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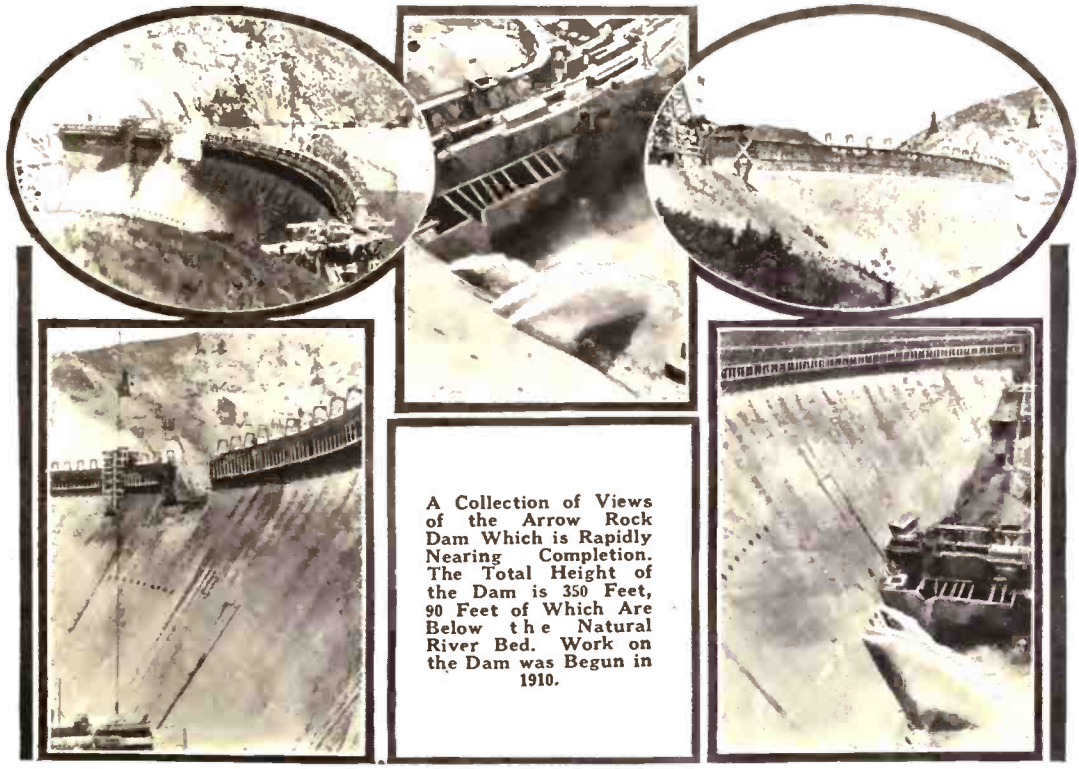
ARROW ROCK DAM NEARING COMPLETION

ONE of the most important links in the reclamation project of the United States Government for the making fertile of 30,000,000 acres of desert land is nearing completion at Arrow Rock, Idaho. Preliminary work on the Arrow Rock Dam was done in 1910. According to the United States engineers in charge of the construction, the dam will be finished during the summer of this year—two years less than the time estimated. The construction machinery is driven by electricity generated at the Government diversion dam, twenty miles down the river, where most of the water is used for irrigation. More than half a



A Collection of Views of the Arrow Rock Dam Which is Rapidly Nearing Completion. The Total Height of the Dam is 350 Feet, 90 Feet of Which Are Below the Natural River Bed. Work on the Dam was Begun in 1910.

million cubic yards of concrete has been used in the construction of the Arrow Rock Dam.

A series of views showing the new dam and the river in its vicinity is reproduced on the foregoing page. The first view, taken from the upstream side, shows the reservoir which contained then over 125 feet of water. The two cableways were used for transporting workmen and materials. The second view was taken from a point above the south end of the structure. It will be noted that a section has been left out near the middle. The spillway will eventually be on the far side, but it is still incompleted, so that it was necessary for a portion of the dam to be left open in case of an emergency. The third view was taken directly under the downstream cableway and above the concrete mixing plant. The cableway picks up the concrete and transports it to the tower seen on top of the dam. The fourth view was taken from the spillway side looking across the downstream face. The middle tier of outlet pipes is shown discharging water. The mixing plant can be seen directly above. The fifth view was taken from the top of the dam and shows discharge openings. The high board fence was erected in front of the mixers to ward off the spray.

Thermophones were installed at different points in the concrete to indicate the temperature of the mass as the work progressed. A very interesting record has resulted which shows the high temperature of the setting concrete. This record will have future value in enabling engineers to study the expansion and contraction of concrete.

The total height of the dam is 350 feet. 90 feet of which are below the natural river bed.

THE ELECTRIQUETTE OR MOVING CHAIR

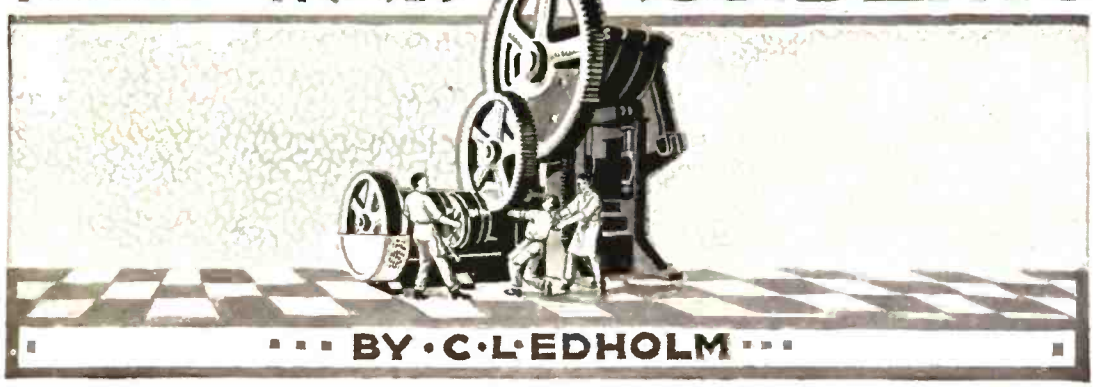
One of the interesting features of the San Diego Exposition which is now being held are the electric moving chairs or electriquettes which enable the visitors to ride around without becoming tired. In fact, these vehicles are very similar to those that may be seen at many seashore resorts, with the exception that electric current serves as the motive power.

Movable chairs were first used at the Paris Exposition in 1889 and since then they have made their appearance at most of the expositions held in different parts of the world. However, these chairs were crude affairs when compared to the electriquette which requires no "pusher." The person riding about in the electriquette can control the speed and direction in much the same way as in the ordinary electric automobile.

Vice-President Marshall Enjoying a Ride in an Electriquette.

Increasing use of the national forests by local farmers and settlers to supply their needs for timber is shown in the fact that small timber sales on the forest numbered 8,298 in 1914, against 6,182 the previous year.

THE WAR ON ACCIDENTS



BY C. L. EDHOLM

WHILE the leading powers of the world are busily engaged in a bloody struggle for supremacy, the United States is also conducting a war—a humanitarian war aiming at the reduction of the number of casualties yearly resulting in the pursuit of industrial activities. Our enemy is Carelessness, who causes as many deaths and cripples in the course of a year's work as the machine guns and shrapnel of an army in a big battle. How to reduce the danger in all lines of industry is a problem that interests the workmen and capitalists alike.

"MORE than ten thousand workers of the United States will be dead in one year from to-day, merely because they did not heed these simple suggestions." This is the sort of a prophecy based upon accident statistics that jars the most sluggish mind; and that is the intention, for it accompanies a set of instructions on how to prevent accidents among laborers—men who are so accustomed to "taking a chance" in the course of the day's work that a habit of recklessness is formed.

It was an inspiration to word the summary of accident reports in the future tense. When the average man hears that his old shop-mates, Bill and Tom and Harry, were killed as a result of somebody's carelessness, he will sigh, "tough luck," and go right on being careless in his daily work; but when it is put up to him that these good pals and ten thousand like them will be killed within a year, he is more than likely to think twice about it, and, if he is occasionally prodded, may even mend his ways.

One of the huge tire and rubber companies of the world is engaging in a systematic war on accidents, and among its principal activities is the education of the working force in habits of caution. To this all-important measure is added the inspection of the plant and the analysis of current accidents, as well as the installation of mechanical devices to guard against trouble. In the company's plant at Akron, Ohio, the idea of enlisting the employees themselves as volunteers in the "safety first" army is securing the results desired. In addition to the Central Safety Committee, which includes a number of department heads, there are nine sub-committees, each of

which consists of four workmen regularly employed in the various divisions of the great factory. They change thirteen times a year, so that in that time 468 laborers take an active interest in the prevention of accidents.

The results of this method are that the entire force is led to consider the "safety first" movement as an effort by the men for their own benefit and not as some philanthropic work done for them by their employers. That mental attitude produces the most effective results in every line of endeavor.

Experts direct the work, however, and the Central Safety Committee is composed of the safety engineer, fire chief, police chief, employment manager, three foremen and an experimental engineer, while a member of the Labor Department acts as secretary, and the assistant to the factory manager is the chairman. The sub-committeemen—the groups of laborers—begin their efforts with a general get-together meeting in which the general idea of the crime of carelessness is dwelt upon, and the members are impressed with their responsibility and the importance of the work they are undertaking. It is a good move to induce the men to take themselves rather seriously, and a formal visit to the factory photographer who takes official photographs of the sub-committees, is in line with that idea.

Plant inspection is the ostensible duty of these committees, for which two hours a week on the company's time is allowed. The members make their visits in pairs, alert for conditions or shop practices that may lead to accidents, and their conclusions are submitted in writing to the chairman who takes steps toward remedying genuine abuses or neglect, and returns an answer to each suggestion. In other words, no suggestion is ignored, even though it may be rejected for some valid reason which is duly explained to the committee.

While many valuable suggestions have been thus received, resulting in the elimination of dangerous conditions, the main object of the system is to educate and interest the working force of the company. Each chairman is instructed to stimulate the interest of his group by getting them together for discussion, providing them with reports on current accidents, giving them literature on the subject of "safety first" and otherwise extending the proper spirit. When the committee is through with its labors, a follow-up system is used to retain the interest of the ex-members in the movement. Every month they receive an intimate letter giving them inside information on the progress of the movement and soliciting their suggestions on new problems that may have developed. This method keeps alive their pride in safety service by appealing to their experience, while the fact that the letters are sent to ex-committeemen exclusively tends to add to their dignity.

Gears are Recognized as a Constant Source of Danger to the Operatives. A Simple Metal Cover Does Much to Reduce—if Not Entirely Eliminate—the Danger.

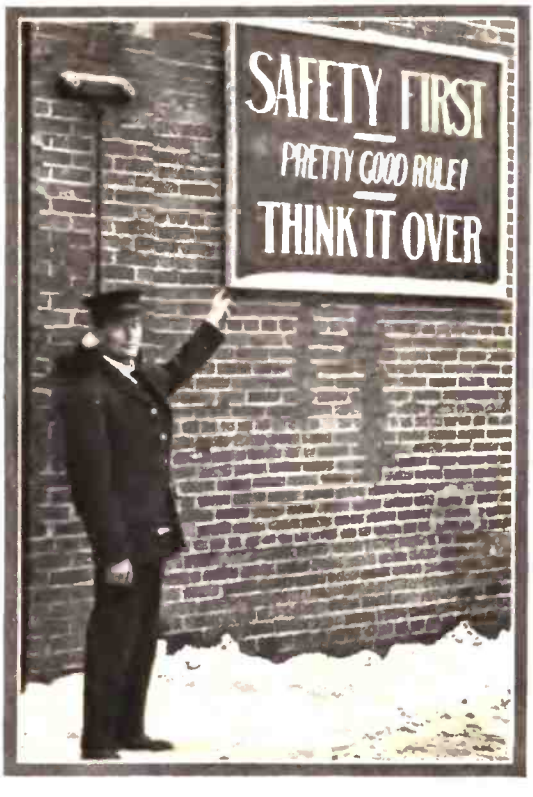
Through these 468 men, brought in close touch with the safety movement every year, the spirit of care and thoughtfulness

A Graphic Lesson in "Safety First" Methods: At the Left, the Old Way of Chipping Off Burrs from Castings; At the Right, the New and Safe Way.

is developed to a great extent throughout the working force.

Still other methods are used to reach all the employees directly. A weekly newspaper is published for free distribution in the factory and which carries valuable material along the line of accident prevention, although the liberal sugar coating of personal comment, chaff, cartoons and news of the force makes it far more welcome than straight "safety first" pamphlets would be. Photographs illustrating the right way and the wrong way of doing the day's work are used with telling effect, and when an accident occurs which can be described together with such photographs, the lesson is effectively driven home. In this way many careless habits that lead to mishaps are done away with.

The use of safety slogans is considered an effective method of reaching the employees. At each gate house may be found a huge sign with a brief slogan which is changed every other month. Their wording is something like this: "SAFETY FIRST. PRETTY GOOD RULE. THINK IT OVER." By putting this idea into new and crisply worded phrases, the attention of the men is caught and held, and the constant hammering away at the thought of "safety first" is bound to produce the desired results.



The Workmen are Constantly Reminded to be Careful in a Typical "Safety First" Plant.

Special attention is given to all foremen to bring them in line with the policy of accident prevention, as they have a most direct influence upon the men under them. Wherever the employment is extra hazardous, a set of rules is posted—rules, by the way, that are by no means dead letter laws. The new employees are required to memorize these regulations and strict penalties are prescribed for their violation. This system is coupled with enlightened policies regarding safety devices, guards and other accident prevention appliances that are not only provided but the use of them by the employees is enforced. The safety engineer is intrusted with this work, and he is in direct co-operation with the Central Safety Committee and also with the committees of workmen, from whose reports he frequently secures information and suggestions of value.

Such accidents as occur in spite of all these precautions are given the fullest publicity in order to impress the lesson upon the employees that "Doing things right is just as easy as doing them wrong —and a whole lot safer." The results of this effort, begun late in 1913, have shown in a year the reduction of serious injuries by one-third, and indicate that the dream of an "accident-proof factory" may be realized with persistent work on the part of the safety committee and the increasing co-operation of the men as they are educated up to the slogan at one of the gates, "IT IS YOUR FIRST DUTY TO BE CAREFUL. PREVENT INJURY. SAFETY FIRST."

CROSSING THE CONTINENT HANDCUFFED TO HIS BICYCLE.

Francis de L'Ackso, a young man from Fontainbleau, France, is crossing the continent in a most unusual manner. He is making the long trip chained to his bicycle. A chain 34 inches in length is fastened in the middle to the front vertical bar of the main frame of the bicycle, and the two ends are fastened to handcuffs or manacles which are locked on his wrists. The chain, though very short, gives him just enough slack to repair his bicycle and to guide it while riding. One of the conditions he has imposed upon himself in this queer trip across America is that he is never to be unchained from the wheel, but must eat and sleep chained and handcuffed to it.

Handcuffed to His Bicycle, This Young Man is Crossing the American Continent in a Most Novel Manner.

De L'Ackso is competing for a $1,000 prize offered by the Exposition at San Francisco for the person making the trip from New York to San Francisco in the most novel manner, not taking more than from February 26 to July 26 for the trip. The plucky young traveler has also made it one of the features of his trip to do all the repairing on his bicycle without assistance.

COAT OF CONCRETE PREVENTS RAVAGES OF SMOKE.

It is not uncommon for railroads to experience considerable trouble and expense in maintaining iron cross-over bridges; the sulphurous gases of the locomotive smoke causing the iron of these structures to deteriorate and finally become unsafe.

A Typical Iron Bridge Crossing Railroad Tracks, Which Ultimately Became Weakened by the Corrosive Effects of Locomotive Smoke.

A very novel way of solving the problem of combatting locomotive smoke ravages was recently effected by a railroad through the simple procedure of coating an iron bridge with concrete. Although the smoke darkened the white concrete walls and certainly made them unattractive in time, yet the iron was perfectly protected and the structure insured against deterioration.

RADIUM AS A FERTILIZER

Extensive tests of fertilizing fields with radium by a university in this country, although interesting from a scientific point of view, will hardly appeal to the average farmer. Experiments covering a period of two years have been made on patches of corn and soy beans with the following results:

Amounts of radium costing one dollar, ten dollars, and one hundred dollars per acre have no detectable effect on the crops. The amounts of radium emanations used by Fabre, which were unsuccessful in plots 4 inches square, would cost on a commercial scale $58,800 per acre.

If radium affects plant growth at all, the action must be that of a stimulant, it is doubtful that radium forms a source of energy, inasmuch as $1,000 worth of the element acting for three and a half months on one acre equals in total energy the sun's rays on one square foot during thirty seconds.

A French inventor has secured very promising results with an automobile driven by an aerial propeller. The propeller is shaped like a bird's wings, which is said to account for the vehicle's success.

The Same Bridge as Above After it Was Covered Over with Concrete So as to Render it Impervious to the Action of Locomotive Smoke.

True Novelty in House Numbers

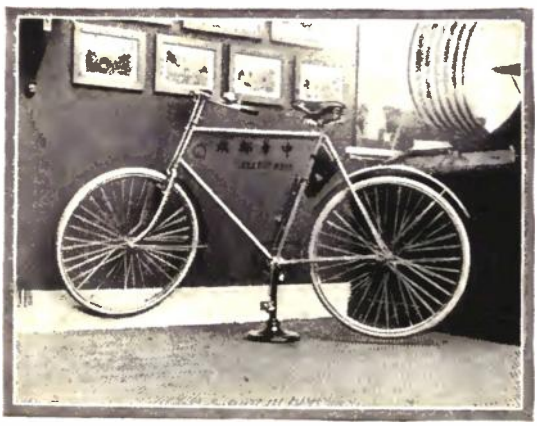
NOVELTY in house numbers is one of the latest "fads" of residents in the western part of this country. This is only in keeping, however, with the unusual things these people are doing with regard to other sections of the home, such as the porch, the pillars, the driveway, the garage and the chimney. Their search for the novel and the new is resulting in that section of the country being "different," and is putting that locality in a class by itself.

Some of the novel house numbers shown on the facing page are made of wood, others are of metal, while still others are of combined materials. Some are electrically illuminated, working both night and day, while others are not. Several very new ideas are shown, such as the placing of the name of the home owner just above the number, and the forming of the numbers in cement. Some of the numbers are attached to the home itself, others are located upon the gate posts, or are situated upon the curb. The variety is so complete that a suggestion may be found to suit every requirement.

THE VIEWS APPEARING ON THE OPPOSITE PAGE ARE AS FOLLOWS:

(1) An Illuminated Number Located Between Two Homes. (2) A Combined Curb House Number and Name. (3) A Number Placed on the Edge of the Porch Roof. (4) Name Hung from Porch Beam and Number Placed on Beam Above Entrance to Home. (5) An Attractive Porch Lamp with House Number. (6) Name of the Home Painted on a Rustic Panel. (7) House Number Placed on an Entrance Pillar. (8) Another Example of a Number Placed on a Pillar. (9) Number Located on End of a Porch Beam. (10) House Number Placed on Either End of Porch Roof. (11) House Number Placed on One of the Steps Leading to It.

The style and placing of the number are things in which it is very easy to show originality. It does not take a great deal of brain effort to create something new in this line, while the pleasing result of a little work in this direction is indeed gratifying. In this work two points should be remembered. No matter what else is done, it should be made certain that the numbers are sufficiently large and so located as to be easily seen and read from the street in front of the home.

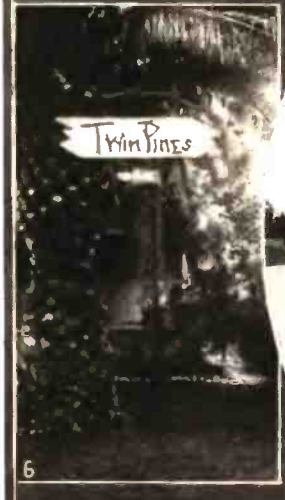


A Swedish Bicycle Intended for Chinese Postal Service.

SWEDISH BICYCLES FOR CHINESE POSTAL SERVICE.

Among other evidences of the industrial growth of Sweden and her reaching out into foreign markets, there is exhibited in the Sweden Building at the Panama-Pacific Exposition a queer-looking bicycle with a hand-brake, used in the postal service of China. This vehicle is of Swedish manufacture, and is labeled in two languages, the Chinese characters and the English words being placed one above the other on the metal panel beneath the main bar of the bicycle frame.

VIEWS SHOWING INGENIOUS DISPLAY OF HOUSE NUMBERS AND NAMES.



Electrical Voting Apparatus Being Tested Out by a Committee. The Inventor of the System Claims a Great Saving in Time and Money in Voting by This Means.

SHORTENING LEGISLATIVE SESSION BY ELECTRICAL VOTING

In order to prove to the nation that there will be a great saving in time before legislative bodies in taking roll calls by electricity, a Milwaukee inventor has offered to install at his own expense an electrical voting system for the use of any legislative body. He does not wish to be paid for the installation unless it demonstrates a saving of double its cost during a single session. The Wisconsin Legislature has taken up his offer which may mean the installation of the voting device before another legislative session. The plan is already under investigation in Congress.

Here is the manner in which he figures out the saving.

"Let us take the statement of Mr. Hambrecht, father of the bill to accept my device which was introduced at Madison, that in the 1913 legislature there were 852 roll calls. These roll calls consumed about twenty-four legislative days. Twenty-four legislative days cost the Government in the neighborhood of $24,000.

"By means of my system, 99 per cent. of the twenty-four days could be saved, and coupled with the other necessary elements in practical legislation with the efficient means which my device offers, it would shorten the session for all time to come from five to eight weeks, which would mean a saving to our State at a minimum of $35,000 per session.

"The resolution which provided for the installation of a system of electrical voting asked for an appropriation of $15,000 to install a complete system in both houses. From a business viewpoint, an investment of $15,000 would bring a return of $35,000 at a minimum every session. In other words this device would more than twice pay for itself in the first session of its installation."

The device not only records by colored lights and printed words each lawmaker's vote on a large board in full view of the assemblage, but automatically, also by electrical mechanism, keeps before the speaker of the house the totals for and against the measure voted upon.

A CLEVER DEVICE FOR TAILORS

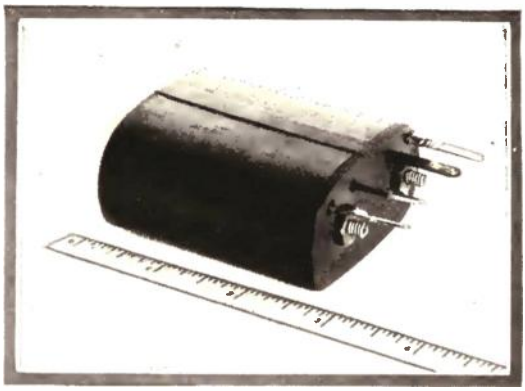
To the average man it is a difficult matter to decide on a piece of cloth for a suit and still feel confident that it will prove pleasing in the finished product. There are so many factors that enter into the making of a pleasing suit that a strip of cloth placed on a tailor's table

is almost meaningless to the majority of suit buyers.

In order to avoid disappointments to the clients as well as make the selection of different cloths a simple matter, a New Yorker has invented a simple device which he calls the "instantailor" or "garment stimulator," and on which any piece of cloth that may be selected can be placed in order to demonstrate to a client how the finished suit will be. No cutting is required to secure the effect of a finished suit.

As may be seen in the accompanying illustration, the "instantailor" is adjustable for height as well as girth. The tailor, after adjusting the form to the size of his client, has simply to pass the bolt of cloth over the device and place the framework over it. The result is a finished suit which can be carefully examined by the client in order to determine whether the color and pattern of the cloth will be pleasing.

To Secure the Effect of a Finished Suit from Any Piece of Cloth is the Purpose of a Simple Framework Known as the Instantailor.



A Clear Telephone Line from a Subscriber to the Central Office is Possible with the Use of This Automatic Locking Device Recently Invented.

DEVICE WHICH PREVENTS LISTENING ON PARTY LINES

An automatic locking device which prevents eavesdropping and interruptions on party lines will be of interest to many telephone subscribers. The lock weighs less than a pound and can be carried in the vest pocket. It may be connected to the telephone it serves or to the terminal box from which the several lines are distributed. The action is automatic, the mechanism being composed of a series of magnets and contacts which are brought into operation when a receiver any place on the party line is removed from the hook. A clear line from a subscriber to the central office is made automatically by the magnets and contacts. Telephone engineers have tested the invention and it is said to have worked properly and promptly.

BUOY LOCATES LOST SUBMARINES

One of the latest inventions to be brought out as a result of the war is a signal buoy, attached to a submarine. In case of an accident to the submarine the buoy is automatically released and floats to the surface, indicating the point where the submarine has sunk. A long reel of wire which pays out automatically anchors the buoy to the wrecked vessel. The buoy is held firmly in a steel case on the deck of the submarine by electromagnets.

A WOODEN TRAFFIC OFFICER.

Charlotte, Michigan, a town the exchequer of which will not permit salaried traffic officers, has solved the "safety first" problem at the street crossing in a most unique and effective fashion. This is accomplished through a mechanical "traffic officer" which stands at its post in all kinds of weather without salary or complaint.

A Wooden Sign Post at a Street Intersection Solves the Traffic Problems of a Small Town.

Stout cross-arms have been erected at the intersection of the principal street, properly fastened to the pavement to insure permanence. These cross-arms bear crisp, brief legends which direct the traffic. At first these devices invited some criticism because of their novelty, but practice has demonstrated their efficiency in reducing cross confusion, with the result that the idea is spreading to neighboring cities.

AUSTRIAN SUBMARINES BUILT BY AMERICANS

A recent incident demonstrates the value and efficiency of American construction and invention: The Austrian submarine known as the *U*-5 which destroyed the French cruiser *Leon Gambetta* in the Adriatic, was built by the Whitehead Company at their docks in Fiume, Austria, under license of patents belonging to the American firm known as the Electric Boat Company.

The *U*-5 was delivered to the Austrian Government as far back as 1910. According to Lawrence Y. Spear, vice-president of the Electric Boat Company, the craft was constructed under the supervision of his company, and from detailed plans supplied by them. The engines and other important machinery were constructed by the same company in this country and shipped to Austria for installation.

The vessel and her sister ship, the *U*-6, are of the same displacement, speed and radius as the five United States submarines of the *C* class which now constitute the floating defence of the Panama Canal. All the above vessels are smaller and less powerful than the more modern boats, but have nevertheless shown great utility for defensive purposes. It must be remembered that the torpedoing of the *Leon Gambetta* occurred nearly 300 miles away from the base of the submarine.

WOODEN VALVE 100 YEARS OLD FOUND IN NEW YORK.

While making excavations in one of the most congested sections of the City of New York, workmen recently came upon several relics of a day long past in the history of the water supply service of that city. The most interesting specimens of the find consisted of a number of old, wooden gate-valves, which were used in the period shortly following the war for American independence, for regulating the flow of water through the wooden pipe lines which formed the water supply system of the city at that time.

Although Buried in the Earth for Nearly 100 Years, This Wooden Valve Was Found in Excellent Condition.

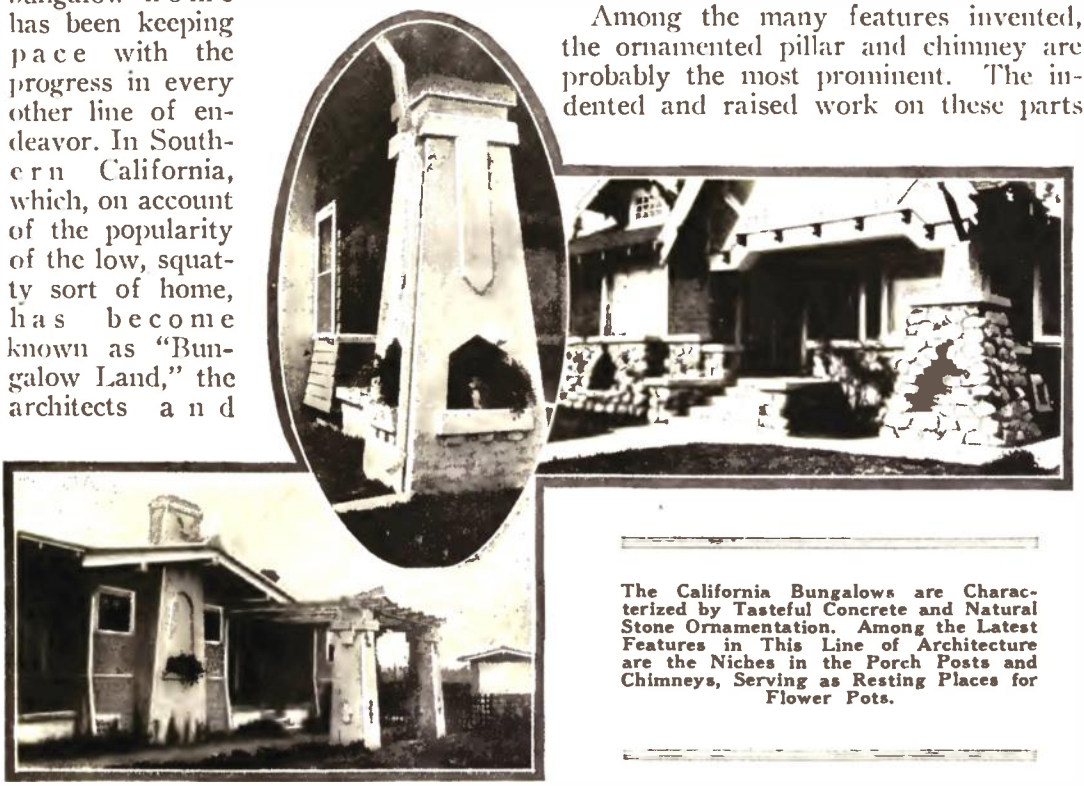
Iron was not used then for pipes, as it was considered injurious to the health to drink water which had been in con-

tact with that metal. In fact, iron pipes were not installed until about the year 1825, at which time most of the wooden pipes and valves were disconnected.

The wooden valves, one of which is shown in the accompanying illustration, were in an excellent state of preservation when found, and the iron parts in spite of their lengthy stay in the moist earth were not eaten away as much as might have been expected — certainly testifying to the excellent quality of iron manufactured in this country along in the early part of the last century.

MODERN BUNGALOW FEATURES

During the last few years the progress in the way of improvements for the bungalow home has been keeping pace with the progress in every other line of endeavor. In Southern California, which, on account of the popularity of the low, squatty sort of home, has become known as "Bungalow Land," the architects and home builders in general have been endeavoring to outdo their competitors in the line of creating something new and different for the bungalow home. To say that the work of home building in that section has been keen is putting the matter mildly.



The California Bungalows are Characterized by Tasteful Concrete and Natural Stone Ornamentation. Among the Latest Features in This Line of Architecture are the Niches in the Porch Posts and Chimneys, Serving as Resting Places for Flower Pots.

Thousands of home seekers have been flocking into that territory. They demanded homes and as a result several hundred building companies were formed, and for years the chief industry of that country has been home building. It is perfectly natural that these companies should vie with one another in the creating of new and attractive features.

Among the many features invented, the ornamented pillar and chimney are probably the most prominent. The indented and raised work on these parts of the home were the first things in the way of ornamentation to be presented. They were made in many styles and shapes and were indeed improvements. The most recent improvement, however, is the flower holder used in connection with these features. As a rule these holders consist of indentations left in the sides of the cement, brick and stone work during progress of construction. These holders are of various sizes and shapes and are employed to hold different kinds of flowers, ferns, and other plants.

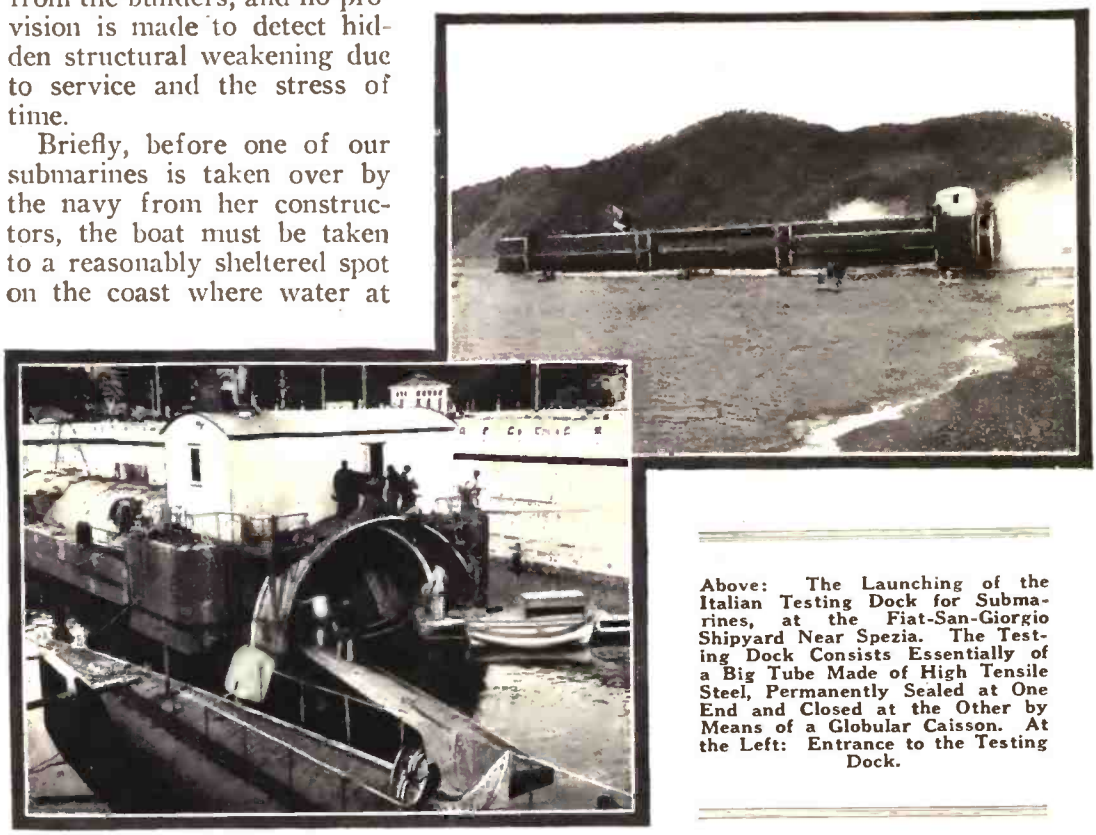
THE LAST WORD IN SALVAGE SHIPS FOR SUNKEN SUBMARINES

THE sinking of submarine *F*-4 has brought home to the people of the United States an amazing deficiency in the material of our fighting fleet. We are sadly lacking in special craft purposely equipped and intended to salve sunken submarines. In this shortcoming we lag years behind other maritime powers.

But it is not only in this direction we are wanting: we still test our under-sea boats in a crude and unsatisfactory manner in seeking to prove that they are strong enough to stand their maximum designed submergence of two hundred feet. The manner in which this trial is now made practically precludes a repetition after first acceptance from the builders, and no provision is made to detect hidden structural weakening due to service and the stress of time.

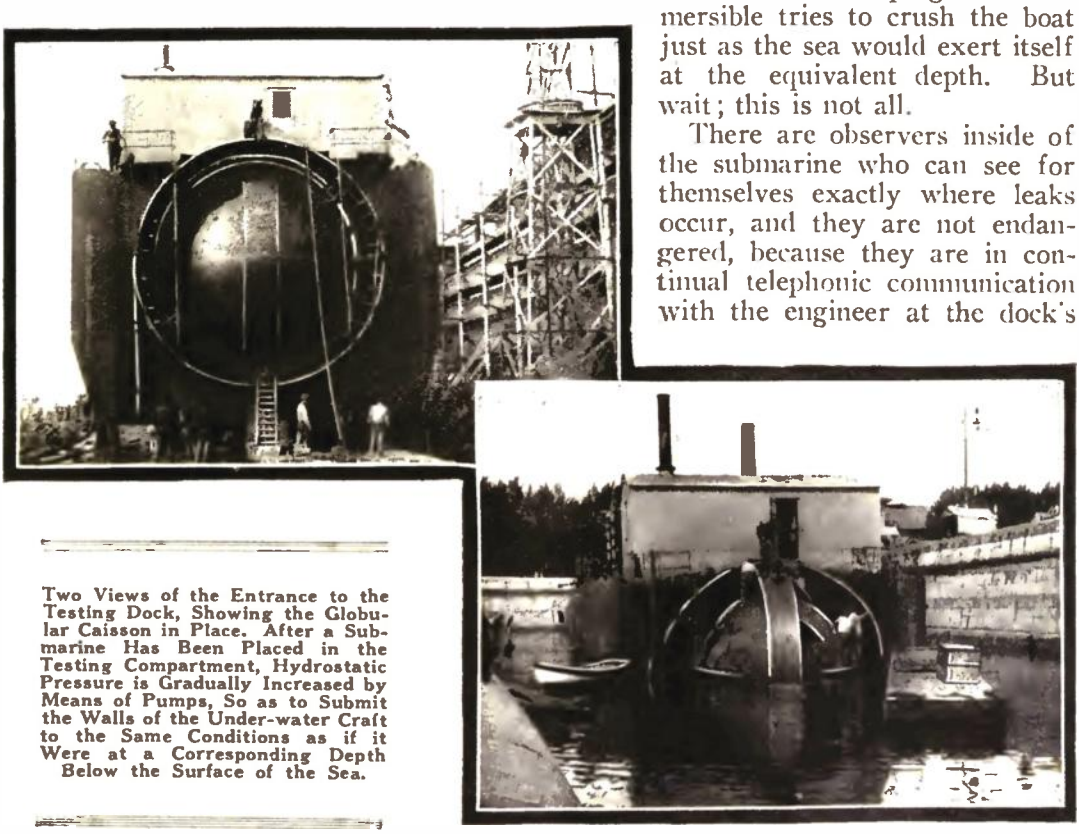
Briefly, before one of our submarines is taken over by the navy from her constructors, the boat must be taken to a reasonably sheltered spot on the coast where water at least two hundred feet deep can be found. There the craft is forcibly hauled down by a wire cable passing through a ring in a twenty-ton anchor, successively to depths of 100, 150 and 200 feet, and returned each time to the surface for examination. No one is in her during these trial dips. Structural yielding is registered at various points, if such take place, by means of instruments, and the sources of leakage are doubtless traced back by starting with tell-tale pools that may be more or less remote from the actual leak.

Trials of this sort are expensive. They take time—much of it if the weather is unfavorable, and invariably a floating machine shop has to be taken along because the building yard may be many scores of miles away. In the case of one of our submarines, the builders had to send her from Philadelphia to Castine, Maine, to find a suitably deep spot for her hull-strength submergence tests! It is largely because of these inconveniences



Above: The Launching of the Italian Testing Dock for Submarines, at the Fiat-San-Giorgio Shipyard Near Spezia. The Testing Dock Consists Essentially of a Big Tube Made of High Tensile Steel, Permanently Sealed at One End and Closed at the Other by Means of a Globular Caisson. At the Left: Entrance to the Testing Dock.

that our under-water craft never purposely go to their maximum designed depths after their one constructors' trial. This is a serious state of affairs, because the Germans have shown us how important it is for the submarines to be able to sink to the ocean bottom to give the crews a chance to rest from their nerve-racking work. Again, it is vitally necessary that the boats should be frequently examined under submerged conditions, and this can not be done in a dry-dock. What, then, is the remedy? The Italians have answered this urgent need.



Two Views of the Entrance to the Testing Dock, Showing the Globular Caisson in Place. After a Submarine Has Been Placed in the Testing Compartment, Hydrostatic Pressure is Gradually Increased by Means of Pumps, So as to Submit the Walls of the Under-water Craft to the Same Conditions as if it Were at a Corresponding Depth Below the Surface of the Sea.

The famous shipyards of the Fiat-San-Giorgio near Spezia, builders of the notable Laurenti submersibles, have evolved a special type of submarine testing dock consisting fundamentally of a big tube fashioned of high tensile steel—permanently sealed at one end and closed at the other by means of a globular caisson seated against an annular gasket of heavy rubber. Into this dock all of their boats are put; the tube filled with water and closed; and then hydrostatic pressure is applied by suitable pumps. Gradually the pressure is raised within the tube, and the water enveloping the submersible tries to crush the boat just as the sea would exert itself at the equivalent depth. But wait; this is not all.

There are observers inside of the submarine who can see for themselves exactly where leaks occur, and they are not endangered, because they are in continual telephonic communication with the engineer at the dock's pressure pump. Instantly the pressure of the enveloping water can be released. Thus, right at the building yard, a submersible can be tested under physical conditions that actually reproduce those of a deep submergence, and it is not necessary to wait for the weather or to go hunting for some out-of-the-way hole along the coast. More than this, boats can be frequently tested in this way—should be, in fact—and all of their emergency apparatus, such as automatic blow-outs for the quick expulsion of water-ballast and pumps designed to work against great heads of water, can be put through their paces to see that they are fit and capable. To-day our sailors and officers have to take a good deal of this readiness for granted!

Some years ago a French boat was lost because a pebble was jammed in one of

the sea-valves, and that little stone was forced in when the submarine grounded on a sandbank about a week before she foundered. One of our own submarines narrowly escaped loss because an engine exhaust-valve became fouled and would not seat properly. Again, another underwater craft had some of her tanks flooded with an excess of ballast because of a chip of wood that had clogged a valve. We must remember that the sea is more of an enemy toward the submarine than toward a surface vessel, for the reason that when the submersible is in battle trim she is completely surrounded by water seeking an entrance with increasing force as the boat settles deeper beneath the waves.

Since the Laurenti dock first made its appearance about four years ago the Fiat-San-Giorgio has developed a novel advance in the shape of a mother-ship having within her a tubular testing dock long enough to receive submarines up to 190 feet in length. This special craft has a normal seagoing displacement of 3000 tons and can make 14 knots an hour at full speed. She is driven by two heavy oil Diesel engines operating twin screws, and at a 10-knot cruising speed has sufficient fuel to take her 4000 miles. The mother-ship uses the same fuel as the submarines, for which she constitutes a mobile supply base.

The Italian government has just added to its fleet a special vessel of this sort. She is at once a mother-ship, a supply ship, a repair vessel, a testing dock—the tube can also be used as a dry-dock, and a salvage craft capable of raising a sunken submarine. The mother-ship is supplied with numerous compressors and dynamos so that she can charge the air-flasks of a flotilla and also charge the storage batteries—thus saving the machinery of the submarines. In order that she can hold her own against an enemy's destroyers, the mother-ship carries a battery of rapid-fire guns of the necessary calibre.

DIMINUTIVE RAILROAD FOR FREIGHT YARD SERVICE

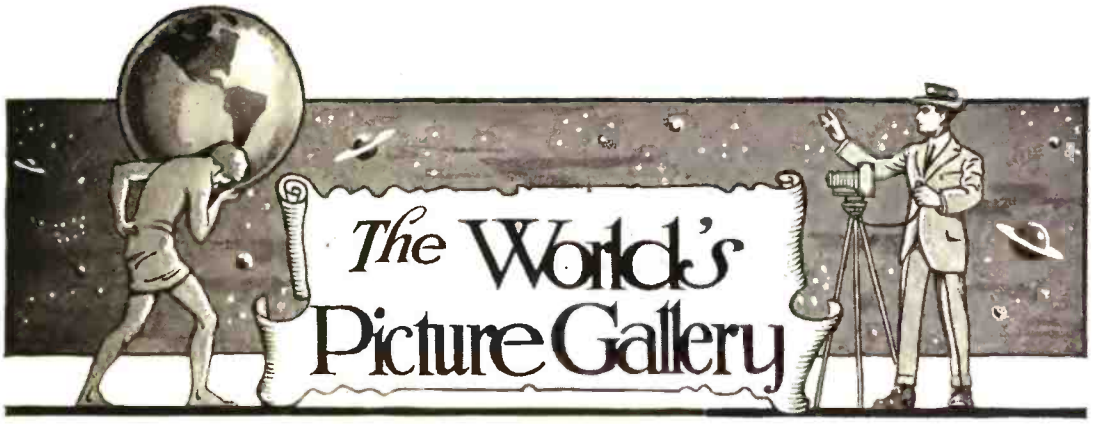
A portable track and car of small size is in use in a Brooklyn freight yard for transporting heavy objects. Where space is limited a portable railroad of this sort is useful. The track is made in sections of six feet, which may be readily bolted. A turntable is used when there are corners to run.

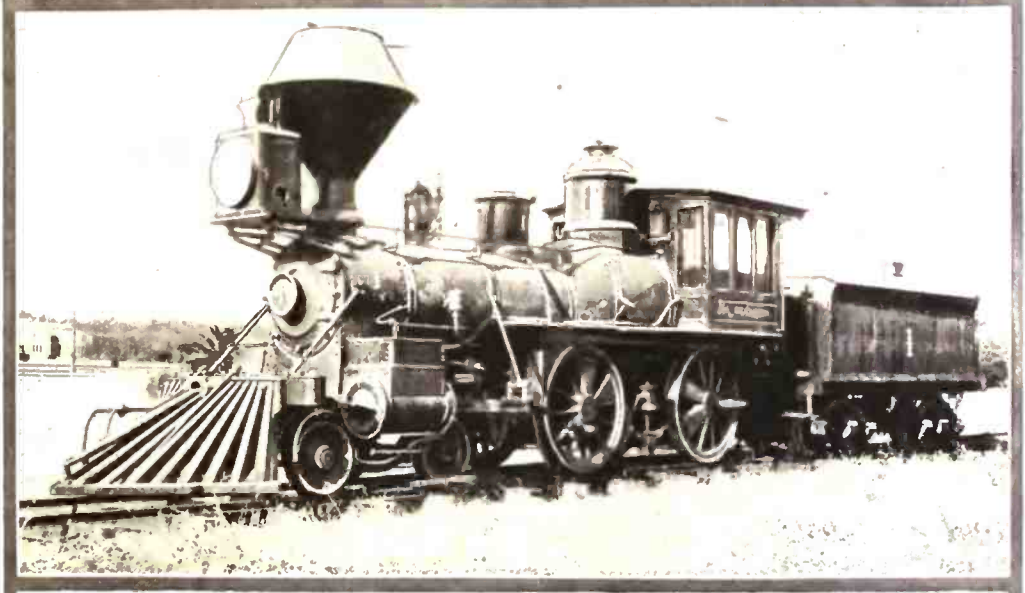
A Portable Railway and Hand Truck Greatly Facilitate the Handling of Merchandise.

"MOVIES" ON A SKY-SCRAPER

An innovation is planned by the architects at work on the sky-scraper to be erected by the Consolidated Gas, Electric Light & Power Company in the heart of the Baltimore shopping district. On the roof of the twenty-two story structure a moving picture parlor will be installed.

This enterprise will be started in an auditorium which will have a seating capacity of between 600 and 800 people. It will not be confined to the use of the occupants of the building, it is understood, and artistic announcements of the various pictures to be shown will be displayed in the foyer or lobby of the theatre.





A PIONEER AMERICAN LOCOMOTIVE

"GOVERNOR STANFORD," the first engine over the Central Pacific Railroad, is a typical old-timer, with its diamond-shaped smoke-stack, huge headlight and pilot. The Central Pacific was the last link in the first transcontinental railroad and was completed in 1869.

IN THE REAR OF THE TEUTONIC BATTLE LINES

Russian prisoners in Germany put to work building a stockade in which they are to be confined. There are a large number of Russian prisoners in both Germany and Austria, especially since the terrific Austro-German drive in Galicia, which has resulted in the retaking of much Austrian territory, including the fortress of Przemysl.

One of the famous Austro-Hungarian motor guns in a wood in Russian Poland. This gun is interesting not only because of the remarkable way in which it is loaded—the view shows a projectile sliding on rails into the breech—but also because it can be taken apart, placed on heavy motor trucks and transported from place to place.

A heavy tractor used in hauling the big German guns.

German infantry using scaling ladders in order to leave their intrenched position and attack the enemy. Ladders are used by both German and Allied troops to facilitate leaving deep trenches.

Photos. Robert H. Moulton.

WITH THE GERMANS IN THE EAST AND WEST

German troops defending the ruins of a house against the attacks of the enemy. Practically every building of substantial construction in the war zone is converted into a veritable fort, not only manned by infantry but also equipped with machine guns and even field pieces.

The Kaiser and his brother, Prince Henry of Prussia, leaving the Kaiser's headquarters for a walk. Prince Henry, who is well known to Americans because of his visits to this country in the past, is identified with the naval forces of Germany in the present war.

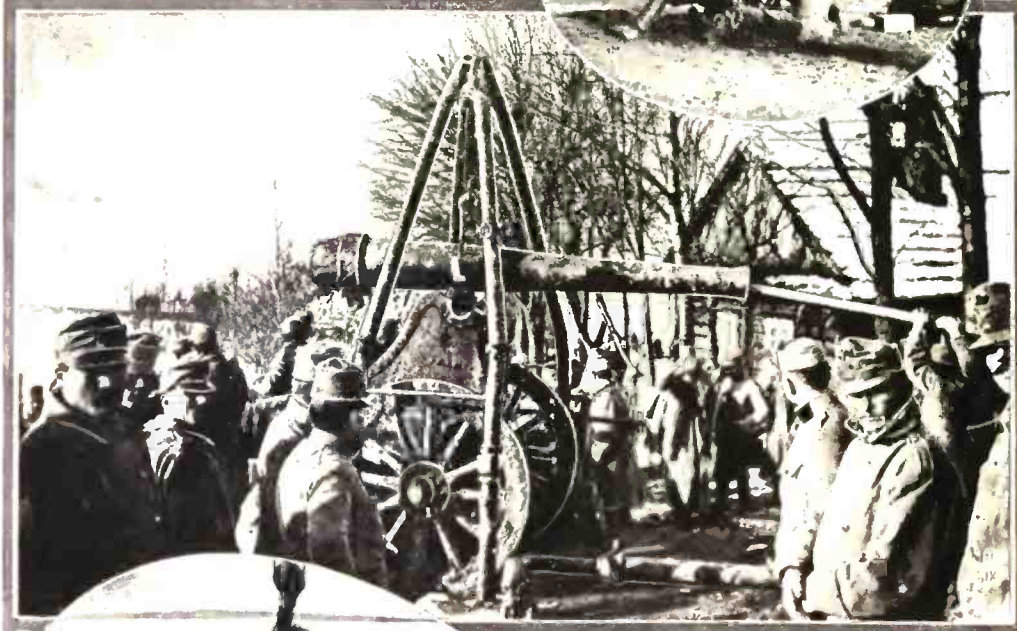
Below: An observation post for German batteries in Poland.

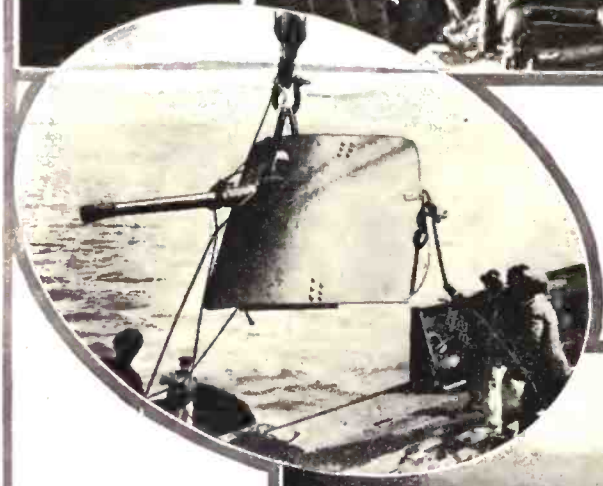
Above: From one end of the German east front to the other long trenches have been dug and protected by abatis of barbed wire. In this view the soldiers are seen at work making the abatis for protecting the trenches against the charges of the enemy.

Photos. Robert H. Moulton.

ARTILLERY—THE GREAT ARM OF THE FIGHTERS

German machine gun squad shooting at an enemy aeroplane. Her preponderance in machine guns has done much to enable Germany to hold most of the territory acquired by her since the war, even in the face of attacks by the numerically superior forces of the Allies on the western front.



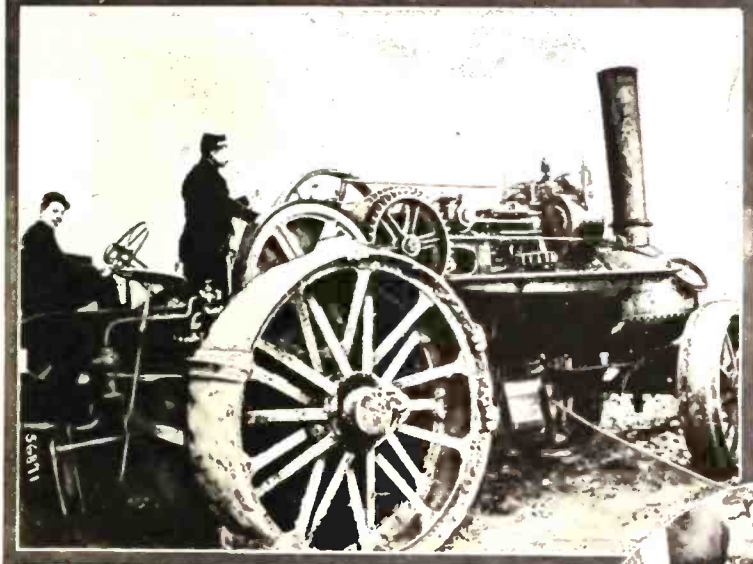


Above: Placing in position a heavy Austrian gun in the Carpathian mountains. At the Left: A British twelve-pound gun for use on an armored train, being taken ashore for the warfare in German Southwest Africa.

Four hundred French and English field pieces which have been captured by the German armies.

Photos. Copyrighted International News Service.

THE WAR AS VIEWED BY THE FRENCH SOLDIERS



A traction engine employed by the French troops in connection with a harrow or similar implement for the purpose of leveling fields that have been broken up by shell fire. With this tractor a plow or harrow may be drawn by means of a cable winding on a drum.

A scene at St. Eloi, France, where some of the fiercest fighting has taken place. The holes in the wall serve as passageways from house to house.

French soldiers examining the base of a German shell which exploded and caused the big hole in the ground. More ammunition has been used in the present war to date than that consumed in all the wars prior to August 1, 1914.

WARFARE WITH GAS CLOUDS AND BOMBS

A German trench mortar used especially for the hurling of gas bombs, captured by the French. The asphyxiating gas employed by the Germans is either released into the air and blown over the enemy's lines by the wind, or is placed in bombs and shot from special mortars.

French infantrymen who have been victims of a German gas attack.

A company of British infantry wearing special respirators for protection against German gas attacks.

Type of respirator worn by the French soldiers and which forms an effective protection against the asphyxiating gas clouds employed by the Germans. The respirators are very simple in design, yet their use enables the British and French infantrymen to hold their trenches in the face of a gas cloud and repel the German infantry attacks that generally follow.

VEGETABLE FIBRE OF GREAT BUOYANCY

Playing a game of cards in the water, using a floating table consisting of carded Kapok—a vegetable fibre which is impervious to atmospheric conditions and water, and is unsinkable. The players are dressed in suits containing Kapok.

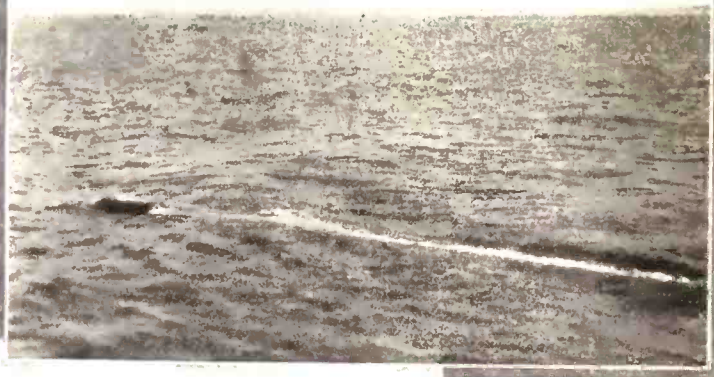
Different styles of suits that have been filled with Kapok. At the Left: An aviator's costume. In the Center: Life-saving vest for women and children. At the Right: An admiralty service jacket. Kapok is a British discovery which is now receiving extensive tests.

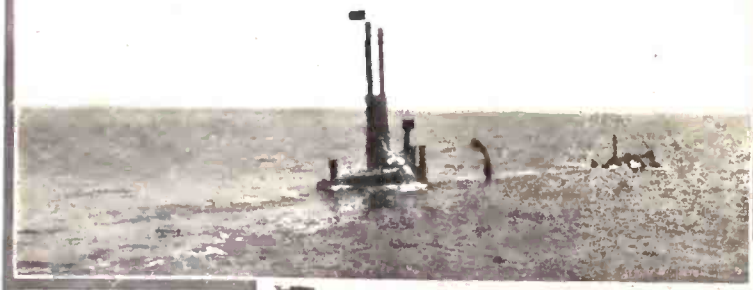
Two men floating in the water, due to the buoyancy of Kapok. One of them is resting on a blanket of carded Kapok measuring five feet by two feet six inches and which will keep any person afloat for an indefinite length of time. The other man is wearing a Kapok padded suit.

AMERICAN SUBMARINE AT BATTLE PRACTICE

The United States submarine "H-2" firing a torpedo during target practice at San Pedro, California.

A spent torpedo fired during maneuvers The trail of the torpedo through the water can be easily followed by the foaming wake left by the missile.





The American submarine "H-2" coming up to the surface after a submerged run, during the maneuvers at San Pedro.

The crew of the "H-2" hoisting a spent practice torpedo on board. The torpedoes are fitted with dummy heads for target practice and are picked up by the crew, recharged with compressed air and used over again.

AN ACTIVE AMERICAN VOLCANO

One of the results of the eruption of Mount Lassen in California: Big trees that have been uprooted by the flood of mud and water strewn in piles on the sides of the mountain.

General view of the wreckage in Loss Creek. This locality was once fine ranch land, but it has been transformed by the volcanic eruption into a chaotic mass of mud and lava.

North side of Mount Lassen, showing the crater of the mountain. Much of the landscape that appears in this view was damaged by the eruption.

A view of Mount Lassen as seen from the south side of the mountain. This is one of the Californian volcanoes that have long been considered extinct.

Photos. Copyrighted International News Service.

RELIEF EXPEDITION SAILS FOR THE NORTH

The auxiliary schooner "George B. Cluett" starting out from New York on the first leg of her long journey to North Greenland.

Captain H. C. Pickles, Commander of the MacMillan Relief Expedition, which started off on the auxiliary schooner "George B. Cluett" on June 9, bound for Etah, with the object of finding Donald B. MacMillan and his party. MacMillan set out in 1913 under the auspices of the American Museum of Natural History.

Members of the crew of the auxiliary schooner "George B. Cluett" and their mascot, photographed just before they sailed from New York under the command of Captain H. C. Pickles and Dr. Hovey of the American Museum of Natural History. They are supplied with two years' provisions and fuel. The expedition will endeavor to locate Donald B. MacMillan and his party, who set out two years ago for the purpose of finding Crocker Land, first reported by Admiral Peary.

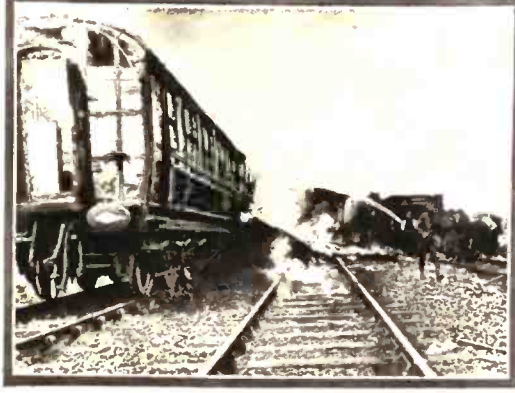
THE BRITISH TROOP TRAIN CATASTROPHE

At the Right: The burning debris of three coaches in the troop train disaster at Gretna, England.

Above: A burning coach.

Two telescoped coaches which escaped the conflagration following the train wreck. The Gretna catastrophe resulted in a death toll of over 200, 194 of the victims being soldiers.

Two of the wrecked engines in the Gretna wreck. A wreckage crane may be seen in the background at work clearing the tracks of the debris.



A near view of a coach that has been partially consumed by fire, leaving just the framework. The Gretna catastrophe is one of England's greatest train wrecks and would have been a world-wide topic had it not been for the all-important events of the European war which overshadow all other happenings of today.

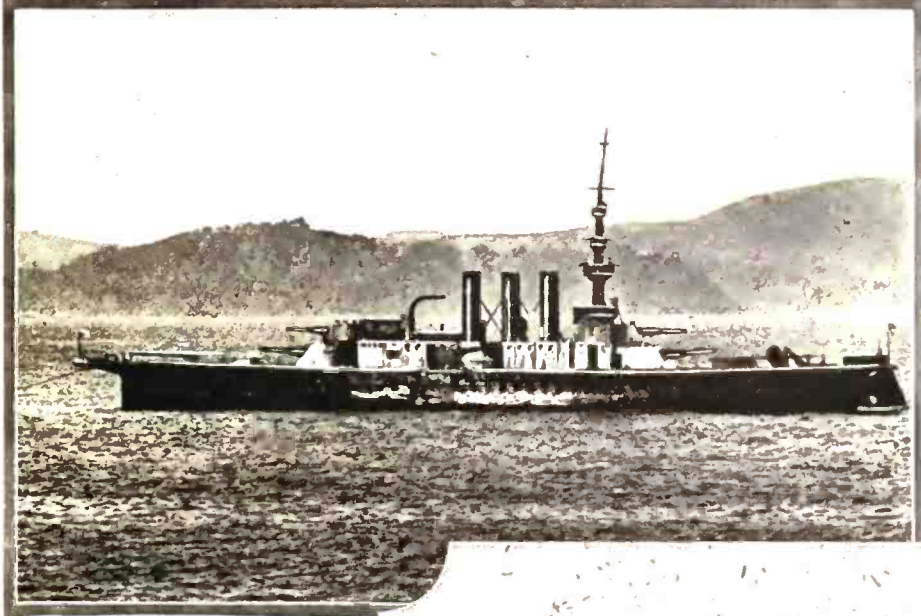
CAPE COD CANAL AND CALIFORNIA WASHOUTS

The "James S. Whitney," the first ocean liner to pass through the Cape Cod Canal on May 21, 1915, the opening day of the recently completed waterway for ocean steamers. The Canal saves seventy miles' travel in the journey from Boston to New York. The "James S. Whitney" went through the Canal in one hour, the distance from one end to the other being eight miles.

A near view of a washout in northern California and its effect on a railroad track. The rails and wooden ties have been left hanging in the air after the earth heneath them was washed away by a torrent of water.

A general view of the same washout which was caused by heavy rains. One hundred and fifty feet of railroad track was left suspended in the air when the embankment was swept away. A telegraph pole may be seen suspended in the air, hanging from the telegraph wires.

PROVING THE EFFICACY OF MILITARY MINES



One of the most spectacular entertainments of the Panama-Pacific Exposition was the recent blowing up of a "battleship" built of papier mache and canvas. In order to demonstrate the effectiveness of mines in defensive naval operations, mines were planted in the waters adjoining the Exposition Grounds, under the supervision of Colonel S. M. Foote, Commander of the United States Pacific Coast Defense, and Major H. H. Whitney. The battleship "Zone" was constructed of papier mache and canvas on the hulk of the old Southern Pacific ferry boat "Amador." The ferry boat was launched in 1869 and kept in service until 1914, when it was condemned. One of the views shows the "battleship" before it was blown up, while the other was photographed at the moment it struck a mine.

VARIED MOMENTS WITH EUROPEAN FIGHTERS

Above: An Austrian army resting during a march through the Carpathians. At the Left: French soldiers wearing steel skull caps. These head pieces are usually the gifts of relatives and friends, being sold in Paris and other French cities at practically cost price. They have proven invaluable protection against enemy bullets and shell splinters. Below: A remarkable photograph taken in an Austrian trench in Russian Poland. This view, showing the defenders actually repulsing a vigorous Russian attack, was taken by the photographer at a considerable risk.

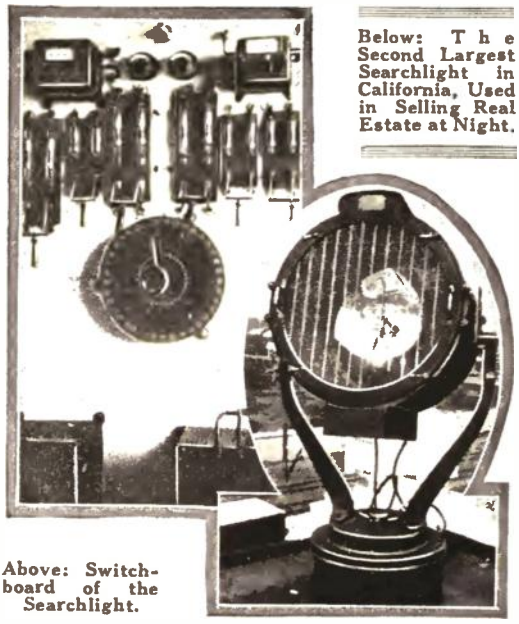
NEW USE OF GRAPHITE SAVES INNER TUBES OF TIRES

Coated with graphite instead of soapstone, which was formerly used, the inner tubes of automobile tires have been discovered to last twice as long as under the old process. This new process of coating is being used by a western tire concern in the manufacture of their tires. Graphite prevents blooming, deterioration, and absolutely eliminates friction between the inner tube and casing. It is impossible to destroy graphite, wear it out or make it change its form, the latter being the main drawback in the use of soapstone.

MOTOR CANOE OF NOVEL DESIGN

A Japanese photographer of Battle Creek, Michigan, has built a most unusual water craft in the form of a motor canoe. He took an ordinary canoe and placed in the bow a detachable motor boat arrangement, which pulls the canoe forward when the motor is operated reversely. At the stern of the canoe he rigged up an aeroplane propeller, which is driven by a separate engine. In order to insure safety, pontoons were fastened on either side of the craft, and the steering gear of both motors was placed within easy reach near the center of the canoe. The motor-canoe is said to be much safer than the average canoe, and considerable speed can be developed by this strange harnessing of power.

Propelled by Both a Marine and Aerial Propeller, This Canoe is Claimed to be Safer Than the Ordinary Craft of That Class—and Far Speedier.



Below: The Second Largest Searchlight in California, Used in Selling Real Estate at Night.

Above: Switchboard of the Searchlight.

"SELLING THE EARTH" AT NIGHT

For years the brains of all the real estate men of Southern California have been busy in devising new ways and means of "selling the earth." Every method that has come up to improve the appearance of a new tract and that would tend to quicker selling has been eagerly grasped and worked, and, it might be said, "worked to a standstill." But after everything is said it remained for the Harry H. Culver Company, of Los Angeles, to introduce the most novel method yet employed. By this company's method a large searchlight is introduced into the real estate business. It has a two-fold purpose and effect. First, it attracts attention to the city, for its rays may be seen for miles around; second, it permits the sale of real estate by night, this probably being its strongest feature. There are hundreds of people who are unable to visit Culver City during the day and these people are shown the land during the dark hours. The light is located upon the top of a three-story building, and from this point it is a simple matter to turn its strong ray of light upon any lot or section of lots in the entire

city. The point upon which its rays are turned is made as light as noonday, and selections in real estate may easily and safely be made.

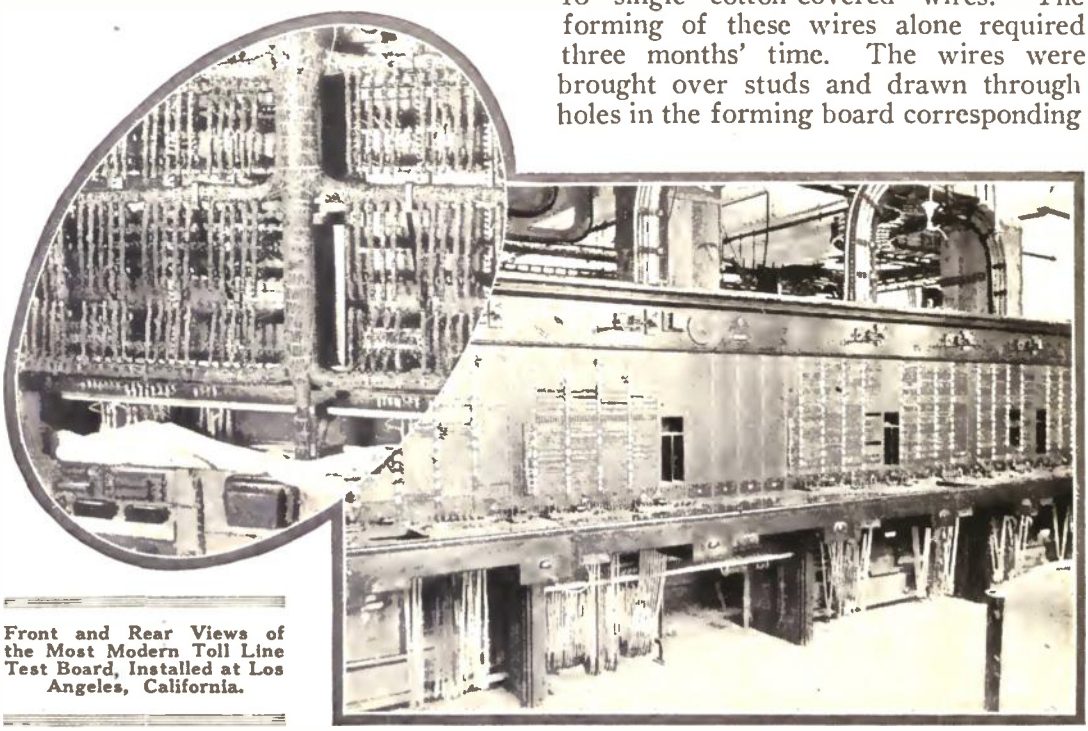
The searchlight is a very powerful one, being second in Southern California only to the celebrated Mt. Lowe searchlight. It has a rating of 8,500,000 candle-power and throws a brilliant stream of light a distance of thirty-two miles. The lamp itself is thirty inches deep and thirty inches in diameter. The light and the stand upon which it rests have a combined height of five and a half feet.

The switch room for this light is located on the floor below it. In this room are switches, meters, starting boxes and other controlling devices, as well as a 60-cycle, 15 horsepower electric motor and a 56-ampere continuous current generator.

NEWEST LONG DISTANCE TELEPHONE TEST BOARD

The most up-to-date toll-line test board in the world comprises part of the recently completed new long-distance exchange at Los Angeles, Cal. Any line, inside or outside of the exchange, may be plugged into the board for any kind of test imaginable. Breaks or crosses on long lines are measured to a fraction of a mile with a Wheatstone bridge and galvanometer. A line inside the exchange causing trouble is cut off from its corresponding line outside and another line temporarily "patched in" through plugs in the board.

Each form in the rear of the board supplies two of the eight sections. Leading in at the top are 1,800 pairs of No. 16 single cotton-covered wires. The forming of these wires alone required three months' time. The wires were brought over studs and drawn through holes in the forming board corresponding to the jacks to which they lead. The form was then sewed with No. 12 thread lock-stitches and the board removed. It was then given a coat of shellac, followed by the most tedious job of all, the connecting and soldering. The final dressing-up and shellacing alone took one man two weeks' time.



Front and Rear Views of the Most Modern Toll Line Test Board, Installed at Los Angeles, California.

Motion Picture Exhibit of School Activities

By Thomas J. Davis

DURING the past few years motion pictures have been used in various departments of school work and have proved of great value as a supplement to textbook and oral instruction. Not only have they been the means of imparting to pupils in an interesting way a vast fund of information concerning a variety of subjects and of enabling pupils to obtain a clear conception of many of the principles of science, art, and other subjects, but also, by portraying actual working conditions in industrial and business enterprises, they have given school children a more definite understanding of how things are done in the real workshops of life than the scholars could possibly acquire through any amount of theoretical instruction.

Since motion pictures have thus been used to show teachers and pupils what is going on outside the school walls, it is but fitting that they should be used to demonstrate to the rest of the world what the schools are doing. There is no exaggeration in saying that the average adult is as ignorant of modern school activities as the average school child is ignorant of the industrial, commercial and social activities of modern life. This is especially true in large cosmopolitan cities which maintain, in addition to the regular academic schools, polytechnic high schools, schools of manual arts, trade, neighborhood, continuation and other schools of the very existence of which many of the people of any city are entirely unaware.

It has always been difficult, indeed impossible, to get any large number of men and women to visit the public schools, and schoolmen everywhere have longed for some means of showing their patrons the essential facts concerning the equipment, accomplishments and needs of the schools under their direction. Motion pictures are the fulfilment of that wish.

Among the very first cities to employ this means of publicity is Los Angeles, Cal., where there has just been completed a remarkable record, six thousand feet in length, of the activities of the public schools. This six reel film was made primarily for the educational exhibit at the Panama-Pacific International Exposition, but later it will be shown throughout California and in all the large cities of the country.

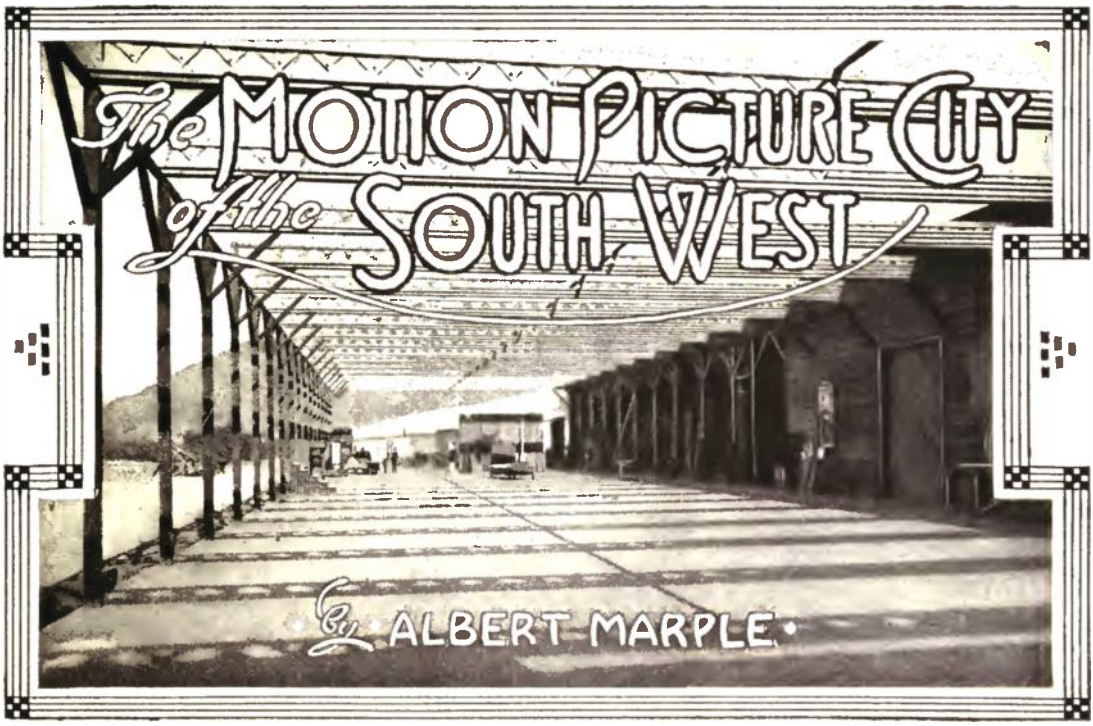
These pictures cover the work of all grades from the nursery to the junior college. There are exterior and interior views of some of the more modern buildings and many views of equipment. Regular academic classes are shown where it is possible to illustrate an unique method of instruction or to present a typical grouping of nationalities. Many pictures of school shops, kitchens, sewing

rooms and gardens testify to an earnest endeavor to approximate, in methods and equipment, actual working conditions. Outdoor school life is represented by many views not only of physical culture drills and regular athletic sports, but also of outdoor classes, nursery games, kindergarten plays, folk dances, trips to the beaches and the mountains, camp life, and many other school exercises that in most parts of the country must be conducted indoors. The pictures of neighborhood and continuation schools show how these may be made to serve the communities in which they are located in all their diversified affairs, domestic, industrial and economic, which in any way contribute to the welfare of their children. The views of the intermediate school activities will be of especial interest to educators, for they demonstrate the excellent results that have been attained in these special schools which have been organized out of what was formerly the seventh and eighth and ninth grades, and the work of which has been planned to bridge the chasm that has always existed between the grammar and the high school. Not the least interesting of the pictures are those which show how the home economics department seeks to train all school girls to become true home makers and how the manual training department is striving to develop some degree of manual dexterity in all school boys and at the same time familiarize them with some of the constructive processes by which "society keeps itself going." The high school pictures show the culmination of the many lines of work which the pupils have pursued from grade to grade and those special activities by which they are prepared for the duties and responsibilities of life.

All in all, these reels constitute one of the most important educational films ever shown. They tell a story of vital interest to the people not only of Los Angeles, but of the rest of the country as well.

Taking Motion Pictures of the Activities of One of the Los Angeles Schools. Many of These Pictures are Taken Outdoors in Order to Secure Better Photography.

Fifteen expert cameramen are engaged in the "taking" of the scenes for "The Diamond from the Sky," the great Flying "A" serial photoplay.



TWO years ago one of the leading motion picture producers conceived the idea of a community that would be exclusively devoted to the making of photoplays. Today the idea is realized in the vast ranch and municipality known as Universal City, located in the beautiful San Fernando Valley of California. Although this community has already been described in a past issue under the caption "Chameleon City," its recent completion permits of a more detailed account of the many wonders of the world's only motion picture city.

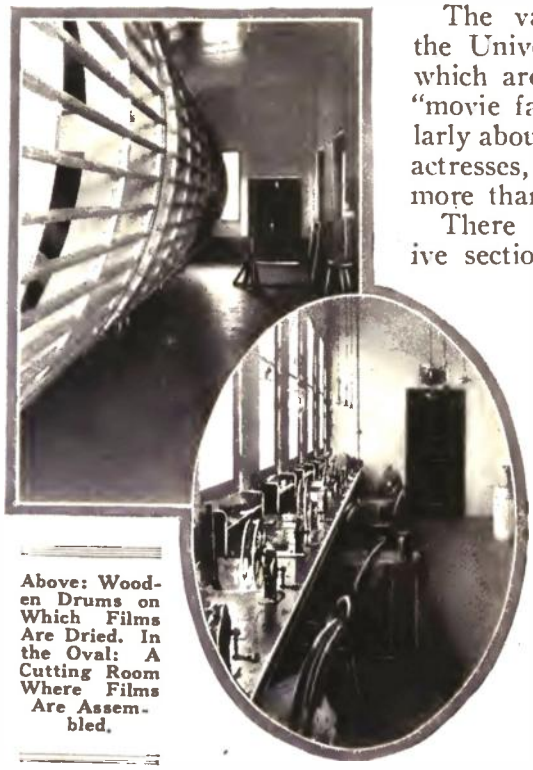
ANY ONE who is familiar with the producing of motion pictures is aware that slowly but surely the film companies are taking up their residence in southern California. At the present moment it is estimated that three-fourths of the films manufactured, or rather motion pictures produced, come from that favored section. The annual payroll of employees of the motion picture companies in southern California is at this moment about $7,000,000. It is claimed that the property and equipment of these companies is worth more than $3,000,000, and that this sum will ultimately be increased to $6,000,000 when the many improvements planned and now under way are consummated. The actors and actresses alone number over 10,000.

But the object of this story is not to tell how many companies are located in

California, for these facts are merely mentioned in order to convey to the reader's mind a fair conception of the magnitude of the motion picture industry in that sunny locality. The story is rather to literally convey the reader through one of the largest—if not the largest—producing plants in the United States.

The Universal Film Manufacturing Company has the unique distinction of being the first motion picture producing firm to own an entire city for the carrying on of the work. While other companies are spending vast sums of money in acquiring land and erecting huge studios and laboratories, it is probable that no other company is doing this work on such a stupendous scale as the Universal.

Prior to about two years ago the main plant of the Universal was situated in Hollywood, Cal. At that time the officials of the company realized the growing necessity of spreading out, and, fitting the action to the decision, the company purchased a large piece of land — something like 500 acres—in the beautiful San Fernando Valley. Improvements were started at that time which will eventually total up more than $2,000,000.



Above: Wooden Drums on Which Films Are Dried. In the Oval: A Cutting Room Where Films Are Assembled.

Universal City, as the entire community and plant are named, includes practically everything that is necessary for the staging and manufacturing of motion pictures. It is very seldom indeed that the directors are compelled to leave the grounds for any setting. The property includes hilly land both with and without dense growth of trees, valley property, wash property in which desert scenes are staged, and an abundance of land especially suited for street scenes and city atmosphere. The Los Angeles River runs directly through the center of the property, so that water scenes of all kinds are possible, while the convertible bridge crossing the river is so designed that it may be changed in a few minutes' time from one type of structure to another for use in different pictures.

Everything that could be desired by a motion picture director is available in Universal City. Mr. H. L. Caulfield, general manager of the Pacific Coast studios of the company, has proved himself a wizard in the selection of a site as well as in the planning and construction of the community.

The various brands of the Universal company which are known to many "movie fans" employ regularly about 2,000 actors and actresses, or a payroll of more than $26,000 weekly.

There are two distinctive sections to Universal City — the ranch section, which was completed more than a year ago, and the new section which has just been completed. For the most part the ranch is used in making pictures of western life, Indian subjects and other photoplays that necessitate rugged backgrounds. On the other hand, the new section is employed in producing pictures requiring special and elaborate settings; the permanent buildings in this section being constructed of reinforced concrete. In the construc- of these buildings 150 carloads of rock has been employed, as well as twenty-five carloads of cement.

The main feature of the new section of Universal City, and, in fact, of the entire property, is the enormous outdoor stage which is built entirely of reinforced concrete and steel framework. It covers a ground space of 156 by 320 feet.

The concrete of the floor is six inches in thickness, as are likewise the walls of the buildings adjoining it. At the rear of the stage are the dressing rooms, directors' offices, toilets and shower baths. Hot and cold water, electricity and all other modern conveniences are features of the stage. In the "acting" space there are three pits, twelve feet deep, which are intended for water and basement pictures. These pits are 10 by 20 feet in size and are lined with concrete floors and walls ten inches in thickness. The stage has two scene docks 50 by 120 feet, the roofs of which are used to house the light diffusers. The acting space measures 65 by 320 feet and is covered over with span steel trusses upon which the diffuser tracks are run.

Various Scenes of Universal City: In the Uppermost View, a Scene in the Hospital of the City. In the Oval: Isidor Bernstein, the Man Who Did Much to Make Universal City What It is Today. Above: The Mammoth Outdoor Stage Where Many "Interior" Scenes Are Photographed. At the Right: A Desert Picture Staged at Universal City.

Universal City is a modern motion picture community in every sense of the word. It has its own sewerage, water supply and electric lighting systems, telephones and telegraph service. Miss Laura Oakley, a prominent actress, is chief of police of the entire city, and residents claim that the community is the most law abiding in the United States. The city has been incorporated as a city of the sixth class. It has a United States post office and money orders can be sent and received there.

The principal building in the new sec-

tion of the city is the administration building. This contains the manager's office, directors' office, reception hall, bank, business office, telephone and telegraph booths and literary rooms, while above the center of the main floor is the observation tower from which the manager may see all sections of the ranch.

Directly to the left of the administration building is the carpenter shop, where all of the accessories needed by the moving picture city will be manufactured. In this building is also located the plumbing shop, electricians' headquarters, and the drafting rooms, as well as the dark rooms and camera rooms. The restaurant and confectionery stand for this section are located at the right of the administration building. There is both an open air and a closed café.

The hospital, which has a trained nurse and a physician always in attendance, is being erected on the hillside. It will have two wards, one for the men and the other for the women, each having two beds.

THE VIEWS OF UNIVERSAL CITY APPEARING ON THE OPPOSITE PAGE ARE:

(1) The Front of the Administration Building. (2) The Restaurant Building. (3) One of the Bunkhouses Built Especially for the Cowboys. (4) A Bird's-eye View of the New Part of the City. (5) General View of the Ranch Part of the City. (6) One of the Several Sewerage Pipes That Form the Sanitary System of the City. (7) A Few of the Animal Cages at the Zoo. (8) Entrance to the City as Seen from the Boulevard.

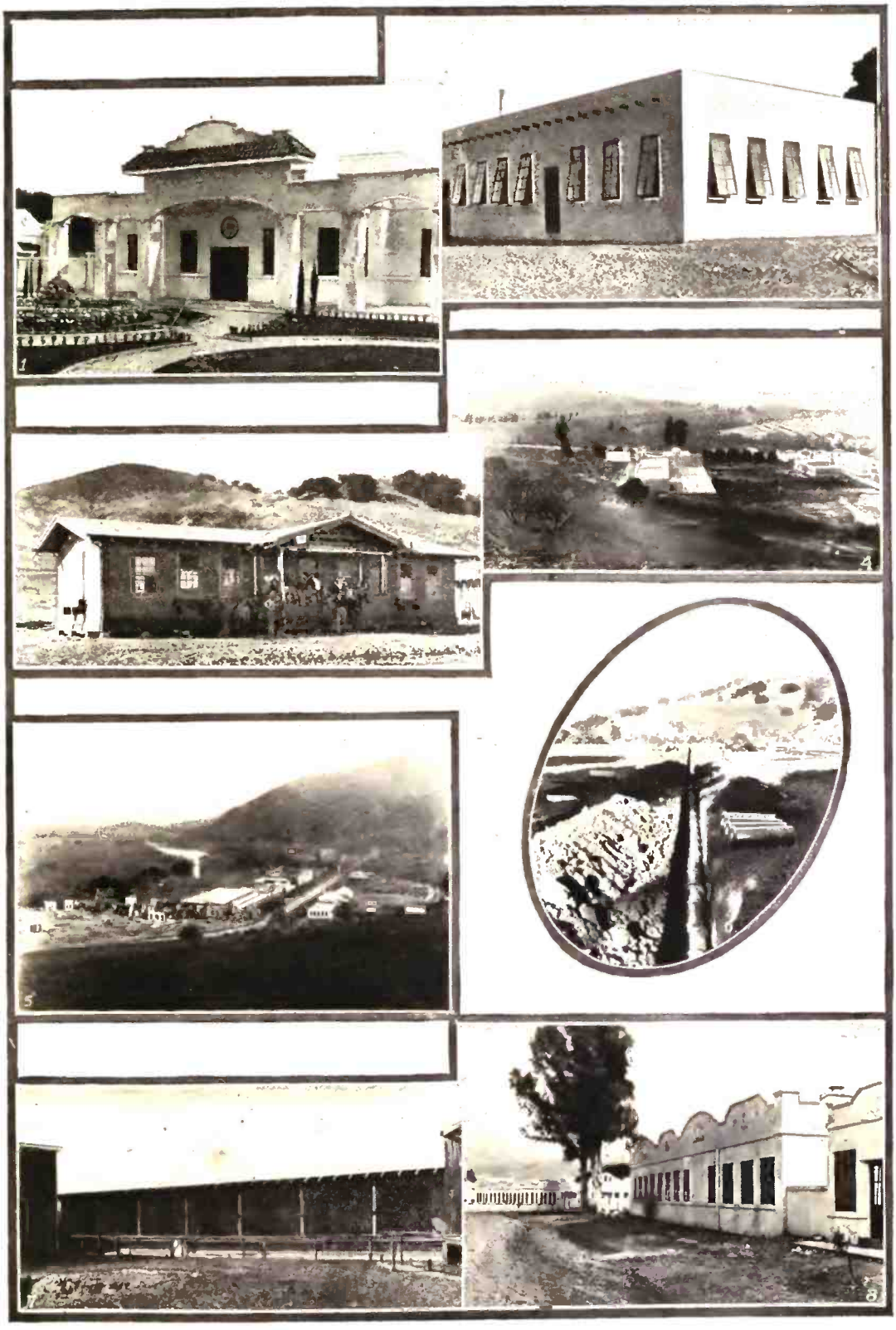
In one of the canyons close by there is a Roman theatre and a stadium, having a seating capacity of about 1,400 people. The grounds before and behind the buildings are laid out in lawns, there being a Roman bath with pool and fountain. There is also a building, 50 by 200 feet, known as the electric studio, where pictures may be made during rainy weather and at night.

The ranch or western section of the city is just as interesting, if not a little more so, than the new portion. This is truly an "out west" locality, with real cowboys and genuine Indians. In this section is also a large stage behind which are dozens of dressing rooms and property rooms. Farther on is a fully equipped carpenter shop and scenery department. A prominent feature of this section is a large zoo, containing twenty camels, two elephants, several lions, seals, tigers, leopards, snakes, bears, wolves, dogs and monkeys; among the latter being Joe, the chimpanzee who sleeps in a real brass bed, picks his teeth after meals, and has several other habits of the human race.

Still further on are harness and blacksmith shops, which are built to resemble buildings characteristic of old England. Directly in the center of the zoo enclosure is an immense arena where the Roman thrillers are staged. This arena is equipped with a maze of tiny cages where, in times of danger, the camera men and actors may seek safety. The arsenal is near the blacksmith shop and contains a wide variety of firearms of all kinds, which are found indispensable in producing many of the photoplays. There is also a large corral which contains upward of one hundred and fifty horses, situated directly behind the arena.

The water supply of the city is secured from six wells which have been dug on the ranch. Two reservoirs have been constructed upon the hillside, one of which contains 150,000 gallons for domestic purposes, while the other holds 500,000 gallons, this being for fire purposes only and supplying fire hydrants located in various parts of the ranch through six-inch mains. The sewerage system consists of a modern septic tank and several miles of eight-inch pipe. From one end of the city to the other and connecting the ranch with the new section is a macadam boulevard, twenty feet wide with five-foot shoulders. The roadway has an eight-inch rock base and cost $12,000 to build.

Although Universal City has just been completed, it has traditions of hundreds of years ago. Its buildings, both great and small, are built on Mission and Spanish lines and are extremely attractive in

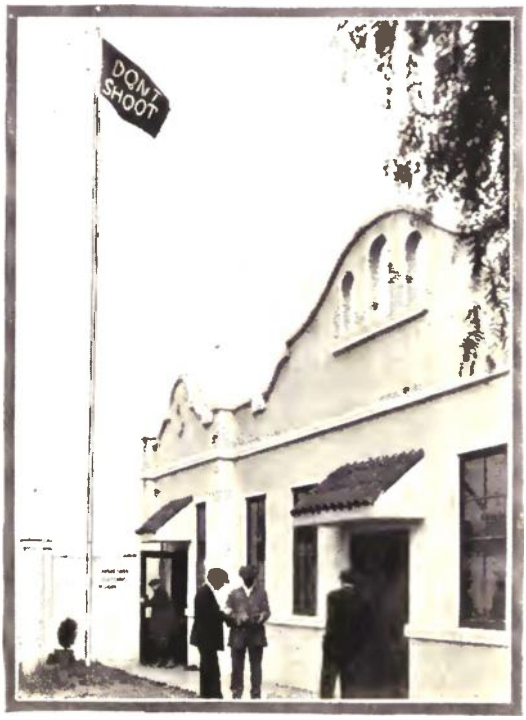


appearance. The smaller buildings, which are used for picture producing purposes only, are simple front exteriors which are erected in a day and are torn down just as soon as they have served their purpose. Expensive street scenes are built for a single picture and then torn down. In many instances the cost of preparing elaborate settings aggregates thousands of dollars.

THE "MOVIE" WEATHER MAN

The name, "The Movie Weather Man," has been given to the head camera man of the Universal Film Manufacturing Company in Southern California. The reason for this is that he is the creator of the "Don't Shoot" flag, which in this instance regulates the operations of twenty or more camera men employed by this concern.

Throughout the past winter the weather and lighting conditions in that southern section have been anything but favorable to the motion picture business; that is, when compared to the same months in other years. The days have been cloudy and hazy and a great number of the pictures that were made under these unfavorable weather conditions proved unsatisfactory for distribution. A poor strip of film means quite a loss to the picture company, for it does not simply mean the loss of the film and of the camera man's time, but of the loss of the entire company which made the picture and of the scenery men, for the scenes have to be rearranged and the picture retaken.



The "Don't Shoot" Flag Has Much Significance to the Camera Men of Universal City. It is Displayed When the Weather is Not Suitable for the Taking of Motion Pictures.

GRIFFITH BEGINS WORK ON ANOTHER GIGANTIC FEATURE

Much speculation is rife in filmland as to what will be the subject of the next feature photoplay to be produced by David Wark Griffith, who recently returned to the Reliance-Majestic (Mutual) studios in Hollywood, Cal., after a long sojourn in the East, where his masterpiece, "The Birth of a Nation," is being presented.

It is said that he has under consideration plans for the production of "The Quest of the Holy Grail," suggested by the famous frescoes of Edwin Austin Abbey, that adorn the walls of the Public Library in Boston.

Reproduction of these frescoes is controlled by Mrs. Abbey, widow of the noted artist, and negotiations are being made with her and her brother-in-law, Charles Scribner, the New York publisher, who manages her affairs, for the rights to photograph the frescoes.

If you enjoy THE WORLD'S ADVANCE, please tell others; if not, write us your reason. Have you any suggestions to make?

The Technique of Photoplay Make-Up

"YOU cannot use much make-up for the movies. Particularly is this true if the pictures are made indoors, under the searching studio lights. Then rouged lips take on the color of uncured ham and beaded eyelashes become a cross between a king's moustaches and a porcupine's bristles. So usually we have to go it alone, with nature only slightly aided."

It was Miss Fan Bourke talking — Fan Bourke of Mutual Film stardom in drama and comedy. If any one should know thoroughly the technique of photoplay make-up it is Miss Bourke. For, if there is any rôle she has not played — from comedy scrubwoman or dog-catcher's bride to heavy villainess or sweet-faced madonna—it is solely because somebody in the studios failed to awaken from his torpor and wish the part on her. Wherefore we asked Miss Bourke, who used to be on the speaking stage and therefore knows the technique of both the spoken and the silent drama, to tell us some more about motion picture make-up.

FAN BOURKE, MUTUAL FILM STAR.

Above, as she is off stage. At the Left, in tragedy. At the Right, in an ingenue role. Below, in farce comedy.

(Photos. by Bangs, N. Y.)

"A girl who wants to become successful in motion pictures," said Miss Bourke, "has to start out with a few natural adornments. But these are not always the adornments that make men gaze upon her or women envious of her. Because a girl 'screens' well, as we call it, is not saying that she is easy to look at.

"On the contrary, there are many favorite photoplay actresses who, out of their films, are not beautiful except in the sense that they are interesting of appearance and intelligent of expression. Blue eyes that are of the prettiest in the drawing-room or on the street may be wholly inadequate for the sternly scrutinizing eye of the motion picture camera. A mouth whose lines

carry their own sweet messages may look on the screen like a torn pocket.

"To some extent we can with make-up remedy certain small defects of shape and color in the features. We even can turn a naturally bad line into a distinct asset.

"Now, as I see it, the spoken drama, pantomime and motion pictures are three distinct and diverse arts. Too often motion pictures are considered part of the pantomimic art. Nothing could be further from the truth. And so motion picture make-up is as distinctive as motion pictures: it is predicated upon one's methods of before-the-camera acting.

"Assuredly, success in motion picture acting depends on one's ability to think one's rôle so hard that it fairly exudes through the pores of the face. One thinks it hard against the inside of one's forehead (yes, it is as physical as that) and forces the idea against and through the camera lens. I think the success of directors like Griffith, Ince, Fleming and others of their class hinges on their ability to get their actors to do this.

"I have tried the plan, and it seems to succeed—for me, anyhow. I never use much make-up (fortunately, I have just enough natural color in my skin to overcome the green of the studio lights). But I do have to think my rôle and the lines I would be saying were it a speaking part as hard as ever I can, so that my eyes will look my thoughts and the lines of my mouth will echo my eyes.

"To be sure, one may accentuate a heavy dramatic or a farcical rôle by some trick of garb or hairdress. But all such trickery should but frame the face and the thoughts behind the forehead. The motion picture is not an X-ray machine, but it comes pretty close to photographing through the forehead the ideas behind it."

USING A BATTLESHIP IN A PHOTOPLAY

In the recent Lubin production entitled "The Insurrection," one of the scenes shows an American battleship bombarding a South American town where revolutionists are about to massacre all the Americans, as well as blow-up American vessels in the harbor.

The production of this unusual scene called for considerable preparation. To begin with, Director Terwilliger asked for, and succeeded in obtaining, permission to take scenes on board the battleship *Alabama*. He also was granted permission to fire a special light shell from one of the big 13-inch guns mounted by the warship. The shell was of special design and filled with a chemical capable of emitting an intense flash of light. It was constructed in the Lubin shops.

The climax scene of the film was taken at night. Four powerful searchlights concentrated their rays on the afterdeck, so as to permit the twelve cameras to register the action. Finally, the lights were extinguished at the command of Director Terwilliger and the cameramen continued to crank in pitch darkness. Suddenly the flash of a 13-inch gun penetrated the darkness, followed an instant later by a tremendous flash of light in the distance.

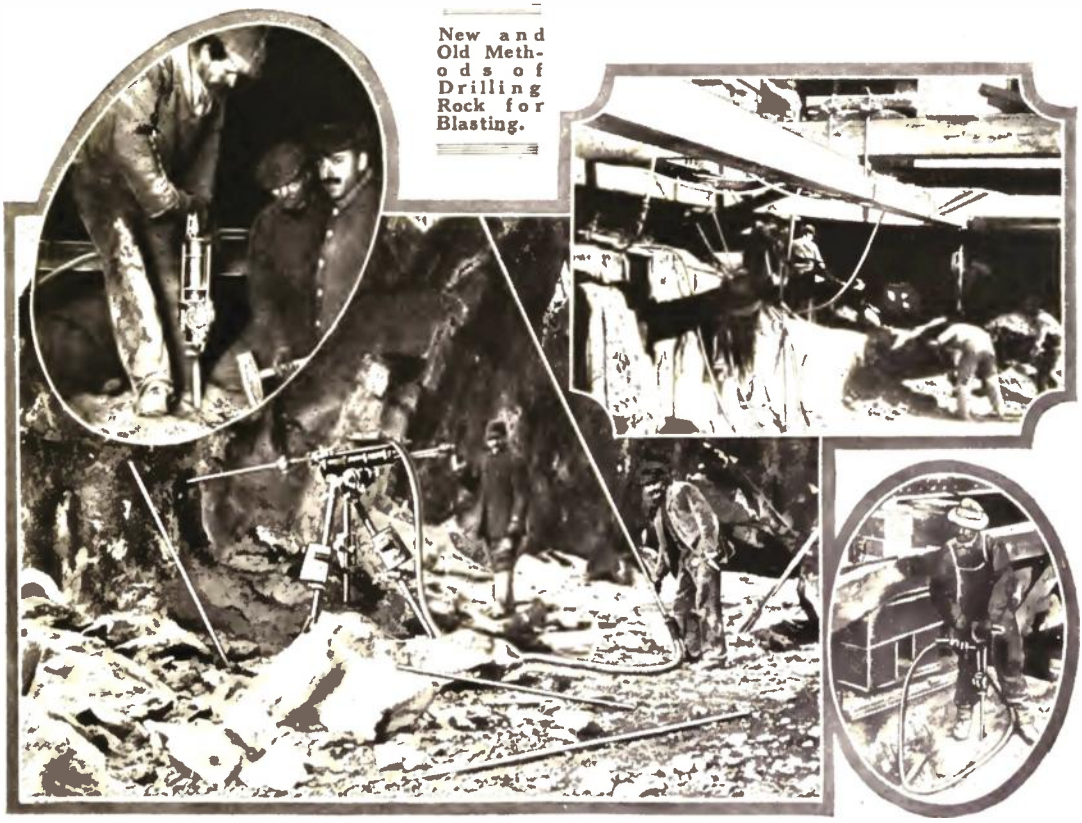
The realistic effect obtained in the finished picture does not fail to momentarily convince the audience that the shell from the big gun has wiped out the band of revolutionists who threatened the Americans.

NEW ANIMATED CARTOONS

A cartoon comedy, drawn by Carl Francis Lederer, of a somewhat different sort, and introducing a droll addition to the pen and ink creations of the screen, was released by the Lubin Company recently. The comedy is called "Ping Pong Woo." Ping is a Chinese urchin whose grimaces and gyrations are extraordinary examples of the camera's power to make a line of ink seemingly take on life.

HIGH SPEED REPLACES WEIGHT IN DRILLING ROCK

Quite a contrast in methods of excavating rock is furnished by the construction of the new subway system in New York as compared with the first New York subway, which was completed in 1904. In the former case practically all the rock was drilled by means of heavy reciprocating drills mounted on heavy iron tripods. Weight was the predominating factor—the apparatus was heavy and the blow was heavy, but the speed of operation was correspondingly slow; in fact, the apparatus was so cumbersome that it frequently required as much time to set up the drill as to drill the blast hole.



New and Old Methods of Drilling Rock for Blasting.

Hand drills without any mounting whatsoever are the principal means adopted for cutting the rock in the new subway. These little drills, known as Jackhammers, represent the other extreme. They weigh from forty to ninety pounds, depending on size, as against a total weight of from 500 to 1,000 pounds for the mounted type. The strange feature about these little drills is that, in spite of their size, they make faster progress than the heavier type. The secret of their great cutting speed is due to a number of factors. In the first place they strike three or four times as many blows per minute. The cutting steel does not reciprocate, but rests against the rock while a rapid succession of hammer blows strikes its upper end. At the same time the drill automatically rotates the steel and blows a jet of air down the hollow steel so as to eject the cuttings and constantly present clean rock to the cutting edges.

Furthermore, the dead time formerly consumed in setting up and adjusting is entirely eliminated with the new type of machine, as it requires but an instant to apply the drill to any spot desired, and the drill can be used conveniently in all sorts of out-of-the-way locations where cutting by any other method would be extremely difficult to accom-

plish. It is a common sight to see dozens of these little drills at work at all places where the excavations are open, and their peculiar humming sound may be heard all along the subway route where the workings are uncovered.

HOME-MADE AUTOMOBILE SHOWS MUCH INGENUITY.

Much ingenuity has been displayed by the driver of the automobile shown in the

Although Built from Odds and Ends, this Automobile Affords Much Pleasure to its Owner.

accompanying illustration. During his spare time he succeeded in constructing this vehicle from odds and ends. The automobile is capable of carrying his entire family and compares favorably with most manufactured cars in general practicability.

GLASS COOPS INCREASE POULTRY PROFITS.

The results of raising and keeping chickens in coops equipped with glass windows are eggs and plenty of them, according to a man in New Mexico who has experimented along these lines.

The chicken coops are made of ordinary ⅞-inch lumber of the dimensions 3 by 6 by 2 feet 4 inches high; that is to say, the coop is two feet high and rests upon a four-inch foundation. In the foundation a partition is made directly in the middle; a board floor three feet square being placed over one-half the coop floor space, while the other half forms a dirt floor, where grain of any kind can be sown for scratching. On the board floor is placed a quantity of litter under which grain is scattered at night, so that in the morning the fowls will scratch for their breakfast. The grain sown in the dirt is also scratched for, and what is not found will sprout, so that none of it is wasted. By this system of coops and feeding the hens have to work for every bit of grain they get, and it is this compulsory exercise that produces the results.

The coops were tried out two years ago by placing five pullets in each, and during the winter four or five eggs a day were secured from each coop. This rate continued, although the thermometer went down to 17 degrees below zero. Last December fourteen hens were kept in these coops, with a return of 32 dozen eggs for the month.

In addition to the grain, the hens receive plenty of fresh water, charcoal, grit and oyster shells, as well as a dry mash composed of one part each of wheat

Increased Poultry Profits Are the Result of the Use of Glass Chicken Coops.

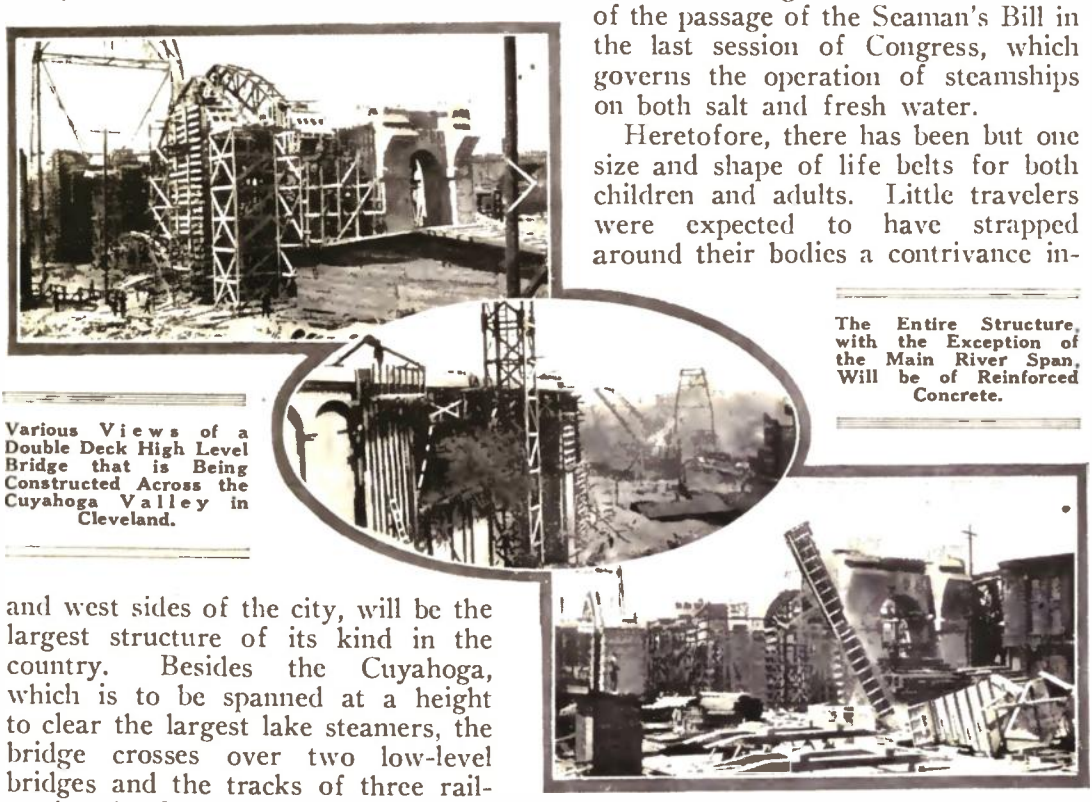
bran, alfalfa meal and whole oats, while a little fresh beef scraps go into the coops once a week. Green stuff in addition to the sprouted grain is also supplied.

The top of each coop can be raised to any desired height to admit air, the chicken wire cover preventing the hens from escaping. The glass sides of the coops are turned to the south in winter in order to secure plenty of heat, but in summer they are turned to the north and

the coops are kept in the shade. With the glass acting as a hothouse, the chickens keep warm even in winter weather, and the animal heat keeps them comfortable even though the top of the coop is open a little for ventilation.

A DOUBLE-DECKED CONCRETE BRIDGE

The double-decked, high-level bridge which is being built across the Cuyahoga valley in Cleveland, connecting the east and west sides of the city, will be the largest structure of its kind in the country. Besides the Cuyahoga, which is to be spanned at a height to clear the largest lake steamers, the bridge crosses over two low-level bridges and the tracks of three railroads—the Erie, the Big Four and the Baltimore & Ohio.



Various Views of a Double Deck High Level Bridge that is Being Constructed Across the Cuyahoga Valley in Cleveland.

The Entire Structure, with the Exception of the Main River Span, Will be of Reinforced Concrete.

The entire structure, with the exception of the main river span, will be of reinforced concrete. There will be twelve concrete arches averaging 140 feet in length, and the west and east approaches will be 386 and 230 feet, respectively. The concrete arches will be reinforced with 6,000,000 pounds of steel bars and 746,000 pounds of structural steel. The main river span will contain 3,800 tons of steel.

The upper deck of the bridge will be used for vehicles and foot travel. It will have a roadway forty-five feet wide and two fifteen-foot sidewalks. Four street car tracks will cross the lower deck of the structure. The concrete tower pylons will be 145 feet above the ground.

LIFE BELT ADJUSTED TO ANY SIZED CHILD OR ADULT

An adjustable life-preserver has been designed in Chicago as one of the results of the passage of the Seaman's Bill in the last session of Congress, which governs the operation of steamships on both salt and fresh water.

Heretofore, there has been but one size and shape of life belts for both children and adults. Little travelers were expected to have strapped around their bodies a contrivance intended to be worn by the small, middle, and heavy weight men and women.

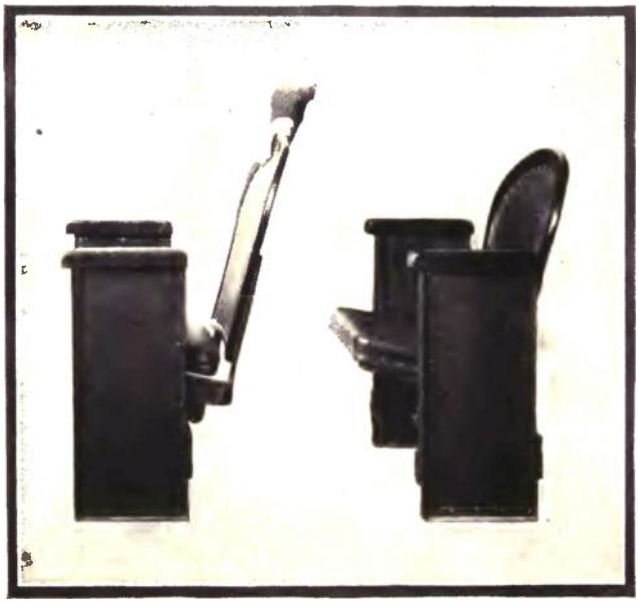
The new law requires a steamship to be equipped with life belts for both adults and children. In case of an emergency, a child would have to search for a child's belt, while the men and women passengers would have to seek the sizes for grown-ups.

The manager of a steamship line and a mate on one of the boats have jointly contrived an adjustable belt calculated

to fit a body of any girth. It may be adjusted in a jiffy to encircle the waist of a small boy or girl, or any man or woman from the lightest to the heaviest. This is the first known attempt to fashion a life preserver designed to snugly fit the body and allow free, unhampered use of arms and legs in striving to keep afloat until rescued.

MOVABLE SEATS FOR PICTURE THEATRES

It has always been a problem to get in or out of a theatre seat without disturbing persons sitting in the same row or in the rear rows. What promises to eliminate this existing difficulty is presented in the invention of a Seattle contractor. This invention consists of a chair which is so constructed that the seat portion is movable and has a backward play of about 5½ inches. Instead of making it necessary for every person in a row to stand up to allow another person to pass in or out, the new chairs enable the person sitting down to slide back a few inches and thus provide ample room for passing.



No Longer Will it be Necessary for an Entire Row of Persons to Stand Up at a Motion Picture Theatre to Allow One to Pass to and from a Seat When These Movable Seats Are in Use.

PASSERS-BY ATTRACTED BY NOVEL FLORAL DISPLAY

A florist in New York City has hit upon an ingenious way of attracting the attention of passers-by and thus divert customers into his store. His advertisement consists of a window display showing a garden landscape in miniature. From one corner of the window a garden hose is suspended, from which water appears to be pouring forth. Instead of water, however, pieces of string are inserted in the nozzle and lead in all directions over the garden.

TREMENDOUS SPEED CHARACTERIZES NEW AIR BOAT

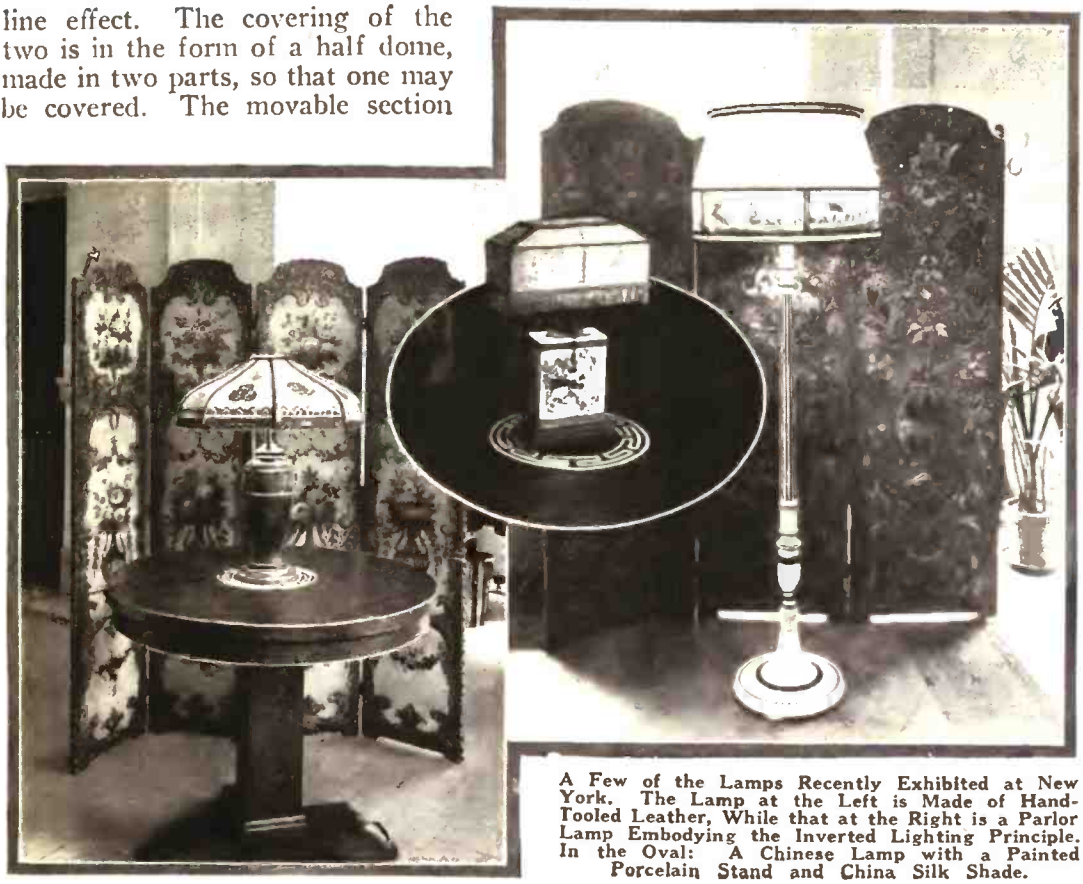
Greater safety and tremendous speed are the important features of a new model hydro-aeroplane which was recently tested by its inventor, Anthony Jannus, of Baltimore. The tests were made over historic Fort McHenry. Seventy miles an hour on the water was made by the new machine on its trial trip, and eighty miles was the speed attained in the air.

Staggered planes are used in the new hydro-aeroplane; the upper plane extending beyond the lower for eighteen inches. By this means the lifting power of the machine is greatly increased.

The uprights used in its construction are markedly different from the usual struts, and are made so as to offer the least possible resistance to the passage of the machine through the air. Whereas on the older models there are sixteen uprights used, this machine has but six, so that air resistance from this source is cut one-fifth. These unique uprights are adjusted to the center of the planes, instead of to the front and rear ends.

The hull of the boat is 25 feet over all, and in it are placed the controls, engine and aviator's seat. The bow of the boat is made so as to produce a stream-

line effect. The covering of the two is in the form of a half dome, made in two parts, so that one may be covered. The movable section



A Few of the Lamps Recently Exhibited at New York. The Lamp at the Left is Made of Hand-Tooled Leather, While that at the Right is a Parlor Lamp Embodying the Inverted Lighting Principle. In the Oval: A Chinese Lamp with a Painted Porcelain Stand and China Silk Shade.

covers a sort of promenade that leads to the passenger compartment. The construction of the hull is quite a deviation from established models. It has a V-shaped bottom instead of the flat bottoms formerly used, permitting the machine to rise more readily from the water.

ORNATE TABLE LAMP COSTS HUNDREDS

Electricity has grown in two opposite directions: It has brought cheap, healthful light to the poor and it has opened up new avenues of expenditure for the rich. A hovel may be wired for a few electric lamps at a cost of five dollars, while the elaborately intricate systems of concealed lighting which are installed in the mansions of the wealthy cost thousands of dollars. A highly ornate table lamp was recently shown at an exposition in New York which was worth $250, and a hand-tooled leather screen which served as a background, $250 more. Exhibited with this lamp were others ranging in price from $6 to more than $250.

CURIO DEALERS ON EUROPEAN BATTLEFIELDS

The most numerous visitors on the battlefields of Europe are the curio dealers of the belligerent and neutral countries. These men are endeavoring to buy trophies of all kinds which they believe in time will be valuable. In Belgium these dealers have bought articles for next to nothing and which at the end of the war will be worth a fortune. Fanciers who secure such trophies hold them for high prices or will not sell them on any consideration.

A bookseller during the American Civil War made his fortune in collecting

and selling trophies. When the cargoes of the blockade runners were sold at auction in the harbor of Hamilton this book dealer bought a number of package cases without the least knowledge of their contents. These turned out to be boxes of old brass buttons on their way to the Confederate headquarters for use on the uniforms of the southern soldiers. This man made his fortune on these buttons which he bought so cheaply.

A CLOCK THAT INDICATES BIRTH AND DEATH RATES

An unusual device intended to illustrate the national carelessness in the matter of preventable deaths has been built for the exhibit of the National Conference on Race Betterment at the Panama-Pacific Exposition. The device is a clock which, in addition to giving the correct time, also gives a graphic illustration of the frequency of births and deaths in the United States. For every birth—there are four every minute—a white ball ascends the column at the left of the dial. For every death—three each minute—a red or black ball descends the columns to the right of the dial. Of the "death balls," one is black and two are red, indicating that two out of every three deaths are due to diseases which are preventable through proper hygiene and health caution. The clock is operated by electric power, two small motors being concealed among the works of the clock. The added functions of the time-piece do not disturb the time-keeping excellence of the strange clock.

Unique Clock Which is Being Exhibited at the Panama-Pacific Exposition and Serves to Indicate the Number of Births and Deaths in the United States Every Minute.

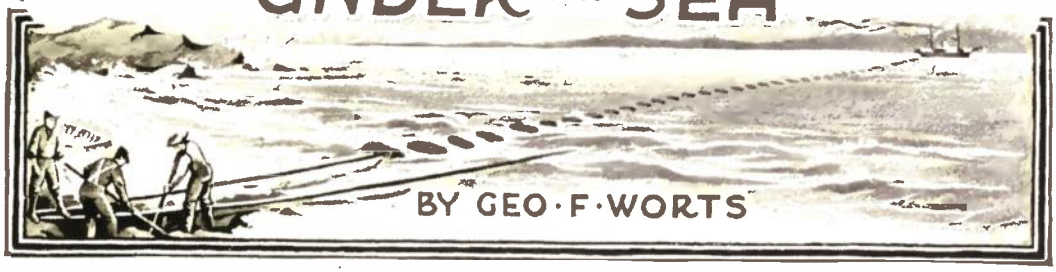
NAVY DRY DOCK REPRODUCED

Among the many instructive exhibits in the Palace of Manufactures at the Panama-Pacific Exposition is to be found a very complete model of Dry Dock No. 4, located at the New York navy yard. This model was constructed under the supervision of a corps of civil engineers of the United States navy, and is particularly instructive because it shows the arrangement of the materials and the construction of the hidden parts of the dock.

NEW FIELD FOR RADIUM

Since great physicians began experimenting with radium as a cure for cancer, mankind has placed far greater importance on its future and every possible means is being tried to make its production cheaper and easier. In view of these facts, scientists are much interested in the announcement that Dalavit, on Loch Lomondside, in Scotland, is to be the home of a new radium industry. John S. MacArthur, a noted metallurgical chemist, it promoting the plan, and he believes the cost of the product can be lessened materially.

KEEPING the DOTS and DASHES UNDER the SEA



BY GEO·F·WORTS

ONE puncture the size of a needle in a three thousand mile length of submarine cable would sever the ties that bind continents. The utmost care must be observed in the manufacturing, the laying and the repairing of cables. Every step taken is the result of exhaustive scientific research, of the rigid guidance of experienced engineers — for millions of dollars are staked on the success or failure of the tiny thread of copper which reaches out under the sea.

BECAUSE a whale became entangled in a submarine cable, one of the arteries through which throbbed the life of two continents was severed. That is just one of the contingencies which may arise to test the resourcefulness and the daring of the "trouble shooters of the depths." Another time, a hungry tiger shark bit deep into the gutta-percha insulation and let the dots and dashes leak out into the sea. But before relating any further mishaps, let us turn to a few of the interesting incidents in the career of a submarine cable which leads to the point where the first-aid-to-the-injured services of a repair ship are required.

The War and the Cable

Before hostilities began in Europe, 322,000 miles of submarine cable were in operation—more than enough to encircle the world a dozen times. It would be difficult to say just how many miles have been destroyed or rendered inoperative by the warring powers. Raising a cable in shallow water and cutting it, if its approximate location be known, is a comparatively simple matter. But it is a much easier matter to steam into an unguarded port, where a cable station is located, and destroy the instruments, as did the German cruiser *Emden*, for instance, at Discovery Island. Then, too, a cable may lie between two hostile nations, Germany and Great Britain, for example; needless to say, the Anglo-German cables will lie idle until the war is over.

Submarine cables owe their successful existence to the fact that gutta percha, a form of rubber gum, has high electrical insulating qualities, and, like the cypress, will deteriorate if it is not submerged in water.

Gutta percha is the sap of a curious tree found in the Malay and Sunda Ar-

chipelagos, off the southeast coast of Indo-China. It is drawn from the trees as a thin, milky fluid, which soon discolors and rapidly becomes thick and gummy.

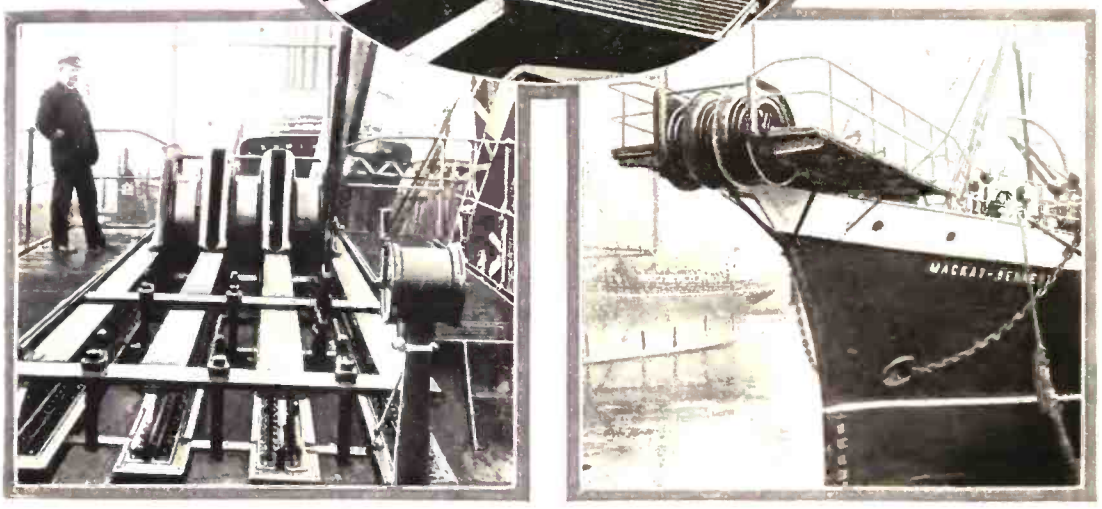
The Heart of the Cable

The copper wire which forms the core of the cable must be the purest obtainable, or the flow of electricity will be retarded, and the efficiency greatly lowered. The size of the wire has quite as great an influence upon the conductivity; the smaller the wire the greater will be the retarding effect. To illustrate: a copper wire which weighs 100 pounds per nautical mile is not nearly so conductive as one which weighs 200 pounds. In several of the modern Atlantic cables 700 pounds of copper are used every mile.

Early in the career of electricity the discovery was made that a conductor made up of a number of strands of fine wire possessed far more strength than a solid conductor of the same weight. Consequently, the stranded core, in spite of its greater cost, has been universally adopted.

Although there is no particular reason why the bulk of submarine cable should not be made in America, it is manufactured almost exclusively in Europe. Giant machines are used in stranding the cores. As the wire emerges, it is coiled in three-mile lengths on huge drums. The process is completed by coating the copper with an insulative and a protective covering of gutta percha and metal.

The cable, which lies along the bottom of the sea at a depth of several miles, is in no particular danger of destruction, and, in consequence, it is small and light. Giant fish ordinarily do not penetrate to a depth of more than several hundred fathoms, because of the pressure. Closer to shore, however, the danger from this and other sources is greater.



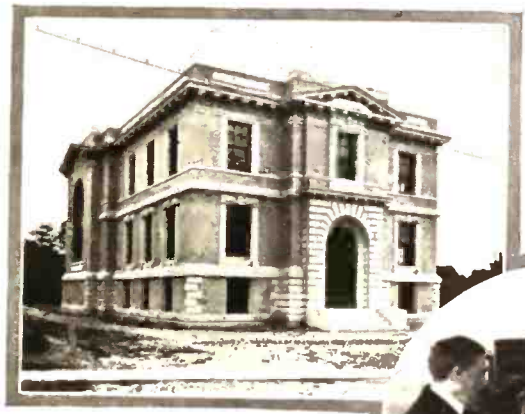
The Sheaves of the Cable Steamer "Mackay-Bennett." At the Left: The Bow Cable Sheaves as Viewed from Inboard. At the Right: Another View of the Bow Sheaves that are Used for Paying Out and Picking Up Submarine Cables. In the Oval: The Stern Sheaves that are Used for the Same Purpose as Those at the Bow.

Intemperate Workmen a Menace

The shore end of the cable is often

four times as thick as the deep-water type. The copper wires are first wrapped with gutta percha, then brass tape; next, a thickness of jute yarn is applied, followed by a sheathing of galvanized iron wire, more jute, more wires and a final outer covering of jute-steeped yarn. Accordingly, while the deep-sea portion of the cable may weigh no more than 2½ tons per mile, the shore end, armored against icebergs, may weigh 60 or 70 tons.

A deep-sea cable jointer must be a man both temperate and healthy. It seems incredible, but nevertheless it is true, that the exudation of the pores of the skin at the finger tips of intemperate or unhealthy workmen contains harmful secretions which will in time rot the gutta percha.



Above: The Cable Station at Far Rockaway, N. Y. In the Circle: A Commercial Cable Company Operator at His Instruments in the Far Rockaway Station.

Below: General View of the Instrument Room at the Far Rockaway Station. The Messages are Received on Paper Ribbons, Thus Comprising a Permanent Record.

When the cable is completed, it is coiled with the precision of thread in large water tanks aboard the cable ship in readiness for laying. The largest cable ship is the *Calonia,* of London, which was used in laying the trans-Pacific cable of the Commercial Pacific Company. The *Calonia* is 500 feet long, with a capacity of 4,000 miles of cable.

Cables of any considerable length have only one core, as the nearness of two parallel wires in a circuit several thousand miles long would create a powerful electrical disturbance which would interfere seriously with the transmission of messages. The longest cable with two cores is only a trifle longer than five hundred miles. It is laid between Canso, Nova Scotia, and Rockport, Mass.

Surveying the Bottom of the Sea

The cost of laying a submarine cable is enormous, so that the greatest precautions are observed in order that the thin line of copper lying miles deep does not come in contact with the smallest trickle of sea water. In case any of the numerous undersea enemies of the cable should attack the insulation and let the water in, a second necessity arises—that of laying the cable so that it can be drawn readily to the surface for repairs. These two problems are solved, first, by making the cable flexible as well as strong, and, second, by surveying the sea bottom over which the cable will lie.

The geography of the ocean floor is in many respects a counterpart of the topography of dry land. That is to say, there are hills, valleys, plateaus—even an occasional volcano. The question: does a submarine cable sink to the bottom of the ocean? is answered very emphatically in the affirmative. The waters of the sea are never at rest, and a cable spanning two subterranean mountain peaks would

be chafed through in short order. Accordingly, the bottom of the sea is carefully surveyed beforehand, and the smoothest route selected.

These soundings not only reveal the contour of the ocean floor, but they also determine the chemical quality and the temperature, both of which have a decided influence upon the life and the behavior of a cable. If the examinations should prove that the ocean floor contains chemicals injurious to the protective covering, a wide detour is made. The matter of volcanic heat is as interesting as it is troublesome. Heat lowers the electrical conductivity of a wire as well as the insulative ability of the gutta percha; moreover, it shortens the life of that insulation to a serious extent. An ingenious sounding machine, invented by Lord Kelvin, is used for making the surveys.

Landing the Shore Cable

As I have explained, the laying of a cable between two continents does not consist merely of tying one end to a post on one shore, and paying it out while the vessel steams at top speed to the opposite side. The numerous steps of the process are based on long scientific experience, and they are carried out with painstaking attention to the smallest details.

The shore end of the cable is usually landed by means of rafts and india rubber buoys, which are anchored to the bottom. A trench running from low-water mark to the cable hut is dug and the cable laid in it and covered.

When the ship is finally under way, the deck presents a scene of lively interest. The cable is dragged into the water from the storage tanks, like thread from the paunch of a spider. Between the drum and the sheaves at the stern, over which the cable slips into the water, stands the dynamometer. This instrument registers the strain to which the cable is subjected; it is, so to speak, the finger on the pulse of the entire enterprise.

As deeper water is reached the weight of the cable increases, and brakes must be applied to the drum. In 2,900 fathoms, with the ship progressing at the usual rate of eight knots, more than twenty-five miles of cable are in suspension.

If the Cable Should Break!

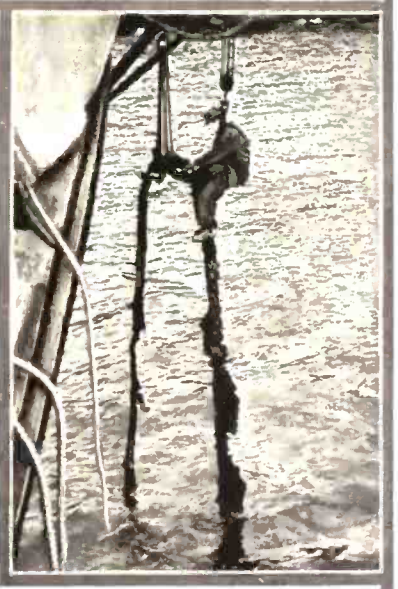
Near the drum from which the black, snake-like reel is uncoiling, the testing room is situated. Here, an expert electrician bends over a table littered with gleaming instruments. An electrical connection is made between the cable and a delicate receiving instrument — the mirror galvanometer. Every fifth minute an electrical impulse is sent out from ashore, and the spot of light of the galvanometer flutters back and forth. As the cable sinks into the freezing-cold water at the ocean bottom, the insulation steadily improves, and the spasms of the point of light weaken until it finally sinks almost to the zero point. A defect in the insulation is indicated by a sudden violence of the light spot, and the repair is quickly made.

When the first drum is uncoiled the vessel is brought to a stop, and the delicate task of splicing the two cable ends is performed. To the observer, an exaggerated amount of pains seems to be taken in splicing a deep sea cable, but every precaution is absolutely necessary. Air holes in the insulation, no matter how tiny, when they are subjected to the enormous pressure of the sea will burst, water will rush in—and the cable will be useless.

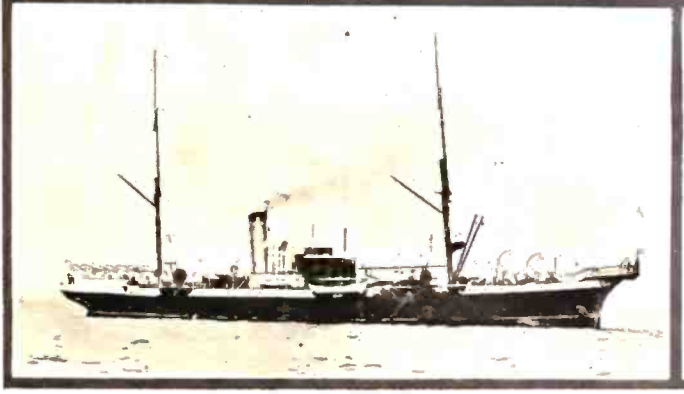
When a storm comes, the odds are heavily in favor of losing a cable. To avert such a mishap, buoys are slung in the rigging ready to be lowered and attached to the broken line at a moment's notice. In spite of this precaution, the cable may snap, as the ship pitches and rears, and slip overboard. Its recovery then resolves itself into a search of long, anxious days—often weeks—and occasionally months. The ocean bottom must be dragged with grappling hooks — a blind, groping, discouraging task. For that reason, very naturally, the shallowest possible route is selected.

During the preliminary surveys for one of the trans-Pacific cable routes, a "valley" nearly six miles deep was sounded, off the island of Guam. The

LIFE ON BOARD ONE OF THE CABLE SHIPS



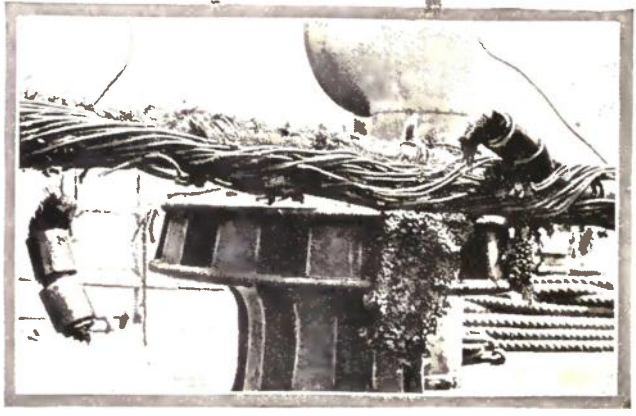
Above: Grappling for a Cable at Close Quarters. As May be Seen in this View, the Cable Ships are Often Obliged to Operate Very Close to the Shore. At the Right: Hooking an Ocean Cable in Order that Repairs May be Made. In the Oval Below: Crew of the "Mackay-Bennett" Breaking Away Ice from the Forecastle.



Above: A Seven-Ton Buoy which indicates the Location of a Cable End. At the Left: The Cable Steamer "Mackay-Bennett."

pressure at that depth is about five tons per square inch, and as it would be quite impossible to recover an injured cable at that point, a wide detour was made. Most of this cable, incidentally, lies in water deeper than three miles.

In the telegraph code the letter "e" is translated into a single dot. The electrical impulse which carries this signal down under the Atlantic, from America to England, consumes, in time, about one-sixth second—an eye-wink—reckoning the speed of electricity at 180,000 miles per second. When the first cable was laid, 500 volts of electricity—enough to drive a street car—propelled the dots and dashes from one side to the other. The life of the cable under that terrific strain was tragically short. It performed fitfully during a brief two months, from August 17, 1858, until the latter part of October. Then the powerful currents, continually seeking an escape, finally broke through the weakened insulation of the cable.



Above: A Section of an Ocean Cable on the Deck of the "Makay-Bennett," Ready to be Repaired. Below: Another Near View of an Ocean Cable, Showing How Damaged the Covering May Become, Especially in the Instance of Cables Near Shore.

The mirror galvanometer, an invention of Kelvin, was then adopted, because only a fraction of the original current was required to operate it—a battery the size of a child's thimble was sufficient—and it increased the speed of transmission six times. Twenty years later, Lord Kelvin, who has been most aptly named "The Father of the Cablegram," perfected the siphon recorder, which prints a graphic record of all messages. Additional improvements came in the form of the automatic printing machine, which entirely eliminates the error of the human equation, and a duplex circuit system which ingeniously permits two messages to go over one wire at the same time. These improvements and others of later origin and lesser importance are incorporated in the majority of present-day cable systems, although the old mirror-galvanometer can still be found in a few out-of-the-way corners of the world.

Hundreds of accidents may happen to a cable to interrupt the flow of conversation between continents. In very deep water the sea bottom consists of decomposed shell matter known as *globigerina ooze*. This substance is harmless, and cables recovered from a globigerinous floor after a repose of thirty years were as sound as the day they were laid. Greater danger lurks in shoal waters. One of the tiniest but most terrible enemies of the cable is the teredo worm; apparently it thrives on a diet of gutta percha! The attacks of

the teredo are repulsed with a thin sheathing of brass. A more inert but none the less virulent enemy is the chemical iodine, which is a by-product formed in the maturation of sea-weed. Iodine rapidly corrodes the armoring wires of the cable.

In the Pacific, where the sea bottom occasionally displays the acrobatic ability of rising and falling a few miles overnight, a submarine cable leads a life of extreme uncertainty. Volcanic eruptions, which will burn a cable completely in two, although not frequent, are a constant potential danger.

The shore ends of all cables are regularly subjected to the strain of surging water; tides, storms and the general restlessness of the sea—the "ground swell," as it is called—all contribute. Anchors of vessels, wrecks and icebergs are a constant menace.

The Trouble-Shooters of the Deep

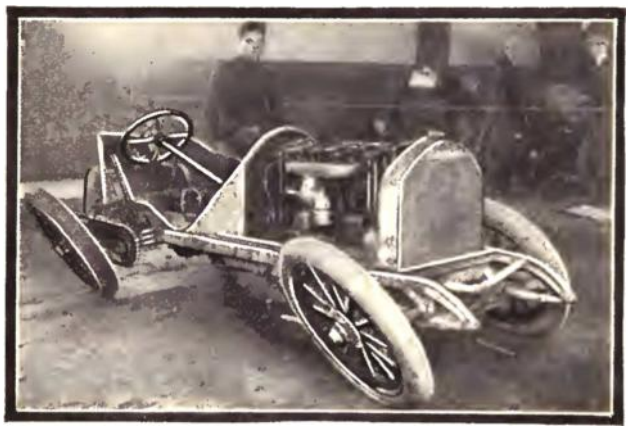
The exact location of a puncture in a cable is found with delicate electrical testing instruments which are connected at either end. The latitude and longitude are immediately given to the commander of the cable ship, and he steams post haste to the zone of trouble. The bottom of the sea is dragged, the cable pulled to the surface, and the repair quickly made. Unfortunately, cables usually break during the heaviest storms of the year, and the task of the trouble-shooters demands the highest qualities of fearlessness and skill. The *Mackay-Bennett,* during one spell of bad weather not long ago, remained at sea three months in the endeavor to make a single repair. She was repeatedly blown hundreds of miles away from the ground of operations.

In conclusion, the fact may be again emphasized that putting a submarine cable under the sea is by no means a haphazard proceeding. Every step is the result of years of experience, of the tireless planning of scientists, of the rigid guidance of skilled engineers—to insure the millions of dollars that are staked on the ability of the slim line of copper to carry the voices of the nations to the ends of the world.

THE WORLD'S OLDEST RACING CAR

In the accompanying view may be seen the oldest racing automobile in the world. It is the Fiat Tornado last used by Louis Meneghetti, and the illustration shows the car as it was picked up from a short, circular dirt track in a western state. A Richmond (Va.) capitalist now owns the car, which has undergone extensive repairs, and it will be seen on some of the well-known tracks during the next season.

Meneghetti, before he was killed, said this car could not over-turn on a short track if it were properly controlled. He gave that reason for his triumphant success with the car in South America. But the car did over turn, despite the slant of the wheels which was intended to overcome the tendency of an automobile to fall over when taking curves at high speeds.



The Slanting Wheels of This Early Racing Car Were Intended to Prevent Overturning—But They Did Not.

Safer and Better Motion Pictures

By Robert G. Skerrett

HEREAFTER, according to a recent invention, it will be possible to show moving pictures in broad daylight, and there will be no further need to darken the places in which "movie" entertainments are given. The spectators will be able to sit in a brightly illuminated room or out-of-doors, and there will be no necessity for that gloom which has proved itself in the past a cloak for a variety of questionable ends.

The new invention certainly promises to revolutionize the art in more ways than one, and its most striking feature is extreme simplicity. At present, an opaque screen or kindred white surface forms the reflector by which the illumined image is cast back into the eyes of the spectators. The picture is projected against the screen from some point in the midst of the audience; the reflecting surface absorbs a considerable percentage of the light; and what is left is made seemingly bright by darkening the surrounding space. It is a contrast that would not exist if the place were otherwise illuminated. But this is not the only handicap to successful motion pictures under present conditions.

If the patron of such a theater has been unfortunate enough to get a seat well off to one side he sees the screen at an acute angle, and all of the images are unpleasantly foreshortened. Only the spectators in the middle of the theater, and these, of necessity, are comparatively few, escape this distortion. Again, the contrast between the shimmering pictures and the enveloping gloom hurts the eyes. Mr. John F. R. Troeger has disposed of these difficulties by means of a translucent screen of novel construction, and at the same time he has provided other betterments through its use.

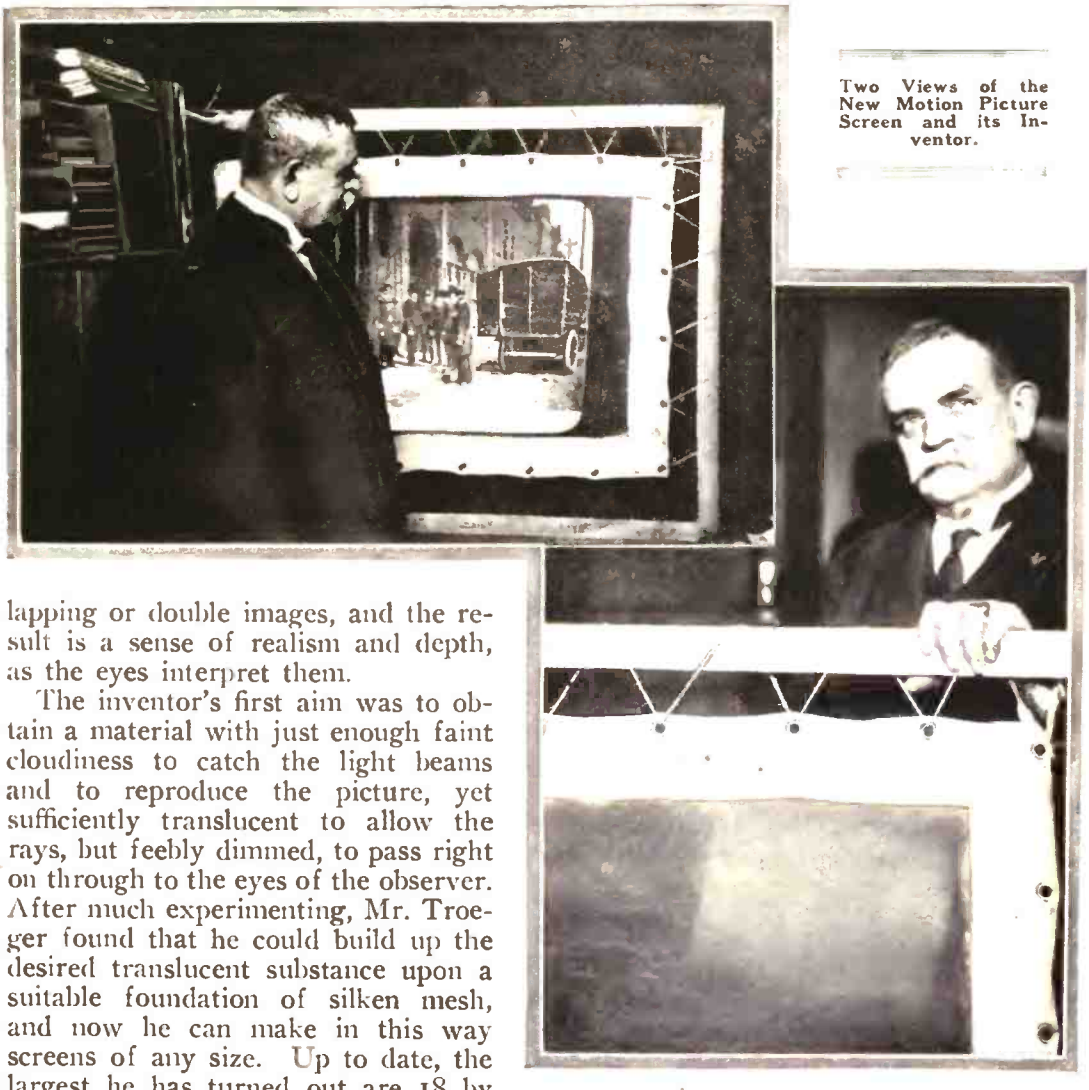
To-day there are at least 19,000 moving picture theaters in the United States, and the attendance numbers every twenty-four hours something like 17,000,000 persons. Every once in a while we hear of a fire or a panic in a show of this sort, and the peril is directly due to the presence of the machine and its inflammable reels right in the body of the house and among the audience. The reflecting screen is at the bottom of the menace. It was to overcome this danger that Mr. Troeger spent a long time in hunting for a suitable material for a translucent screen, for he wanted to make it possible to place the picture apparatus in a fireproof annex at the rear of the theater, back of the stage, from which the images could be thrown through a small hole in the intervening wall.

As he says, "It will thus be clear that I have provided a screen which may be disposed between the projecting machine and the spectators, upon which the picture may be cast so that the rays of light pass directly from the machine to the audience, thus increasing the intensity of the light and making the image visible day or night. By reason of the novel formation of the screen, the picture stands out in relief and is much more lifelike than kindred images heretofore exhibited." How is this?

The translucent screen is ribbed vertically on its front face, and these corrugations are virtually prisms, so that the refracted beams are bent well to the right and left, as well as projected directly ahead. The first effect of this is that there is very little of the distortion due to foreshortening which is so noticeable with the ordinary screen—the spectator well off to either side has substantially as perfect a picture as his fellow sitting in the middle of the hall. But this does not explain the feature of improved relief now not possible with the usual apparatus and the commonly-employed reflecting surface.

A photograph is flat because it reproduces the picture impressed upon a single objective. The sense of depth which we get in looking at objects is due to the employment of two eyes and

the fact that each orb sees the scene from a different point. These double images are blended and produce a single impression upon the mind. This is what is called the stereoscopic effect of double vision. Mr. Troeger eliminates the flatness of the ordinary moving picture by means of his screen's vertical ribs. These prisms give slightly overlapping or double images, and the result is a sense of realism and depth, as the eyes interpret them.



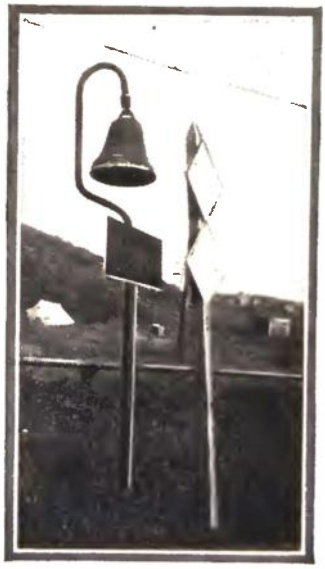
Two Views of the New Motion Picture Screen and its Inventor.

The inventor's first aim was to obtain a material with just enough faint cloudiness to catch the light beams and to reproduce the picture, yet sufficiently translucent to allow the rays, but feebly dimmed, to pass right on through to the eyes of the observer. After much experimenting, Mr. Troeger found that he could build up the desired translucent substance upon a suitable foundation of silken mesh, and now he can make in this way screens of any size. Up to date, the largest he has turned out are 18 by 20 feet.

Apart from the ordinary field of entertainment, he now looks to daytime advertising as a further direction of valuable employment. Where electric signs serve their purpose only after nightfall, movies, designed for the same end and using the Troeger screen, could be effectively displayed at any hour. Open-air shows, that cannot now begin until dark, may operate early and late to the advantage of both the public and the proprietors. The public lecturer should find this new screen a great aid, for instead of talking into a darkened hall he will hereafter be able to see his audience and to respond more sympathetically to the mood evidenced by their faces. In educational work, much may be gained by the improved sharpness of the pictures and, for students engaged upon technical subjects, exact reproduction is very important. As we have seen, the screen eliminates or greatly reduces abrupt foreshortening.

THE EL CAMINO REAL BELLS

The El Camino Real bells are a feature of the motor travel through California. In the olden days when the Spanish government was in control of the section now known as California, a winding road led from the northern to the southern limits of the state, and still farther. At that time this road was known as the El Camino Real, or The King's Highway. This was the thoroughfare which connected the various missions of California, and it was along this road that Anna B. Pitcher established refreshment and rest rooms. During the past few years this road has been transformed from the crooked, winding cow trail to a comparatively straight boulevard, improved under the most modern methods. In making this boulevard care was exercised to deviate as little as possible from the original highway. In order to retain the idea of this road being first cut by the Spanish, and also to remind travelers that this was the original Mission road, hundreds of bell-like indicators have been erected, one at each mile point. Divergent and cross roads and also historic objects and points are indicated on the metal sign of the bell post. The distance and directions to various towns and cities are also indicated. The series of El Camino Real bells extends from San Diego to Sonoma, in Sonoma county, and lends an atmosphere of distinct attractiveness to the famous highway.



Hundreds of Bell-Like Indicators Dot the Original Mission Road of California.

ANCIENT CHINA AND MODERN ELECTRICITY

It is a sign of the progress of the Chinese people that on the grounds of the Chinese exhibit at the Panama-Pacific Exposition the modern electric globe is applied as a source of light for the ancient Chinese lantern. Beside the miniature Ancient Wall of China and the curiously beautiful examples of Far Eastern architecture stands a strictly American lamp post from which is suspended a beautifully marked Chinese lantern, electrically lighted—the only sign of advancing civilization in the Chinese exhibit.

A PIONEER AMERICAN LOCOMOTIVE

One of the most interesting of old-time American locomotives is the "Atlantic," the second locomotive used on the Baltimore & Ohio Railroad. This engine was built in 1832 by a watchmaker named Phineas Davis of York, Pa., who also constructed the "York" one year previous, the latter being the first locomotive used by that railroad. Along with some forty odd locomotives, among them many historic ones such as the "Thomas Jefferson," "Mt. Vernon," "Mississippi" and the "Sandusky," the "Atlantic" has been stored in the shops of the railroad at Martinsburg, W. Va., since the St. Louis Exposition.

The Second Locomotive Used on the Baltimore & Ohio Railroad.

MEDICAL ELECTRICITY'S LATEST TRIUMPH

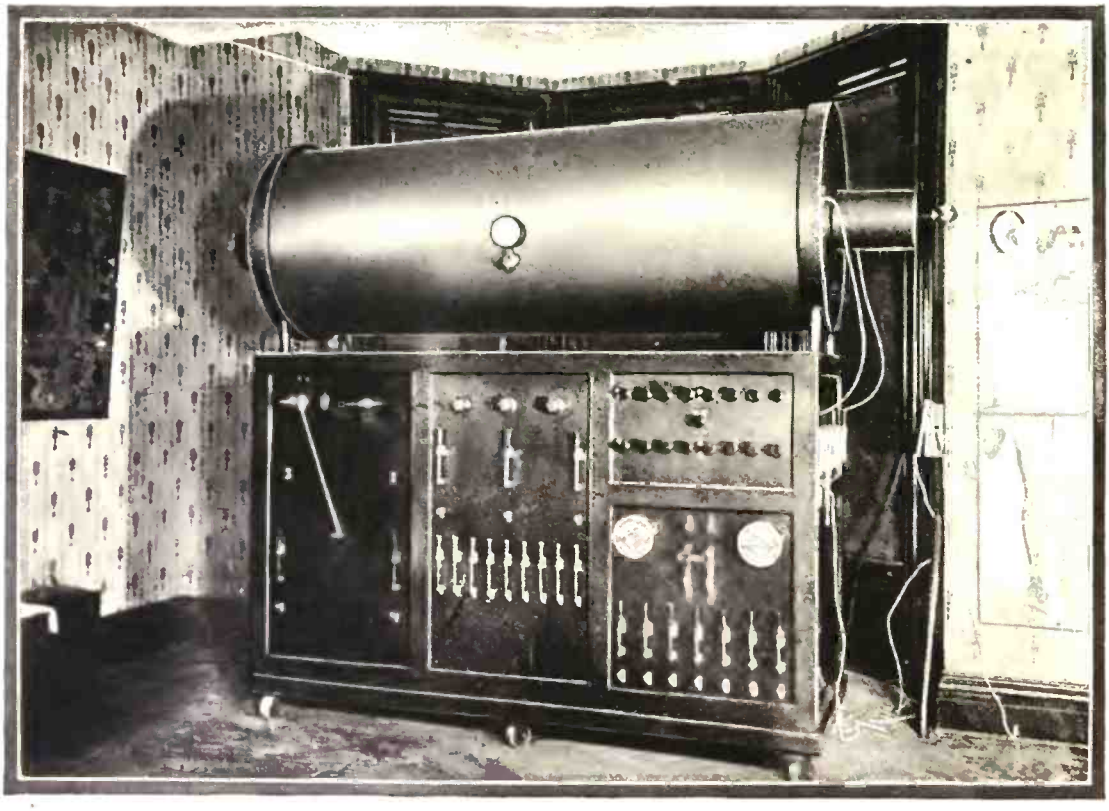
By THOMAS STANLEY CURTIS

THE tendency in the development of X-Ray apparatus has been largely in the direction of greater power and penetration in order that the exposure required for a radiograph of the heavier portions of the body might be reduced to a minimum. Little has been told the public of the efforts expended to make the Roentgen ray safe—to reduce the danger of the horrible burns so prevalent in the early days of the art. Within the last month comes an announcement of a new type of apparatus which, according to its inventor, combines the features of power, speed and safety to an astonishing degree.

"MY apparatus generates a burnless X-Ray." Such was the simple and direct answer to his first question when the author called on Charles H. Stanley at his New York laboratory in search of particulars relative to the new electro-therapeutic apparatus that the little bird had whispered was to be found at a certain address. Realizing, of course, that a statement fraught with such tremendous importance was not to be taken at its face value, the inventor immediately proceeded to elucidate.

In response to the natural inquiry as to why his new ray did not exhibit the burning tendencies of the familiar X-Ray, Mr. Stanley instantly came back with the question, "Why does the conventional ray produce these burns?" Frankly, we did not know beyond the fact that the action of the X-Ray is destructive to the tissues when applied in dosages above a certain degree. Just why it is destructive we are not at all certain. Permitting his visitor to reach this obvious and rather unsatisfying conclusion, and without offering any further light on the subject, Mr. Stanley led the way to the room in which his apparatus had been installed.

"Here," said the inventor, "is a machine which takes its current from the central station mains at 220 volts pressure with a frequency of 60 cycles per second, and which delivers to the X-Ray tube a current of enormous voltage and at a frequency well into the millions." The machine, if such it may be called, proved to be a monster high frequency coil. The lower portion which houses the transformer, condenser and spark gaps is some ten or twelve feet in length,



The Stanley X-Ray Apparatus: High Tension Transformer and Switchboard Producing and Controlling the Current for the X-Ray Tube.

half that in height and perhaps a third in thickness. Upon the front of this case are mounted the switchboards of highly polished black glass with their myriad of meters, control knobs and levers, knife switches, and other instruments, all in shining copper. Surmounting the lower cabinet is a gigantic cylinder resembling the familiar induction coil in general appearance. It is from this latter cylinder that the useful current is obtained.

While the inventor did not make clear in technical terms just wherein his apparatus differs from the modern high frequency outfit except in point of size, still, credit must be given him for a truly wonderful system of control which enables him to utilize to the fullest extent the possibilities of the oscillatory current, not only in X-ray work, but in the general practice of electro-therapeutics. The inventor claims for his coil some very broad ranges of frequency and voltage, as well as volume of current administered.

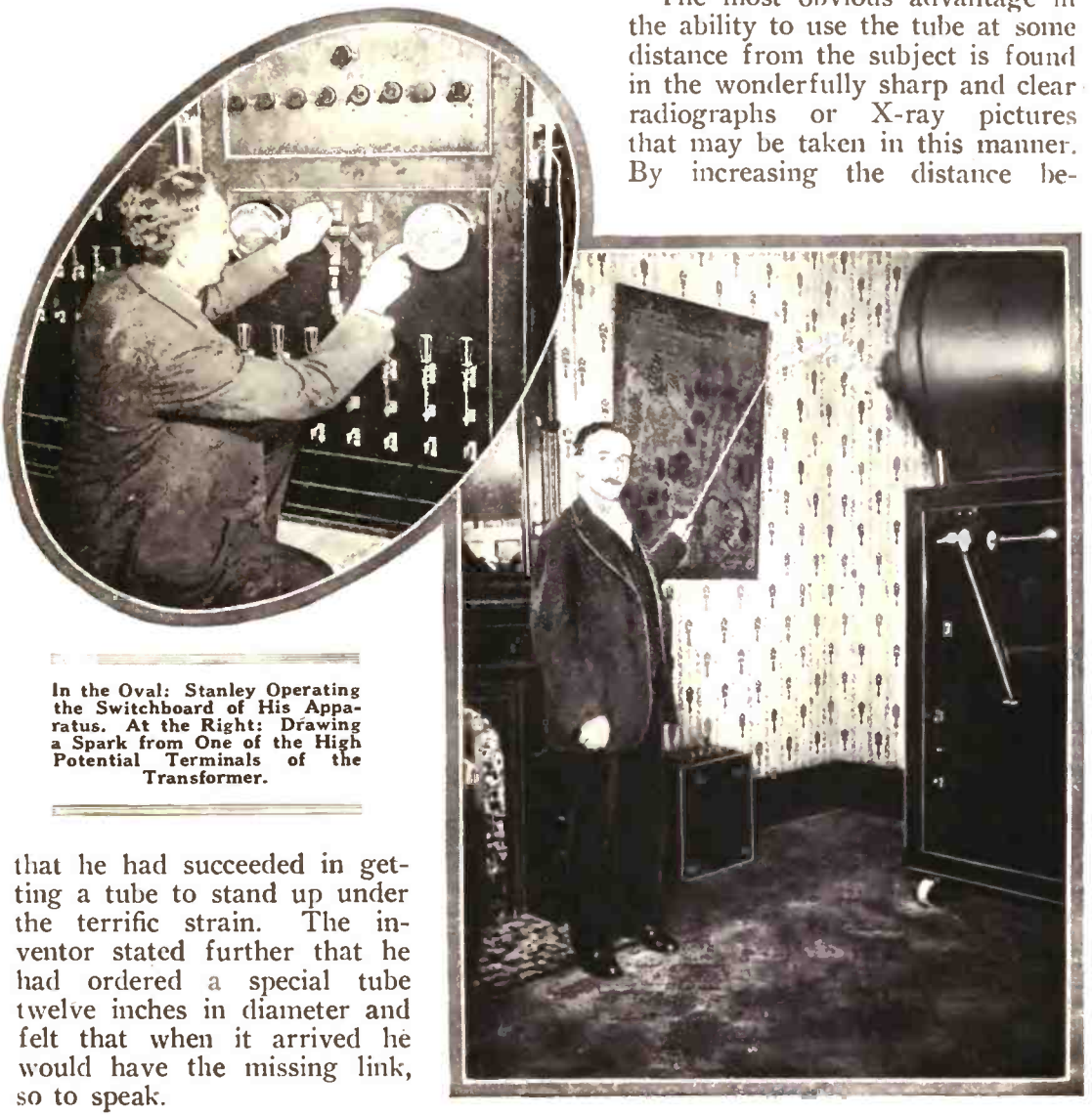
Proceeding with his explanation of the theory upon which his ray is based, Mr. Stanley went on to point out that practically all efforts in the past few years have been directed toward the reduction of exposure and the production of more powerful apparatus in order that the penetrative properties of the X-Ray might be enhanced. The tendency in this direction has led to the evolution of special transformers to deliver a comparatively heavy current at a moderate voltage to a tube built to stand the added volume with its attendant heat. Mr. Stanley has gone about the problem in a different manner, his theory being that a current of exceedingly high potential and high frequency put through a specially designed tube will give the desired penetration and speed without the danger of burns. Working on this theory, the inventor has experimented, so he states, for the best part of fifteen years and during the past five years he affirms that his hands and body have been exposed, sometimes for hours at a time, to the most powerful rays from his tubes. A

close scrutiny of his hands disclosed not the slightest symptoms of the familiar *dermatitis,* and, as the inventor remarks, "The proof of the pudding is in the eating."

Some small experience in connection with the use of tubes on very high voltages prompted the visitor to inquire whether or not the inventor had experienced any difficulty with punctures when operating the tube at great potentials. To this Mr. Stanley replied that in this very direction was to be found his chief obstacle. In the early days of his experiments, he stated that he had punctured one tube after another and it was not until within the last few years that he had succeeded in getting a tube to stand up under the terrific strain. The inventor stated further that he had ordered a special tube twelve inches in diameter and felt that when it arrived he would have the missing link, so to speak.

The demonstration of the apparatus served very largely to dispel the inevitable doubt that had formed itself in the visitor's mind. The apparatus beyond any question exhibits a remarkable penetration. Fluoroscopic examinations can be made at a distance of thirty feet from the tube, and when the apparatus was placed at a distance of six or seven feet from a heavy oak door, the rays readily penetrated in order that the bones of the hand might be examined on the far side of the door. While this penetration is, in itself, not remarkable, when one stops to consider that the ray of this power is apparently harmless, the wonder of the feat can be more appreciated.

The most obvious advantage in the ability to use the tube at some distance from the subject is found in the wonderfully sharp and clear radiographs or X-ray pictures that may be taken in this manner. By increasing the distance be-



In the Oval: Stanley Operating the Switchboard of His Apparatus. At the Right: Drawing a Spark from One of the High Potential Terminals of the Transformer.

Above: Applying the High Frequency Treatment to a Patient. In the Oval: Looking Through a Patient's Body by Means of an X-Ray Tube and Fluoroscope Screen.

Above: Taking an X-Ray Photograph of a Patient. The Photographic Plate, Wrapped in Black Paper, is Placed Below the Part of the Body that is to be Photographed.

Photos. Janet M. Cummings.

tween plate and tube, the shadow cast upon the former is sharpened and distortion and enlargement are obviated. The ray also exhibits some interesting properties in connection with work on the tissues and organs. The production of a bone shadow and even bone detail is not difficult, but when the work embraces the differentiation of organs and blood vessels, the problems arise. From the specimen negatives Mr. Stanley showed the author, it may be assumed that his apparatus possesses some unusual advantages in this direction.

WORLD'S LARGEST TEA POT

According to the statement of the Japanese proprietor of a tea house at the exposition in San Francisco, the giant tea pot which he uses as a novel attraction is the largest in the world. It is over three and one-quarter feet in diameter, and stands three feet and a half high without its heavy wicker handle. Including the handle, the total height of this enormous tea pot is five and a half feet. It was made specially for this tea house in Shigaraki, a town 200 miles from Toyko in Japan, and cost, when delivered to the tea house, in the neighborhood of seventy-five dollars.

The Largest Tea Pot in the World.

A DARING PHOTOGRAPHER

For the purpose of taking a picture of the new giant of the seas, the battleship *New York,* a well-known marine photographer, E. Muller, Jr., risked his life in a little motor boat when he steered it directly in front of the battleship as it ploughed ahead full speed on its trial trip off the coast of Massachusetts.

In recounting his experience, Muller tells how he calculated his distance before the oncoming monster and at the crucial moment, when he sought to get the best possible picture, swung his little 16-foot open launch directly in the path of the ship, stopped for

a moment and sped out from under the very bow of the battleship. He took the picture as the big ship was making the last of her twenty-one trial runs and was under forced draft, going at a speed of twenty-three knots an hour.

The snapshot of the battleship was made "bow on" and is probably the best picture of its kind ever taken.

THRESHING FOREST SEED WITH A SIMPLE DEVICE

Every spring for the past few years the Forest Service has been setting out hundreds of thousands of young pine trees on the barren ranges of the western mountains. These young plants are first grown from seed in immense nurseries in which the seed is planted and grown just as in a private garden.

The hundreds of bushels of seed are bought from the farmers and settlers. The seeds are dried and then placed in a big, wire-meshed hopper and threshed out quickly. The threshing device, which is shown in the illustration below, is a simple device which is turned by hand. The seeds drop into a bin below, while the cones remain in the screened box.

It is estimated that at least ten million young trees have been set out in the West this year. While these are mostly pine, there are also large quantities of larch, spruce, fir and cedar, but all that are thus grown are of the cone-bearing family of trees.

A Simple Screen Arrangement for Separating Seeds of Cone-Bearing Trees from Their Cones.

Thin Slabs of Concrete Placed Over the Brick Walls of this Church have Given it the Appearance of a New Building.

IMITATION STONE MADE FROM CONCRETE

Frame or brick houses can be faced with thin blocks of concrete so that a close imitation to stone results. The blocks are made in various sizes with a number of molds. A brick church which has been clad in a new dress to closely imitate colored sandstone is shown in the accompanying illustration. The change was made in about three weeks.

At last the question of how England can transport her troops across the Channel to France, in the face of the German submarine blockade, is explained. It is said that a netting extends across the Channel, thus preventing attacks on troop ships. The netting is made of heavy cables that are woven into meshes 18 inches square, thus making an effective barrier against submarines and torpedoes.

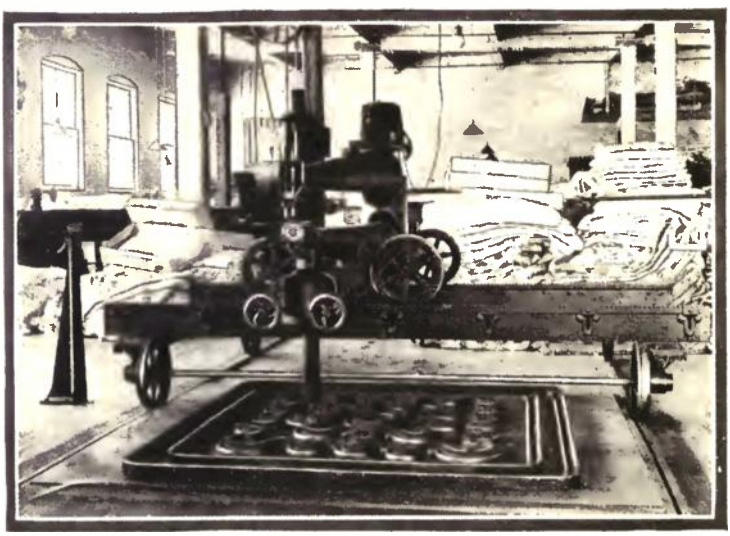
Miniature Automobiles Racing Around a Diminutive Track Form the Attractive Show Window Display of a Western Tire Dealer.

A RACE TRACK ON A MOTOR TIRE

With a large tire for the race track, a couple of miniature "speed devils" were sent around and around the show-window of a Houston, Texas, tire dealer. The little machines were operated by an electric motor in the center of the race course, which was quite invisible, and the wires that connected with the little automobiles were concealed by the high artificial grass. The window attracted a great deal of attention, as a crowd is always held by a moving display. The window was arranged thus for the holiday season, and the car ahead bore the number of the old year while the pursuing machine bore that of the new year, the idea being that the New Year was chasing out the Old.

MACHINE SEWS COMFORTERS BY INTRICATE COGS

A machine which has the cumbersome appearance of a huge drill press yet the delicacy of adjustment of a jeweler's lathe is employed by a New York manufacturer for sewing the various layers of cotton comforters together. The machine runs by electricity, and the design to be made on the comforter is controlled by a long steel arm which reaches to the floor. At its lower end is a cog which intermeshes with a "cog track" running in waves and loops over the floor and under the machines. As the comforter moves under the needle, the path of the needle is directed by the curious windings of the cog track on the floor. The cog track may be altered at will to suit the requirements.



By Means of an Intricate Cog Track on the Floor, this Sewing Machine is Guided in Sewing Comforter Layers Together.

PANAMA-PACIFIC EXPOSITION NOTES

by H. A. EVELETH

ONE of the largest electrical goods manufacturing corporations in the country has an elaborate display of its products in the Manufactures Palace. Among the constituent parts of this exhibit are several which prove of special interest to the layman. In one glass case are a score of incandescent lamps representing the gradual advance made in the development of this product. The first lamp is one originally produced by Mr. Edison in the year 1880. The filament is of carbonized bamboo and is fastened to its feed wires by means of two minute metal screws and clamps. The latter are soldered to the feed wires and their jaws clamp the filament terminals when the screws are set. Sufficient current is fed to the lamp to maintain the filament at a dull red color, for great care is taken not to burn it out. The last lamp of the series is one of the latest nitrogen-filled products. Near by the visitor will see the largest incandescent filament lamp yet produced. It has a candle-power of seven thousand, and, with the aid of a reflector, produces an intense white light of extraordinary brilliancy.

To illustrate the high tensile strength of a tungsten filament, an exhibit has been prepared wherein a 60-watt lamp is shown supported by the tungsten filament of a 100-watt lamp in such a manner that it is free to oscillate when acted upon by the air currents in the building. A thread of tungsten 0.005 inch in diameter will support a ten-pound weight, while the tensile strength of this metal is 600,000 pounds per square inch. It is so hard that it cannot be machined and must be fashioned by a process of grinding.

The chief feature of the exhibit is the Home Electrical, a ten-room house elaborately furnished, and fitted with every type of electrical apparatus which could be of possible use in such an establishment. The house is a marvel of simplicity and cleanliness and strikingly illustrates the usefulness and necessity of electrical energy as a medium for light, power and heat in the modern residence. This captivating Home Electrical is burglar-proof in that the doors and windows are fitted with burglar alarms, and a "master switch" is located near the head of the bed in the master's bedroom. By means of the latter the lights over the entire house may be thrown on; to the ineffectiveness of their associative switches and consternation

of the night prowler. The various rooms are interconnected by the inter-phone system, equipped with electric fans and illuminated by both the direct and indirect systems. A stationary vacuum cleaner located in the basement is piped to outlets set in the baseboards of the principal rooms, thus furnishing a more convenient method for housecleaning than would be derived from a portable machine. To give an idea of the completeness of the electrical installation, it will be necessary to mention the equipment of each room, while the figures in parentheses denote the cost of operating in cents, for one hour, the apparatus after which they are placed; calculations being based upon the rate of ten cents per kilo-watt hour.

LIVING ROOM

This room is warmed either by a quadruple glower radiator (20) or an air warmer (10). An electric reading lamp and cigar lighter (¾) are present on the library table, and an electric piano is playing over in the corner.

DINING ROOM

Upon the sideboard and dining table are a percolator urn (3½), a uni-set chafing dish (5), uni-set samovar (5), radiant grill (6) and toaster (5½). A telephone connecting with the kitchen is located near the head of the table. The room is warmed by a luminous radiator (10).

BEDROOM

Near the head of the bed is located the inter-phone and master switch. An electric heating pad (½) replaces the vexatious hot-water bag, and a glower radiator (7) warms the room. The shaving equipment consists of a one-quart water heater (4) and an indirectly illuminated shaving mirror. Other necessities are a hair drier (cool or warm air), a massage vibrator (½) and a curling-iron heater (¾).

NURSERY

Here we find a one-pint milk heater (3), a uni-set nursery outfit (5), a twin radiator and a heating pad.

BATHROOM

The room is warmed by a triple glower heater (7½) or cooled by a six-inch electric fan. A ventilating fan, placed in the outside wall of the room, serves to draw out the impure air. A pedestal type hair drier (½), one-half pint hot water cup (1½), and shaving mirror complete the list.

SEWING ROOM

The sewing machine is actuated by an electric motor (1) and the room warmed by a glower heater. The small-sized ironing board is equipped with a three-pound electric flat-iron (2¾).

KITCHEN

There should be no trouble about "keeping" the cook with such an equipment as this! The electric range (10 to 44) will boil the onions while the ozonator (1) will neutralize the odors emanating therefrom. If the air becomes too "close" the ventilator in the wall will draw it out-of-doors; if too warm the electric fan will adjust matters. The circulation hot water heater (30) supplies hot water for the baths in twenty seconds, or for the electric dish washer (2), if desirable. In contrast to the former is the electrically operated refrigerator and the ice cream freezer (2).

LAUNDRY

The laundry is complete with the washing machine (2), mangle (1¼), drier and flat-irons (3 to 5).

MILK ROOM

The equipment herein will appeal to those who keep one or more cows. It consists of a milking machine, cream separator (¾), bottle washer (1), churn (1¼) and cooler for creamery packages.

WORK ROOM

The handy man of the household will welcome the electric soldering iron, metal melting pot, grindstone, drill press, riveter, glue pot, chipping hammer and motor-driven lathe, which are to be found in this room.

THE GARAGE

The electric automobile is having its battery charged from the mercury arc rectifier, while the motor-generator in the corner is humming a tune to the accompaniment of the electric piano located in the living room; and rightly it should, for neither could live without the other. Receptacles are provided for connecting up the buffing motor and vacuum cleaner. The inter-phone on the wall completes the last detail of this remarkable Home Electrical.

He who hails from the country will be attracted by the live stock and poultry exhibits. There are pigs, horses and cows a-plenty, and they represent the leading types of American and foreign-bred stock. Among the several score magnificent horses is a blue-ribbon mare which tips the scales at 2,150 pounds.

The Carnation Stock Farm barns, wherein the cattle are kept, is equipped with the most modern apparatus for the care of the live stock and from a sanitary viewpoint is well nigh perfect. The men in charge are dressed in white, the cows are milked by vacuum machine and the milk is not exposed to the air until it reaches the dairy. Posted conspicuously is a notice, which reads, "No swearing allowed in Carnation Dairy Barns. These contented cows are not accustomed to profane language."

The Japanese long-tailed roosters are the most popular birds in the poultry exhibit. Akazasa, Haku and Shirafuji are their names, and they are proud possessors of tail feathers from eight to twelve feet in length. These dignified birds are taken out to exercise once a day and their tails are carefully enclosed in paper bags to keep them out of the dirt. Each rooster has a specially constructed home of his own. It can best be likened to the tall case of a hall clock with a small compartment fitted to its side at the upper end. The proprietor roosts in this compartment and lets his tail hang down in the space which would be occupied by the pendulum of the clock.

¶ A visit to the leading exhibits at the Panama-Pacific Exposition is afforded to the reader who follows this series. True, the visit is but a literal one, yet nevertheless a goodly portion of the vast fund of knowledge available to those visiting the Exposition Grounds is offered in these pages each month.

The dog fancier will be attracted to the remarkable collections of canines to be seen at the "Dogs of All Nations" concession. There are big dogs, little dogs, long dogs, short dogs; in fact, every type of a canine from a Japanese spaniel or a Mexican hairless to a Great Dane or an African bloodhound. Of unusual interest are two of the most distinguished dogs in the world, namely, the two surviving Esquimau dogs of the pack which accompanied Captain Peary to the North Pole. Ipsu, their leader, is now fifteen years of age.

Probably the most complete assortment of vehicles ever seen assembled under one roof is to be found in the Palace of Transportation. Here the visitor may view practically every type of conveyance used upon the land and water and in the air. The greatest space is devoted to the rolling stock used by the many railroad and railway companies of this country. The display includes various types of steam and electric equipment for both suburban and interstate service.

The paramount feature of this instructive exhibit is one of the oil-burning Mallet articulated compound locomotives. This engine is equipped with the Southern Pacific standard incandescent headlight. The source of light is from one of the latest types of nitrogen electric lamps of 140 c.p. and the beam projected is of sufficient intensity to enable the engineer to observe a man on the track at a distance of a quarter of a mile; or twice the distance required to stop a train running at a rate of forty miles per hour, by the emergency air brakes.

The official classification of the rolling stock employs letters and figures to indicate principal dimensions and is of interest by reason of its being printed upon some conspicuous portion of the vehicle. Thus, upon the cab of the Mallet locomotive appears the classification

$$\text{MC-57}\ \frac{\text{26-40}}{\text{30}}\ \text{401-S},$$

in which "MC" denotes that the locomotive is of the Mallet Consolidation type; "57," the diameter of the driving wheels in inches; "26-40," diameter of high and low-pressure cylinders in inches; "30," stroke of piston in inches; "401," weight in pounds on driving wheels in nearest

even thousands; and "S," that locomotive is equipped with a superheater.

The maximum tractive power of this engine is 94,880 pounds, while its hauling capacity at 10 miles per hour on a level tangent track is 16,940 tons. In marked contrast to this great machine is the first locomotive to traverse a transcontinental railroad. It was built for the Central Pacific R. R. in the year 1863 and has a hauling capacity of 660 tons under the conditions specified for the Mallet locomotive. Additional data relative to the latter is presented in the following table:

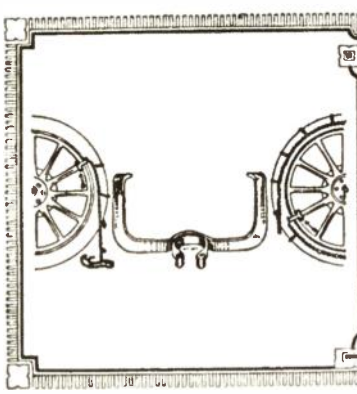
Total weight of engine	435,800 lbs.
Loaded weight of tender	189,200 lbs.
Capacity of tender, water	9,816 gal.
Capacity of tender, fuel oil	3,610 gal.
Total wheelbase of engine	57 ft. 7 ins.
Total wheelbase of engine and tender	90 ft. 4 ins.
Diameter of driving wheels, outside	57 ins.
Diameter of tender wheels	33 ins.
Type of boiler	Straight
Working pressure per square inch	200 lbs.
Outside diameter of boiler, first course	84 ins.
Length of fire box, inside	126 ins.
Width of fire box, inside	78.25 ins.
Heating surface of superheater	839.0 sq. ft.
Total equivalent heating surface	6876.0 sq. ft.
Grate area	68.4 sq. ft.

The varied assortment of waterfalls and artesian wells in the Palace of Machinery demonstrates the efficiency of the many types of pumping and irrigation apparatus on display. Chief among these is an irrigation plant consisting of an 80 h.p. Bessemer oil engine connected by rope drive to a centrifugal pump having a capacity of 5,000 gallons of water per minute. The water is forced through a 12-inch diameter wood-stave pipe to a height of about thirty feet, from which it falls in a huge cataract to a tank below.

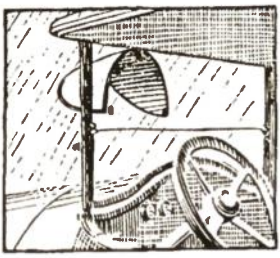
The largest color press ever built may be seen in operation at the Palace of Machinery. It is known as the Pancoast Universal Unit Press, and prints a portion of the Sunday edition of the "San Francisco Examiner." This gigantic machine is 48 feet long, 9 feet wide and over 12 feet high. It has a net weight of 130 tons and an 80 h.p. electric motor is required to operate the mechanism. Every precaution against accident has been taken by the application of "Safety First" devices. The gears are protected by iron guards, an electric gong rings automatically just previous to the starting of the machine; contrivances are present which make it impossible for a pressman to have his hands caught between the cylinders, and the entire operation of the press is controlled by several electric push-buttons. The construction is more rigid than heretofore attempted, and it is claimed that the vibration has been so minimized that a nickel can be balanced on the edge of the top frame when the press is running at full speed. The hourly capacity of this press is 40,000 copies of a 48-page paper, but the production varies with the number of colors being employed and the number of pages being printed. The rolls of paper are 73 inches wide and weigh 1,200 pounds each. Six rolls are loaded on the machine at one time. The Sunday edition of 250,000 copies of 80 pages each, requires more than 3,400 miles of paper of a width of one page.

STEAMERS TO CARRY AEROPLANES TO ARCTIC REGIONS

An aeroplane on each steamer which plys to the Arctic regions will be the latest use of this invention. The northern route is frequently blocked by icebergs and ice floes. Steamers lose much time in searching for a channel and then usually do not find the best one. The plan adopted by a Norwegian steamship company and which will soon be put in operation is to have an aeroplane on each of their steamers, so that when ice is sighted the aviator will ascend and fly over the ice until he determines the best channel. Then he will inform the captain by a signal system which route to follow. This novel use of the aeroplane will greatly reduce the time rate from the Norwegian ports to the Russian destinations on the Arctic Ocean.



Tool for Tire Chains.



A Novelty in Wind Shields.

A Combined Umbrella and Cane.

Recent and Improved Devices

Helps Attach Tire Chains

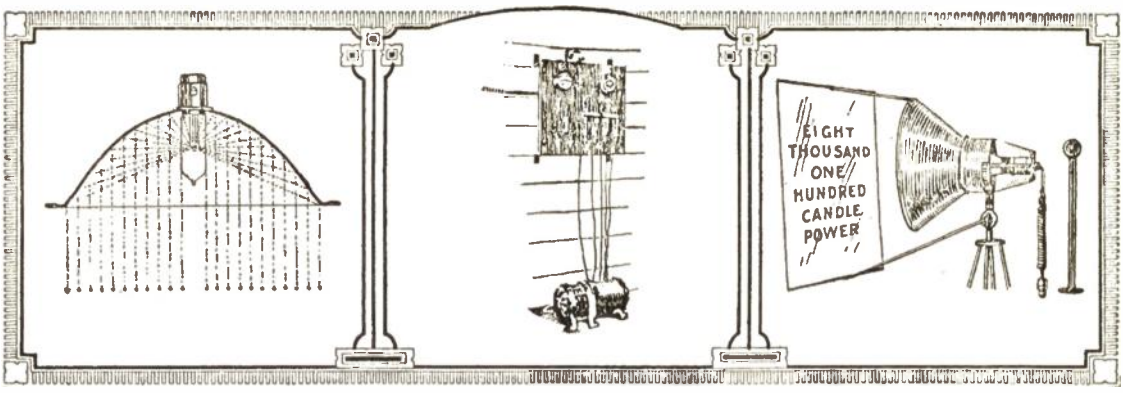
Instead of undergoing the unpleasant task of attaching tire chains to the rear wheels of an automobile by the usual process of placing the chain on the ground, running the automobile over it until it is properly in place—a task which is accompanied by soiling the hands and clothing—an attachment has been placed on the market to prevent all these unpleasant things, and it can be put in place with very little effort. It consists of a stout metal U-shaped clamp which fits about the rim and holds the chain firmly in place. The attacher is snapped in place in an instant. One end of the chain is hooked about a curved projection, the car is run ahead one revolution of the wheel, the other end of the chain is hooked, and the usual troublesome task is over with. A jack is unnecessary.

Something New in Wind Shields

Wind shields ordinarily have one grave disadvantage; that is that they instantly become clouded in snow or rain storm. A new type of shield has been brought out which entirely banishes this evil, by giving an unobstructed line of vision to the driver, whether it rains, snows, hails or what not. The new wind shield is nothing more nor less than a transparent, cap-like attachment which fits on the glass at the spot where the driver's line of vision passes. The cap projects out over this spot to a sufficient distance so that no matter how heavy the rain or snow storm is, the cap and the air currents which it creates prevent any vestige of moisture from collecting on the glass in front of the driver. The rain shield is constructed of a flexible, transparent sheet of "pyralin," which can easily be adjusted to any desired shape, like a visor or bonnet. It is held securely in place by five vacuum cups. These cups hold the shield in place so rigidly that wind, no matter how forceful, will not tear them loose; yet they can be removed if desired by sliding the thumb nail under the rim.

Umbrella and Cane Combined

A western manufacturer has hit upon the ingenious idea of combining for wet and sunny weather, respectively an umbrella and a cane. Now that walking sticks have again come in vogue, the man who for personal reasons objects to carrying an umbrella on cloudy days on the uncertain possibility that rain may set in and he will be caught in it, can carry a cane which to all appearance is nothing but a cane, but which in reality is nothing but the ornamental outer structure of an umbrella. The cane is constructed of a varnished stick of hollow bamboo sections which fit over the silk umbrella covering, and when not in



A Parallel Ray Reflector. Battery Charging Equipment. New and Powerful Lamp.

use can be collapsed and readily carried in the pocket.

Lamp Reflector Throws Parallel Rays

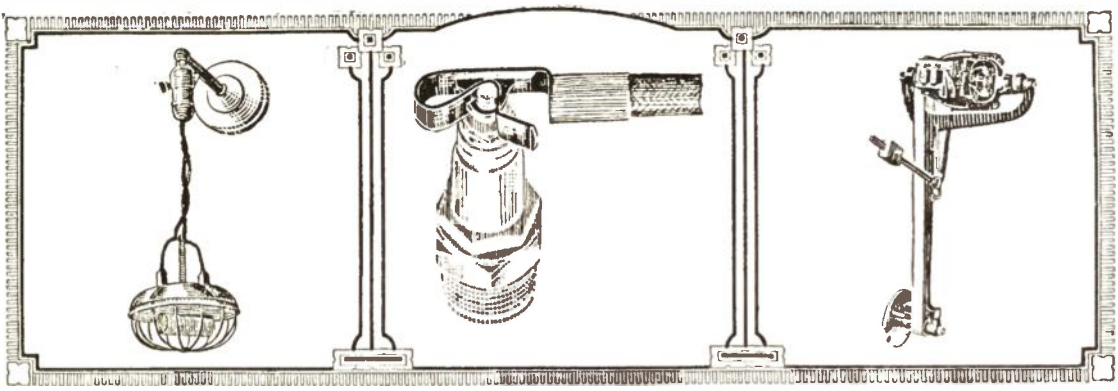
One of the latest conveniences for automobile and motor boat owners is an electric lamp and reflector which throws a powerful concentrated beam of light straight ahead. The lamp is claimed to be more efficient and brighter than even the nitrogen-filled lamp which has already made noticeable inroads into the ordinary tungsten lamp trade. The new lamp is filled with a peculiar new gas of unusual properties, and it is manufactured in sizes small enough to pass through the rear of any reflector without fingering the reflector as is ordinarily necessary. A slender tubular bulb is employed instead of the usual round lamp, with the result that greater efficiency is gained. In using a round bulb the rays of light must pass through the glass globe twice after leaving the reflector surface, whereas in the case of the tubular lamp all rays of light are projected ahead with no resistance after they strike the reflector. A small, intensely bright "spot" of light characterizes the new bulb, with the result that the rays are of a clearer quality than is obtained with the long, diffusing filaments.

Battery Charging Equipment

A battery charging equipment to meet the constantly increasing demands of the automobile trade has recently been put on the market. This equipment consists of an exceedingly compact motor-generator and a simplified switchboard, so that an inexperienced operator cannot cause a great deal of harm. One of the most ingenious details of the equipment is its provision for starting. The motor is non-self-starting, being started from the direct current end, the current being supplied by the batteries which are to be charged, the generator acting temporarily as a motor. This method of starting is accomplished by an arrangement of the knife switches on the switchboard. When the switch is thrown partly in, battery current flows into the generator; it acts as a motor, and when sufficient speed has been attained the switch is pushed in the remainder of the distance, and the line current takes up the work. No other change is necessary, as the batteries are already in circuit.

Photographic Light

The nitrogen filled lamp makes it possible for the photographer to make quick, fully timed exposures by artificial light and this without the use of the objectionable explosive flashlight. Among the several reflectors and diffusers recently placed upon the market to meet the demand for a suitable fixture in which the nitrogen filled lamp might be used for photographic purposes is the one shown on this page. This device, it is claimed, will furnish a splendid light for the studio, for home portraiture, and for printing and enlarging. Ample provision is made for the dispersal of the heat generated and the reflector is so arranged that a perfect diffusion of the light is effected.



Novel Electric Heater. Connector for Spark Plug. Motor-Driven Swing Saw.

A New Idea in Electric Heaters

An electric heater which has features decidedly original is illustrated in one of the drawings on this page. One of the smaller editions of the heater is manufactured in the form of an inverted incandescent lamp, and it is particularly adapted to the heating of small rooms, such as nurseries, bathrooms and offices. It can be suspended from the electrolier or socket and quickly removes the chill and dampness of early mornings and evenings. Another heater of the same type is made to resemble an open wood fireplace. Coils are inserted inconspicuously between two of the front logs, and the appearance of the glowing coils when they are in use closely resembles that of logs that are really burning. The log is made of a composition of lasting material. These heaters are constructed on a new principle. Each unit attains a temperature of 2,000 degrees Fahrenheit. In other forms, the maximum temperature reached is never greater than 600 degrees. About one or two minutes are required to attain 2,000 degrees, at which point the temperature remains constant.

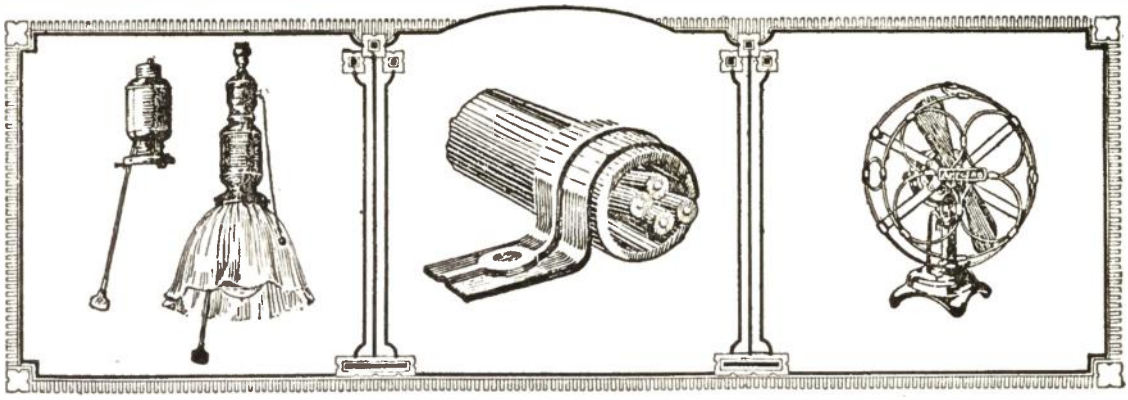
Novel Spark Plug Connector

A spark plug which can be attached in remarkably short order has been put on the market by a well-known manufacturer of electrical apparatus. Motorists will appreciate the saving in time which is effected by the new clip for testing for burned out porcelains and the other faults common to spark plugs. The clip is fastened to the end of the high-tension cable and can be attached to the spark plug by slipping the threaded stud of the plug through the hole of the connector, releasing the spring, and the stud will be gripped tightly by the strong spring pressure. This connector has the added advantage that it can be shaken off only with great difficulty.

Compact Electric Saw

A saw for packing rooms which is remarkably light and compact has recently been designed by an electrical manufacturer. It is intended for use in factory shipping rooms for the preparation of crating lumber. A number of original features are claimed. In the first place, the motor and saw are combined into a single unit. They are joined by an arrangement of cogs which are contained within the walls of a rigid steel case. A second feature is that no line shafting of any sort is required. The complete equipment can be installed wherever it is desired in a few seconds, merely by attaching it to a solid support of some kind with four bolts or lugs. The motor is self-regulating, current being supplied to it through two wires. Aside from the advantage gained in its movability, a considerable saving is effected in the fact that no line shafting with its constant loss is necessary. This means that when the saw stops work, the consumption of current likewise stops.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us.



A Turn-Down Lamp Socket. Simple Conduit Clamp. Fan with Aeroplane Propeller.

Lamp Socket Saves Electricity

There are a number of devices on the market for the purpose of dimming the glow of an electric incandescent lamp, but they are either uneconomical of energy consumption or else their construction is delicate and they require a high maintenance cost. If economy in power consumption is to result from the use of devices of this kind, they must be exceedingly efficient, because the energy consumed by the lamp, even at normal voltage, is very small. A new device, called the "Turn-lo," averts these disadvantages in economizing energy by the use of an inductance coil, which may be connected in series wholly or in part with the lamp or a similar load. During full illumination, that is, normal operation, the inductance is short-circuited upon itself, and thus not subject to energy losses, while for conditions of reduced illumination, a part or whole of the inductance is connected in series with the lamp filament.

A Novel Clamp

One of the greatest time consumers in the field of electrical contracting is the ordinary conduit clamp, which requires much costly effort on the part of high-priced electricians to install. This disadvantage is eliminated to a large degree in a new conduit and cable-hanging clamp, or clip, which has recently been put on the market. Only one bolt, lug or screw is required to install it, yet it supports the heaviest of conduits and cables readily.

Fan Built Like an Aeroplane

An electric fan which resembles in many ways an aeroplane and upon whose behavior some interesting statistics have been tabulated is now manufactured. The "Aerofan," as it is called, embodies only two blades, instead of the conventional four, yet it ejects an astonishing amount of air. Two thousand nine hundred and ten feet of air a minute at 28.4 miles per hour is the output of the Aerofan. This air current can be felt noticeably at a distance of more than thirty feet. The various requirements which are demanded of any electric fan are met, in spite of the fact that the Aerofan weighs less than five pounds. Probably the most interesting claim of the manufacturers is that the new fan will actually blow air back through the blades of any fan of its size on the market. However, for sick room use and in places where a strong breeze is not desired, the usual adjustment arrangement is provided, so that a very gentle breeze can be obtained. The Aerofan, because of its small size, has required an infinite amount of resourcefulness in the construction of its tiny motor. The shaft and armature are perfectly balanced—just as in large, costly machines; the bearings are of babbit metal and a gravity wick oil feed is provided.

By placing a small, two-candlepower electric lamp on the front porch and back porch of a country home, a fair protection against burglars is secured. The cost of operating two such lamps throughout the night is not over one cent—cheap burglar insurance indeed.

A PROFILING FIXTURE

By E. P. Fickes

In the construction of small machines, such as cash registers, sewing machines, etc., there are parts that must be machined with the least amount of variation possible, and the manner in which these parts are held is worthy of much consideration. Difficulties arise when the part has no projection or lugs, making it impossible to use clamps. The fixture described is designed to hold two castings while profiling the top and the bosses on the inside. One of these castings is shown clamped in position on the fixture at *A*.

The base, *B*, Fig. 1, consists of a casting finished on the top and bottom. Holes should be drilled and reamed for the stationary jaws, *C*, *C*, and for the movable jaws, *D*, *D*, *D*, *D*, as well as for locating pins, *E*, *E*, *E*, and adjustable supports, *F*, *F* and *H*, *H*.

Two holes should be drilled, counterbored and tapped in the sides for the adjusting screws, *I*, *I*, and *J*, *J*. The jaws, *C*, should be turned from a piece of tool steel to the desired shape, then hardened and ground where necessary and driven into the base, *B*. The movable jaws, *D*, shown in Fig. 2, should be made in two parts. The body, *K*, consists of a tool steel forging finished to fit the hole at *L*, then milled flat on each side at *M* to fit into slot, *N*, in the base, *B*. A hole is drilled and reamed in the end for pin, *O*, after which it is cleared away, as shown at *P*, to allow the body, *K*, to move back and forth. The jaw, *D*, is made of tool steel, hardened, ground, and lapped to fit shoulder on body, *K*, and is held in place by screw, *S*, which also serves to hold in position dust washer, *T*, thus preventing chips or dirt from interfering with its movement.

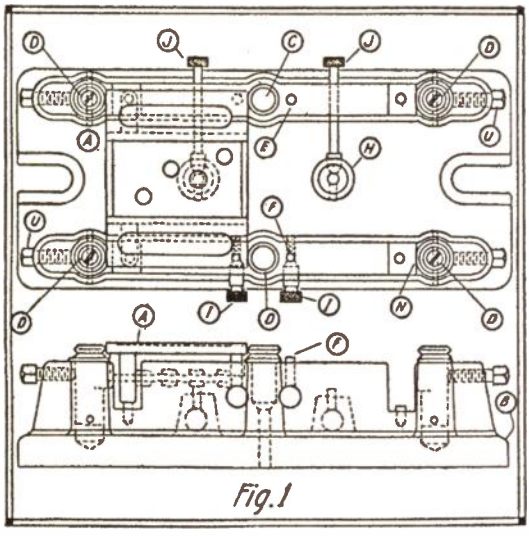


Fig. 1

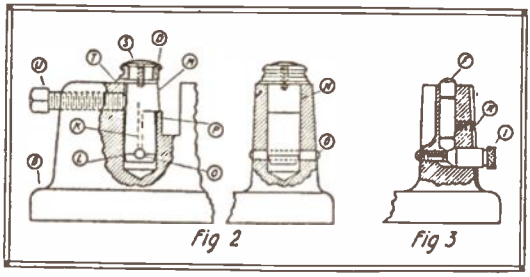


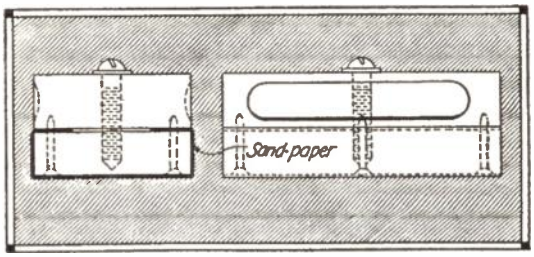
Fig 2 Fig 3

In Fig. 3 is shown the adjustable support, which is operated by means of the cone-shaped screw, *I*, against the inclined surface of pin, *F*. This support is also used at *H*, taking care of the thrust of cutter while profiling the bosses or lugs on the casting, *A*. This method of clamping affords little chance of springing or

distorting the parts to be milled, and holds them rigidly, requiring but little pressure on the screw, *U*. The jaws, *C* and *D*, can be used their entire circumference before being replaced, making the upkeep comparatively small.

Handy Sandpaper Holder

A handy sandpaper holder can be made from two blocks of wood, one of which is ½" thick and the other ¾"



thick, both being of the same length. The width is optional. With a marking gauge, lines should be scribed ⅜" in from the edge of the ½" block. Drill a 3/16" hole through the exact centre of the ¾" block and fasten the two blocks together with a round-head brass screw. Where the scribed lines cross on the surface of the thin block, drive No. 16 steel brads, ⅝" long, through into the thick block, and another brad in the centre of each of the long sides, or six brads altogether. These brads are for the purpose of holding the sandpaper in place. With a gauge cut grooves along each of the edges of the thick block for finger holds. The sandpaper should be clamped in place as shown.

Contributed by

A. P. H. Paul.

Substitute for Filter Paper

In case of a lack of filter paper for use in experiments in chemistry, a very good substitute is found in sanitary paper towels which are now in such common use. Cut the paper into circles the desired size, and it will be found to do the work practically as well as the regular filter.

Contributed by S. H. Samuels.

A Rubber Name Stamp

A rubber name stamp can be made quite easily if the following directions are observed. The name should be written on a waxed zinc plate, care being taken that the wax is cut completely through. Hydrochloric acid should be painted over the wax and allowed to eat its way half through the plate which should be ⅛ inch thick. Hot water should be poured on the plate to remove the wax. The rubber should be pressed into the etched lines and vulcanized.

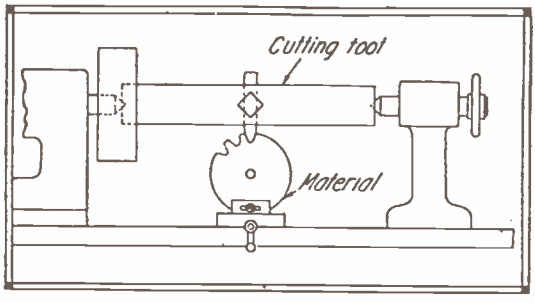
This suggestion is given as an improvement upon the method described by Mr. E. F. Hallock in a previous issue.

Contributed by

W. Christnagel.

Cutting Small Gears in a Lathe

A gear-cutting tool for the amateur mechanic is shown in the accompanying illustration. The body of the tool con-



sists of a 1½" steel rod about 15" in length. This rod should be centered at both ends in the lathe. At the centre of the rod, two small holes should be drilled. One of these should be filed out square to accommodate the cutting tool and the other threaded for a lock bolt. The material for the cog is a disc of metal of the desired diameter. It should be clamped in a slide rest and turned as the succeeding teeth are cut.

Contributed by F. P. Dickover.

Acid Cuts Hole in Glass

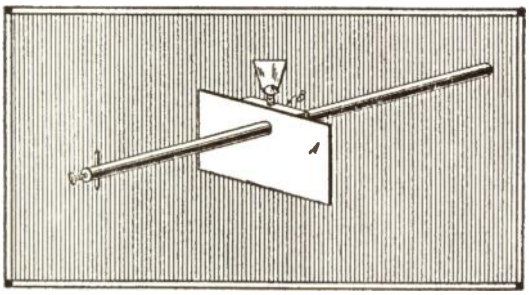
Hydrofluoric acid will cut a hole through glass in short order. A dam of wax should be placed about the spot where the hole is to be made, and into it a few drops of the acid should be poured. Hydrofluoric acid will dissolve nearly all substances, and it should be handled carefully. It is sold in small wax bottles.

Contributed by
THEODORE GOTHMANN.

A Makeshift Marking Gauge

A marking gauge that will answer for most purposes about the experimenter's workshop can be constructed along the following lines:

A long, true rod of brass or iron should

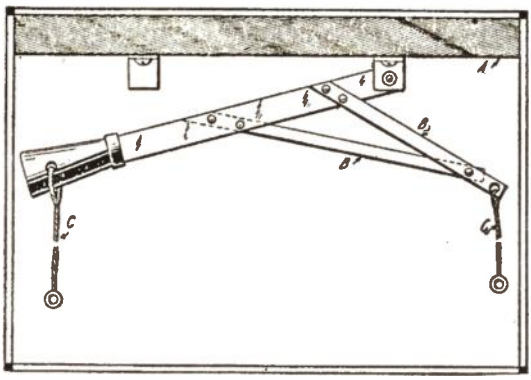


be bored at one end with two holes, one for a marking point and the other for a set screw to hold the marking point, or scribe, in place. Referring to the drawing, *B* is a block of hard wood bored with a hole which should be threaded to accommodate a wing clamp screw. *A* is a larger wood board of thinner material along which the object to be marked slides.

Contributed by
JAMES J. ROGERS.

Knife Switch Controlled by Cords

A knife switch located on the ceiling can be controlled by two cords, if two stiff metal strips are brought out to a point, one from the hinged end of the blade and the other from its centre and riveted as shown. One cord should be fastened to the end of the two strips and the other knotted through a hole



bored in the handle. Pulling on cord *G* closes the circuit; pulling on cord *C* opens it. The metal strips are indicated as *BB* in the drawing.

Contributed by
EARL B. WILLIAMS.

Freeing Sash Weights

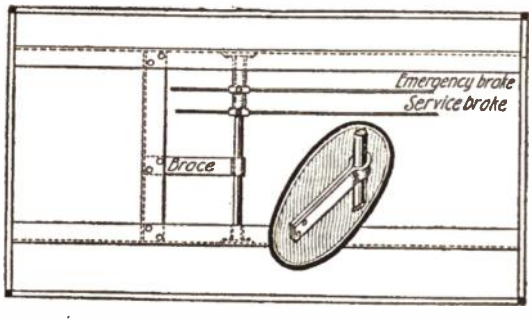
Sash weights which have become jammed can usually be freed by removing the pulley and prodding. A length of stiff wire or an ordinary kitchen poker will do.

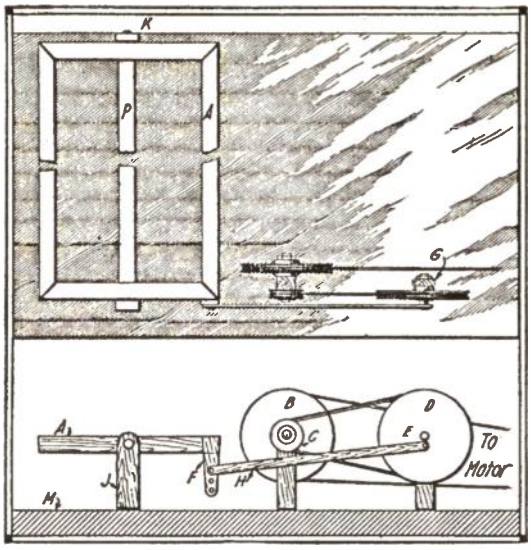
Contributed by
WM. C. HOUGHTON.

To Reinforce a Strained Brake Shaft

An automobile brake shaft which has become bent through repeated strains and jolts can be stoutly braced with little trouble, so that further bending is avoided and the possibility of the shaft breaking is eliminated. A strip of heavy steel should be bent at the middle to fit snug about the shaft and its two ends brought back and riveted to the cross beam.

Contributed by ADOLPH KLEIN.





Developing Plates by Motor Power

When a large number of plates are to be developed the following machine will save considerable labor:

The entire frame is made of ¾" by ¾" white pine.

The wheels, *B*, *C* and *D* should be built according to the speed of the motor since the wheel *D* must run very slow, namely 30 r.p.m. The wheels, *B* and *C*, are mounted on a shaft threaded at both ends, with a burr on both sides. A round-headed screw is passed through the wheel, *D*, into the support, *G*.

The rack, *A*, may be made as large as desired to fit any number of trays. The supports, *J* and *K*, are slotted at the top, so that one rack can be easily taken out and another put in its place.

The stroke at *E* should be very short and allowance made for adjustment at *F*; otherwise the rack will be tipped too far and the developer will be spilled.

The pitman, *H*, is made of ½" x ¼" white pine, and slotted at connection with *F*, so that it can be lifted off when taking out the rack.

The brace, *P*, connects the feet, *M* and *N*. If the machine is to be used for large plates or many trays, two pieces should be put in, one at each end of *N*.

With any small battery motor and two or three dry cells this machine will operate successfully.

Contributed by M. A. Piper.

Improved Non-acid Soldering Paste

Zinc chloride, one of the constituents of a non-acid soldering paste described in the January issue of this magazine, is not kept in stock by the average druggist on account of the fact that this chemical is very deliquescent, that is, it absorbs moisture very rapidly. Ammonium chloride, which does not possess this undesirable quality, can be substituted with equal results in the formula.

Ammonium chloride flux can be put up very conveniently in old library paste or tooth paste tubes which have previously been thoroughly cleaned.

Contributed by

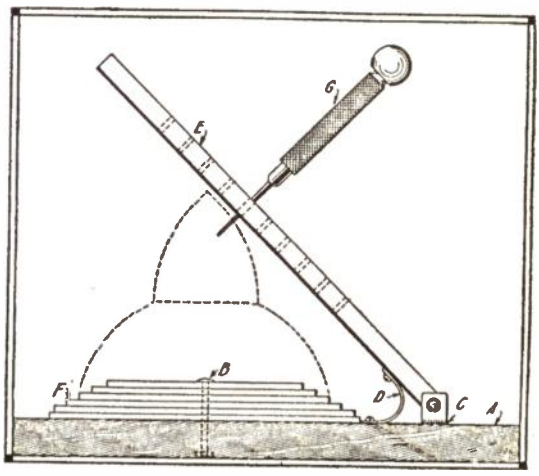
Reid L. Kenyon.

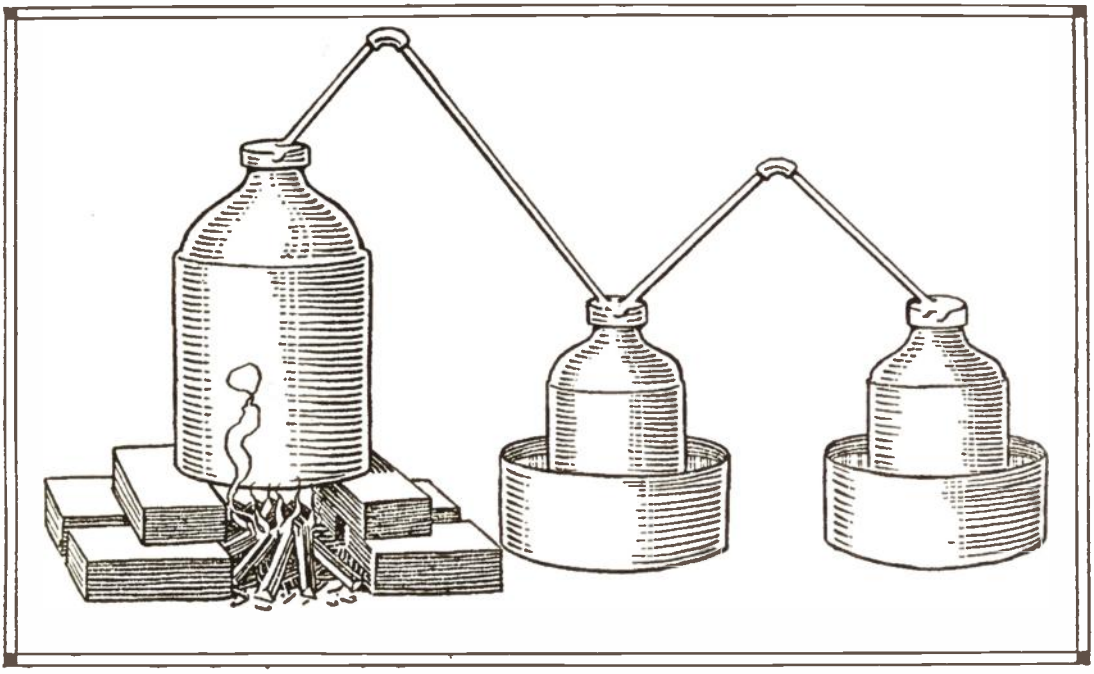
Marker for Spun Brass Caps

Marking lines about spun brass caps of various shapes can be done easily and quickly with a tool of the following construction:

Referring to the accompanying drawing, *A* is the work bench top, and *B* is a long bolt with which fibre discs, *F*, in graduated sizes are bolted to the bench. The marker consists of a spacing bar, *E*, bored with spaced holes to fit the point of the marker, *G*. The space bar is hinged to the bench top at *C*, while a spring, *D*, serves to maintain a constant pressure. The cap is marked by revolving it upon the fibre base, the marking tool meanwhile scribing a line.

Contributed by Earl B. Williams.





A MERCURY STILL USED BY ALASKAN MINERS

By Geo. F. Worts

Several times during the gold strikes in Alaska the cost of mercury, which was used for amalgamating gold from loose sand, rose in price to a point far exceeding that of pure gold itself. This was particularly true when "color" was discovered in the fine sands along the banks of the lower Yukon, several years ago. A miner with a pan and a bottle of mercury could recover as much as $50 worth of gold in a day in some of the richer localities, if he worked diligently. When the gold amalgam became saturated with the precious metal it was necessary for the miner to suspend mining operations and distill the mercury from the gold, thereby recovering in their more or less pure states both the mercury and the gold.

Some of these mercury stills were quite ingenious, although naturally very crude, and their construction, or, at least, their theory of operation will probably contain a helpful suggestion to the amateur chemist.

The thick, yellow alloy of mercury and gold was placed in a small yet deep earthen jug (metal vessels are not suitable for handling mercury) and from the mouth of the jug a wooden tube was projected. This tube was sealed into the mouth of the jug with clay. About a foot from the mouth of the jug the tube was joined to another of the same size at a sharp angle by means of wire and clay. This second tube led down into another earthenware jug, which was set in a pan of cold water. The purpose of the sharp angle at the juncture of the two points was to prevent any mercury which condensed in the tube from remaining there. Then, too, wooden tubes are difficult to bend.

From the second jug, which was the primary condenser, a third tube ran and was jointed at a sharp angle identical with the other. The fourth tube was led into a second condensing chamber, set, as in the case of the preceding one, in a pan of cold water.

To operate the mercury-gold still, the amalgam was placed in the first jug and the jug placed upon small stones between which a fire was built. When the tem-

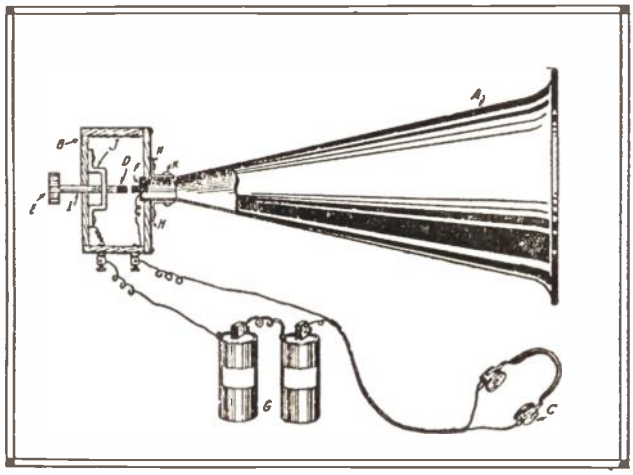
perature was raised to a point sufficient to distill the mercury, mercury vapor was formed, which passed through the tubes and condensed in the other two jugs. Pure gold remained, and the mercury could be used repeatedly.

The writer has witnessed the selling of a mercury still of this type, by a miner who had taken out all the gold he could carry, to a newly arrived prospector for the sum of $175. It would cost probably no more than fifty cents to construct.

To Study the Acoustics of the Air

In the accompanying drawing is shown an instrument which will give excellent results in studying the acoustic properties of a room.

It consists of a horn, *A*, which may be an ordinary phonograph horn, for collecting the air vibration. At the small end of the horn a microphone, *F* and *D*, should be attached. One side of the microphone should be made of a mica diaphragm to the center of which a small carbon projection is fastened, and both fastened to the end of the horn. The other contact of the microphone should be supported by a brass frame, *J*. The carbon should be fastened to the end of the threaded rod, *I*, which should be made adjustable by the knob, *E*. The frame is to be constructed of ¼-inch brass rod. A wood box, *B*, should be built about the microphone, and attached to the horn by brass strips, *H*, *H*, and by brass screws, *K*, *K*. The remainder of the equipment consists of a set of two dry cells, *G*, and a pair of sensitive double-telephone receivers.



Sound waves will be collected by the horn and registered in the receivers, after the microphone has been adjusted properly. Records of sound waves as affected by temperature and air pressure may be kept.

Contributed by
FRANCIS B. DEARDORF.

Carrying Case for Small Drills and Taps

A handy carrying case for small taps and drills can be made from a short length of brass tubing. The tube should be sawed into two lengths, one of which is to serve as a cap for the case. One end of each tube should be closed with a brass disc which is first soldered in place and then filed to the size of the tube. A strip of brass an inch wide should be rolled, fitted into the neck of the longer tube so that half of it protrudes, and soldered. The shorter end—the cap—fits on over this.

Contributed by
EARL B. WILLIAMS.

Odd Use for Old Files

The old custom in machine shops of tacking a strip of sandpaper under each gas jet for the purpose of striking matches can be improved upon consider-

ably by using short lengths of worn out files. The files should be annealed and cut into short lengths, and a hole drilled in one end for a nail.

Contributed by
CHARLES H. ANDERSON.

Instead of Tapped Holes

Difficulty is usually experienced in tapping holes in thin metal. A simple method which will accomplish the same results is to bore a hole somewhat larger than the shank of the screw and solder a nut, tapped for the same thread as the screw, on one side of the opening.

Contributed by
WALTER FRANSEEN.

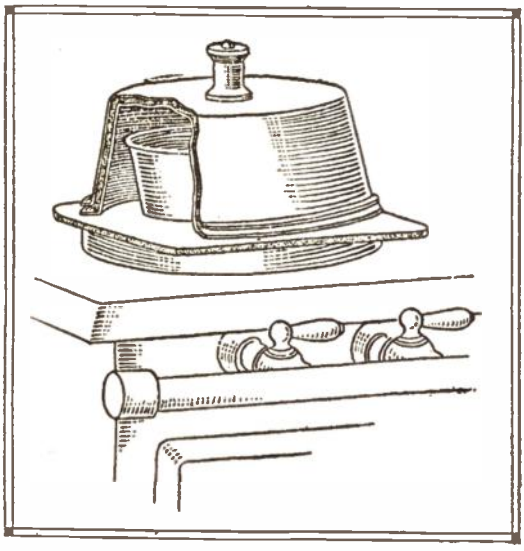
Useful Device for the Stove

This is a heat-retaining cover for flat irons having detachable handles. Incidentally it can be used as a potato-baking oven. The construction follows:

Separate two deep pie pans about ten inches in diameter with several layers of sheet asbestos. Clamp them together with a bolt passing through a hole in the centre of the bottoms and terminating in a wood spool.

In use, the pans should be placed upon a square board of asbestos, which in turn is placed upon a ring of iron.

Contributed by C. H. PATTERSON.



Improvised Wood Clamp

In constructing the table which was described in the April issue of THE WORLD'S ADVANCE, the writer experienced considerable difficulty in clamping the ends together. However, he finally hit upon the plan which is illustrated in the accompanying drawing, and it accomplished the desired results very satisfactorily.

Contributed by
E. A. HODGSON.

A Chart for Computations

In all computations involving a common factor—and this applies to a great many workshop and laboratory problems—the short cut described below will be found useful. A large sheet of paper should be ruled with fifty lines in one direction and sixteen in the other. In the first column the consecutive numbers from 2 to 50 should be written. A decision should then be made as to what factors are the most commonly used. One commonly used factor is 3.1416, which is used in determining the different values of circles. One of the remaining columns should be headed with this number, and the various products of 3.1416 found by multiplication and inscribed in the various columns from 2 to 50 (or from 2 to 99, if provision has

been made for that many numbers). The other columns should be headed by other commonly used factors, which should be multiplied by consecutive numbers and placed on the sheet in their order.

Contributed by

H. JOHN GRAY.

A Home-Made Table Lamp

A little experience in forging and lathe work is necessary in order to construct the student's table lamp illustrated in the drawings which accompany this article.

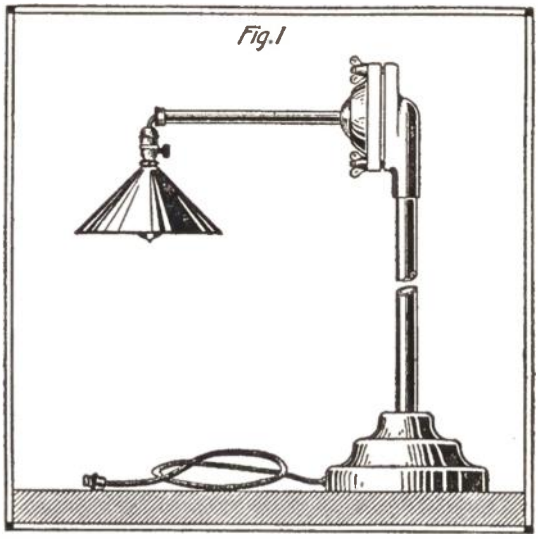


Fig. 1

The completed lamp is shown in Fig. 1; the casting for the base, in Fig. 2, and the adjustable socket for regulating the light, in Fig. 3.

The base may be cast of brass, iron or aluminum in the desired proportions. A pipe of any desired length connects the

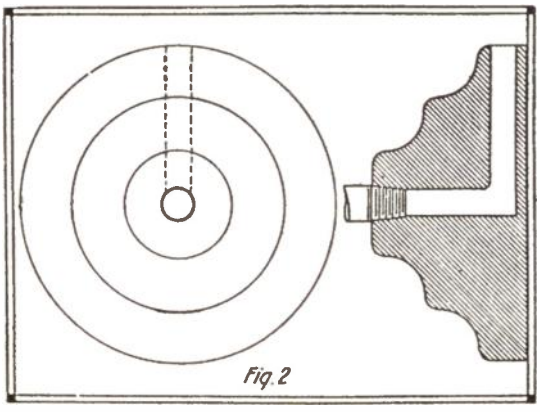


Fig. 2

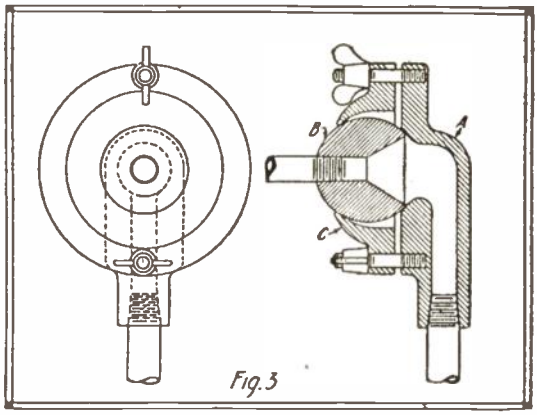


Fig. 3

base to the adjusting clamp and socket. This pipe should, of course, be hollow to admit the passage of lamp cord. Referring to Fig. 3, the tube from the base is screwed into a small culvert running through a round casting and terminating in a flaring opening. The socket, rounded as shown, fits into this opening. A smaller tube connects the socket to the lamp socket.

Regulation of the lamp stand is had by loosening and retightening winged nuts which clamp a metal covering tightly over the socket.

Contributed by

G. W. JAGER.

An Emergency Ruby Lamp

A makeshift ruby lamp for photography can be made by wrapping several thicknesses of Japanese ruby tissue paper about an electric light bulb and held securely in place by several rubber bands. Several thicknesses of paper should be used to guard against pin-holes.

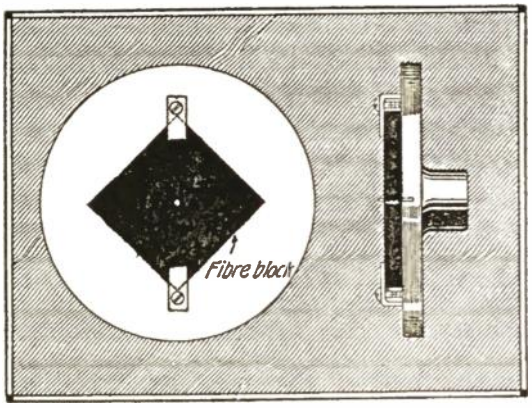
Contributed by

H. W. PRATT.

Dustless Window Cleaner

A dustless window cleaner can be made by filling a linen bag with powdered chalk. When the cleaner is used, the bag should be dipped in a bowl of denatured alcohol. When the bag is rubbed over glass a milky surface results. This should be removed by brisk rubbing with a clean cloth.

Contributed by L. E. FETTER.



To Cut Large Holes in Fibre

Large holes can be cut in small-sized fibre pieces by clamping the fibre in a lathe chuck by means of a special holder, as shown. The cutter should be small and thin.

Contributed by

JOHN TIMMER.

To Remove Surplus Glue

Surplus glue should not be wiped off while fresh, nor should it be left to dry. In the first case, it lowers the appearance of the work and often prevents stains or varnishes finishing properly. If it is left until dried, it is difficult to remove, and the work may be marred in the effort. The best plan is this: Allow the glue to remain where it is for an hour or two until it becomes jellied; then scrape it off cleanly with a thin knife or chisel.

Contributed by

WM C. HOUGHTON.

Triangle Protractor

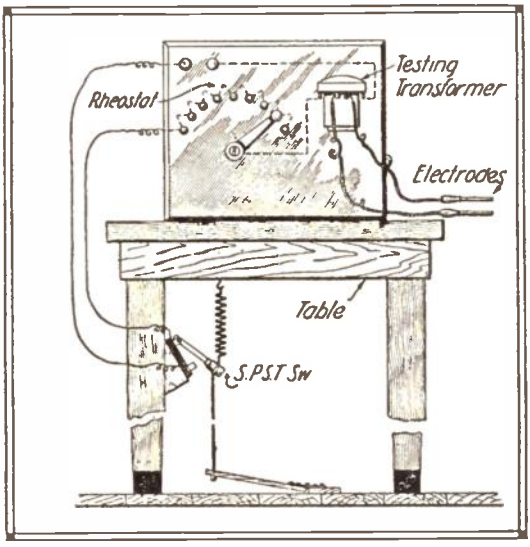
The combination of a triangle and protractor will prove to be a very useful addition to the implements of the draftsman. The degrees may easily be marked on the surface of an ordinary celluloid triangle, as this material is readily scratched with a sharp point. On the perpendicular of the triangle, a scale may be marked, thus further enhancing the value of the instrument. The degree markings may be placed in their proper positions with the aid of a protractor.

Contributed by

FRANK HARAZIM.

Foot Pressure Closes Switch

A safety switch, closed by the pressure of the foot, is illustrated in the accompanying drawing. In case the workman should receive an electric shock the withdrawal of his foot from the pedal immediately opens the circuit. This suggestion will find valuable application



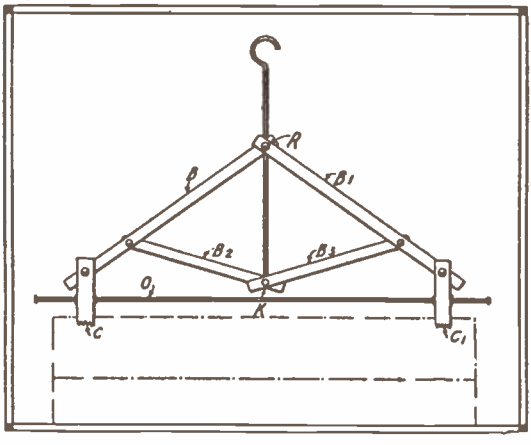
in laboratories where high voltage current experiments are carried on.

Contributed by

FRANK HARAZIM.

Improved Coat Hanger

An improvement upon the coat hanger which was described in these columns



in March is suggested by one of our readers. Instead of a hook for the coat and hat, a cross-arm should be nailed across the board and a wooden peg driven above it for the coat and hat, respectively. The rest of the construction is the same.

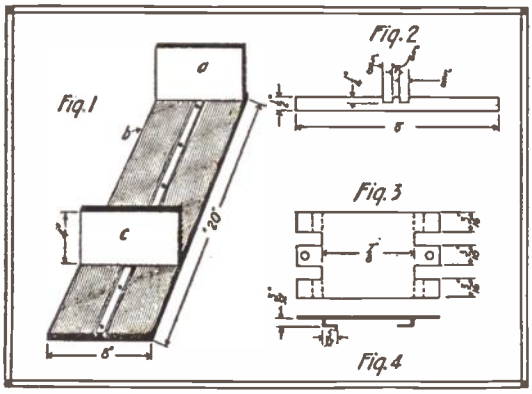
Contributed by

C. L. MACAULAY.

The Construction of a Book Rack

The book rack illustrated in the accompanying drawings was designed by the writer for filing copies of THE WORLD'S ADVANCE, and it has proved very satisfactory for that purpose.

The base of the rack, *b*, is made of hard wood and measures 20" x 8" x ¾".



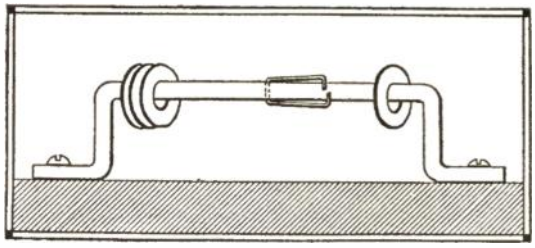
Two parallel grooves should be cut along the centre and a brass strip mounted along the track between them. One end rest, *a*, should be secured to the base with wood screws, while the other, *c*, slides along the track by means of the brass slider shown in Fig. 4. The end elevation of the base is shown in Fig. 2. Fig. 3 shows the slider before it is bent to the proper shape.

Contributed by

LESLEY BERGVALL.

A Counter for the Delivery Man

In counting the number of bottles of water or barrels or cases of other liquids which are delivered, a counter such as is used in billiard games will be useful. The counter consists of a long brass handle, fastened to the back of the delivery wagon and containing a number of washers. When one delivery is made a number of washers to correspond with the number of units of whatever sort are delivered are moved from one side of the handle to the other. To prevent them sliding back and becoming mixed when the wagon is under way, a small wire clip, inserted through a hole drilled in the handle and bent at the ends as shown should be added.



Contributed by

EARL B. WILLIAMS.

A Watch Case Calendar

The owners of hunting case watches will find it very convenient if the calendar for each month is inserted in the front cover of the watch. The calendars should be pasted in with flour paste so that they can be easily removed at the end of each month.

Contributed by

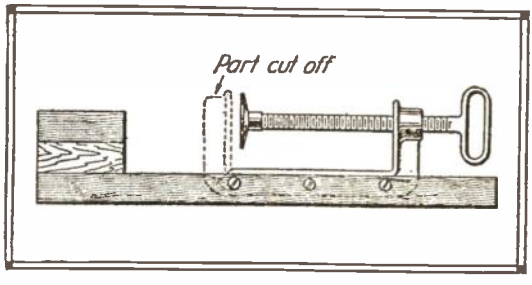
A. STANLEY WIENOLD.

An Enlarged Clamp

The scope of a clamp can be increased to an almost unlimited degree if the lower part is cut off and the frame bolted to a long wooden bar, one end of which is built up with several 2 x 4 blocks. These blocks should be securely bolted to the bar.

Contributed by

S. PENBERTHY.



To Anneal Steel Quickly

Tempered tool steel, such as files or drills, may be quickly annealed by heating the object to a dark red in a slow fire, cooling it in the air until the red color has almost disappeared, and plunging it into cold water. A few trials will be necessary before the correct cooling point is found.

Contributed by

F. M. A'HEARN.

Whites of Eggs for Pasting Labels

A good adhesive for fastening labels on bottles is fresh egg albumen. When dried, the label will not come off even in water.

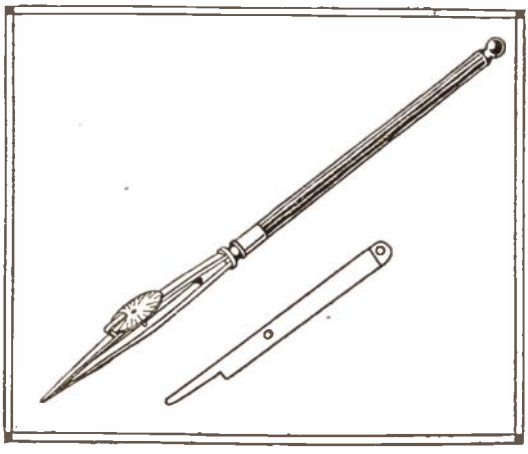
Contributed by

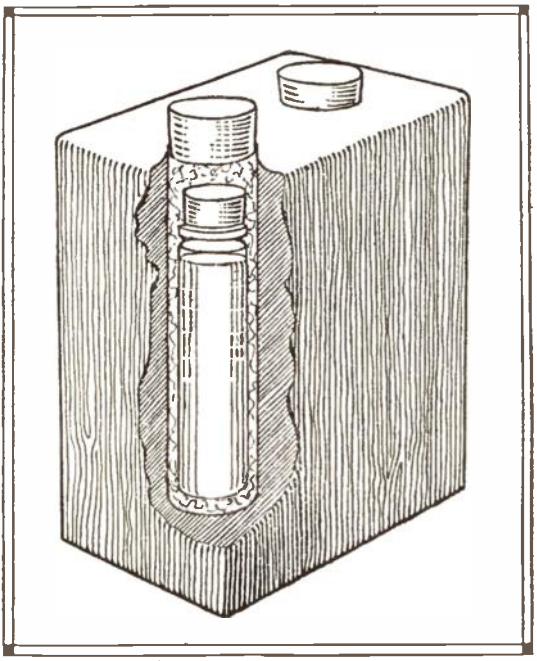
A HANDYMAN.

Index Wheel for Ruling Pens

If an index wheel of the following description is attached to a ruling pen, greater uniformity will result in the finished drawing. The wheel may be cut from sheet copper or brass. The index finger is also made of the same material. To assemble, the pen points should be removed from the handle and the regulating screw passed through the hole in the end of the index finger. The screw of the thumb wheel should be inserted through the central hole of the index finger and the pointer bent up over the index wheel as shown.

Contributed by C. H. PATTERSON.





Parcel Post Mailer for Small Tubes

Small phials can be safely mailed if they are placed in holes bored in soft wood and packed with cotton batting or sawdust. It should be remembered that liquids and explosives are barred from the mails.

Contributed by

FRANCIS W. NUNENMACHER.

A. C. Motor Troubles

An experience is cited here that may save amateur experimenters considerable trouble in doing welding on the rotors of alternating current motors. An armature of the "squirrel cage" type, having about 83 copper bars, had been welded on the resistance rings, using brass sputter and borax as a flux. When current was sent through the motor it failed to rotate, owing to the fact that the flux had flown under the bars and had insulated them from the rings. It was necessary to apply an extremely high heat to the brazing metal to run it out. Then the rings were turned up in a lathe and the bars filed to make contact. After this they were tinned and soldered to the rings, thus completely curing the trouble.

Contributed by F. W. LEHR.

A CRAFTSMAN SUMMER COTTAGE

Describing a Summer Dwelling that May Be Constructed by the Average Handy Man at Low Cost.*

By Ralph F. Windoes

Instructor of Manual Training, Davenport High School, Davenport, Ia.

Illustrations from drawings made by the author

WITH the main room framing completed, build up the lower part of the porch frame. Fig. 20 gives a detail of this framing in sections. The front should be made up first —upon the floor—in a manner similar to the framing of the main walls.

Select two 2 x 4's of the same length as the width of the porch for plates, and cut fifteen 2 x 4's that are 32" long for studs. Nail them in place 24" on centers, and double at the ends. Set this frame up, and spike it to the floor. It will not be necessary to brace it, because of its short height.

Next, frame the right side in exactly the same manner, and toe-nail the ends of the plates onto the front and the double corner of the main frame.

The left wall frame will be made a little different, as the screen door must be provided for. Notice that the two long studs do not have a plate on their upper ends, as this plate will be placed when the upper section is built, but they must be held, temporarily, with a diagonal brace to the main wall frame. When fitted in place and secured by the upper section plate this brace will be removed. Fit the studs and the header around the screen door frame, exactly as you did before, allowing a little clearance on each side. When ready, raise the frame and securely nail it in place.

Fig. 21 gives a detail of the three columns supporting the front of the upper section. Each is built up of 2 x 4's dressed on all sides and carefully nailed together. Two blocks 1¾" square are nailed to each end, the upper to serve as the abacus, and the lower, the plinth. When ready, nail these in place on the front plate, as seen in Fig. 22, and brace them so that they are perfectly plumb and in line.

Upon the upper ends of these columns must rest the header that supports the roof. It is nailed up from the two 2 x 10's, and is cut as long as the plates of the lower section. Spike these planks firmly together, and straight on both edges. Carefully raise it into position on the posts, and toe-nail it to the abacus of each post.

The next step will be the framing of the porch roof, using the 18-foot 2 x 4's for the rafters. This framing problem is so simple that a detailed description is hardly necessary. Each rafter at the high end is fitted over the plate of the main wall frame, and at the low end over the porch header, as illustrated in Fig. 23. Run the upper end about one foot past the plate and nail each rafter to a corresponding rafter of the main roof. At the lower ends, cut the rafters with a 12-inch lookout. Spiking this end firmly to the header will complete the roof framing of the porch.

Next, frame the upper sections of the porch, as detailed in Fig. 24. First nail the plates across, toe-nailing their ends into the double studs of the main frame, and the porch header. These plates must be straight and level. The left side plate, of course, will rest upon the upper ends of the long studs already in place, and will be nailed to them.

Between each plate and the outside rafters, nail in the studs. They are cut at the upper end in the same manner as the studs in the main frame, excepting

* This article is one of a series that has appeared in every issue of THE WORLD'S ADVANCE, beginning with the May number. The series is completed with this instalment.

The Craftsman Summer Cottage, as it Appears when Completed. In Order to Derive the Greatest Pleasure from the Possession of Such a Dwelling, the Site Selected Should Preferably be Near a Lake or River.

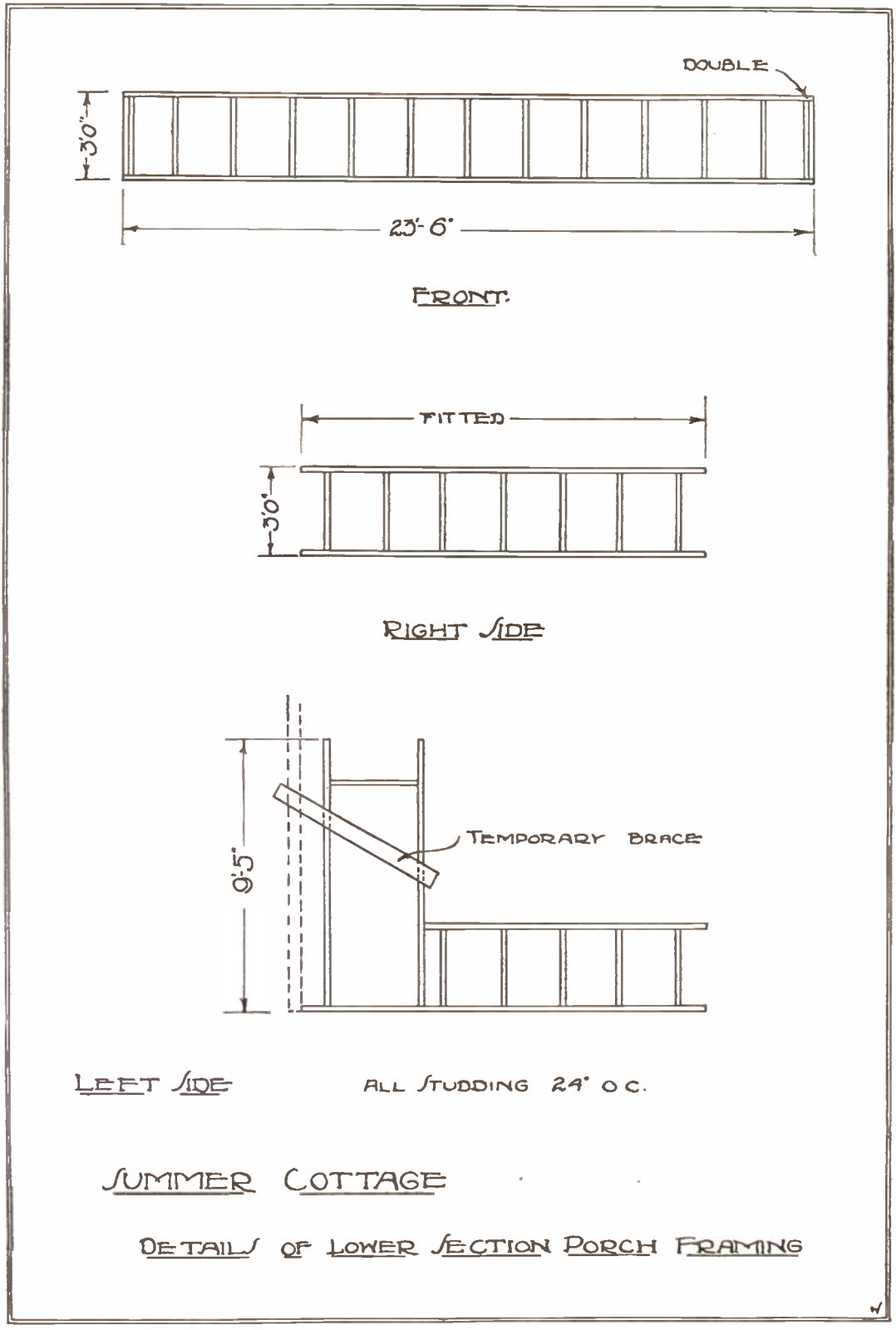


Fig. 20.—Constructional Details of the Lower Section of the Porch Framing.

that the cut will be on the inside instead of on the outside, as in the former case, as all studding must be in line. When this much has been completed, your porch framing is finished.

The framing of the kitchen is very similar to the work already undertaken. The rear wall is framed, as detailed in Fig. 25, raised into place, and firmly braced. Next, the rafters are cut and fitted exactly as was done with the porch roof, and the side wall floor plates are laid. The studs are built in, as before, allowing clearance for the door and window frames. Fig. 26 gives a detail of each section of this framing.

With this much accomplished, you will be ready to begin the finishing. First, put on all of the drop siding, working from the bottom toward the top of the structure. The first boards laid should be very nearly straight, and their lower edge, which will contain the

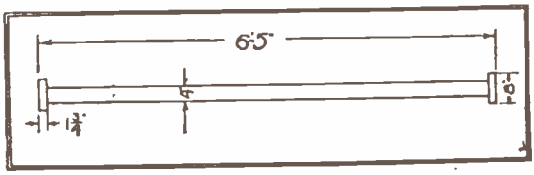


Fig. 21.—Detail of a Porch Column.

groove, should extend a little below the lower edge of the sill plate. This is to allow all rain to drip to the ground without working under and rotting the sill members. A detail of this finishing is given in Fig. 27. In breaking joints, try to bring the ends of the boards where the casings will cover them, as illustrated in the elevations in the opening chapter of this series. If this is impossible without wasting a great deal of material, be very sure that the butting ends are sawed square, and each joint comes over a stud. Fit around each opening, flush with the inside face of the studding, and carry the siding up to the top edge of the end rafters. The lumber bill calls for enough

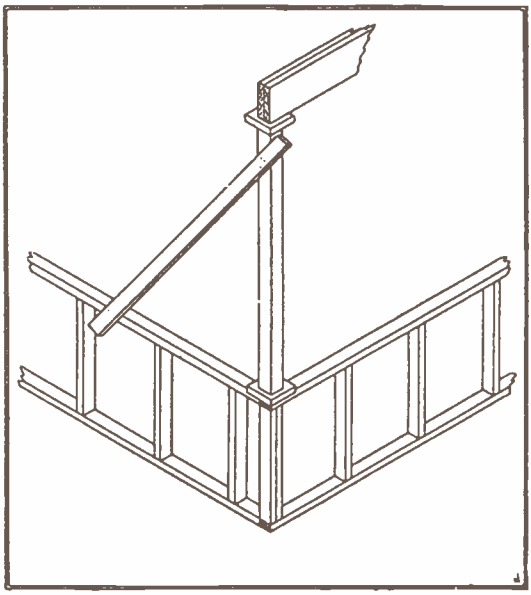


Fig. 22.—Porch Framing Detail.

material to cover the partition between the living room and the kitchen, applied from the kitchen side, but if the craftsman decides to cover his walls with wall board, as suggested at the end of this instalment, of course this siding must be omitted, as all sides of the kitchen should be covered alike.

Next, drive the pump pipe in the kitchen, as the upper end—while driving—must project through the roof, and the roof boards would interfere if they were to be laid first. At the point in the floor where your pump will stand, bore a hole large enough to admit the 1¼" pipe and coupling. Attach the drive point to the lower end of the pipe, and the drive cap to the upper. Insert the lower end through the hole and allow

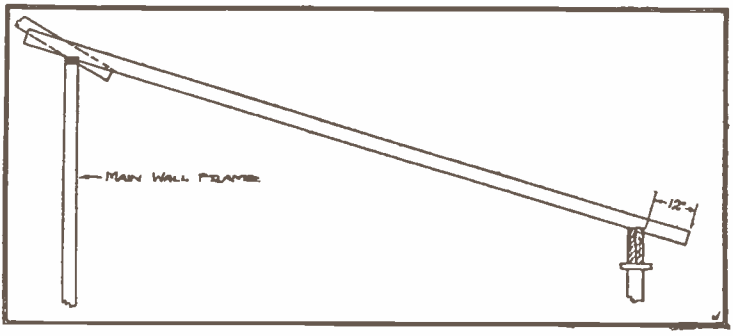


Fig. 23.—Detail of Porch Rafter Framing.

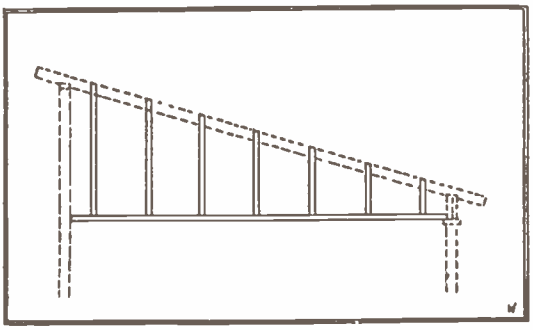


Fig. 24.—Detail of Framing of Upper Porch Section.

the upper to project straight through the rafters. Fastening and securely bracing your 18-foot ladder so that you can use it to conveniently reach the upper end of the pipe, carefully drive the point into the ground. Using the ladder to stand upon, you are thus enabled to descend, as your pipe is driven down. When it is the proper distance from the floor, remove the drive cap and drop a string down the pipe with a weight attached. Leave it for some little time, as the water might be slow in entering on account of the dirt in the perforated jacket. If, upon withdrawing the string, the lower end is wet, you have probably gone deep enough. Generally, being near water, 20 feet is sufficient unless the cottage is built upon a very high elevation. Attach the pump, prime it, and give it a try-out before leaving this important part of the equipment.

Next, put on the roof boards, just as you did the flooring, allowing them to project out on each side one foot for a cornice. Cover with the rubber roofing, *according to the directions of the manufacturer found upon each roll,* turning the outside edges under the cornice and securely fastening them; also the ends at the lower edges of the roof.

Build the bracket in the kitchen to carry the chimney, next, as illustrated in the left side elevation in the May instalment. Carefully cut a circular hole in the roof above this bracket, and place the tile, large end down. The lower end of the T-branch should be filled with a rich cement mixture, also each joint. Strengthen with the wire guys to the roof, and fit the rubber roofing very snug around the pipe, using plenty of roofing cement to make a good job of it.

Fit all door and window frames into place, and nail them securely to the siding and the studding. Next place all casings, the frieze, water table, etc., as illustrated in the elevations and in Fig. 27. Be sure that you make neat, sharp joints where the various pieces join. A good way to do this is to saw a bit outside of the pencil line, and plane down to it, constantly trying the piece in position. The upper end of the water table is to be planed to an angle of 45 degrees, so as to guide the water away from the building.

Fit the windows and doors very carefully into their respective frames. Take a great deal of time for this important part of the building, as a poor job of fitting will reflect discredit upon the builder as long as the cottage stands. The kitchen and balcony single-sash windows are hinged at the top, while at the bottom they are fastened with the transom catches. The other windows have the spring bolts inserted through their sash with holes bored into a number of positions in their frames, these holes permitting the windows to be raised to various heights. The doors are all to be equipped with the lock sets, and the screen with its attachments.

There are a number of odd jobs left such as the placing of the sink with its drain pipe, building the balcony ladders, the porch seats and the steps. As these tasks are so simple for the craftsman who has just built a complete structure,

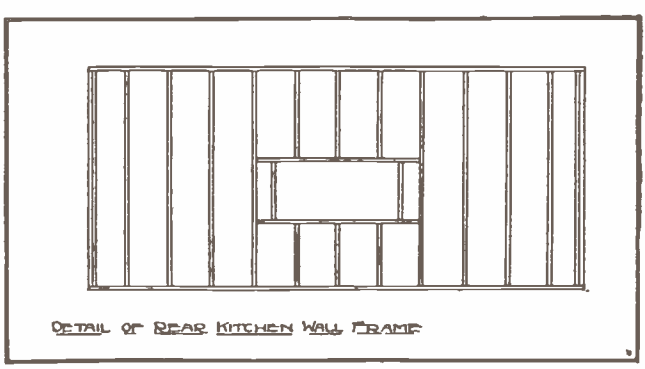
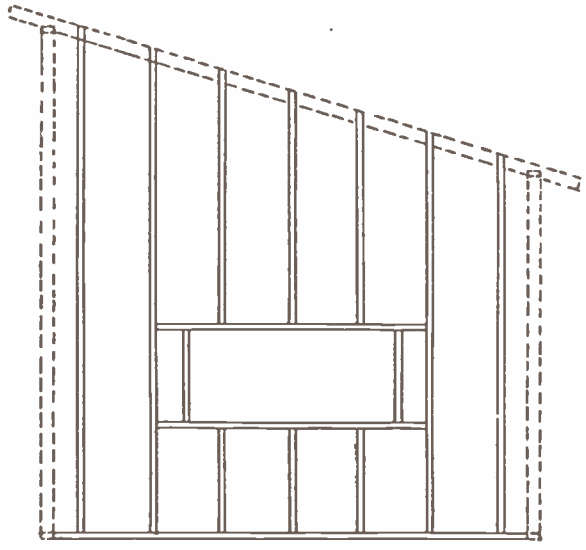
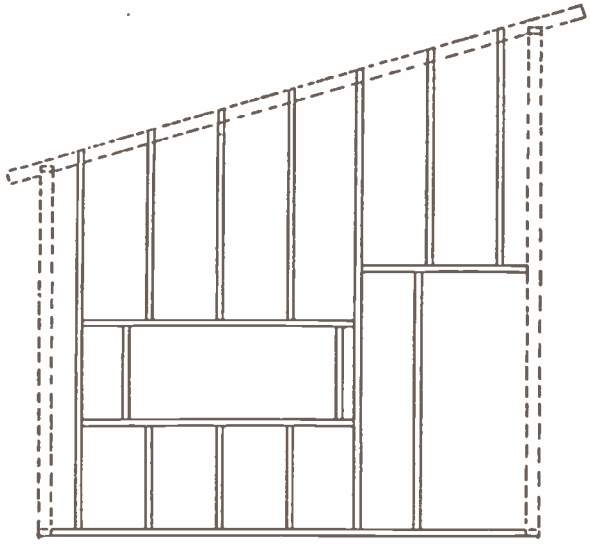


Fig. 25.—Arrangement of Framing for Rear Kitchen Wall.



RIGHT SIDE



LEFT SIDE

SUMMER COTTAGE

DETAILS OF KITCHEN WALL FRAMING.

Fig. 26.—Framing for Kitchen Wall.

we will not take the space to detail them.

Now to paint the cottage: Select a dry day and be very sure that the wood is clean and free from all moisture. With the small can of shellac, well shaken up, cover all knots and bad, sappy places, as the pitch from these is liable to work through the paint. When this has dried thoroughly—it will only take an hour or so—apply the priming coat. This is mixed from the two gallons of gray prepared paint, thinned out with the gallon of boiled linseed oil. Stir the mixture until it is perfectly even and rather thin. Use a wide brush, four inches or over, and cover the entire structure, including the casings and the porch floor. The priming coat should not be heavy, but it should be brushed out well.

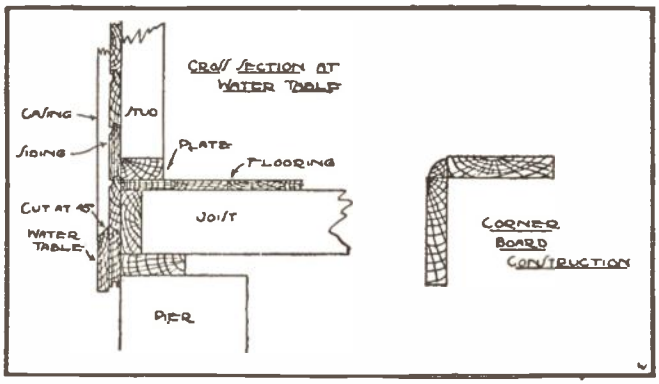


Fig. 27.—Details of Exterior Finish.

From four to six days should be allowed for the first coat to dry. Do not thin the paint for the second coat, but stir it up constantly. Apply the body color and go over the second time with the trim. The black sash paint is carefully applied with a small brush, preferably flat, and is put on before the porch paint.

Finally, attach the wire screen cloth around the porch and cover the window openings. If the craftsman has the time, and so desires, it would be a good idea to build frames for the screen, which would fit in between the posts on the porch, also in each window. They could then be taken down and stored inside during the winter, which would greatly prolong the life of the screen.

This practically completes the structure as originally planned, with the exception of the curtains, as described in the opening instalment. They are made to slide on wires so as to be out of the way in the day time.

Of course, the inside of the cottage will have a rather crude appearance with no casings or wall covering, so if the craftsman cares to add a little more to its comfort, and, incidentally, to its expense, it would be advisable to cover the walls with wall board, and put on casings of yellow pine. The additional expense would be about $50, depending, of course, on the kind of wall board purchased.

If Mr. Curtis's articles on the lighting of the cottage are taken advantage of, it would be advisable to wire it before putting on the wall board. It might be a good plan to wire it anyway, even if the cost of a lighting plant prohibits the use of the lights at first, as it will be much easier to run the wires when the framing is open.

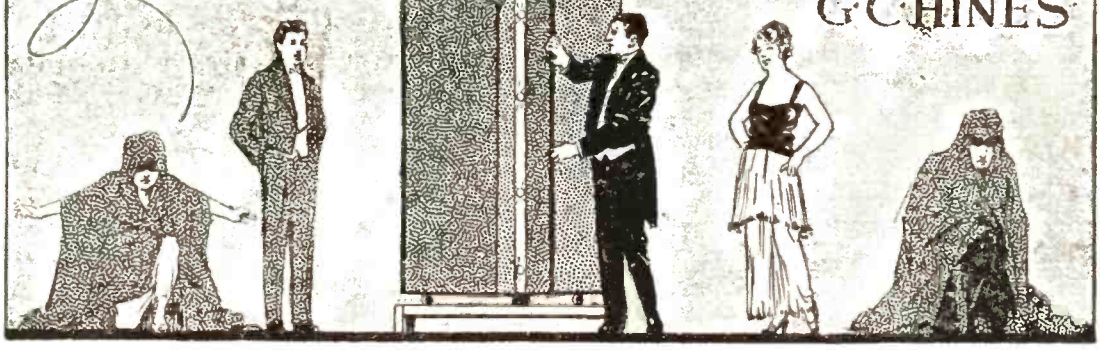
Furniture especially suited for making the summer cottage both comfortable and attractive will be described in the September issue of THE WORLD'S ADVANCE.

WHAT HAPPENED TO AN OWL

One evening not long ago a great horned owl alighted on one of a pair of conductors carrying an electric current of 20,000 volts in the neighborhood of Montreux, Switzerland. He knew nothing of what was passing under his feet, and would have been safe had he not idly stretched out one of his great wings, more than two and a half feet long, until it touched the other conductor. Instantly all over the region supplied with electricity by this line people found themselves plunged in darkness. When the cause of the short circuit was investigated, the body of the big bird was found with the head burning on one wire and the wing on the other.

The MYSTIC CABINET

by G. C. HINES



THE illusion about to be described, although embodying several old principles in the art of magic, nevertheless produces a very startling effect on the average audience. The presentation is as follows:

The performer first directs the attention of the audience to a cabinet which is about four feet square and mounted on roller casters. The cabinet is then placed on a small platform so that it can be revolved and at the same time it can be proven that no trap doors are used. In the center of the cabinet is placed a row of electric lights mounted in front of suitable reflectors, and extending from top to bottom. There are also two doors placed on the back of the cabinet which serve the purpose of proving to the audience that the cabinet is empty.

The row of lights is illuminated and the performer, stepping inside the cabinet, holds a piece of black cloth so as to hide the front, but as he is thus holding the cloth a form is seen to shape itself in the cloth and a moment later the person thus produced steps down from the cabinet and crouches in front of the footlights, with the cloth still over him. Another piece of cloth is taken and a second person produced in a similar manner, followed by a third. The performer's lady assistant then steps into the cabinet and also produces a person in the same manner as the performer. She then steps from the cabinet, whereupon the two rear doors are opened and the cabinet revolves, thus showing it to be empty. The wonder of the trick is that the audience has been able to see beneath the cabinet during the entire time, and that the cabinet being placed ten feet or more in front of the back curtain has rendered it impossible to place a plank from the rear to gain access to its interior.

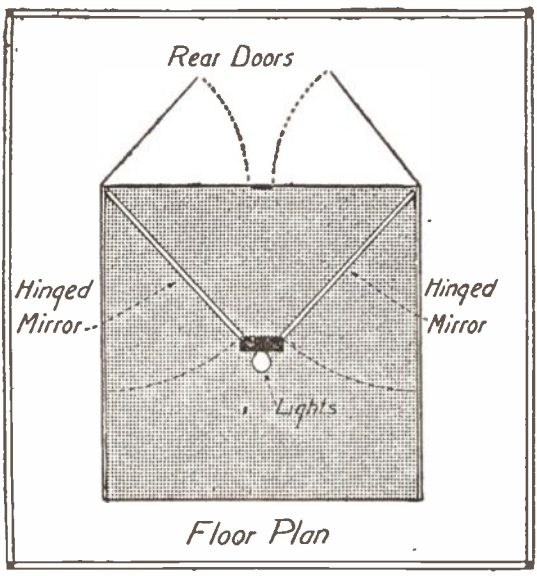
After the cabinet has been proven empty, the performer steps into the cabinet, which is then given a turn, and as the front of it meets the eyes of the audience the performer is missing. His lady assistant then vanishes in the same manner. At this point of the illusion another assistant fires a pistol and, to the amazement of all, two of the figures previously produced from the cabinet jump up and throw off their cloths, and prove to be the performer and his assistant.

As mysterious as the illusion may seem, it is very simple to produce, the main requisites being two substitutes—one for the performer and the other for the lady assistant—and two mirrors. The interior of the cabinet must be lined

with some dark cloth. The row of lamps serves to hide the fact that at this point the edges of two mirrors come together, the opposite edges being hinged to the rear corners. When the mirrors are in their normal positions they reflect the sides of the cabinet, therefore deceiving the audience into believing that they can see the back of the cabinet. The backs of the two mirrors are lined with the same kinds of cloth as the inside of the cabinet.

At the beginning of the illusion the mirrors are placed so as to reflect the sides of the cabinet and behind them four people take their places; two being the ordinary assistants while the other two are the substitutes and are made up to resemble the performer and his lady assistant as closely as possible. This is very easily accomplished if the persons are of the same build. When the performer holds up the first two pieces of cloth, the assistants push open the mirrors and take their places beneath the respective cloths. However, when the performer holds up the third cloth his double takes hold of the cloth while the performer stays under the sheet and thus hidden from view steps down to the footlights with the two assistants. The lady assistant then takes her place in the cabinet, going through the some procedure as the performer. When the lady's double takes hold of the cloth the two mirrors are pushed over to the sides of the cabinet where they are held by small metal clips. Thus the two rear doors can be opened and the cabinet freely shown. After the cabinet has been shown the performer's double steps into it and while the cabinet is being turned he closes the mirrors and steps behind them, hiding himself from view. The lady's double then follows suit. Thus, when the pistol is fired it is a very simple matter for the performer and his assistant to jump up and throw their covers off, bringing the illusion to a very striking climax.

To obtain the best results the illusion must be worked with snap and energy. It is a very good idea to have the assistant do most of the work so as to have the attention of the audience diverted from the performer and his collaborator.



Plan View of the Cabinet for Performing the Illusion.

NAPHTHALINE AS MOTOR FUEL

The war blockade is forcing Germany to save her store of gasoline by developing acceptable substitutes for motor fuel. The distillation of coal tar gives her great quantities of benzol, and when this is properly purified it can be used without a bad deposit of carbon in the cylinders. The Feld process of distillation now used in Germany furnishes the desired grade of benzol.

Naphthaline, another product of coal tar distillation, is receiving much experimental attention in Europe. At present it has no use except as the base for about twenty million dollars output of artificial indigo and a very limited use in the form of moth balls. Germany alone makes 175,000 tons of naphthaline every year and she has already demonstrated that with special apparatus for making an explosive mixture with air, melting the solid, of course, at 79 degrees Centigrade, power may be obtained at an extremely low cost.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us.

Electric Lights for the Summer Cottage*

IN the selection of a generating equipment for the charging plant of the summer cottage, the worker has a number of options. For instance, he may investigate the claims made for the many small generating units consisting of dynamo and gasoline engine either direct connected or belt driven. While these little plants are perhaps high in price for our purpose, still they have many features of merit which commend them to the notice of the amateur engineer in charge. On the other hand, the ingenious man may couple together a small engine and dynamo, mounting them on a single wooden base, and perhaps get quite as satisfactory results as the other fellow who put a hundred or two into a regulation plant. This article is intended for the handy man who, for some reason or other, scorns the idea of purchasing the plant complete, and who wishes, perhaps, to pick his engine from some place near the junk heap and to rewind an old fan motor to make his generator. This very thing has been done, and that more than once within the knowledge of the writer.

To this end, therefore, let us consider the amount of electrical energy necessary to charge the battery and after that the horsepower required to get this energy out of the dynamo.

The battery suggested in former articles is of a capacity ranging from 80 to 100 ampere hours and its charging rate is in the neighborhood of 10 amperes for from eight to twelve hours. A generator having a capacity of 100 watts will do the work if this capacity is actual as well as theoretical. The voltage should be in the neighborhood of eight or nine and the machine should be capable of standing a continuous run of twelve hours, delivering a current of ten amperes without overheating either in the windings or the bearings. Perhaps the most prolific source of trouble in the small machine is found in the bearings, which are seldom well designed and frequently without adequate oiling facilities. Of course, the ideal generator for our purpose is one of the standard automobile lighting and charging type. It is likely that the cost of a new one will scarcely be justified, and, unless the worker is able to buy a second-hand generator in good condition, it is probable that he will be obliged to have recourse to a dynamo of inferior design.

In the writer's experience one of the most satisfactory small generators available is one made from a rewound small-power motor. The case of a one-eighth horsepower machine of this type is recalled. The motor was picked up in a junk shop at a price commensurate only with the iron and copper in it, and, while the windings were quite worthless since they had been literally burned up, still the frame, bearings, armature and commutator were in excellent shape after the dust and oil were cleaned off. The machine had originally been wound for 110 volts and of the shunt type. In removing the winding, or rather its remnant, the sizes of the wire on armature and field were carefully noted and in rewinding there was used a wire having ten times the area of the original one. The carbon brushes of the motor were displaced by ones of copper gauze and

* Continued from the July number.

the small pulley exchanged places with a larger one having a flange to serve as a balancing flywheel. After an initial charging of the field by connecting it to the ignition battery of the engine, this little piece of junk started generating without the slightest difficulty and for all the writer knows it is still working, although at this writing the machine has been out of his possession for a matter of five years. On a slight overload the fields would run warm, and in order to cool them a crude fan was attached to the pulley inside the rim. This completely obviated the difficulty, and after its adoption the generator would deliver for half an hour at a time more than twice the current it was intended to supply, without developing serious heat.

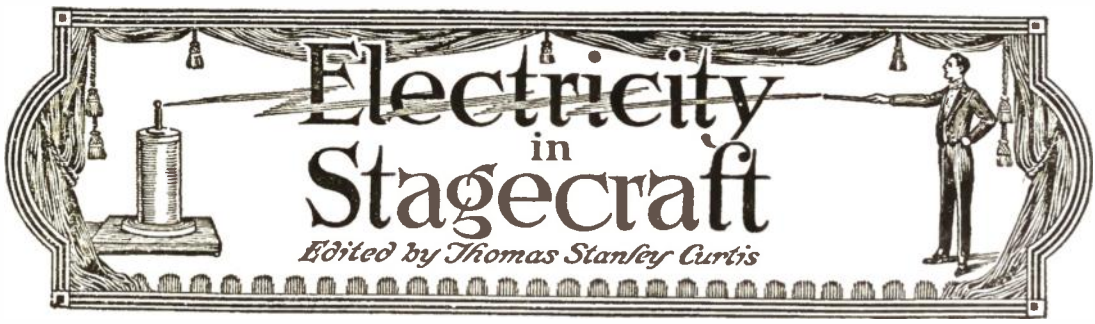
The remarks in the last paragraph are given solely with the idea of offering a suggestion to the handy man who feels that he is courageous enough to attempt the rewinding of an old machine. The principal point to look out for in the buying of such a machine is the form of lubrication and the size of the shaft and bearings. The conventional wick oiler so frequently found in small motors is quite satisfactory if the proper lubricant is used and assuming, of course, that the wick is held against the shaft by means of a spring of the correct strength. The ideal oiler is the ring type, and if the machine is so equipped the worker need not look much further beyond ascertaining whether or not the bearings are fairly snug and the shaft in good condition. A machine equipped with ordinary oil-cups or oil holes in the bearings is nine times out of ten a poor buy except for purely experimental work. So much for the dynamo.

If the worker is fortunate enough to have a small stream on or near his place, three-quarters of his problem is solved. The amount of water power needed to turn a 100-watt generator is so small that the crudest type of waterwheel will answer in most cases. This question of water power is brought up at the present point before the selection of a gasoline engine is suggested, and water power in the case of the summer cottage is, in more ways than one, ideal.

If the water power is found to be unavailable, however, the worker had best resort to the gasoline engine. In this event the plant would be housed beneath the seat on the porch. The engine need not be larger than a half or even a quarter horsepower if the rating is honestly given. Air cooling is satisfactory if the machine is properly designed and equipped with a cooling fan, but a water-cooled machine is to be recommended if available. There is little choice between two and four-cycle machines, but in either case the engine should be governed closely. A new engine is advised unless a second-hand machine can be obtained from a responsible dealer who will guarantee the condition of its valves, bearings, cylinder and piston. In the internal combustion engine these parts are subjected to strains that weaken the output of power without materially affecting the running qualities of the engine when the load is off.

Assuming that the dynamo and engine have been obtained, the worker may proceed to assemble them, preferably on two substantial struts of wood, the dynamo being so mounted that it may be slid forward or backward to tighten or loosen the belt. The skids may rest on thick pads of rubber or felt fastened to the porch floor, or, better still, four upright posts may be set in the ground beneath the porch, passing up through its floor without touching, to afford a substantial foundation for the little plant, which is thus independent of the cottage, although housed by it. The vibration is likely to be annoying unless some provision is made in this manner to absorb it.

The belt from engine to generator should be long and pliable; a tight, short belt has no place here. The gasoline should preferably be kept in an underground tank a short distance from the cottage and fed under slight air pressure through copper tubing to the engine. The voltage of the dynamo should be made variable through the insertion of a small rheostat in the field circuit. The leads from the dynamo are secured to the right-hand poles of the switchboard shown in the preceding installment of this series.



The Preparation of an Electrical Act in Vaudeville*

"A Million Volts Through the Body"

FOR several months past there has appeared in this department a series of articles describing the construction and use of electrical apparatus designed for the production of spectacular experiments with the electric current. The assembly of the entire apparatus as described would entail a considerable expenditure of time and money and there are cases where this outlay would scarcely be justified. For instance, the platform lecturer would scarcely care to burden himself with the cumbersome and expensive equipment so essential to the performer on the stage. For the benefit of the readers to whom the elaborate outfit does not appeal, the present article will give a summary of the various instruments necessary for the successful presentation of both the big vaudeville act and the modest lecture as well, pointing out how the cost or weight may be cut down here and there.

The one big feature of any electrical act is the high-frequency work. This fact is admitted by dozens of performers and lecturers alike. The very idea of taking thousands of volts of electricity through the body and still living to tell the tale is theatrical in the extreme, and it is no wonder that so many so-called electrical kings separated a gullible public from their dollars for years on the sole claim that a supernatural or other unusual power made it possible for them to take the enormous voltage through their bodies. The high-frequency coil may therefore be regarded as the one essential part of the outfit, and the other instruments more in the light of accessories.

The coil described in recent articles will deliver a spark several feet in length. That this is spectacular and impressive no one will deny, but the outfit weighs hundreds of pounds and requires for its operation several kilowatts of electrical energy. The utter uselessness of such apparatus for the small lecturer is at once apparent. Far better it is for him to make or purchase a small coil capable of giving an eight or ten inch spark and taking its current from the nearest lamp socket. Furthermore, the large apparatus requires for its operation an alternating current, and this is not always obtainable. The only practical alternative is a rotary converter which in this large size is heavy and expensive. The small coil may be made on the "kick-back" principle, and in such event its operation is equally satisfactory on either direct or alternating current through the change of a simple connection.

The question of the high-frequency

*This article is one of a series that has appeared in past issues of *Modern Mechanics* and THE WORLD'S ADVANCE since September, 1914. Previous instalments have covered the construction of the apparatus referred to in this article. The series is completed in the present issue. The demand for the back numbers has been so great that several issues are now out of print and can no longer be supplied. The author has in preparation, however, a very complete book dealing with this subject in a thorough manner and interested readers may obtain information relative to the work through our Book Department.

outfit therefore resolves itself into one of whether the performance is to be given in a chain of small lecture halls or good-sized theatres. In the former case the small portable outfit is ample and certainly far more useful, while the latter use would justify the best aggregation of paraphernalia the capital of the owner would command. The salaries of feature vaudeville acts are, as a rule, commensurate with the pulling power and therefore the attractiveness of the act itself. Recognizing this, it is certainly wise to put forward every effort in an endeavor to make the true vaudeville act as big, as spectacular, and, to sum it up, as impressive as may be possible. The results justify the expenditure.

In the construction of the apparatus the average reader is face to face with a problem. The manufacturer of standard apparatus will not even quote on this special material; the model shop wherein inventions are developed is too thorough and expensive; the average electrician knows nothing whatsoever about the apparatus in question; the typical machinist is worse than useless where complete assembly is concerned, as he is either too "rule of thumb" or too literal. The reader will wonder what he is to do. The answer is to build a home workshop. It is cheaper in the beginning and in the end, and if the apparatus is worth having and building, it is deserving of a proper birth place. The tools required may be purchased for perhaps a quarter of the sum demanded by the combined carpenters, machinists, electricians and the rest of the vast army of mechanics, each one of whom does not know just what is desired, but is certain that he is capable of building it just the same.

The construction is best done in a spacious room wherein the apparatus can also be set up and tested, and the act rehearsed. This means, of course, the installation of electric service. The room should have plenty of open floor space rather than spacious work benches, although these are quite as essential within reason. The tool equipment may consist of a fairly complete set of wood-working tools and bench, an engine lathe of light construction but of large capacity as regards swing, a small drill press and complete set of metal tools, such as pliers, hacksaw and files. With such an equipment the handy man—and it is assumed that the would-be entertainer is a handy man or he had better not start on the road with his outfit—may construct the entire set of apparatus with the assistance of a bright boy or even girl if she be mechanically inclined. And after the apparatus has been built by the man who intends to use it, who can gainsay the fact that he, better than anyone else, is prepared to take care of it and repair it if necessary? If some of the more intricate machine work, of which there is little, is beyond the capabilities of the amateur, then let him go to the regulation shop and have just that part finished up to drawings.

The question of drawings brings us to a point of vital importance. Before a stroke of work is done on the apparatus, each and every part should be depicted in a large drawing and all dimensions checked to determine their accuracy. The space available in this magazine has not rendered it possible to cover this detail with any thoroughness, but the individual worker should develop his design from the suggestions given, making his drawings complete in order that he may fully understand the construction of the various parts. For the convenience of those who do not feel capable of developing these drawings, the author of this series has prepared a set of detailed blueprints showing the construction of the apparatus as a supplement to the articles.*

In no sense is the work of building the apparatus difficult and neither does it require the services of skilled labor. The ability to use tools in an intelligent manner and, what is far more important, a fairly intimate knowledge of the apparatus being built, may be said to constitute the qualifications for success. In order that the latter qualification may be obtained, it is suggested that the prospective builder diligently consult every book pertaining to the subject that he can lay his hands on. These books may be numbered on the fingers of one hand,

(*Continued on page 246*)

*These blueprints may be obtained at a moderate price through our Book Department.

Practical Electro Therapy

Edited by Thomas Stanley Curtis

High Frequency Apparatus*

THE production of a highly concentrated heat in certain areas of the body is desirable at times in the practice of electro-therapeutics, and to make possible this localized application a special form of current is supplied by the modern apparatus.

THE THERMO-FARADIC CURRENT

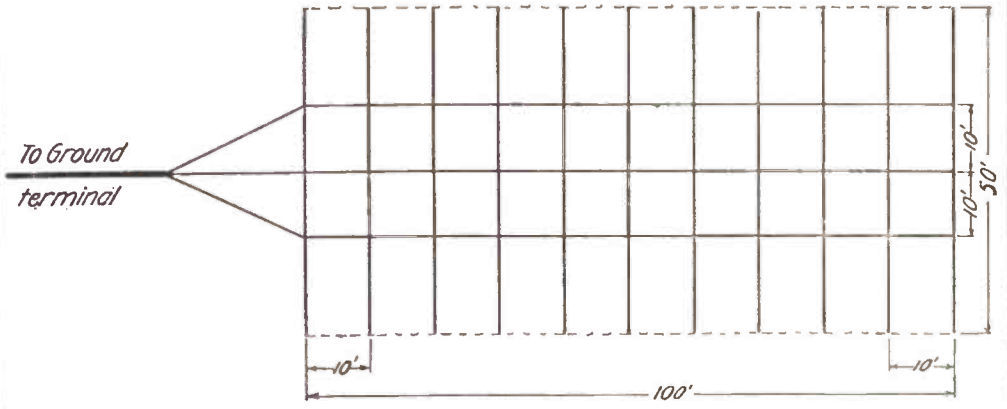
The thermo-faradic current is in effect a true D'Arsonval current of comparatively low potential but very high frequency and comparatively large volume. The name thermo-faradic is suggested by the pronounced thermal effects together with a slight sensation of muscular contraction, particularly when the frequency is lowered slightly by an adjustment of the frequency regulator on the coil. So effective is the current in the production of local heat that the hands grasping the electrodes may become covered with perspiration and the wrists acquire a sensation of warmth, which increases to a degree where it may become unpleasant if treatment is prolonged. Incidentally, an interesting experiment that illustrates the heating effects in a graphic manner may be performed by placing a piece of metal on either side of a beefsteak and connecting the thermo-faradic terminals to the metal plates. The application of the current full force will shortly serve to actually cook the steak. Notwithstanding this evidence of the potential possibilities of this form of current, it is probably the safest of all the high-frequency modalities to apply. The danger of shock is quite absent, and the discomfort of the patient would soon manifest itself if the heat were to become too great. This symptom would be merely an indication that the electrodes should be moved or the current reduced.

The thermo-faradic current is best applied through the agency of large metallic electrodes which may either be placed in direct contact with the area to be treated, or, what is perhaps better, the electrodes may be wrapped with bandage and padded with cotton in order that the application may be made through a saline solution with which the bandage is saturated. Another approved method is to apply sheets of heavy tinfoil to the desired area, bending the metal so that it may conform with the shape of the part under treatment. The movable moist electrodes are probably the better, however, as their positions may be changed at will when the heat becomes too great in one spot. In the application of the current the operator should use great care to see that the electrodes are in absolute contact with the patient at all times when the current is passing; the separation of the electrode from the body for even a fraction of an inch would give rise to a spark which would be rather painful and startling to the patient, although beyond this it would have no serious consequences whatever. If the precaution is taken to see that the contact is good when the current is turned on and continued good until the switch is opened, there will not be the slightest cause for concern.

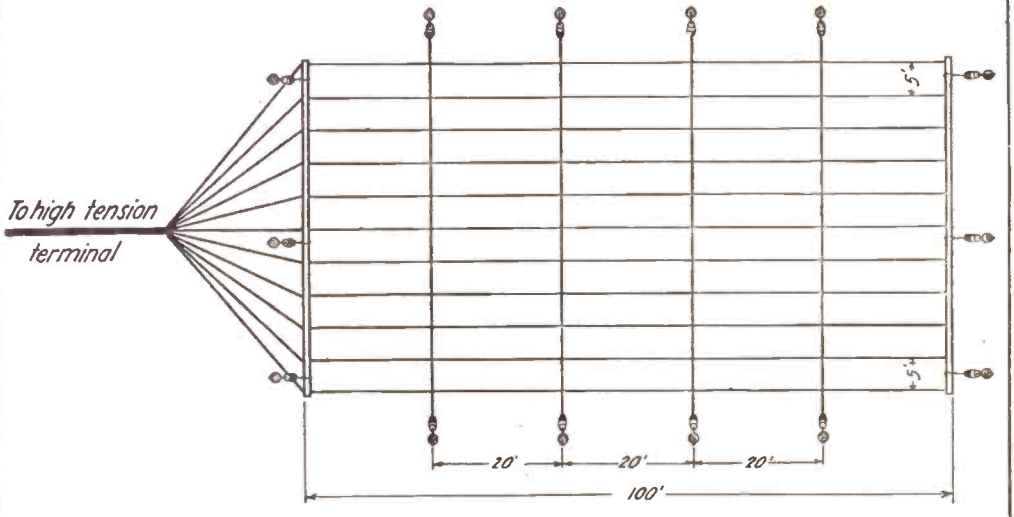
The use of the thermo-faradic current is particularly indicated in cases of sprains and chronic arthritis.

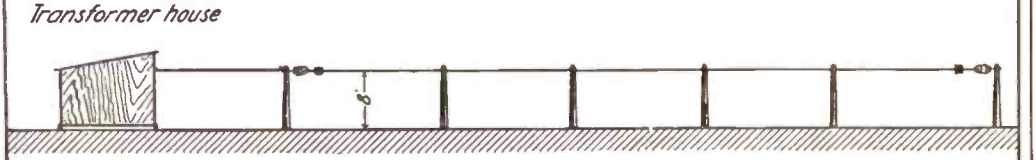
* This article is the sixth of a series on high frequency apparatus. The first article appeared in the March issue of *Modern Mechanics*.

Plan of Ground Wires



Side Elevation and Plan of Overhead Wires





Electricity in Horticulture
Edited by Thomas Stanley Curtis

Plant Culture by High Frequency Current*

Part VI. Wiring the Plot

THE high-frequency current produced by the apparatus described in past articles is administered to the plot of ground under cultivation through the agency of an overhead network of copper wires and a ground connection consisting of strands of wire buried in the earth of the plot. The transformer house is preferably located at one end of the plot in order that the high-frequency current may be carried to the area under cultivation by the shortest possible route. This is highly desirable, as an appreciable loss would be sustained in a long transmission line.

The equipment recently described is of sufficient power to cultivate a plot of ground embracing 5,000 square feet, and in the case under the writer's observation the plot measured 50 feet in width by 100 feet in length. The ground wires, three in number, were run the entire length of the plot and spaced ten feet apart. Crossing these wires at ten-foot intervals were ten bridging wires arranged as shown in the illustration and soldered at each joint. In all cases the wire was of No. 16 bare copper. At the end of the plot nearest the transformer house, the ground wires were brought together in a rat-tail and connected with the ground lead of the apparatus.

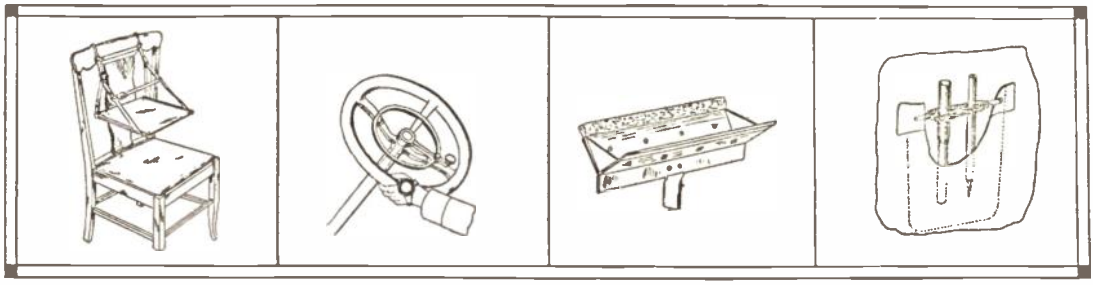
The overhead network presents a more difficult problem. In the experimental plot ten wires spaced five feet apart ran the entire length of the plot and were supported at either end upon high-tension insulators held by posts which were of such a height that they suspended the wires seven feet above ground. At twenty-foot intervals on either side of the plot, additional posts were located and cross wires between each two of these posts completed the network and at the same time relieved the strain upon the slender wires running the length of the plot. As in the case of the ground network, all joints were soldered. The overhead connection is in the nature of a continuation of each of the long wires to form a rat-tail, grouping all of the wires where they are connected with the high-tension lead passing through the glass window of the transformer house.

The insulators on the posts may be of the conventional glass high-tension type or they may be cobbled up by grouping a series of porcelain cleats as suggested in the appended illustration. The best of insulation is none too good, particularly in damp weather, as the high-tension current leaks badly in its effort to find its way to the ground.

The actual time of treatment will naturally rest with the individual investigator. From one to four hours, both night and morning, is a fair dosage, and noteworthy results have been obtained with this average treatment. The plants or vegetables under cultivation should be planted in duplicate in a neighboring

(*Continued on page 246*)

* This article is one of a series dealing with various methods of electrical plant culture that has appeared in this publication since September, 1914. The various instalments have dealt with the different methods of applying electricity to horticulture, as well as described the construction of the apparatus required. Back numbers may be secured at 15 cents each while the supply lasts.



Recent Novel Patents

High Chair for Children

An apparatus which can be attached to the back of an ordinary dining-room chair and convert it into a high chair suitable to children, is the subject of a patent recently granted to an inventor of Ohio. The device consists of a stout board fitted with several straps which serve as braces and supports to hold the child in place. These straps pass over the back of the chair and are buckled behind.

Hand Mirror for the Motorist

A convex mirror, to be attached to the back of the hand, and whose purpose is to show to the driver of an automobile the condition of the traffic behind him, has been brought out by a Chicagoan. The mirror, which is quite small, is attached to the back of the hand by means of three straps which converge at a point in the centre of the palm. The advantage of the mirror is that it does not interfere at all with the freedom of the chauffeur's hands, and is at the same time always convenient.

An Improved Window Scraper

A decided improvement upon the usual type of window cleaner, or scraper, which consists of a rubber lip held at the end of a long handle, has been invented by a man in Georgia. It consists of a long, shallow trough along one side of which is fastened the customary rubber lip for scraping the moisture from the surface of the window. In the ordinary type of window cleaner the moisture drips from the rubber, but in the new one the trough catches the water.

Pocket Pencil Holder

Two light coils of spring wire, which stretch across a vest pocket to hold pens and pencils in place, is the subject of a patent recently granted to a man in Massachusetts. The ends of the coils are fastened to the inside of the pockets and the pens and pencils are thrust down between them. Half way between the ends of the coils a joint is made, its purpose being to give more rigidity to the hold which the coils have upon the pens and pencils.

Combined Table and Settee

A broad settee, which in the twinkle of an eye can be converted into a broad, solid table, has been patented by a New York inventor. Unlike its prototype, the innocent looking centre table, which can be changed by a hand twist into a poker table, or vice versa, this invention is intended for purely domestic purposes, where space is limited. The table top, when not in use, slides and folds back of the seat by means of an ingenious arrangement of hinges. To convert the bench into a table, the back board is swung up and over, fitting in grooves cut in the arms.

Chain-Engaging Machine

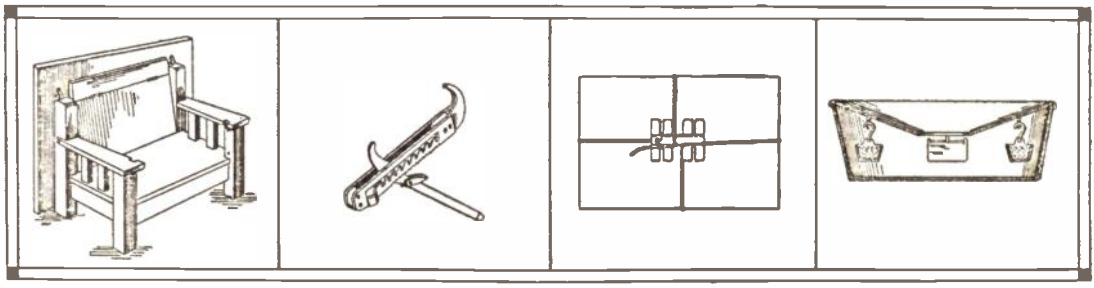
A chain-engaging tool by means of which a tremendous amount of leverage is gained in handling large chains has been patented by a Detroit man. The tool is provided with a heavy hook at one end and along its sides are riveted notched tracks. A bar is inserted through a long slot in the centre of the machine through which a bar passes, having a pin and rachet by means of which the chain is advanced. A hook is fashioned on the end of the bar.

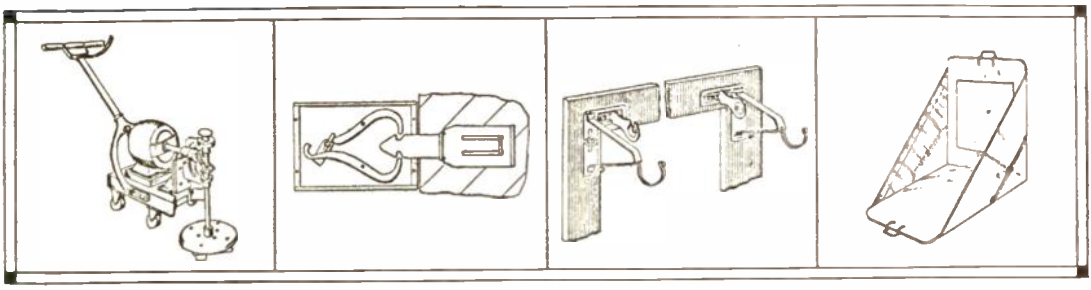
Saves Time Tying Packages

A package tying device, which will probably be of interest to mail order houses and magazines, is the subject of a recent patent. This device consists merely of a stamped fibre piece containing a number of slots into which the cord passes.

Sanitary Cuspidor

A cuspidor, containing a self-disinfecting apparatus, is the latest word in sanitation. Outwardly it resembles the usual type of office cuspidor, but inwardly there is sufficient difference to earn the inventor patent rights. At several points about the inside of the cover small hooks are provided. Upon these hooks hang tiny, non-spillable cups filled with a powerful disinfectant. The disinfectant constantly evaporating, completely stifles the usual offensive odor of the cuspidor.





An Electric Floor Polisher

To a Missouri inventor credit is due for a clever floor polisher, operated by electricity, and on which he has been successful in obtaining patent rights. Briefly, the floor polisher consists of an electric motor driving a polishing member through suitable gearing, the entire equipment being mounted on a small truck.

Novel Door Lock

A new type of door lock somewhat different from the thousands that have gone before it, has secured patent rights for a Michigan inventor. The new lock is of the sliding type, and is fundamentally simple in design and operation. Two curved, pivoted arms whose outer ends drop into slots on a bolt, which is screwed to the opposite door jamb, are manipulated by a key, or knob, which turns from the outside. When the door is closed—it must be a door of the sliding type—the two curved rods slip up over the tapering bolt and drop into the slots, and the door is locked.

Shade and Curtain Pole Hanger

The handy-man-about-the-house will appreciate a combined curtain pole and shade hanger which has been devised by an inventor in Pennsylvania to alleviate a considerable portion of his labors. The hooks which support the curtain-pole and the bearing supporting the ends of the shade roller are made in one piece, so that a couple of nails or screws will do for both. The shade roller supports are adjustable. They fit into small grooves with notches along the bottoms, so that by advancing the support forward or backward shortens or lengthens the distance between the roller tips.

Hand Bag and Dress Protector Combined

Amidst the outpouring of new ideas in vanity cases, hand bags and other feminine requisites, comes an invention from a young woman in Philadelphia which is genuinely refreshing. It consists of a hand bag which can be unfolded to form a seat. The two sides of the bag are hinged at the ends, and they are provided with light but strong braces, the purpose of which is to stiffen the folding-in sides of the bag, thereby forming the sides of a seat which will prevent dirt and dust from coming in contact with the dainty dress of the shopper.

A Detachable Handle

A new idea in detachable handles for lifting hot cooking pans with a minimum of trouble and a maximum of safety has been patented by a man in New Jersey. His invention consists of a pair of handles which hold the pan-grasping mechanism in a tight spring. The stiff iron wire around which the top of the pan is rolled is turned downward in the shape of a narrow "U." Members at the end of the handles clutch this U-shaped projection so that a heavy pan can be lifted without difficulty.

Ingenious Cigarette Case

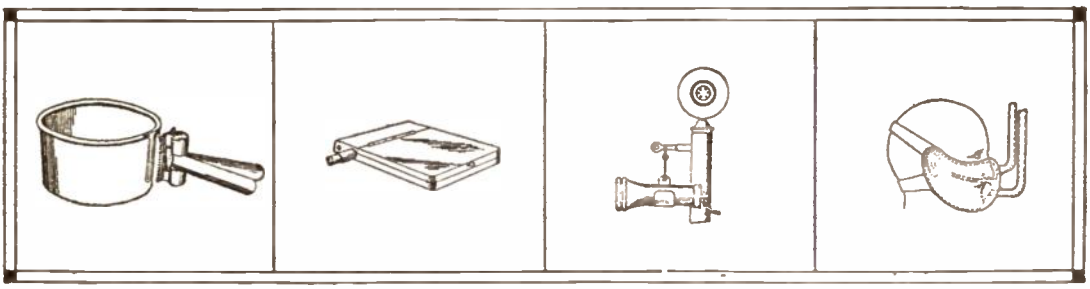
A cigarette case, which ejects one cigarette at a time from an opening in the side of the case, has been patented by a man in Kansas. The cigarettes are placed side by side in the box, held against one side by a spring, and ejected one at a time through a little opening in one side near the end. The cigarettes are fed upward and through this hole almost automatically, the only effort on the part of the user being to press a little thumb plate. An ingenious arrangement of springs does the work.

Fire Alarm on Telephones

To dispense with the ordinary costly and complicated fire alarm system, an inventor in New Jersey has brought out a small device which is intended to be attached to a desk telephone. The telephone receiver is suspended from the hook by a wire and clamp. In the wire is an element which melts in the presence of abnormal heat. This releases the receiver, the hook flies up, warning the central station operator or an operator at a factory or office switchboard that a fire is in progress in the immediate vicinity of the particular telephone.

Breathing Mask for Divers

A compact breathing apparatus for pearl divers and others who do not wish to go to the expense of equipping themselves with the usual costly diver's gear, is the subject of a patent recently issued to an Ohio inventor. A flexible mask stretches from the ears around the mouth and nose. In its fore part two hose connections are provided, one opposite the nose and the other in front of the mouth. Inhaled air passes through the upper tube; exhaled air through the lower.



CHESTNUT POLES REPLACING YELLOW PINE

Extensive experiments have proven that yellow pine poles last about four years, while chestnut poles have a life of about ten years. The city of Brooklyn has recently approved of the plan of replacing the present yellow pine octagonal poles with chestnut poles. The work will soon be under way and the old poles will be sold for kindling. The new poles are to be 25 to 30 feet long and used for the suburban street arc lighting system.

ELECTRIC POWER RUNS ARABIAN PALACE

The first installation of electric lighting equipment in Arabia has just been completed in the palace of the Sultan. N. S. Bayanker, a young electrical engineer of India, persuaded the monarch that electric lights and power were not only safer than the old forms, but a great deal more agreeable. Tungsten lamps now cast their cheery glow in all of the rooms of the palace, while a system of motors is in process of installation for the purpose of swinging the huge fans, or punkahs, as they are called. The young engineer has secured permission to erect and operate a small power plant in Arabia as soon as he can secure the apparatus. There will be two 30 K.W. generators, supplying current for six thousand lamps. One set of machines will be run at night, the other during the day, principally for the purpose of driving the punkah motors. Electric fans have not been received very cordially by the Arabians, although a few have been introduced.

Power will be furnished by oil engines and direct current will be used. High tension lines will never figure prominently in Arabia, as there are no sources of water power to furnish the energy for hydro-electric plants. All the equipment will be of German manufacture. It arrived on the edge of the Arabian desert shortly before the outbreak of the war, and is being transported inland by camel caravan trains.

Another Arabian ruler—the Sultan of Lahej—recently purchased an electric generating set at Cairo, Egypt, with which he will illuminate his palace at Lahej, an Arabian town eighteen miles northwest of Aden. A complete equipment of electric lamps, wires, punkah motors, and ice-freezing machines has also been bought. A young native electrical engineer has been engaged for looking after the plant.

THE PREPARATION OF AN ELECTRICAL ACT IN VAUDEVILLE

(*Continued from page 240*)

and when one has assimilated their entire contents, there is still a good deal to learn on the subject. But every iota of knowledge helps, particularly in the theoretical end, which does not necessarily mean the mathematical end. Probably the less mathematics the practical builder tampers with, the better he will be off, for the actual design of the apparatus has been spared him. What he needs is a good, sound knowledge of the characteristics of the high frequency current, and this may be quite readily obtained from a few good books. With knowledge and a fair equipment of tools, let him start in with what will probably prove to be the most interesting and fascinating work he has ever attempted.

PLANT CULTURE BY HIGH FREQUENCY CURRENT

(*Continued from page 243*)

bed in order that comparisons may be made at frequent intervals. In order to put the experiments on a practical footing, the notes taken during treatment and subsequently should include data on the weight, amount of foliage, percentage of edible portion, quality of the latter, time required to bring plants to maturity, etc. These notes will be useful not only to the individual investigator, but to the world at large.

Questions and Answers

This department will appear regularly in THE WORLD'S ADVANCE, subject to following regulations: The questions must be legibly written with typewriter or in ink, on one side of the sheet. Each question must be definite and cover but one point of the subject under consideration, although a letter can contain more than one question. On the 10th of the second month preceding the date of issue of the magazine all the questions on hand will be considered and those which are put in the most intelligent manner and of widest general interest will be selected for publication in such issue, the number being governed by the space available. All other questions will be returned to the writers with a statement of the price for which they will be answered by letter. Return postage must be enclosed with each letter containing questions, and the letters must be addressed to the Questions and Answers Department and contain nothing relative to other departments of the magazine.

WAVELENGTH.

(7) W. P. R., Cresco, Iowa, asks:

Q. 1.—My aerial consists of eight wires, 140 ft. long and spaced 3 ft. apart. I am greatly bothered from static and am under the impression that the number of wires does not affect the strength of received signals. If I should change my aerial to two wires would I receive just as well and at the same time cut the static down to one-fourth?

A. 1.—The number of wires in the aerial does have an effect on the strength of received signals, but it is in no manner as marked as in the case of transmitting. You would not notice any great difference in the strength of signals by cutting down your aerial to two wires, but by doing so you would gain little in the reduction of interference from static. Better leave the arrangement as it is.

Q. 2.—The wavelength of my aerial is about 300 meters. Could I reduce it to 200 meters? If so, what value of capacity would it be necessary to insert in series?

A. 2.—You could cut it down by inserting a capacity of approximately 0.0002 m.f. This is a heavy photographic plate 6 in. x 8 in. coated to within an inch of the edges with heavy tinfoil.

Q. 3.—What is the formula for calculating the wavelength of a set when additional capacity has been added in series?

A. 3.—If W is the wavelength in meters, L the inductance in centimeters of the aerial circuit, C the original capacity in microfarads of the aerial circuit, and K the added capacity in microfarads, then

$$W = 59.6\sqrt{L\left(\frac{CK}{C+K}\right)}$$

Q. 4.—What causes wireless signals to fade?

A. 4.—The throwing out of adjustment of the detector and loose connections are the most prolific causes of fading signals. Other than this, there are the atmospheric conditions which cause both fading and swinging.

REWINDING MAGNETO MACHINE.

(8) B. H., Ithaca, N. Y., asks:

Q. 1.—How can a low-tension Kellogg magneto telephone bell ringer be changed into high-tension motor suitable for operation on battery currents?

A. 1.—Undoubtedly you have just exchanged the use of the high and low-tension statements, for you mean how to turn the relatively high tension—75 volts—alternating-current generator into a low-tension—6 volts—direct-current motor. Dependent upon the room available at the connection end of the armature and your facility with tools, you will have satisfactory results, or otherwise, with the attempt. After removing present wire, draw out the insulated pin and the insulation itself—you will need the full size of the hole for the two commutator wires. Insulate the iron core with "Empire" cloth, taking especial pains to cover the sharp edges that are difficult to keep away from the wire. Perhaps No. 23 would be a good size to use, and, instead of beginning at one end of the wire, estimate about what length will be required, make a loop, and begin at the middle, winding a dozen or twenty turns first with one end, then with the other, the result being that both terminals are outside ones. To these ends solder "fixture" wire, or such other flexible sort as can be led through the hole in the shaft. A disc rather than a cylindrical commutator can be made by use of a fibre washer, say ⅛ in. or more in thickness, on which is fastened by at least four small screws a brass or copper washer about 1 in. in outside diameter, with large enough hole to clear the shaft. A diametrical saw-cut can be then made, separating the washer into two semi-circles, and one of the two wires pinched under each. Let the two copper brushes stand up vertically from the wooden base, bent at their contact with the commutator so as to permit rotation in either direction. With the field magnets pulling the "H" armature into its resting position the tips of the brushes should be bridging across the saw-cut.

LIGHTNING PROTECTION.

(9) C. T. P., New York City, asks:

Q. 1.—What kind of a ground connection as a protection against lightning can I have in an apartment house where no space is available for above purpose?

A. 1.—This all depends on the facilities at hand. The Fire Underwriters usually require a No. 4 copper ground running from the point outside of the house where the ground switch is located to disconnect the aerial from the instruments to a good earth or pipe ground outside of the house. Is it impossible for you to drive a 1 in. iron pipe in the ground directly below the point of entrance of your lead-in and to run a No. 4 copper wire to this pipe? If your aerial is not large, the inspector may give you permission to connect your ground wire to a radiator inside of the house. This method has been used where there is a radiator in the room near the lead-in, and it has been found to work satisfactorily, although it must by necessity add an element of danger if the ground wire runs in an exposed position or for any considerable distance within the house.

Q. 2.—What detector is known to be the most sensitive at the present time?

A. 2.—The audion in some of its more complex forms is unquestionably the most sensitive detector yet known. By using three audions very extensive amplifications are obtained.

STORAGE BATTERIES.

(10) A. J. M., Wausaukee, Wis., asks:

Q. 1.—How to connect a storage battery with the magneto generator on a Ford automobile?

A. 1.—A storage battery requires a direct current, and, since the Ford generator gives alternating currents, the project is impossible. You will have to substitute or add a direct-current magneto. A number of firms are making specialties for Ford cars, and it might be worth your while to address the Gray & Davis Co., Amesbury, Mass., or some of their agents, or the General Electric Co., at their Milwaukee office, in the Public Service Building. Electric auto-starters, involving a motor and storage batteries, are offered that will exactly fit the space available, and give a very satisfactory equipment, the expense being $75.

INDUCTION MOTOR PROBLEM.

(11) M. E. P., Wrangell, Alaska, asks:

Q. 1.—What is likely to be the reason that an induction motor modified from an old direct-current Westinghouse fan motor will not operate? A new 20-slot laminated stator was made, and the original armature was fitted with eleven No. 4 copper wires, soldered, though imperfectly, to copper end-rings.

A. 1.—The use of 20 slots is permissible, though in keeping with the number required for the running coils of Watson's motor, to which you referred, you would have had but 16. You did not state how the winding was arranged, but it should be as follows: A coil filling slots 3 and 4; a concentric coil in series with this filling slots 2 and 5; a coil concentric with these and occupying only one-half of slots 1 and 6. This group would constitute the winding for one of the four poles. Similarly, there will be full coils in slots 8 and 9, 7 and 10, and a half coil in 6 and 11; a third group will be in slots 13-14, 12-15 and 11-16, the fourth in 18-19, 17-20 and 16-1. As the inner coils embrace very little iron, it would have been an improvement to have had the four central teeth larger. You should rebuild the rotor, using copper rods long enough to extend through holes drilled in the end rings, then head them over and solder-sweat them in position.

AERIAL.

(12) C. W. S., Modesto, Cal., asks:

Q. 1.—Would you consider an aerial for wireless work well proportioned with the following dimensions: 125 feet long, with a height of 100 feet at one end and 50 feet at the other end, consisting of eight stranded wires 30 inches apart?

A. 1.—Yes, it would be satisfactory but would have a wavelength of greater than 200 meters.

Q. 2.—How would you split this aerial in order to use two leads so as to send or transmit on part of it without exceeding the 200-meter limit and yet do efficient work?

A. 2.—Any method of trying to split it will prove unsatisfactory. If you desire to use this aerial use as short a lead-in as possible and put a condenser in series. This will not be as efficient as having an aerial of the correct proportions to start with.

THE DISCOVERY OF GUNPOWDER.

(13) H. S. S., Cedar Rapids, Neb., asks:

Q. 1.—Was gunpowder discovered or invented?

A. 1.—That a mixture of sulphur, charcoal and salt-peter would unite with explosive force was certainly a discovery, and even the determination of just what proportions of the chemicals to use, in what forms, etc., would also properly be termed discoveries, but processes for manufacturing the article might be termed inventions. Discoveries are not patentable, but a manufactured article or invention, resulting from discovery, is patentable. Certain processes for making gunpowder, perhaps the only ones for particular kinds, may be patented.

No questions will be answered by mail unless they are accompanied by the fee of fifty cents. This fee is charged to partly defray the time involved in answering inquiries.

RADIO SECTION

Devoted to the Encouragement of Amateurs and Experimenters in the Field of Radio Communication.

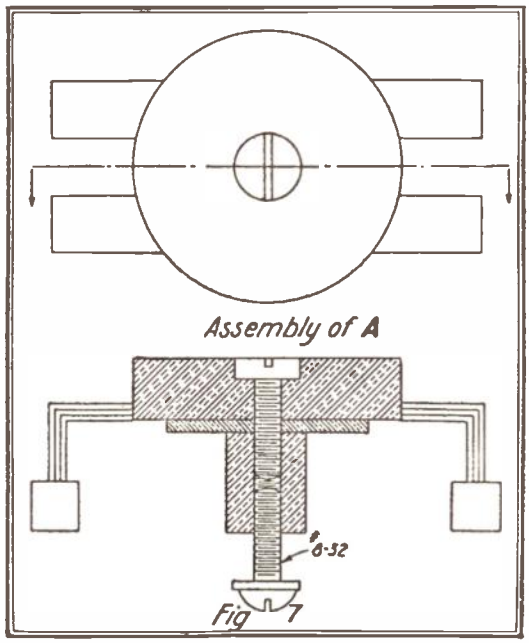
A Multiple Receiving Tuner*

By Chas. P. Seeger

AFTER having accomplished the work outlined in the first portion of this article, the reader is prepared to pursue the task as follows:

DETECTORS: In the first detector to be described the pillar is a piece of ½" brass rod cut to the dimensions indicated, the springs being inserted on either side of the central piece. The retaining bolt should be made by drilling a hole in a piece of ½" rod and "sweating in" a piece of 5/32" rod, threaded at the end to receive an 8-32 hexagonal nut. A similar but shorter retaining bolt is used in the free end of the detector. Before cutting the rod into the desired lengths for the pillars, it is suggested that a 3" piece be taken to a machine shop in order that the 5/32" hole necessary to receive the retaining bolt may be drilled through the *center,* otherwise it will be difficult to assemble the parts into a neat appearing unit.

Instead of the designated contact point, sharp pointed 8-32 fillister head machine screws may be used, either of iron or brass, depending on the crystal in use. For the springs use 18 or 20 gauge springy stock, cutting to the desired length. Cups for the detector may be purchased or made by soldering a plug in a piece of ⅜" tubing and fastening a pivot to the plug. A base may be made of ½" round rod, 3/16" thick, soldering a piece of 5/32" brass rod, threaded 8-32,



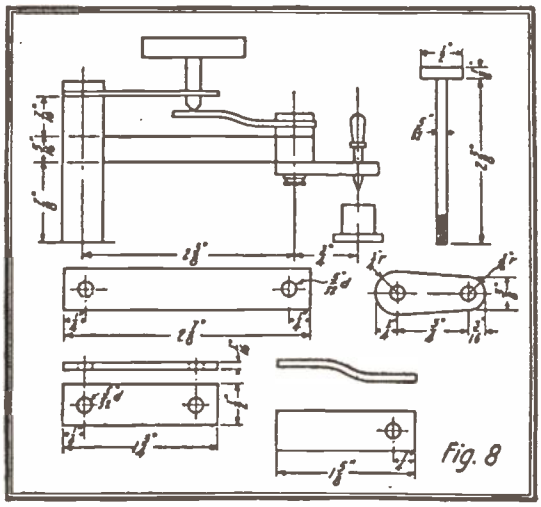
Details of One of the Switches.

to one side, and drilling the other to fit the pivot.

The second detector is truly a universal detector, for one in use at the present has been converted into the well-known cat-whisker type, by interchanging the cup and the clamping screw, and fastening a wire to the movable arm.

Obtain a piece of tubing ¼" outside

*Continued from the July issue of THE WORLD'S ADVANCE.



Various Parts of the Mineral Detector.

and 3/16" inside diameter. Into one end solder or "sweat in" a piece of tubing 1/8" inside diameter. It will probably be necessary to sandpaper the outside of this latter tube to a considerable extent, as the nearest sized tubing manufactured is somewhat larger than 3/16" outside diameter. Drill the standard as indicated for a 1/4" hole, and after sandpapering the tube, and the standard as well, ready for finishing, drive the tube into position. Then drill and tap a piece of 3/16" rod for a 4-36 thread, and screw into this a piece of threaded 1/8" rod, about 2" long. Obtain a spring to fit over the 1/8" rod and fit the parts together as indicated. Purchase or turn a rubber handle—a disc may be used—and fasten to the 1/8" rod by drilling and threading for a 4-36 thread. A forced fit, using a drill slightly smaller than the rod, will frequently give good results.

It will probably be found easier to purchase the cup and fit it to a 3/16" rod than to turn it up. A piece of 3/16" rod should be soldered, or fastened by threading, to the cup.

Drill 3/16" holes in the standard bases, and solder in 3/16" rod, threaded at the other ends for a 10-24 thread. Drill through the lower part of the movable standard, fitting the rod to the lower part, the upper part serving as a socket for the pivot. These standard pieces should be squared up with considerable care, the centers for the holes also being located carefully.

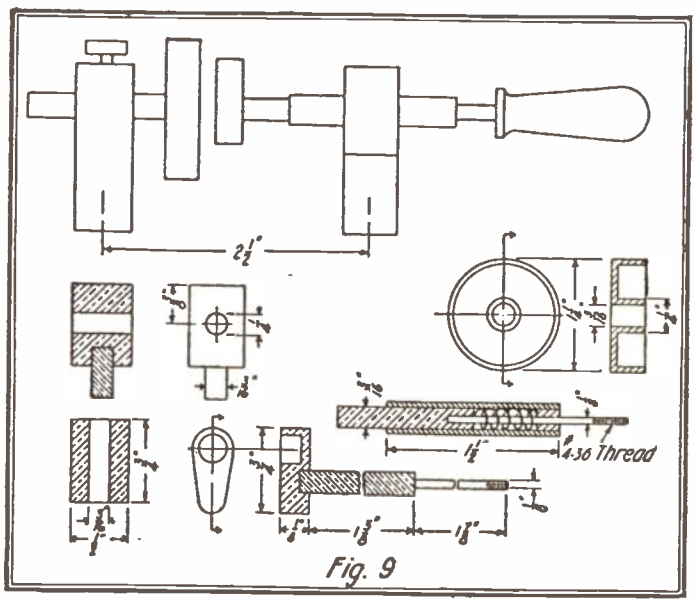
ADDITIONAL DETAILS: Besides the four handles for the switches, one should be turned up to the size indicated in *E*, Fig. 6, as a handle for the coupler axis.

Turn up three rings to the size indicated in Fig. 1, 2 1/8" O. D. and 1 5/8" I. D., and from 5/8" to 3/4" thick. The rings should preferably be of black fibre, though stained wood will serve the same purpose.

In case the telephone key is not used, it will be necessary to use the Type *D*, a three pole Keystone rubber base switch, as indicated, as well as a double-pole double-throw switch, placed not on the box but conveniently near it.

ASSEMBLY.

If the box was not made with the top and sides hinged to the bottom—the top being glued to the sides—it will be necessary to fasten the interior apparatus to the bottom instead of the top. How-



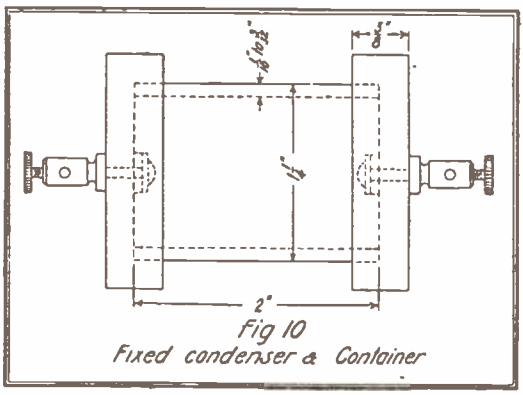
Details of a Perikon Type Detector.

ever, the hinging is suggested as it not only affords accessibility, but also simplifies the connecting of the instruments.

Fasten the first primary to the bottom of the box—or the top as the case may be—by means of small tacks, or a thin brass strip. Support the second by thin brass clips as illustrated in Fig. 11. *The couplers must be mounted as illustrated with their planes at right angles to each other,* in order that no mutual inductance may exist between them.

Slip a 3/16" rod 16" long, threaded 10-24 for 12" of its length, through the primaries and secondaries as indicated, fastening the secondaries in position with lock nuts at right angles to each other. One end of the box serves as one support and bearing for this rod. At the other any convenient form of support may be arranged. The handle should be graduated for one-quarter of its circumference into eight equal divisions in order that the coupling may be readily set to any degree. It is unnecessary to move the secondaries through a greater angle than 90°, and if this is exceeded, connections are liable to be disturbed.

Fasten the loading coil to the con-

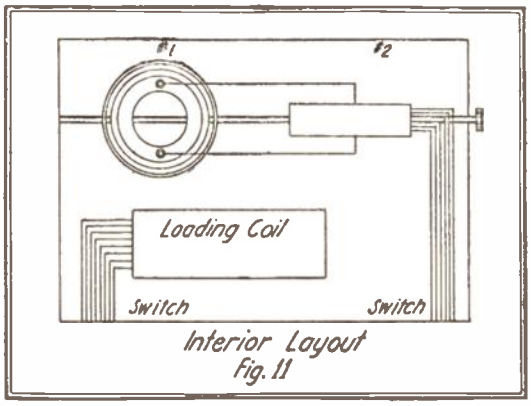


The Case of the Fixed Condenser.

tainer box with two brass strips, or by turning up wooden standards for it.

Before mounting the switches, make a full-sized drawing of the top and sides on paper, laying out the positions of contact points and switch centers on the paper. Then place the paper on the box, and indicate all holes by light punch marks through the paper. This prevents unnecessary scarring-up of the box.

The circles indicated for the switches are the circles on which the contact centers are placed. The contacts are ¾" apart, measuring from center to center, and are placed as indicated in the connection diagram. The *A* switches have



Arrangement of Loose Couplers and Loading Coil.

four points per side, while type *B* is an eight-point switch with its contacts spaced ½" apart, center to center. The telephone switch, if used should be placed between the *B* and *C* switches.

No attempt has been made to describe the construction of the three variable condensers, which should be of the rotary plate type. Should the reader desire to make them, he is referred to an excellent description in *Electrician and Mechanic* for October, 1912, or the plates may be purchased from the makers of variable condensers. Condensers Nos. 1 and 2 should be filled with castor oil to the level of the top plates. The condenser in the detector circuit is kept at the original capacity. The condenser in the intermediate circuit should have a thin copper strip fastened to the stationary plates so that the condenser is short-circuited when turned past zero.

The small fixed condenser consists of eight strips of foil, measuring 6" x 1", placed between paraffined paper measuring 6" x 1½"; the foil projecting at opposite ends. It should be rolled up and slipped within the tube prepared for it, the terminal being connected to the binding posts which slip on studs projecting from the box. (See Fig. 10.) C4 is in the audion box.

While connecting wires may be strung

at random within the box interior, it is suggested that bare wire encased in thin rubber tubing be used, the wires thus insulated, being fastened to the box in a pre-arranged manner by means of small escutcheon pins.

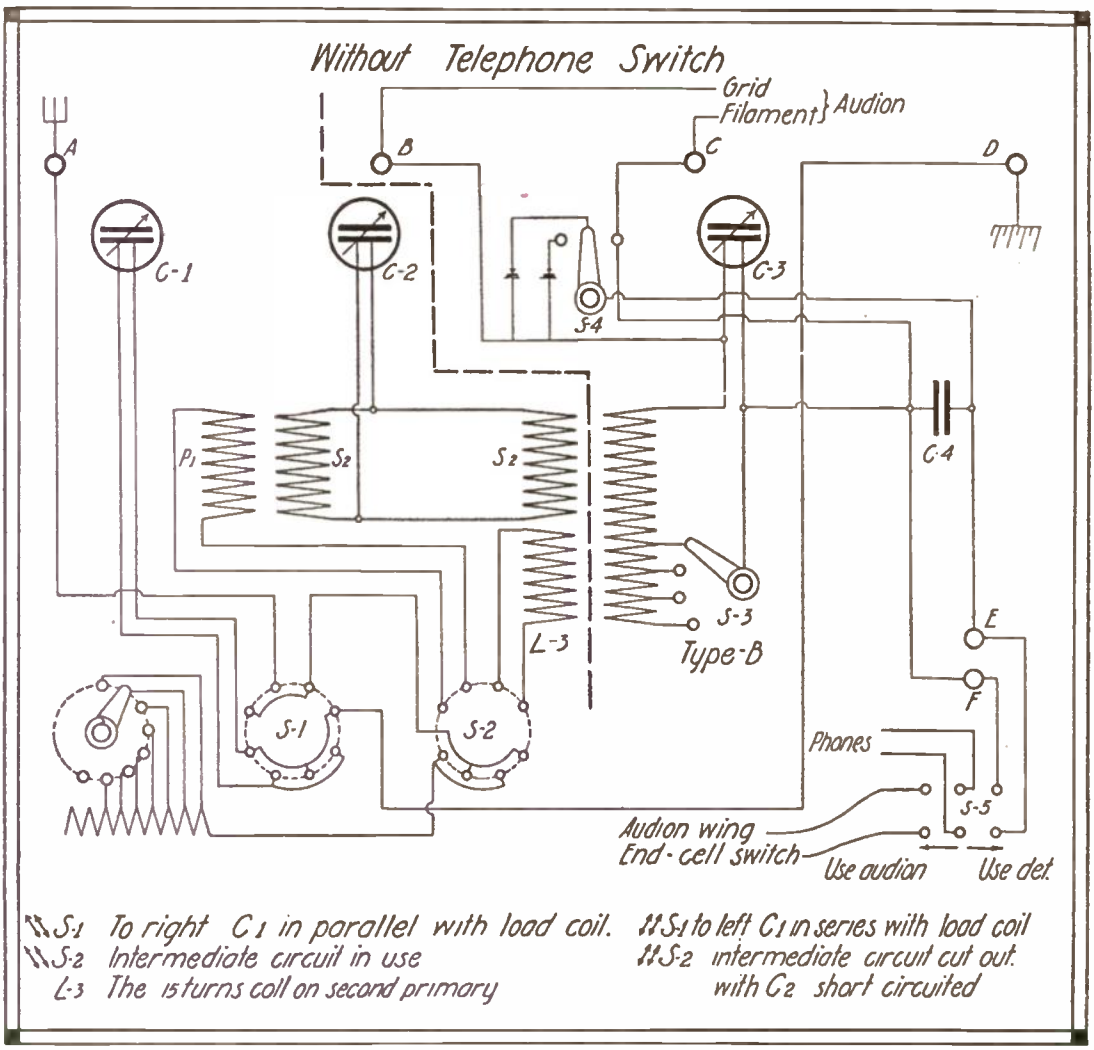
This set will perhaps furnish a little difficulty, as regards facility of operation, when used for the first few times.*

"No matter what coupling may be used, the set is always tuned to two wave lengths. Provided all other adjustments of the set remain fixed, increasing the coupling causes an increasing difference between the two waves to which the set is tuned, one a long, the other a short wave.

"Assume that the original setting is coupling K_1, and condenser capacity C_1 (No. 1 condenser) the set being tuned at 1200 metres and 200 metres. Then assuming that it is desired to receive from a 1200 metre station, and eliminate one at 200 metres, the process of tuning out is as follows:

"1. Increase the condenser capacity C_1 to a new value C_2, so that the 1200 metre station is lost for a moment, and the 200 metre station has become very faint or is also cut out.

"2. Loosen the coupling until a point is reached where the 1200 metre station is again heard, but at this new coupling, the 200 metre station is entirely cut out."*

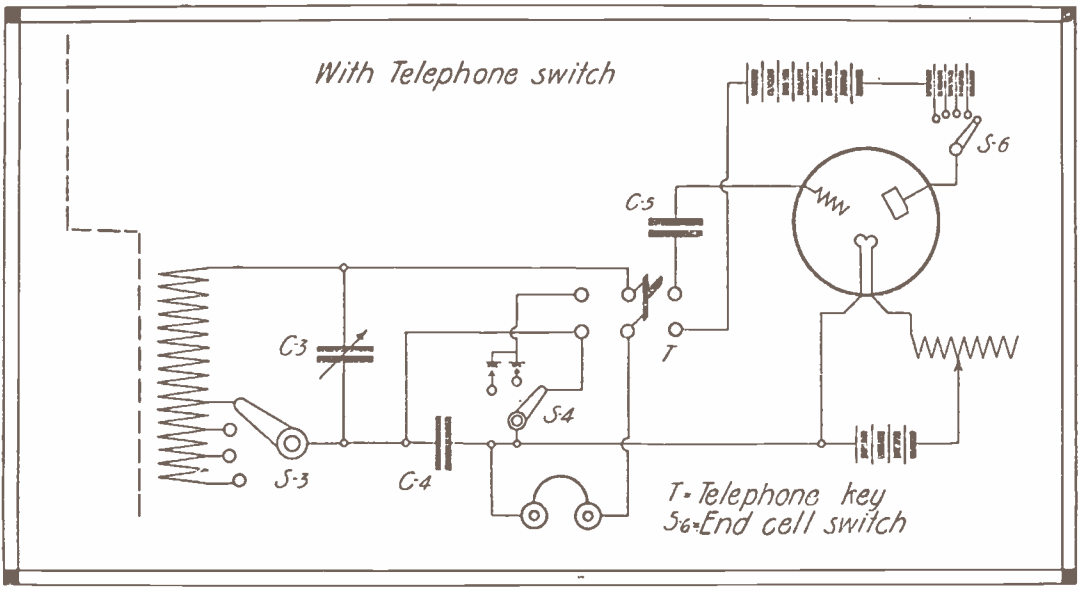


Wiring Diagram for Complete Receiving Set Without the Telephone Switch.

Arlington may be heard by turning S_1

*See *London Electrician*, July 19, 1912, p. 623, and *Electrician & Mechanic*, September, 1911.

*Quoted from a lecture by Mr. A. S. Blatterman at the Washington University, 1914, on the Marconi multiple tuner.



Wiring Diagram of Complete Receiving Set, with Telephone Switch.

to the right, S_2 to the left, and short-circuiting condenser No. 2. This procedure enables the reception of very long waves.

The two connection diagrams follow, depending on whether or not the telephone key is used. Binding posts *B* and *C* and *E* and *F* may still be used in the second diagram. S_3 in the first diagram is an ordinary double-pole double-throw switch, *not* placed on the box of the receiving set.

AMATEUR MARCONI RADIO ASSOCIATION

There has recently been formed at Troy, N. Y., the Amateur Marconi Radio Association, which now has a membership of nearly thirty. The association has for its object the bringing of amateurs into closer touch with each other. The club takes in a radius of about five miles with Troy as the center.

The officers of the association are as follows: President, Wendell King; Vice-President, William Robbins; Secretary, Harold Connor and Treasurer, Everett Barnes.

Each member owns a wireless receiving set, capable of receiving the time signals from the Government station at Arlington, as well as those from the Sayville station. The association has recently purchased a hot wire meter for its use in order to enable closer tuning of the sending sets of the more advanced members.

Correspondence with other similar organizations and with amateurs desirous of joining the association is solicited. All communications should be addressed to the Secretary, 827 Third Avenue, No., Troy, N. Y.

ERRATA

The article entitled "A Memorial Fountain to Wireless Operators," which appeared in the July issue, gave the death of Wireless Operator George C. Eccles of the steamship *Ohio* as August 26, 1912. The correct date is August 26, 1909.

A Wireless Direction Finder

By J. Andrew White

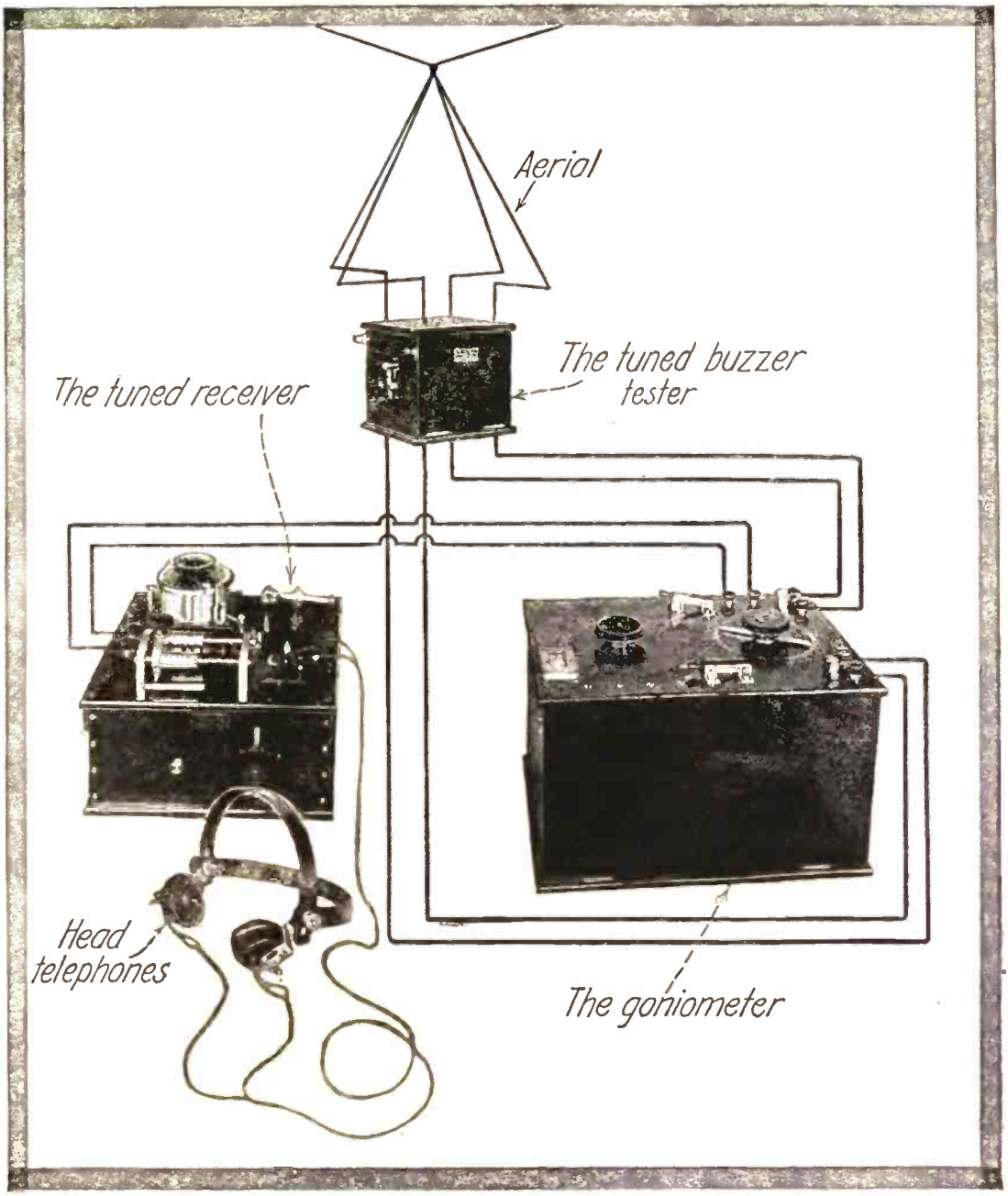
WITH its primary object to enable a ship's navigating officer to take bearings in fog or under unfavorable weather conditions, the development of the radio-goniometer, or wireless direction finder, has disclosed many applications on land and sea, in peaceful quarters and in the center of hostilities. It is reported by an engineer recently returned to this country that the British are employing this new instrument for scouting purposes, and on one occasion secured the position of the Admiral's flagship of the "hidden" German fleet. Its aid as protector of ships and human life was still more recently demonstrated by the captain of a Norwegian merchant vessel in the presence of officers of the Royal Norwegian Navy, an army engineer and two telegraph and radio inspectors.

The experiments were conducted with naval vessels off the Norway coast and the report of the trials as rendered by Captain L. C. Hjortdahl stated that the signals were good even at a distance of 130 miles and were heard at 240 miles. At a distance of 34 miles bearings taken through the Flekkero wireless station corresponded exactly with the ship's position and a series of bearings secured with the direction finder in a voyage between Christiania and Bergen disclosed the positions of various warships scattered along the coast. In the port of Bergen tests were made with a warship lying but one-third of a mile away, proving that it is possible with this new instrument of science to take the position of other steamers in foggy and thick weather even at short distances, and thus avoid collisions.

In the absence of definite reports from the British military and naval forces, which will of course not be available until the end of the war, the details of the investigations pursued by Captain Hjortdahl stand as the only complete record of what may be expected of the newest device to insure safety at sea. Meanwhile government inspectors are experimenting on land to determine the usefulness of the apparatus in detecting the whereabouts of interfering amateur wireless stations, and commercial operators are finding a new effectiveness in "screening out" messages not wanted when working in crowded waters.

Since the earliest days of wireless telegraphy the problem of determining with an instrument the direction from which radio signals arrived has engaged the attention of inventors. Ten years ago Marconi began the preliminary investigations that bore fruit two years later in an apparatus evolved and patented by two of his countrymen, Dr. Ettore Bellini and Captain Tosi of the Royal Italian Navy; the device as developed was not adapted to ship working, however, and the intervening years were devoted to perfecting an equipment entirely satisfactory for use by navigators. The apparatus in use today permits bearings to be taken within two or three degrees of accuracy and is technically known as the Marconi-Bellini-Tosi radio-goniometer. It is not claimed for the invention that the bearings taken by this means exceed, or even equal, in accuracy those secured by the optical instruments of navigators, but the utility of the instrument is found in obtaining reliable bearings when direct readings cannot be taken because of unfavorable weather conditions. It is not necessary to swing the ship to secure a reckoning, and the range of the instrument exceeds the distances required in practical working, being largely governed by the power of the wireless station from which the signals are being received.

The complete equipment consists of the goniometer, a tuned wireless telegraph receiver, a tuned buzzer tester, an angle divider and a special arrangement of aerial wires. Apart from the ordinary aerial or antenna swung between the



Arrangement of the Different Pieces of Apparatus, as Well as the Wiring Scheme for a Direction Finder Receiving Set.

masts, a ship operating the direction finder is required to have two closed circuit loops in the form of triangles of equal size, suspended vertically and crossing each other at right angles. These are usually suspended from a fore and aft stay, or from a sprit, gaff or bracket on one of the masts. Connection to the instruments is made from the centers of the horizontal base wires, this distance being kept as short as practicable and governed largely by the wave length of the wireless apparatus. The wires lead directly into the radio-goniometer case and the received electric energy flows through two excitation coils, setting up a magnetic field which acts upon a third coil known as the exploring coil.

This movable exploring coil is attached to a handle which carries a pointer moving over a graduated 360-degree scale on which the reading of direction is taken. The exploring coil is connected to the wireless receiver and the direction of the arriving wave or signal is indicated by turning the index handle until the position of maximum strength of signals is found. With the goniometer placed so that the zero position of the scale coincides with the bow and stern line of the vessel, the position of the pointer when the signals are strongest in the head telephones of the operator shows the direction of the signals in reference to the bow and stern line. The geographical direction is then secured by a glance at the ship's compass. If for any reason the signals have about equal strength over a considerable portion of the scale, note is made of the pointer's position when the signals die out, and with the angle divider furnished with the set a mean of the two readings is taken.

The action of the received energy on the aerial is interesting and is really the keynote of the operation of the apparatus. Each triangular loop is a directional aerial in the wireless telegraph sense of the term, receiving best when its plane is in the direction of the sending station. When either of the aerials is at right angles to the direction of the incoming signals nothing is heard; in intermediate positions the induced current varies with the angle and is set up in both aerials. Carried to the goniometer, or direction finding instrument, current of the same relative strength passes through the corresponding crossed coils and forms in the space enclosed by them two magnetic fields at right angles to each other. These two fields combine and form a field at right angles to the direction from which the signals are coming. The exploring coil thus receives the signals strongest when its plane is at right angles to this field, or in the direction of the signals, the pointer mounted on its spindle indicating this position on the dial.

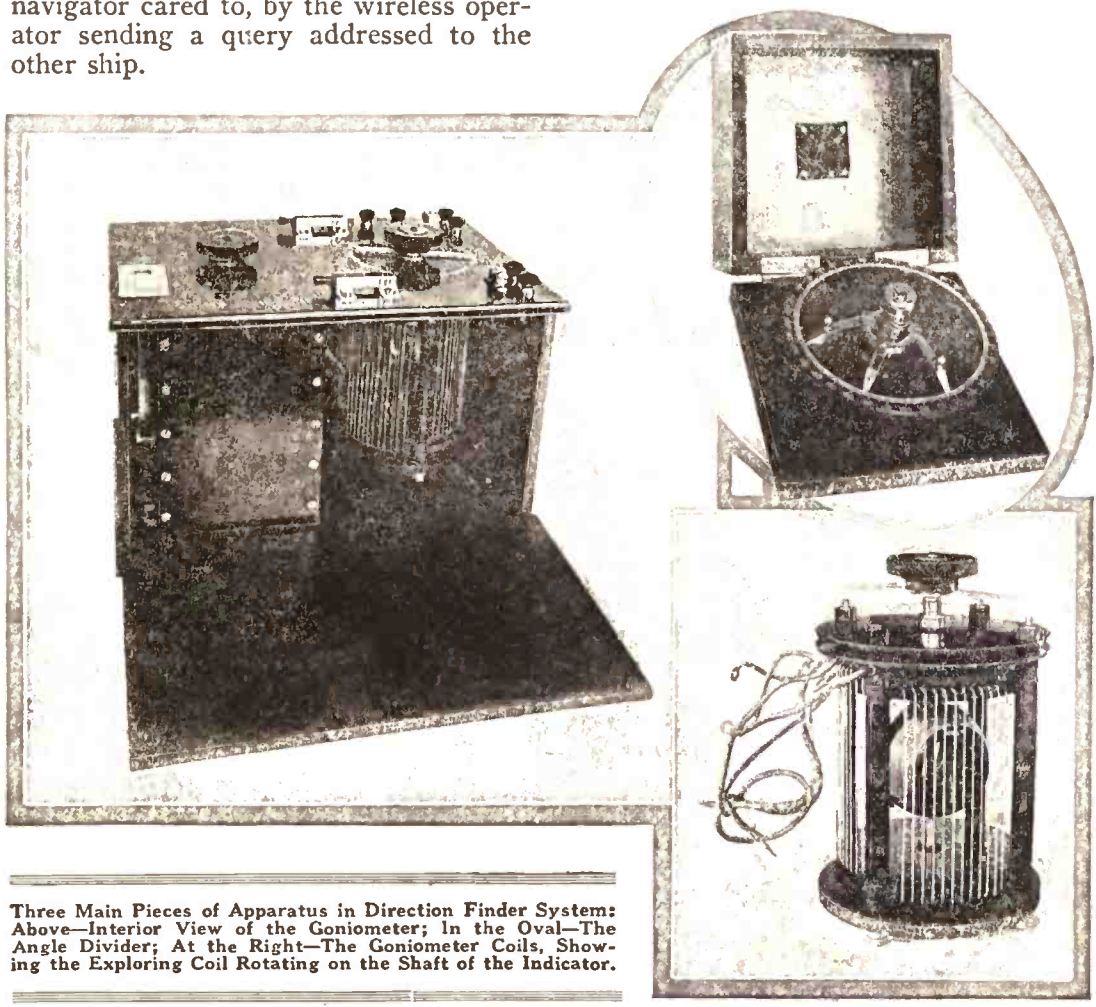
An oscillatory circuit composed of a condenser and a coil of wire is used for testing, the instrument being adjusted to the desired wave length by means of a switch. The wires connecting with the aerial are taken past the coil at equal distances, so that the two aerials are equally excited. The buzzer is of the type in which a non-inductive shunt is connected across the magnet coils, sparking at the contacts being thus reduced and a sudden interruption obtained.

When the direction of the wireless station sending is indicated by the pointer, only the line on which it lies is given. That is, it may indicate a direction thirty degrees off the course of the vessel, but it does not distinguish whether this is off the port bow or its diametric opposite, the starboard quarter. If the test is being made with a land station there is seldom any doubt of the direction, as it is generally known whether the land lies to the port or starboard side of the vessel. And whether the ship is approaching or receding from the land station is at once obvious; in most cases there is only one possible interpretation of the indication, for by the reverse interpretation the ship would be somewhere inland and the land station out to sea. Two successive readings while the ship is on a fixed course place the matter beyond doubt and at the same time give the distance to the station by the usual nautical method. By taking simultaneous bearings of two fixed stations the ship's position is easily reckoned. Or a reading taken with a single fixed station and a second observation made after the ship has moved forward a definite distance in a straight course establishes the position equally well.

One of the things which the navigator may learn through the wireless direction finder is whether the ship is on a course which will take him inside or outside a lightship. The captains of many vessels on the Atlantic lay their course for the Nantucket lightship and after they have made this isolated beacon trace their course to another point. Often they run inside the lightship and miss sighting the vessel. A few signals from the wireless equipment aboard her will secure the location as certainly as if the light were visible.

When making a harbor a few signals from the land wireless station show immediately whether the ship has drifted to one side of the entrance.

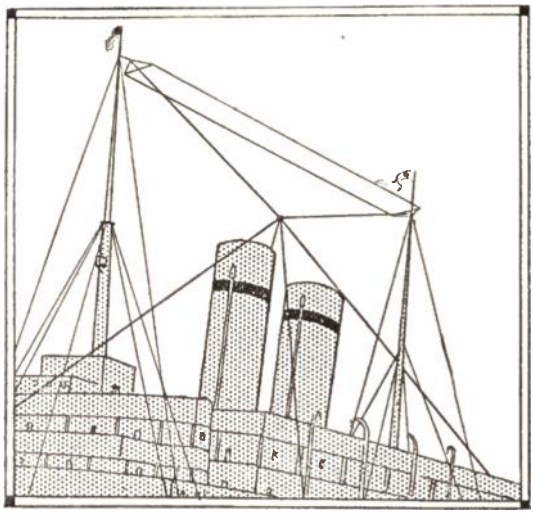
Collisions in fog may also be avoided through ascertaining the presence of another vessel by a regularly repeated signal. The direction determined, the increasing strength of the signals would indicate that the other ship was approaching and the course could be slightly altered to avoid her. Any question as to whether the ship was approaching on the port bow or overhauling on the starboard quarter could be determined if the navigator cared to, by the wireless operator sending a query addressed to the other ship.



Three Main Pieces of Apparatus in Direction Finder System: Above—Interior View of the Goniometer; In the Oval—The Angle Divider; At the Right—The Goniometer Coils, Showing the Exploring Coil Rotating on the Shaft of the Indicator.

In the avoidance of collisions at sea the direction finder has a field of incalculable value. So also in rescue work is it of the greatest assistance. It will be remembered that when the heavily laden steamship *Monroe* received her death blow off the Virginia coast she sank so quickly that there was no time for the wireless operator to send out the ship's position. In such emergencies the distress call alone would be sufficient for the direction finder to give to the captain of the rescuing vessel the direction to take through the thickest blanket of fog. Once turned in the direction given by the pointer a straight course would bring the relief vessel to the scene of the disaster in the shortest possible time. What a few minutes lost in blindly groping through the fog means is best appreciated by a mental picture of hundreds of struggling humans striving to keep afloat in the icy waters of midwinter.

The accuracy of the instrument is surprising in view of the fact that Marconi claims for it a possible error in taking bearings of two to three degrees, and under the most unfavorable conditions not in excess of five degrees. Tests made along the Atlantic on the steamship *Northland* checked absolutely with the



The Usual Aerial and the Direction Finder Aerial on Board Ship.

captain's compass and chart reckoning and resulted in the United States Navy and the revenue cutter service installing the equipment on some of their vessels. The exhaustive investigations yet pursued, however, are those made from the Norske Amerika liner *Kristianiafjord* and mentioned earlier in the article. In the report presented by her captain, L. C. Hjortdahl, it is stated that distances of 90 to 130 miles were obtained and bearings were taken very quickly. There were present besides the wireless men and government telegraph experts, Captain Gootwaldt, of the Royal Norwegian Navy, and Engineer Skolem of the army, the investigation being an official one of the little country that ranks fourth in tonnage among the maritime nations of the world. For this reason the report is of significance beyond its value as the first record made of an instrument probably destined to become an important factor in safety of life at sea.

A translation of the substance of the report follows:

The *Kristianiafjord* left Christiania on March 21, at 9 a. m. During the passage out of the Fjord wireless communication was steadily maintained with the land station at Ovresaeters, a one-half kilowatt temporary military installation.

At Filtvedt bearing was taken from the Navy Yard station at Horten by the direction finder until we had the station abeam. The bearing was checked with the one taken from the bridge and found correct. The communication with Ovresaeters was lost fifty miles off —when we passed Fuflehuk.

We were keeping steady bearing with the Tjomo station while we were going out of the Fjord past the Faerder lighthouse, and results very good. At 5:30 p. m. bearing was taken with the Flekkero station at a distance of thirty-four miles. The bearing corresponded exactly with the ship's position. At the same time bearing was taken of the naval station at Horten, ninety miles off. The discrepancy in this bearing appeared to be one and one-half degrees and two miles off the ship's actual position.

At 6:20 p. m. bearing was taken with Flekkero at a distance of twenty miles. The discrepancy of the angle was about one-half degree. At 7 p. m. we again took bearing with the Tjomo station, ninety miles off, the discrepancy in the angle being one degree, and referring to the ship's position, 1.6 miles.

At the inlet to Christianssand, at 8 p. m., bearing was taken with Flekkero and this corresponded; the same good results were observed when we passed out from Christianssand again at 9:45 p. m. During the voyage westward we found by the direction finder the correct position of different Norwegian warships scattered along the coast.

At midnight we took bearing with a Norwegian torpedo boat destroyer, which we then called up by wireless and checked the position; it was one degree off. At 1 a. m. bearing was taken with a Norwegian cruiser and from communication learned that the distance was 38 miles and the discrepancy of the bearing two degrees.

At 2:45 a. m. bearing was taken with the same warship, twelve miles off; the fault was three degrees. At 5:30 a. m. and the distance seventeen miles, the fault was one and one-half degrees.

At 6:30 a. m. bearing was taken with a gunboat lying at Haugesund, thirty-one miles away; the discrepancy was one degree. At Stavanger at 10:45 a. m., the same ship was thirty and one-half miles away and the fault was two degrees. At 4 p. m. bearing was taken with the same ship repeatedly, the faults being on an average of one degree.

During the voyage from Stavanger to Bergen, on the same evening, bearings were taken with a Norwegian cruiser and a torpedo boat destroyer stationed in these waters. These bearings showed a constant fault in a southerly direction of six-eighths of one degree, and it is believed that this fault was due to local conditions of the district. During the trials later made with the Bergen station and a Norwegian warship lying in that port, the results varied between one and four degrees from the ship's actual position. The distance to Bergen and the warship ranged between fifty and sixty-two miles.

While lying in the port of Bergen tests were made with the same warship, anchored only 600 meters from the *Kristianiafjord,* and the results were exact. This should prove that it is possible with the direction finder to take the exact position of other steamers in foggy and thick weather even at short distances.

During the afternoon of the 21st, bearings

were taken repeatedly with the station at Gothenberg, in Sweden, and faults of from eight to ten degrees were always found. These discrepancies were always in the northern direction. As no such deviation was found during the tests with other wireless stations this is apparently due to some fault. The Telegraph Department will investigate whether the regular wireless communication from Gothenberg in this direction shows variations. The signals from Gothenberg were very good even at a distance of 130 miles, and in the evening of the 22nd, Gothenberg was heard at a distance of 240 miles.

Conclusions:

Although it has only been tested during a short voyage, the impressions of the instrument are that if reckoned with about a three degree discrepancy in the bearings we have here an excellent aid to safe navigation. The manipulation of the apparatus is very easy and with a little experience bearings can be taken very quickly.

(Signed) L. C. HJORTDAHL.

FREAKS OF THE ETHER

"SINGING static" is probably a new term to many of those interested in electrical phenomena, but it is a condition that is often met with in the tropics, or any heavily charged electrical area. "Static," as most of those who have handled wireless receiving sets know, is a succession of electrical discharges passing from the aerial to the ground, and, as a rule, of a scratchy, rasping note, irregular in character, and generally more prevalent during hot, dry winds. "Singing static" differs in that the note is steady, often of high musical pitch, varying from a note similar to that emitted by a 240-cycle generator to that of 500 cycles and over. Unlike ordinary static, it is ofttimes capable of being sharply tuned, from what observations the writer has made, being on an average of 1,000 meters. It is noted most during a rain squall in hot, humid weather, and at times the discharge will be heavy enough to cross an anchor gap or ground plate, accompanied by its characteristic note.

During hot, dry weather a blast from the whistle of a steamship will induce a rough note in the wireless set, and at times a stream of sparks across the anchor gap. This phenomenon is less noted during fog, but at times when the whistle is being blown frequently it will interfere with the reception of messages.

While off the Delaware breakwater during the month of August, the writer had occasion to note a static phenomenon that is not often met with. There had been several thunder showers and the weather was humid. The aerial clip had been detached from the helix and was hanging free without connection to the ground. Immediately after a squall, a high whining note was heard in the wireless cabin, coming apparently from nowhere. Approaching the helix clip, this note rose higher than before, and a small brush of flame played around the clip. With the receding of the body, the note died down, to rise again with the approach. Moving the hand rapidly back and forth from the clip caused the note to rise and fall with the motion of the hand. With the hand three inches or so from the clip, a shock was felt. Using a long insulator, the helix clip was brought close to a deadlight curtain rod fastened to the wall and insulated from any conductor. At two inches a bright brush discharge was obtained, accompanied by a high note, and holding the helix clip at three to four inches the discharge changed to a succession of sparks, with a resultant broken note. Leyden jars were charged, and bringing the head of a person within six inches of the clip caused the hair to stand on end in ludicrous fashion. The discharges continued for an hour, slowly dying in pitch and volume, until only an occasional spark could be drawn. Following the ceasing of the discharges, lightning began playing on the horizon. Each flash of lightning was followed by a heavy discharge across the ground plate. It is interesting to note that where the lightning flashes could be seen from the deadlight port, that the flash and the crash of flame

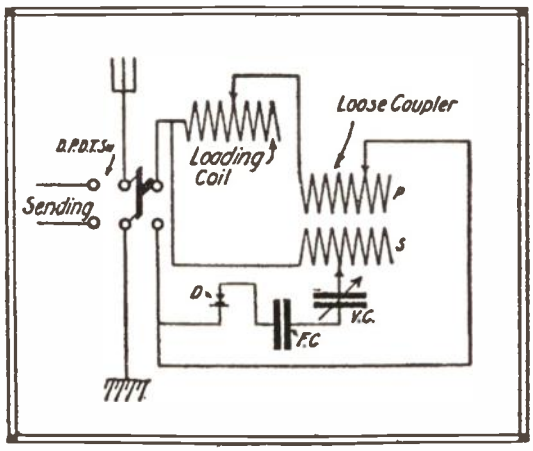
across the ground plate seemed simultaneous, the resultant thunder accompanying the lightning was heard from one to three seconds later.

The last sentence recalls an instance which serves to show the wide difference between the rate of travel of ether waves and those of sound. At San Pedro, Cal., many of the ships entering that port dock within a few hundred feet of the wireless station at that point. The power, 5 K.W., is sufficient to send a discharge across the anchor gaps on the sets aboard the larger ships, the character of the note reproduced in the ship station when the operator was sending in the shore station enabling a message to be read without the use of the 'phones. On calm days the spark could likewise be heard with the naked ear by an operator standing in the doorway of the wireless cabin. When the operator had finished sending, the finish signal could be seen, heard and read across the anchor gap, and, following that, would come the sound wave, tardily straggling along, considerably later than the electrical discharge.

Aboard the *S. S. Pleiades,* en route from Balboa to San Francisco, lightning struck the foremast of the ship, forking from there to the aerial. The shock of the bolt was felt over the entire ship. The current, choked by the aerial loading inductance in its course to the ground, struck off at an angle to an iron beam two feet from the helix. The helix was completely shattered, the two end pieces being split in a dozen sections and the cross beams, held in place by wooden pins, twisted and pulled out. The receiving tuner, separated only by a small single throw switch, was unharmed. All the wheel house and lifeboat compasses aboard ship were reversed, with no two registering alike, and considerable trouble was occasioned in holding the ship to her course the rest of the trip. Steel plates and parts of the ship were magnetized, and when the compass adjuster was called to adjust the compasses, he had more than the usual amount of trouble in so doing.—PAUL OARD.

NEW HOOKUP FOR LOOSE COUPLER

Without offering any explanation of the principles upon which his diagram is based, the contributor submits the accompanying hookup for a receiving set comprising a loading coil, loose coupler, variable and fixed condensers and detector. He claims very good results with the method of connection shown in the diagram. whereas with the conventional form of hookup his receiving radius was small.



An Unusual Hookup Scheme for a Loose Coupler Receiving Set, which Gives Excellent Results.

While the precise reason for improvement is not clear, still the experiments of this contributor might well be imitated with a view to developing any possible merit the new diagram might possess.—FRANK GAMMON.

AN INVITATION TO WIRELESS ORGANIZATIONS

Wireless clubs are requested to communicate regularly with the Editor of THE WORLD'S ADVANCE, stating the activities of the club, which will be brought to the attention of readers. Notices of the formation of new clubs are published when received. Especially are the proceedings and discussions of wireless organizations solicited for the benefit of other similar clubs.

Long Distance Wireless Telegraphy*

By J. B. Woolsey

PREVIOUS to the outbreak of European hostilities, the station at Sayville was engaged in a series of experiments with the Telefunken station at Nauen, in Germany. The Sayville station has since been engaged in the receipt of commercial and official war bulletins from this point, at irregular intervals. The Nauen station (POZ) operates on a wave length of about 9,500 meters and makes use of the so-called Count Arco step-up transformer system for the generation of undamped oscillations.

This system is of interest because the alternations of a generator having an initial frequency of about 20,000 cycles per second are raised to double or triple this value by means of ingeniously constructed step-up transformers, each one of which doubles the frequency supplied to its primary winding. The cores of these transformers are magnetized by direct current flowing through a special winding and are thus saturated to a certain critical degree. When in this state of magnetization, alternating current is passed through another winding (which is the primary winding), causing a change of the existing flux that has been produced by the D. C. winding. Thus a single alternation of current will cause a weakening and strengthening of the existing flux, which in turn produces two alternations in the third winding for every impulse in the primary winding. Thus the frequency is doubled and may be doubled again by the addition of a similar transformer.

The signals from this station are received at Sayville on a special form of Lieben and Reisz current relay which in reality is a type of the gaseous valve detector. This relay is fitted with local fixtures, making it a generator of undamped oscillations which in turn produces the phenomenon of beats from the incoming signals causing an audible note. The Lieben and Reisz relay is, in fact, a copy of the well-known audion.

The Sayville station employs a 500-cycle quenched spark transmitter of 35 K. W. capacity and cannot send to the Nauen station in the daytime. The operators are therefore required to reply to Nauen's communications during the more favorable hours at night time. The Sayville station employs for this work a wave length of about 4,800 meters.

Provided static conditions are not severe Nauen's signals can be read throughout the day at Sayville, but the reception of signals at Sayville is not constant. The station is therefore requested many times to make repetitions.

The traffic sent to Nauen from Sayville is repeated three times to insure accurate reception. This route to Germany is limited in the amount of traffic that may be handled, but nevertheless it is of considerable aid to the Germans while they are cut off from cable communication.

The amateur experimenter who believes that the Arlington station at Radio, Va., is silent during the day may be surprised when he finds that this station is at that very moment apt to be in communication with the naval station at Point Loma, California. These naval stations are fitted with the Poulsen arc type of transmitter having a capacity of 30 or 40 K. W. The receiving apparatus employed for this work is a special form of audion which is particularly suited to the reception of undamped oscillations.

Communication via this route is quite reliable by day and night, a fair amount of official business being dispatched in both directions.

The Arlington station also communicates by means of undamped oscillations with other naval stations which are fitted with receivers for the reception of undamped energy.

A large naval station is about to be opened up at Darien on the Isthmus of Panama. This station is expected to employ a wave length of nearly 20,000

*This is the second portion of Mr. Woolsey's most interesting article on long distance wireless systems and stations. The first half appeared in the July issue of THE WORLD'S ADVANCE.

meters and the arc will consume about 100 K. W. of energy.

Another large transmitting station employing undamped oscillations has been erected by the Universal Radio Syndicate at New Castle, New Brunswick, Canada. This station is now in operation and is fitted with a Poulsen arc type of transmitter. It has not been definitely discerned with whom this station communicates, but it may be heard at certain intervals in the United States, testing. This station was designed with the idea of carrying on correspondence with the similar station located at Portsmouth, England. Such communication, however, has not been established.

Another highly successful long distance radio circuit is that of the Marconi Company between Bolinas and Marshalls, Cal., and Kahuku and Koko Head, Hawaii. These stations employ the rotary disc type of spark discharger giving feebly damped oscillations and a very clear musical note. The service rendered between these two points has been very satisfactory, so much so that the cables were compelled to reduce their rates in order to meet the competition. Owing to the fact that the transmitting and receiving stations on the Pacific coast and at Hawaii are separated by a number of miles, it is possible to carry on communication both ways simultaneously. In fact, this is the great feature of the Marconi long distance systems not yet attained by others. By this method they are not only enabled to handle traffic in both directions, but the operators also may break each other and request the instant repetition of a word or sentence.

Signalling is carried on between these stations at any speed desired, and it is proposed at a later period to operate them at a speed of 75 words per minute.

It may be interesting to the reader to know that the high potential circuits from the secondary of the transformer at these stations is interrupted by means of a specially designed high potential relay in turn operated by a smaller key. In fact, it is of interest to sum up the methods by which the signalling in these large stations is effected, viz.: (1) in the case of the spark stations, the high potential circuit from the secondary winding of the transformer to the condenser is interrupted by a specially designed high potential electro-magnetic break fitted with air blasts; (2) in the arc stations a portion of the aerial tuning inductance is shunted by a telegraph key, thereby changing the emitted wave length; (3) in the high-frequency alternator systems, the D. C. circuit to the field coils is generally interrupted by a telegraph key.

The universal use of arc stations is apt to cause a conglomeration of radio traffic for the reason that these sets emit two wave lengths, one of which is radiated when the transmitting key is up, and the second wave length when it is depressed, thus doubling the interference produced by the ordinary spark for generator stations. This may become a

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¶It is now a matter of history that the first "long distance" attempts at wireless communication took place on March 27th, 1899, when Marconi succeeded in sending messages between the station at Wimereux, near Boulogne, France, and another at the South Foreland Lighthouse, on the Goodwin Sands, England. The total distance traveled by the signals was about thirty-two miles, and so remarkable was the feat considered that newspaper men from almost every nation were present to witness the tests. A ten-inch spark coil was employed to transmit the signals, which were detected by a coherer and recorded on a paper ribbon by means of a Morse register.

¶Sixteen years have elapsed since the English Channel experiments, and the meaning of "long distance" wireless communication has been constantly altering on an ascending scale. Today a long distance radio station can send and receive messages thousands of miles: the Arlington station keeps in touch with the Pacific coast stations; the Eiffel Tower station in Paris communicates with stations in Russia; the powerful Marconi stations in England, which have been taken over by the British Government, transmit orders to warships in the distant Mediterranean and, perhaps most remarkable of all, the Nauen and Eilvese stations in Germany permit of communication with the outside world.

serious hindrance to stations working on other wave lengths.

Within the past several weeks the Tuckerton station has been engaged in making comparative tests between Tuckerton and Eilvese of the arc and Goldschmitt high-frequency alternator. In fact, they have been alternatively employed through the days' schedule. It is generally understood as a result of these tests that the arc set carries further than the high-frequency generator, but the note produced by the arc has no where near the purity of that obtained by means of the generator.

In the third method referred to at the beginning of this article, viz., the high speed, high-frequency alternator, outside of experimental laboratories it has not been employed for commercial work. The initial speed of this machine is so high (20,000 r. p. m.), that they are not yet considered as a commercial proposition.

The General Electric Kenotron is a new-comer in the field of radio telegraphy, and is, in fact, a special form of vacuum valve oscillator comprising a hot filament and a cold plate placed in vacua. When a direct current is made to flow between the filament and the plate and is in turn shunted by an inductance and capacity, the Kenotron becomes a generator of undamped oscillations, which may in turn be transferred to an antenna circuit by means of an oscillation transformer. The Kenotron is exhausted to the highest possible degree—practically a perfect vacuum is obtained. At the present writing the output of this type of undamped generator is limited, but future experiments may reveal that a number of these can be placed in parallel, and if so it will probably take the place of the high-frequency alternator or the Poulsen arc.

It would seem from a review of the various systems just described that we are on the eve of important developments and extensions of long distance radio service and that within the very near future a number of extremely long distance radio circuits will be available for communication with foreign countries, giving the same degree of accuracy as the ordinary cable.

TIFFIN RADIO CLUB

The Tiffin Radio Club has recently been founded at Tiffin, Ohio, and the following officers appointed:

President, John J. Grossman; Vice-President, Paul E. Fredericks and Secretary-Treasurer, Harold C. Buck.

All the members of the Tiffin Radio Club have stations.

All correspondence to the club should be addressed to the President at 181 Hudson Street.

The Logarithmic Decrement

By H. B. Richmond

SINCE the passage of the radio act of August 13, 1912, the amateur, as well as many commercial, operators have come to realize that the operation of a radio transmitting set is no longer a merely hit or miss affair, but has become an exacting procedure. Resonance, damping, logarithmic decrement and many others are expressions with which they must be familiar. Probably as important as any, and at the same time the least clearly understood, is the logarithmic decrement. Although this term is by no means limited to radio work, it will here be considered only from that aspect. Let us first consider why the term has such an important place in radio work and then what it really means.

Suppose there were but four radio stations in the world and each station had identical equipment throughout. Let these stations be located at the corners of a square and A always work with A', and B with B', Fig. 1. Let all stations use the same power but operate on slightly different wavelengths. If B is receiving from B' and A and A' are working, B will experience interference from A and A'. Interference to the same extent will be experienced by A when A is rereceiving from A' and B and B' are working. The operators of the four stations then get together and agree to reduce this interference by adjusting their transmitting sets so that A will not hear B or B' and B hear A and A' for a distance of over ten turns on the primary of their loose couplers either side of the point of maximum strength. This is a rather crude agreement, but it serves its purpose by actually limiting the broadness of wave which the several stations may use.

Now let us go one step further and let any one of the four stations work with any of the other three. If A is working with B, B' may say B is all right but A is too broad. The reason for this being that B is farther from B' than A is. The energy received from B is accordingly less than that received from A and it will appear to B' that A is broader than B, although in fact they are both the same. Thus it becomes evident that some new method of measuring the broadness must be adopted. And as we increase the number of stations indefinitely using different types of apparatus, different powers, different wave lengths, etc., it at once becomes apparent that any method of measuring the broadness of a wave must take into account wave length, power and all other factors which enter into it. This is exactly what the logarithmic decrement does. It is a measure of broadness which will apply under all conditions of operation.

Before attempting to conceive of the meaning of the expression as applied to radio work, let us take an example which we can actually see worked out without the aid of any elaborate apparatus. Take a piece of twine or fine wire 39 inches long and fasten a small weight to one end, then suspend the pendulum thus constructed so that it will swing freely. Carry the weight to one side and carefully release it so that it will start swinging straight back and forth and not acquire a rotary motion: *i.e.*, its swing will be limited to one plane. It will be observed that the time required for the bob to swing from the perpendicular position at the lowest point of the arc of swing out to the end and back to the center is just one second. To start from the center, swing to the right, swing back past the center to the left, and then swing back to the center again will of course require twice as long as a swing from the center to but one side and back again, and accordingly will require two seconds. This full swing is a complete circle of events or *cycle*, and as *frequency* is measured in *cycles* per second we have a frequency of 0.5. If we had 25 complete swings per second we would have a frequency of 25 cycles. In addition to the fact that the time is remaining constant for each swing it will be noticed that the distance which the bob swings from the center is constantly

diminishing. Thus we have a pendulum whose time of swing, or *frequency,* is constant, and whose length of swing or *amplitude,* is diminishing.

Now let us make some measurements with this pendulum. On a piece of paper draw a line *OX,* Fig. 2, and divide this line into a number of equal spaces, *OC, CF, FM,* etc. Let each of these spaces represent the time it takes the bob to go from the lowest point of the arc to either extremity and return, *i.e.* 1 second. As it takes the bob just one-half of this time to go from the lowest point to an extremity, let us divide the given space into two equal parts, representing 0.5 seconds, and at these middle points erect perpendiculars alternately above and below *OX,* as *AB, DE,* etc. Now let us measure the actual swing of the pendulum. Suppose on the first swing it goes 12 inches to the right and 11 inches to the left. If we take some convenient scale, such as one inch to the foot, we can lay off on the perpendicular lines which we constructed the actual swing of the pendulum. Let swings to the right be laid off above and swings to the left below *OX.* We will get a series of points such as *A, E, G,* etc. If we take points in addition to the middle ones and measure the swing at these intermediate points, we will get a series of points through which we can draw a smooth curve, as shown in Fig. 2. This curve gives us a method of studying the relation of the amplitude of swing to the time of swing.

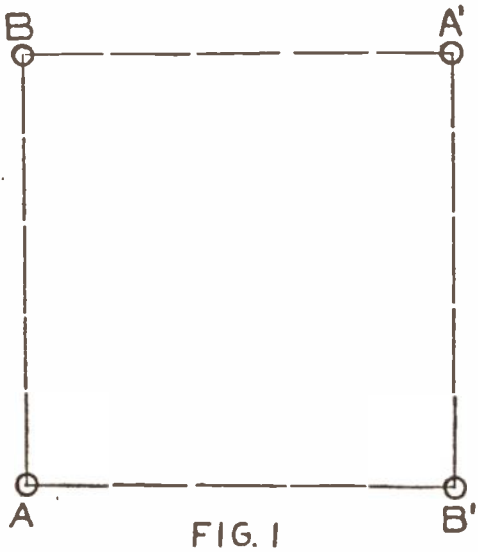


FIG. 1

Diagram Serving to Explain the Necessity for Sharply Tuned Transmitting Sets.

If we take the amplitude of the first swing, indicated on the diagram by *AB* and numerically equal to 12 inches, and compare it with the amplitude of the second swing *DE,* equal to 11 inches, we obtain a definite relation between the two, which is numerically equal to 12/11 or 1.09. A close study of the curve will reveal the fact that no matter where we take one perpendicular if we take the other in the corresponding place in the next loop in the opposite direction the ratio will always be the same and for this particular case, 1.09. The less the number of swings before the bob comes to rest, the greater will be the ratio between these perpendiculars. For this simple case we might stop here, for we have a perfectly definite measure of the characteristic of the curve when we state the ratio between the amplitudes of any two successive swings. For the comparison of similar curves this method is often used. But when we come to radio work it becomes especially desirable to go a step further in order to cover the case more completely. Instead of stopping with the simple ratio of the amplitudes of two successive swings taken in opposite directions we take *the natural logarithm of the ratio of the amplitudes of two successive swings taken in opposite directions.* This is what is defined as the *logarithmic decrement.* For the benefit of those who are not familiar with the subject, it might be well to stop a moment before going further to explain what logarithms are.

If we consider any real number whatsoever, we can establish a relationship between that number and every other number. Consider the number 10. 12 is 10 plus 2. 7 is 10 minus 3. 100 is 10 plus 90. 100 is also 10 times 10, or as it is more commonly written, 10^2. 1000 is $10 \times 10 \times 10$ or 10^3. It is perfectly evident that where we have a perfect power of 10 as 1000 that it is correct to write 10^3, but it is just as true for numbers which are not perfect powers. Let us consider 45. 10 is 10^1, and 100 is 10^2. As 45 is between 10 and 100 it must be 10 to some power between the first and second, and is actually found to be $10^{1.65}$. If we take

368, it is between 100 and 1000, or between 10^2 and 10^3, it actually being $10^{2.59}$. This number, which expresses what power of 10 the number under consideration is, is called the logarithm of that number with respect to base 10. Thus 1.65 is the logarithm of 45 with respect to base 10, and 2.59 is the logarithm of 368 with respect to base 10. Hence it is at once apparent that we can take any number as our base and express every other number as a power of that base; that is to say, every number has a logarithm with respect to every other number. Many of our every day computations are made by first expressing the numbers as powers of 10, then working out the computations and finally converting the numbers back again. Tables known as logarithm tables are found in many mathematical books, and express all numbers in powers of 10, so that by means of these tables much laborious work is saved.

For such calculations as the logarithmic decrement there is another base other than 10 which is used. This base is designated by the letter *e* and is numerically equal to 2.718. It is known as the hyperbolic or natural base as contrasted with the 10 base which is called the common or Briggs' base. It is beyond the scope of this article to take up the derivation of the number *e*, but it seems well to add just a word about it lest the subject of logarithms be left in too hasy a state for those not already familiar with it. Many mathematical curves, as for example the one under consideration, appear to have peculiar properties when considered from our decimal system of counting, but which are perfectly regular when considered with respect to the irrational number designated by *e*. Thus in order to simplify many computations they must be based on *e* rather than on our decimal system with 10 as the base. *e* gets its value from the expansion of the convergent series $(1+h)^h$ where *h* approaches O. Expanding by the binomial theorem we get

$$e = 1+\frac{1}{1}+\frac{1}{1\times2}+\frac{1}{1\times2\times3}+\frac{1}{1\times2\times3\times4}+\ldots = 2.718\ldots$$

If we consider *e* as our base, the logarithm of 45 would be 3.81 instead of 1.65 when we considered 10 as our base. Its meaning is similar in that 45 is 2.718 to the 3.81 power just as we saw it to be 10 to the 1.65 power.

But let us now return to our curve. Instead of stopping with the simple ratio of *AB/DE* which we found to be equal to 1.09 we are to take the natural logarithm of this ratio. From a table of natural logarithms we find that 0.09 is the natural logarithm corresponding to the number 1.09. Our logarithmic decrement per half period is therefore 0.09. To get it for a whole period it is merely necessary to multiply by 2 and get 0.18 as the decrement, which latter figure is the logarithm of the ratio obtained by taking *AB/GJ*. Here is one place where our logarithmic expression is an aid to us. The logarithm of any ratio of corresponding perpendiculars taken any number of loops apart is equal to the logarithm per half period multiplied by the number of loops below the one in which the initial perpendicular is measured. No such relationship exists in the simple ratio.

When we come to radio telegraphic work we have a condition similar to that illustrated by the string. A condenser is charged until the voltage is sufficient to break down the spark gap, then we get a rush of energy through the closed circuit which sets up a current in the open antenna circuit. This current in the antenna circuit may be likened to the swing which we gave the bob. It is greatest at the instant we start it, swings back and forth, gradually dying out to 0. The time of swing is constant but the amplitude is decreasing. While we cannot measure it with a yard stick, the way we did for the pendulum, it is possible to photograph the discharge, and the result will show a curve exactly the same as developed by the string. The perpendiculars such as *AB* representing the currents and the distances along *OX* the time required per oscillation. Instead of requiring two seconds for a complete oscillation, or cycle, the time is now but a small fraction of a second, the actual time depending on the wave length. For 200 meters this time per complete oscillation is 1/1,500,000 sec. Compare this frequency of 1,500,000 cycles with 0.5

obtained with the plain string!

We can now take the ratio of corresponding amplitudes in any two loops and obtain the logarithmic decrement exactly as we did for the string curve. Suppose we take the ratio of *AB* to *DE* and get 1.09 as we did for the string. The logarithmic decrement per half period is accordingly 0.09 and 0.18 for the whole period. Our set is, therefore, tuned within the requirements of the radio act which says, "At all stations the logarithmic decrement per complete oscillation in the wave trains emitted by the transmitter shall not exceed two-tenths except when sending distress signals or signals and message relating thereto."

Unfortunately it is not as easy to construct the curve for a radio transmitter as was the case with the pendulum, and in general other means have to be resorted to in order to compute the decrement. Several ingenious devices have been developed for this purpose, the most notable of which is the direct reading decremeter and wave meter designed by Mr. Frederick A. Kolster of the Bureau of Standards. This is the form of decremeter used by the U. S. radio inspectors and it is mounted in a leather suit case, in order to make it suitable for transportation on inspection tours. An excellent description and mathematical discussion of this decremeter by Mr. Kolster himself is found in Volume 3, No.. 1, March, 1915, issue of the *Proceedings of the Institute of Radio Engineers.*

To all operators who have worked in congested districts the effect of a high decrement is known only too well. The higher the decrement the less oscillations per train and the broader the wave. For a decrement of 0.2 per complete period there will be about 15 waves per train. It is beyond the scope of this article to go into the causes and effects of a large value of the decrement, but it may be said that the decrement will be high when there is a high resistance in the circuit, when there is a transfer of energy back and forth between the primary and secondary circuits, or when the two circuits are not tuned to the same wave length. These two last conditions are nearly of the same character. The result is a broad wave, and as the energy is not concentrated over a short space the damping or decrement will be high.

To sum up, it may be said that the

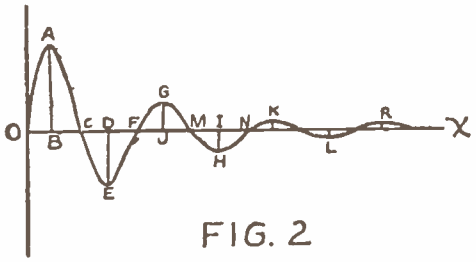


FIG. 2

Diagram for Explaining the Decrement of a Pendulum.

logarithmic decrement is a convenient measure by which the damping of a circuit may be determined. The clause in the radio act of Aug. 13, 1912, defining the maximum value of the logarithmic decrement, sets a standard for the maximum amount of damping permitted to be used by any station. It is desirable to have the damping or logarithmic decrement small in order that the emitted wave will be sharp and can be readily tuned out by stations not desiring to receive that wave. Distress signals should be sent with a relatively large value of the logarithmic decrement in order to have a sufficiently broad wave to attract the necessary attention. The correct adjustment of a transmitting set for a logarithmic decrement below 0.2 is just as essential as having the correct wave length.

RADIO SECTION OF THE SEPTEMBER ISSUE.

The Radio Section of the September issue will contain several short, constructional articles, as well as longer articles, dealing with advanced phases of wireless engineering. One of the latter articles will be by Mr. A. S. Blatterman, and will cover many points that are not clearly understood by the majority of wireless amateurs. The policy followed in the past few issues, namely, that of presenting long articles of an authoritative nature and prepared by well-known writers in the field, will be continued, although there will be quite a number of short contributions similar to those that characterized the Radio section of previous issues.

The Danger of Hertzian Waves

By B. S. Blakee

THE discharge of an electric spark is the source of radiant energy capable of producing at a distance upon an electrical apparatus called a "resonator" powerful vibratory movements which are liable to give rise to other sparks. This phenomenon was first observed by the German physician Hertz, by means of a metallic circle cut in such a way as to leave the free ends close together, placed in an oscillating field of induction. This principle has been made use of recently in England to cause an explosion in the hull of an old ship lying at some distance from a wireless station. The details of the operation have been kept secret, but a similar experiment may be made with the following simple apparatus:

Fill a glass flask with an explosive mixture of oxygen and hydrogen (two volumes of H to one of O) and close the mouth of the flask with a stopper of paraffin through which have been pushed two steel needles with blunt and polished points, so that they approach at an angle and leave a small space between the ends. Now connect the needles to long insulated wires, which may be extended to the earth or hung on brackets in opposite directions. If operated in stormy weather, or in the neighborhood of a wireless station, one will not have to wait long for a spark induced by an electric wave, which will cause the explosion of the gases with a report like the crack of a pistol.

This experiment of the English Admiralty is probably the first in which these waves have been voluntarily used to cause destruction, but it is not certain that the destroyed ship is the first victim of electric resonance.

The accidental occurrence of the Hertzian experiment is perhaps more common than is imagined, on account of the numerous resonators which chance leaves in the paths of the electric waves. It is only necessary that such conditions be present in an inflammable medium to cause a fire.

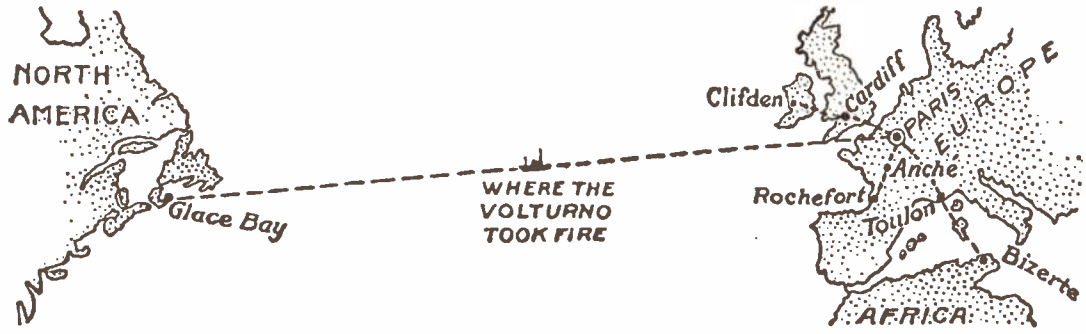
M. Duroquier, writing in *La Nature*, says that he would be sorry to cause unnecessary alarm to sailors, miners and aeronauts, but the memory of recent catastrophes in which many lives have been lost leads one to believe that special care should be taken under certain conditions and in certain localities to counteract the effects of the electric waves which reach to the depths of a mine as readily as they reach a ship at sea or a dirigible balloon in the air.

On board ship some chain, or perhaps scrap iron in the coal bunkers may cause sparks which will start a fire. In the case of a battleship, shells lying close together in a badly ventilated ammunition vault may be exploded by the same means. To cause the firing of a dirigible, all that is necessary is the formation of sparks across some gap in the metallic frame-work.

Numerous instances may be cited of the inductive effects of these waves. At the wireless post at Mont-Valerien, several miles from Paris, the emissions from the Eiffel Tower give rise, by resonance, to sparks several millimeters in length at the point of the detectors on the receiving table. On shipboard, also, this effect can be observed in the metallic rigging when the wireless is in operation.

Continuing, M. Duroquier says that the dangerous effects of induction are to be feared not only under a storm cloud, or near a radio-telegraphic station, but especially at points halfway between two powerful stations. He noticed that at his own wireless station some of the delicate instruments were frequently out of order from some unknown cause and by drawing a straight line on a map from Paris to the nearest wireless station, situated at Rochefort, he

found to his astonishment that his own station is just midway between the other two. By connecting the various large stations in Europe and America, he made the further discovery that halfway between Glace Bay and Paris is the region in which the *Volturno* took fire; that halfway between Paris and Bizerte on the north coast of Africa, is the harbor of Toulon, where explosions have occurred on a number of French warships; and that halfway between Paris and Clifden, Ireland, is Cardiff, at which disastrous mine explosions have taken place in the recent past.



Map Showing the Location of Several Powerful Wireless Stations, the Waves of Which Are Said to Have Caused Disasters.

Possibly the recent burning of a Zeppelin airship may be put down to the same cause, but in any case it would seem wise to take special precautions against fire in these localities.

CONNECTICUT VALLEY RADIO CLUB

The Connecticut Valley Radio Club with headquarters at Springfield, Mass., recently elected the following officers: President, Glen Sabin; Vice-President, Dean A. Lewis; Secretary, George F. Beecher and Treasurer, F. K. Ostrander, Jr.

The club was organized on December 8th, 1913, with an initial membership of eight. A recent membership campaign has resulted in a considerable increase, and it is hoped that there will shortly be at least fifty members.

The vice-president of the club holds a special Government license and has communicated with other wireless stations 1,800 miles away. Anyone desirous of getting into communication with the club may do so by calling IZL, which is the call of the vice-president's station. Correspondence is also solicited and may be addressed to the Secretary at 416 Allen St., Springfield, Mass.

A NEW WIRELESS CLUB FORMED AT BUFFALO

There has recently been formed at Buffalo, N. Y., a wireless club with its headquarters in the Buffalo Y. M. C. A. building, where members are given instructions. Mr. Rice is in charge of the wireless class, while the officers of the club are: President, H. L. Moershfelder; Vice-President, Russell Paris; Secretary, Emil Ferris and Treasurer Wm. Feuchter.

NEW WIRELESS TELEPHONE.

The General Electric Company has recently been conducting experiments with a wireless telephone system of their own design and manufacture, between the plants at Schenectady and Pittsfield. It is said that ranges in excess of fifty miles have been covered without difficulty.

What the World is Doing

BY the end of the current year approximately 10,000 workingmen will have been killed in the pursuit of their daily tasks! In this sentence, the opening one of a noteworthy article in the present issue, the reader will find food for thought. For the greater part these unfortunate men are engaged in supposedly safe occupations, many of them working in factories and meeting their fate through faulty equipment or through sheer carelessness on their part.

With the inauguration of the Safety First movement, all manner of protective coverings and guards were devised to shield the operator from the dangers of his machine, and there is little excuse for the factory owner who wilfully neglects to safeguard his employees by covering the moving parts of the machinery. The expense is slight and the feeling of security is conducive to better and faster work on the part of the operator.

But the matter of safety does not always rest with the employer. The workman must also do his part. Many accidents, seemingly trivial in themselves but far-reaching and pernicious in their effects, are the direct results of plain carelessness and thoughtlessness on the part of the workman. For instance, in a foundry two workmen may be standing side by side, chipping burrs from rough castings; a chip flies off at a blow from the hammer of one of the men and strikes his companion in the eye. Such accidents happen almost daily under conditions where no actual machinery is used. The result may be the loss of the eye and once one is affected, the other is likely to follow its mate. Such an accident could positively be prevented if the workmen were to stand one in front of the other instead of side by side or facing each other.

It is the little things that count in any walk of life. Let the employer do his part to be sure, but—and what is of even greater moment—let the employe enter into the spirit of Safety First with a will and a determination to lend his individual efforts to the common cause—the elimination of careless, inexcusable accidents.

WHAT is your definition of a person worth while? Of all the people you have met can you not pick out a certain few who have impressed you as being particularly interesting, who have made you feel that you wanted to see them again, to know them better? Are not these very special people the ones who have talked to you about *things* rather than *persons?* Ofttimes we hear a man spoken of as one who does things—a man of deeds. Do we not unconsciously weave a halo around his head when we speak or think of him?

The mind of a growing boy is plastic and upon his early training and surroundings depends to a great extent the form it will take in later life. The receptive young brain yearns instinctively for knowledge and the boy's habits are largely the result of a mere suggestion here and there. The creative instinct is strong within the average healthy boy—he wants to make things with his own hands—wants to see them grow under his guidance.

This inborn desire of the boy to accomplish things should be encouraged. Let the boy have his little workshop in a corner of the attic; let him build things and devise ways and means to overcome obstacles that arise through lack of proper tools—the development of this quality of self-reliance will stand him in good stead in later years when he brushes up against the world. Let the youngster take his camera into the woods and fields in the summer—encourage the feeling that he is actually producing something. In the course of a few years he will begin to sense the possibilities of making money out of his hobby, whatever it may be, and this will mark the awakening of the business instinct in him.

The athletic development of the boy is natural and of vital importance. In no sense should the above remarks be construed to mean that the boy is not to be encouraged in his play. The life of a normal individual should, however, be made up of about equal parts of work, play and rest. Work is just as essential to the well being of the boy as it is to the adult; but to the youngster the work must take a form that makes it seem like play. Just as his games develop his muscles so should his work mould his mind and develop his natural desire to do things.

"Why don't you marry, old chap?"

"Do you think a man could procure all the necessities of life on $1,800 a year?"

"Of course; but not the luxuries."

"Well, I haven't decided yet whether a wife is a necessity or a luxury."—*Boston Transcript.*

⁂

"What do you make of his name?" asked the police chief.

"Well," responded the great detective, "from the spelling, I should judge that he's either a parlor car or a Russian dancer."—*Philadelphia Ledger.*

⁂

"The great trouble with the American people is that they eat too much," said the doctor.

"Nonsense," retorted the statistical person. "I can easily produce figures to prove that one-third of the American people live in boarding-houses."—*Judge.*

⁂

Wild-eyed Customer—I want a quarter's worth of carbolic acid.

Clerk—This is a hardware store, but we have—er—a fine line of ropes, revolvers and razors.—*Yale Record.*

⁂

Once upon a time a man invented glasses with which people could see their own faults. He starved to death.—*Cincinnati Enquirer.*

"I would I were a bird," she sang.

"I would you were," said her husband. "You could go South for the winter without its costing me anything."—*Life.*

⁂

Knicker—What succeeds that tired feeling?

Bocker — That fired feeling. — *New York Sun.*

⁂

"Why did the great pianist refuse to play?"

"Temperament. He got mad because his name was printed in smaller type on the program than the name of the piano."—*Chicago Record-Herald.*

⁂

Trott—Well, my dear, did you enjoy your shopping trip today?

Mrs. Trott—No, I didn't. I found exactly what I wanted in the very first store I entered.—*Boston Transcript.*

⁂

"Is he a credit to his family?"

"No; a debit."—*"Concord Herald.*

⁂

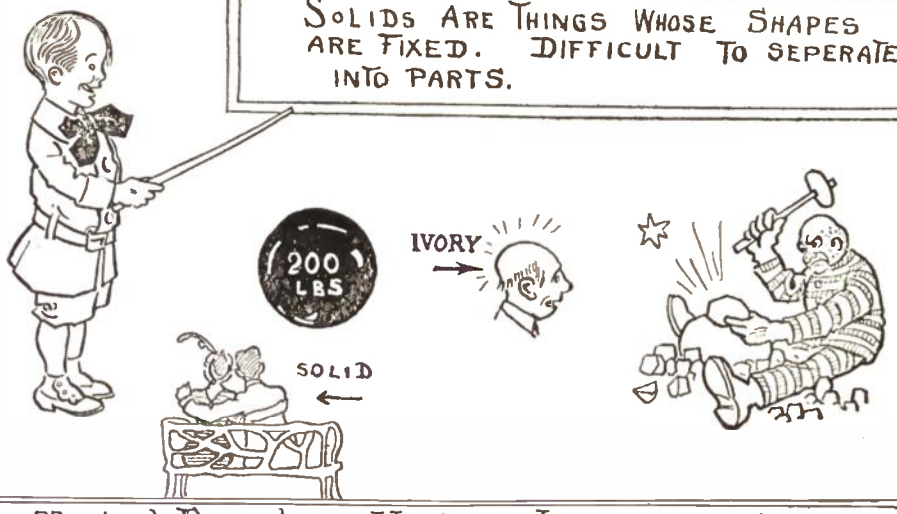
"Penley used to think his poems were immortal."

"What changed his opinion."

"The editors 'killed' so many of them."—*Boston Transcript.*

Scientific Sammy on Solids and Liquids

In Two Comprehensive Chapters



Neutral Examples - Neither Liquids nor Solids