of

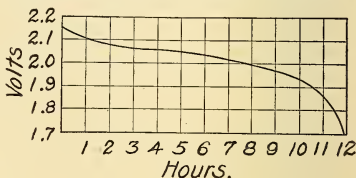


Fig. 81. Typical Discharging Curve

the solution, liberating hydrogen gas at the negative and oxygen gas at the positive plate. These gases reduce the amount of the solution in the cell, both by the decomposition of the water and by the acid which is carried off in spray by the gases. This spray is also carried off if the charging current is too strong, so that the active material on the electrodes is affected at the surface much faster than nearer the center of the plate. On the other hand, if the charging current is less than about one-fifth of the normal current, the insoluble sulphate is apt to form and permanently injure the plates. Manufacturers furnish the user with instructions for caring for the battery which include directions for charging, but should these instructions not be obtainable, the charging rate may be determined approximately by figuring .040 amperes

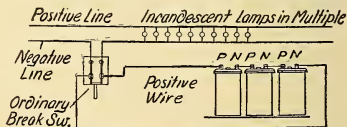


Fig. 82. Charging Battery through Lamps

per square inch of positive plate surface as normal. This can be checked also by trials, noting the length of time from the beginning to the end of the charge, as evidenced by the voltage rising to about 2.5 and vigorous gassing. For power station cells the eight hour rate is usually taken

as the normal and the four hour rate is considered correct for motor car batteries. According to Lyndon the maximum charging rate is that at which the cell will absorb energy without heating more than 25° F. above the surrounding atmosphere and not gas excessively. This usually corresponds to about the two hour rate. Fig. 82 shows the connections for charging a few cells from an ordinary lighting circuit.

In operating a power station battery a pilot cell should be selected to be used as a guide in the operation of the battery. Readings should be taken on this cell with sufficient frequency to indicate its state of charge and discharge, and thus serve as a guide in the operation of the battery as a whole. The height of the electrolyte in this cell should be kept at a fixed point, either by means of an automatic filler or by the addition of a small quantity of *distilled* water at least once a day. This will prevent the sudden drop in the gravity of the electrolyte consequent upon the addition of a considerable quantity of water and the following increase in gravity as it slowly evaporates. The fixed point may be marked in a convenient manner; for example, in a glass jar battery, by a painted line on the outside of the jar, or, for tanks, by an S-shaped strip of lead hung over the edge of one of the glass supporting plates.

Every power station battery should be provided with a recording voltmeter to be used in conjunction with the pilot cell readings to note the progress of charge, overcharge and discharge, and to determine when each should be stopped. It should be connected across the main battery, as indicated by Fig. 83, and not include any end cells or counter electromotive force cells.

The battery should be charged, preferably at the normal rate, and where possible, the battery should be recharged when it is from one-half to two-thirds discharged. The *regular charge*, which is usually the daily charge, should be continued until the following conditions are filled: (1) That specific gravity of the pilot cell should rise within five points (.005, specific gravity) of the maximum reached on the previous overcharge; for example, if the maximum reached on the previous overcharge was 1.210, the gravity to be reached on the regular charge is 1.205. (2) The voltage across the main battery should rise to within .05 to 0.10 volts per cell below what it was on the preceding overcharge, the charging rate being the same in both cases; for example, if the maximum voltage per cell on the previous overcharge were 2.55 the voltage per cell to be reached on the regular

charge would be 2.40 to 2.45 volts per cell. (3) The cells should *all* gas moderately. If the battery is charged every day, then once a week and preferably on the same day of the week, the regular charge should be prolonged until the following conditions are fulfilled: (1) The specific gravity of the pilot cell having reached a maximum, seven successive fifteen minute readings of this cell should show no further rise. (2) The voltage across the main battery having reached a maximum, seven successive fifteen minute readings should show no further rise. (3) The cells should *all* be gassing freely. If the battery is not charged daily then the overcharge need be given only once every two weeks.

The voltage at the end of charge throughout the life of a battery is not a fixed voltage, but will vary, due to several causes; namely, age of the battery, temperature of the acid, and the charging rate; therefore, a fixed voltage must not

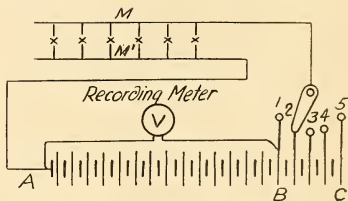


Fig. 83. Voltmeter Connection across Main Battery

be considered when using the voltage method in determining the end of charge. When first installed, the voltage at the end of the overcharge, with normal rate will be as high as 2.65 volts per cell with the temperature at 70° F., but as the age of the battery increases this voltage gradually falls until in some cases it is as low as 2.4 volts per cell.

The voltage varies greatly with the temperature. A particular cell was charged at the normal rate to the point of copious gassing by Prof. Heim. The voltage readings were as follows:

At 14° C.....	2.70 volts
At 30° C.....	2.58 volts
At 45° C.....	2.52 volts

On charge, the voltage increases with the temperature and the internal resistance decreases because of the decrease in the resistance of the acid.

Higher or lower rates than normal will respectively produce slightly higher or lower final charging voltages.

After a charge has been completed and the current cut off the voltage per cell will immediately fall to about 2.20 volts and then very rapidly to about 2.05 volts, at which point it will remain until the discharge is started. When the discharge is started, the voltage will fall at once to about 2.00 volts per cell.

During the greater part of a complete discharge the drop in voltage is slight and very gradual with marked rapidity near the end. The safe limit of discharge is reached when the voltage has fallen to about 1.80 volts per cell, with current flowing at normal rate. At higher rates of discharge the limiting voltage is somewhat lower. As a rule, however, it is advisable to stop the discharge considerably above this point, especially if it is desired to have a reserve in case of emergency.

The fall in specific gravity of the acid is an important factor in showing the amount taken out of the battery and is in direct proportion to the ampere-hours taken out, thereby differing from the voltage which varies irregularly for different rates and degrees of discharge; so for this reason, under average conditions, the fall in gravity is to be preferred in determining the amount of discharge.

The actual amount of variation in the specific gravity of the acid between a condition of full charge and complete discharge is dependent upon the quantity of solution in the battery jar compared with the bulk of the plates.

A careful inspection of each cell should be made periodically. This is very important, as it is bad practice to wait until trouble develops and then to look for the cause. The secret of successful storage battery operation is to keep the cells in a healthy condition from the beginning. Special attention should be given to cells that read low at the time the cell readings are taken. Look for the cause and remove it as soon as possible and not later than the beginning of the overcharge. Short circuits should be removed with a thin strip of wood or rubber. Near the end of the overcharge all cells should be looked over to see that they are all gassing freely.

The chief indications of trouble are (a) falling off of specific gravity or voltage relative to surrounding cells, (b) deficiency of gassing on overcharge as compared with surrounding cells, (c) color of plates markedly lighter or darker than in surrounding cells. The above symptoms in a cell indicate that it has fallen below the rest in its state of charge. If the cause is discovered and removed immediately, it will usually be restored to normal condition by the following

overcharge. If only partially restored, it must be carefully watched during the ensuing week. If the next overcharge does not completely restore it or if the original deficiency was excessive, it will be necessary to give it a separate charge.

The accumulation of sediment in the bottom of the cells must be watched carefully and removed when the clearance has been reduced to one-half inch below the bottom of the plates; under no circumstances must it be allowed to get up and touch the plates, as, if this occurs, rapid deterioration will result. Very often it will be found that the depth is greatest under the middle plates, and if the sediment is leveled over the bottom of the cell its removal will not be necessary for some time longer. The leveling can be done by using an L-shaped device containing no metal in its construction.

To remove the sediment, the simplest method if the battery has bolted connections between the cells, is, after fully charging the battery, to lift the plates out of the jars, not disturbing the separators; draw or pour off the electrolyte carefully; dump the sediment; clean with water then put back the elements and cover quickly with electrolyte, adding enough new to replace that lost. The elements must not be exposed to the air except for the very shortest possible time and must not be allowed to dry out in the least. For this reason only one cell should be emptied, cleaned and refilled at a time.

If the cell connections are burned together, the sediment can be taken out by using a special form of scoop for drawing it from beneath the plates and then removing it from the jar or tank.

A third method is to draw off the electrolyte and flush the cell with water (using the local supply) in such a way that the sediment will be continually stirred up; at the same time a syphon inserted at the bottom of the cell, and with such capacity as will keep up with the water supply, should be started; the more rapid the flow in and out the better. This operation should be continued until the cell is entirely free of sediment. The water should then be withdrawn and the cell quickly refilled with electrolyte.

Immediately after the battery is cleaned and the stronger acid added, it should be given a long charge, continuing until the cell is fully charged, when the gravity of each cell should be read and adjusted to standard.

The electrolyte is dilute sulphuric acid, prepared by mixing suitable commercial sulphuric acid, or "oil of vitriol," as it is more commonly

called, with pure water. It is essential that the acid and the water be free from impurities such as iron, arsenic, nitric or hydrochloric acid.

The proportions of acid (of 1.840 specific gravity) and water in preparing electrolyte of 1.210 specific gravity are one part acid to five parts water by volume. The acid must be poured into the water and not the water into the acid. The acid must be added to the water slowly and with great caution not only to prevent excessive heating but more particularly splashing, on account of the painful and dangerous character of acid burns. The final gravity of the solution must be read when it has cooled. The vessel used for mixing must be a lead lined tank, one of glazed earthen ware, or one of wood which has not been used for any other purpose, such as a new wash tub.

The specific gravity of the electrolyte of a cell in good condition when fully charged and at normal temperature (70° F.) should be between 1.205 and 1.215. Due to loss through spraying at the end of charge and to absorption by the sediment, there is a gradual lowering of the gravity, its rapidity depending on the work and care the battery is receiving.

Unless a compensating hydrometer is used, allowance must be made for temperature variation on the basis of an increase of one point in gravity for each three degrees Fahrenheit decrease in temperature and vice versa; for instance, electrolyte that is 1.210 at 70° F. will be 1.213 at 61° F. and 1.207 at 79° F.

[THE END]

Acid of about 1.400 specific gravity is generally used for restoring lowered specific gravity. Never under any conditions add acid to a cell in which short circuits, high temperature, or partial charge might account for the low gravity.

Only pure water, preferably distilled, should be used for replacing evaporation. The acid must never be allowed to get below the top of the plates, nor must the cells be filled too full.

The temperature of the battery room should be moderate and the air dry. The battery room should be properly ventilated, not only to insure dryness but to prevent the chance of an explosion, as the gases given off during charge form an explosive mixture if confined.

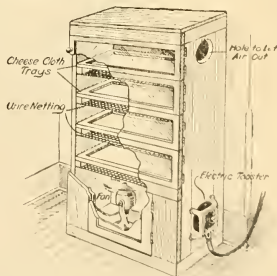
If the use of the battery is to be discontinued for any considerable time, say six months or more, and it is not convenient to give it a freshening charge every week or two, it should be taken entirely out of service. This is done as follows:

After thoroughly charging, syphon off the electrolyte into convenient receptacles and as each cell becomes empty fill it with fresh pure water. When water is in all the cells, allow them to stand twelve to fifteen hours, then draw off the water. The cells will then be in a condition to stand indefinitely. When it is desired to put the battery into commission again, replace the electrolyte and charge at the normal rate for from 45 to 60 hours, continuing the charge until the specific gravity and voltage have ceased rising for a period of ten hours.

RAPID ELECTRIC PRINT DRIER

A photographer who makes a specialty of quick work in making prints employs electricity for drying prints in the following manner: A cabinet of convenient size was constructed and fitted with glass doors and removable wire shelves as illustrated. In one side of the cabinet near the bottom, a hole was cut just a little smaller than the outside of a toast stove and the stove fastened over the opening with screws. In the bottom of the cabinet a small electric fan was installed in a horizontal position. Holes were provided near the top to allow the escape of the moist air.

The prints, spread out on cheesecloth trays, are placed on the wire shelves and the current turned on the fan and stove. A circulation of warm dry air is produced and the glass doors enable the operator to watch the prints and to



Print Drier

remove them when sufficiently dry.—J. R. McCALLUM.

ELECTRIC SIGNALS IN SKYSCRAPER CONSTRUCTION

In the construction of the Municipal Building in New York, a system of electric signaling has been used, of deep interest to construction engi-

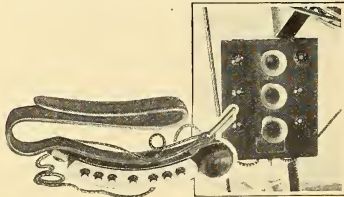


Fig. 1. Button Blocks, Siren Horns and Lamps

neers. It seems to do away with all uncertainty with regard to signals and is regarded by many as a long step in the "safety first" movement.

This system comprises five essential parts, i. e., the button block; the electric cable; the signal box; the recorder and the safety device. The button block is either a pear shaped block or a rectangular one, fastened to a belt and worn around the waist of the signal man. This block contains a series of seven signals. The first three



Fig. 2. Signal Man Operating Hoist

at the left are for the boom movements of the derrick; the one in the center is for swing movements, while the remaining three at the right are for load movements. In using this system a conducting cable made up of several copper wires properly insulated is run from the engineer's station to the signal man above, and the signals are transmitted by electric current.

Fig. 1 shows the button block; Fig. 2, the button block in position around the signal man's waist, and the hoist ready for the "UP" signal; Fig. 3, the cables of the same hoist as shown in Fig. 2. This last picture was taken at the twenty-sixth floor or what is the main roof of the Municipal Building. Here a second signal man is stationed who takes charge of the upward moving load as it comes within his range of sight.

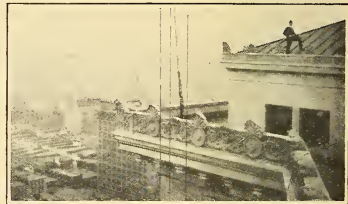


Fig. 3. Hoist Cables Taken at Twenty-sixth Floor

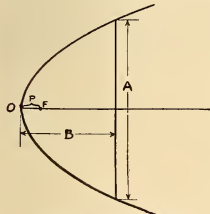
There is of course no uncertainty in such a system of signals, as the message is almost instantaneous and the entire system is as simple as the stopping of a street car by the pushing of an electric bell. At the hoisting engineer's station there are located siren horns and electric lamps, as shown in Fig. 1. This is known as the signal box and is located directly in front of the drums of the hoisting engine. The signals given down here comprise the lighting of colored lamps and the operation of three siren horns, each one of a different tone. The whistles work simultaneously with the colored lights. For instance, one whistle may mean a signal for the boom, while if a red lamp is flashed at the same time the engineer knows that this means to stop. The code of lights are white—slow; green—speed, and red—stop. In this way the engineer receives a positive order, one that is both visible and audible. It seems to be easy of interpretation, simple in construction, and increases the efficiency of the men employed as well as decreases the possibility of accidents.

In connection with the other parts of the system there is what is known as the safety device.

By this arrangement any severing of the cable, short circuit or trouble on the line causes to be put into operation, automatically, a large gong. This continues to ring as long as the line is out of order and is a danger signal to the engineer.

TO FIND FOCUS OF PARABOLIC REFLECTOR

Parabolic reflectors with electric lights are coming into almost general use for headlights on automobiles, motorcycles, motor boats and the like. In order that these reflectors may make the most efficient use of the light sources it is necessary that this light source be placed at a certain point with respect to the curves of the reflector, called the focus. The principle on which the parabolic reflector is designed is that all the rays coming from this focus that strike the reflector will be reflected parallel to each other along the axis of the reflector; therefore, it is necessary that the position of this point be accurately known, and in a good many cases where reflectors have been designed to use several



Finding Focus of Reflector

different sizes of lamps or without any regard to any specific lamp, they require some adjustment. A very simple rule for finding the focus of a parabolic reflector will often be found valuable.

Referring to the figure, let (A) be any distance across the reflector at right angle to its axis, and let (B) be any distance from this line to the back end of the reflector; then (P) a distance from the back end of the reflector to the focus (F) is found by the following formula:

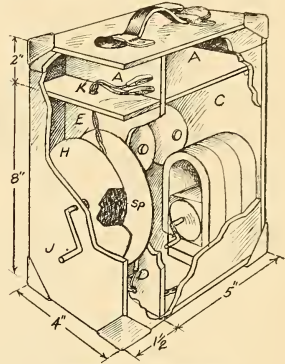
$$P = \frac{A^2}{16 B}$$

It is easy to apply this rule to any reflector simply by taking a pencil, short rule or other stick and holding it across the reflector, then measuring back to the back end. These two distances, substituted in the formula, will give the focal distance; subtracting the length (P) from (B) gives the distance of the focus back of the first line across the reflector, which will be the position of the light source for the most concentrated beam.

PORTABLE TESTING SET

A case in which to carry a magneto, bell, wire reel and a few tools may be made as follows:

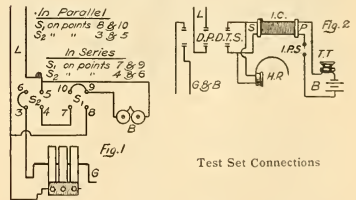
The disks of the reel (H) are of sheet copper and contact is made at (D) with each disk by a flat spring attached to the side of the compart-



Carrying Case for Testing Set

ment. The shaft of the reel is of dry wood. The floors (A) rest on strips on the walls and may be taken out.

Fig. 1 shows one way of connecting up the set. (S₁) and (S₂) are three-way switches. With (S₂) connecting (6) and (4) and (S₁) on points (7) and (9), the bell (B) is in series with the



Test Set Connections

magneto (G). The parallel connection is also given in the drawing.

For telephone work the arrangement shown in Fig. 2, using watchcase receivers, may be employed. (G) and (B) connect to the generator and bell. The double pole double throw switch is arranged to make connection to the magneto set or to the telephone set. (I.P.S.), Fig. 2, is a single point switch used to disconnect the telephone transmitter and battery when not in use.

RADIO-TELEGRAPHY SET FOR AEROPLANES

BY L. J. LESH

Apparatus for transmitting wireless messages from aeroplanes to stations on the ground may assume a variety of forms but lightness and efficiency are ever the main requirements.

At first, it would seem that the problem could be easily solved by belting the generator direct to the motor of the aeroplane. This has been tried but the system has a fatal defect. The wireless is inoperative when the motor stops or slows down. In other words, when an aviator is out over the ocean and runs out of gasoline he will have no power with which to send his call for help. A storage battery interposed in the

voltmeter and tachometer were arranged so as to give complete data on the tests. Readings were taken at speeds from 30 to 65 miles per hour and the results were very interesting. It was found that the power developed increased with the speed but reached a maximum limit at about 60 miles an hour. Just what happens then is a question, but it was definitely established that between the speeds of 55 and 65 miles per hour there is a comparatively small variation of power developed. A like phenomenon is observed in experiments with propellers at high speeds. The blades get in each other's way and fail to take a proper grip on the air.

The generator developed a full three-quarter kw. at 60 miles per hour. It was only designed for one-quarter kw. but on account of excellent cooling it was possible to work with considerable overload. This is a point to be remembered by electrical engineers who design wireless generators for aeroplanes.

Taking up the design of the aerofan, it may be described as similar in construction to a bicycle wheel. A steel rim is used with steel spokes in tension and aluminum blades annealed and creased around the spokes. The hub was of course equipped with ball bearings.

A wireless key being interposed in the electrical circuit, experiments were made in taking a load on and off the generator. A resistance in the form of a bank of lamps was cut in and out, as in transmitting messages, with no very evident effect on the speed of the generator.

These trials having proven automatic speed regulation to be inherent in the fan and that ample power was developed for wireless, the apparatus was transported from New York City to Hammondsport and installed in a regular Curtiss hydroaeroplane.

The aerofan was clamped to the frame of the machine in such a way that it could be raised and lowered to adjust the belt passing through aluminum tubes to the generator situated beneath the seats. The object of the tubes was to



Trying out Windmill on Automobile

circuit would remedy this trouble if some genius would invent a battery weighing little.

Consideration of the above problem led the writer to investigate the possibility of deriving power from the speed of the aeroplane itself, independent of the motor. As the flyer must always maintain considerable forward velocity in order to stay in the air, it was apparent that a light and efficient windmill would provide an ideal source of power for the wireless dynamo. Actual experiments with the windmill were first tried using an automobile. The fan was belted to the generator which is a 500 cycle machine with direct connected exciter. At a speed of 50 miles per hour the fan rotated at 1,000 r. p. m. and the generator at 4,000 r. p. m. Ammeter,

prevent the belt from being blown off the rim of the fan. A tachometer gives a direct indication of its speed of rotation.

The transmitting set consisting of a one-quarter kilowatt, quenched gap, transformer, helix and condensers was placed aft. The adjustment of the apparatus was calculated beforehand by its designer, Mr. Emil Simon and the only wave regulation used was obtained by



Apparatus Installed on Curtiss Hydroaeroplane

raising and lowering the antennæ. The latter was manipulated by means of the hand reel shown and was adjusted until the maximum radiation was indicated by an ammeter placed in the antennæ circuit.

The key, which the operator strapped to his knee, had two contacts, one of which put the generator in series with the transmitting set, while the other connected it to an artificial resistance of the same value as the set. As one or the other of these was always in circuit, the load on the generator was fairly constant and the fan did not "race."

No attempt was made to break long distance transmission records, the object of the experiments being primarily to determine the efficacy of the aerofan.

The results obtained were entirely satisfactory, messages being transmitted to the land station from the aeroplane at a considerable height and on "volplane" as well as on straight-away flight.

It was found, moreover, that tuning could be easily accomplished by raising and lowering the antennæ.

STATIC KICK-BACKS AND THEIR ELIMINATION

The static kick-back is a source of annoyance to all who operate wireless high tension transformers. The cause of these currents is the inductive effect between the circuits of the radio transmitter carrying high potential, high frequency currents, and the primary and power leads and as a result, currents of medium voltage

(from 500 to 2500 volts) are set up in the primary mains. This voltage is sufficiently high to jump small air gaps such as are present in lamp sockets, switches, etc., and when such a spark occurs the low voltage a. c. current flows across the gap, the resistance of which has been lowered to a few ohms by the presence of the high frequency spark. Such a flow of current through this path of low resistance establishes an arc which is detrimental to sockets and fuses in the circuit and windings of meters and motors on the line may be burned out. To

prevent these these currents must be disposed of.

The underwriters' rules require that condensers of not less than one microfarad capacity each be connected in series and then shunted across the line and the middle point connected to the earth by means of a No. 4 wire or its equivalent, Fig. 1. Theoretically these condensers are supposed to be charged with the high potential

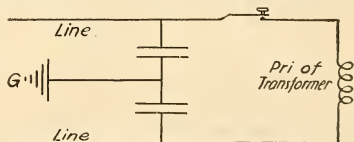


Fig. 1. Condensers Connected in Series Across the Line

induced currents and then to discharge into the ground, but there is a chance that when the condensers become charged to a high potential they will discharge back again onto the mains, creating more damage than they are supposed to prevent. Recent experiments seem to uphold this theory and therefore condensers are not con-

sidered very efficient by some. They have, however, given perfect satisfaction in many installations.

A second method which is one of the most simple to use, is to employ a micrometer spark gap, the construction of one being illustrated in Fig. 2. The discharge rods are made from $\frac{1}{8}$

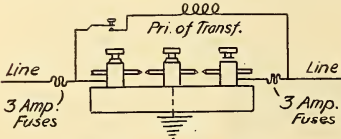


Fig. 2. Micrometer Spark Gap

inch brass rods about two inches long. The length of the gap between the rods should be very small — about $\frac{1}{8}$ of an inch or less. The gap should also be protected by three ampere fuses connected in series with the line and rods, as otherwise, if an arc is started across the gap, quite a pyrotechnic exhibition will be sure to follow with disastrous results. A combination of the condenser method and micrometer gap may be employed to good advantage.

The graphite-rod preventer, as used by the American Marconi Company, is coming more and more extensively into use on account of its simplicity and cheapness. It consists of two high resistance graphite rods (or one with a connection in the middle of its length) connected in series and shunted across the line with the middle connection grounded, Fig. 3. The

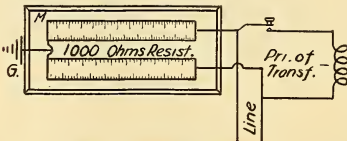


Fig. 3. Graphite-rod Preventer

ohmic resistance of the rods is so high as to allow them to be connected permanently across the line without consuming enough current to register on the meter, yet they offer practically no resistance to the high frequency surges which are thus immediately conducted to ground.

Another simple device to use is an electrolytic condenser. The construction is illustrated in Fig. 4. Three aluminum wires are arranged in the form of an equilateral triangle with the wires forming the vertices. These are lowered into a solution of sodium phosphate mixed in

the proportion of sodium phosphate, one part; distilled or rain water, five parts. Two of the

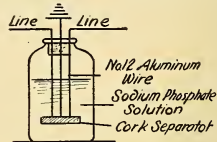


Fig. 4. Electrolytic Condenser

wires are connected to the line and the third grounded. One theory of its operation is as follows: A thin non-conducting film is deposited on the wires by chemical action and this film is of a sufficiently high resistance to oppose the flow of 110 volts a. c. but the high potential surges break down this film and are led to the ground. The film being self restoring, it is immediately ready for the next kick-back.

A fifth method and one which has worked

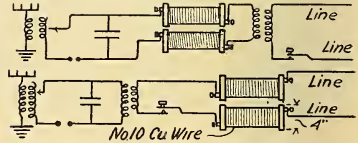


Fig. 5. Using Choke Coils in the Circuit

successfully where all the other methods have failed, is the use of choke coils in either the primary or secondary leads, preferably the latter, as a better spark seems to result. This method is based upon the fact that the reactance of a coil varies directly as the frequency; therefore, if we wind up a choke coil of large size wire and use an air core, the coil will offer hardly any resistance to the 60 cycle current but when kick-backs or high potential current surges try to pass through the winding of the coil they will meet with such a barrier as to effectively prevent their passage. It should be noted that these

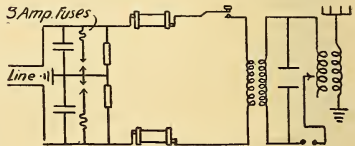


Fig. 6. Combination of Methods

coils are not grounded, but are connected in series with either the line or secondary leads,

Fig. 5. Coils of this type have been found very satisfactory where condensers, gaps, etc., have proved useless. Fig. 6 is a combination of the methods, except the electrolytic, discussed. Usually the condenser and spark gap methods are used together.—H. PETERSON.

WIRELESS GUARDS BRITISH COLUMBIA FORESTS

By employing the forces of wireless telegraphy and the telephone, the stupendous task of safeguarding from fire the British Columbia forest reserve of nearly 20,000 square miles has been reduced in cost to between one and two cents an acre. This reserve contains some of the most valuable tracts of timber and pulpwood in the world, the aggregate value of which runs

can readily be located and all assistance directed to that point.—ROBSON BLACK.

TO SIMPLIFY OPERATION OF WIRELESS

Two commissions, one international and the other British in organization, have commenced a highly important investigation of the most baffling problems surrounding the operation of wireless telegraphy. The object is to codify the "natural laws" which are believed by scientists to govern wireless working, and to eliminate such obstacles as the "strays" or "x's" of the operator and the difficulties of communication encountered near the periods of sunset and sunrise and from atmospheric conditions generally. By the assembling and study of the peculiar "natural laws" affecting wire-



Once Well Forested Country Where Fire Killed the Timber

into hundreds of millions. It is divided into five sections, each of which is under control of a forest supervisor. These divisions run from 1,000,000 to 3,000,000 acres in area and are laid out on topographical lines so that they can be administered practically independently of each other. Each supervisor further subdivides the district under his charge into ranger districts of about 200,000 acres each. In each of these he establishes certain of the mountain peaks as points of look-out, and there he locates permanently wireless equipment or telephone, wireless being more popular owing to the danger to telephone wires in great conflagrations. Without this means of summoning aid from other subdivisions as well as from distant parts of his own, the ranger would be practically helpless. Scientific instruments are kept in readiness at the look-out points so that by a system of triangulation the approximate locality of the fire

less, it is hoped to greatly extend the commercial possibilities of wireless. For such a purpose simultaneous observations will be made at various parts of the earth.

NEW ZEALAND'S WIRELESS CHAIN

The wireless system of New Zealand, which is a very perfect one, is now practically complete, according to the *Auckland Weekly News*. There is a high power station at the northern extremity of the North Island, and a corresponding station at the southern extremity of the South Island. Between these stations are two of lesser range, and an outlying station on the Chatham Islands. This arrangement makes New Zealand as far advanced in wireless telegraphy as most other countries, and communications from within 1000 miles are practically certain to be picked up by one of the stations.



On Polyphase Subjects

REGARDING THE RECENT CHANGES IN THE MAGAZINE

An enlargement was made six months ago in the scope of this magazine, admitting to its pages some material not bearing upon the subject of electricity. When the first issue had appeared under the new name, *POPULAR ELECTRICITY AND THE WORLD'S ADVANCE*, we knew that a much brighter and more readable magazine had resulted, which, by its wider appeal, would carry the message of "Electricity in Plain English," into a great many quarters not reached before. As upholding our personal opinion in the matter, we were gratified to see, in a single month, the number of news-stand readers and subscribers increase by over 45 per cent.

It would have been unwise, however, to assume that the change was going to meet with the favor of all the old readers. Although gratified with the increase in circulation and with the congratulatory letters received, it was with no little interest that we looked forward to the criticisms which were absolutely certain to follow this as any other change in established policy. They came. Mixed in with the letters of pleasing approbation were others of a tone which left no doubt of the writers' opinions—in short, they were decided "kicks." Happily, however, the favorable opinions were greatly in the majority.

As a matter of interest, we are printing here a few of the letters of both favorable and adverse criticism. The feeling back of the latter is not difficult to determine. They come principally from those of a practical turn who have been buying the magazine purely for information and in no degree for entertainment. They cannot bear to have even a single page of it devoted to subjects other than their favorite one of electricity. Every letter of this kind has received our most careful consideration, for these people have been, no doubt, in the past, our most loyal friends. To them we have this to say: The change in policy must continue, for it is, on the whole, a good change, considered from all points of view. At the same time we are going to try earnestly to so balance the magazine as to hold their favor, which we esteem, and at the same time keep the new features which, as already stated, are making the magazine far more popular and widely read than before.

Here, then, is what we propose to do to meet the objections of the "minority" readers who feel that they are not getting enough electricity and want more practical articles: Beginning with the April issue the Household Department will be discontinued and the space so gained will be turned over to the departments for Practical Workers and the Wireless Club. This change had been contemplated for some time, owing to the fact that a careful test showed that over 98 per cent of our readers were men, and the advisability of keeping the Household Department had been in question. Although it will now be discontinued, the latest developments in the use of electricity in the home will not be lost sight of, but will be followed elsewhere in the

magazine. Twenty-two or more pages will therefore be available for the practical electrical features, which, being set in smaller type, as now, will be equivalent to nearly 30 pages of ordinary magazine type. We want our practical friends to watch that section, and we sincerely believe that after one or two issues they will be willing to say that, alone, it is worth the price they are paying for the magazine.

As to the Motion Picture Department and the World's Picture Gallery, they will be continued, for we are satisfied that the majority wants them. And so, also, with the comparatively small amount of matter foreign to electricity, but decidedly interesting to the average reader, to whom solid cake appeals but who rather likes the frosting and may even be inclined to eat the frosting first.

PRACTICAL ARTICLES WORTH THE PRICE

"I have just finished reading the September issue of your magazine and am well pleased with the new additions. I think that most anyone who is interested in electricity would be interested in motion pictures and any other late scientific discoveries. The kids found the stories first thing and then all the family had to look the magazine clear through, when they had hardly noticed it before. The department for practical workers, alone, is worth the price to a fellow who wants to learn." — *Frank Wolfe, Vanndale, Ark.*

NOT TECHNICAL ENOUGH

"The magazine does not fill my needs. The character of its contents is changing and getting away from what I want. In fact, it has ceased to interest me, for this reason: It is becoming so popular that the articles have a tendency to omit or miss the important details. I do not feel interested in the fact that some city has installed a lot of new lamp posts unless some notice is taken of the details of the installation and the results obtained. You are trying to do too much. Your effort is scattered over such a wide field that it is ineffective. I don't believe that you can cover the 'world's advance' for a month in one magazine issue. Several hundred short articles stuck into a magazine cannot by any chance form a coherent, unified whole, so the result is ineffective. You tell what is being done but not how or why. You have avoided all the hard technical details so that the ordinary public can read your articles and in so doing I believe you have gone too close to the kindergarten stage." — *H. D. Hineine, Beloit, Wis.*

SHORT BUT ENCOURAGING

"Your magazine for September is the best ever. Keep it as it is, POPULAR ELECTRICITY AND THE WORLD'S ADVANCE." — *Jas. F. Elliott, Jr., Islip, L. I.*

A WOMAN CONVERT

"My opinion has always been of the highest concerning your magazine. I never miss an issue, although I know very little about electricity. However, such things as your publication, *Popular Mechanics*, *Scientific American*, *Literary Digest*, *World's Work*, *Harper's Weekly* and so on are my class of reading. But of all of these which had their own place in the house, 'that old truck of yours' the women would have nothing to do with, and by 'old truck' they meant all the periodicals mentioned above. The motion picture and such magazines suited the ladies, enough said. And just by chance my wife saw "Motion Pictures" on your September cover. That was enough: she's a victim with the first issue and she also has seen the Kinemacolor pictures and read how they are made. Then she wondered after reading 'Electricity on the Emperor' and several other articles how it was that she never got interested in them before. Hence, your first issue under the new order has made at least one convert, and a woman." — *Norman J. Burns, Buffalo, N. Y.*

A WIRELESS GRIEVANCE

"While your magazine with the enlarged scope of broadened field at the time of changing the title may have suited many much better, I must say that it was not that way in my case. I, like thousands of others of your readers, belong to the amateur wireless class and where you were giving us ten or twelve pages and perhaps more, pertaining to that science, with the change in name came a great change in that department; we hardly get one page now of our favorite stuff. An amateur in the wireless field, like the proverbial drowning man grasping at a straw, will peruse from cover to cover, every article on 'making a tuning coil,' a 'new type of detector' or 'hook up,' but with the change, I feel that this class has lost most of its interest in the columns. To be sure the publication is

enlarged and is I'm sure a valuable one to a large field of readers. I feel that where they were the gainers, we wireless amateurs and even the professional commercial operators, etc., are the losers. I think about the time you made the change and came out with the first issue you invited criticism on the product." — *F. L. Wheeler, Cliftondale, Mass.*

SUGGESTIONS FOR SERMONIZING

"Sample copy of POPULAR ELECTRICITY just received and am more than pleased with it; so much pleased indeed, that you have won me as a regular subscriber. I may say that I am a minister and your magazine, along with *Popular Mechanics*, *Technical World*, etc., will keep me posted on what is going on in the scientific world. I want these magazines especially for the many suggestive illustrations they furnish me in my sermonizing. Evidently that is a use to which perhaps you never dreamed your magazine would be put. The very variety appeals to me. I feel sure the odd and unique subjects are a feature of the magazine that will make it extremely interesting." — *H. E. Zimmerman, Mount Morris, Ill.*

WANTS ALL INSTRUCTION AND NO AMUSEMENT

"With all your POPULAR ELECTRICITY on file since 1909, and referring to papers of that year you can see things printed and illustrated that so interest the mechanic and bring publisher and subscriber closely together. I dislike to give up POPULAR ELECTRICITY after receiving it so long, but these moving picture things from the amusement point do not interest me. I believe I am right in saying you have taken the magazine from the mechanic and placed it in the hands of people who only care to be amused, not taught. However, the loss of my subscription will not amount to anything either way and I do not believe that I am making a mistake." — *Wm. W. Kable, Pittsburgh, Pa.*

IMPROVED BY 100 PER CENT

"You have certainly improved the magazine this month. It is 100 per cent better than ever. I am the 'right hand man' at the moving picture theater here and have been teaching amateur photography for some years, so these topics in the magazine interest me as well as electricity. It will certainly be 'my magazine' as long as I am able to pay for it." — *C. W. Moulten, Harmony, Minn.*

IN FOR TWO YEARS AND GLAD OF IT

"I am extremely interested in your splendid magazine and certainly delighted with every item printed therein, in its present form, and I am sure to be delighted still more so in the new form or rather in new combination; so much that I shall give you my subscription by return mail for two years at the very least." — *Jule B. Clark, Rome, Ga.*

BOTH INSTRUCTIVE AND ENTERTAINING

"The writer spent the evening in perusing a sample copy and while electricity is a subject very foreign to me, must say that the class of matter in your magazine struck me as being both instructive and entertaining. From a technical standpoint I will not venture an opinion, but from a point of interest and variety your magazine is a hummer, and you ought to say 'thanks be' three times a day for the co-operation from the editorial department. Not many that reach us cover their subject like yours." — *Jay J. Dwyer, Oklahoma City, Okla.*

FROM A RETIRED LAWYER

"I deem your magazine immense. It skillfully combines much general information with the technical. Being a retired lawyer, I find it very valuable as an introducer to my mind of the wonderful uses to which electricity is being put the world over. I have not time to read the magazine through each time and (if I did) there is much technical knowledge imparted which I could not understand. The illustrations are so profuse and so well and admirably explained that I gain much knowledge by simply looking at them and reading their descriptions. 'Short Circuits' is comprehensible wit." — *E. H. Sanford, Chicago, Ill.*

BETTER FOR THE CHANGE

"I have been an appreciative reader of POPULAR ELECTRICITY for three years now and always look forward to the mail about the 25th of each month. So far, I have always had a high opinion of the magazine; it certainly was my favorite magazine and I like it all the more. The World's Picture Gallery is of great interest to me and adds to the attractiveness of the magazine greatly, and I think I can best express my appreciation of the change by continuing as a delighted reader and by saying, 'I liked it well before, but I like it better for the change.'" — *Harold Sinclair, Durban, S. A.*



Short Circuits

Timekeeper (arranging starts for Scottish golf competition)—Name, please.

Golfer—M. de Valmont.

Timekeeper—Tuts, mon, we canna bother ourselves wi' names like that here. Ye'll start at nine-thirty the morn's mornin' to the name o' McPherson.

* * *

"Waiter," asked the impatient customer, "do you call this an oyster stew?"

"Yessuh," replied Mr. Erastus Pinkley.

"Why, the oyster in this stew isn't big enough to flavor it."

"He wasn't put in to flavor it, suh. He is jes' supposed to christen it."

* * *

"Why does that darned old hen always want to roost on a letter box?"

"She was hatched from a parcel-post egg."

* * *

A Yankee, seeing an Irishman bringing a prize dog to the show yard, thought he would have a joke at the Irishman's expense.

"I say, Paddy," he began, "do you expect that dog to win a prize? Look at his legs, man; they are far too short for the size of his body."

Pat—"Sure, his legs reach the ground, and that's all he wants."

* * *

"Gracious! That skirt is so tight that I can plainly see what you have in your pocket."

"But I have no pocket."

"Then what is that lump?"

"Oh, that's a mosquito bite."

* * *

"Let me introduce you to the most honest young man I have ever known."

"But mama doesn't want me to meet any poor young men."

* * *

Progressive Offspring—Pause, father! Is that whip sterilized?

* * *

Maiden—What's this "trough of the sea" we read about?

Corney—Oh, I guess that is what the ocean greyhounds drink out of.

* * *

The Policeman—Where are you going at this time of night?

The Wanderer—I'm—hic—going to a lecture.

The palm for absentmindedness is probably taken by a learned German. One day the professor noticed his wife placing a large bouquet on his desk.

"What does that mean?" he asked.

"Why," she exclaimed, "don't you know that this is the anniversary of your marriage?"

"Ah, indeed, is it?" said the professor politely.

"Kindly let me know when yours comes around and I will reciprocate."

* * *

A wiring contractor was laughing at a man for doing a wiring job too cheap. Said the man, "There once was a tourist met by a small boy in Florida who asked if he'd give a quarter for a terrapin. 'Young man,' said the tourist, 'if you were in New York you could get \$3.00 for it.' Said the boy, 'That's all right, boss, and if I had a bucket of water in hell I could get a million dollars for it.'"

* * *

"What's the matter with this elevator?" asked the nervous man. "You keep trying to run it through the roof."

"You'll have to excuse me," replied the operator. "I'm not used to one of these little twenty-story buildings."

* * *

Pat, the hodcarrier (to the carpenter who is vigorously sucking his thumb, cursing at the same time)—Don't you know how to drive a nail yit, without smashin' yer finger?

Carpenter—No, you blamed fool, and neither do you.

Pat—Shure I do. Hold the hammer in both hands.

* * *

"Before slates were used people used to multiply on the face of the earth."

* * *

The Teacher—Can you describe a seahorse.

The Kid—Yes'm. It's the present tense of a sawhorse.

* * *

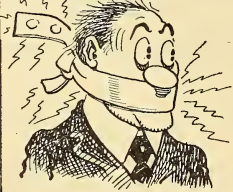
"A farmer near abouts defined extravagance as wearing a necktie when you have a beard."

* * *

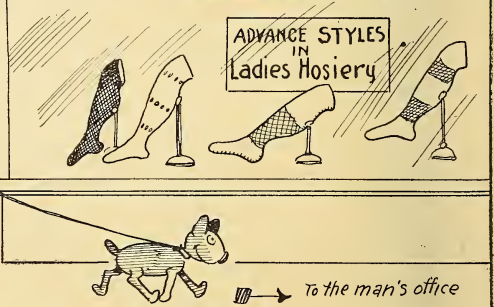
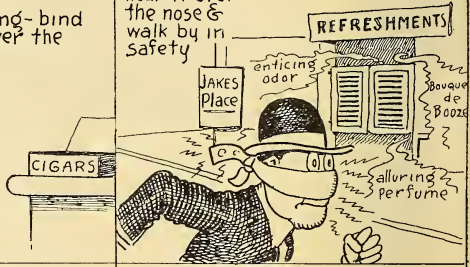
An editor, who started 20 years ago with only 55 cents, is now worth \$10,000. His accumulation of wealth is due to his frugality, good habits, strict attention to business, and the fact that an uncle died and left him \$9,999.

Yes - the Electric Belt really will make the weak strong - if rightly used.

For example -
To keep from smoking - bind the belt tightly over the mouth.



Wear it over the nose & walk by in safety



In a case of this kind the electric belt should be worn over the eyes

When tempted to go to a ball game & neglect your work - use belt to tie your self to your chair with -

