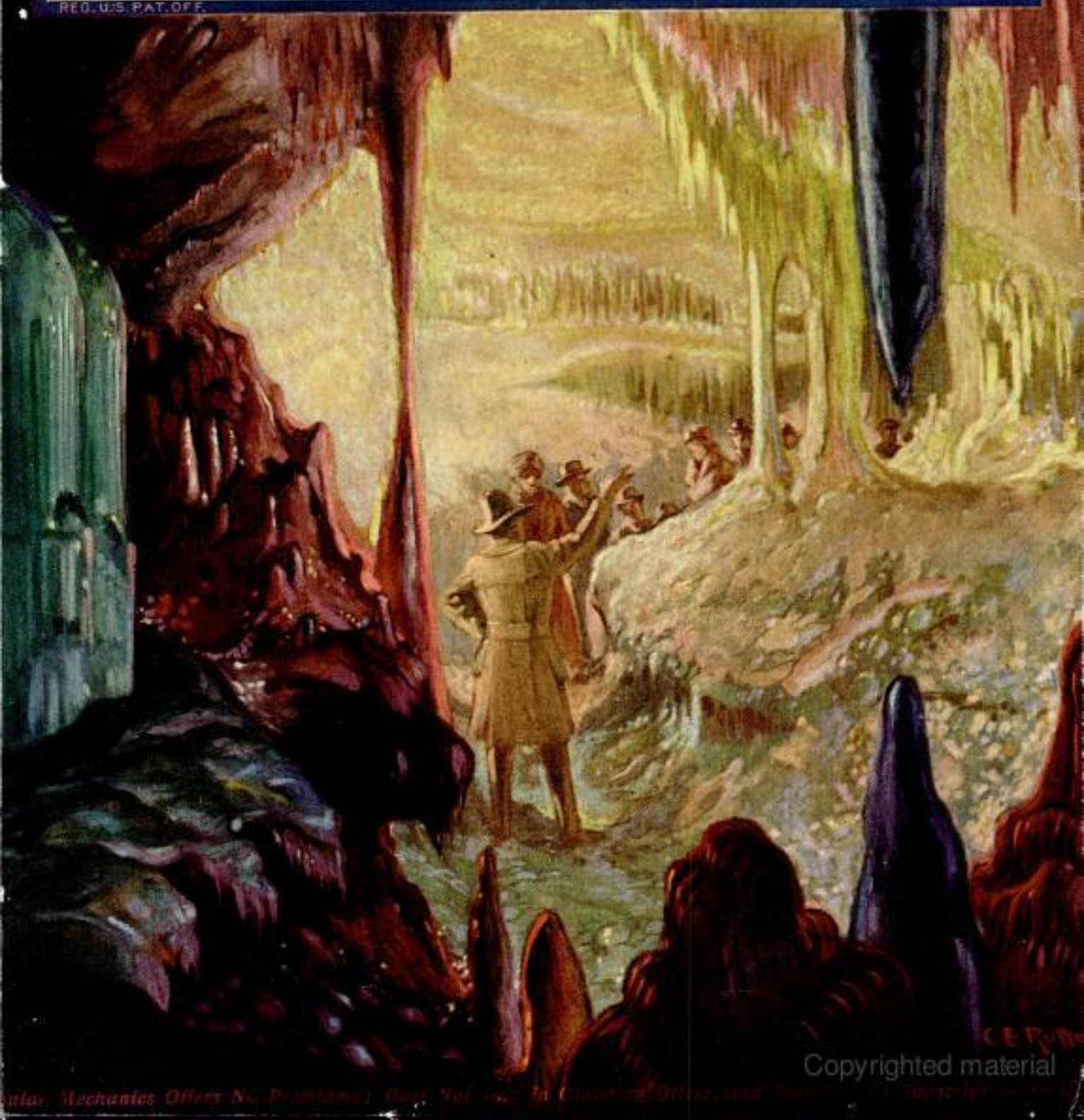
June

25 Cents

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



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HENRY J. RAHE (Dept. 2891) **Kansas City, Mo. Cincinnati, Ohio**

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AMATEUR MECHANICS

Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE

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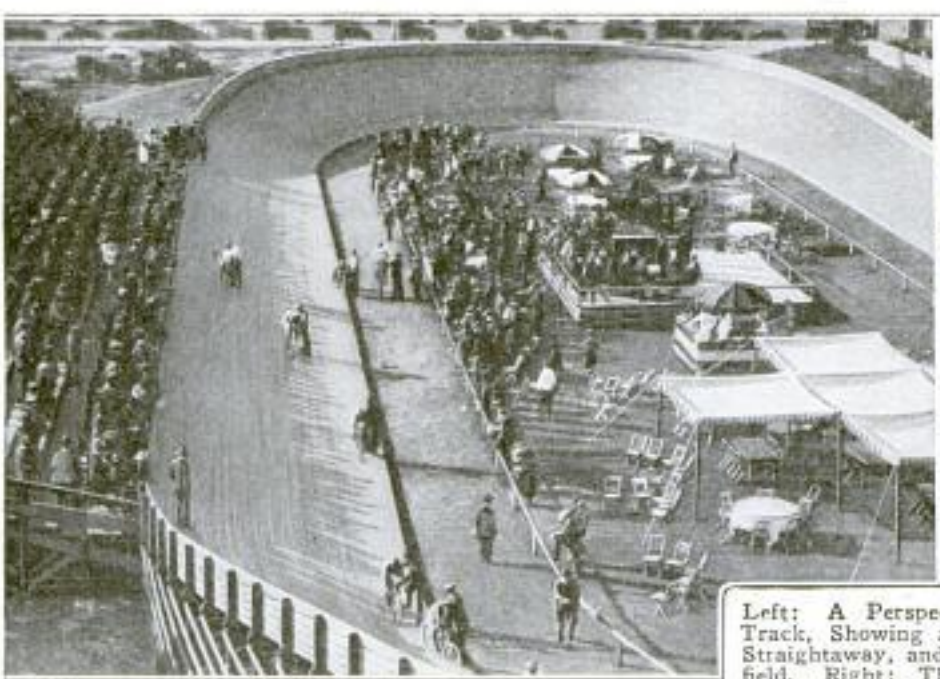
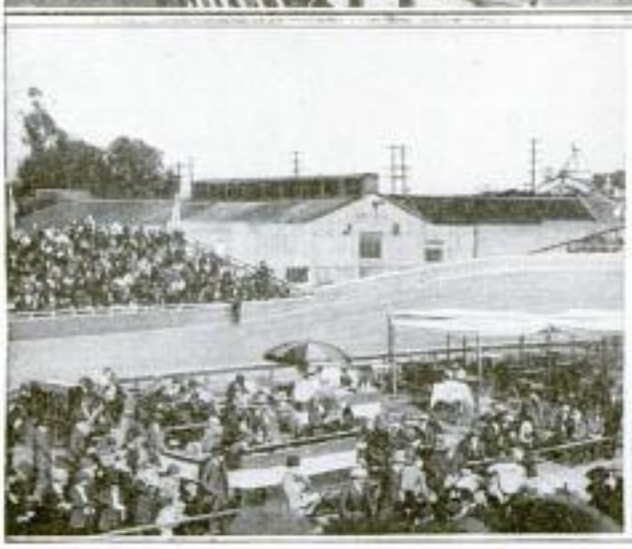
Vol. 35 JUNE, 1921 No. 6

Bicycle-Racing Bowl Has New Features

BICYCLE racing has been reintroduced on the Pacific coast in an elaborate stadium just completed at Los Angeles. Many points of construction in the ⅛-mile board track are entirely new so far as bicycle racing is concerned. The influence of the automobile-speedway style is at once apparent, for the new track is steeply banked at each end, and slightly banked all the way around. It is an exact duplicate of the famous Beverly Speedway, reduced to one-tenth the size of the latter. Inside the track has been laid out what is called a "Parisian garden." Tables and sunshades have been provided, and patrons may sit here and partake of cool drinks while watching the races. Nearly 5,000 spectators attended the contests.



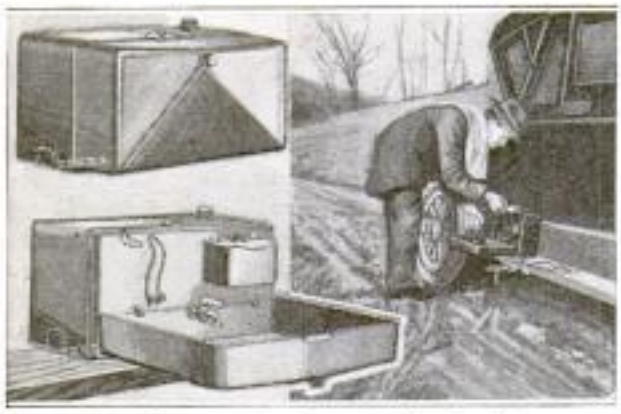
Left: A Perspective of the New Bicycle Track, Showing a Steeply Banked Turn, a Straightaway, and the "Parisian Garden" Infield. Right: The Rider and Relic Made a ¼-Mile Sprint against Time on Opening Day



To the Left Is a Close View of the "Parisian Garden" with a Section of the Bleachers in the Background. Right: How a Race Looks from an Airplane. Modeled after Automobile-Speedway Designs, the Track is Said to be Exceptionally Fast. The Speedway Influence Is Apparent in This and the Top View. Note the High, Smooth Outer Retaining Wall on the Ends and the Space between the Track and the Infield Fence

AUTOMOBILE LAVATORY FIXED TO RUNNING BOARD

Soon, perhaps, automobiles will be furnished with all the comforts of a home. Already they have been equipped with

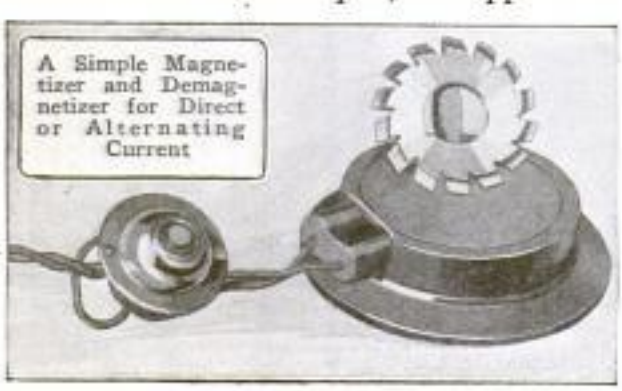


Left: The Lavatory is Shown Closed, Above, and Below It is Shown Open. Right: Lavatory on the Automobile Running Board Ready for Use

sleeping quarters, and now there is available a lavatory. The auto lavatory includes a water reservoir, a basin, a faucet, a towel holder, and a soap dish. It is carried on the running board of the car, to which it is bolted, and when not in use, the basin folds up against the water reservoir, where it can be locked. Everything is then inclosed, and the outfit has the appearance of a box, which can be ornamented in the same style as the car.

MAGNETIZER OPERATES QUICKLY AND HAS MANIFOLD USES

An electrical device that can be made to magnetize or demagnetize instantly, according to the requirements of the user, and which is applicable for commercial use in machine shops, jewelry shops, etc., is a recent development. It may be used with alternating or direct current with equally satisfactory results, but the length of time the object rests on the charged plate is slightly different in each case. The device weighs only 4 lb. and resembles an inverted pan, the upper surface of which is a magnet. To demagnetize, the magnetized object is rapidly passed over the charged surface. To magnetize an object, it is only necessary to place it in the center of the device and press the button switch for three seconds.



A Simple Magnetizer and Demagnetizer for Direct or Alternating Current

DAILY PAPER TO BE PRINTED ABOARD FLYING AIRPLANE

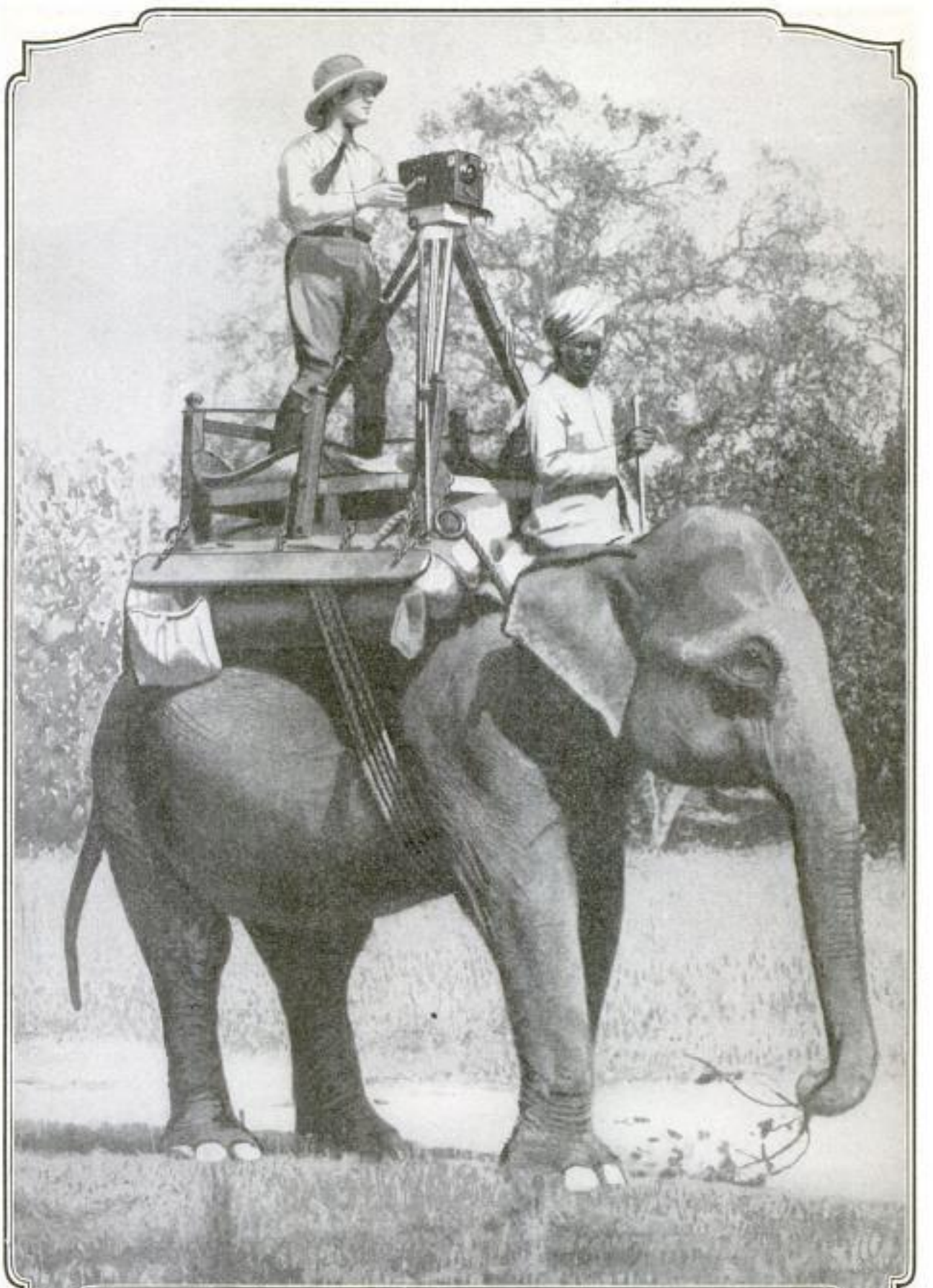
If present plans mature, within a short time the Aerial Mail, a daily newspaper, will be made up and printed aboard fast airplanes plying between London and Paris on regular schedules. The edition destined for the latter city will be in French and that for London in English. The machines will be in constant wireless communication with both terminals, and news of special moment, as well as the latest market quotations, will be written up, edited, set into type, and printed "on the fly." The venture is sponsored by a famous English publication, and while there may be some question as to the actual utility of the undertaking, that it will have a certain spectacular publicity value there can be no doubt.

BORAX MOUNTAIN IN NEVADA IS WORLD'S LARGEST

A mountain of colemanite, the ore from which borax is extracted, was discovered in Clark County, Nevada, January 23, and will supply the widely used chemical for many years to come, as it is estimated that there are over 500,000 tons of it in sight. The immense outcropping is, roughly, 3,000 ft. in length and about 500 ft. high. The full depth will not be known until borings are made. The element of romance is strong in the story of the discovery. The lucky prospectors, having tramped for weeks through the practically unexplored "Muddy Mountain country" without making a strike, and having almost exhausted their "grub stake," were about to pass an unlikely looking cañon when one of them happened to notice the whitish outcroppings characteristic of the deposit. This was on the wedding anniversary of the capitalist who purchased the claim from its discoverers for a price which will enable them to retire to lives of ease and comfort.

¶ On one of the uninhabited islands of the Loochoo Archipelago, which stretches in a long chain southward from Japan, large deposits of phosphorus are reported to have been discovered.

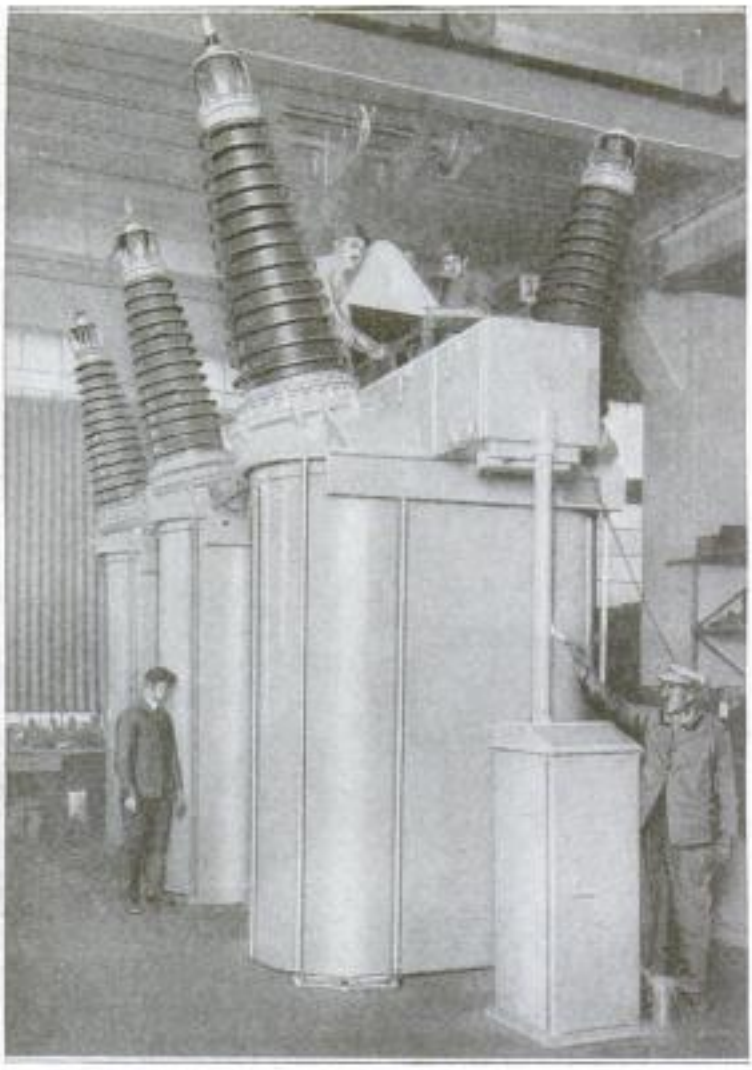
AN ANIMATED PHOTOGRAPHIC OUTFIT IN INDIA



YANKEE ingenuity has made photography in India easy by making use of that oriental jack-of-all-trades—the elephant. The photographer is an American, who is accompanying the Duke of Connaught on his tour of India. He is prepared for all emergencies, excepting rain, and rain occurs in India only at dates that are about as precisely known as New Year's Day.

HUGE OIL CIRCUIT BREAKER IS LARGEST IN THE WORLD

What is believed to be the world's largest oil circuit breaker has just been completed. It is one of seven of the same size that are being built for a California power company. It is no wonder that it has to be so large, for it operates at 165,000 volts, 400 amperes, at any altitude from sea level to 4,000 ft. above. The solenoid, by which it is operated, is actuated through a relay that is energized by a bushing transformer. It is closed by means of a push-button switch. The circuit breaker is composed of three units which together have a total length of 32 ft., and the height from the bottom of the tank to the top of the insulators is 16 ft. The apparatus weighs approximately 50,000 lb., and requires more than 4,000 gal. of oil.



The Enormous Size of the Circuit Breaker can be Judged by Comparing It with the Men Who are Standing beside It, and with the Two Men Above, beside the Insulators

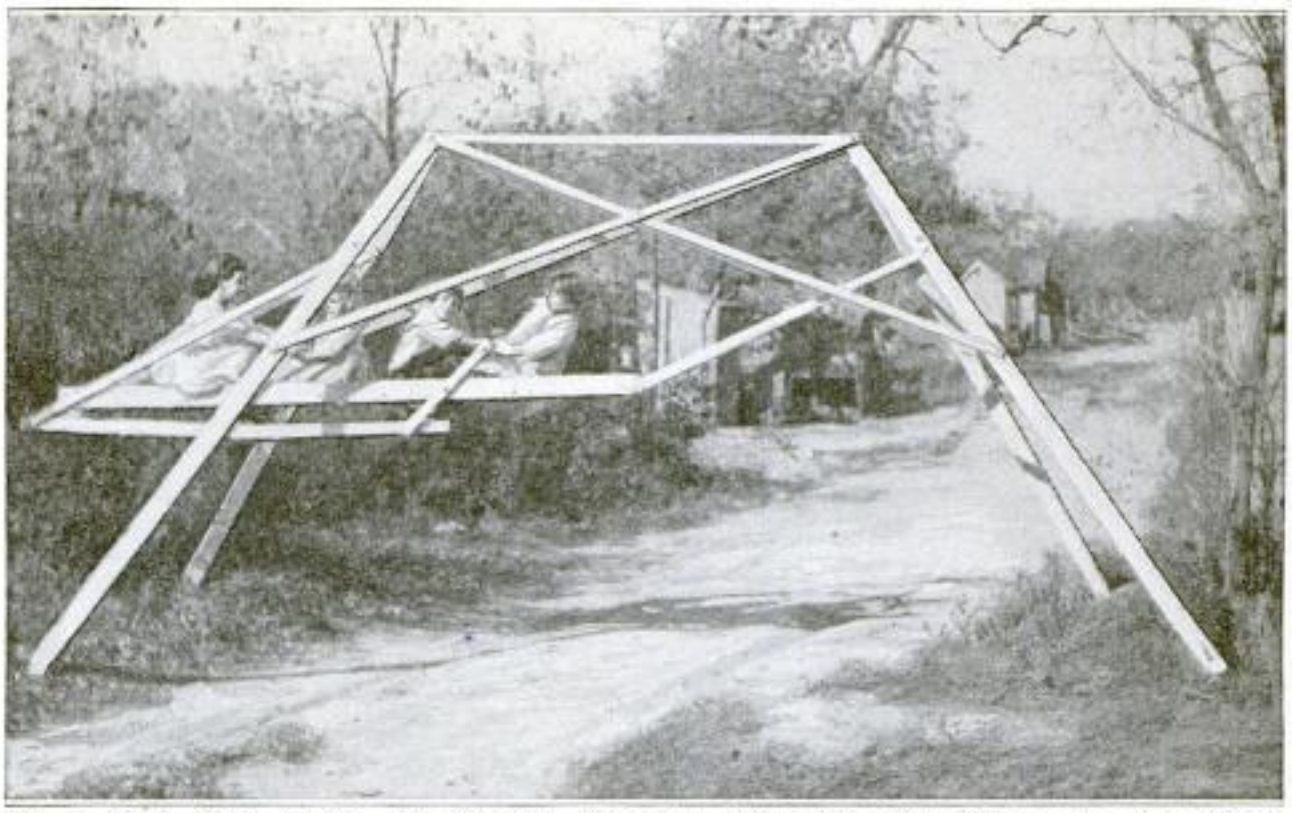
EVERY VARIETY OF COTTON GROWN IN CALIFORNIA

Cotton culture in the San Joaquin Valley, California, has had such successful results that ginneries and by-product plants have had to be erected in Kern County, where the product of more than 20,000 acres is being ginned. But the really remarkable feature of this crop is that it shows that every species of cotton grown in any other part of the world is being successfully produced in this district. The yield per acre compares favorably, in both the short-staple and long-staple varieties, with the yield in any other state.

ULTRAVIOLET RAYS DISCLOSE SECRETS OF OLD PARCHMENTS

Much of the lore of ancient palimpsests —parchment manuscripts from which the original writing has been erased and written over at a later date—is about to be laid bare by the mysterious power of the ultraviolet light produced by the mercury-vapor lamps. Previous to 1914 the discoverer of a new method of using the rays, a Benedictine monk of the Bavarian order, had made such progress that many of the ancient parchments in the Benedictine Abbey of Wessobrunn had been made to disclose their secrets. In principle the new method is quite simple, being based upon the peculiarity, possessed by many organic substances, of fluorescing—glowing with a pale canary-colored light—when brought under the influence of the invisible ultraviolet rays. The old parchments possess this property to a remarkable degree, while the ink of the older writings upon them, containing ingredients insensible to the action of the rays, remains dark and forms a contrast of sufficient intensity to register clearly on a photographic plate.

¶A radio station has been proposed for Greenland which would bring it into contact with the outside world during the winter months. It is estimated that such a station for direct communication with Copenhagen, Denmark, would cost about $2,000,000, and for intercourse with Iceland and Canada, about $250,000.



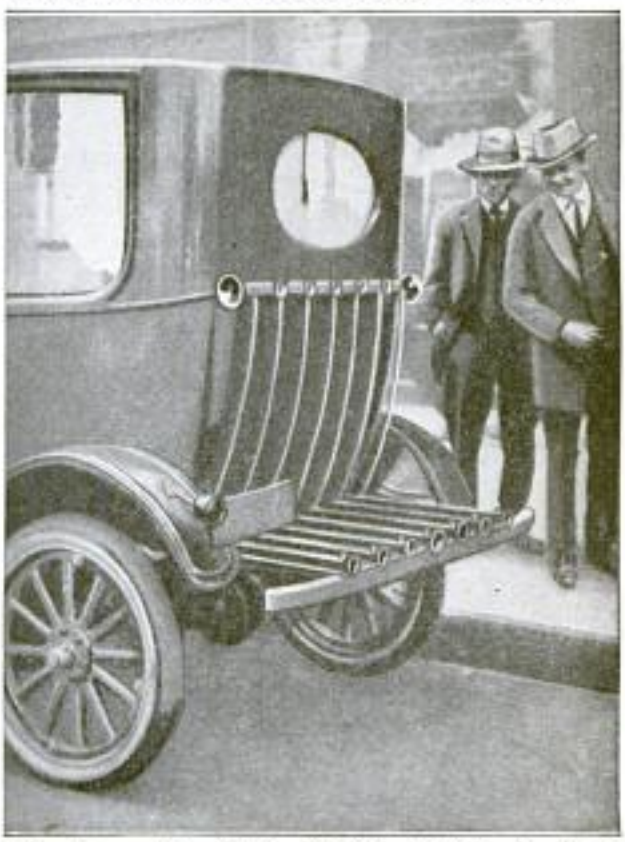
The Hands Assist the Feet in Propelling the New Lawn Swing. The Rider, Sitting on a Cross Board, Pushes a Hand Beam. With His Feet He Pushes a Second Beam the Opposite Way and the Coöperative Action Moves the Suspended Carriage

LAWN SWING OF LATE DESIGN IS HAND-OPERATED

A lawn swing, different from most in that it is propelled with the hands and the feet, has lately been introduced. The rider, or riders, sit on cross boards and place their feet on an underlying rest, grasping a handle beam at the same time. With the inclination to swing, they push forward with their feet on the underlying rest and pull on the handle beam. These two beams are connected and their co-operative action moves the swing body, which is suspended by rods from a frame.

TRUNK-RACK PIPE ORGAN IS AUTO JAZZ BAND

A musically inclined motor enthusiast of California has had his car equipped with a miniature pipe organ so that he may enjoy his two pleasures simultaneously. The tubes of the organ are arranged at the back of the car in the form of a trunk rack, the horn bells on the tube ends being all there is to indicate that the luggage carrier is not all that it seems to be. They are not true organ pipes, but merely serve as conduits to conduct the music from a small reed-type organ located under the car floorboards. This is electrically driven by a small motor which draws its power from the car storage battery. A switch placed on the steering column, within easy reach of the driver, makes it possible for him to enjoy all the latest airs whenever he wishes.



This Apparently Substantial Trunk Rack Is Really Made Up of the Outlet Tubes of the Auto Pipe Organ. The Organ Proper is Slung under the Car Floorboards and is Electrically Driven

AQUARIUM AT

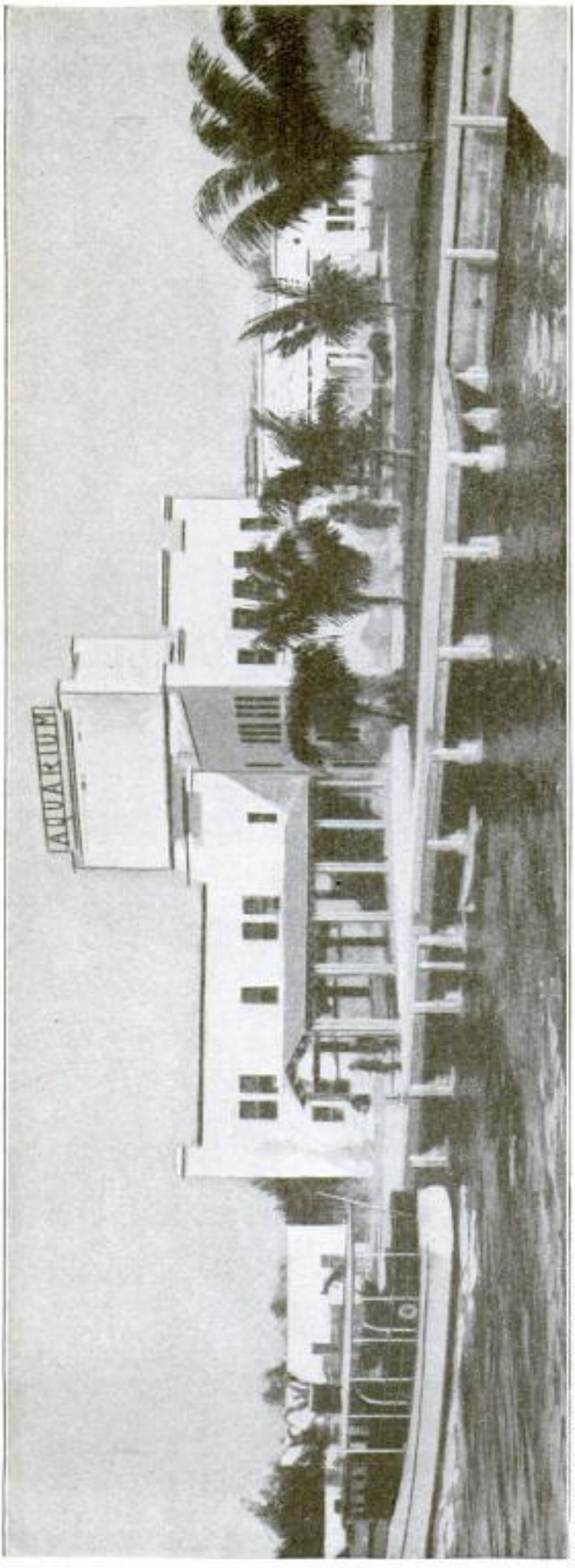


PHOTO BY COURTESY OF THE NATIONAL GEOGRAPHIC MAGAZINE

A General View of the New Aquarium at Miami, Florida, as Seen from Biscayne Bay, within a Few Hundred Yards of the Ocean, and, Therefore, with a Constant Supply of Clean Salt Water for Changing the Tanks: In the Right Wing of the Building Is a Biological Laboratory Which Offers Unusual Facilities for Study and Research. Moored to the Dock Is One of the Three Boats That Constantly Collect New Specimens for the Aquarium

WHILE the land-animal kingdom of the world has been so thoroughly explored that only at rare intervals, today, is a new and distinct species made known to us, very much the contrary is true concerning our knowledge of the denizens of the deep. In this department of zoölogical research there are large areas rich in marine fauna still to be explored scientifically for the common good of mankind, especially among the warm waters of the semitropic regions. Of all such regions none can compare as a happy hunting ground for scientist, amateur angler, and professional fisherman with the region of the Gulf Stream which skirts the shores of Florida.

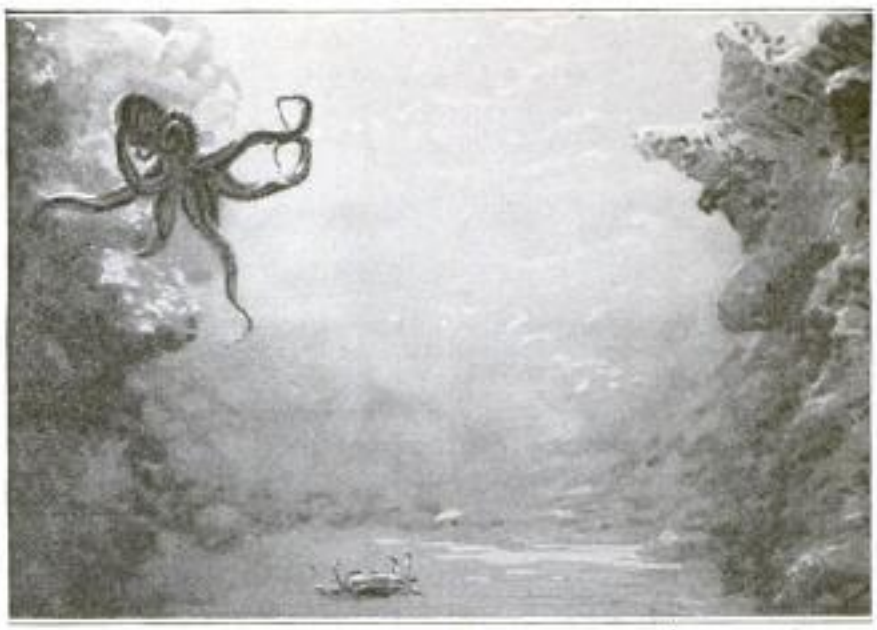
The most southerly city on the Florida mainland is Miami, nestling beside the limpid waters of Biscayne Bay, and protected by a peninsula from the heavy seas of the ocean in times of storm. At Miami Beach there was opened early in January an aquarium and biological laboratory which will take rank with the great aquariums of the world. Its exhibits will be constantly renewed, for it is equipped with three collecting cruisers to gather specimens. Fish have always seemed to have a peculiar appeal to man, who, as a child, turns from his favorite toy to gaze upon a goldfish in a tiny bowl, and, as an adult, will sit beside a stream by the hour in the hope of landing a "string." Therefore it is reasonable to expect that in point of popular interest the aquarium will make of Miami the

MIAMI, FLORIDA, RIVALS ANY IN THE WORLD

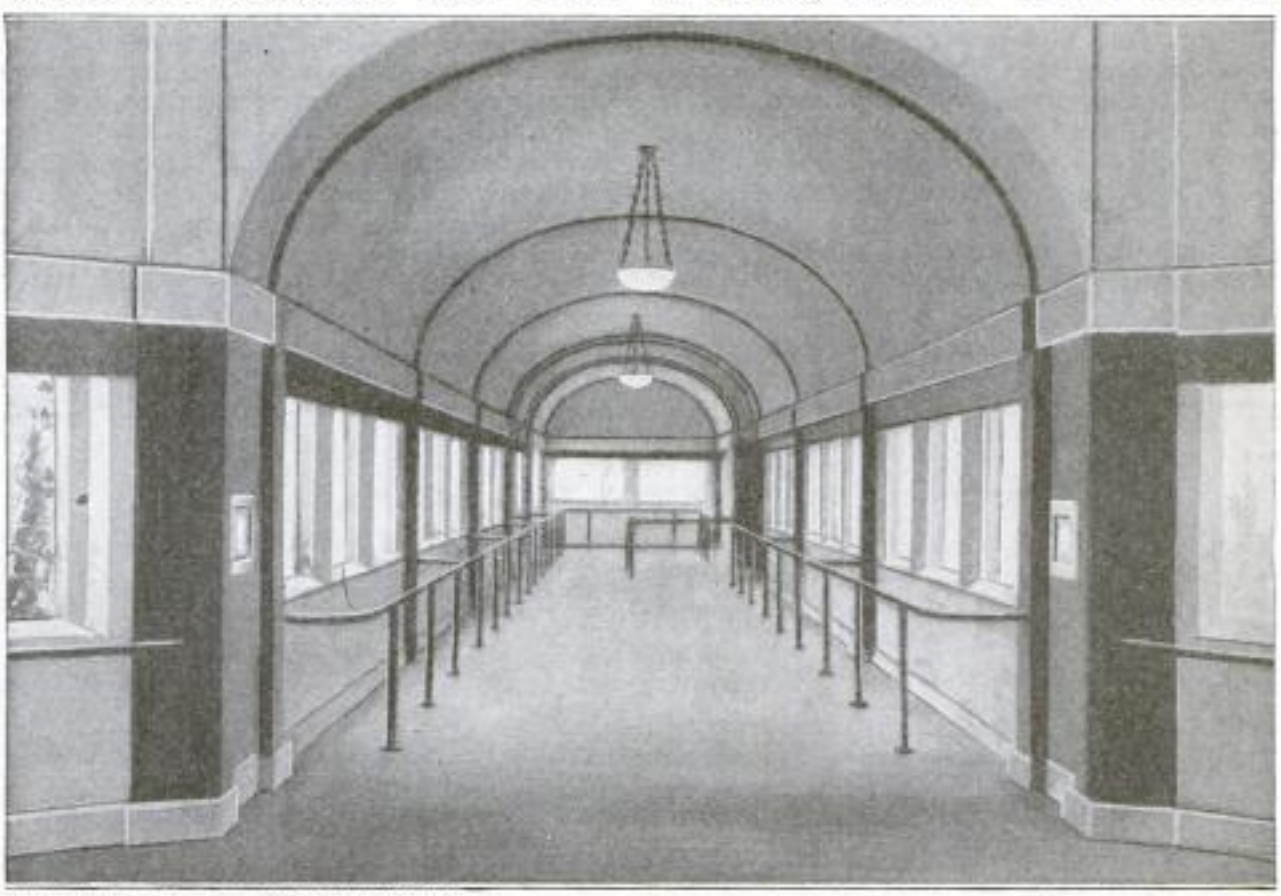
By HENRY S. WHITE

Naples, or Monaco, of America, with an opportunity for the Florida visitor to observe the mystery and beauty of deep-sea life afforded to an equal extent only in the famous aquariums of those Mediterranean cities.

The Miami aquarium is equipped with 50 exhibition tanks, each with a visible area of 4 by 6 ft. One of the glass tanks is 36 ft. long, 15 ft. wide, and 10 ft. deep—probably the largest tank in the world. In it may be shown fish up to 12 ft. in length. The exhibition tanks are arranged along corridors in the general form of a Maltese cross, with a central rotunda. There are no direct openings in the corridors, the only light admitted being that from skylight openings directly over each exhibition chamber, so that the sun's rays, filtering through the waters of the tanks, give the interior of the aquarium the atmosphere of the ocean depths. To make this illusion more realistic, the tanks are lined with coral rock, and festooned with living specimens of the wondrous

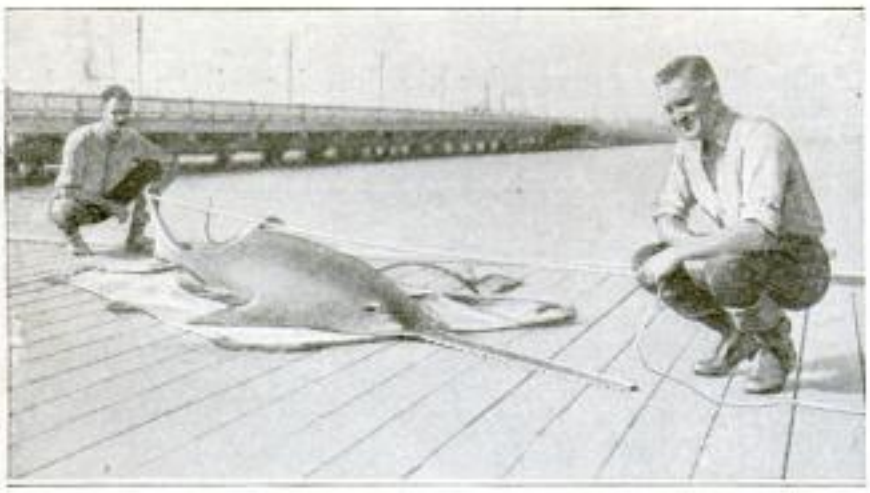


An Octopus in One of the Aquarium Tanks: This Eight-Armed Ocean Scamp Has the Faculty of Changing Color at Will



PHOTOS BY COURTESY OF THE NATIONAL GEOGRAPHIC MAGAZINE

One of the Corridors of the Aquarium, Designed So That the Only Illumination Admitted Is from Skylight Openings over Each Tank, Diffusing the Light through the Sea Water and Producing a Weird Resemblance to the Ocean's Depths



Here is Shown a 15-Foot Swordfish, Which Lived for Many Weeks in the 36-Foot Tank of the Aquarium. The Men are Verifying Its Length by Measuring It with a Tape

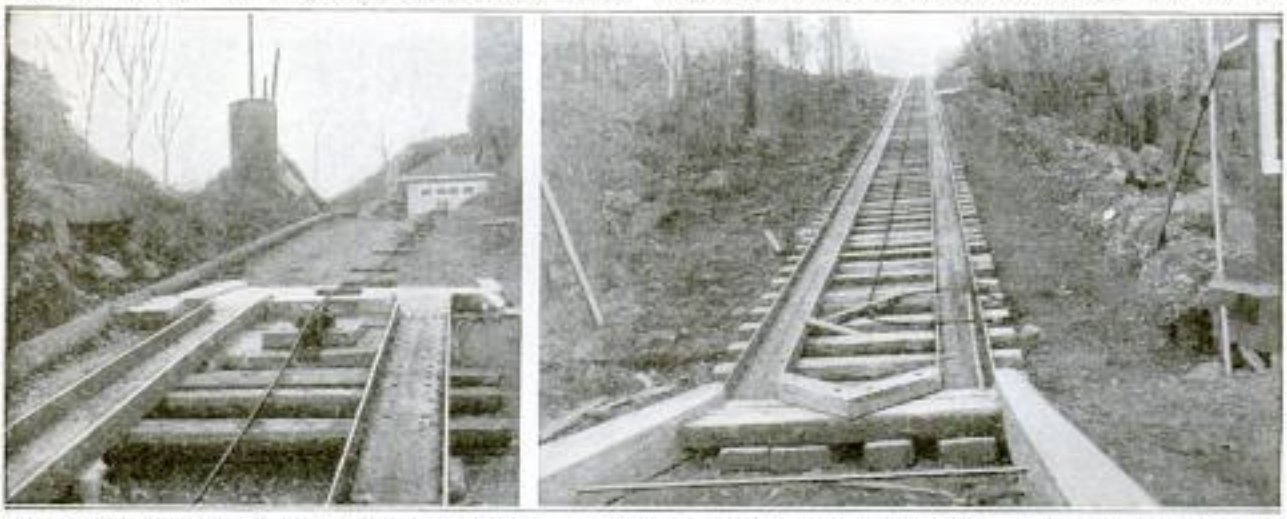
flora of the ocean bed. Most people who live far from the subtropic seas, especially those in inland America, have little conception of the beauty of this combination of the colored fish of our southern waters, and the beautiful flora of the ocean. To them a visit to the Miami aquarium will be one of the unforgetable incidents of their lives. And it is no longer necessary to go to the Mediterranean to enjoy this gratification.

GRANITE FROM QUARRIES BY AUTO TRACK

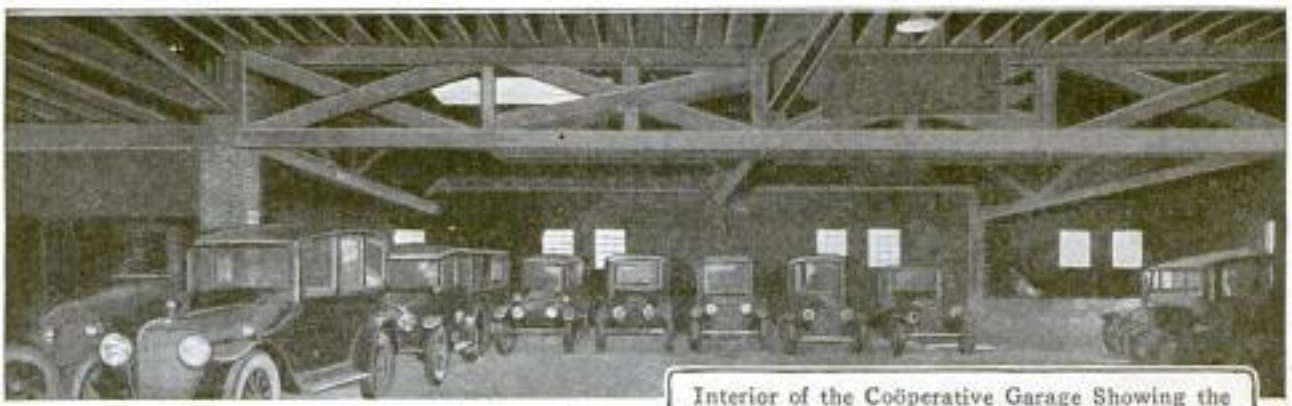
The first railroad in the United States was built at West Quincy, Mass., and now there has been constructed there an automobile track that supersedes the railroad and does its work more efficiently and economically. At a near-by granite quarry, the stone was formerly transported on freight cars, which had to circle the high hills in order to reach the point where the granite blocks were deposited, after they had been brought up from the quarry pit. That involved considerable waste of time and power. The remedy was to travel in a straight line, from starting point to destination, instead of in a series of circles or, rather, spirals. This is done by means of an automobile track, consisting of two steel troughs, each 14 in. wide and 5 in. deep, spaced to suit the standard wheel gauge. At the top of the incline, which is about 500 ft. long, is a power house, where a cable windlass is electrically operated. By means of the cable any auto truck can be hoisted up to the top of the track. Here the granite is loaded onto the truck, which is then lowered, by means of the windlass, to the bottom of the track. The loaded truck, without any further attention, is then free to carry its load to any destination.

COÖPERATIVE GARAGE PLAN PROVES QUITE PRACTICABLE

The conducting of a coöperative garage on a large scale by the undertakers of Bloomington, Ill., has proved so entirely successful that other similar organizations in surrounding cities contemplate giving the plan a trial. The garage building, modern in every particular, was built especially for the purpose, and has a frontage of 125 ft. and a depth of 150 ft. A skilled mechanic keeps the cars and hearses in good running order, for which



At the Left Is the Top of the Automobile Track, Showing the Cable That Hoists and Lowers the Cars Running Back to the Power House Seen in the Background. The View at the Right was Taken from the Bottom of the Track. The Approach to the Wheel Troughs had Not been Laid at That Time



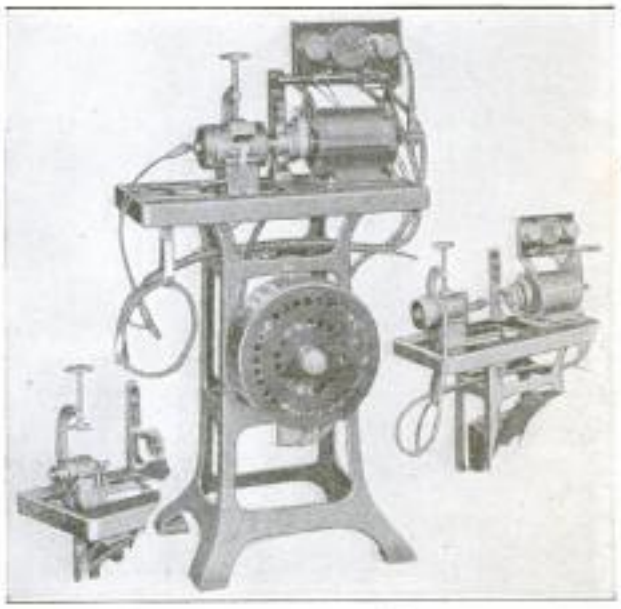
Interior of the Coöperative Garage Showing the Members' Cars Grouped in Permanently Assigned Places: Truss-Beam Ceiling Construction was Used, Thus Eliminating Posts. Skylights and Plenty of Windows Provide Illumination for All Parts of the Floor

Exterior of the Well-Thought-Out and Designed Coöperative Garage Located at Bloomington, Illinois: With a Frontage of 125 Feet and a Depth of 150 Feet, the Substantial Building Easily Houses the Hearses and Livery Cars Belonging to the Members of the Undertakers' Association of That City

he is paid. He also has the privilege of taking other cars in for repairs during his leisure time. Operating expenses are charged on a pro-rata basis, and it is said that the plan has resulted in a saving of 50 per cent to every member of the organization.

IMPROVED APPARATUS TESTS ELECTRIC AUTO STARTERS

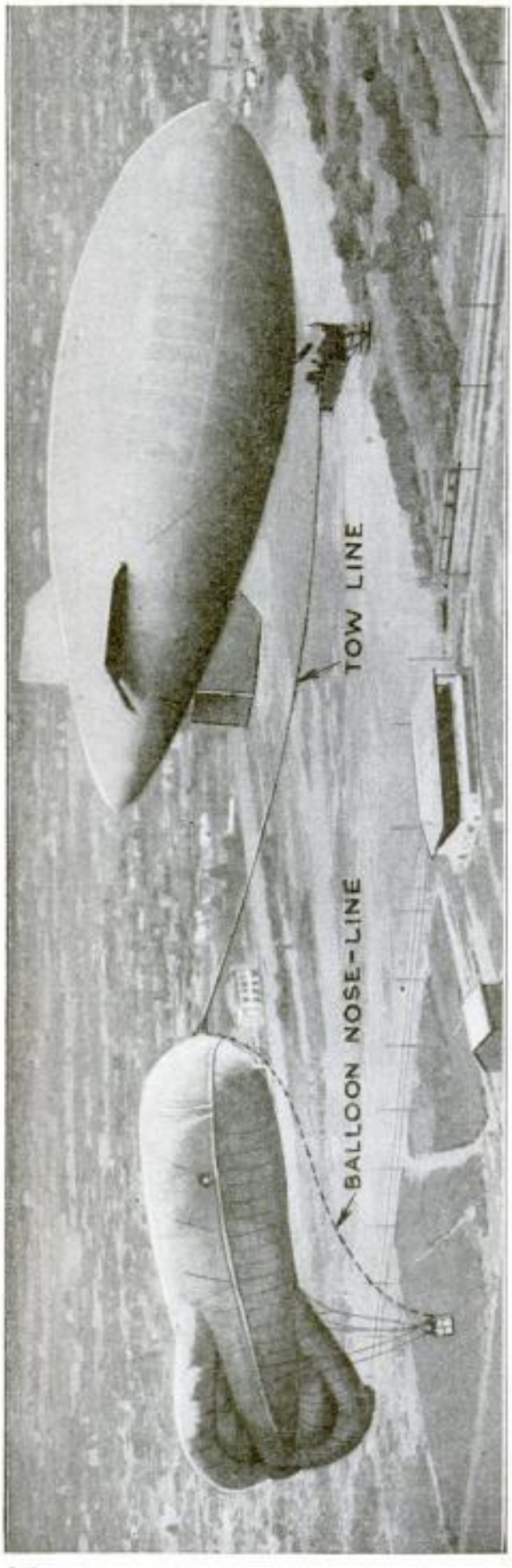
A compact testing unit, especially designed to locate the faults in the electrical equipment of a popular make of automobile, can be adapted to make generator, starting-motor, armature, field-coil, and automatic cut-out tests on about 90 per cent of the various types of these apparatus in use on the many different makes of cars. The driving motor of the device is rated at ⅓ hp. and has a speed range of from 300 to 3,000 r.p.m., governed by a controller mounted on the front of the supporting stand. A V-type vise, which holds either the generator or the starting motor when undergoing test, is equipped with a winding and can be used as a "growler" to locate short and open circuits in armatures. The pulling power and current consumption of starting motors are measured by means of a spring scale, a short brake beam and clamp, and an ammeter having a range of 600 amperes. A voltmeter with a range up to 15 volts, and a revolution counter reading from 300 to 3,000 r.p.m., complete the outfit, which is entirely self-contained and occupies but little floor space.



Left: The V-Vise in Use as a "Growler" Testing an Armature. Center: Note the Compactness of the Apparatus. Right: Testing a Generator

BLIMP TOWS HOME STRAY OBSERVATION BALLOON

By JOHN EDWIN HOGG



After an Exciting 20-Mile Stern Chase the Nimble Blimp Overtook the Runaway Sausage Balloon and, Passing under It, Picked Up the End of the 400-Foot Nose-Line. Then Followed Some Expert Aerial Jockeying to Bring the Blimp Up to the Level of the Runaway without Fouling the Line with the Propeller or the Rudders and without Ripping the Big Gas Bag by a Sudden Unexpected Lunge. Skillful Maneuvering Finally Won, and the Valuable Craft was Brought Safely into Port

WHAT is believed to be the first instance of the kind in the history of aerial navigation occurred over Los Angeles County recently—an aerial derelict being pursued by an airship, overtaken, captured, and towed home.

An observation balloon in use over Ross Field, Arcadia, soared aloft over the Pomona Valley when a sudden gust of wind snapped its anchoring cable. Lieut. Harry M. Nelson was in the balloon basket at the time, conducting some experiments with a newly installed radio-telephone. When he discovered himself soaring through space in a free balloon, his first thought was to parachute to the earth, and let the balloon go. Having the phone at his disposal, he decided, however, to secure the sanction of his superior officer before abandoning the balloon to its fate. Getting in touch with the officer, Lieutenant Nelson stated his predicament, and asked permission to jump with the parachute. "Don't jump," replied the commanding officer; "stick with your balloon. We are getting a blimp out to come after you and tow you in. Jump out if your life is endangered, but otherwise stick with your balloon."

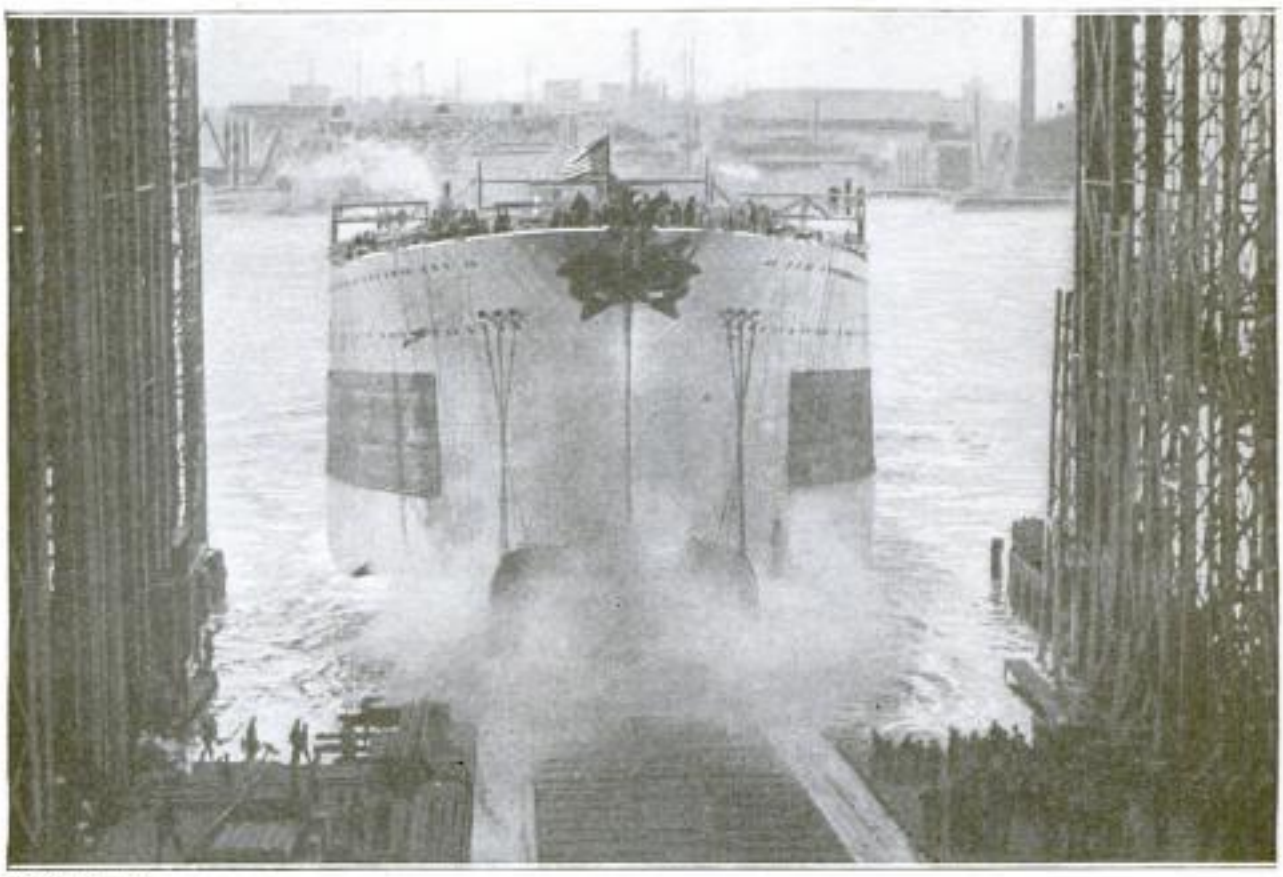
A few moments later two blimps were soaring through space in pursuit of the derelict balloon. Running before the wind the power balloons quickly overhauled the runaway, which was drifting helplessly with the wind. Five airplanes, carrying sandbags, also joined in the chase. They carried the bags to be dropped upon the runaway balloon after its passenger should have dropped to the earth with his parachute, and in the event the blimps failed to capture the derelict. The airplanes quickly caught up with it, and hovered around it until the blimps came.

One of the blimps was equipped with radiotelephone, and in a very few minutes its pilot was in communication with the helpless lieutenant in the runaway. "Drop your nose-line," called the blimp pilot, Carl Wallon, to the officer in the derelict balloon. Lieutenant Nelson heard the words distinctly. He cut away the nose-line, and 400 ft. of stout manila rope dangled earthward from the nose of the sausage.

The chase had progressed approx-

imately 20 miles out over the Pomona Valley before the blimps maneuvered alongside the runaway balloon. Pilot Wallon managed to get under the runaway, and after several attempts his assistant, Sergeant Fred Campbell, succeeded in reaching out with a balloon-cord hook (a device used in ballooning, very similar to an ordinary boathook), catch the noseline of the derelict and pull it into the gondola of the airship. The latter was promptly given power ahead, and was sent upward to the level of the derelict balloon. In a few seconds more the tow line was stretched taut. It took 40 minutes for the blimp to tow the runaway back to the field, but in due time both air craft were safely under the care of the ground crews. The other blimp, and the airplanes which took part in the chase, returned to the field ahead of the airship and the runaway balloon. The only difficulty encountered by the blimp in towing the balloon was in keeping the two balloons ballasted equally. After a few minutes of experimentation along this line, however, the balloon lieutenant succeeded in keeping the weight of his craft properly adjusted, so the blimp pulled the balloon to the field like a docile kitten on the end of a string.

Capturing the runaway balloon with the blimp proved to be highly advantageous. Not the slightest damage to either air craft resulted, and at no time was the life of the balloon lieutenant endangered. A similar accident, which occurred on the same field about three years ago, when no blimps were available at the field, cost the life of a balloon officer, and resulted in the total loss of two balloons worth $15,000 each. A gust of wind broke one balloon from its cable. It crashed into a second balloon, tearing the basket from it and dashing the officer 500 ft. to earth. One balloon fell to earth as a mass of wreckage, while the other soared away to be torn to pieces in a tree. The occupants of the second balloon parachuted to earth and escaped without injury. The use of airplanes to bring runaway balloons to earth by dropping sandbags upon them was described in this magazine some time ago.



WIDE WORLD PHOTOS

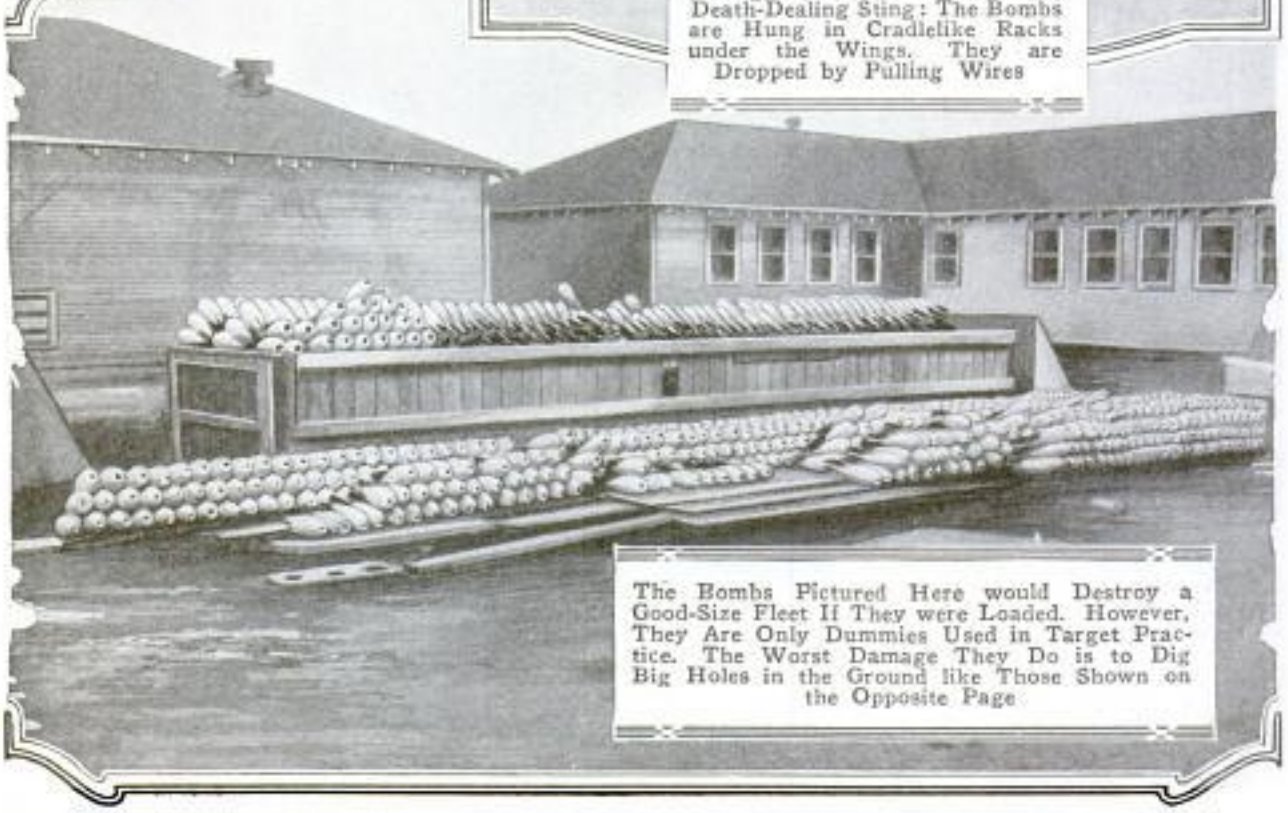
LAUNCHING THE LARGEST U. S. SUPERDREADNAUGHT

THE largest warship ever launched on this continent, the superdreadnaught "Colorado," is seen here just as it leaves the slip, and takes the water gracefully. The launching took place at Camden, N. J., and was attended by Theodore Roosevelt, assistant secretary of the Navy. The christening ceremony was performed by Mrs. Max Melville, a daughter of U. S. Senator Nicholson, of Colorado, who represented the state for which the great ship is named.

ARMY AIRMEN TRAIN TO PROVE THAT

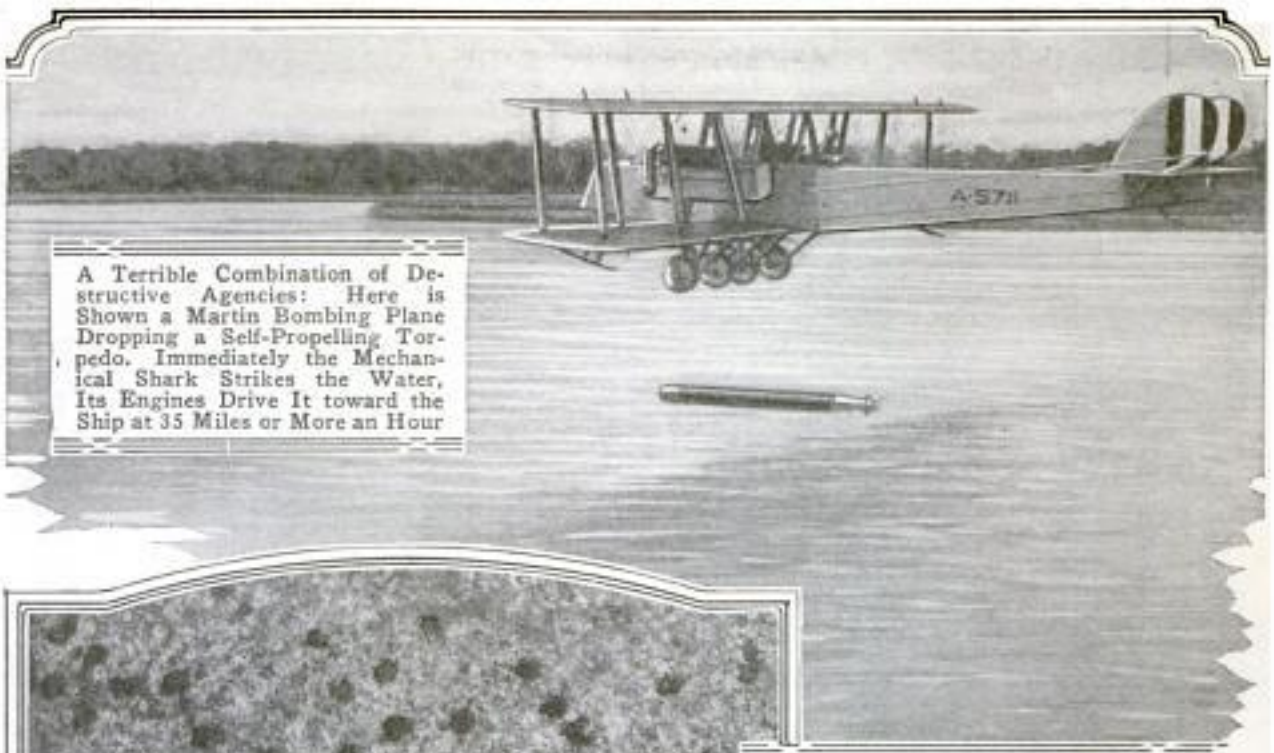
The Bombs do Not Turn Point Downward Immediately After They are Released, but Fall Many Feet in a Horizontal Position. Gradually the Heavy Head Overbalances the Lighter Tail Piece, and the Deadly Missile Plunges toward Its Target

Giving the Giant Hornet Its Death-Dealing Sting: The Bombs are Hung in Cradlelike Racks under the Wings. They are Dropped by Pulling Wires

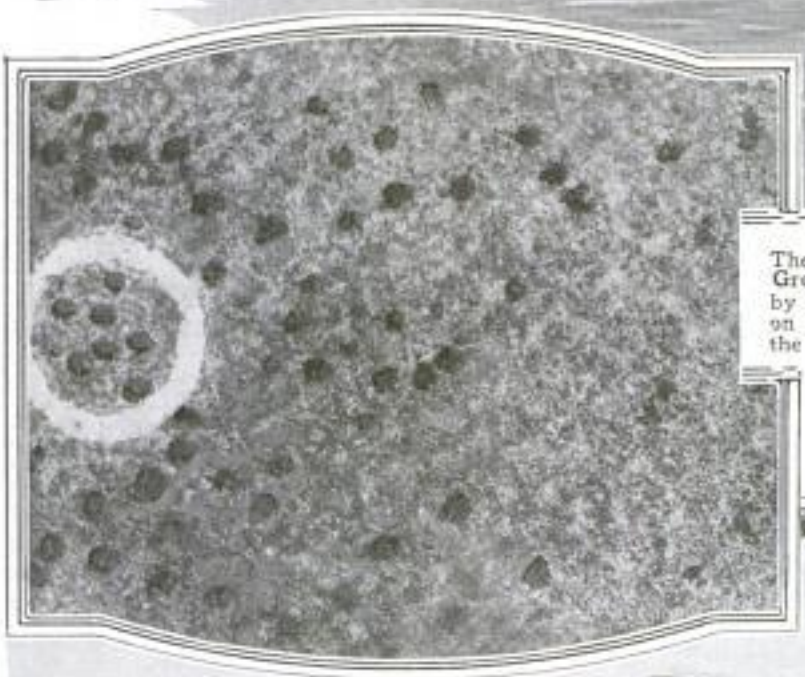


The Bombs Pictured Here would Destroy a Good-Size Fleet If They were Loaded. However, They Are Only Dummies Used in Target Practice. The Worst Damage They Do is to Dig Big Holes in the Ground like Those Shown on the Opposite Page

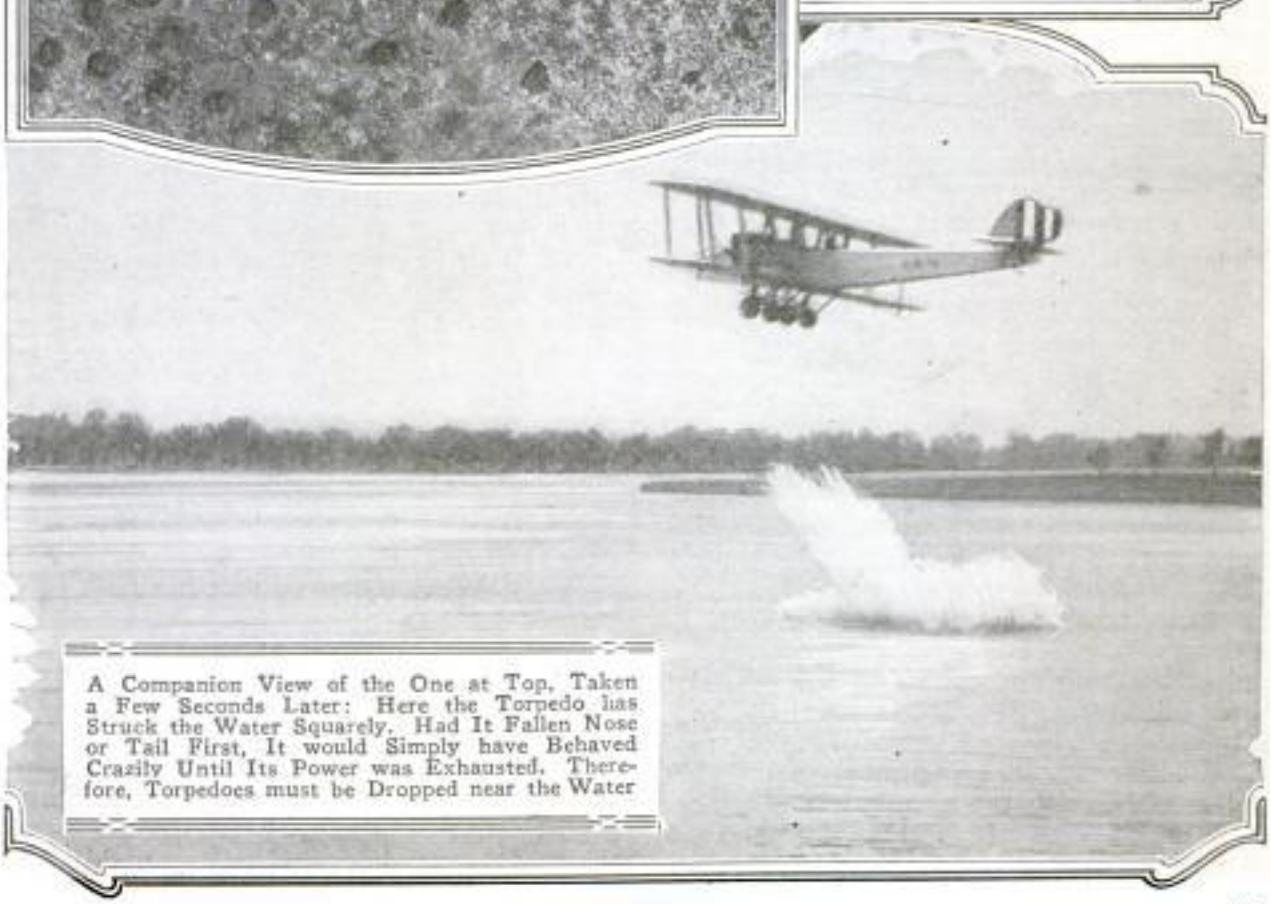
AIRPLANE IS BATTLESHIP'S MASTER



A Terrible Combination of Destructive Agencies: Here is Shown a Martin Bombing Plane Dropping a Self-Propelling Torpedo. Immediately the Mechanical Shark Strikes the Water, Its Engines Drive It toward the Ship at 35 Miles or More an Hour



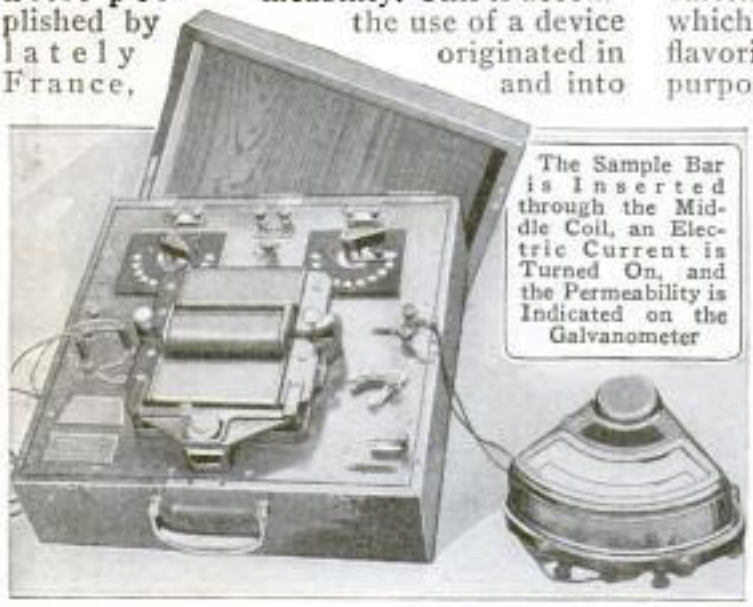
The White Circle Is the Bull's-Eye of Ground Target. Eight Holes, Made by Dummy Bombs like Those Shown on the Preceding Page, Speak Well for the Bombers' Marksmanship. Good "Shooting" is Indicated by the Honeycomb of Holes All around the Bull's-Eye. The Dummies are Balanced and Fall Just like Real Bombs



A Companion View of the One at Top, Taken a Few Seconds Later: Here the Torpedo has Struck the Water Squarely. Had It Fallen Nose or Tail First, It would Simply have Behaved Crazily Until Its Power was Exhausted. Therefore, Torpedoes must be Dropped near the Water

LATE FRENCH TESTING DEVICE RECORDS IRON PERMEABILITY

Iron to be used as cores for fields or armatures must be tested as to its magnetic permeability. This is accomplished by the use of a device lately originated in France, and into



The Sample Bar is Inserted through the Middle Coil, an Electric Current is Turned On, and the Permeability is Indicated on the Galvanometer

which a sample bar of the piece may be placed for the test. Three coils are located side by side on top of the instrument box, a soft-iron frame passing through the two outer coils. The piece to be tested is inserted through the middle coil in contact with the soft-iron frame, thus completing a magnetic circuit. Suitable switches permit sending variable electric currents through the parts of the instrument, and an index to the permeability of the test piece is found in the reading of the sensitive galvanometer. By the convenient and compact arrangement of the instrument, much time is saved in making the test.

AIRPLANES MAY BE USED TO TOUR GRAND CAÑON

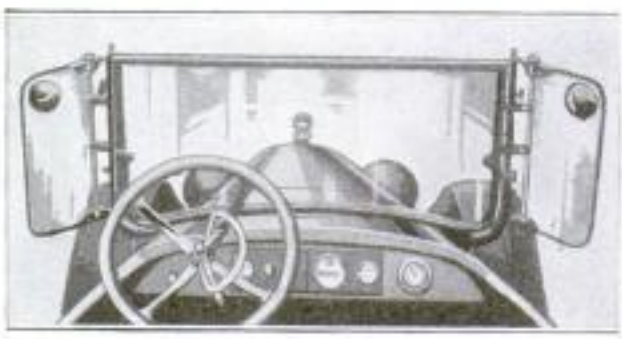
Viewing the wonders and grandeurs of the famous Grand Cañon of the Colorado River as the eagle sees them may be a possibility for tourists in the near future if the plans of the secretary of the interior work out as they are expected to. He has forwarded a request to the War Department that it lend its coöperation in making an aerial survey of the great gorge and in locating and mapping suitable airplane-landing fields. To accomplish these purposes the use of an army plane is projected. Should it be found practicable and safe to tour the chasm via airplane, commercial interests will be encouraged to engage in the undertaking on a large scale.

WASTE APPLES YIELD RICH SIRUP BY NEW PROCESS

A new extraction process converts the juice of even the most intensely acid varieties of apples into a sweet, rich sirup, which is entirely suitable as a base for flavoring extracts and for many other purposes. A valuable by-product of the process is a compound, known as calcium malate, which is identical with the so-called "sugar sand" hitherto derived from maple sirup exclusively. This compound forms the basis of malic acid, and was valued at $1.50 per lb., and more, before the war, at which price it was purchased by German interests in lots of hundreds of tons. At present, the only plants employing the process are located in Nova Scotia, but, as it utilizes a fruit which is now being allowed to go to waste to the extent of hundreds of thousands of tons a year, it is to be expected and hoped that the method will come into wide general use within the near future.

AUTO REAR-VIEW MIRRORS ARE PART OF WINDSHIELD WINGS

A novel placement for automobile rear-view mirrors is at the upper corners of the auxiliary side deflectors which have come into wide use recently. An eastern manufacturer of these fitments is supplying the wings with generous-size circular lenses in the upper corners, specially ground in the plate glass and heavily silvered and protected against scratching. These form wide-angle mirrors which show all the road to the rear as well as a considerable part of the landscape on



Auto-Windshield Deflector Wings with Rear-Vision Lens Mirrors Ground into the Glass

both sides. The deflectors may be so adjusted that the mirrors are correctly focused for both the driver and the passengers in the rear seats.

The Entrance House to the Endless Caverns, Beautifully Located in a Shady Wood, on the Western Slope of One of the Foothills of the Massanutten Mountain, About Four Miles South of the Town of New Market, Virginia

THREE MILES OF CAVERN WIZARDRY

BY HENRY S. WHITE

THAT the human craftsman is a tyro as compared with nature is, of course, a truism, and this is nowhere more effectively demonstrated than in the great caverns that are fashioned by the action of water on limestone. This rock formation is easily dissolved, and in limestone regions running water often leaves in its wake underground channels that form caves and caverns, adorned by graceful stalactites and stalagmites, with tessellated floors, groined roofs, and sculptured walls that, though in many ways they resemble it, surpass the most elaborate products of Gothic architecture.

There is nowhere a more striking example of this magic work of nature than in the so-called "Endless Caverns" of New Market, Va., which have recently been thrown open to the public. Here is a subterranean art gallery, three miles in length, consisting of many rooms, corridors, and hallways that may fairly be called one of nature's masterpieces.

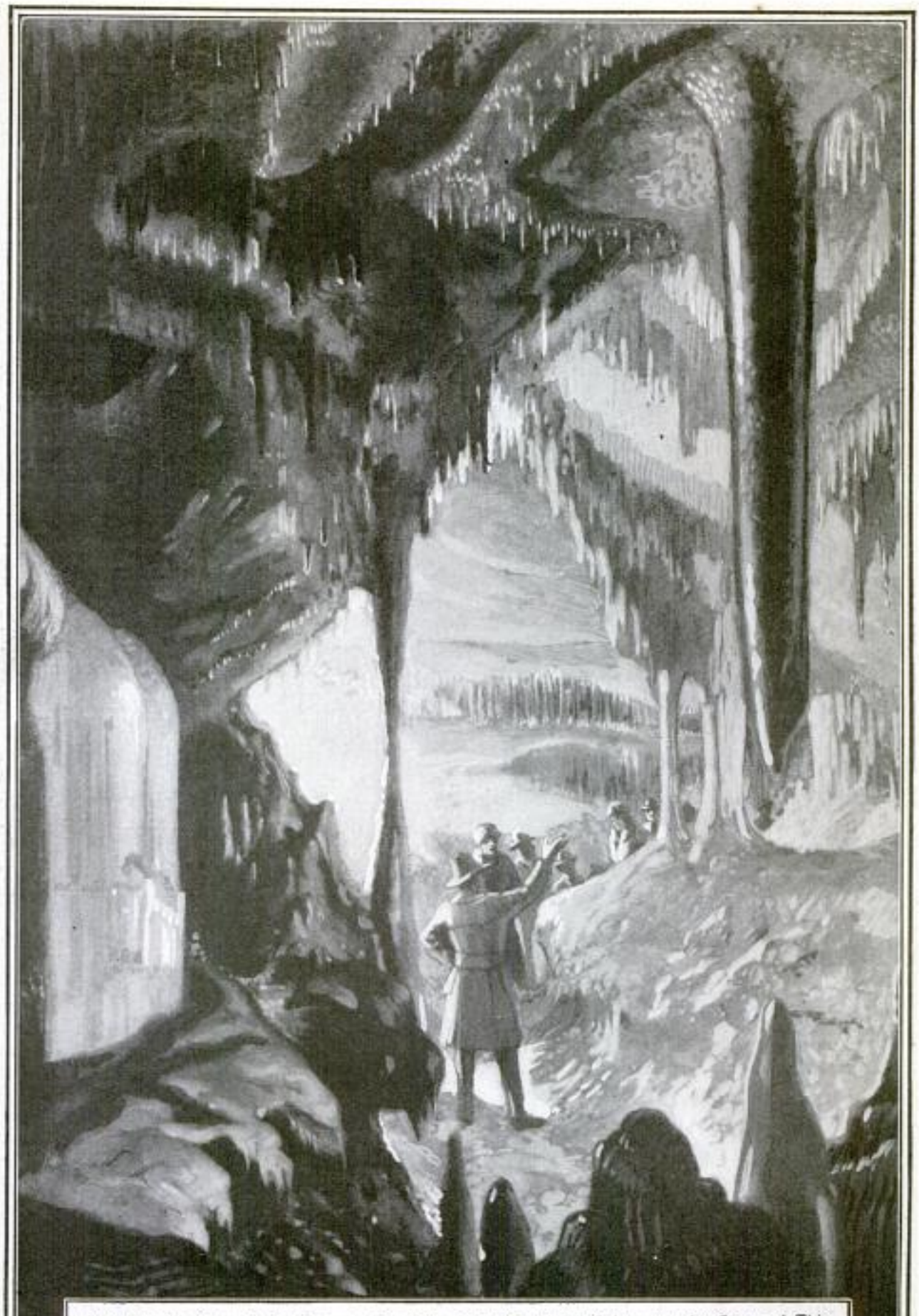
These vast caverns were accidentally discovered on a Virginia farm, four miles south of the town of New Market, as long ago as October, 1879. They have been somewhat neglected until last year when, on August 14, after elaborate preparatory work, they were formally opened to the public. The preparatory work consisted in such enterprises as the construction of a first-class macadam road, with a steel bridge spanning Smith Creek, that connects the caverns with the national highway between New York City and Atlanta, Ga.; the erection of an entrance house, of unique design, and last, but not least, in the caverns themselves, the installation of what is, perhaps, the most elaborate electric-illumination system that exists in any caverns in the world. The electricity is supplied by a power plant consisting of two 25-hp. engines driving two 15-kw., 125-volt generators, with storage batteries, and also two 3-kw. engines for any emergency requirements. The current is conducted to every cranny and nook of the caverns by means of an elaborate system of underground lead-covered cables, and the lighting is of the concealed indirect flood system, so that there is nothing visible but the illumination itself, which appears to be spontaneous, and greatly adds to the charm of nature's part of the work.

Over 30 rooms and passages are now open to visitors, and they are all clean and dry, and as well ventilated as a city residence. Inside the caverns the temperature is uniformly about 56° F., and it is only in hot summer weather that any additional clothing might be needed.

The entrance to the caverns is from the western slope of one of the foothills of the Massanutten Mountain, situated in the northeastern part of Rockingham County. A stairway leads to the first room entered, which is called the "Oriental Palace." It measures 25 by 90 ft., with a

At the Left is Seen a Corner of One of the Largest Rooms in the Caverns, Called "Skyland," Which Is Particularly Rich in Stalactites That Hang from the Roof like Huge Variegated Icicles, Though, Unlike Icicles, They Convey the Impression of Endless Durability. On the Right Is the Exit from This Room in the Form of a Steep Stairway, Which has Aptly been Named "The Straight and Narrow Way"

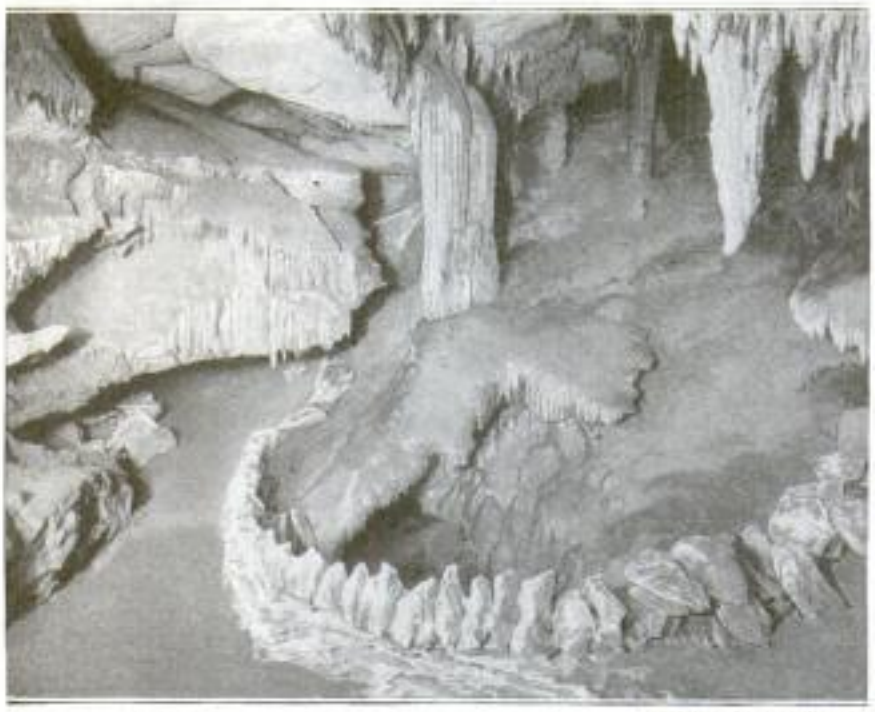
This Is the Entrance to the Gem of the Caverns, and is Therefore Called "The Gateway to Fairyland." It Is a Fitting Introduction to Fairyland Itself, and Has Much of Its Charm, Both in Form and Color, Enhanced by the Effect of the Indirect Electric Lighting. The Stalactite and Stalagmite That Run Together, on the Left, are Called "Cleopatra's Needle"



A Composite View of the Caverns, the Same as is Shown, in Colors, on the Cover of This Magazine, Made by Combining Views of Alexander's Ball Room, Skyland, Solomon's Temple, and, in the Immediate Foreground, of Fairyland. So as to Give One Comprehensive Impression, Such as a Visitor would Get after Completing a Tour of the Caverns: There Is Every Shade of Color, from the Bright Prussian Blue of the Stalactite on the Right, to the Rosy Hue of the One to the Left

FROM PAINTING BY C. E. RITTAN

beautiful groined ceiling, 20 ft. high. This room probably thrills the visitor as much as anything that follows, because it is the first revelation of these strange cavernous marvels, although later ones surpass it.



A Corner of "Solomon's Temple," Showing in the Background One of the Curious Twin Columns That are Colored as if They were Made of Bronze: In Another Part of the Temple Is the King's Bejeweled Throne

From the Oriental Palace a winding passage, 75 ft. long, leads to the Tree Grotto, and so on from room to room until all 30 have been visited. All have special descriptive names, of which some of the most striking are: Alpine Pass, Grand Cañon, Crystal Falls, Skyland, Alexander's Ballroom, Solomon's Temple, Marble Hall, Dante's Inferno, and finally, the gem of the series, Fairyland, where the beautiful Diamond Lake is situated. The gateway to Fairyland is one of the most charming spots in the whole length of the caverns. It displays to the visitor a wonderful example of the art effects produced by the erosion of limestone, and the formation of stalactites and stalagmites in all kinds of weird shapes and various colors, its charm accentuated by the artificial illumination. Diamond Lake is about 15 ft. square, with a depth varying from 6 to 18 in. The water is clear as crystal, and beneath it the stalagmite formations glitter like huge diamonds. The light thrown on the ceiling transforms it into a fretwork of precious stones. To the left of Diamond Lake is the Palace of the Fairies, considered by some visitors to be even more beautiful than the lake.

Not far from the entrance to the caverns is a particularly large room called "Skyland," which is very rich in stalactites that hang from the roof in clusters, as though they might be the leaves of some antediluvian form of the Virginia creeper, petrified. The visitor leaves this room by ascending a steep stairway, in part so constricted that it is called the "Straight and Narrow Way."

Proceeding through various rooms and passages the visitor comes to Alexander's Ballroom, which is particularly notable on account of a mass of stalagmites rising from the floor, like a huge petrified weeping willow. Near the entrance is a somewhat remarkable stone formation that resembles a sleigh that has been frozen solidly and permanently to the ground. About 90 ft. from this room is King Solomon's Temple, appropriately furnished with a bejeweled throne for King Solomon, and a Queen of Sheba's Pass. One of the conspicuous features of the temple is a large twin column, colored as if it were made of bronze.

WIRELESS STATION TO CONNECT EUROPE AND ARGENTINA

Concessions have been granted a French company by the Argentine Republic for the construction of a powerful wireless-telephone and telegraph station on the coast, for communication with France and other European countries. The station will be of 80-kw. capacity, and continuous waves will be used to talk to Paris. Three experimental plants are to be erected under the concession grant, which is to run for 30 years. If, after three years, the experiment should prove satisfactory, Argentina will allow the company to install commercial wireless-telephone and telegraph systems throughout the country.

¶As a fitting celebration of the completion of the first direct telephonic-cable connection between the United States and Cuba, President Harding, on April 11, conversed in terms expressive of national good will with President Menocal of the latter country.

COMMENT AND REVIEW

[These pages were printed April 26, 1921.]

DISAPPOINTMENT at the loss of the great Caproni airship is by no means limited to Italy and its builders, but is shared by the entire world. It is really a cosmopolitan loss, for the results so anxiously awaited from this mammoth 100-passenger plane must now be deferred for at least one year, and probably several years. If its trial flights had met the expectations of its daring inventor and his financial backers, the ship would have gone into transatlantic passenger service. Regardless of the advance made in air navigation, the effort was little less daring than the dream of Jules Verne half a century ago. Already, in the submarine, has the dream been fully realized, but the air is yet to be as completely conquered.

A World Loss

Transportation of passengers by air craft, operating on regular schedules, has advanced so far that it is inevitable that a larger carrying capacity will be steadily attempted. Caproni hoped to jump over that slower growth, and arrive by a bound at the goal which natural development would require several years to accomplish. Whether this is possible or practical remains to be seen. The first automobiles were built to carry two persons; their development to the motor vehicle carrying 20 or 30 passengers consumed several years. The auto, moreover, had one big problem only—propulsion—while the passenger plane has both propulsion and elevation to accomplish. The transportation on regular schedules, of a small number of passengers, for comparatively short distances, such as London to Paris, has already been set down to the credit of the plane, but for any considerable number of passengers the dirigible still maintains its supremacy. The Caproni, therefore, was expected to determine the relative value of the two types. The dirigible, to date, has the advantage of far greater load-carrying ability, but the disadvantage of its unwieldy size. It is also generally regarded as more difficult to manage in bad weather, and its liability to destruction by accident and fire is greater.

And now comes the report that the Caproni lost itself by burning, which, if true, would seem to put both types in nearly the same class. But did the Caproni really burn? There is a first-class mystery as to the actual cause of its destruction. The illustration of the wreck, in this issue, affords no suggestion of fire, and yet, if it started to burn, even resting on the water as it did, would any part of the nine planes escape? The official report in the Italian press states that after making a flight of one mile it was damaged in descent, and plunged. Another story has it that the pictures are those of a much smaller plane which was wrecked in the same way at the same time. The editor of The Aeroplane, London, who visited the scene a few hours after the accident, reports finding on the shore and floating about the wreck pieces of wreckage which exactly corresponded to parts of the Caproni. It is unthinkable that a ship costing a million dollars could for any reason at the present time be purposely destroyed after demonstrating its success. One rumor is that the several tons of ballast on board shifted, making it impossible to overcome in time the descending inclination by means of the ailerons.

Whatever the cause, the universal regret must be the same, that the day of the reliable ocean-passenger airship has been deferred. In the meantime, our European tourists will have to get along as best they can with a steamship service which is both luxurious and safe, even though much slower.

WHILE on the subject of air craft, the reader should not fail to note the first successful flights of a helicopter—a heavier-than-air machine which does not rise by soaring, but just rises. Straight up it goes in the air; how high it may go is not yet determined, for the present machine was tethered by a cable. Its use, obviously, is that of a craft which will remain stationary in the air for an indefinite length of time; for war observation purposes it offers a very much smaller target, and is much easier concealed and transported on the ground. For photographic work it is fully equal to a blimp and, moreover, it can actually be equipped with a giant parachute.

The Helicopter Success

Long before the first successful plane, inventors worked to produce a helicopter, which, in its innumerable fantastic shapes, has been the joke of air-craft men. These took on every conceivable shape of lifting medium,

of which, for a time, the air beaters—wings which closed on the upstroke and opened on the downstroke like a duck's foot—were the favorite effort. Even as far back as the Middle Ages, Leonardo da Vinci planned and tried to construct one. The 18th century marked several efforts; and in 1909 Edison predicted that the helicopter would prove to be the ultimate successful type of flying machine. Renard, Maxim, and Berliner, each conducted exhaustive tests, but without accomplishing any satisfactory results. The record of failures of inventors, great and small, at last became so long that when one ventured the word "helicopter," he was regarded with almost pity. Helicopters were built in almost every country—many in this—and some were as large as a fair-sized two-story house. But of the hundreds, none ever remained in the air more than a few moments nor rose many feet above the ground. It remained for Professor Karman, an Austrian, to attain the first success. The propellers, of course, are horizontal, instead of vertical as in a plane. For domestic purposes it will be useful in aerial photography, radio work, for surveys on land and water, and for forest observation; and last and possibly its most general use—that for tourist observation and thrills at county fairs and summer gardens.

Department of Education

IT IS a far cry from the Little Red Schoolhouse to the bill now pending in Congress, which would annually appropriate $500,000 for a new cabinet department of education, and $100,000,000 for distribution among the states to encourage them in the instruction of illiterates 14 years of age and over. With the exception of some of the southern states, the facilities for securing a common school education cannot be greatly criticized. I recall my amazement at the size and quality of country schools in a most sparsely settled portion of the Salt River Valley in Arizona. They are in the midst of what will continue to be a desert covered with cactus and mesquite, until population and irrigation transform it into one of the richest soils in the world. But there they are, brick buildings of permanent character, suitably ornamental, which would do credit to any town of 2,500 in New England or the Middle West. No homes or other buildings of any character are near, but the settlers justly anticipate a large population and are providing for it in advance. The government could do no better. The states, with the exceptions noted, have prided themselves on their schools. To have the system which each has worked out to its satisfaction changed more or less and subjected to dictation from Washington, as to what shall and shall not be taught, and how, deserves consideration. The immediate increased cost is $35,500,000, for already the Department of the Interior is expending $65,000,000 annually in its Bureau of Education. It would, however, increase centralization, and we all know how much time is required to get necessary authority from Washington with all its red tape. Whether a central bureau at the capital is as well qualified to determine what the citizens of Ohio or New Hampshire want, is a question. So far it would seem the people on the spot have managed to build up a pretty good system of schools. If the requirements of a few states are greater than the state funds permit, and they need help, that is another matter. Great efforts are being made just now by certain interests to increase the state educational fund in Illinois from $2,000,000 to $20,000,000, and the appropriations are increasing in other states.

Would it not seem that with the day and night public schools, the academies, colleges, and state universities, supplemented by the free, or at nominal tuition, instructive work of Y. M. C. A.'s and similar organizations, the need is not so much for more facilities, as for more scholars of the ignorant type? The children of families in fairly comfortable circumstances attend school as a matter of course, while those of some nationalities desire or are forced by their parents to work. It would appear that to some extent studies as well as clothes, food, customs of life, are local to some parts of the country, and that what is acceptable and best in one state would be quite the contrary in another. Distance is another handicap. Suppose a country-school district in southern California wishes to make some change; two weeks would be required for letters to go and return, alone.

The trend in all our systems of education already is to pass over the rudimentary essentials more hastily each year, and elaborate more and more on what

used to be known as "higher education." What the business world desperately needs is young men and women who can spell, write a legible hand, and are grounded in the three R's. With school management in the hands of the people at home, needed changes can often be made; with our home schools managed from Washington—what?

THE "Financial World" says: "It is not overtaxation that is burdening the world and stopping its rehabilitation as much as it is burdensome, unwise and inequitable taxation." If business is to recover, it is absolutely necessary to repeal the present absurd, exasperating, unjust, and expensive system without delay. A member of the Finance Committee of the House said to me: "In my judgment the present system adds fully 20 per cent to the selling cost of merchandise, taken as a whole." At present it costs the Government millions a year to collect the tax—and it does not get near all of it at that. It costs the taxpayers many millions more for time, attorneys, and experts to make out the annual reports. Even then, no one knows for several years whether or not the report is right—from the revenue department's point of view.

The Proposed Sales Tax

It is needless to go into details of the exasperations of the present system: Every taxpayer, large and small alike, is agreed as to this. The question then resolves itself into, "What is a better method?"

Several bills have already been introduced in the present Congress to substitute a "sales tax." This has aroused the most vitriolic and frantic objection on the part of a few congressmen. They have not, so far, offered sound reasons for their disapproval, although supported in their attitude by some college professors, and to some extent by the Secretary of the Treasury. Perhaps the best explanation of a sales tax is that written by an eminent financier, Jules S. Bache, who suggests the following general plan:

A tax of 1 per cent to be paid monthly on the actual receipts of all engaged in business, with an exemption of all small businesses collecting $6,000, or less, per year. Any grammar-school boy can make up the monthly report for the largest concern; he takes the total amount collected and if it exceeds $500 he points off two figures. On a monthly collection of $10,000, this would be $100. If some months exceed $500 and others fall below, a refund is made at the end of the year if the total 12 months' reports do not exceed $6,000. The monthly payment would prevent the heavy quarterly borrowing at banks, now necessary to many, and the government, by reason of this steady, regular flow of money, need not issue the short-time "certificates" as at present, on which interest has to be paid. The 1 per cent is estimated by careful financiers to produce between $3,500,000,000 and $7,000,000,000, probably about $5,000,000,000; this, with the tobacco tax of $500,000,000 and the equal amount now collected from personal incomes, should produce the enormous revenue of $5,000,000,000 annually. With any sort of economy this would be more than required in peace times.

The average increase in the selling cost of merchandise does not figure over 3¼ per cent, from raw material to consumer, against the 20 per cent being added at present to anticipate the excess-income tax in force. On a $50 article, such as a suit of clothes, the sales tax would be 50 cents. Distributed between wool grower, mill, wholesaler, and retailer, the suit could still sell for $50. On the multitude of small purchases of one dollar or less, the 1 per cent is so small, it could not increase the retail price, yet would not be a burden on the seller, who would gladly absorb it, as his yearly tax would be less than at present. The Illinois Credit Association voted against a sales tax, on the ground that many dealers were now selling at less than cost the goods bought by them at war prices. But should a post-war condition, which is unlikely to occur again for years, we hope never, stand in the way of a lasting improvement? And anyway, the sales tax could not go into operation this year, and readjustment should be pretty well accomplished within 12 months. Admittedly, a sales tax would not be welcome to a business being run at a loss, which now pays no taxes. On the other hand, the business of the country is run at a profit, and a losing business cannot last very long in any event. The payment of $10,000 on annual receipts of $1,000,000 would make very little difference, even if that

million receipts showed a loss. No tax system can ever be devised which does not hit here and there. The present one seems to hit everywhere and is full of injustice and inequalities, for which there has been and is no relief whatever.

The best test of anything is the verdict of those who have used it. A sales tax of 1 per cent has been in force in the Philippine Islands for the past 15 years. For the first few months it was unpopular, but ever since it has met with universal approval. Any tax system which is allowed to continue for 15 years in a country where the taxpayers have any voice in the matter, must be pretty good. The Filipinos even have under consideration at the present time an increase in the rate to 2 per cent, in substitution for all other taxes of every kind. It may dent our pride as financiers to borrow a tax system from our distant dependents, who, in years past, have had more publicity as head hunters than economists, but is it reasonable to suppose they enjoy taxpaying any more than we, and there is the record of 15 consecutive years as evidence. Whatever our views, we can't get away from those 15 years of satisfied taxpaying.

Of course it cannot be denied that skilled accountants are hardly necessary to check off the two points, nor that an audit of a firm's books could ordinarily be made in as many hours as it now requires days. The department is steadily falling behind (the reports for 1918 have just been reached), and this means a still further increase in help. With the sales tax, the greater part of this work would vanish, and most of what remains can be performed by much less experienced and less expensive clerks. Some would still try to evade their tax, but it would be incomparably easier to detect them, and after all not so many of us are unpatriotic or trying to flimflam our Uncle Samuel.

Remember the 15 years.

H. H. WINDSOR

LACES MADE UNNECESSARY BY NEW SHOE FASTENER

A time and trouble saver, that also ornaments the shoe, ought to have considerable charm for the busy modern lady. Two engaging plates are secured to the front of the shoe, against the edge of the opening, one on either side. These plates are about an inch long and are bent to the shape of a hook, with ridges formed at the line of the bend. Into these hooks slides a securing plate, about 2 in.

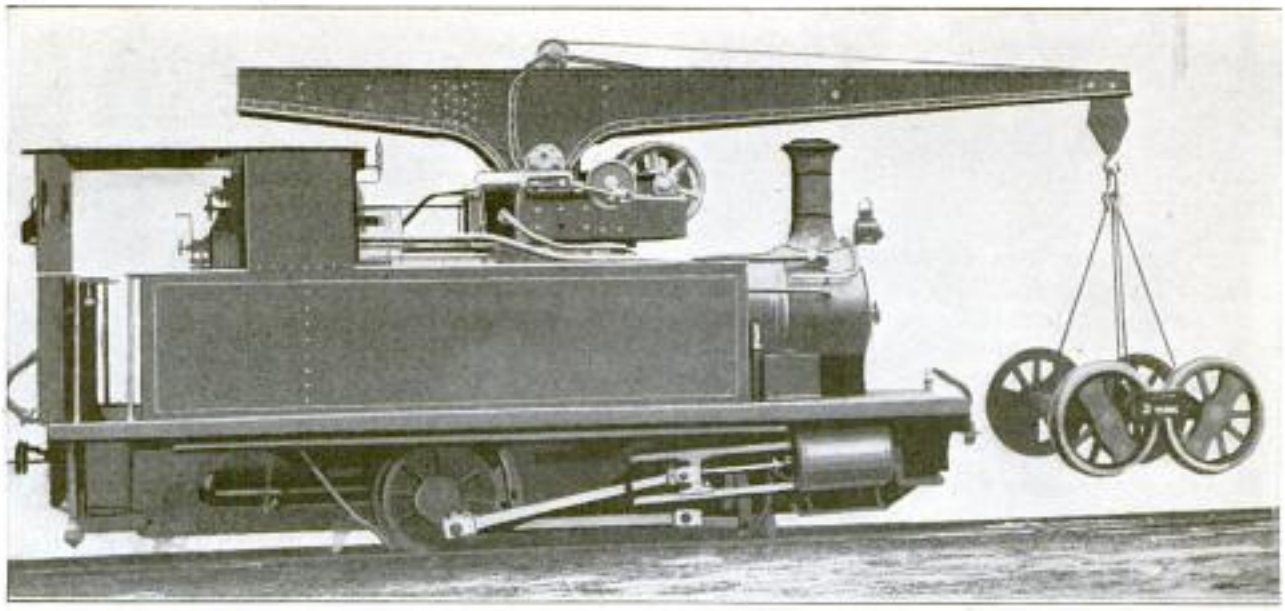
One Shoe Has a Highly Ornamental Securing Plate, the Other Has Only a Plain Bow. These are Also Shown Detached from the Shoes

long, wedge-shaped, and which has its two edges bent over to fit into the engaging hooks, and with toothed edges that match the ridges in them. This securing plate may be ornamented in any way to suit the wearer's taste. To fasten the shoe the securing plate is held with the thumb at the upper end, and the forefinger at the lower end, and is slid upward in the engaging plates. The higher it goes, the tighter the shoe. The reverse process, of course, unfastens the shoe.

AIRPLANE SQUADRONS SUCCOR EARTHQUAKE VICTIMS

The recent extensive earthquakes in Chile and Argentina afforded an opportunity for the airplane to shine in the rôle of angel of mercy on a large scale, to which airmen and machines responded nobly. Called upon by the Red Cross, several squadrons of fliers rendered invaluable assistance, transporting physicians, nurses, and food into the stricken area and, by rapid surveys, determining quickly where aid was most urgently needed. As all other means of communication had been cut off, the airmen performed in hours services which would have required days without their coöperation.

¶A large deposit of platinum has recently been discovered near Sulphur Rock, Ark., according to late reports. If these reports are true, Arkansas may become in increasing degree a producer of raw materials for the jewelry industry, as that state already has a diamond field of some consequence.



The Locomotive is Shown with the Jib Crane Carrying a Load, Which It can Swing to Any Position at a Radius of 16 Feet. One of Its Power Cylinders is Seen beside the Trunnion on Which the Crane is Pivoted

LOCOMOTIVE HAS JIB CRANE MOUNTED ON ITS BOILER

A narrow-gauge locomotive that is fitted with a jib crane, mounted on top of its boiler, is used by the Victoria Falls and Transvaal Power Co., South Africa. The crane revolves with a working radius of 16 ft. and lifts a load of two tons. It has its own power cylinders, and operates independently of the locomotive, excepting as regards its steam supply. The locomotive has side tanks nearly its full length, with a capacity of 600 gal., and outside cylinders driving its four-coupled 36½-in. drivewheels, with a base of only 6 ft. Its total weight is 35 tons.

LIFELONG HEALTH CONDITIONS NOTED IN ONE CERTIFICATE

A very comprehensive form of health certificate is proposed for use in Germany. If adopted, it would form a record of the health of each individual at any stage of life, and at death would furnish a complete history of that individual's whole physical life. This record would constitute a single health certificate, in which would be combined the certificates of birth, of vaccination, the health reports of school medical examiners, and in later life the reports of health-insurance societies, in which all Germans in industrial life are registered. The result would be of value, during the life of the individual, in furnishing any attending physician with a complete family history; and after death, these certificates would be collected in a central bureau, where they would furnish material for the study of heredity.

CHILDREN TAUGHT TO WRITE BY INDENTED METAL STRIPS

A new-method writing teacher, in the form of aluminum strips indented with alphabetical and numeral characters, promises to be very useful in conveying that knowledge to children. These strips clip to the edge of a tablet so that the indented characters aline with the tablet ruling. The child moves a pencil in the groove of a character until its shape becomes fixed in his mind, after which he transcribes it on the lines of the tablet, independent of the guide. Three of the strips are included in the set, representing capitals, small letters, and numerals, respectively. The method is similar to

The Metal Strips are Indented with Letters and Characters Which the Child Traces with a Pencil

that of the well-known Montessori system, in which a child traces sandpaper letters with his finger tips, until finally their forms become so familiar to him that writing develops as an instinct rather than an acquisition.

TRANSATLANTIC WIRELESS MESSAGES PRINTED BY SIMPLE RECORDER

By E. A. ECKHARDT

FOR several months past there has been in operation in one of the laboratories of the Bureau of Standards a radio recorder, an instrument which writes down radio messages. This in itself is not remarkable, since radio signals have been recorded in a variety of ways. If one visits the laboratory, however, and observes the apparatus, he is first impressed with its simplicity and smallness, and, secondly, somewhat startled when told that the fountain pen which is seen snapping back and forth is being operated by a man somewhere on the European continent. As a matter of fact this apparatus has recorded the transmission of Lyons, France, 3,800 miles away by air line, almost daily during a period of several months. The recording at such great distances is, therefore, not a freak achievement accomplished under exceptionally favorable circumstances, but is a process which is well controlled and which may be repeated indefinitely at will.

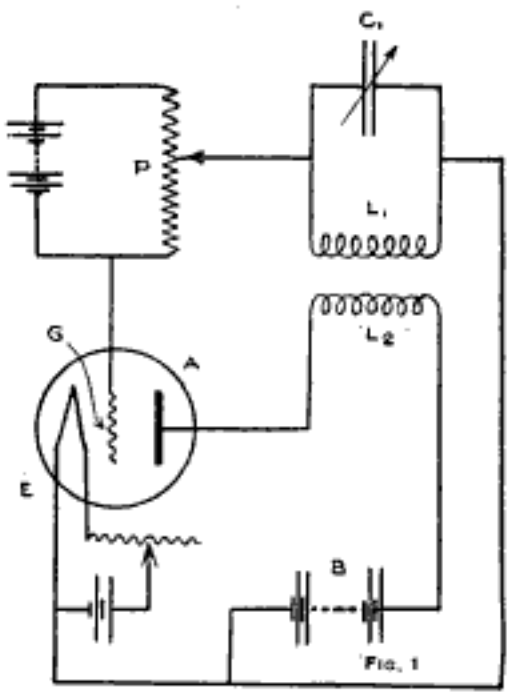


FIG. 1

Simplified Circuit Diagram of the Regenerative Apparatus: Very Faint Initial Currents in the Audion-Bulb Grid, G, and Plate, A, are Instantly Built Up to a Great Enough Strength to Operate a Relay

The apparatus was developed jointly by Dr. J. C. Karcher and the writer for the specific purpose of recording radio time signals. The recording of other radio signals was a natural consequence.

It is a matter of course that the form of the apparatus was largely determined by its proposed use, and many changes could be made with profit if it were proposed to use it at a radio-receiving station. The most interesting thing is the apparatus itself and the manner in which it works. Its first essential part is a regenerative electron-tube circuit, of which one form is shown in Fig. 1. Here, E is an electron tube, better known to some as an audion bulb; P is a potentiometer for adjusting the mean potential of the grid G to any desired value. The variable condenser C_1 and fixed inductance, L_1, constitute a tuned circuit in the grid circuit of the tube. In the plate circuit there is a fixed inductance, L_2, and a plate battery, B.

If the inductances are suitably coupled, a rise in the plate current will cause a rise in grid potential. This rise in grid potential will in turn result in a further rise in plate current, etc. In other words, the circuit is regenerative. If, for a suitably chosen filament temperature, we start with a sufficiently negative grid potential and gradually alter the same in the direction of more positive values, a critical grid potential will be reached at which the circuit becomes self-oscillatory, the frequency of the oscillations being determined in the main by the combination of L_1 and C_1. The starting of these oscillations is furthermore accompanied by a rise in the mean plate current. The amount of this rise is largely a matter of circuit design. In one circuit which

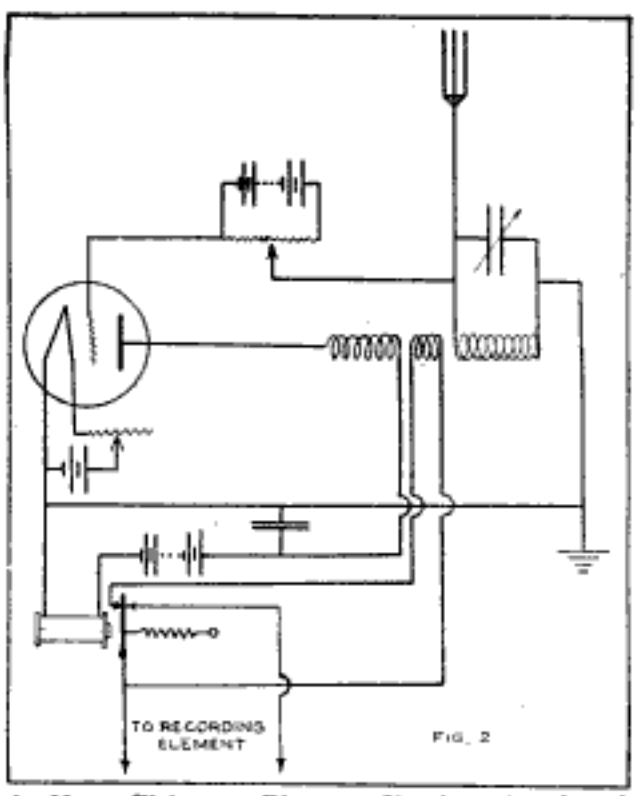


FIG. 2

A More Elaborate Diagram Showing the Actual Hook-Up and How the Relay Armature, by Short-Circuiting a Winding between the Regenerating Coils, Causes These to Become Inoperative

we have used, the current rises from a fraction of one milliampere to several milliamperes, and in another circuit, the rise was from an initial value of one or two milliamperes to a final value of 50 milliamperes. If, therefore, we insert the windings of a telegraph relay in the plate circuit of this regenerative system, the relay may be so adjusted that the starting of the self-oscillations in the regenerative circuit will cause the relay magnet to attract the relay armature. Conversely, the stopping of the oscillations will release the relay armature. If finally the circuit L_1C_1, properly tuned, is suitably related to a radio-receiving antenna and the mean grid potential is adjusted to a value just below the critical one, an incoming signal raises the grid potential momentarily above the critical value, the regenerative circuit becomes self-oscillatory, and the telegraph relay operates.

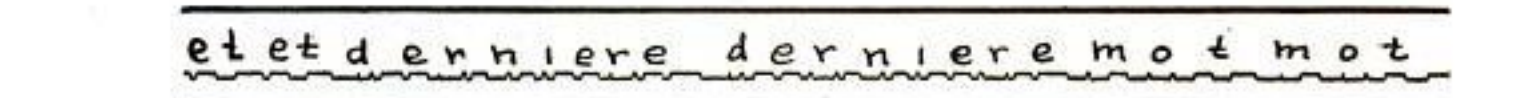
This is beautiful, for, of course, the telegraph relay can be made to operate any recording device. Unfortunately, however, when the radio signal stops, the regenerative circuit keeps on oscillating, and means must therefore be provided for restoring the circuit to the receptive state. This is accomplished by having two contacts on the relay, one of which is closed when the relay armature is released, the other contact being closed when it is attracted. The closing of the inner contact (armature attracted) short-circuits a low-resistance coil of a few turns placed between the two regenerative coils. The effect of this operation is to practically screen one of the regenerating coils from the other, and the self-oscillations stop. The opening of the screening coil does not involve any readjustments in the regenerative circuit, and hence there is no "kick-back." This fact makes it possible to work with a very narrow margin with reference to the critical potential.

The circuit diagram of a form of our receiver-recorder is shown in Fig. 2. In connection with the preceding description it will be easily understood. Any form of printing telegraph now used in wire telegraphy may be attached to the wires indicated as leading to the recorder.

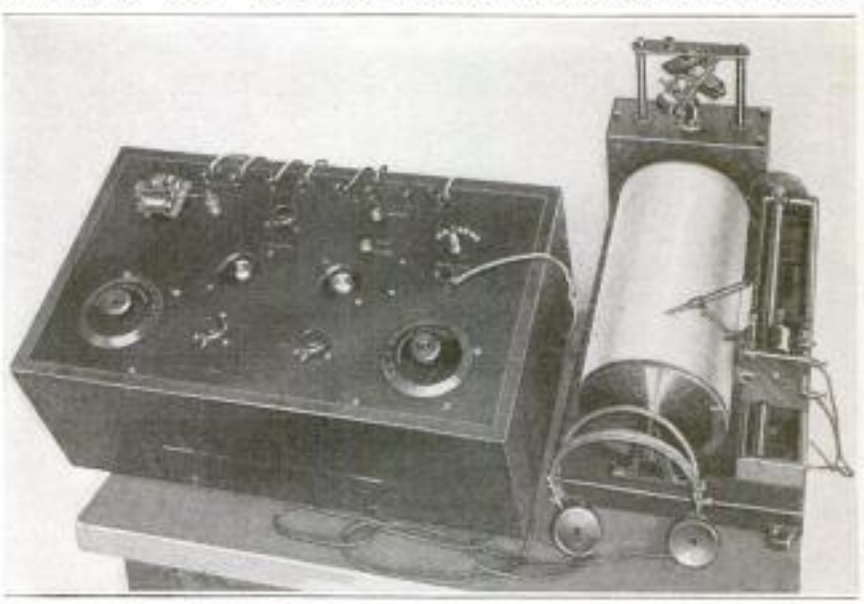
A similar recording system has recently been described. In this, the method of stopping the local oscillations involves readjustments in the regenerative circuit which necessarily prevent an indefinitely close approach to the critical point, for if the adjustment is too close, the surges or readjustments of potential, incident to the opening of the oscillation-destroying contact, will again start the oscillations, and spurious signals will be recorded.

The entire absence of kick-back, or readjustment in the regenerative circuit when the oscillation-killing contact opens, is the principal source of sensitivity and range of our apparatus. As far as we know, our recorder is the first to record mechanically, using but a single electron tube, messages from transatlantic stations.

Moreover the apparatus is portable. All of it can be packed on the back seat of a small touring car, and when connected to



A Message in the Continental Wireless Code as It Appears on the Revolving Cylinder of the Recorder: Each of the Words "Et Derniere Mot"—Meaning "And Last Word"—is Repeated to Avoid Errors. This Message, Received in Washington, District of Columbia, was Sent from Lyons, France. It should be Noted That the Pen Record is Here Shown Upside Down to Make the Translation Readable from Left to Right.



Attached to a Wireless Aerial, This Compact Recorder Writes the Messages on the Revolving Strip of Paper. Dots and Dashes Appear as High Points in an Otherwise Unbroken Line Traced by the Pen

an improvised antenna, can be operated there. It was devised for use as a field instrument, and such use is projected for the coming summer.

A brief account of the recording apparatus proper may be of some little interest. A sheet of paper, which is to receive the record, is wound about a cylinder which is rotated at a uniform rate by a clockwork, actuated like that of the grandfather clocks in the hallways of our homes, by falling weights.

When no signal is being received, the pen traces a straight line, which we shall call the "datum line." If we tune in on any transmitting station, the pen departs from the datum line when the signal begins and returns to it when the signal ends. Thus there are short and long humps in the datum line, corresponding to the dots and dashes which make up telegraphic signals.

A sample record is shown in one illustration. The recording apparatus used is a chronograph on which the paper advances past the pen, so as to make the record read from right to left. The record shows the words "et derniere mot" received from Lyons, France. Each word is repeated. The meaning of them is "and last word," which signifies, of course, that this is the last word in radio recording.

FOUR-HANDED TWIN-GRAND LAST WORD IN PIANOS

A twin-grand piano, the first of its kind ever constructed, was recently demonstrated at an orchestral concert, at Leipzig, Germany. This novel instrument is like two grand pianos placed end to end and inclosed in one frame, excepting that it has only one soundboard. Consequently, the keyboards are at opposite ends, and the players face one another. The soundboard is constructed so that there is no intermingling of sound waves, and it is said that, without watching the players, it is impossible to tell which side of the piano is being played.

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The New Twin-Grand is Shown being Played by the Well-Known Pianists, Leonore Erdman and Werner Eischorn, at a Recent Demonstration

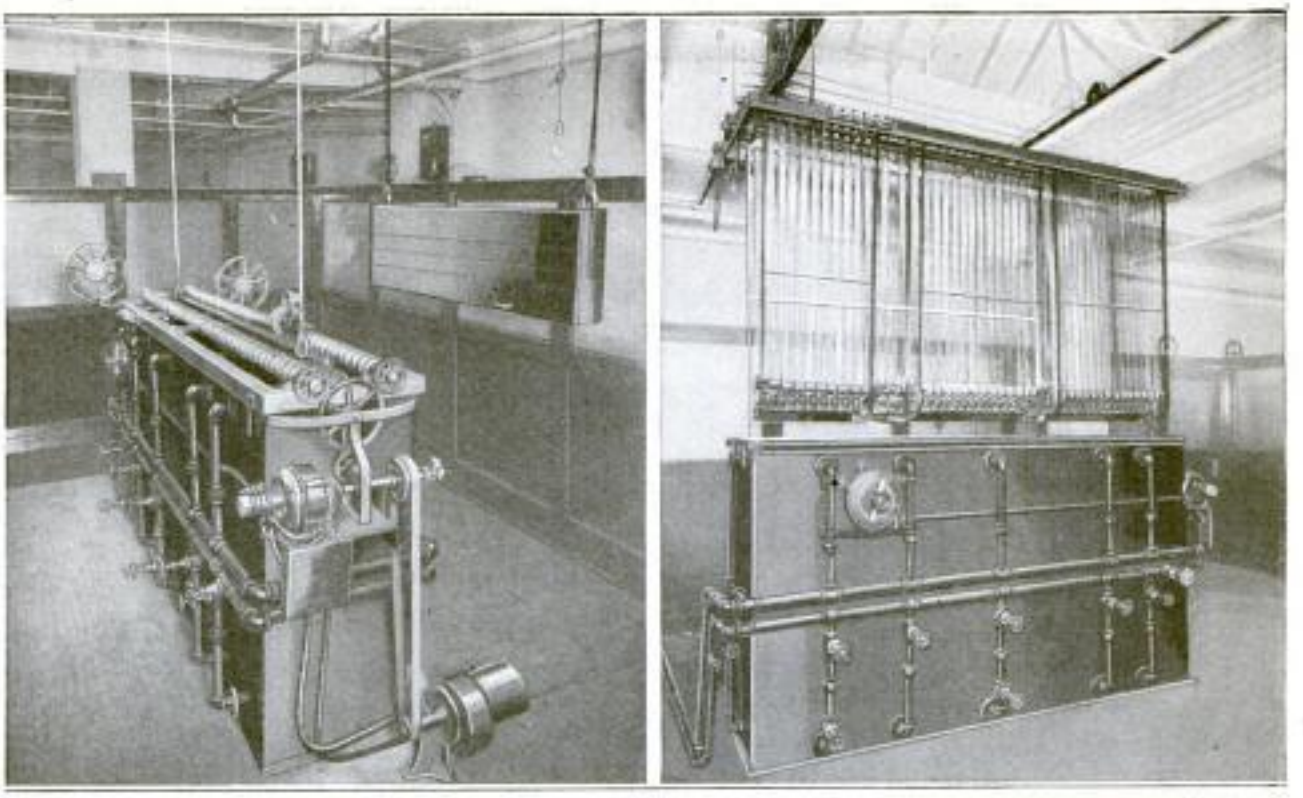
¶Smoking in public places and the sale of cigarettes are now barred in Utah. A bill signed by the governor on March 8, becomes effective 90 days thereafter.

BRITISH NAVAL MOTORBOAT HAS SPEED OF A RACER

A speed of 47.2 miles an hour in a racing motorboat would not be anything exceptional, but when such a speed is attained by a boat built for regular naval coastal service, it is, popularly expressed, "going some." The vessel was built for the British admiralty and attained this speed at the official trials. It is 70 ft. in length, and is fitted with two gasoline engines, each being, it is claimed, the largest yet used in any motorboat. They have 24 cylinders each that develop 800 hp. These engines are a development of a type of motor that was used largely during the war, notably in the Zeebrugge and Ostend raids, which, it is generally conceded, were the most spectacular naval events of the war. High speed was essential to success in these raids.

ELECTRIC FILM DEVELOPER THAT IS VERY COMPACT

A new machine that develops, fixes, washes, and dries photo films is designed to save space. It is in the form of a rectangular tank in which operate a series of rollers carrying the film. At one end of the tank is an electric motor which drives these rollers, and also a blower for forcing warm air from electric heaters into the drying compartment of the tank. The frame that carries the rollers can be



PHOTOS BY AMERICAN PHOTO SERVICE

At the Left, the Film Developer is Seen in Operation, Showing How Little Floor Space It Occupies. The Reels on Which the Film is Wound and Unwound, are Seen at the Far End. At the Right, the Frame Carrying the Film-Bearing Rollers is Shown Raised for Inspection of the Films

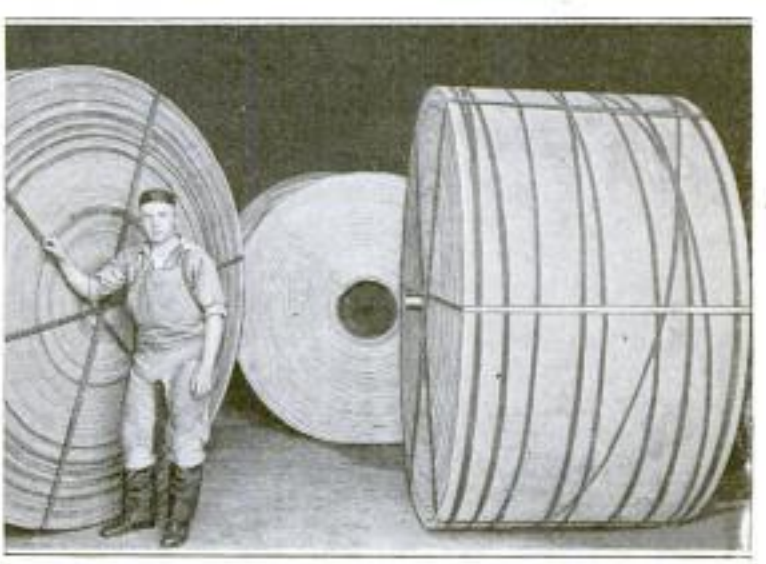
raised from the operating tank, so that all parts can be inspected, when it is desired to see that everything is in proper working order. The film passes slowly from one reel, through the four operations that take place inside the tank, and is wound onto another reel. It is then ready for the cutting room.

MAIL-BAG LABELS ON RIBBONS SAVE SPACE AND LABOR

A simple method of printing labels for mail bags, recently adopted by the Post Office Department, is saving much space used for storing the old labels, and the labor of keeping them in order. The new labels are printed on sheets carrying 25 lines of five names each. These sheets are cut across into ribbons, 15/16 in. wide, fitting easily into the metal holders on the bags. Each post office orders the names printed in the order the bags are hung on the racks, so that the ribbon may be slipped into the holder, and torn off, on one bag after another. If more than one bag is used for a single post office, the name is repeated on the ribbon. A superintendent in the Chicago, Ill., railway division has originated the idea.

IMMENSE CONVEYOR BELTS USED IN COAL FIELDS

Two recently manufactured gigantic belts, of fabric construction, are each over 1,000 ft. in length, 4 ft. in width, nearly 2 in. in thickness, and weigh nearly 14,000 lb. When rolled up each makes a roll over 10 ft. high. In point of all-round dimensions these are among the largest belts that have ever been manufactured. They were fabricated by one of the large rubber manufacturers and will be used as a conveyor in a Pennsylvania colliery.



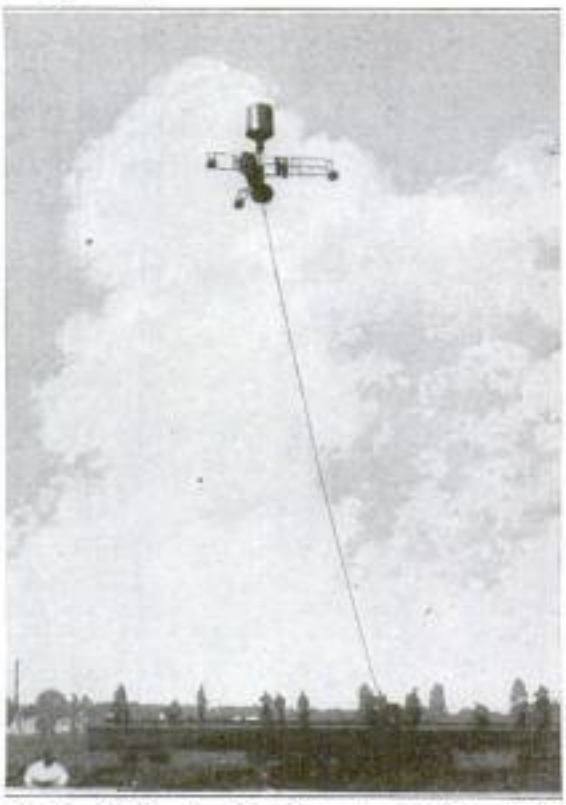
Each of the Rolls in the Foreground Is a Giant Fabric Belt, 1,000 Feet Long and 4 Feet Wide, Weighing Nearly Seven Tons

HELICOPTER HOVERS WITH FULL LOAD

New-Type Flier Makes Several Vertical Ascents Held Captive like an Observation Balloon

BY WM. H. HUNT

VERTICAL hovering flight, the ambition of every air-craft builder since the beginning of aerial navigation, is now an accomplished fact, an Austrian heavier-than-air machine of the helicopter type having made 15, or more, vertical ascents to heights of from 30 to 160 ft. These figures would have been exceeded but for the restraining cable which held the strange-looking apparatus captive.



Captive Helicopter Hovering at a Height of 160 Feet: Though the Wind was Blowing at About 18 Miles per Hour, the Machine Soared Steadily

Designed as a substitute for the captive observation balloon, the present machine is not intended for horizontal flight, but is so made that all the power of three 120-hp. engines is converted into a straight lifting force of 4,000 lb., about 11 lb. per horsepower, which is ample to raise its 2,900-lb. weight, plus that of a pilot, observer, gunner, and machine gun, at a rate of 4 ft. per second.

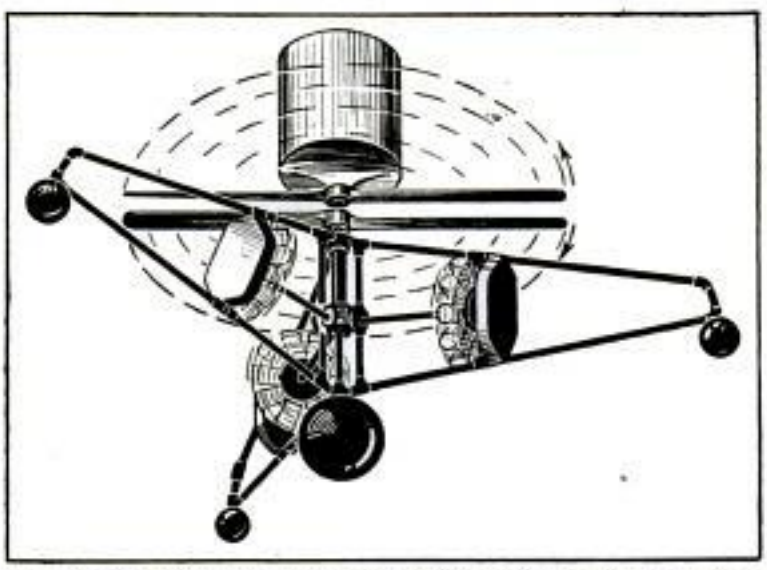
Two 20-ft. propellers, placed one above the other, revolving horizontally in opposite directions at a speed of 600 r.p.m. about a vertical shaft passing through their centers, are driven through a bevel-gear transmission and telescoping sleeve shafts.

The frame of the odd contrivance is made of steel tubing in the form of a tripod. At the outer end of each arm, and also at their common inner junction point, are strongly made air-tight bags, which are inflated to lessen landing shocks. Besides forming a stable base for the machine when at rest, the frame also carries the engines and the fuel tanks, one of each in each arm.

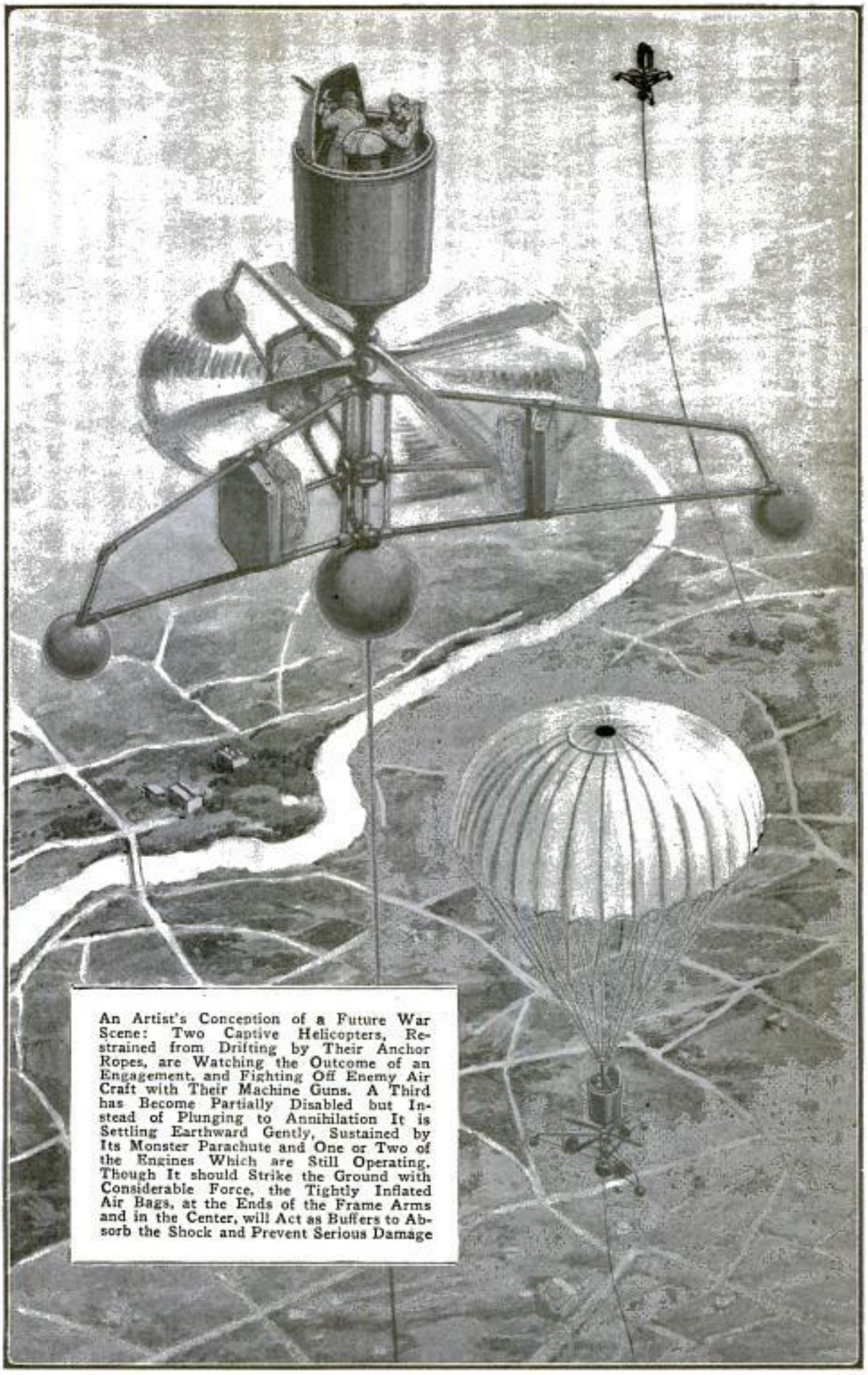
The passenger compartment, placed at the extreme top, immediately above the giant propellers, is made of plywood veneer for the sake of lightness.

An earlier model machine, of the same general design, was equipped with a 225-hp. electric motor, to which current was fed through the holding cable. It was not entirely successful for the reason that the motor, one of the lightest ever built, weighing only 430 lb., was unequal to the demand and was abandoned after having run only 15 minutes. However, this short trial demonstrated the practicability of the idea, as this machine rose to a low altitude with three passengers.

Safety of craft and passengers has been considered in the present model, and besides the individual pack parachutes carried by each person, a monster one having a surface of 2,690 ft., which is automatically ejected when the propeller speed falls below a certain figure, is permanently attached to the machine's center shaft. Should two engines fail, which is most unlikely, the remaining one, aided by the



This View Shows the Mounting of the Three 120-Horsepower Engines and Their Fuel Tanks, and Also How the 20-Foot Propellers are Driven in Opposite Directions



An Artist's Conception of a Future War Scene: Two Captive Helicopters, Restrained from Drifting by Their Anchor Ropes, are Watching the Outcome of an Engagement, and Fighting Off Enemy Air Craft with Their Machine Guns. A Third has Become Partially Disabled but Instead of Plunging to Annihilation It is Settling Earthward Gently, Sustained by Its Monster Parachute and One or Two of the Engines Which are Still Operating. Though It should Strike the Ground with Considerable Force, the Tightly Inflated Air Bags, at the Ends of the Frame Arms and in the Center, will Act as Buffers to Absorb the Shock and Prevent Serious Damage

huge parachute, will, it is thought, permit the heavy apparatus to drop gently to earth. As mentioned before, the present machine is designed for vertical ascents only and to be held from drifting by a cable, as are captive balloons. It is intended to take the place of these unwieldy apparatus and perform services for which they are ill adapted, such as ascents from the decks of ships and the support of wireless aerials.

Owing to its small size and consequent low visibility, it is expected that the helicopter will be far superior to the captive balloon for observation service in war time.

RAILWAY INSPECTION CAR BUILT LIKE BICYCLE

What might be described as a railway bicycle, were it not for the fact that it has four wheels, has been brought out by a

This Railway Motorcycle Has a 2½-Horsepower Engine, and Scurries Along at a Rate of 30 Miles an Hour. The Wire Wheels Make It Very Light and Easily Controlled

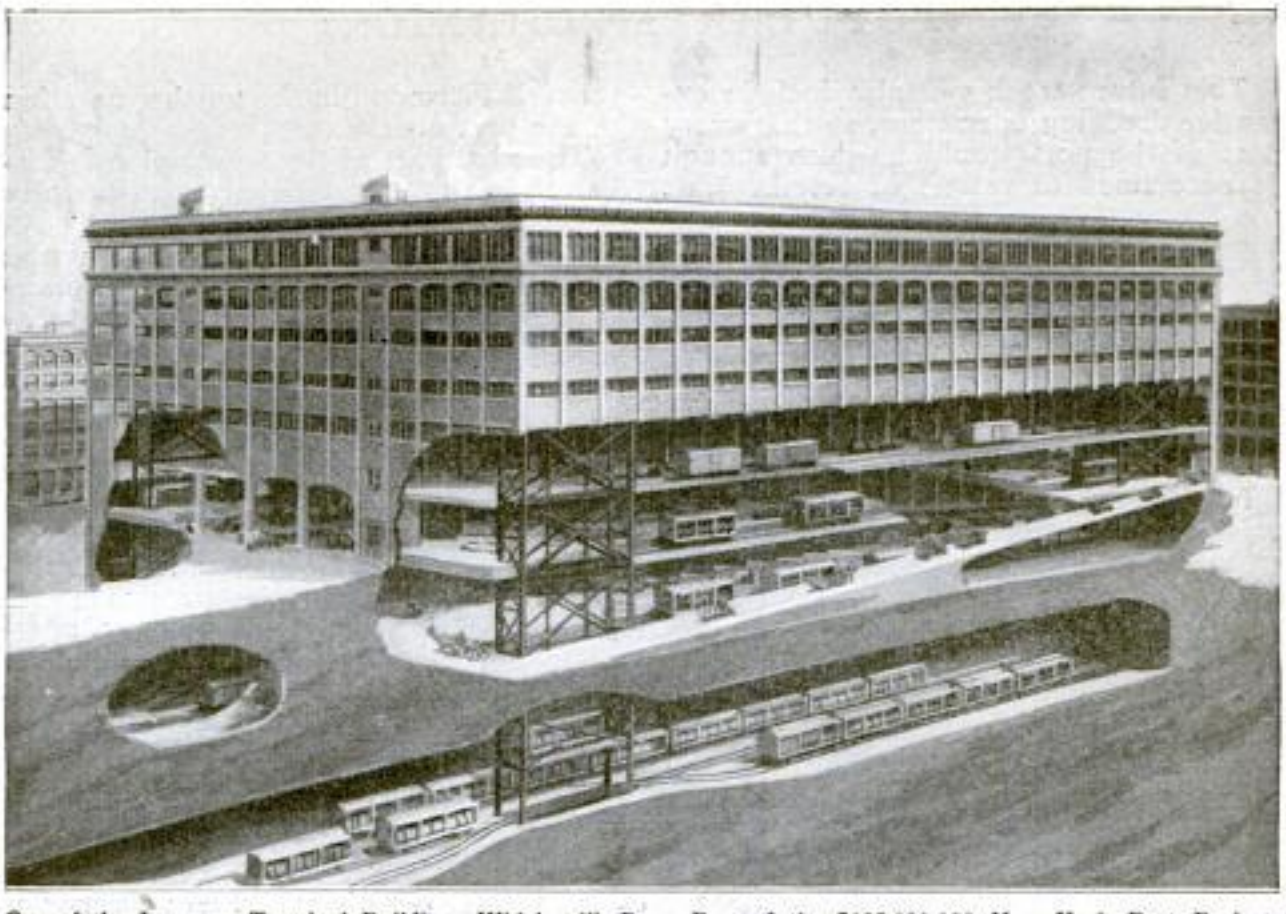
motorcycle manufacturer. It is of conventional motorcycle construction, in its principal features, even to the wheels, which are of the wire-spoke type instead of being solid cast-iron car wheels such as are usually used on devices of this kind. The light rims are flanged, of course, to fit the rails. Powered by a single-cylinder, air-cooled engine of 2½ hp., the little vehicle is said to be capable of a speed of 30 miles an hour. It is so light that one man can easily lift it to and from the track.

RUBBER-TIRED LOCO-TRACTOR SERVES AS LOCOMOTIVE

A novel narrow-gauge railway has been in experimental operation at Canada Junction, Johannesburg, for two years under the supervision of the South African Railway Administration. The rolling stock is the same as that used on other lines of the same kind, with the exception of the locomotive, called a loco-tractor, which combines some of the features of a standard locomotive with those of motor tractors, the latter predominating. The machines are really standard highway tractors and are used as such on occasion by making minor changes which require but a few moments. When used to haul the railway trains, the front wheels of the tractor are run onto a low truck having flanged wheels. The rubber-tired rear wheels, running on flat steel tracks, outside the rails, do the pulling. A 35-hp. engine drives the 4½-ton machine at speeds of 12 to 18 miles per hour up long grades and around 50-ft. curves without upsetting. After two years' service, the tires show wear of only ½ in., though having transmitted a tractive power of 5,985 lb. for practically the whole term of service. Being experimental, the road was built of secondhand and defective rails, weighing 16 lb. to the yard, and was simply laid on the ground without ballasting of any sort. Many of the curves are purposely short and banked on the wrong side, to make operating conditions as severe as possible.

POCKET HORSE-RACE TRACK RESEMBLING WATCH

A striking example of extreme compactness is a complete horse-race track, not exactly in a nutshell, but at least in a watchcase. It fits the watch pocket comfortably. It is stem-wound, and has 12 recesses around the outside of the dial, each of which contains a disk with a picture on it of a horse and a distinguishing number. Upon pressure of a lever, this dial spins rapidly, and carries the disks with it. The first horse that reaches the finishing post is the winner. After each race the disks are returned to their recesses, and the device is rewound.



One of the Immense Terminal Buildings Which will Be a Part of the $225,000,000 New York Port Project: Four Mammoth Elevators in Each Building will Lift Entire Cars of Merchandise from the Automatic-Electric System Tracks, Many Feet below the Deepest Present Subways, and Distribute Them to the Proper Floors

IMPORTANT NEW YORK PORT IMPROVEMENTS

By WILLIAM RESSMAN ANDREWS

THE sum of $225,000,000 will be expended on the development of the port and harbor of New York and New Jersey when the plans are carried through as worked out by a commission that has studied the question for several years with a view to prevent the loss of business to other ports on the Atlantic seaboard.

There will be no more congested water fronts; the cost of transportation will be lowered materially; and the needs of the 8,000,000 living within the "port district" created to facilitate the operations of this vast undertaking will be provided for on a scale of expeditious service and economy beyond the dreams of previous generations. The port district, which will be governed by a single "port authority," embraces a considerable area. Not only does it include all the boroughs of New York City, and the miles of suburban section on the New Jersey side of the Hudson River, but it practically reaches to Tarrytown, about 15 miles north of the city line, and on the east touches the Connecticut boundary.

The unusual scope of the plan includes in brief the following: Steam-locomotive belt lines along the water fronts of New York and New Jersey; a system of middle belt lines in those states; an outer belt line in New Jersey alone; an automatic-electric system in Manhattan (the old city of New York), with joint terminals where food products and general merchandise will be collected and distributed; the consolidation of marine operations connected with the 11 railroads which reach the shores of the port, with the exception of those not eliminated by the automatic-electric and extended rail service; a car-float service, and lighterage facilities.

A still greater development, not included in the initial cost but to be determined later, is expected to follow the completion of these plans. One of the improvements will be food-receiving stations and the creation of a system designed for the inspection and certification of foodstuffs received at the joint railroad yards. The building of terminal markets —badly needed by the outer districts of the city for years—near the stations of the automatic-electric system in Manhattan and the Bronx, would then be possible. More warehouse facilities and wider piers and slips would be part of this additional improvement.

This future work will also include extensive dredging operations, so that every part of the port would be deep enough to accommodate vessels of certain draft

Map of the Projected New York Port District: The Broad, Angular Outline Is the Boundary, and the Various Steam and Electric Belt Lines are Shown by the Deeper-Shaded and Black Lines. The Automatic-Electric-System Tunnels are Indicated by the Black Dotted Lines

likely to enter particular docks; a series of highways to give access to the important points of the water front; additional terminal stations for the New York Barge Canal; freight-handling machinery on a much greater scale than is in use at present; fuel-reserve stations for steamships, and better bunkering facilities; easier and quicker means of handling building material; a system of zone steamship terminals by trade routes, and the erection of grain elevators for the joint use of the New Jersey railroads and the New York Barge Canal, at a southern terminal station of the outer belt line, and at the town of Piermont, in the northern section of the port district.

The vital part of the whole plan is embraced in the automatic-electric system in Manhattan itself. All the rest is in a measure subordinate in importance and tributary to its operations. A great saving in terminal costs will be effected, and the rapid distribution of freight to the various parts of the city will be possible as in no other way.

In general, the automatic-electric will resemble a subway operated on the continuous-conveyor principle, broadly speaking, the moving-platform idea. In appearance it will seem like a railroad, but there the resemblance ceases, as it will be run like a conveyor. An absence of visible mechanism for holding the cars and trains together is a distinguishing feature; they will be kept in virtually fixed positions relative to each other by electric circuits. No motormen or brakemen will be necessary. A train dispatcher, with a few assistants, will shunt the cars back and forth by electric controlling devices. The elimination of train crews is of course going to bring about a large reduction in the operating expenses.

The automatic-electric has the advantage over any other system, experts say, for the expansion necessary to meet the needs of the growing boroughs. The line will run at great depth to avoid conflict with not only the present passenger subways, but whatever others may be built. The tunneling operations will be conducted so far underground as to do away with the necessity of propping up the walls of buildings along the route and buttressing their foundations, as was the case in the construction of the first subway.

In the automatic-electric development there are two stages: In the first, the New York Central Railroad, entering the

city on the west side of the Hudson from the north, will be linked up with the railroads on the New Jersey side of the river by a loop from a joint yard in New Jersey and a spur to the Sixtieth Street yard of the New York Central. By this means the tracks of the company in Tenth and Eleventh avenues, which have been a death trap to the people in that district and have likewise retarded its industrial growth, will be removed. Twelve union terminals in lower Manhattan will provide equal service for the railroads. The second part of the plan provides for freight coming into the city over the New York, New Haven, and Hartford, and the Long Island railroads. They will be brought into the system by another joint yard near Ward's and Randall's islands, in the East River.

At the terminals, served by eight-car electric trains, the cars will be lifted one at a time onto elevators which bring them to platforms near the surface for the discharge of their freight and for reloading.

POULTRY GUILLOTINE KILLS WITH SPEED AND PRECISION

The days of the unwieldy meat cleaver, or the dull-edged ax, for killing poultry are fast fading away as a new fowl decapitator becomes more popular. Poised vertically above a base about 10 in. long, is a spring-controlled striking hammer. The hammer has a flat, round striking surface on one end and a slanting, guillotinelike knife on the other. The head of the fowl is placed in the holder set in the base, and by a smart downward blow on the hammer end, it is cut off.

PHOTO BY CENTRAL NEWS

GIGANTIC TRIPLE TRIPLANE IS WRECKED DURING TRIALS

ALL that is left of the giant Caproni triple triplane is shown in the above photograph, taken shortly after the 100-passenger flier had been strewn along the shores of Lake Maggiore, Italy, a mass of tangled wreckage. Reports of the disaster vary, some stating that the immense craft plunged to destruction from a height of 60 ft. during trials, as a result of structural defects, while others state that an unexpected hurricane was responsible for the untimely annihilation of the 25-ton miracle, built especially for over-sea flights. A still later rumor says that the wreckage was consumed by fire.

SACK CAMOUFLAGE USED TO PRODUCE BIRD FILM

It is a hard matter to procure good films of birds, and especially is the work complicated when the camera man has to climb the trees to their nests, hide behind blinds, and subject himself to other similar inconveniences. In photographing the actions of a group of kestrels, nested high in a tree in England, one man was obliged to build a screen behind which to hide while at work. The blind consisted of old sacks draped over an improvised bough seat and the camera, which was screwed to a projection from the tree. Two outlook holes were cut in the drapery for the camera lens and for the operator. It was necessary to build the blind piece by piece and very quietly, for the kestrel is wary and easily frightened. Three months were required to complete the construction. By the exercise of extreme caution throughout all the photographic operations, many interesting pictures were made. The kestrel is a small bird belonging to the falcon group.

Filming English Kestrels from a Blind of Sacking and Tree Boughs: Three Months of Quiet, Piece-by-Piece Assembly were Required to Make the Curious Camouflage

JOHANNESBURG MINE SHAFT 7,000 FEET DEEP

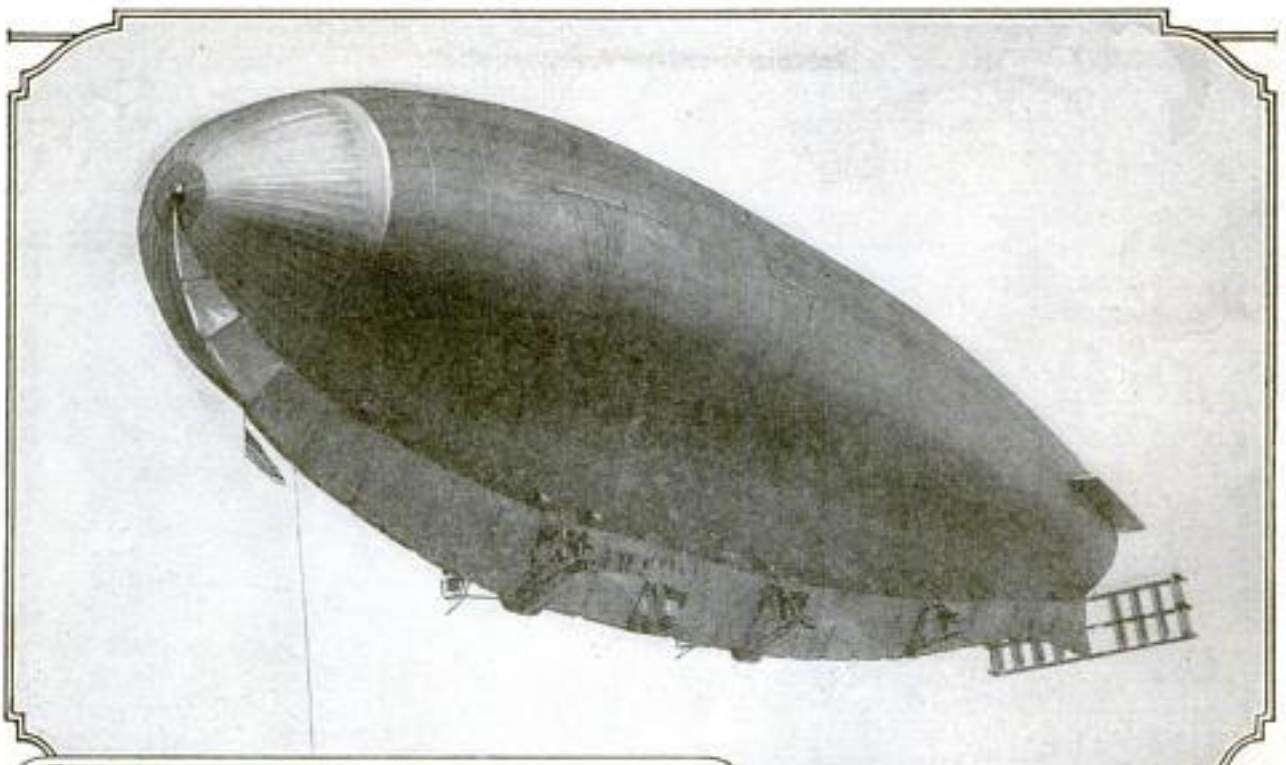
Deep mining on the Rand, the great gold reef neighboring Johannesburg, South Africa, has been in practice for many years. At the City Deep Mine there were two shafts, 3,300 ft. and 4,000 ft. deep, respectively, but to exploit the mine thoroughly it was found that a much greater depth would be needed, and, therefore, it has been decided to sink a shaft of circular section to a depth of 7,000 ft. The shaft will have a diameter of 20 ft., and will be fitted all the way down, at 10-ft. intervals, with concrete rings, each 18 in. deep by 15 in. wide, to provide fastenings for the necessary guides, pipes, and cables, and also for any lining that may be needed in the future. The capacity will be 2,000 tons of ore per 24-hour day; and the cage operating in it will be 5 ft. 3 in. by 15 ft. 6 in., with two decks, and will be made entirely of steel. There is already in operation at the mine a double-inlet sirocco fan, 12 ft. 10 in. in diameter, with a capacity of 420,000 cu. ft. a minute, and it is thought that this will be able to care for the new workings of the mine, as well as the old, for some time to come.

RADIO MEDICAL ADVICE FOR SEAMEN

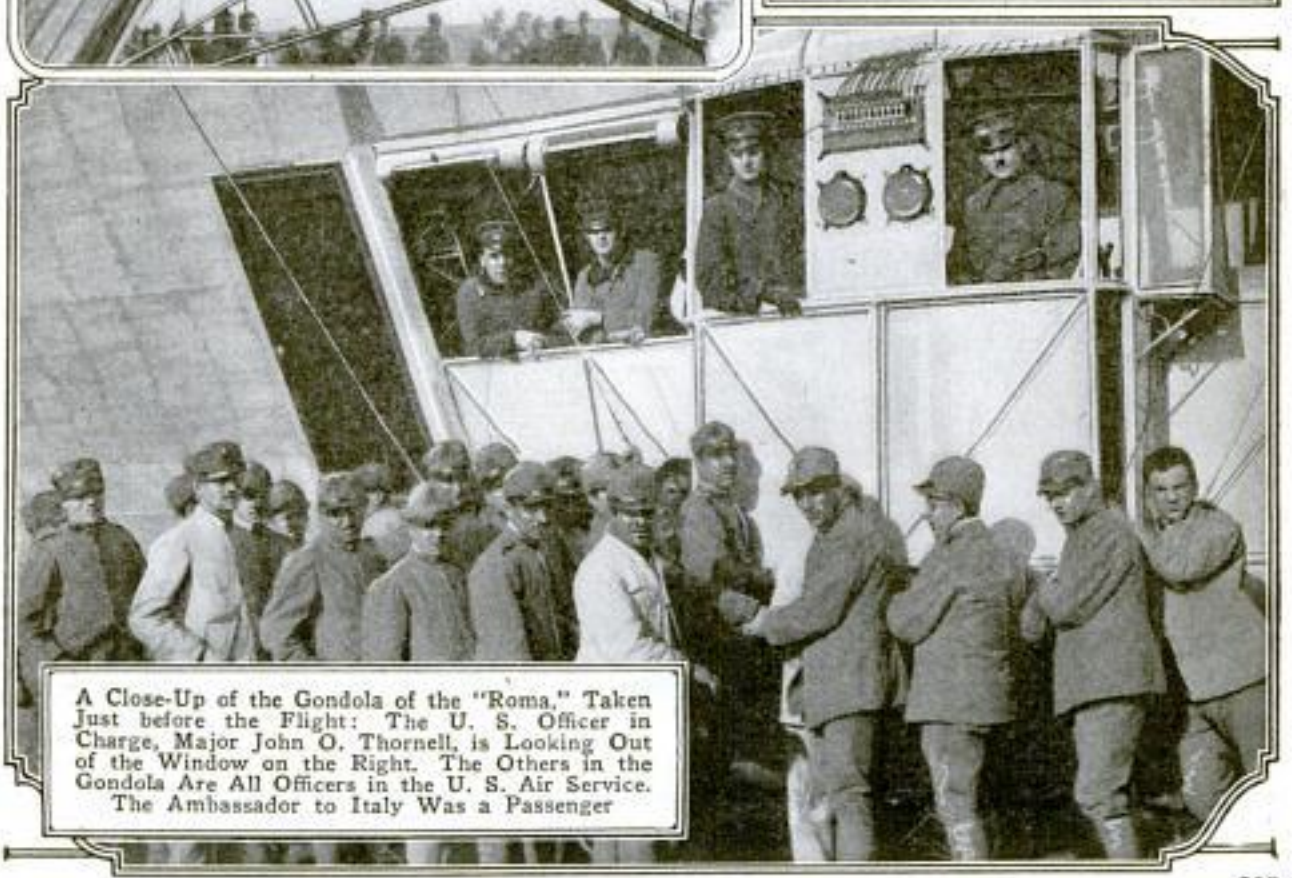
It is estimated that 75 per cent of the vessels in the merchant marines of all nationalities, do not carry an attendant physician. Many times the right word of medical advice at the right time would prevent serious consequences, and to give this advice, the medical director of the Seamen's Church Institute, New York, is at the service of the sick seamen by wireless. His signal is KDKF, and when emergencies aboard demand expert advice, this signal will effect connection with him. Vessels out of the institute radius can reach him by relaying.

¶An improved method of shaping and treating the parts of bent-wood furniture, invented by an Italian craftsman and now in use in both Italy and Czecho-Slovakia, produces 25 pieces at a time, it is claimed, from the raw stock to the finished part, in two hours.

ITALIAN-BUILT AIRSHIP DELIVERED TO U. S. CREW



The Great Italian Dirigible "Roma," Which was Purchased Recently by the U. S. Government, is Seen, Above, in Its First Flight from Rome to Naples and Return, in Charge of American Air-Service Officers. The "Roma" Is the Second Largest Semirigid Airship in the World, Measuring 410 Feet in Length, with a Cruising Range of 3,300 Miles. On the Left, One of the Engines is Seen, with an American Officer Examining the Supporting Frame



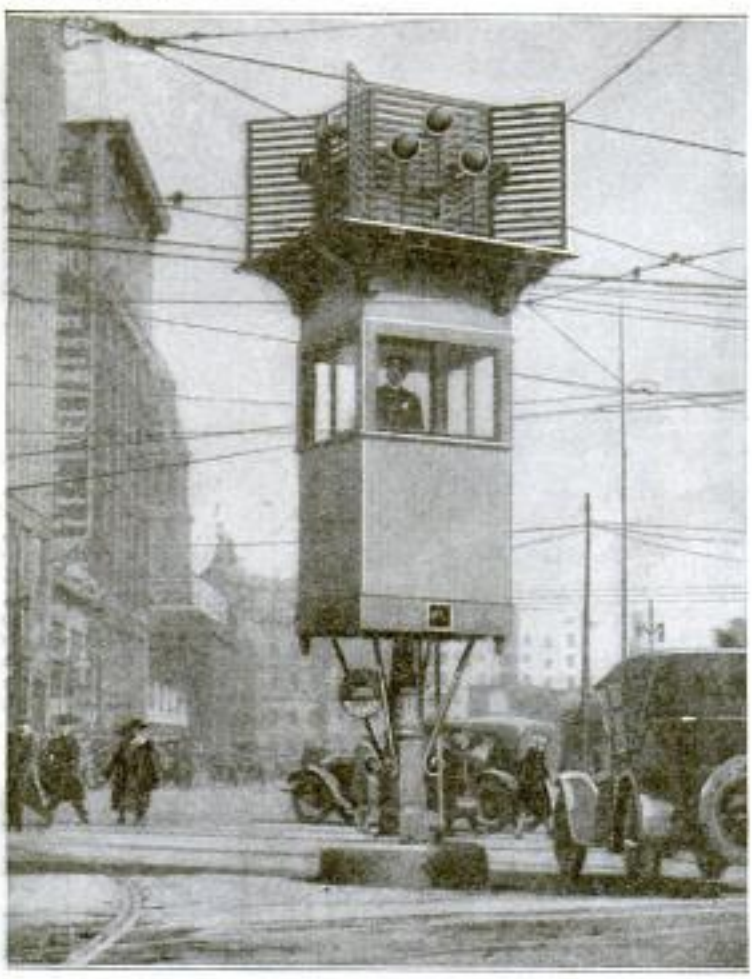
A Close-Up of the Gondola of the "Roma," Taken Just before the Flight: The U. S. Officer in Charge, Major John O. Thornell, is Looking Out of the Window on the Right. The Others in the Gondola Are All Officers in the U. S. Air Service. The Ambassador to Italy Was a Passenger

DETROIT'S NEW TRAFFIC-CONTROL SYSTEM

By C. E. PLANCK

DOWN-TOWN traffic in Detroit is efficiently and ingeniously controlled by a system designed and installed by members of the city police department.

The apparatus consists of two "master" towers; two smaller towers, called "crow's nests," and small standards operated by patrolmen standing on the street level. In the two master towers, which are inclosed to protect the traffic officers in inclement weather, are a series of switches which operate red, green, and yellow lights, one of each being mounted on the four sides of the tower. While the green light burns on the east and west sides of the tower, traffic in those directions may proceed. A few seconds before the traffic direction is changed, yellow lights are flashed on, and the green ones darkened, warning motorists, street cars, and pedestrians that the change is about to take place. These lights are visible to traffic men on all the 20 corners in view of the tower, and to those on intersecting streets one block from Woodward Avenue, and they change the signals on their standards accordingly. After the yellow lights are extinguished, the red lights appear on the east and west sides of the tower, and the green ones are lighted on the north and south sides, permitting movement of traffic up and down Woodward Avenue, and on the parallel streets one block distant. Where the avenue makes a slight turn, at Adams Avenue, a second master tower has been erected, which is governed by the signals flashed from the first-mentioned one. At each street intersection on Woodward Avenue, bells have been installed connected with the apparatus that controls the yellow lights on the master tower. While the yellow light is visible, the bells ring. At a few corners, where the use of the standard and patrolman is impracticable, small miniature towers have been suspended above the intersections. On each of its four sides, are a yellow, green, and red light, and these automatically flash on and off as the operator in the master tower controls his switches.



From This "Master" Tower the Traffic Officer Signals All Other Crossing Guardians within a Radius of 10 Blocks and Thus Directs All Traffic in the Down-Town Section of Detroit, Michigan

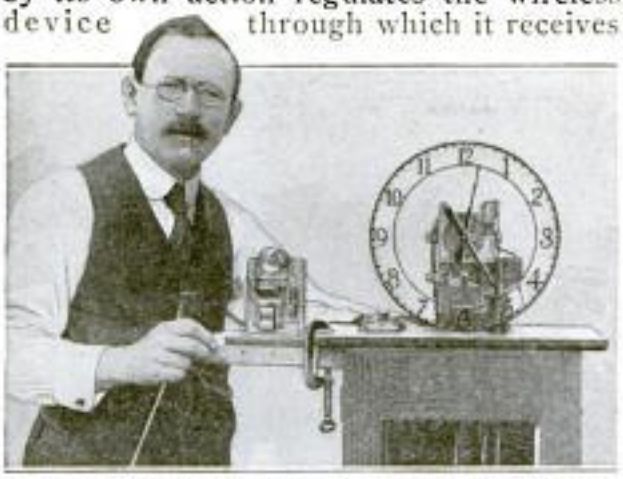
The master towers, like the crow's nests, are erected on heavy concrete bases. The latticework is of steel bars, arranged to form a background for the lights, making them more clearly visible to distant observers.

The chief advantage of the system, according to Inspector Harry Jackson of the traffic division, is that it quickens the movement of traffic in all the down-town sections, and prevents the tie-ups that always occur when the traffic patrolmen are acting individually on their several corners. When the green lights signal "Go" to the Woodward Avenue traffic, for instance, a straight-away of, perhaps, 10 blocks is opened to the motorist. He need not decrease his speed to any appreciable extent at intersections, because pedestrians are warned that he has the right of way, and he is, himself, warned by the yellow signal in plenty of time to stop at the proper intersection. The plans of Inspector Jackson contemplate the final removal of the individually operated standards, permitting the traffic men to devote their entire time to the pedestrians, and have the motorist

governed solely by the signs. A new type of tower, to be erected above the grade entrance to the approach to Belle Isle, Detroit's municipal park, will be of a more ornamental design than those pictured, but the operating system will be the same.

CLOCK ADJUSTMENTS NOW MADE BY WIRELESS IMPULSES

Wireless impulses sent from the Washington Observatory station are now correcting the time of a self-winding electric clock at a point in New Jersey. This clock is equipped with a sensitive radio selecting, receiving, and relaying apparatus, by means of which it takes the impulse from the air and is adjusted thereby. At one minute of twelve, noon, the clock automatically closes a switch by which the radio apparatus is thrown into operation. It is tuned to receive only that time signal which is sent out at noon by the observatory. After the clock has been set by a message, the same switch is automatically opened. In the event that no message is received, the switch opens anyway at 30 seconds after twelve and will not close again until the following day at one minute before noon. Thus the clock by its own action regulates the wireless device through which it receives

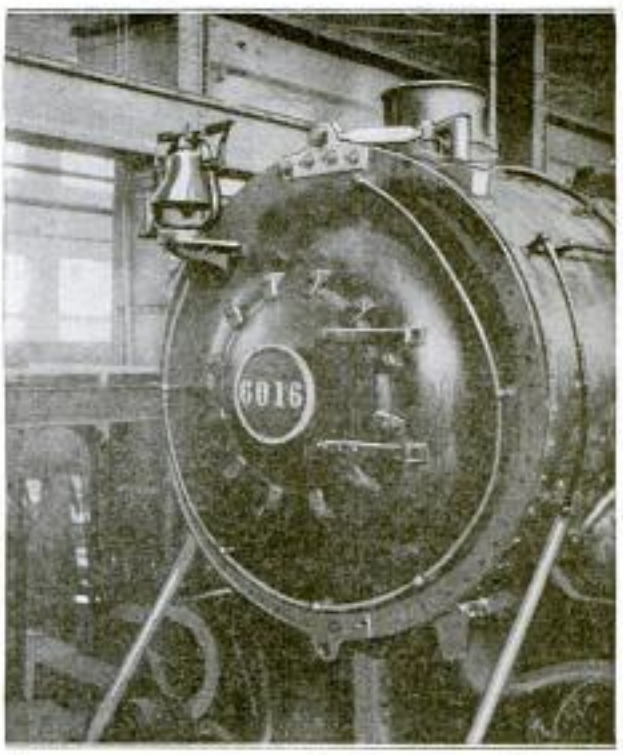


This Clock in New Jersey is Corrected by Wireless Impulses from Washington. It Automatically Opens and Closes Its Radio-Control Switch

correction. Plans are now being laid whereby the timepiece will be used as a master clock to regulate other clocks elsewhere in the country.

SMOKEBOX-DOOR-RING HINGE DISPLACES TACKLE

To eliminate time loss and danger in the removal of smokebox-door rings for cleaning out dirt accumulations from the boiler flues of a locomotive, a suitable hinge has been produced. This hinge consists of a forged bracket that is bolted to the end of the boiler shell. Connected to this bracket is a rod, jointed to permit it to swing from side to side. The rod is



After the Bolts of the Smokebox-Door Ring are Removed, It may be Swung Clear of the Box on the Hinge Fastened to Its Upper Edge

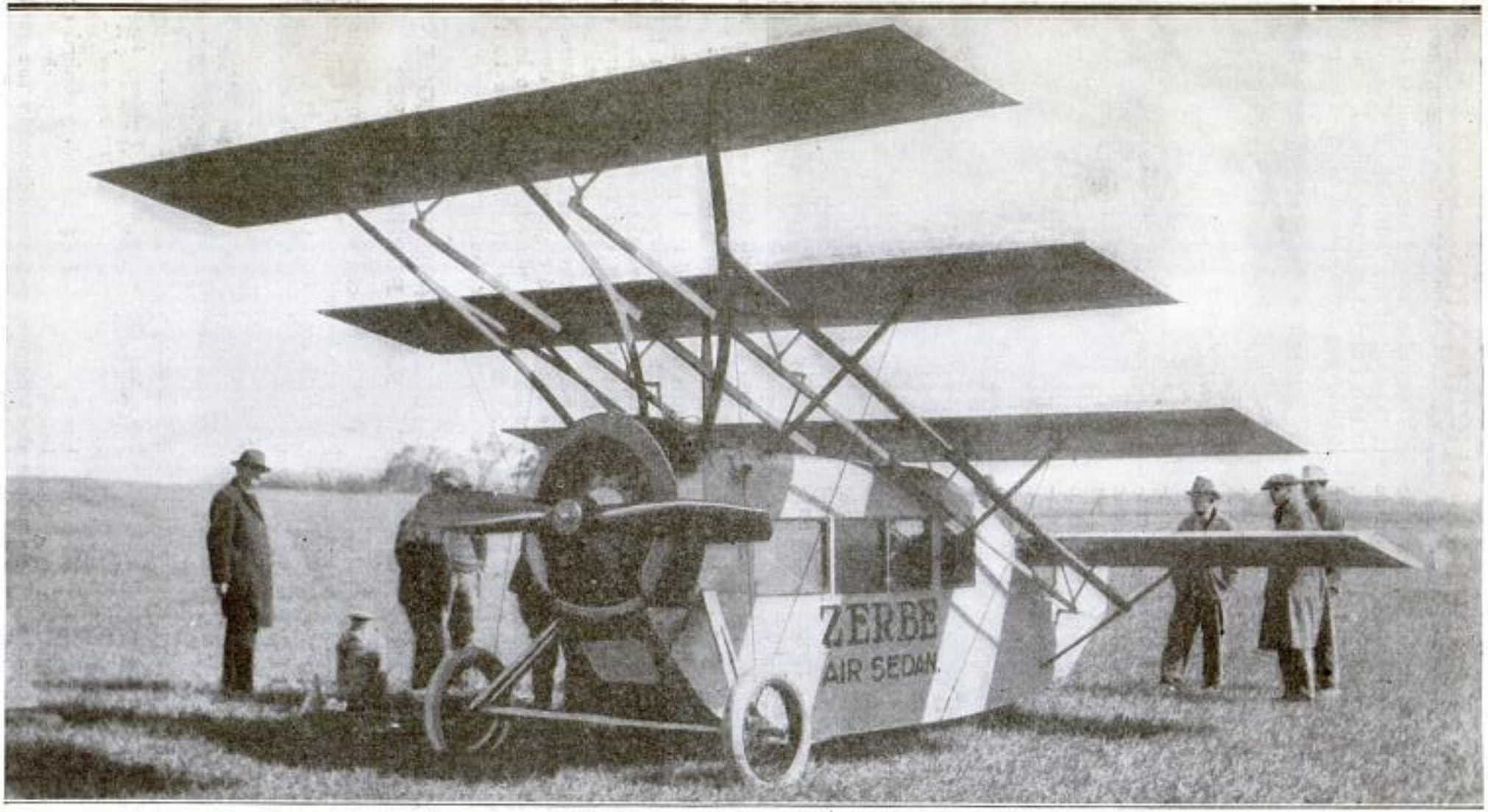
in turn connected to a plate bolted to the top part of the ring. Thus, when it is desired to remove the ring, its bolts are taken out, and it can then be swung on the hinge clear of the smokebox without the aid of overhead tackle. Because of this facility, the cleaning can be done at any convenient place, and it is no longer necessary to take the locomotive to the roundhouse for the purpose.

GRILL SAFEGUARDS COOK FROM BURNT FINGERS

A grill that can do its cooking without having to be touched by the hand will save the cook from burnt fingers. It is raised or lowered with a detachable cranklike

Left: The Grill in Its Normal Position. Right: Raised, Obviating the Necessity of Removing It from the Oven to Change Its Position

handle, so that the food being cooked or baked can be evenly browned to the desired degree, without removing the grill to change its position.



TANDEM-PLANE AERIAL SEDAN MAY REVOLUTIONIZE FLYING

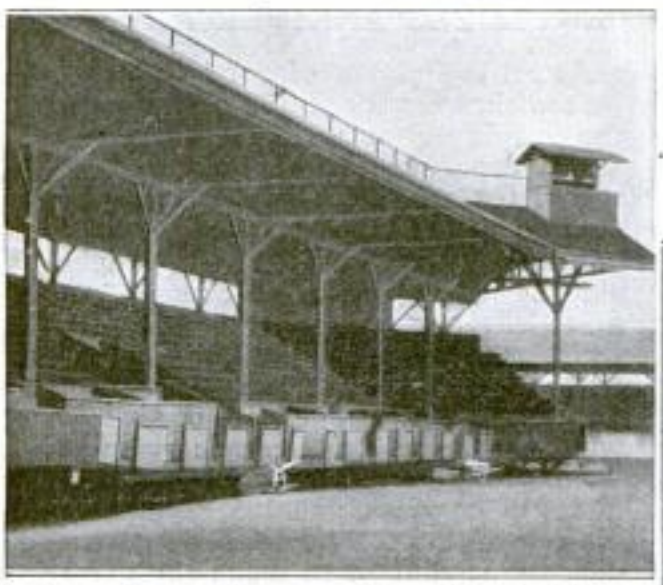
ABOVE is pictured what the inventor and builder, who passed away before it was ready for flight, called an "aerial sedan," and which he firmly believed would revolutionize future air-craft design as, according to his claims, it is noncapsizable and, in the event of a failure in mid-air, will drift easily and gently to earth. Working alone, quietly and almost secretly, he assembled the machine in his shop in the city of Fayetteville, Ark. Within a few days a veteran pilot, who shares the builder's beliefs, will make trial flights and announce to the world whether or not safe flying is to become possible for all. Rumor has it that two leaders in the automotive industry, one a prominent manufacturer of a popular low-priced automobile, have offered to finance the manufacture of the new machine on a quantity-production basis.

MOVING A BASEBALL PARK TWO HUNDRED FEET

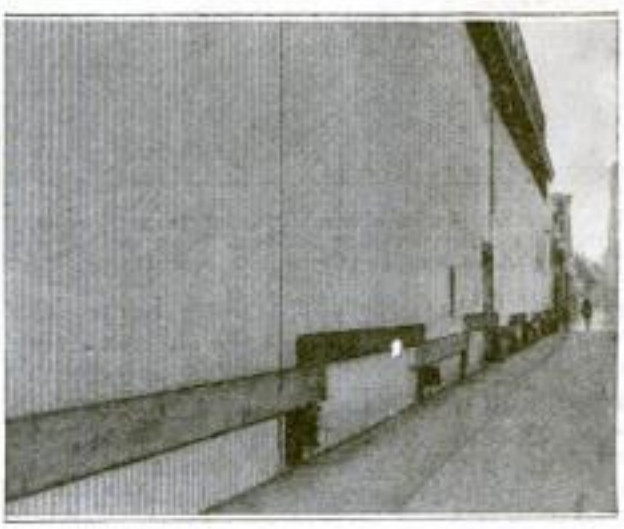
Proprietors of a Los Angeles baseball park were recently notified that a street, to be opened by the city, would pass through a portion of their grounds. Rather than move the ball park from its well-advertised location, the owners acquired a strip of land adjoining the old site, and planned to move the grounds some 200 feet east, so that most of the existing park could still be used.

At first it was planned to tear down the grandstand and other features of the old park and build new ones. However, a local house mover offered to undertake to shift the huge stands, and was given the job. The grandstand and bleachers were cut into 100-ft. sections, and heavy timbers were then run around the base and bolted together, forming a connecting support. The stands were then jacked up and moved to the new location in the same manner as a house.

Another contractor was found who undertook to move the grass infield of the grounds. Consequently the new season found the entire ball park practically the same as it was last year, although situated about 200 feet farther east.



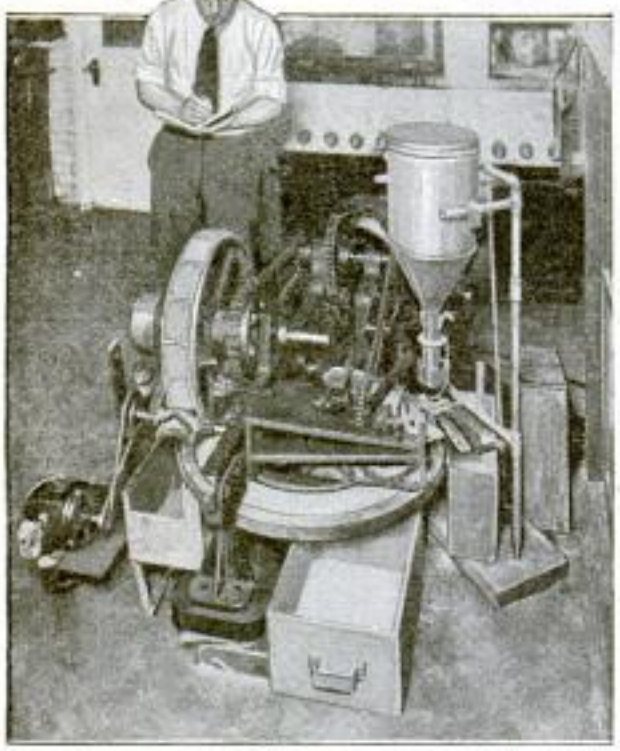
In Moving the Los Angeles Ball Park, the Grandstand and Bleachers were Shifted in Sections to Foundations Previously Prepared. The View Above Shows the Main Grandstand Section on Its Way to the New Location, 200 Feet Away. The Picture on the Left Shows One Section as It Appeared When Placed on Jacks for Moving. In the Background Are the Remaining Sections. The Method of Reinforcing the Sections with Heavy Timbers is Shown in the Picture Below



Moving the Grassy Infield: The Sod was Cut into Strips of Equal Width and Thickness and Transferred to the New Site; the Park Was Then Complete in the New Place

LEATHER TAKES TEST WALK TO REVEAL QUALITY

Leather samples are made to walk with the average weight and motion that the shoe sole of the wearer is subjected to in a machine used by the Bureau of Chemistry for testing them. The machine is equipped with a revolving wheel on which the samples are rigidly fixed, and a rotating disk, carrying a definite amount of sand to represent hard walking surfaces, makes contact with it. The wheel is pressed to the disk with 135-lb. pressure, and the operation of the two parts is so varied as to permit a rubbing action on the leather. The sand is replaced every 15 minutes, and the machine is equipped with a funnel feeding the right amount. Brushes are arranged for cleaning off old sand from the track. A 1½-hp. motor is used to drive the unit, and 12 samples are tested at each setting.



The Leather Samples are Fastened to a Revolving Drum on the Tester Which Subjects Them to Ordinary Walking Abrasions by Contact with a Sanded Disk

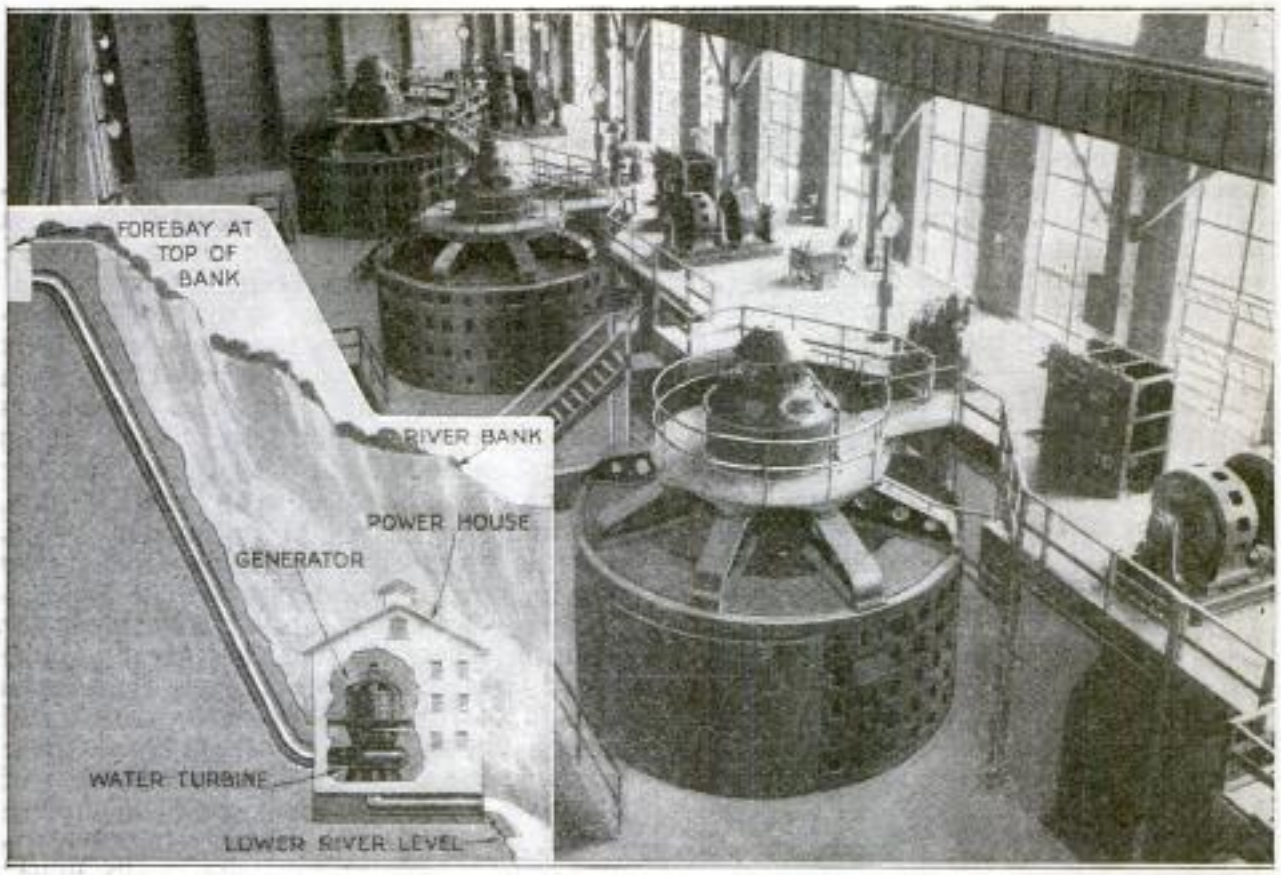
ARMY MINE-PLANTER SERVICE DOES INTERESTING WORK

The U. S. Army Mine Planter Service is a new organization that is doing a great deal of highly important work in the development of coast defense, in conjunction with the coast-artillery forces. It has in its service now 20 mine-planting vessels, with a cruising range of 1,500 to 2,000 miles, and covering approximately 6,000 miles of coastal waters against possible invasion. These vessels are 172 ft. in length, with a beam of 48 ft., and a draft of about 12 ft. Their speed ranges from 14 to 17 miles, with an oil consumption of 200 gal. per hour at full speed. Their duty is to plant electrically controlled mines, and to lay cables for military and commercial purposes. The crews' quarters are very comfortable, and this, combined with a good library and music, makes life on board very pleasant. The mine planters, stationed at New York City, are looking for efficient men in this service, which affords good pay, and rapid promotion for apt recruits.

SILVER REPLICA OF STORE IS EMPLOYES' ANNIVERSARY GIFT

As an expression of good will and the best wishes for the future of the concern, the employes of a large Los Angeles, Calif., department store presented to the proprietor an exquisite miniature reproduction of the building, true to the most minute details, beautifully wrought in sterling silver, on the occasion of the firm's silver jubilee. The gemlike replica contains 620 oz. of the precious metal, finely carved, molded, and hammered into thousands of small, delicate parts, such as window frames, fire-escape ladders, a wonderfully carved fountain, six different styles of cornices, and 105 capitals in the top one of these. Fourteen specially made dies were required to make the parts for the 152 windows alone, and also many other special tools for other delicate, intricate parts. Working to a scale of 3/32 in. to the foot, a group of silversmiths devoted seven weeks to the task. The back of the model pictures the company's growth.

This Exquisite 3/32-Scale Model of a Los Angeles Department Store Is 22 5/8 Inches Long, 15 3/32 Inches Wide, and 13 1/16 Inches High



The Three Latest Generators Installed at Niagara Falls Exceed by Three Times **the Current Output of Units Previously Built. A 15½-Foot** Column of Water, Dropping 210 Feet, is **Required to Whirl the New Turbine Rotors. Insert:** Driving-Water Course and Turbine Arrangement. **Below: A Close-Up of One of the Generator** and Turbine **Units**

MORE POWER FROM NIAGARA

ANOTHER great power project has been successfully carried out at Niagara. About 15 years ago, generators and water wheels capable of developing 13,000 hp. per unit were installed. At that time these units represented the limit of engineering skill. They were the largest producers of power in the world.

Recently three power units were installed which are capable of developing 37,500 hp. each. This is nearly three times the amount of power developed by the older units.

The end of high-power development is not in sight. Units of 55,000 hp. have been designed and are now under construction, which will be installed shortly on the Canadian side of the river. It is hard to realize the terrific force necessary to whirl these Herculean current producers.

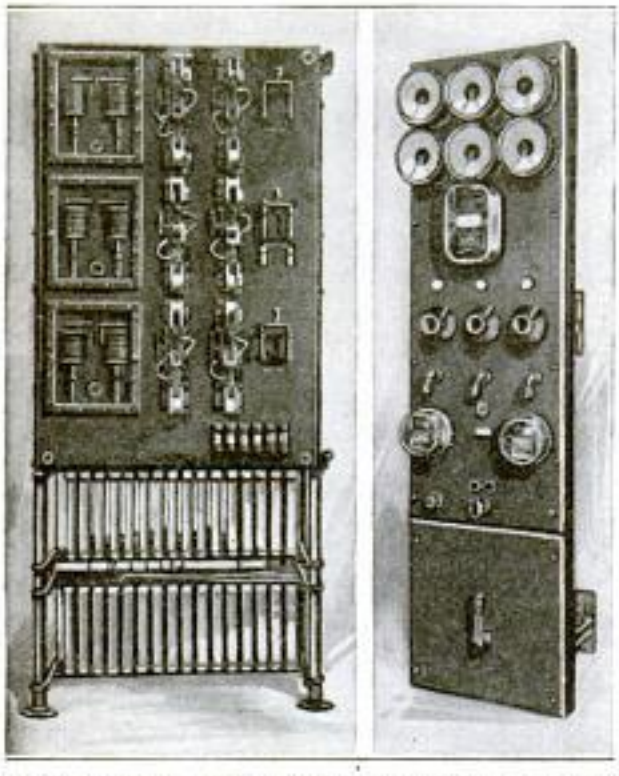
In the case of the 37,500-hp. generators on the American side of the river, a solid column of water 15½ ft. in diameter drops over a bank 210 feet high and rushes into the turbine below. The rotor of the turbine is mounted concentrically within a doughnut-shaped steel casing. The water, traveling over three miles a minute, strikes the rotor at a tangent and whirls it around, dropping out at the center into the discharging basin. The turbine is mounted horizontally, and a vertical shaft connects the rotor of

the turbine with the enormous generator a few feet above. Specially designed thrust bearings are used to take up the terrific weight of the moving parts.

In the great 15½-ft. penstock which carries the water to the turbine, there is located a hydrostatically controlled valve. By the use of this valve the water can be cut off with very little trouble.

ELECTRIC-FURNACE REGULATOR SAVES TIME AND CURRENT

Electric-arc furnaces with movable electrodes, for melting iron and steel, require quick and reliable regulation if maximum



Left and Right: The Regulator and Control Panels of an Electric-Furnace Regulating Apparatus. Three Automatic Magnets on the Regulator Hold the Temperature Constant

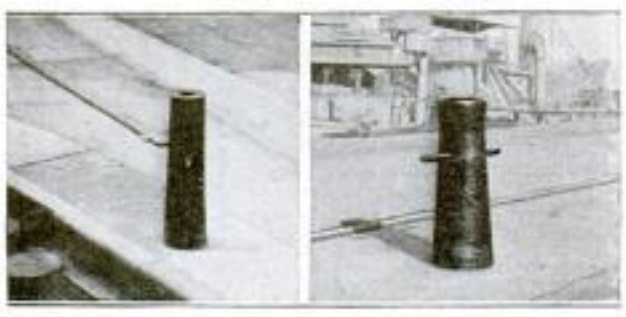
efficiency is to be attained, and current surges prevented from setting up high-demand peaks at the meter. An automatic apparatus, recently designed for this purpose, consists of a regulator panel carrying magnetic switches for the electrode motors, and a control panel equipped with the necessary relays and instruments. The time required for melting a charge is reduced by the use of this apparatus, and a saving of labor is effected because less attention is needed. Although the adjustment of electrodes takes place at high speed, they are prevented from getting into the melted metal, and the changes are made without "hunting." The regulator is made for one and three-phase furnaces.

IMMENSE AIR-CRAFT ENGINE RATED AT 700 HORSEPOWER

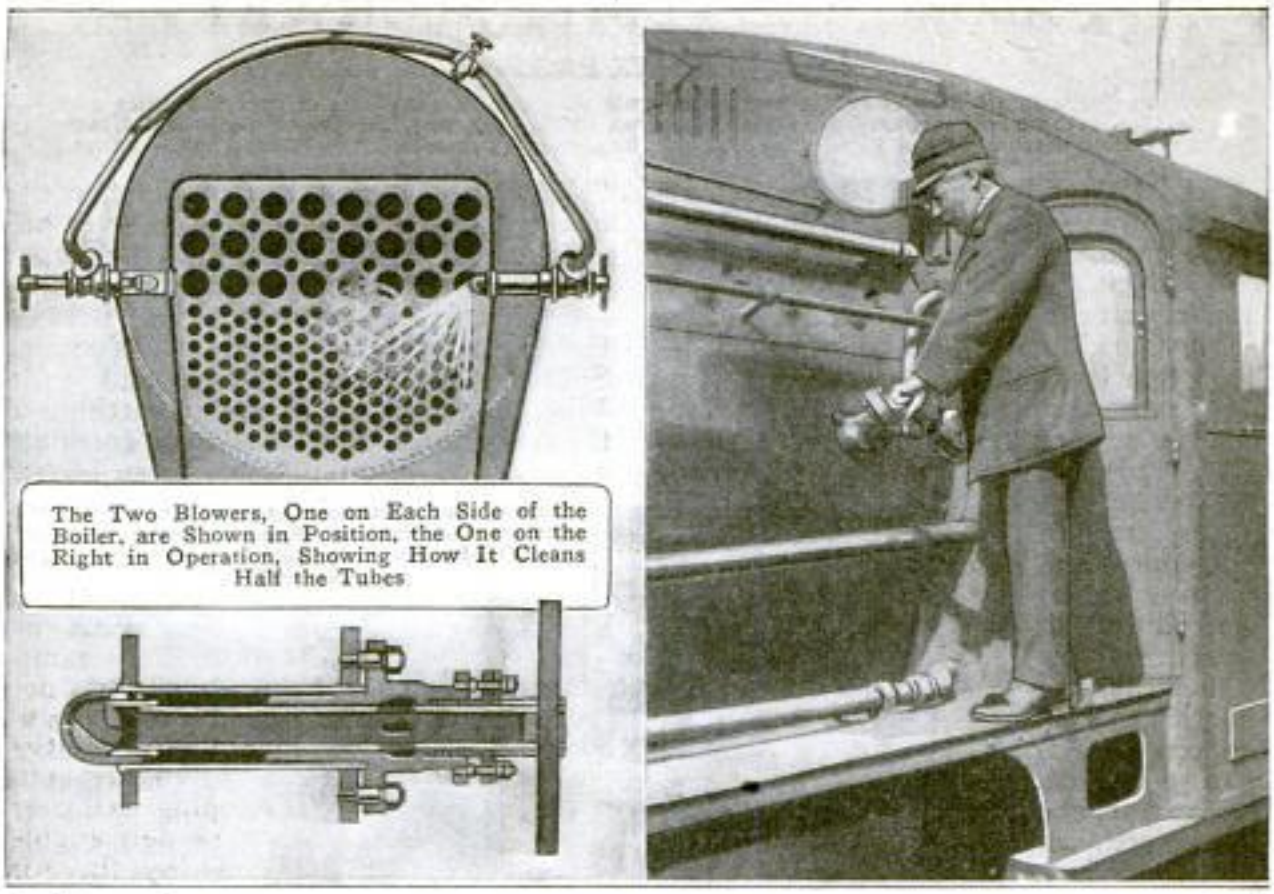
The largest air-craft engine of American construction was recently given its initial tests at McCook Field, Dayton, Ohio, where it was built. It is what is called a W-type, meaning that its 18 cylinders are arranged in three groups, of six cylinders each, in such a way that, when viewed from the end, the formation roughly resembles the letter "W." At its normal speed of 1,700 r.p.m. the big engine develops well over the 700 hp., originally estimated as its normal rating. At this speed each of the 5½-in. bore by 6½-in. stroke cylinders takes in and exhausts gas at the rate of 850 times per minute. In order that this great volume of gas may pass freely, each cylinder is equipped with four valves, two inlet and two exhaust, or a total of 72 of these parts to the engine. The steel jackets of the water-cooling system are welded to the cylinders, as in the Liberty-engine construction. Although developing well over the power expected of it, the new engine weighs only 1,720 lb. Built by the Air Service engineering division for use in medium-weight airplanes, the engine is the first of its type and of a series which will be produced for Army Air Service experimental purposes.

DISCARDED CANNON USED AS SNUBBING POSTS

Old cannon that have once seen active service on the battle front have entered a different field of use as snubbing posts for mooring ships at the docks of the Mare Island Navy Yard. They are cut to suitable length and placed in concrete bases with cleats on their sides to prevent the mooring lines from slipping. Formerly such relics were mounted on carriages and placed about the grounds of public and state buildings, but their use as snubbing posts is entirely practical.



The Mare Island Navy Yard Uses Old Cannon for Mooring Ships. They are Cut and Fitted with Cleats, Making Very Practical Snubbing Posts When Mounted in Concrete Bases



The Two Blowers, One on Each Side of the Boiler, are Shown in Position, the One on the Right in Operation, Showing How It Cleans Half the Tubes

At the Left Is an Enlarged Sectional View of the Blower, Showing How It is Connected to the Outside Boiler Shell, and Penetrates the Wall of the Fire Box. The Right-Hand View Shows the Engineer Operating the Blower by Turning the Lever That Opens the Valve and Admits the Steam

LOCOMOTIVE STEAM BLOWER CLEANS BOILER TUBES

Exigencies of the great war caused many mechanical developments in nearly every country of the world. In Sweden, one such notable development was a new steam blower for removing soot, scale, and other obstructions from boiler tubes. The blower can be used on stationary boilers, but it is on locomotive boilers that it will find its most important application. The blower is attached to the fire box, and is permanently connected to the steam supply by means of a pipe. There is a valve in the blower, controlling the steam supply, and this is opened for only a few minutes when the boiler tubes are being cleaned. The blowing is done when the boiler is hot, and thus the steam is kept dry, and removes the soot quickly. The blower is guided by the operator so as to let the steam jet impinge upon the tube plate. At the same time the steam blast in the smoke box is turned on, which helps remove the soot and enables the operator to judge, from the color of the issuing steam, when the tubes are sufficiently cleaned. Two blowers, one on each side of the boiler, clean all the tubes.

AN ADJUSTABLE SHOE JACK HELPS THE SHOEMAKER

A shoe jack that simplifies the work of shoemaking is being made at a western factory. It consists of an upright iron stand that is bolted to the floor, and in which slides telescopically a circular post for carrying the shoe. This can be adjusted to hold the shoe at any height, from a position convenient to the operator seated, to a height that would be necessary for an operator over six feet tall, when working standing up. The shoe can be turned to any position. This part of the apparatus can also be taken out and be supported on a bench, holding the shoe in a position convenient for trimming.

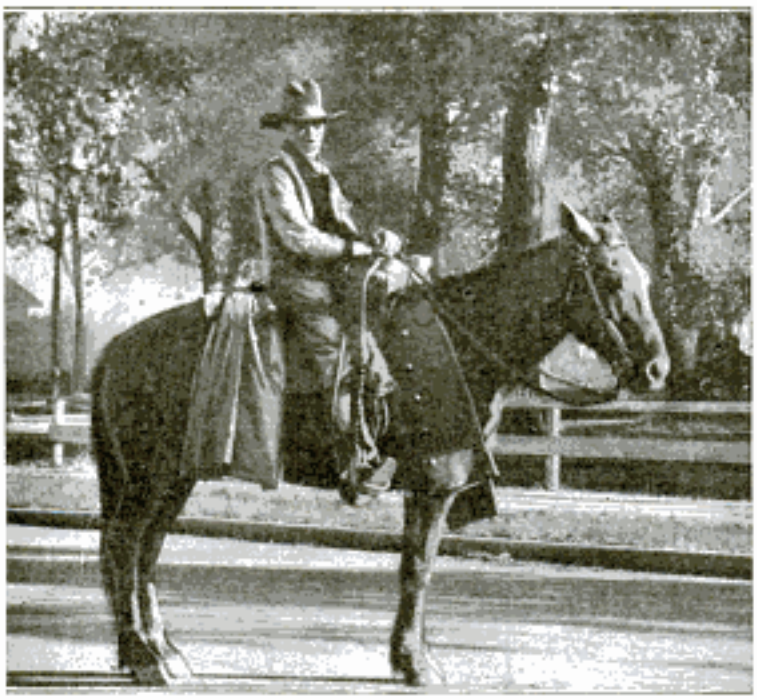
NINE HUNDRED MILES ON HORSEBACK ALONG THE CUSTER HIGHWAY

BY WHITE EAGLE

[White Eagle is a full-blood Indian and a deaf-mute who made a pony ride of over 900 miles over the Custer Battlefield Hiway. After the completion of his long ride, the Custer Battlefield Hiway Association purchased "Red Bird," the pony, from its owner and presented it to White Eagle.—Editor.]

THE Custer Battlefield Hiway, extending from Omaha, Neb., through Iowa, South Dakota, Wyoming, and to Glacier Park, Mont., a distance of 1,475 miles, is creating much public interest.

The marking of this highway was finished late last fall. Posts painted white are firmly set into the ground; large wooden arrows bearing names of towns and distances are bolted to the tops of the posts; the colors are red and white, and the number of the route is 12. Besides the guideposts, the colors are also painted on telephone poles, bridges, fence posts, etc., so that there is a sign on an average of every eight miles of the entire distance of the route.



Chief White Eagle and His Faithful Mount, "Red Bird": It Is Quite Likely That They Know Nearly as Much about the Custer Battlefield Hiway as the Engineers in Charge of Its Construction, Having Traveled 900 Miles of Its Length

Sept. 29, 1920, mounted on "Red Bird," a six-year-old Montana cow pony, the writer, escorted down the main street of the town by the entire population and the school children of the town, and a brass band, set out from Hardin, Mont., for Omaha, Neb., over 900 miles distant.

So there are only a few people who have had a better opportunity of observing the work that has been done and is being done, on the highway, than I have, and, besides, the Custer Battlefield Hiway goes right through my field—almost within a stone's throw of my front door, at Gillette, Wyo. There wasn't a section of this highway in any of the counties in the four states through which I rode that work was not in active progress, and, in some cases, had been completed; stretches of the roadbed, often extending for 10 miles in as straight a line as is possible for the surveyor's instruments to lay it out, had been graded and smoothed; "kinks" had been taken out and, consequently, distances lessened wherever possible, and it never seemed to be impossible, for the engineers had no respect for fields, fences, or front yards. Between the towns of Sun Dance, in Wyoming, Spearfish, in South Dakota, and on to Whitewood, S. D., I saw something of the difficulties road builders encounter and of how they combat them. There were camps along the entire 900 miles that I rode over, just like soldier camps, but it was near the above South Dakota towns that it was most interesting. The camps had a permanent air about them; houses to shelter the men, and blacksmith shops were up and were in operation. The gangs were cutting right through big rocky hills. The familiar steam shovel that takes up a big bunch of earth, swings it round, and dumps it in a truck or cart, was there and being worked for all it was worth. The rock and earth removed by making these cuts were hauled by the trucks to depressions and valleys where roadbeds were being built up; great trees were being taken up by the roots, where in the way, and removed; bridges were being built, and culverts put in. The latest and best makes of road-building machinery were in use at these and other camps along the highway. Grading was being done by big endless-tread tractors, which pulled from two to three giant grading machines. The tractor, in turn, was followed by gangs of men with teams, and the smaller graders and scrapers who finished off the work that the big tractor could not do, and put in the bridges and culverts.

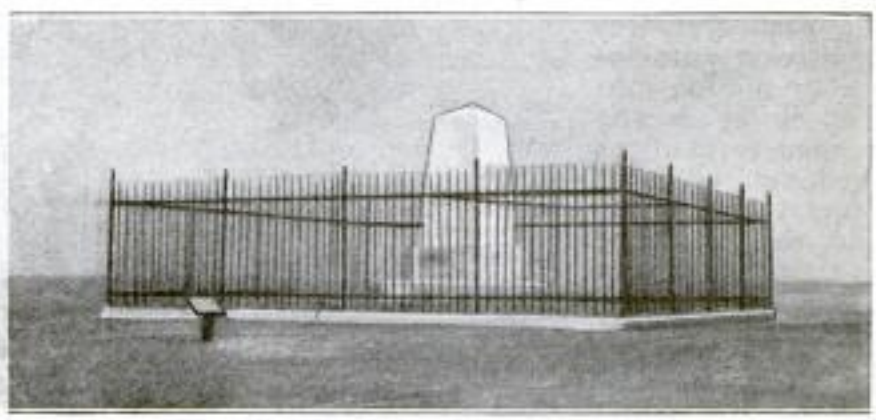
Map of the Custer Battlefield Hiway: Connecting with the Lincoln Highway at Council Bluffs, Iowa, the New Memorial Road Winds through Picturesque Portions of Four States. The City of Hardin Is About One-Third of the Way between Billings and the Custer Battlefield National Cemetery

Good bridges are hand in hand with good roads, especially in the western mountainous country where a cloudburst sometimes changes, within a few minutes, a crawling, ankle-deep stream into one of swirling, raging waters, bank-full, and sweeping all before it. I saw at several points of my ride over the highway some fine examples of later-day bridges in course of construction, and a few finished, but the greatest was the bridge being built across Spotted Horse Creek on the highway between Arvada and Gillette. The state engineers and crews were at work on the bridge when I passed. This bridge has wide, guarded approaches, is being constructed of steel and concrete throughout, and when finished will have cost $40,000. Although not yet having been fully in work two years, the Custer Battlefield Hiway may now be traveled from end to end, nearly 1,500 miles, without asking directions or having to open a gate. May is not too early for a trip over this highway, but the best months are June and on up to October at the present time. As soon as the new roadbed has had time to pack properly, and all surfacing and graveling is finished, it will be a 365-day road.

I reached Omaha, Neb., "the end of the trail," and more than 900 miles from my starting point, Dec. 12, 1920, and, dividing hours into days, found that I had been in the saddle just 24 days 5 hours.

MISSISSIPPI BOTTOM LANDS TO BE MAPPED FROM AIR

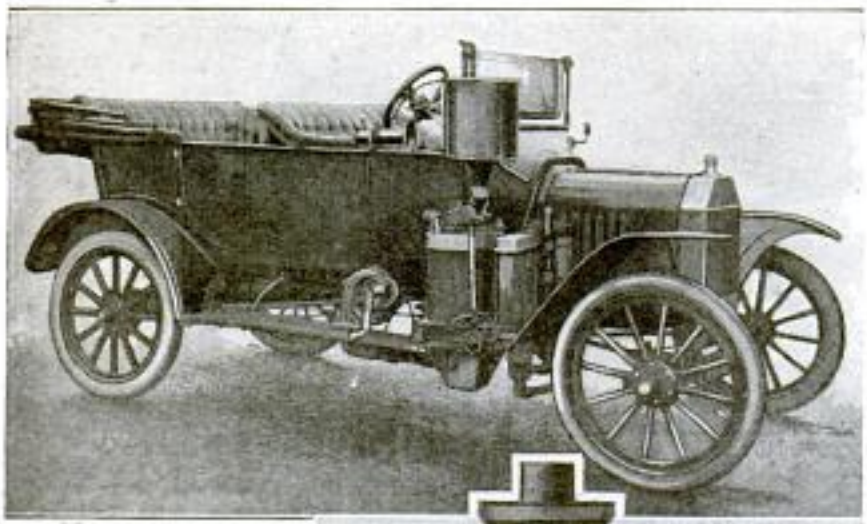
Coöperating with the U. S. Public Health Service, the Army Air Service is about to begin a photographic aerial survey of the thousands of square miles of swamp lands of central western Mississippi. The corporations of Rosedale, Cleveland, and Merigold will be included in the very extensive operations, which, it is thought, will be finished by the latter part of July. While this work is going forward, seaplanes will be making a like survey of the lower Mississippi River, including the deltas. The Navy Department will lend the seaplanes as there are no suitable landing places for army planes.



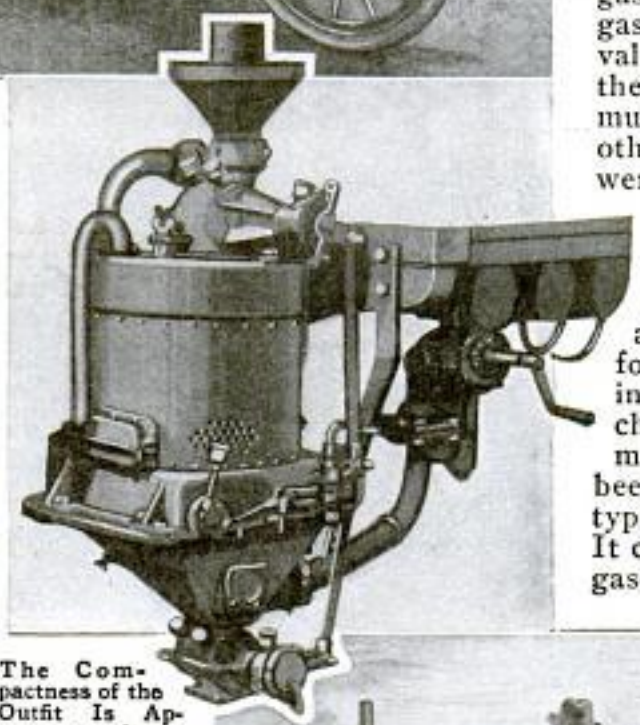
This Monument on the Custer Battlefield Hiway Marks the Spot Where General George Custer Made His Last Stand

NOVEL GAS PRODUCER EVADES HIGH COST OF GASOLINE

Conditions in the oil industry have caused, in Europe, a far greater price inflation than in this country. Therefore, there has been a greater incentive there to find a substitute. The manifest alternative is solid fuels, and the only practical way to use solid fuels for such purposes as driving automobile or marine motors, is by means of some form of gas producer, which in general terms implies the passing of steam and air through a mass of heated fuel, resulting in the product of a combustible gas.



A Small Car Equipped with the Gas Producer, Which is Seen beside the Windshield, and Partly on the Running Board, a Substitute for Gasoline Tank, and Carburetor



The Compactness of the Outfit Is Apparent from This Sample of Complete Gas Producer for Motors

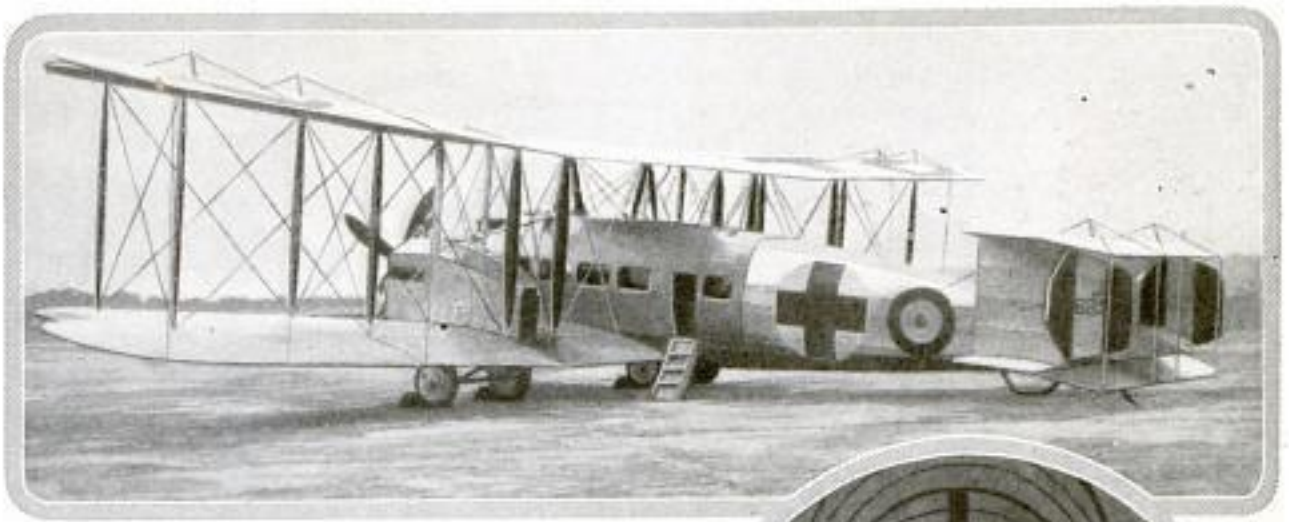
A gas producer of this type has now been applied, in England, to use on a small car, and in a 35-ft. launch. In the past, the greatest difficulty in the application of gas producers to work of this nature has been the entire absence of flexibility. There was no means of regulating the supply of the gas to the motor in response to variations of the load—nothing, that is to say, corresponding to the action of the float-feed carburetor which automatically proportions the fuel supply to the amount of the load. The new English producer has a means of automatically feeding the solid fuel to the producer continuously in proportion to the demand of the load, the heating of this constant supply of small and varying amounts of fuel being instantaneous. The ashes are removed continuously and automatically, and water is fed to both the vaporizer and the scrubber in the same manner.

Trials of this producer were first made in a 35-ft. launch, in which the engine, of 75 hp., had previously been run with gasoline. The producer gas had a lower caloric value, and consequently the motor did not give as much power, but in every other respect the results were just as satisfactory as with gasoline, and, of course, the cost of the fuel was very much smaller, being actually less than one-fourth. Improvements in the details of the machine are still being made, and already it has been applied to several types of motor vehicles. It can be made to replace gasoline in any engine.

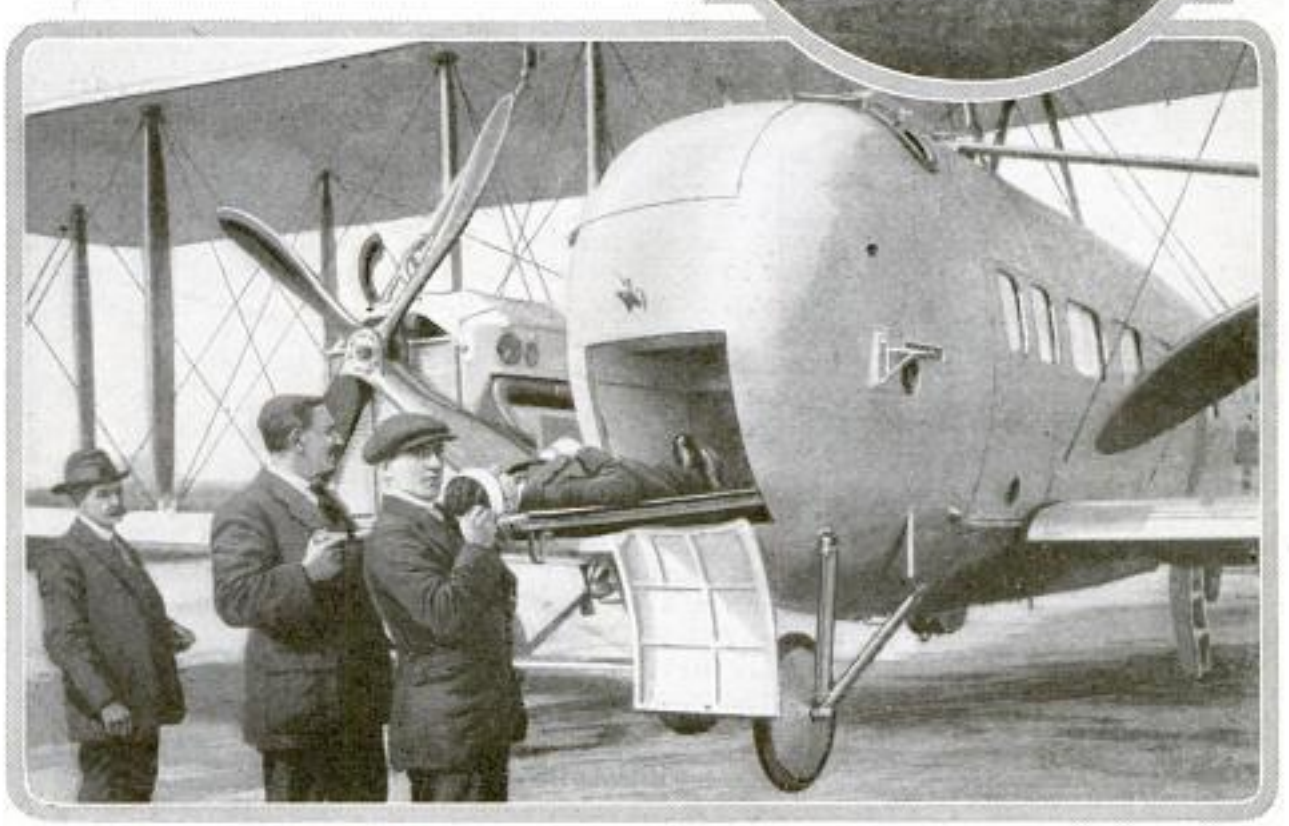
The First Trials were Made in This 35-Foot Launch, Equipped with the Gas Producer to Furnish Fuel to Its 75-Horsepower Motor

¶An aerial transportation project with a route from Reykjavik, Iceland, via Scotland and England, to Copenhagen, Denmark, is being considered by an Icelandic aviation company. The principal object is the speeding up of postal service.

BOMBING AIRPLANE BECOMES FLYING AMBULANCE



IF the former warring nations are not yet beating their swords into plowshares, they are at least turning some of their fighting equipment to constructive uses and improving it with these ends in view. One of the latest developments along this line is the aerial ambulance built by the Vickers Vimy concern of England. Originally designed as a bombing plane, this angel of mercy, powered by two engines with a rating of 500 hp. each, is capable of transporting four patients, a physician, nurse, and pilot. As was to be expected, this, the latest in its field, is a decided improvement over a former flying ambulance written of in the November, 1920, issue of this magazine. It is so constructed that the stretchers can be loaded through the front end of the fuselage, as shown in the lower view, and securely clamped to laterally projecting arms in a double-deck arrangement (right). First-aid and minor-operation kits, a stationary washbowl with running water, and a seat for the attendant in charge, are part of the very complete equipment. Though the blunt end of the cabin suggests that it offers a heavy wind resistance, the contrary is the fact, as the bluntness is part of the truly splendid streamline design.



WIDE WORLD PHOTOS

Weeds Die and Grass Thrives When Ammonium Sulphate is Used as Fertilizer. The Patch in the Picture at the Left Is a Weedy Section Before the Chemical was Used. Right: The Same Patch Devoid of Weeds after a Series of Ammonium-Sulphate Treatments

WORLD'S SMALLEST STORE SELLS FRIED HAMBURGER

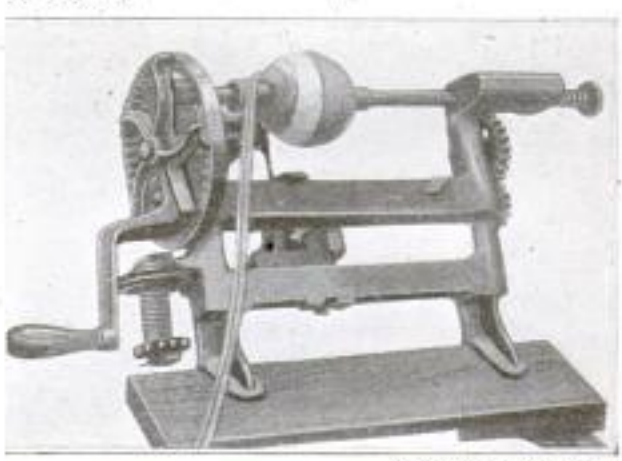
Fried hamburger, cigars, and checking facilities are the main features of the business carried on in the smallest store in the world located at Duncan, Okla., It measures 22 in. in width and has just enough room for one man to get inside and turn around. Shelves are a part of the store equipment and are located high so as not to crowd the keeper too much. It would require a very lean burglar to rob the place, for the manager, who is slight in stature, must bend almost double in order to get inside.

CHEMICAL SOIL FOOD KILLS WEEDS AND AIDS GRASS

It has been recently announced that sulphate of ammonia is a successful and economical alternative for use as a grass fertilizer in the place of nitrate of soda. It also has the property of slowly but surely killing off weeds. The persistent use of the latter element has a tendency to produce an alkaline condition in the soil which is conducive to weed growth. Ultimately, under these circumstances, the grass is overcome by the weeds. In the use of ammonium sulphate, the situation is reversed and the weeds become crowded out while the necessary acids are maintained in the soil. Care must be exercised in the proportions of the new fertilizer or the grass may be burned out instead of aided by it. Any substance that tends to cause an alkaline reaction must be kept away after an application, and the ammonium phosphate laid on as a top dressing each spring. The doses are graduated thereafter as the weeds begin to disappear, and their eradication by this process is slow but certain.

ORANGES PEELED BY MACHINE WHILE YOU WAIT

The cost of an orange in Havana, Cuba, is five cents and that price includes the peeling of it, which is done on a specially designed machine. The orange is held between two clamping lugs and is turned by means of a crank handle and gearing. A small blade engages the skin as the fruit revolves. The device is clamped to a board or stand.



The Clamping Lugs of the Orange-Peeling Machine Hold the Fruit While It is Revolved against a Sharp Blade by the Handle

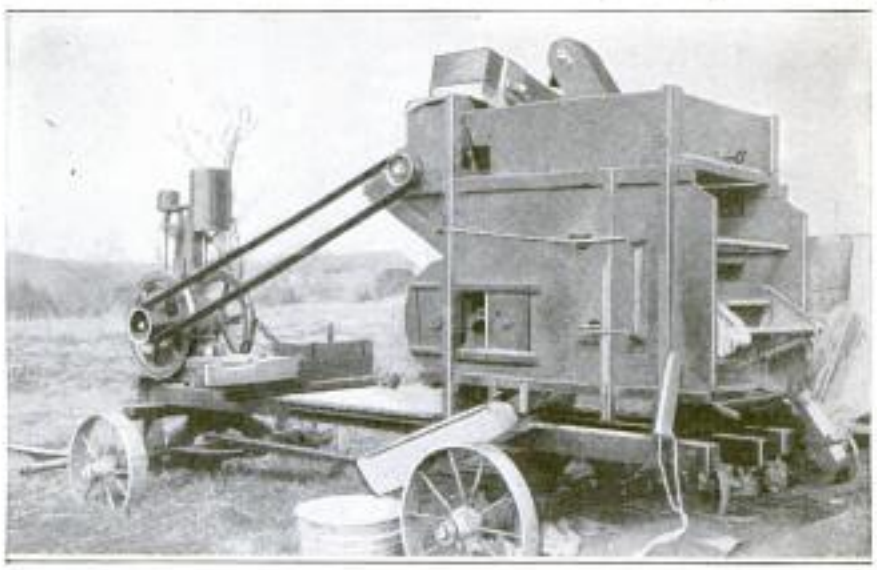
A BOAT THAT IS PROPELLED BY A SUBMERGED SAIL

The general impression of a sailboat is that to impel it the sail must be hoisted. The opposite is the case with the boats of the pearl hunters of American rivers. To impel their boats they sink the sails. The reason for this difference is that in one case the motive power is the wind, while in the other it is the water. In the pearl hunter's boat the sail, consisting of canvas stretched on a frame about 9 ft. long and 3 ft. wide, normally carried horizontally at the bow of the boat, is submerged in a vertical position so that the current gives the boat much more speed than it would have by just drifting. Where the pearl-bearing clams live there always is a strong current. To catch the clams, the pearl hunter carries a rack, on either side of the boat, composed of bars from which dangle chains with hook ends that scrape over the bottom of the river, and the clams close their shells upon them.

The Sail is Seen in Front of the Boat. When Used to Propel the Boat, It is Turned into a Vertical Position, and Lowered into the Water

FANNING-MILL ACCESSORY EXTRACTS HEMP SEED

A hopperlike device, containing rubbing rollers, has been constructed so that it can be installed on top of any ordinary fanning mill, and be used for loosening the seed from hemp when it is fed into the hopper. This is done by the action of the rollers. The seed flows from the hopper, through the fanning mill, into a galvanized chute, which deposits it as required. This simple device, connected to his fanning mill, enables a farmer, who has only a few acres of hemp, to dispense with costly hemp-threshing machinery.

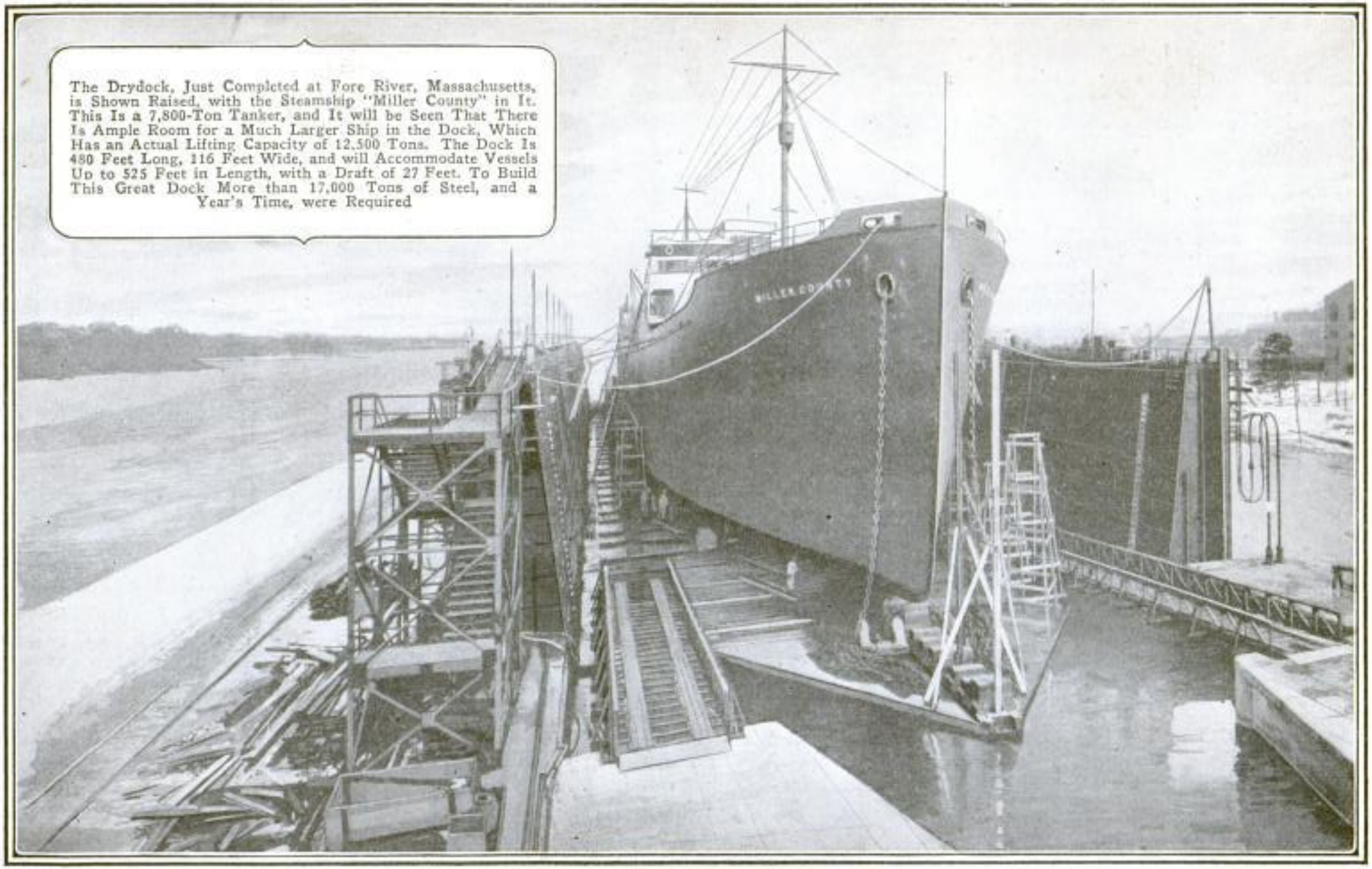


On Top of the Fanning Mill is Shown the Hopperlike Device, into Which the Hemp is Fed, and Which Extracts the Seed. The Latter is Delivered Outside the Machine through the Chute Shown beside the Wheel in Front

GRAND CAÑON NATIONAL PARK TO ATTRACT TROUT ANGLERS

Although no game fish exist naturally in the Grand Cañon National Park, that great national playground is nevertheless to be an attraction for the trout fisherman. Since the Grand Cañon came under the jurisdiction of the national-park service, a careful survey has been made to determine the possibilities of trout propagation within the park. The result of this investigation was that Bright Angel Creek afforded the only logical place. This stream, which flows down the wall of the cañon in the vicinity of El Tovar, was recently stocked extensively with eastern brook trout.

No game fish exist in the Colorado River at the bottom of the Grand Cañon. The only native fishes are the Gila trout (a sluggish, nongame fish), carp, suckers, and occasionally a salmon.



The Drydock, Just Completed at Fore River, Massachusetts, is Shown Raised, with the Steamship "Miller County" in It. This Is a 7,800-Ton Tanker, and It will be Seen That There Is Ample Room for a Much Larger Ship in the Dock, Which Has an Actual Lifting Capacity of 12,500 Tons. The Dock Is 480 Feet Long, 116 Feet Wide, and will Accommodate Vessels Up to 525 Feet in Length, with a Draft of 27 Feet. To Build This Great Dock More than 17,000 Tons of Steel, and a Year's Time, were Required

NEW DRYDOCK HAS LIFTING CAPACITY OF 12,500 TONS

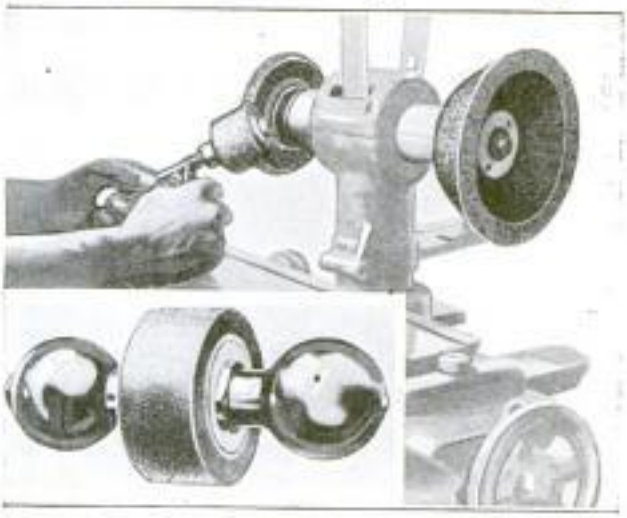
One of the largest of privately owned drydocks in the United States has just been completed at Fore River, Mass. The dock will accommodate vessels up to 525 ft. in length over all, with a draft of 27 ft. The dock itself is 480 ft. long, 116 ft. wide, and 35 ft. high. It is a floating dock composed of 10 pontoons, on each of which are two pumps, each operated by a 60-hp. motor, which works at three speeds. The pumps can be operated separately or collectively. They will empty the pontoons in 90 minutes. The dock has an actual lifting capacity of 12,500 tons, although it is rated at only 10,000 tons. It has a complete system of piping for steam, air, and tank water. There are more than 17,000 tons of steel in this huge structure, and it required a year's time to build it.

DRY-CLEANING MADE SAFER BY FOUNTAIN-TYPE BRUSH

The use of inflammable liquids—gasoline, benzine, and naphtha—in dry-cleaning processes is made safer by a fountain-type brush, recently introduced by an eastern manufacturer, which stores them in a reservoir in the handle-shaped body, and delivers small quantities through the brush when a button-headed plunger, projecting through the side of the device, is pressed with the thumb. Made of sheet-metal stampings, soldered together at their edges, the contrivance is but 8½ in. long and, filled to its ½-pt. capacity, weighs only 1 lb. Although designed primarily for cleaning, it may be used to apply shoe or stove polish, mucilage, ink, or any other liquids usually applied with a brush.

GRINDER-WHEEL DRESSER CUTS WITH ACCURACY OF DIAMOND

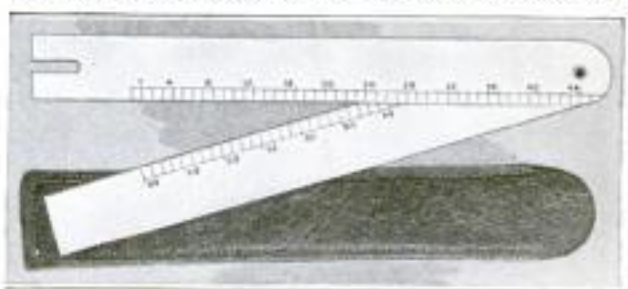
A new grinder-wheel dresser is made with a circular cutting stone which may be used to dress an emery wheel to a slant or to finish its working surface for precision tool grinding. The cutting wheel is made of finest quality carborundum and is mounted on a rod having knobs on its ends for holding the cutter against the grinder wheels. Diamond wheel dressers have long been in use for this purpose, but the carborundum tool has demonstrated the practicability of using one abrasive surface against another to get a good cutting effect economically. The cutting stones are removable and can be replaced when worn.



The Grinder-Wheel Dresser Mills the Working Face of the Wheel to a Surface Suitable for Accurate Grinding. Insert: A Ball-Handled Dresser for Use in Easy Places

HANDY RULE FOR LOCATING DEFECTS IN PLAYER PIANO

A celluloid rule that doubles up into a leather cover, and fits any pocket, is handy for use on a player piano. On one side is a tracker-bar gauge, with which any notes which the test roll shows to be not working properly, can be measured off without the necessity of counting the holes to find the defective note. On the other side it is divided into inches and sixteenths, and can be used as a 12-in. rule. A notch in the rule forms a primary valve gauge.

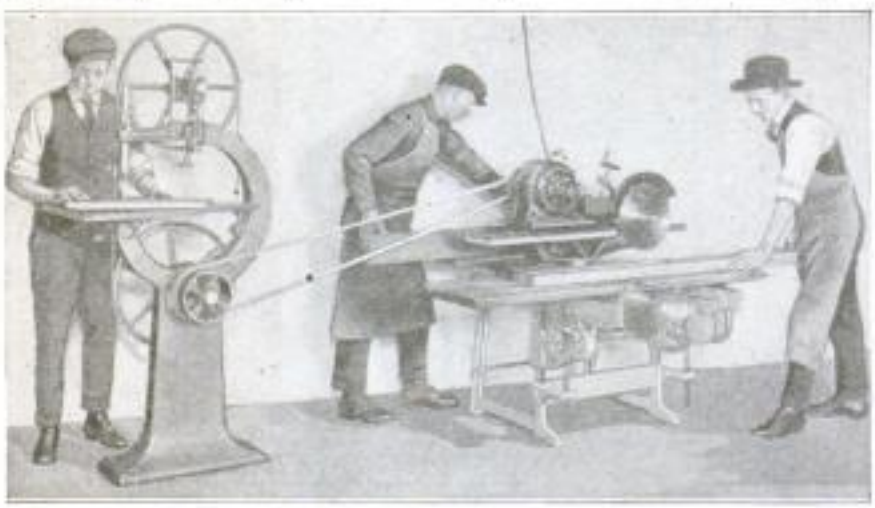


The Rule is Shown Out of Its Case with the Side Exposed That Has 88 Graduations for Measuring the Piano Notes

¶Nineteen of 30 five and ten-ton tractors, part of the War Department's surplus, purchased by South Carolina, have been put to work on the state roads, and the remaining 11 will soon be in commission in the same service.

WOODWORKER IS ADJUSTABLE TO MANY DIFFERENT USES

A woodworking device that is a veritable jack-of-all-trades when it comes to machining lumber, has recently been placed on the market. Fitted with two mandrels for saws, the machine is made to do ripping or the many intricate sawing jobs, such as stair-routing, molding-cutting, or dado work, by simply lowering or raising a table which is slidably attached to the machine frame, bringing the work into contact with the suitable tool. Boring is accomplished by placing a self-centering chuck on the upper mandrel, and adjusting the worktable to a cross-travel beam, enabling the operator to move the wood into contact with a bit in the chuck. An additional pulley on the driving motor makes the operation of a band saw possible when belted for the transmission of power. All accessories for the various operations are detachable.



The New Woodworking Machine Has an Adjustable Table and Two Mandrels Equipped with Saws. Picture Shows Machine Used in Connection with a Band Saw

HEATING BY CATALYSIS IN SMALL STOVES

As long ago as 1817 Sir Humphry Davy discovered that a spiral of platinum, previously heated, will remain hot when immersed in a mixture of air and inflammable gas. No matter how long these conditions continue, the platinum remains unchanged, but the gas is decomposed, and therefore, has to be renewed. This phenomenon is known as catalysis, and many practical applications of it have been made. During the war the principle was applied in France to a device for overcoming the difficulty of starting airplane motors, on account of the low temperature of the water in the radiators. A catalytic heater was devised that kept the radiator warm, and at the same time avoided setting fire to any inflammable part of the plane. On the same principle heaters are now being made that can be used as hand warmers in a muff, foot warmers in a motor car, or to temper the coolness of a room. As may be easily realized, no fire danger attends the use of these devices.

BY COURTESY OF LA NATURE

From the Left Consecutively Are: The Device That is Used for Heating Radiators, a Small Stove, and a Foot Warmer for Vehicles

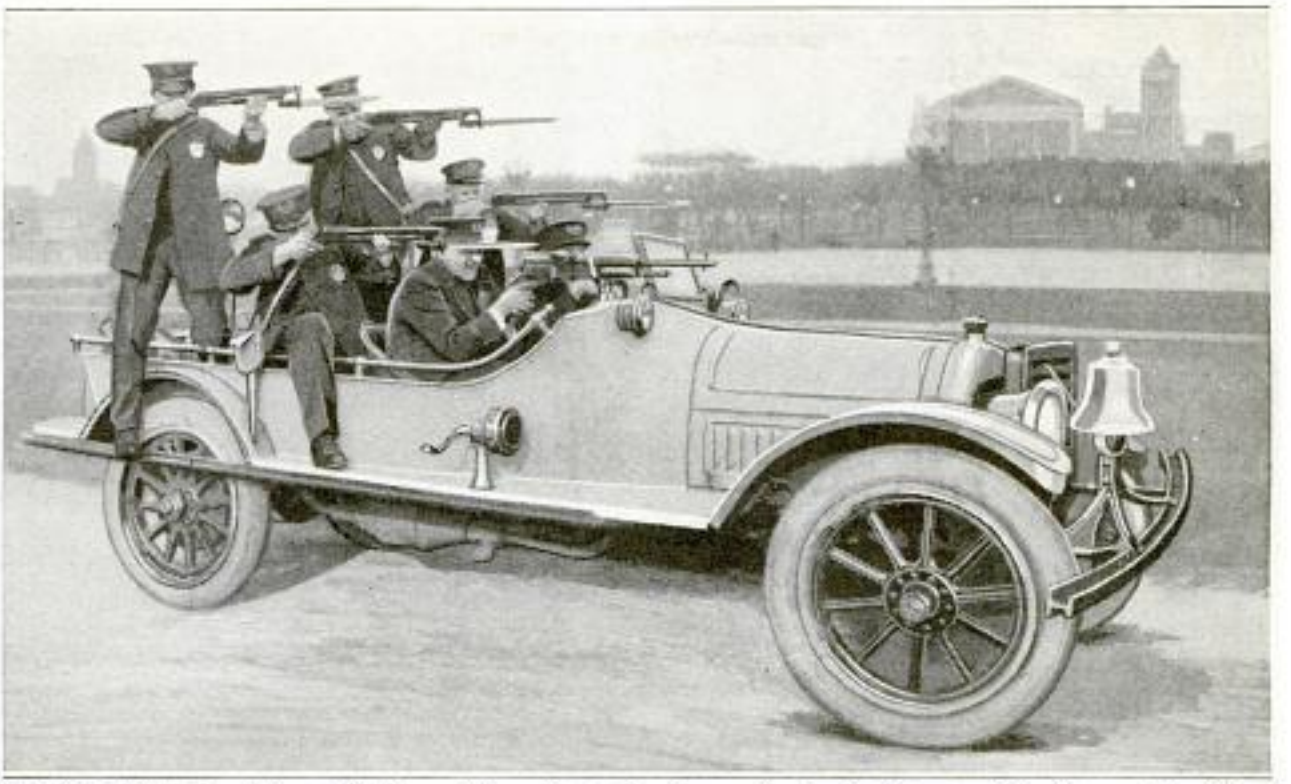
HANDLES OF NEW GRASS SHEAR OPERATE VERTICALLY

The horizontal blades of an improved grass shear are operated by handles which work up and down, thus avoiding turning the hand to the awkward sidewise position. The change in motion is accomplished by a plunger which is part of the lower handle, and, working through slots in the rear ends of the blades, forces them together when the handles are squeezed. The blades are opened by a spring when the lower handle is released.

An Improved Grass Shear with Horizontal Blades and Vertical Handles, Which can be Used without Turning the Hand to the Awkward and Tiring Sidewise Position

BANDIT-CHASING AUTOMOBILE MAKES GOOD IN DENVER

Motor pirates, holdup men, and other desperadoes, have small chance when the bandit squad of the Denver police force takes up their trail in the high-powered, amply protected bandit-chasing auto-



This Bandit-Chasing Automobile Has a Heavy Protective Screen for the Radiator, and the Bumper Consists of a Special Rolled-Steel Rail Section. The Windshield Is Bullet-Proof. Riot Guns, Searchlights, and a Swivel Machine Gun Are Part of the Bandit Chaser's Equipment

mobile patrol. The plan to build such a car was announced in the February number of this magazine. The machine differs somewhat, however, from the original design. The chassis, hood, and cowl are of a standard make, but the body and protective features are as planned. The latter consist of an exceptionally heavy curved bumper, made from a section of railway rail; a strongly made protective screen for the radiator; a bullet-proof windshield, and channel-section steel rails which, projecting beyond the outside line of the fenders, protect the body in case of a wreck. The armament of the businesslike outfit consists of riot guns, and a machine gun mounted on the dash. Two searchlights are used to illuminate the roadside shrubbery when a hunt is on.

RADIO WILL WARN U. S. SHIPS OF WORLD STORM CONDITIONS

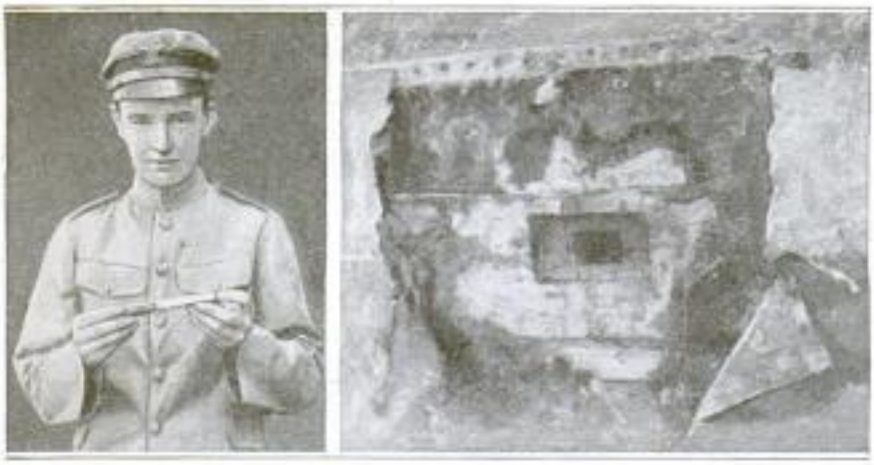
By virtue of extensive arrangements made by the United States Shipping Board with most of the high-powered radio stations throughout the world, American ships are to be furnished by wireless with reports of storm conditions prevalent at each sending point. These reports will be of invaluable aid to mariners in that they will indicate the approach of adverse weather conditions in time to permit them to make preparations to meet the emergency.

BARREL PROTECTOR PREVENTS COLLAPSE IN TRANSIT

Merchants, shipping such commodities as cement, flour, or sugar in barrels, face considerable loss because of the collapse of these carriers and the consequent spilling of their contents. To lessen the loss thus sustained, a protector, or brace, made of two crossbars mortised at the center for fitting together, has been developed by a southern inventor. The ends of these crossbars are two arc-shaped pieces designed to fit the internal contour of the barrel. A second form of the brace is also designed, which may be made in one piece to be placed in the barrels during the manufacturing process. The cubic space required by these braces is only 2 per cent of the entire barrel capacity, a small loss compared with the advantages.

SWORDFISH'S SWORD IMBEDDED IN HULL OF A STEAMER

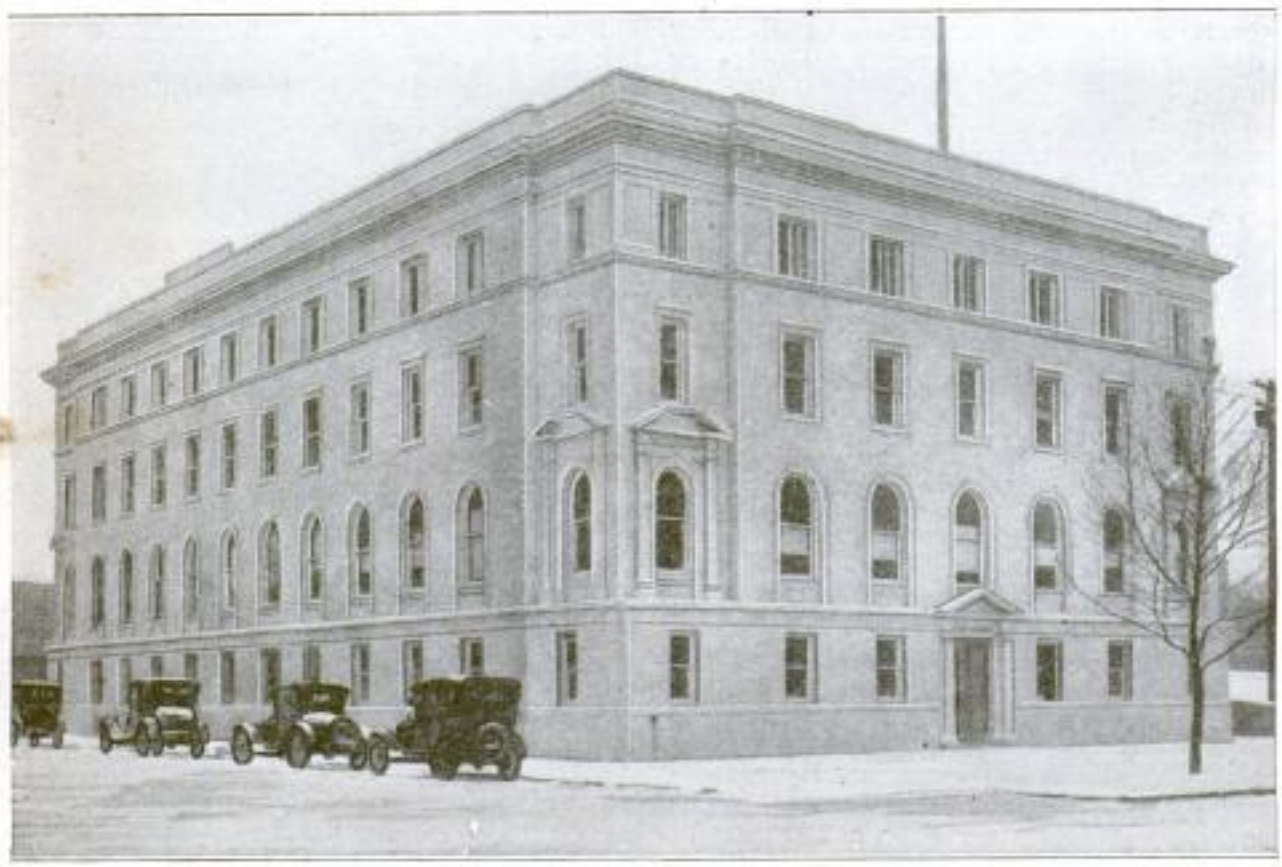
The cutter "Marinduque," of the Insular Bureau of Commerce and Industry, Philippine Islands, was recently dry-docked in Manila, and the 6-in. snout of a swordfish was found imbedded in the vessel's side. The tough, bony snout had penetrated the copperplated 3-in. teak hull until it actually protruded nearly an inch into one of the cabins. The other end of the snout was snapped off, flush with the ship's side. The point inside the cabin had been noticed by some members of the crew, but they had supposed that it was a steel spike. When the snout was removed, it was identified by an expert at the bureau of science as the "sword" of a swordfish. Other such cases have occurred in the Indian Ocean.



Left: An Officer is Shown Holding the Swordfish's "Sword," Which was Broken in Extracting It from the Ship's Side. Right: The Hole That had to be Made to Extract It

CLEVELAND CLINIC IS DEDICATED TO HEALING ARTS

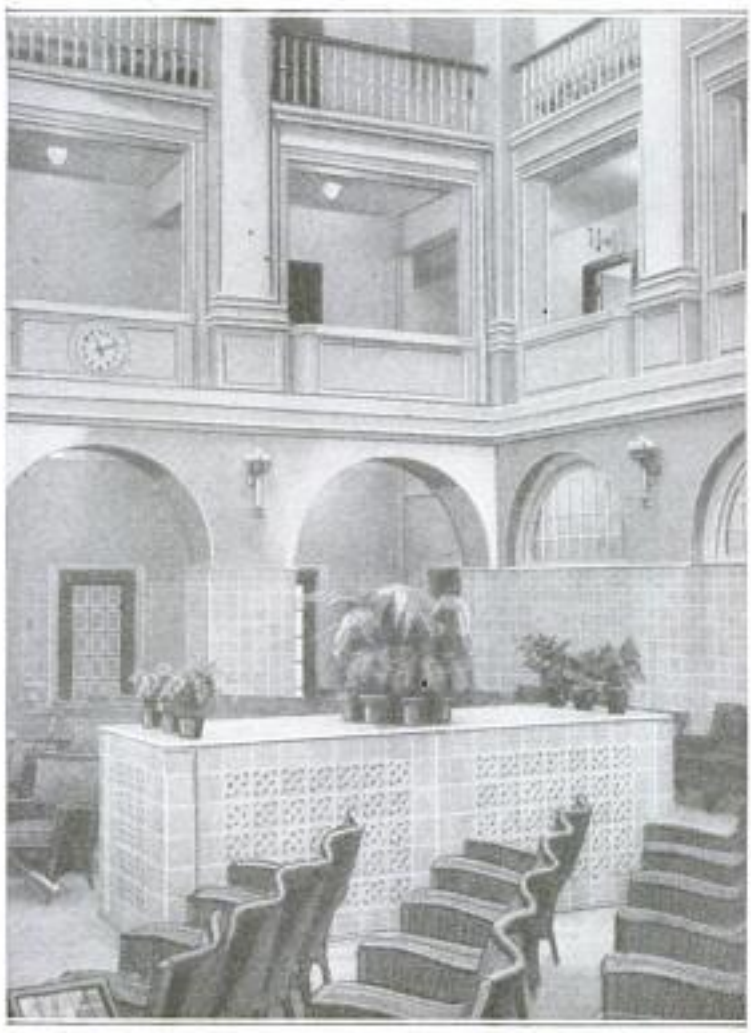
"The opening of the Cleveland clinic is an epoch-making step in American medical progress." These were the words spoken by Dr. William J. Mayo, honored as the "statesman of medicine" by his colleagues, in his dedicatory address upon the occasion of the formal opening of that institution. Equipped with every device known to science for the correct diagnosis of human ailments, the splendid edifice, with grounds and furnishings costing well over $500,000, is designed to serve as a



Housed in This Substantial Building Is the Cleveland Clinic, Dedicated to the Intensive Study of All Human Ailments and the Devising of Methods for Their Prevention and Cure

A Secluded Nook in the Very Complete Library of the New $500,000 Clinic at Cleveland, Ohio

clearing house of the latest and best developments in all branches of the healing arts. Here the claims of all systems of alleviating or curing human maladies will be given impartial, scientific analysis, and the true in each will receive official sanction and recognition. It is this breadth of vision on the part of its founders, Drs. George W. Crile, F. E. Bunts, William E. Lower, and John Phillips, which is destined to insure Cleveland clinic a unique place



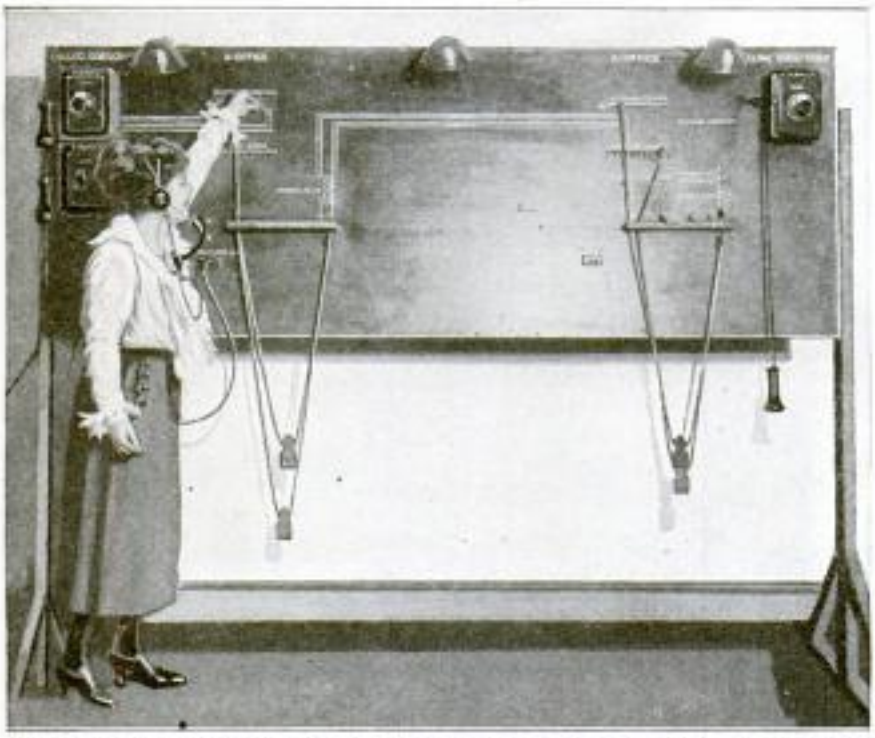
One Corner of the Reception Room, Showing the Comfortable Chairs and Cheery Surroundings of Growing Plants and Warm Buff-Colored Tile Walls

Here may be Found Works on All Phases of Human Illnesses, Printed in Various Languages

in the records of institutions dedicated to similar purposes. Diagnosis of all forms of ailments will be made by means of the most perfect X-ray, electrical, and biophysical apparatus that have been, or will be, devised. The four founders, after having borne the expense of building and equipping the institution, propose to organize the Cleveland Clinic Foundation that the great work may endure perpetually, a noble ideal realized.

WORKING MODEL OF EXCHANGE GUIDES TELEPHONE USERS

What may be described as a working diagram of a city telephone system, in which two exchanges, with subscribers' instruments connected to them, are represented on a board about 3 ft. wide and less than 8 ft. long, is being used in Detroit, Mich., for public demonstration. One exchange is used for originating and the other for receiving calls, each being equipped with one pair of cords and the necessary keys and jacks. With this portable set, one operator can illustrate to an audience the whole series of 25 operations necessary for connecting two subscribers, showing telephone users the correct use of the instrument.



A Working Diagram of a City Telephone System, Used for Public Lectures: The Portable Board Represents Two Complete Exchanges with Subscribers Connected to Them

MANY VOLUNTEER FOR MEDICAL EXPERIMENT PAYING $1,000

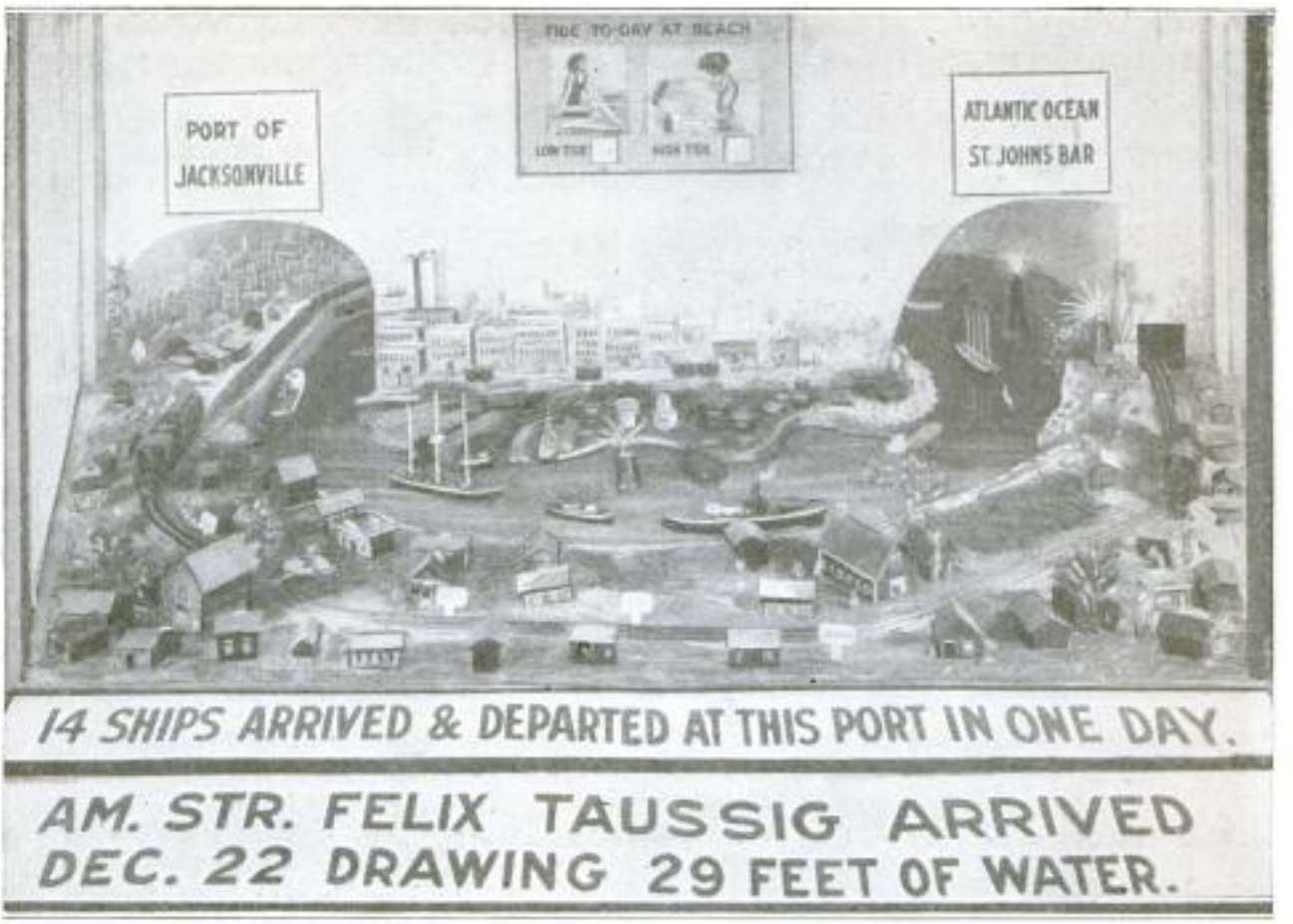
In the hope of winning the $1,000 reward offered to volunteers who contract scarlet fever as the result of inoculation with the germs of the disease, dozens of persons have offered themselves to Drs. Ludvig Hektoen and George F. Dick of the John McCormick Institute for Infectious Diseases, of Chicago. The experiment is being made in an effort to discover a preventive serum. A reward of $70 is paid for inoculation, and an additional $1,000 is promised if any of the dozen forms of the disease develops.

GREAT BRITAIN OFFERS GIFT OF LARGE AIRSHIP FLEET

The most remarkable gift proposal in history is that made by Great Britain in offering a large portion of its airship fleet to any responsible individual or organization that will accept, operate, and maintain it. The only stipulation is that experimental work be carried on, and that all knowledge gained be communicated to the government exclusively. The reason given for this momentous step is the necessity of economizing. The fleet is made up of the dirigibles 32, 33, 36, 37, and 80 of the R-series, the L-164 and 71, and two of the Zeppelin type taken from Germany. They are all of the rigid type and can be remodeled for passenger and freight traffic. In fact, the "R-36," sister ship of the "R-34" of transatlantic-flight fame, has already been reconstructed and is now 30 ft. longer than when first built. A rearrangement of and addition to the power-plant has increased the power from the original 1,250 hp. to 1,570 hp. The estimated value of the fleet is $15,000,000.

WIRELESS FOR POLICE AS AID IN CRIME-WAVE CHECK

Wireless telephony, with all of the latest amplification features, will be utilized by the city of Chicago as an assistant in checking its wave of crime. A sending station with a range of 1,000 miles is to be installed on the city-hall roof. From this station, messages will be flashed to receiving stations on two fire boats, two lake cribs, two fire-engine houses, one central fire-alarm station, two patrol wagons, and on two of the fast bandit-hunting autos which work out from the detective bureau. The latter stations are to be equipped with amplifying devices of sufficient strength to announce a message loudly enough for hearing above the din of a moving automobile. Through this wireless system, it is expected that the department will be kept immediately informed of the latest criminal movements.



This Miniature Panorama of the Port of Jacksonville, Florida, Is Faithful to the Original in the Smallest Details. Tiny Ships Navigate the Real Water, Passing Each Other Safely, and Lilliputian Trains Make Scheduled Stops at the Regular Stations. The Insert at the Top Shows the Time of High and Low Tides

WORKING MODEL OF PORT IS FLORIDA WINDOW DISPLAY

Civic spirit of a decidedly practical nature inspired the design of a miniature working model of the port of Jacksonville, now occupying the display window of a ship chandler in that Florida city. Tiny but real ships go into and out of the harbor, passing each other without accident, while a complete little railroad train skirts the shore, stopping automatically at the stations. Above the model are statistics of the port, indicating that its commerce doubled in the past year.

WASHER, WRINGER, AND IRONER ALL IN ONE MACHINE

Home-laundry work in its entirety includes not only washing and wringing the clothes, but ironing them too, and that is regarded as no light task by many housekeepers. Therefore a new type of washing machine is made unusually interesting by the fact that it performs all three operations, using electric power. The ironer is less than 2 ft. long, with an open end permitting clothes to be slipped easily on and off, and its roller may be heated either electrically or by gas. It is pivoted at a corner of the washing machine, alongside the wringer, so that it may be swung over the flat top of the machine for use.

The Electrically Operated Ironer is Pivoted at the Right-Hand Corner of the Washing Machine

IMPROVED GASOLINE PUMP HAS CASH-REGISTER FEATURES

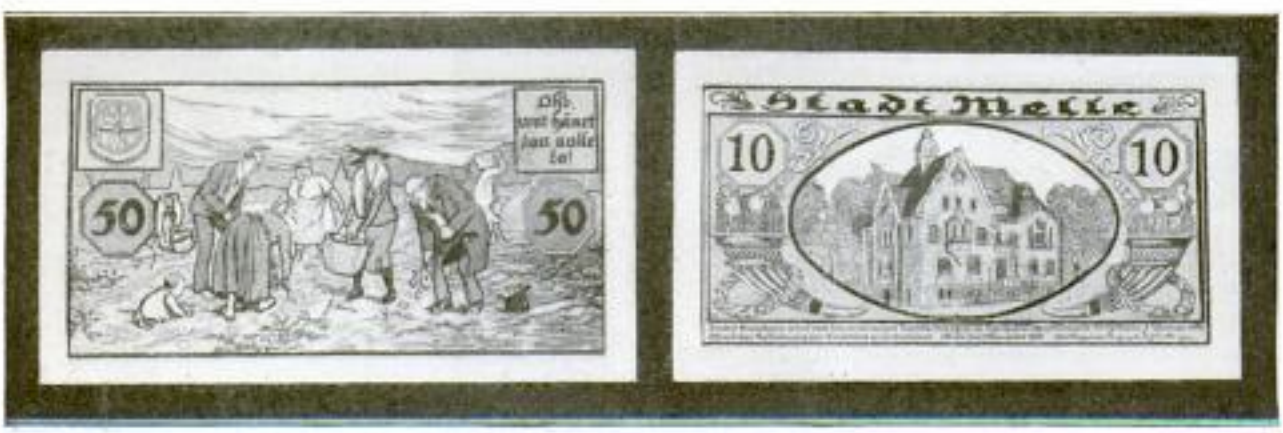
Printing a customer's receipt and making three records of the number of gallons dispensed, all at the same time, is a feature of an improved gasoline pump recently placed on the market by an eastern manufacturer. The measuring chamber is a one-gallon glass cylinder, at the top of the apparatus, which is protected from the weather and damage by a larger glass cylinder which surrounds it. To use, the operator inserts his individual key, sets the indicating lever to the quantity wanted, and starts an electric motor which operates a vacuum pump. When the required quantity has been pumped the motor stops automatically. The recording mechanism keeps track of each operator's sales, total daily sales, and a grand total for the season, as well as prints a customer's receipt, showing the amount of the transaction. As all the gasoline must pass through the officially tested and sealed measuring cylinder, the customer can see that he is getting full measure.

POTASH OUTPUT INCREASED DURING YEAR 1920

An encouraging increase in the potash output of the United States has been noted in the Geological Survey covering the production of that commodity. Of the 167,346 tons of crude potash produced during 1920, 78.4 per cent came from the saline deposits and lakes in Nebraska and elsewhere, while the remaining 21.6 per cent was extracted from distillery waste, cement dust, kelp, alunite, and other similar sources. This represents an increase of 57,103 tons in 1920 over 1919. Several handicaps were encountered during the year which impeded potash recovery to a noticeable extent. The demand for it as a fertilizer suffered somewhat because of adverse economic conditions. Heavy rains also complicated matters by diluting the brines of the potash lakes so that concentration was made very slow.

POTATO-HARVESTING SCENES ON GERMAN MONEY

The reputation of the Germans as propagandists is upheld by some new paper money issued in the city of Melle, in the potato district, for the money not only serves as a medium of exchange, but in pictures and verse urges the people to work hard and save their money. Both the quality of the paper used and the workmanship are much inferior to that of our own bank notes, being of about the variety used in a good grade of commercial printing. The legend on the face of the note informs the holder that it is exchangeable at any time for state currency at the city treasury. The cartoons on the reverse side are printed in three colors, that on the 10-mark note carrying a message of thrift, and that on the 50-mark note urging the necessity of work by all.



Specimens of the Paper Currency Issued by the City of Melle, Germany: The Faces Bear a Promise of Exchange at Any Time for State Currency, and the Backs, Legends Urging Hard Work and Thrift

BIG CANADIAN COPPER PLANT DESTROYED BY FIRE

The plant of the largest copper mine in the British empire, known as the Britannia, and located on the coast of British Columbia, was destroyed by fire, on March 21, last. That day of the year has evil associations for this great enterprise, for on the same date in 1915, 54 persons were killed there by an avalanche, and on the same date in 1913, four men were killed by a snowslide. The loss is valued at $1,500,000, and destroys the development work of 30 years. At the time of its destruction, the mine had reached an output of 25,000 tons of ore daily, and produced 2,000,000 lb. of copper a month. The plant ran 270 ft. up a mountainside where the ore entered, and whence it was carried through the various processes of copper production entirely by gravity, with great economy of power.

A View, Before It was Destroyed by Fire, of the Great Canadian Copper Plant, Showing Smelters, and Tramway Running a Mile Back into the Mountains

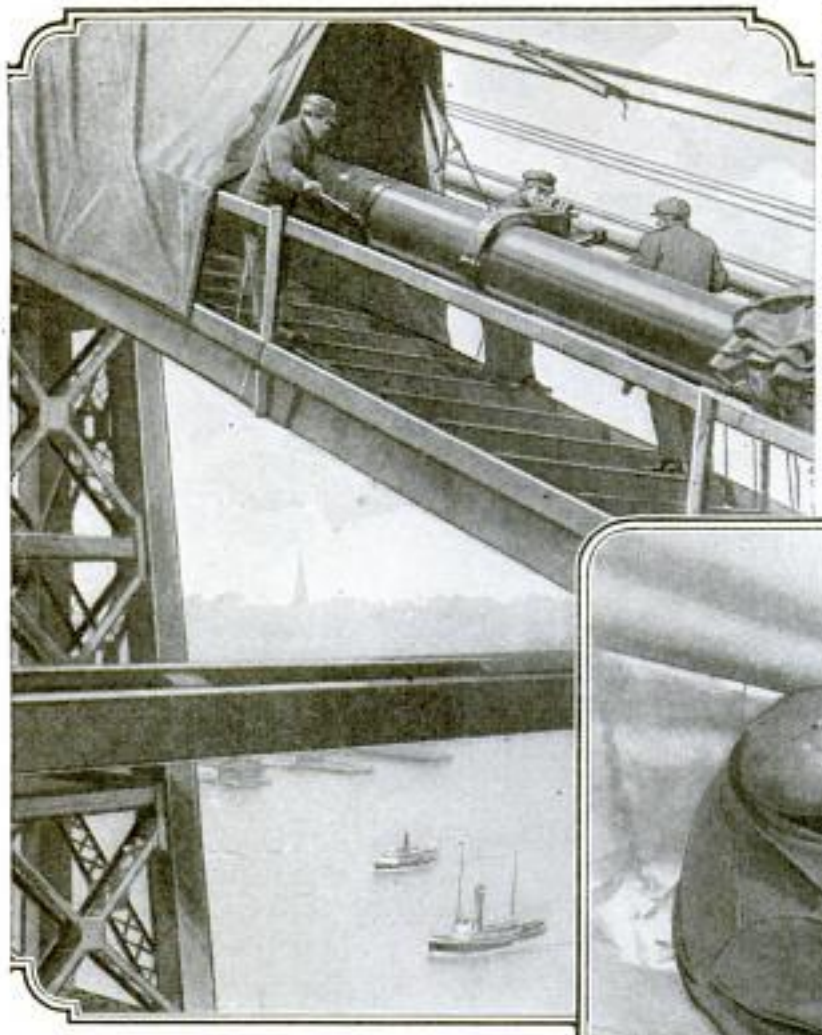
A View Taken Immediately after the Fire, While the Lower Part was Still Burning, That Shows the Great Gap in the Plant Made by the Fire

CROSSING GUARDED BY NUMEROUS SAFETY DEVICES

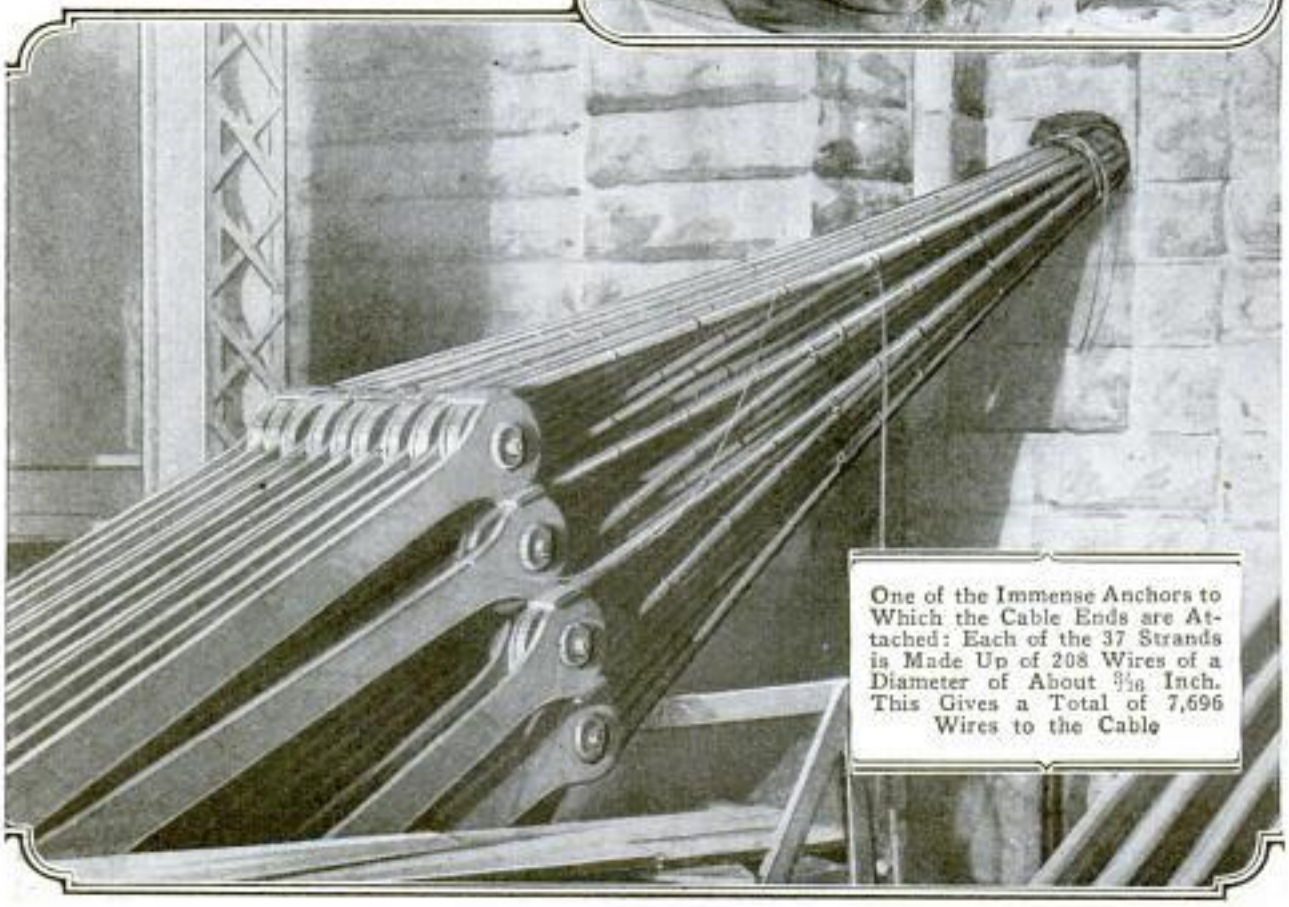
In San Diego, Calif., is a railroad crossing that is often characterized as the best protected in the West. Enumeration of the precautionary measures taken for the public safety bears this out completely. On either side of the track, a block distant, stand warning signposts. Paralleling the track when lowered, are four crossing gates of the bascule type, with sidewalk extensions. On right and left are two electric wigwag signals, and at one side, a large sign with electric gong. Finally, to halt the unobservant ones who would pass all these warnings by, there is the crossing tender with his red flag. A bell in his cabin sends him to his post in the middle of the street when a train approaches. Only a person dogged by persistent ill luck or intending suicide could sustain injury at this point.

Crossing Gates, Wigwag Signals, Electric Gongs, Signs, and a Crossing Tender Combine to Protect This Crossing

WEATHERPROOFING HUGE SUSPENSION BRIDGE



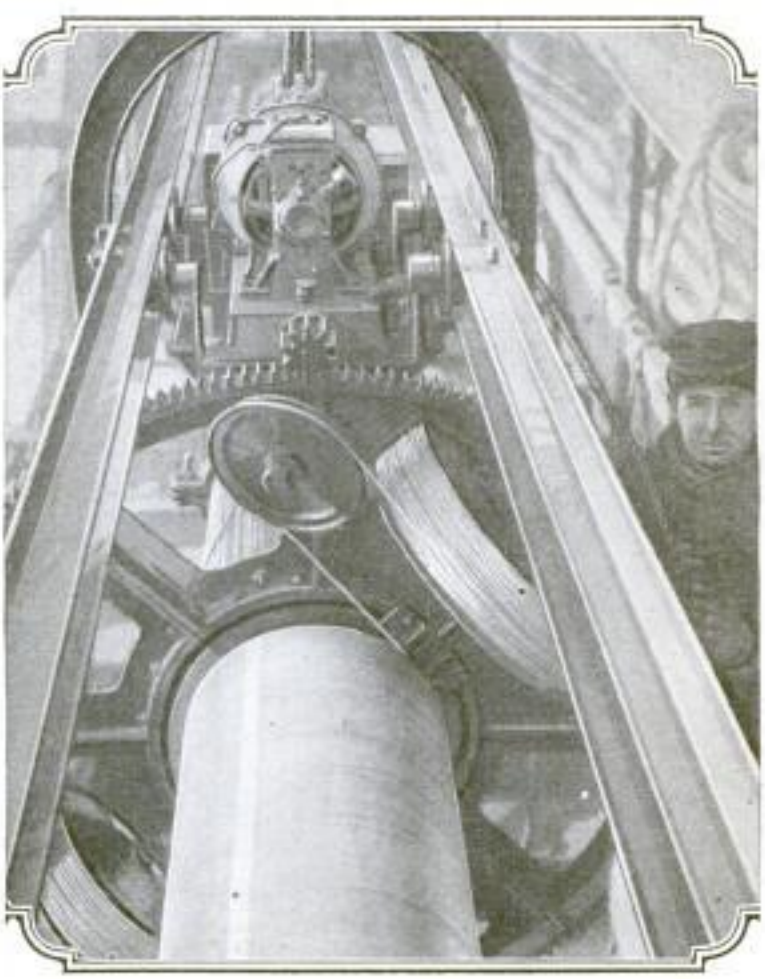
A Close View of One of the Specially Constructed Stairways, Running the Full Length of the Inclined Portion of Each Cable, and a Huge Clamp with Which the Big Rope was Compressed under a Force of 15 Tons, Preparatory to being Wrapped with a Layer of Steel Wire 5/8 Inch in Diameter: Nine Hundred and Seventy Miles of This Wrapping Wire were Required. After the Sections were Wrapped, Steel Bands, Made in Halves, were Applied and Drawn Up Tight with Heavy Bolts. The Vertical Cables, by Which the 1,600-Foot Main Span of the Bridge is Suspended, were Then Attached to the Bands. Below: Lead-Calking One of the Bands to Prevent Moisture from Seeping under It



One of the Immense Anchors to Which the Cable Ends are Attached: Each of the 37 Strands is Made Up of 208 Wires of a Diameter of About 9/32 Inch. This Gives a Total of 7,696 Wires to the Cable

TESTS SKILL OF ENGINEERS AND CRAFTSMEN

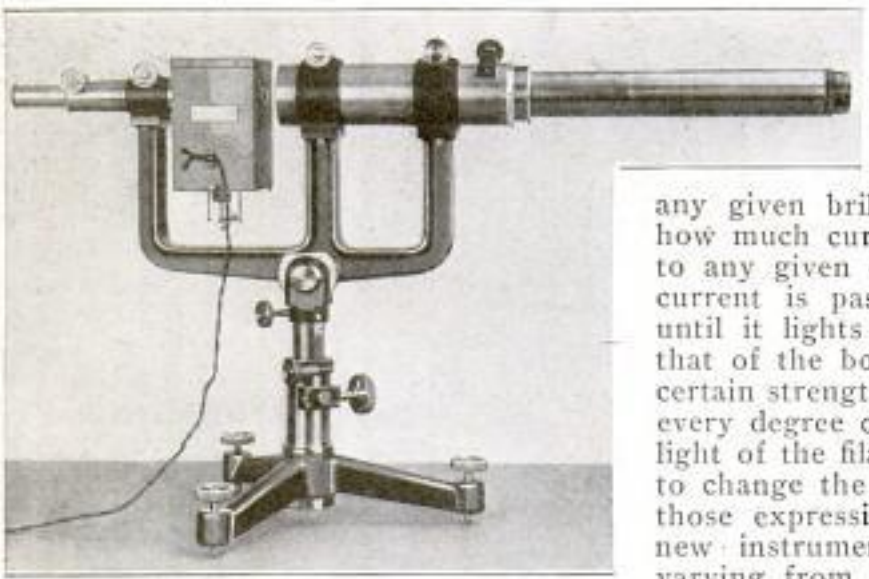
Painting a Bridge would Hardly Seem to Come under the Classification of Engineering Operations, and Does Not When It is Performed on an Ordinary Bridge. However, the Weatherproofing and Decorating of the Immense Williamsburg Suspension Bridge, Spanning the East River from New York City to Brooklyn, cannot be Called an Ordinary Undertaking, but Was Really a Not Inconsiderable Engineering Feat. The Four Great Cables, Shown Above Rising to the Tops of the 332-Foot Towers, Are Each 2,880 Feet Long. When Originally Installed, They were Wrapped in Thick Layers of Oil-Soaked Cloth. It was Decided to Remove These and Replace Them with a Wrapping of 1/8-Inch Steel Wire and to Apply Three Coats of Paint on Top of It. To Do the Job, It Was Necessary to Build Staircases and Platforms under Each Cable and Mount a Heavy Wire-Wrapping Machine in Such a Way That It could Traverse Their Length as the Work Progressed. To the Right Is the Wrapping Machine Traveling along Rails and Wrapping a Section at a Time. Note the Size of the Electric Motor Used to Drive the Apparatus



The Soft-Steel Wire on the Two Reels Measures 1/8 Inch in Diameter and Holds the Thousands of Wires of the Cable under a Pressure of About 15 Tons. This is Done to Prevent Movement of the Wires on Each Other, Which would Result in Chafing and Wear. Each of the Big Ropes is Made Up of 7,696 Wires of a Cross Section of About 5/16 Inch. This Gives a Diameter of 18¾ Inches and a Circumference of Almost Six Feet. The Weight of Each Cable Is 1,116 Tons, with a Rated Breaking Strain of 22,320 Tons

NEW INSTRUMENT MEASURES HEAT WITH LIGHT WAVES

A supersensitive thermometer—scientifically known as a pyrometer—is used in government service to measure the great heat of furnaces, masses of molten metal, etc., by comparing the light thrown off by them with that of the glowing filament of a small incandescent lamp. The latter is inclosed in a chamber, which forms part of a telescope with a magnifying power of 50 diameters. It is known exactly how hot the filament must be to throw off light of any given brilliancy. It is also known how much current is required to light it to any given degree. In use, therefore, current is passed through the filament until it lights to the same brilliancy as that of the body being measured. As a certain strength of current is required for every degree of increase in the heat and light of the filament, it is an easy matter to change the electrical values over into those expressing degrees of heat. The new instrument measures temperatures varying from 1,292° to 9,032° F. within about .2° of absolute accuracy, which is a close limit considering the wide range.



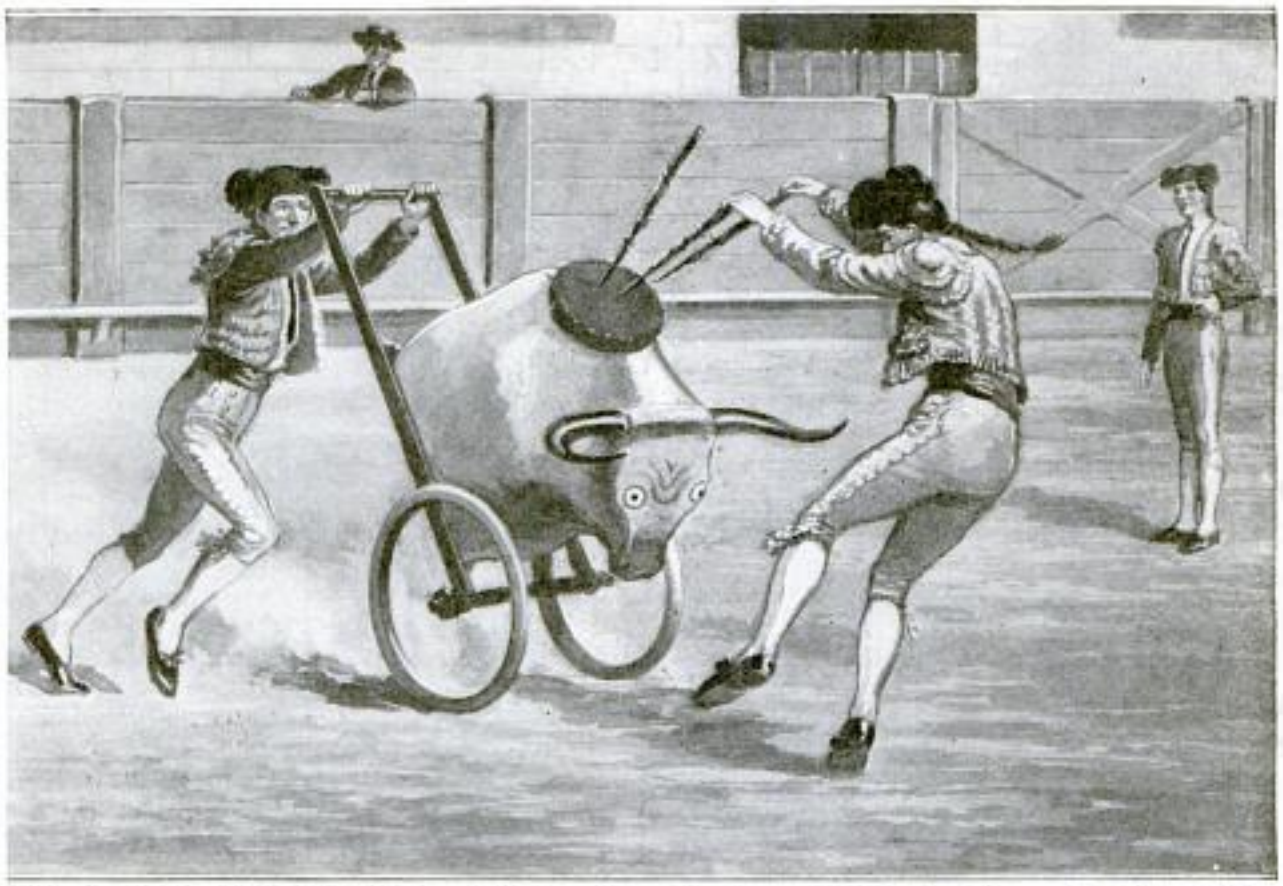
Pyrometer—High-Reading Thermometer—Used by the Government to Measure Temperatures of from 1,292° to 9,032° Fahrenheit

SINKING A CAPTURED U-BOAT

On a foggy afternoon recently the famous German "UB-88," which sunk 16 allied ships during the war, was towed to a point five miles off the San Pedro, Calif., lighthouse; the destroyer "Wickes" took up a position approximately two miles away, and in a few moments 43 shells of 55 fired by the 4-in. guns of the "Wickes" sunk the huge iron monster.

The "Wickes'" shots nearly all took effect in the bow of the U-boat; consequently this end quickly became filled with the inrushing water. Sinking lower and lower, the stern suddenly lifted until fully 100 ft. of the boat was out of water. It stood in this position for a moment, and then dived for the last time.

The Last of the German Submarine "UB-38": Pausing an Instant, as if in Farewell, with the Bow Submerged and Over 100 Feet of Its Length Extending Heavenward, It Finally Passed from Sight in a Mighty Dive. Right: The Undersea Fighter being Towed to Its Last Resting Place



Using the Mechanical Bull for Training Bullfighters in a School near Madrid: Swinging on Its Light Rubber-Tired Wheels, the Machine is Made to Execute All the Motions of an Enraged Animal

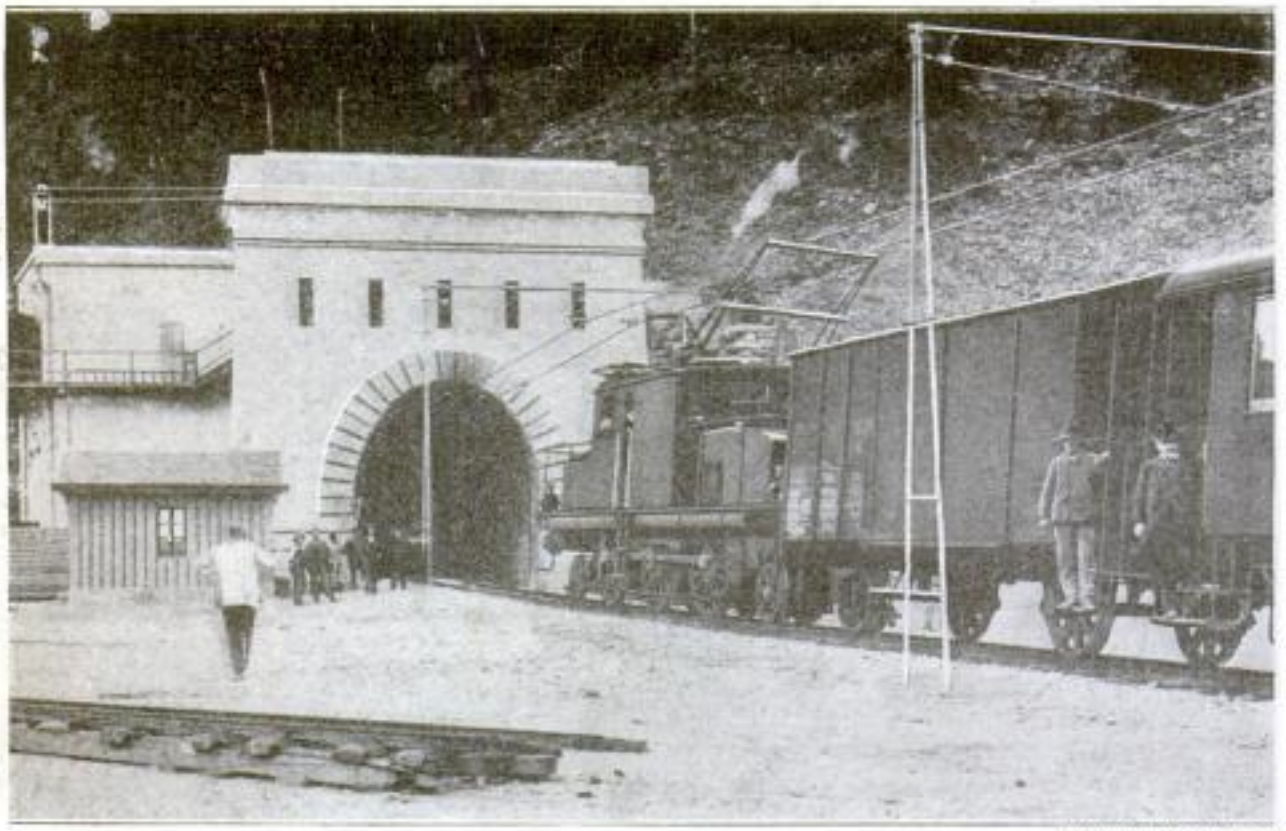
MECHANICAL BULL ON WHEELS TRAINS SPANISH MATADORS

Bullfighting as a sport is so important a part of life in Spain that a school in a Madrid suburb is devoted to training young toreadors and matadors in the dangerous art. The apparatus used consists of a massive block of wood roughly shaped like the head and shoulders of a bull, equipped with real horns, and mounted on a pair of rubber-tired wire wheels. By means of a handlebar at the rear, the instructor plunges this formidable machine toward the student, who must learn to avoid the menacing horns while making effective use of his lances. Swinging quickly on its light carriage, the mechanical bull makes a most realistic imitation of an enraged animal.

LOG CABIN OF RUGS MAKES NOVEL WINDOW DISPLAY

An Idaho merchant desiring to make a pleasing display of an assortment of rugs, conceived the idea of building a cabin of them whose logs were the various rugs rolled up. The cabin had a window and door in it, and these were contrived by the use of smaller rugs, not long enough to stretch from corner to corner of the building. Cards bearing significant advertising were placed about the log house, and fir trees stood in the clearing in front of it. Many people were attracted to the window because of the unusual display.

The Logs of the Cabin Window Display Were Rugs Rolled Up. Card Ads and Fir Trees Helped to Set Off the Attractive Scene

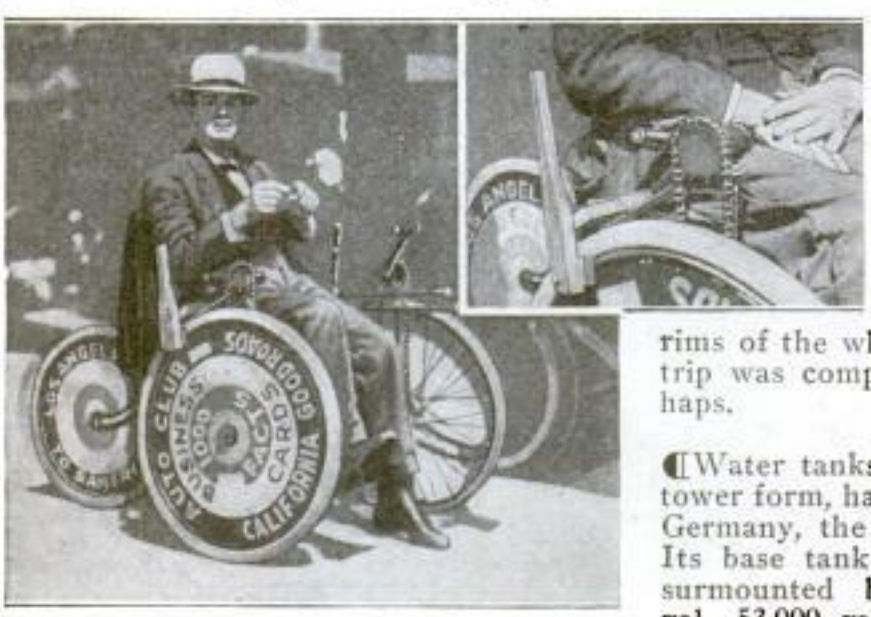


ELECTRIC TRAINS SOON TO RUN THROUGH SIMPLON TUNNEL'S SECOND BORE

THOUGH the great Simplon tunnel, boring for more than 12 miles through the Alps from Italy to Switzerland, has always been listed as a single-line railroad tunnel, a second parallel gallery was cut for ventilation purposes at the time the main opening was made, in 1906. The work of enlarging this second bore to accommodate another line of electrified track, interrupted by the war, is now nearing completion, and this summer, it is expected, modern electric trains will begin to stimulate European traffic by adding their 100 per cent to the transalpine facilities. In the picture, an electric locomotive hauling the type of train used is seen as it is about to enter the long subterranean passage on the Swiss side.

AGED INVALID MAKES LONG TRIP IN WHEEL CHAIR

A remarkable trip from Los Angeles to San Francisco, via hand-propelled wheel chair, was recently completed by E. B. Davis, an invalid gentleman 60 years of age, in the very good time of 30 days and at an expense of $100. Due to the fact that the chair could not be quickly stopped, it once crashed into the curb and threw the rider out. At another time the breaking of a chain, on a downgrade, resulted in the chair and rider tumbling down a 100-ft. sloping embankment. Following these accidents, hand-operated brakes, bearing upon the rims of the wheels, were devised, and the trip was completed without further mishaps.



This Courageous Tourist Made the Trip from Los Angeles to San Francisco in 30 Days. Top View: One of the Emergency Brakes

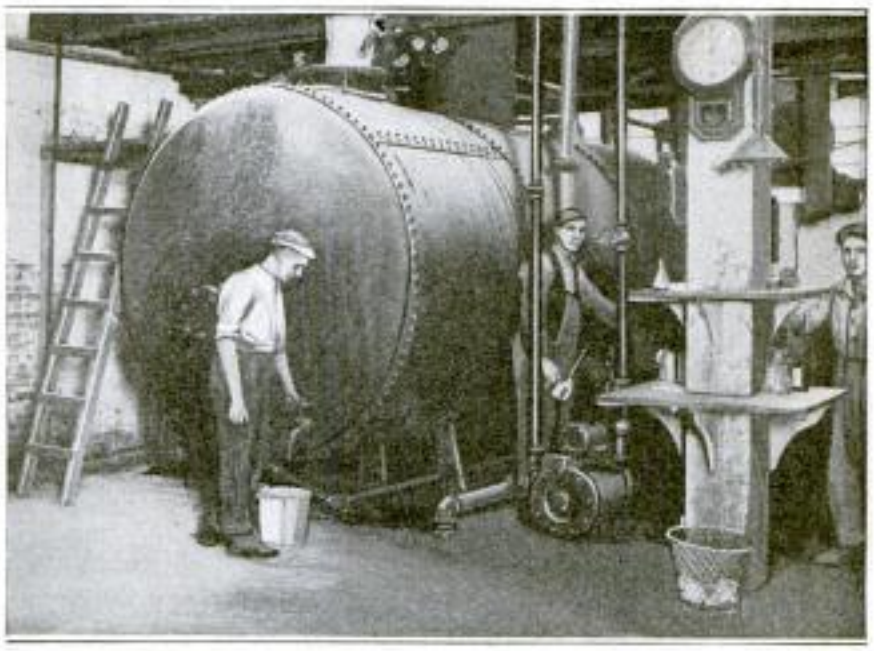
¶ Water tanks of reinforced concrete, in tower form, have recently been adopted in Germany, the largest being 200 ft. high. Its base tank holds 132,000 gal., and is surmounted by others, holding 17,000 gal., 53,000 gal., 132,000 gal., and 262,000 gal., respectively, the top tank being 36 ft. high.

CRYSTALLIZED SUGAR MANUFACTURED FROM CORN

By S. R. WINTERS

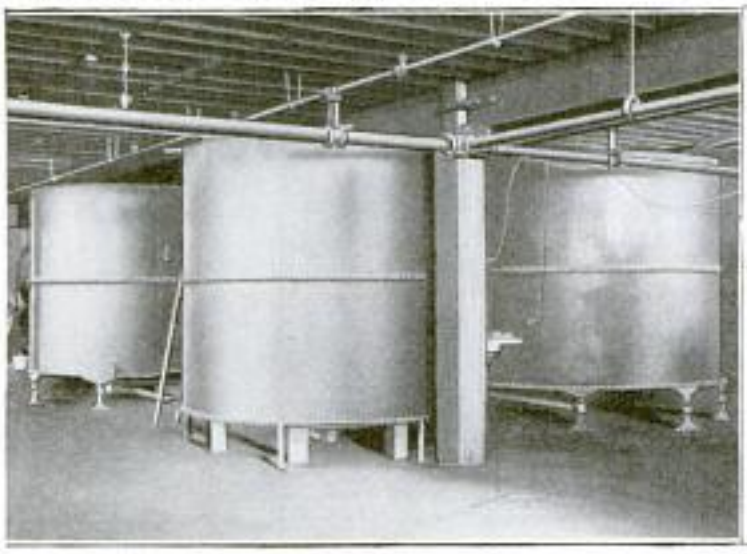
THE commercial production of a sugar possessing the approximate sweetness of cane sugar, obtainable from a source of low-priced raw material, with the finished product resolving itself into a crystallized form, has been the objective toward which chemists have struggled unceasingly for decades. Now, thanks to the unremitting research of an eastern chemist, sugar is being made commercially from corn. A Baltimore manufacturing establishment, working two shifts of 12 hours each, is producing approximately 70,000 lb. of corn sugar daily, chemically known as "invertose."

The new process involves the production of sugar of a group technically known as ketohexoses, or fruit sugars. The fruit sugars are sweet, the sugar obtained by this process being 80 per cent as sweet as cane sugar, and possessing other favorable qualities. One of the members of this group is levulose, or honey sugar, which is found in honey, sweet fruits, and is present in invert sugar, which is made from cane sugar. Methods are known for producing honey sugar, but they are chiefly laboratory methods—extremely costly, utilizing rare materials, and therefore beyond application to commercial production. Corn, containing from 65 to 70 per cent of starch, was selected for its starch-yielding capacity, and by reason of its well-nigh inexhaustible supply and availability. One bushel of corn will yield 46 lb. of invertose.



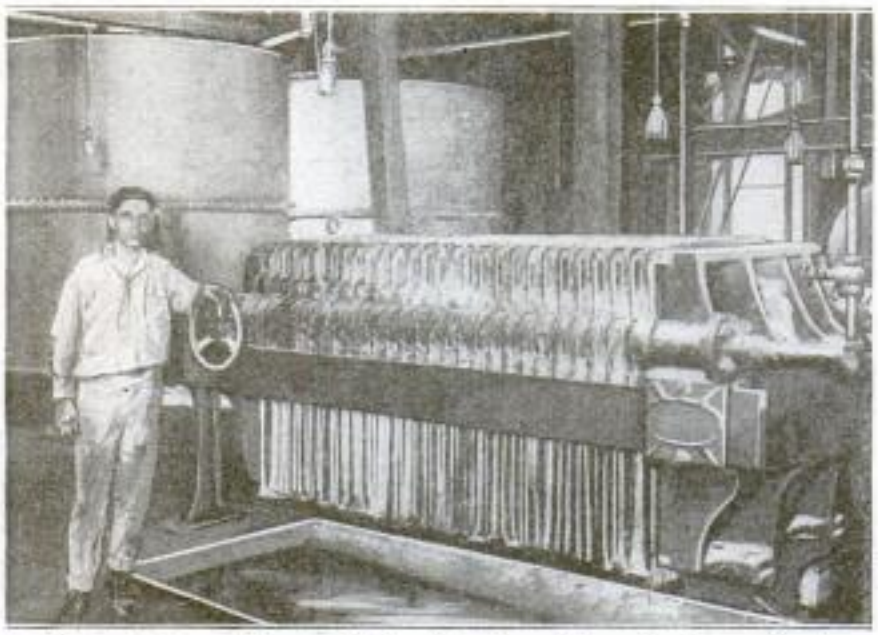
The Converter in Which the Starchy Content of the Material is Transformed into Liquid State: The Converter Is Seven Feet in Diameter, 16 Feet in Length, and Air Instead of Mechanical Agitation is Used to Stir the Contents

The method as discovered for preparing invertose from corn, or other starchy material, is first to produce an intermediate compound from starch in the material used and then convert this intermediate into a ketohexose, or fruit sugar, by well-known means. To effect the first reaction, a new kind of malt is used, heretofore unknown, which accomplishes this



Left: From the Converter, the Starch Liquor is Conveyed to Two Tanks, Ten Feet in Diameter and Eight Feet High, with a Capacity of 30,000 Pounds. Situated Immediately in the Rear Are Two Tanks Where the Third Process, Namely the Formation of Honey or Fruit Sugar, is Completed. The Reduction is Effected by the Process Known as Hydrogenation. Right: Flow Sheet Showing the Entire Process of Manufacture of Invertose Sugar

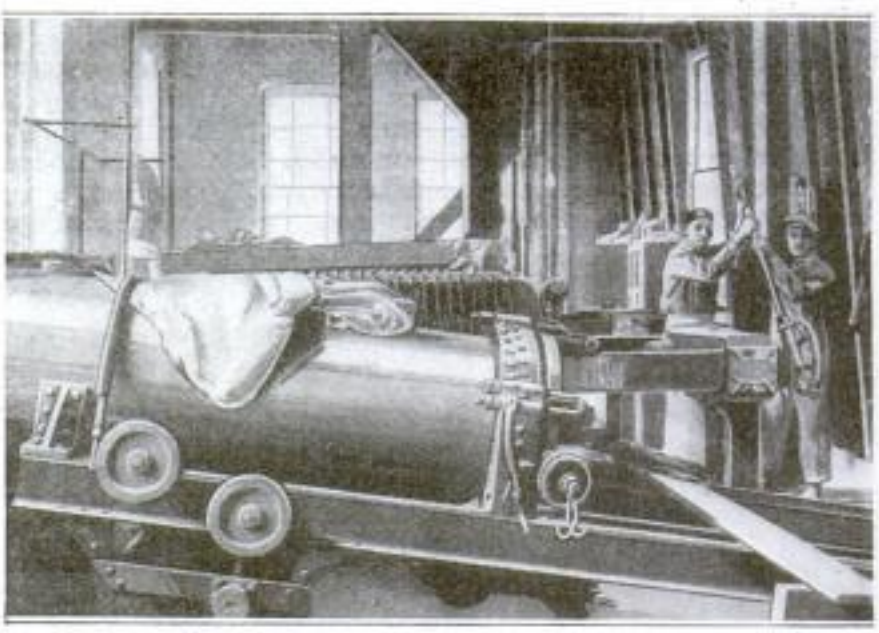
transformation quite readily. The formation of the intermediate compound from the starch, which was previously treated so as to be readily acted upon by the new malt, proceeds smoothly. The second reaction is effected by any of the well-known methods of reduction, such as hydrogenation, or treating with hydrogen gas, whereupon is formed the fruit sugar, or invertose.



By Means of Steam Pumps the Liquid is Forced from the Large Tanks on the First Floor to the Fourth Floor, Where Filtration Serves to Separate the Insoluble Protein Material. The Residue is Used as Stock Feed

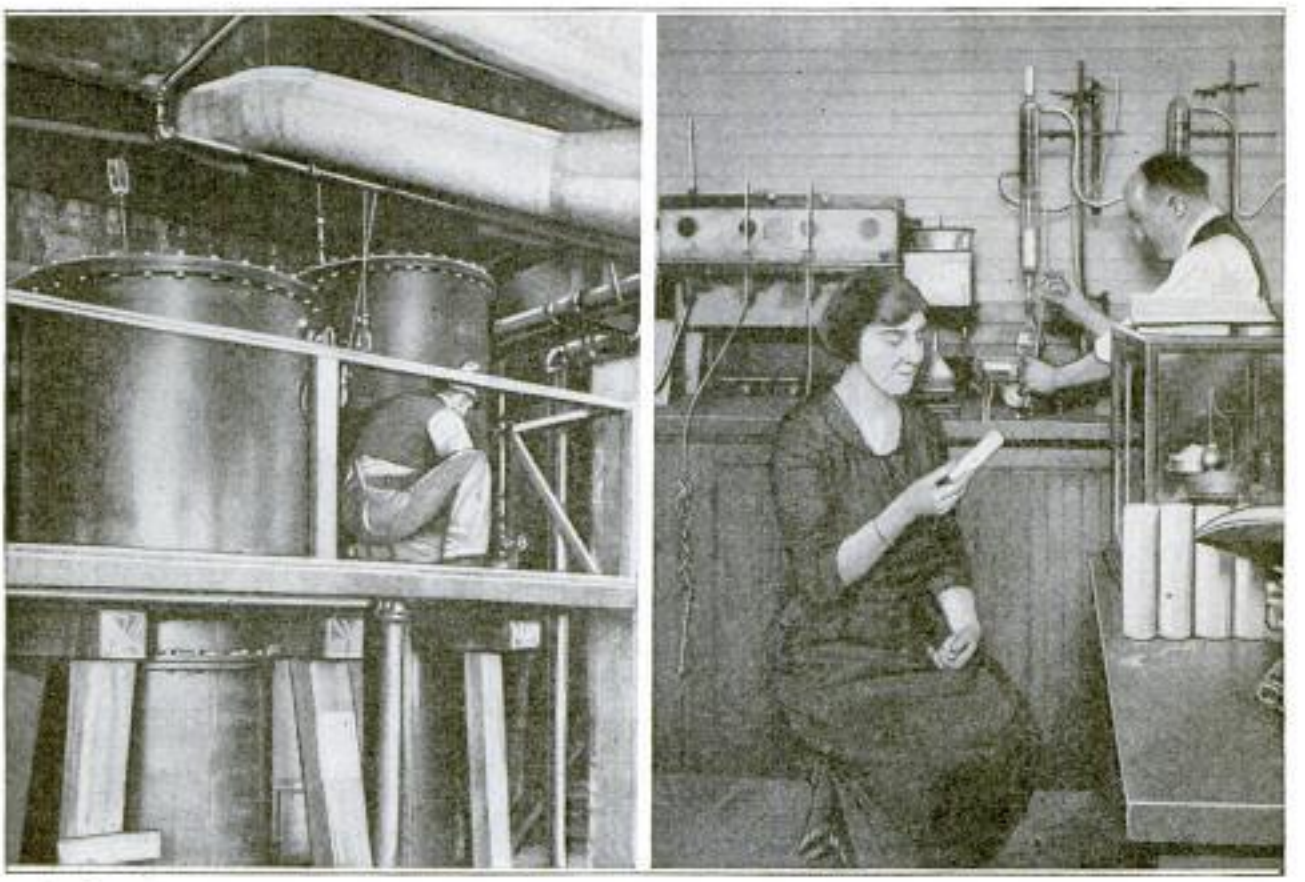
Only six hours elapse from the time the ground corn—either corn meal or flour—is placed in the machine for the formation of the starch until the finished product comes from the evaporators in the form of a sirup to be barreled for shipment. Invertose is not a by-product, but is made directly from whole corn, with no waste, as about 16 lb. of wet mash to every bushel is recovered as cattle food. If sold in crystallized form, two days are required in which to crystallize the product. It is readily marketable to confectioners, preserve and fruit packers, ice-cream manufacturers, soft-drink bottlers, and also for use by the restaurant trade. With corn selling at $1 a bushel, the new sugar can be manufactured for 2½ cents a pound, thus salable at half the price of cane sugar.

Invertose, according to claims of its producers, is practically all sugar, containing 55 per cent dextrose or grape sugar; 25 per cent levulose (honey or fruit sugar), and 20 per cent water. In its solid, or dry, form the analysis shows 65 per cent grape sugar, 33 per cent honey or fruit sugar, and 2 per cent water. When dry, it is 80 per cent as sweet as cane sugar, and in the other (sirup) form is 65 per cent as sweet as cane sugar. The honey or fruit sugar contained in the new product has hitherto never been obtained from starch, and there has never been a sirup of this kind produced from corn or any other starchy material. Previous experiments for a quarter of a century failed to perfect a process to produce this honey or fruit sugar commercially. Corn sirup, and sugar as commonly manufactured, require a twofold operation, it being essential first to produce the starch and then the finished product. Four days are necessary to complete the corn-sirup process, while the new process takes only six hours.



Sugar is Supposed to be White; Therefore in Changing the Original Brownish Color of Invertose Sirup to the Whiteness of Granulated Sugar, Bleaching with Charcoal Is Necessary. A Common Filtering Machine is Used to Separate the Charcoal from the Sirup after the Bleaching

Calculating the yearly corn crop in the United States to be 3,000,000,000 bu., if the entire yield were converted into in-

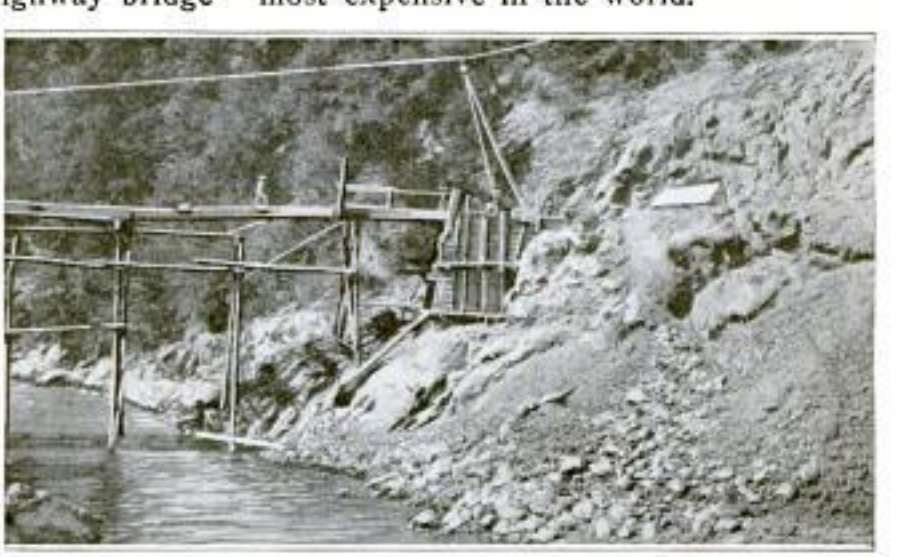


Left: A Second Set of Evaporation Tanks Reduces the Sirup to the Required Density. It is Then Pumped into Barrels as a Sirup or Noncrystallized Sugar. Right: Two Days having Elapsed, the Sugar Assumes a Crystalline Form, Hard Enough Even to be Eaten as Candy. It Has 80 Per Cent of the Sweetness of Cane Sugar, and Is as White in Color

vertose, there would be 70,000,000 tons of corn sugar. This imaginary output exceeds by four times the annual production of cane sugar throughout the entire world. Any product possessing a high percentage of starch—for instance, tapioca—is convertible into sugar by the application of the new chemical process.

CEMENT FOR CONCRETE BRIDGE SHIPPED BY PARCEL POST

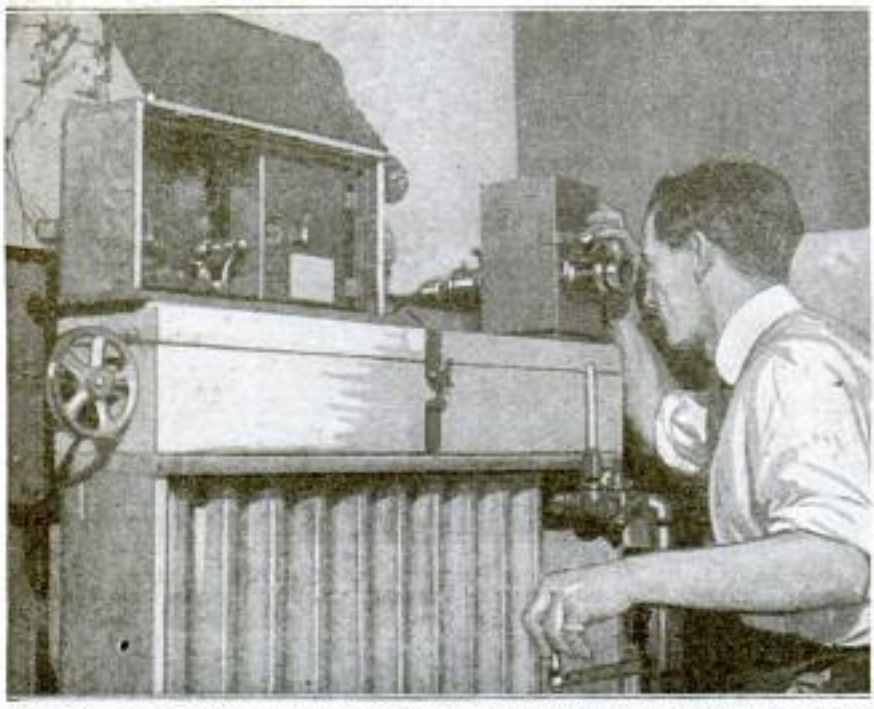
Across a stream in Siskiyou County, northern California, is a highway bridge which has as its title to fame the fact that the first work was done with cement shipped by parcel post. This novelty was the result of the contractor's discovery that, because, at first, the roads would be bad, it would cost him more to truck the material himself than to let the Post Office Department do the carrying at its usual rates. In consequence he split the sacks in two to keep the consignments within the weight limit, and mailed them to the scene of operations at the rate of $1.16 a hundred pounds. A total of several barrels was made available in this way for the first work on the abutments, which, for their size, are, probably, the most expensive in the world.



In the Middle of the Picture is Seen the Abutment, the First Work on Which was Done with Cement Shipped by Parcel Post. A Total of Several Barrels was Mailed to the Scene in This Way

NEW SYSTEM DEVELOPS MOVIE FILMS IN DAYLIGHT

Development of motion-picture films, commonly a matter of huge dark rooms, cumbersome racks, and wasteful troughs of fluid, has been greatly simplified by a new form of developing machine, now in use at a west-coast studio. In the improved process, the film is developed in 10 vertical tubes 20 ft. long, with 40 ft. of film looped in each tube, so that 400 ft. is handled at one time. The film magazine is transferred from the camera to the machine in broad daylight, and the pictures are viewed, while developing, through a lens at the top. Fixing solution and washing water are substituted for developer by means of hand valves, and a gauge shows the height of liquid at all times. Larger models will handle an entire 1,000-ft. reel in one 30-minute operation, giving pictures of uniform density and clearness.



The Operator is Observing the Development of the Films through a Lens Which He is Focusing with His Right Hand, While, with His Left, He is Controlling the Developing Machine

POP-CORN CRIB IS LARGEST IN THE WORLD

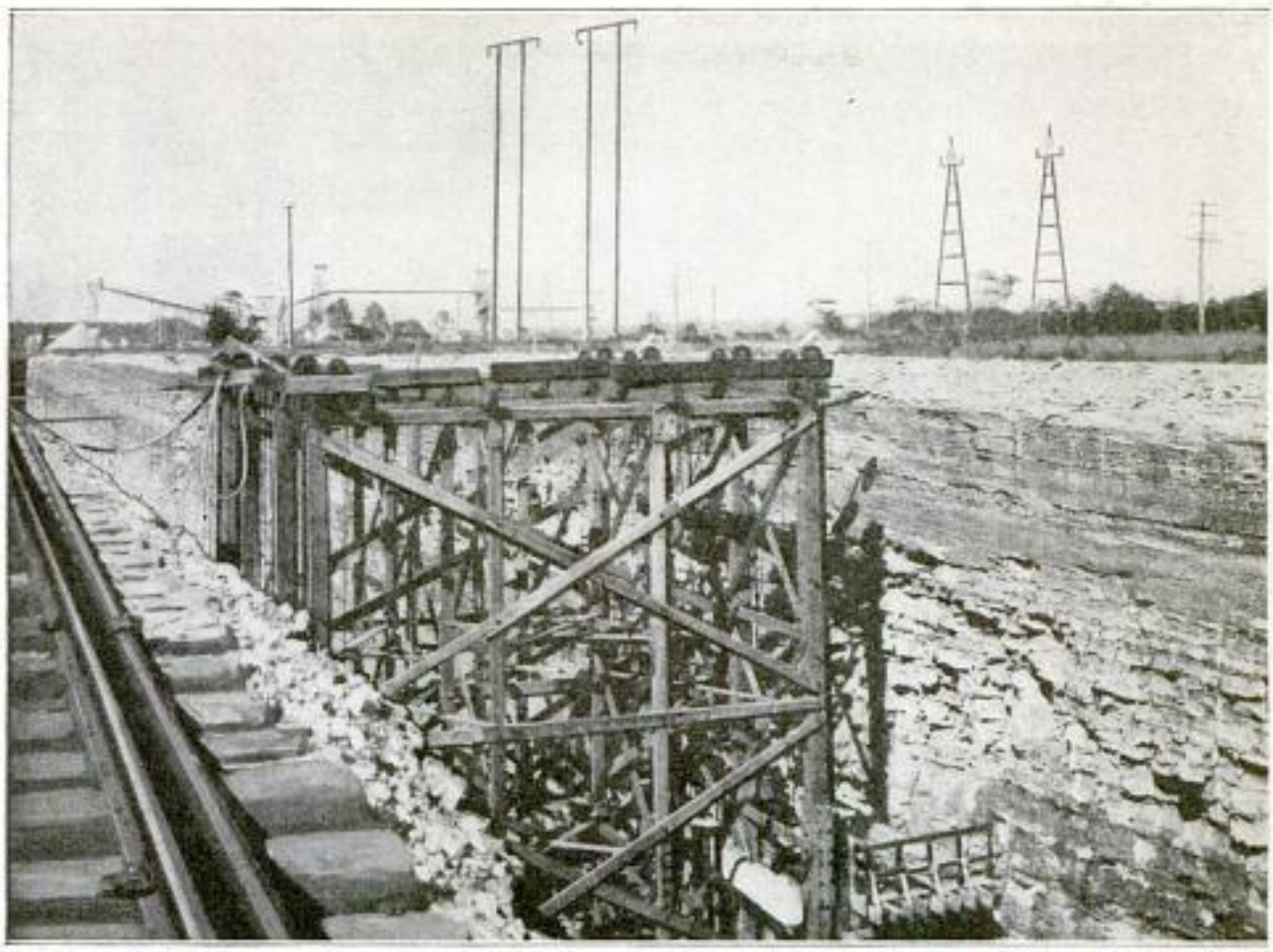
A corncrib built expressly for the storage and dispensation of pop corn and, it is said, without competition for size, is located at Leeds, a village near Sioux City, Ia. It handles a large part of the corn harvested in the adjacent territory and is equipped with a modern conveying system for receiving and removing the corn. The building is 170 ft. long, 24 ft. wide, and 24 ft. high, and is erected upon concrete posts for keeping rats out. Storage capacity for approximately 3,000,000 lb. of ear pop corn, is available.

"ULTRACLAY" IS NEW SUBSTANCE FOUND IN SOIL

The subject of the mechanical properties of soil has long been an important, and often vexing, problem for engineers, and many questions yet remain to be worked out in spite of about a hundred years' study. The Department of Agriculture has just announced the discovery of a new substance in the soil which may help clear up the subject. This new material has been given the name of "ultraclay." It resembles resin in appearance when dry, and when wet it is a gelatin-like material, quite sticky and plastic. It seems to be a silicate of alumina. Sand, when mixed with 10 per cent of this substance and made into blocks and dried, has a crushing strength equal to the same quantity of Portland cement, but these briquettes will fall to pieces when wet.

PNEUMATIC ARCH SUPPORT BOON TO TIRED FEET

Those who are compelled to be on their feet many hours a day, and who, therefore, suffer from foot and limb fatigue and the pains arising from this cause, will be interested in a sponge-rubber arch support especially designed to relieve the small bones of the foot of their burden and transfer it to the larger bones and parts which do not tire so easily. The soft-rubber pad, shaped to a correct fit, is recessed with 15 indentations which permit greater flexibility than would be the case were it solid. It is cemented to a smooth leather insole, which is worn next to the hose.



Finishing the Queenstown-Chippewa Canal around Niagara Falls: The Traveling Frame is Moved Along as the Work Progresses. One of the Suspended Platforms is Shown at the Right

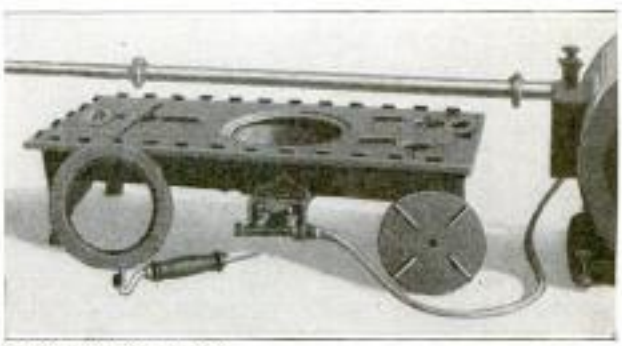
TRAVELING SCAFFOLD USED IN FINISHING CANAL WALLS

The lower end of the Queenstown-Chippewa canal, around Niagara Falls, was blasted for about two miles through the solid limestone of the region, leaving the walls very rough, with sharp, jagged masses of rock projecting beyond the true vertical line. To remove these and finish the walls quickly, a timber framework, the full depth of the cut and almost the full width, was constructed and mounted on car wheels, upon which it was easily moved forward as the work progressed. Workmen, standing upon vertically movable platforms, suspended by cables from both sides of the structure, chopped away the projecting rock points with picks. At the same time steel rods were driven into the walls, at intervals of about 2 ft., and bent upward at right angles, to afford a solid anchorage for the concrete facing which was applied later.

¶A school for the training of expert diamond cutters will be opened at Johannesburg, Africa, in the near future. The cost will be about $75,000.

IMPROVED GAS STOVE IS VERY ECONOMICAL

At a recent exposition of stoves and cooking equipment, held in France, an improved gas stove won honorable mention on account of its exceptional economy. It has but one burner, which is so completely surrounded by heat-insulating materials that nearly all the heat is directed to the cooking vessels, very little of it being lost and wasted in the air. The scientifically insulated internal passages lead the heat to holes, over which three or four cooking operations may be carried on at one time.



A Single-Burner Gas Stove Which Cooks Three or Four Things at a Time

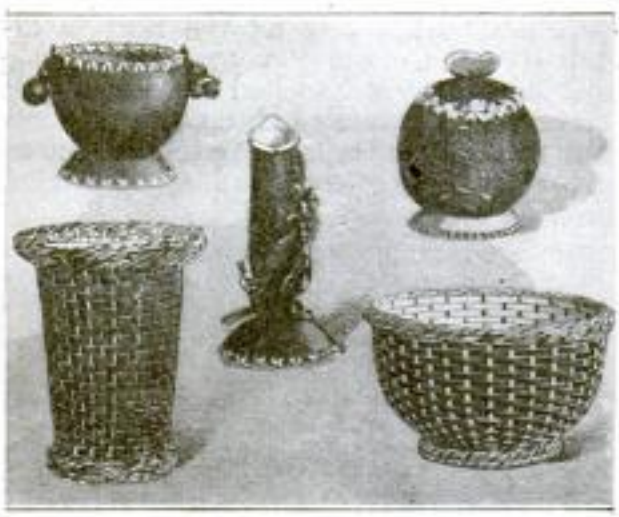
TREES WATERED BY SWINGING SPOUT ON TANK WAGON

A California city is carefully cultivating a row of young live, or evergreen, oaks along an eight-mile stretch of highway. After attaining a certain stage in their growth, the trees thrive through long arid spells without irrigation, but the young trees demand careful attention and frequent irrigation. To facilitate watering the trees, the municipal gardeners have mounted a large water tank on a spring wagon. The tank is equipped with a swinging spout which conducts the water to the trees.

Tank Cart, with Swinging Spout, Used to Water an Eight-Mile Row of Evergreen Oaks along a California Road

WEAVING SEAWEED BASKETS IS A GROWING INDUSTRY

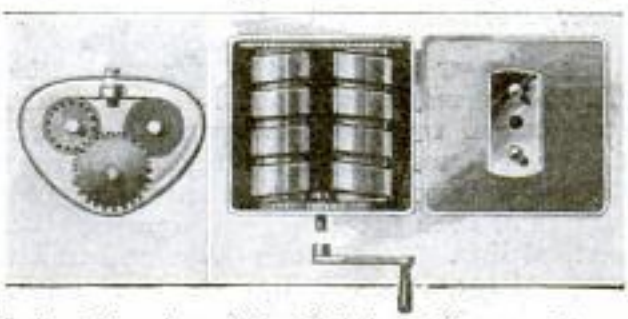
The strong, tough strands of the variety of seaweed known as giant kelp, which grows in abundance along the coast of the Americas, have been found to be an ideal material for the weaving of all sorts and sizes of baskets, reed furniture, and like articles. It is said to be greatly superior to willow and rattan for the purpose, as it is much more pliable than other materials, and therefore more easily worked. Many persons believe that plants which grow in water are tender when wet, and fragile when dry. This is not true of kelp, the fibers being of leatherlike consistency and toughness, and the strands, size for size, nearly as strong as leather. So rapidly does the weed grow that the crop may be harvested at six to ten-week intervals. The 50 to 100-ft. lengths are split up into narrow strips and dried. In fashioning the various pieces of furniture, the strands are woven in such a way that the natural brown shade of the plant's exterior forms the outside of the article, and the velvety white heart, the interior.



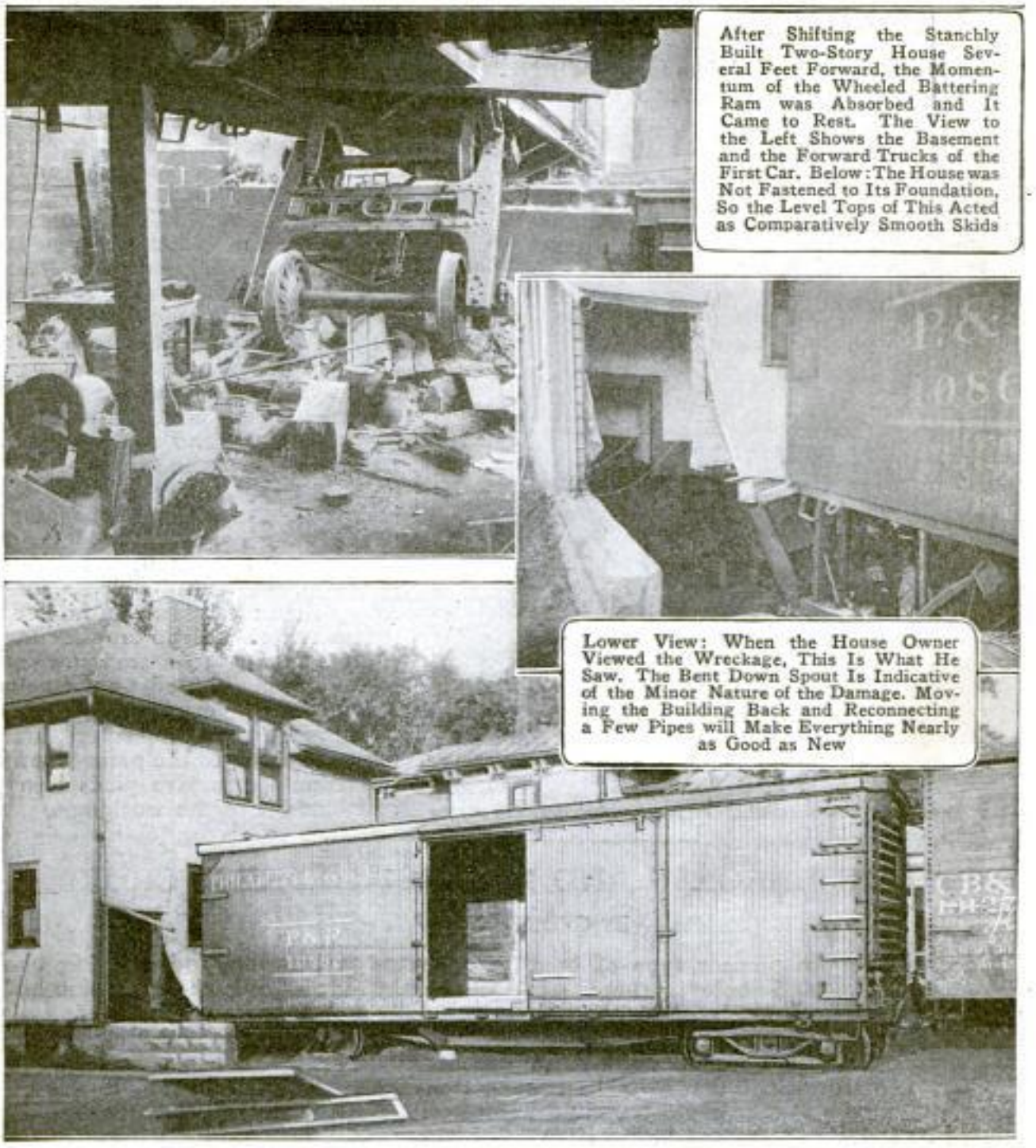
Fancy Baskets Woven of the Variety of Seaweed Known as Giant Kelp: This Material Also Makes Large Articles Such as Clothes Hampers and Reed Furniture. It is Said to Be Easier to Weave than Rattan or Willow

SHARPENER FOR RAZOR BLADES HOLDS THEM MAGNETICALLY

A novel feature in connection with a razor-blade sharpener is the use of a magnet for holding the blades in place during the sharpening process. The sharpener is in the form of a box containing two sharpening cylinders, which are geared together and are operated by a small crank outside of the box. The hinged lid of the box carries on its inside face a permanent magnet, from either end of which are circular projections to fit the holes in the razor blade. When the box lid is open, the blade is dropped onto the pins which magnetically retain them, and when the lid is closed the blade is brought into position for sharpening by the revolving cylinders.



Left: View through the End of the Sharpener Showing the Driving Gears. Right: Device Open, with Razor Blades Held in Position by the Magnet



After Shifting the Stanchly Built Two-Story House Several Feet Forward, the Momentum of the Wheeled Battering Ram was Absorbed and It Came to Rest. The View to the Left Shows the Basement and the Forward Trucks of the First Car. Below: The House was Not Fastened to Its Foundation, So the Level Tops of This Acted as Comparatively Smooth Skids

Lower View: When the House Owner Viewed the Wreckage, This Is What He Saw. The Bent Down Spout Is Indicative of the Minor Nature of the Damage. Moving the Building Back and Reconnecting a Few Pipes will Make Everything Nearly as Good as New

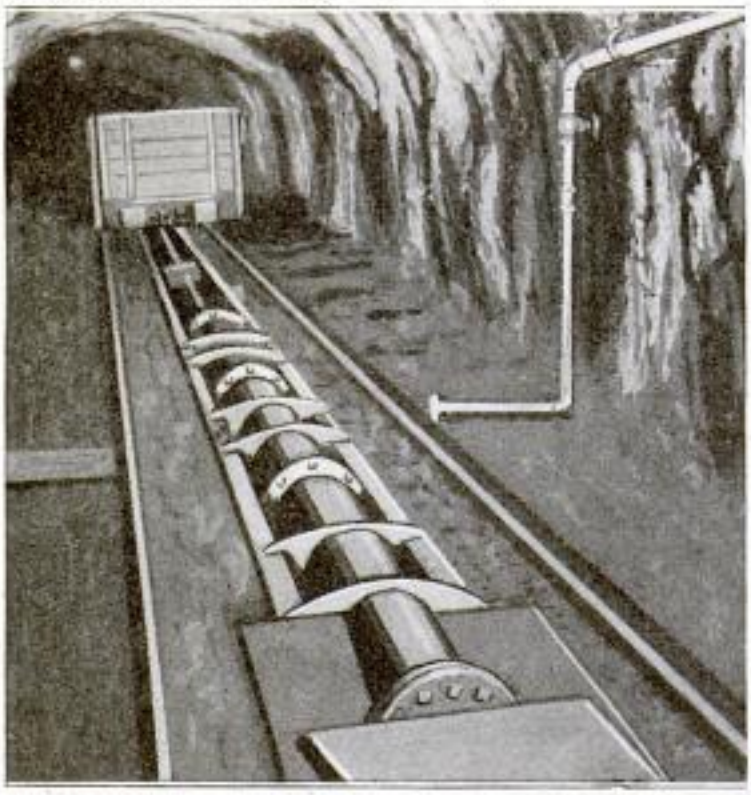
IMPACT OF FREIGHT TRAIN MOVES HOUSE SIX FEET

It is an incredible thing to return home from a day's work in a peaceful country town, knowing there has been no earthquake or tornado, and find that one's house has moved forward 6 ft. on its foundation, leaving the front porch hanging in the air. Yet that is just what happened the other day to a resident of Lake Geneva, Wis. The astonishing displacement of the good-sized stucco house was caused by the impact of two freight cars against its rear wall. The cars had been standing on a siding whose earth bumper was a good 60 ft. away, but when a loaded ice train backed swiftly into them, instead of making a coupling they hurtled over the bumper, through a high board fence, across the back lawn, and into the house, where the leading car dropped its foremost truck into the basement through the opening it made. A curious feature of the accident was that no windows were broken.

¶A paint, so luminous that a newspaper may be read in its soft glow and which can be used in connection with advertisements in darkened rooms, such as motion-picture auditoriums, etc., has recently been produced by an Italian inventor.

COMPRESSED-AIR GUN SHIFTS COAL-MINE CARS

Both empty and loaded cars are handled in an eastern mine by a clever system of inclined tracks, a switchback, and a 12-ft. compressed-air cylinder and piston, located between the tracks, which might properly be called a gun, as it actually shoots the cars into position on an incline leading to the hoisting cages. The gun, or pusher, as the miners call it, is located 42 ft. from the cages. The first 12 ft., the length of the piston travel, are upgrade from the pusher, and the remaining 30 ft. downgrade. When a loaded car comes within reach of the pusher piston, a fitting on the latter engages the axle, and as the piston moves outward, the car is pushed up the short grade onto the 30-ft. incline to the cages. Dropping to the latter by gravity, the loaded car "kicks" the "empty" off the platform, and takes its place. The empty then rolls down an incline, past a switch and up another incline. Coming to a stop it rolls back, but is shunted to a track, reserved for empties, by the switch. A second pusher then moves it along to the point where the mine locomotive picks it up and hauls it to the workings.



BY COURTESY OF THE COAL AGE

The 12-Foot Cylinder and Piston Rod of This Compressed-Air Gun, or Pusher, Move the Loaded Cars up a Short Incline. They Then Run Down Another Incline to the Hoisting Cages

WORLD'S LARGEST AND FASTEST EXPRESS CRUISER

BY GEORGE F. PAUL

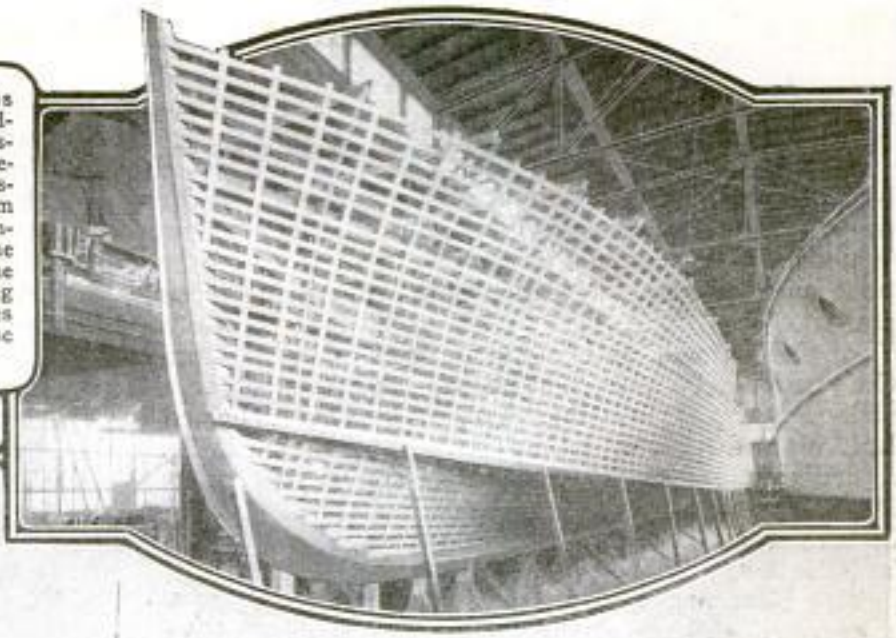
BY developing a pioneer type of boat never attempted before, there has been built what is declared to be the world's largest and fastest express cruiser. The boat builders were commissioned to produce a motor yacht that would have abundant room and that could travel at a clip of 30 miles an hour, or better if desired.

After a great deal of experimental work, involving tests of various models at the naval tank at the University of Michigan, it was decided that a boat could be built substantially 104 ft. in length, which would develop a speed of better than 30 miles an hour, powered with 1,600-hp. gasoline engines.

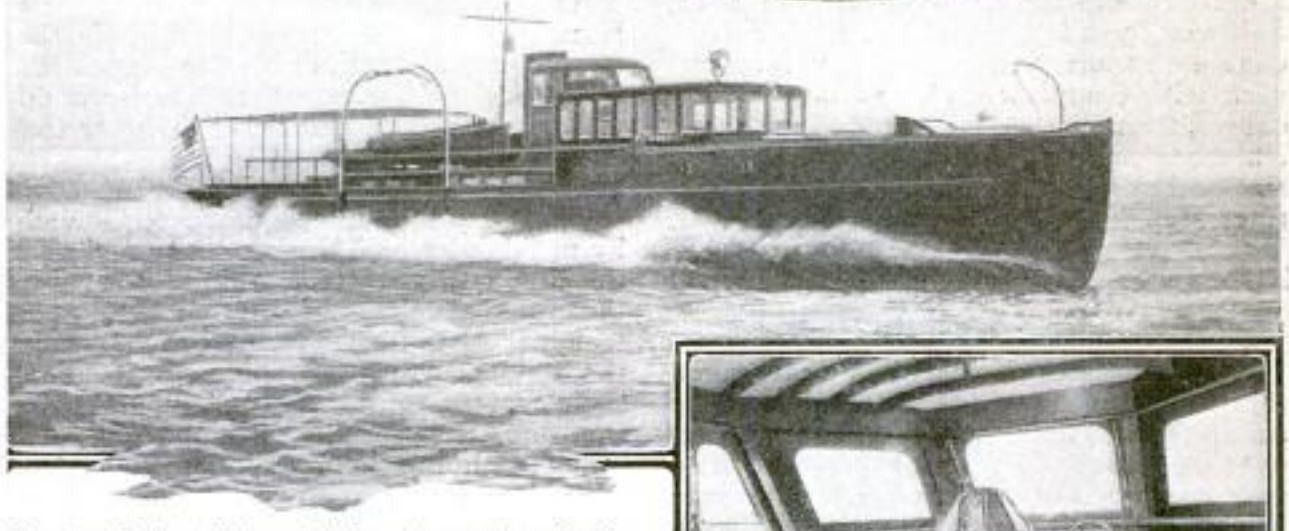
It was necessary to develop a hull structure of unusual strength and rigidity to withstand the terrific strains and stresses that would result at a speed of 30 miles an hour or more when driving through a heavy seaway. The specifications contemplated batten-seam construction, reinforced with steel hogging girders, running from stem to transom, and carrying two thicknesses of planking, the inner skin laid diagonally and the outer skin fore and aft with drilling between, the outer skin to be mahogany, finished natural.

A difficult engineering problem was involved in the installation of the power plants, the ultimate solution being in the use of triple screws, the two wing shafts operated by individual power plants, and the center-screw drive by two 400-hp. engines in tandem; the wing engines to be used for navigating in close quarters and for cruising at 22 to 23 miles an hour, and all four engines to be used for maximum speeds. The controls for all power plants are carried to one central operating board, so that one chief engineer handles all the engines through air clutches on the reverse gears and direct control of all sparks and throttles.

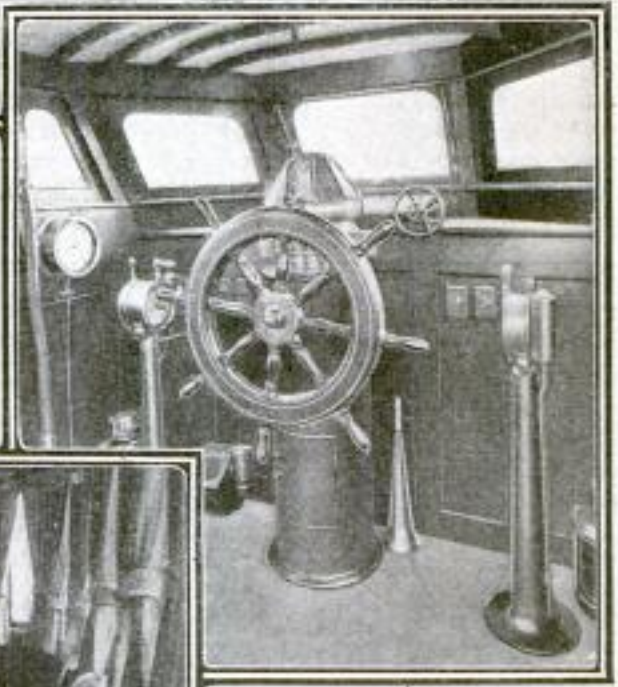
This cruiser, 104 ft. long with a beam of 15 ft. and with full cruising equipment aboard, actually developed 31.3 miles an hour as officially checked. This speed

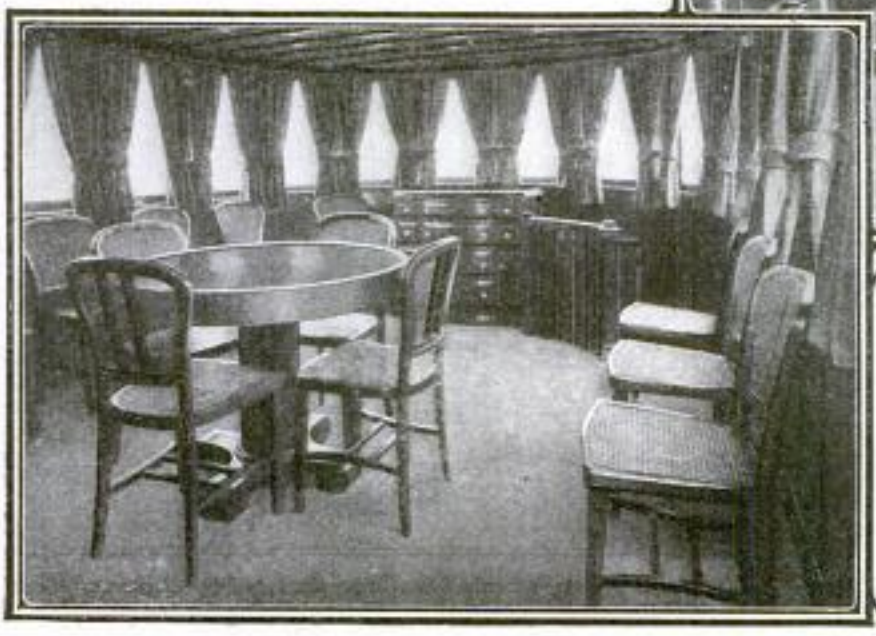


The Frame of the Express Cruiser "Frances" on the Building Ways: Owing to the Excessive Speed the Ship was Designed to Attain, It Was Necessary to Depart Somewhat from Conventional Shipbuilding Methods. This Accounts for the Latticelike Appearance of the Framework, the Timbers having been Divided into Smaller Pieces than would have Been the Case in Building a Smaller Craft



Express Cruiser "Frances" Running at Its Cruising Speed of 22 to 23 Miles an Hour: At This Speed Only the Two Individual 400-Horsepower, Wing-Shaft Engines are Used. The Full 1,600 Horsepower, Developed by All Four Engines Running at Once, Drive the 104-Foot Craft at a Maximum Speed of 31.3 Miles an Hour. Below is Shown the Commodious Dining Saloon, Which, Built in the Forward End of the Superstructure, Commands an Unobstructed View Forward and to Both Sides. The Pilot House Overlooks the Compartment from the Rear





Pilot House of the Palatial Express Cruiser: It is provided with Every Up-to-Date Device and Instrument Known to Navigation. Compressed-Air Apparatus, Governing the Speed of Each Engine Independently, Center Here in One Controlling Mechanism Directly under the Supervision of the Chief Engineer. All Maneuvers can be Performed by One Person Directly, without having to Lose Time Signaling to the Engine Attendants

has never been attained before in an express cruiser of this size. There is no vibration or noise even when the cruiser is traveling at top speed. This is largely due to the fact that underwater exhaust is used. This makes the operation of the boat as silent as if steam plants were installed.

At full speed, and with the use of all the auxiliaries, the "Frances" consumed 160 gal. of gasoline an hour. The tanks hold a total of 2,400 gal., and the boat has a cruising radius at maximum speed of 500 miles, and at medium speed of 20 to 22 miles an hour, a cruising radius of 1,000 miles.

The boat provides accommodations for a crew of eight and the captain forward, followed by a large inclosed bridge deck, engine compartment, two staterooms, each with complete bath and lavatory facilities, shower bath, large lounging double stateroom, and very sizable cockpit. The size and speed of this cruiser mark a distinct step in boat building.

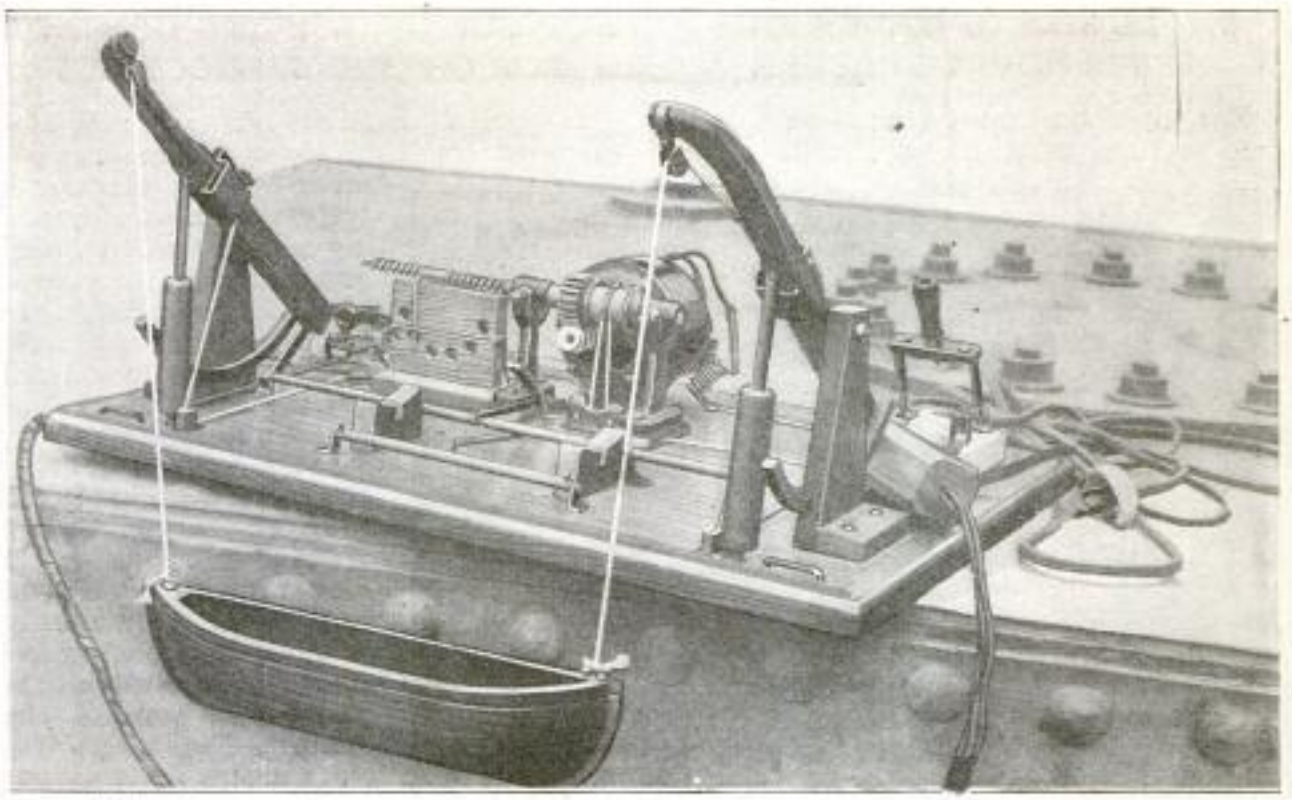
RUNNER ARRANGEMENT ON AUTO HELPS CAR CLIMB DRIFTS

One Montana farmer has rearranged the running gear of his automobile to be suitable for climbing drifts and getting over the snow. In place of the front tires, two runners are attached and the rear wheels are built up tractor style. These two runners are made of wood, shod with strips of iron, and curved upward to ride over the bumps. Two additional rims are attached to the rear wheels and held together by light pieces of angle. On account of being 40 miles from a railroad and the prevalence of heavy snows in that section, auto travel was so difficult that the new arrangement was tried out and found to be successful. Another light car, in an attempt to follow the improvised sleigh, sunk hub deep in the snow and stuck there, while the latter climbed over the drift with ease.

LIFEBOAT-LAUNCHING DEVICE THAT IS AUTOMATIC

Any means that will simplify the launching of lifeboats from ships in distress will greatly diminish the loss of life. On the Pacific coast there has been devised a method of launching lifeboats that is entirely electrical, and to a great extent automatic. It is controlled from the ship's bridge, where is located an electric switch, by means of which a motor, situated near the lifeboat, is started. This motor raises the lifeboat clear of the chocks, upon which it rests normally, and then rotates the davits, which are pivoted at about their centers, until the boat hangs clear of the ship. Each davit is supported by a plunger sliding in a cylinder in such a manner that the air therein forms a cushion, preventing shocks. The boat is automatically lowered to the level of the deck

The Light Car Climbs the Deep Drifts Easily, for the Front Wheels have been Replaced by Runners. Two Extra Rims have been Fitted to Each Rear Wheel Which Gives Increased Traction. The Rims are Held Together by Crossbars Made of Angle Strips



The Lifeboat is Shown Swinging Clear of the Ship. The Switch behind the Davit at the Right would Be on the Ship's Bridge, under Control of the Officer in Charge, and the Controlling Block would Be in the Boat. The Operating Motor is Seen between the Davits

from which the passengers are to be taken aboard. It is equipped with a control block, which is connected by a cable with the control system aboard the ship, and the man in charge of the lifeboat raises or lowers it, as desired, by the pressure of a button.

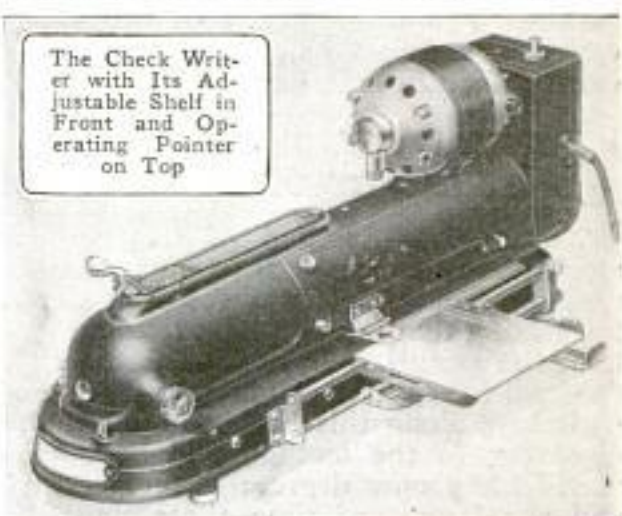
NEW THERMOSTAT REGULATES HEAT UP TO 400 DEGREES

An electric thermostat controlled by the expansion and contraction of a volatile fluid inclosed in a capsule, and which can be adjusted for temperatures up to 400° F., has recently been produced. The temperature fluctuations within the oven, or other device wherein the heat is being maintained, react upon this volatile fluid which thus switches part of the heating element on or off as the temperature falls below or rises above the desired point. The adjustment is made by shifting a weight along a lever extending outside the oven.

¶Two motor-car roads from the Kilo goldfields, in northeastern Congo, are nearing completion, one running to Redjaf, on the Nile, and the other to Lake Albert, at Kaseny. The former will facilitate the transport of heavy machinery to the goldfields.

CHECK WRITING MADE EASY BY ELECTRIC WRITER

Writing checks electrically is the latest development in check-writing machines. Fitted to the machine is a small universal motor, which does all the work of the check writing. On one side of the machine is an adjustable shelf, by means of which the operator feeds the checks into the machine with his right hand, while with the left he guides a pointer along a

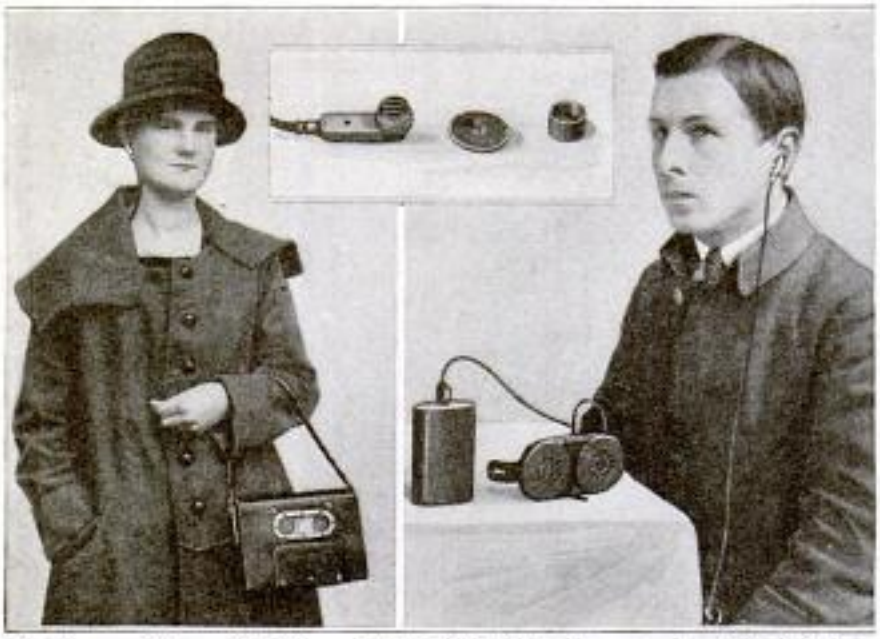


The Check Writer with Its Adjustable Shelf in Front and Operating Pointer on Top

dial, conveniently located on top of the machine, to the figures that have to be written on the check. The electric motor does the rest.

SMALL SIZE OF TELEPHONE IS ITS NOVEL FEATURE

For special purposes, such as use by deaf persons, telephones are made in very compact form, but an instrument now being offered for general use by a German concern is even smaller than most of those. There are two receivers in a set, and though they are of the standard magnetic type, their diaphragms measure but a fraction of an inch in diameter, permitting their actual insertion in the user's ears. The transmitter case is a thin oval, with perforations instead of a mouthpiece, and may be set on edge on a table, hung on a coat button, or carried in the pocket. The whole set, with battery, is easily packed in a handbag, for use in a church, lecture hall, or theater.



The Transmitter and Battery of the Little Telephone can be Fitted into a Handbag or Placed on a Table. Insert: The Receiver; Note the Size as Compared with the Coin in the Center

GERMAN DIRIGIBLE SECRET FOUND BY SCIENTISTS

The German method of treating the aluminum alloy used in the frames of their rigid dirigibles was long a well-kept secret. Suspecting that it was a heat-treating system, the scientists in a large Pittsburgh steelmill have, after conducting many experiments along this line, announced the discovery of the method and have tabulated the proper degrees of temperature and the length of time these must be maintained. An unlooked-for outcome of the experiments was the discovery of a material which is said to produce an alloy superior to that produced by the German method.

AUTOMATIC TEST AND CONTROL FOR CHEMICAL PROCESSES

Industrial chemistry gains a new element of efficiency through the development of an electrical system of automatic testing and control, by which any change in the proper action of the process, as it proceeds, is not only reported, but is corrected as well. Thus the strength of a solution, its acidity, gaseous content, or other characteristic, may be recorded continuously on a distant chart, while electrically operated valves work automatically to offset immediately any shortage or surplus of a constituent part of the mixture. The system provides means for compensating against changes of temperature, pressure, or time of reaction, and even the problem introduced by different mixtures having the same electrical resistance has been solved.

NEW AMMETER SHOWS CHARGE IN STORAGE BATTERIES

A storage-battery cell tester, which departs in principle somewhat from similar devices on the market, reads the actual cell capacity in amperes instead of simply giving voltage readings from which to calculate the values. The instrument proper is calibrated to show ampere values ranging from 0 to 300, which is high enough for all practical purposes. The greater volume of the current passes from leg to leg through the framework of the device, only a small fraction of it being shunted through the meter. This arrangement permits the use of an instrument with a very fine winding.

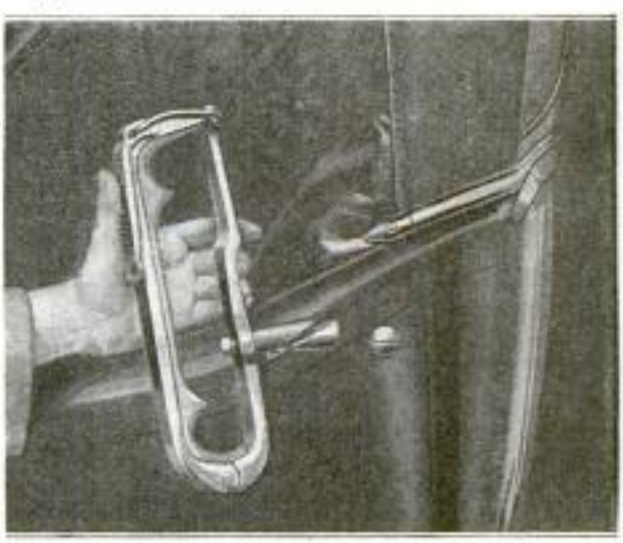
The Rock Drill is Shown Supported between the Roof and the Floor of a Drift with Its Automatic Feed Device in Operation. Under the Drill is Seen the Guide as Well as One of the Holding-Up Springs Connected to It. It will be Seen That Vertical as Well as Horizontal Adjustment is Provided For

ROCK-DRILL FEED DEVICE OPERATED BY A SPRING

From the great gold mines of Johannesburg, South Africa, comes a device for doing automatically with a rock drill, what is usually done by hand by the operator. The drill is mounted in a cradle which carries a slidable guide, and to which is anchored a spring, in such a manner that it will feed the drill forward, and also allow it to be adjusted suitably, as the work progresses. The spring at the same time exerts a constant pressure upon the drill point, further relieving the operator from an effort which, continued through long working hours, reduces his efficiency.

REMOVABLE TOP-BOW SUPPORT IMPROVES AUTO-BODY LINES

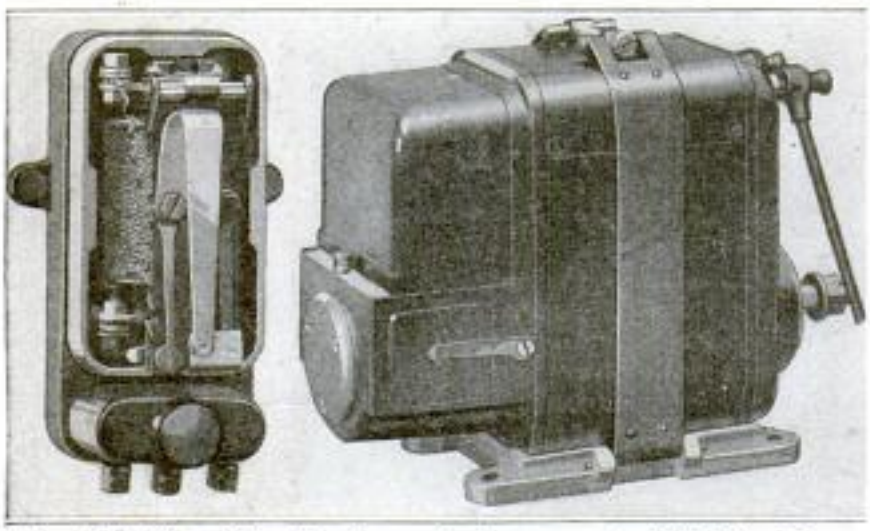
A prominent motor-car manufacturer is equipping all his latest-model cars with top-bow holders, which may be removed and stowed in the tool box when the top is up. The holder is of the conventional type, with the exception of the stud which fits into the body. This is split lengthwise on a diagonal line, and forms two wedges which expand when a bolt, running through them, is screwed in. The hole which holds the stud is fitted with a steel bushing, which takes the strain of the expansion, and which is also threaded to hold a screw with a nickelplated head, put in for the sake of finish when the support is taken out.



A Removable-Top Bow Support: To Install, the Nickel-Headed Screw is Removed and the Split Stud of the Support Inserted. Screwing In the Center Bolt Expands It

AUTOMATIC CURRENT CONTROL FOR AUTOMOBILE BATTERIES

An entirely automatic regulating device for the control of the current into, and out of, the storage battery used on automobiles for the supply of current to the motor starter, lights, the horn, and other accessories, has recently been produced in Paris. It is directly connected to the motor-driven dynamo which charges the storage cells, and automatically cuts off the battery when it is fully charged, making an injurious overcharge impossible. At the same time it regulates the supply of current in such a manner that the charging of the battery is uniform at all speeds of the motor that drives the dynamo. The device is of strong construction, and the moving contact tongues are tipped with carbon, and are so constructed that sparking will not occur. A strong magnetic blow-out is provided to prevent any possible damage. The regulator is tightly inclosed in an iron box, and requires no attention whatever.



Left: End View of the Regulator; the Electromagnet behind the Contact Tongue can be Seen. The Other View Is a Side Elevation

SKULL OF DEEP-SEA MONSTER FOUND NEAR MIAMI

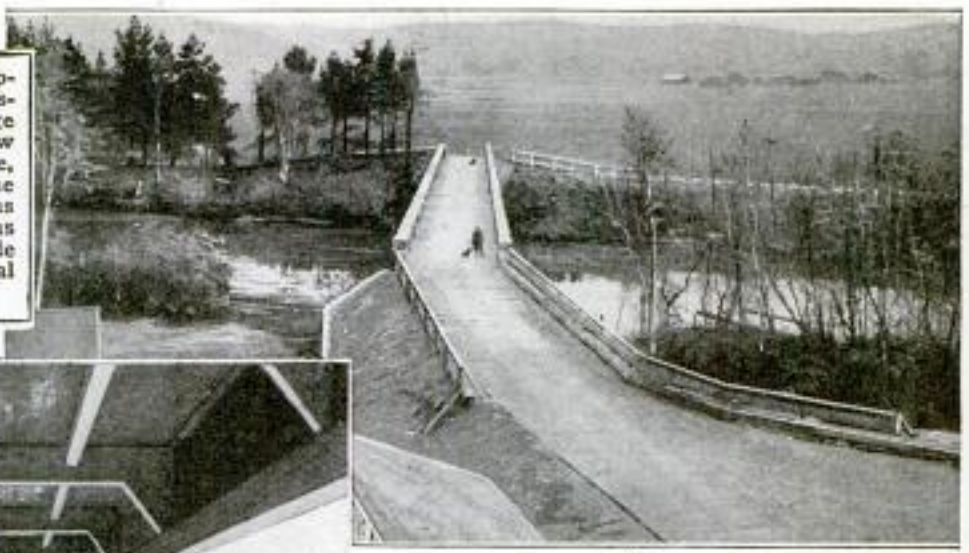
A portion of the skull of a deep-sea monster which, if the body were as big in proportion as the skull indicates, would favorably compare with the "Narwhal" told of in one of Jules Verne's works, was towed in from the sea 15 miles to Miami, Fla., recently. The flesh clinging to the immense bone, when cut away, covered a space about 40 by 30 by 7 ft. Numerous sharks were feeding upon it when it was discovered. The animal is placed in the turtle class by scientists, who also say that it was 125 years old. A man is a small object when viewed within one of the head recesses, and the entire fragment measures 15 ft. in length. Judging from this dimension the authorities believe the full-size monster weighed about three tons and measured 80 ft. in length. The age estimate was based on ring formations on the animal's neck.

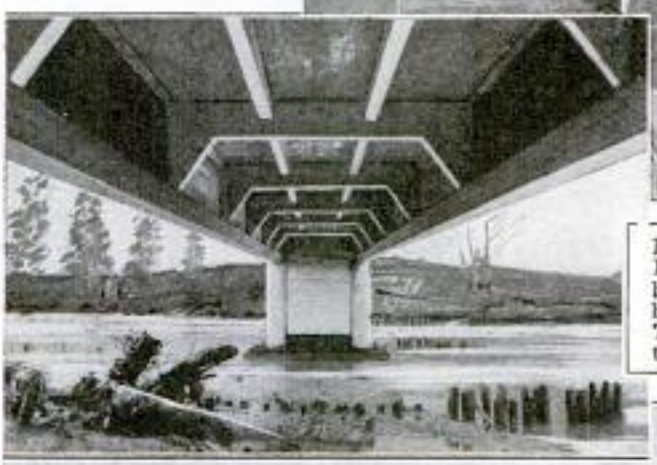
How a Man Looks in One of the Head Recesses of the Skull Fragment. The Huge Bone Section was Towed 15 Miles to Miami

PHOTOS COPYRIGHT, R. L. COX

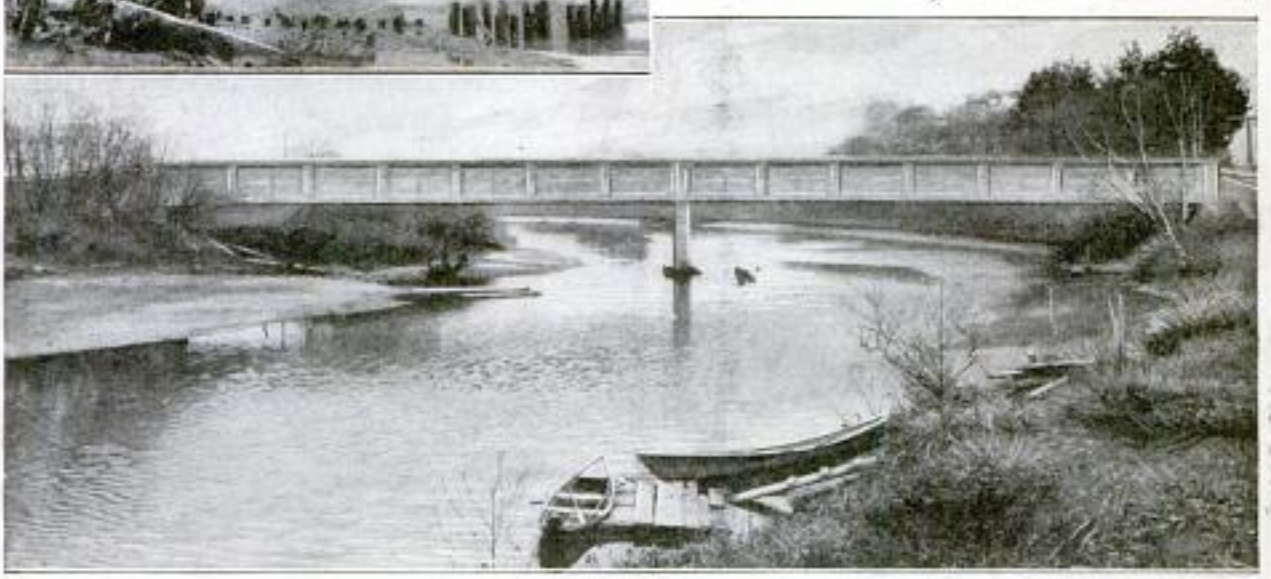
The Skull Fragment from the Back: The Piece Is Nearly Six Feet High at This Point

Right: One of the Approaches, and a Bird's-Eye View of the Bridge Itself. Below Is a View Taken under the Bridge, Showing Very Clearly the Concrete Floor Beams and Stringers, as Well as the Bottom of the Side Girders and the Central Supporting Pier





Below: A Side Elevation of the Bridge. The Length of Each Span can be Easily Estimated by Observing That There Are Seven Spaces between the Pilasters, Which Are 20 Feet Apart. The View Is at Such a Distance That It Is ...d to Realize That the Side Girders Are 12 Feet Deep



GREAT LENGTH OF SPAN MARKS CONCRETE GIRDER BRIDGE

Two straight spans of 142 ft. each, an unusual length for concrete beams, distinguish a bridge of the girder-type built a short time ago across the Salt River in California. Each of the four big girders is 12 ft. deep, 24 in. thick at the top rail, 18 in. at the bottom, and 7 in. in the web, with 30 by 18-in. pilasters every 20 ft. At each pilaster a reinforced-concrete floor beam crosses, supporting two 20 by 9-in. stringers of the same material, which carry the 5-in. concrete floor. There is no expansion joint at the center pier, where the girders abut. Concrete was poured first for the lower halves of the girders, then for the floor system, and finally for the top halves of the girders.

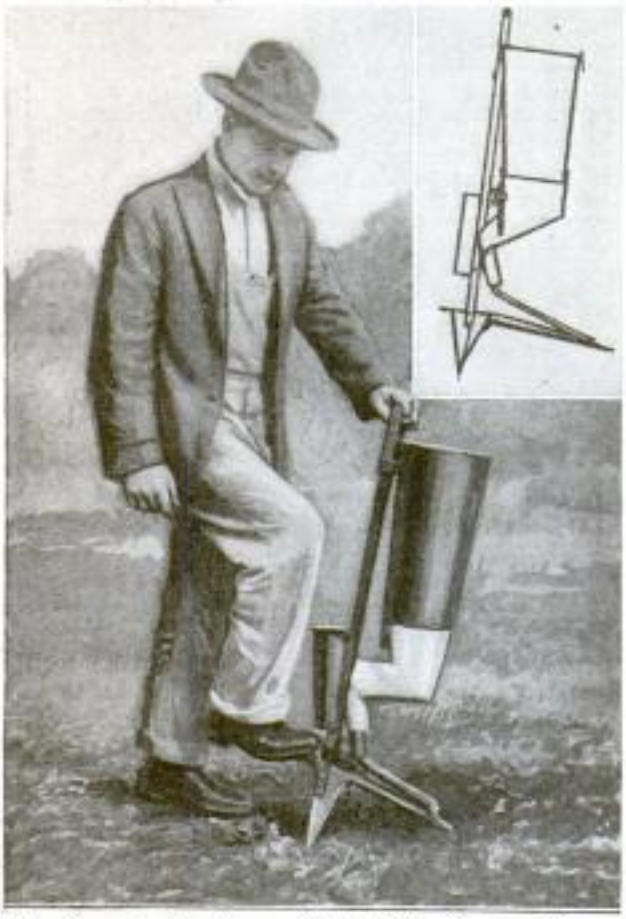
AUTO CLOCK LIGHTS LAMPS AT LEGAL HOUR

Most city ordinances provide that all vehicles upon the streets, whether running or standing, shall show lights at front and rear beginning one hour after sunset. As it is not always convenient for the owners to turn on the lights of cars standing at the curb, there are many technical violations of the rule. A new motor clock, designed to be mounted on the in-

strument board, makes easy the compliance with the law, as it is fitted with an alarm-clock mechanism which closes contact points at any time for which it is set. Two wires, part of the outfit, are connected to the regular car switch. When the hour arrives the device turns on the dimmer headlights and also the rear light.

HAND POTATO PLANTER SETS TWO ACRES OF SEEDS DAILY

A hand potato planter which will hold 22 lb. of seed potatoes and plant a row 200 ft. long without refilling, has recently



The Jaws at the Lower End of the Potato Planter are Dug in the Ground, and a Seed is Dropped by Pushing the Handle Forward. Insert Gives a Diagram of Construction

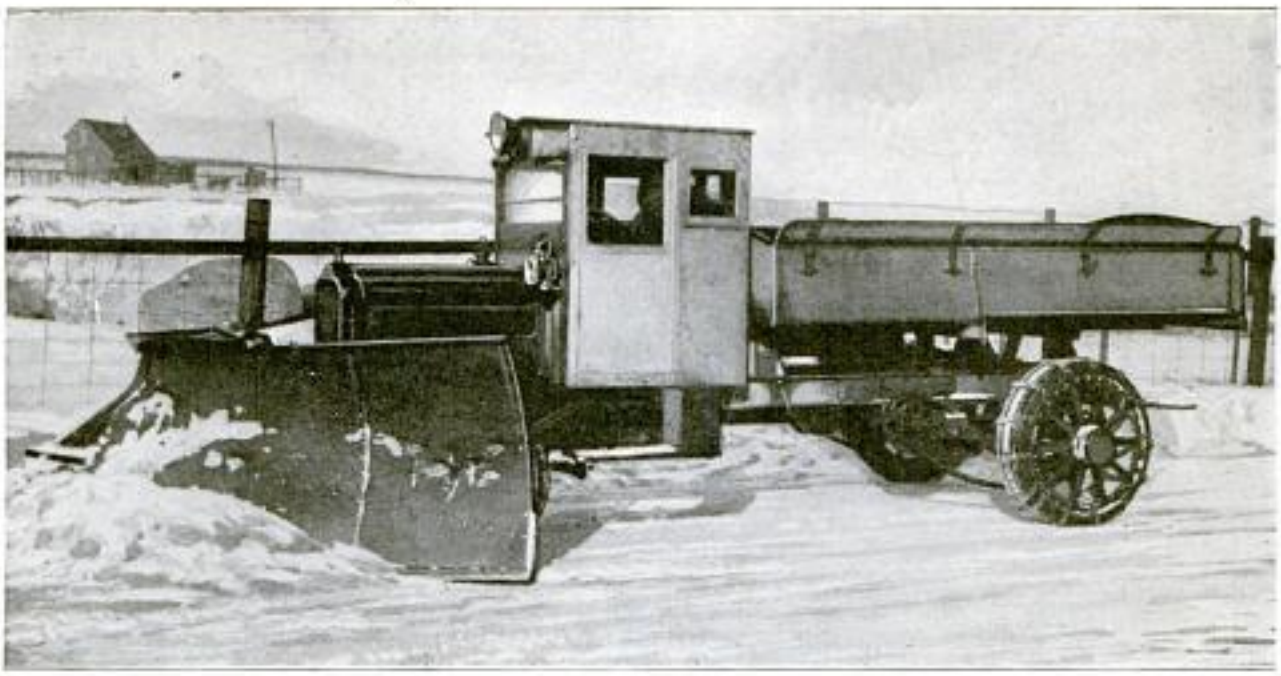
been invented. A pair of jaws at the lower end of the device are dug into the earth at a point where the potato hill is desired. These jaws are closed when sunk into the ground and opened by pushing the handle of the planter forward. One jaw is pivotally joined and operates a seed-discharging plunger when the lever is pushed. Upon return of the handle to an upright position, the jaws are again closed and the planter withdrawn from the ground, causing the dirt to cover the seed.

WYOMING MAKES FINE LINCOLN HIGHWAY BUILDING RECORD

A finished Lincoln Highway, spanning the continent from coast to coast with a ribbon of solid concrete, would be an accomplished fact in another year if all the states traversed by it would invest in it the time, money, and effort, in proportion to their population, expended by Wyoming during 1920. Though thinly populated and having 425 miles of the highway as its quota, Wyoming has spent without stint, though wisely, to such good purpose that all but about 40 miles of this distance has been surfaced with a boulevardlike coat of finely crushed granite, 16 ft. wide and 5 in. thick. The year 1920 saw 237.5 miles of this roadbed finished at a cost of about $3,000 per mile. The low figure is accounted for by the facts that the material is plentiful along the whole route, and that for several miles the old roadbed of the Union Pacific Railroad has been utilized. Funds from a $2,800,000 good-roads bond issue of 1918, supplemented by Federal aid and Lincoln Highway Association contributions, plus plenty of work and determination, have placed Wyoming in the front rank of accomplishment in this highly meritorious undertaking. A slogan, expressive of the statewide sentiment, is "The Lincoln Highway First."

NEW AUTO REAR SIGNAL HAS INTERESTING FEATURES

A new intention signal for automobiles, which informs the driver of a following car whether one intends to turn to the right or left or come to a stop, is of the all-electric type, the signals being flashed by lights of green and yellow arranged above and to the right and left of the conventional red rear light. The device is claimed to work equally well in daylight or darkness, as the light bulbs are of sufficient power to make the small direction arrows, painted on the colored lamp lenses, show up in bold relief even in bright sunlight. The green right-hand light denotes a right turn; the yellow one, to the left, a left turn, and both burning at once warn of a full stop.

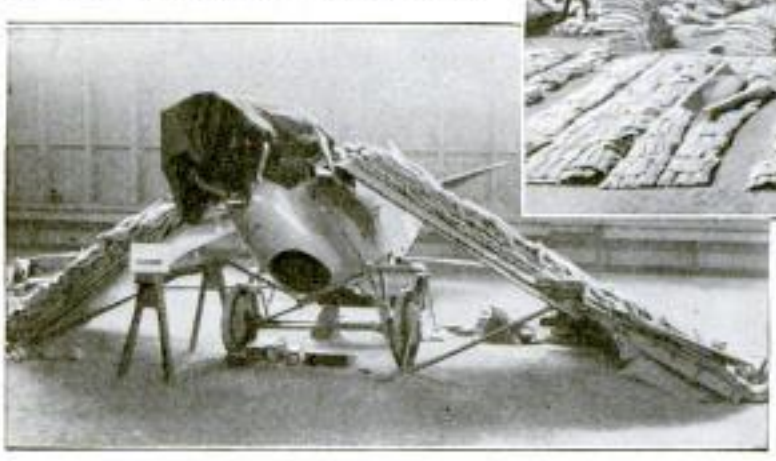


PLOWING HEAVY MINNESOTA DRIFTS TO KEEP BUS ROAD OPEN

INTERCITY bus lines are becoming more and more popular because their schedules can be so arranged as to give transportation at more frequent intervals than railroads. In many sections of the country, trains are operated on once-a-day schedules, and unlucky is the person who fails to make connections or who is obliged to wait a good part of the day for one train. Bus lines operating in the northern parts of Minnesota are hindered by heavy snows, and a truck fitted with a plate-steel plow has been built to keep the road clear. The plow is braced against the frame of the truck and pushes through the drifts, leaving a hard smooth road for the busses to travel over. A heavy truck is used for the work, and its wheels are equipped with skid chains to prevent slipping.

DESTRUCTION TESTS DETECT AIRPLANE FAULTS

Building expensive airplanes with the intention of destroying them before they have ever flown, would seem to be the wildest kind of extravagance, and so it would be were it not that, weighed against the value of a human life, the cost sinks into insignificance. During the war, airplanes were tested by actual flying. If they developed weaknesses, sometimes the unlucky tester lived to report them; more often he did not. This has been changed since the war, the testing now being done by loading the wings with sandbags and noting which parts fail to bear up under the weight. The bags are of various sizes and their weights are known to the ounce. If a wing or part fails to show a factor of safety of five—that is to say, the ability safely to carry five times its own weight—the design or material is considered faulty and is remedied.



Testing an Airplane to Destruction by Overloading It with Sandbags: In This Case Not Only have the Wings Given Way, the Fuselage Also has Collapsed

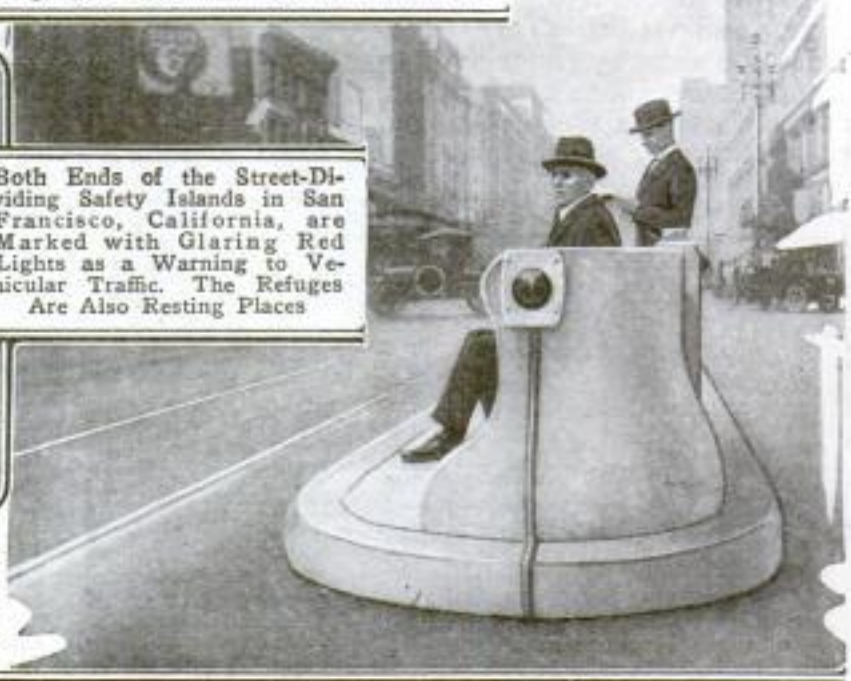
In the Destruction Tests Hundreds of the Sandbags, Shown in the Foreground, are Used. Each is Marked with Its Weight. The Airplane in the Background Is Upside Down

SOLVING PERPLEXING TRAFFIC PROBLEMS

Many of the Roads about Minneapolis and St. Paul, Minnesota, are Protected at Dangerous Spots with Fences Painted a Dead White. While They would Scarcely Prevent a Car from Rolling down the Steep Embankments, They Serve as a Warning, and Reckless Indeed Is the Driver Who Disregards the Ghostly Caution Looming Suddenly before Him

The Officer Instructor is Showing a Class of Traffic-Rule Violators the Right and Wrong Ways of Meeting Unexpected Situations. By Moving the Figures of the Model Street Intersection About, All Kinds of Traffic Conditions can be Duplicated. This "Safety First" Education is Producing Good Results in Seattle, Washington

Lake County, Florida, Welcomes the Motor Tourist to Its Hundreds of Miles of Asphalt Roads with a Large Map of Its Highway System, Placed on Every Road at the County Line



Both Ends of the Street-Dividing Safety Islands in San Francisco, California, are Marked with Glaring Red Lights as a Warning to Vehicular Traffic. The Refuges Are Also Resting Places

BY NOVEL UP-TO-THE-MINUTE METHODS

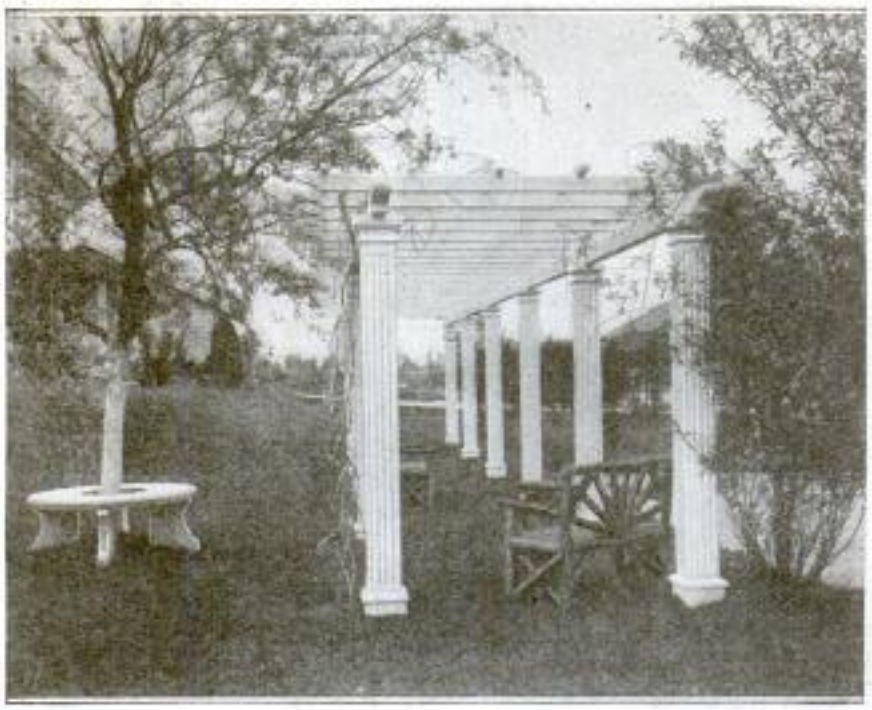
Street Cars in Newark, New Jersey, are Not Held Up While the Conductor Makes Change. A Track-Side Ticket Seller Supplies the Patron with a Ticket and Change

The Traffic Marker at the East Entrance to the White House Grounds Challenges the Attention of Drivers Both Day and Night. Placed Squarely in the Center of the Highway, It Automatically Enforces the "Keep to the Right" Rule. The Red Lights Flash On and Off at One-Second Intervals

In Self-Protection, the Street-Railway Company of Washington, District of Columbia, has been Compelled to Make Its Trolley-Wire Poles So Conspicuous That Motorists cannot Help Seeing Them. A Startling Color Scheme of Green and White Stripes Has the Desired Effect

PIECES FOR CONCRETE PERGOLA PRECAST IN WORKSHOP

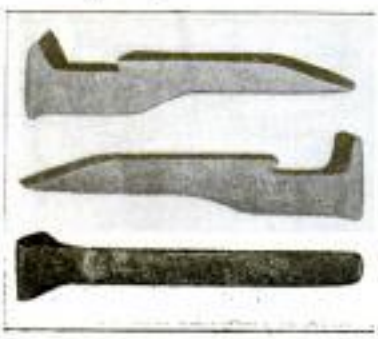
The pieces for a beautiful concrete pergola recently erected on the estate of an eastern contractor were cast in a workshop and later hauled to the grounds where they were erected. Twelve columns support a superstructure built of two beams running lengthwise across the top of the columns, on which are laid the crosspieces.



This Beautiful Concrete Pergola is Made of Individual Sections Which were First Cast in a Workshop and Later Hauled to the Grounds for Erection

NOTCHED TRACK SPIKE LOCKS RAIL AND PLATE TOGETHER

A number of southern railroads are making experimental trials of a new form of track spike, whose peculiarity is that it has a notch, under the head on the rail side, that catches the edge of the tieplate. The formation of the back of the spike, when it is driven in the usual manner, forces it against the rail and plate, and locks them together in its notch. It is pulled out with the ordinary claw bar. The new spike is declared to remain tight for an indefinite time, and to serve well in soft ties.

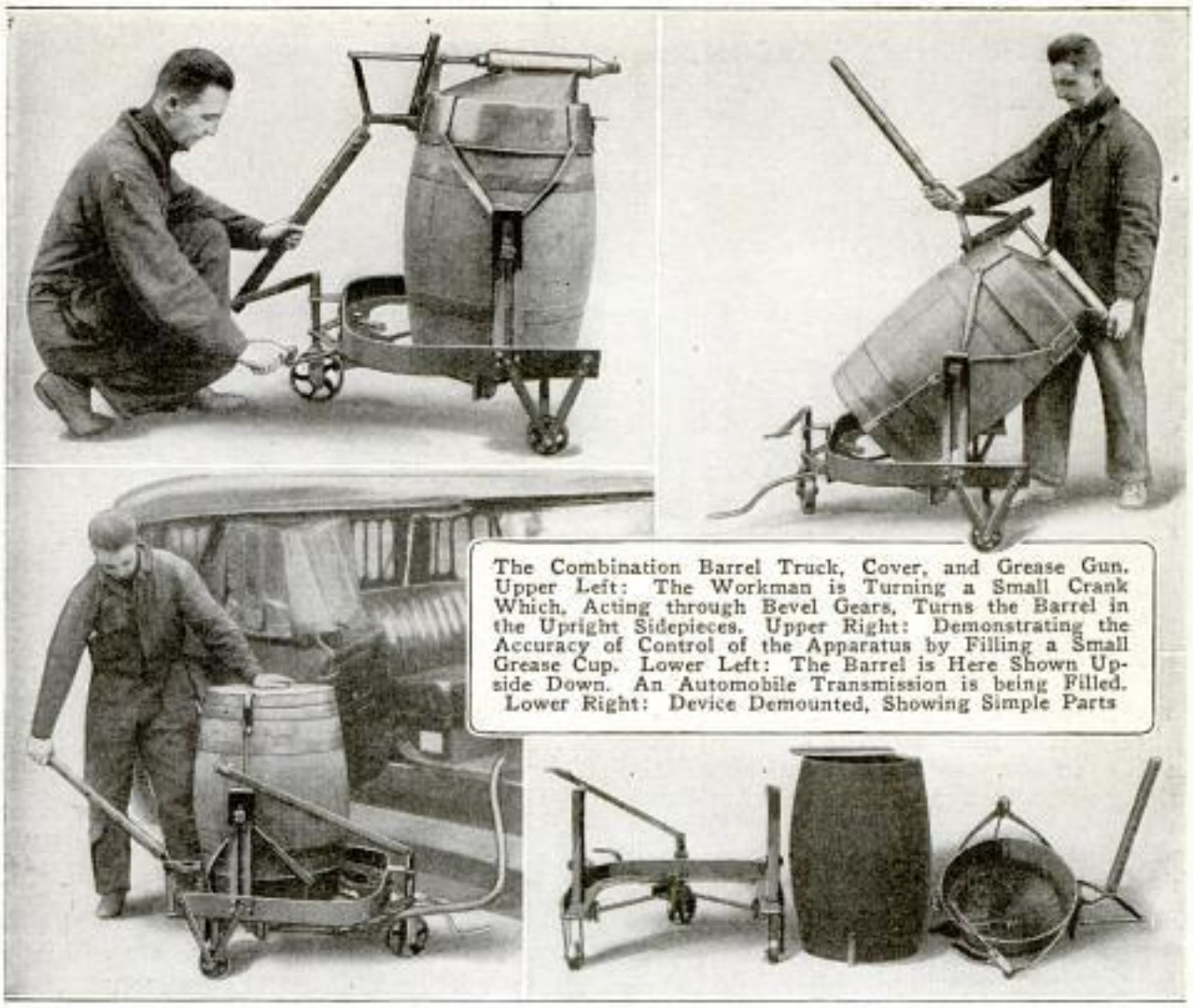


CALENDAR REVISION IS GIVEN WORLD-WIDE CONSIDERATION

Declaring the present form of calendar to be complicated, cumbersome, and obsolete, the newly created International Chamber of Commerce has issued a call for an international convention for the express purpose of considering revisions of the old calendar, or even the formulation of an entirely new calendar. At present two revision plans are being considered by the British parliament and our own congress. These are known as the Swiss and the Liberty plans. The former is favored by the British, while the latter has the American preference. This plan contemplates the division of the year into 13 months, named as at present, with the exception that the extra month will be called Liberty. It will come between February and March. Every month will be exactly 28 days in length, and the first of each month will always fall on Monday. The odd day of each year will be set aside as New Year's Day and will have no real place on the calendar, although it will always fall between December 28 and January 1. Every four years another independent day, called Leap Year Day, will be added to make up for the odd one-fourth day by which the present calendar differs from the true solar year.

TIME LOSS AND DANGER IN USE OF CHEAP DETONATING AGENTS

Because of costly complications and danger due to misfired explosion charges, a warning against the use of cheap, imported detonators for setting off such charges, has recently been issued by the Bureau of Mines. It is pointed out that many agents of varying strength and grades have been tried from time to time, and it has always been those of the highest quality that insure prompt and certain action of the explosive. At times, it is further stated, even these reliable grades become slow in action, due to the age of the explosive or wetness of the bore hole.



The Combination Barrel Truck, Cover, and Grease Gun. Upper Left: The Workman is Turning a Small Crank Which, Acting through Bevel Gears, Turns the Barrel in the Upright Sidepieces. Upper Right: Demonstrating the Accuracy of Control of the Apparatus by Filling a Small Grease Cup. Lower Left: The Barrel is Here Shown Upside Down. An Automobile Transmission is being Filled. Lower Right: Device Demounted, Showing Simple Parts

IMPROVED GREASE GUN PUMPS DIRECT FROM BARREL

A new article of garage equipment which economizes both time and material, besides performing a disagreeably messy operation cleanly, is a combination barrel truck and grease gun. The latter is located at the apex of a conical sheet-metal stamping, of correct size to fit the end of a barrel tightly, and which acts as a funnel when in position and the barrel is turned upside down by a bracket on the truck. A hand lever operates the pump, forcing a pint of either heavy oil or grease into automobile transmissions or differentials at every stroke. The truck is strongly built of steel and mounted on three wheels, one of which swings with the truck tongue and is used for steering. As the grease or oil drains to the lowest point—the apex of the cone—every particle is delivered to the pump with the result, according to the claims, that it is all utilized without waste. The discharge control is so accurate that grease cups can be filled without running them over.

GOLF, POOL, CROQUET RIVALED BY NEW LAWN GAME

A new lawn game of unusual interest, suggesting some of the features of golf, table pool, and croquet, but imitating none of them, is being offered for the coming season. Four round-end, rubber-tipped mallets and four balls of distinctive colors, six numbered aluminum pockets to be set on the lawn at specified places, and two end stakes, constitute the outfit for two or four players. The pockets are arranged in a rectangle which may be of considerable size, and each player is allowed three mallet strokes to pocket his ball, making many interesting situations.

The Outfit for Playing the New Lawn Game: In Practice, the Numbered Pockets are Set Quite a Distance Apart

DYNAMO FLASHLIGHT GIVES GLOW FOR THIRTY SECONDS

A new generator-type flashlight, somewhat similar to that used by the Germans during the war and described in Popular Mechanics at that time, is now being manufactured by a French producer. The flashlight resembles a small black box, with an electric bulb and reflector located at the bottom. It is worn suspended from the neck of the owner on a strap, and current is furnished to the bulb from a small dynamo on the inside, which is rotated by the pulling of a short chain. This chain hangs under the case and is equipped with a convenient finger ring. The light will shine for 30 seconds after the chain has been given a smart jerk.

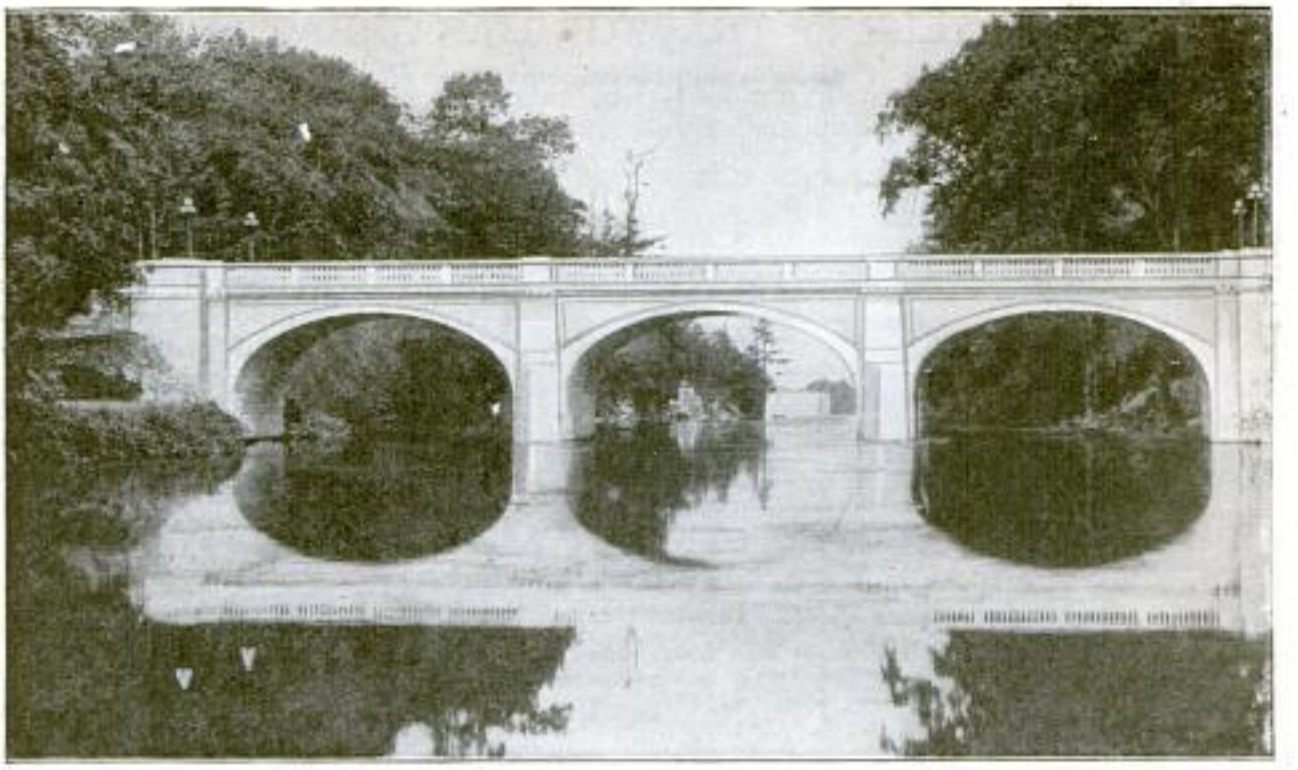
NILE SUDD TO BE UTILIZED FOR MAKING POTASH

A tangled mass of floating vegetal matter, called sudd, has always been a hindrance to navigation on the great Egyptian river Nile. It has to be removed, and now it is going to be utilized for the production of potash, nitrates, and other valuable chemicals. The sudd, when dried, contains about one-fifth of the thermal energy in a ton of coal, together with about 45 lb. of potassium salts. By one process it is intended to burn the sudd in a gas-producer plant, and with the resulting gas drive a gas engine and a dynamo, using the current therefrom to electrolyze the potash salts obtained from the ashes. By another process similar results are obtained by burning the sudd to charcoal in an oven heated by the sudd, and then using the charcoal for the manufacture of similar chemicals.

MOTORCYCLE OUTRIGGER HELPS VEHICLE OVER MUDDY ROADS

A western cyclist whose usual route of travel often takes him over muddy roads has devised an outrigger for his motorcycle which he finds of great assistance in getting it over almost impassable highways. This outrigger is made up chiefly of an old buggy wheel and iron scraps from the local blacksmith-shop discard pile. A buggy axle with one wheel removed is attached at its free end to the main frame member of the cycle under the seat, and the wheel end is held outward at the right position by guy rods. The outrigger is weighted by fastening an old boiler grate bar to the center of the buggy axle, and the traction on the road is thus increased so that the soft ground is easily traversed.

The Views on the Left Show the Motorcycle Passing through the Soggy Wagon Ruts, by the Aid of the Outrigger Wheel. Right: How the Outrigger is Attached to the Cycle Frame; the Fitting was Made of a Buggy Wheel and Axle, and Blacksmith-Shop Scraps



This Impressive White Marble Bridge Spans a Picturesque Stream in Vermont. The Piers and Other Heavy Masonry were Built of Concrete. The Rails and Facings Are Pure-White Marble and Set the Bridge Off Beautifully

WHITE-MARBLE BRIDGE SPANS VERMONT RIVER

An almost pure-white marble bridge, given to the community by an eastern quarrying concern, spans a picturesque stream in the state of Vermont. The arches and interior masonry of the structure are of concrete, but the facings and railings are of polished white marble. The bridge is built in three spans and is a beautiful complement to the quiet water that flows beneath it.

FIREMEN'S SMOKE MASKS TESTED FOR LEAKS

Smoke masks must be absolutely air-tight or the fire fighters who wear them are liable to lose their lives. To insure protection, the San Francisco fire department has inaugurated a series of tests for the masks that is very efficient. All of its joints are coated with soap lather, after each man has donned it, and it is then operated as when in use within a smoke-filled building. Wherever a bubble appears persistently, a leak is indicated and marked for future repair. If the masks are found to perform satisfactorily in the bubble test, the men, still wearing the masks, enter a room filled with a "tear gas" consisting of formaldehyde issuing from an open fire on the floor. The wearer will at once notice the existence of a leak in this instance, and the bubble test will then be repeated as many times as necessary until the location of the leak is positively determined.

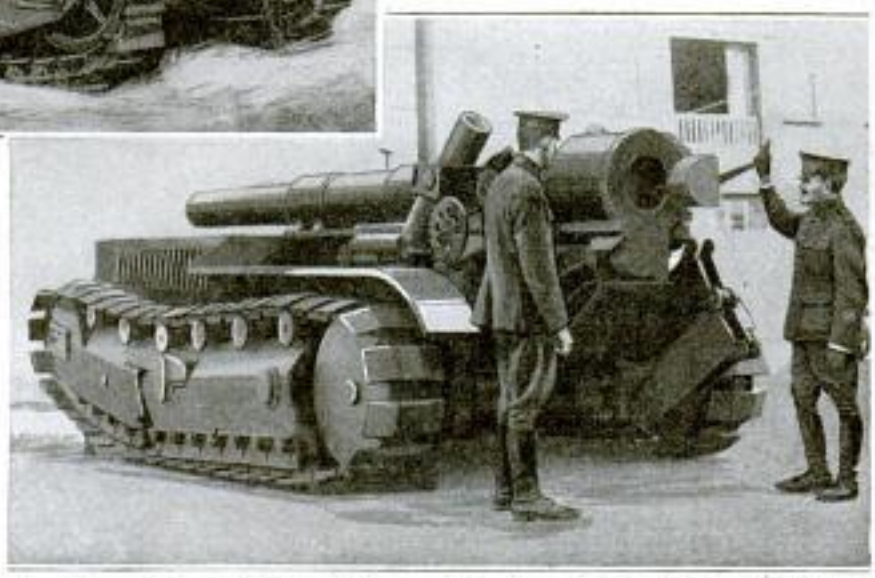
Daubing One of the Gas Masks Used by the San Francisco Firemen with Soap Lather, to Indicate Leaks. A Bubble will Appear Where a Leak Is Present

¶The installation of a radiotelegraph station on one of the Willis Islands, 250 miles off the Queensland coast, is contemplated by the Australian government in the belief that it will make for greater accuracy in forecasting weather conditions.

NEW ARTILLERY TRACTOR HAS GREAT SPEED

With a 4.13-in. anti-aircraft gun mounted directly upon it, a newly designed artillery tractor of the endless-tread type, weighing 13,000 lb. and driven by a 75-hp. engine, is capable of the remarkable speed of 25 miles an hour. To fire its 95-lb. shell, with a range of 11 miles, the gun swings over the driver's head, automatic anchor plates dropping down behind the tractor to take the recoil. The treads are of specially constructed rubber, and the machine, fitted for six speeds forward and two reverse, easily mounts a 60-per-cent or descends a 70-per-cent grade, and turns in its own length. The tractor is equipped with an electric starter and other conveniences. For heavier work a similar model of 250 hp., and mounting a 6.1-in. howitzer, also capable of high speeds, has been successfully developed.

A Rubber-Tired, Endless-Tread Artillery Tractor with a Speed of 25 Miles an Hour, and Mounting a 4.13-In. Anti-Aircraft Howitzer



Rear View of the High-Speed Tractor, Showing the Breech of the 4.13-Inch Anti-Aircraft Howitzer and One of the Anchor Plates

UNUSUAL DESIGN OF CONCRETE ARCH BRIDGE

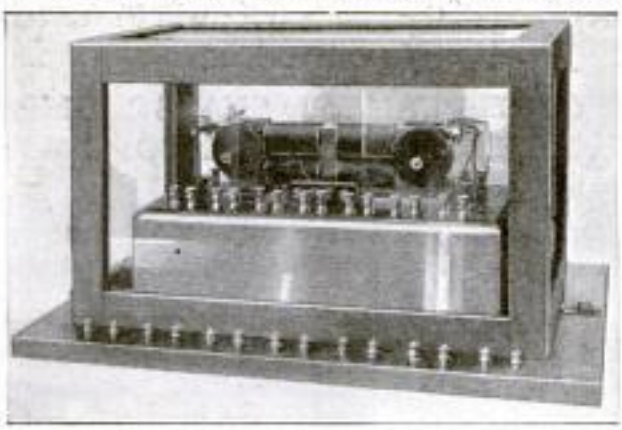
A concrete arch bridge of unusual design has recently been completed by the government across the Republican River, Fort Riley, near Junction City, Kan. The beams and slabs of the floor system, in addition to the railings, are suspended from overhead arches. In bridges of this character, one of the usual methods of design is to support the floor and railings by concrete members extending upward from the underhanging arches. The bridge consists of two spans, each 140 ft. long. It is claimed that the longest span of this type previously built was only 50 ft. The bridge was given a series of tests by driving a seven-ton steam

A Departure in Concrete-Bridge Construction: The Weight is Suspended from the Arches Instead of Resting upon Their Tops as in the Conventional Design

roller across it at various speeds, before acceptance by the army board. No vibration was noted in any of the tests.

TIME SWITCH MEASURES LIFE OF AUTO BATTERIES

An interesting apparatus, used by the Bureau of Standards, gives an accurate answer to the question, "what is the life of an automobile self-starter battery?" asked daily by thousands of motorists, and also measures the life and capacity of dry-cell batteries. The device consists of a master clock, a system of relay switches, and three commutator switches, which are actuated by electromagnets. The commutator contact pieces are of platinum and have brushes with platino-iridium contact parts bearing upon them. The first commutator turns once in 60 minutes; the second once in 24 hours, and the third once in seven days. Current to actuate the first commutator is sent to it at one-minute intervals by the master clock. The daily commutator is controlled by the hourly one and, in turn, controls the weekly one. It is the last which causes the batteries undergoing test to be charged and discharged in regular

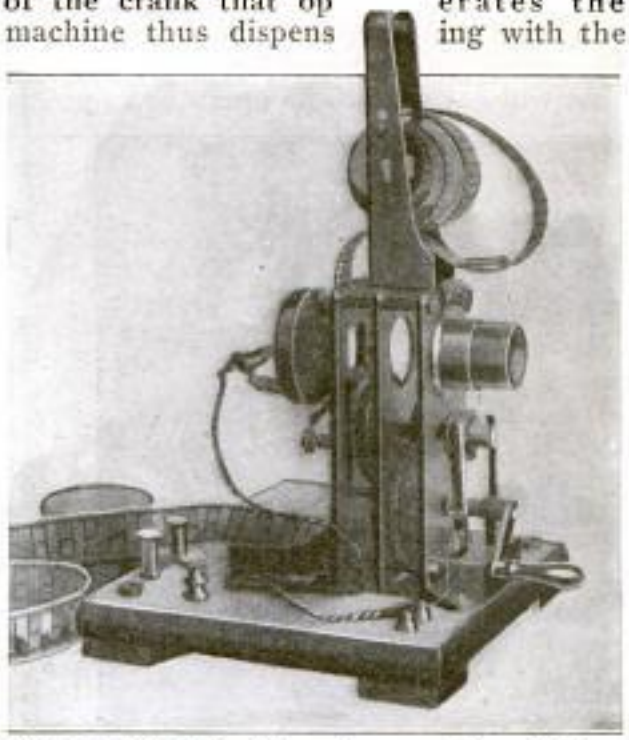


Bureau of Standards Battery-Testing Time Switch, Which by Alternately Charging and Discharging a Battery, Indicates Its Life of Normal Service

24-hour cycles. The number of cycles through which a battery will pass before breaking down is practically an infallible index to its life in normal service.

MOVING-PICTURE MACHINE USING TUNGSTEN LAMP

The fact that the tungsten filament of a lamp will stand a considerable overload, for some time, has been made use of in connection with moving-picture machines. The extra current, of course, makes the light very brilliant—so brilliant, indeed, that it displaces the usual arc light. The current passes through the lamp only when a picture is in the frame of the machine, and is controlled by the turning of the crank that op erates the machine thus dispens ing with the



This Movie Machine Has a Tungsten Lamp in Place of the Usual Arc Light

revolving shutter used on standard moving-picture projectors.

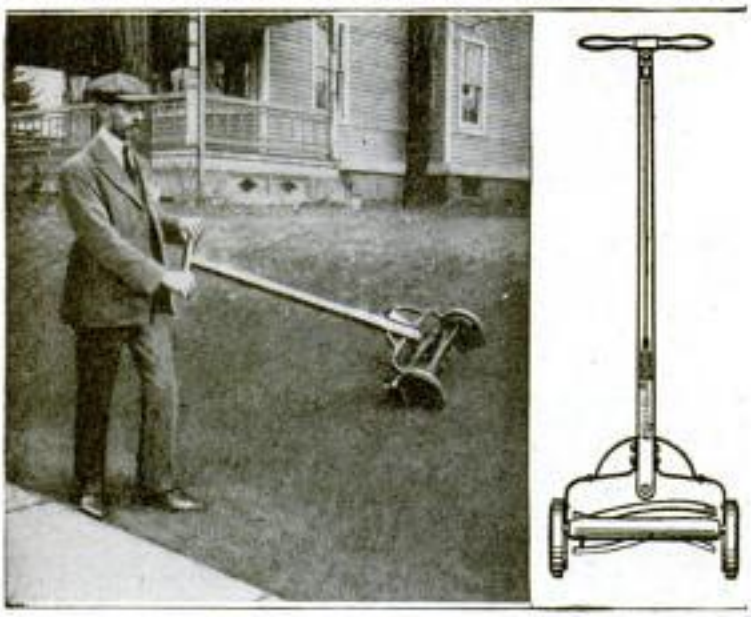
UNUSUAL AMERICAN FLAG IS MADE OF WOOLEN BALLS

A total of 3,311 balls of wool about the size of a dime and with colors suited to the emblem they compose, were worked recently into an American flag for use as a davenport or library-table scarf. Twelve ounces of yarn, three spools of special thread, and sixteen spools of mercerized cotton were used in the flag. It is mounted on a background of golden-colored yarn, and is framed by a red, white, and blue border of the same material.

Balls of Wool, About the Size of a Dime and of Suitable Colors, were Used to Make This American Flag

TERRACE LAWN MOWER SAVES WALKING UP AND DOWN BANK

A lawn mower that will successfully cut the grass on the incline of a terrace and that will not require its operator to pull it up and down, nor run up and down the grass bank himself, is now introduced. In construction the new device does not differ greatly from the old-style lawn mower. Instead of the stationary handle, the new machine has a pivoted handle set on a toothed quadrant. By lifting a stop pin from between the teeth of the quadrant, and setting it to the desired point, the mower is brought into an angular position relative to the operator, so that he can cut a lengthwise swath on the slope without leaving the ground level. The stop pin is pulled out of its place in the quadrant by a rod attached to a finger clip located on the handle.



A Swivel Arrangement in the Handle Fitting of the Terrace Lawn Mower Allows the Operator to Walk on the Ground and Mow the Incline

NAVY COLLIERS USE WIRELESS TO LESSEN TOWING DANGERS

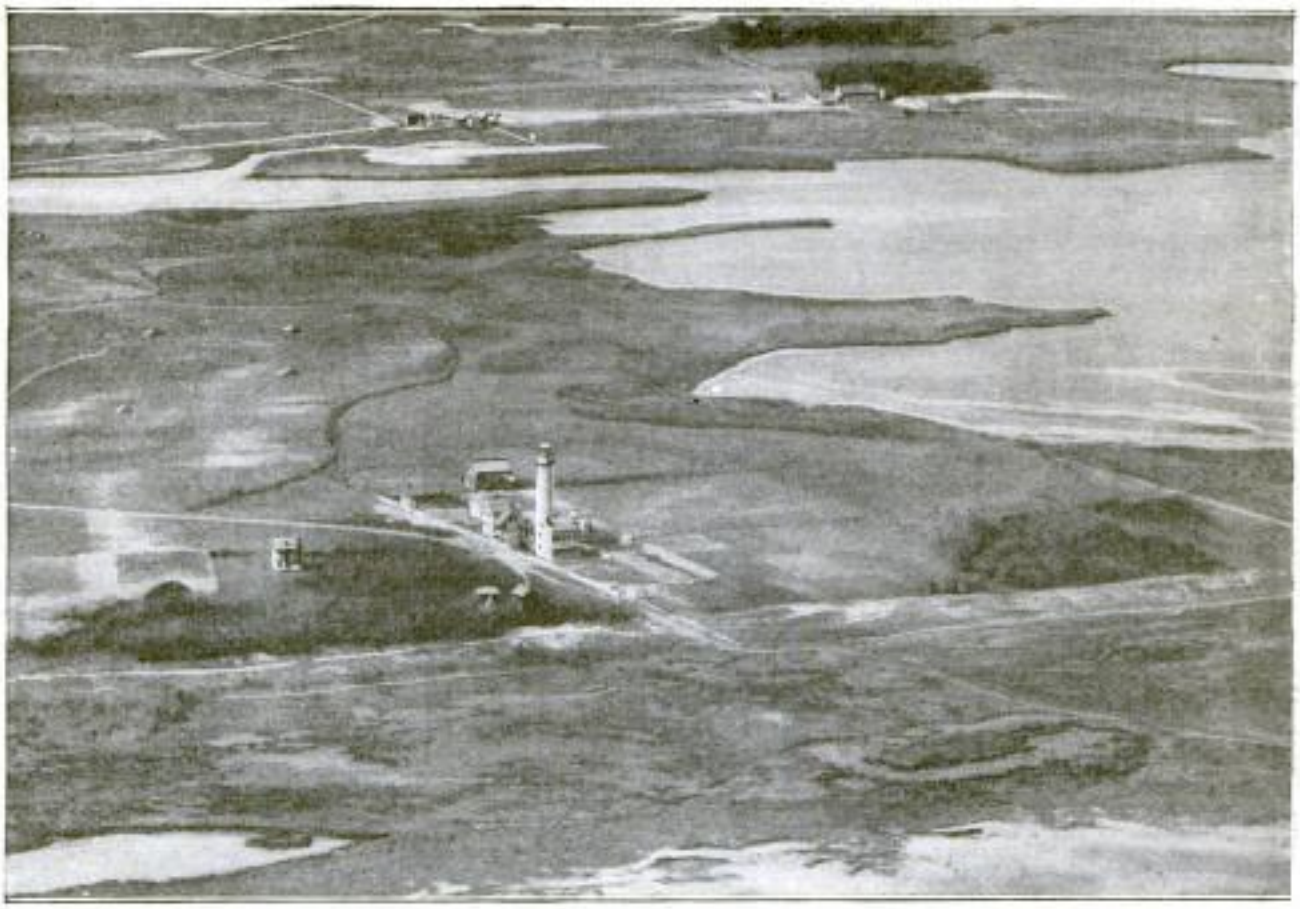
Two 14,000-ton navy colliers engaged in towing two barges of the Panama Railway Steamship Company, with a displacement of 7,500 tons each, have recently been equipped with wireless telephones in order to keep in contact with one another in rough weather. The barges are also similarly equipped. These wireless outfits are built with special facilities for selectivity to avoid interference with other stations. It is expected that this equipment will entirely displace the Morse signals and flashlights, commonly used by these vessels for communication.

RARE DATE PALMS ARE FOUND AFTER 20-YEAR SEARCH

Within a few years the Salton Sea basin, near Indio, Calif., may become the center of the world's date culture, thanks to the unremitting efforts of the Department of Agriculture. For nearly 20 years the Bureau of Plant Industry has been endeavoring to procure shoots of the date palms which bear the fruit, known commercially as the Saidy, or Wahi, and Sewi varieties. So difficult was the source of the splendid fruit to trace that, up to 1913, only a few shoots had been procurable. At that time an immense grove of 200,000 of the palms in the Oasis of Dakhla, Tunis, was discovered. Negotiations for the purchase of specimens having been satisfactorily concluded, the collection of the shoots was begun. That it was slow is accounted for by the fact that a tree puts forth only 20 to 30 shoots during its lifetime. However, the collection was finally completed and the work of setting out 2,800 of the young trees will be started within the near future.

POCKET CAMERA SNAPS BLIMP THROUGH A TELESCOPE

Many an amateur photographer has snapped his shutter at a flying airplane or dirigible, to be rewarded only by an almost invisible speck on the developed film. One enthusiast, however, has managed to get a good-sized picture of a British blimp that was at least two miles away, and flying at 50 or 60 miles an hour. The exposure was made by holding a vest-pocket camera to the ocular lens of a telescope, which was first trained just ahead of the moving craft. Many amateurs are unaware that interesting pictures can be made in this way with a very ordinary telescope.



Fenwick Island Light and Surrounding Country: This Is Part of the Delaware-Shore Survey Performed by Airplane. Oblique Photographs, Such as This, Are Taken for Interpreting Those from Directly Overhead

SURVEYING FROM THE AIR

By HAROLD B. SAY

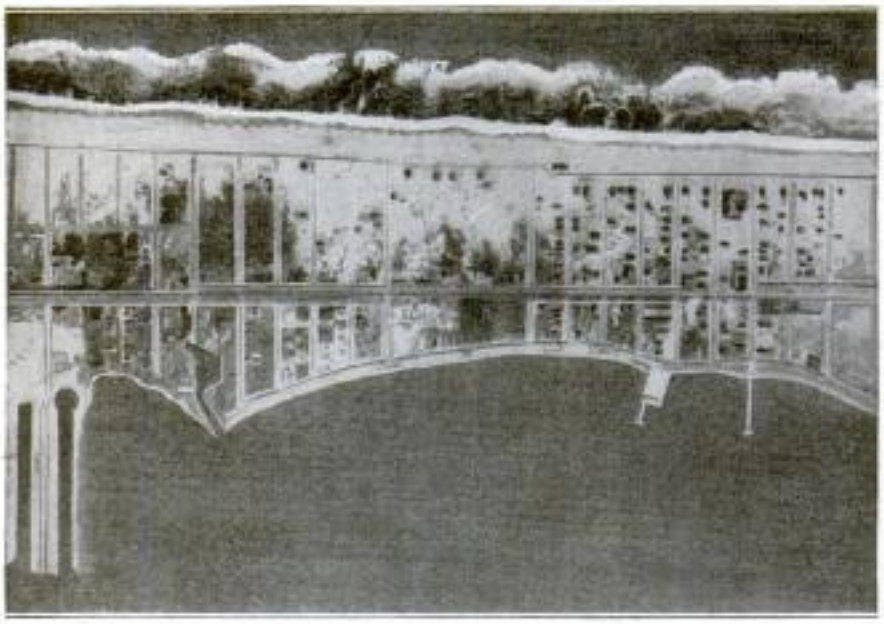
DEVELOPMENT of the airplane from a device that simply proved man could fly, to a machine vital in peace and war, and the advances in aerial photography achieved during the recent war, have combined to furnish the surveyor of continents with a new and highly valuable set of instruments. For the first time the annual report of the director of the United States Coast and Geodetic Survey devotes pages to this phase in map making.

Probably the work which most strikingly demonstrates the possibilities of aerial surveying is that done on the New Jersey coast between Cape May and Seabright. A single flight was made over the distance of 120 miles of coast line. Two hours were required for the trip. A total of 183 photographs were taken. Development of the films and the printing required two days of one man's time. The work of interpreting the photographs, assembling the mosaics, comparison with topographic sheets, and reduction to the scale of the chart of the outside shore line, consumed 15 days of office work by one engineer.

Bogs and Marshland near Atlantic City: It Is in Mapping Such Localities That the Airplane Demonstrates Its Supremacy.

Had the work been done by a land and boat party, several men and several weeks would have been required to do the actual field work, to say nothing of the drafting-room labor.

Most pertinent of all, the photographs taken during the two-hour trip are now

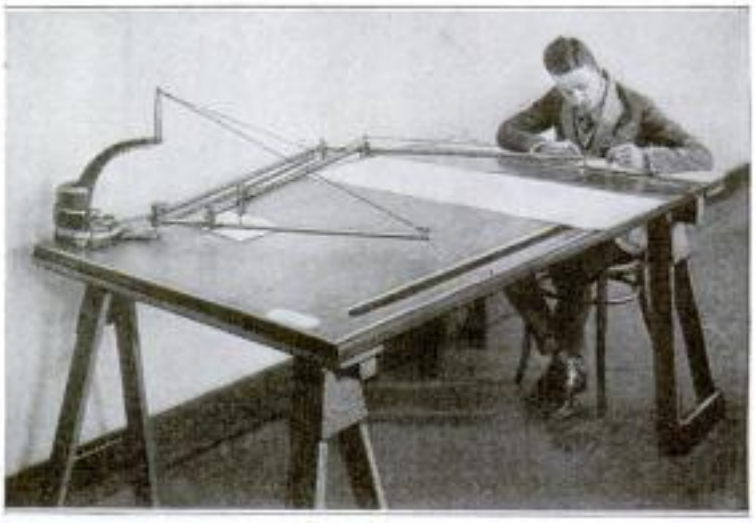


A Part of Seaside Park, New Jersey, Showing the Beach, in the Background, and the Landlocked Interior Waterway with Artificial Small-Boat Harbors

being used to revise the charts of the coast of New Jersey.

An army plane was used for the work. The camera was mounted in gimbals, with a lead weight at the lowest point, to aid in holding the optical axis of the camera vertical, and levels were used on it to keep the machine in the correct position. The exposures were made while the plane was at a height of 10,000 ft. The negatives were 18 by 24 centimeters (about 4½ by 6 in.) in size. The approximate scale used was 1:10,000.

The process of mapping from the finished photographs is simple. The prints are mounted in strip mosaics, generally about 4 ft. long. The composite photograph is compared with the topographic sheets of the same area, and control points are identified. The scale of the photographic mosaic is then determined, and by means of the pantograph the data are reduced to the scale of the chart and transferred from the photographs to the tracing paper.



Above: Using the Pantograph to Bring All Drawings and Photographs to the Same Scale. This Is Necessary When All the Photographs are Not Taken at the Same Altitude. Left: Airplane View of a Section of Atlantic City Showing Park Arrangement, Boulevards, and Railways

Aerial phototopography experiments were conducted at Atlantic City during July, 1919. That area was chosen, according to Director Jones, because it is characteristic of a great portion of the coastal-plane territory of the Atlantic coast. The most important point brought out in these experiments was the great possibilities of map-revision work, especially in sections where

the shore line is subject to frequent changes.

"Both land and seaplanes were used," says Director Jones of this work, "and in addition several photographs were made from a dirigible. Three types of mapping cameras were tried out, the 'L-type,' 'K-1,' and 'Trilens.' An officer of the survey kept in close touch with the work and furnished the ground control, constructing special targets in some cases.

"A mosaic was constructed by members of the air service of the army, using the photographs made with the 'K-1' mapping camera. These were taken at an altitude of 7,000 ft., using a 10-in. focal length with a resulting scale of about 1:8,000. A rough control scheme was first laid out and the mosaic constructed over this. This mosaic, and also the individual photographs, have been the subject of study by engineers of the survey, especially with reference to control and interpretation. Various methods of reduction for chart use were tried out."

While the phototopographic experiments were being conducted at Atlantic City, aerial photohydrographic work was under way at Key West, Fla. Of this phase of the work, Director Jones reports:

"Photographs were made by the naval air service to determine the possible use of aerial photographs in connection with hydrographic surveys. The primary object in view was the elimination of wire-drag work, especially in the clear waters of the Florida coast. An attempt was made to photograph small coral heads and pinnacle rocks, as it is the existence of these needlelike dangers to navigation that require the use of the wire drag. The equipment at the air station at Key West was limited, but thorough tests were made with that available. Various types of cameras were used, as well as different combinations of filters and plate emulsions. Photographs were made at altitudes of from 200 ft. up to 4,000 ft., and under various light conditions. It was hoped that some combination of the various factors involved would produce satisfactory results.

"The problem of control was solved by including in each photograph two vessels of the survey. The photographs could not be corrected for tilt with only two known points as a base, but the control, as furnished by the positions of the two vessels, was found to be sufficient for the experiments.

"A well-surveyed area near Key West was chosen, and the vessels proceeded on parallel courses over this area at full speed, the plane flying forth and back above the course. The courses and positions of the vessels were recorded as in ordinary sounding work. The photographer in the plane recorded the exact time that each exposure was made, with other data, such as altitude, exposure, plate, filter, etc. Each photograph was later oriented by plotting the positions of the vessels on the chart at the instant the exposures were made.

"These experiments proved very conclusively that photographs from the air, using present-day equipment, are of little practical value to the hydrographer. When any of the underwater features did appear in the photographs, contrast in color was the most prominent, with no indication as to whether the contrast indicated shoal or deep water. Varicolored bottom, of uniform depth, appears in the photograph as apparent difference in depth. Many charted shoals are not indicated in the photographs, while adjacent ones show clearly. Taken altogether, the results are so uncertain that the chances of eliminating field work in hydrography are very remote."

AIR BRUSH IS CONTROLLED BY ANGLE OF SLOPE

An air brush that atomizes its liquid contents in the usual manner by means of compressed air, has a special feature of control that depends entirely upon the manner in which the brush is held. The intensity of the spray is regulated by inclining the brush, more or less, according to the pressure required. The greater the angle of inclination the more will the color be divided. The spray is stopped by simply reverting the brush to its normal position. The operator unconsciously moves the brush to the suitable slope.

At the Slope at Which the Operator is Shown Holding the Air Brush, the Pressure would Give a Very Finely Atomized Spray

PREMATURE SHOT IN OIL WELL PUTS DRILLERS IN PERIL

Considering the large quantities of nitroglycerin used for "shooting" oil wells, the accident percentage is small. Occasionally, however, the erratic fluid fires before the shooters are ready. This is what happened the other day in western Kentucky. The drillers had scarcely placed the charge before it exploded. Immediately a roaring spout of oil and gas shot high in the air, while flying fragments of rock warned the deluged workers

Oil Spout Started by a Premature Explosion of Nitroglycerin Used to "Shoot" the Well: The Workers are Running for Cover from the Flying Rocks

that the care used in handling explosives cannot be too great.

PORTION OF ARIZONA DESERT TO BE NATIONAL MONUMENT

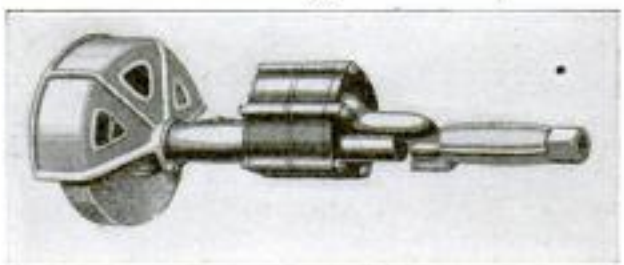
In order to conserve certain types of desert animal and plant life, which are fast being eradicated by the increased cultivation of soil, the Department of the Interior has ruled that a stretch of desert on the Apache Trail just east of Phoenix, Ariz., must be left untouched by land-reclamation projects. This tract will be a preserve showing what the country was before irrigation was put into service, and all of its plant and animal life will be allowed to thrive as it did before the desert was artificially watered. This new national monument represents a "cross section" of the state of Arizona and will be one of the future playgrounds which are set aside by the government.

EXPERIMENTAL MANUFACTURE OF GAS-FREE GLASS

A series of experiments have recently been made by the engineering experimental station of the University of Illinois, with the object of discovering, if possible, a method by which a glass free from the small gas bubbles, technically known as "seed," might be produced. The results of this investigation proved that all varieties of glass in the finished state contain dissolved gases, which are the prime cause of the formation of these bubbles. The amount and composition of the dissolved gas varies greatly with the type of glass, and the details of the manufacturing processes employed. A convenient apparatus for measuring and analyzing the dissolved gases was developed, and an improved type of vaccum furnace for the manufacture of gas-free glass was constructed. This is believed to be capable of commercial application.

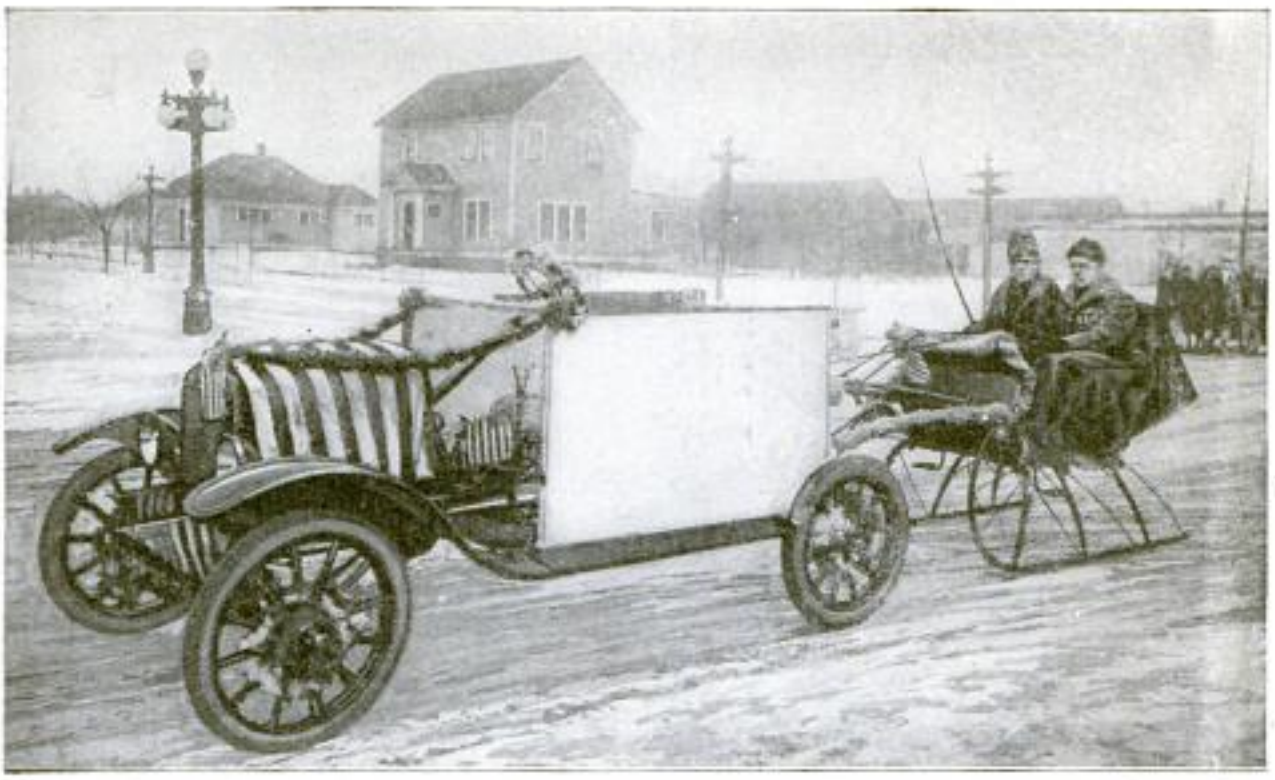
PORTABLE PNEUMATIC GRINDER IS OF LIGHT CONSTRUCTION

A portable grinder driven by compressed air and built with a nonslipping throttle handle, is now being marketed. The air enters the driving pistons through one handle. The pistons are integral with the rotating shaft that turns the grinder, eliminating the necessity of cranks and connecting rods. It is claimed that the machine is free from noticeable vibration, and because of its light construction can



Air Pressure for Operating the Portable Grinder is Admitted to the Motor through One Handle. The Compact Arrangement Permits Its Use in Tight Places

be moved about readily. The grinder is automatically oiled and weighs only 14 pounds.



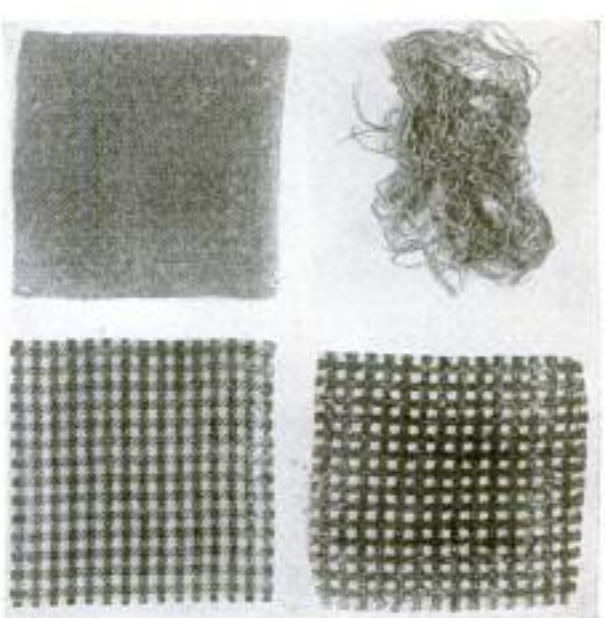
The Auto-Horse Taking Its Owner for a Sleigh Ride: Steel Cables, Connected to the Machine Control Parts and Steering Gear, Serve as Lines and Enable the Rider to Drive with Perfect Precision, Stopping, Starting, Changing Speeds, and Turning as Desired.

AUTO IS "BROKEN" TO DRIVE IN SINGLE HARNESS

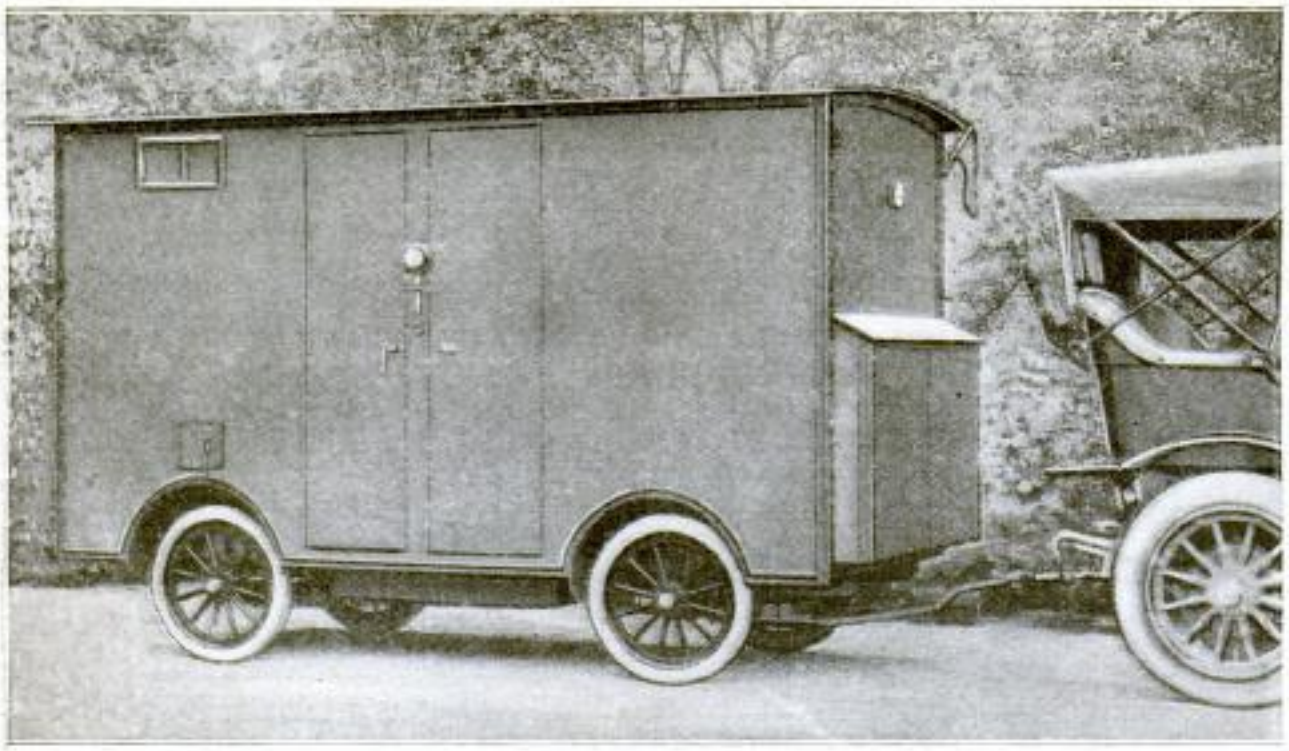
As an advertising novelty an automobile dealer of Hibbing, Minn., hitched a cutter to the chassis of a car and rode about the city streets, seated in the former, driving by means of "lines" of cables running from the sleigh to the control parts of the machine. The chassis behaved as well as would a well-trained horse, starting, stopping, walking, trotting, or running at the conventional words of command. The cutter equipment included a buggy whip, which was carried principally for effect, as it was not found necessary to use it on the willing steed.

SIMPLE TESTS DETECT SHODDY IN DISHONEST FABRICS

According to the Department of Agriculture there is no need of being uncertain regarding the honesty of fabrics, as a few simple tests will determine whether or not they contain "shoddy," or other adulterants, and in what proportions. Mercerized cotton in a supposedly pure silk article is detected by boiling a sample in a lye or caustic-potash solution—two tablespoons of lye to one pint of water. The silk will dissolve out, leaving a network of cotton threads. Suspected woolens are treated in the same way, the wool being consumed by the chemical. Care must be exercised to prevent getting the solution on the skin, or a bad burn may result. Many times silks are "loaded" with mineral salts to give them a false weight and body. When test samples of such fabrics are burned, the ash preserves the thread form, while that of pure silk crumbles to a shapeless mass. Pure-linen fibers are long, fine, and glossy, while cotton threads are short and lusterless.



Lye-Solution Test of "Woolen" Fabrics. Above, Right and Left: 53 per Cent Cotton Filling in a Piece of Serge. Below: Shepherd's Check. Adulteration, 77.6 per Cent. Left: Before Treatment. Right: After

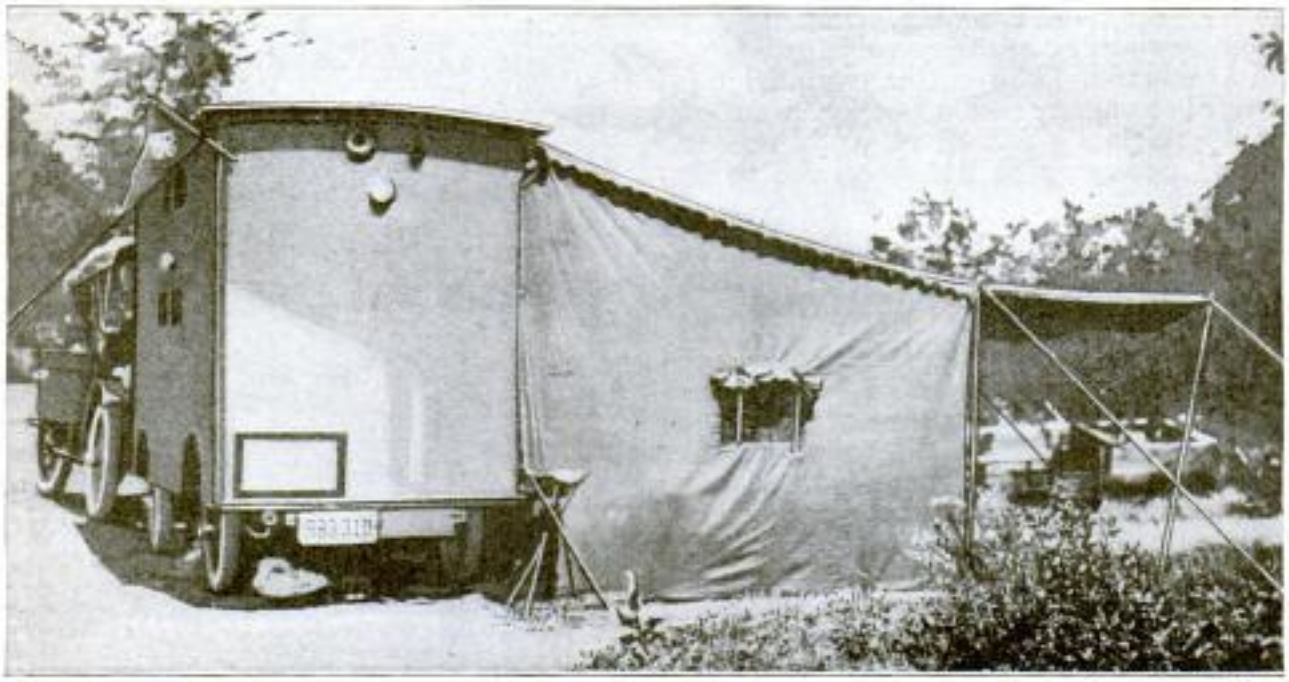


The Highway Palace Car en Route: The Large Locker Contains a 35-Gallon Tank of Water, a Refrigerator, Three Stoves, a Collapsible Rubber Bathtub, 40 Feet of Clothesline, Fire Extinguishers, a Kitchen Cabinet with Four Days' Provisions, a Bicycle, and Other Articles Too Numerous to Mention

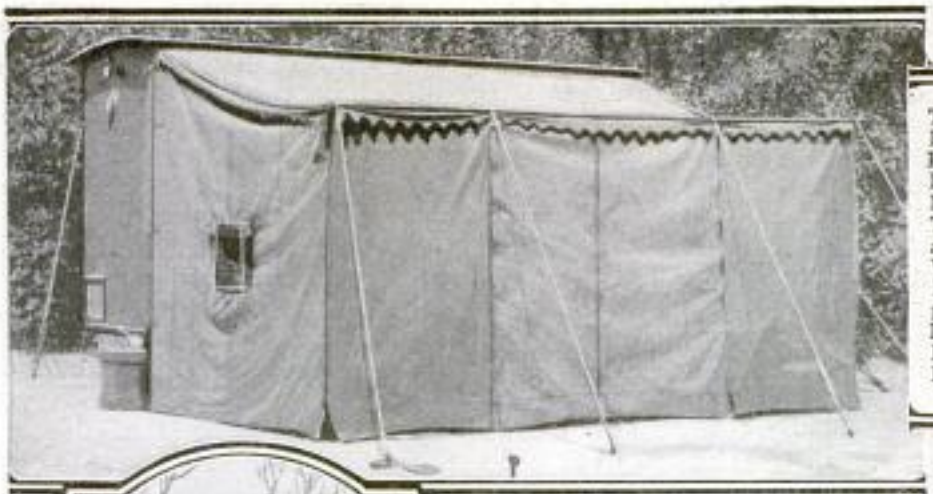
A PALACE CAR OF THE RAILLESS WAYS

BY WM. H. HUNT

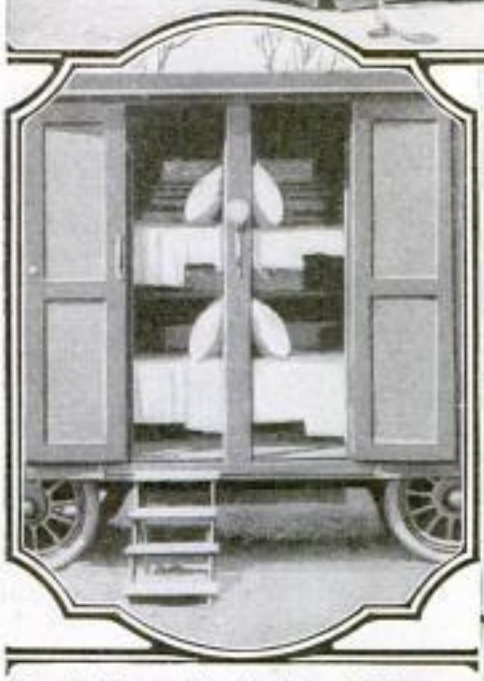
THE independent trailer, or the completely self-contained traveling home, mounted on a passenger car or light truck chassis—which? This question is agitating the minds of hundreds of motorists who have felt the lures of spring and the open road leading away into the mysteries of tomorrow. Elaborate outfits, built directly on the chassis, there are many, but it has remained for a citizen of Buffalo, N. Y., to design and build a touring trailer which is literally a palace car of the highways. A double-decking arrangement provides ample space for four full-size single berths—not bunks—each with its comfortable mattress, and numbered as is the practice in railway sleeping coaches. Besides these, four additional folding cots can be made up in a specially made tent which, fastening to the



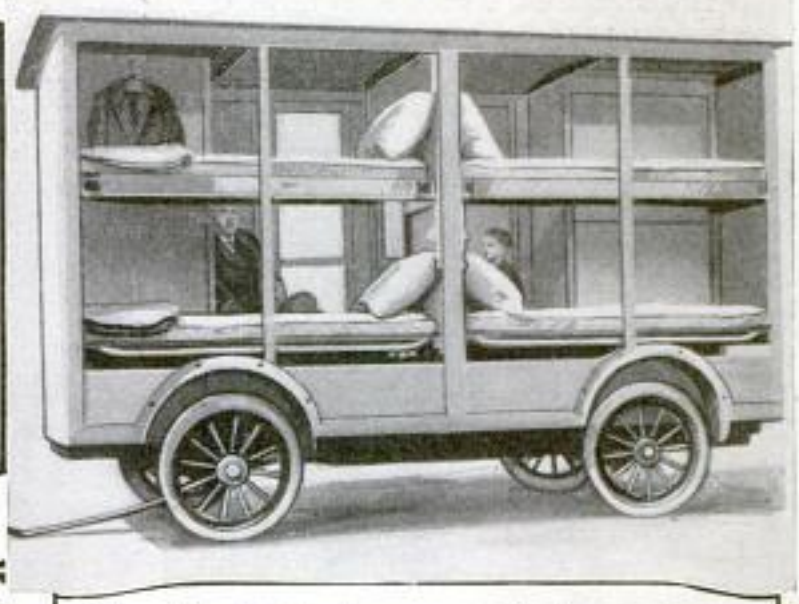
Encamped, Following a Day of Sight-Seeing Unmarred by a Doubt Concerning the Night's Lodgings: When the Front Tent Wall is Raised, It Forms the Roof of a Spacious Porch. In This Case the Total Space under Shelter Measures 14 by 21 Feet



The Combination Dining Room, Library, Front Porch, Parlor, and Guest Chamber Fastened Up Tight against a Night of Boisterous Weather: The Windows are Screened and Curtained and a Heavy, Waterproof Ground Cloth Forms a Floor That Is Impervious to Dampness and Insect Pests. The Tent Poles, Fabric, and Gear Collapse and Fold into a Compact Bundle



Here is Shown the Partition Dividing the Interior of the Palatial Trailer into Two Compartments Which Communicate by Means of a Sliding Door. The Steps are Covered with Rubber Matting to Prevent Slipping, and a Doormat is Fastened to the Bottom One



View of the Interior Arrangement, Showing the Partition More Clearly and Also the Disposition of the Large-Size Comfortable Berths: An Idea of Their Dimensions can be Formed by Comparing Them with the 14-Foot Length and 5-Foot Width of the Body. Each Berth Has Its Own Window and Electric Reading Light

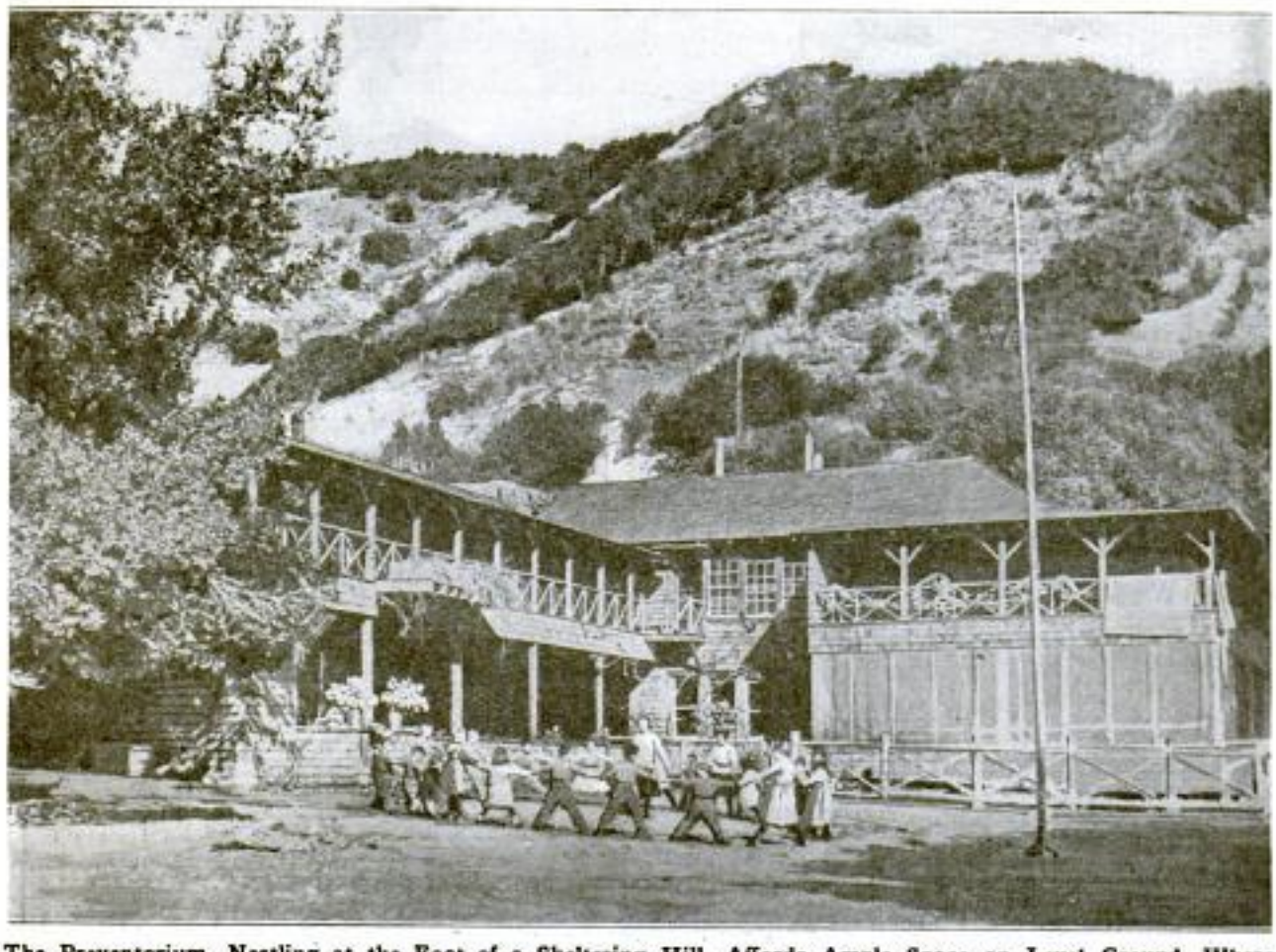
With the Extra Cots Stacked to One Side, the Porch Becomes an Outdoor Dining Hall, or Whatever Else Fancy may Suggest. Right: One of the Sturdy Chairs Which Fold and Pack into a Small Space. The Combination Pick and Shovel Is an Almost Indispensable Part of the Outfit

Besides the Four Berths in the Trailer, Four Additional Folding Cots are Carried for Emergencies. The Curtained-Off Space to the Left is Reserved for Any of the Party Who may Have the Snoring Habit. At Least This Is the Explanation Given by the Owner

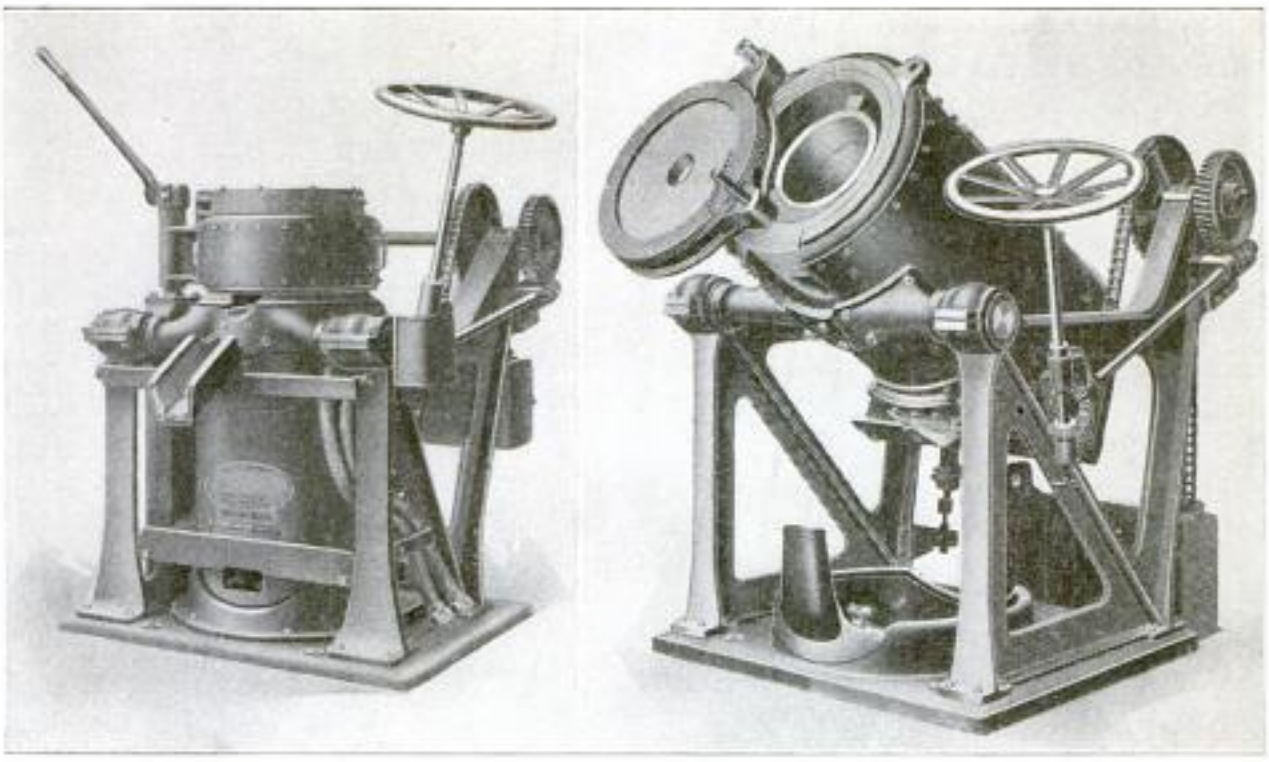
side of the main body, extends outward several feet, forming another large room. A number of 21-cp. nitrogen-filled incandescent bulbs light the spacious outfit inside and out, and are so connected that the outside lights may be turned on by switches at the head of each berth. A 5-ft. locker, extending across the front of the body, contains a 35-gal. water tank, dampness and insect-proof provision bins, a refrigerator, one kerosene and two wood-burning stoves, axes, shovels, and a bicycle, the latter for running short errands. Water is heated in small quantities and stored in a smaller tank in the lavatory. The appointments of this little room are quite ingenious, numbering among other novelties a locker containing small compartments, each bearing a number corresponding with that of one of the berths. This arrangement gives assurance that the intimate individual effects of the party will not become mixed. Folding chairs, tables, cots, suitcases, and tent stow away in a generous space under the body floor. Another unusual arrangement, assuring the privacy of feminine members of the party, is a sliding door which divides the body into two compartments. Despite the spaciousness of the outfit it is no longer or wider than the average touring car.

PREVENTORIUM RESTORES TUBERCULAR CHILDREN

Ideally situated at the foot of a hill, where there is plenty of sunshine and fresh air, in Marin County, across the bay from San Francisco, is a preventorium for the care of pre-tubercular children. It is the result of the work being done by the San Francisco Tuberculosis Association in its war against the great white plague. Twenty-five children are continuously provided for by the institution, the patients coming from five free clinics operated by the association in San Francisco, and from cases discovered by the association's staff of nurses. With outside sleeping accommodations and the large playground, the children have the benefit of healthful conditions day and night, that, added to regular educational work, soon enable them to return to the city, with regained health, and abreast of their classmates at school.



The Preventorium, Nestling at the Foot of a Sheltering Hill, Affords Ample Space on Level Ground, Where the Children Play and Take Exercise. The Outside Sleeping Accommodations can be Plainly Seen under the Eaves of the Roof



Two Views of the Late-Model Crucible: On the Left, the Gas-Fired Model When Upright for Use in Melting. The Tilted Position of the Oil-Fired Unit on the Right is Accomplished by Turning the Handwheel

LATE-MODEL CRUCIBLE POURS AT A CONSTANT POINT

A crucible designed in such a way as to pour at one point constantly, no matter at which angle the pot is tilted, is now in use for melting brass, gun metal, aluminum, and copper in quantities up to 600 lb. The furnace is tipped by turning a handwheel which is geared and fitted with a chain. The chain engages a sprocket at the base of the furnace and as the handwheel is turned, the vessel is tipped, pouring the metal. A pouring aperture is located in the crucible body, so close to the trunnion axis that the delivery point of the molten stream does not vary when pouring, no matter how much or little the crucible is tilted. Thus without splashing the metal may be received in the ladle below. Oil or gas may be used as fuel by changing the heating burners and piping.

LIGHT TRUCK IN TIGHT JAM BETWEEN TWO STREET CARS

A light delivery truck traveling one of the busy thoroughfares of Chicago recently was badly wrecked in a jam between two street cars. Evidently the driver thought he could get around the front of one of the cars in time, but miscalculation in this respect pushed the nose of the truck a good distance between the two cars. There is not a great deal of space between two passing cars in that city, and only the wreck of the truck remained to tell the tale of poor judgment and a disregard of "safety-first" principles.

A Light Truck Failed to Beat a Chicago Street Car to It, and the Picture Shows the Result. The Necessary Speed Spurt Drove the Little Truck Up between the Trolley Cars

NEW NAVAL AIR STATION HAS CROW'S NEST FOR LOOKOUT

A feature of the navy's Pacific-coast air station is the watch tower that has been incorporated in the design of the administration building. The tower is in the center of the building and is flanked by other buildings of the station. From the glass-inclosed room at the top of the tower an unobstructed view of the sea for miles is obtained, making the lookout's station of great value for training sailors in observation, range finding, and other duties. It also serves as a landing marker for airplanes.

The Navy has Equipped the Administration Building of Its Pacific-Coast Air Station with a "Crow's Nest" for the Lookout for Sighting Incoming Air Craft. The Tower Is Also of Value for Instructing Sailors in Range Finding, Observation, and Other Duties

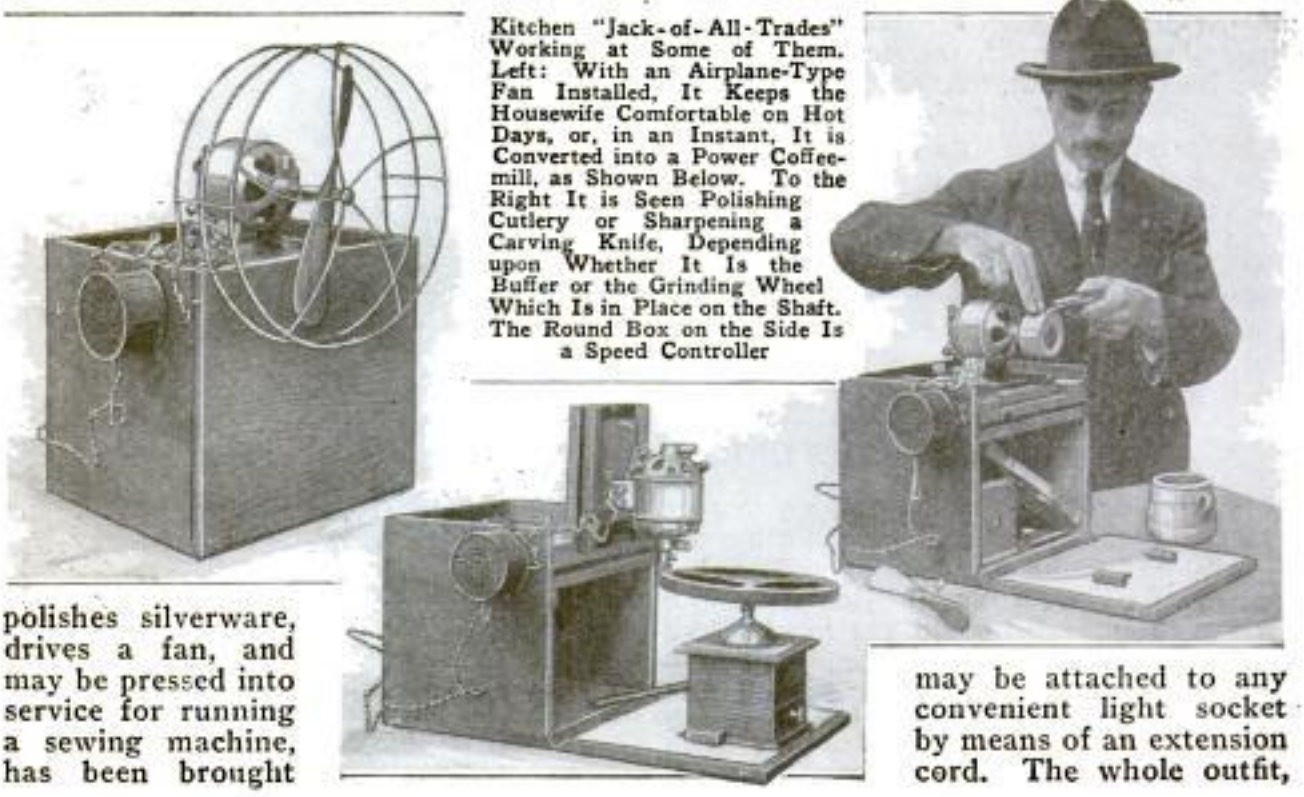
HISTORIC PLYMOUTH ROCK TO BE WATERPROOFED

Plans are under way to preserve Plymouth Rock, the great bowlder on the coast of Massachusetts, which has always been regarded with veneration as the landing place of the Pilgrim Fathers, who were the founders of New England. The rock has shown signs of deterioration from the effects of frost and water, and has given evidence of ultimate disintegration.

Some years ago a great crack appeared, which split the upper half of the rock, and there was danger of this recurring in other parts. Therefore, large fissures and cracks in its sides have now been filled with a weatherproof substance, and as, lately, vandals have done willful damage to the relic, it has been placed inside a brick building with its doors and windows locked and barred.

MIDGET MOTOR IS KITCHEN "JACK-OF-ALL-TRADES"

A many-purpose electrical kitchen outfit which runs an egg beater, grinds coffee, polishes silverware, drives a fan, and may be pressed into service for running a sewing machine, has been brought out by a French inventor. The power is supplied by a small electric motor which may be attached to any convenient light socket by means of an extension cord. The whole outfit,



Kitchen "Jack-of-All-Trades" Working at Some of Them. Left: With an Airplane-Type Fan Installed, It Keeps the Housewife Comfortable on Hot Days, or, in an Instant, It is Converted into a Power Coffee-mill, as Shown Below. To the Right It is Seen Polishing Cutlery or Sharpening a Carving Knife, Depending upon Whether It Is the Buffer or the Grinding Wheel Which Is in Place on the Shaft. The Round Box on the Side Is a Speed Controller

consisting of the motor, cord, current controller, and various fittings for the motor shaft, is contained in a small neat box, which makes it handy to carry wherever needed.

ELECTRICITY DOES WEIGHING IN UP-TO-DATE GROCERY

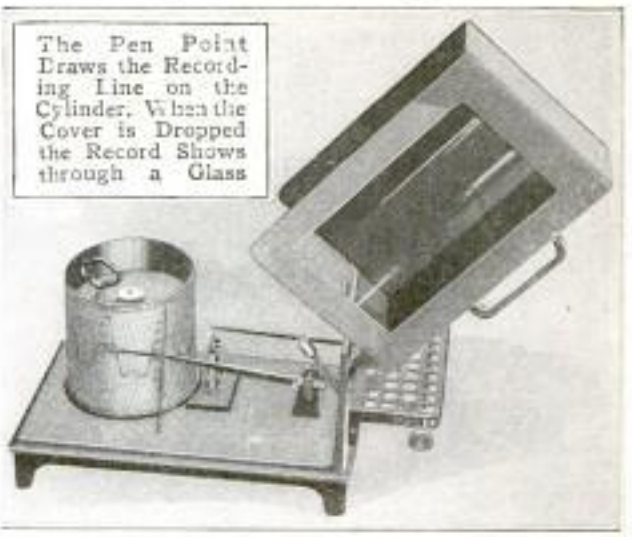
The all-electric grocery store has arrived. It is located in Colorado Springs, Colo. Even the scales are electrified so that they will weigh out coffee, tea, sugar, etc., to the exact fraction of an ounce. The openings of the bins containing the various commodities are fitted with electromagnets which hold them open as long as current flows. The scales form part of the electric circuit, and as soon as whatever weight they are set for causes them to balance, the current is shut off. The magnets then release the bin shutters, allowing them to close. An upright

Weighing Groceries Electrically: The Scales, Upright Fitting, and Bin Outlets Are Part of a Circuit. When the Scales Balance the Outlets Close

fitting, placed on the scale platform, holds paper bags, and also forms the electrical connection between the scales and the bin-outlet control mechanism.

SELF-RECORDING INSTRUMENT CONTROLS AIR HUMIDITY

A new ventilating instrument records graphically the amount of humidity in the air, throughout an entire week. The instrument consists of an independent, self-recording mechanism, and an eight-day clock, inclosed in a brass cylinder, which revolves once around its axis in seven days, and which carries on its exterior face an engraved sheet, or chart, for receiving, by means of a line-drawing pen point, the indications of relative humidity. The instrument can be set to give any desired degree of humidity, and when



once adjusted, operates automatically. At any time the existing humidity conditions are seen at a glance.

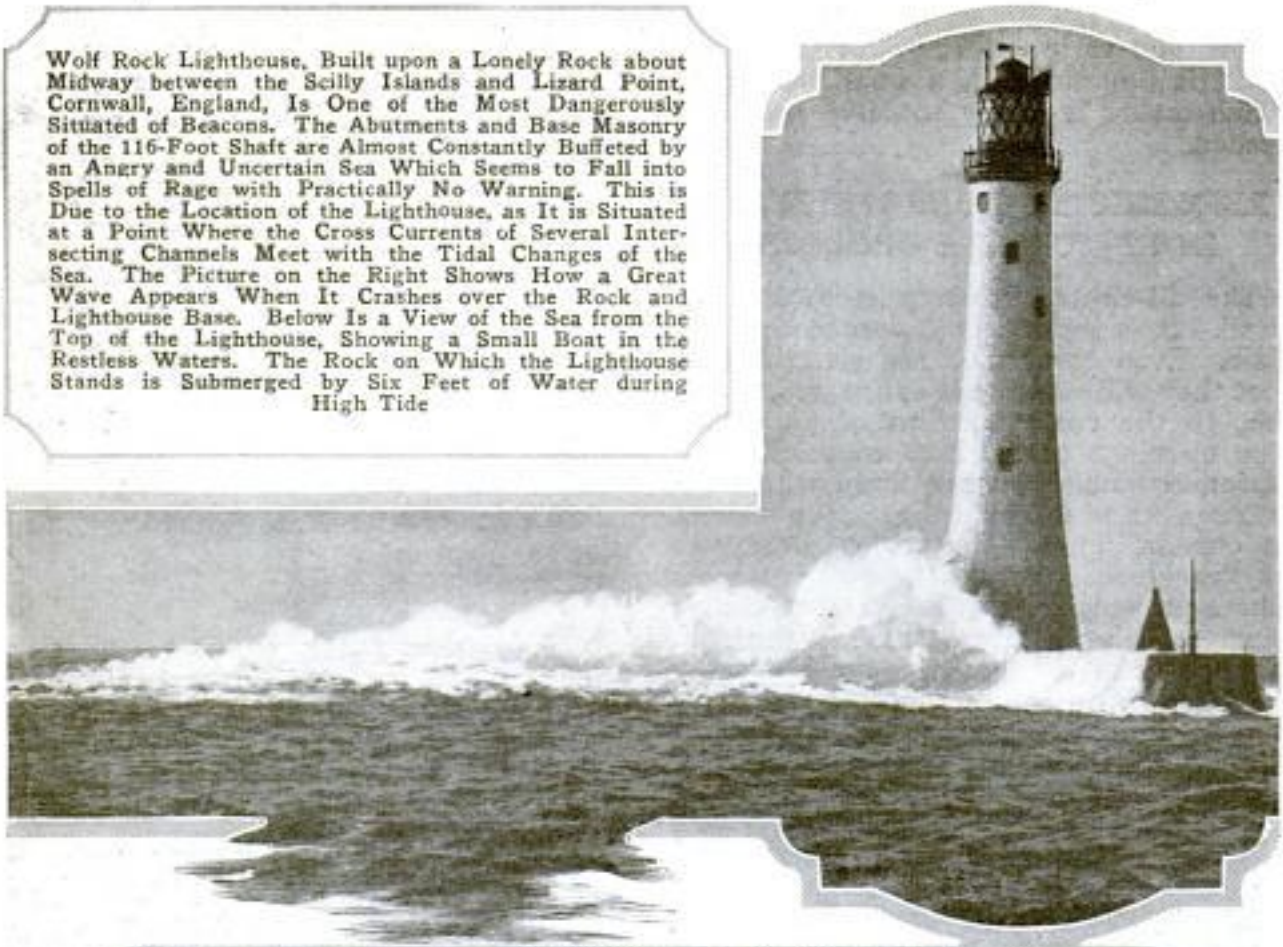
HANDS KEPT DRY IN WRINGING MOP OF LATE DESIGN

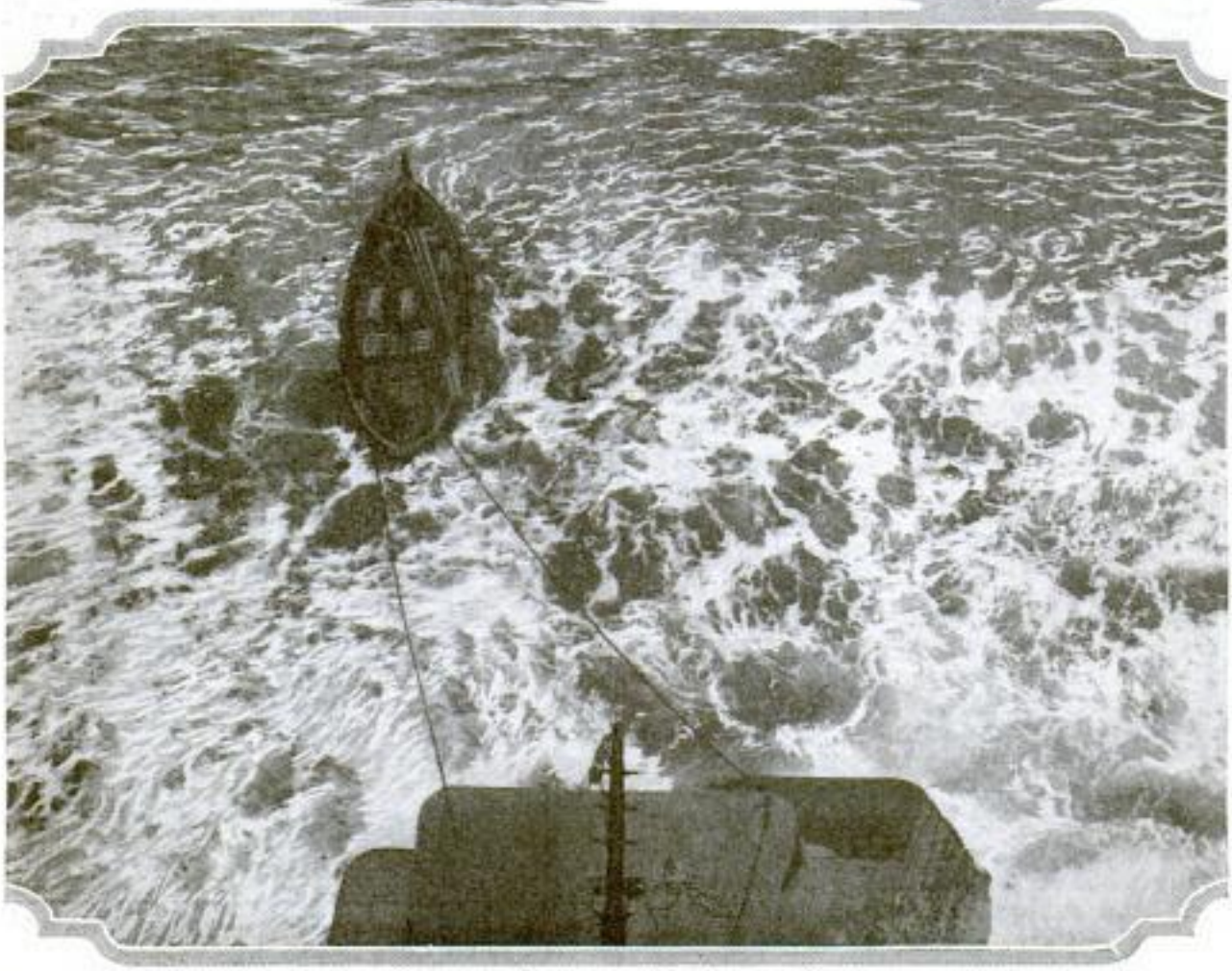
A mop recently produced does away with getting the hands wet when scrubbing, and so prevents the resultant chafing and cracking so frequent after they have been bathed for hours in scrub water. The mop, when in service, hangs down over the end of the pushing stick in a bunch suitable for drying a reasonably wide swath. When it becomes water-soaked, it is placed over a bucket and wrung by the use of a wooden handgrip with which the cloth strands are pulled up on the handle and twisted until dry. A spring, seated against a shoulder on the mopping stick, reacts against the grip when the hand relaxes, and returns the cloth strands to the lower end.

The Hands do Not Get Wet in Wringing the New Mop, as the Cloth Strands are Contained at One End in a Wooden Handle, Which is Twisted

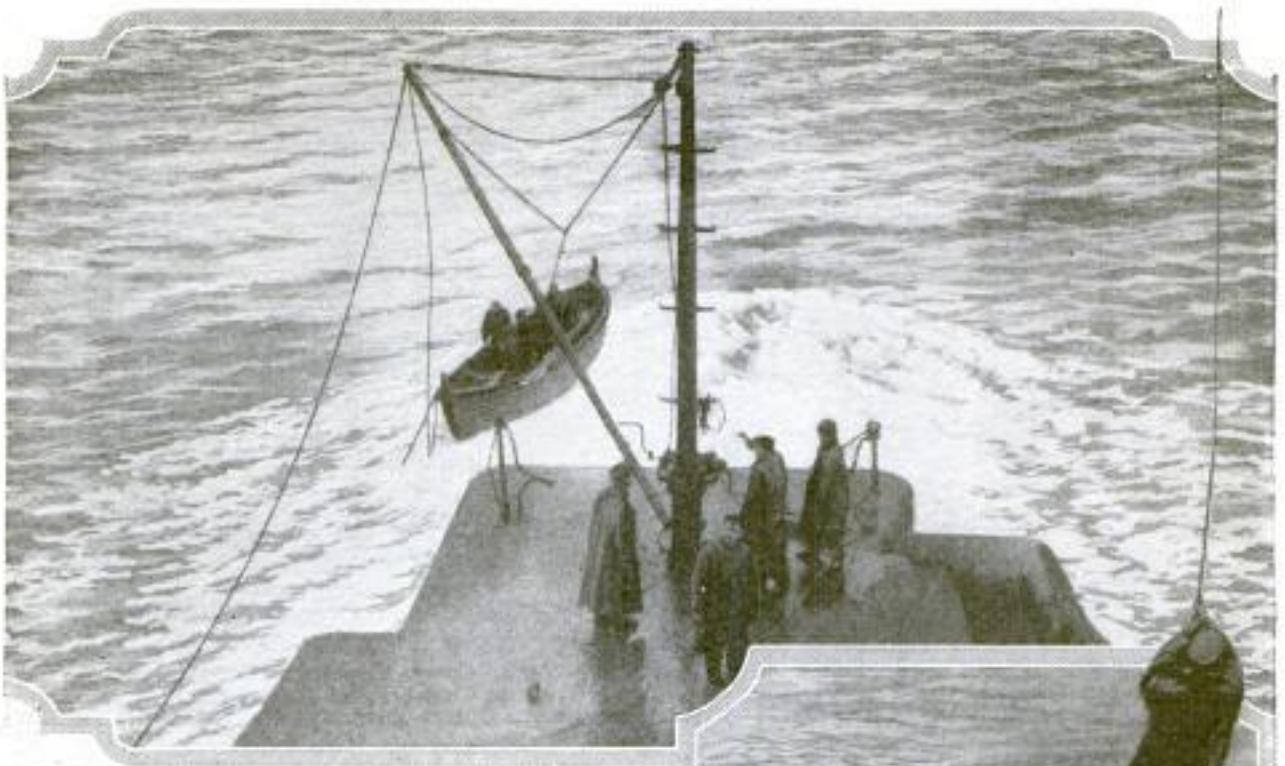
BEACON ON WOLF ROCK OFF COAST OF CORNWALL

Wolf Rock Lighthouse, Built upon a Lonely Rock about Midway between the Scilly Islands and Lizard Point, Cornwall, England, Is One of the Most Dangerously Situated of Beacons. The Abutments and Base Masonry of the 116-Foot Shaft are Almost Constantly Buffeted by an Angry and Uncertain Sea Which Seems to Fall into Spells of Rage with Practically No Warning. This is Due to the Location of the Lighthouse, as It is Situated at a Point Where the Cross Currents of Several Intersecting Channels Meet with the Tidal Changes of the Sea. The Picture on the Right Shows How a Great Wave Appears When It Crashes over the Rock and Lighthouse Base. Below Is a View of the Sea from the Top of the Lighthouse, Showing a Small Boat in the Restless Waters. The Rock on Which the Lighthouse Stands is Submerged by Six Feet of Water during High Tide



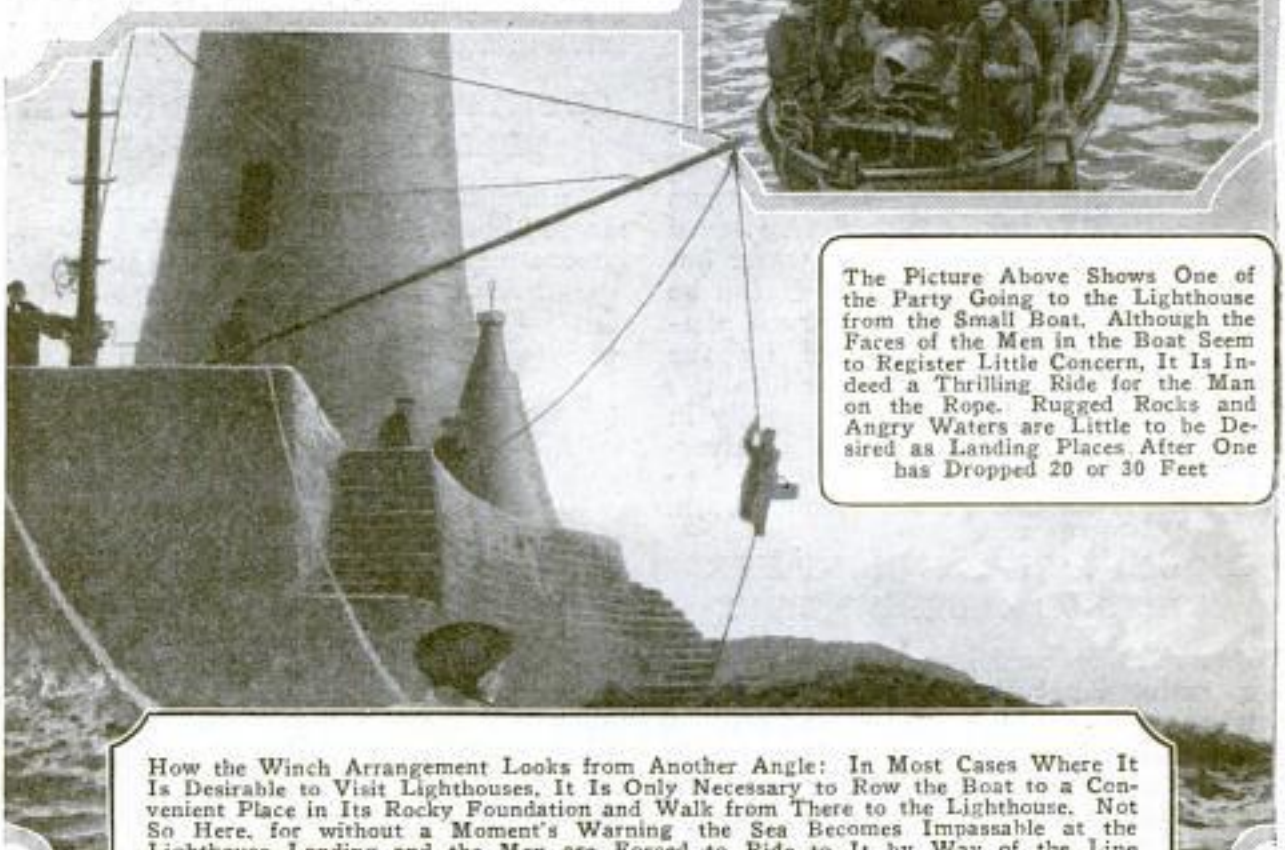


IS MOST DANGEROUSLY SITUATED LIGHTHOUSE

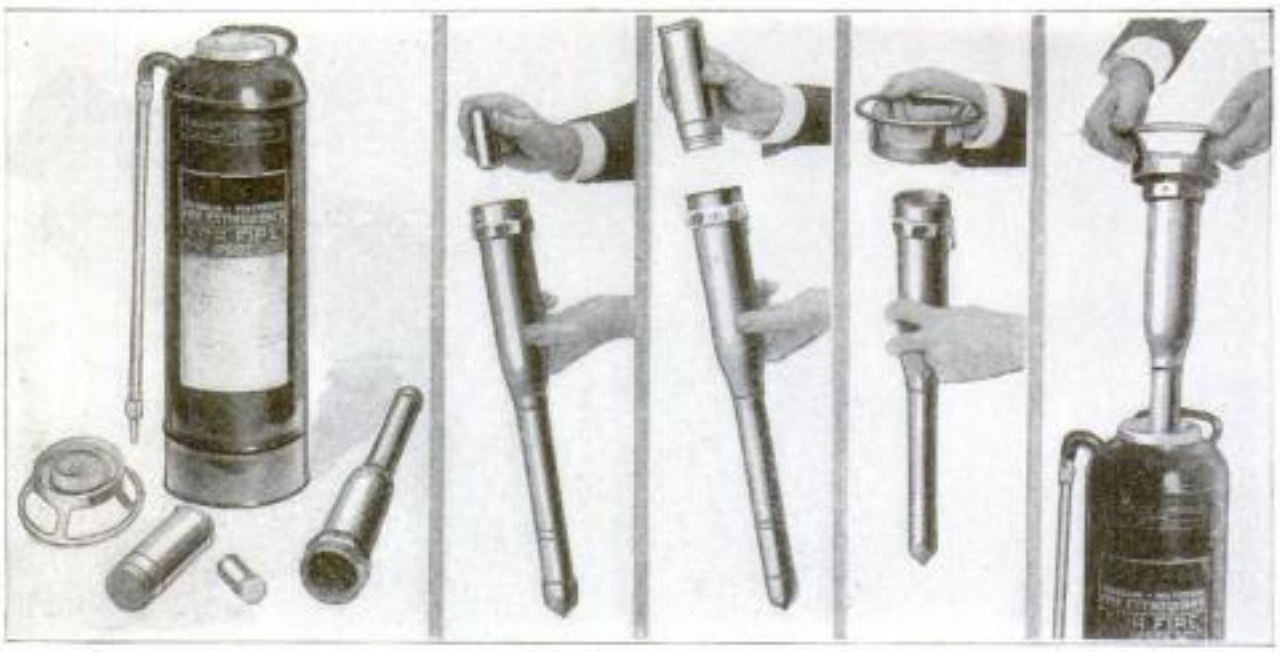


The Lighthouse Keeper is Allowed a Holiday Once in a While, and the Change of Operating Forces at the Station Is Very Interesting. The Relief Party Arrives, and a Small Boat, Let Out by a Rope, Receives Them. This Little Craft Tosses About on the Sea Surface during the Change, at About 30 Feet from the Lighthouse Base, and a Line is Thrown to Its Occupants. Grasping It with Their Hands, They are Hoisted, One at a Time, through Space, to a Point of Safety, by a Special Winch Which is Operated by Those on the Landing

The Picture Above Shows One of the Party Going to the Lighthouse from the Small Boat. Although the Faces of the Men in the Boat Seem to Register Little Concern, It Is Indeed a Thrilling Ride for the Man on the Rope. Rugged Rocks and Angry Waters are Little to be Desired as Landing Places After One has Dropped 20 or 30 Feet



How the Winch Arrangement Looks from Another Angle: In Most Cases Where It Is Desirable to Visit Lighthouses, It Is Only Necessary to Row the Boat to a Convenient Place in Its Rocky Foundation and Walk from There to the Lighthouse. Not So Here, for without a Moment's Warning the Sea Becomes Impassable at the Lighthouse Landing and the Men are Forced to Ride to It by Way of the Line



Details of the Freeze-Proof Fire Extinguisher. Left: The Tank, Cover, Cartridge, Weight, and Pressure Chamber. Center: Inserting the Weight and Cartridge in the Pressure Chamber and Applying the Cover. Right: Placing the Pressure Chamber in the Tank. Turning the Device Upside Down Quickly, Fires the Cartridge

MUD SCRAPER TAKES PLACE OF BICYCLE WHEEL GUARD

From Europe comes a simple fitment for bicycles which is designed to take the place of the somewhat awkward and fragile wheel guard. It is a simple scraper which bears lightly against the tire, near the ground, and brushes off the mud and water before it can be thrown upward by the wheel. Two steel rods, clamped to the bicycle frame, hold the scraper rigidly in position. The device is made with universal fittings so that it may be attached to either the front or rear wheel, or to both.

LIQUID FIRE EXTINGUISHER WORKS AT 40° BELOW ZERO

The solution used in a portable 2½-gal. fire extinguisher, lately placed on the market, is made with calcium chloride—the chemical used for some years past in making antifreeze solutions for automobile radiators—which will not freeze at temperatures as low as 40° F. below zero. The method of generating pressure in the device is also quite novel. A vertical tube, contained within the tank, has a cartridge of a slow-burning powder inserted in its top end and a small, but heavy, weight at the bottom. Upon turning the tank upside down, the weight falls and strikes a percussion cap in the head of the cartridge. This, exploding, fires the powder charge, which liberates a large volume of gas that almost instantly creates a pressure, in the tank, sufficient to throw a stream of the solution a distance of 30 to 40 feet.

COUNTER FOR SHIP TURBINES TELLS SPEED OF SHAFT

An engine-room counter that tells, on a single 9-in. dial, the total number of revolutions made by a turbine-driven propeller shaft, and also its number of revolutions per minute in either direction, is a new item of marine equipment. A friction-clutch mounting enables the pointer to be held at zero, released for timing with a watch, and stopped at the expiration of a minute, giving a direct reading of the revolutions-per-minute figure. The scale on the periphery of the dial has 100 divisions, and the pointer advances one division for each shaft revolution. The totaling counter, under the pointer, reads to 99,999,999 and repeats.

EXPERIMENT WITH NEW SERUM FOR TUBERCULOSIS

Though reports of antituberculosis discoveries must be viewed with extreme caution, the persistent experiments of European scientists seem to be producing some hopeful results. Henri Spahlinger, a Swiss bacteriologist, records the apparently successful arrest of a number of pulmonary and other cases by his process, which comprises first the destruction of the disease toxins, and second the injection of immunizing serums. Physicians in this country generally decline to comment on the reports until further evidence becomes available.

Details of the Calmette experiments, mentioned in this magazine last March, have been disclosed. The cultures of tuberculosis bacilli, made in glycerin containing bile, are stated to lose their power of communicating the disease, and apparently act as vaccines in immunizing cattle against subsequent attacks for a year or more.

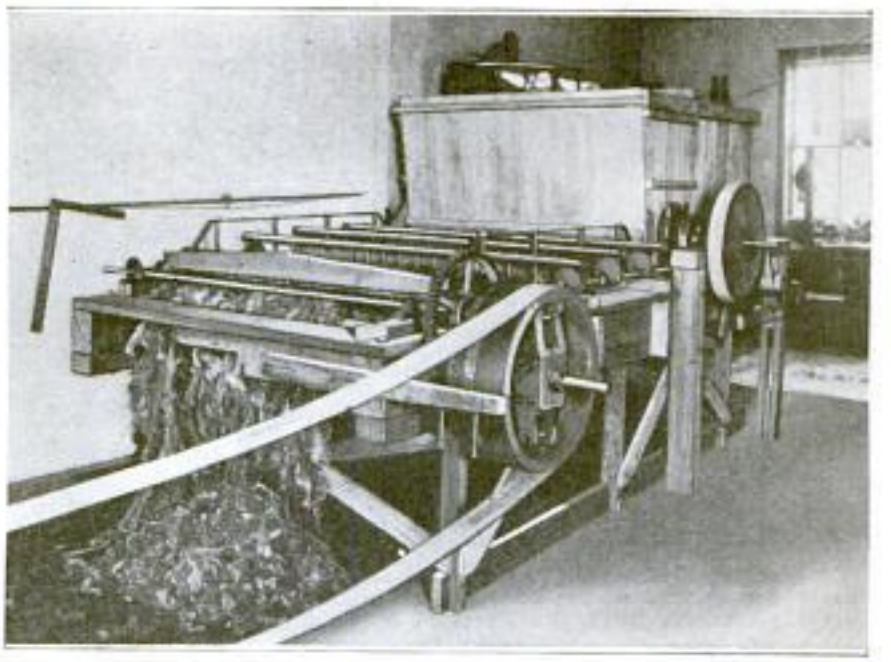
HELICALLY CUT TEETH USED ON FORMED MILLING TOOLS

Formed milling cutters which have helically cut teeth are a new convenience for the machinist. Because of this form, the point of the second tooth is engaging the stock before the first tooth has finished its cut, which provides for a shearing action instead of the usual chopping occurring where square teeth are used. The form of the cutters is made according to the specifications of the user, which are in turn contingent upon the shape cut to be made in the stock.

The Formed Milling Cutters Make a Shaped Groove in the Metal Stock. The Teeth are Helically Cut

RAGS CONVERTED INTO WASTE BY NEW MACHINE

For shredding old cotton rags that are of little or no value for other purposes into waste, for wiping off machinery, printers' rollers, and the like, a machine has been invented recently. The rags are dumped into a large hopper at the rear of the machine and are automatically fed into the shredding mechanism. The rag waste may either be used "straight" or mixed with the familiar cotton-mill waste. The machine handles 25 tons a day.

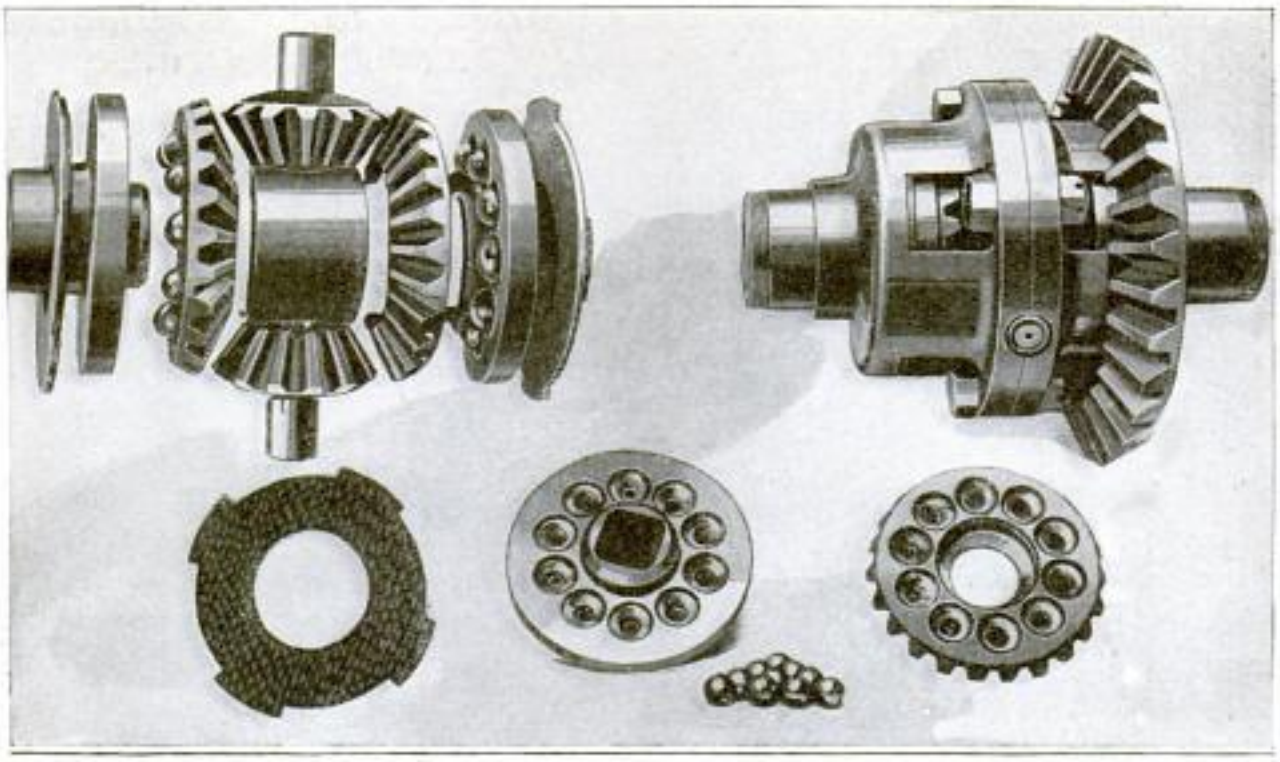


A Machine Which Chews 25 Tons of Old Rags a Day into Waste: The Rags are Fed into the Large Hopper at the Rear and Automatically Conveyed into the Shredding Mechanism

CHINESE SKATING CLUB HEARS JAZZ MUSIC FROM AMPLIFIER

The telephone amplifier was recently put to the novel use of furnishing the members of a Chinese skating club in Peking with exaggerated jazz music. The instruments employed were similar to those used at the recent inauguration, comprising a series of horns at the top of a room, connected by wiring to a phonograph in the basement. As the phonograph records were played, magnified jazz music issued from the throats of the horns and provided a fitting complement to the pleasure of skating.

¶A new incandescent lamp, filled with Neon gas, can be burned continuously at a cost of about 36 cents per month, as it consumes current at the rate of only five watts. The red light emitted is used for signaling.



The Nonstall Differential. Above, Left: The Parts in Their Relative Positions. The Flanges, but Not the Gears, are Secured to the Axle Shafts. Right: The Unit Assembled. Below, Left to Right: One of the Braking Washers, Inside Surface of an Axle-Shaft Flange, and Outside of a Gear Showing Recesses for the Balls

NEW AUTO DIFFERENTIAL GEAR PREVENTS WHEEL SLIPPAGE

An improved differential, or equalizing gear, for automobiles is said to accomplish the purpose of practically locking the axle driveshafts together on a straight pull, while allowing one wheel to run faster than the other when rounding a curve. The gears are not rigidly attached to the shaft ends, but are simply supported upon them. A few inches from the ends the shafts are fitted with rigidly attached flanges. The inner face of each flange, as well as the outer face of each gear, is machined with 10 recesses, into which ball bearings are placed when the apparatus is assembled. The balls transmit the drive from the gears to the flanges and also exert a heavy side thrust on the latter when the driving force is applied. Between the outer faces of the flanges and the inner sidewalls of the differential case are placed thick washers of brake-lining material, anchored in such a way that they cannot turn. Their purpose is to act as brakes when there is any tendency of either wheel to turn faster than the other. When one of the wheels encounters a slippery place, the drag of the washer on its side is heavy enough to cause the driving force to be transferred to the wheel having traction, thus causing it to pull the load. There is some dragging of the brake material when turning a corner, but it is very slight.

PHOTOGRAPHING STARS NEAR THE SUN'S EDGE

In the past it has been necessary to wait for an eclipse of the sun before it was possible to photograph a star in the vicinity of the sun's disk. The intensity of the light of the sun is so great that even the sky for a considerable distance from it is very bright, and sufficient to overwhelm completely the image of any stars that might be in the field. This can be better understood when it is stated that the brightness of the sun is equal to 120,000,000,000 first-magnitude stars.

The subject of the apparent position of the stars, as seen near the sun's limb, has recently become of great theoretical importance in connection with the gravitational theory of Professor Einstein. At the last eclipse photographs were obtained of stars near the sun; and the results appeared to indicate that Einstein's theory was borne out. However, the question is of fundamental importance to physicists and astronomers, and the effects are so minute that further data are wanted before a final conclusion is drawn; and it was naturally thought that they could not be had until the next total eclipse.

It has just been announced, however, that a French scientist has succeeded in photographing stars in the vicinity of the sun in broad daylight. This is accomplished with the aid of a screen which intercepts the direct image of the sun,

and the effect of the intensely bright sky is disposed of by using suitably stained photographic plates making them sensitive to the red light, and by the employment of red filters which only allow light of certain wave lengths to pass through. It is possible, therefore, that it will not be necessary to wait for another eclipse before obtaining additional data on the Einstein theory, but that photographs can be taken at any time when the sun appears to be in the neighborhood of a star which will best suit the purpose.

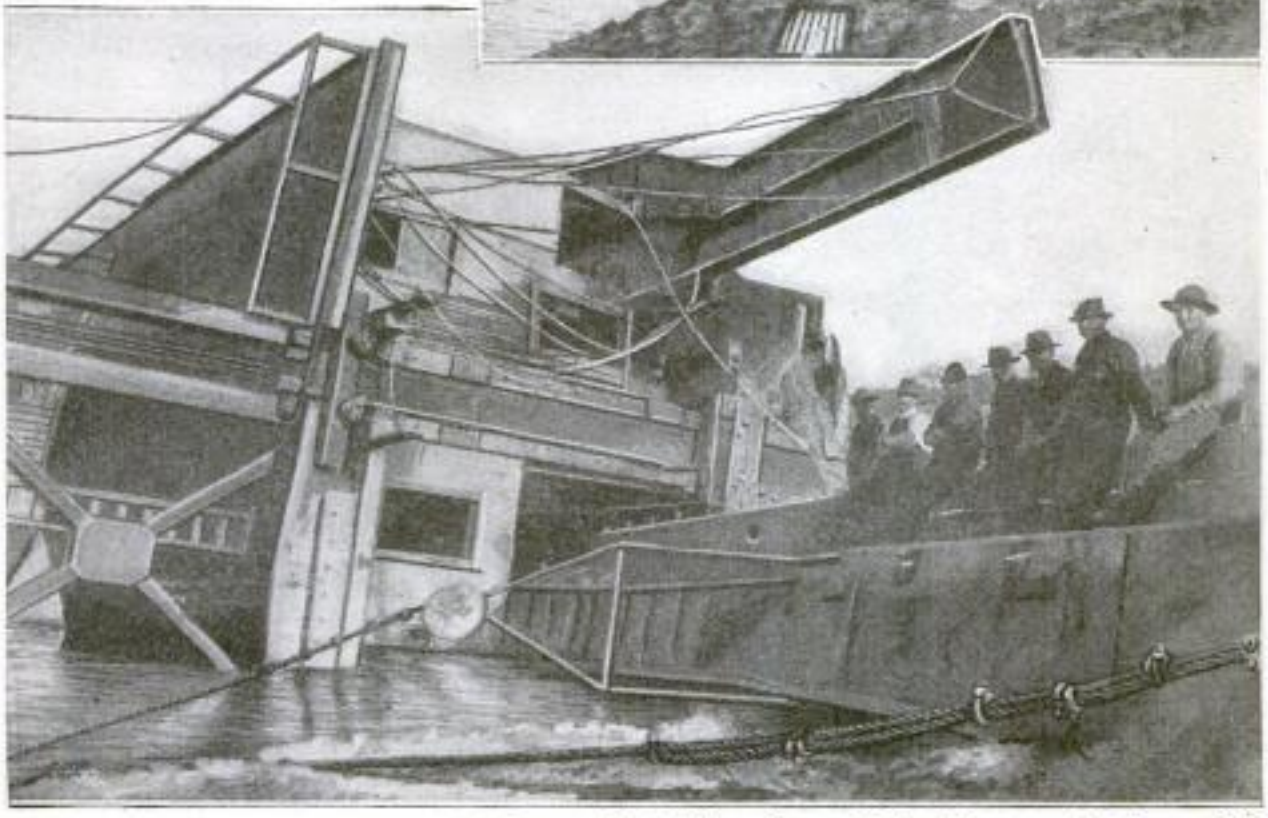
GOLD DREDGE TURNS TURTLE IN THIRTY FEET OF WATER

No definite reason can be given as to why a large dredge, working in 30 ft. of water near La Grange, Calif., turned turtle. It is supposed that the hull sprung a leak, partly filling with water, and a sudden list caused the bulky craft to capsize. Two men were aboard when the craft went over, but saved themselves by swimming ashore. The dredge was used to suck the gravel from the bed of the river, passing it onto the separator tables, where the gold is taken from the gravel by the usual processes.

SIMLA, INDIA, TO HAVE ELECTRIC BUS LINE

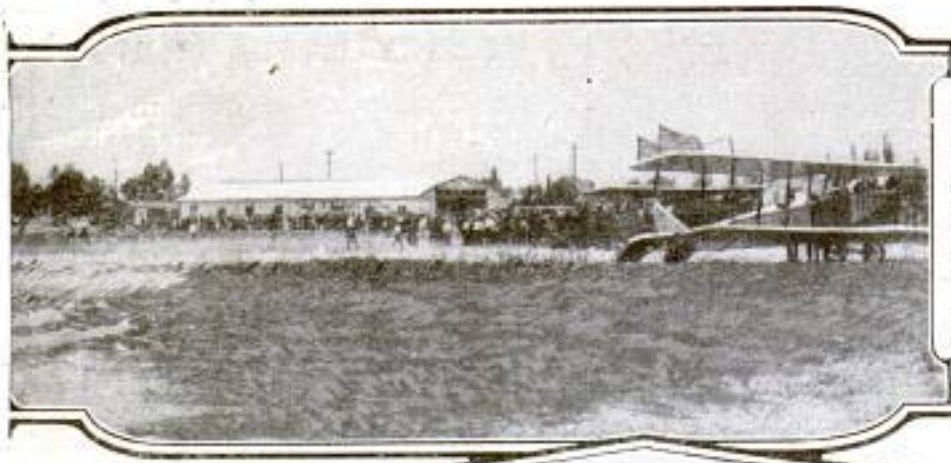
As an experiment a one-ton electric omnibus, seating 12 passengers, will soon be placed in service running between Simla and Mashobra, India. The venture is expected to be a success, as it is believed that the natives will take kindly to the new mode of locomotion. If so, a fleet of the busses will be ordered. They will run on regular schedules between the cities as well as serving as street cars.

¶A rubber envelope, or covering, that is impervious to shocks or chemical reaction, and which fits snugly around the standard cans, constitutes a new precaution used in transporting nitroglycerin.



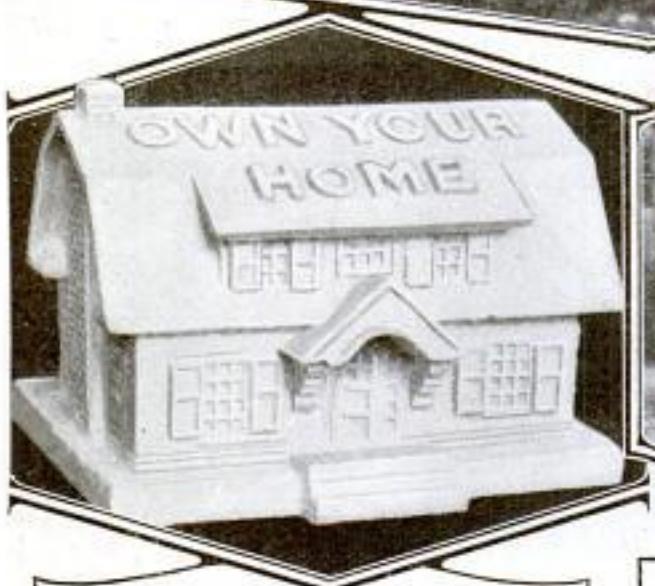
The Great Gold Dredge, for Seemingly No Reason, Capsized in a Stream 30 Feet Deep, near La Grange, California. It is Supposed That a Leak Partly Filled the Hull with Water, Causing It to Overturn

CIVIC FEATURES THAT PROMOTE THE COMFORT



The Wants and Desires of the Passing Airman are Given Consideration at This Aviation Hostelry. It is Located at Venice, California, and is Equipped with Hangars That may be Used at a Nominal Price. Gasoline, Oil, and Other Supplies Are Also Available. The Public Field Is of Great Value to the City, for Transient Airmen are Stopping Here at the Rate of Three and Four a Day

World-War Veterans of Grant County, Washington, have Again Lined Up in Battle Formation, but This Time for the Extinction of the Rabbit Pest Instead of the Hated Boche. These Men have Organized the Farmers of Their Neighborhood into Regular "Rabbit Squadrons," and the Photo Above Shows One of These Squadrons in Search of the Wary Marauders



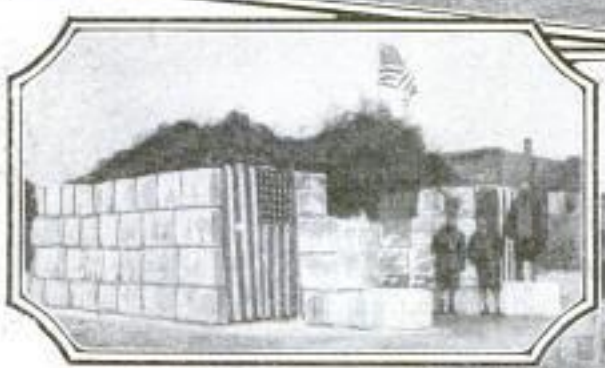
Models of a Bungalow, on the Roof of Which is Printed the Slogan, "Own Your Home," have been Scattered throughout Seattle, Washington, and may be Seen in Most of the Display Windows There. It Is a "Booster" Idea, and the National Association of Real-Estate Dealers have Considered Making the Model for National Distribution

A Sign Located in Whitehall, Indiana, Marks the Point of the Center of Population of the United States. In 1910 the Point was Located on a Factory Site in the City of Bloomington, Indiana, and has Moved a Distance of Eight Miles to Whitehall. Although the General Trend Is Westward, the Whitehall Mark Shows that Most of the 100,000,000 People of This Country Are in the North and Eastern Sections

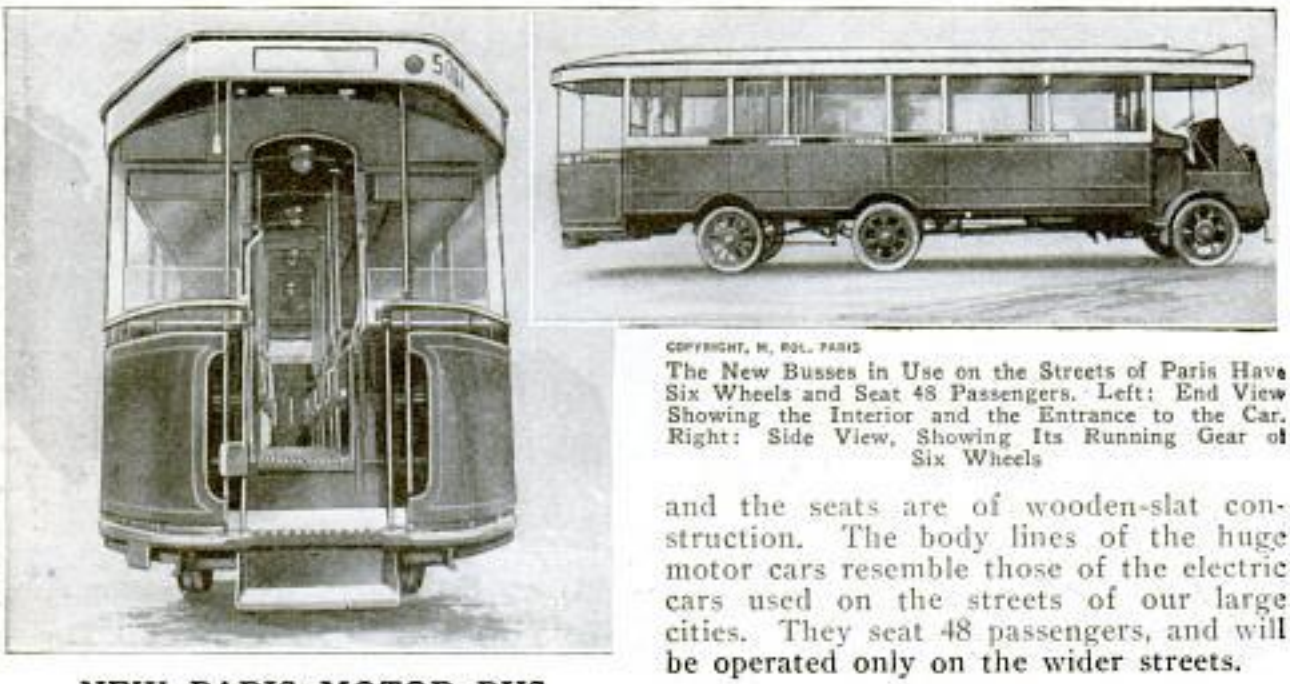
The States of Tennessee, Virginia, and Kentucky Converge at a Point near the Village of Cumberland Gap, Tennessee, and This Three-Foot Shaft of Limestone Marks the Interesting Point

This "Victory Arch" Spans the Yellowstone Trail at Ipswich, South Dakota. The Structure Tells in Black Lettering the Distance to the Cities Each Way from Ipswich and Also Announces the Nature of the Country in Which the Towns are Located. It was Erected in Honor of the Town's World-War Veterans

Thousands of Philadelphia Bathers were Given New Opportunities for the Pursuit of Their Favorite Sport by the Opening of Two New River Beaches. The One Illustrated Above is Located on the Delaware River and Has a Large Natural Park as Its Background



An Ice Palace Erected in the Heart of Hibbing, Minnesota, was Attacked by Baby Tanks during a Midwinter Carnival Held There Recently. These Tanks Were in the City for the Purpose of Stimulating Enlistment in the Tank Corps. The Picture Above Shows the Palace before the Attack, and at the Right the Tanks are Shown in Action



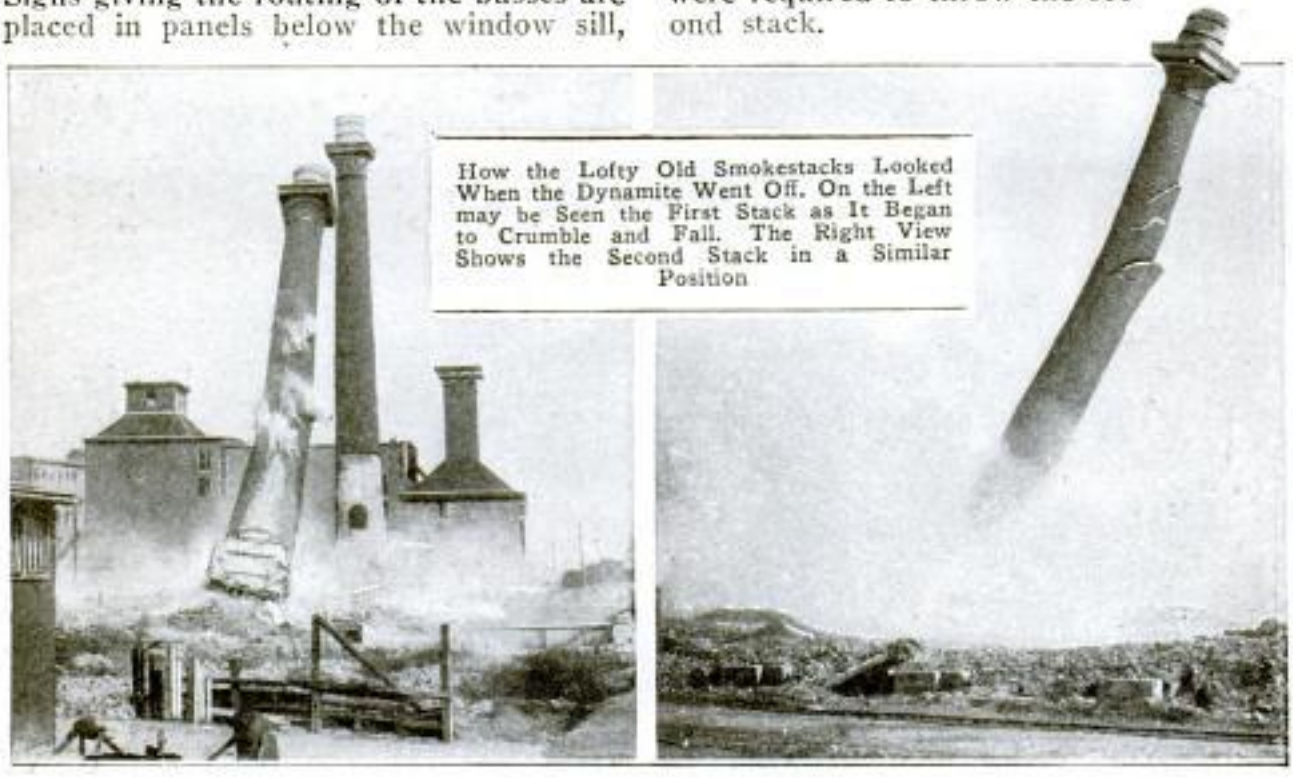
The New Busses in Use on the Streets of Paris Have Six Wheels and Seat 48 Passengers. Left: End View Showing the Interior and the Entrance to the Car. Right: Side View, Showing Its Running Gear of Six Wheels

NEW PARIS MOTOR BUS HAS SIX WHEELS

To aid in the solution of transportation problems in Paris a number of six-wheeled motor busses capable of carrying a large number of passengers have been recently put into service on the streets of that city. Entrance is gained from a platform at the back, to which a step is attached, and the passenger compartment is well lighted by windows extending all around the body. The third pair of wheels is used as trailers to aid in distribution of the truck load and in turning corners, as they are connected to the steering gear. Signs giving the routing of the busses are placed in panels below the window sill, and the seats are of wooden-slat construction. The body lines of the huge motor cars resemble those of the electric cars used on the streets of our large cities. They seat 48 passengers, and will be operated only on the wider streets.

DYNAMITE USED TO RAZE TWO LOFTY SMOKESTACKS

The old Front Street pumping station in Cincinnati lost its two smokestacks recently in a dramatic dynamiting job, planned and worked out by contractors who were razing the station to make room for a warehouse. The stacks were built of brick and stood 125 ft. high. Eighteen sticks of the explosive were set in holes made at the base of the first chimney, and when the dynamite was exploded, it slowly toppled over and fell to the earth. Twenty sticks of dynamite were required to throw the second stack.



How the Lofty Old Smokestacks Looked When the Dynamite Went Off. On the Left may be Seen the First Stack as It Began to Crumble and Fall. The Right View Shows the Second Stack in a Similar Position

HUGE SEWAGE-DISPOSAL PLANT SOLVES BIG-CITY PROBLEM

Among those engineering achievements that, paradoxically, are least apparent when they work the best, the sewage disposal of a large city easily stands first in importance. Because dumping its millions of gallons of daily waste into Lake Michigan no longer solves the growing problem, Milwaukee, Wis., is spending more than $6,000,000 on an enormous plant, operating on the activated-sludge principle. In this process, the sewage enters huge tanks with porous bottoms, up through which compressed air is forced at a rate that keeps the liquid in vigorous commotion. Six hours of this treatment so stimulates the putrefactive bacteria that the sewage is resolved into its organic constituents. After 15 or 20 minutes in settling tanks the sludge is dried, compressed, and ground, and may then be sold as fertilizer, rich in ammonia.

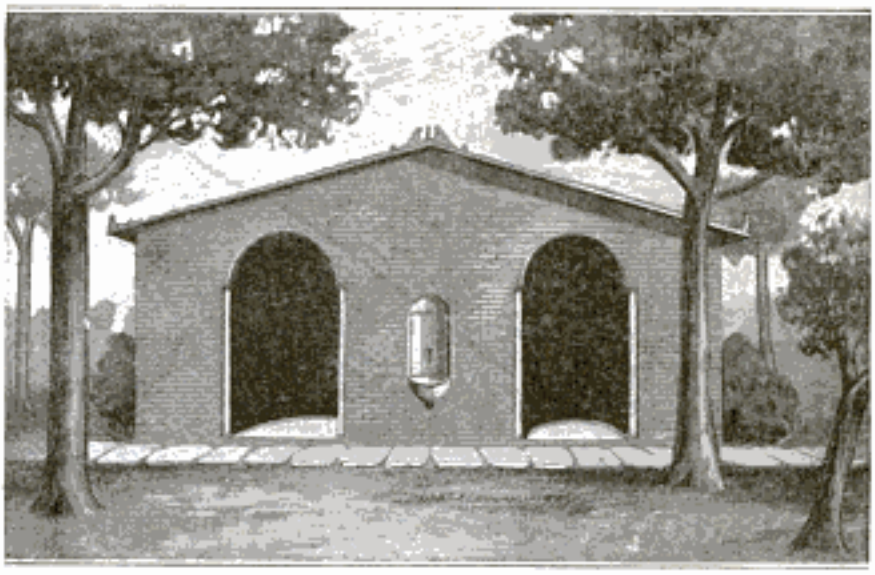
CARBON-PROOF SPARK PLUG IS SELF-CLEANING

A non-short-circuiting spark plug, so described by the inventor, has the center electrode ending in a downward-pointing bell-like form, the sides of which are of the same taper as another upward-pointing piece, of the same shape, which forms the lower, inside extremity of the shell. The bell edges are separated by a gap which may be varied from .012 to .032 in. This is the spark gap. It is claimed that, in service, the bell forms cause oil and carbon to be blown away from the plug by the force of the explosion, thus preventing them from reaching and being deposited upon the electrode insulation and causing a short circuit.

¶Four women are now serving the Ohio bureau of fish and game as official game protectors, with all the authority of the regular wardens.

FARGO PARK BOARD BUILDS NEAT CANOE LOCKER HOUSE

Part of the city-beautification plan of Fargo, N. D., is the erection of a substantial and ornamental canoe locker house on the banks of the Red River of the North at a point within easy access of the city's center. The building will be of concrete, brick, and hollow tile, finished with an asbestos-shingled roof supported by steel columns. It will be doorless, in order that watchmen may see completely through it while passing, but each of the canoe lockers, which are arranged in tiers running lengthwise of the building, will be fitted with a strong door secured by an individual lock. The ornamental effect of the clean-cut structure will add to the beauty of the riverside drive and parkway.



Canoe Locker House to be Erected on the Riverside Drive by the City of Fargo, North Dakota: The Canoe Compartments will be Arranged in Tiers Running Lengthwise of the Building

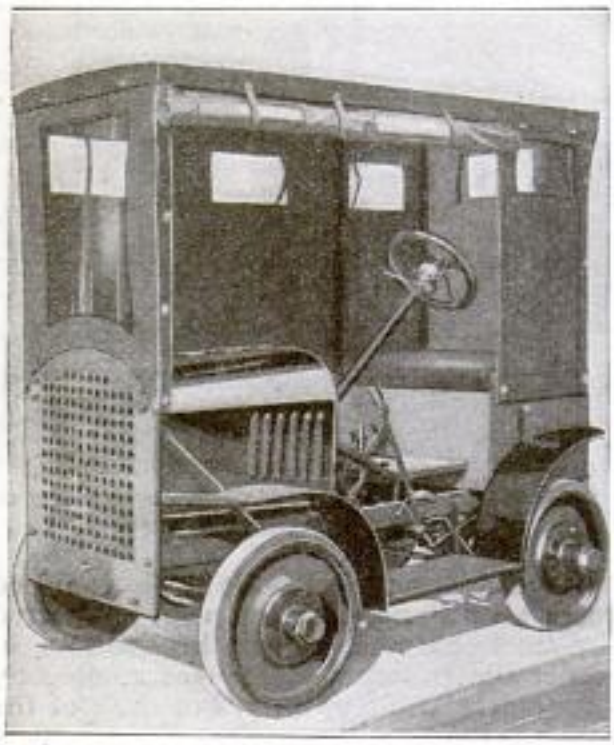
JAPANESE USE MOVIE FILMS FOR PEACEFUL CONQUEST

A curious and illuminating example of the highly efficient methods employed by the Japanese in the peaceful conquest of lesser peoples is seen in the Marshall Islands, between Hawaii and Yap. Instead of using military display to impress their new subjects, the Japs took the kings, queens, and other personages of the islands on a luxurious tour of Nippon. Motion pictures were made of all their travels, taking care to include the wonders of the Japanese empire in the scenes. When the islanders returned home to tell of their experiences, the films accompanied them, to convince the home folk of their new master's wealth and power.

As a result of Japan's introduction of vocational schools, agricultural regulation, and other elements of civilization, the islands are assuming considerable commercial importance.

ALL-WEATHER TOP ON TRACTOR KEEPS DRIVER COMFORTABLE

A refinement in industrial tractors consists of an all-weather top with celluloid-windowed front, side, and rear curtains,



The All-Weather Top for Industrial Tractors Keeps the Driver Comfortable and Also Protects the Interior from the Ravages of the Weather

which may be quickly fastened down all round, or rolled up, leaving the machine open on all sides. The arrangement adds greatly to the efficiency of the machine when it is used extensively out of doors, as it keeps the driver comfortable, protecting him from numbing cold and disagreeable wettings. It also keeps the electrical parts dry and in good working order. The whole framework can be quickly demounted when desired.

NEW JAPANESE ENAMEL WARE LOOKS LIKE PORCELAIN

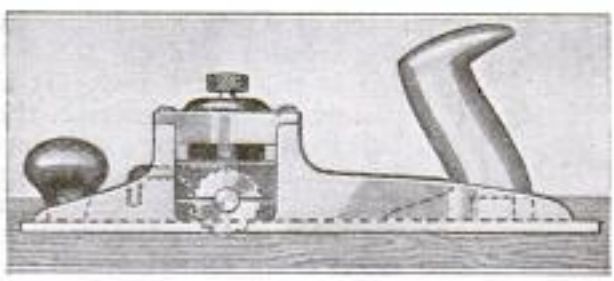
The Japanese have carried the art of depositing exquisite enamels on metal bases to a high state of perfection in what is known as cloisonne ware. Some specimens recently imported into the United States so closely resemble fine porcelains that close inspection is needed to detect the difference. Designs, such as delicate flower outlines, are first soldered to a form —vase, bowl, cup, or other shape—of gold, silver, or copper. The enamel is next applied, covering both the interior and the outside of the vessel with a semi-translucent coating in any desired single shade or combination of shade effects. In some of the pieces the form is removed, having been coated on the outside only, leaving a dainty shell of the fragile enamel. The ware is quite expensive, a small bowl, 7 in. in diameter, having a silver base and gold-wire pattern, being valued at $100; this for the reason that several weeks are required to produce it.

BIG GERMAN SHIP "IMPERATOR" NOW BRITISH "BERENGARIA"

In common with other German ships taken over by the victorious allies after the war, the great passenger liner "Imperator," of many vicissitudes, has lost its former identity in a British drydock, and now becomes the Cunarder "Berengaria." The name was that of the queen of Richard I of England, daughter of Sancho VI of Navarre. The huge vessel, largest in the world at the time of its launching in May, 1912, is 900 ft. long, 96 ft. wide, and has a displacement of 72,000 tons.

PORTABLE POWER MILLER IS USED LIKE A JACK PLANE

A small miller, planer, and grinder looks and is used like a carpenter's jack plane. Here the resemblance ceases, as the device is a true power tool, the cutters being rotary and driven by a portable electric motor, suspended from the operator's shoulders, through a flexible shaft. It may be used for milling metal, planing wood, and also as a sander by installing the proper cutters or wheels. One of these, which projects from the side of the



A Portable Power Miller-Planer-Grinder: It is Moved over the Work like a Carpenter's Hand Plane. The Cutters are Driven by a Small Electric Motor, Suspended from the Operator's Shoulders, through a Flexible Shaft

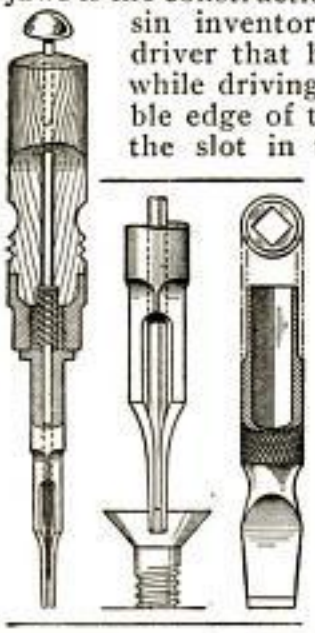
device, is fitted with a sheet of emery cloth on its face and serves the purpose of a small disk grinder.

TEMPERED COPPER'S "LOST ART" IS IN EVERYDAY USE

To correct the impression, still prevalent in many quarters, that tempering copper is a lost art, the Bureau of Standards calls attention to the fact that large quantities of hard copper are in everyday use, with new applications constantly being found. The soft metal may be hardened by mechanical treatment, as in hard-drawn wire, or by alloying with other metals. Experimenters frequently "rediscover" tempered copper by fusing the oxide in with the metal, making a very hard but brittle alloy.

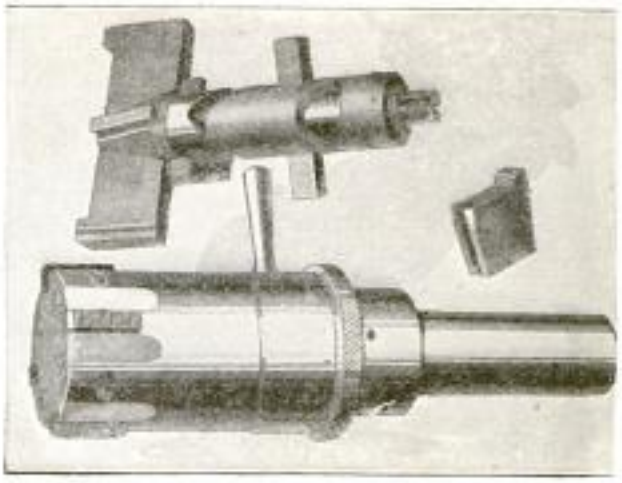
SCREWDRIVER BLADE EXPANDS AND HOLDS SCREW TIGHTLY

A split blade with a wedge between its jaws is the construction used by a Wisconsin inventor to make a screwdriver that holds a screw tightly while driving it. When the double edge of the blade has entered the slot in the screw head, the wedge is pushed down by means of a button set in the end of the handle, clamping the blade securely in the slot. A heavy, solid blade may be set over the split one when the holding device is not needed, and an insulating handle is provided for electrical work.



ADJUSTABLE TAP RELEASES WHEN THREADS ARE CUT

A new adjustable-tap arrangement releases when the automatic stop on the screw machine or turret lathe comes into operation, and does not have to be reversed to back it out of the stock. A core, shaped with flutes on which the thread-cutting chasers slide, is pulled up by the action of a series of cams on its shank, causing the threaded chasers to slip downward far enough to clear the top of the threads. Pulling on the core is effected by the chasers running into the spinning stock after the depth stop on the machine has acted, the force thereby created being applied momentarily against the chasers which throw the cams into operation. After the cams have operated, the chasers are clear of the stock. The unit is incased in a body that is equipped with a thread-depth adjustment ring, and the complete assembly is operated without the use of springs.



The Adjustable Tap Releases When the Proper Number of Threads are Cut, by the Action of Two Cams on Its Shank. The Photo Shows a Working and an Assembled View of the Tool

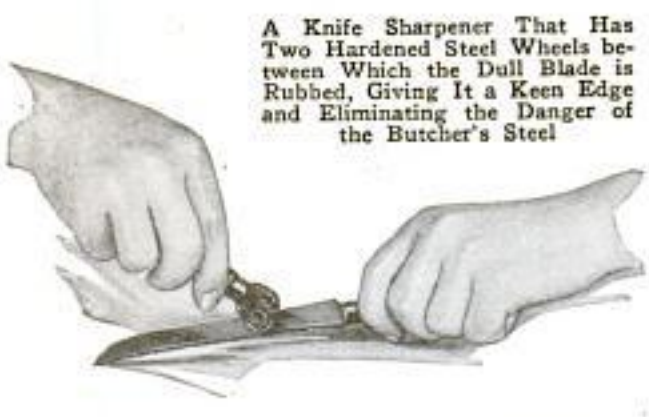
PORTABLE VOLTAGE METER IS COMPACTLY BUILT

A portable voltmeter, compactly built and handy for use with radio apparatus, automobile batteries, etc., has been placed on the market. The case is made of a molded composition of sufficient strength to prevent breakage during ordinary service, and the assembly is such that repairs are readily made. All of the movements are very light and so disposed as to preclude the possibility of breakage due to shock or vibration. A chart under a glass protector indicates the amount of voltage on the line being tested, and the composition of which the case is made is not affected by acids.

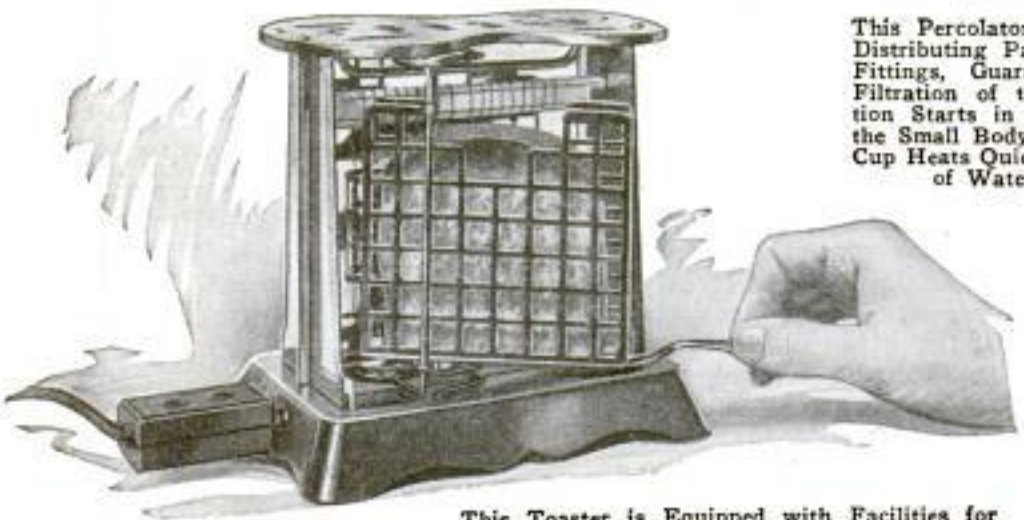
¶Along the Atlantic coast the naval service of Canada is installing a series of wireless direction-finding stations, the fourth being recently opened at St. John, New Brunswick.

SOME NOVEL AND LITTLE-KNOWN ACCESSORIES

A Knife Sharpener That Has Two Hardened Steel Wheels between Which the Dull Blade is Rubbed, Giving It a Keen Edge and Eliminating the Danger of the Butcher's Steel



This Percolator Has an Additional Distributing Pan among Its Upper Fittings, Guaranteeing a Uniform Filtration of the Coffee. Percolation Starts in 10 Seconds Because the Small Body of Water under the Cup Heats Quickly. The Main Body of Water Never Boils



This Toaster is Equipped with Facilities for Reducing the Temperature of the Heating Element So That the Bread will Not become Carbonized. The Handle Turns the Slice to the Opposite Side

By the Use of This Scrubber, the Hands are Saved the Usual Abuse of Striking the Washboard Corrugations. Soap is Placed in a Cavity of the Device and Rich Suds Ooze Through Small Holes in the Contact Side

Stale-Cigar Odors do Not Permeate the Atmosphere of the Home When the Lid of This Ash Tray is Closed. A Match-Box Stand and Two Cigar Troughs are Included in Its Lid

Flutes on the Scoop Assist in Distributing the Charge of Fine Coal and Dust. When the Loaded Shovel is Swung to the Firebox, the Coal is Delivered Evenly to All Parts of the Fire

The Stirring Spoon cannot Slip into the Cooking Food When Placed in This Trough. Being Removable, It may be Fitted to the Most Convenient Point of the Rim

Anyone wishing further information on devices described in the editorial pages can

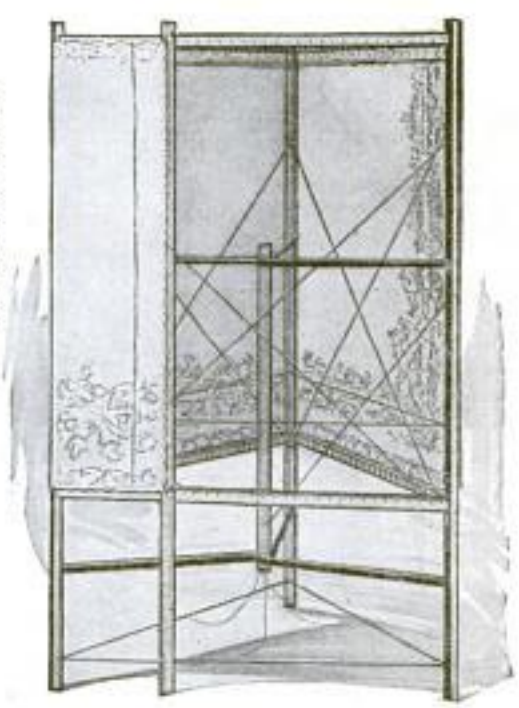
The Heel Protector Prevents Abrasions on the Shoe of the Wearer When Adjusting the Pedal Levers of the Motor Car. It is Made in Colors to Match the Shoe and is Strapped in Place

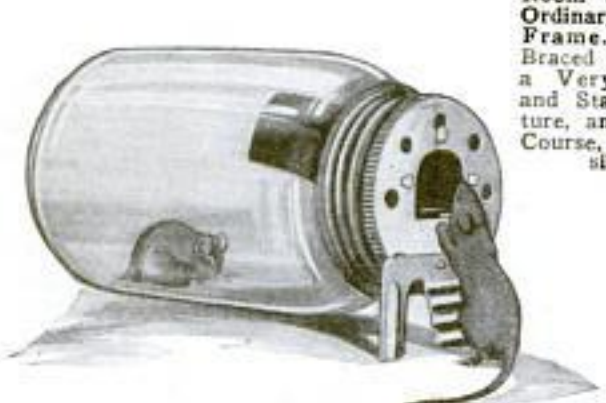
Holes Made in Doors at the Wrong Place, may be Filled by This Appliance, Which Resembles a Lock, and is Bolted in Place

The Clock in the Pillar of the Floor Lamp Is a Convenient and Ornamental Addition to the Beautiful Parlor Fitting. It Is of Special Benefit to the Night Reader

Two Novel Pieces of Furniture Are the Removable Ends of This Table. It Becomes Elliptical with their Application and Its Space is Materially Increased

This Triangular Curtain Stretcher Takes Much Less Room than the Ordinary Square Frame. It is Braced to Form a Very Rigid and Stable Fixture, and Is, of Course, Collapsible

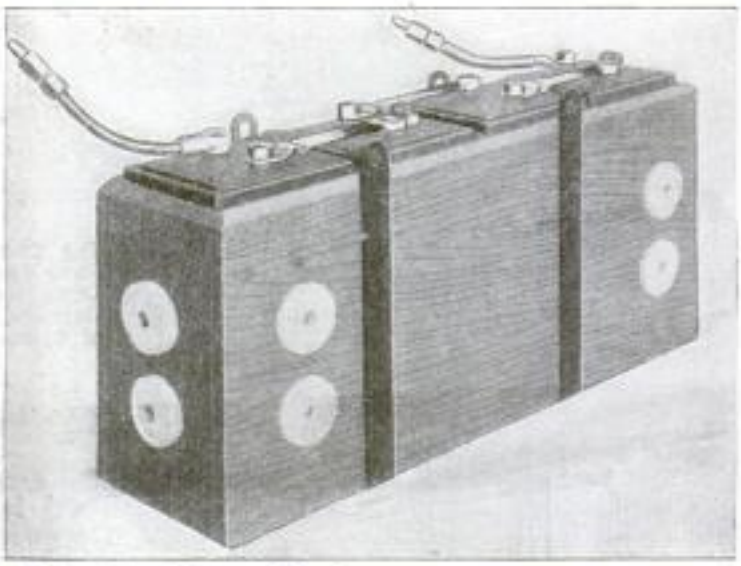




The Cap of the Bottle Makes the Unit a Mousetrap. It Has No Springs and can be Applied to Any Mason Jar

NEW CELL CONNECTOR SPEEDS STORAGE-BATTERY REPAIRS

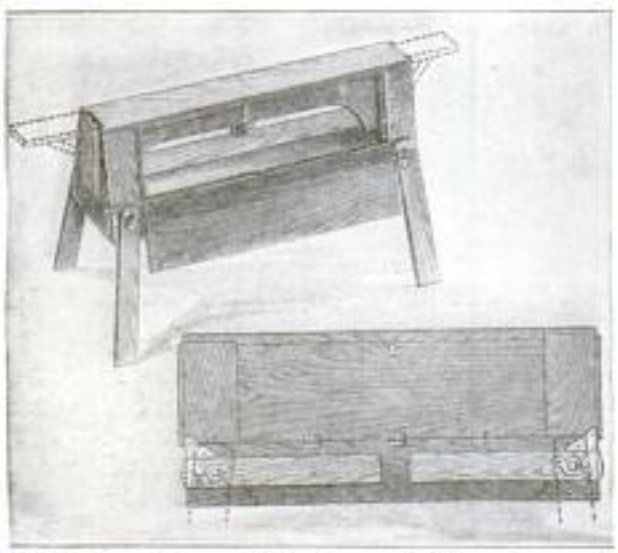
A new method of connecting the cells of storage batteries, which greatly facilitates their repair, is being used by a battery-manufacturing concern in electric mine-locomotive installations. It is also to be adapted to smaller units, such as those used in automobiles, in the near future. The success of the method is dependent upon the fact that the battery acid does not badly corrode negative connections, so that these may be bolted together with perfect success. On the other hand, the positive connections, which the acid attacks and eats up rapidly, if there are any exposed chinks, must be solidly "burned"—welded—together. Therefore, instead of burning or bolting both ends of the connectors, one of which methods has been generally used heretofore, the connectors are burned at one end to the positive terminals of the cells, but bolted to the negative terminals at the other.



A Four-Cell Unit of Mine-Locomotive Storage Battery: To Remove a Cell for Repairs, All That Is Necessary Is to Unfasten the Connectors at Their Bolted Ends, Leaving the Solidly Welded Positive Connections at the Other End Undisturbed

CARPENTER'S TOOL BOX USED FOR TRESTLE

A carpenter's combination that serves as both tool box and trestle has lately been produced. The legs of the combination are attached to the box part by swivel lugs, and the two ends of the work board are hinged to permit raising and lowering. Sideboards are hinged for dropping and are held, when the combination is a box, by cleats. The bottom corners of the body part are fitted with brass protectors to prevent splitting when the box is placed firmly on a hard surface. Thus equipped, the carpenter may fold the ends of the trestle to the ends of the box, and in turning the legs to a position alongside it, transform what he used as a trestle during the day into a tool box.



The Sides and Legs of the Carpenter's Trestle may be Folded Up, and the Ends Down, Making the Combination a Tool Box

RECORD-BREAKING BUSINESS SWAMPS PATENT OFFICE

All patent-office records were broken in 1920, and it has been officially stated that seven months will be required to examine and pass upon 40,000 applications now on hand unless the facilities of the department are substantially increased. The increase in patent applications was seven per cent over 1919 and 43 per cent over the preceding year. Trade-mark applications showed increases over 1919 and 1918 of 27 and 126 per cent, respectively. Trade-marks registered totaled 10,282, as compared with 4,208 for 1919, an increase of 144 per cent. Cash receipts amounted to $262,876.54 which bettered the previous year's record by 10.9 per cent.

¶In a motorboat race recently held over a 129-mile course from Miami to Palm Beach, Fla., and back, the "Gar, Jr." made a record of 32.8 miles an hour, completing the run in 3 hr. 55 min. 51 seconds.

NEVADA TEMPERS JUSTICE BY PAINLESS EXECUTION

Capital punishment is to be administered with lethal gas, in the state of Nevada. This is provided for in a bill, signed by Governor Boyle, March 28, which abolishes all other forms of capital punishment, and which enacts that the death warrant must designate a week, which must be not less than 60, nor more than 90, days from its date, during which the execution must take place. The warden, a physician, and six other citizens, must be present as witnesses. The execution is to take place in a suitable cell, fitted with valves admitting fresh air, that can be closed at some moment when the culprit is asleep, and other valves opened to admit the lethal gas. It is hard to imagine a more merciful manner than this of inflicting a death sentence.

RIGID DOUBLE-EDGED HACKSAW HAS REMOVABLE HANDLE

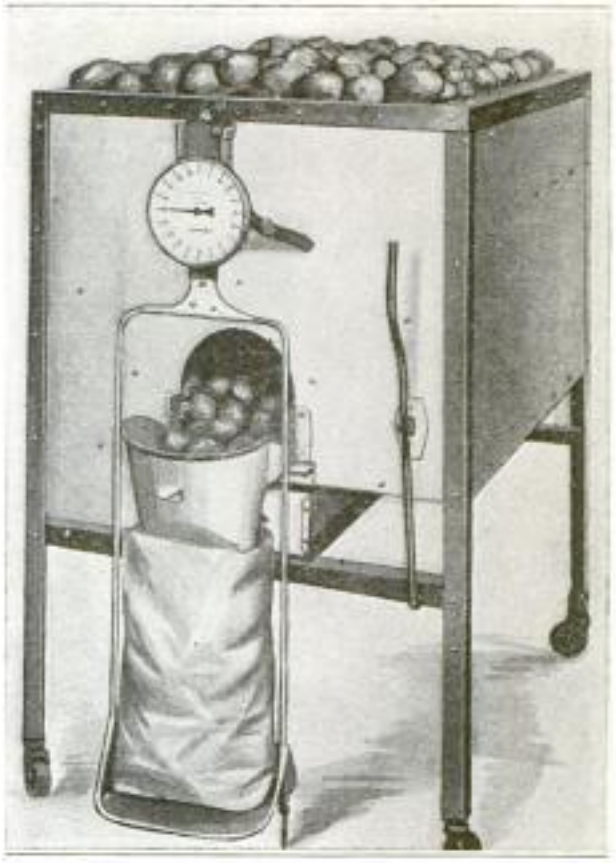
A rigid, double-edged hacksaw having a removable blade which has two cutting edges, is now on the market. A setscrew placed in the upper section of the handle makes secure the contact between the blade and the handle, while the lower portion is slotted to receive the back edge of the saw. The upper edge of the blade has 20 teeth to the inch, unset, while the lower edge has 32 teeth, set. The handle

The Two Edges on the Blade of the Hacksaw are Cut with Different-Size Teeth. The Handle may be Removed by Loosening a Setscrew

is made of tool steel knurled to prevent the grasp from slipping, and the blade is made of tungsten steel of durable quality.

VEGETABLE METER WEIGHS AND SACKS POTATOES

An ingenious apparatus for the use of retail stores, which weighs potatoes, apples, or any other of the small vegetables, and puts them in sacks without the necessity of handling them, has been placed on the market by an Illinois inventor. The device consists of a large hopper, ending in a discharge spout, under which is the pan of a scale which is suspended from the front of the contrivance. With the sack in place on the pan, the vegetables are allowed to roll into it until the desired weight is registered by the

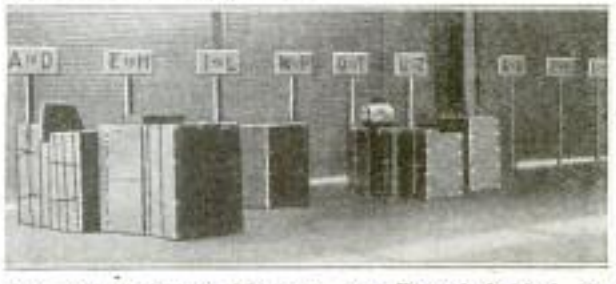


The Vegetable Meter in Service: Fifteen Pounds of Potatoes have been Weighed Out. The Hopper Holds Several Bushels. Note the Simple Lever Control

dial. Caster rollers make it easy to move the outfit about.

IDENTIFICATION OF TRUNKS AT STEAMBOAT DOCKS

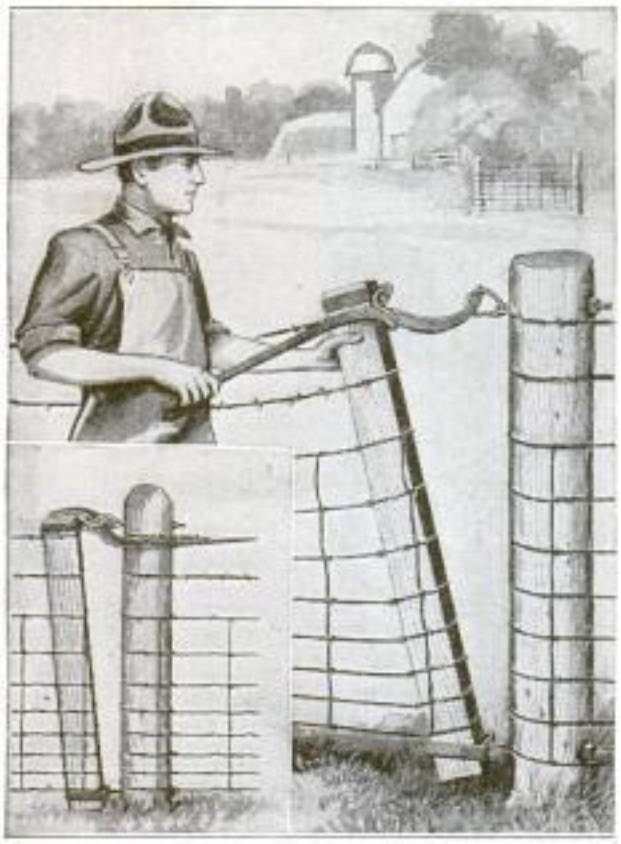
To facilitate the identification of the trunks of passengers boarding outgoing steamboats, a series of six portable boards, lettered with approximately four initial letters to each board, are arranged in a location convenient to the gangplank. There may be more than one of such series, but each provides for the whole alphabet. As soon as the passengers' trunks have been loaded onto the steamboat, the boards are removed, leaving space for piling cargo.



The Six Portable Markers are Placed behind the Trunks, Which are Sorted According to the Owners' Initials, and Moved When the Baggage is Taken Away

NOVEL FARM GATE REQUIRES FEW FITTINGS

A new farm-gate fastening, consisting of three iron lugs and an operating



The New Farm Gate Consists of a Lever and Lugs. The Lever Is the Locking Member and Keeps the Gate Closed. Insert Shows Gate Locked

lever, has recently been produced to minimize gate upkeep costs and add to the general appearance of the fence. Two of the iron lugs are fitted to the top of a removable piece of 2 by 4-in. lumber and to the permanent fence post. This two-by-four fits in a third lug which is bolted through the bottom of the permanent post. The upper lugs are fitted with links brought together and held in place by the curved lever. The wires of the fence are fastened to the removable two-by-four, and the gate in reality forms a division in the fence which can be opened.

THOUSANDS DO RESEARCH WORK IN BIG AMERICAN PLANT

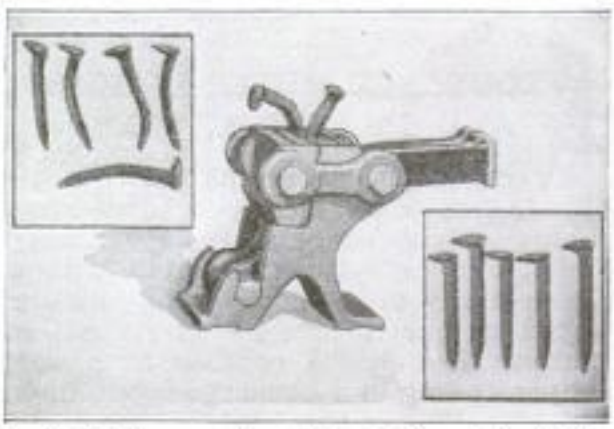
One of the many erroneous statements often made, in comparing Europe with America, is that the industrial use of scientific-research departments is distinctly European, and represents a point of achievement to which American plants have not yet progressed. A most striking refutation of this theory is observed in a large American concern engaged in the development of telephone and telegraph enterprises. In the laboratories of this business house are no fewer than 2,800 employes devoted exclusively to research and experimental work. Of these, 1,100 are engineers, physicists, chemists, and scientists of other specialized lines of study. No less than 2,500 research and development projects were in hand at the close of last year.

BIG AERIAL BOMB ON WARSHIP DOES LITTLE DAMAGE

In view of recent statements to the effect that modern warships would be powerless against attack by bombing planes, it is interesting to note the result of certain experiments announced in this magazine last April. The obsolete battleship "Indiana," used for the test, was subjected to the explosion of a 1,600-lb. aerial bomb, loaded with "TNT," and placed to give the maximum destructive action. Despite the old ship's lack of protection as compared with modern naval units, the terrific explosion did practically no damage below the protective deck, and below the water line the vessel was wholly unaffected, indicating the improbability that an armored ship could be sunk by aerial attack.

SPIKE BENDER RESTORES DEFORMED TIE NAILS

Railroad spikes, becoming bent when drawn from ties, are now being restored to proper shape and further usefulness by straightening in a machine recently designed for the purpose. The twisted nails are placed between two grooved dies. One die is located in a pivoted-arm casting, which is hooked to a hand-lever-operated cam by two connecting rods. When the lever is depressed the movable half is brought into contact with the stationary half, in which is situated the

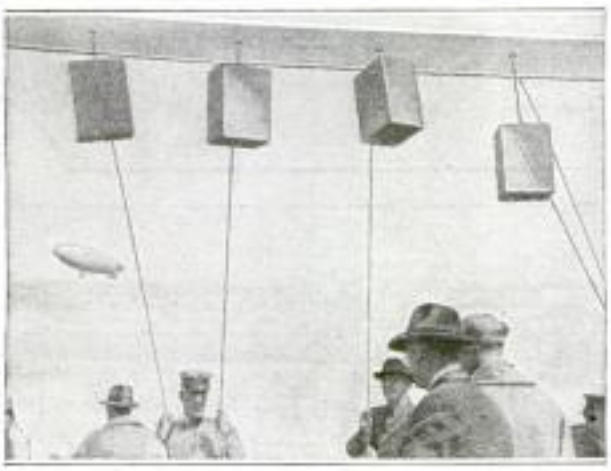


Crooked Spikes are Placed in the Dies of the Bender and the Lever Depressed. The Force Applied Straightens Them for Further Use

second die. Terrific pressure is exerted against the spikes and they are quickly straightened. The machine is made of electric heat-treated steel and is small enough to be easily moved about.

NEW FLYING-START SYSTEM USED IN MOTORBOAT RACING

In order that all contenders in power-boat races may have an even chance and cross the starting line on equal terms, a west-coast boating club has inaugurated a new system of signaling flying-start races. Suspended on cords, from a framework on the judges' barge, are four boxes, painted a brilliant red, and visible a long distance. At regular one-minute intervals, following the preliminary warning gun, fired four minutes before the start, one of the boxes is dropped. The dropping of the last box is the official starting signal. By expert timing and jockeying,

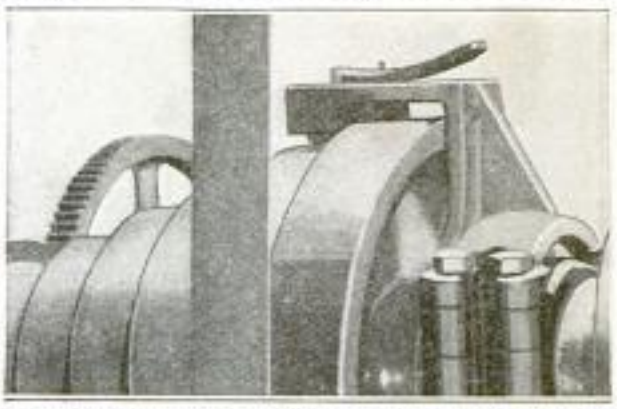


New Visible Signal Used in Sending Racing Speed Boats across the Starting Line on Even Terms: The Drop of the Last Box Means "Go"

the drivers maneuver their craft into such position that all cross the starting line at full speed and at the same instant.

LATHE FRICTION BRAKE MAKES FOR SPEED AND SAFETY

When truing a piece of material in the chuck of a lathe preparatory to turning, the lathe must be stopped and started many times. The chuck of the lathe makes many turns after the power is shut off, because of its own momentum. Lathe operators stop this turning of the chuck by pressing on the belt cones with their hand. A friction brake located on a casting which hangs over the entire large belt-cone surface that does not come in contact with the belt, now takes the place of the hand. Fitted with a handle that is returned to place by a spring coil, the brake leather is pressed against the spinning belt cone, and a stop is effected im-

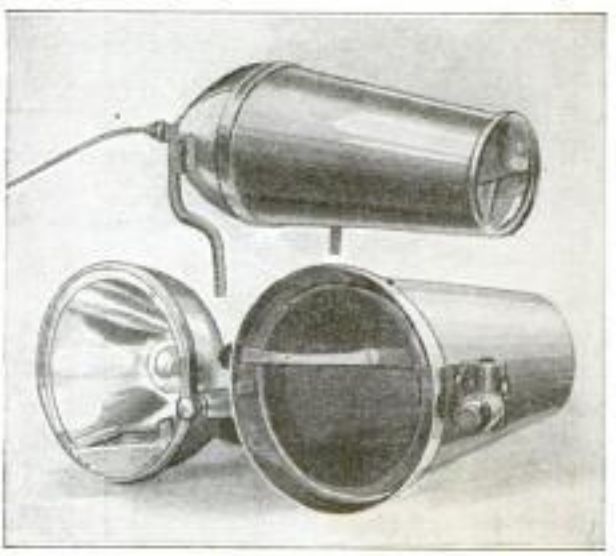


The Friction Brake is Fitted over the Largest Belt Cone of the Lathe. When Applied, It Overcomes the Lathe Momentum and Keeps the Operator's Hand Out of Danger

mediately. All danger of injury to the operator's hand is also eliminated.

CARTRIDGE-TYPE AUTO LAMP IS NONGLARING

A new automobile headlamp, of English manufacture, is claimed to be a very near approach to the perfect nonglaring light source that the public is loudly demanding. At recent trials, the light beams did not dazzle the spectators when thrown directly into their faces at close range from a height of 5 ft. above the ground. The report also indicates that the beams are quite narrow, not over 20 ft. wide, and that the device absorbs much more light than do those of the present type. A somewhat elaborate system of 10 lenses and two prismatic reflecting condensers, arranged at the front and rear of the cartridge-shaped body, accounts for the nonglaring properties of the new lamp.



A New Nonglaring Auto Lamp. Below: Rear Door Open, Showing One Lens and One Prismatic Condenser, the Latter at the Bottom of the Reflector

A Rabbit Kindergarten: This Interesting and Amusing Scene Is Part of a Children's Museum Exhibit in Sussex, England. The Pupils Are Rabbits Which have been Caught in the Neighborhood, Stuffed, and Posed in Lifelike Positions. The Man in Charge of the Museum Knows Just What Children Like Best, So, from Time to Time, New Pupils are Enrolled and the Whole Arrangement Changed. It Looks as Though the Second Little Rascal from the Right, at the Big Bench, had been Caught Copying

This Winning Little Miss Is So Full of Life and Mischief That They Fairly Shine from Her Eyes. Dancing Is Her Favorite Pastime and She will Keep It Up from Morning Till Night and Then Begin All Over Again, Keeping Right On Steadily until Next Morning, Just as Long as She can Find a Partner Who Is Willing to Wind Up the Clockwork Motor Which Supplies Her Never-Tiring Strength. When She Falls, Which Is Rarely, No Damage is Done as She is Made of an Unbreakable Material

This Businesslike-Looking Weapon was Removed from a Toy Submarine Chaser Very Much against the Commander's Wishes. It is Said to be Perfect in All Details and Made to Fit Exactly the Little Ship on Which It was Mounted. The Barrel is Made of an Old Brass Automobile-Tire Valve, Turned Outside and Bored Inside

When Next the Children Go to the Seashore Many of Them will Carry New, Shiny "Rough and Tumble" Sand Buckets Which do Not Rust, Break, Dent, Get Out of Shape, nor Have Unexpected Sharp Edges to Cut Tender Fingers and Toes. They are Made of a New Kind of Paper, Which, When Pressed, Becomes Very Hard, with a Glass-like Surface. The Pictures Painted upon Them Are Mostly of Children at Play

At the Time Gulliver Left the Island of Lilliput He Thought He Left All the Little People Behind. It Seems That He was Mistaken, as There Is Quite a Party of Them Touring the World Giving Entertainments. These Tiny Folks Are So Small That, Many Times, They Have Trouble Fitting Themselves to Grown-Up Peoples' Furniture. In Order to Write Their Names in Hotel Registers They Have to Climb Up on the Clerk's Desk

Learning the Piano is Made Easier with the Game Board Shown at the Left. The Keys Are Loose Wooden Blocks; a Strip at the Front is Marked with the Letters of the Musical Staff, and Movable Notes and Clef Characters in the Upper Section Permit Hundreds of Combinations

A New Model "Safety First" Training Plane Which is Attracting a Great Deal of Attention in Seattle, Washington, Where Its 13-Year-Old Inventor, Engineer, Builder, Proprietor, and Flier, Ray Galor, Has His Home: He Claims That on Steep Downgrades the Machine Shows Wonderful Speed

LATEST DEVELOPMENTS IN SCIENTIFIC RESEARCH

By C. A. BRIGGS

THE MILKY WAY DOES NOT APPEAR TO BE A SPIRAL NEBULA

Information about the stellar universe is now being obtained at a tremendous rate, but just what we are is yet something of a riddle. Nebulæ are very common objects in the sky, and many of those are disklike in form, and appear to have the texture of a delicate veil whirled in a spiral with stars caught therein. It has been suggested that our own system and the vast milky way, or stellar galaxy as it is called, may be one of these disklike light patches in the sky. In other words, it has been suggested that if an observer could go many millions of miles in the direction of the north pole, the milky way would turn out to be one of the nebulæ.

Recent studies reported by one scientist indicate that this would not be the case, as the light given off by the milky way is not sufficient to give it this appearance. For instance, many well-known nebulæ appear to be 100 times as bright as the milky way would appear from a distance.

*

CARBONIC-ACID GAS BY-PRODUCT OF INDUSTRIAL-ALCOHOL MANUFACTURE

There is no danger of the soda fountains closing down for want of carbonizing gas. The largest plant in the world for producing industrial alcohol is located at Baltimore; and in the processes of fermentation about half the sugar used goes to make alcohol and the other half produces carbon-dioxide gas. The carbon dioxide thus formed was formerly wasted, but is now caught, washed, and stored under pressure in steel containers for charging soda fountains, and for use wherever this gas is employed. Formerly the chief supply of this gas was produced by the action of sulphuric acid on marble. Now, however, the output of the Baltimore plant alone is sufficient to supply the needs of the world's soda fountains many times over.

*

WHITE ANTS AS FOOD

In certain sections of Africa, white ants, or termites, are common. These are used by the natives for food. They are eaten either raw or fried, according to circumstances. The variety of ant used for food is of large size, being roughly about 1 in. in length. These large white ants, however, do not make the largest nests.

An American scientist reports that he has eaten them repeatedly and finds them agreeable, particularly the raw ones. In serving them on the half shell, so to speak, all that is required is to pull off the wings and pop them into the mouth. It is not necessary to take the trouble to remove the heads. They have a sweetish flavor, tasting somewhat like beechnuts. When fried, their fatty character becomes apparent, and they are not so highly esteemed by the scientist referred to.

*

ALL SUBSTANCES NOT RADIOACTIVE

Several of the chemical elements have been found to be radioactive to some degree; and it has been surmised that yet other elements may be radioactive, but of such a character or to such a slight extent as to be very difficult to detect. A recent investigation gives evidence of the improbability of substances like copper possessing the characteristics of radioactive substances.

*

SWISS CHEESE MADE IN AMERICA

The Swiss cheese, which has succored many a jokesmith in times of need, is now being made of good quality in this country. The technique has been mastered, and it may not be long before we can ship Swiss cheese to Switzerland. In manufacturing this cheese, there is first a fermentation brought about by bacteria, which takes place at relatively high temperature, and uses up the lactose, or milk sugar. After this the temperature is lowered, and curing is produced by other bacteria, acting over an extended time, which yields the final product. The holes in the cheese, which have engaged the thoughtful consideration of many a consumer of analytical temperament, are formed during the second stage, in which the cheeses expand as they form. Ordinarily the presence of holes is not desired in cheese and is the result of abnormal ferment, in which the gases carbon dioxide and hydrogen are formed. In Swiss cheese, however, the holes, or "eyes" as they are termed, are found to contain only carbon dioxide. This is the result of lactose being used up in the first stage.

*

PURPLE LIGHT FACILITATES CONCEALMENT

Lights of different colors are not all brought to a common focus by the eye. Under given circumstances, the red rays will be brought to a focus at a point farthest back, and violet light will be focused farthest toward the front, with the other colors ranging in between. For most objects of combined colors, the eye tends to focus for one representing an average, and the defects in the image formed are disregarded by the observer, who usually is not conscious of their existence.

Purple light, however, is formed by the red of one end of the spectrum combined with the violet of the other, and this combination produces a maximum of confusion. This fact is made use of in the theaters, where a purple light is employed when weird effects are desired, or when a relatively strong illumination, combined with the advantage of concealment, is required.

*

NEW FORM OF WIRELESS ANTENNA

In wireless sending stations, the antenna may be likened to a sort of large electric paddle by means of which the surrounding ether is splashed or jiggled, setting up a motion which, propagated outward, constitutes the electric waves of wireless telegraphy. These antenna systems may take many forms, each with its special characteristics, and of varying efficiency according to the circumstances.

The Bureau of Standards has been conducting experiments on a condenser type of antenna with interesting results. This form consists of two metallic plates, or electrodes, placed horizontally one above the other. For very short wave lengths, such as are used sometimes by amateurs, this type of antenna gave more intense signals than the coil antenna of the same general dimensions. As compared with ordinary antennas, in which ground connection is used, the condenser antennas appear free from electric disturbances. The condenser antenna is adaptable for both sending and receiving.

*

SCIENTIFIC WORK FOR SMALL TELESCOPES

Scientific work of serious character can be attempted with small telescopes of 5 or 6-in. aperture according to the statements of a western astronomer. Photographs of the spectrum of stars can be obtained by placing a glass prism having an angle of about 20° over the object glass of the instrument and by equipping it at the eyepiece with a suitable plate holder. If the work of photographing the spectra of the stars is carried out properly, results of permanent value to astronomy can be secured.

*

ITALY RECENTLY INVADED FROM AUSTRIA

An Austrian army invaded Italy recently. This time the invading host was composed of hordes of rats and mice. During the past summer, an American scientist called at the museum at Florence to pay a visit to a member of the staff. He was reported, however, to be away fighting a pest of rats and mice which had come into Italy across the Austrian border. One cause assigned for this was that, on account of the terrible conditions existing in Austria, the cats and dogs which ordinarily kept the rodents in check, had been eaten by the population, so that rats and mice multiplied to large numbers which the decreased food supply finally induced to migrate.

How to Make a Floating Boat Landing

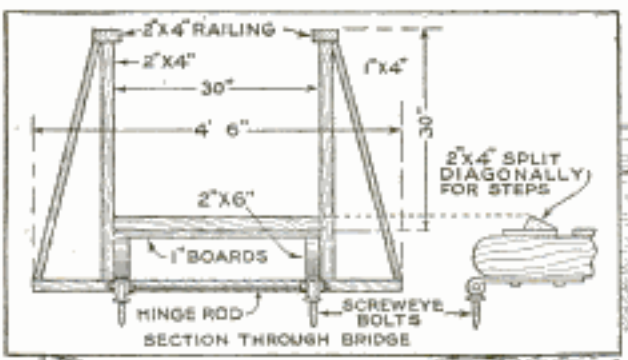
By J. A. STEVENS

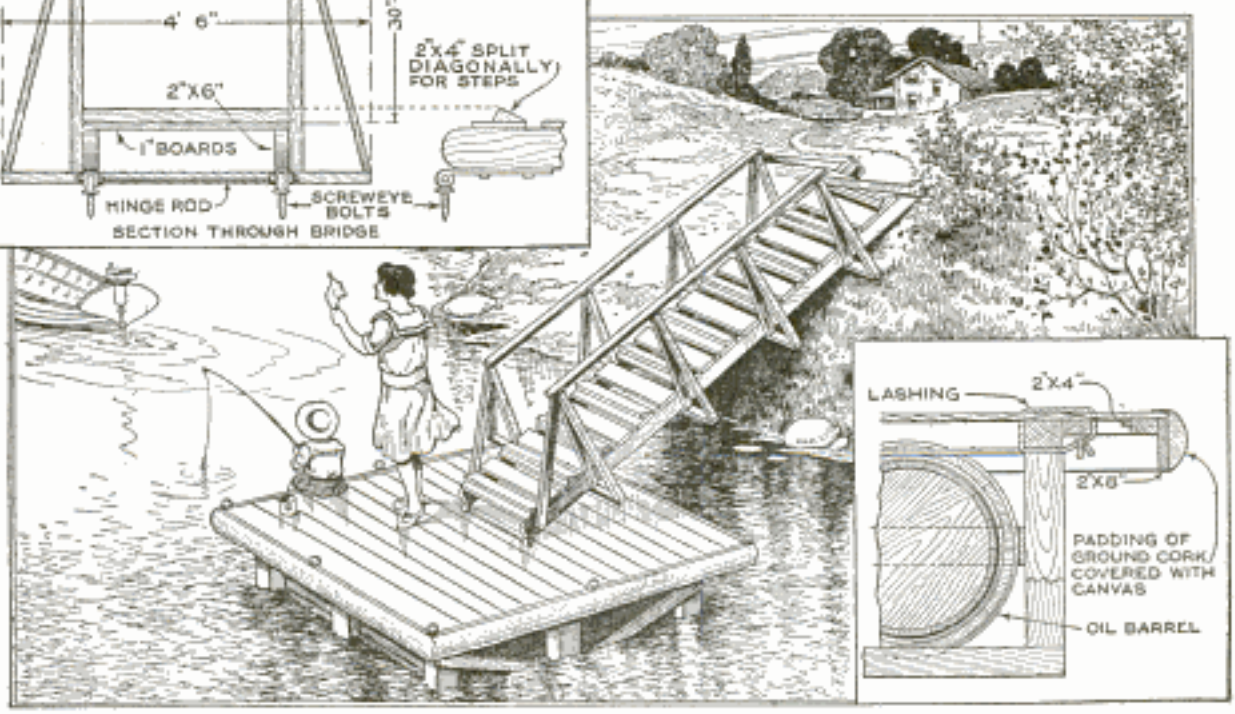
A VERY neat and serviceable landing for the summer home or yacht club can be made from empty oil barrels, held securely in position by a wooden framework, which is decked over to form the landing platform.

Six empty barrels, which must be watertight and in good condition, will make a float large enough for average requirements. The frame can be made up with sills, corner posts, and plates of 4 by 6-in. material, if the float is to be used in exposed locations in salt water, but a lighter frame is permissible if it is to be located in sheltered water. The plates and sills may be bolted together and nailed to the corner posts with 60-penny spikes, well galvanized. The corner posts can be made without tenons, while the intermediate posts may be mortised and tenoned into the plate and sill, as shown in the drawing.

The bottom and top of the frame are made large enough to permit the barrels to be placed inside, and allowance is made for the ⅞ by 4-in. braces above and below the barrels and at the ends and sides; these hold the barrels securely in place. Three intermediate crosspieces, one over each row of barrels, may be used after the braces have been fastened to the plates. The diagonal braces at sides and ends are added last.

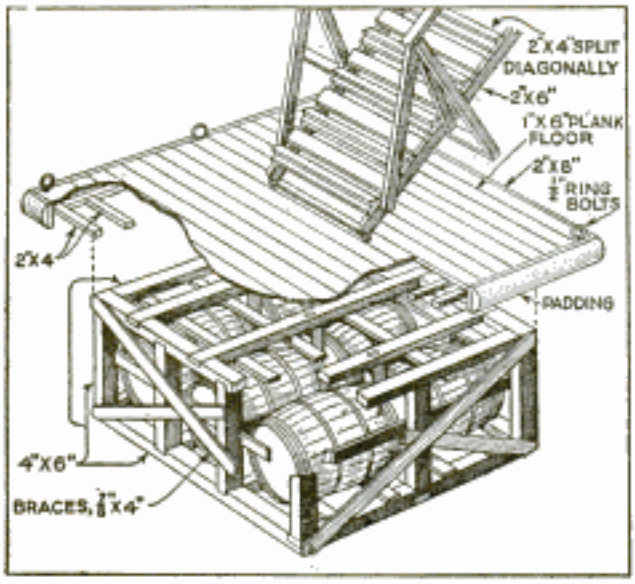
The deck should be laid on a framework of 2 by 4-in. material with a center frame just large enough to fit over the float frame, to keep it in position. The deck may overhang the float itself about 1 ft. on all sides, and should have a 2 by 8-in. plank around the edge; this plank is padded as indicated. The deck planking is 1 by 6-in. stuff, laid closely together, and holes are drilled at each corner for lashing the deck to the floating substruc-





A Landing That Adjusts Itself to Varying Water Levels: It will be Found Very Convenient Either for the Small-Boat Owner or the Yacht Club

ture. The gangplank connecting the landing to the shore is constructed as indicated and attached to the landing with



This Illustration Shows the Method of Making the Framework Surrounding the Barrels

hinged eyebolts so that both the landing and gangplank can rise and fall with the movement of the water.

The landing is anchored at all four corners, and by placing the anchors diagonally the lines will be deep enough under water to clear boat propellers. Large, flat stones make as good an anchor for the purpose as anything else, and cost nothing. On larger floats, it is advisable to use a roller at the lower end of the gangplank instead of the hinged connection described.

Before the landing is launched it should be painted, and should be repainted annually.

Such a floating landing can be made to almost any dimensions by increasing the number of barrels used; it should be ascertained that they are absolutely water-tight before the landing is launched, and if not, they should be made so.

Cementing Leather to Iron

Paint the iron with a mixture of white lead and lampblack in oil. Then cover with a cement made of the best glue soaked in water until soft, and dissolved in vinegar. This is mixed thoroughly with one-third its bulk of white-pine turpentine, and thinned with vinegar until it can be spread with a brush. It should be applied to the iron while hot, and the leather put on and quickly pressed into place. It must be held tightly by a clamp while drying.

Drilling Holes in Porcelain

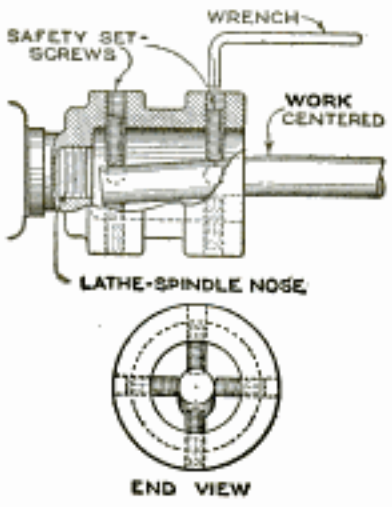
The mechanic who attempts to drill holes through insulators, or other pieces made of porcelain, generally succeeds only in breaking the article he is working on. But although very brittle, porcelain can be readily drilled if properly handled.

The main difficulty lies in getting a start on the glazed surface of the material. At the point where the hole is to be drilled scratch a small pit with a glass cutter, or a sharp-cornered piece of glass. Also scratch a few lines through this pit, corresponding in length to the diameter of the drill. The pit furnishes a starting point for the drill and the lines allow the glaze to be chipped off without much pressure.

Use an ordinary twist drill. Since the function of the drill is not to cut, but rather to chip away the material, it must revolve very slowly and with but little pressure on the object. Clamp or hold the work rigidly, for any side movement, after the drill has entered the porcelain, will result in cracking it.—H. H. Schneckloth, Omaha, Neb.

The Use of the Bell Chuck

The bell chuck, or, as it is sometimes called, the shell chuck, is a device well-known to older machinists, and one deserving of more attention than it receives nowadays. It is simply made, and while serving the purpose of an independent-jaw chuck, within the limits of its internal diameter, has one advantage that the expensive independent-jaw chuck does not possess, in that work out of parallel may be so held that the projecting portion will run true. This is shown in somewhat exaggerated form in the drawing; the construction of the chuck is so plain that no explanation is necessary, beyond that, as the drawing shows, safety setscrews are used instead of the dangerous projecting ones of the older form.—H. H. Parker, Oakland, California.

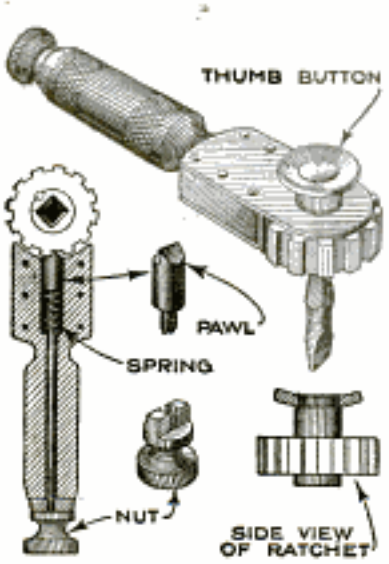


Danger in Handling Cyanide

In many shops, cyanide is used to a greater or less extent for casehardening. It should always be remembered that this substance is a deadly poison, and special care should be taken to avoid taking any of it into the mouth, or inhaling any of the fumes that arise from it. Cyanide should be kept in a safe spot, and plainly marked "poison," and it should not be allowed to lie on the floor, forge, anvil, or bench. Draft hoods should be provided to remove the fumes produced when working with cyanide, and nobody should be allowed to handle it without being fully instructed with regard to the danger involved. This warning is especially important because the men who handle cyanide are often unaware of its deadly character. Men often work over pots of cyanide, thrusting pieces of hot metal into it, and stand over the deadly fumes, without any idea of the risk.

A Ratchet Screwdriver for Confined Places

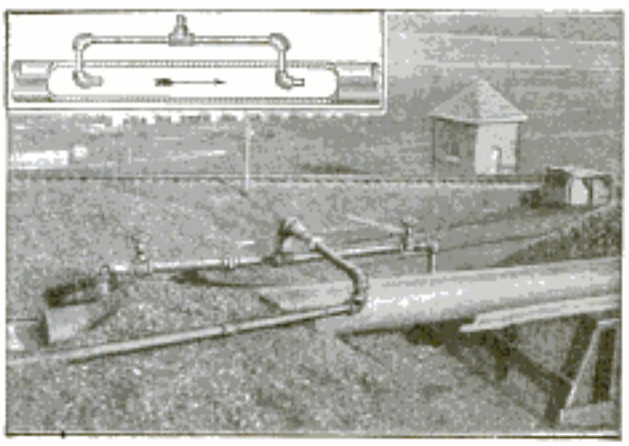
Having often experienced difficulty in removing screws from narrow and shallow places, and finding the usual bent screwdriver unsatisfactory, I devised a simple and easily made ratchet tool for work of this character.



I flattened one end of a piece of ½-in. round steel, and drilled it through the center, one end being counterbored to accommodate the pawl and its spring. Three small holes were drilled on each side of the flattened portion for riveting two sheet-iron pieces, which serve as bearings for the ratchet wheel. The ratchet is made from 1-in. round stock, with a square hole at the center to hold the square-shank screwdriver bit. A thumb button is riveted to the top of the ratchet wheel, holding the tool to the work. By pulling out on the nut and giving it a half turn, the direction of rotation can be changed at will.—J. Magis-Frankhart, Ouffet, Belgium.

"Shooter" for Moving Coal

A simple "shooter" for moving steam coal short distances is in operation at a mid-western power plant. The device,



A "Shooter" That Uses Steam for Moving Coal Away from the Bottom of a Chute: The Two Internal Steam Jets Serve to Project the Coal from 20 to 50 Feet beyond the "Nozzle"

which consists of a large wrought-iron pipe, a few fittings, and a steam line from the boilers, makes it possible to store the coal farther from the end of a stationary conveyor than it can be placed with a gravity chute.

At this plant the surplus fuel, which accumulates during mild weather, is stored in a stock pile at the end of the power plant. The coal is carried to the end of the building by an overhead conveyor, and discharged through a gravity chute to the coal pile. When this pile grew so large that the chute could handle no more coal, the "shooter" was put to work.

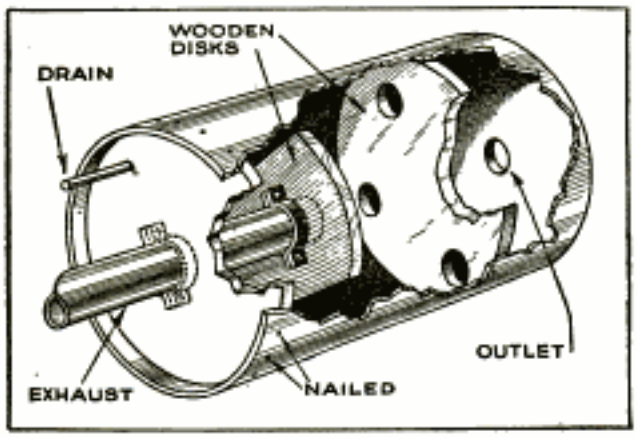
A piece of 10-in. wrought-iron pipe, about 10 ft. long, is drilled for two branches of a 1¼-in. steam line. These branches are about 4 ft. from center to center, with one branch about 18 in. from one end of the large pipe. Each of the branches was turned, by means of an elbow and a short nipple, so as to discharge the steam along the center line of the larger pipe toward the far end of the pile.

In use, the "shooter" is placed in a horizontal position at the end of the gravity chute, and as the coal slides down the short end of the large pipe, the two blasts of steam blow it from the opposite end with sufficient velocity to carry it from 20 to 50 ft. from the opening. Later, it was found that by elevating the muzzle of the "shooter" slightly, the coal could be "shot" still farther.—Franz Szabo, Kewanee, Ill.

¶When welding cast iron with the oxy-acetylene torch, always use a flux.

A Cheap Exhaust Head

When exhaust steam is allowed to escape freely into the atmosphere, the surrounding roofs and walls soon become



For the Small Power Plant an Exhaust Head Made of an Empty Container and Three Wooden Disks will be Found Economical and Satisfactory

covered with a coating of oil, which in time collects dirt and dust.

To avoid this trouble, exhaust heads are used. These are somewhat expensive, and in many cases are not used, in small plants, on account of the cost. A practical head may, however, be made from materials that will cost little or nothing and that will last for a few years.

A sheet-iron container, such as used for paint, soda, brick-covering compound, etc., of 10-gal. or larger capacity, is obtained, and the top removed. A hole, slightly larger in area than that of the exhaust pipe, is cut in the bottom. Obtain three pieces of 2-in. plank, cut them into disks of the same diameter as the inside of the container, bore four holes in one and fasten it by means of nails driven through the container sides, about one-third of the way inside, as shown. Another disk has two segments cut from it, and is fastened in the center of the container. This disk is bored in the center for the exhaust pipe, which is pushed through the disk for an inch or two; then the clamp shown is tightened to prevent the pipe from going farther.

Another clamp is fastened on the pipe at the position desired for the third disk, which is bored for exhaust and drain pipes, pushed against the clamp and then nailed in position; the addition of the drain pipe completes the head. For larger heads, containers up to 40-gal. capacity, with 2½-in. wooden disks, may be used with satisfactory results.

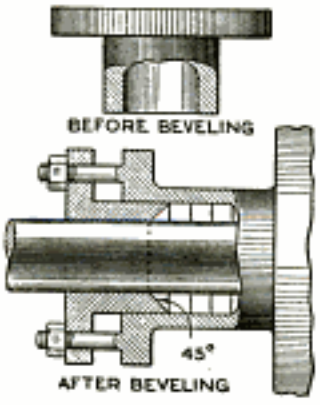
¶Do not use lubricating oil over and over again, without filtering it.

Preheating Cast Iron for Welding

Preheating cast iron for welding should be done slowly but thoroughly. There is great danger of warping or cracking a thin iron casting by improper heating in an open fire. It is advisable, wherever possible, to place a steel sheet between the part to be preheated and the direct flame. While this increases the time required for heating, it reduces the danger of overheating and of unequal expansion. The top of a stove is ideal for preheating small parts. The heat obtained is ample for general requirements, and there is no danger of overheating.—A. MacCullough, Chicago, Ill.

Repair for Leaky Stuffing Box

Considerable difficulty was experienced in the operation of a power plant's boiler-feed pumps because it seemed impossible to keep the packing in the stuffing boxes tight enough to prevent escape of steam and water.



To remedy this, the stuffing-box glands were removed, and the end next the cylinders beveled at a 45° angle. The stuffing boxes were then repacked, the glands bolted in place, and the pumps started and operated without a recurrence of the former trouble.—Lloyd Reeve, Dover, N. J.

Gluing Rubber to Metal

The rubber pad on the big wheel of a bandsaw became loose, and several attempts to glue it tight resulted in failure, until the following preparation was made and applied.

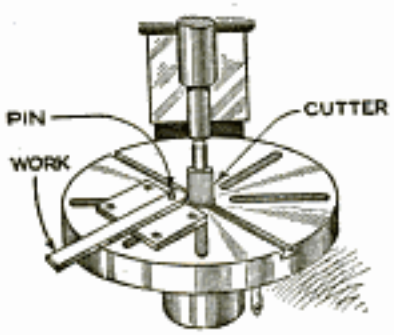
From the bindery of a printing house, a quantity of flexible glue was obtained; this was melted and thoroughly mixed with an equal quantity of acetic acid. The surface of the wheel and of the pad were scraped clean, and both were scrubbed with a solution of oxalic acid, about a teaspoonful of the acid crystals being dissolved in a pint of warm water. Both surfaces were wiped dry, after which they were given a coat of the glue-acid mixture. In about a half hour this was

dry, and the surface of the wheel was then coated with glue, using, in this instance, a commercial brand of prepared glue. Then the rubber pad was stretched on and tapped with a piece of board all the way around the wheel. The next day, when the glue had hardened, it was found that the pad was attached to the wheel tighter than it had ever been.

The glue-and-acid mixture is effective for cementing other materials, such as glass, celluloid, china, and the like, to metal.—Edwin R. Mason, Indianapolis, Indiana.

Cutting a Radius on the Drill Press

A quick method of forming a radius on the ends of flat links, where there is much of this work to be done, is shown in the illustration. A milling cutter is mounted on an arbor in the drill press, the end of the arbor fitting the center hole in the table for additional stiffness. A flat plate, fitted with a pin to fit the holes in the links, is attached by means of flat-head screws to the table, at the proper distance from the cutter to give the required radius. The cutter is revolved at a high speed, a link dropped over the pin and swung around in a half circle against the cutter.



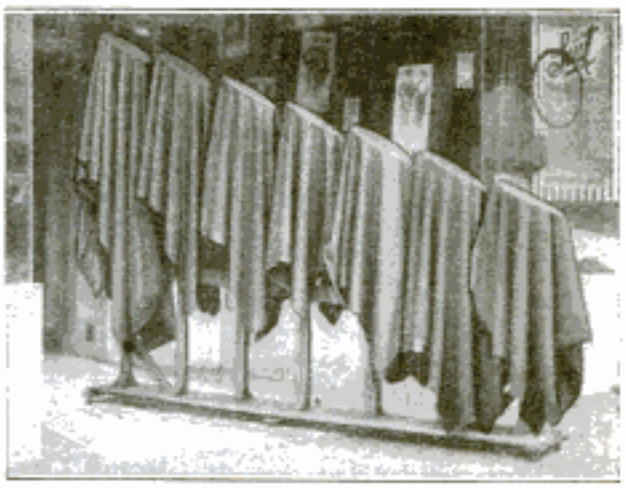
Care must be taken to turn the link so that the end on which the radius is being cut moves in the opposite direction to the cutter, that is, against the teeth.—Harry Moore, Montreal, Can.

Mosquito-Bite Preventives

Most mosquito-bite preventives are more or less ineffective because they are volatile and evaporate within a few hours. A mixture in which the evaporation of the oil of citronella, the most commonly used preventive, is greatly retarded, is composed of oil of citronella, 1 oz., and liquid vaseline, 4 oz. A mixture that will also prevent mosquitoes from biting and which contains no oil of citronella, the odor of which is objectionable to some people, is made of castor oil, 1 oz., alcohol, 1 oz., and oil of lavender, 1 oz. A few drops of either preparation rubbed on the hands and face will usually remain effective overnight.

Rack Displays Cloth in Natural Light

All tailors and others selling piece goods, as well as the buyer, realize that the true color effect of the material is not



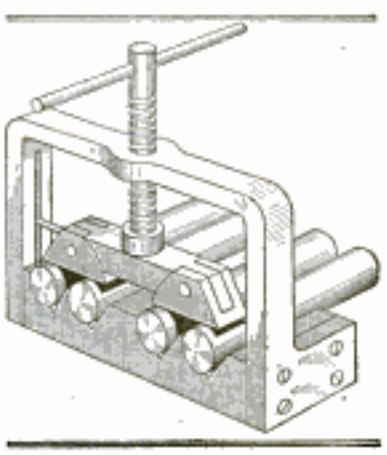
In Order That His Prospective Buyers may Have the Opportunity of Comparing His Suitings under Natural Light, a Tailor Makes Use of This Movable Display Rack

obtained in the dimly or artificially lighted store. Under most conditions, this means that the material must be carried to the entrance in order to show the actual appearance of the piece.

In order to facilitate the inspection of his stock by a prospective buyer, and at the same time give him the chance to compare several pieces of cloth, a tailor uses the movable rack shown in the drawing. The rack consists of a series of graduated uprights with the oval top pieces set at an angle that will bring them all in the same line.

An Equalizing Clamp

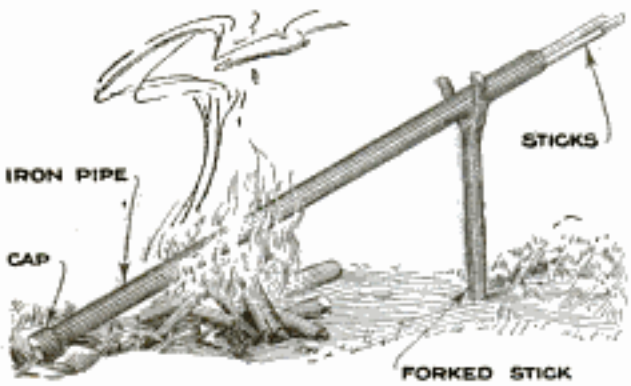
A simple idea for holding four or more pieces of stock, as easily as one, on a power hacksaw, drill press, or other machine, makes use of equalizing clamps.



As shown in the drawing, the two clamps are mounted at the ends of the clamping bar. A guide pin, traveling in a groove at one or both sides, prevents the bar from turning when pressure is applied. With a few turns of the handle an equal amount of pressure is brought to bear on all the pieces.

Steaming Wood for Bending

There are many devices and methods for steaming woods, most of them more or less complicated and unhandy, and de-



A Convenient Method of Steaming Lumber for Bending Requires Nothing More Complicated than a Piece of Iron Pipe and a Forked Stick

pending upon a supply of steam from a boiler or kettle.

An inexpensive method of steaming lumber for bending, when there is but little of this work to be done, is shown in the drawing. A piece of iron pipe, a little shorter than the sticks to be steamed, and having a diameter large enough to accommodate several pieces, is capped at one end. The closed end rests on the ground and the open end is elevated at an angle of about 30°, supported in the crotch of a forked stick. The pipe is partly filled with water, the sticks inserted, allowing them to project an inch or two, first tying the pieces together so that they can be pulled out and reversed in the pipe when one end has been sufficiently treated. By replenishing the water as often as necessary, the wood can be both boiled and steamed until it is thoroughly pliable.—L. B. Robbins, Claremont, Calif.

Distinguishing White Oak from Red

More than 50 species of native oaks assume the proportion of trees, and about 25 are used for lumber. After the oaks are cut into lumber, there is no means known by which they can be identified as to the exact species. By examination of the wood alone, however, it is easy to separate the oaks into two groups—the white oaks and the red oaks; and for most purposes, fortunately, it is not necessary to classify them any further. The oaks all average about the same in strength, but those in the white-oak group are much more durable under conditions favorable to decay than those in the red-oak group.

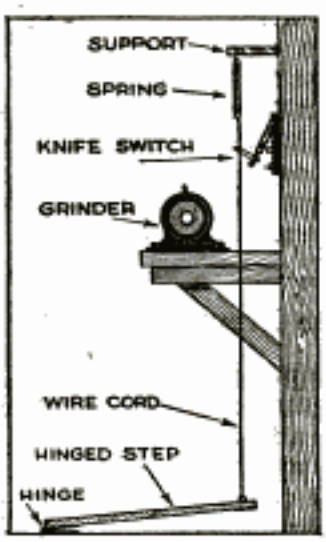
The white-oak group includes true white oak, swamp oak, burr oak, cow oak, post oak, overcup oak, and chestnut oak. The red-oak group includes true red oak, yellow or black oak, black jack, water oak, willow oak, and laurel oak.

The color of the wood is a ready but not absolutely reliable means of distinguishing the white oaks from the red. The latter usually have a distinctly reddish tinge, especially near the knots. The wood of the white oaks is generally a grayish-brown, but occasionally a reddish tinge is found in white-oak lumber.

To tell for a certainty whether a piece of oak belongs to the white or the red-oak group, cut the end grain smoothly with a sharp knife across several growth rings of average width. With the aid of a hand lens examine the small pores in the dense summer wood. If the pores in this part of the growth rings are plainly visible as minute rounded openings, and are not so crowded but that they can be readily counted, the wood belongs to the red-oak group. If the pores in the summer wood are very small, somewhat angular, and so numerous that it would be exceedingly difficult to count them, the wood belongs to the white-oak group.—U. S. Forest Products Laboratory, Madison, Wisconsin.

Foot Switch for Electric Motor

Small electrically driven grinders, and similar tools, are frequently allowed to run unnecessarily, because the last person using the machine neglected to turn off the current when he had finished. A simple method to avoid this waste of current is to provide a hinged step, or treadle, upon which the user must press to operate the machine. A stout wire connects the step with a knife switch and coil spring in such a manner that when the operator's weight is removed from the step, the switch will be opened.



¶Never stop a motor by pulling the rheostat arm to the "off" position, without opening the line switch. Open the line switch first, and then make sure that the rheostat arm is released and drops back.

Turning Long Light Stock

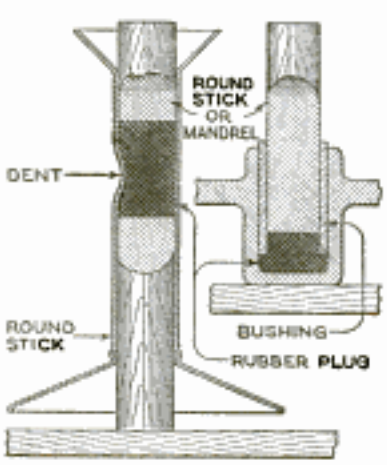
Very often a man unaccustomed to the use of a lathe will put a long bar of small-diameter stock in the chuck, allowing it to extend back through the headstock. As the turning is of such small size, the highest lathe speed will naturally be selected, but this operation is attended with considerable danger.

The end of the long rod, unless it is absolutely straight, is more than likely, because of its high speed, to describe a constantly increasing circle. If the speed is high enough, it will suddenly bend at right angles at the back of the headstock and thrash around the end of the lathe.

When a long bar of light stock is to be worked, at high speed, in a lathe in this manner, a loose bearing or steady rest of some sort should be provided to restrict this movement of the bar.—H. S. Trecartin, Wakefield, Mass.

Removal of Indentations with Rubber

Rubber plugs may sometimes be used to advantage in removing bruises from tubular parts. For example, the bruise in the part shown in the drawing was removed by inserting a rubber plug as shown, placing a round wooden stick below the rubber and resting it on a firm surface, then placing another stick on top of the plug; by striking the upper stick with a hammer, the rubber was swelled, removing the dent in a quick and easy manner.

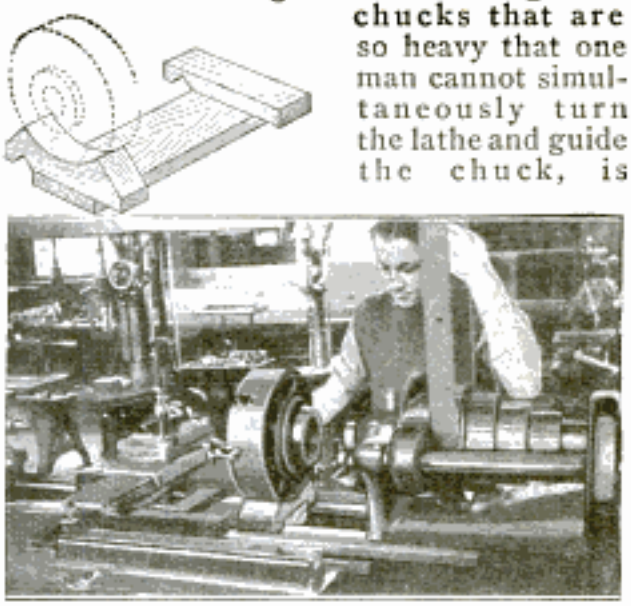


Another use to which the plug may be put is that of removing blind bushings, as shown in the right-hand figure. If a slight distance exists between the bottom of the bushing and the casting, the rubber will swell, driving the bushing up. In the absence of a rubber plug, oil may be poured into the bushing, then by inserting a tight-fitting mandrel into the bushing and striking it, the oil will force the bushing out.

¶When using soft-steel arbors in cast-iron or steel work, lubricate both arbor and work with red lead. This will prevent the arbor from roughing.

Mounting Lathe Chucks

A convenient and inexpensive arrangement for mounting and dismounting lathe chucks that are so heavy that one man cannot simultaneously turn the lathe and guide the chuck, is made from a piece of hardwood, as shown in the drawing.



Mounting or Dismounting Heavy Lathe Chucks Is Apt to Damage the Ways or the Thread on the Spindle Nose. The Illustrations Show the Construction, and an Application, of a Simple Device Which Removes the Usual Anxiety of the Workman

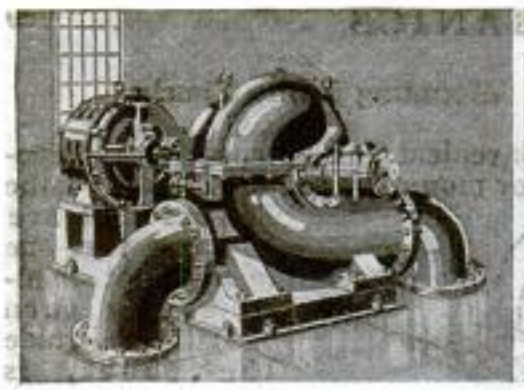
Two blocks, connected by a short piece of board, are provided with a V-shaped groove at one end to fit the lathe ways. The forward block is curved to suit the chuck body and is just high enough so that, when the chuck is in the position indicated by the dotted lines, the spindle will be in line and will easily enter the chuck.

To mount the chuck, the tool carriage is run back toward the tailstock, and the mounting device is placed on the bed, anywhere between the head and carriage; the chuck is then put upon the block, and the whole is moved against the spindle by feeding the carriage forward. The spindle is then screwed into the chuck in the usual way, by pulling on the belt.—E. H. Kreider, Lancaster, Pa.

A Good Splice without Solder

When, as frequently happens, a permanent joint or splice in electric wiring is to be made, and the necessary soldering materials are not at hand, tinfoil will make a good substitute.

Thoroughly clean and brighten the ends to be joined as for a soldered joint; twist them firmly together and then wrap the connection snugly with a strip of clean tinfoil. The joint is then carefully taped.—D. C. Stephenson, Augusta, Kan.



PUMP TROUBLES

By A. P. Blackstead and G. P. Hargis

[In this article, the second of the series, various instances of the troubles caused by air leaks, whether due to faulty packing or to other causes, are discussed. Full explanations of the causes of the troubles and the remedies applied are given, making this a very valuable article.—Editor.]

OBVIOUSLY the best manner in which to warn readers of possible troubles with packing boxes of centrifugal pumps is to cite as examples several outstanding cases encountered in the field of operation, and to present with each situation the remedy prescribed. This method we will follow.

At a chemical plant, near Boston, Mass., was installed a 5-in. single-stage, steam-turbine-driven centrifugal pump, designed to deliver 800 gal. of water per minute at about 60-ft. total head, of which 10 ft. was estimated by the purchaser as suction lift.

The pump delivered into an elevated tank with comparatively short and direct discharge line. The suction pipe was extremely long, approximating 1,000 ft. Water was drawn from a very shallow pond with a static-suction lift of not over 6 ft., average. The pond was of such nature that in the hot summer months the water receded a long distance from the pump house. This drought naturally necessitated a long suction pipe, in order to reach a sufficiently deep part of the pond always to seal the suction intake, which was fitted with foot valve and strainer.

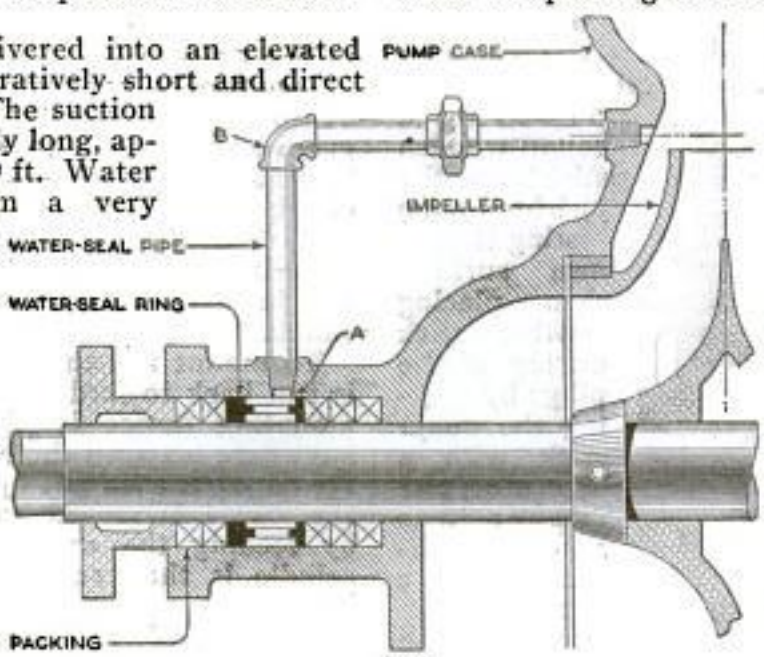


Fig. 1

Showing the Proper Arrangement of the Water-Seal Ring and Packing: Departure from This Arrangement Caused Considerable Trouble in One Pump Unit

The resultant pipe friction greatly increased the total suction lift, a point which the plant engineers had entirely overlooked. In fact, the dynamic lift was measured later with the pump in operation and found to total 20 feet.

It had been reported that the pump would deliver only a small portion of its rated capacity. This was investigated, and found to be true, by noting the time required to fill the discharge tank. Examination proved that the packing boxes were leaking badly, air being drawn into the pump by the rather excessive suction lift. This condition was attributed to the fact that the operator in charge had paid no attention whatever to packing or packing boxes. In fact, the gland bolts had not been tightened since the pump was first started up. The use of water seals for packing boxes was not, at that time, such a general practice as today, and the pump was not equipped with such devices.

The operator's ignorance of packing boxes, however, nearly proved fatal, as the purchaser was ready to throw the pump out. Therefore, the importance of proper attention to the packing, especially on suction lifts of 20 ft. or more, cannot be too strongly urged upon the pump operator.

By simply tightening up the gland bolts, squeezing the packing fairly tight around the shaft, and expelling the accumulated air in the pump case and elbows by allowing the discharge-head pressure from the elevated tank to act on the pump, the capacity was increased to a large extent; in fact, to such a point that the purchaser's desire to reject the pump dis-

appeared immediately. Measurement of the total head then showed a marked increase above the contract head, due principally to the neglected friction head in the suction pipe. Slightly increasing the tension in the steam-turbine governor spring speeded up the unit sufficiently to overcome the additional head—the turbine being sufficiently large to carry the additional load thus produced.

Proper diagnosis of the symptoms, and about one hour's time, thus changed the wrathful purchaser into a grateful, and as proved later, a very stanch customer.

Another incident occurred at a municipal pumping station, located in eastern New York, where were installed two engine-driven centrifugal pumps, of 30-000,000-gal. per day capacity, for low service, raising raw water from the river to the filter beds. One of these gave considerable trouble on account of air leaks. The total pumping head was quite low, not over 15 ft., average, and consisted mainly of suction lift. While the packing boxes were fitted with water-seal piping and rings, yet the pump would lose its suction at times. An appreciable quantity of air was continually ejected with the water, being readily observed at a point where the discharge pipe emptied into an open outfall conduit. Also, it was noticed that when delivering water, the pump casing showed a considerable amount of "sweat," but that the water-seal pipes showed none, indicating lack of circulation.

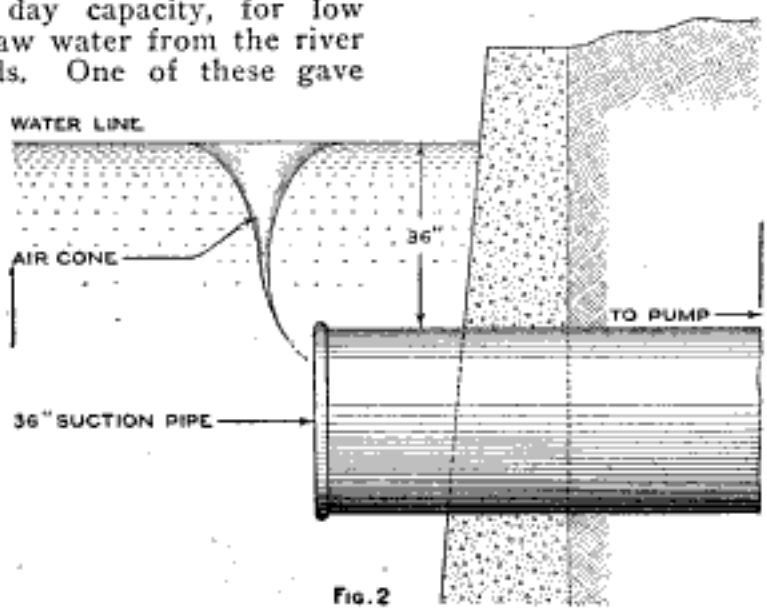


Fig. 2

Condition That may Arise Where the Suction Pipe Is Only a Few Feet below the Level of the Suction Water: Air Cones are Formed by the Powerful Suction and Drawn into the Pipe

The packing boxes were intended to have been arranged as shown in Fig. 1, but examination proved that the pump attendant had found occasion to repack one pump, and had paid little attention, or none, to the proper method of putting in the packing. The water-seal ring had been pushed into the bottom of the stuffing box as far as it would go, and the box then filled with packing, thus covering the water opening at the point A. Such careless work totally destroyed the water-seal effect, as the water from the pump case could not pass through the packing. A simple adjustment, back to Fig. 1, restored the effectiveness of the sealing device and reduced the air trouble to such an extent that the suction was maintained at normal and the operation of the pump considerably improved.

However, this change in the stuffing box did not eliminate all the air, as was perceived by further observation at the point of outlet. Tracing back along the suction line revealed a condition at the point of intake as indicated by Fig. 2. The inlet pipe, 36 in. in diameter, was submerged about 3 ft. below the water level, and the pump, moving such a large volume as 21,000 gal. of water per minute, set up a violent commotion on the surface of the water, with much eddying and swirling, developing into a whirling, hollow cone of air, which would, at almost regular intervals, be gulped into the suction pipe. This would cause the destruction of that particular cone, but in a few moments, another would form from the swirling-suction effect, and the same performance be repeated. A large wooden raft, made of solid planking, was constructed, floated over the suction-intake pipe, and securely held in this position, thus breaking up the whirlpool action. The adoption of the foregoing measures effectively solved this problem.

A word of caution at this juncture, in reference to inserting packing in water-sealed boxes, is offered. Make sure, when new packing is set into the box, that a sufficient number of coils are placed ahead of the seal ring, to permit the opening in the ring to just about meet the far edge of the hole provided for the admission of water, as shown at point A, Fig. 1. This will allow the ring to travel inward as the packing wears and is squeezed up, without blocking the hole drilled in the stuffing box. A narrow groove, as shown at this point by the dotted line, has been introduced by some

pump builders. This permits water to enter freely when the groove is clear, but is likely to fill with packing or dirt, rendering it useless; the groove, therefore, is not generally advocated.

The arrangement of the box, as shown, will also permit the ring to move outward in case of new packing swelling when saturated with water. Upon starting up new pumps, it has been found necessary, on some occasions, to slack off the gland bolts for this reason.

The seal-ring length should equal at least two coils of the packing, and by the time the packing has been compressed to the extent that the outer edge of the ring opening reaches the inlet hole A, repacking of the box will be found necessary.

Soft flax is generally used for packing and gives very good results when the liquid pumped is clear and free from acids, but in many cases other standard, and also special, types of packing have been resorted to, dependent on the nature of the liquid handled.

When pumps handle acidulous liquor, gritty water, etc., it is advisable to connect the water seals to an independent supply source, using clean water, oil, or other liquid, as may be required, in order to prevent pumpage from coming in contact with rotating parts of the pump. Care should be taken that the sealing liquid is not under a pressure largely in excess of that under which the pump operates, for in such a case the danger of breaking the pump casing is great. An example of two river pumps on low-service operation, connected up to high-pressure sealing water, is recollected, where the operator, on shutting down the pumps, neglected to close the valve in the water-seal line, with the result that the pressure built up during the night, and both main casings were cracked.

It is erroneous to assume, however, that all stuffing-box troubles are caused by air leaks. A palpable illustration came to the writers' attention with a pump having well-designed water seals. The pump was intended for use on a fairly low head, the purchaser not specifying that it would be applied to booster service. Water flowed to the inlet under varying pressure—at times the total discharge head reaching 75 lb. This caused a heavy pressure on the packing, and in order to prevent excessive leaks from the boxes, required the glands to be pulled up tightly, resulting in the packing severely scoring the shaft sleeves, which necessitated frequent renewals. The outcome of this was the insertion of an angle valve at point B, Fig. 1, replacing the elbow, thus affording a means of throttling, or shutting off altogether, the pressure from the pump casing. Pump manufacturers today, as a rule, equip all standard pumps with valves in the water-seal pipes, to obtain this feature of regulation.

It must not be construed that all air troubles with centrifugal and other types of pump are directly attributable to faulty packing-box design and care, or to leaky pipe joints. It is a certainty, nevertheless, that centrifugal pumps are much more sensitive to air than any type of plunger pump. Many cases have cropped up where air carried in the water itself has resulted in the abandonment of the pumps. An instance of this nature occurred at a southern papermill, with a small centrifugal pump, drawing directly from an artesian well. At times the pump would run for 10 or 12 hours, giving excellent service, with practically constant output, and then suddenly balk and lose the suction. Then again the same thing would happen after a run of only one hour's duration.

The introduction of an air chamber in the suction line, equipped with a steam ejector to exhaust the air which accumulated in the chamber, helped somewhat, but did not completely overcome the trouble. In fact, service from this unit was so unreliable that the substitution of a plunger-type pump was resorted to in order to eliminate this uncertainty.

Still another example is offered by a number of vertical-shaft, motor-driven units, on irrigation service, which gave only partial satisfaction on account of entrained air entering the pump with the suction water. These pumps had previously passed a successful shop test, but in spite of the fact that positive-displacement vacuum pumps were installed to remove the air, entire elimination and perfect operation could not be attained.

Yet, withal, the centrifugal pump should not be condemned on the strength of such performance, for it never was intended to handle water carrying air to any great extent. Hence, the proper definition of failure in such unsatisfactory cases is—misapplication. Give the pump a chance; properly installed, and with careful attention, it will, within its sphere, exhibit bulldog propensities.

¶Pieces of old piston rings can be used as scrapers in place of glass, for dressing down hammer handles and for similar purposes, when glass is unavailable.

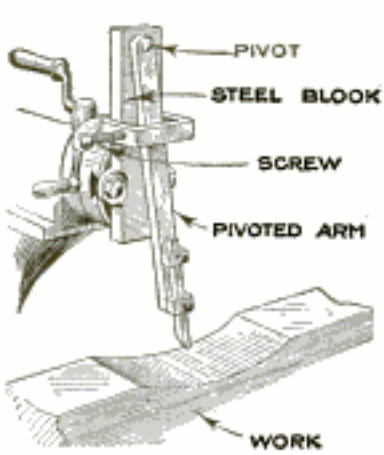
Steaming Green Lumber

Saturated steam as a means of counteracting the tendency of green lumber to honeycomb in the kiln has for some time been successfully applied to the commercial drying of heavy vehicle stock. So far, however, the steaming treatment has been confined to straight stock. The contention has always been that bent stock, such as rims, should not be steamed after removal from the form, experience indicating that stock so treated would tend to straighten out to its original shape. The kiln-drying of heavy rims has been carried on, therefore, without resorting to steaming to remove case-hardening and other defects of drying.

Experiments have shown that judicious steaming of heavy bent vehicle stock results in a considerably improved product, and that the operation can be accomplished without serious effect upon the curvature. Careful judgment is necessary, however, as it is a very easy matter to ruin the entire charge by too severe treatment. Contrary to the common impression, this steaming has been done at high temperatures of from 150 to 180° F. and for short periods (one-half to three hours), the temperature and time varying according to the requirements of the case.

Machining Radii on the Shaper

An ordinary shaper may be made to machine an arc of long radius by making use of a simple fixture substituted for the clapper box as shown in the drawing.

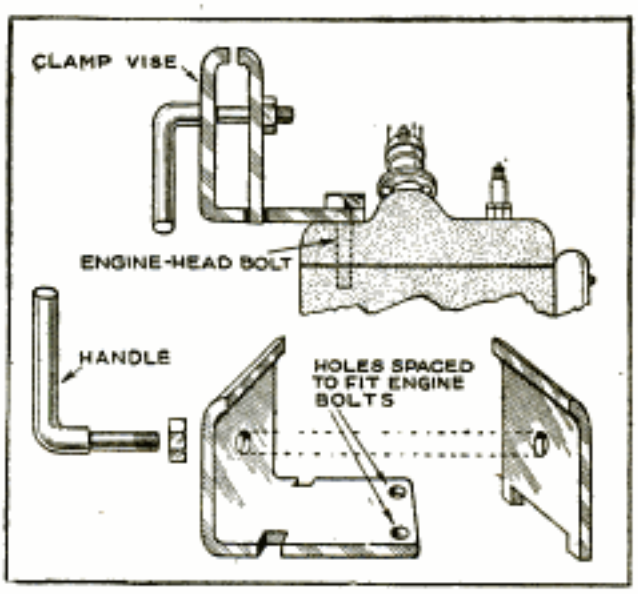


All that is required is a steel block and the pivoted arm, at the outer end of which the cutter is attached. Depending upon the location of the pivot, a number of different radii are obtainable, and smaller variations are to be had by moving the cutting tool up or down. The movable arm is traversed through the arc by means of a hand screw working through a nut pivoted on the lever.

Such a fixture costs next to nothing to make, but adds greatly to the possibilities of any shaper or planer.

An Automobile Clamp Vise

Many occasions arise on an automobile tour when a light, fixed vise would be highly convenient. A fixture for holding small parts, while working on them, is shown attached to the engine by the cylinder-head bolts and concealed by the hood.



A Substantial Vise Attached to the Cylinder Head and Concealed under the Engine Hood Is Always Ready for Use When the Motorist Makes Minor Repairs

Two pieces of ⅜-in. machine steel, or iron, are bent and formed as indicated, holes being drilled in the end to fit over the cylinder studs. If these studs are of sufficient length, no alteration will be needed, but it will probably be found, in most cases at least, that the studs will be too short and that longer ones must be provided.

The movable section of the vise has two lugs fitting into corresponding slots in the fixed part. The screw is made from any suitable ½-in. material, with a bent handle and a ½-in. nut behind the movable jaw.

"Weathering" Concrete

All concrete work exposing a large surface to the air should be kept moist by some such protective covering as burlap or canvas, to prevent too rapid drying through the action of sun and wind. The covering should be moistened by frequent sprinkling until the concrete has attained the desired hardness.

¶When hardening tools with delicate cutting edges, heat the large part, and let the heat run to the fine edge.

A Hydraulic Relief-Valve Repair

The valve seat in the relief valve of a hydraulic pressure pump became worn to such an extent as to make the valve useless, and instead of considering its replacement with a new seat, it was decided to repair it.

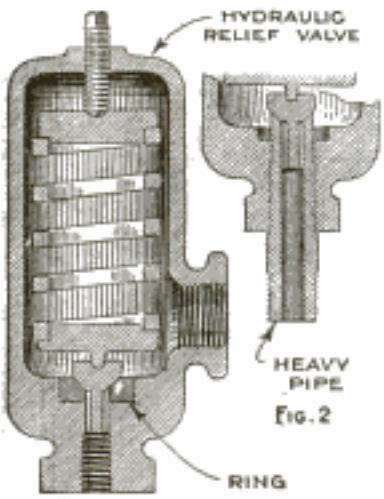


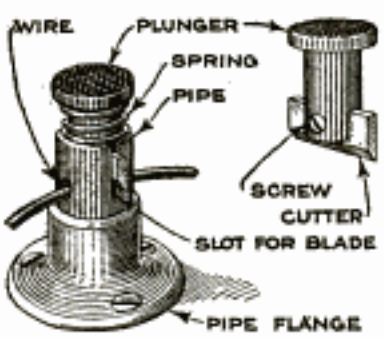
Fig. 1

Fig. 2

The first attempt in this direction consisted in boring out a seat and pressing in a ring with a new seat in it, as shown in Fig. 1. However, the ring pumped out the first time the valve tried to relieve, and a second and more successful method was tried. A piece of double extra-heavy pipe, the same size as the valve connection, had a long thread and seat turned on one end. The thread was then turned off the end to such a distance as to allow the end to come a little above the point of the original seat when the pipe had been screwed home, as indicated in Fig. 2. This resulted in a satisfactory repair, and when the seat needs renewing it is only necessary to unscrew the pipe, chuck it in a lathe and reface it.—Earl Pagett, Cherryvale, Kan.

A Cutter for Heavy Wire

The wire or steel-rod cutter shown in the drawing is a "big brother" to the wire-cutting pliers. A piece of heavy pipe and a pipe flange form the body of the tool, the pipe being slotted to form guides for the cutter. A piece of cold-rolled steel is turned down with a shoulder to make a good sliding fit inside the pipe, and is slotted across the end to take the cutting blade, which is held in place with a flush-head setscrew, so that the blade can be removed for sharpening or renewal. The spring between the pipe and the plunger should be heavy, and have a reasonable amount of tension. Before screwing the cutter to the bench, a piece of round steel is tightly driven into the pipe from the bottom, until the end of the steel is flush with the hole in the pipe through which the stock to be cut is inserted. The piece is then sawed off flush with the bottom of the tool.



The finished cutter may be used as a part of the mechanic's tool kit, or mounted permanently on the workbench. Such a tool will be found indispensable where a large amount of heavy wire is to be cut into lengths. The tool is operated by inserting the wire through the opening and striking the top of the plunger with a hammer.—Elmer O. Tetzlaff, Milwaukee, Wisconsin.

Coloring Copperplated Articles

Through the use of various chemicals, copperplated articles may be so colored as to obtain unusual and artistic effects. The parts to be treated are prepared for the plating bath by immersion in an acid dip. A cyanide plating solution should be used in preference to an acid electrolyte, particularly if metals such as iron or zinc, which are electropositive with respect to copper, are to be plated. Brass may be copperplated with greater ease in an acid bath, but the finish will not compare favorably with that obtained by the slower cyanide process.

Upon removal from the plating bath, the articles to be colored are immersed in a warm solution, composed of 2 oz. polysulphide of sodium to 1 gal. of water. The best results are obtained when the temperature of this solution is about 90° F. Increasing the temperature speeds up the coloring process. The articles are suspended in this bath until a shade of bronze-black is obtained, a pure black being obtainable if desired.

The colored articles should be thoroughly rinsed in clean water when removed from the coloring bath, and dried in warm sawdust. Pleasing effects, similar to the finish employed on many articles of metal furniture, may be obtained by "spotting" the work with felt or cloth buffing wheels. In this manner the black deposit is buffed off, leaving black spots and streaks against a copper-colored background.

Another good coloring solution is composed of 6 oz. potassium sulphide and 1 gal. of water. This also works best when warm.—Kenneth M. Coggeshall, Webster Groves, Mo.

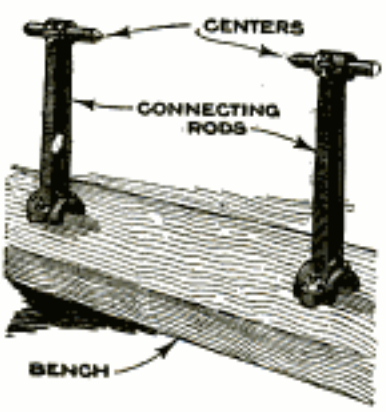
A Pantograph for Laying Out Work

Sheet-metal work often involves complicated layouts and developed surfaces, and where only a few pieces of a certain kind are to be cut, it is too expensive to have templates made.

Drawings frequently come from the drafting room that have the shape correctly laid out, but drawn to ½ or ¼ scale. One foreman solved the problem of laying out special sheet-metal jobs by using a pantograph. Assuring himself that the drawing was to scale, the shape was transferred to the sheet metal with the pantograph. Although the drawing was ½-size, it was possible to enlarge it in the correct proportion. The scheme worked out so satisfactorily that a special pantograph was developed that is capable of reproducing and enlarging any size of drawings.—Lowell R. Butcher, Colfax, Ia.

Easily Made Bench Centers

For use in garages and small repair shops, where it is often necessary to swing an armature, shaft, or other part between bench centers, the device shown in the drawing can be made from a pair of discarded connecting rods.



The connecting rods are bolted to the bench through the bearing-cap screw holes, as indicated, and the wristpin ends are provided with centers made from round steel rod. The centers are adjustable for various distances, the setting being maintained by tightening four wristpin bearing bolts.—Edwin Schubach, Chicago, Ill.

Auxiliary Valve for Blowtorch

The hand-operated pumps with which gasoline blowtorches are fitted become useless after considerable wear. One user of such a torch soldered an ordinary bicycle-tire valve into the top of the fuel reservoir and carried a small tire pump in his tool kit, a few strokes of the pump being sufficient to furnish the desired air pressure.—Wm. McSorley, New York, New York.

A Homemade Broom-Display Rack

Brooms constitute a line of merchandise that gives the storekeeper considerable trouble in displaying so that they will be compactly stocked, yet easily removed for inspection or sale.

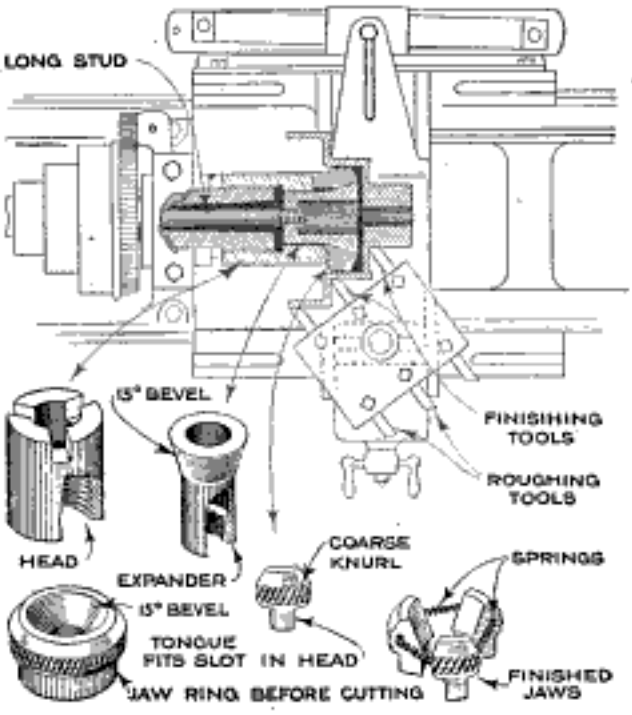
The photograph illustrates a display rack that can be made by drilling a series of holes in the top and bottom of an ordinary wooden box. Cleats nailed across the bottom prevent the broom handles from dropping through, making the rack easy to move, and holding the brooms upright at all times, while allowing them to be withdrawn with ease when necessary.—Chas. A. Goddard, Los Angeles, Cal.

Lengthening Storage-Battery Posts

The adjusting yoke from the steering rod of a light automobile is used, without alteration, as a mold for lengthening storage-battery binding posts. The threads of the yoke are cleaned out with gasoline, and graphite is applied until they are almost completely filled. The ends of the battery posts are filed and scraped bright, and the yoke is screwed down on the post for a few turns. Flux is applied to the end of the post, and the yoke is filled with melted lead. When the lead has cooled, the yoke is unscrewed slowly and carefully, working it in much the same manner as a diestock, to cut threads in the extension, that is, one full turn backward, then a half turn forward.

A Cone-Pulley Chuck

Having several hundred cone pulleys to turn, I cast about for a suitable way to hold them, as a common lathe chuck



A Chuck Specially Made for External-Diameter Turning Operations on Cone Pulleys: It Is Rapid in Action and Takes a Firm Grip on the Pulley

would spring the last step so badly, that many pulleys would have been rejected for running out of true, and, even if this had not hindered, the job would have been a slow one, due to the impossibility of drawing up the jaws tight enough to take a heavy cut.

I designed and built the chuck shown in the drawing, and although three tools were used at once and heavy cuts taken, not a single pulley slip or move occurred.

A head was made out of a piece of steel and fitted directly to the nose of the lathe spindle. The forward end of the head was slotted for the three jaws, the tongues of which slid in these slots, and drove the jaws by their square faces.

The expander unit was also made from a piece of steel, finished to a nice sliding fit in the head; the taper on the cone end was 30°, included angle, and the whole piece was casehardened to prevent excessive wear.

The jaws were each one-sixth of a circumference when split, and only three were used, so as to give the gripping faces a three-point hold on the job. These faces were heavily knurled, a three-cornered file being used for the purpose, and the grooves spaced about ¼ in. apart.

Holes were drilled in the ends of each jaw, to receive the eye of the spiral springs, which were used to draw the jaws together. When the spring eyes were inserted in these holes, a small pin was dropped down through the eye and riveted over.

The bottom of the expander was tapped for a ¾-in. stud, which ran through to the rear of the spindle and was drawn up tightly by a nut.

The action of this chuck is as follows: When the stud is relieved of the pressure exerted by the nut, the expander moves forward, and the three jaws contract, releasing the work.

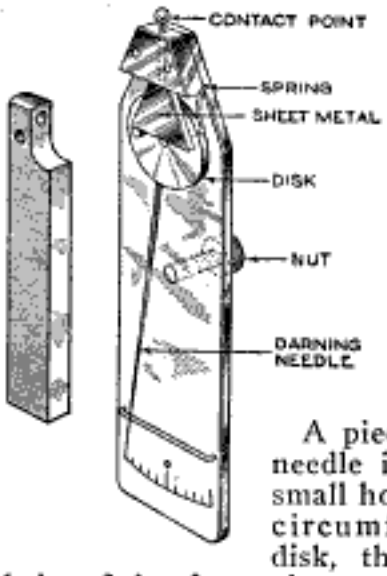
After placing a new pulley in the jaws, the tightening of the nut on the rear of the lathe spindle pulls the expander back, and throws out the jaws against the work.

As will be seen by the drawing, a block holding three tools on each of two of its faces, was used to turn the pulleys, one set being used for roughing and the other for finishing, all three working at a time. By using the taper attachment, set at the proper angle, the pulleys were crowned in the regular way.

Boring the pulleys was done by using the tailstock; a boring bar with a single cutter roughed out the holes, and then a reamer was used to size them.—J. V. Romig, Allentown, Pa.

An Easily Made Indicator

A simple test indicator for use in the lathe, shaper, planer, or on the surface gauge, is shown in the drawing.



The body is made of a piece of 1/16-in. sheet steel, nicely polished, with a short piece of ⅛-in. steel riveted to the upper end. The disk is cut from a piece of ½-in. cold-rolled steel and is 3/64 in. thick.

A piece of a darning needle is forced into a small hole drilled in the circumference of the disk, the needle point being 3 in. from the center of the disk pivot. The disk carries a small pin, driven into its face, off center; a triangular sheet-metal piece, attached to the contact point, bears against this pin, turning the disk, and causing the indicator needle to move over the scale when the contact

point is pressed against the surface to be gauged.

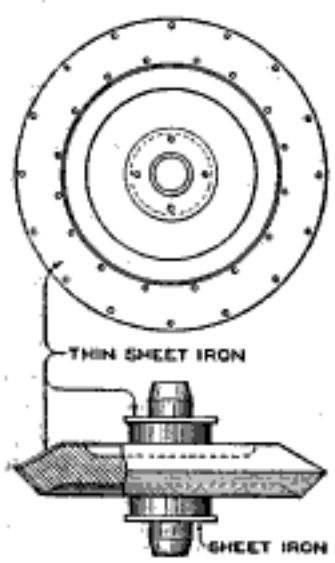
The contact point should be of tool steel, and hardened. A light spring, driven into a hole drilled into the periphery of the disk, keeps the contact point pressed out. The disk should turn very easily on its pivot.

A simple way to calibrate the instrument is to clamp it to an angle plate, adjust a stop against the contact point so that the needle is at zero, then insert the leaves of a thickness gauge differing by even thousandths, one by one, between the point and stop, marking the position of the needle point for each leaf. This marks off one side; to mark the other, adjust the stop, when all the leaves of the feeler are between it and the contact point, to bring the needle again to zero. Withdraw the leaves one by one, marking the indicator as before, afterward deepening the lines with a draw-cutting tool.

The instrument may also be calibrated with the aid of a large micrometer.

Protecting Much Used Patterns

A very interesting idea, for the conservation and protection of much used patterns, consists in covering the parts most likely to be damaged with thin sheet metal, in the manner shown in the drawing. The particular pattern shown is faced with thin sheet iron plates, and the two core prints are made of mild steel.



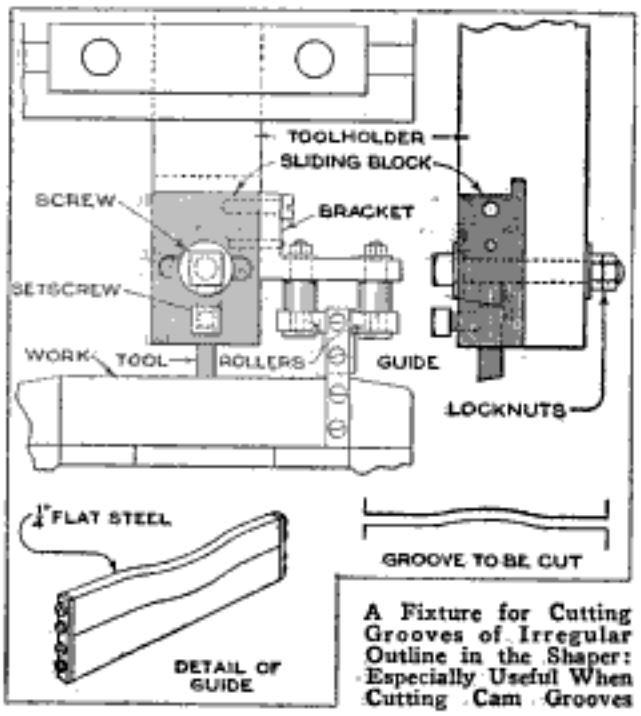
This method adds considerably to the life of the pattern without greatly increasing its weight, the latter being one of the main objections to iron patterns.—Ernest Schwartz, Brooklyn, New York.

Removing Taper Pins

When a taper pin is placed in a position where it is hard to drive out, a standard thread of suitable size should be cut on the large end of the pin. It is then only necessary to screw a nut onto this end in order to remove the pin.

Cutting Cam Grooves in the Shaper

The tool shown in the illustration was designed for cutting irregular, or cam, grooves, in the shaper, and proved very satisfactory in operation. A length of 1 by 1⅛-in. machine steel was machined to take the sliding block shown, a tongue on the block fitting into a groove on the machine-steel bar, which forms the toolholder. The block is slotted to fit the special screw that holds it to the toolholder, drilled and tapped for a setscrew, for a machine screw to hold the bracket, and drilled for a dowel pin; a square hole is also cut in the nose for the tool bit. An angle bracket is screwed and doweled to the side of the block; this bracket carries the rollers that bear on either side of the template or guide.



A Fixture for Cutting Grooves of Irregular Outline in the Shaper: Especially Useful When Cutting Cam Grooves

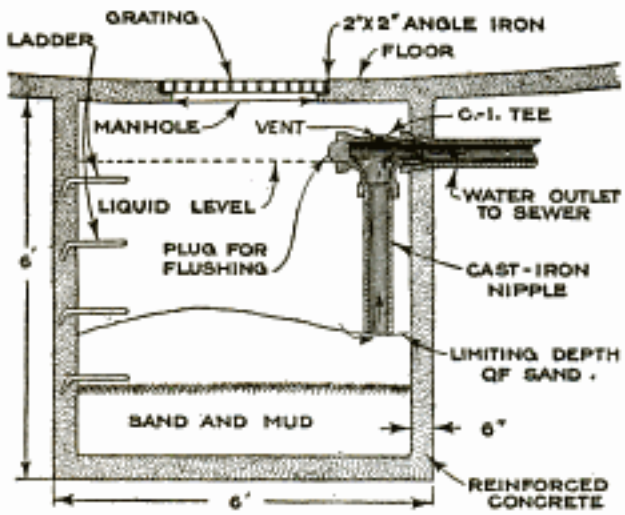
The guide is a piece of ¼-in. flat steel, formed to the shape of the groove desired and mounted, as shown, on another piece of flat stock. The work is gripped, together with the roller guide, in the shaper vise.

As the ram moves forward, the sliding block is forced to move by the rollers bearing on the guide, thus making the tool follow the desired path. A roughing and a finishing tool are used for each groove. The guide, of course, may be permanently fastened to the vise jaws, if so desired.

¶Enamel thinned with benzine may be worked very easily, and as the benzine evaporates, it leaves a very smooth finish.

Trap Prevents Clogging of Sewer

A western city operating a municipal garage had considerable trouble in keeping the sewer that drained the wash rack



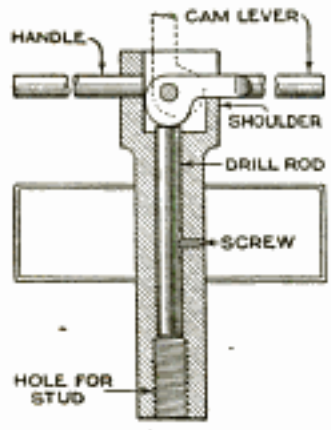
A Simple and Efficient Sump or Trap, for Use in Garages: The Trap Requires No Attention Until Signs of Flooding Indicate That It Should be Cleaned Out

clear. It was also discovered that the city was spending quite a lot of money and time in keeping the sewers of other public garages free of the mud and sand that was washed from the cars.

The result of the city engineer's investigation was the designing and installation of the trap shown in the drawing, which compels attention when the sand in the bottom stops the water from flowing through the vertical cast-iron nipple. The trap requires no attention until it gives evidence of flooding, which is sufficient indication that it needs to be cleaned out. —Mrs. Ruth D. Shultis, Lansing, Mich.

A Hand Stud Driver

Wherever a number of studs of the same size are to be driven, the hand-operated driver shown in the drawing will be well worth making.



The body is drilled entirely through, and is tapped for a short distance at the bottom to take the studs to be driven. A piece of drill rod, cut to the required length, is provided with a small flat so that it can be held loosely inside the body by a small setscrew, as indicated. The top of the body is slotted to take the cam lever, leaving a shoulder for the lever to rest upon when the stud is being driven. The cam lever is made as shown, and is held in place with a pin, upon which it turns, while a fixed handle is set into the opposite side of the body.

In use, the driver is threaded onto a stud until it touches the end of the internal rod, the cam lever being horizontal. The stud is then driven home in the work. To release the driver and permit it to be backed off the stud, the cam lever is raised to the position indicated by the dotted lines, which relieves the pressure against the stud.

Testing Wallpaper for Arsenic

A simple test for arsenic in wallpaper is to take some of the coloring matter from the suspected paper and dissolve it in a little ammonia hydroxide. Pour off this solution onto a piece of glass and drop into the liquid a crystal of silver nitrate. A yellow color around the crystal will indicate the presence of arsenic.

An Original Drill for Sheet Metal

The drawing shows an original design in drills for the particular purpose of drilling holes in sheet metal. It is sometimes dangerous to undertake the drilling of very thin sheet-metal stock with an ordinary drill, and the hole that results is generally very ragged.

This drill will make a hole from ⅛ to 1 in. in diameter, each step advancing in size ⅛ in. It would at first appear that drilling, say a ¾-in. hole, with this tool would be a slower operation than with a drill of that size, but this is incorrect, as each succeeding step removes the same amount of metal and permits a quick feed.

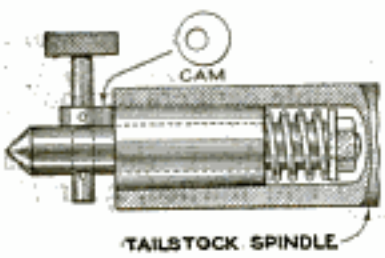
The steps are formed on the lathe, and are backed off or relieved on the bottom only, after the flutes have been milled or filed to form the cutting edges. The radii of the cutting edges are left as they come from the lathe, thus assuring a smooth even hole. To operate the tool for cutting a hole of a certain diameter, it should be fed through the sheet stock until the desired size is obtained; then, if several holes of the same size are to be drilled, the stop on the drill press should be set for the proper depth.

Removing Broken Taps

A tap, broken off in a hole, is often very difficult to remove by ordinary means; sometimes, in fact, it pays to throw away the part rather than attempt to remove the tap. But the oxyacetylene flame makes the job easy. The flame, directed against the tap, will often expand it so much that the walls of the hole are pushed back sufficiently to allow the tap to be extracted easily when cooled. If it does not, it will soften the steel so that the tap may be easily drilled out.

A Quick-Release Lathe Center

The drawing shows a device for adjusting the tailstock center quickly when using small arbors. When doing duplicate work, it is customary to use two arbors so that, while one is in the lathe, the work is being released from the other.



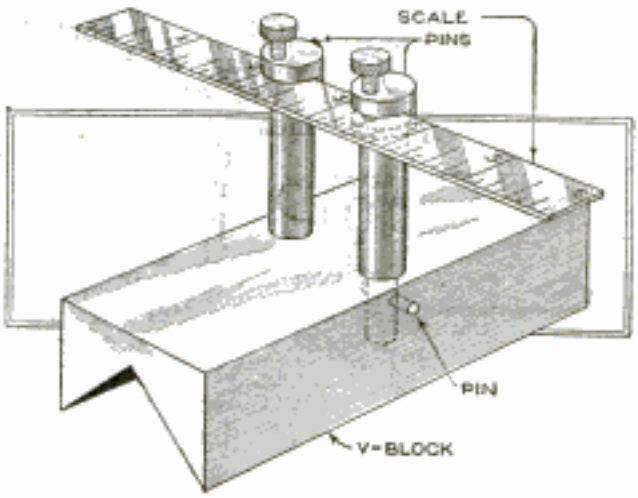
With a tailstock center of this type the adjusting of the center is greatly simplified, with a consequent saving of time.

A sleeve, turned to fit the tailstock spindle, is bored out to take a sliding center, threaded at the rear end for a shoulder nut. A hole, drilled at right angles through this center, takes a knurled-head pin, to which the cam shown is attached. A stiff spring over the end of the center, between the sleeve and the nut, serves to keep the face of the cam in contact against the sleeve. A small flat should be provided on the cam at its highest point, to keep it in place when set, and to enable the operator to feel when the flat is in place, and know at once that the center is in the proper position.

Alinement Gauge for Milling Machines

When milling keyways on shafts, squaring round stock, or performing other operations of a similar character, it is a somewhat tedious job to line up the work to the path of the cutter.

The gauge shown in the illustration makes this portion of the work very easy and quick. It consists of a long V-block, drilled for the two shouldered pins that support the scale. These pins are fastened by means of small pins driven into holes drilled through the V-block and the shouldered pins. The supports are slotted near their upper ends to take a 6-in. steel scale,



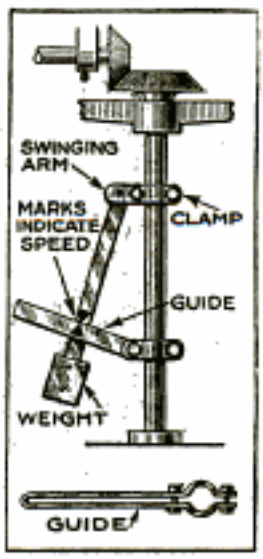
A Gauge That Relieves the Milling-Machine Operator of Much Tedious Work When Alining Round Stock with the Path of the Cutter

which is locked in position by knurled setscrews. The bottom of the slots should be exactly at right angles to the V-groove.

The gauge is laid on the work, and moved until the scale touches the cutter arbor, the cutter and spacing collars being removed. The edge of the scale will show how much the work is out of alinement; it is then an easy matter to adjust the work so that the scale bears on the arbor throughout its length, when the work will be in line.

Speed Indicator for Vertical Shafts

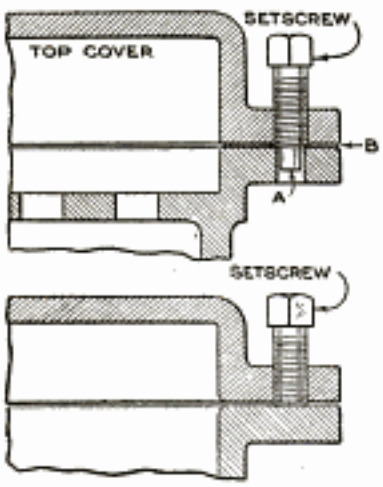
Where vertical shafts are to be run at a constant speed, as with dynamos and water-power apparatus, a simple speed-recording device, using the principle of centrifugal force, can be easily made.



A strip of flat stock is bent to make a guide for the swinging arm, and clamped to the shaft in the manner shown. A weighted arm is similarly clamped to the shaft, in such a manner that when the shaft is rotating at the proper speed, the position of the weighted arm is noted and the place conspicuously marked on both guide and arm. The guide may be temporarily marked by attaching a piece of chalk to the arm.

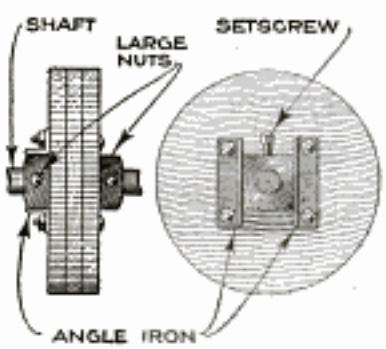
Removing Valve-Chest or Cylinder Covers

Very often, when removing cylinder or valve-chest covers, the engineer finds that the packing, not having been coated with graphite before closing, or in spite of this, has "frozen" the cover to its seat. Where proper means of removing the cover have not been supplied, the usual procedure is to drive a chisel in between cover and seat, at the point B, burring up the edges, and running the risk of breaking a flange. To avoid this difficulty, four of the bolt holes in the cover, spaced equidistantly, can be drilled or reamed out a little larger, and tapped to take setscrews, as shown in the upper figure, the screws having pilots, as shown at A. By screwing down on the setscrews in turn, a little at a time, the cover will be forced off. It is well, in any cover where such means are not provided, to drill four holes, spaced equally around the cover, and tap them for permanent setscrews, as shown in the lower drawing. The operation of raising the cover is similar to that first described. If the setscrews are left in the cover, be sure to back them out enough to clear the seat when the cover is replaced.—James E. Noble, Portsmouth, Ont.



Fastening Homemade Pulleys to Shafts

The accompanying drawing shows a very satisfactory method of fastening homemade wooden pulleys to shafts. This fastening can be used with pulleys and shafts of almost any size, and if properly made will transmit plenty of power. Two nuts, just large enough to slip over the shaft, are fitted with setscrews through one side. One of these nuts is placed on each side of the pulley, as shown. Two pieces of angle iron, or hardwood blocks, are bolted to one side of the pulley, so as to bear against the nut. If a great amount of power is to be transmitted, irons can be bolted to both sides, so that both setscrews will carry the load. If the hole in the pulley is not a close fit on the shaft, a piece of sheet iron, with a hole of the proper size, should first be firmly screwed to each side of it, or the pulley should be bushed.—Chas. Albert, Chicago, Ill.



Storing Lumber to Prevent Decay

Serious losses from decay in wooden structures may be due to the fact that the timbers used were infected with wood-destroying fungi while in storage. These losses can be greatly reduced by keeping lumber-storage yards in a sanitary condition.

Strong efforts should be made to store the product on well-drained ground, removed from the possible dangers of floods, high tides, and standing water.

All rotting débris about the yards should be collected and burned, no matter whether it is decayed foundation and tramway timbers, or stored lumber that has become infected. In the case of yards already filled to a considerable depth with sawdust, and other woody waste, the situation can be improved by a heavy surfacing of soil, slag, or similar material. Weeds should be cut away from the piles to allow good ventilation.

More attention should be given to the foundations of lumber piles, in order to insure freedom from decay and better ventilation beneath the stacks. Solid foundations should never be used. In humid regions, the stock should not be piled less than 18 or 24 in. from the ground. Wood blocking used in direct contact with the ground should be protected by the application of creosote or similar preserving oils, or else replaced with concrete, brick, or other durable materials. Treated skid timbers would also be highly advantageous.

Foundations should be built so that the piles will slope approximately 1 in. to every foot of length.

In most regions lumber should not be close-piled in the open, but should be "stuck" with crossers, at least 1 in. thick. Lateral spacing is also very desirable. Roofing or cover boards on the piles should not be neglected, and should extend several inches beyond the front and back.

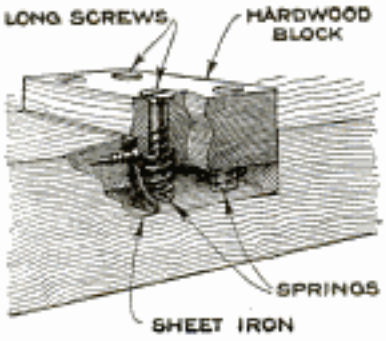
Instead of throwing the "stickers" about on the ground to become infected,

they should be handled carefully when not in use, piled on sound foundations, and kept as dry as possible. If pine, saturated with resin, or the heartwood of such durable species as white oak or red gum is employed, the danger of infection will be greatly decreased.

Should fungous outbreaks occur in storage sheds, not constructed to meet sanitary needs, the infected foundation timbers should all be torn out and replaced with wood soaked in an antiseptic solution, or by concrete or brick. In all cases, the lumber should be kept well off the ground, and the soil and timber immediately adjoining the infected area should be sprinkled or painted with an antiseptic solution of a water-soluble salt such as sodium fluoride, mercuric chloride, zinc chloride, or copper sulphate.

A Simple Adjustable Bench Stop

A simple stop for the carpenter's or cabinetmaker's bench, and one that is easily adjustable for height, is made of simple materials, and set into the edge of the bench as indicated in the drawing.

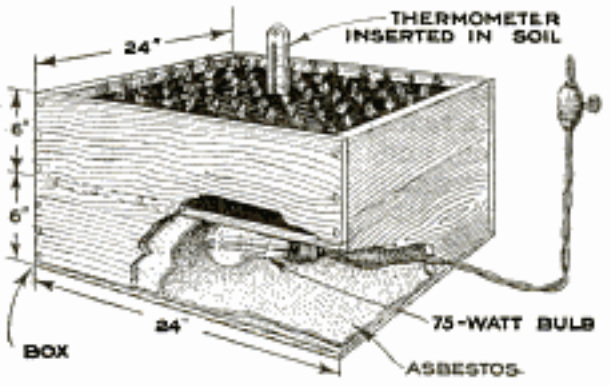


A cavity, 1½ by 3 in., and as long as desirable, is cut in the bench. After smoothing and squaring the sides, fit a block into the recess as snugly as possible, while allowing enough room for it to be raised or lowered easily. Drill and countersink four holes, one in each corner of the block, to take ordinary wood screws, about 1½ in. longer than the thickness of the block, and, on the underside of the block, counterbore the holes to fit short stiff springs. Insert the screws and equip each with a spring, so that a constant upward pressure will be obtained at any adjustment of the screws. The block should be made of hardwood, and if, after considerable use, the cavity becomes worn, it can be faced with a piece of sheet metal.

¶A good putty to fill cracks in wallboard is made from paper, boiled to a pulp, with whiting added to make a stiff paste, and enough glue to make the mass firm. This will not shrink, and paper pasted over it will not crack.

Seed Bed Heated by Electric Lamp

Professional and amateur gardeners, endeavoring to raise plants of various kinds from seed, frequently meet with disappointing results. In most instances plant growth depends largely upon a warm soil, and under usual conditions this warmth is generally lacking. Also, "bottom heat," as it is known among the professionals, is an absolute requirement in getting some seeds properly started.



An Electric Plant Grower Which Furnishes the Necessary Warmth to the Soil through a 75-Watt Lamp Bulb underneath the Compartment in Which the Seeds are Growing

The drawing shows how an electric lamp can be made to furnish the desired heat to the soil in which the seeds are planted. As will be seen, the box is divided by a thin horizontal partition into compartments of equal depth, the upper part containing the soil. The lower section is lined on the sides and bottom, but not on the top, with asbestos paper, and an opening is provided at one end for the insertion of a 75-watt bulb. A thermometer, to enable the gardener to control the temperature, is inserted about 2 in. into the earth just above the lamp.

To keep the ground in a nice, warm condition, making for ideal growth of the plants, the lamp is turned on from 30 to 45 minutes in the morning and evening, allowing the temperature to run up to about 85° and then shutting off the current.—Richard Newbecker, Tonawanda, New York.

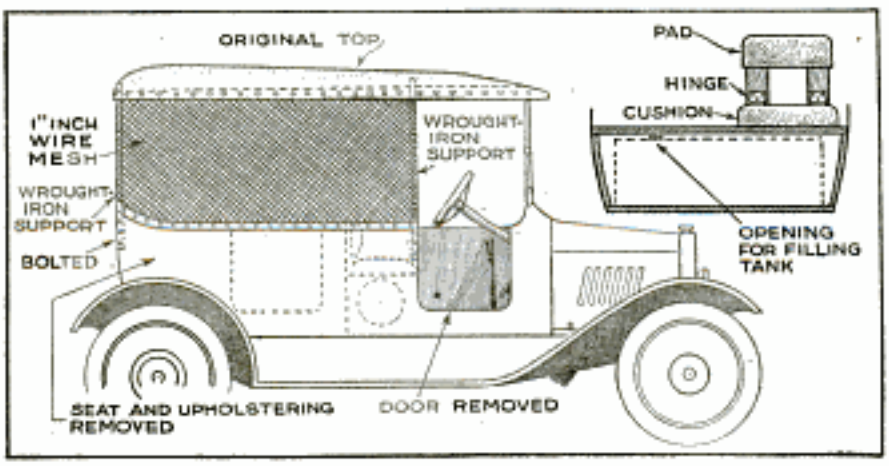
Wire Cable on Auto Meets Emergencies

Two 6-ft. lengths of wire cable, provided with a heavy hook, or harness snap, at each end, can be stowed under the seat or in the tool box, and make useful traveling companions. They may be hooked together to make a towline; wrapped around the tires for skid chains, or used for attaching luggage to the car, to mention only a few purposes they will serve.

Touring Body Makes Delivery Truck

With a few simple alterations, an old touring-car body can be converted into a serviceable delivery car for the merchant or gardener.

The alterations consist mainly in the addition of substantial top supports and a wire-mesh screen around the sides and rear. The seats are removed and the floor made even, and, if the gas tank is inside the car, a rectangular box is made to fit closely over it. The driver's seat consists of a single cushion at one side of the box, to which a hinged back is attached. Four pieces of ⅞-in. pipe are used for supporting the top, the ends of the pipes being flattened and bolted to the body. The original top, if it is in good condition, can be used; it is strengthened at the sides and rear with 1 by 3-in. strips, to which the top bows and the pipe supports are bolted. After the wire screen has been applied, the edges are concealed under a strip of wooden molding; the car is given a coat of paint, and the owner's name and business is painted on both sides and rear of the body.



A Convenient Method of Converting a Touring Car into a Delivery Truck, Simple and Generally Available Material being Used

A Good Bronzing Mixture

A mixture that will not change the color of bronze is made from equal parts of amyl acetate (banana liquid), acetone, and benzine, with just enough pyroxyline dissolved in the medium to give it the proper body. When using, shake it occasionally, to keep the bronze powder in suspension. The thin coat of pyroxyline left when the remaining liquids have evaporated will protect the bronze from the air. This is a good mixture for use on outside work, or where the ordinary bronze mixture rapidly loses its color and lustre.

Making Rubber Packing Steam-Tight

To make rubber packing steam or air-tight, brush it over with a solution of powdered resin in 10 times its weight of ammonia. This mixture, when first made, is unfit for use, but in three or four weeks it readily adheres to rubber as well as to metal or wood, and becomes absolutely impervious to liquids.

Making Glued Joints

Whether a hide-glue joint will be weakened or strengthened by heating the wood before gluing depends on the size of the joint. It is assumed, of course, that the work is being done in a warm, draft-free glue room, and that the wood itself is at room temperature. Under these conditions, if the joint to be made is of small area, heating the wood is unnecessary. In fact it may be detrimental, for the warmth of the wood will keep the glue thin; and, when pressure is applied, too much glue may squeeze out, leaving a "starved" joint. It is very easy to apply too much pressure to a small area.

In making glued joints of large size, several inches each way, heating the wood before gluing is of distinct advantage. Many experiments have proved that, when the wood in large-joint work is not heated, the joints develop full strength only in spots.

Uniform high strength in joints of large size may be secured by heating the wood in a hot box for 10 or 15 minutes at 120 to 130° F. just before gluing. The heat from the wood keeps the glue from chilling, so that it remains liquid until pressure is applied.

It should be remembered that heating the wood retards the setting of the glue to some extent. In heavy woods, from which the heat escapes slowly, this retarding effect is more marked than in lighter woods.

¶Wood has a tensile strength, parallel to the grain, up to 20 times as great as across it, and an elasticity 15 to 20 times as great, according to Forest Products Laboratory tests. The shearing strength, however, is very much smaller parallel to the grain.

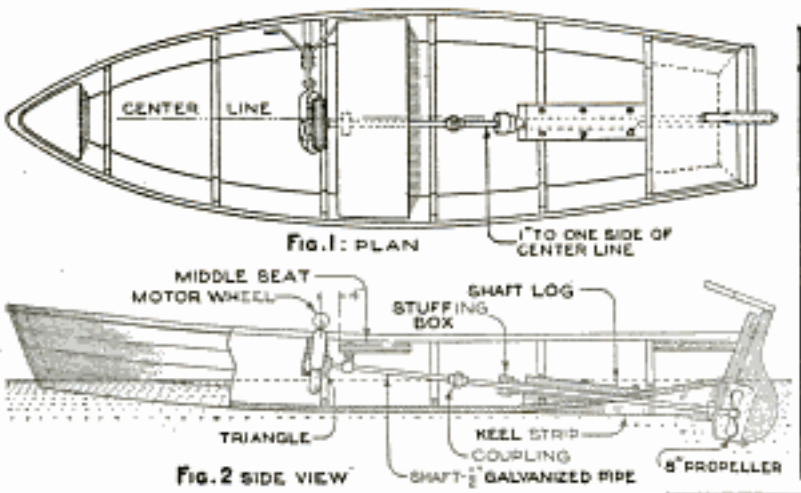
Motor-Wheel Drive for Rowboat

By L. B. ROBBINS

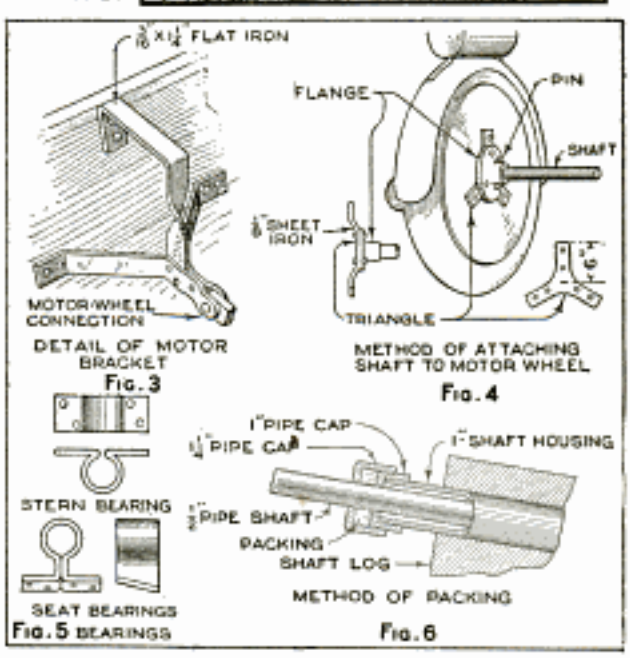
A REAL power boat is within the reach and means of any owner of a motor wheel; all that is needed is an ordinary rowboat and some plumbers' fittings.

As shown in Figs. 1 and 2, the motor wheel is located so that its center is a little to one side of the center line of the boat, in front of the midship seat and slightly below it. The first requisite will be the motor-wheel bracket, and its construction, from flat iron, will be readily understood by reference to the detail drawing, Fig. 3. Measurements for this bracket should be such that the hole for the motor-wheel connection will bring the center of the wheel to one side of the boat's center, as shown in the plan, Fig. 1. This bracket is bolted to the starboard side of the boat, as in Fig. 3.

The shaft is made of two lengths of galvanized-iron pipe. These two shaft sections are joined by a coupling made of pipe flanges screwed to the ends of the pipes, and then bolted together. Holes are drilled through the flanges and pipes, and metal pins are inserted to prevent their unscrewing. The forward end of the shaft, detailed in Fig. 4, is provided with a similar pipe flange, which is attached to a triangular piece, or spider, on the motor-wheel disk. This triangular piece is made from sheet metal, with holes drilled in each arm for attachment to the motor wheel. Holes, to correspond with those in the triangle, must be drilled in the motor-wheel disk, and the triangle bolted to it. The shaft should line up exactly with the center of the motor wheel, otherwise it will whip badly, to the detriment of the motor. Two flat-



The Location of the Motor-Wheel Power Plant and Shaft with Their Relation to the Center Line of the Boat is Shown in Figure 1. The Side View, Figure 2, Shows How the Shaft is Attached to One Side of the Keel



Figures 3 to 6 Illustrate in Detail the Motor-Wheel Bracket; the Method of Attaching the Shaft to the Motor Wheel; the Stern and Seat Bearings, and the Method of Packing, in the Order Named

iron bearings, shown in Fig. 5, are provided for attaching the shaft to the underside of the seat and to the side of the keel, respectively. The location of these bearings is indicated in Fig. 2. The inside of both bearings, and the bearing surfaces of the shaft, should be smoothed and polished, and kept well oiled.

The rear section of the shaft must pass through a shaft log, which is merely a wedge-shaped piece of wood. This piece should be bored out to receive a pipe housing, or lining, of 1-in. pipe. If the housing is brought far enough inside the boat, no water will enter through it, but it may be packed by providing the simple stuffing box shown in detail in Fig. 6. Openings that leak water are calked with strips of rag, soaked in white lead.

As the motor operates at a fairly high rate of speed, the propeller should not have too much pitch.

Ruling Paper by Hand

A filing card, or other form, may be ruled at a single stroke by using the simple holder shown in the illustration. Two pieces of wood are grooved to take the pencils, the number of grooves and pencils depending upon the number of lines desired. The pencils are inserted between the strips and firmly clamped by means of small bolts. A makeshift method is to take two rubber bands, the same width as the wooden strips, stretch one over each strip, then place the strips together and snap a third rubber band over both. The pencils are held by the friction of the rubber. The first method, however, is preferable, as the pencils are held in a more rigid manner.

Using Small Shot for Large Game

When large game is likely to be encountered and nothing more than the usual shotgun charge of small shot is at hand, the problem may be solved by removing the outer paper wad from the cartridge and pouring melted tallow over the shot, after which the wad is replaced and the shell crimped. When the cartridge is discharged, the whole body of shot will be held together until it strikes the object aimed at. This method is practical also for killing beeves on the farm.—G. G. McVicker, North Bend, Neb.

Pressing Clothes Properly

Blue serge and similar hard-finished fabrics, when pressed at home, often show shiny spots and streaks over the seams and pockets due to the fact that the presser is possessed with the idea that the garment must be ironed until dry.

Of course the nature of the fabric must be taken into consideration, but ordinarily a neat job may be obtained by removing the iron and lifting the pressing cloth while the garment is still steaming. This allows the rising steam to lift the nap of the fabric, and, besides eliminating shiny spots, imparts an appearance of freshness to the suit which can be obtained in no other way.—G. E. Hendrickson, Argyle, Wis.

Lawn Receptacle for Refuse

For use in parks and private grounds an appropriate trash receptacle can be made from sections of a hollow log. The interior of the log is cleaned out and the bottom squared off to stand upright, then closed with 1-in. boards.

A wire basket is made to fit the cavity in the log by rolling a strip of wire cloth to form a cylinder of the proper dimensions, overlapping the edges a few inches, and fastening them together with wire; a wire bottom is attached in the same way. The log itself will usually be heavy enough to remain firmly in position, while the light, though strong, wire basket makes emptying an easy matter. The bark should be left on the log to add to its appearance; it may be kept from falling off by tacking with flat-head nails. —C. L. Meller, Fargo, N. Dak.

Reclaiming Tennis Balls

With the opening of the tennis season, the problem of furnishing balls confronts the players. Players and dealers always have a number of "dead" balls on hand which can be reclaimed at a very small cost. They are made "live" again in much the same manner that a punctured bicycle tire is repaired.

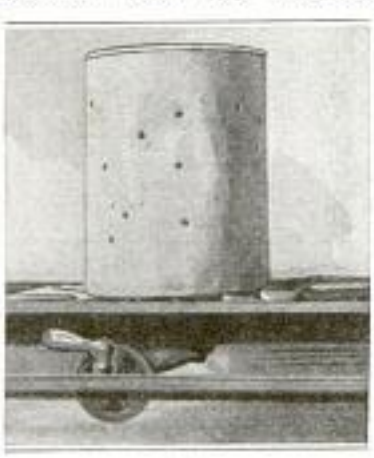
An old hypodermic syringe and needle, which can usually be obtained from a doctor for the asking, a tube of tire filler, and a bicycle pump constitute the necessary equipment for restoring the balls to usefulness.

Simply fill the hypodermic syringe with the tire-filler compound, then puncture the ball casing with the needle, and squirt the compound into the hollow interior. All the balls can be treated before passing to the next operation and, in fact, it is desirable that the compound should be allowed to harden slightly.

The piston is removed from the hypodermic syringe, and the barrel is connected to the bicycle pump by means of rubber tubing; the needle is again inserted into the ball, and on operating the pump, the ball is inflated to any desired pressure. On withdrawing the needle the puncture-proof compound fills up the minute needle hole, and holds the pressure inside the ball. The fluid is allowed to harden, after which the ball is ready for use.—Hale Little, Oak Park, Ill.

An Improvised Heater

A very satisfactory heater for taking the early-morning chill from the kitchen can be made from an old can. A medium-sized can is selected, punched with holes, and inverted over one of the burners of the gas stove, or hot plate. A small room can be warmed very quickly by a heater of this sort.—Oden Liljegren Fern, South Pasadena, California.



¶When preheating a large casting for welding, always use a soaking heat.

An Inexpensive Lighting Fixture

Wishing to replace an inefficient dining-room electrolier with something more economical of current and better in appearance, the attractive and inexpensive fixture shown in the photographs was devised.

An Attractive and Easily Made Fixture Designed to Replace a Crude and Inefficient Dining-Room Electrolier: Long Screws are Used in the Globe Holder so That the Shade Frame may Rest upon Them; the Shade is Thus Easily Moved While Cleaning the Globe

An artistic silk shade was made over a wire frame, and a globe holder was attached to the lamp socket to support the shade. It may be found necessary in some cases to retap the screw holes and insert longer and larger screws, so that the wire shade frame will rest upon the projecting ends.

The old fixture was taken down, and the new one, which is suspended from a brass fixture chain, was put up in its place so that the lower edge of the fringe would be about 16 in. above the table. A 75-watt nitrogen-filled lamp will be found to produce the most satisfactory results.—L. H. Georger, Buffalo, N. Y.

Cleaning Old Paintbrushes

Many amateur painters and others accumulate a number of brushes that have become hard because the water or turpentine in which they were set away has evaporated.

Soaking in benzine or gasoline gives but poor results, but the brushes may be restored to good condition by soaking for a few hours in paint remover, then scraping off the surface paint, and finally washing out with warm water and soap. This will not hurt the brushes and will remove all paint.

CONCRETE GARDEN FURNITURE

By Donald MacKay

Part II — Pedestals and Bird Baths

THE methods of making wooden forms described in Part I, and illustrated in Figs. 1 and 2, may also be used in making the vase and pedestal shown in Fig. 7.

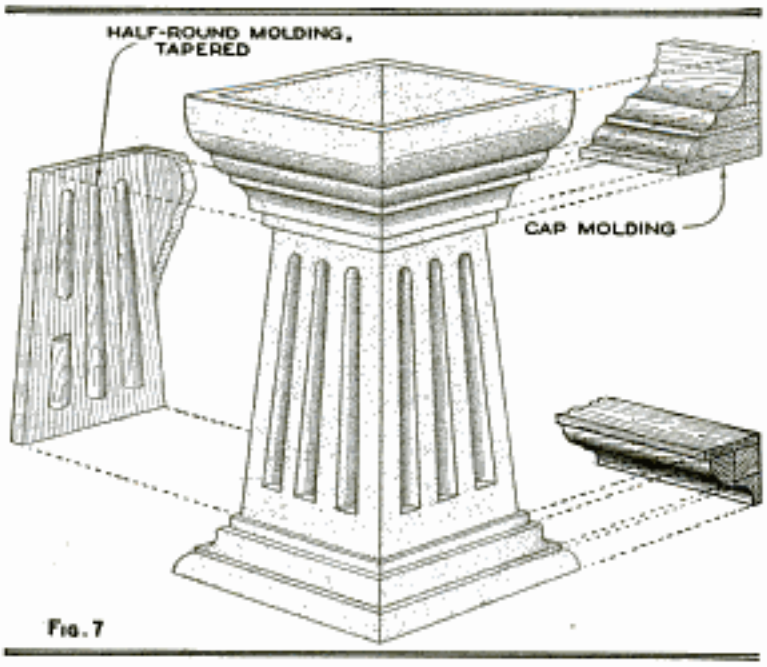
The forms for the top of the pedestal, or capital, and for the base, may be built up of molding sections, as shown; these moldings can be procured from any dealer in millwork; some forms of cap molding or plate-rail molding come in the shapes illustrated; if these are not easily obtainable, the form may be built up of simple sections; half-round molding, tapered and nailed to the sides of the pedestal - body form, will form the grooves.

The pedestal, base, and vase are preferably reinforced with wire mesh, and the pedestal may, by using a tapered wooden core, be cast hollow, thus saving material.

The whole piece may be cast as a unit, if desired, but if the cap, base, and pedestal are cast separately, they should be formed as shown in Fig. 6; this makes the unit much more solid than if the ends were merely left flat.

A number of designs for sundial pedestals and bird fountains are shown in Figs. 8 and 10. The bases and square capitals are cast in wooden molds, or made as shown in Fig. 11, by means of a template working on the edge of a box.

A square bottomless box, of the desired size, is placed upon the foundation board; a template is cut from galvanized sheet iron, to the proper shape, and fastened to a wooden guide, as indicated. After the cement has been placed in the box, the template is moved along each side in turn, the material scraped off being carefully removed. This method may, of course, be applied also to the making of the caps and base in Fig. 7.



Wooden Molds for Pedestals and Vases may be Built Up by Using Cap Molding or Simple Moldings, as Shown in This Illustration

A simple method of placing the pedestals on the lawn is indicated at B, Fig. 8. A hole is cored in the base of the pedestal; when it is set in position, a post, driven into the ground and a neat fit in the pedestal hole, will hold the unit firmly in place.

The sundials used with the pedestals illustrated are not usually fastened in place, their weight being sufficient to hold them in position, but for light dials, or where a permanent fastening is desired, four small holes may be made in the cap by inserting shellacked and oiled plugs into the soft concrete. The dial is then mounted as suggested in Fig. 9, the holes being filled with neat cement.

Little need be said about the bird bath and fountains shown in Figs. 10 and 12,

except that the fountain in Fig. 10 and the pedestals of Fig. 12 should be made by the method shown in Fig. 3, Part I, while the small bird bath, the top of the table, and basin of the fountain in Fig. 12, can best be made by the fixed-template method illustrated in Fig. 5, Part I.

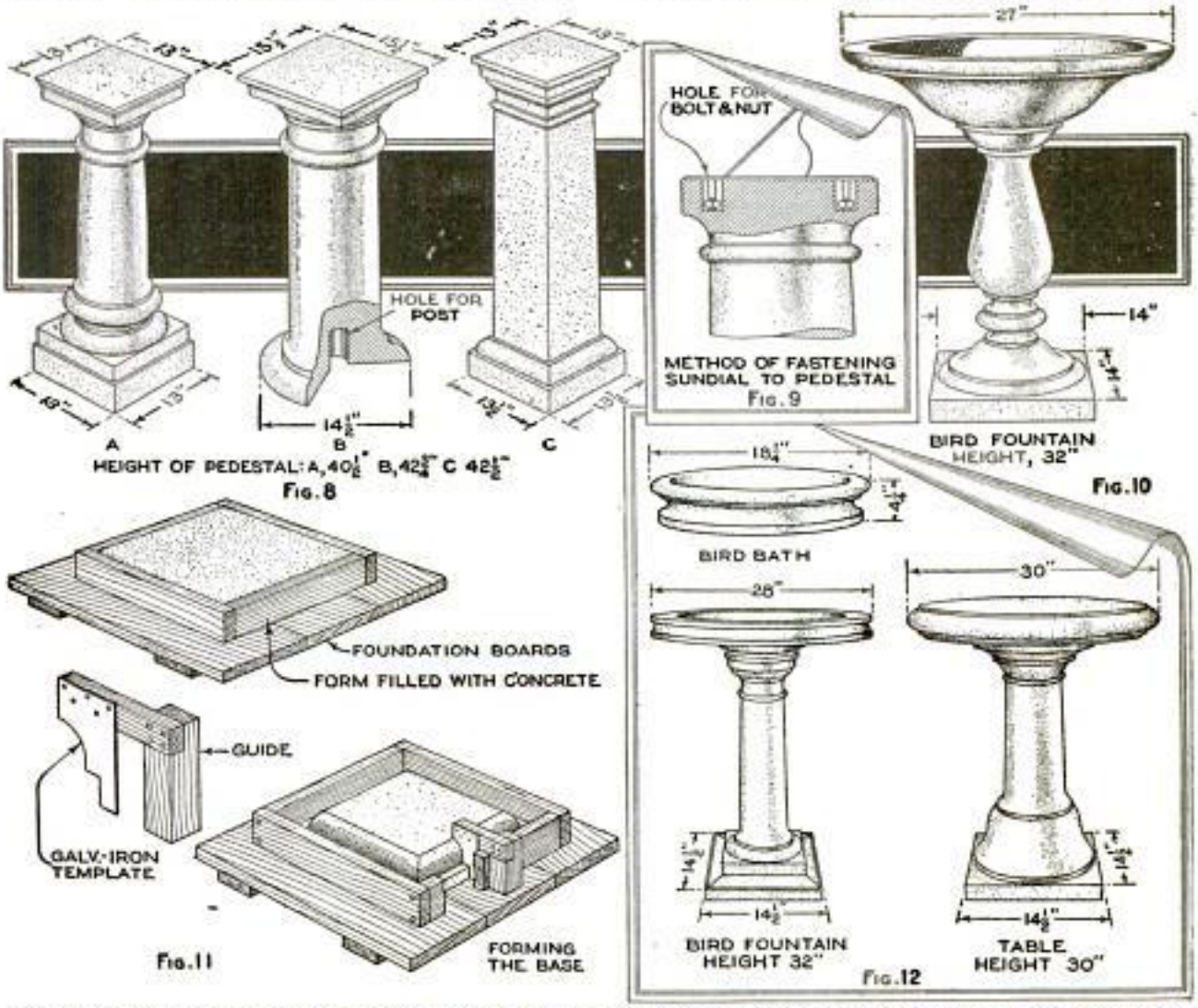
Where a vase, pedestal, bird bath, or any similar article is already at hand, and it is desired to duplicate it, the best method, if the design is not too elaborate and has no undercut portions, is to make a plaster mold.

The making of plaster molds for elaborate pieces demands a great deal of experience. We will, therefore, choose only such designs as can easily be made by the amateur, commencing with a simple rectangular vase.

The vase shown in Fig. 13 can be made in a wooden mold; in fact, it would be advisable to make it this way, but it is convenient for illustration, and as a simple exercise for the beginner.

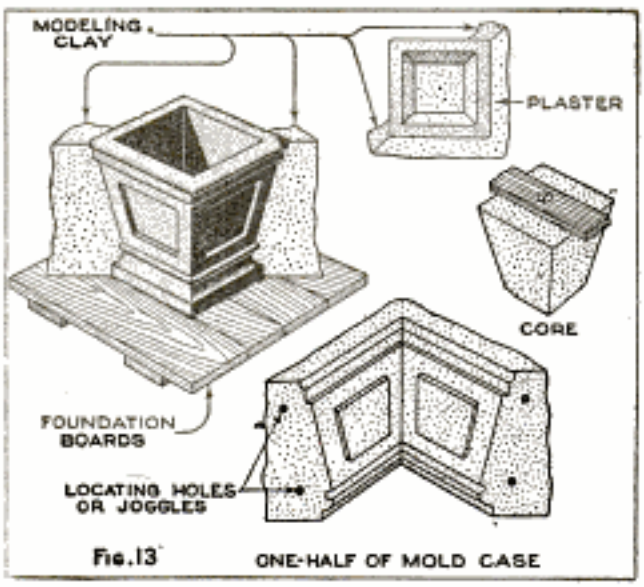
The materials needed are: fine casting plaster, moist modeling clay, stearin, a good heavy-bodied oil, such as lard oil, some loosely woven burlap, and orange-shellac varnish.

Shellac the vase, inside and out, two or three coats, permitting each coat to harden before applying the next, then set the vase on the foundation board. Build up, on diagonally opposite corners, with the modeling clay, as shown, making one face of each wall straight. Dissolve some stearin in kerosene, and apply a thin coat to the vase faces; coat the clay walls and foundation boards with the oil, then mix up the plaster. This should be mixed by first filling a wide basin with water, then taking up the plaster in double handfuls and sifting between the fingers into the water. Some judgment as to the amount mixed and the proper consistency is necessary; 11 cups of plaster to 7 cups of water is about the right proportion. Build the plaster onto the vase, as shown in the plan, and allow it to harden. When it has hardened, remove the clay and scrape two holes, about ½ in. deep and ½ in. in



Various Designs for Sundial Pedestals, Bird Baths, and Fountains are Shown in Figures 8, 10, and 12. Figure 9 Illustrates a Method of Fastening Sundials to Pedestals; Figure 11, Molding Bases by the Template Method

diameter, on each end face of the half mold. These are known as "joggles," or "joggle holes," and when the other half



The Making of a Simple Plaster Mold for a Rectangular Vase: This Is a Good Exercise for the Amateur Concrete Worker

of the mold is cast, small projections fit into the holes, thus locating the halves accurately.

Shellac and oil the exposed edges of the half case, and then plaster on over the remaining sides of the vase, to form the other half of the mold. Coat the inside of the vase with stearin and fill with plaster, then lay a strip of wood, with a woodscrew in the center, across the center of the vase, sinking the screw down into the soft plaster. This will form the core of the mold. The core may, if desired, be made of wood, well shellacked. When choosing designs to copy, it is well to pick one having the interior well tapered, so that the core may be made in one piece. If the plaster mold is to be used for many pieces, it should be reinforced with burlap. This is cut into two lengths, each a little shorter than the length of two sides of the vase, and somewhat narrower than its height.

When the plaster is applied to the vase, to about half the thickness of the case, one of the lengths of burlap is dipped into the plaster and applied to the case; the remaining portion of the plaster is then applied over the burlap to the proper thickness. This strengthens the case considerably.

When the core and casing have hardened, give them two coats of shellac, then a light coat of stearin, and assemble them on the foundation boards. The two halves of the mold may be held by dipping strips of burlap in a thin plaster mixture and pasting them over the corners of the case. These, when hard, will hold the case firmly. Suspend the core in the center of the case, by means of the wood strip, and pour in the concrete. When this has hardened, remove the burlap strips, pull out the core, and withdraw the case carefully. Cover the vase with wet cloths for two days, then place it in a tub, and keep it covered with water for several days.

Further instructions in making plaster molds will be given in the next installment.

Packing Fragile Goods in Straw

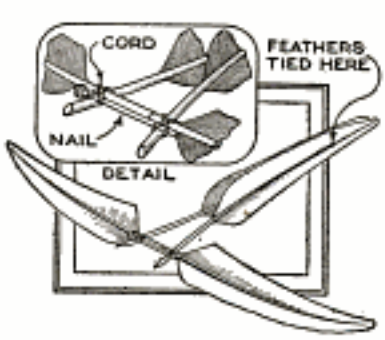
A Japanese method of packing fragile porcelain, and similar articles unaffected by moisture, involves the use of wet hay, or straw.

Long-strand straw is soaked overnight so that it will be soft and pliable. The strands are wrapped around each piece closely and tightly, the smaller pieces being gone over twice, and the larger ones three times in the same manner. Then the straw-wrapped articles are packed in boxes, or barrels, and the interstices are tightly stuffed with the same material.—Mrs. Chas. C. Neale, South Minneapolis, Minnesota.

¶Rust stains on glass may be removed by rubbing with a rag dipped in a solution of seven parts muriatic acid in 30 parts water, to which a few drops of iodine have been added. Finally polish with a soft dry cloth.

A Feather Airplane Dart

Four feathers, a nail, and some string are all the materials needed for making a glider that will fly gracefully through the air for considerable distances.



The feathers are cut and fitted together as shown in the drawing, the nail being placed horizontally in front of the wings, to keep the glider "trimmed."

The feather dart is shot in the same manner as a paper dart, and as the feathers are stronger, it will last much longer than the paper article.—**J. E. Loucks, Cleveland, Ohio.**

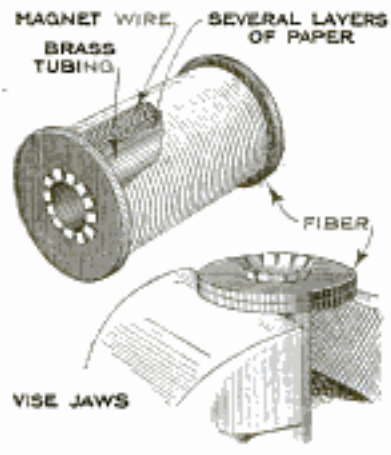
Rejuvenating Old Floor Rugs

When the floor rug has become so much worn as to show holes, or other signs of decreasing usefulness, it may have its life lengthened by a simple process. Turn the rug upside down, and, after sewing or gluing pieces of burlap over any holes or thin spots, make a paste of common gloss starch, thinned to the consistency of paint, and thoroughly saturate the upper surface of the rug, brushing it smooth and even. When the starch has dried thoroughly, apply a ground coat of any good floor-graining varnish, and when this has hardened, the second, or graining, coat is applied, followed, when dry, with a coat of floor varnish.

Handy Spools for Coil Winding

A good substantial spool is the first step in winding any coil for an electromagnet, if it is to be prevented from collapsing or "loosening up."

Get a piece of brass tubing a little longer than the finished coil is to be; thin brass tubing is best, but if it cannot be had it is entirely possible to make one from a piece of sheet brass. The joint need not be soldered, although this is advisable.

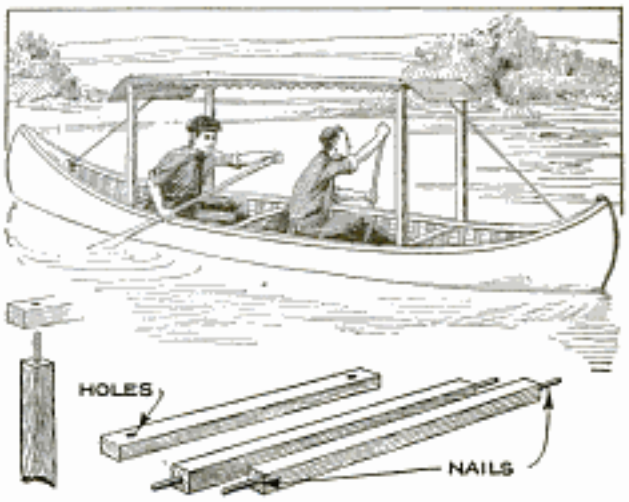


The ends of the tube are slotted for a short distance with a hacksaw, as shown in the drawing, to form lips which are bent over the coil ends and serve to hold them securely in place. The coil ends are preferably made of fiber in the form of washers, with the hole at the center just large enough to slip over the ends of the tube. The lips are bent over at right angles, and care should be taken to see that the ends are perpendicular, as failure in this respect is sure to make it difficult to wind the coil evenly.

Several layers of paper are glued or pasted around the core, shellacked, and allowed to become thoroughly dry before starting the winding, and the coil, when wound, should also be wrapped with one or two layers of shellacked paper to protect the wires from injury.—Curtis Ralston, Springfield, Ohio

A Simple Canoe Awning

Canoeists are familiar with the disadvantages of their craft in the lack of protection from the burning effects of the sun. However, a very neat and effective protection is afforded by an awning of the type shown in the drawing.



A Neat Awning for the Canoe Adds Greatly to the Pleasures of Such a Boat. This Awning can be Stowed Away Compactly and Set Up in a Few Minutes

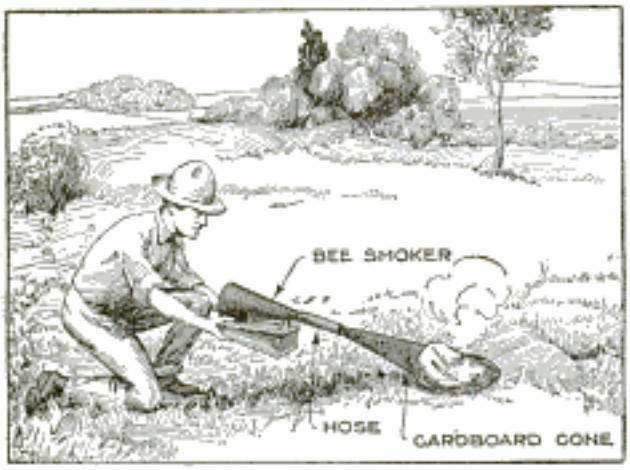
The awning consists of five pieces, the canvas awning and four removable uprights. Naturally, no dimensions can be given, the awning being made according to the length and width of the canoe. The uprights are made of 1-in. square material, rounded at both ends to fit into ½-in. holes in the thwarts, or gunwales, and into the stretcher across the top. If it is not desired to drill holes in the canoe to hold the awning supports, there are various types of sockets that can be bought or easily made. The canvas awning strip has a stretcher inserted through a hem at each end, and a light rope is tied to the awning, as indicated. After the uprights are in position, the awning is stretched across them, and the ends of the ropes are made fast through conveniently located screweyes. An awning of this, or any other type, positively should not be used in waters where danger of sudden wind exists.—H. E. Mende, Irvington, New Jersey.

Removing Enamel Insulation

Amateur electricians have their troubles winding coils with enamel-coated wire, particularly with the finer sizes, as it is very difficult to scrape off the insulation without breaking the wire. By passing the wire through the flame of a gas burner several times, the enamel will be melted, and will drop off.—Paul I. Schmidt, Meno, Oklahoma.

Smoking Out Underground Animals

A woodchuck or other burrowing animal cannot remain long underground if the device shown in the drawing is used.



"Smoking Out" Woodchucks, Rabbits, and Other Burrowing Animals is Greatly Simplified by Using an Apiculturist's Bee Smoker

A funnel-shaped cardboard cone, about 1 in. in diameter at the small end and large enough to cover the opening of the burrow at the other, is connected to a beekeepers' smoker by an 8 or 10-in. length of garden hose. The smoker is filled with rags and lighted, the large end of the cone being placed over the hole and a wet gunny sack packed around the cone and hole. With the rags burning and making a good smudge, the bellows of the smoker is worked, to drive the smoke down into the burrow. A little of this treatment will speedily bring any animal out of his "emergency" entrance, dazed and stifled.—Truman R. Hart, Ashtabula, Ohio.

Growing Large Grapes

By making use of a method not widely known, fruits of large size can be obtained from trees and vines. The idea is based on certain characteristics of the sap flow in the plants. The sap that contains the plant nourishment goes up in the outer cells of the sap wood; it descends late in the season, not through the same cells but through the large so-called sieve cells of the inner bark.

A prize-winning bunch of grapes was produced by an application of this knowledge in the following manner: The grower first selected a perfect bunch of grapes growing from a good, strong cane; next, he cut off all bunches above it on the same cane, and just below the selected cluster the cane was girdled, the bark being removed in a band about 1 in. wide. A paper bag was then pinned over the bunch.

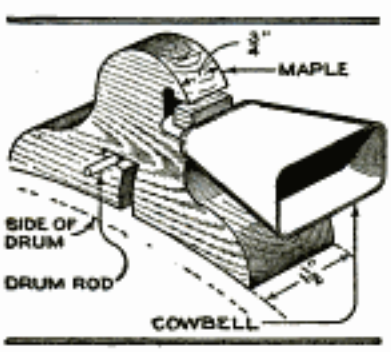
When the sap started back along the canes to the roots, it would be richly laden with the starch manufactured by the leaves. Ordinarily this nourishment would go largely to the roots, there to be stored. In this case, however, the ring of bark that was removed acted as a dam, beyond which the downward-flowing sap could not pass. Consequently the sap would be backed up and be converted into fruit, which would naturally be larger than normal.

The professional horticulturist calls this method "ringing," and there are other ways in which it can be applied to special situations. It is a fact observed by fruit growers that a very heavy crop which bends the branches of an apple tree far down, seems to establish the bearing habit so that afterward the tree will bear unusually well. The scientific explanation is that the bending down of the branches has constricted the inner bark, and the downward flow of sap is distinctly below normal.

A selected branch of a fruit tree can be made to bear better by twisting a wire around it. A young apple tree can be brought into bearing earlier than normal in the same manner, and a backward pear tree can be stimulated to fruit by weighting down the ends of the long branches in summer and throughout the dormant winter period. This will often force productiveness the next year. The secret of the abnormally large pears, apples, and other fruits grown on dwarf trees lies in this general principle; an imperfect union at the grafting point prevents the normal downward flow of sap, and the dammed-up plant food goes into fruit.

Cowbell Holder for Drum

The trap drummer of an orchestra uses a holder for his cowbell that slips over one of the tightening rods of his drum, both the holder and the bell being almost instantly removed.



Hard maple is used for making the holder, and two slots are cut for attachment to the drum and for holding the bell, the under-

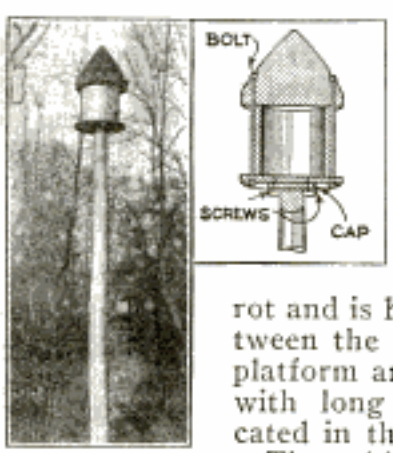
side of the block being curved to conform to the drum shell. The maple block gives a better, clearer tone than the same article made of metal.—M. E. Duggan, Kenosha, Wis.

Paste for Mounting Photographs

A good paste for mounting photographs is made by mixing 12½ oz. of white dextrin in 15 oz. of water, and then adding 2 oz. of sugar, ½ oz. of powdered alum, and ¾ oz. of carbolic acid. The ingredients are thoroughly stirred until they are evenly mixed and no lumps remain. —Robert Page Lincoln, Minneapolis, Minnesota.

Hollow-Log Bird Houses

Using sections of hollow logs, bird houses that are far more attractive than almost any kind made of boards, are easily made by those who delight in watching their feathered friends.



The type shown in the drawing is made from a length of log mounted on a pole. The piece of log is thoroughly cleaned of all rot and is held in place between the circular bottom platform and the solid top with long bolts, as indicated in the illustration.

The thickness of the walls will be determined to some extent by the amount of sound wood in the interior of the log, although if this is too thick, it can be cut down by using a carpenter's gouge. Holes are drilled through the sides, and the interior may be divided off into several compartments by suitable partitions.

Most pleasing proportions are obtained with a bird house of the type shown, when the section of log forming the body of the house is about 2 in. longer than its diameter, the height of the cap or top being made a little less than that of the walls. Such a bird house can be mounted on the end of a pole, as shown, or, by putting a screweye into the center of the cap, suspended from a tree branch.

¶Old dry cells may be used as weights for closing doors, and similar purposes.

Making a Catamaran Raft

A simple raft, that will meet the requirements for an inexpensive and simple

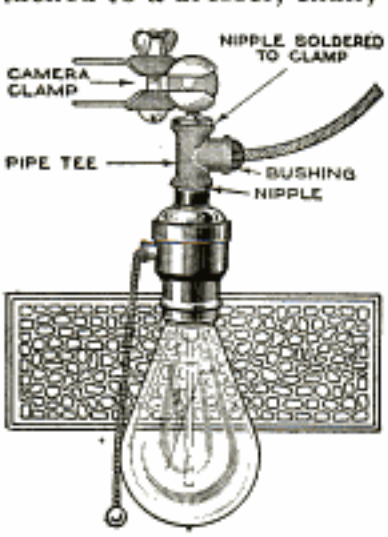
A Useful Boat, Built of Logs as a Catamaran Raft, Takes the Place of a Regulation Rowboat When the Latter is Not Easily Obtained

boat, can be made from two or three logs in the manner indicated in the drawing.

Two logs, about 12 ft. long, are used for the sides, and connected with crosspieces, spikes or wooden pegs being used to secure the parts together. A piece of split log answers for a seat, and two forked branches, inserted into the sidepieces, make satisfactory oarlocks. In the absence of regulation oars, pieces of board can be cut to approximately the proper shape.

An Adjustable Reading Lamp

An adjustable lamp that can be carried around in the traveling bag and attached to a dresser, chair, or bedstead, can be easily and cheaply made from a camera clamp of the type shown in the drawing.

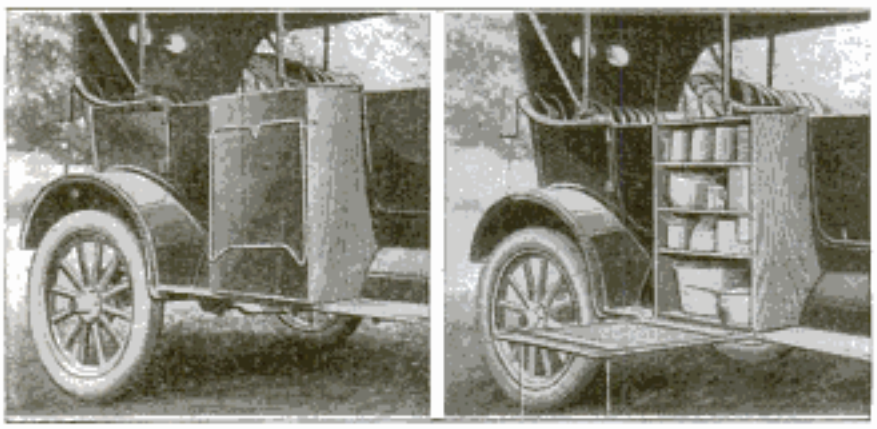


The threaded stud of the clamp is soldered into a short nipple that is screwed into the pipe tee, the lamp socket being attached by another nipple to the opposite end of the tee. The lamp cord is led to the socket through the side opening of the tee, as indicated.—P. L. Lowry, Brooklyn, N. Y.

An Automobile Kitchenette

The automobile kitchenette shown in the accompanying photographs was used during a 3,300-mile tour, with the utmost satisfaction.

The box is made of wood, and the sides are cut to follow the curve of the body of the car, a piece of tin being used for the back. The cover is hinged at the bottom and drops down to form a table, the legs of which are made of a piece of ¼-in. round-iron rod, bent as shown and fastened to the door with staples. Bolts are used for attaching the box to the running board, while a U-shaped strap at the top passes over one of the brackets supporting the top bow.



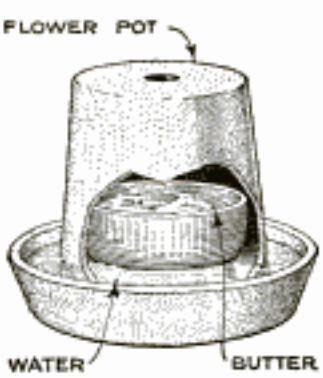
An Automobile Kitchenette Constructed at a Cost of Less than a Dollar: The Picture at the Left Shows the Appearance of the Box When Closed, with the Table Support Folded. At the Right, the Cabinet Is Open

The cost of the whole arrangement, including the paint, did not exceed a dollar.—Harry E. Forbes, Van Wert, Ohio.

A Flowerpot Refrigerator

An ordinary unglazed-clay flowerpot can be used for keeping butter and similar articles of food cool in hot weather.

The dish containing the food is set into a larger dish, as shown in the drawing, and the flowerpot is inverted over it. Water is poured in the larger dish and the whole arrangement is set in some place where there is a free circulation of air. The porous clay pot absorbs the water, which, rapidly evaporating, keeps the contents of the food dish sweet and cool for a reasonable length of time.—C. A. Pease, Monrovia, Calif.



Obtaining Red Tones on Prints

To obtain red tones on photographic prints, it is much better to procure the desired color by chemical means than by dipping in a dye solution. By the former process the whites are left clear, but, when using dyes, the whites are inevitably stained.

The prints are first bleached out in a solution of 7 oz. distilled water, 100 gr. potassium bromide, and 75 gr. potassium ferricyanide (poison). The bleached prints are then transferred to a sepia-toning solution, composed of 25 gr. sodium sulphide in 10 oz. of water. The operation can be stopped here, and the prints washed and dried in the usual way if a sepia tone is desired. An additional solution is required to impart the desired red tone. This solution is composed of 10 gr. gold chloride and 100 gr. of ammonium sulphocyanide, dissolved in 10 oz. of pure water. The prints are allowed to remain in this bath until the desired tone or shade of red is obtained, when they are removed, washed, and dried.

Coins Used for Weighing

In photographic laboratories and other places where small quantities of chemicals or other materials are measured by weight, ordinary coins can be used for weights.

A copper cent weighs 50 gr., a nickel 80 gr., a 10-cent piece 40 gr., while a quarter and a half dollar weigh respectively 90 and 190 gr. A slight allowance should be made if the coins are badly worn or "slick." It should also be borne in mind that apothecary's weight, which consists of 480 grains to the ounce, is generally used in the preparation of photographic chemicals.

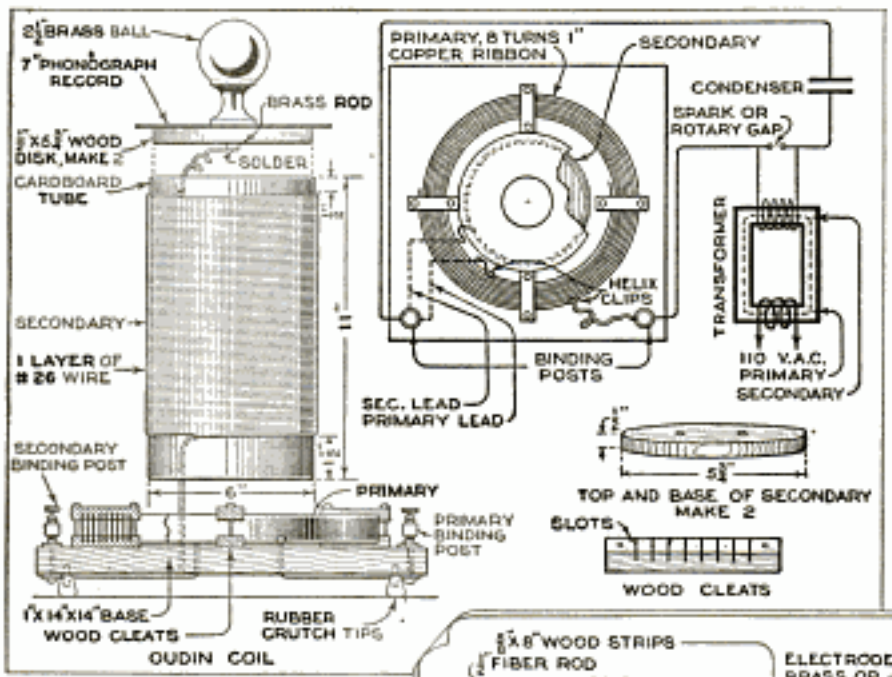
Keeping Coffee Hot

To keep a cup of coffee hot for a longer period, the cream and sugar should be added as soon as possible after the coffee has been poured. The cream and sugar absorb a certain amount of heat which would otherwise be dissipated as the beverage cools.

Making High-Frequency Oudin and Tesla Coils

By F. L. BRITTIN

HIGH-FREQUENCY coils are easy to make, and the materials are, for the most part, to be found around the average radio laboratory. Most experimenters want either an Oudin or a Tesla coil, and as they usually have all other necessary equipment on hand, such as transformers, high-tension condenser, and rotary gap, it is comparatively easy to gratify their ambition.



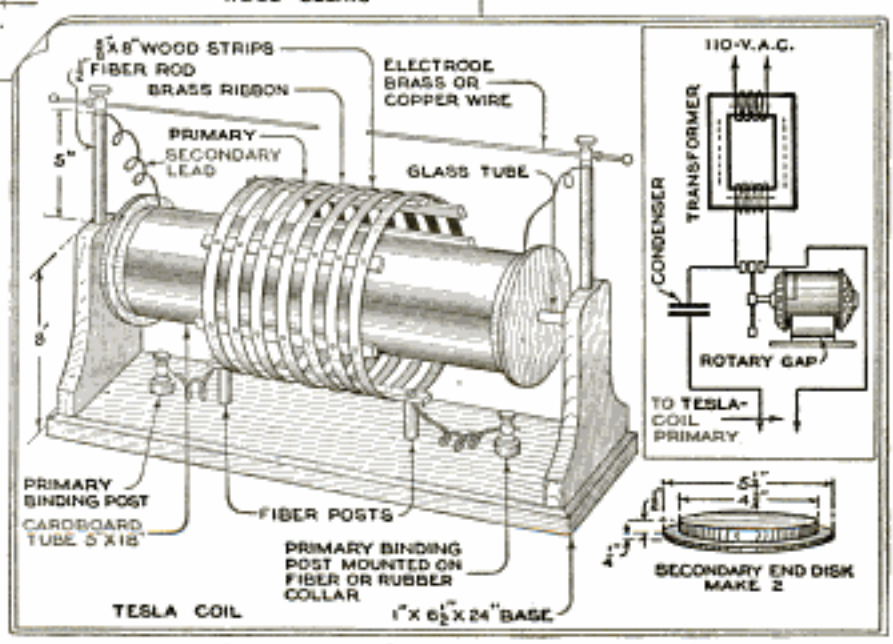
The wooden disks, as shown in the drawing, are made to fit into the ends of the secondary; the bottom disk is screwed to the base, and the top one is drilled through the center to accommodate the brass rod leading to the ball, and is then attached to the tube. A neat cap for the coil is made from a 7-in. phonograph record; the hole at the center being enlarged to take the brass rod, and small holes being drilled at opposite points for the small round-head wood screws which are used to fasten it to the wooden disk.

Almost any junk yard will yield the brass ball, which is of the type commonly used on metal bedsteads.

The base is preferably made of hard wood, which may be finished as desired; it is supported and, at the same time, insulated by rubber crutch tips, which are fitted over wooden pegs, one at each corner.

The Amateur Radio Operator of Limited Means need Not Deny Himself Necessary High-Frequency Coils

To make an Oudin coil, a cardboard tube, 6 by 11 in., is needed for the secondary; this is given two or three coats of shellac, and when the last coat has dried, a single layer of No. 26 double silk-covered magnet wire is wound on. Start the winding ½ in. from the upper end of the tube, first fastening the end and allowing a loose end, of about 8 in., for connecting to the brass rod. Wind to within 1½ in. of the lower end. Small holes are made in the tube at the start and finish of the winding, and the loose ends of wire are pulled through and fastened. When the winding has been finished, it is given a coat of shellac, which is allowed to dry thoroughly before proceeding further.



Oudin and Telsa Coils may be Made of Such Simple Materials as Cardboard Tubes, Discarded Phonograph Records, Scraps of Brass, Wood, and Fiber

The secondary having been completed and connections made, the maker must direct his attention to the primary winding. This winding consists of eight turns of 1-in. copper ribbon, which is held to the base by four wooden cleats, as indicated; these cleats are slotted, to separate the individual turns from each

other. Flexible leads, with helix clips attached to one end, are connected to the binding posts, as indicated, to complete the instrument. Using a ½-kw. transformer and a regular single-unit, oil-immersed, high-tension type condenser, sparks from 10 to 16 in. long can be drawn from the coil, which is connected in circuit as shown in the diagram.

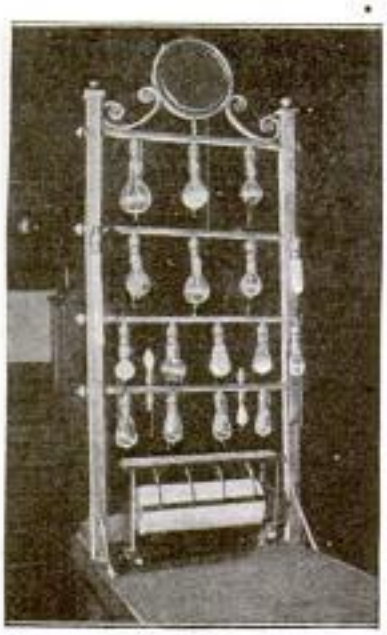
The Tesla-type coil is simple to make and operate, and consists of a secondary winding of a single layer of No. 28 single cotton-covered magnet wire over a well shellacked 5 by 18-in. cardboard tube. After the winding has been applied, it is given two coats of shellac, each of which is allowed to become thoroughly dry. The wire is wound around the tube to within 1 in. of each end, and two small holes are punched through the cardboard at the terminals, for drawing the wire through and fastening it. After the wires have been looped and made fast to the tube, the ends are brought to the binding posts and soldered. The secondary end disks are turned to fit the ends of the tube snugly, and are drilled through their centers to receive the ¾-in. glass rod, or tube, which is supported in blind holes in the endpieces; this glass support is 21 in. long; if glass cannot be obtained, a wooden rod of the same dimensions will answer as well. The end blocks supporting the coil are drilled at the center of their upper edges to take ½-in. rods of fiber, to the upper ends of which the secondary binding posts are screwed, as shown.

Seven turns of 1/16 by ⅝-in. brass ribbon form the primary, the separate turns of which are held apart by means of wooden strips, or cleats, to which the ribbon is fastened with small tacks or screws. The terminals of the primary are brought out and fastened to the bases of binding posts, which are elevated from the wooden base on short posts of hard rubber or fiber. Similar fiber posts, fastened to one of the cleats, are used to support the primary, and keep it properly spaced with relation to the secondary. The wooden parts of the instrument are made from yellow pine to the dimensions shown in the drawing, and finished with black asphaltum paint. The wire electrodes slide back and forth through the secondary binding posts, and regulate the length of spark as desired. A Tesla coil of this type is very powerful, and with it many interesting experiments with currents of high frequency can be performed without difficulty. The circuit in which a coil of this kind is used requires the same type of condenser as that shown in the wiring diagram of the Oudin coil.

Display Rack for Electric Lamps

In order to display the various sizes and styles of electric-lamp bulbs carried in stock, a western dealer uses the display rack shown in the photograph.

The rack is made of metal tubing, the wires being concealed inside, and pull-chain lamp sockets are used so that the customer can operate them easily, although key sockets may be used, if desired.



This arrangement saves much time for the dealer, making it unnecessary to take bulbs from shelves, open packages, and place one after another in a socket; in addition, the customer is able to compare the light given by the different bulbs fairly, because he can see them burning side by side.—John A. Ford, Los Angeles, California.

Beech Leaves to Stuff Beds

Dry beech leaves make an excellent material for stuffing beds, as they are surprisingly springy and comfortable. The dry leaves are gathered in the fall and may be mixed with other leaves, but beech should predominate. The leaves have an agreeable odor and will not harbor vermin.—S. Leonard Bastin, Bournemouth, Eng.

¶Special care should be given to the storage of oxygen and acetylene tanks. Acetylene is classed as an explosive with other hydrocarbon gases, and only a limited number of containers should be stored in one place. Oxygen tanks should be stored in a separate place from acetylene tanks.

Washbasin for Camp or Summer Home

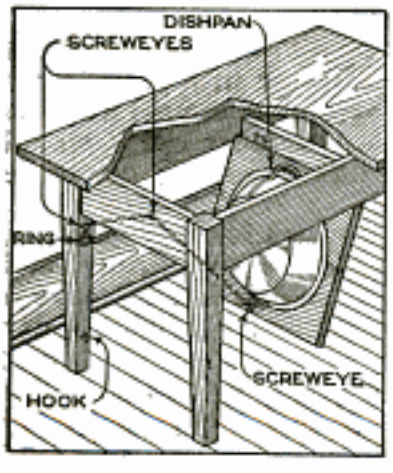
A stationary washstand that lacks only the refinements of the home article, can be installed in any summer home or camp, and fitted with drainpipes, at a very slight expenditure of money or effort. A tin washbasin of any convenient size, and the proper amount of tin speaking tube and fittings are all the materials needed. The speaking tube comes in lengths of about 5 ft. and is so formed that the sections fit into elbows, tees, and the like. A hole is cut in the bottom of the basin with a chisel, smoothed with a half-round file, and an elbow soldered to the bottom. The basin can be supported in a frame made from an old box, and the drainpipe is run outside the house into a pit.

Handle Grips Made from Old Tire

Rubber handlebar grips for bicycles or motorcycles are more or less expensive, and an acceptable substitute can be made by cutting suitable lengths from an old nonskid bicycle tire.—Clay Hewes, N. Chatham, N. Y.

Keeping the Dishpan from Sight

The household dishpan doesn't seem to fit properly anywhere, and its disposition furnishes something of a problem to the mistress of one of the present ideas in "apartments."



The drawing shows clearly, how, in one instance the dishpan has been concealed, when not in use, under a table, although the same idea might even be more satisfactorily applied to the underside of the sink drainboard. The pan rests on a hinged board under the table, is held in place by properly placed pegs, and is raised to, or lowered from, its place of concealment, by a light wire or string passing through screweyes. A ring on the end of the string is slipped over a hook on one of the legs when the pan is in place and hidden from view.—Lloyd R. Dickens, Stratford, Ont.

Artistic Rustic Signs

As signposts to guide visitors to camp sites, or for other like purposes, nothing

Rustic Signboards That Are in Entire Harmony with Their Surroundings at the Summer Home or Camp, can be Made from Twigs Tacked to a Board Support and Finished in an Appropriate Manner

serves the purpose, or harmonizes with the surroundings, quite so well as a rustic sign of some sort. Two examples of such work are shown in the engraving; the larger one shows a very attractive piece of work made from poplar twigs tacked to a light board, the whole being finished off with a coat of shellac or varnish. The smaller picture shows a similar sign in which heavier material has been used. Enough small nails should be used, when tacking the twigs in place, to prevent the bark from peeling off.

When Spark Plugs are Oil-Clogged

Frequently some one cylinder of an automobile engine is subject to excessive oil leakage, with the result that the spark plug fails to fire. While a fresh plug will start the cylinder firing, this is not always at hand. By shifting the troublesome plug from one cylinder to another, the trouble may be overcome, temporarily at least. Where the cylinder fires regularly, the plug seldom needs cleaning, as the dirty plug will be gradually cleaned by the heat of combustion in the cylinder.—G. A. Luers, Washington, D. C.

Gathering Dead Leaves

A 5-ft. square of cloth, having light sticks of equal length tacked to opposite sides, makes a simple device for gathering dead leaves quickly and easily. The leaves are first raked into piles in the usual manner, and are then gathered by holding one of the sticks at the base of the pile on one side and passing the other over and under the heap.—Oscar C. Place, Boulder, Colo.

An Illuminated Gatepost

A pleasing and substantial gatepost, built of concrete and field stone and provided with an electric lamp, such as shown in the photograph, gives the visitor and passer-by a pleasant impression. The foundation may be either concrete or stone sunk into the ground, with a flare at the bottom as indicated in the insert. When laying the foundation, provision should be made for the pipe conduit through which the wires are led to the light.

An Electrically Illuminated Gatepost of Concrete and Field Stone Provides an Attractive and Substantial Entrance to Public or Residential Premises

In forming the post of concrete, the central part can be poured in an ordinary box form and later faced with masonry, as desired.

Each of the four windows is about 6 in. square. Three of them are of the fixed-sash type, and the other is provided with a hinged door for renewing the bulb as may be necessary. A stone or concrete slab, about 2 in. thick, is used to cap the post, and this overlaps about 1 in. on each side.

The light is controlled by a switch located in the house or at any other convenient point.—Frank W. Harth, Bayside, Long Island.

¶If a cupboard door that is held shut by friction alone becomes loose, stick a large thumbtack in the edge.

Novel Uses for the Hectograph

The hectograph, as an office convenience, is well known, and some workers have utilized it as an aid in certain kinds of drawing, where a number of copies are required. Anyone who has worked with tracings knows how soon the paper wears out and how the finer details are lost or altered. The hectograph makes many copies before a new drawing is needed and is particularly desirable in reproducing detail and insuring uniformity. It can do still more, and reproduce flat washes of its various inks, red, green, violet, and black. In spite of their crude aniline character, these inks, when thinned a little and used with discretion, give flat tones equivalent to a first wash which it is easy to bring up to the right shade with water color or crayon; it will even reproduce colors made with certain of the package dyes.

Hectographs, with directions for using, are obtainable at office-supply stores in various sizes; but as they are rather expensive in the larger sizes, the experimenter can make his own hectograph from the following recipe: white glue, 4 oz.; water, 8 oz.; glycerin, 8 oz. Dissolve the glue by setting the vessel in boiling water until the glue is thoroughly liquefied and at this point add the glycerin, mixing thoroughly and straining through a fine screen into a shallow pan, preferably square or oblong in shape. Before using, the mass should be allowed to cool about six hours or until it is a firm jelly. This mixture works best at a temperature of 70 to 75°. For hot-weather use it would be advisable to add about ½ oz. more glue.

In preparing drawings for reproduction, use a fine pen and draw firmly and evenly, using just enough ink to make a full, glossy line. Allow the ink to dry thoroughly before placing the drawing on the hectograph. Use paper with a firm texture and of sufficient surface to prevent absorption of the ink. When making drawings of buildings, or other objects where more or less accuracy is desired, the hectograph-ink drawing may be made on tracing paper or on the photograph or blueprint itself, although the paper of the latter is a little too absorbent. In making flat washes, get the ink on evenly with the first few strokes of the brush, or the result will be patchy to work over. In printing candle shades, only half of the design need be drawn, if care is used in registering and printing. Any part of a design may be stopped out by laying a

bit of paper over it while printing. In applying a wash over the printed tone, work quickly, with the brush not too wet, to avoid spotting and spreading the ink beneath. Small outline drawings, especially, if made in one or two colors of ink, can often be used without retouching, for place cards, invitations, announcements, and the like.—Corinne Rockwell Swain, Philadelphia, Pa.

Swing Made from Machine Seat

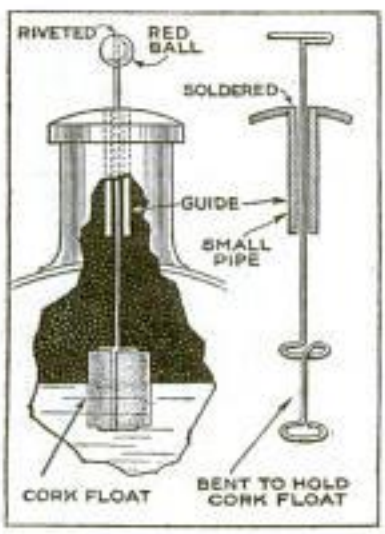
A stamped metal seat, such as used on mowing machines, can be converted into a neat and substantial children's swing. Two holes are drilled at opposite points into the front and rear edges of the seat, which is then suspended from a tree or ceiling by means of chains.—Mrs. Ruth Darling Shultis, Greeley, Colo.

Eliminating Dampness in Closets

Closets and cupboards that have a damp, musty odor can be sweetened by placing a dish of unslaked lime (quicklime) inside. The lime will absorb the moisture, gradually slaking itself; as this occurs, fresh lime should be added. The lime also can be used in refrigerators.

Low-Water Alarm for Auto

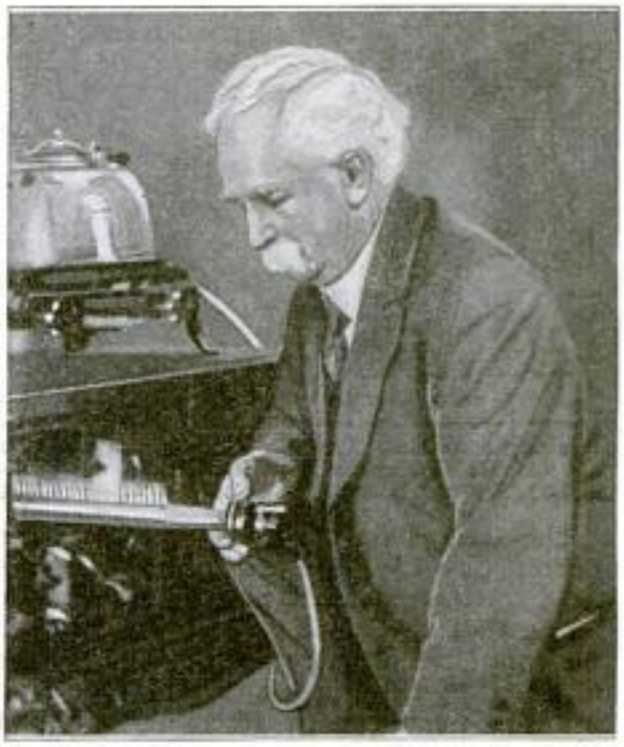
A simple attachment for indicating the amount of water in an automobile radiator, and which also indicates boiling, consists of a float attached to the filler cap.



A shellacked-cork float is attached to the end of a piece of brass wire, led up through a short tube, and through a hole in the filler cap, the tube being soldered to the underside of the cap. The upper end of the wire can be simply bent over, or fitted with a bright-colored wooden bead, the position of which serves to indicate the water level in the radiator, or, by its violent movement, giving warning of the water boiling.

Attachment for Stove Heats Water

To make the coal-burning cookstove in his home suitable for heating water the year round, whether coal is burned in the stove or not, a westerner has devised a simple gas attachment, by means of which the water can be heated with gas when it is not desirable to use the ordinary fuel.



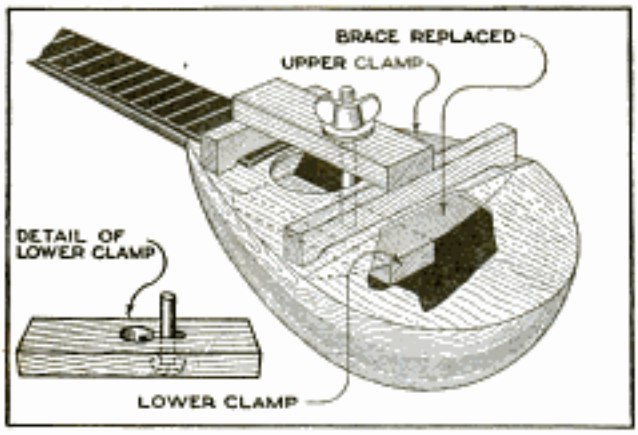
The Burner from an Old Gas Stove, Used to Heat Water, Dispenses with the Need of Maintaining a Coal Fire in the Coal-Burning Cookstove in Hot Weather

This attachment consists of an ordinary burner taken from the oven of an old gas range; it is about 15 in. long and is connected to a convenient gas jet with a rubber tube. In hot weather, when warm water is wanted, the burner is laid in the firebox and lighted, instead of building and maintaining the coal fire. The flames come in contact with the heating coil of the "water back," and the water is heated quickly. When it is desired to return to coal or wood, the burner is lifted out of the firebox and laid to one side. This attachment, properly supported under the grate, may also be used as a substitute for paper and sticks when lighting the coal fire, thus saving much labor.

¶When oil ignites, do not attempt to quench it by throwing on water; this merely spreads the flame. Throw on sand or sawdust in sufficient quantities to exclude the air; this will smother the fire.

Repairing a Broken Mandolin Brace

Permitting a mandolin to remain in a damp place resulted in a broken brace and a caved-in top, due to the pressure



Repairing a Broken Mandolin Brace and a Caved-In Top without Having to Send the Instrument to the Factory, by the Use of a Simple Wooden Clamp

of the strings on the bridge. The brace, located directly underneath the bridge of the instrument, could not be reached on account of the small size of the hole in the sounding board, which added to the difficulty of making a repair. After two or three unsuccessful attempts at repair without special preparation had been made, the following method was used successfully.

A clamp was made, as in the drawing, from ¾ by 2-in. hardwood, with a lower piece, about 6 in. long, provided with a block on one end, and a hole and slot in the center. The upper part of the clamp was made with a similar block at one end cut out to clear the fingerboard, and a bridge, fashioned to rest on top of the instrument near the edges, on the other.

Using the broken pieces of the old brace as a pattern, a new one was made, and, holding the mandolin upside down, the brace, well smeared with glue, was placed as nearly in the proper position as possible. The lower half of the clamp, inserted through the sound hole, was placed with the block resting under the end of the fingerboard. The head of a ¼-in. bolt was inserted through the hole, secured by sliding into the narrow slot, and then fastened through the upper half of the clamp with a wingnut. After adjusting the upper clamp so that one block bridged the fingerboard and the other one rested on the edges of the instrument, the wingnut was given a few turns, bringing the brace back into position, and the top of the mandolin with it. When the glue had been allowed to harden properly, the clamp was removed.—C. M. Vail, San Francisco, Calif.

Roller Skate Aids Crippled Cycle

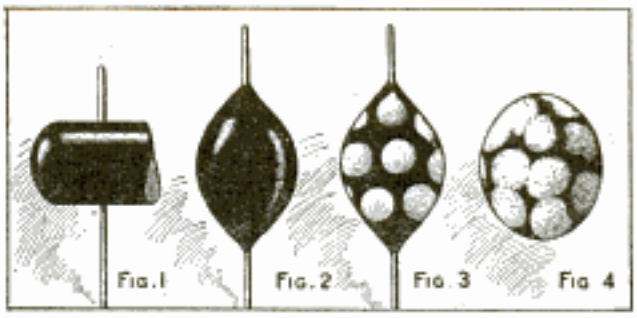
As he was about to start for school on his bicycle, a schoolboy discovered that the tire of the front wheel was carrying a big tack in the tread. In this emergency he strapped one of his roller skates securely to the rim of the wheel, secured the wheel firmly to the fork, and was able to get to school in time for roll call.

Making Sealing-Wax Beads

Beads of individual design and appearance require no more elaborate or expensive apparatus and materials than an assortment of colored sealing wax, a steel knitting needle, and an alcohol lamp, the latter being used in preference to any other flame, because it leaves no deposit of soot on the wax.

First, break off a piece of sealing wax about the size of the bead to be made, heat the knitting needle and press it carefully into the wax as indicated in Fig. 1. Hold the piece of wax over the alcohol flame, revolving it slowly until an even bead, like Fig. 2, is formed; then dip in water until cool.

Choose colors that blend or contrast well with the wax used in forming the bead. Heat each stick in turn and dot a



Odd and Attractive Effects in Beads are Obtained by Making Them of Differently Colored Sealing Waxes

little of the wax upon the cool bead, as in Fig. 3, and then revolve over the flame again. The wax, when warm, will flow around the bead, intermingling with it, and forming odd and attractive designs, such as the one shown in Fig. 4. Cool the bead as before by dipping in water; dry and pass over the flame again to restore the luster. The completed bead is removed from the steel needle by heating the metal on each side of the bead. When the bead is loose, it is slid back and forth on the needle a few times to make a clean-cut hole.

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