The WORLD'S ADVANCE

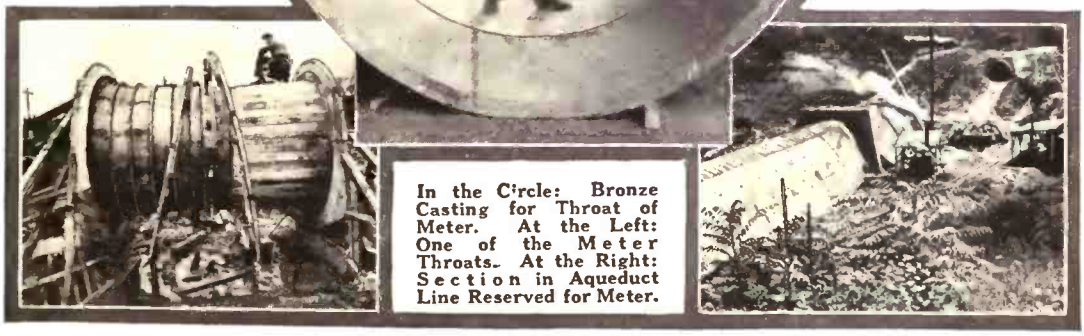
Vol. 31 SEPTEMBER, 1915 No. 3

How New York Will Measure 500,000,000 Gallons of Water a Day

By Charles W. Person

GALILEO said in 1700 that he could learn more of the movements of Jupiter's satellites than he could of the flow of a stream of water. Ninety-seven years later, however, an Italian philosopher, J. B. Venturi, discovered a principle which enables the engineers of this century to measure accurately and quickly any given quantity of water from a drop up to a billion gallons and more. It is this old Italian's principle which makes possible the method and apparatus for measuring the flow of water through the Catskill Aqueduct.

The completion of the Catskill Aqueduct will provide means of delivering to New York City a daily water supply of at least 500,000,000 gallons, through its 100-mile chain of dams, aqueducts, pressure tunnels and steel pipe siphons. A comprehensive plan for determining how much water the Aqueduct will deliver has been developed, and three meters will be placed at three



In the Circle: Bronze Casting for Throat of Meter. At the Left: One of the Meter Throats. At the Right: Section in Aqueduct Line Reserved for Meter.

points in the line, so that a continuous record of the actual flow will be available.

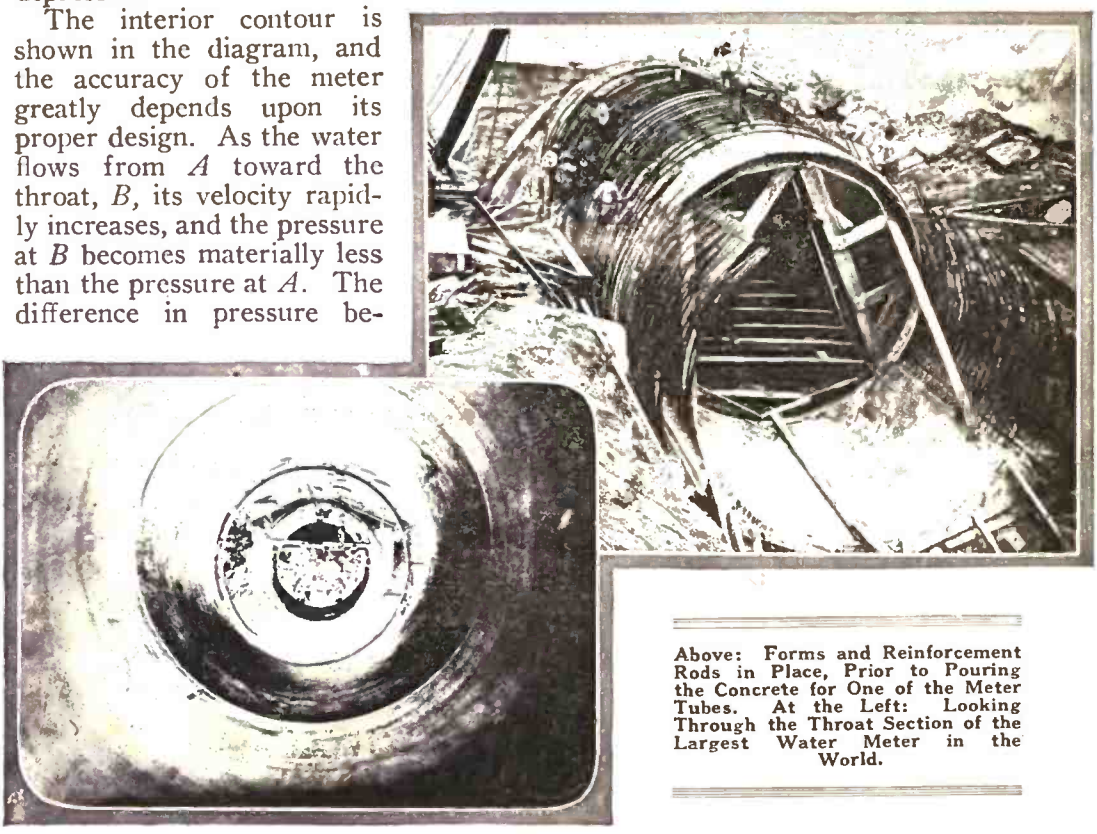
These meters are on a colossal scale; in fact, they are the largest meters ever built. At the upstream castings the diameter of the waterway is 17 feet 6 inches, and at the throat of the meter the diameter is 7 feet 9 inches. Each meter is based upon the principle of the conservation of energy, and each consists of a contracted section, or throat, the function of which is to introduce an artificial depression.

The interior contour is shown in the diagram, and the accuracy of the meter greatly depends upon its proper design. As the water flows from *A* toward the throat, *B*, its velocity rapidly increases, and the pressure at *B* becomes materially less than the pressure at *A*. The difference in pressure between *A* and *B* can be accurately measured, and bears an exact ratio at all times to the flow through the throat *B*.

After passing the throat the velocity begins to decrease with an accompanying rise in pressure, and when *C* is reached the pressure temporarily lost at *B* has been almost entirely regained. Therefore, a properly proportioned tube not only provides a basis for accurate measurement of the flow, but it delivers practically the same amount of water as a straight pipe of equal length and diameter.

In order to fix the location of these huge measuring devices it may be advantageous to review briefly the principal parts of the Catskill system. The water will be collected in the Ashokan reservoir, 100 miles north of New York, and will flow south by gravity through the aqueduct to the Kensico storage reservoir, about 30 miles from the city. From the Kensico reservoir the water will be delivered into an equalizing basin at Hill View, and from this point the flow will be carried to points of connection with the city's distribution system by means of a deep pressure tunnel in rock, driven the entire length of Manhattan Island. The first of the three large meters is located at the outlet of the Ashokan reservoir; the second is at the inlet to the Kensico reservoir; and the third is at the outlet from the Kensico reservoir.

All the meters are built in the aqueduct line and will carry the full flow. There are several reasons for using three meters instead of one. On a conduit the length of the Catskill Aqueduct there is



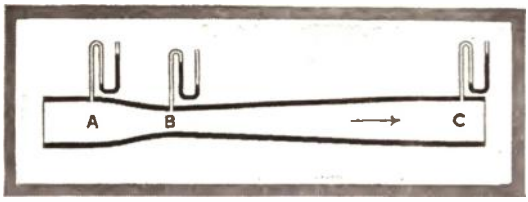
Above: Forms and Reinforcement Rods in Place, Prior to Pouring the Concrete for One of the Meter Tubes. At the Left: Looking Through the Throat Section of the Largest Water Meter in the World.

certain to be leakage at some points and infiltration of ground water at others. The measurement of the flow at the Ashokan reservoir, therefore, would not be a true index of the amount delivered to New York City.

By putting in a meter at Ashokan and another at the inlet to Kensico and comparing the volume of the flow recorded at each of these points, it is possible to determine accurately just how much water is lost by leakage or gained by ground water seepage.

The third meter at the Kensico outlet is necessary to determine the quantity of water actually delivered into the city distribution system. It is possible that the aqueduct may be delivering water into the Kensico reservoir at a time when none is being withdrawn, or that the aqueduct supply may be cut off when the Kensico water is feeding into the city distribution system. Under conditions such as these it is apparent that one meter would not be sufficient to give the data desired regarding the quantity of water.

Each meter is built of reinforced concrete, with a bronze lining and annular pressure chamber at the throat and a



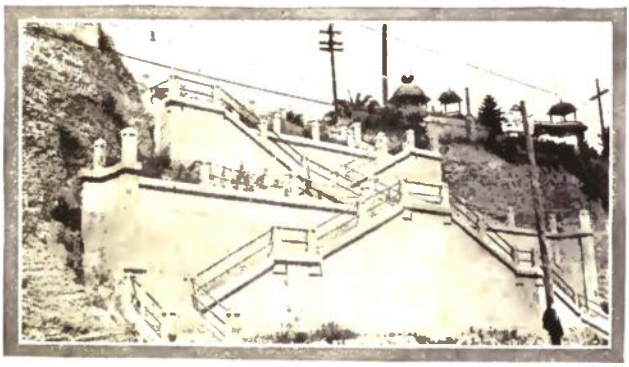
A Simple Diagram to Indicate the Action of the Water Meters Used in the Catskill Aqueduct.

second bronze pressure chamber at the upstream end of the tube. It was desired always to have the throats of the meters full of water, and for this reason the tubes were built as inverted siphons with the throats 18 feet below the hydraulic grade line.

The length of the depressed section is about 408 feet, including 30 foot transition lengths at either end which convert the 17-foot horseshoe section into a 17-foot circular section. The length of the tapered portion of the meter on the upstream end is more than 26 feet and at the downstream end more than 111 feet. When one considers that the ordinary meter is not larger than the palm of one's hand, the extraordinary size of these huge meters can be realized.

CONCRETE STAIRWAY OPENS A STREET BLOCKED BY A HILL

The accompanying illustration discloses a novel way in which a city in the western part of this country "opened" a street, the end of which ran into a deep cut of about sixty feet in height.



A Stairway of Unusual Design, which was Constructed in Order to Open a Street.

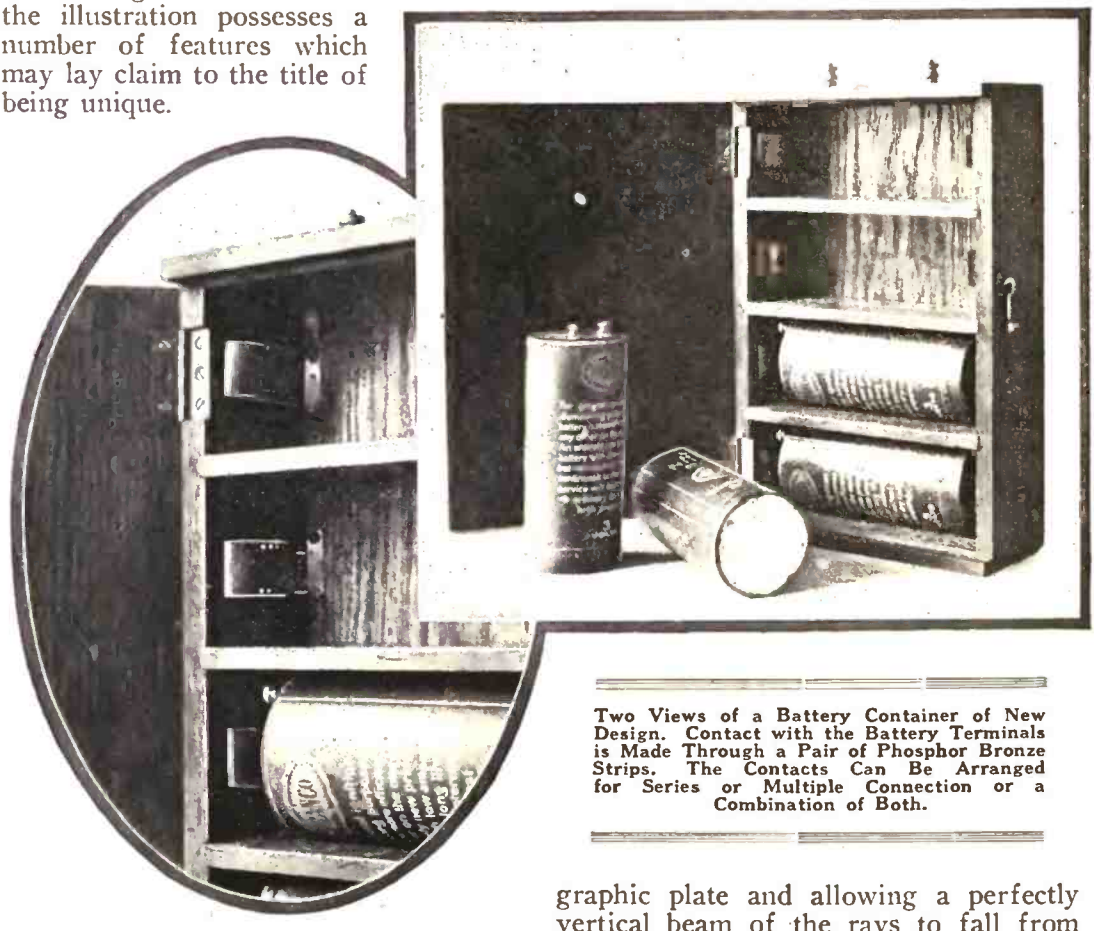
The improvement consists of an elaborate set of concrete steps of unusual design. At the bottom there are two entrances to the stairway. After a short flight at these entrances these series of steps turn and run toward each other, meeting in the center and continuing upward for about twenty steps. From this point they again part, going outward until they are about fifty feet apart, at which point they again turn up the hill, continuing to do so until they reach the top of the grade, when it is found that each of the series of steps is directly

even with either of the sidewalks of the street above.

The concrete work in this instance is reinforced with strong steel rods one-half and three-quarter inch in diameter. At all sides of the steps, where there is no wall cement, column and pipe railings have been provided. The entire concrete work has been given a sanded finish.

A BATTERY CONTAINER THAT CONNECTS ITSELF

Every user of dry cells in quantities knows the value of a device which makes it unnecessary to connect each cell when it is put in the place of an exhausted one. While several practical methods of accomplishing the desired result have been suggested and put into operation, the arrangement shown in the illustration possesses a number of features which may lay claim to the title of being unique.



Two Views of a Battery Container of New Design. Contact with the Battery Terminals is Made Through a Pair of Phosphor Bronze Strips. The Contacts Can Be Arranged for Series or Multiple Connection or a Combination of Both.

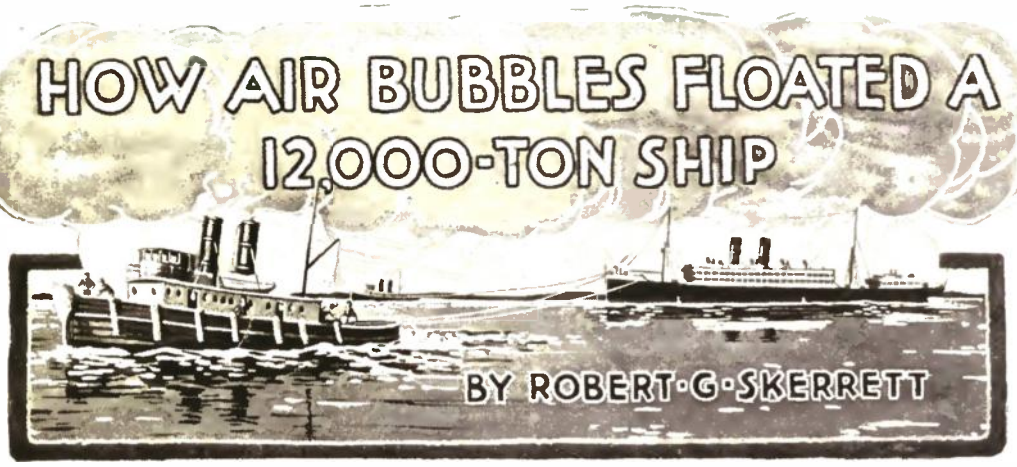
The contact device in this container consists of a pair of phosphor bronze spring strips, one of which makes connection with the carbon and the other with the bare zinc at the bottom of the cell. Thus it is obvious that by merely removing the paper carton from the cell, or cutting the bottom out of it and pressing the cell into place, the connection is made and the battery secured in place almost instantly.

The contacts can be arranged for series or multiple connection or a combination of the two.

TINY X-RAY PICTURES

Professor Pierre Goby appears to have been the first man to obtain photographs of very minute specimens by the use of the X-rays, such as diatoms and the like, which have about the size of a grain of sand. This he does by placing the specimens directly upon a photographic plate and allowing a perfectly vertical beam of the rays to fall from the bulb above, through a special tube so as to properly direct the rays on to the object.

HOW AIR BUBBLES FLOATED A 12,000-TON SHIP



BY ROBERT·G·SKERRETT

IT was a most unusual problem that confronted the American engineer who undertook refloating the "Zeeland," grounded on a mud bank in the St. Lawrence River, within three days' time. The task was to be so accomplished that the steamer could immediately proceed to Montreal, take on war supplies and depart for England; no damage of any kind that would further delay the steamer's sailing was to be incurred in the refloating. How the vessel was freed by the application of compressed air within ten minutes after starting the actual operations is a typical instance of the adaptation of simple principles to gigantic and seemingly impossible enterprises.

THE skill of the engineer is not always proved by originality; he shows his cunning equally by adaptation of other men's work. In other words, resourcefulness is his trump card. Proof of this capacity to profit by the labors of others was shown in the clever way in which Mr. W. W. Wotherspoon, of New York, succeeded in refloating a stranded ship of nearly 12,000 tons.

All of us were very much interested in the work of the army engineers when they raised the wreck of the old battleship *Maine* from the bed of Havana Harbor. As can be recalled, a novel cofferdam was built completely around the hulk, fencing it in, so to speak, with an elliptical wall of steel and mud; the unit cylinders being filled with the stuff dredged from around the wreck. With this done, the enclosed space was pumped out slowly until the shattered body of the battleship was finally exposed to the air and sunshine.

But the object of the undertaking was to refloat a large part of the craft so that it could be bodily removed to the deep waters of the Gulf Stream and there sunk for good and all. After draining the cofferdam space the task was not finished by any manner of means, for the tenacious clay underlying the silt of the harbor bottom gripped the ship. To refloat her this hold had to be broken, and the operation was accomplished in the following manner: Holes were drilled through the bottom of the

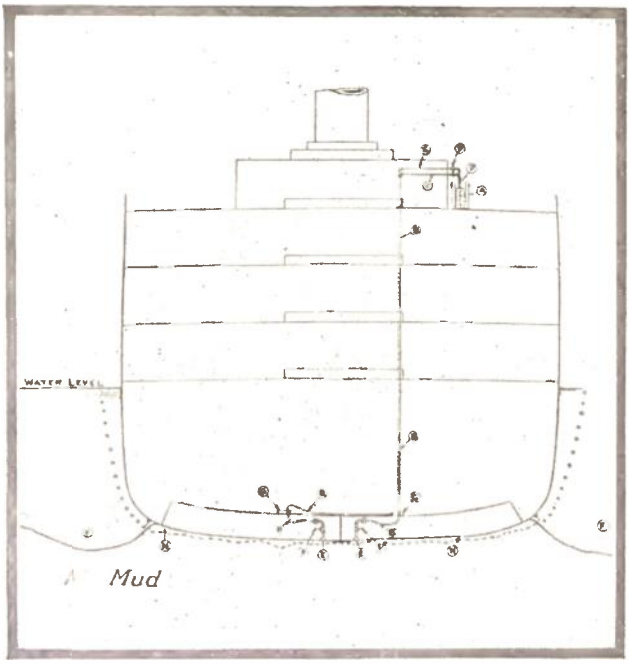


Diagram of the "Zeeland's" Position on the Mudbank, as Well as the Method of Installing the Piping Through Which the Compressed Air Was Forced for Blowing Out the Mud Beneath the Vessel.

hull all around the contour of the craft, and through these water jets were sent to break the seal between the steel plating and the surrounding clay. These jets answered their purpose well, saved an immense amount of excavating, and freed the wreck so that it floated when the enclosed space was refilled with water. Now for the novel manner in which Mr. Wotherspoon applied the lesson thus taught him three years ago.

The steamship *Zeeland* was on her way up the St. Lawrence from England early last November. Although there was fog in that treacherous river, the steamer sped on, for she was after a war cargo and her object was to reach Montreal and to be off again as soon as possible. Luck was against her and she ran aground about midway between Quebec and Montreal and pushed so high upon the mud that she was raised nearly three feet above her light load line. The season for ice was near at hand and there was fear that she might be caught and held for the winter in the river. If the ship was to be freed in time her refloating must be accomplished shortly, but she was so firmly stuck in the mud that it was quite impossible to pull her back into the channel even with the aid of a flotilla of the big ocean-going tugs of the St. Lawrence.

At this stage of the game the salvors were about decided to drop some of the bottom plates out of the ship, charge the overlying compartments with compressed air, and count upon the escaping bubbles to break the seal between the ship's bottom and the gripping mud. As a preliminary, a channel had been dredged on each side of the *Zeeland* and thence sternward out to the main waterway. But the dredges could not get under the vessel, and, therefore, she rested upon a mound of clay which held her fast. Now, the releasing of a number of the bottom plates, by cutting the rivets from the inside, might have answered to free the liner, but then she would have had to go into drydock at Montreal for repairs before she could be made fit again for sea and ready to take on cargo. Each day was precious, and the closing of navigation unpleasantly near. What was to be done? Here is where Mr. Wotherspoon was called into council and asked to take charge of the refloating of the ship.

It was Sunday, and he was given until Wednesday to get the steamer free, and it was a case of "no cure no pay." Besides, he was to avoid any delays due to repairs. After making some examinations, he accepted the job.

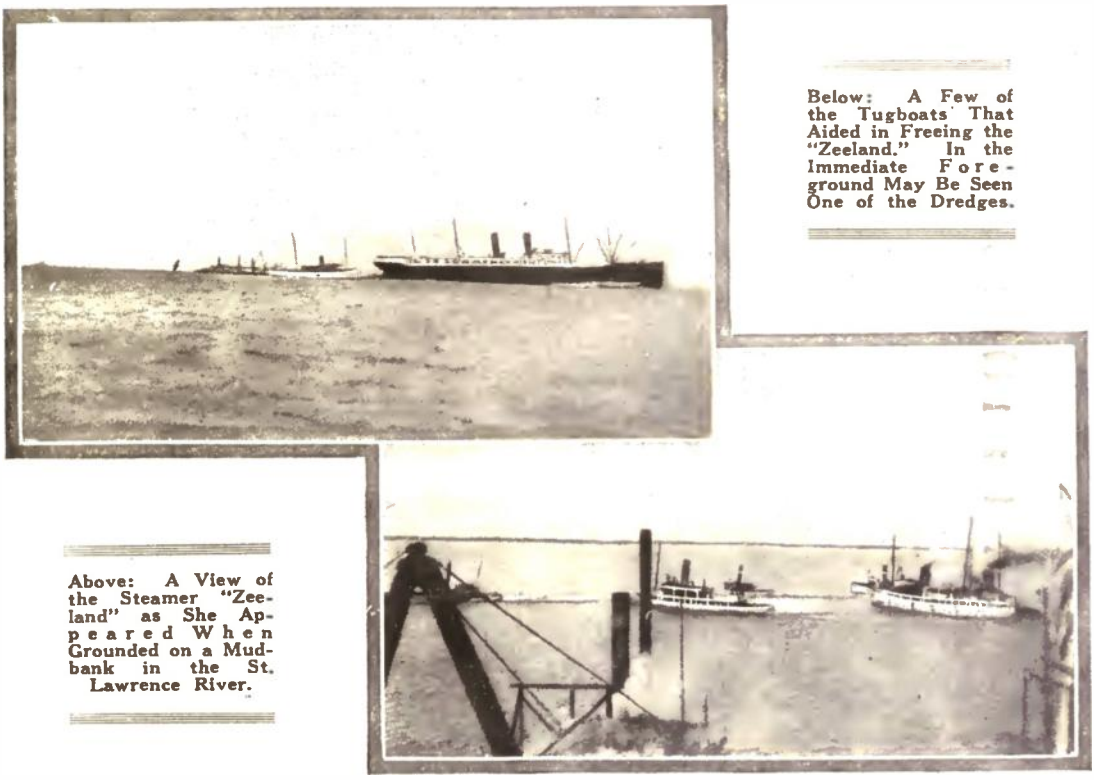
Most big ships have screwed into their bottoms from the outside a double line of bronze plugs spaced at intervals from stem to stern. These are called drainage plugs and are withdrawn when the craft is in drydock so as to free any water in her bilges or double bottom. The *Zeeland* was provided with these plugs. Mr. Wotherspoon removed fourteen of them, seven on each side amidships, and at such intervals that they spanned the length of the ship where she rested deepest in the mud. The

plugs were tapped with two holes on their inner ends, and with key wrenches it was an easy thing to screw them outboard and clear of the ship.

As these holes were threaded and had a diameter of more than an inch, they were all ready for the attaching of pipe fittings, and this was done so quickly that only a little ooze forced itself upward and inboard. With these fittings in place, rubber hose was then connected to each one of them, and this flexible tubing, in turn, led to the feeds from an air compressor having a capacity of a thousand feet of free air per minute. In the meantime, all water ballast was removed from the ship and her lifeboats and some other removable weights put over the side. Further, lines were led from the stern to five tandem teams of powerful tugs, and a separate wire cable was passed around the *Zeeland's* bow and led to the windlasses of the two dredges. These craft were firmly secured by their prods driven deeply into the mud. To facilitate guiding the liner, two smaller tugs were stationed at her head—one on each bow.

With everything in readiness, the ship's engines were backed, the dredges wound in on their windlasses, and the ten tugs at the stern pulled with all their might. Mr. Wotherspoon then let loose the compressed air through the fourteen openings in the steamship's bottom. The buoyant bubbles crowded surfaceward, and, in their struggle to rise, spread out and broke the contact between the steel plating and the tenacious clay. In this way the grip of the waterbed was destroyed, the liner lifted, floating, as it were, upon a film of air, and then it was an easy thing for her engines and the tugs to get her back into the river's highway. Indeed, inside of ten minutes from the starting of the joint operations the *Zeeland* was out in the channel and ready to move under her own power up to Montreal.

If Mr. Wotherspoon had used water instead of compressed air, as was done in the case of the *Maine,* the effect would not have been so broadcast, and it is doubtful if the fourteen small openings would have sufficed. Here is where he profited by the lesson taught him and



Below: A Few of the Tugboats That Aided in Freeing the "Zeeland." In the Immediate Foreground May Be Seen One of the Dredges.

Above: A View of the Steamer "Zeeland" as She Appeared When Grounded on a Mudbank in the St. Lawrence River.

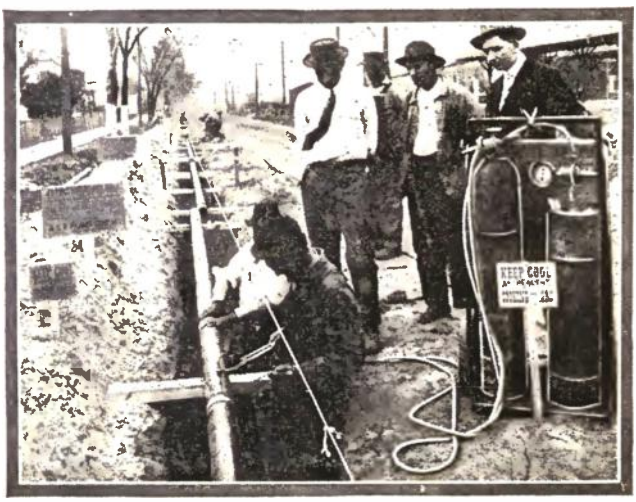
Tandem Teams of Tugs Trying to Pull the "Zeeland" Off the Mudbank. There Were Ten of These Boats at Work, Among Them the Largest Sea-Going Tugs in the World, Representing a Total Pull of 14,000 Horsepower.

went his teacher one better by substituting another seal-breaking medium. As soon as the *Zeeland* was out in deep water, it took but a little while to break the hose connections, to withdraw the pipe fittings, and to replug the holes from within the ship. Thus was she made absolutely secure without going into dry-dock, no time was lost, and when she reached Montreal she was ready to take on freight and load up for the return voyage to England. This she did, and she left the waters of the St. Lawrence before the gathering of the ice.

WELDING FOUR THOUSAND FEET OF GAS MAIN

There has recently been completed at New Bern, N. C., the task of welding four thousand feet of four-inch gas main by means of oxy-acetylene torches.

Acetylene gas was supplied the torches from 100 and 300 cubic foot cylinders, and oxygen from 100 and 200 cubic foot cylinders. The contractors in charge of the work found that with reasonable care as to waste it was possible to obtain twenty or more four-inch joints with each 100 cubic foot cylinder of oxygen, and twenty-five or more four-inch joints with each 100 cubic foot cylinder of acetylene gas. It was also found that the welds could be made faster and better when working in the trench than on the level; the reason offered being that the torch draws an excess of oxygen from the air when burning in the wind and causes a tendency to burn the filling material. This difficulty would not occur on larger sized mains.



The Modern Way of Laying Gas Pipe is to Weld the Separate Lengths Together So as to Form One Continuous Piece of Metal.

Good joints were made in seven to ten minutes when working in a trench. In one afternoon fifteen leakless joints were made with only one torch, the apparatus being moved a distance of twenty feet after each weld. The pipe was tested under air pressure, using soap suds on the joints to detect leaks.

As a filling material No. 8 gauge soft steel wire was used, since it was found that this material flows better and has less tendency to stick than Norway iron.

A MINER'S BLAST THAT OPENED A BOTTOMLESS PIT

A miner's blast opened a subterranean pit of undetermined depth near Volcano, Nev., a small town eighteen miles north of Tonapah. A miner was lowered into the cavern for two hundred feet with a light to examine the opening. He reported that he could not find or see the ends of the fissure. Stones dropped through the opening could be heard bounding from wall to wall until the sounds died away—but no sound which would indicate the bottom was reached was heard. Lights showed sparkling stalactites hanging from the sides of the cavern.

A QUEER ELECTRIC BUG

Composed of electric light bulbs, and with wings of stained glass and legs of thin metal strips, the "insect" shown in the illustration forms the conception of a Kodak Bug, or at least that is the idea of the Los Angeles camera man who designed it. It is wired for illumination, so that when set in a show window it forms a display that attracts instant attention.

The "Kodak Bug"—the Attractive Window Display of a Photographic Supply Store.

By Lettering His Name and Occupation on an Old Sink, a Plumber Has Made An Effective Sign for His Business.

THE KITCHEN SINK AS A SIGN-BOARD

That the limit to novel business signs is not yet is demonstrated by the accompanying illustration. This plumber has created something new along this line by the painting of his name and business upon the bottom of a worn-out sink. The sink has in turn been fastened to the trunk of a tree in the front yard of the plumber's home.

JITNEY ROLLING CHAIR

The latest feature for the seaside resort is the jitney rolling chair. For years past rolling chairs have been operated at all of the beach towns of any importance, but it seems as though these man-operated affairs have at last seen their day. The unique bus seen in the accompany-

An Electrically Operated Rolling Chair Which is Being Operated at a Californian Seaside Resort.

ing view has just made its appearance at Venice, California. It is being operated between Venice and Ocean Park, a distance of about a mile. Between these points is a wide cement walk running along the ocean front, and it is along this walk that this "jitney" runs.

The novel car is twelve feet in length and is run by a two-horsepower electric motor. It attains a speed ranging from four to ten miles an hour. There is a seat running entirely around the central back-rest of the car, both the seat and the back-rest being upholstered. The car accommodates eighteen passengers in addition to the motorman, who also acts as the conductor. The fares are collected when the car is midway between the two cities and while the car is stopped.

BUILD YOUR HOUSE IN A TREE TO ESCAPE FLOOD

Floods and fires and the moths that corrupt one's earthly possessions have little terror for the householder who builds his home in the tree tops. The novel home shown in the accompanying view was erected near the banks of the river in one of the fashionable summer home suburbs of Des Moines, Iowa. After the home in the tree tops had been completed a short time the floods came, but they only served to demonstrate the wisdom of the builder rather than causing him any great inconvenience. The homes of some of the less fortunate neighbors can be seen at the water's edge, while others were partly submerged by the overflowing water.

The sleeping tent and the other accommodations of the home are built on a large platform which has as its support the trunks of four large trees. The ladder built alongside one of the pillars forms an easy means of reaching the tree top home. In addition to its safety features, this "nest in the trees" has the advantage of being cooler and free from ground dampness, as well as being less accessible to the crawly things that bring fear to the heart of the housekeeper.

A Shelter Erected on a Platform Among the Tree Tops Possesses Many Advantages.

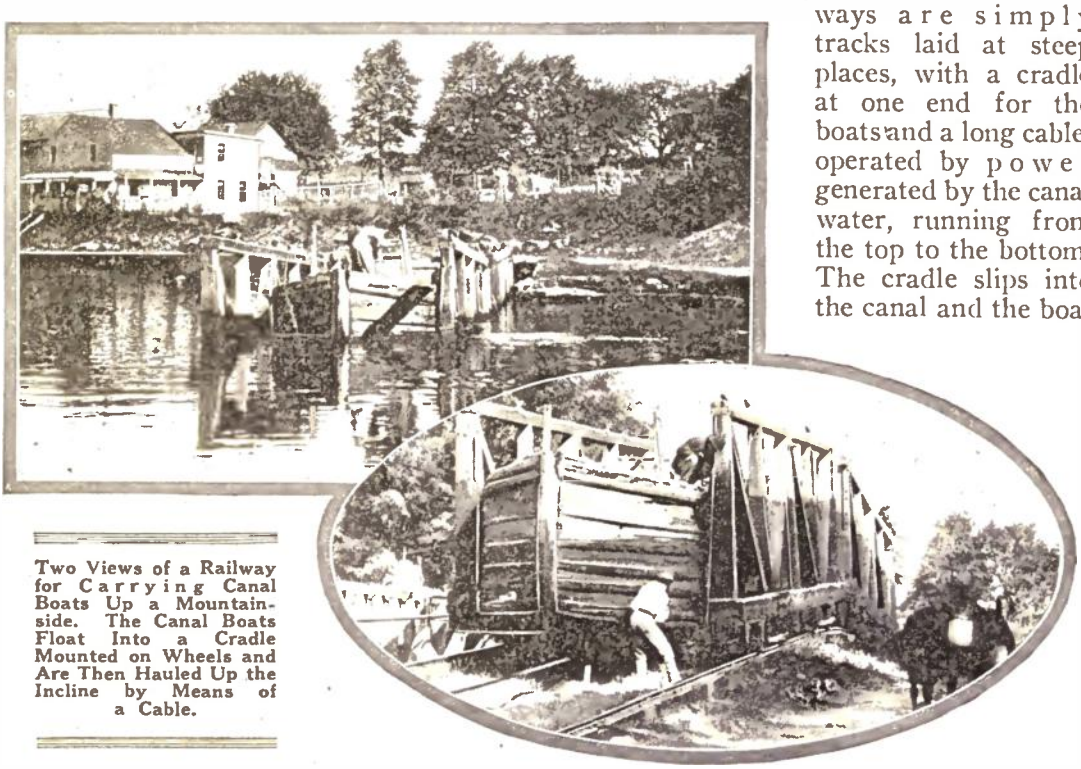
FELLING TREES WITH AN AUGER

Business men in India have urged United States Consul Baker to introduce a new type of portable timber felling machine. Many of the steep slopes of the Himalaya and other mountains are

heavily wooded, but the grade of fifty degrees makes ordinary sawmilling machinery useless because of the lack of level resting places.

It was suggested to the consul that possibly an auger, portable by hand, which could bore holes through a trunk radially with an electric motor, working automatically or by hand control, would be just the kind of appliance which would be very useful. The tool should be of sufficient strength and stiffness and be a sort of screw auger, able to clear itself after boring the desired holes.

If the timber could once be felled it could easily be lowered down the mountain slope to rivers or to any sawmills in level spaces below.



Two Views of a Railway for Carrying Canal Boats Up a Mountainside. The Canal Boats Float Into a Cradle Mounted on Wheels and Are Then Hauled Up the Incline by Means of a Cable.

A CANAL BOAT ON RAILS

The canal boat which climbs mountains to an elevation of a thousand feet and then crawls down to water level again is not a freak but just an ordinary, every-day craft that is engaged in carrying coal across the State of New Jersey to tide water. From the Delaware River to the Atlantic seaboard is a matter of about ninety to one hundred miles as the crow flies, but as the old Morris and Essex Canal runs it may be anywhere from one hundred to one hundred and fifty miles. To make this comparatively short trip, however, the canal boats must climb nearly a thousand feet above the sea level.

Locks are not sufficient to raise the boats quickly to the great elevation attained by the canal, so the boats crawl out of the water at several places and take to the railways. The inclined railways are simply tracks laid at steep places, with a cradle at one end for the boats and a long cable, operated by power generated by the canal water, running from the top to the bottom. The cradle slips into the canal and the boat floats into it. Then the two are hauled up to a higher level, and the boat once more resumes its journey by water. At one point on the Morris Canal there is a series of half a dozen of these inclined railways, and the canal boats climb several hundred feet over land in a short time. Everything is hauled up except the mule. He makes the climb on foot, and comes out on the tow path ready for another long, lazy pull. The canal boatmen usually take advantage of the opportunity when their boats are in the cradle to repair leaks and clean off the bottom. It is the only dry dock that the canal boats ever see.

Unusual Flower Containers for the Home

By Albert Marple

IT is very evident to the person who travels through the residential section of various towns and cities that little general effort is exerted to beautify the homes by the use of flower holders of various kinds and shapes. The general public is apparently unaware of the effect the "business" spirit of this day and age is having on the general appearance of the homes of our communities. There seems to be a feeling abroad which sounds something like this: "Anything will do for our homes, so long as our business progresses." This, then, may be considered as a sort of appeal for "back to the home."

The accompanying illustrations show that there are at least a few home owners who do not have business constantly in mind. They give a little time to the beautifying of their dwellings, and as a result their homes generally are prominent on their streets as a diamond would be if placed among a number of black beads. Their places have that "different" appearance and are comfortable dwellings.

THE VIEWS APPEARING ON THE OPPOSITE PAGE ARE AS FOLLOWS:

(1) A Wooden Flower Box Adorning a Porch; (2) Flower Box Placed on the Top of a Stair Post; (3) Flower Boxes of Different Designs which Lend Attractiveness to Bungalow Steps; (4) Two Old Kegs Being Used as Pots for Plants; (5) An Effective Flower Box Surrounding a Porch Column; (6) Shelves and Niches in Concrete Pillars, for Holding Flower Pots; (7) Flower Pots Made from the Bark of Trees; (8) An Odd Way of Placing Flower Pots Between the Porch Posts; (9) Combination Bench and Flower Box; (10) A Chimney Flower Box.

Of the accompanying views the third shows a pretty flower box which may easily and at small expense be constructed against the side of a porch pillar. The heavy beams, which constitute the railing of this porch, continue entirely through the pillar, and it is to one of these that this flower holder is fastened. It is made of one-inch boards and is large enough to accommodate a pretty leafed vine which, after growing over the sides, hangs down against the sides of the pillar.

Another beautiful type of pillar flower box is shown in the fifth view. This is one of the very latest holders to make an appearance in Southern California. It continues entirely around the pillar. While the pillar is "shaked," as is the exterior of the home, the holder is of plain material. It is eight inches square, furnishing plenty of room for the growing of many kinds of pretty vines.

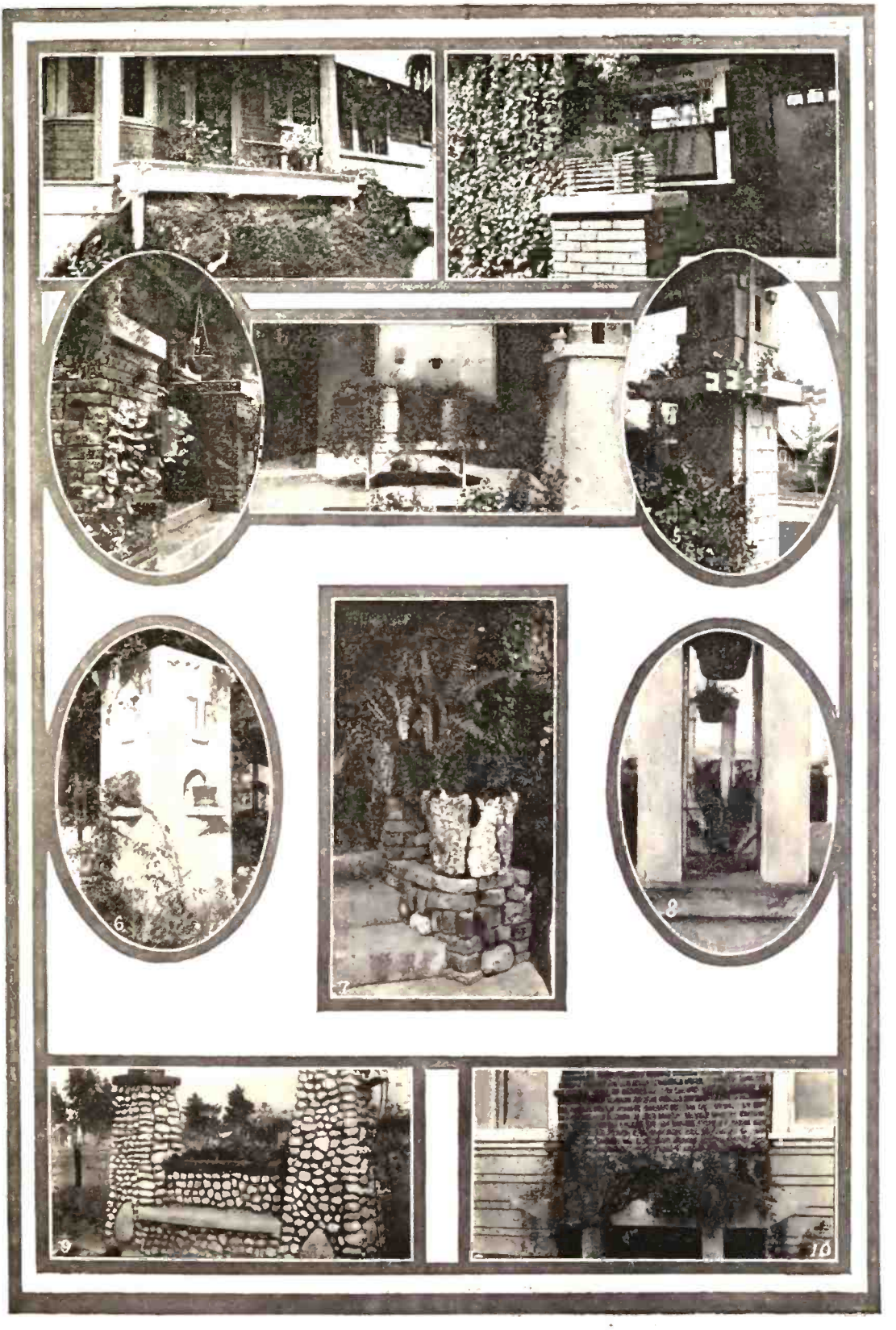
Another novelty in the way of a pillar flower holder is shown in the sixth illustration. This consists of a two-inch indentation in the side of the pillar, beneath which is a 10-inch shelf and upon which the flower pot is placed.

In the eighth view is seen a flower holder left in the top of a short pillar. This holder is twelve inches in diameter and a foot deep, and is surmounted by four porch pillars.

A pretty flower box for the beautifying of the chimney is shown in the tenth illustration. This box is about nine feet in length, a foot deep and twelve inches wide. The two supports are short sections of eight by eight beams. The earth is put directly into this box and in it are planted the ferns and trailing vines. This serves to break the plain lines of the chimney.

In the fourth view is demonstrated how a little foresight paid big returns. During the construction of this home the builder saved several of the empty nail kegs. After the building was completed two of these kegs were painted to match the home and now serve as fern holders upon the front porch.

That a very pretty flower holder can be made out of ordinary sticks is proven in the second picture. The material used in this holder are plain eucalyptus sticks, but when assembled in this novel manner result in an attractive home ornament.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A cork bark-covered flower pot is shown in the seventh view. In truth this holder is simply a plain, round wooden box, to the outside of which these strips of bark have been tacked, resulting in a pretty and unusual flower container.

An unusual porch flower box may be seen in the first illustration. This runs entirely along one side of the porch. It is a foot square and about twelve feet in length and is made of common one-inch boards. Flowers and ferns grown on the ground beneath this box add to its attractiveness.

A RAILROAD BRIDGE CARRIED ON A BOAT

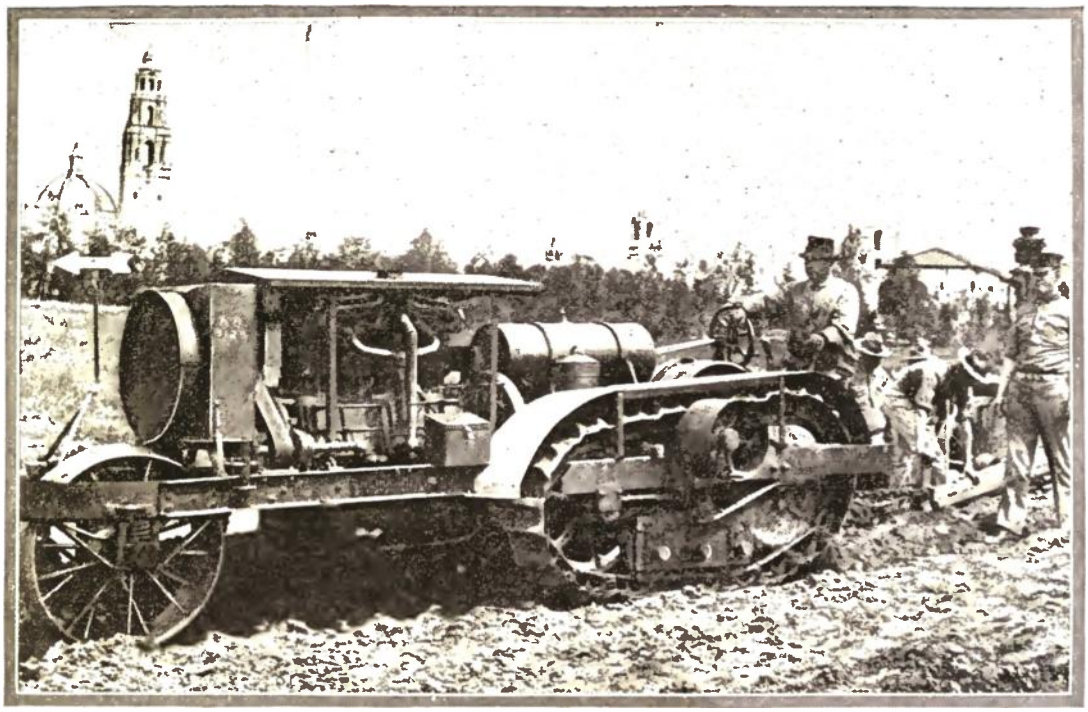
One of the notable features of a railroad bridge over the Miami Canal at Mebase, Ohio, is that the rotating end is carried on a float or pontoon when the bridge is swung.

With the canal gradually falling into disuse, a bridge was needed at this point which would be a fixed span from the standpoint of the railroad, yet capable of being converted into a drawbridge on short notice and opened to allow boats to pass.

It takes one man about half an hour to open and close the bridge, which is interlocked with electric signals to indicate to approaching trains the position of the draw. Half an hour seems a long time to hold up railroad traffic, but boats are so infrequent that the total delay to trains is more than offset by having a bridge over which trains can pass at full speed.

In opening the bridge, which is accomplished by hand, the bridge tender goes about it as follows: the rail locks, which make the rail on the bridge to all intents continuous with the rails on land, are opened. The beginning of this movement sets the electric signals to danger, or "block," as railroad men call it. The lock bars extending into recesses in the concrete abutments are pulled clear. The gate valve, which admits water into the float, is then closed. The float is unwatered by the diaphragm pump until

A Drawbridge Which is So Constructed That Trains May Pass Over it at Full Speed. It Requires One Man About Half an Hour to Open and Close the Bridge.



We are told that this is a "Machine War." So it is. Even the trenches of field fortifications, made so that a retreating army may retire to them when hard pressed, are dug by machines. This picture shows the experiment in machine trench digging carried out at the San Diego Exposition. A gasoline farm tractor was used to haul a file of sappers and digging machinery.

the girders are raised off their bearing at the movable end. The other ends of the girders are pivoted.

By means of the crank on the side of the girder the bridge is then swung by winding up on the windlass the chain which is anchored on one shore and paying out chain to anchor on opposite shore. In clearing the bridge the operations are reversed.

DIGGING ARMY TRENCHES WITH A FARM TRACTOR

A heavy farm tractor was recently borrowed from the agricultural exhibit of the San Diego Exposition and driven to the marine barracks, where in a demonstration before Vice-President Marshall and other Government officials it dragged a file of sappers. The trench which resulted formed a substantial barricade, to protect the firing line of an army. The demonstration was given to prove that the farm tractor could perform serviceably in times of war.

FIVE MILLION FEET OF LUMBER SENT ABROAD TO BUILD ARMY AEROPLANES

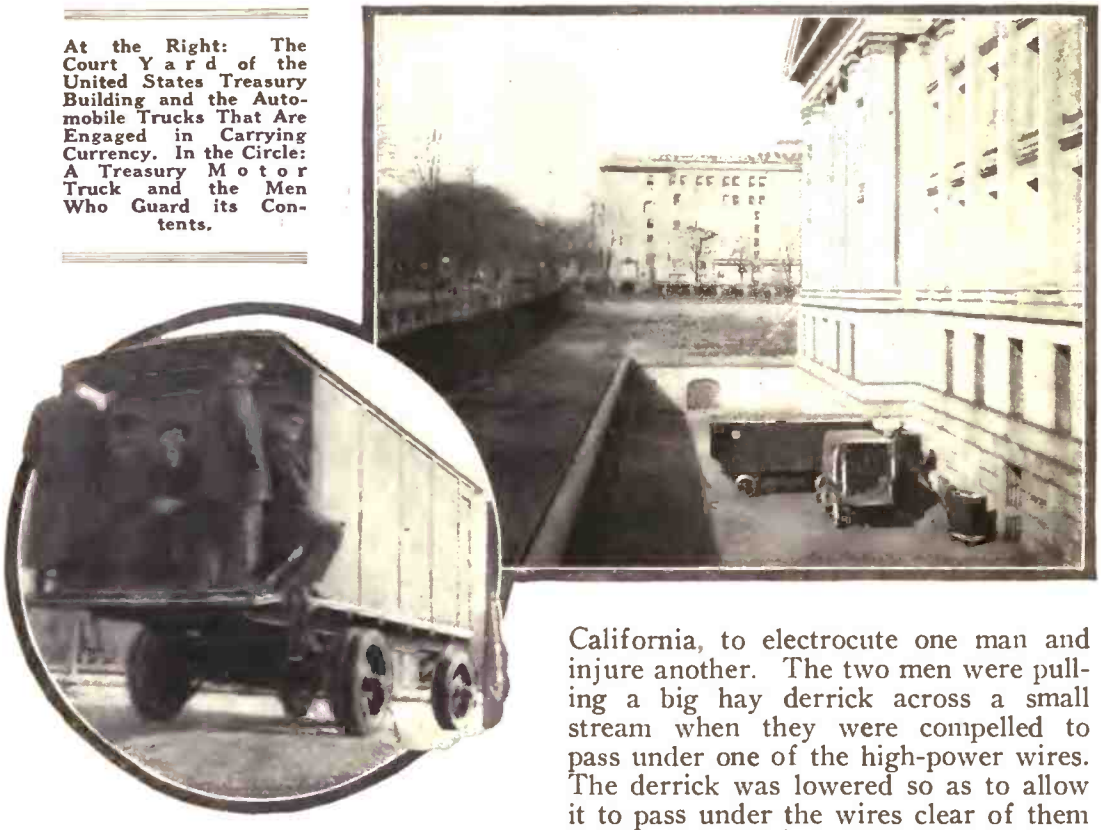
More than 5,000,000 feet of Oregon spruce have been sent to the warring nations of Europe within the last three months from Portland, for use in the making of military aeroplanes. Orders for additional amounts were not filled on account of the great scarcity of shipping space. As a result of the heavy demand, Oregon spruce has jumped from 32 to 40 dollars per thousand feet. The spruce logs have advanced from seven and one-half dollars to nine dollars per thousand feet. Great Britain has been the principal buyer to date.

It is reported from Berne, Switzerland, that in Berlin and other cities of Germany there has recently been introduced a new form of food. Consisting of flour, maize, dried vegetable and dried meat, two cents' worth of this composite food is said to be sufficient for a meal.

GUARDING A TRUCK LOAD OF CURRENCY

Three times every working day a large, enclosed motor truck of unusual length backs up to a rough wooden platform near one of the iron grated basement doors of the United States Treasury building. The doors in the rear end of the truck swing open and large yellow chests, on small trucks, are rolled out onto the platform, down an incline and into the building. In these chests is paper currency representing hundreds of thousands of dollars, the amount, of course, depending upon the denominations of the bills, which have been made at Uncle Sam's newly constructed money-making establishment down on the banks of the Potomac River. The precious load is deposited in the vaults of the Treasury building.

The trip from the Bureau of Engraving and Printing to the Treasury building is not a long one, yet on the end gate of the truck, occupying a cushioned seat provided for the purpose, may always be seen a small squad of uniformed men, whose business it is to protect this immense wealth from any hold-up men who may be lurking on the streets of Washington.



At the Right: The Court Yard of the United States Treasury Building and the Automobile Trucks That Are Engaged in Carrying Currency. In the Circle: A Treasury Motor Truck and the Men Who Guard its Contents.

A HAY DERRICK MEETS A LIVE WIRE—TWO MEN ELECTROCUTED

A small iron plate on top of a hay derrick attracted enough electric current from a high-power wire near Yuba City, California, to electrocute one man and injure another. The two men were pulling a big hay derrick across a small stream when they were compelled to pass under one of the high-power wires. The derrick was lowered so as to allow it to pass under the wires clear of them by about a foot. The iron plate on the derrick was directly under the wire when it drew the current from the naked copper. The electricity passed down the guy wire of the derrick. The man who was killed was holding one end of the guy wire and the man who was injured was holding the other end. The current carried by the transmission line outside of Yuba City is of extremely high tension, which accounts for its leaping twelve inches through the air.

SOWING THE SEEDS OF DESTRUCTION

THE "Iphigenia," one of Great Britain's many mine layers. The mines are cast into the water from the stern of the vessel by means of two adjustable gangways.

Photo. C. L. Aab.

LIFE BEHIND THE GERMAN BATTLE LINES

It is hard for an air scout to pick out his landing place or to communicate while in the air with his commanding officer. Among other devices for signalling, the Germans are using pistols that fire rockets.

The German Dogs of War. They are not savage, for theirs is a mission of mercy. They succor the wounded on the battlefield.

Entrance to officers' lodgings in a trench in France. This shelter has been built underground by the Germans and rendered shell- and water-proof by heavy masses of earth piled on its roof.

Photos. Robert H. Moulton.

SERVIAN SOLDIERS AND BRITISH GUNS

Crown Prince Alexander of Servia at the British range finder station. Admiral Troubridge of the British navy is seen in the center, observing the effect of his naval guns on the Austrian positions.

A Servian light field gun in action against the Austrians. The gun has just been fired. The camera caught it, poised in the air.

Servian infantry entrenched on platforms built within steel barges. These barges are floated down the Danube River to the Austrian positions in advance attacks.

A British naval gun which is being used in Servia to combat the Austrians. This view, as well as the others appearing on this page, confirms the report that British guns and men are aiding Servia in her war.

WITH THE ITALIANS AND AUSTRIANS

Italian infantry passing through the streets of Milan on their way to the Austrian frontier.

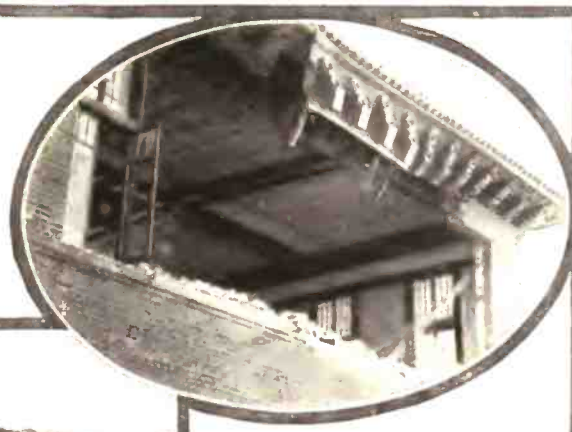
An Italian soldier bidding farewell to his wife and child before departure with his regiment for the front.

Serving hot soup to the Italian soldiers at one of the barracks in Italy.

In the Oval: A company of Bersaglieri on the march. The Bersaglieri are light infantry. At the Left: An Austrian armored train in the Carpathian mountains. To deceive aerial scouts, the Austrians have covered the armored cars with brush and young trees.

DESTRUCTION WROUGHT BY AN EARTHQUAKE

An earthquake that occurred in Southern California, on June 23, killed ten people and damaged along the Mexican border. It $1,000,000 worth of property shook off part of the upper story of the building.



One of the several wrecked buildings at Calexico, California, following the earthquake.

How the ice plant in the city of El Centro looked after the earthquake. Not only frame buildings, but even those built of brick were destroyed by the shock.

After the telephone building of El Centro was converted into second-hand lumber, a temporary central office was established under a tent in the streets. Despite the loss of life and property occasioned by the earthquake, the telephone girls went about their work undaunted.

THE STRUGGLE FOR THE DARDANELLES

The British battleship "Majestic" was torpedoed by a German submarine. This picture was taken just as the ship was in the act of capsizing.

Turkish artillery going to the heights along the Gallipoli Peninsula to stop the advance of the Allies.

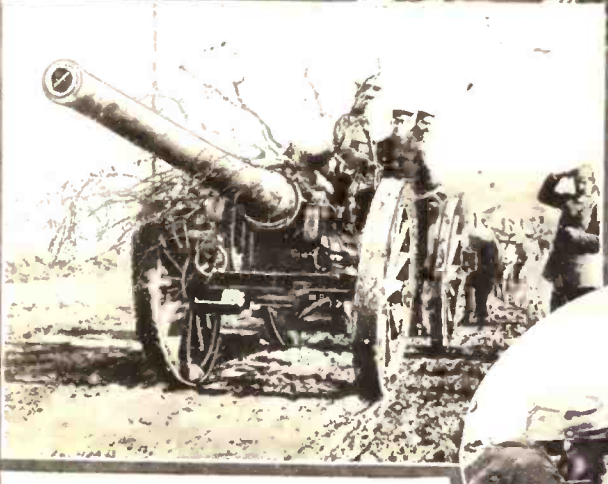
Djemal Pasha, the Turkish general, consulting with his staff officers as to the disposition of the Ottoman forces for the purpose of halting the advance of the Allied landing forces on Gallipoli Peninsula.

A 9.5 calibre Krupp gun in the Turkish fort at Cape Helles, wrecked by the fire from the Allied fleet. Brialmont, the Belgian military engineer, who built the forts of Liége, Namur and Antwerp, designed the Dardanelles defences. He selected German guns.

MODERN WARFARE'S LATEST NOVELTIES

A French soldier using a special gun for discharging luminous balls, which are employed for lighting battlefields at night. The soldiers in the present war are called upon to fight at any hour of the day or night, and it is due to the large amount of night fighting that all kinds of light-producing devices are being used.

A new type of respirator now being used by the British soldiers to protect themselves against poison gas clouds.



A British naval gun going to the front in Servia. This gun and several others have been dismounted from the old English warships at Malta.

French soldiers in Flanders using rifles equipped with periscopes in order not to expose their heads over the tops of the trenches.

WAR'S TOLL IN LIVES AND PROPERTY

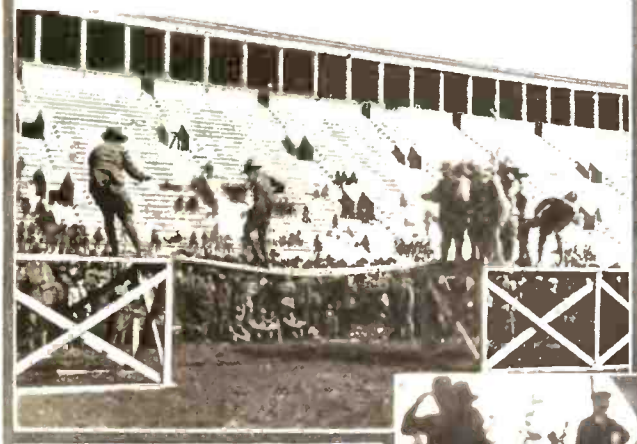
Austrian engineering corps at work repairing a bridge that was destroyed by the Russians in their recent retreat.

The boiler room of the electric power station at Arras, showing the damage resulting from German shell fire.

French officer and priest preparing the German dead for burial immediately after an engagement in Champagne.

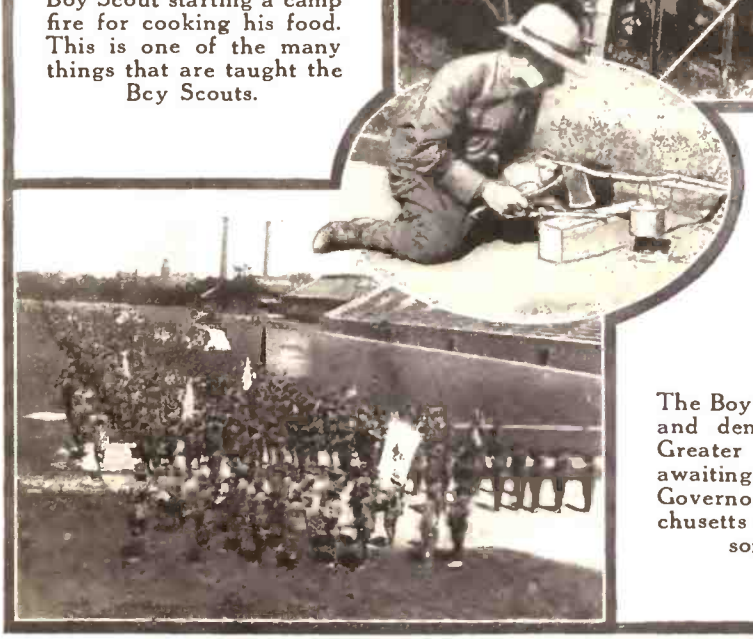
Another of the already too familiar scenes of destruction that mark the visit of the armies. Here is a street in the town of Ypres which has been the target of cannons for many months.

FUTURE DEFENDERS OF AMERICA



A feature of the recent annual rally and demonstration of the Greater Boston Council of the Boy Scouts of America: Having just completed a rough bridge, the troopers are safely crossing over it.

Two Boy Scouts of the Signal Corps operating a wireless station during the rally. Many of the Boy Scouts are wireless amateurs and build the apparatus which they operate. In the Oval: A Boy Scout starting a camp fire for cooking his food. This is one of the many things that are taught the Boy Scouts.



The Boy Scouts at the rally and demonstration of the Greater Boston Council, awaiting the review by Governor Walsh of Massachusetts and Mayor Higginson of Boston.

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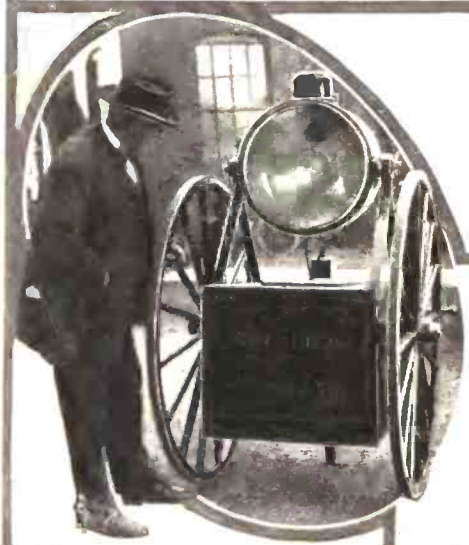
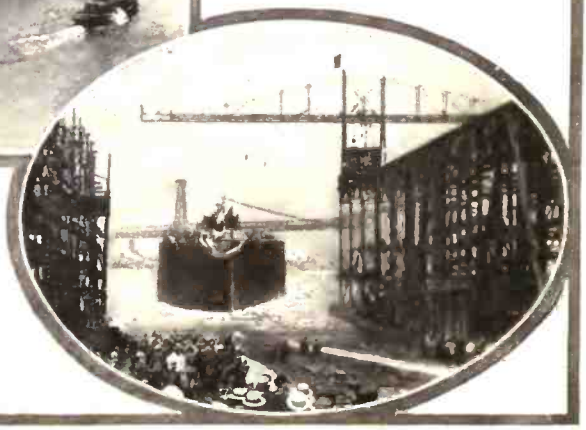
CURRENT EVENTS IN OUR OWN COUNTRY



Thomas A. Edison inspecting his latest product, a storage battery searchlight of 3,000,000 candlepower.

Below: Famous old submarine, "Holland No. 9," on a freight car at the League Island Navy Yard. It was bought by the Government in 1900 at a cost of $150,000. Instead of using the ballast tanks for submergence, this prototype employs horizontal rudders, which may be seen at its stern.

The United States superdreadnaught "Arizona" just after launching. It will be equipped with oil-burning engines.



The launching of the superdreadnaught "Arizona" at the New York Navy Yard on June 19. The "Arizona" is the sister ship of the "Pennsylvania."

CONTROLLING A FACTORY FROM SIGN BOARDS

A WELL-KNOWN American automobile factory at Syracuse, N. Y., has developed a remarkable system whereby an accurate record is maintained of the thousands of parts both in stock and in process of manufacture. Thus it is possible to keep the stock within certain satisfactory limits and not have it too great or reduced to a point that may cause delay in the assembling of the cars. From a financial standpoint the system is commendable, since it eliminates the constant menace of involving large sums of money in surplus stock and labor.

The system consists of thirteen semi-mechanical boards, indicating constantly every operation in the manufacture of an automobile in the plant. A perfect time schedule is kept of over 14,000 manufacturing operations, and every step in the making of 1,300 automobile parts is directly controlled. Besides, a control is incidentally exercised over 2,500 parts in process of manufacture.

Briefness prevents a complete description of the boards, but the following essential points are of interest: The various pieces of information that are posted on the control board are secured from slips of paper coming from dispatch stations in different parts of the plant; the board entries being made by inserting letters and figures, face out, into small cages clipped on to strips which run horizontally across the frame or board.

The dimensions of each of the boards are eight by ten feet. The data is set up much in the same way as type, and the location of the type-holding cages day by day in relation to the movable production schedule, work-day measuring and calendar tapes of steel, show at a glance the exact position and volume of each factory operation.

If the production of one group of automobile parts is for any reason running behind as compared to other groups, the delay immediately becomes known and is

Above: Two of the Control Boards used in an Automobile Factory, Enabling an Accurate Record to be Kept of the Numerous Parts being Manufactured and Those in Stock. At the Right: A Close View of a Control Board, Showing the Method of Inserting the Lettered Blocks.

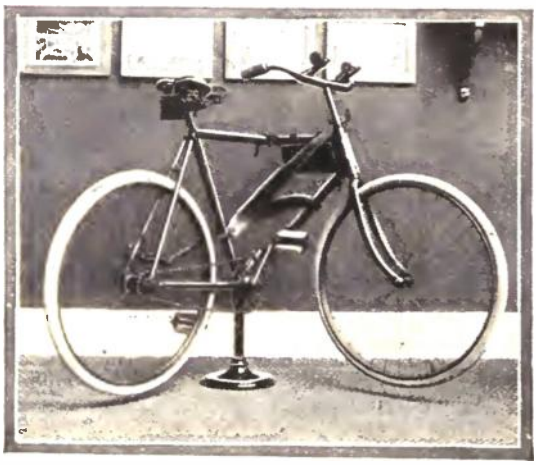
corrected. All specific instructions go through the control boards which make possible a perfect co-ordination of efforts leading to complicated assemblies. From raw material to finished product everything is kept moving in harmony to meet the requirements set on charts at the boards. The records on the boards are made permanent by photographs taken once each week.

Plans for building 3,500 automobiles this year mean the setting of a task involving specific instructions on about 52,000 things to be done. To check the accomplishment against the task, the accomplishment of the individual is brought back to the control board and the two compared. But since the initial instructions were exact and the methods of the factory would fail only through inaccurate orders, comparison of attainment to task is a matter principally of check to show what has been done and thus prevent duplication of orders.

As a result of the installation of the boards there has been a marked reduction in the stores and work-in-process investment in the last year and a half, although the firm is turning out twice as many cars per month.

THE FOLDING BICYCLE OF THE SWEDISH ARMY

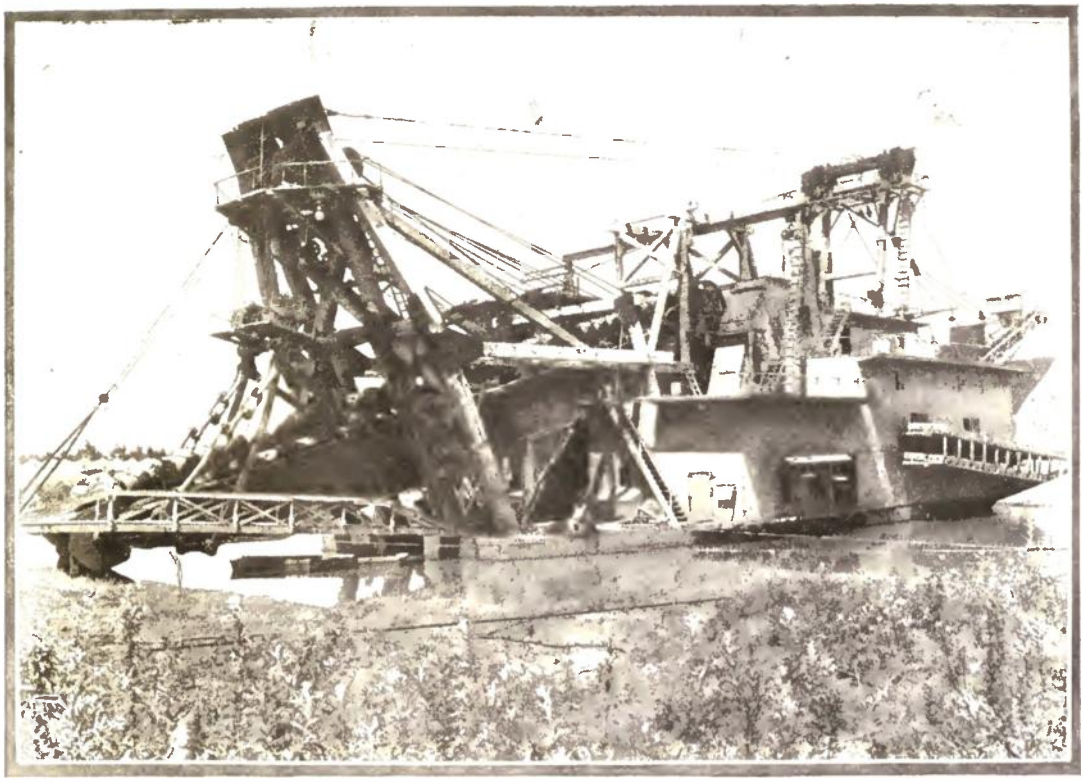
The accompanying illustration shows a useful and ingenious type of folding bicycle used in the Swedish army. There are two hinges in the frame, one in the top horizontal bar and the other in the front slanting bar directly beneath. These hinges are provided with bolts for locking them shut, so that the frame is in no danger of suddenly folding up while the bicycle is being ridden. This folding feature enables the rider to carry the bicycle on his back with ease while marching over rough roads; a leather sling being utilized for that purpose. Folding the bicycle makes it easier to carry, as the weight is more compact and not so awkward to manage. This type of bicycle enables a bicycle squad to walk closer together when dismounted and carrying their wheels over impassable roads, and also permits of packing the wheels more closely together in railway freight cars. Special apparatus for conveniently holding the knapsack is attached to the handle bars. This queer but practical army bicycle is on exhibition in the Swedish Building at the Panama-Pacific Exposition in San Francisco.



One of the Folding Bicycles used in the Swedish Army, which can be Folded and Carried on the Soldier's Back by Means of a Strap.

REDWOOD SPLINTERS MILLIONS OF YEARS OLD

The discovery of splinters millions of years old has been made by a professor of paleontology at the University of California. The splinters are neither decayed nor petrified, but retained the grain and distinct markings of the California redwood, and it is even possible to whittle shavings from the larger splinters. The discovery of these splinters was made at Mussel Rock, California, a bank of rock about twenty miles out of San Francisco. This stratum of rock offers an excellent opportunity for the study of rock formations, and it was while on a trip of this kind that the splinters were found imbedded in the sandy base of the



Claimed to be the Largest and Most Powerful in the World, this Dredge is Being Used in California for the Recovery of Gold. The Dredge has 87 Buckets of 16 Cubic Feet Capacity Each and is Electrically Operated.

rock. Furthermore, these splinters were contained in a stratum which had sunk under the sea and had been afterward raised and turned over in a different position so that the redwood trees were in a horizontal position instead of vertical.

HOW ONE MAN IN A DAY EXCAVATES 15,000 TONS OF DIRT FOR GOLD

What is claimed to be the largest and most powerful dredge that has ever been built is operating at Marysville, California. The dredge weighs 2,000 tons and cost $360,000. It is used in the recovery of gold, digging seventy feet below the water level and extracting gold from 15,000 tons of material in a twenty-four-hour day. The gold is recovered and the refuse stacked out of the way for two cents per ton.

The dredge has 87 buckets, each of 16 cubic feet capacity and weighing 4,600 pounds each. These buckets continually eat into the bank before the dredge, scraping clean the surface of the soft bed rock covered with gold particles. They then carry the gravel to a revolving screen where the fine particles—among which is the gold—are separated from the heavy gravel and boulders and passed on to a gold-saving table. Here the gold is retained by mercury and the refuse passes off. The dredge is run by electricity; a 400-horsepower motor being used to drive the bucket line. Three men on each of the three eight-hour shifts run the dredge, and so excellently is it designed that one man handles all the movements.

The labor of the great number of prisoners of war in Germany has been utilized in reclaiming more than 186,000 acres of marsh land in Prussia alone. Aside from this area, there is an additional 62,000 acres reclaimed by private organizations. This land is said to be available for an additional 13,000,000 bushels of oats this year.

By Nailing a Few Branches of Equal Length Around the Trunk of a Tree, Fastening Them Together with Wire, and Lining with Moss, an Attractive Tree Flower Basket is Formed.

TREE FLOWER BASKET — THE LATEST OUTDOOR ORNAMENT

A feature which has been termed "The Tree Flower Basket" is one of the latest things presented in the western part of this country for the beautifying of the home property. The owner of the home place knows that almost any kind of flower holders, if they are put to work, serve to add to the appearance of the property. Furthermore, where a novelty in the way of a flower basket, such as is seen in the accompanying illustration, is erected, it does more than merely serve to enhance the attractiveness of the place —it adds individuality to the dwelling.

Surely this feature adds the "individual" touch to the home it adorns. Altogether there are eight trees that have been treated in this manner, these running along the parkway beside this home. The idea is especially valuable when used in connection with trees that have tall, plain trunks, for the little baskets serve to break the trunk's plainness.

These baskets are simple in construction and inexpensive. A number of branches are cut in uniform length; palm branches being used in this instance, and the length being about eighteen inches. These are arranged around the tree about three inches apart and are held in position by wires run around their lower ends, fastening them tightly to the tree. A lining such as moss is then secured for the baskets, after which earth is placed in them. Flowers can then be planted in the earth. While many kinds of flowers may be grown in these baskets, vines and ferns which hang down against the side of the tree are very acceptable.

A SIDEWALK THAT BECAME A WALL

A novelty in the form of a retaining wall is disclosed in the accompanying illustration. It consists of sections of cement sidewalk. A short distance from the place where this retaining wall is located a street was ordered widened, necessitating the tearing up of the sidewalk along the strip to be altered. The property owner, being in need of a retaining wall along the side of his property, devised the unique idea of securing the sections of sidewalk and placing them in the position in which they are seen in the accompanying illustration. The sidewalk was five feet in width and each sec-

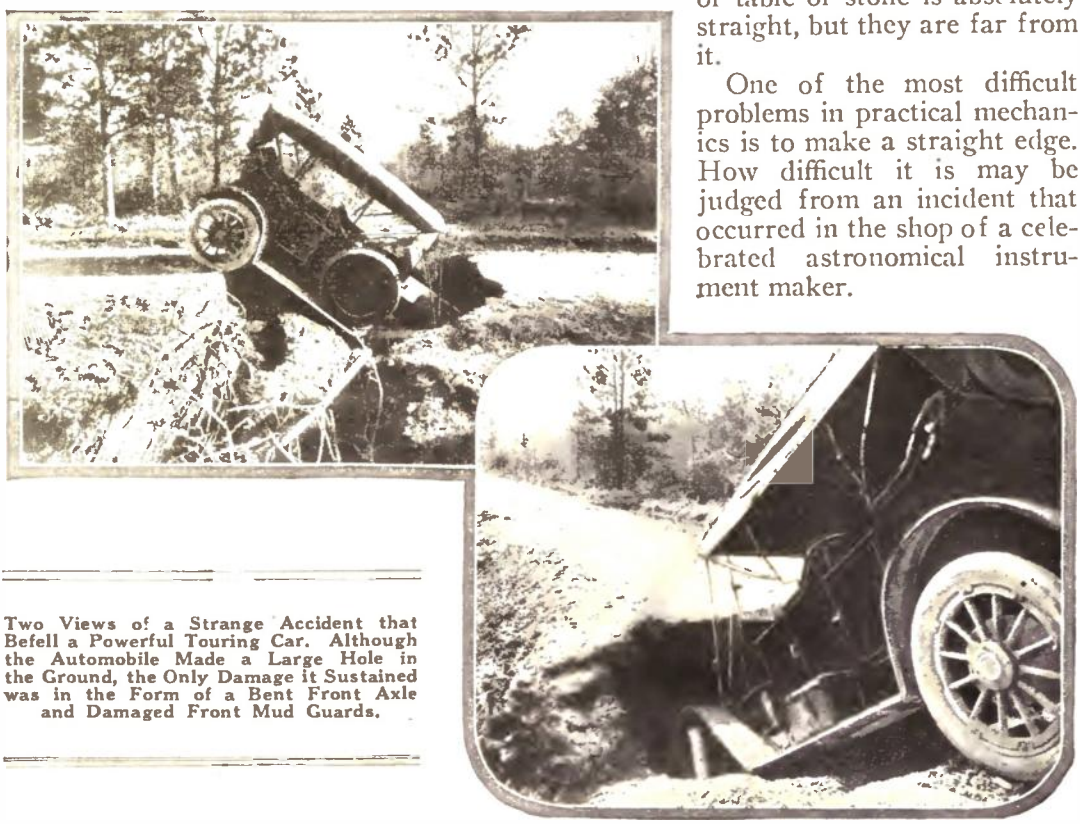
An Enterprising Property Owner has Made Good Use of Discarded Sidewalk Slabs by Using Them as a Retaining Wall.

tion was about five feet in length. The sections of cement were buried two feet in the ground, thus leaving three feet of the wall exposed to view.

The unique wall stands up alone, there being nothing to reënforce it. The points where the sections meet are not even cemented together. Without having cost the owner a cent, this feature serves the purpose of an expensive retaining wall.

AN AUTOMOBILE THAT TRIED TO TRAVEL UNDERGROUND

The latest method of travel to be inaugurated is that of automobiling underground—at least a large touring car recently tried to establish an underground travel era, and not through a hole in the ground either.



Two Views of a Strange Accident that Befell a Powerful Touring Car. Although the Automobile Made a Large Hole in the Ground, the Only Damage it Sustained was in the Form of a Bent Front Axle and Damaged Front Mud Guards.

The automobile in question attempted to dig its way underground, occupants and all, but through lack of strength it failed, as the illustration shows. No one was injured by the accident, and after the automobile was pulled out of the hole it was learned that no more damage had been incurred than the bending of the front mud guards and front axle.

$40,000: THE PRICE OF A STRAIGHT LINE

It is very difficult to make a perfect straight edge. We think a ruler has a straight edge, or that the edge of a knife or table or stone is absolutely straight, but they are far from it.

One of the most difficult problems in practical mechanics is to make a straight edge. How difficult it is may be judged from an incident that occurred in the shop of a celebrated astronomical instrument maker.

A patron asked what would be the price of "a perfect straight edge of glass thirty-six inches long."

"It cannot be made perfect," said the instrument maker, "but it could probably be made with a limit of error amounting to only a fraction of a wave length of light."

"How much would that cost?"

"About $40,000."

It turned out that the customer wanted the straight edge for a scraper and that

an error of one sixty-four thousandth of an inch would not bother him.

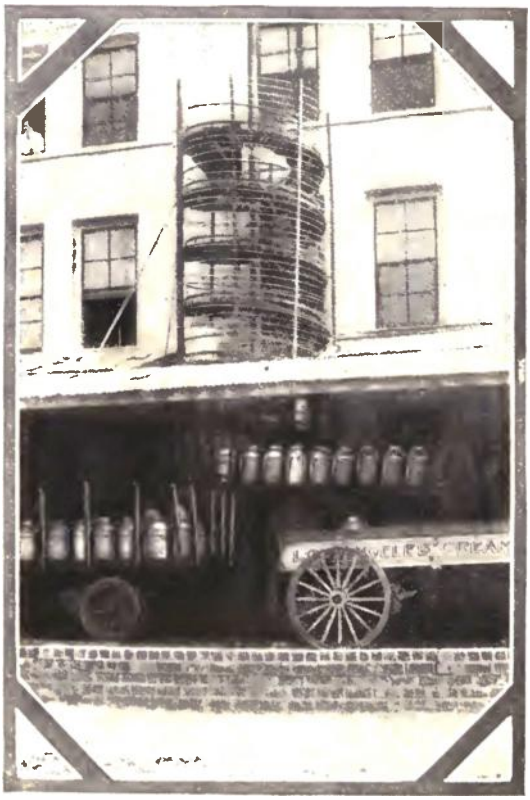
A MEMORIAL IN THE SKY TO AVIATORS

The citizens of Mill Valley, a town at the foot of the famous Mount Tamalpais which overlooks San Francisco Bay, have chosen a novel place to locate a memorial to the nation's heroes of the air. On Decoration Day they unveiled a gigantic monument to the airmen at a point three thousand feet above the place where Beachey, the dare-devil bird-man, recently met his death.

A MILKMAN AND HIS SPIRAL CAN SLIDE

The spiral can slide is one of the latest features invented for use in connection with creameries. It is used to convey empty cans from the third floor of a creamery to the ground floor. The cans are conveyed from the truck by elevator to the third floor, where they are emptied and placed upon the upper end of this slide. When the entire truckload of cans are upon the slide the trap door is opened and the cans naturally start down the chute, which is provided with steel tracks and guide rails. At the bottom the cans run upon a long platform, from which they are taken by the employee who a few moments before loaded them upon the elevator

It takes but five or six minutes for these cans to make the return trip from the truck to the third floor and back. This spiral slide is thirty feet in height and about twelve feet wide.



Much Time in the Handling of Milk Cans is Effected with the Use of a Spiral Can Slide.

MINIATURE SCENIC RAILWAY WITH CARS CARRYING NUTS

Designed to show the ability of the boys in the mechanical department of the Kern County (California) High School and to present the various kinds of nuts raised in the county in a novel and pleasing manner, the miniature scenic railway operated as a part of the exhibit of that county in the California Building at the San Francisco Exposition affords much amusement to visitors. The entire structure stands 10½ feet high and is made of strap iron and bolts, while the decorations are formed of the different kinds of nuts grown in the county, walnuts, peanuts, almonds and pecans, while the three cars which are operated upon the track are also loaded with nuts. A small electric motor operates the lifting device, consisting of a chain drive, which pulls the cars up the steep incline. In the accompanying photograph one of the loaded cars is shown just at the top of the incline, while another is seen on the dip in the second circle of track.

The Indians living near the celebrated Messa Verde in southwestern Colorado have predicted that the Government telephone line through that section will be destroyed. The Indians believe that the spirits of the ancient cliff dwellers will attack the telephone line, which passes near the deserted cave habitations.

The Deceiving Motion Picture

By Albert Marple

IT might be said that "Deception" is the middle name of the motion picture business. By this I mean that the majority of the most startling effects obtained are secured through deceptive methods. For instance, anyone who sees the heroine of a photoplay jump from the roof of a ten-story building may be sure that the fall effect is secured by unreal and ungenuine means. Then, too, if the actor appears to spring to a bridge from the stream below, or to roll, when confined within a barrel, uphill, it is easy to believe that those effects have been faked.

However, there are numerous effects that are thrown upon the motion picture screen which completely deceive the eye and convey the impression that they are genuine. There is no reason why those incidents could not have taken place just as they are projected upon the screen, and it is accordingly natural to accept them as real; although if the truth were known the ingenuity involved in producing them would be much admired.

Then, again, some of the effects that are flashed upon the curtain are generally taken to be faked, while the truth is that those particular scenes were acted out in exactly the same manner as they appear before the audience. For instance, there is an incident in "Birth of a Nation" —the multi-reel film now being exhibited in several cities of the United States to big audiences—which many will not believe is truly acted out. In one of the skirmishes an actor is seen to fall from the balcony in front of one of the residences to the ground, a distance of about twenty feet. The fall is done so recklessly that the general verdict of an audience is that a dummy has been employed. But in reality the feat was performed by a live actor who has a reputation of having fallen five miles during the past three years. Falling is his business and he seems to thrive on the severe jolts he receives.

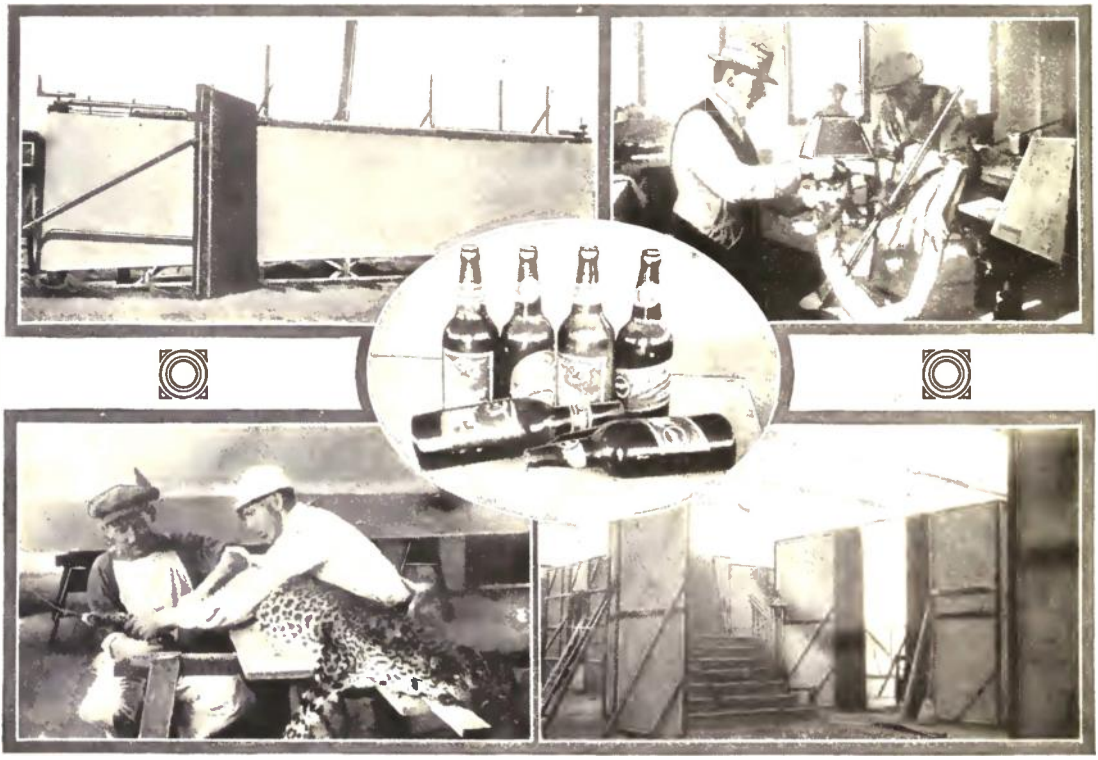
For the greater part the faking done in motion picture producing is executed along the mechanical line, that is to say, the mechanical apparatus one sees in pictures is often unreal as is also most of the machinery. To illustrate the point, one of the accompanying illustrations shows a long and wide canvas strip on which clouds have been painted. The strip is so mounted that it can be unwound from one of the supporting rolls on to the other. This device was used for a scene depicting an aeroplane in flight. The clouds realistically flashed by the machine and to all appearances the aviator impressed the audience as being actually engaged in a flight through the

air. As a matter of fact, the aeroplane was perfectly stationary while the canvas screen in back of it was moved past. At a given signal the operator of the curtain began turning one of the spools, drawing the canvas past the machine while the scene was being photographed.

Another interesting case of deception is the building of an aeroplane for pictures. In one of the illustrations may be seen the skilled artisans of a film producing concern making a tire for a studio built aeroplane — canvas and sawdust being used for this part of the machine. The dummy machine thus produced was used in a spectacular air battle scene.

Still another view shows how a stairway can be faked. The rooms are merely frames, and in this instance there is a doorway in the center of the rear. A section of stairway is placed behind this opening and as only a few steps appear within the scope of the camera, it would seem to the audience that there is a complete stairway.

The two remaining illustrations are of equal interest in the subject of motion picture deception. In one of them may be noticed a group of fake beer bottles made of papier-mache and weighing but a few ounces each. Were it not for these bottles, few actors who are struck over the head in a fight scene would really survive. In the other view a leopard skin has been sent to the property department with the request that it be stuffed at once. In such an emergency the men have had to use strong wire and excelsior, owing to the lack of other materials—but the audience will never know it.



Various Views of the Methods of Deception Practiced in Motion Picture Production. It is in the Ease with Which Striking Effects Can Be Secured by Simple Means in Motion Pictures That This Form of Drama Has Its Greatest Advantage Over the Spoken Drama.

DANCING AS AN ARMY EXERCISE

A recent film produced by Pathé Frères, of France, depicts the physical training of French soldiers. The film shows the usual gymnastics and fencing indulged in by the soldiers at the Joinville School and other similar institutions. Dancing has been added to the exercises.

AS CLEAR AS A BELL

BY GEO. F. WORTS

CONGENIALITY is the prevailing climate of the Lubin system—a climate which has pervaded and nurtured every growing branch of the Lubin tree since it first began to sprout twenty years ago in the musty cellar of a little optical shop in Philadelphia. Lubin set his ideal then—moving pictures "as clear as a bell"—an ideal towards which all of his life efforts have converged.

"POP" LUBIN began his career as a moving picture king in the damp, murky cellar of a little optical shop down town in Philadelphia. Let me explain before continuing that the title "Pop" is by no means an irreverence: it is an affectionate addition which has grown upon his name as the result of a consistently congenial attitude towards his workers — and this in spite of the vise-like grip he has upon the most infinite details of the Lubin machine. Congeniality is the prevailing atmosphere throughout the entire Lubin system—an interesting feature which will be dwelt upon more fully later.

Genius in the Cellar

The first Lubin moving picture machine was inspired by a keen, far-sighted glimpse into the future, based upon a genius's knowledge of optics—and odds and ends found in the little Philadelphia shop, which shop, for reasons more or less of sentiment, is still in existence.

Mr. Lubin devoted all of his spare time in constructing his first moving picture machine along lines decidedly his own. His ideal was a machine which would avoid the glaring faults of the moving pictures of that time, namely, unclearness and unsteadiness of the projected image. In other words, he wanted his pictures to be "as clear as a bell," and towards this ideal he has worked constantly.

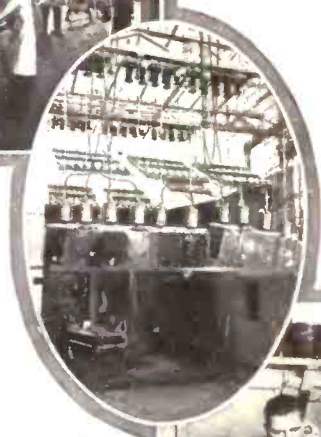
A Talk With Mr. Lubin

To span in a breath the twenty years intervening between then and now, the ideal, "as clear as a bell," has been completely achieved — success to which a well-flung fame amply testifies.

It is proverbial that inventors are poor business men and worse organizers. But several striking contradictions to this rule—successful inventors, keen business men as well as masterful organizers—have sprung into being with the development of today's industrial system. Edison, Marconi and Lubin are three men of this type.

Mr. Lubin's rule of success in a nutshell is to look as far into the future as

one conveniently can. He does not look back, for to look back nowadays is to turn into an industrial pillar of salt. A few years ago a valuable collection of Lubin films was destroyed by fire. This was a blow that hurt "Pop" terribly, but he was far from being crushed. He ordered ponderous underground fire-proof vaults to be built. Nothing short of a volcanic eruption can disturb these celluloid treasures now. His attitude of "looking back of the beyond" was typified in the short talk I had with Mr. Lubin. Middle-aged successful business men, especially when interviewed for a magazine, almost always fall to reminiscing. What Mr. Lubin did, however, was to grasp me firmly by the coat collar and tersely outline his big plan for the future activities of the company.



Above: A View in the Lubin Machine Shop Where the Cameras for Producing the Lubin Films Are Made. This Company Has Been Making Its Own Cameras Ever Since It Began Business.

In the Oval: A Stage Setting in the Lubin Studio. Below: A Member of the Lubin Organization Examining a Reel of Film to Determine Whether the Various Scenes Are in Proper Rotation.

"I'm going to put every good play on Broadway in moving pictures," he said, "especially comedies."

"What about your regular productions?"

"They go on as well. I'll enlarge this plant, and build a half-dozen more if necessary."

The Lubin Family System

Then he elaborated upon his plans, but not a single word about the past. In concluding he smiled genially. "While you're here, remember you're a member of the Lubin family," he said.

Every one working there is, so to speak, a twig of the Lubin family tree, a fact which holds with the more distant branches in Los Angeles, Jacksonville, Brooklyn, Betzwood, and even to Romaine Fielding's company—the Lubin nomads.

The direct result of the Lubin family system can be compacted into two words: complete co-operation. Congeniality, self-help and all those sort of things, of course, go along with it. Five minutes after I had been introduced to Ormi Hawley, the young lady who has captivated Australia, I was an "adopted son" —even if I did happen to be the two or three hundredth!

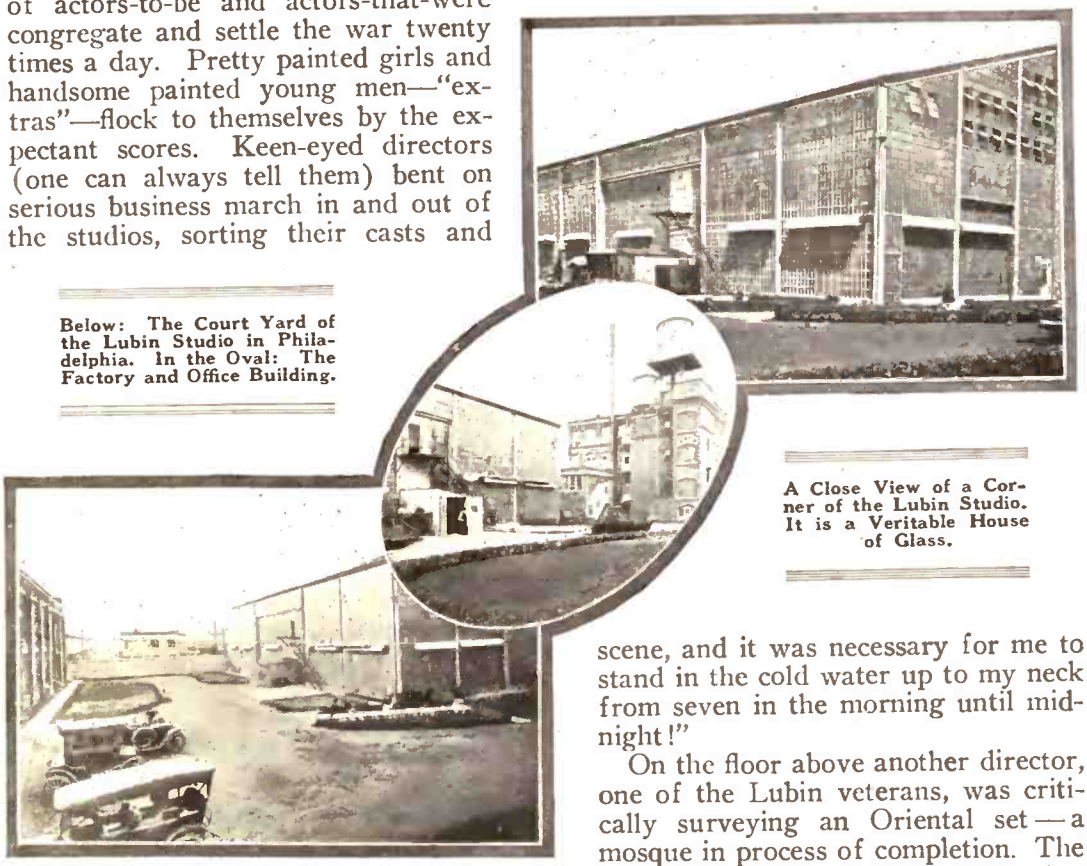
The stranger at the Lubin gates is welcomed warmly—because everybody there is proud to show what he is doing — and they have a right to be proud.

In the Lubin Courtyard

The Lubin plant in Philadelphia consists of a group of large, airy buildings surrounding an attractive court of well-kept lawns, hedges and a broad

roadway where a battery of Lubin automobiles is parked ready for service at an instant's notice.

In the courtyard little sociable groups of actors-to-be and actors-that-were congregate and settle the war twenty times a day. Pretty painted girls and handsome painted young men—"extras"—flock to themselves by the expectant scores. Keen-eyed directors (one can always tell them) bent on serious business march in and out of the studios, sorting their casts and



Below: The Court Yard of the Lubin Studio in Philadelphia. In the Oval: The Factory and Office Building.

A Close View of a Corner of the Lubin Studio. It is a Veritable House of Glass.

talking vigorously with their leads and their assistants.

The studio building—it must be remembered that the East Philadelphia factory is only a replica in miniature of the giant at Betzwood—is a sloping, crystal-covered structure of red brick. Any number of scenes go on in there continuously. A hospital ward, suggestively warlike, was being staged on the lower floor. The detailed workings of this set were courteously explained by Crane Wilbur, who was somewhat limited in his gestures by a swathing of bandage. Crane was a battle-worn hero, and he looked the part.

Bringing the World to the Studio

Beneath the floor planks of this studio, so the director in charge explained, is a large tank for staging "water stuff."

"I had one amusing experience here," said the director, smiling, "at least it seemed to amuse everybody, even if I did miss the point. We staged a mill scene, and it was necessary for me to stand in the cold water up to my neck from seven in the morning until midnight!"

On the floor above another director, one of the Lubin veterans, was critically surveying an Oriental set—a mosque in process of completion. The proverbial nicety of scene construction and design was well illustrated here. The grain of the marble—wood that had been transformed through the skill of a scene painter—would have deceived the eye of a stone cutter.

The director was a busy man, but he stopped work promptly to explain things—wherein he exemplified the usual Lubin spirit.

"We design all of our scenery to be absolutely accurate. The mosque is taken from a book on the architecture of Turkey—it is a faithful reproduction. We have a valuable collection of books covering in detail the architecture of a wide range of countries and periods. Whether we are staging a play laid in old Greece or new Ireland, we always manage to have the correct background. We cannot very well go out all over the world for local color, so we bring the

world to the studio, as you now see."

The studio was not large, as movie studios go in these days. Used scenes were shelved about the walls and in the corners. Not an inch of space was wasted.

A Miracle-Man-of-the-Movies

"We work always at top notch speed," continued the director. "Our output is a play a day, and if any contingency should arise we have enough finished reels on hand to supply the exhibitors indefinitely. Our play-a-day capacity excludes, of course, the new V-S-L-E compact (Vitagraph-Lubin-Selig and Essanay) to produce in rotation one big feature a week."

In another part of the studio building George W. Terwilliger, the Lubin director-prodigy, was directing the filming of a breakfast room scene. I mean prodigy in the sense of youth and unusual ability combined, for George Terwilliger has youth and an uncanny amount of moving picture resourcefulness. George is the kind of a man who will take pictures at random of the large fires, railroad wrecks and naval maneuvers, and then spin a heart-throb plot to fit spectacular parts.

One time he was on the ground with a cameraman during a U. S. Navy sham battle. In the back of his facile mind he had previously hatched a scenario in which a South American revolution played an important part. The way he worked the idea out, in order to combine U. S. Navy uniforms with a South American revolution, was to have his revolutionists steal several thousand U. S. Navy uniforms—and thus his flicker-story ran logically.

Nomads of the Reel

In the winter time Mr. Terwilliger Lubinizes at the Philadelphia studio, or perhaps he and his company will take a flying trip to Florida, for he is one of the Lubin's several nomads. In the summer he goes to Newport, where he directs the staging of society and navy plays—or to Cape Cod to build flicker dramas on the grounds of our Pilgrim fathers.

Perhaps the most interesting of the Lubin nomads is Romaine Fielding, who at this particular moment may be in Tasmania, the Yukon, or Chihuahua, as the spirit moves him. Fielding, like Terwilliger, writes his plays as well as directing them, while occasionally he acts.

A Scene Painter at Work Sketching the Outlines of the Scenery for a Lubin Photoplay.

Two Views in the Lubin Property Rooms. In the Above View is Seen the Large Stock of Furniture Which is Used for Furnishing Indoor Sets. In the View to the Right May Be Seen the Workmen Preparing Elaborate Statues and Panels Modeled in Clay.

Fielding has a fine sense of the artistic in scenery, and he makes it his business to search the ends of the earth for picturesque settings for his film stories. A collapsible studio is part of his equipment. Whether he is in Alaska, Japan or Somaliland, his indoor studio is always convenient.

Capturing a City to Order

During one of the numerous Mexican revolutions recently Fielding and his company attached themselves to the regular staff of one of Villa's generals. The amusing story is told of a certain attack on a city which Fielding was anxious to photograph. The general promised Fielding to make the attack in the daytime, but for strategic reasons the city was taken during the night. Fielding thereupon flew into a rage and threatened to do terrible things. So, on the following morning, the repentent general withdrew his army from the city, made the attack all over again—and Fielding got the picture he wanted! Another time he visited Mexico, Fielding needed an army to lend a punch to a play he was finishing, so, with his usual nonchalance, he calmly borrowed the entire army. It is needless to say that his personality is tremendous.

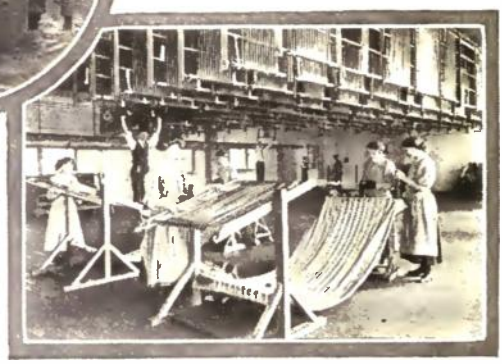
Aside from Terwilliger and Fielding, who go wherever the scenery pleases them, the Lubin has stock companies permanently installed in Brooklyn, Atlantic City, Jacksonville, Los Angeles and Betzwood. Feature plays, in which Broadway favorites appear, are produced in the Brooklyn studio; summer comedies come from Atlantic City; cowboy and Indian pictures are made at Los Angeles, while Jacksonville is the source of nearly all the comedies.

The Ranch at Betzwood

Although the main offices and some studios and a portion of the manufacturing plant are located in Philadelphia, the main plant of the Lubin is several miles from Philadelphia, at Betzwood—the Betzwood Ranch, it is called. Here highly diversified scenery makes possible almost every sort of play. In the seven hundred acres there are hills, valleys, forests, rolling plains and a river, the Schuylkill, which cuts across one corner, not to speak of ranch houses, corrals and cowboys—real ones direct from the West. Three large studio buildings and an enormous manufacturing plant with a weekly output of one and a half million feet of film comprise a productive unit in themselves. Lubin cameras, for Lubin use only, are also manufactured, and in a spacious, well-equipped laboratory

experiments are constantly in progress in an effort for a fuller realization of the Lubin ideal—moving pictures "as clear as a bell."

In a machine shop on the top floor of the administration building in Philadelphia the complicated Lubin cameras are made in small quantities, although repair work is the chief function. Film-developing and printing rooms and a projecting room occupy a large concrete building on one side of the courtyard, the scenario offices and studio flanking it on the opposite quarter.



Above: A Corner of the Cutting and Assembling Room Where the Various Strips of Film Comprising Different Scenes of a Photoplay Are Assembled in a Continuous Piece by Girl Workers.

In the Circle: An Incinerator in Which Discarded Film is Destroyed. Below: The Drying Room Where the Strips of Film Are Wound on Wooden Racks and Hung Up to Dry.

The "Knocklodeum"

Every picture that is made in the various Lubin studios is sent by express to the headquarters at Philadelphia, where it is freely criticized by the company officials, amended perhaps, and then released to the National Board of Censorship for a final reckoning. The projection room is as large as the average moving picture theatre, and is filled with theatre seats to accommodate the directors and the company critics as well as any players who desire to view their dramatic efforts as seen by the eye of the camera. Criticism is frank and generous; not without reason, therefore, is the projection room called the "Knocklodeum."

Just to show how expensive a matter it is to make moving pictures of the spectacular sort, a number of special reels have been prepared which consist of strips or sections from the "punches" or climaxes of costly Lubin productions. There was, for example, a railroad wreck with the camera placed thrillingly close, showing two fast trains hurtling head-on into each other, telescoping and spreading in all directions. Another piece showed an old colonial mansion, especially built for the purpose, belching flames and smoke and finally burning to the ground. In others, a building was blown up by dynamite, a ship was torpedoed, a magnesium shell was exploded from the fourteen-inch gun of a dreadnaught. There were about two dozen incidents in all.

"We tried to estimate the amount of money which these punches represent," said one of the men. "But it ran so far into the hundreds of thousands that we lost count!"

The Lubin Climate of Congeniality

Harking back again to the climate of good fellowship, of sincere congeniality, which pervades the uttermost division of the Lubin system. This atmosphere is generated first of all from the dynamic personality of "Pop" Lubin himself and is taken up and re-echoed by the hundreds of workers under him. The sphere

of this influence of congeniality extends far beyond the zone of the Lubin factory, for charitableness of this kind is a fluid that gathers volume as it flows.

A number of plays for the benefit of the Belgian sufferers have been produced by Lubin talent in Philadelphia theatres. There is no recompense, yet every one gladly volunteers. Almost every charitable affair in the Quaker City finds Lubin players enrolled. Outcroppings of the Lubin spirit such as these are constantly stimulated by activities within. The Lubins have an enthusiastic baseball team and a good orchestra.

Just across the street from the factory is a little cafe popularity known there as The Madhouse, where the Lubin workers take their meals. Caste distinctions are leveled; sedate directors mingle with unemployed "extras"; leading ladies joke with waiters—everybody joins in the fun, no matter who he is. "Pop" Lubin over in one corner, who can't count his millions on all his fingers and toes, may be telling his latest story to one of the directors. Next table may be occupied by twelve-dollar-a-week scene shifters, while scattered about the room are temperamental scenario writers, sparkling leading ladies, placid cameramen and clerks, eating and drinking without a care in the world.

Our table, which was built to accommodate two, was surrounded by a dozen —Terwilliger, the Lubin miracle man; Fife, a youthful scenario editor, who wrote his way through the University of Pennsylvania; Ormi Hawley, the leading lady who has captivated Australia; a scenario writer who lives somewhere on Long Island and comes to town periodically with a batch of throbbing scripts (he had just come to town, and was blowing off steam to the extent of Champagne for the tableful); J. Allen Boone, the Publicity manager, who made a name and a fortune as a newspaper correspondent in the wake of Roosevelt's Egyptian and European tour; Mary Charleston, a lively little dare-devil of the movies, who is paid several hundred a week for jumping off precipices and swimming ice-filled rivers—and several others, equally interesting, whose names I have forgotten.

Nobody in the entire room, apparently, held himself or herself to be socially superior to anyone else in the room. Personal esteem seemed to be based entirely on one's ability to make himself agreeable—certainly not on any such undemocratic things as salary or fame.

Just why the Lubin scheme is overwhelmingly successful is, to repeat the words of the Lubin motto, "as clear as a bell," because—but why begin our story all over again?

DRILLING A CROWD TO SURGE FOR THE CAMERA

"In producing a feature," said Thomas H. Ince, the famous director who has produced several of the remarkable Mutual Masterpictures, "the crowd picture is invariably the hardest to secure. First, the important characters must be to the fore. Then again, there may be a bit of superb acting in front and some farcical stuff being parcelled out in the background. All this must come under the director's vision and the characters be so disposed as to meet the requirements of mechanics and photography.

"In 'The Sign of the Rose,' in which we starred George Beban, there is an excited, surging crowd. Here the difficulty was not with the principal players, but with those in the minor roles. For one thing, it was difficult to convince the crowd that it should be both excited and surging; it was doubly difficult to convince the policeman that he should force the crowd back just as hard as a New York copper would. It was necessary to change policemen before we found a good near-cop. The crowd rehearsed one scene twenty-four times before it reached that pitch of excitement that called for the camera man.

"All this costs money. It is part of the expenditure necessary to the production of feature pictures which have be-

come the great bulwark of the motion picture drama business. This is natural, as well as evolutional, for a feature which calls for a world of work and money. We spent $100,000 on 'The Sign of the Rose,' but we do not begrudge the expenditure, because we know we have produced something that is worth while and will repay us."

MOTION PICTURES COST $275,000,000 ANNUALLY

It is estimated by prominent motion picture producers that over $275,000,000 are being spent annually by the people of the United States for the production and maintenance of moving picture enterprises throughout the country. Few people realize that the ordinary feature-film which provides the evening's entertainment costs between $15,000 and $30,000 to produce.

Aside from the money actually spent on admissions to the shows all over the country, the greater part of the capital used in connection with the moving-picture industry is that tied up by the producers of the embryo features. Over $120,000,000 are tied up in the apparatus and property of the giant syndicates.

HOW THE WAR AFFECTED ONE FILM

"All For Old Ireland," the first of a series of made-in-Ireland comedy dramas, was finished under the greatest of difficulties last August after the outbreak of the European war. Sidney Olcott, who directed the pictures, had, the day before the declaration of war by Great Britain, taken a number of scenes on the Island of Valentia where the great cable station connecting Ireland with America is located.

Not having finished the required number of scenes, Olcott and his company returned from Killarney to the island the day war was declared, and found the island under martial law and photography absolutely forbidden. When it is considered that a number of natives, together with a lugger, manned by captain and crew, had been used, and in no way could be again secured, a serious problem confronted the producer. Olcott, however, managed to find a way out of the difficulty. The scenes were finished fifty miles away without using the same people, and yet the manner of doing so defies detection even by experts. Olcott said he was not only glad, but lucky to get back with any pictures at all after the torch had been applied which set all Europe ablaze.

THE LOS ANGELES UNDERWORLD'S CONTRIBUTION TO A CHICAGO SLUM PICTURE

Chicago's famous Metropolitan Music Hall, one of the best known resorts in the country, suggested the model for the immense setting of the dive, one of the many vividly realistic scenes depicted in "Up From the Depths," the new Mutual masterpicture, screened at the Reliance studios by Director Paul Powell.

This set, measuring 150 x 50 feet, is one of the largest ever constructed solely for motion picture work. Some idea of its vastness may be gleaned from the fact that in the scene 200 persons are shown seated or dancing in the resort. To secure the proper types for this particular scene Director Powell made a careful search through the slums of Los Angeles, with the result that many denizens of the resorts were brought to the studio, specially trained, and then assigned parts in the scene. Indeed, so realistic is this setting that one would all but imagine himself or herself seated in the resort.

AN ENTHUSIASTIC RESPONSE TO A FILM CALL TO ARMS

While the Italian armies were scaling Alpine heights in their invasion of Austrian territory, over three hundred of their countrymen were having a riotous skirmish and battle around the imperial throne in Urania, temporarily located in

the Lubin studio. The battle is the big scene in "The Coming of the Kingdom," the fifteenth part of the "Road O' Strife" serial, in which the Lubin Company is featuring Crane Wilbur, Mary Charleson and Jack Standing.

When a call was sent out by the Lubin Company for Italian volunteers, Little Italy in Philadelphia responded so nobly that it was necessary to get a number of policemen to keep them in line at the studio while the best types were selected. Over three hundred of the volunteers got uniforms and joined either the army of Urania under King George Soule Spencer or that of Hervo-Alesia, the kingdom of Queen Mary Charleson. Director John Ince took charge of the two armies and directed manœuvres and battles.

The two kingdoms had a strenuous day of it and the armies charged, fought, slaughtered, retreated, and did almost everything in the fighting line excepting dig trenches and duck real bullets. The war would undoubtedly have continued indefinitely, but Queen Mary Charleson decided emphatically that she had lost all interest in Hervo-Alesia and spoiled the plans of the ambassadors, princes and others by marrying Crane Wilbur, a student and dreamer of whom she had been very fond since their meeting in the first chapter of "Road O' Strife."

MAKING UNITED STATES MARINES ACT FOR THE MOVIES

The United States marines are called on to do many queer things and perform many strange acts, but one of the most novel stunts they have had to do was that which recently took place at San Diego. The Fourth U. S. Marine Corps is located adjoining the Exposition grounds, and one of the directors of the Lubin company had a bright idea as a result. A drama was filmed on the grounds in which the most realistic of battles was fought between the soldiers and Filippino warriors, the latter being merely more soldiers from the Government post in San Diego, properly dressed, or rather undressed, and painted in most hideous

The Members of the Fourth United States Marine Corps Taking Part in the Production of an Exciting Military Photoplay.

splendor. A battalion of marines, together with cavalry and artillery, was used in making this picture, and the soldiers keenly enjoyed the charging back and forth, the volleys of "blanks," and the novelty of being ordered around by a movie man instead of their usual officers.

DYNAMITING A HOUSE TO MAKE A PICTURE

Out in Santa Barbara, California, the general public was invited recently to view the filming of a thrilling scene designed for inclusion in the four part Mutual Masterpicture, "The House of a Thousand Scandals." The production is being superintended for the American company by Director Thomas Ricketts, and plenty of action preceded the chief incident, the blowing up by dynamite of a specially constructed house. A large crowd assembled to see the explosion, and a crowd of four hundred "extras," whom Mr. Ricketts had been rehearsing for over a week, added to the picturesqueness and realism of the scene.

A MANSION BUILT TO ORDER FOR PHOTOPLAY

Plans for staging the great $20,000 All-American prize photoplay are proceeding merrily. In the hills back of Santa Barbara workmen from the American-Mutual studios are constructing an old fashioned colonial mansion and doing it under difficulties. All the building materials have to be transported on burros. In addition to the house, winding drives, walks, arbors and outbuildings have to be constructed. This prize winning scenario writer evidently had little sympathy with the troubles of the property man and chief carpenter.

According to Director Jacques Jaccard, who is producing the big serial for the North American Film Company, the location must have been sighted from an aeroplane. Mr. Jaccard, however, has to climb there, and every one concerned has to climb to keep him company. When completed the mansion will be like the home of some great duke or millionaire.

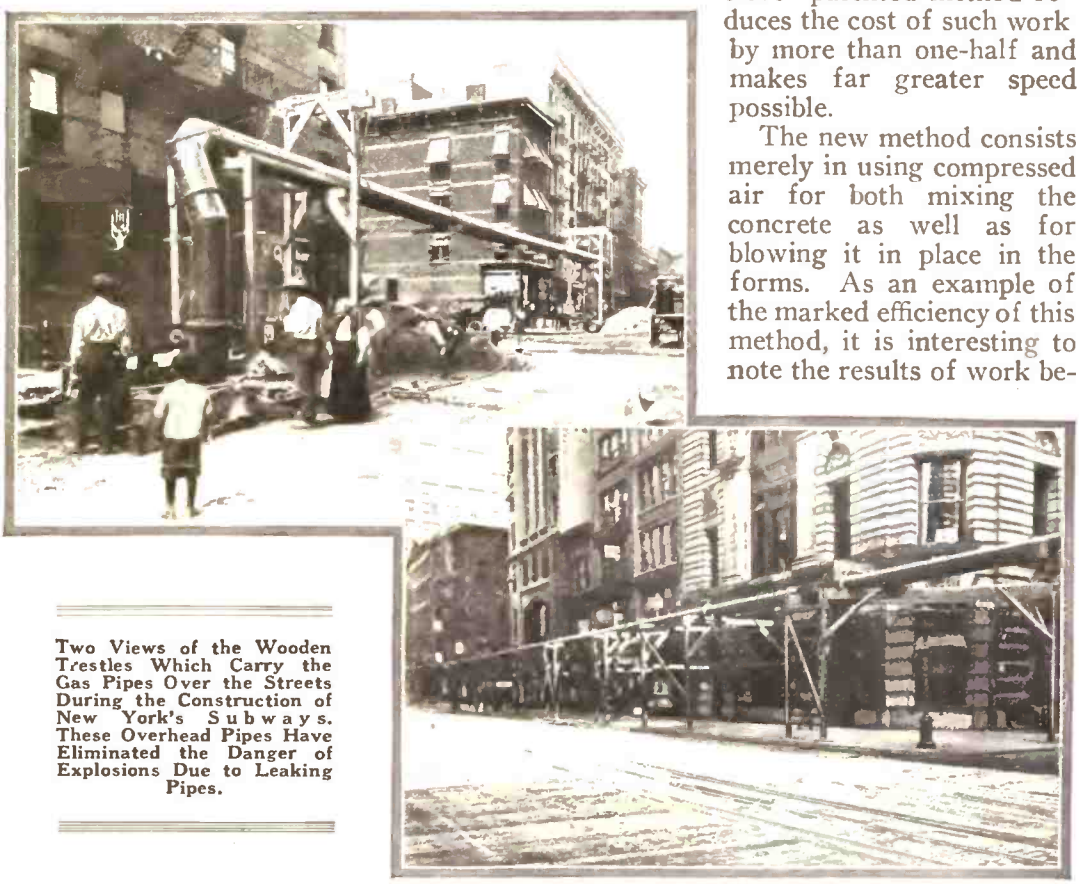
NEW YORK CITY'S ELEVATED GAS PIPES

IN many of the streets of New York where the new subways are being built, the mains of the gas companies are laid. One of the chemical properties of illuminating gas is that when mixed with an equal amount of air it forms an explosive mixture which ignites at the slightest spark, and according to the volume causes an explosion of more or less intensity. Excavations for the subways in streets carrying gas mains cannot be conducted without the danger of breaking or loosening the joints of mains, thereby allowing the gas to escape. A chance spark from one of the many underground electric wires or from the street railway would ignite such an explosive mixture, and result in serious damage. Consequently, the gas pipes, wherever the subway work is being carried on, are led above the level of the streets along structures resembling trestles or suspension bridges in miniature. This method is very similar to that used in conducting conduits along mountainsides in the west for irrigation, mining and hydro-electric purposes.

The New York "elevated pipes" are carried above the streets at a height sufficient to clear all vehicles, the average height being about twenty feet.

The neglect of other cities in diverting the gas pipes during underground work has led to serious consequences.

In Boston, for instance, during the construction of the subway in 1897, a serious explosion occurred as a result of leaking gas. Several people were killed and much property was damaged. Philadelphia had a similar experience in 1906, during the construction of the Market street subway. In neither Boston nor Philadelphia was the gas supply transferred from the underground mains to pipes laid above the ground in the open air.



Two Views of the Wooden Trestles Which Carry the Gas Pipes Over the Streets During the Construction of New York's Subways. These Overhead Pipes Have Eliminated the Danger of Explosions Due to Leaking Pipes.

In New York these gutter mains, or "by-passes," as they are called, are carried around the curb corners and back into the crosstown streets far enough to insure safety against a leakage of gas through the intervening earth and into the excavation. They are then carried across the street underground and connected to the existing mains. Where trunk mains run in the street, parallel to the excavation, they are carried on trestles built over the sidewalk.

SHOOTING CONCRETE IN PLACE WITH COMPRESSED AIR

The old method of laying concrete tunnels for sewers or railroad work involved the slow and laborious task of packing the concrete into tunnel forms by hand. Today, however, a new and clever patented method reduces the cost of such work by more than one-half and makes far greater speed possible.

The new method consists merely in using compressed air for both mixing the concrete as well as for blowing it in place in the forms. As an example of the marked efficiency of this method, it is interesting to note the results of work being undertaken at Memphis, Tenn., where two great concrete tunnels which will be employed to drain a disease-breeding bayou are now under construction. The tunnels are sixteen feet in diameter and dug by forcing steel shields through the soft dirt. As the shields move along inch by inch, the dirt is carted back. Wooden rings prevent the earth from caving in, while steel tunnel forms sustain the concrete in place until it sets. An eight-inch pipe connected with the pneumatic mixer and conveyer delivers into the form the proper proportions of sand, gravel, cement and water. A thirty-foot section is filled in three or four hours and, in view

of the fact that the concrete tube is two feet thick, this achievement may be considered remarkably fast work.

A STORE ENTRANCE BY DAY—A SHOW WINDOW BY NIGHT

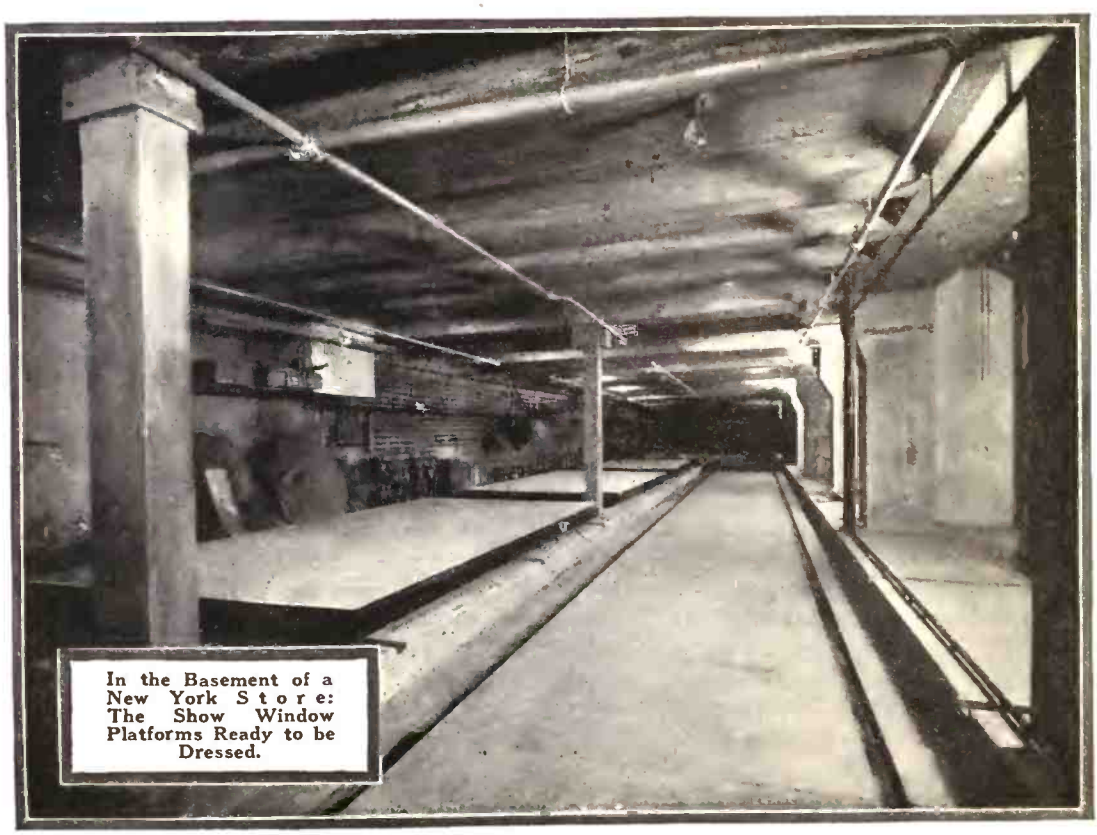
In one of New York's Fifth Avenue stores three long show windows are so constructed that they are lowered into the basement, where the window dresser may arrange his displays at leisure. They are the first hydraulic elevator show windows in existence, and represent the last word in show window advertising.

The window dresser's chamber extends under the sidewalk the entire front of the store and is illumined in the daytime by sidewalk lights. There is a trackway running the entire length of this chamber and on it is a bridge or truck which receives the window platforms mounted on rollers and carries them down the trackway to any desired window elevator, where they are moved on the elevator and raised to the show windows, level with the sidewalk above.

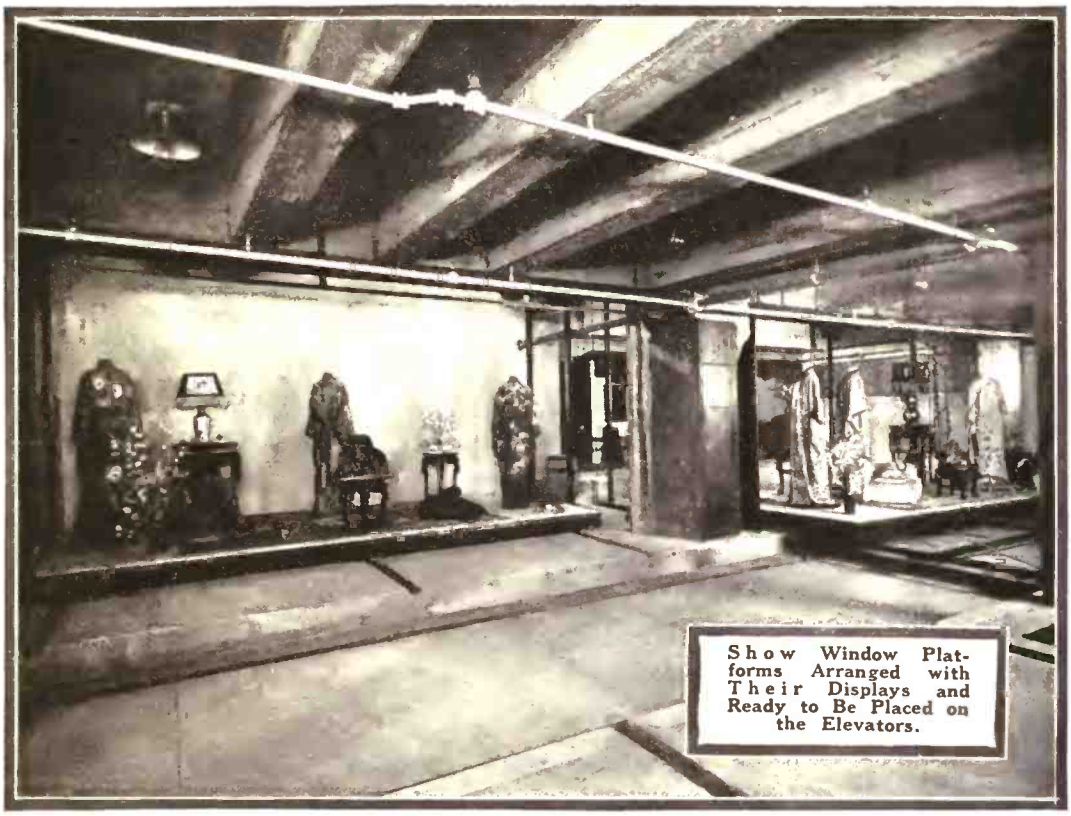
The entire set of displays may be prepared in the basement in the day time by the window dresser, and he can thus accurately gauge their effect. After he has set up a number of displays, he lowers the show cases that have been on view, shunts them out of the way, puts the new displays on the elevators and raises them to the windows. He does his work in the day time and once the displays are in position they are never changed. All other window dressers do most of their work at night.

The most remarkable feature about the elevator show window is shown in this same store. Display advertising is so valuable on Fifth Avenue that the store entrance or vestibule is actually used at night for display purposes. This is easy enough with the elevator. Persons walking by the store at night may see the floor of the vestibule or entrance begin to rise, and presently a completely dressed show window emerges.

This vestibule elevator show window



In the Basement of a New York Store: The Show Window Platforms Ready to be Dressed.



Show Window Platforms Arranged with Their Displays and Ready to Be Placed on the Elevators.

remains in this position until the avenue becomes deserted, when it is lowered to the basement. Thus a person may walk by the store and be puzzled at not finding the slightest evidence of an entrance anywhere, and return in an hour or so to see the entrance in its accustomed place. He may even walk up to it without knowing that his feet are standing on the roof of the show window, so complete is the transformation.

TURNING THE SEWERAGE TO PROFIT

Anaheim, California, has demonstrated that a septic tank through which the sewerage of the city is passed may be turned into a source of revenue to the city instead of being a nuisance, as these tanks are supposed to be. One of the most fertile tracts of land in Southern California is a section just outside of that city, known as the "sewer farm." On the highest point of this farm is located the septic tank, and the purified water which passed through the tank has been used for several months for irrigating purposes and the resultant growth of vegetation shows that this generally expensive improvement has been turned into a source of profit.

LAKE OF WINE BURNS BLUE

A lake of wine, consisting of 1,000,000 gallons, formed a most spectacular sight when it burned blue against the blackness of the night, near Fresno, Cal. This lake was formed near the burning building of a winery, and the light blue blending with the orange tinge of the darting flames was like a huge fireworks celebration. The lake of wine extended for about a block and burned for over an hour. The loss from the burning of the winery will amount up to a half a million dollars. It was the largest in the Fresno grape district, the warehouses and fermenting rooms covering several acres. The cause of the fire is a mystery.

DETECTING AND MEASURING THE WABBLE OF THE NORTH POLE

The majority of us who look upon the North Pole as the unswerving standard of permanency will be astonished to learn that the pole "wabbles" and is not true to the central point in the heavens towards which it is supposed to be fixed.

The "Wabble" of the North Pole is Detected and Recorded by This Instrument.

The tilt of the earth was believed for many hundreds of years to remain in the same position, unaffected by its daily revolution on its axis or its whirl around the sun. But as its divergence has become a matter of record among some astronomers, the United States Naval Observatory has just finished installing a machine that will detect the polar variations with absolute accuracy. This machine, which is spoken of by the laity as the "Wabbler," has a long scientific name given it by the observatory experts. It is housed in a small building on the grounds, where tests can be taken frequently and the conduct of the pole properly watched.

The variation of the pole from the supposed straight position of its axis is a spiral course—in other words, it "wabbles" about its fixed center to a matter of sixty degrees—thirty degrees on each side. It does so just in the same manner as a top that is "dying," as the boys say, swings around from its upright position. This polar activity lasts for a space of seven years. It takes about three and a half years to spin on its outward course, then the same time to return to its point in the center. It has also been remarked by scientists that the occurrence of earthquakes is common when these polar variations are greatest. Hence the theory has been advanced that there may be some sort of connection between the "wabbling" of the pole and the earthquakes which cause such great disaster. The machine at the observatory is in charge of Dr. F. E. Ross, who will study the polar behavior with a critic's stern eye and report to Uncle Sam on its conduct.

ENGLAND'S NAVAL INVENTION BOARD

Following the example of the United States, England has formed a Naval Invention Board. Among the well-known members of the board are Crookes, Lodge and Parsons, of electrical, wireless and steam turbine fame, respectively.

BOY CHAMPION RACING DRIVER

Harry Hartz, champion junior racing driver of the world, drove over the 75-mile course of the Junior Grand Prix race at the Exposition Grounds in San Francisco in 1 hour, 36 minutes, 56¼ seconds, remarkably fast time considering the youth of the drivers, the small size of the cars and the difficult course. He had already won the Junior Vanderbilt race a short time prior to this victory, thus he is now undisputed champion. Twelve cars raced in this event for the coveted honor, and many thrilling battles for place were fought as the tiny cars whirled over the track. Young Hartz won both races in his speedy little Mercer automobile.

In a Miniature Racing Automobile the Driver, Harry Hartz, Drove Over a Seventy-five Mile Course in One Hour, 36 Minutes and 56¼ Seconds.

THE DEVELOPMENT OF AN IDEAL STEAM LOCOMOTIVE

BY ARTHUR CURRAN

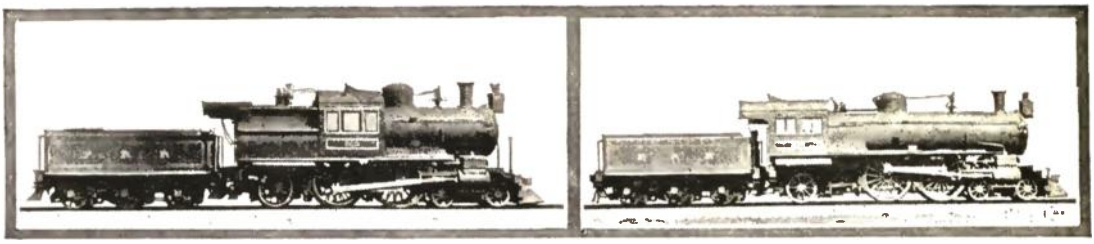
FIFTEEN years ago a leading American railroad built a locomotive which was believed most suitable for the passenger traffic at that time. But actual use pointed out many constructional features that could be improved upon; and, too, the introduction of heavier cars and longer trains necessitated the continual increase of the locomotive's pulling power and steaming capabilities. Diligently and untiringly the company labored on until there was finally evolved a most successful locomotive combining speed with power, and—what is of utmost importance—a high degree of reliability.

HOW a great railroad developed a most remarkable steam locomotive is an absorbing story to those interested in mechanical achievements, especially in view of the fact that the development has called for infinite pains in every detail and much hard and patient toil. This story is woven around the evolution of the Pennsylvania Railroad's class E-6-S locomotive handling most of the important passenger trains and which is the result of some five years' experimenting, although its origin dates back even further.

Fifteen years ago the Pennsylvania Railroad built the engine shown in the first view. This was the first locomotive of the Atlantic type to be used on that road, and included much that was common on other roads at the time, together with certain features that were identified chiefly with that railroad. The tender, however, was of the English type, mounted on six wheels after the fashion of that country. From a mechanical point of view this engine, No. 820, was a success. By reason of its "Mother Hubbard" form of construction, however, which had the effect of separating the engineer and fireman, it was not altogether satisfactory.

As a result the engine shown in the second illustration was built, with the cab in the normal location. The English tender was retained in this case, but was ultimately abandoned. With gradual modifications, this type remained standard on the Pennsylvania for a decade. When the motive power officials had reached the conclusion that this type had arrived at the limit of its possibilities, something new was decided upon.

The new idea is displayed in the seventh picture. Briefly described, this engine,



Two of the Earlier Atlantic Type Locomotives Used on the Pennsylvania Railroad. At the Left is the First Locomotive of That Design, Which Was Later Replaced by the One at the Right for the Reason That the Arrangement of Separate Cabs for Engineer and Fireman Was Found Impracticable.

No. 5075, amounted to nothing more than a big freight boiler on passenger wheels. The scheme was an instant success. The big boiler gave the engine tremendous steaming capacity, while the passenger style of wheel arrangement permitted it to run smoothly at a high rate of speed.

This engine was tested on the road and finally on the special testing machine at Altoona, as shown in the third view. Tests furnished data on horsepower, speed and other factors, which enabled the officials to arrive at accurate conclusion regarding the engine's capacity. As a result of these tests the engine was equipped with new and lighter crossheads of a special design, a new trailing truck and a superheater. It was then renumbered 1067, as shown in the fifth view.

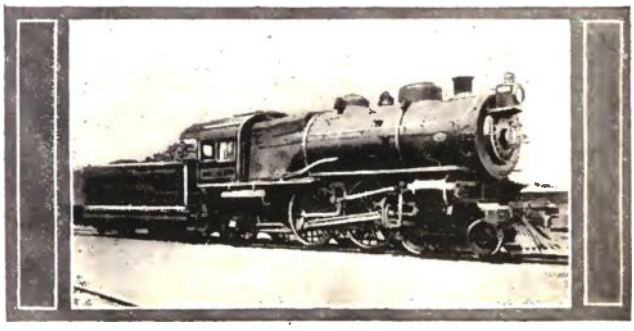
In the meantime another engine, No. 1092, illustrated in the fourth view, had been built with rotary valves. This was done in a conscientious attempt to arrive at the truth respecting various systems of steam distribution. The engine was not a success, and had to be rebuilt, but it served the purpose of showing the deficiencies of this form of construction.

The sixth picture represents one of the latest E-6-S engines. This class is very popular among engineers on account of its speed and power, and among repair inspectors because it never breaks down. The officials are interested because the engines of this class are remarkably economical.

While the foregoing-mentioned development was in progress, the Pennsylvania Railroad experimented with Prairie and Pacific types of American-built locomotives and with an Atlantic engine imported from France. Not one of these types has been able to compete successfully with the E-6-S engines on the ordinary divisions of the road.

The traffic is very exacting, owing to the crowded condition of the road and the importance of the trains that must be handled every day. High speed has been a requirement for a number of years. This will be understood when it is explained that the standard driving wheel diameter for express engines has been 80 inches for more than twenty years on the Pennsylvania Railroad. This dimension was incorporated in all the locomotives shown herewith.

The object sought in designing the latest class was a combination of speed and power. This was achieved, although every expert knows the difficulty of attaining such a desirable result. Some remarkable speed records were made years ago, but the weight of the trains involved was not great. The old-time fast engine had what, for want of a better term, may be called a genteel



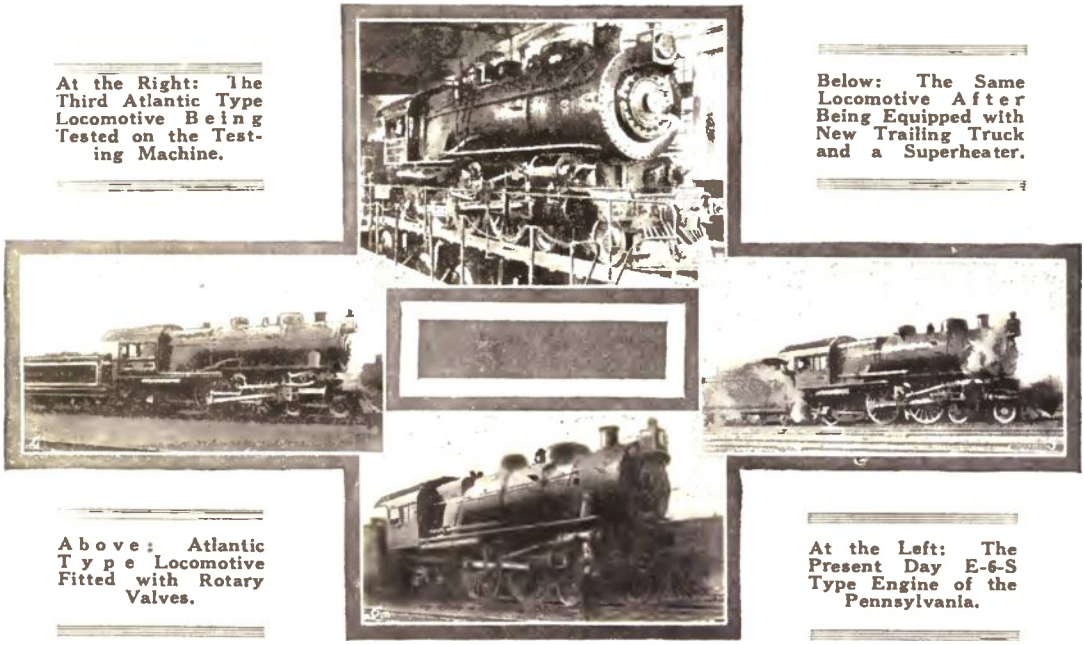
The Third Atlantic Type Locomotive Used Was in Reality a Freight Engine Boiler Mounted on Passenger Engine Wheels.

job. Moreover, it was maintained with greater care than most roads wish to bestow on an engine these days.

One of the most remarkable features of the E-6-S engines is the lightness of their moving parts. This was made possible by the use of a very fine quality of steel. It will be observed that by saving weight in the construction of these parts a larger and heavier boiler could be used without exceeding the limitations as to total weight imposed by the permanent way. Even at that the weight on the driving wheels is greater than many roads could stand. It should be understood that the difference between the static and dynamic weight of an engine may be sufficiently great to wreck a track in the construction of which due allowance has not been made for such variations. The Pennsylvania permanent way is strong enough to stand this punishment, and so the new engines roar along in perfect safety.

The weight of this type, without tender, is 240,000 pounds, of which over 133,000 is on the drivers. The cylinders are 23½ x 26 inches and the boiler is 78½ inches in diameter at the first ring.

Thus far, no attempt has been made to ascertain how fast a locomotive of this class can travel. Even the most daring of the runners have not tried to investigate this point, although it is known that such engines have been permitted to exceed 80 miles per hour. It seems likely, however, that they could attain 90 miles per hour—perhaps more.



At the Right: The Third Atlantic Type Locomotive Being Tested on the Testing Machine.

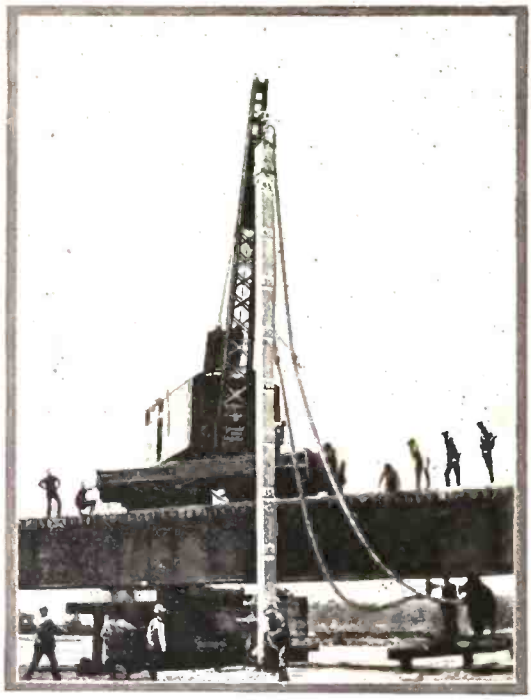
Below: The Same Locomotive After Being Equipped with New Trailing Truck and a Superheater.

Above: Atlantic Type Locomotive Fitted with Rotary Valves.

At the Left: The Present Day E-6-S Type Engine of the Pennsylvania.

FISHNETS PROTECT ROOFS

The thrifty fishermen who inhabit the coasts of England have discovered a new use for their old fishnets. During the heavy gales which blow in from the Atlantic during the winter season the fishermen are in constant fear of their straw-thatched roofs being torn away. To counteract the disastrous effects of the wind old fishnets are thrown over the roofs and their ends made fast to the stout poles which project from the eaves of the houses. As the net dries it shrinks, and the roof is held down securely.



The Many Difficulties of Pile-Driving Have Been Eliminated in This New Pile Which Bores Its Own Hole.

DRIVING A PILE WITH WATER

The difficulty of driving concrete piles into the ground with the ordinary pile driver has been eliminated in a concrete pile recently invented, which is driven by boring its own hole with a stream of water forcibly ejected at the point. An iron pipe forms the core of the pile, and water is forced through at high pressure, eroding the earth as the pile proceeds. Sand and earth are dissolved and rocks are washed away. The water pressure is 250 pounds.

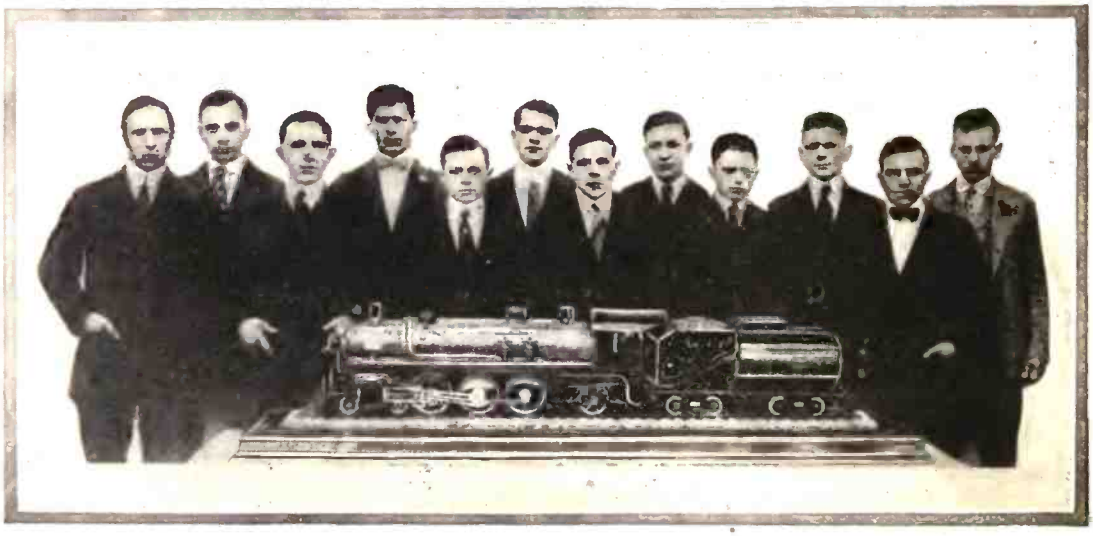
NEWTON'S GRAVITY THEORY UPSET

A California professor has made the statement that Newton's law of gravity is incorrect. After years of experiment he is now able to prove conclusively, he says, that gravitation is transmitted with the velocity of light.

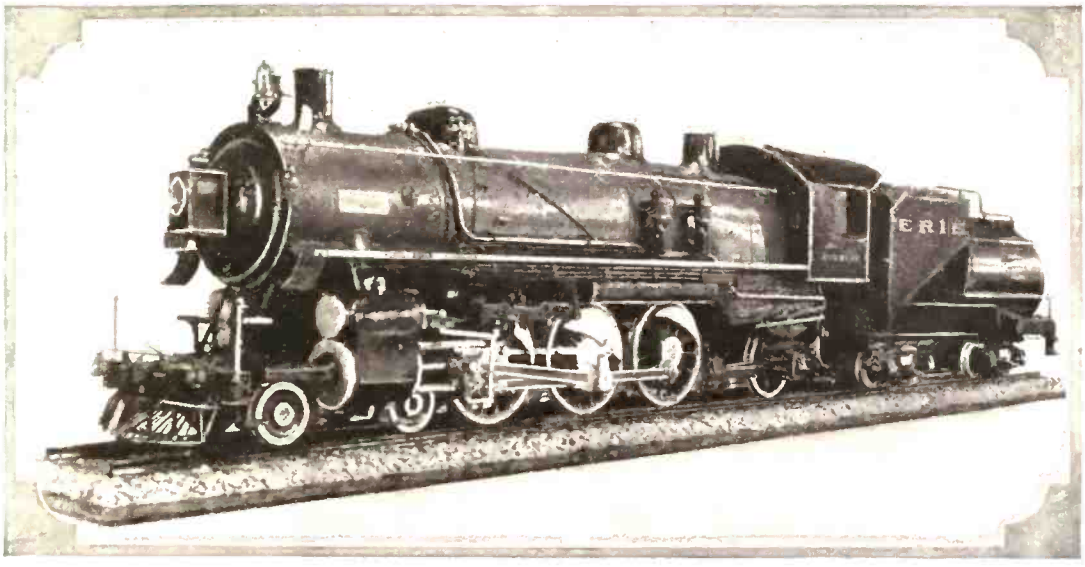
Whether or not this professor's claims are well founded, his theory is at least very interesting. Gravitation comes to the earth from the sun, according to his hypothesis, and reaches here in eight minutes.

MODEL LOCOMOTIVE BUILT BY APPRENTICES

In an effort to determine the ability of apprentice boys who were being given engine shop instruction, an eastern railroad recently put to the boys the task of building a small locomotive and a workshop. The apprentices went to work with enthusiasm. Amateur



Apprentices of the Erie Railroad Shops and the Model Locomotive Which They Constructed.



A Near View of the Model, Which Measures Fifty-seven Inches in Length and is Complete to the Minutest Detail.

draughtsmen among them quickly designed the model shop. Within a few days, both shop and locomotive were well under way. The locomotive was completed in two hundred working days, and it is perfect in every detail. It was built on a one-sixteenth scale, after the Pacific Type Class "K-4," and measures fifty-seven inches in length. It is now on exhibition in a Broadway ticket office of the Erie Railroad.

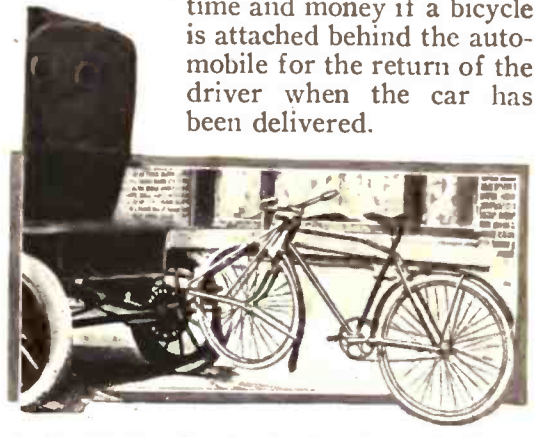
PECULIAR KIND OF GLASSES USED BY COMMANDERS OF SUBMARINES

Peculiar glasses are now being used by the commanders of German submarines. These are known as double vision glasses or bifocals and are especially adapted for use under the sea. In the undersea warfare they are very important, for they allow the officers in charge to observe hostile ships through the periscope and then consult their charts or maps without removing their glasses. The time saved in this way is very important when a torpedo is to be fired or when the submarine must make a hasty getaway. These glasses are made from a single piece of perfect ophthalmic glass, combining both distance and reading portions in one lense.

It is largely due to small details such as the glasses just described that the German submarines have proven so efficient in their deadly work.

MOTOR LEADS BICYCLE

Garage owners who make a practice of delivering their patron's cars can save time and money if a bicycle is attached behind the automobile for the return of the driver when the car has been delivered.



A Special Clamping Device Permits of Trailing a Bicycle in Back of an Automobile.

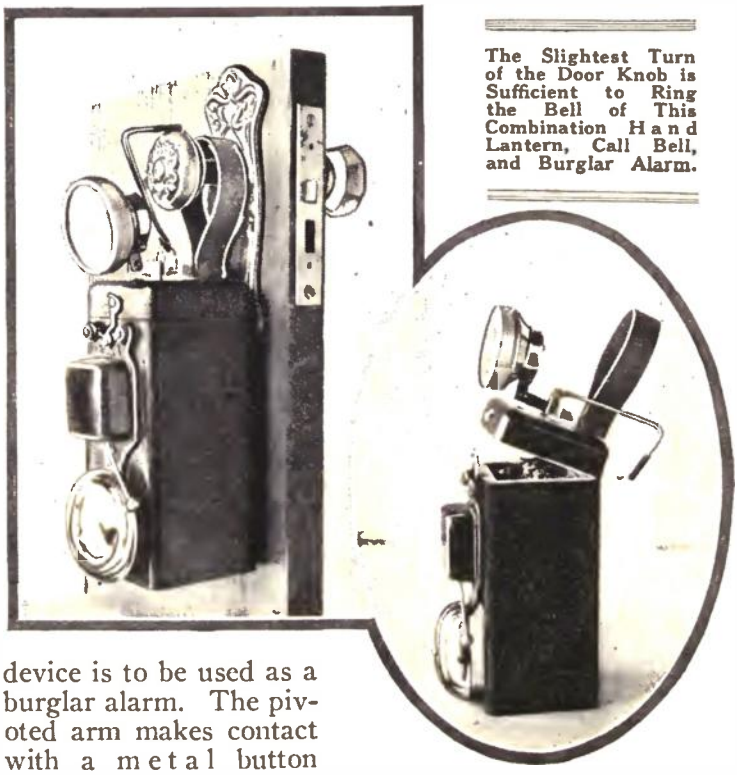
The clamp by which the bicycle is attached to the automobile consists of a pair of rubber-faced hardwood jaws and

a bolt and nut for adjustments. It is held in place before the front wheel of the bicycle by two pairs of rods, one pair being fastened to the stem of the handlebars, the other to the ends of the front axle.

NOVEL BURGLAR ALARM DEVICE AND HAND LANTERN

The combination of a hand lantern, call bell, photographic ruby lamp and burglar alarm in a single device and all so arranged that in no case is efficiency sacrificed, affords an interesting example of inventive genius. In the illustration may be seen the outfit which combines these many features in a perfectly practicable manner.

On the top of the wooden container is a pivoted arm carrying at one extremity an electric lamp in a reflector and at the other end a leather strap which is slipped over the door knob when the device is to be used as a burglar alarm. The pivoted arm makes contact with a metal button when the outfit is suspended from the strap, and this contact serves to light the lamp and ring the bell. The reader will note that when the device is set the outfit is suspended from a bent rod of metal which is tipped with rubber in order that it may rest on the door knob. The slightest turn of the knob, should any one try the door, would serve to let the rod slip from the knob, thus throwing the weight of the outfit on the strap which, of course, closes the circuit. The lamp may be used independently of the bell if so desired and the reflector is arranged on a swivel, so that the light may be directed up or down as desired, without moving the entire equipment.



The Slightest Turn of the Door Knob is Sufficient to Ring the Bell of This Combination Hand Lantern, Call Bell, and Burglar Alarm.

In replacing an exhausted battery, there are no wires to connect. A spring contact within the box makes connection the moment the cover of the case is closed.

PULVERIZED COAL

With the commercial advent of pulverized coal, many engineers, who made preliminary tests with the substance, drew conclusions that it would never become an important factor in power development. At that time the remarkable ability of the internal combustion engine became known, and coal-power engines, as a whole, were given but a short period of life. Investigations have proved, however, that coal as a power factor will live for many years to come, at least in this country, as the United States contains more than half the available coal deposits in the world.

Pulverized coal has one decided advantage: It burns almost smokeless. Injecting the pulverized material into the furnace is accomplished by much simpler means, also, than with lump coal. Boiler repairs are less frequent in factories using pulverized coal than those where lump coal is employed.

SOME INTERESTING FACTS ABOUT LARGE SHELLS

One defect of large steel shells is their liability to spontaneous fracture due to severe internal strains when the steel is cooling. Modern practice in ammunition factories usually forestalls these accidents.

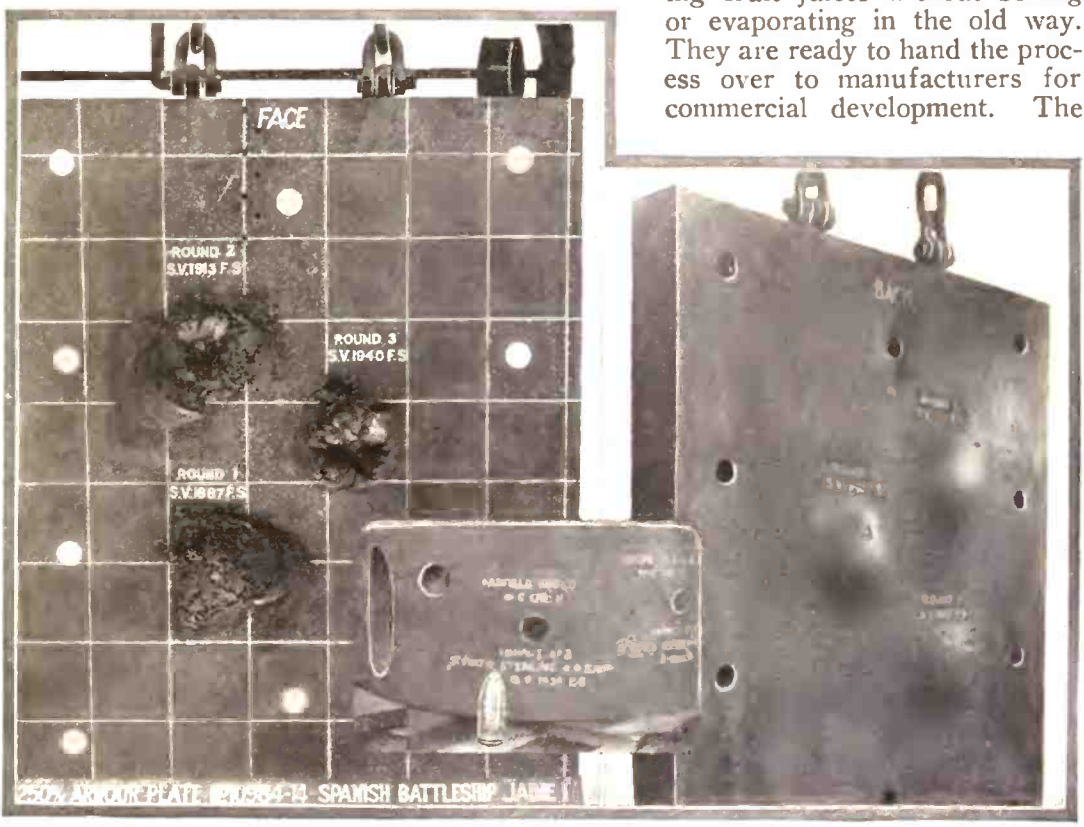
Interesting results have been secured in the Hadfield plant in England during tests of shells upon armor plate. On one occasion, a 14-inch shell, weighing nearly 1,700 pounds, perforated a 12-inch steel plate at the low velocity of 1,490 feet per second. The shell was recovered unbroken. Another shot of the same calibre was recovered, unbroken, 900 yards in front of the target. It had rebounded.

The English claim that the capped projectile has a much higher efficiency than the uncapped variety. The cap, it is said, prevents tumbling.

CONCENTRATING FRUIT JUICES BY FREEZING

Scientists of the United States Department of Agriculture have recently developed a novel process for concentrating fruit juices without boiling or evaporating in the old way. They are ready to hand the process over to manufacturers for commercial development. The products will probably be put on the market this summer.

Grape juice, or cider, for that matter, is frozen and the ice cracked into pieces the size of walnuts. These are then whirled at high velocity in a centrifugal machine such as is used in separating molasses from sugar crystals in sugar making. The syrupy portion of the grape juice is thrown out of the ice and is collected in the receiving chamber of the centrifugal. Practically nothing but frozen water is left behind. The whole separation is based on the fact that when a solution freezes the pure solvent, water in this case, tends to separate in crystals. By removing these crystals the remaining solution is concentrated.



The Effect of Modern Shells on Steel Armor Plates: At the Left is an Armor Plate of the Spanish Battleship "Jaime I," Which Was Damaged by Fourteen-Inch Shells.

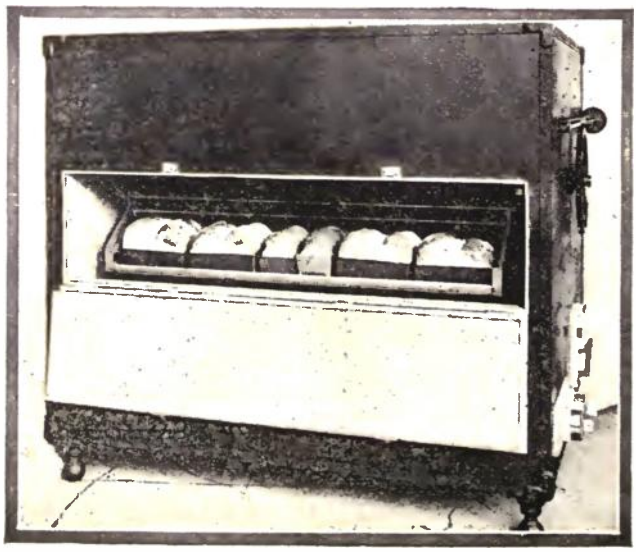
This method quickly concentrates a gallon of grape juice to one quart of syrup without impairing the flavor. To be exact, the flavor is improved because of the fact that part of the cream of tartar which gives acidity to the grape juice is left in the ice. Some juices are too acid, and this treatment improves the juice. This is notably true of the Concord grape, and in the case of the Ives grape the "rough" taste is removed.

Aside from convenience in handling, this rich syrup will save freight rates. It will be popular as a syrup for ice-cream sundaes and as a flavoring syrup in cooking. Of course, it is heated to the sterilizing point before bottling.

BAKING BREAD BY ELECTRICITY

An electric bake oven has been built for an enterprising Minneapolis baker. One of the ovens was designed for baking bread, biscuits and cake for demonstrating flour, baking powder and yeast. The current consumption is 2,400 watts for the first 45 minutes, and thereafter about 300-600 watts. The temperature is 400 to 550 degrees F.

The baking oven has two-inch heat retaining walls with highly polished steel covering. The framework is of angle iron and the corners of bronze. The metal fittings are nickel plated.



An Electric Oven Designed by a Minneapolis Baker for Baking Bread, Biscuits and Cake.

CYCLOMETER MEASURES WORK OF HARVESTER

A resourceful ranch owner in Washington measures the number of miles traveled by a harvesting machine and the number of acres of grain that it cuts by using a bicycle wheel on which a cyclometer is mounted. The bicycle wheel is turned by making contact with the top of the large wheel of the harvester. When a sixteen and one-half foot swath has been cut for a distance of one-half mile, one acre has been harvested.

A Bicycle Wheel and Cyclometer Serve to Measure the Harvester's Work.

WOODEN FLAGSTAFF OVER TWO HUNDRED FEET HIGH

"The longest flagstaff produced in British Columbia will be forwarded soon to Great Britain as a present from the provincial government, and will be placed in the Kew Botanical Gardens, a few miles out from London," says a report by R. E. Mansfield, United States Consul-General at Vancouver, B. C. "The tree from which it was made was a perfect specimen of fir pine, and the staff, which is 216 feet in length, is without flaw or defect.

"In its original state the stick was 5 feet in diameter at the butt and 14 inches in diameter at the top, and perfectly straight. Dressed into shape, the staff has a diameter of 32 inches square at the butt for a distance of 16 feet. For the next 100 feet it is octagonal in shape, and for the last 100 feet it is round. The upper 200 feet has a gentle taper.

Establishing a New Gradient Record

By F. J. Dickie

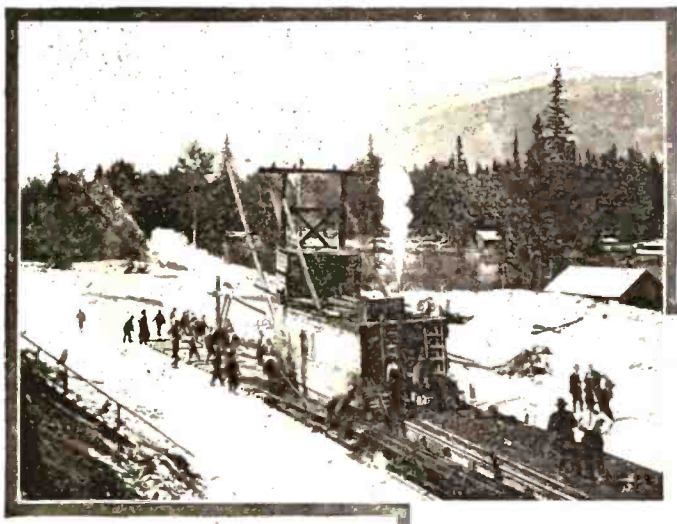
EVER since railroad construction became general on the North American continent one of the most important matters to be considered when building has been the obtaining of a minimum gradient. Particularly has this been so in the case of transcontinental lines, where long freight hauls on heavy grades eat enormously into the profit.

When the first coast to coast train was run recently over the Grand Trunk Pacific, the second transcontinental railway to be completed across Canada, it marked the culmination of eleven years of construction endeavor, the chief feature of which was the obtaining of a new and the lowest gradient on the North American continent.

In the obtaining of this the engineers had to find the pass across the Rockies which offered the minimum altitude. Beginning in 1903 exhaustive explorations of the Rockies were made for a period of three years. During this time four main passes, the Peace River, Pine River, Wapiti and Yellowhead were thoroughly gone over as well as half a dozen smaller intermediate ones. At the end of this time the Yellowhead Pass route was selected.

Here a maximum gradient of four-tenths of one per cent. was obtained, a rise of twenty-one feet to the mile. Considering the mountainous country passed through—one of the roughest in the world, where sheer cliffs hundreds of feet high had to be blasted into in order to provide a foothold for the steel—the obtaining of this grade against eastbound traffic from the Pacific Coast to Edmonton, a distance of nine hundred miles, ranks among the world's greatest engineering feats. Five-tenths of one per cent., or a rise of twenty-six feet to the mile, was obtained against westbound traffic.

Only one summit was encountered in crossing the mountains at a maximum



Above: A Track-Lay'ng Machine Working Near the Summit of Yellowhead. In 1913 and 1914 This Machine Averaged Nearly Two Miles of Track Per Day. At the Right: Banks Along the Skeena River, British Columbia, Through Which the Line Was Built.

Supplies and Building Materials Were Shipped in Flat-Bottomed Boats While Building the Road on the Banks of the Fraser River.

altitude of 3,712 feet. These conditions, remarkable from an engineering standpoint, exist in this northern locality because the ranges of mountains along the western portion of the American continent reach their maximum altitude in the region of the 40th parallel of latitude, from which they gradually recede to the north, where the Yellowhead Pass runs through them in the region of the 54th parallel. Probably the best illustration of the varying physical conditions as met by various railroads can be shown by the following table:

Railway.	Highest summit.	Max. grade in feet per mile. Eastb.	Westb.	Total ascent in feet overcome. Eastbound.	Westbound.
Grand Trunk Pacific	3,712	21	26	6,990	6,890
Canadian Pacific	5,299	116	116	23,106	23,051
Great Northern	5,202	116	116	12,861	12,165
Northern Pacific	5,569	116	116	17,830	17,137
Southern Pacific	8,247	116	105	18,575	17,552
Western Pacific	5,712	52.8	52.8	9,385	5,076
Santa Fe System	7,510	175	185	34,003	34,506

GROWTH OF THE LIQUID AIR INDUSTRY

Liquid air is no longer a mere curiosity but a commercial product of great value. Most of it is used in making pure oxygen and in this fluid it has practically driven the older Brim's barium peroxide process to the wall. In fact, the sole competitor is the electrolysis of water, which is a rival only when the other product, hydrogen, has a ready market. The hardening or hydrogenation of liquid fats provides a limited market for this hydrogen.

The great demand for oxygen is for the oxy-acetylene blowpipe for welding and cutting metals, Germany, France and Great Britain using 300,000,000 cubic feet yearly. The possibility of another great use for oxygen was demonstrated in a Belgian steel plant just before the war. Enriching the air blast in a pig iron furnace with 21 per cent. oxygen saved 100 pounds of coke to every ton of iron and increased the output of the furnace 10 or 15 per cent. Liquid oxygen has also been used successfully in explosives.

The evaporization of liquid air separates the nitrogen and oxygen because of their different boiling points. The problem of a sale for the nitrogen has been solved. When almost pure nitrogen is passed over calcium carbide heated to 800° C., the nitrogenous fertilizer, calcium cyanamide, is formed. This is already a large industry. Nitrogen can be produced at ten or twelve cents per kilogram.

A by-product of the liquid air industry is the rare gas, neon.

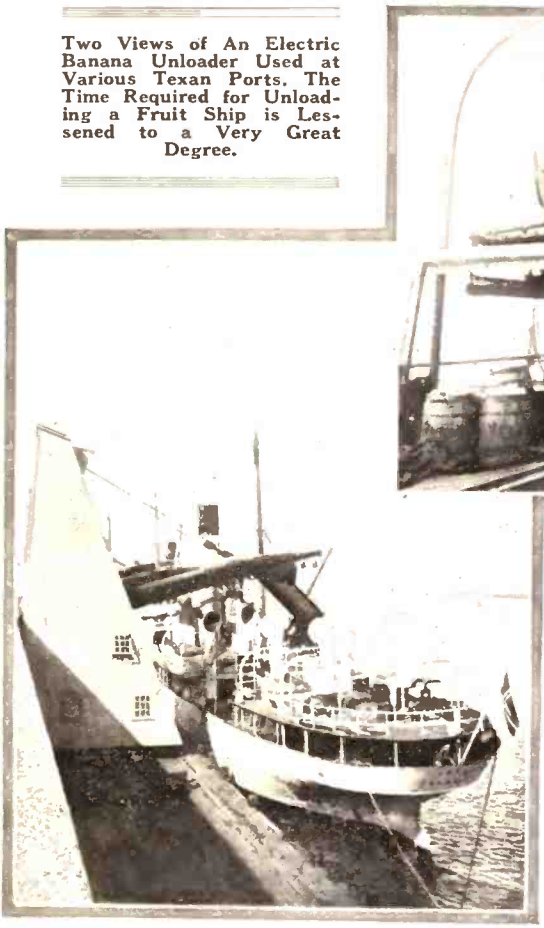
ICELAND SPAR AND LIGHT

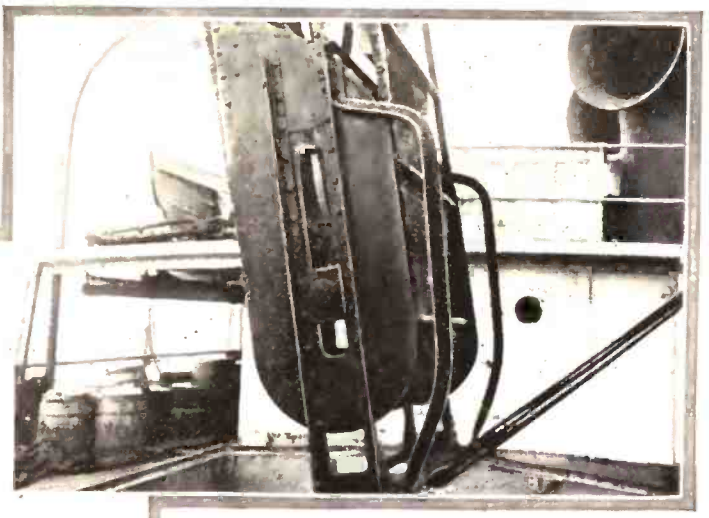
With reference to the general subject of light transmission and pressure, the Museum of Natural History in New York maintains a room devoted to the exhibition of gems and precious stones, which room contains a plate of Iceland spar—crystallized carbonate of lime—placed just over an incandescent electric lamp. Looking down at the lamp through the spar plate, two lamps are seen burn-

ing side by side. The explanation is that the crystals of the Iceland spar are so formed that the ether contents of the plate are of two distinct densities. Thus the light attempts to penetrate either of two different elasticities. The result is the doubling of the image of the bulb as seen through the spar.

ELECTRICITY UNLOADS BANANAS

In Texas, bananas are unloaded by electricity. When the bananas arrive from tropical ports it is necessary that they reach their northern destinations as promptly as possible, to prevent them from rotting. Electric unloaders are accordingly used, as they cut to an infinitesimal fraction the time formerly required by the picturesque man with a wheelbarrow.





Two Views of An Electric Banana Unloader Used at Various Texan Ports. The Time Required for Unloading a Fruit Ship is Lessened to a Very Great Degree.

SLOW SAFE-BREAKING

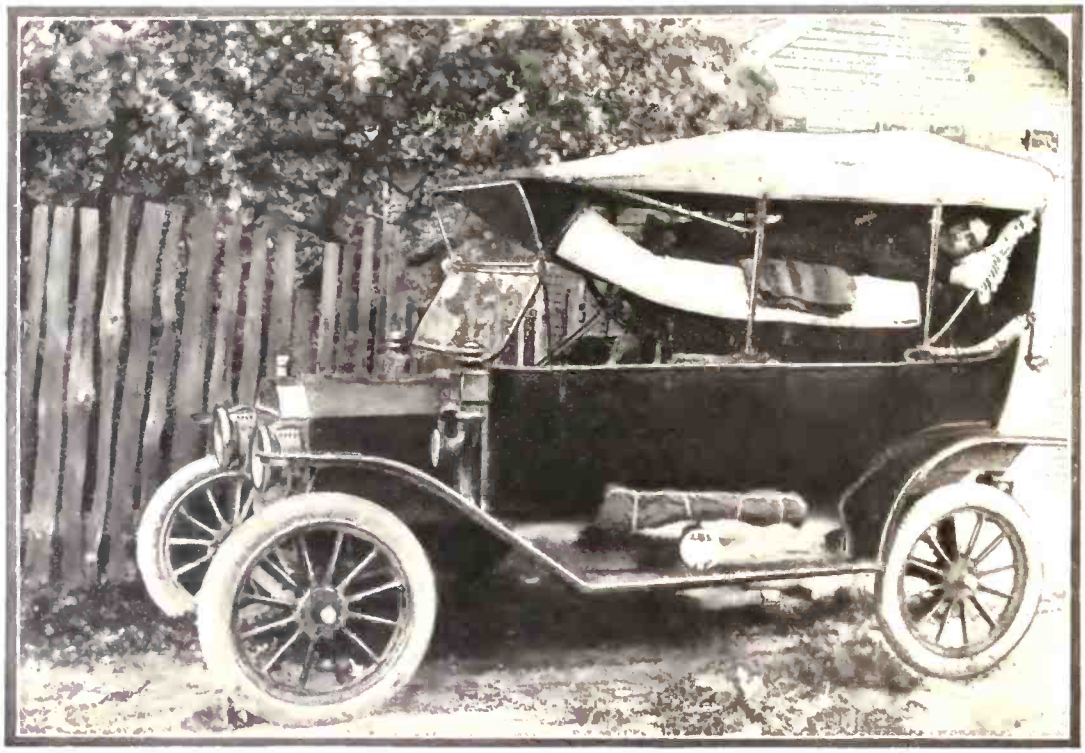
The famous firm of Krupps over in Essen, Germany, make more than "Jack Johnsons" and "Busy Berthas." They have now turned out a brand new safe which they guarantee to be burglar-proof. While this is not strictly the truth, inasmuch as burglars could break into it, the conditions necessary for getting into this safe are such that it is doubtful if one of these safes could ever be successfully burglarized.

The reason is simple enough, for while burglars can get into it with modern appliances, it would necessitate 50,200 pounds of liquid and six hours' work to make a hole large enough to permit the entrance of a human hand!

At a melting test, steel plates with a surface of 11.8 by 11.8 inches and a thickness of 1.57 inches were used, which, in the separate testings, were subjected for a different length of time to an oxy-acetylene flame. At one of these tests a hole of 1.968 inches diameter and 1.377 inches depth was burned into the plate, but for this not less than 476 gallons of acetylene and 534 gallons of oxygen were used, and the time consumed was one and one-quarter hours. In order to produce a hole large enough to admit the hand, 2,642 gallons of oxygen and 2,378 gallons of acetylene would be needed, while the performance of this work would require six hours. Conse-

quently it is clear that burglars will never succeed in melting open a safe made from the new steel, because, aside from the great outlay of time needed for this, they could not bring with them the great quantities of gas, since four steel cans weighing 154 pounds apiece would be required.

The steel plates are very hard and cannot be bored, consequently the holes for the screws and rivets must be made at the start. The new material does not lose its hardness by annealing and by reason of its tenacity can be bent to a certain degree.



No Longer Is It Necessary for Motorists to Put Up Over Night at a Hotel or Inn for a Comfortable Rest. A Washington State Inventor Finds His Automobile Bed Just as Comfortable—and Less Expensive.

CAMPING OUT IN AN AUTO

When he goes on long auto trips a Washington state inventor "camps out" in a bed swung from the top of his automobile. The bed is not merely a hammock, but utilizes the seat cushions as well. Rods, fastened over the backs of the seats and extending from the top of one seat back to the top of the other seat back, support the cushions which are taken from the seats directly beneath the bed. In this manner there is improvised a real spring bed which is roomy enough for two people. Except for the slight inconvenience of climbing into this new kind of an "upper berth," this form of camping out while on long trips involves no discomfort. The bed can be made up in from three to five minutes and when taken down is folded into a compact bundle that does not take up much room in the automobile.

A NATURAL HEATING PLANT

It is now said that hot water provides the perfect heat. The stoker of the heating plant, however, may now and then entertain the idea that there is as yet no universally perfect way of making the water hot. It is of interest to know that in at least one place on the earth Nature has been so lavishly kind as to provide and run, by her own efforts and without cost to the user, a hot water plant, and that

the inhabitants of that spot have very gladly accepted the service.

There is at Grenelle, Paris, an artesian well which provides a plentiful and constant flow of water, the temperature of which stands at something near 82 degrees F. This is a sufficiently high temperature to enable the city to make the wise and unusual use of the water above mentioned. Therefore, instead of having individual or municipal heating plants from which steam or hot water would be supplied to the various buildings or parts of the same building, the hot-flowing well is used as a central heating plant. From it pipes are run over the city, and the hot water so generously provided by the earth is distributed through them just as from the usual form of heating plant. The result is so sufficiently satisfactory that the custom bids fair to remain.

There are a number of artesian wells in various parts of the earth which provide water running to as high a temperature as eighty degrees. The temperature of the water supplied is apt to be governed by the depth of the well, the rule being that the deeper a well is bored the higher will be the temperature of its flow. The average temperature of the water flowing from these wells is not high, though it is considerably higher than that of water obtained near the surface.

The name artesian really relates to the depth of the well rather than to the taste or mineral qualities of the water obtained. The name artesian well was originally adopted as meaning a deep well. Therefore, it follows that there is really no such thing as artesian water, any kind of water being natural to an artesian well just as to any other well less deep.

GERMAN CRANE AT PANAMA CANAL

The floating crane *Hercules,* of German make, has recently been placed in commission at the Panama Canal. The *Hercules* has a lifting power of 300 tons. Some idea can be gained of the enormity of this crane by comparing its size with that of the man standing on the dock.

This Gigantic Crane of German Manufacture is Now Being Used for Mounting Guns in the Canal Zone.

The *Hercules* has been employed for mounting guns at Toro Point forts and raising machinery of various sorts which sank during a storm within the east breakwater at Coco Solo recently.

AMERICAN SUBMARINES TO UNDERTAKE LONG TRIP

In order to test the endurance capabilities of our submarines, it is announced that during the month of September the American submarines *K*-3, *K*-4, *K*-7 and *K*-8 will be sent under their own power from San Francisco to Honolulu. The journey will exceed 2,200 miles, and it is to be attempted without stops of any kind. Although there will be a convoy of submarine tenders accompanying the under-water craft, these are only to give aid in case of an emergency.

Minting in Miniature

By Oscar Lewis

IN one corner of the great exhibit palace sheltering the Departments of Mines and Metallurgy at the Panama-Pacific Exposition, there is to be found one of the most interesting of the United States Government exhibits. It is part of the display of the Treasury Department and consists of a miniature mint that is complete in every detail. There one may see and have explained to him each successive step in the minting of the Government coins, from the time that the bars of impure metal are refined by the new electrolytic process until the shining new coins pass the final inspection and are ready to go out into circulation.

To one who has never before witnessed the process, the various steps that are gone through in the minting of a coin are interesting. The metal, when it reaches the mint, is in an impure state and after being refined by means of the electric current in the new "electrolytic," as the machine is called, the pure metal is melted in an electric furnace and mixed with its alloy. Both gold and silver in their pure state are very soft, and a small amount of some harder metal must be added to them so that the completed coin will be hard enough to resist the wear that it will be subjected to when placed in circulation.

After the alloy has been added the crucible is tilted and the molten metal poured into moulds. After a moment these moulds are removed and the metal bar is cooled before being run through the rolling machine. The size of the ingots into which the metal is cast depends upon the denomination of the coins to be made from them. For double eagles, the largest gold piece that the Government mints, the ingot is slightly over a foot long by one and one-half inches wide and a half inch thick, and has a valuation of $1,488.

After passing several times through the rolling machines the bars are greatly lengthened, coming out finally over four feet long, while in thickness they have been reduced to seven-sixteenths of an inch—slightly thicker than the finished coin.

The strips of metal are now ready for delivery to the next machine where another important step in its transition from the ingot to the coin takes place. This is the automatic cutting press that grasps the strips as they are fed into the machine and draws them under a steel punch which, at the rate of eighty a minute, stamps out the round coin blanks or "plankets," as they are called. These plankets are slightly smaller and thicker than the completed coins. The perforated strips are sent back to be melted over again, while the coin blanks are inspected and weighed and then passed on to the "upsetting machine" for the next process.

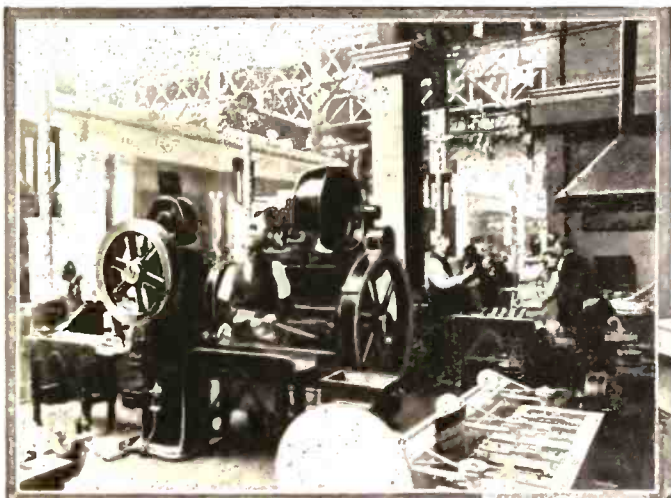
In the upsetting machine the blanks are caught between two high pressure stamps which raise, or "upset," the outer protecting ridge on the edges of the coin, the purpose of which is to make the completed coins "stack" properly, and also to protect the impression on the face from wear.

The blanks are now heated, cleaned and dried—each process being carried on in a special machine—and are once more inspected before the actual striking of the impression on the coin takes place. The coining press is large and massive in construction. The oval-shaped frame is

made of solid steel and weighs several tons, for the striking of the coins is a very delicate task and must be done upon a base that is absolutely stable and rigid.

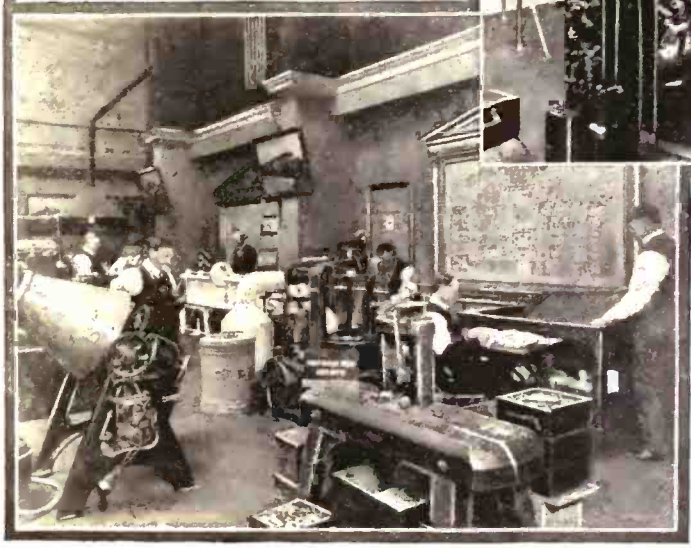
As is the case with the other machines in the miniature mint, the stamping press is automatic and runs at high speed. The blanks are put into a vertical tube at one end of the press and fed automatically to the lower die which remains stationary while the upper one descends upon it, catching the blank between the two dies as they come together. The pressure exerted amounts to 160 tons, which stamps at the same time the impressions on the two faces and the letters or etchings on the outer edge. An instant later the completed coin drops into a box below. The machine does its work at the rate of about 100 coins a minute.

After undergoing the final inspection, the new coins are weighed and then counted by being placed on an ingenious counting board which is of a certain calculated size, so that when the coins are spread evenly upon it in a single layer, the number of pieces is instantly known. Much time is thus saved, since it is unnecessary to count each coin individually. This completes the process, for the



The Coining Press in Which Blank Coins Are Fed to the Dies and the Impression Stamped.

The White Apparatus in the Foreground is the Electrolytic, or Metal Refiner. At the Extreme Right is the Electric Furnace. The Large Machine in the Center is the Rolling Mill.



At the Left May Be Seen a Machine for Polishing the Coins. The Man at the Extreme Right is Operating a Counting Board. In the Foreground is the First Coining Press Used by the American Government.

coins are now ready to be placed in circulation.

Although the coins minted at the Exposition model mint are not actual money but silver and copper souvenirs commemorating the completion of the Canal, yet they are made with the same care, methods and machinery as are found in five Government mints.

Besides the mint exhibit itself there is a supplementary display showing a complete and very valuable collection of all the coins issued at various times from the mints. The variety of these coins and the widely different designs in use during the various periods of the nation's history, make the exhibit an interesting one. A full set of the many medals that from time to time are awarded by Congress or other branches of the Government is also shown. These medals, which range in composition from bronze to gold, are all made at the several Government mints.

Another relic of rather unique interest is a crude iron hand press which was the first implement used in the coining of American currency. This press was in operation at Philadelphia for some years and with it were struck coins of various denominations until in 1793 it was superseded by more efficient equipment.

NEW SYSTEM OF LAWN SPRINKLING

A new system of lawn sprinkling in the Los Angeles parks has been installed and has already proven a great time and money saver. Water pipes are buried in the new lawns, connecting with sprinklers spaced a few feet apart so that when the water is turned on the whole lawn can be watered at one time. In this way the watering for a very large park can be attended to by one man. It has the further advantage of sprinkling a lawn more evenly than is possible by older methods.

A System of Lawn Spraying Which is Permanent: The Water is Fed to the Nozzles Through Pipes Buried Beneath the Grass.

MINUTE TELEPHONE RECEIVER

The thermaphone, an improved vest pocket edition of the telephone, is the recent invention of P. de Lange, of Holland. The United States Consul at Amsterdam, Mr. D. I. Murphy, used the contrivance and vouches for the inventor's claims.

Both receiver and transmitter can be carried in a vest pocket; in fact, they are no larger than a watch. The cost of manufacture is estimated at about thirty cents. In the thermaphone there are no magnets and diaphragm as in the telephone, but instead there is a loop of very fine platinum wire within a small aluminum cover pierced with minute holes. Electric currents passing through the wire cause changes in temperature alternating from hot to cold with great rapidity. The resulting expansion and contraction of the surrounding air becomes evident as sound.

The great advantage of the thermaphone, aside from compactness and cheapness, is its wonderful clearness of enunciation. There is no confusion of vowel sounds, letters or figures. The receiver is not more than an inch long, and no thicker than a lead pencil, so that it may be placed in the ear. This permits the use of a double receiver while the hands are left free to take notes.

POPULAR SCIENCE MONTHLY

and

THE WORLD'S ADVANCE

Good News to our Readers:

The WORLD'S ADVANCE has purchased the Popular Science Monthly, a publication of long established reputation, and beginning with the October number these two publications will be consolidated into a bigger and better magazine.

In science, in invention, in mechanics, in electricity, the greater magazine will continue to give its readers Truth, which is ever stranger than fiction, and facts which are more absorbingly interesting than fiction.

Never before in the history of our country have inventions, mechanics, electricity and all the subjects that come under the broad head of Science been of such vital interest, of such usefulness, of such importance to our country itself as right now.

More pictures, better pictures, more news of THE WORLD'S ADVANCE, more pages of reading matter than ever before will mark the future issues of this magazine.

THE EDITOR.

A WELL A MILE AND A HALF DEEP

The deepest well in the world is nearly a mile and a half deep—7,350 feet. It is in Upper Silesia, in the coal fields, and was sunk by a diamond drill. According to the United States Geological Survey, there is now being drilled in this country a well that may go deeper. It is now 7,174 feet deep, and is four miles northwest of McDonald, Pa., and about 15 miles west of Pittsburgh.

This well is being drilled until it reaches Medina standstone, which contains oil and gas. In the upper parts of the well a little oil and gas were found, and later rock salt and salt water. At a depth of 6,775 feet a temperature of 145.8 degrees Fahrenheit was met. Wells 5,000 feet deep are common in Pennsylvania.

A PINE TREE PATRIOT

Mr. Richard J. Donovan leads in a new and much needed type of patriotism —reforesting the hills of America. In the past three or four years he has planted nearly 400,000 pine trees at Pine Park in the Adirondacks. Mr. Donovan made a personal study of reforesting as carried on in Switzerland and Germany and secured expert advice from the German school of forestry and state officials. As an evidence of care in the selection of proper varieties for the soil and climate and care in planting is the fact that ninety-five per cent. of all trees planted are thriving.

Conditions in the Adirondacks, according to the school of forestry, are ideal for tree planting, especially for pine and spruce and other conifers. The cost of an acre will vary from two to seven dollars depending on the age of the trees, distance apart, soil conditions and efficiency of the tree planters.

Small trees can be purchased from the state conservation commission for from one and a half to four dollars a thousand. They are usually planted at the age of from two to four years. Seedlings cost only a dollar and a half a thousand and are easy to plant and more apt to live.

COBALT TO REPLACE NICKEL IN PLATING

The investigations of Kalmus-Harper-Savell show clearly an unexpected superiority of cobalt plating over nickel plating. The demand for cobalt has not been great and its use in plating is much to be desired. Solutions suitable for commercial practise are given below.

SOLUTION A.

Cobalt ammonium sulphate with its water of crystallization, 200 grams to the liter of water, equivalent to 145 grams of the anhydrous salt to the liter. Specific gravity is 1.053 at 15° C.

SOLUTION B.

Cobalt sulphate	312 grams
Sodium chloride	19.6 grams
Boric acid	Nearly saturated
Water	One liter

Specific gravity is 1.25 at 15° C.

Cobalt plating from these solutions on brass, iron, steel, copper, tin, lead and other metals is firm, adherent, uniform and much harder than nickel plate. These surfaces may be buffed to an excellent finish of high luster and brilliant white. The electric conductivity of these solutions is higher than that of standard nickel solutions so that cobalt may be deposited at a lower voltage for a given speed.

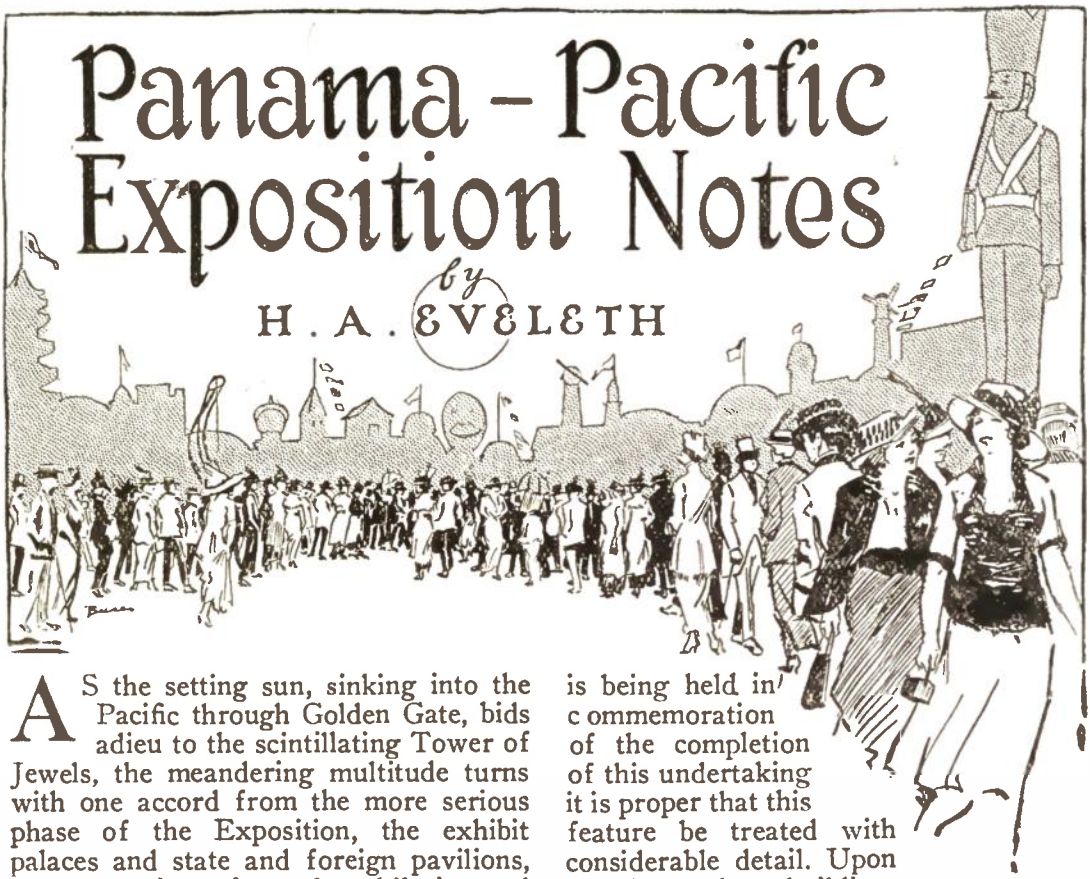
Solution *A* may be plated four times as fast as the usual nickel solutions. Solution *B*, fifteen times as fast. Cobalt deposits remarkably well in indentations of the objects plated. The high speed of deposit does not require agitation of the solutions. Since the cobalt plate is so much harder than nickel, one-fourth the weight gives the same protection as nickel. Ornamental work not subject to great wear requires only one minute deposit and fifteen minute deposits withstand great friction or atmospheric attack.

Cobalt plated skates showed far greater resistance to corrosion, wear and scratching than similar nickel plated skates. Similar results were obtained with automobile parts.

Panama-Pacific Exposition Notes

by

H. A. EVELETH

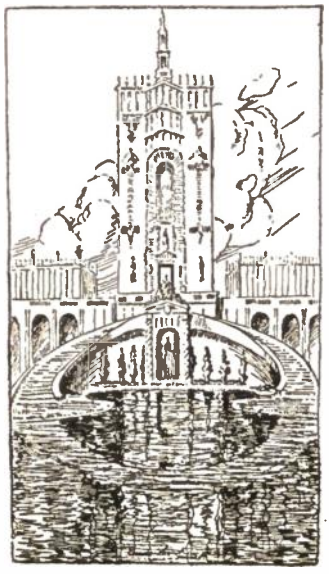


AS the setting sun, sinking into the Pacific through Golden Gate, bids adieu to the scintillating Tower of Jewels, the meandering multitude turns with one accord from the more serious phase of the Exposition, the exhibit palaces and state and foreign pavilions, to that region of carefree hilarity and fascination, known as the Zone. This district, sixty-five acres in area, is traversed by a three thousand foot road, named Amusement Street, on either side of which are located the ten million dollars' worth of amusement concessions which constitute the features of the Zone. Less than one hundred of the six thousand applications for concessions were accepted and those granted have been chosen with the most rigid selectiveness. Those admitted have conformed to a high rank of decorum, good taste and educational value, while on the other hand they have satisfied the requirements of effective fun-making and entertainment. Let us take a trip through the Zone, join the surging crowd and examine the alluring concessions which so earnestly solicit our patronage through the "spieler" with tin-horn and hullabaloo.

The Panama Canal concession is paramount among the educational attractions, and inasmuch as the Exposition is being held in commemoration of the completion of this undertaking it is proper that this feature be treated with considerable detail. Upon entering the building, wherein is located this concession, we seat ourselves upon a moving platform which is impelled by electric motors at a speed of 8½ inches per second, around the perimeter of the huge oval model of the Panama Canal and Canal Zone, which lies in a depression about 20 feet below us. A duplex telephone receiver is hanging on a hook in front of our chair and we remove it and place it over our ears that we may hear the phonographic lecture which describes the points of interest along the Canal. What a remarkable model this is! Every detail has been carried out to scale. Miniature ships travel through the locks, trains run along the tracks bordering the Canal, the illuminated buoys marking the channel flash in various colored lights, sparks leap about the miniature aerials of the radio-telegraph stations; and all this occurs without the aid of visible mechanism. The secret of this lies in the application of electromagnets. which are moved about on tracks placed

beneath the model and directly underneath the route to be taken by the working model above. At the locks the steamers drop their hawsers, tow lines are magically attached to them and miniature electric locomotives tow them through the locks.

In thirty-three minutes we have completed the trip about the 1,440 foot perimeter of the model and are invited to inspect the room wherein is located the mechanism for operating the attraction. The platform or revolving auditorium encircles the model and consists of 144 cars, each ten feet long, endlessly connected. It is obvious that the lecture being delivered to a certain section of the platform must be in conformity with the position of that section in regard to the model. Hence it is necessary to divide the perimeter of the model into sections, each of which shall have a definite lecture and be so arranged that this lecture will be delivered to that section of the platform which is passing above it. To accomplish this requires a complex system of electrical mechanism. The 144 cars are divided into forty-eight sections of three cars each, and forty-eight phonographs are employed to deliver the series of fifteen lectures which are given on each trip. Space does not permit a detailed explanation of how this is done, but it is sufficient to state that each person listens to a description of that portion of the model which is directly in front of him.



The Bowls of Joy next attract our attention. We seat ourselves in a little car, are told to "Hold on tight!" then are given a shove which sends our car into the bottom of bowl number one. A revolving arm pushes us along a spiral track running around the interior of the bowl; upon reaching the top we shoot across a bridge to the top of bowl number two, where with increasing speed our car rushes downward around the spiral track and out at the bottom. We alight and then grasp the nearest post until we are able to maintain our equilibrium.

The Submarine is a $250,000.00 concession of great merit. Here we enter what purports to be a steel model of a submarine. The interior is supposed to represent that of a real underwater craft; on our right is the torpedo tube and also the depth indicator, while on the left are a number of levers and electric switches. A glass window, located in the side of the ship in front of each person, enables us to view the wonders of submarine life. At last a gong sounds, the bilge-tanks are filled and our submarine is apparently gradually submerged. For fifteen minutes we cruise about and gaze upon the peculiarities of marine life. We pass the hulks of wrecked ships, treasures scattered about on the floor of the "ocean," coral formations and Davy Jones' Locker. The fact is, we have not been submerged at all, but view the various scenes through a sheet of water, with an apparent submersion effect. The "submarine" cruise over, we are taken in hand by a guide and conducted through a series of caves, grottos and labyrinths. We pass such grotesque places as the Cave of Winds, the Valley of Mists, and Neptune's Abode. At the Love Stone our party is halted for one minute in order that any young couple present may "make love." Finally, we play the part of Jonah and enter the gaping jaws of a huge "whale." However, our host does not cough us up, as was the custom in the olden days, and we are forced to find our way out through a most intricate series of winding passages.

L. A. Thompson is represented by several concessions. There are the Thompson Safety Racer and the Thompson Scenic Railway, the former being equipped with block signals which remove all danger of rear-end collisions.

Toyland Grown-Up is another Thompson concession and is one of the largest

features on the Zone. We enter the Giant's Kitchen and sit down to rest on the castor of a kitchen chair. A five-foot candle is burning on the top of a thirty-foot table, while the Giant's twenty-foot hatchet stands in the corner at our right. Passing on we come to Topsy-Turvey Village, where the walls and doors and windows of the buildings are all askew and look as if some great weight had been dropped upon them. At the Midget Theatre we are entertained by a group of talented little people whose height ranges from thirty to forty inches. They present a little three-act play which is very amusing and intensely interesting. At the Flea Circus we are fascinated by the actions of trained fleas which toss miniature balls, walk the tight-rope and haul little cars around. These Human Fleas, imported from Europe, are fed on the blood of their trainer and are kept in captivity by means of fine German-silver wires looped about their necks. Four of these fleas will haul a car weighing one ounce. "King," the educated horse, understands the English language and will obey commands given by persons in the audience. Then we may take a Boat Ride or a Burro Ride, pass over Cobweb Lake and finally view the Lady Doll who is "22 years old, 32 inches high, weighs 27 pounds and speaks seven languages."

Joe's Alligator Farm, comprising a collection of turtles, rattlesnakes, pelicans, sea-cows, and five thousand alligators and crocodiles, is the next attraction. Here the oldest alligator in captivity can be seen. Jumbo Joe is his name and he is 14½ feet long, 1,800 pounds in weight and, according to the "estimates of six scientists," is 1,947 years old.

Let us take a ride in the Aeroscope and obtain a birdseye view of the Zone from a height of several hundred feet. This structure, designed by Mr. J. B. Strauss, of Chicago, lifts passengers seated in a double-deck compartment, to a height of 265 feet, makes one revolution and then returns them to the ground. The mechanism operates on the principle of the bascule bridge, weighs 700 tons, is operated by a 220 h.p. electric motor and has a cement counter-balance, weighing 380 tons. The capacity of the compartment is 118 people and water ballast is taken on automatically if the compartment is not fully loaded. The trip takes ten minutes, three and one-half of which are required to bring the structure to the near vertical.

We now pass under the colossal image of Buddha and enter Japan Beautiful. Here we are treated to exhibitions of wrestling and jiu-jitsu given by champions brought from Japan. After patronizing the Monkey Show and the Mystic Cave we pause to let Baron Scotford execute our silhouettes. A Trip to Japan gives us a good idea, by means of panoramic scenery, of the charms of that country. Then last, but not least, are the scores of ingenious games of chance which tempt us to part with our nickels and dimes.

Of course we must visit the '49 Camp, for we are promised a "good run" for our "dough," and besides, it is a "real '49 Camp, just as it used ter be with not a detail lacking." So we enter therein, pass by the Jimetown Dance Hall and the Grizzly Bear Saloon, and stop at an enclosure where we witness such scenes as "The Hold-up of the Stage," "The Robbery of the Mails" and the "Hanging of Swede Sam." Passing on we come to another enclosure where, for a small sum of money, we are given a spade and pan and are told to dig for gold; and if we have good luck we are rewarded with a real gold nugget. At the Eldorado "Klub" we may read such notices as "Come on in the dog is tied," "Leave shooting irons with Red Mike," "A piece of the rope that hung Big Foot Walace" and "Any one caut picking up a cler'er will be find the drinks." The '49 Camp is a most interesting concession, albeit

it has been closed up once for being too realistic, but then, as the "spieler" says, "This ain't supposed ter be a place for Sunday School picnics."

Passing onward we come to Tehuantepec or the Mexican Village where we are entertained with Fandango dances, given by gayly clad señoritas who gracefully whirl and dip to the accompaniment of Torreblanca's Orchestra. The selections given by this orchestra, many of the members of which are graduates of musical conservatories of Mexico City, have a charm which is best portrayed by the repeated encores from the delighted audience. The concert over, we view works of art in the line of pottery, basket making, leather and needle work, wax, cloth and feather-card work; all of which is being done right before our eyes by native artisans imported, with great difficulty, from turbulent Mexico.

Then, too, we may visit the Hawaiian Village, where we are treated by Princess Lei Lokelaui and her followers to native songs and dances, accompanied by the soft twanging strains of the ukeleles. The swarthy, sinewy, scantily-clad occupants of the Samoan Village amuse us with their Siva Siva and Head Knife dances; and in a similar manner we are entertained by the dusky occupants of the palm-shaded, thatch-roofed, Australasian Village. In the Irish Village we may take a ride in the Jaunting Cars and visit numerous other attractions which are suggestive of the shamrock.

The Freaks and Curiosities are sure to interest us. Here we gaze upon the fat lady who tips the hay scales at 617 pounds; the armless lady and armless man, both of whom are able to do with their feet those things which the ordinary person does with his hands; the man with the exposed heart; the four-legged, two-armed Filipino girl and the "elephant-skinned boy."

We may visit the Grand Canyon of Arizona, a great scenic and most faithful production built under the direction of the Santa Fé Railroad. The trip is made on a moving platform and the artificial scenery is said to give the beholder a very accurate conception of the wonder and beauty of the real Grand Canyon. Here also we may see remarkable reproductions of Pueblo and Navajo Indian Villages. The occupants have been brought from New Mexico and Arizona, and it is intensely interesting to watch them shape pottery and weave blankets and baskets; in fact their every-day life is practically the same as it was several centuries ago.

The Union Pacific Yellowstone Park concession is another great scenic production. We may dine at the Old Faithful Inn and, from the spacious veranda, gaze down upon an immense relief map of the Yellowstone Park. In the distance are great artificial mountains and waterfalls, and now and then Old Faithful bursts into action.

The "Big Four" series of concessions comprising Creation, Dayton Flood, Evolution of the Dreadnaught, and the Battle of Gettysburg are masterful productions requiring manifold electrical and mechanical contrivances, and we are thrilled by the roar of battles and tumultuous storms.

The London to the South Pole attraction is another scenic and electrical masterpiece in which we follow Captain Scott and his brave party from the time they leave London in the good ship *Terra Nova,* to the time when Scott, dying alone in his tent in the frozen South, writes a farewell message to the world, saying: " . . . these crude notes and our dead bodies must tell the tale . . . "

The Universal Motion Picture Company's concession, Filmland, is combined with the 101 Ranch Show, and thus the latter, with its troupe of Indians and cowboys, enables the filming of a large variety of scenarios. Here we may witness the taking of the motion picture, its development and finally its presentation upon the screen.

We may go slumming in the Chinese Village and see the opium smokers, the sordid life in the opium dens and the ravages of the drug upon its victims. Mr. Opium Fiend, sallow-faced and blear-eyed, lies down upon a cot, gathers some of the viscous black opium upon the end of a stick, holds it over a flame until it bubbles, places it over the end of his large tubular pipe, inhales the smoke and then falls fast asleep and has beautiful

dreams and forgets his worldly cares. Then comes the awakening; the realization that his dreams are false, and he arises in terror and reaches for his indispensable opium pipe that he may again partake of its diabolical virtues.

Then we may take a boat ride through the Old Red Mill, visit the Streets of Cairo, Eden Musee, Melodia, Dixie Land, "Our Girl's" Frolic, the Ostrich Farm, Stella, the Diving Girls, Jesters Palace, La Feria de Sevilla and Gran Plaza de Toros.

On our left, in the building near the pen of graceful storks, are housed the Incubator Babies.

"Captain," the Educated Horse, draws our admiration by his remarkable intuition of the English language and the art of reading and writing.

Of course we should patronize the Merry-Go-Round, the Picture Parlors, the Roulette Wheels and all the other whirligig contrivances which can be found in such a place as the Zone—but it is getting late; come, let us take a jitney-bus and try to catch that 2:00 a. m. ferryboat!

PARACHUTE FOR BOMBS NEW PHASE OF WARFARE

Self-propelled bombs provided with parachutes are the latest war invention. The bombs are timed so as to explode when they reach the trenches of the enemy. These bombs were invented by the Austrians and are being used extensively by their aviators. The Allies have trained sharpshooters to combat this dangerous device. These men aim to hit the bombs in mid-air, thus causing them to explode prematurely and harmlessly.

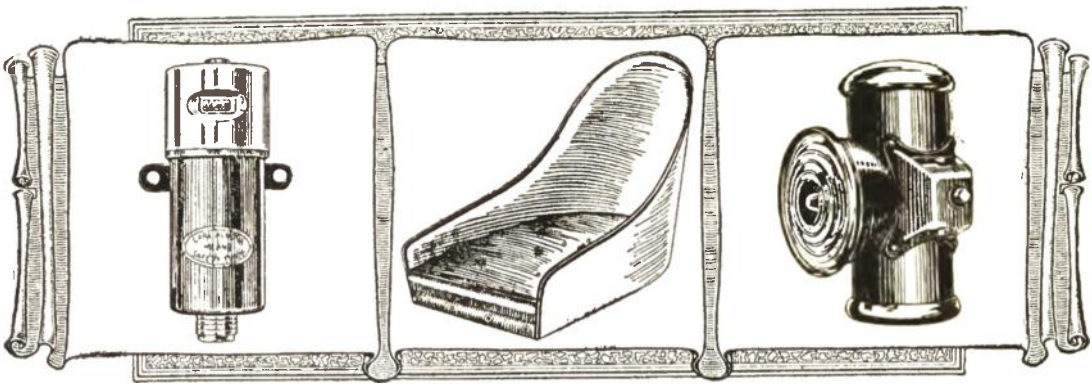
REPAIRING AN AIRSHIP'S PROPELLER IN WAR TIME

The height of boldness and fearlessness yet attained by the intrepid British air scouts was reached in the early days of the war, when the propeller of an air cruiser which was convoying a troop ship across the English Channel snapped off short and left the dirigible suspended helplessly in mid-air.

The Captain of the dirigible feared it would be necessary for his craft to descend for the repair, but two of the crew instantly volunteered to crawl out to the stern with a new propeller. Two thousand feet over the sea the helpless ship hovered, while the two mechanics crawled out upon the bracket which supports the propeller shafting. With the rest of the crew watching them in awe, the two men clambered out fearlessly and with an astounding degree of coolness attached the new blades. Passengers on steamers below watched the feat with enthusiasm, for this was the first attempt ever made to repair the broken propeller of a dirigible in mid-air.

THE MOST SOLID BOOK IN THE WORLD

Consisting of but ten pages, yet laying claim to the title of the most solid book in the world, a volume recently presented to the Columbia Field Museum is an unique work of art. It is made up of ten slabs of the finest jade, exquisitely engraved with Chinese characters. The text is in both Chinese and Manchu, with the most elaborate ornamentations on the first and last pages. This queer jade volume was made at the order of the Emperor Kang-hsi, who lived from 1662 to 1722, and it is a family document of great historic value. It is supposed that this precious relic was sold on account of the financial stringency affecting the deposed Imperial family, who have been in retirement on a limited income ever since the establishment of the Chinese Republic.



A Curb for Joy Riders | A Comfortable Racing Seat | Automobile Tail Lamp

Some Handy New Inventions

An Automatic Curb for the Motor Truck Joy Rider

A device which prevents the misuse of motor trucks is now manufactured and should prove of interest to the motor truck owner who desires to extend the life of his motors to the greatest possible limit. It is known as the "Autoprotector," and acts as a check upon reckless driving. It calls attention to carelessness and by temporarily checking the speed causes the driver to pay attention to the careful operation of the car. Unlike other types of "governor control," the Autoprotector, so its manufacturers claim, is the only device on the market in which the full power of the motor is always available. In operation, when a violation of the proper and safe methods of running a motor truck or an automobile is incurred, the instrument at once comes into action and the car stops or a temporary reduction in speed takes place.

Comfortable Racing Seat

That the automobile racing craze is not "here today and gone tomorrow" but is an institution firmly fixed among people who can afford racing cars is proved by the fact that an Ohio manufacturing concern whose output formerly encompassed a variety of automobile accessories has devoted its attention exclusively to the manufacture of racing seats. The seat which is shown in one of the illustrations is constructed of heavy galvanized iron framed in wood and covered with imitation leather of high durability. The cushion is removable.

"Wireless" Tail Lamp

A tail lamp for automobiles has been put on the market to replace the oil lamps on automobiles not equipped with storage battery systems. In one sense, the new lamp is "individual," because it contains its own battery and a universal socket, so that the only effort required to attach it is to hang it on the bracket formerly occupied by the oil lamp. When the battery is dead it can be quickly replaced by slightly turning the lamp top and slipping the new cell into the body of the lamp. The connection is made with the center pole of the battery, and the top is replaced. The light is turned on or off conveniently by means of a small button on the side. The side lenses are corrugated crystal and corrugated ruby in the rear. The advantages of the new lamp are that it is not affected by rough roads or heavy winds, that it does not accumulate soot and grease, and, lastly, that it can be removed and put into service as a trouble lamp. Used intermittently it will burn from fifty to one hundred hours, according to the battery. These lamps are also furnished with green or crystal rear lenses, suiting them for marine as well as for automobile purposes.

An Adjustable Wrench | Sign That Rolls Up | Pliers of Improved Design

A Tool That Takes the Place of Nine Wrenches

An adjustable wrench which will replace nine sizes of solid wrenches has recently been put on the market. The "Crescent" wrench, as it is called, follows in outline the 22½ degree engineer's wrench. It was originated to meet the demand for a tool that would equal the solid wrench in efficiency and eliminate the necessity of having a separate wrench for each sized nut. It is drop forged of open hearth steel made according to a special formula. The heat treatment is unusually interesting. Ordinary case hardening hardens the surface of the tool but leaves the interior porous and brittle. To administer the correct heat treatment which will result in toughness both exteriorly and interiorly is the result which the manufacturers of this wrench worked for several years to accomplish.

"For Hire" Sign That Rolls Up

A "For Hire" sign for use on "Jitney" busses, which rolls up out of the way when the automobile is commissioned, is in general use among the chauffeurs of Portland, Oregon. The sign is built like a shade, consisting of an ordinary white or light cream-colored window shade about eighteen inches wide on both sides of which are painted the words "For Hire" in large letters. The shade roller is attached by screws directly below the wind shield frame. When the automobile is untenanted, the shade is drawn up and hooked over the top edge of the glass. When the automobile is in use, the sign is rolled up out of the way.

Pliers That Work Close to a Wall

Hand-forged pliers which are the acme of simplicity and durability—simplicity to the degree that they are only manufactured in one size, and durability in that they are made of hand-forged tool steel—are now being manufactured to meet the exacting wants of the iron worker and electrician. The jaws have a large compass; that is to say, they will grasp surfaces of varying size, while the cutting teeth are so incorporated into the design that a wire can be easily cut, no matter how close to the wall or to a similar wire or bundle of wires it lies. The "D. & H." pliers, as they are known to the trade, can be readily sharpened or renickeled. They are seven inches in length.

An Automatic Automobile Jack

An automobile jack that works automatically is one of the latest luxuries that have been perfected for the motorist. The jack, which is a long, low affair, is placed on the floor of the garage, the automobile is driven upon it, the wheels following guides. When the proper place is reached the car is stopped and four traps automatically drop from beneath the four wheels. This is accomplished without lifting the weight of the car. The car is left supported on rubber

An Automatic Automobile Jack An Alarm Watch That Pinches Vise With a Swivel Base

cushioned jacks with all wheels free to be turned. To remove the car from the jack, a foot trip is depressed, and the car is gently backed down under its own power. The weight of the car backing out automatically resets the jacks. This contrivance is of unusual interest when it is remembered that only a fraction of a second is required to jack up all four wheels—a feat accomplished with no effort on the part of the driver whatsoever.

Ingenious Vise for Drill Presses

A vise mounted on a swivel base, which particularly adapts it for use in connection with drill press and shaping work, is one of the latest entries into the hardware market. A swivel base of this sort is a new feature in vises and one that should be quickly appreciated by tool makers and machinists. The swivel base is easily locked into the desired position. The weight of the vise and swivel is about thirteen and a half pounds.

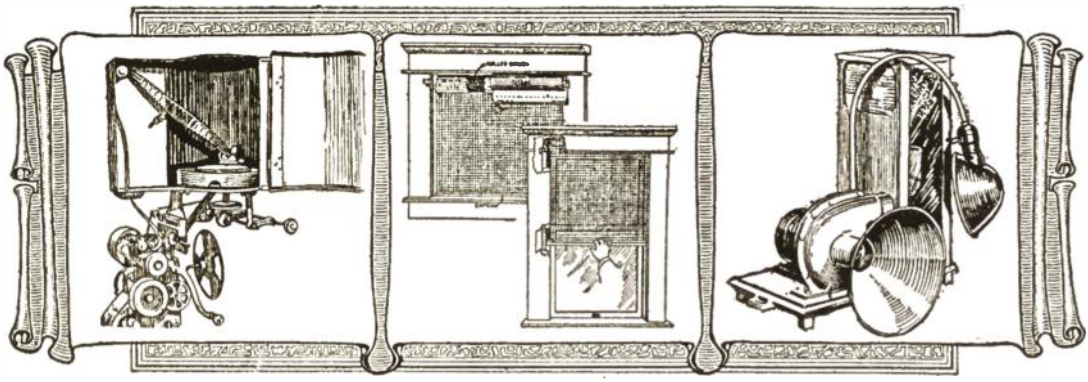
A Silent Alarm Clock

Alarm watches that signal the time for which they are set by a shrill ringing are common, but a "noiseless" alarm watch which accomplishes the same result is entirely new.

The story has been told of a married man who possessed a ringing alarm watch and who, with his wife, was awakened every morning by the silvery tinkle of the watch under his pillow. It took this man's wife five years, so the story goes, to discover that the alarm watch and not the neighbor's alarm clock was really awakening her every morning. The noiseless alarm watch, however, performs its early morning task differently. The noiseless alarm consists of a cord which tightens about the wrist, the pressure gradually increasing until released by the wearer of the watch. This is accomplished by pushing a small slide and twisting the stem of the watch a half turn.

New Projecting Machine Averts Rewinding

The lost motion and the danger from fire which are present in the usual motion picture projecting booth are entirely eliminated in a new projecting machine recently placed on the market. Rewinding is unnecessary. The film, as it flows past the condensing lenses, is wound in a reel as usual. This results in the beginning of the film being at the center of the reel. Instead of rewinding, the film is placed in a metal canister above the shutter and the machine "threaded" from the center of the reel. The advantages claimed for this new method, aside from the labor saved in banishing the task of rewinding, are that the operator can give more attention to the operation of his projector, the life of the film is prolonged and the chances of a film breaking because of tension are greatly lowered.



A Non-Rewinding Film Device An Adjustable Window Screen An Electric Fly Catcher

Window Screen on a Roller

A practical type of disappearing roller screen has been devised which can be installed without a special type of frame and is quite simple in construction. The screen rolls into a metal cylinder two inches in diameter, similar to those commonly used for house shades. On the bottom of the screen is a metal slide which moves in a groove on either side of the window frame.

The advantage of this type of screen is that it can be rolled up out of the way when not in use and is thus well protected in case of rain or snow storms.

Another advantage of this screen is that when it is not required—when the window is closed—better light is obtained.

Electrical Fly Catcher

A fly catcher which operates on the principle of a vacuum is the latest addition to the sanitary forces of the "swat the fly movement," as it is popularly expressed. Various types of mouthpieces are utilized, and extensions can be made in any direction to catch flies or insects. The fly catcher performs a double function, its latter being that of an air circulator. A moistened sponge is placed over the opening of the outlet and saturated with disinfectants or perfumes, as desired. At night time an electric bulb with a reflector is placed before the funnel-like trap, for the purpose of attracting moths and other "night" insects. In ordinary use in the daytime, various sorts of baits are used. It has been found by sanitary experts that milk attracts flies more quickly and numerously than any other substance. The "vacuum fly trap" weighs about thirty pounds and consumes as much current as a 16 c. p. carbon filament lamp.

Using Kerosene to Extinguish Fires in Cotton Bales

Kerosene would not seem of much value as a fire extinguisher, yet the Standard Oil Company of California recently sold a barrel of it for that purpose. It put the fire out, which was something water could not have done.

The fire was inside a bale of cotton in a warehouse. Cotton is packed so tightly that water will not penetrate deeply, so that, although the outside of the bale may be wringing wet, the fire may be still eating its way slowly through the cotton inside. Kerosene is much more penetrative than water, and will go to the center of the tightest bound bale.

Such kerosene soaked cotton requires a higher temperature to ignite it than the fire inside can reach, due to the tight packing and lack of air. Consequently, the fire stops when it reaches the kerosened part. After waiting a day or two for the fire to burn itself completely out, the bale is broken open and spread out for the kerosene to evaporate, leaving the unburned cotton as good as before.

A HOME-MADE POWER HACK SAW

By Ray F. Kuns.

The power hack saw is a well-known time, labor and material saver. The machine illustrated will cut anything which can be held in the vise, from thin brass tubing up to four-inch solid bar. The feed is automatic and may be varied by means of the sliding weight to suit the cut being made. Once correctly adjusted the machine needs no further attention until the cut is finished.

The wheels, frame, carriage, vise jaws and other wood parts are made from oak, maple or other hard wood. The metal parts are mostly of mild steel, excepting, of course, the cold rolled shaft and the vise screw. Inasmuch as there are no hard joints to make, the wood parts may be very quickly gotten out and fastened together.

BASE: Use one solid piece for the base, working out approximately to the size suggested.

BEARING SUPPORT: Two of these are required. Refer to page 349 for detail and to *B S*, below, for the location on the base. The hole may be bored with one inch auger bit and used for the bearing, or it may be worked out larger and bushed or babbitted. The hard wood bearings will run quite a while, even for continuous use, in a machine of this kind, since it should run but forty-five strokes per minute. The support is fastened to the base by means of bolts or lag screws.

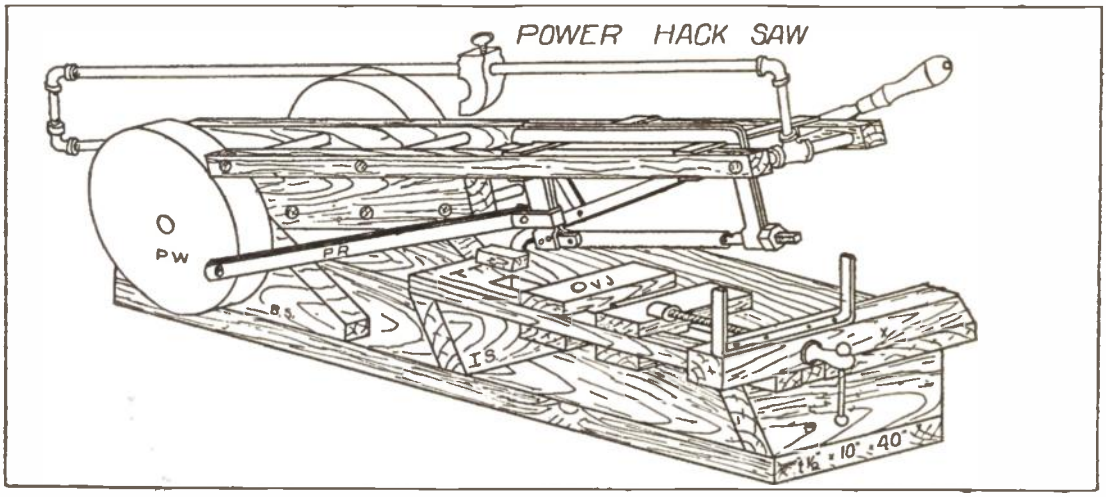
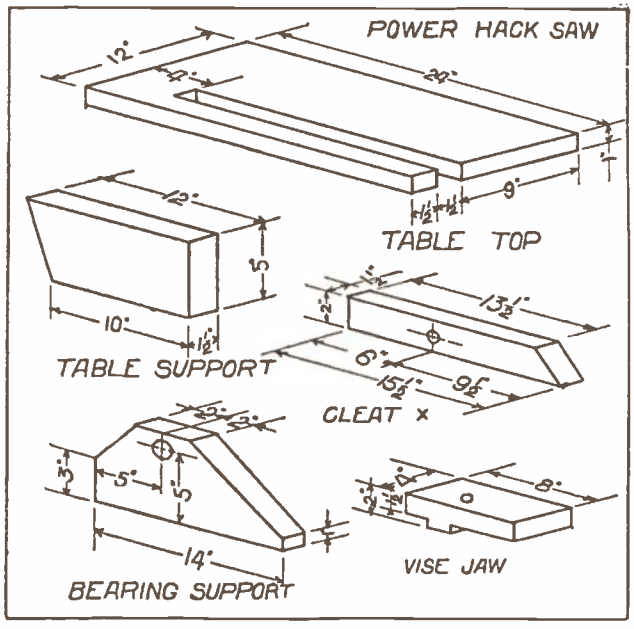


TABLE: Get out the table top and supports, shown on page 349, and fasten them together with nails or screws. Secure the supports to the base by means of nails or lag screws. The supports may be braced to make the table more rigid.

VISE: Four jaws are required for this, the detail of which is shown on page 349. The two back jaws are held firmly in

place by means of the half-inch bolt which passes through both of them. Loosening this bolt permits of adjusting the jaws to accommodate the stroke of the saw to the work. The front jaws are also held together by means of a half-inch bolt which is kept just tight enough to allow the jaws to slide back and forth.

The vise screw is taken from an old broken vise. The nut is fastened to the top one of the front jaws by means of bolts. A washer is placed on the screw on the inside of the cleat *X* and a 3/16" hole drilled for a pin on the outside of this washer. This prevents the screw from forcing back through the cleat as the vise is tightened.



SAW CARRIAGE: In working this up it is necessary to bear in mind the work to be handled. It is designed to fit between the bearing supports which have been previously described. It is attached to the frame and supported entirely by means of the shaft passing through the two holes shown in the detail on page 350. Inasmuch as these support much of the weight of the carriage, and the shaft turns in them, they should be arranged as bearings and provision made for oiling them.

The saw carriage is held together by means of ¾" dowel rods, which are held in place by means of screws. Two iron braces are also fastened on, as suggested in the detail, to insure the rigidity of the frame. These braces are of ¼" x 1" iron or mild steel.

Especial care should be used to have the space for the slide true and smooth.

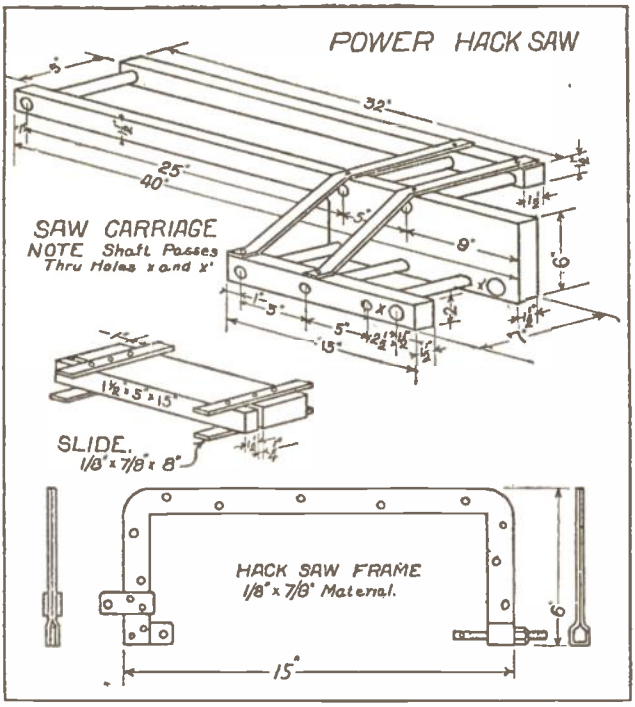
SLIDE: This is very simple. Four iron plates are fastened on the wood block, as suggested in the sketch. Either screws or bolts may be used for this. The holes shown cut in the ends of the wood block fit the frame which holds the saw.

HACK SAW FRAME: This is also detailed. As in all frames of this nature, provision must be made for tightening the blade. In this case threads are cut on a 5/16" piece of cold rolled steel or iron. A pin for holding the end of the blade is riveted in one end of this piece. This end of the bolt, as it may be called, should have no threads on it, but instead should have the side the rivet projects from filed flat, thus permitting the saw blade to come to the center of the frame. This will also keep it from twisting. The threaded portion of the bolt is next filed square, preventing it from turning in the frame as the nut is tightened, as well as holding the blade in alignment.

The frame itself needs little description. It may be made as shown or worked up from a piece of quarter-inch material. The method shown requires that the parts be riveted together. The end opposite the bolt has a small piece of ⅛" x ⅞" material riveted in. This in turn has another pin, for holding the saw, riveted into it. A clip of the same material is made and riveted onto the frame just above this piece. This clip has a hole drilled through its open end to allow for connecting the end of the pitman rod. A 3/16" pin is about right for this.

PITMAN ROD: This is marked *P R* on page 348. It may be made from solid stock, or ⅛" x ⅞" stock may be doubled for it. The length should be figured after the rest of the machine is assembled.

PITMAN WHEEL: Made from 2" maple or oak, as is also the pulley wheel. The



pitman wheel is ten inches in diameter. An eight-inch stroke is about the proper length for ordinary work with a 12" blade in the frame. A shorter or longer stroke is easily obtained by varying the location of the 5/16" x 1½" lag screw which is used to fasten the end of the pitman rod to the wheel.

PULLEY WHEEL: This may be something on hand or worked up for the need. The size of it must be varied to secure a speed of about 45 strokes per minute.

SHAFT: A piece of 1" cold rolled steel is used for this. If tight and loose belt pulleys are to be used it should be of a suitable length to accommodate them.

A half-inch lag screw should be run in from the rim of the pitman wheel and into a hole countersunk into the shaft for it. This will secure the wheel in its place and effectually prevent all slippage. A very neat job may be made of the set screw by sawing off the head and then sawing a slot in the end thus left, to serve as a hold for the screw driver when tightening it.

SLIDING WEIGHT: Some ⅜" pipe and fittings were used for this, as shown in the drawing. The weight itself is merely the front jaw off the old discarded machinist's vice from which the screw was taken. A set screw is provided to keep this in place, though it is not absolutely essential.

LEVER: This is provided for raising and holding the saw away from the work.

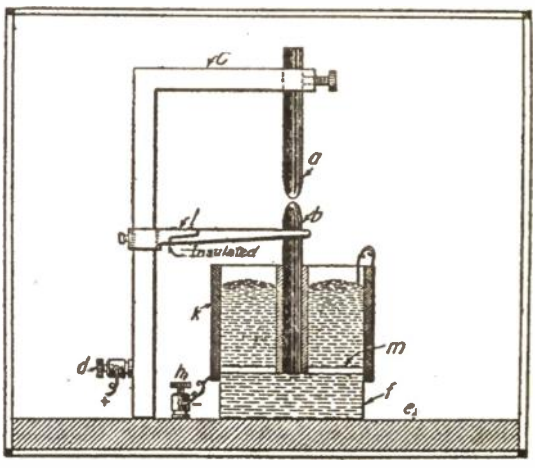
BRACKET: An iron bracket is provided as a guide for the front end of the saw carriage. It is merely to prevent any lateral movement of the carriage in actual use. This is shown fastened on cleat *X* on page 348.

This saw has been in almost constant use for nearly one year and is giving good satisfaction. Perhaps the heaviest duty it has done was when it was used to slot an armature for an electric motor. In this case 16 slots, each ¼" wide, ⅜" deep and 3¼" long were cut. Six blades were used in the saw at one time to give the proper width to the grooves or slots.

An Easily Constructed Arc Lamp

A self-operating arc lamp, which can be made of simple materials, can be constructed as follows:

An L-shaped brass standard, *C*, of heavy stock should be machined or cast and fitted with a brass binding post, *D*, and bored with holes for the carbon, *A*, and a set screw to hold the carbon in place. The other carbon, *B*, slides in a



hole in the end of the arm, *L*, which is locked to the standard. This arm should be insulated, as shown, by a fibre joint. The self-operating device consists of a glass vessel, *f*, around the upper part of which a layer of heavy magnet wire (No. 14 is large enough) is wound. The vessel is nearly filled with mercury. The carbon, *B*, fits in a heavy iron sleeve which sinks into the mercury until its weight and that of the carbon and holder are displaced.

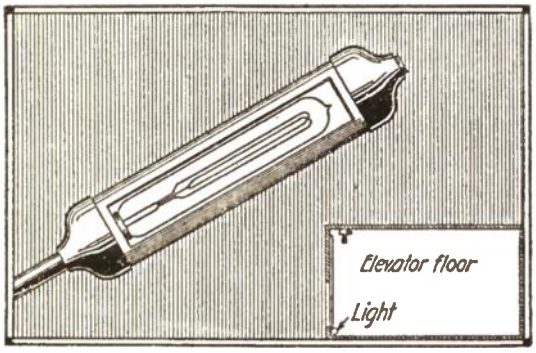
Current flows from the two binding posts through the coil and mercury and the two carbons, which are touching. The energized coil causes a solenoid effect, drawing the lower carbon down into the mercury until the arc is the correct length. A metal strip, *M*, is placed across the mercury vat and is bored with a hole of sufficient size to admit the passage of the iron sleeve. In that way the lower carbon is guided. The weight of the mercury pushes the carbon upwards.

Contributed by

NOORMAN WINDERLICH.

An Elevator Lamp That Insures Safety

The danger of persons stumbling upon entering or leaving elevators because of the unequal levels can be eliminated by the use of a lamp having a shielded ray,

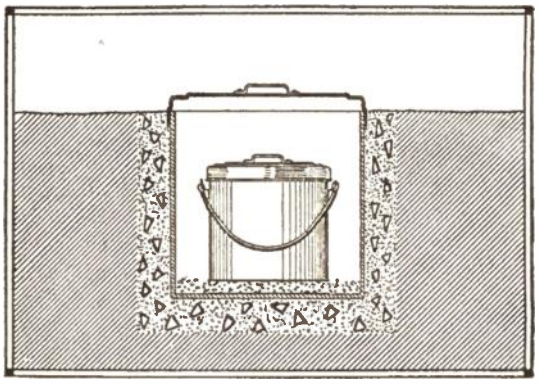


as shown in the accompanying drawing. The lamp should be attached to the floor of the car by means of a crow-foot, and connected so that it will light when the elevator is stopped. This can be accomplished by making an extra connection or two at the starting switch.

Contributed by JOHN J. KUNTZ.

Sanitary Garbage Pail Container

Garbage pails, unless they are kept scrupulously clean, draw flies and thus spread disease. The simplest way to prevent this condition is to dig a pit in which a pail large enough to hold the garbage can is placed. Between the larger



pail and the earth surrounding it a thick layer of coal ashes should be poured and tamped. The smaller pail is placed within the larger one, as shown, upon a layer of tamped ashes. The cover of the large pail is elevated a short distance.

Contributed by

FRED KUNCHMAN.

To Punch Holes in Steel Springs

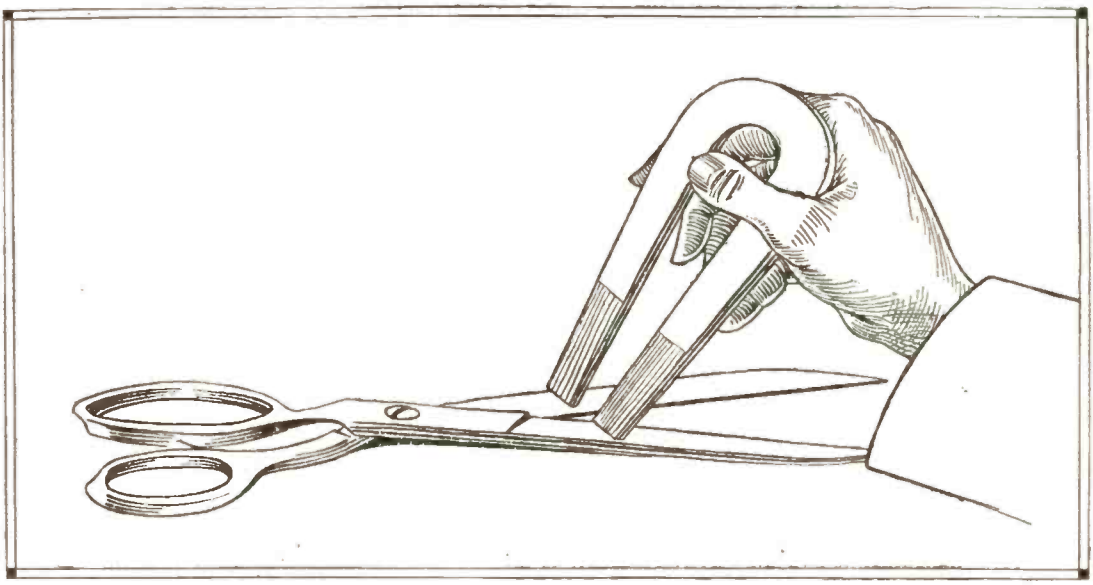
Holes may be punched in steel springs or other stiff metal if a plate of thin galvanized iron or brass is placed between the metal and the anvil. Two or three thicknesses may sometimes work better than a single sheet. The punch should have a flat end surface and, preferably, a shank which does not taper.

Contributed by

J. C. LINDSTROM.

Magnetic Scissors That Picks Up Needles.

A pair of magnetic scissors will be found very useful in the sewing room and elsewhere about the house. It will pick up needles or other iron or steel articles, but will not attract any other metal. This will enable any one to distinguish between brass hooks and iron ones which must not be used on clothing that is to be washed. A small horse-

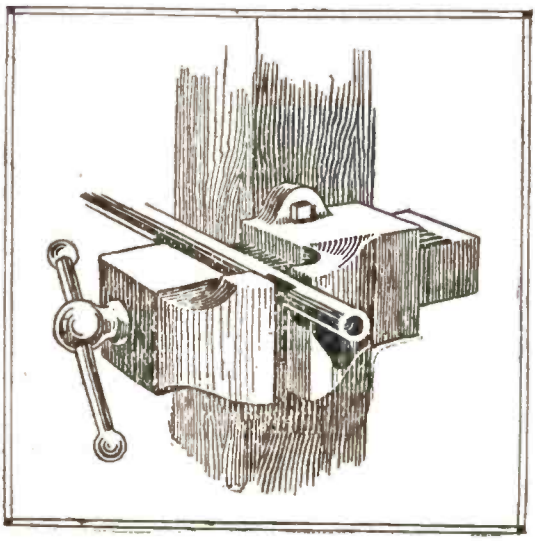


shoe magnet can be employed for magnetizing any pair of scissors. To magnetize the scissors the two poles of the magnet are placed in contact with the scissors near the pivot, and drawn to the end of the blades. This operation is repeated several times, care being exercised that the same poles of the magnet touch the same blades of the scissors.

Contributed by
WM. C. HOUGHTON.

Setting Up a Vise for an Emergency Piping Job

The author was recently confronted with the problem of doing a little piping job around his machinist's vise where there was not enough room to work in. The problem was solved by removing the vise from the bench and bolting it to a convenient door jamb. One of the posts supporting the floor above would have served the purpose equally well, and even a brick pillar or iron post could have been utilized by making a rough clamp of two by four inch timber and a couple of long bolts or studs. When fastened to the door jamb, the vise had to be placed with the jaws vertical, but it served the purpose nicely.



Contributed by
WM. C. HOUGHTON.

A Belt Dressing Tool

Belt dressing compound can be applied evenly to a belt surface by using a spool wrapped with cloth and revolving easily upon a handle of some sort.

Contributed by JACOB LIEBMAN.

Typewriter Eraser Holder

Instead of bothering to look for the typewriter eraser on the numerous occasions when it is needed, a much better plan is to bore a small hole in the table near the typewriter, thread a length of stout string through it, attach the eraser

at one end and a light weight at the other. The weight should be slightly greater than that of the eraser. When the eraser is not in use the weight pulls it down over the hole, where it can always be found promptly when it is wanted.

Contributed by

L. C. LUNDHOLM.

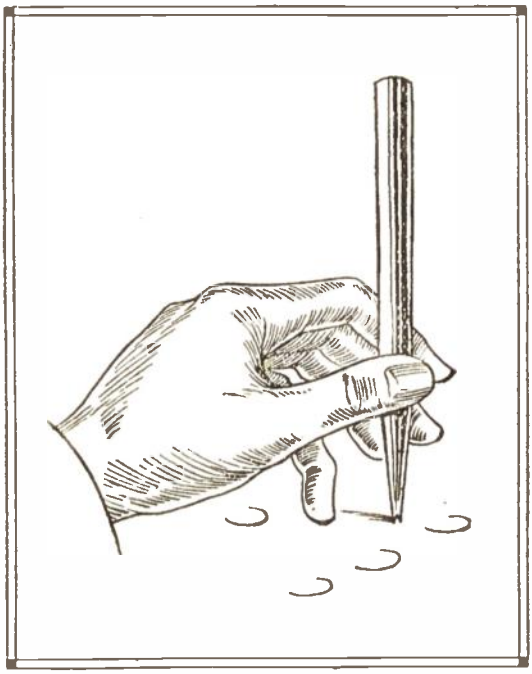
Reviving Dead Rubber

Elasticity can be restored to rubber by dipping it in a mixture composed of one part household ammonia and two parts water.

Contributed by FRED MURSCH.

A Handy Tool for the Layer-Out

A very handy and time-saving tool for the layer-out engaged in sheet iron or boiler work is a double center punch for

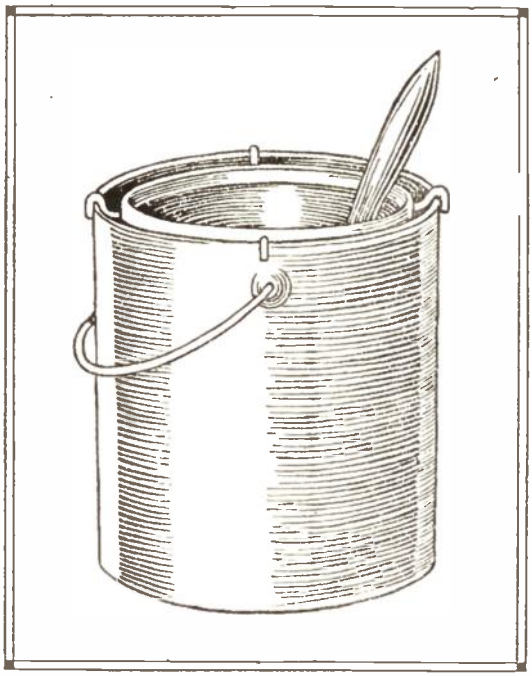


the centering of flange or shear lines which are usually centered with two marks close together for the purpose of distinguishing between the center marks for holes and those of the shear or flange lines. The idea is made clear by the illustration.

Contributed by N. H. BABCOCK.

Convenient Paint Brush Drainer

It often happens that the handy man desires some form of device for keeping the outside of a bucket free from paint, while painting. An idea for accomplishing this result is shown in the accompany-



ing illustration. It consists of a strip of metal bent in the form of a circle of such size as to be slightly smaller than the bucket into which it fits. The circle is held in place by small hooks which fit over the top edge of the can.

Contributed by

W. R. COTTRELL.

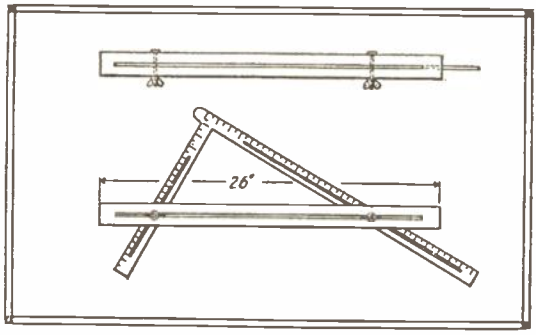
Removing Adhesive Tape Painlessly

The usual pain which accompanies removing adhesive tape from cuts or bruises can be avoided if a few drops of benzine are applied to the edges.

Contributed by CHARLES A. ALLEN.

Pitch Board and Template for Stair Builders

A new idea in tools for designing stairways is suggested in the accompanying drawing. It is constructed of steel, and should be made according to the propor-



tions given. This pitch board and template may be used on other work than building stairs—laying out trusses, rafters, braces, etc.

Contributed by

WILLIAM ALBIN.

Large Drill in Small Press

Drilling a hole larger than the maximum capacity of a small drill press can be done by turning down the shank of the drill to a size that will fit the chuck. The hole should first be drilled a size smaller than is desired; then the large drill used. This step is necessary, because the speed of the average small press is too fast for a large drill.

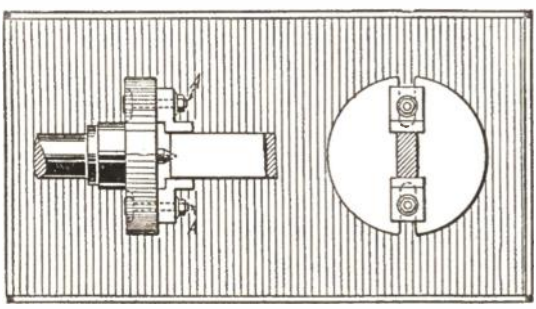
Contributed by

CHARLES H. ANDERSON.

A Hint for Lathe Workers

Work with parallel sides can be easily driven if two pieces, *A, A,* as shown in the drawing, are added. These pieces can be made from flat, cold-rolled steel, by bending the steel to the desired shape and drilling the bolt holes. These clamps can be adjusted to fit any sized stock within reasonable limits.

Contributed by C. H. ANDERSON.



Cutting Glass with Shears

Sheet glass, provided it is not too thick, can be cut into any desired shape with a pair of heavy shears by submerging the shears and glass in water. The edges may be smoothed afterwards with a file or sandpaper.

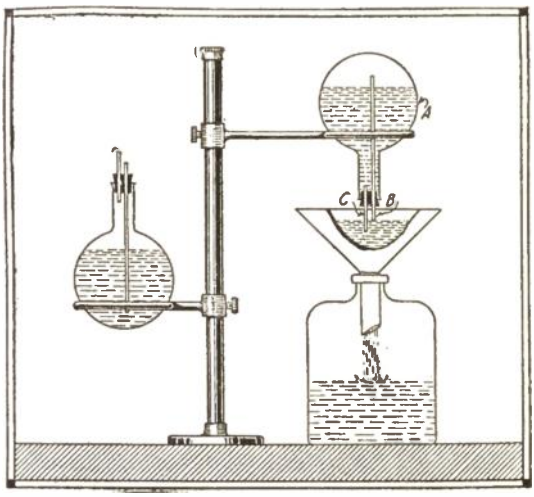
Contributed by

FRED. W. POTTER.

A Filter for the Chemist's Laboratory

To filter large quantities of chemical solutions, an apparatus constructed as follows will give satisfactory results:

A is a large flask or bottle into which the solution to be filtered is poured. It is inverted so that the ends of the tubes, *B* and *C*, are some little distance below



the top of the funnel. The solution runs out of tube *C* until the rising liquid closes the end *B*, thus automatically checking the flow. This goes on continually until the whole of the solution has been filtered.

Contributed by

G. E. WELCH.

A Chemical Barometer

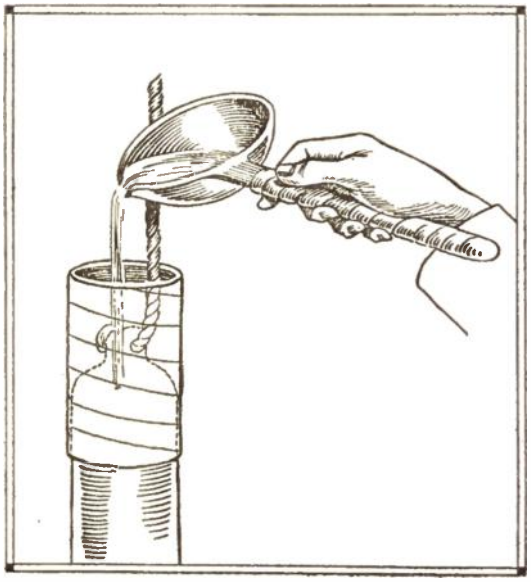
Chemical barometers, although not as sensitive as the mechanical type, will indicate changes in weather, and they are unique. A fairly reliable chemical barometer can be made by dissolving ¼ ounce of powdered camphor, 62 grains of powdered potassium nitrate and 31

grains of ammonium nitrate in two ounces of alcohol. The solution should be put into a slender bottle, over the mouth of which is stretched a diaphragm of thin rubber punched with a tiny hole. During fair weather the liquid will remain clear, with the solid particles settled close to the bottom. If a high wind is coming, the liquid will take on the appearance of fermentation, a film of solid particles spreading over the surface. The approach of rain is signaled by the formation of crystals throughout the solution.

Contributed by
GEORGE W. GREENE.

Making Sash Weights Heavier

The author experienced trouble with his windows which would not stay up because the weights were too light. After determining how much additional weight was needed, the weights were taken out, cord and all, exercising the precaution of drawing in a thread for pulling the cord back. Some heavy wrapping paper was then wrapped around the head of each weight, tied tightly in place and melted

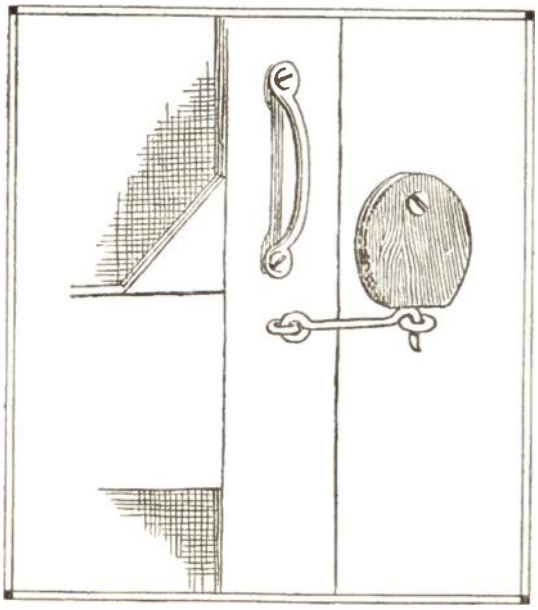


lead poured in. This flowed around the cord and head of the weight, making a neat job.

Contributed by
WM. C. HOUGHTON.

A Safety Lock for Hook on Screen Door

A simple safety lock for the ordinary hooks used on screen doors can be made from a block of wood half an inch thick,



two inches high and one inch wide. The corners are cut off so as to give it the shape shown in the illustration. A hole is then bored in one end so that it may be fastened in place. The other end is cut off in order that it will cover the hole of the eye.

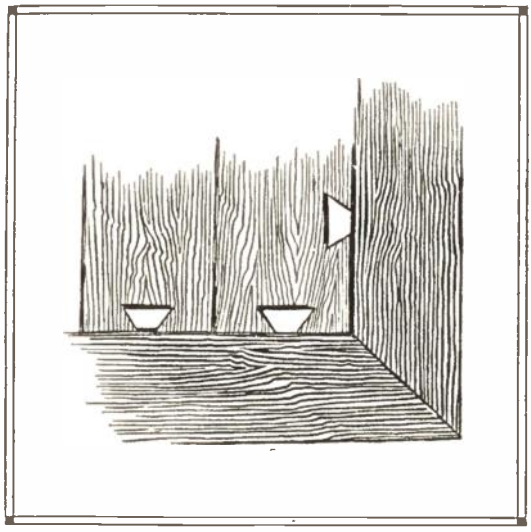
The block of wood is then screwed over the eye sufficiently tight so that it will remain in whatever position it is placed. The action of the lock can be easily understood by studying the drawing.

Contributed by
THOMAS SHEEHAN.

To Moisten Fingers Without Chapping

In order to prevent the chapping of the fingers of clerks who are compelled to use finger moisteners continually, an army surgeon has suggested that a small amount of glycerine be poured into the container of the moistener with the water.

Contributed by
CHARLES M. STEWART.



Glazier's Points for Fastening Pictures in Frames.

The little triangular pieces of sheet metal known as glazier's points will be found more suitable than nails for holding the backing in picture frames. They may be bought at hardware stores or, if only a few are required, they may even be quickly cut out with a pair of shears. Zinc is the metal commonly used, although tin or sheet iron will serve.

Contributed by

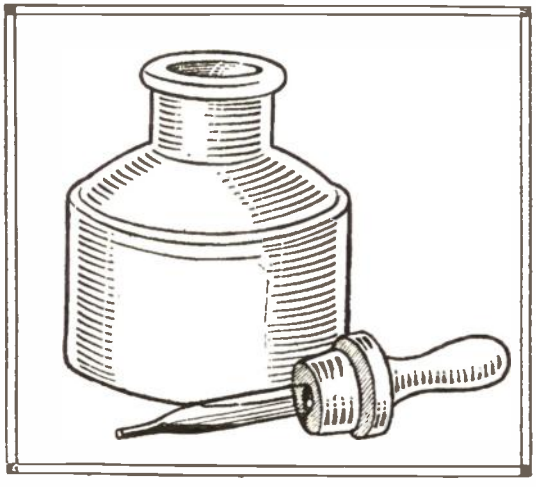
WM. C. HOUGHTON.

Fountain Pen Filler in the Ink Bottle Stopper

The fountain pen filler is a messy thing to keep around the desk and is apt to be mislaid at that. A convenient way of keeping a filler is to bore a hole through an ink bottle stopper and push the filler through it. The filler will then be always handy when wanted and perfectly clean.

Contributed by

WM. C. HOUGHTON.



Gilt Signs on Glass

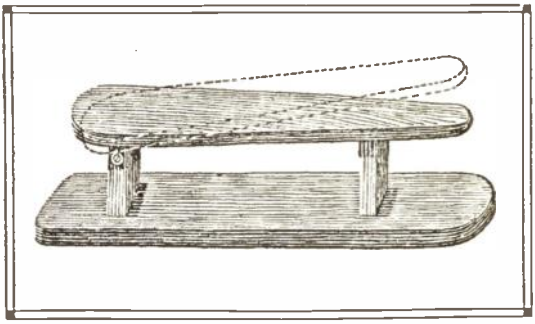
Gilt letters may be painted neatly upon glass surfaces by outlining the letters in varnish, then dusting on gilt powder.

Contributed by

FRED KUNCHMAN.

Ingenious Sleeve-Pressing Board

An ironing board for pressing sleeves can be improved considerably by hinging the top board. The nails should be removed, the standards strengthened and the broad end of the board hinged by means of screw-eyes to one of the standards. The top of the upright upon which the board hinges should be planed round.



Contributed by

WM. C. HOUGHTON.

Resined Cord Tips

If flexible cord tips are resined instead of wrapped with fine wire as is usually done, they will not fray, and their appearance is much better. The resin should be applied to the wire, and the braided sleeve pulled down to the nickeled tip and rolled between the fingers.

Contributed by

NORMAN B. DORWART.

To Oil Automobile Springs

If the leaf springs of automobiles are oiled carefully the car will ride much easier and the life of the springs will be considerably lengthened. The leaves should be pried apart with a screw-driver or chisel and the separated surfaces swabbed with a feather 6 or 7 inches in length, which has been saturated with oil.

Contributed by

JOHN HOECK.

Prevents Drawer Falling

If the drawers of tables or dressers are pulled out too far, the drawer often falls, and the contents are scattered on the floor. This inconvenience can be prevented by screwing a small metal catch at the back of the drawer, so that it projects upward far enough to catch the upper panel when the drawer is pulled out.

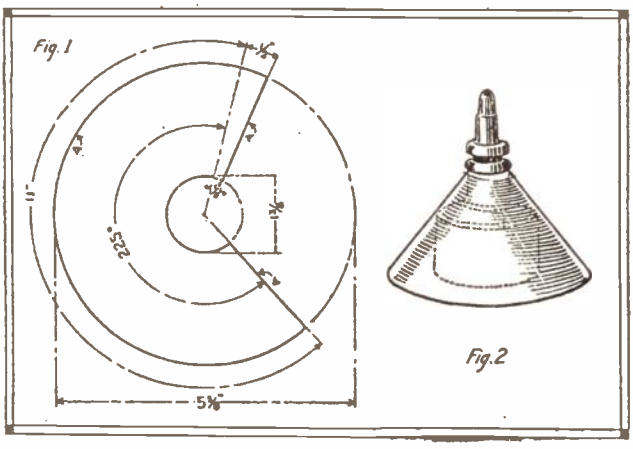
Contributed by

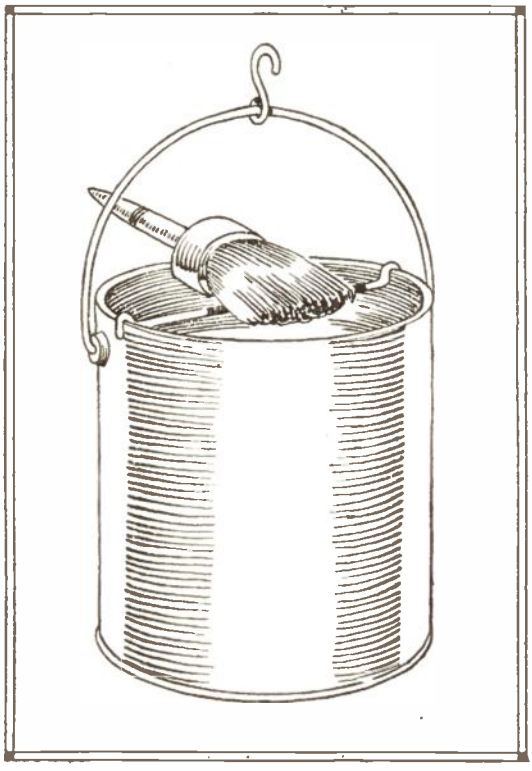
B. W. VERNE.

An Ink Bottle That Will Not Upset

The ever-present danger of an india-ink bottle tipping over and spilling its contents upon an unfinished drawing can be averted by building up a conical cardboard support, such as is shown in the accompanying drawing. The cardboard should be as stiff as is procurable, and cut and assembled as shown in Figs. 1 and 2.

Contributed by L. B. LAWRENCE.





Two Hints for the Amateur Painter

The amateur painter will find the following hints of great help to him in his work.

It is often desirable to hang a pot of paint from a rung of a ladder, while painting a ceiling or a wall. This can be easily accomplished by bending a heavy piece of wire in the shape of an S and using it to hold the paint pot.

The second device is to eliminate the necessity of laying the brush on the ladder or on some surface where it can pick up dirt while moving the ladder from place to place. It consists of a piece of stout wire, bent as shown so as to fit diametrically across the pail. The brush may be laid on this wire and there will be no danger of its becoming laden with dirt or its handle covered with paint.

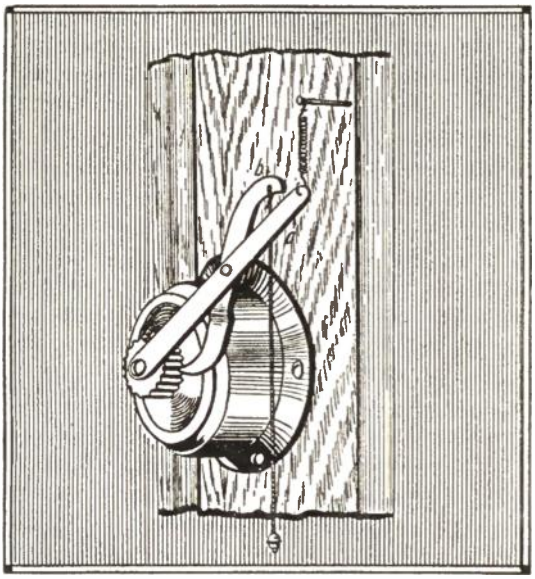
Contributed by

C. S. ROBINSON.

Contributions to this department will be paid for at space rates, with a minimum of one dollar per idea.

Chain Attachment for Snap Switch

The accompanying drawing illustrates a snap switch equipped with a scissors-like ratchet and string to avoid the time-consuming operation of feeling for the knob and twisting it as is usually done.



A little adjustment will be required to determine the correct spring tension.

Contributed by

DAVID SCHELL.

Vise for Polished Pipe

Polished pipe can be held in a vise without scratching the surface if the pipe is rolled in paper upon which plaster of paris is plentifully sprinkled.

Contributed by

JACOB BLASS.

Removing the Tarnish from Silver

Tarnish may be removed from silverware by means of a "silver tarnish battery." For the battery, a tin pail or a pan is required, in the bottom of which two strips of zinc are placed cross-wise. These strips should be about one inch wide and a little shorter than the diameter of the containing vessel. The pail should be half filled with hot water, and for every quart of water four teaspoonfuls of salt and one of baking soda should be added.

To remove the tarnish, the silverware should be placed in the pail so that some part of it comes in contact with the zinc strips. The tarnish will disappear rapidly. The experiment should not be tried with oxidized silver, as the electrolytic action causes the oxidized surface to be eaten off.

Contributed by

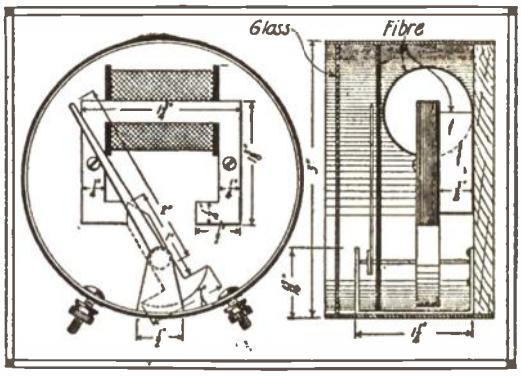
CLYDE MORGAN.

A Polarity Indicator

This instrument may be used for determining the direction of a storage battery charging current. Its operation is based on the fact that unlike magnetic poles attract and like poles repel.

The case is made from fibre or hard rubber. The magnet core is made of solid iron or soft steel—it must be permanently magnetized. The pointed end of the armature should have a known polarity. The purpose of the weight on the armature is to bring it back to an upright position. The pointer should be made of aluminum on account of the lightness of that metal. The size of the wire used on the magnet will depend upon the current with which the instrument is to be used.

The dial should be marked according to the following directions: Grasp the



coil in the right hand, so that the fingers encircle it in the direction of the north pole. The dial may be divided in any way, to indicate the direction of the current.

Contributed by

CLARENCE POOL.

Acid Pyrography

Artistic designs can be burned in wooden surfaces by the use of an acid solution formulated properly with equally as good results as are obtained with the pyrographic needle.

A 20 per cent. solution of sulphuric acid should be mixed in an ordinary ink bottle, and the liquid tinted with red ink or other coloring matter, so that the acid line will be visible when it is applied.

After the design has been printed or drawn on the wood surface, a tailor's iron should be rubbed carefully over it until the desired shade is obtained. The acid should be painted over the design with a small camel's hair brush.

Contributed by

J. BRAFF.

Pole Testing Paper

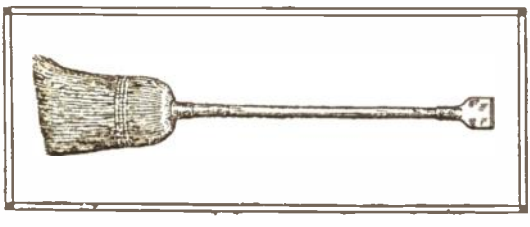
Pole testing paper can be prepared by soaking thin blotting paper in a starch solution; when it is dried and cut into strips, it should be immersed in a solution composed of ½ ounce of potassium iodide in 1 pint of water. The polarity of a current is determined by placing two wires ½ inch apart on a sensitized strip. The positive pole will be indicated by a violet covering.

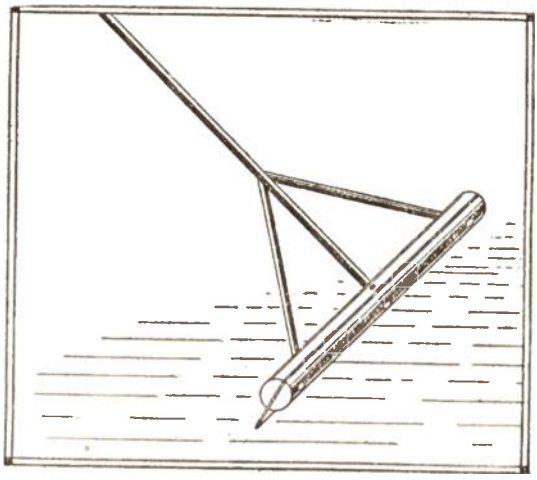
Contributed by G. W. GREENE.

Combination Ice Chipper and Broom

A combined broom and ice chipping tool will save time in cleaning the snow and ice from walks in the winter. The chipping tool should be removed from its original handle, driven on to the broom handle and held in place with wood screws.

Contributed by G. G. GUNKLE.





A Tennis Court Scraper

A serviceable tennis court scraper can be made in the shape of a large hoe. A wooden rod 2 inches in diameter should be sawed down the center and a thin strip of steel clamped between the faces of these two halves so that it projects about two inches from one side. In the center of the rod and at right angles to the blade a hole should be bored to fit the end of a long handle. The rod and the handle should be braced as shown.

Contributed by

ARTHUR EDGAR.

A Stove Leg Fastener

In moving or lifting stoves, the legs often drop out, or become loose. This can be prevented by bending a strip of heavy tin over the top of the leg, to fill the space between the top of the leg and the stove, and fastening the opposite end to some projection on the body of the stove.

Contributed by

B. W. VERNE.

Hanging Hard Wood Shelves

Instead of the usual wooden pegs for assembling the parts of hardwood shelves, a substitute which will serve the purpose equally as well consists of wire nails driven into one board, the heads filed off, and these protruding ends plugged into holes in the other board. A

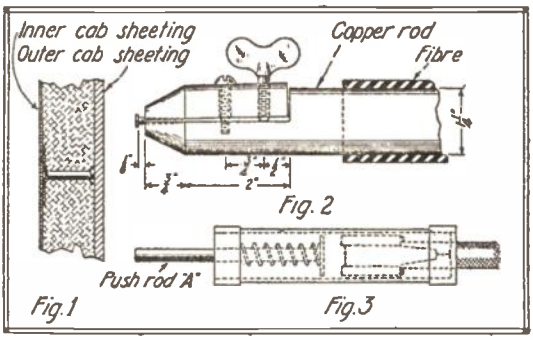
solid joint much stronger than could be secured with wooden pegs results.

Contributed by

ARTHUR CALL.

Spot Welding on Locomotives

A novel method of attaching a non-conducting, heat-resisting lining to sheet steel is used on the cabs of modern elec-



tric locomotives. This lining of asbestos board is necessary to keep the engineer's traveling quarters comfortable at all times—warm in winter and cool in summer.

One-inch nails are electrically spot welded by their heads to the inner surface of the outer steel sheeting of the cab, as shown in Fig. 1. The asbestos lining is driven home on the nails, which are then tightly clinched over large tin washers. A thin metal sheeting is applied over all, giving a smooth, finished appearance to the interior of the cab.

A more detailed description of the spot welding equipment is given, in the hope that it may suggest further uses of a similar nature.

A special transformer, capable of transforming about six kilowatts from a 550-volt shop circuit to a working pressure of from three to five volts, is used. At this low voltage a current of from fifteen hundred to two thousand amperes gives good results.

One of the low-voltage terminals of the transformer is connected by heavy cables to the locomotive frame, while from the other a heavy, flexible conductor (cable) carries the current to a sturdy copper terminal arranged to grip the nail for welding. A fibre sleeve, fitted over this terminal, furnishes a handle for the operator. The terminal is shown in detail in Fig. 2.

The primary circuit of the transformer is closed by a small, oil-immersed contactor energized by a 110-volt circuit. As approximately two pounds of nails are required for each cab, the operator must lose no time in making and breaking connections. An ordinary snap switch was found to be too slow and awkward to handle. A push-button control switch was made up from an old cartridge fuse and so arranged that the workman can close the circuit by pressing the rod, *A*, shown in Fig. 3, against the cab or locomotive frame.

Contributed by

HANDYMAN.

Grinding Ball Bearings

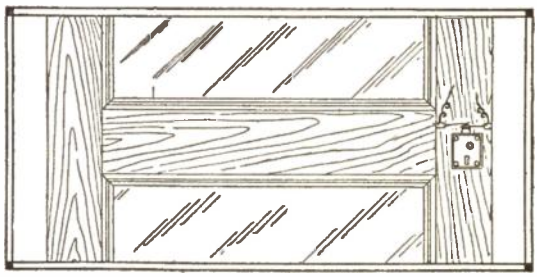
Bicycle hub cones, which have become deeply rutted by continued wear or not enough oil, can be renewed by placing them in a lathe and grinding down with an emery stone and fine sandpaper.

Contributed by

ARTHUR EDGAR.

Gives Warning When Lock is Touched

Door locks of the type wherein the bolt slides in and out of the rest of the mechanism, as shown in the drawing,



can be made "tamper-proof" by screwing two springs above the bolt, so that when the bolt is withdrawn from them they are separated. If the springs are placed in an electric circuit composed of dry cells and a doorbell, when the lock is tampered with, the bell will sound an alarm.

Contributed by F. T. STURTEVANT.

FURNITURE FOR THE SUMMER COTTAGE

Describing the Construction of Simple Cottage Furniture of Substantial Design and Finish

By Ralph F. Windoes

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

Illustrations from drawings made by the author.

COTTAGE furniture, to be perfectly successful, must be substantial and capable of withstanding all sorts of weather conditions. It must also be neat in appearance, and comfortable. With these thoughts in mind, the author is presenting detail drawings of a porch swing, arm chair and rocking chair, with the hope that many craftsmen will utilize them in the construction of their summer cottage furniture.

Plain red oak is recommended for the lumber, as it is much cheaper than quarter sawed and just as strong if the pieces are properly built. Cypress might be substituted, but, being a softer wood, it would not stand up under the "roughing" as well as the oak.

PORCH SWING.

For the porch swing will be needed the following stock, planed and sandpapered to dimensions at the mill:

2 pcs. 1¾″ x 1¾″ x 27¼″, back posts.
2 pcs. 1¾″ x 1¾″ x 16⅝″, front posts.
3 pcs. ⅞″ x 5″ x 59″, long rails.
1 pc. ⅞″ x 4″ x 59″, long rails.
2 pcs. ⅞″ x 5″ x 24″, end rails
2 pcs. ⅞″ x 5″ x 27″, arms.
2 pcs. ⅞″ x 2½″ x 21½″, seat supports.
6 pcs. ½″ x 5½″ x 11″, back slats.
4 pcs. ½″ x 5½″ x 12″, end slats.
11 pcs. ½″ x 1½″ x 57″, seat slats.
4 iron brackets with hooks attached.
1 set porch swing chains.

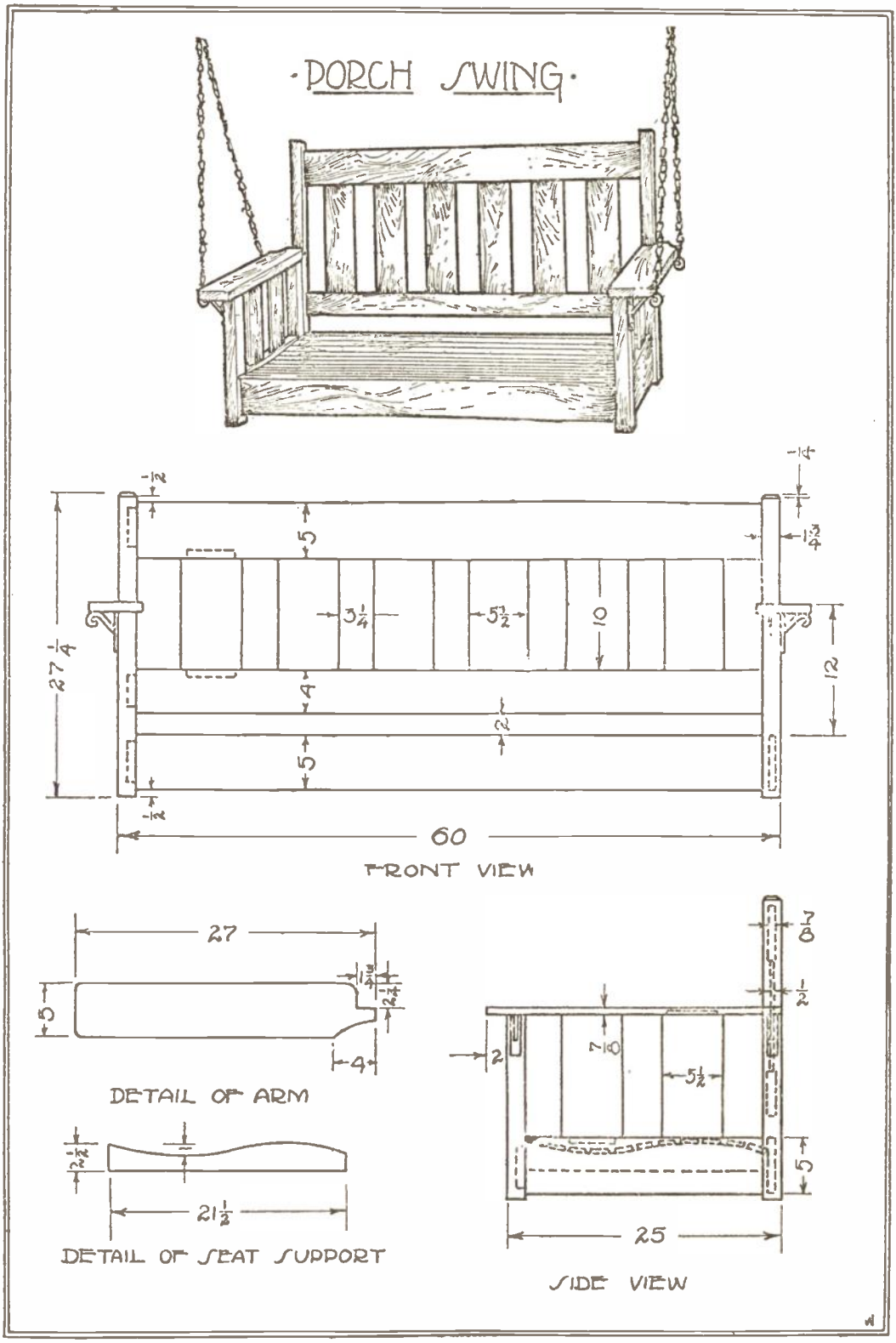
Begin the construction, as usual, with the posts. Square up the stock, and cut the mortises in them. Cut their corresponding tenons on the rails and clamp up dry. Fit the back slats into place and glue this much up. The arms are detailed, and are screwed into place. The end slats are mortised into the arms and the top edge of the end rails.

A detail of the seat support is also given. These are screwed into the end rails from the inside. The slats are nailed onto these pieces, leaving a slight crack between each slat.

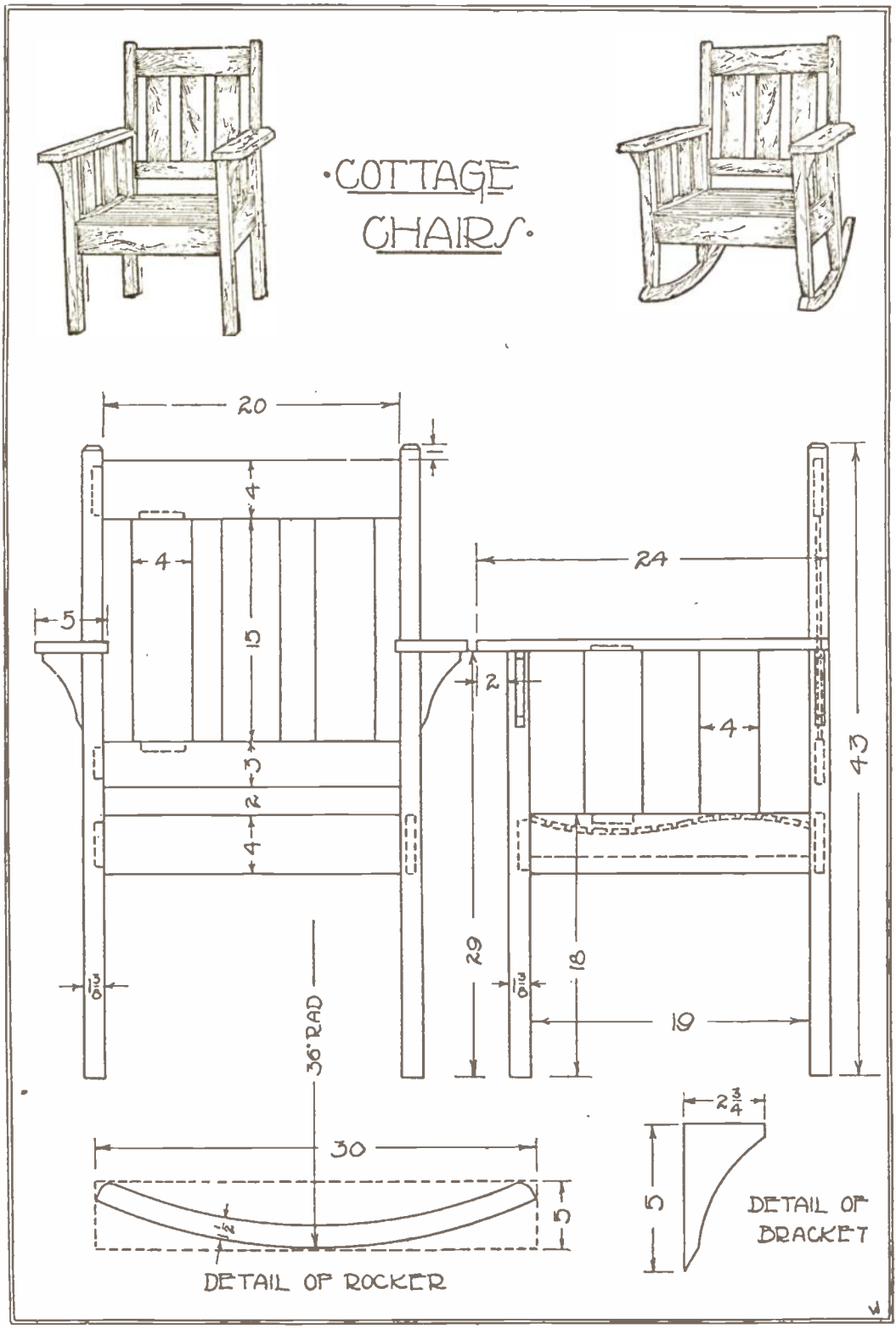
Regarding a waterproof finish for the swing. A wax and shellac finish will serve, but a spar varnish over properly filled grain is much better. Detailed, this is applied as follows:

1st. One coat of oil stain, of the chosen color, carefully wiped off as applied. Let it stand twenty-four hours.

2nd. One coat of paste wood filler, thinned out with benzine and rubbed into the grain with the finger tips. Wipe



The Various Details of the Porch Swing as Well as its Appearance When Completed.



The Various Details of the Chair and Rocking Chair as Well as the Pieces as They Appear When Completed

off with dry cloth or waste. Let stand twenty-four hours.

3rd. One coat shellac. Let stand about three hours and rub down with fine sandpaper.

4th. Repeat 3rd step.

5th. One coat best spar varnish, applied *all over* the swing. After thirty-six hours rub down with No. 00 steel wool.

6th. Second coat of varnish, rubbed down after forty-eight hours with pumice stone and water.

This finish will undoubtedly be satisfactory, but if a great gloss is desired, apply another coat of varnish and rub it down in two or three days with pumice stone and oil.

If a waxed finish is desired, after the 4th step, apply a thick coat of prepared wax. Allow it to stand over night, and rub it to a good polish in the morning with a dry cloth.

COTTAGE CHAIRS.

The arm chair and the rocker illustrated are so very simple that one drawing will suffice for both. For the arm chair purchase the following stock, finished sizes:

2 pcs. 1⅜" x 1⅜" x 43", back legs.
2 pcs. 1⅜" x 1⅜" x 29", front legs.
3 pcs. ⅞" x 4" x 22", front and back rails.
1 pc. ⅞" x 3" x 22", back rail.
2 pcs. ⅞" x 4" x 21", side rails.
2 pcs. ⅞" x 5" x 24", arms.
2 pcs. ⅞" x 2½" x 19", seat supports.
3 pcs. ½" x 4" x 16", back slats.
4 pcs. ½" x 4" x 12", end slats.
9 pcs. ½" x 1½" x 21", seat slats.
1 pc. ⅞" x 2½" x 21", brackets.

For the rocker the only changes will be to make the back legs 38" long and the front 24". The rockers will be made from two pieces 1⅜" thick, 5" wide and 30" long.

The chair construction is identical with that of the porch swing in its main details. The brackets will be made of wood and screwed into place.

The legs for the rocker, as suggested above, will be five inches shorter than the arm chair legs. The rockers will be screwed onto the legs with long flat head screws.

If possible, it would be a very good idea to have the rockers sawed on a band saw at the mill, as it is a very long and tedious job to do it by hand.

The same finish is suggested for the chairs as was detailed for the swing.

A WINTER PORT FOR RUSSIA

Without question an important part of Russia's interest in the war is due to her ambition for a year-round outlet to the ocean. She has fought to win Constantinople years ago and been balked and even now it does not seem at all certain that she will be rewarded with entire control of the Dardanelles. Of course, Archangel is her port on the Arctic but it is ice-bound half the year with the drifting ice blown down from Nova Zembla by northeast winds.

Russia is now assured that she has the key to the situation in the development of a great harbor at Kola near the Norwegian boundary. Here is a bay running about twenty-seven miles inland from the Arctic Ocean and about three miles in width with a depth of two hundred and forty feet. Although much farther north than the port of Archangel on the White Sea (and west) this bay is open all year. The Gulf Stream sweeps around the end of Norway and keeps this section of the coast free from ice. In fact, the temperature is 30 degrees Fahrenheit warmer than the forests of Lapland to the south. A branch of the Petrograd-Archangel railway could reach this bay without any insurmountable engineering difficulties for the tundra swamps are underlaid with granite. Had this port been developed years ago the history of the world might have been changed.

MAKING *the* CABIN CRUISER COMFORTABLE

BY PETER SUAU

WHILE the average cabin cruiser is equipped with numerous accessories for extending the maximum comfort to its passengers, still there are many additional pieces of equipment that may be installed in order to render the craft most suitable for long cruises. The average short trip requiring but a few hours or even a day's stay on board the cruiser does not call for any luxuries, but it is on voyages of several days' duration that all the comforts of home are longed for.

THE cabin cruiser — no matter how small it may be—can be made a real home. One of the essentials in making the cabin cruiser homelike is to provide a place for everything and always have everything in its place. Otherwise chaos reigns. While the following suggestions are for the most part easily followed out by the average handyman and at a slight cost, they will contribute materially towards securing the degree of comfort that is associated with one's home.

There should always be a few extra sweaters or even old clothes for wear on board the cruiser, for a change of clothes is conducive to the fullest enjoyment of a cruise. But the clothes must be dry. If they are stowed away in the lockers beneath the seats or berths from one week to the next, they are sure to become damp. Furthermore, any clothing that may be brought on board the boat will, in a short time, be unfit for wear.

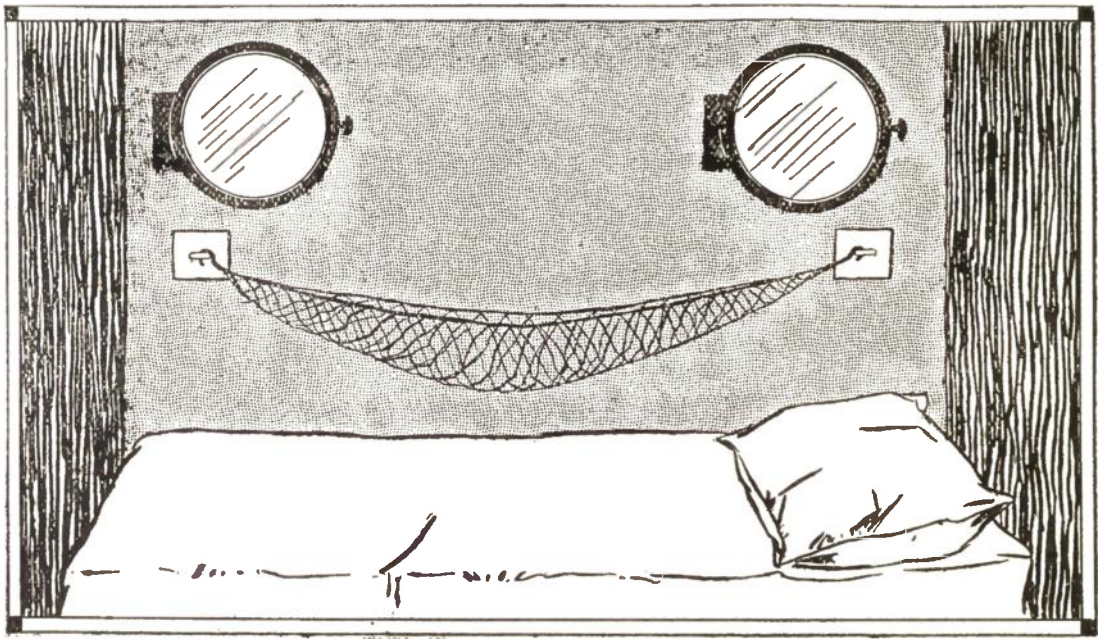
The foregoing disadvantages may be readily overcome. There is always space over a berth along the side of the boat. This can be best utilized by hanging up a small hammock, such as can be purchased for a few cents. It is known as a children's or baby's hammock, and measures about five feet long. Such a hammock makes an excellent receptacle for the clothing, and is not in the way at any time. A simple and very effective way of attaching it to the side of the boat is with a ring plate at each end. The ring plate may be fastened to the wall by means of four screws. The hammock can be attached to these rings with small S hooks. The ring plates are very

strong and will not pull out as screw-eyes would.

Every ship must have its clock, but to the moderate purse the regular ship clock is rather an extravagance. A very neat clock can be constructed at little expense, yet in appearance it can be made the equal of a very expensive ship clock. The sole difference is that the clock will not strike the ship bells.

The only materials for the clock are an old steam gauge and an ordinary cheap alarm clock. The brass steam gauge can be picked up in any second-hand junk shop for a very few cents, and the interior mechanism of the gauge and dial removed, leaving a shell for the alarm clock. The back of the gauge in most cases is threaded and screws to the body, so that the back can be taken off and two small holes bored to take a couple of wood screws of sufficient length to attach it to a wall of the boat. Remove the feet and usual top ring from the clock and place it inside the case of the gauge. A hole bored through the top with a screw to fit where the small ring on the top has been removed will hold the clock in place. This permits the whole to be unscrewed from the back for winding and setting the clock. With the brass well polished and given a coat of transparent lacquer, the arrangement affords a very attractive addition to the cabin of the boat.

With room at a premium on board a cruiser, the equipment of the galley is usually overlooked, and the space saved given over to fancy cushions, extra sitting room or something of this character, whereas in reality, whether for a short trip or a long cruise, the galley is one of the most important sections of the boat. A good stove is an essential, and its choice is very difficult. There are a number of types on the market, but for a type that will give all-around satisfaction and is inexpensive to run, the blue flame kerosene stove is probably the most satisfactory. The oil is held in a tank which forms the base of the stove. The stove has two burners, and it is surprising to learn of the excellent meals that can be prepared with it by a little manipulation and ingenuity.



A Small, Inexpensive Hammock, Such as are Sold for the Use of Children, Forms an Excellent Holder for Clothing when Fastened to the Wall of the Cabin.

An equipment of noteworthy compactness and suitable for cooking food for five persons can be made up as follows:

One 10" frying pan.
One 2-qt. coffee pot.

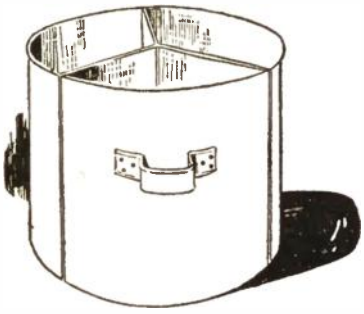
Three triangular pots which go on one burner at the same time, having the same effect as a 10" pot.

One large pot into which above three pots will nest.

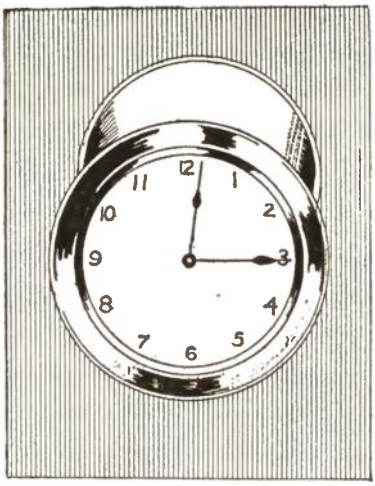
With a limited number of cooking utensils the most elaborate meals can be prepared. For instance, the three-pot utensil permits of cooking three entirely different dishes on one burner. Without it great inconvenience would be felt for lack of cooking surface on the stove. The three-pot utensil is of aluminum, and although more expensive as to the initial cost, it will be found more practicable in the long run, because it will not rust. Compare this to an ordinary iron frying pan which rusts in a day or two with the dampness on a boat and requires considerable scouring before it can be used again. It must be borne in mind, however, that salt water attacks aluminum very readily, so that if the first washing of these pots and pans is in salt water they should be rinsed in fresh water before being put away. A small oven can also be secured, and in combination with the stove makes a complete outfit.

To minimize the worries of housekeeping, paper plates will be found invaluable. In serving soft boiled eggs paraffine paper cups of a similar kind to those supplied at the public drinking fountains can be used, for it is well known that egg is disagreeable to wash from china or glassware. A paraffine cup, set into a glass which holds it firmly, affords a very appetizing way to serve eggs.

Everything that is not tied down hard and fast aboard a cruiser receives a bad mixup at one time or another, and if china or glassware is included it is rather a disastrous mess that one will find upon opening the locker. Glasses should all be kept in racks. A small and attractive rack is shown in one of the accompanying sketches and can be made very easily. The only tools required for making the glass rack are a hammer, a screwdriver, an expansive bit, a ¼" chisel, a small plane and a small, fine-toothed saw.



This Utensil of Aluminum Permits of Cooking Three Kinds of Food at One Time.



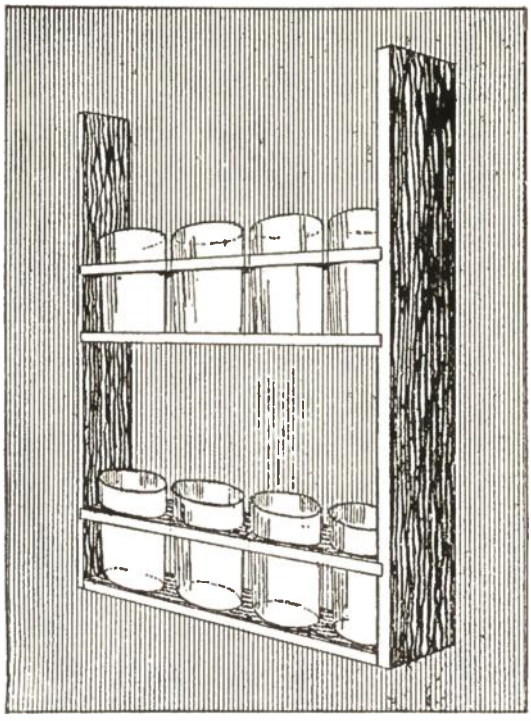
By the Ingenious Combining of an Alarm Clock and Steam Gauge Case, A Ship's Clock is Obtained.

The following materials will be required for the glass rack to hold eight glasses:

Two pieces 12 x 3¼ x ⅜ inches.
One piece 12¾ x 3¼ x⅜ inches.
Three pieces 13⅛ x 3¼ x ¼ inches.
Two pieces 13½ x 1 x ¼ inches.

Since the quantity of lumber required is very small, it is advisable to use mahogany. One of the accompanying sketches shows the general construction of the rack. The various pieces of wood should be put together with ¾-inch finishing nails with the single exception of the two back strips, which may be held by small brass screws. The rack may be finished by sandpapering it thoroughly and giving it a coat of orange shellac, followed by another sandpapering and a final finish of one or two coats of varnish.

Sugar and salt are the two foodstuffs which are most affected by the dampness when carried on shipboard. A very simple way of preserving them indefinitely is to produce about half a dozen preserve jars fitted with metal screw tops and provided with rubber washers for holding the sugar and salt supply, as well as other foodstuffs. Jars of three to three and one-quarter inches in diameter and of one quart capacity will



Glass Tumblers Held in a Simple Rack are Safe from Breakage when the Cabin Cruiser Begins to Roll.

probably serve the purpose best. In order to prevent these jars from rolling about when stored in a locker, a small rack may be constructed as follows:

Secure a piece of wood one-quarter inch thick and of such length as to accommodate as many jars as are to be held in place. At suitable intervals holes are bored with the expansive bit in order to hold the jars. The board is placed about three inches above the shelf of a locker so that the jars may be dropped through the holes and will rest on the shelf.

For the benefit of the handyman who is not already familiar with the handling of an expansive bit, it is well to add a word of caution. In using one of these tools the hole should be bored halfway through or until the point of the bit is seen on the other side of the board. The board is then turned over and a hole bored from the other side, using the small hole as a guide. By this means a perfect hole is made with smooth edges.

The foregoing suggestions for making the cabin cruiser comfortable are but a few, and with the experience the boat owner secures in building and securing the different things described, it is more than probable that other equally or even more important ideas will suggest themselves.

SODIUM SALTS AS FERTILIZERS

It has been shown by the work of investigators in America and Europe that sodium salts will, in part, replace potassium salts, especially with certain crops.

Soda can never entirely replace potash, but certain classes of plants take up more potash than they actually need, if an excess is present in the soil. If available soda is present it seems to be substituted for some of the potash without injury to the plant.

Of course, the soda also serves as a neutralizing agent to combine with the organic acids produced in the soil. Sodium salts are particularly helpful to such crops as turnips, beets and radishes and probably for cabbage. On the whole, it may be stated that some of the root crops like beets, turnips and wurzels make a greater use of soda than do cereals.

NAVY TAKES OVER SAYVILLE WIRELESS STATION

After a series of conferences and controversies covering a period of nearly one year, the United States Naval authorities have taken complete charge of the German wireless station at Sayville, L. I. The charge was made that unneutral dispatches cunningly concealed within apparently innocent commercial and diplomatic messages were being transmitted to the station at Nauen.

Some Useful Picture-Framing Hints

By Charles A. King

BEFORE a picture is measured for its frame, its opposite sides should be parallel and its adjoining sides at right angles. The "sight" of the frame, or its extreme inside dimensions, should be ⅜-inch smaller than the picture, thus a picture 14 inches wide and 20 inches long would require a frame 13⅝ x 19⅝ inches inside, or sight dimensions.

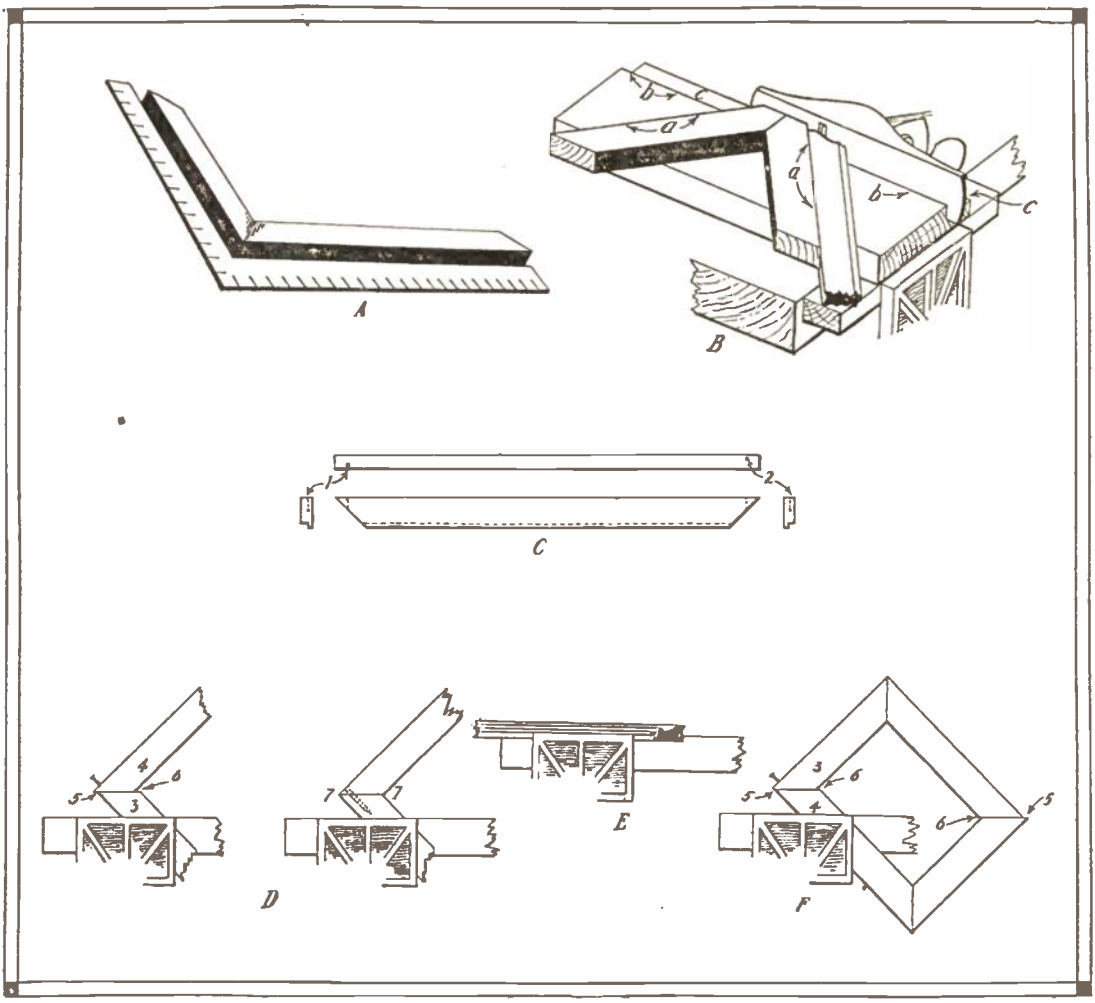
An iron miter box is more satisfactory than a wooden one for sawing the miters, though accurate work may be done by the latter. Often, after using either, the joint can be improved by block planing, so that the surfaces of the miters will be in perfect contact when the back of each moulding lies closely upon some flat surface and the outside edges rest against the inside edges of a steel square, as shown at *A*.

If satisfactory results cannot be obtained by this method, a "shooting board," shown at *B*, may be used; the edges *a a* must be at right angles to each other and at angles of 45° to the edge *b*. The two angles, *a b*, are necessary to permit the opposite miters of a moulding to be planed. The edge of the plane iron should be straight, instead of slightly rounded as usual, and adjusted to cut a thin shaving of uniform thickness from the entire surface of the miter.

After the joints have been fitted and the opposite pieces of moulding made the same length, holes should be bored from the back edge through the mitered ends of each piece, as at *C*, hole 1 being placed near the face, and 2 near the back.

There are two methods of placing mouldings in a vise to nail them; a flat, unfinished piece may be held as indicated at *D*, while the method illustrated at *E* is better adapted to one with a finished or moulded face, as it will not be marred by the jaws of the vise. The inexperienced worker should practice upon small pieces before attempting to fasten the frame together, as the principal difficulty lies not so much in the fitting of the joints as in the nailing. The short piece 3 should be placed in the vise, and the long piece 4 nailed upon it as at *D*. The nail should be placed in the hole 1 near the end of 4, and the mitered end lightly touched with glue, and placed with its edges about ⅛-inch beyond those of 3, as at 5 6. The backs of the pieces must coincide so that when the nail is driven through 4 into 3 the sliding of 4 will permit the face members of the mouldings to intersect, as at 7 of *D*. Piece 4 may be held with one hand while the nail is being driven with the other; a firm pressure, perpendicular to the surface of the miter, must be applied, or the moulding will slip.

One nail through 4 into 3 should hold the pieces in place while their positions are carefully reversed, in doing which care must be used to avoid moving the pieces by each other, and a nail driven through 3 into 4. Unless the foregoing task is done carefully, the joint may be started. After the other two pieces have been nailed together by the same method they must each be handled as one piece,



The Tools Required for the Making of Frames, as well as Details of the Work in the Various Stages.

and both fastened together, as at *F*, though a finished moulding should be held in the vise as at *E*. This is the most difficult part of the entire frame, as only one joint can be nailed at a time, which necessitates turning the entire frame while one joint is unsecured, and the other has but one nail in it. In nailing the first joint an allowance for sliding should be made.

The frame should be allowed to stand until the glue has hardened, after which the corners may be trimmed, the bare wood touched with stain, and the frame repolished with a light application of wax; if made of unfinished wood, it should be stained and finished at this time.

Lay the face of the frame upon a piece of cloth to prevent its being marred, and measure it for the glass. If its sight is less than 20 inches in its largest dimension, single strength glass will generally be satisfactory, but if larger, double strength may be necessary. The glass should be thoroughly cleaned, and unless it is perfectly straight it should be laid in the rabbet with its concave, or hollow side, toward the front of the frame. The picture should be laid face downward upon the glass, and a cushion, the same size as the picture, made of several sheets of smoothly folded paper, placed upon it to hold the picture smoothly against the glass, after which a back of thin wood or cardboard should be fitted closely

into the rabbet and fastened with small nails.

The back of the frame can be made dustproof by covering it with a strong piece of paper which should be cut about half an inch shorter and narrower than the extreme outside dimensions of the frame. After sponging it until it has become well dampened, spread cold glue evenly, but not thickly, for at least half an inch around its edges on one side. Its glued side should be laid upon the frame and rubbed or pressed with a case knife until it adheres closely. It will not be necessary to work all of the wrinkles out of the paper, for when it dries it will shrink and become tight and smooth.

The screw eyes by which the picture is to be hung should be placed one or two inches above the center of the frame so that its lower part will be the heavier and the frame will hang properly.

A SELF-WINDING ELECTRIC CLOCK.

AN electric clock is being sold in France which will run for a length of time determined by the life of the battery—usually from one to three years—without attention. The winding mechanism is so simple that it could be made by any amateur electrician. The clock movement is the same as that of any clock, so that the winding mechanism can be attached to any time piece.

Referring to the accompanying diagram, the armature *C* (the size of which varies according to the size of the movement) is placed between the two poles of a permanent magnet. The axis of this armature is terminated by an endless screw driving an ebonite wheel, *A*, which actuates a second larger wheel, *B*, rotating upon an axis which also carries the square spring shaft. The armature is placed in the circuit of a dry cell of suitable size, having its terminals connected to two metallic brush-carriers, *P* and *N*. The positive connection runs direct to the brush, but the negative connects with a wheel *G* of insulating material, upon one-half of the circumference of which is fastened the strip of silver plate *E*. The movements of this wheel are controlled by a finger *H*, causing a rotation of *G* sufficient to bring the strip *E* in contact with the spring of *N*. This finger is attached to the axis of one of the movement wheels which makes one revolution every two and one-half hours. During its rotation it comes in contact with another finger, *K*, which turns the wheel *G* an amount sufficient to close the

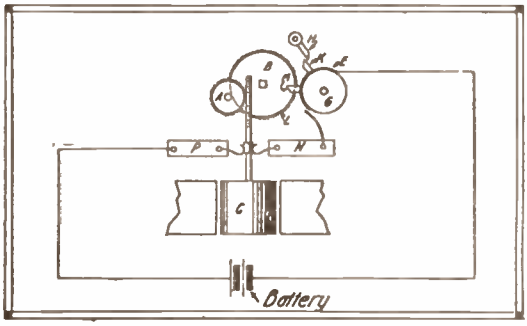


Diagram of the Working Parts of an Electric Clock that will Run for Three Years without Attention.

circuit. As soon as the motor turns, the wheel *B* also turns and continues until the pin *L* raises the arm *M* of the wheel *G*, and so breaks the circuit. In two and a half hours the finger *H* again gives the wheel *G* a fraction of a turn and closes the circuit. At this moment the pin *L* is above *M*, and consequently the circuit remains closed during the time of one revolution of the wheel *B*.

Several of these clocks, according to *La Nature*, have been placed upon the cars of the Paris street railways, and, notwithstanding the continuous vibration and shock to which they are subjected, have been recording the time faithfully for a considerable period without any attention whatever.—J. H. BLAKEY.

MASSACHUSETT'S NEW ELECTRICIAN'S LAW

A law of great importance to residents of Massachusetts became effective July first. The most important clause in this act is as follows, "Except as hereinafter provided, no person, firm or corporation shall, after the first day of September, nineteen hundred and fifteen, enter into, engage in, or work at the business of installing wires, conduits, apparatus, fixtures or other appliances for carrying or using electricity for light, heat or power purposes in this commonwealth, either as a master or employing electrician or as a journeyman electrician, unless such person, firm or corporation shall have received a license or certificate therefor, issued by the board provided for in section two of this act, and in accordance with the provisions hereinafter set forth."

This means that unless he has a license no person may repair a fixture of any sort, install or repair any wiring—with a few minor exceptions—or do any power wiring incident to lathe motors, wireless telegraph sets, etc.

A commission is formed to carry out the provisions of this act and it is expected that this commission will from time to time hand down decisions regarding the application of the act so as to make it work a little less hardship than it now does. While in its essence it is a desirable measure in that it eliminates a very undesirable class of person who is accustomed to do work of a very questionable character, it appears as if the act was going to restrict, in many cases, the growth of the industry. It is already rumored that the commission will issue a ruling forbidding electrical houses from giving net rates to persons or companies not holding a license.

Examinations will be held at frequent intervals at Boston, twice a year at five other appointed places, and at any other times or places the examiners may deem necessary. A fee of $25.00 is required to take a master's examination, and $1.00 for a journeyman's examination. In order to perform the work one must have a journeyman's license, and in order to contract for the work it is necessary to have a master's license. Thus to install an electric light fixture for one's self one need only have a $1.00 license, but to do the work for a neighbor one must have both licenses. Any person actively engaged in electrical wiring for a livelihood for the five consecutive years next preceding his date of application will be issued a license without examination. The license is renewable each year upon the payment of a fee of fifty cents for a journeyman's license and of $15.00 for a master's license.

There are certain exceptions to this act, the most important of which are the exemption of public service corporation employees doing outside and meter installation work, certain temporary theatre work, elevator repair work, incorporated companies engaged in the transmission of intelligence by signalling with electricity, and apprentices working under the direction of a licensed electrician. A maximum penalty of $100.00 is imposed for the first offence of the violation of the provisions of the act. Subsequent violations by the same person are subject to a maximum penalty of $500.00.

A complete copy of the act may be obtained by addressing the Secretary of the Commonwealth, 331 State House, Boston, and asking for a copy of the "Act Relative to the Registration of Persons, Firms and Corporations Designing to Install Wires or Apparatus for Electric Light, Heat or Power Purposes."

NEW EXPLOSIVE FOR SUBMARINE TORPEDOES

A new explosive for use in submarine boat torpedoes which is said to be immeasurably more terrific in its destructive power than the explosives now in general use has recently been perfected by an inventor connected with a submarine construction company of this country. The new explosive is used in connection with mechanical devices upon which patents are now pending. Although the Allies have offered to buy the patents, arrangements are already being made whereby the United States navy will secure them.

Electricity to Be Used in Farming

By Albert Marple

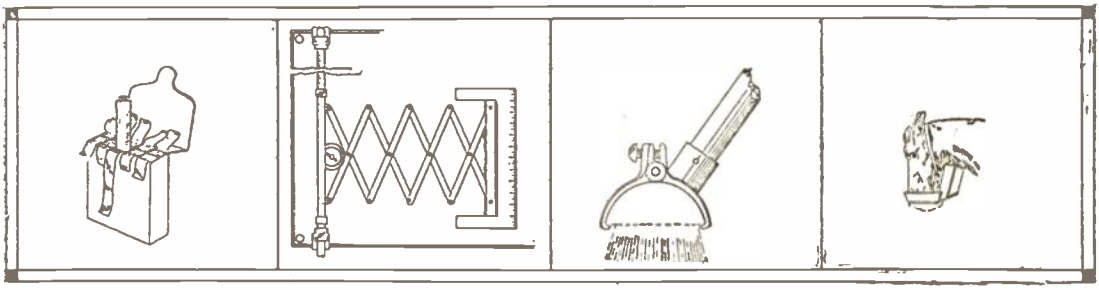
A PROCESS has just been announced by W. J. Anson, an inventor of Southern California, whereby it is claimed that electricity may now be used in connection with farming in a manner which has up to this time probably never been even suggested. In a word, by this new system electric current is used in the sub-irrigation of the soil, it stimulates and accelerates plant growth, while at the same time it protects the trees against extreme heat and winter frosts. This inventor has been working on the system for years and has had such wonderful results that prominent horticulturists and agriculturists are taking notice and are making a thorough investigation.

During the past year Mr. Anson has been operating in the San Fernando Valley. He said recently: "During my experiments in the San Fernando Valley I proved to my entire satisfaction the merits of my system as a protection from frost. In a small tract in which I had ascertained the character of the soil to be identical throughout, I had one acre in which my process was used, one acre under dry farming and part of an acre under surface irrigation. Seeds of the same kind were planted in each piece. The test came unexpectedly during a heavy frost in my section. The plants in the ground that was treated by my process revealed the hardiest growth of all, and were the only ones that were alive and thriving after the frost. Of the four palms in our front yard, the one treated by my new method was the only one that was not frozen down to the ground."

For this system the claim is made that it aerates the soil, the currents of air and electricity passing through the conduits causing a capillary attraction which reaches moisture from depths of from five to seven feet. It causes the soil to retain its moisture so that it remains in a pulverized state and does not bake, as is the case in ditch irrigation. It is claimed that with this system one gallon of water will do the work of forty gallons used under ordinary conditions. The water is carried to the place where it is needed. As this system is almost entirely under-ground it saves the space ordinarily taken up by ditches.

This system is simple both in installation and operation. Tile conduits are laid in the soil at depths ranging from fourteen to sixteen inches, these being about ten feet apart. Galvanized wiring is run through each conduit, the current that works these various benefits being derived from a feed line extending across the end of the orchard or garden plot. Where the process is used in groves the plan followed is that of having a positive and negative current on either side of a row of trees, with an upright tile outlet at each tree; there being, at the top of each of these outlets, a resistance coil. In winter the coils are heated by electricity, the current being governed by a thermometer which automatically opens a switch the moment the mercury goes below a given point. This automatic regulation of current will create in the coil sufficient heat to keep the atmosphere around the trees at a safe temperature.

The discovery promises to revolutionize farming, especially in those sections where irrigation is necessary.



Recent Novel Patents

Convenient Cigarette Box

Probably the latest luxury for the growing army of American cigarette smokers is a compact box from which the cigarettes are withdrawn by means of paper tabs. The tabs extend to the bottom of the box, under the cigarettes, and up to the opposite side, where they are pasted.

Novel Drafting Instrument

An instrument which is claimed to be able to perform a variety of drafting gymnastics has recently been invented by a Los Angeles man. It consists of a rigid support attached to the drafting board and a collapsible frame resembling in operation the collapsible doors at the ends of Pullman trains. This frame extends outwards to a considerable distance over the drafting board surface and, because of its peculiar construction, always remains parallel to the point at which it is originally fixed. A ruling device is attached to the end of the collapsible support.

Ingenious Brush Holder

A Philadelphian has invented a brush clamping device which is ingenious in many respects. The brush holder comprises a pair of duplicate clamps which are pivoted together and forced into close contact with the bristles by means of a machine screw. A socket is provided which projects from one clamp and into which the brush handle is inserted; a screw hole is provided for fastening the handle to the socket. The jaws of this clamp are curved, to accommodate various brushes.

New Food Bag for Horses

The old idea in feeding bags for horses, no matter what were its humanitarian intentions, was more or less of a de-appetizer for the animal. A new bag for feeding grain to horses has been brought out by an inventor in Newark and has advantages manifestly superior to the old type. It consists of a pan having folding sides and ends and a metallic hopper which allows the grain to run automatically into the pan as the horse eats.

Cigarette and Match Holder

Anything to do with cigarettes is interesting to the American public, because the American public, according to very conservative estimates, smokes upwards of one hundred million cigarettes a day, and that estimate is increasing very rapidly. A really useful and ingenious cigarette appliance will bring more royalties to an inventor than an automobile invention. One of the latest "cigarette patents" issued was based on a combination cigarette and match holder. The matches are contained under the flap of the cigarette box. A scratching surface is provided.

Holder for Pocket Lights

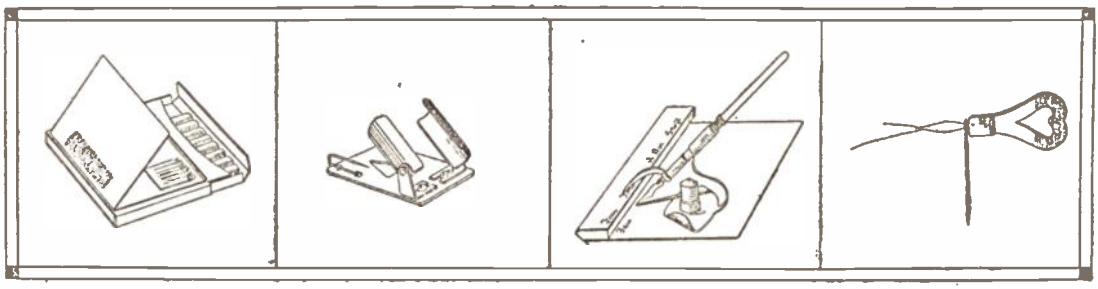
No other field of electrical development has seen such a rapid increase in the number and diversity of applications as that taken by the seemingly commonplace electric pocket flashlight. Within the past few years it has improved from a toy and an uncertain speculation to a thoroughly reliable and highly efficient tool. One of the most recent improvements for the benefit of the user is an adjustable holder into which the pocket lamp may be placed and held in any position while work in the darkness is going on.

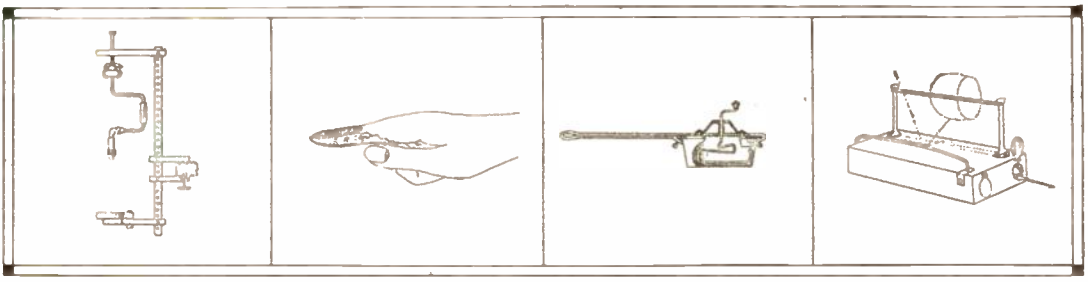
A Copying Device

From a small settlement in the Canadian Northwest comes a clever idea in a hand writing device which the patent authorities at Washington consider ingenious enough to warrant the granting of a United States patent. The writing to be copied is placed on a ruler-like support above the pen. A curved tracing point follows the curves and angles of the writing.

A Needle-Threader

A needle-threading device which, from the standpoint of simplicity of construction and operation, is a vast improvement over the countless needle-threading machines brought out since the needle was first thought of, is the subject of a patent recently granted to a New York inventor. A thin wire loop is attached at one end to a small handle. The opposite end of the loop terminated in a sharp angle.





A Drill Press

A drill press which will be of interest to the amateur mechanic who is handicapped by lack of funds is the subject of a patent granted to an inventor in Michigan. The press consists of an upright standard in which a number of holes spaced equidistantly are bored. Bolts passing through the holes into a clamp hold the press in place on the workbench. An arm projects at right angles from the top of the standard and to it is attached a screw, at the lower end of which is a clamp for holding the handle of the drill. The drill is an ordinary brace-and-bit.

Combination Clamp

Two young men in Illinois have been granted a patent upon a combination clamp for use about the workshop or garage. It consists of a stout bar with depressions cut regularly along one side and terminating at one end in a curved up foot. The remainder of the clamp, which, with the exception of the screws, is cast in one piece, moves up and down the main bar, one projection fitting into the depressions. Two distinct clamping operations, neither of which interferes with the other, are possible.

Toothbrush on Finger Tip

Tooth brushes of every conceivable shape and design have been patented since the antiseptic properties of that implement were first exploited by the dental and medical professions some years ago. One of the most unique ideas in this direction has just been granted a patent. A man from Texas, where compactness in the minor luxuries is still at par, is the inventor. The new tooth brush resembles the glove finger tip used in protecting injured fingers.

Wire Puller

A wire pulling machine which has advantages over those now on the market hasejust been patented. It embodies a combined ratchet, a pull in one direction locking the wire and spur in a sliding bar. A handle engages another spur in a sliding bar. A hook is provided on a bar to which the handle is pivoted. The handle is a powerful lever.

Mixes Cakes and Frostings

A pan for mixing cakes and frostings is the subject of a patent recently granted to a Wisconsin inventor. The pan, except for its unusually long handle, outwardly resembles the conventional household coffee mill. A knobbed handle projects from the top and is braced by iron arms which go to the sides. Within the pan, the handle is bent in a series of convolutions of a design best adapted for the purpose of mixing frostings thoroughly.

Turns Leaves of Music Portfolios

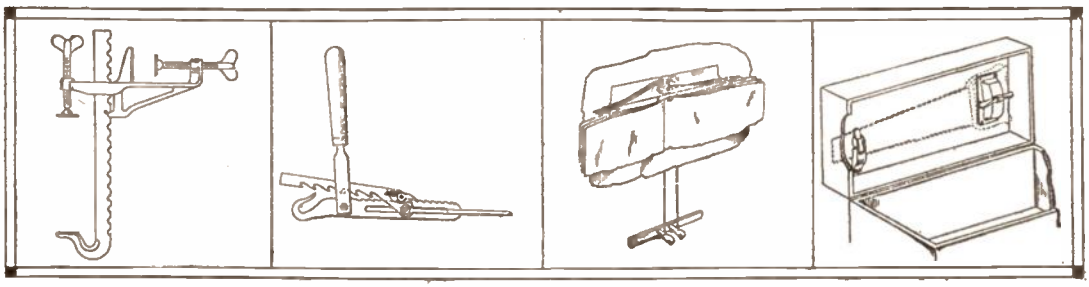
Pianists appreciate the embarrassment which arises when suddenly, in the midst of a difficult selection, a draught of air causes the sheets of music to fly over and the exasperated musician to lose his place. This unpleasantness is eliminated in an ingenious little device, invented by a man in Indiana, which turns the pages over as the pianist wills. Thin levers reach out to the individual leaves of the music book, and when the pianist desires to turn over a page, he or she merely presses a pedal. Pressing another pedal, by an arrangment of cogs, turns the leaves in the reverse direction.

Crochet Thread Holder

Now that the craze of knitting various articles of usefulness for intrenched soldiers is at its height, the social world should be interested in a patent which has recently been granted to an inventor in the District of Columbia for crocheting. The device, which appears to be somewhat complicated to the layman, consists of a base, spindle supporting uprights and a bow-shaped guide. The bow-shaped guide has a length equal to that of the bulk which moves along the spindle, thereby permitting the thread as it unwinds an unhampered movement. The bow-shaped guide prevents the bulk from moving against the spindle supports.

Saw Holder

A duplex clamp for holding a saw in place in the top of a tool chest has been brought out by a Pennsylvania inventor. The handle of the saw is clamped in place by a block and winged screw, while the opposite end is held by a spring snap. This holder effectively prevents the saw teeth from coming in contact with other tools and thereby suffering injury. It also makes certain that the saw can be found, when required, in its proper place.



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.

DETECTORS.

(14) R. O. S., Williamstown, Pa., asks:

Q. 1.—What size of storage battery is best to use with a one-inch Bull Dog spark coil?

A. 1.—We are not familiar with this particular type of coil, but a 6-volt 60-ampere-hour battery is usually used for a one-inch coil.

Q. 2.—Is the Radioson detector very sensitive and reliable? What stations use it? Is it better than the Crystaloi?

A. 2.—We have never tried the type of detector mentioned. Better write the makers direct and find out what they have to say. You can also ask them what voltage is necessary to be used with their Bull Dog coil. We have tried the Crystaloi detector and have found it very satisfactory for all-around work.

LIGHT AND POWER FROM BATTERIES.

(15) G. L., Clifton, N. J., asks:

Q. 1.—Is it practicable to install a small electric lighting outfit, for miniature lamps, door bells, etc., in a house remote from a regular supply?

A. 1.—Yes, very acceptable and economical installations can be made by use of a few storage cells permanently wired to gravity cells. A satisfactory number of storage cells will be three, for this being common with automobile practice, you will be able to utilize standard appliances. You can make the entire outfit yourself. For storage cells you can make plates of the Planté sort by following the description in the first part of Watson's book on Storage Batteries, the material being ordinary roofing lead. Electrical formation can be hastened by modifying the arrangement a little, first separating the strips with toothpicks and filling the intervening space with litharge or red lead, then removing the sticks and fastening the plates together with soft rubber bands. Though these latter will not be very long lived, they will endure until the chemical changes have become well established. Make a dozen gravity cells, using 6" x 8" glass jars, perhaps by removing the tops from bottles. You can cast your own zincs in foundry sand. In order to prevent the zinc salts from creeping over the edges of the jars and to avoid loss from evaporation, you can well adopt the expedient of pouring on top of the solution a layer of paraffin oil, say ¼" deep. Also, after the right specific gravity of storage battery solution has been attained, oil in these cells is highly to be recommended. In a warm attic, where you propose to locate the equipment, this is almost your only method of sure operation. We would advise you, however, to put all the batteries in the cellar, and run the wires to the attic. A broken jar will not then result in ruined ceilings and carpets. In use, the gravity cells will regularly be charging the storage cells at a slow rate; when apparently drawing from the latter you will really be drawing from both sets in parallel, but almost all the current will come from the storage cells; their low internal resistance permitting them to follow the demand. You will be readily able, with such an equipment, to operate a fan or a sewing machine motor of suitable voltage.

AERIAL.

(16) R. A., Dexter, N. Y., asks:

Q. 1.—Would an umbrella aerial about 80 feet high having about 1,000 feet of wire on it be as efficient as a single wire flat-top aerial 2,000 feet long strung on telephone poles about 15 feet high?

A. 1.—Yes, the umbrella aerial would be far preferable.

Q. 2.—Please mention one or two wireless stations using a wavelength of 10,000 meters or more.

A. 2.—The Federal Company stations at South San Francisco and Heeia Point, Hawaii, are fitted out to use wavelengths of 10,000 and 12,000 meters. Tuckerton, N. J., also uses long wavelengths. The Marconi Company is building stations both on the Atlantic and Pacific coasts which will doubtless use wavelengths of this character.

SELENIUM CELL.

(17) A. J. H., Cleveland, Ohio, asks:

Q. 1.—Using a selenium cell with a telephone receiver and batteries, will the cell, acted on by light, cause the 'phone to respond to the variation in light? Will the pull of an electro-magnet vary as the intensity of the light on the cell?

A. 1.—We always regret to have to inform our readers that experimenting with selenium is not a very easy undertaking. At present selenium has only been successfully used in laboratories or under conditions approaching laboratory conditions, and then only by persons familiar with its properties. About all you will probably be able to record in the 'phones will be a click when the light strikes the cell. Work has been done on "light telephones," but, as far as we know, no practical results have been obtained. A spot of light has been caused to fall on a cell, which in turn operates a 'phone. The spot of light is reflected from a mirror controlled from some form of transmitter. In this way the telephones have been made to respond to sounds transmitted by means of light. As the current handled by the cell is very small the only type of electro-magnet that would be used is that of a sensitive telephone receiver or something of that type. Selenium cells are made to perform various "feats" by means of secondary circuits operated from relays controlled by the selenium cells.

TRANSFORMER HEATING.

(18) K. T., Nicholson, Pa., asks:

Q. 1.—How long should a step-up transformer for wireless work stand the current on without heating to such an extent as to make it necessary to shut the current off?

A. 1.—This all depends on the quality of the transformer. As such a transformer is designed only for intermittent work, a higher heating loss can be permitted than for a power transformer which must remain in the circuit all of the time. We have tested a well-known make of Type E transformer and found that it is capable of running several hours without becoming heated to a dangerous temperature. The secondaries of some open-core transformers heat very badly even on short runs.

UNIVERSAL MOTORS.

(19) F. A. A., Silver City, N. M., asks:

Q. 1.—Is it possible to change a direct-current motor so that it will operate on alternating currents?

A. 1.—Certain specially designed series motors will operate on both direct and alternating currents. Illustrations of this are seen in small sizes of household vacuum cleaners that operate at from 4,000 to 7,000 or more revolutions per minute. As induction motors on 60-cycle circuits, the maximum speed would be under 3,600 revolutions. A series motor is practically unlimited in speed. Sometimes these "a.c.-d.c." motors are called "universal" motors. As an illustration of the largest motors with such qualifications may be cited those operating on the N. Y., N. H. & H. R. R., between New York and New Haven, which receive direct currents while on the section involving the N. Y. Central's terminal, but alternating currents when on their own tracks. As a first necessity for such motors, the field magnet must be laminated, and since there is no suggestion that yours is of this sort, the case is hopeless.

CHANGING DIRECT-CURRENT MOTOR INTO ALTERNATING-CURRENT MOTOR.

(20) H. R. B., New Haven, Conn., asks:

Q. 1.—How can I change a direct-current fan motor to adapt it for use on a 60-cycle, 110-volt, 20-ampere alternating-current circuit? Motor has two field poles and a 12-slot armature.

A. 1.—Unless the field structure is laminated you cannot make the change. Even if field is of the desired sort, you may find that motor will hardly run, there being too many turns of wire to permit the necessary current to flow, for with alternating currents there is a choking effect in proportion to the square of the number of turns opposing the current in addition to ordinary resistances and counter electromotive forces. You would have to rewind with coarser wire, say three sizes larger than at present. You can even then expect lively sparking at the commutator. The 20-ampere designation is inappropriate, as the motor ought not to require more than one ampere.

ONE KW. TRANSFORMER.

(21) S. T., Reedsville, Pa., asks:

Q. 1.—I desire to build a one-kilowatt transformer to operate on 110 volts, 60-cycle supply. Would it be best to build a closed core or an open core transformer?

A. 1.—By all means build a closed core transformer. Its cost will be far less and its operation certainly more satisfactory than the open-core transformer.

Q. 2.—What size core should be used?

A. 2.—Sides 6¾" x 2". Use 170 pieces of 0.017" silicon steel per side. Ends 5¾" x 2". Same number and thickness as sides. Use lap method of jointing.

Q. 3.—What size wire should be placed on the primary?

A. 3.—Use 110 turns of No. 11 D. C. C. wire.

Q. 4.—What size and how many turns of enameled wire should be put on secondary?

A. 4.—The secondary will require 8,400 turns of No. 28. Unless you are familiar with transformer construction we would not advise you to attempt to build the transformer until you had read up considerable data on the subject.

MEETING THE DYESTUFF SHORTAGE

THE dependence of American textile manufacturers on the German coal tar dyes has placed some of our big industries in a difficult position. Though some importations still get through, they are inadequate. It is interesting to learn from official Government reports that American manufacturers of dyes are taking extremely active steps to establish new color works and enlarge existing plants. In the last few months the progress has been noteworthy.

Benzol is the starting point for most of the aniline dyes. It is a product of the distillation of coal tar, and in Germany coke ovens are built and operated so as to collect all the tar and finally the benzol. In America most of our coke ovens are of the old bee-hive type, which waste everything except the coke. This accounts for a shortage of one of the most important raw materials. However, much is being done to correct this waste. By-product coke ovens are becoming more common. One company has awarded contracts for 92 additional by-product coke ovens with complete equipment for benzol recovery, and expects to spend a million dollars on the plant. The Combria Steel Company, of Johnstown, Pa., has perfected its new battery of benzol scrubbers so as to secure a daily output of five tons of benzol, one ton of napthalene and the usual smaller amounts of toluol and xylol. To use this raw material the firm expects to erect at once a plant to manufacture dyestuffs. At first they will make only the staple dyes in greatest demand.

At Woodward, Alabama, a recovery plant is nearing completion that will furnish seven tons of benzol daily, and the new benzol plant of the Tennessee Coal and Iron Company will have a daily output of 13,000 gallons. Additional recovery plants are being built in connection with the coke works of the Republic Iron and Steel Company, of Youngstown, Ohio, of the Lackawanna Steel Company, at Buffalo, and of the Inland Steel Company, of Inland Harbor, Ind. The United States Steel Corporation in Indiana has in active operation a plant producing 12,000 gallons of benzol daily.

As to the actual manufacture of dyes, the Benzol Products Company has nearly completed an extensive plant at Marcus Hook, Pa., to be devoted to the manufacture of intermediate products on a large scale. They hope to produce most of the aniline oil and salts required by American color works. The W. Beckers Aniline & Chemical Company, of Brooklyn, has greatly widened the scope of its manufacturers, increasing its capital to $1,000,000. They will make a variety of aniline colors. A large chemical plant at Stamford, Conn., idle for two years, has been leased by a new company organized by Joseph Doelger, of New York. They will soon make on a large scale many aniline dyes never before produced in America. E. C. Klipstein, of New York, is making sulphur blacks which are in even greater demand in the hosiery industry than the famous aniline black.

Alizarin red and indigo blue are not planned for, yet they are the two most important coal tar dyes. There is a great increase in manufacture of vegetable dyes, such as logwood, fustic and orchil, white cochineal and mineral dyes, such as Prussian blue, chrome green, manganese brown, chrome yellow, and many others, will meet an increased demand.

LARGE BATTLESHIPS USE PANAMA CANAL

For the first time since its completion, the Panama Canal has been used for passing large United States battleships. On July sixteenth, the *Missouri, Ohio* and *Wisconsin,* carrying naval cadets from Annapolis to San Francisco, made the trip from the Atlantic to the Pacific.

The canal has been used by battleships before. The Peruvian gunboat, *Tentiente Rodriguez,* passed through the waterway about a year ago, and a flotilla of American submarine boats during February of this year navigated the canal during battle practice.

RADIO SECTION

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

An Improved Inductive Tuner

By Charles Horton

THE different types of couplers or receiving transformers now in common use may be roughly divided into classes as follows:

(1)—Couplers in which the adjustment in coupling is obtained by sliding the secondary within the primary.

(2)—Couplers in which the adjustment in coupling is obtained by rotating the secondary within the primary.

In the first class may be included three sub-types:

(*a*)—Those having slider adjustment on primary and slider adjustment on secondary.

(*b*)—Those having slider on primary and switch adjustment on secondary and

(*c*)—Those having switch adjustment on primary and switch adjustment on secondary.

In the second class may be included two sub-types, as follows:

(*a*)—Those having sliders and

(*b*)—Those having switches.

There are also a few other types which may be classed as imperfect types of any of the above, such as that type which has neither primary nor secondary adjustment, but relies entirely upon adjustable condensers for tuning.

All of the above types of couplers will be found to have one or more of the faults outlined below:

(1)—Presence of unused masses of wire giving rise to losses in efficiency.

(2)—Imperfect contacts causing resistance and unreliability.

(3)—Dead ends causing imperfect tuning qualities.

It will be evident after consideration that all of the above-mentioned types are subject to one or more of the faults enumerated, owing basically to the attempt to provide in one instrument a multitude of combinations in order to be able to receive on aerials of varying size from many stations working on various waves. Consequently, it will also be apparent that much higher efficiency is obtainable in the use of any particular aerial by the use of a coupler wound particularly for receiving from any particular station. Thus, if it were possible for each station to be provided with a number of specially wound couplers in addition to its adjustable coupler, accurate adjustment for any station with which it was in the habit of holding communication would be merely a matter of connecting its aerial and receiving circuits to the particular coupler provided. The author has long been of the opinion that just such an arrangement will be the final outcome of the present extensive experimentation in tuning, and has consequently designed an apparatus embodying this principle. This arrangement makes it possible to be receiving from, say, Nauen or Colon, or any other distant station, and by the mere throwing of a switch to connect with one's friend who is calling, see what he has to say, and by simply throwing the switch back again, to be in perfect tune as before with the distant station. The inestimable value of this apparatus will from the above be readily apparent. The chief objection to a set of this kind would naturally be the high cost, but in this set the cost is greatly reduced, and withal a wonderfully perfect receiving set pro-

vided, which has efficiency far greater than most receiving sets now available.

The set to be described is of the popular "panel" style, in which all the adjustments are placed upon the front side of a cabinet containing the various coils and other components. There is provided an ordinary receiving transformer with taps, and in addition twelve of the special couplers which will hereafter be known as "fixed" couplers. Upon the front face of the cabinet there is mounted, in addition to the tap switches for the receiving tuner and the variable condenser knobs, a special switch for cutting in any one of the fixed couplers, and also a compound switch for changing from the use of the receiving transformer to the fixed couplers. The switch for connecting any one of the fixed couplers is made double in order to insure that when any one of the couplers is in use there shall be absolutely no connection to any other coupler, as such connection might possibly set up oscillations in coils not intended to be used at the particular time considered. In order to accomplish this highly desirable severance of all connection with foreign circuits, switch points are provided for both ends of both secondary and primary coils of the fixed couplers. Finally, in order to prevent production of induced currents in any of the fixed couplers while one of them is in operation, the fixed couplers are arranged parallel to each other, this arrangement being devoid of inductive connection.

Referring now to the drawings, there is provided in Fig. 1 a perspective view of the completed instrument. In this view the arrangement of switches and adjustments is clearly shown on the front of the box, the handle for adjusting the secondary of the receiving transformer is shown on the right side of the same and the binding posts for the apparatus conveniently placed at the rear. The secondary is controlled by turning the knurled knob and the coupling by pull-

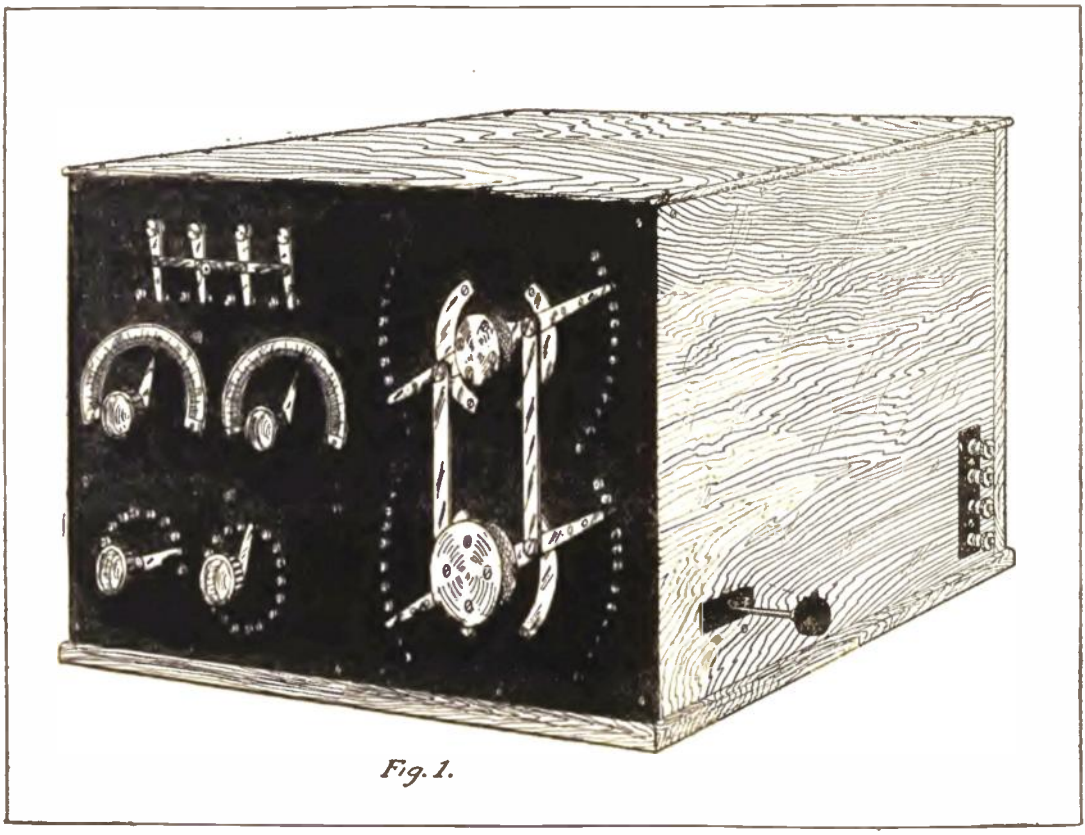


Fig. 1.

The Improved Inductive Tuner as it Appears when Completed.

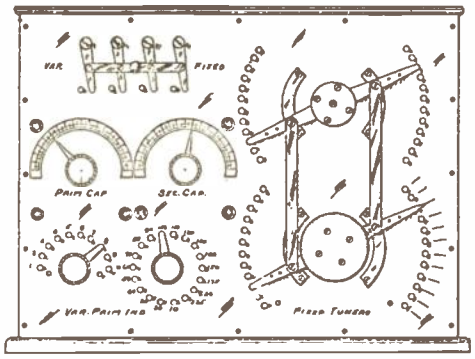


Fig. 2.

Fig. 3

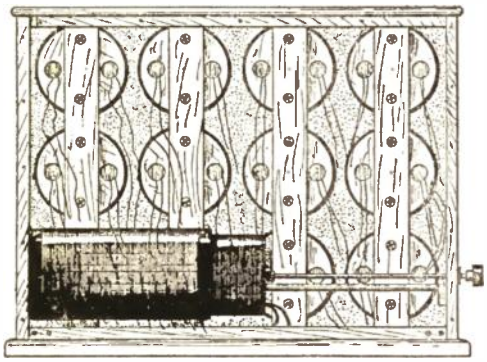


Fig. 4.

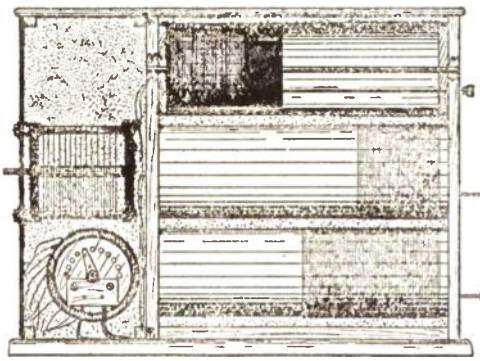


Fig. 5.

Views of the Exterior and Interior of the Inductive Tuner, showing the Location of the Different Parts.

ing the same to the right.

In Fig. 2 there is shown the front elevation of the instrument drawn to scale. It will be noted that the lower right hand arm of the fixed tuner switch is made to act as a pointer and lines are engraved on the front of the case corresponding to the different switch points. Adjacent to these lines may be placed the call letters of the different stations standardized in the instrument, and thus it will be an easy matter to pick out the tuner for any particular station.

Fig. 3 gives a side elevation of the cabinet, showing the secondary controlling handle and the binding posts.

Fig. 4 is a front elevation of the instrument with the front panel removed to show the interior arrangement. Here may be seen the receiving transformer mounted in the front part of the cabinet and also the twelve fixed tuners in the back of the same. The receiving transformer is mounted in an extremely simple though quite effective way. As will be seen, the primary coil of the same is supported entirely upon the left-hand end of the cabinet to which is screwed the wooden disk fastened in that end of the coil form. The secondary, as usual, slides backward and forward upon two metal rods which extend the full width of the cabinet and at the left-hand or primary end are supported in holes in the primary coil disk above mentioned, while at the right they are held in holes in a small piece of wood provided for the purpose and which is screwed to the right-hand end of the cabinet. The secondary switch mounted on the end of the secondary coil can also be seen, as well as the rod at its center passing

through the hard rubber bushing in the right-hand end of the cabinet to the controlling handle.

Fig. 5 is a side elevation of the cabinet showing the side removed. Here may be seen the three tiers of fixed couplers, the receiving transformer and also the method of mounting the adjustable condensers at the back of the front panel. The upper one of the fixed tuners is shown in section and discloses the secondary coil, the method of mounting the same within the primary and the means for adjusting the coupling. It may be stated here that it is intended to have the coupling in any of the fixed couplers made as loose as is consistent with clear reading, but in some cases, as in especially long distance work, coupling may have to be quite close. Consequently, the coupling could not be made invariable as by winding the primary and secondary windings side by side on the same form, which would be a simpler construction. It is intended that any change in inductance of the associated receiving circuits occasioned by the adjustment of coupling of these fixed couplers shall be compensated for by the adjustable condensers. The coupling, however, is intended to be seldom if ever changed when once standardized.

Before proceeding to a detailed discussion of the several parts comprising the instrument, it will be well to show how the fixed tuners are to be standardized. To this end it should be noted that the cabinet is to be completed in every way and ready for the reception of signals with the receiving transformer before the fixed tuners are wound. The apparatus is then connected up to the aerial and detector and a station accurately tuned in. In doing this both adjustable condensers are set with their rotating plates half in their stationary plates. When perfect resonance has been obtained, the exact number of turns in use on the primary and secondary are noted. With this data one of the fixed tuners is wound with the same number of turns, as noted, and the tuner marked with the call letters of the station corresponding and then laid aside. A second station is then similarly measured up and a second fixed coupler wound to agree with it. In this way the twelve tuners, or as many as may be needed, are wound and provided for as many stations.

The next step is, of course, to mount the same within the cabinet and make the proper connections. Finally, when each station represented among the fixed tuners is picked up on the receiving transformer it is switched in to the fixed tuner provided for it and the coupling made as weak as possible, the adjustable condenser's best position being also noted and recorded along with the corresponding station's call letter, etc. When the twelve tuners are mounted and connected the arrangement is similar to a telephone switchboard at a central exchange, where the operator can plug in any station desired without a volume of tiresome adjustments.

Returning now to consideration of the drawings, Fig. 6 is an assembly of the cabinet proper containing the strips for supporting the fixed tuners. This is best made of mahogany, but whitewood stained in imitation, or oak, may be used.

Detail No. 1 is the bottom of the cabinet, with strips for connecting the tuner supporting strips to the base and for receiving the front switch panel.

Detail No. 2 is the top of the cabinet. with similar strips.

Detail No. 4 is for the left and the right hand sides of the cabinet. It should be noted that not all the holes shown should be drilled in either piece, but that they should be drilled exactly as noted thereon.

Detail No. 5 is the back of the cabinet and is drilled for mounting fixed tuners and accommodating the coupling controlling rods for the same.

Detail No. 6 is the front switch panel, and is best made of hard rubber. The popular dull finish on hard rubber can be obtained, if desired, by taking off the polish with fine pumice powder and water. Hard fibre or even wood stained black may be used in place of rubber.

Detail No. 7 shows the coil forms for the fixed tuners, and is self-explanatory.

Detail No. 8 is the primary coil form of the receiving transformer.

Detail No. 9 is its secondary coil form.

Detail No. 10 shows the rods on which slides the primary.

Detail No. 11 is the hard rubber bushing for the secondary switch.

Detail No. 12 is the hard rubber base for the binding posts.

Detail No. 13 presents the tops and bottoms of the adjustable condensers. If adjustable condensers are already at hand these pieces need not be made, as the condensers can be mounted in place of them. Any adjustable condenser of large capacity will do.

Details Nos. 14 and 15 are the stationary and movable plates of the condenser, respectively, and demonstrate a method of cutting both plates from one square piece of plate. The diagonal lines are, of course, first cut, thus releasing the corner from which the movable plate is cut.

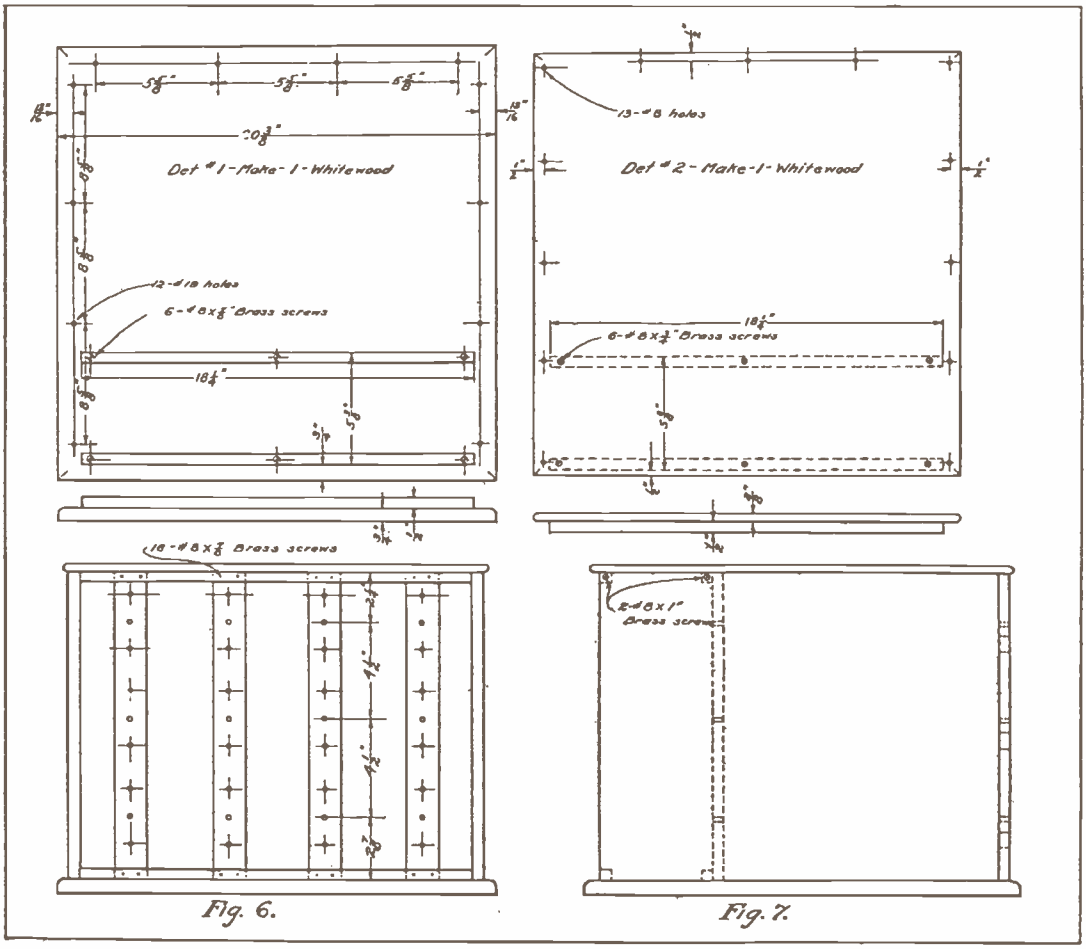
Detail No. 16 shows the separating washers for the condensers.

Detail No. 17 indicates the rods for the washers. The length of these rods is dependent on the thickness of the plates used and can be readily estimated once the plate stock is at hand.

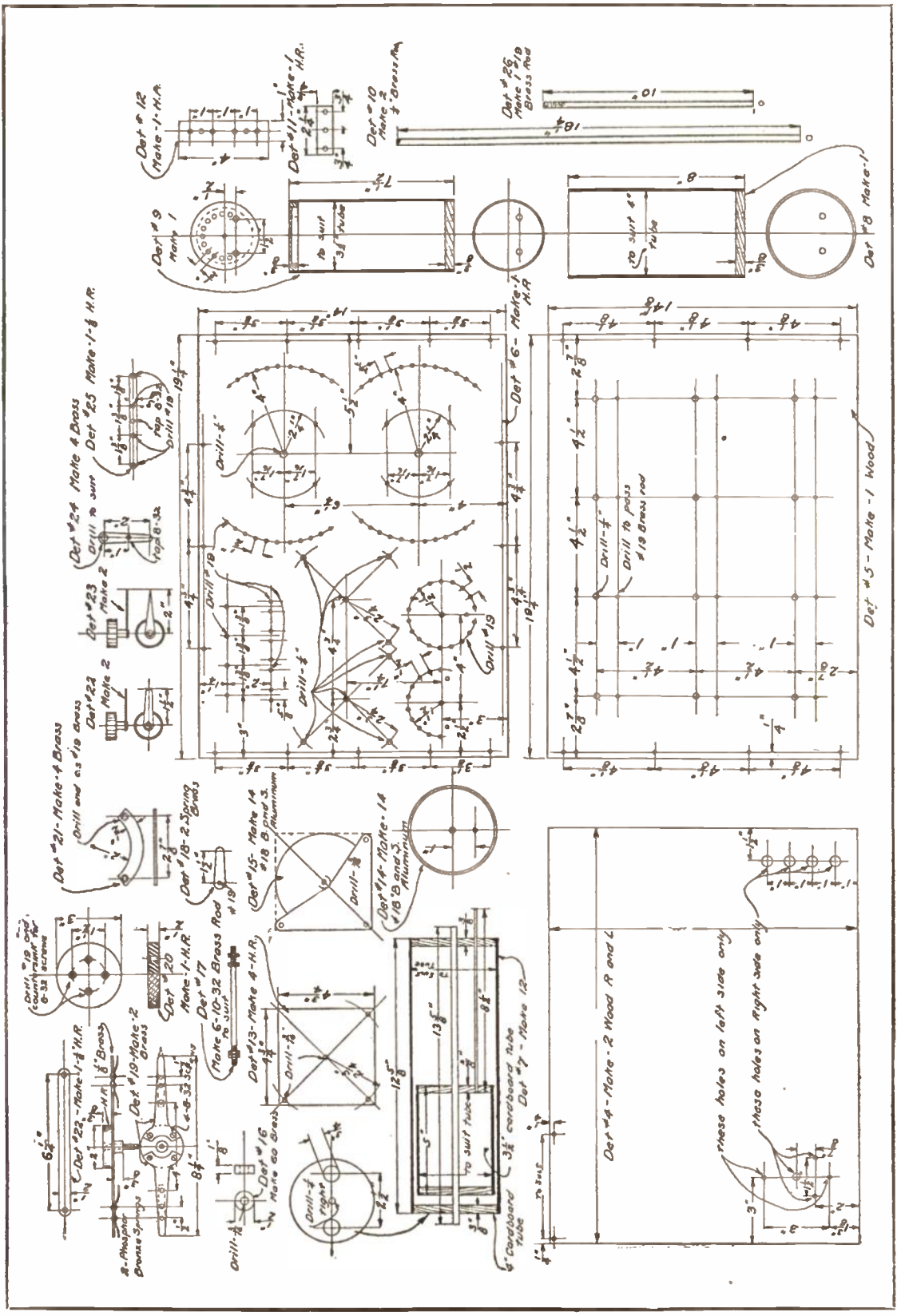
Detail No. 18 is the switch lever for the secondary of the receiving transformer.

Detail No. 19 shows the fixed tuner switch lever. One end of one of these levers should cut to a point to act as a pointer.

Detail No. 20 is of the knurled adjusting disc which is to be screwed to the center of one of the switch arms shown in Detail No. 19.



Details of the Case for the Inductive Tuner. It is Best to Use Mahogany or Oak, although a Good Grade of Whitewood can be Substituted.


Det #12 Make-1-H.R.
Det #11-Make-1-H.R.
Det #10 Make 2 Brass Rod
Det #26 Make 1 Brass Rod
Det #9 Make 1
Det #8 Make-1
Det #24 Make 4 Brass
Det #25 Make-1-H.R.
Det #6-Make-1-H.R.
Det #5-Make-1 Wood
Det #23 Make 2
Det #22 Make 2 Brass
Det #21-Make-4 Brass
Det #18-2 Spring Brass
Det #15-Make 14 #18 B and S. Aluminum
Det #14-Make-14 #18 B and S. Aluminum
Det #13-Make 4-H.R.
Det #22-Make-1-H.R.
Det #19-Make-2 Brass
Det #17 Make-1-H.R.
Det #16 Make 60 Brass
Det #7-Make 12
Det #4-Make-2 Wood R and L
Drill to pass #19 Brass rod
These holes on left side only
These holes on right side only
3½" cardboard tube
6" cardboard tube
To suit tube

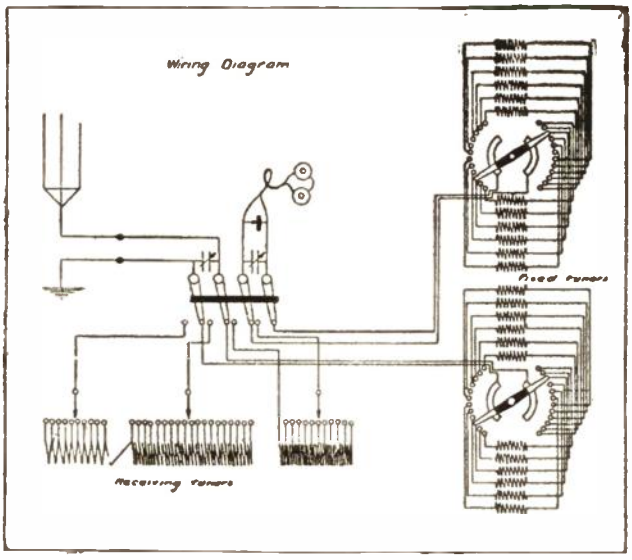
Detail No. 21 shows the contact strips for the switch levers in detail No. 19.

Detail No. 22 is the switch lever for the primary adjusting switches of the receiving transformer. The knobs shown are of the regular typewriter type. The best way to attach the lever to the hub of the knob is to turn a shoulder on the hub, force the lever on this shoulder and rivet it over. Soldering is difficult, as these knobs melt very easily.

Detail No. 23 shows the handles and pointers of the adjustable condensers. The remarks in detail No. 22 apply here also.

Detail No. 24 is of the levers for the circuit changing switch.

Detail No. 25 refers to the hard rubber connecting bar for the foregoing-mentioned switches.



Wiring Diagram for the Inductive Tuner.

Detail No. 25 refers to the hard rubber connecting bar for the foregoing-mentioned switches.

Detail No. 26 is the rod for the secondary switch on the receiving transformer.

The instrument should be carefully made, but does not present any great difficulties. When the fixed tuners are properly calibrated the instrument becomes a very valuable adjunct to the wireless station and indirectly acts as an indicator of stations picked up at random.

Considering more in detail the receiving transformer, it should be stated that the primary coil of the same is in this particular instrument wound with 225 turns of single cotton-covered magnet wire winding, approximately 40 turns to the inch; there being at the left-hand end ten sections of one turn each, while the remainder of the coil is divided into 18 sections, the first 15 sections thereof containing ten turns each and the remaining sections 25 turns each.

The arrangement just described, however, need not be adhered to in all cases, such, for instance, where a short aerial is used, in which case it would be desirable to wind the coil with finer wire in order to receive the long-wave stations.

The secondary of the receiving tuner is wound with single silk-covered magnet wire No. 26 or 28 and divided into 11 equal sections.

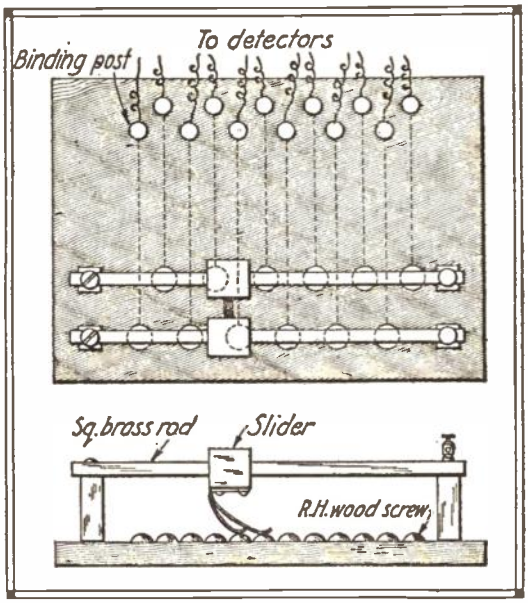
If, as is quite possible, the circuits should in practice require a loading coil to get perfect tuning, the fixed tuners may be wound with the number of turns required with a loading coil, thus replacing and thereby adding to the efficiency of the combination.

By providing on the two-way, four-lever switch described a third set of contact points, and making proper connections thereto, it is possible to arrange to use, if desired, the receiving tuner in cascade with one of the fixed tuners, and thus have a multiple receiving set with its correspondingly greater selectivity.

It is best that no shellac or varnish be used on the fixed tuner coils, as this increases the distributive capacity of the coils.

A LOG THAT CONTAINS 3,000 FEET OF LUMBER

The largest log yet found in the Northwest was cut down near Ridgefield, Washington. The log was twenty-four feet long and seven feet in diameter at the big end. The log contained about 3,000 feet of cedar. It was so large that the shed roof over the saw had to be raised to allow the log to get to the saw.



Any One of Several Detectors May be Cut In by Means of This Simple Detector Switch.

DETECTOR SWITCH HAS NOVEL FEATURES

A detector switch that will be found very useful for making comparative tests with various types of detectors is shown in the accompanying drawing.

The construction is quite simple. A block of wood measuring eight inches by six should be cut. Brass rods of the same approximate length as the block should be procured and fitted with sliders. The rods are to be mounted on the base about one inch apart. Contact springs are soldered to the under surface of the sliders, and the sliders connected firmly by a stout fibre bridge.

Round-headed brass upholstering tacks should be driven in the baseboard and wires led from them to binding posts. It will be seen by consulting the drawing that the tacks are "staggered," that is, the tacks in the two rows are not opposite. When one contact spring touches the head of one tack, the other spring will be resting upon the tack head a fraction of an inch in advance of it in the other row.

Detectors of various sorts can be connected to the binding posts, as shown. The two rods should be inserted in the receiving circuit in the same way that a single detector is inserted ordinarily.—H. S. PAINE.

PLYMOUTH RADIO ASSOCIATION IS FORMED

At a recent meeting of the radio amateurs held in Brockton, Mass., the Plymouth County Radio Association was formed and the following officers elected for the first term: President, Arthur Barnes; Vice-President, Fred Elliott; Secretary and Treasurer, Thos. C. Barham.

The purpose of the association is to promote good fellowship among the amateurs of Plymouth County as well as to aid them when obstacles are encountered. The association will be glad to hear from other similar institutions. Correspondence should be addressed to Thos. C. Barham, 833 Brockton Avenue, Abington, Mass.

MASSACHUSETTS RADIO CLUB ORGANIZED

The organization of a new radio club—The Massachusetts Radio Society—took place in May. The following officers, who are distributed over the state, were elected: Herbert L. Fowle of Reading, President; Leland Cummings, Stoneham, Vice-President; Dustin Downs, Stoneham, Secretary, and Herman Arnold, Stoneham, Treasurer. The new club announces that all wireless enthusiasts of Massachusetts who wish to join should communicate with the president or secretary for application blanks.

WEATHER FORECASTS SENT BY WIRELESS

It is announced that inland distribution of weather forecasts by wireless will soon be inaugurated for the Middle West. The plan contemplates the sending of forecasts for Illinois from the wireless station at Illiopolis between 12.45 P. M. and 1 P. M. each day. The station sending the weather bulletins will have a range of at least 125 miles and it is proposed to send the messages at a slow speed so that they may be read by the amateur wireless operators.

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

An Automatic Receiving Set

By Austin C. Lescarboura

THAT a wireless receiving set should be no more complicated to operate than, a simple telephone switchboard or a typewriter is the contention of Walter Goodchild, a wireless investigator and inventor of New York. And in the way of proving his assertion this inventor has brought forth a most ingenious receiving set that may be operated by pressing various buttons.

The automatic receiving set, for such it must be called since all the tuning operations are automatically performed upon the pressing of various buttons, consists essentially of an inductive type tuner, a loading coil for the primary circuit and another for the secondary, two variable condensers and the usual accessories such as the detectors, fixed condensers and telephones. The different tuning instruments are controlled by a keyboard containing ten keys placed in a row at the front of the receiving set.

Front View of the Automatic Receiving Set: The Main Motor may be seen in the Center, and the Variable Condensers on Either Side of It. The Keyboard is Placed in Front.

The keys serve the purpose of closing various circuits which in turn operate the different instruments. They are divided into the following groups: The first two alter the coupling of the inductive tuner; the second two vary the primary winding of the coupler; the third two vary the winding of the secondary; the fourth two alter the adjustment of the primary condenser and the fifth two the secondary condenser.

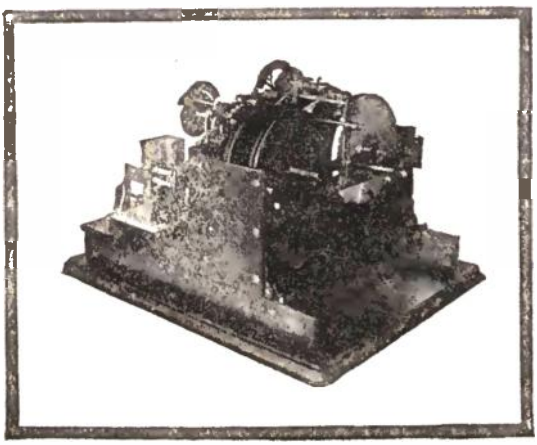
In order to adjust the coupling of the inductive tuner the first or "In" key is pressed, starting up a small motor which supplies the motive power for all the operations with the exception of the two variable condensers, each of which has its individual motor. A set of electro-magnets throws in a spiral drive which causes the inductive coupler coils to be brought closer together so as to tighten the coupling. To reverse the operation the "Out" key is pressed, resulting in another set of electro-magnets throwing in the spiral drive but rotating it in the opposite direction, so that the coils are separated further apart. Both the "In" and "Out" keys drive the coupling spiral in either direction as long as they are held down. When the spools are brought too near each other or separated too far apart, automatic circuit breakers come into play and cut off the motor's supply.

The inductive tuner in reality consists of four spools, although two are actually used for the tuner proper. These spools are mounted on shafts so that they may be revolved. Two spools are used for the primary winding and two for the secondary; the winding consisting of a flat copper ribbon coated on one side with enamel so as to insulate the turns. The copper ribbon winds one turn above the other on the narrow spools of the tuner, as much wire being placed on the spool of either the primary or secondary as is found necessary. The balance of the ribbon is kept on the companion spool. Contact with the copper ribbon is made at one of its ends, while the other end of the winding is connected by means of a spiral brass belt which also serves the purpose of keeping the ribbon in place.

In adjusting the inductive tuner the

keys of the primary and secondary circuits are pressed. When the primary "In" key is pressed the primary spools rotate so that the copper ribbon winds from the companion spool on to the active spool of the tuner. On the other hand, the pressing of the "Out" key causes the ribbon to unwind from the active spool on to the companion spool. The same procedure is observed in adjusting the secondary of the tuner. The tuning, obviously, is exceedingly sharp, since a fraction of an inch of ribbon can be reached by this method. Furthermore, the motor drives the spools at a fairly high rate and to wind the ribbon from one spool to the other is but a moment's work.

There are two loading coils used in this receiving set, one for the primary and the other for the secondary of the inductive tuner. These coils are wound on a flat spool and have taps taken off at certain intervals and connected with the contact points of switches. Over the contact points slide switch arms which are operated by a pair of electro-magnets through a ratchet movement. To cut in or out the loading inductance in the primary or secondary, the same sets of keys —the second and third couples—as were employed to operate the winding on the primary and secondary spools, are pressed. However, in this instance, one of the keys of the first group is pressed, operating as a "shift key," to use the expression of the inventor. By pressing the shift key the differentiation is made so that the switches are operated instead of the winding. The "In" keys adjust the primary or secondary loading coil switches; the "Out" keys adjust the same switches in the reverse direction. The reason for the shift key is that it saves at least four extra keys, the addition of which would unduly complicate the manipulation of the receiving set. Mr. Goodchild states that a separate shift key in the form of a long bar will be used in the future.



A Partial Rear View of the Set: The Black Inductive Tuner Spools may be Seen, as well as the White Spool of the Loading Coils.

The last four keys are used in controlling the condensers in the primary and secondary circuits. Each condenser consists of a large number of brass sheets separated by a special insulating fabric. Brass rods passing through holes bored in the plates serve to short circuit more or less of the condenser, thus varying the capacity in circuit. A small motor operates each condenser, cutting in more or less plates until the required capacity is attained.

The automatic receiving set is quite simple to operate. It is claimed by its inventor that within twelve seconds every tuning operation can be performed throughout its scope. The first step in tuning is to press the "In" coupling button so as to bring the coupler spools close together. The loading coil switches are then adjusted, followed by a closer adjustment by means of the ribbon windings. Finally, the sharpest tuning is sought by adjusting the primary and secondary condensers. The operator can then make the coupling looser if he so desires.

By the introduction of a keyboard the operation of a receiving set is greatly simplified, for, after once learning the different functions of the buttons, any one can receive signals without having to master the action in back of each button. Dials are provided on the different parts of the set so that an operator can pick up any station at any time by knowing the necessary adjustments of the different parts.

The motive power is supplied by a twelve-volt motor operating from a storage battery. The two condensers each have individual motors that draw their supply from the same battery as the main motor. The various pairs of electro-

magnets also take their current from the common battery; these electro-magnets serving the purpose of throwing in various friction drives as the buttons are pressed. The main motor is mounted on a felt base and has a special gear case filled with oil, insuring practically silent operation.

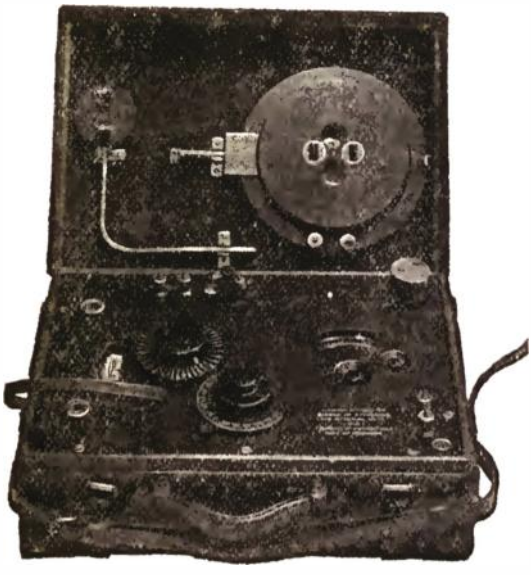
Weighing but thirty pounds in all, the automatic receiving set, aside from its use by amateurs, Government and commercial operators, promises to become widely used on aircraft, according to Mr. Goodchild. That it is ideal for this purpose would seem true from the fact that an aviator could press the different buttons while driving his machine, whereas the average receiving set would require too much attention. Furthermore, by the use of a fixed and permanent detector that requires no adjustment whatsoever and is not affected by vibration, which is incorporated in the set, the outfit is absolutely dependable.

But the greatest field of employment of the automatic receiving set will probably be on shipboard in times of disaster, either to the ship on which it is installed or when the ship is speeding to the succor of another vessel in distress. By means of a multi-conductor cable and a small push button board the receiving

Especially Intended for Amateur Use, this Inductive Tuner is Designed along the Same General Lines as the Automatic Receiving Set. It is, However, Manually Operated

set in the wireless room can be operated from the bridge or, for that matter, any other part of the ship. The operator, receiving messages and standing beside the captain and other officers, can keep them constantly informed regarding the messages he is receiving.

The appearance of the automatic receiving set marks a new step in wireless. It is but a forerunner of the efforts that are bound to follow towards simplifying radio apparatus and bringing its operation within the scope of the laity.



AN INSTRUMENT FOR MEASURING DECREMENT OF TRANSMITTERS

Professor Kolster, of the Bureau of Standards, has recently designed an in-

A Portable, Direct-Reading Decremeter Designed by Professor Kolster of the Bureau of Standards.

strument by which the decrement of a transmitter may be measured. The instrument is now largely employed by radio inspectors in determining whether or not transmitting sets are tuned sufficiently sharp to emit the waves in keeping with the wireless laws.

A Telephone Receiver of New Design

By Charles Horton

THERE has lately appeared on the market a new type of wireless receiver that is claimed to be far more sensitive than any in present use. The extreme sensitiveness of this new receiver is due to the employment of an entirely new and novel arrangement of parts.

In the accompanying drawings appears a semi-diagrammatic view of such a receiver arranged to show clearly the arrangement of parts, as well as three views showing the operation of the receiver.

The new receiver consists of a ring type permanent magnet, *A*, provided with U-shaped pole pieces of soft iron, B^1 and B^2. Supported between these two pole pieces is arranged a flat coil of high resistance, *C*, having a slot at its center in which is balanced an armature, also of soft iron, *D*, which is arranged for limited rotation about the pivot *E* in the center of the coil. One end of this armature, *D*, is connected by means of the wire, *G*, to the mica diaphragm, *F*. All the parts described are neatly mounted in a hard rubber case of the usual head type.

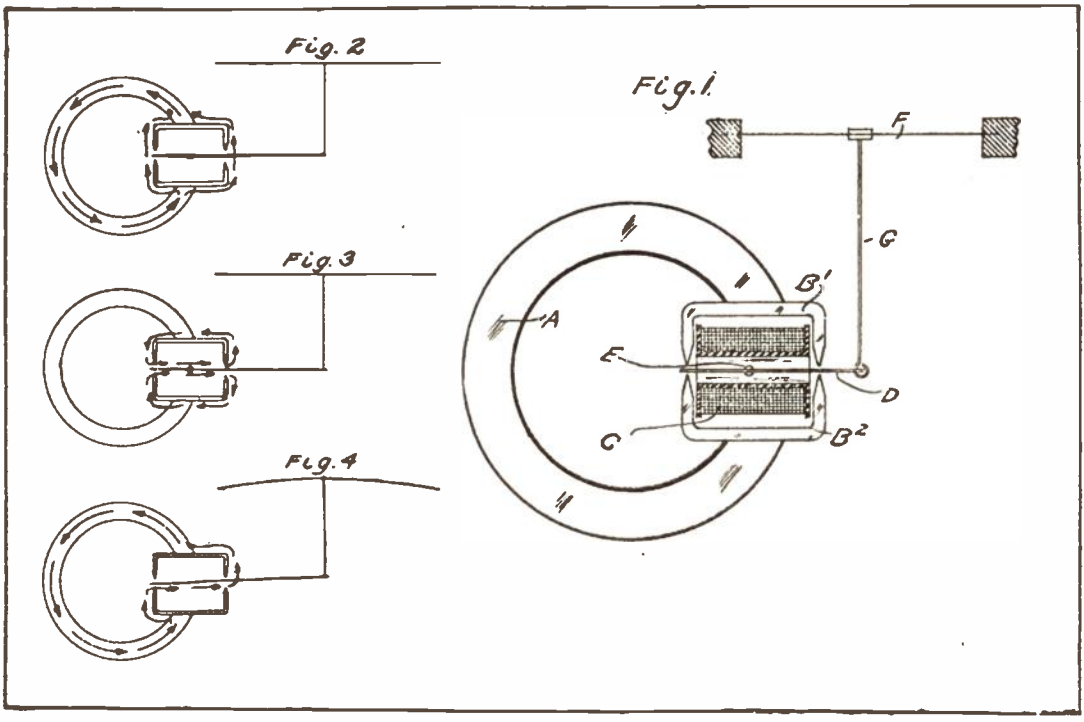
The operation of the receiver is apparently as follows:

In Fig. 2 the arrows on the permanent magnet represent the path and direction of the magnetic flux in the receiver when no current is flowing in the coil, and it will be seen from this that the flux produced by the magnet divides equally through the two limbs of the U-shaped pole pieces and to the lower pole pieces, it is under no strain whatever, and consequently the mica diaphragm is not at all deflected. This is quite a contrast to the state of the diaphragm in the ordinary receiver, which is deflected towards the permanent pole pieces at all times.

If, now, a current is caused to flow through the instrument, say a direct current of constant value, the coil sets up a flux through the armature longitudinally; this flux, as in all solenoids, passing out of one end of the coil and in at the other, as shown by the arrows in Fig. 3. The flux also divides and flows equally in both U-shaped pole pieces and thus the armature at both ends is equally attracted to upper and lower pole pieces and is thus under no tendency to change its position. It will be seen that acting separately neither the flux due to the permanent magnet nor the flux due to the coil has any effect on the armature.

The action is quite different when both fluxes are acting simultaneously. In Fig. 4 this effect is clearly shown by the arrows. The flux from the permanent magnet in attempting to pass up through both branches of the lower U-shaped pole piece meets in the left branch a part of the flux due to the coil, which is in the same direction as itself. On the other hand, the flux, in attempting to pass up through the right branch, is opposed by the same flux from the coil, which passes downward. Likewise, the permanent magnet flux in continuing its flow upward attempts to pass up through the left branch of the upper U-shaped pole piece and is here opposed by the descending flux from the coil, while in the right branch it is assisted by the ascending flux from the coil. The final result of this opposing and assisting of the flux from the permanent magnet is to cause a strong flux to flow in the magnetic circuit as shown by the arrows and a weaker flux to flow in the parts of the magnetic circuit not included in the circuit outlined by the arrows. Owing to the strong flux the armature is attracted at its left hand end to the lower pole piece and at its right hand end to the upper pole piece and consequently is slightly rotated on the pivot *E*. The movement is transmitted to the mica diaphragm through the link *G*.

It will now be easily understood that should a current flow in the coil in the opposite direction to that which we previously supposed, the resultant flux in the magnetic circuit will be from the lower end of the permanent magnet upward through the right hand branch of



A Schematic Drawing of a Telephone Receiver of New Design, as well as Diagrams of the Magnetic Circuits and their Effects on the Diaphragm at Different Periods in its Operation.

the lower U-shaped pole piece, longitudinally through the armature and through the left hand branch of the upper U-shaped pole piece to the upper end of the permanent magnet, and thence through the permanent magnet to the other end. In this case the armature is rotated in the opposite direction on its pivot and transmits to the diaphragm a movement in the opposite direction to that in the previous case.

The extreme sensitivity of the new receiver is probably due to two causes: First, that the diaphragm is at all times when not acted upon in nowise deflected and therefore—as in the case of a spring—is easier to deflect than a diaphragm which is under constant strain as in the ordinary types of receiver. Secondly, that the armature is acted upon at both ends and the flux is produced differentially, a very similar action to that existing in a polarized relay.

The receiver is undoubtedly more delicate than standard types, but, it is claimed, owing to its great sensitiveness, it will probably be widely adopted in wireless work.

CONTAINERS FOR WIRELESS INSTRUMENTS

Serviceable cases for condensers, test buzzers and other wireless instruments can be easily made from cigar boxes. The labels of the boxes can be readily removed by thoroughly moistening them, followed by scraping. The top and bottom of the boxes are apt to warp but this can be prevented by gluing across the inside small strips of wood.

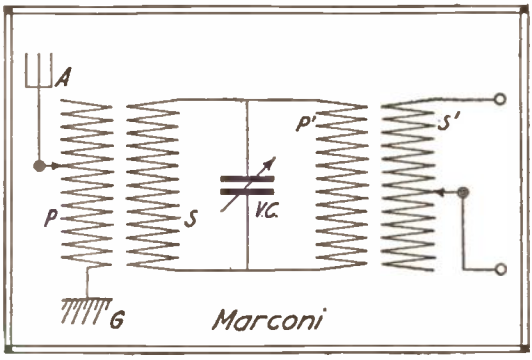
For large fixed condensers, the cigar boxes used as containing cases can be filled with melted paraffine. This will insure good insulation. In the case of a test buzzer the noise can be materially lessened by packing felt, waste or excelsior around the buzzer.—JOHN B. RAKOSKI.

A New Type of Multiple Tuner

By Thomas W. Benson

THE multiple tuner has in actual practice shown its superiority over all other common methods of tuning and, despite its selectivity, it is rarely found in the amateur's station.

A multiple tuner is one in which an intermediate circuit is used to transfer or carry the energy from the aerial circuit



A Diagram of the Marconi Scheme for a Multiple Tuner.

to the detector and 'phone circuit. The advantage of this arrangement lies in the fact that as the intermediate circuit has little or no damping it oscillates longer even when energized by highly damped waves in the aerial circuit. These oscillations, having a small decrement, can be sharply tuned by the detector circuit, resulting in great selectivity.

The disadvantage, however, of the multiple tuner has been in the room it takes up, requiring as it does two sets of variable, inductively coupled coils, besides the various variable condensers. To overcome this Prof. Cohen, of the Bureau of Standards, has brought forward a tuner possessing all the selectivity of the Marconi type with only two inductances, and he secures loud signals, due to his extremely close coupling.

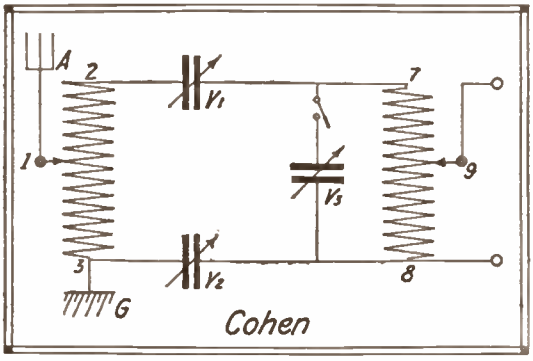
In Fig. 1 are shown both the Marconi and Cohen circuits, simplified, of course, to enable them to be understood at a glance.

In the Marconi hookup the intermediate circuit consists of inductances S and P^1 which are of fixed value, and variable capacity VC which is used to tune the circuit.

In the Cohen circuit instead of inductively coupling the intermediate circuit he connects it direct, thus coming back to the double slide tuner days. His apparatus actually consists of nothing but two tuners connected together with the variables. The middle circuit in this case, therefore, is formed by 2, V^1, 7, 8, V^2, 3 and V^3. This circuit is closely coupled both to the aerial and detector circuits and this explains the louder signals.

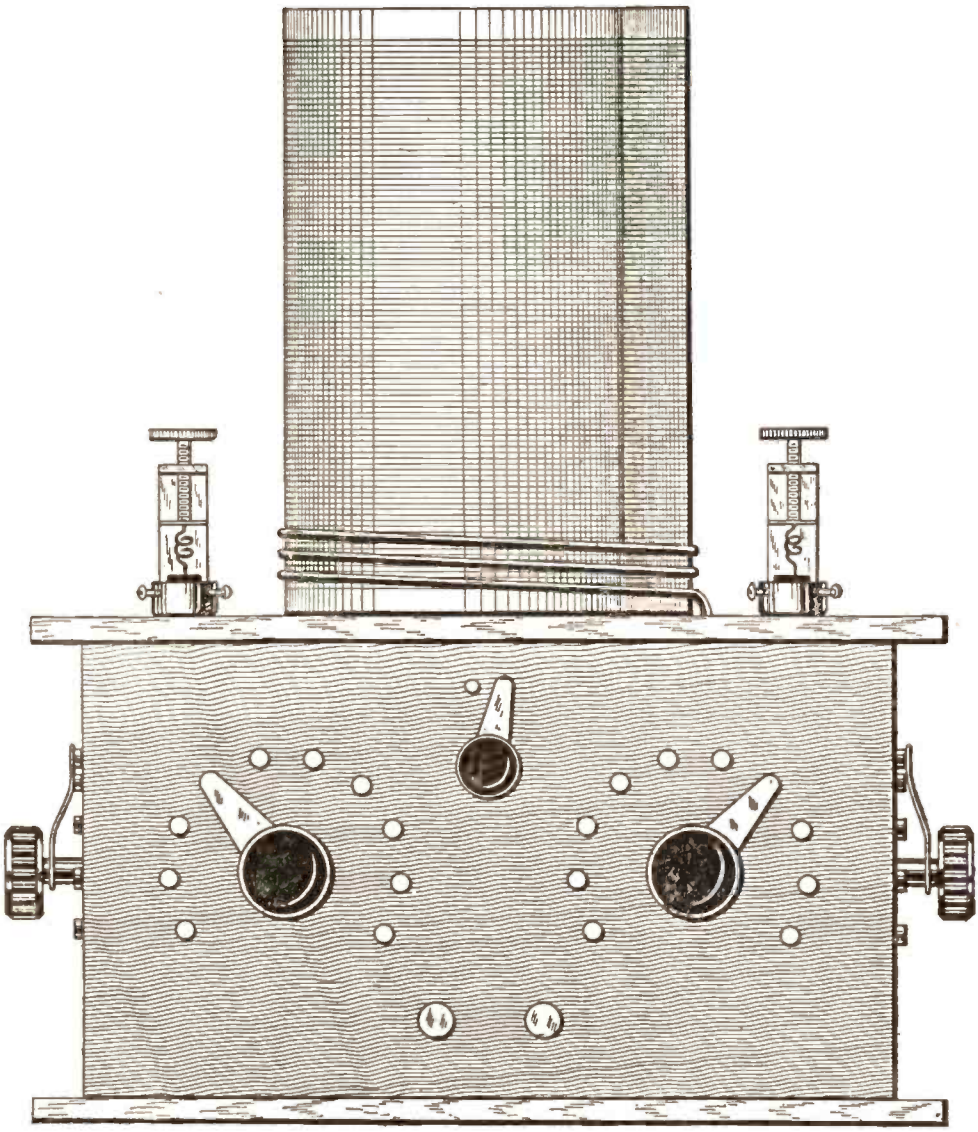
The condensers are used to tune this intermediate circuit, but it will be noticed that V^3 has a switch to cut it out and by following the next few paragraphs carefully it will be shown how it is possible to design a multiple tuner that will not need any condensers in the intermediate circuit.

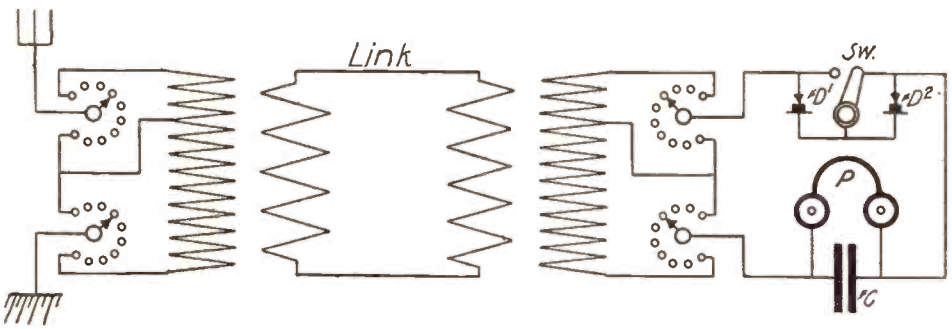
Consider V^3 switched out of the circuit, add series capacity by turning V^1



Wiring Plan of the Cohen Circuit for a Multiple Tuner.

and V^2 and as the capacity is added the wave length, to which the circuit will respond, will become shorter and shorter until a point will be reached, provided there is sufficient capacity, when the inductances will be offset by the capacities and a circuit will have, practically speaking, no capacity or inductance. That is, although both are present, they counterbalance each other and neither has any effect on current flowing in the circuit.




Link
SW.
D1
D2
P
C

Under this condition it would be thought that no energy would be transferred to the detector circuit, but, as a matter of fact, the opposite is true. This sounds far fetched, but here is an analogy:

Every one has read of Tesla's experiment where he puts a heavy ring of copper in a high-frequency field. What happens? He induces so much current into that ring that it grows red hot and, if continued long enough, it melts.

Now, returning again to the circuit in the Cohen tuner, the question is asked: "Can you induce a current in a circuit possessing no capacity or inductance?" The answer is yes.

Following up this line of reasoning, it will be noticed that if we could do away with the effect of inductances in the intermediate circuit we could remove the capacities likewise. It is, of course, impossible to entirely remove the inductances, but we can reduce them to such a small amount that their effects on the circuit will not be noticeable to any great degree.

This is done by using two or three, no more, turns of stranded wire for each coil in the linking circuit and keeping the leads between them as short and straight as possible.

In Fig. 2 are shown the hook-up and a front view of a cabinet incorporating the link circuit. Of course, the coils of the aerial and detector circuit should be so placed as to have a minimum amount of direct inductive effect on each other and this can be obtained by placing them some distance apart or by placing their axes at right angles to each other, as is done in this case to make it as compact as possible.

The box is made of ¼ inch walnut or mahogany and fastened together with brass screws. The dimensions are optional with the builder. Holes are drilled in the front to accommodate the two ten-point switches and the small two-point switch as well as the binding posts for the 'phones shown near the bottom.

Each end is also drilled for a ten-point switch. The switches on the ends have every other turn connected to their contacts, while those on the front have twenty turns between contacts.

The coils are similar and wound on cardboard or fibre 6 inches long and 4 inches outside diameter. They are wound with No. 24 enameled wire topped every other turn for the first twenty turns and then every twenty turns till 200 more turns have been wound on. The taps from the coil mounted on the top of the box should be taken down the inside of the tube, while those from the coil inside the case can be run direct to the switches.

The right-hand switches control the primary and the other two are for the secondary adjustment. The aerial and ground binding posts can be mounted anywhere the builder decides.

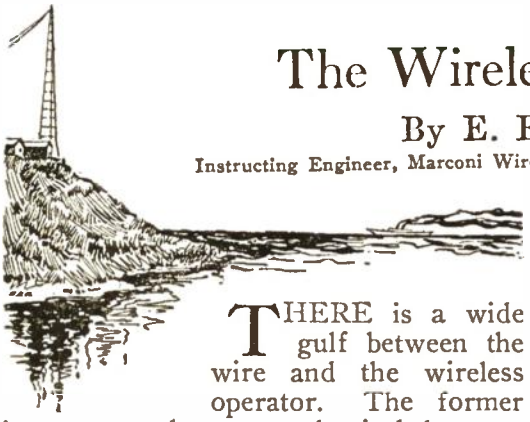
The link circuit consists of three turns taken around each coil, using No. 18 stranded copper wire; silk covered flexible cord is the best. These coils are wound around the end of the coil from which the top is taken at every other turn so as to always be in the active field of the coil.

The type of detector is immaterial, but the shorting and selecting switch deserves special attention. The two contacts of this switch are mounted very close together, so close that the switch blade can bridge the two. Now referring to the hook-up, it will be seen that the detectors are really in series and the switch shorts the one not in use, but when the blade bridges both contacts both detectors are shorted. This method saves the expense and trouble of having a separate switch to short the detectors when sending.

In using this set the switches on the front are adjusted first for coarse tuning and when the signals are the loudest the other two are used for fine tuning.

The selectivity is high, due to the linking circuit having practically no damping and though not capable of sustaining oscillations it will not damp them out, thus enabling sharp tuning and the elimination of stray currents and static.

The set described will tune to about 600 meters or higher if variable condensers are added in parallel to the windings. In the latter case the two switches on the ends may be done away with and the two variable condensers inserted into the open ends of the tube inside.



The Wireless Operator

By E. E. Bucher

Instructing Engineer, Marconi Wireless Telegraph Company of America

THERE is a wide gulf between the wire and the wireless operator. The former is more or less a mechanical human; he is simply the interpreter of the little instrument before him. He has no problems, no responsibilities outside of those of transcribing the message. He rarely has thrilling situations nor is he called upon to face unusual conditions. He is not placed upon his own resources. A skilled force is maintained to take care of the engineering details of his work. He is not thrown in contact with new peoples and surroundings. On the other hand, the wireless operator is a trained engineer who possesses basic knowledge of his profession. In addition to his knowledge of the telegraphic codes he is required to exercise his mental faculties in the everyday routine. He is—so to speak—in charge of a small laboratory, the efficiency of which depends to a large extent on his understanding.

What opportunities for development the profession of wireless operator offers! Men have worked for years to gain similar surroundings. One who has worked in the art for three or four years and is not a brighter and more alert individual owes it to himself for the failing.

The question is asked, "Where do these young men receive their training?" The great commercial companies maintain schools of instruction at various cities of the globe specifically for this purpose. Here young men of desirable qualifications, who have passed the mark of 18 years, are accepted and thoroughly schooled in the intricacies of the art. At a very nominal fee they receive a training in the elements of electricity which, at a future date, should fit them for a better position in the allied branches of electrical work.

They are taught the construction, design and assembly of the complete wireless equipment. They are taught what to do in an emergency and how to make repairs in case of accident. Their education does not rest on this alone but the geographical features of the universe are discussed and studied. Steamship routes are mapped out; distances are measured; important local conditions at each port are taken into account.

The student is instructed in the despatch of radio traffic—how to account for the tolls on a message. Intricate problems which may arise are solved. The student is thoroughly familiarized with the International Regulations by which the radio situation is universally controlled. He then passes a Government examination, receiving a certificate of proficiency. Could a more comprehensive profession be imagined? Or a more interesting one?

The applicant for admission to these classes must undergo a slight grilling. Entrance examinations are required and the boy who has long since left school is dazed at the questions asked. He finds the same old problems which he battled with during his later days at school.

Perhaps he is asked to add a column of fractions or to state where the north magnetic pole is located. He might be queried as to the number of days constituting the complete year or to name the months having 31 days. And then the old bugbear — decimal fractions. Again he might be required to disclose his knowledge of distances and he is requested to state the miles intervening between, say, New York and Buenos Aires or perhaps the time required to make a return voyage between these two points. But when he comes to the query, "How often does the earth make a complete rotation on its axis?" he throws up his hands in horror. Sometimes the replies received are humorous in the extreme. Take, for instance, the following description of the action and construction of a

telegraph sounder, a reply to a query of the entrance examination:

"A telegraph sounder is composed of a pair of magnets, an anvil and a hammer wound to a certain ohmage. When the electric current is put through the electric magnets it draws the iron crossbar down and bangs the hammer on the anvil, and when the current is stopped the hammer is released."

This young man is given a little private tutoring in the art of expression, and after a few weeks' training is able to describe the actions of such apparatus with grammatical and technical accuracy. Other statements are equally humorous, but none the less blameable. For instance, we have been told that it is 5,000 miles from New York to Colon, Panama; that the Panama Canal is 300 miles in length and a ship requires one month to take a round trip from New York to Southampton.

We are advised that the earth rotates on its axis once in a year and that the month of February has 31 days. According to some, there are only three seasons per year. The query as to which is the port or starboard side of a vessel elicits this reply: "The port side of a vessel is the side tied up to the dock!" and so on.

It is a difficult matter sometimes to convey to the raw recruit that time is an evasive factor and that at the same instant widely separated portions of the universe bear a different relation to the sun. The wonderment is intensified when as a trans-Atlantic voyager he sees the clock changed from day to day. He tries to keep pace with the changes and finally gives up in despair.

On his first trip to the land of the Southern Cross he receives another shock when he finds the moon on the north side of the continent. It takes days and days of reassurances from his fellow travelers to ground this fact in his consciousness.

Gradually he is lifted out of ignorance and provincialism and he is the better for the awakening.

It has been the writer's experience for some years to have under observation several hundred of these roamers of the sea. The psychological effects of environment are more than proven, and, like all man-made rules, unfortunately work both ways.

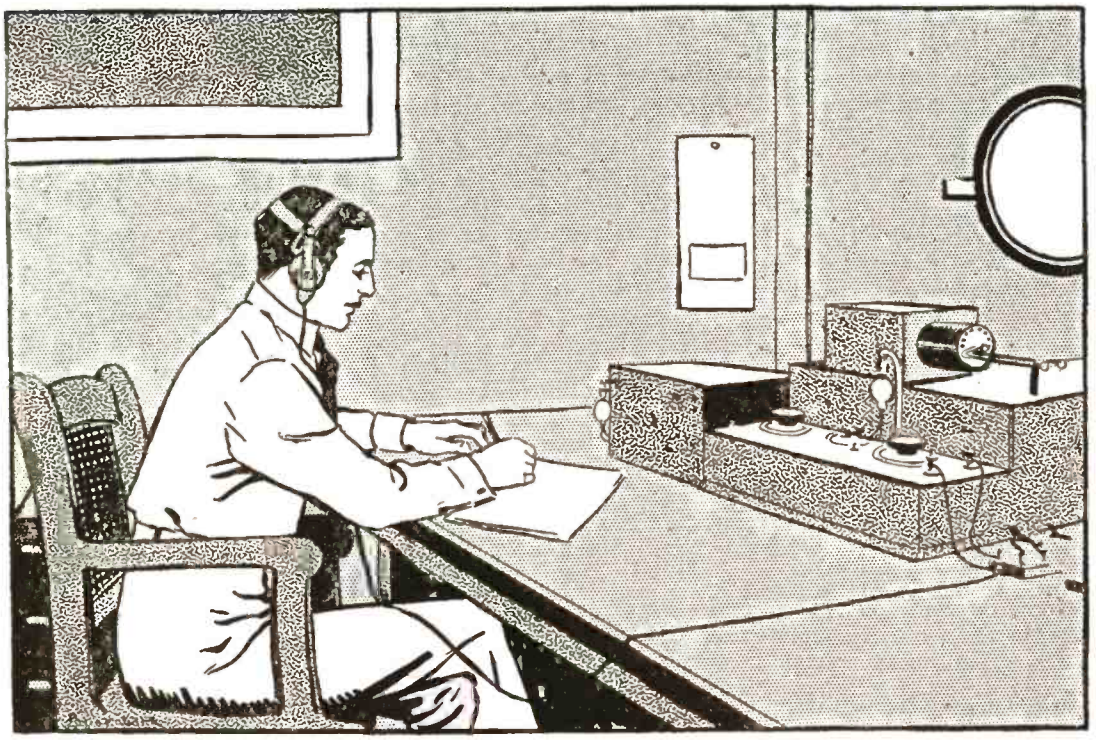
On one hand we have the newcomer who has not had the benefits of the better things of life and whose appearance is somewhat unkempt and slovenly. Perhaps he is careless in conversation and manner and affects an indifferent attitude to law and order. Several months at sea on the better class of vessels has completely transformed his disposition and manner. His entire being is changed. He is no longer slovenly, but dresses neatly. His form is erect; he is dignified and courteous. He has caught this atmosphere from contact with the better class of travelers. He can never return to old conditions and habits. He forms associations which some day when he has tired of the sea are certain to redound to his benefit.

On the other hand, in a few instances young men who have had the best of home training and environment have made companionships in distant seaports which have all but reduced them to a wreck. Fortunately, such cases have been very few indeed. After all, is not man the master of his own destiny?

The situations sometimes arising at sea are dramatic in the extreme. We are all familiar with the events of the past few years when these men have stood unflinchingly at their posts and then gone down with their vessel. These young heroes are reverenced and their feats proclaimed broadcast.

The writer never so appreciated the tenseness of the situation when a ship is in distress and the part the wireless operator plays until he met with an experience some few years ago.

While conducting some experiments in radio telegraphy on a Government vessel in Chesapeake Bay he was alarmed by an insistent call for help from the S. S. *Kentucky,* in distress a few hundred miles distant. The call "S O S" had not yet been adopted, but the operators made known their needs in no uncertain manner. A reply was sent from the station at Cape Hatteras, N. C., and somewhat later from a coast liner about 110 miles distant. After the situation had been explained there was a great silence, and one could not help but feel for the occupants of that vessel, particularly so on knowing that they were out of the path of regular traffic.



There is a Wide Gulf between the Wire and the Wireless Operator. The Former is More or less a Mechanical Human—He is Simply an Interpreter for the Little Instrument before Him. The Latter is That and Much More. He is Placed on His Own Resources; He Must Possess a Thorough Knowledge of His Apparatus, and What is Paramount, He Must be Big Enough to Face Disaster at any Moment.

After a while a faint sputtering came out of the stillness. "Hurry, the water is flooding our generators—our power is going." There was no need of going into details, the character of the signals was sufficient proof of the correctness of the statement. For several hours the ether was in a state of great calm about the Virginia capes. Government stations, commercial stations and vessels lying at their dock all eagerly listened to get a parting message from those whom they thought were going to certain oblivion. Communications between these several stations were very curt and limited to a few words. They could take no chances at losing even a letter.

A heavy spark thundered through the quiet. It was the station at Cape Hatteras. "S. S. *Alamo* has gone to the rescue of the *Kentucky* and should be there in two hours."

The relief was only temporary. Would the ship hold out until succor arrived? Would the helper be able to locate the helpless?

After this more intense calm than ever prevailed. It was interrupted a few hours afterwards by a faint message from the S. S. *Alamo* herself. "Crew *Kentucky* rescued—safe on board—vessel abandoned in a sinking condition."

Congratulations were exchanged between the ship and Hatteras and a sigh of relief was signalled from station to station. The *Kentucky* sunk shortly after being abandoned.

We should not forget, however, that wireless telegraphy was not primarily intended for the exploitation of the sensational nor for promulgation of heroic fame, but that its real value lies in the every-day commercial and humanitarian applications.

Contrast the situation of fifteen years ago with that of today. Only a few days ago the operator on a trans-Atlantic vessel told me that when in mid-ocean he was simultaneously in touch with the great Marconi station at Poldhu in England, the Eiffel Tower in Paris and the high-power Government station at Arlington, Va.

It is work of this nature which inspires

these young men in their labors, and, in their own language, "Keeps the ball a-rolling."

What becomes of these roamers of the deep? Are there opportunities beyond the mere profession of operating? To be sure. If he remains more than four years at sea he usually decides to make it his life work. There may be a vacancy at a shore station, where he settles down for an indefinite period. Then there is a berth awaiting him at one of the large trans-Atlantic or trans-Pacific stations. Here he either enters the traffic division or becomes one of the engineers. He indeed enters a new atmosphere. He finds comfortable hotels with every possible modern convenience, or perhaps a private cottage erected by the company. His work is of added dignity and importance—he finds a certain social atmosphere which makes life more real.

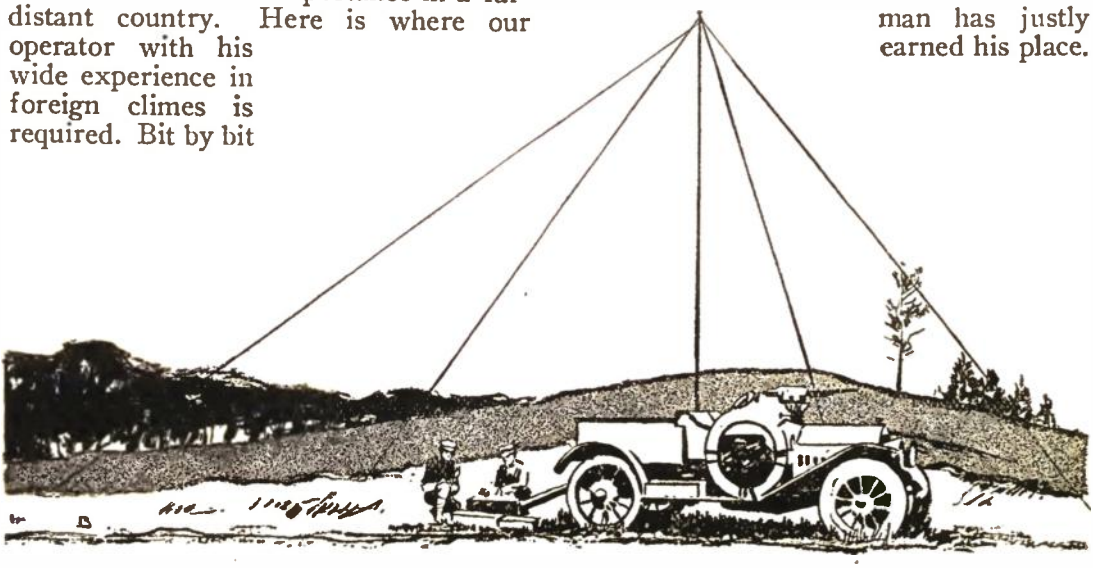
Perhaps he is in charge of more complex apparatus than was entrusted to his care at sea, and he therefore receives increased compensation.

A vacancy occurs in the engineering department requiring a man of wide, practical and theoretical experience. A man from the ship service is selected. Soon he is an invaluable assistant. Again, he may join the research department, where his work is indispensable. Perhaps the ship fitting department requires a new employee, and he, too, is selected from the sea rovers.

Then it is decided to erect a land station of considerable importance in a far-distant country. Here is where our operator with his wide experience in foreign climes is required. Bit by bit he has become familiar with the language of this particular country. He has an array of statistics he has collected during his various visits, which are now invaluable to him.

He is selected to supervise the job. The station is completed in due time and our former sea rover now becomes a land *voyageur*. He is sent to out-of-the-way places to connect up widely separated and impassable districts. He assists in welding together the broken links of advancing civilization. He is engaged in a noble work, the far-reaching consequences of which he has not yet realized. Now he is in an outlying island of the South Seas. Next he is in the interior of Africa, then we hear from him in the jungles of Brazil. Perhaps he accompanies a polar expedition or assists some boundary commission in locating the line of division between two semi-belligerent countries.

He erects portable wireless stations to assist in this work. In the meantime his knowledge of affairs, people and conditions is on the increase, and after a number of years he returns to his native country. He is now a man whose word in engineering problems is final. There is no occasion for dispute. There is a position awaiting him at the home office. He is now in charge of a great engineering force which is engaged in a universal radio development. He directs the fundamentals. He is assisted by a small army of co-workers. This man has justly earned his place.



STATIC—NATURE'S PROTEST AGAINST WIRELESS

THE most difficult problem that the modern wireless engineer has to contend with is the elimination of "static" or "atmospherics." The recent interruptions in the radio service between Nauen, Germany, and Sayville, Long Island, are entirely due to the increase in strength of these disturbances during the summer season.

Static may be defined as any form of natural electrical discharge which produces undesirable noises in the head-telephones of a wireless receiver. The radio signals proper are heard as long and short buzzes of various pitches or frequencies. The atmospheric noises are crashes and rumblings of a very low pitch, which may on occasion completely drown out the signals and render communication impossible. They are the curse of the commercial operator because they prevent the delivery of messages and cut down his commissions, and they embitter the life of the amateur experimenter, who can hear distant stations only when the air is absolutely quiet.

Static interference is caused in two ways:

During the spring, summer and fall the potential of the air in the vicinity of an aerial is higher than that of the ground. This difference of potential causes bursts of electricity from the air through the wires and instruments down into the earth. In the Philippine Islands Government stations these local discharges become so violent at night that the telephone receivers and the tuners of the receiving instruments are burnt out and the operator's life put in jeopardy. Even in northern States of our country, where conditions are not as bad as in tropical regions, the "riggers" who erect large aerials frequently receive severe shocks when the wires are ungrounded.

The second kind of atmospherics is caused by lightning discharges which radiate "stray" ether waves in every direction for hundreds of miles. A thunder-storm off Hatteras may in this way tie up radio traffic all along the coast.

So far all attempts to get rid of the demon Static have been in vain. The use of very high-pitched, shrill, musical signals has made possible the reading of messages through moderate disturbances, but that this remedy is not sufficient is shown by the sad experience of the Sayville and Nauen stations, which employ the most modern apparatus in this respect. All attempts to filter the static impulses from the legitimate wireless oscillations and get them to take a separate path have failed. However, the ablest minds in the radio field are now at work on the problem and ultimate success is not too much to hope for.—CARL DREHER.

A SUBSTITUTE FOR AN AERIAL

During the stormy summer months, when many amateurs are deprived of their aerials, an excellent substitute may be found in the following:

Tap one of the wires of the nearest telephone wire and bring this wire to a fixed condenser. Connect the other terminal of the condenser to the primary of a loose coupler. With this improvised aerial, signals of considerable wave length can be received. As an illustration: An audion set using an ordinary aerial was barely able to receive Sayville, but when the telephone line was used WSL could be copied with the telephones on the table. This idea may also be used on single slide sets.—JOHN BUCKNAM.

On Tuesday, July 27th, the wireless station at Funabashi, near Yokohama, Japan, transmitted the first message to the station at Koko Head, Hawaii. These two stations are links in the world-encircling Marconi chain, which extends about two-thirds around the world and would probably have been now completed but for the European war.

What the World is Doing

THE inauguration of an Advisory Board of Inventors by Secretary Daniels, of the United States Navy, is a commendable achievement of the highest order. Likewise is the hearty support which the idea has received from the prominent inventors who have been fortunate enough to be invited to serve as advisors. Thus far, such names as Thomas A. Edison, Charles Proteus Steinmetz, Hudson Maxim, Orville Wright, Alexander Graham Bell, Professor R. A. Fessenden, Peter Cooper Hewitt, Nikola Tesla, Lewis Nixon, Henry Ford, Simon Lake and John Hays Hammond, Jr., have been mentioned in connection with the Board. These names are all synonymous of some of America's greatest industries and discoveries, and are truly household words. But the task before the men is one worthy of their skilled efforts, for they shall be called upon to examine thousands of ideas among which may lie many wonderful inventions requiring proper development. Their vast knowledge in many fields will be a tremendous asset.

It is but appropriate that the United States should at last have an Advisory Board of Inventors, for is it not the Americans who have given the warring nations a goodly part of their fighting equipment—the aeroplane, the submarine, the telegraph, the telephone and countless other inventions? Yet America today has made less use of these inventions as applied to warfare than the countries of Europe which have borrowed the ideas. In a large measure this is due to the lack of encouragement to inventors in the past. It is a matter of history that more than one American inventor, on failing to interest the authorities at Washington, has gone to the European governments and by them has been accorded every possible facility to demonstrate the worth of his ideas.

All this will now be changed by the existence of the Advisory Board of Inventors. At last the inventive genius of America—the most versatile in the world—will be granted a hearing and accorded every possible facility for the testing and developing of new inventions that may be of value to the Navy. In all probabilities there will be a testing ground established where ideas, after they have been approved of, can be tried out and subsequently developed under proper and skilled guidance. Once more, the idea is a highly commendable one and indeed worthy of the great men who have been given such an enviable opportunity of serving their country's interests.

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ELSEWHERE in this issue appears an announcement that must necessarily be of greatest interest to our readers—the purchase of the *Popular Science Monthly* by THE WORLD'S ADVANCE. The former is a publication of long established reputation, and its acquisition by this magazine is of greatest importance. Beginning with the October issue the two publications will be consolidated into a bigger and better magazine, which will contain more pictures, better pictures, more news of the world's advance and more pages of reading matter than ever before. In science, in invention, in mechanics, in electricity, the greater magazine will continue to give its readers Truth, which is ever stranger than fiction, and facts which are more absorbingly interesting than fiction.