

OUR NEWEST BIRDS OF WAR

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



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SEE PAGE 26

BSEE

"PRESTONE" ANTI-FREEZE

in National Defense



"PRESTONE" ANTI-FREEZE is going aloft in many of America's new liquid-cooled fighting planes... playing a vital part in their efficient performance... and in the nation's defense!



MANY OF THE ARMY'S HIGH SPEED TANKS and tough little reconnaissance cars depend on the *one shot*, winter long protection of "Prestone" anti-freeze... because it will not boil away!



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UNCLE SAM'S NAVY is the most powerful afloat. "Prestone" anti-freeze helps keep our ships in fighting trim! U.S.S. Ranger, aircraft carrier, shown above, is one of the many important naval vessels whose mechanism is protected by "Prestone" anti-freeze.



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Remember this In addition to the demands made on "Prestone" anti-freeze, thousands of tons of raw materials necessary for its manufacture are now being used in making vital defense equipment of many different kinds. Some of the uses to which these raw materials are being put were born in the laboratory but a short time ago.

Despite these heavy defense requirements, quantities of "Prestone" anti-freeze are still available to American motorists. But we suggest that you buy without delay. The supply may not be sufficient to meet all civilian needs.



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The Storm Got On My Nerves!



I WAS as run-down as a watch in a pawn shop. My power and pep had faded away, and I swallowed gas by the tankful—but still the boss neglected me. Then one day I was caught in a storm—but you should have heard the boss storm when I couldn't get started!

LUCKILY, someone pushed us into a Packard Certified Re-Wiring station. One peep under the hood, and the mechanic discovered my soggy nerves. 'The insulation on this wiring is rotten,' he told the boss. 'It's soaked right through.'

THE Packard Re-Wiring check-up showed 'leaks' and 'bottle-necks' all through my electrical system. After the mechanic put in new Packard cable, my old performance returned. Now the boss pays more attention to my 'nervous system'—and I get a Packard Certified Re-Wiring check-up regularly!

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If your car is "acting up," don't wait for it to "lie down"—get a Packard Certified Re-Wiring check-up *now!* It's the surest, quickest way to locate trouble anywhere in the starting, lighting and ignition systems—including the electrical units themselves. Packard-trained mechanics have the technical skill and the right tools for the job. They'll use only Packard cable of the right type and size, if replacements are necessary.

You'll get more comfort, economy and safety out of your car if you make Packard Certified Re-Wiring

check-ups a regular habit. If your service station or dealer doesn't offer Packard Certified Re-Wiring Service, have him get in touch with his Packard jobber. Packard Electric Division, General Motors Corporation, Warren, Ohio.



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DECEMBER, 1941

This One



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1A

EVERY EXTRA LEAF IN THE TABLE
**AND FAR
TOO MANY GUESTS**
FOR CHRISTMAS DINNER!



That's the situation your telephone company faces every Christmas. That's why there may be delays on some Long Distance Christmas calls.

• Last Christmas Eve and Christmas Day — with every available circuit in service, and thousands of extra operators on duty — the demand for Long Distance telephone calls at many points was *three, five and even EIGHT times normal.*

We're glad so many folks want to exchange friendly greetings across the miles at Christmas — but sorry that, because of it, we can't supply service as good as usual.

We expect the biggest rush of calls we've ever had this coming Christmas. We'll do our best to prepare for it. But some calls will be slow. Some may not be completed. For these, we ask your patience and understanding. *Thank you.*

BELL TELEPHONE SYSTEM



Popular Mechanics Magazine

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H. H. WINDSOR, Jr., Editor and Publisher

December, 1941

Vol. 76, No. 6

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From the Air—Tomorrow's Car

SOME day the automobile builders will break loose from the conventions to which they have been bound by habit and by their vast investment in tools. Then they'll turn to the airplane for new ideas. They'll build a fenderless car with six-foot seats, 50 percent lighter and 50 percent more economical than your '42 sedan; and they'll tuck the air-cooled engine of airplane type under the luggage in the rear. These are some of the ideas William B. Stout, noted automobile and airplane designer, propounds in a January article—"Out of the Air—Tomorrow's Car."

Warriors on Skis

THEY sleep in the open in sub-zero weather, tow guns on dog sleds and motor-driven toboggans, eat rations dehydrated to keep them from freezing. Dressed in white parkas, they are invisible from the road 600 yards away. These are Uncle Sam's ski troops, on winter maneuvers across the northern states. Follow them in the January story, "Warriors on Skis."

Next Month

WHAT'S the difference between a blonde and a brunette? Precious little, and that's only on the surface. Put them in front of the critical eye of a recording photoelectric spectrophotometer, which detects variations in hue far too delicate for the human eye to notice, and the "color curve" of the brunette's skin differs very little from that of her fair sister. Science has learned many fascinating "Secrets of Color," and that's the story in the Coloroto section in January.

Marching on Wheels

DRAGGING into camp after 48 hours of battle maneuvers, the 15th Infantry found emergency orders waiting. In three hours one battalion was to march on to the coast, another to an army air field. Two thousand men, hundreds of troop carriers, trucks and gun tractors move 250 miles overnight. Ten years ago the army waited for the next train. Today they roll on a moment's notice. Read "Marching on Wheels" next month.

Cinderella Metals

HEARD about the new cash crop in your basement and back yard and barn? It's junk. Scrap iron and aluminum and copper are the Cinderellas of the defense production boom. The local junk man is glad to buy, and if you don't comb your house and lot for "rags and old iron" you're missing a bet. Watch for "Cinderella Metals" in January.

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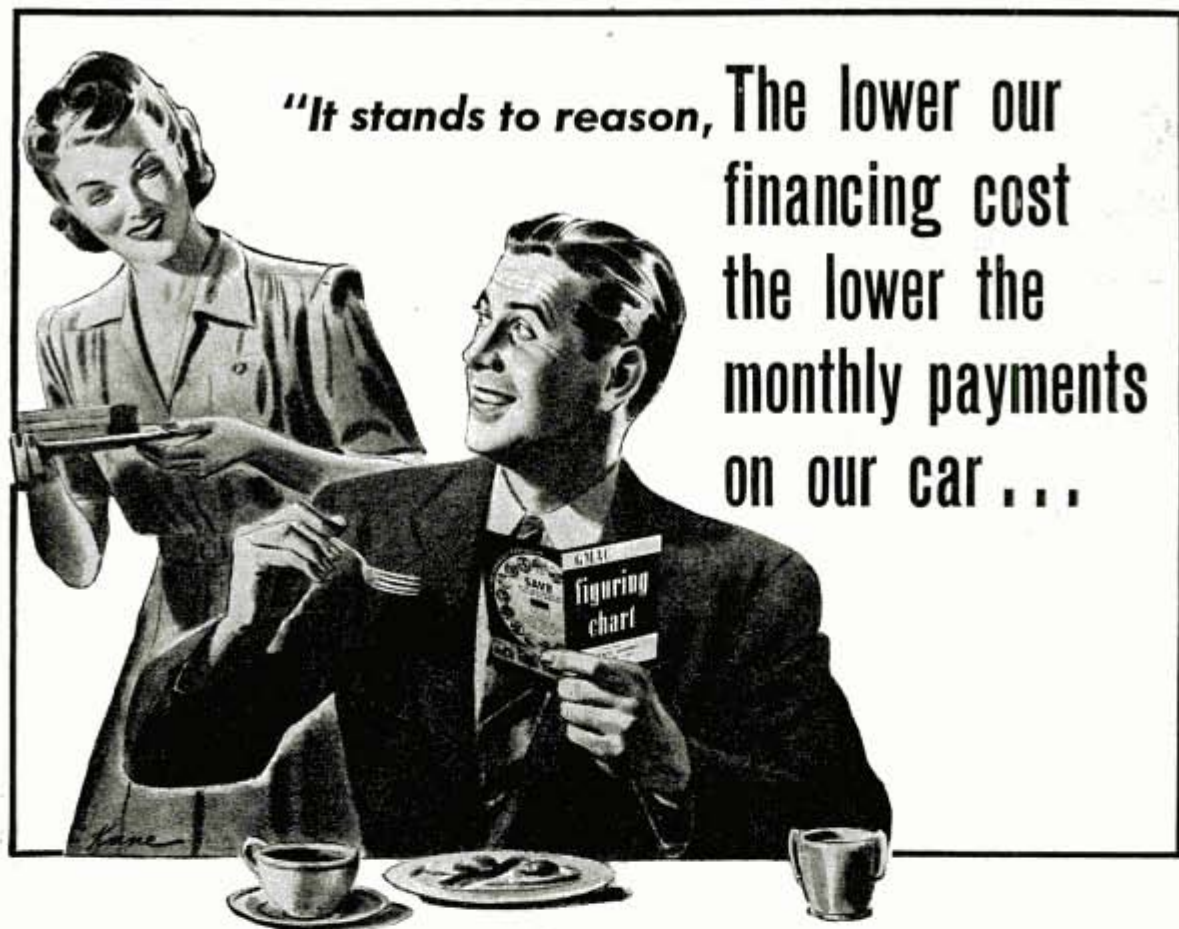
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Where no name and address appear directly under an item, the product is not believed by us to be commercially available

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"It stands to reason, The lower our financing cost the lower the monthly payments on our car . . .

Here...it shows you right in this Figuring Chart!"

When you buy a car on time, naturally you want a low cost plan...one that offers you the lowest monthly payments, sound insurance, and reliable service. Here's a suggestion to help you find that plan—

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plans and what they offer...see for yourself just where and how you can save!

You'll see definitely that the lower the financing cost, the lower your monthly payments will be. You'll be surprised at how little it really costs for financing on the General Motors Instalment Plan! And remember, *this* plan includes broad insurance protection for your car!

But learn for yourself why the GMAC Plan is *the* low cost way for you to buy a car on time. Send the coupon for your Figuring Chart right now!

This plan is available only through dealers in Buick, Chevrolet, Pontiac, Oldsmobile and Cadillac cars.

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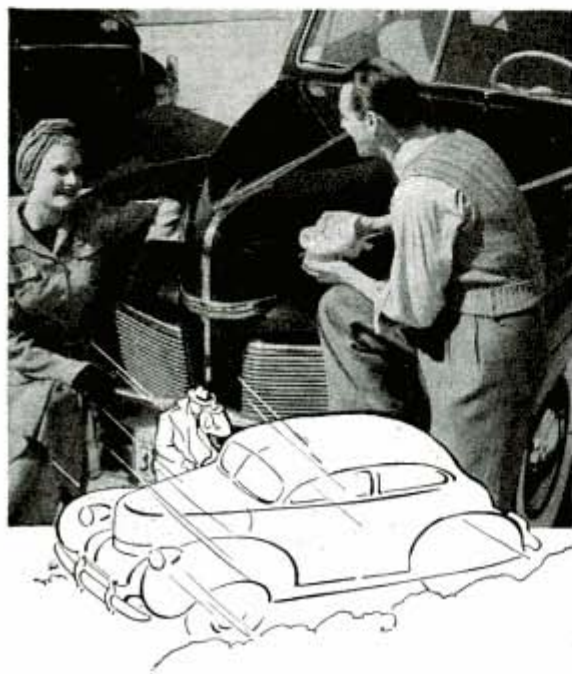
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Are Sold

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The SOLDIER TRAINS FOR HIS SERVICE—

Photo
courtesy
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Signal Corps



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YOU →→→→→
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YOURS?**



NEARLY 2,000,000 men are training in our armed services—developing their ability to serve our nation better. Millions more of us have just as great a duty to train for our part in civilian service—to develop our talents in office, store and factory—so that we may back that soldier better. Our nation needs our utmost capacity, the best that we can be and do.

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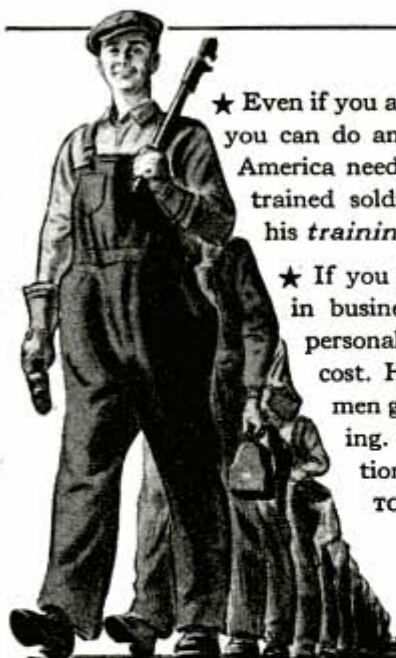
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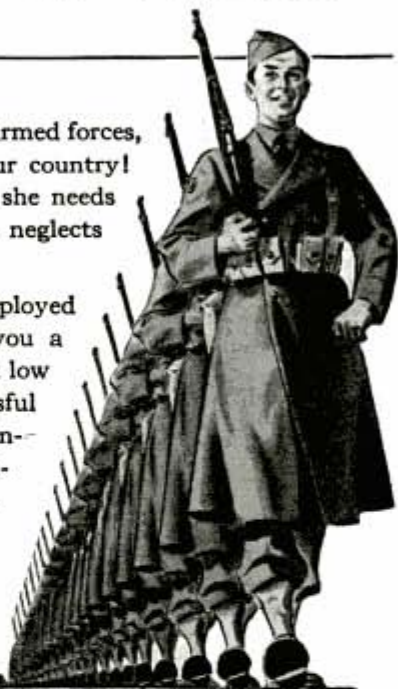
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| <input type="checkbox"/> Boilermaking | | | <input type="checkbox"/> R. R. Section Foreman | | <input type="checkbox"/> Textile Designing |
| <input type="checkbox"/> Bridge Engineering | | | | | <input type="checkbox"/> Toolmaking |
| <input type="checkbox"/> Chemistry | | | | | <input type="checkbox"/> Welding, Electric and Gas |
| <input type="checkbox"/> Civil Engineering | | | | | <input type="checkbox"/> Woolen Manufacturing |
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- | | | | | | |
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| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> Commercial | <input type="checkbox"/> Good English | | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Business Management | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> High School | | <input type="checkbox"/> Secretarial |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Business Management | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Illustrating | | <input type="checkbox"/> Showcard and Sign Lettering |
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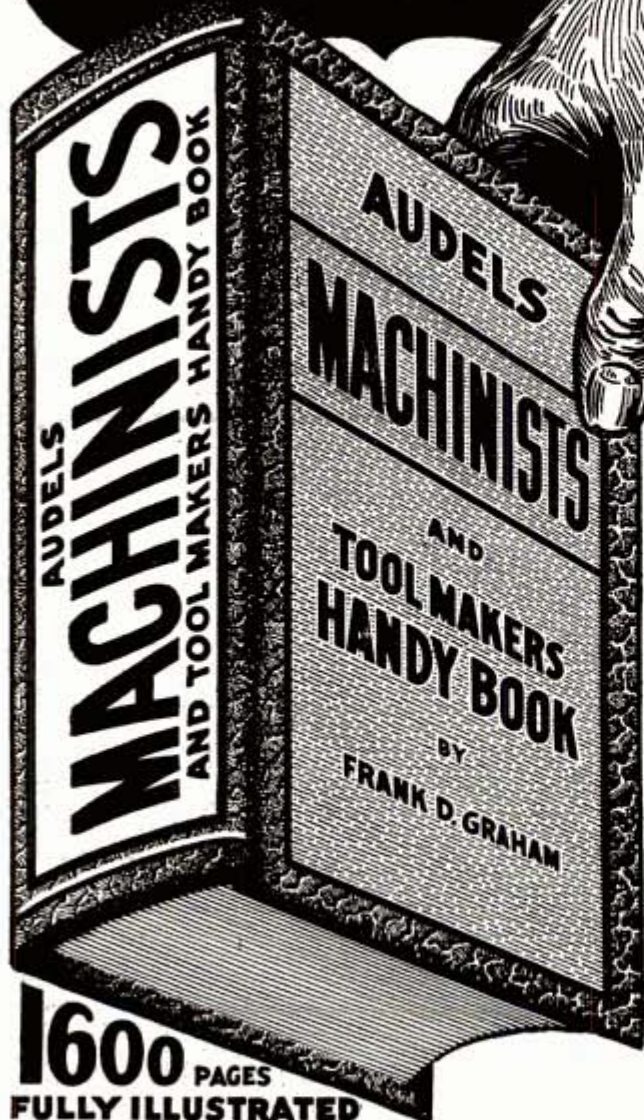
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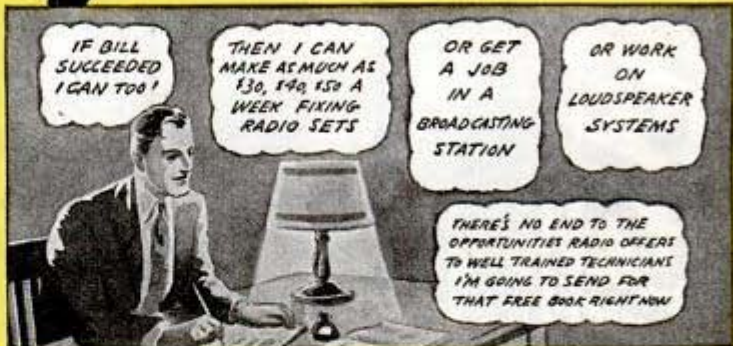
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YOU, OLD
BOY?

BILL! GOSH, I DIDN'T
KNOW YOU IN THOSE
NEW CLOTHES AND
THAT SHARP CAR.
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YOU A MILLION?



ONLY A SHORT TIME
AGO YOU WERE
SLAVING AWAY AT
THE SAME JOB AS
THE REST OF US.
NOW LOOK AT YOU!
HOW COME?

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I'D NEVER GET
ANYWHERE UNLESS
I PICKED A BUSINESS
WITH LOTS OF OPPOR-
TUNITIES AND TRAINED
MYSELF FOR THEM—
SO I PICKED RADIO



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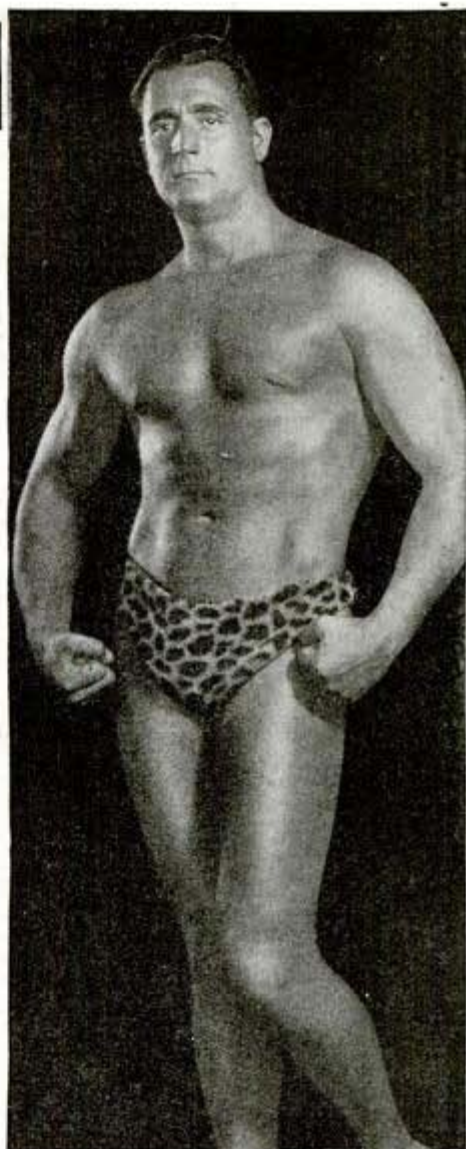
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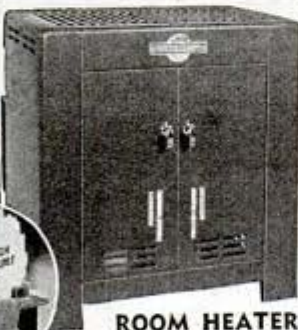
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While attending a technical school I became very much annoyed with the inadequacy of one of the tools required in the course of my study. As a result I conceived an idea for an improvement which I felt so surpassed the tool then used, that I was certain other students and professional men would find it very valuable. I demonstrated it to my friends and they were so greatly impressed with its commercial possibilities that they advised me to get a patent on it.

Acting immediately upon this suggestion, I wrote to Clarence A. O'Brien, having been advised that he was a reliable and competent registered patent attorney. Following prompt instructions from Clarence A. O'Brien, I submitted my invention to him for the purpose of making a preliminary patentability search of the Patent Office records. The good word soon came back . . . my invention appeared to be patentable! I believe that this was one of the greatest moments of my life. Armed with this assurance, I promptly filed application for a patent. As soon as the patent was thus pending, I was in a position to commence volume production of my invention. I then arranged an interview with one of the largest manufacturers in the business, and demonstrated the model to him, since in the meantime Clarence A. O'Brien had secured the necessary patent for my invention. The manufacturer was so favorably impressed, that he gave me a substantial order. He was so pleased with the sales results of my invention that he is now reordering in great quantities. Other manufacturers caught up the idea, and today I am supply-

ing most of the market, and am protected against infringement by the patent obtained through the efforts of Clarence A. O'Brien.

I feel that the whole basis of my good fortune may be traced to the intelligent, careful cooperation of Clarence A. O'Brien in securing a patent on my invention. Without the assistance of Clarence A. O'Brien, my tremendous success would not have been possible . . . I can wholeheartedly recommend his services to any inventor who has an idea worth protecting by a U. S. Patent."

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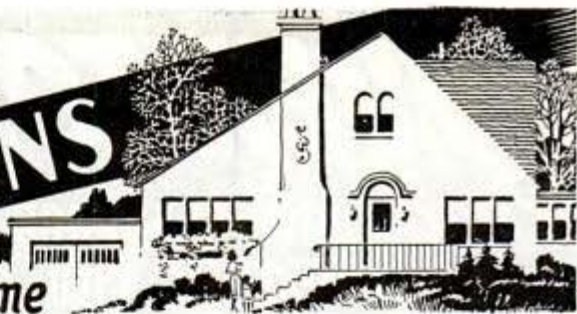
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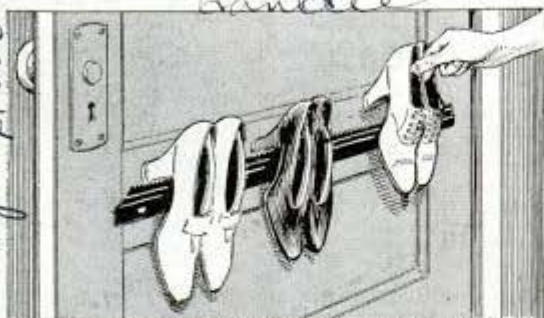
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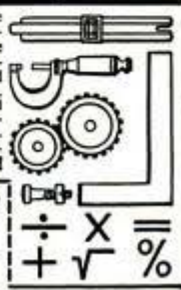
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State of Illinois, County of Cook, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared H. H. Windsor, Jr., who, having been duly sworn according to law, deposes and says that he is the Editor of the Popular Mechanics Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to-wit: First. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Popular Mechanics Company, 200 East Ontario St., Chicago, Ill.; Editor, H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill.; Managing Editor, H. W. Mason, 200 East Ontario St., Chicago, Ill.; Business Manager, H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill. Second. That the owner is (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock; if not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Popular Mechanics Company, 200 East Ontario St., Chicago, Ill.; L. H. Windsor, 200 East Ontario St., Chicago, Ill.; H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill.; Henry H. Windsor, Jr., Trustee under the will of Lina B. Windsor, Deceased, 200 East Ontario St., Chicago, Ill. Third. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. Fourth. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. H. H. Windsor, Jr., Editor, Sworn to and subscribed before me this 23rd day of September, 1941. N. E. Toole, Notary Public. (My commission expires March 24, 1944.)

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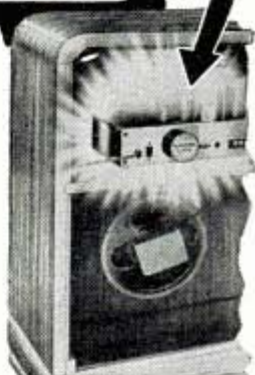
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MAGICIANS Catalog newest tricks 10c. Sterling Magic Co., 345 John R., Detroit, Mich.

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MAKE Money our way. Details 10c. The Jeffers Company, Pittsburg, Kas.

"SCHEMER" Magazine. Alliance, Ohio, prints schemes, tips, opportunities, formulas, winners! Earnings reported reaching \$50,000. 43rd year. Special: Six months, 40c.

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DEEP Crease in pants holds one month. Copyrighted formula \$1. Start home business. Women prospects 10c. Premier Systems, Box 1608, Hollywood, California.

TYPISTS. Added incomes. Homework. Literature, stamp. Susquehanna Service, Steelton, Penna.

TURN Old iceboxes into money. Information, 25c. Judson, 830 College, Morgantown, W. Va.

MAKE Novelties, molds, mats, toys from old inner tubes, rags, newspapers, sawdust. Real estate sideline. Used car opportunities. Used clothing scheme. \$2.00 starts upholstery cleaning business. Booklet, 36 pages, 10c. Melots, 1318 S30, Omaha, Nebr.

MAKE \$1.00 An hour, year round, full or spare time, entirely by mail. Details free. Reliable, Box 182, Springfield, Ill.

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DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

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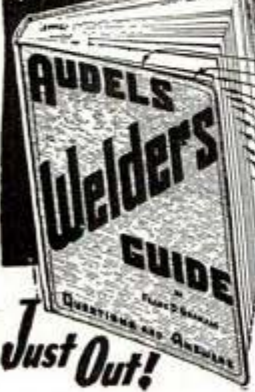
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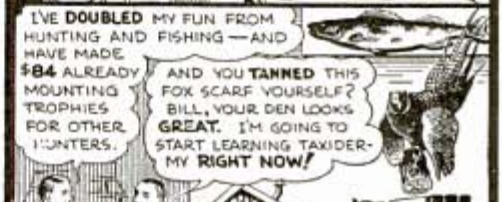
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Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 76

DECEMBER, 1941

No. 6

esra ut

L1072

PINCH HITTERS *for* DEFENSE



Above, quarter-scale model of Ford plastic car and its welded tubular steel frame

Last year Westinghouse recovered 60,000 → gallons of paint that "missed" in spraying

OVER in England it's saccharine for sugar; on the continent it's charcoal "gasogenes" in the rumble seat instead of gasoline in the tank. Here in America there's plenty of sugar, plenty of gasoline. Yet there's an industrial revolution in progress just the same, a revolution in materials that will affect every home.

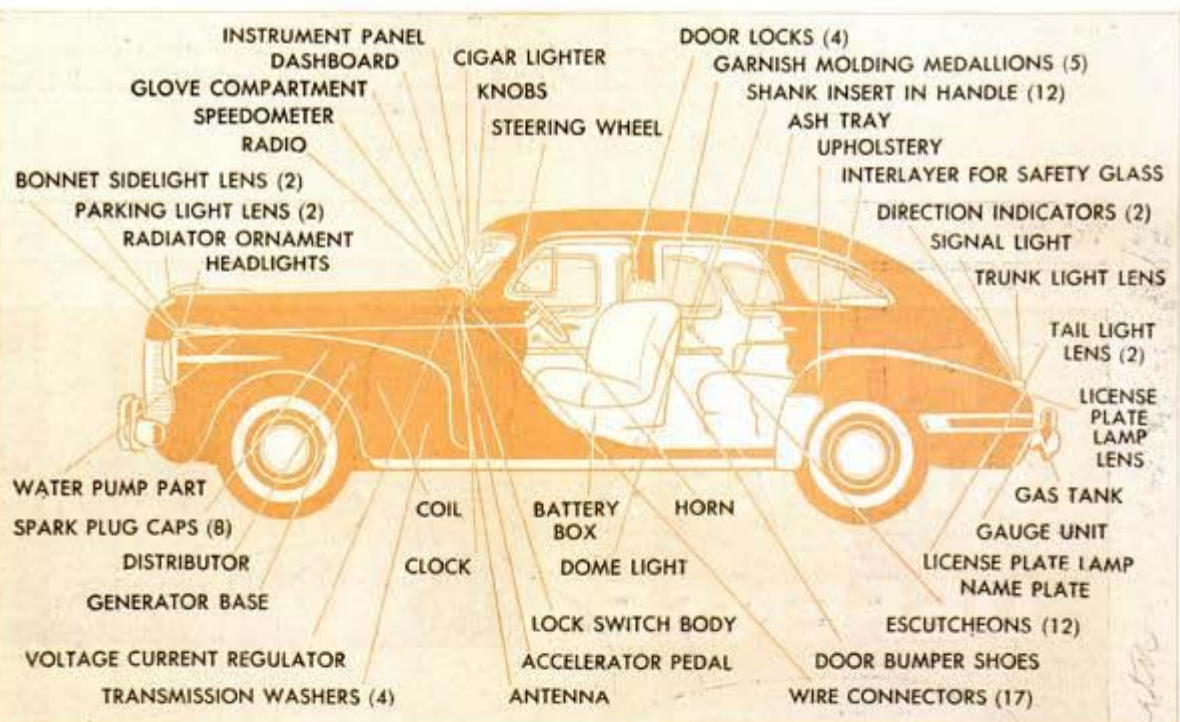
Perhaps it won't change your way of living very drastically. You shouldn't care greatly if the



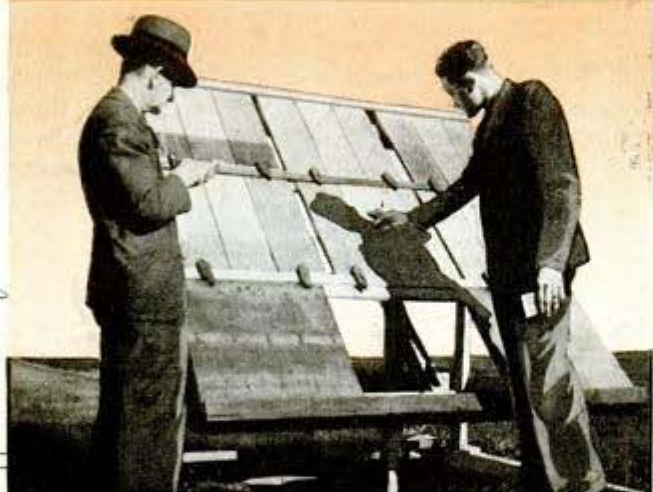
DECEMBER, 1941

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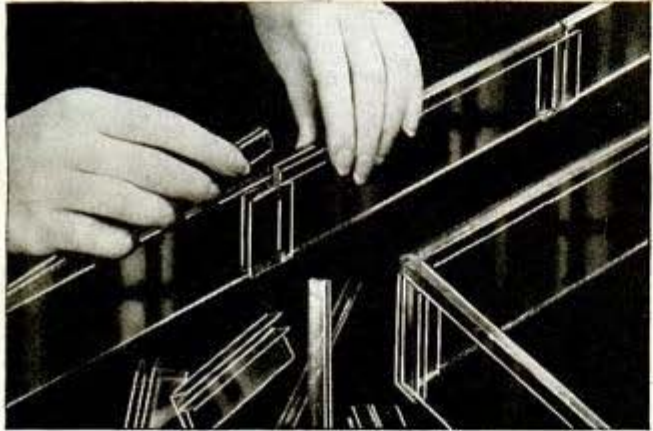
2 10 9 2



Bureau of Agricultural Chemistry and Engineering



Department of Agriculture scientists inspect test panels of varnish made from soy bean oil. They are busy in studies seeking new uses for the important soy bean crop



These are the plastic parts of your car

glint of chromium on your car is replaced by the brilliance and color of plastics; you won't mind wearing hairpins of wood or plastic when you know that even the metal in hairpins is coveted by defense factories; and what if you must step backward from zipper to buttons? After all, your grandfather's overalls got along tolerably well before the era of the slide fastener. And perhaps you won't be denied the zipper anyway. Metal ones, true, may vanish from the counters, but already a zipper of glass is being tested in government laboratories, a machine sliding it open and shut hundreds of thousands of times to determine how it will wear.

Yesterday you lived in the age of metals. Today, metal is yours only to the point where your need encroaches on that of your country's defense; for the moment, it is an age of substitutes. Tomorrow—the post-war tomorrow—those substitutes may have proved su-

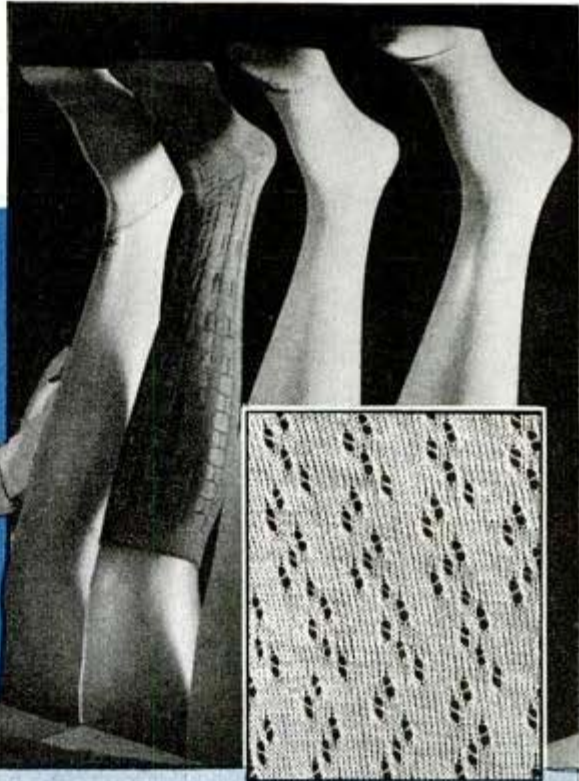
Strips of Tenite, a shatterproof plastic extruded like toothpaste, are replacing aluminum and other metal moldings

Kensington
molded by Extruded Plastics Co.
1101 Colburn St. New York

*Gennessee Eastman Corp
Kingsport, Tenn*

L 1072

Here are some of the more than 150 new designs for cotton stockings developed by the U. S. Bureau of Home Economics in advance of a silk shortage



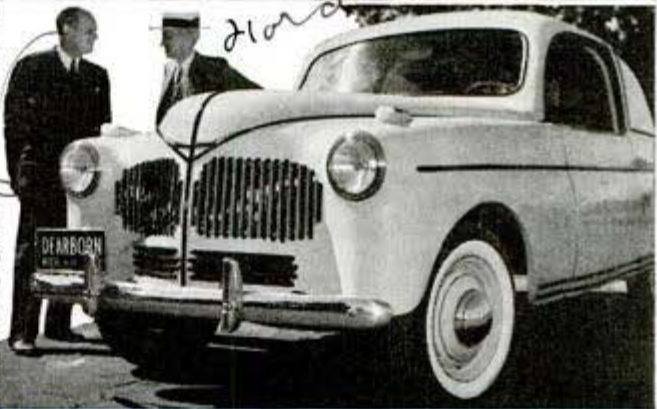
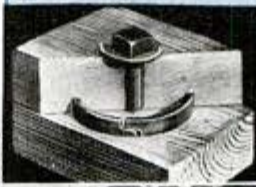
see det
1938-564
W.A. G
Deco connector
Timber Engineering Co
1337 Connecticut Ave
N.W. Washington, D.C.

perior; the plastics and synthetic yarns and new chemicals and molded wood products and other substitutes invented under the drive of necessity may crowd out the traditional materials in a brighter new world.

Despite the swiftness of the changes, most of them you will never notice. Since human nature resists radical change, the manufacturers are seeking substitutes as nearly like the originals as possible. Neckties of spun glass are as beautiful as those of silk, may resist wrinkling even better. Plastic tips for shoestrings released about a half million pounds of metals, principally tin, to more vital industries in 1941 alone and you never knew the difference. Long before the emergency shut down silk supplies, du Pont chemical magicians had plucked out of the air, the sea and the coal mine the elements of nylon, and mills fabricating nylon hosiery were expanding rapidly; and government research men were developing lovely new designs for cotton

Order a 50 year research chemist

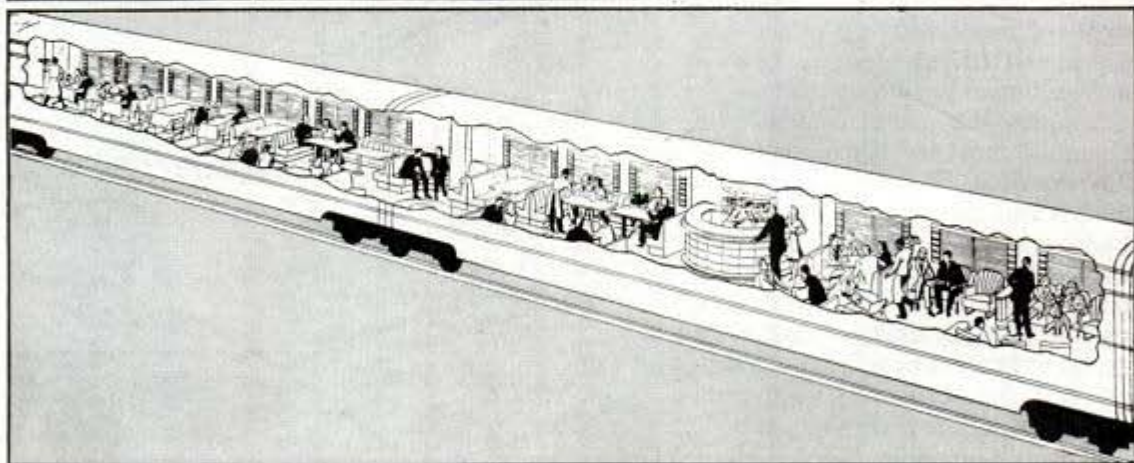
The 326-foot wooden tower of a radio station (below) was built by using timber connectors, shown in inset. Ordinary bolted construction would be limited to a height of about 80 feet. Use of wood saved considerable steel



Here is the auto Henry Ford "grew from the soil." Its plastic panels, with impact strength 10 times greater than steel, were made from flax, wheat, hemp, spruce pulp

(Continued to page 201)

Three-in-One Rail Club Car Has No Partitions



Circle in floor, center foreground, is spot where two car bodies join, made barely perceptible by lounge seats and lack of partition. Sketch shows how trucks are mounted between the cars

Three cars coupled together as one, creating the appearance of a single long room, offer railroad passengers a new kind of club service. With the usual between-car partitions removed, the articulated car bodies are so cleverly designed that the unit seems to consist of but one car. Originated for operation on the Los Angeles-San Francisco route of the Southern Pacific Lines, the triple-car assembly is 204

feet long and costs approximately \$125,000. In actual practice, one car is used as a kitchen and dormitory for cooks and porters, while the remaining two sections contain the lounge, cocktail bar, coffee shop, library, smoker and card room. Appointments include fluorescent ceiling lighting, leather upholstered chairs, heavily carpeted floors, venetian type blinds and photomurals at end walls of the car. An electro-

Car. Mel Wharton, 1144 S Grandview
 Los Angeles Calif

2400 d. malyan (Chugaj)

pneumatic door operator opens the door automatically when the handle is tapped slightly, closing it again gently behind the passenger. Any portion of the car may be converted for either dining or lounge service.

L662

Shifting Gears Is Harder Than It Seems to Be

To learn whether it is as easy and effortless as it looks to shift gears on a modern automobile, engineers of the Illinois Automobile Club made tests that prove it requires an average of 58.9 foot-pounds of energy in manual shifting to get the car into high. Of this effort, 88 percent goes into clutch manipulation, 7½ percent into gear lever operation, and the balance into pressure on the accelerator pedal. This energy was measured with an instrument attached to the top of the clutch pedal that recorded accurately the distance it traveled and the amount of force applied. A sensitive spring on the gear lever furnished similar information on shifting. The tests also revealed that only four pounds less effort is used in releasing the clutch than in depressing it. This is because the clutch must be engaged smoothly, requiring foot pressure against the pedal as it rises.

Press cover in door 50 Rochester Plaza

BB Shot Fired by Army Gunners In Machine Gun Practice

Capt. George Briskey



Gunner testing BB rifle attached to .50-caliber machine gun

Machine gunners, whose trigger fingers become restless when sighting and aiming an unloaded gun for practice, have had their interest quickened by a BB gun mounted alongside the regulation army rifle by Lieut. Col. Manly B. Gibson at Camp Callan, Calif. A box rigged up behind the target catches the shot so it may be used over and over again.

L1034

Airship Car Minus Gas Bag Gets First Ride on Trailer



Control car, without envelope, ready for ride to assembly dock

Hauling the huge control cars for the six 404,000 cubic foot airships being constructed for the United States Navy was a big problem even for movers of heavy equipment. The control cars are being built at Akron, O., by Good-year Aircraft Corporation, and as each is completed it must be transported some 10 miles to the assembly dock where the ship's envelope is installed. For this ride the control car is loaded onto a stout trailer on which a special cradle designed to receive it has been built.

L 1066 Comb. Aeriographic Co
30 Union St. New Orleans

Small Navy Craft Climb Ashore to Land Tanks



Three "invasion" boats making simultaneous landing on beach, carrying mechanized and armored forces

For forcing landings with hard-hitting units under conditions of modern warfare, the U. S. Navy is being supplied with small boats capable of climbing out of the water onto sloping beaches. The boats, made by Higgins Industries, Inc., carry tanks, heavy

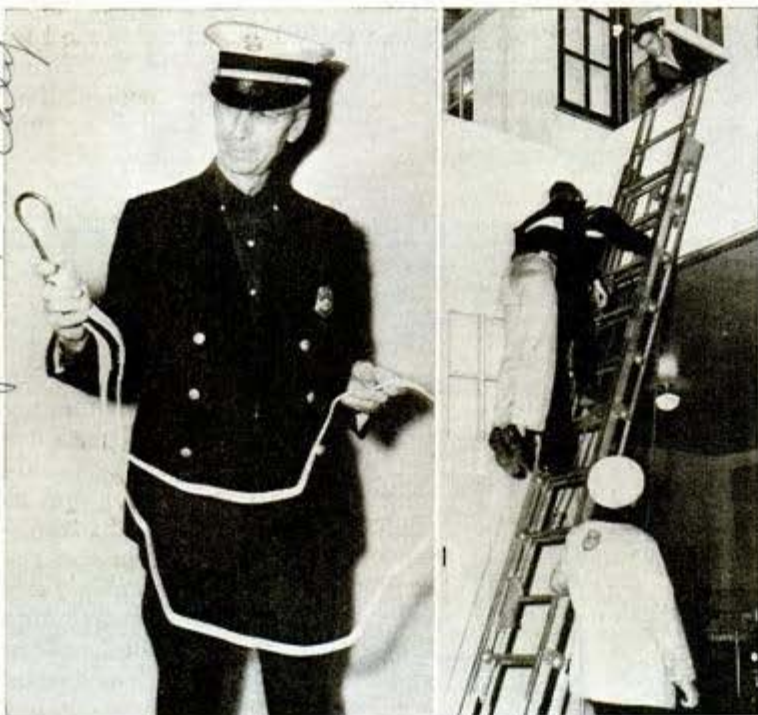
trucks or armored cars, together with units of fast moving troops. As a boat strikes shore it lowers the front "gate," forming a ramp to unload the war vehicle ready for instant action. Some of the boats are constructed of wood and others of metal.

Belt Helps Firemen Carry Fire Victims Down Ladder

Difficult under the most favorable conditions, rescuing people from burning

buildings can be made less burdensome with the aid of a safety belt developed by

Fire Chief Roscoe Casity of Monrovia, Calif. The belt permits the fireman to carry the victim on his back, leaving his hands free to grasp the ladder as he descends. In case rest is needed, a metal hook attached to the belt may be hooked on one of the rungs to support the load for momentary respite. The carrying "harness" has a large loop of heavy web belting which is placed around the back of the victim and passes through under his arms. The fireman then works his arms through the extending loops, lifting the subject like a knapsack. The belt is also used in carrying hose and other heavy objects up ladders, rung by rung.

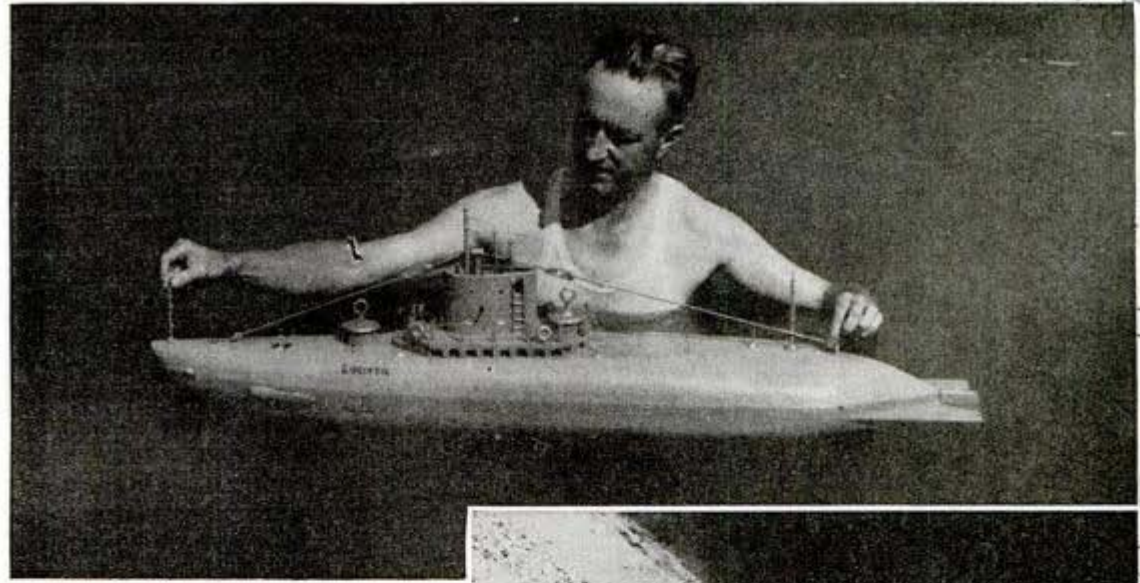


Belt, left, helps carry victim from burning building as shown at right

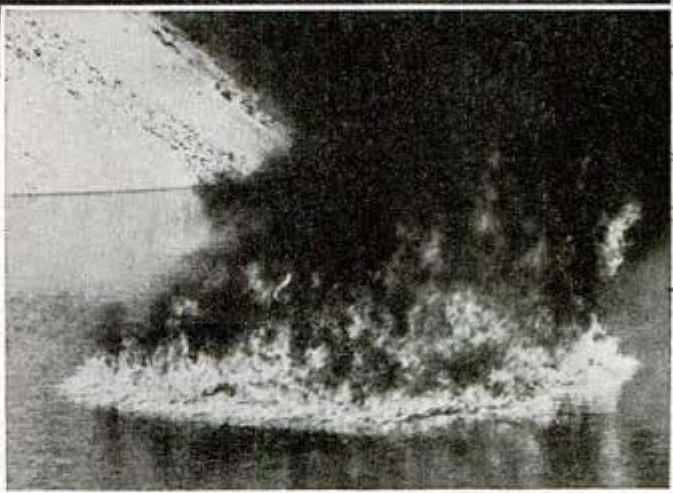
1755 - St. Charles Ave
New Orleans, La
L 1020
Comb. George H. West
126 S. Myrtle, Monrovia, Calif

L1053 C.W. E. Hogg, 825-5th Ave Los Angeles

Submarine Sets Sea Afire to Trap Enemy Ship



Surface boats of belligerents will face a new menace if the incendiary submarine, a four-foot model of which was tested recently, proves successful for war purposes. The menace will be a "sea of fire" which can be made to engulf a vessel by releasing a large quantity of liquid fuel from beneath the surface. In a recent demonstration the model dove underwater and sent up a bubble consisting of six quarts of oil that spread quickly over a 50-foot circle. Chemical detonators released with the fuel turned the mass into a blazing inferno that lasted five minutes. The inventor be-



Working model of submarine, top, sets fire on surface of lake

lieves attacks of this kind would be possible against seaports by launching the oil so it would ride in with the tide.

Capt. John Angilio / Harry / 218 / [unclear]

L1038

Exhaust Leaks Found Quickly by Making Fumes Visible



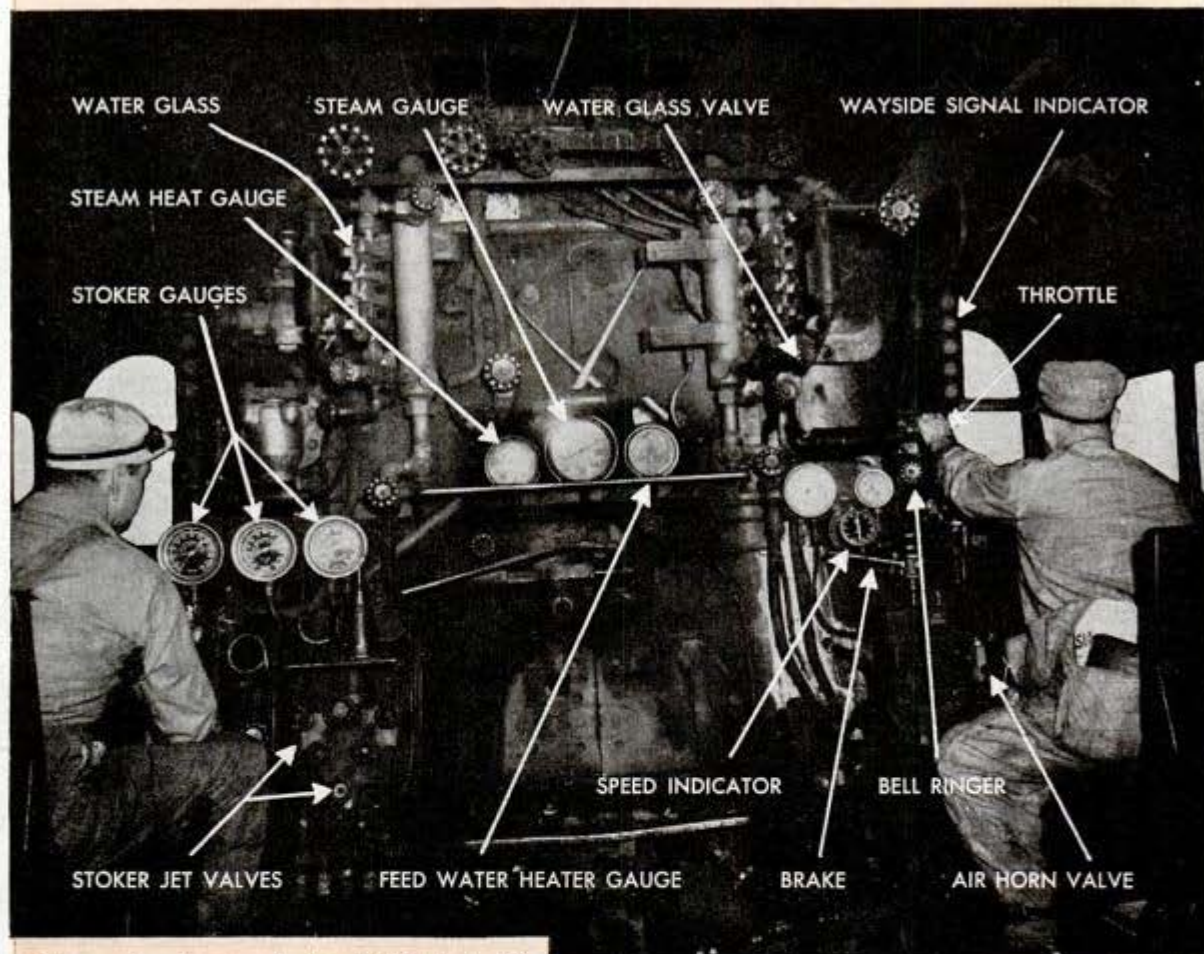
Leaks in the automobile exhaust system may be found easily with a fume detector that makes the burned gas visible if it escapes along the exhaust pipe or muffler. While the car is on a lift, the detector, which contains light crankcase oil, is attached to the air cleaner. Then the tail pipe is plugged with a hardwood stopper, and oil is forced into the carburetor by squeezing a rubber bulb, with the engine running. The oil leaves the cylinders as smoke and by its visibility reveals leaks.

Tube from leak detector carries oil to carburetor through air cleaner, making exhaust visible

DECEMBER, 1941

Aluminum Industries
Keller & Selman
Cincinnati, Ohio 7

RIDING *the* GARGANTUA



Above, the fireman of No. 6100 checks his gauges as the engineer pulls throttle to start train. Below, lubricating a cross head pin on the engine. There are 350 points for the grease gun



By Roderick M. Grant

VASTER than a Hollywood producer's dream, there is nothing on rails so colossal as No. 6100. She is the "Queen Mary" of locomotives, the largest steam-breathing passenger engine ever built, the only one of her kind. Stack her on end against a 14-story building and her out-thrust, striped chin will jut into the sky past the roof garden.

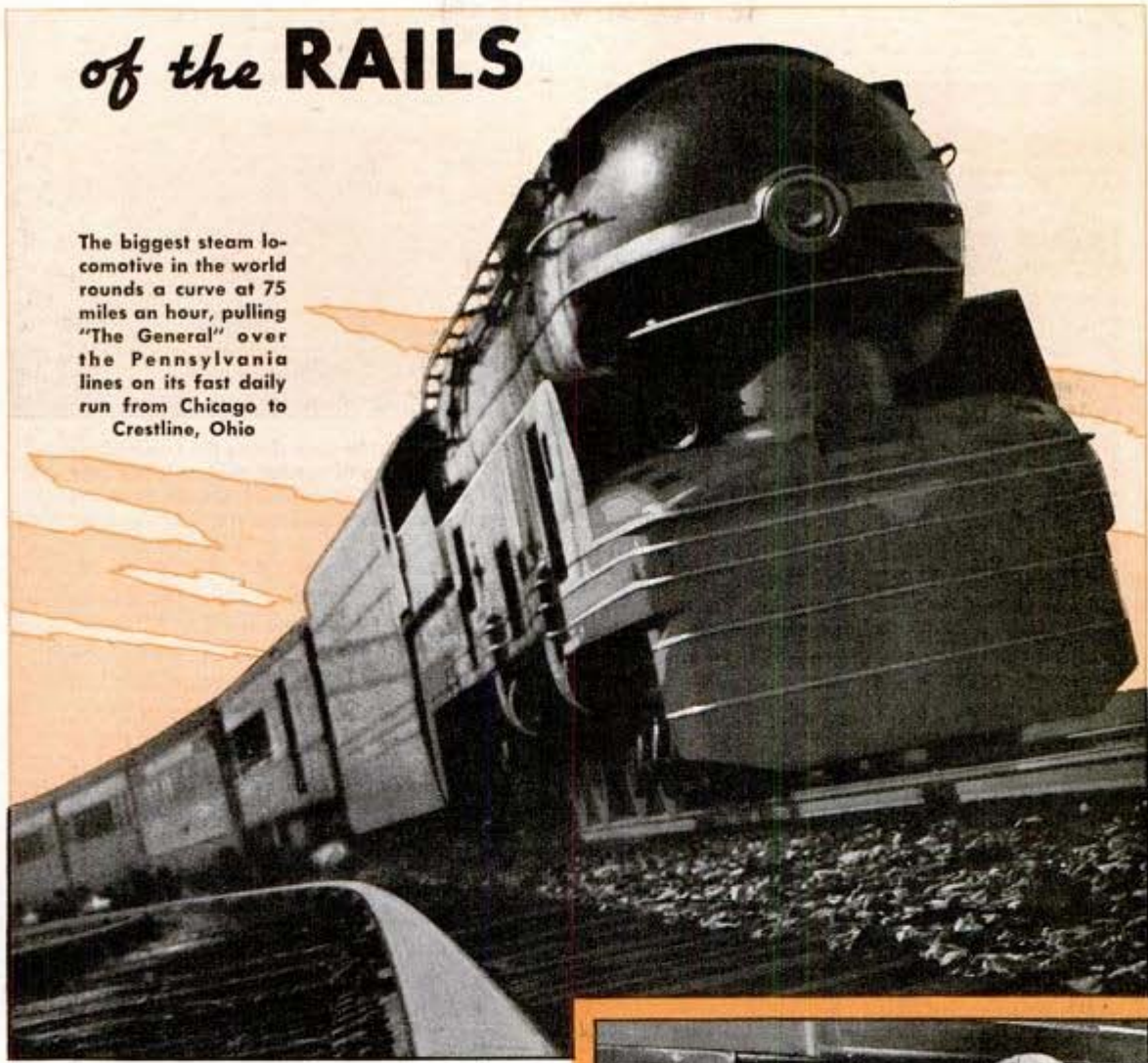
You can take it from any engineer who has opened her throttle, she is also the fastest. Nobody knows just how fast. You don't let out a million-pound locomotive to the limit, as you might tramp the accelerator of your car to the floor to see what it will do. But unofficially she owns the world speed record that has officially belonged for 36 years to another Pennsylvania Railroad engine, which, pulling the

© 1951 at Penn. Railroad Works

L 982

of the RAILS

The biggest steam locomotive in the world rounds a curve at 75 miles an hour, pulling "The General" over the Pennsylvania lines on its fast daily run from Chicago to Crestline, Ohio



father of today's Broadway Limited, on June 12, 1905, was clocked by telegraph at 127.2 miles an hour for three miles.

One day Charlie Wappes, assistant road foreman of the Fort Wayne division, who rode No. 6100 on her test runs and taught most of the engineers how to handle her, noticed that the speedometer was bang up against the 110-mile mark, the limit of the gauge. He pulled out his watch, started clocking at Wanatah, Ind. Two minutes and 50 seconds later they passed the next station, Hanna, 6.3 miles on. That's 133.4 miles an hour. Back of the big engine were 12 cars, heavy equipment. There was no deliberate attempt to write up a new speed record. As



Greasing the rods at the engine's private pit



An inspector climbs inside to look over the feed water heater
Dispatcher in Chicago tower throws switch to clear No. 6100



This broadside view shows the tremendous length of the "torpedo" engine; it has four cylinders and eight drive wheels, stretches 140 feet 2½ inches from coupler to coupler

Charlie Wappes said afterward, "It's pretty hard to hold her back. She'd do 150 if we let her."

You have to see No. 6100 to believe her bulk. You have to ride her to sense the easy power. Climbing up the ladder into the cab you notice that she towers within inches of the ceiling of Chicago's Union Station.

It's one minute until train time. The steam pressure gauge shows 300 pounds. Fireman F. A. Cartwright twists the stoker valve and there is a hiss of steam from 14 jets beneath the firebox door, each jet a tiny gale picking up the crushed coal as it falls from the lip of the stoker screw and blowing it to a particular spot in a firebox big enough to bed down an army tank.

Engineer I. G. Kilpatrick gets the highball from the conductor. Brakes are off. In a few seconds the signal tower clears the station block, three dots gleam vertical on the board and Kilpatrick, without another backward glance at his 14 cars, grasps the throttle. Steam leaps into four cylinders, eight seven-foot drive wheels respond and No. 6100 crawls out of the cavernous station on one of the only two terminal



This powerful stoker screw delivers coal to firebox



"Coasting" at a 100-mile speed that blurs telegraph poles, the engineer has time—between blasts of horn and watching signals—to admire a herd of cattle

tracks straight enough to carry her. The rest of the tracks, easy rolling for any normal 95-foot locomotive, curve too sharply into the yards for the 140-foot, 2½ inch length of the Pennsylvania's big engine.

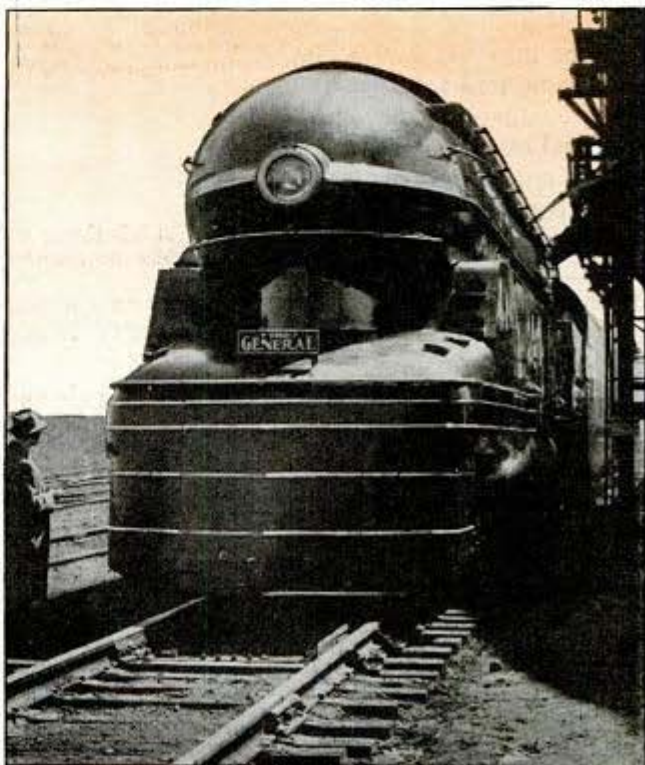
The train clatters through the maze of switches and crossovers, effortlessly gathers speed for the seven-mile run to suburban Englewood. There is a minute's pause there, and with the observation car out of sight around the curve at that station, two short hisses from the signal whistle give the highball. Wheels are rolling again toward Gary, to the rhythmic chuff-chuff of No. 6100's four cylinders. Really the equivalent of two "Atlantic type" locomotives, she is a double engine with four cylinders instead of two, with 6-4-4-6 wheel arrangement—six pilot wheels, eight drivers, six-wheel trailer truck and 16 wheels under the tender, which is as big as a four-room house and carries 25,000 gallons of water, 26 tons of coal.

Why the double engine, and why this Gargantua on rails? Well, the Pennsylvania wanted an outstanding coal-burner that would pull heavy passenger trains uncomplainingly for long runs on better than mile-a-minute schedules. With conventional engines,

long trains mean double-heading or splitting into two sections, requiring extra crews, extra lounge and diner. So they built No. 6100 at the Altoona, Pa., shops, giving her two extra cylinders to increase the tractive effort; and she has pulled a 2,000-ton passenger train of 22 cars.

You're roaring around a curve this side of Gary—and I mean roaring—when you

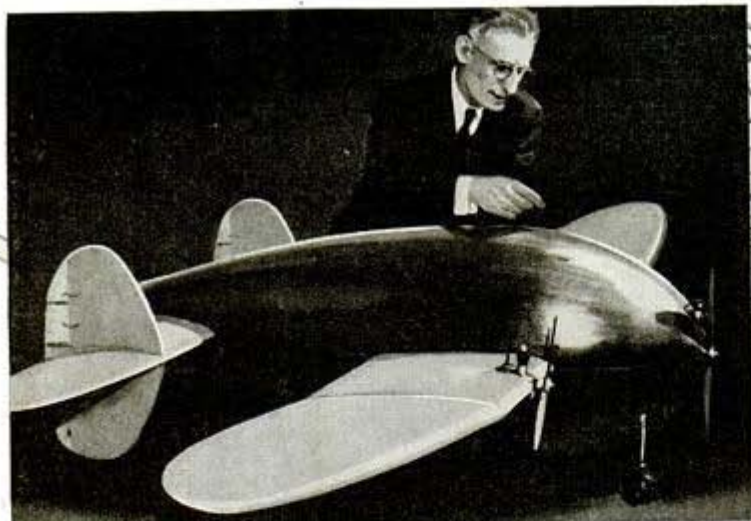
(Continued to page 197)



The tender takes on 26 tons of coal and 25,000 gallons of water for 280-mile trip

21087

Flying Torpedo Is Directed at Target by Radio



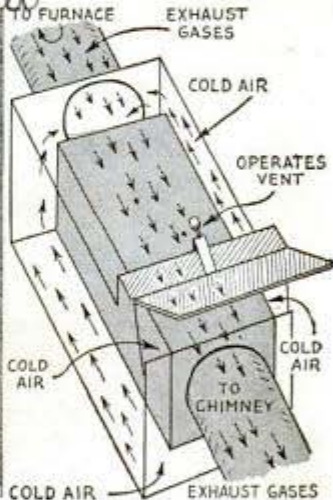
Controlled by radio and flying under its own power, an aerial torpedo invented by John Hodgdon, an engineer at Mare Island Navy Yard, may introduce a new branch of aerial warfare. The torpedo, which operates on a gyroscope principle, could fly at 30,000 feet and dive at an enemy target, spraying its load of bombs over a wide area.

This six-foot working model of the torpedo was tested before officials of the U. S. Army

Living Fuel Saver Corp. 2432 Strong Park Chicago

Fuel Saver Lets Air Into Flue Between Furnace and Stack

Fuel savings from 25 to 40 percent are claimed for a draft regulating device which draws cool air into the flue between the furnace and the chimney. The effect is to slow down the velocity of gases passing through the boiler and thus allow a longer period of time for the absorption of heat into the heating surfaces, and promote complete fuel combustion. The fuel saver can be installed quickly on any furnace or boiler using any kind of fuel. Its draft stabilizer automatically



The photo at left shows a fuel saver installed between the furnace and chimney, while the diagram at right indicates the flow of air and gases

balances any excessive stack suction above the chimney. Accumulation of soot which might be caused by high winds is minimized and radiation increased.

2978

Auto Body Made of Plastics Resists Denting Under Hard Blows.



Car with plastic body hints possible end of steel bodies

After twelve years of research, the Ford Motor Company has completed an experimental automobile with a plastic body. Although its design takes advantage of the properties of plastics, the streamline car does not differ greatly in appearance from its steel counterpart. The only steel in the hand-made body is found in the tubular welded frame on

Lowell E. Burley, Engineer, Dept.

Dearborn Mich

2967

which are mounted 14 plastic panels, $\frac{3}{16}$ inch thick. Composed of a mixture of farm crops and synthetic chemicals, the plastic is reported to withstand a blow 10 times as great as steel without denting. Even the windows and windshield are of plastic. The total weight of the plastic car is about 2,000 pounds, compared with 3,000 pounds for a steel automobile of the same size. Although no hint has been given as to when plastic cars may go into production, the experimental model is pictured as a step toward materialization of Henry Ford's belief that some day he would "grow automobiles from the soil."

L1039

Underground Ducts Supply Air To Planes at Airport

Airplanes are kept at a comfortable temperature between arrivals and departures with the aid of an air conditioning tunnel that supplies warm or cool air to the interior of the plane as needed. The ships have little insulation and change temperature quickly on hot summer or cold winter days while parked with their own air conditioners shut down. The underground system, installed by Northwest Airlines at the Minneapolis terminal, draws air through 558 feet of tunnels and ducts.

Cent. Milton Egle, 1712 8th Ave, North Minneapolis



Tube from underground duct blows air into plane

DECEMBER, 1941

Electric Vibrating Tool Aids In Carving and Decorating

87 50 Paulson



Electric tool vibrates shaft in up-and-down motion to operate hammers, cutters, files and other heads

Offering an infinite number of uses to the home craftsman and many shop workers, a versatile tool operating on the vibrating principle makes 7,200 up-and-down strokes per minute. The chuck, adjustable to make strokes up to one-eighth inch, is designed to hold a large variety of engraving needles, cutting knives, gouges and hammers. Among the materials it will mark or cut are wood, leather, rubber, glass, ceramics, plastics and metal. The tool may be used for marking or decorating tools and machine parts; engraving or cutting designs on jewelry, instrument panels or glass; hammering reliefs in plaques, signs and ornamental objects; and for making clean cuts in wood, plastics, etc., to be inlaid. With special fittings, such as depth gauges, uniform and accurate carving can be achieved. A comfortable ball grip makes it easy to handle and permits positive control in guiding the tool.

☐ Ninety-nine percent of the weight of the earth is made up of only nine of the 88 known elements.

no data

see ad Oct. 202

Burgess Handicraft and Hobby Service 180 N. Wash. Chicago

L 939

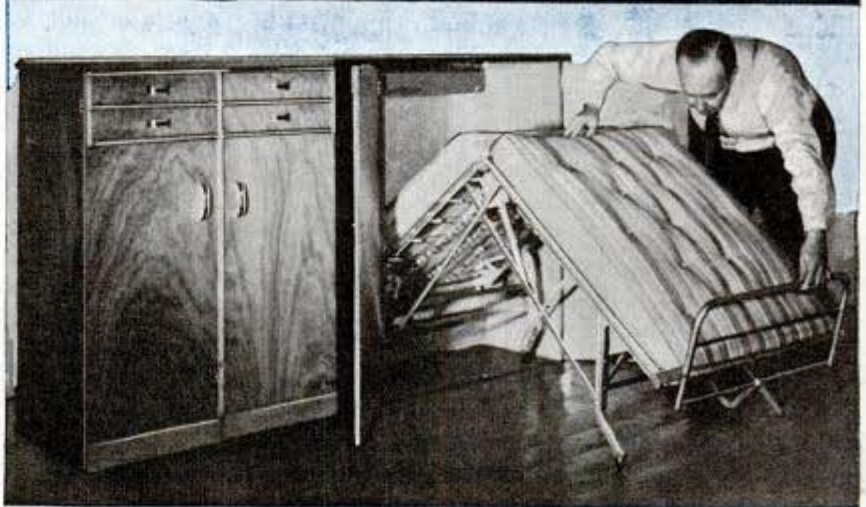
Emb. Ellen Warren Elliott
343 E 34th Street

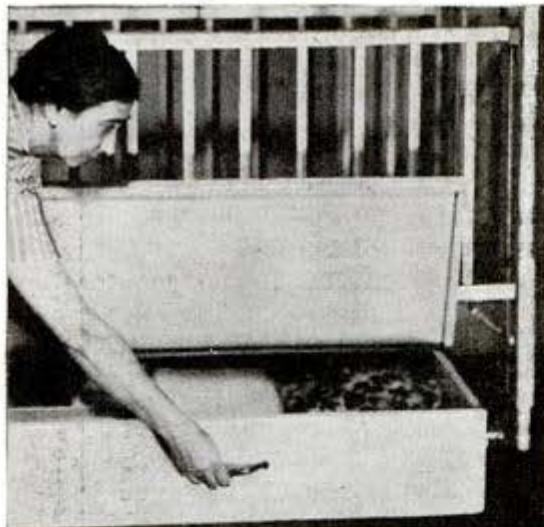
SPACE-SAVING FURNITURE

Space-Saving Furniture Co
503 E 34th Street



Small homes and housing projects are mushrooming around the busy factories, apartments are growing smaller while rent bills grow larger, and the result is that more and more people are making their furniture do double-time. If a living room is to be also a bedroom and sometimes a dining room, the lounge must be magically convertible into a bed or a buffet or something triply useful. And the tighter living space becomes, especially in the big cities, the more versatile is the furniture brought out by the manufacturers. At the top, for example, you see a fireplace that is also a china cabinet with ample space for storing odds and ends. Pull the handle on the breakfast bookcase (upper right) and its false front moves, disclosing a mattress on a rolled-up bed. The love seat (center) transforms into a chaise longue or a single bed at the touch of a lever, and the decorative cabinet (bottom) hides twin beds until you turn living room into bedroom





Even the space under the baby's crib is utilized. Any householder knows the value of storage space, so here is an infant's bed with patented chest hung on rollers underneath, providing room for storing bedding and equipment

The console table at right, 20 inches deep, 28 inches wide and 30 inches high, is one of the smallest kitchenettes you'll find. Open the decorative top and front and you discover an electric kitchenette, shelf and table

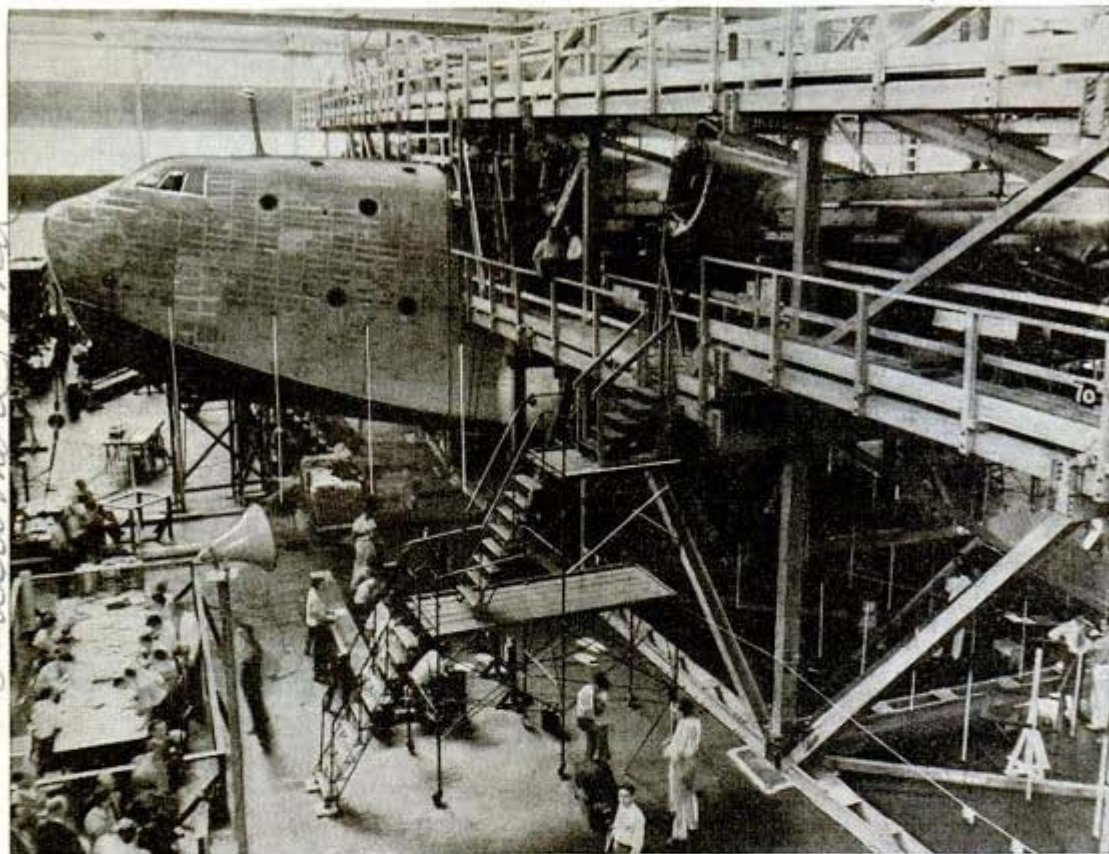


Visitors will admire the handsome console, below, against your living room wall. It occupies a space only 18 inches deep. If they stay for supper, they'll be surprised to see you pull out what appeared to be a drawer handle and bring out a bench seating two. Then you move the table out from the wall, lift a leaf, pull out two end chairs, and add four more, and eight persons can sit down at a table now measuring 36 by 60 inches



L7064

Giant Navy Bomber Can Fly Atlantic and Back



With nose poking out of scaffolding, the big ship stands ready for installation of furnishings

When it takes to its wings, the Navy's 140,000-pound flying boat will be the largest flying vessel in the world. The winged battleship, known as XPB2M-1, built by The Glenn L. Martin Company, has a wingspread of 200 feet, its 117-foot hull has two decks, and it can carry enough fuel for its

four 2,000-horsepower Wright duplex Cyclone engines to fly it nonstop across the Atlantic ocean and back. It will carry guns, bombs and torpedoes. The craft is intended for high-altitude operation. Cruising speed probably will be about 150 miles an hour, with a top speed near 200 miles.

Helmet 'Punished' by Cannon to Test Nondenting Ability



Steel headgear worn by England's fire guards must be able to "take it" under a hail of anti-aircraft fragments if they are to give adequate protection. In one test, shrapnel balls are fired at the helmets to make sure they will not be so dented that the metal comes into contact with the head.

Gunner firing steel balls at helmet tests its ability to shed shrapnel fragments with safety

*Middle River plant.
Baltimore Md.*

Acme

Acme

2854

Leggett

AMERICA'S NEWEST BIRDS of WAR



An inspiring picture for any American is this view of a formidable Curtiss scout bomber above a line of mighty aircraft carriers of the United States Navy. More speed and more range are features of the latest scout bombers



18
2834

By Julian Leggett

IF SPEED and fire power are the keys to victory in the air—and military authorities agree that they are—the United States is being equipped to deal with any emergency involving the use of aircraft.

Already fighting planes for the Army and the Navy are coming off the production line with ratings of "more than 400 miles per hour" and aviation circles whisper of a mystery warbird with the long-dreamed-of speed of 500 miles an hour.

Here is another of the Navy's big planes, a patrol bomber. Note the "blister" amidships from which observations are made and guns fired

Even the big bombing planes, designed primarily for load-carrying and long-range work, are being stepped up above 300 miles per hour. One type, which went into production recently, is said to be faster than most pursuit planes being used in the European struggle.

Lessons learned from air battles over the war zone are being incorporated into the American warplane, with the result that newer types not only are fast but have awe-inspiring firing power. Instead of the 20-millimeter cannon on British and German planes, two or more of Uncle Sam's fighting ships are fitted with 37-millimeter cannon, in addition to .50 and .30-caliber machine guns, giving them such striking force that engineers claim no plane ever built could withstand their full fire. And there is hushed talk that even more powerful weapons may be installed in improved models of our

Left, center sections and monocoque rear fuselage sections lined up in North American Aviation plant

Inglewood
Calif.



19 2854

latest planes. Indeed, one type now in production could be fitted with one 37-millimeter cannon to fire through the propeller hub, four 20-millimeter cannon in the wings and two .50-caliber machine guns atop the fuselage, just in front of the pilot.

The 37-millimeter cannon is the most powerful gun ever mounted as standard equipment in warplanes. Its big shell, many times the size of a .30-caliber bullet, can crash through the thickest armor ever employed on military aircraft; in fact, it could knock out most tanks in a low-altitude strafing. With the gun mounted in the nose, or the hollow propeller shaft, of his ship, the pilot aims by training his whole plane on the target. Firing tests have been marked by amazing accuracy.

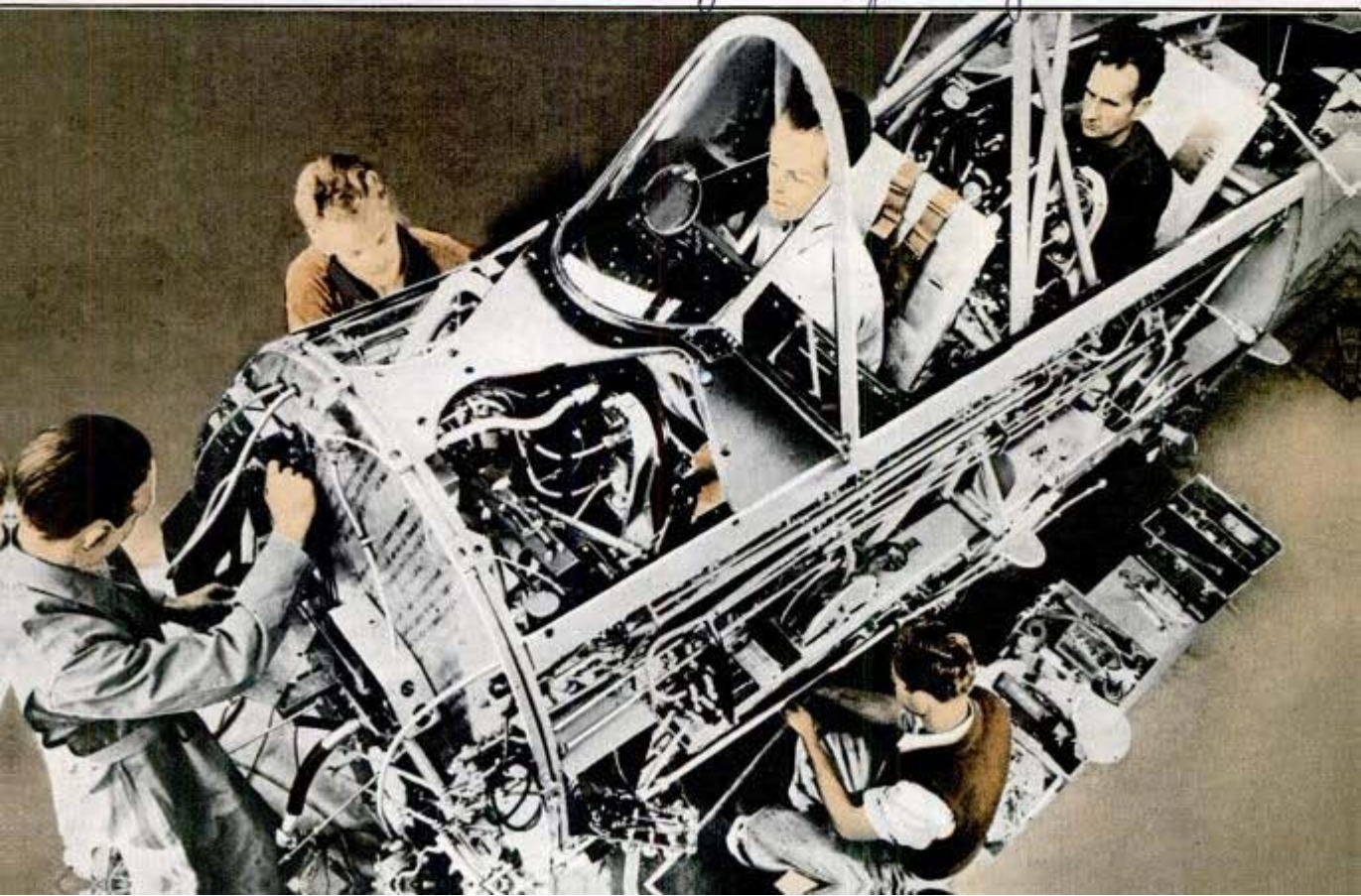
In the rush to develop fighting planes for defense against bombing planes, the striking power of our own bombers has not been forgotten. Improved types of the "flying



Closeup of the nose of U. S. Army's gigantic Douglas B-19 shows two of the four 2,000-horsepower engines. Below, rushing assembly of advanced training plane. The production pace is being accelerated

*Santa Monica
Calif*

Wright Duple Cyclone





20
2854
Douglas dive bombers and attack bombers on the last lap of their manufacturing and assembly journey

Below, natural color photograph of a Douglas DB-7B undergoing a test run of the engines near plant



fortress" can carry several tons of bombs and have a cruising range of 3,000 to 4,000 miles. Smaller bombing planes carry 3,000 to 4,000 pounds of bombs, have a range of 1,000 miles and are armed for defense with a battery of machine guns. One type, with still less range and bomb capacity, is faster than any bomber in the air, except a few equipped with turbo-superchargers to give more speed at altitudes above the 15,000-foot level at which this ship performs best.

Biggest of all the bombers is the 80-ton Douglas B-19, which has far greater range and bomb capacity than any military aircraft ever built. Its principal purpose, however, is to serve as a model for tomorrow's bombing



2854

Aircraft Co. Burbank

21

Boeing Aircraft Co. 2950 The Boeing Bldg. Seattle

Boeing Aircraft Co. Seattle

plane, as its speed is not considered sufficient for actual warfare. In its role of "laboratory on wings" for the Army Air Forces, the B-19 is a mass of superlatives; for instance, it has been fitted recently with the largest de-icers ever built. Weighing 395 pounds and totaling 287 feet in length, these overshoes for preventing formation of ice contain enough rubber to provide de-icing protection for 14 pursuit planes and they have six times the area of those used on 21-passenger commercial transport planes. The de-icing system is operated automatically.

↑ This is the "flying arsenal"—Bell Aircraft's P-39, or Airacobra. It is powered by the Allison liquid-cooled engine located behind pilot's compartment

Top, left, pilot with full gear for high altitude experimental flight at Boeing plant. High altitude research is becoming more and more important

Among the fastest Army and Navy fighting aircraft in use today are the Lockheed Lightning, or P-38, the Bell Airacobra, or P-39, the Curtiss P-40 and the Vought-Sikorsky. All can do six to seven miles a minute. The Lockheed is distinguished by twin booms which replace the customary fuselage. It is powered by two liquid-cooled Allison engines, each of 1,150 horsepower. The pilot-gunner rides in a bulletlike nacelle between the booms. Cannon and machine guns are mounted in the nose of the nacelle. Turbo-superchargers maintain constant power for operations at 35,000 feet—nearly seven miles above the earth. The P-38's three-blade propellers rotate in opposite directions.

This is the speedy Lockheed Lightning—P38—which is one of Uncle Sam's best fighting planes. It is distinguished by twin booms. Two Allison engines propel it

Curtiss Aeroplane and Engine Corp. Curtiss-Wright Corp. Buffalo, N.Y.



2854



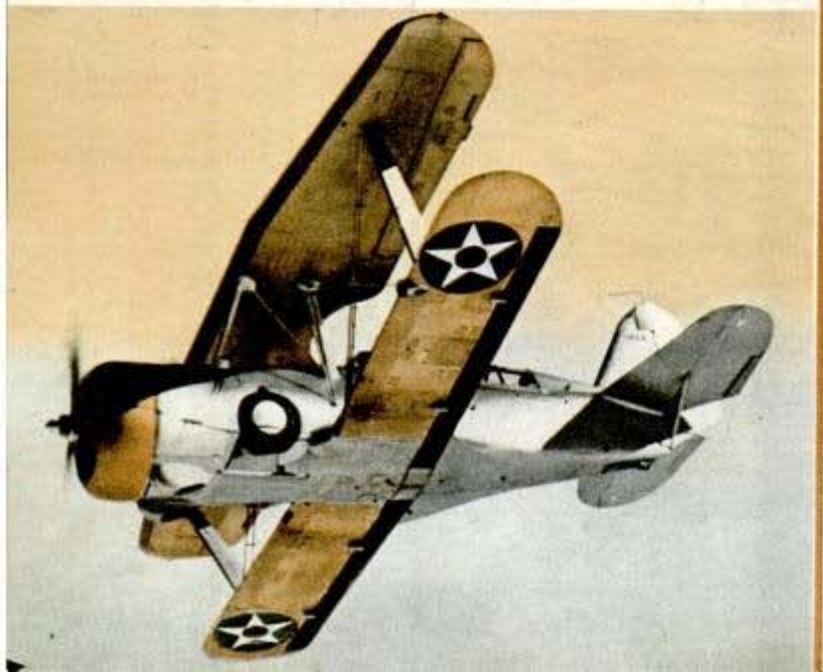
↑ Vought Sikorsky fighting plane, one of the fastest in the world, is in service in the Navy. It is efficient at 30,000 feet



Uncle Sam's rapidly expanding air forces are equipped with many Curtiss P-40 fighters and improved models of that ship. The later planes have more horsepower, firepower and speed than the P-40, which has been freed—falling with motor idling—at a record rate of 661 miles per hour—a mile every 5.45 seconds. Curtiss has produced a possible successor to the P-40—the XP-46—which is believed to have a top speed of well above 400 miles per hour.

Bell's Airacobra literally is a flying arsenal, boasting a cannon and six machine guns, all of which may be fired by the pilot-gunner pressing a single trigger. The gun or guns to be fired are controlled by electrical switches. Although heavily armored with steel and bulletproof glass, the Airacobra can climb vertically at a mile-a-minute clip. Like the Lockheed and the P-40 series, it is powered by the Allison liquid-cooled engine, which is mounted behind the pilot and connected to the propeller by a long shaft. The 'Cobra has been dived at 620 miles per hour.

Pride of the Navy is the Vought-Sikorsky fighter, fastest in the service. A single-engine ship, it has a cruising range of 1,000 miles and can operate efficiently at 30,000 feet. Its fire power compares favorably with that of the Army's fighters. Another much-talked-about Navy plane is the Curtiss scout bomber SB2C-1, on which large-scale production



Center of page, Test Pilot Lloyd Childs inspects huge retractable landing gear of the Navy's "super-dive bomber" built by Curtiss

← Another Navy plane, used for scout observation and dive bombing is the Curtiss biplane powered by a nine-cylinder radial engine

23

2854

AIRCRAFT



Loading a big twin-engine bombing plane from a small truck especially designed for handling bombs. The bomb bays are being opened to receive the explosive. Uncle Sam's supply of medium bombers is growing

San Diego Calif

is about to begin. Compared to previous planes of the same type, it is 100 miles per hour faster, carries twice as many heavy bombs—all transported inside the fuselage—has 600 miles greater range, stays in the air 4¼ hours longer and has twice as much armament, giving a fire power greater than any other single-engine naval plane. After the Navy's airmen saw this dive bomber go through its paces, they signed on the dotted line for an initial order totaling \$50,000,000.

Latest of Boeing's "flying fortress" bombing planes is the B-17E, powered by four mighty engines that give it a range of more than 3,500 miles and a ceiling of about 36,000 feet. Capable of lifting several tons of bombs across the American continent and halfway back, it is manned by seven to nine men. Boeing, Douglas Aircraft Corporation and Vega Airplane Company have pooled production facilities to turn out flying fortresses in large numbers. The bombing planes will be identical, even to the point of interchangeability of parts. Several other manufacturers are contributing to the program through subcontracts.

Consolidated's version of the heavy bomber is a four-engine warplane with a 3,000-mile range and a bomb capacity of 8,000 pounds. Its top speed is above 300 miles per hour. Better known is the Consolidated patrol bomber, due to a ship of this type having played a leading role in the successful hunt for and subsequent destruction of the German battleship Bismarck. In British sea patrol work, this ship has a crew of ten men—three pilots, an observer, radio operator, radio mechanic, flight engineer, flight mechanic, gunner and flight rigger. The pilots share the responsibilities of navigation with the observer. There is accommodation for four men on canvas bunks in the cabin and during an around-the-clock patrol, hot meals may be prepared on a small stove.

Always the men on duty in the pilot's cockpit or in the transparent "blister" amidships scan the seas for enemy submarines. At the first sign of a telltale plume of water from a periscope, the pilot dives and releases powerful depth bombs, while the radio flashes the submarine's location to warships and merchant ships.

*Aircraft Corp
Seattle, Wash.*



Bell

The sign of the Airacobra—a warning to any “enemy” plane its pilot encounters

↑ This line of Douglas bombers is encouraging, since it represents more additions to American aerial forces. Tens of thousands of planes—birds of war—will be produced by this country within twelve months

Airmen being supplied with oxygen before taking off for high altitude flight in Boeing plane which can climb to the sub-stratosphere. Note the line leading from tank to each man. This is a natural color photo



Selenia Dalmarone

Two of the outstanding medium bombers used by the Army are the Martin B-26 and the North American B-25, both fast and capable of carrying 3,000 to 4,000 pounds of bombs. The Martin is heavily armed with machine guns and has leak-proof fuel tanks and armored cockpits. Martin also is producing its “187” bomber for the British. The 187 is driven by two 1,850-horsepower air-cooled engines. North American’s B-25 has two 1,700-horsepower engines, tricycle landing gear and calls for a crew of five.

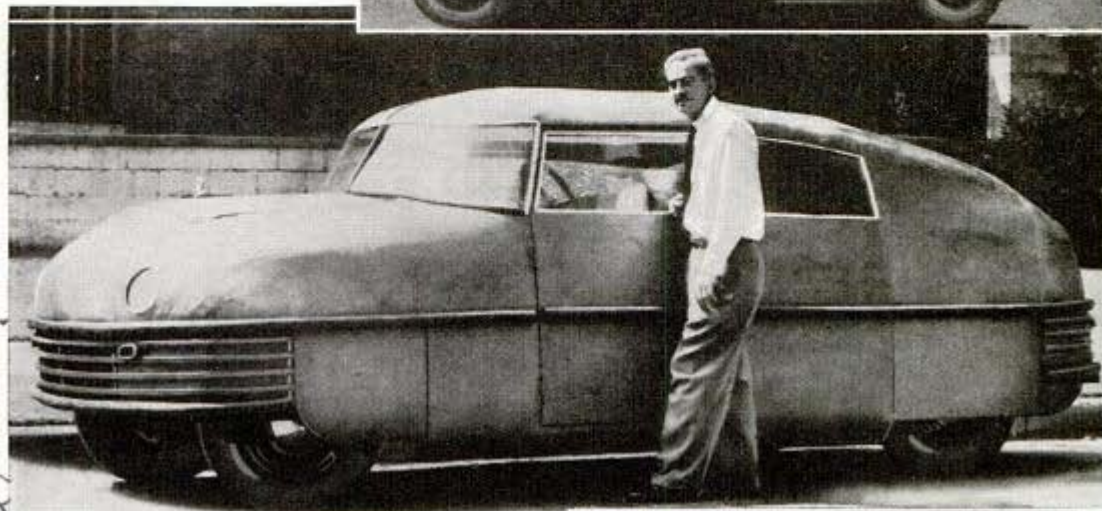
The American counterpart of the DB-7s which have been extremely active in the British Royal Air Force recently under the names of “Boston” and “Havoc,” is Douglas’ A-20 attack bomber. The A-20 is said to be materially faster than the DB-7, which is reported to be faster than the German Messerschmitt 110 pursuit.

(Continued to page 176)

2984.

Screen Car-Body Covered With a Plastic Coat

Framework of steel tubing → for the body was visible through the screen covering before plastic covering had been applied. Car without protruding fenders was designed by the builder



Finished car as it appears after receiving coat of plastic which forms a firm bond with the wire mesh

Spreading plastic over a base of wire mesh was the novel way in which Ray Russell of Grosse Pointe, Mich., completed the body of his homemade automobile. The same method offers possibilities in fashioning the bodies of toy vehicles and even the upper structure of small water craft. Using a standard chassis, the builder made a framework of steel tubing, $\frac{3}{4}$ inch square. This he covered with 20-mesh wire screening, attaching it by drilling the tubing and inserting self-tapping screws. After being hammered and bumped out with a rubber mallet to form the desired contour, the screen was coated with ethyl cellulose plastic having the viscosity of heavy honey. This was applied with an ordinary calking gun fitted with a three-inch nozzle, which spread a thin ribbon that filled the meshes. This operation was repeated until a coat $\frac{1}{16}$ to $\frac{1}{8}$ inch thick covered the body. The roof was left thin enough for the sun to show through, but not quite transparent. The entire job required some 500 feet of steel tubing and 300 square feet of screening. Tubing was bent on wood forms having diameters of



Wide-nozzle calking gun used for spreading plastic

six inches, 18 inches and four feet. In bending the 20-foot lengths on the four-foot frame, the spring-back of the tubing was found to produce an actual six-foot curve. For windows, Plexiglass was inserted into channels, the windshield being bent to proper curvature and screwed into position. Headlights and rear window openings, being flush with the body, were cut through the finished body and clear plastic installed in the openings.

Write to the firms listed in the Where-to-Buy-It index, page 4-A, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

Ethyl-cellulose Chemical Co. Grand Rapids, Mich.

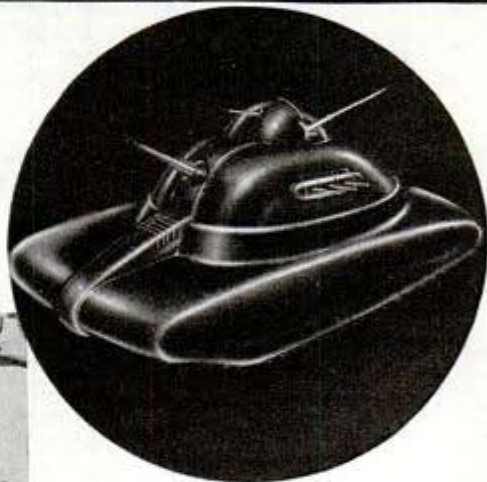
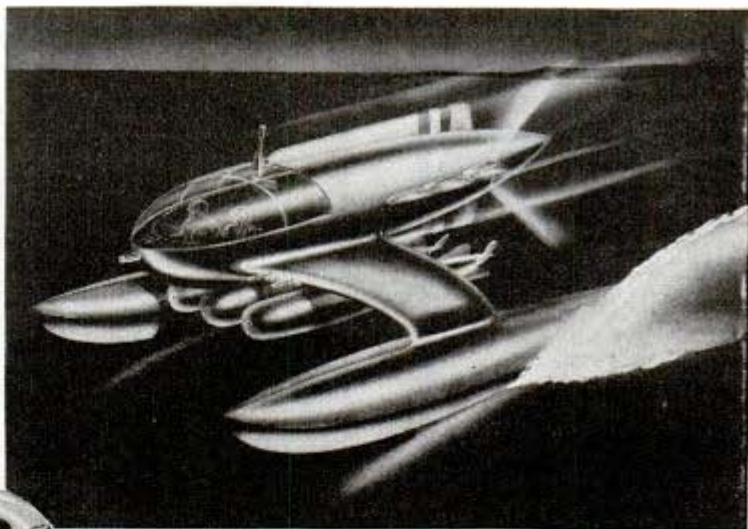
2946

Streamline Designs for New War Machines

*New Century Cold
Electric Mach*

Three new weapons—a torpedo boat that can fly away after firing its explosives, a streamline “baby” tank and an armored motorcycle — are suggested in designs prepared by George Walker, industrial and automotive stylist, as means of increasing striking power and mobility of America’s fighting forces.

The flying “mosquito boat” would be capable of



Three new war-making devices, as visualized by Designer George Walker: top, combination torpedo boat and plane; left, armored motorcycle, and, right, mile-a-minute “baby” tank

skimming across the water’s surface at 110 miles per hour with three torpedoes, each weighing 1,200 pounds. After discharging the 3,600 pounds of projectiles at an enemy warship, it would rise from the water and fly back to its base at a speed of 250 to 300 miles an hour. Although unable to get off the surface until after the torpedoes had been fired, it would outperform present mosquito boats by far. Its crew of two would operate the craft and a 37-millimeter cannon protruding from its nose and machine guns located at the leading edges of the oddly shaped wings. The engine and propeller would be located at the rear. The

crew’s compartment would be covered with a clear plastic to give full visibility.

Another of the Walker designs calls for a streamline two-ton tank—a mile-a-minute machine powered by an eight-cylinder engine. Its scientifically designed surfaces, made of curved steel stampings, would deflect shells and bullets and also reduce wind resistance, resulting in more speed. It would be armed with a 37-millimeter cannon and six machine guns. A thick plastic lining to cut down interior noise, leather padding to absorb shocks as it bumps over rough country and special shock-absorbing helmets for the crew are

2946

2945

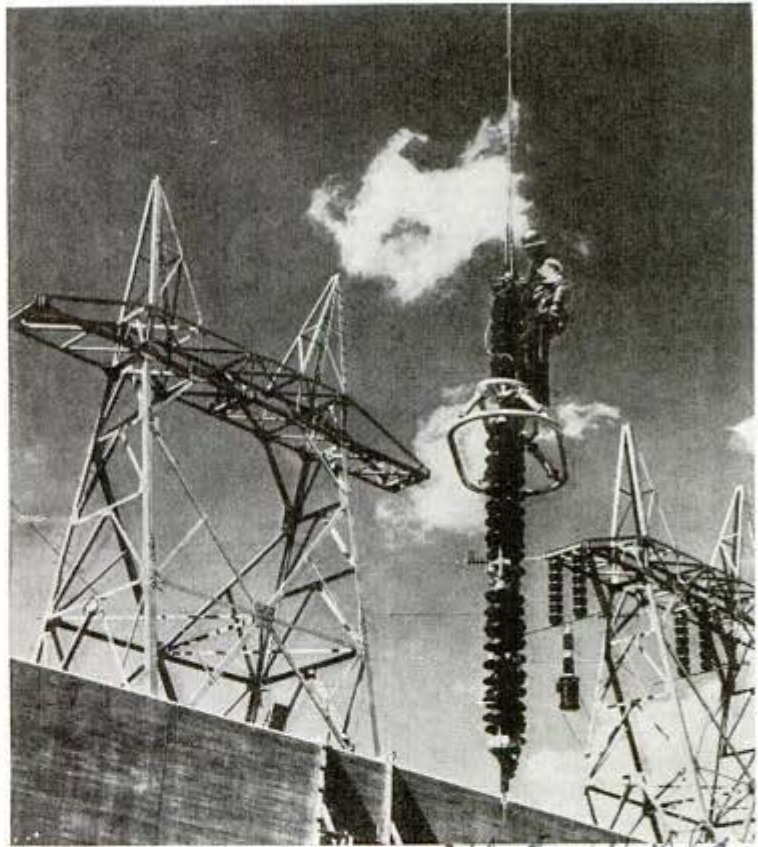
other features. One advantage of such a fighting machine is that it would lend itself to production in vast numbers. From a military standpoint, it could be used for speedy thrusts far ahead of slower vehicles of the armored divisions or for lightning-like sprints aimed at outflanking the enemy.

Hand-in-hand with the baby tank would go the third machine designed by Stylist Walker, the armored motorcycle. A three-wheeled rear-engine vehicle capable of 70 miles per hour, it would be covered with a tough steel "fuselage" extending as high as the driver's shoulders and clearing the ground by less than a foot, thus protecting wheels and tires from bullets. The upper shell, covering the heads of driver and his teammate, would be of clear plastic such as is used in the nose of the modern bombing plane, giving full visibility and also protecting the crew from wind and bad weather. The second man in the vehicle would operate a fixed machine gun of large caliber, although the driver also might do the firing if unaccompanied. The driver would wear a close-fitting steel helmet, fitted with plastic-lens goggles, which would protect his head, most of his face and even his neck from rifle and machine gun bullets. This formidable machine, like the midget tank, might be employed on dashes by large units far into enemy territory.

The Walker designs are being studied by military authorities.

DECEMBER, 1941

Fifteen-Foot Lightning Arrester Guards Generator at Dam

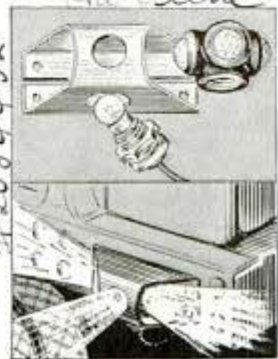


Rigger riding 15-foot lightning arrester as it is swung into position

Lightning will stab harmlessly at the 108,000-kilowatt generators installed at Grand Coulee dam because its fury will be harnessed by a series of special lightning arresters. Three such 15-foot strings will guard each main unit. A rigger rides the arrester as it is hoisted into place.

Armored Side Light for Trucks and Buses

Housed within an armored casing, a three-way side light available for trucks or buses is sturdy enough to resist breakage from ordinary sideswipes. The lamp member, made in one piece of rubber, contains three jeweled lens-reflectors of orange, red and green which may be interchanged to meet various state regulations. The unit has openings toward the front, rear and side so it may be seen from all directions. Two lights are required for each truck, one on each side, and may be installed through the wall above the rear wheel or near the roof.



220- Day Mfg Co.
1462 S Michigan Ave
Chicago

26401 Capt. Thomas E. Stinson, Jr.
3872 Franklin Ave
Los Angeles

ADVENTURES of the DEEP SEA

Reg. Capt. "Yank" Kaseroff of "M.V. Yankee Clipper" Terminal Chartered Cold
 Co's Harbor Boat works



In the wheelhouse of a purse seiner, with "metal mike" automatic wheel in foreground and loop of radio direction finder in the rear



Shaded area of map shows the region fished by the California tuna fleet

THERE'S nothing dangerous about a sardine, and a jellyfish is as harmless a creature as there is; but put the two together and you have a combination that can sink an 80-ton fishing boat and drown its crew.

Eight sardine boats working out of San

Francisco were lost last winter because they caught too many jellyfish in their hauls of sardines. The jellyfish make the cargo slippery and when the ship rolls in a big swell the cargo slides to one side. Water pours aboard and the vessel sinks.

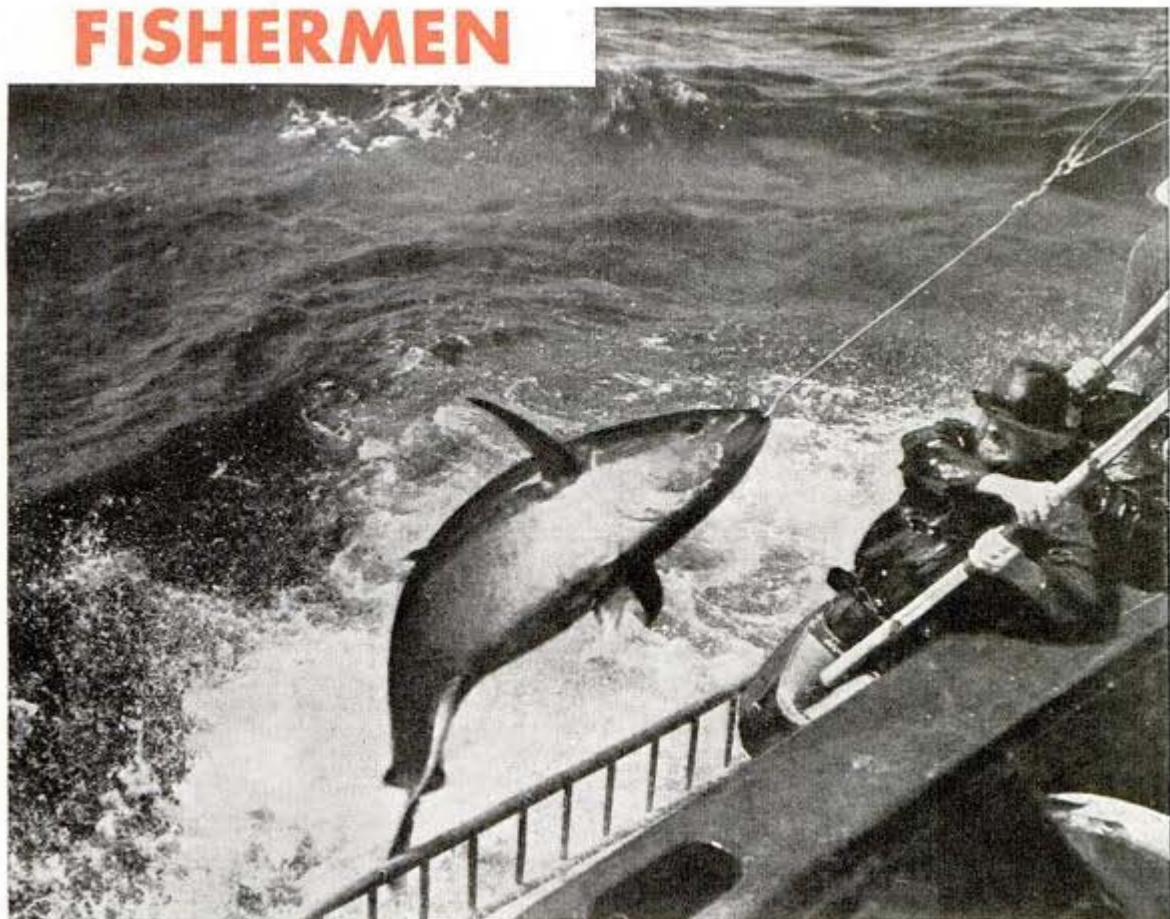
Jellyfish are not the only perils of the fishing fleet. Two big tuna clippers turned over and a third was lost with all hands because the big live-bait tanks on deck made them topheavy. Some such tanks hold 100 tons of water and many boats have been redesigned to keep them seaworthy in rough weather.

Once a tuna boat crew was so busy hauling in fish that they kept storing the catch in one side of the hold, expecting to equalize the weight as soon as the fishing ended. But a big swell shifted the



Sixty-pound "two pole tuna" is pulled aboard by two-man team

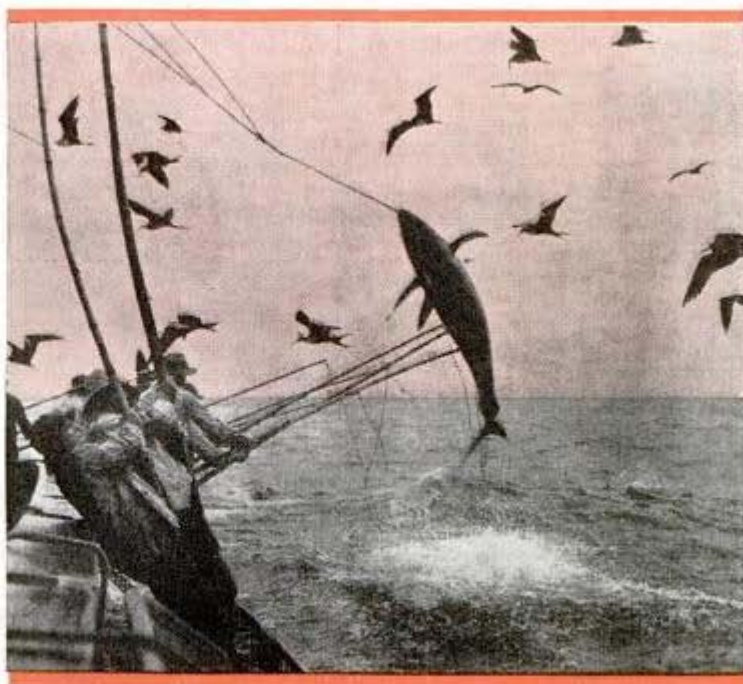
FISHERMEN

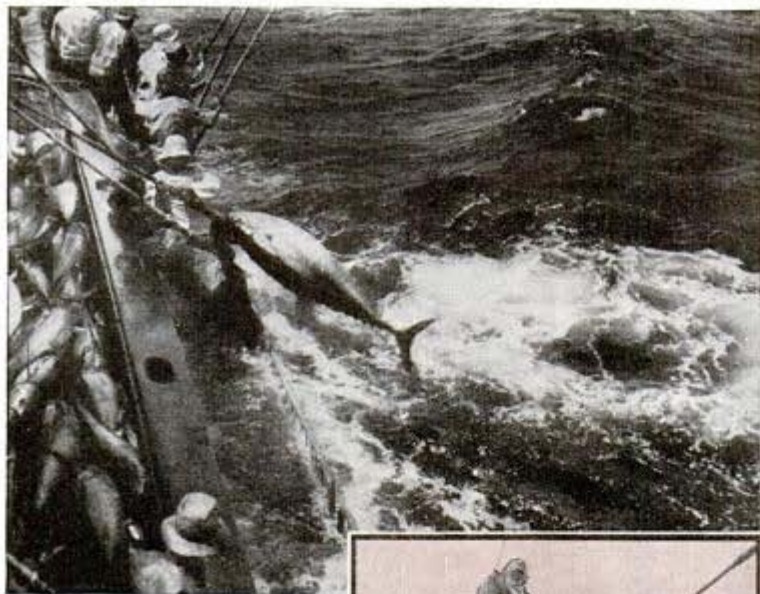


load even farther to one side and the boat listed and began to ship water through its open cargo hatch. The stern was under water and some of the men, in life belts, nailed the hatch cover down just in time to prevent more water being taken in. They weren't out of danger yet because the boat was still on the verge of capsizing. Starting the main engine, they steered the ship in a tight circle, utilizing the tipping tendency of the turn to offset their list until they could move some of the fish to the other side of the hold.

The big modern fishing vessels of the west coast cost upwards of \$120,000 each and are provided with every safety feature

Three fishermen pull in a 100-pound tuna with three lines attached to the leader. The hook is barbless, flies free when the fish hits deck. Sometimes the entire crew lines the rail, letting the boat run itself





↑ Metal grating used as fishing platform outside bulwark of vessel is awash as ship rolls

After the lookouts sight fish, → other ships in the fishing fleet are notified by radio

science can devise, but deep-sea fishing still has its hazards. Collisions at full speed in the dark are one of the dangers of fishing for sardines. These fish are netted after dark in the dark of the moon, they are detected by the phosphorescence that they stir up in the water. Hunting for such schools, the ships run without lights to prevent reflections from spoiling the lookout's vision. In such circumstances they sometimes collide.

There are two main types of offshore fishing vessels on the west coast. One is the tuna clipper, a stout seagoing vessel of up to 120-foot length, that can cruise down to the equator and out to the Galapagos Islands if fish can't be found nearer home. Such a ship may carry 30,000 gallons of fuel oil and cruise 8,000 miles on a trip. Live bait is carried in a big tank on deck and these small fish are thrown overboard to attract schools of tuna when on the fishing grounds. Once the tuna begin to strike, the crew starts fishing with poles



and lines, using a feather lure that contains a barbless hook. It's hard and fast work, and as soon as a fish strikes the lure, the fisherman swings it up over the rail and on the deck. The barbless hook flies free and the lure is tossed back in the water. If the fish weigh 30 pounds or more, two men tie their lines together and fish as a team; fish that run 60 pounds each take three poles to a line and occasionally a boat finds a school of fish so large that four or five poles are used on each hook.

Schools of mixed sizes of fish are not only annoying but dangerous because if the men are fishing singly for 30-pound fish and there are some 150 pounders in the school that take the lures, the big fish usually wins and pulls the fishermen overboard or tears the lines and poles away time after time. There is one story of a boat that lost all its poles and lines and had to cruise around in search of poles that might be floating on the

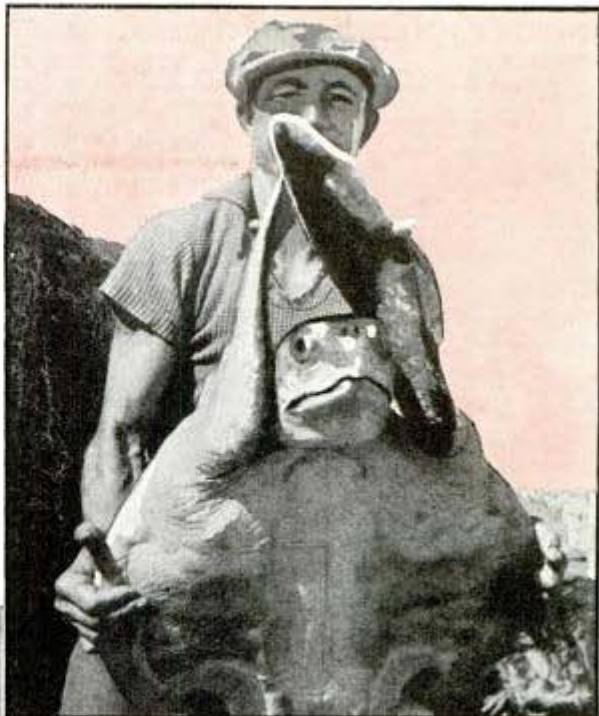
Small live bait is dipped with nets from this floating tank ↓



water before fishing could be resumed.

Somewhat smaller than the live-bait boats are the purse seiners that take fish by surrounding a school with a 2,100 foot long net and then drawing the bottom of the net together with a purse line to prevent the fish from escaping. During the winter months the purse seiners fish for sardines, using small mesh nets, and change to the larger tuna nets during the spring and summer.

Depending on its size, a western fishing boat is powered with a 200 to 400-horsepower Diesel main engine, in addition to a smaller auxiliary engine that drives the electric generator, pumps, and refrigerating units. Most of the boats use a combination of



↑
This huge sea turtle was caught in the net on one trip of the California fleet



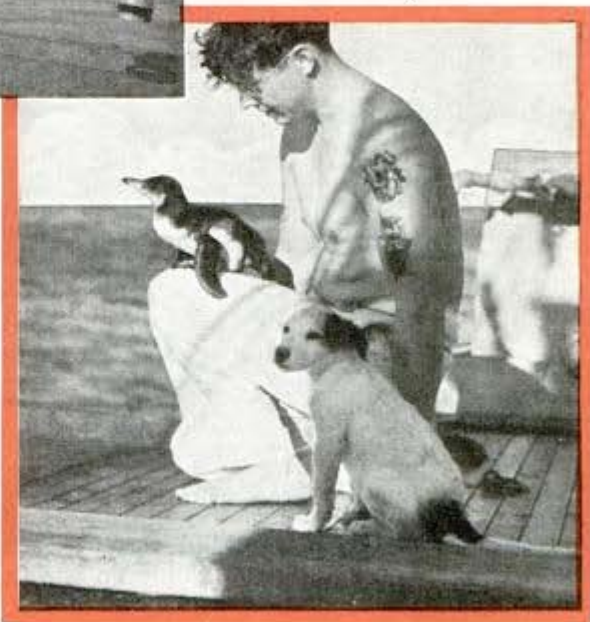
← This is Fish Harbor, Los Angeles, now claimed to be the greatest fishing port in the world. The tube in the foreground is used to load cracked ice in the holds of the fishing vessels

↓
The Galapagos penguin was captured by a member of a tuna clipper's crew on a visit to the southern islands

cracked ice plus either brine or ammonia refrigerating systems to keep their catches below freezing.

All of the fishing fleet skippers use radio telephone for emergencies and to keep them posted as to which boats are catching fish. Most of the vessels are equipped with airplane-type compass to take radio bearings on shore stations and on other ships. Sonic depth finders are used as an aid to navigation and many of the boats have a small "metal mike" automatic steering apparatus that takes charge of the wheel for hours on end.

(Continued to page 168)



2893

Gun Applies Ribbon of Glue With Even, Uniform Flow



The glue gun lays down its sticky ribbon on a board

Dispensing a smooth one-inch line of glue without waste, a glue gun just put on the market eliminates mess and reduces labor cost. It holds two quarts of wet glue, enough for 408 lineal feet of studding. The narrow ribbon of glue that it lays is sufficient with slight even pressure, if self-bonding water-resistant glue is used, to bond permanently wallboards and two-by-fours. Stoppers at each end make it easy to clean the gun with hot water.

—Dr. Campbell calculated that for every pound of matter returning to the earth a million tons would have to start out. If the returning portion weighed 500 tons, he figured, the mass required at the takeoff would be equivalent to a ball five miles in diameter. Nor would this take into account the mass required for steering controls nor the resistance of the earth's atmosphere.

USE THIS TIME SAVER

In these busy times people want to get things done in a hurry. That is one reason readers like our new Where-to-Buy-It index. To obtain additional information about any commercially available product described in Popular Mechanics, note the page on which the article appears, turn to the index, starting on page 4-A, and find the name of the manufacturer or distributor listed directly under the indexed item. Write to the firm listed and to be doubly sure of a quick reply —Say You Saw It in Popular Mechanics.

2632

Fishbowl Is Illuminated by Bulb Mounted in Metal Band

Now the commonplace fishbowl may be illuminated in competition with the more expensive lighted aquariums. It is done



Electric lamp in metal ring bathes fishbowl in light

with a decorative band, housing an electric light bulb, that fits about the base of the average fishbowl. Plug in the cord and the bowl takes on a sunburst effect that brightens the living room.

I. F. Lamb, due 911 Western Ave. Seattle, Wash

Edmonton Alta Canada.

Rocket Ship to Reach the Moon Must Be Five Miles Long

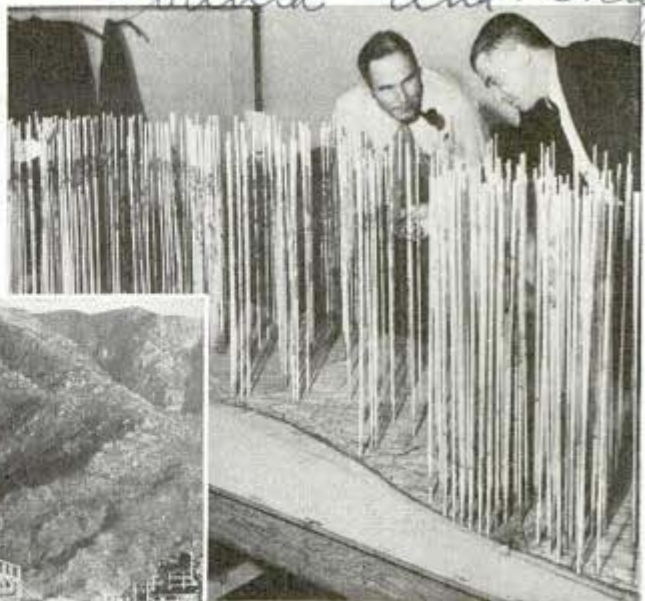
Anyone seriously contemplating a trip to the moon by space ship is advised by a Canadian scientist that a rocket vehicle capable of a round trip must be at least as massive as 29,000-foot Mount Everest. Dr. J. W. Campbell of the University of Alberta reached this conclusion by mathematical studies. In a rocket ship, the impulse would come from expanding gases. Molecules of gas would be fired away in a constant stream. If these "bullets" of expanding gas had a speed of about a mile a second—twice that of artillery shells today

1948

Com. Ralph Baker
611 Virginia St.
Santa Ana, Calif.

Geologists Fight Underground Invasion of Sea

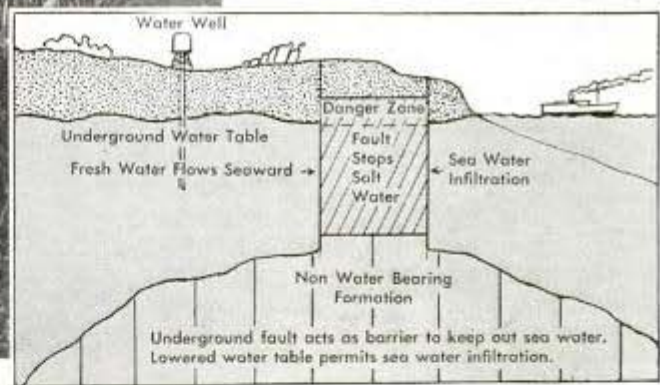
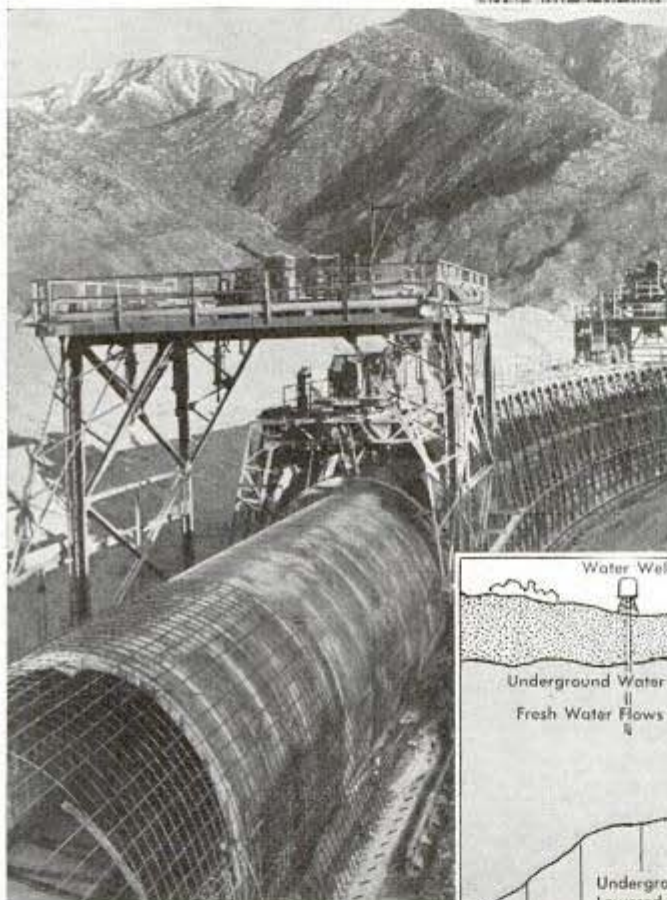
Threatened with contamination of its underground fresh water by infiltration of sea water, Los Angeles is calling on engineering skill for help. The sea has been held at bay by a fault, or slippage of the earth's crust, which extends underground along the coastal plain and is impervious to water.



Colored shafts in map, each representing a well, show geological formations

← Colorado River aqueduct may supply water to raise level of fresh-water table

Sketch shows how fault sets up barrier between fresh-water table and the sea

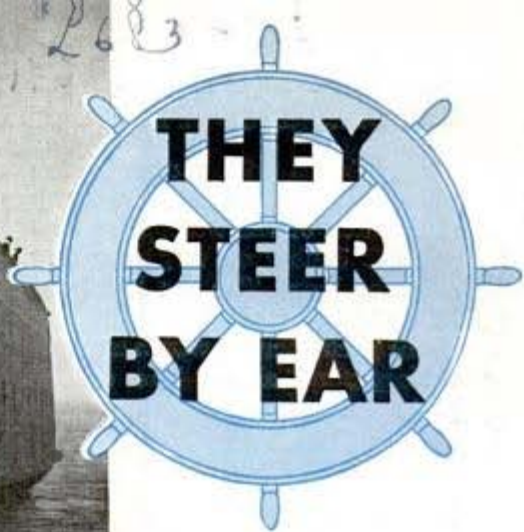
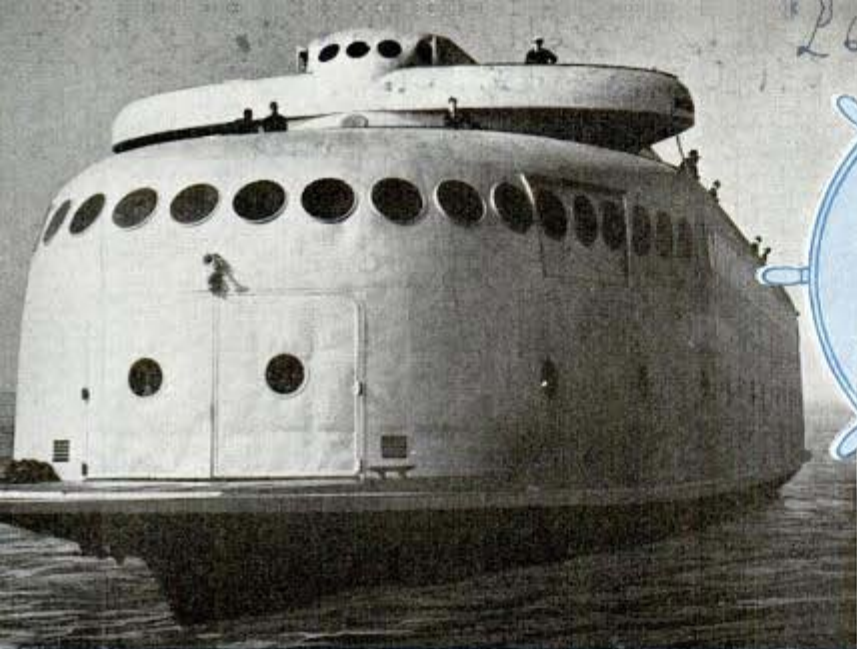


However, rifts have now developed somewhere along this fault, and, to make things worse, a lowering of the inland fresh water level through domestic use has reduced the back-pressure against the fault. Two plans are being considered to prevent the sea water seepage once the points of trouble have been established. One is to pump vast quantities of fresh water into the ground to restore the high water level; the other is to seal the fissures by forcing liquid cement directly into them. In their quest of the location of the rifts, U. S. Geological Survey engineers have been studying the

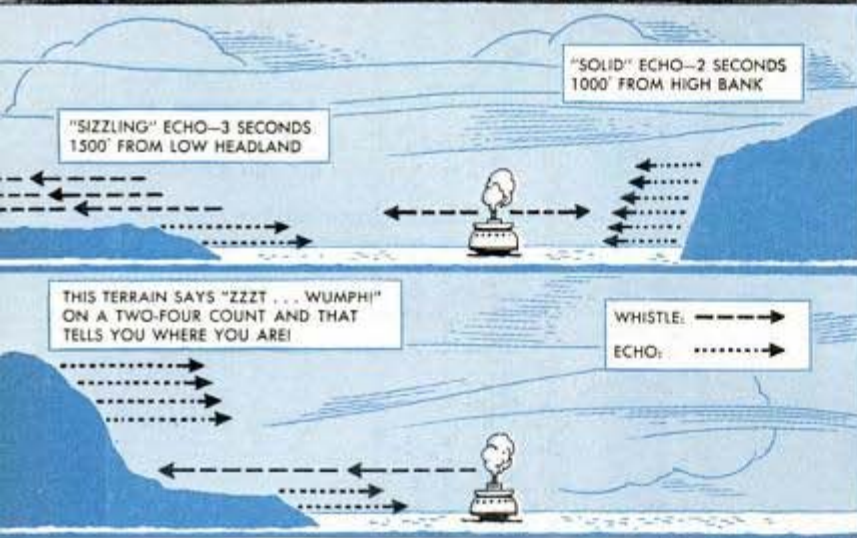
drilling logs of all the water and oil wells in the affected area, and the information about underground formations is being incorporated into a three-dimensional map in which the different types of geological structures are represented by arrowlike shafts stuck into a large table chart of the district. In a further effort to trace the points of infiltration, water from all the wells is being tested for salinity.

See index, page 4-A, to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

Washington, D.C.
R.B.



← Streamline Kalakala carries two horns, one topside, the other just above automobile doors



← Top sketch shows how echo from low headland compares to one from opposite high bank. Bottom sketch shows kind of terrain which gives a two-tone echo when ferry whistles

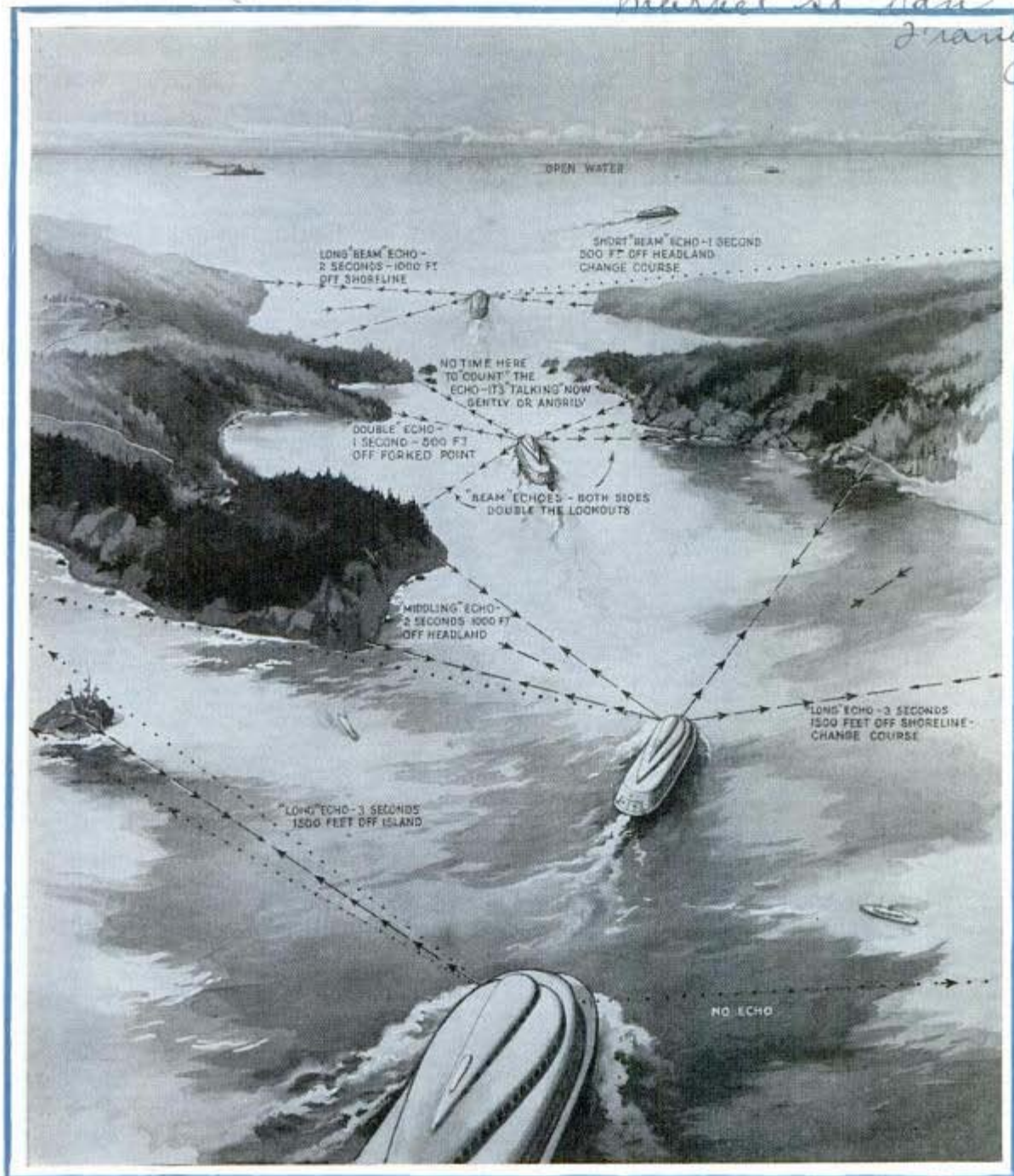
Some craft carry a "screacher" for better echoes. Short blast works best in close quarters



GROPING through your pitch-dark front hall tonight on the way to bed, let out a warwhoop . . . then listen! If you get back a short, sizzling echo from the telephone stand in one second; beam-echoes from both side walls in two seconds, and a long, solid echo from the kitchen door in four seconds, you'll realize you're about to step on that slippery Oriental rug—and you'll walk around it. That's echo-navigation.

Of course, you wouldn't use echo-navigation in your front hall, because it's too small to let the echo get started, but if you were a skipper on Puget Sound, you would prize the echoes because they would help to keep your ship out of trouble.

The bat, flying through dark caves, was the pioneer echo-pilot. Supersonic vibrations, echoing back to his big ears, tell him



This sketch illustrates how craft proceeds in fog, with the skipper setting his course according to the echoes from shore formations on each side. Note double echo from the forked point

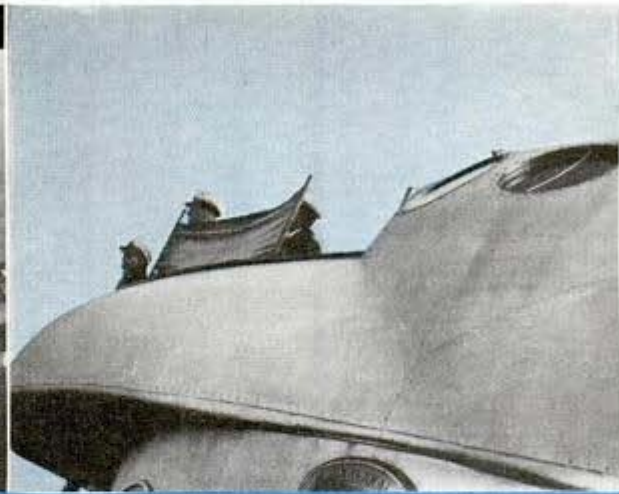
exactly where the walls of the cave are located; he flies toward the place which yields no echo, and thus darts through an opening. Human echo-pilots work in larger quarters, but on the same system. One Puget Sound skipper captained a fast steamer for 30 years through sunshine and dense fog and was frightened only once—

when his whistle-cord broke while he was rounding a rocky point at full speed, in a pea-soup mist that made the shore invisible. It was as if he had been struck blind.

Schedules, and the need for maintaining them in any weather, gave Puget Sound skippers this amazing gift of steering by ear. Water distances are too great for



In fog the skipper himself stands beside the quartermaster at "electric rudder"



Fog lookout on the "flying bridge" of the streamline Kalakala. "On the horn," they're groping past another vessel

bridges—up to 40 miles—so the whole commerce of the region is carried every day by fast double-ended ferries. They travel 1,500,000 miles every year, to haul 1,000,000 vehicles and 5,000,000 passengers, and they never lose sight of land except when the fog sets in. Then they can't tie up. They must hold schedule, keep moving, or paralyze the whole busy international region. A 10-minute ferry crossing can save 126 miles on the highway, or reach a big island which has no highway access at all, so the ferries must shuttle reliably back and forth the year round.

In fog, they "go on the horn." Sound travels through wet air at about 1,100 feet per second. The skippers call it 1,000 feet and then divide by two, since the outbound

whistle must strike the shoreline and the inbound echo must return to the boat. Thus a one-second echo puts the shore 500 feet from the pilot house; a three-count echo means 1,500 feet clearance, and a 10-count echo, being nearly a mile, is the outside limit of a skipper's interest.

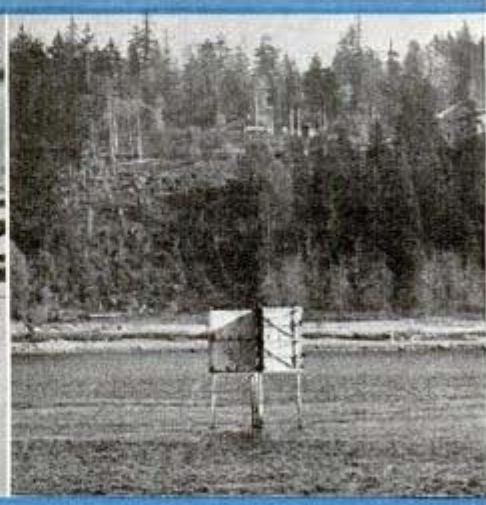
The ferries regularly churn through passes 300 to 500 feet wide without ever seeing them. The skippers steer by ear, as accurately as by eye, and the echoes "talk" them through because the sound fits into the skipper's memory of the shore he has skirted hundreds of times in fine weather.

A low coastline returns a "sizzling" echo, while a high cliff gives a solid "plunk." The echo "scrapes" from a beach of sand

(Continued to page 180)

The Kalakala's ten-cylinder Diesel engine is streamlined, too. Ports are for observation of the pistons in operation

Echo board ashore at Rich Passage, Puget Sound, sharpens echo from ferry whistle



2920

Locomotive Turns Fire Engine to Fight "Blitz"

Small freight locomotives have been converted into fire engines to fight flames started by enemy raids along the lines of the Southern Railway in England. Equipped with a 60-foot flexible suction pipe, these freight engines have steam-driven pumps capable of delivering a ton of water per minute. The pump is mounted on the rear of the locomotive. Special wrecking trains and fire and bomb cars are also held in readiness for emergencies on the British railways.



Pumps on fire-fighting locomotive deliver a ton of water per minute

2961

Camouflage Cape Turns Hunter Into Human Duck Blind



Duck-blind cloak blends with surrounding landscape to conceal the hunter, but does not interfere with aiming the gun and shooting

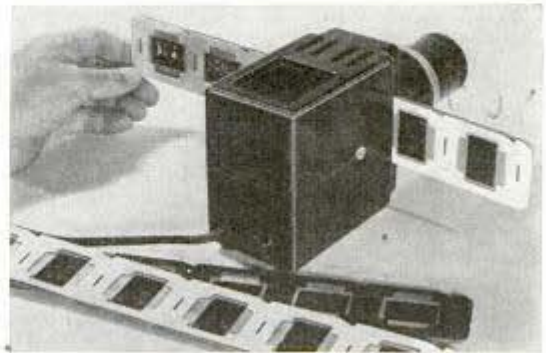
Borrowing a sniper's trick of camouflage, a canvas cape now on the market permits the hunter to wear a duck blind on his back. Large enough to slip over the regular hunting coat and cap, the cape is fitted with elastic loops into which the hunter fits branches, grass and other natural material to make it blend with surrounding landscape. The cape doesn't interfere with shooting.

*Hastings Canvas & Mill Co
"Dastings" Giber*

2934

Projector Strip for Color Films or Slides Holds Six Transparencies

Camera fans who keep their color transparencies in readiness for use in a projector are offered a combination file and projector strip that has space for six films. It is of a size and shape that will slide easily through most of the popular priced projectors on the market. If it is desired to refile or rearrange them, the individual transparencies may be removed easily and replaced with others. Space for numbering and writing titles of the film is provided on each strip. An attractive storage case, also available, holds about 36 projector strips, or the equivalent of 216 Kodachromes.



Combination file and projector strip has space for six films. It fits most popular-priced projectors

*Filmstrip, Int'l. Resco
New York*

21045. *Inv. and design.*
Harry Hedges, Seattle

Engine One Man Can Carry Develops 130 Horsepower

over 247 Hightstown, N.J.



167-pound airplane engine resting on man's shoulder

Fewer pounds per horsepower are required in a two-cylinder airplane engine developing 130 horsepower and weighing 167 pounds, which is not too heavy for a man to hold on his shoulder. Most other engines of the same power would weigh 300 to 350 pounds. This lightweight power plant was built by the inventor, Al Bennett, test pilot and technical aviation adviser merely to prove his theory. Later he expects to obtain 2,400 horsepower from a 1,200-pound engine, or two horsepower per pound. Weight is saved by putting two combustion chambers in each cylinder, thus getting four times as many impulses as in the conventional engine.

Body Electricity of Four Types Is Found in Man

Life and death of man have been found so closely associated with electrical activity that scientists are tempted today to describe the human being as an electrically operated machine. Dr. Robert S. Schwab, of the Harvard medical school reports finding four different types of electricity in the

human body. One is a small direct current in which the cells act as a B battery. Another is an alternating current wave accompanying contraction of muscle tissue and nerve fiber activity. A third is the current used to operate the electrocardiograph in diagnosing heart ailments. The fourth, says Dr. Schwab, is associated with the central nervous system of animals. The ganglia and brain-cell tissues, he explains, are ever active electrically, never resting as do muscles and nerves. Each brain cell does not actually beat alone but by a system of interconnections they keep each other stimulated to activity. These currents have been recorded by extremely delicate equipment.

Lightweight Armor for Cockpit Guards Sky Fighters

Pilots and fighters of United States war-planes will be hemmed in by lightweight armor plate evolved by Breeze Corporation, Inc., of Elizabeth, N. J. Despite its lightness, the metal is stronger and tougher than most armor plate, which makes it specially useful in planes for protecting the men and vital parts from enemy bullets. Large plates are bent to fit snugly about the seats or other sections of the plane and so take up little extra space.



Armor plate shaped to fit around seat of plane pilot

Alfred B. Bennett, Bennett Air Service, Central Jersey Airport
est pilot
6/16/44
over
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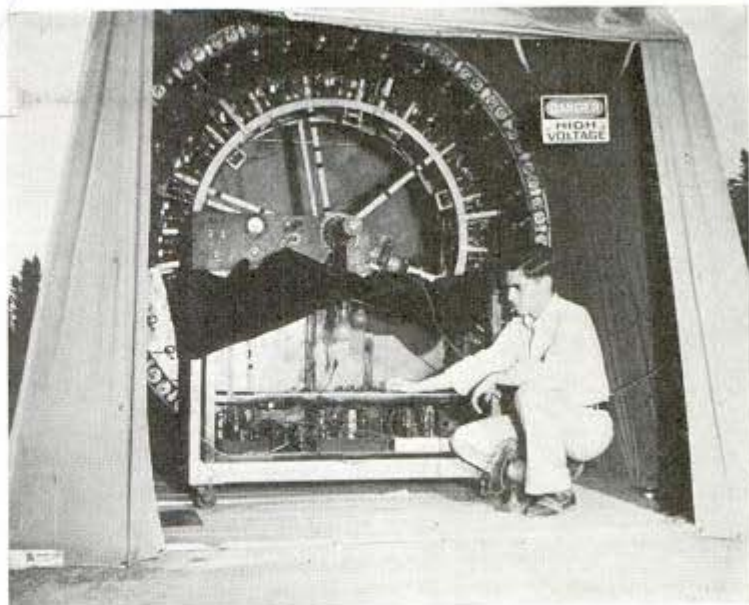
21025
38864
Al Bennett
Al Bennett

38 *Brain Wave Laboratory, Massachusetts General Hospital, Boston, Mass.*

2961 % Prof E. J. Shreiner

Seven-Foot Wheel Traces Cosmic Ray Paths

To verify and refine certain discoveries about what is called the angular distribution of cosmic rays, a complex machine built by Max L. Yeater, graduate student of Washington University, St. Louis, Mo., counts and records these rays only when they strike at an angle that passes them through the rim and across the hub. Because of its appearance the machine has become known as a "Ferris Wheel," but instead of seats at the outer rim it carries 72 Geiger-Muller cosmic ray counters each about a foot long. Arranged in a straight line across the hub, one group of counters is connected in series to a group exactly opposite on the other side. There are 18 such series which in turn are connected to an automatic register with 18 counting devices located on a shelf below and in front of the wheel. The upper half of the wheel rim faces a fan-shaped section of sky from horizon to horizon across the zenith, covering 180 degrees, and thus each series of counters receives rays from a sec-



Wheel records only cosmic rays passing through rim and across middle

tion of sky 10 degrees high. Rays that come in from the side so they touch only counters that are side by side, do not register. Thus, the seven-foot wheel is expected to reveal the degree to which numbers of cosmic rays vary from different angles of approach. There are 234 vacuum tubes mounted on the drum inside the outer rim, and almost as many more on the rim and in the intricate series of relays that carry the count to the panels.

21035

Four Lewis Guns Mounted Together Are Fired as One

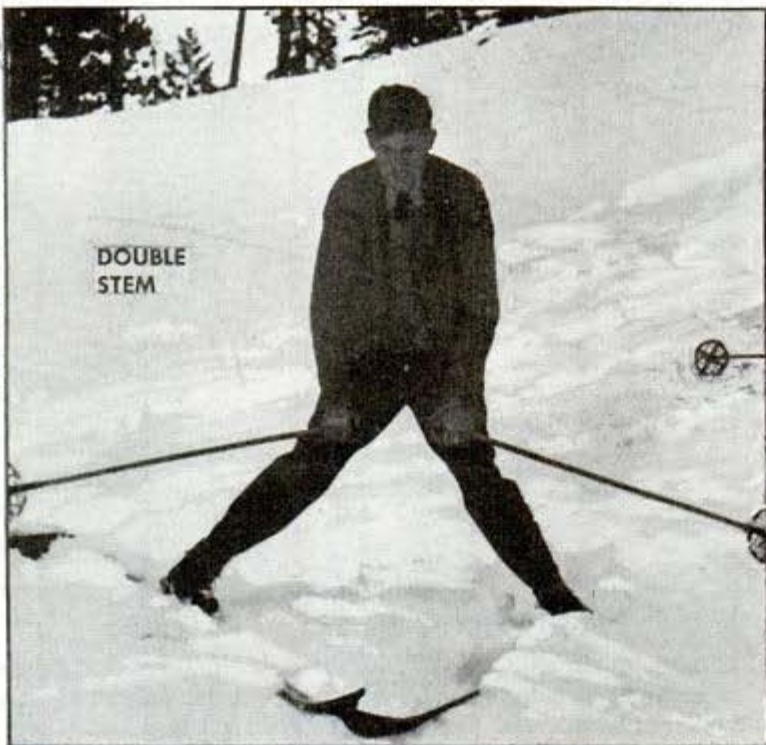


This deadly foursome shoots a wide stream of lead at enemy airplanes

Killing power of the Lewis machine gun has been quadrupled by combining four guns in a single mount and firing them as one. This weapon, used by Britain's fighting forces, is said to be effective for a variety of purposes, particularly in defense against aircraft.

Write to the firms listed in the Where-to-Buy-It index, page 4-A, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

SLIDE, BROTHER, SLIDE



DOUBLE
STEM

In a double stem, used here to achieve a complete stop, points of skis are turned inward until they are almost touching



TELEMARK

Fastest and most streamlined of all turns is the Telemark

One ski is lifted entirely off snow in kick turn. Poles jammed in snow at rear aid in balancing



KICK
TURN

By Alf Ingvar Haugan

Skiing Instructor, David O. Selznick Studios

IF PEOPLE who spend part of the winter on skis knew more about what they were doing, they would get more pleasure out of the sport. After all, good skiing isn't hard to learn. The basic turns, stops and jumps are easy. I've taught thousands of skiers and I've found that with proper instruction a skier can learn all the fundamental maneuvers in a short time—often in less than a week.

The whole trick is in getting started right. There is one right way to perform each maneuver—and only one. Strangely enough, the right way is always the simplest way. For instance, take the matter of how to hold ski poles:

Simply place your hands through the straps and grasp the poles, turning the hands so that the points where the straps fasten to the poles are over the backs of the hands. In this position the strap binds across the heel of the hand. As no veins or arteries are close to the surface in this part

716 N. Hollywood Blvd. Los Angeles, Calif.

Emb. Co. 26 With Muller, are 457 S. Beverly 714



Photo by All-Year Club of Southern California
Charles Proctor, director of Yosemite Winter Club, in one-pole jump in Yosemite National Park

of the hand, the strap will not cut off circulation. Some instructors teach a hold in which the strap is looped around the hand and thumb. Although this hold gives a steadier grip for speed skiing, it is not satisfactory for the average skier, as the strap tends to bind across the back of the hand, thereby cutting off circulation through the veins.

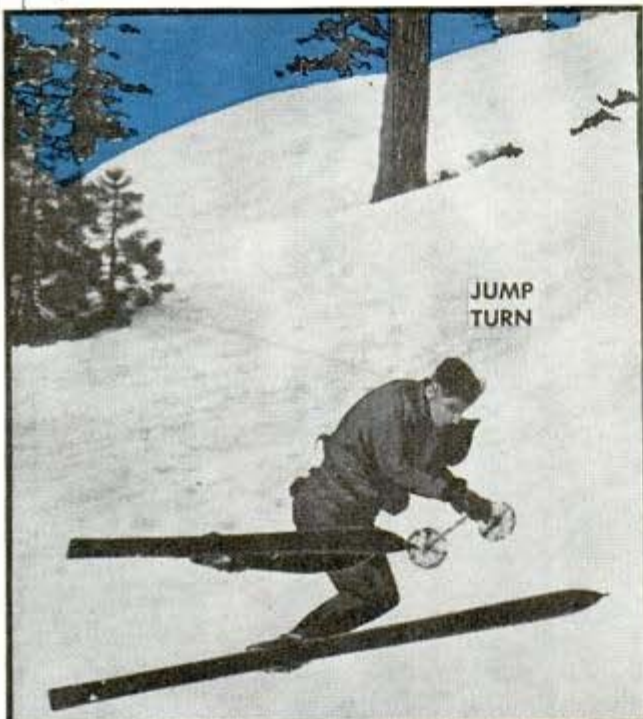
Before describing the fundamental turns, jumps, and stops, a word should be said about how to fall. Falling is inevitable—even the best skiers fall occasionally—but it need not be dangerous. The first mistake which the inexpert skier makes is to try to stay on his skis too long. In so doing he becomes tense and his weight shifts forward so that when he eventually falls, he falls forward and with his muscles tight. Therefore, when you feel that you are about to fall, go ahead and fall.

Always fall backward, with your ski poles behind you and your skis

Wrong way to fall and (bottom) right way. In lower photo, note skis are parallel and the ski poles are behind the skier



9974



As your ski poles are behind you, they cannot jam into the snow with the result that the butt ends jab into your body. Moreover, if you fall sitting on the side and back of your skis, you can get to your feet simply and without changing the position of the skis. This is particularly important when you fall on a hill or other difficult terrain.

In learning to jump, stop, or turn, there is one basic law: stay relaxed. In this connection it is advisable to ski in a crouched or semicrouched position. Many expert skiers use an erect position,

← Jump with the body, swinging skis at right angles to direction of travel, to make a jump turn for a quick stop

Method of holding ski pole for Gelandesprung; strap is twisted about wrist, end of pole thrust into palm ↓



Ski pole grip (left) gives maximum firmness and control, but is apt to cut off circulation as strap binds across base of thumb and back of hand. Center photo shows more natural grip, with strap binding across heel of hand, avoiding restriction of circulation

Demonstrating side step used in climbing. →
Note that the skis are kept parallel

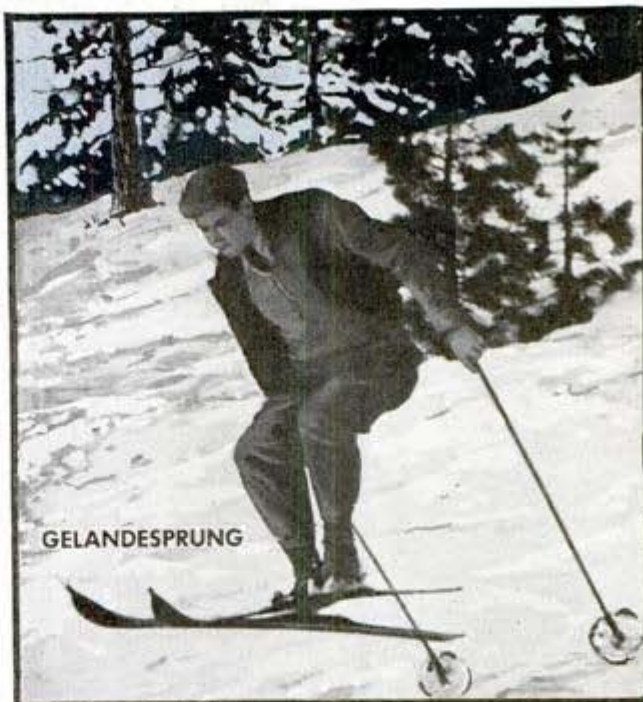
parallel. Attempt to fall in such a way that you sit down on the rear and side of your skis. By doing this, your skis will be kept parallel and will be raised off the snow. In this position they will not dig in. Be sure not to fall directly on the back of your skis. Should you do this, you would fail to stop. By falling on both the back and sides of your skis, the weight of your body acts as a brake.



but for the average person the crouch is preferable. A crouch aids in relaxing the body, and the position is such that the skier does not have so far to fall. The crouch also reduces wind resistance.

Before taking up action turns, stops, and jumps, the skier should learn the "side step." This is simply a method for climbing steep hills. When climbing the side of a steep hill, lift your upper ski and ski pole and place them about a step farther up the hill. When your upper ski and pole feel secure, move your lower ski and pole up next to them. By continuing this process, an extremely steep hill can be climbed with ease and safety.

Should you desire to change direction while climbing by this method, use the "kick turn." To do this, place your weight securely on the upper ski and on the poles, which are thrust into the snow at either side and behind you. The lower ski is then lifted off the snow, swung completely around, and so changed to the opposite direction. The upper ski then follows in the same way. To execute this maneuver successfully, your body, and particularly



This maneuver is simply a jump assisted by the poles and is used to clear obstacles too high for plain jumping

your hips, must be flexible. This maneuver can be used for turning when zigzagging up a hill. You use the zigzagging method of climbing a hill when the incline is not steep enough to require a sidestep.

(Continued to page 170)

Luggi Forger of ski school in Yosemite National Park demonstrates a pure Christiania, a spectacular maneuver for the skier. Note how the body is employed in making the turn



Photo by All-Year Club of Southern California

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21011
Q. M. Swardon & Co. Inc. New York City
189 Greene St
Science Service
8/19/41
986
21011

Tree Ornaments Set Aglow By "Black Light"



"Black light" makes Christmas tree ornaments glow

Made of fluorescent plastic, unbreakable Christmas tree ornaments change colors and glow as though lighted individually in the presence of ultraviolet light. A special electric unit supplying the "black" invisible light is furnished with the decorations, one being sufficient to illuminate an entire tree. Under the "black" light, ornaments which were red turn into orange, the greens become an emerald shade, and blues emerge as azure.

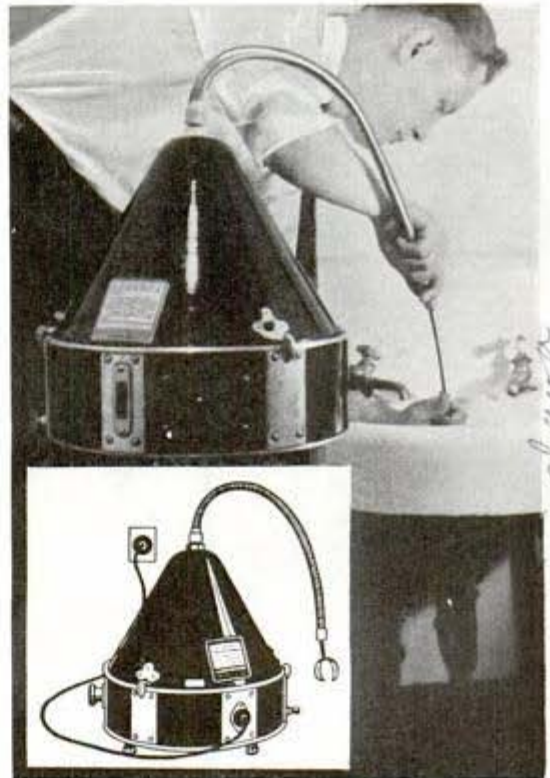
Treatment Speeds Peach Tree To Bear Fruit in Two Years

Prodding Mother Nature by a new treatment for fruit pits, Dr. W. E. Lammerts of the University of California can make a peach tree yield fruit in two years. This compares with three to four years under ordinary methods. Dr. Lammerts removes the kernels from their hard pits and soaks them in a nutrient solution of agar, sugar and vitamin B₁ for three weeks, which

hastens sprouting. They are then removed to clean washed sand, where they are kept moist for another three weeks. By then the seedlings are large and strong enough to be placed in soil-filled pots. At nine months the plants are set out in the field, and by their second birthday the trees start producing peaches. This two-year breeding cycle permits quicker study of such characteristics as skin and flesh color, free or clinging pits, and chilling requirements. Within five years more than 5,000 cross-pollinated seedlings have been grown and studied at the Armstrong Nurseries in Ontario, Calif., where Dr. Lammerts has carried on his experiments.

Steel Blades on Rotating Cable Bore Open Clogged Drains

Razor-sharp steel blades spinning on the end of a motor-driven rotating cable make quick work of freeing clogged drains in the bathroom or kitchen, or opening steam or water lines. The cleaner is operated by an a.c., d.c. or universal motor with all moving parts enclosed. It is built for efficient use in cramped quarters, and for thorough cutting and removal of all grease, hair, scale and encrustations from pipes.



Drawing shows the sharp blades which spin in pipe

Plato - Rooder Car 12
2302 University Ave
 POPULAR MECHANICS
21011

L 989

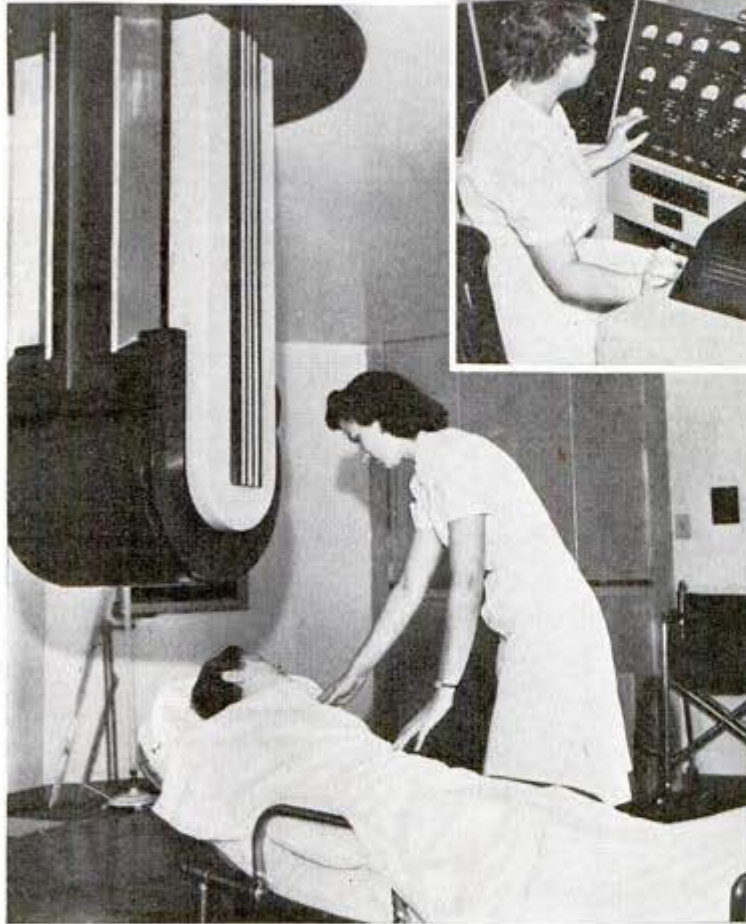
Gigantic "Cancer Tube" Controlled From Desk

To carry forward research into cancer treatment, which was conducted at the California Institute of Technology from 1930 to 1938, a gigantic X-ray tube of 2,000,000 volts, almost twice as powerful as any other "cancer tube," has been installed at a research and treatment center in Los Angeles, Calif. This tube and



Scene
Control desk for the giant and four other X-ray "cancer tubes"

four less powerful tubes are controlled from a large desk, with the operator able to communicate with all of the treatment rooms. Reinforced steel walls of the 2,000,000-volt X-ray treatment room, that vary, in thickness from 20 to 30 inches, and heavy lead shields protect physicians and nurses from dangerous exposure to escaping rays. The 10,000-pound counterbalanced chamber door closes by rising from the floor.



Here is the 2,000,000-volt X-ray treatment room, shielded by steel walls

L 912 *Bloomfield N.J.*
"Dimout" Instead of Blackout Is Achieved by Voltage Regulators

Rather than subject the civilian population of the United States to a total blackout, with its attendant traffic dangers, if war should bring air raids to this country, Samuel G. Hibben, Director of Applied Lighting for Westinghouse, proposes instead a "dimout." If power stations were equipped with voltage regulating devices, he says, street lighting circuits could be

reduced instantly in event of an enemy raid so that exposed lights would pale to a red glow. He suggests that city police carry shielded traffic lights strapped to their shoulders, that cars and trucks have a white band painted around their bodies, with cat-eye slits in headlights and that all vehicles have small running lights suspended under the chassis.

Scene Service July 24, '41

OBSTACLE RACES

Capt. J. W. McIlhenry, Office of the
 Commanding General, Ft. Belvoir, Va.



Like football men, soldiers are toughened by racing through a field of tires raised above ground. In background, crossing stream on ladders

In one strenuous phase of the course, the trainees with full equipment crawl through ten-foot pipes three feet in diameter

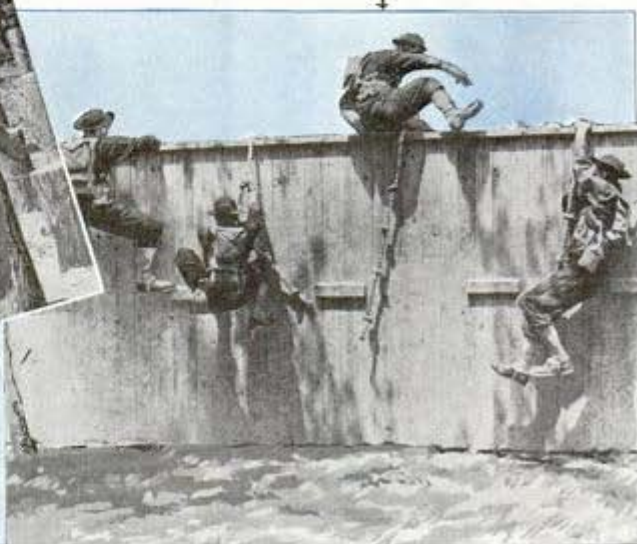
To make a tank barricade difficult for infantry as well as tanks, a network of wires is strung between trees or heavy posts sunk in the ground



Part of the process of turning a civilian into a soldier in the U. S. Army is a "steeplechase" that makes him both tough and agile. One obstacle on the course is a water trap ten feet wide crossed by swinging ropes, Tarzan style



Just beyond a narrow ditch, the soldiers come to a board wall twelve feet high. They are over this in a few seconds, helped by knotted ropes



2892

TRAIN SOLDIERS *for* WAR



Official Ft. Belvoir photo

↑ The 400-yard obstacle course offers the infantryman a sample of the variety of hazards he would encounter in a war campaign. First hurdle in the race is this two-foot pile of logs; the tough jobs are ahead. Throughout this steeplechase the soldiers usually are equipped with rifles and packs



↑ Once over the fence, the trainees find another water hazard. If they're well balanced, it's no trick to cross the creek on six-inch beams. If not—the penalty is loss of distance, and wet feet!

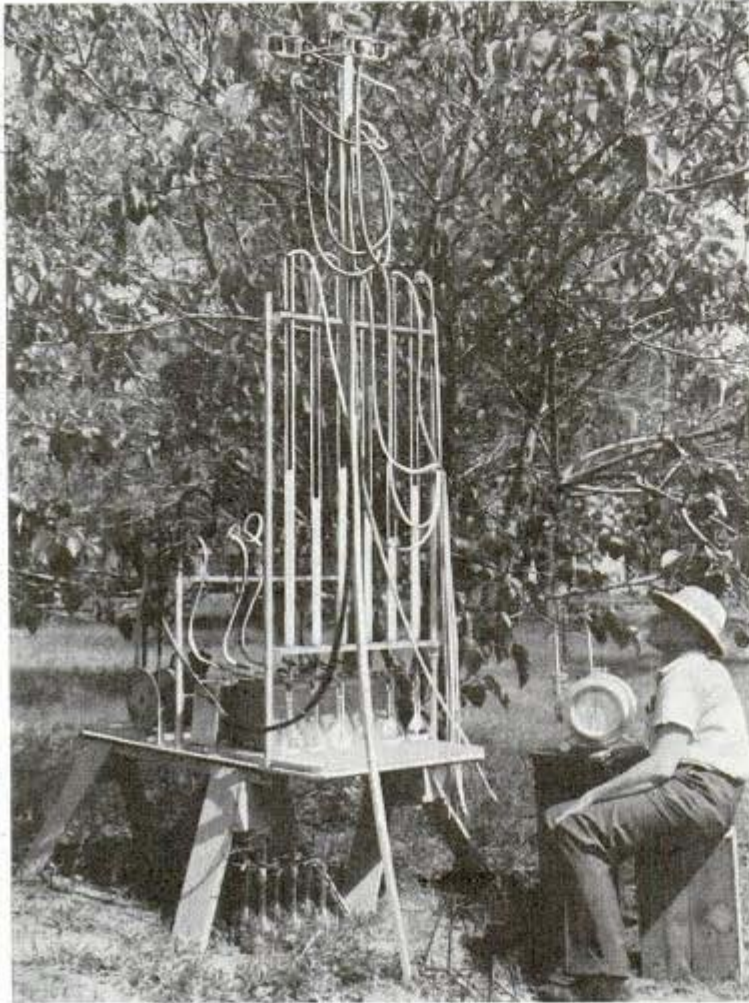
Add up all these exercises, plus a trip up and down a twelve-foot ladder and a jump across a trench, and you have had a strenuous day. At right a group of soldiers makes the final jump from a sandbag barricade



2942.

Breath of Tung-Tree Leaf Is Analyzed In "Pipe Organ" Tubes

(Emb. Andrew La. Terry
11 W. 42 nd New York)



Tree specialists use this portable analyzer to learn how leaves breathe

Dwindling imports of tung oil from China have spurred the U. S. Department of Agriculture to stimulate domestic production of the oil to meet defense requirements. In one investigation to learn more about the tung tree's growth and boost its propagation in the Gulf states, a photosynthesis machine analyzes air "breathed" by the leaves. Used at a government laboratory at Gainesville, Fla., the machine was developed by Prof. A. J. Heinicke and students of Cornell University. Its six glass tubes, called "absorption towers," give it the appearance of a queer sort of pipe organ. Four of the tubes, sealed against outside air, draw by suction from "assimilation chambers" what is left of the air after a leaf has absorbed some of its carbon dioxide. This used air is bubbled through an alkaline solution in the lower

Ulster, N.Y.

half of the absorption towers, where all remaining carbon dioxide is removed. This is then compared with the carbon dioxide content of air drawn into the two remaining absorption towers which are open to the air and unattached to the assimilation chambers. In this way the efficiency of the leaf in carbon dioxide absorption can be determined. The young tung oil industry, which produced but a single tank car of oil in 1932, has stepped up its output during the past year to over 5,000,000 pounds.

2999

Handy Kit on Visor Is in Easy Reach Of the Driver

Small articles such as sun glasses, road maps, chewing gum and cigarettes carried by motorists can be stored conveniently in a kit that attaches to the visor by means of a strong clip. It is claimed the kit is an aid to safety as the driver can reach into it and remove any desired article without taking his eyes off the road.

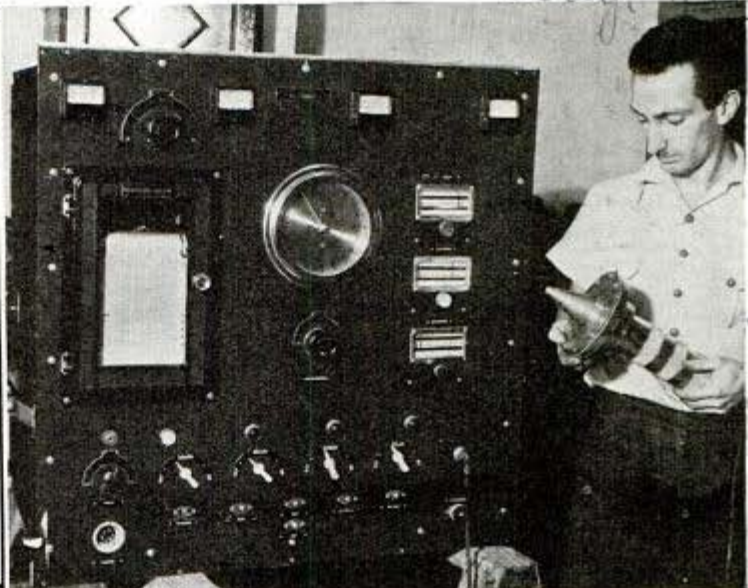
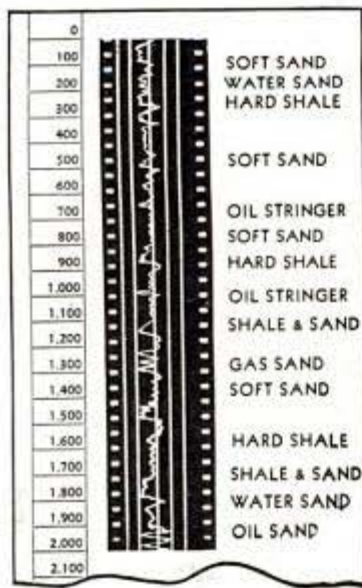


Driver can reach into kit mounted on sun visor and take out article without removing eyes from the road

Shur-A-Lite Co.
Melrose Park, Ill.

2917 California Geophysical Laboratory 2912 Hollywood Way, Burbank Calif

Sound Waves Plotted on Film Map Strata of Oil



At left, strip of film showing wavy line and the geologist's translation; at right, the instrument board

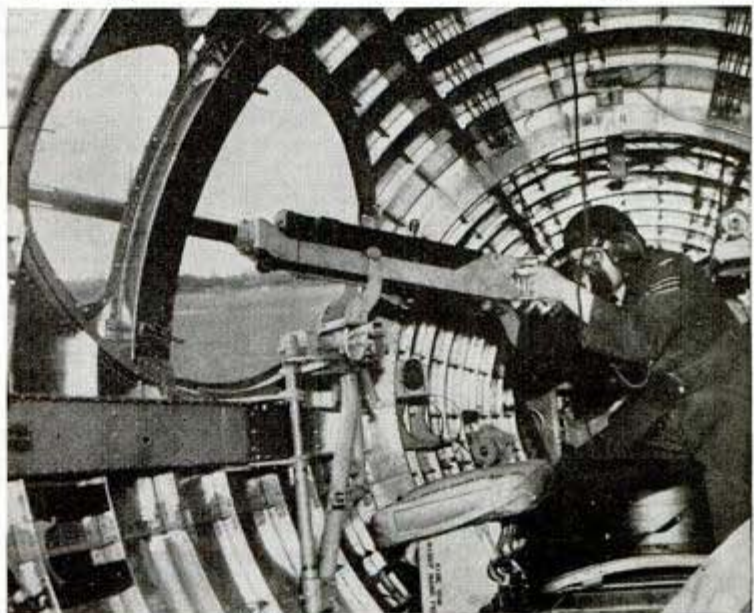
Echoes translated to motion picture film are the newest tool of the oil prospector hunting "black gold" in unexplored fields. From a wavy line recorded on a graph the geologist can read the type of formation—oil, water, or gas, sand or hard or soft shale—at levels as far down as 12,000 feet. The method combines techniques of the seismologist, the sound expert and the movie cameraman. A special gun buried in the

earth's surface sends sound waves deep into the ground, and their echoes, bouncing back as the waves enter various strata, are filtered and amplified in a vacuum-tube circuit. The camera, in conjunction with a cathode tube, then records the sound vibrations as a wavy line. Two men working the "petrograph," which is operated by six-volt batteries, can make a complete survey of a location in a half hour.

*Cont. Thomas & Stinson
3872 Franklin Ave.
Los Angeles*

"Flying Fortress" in England Is Effective on Long Raids

Well-armed to fight its way through the skies against hostile aircraft, the American-made Boeing "flying fortress" is building up an enviable record in long-distance flights to carry out raiding assignments. The powerful four-motored aircraft, used by England's Royal Air Force, contains the automatic bomb sight, and it flies in the sub-stratosphere out of reach of most enemy interceptor planes.

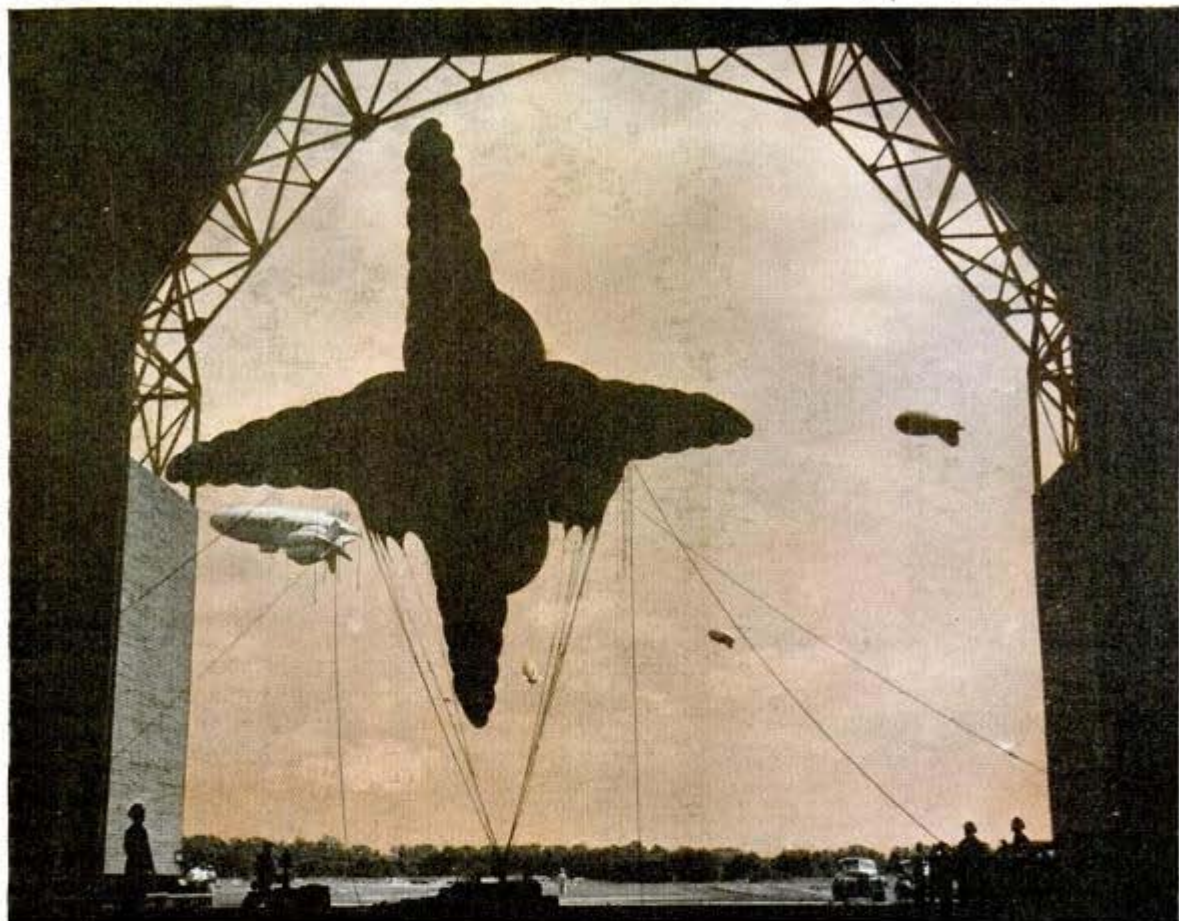


The gunner's cabin in "Flying Fortress" where hot reception is prepared for enemy planes

Thompson

2707
S. J. J. J.

GAS BAGS ON PATROL



Six-lobed barrage balloon leaving hangar at Goodyear's Wingfoot Lake base. Below, officer explaining arrangements of gondola suspended beneath a blimp



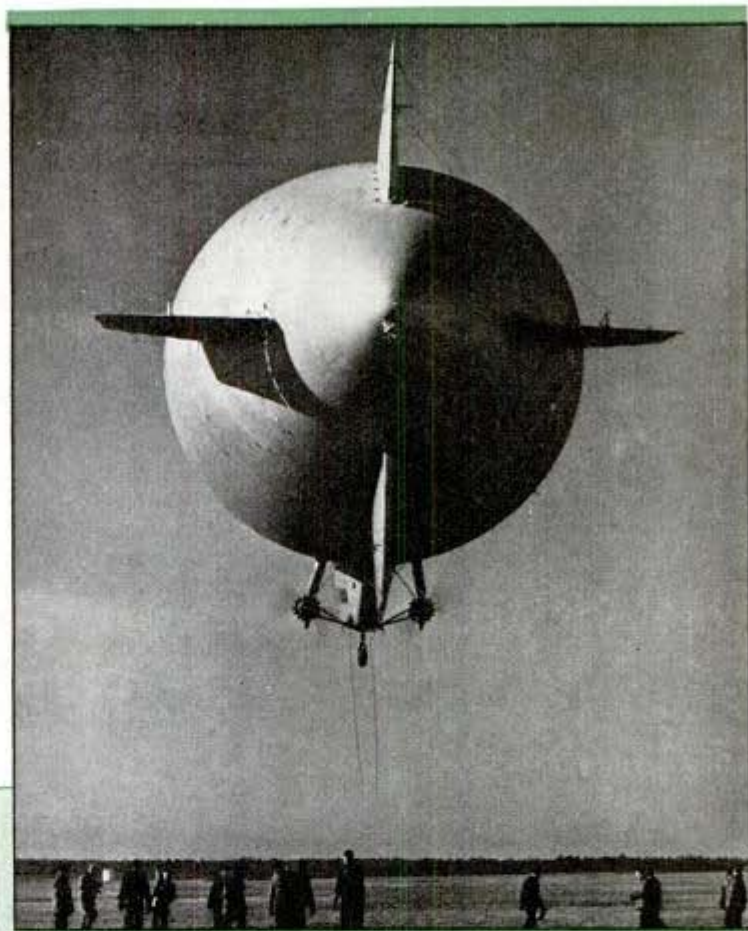
EXTRA "eyes aloft" will help to protect America's naval bases and important ports under the Navy's plans to place nearly 50 blimps—nonrigid airships—on lookout duty as soon as they can be constructed.

Cruising about three times faster than a destroyer, a blimp can keep watch over vast areas of home waters, patrolling an ocean lane 100 miles wide while flying between 500 and 1,000 feet high. Submerged submarines can be spotted easily and followed until a radio alarm brings surface warcraft to destroy the undersea raiders. This is possible because the blimp can hover, held up by the helium in the big gas envelope while its engines turn over too slowly to produce forward motion. Other work for the blimp includes detection of floating mines, investigating merchant ships from aloft and keeping an eye peeled for enemy warships and aircraft.

Though slow diffusion of the 400,000 cu-

bic feet of helium filling the gas envelope, even after the bag has been riddled with bullets, reduces vulnerability of the blimp to attack in an area "infested" with enemy airplanes, like the English Channel, the craft's chief value lies in patrol of sea approaches near home. For this duty it has a top speed of 75 knots and a cruising range almost as great as that of large seaplanes. Its cost is around \$200,000 and its life five or six years.

Training of pilots and ground crews for the forthcoming blimp fleet has been in progress for some time under the direction of Capt. Charles Rosendahl, aided by vet-

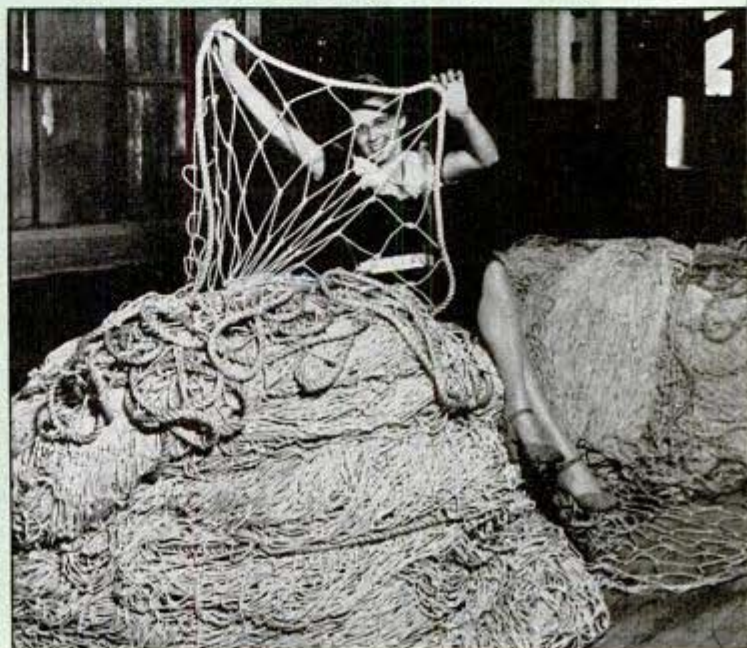


Blimp coming in low with nose landing ropes extended will circle field before coasting in for the ground crew to land it

Forty miles of continuous cotton cord, tied with 181,482 knots, form net used to hold blimp "envelopes" during inflation



↑ Ladder from blimp may be used for such operations as transferring men from ships to a blimp





↑ Inspecting blimp calls for man in gas mask to enter the big envelope in search of leaks and weak places in the bag



↑ Closeup of pilot's compartment, with a view of the blimp's instruments

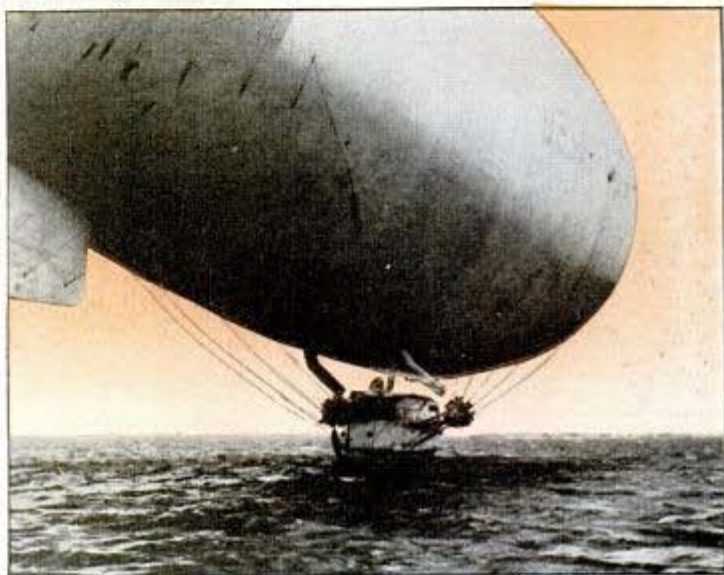
Blimp demonstrating how it can be → brought down to the surface of sea

eran airship officers. The half dozen old blimps used, some of them dating back to the post world war period, have been reinforced with three modern trainer ships—13 more have been undergoing flight tests recently—and a half dozen large patrol ships delivered at intervals during the past summer.

At the same time the Goodyear Tire and Rubber Company has been using its blimp fleet, hangars and other facilities at Akron, Ohio, and Los Angeles, Calif., to train

airship personnel. The Goodyear classes, started in the fall of 1940, included 18 students who completed their course in the summer of 1941 and thus became qualified to seek commissions in the U. S. Naval Reserve. Another class, and a larger one, began training upon completion of the first. Chosen from a large list of applicants from the Goodyear organization, most of the student pilots are college graduates with engineering degrees.

Watching a blimp cruise slowly through the sky leaves you with the idea that flying it must be easy. Just the reverse is true; in fact, the student pilots will tell you it's more difficult than flying an airplane. First the student is required to put in 150 hours in ground classes, studying such subjects as aerostat history, from the first free balloon and its successful demonstration in 1783 to present-day developments; aerostatics, a study of the lift of gases, the derivation of lift, ef-

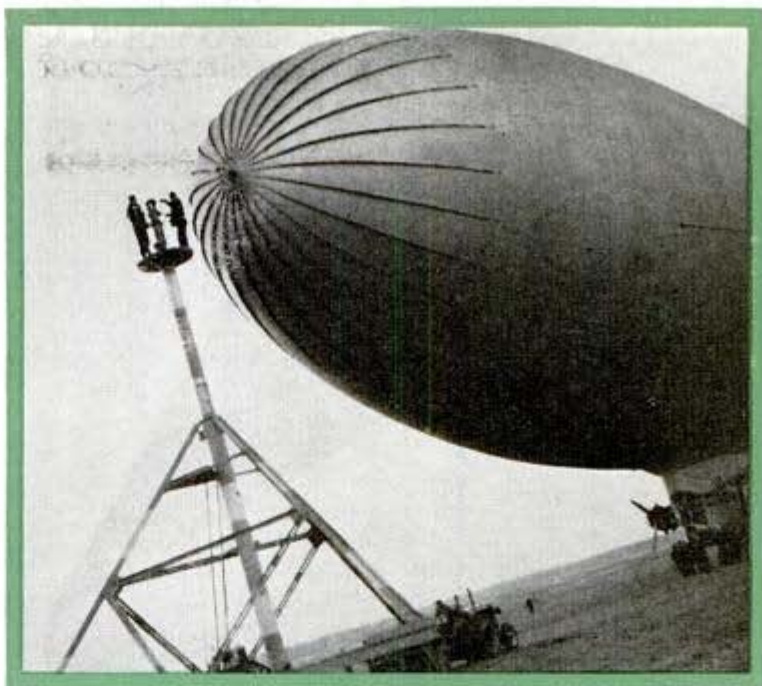


fect of temperature and pressure and humidity on lift, etc.; aerodynamics, the study of airflow around solid bodies and the forces and movements produced by such flow, turbulence, drag, lift, stability, streamline forms, etc., and other subjects.

But at this point the student pilot is far from prepared to take a blimp aloft. He now goes to flight school in which he takes a course in free balloon operation. This calls for seven free balloon flights of at least one hour duration for an accumulated flying time of approximately ten hours. One flight must be made at night and another must be a solo on which the student takes the balloon aloft himself after supervising the layout, rigging and inflation of the bag.

The other course in flight school concerns the blimp, the nonrigid airship, and consists of 200 flight hours of dual instruction and solo time. Here the student puts into practice a lot that he learned in ground school—operating the engines, maneuvering the big gas

(Continued to page 164)



↑ After a blimp has landed, a ground crew "walks" it to a portable mooring mast where it is shown being secured



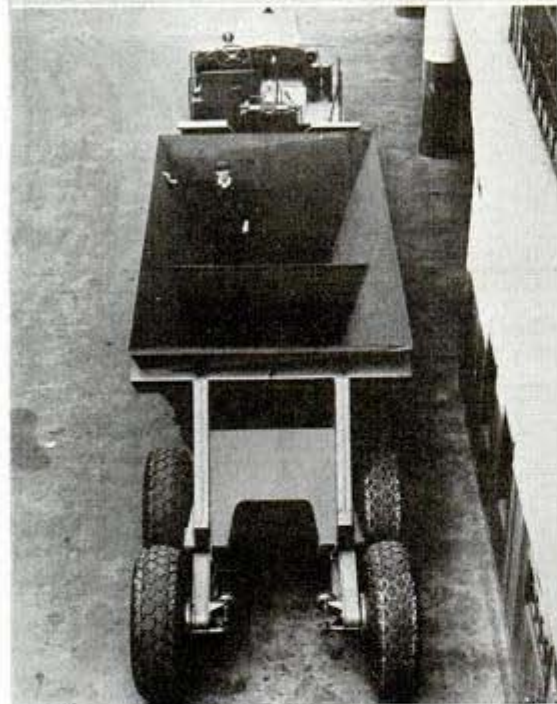
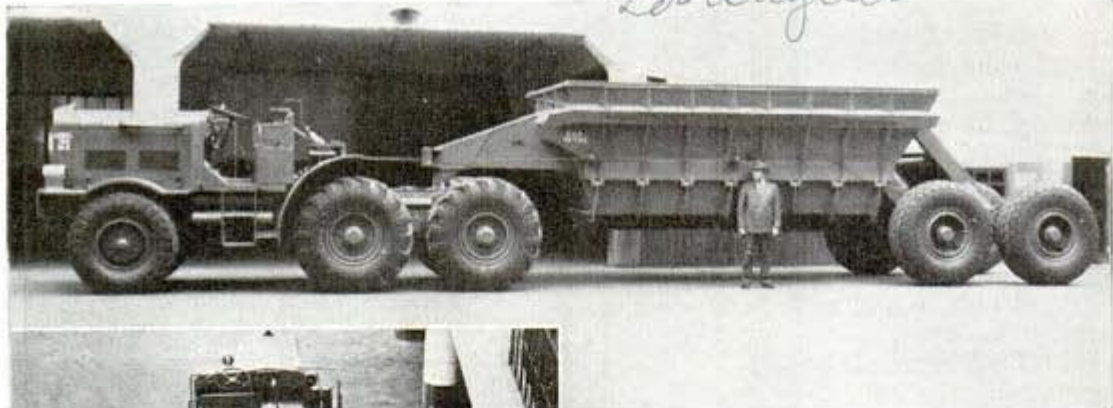
↑ Karl Fickes, director of Goodyear lighter-than-air school, explains the operation of a blimp's engine



← Ward T. Van Orman, famous balloonist, explaining layout principles of a free balloon to a class in Goodyear hangar. Free ballooning is taught students in the blimp school

*2925. Six Wheels, chie
1584 2. 20th by
Los Angeles*

"Goliath" of Earth Movers Carries 125 Tons



Overhead view of big truck shows the two bins from which 125-ton load of dirt can be dumped or spread

If you have a mountain to be moved, a ten-wheel truck and trailer built in Los Angeles is ready for the job. This giant among earth movers is capable of carrying 40 cubic yards of dirt weighing up to 125 tons. The trailer, standing nine feet four inches high, is loaded by power shovels and has two bins which can dump their loads instantaneously or spread a fine layer. The wheels have "walking beams" to make travel on rough terrain easy. The six-wheeled semitractor is powered by a 225-horsepower engine with fluid drive, which controls all operations including dumping. All ten wheels have air brakes to stop the 48-foot freighter—which weighs 25 tons empty—from its top speed of 35 miles an hour.

2970

Sliding Tool-Handle Hammers Tire Loose in Half Time

Del. Delivering sharp blows at the wedge-end of the tool, without the use of a hammer, a shock-type bead loosener removes tires in half the usual time. Sliding the handle

up and down, with the tool pressed against the proper spot, will free even rust-frozen tires without risk of damaging the tire and rim or injuring the hands, due to a rubber safety grip by which the handle is operated. The tool may be used without removing the wheel.



Sliding handle drives wedge between tire and rim

2959

Plane Spark Plug Failure Told By Indicator in Cockpit

Tests have been completed for the Navy by the U. S. Bureau of Standards on an instrument panel indicator which tells the airplane pilot at a glance as soon as any spark plug fails to function properly. If the plug is shown to be too hot, it is pretty certain that the surface of the insulator

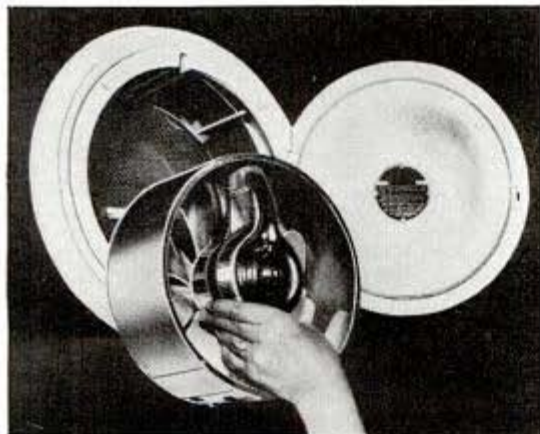
Chap

has been fouled. This can be corrected by reducing the richness of the fuel mixture. On the other hand, if a spark plug becomes too cold, it is because carbon has deposited on the insulator. Speeding up the engine will raise the temperature and burn off the carbon.

2867

Kitchen Ventilator Easy to Remove For Cleaning

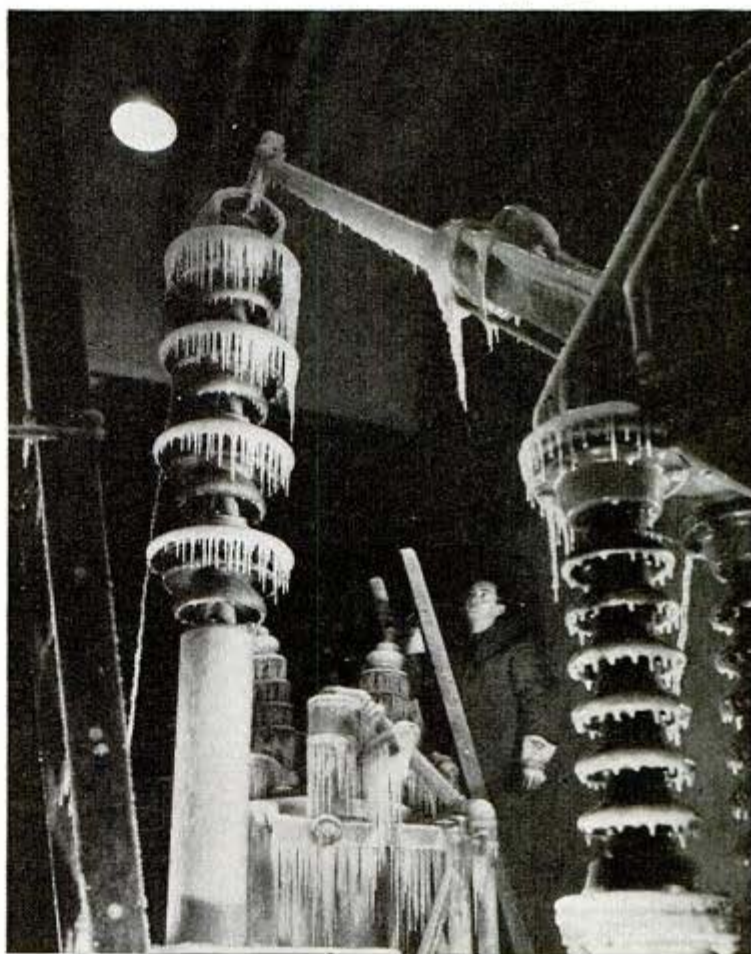
Work of cleaning a through-the-wall kitchen ventilating fan has been simplified by making the fan unit separate from the wall sleeve so it may be removed and inserted again without difficulty. The wall sleeve includes a vane type louver on the outside and a door on the inside which may be closed tightly when the fan is not in use. The fan insert is designed also to fit casings of panel assemblies installed in sliding windows, thin walls, plate glass, or any steel, veneer or fiberboard panel, so the ventilator may be moved from one to the other as desired. It may be placed in either exhaust or intake position.



Fan and motor of this ventilator are easily removed

2985

Igloo at 20 Degrees Below Zero Tests Power Line Equipment



Compressed-air circuit breaker, fringed in icicles, getting sub-zero test

Frigid, man-made weather, as low as 20 degrees below zero, exists in a new arctic laboratory where electrical apparatus designed for power lines is tested for its ability to withstand the rigors of winter. Into the "igloo" Westinghouse engineers bring such devices as compressed-air circuit breakers which must give dependable performance even when coated with ice and snow. Water sprayed on the apparatus forms a heavy covering of ice rivaling winter's severest efforts. Two "peep hole" windows permit engineers to watch from the outside while the circuit breaker is put through a series of operations. The "winter chamber" is a brick building 12 feet wide, 31 feet long and 24 feet high, and railroad tracks extend into the building for hauling heavy pieces of test equipment in and out. The huge cooling unit operates on the same principle as a household electric refrigerator.

2745 Cont. Allen Warren Elliott
3438 53rd Street
BATTLING the RED MONSTER



↑
Testing a carbon-dioxide extinguisher on blazing gasoline at the Underwriters Laboratories

Perhaps man will some day put out fires with sound waves. An auto horn will blow out a candle

The wise motorist always keeps a small extinguisher in his car to protect vehicle and garage
↓



AMERICA has learned a vital lesson, a lesson written in crackling red flames across the skylines of dozens of cities as warplanes dumped thousands of little incendiary bombs in swooping attacks that destroyed large areas.

The lesson is that a small fire can be crushed as easily as a worm. But a few minutes of growth will turn it into a raging red monster that can consume a terrible toll of property and perhaps life, before its appetite for destruction is satisfied.

The first Nazi aerial blitzkrieg took London by surprise, not by unloading huge, flaming bombs, but by scattering clusters of hundreds of little insignificant fellows, most of which could have been snuffed out by a pail of sand, or a few buckets of water. Unfortunately, the sand and water were not available in sufficient quantity and great sections



↑
First of all, send someone to the nearest fire alarm box. If a fire can't be quenched while small, it's a job for experts
American Mutual Liability Ins. Co.
One Park Ave N.Y.C.
of London were turned into blackened wastes.

The English learned the lesson in a hurry, and today bags of sand and buckets of water literally by the millions are ready throughout the city. Factories that had been used to produce weapons of offense have been quickly shifted into the production of a machine for defense—fire extinguishers.

And now, even in the United States where a fire starts in someone's home on an average of every 75 seconds, people are becoming fire conscious.

Fire departments are studying reports, diagrams and photographs showing how to snuff out a number of scattered blazes in a jiffy. Delegations of American fire experts have hastened to London to learn at first hand how to meet the new peril. Volunteer fire departments are being organized in many large cities, particularly along the Atlantic seaboard,



When fire attacks clothing, a blanket can be used very effectively to smother flames. It's dangerous to run when your clothes are aflame
Here's an industrial lifesaver, carbon dioxide pouring from the wide nozzle of his portable extinguisher as he battles the red monster



2745

37 West. St. Bloomfield, N.J.



Before slapping out a "drip" fire, back your car away. A broom is handy, an extinguisher safer
 Photo, Underwriters Laboratories



↑
 A crash truck on a Long Island flying field pours carbon-dioxide "snow" on a blazing airplane motor
 Photo, Walter Kidde & Co.

research engineers reduce the scientific truths of fire to the essential ABC's. America may never experience the attacks which swept a large part of London into ruin, but the Underwriters' Laboratories want you to learn how to meet the fire peril if it strikes at you.

If you were to ask one of the laboratory scientists what to do about a fire in your home, he would ask: "What kind of a fire?" For there are different types of fire just as there are different types of measles and the treatment varies accordingly. In fact, there are more kinds of fire than there are measles, but there are essentially only three principal groups and three principal methods of extinguishing them: separating the flames from the burning material, cooling the burning

If it can be done safely, yank the fuel container away from the oil stove in the event fire breaks out

with retired firemen serving as leaders. The great central educational organizations which spend large sums of money and engage hundreds of scientists and lecturers to teach about fire and fire hazards so you won't burn down your own home, are beginning to sense that America is interested in fire and this is the time to drive home a few simple facts about the red monster. One of the most important of these educational organizations, the Underwriters' Laboratories, with headquarters in Chicago, has had its



POPULAR MECHANICS

Material, энциклопедический словарь



↑ Flaming grease in a frying pan can be smothered quickly by clapping over it a close-fitting pot lid

Another way to quench burning grease (upper left) is to squirt carbon tetrachloride against side of pan

← Fine spray from hose cools and quickly kills oil fire around furnace; heavy stream would spread flames

Two and one-half gallon foam extinguisher putting out a gasoline fire in Underwriters Laboratories

material, and smothering the whole fire with rugs, blankets, etc.

A simple scientific experiment that you have conducted thousands of times will illustrate the separation method. Light a match. Blow hard on it. The flame seems to vanish into thin air. The fire is out.

Aviators use this method when their motors catch fire, either opening their throttles wide and sucking the flame into the motor before the flames generate more inflammable gas; or by going into a steep dive.

(Continued to page 178)



964

Weighing-In a Stratoliner Is Eight-Hour Task



← Tail of Stratoliner suspended from two sets of scales for weighing. Top of fin, in this position, is 30 ft. above floor

Checking weight shown by two sets of 15,000 pound scales under one of the huge wheels. Total weight was 31,200 pounds



Kansas City Ind

Graceful and easy to maneuver in the air, Stratoliners that fly the skyways become awkward and unwieldy when brought into the hangar to be weighed. The process of weighing one of the gigantic queens requires eight hours with a crew of 20 men. To prepare the ship for weighing it is stripped of all accessories, after which two sets of 15,000-pound scales, resembling the bathroom type, are placed under each wheel. Suspended from the hangar roof is another special set of two scales, to which the tail of the plane is attached and lifted until the craft is held in flying position. In the case illustrated the scales were tipped at 31,200 pounds. To strip and weigh the T.W.A. fleet of five Stratoliners required 800 hours of labor by the crew of 20. Uncle Sam requires such weighing of Stratoliners empty once each year because he insists, for the sake of safety, that the gross weight should never exceed 45,000 pounds, which includes all accessories, plus fuel and cargo, as well as the weight of passengers and crew. Periodical changes in equipment for the comfort and convenience of passengers tend to increase the air liner's weight, but keeping the weight down is a matter of concern to the airline

because increased poundage means less pay load capacity. Engineers keep records of the weight of every item added, as well as items removed, so they can give accurate information on the weight of a ship at any time. Calculated and actual weight in this case varied only a few pounds.

Brake Lining Cemented on Shoe Does Away With Rivets

Linings applied to brake shoes by cement instead of rivets offer advantages that are being investigated by auto manufacturers and service stations. With rivets absent

Weight and Balance Engineer, Dick Raymond

2497

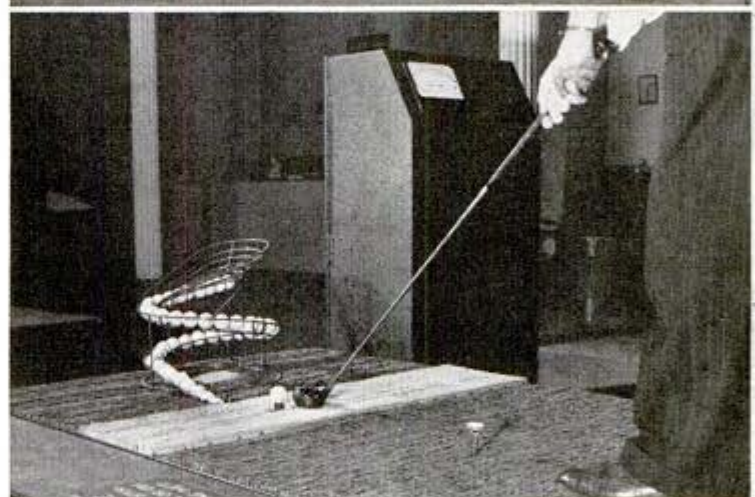
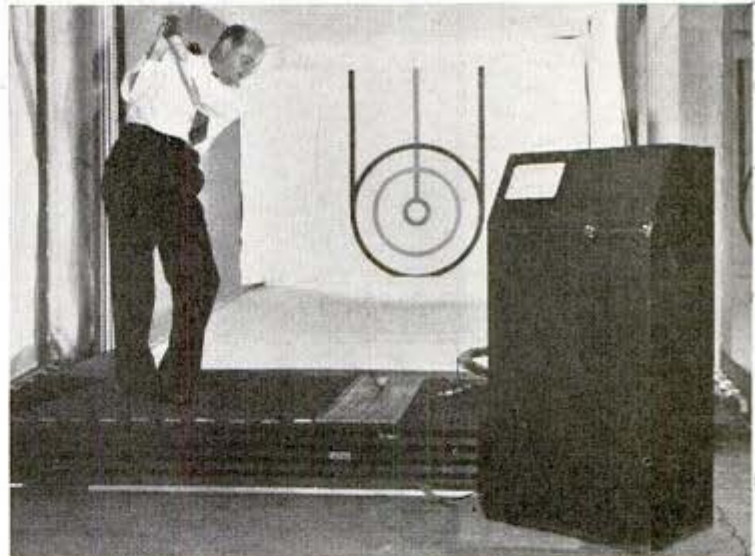
Auto Industries
Apr. 15, 1941

Asbestos Am... Co. 29801
 1 Huntington Blvd.

Electrical Indoor Golf Range Registers Length of Drive

1030 Adams St. Chicago, Ill. 497
 S.W. Tilden, Inc. 1906

It is possible to use the lining until nearly the full thickness has worn away. It is not necessary to drill the shoes or drill and countersink the lining. The lining is applied under pressure to insure an enduring bond over the entire area, which it is believed will eliminate one cause of squeaking brakes. One company has developed an asbestos-filled strip material, called Uni-Fuse, containing adhesive for use in applying its brake linings. Another offers brake linings in combination with specially prepared adhesive under the name Permafuse. These products are available for use on new brake shoes and for re-lining old ones.



Top, indicator stands at right; bottom, plunger in floor tees up ball

158 E. Randolph St. Chicago, Ill.
 (moved 5/23/42)

Saddle Bag Hangs Card Table On Wall

Saddle bags especially made to hold a card table not only permit hanging the table on the closet wall, out of the way, but protect it from scratching. The table can be slipped in and out of the bags without removing them from the hook. A pocket on the reverse side holds the table cover.

Pat # 2,213,151



Golfers may slam the ball in smashing drives or chip it with an iron for a limited shot on an electrical indoor driving range which indicates the length of drives from 20 to 300 yards. Behind the target, a heavy canvas, there are four microphones placed so they pick up sound waves from the impact of the ball. Through a special apparatus, the sound builds up electrical power which is shown on an indicator calibrated into yards. Greatest impulse is obtained at the center of the target, whereas a hit to either side would be picked up by only one or two "mikes" instead of all four. Stepping on a treadle automatically tees up a new ball and also resets the indicator to zero for the next shot.

Write to the firms listed in the Where-to-Buy-It index, page 4-A, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

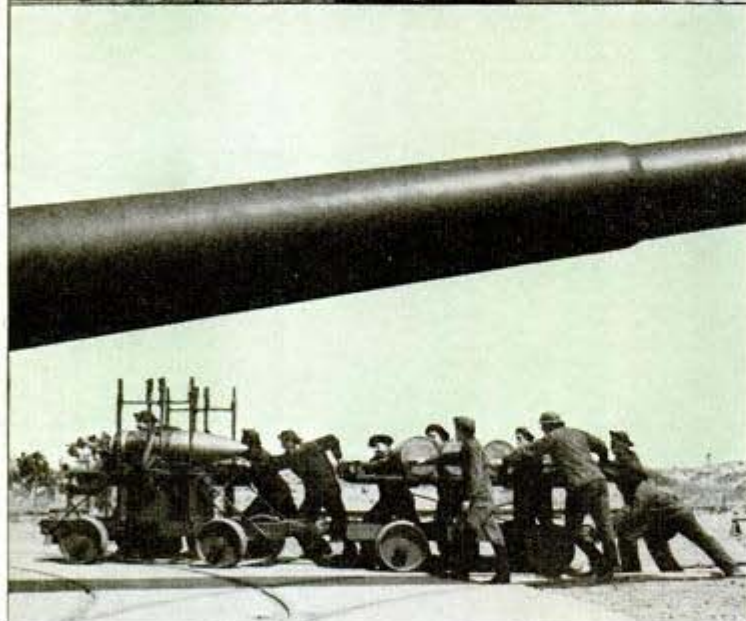
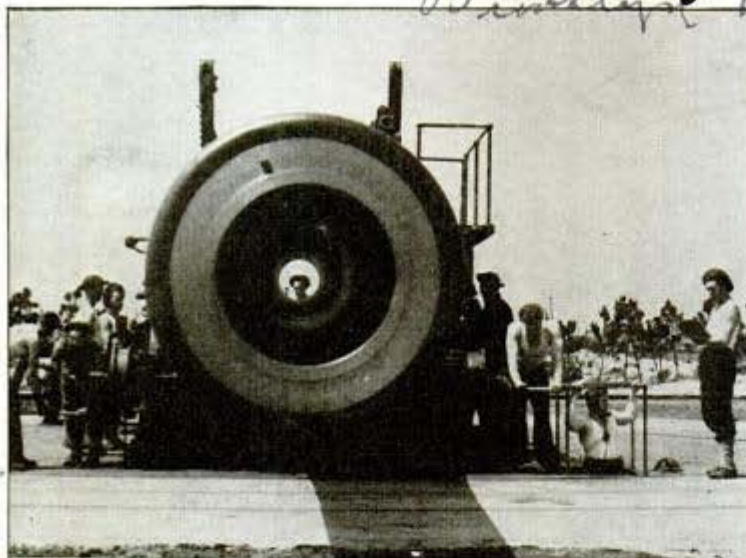
DECEMBER, 1941
 Irene J. Symonds,
 125 N. Lincoln, Hinsdale, Ill.

L 861

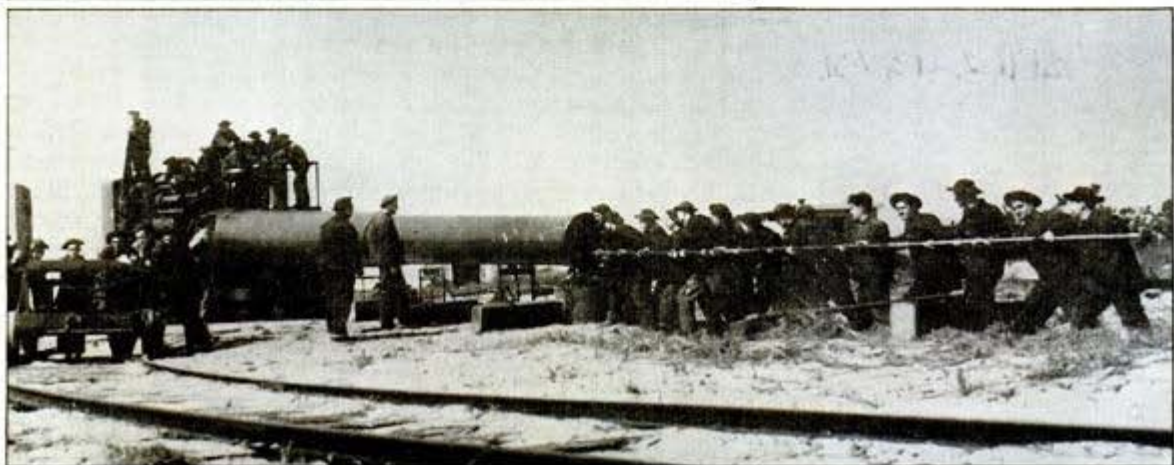
Cyber Rudy Arnold, Box 68
 Sheephead Bay Station

"BIG BERTHAS" of the COAST

Sheephead Bay



Meet the Big Berthas of Fort Tilden, New York. At the upper left you are looking right down the throat of one of these 16-inch giants that stand watch along our coast line. Able to fling a 2,000-pound shell against a target 15 to 25 miles at sea, they must be handled by a team of artillerymen trained to perfect coordination. At upper right, hand raised to signal "all ready," is the azimuth setter who "points" the gun electrically; his partner records data received from the battery commander. At left, a team of the 245th Coast Artillery rolls up a shell; dummy ammunition and powder—it takes 700 to 800 pounds of powder—are used in preliminary training. Below, the gun is cleaned with burlap-tipped rammer stave after firing



2861

ARTILLERY



At right, telephone operator gets signal from battery commander's station, and gun commander shouts the order "Fire!" and whips his arm down

Red flag at observation post warns of firing practice as safety detail watches hits on target towed by tug, which is in contact by two-way radio



The big gun is trained on target electrically, but its crew learns the manual procedure to be prepared in event of mechanical failure. One man handles the elevation, another traverse, upon orders from commander



Pressing this lever fires the Big Bertha, and a one-ton shell hurtles from 50-foot barrel. In the final practice, shells were fired from two guns at 90-second intervals



2968

from News Bureau
es & Co

Germany Muller Co
Merchandise Dept. / Chicago

'Cloud-Top' Desk for Home Is Easy to Move



Desk has large sweeping top and is easy to move

With curved lines that harmonize readily with most interior decorative schemes, and having a large top to accommodate numerous papers and writing material, a cloud-shaped desk now available is particularly suitable for home use. The heavy portion of the desk at the left, where drawers are located, is equipped with rollers, whereas the righthand section is supported by a single prop. In moving the desk it is lifted at the light end and pivoted on the rollers. The cloud-shaped top fits the body comfortably and there are no obstacles or sharp corners beneath to bump or rub against. A built-in lamp is finished in the same style as the desk.

Prof of Psychology
at Chicago Univ
2789

Blind Use Hearing as 'Sixth Sense' To Avoid Striking Obstacles

What has been called a "sixth sense" possessed by the blind, that enables them to avoid obstacles in their paths, was shown to be the sense of hearing in tests conducted by Dr. Karl M. Dallenbach of Cornell University. Blind subjects as well as blindfolded subjects with sight aided in the experiments. They walked toward a movable wall and stopped as soon as they sensed its presence, and then moved for-

ward as far as possible without touching it. After many attempts, the sighted subjects equalled the skill of the blind in noting the presence of the wall. Some claimed they could detect the wall only when sounds were present, while others said they "felt" the wall. However, when hearing was stopped by plugging the ears, each subject ran into the wall every time, but they were able again to avoid it upon removal of the plugs. To test the idea that pressure sensations may be used in some cases, the face of each was covered by a veil of heavy felt, leaving the ears unstopped. This had little effect on the "obstacle sense," since the subjects as a group were able to perceive the wall almost as accurately as before.

2913

Bit Wrenches in a Screwdriver Work at Double Speed

Bit wrenches that fit spiral screwdrivers will drive hollow-head cap and set screws at twice the speed possible by ordinary methods. The bits are available in seven sizes. Especially useful for starting screws in difficult places, they require only one or two strokes of the spiral screwdriver to make them fast.



Bit, shown at right, is driven by spiral screwdriver

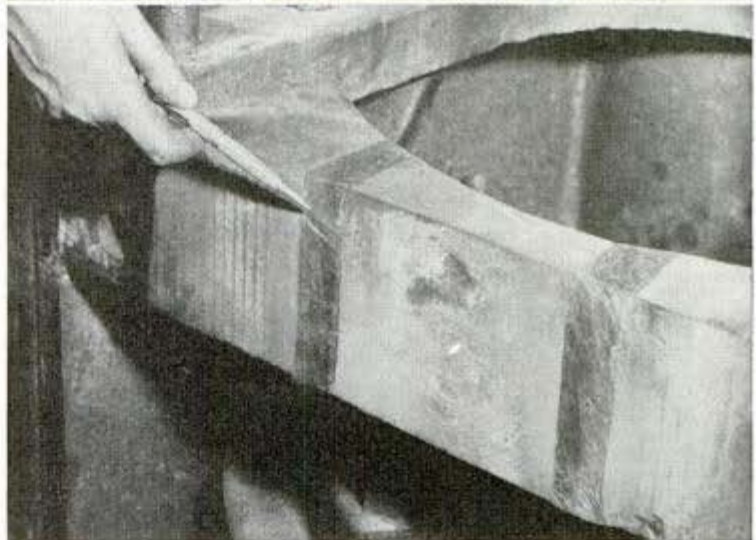
POPULAR MECHANICS

Essex Tool Co
Brookford, Ill

2960 Cmt. Allen Warren Elliott
343 E. 33rd New York

U. S. Welds Foreign Ships Damaged by Crews

Welding processes developed since World War I are speeding the restoration of Axis-owned ships damaged by their crews in American ports before the United States seized them last April. Repairs which would have required three or four months with cast-iron welding rods can now be completed within a period of several weeks with bronze welding rods, a sort of solder, applied at much lower temperatures. This also removes the possibility of causing new injury to cylinder walls and other vital parts that might result under intense heat. The work can be done aboard the vessels without removing the huge engine castings. Where pieces had been broken off and disposed of, "patches" were welded into place. Excess metal is ground off to make a smooth finish. It is believed the mended sections will stand up under use as well as the original.



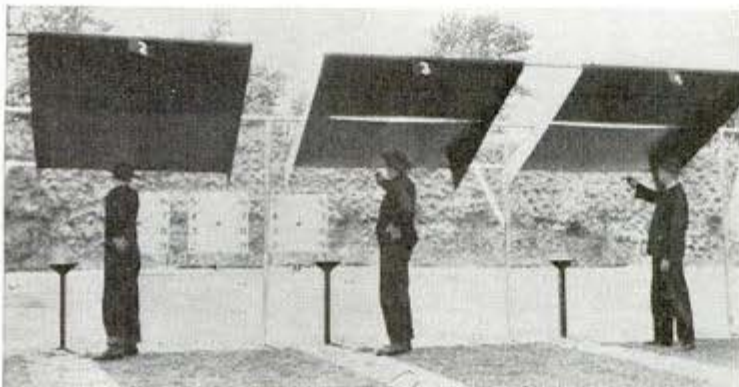
Photos courtesy The Linde Air Products Co.
Top, welding U-shaped "patch" to replace piece smashed from a cylinder wall by ship's crew. Bottom, view of section repaired by bronze weld

30 E. 42nd St. New York City

Steel Shields for Army Target Range Deflect High Shots

Shots fired so high they would miss the targets are prevented from flying beyond

the limits of the reservation at Fort Monmouth, Vt., by overhead shields made of steel. The shields, designed by Lt. Claude V. Wadsworth, Signal Corps range officer, are placed so that soldiers fire from beneath them. Any shot that would be more than a foot above the target is deflected by striking the shield and the bullet falls to the ground several feet in front of the marksman. The shields safeguard people and animals that may venture near.

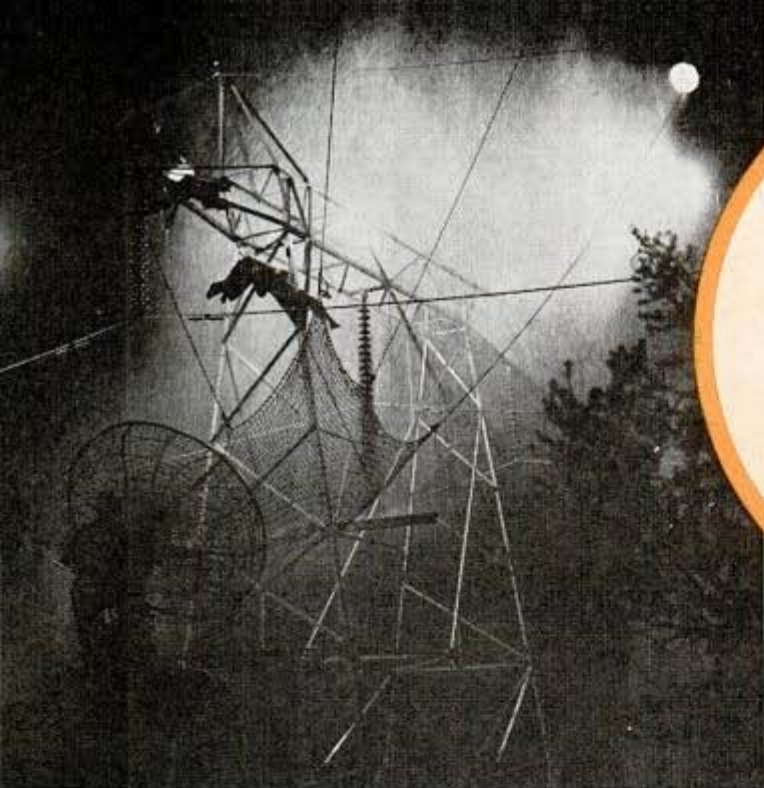


Shields stop flight of bullets aimed more than a foot above the target

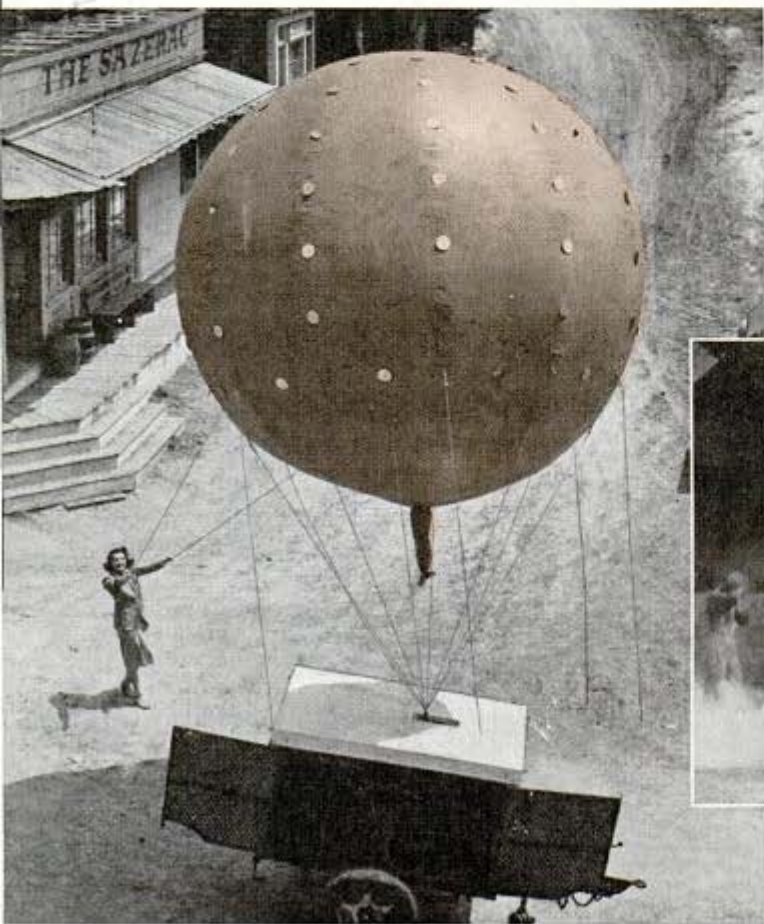
Fort Monmouth 65

2913

MOVIES *that* MIMIC LIFE



Wind, lightning and rain machines in scene on power-line tower
Balloon warns noisy planes away while sound track is recorded



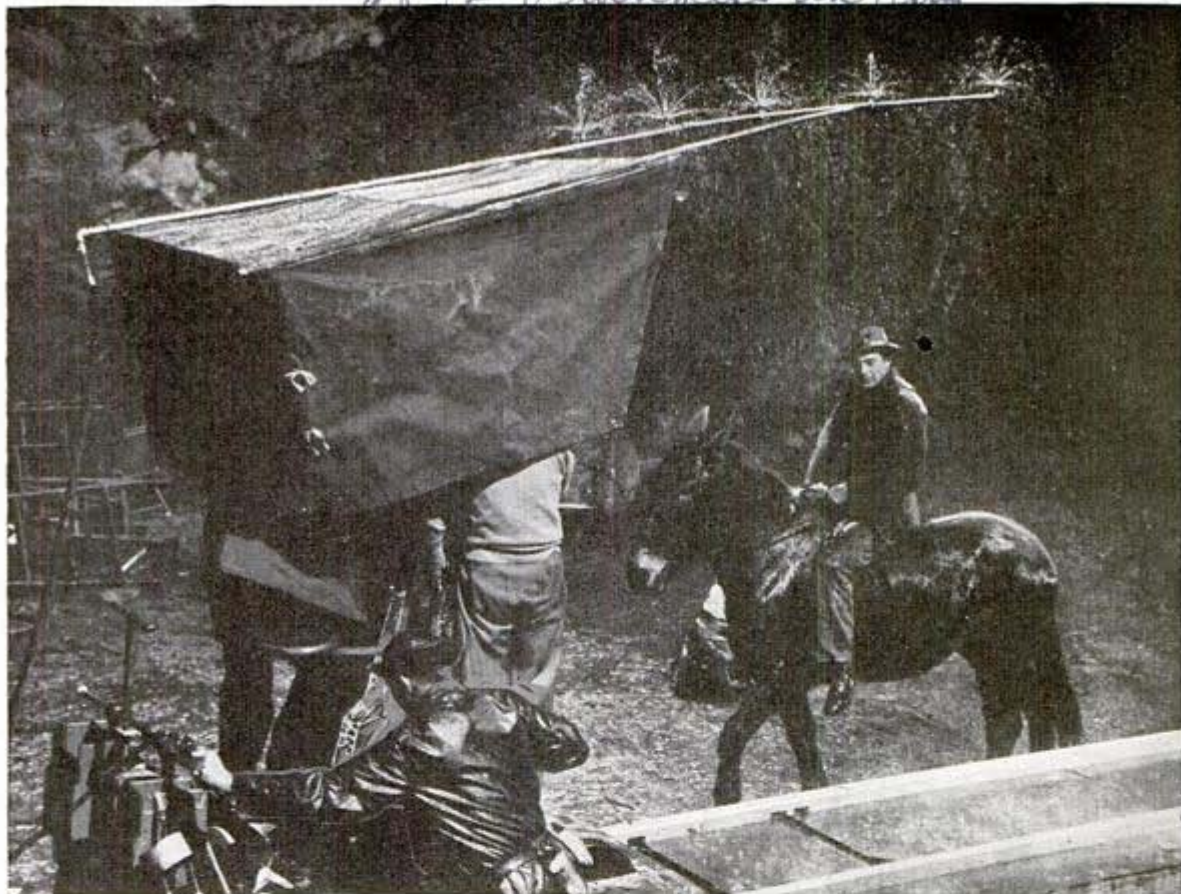
MOTION pictures are approaching the flesh-and-blood realism of living actors. Color film is contributing to the effect, stereophonic sound will heighten the illusion, and if and when the third dimensional screen is perfected the reproduction of life will be nearly complete.

The severest critics of motion pictures are the men who make them. Technical experts of the studios, banded together in the research council of the Academy of Motion Picture Arts and Sciences, are studying new ways to make better pictures.



† Dramatic scene in movie—combatting flames after an airplane crash

Cont. Thomas & Johnson, Jr. / Dec 12 1941
3872 Franklin Ave. / Los Angeles



Traveling "rainstorm" with canvas shelter to protect the camera
Mounting a movie camera on landing gear of plane for air shots

Sound recording and reproduction are increasing in fidelity, the latest step ahead being the adoption by Paramount and other studios of fine grain positive film stock. Formerly much of the clarity and naturalness of sound, as recorded on the fine grain negative film, was lost in transferring the sound track to release prints. With the new fine grain release prints the original sounds are reproduced much more naturally and at the same time the characteristic and bothersome surface hiss is vanquished. The fine grain film also produces a better visual image on the screen, giving more vividness to the picture and preventing the streakiness that sometimes appeared. One result is that more front seats are now usable in the theaters. Another is that a return



Ref: E. W. Hansen Sound Engineers
20th Century Fox Film Corp. Hollywood Hill
Studio, Los Angeles

2713



Arranging lights for filming miniature scene in stop motion

grain film. Improved speakers will have to be installed before all the benefits of the new sound tracks can be given the audiences.

Stereophonic or third dimensional sound will be the next development. An actor's voice should follow him as he moves across the scene or away from the camera instead of emanating as it now does from a fixed sound source. The "fantasound" equipment used in Disney's "Fantasia" has this three-dimensional quality to a remarkable degree and as many as 90 loud speakers must be installed in a theater to give the full effect. This is too expensive for ordinary productions. Members of the research council are working on a stereophonic sound system that employs three microphones, one to the left and one to the right of the camera, and one in the background. Each microphone records the sounds it

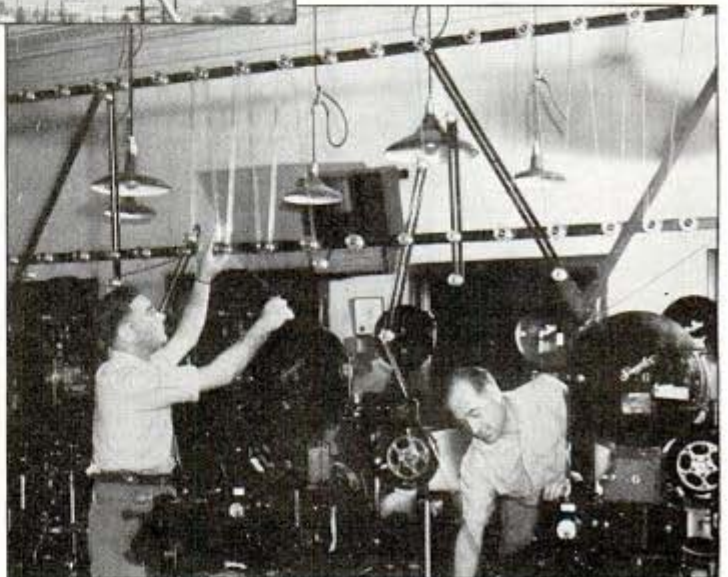


↑ Gun-type microphone screens out all sound except that from direction in which it is pointed

Sound machines by means of which → half a dozen or more sound tracks may be combined into one

to the oversize "grandeur" screen that was tried about 1930, using double-sized film, now becomes possible with fine grain film of the standard 35 mm. size.

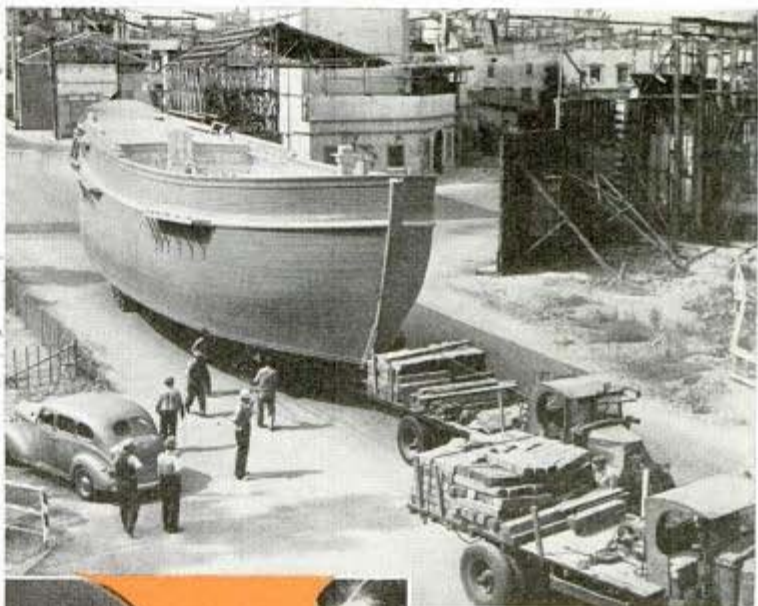
The sound reproduction equipment of many small theaters, the best that could be obtained at the time it was installed, is too crude to translate fully the added qualities and naturalness being obtained from sound tracks on fine



picks up on a separate sound track and each sound track is reproduced in the theater through a separate amplifying system and speaker. The triple track on the film takes up no more room than the present single sound track, and the arrangement of the speakers in the theater is such that an actor's voice seems to follow him as he moves about on the screen.

The studios are looking forward to the time when they will use color for all pictures. High costs, one present drawback, may be reduced with the development of a color film that uses one film strip like Kodachrome instead of the present system in which three separate color films are superimposed for projection. This would meet the objection that lack of sharp detail and outline sometimes occurs when the three strips of a color film are not in perfect register.

(Continued to page 166)



↑ Hauling movie ship on studio street at 20th Century Fox



← Engineer testing contact points on newly perfected sound projector that handles special film on which are three sound tracks and one control track which regulates frequency and amplification and controls the speakers from which the sound will come in theater

Warner Bros. crew films an airplane squadron in action



1933

Tennis Trainer Returns Ball Like an Opponent

Clark

(not on market)



Small "tossler" wheel at end of conduit picks up the ball and bounces it to "stroker" wheel, which delivers it to the player

Notice the snare nets which capture balls hit by the player and let them drop into a trough, to be fed back to player



And Louis F. Clark, 402 Anderson Ave

Clara W. Hummel

Small "tossler" wheel at end of conduit picks up the ball and bounces it to "stroker" wheel, which delivers it to the player. Notice the snare nets which capture balls hit by the player and let them drop into a trough, to be fed back to player.

Curly

For a tennis partner and trainer, a Pasadena man has invented a mechanical opponent that strokes the ball back at net height with a topspin, just as in actual play. The player bangs balls into a two-piece backstop made of fish netting snared in front to trap the ball and keep it from bouncing back to the court. Then the ball drops through the snares to be caught in a trough and carried by a chain conveyor to a conduit which delivers the ball to a small revolving wheel called the "tossler." This administers the bounce a ball would normally take from the

ground, and tosses the ball into a "stroker" wheel, which strokes the ball back to the player. Tossler and stroker can be regulated to return balls at various speeds and directions. By using several balls, practice can be made continuous with the stroker flinging out a ball every four seconds.

Explosive Force of Big Meteor Enough to Destroy City

Scientific studies of a 500-ton meteor that fell near Pittsburgh, Pa., in the evening of June 24, 1938, reveal that its explosive energy was sufficient to have caused a catastrophe, perhaps destruction of that entire city. This conclusion is given by James R. Randolph, Dr. F. W. Preston and Dr. E. P. Henderson in a paper published by Smithsonian Institution. From testimony of many who observed the celestial visitor, it is computed to have been traveling at 45,000 feet a second in the upper air and

about 1,000 feet a second as it neared the earth. At about 12 miles above the earth the meteor broke into two parts, according to observers. Applying complex mathematical formulas, it is determined that one fragment weighed about 109 tons and the other 410 tons. The farther the object traveled before hitting the earth the more of its substance was burned away by the intense heat created in its contact with the air. Since neither of the two large fragments was found, it is probable that they

July 1, 1941

2820

70 Washington, D.C.

were completely burned up before reaching the earth. However, states Mr. Randolph, if the big meteorite had come straight down instead of at the long slant of a 31-degree angle, it could have reached the earth with a lot of its structure still intact. In that event, its mass would have struck with an explosive energy estimated as equal to that of 10,000 tons of TNT. There would have been few survivors if the meteorite had struck Pittsburgh, the scientists agree.

2847
**Juvenile Furniture "Grows Up"
 As Child Gets Older**

Some of the problems of furnishing a child's room can be solved with a new line of juvenile pieces that "grow up" with the child. Besides, they will withstand abuse, since the surface, consisting of a special plastic on which the finish is photographed in linen, is scratchproof, dentproof, waterproof and fireproof except under extreme conditions. The furniture comes in pairs so it is the right height when the child is



Pieces may be used singly or assembled as shown

very small. As he grows up, the pieces are placed one atop the other, making a single unit just as tall as his dad's furniture. In the combination shown here, the bottom piece is a toy and clothes chest; the top a bookcase with a special drawer for handkerchiefs, gloves and so on.

2903
**One-Man Fire Hose Holder
 Is Anchored to Soil**



Fireman stands on holder to focus high-pressure hose

One fireman can control a high-pressure hose when the nozzle is anchored to the ground by a new holder. The portable holder weighs 17 pounds. The fireman stands on its base, which has pointed legs that are driven into the soil. The hose can be swung through a complete circle while in the holder.

2928
**Plastic Nest for Knitting Yarn
 Keeps It Clean and Untangled**

Knitting yarn is kept clean and free from snarling in a handy "nest" made of plastic offered in red, white and blue or other color combinations. The holder is built like a cage, with a flat bottom.



Narrow plastic "hoops" that curve around the ball of yarn are held in position by ribbon strung through slits. These hoops fold flat when not in use.

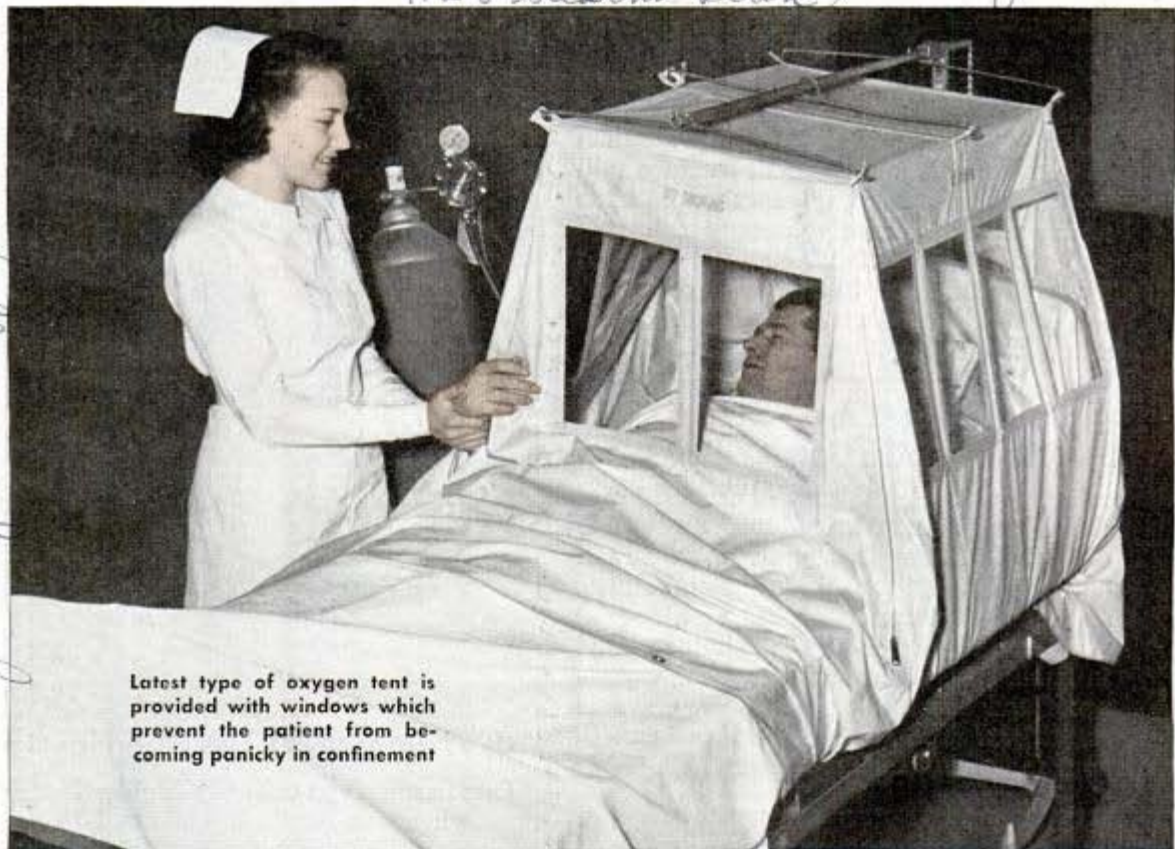
Write to the firms listed in the Where-to-Buy-It index, page 4-A, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

*Lullabye Furniture Co.
 Stevens Point, Wis.*

*Modern Spectator, Inc.
 241 Boulevard, N. E. Atlanta, Ga.*

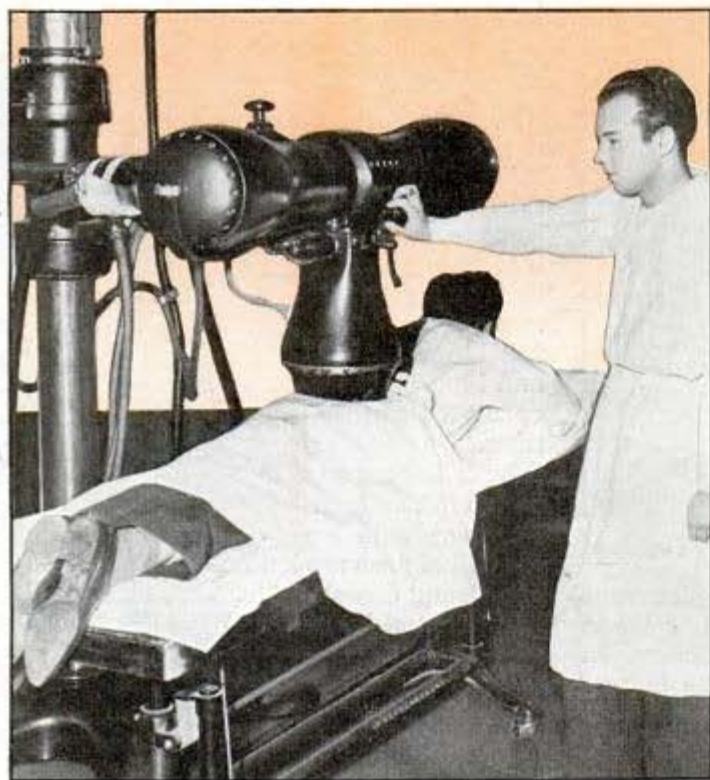
American Fire Hose Corp.

any surgical supply house



Latest type of oxygen tent is provided with windows which prevent the patient from becoming panicky in confinement

GUARDING *the* HEALTH of the

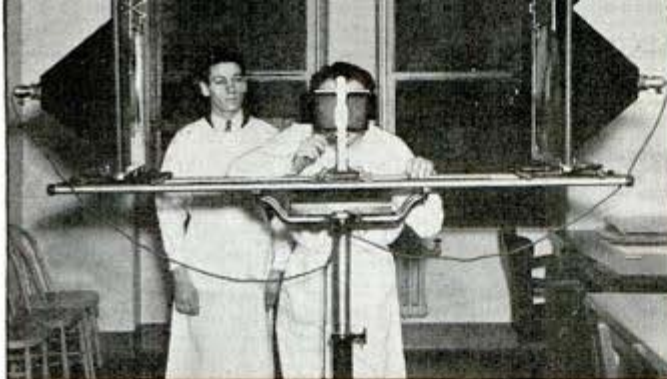


IN TIME of war, doctors have two enormous tasks thrust upon them, and are unable to meet the challenge by readily training new personnel, as do other services and industries.

These tasks are to keep the civil population, especially those working in essential industries, in better health than ever—for no nation is easier to defeat than a sick nation; and to keep the army in the finest physical condition, and care efficiently for battlefield wounds and ailments.

The American doctors are far more ready to meet this challenge now than in 1917, for two reasons. They have a nation-wide organization,

Using a therapeutic X-ray machine to treat the dreaded gas gangrene



Studying X-ray plates with stereoptical viewer

Velometer tests a tank of acid for surface ventilation as air is forced horizontally across surface



DEFENSE ARMY

the American Association of Industrial Physicians and Surgeons, whose sole function is to maintain the health of industrial workers; and they have made innumerable strides since the last war in controlling many once fatal injuries and diseases.

In the last war, the death rate for epidemics and illnesses was enormous. Even if the normal annual toll from such causes is deducted from the total, we find that more American soldiers and civilians died from illness, brought on at least in part by chaotic conditions, than were killed and wounded in action. American doctors are now organizing to prevent a repetition. The government has formed the Division of Industrial Hygiene of the U. S. Public Health Service to track down possible epidemics and industrial illnesses before they start. Thirty-one states have branch offices, and many large cities have sub-units, under the direction of a physician, and staffed by

If the patient's only affliction is a paralyzed diaphragm, he can actually walk about with this new type portable iron lung, carrying its light, battery-operated motor

DECEMBER, 1941

5407 Inchequin
Chicago

make not known
used in San
Francisco here Sept.
73



Sighting the stereoptical X-ray viewer, which offers third-dimension effect. One of the two X-ray plates is at upper left

industrial hygiene engineers. Their duty is to find situations in industry where hazards to health are created, especially those industries which play important parts in war preparations. Industrial ailments fall into three general classifications, and science has presented the medical profession with

New baking machines speed manufacture of foot cast



precision machines, not in existence during the last war, which tell exactly where dangers lurk.

First of these classifications is dermatitis — skin inflammations, often followed by infections, which may be as serious as mustard gas burns, and just as crippling to military efficiency. It results from the improper handling of lacquers, solvents, acids, alkalis, distillates — a general group of skin irritants. Sprays of these substances should usually be applied in a properly ventilated booth, with the operator standing outside. Often protective clothing, such as gloves, goggles, and coveralls are necessary. Tanks should have a specially constructed surface ventilation, which draws fumes away. Inspection is made by a device called a velometer, which reveals whether ventilation is adequate.

Another leading cause of industrial illness is dust. This is subclassified into toxic dusts, including lead, mercury, etc., and irritant dusts, including silica, all types of abrasives, and asbestos, which causes asbestosis. If these are allowed to leak into work rooms, respiratory and organic poisonings and irritations result. Production must be so arranged that the toxics and irritants

Gas indicator tests toxic fumes from a paint spray



L 562

L 1001

are blocked off from the workers, or otherwise carried away. Some are trapped or carried off by ventilation, others can be controlled by masks, still others by wetting down.

Careful dust counts, taken with devices called impingers, will always reveal the presence of these substances in danger zones. A measured sample of air is taken, and the volume of dust is captured in solution. Analysis reveals the kind of dust, and the amount of it in breathable air. If it is excessive, correction of the working conditions must be made as recommended by the industrial hygiene engineers.

Third general classification of industrial illness is the toxic solvent, including such substances as benzol, toluol, chlorinated compounds, etc. These are as lethal as military gases, more so, due to their use in enclosed places. Control is effected by methods similar to dust controls—exhaust ventilation, plus periodic check-ups with combustible gas indicators (though the gas in question is not always combustible).

War would find the soldiers themselves receiving the finest medical care in history. Countless inventions and great medical progress will take much terror out of battlefield wounds and illnesses contracted through hard living. Today's knowledge and technique might have done much for the 14,000 who died of wounds in the last war, the 23,000 who died of sickness, and the countless who suffered physical disability.

Gas, for instance, was the supreme terror of the World War. Masks have reduced its deadliness, but it is still bad enough. However, doctors are now able to give prompt, efficient treatment which will save the lives and health of many gas casualties. Principal tool for this job is a new iron lung, that can readily be carried anywhere. Since paralysis of the diaphragm caused many a gas death,

(Continued to page 192)

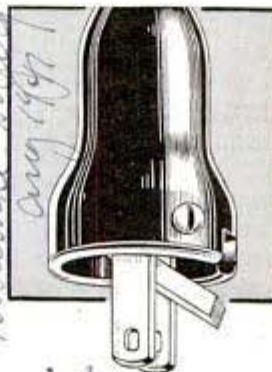
"Fire Swatter" Helps Save Crops In Air Raids on Britain



Long-handled swatter beats out crop fire from a safe distance

Guarding Britain's fields in harvest time against fires started by air raiders is the duty of every person in the harvest areas. The most effective extinguisher used for the crop fires is a beater resembling a tennis racket mounted on a long handle. Large supplies of these, along with other fire fighting equipment, are distributed about farms, ready for smothering flames caused by incendiary bombs.

Circuit Breaker in Plug Guards Tools

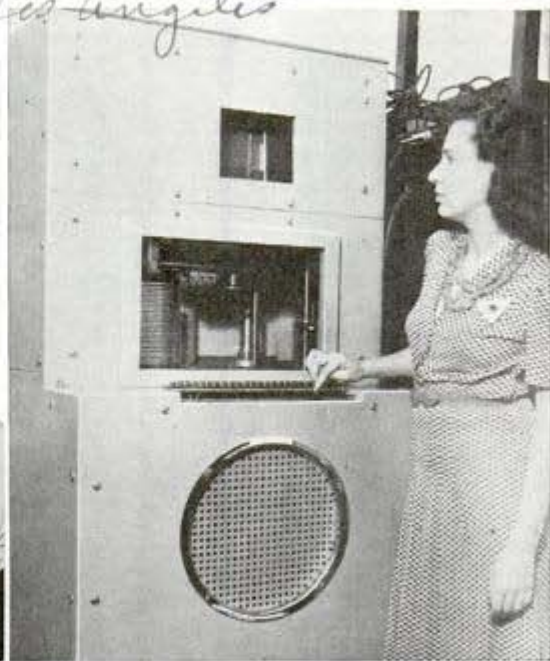


Protecting electrical power tools, appliances and small motor equipment, a circuit breaker plug automatically shuts off the flow of current when an overload threatens to burn out the motor. The plug is reset easily after each break by flipping up and lowering the lever located between the contact prongs.

Handwritten notes:
L 940
Natural safety
Aug 1941
Hoxar Hepies due
Chas N. La Belle Chicago

2927 Cont. Thomas E. Stinson, Jr.
3872 Franklin Ave
Los Angeles

Motion Pictures Made on Phonograph Records



Upper left, scanner transforms movie image into impulses for recording on vision-and-sound disk, shown below. Right, coin machine playing sound movie disk

movie images are transformed into vibrations that are then recorded on a disk, just as sound vibrations are recorded; the record then may be played back through a television-type circuit, using a high-frequency pickup and a cathode ray tube to reproduce the original film. The transmitted image can be enlarged to an 18-by-24-inch screen. To prevent flicker, several parts of each frame are scanned simultaneously. At the present stage of development, a ten-inch disk at 100 revolutions per minute produces a fraction above a minute of screen vision. A sound track on the same disk is synchronized to produce the picture's sound accompaniment. Backers of the "radio vision" machines look forward to ultimate full theater projection from the movie records, and similar projection of home movies and films in coin-operated machines.

Translating light into sound and sound into electrical waves, engineers have succeeded in transmitting motion pictures across the continent by radio or land wires. Still experimental, the method was developed for the rapid transmission of news reels, for television wire networks and for identification of suspected criminals. Home movies reproduced from ordinary phonograph records instead of film are one offshoot of the technique. In transcontinental transmission tests, it took about a minute to send two feet of motion picture frames, with practically no loss of definition. The

2738

U. S. to Grow "Imported" Crops Cut Off by War Blockade

Preparing to pinch-hit for France, Italy, the Balkans, Japan and other countries, growers in Florida are experimenting with foreign import crops which have been interrupted by the war. With the coopera-

Radio Vision Corporation of America
8272 Melrose Ave
Los Angeles

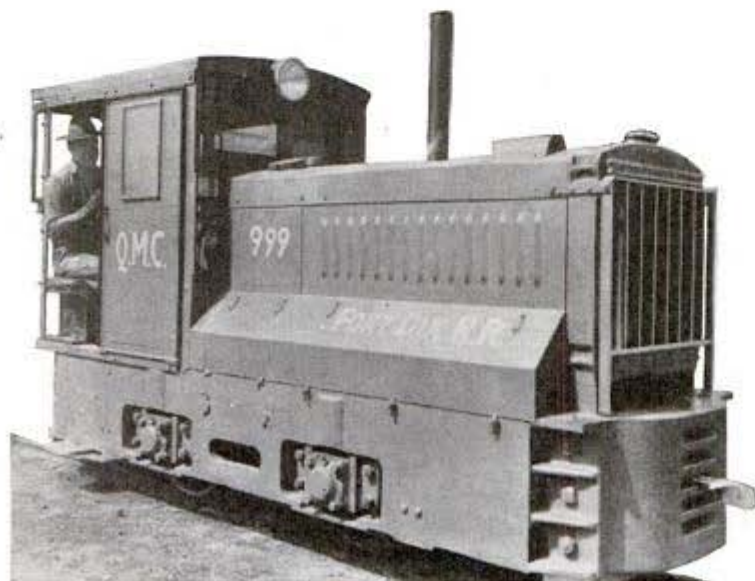
Diene Service
6/9/41

tion of the State Experiment Station at Gainesville, Fla.; the Everglades area is trying to raise French endive, formerly imported from France and Belgium. Several other Florida growers are investigating the special small varieties of tomatoes used in making tomato paste, formerly brought from Italy. Then there is sage for seasoning, from Greece; mustard and turnip seed, from Japan; and teasel burrs, from France, used in American mills for combing wool. All these, it is believed, can be grown in Florida. Paprika, once imported from Balkan countries, already is grown in Louisiana, South Carolina and California, and one seed grower in Florida is raising 100 acres of spinach seed which formerly came from Holland and Denmark.

2805

Army "Mosquito" Locomotives Are Driven Like an Auto

Twenty-ton locomotives that are driven like an automobile are buzzing along railroads at army camps and posts around the country, hauling soldiers and freight and fuel for army planes. These midget "auto-locomotives" are gasoline-powered, with a clutch drive. They can haul trains of 10 to 15 regulation freight cars at average speeds of 15 miles an hour. One of these "mosquito" engines runs on a narrow gauge track at Fort Dix, N. J., where it hauls soldiers to and from the rifle range. One use of this fleet is to move gasoline tank cars from the main line to the storage point.



This gasoline-powered "mosquito" locomotive serves Fort Dix rifle range

DECEMBER, 1941

Com. Randolph Robert
Apr. 2, 4630 New Hampshire Ave NW
Washington D.C.

'Bubble' Rubber Life Jacket Is Twice as Light as Cork



Cellular rubber life jacket is full of gas bubbles

Rubber that is twice as light as cork is used in a new lifesaving jacket adopted by the U. S. Navy. Sponge rubber, which it resembles, is formed of cells that are largely intercommunicating; but the cellular rubber of the life jacket is made of cells walled off from each other, each cell containing a tiny bubble of gas. Ten times as resistant to water as cork or balsa, it could never absorb enough water to cause it to sink. Experiments are being made with this cellular rubber in pontoon bridges and life rafts. It is already being used in selfsealing gasoline tanks for airplanes, and as a heat insulator under the decks of "mosquito" torpedo boats.

Write to the firms listed in the Where-to-Buy-It index, page 4-A, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

United States Rubber Co. Rochester
Center New York

2832 Martin Gardner
6023 W. Oaklawn Ave



Chicago
**TRY THESE
ON YOUR
FRIENDS**

On this and the page opposite are some simple tricks that will take care of that lull in the after-dinner conversation. Below, in circle, is one step in a trick that works automatically. Eight objects found at any dinner table, are placed in front of performer. Someone is asked to think of any object. Performer begins tapping the objects with a knife and the person is to spell silently the name of the chosen object, a letter for each tap. When spelling is completed, the person says "stop." Curiously the object touched by the knife at the word "stop" is object thought of. Here is the secret: performer taps any two objects first, then continues tapping in this order—1, cup; 2, fork; 3, spoon; 4, saucer; 5, ash tray; 6, match-box; 7, cigarette; 8, salt shaker

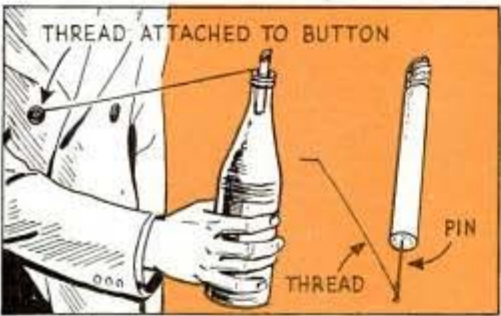
↓



Left, top to bottom, is vanishing knife trick. Napkin is draped over left arm; knife is held in right hand (top). When napkin is shaken open, knife has vanished (center). Secret is revealed in bottom photo; when knife is hidden behind napkin, it is pushed up the left coat sleeve of performer



† Burning cigarette, placed in neck of bottle, is caused to rise mysteriously at performer's command. Then the cigarette and the bottle are passed around the table for examination by the guests



†

Secret of bewitched cigarette is shown in this sketch. A length of black thread, with a pin at one end, is wound around coat button and pin is stuck on inside of coat until ready for trick. When no one is looking, pin is pushed into end of cigarette, which then is dropped into neck of bottle. Bottle is moved forward until thread supports the cigarette, then moving bottle back and forth causes cigarette to rise and fall. Trick should be performed only under dim lights. When cigarette and bottle are handed around table, pin is pulled out to drop in your lap

Right, top to bottom, an easy match trick. Two matches are lighted, then one is held aside in vertical position while other in horizontal position is blown out. Unlighted end of burning match is touched to head of smoking match (center) and horizontal match relights (bottom)



meeting + C. Ave. Detroit 427 Broadway N. much
L 902

Rifle Shoots Uprooted Weed Into Gardener's Baskets



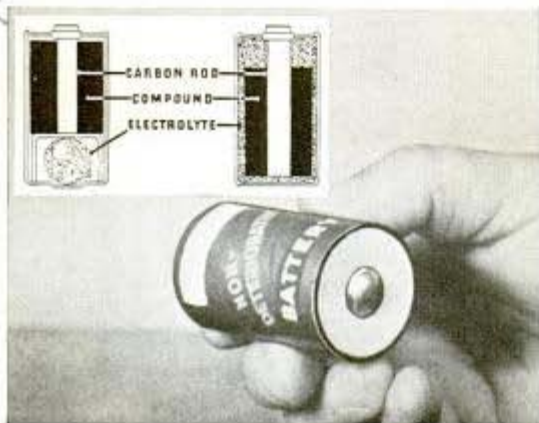
Uprooted weed is shot into gardener's basket when trigger in handle is pressed to release the spring

There's no stooping necessary with a "rifle" weeder that grasps the weed with its six pointed prongs and then shoots it right into the gardener's basket. A trigger in the handle releases a strong spring that will shoot the weed eight feet or more.

L 904

Nondeteriorating Dry Battery Dormant Till Cell Is Broken

Its electrolyte segregated in a glass cell at the base, a flashlight battery just introduced will not deteriorate during storage. Thus it is always fresh when sold, and the



Electrolyte of new battery is segregated in the base

Eastman Kodak Co Rochester NY
L 886

buyer simply taps the blister at the bottom of the battery to break the glass and release the electrolyte. The battery is energized within a few seconds.

Precision Camera for Roll Film Adapts for Cut Film or Plate

Built with the precision of the fine miniature cameras but producing a picture 2¼ by 3¼ inches in size, the newest camera of the Kodak line takes ordinary "620" roll film or, with its accessory back, is adaptable for film packs, cut film or plates. View finder and range finder are combined in a compact unit on top, or a ground glass viewer can be installed on the back. The view finder is designed to give parallax correction automatically. There is also a special arrangement for focusing when infrared film is used, since infrared light focuses at a different plane from other light rays. The range finder measures the distance accurately, then correction is made by



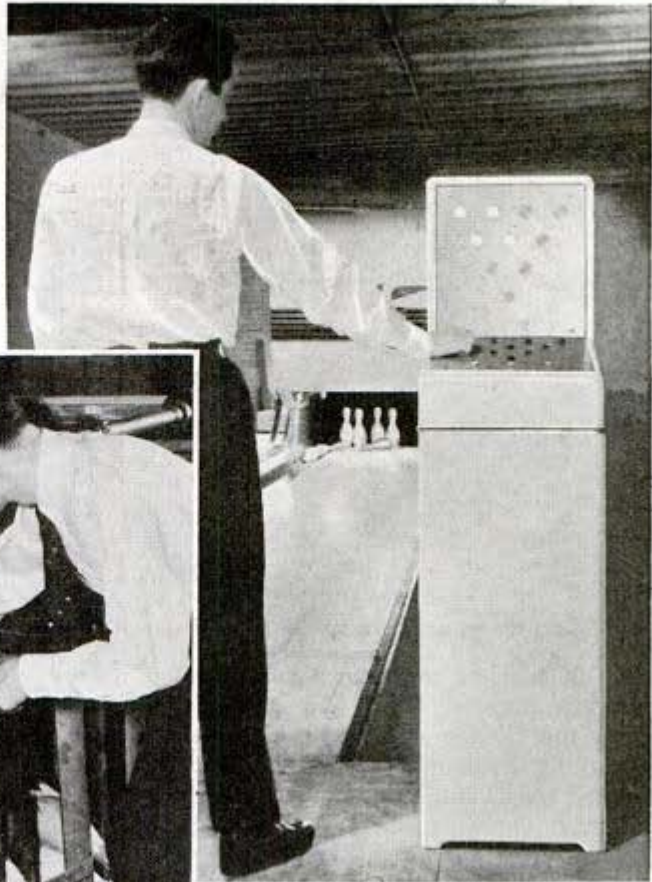
Sighting with ground glass viewer installed on back

manually setting this distance to coincide with a red mark on the dial. Double exposures cannot be made unintentionally, since the shutter, once released, will not operate again until the film is wound into position for the next exposure; winding the film automatically resets the shutter. There is a delayed-exposure mechanism built in, and the camera has a cable socket and photoflash synchronizer. The lens has eight apertures from f32 to f3.5, and the shutter adjusts from bulb to 1/400 second.

2910. B. Automatic Co. 200 Lyndale Ave. Minneapolis, Minn.

Automatic Pin Boy Sets 'Em Up in Ten Seconds

Nimble as four pin boys, an automatic pin setter invented by a Minneapolis man will clear the alley and set 'em up ready for the next ball in ten seconds. At the player's end of the alley there is an electric board operating the system. If a player rolls a spare, for example, he presses buttons representing the pins left standing; then the sweeper clears the



Clare W. Davis, 2212 Grand Ave. S. Minneapolis, Minn.



Top, operator presses buttons corresponding to pins knocked down; below, loading pins into the magazine from conveyor belt

alley, the "spare" button is pressed and down come the proper pins for the second roll. If there is a strike, the sweeper arm clears the alley and down come the ten pins from the magazine. The pin boy has only to keep the magazine loaded with pins after the conveyor belt has picked them up from the alley, and one boy thus can attend four or more alleys.

Light Beam Shot Against Clouds Measures Ceiling for Air Pilots

Two scientists at the National Bureau of Standards have found a way of measuring the height of clouds to assist aircraft pilots in landing safely during thick weather. The "ceiling" is triangulated by means of a flashing light beam, night or day. At night the vertical beam is projected against the cloud, and from some distance away the angle of lines to the beam projector and to the spot on the cloud is measured and the ceiling easily calculated. In daytime the

spot is invisible, so the device breaks up the beam into short light pulses. The detector is an electric eye connected to what is essentially a radio set tuned to the light variations. Pointed at other clouds the electric eye does not respond, but it reacts immediately when pointed at the pulsating signal, and the height can be measured.

To learn where to buy commercial products described in these pages, see the index.

Science Service

Maurice K. Loufer
Lawrence W. Foskett

888

Warren Coffey (Craff) 17th and Ocean, Belmar, N.J.

Twin-Seat Trainer Bicycle Has Two Rear Wheels



Handlebars are geared as a unit to teach beginners

Both teacher and pupil can ride on a "trainer bicycle" for beginners, which allows the novice to acquire the "feel" of riding an ordinary bicycle but without the necessity of balancing it. Two rear wheels make it perfectly safe. The cyclists ride side by side, with twin handlebars geared together and twin pedals and brakes. A New Jersey bicycle rental agent built the trainer to promote his business.

2852

Hand Roller for Wall Coverings Turns Corners Smoothly

Four rubber rollers, mounted in line as one but rotating independently, offer ad-



Note four rollers that turn independently on curves

advantages over the long, single roller in pressing down and smoothing out coverings for walls and floors, flexible wood and oilcloth installations and binding for books. Sweeping curves can be made with the tool without risk to the material, since the rollers create little friction; yet they are soft enough to adjust themselves to high and low spots common to surfaces like plaster walls. The roller is particularly adaptable to work on sink tops, counters and stairs.

2796

Tool to Turn Down Armatures Also Undercuts Mica

To simplify the work of reconditioning armatures in the repair shop not equipped for that service, a hand-operated tool that locks in the bench vise is now available. It is designed to turn down the armature as well as to undercut the mica separations. The armature cutter blade can be adjusted



Undercutting mica after turning down the armature

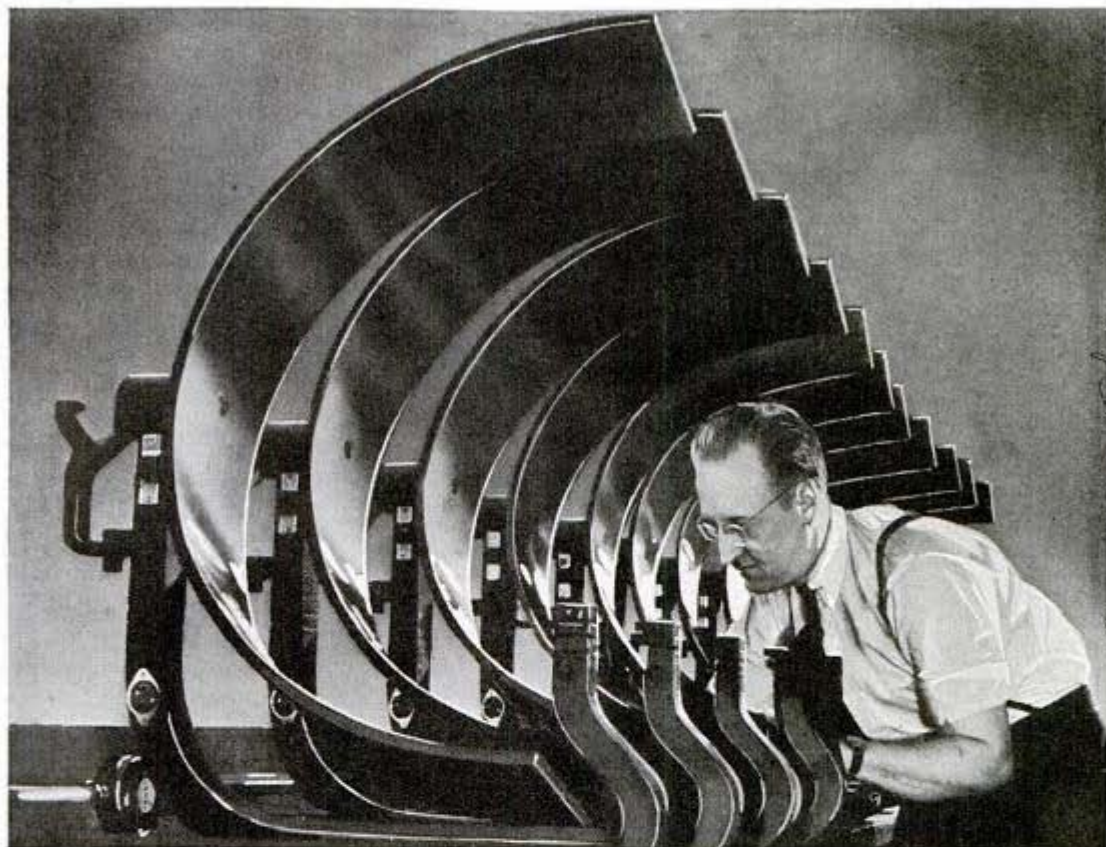
to take the finest shaving. To start cutting, the armature is raised to upper position, whence it lowers automatically as the cutting progresses. Saw blades for undercutting the mica are available in sizes of .015, .020 and .025 inch. The tool will take armatures having $\frac{1}{2}$, $\frac{3}{16}$, $\frac{5}{8}$ and $1\frac{1}{16}$ -inch shafts.

See index, page 4-A, to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

L719 Leggett

NO SUPERMEN WANTED

American Optical Co.,
Southbridge, Mass.



Assembling perimeters used in determining whether a pilot's indirect, or side, vision is normal

CERTAIN rare individuals are able to read letters only 10 millimeters high—about one-third of an inch—from 20 feet away, but their eyes are far sharper than Uncle Sam needs in his warplanes.

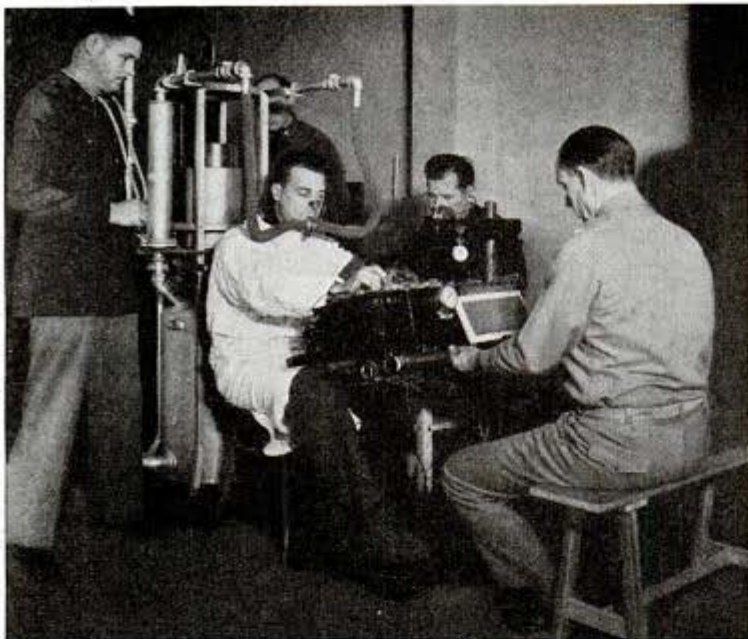
Applicants for service in the U. S. Army Air Forces are required to read letters twice that size, 20 millimeters high, from the same distance. Twenty millimeters is slightly more than three-fourths of an inch. Try it yourself. "Just normal visual acuity," flight surgeons of the School of Aviation Medicine call it.

That word normal describes exactly the requirements for aviation cadets—normal eyes, normal heart, normal reactions, normal muscular balance. Instead of being so rigid that only trained athletes — "supermen" — can pass them, the tests are not too difficult for any normal college man.

Among the aviation cadet's tests

Perimeter in use, with medical officer juggling the white spot as applicant says, "Now I see it, now I don't"





at Randolph Field, Texas, is that of depth perception, the ability to judge comparative distances of objects. Two black rods are mounted on a sliding base. Strings are attached to these rods so that the pilot-to-be can move them from a distance. The idea is to adjust the rods so that they will be more or less equidistant from your eyes. An error of 30 millimeters is allowed. "Just normal," examining doctors say, for some persons can adjust the sticks with an error as small as five millimeters.

Can you make your hands and feet behave?

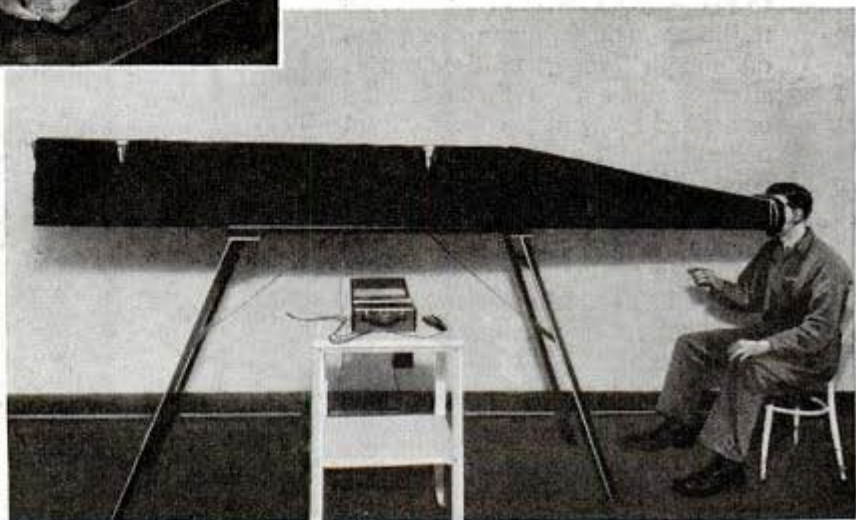
Well, the aviation cadet must, to a certain extent. Into the chair of the automatic serial reaction machine he goes. Facing him are double rows of lights. One row is red and the other is green. Also in front of the applicant is a control stick and rudder pedals, like those in an airplane. Instead of controlling a plane, they control the lights. The entire machine is automatic from this point on. Three red lights flash on, and the applicant moves the controls until the green lights are lighted directly opposite the red ones. When correct, the time to perform this task is registered. Another set of red lights



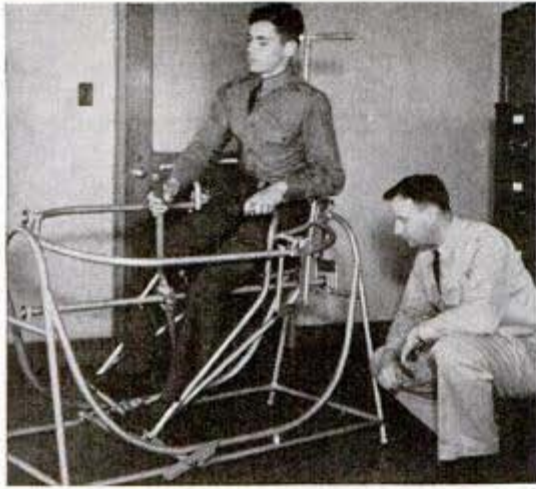
Top, here applicant for military air service undergoes another test given with aid of weird-looking apparatus

Center, cadet moves stick and rudder to match flashing lights on board of automatic serial reaction device

Right, this queer-looking instrument is another eye tester. Defective eyesight causes rejection of more than 50 percent of the applicants for the Air Forces



L 719



↑ Framework in which cadet is seated resembles pilot's position in plane. Even a "stick" is provided for test

Cadet has just completed ten turns → in spinning chair and his blood pressure and eye reaction are recorded



flashes on, then another and another until the applicant has solved 40 settings. This determines his reaction time. From there the cadet-to-be may go to the Barany chair, in which he is spun round and round to test the reactions of the middle ear, where the sense of balance is located.

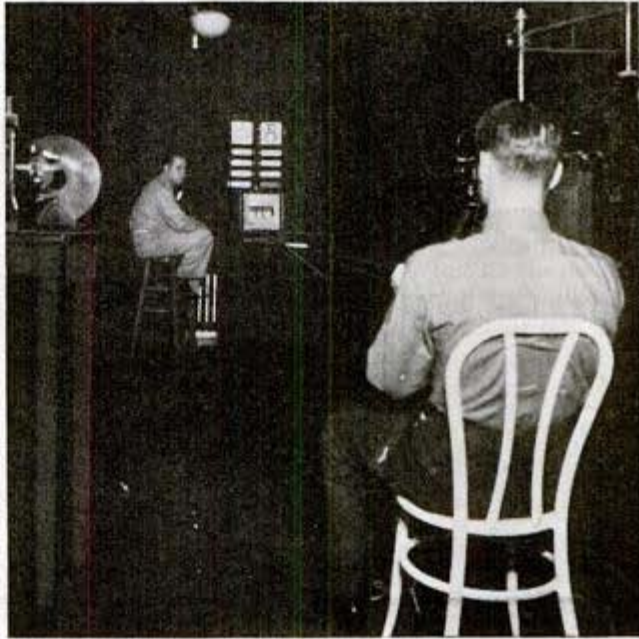
One forbidding-looking instrument is the phorometer, which checks for sharpness of vision and eye-muscle balance.

Even the stereopticon, a familiar fixture in every parlor two generations ago, has its place among the test equipment. Here it is known as the Keystone stereoscope and it is used for research in visual acuity, fusion testing and depth perception tests. Over in another corner is a perimeter, an

(Continued to page 187)

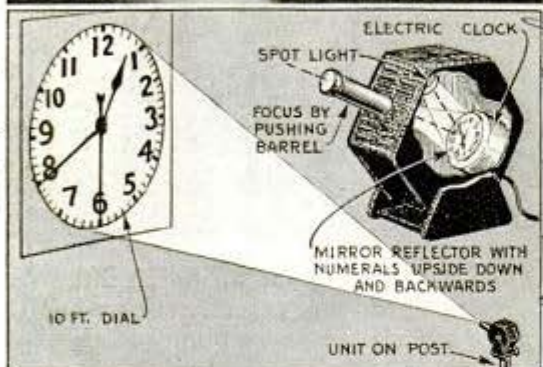
Streamline device for testing the eyes is shown in use at Randolph Field, Tex.

Depth perception test calls for cadet to pull the strings until two rods at end of corridor appear opposite each other



2859.

Projector 'Paints' Clock Dial On Ten-Foot Surface



Sketch, bottom, illustrates details of reflector, top

The image of a clock dial, 10 feet in diameter, can be projected on a white surface with a small reflecting unit designed for advertising purposes. Unlike the ordinary projector, the device reflects the clock face through the lens barrel. An electric clock is used, its face consisting of a mirror with numerals painted upside down and backward. The hands, including a second hand, move counterclockwise, but their movement as well as the clock face is corrected in the reflecting process. Within the unit a light beam strikes the mirrored face of the clock, whence it is reflected directly to the screen, the numerals and hands appearing as shadows and the rest of the face being illuminated. The size of the image and focus are regulated by moving the lens barrel in and out.

2758.

Paint Deadens Sheet-Metal Noise By Preventing Vibrations

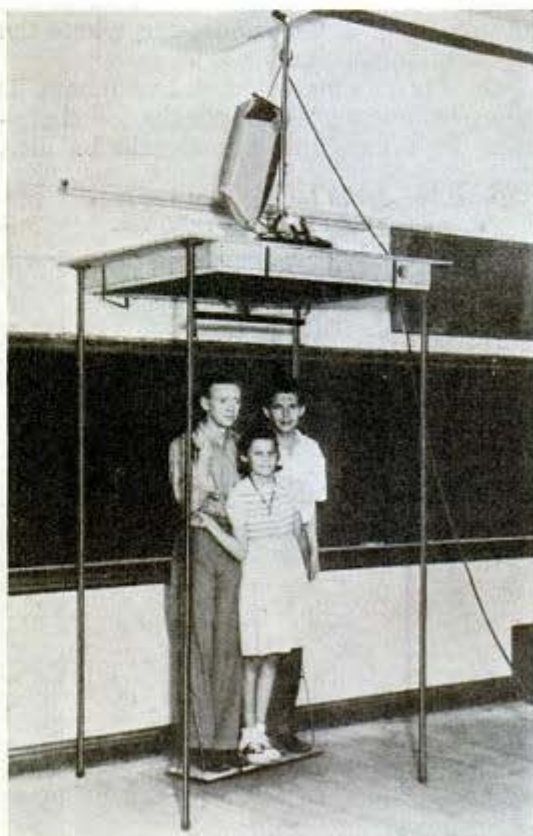
Objectionable noise from sheet metal subjected to vibrations can be hushed by applying a special paint. Prepared in semi-

paste form, the sound-deadening paint may be brushed on without thinning. Though the paint does not kill the first sound, it checks the subsequent vibrations and eliminates virtually all resonance. Produced regularly in gray color, the paint can be made up in any special color.

2865

Vacuum Cleaner Picks Up Swing Loaded With Three Riders

Applied properly, a vacuum cleaner will display a surprising amount of power. In one such instance the suction lifted 600 pounds off the floor. Using a standard General Electric cleaner, Prof. William Schriever of the University of Oklahoma, connected the nozzle to an elevated platform supported by four pieces of pipe. The platform, eight feet in the air, formed a bellows with the underside movable and to it was attached a chain swing of the type used on playgrounds. With this arrangement the cleaner produced a partial vacuum inside the bellows, resulting in enough power to raise the swing and three occupants from the floor. The greatest weight so lifted was 600 pounds.



Three in swing are lifted by vacuum cleaner power

Thompson & Co
Box 6757, Pittsburgh
Pa.

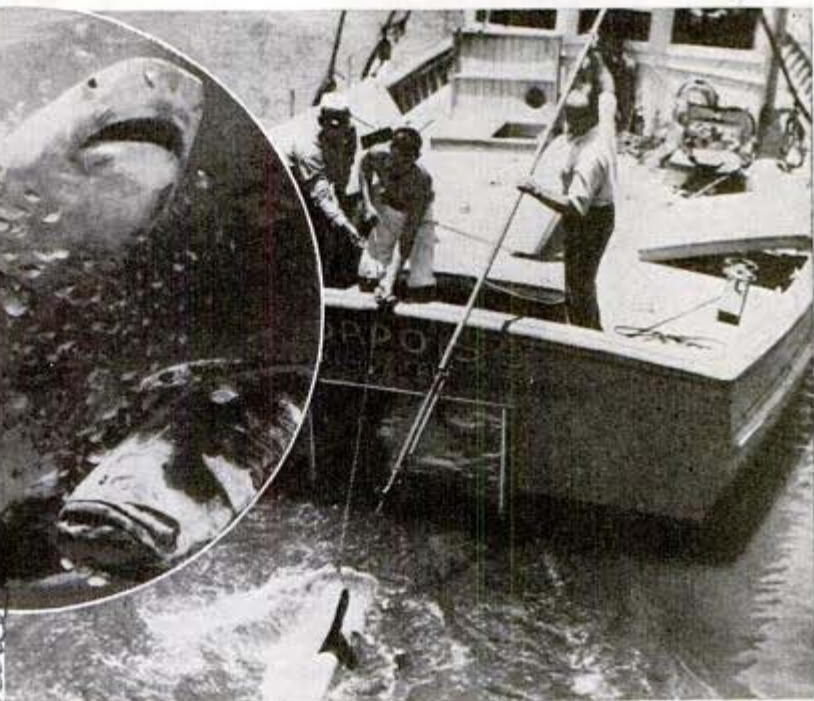
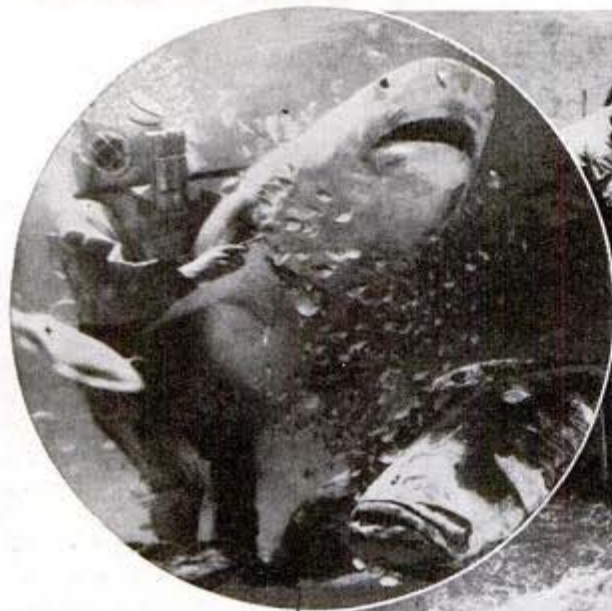
L836.

Count. Andrew La Terna

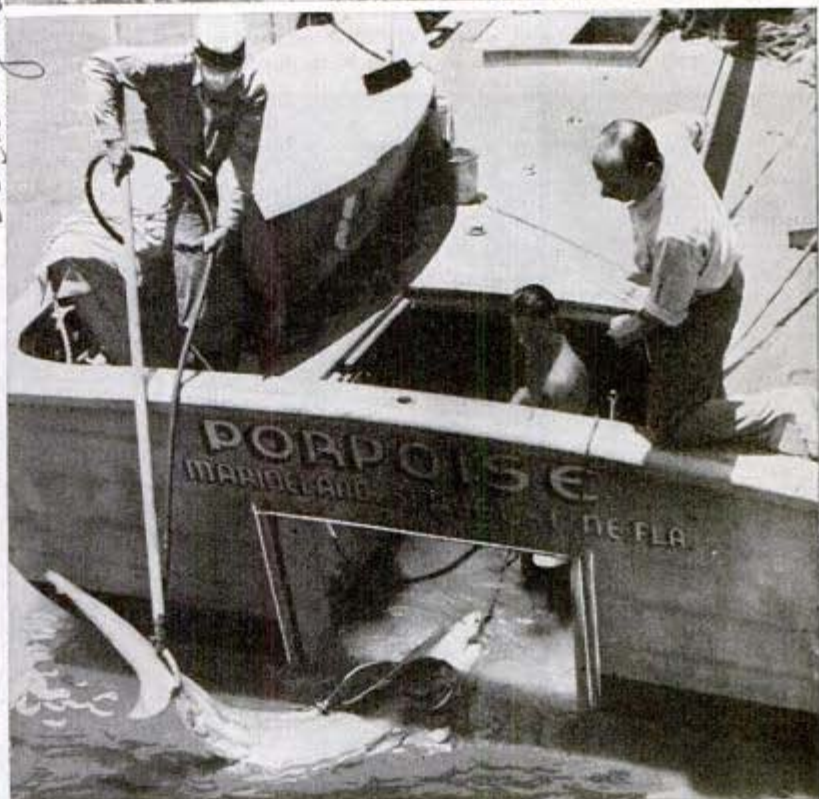
11 W 42nd

New York City

Sharks Caught Alive With Hypodermic Harpoon



Voracious tiger sharks are captured alive for Florida's Marineland Studios with hypodermic harpoons that render them temporarily helpless. Upper right, Count Ilya Tolstoy, grandson of Russian novelist, poises a harpoon. In circle, diver forces water through gills of anesthetized shark in Marineland pool



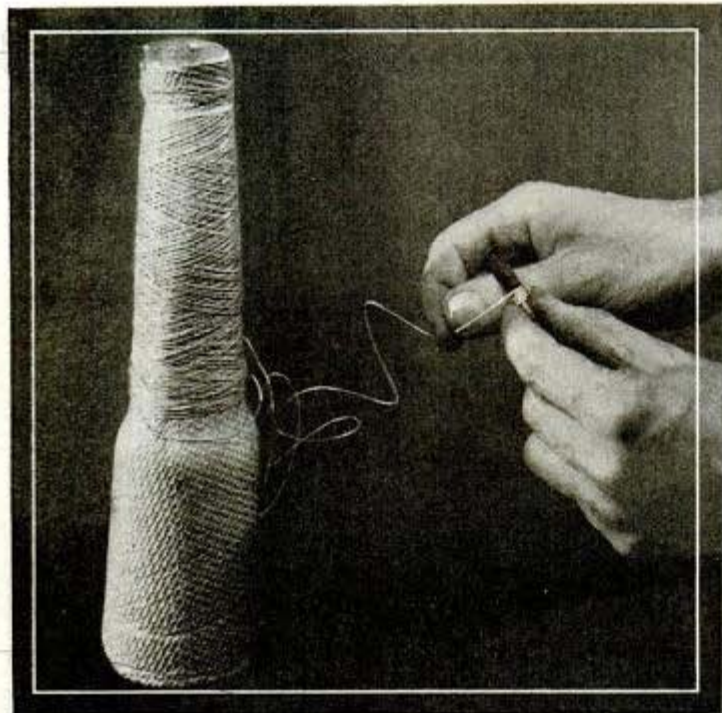
One minute after the harpoon is planted, the shark is helpless and the crew (above) gaff it into a trap in the boat. At left is a closeup of the weapon, showing the disks which prevent deep penetration and injury to the shark. Tiny holes in the steel point let jets of anesthetic spurt into the shark's body. The harpoon's impacting power is supplied by ordinary soda siphon gas

DECEMBER, 1941

and W. Douglas Burden,

87

Goodyear Tire & Rubber Co
Akron, Ohio



Cardboard tube tapered uniformly until plasticized Pliofilm thread was wound on it. Contraction of thread then crushed the cardboard

The stretched sheet material, only 1/10,000 of an inch in thickness, is wrapped loosely around an injured wrist to deaden the pain

Cons. Walter E. Burton, 1092
Florida Ave. Akron, Ohio

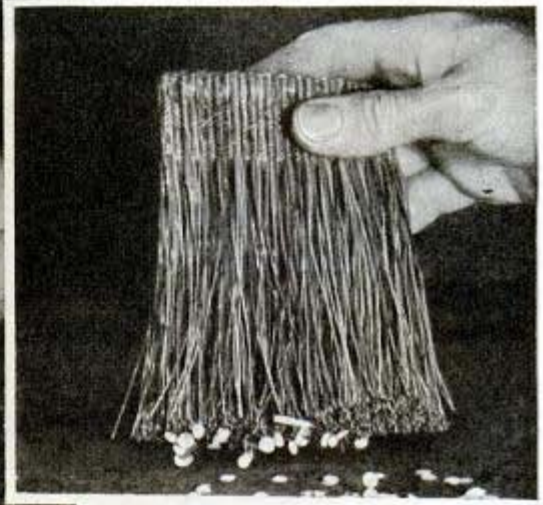


MAGIC

ONE day E. G. Reed suffered a crushed foot while at work. In the hospital, the pain became almost unbearable; but Reed wasn't so overcome that he couldn't hear Opportunity knocking. Here was a chance to test something that had become a mystery in his laboratory. He sent for a few yards of sheet rubber hydrochloride with a two-way stretch. He wrapped this filmy material, 1/10,000 inch thick, loosely around his crushed foot. In a little while, the pain eased.

Was this a new pain killer? Reed is convinced that it was—that this film has seemingly magical antipain properties, although nobody has been able to prove why. A hospital-supply concern is investigating it. Some day, every soldier in the field may carry a package of the material, which he can wrap around a wound to deaden pain until help arrives.

This material is a form of Pliofilm, a transparent



↑ Picking up paper confetti with a Pliofilm whiskbroom charged with static electricity; some of the paper disks are standing on edge. This broom is for use in women's bags

2837

PLASTIC



Even concentrated acid won't hurt this bag crocheted of Pliofilm ribbon

chemical composition sheeting developed by the Goodyear Tire & Rubber Company in 1934. Having as its principal base rubber hydrochloride, Pliofilm combines in its various ingredients unusual physical and chemical properties. Scores of uses have been found for it, and research men and inventors are busy ferreting out still more applications.

Reed, working in his laboratory under patents assigned to Goodyear, has devised more ways of using stretched or "plasticized" Pliofilm than he has had time to put into use. One of his most amazing products is a whiskbroom so dirt-hungry that it has to be shipped in a sealed container to prevent it from grabbing dust along the way and reaching the customer in a soiled condition. When used to brush a hat or coat, the broom doesn't throw dust into the air, but grabs and holds the particles until the straws become so loaded they have to be cleaned. The broom grabs dirt because it

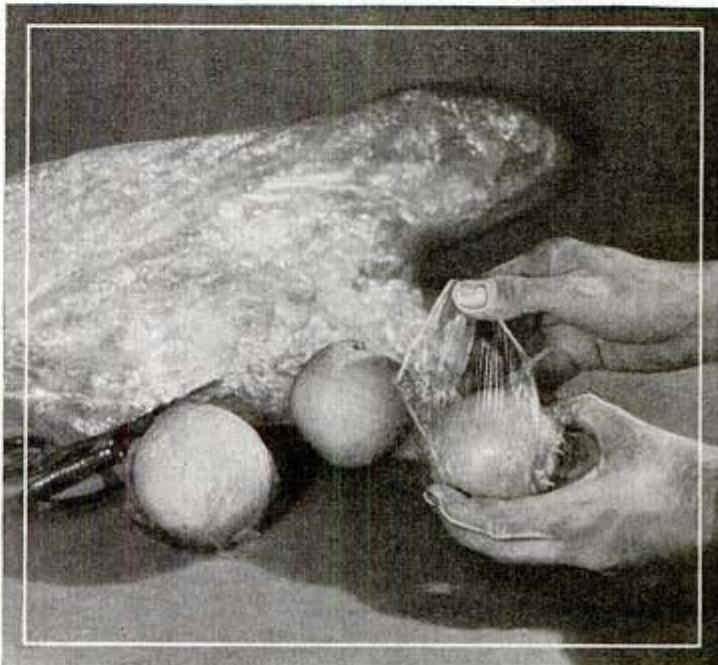
(Continued to page 162)

DECEMBER, 1941



The sailboat in the foreground has a transparent sail fashioned of plasticized Pliofilm. It is light in weight, yet strong and windtight

One of the common commercial uses of Pliofilm is for wrapping perishable products. Here fruit is being wrapped in 1/10,000-inch sheet



*E. L. Reed, Reed Laboratories
c/o. 41 S. 1st St. Akron, Ohio*

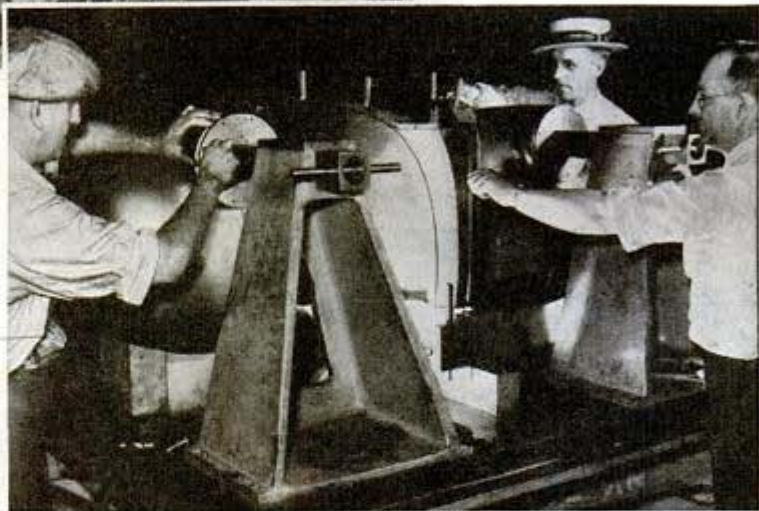
2930.

Steel Plate is 'Trouble Shooter' in Auto Factory



← Checking the frame of an automobile on the 8 by 18-foot steel platform, where the slightest inaccuracy can be detected

Here the Pontiac engineers use the "trouble shooting" plate to measure front-end dimensions against specifications



Production errors that occasionally creep into the automobile assembly plants are discovered early by a huge steel plate that acts as mechanical "trouble shooter" in the Pontiac factory. The plate, which measures 8 by 18 feet, is perfectly level and accurate in dimensions to 5/1,000 inch over its full length and width. Full-sized chassis, bodies and completed cars can be checked on it for interferences and inaccuracies in the relation of chassis and body parts. The engineers can check distance of chassis or body parts above the plate and compare the fig-

ures with blueprints; exact assembly positions of radiator, radiator shell and fenders can be verified, and the geometry of the entire steering gear and wheel system can be measured against specifications.

License Plate Is Kept Clean by Framing Under Glass

Automobile license plates can be kept as spick-and-span as pictures on your wall



Rustproof frame to keep license plate clean can be installed on car in a few minutes

by mounting them in a frame with a glass front. It is constructed of two sections of chromium-plated brass tubing, a rubber-cushioned glass, and a heavy-gauge reinforced back plate. The rustproof frame can be installed in a few minutes.

Silica Gel Guards Plane Motors From Moisture in Shipment

Airplane engines shipped to Great Britain are ready for action as soon as they arrive since the practice of packing them with silica gel was instituted. This dehydrating chemical protects the engines from corrosion and rust. Until recently the plane motors were covered inside and out

POPULAR MECHANICS

New York Times, June 5.

General Motors Corp

Spencer's Electrical Products Inc.

Developed by Sir. Patrick Gifford, Dupont's Chem. Baltimore, Md.

90

490 Broome St New York

Hanson Chemical Corp. 20 Bakersfield
 with anti-corrosion compounds, usually grease and oil. This made it necessary to drain and clean them for several hours after delivery. Silica gel is a hard, granular form of silica, chemically inert. It is a powerful absorbent of moisture, and changes from deep blue to a light pink when near saturation, making it easy to detect moisture during shipment. Plastic plugs containing silica gel are inserted in spark-plug openings, and all other engine openings are covered with some sort of plate containing a porous container or bag of silica gel.

Silica gel sleep

Plane
3rd floor
not now

Target Gun Shoots Light Beam Instead of Bullets



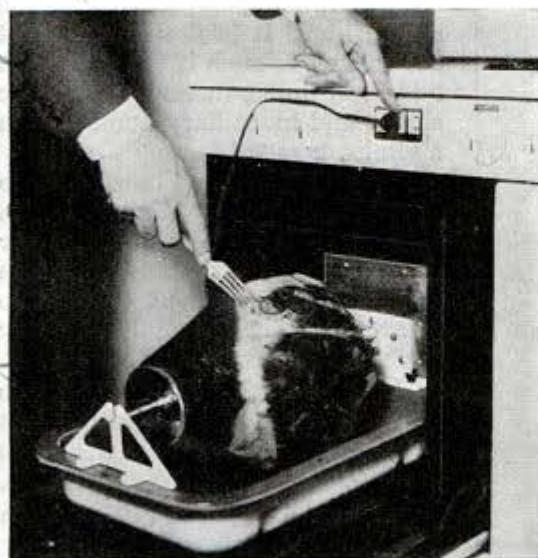
Aerial marksman fires light beam at plane projected on screen

Air gunners practice marksmanship at training quarters in England with the aid of a small spotlight attached to the gun which fires a beam of light instead of bullets. The target is the silhouette of a plane projected on a screen by an instructor. Pilots are given this training just before they are assigned to active squadrons.

Motor-Operated Barbecue Revolves Meat in Oven

Fitting the ovens of most ranges, an electrically driven barbecue spit turns meats slowly while roasting, thus distributing the heat evenly. The spit, operated by a small motor at the rear, is attached to the oven pan. Meat is held by two barbed disks that press against the ends of the roast. When used in an electric range, the cord is plugged into one of its outlets; in a gas range, a wall socket may be used. The flat cord does not interfere with closing the oven door, which may be opened at any time for basting or inspecting the roast.

Chicago. American Furniture Mart



Electric barbecue spit for oven keeps roast turning

Lever Hinged on Screwdriver Applies Extra Power

Equipped with a folding handle that swings into right-angle position for applying extra leverage when needed, a screwdriver lightens the task of loosening "frozen" screws or drawing them up tighter than usual. The lever folds down over the blade when not in use where it does not interfere with regular use of the tool.

Amberyl Electric



Price \$ 5.00

DECEMBER, 1941

State Store Co
Hamilton Ohio

Vaco Products Co 91

1603 S Michigan

Meridian, Michigan

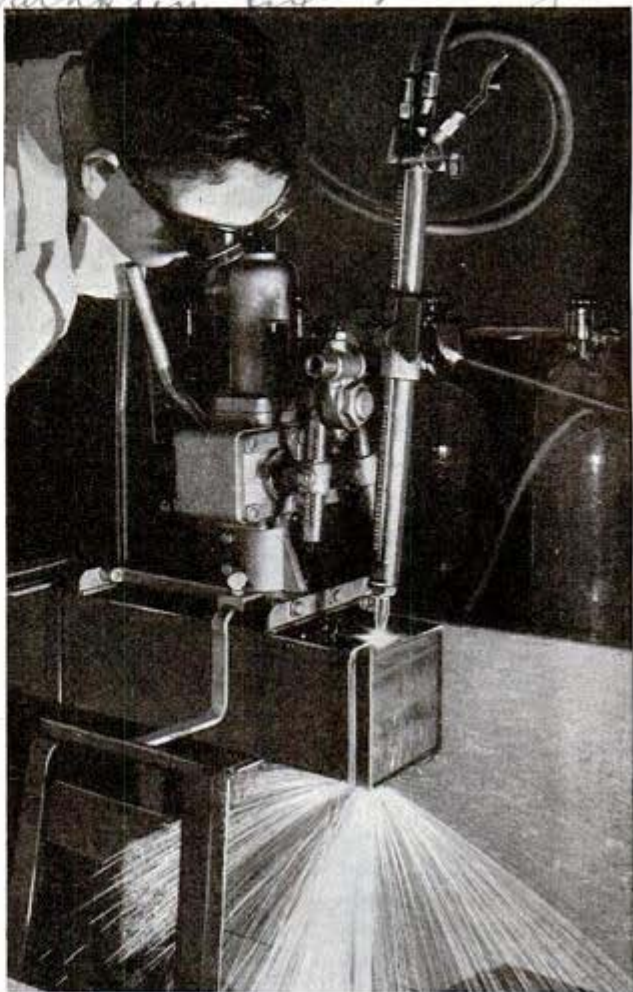
2677 *Cont. Hood & Plimison Jr. Los Angeles*
3872 Franklin Ave.

WONDERS of MODERN METALLURGY

RECENT discoveries and improvements in extracting metals from ores are making the United States independent of foreign sources for some strategic metals, and at the same time making possible the working of huge low-grade deposits of other ores that were uneconomical to mine in the past.

In effect, research has increased our available mineral resources just as definitely as if vast new mineral lands had been acquired. Billions of dollars worth of new wealth have been made available.

Magnesium, the modern wonder metal, is being extracted from the sea instead of imported from abroad, and engineers are also preparing to recover it from common ores. Like aluminum, magnesium is one of the most widely distributed metals in the earth's crust and, like aluminum, it is a difficult substance to refine. It weighs a third less than alu-



Flame cutter saws a six-inch bar of metal

minum and provides aluminum with great strength when alloyed with it, making airplanes stronger and lighter. It is the metal that burns, and as such is used in flares and flash bulbs, tracer bullets, star shells, and incendiary bombs. It is a vital war metal.

Sixty-five hundred tons of it are produced annually from Michigan brine wells. Another 6,500 tons per year are being extracted from sea water at a Texas plant at the rate of a cubic foot of metal for every 1,000 cubic feet of sea water treated. A cubic mile of sea water contains 5,700,000 tons of magnesium, but that amount would require 800 years to extract at the present rate.

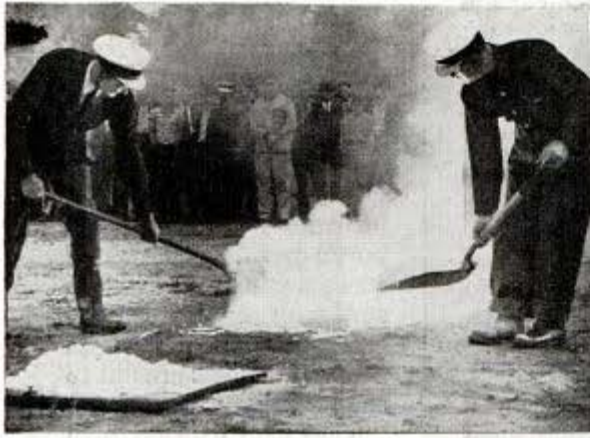
The metal is recovered from

← Stainless steels and alloys are used in fabricating this airplane tail section



Low Chemical Co. Midland, Mich.
Permyente Corp. Latham Square Bldg. Detroit, Mich.

2077



↑ Firemen blanket burning magnesium with layers of sand. Laid on carefully, dry sand will not extinguish the flame but prevents it from spreading

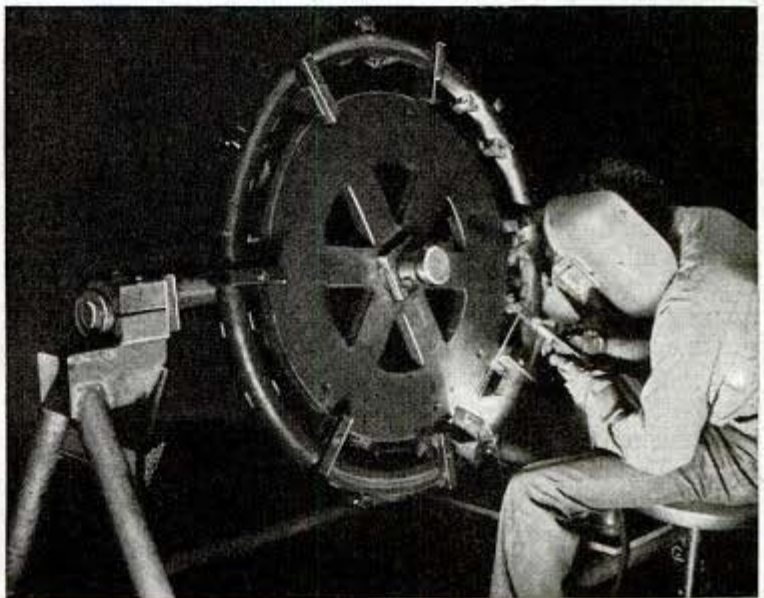


Modern prospector with microscope, blow pipe and chemical reagents making mineral test in the field

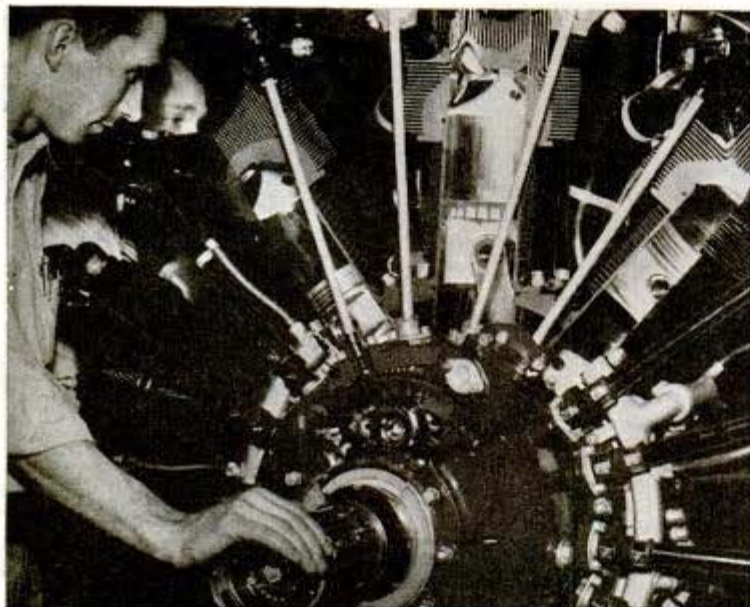


New stainless steel ship anchors weighing 200 pounds replace conventional anchors that weighed tons

brines and sea water by electrolytic action, in which magnesium chloride is used as the raw material. A new electrothermal process, being put to work in California, uses magnesium oxide as the raw material and opens up a way to treat vast deposits of magnesium-bearing dolomite, brucite, and magnesite found in the west. In this electrothermal process carbon and magnesium oxide are volatilized in an electric furnace and their vapors are then shock-chilled, from 4,000 degrees down to 380 degrees, in a fraction of a minute, with



Hard metals made possible long-wearing, precision-built engines. Here a welder is assembling a chrome-molybdenum aircraft engine mount



Cutaway sections of aircraft engine show the different metals used in its manufacture. Demand for these metals has revived prospecting

sprays of cold gas. The result is that pure metallic magnesium is precipitated as a fine powder.

Called the Hansgirg process, this method is an example of the ingenious ways being devised to take ores apart and release their valuable constituents. Practically every ore requires different treatment.

Even ores so complex that no one could break them up profitably in the past are yielding to the new electrical and chemical methods. Sulphate of potash, a valuable plant food usually obtained from Europe, is being refined from New Mexican deposits by a chemical extraction method. A new process is being tried in Tennessee for taking aluminum out of white clay. Most copper is refined electrolytically these days and power from Boulder Dam is being tried out for extracting manganese from the lower grade ore deposits.

A great deal about an ore can be learned by polishing a flat section of it and studying the crystal structure and its arrangements under a microscope. Such research helps point the way to work-

Huge funnels lead into smelter furnace where ore is reduced to metal

ing out the best recovery process. Metallurgy is a complex subject and potential investors in new processes are warned that an extraction method that works perfectly in the laboratory may not always prove a financial success when put to large scale operations. Mechanical difficulties and sheer high costs are apt to spell failure for some.

Vast iron deposits in Texas have lain untouched, except for the manufacture of a few gun barrels during the Civil War, because no coal is available and there was no other economic fuel. Now it has been announced that the half billion tons of iron oxide near Longview will be treated by a new extraction method developed by Julius D. Madaras that takes advantage of the chemistry of natural gas.

Gas from Texas oil fields is cracked to yield hydrogen and carbon monoxide and these gases are introduced under pressure into a cylinder that contains a charge of crushed ore. Oxygen in the iron oxide unites with the hydrogen, forming water, and with the carbon monoxide, forming carbon dioxide, and leaves the iron in a



2677
Southwestern Engineering
Co. 4800 Santa Monica
Los Angeles

nearly pure state. Following successful pilot plant tests, a commercial plant that will use the process is under construction.

Gold is an easy metal to extract from most gold-bearing ores but when it occurs in complex combination, as with zinc, copper, arsenic, and silver, the zinc and arsenic increase the extraction cost. Such troubles are being overcome by selective flotation, a development that is "taming" many ores that were practically worthless in the past.



↑ Identity and purity of metal sample is determined with spectrograph

Selective flotation is an improvement on this. Instead of a simple oil, other reagents are used that collect only certain minerals at a time and not others. Compounds are added to the ore that depress some of the minerals, preventing them from rising to the surface. The result is that from a complex ore one mineral can

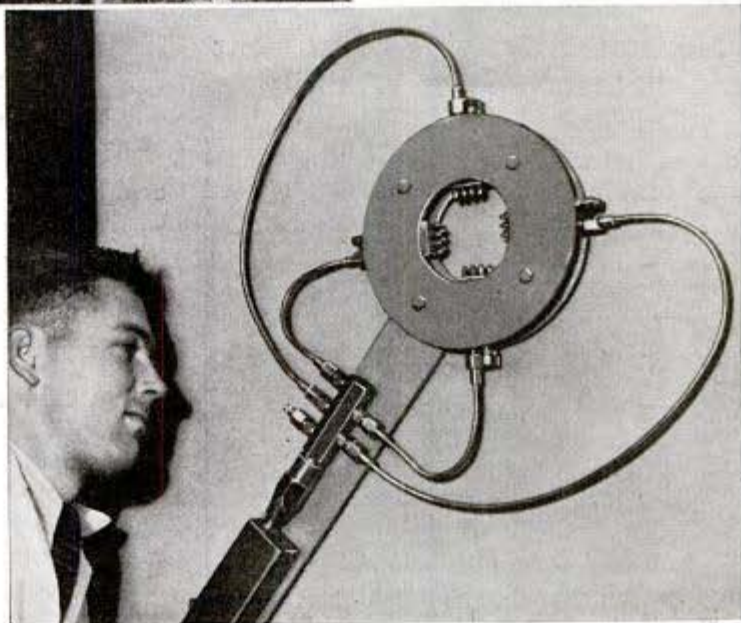
(Continued to page 189)



Drilling powder hole in iron mine

In simple flotation, ore is ground to a pulp and is mixed with water. Then oil and water are bubbled through it. The oily froth collects particles of mineral on its surfaces, rises to the top, and is then skimmed off and concentrated. The trouble with this is that most of the minerals present in the original ore are collected together and the concentrate has to be put through an expensive separation process.

Gas jets of flame hardener used to strengthen metal shafts and tubes



2784. Chicago 400 W Madison

Air-Driven Trenching Spade Digs Hard Ground Easily

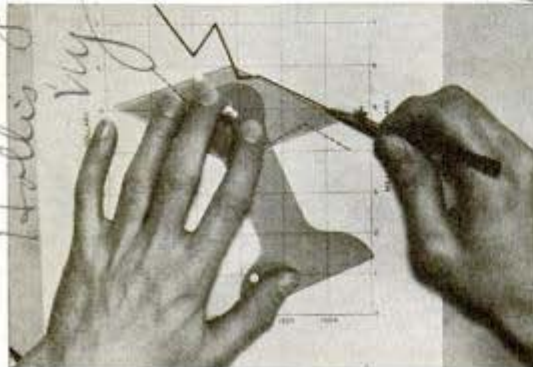


Air pressure drives the small spade into hard clay

Like the pneumatic chisel and the pavement breaker, a pneumatic digger makes the hard work easy. It gouges swiftly into hard ground in making trenches, and there is a smaller clay digger for lighter spading, such as trimming trenches. The heavy-duty trench digger has a longer handle and is designed for quick digging of trenches in construction work.

Nonsmear Drawing Instrument "Floats" Above Wet Ink

Faster inking of drawings, sketches, charts and maps is possible with a "floating" drawing instrument that can be used

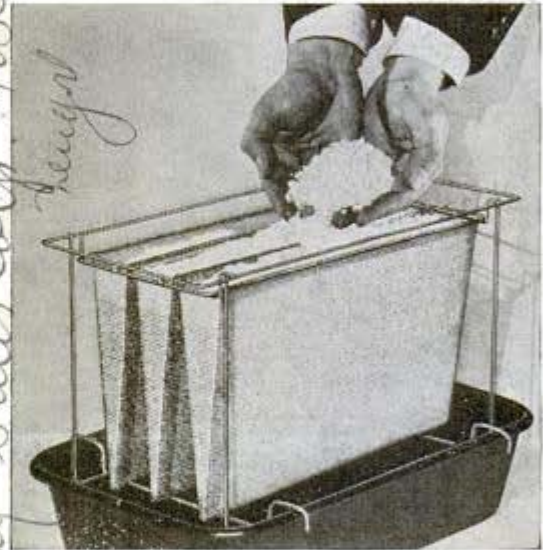


Top plate swivels above drawing without touching it

on the board without waiting for the ink to dry. It consists of two plates, one being the base which remains stationary and rests flat on the work, while the other plate may be rotated into various working positions, clearing the drawing surface so it will not touch or smear wet ink. Both plates are transparent to permit a visual check as the work progresses.

Chemical Unit Dries Air in Room To Prevent Mold and Mildew

Automatically removing excessive moisture from the air, a compact chemical dryer now on the market reduces humidity and thus prevents formation of mildew and mold in such close places as closets, cellars, photographic darkrooms and vaults. The drying unit uses 10 pounds of calcium chloride, which is contained in three V-shaped



Chemical in V-shaped containers attracts moisture

compartments mounted over a pan that catches the moisture drippings. Through large openings at the top, the compartments are filled easily without spilling the chemical, and the pan is large enough to require emptying only once in several days. Because of their shape the compartments offer a large surface contact with the air, and one unit will take care of 800 to 1,000 cubic feet of space.

Write to the firms listed in the Where-to-Buy-It index, page 4-A, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

Washington Camp, Machinery Co.
Harrison
2725
Detroit J. Burnett,
8-41
Hollis
My
Clay Sales Corp. 400 Beech St.



The CRAFTSMAN

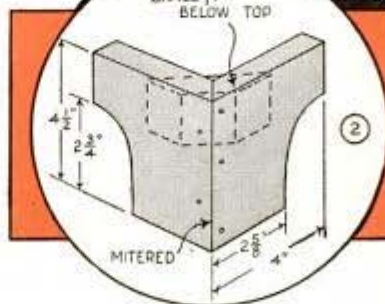
Early American STORAGE CHEST *in white pine*

By Harold T. Bodkin

COPIED from an original piece in an Eastern museum, this attractive chest, Fig. 1, is especially suitable for use with other Early American and Colonial furnishings. Construction begins with the box, or upper part, Fig. 5. The end boards are set in $1\frac{3}{16}$ in. from the ends of the front and back boards, which just come flush with the inner surfaces of the end boards of the base. The sides do not extend down to cover the edges of the bottom boards. The latter are left exposed for later attachment of the base.

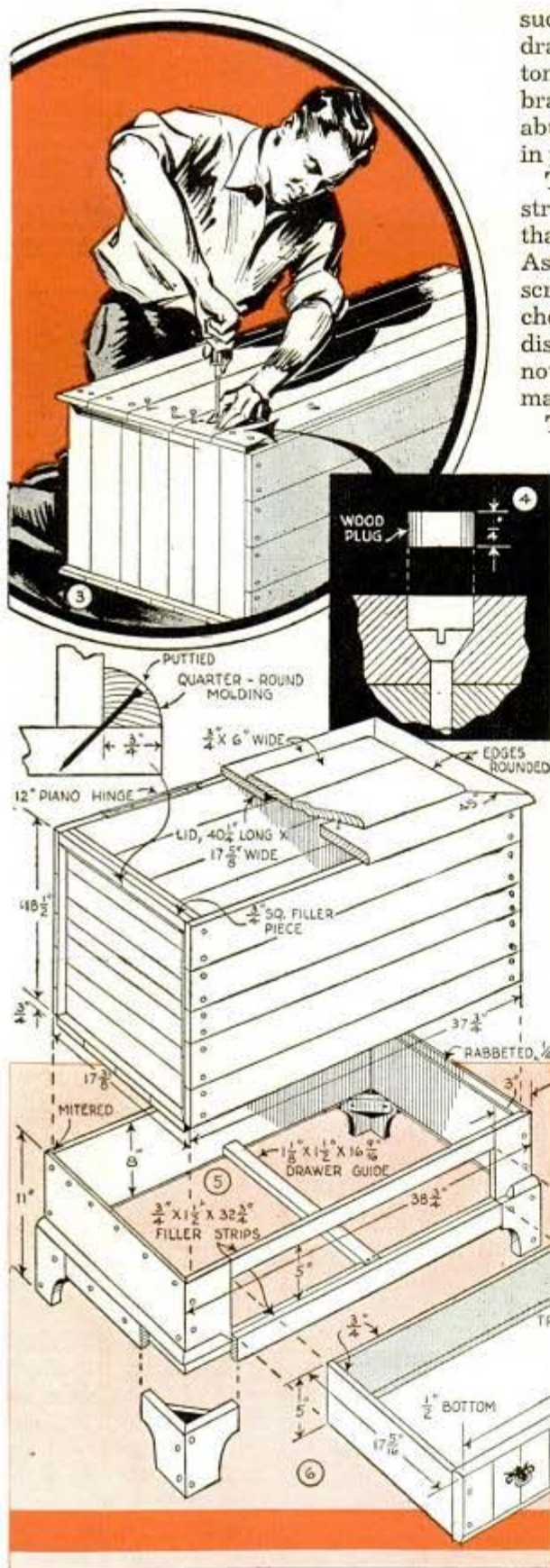
Using boards of varying widths for the ends, front and back gives an appearance of true pioneer craftsmanship. Number 10, $1\frac{1}{2}$ -in. wood screws will handle most of the fastening. The screw holes are counterbored and plugged to simulate old-fashioned doweled construction, Figs. 3 and 4. Quarter-round moldings are fitted around the four sides of the box ends and mitered at the corners. A square filler piece at the top extends this flush with the projecting front, back and bottom boards. The moldings complete the attractive paneled ends.

Detailed drawing of the chest base, Fig. 5, gives the dimensions. Plugged wood screws are again used for this construction.



TYPICAL EARLY-AMERICAN
DRAWER PULL

The base ends are rabbeted along the top edge to accommodate the bottom boards of the box. Filler pieces that frame the drawer opening at the front may be attached with glue and small wood screws, driven diagonally through their ends and into adjoining base members. As an additional detail for strength, small squares of $\frac{1}{4}$ -in. plywood may be nailed and glued over all



such joints on the concealed inside. The drawer guide should project above the bottom filler piece about $\frac{1}{8}$ in. Metal angle brackets can be screwed to the guide and abutting pieces to hold this guide securely in place.

The chest lid is of simple paneled construction. Note that all board edges except that at the rear of the lid are rounded. Assembly of the lid is made with glue and screws. Two 12-in. piano hinges join the chest lid to the box. These are spaced equidistant from the ends. If piano hinges are not available, three 2-in. brass butt hinges may be substituted.

The chest drawer is of common construction, with the exception of the front, Fig. 6. This is made with an assembly of short pieces of random widths set vertically. These are screwed and glued from the rear side to a backing of $\frac{1}{4}$ -in. plywood, Fig. 7. Quarter-round moldings on all four sides complete the drawer front. Note that the two bottom corners are cut off at a 45-degree angle to match up with the base molding when drawer is closed.

A guide slot, $1\frac{1}{2}$ in. wide by $\frac{3}{16}$ in. deep is cut from front to back in the bottom of the drawer. For extra rigidity, $1\frac{3}{16}$ -in. triangular corner battens are fitted around the four sides of the bottom, the batten corners being mitered to a neat fit. Reproductions of typical Early-American drawer pulls Fig. 2, are available from most hardware stores. If metal pulls cannot be had, round wooden knobs of about 2 in. diameter may be turned. Finishing will depend on the wood used. If the chest is of white pine, a stain can be mixed with artist's raw umber oil color

and turpentine. One coat should be enough. If an antique effect is wanted, put a little of the color on a cloth and rub well into the wood at various places while the stain coat is still wet. A cedar chest can be shellacked two coats, sanding well between them. This is followed by furniture wax rubbed with felt or a soft cloth.

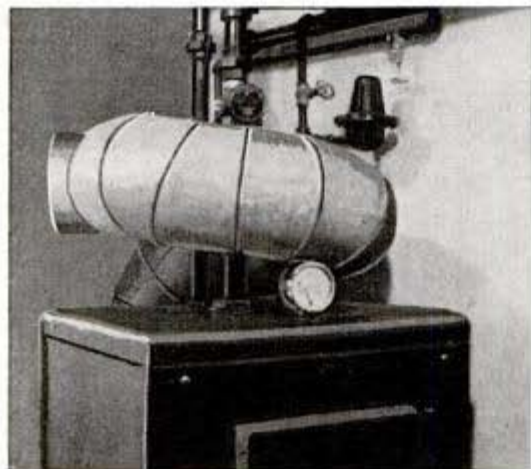
Horseshoe Is Good Foot Scraper



Nailed to the edge of a step, a large horseshoe provides a good scraper to clean your shoes. And it is safe too, because there are no sharp edges or corners on which children might injure themselves.

Oil Burner Has Radiator Loop To Heat Basement

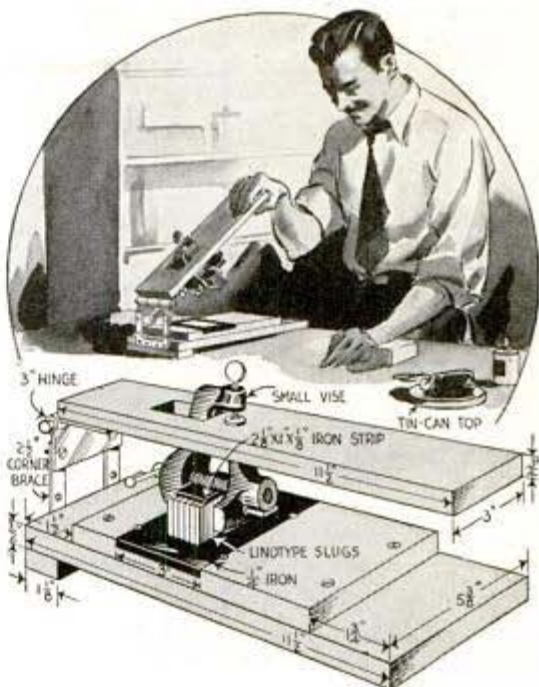
The stack temperature of my conversion oil burner was about 200 degrees Fahr. higher than that usually obtained in installations where the boiler is designed specifically for burning oil. By installing the smoke pipe in the form of a loop as shown,



I obtained a large radiating surface to dissipate into the basement most of the heat ordinarily lost up the chimney. The loop is constructed of five 90-degree elbows and 3 ft. of straight pipe. A balanced damper was also installed in the straight pipe.

—A. D. Molinaro, Philadelphia, Pa.

Hand Press for the Home Printer Uses Linotype Slugs



You can print envelopes, letterheads, etc., with this inexpensive press. The printing is done with linotype slugs which you can get your local printer to produce for you. These are held in a small clamp-on bench vise which is fastened to a handle as shown. Printers' ink is applied to the slugs with a rubber roller.

—Frank Shore, New York.

Uniform Backgrounds Stippled Quickly on Show Cards

Instead of the usual methods of stippling backgrounds on show-card work, I find that a photo-print roller covered with fine-grain sponge rubber enables me to do the job quickly and uniformly. The rubber is cemented to the roller. In doing the work, stencils are used as with other methods, the color being worked out on a piece of glass and the roller run over it and then applied to the show cards.

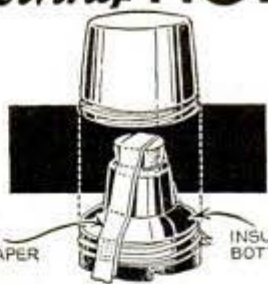


—A. H. Waychoff, Phoenix, Ariz.

Solving HOME



CARDBOARD DISK

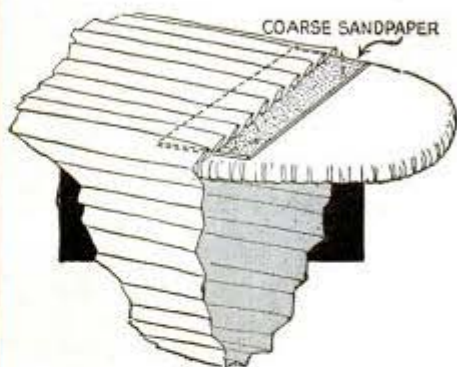


STRIP OF WAXED PAPER

INSULATED BOTTLE

↑ A cork will not work out of an insulated bottle if you fold a strip of waxed paper over it so the ends are held under the cup

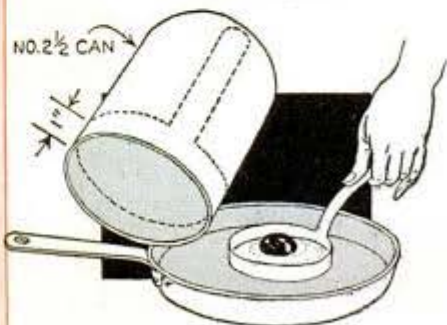
← Children cannot injure their fingers in the rotating handwheel of a sewing machine if you tie a cardboard disk to the spokes



COARSE SANDPAPER

↑ Sandpaper on ironing board helps to hold pleats in position for pressing garment. Removing paper when pleats are formed avoids making impressions in the cloth

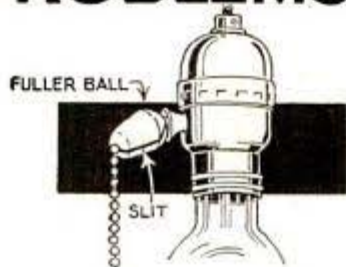
← String stretched across the legs of a card table laid on its side provides line to dry clothes quickly in front of a radiator or a hot-air register



↑ Frying an egg to fit neatly in a round bun is done by using a mold cut from a tin can. The mold is placed in a skillet and the egg is broken into it to fry

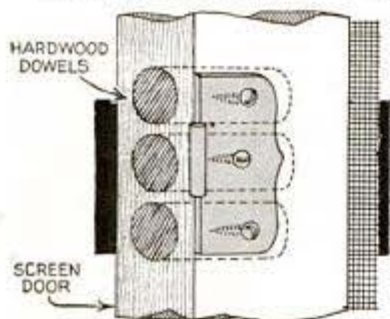
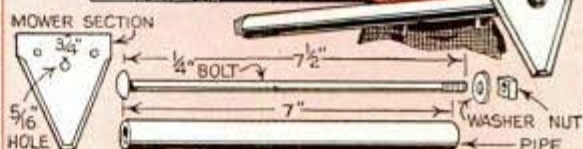
← A prop under a heavily laden clothesline will not sink into the moist turf of your lawn and mar its appearance if you set the lower end in an old bucket or can

PROBLEMS



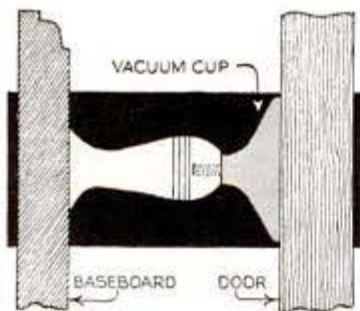
↑ If a chain-pull switch works hard, slit a fuller ball and slip it over the chain next to the socket. This causes the chain to pull horizontally

→ An inexpensive paint and varnish scraper can be made by fitting a mower-sickle section with a pipe handle. The section is attached with a long bolt



↑ When screw holes are worn, hinges are tightened easily by drilling at right angles to the holes and inserting dowels. Then screws are driven into the dowels

→ Coating all exposed edges and contacting surfaces of porch-step assemblies with asbestos flashing compound prevents absorption of moisture



↑ Combination bumper and doorstop made by attaching small vacuum cup to baseboard bumper. For a good grip, the cup should contact a smooth part of the door

→ Shallow pit in front of furnace helps in keeping floor clean as bits of coal and ashes that fall on the floor can be swept into it easily and then removed at regular intervals



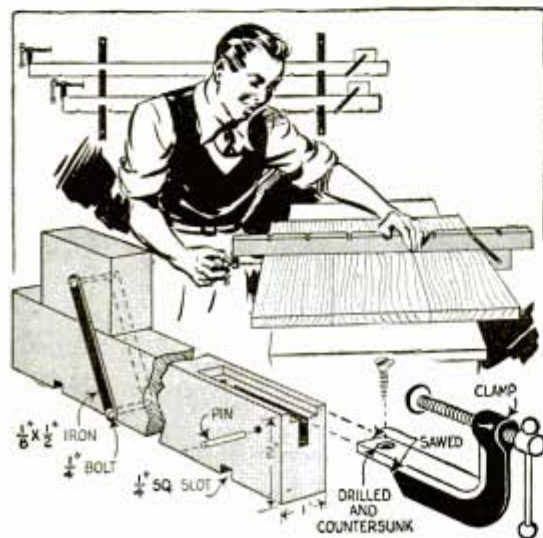
Folding 'Lazy Back' Has Cushion For Comfort at Outdoor Games



You'll enjoy real comfort watching a football game if you take this folding lazy back along. It is nothing more than two pieces of plywood cut to the size indicated and fastened together with a canvas hinge and gussets. An old chair pad glued to the seat provides a good cushion.

Bar Clamps Made Inexpensively By the Home Craftsman

With a few ten-cent C-clamps and some hardwood, the home craftsman can make a



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number of bar clamps of almost any length desired. The C-clamps are cut off as indicated, after which they are attached to one end of 1 by 2-in. strips. The adjustable tail block is held by two pieces of flat iron and a couple of long stove bolts. Slots in the bar for adjustment of the tail block are spaced a distance equal to the original opening of the C-clamp. Clamps made in this way are strong enough to hold glued work but care must be taken not to apply too much force. The glued joint should be brought together with a block and hammer, after which the clamps are used for holding it.
—F. Heckman, Jefferson City, Mo.

Cork Serves as Handle on Cup Of Vacuum Bottle

When drinking hot liquids from the cup of a vacuum bottle, you can provide a good handle for the cup by using the cork from the bottle. The cork is merely lashed to the cup with a rubber band as shown. The band will always be at hand if it is snapped around the neck of the bottle when not in use.



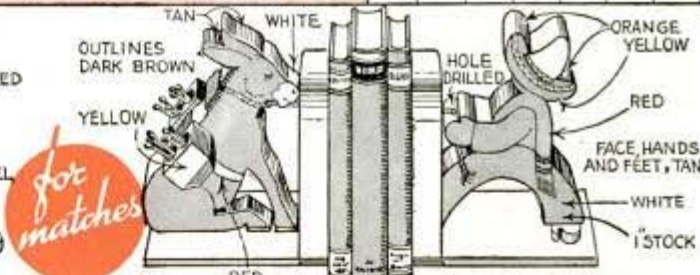
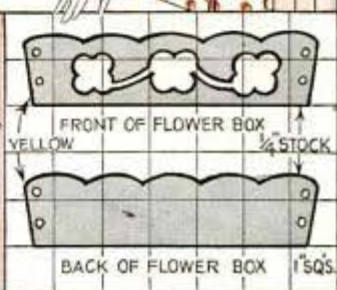
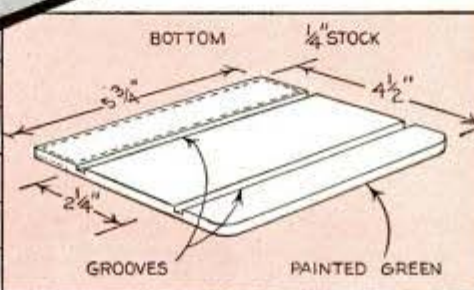
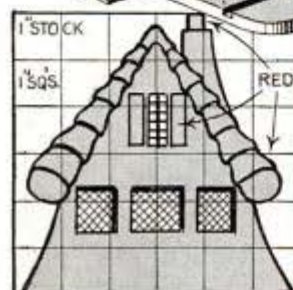
Garment Hanger on Tree Branch Holds Bread for Birds

If dry bread is impaled on a wire garment hanger as shown, it can be hung on a tree branch so birds can eat without danger of being molested by cats. All you need to do to the hanger is cut the crossbar at one end and bend a hook on the vertical wire, as shown, so the severed ends can be fastened together like a safety pin.

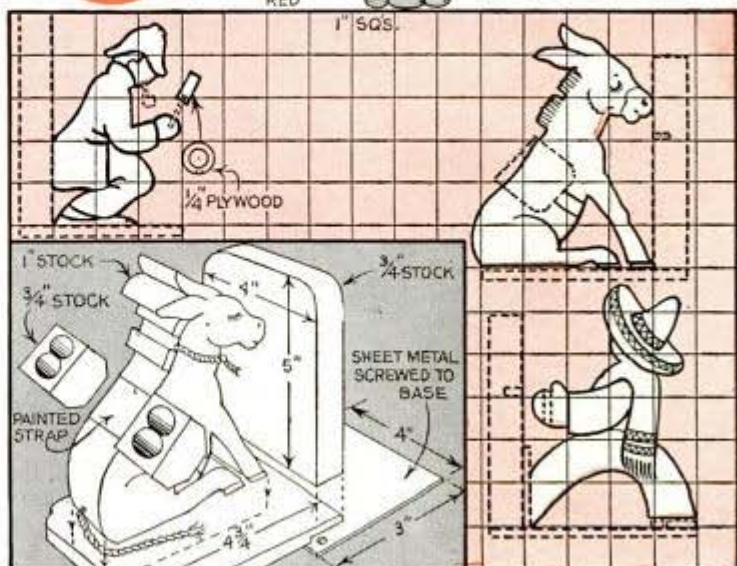


POPULAR MECHANICS

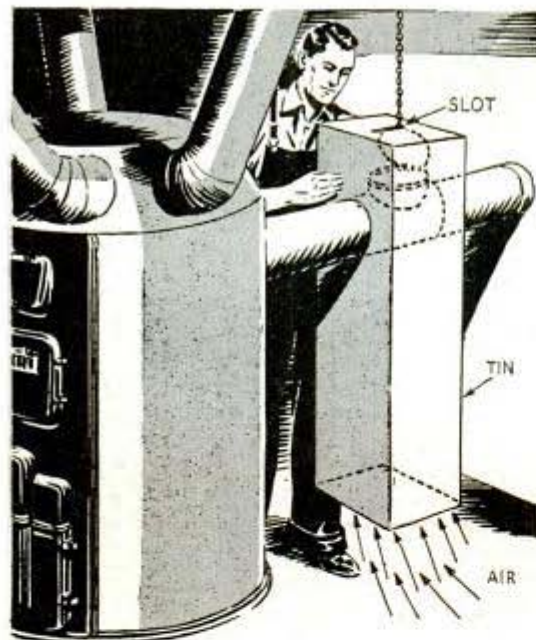
Putting BOOK ENDS to other uses



If you are looking for something different in book ends, these colorfully painted ones are just the thing. The cottage type at the top of the page is ideal for the dining or living room as it holds cut or growing flowers as well as books. For a book end to hold your mystery stories exclusively, the detective with his magnifying glass is appropriate. The peon-and-balky-donkey set will go well in your den or recreation room as the donkey carries a supply of matches on his back. All the book ends are jigsaw projects, and all must have thin felt glued on the undersides, otherwise the metal-bottomed bases are likely to scratch your furniture



Furnace Check-Damper Housing Helps Keep Basement Warm

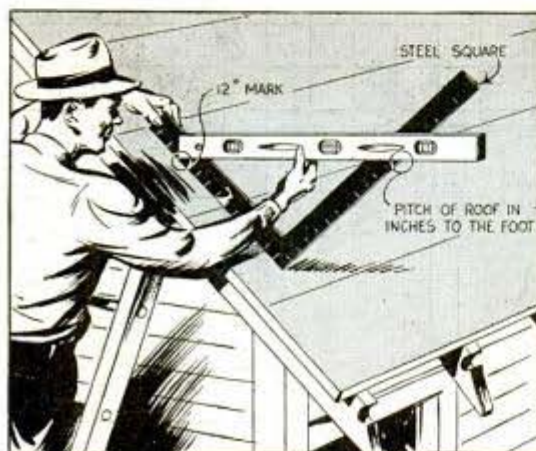


You can keep your basement warmer if a housing is built over the check damper of the heating plant so that air pulled through the opened damper is taken from near the floor. In this way, cold air is withdrawn instead of the warm air nearer the ceiling. The housing can be made of sheet iron, and should be large enough not to restrict air through the damper and thus hamper its efficiency.

—Jack Snodgrass, Fairmont, W. Va.

How to Determine Pitch of Roofs With a Carpenter's Square

It's a simple matter to determine the pitch of a roof with a level and a carpenter's square.



ter's square. Just hold the square on the roof with the tongue, or short side down. Then place the level against the square so that the underside is at the 12-in. mark on the tongue. The reading on the other part of the square at the underside of the level, when it is held perfectly horizontal, will be the pitch of the roof in inches to the foot.

Ruler Holds Typewriter Keys For Easy Cleaning

If you will hold a ruler under each row of typewriter keys while cleaning and polishing them, you will not be annoyed by the usual jamming of the type. You can do the job much quicker than when the keys are not supported.



Improvised "Fence" to Cut Work At Angle on Jigsaw



Tacked to a wood block, a piece of sandpaper makes a good fence or sliding block to hold work at an angle while cutting it on a jigsaw. In use, the block is placed

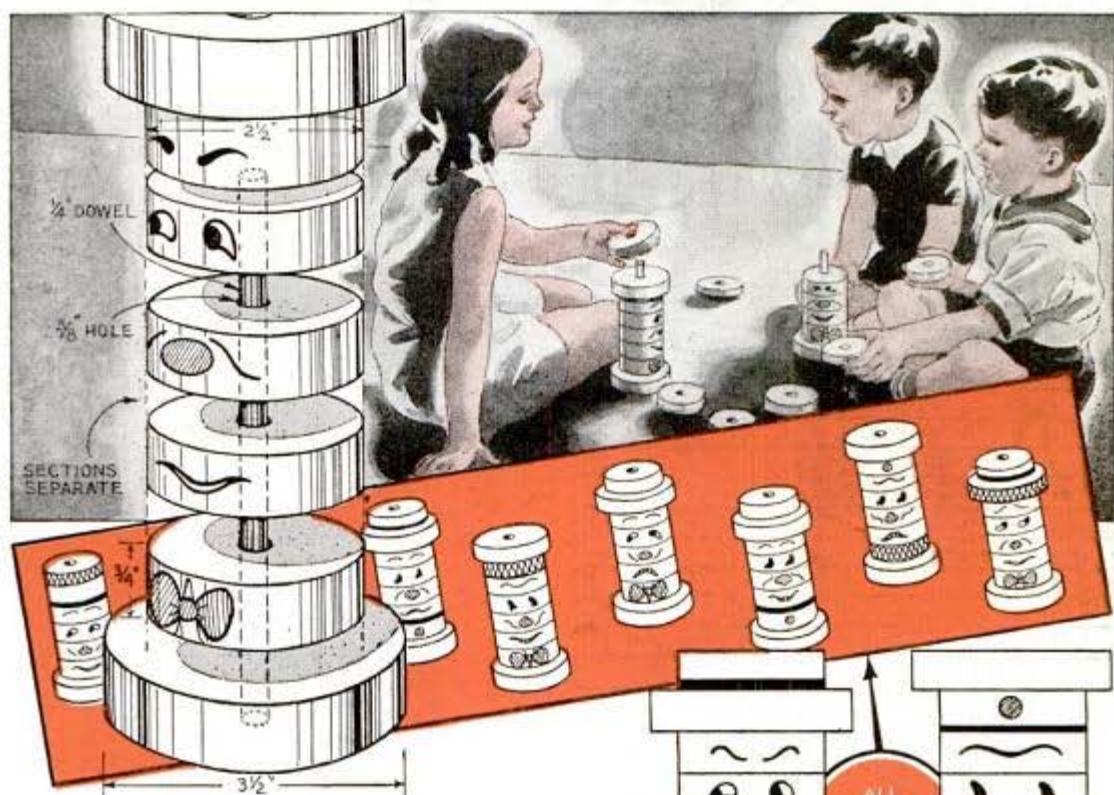
against the side of the saw table with the sandpaper extending over the latter. Then the work is placed on the sandpaper at the desired angle, after which the assembly is pushed through the saw. The table serves as a guide for the block, and the sandpaper provides a rough surface on which to hold the work and keep it from slipping.

Repairing Broken Photo Easel

A photo easel need not be discarded when the support tears or breaks off. Just replace the support with a clothespin which provides easy adjustment to any angle.



Building-Block Heads That Form Many Faces



The desire of small children to "make faces" can be well satisfied with a pair of these heads, which consist of a number of wood disks. Each disk has a part of the facial features of the head painted on it, and when piled one over the other, on a dowel, form the heads in various expressions. As many as thirty-five different expressions are possible. You will need twelve disks $2\frac{1}{2}$ in. in diameter and four

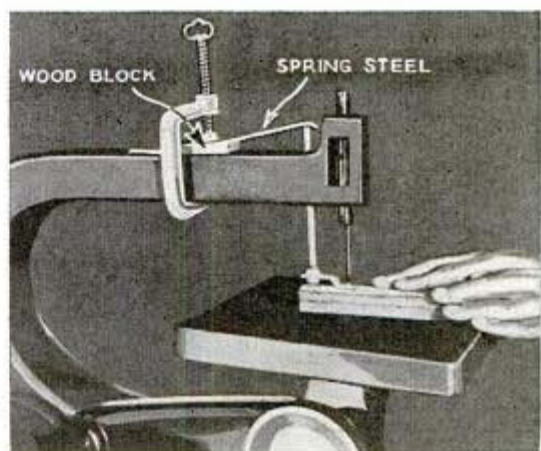
$3\frac{1}{2}$ in. in diameter, using 1-in. white-pine stock. The disks should be sanded together so that they form a smooth cylinder when piled.—R. L. Fairall, Los Angeles, Calif.

Spring Hold-Down on Jigsaw Helps to Cut Rough Work

When cutting work that has an uneven surface you can maintain a uniform pressure with the jigsaw hold-down by putting it under spring pressure. The locking screw is loosened and then a spring is clamped to the saw frame to bear against the top of the hold-down as shown, using a tapered wood block and a C-clamp.

—W. C. Wilhite, Carlinville, Ill.

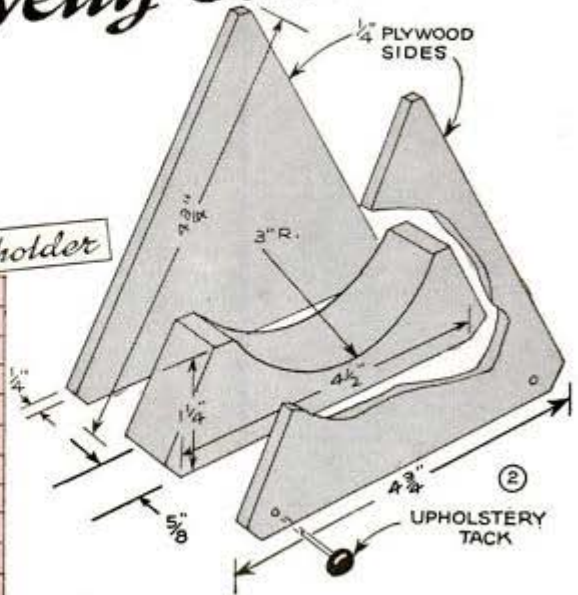
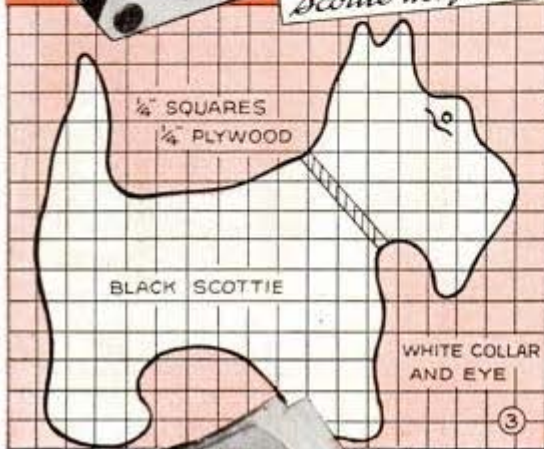
Do not forget to give your evergreens a good soaking once a week right up until after the ground freezes, as their roots require an abundance of moisture to carry them safely through the winter.



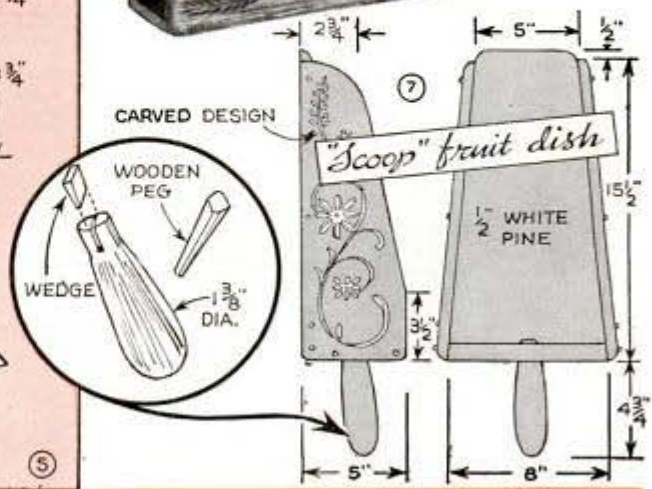
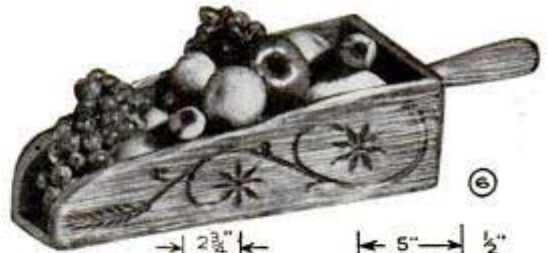
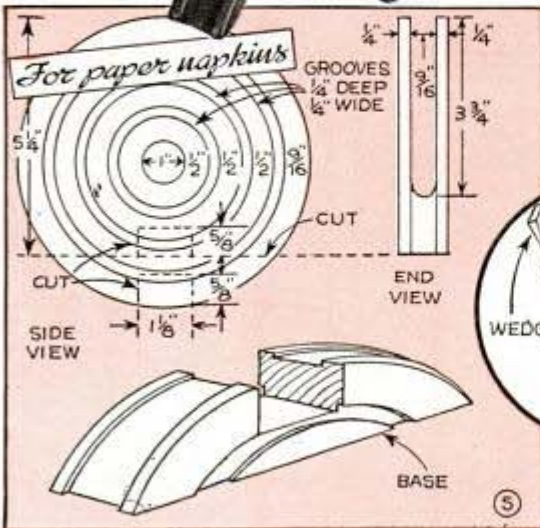
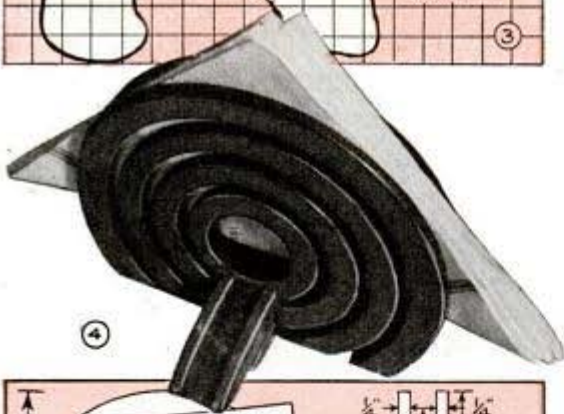
START NOW MAKING *Novelty Christmas*



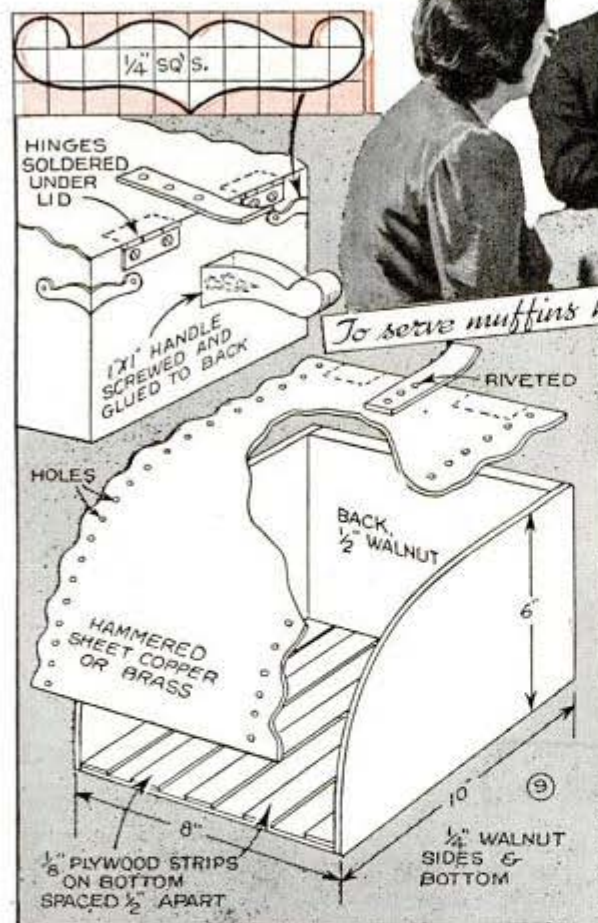
Scottie hot-pad holder



ARE you looking for novel but practical things that you can make for Christmas presents for members of the family or friends? Then there should be something of interest to you in the five suggestions given here. They have been selected especially because they are good gift items, and any craftsman will find no difficulty in

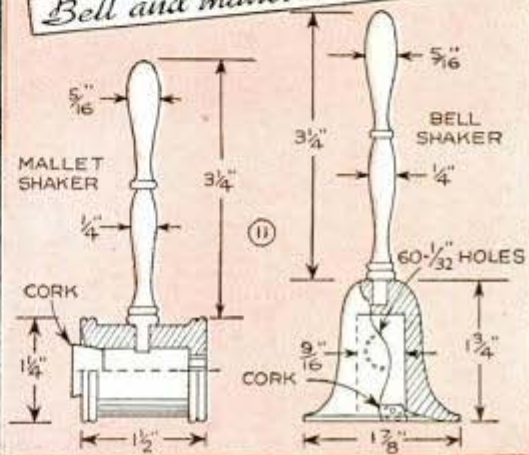


Gifts FOR THE TABLE



making them. The paper-napkin holder, Figs. 4 and 5, and the bell and mallet salt shakers, Figs. 10 and 11, are turned on a lathe; the Scottie hot-pad holder, Figs. 1, 2 and 3, can be done entirely with hand tools including a coping saw. For those who have only hand tools, the fruit dish shown in Figs. 6 and 7, and the hot-muffin holder, Figs. 8 and 9, will have appeal. The former is made entirely of wood and is enhanced with simple carving on the sides, while the latter has a sheet-metal top, preferably copper or brass, which is hammered for appearance. Note the row of holes near the edges to relieve the plain, hammered effect. All necessary dimensions and methods of assembling these items are given in the drawings, while minor dimensions, some of which can be varied, have been omitted.

Bell and mallet salt shakers



Sheet Balsa Wood Cut in Strips With Razor Blade on a Jig

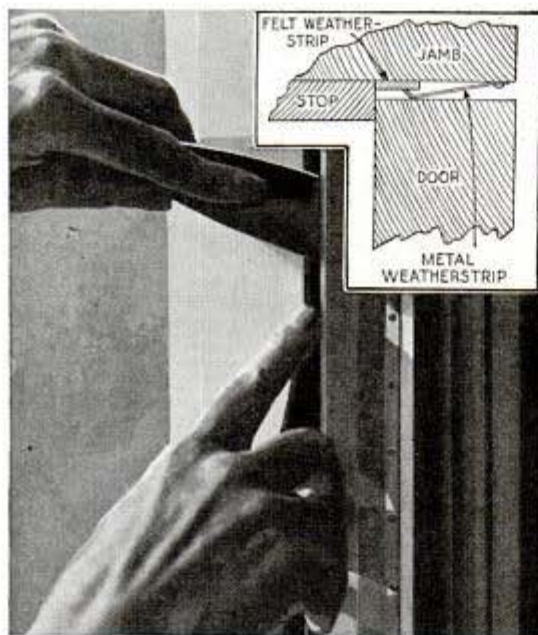


This jig will cut sheets of balsa wood into strips for use in model making. It is made from a couple of wood blocks, which carry the razor blade as indicated. A yardstick is laid on the work to provide a guide for the jig.

—Ray J. Marran, Kansas City, Mo.

Silencing Vibrating Weatherstrip

Under certain conditions, wind causes metal weatherstrips in windows and doors to vibrate and produce a very annoying noise. Usually, this can be silenced by fas-

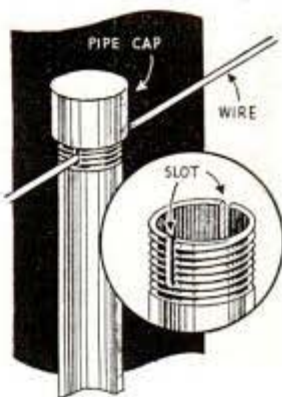


tening a thin strip of felt weatherstripping at the corner where the door stop joins the jamb as indicated. In this position, the free edge of the metal weatherstrip will rest on the felt so that any tendency to vibrate will be dampened.

—John T. Welbourn, Pittsburgh, Pa.

Locking Wire in Pipe Stakes

When building a low fence to enclose a small plot of ground, using a single wire and pipe stakes, the method shown of fastening the wire to the stakes will keep it taut. The upper end of each stake is threaded to take a pipe cap and then slotted to take the wire. The cap is then turned on the end of the stake for driving it into the ground, after which the cap is removed, the wire placed in the slot and the cap turned back down on it tightly.

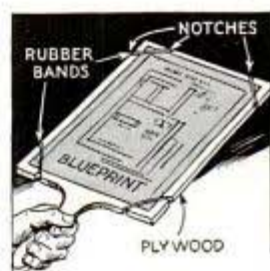


The upper end of each stake is threaded to take a pipe cap and then slotted to take the wire. The cap is then turned on the end of the stake for driving it into the ground, after which the cap is removed, the wire placed in the slot and the cap turned back down on it tightly.

—L. B. Robbins, Harwich, Mass.

Plywood Paddle Holds Blue Print For Reference Without Soiling

Small plans or blue prints and even magazine pages containing drawings can be held on a plywood paddle for easy reference at the workbench. In this way, the pa-

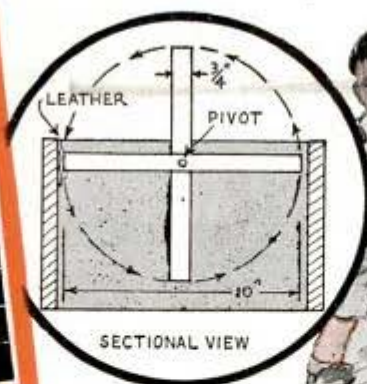


per does not have to be touched with soiled hands. Notches at each corner of the paddle permit rubber bands to be slipped over the corners of the paper to keep it in place.

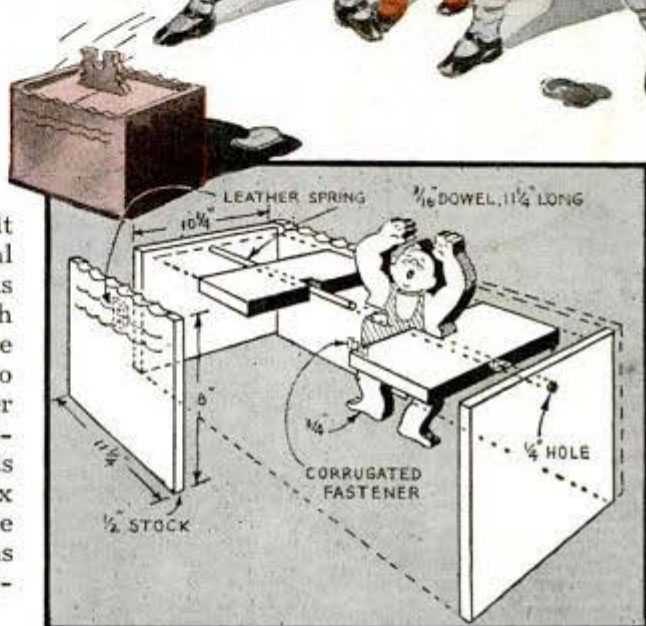
Rubber Glove Used as Ice Bag

If an emergency arises for an ice bag and none is at hand, a rubber glove will serve the purpose for a short time. Just fill the glove with small pieces of ice and wind a rubber band tightly around the wrist end to prevent it from leaking.

Duck-the-Bather Game Played With Bean Bags



This toy game has humor as well as action to amuse children of any age. It is played with a bean bag, which is thrown at a bather that tips over when hit, and stays head down in his wooden "pool" until hit again. Then up he pops to his original position. The bean bags are canvas and the pool is a wooden box. Both the jigsawed bathing figure and the box cover are fastened on a dowel so that the assembly pivots, the cover being painted on both sides to simulate water. A strip of leather is tacked on the front section of the box to act as a spring, which stops the cover in a level position after it has been turned over by hitting the figure with a bag.



Large Strainer on Handle Captures Baby Chicks Easily



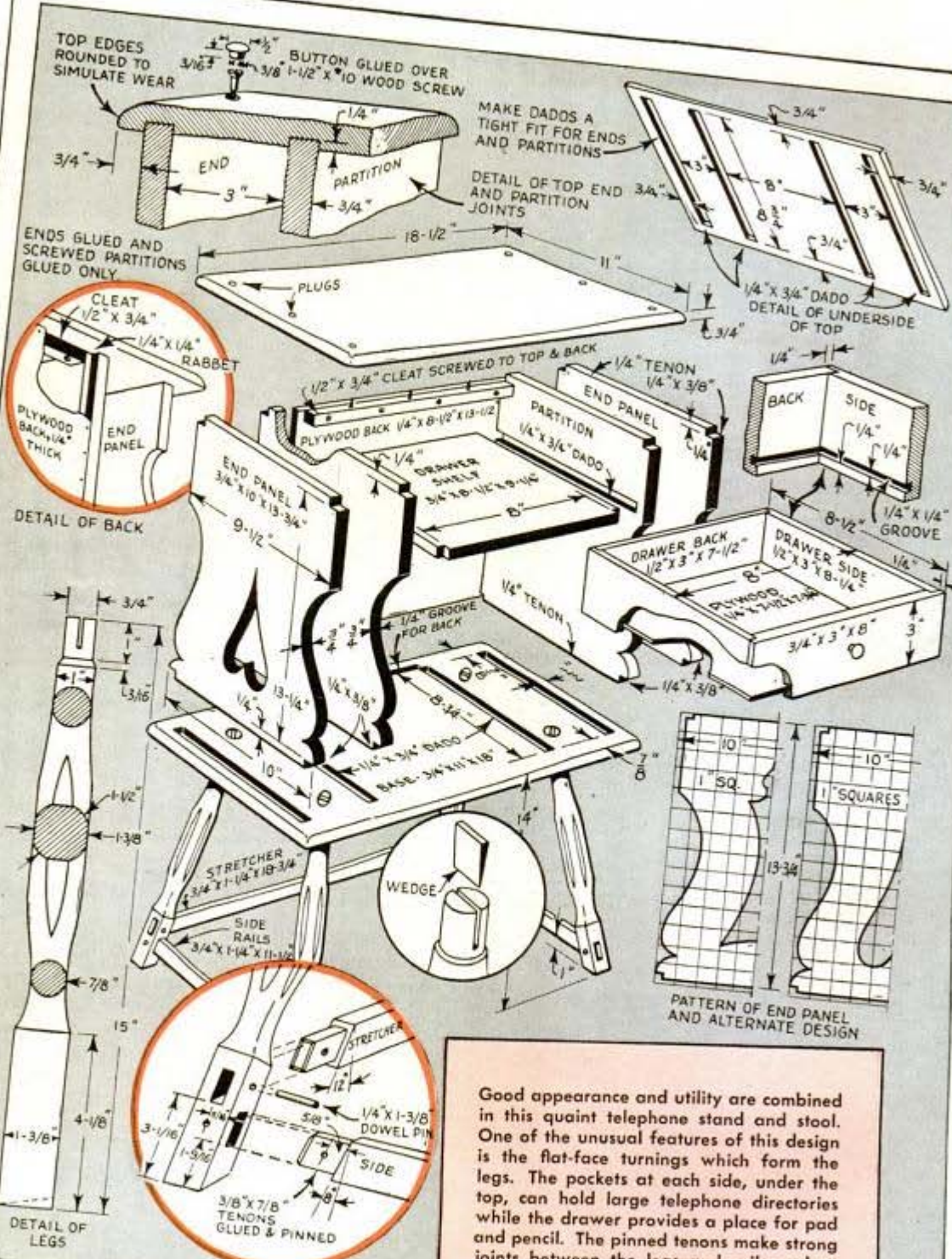
Instead of stooping or running in a crouching position to catch small chicks with your hand when they have escaped, use a large strainer. Attached to a broomstick or other suitable handle, the strainer is safer and easier than the hands, as it eliminates stooping while running so that you are less likely to step on the chicks.

Painting Porch Flooring

When laying or repairing porch floors, I always paint the tongues and grooves of the boards before nailing them. This prevents water, which will get into the cracks regardless of how well the porch is painted later, from soaking under the paint.

—W. J. Barnes, Augusta, Ark.

TELEPHONE STAND *and*



Good appearance and utility are combined in this quaint telephone stand and stool. One of the unusual features of this design is the flat-face turnings which form the legs. The pockets at each side, under the top, can hold large telephone directories while the drawer provides a place for pad and pencil. The pinned tenons make strong joints between the legs and rails and at the same time are decorative. Mortises, and in some cases, screws as well, are used to make a strong, rigid structure that will withstand hard usage

STOOL has Peg Legs



MATERIAL LIST

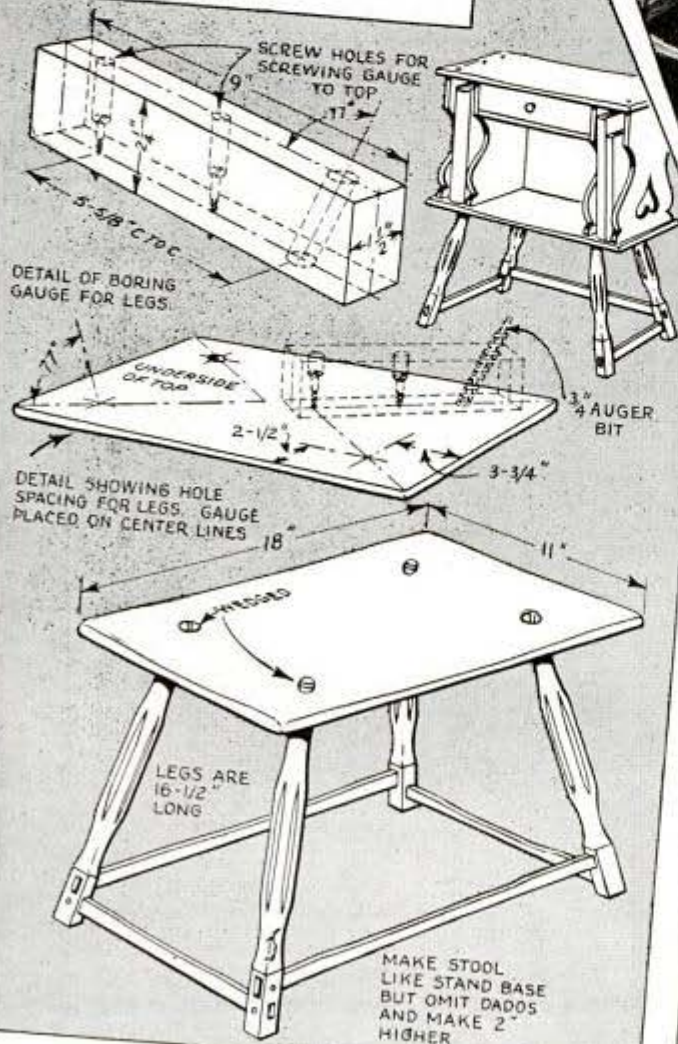
Telephone Stand

- 1 pc. $\frac{3}{4}$ x 11 x 18 $\frac{1}{2}$ in. poplar—Top
- 4 pcs. $\frac{3}{4}$ x 10 x 13 $\frac{3}{4}$ in. poplar—Ends and Partitions
- 1 pc. $\frac{3}{4}$ x 8 $\frac{1}{2}$ x 9 $\frac{1}{4}$ in. poplar—Drawer Shell
- 1 pc. $\frac{3}{4}$ x 11 x 18 in. poplar—Base
- 4 pcs. 1 $\frac{3}{8}$ x 1 $\frac{3}{8}$ x 15 in. poplar—Legs (16 $\frac{1}{2}$ in.*)
- 2 pcs. $\frac{3}{4}$ x 1 $\frac{1}{4}$ x 11 $\frac{1}{2}$ in. poplar—End Rails
- 1 pc. $\frac{3}{4}$ x 1 $\frac{1}{4}$ x 18 $\frac{3}{4}$ in. poplar—Stretcher
- 1 pc. $\frac{1}{2}$ x $\frac{3}{4}$ x 8 in. white pine—Cleft
- 1 pc. $\frac{1}{4}$ x 8 $\frac{1}{2}$ x 13 $\frac{1}{2}$ in. plywood—Back
- 1 pc. $\frac{3}{4}$ x 3 x 8 in. poplar—Drawer Front
- 1 pc. $\frac{1}{4}$ x 7 $\frac{1}{2}$ x 7 $\frac{3}{4}$ in. plywood—Drawer Bottom
- 2 pcs. $\frac{1}{2}$ x 3 x 8 $\frac{1}{4}$ in. poplar—Drawer Sides
- 1 pc. $\frac{1}{2}$ x 3 x 7 $\frac{1}{2}$ in. poplar—Drawer Back

Stool

- 1 pc. $\frac{3}{4}$ x 11 x 18 in. poplar—Top
- 4 pcs. 1 $\frac{3}{8}$ x 1 $\frac{3}{8}$ x 16 $\frac{1}{2}$ in. poplar—Legs (17 $\frac{1}{2}$ in.*)
- 2 pcs. $\frac{3}{4}$ x 1 $\frac{1}{4}$ x 11 $\frac{1}{2}$ in. poplar—End Rails
- 2 pcs. $\frac{3}{4}$ x 1 $\frac{1}{4}$ x 19 $\frac{3}{4}$ in. poplar—Side Rails

* Allowance for turning



EDGES ARE FINISHED WITH FILE AND SANDPAPER

HOLES

KEYHOLE SAW

HOLES ARE BORED AT EACH END TO START KEYHOLE SAW

$\frac{5}{8}$ "

$\frac{7}{16}$ "

$\frac{11}{16}$ "

HOLES ARE OFFSET $\frac{1}{16}$ SO THAT PINS WILL DRAW JOINT TIGHT

Fowls Are Retrieved From Water With Snag-Hook and Rod



To avoid rowing or wading in small ponds, streams and lakes to retrieve ducks or other fowls shot from the shore, a hunter carries a rod and reel with which he casts a special floating snag hook. This consists of a fish-line bobber to which several hooks are attached with small staples as shown in the circle. When cast over the fowl or near it, the snag may be manipulated easily to catch and drag the bird to shore.

Scrub Brush Makes Sanding Block For Lathe Turnings

Sanding the irregular surfaces of a lathe turning is done easily by using a scrubbing brush as a sanding block. The abrasive



paper is stretched over the bristles of the brush and tacked to the back of it. The bristles provide a flexible backing for the paper so that it tends to shape itself to the contour of the work, except where the irregularities are very pronounced.

Extension Spout for Oilcan From Automatic Pencil

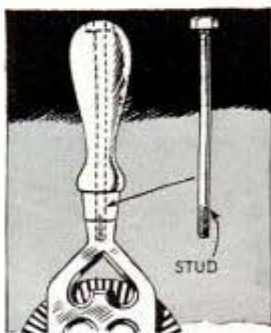
The barrel of an old automatic pencil makes a good extension spout for small household oilcans. If the barrel of the pencil is round, you may be able to force it over the short can spout tight enough to hold it in place. Otherwise, you can hold it in place and secure the joint with an application of cellulose cement. A small quantity of the cement may be placed inside the pencil before fitting it over the spout to make the joint more rigid. After it is thoroughly dry, the cement will hold indefinitely.

—Kenneth Murray, Colon, Mich.



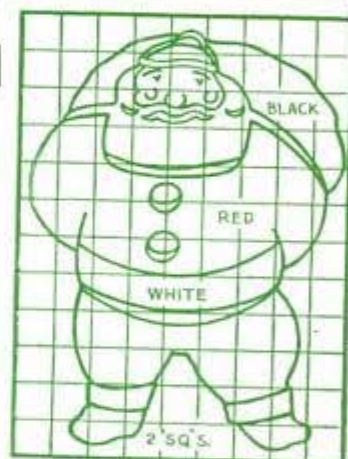
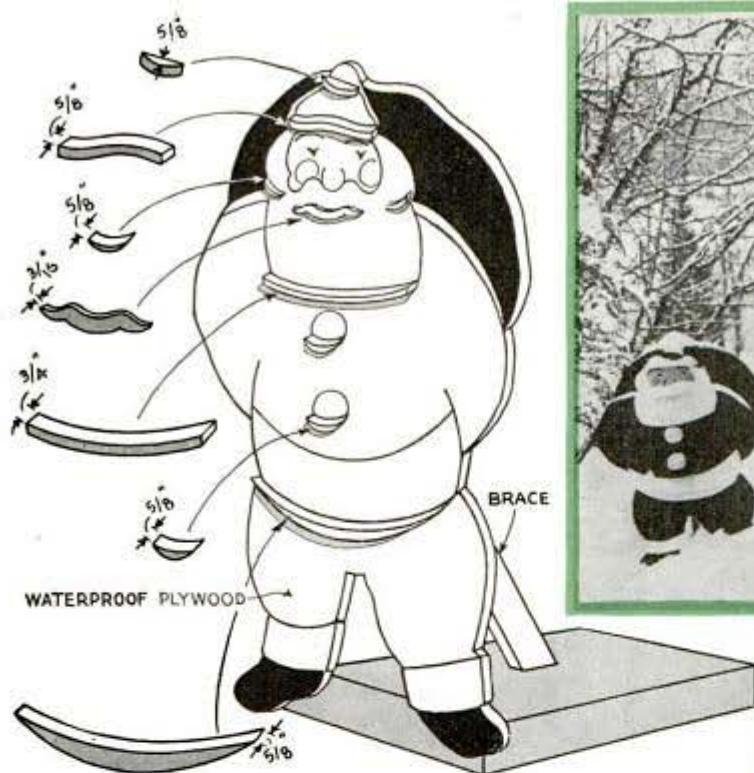
Repairing Grip of Hand Drill

When the wooden grip on a hand drill loosens so that the whole frame tends to twist, it can be repaired by substituting a long stud for the short original one. It will be necessary to extend the hole clear through the handle and countersink the end so that when a nut is driven on the end of the stud to pull the grip up tightly it will not injure the hands. If the stud is a little too long, grind it down and smooth it with emery cloth.



☐ If small corks are slipped over the pointed ends of your knitting needles and crochet hooks, there will be no danger of injuring your hands when you reach into your knitting bag.

This Plywood Santa Looks Real After Snowfall



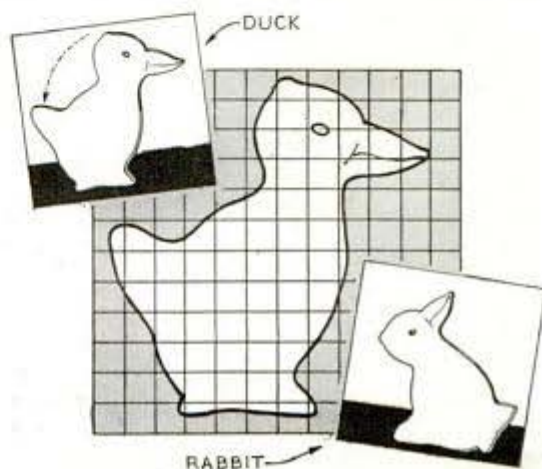
Falling snow builds up on the ledges that define the belt, cap, buttons and whiskers of this plywood Santa to give these features a furry, realistic whiteness. It may be built any height from a 2-ft. miniature to a life-size figure. After jigsawing the figure, a coat or two of outdoor white paint is applied to both sides as a weather seal. Then the colored areas are painted in, and the ledge pieces, which should be cut from straight-grained wood, are attached. If possible, an evergreen setting shielded from the wind should be chosen for the figure.

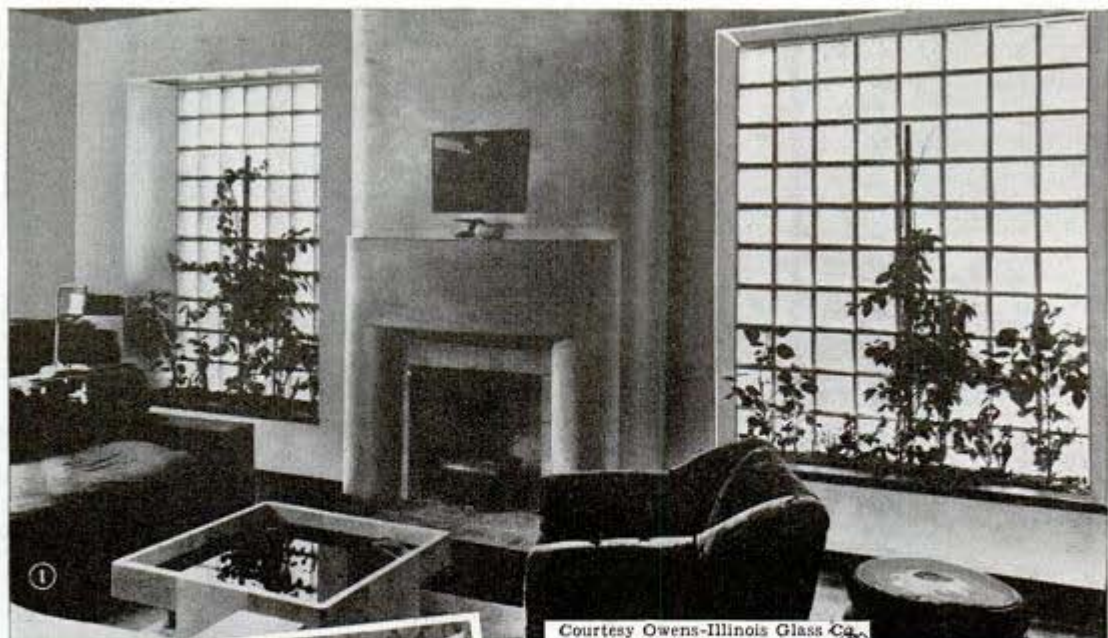
Combination Duck and Rabbit Cut-Out Amuses Children

You can have either a duck or rabbit with this cut-out merely by turning it over. It is just the thing to amuse a fretful child in an emergency because it can be cut from cardboard in a couple of minutes. And, if some school crayons are at hand, you can quickly give the cut-out a colorful appearance. The cut-out can be made any size by drawing it on cardboard marked off in squares as shown.

—Wm. Heding, New Monmouth, N. J.

Ⓛ Oiled silk or Pliofilm makes good school-book covers as they can be cleaned with a damp cloth. The titles are also visible through this material.

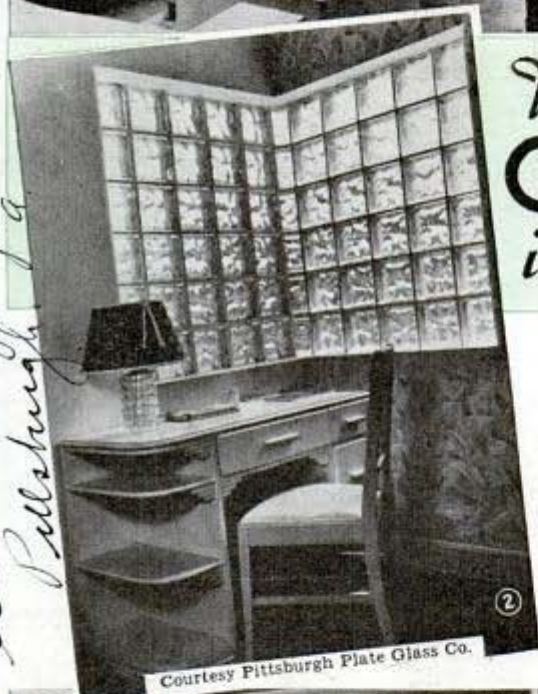




Courtesy Owens-Illinois Glass Co.

Toledo, Ohio
**Where and How to Use
 GLASS BLOCKS**
in Modernizing Homes

*Grant Bldg -
 Pittsburgh, Pa.*



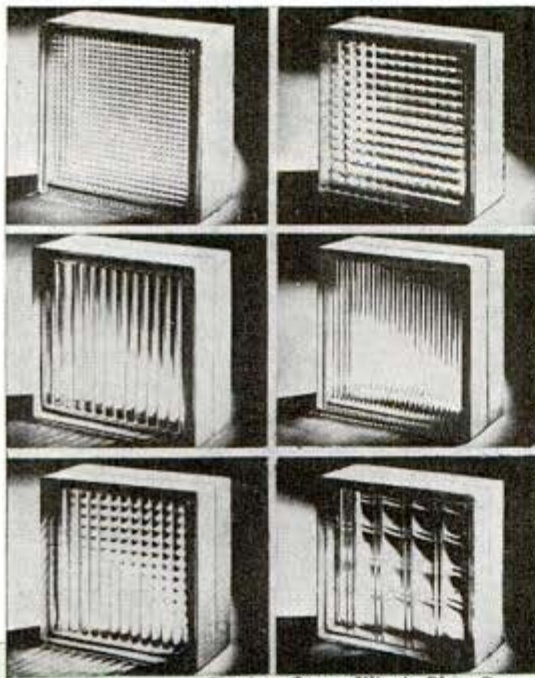
Courtesy Pittsburgh Plate Glass Co.



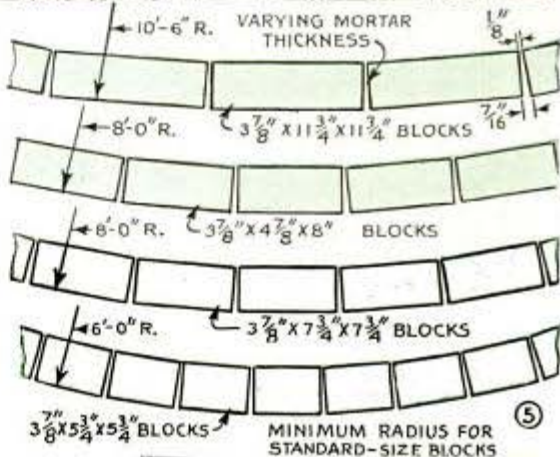
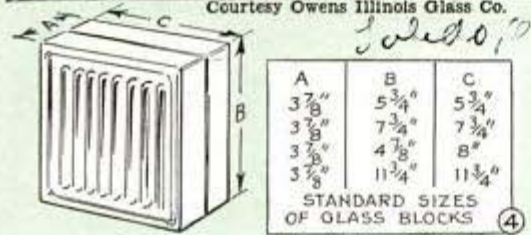
Courtesy Owens-Illinois Glass Co.

GLASS BLOCKS are a revolutionary building material that has real utility as well as decorative value and can be used in either brick, stone or frame structures. Panels of the blocks admit plenty of daylight, have excellent sound and heat insulating properties, are very durable, and show remarkably little tendency to steam or frost over. Maintenance costs are very low, and the material is easy to clean. There are no mullions to divide the area into small panels, and the translucent effect in the blocks makes the panels appear clean longer. Should a block be broken accidentally it can be removed by sawing out the joints and a new block mortared in its place.

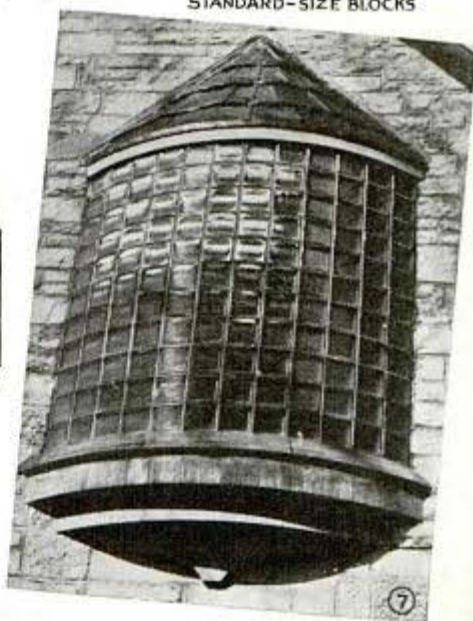
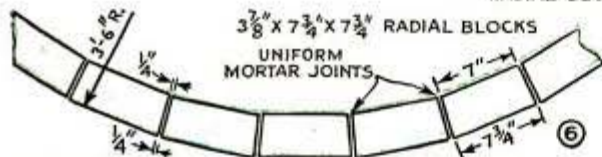
Figs. 1 and 2 are examples of the beautiful interior effects which may be obtained with glass-block panels. Bright, cheerful rooms and an abundance of diffused daylight can be provided in a home without undue heat loss or lack of privacy. Even a bathroom may be lighted in this way as shown in Fig. 3. Glass blocks are hollow and partially evacuated to produce a dead-



Courtesy Owens Illinois Glass Co.



air space. They come ready coated with a gritty material on all surfaces which are to receive mortar so that a perfect bond is assured. The blocks are available in the standard sizes shown in Fig. 4. Corner blocks are available in the sizes shown in Fig. 9. The use of radial blocks or combinations of radial and standard blocks makes it possible to build curved panels, Fig. 7. Figs. 5 and 6 show the minimum radius to which each size of block can be laid. A wide variety of patterns or configurations are available on glass blocks. These not only vary the appearance but determine the amount of light transmission or diffusion of the block. Therefore, selection must be made on the basis of results desired.

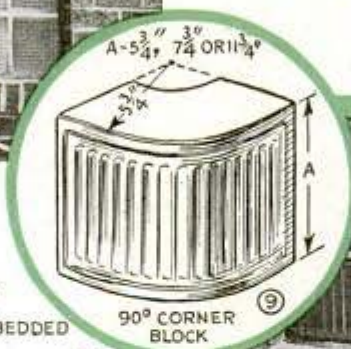
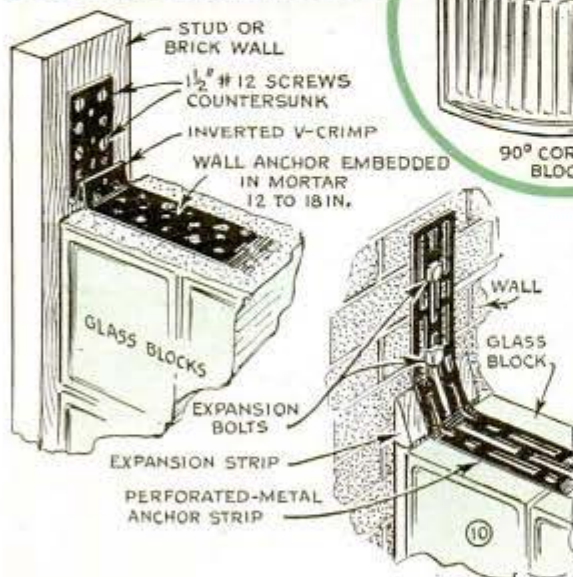


RADIUS FROM 3'-6" TO 6'-0" CAN BE OBTAINED WITH COMBINATION OF RADIAL AND STANDARD BLOCKS

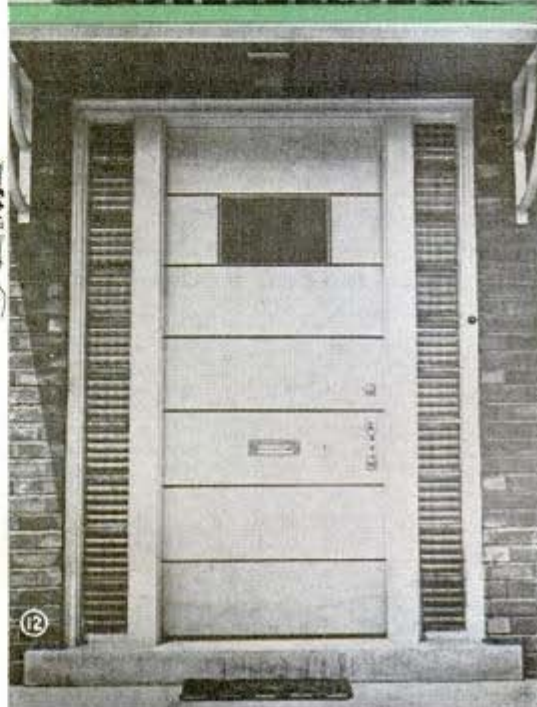


simply be substitutes for brick or stone in a wall. Instead, the glass panel rests on a sill but is supported in some manner at the sides and top just like an ordinary window. Loads above the panel must be carried on timber or steel lintels. For small panels in brick, brick veneer or frame, which do not exceed 80 sq. ft. in area or more than 8 ft. in height, the blocks may be laid on a sill and supported against wind pressure by means of metal wall anchors as shown in Fig. 10. Generally, these are secured to wood framing or fastened to a brick wall with expansion bolts, although they may be embedded 6 or 8 in. in the mortar between courses of brick on new work. Note the bend or crimp between the glass panel and the structure. This provides for expansion of the panel.

Wall ties are also used between courses of glass blocks. These may be of the wire variety shown in Fig. 13 or of expanded or



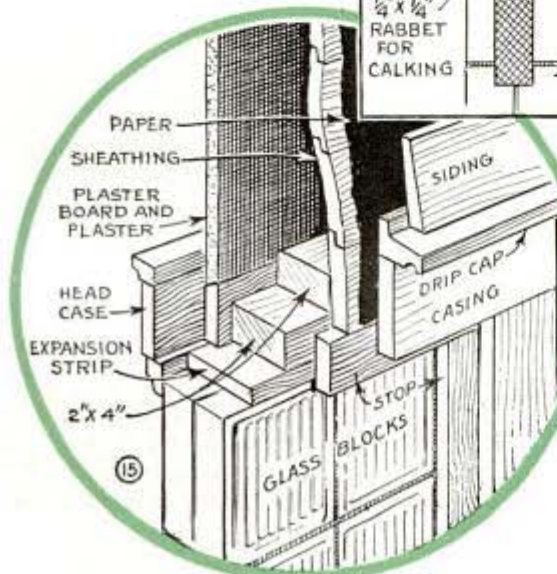
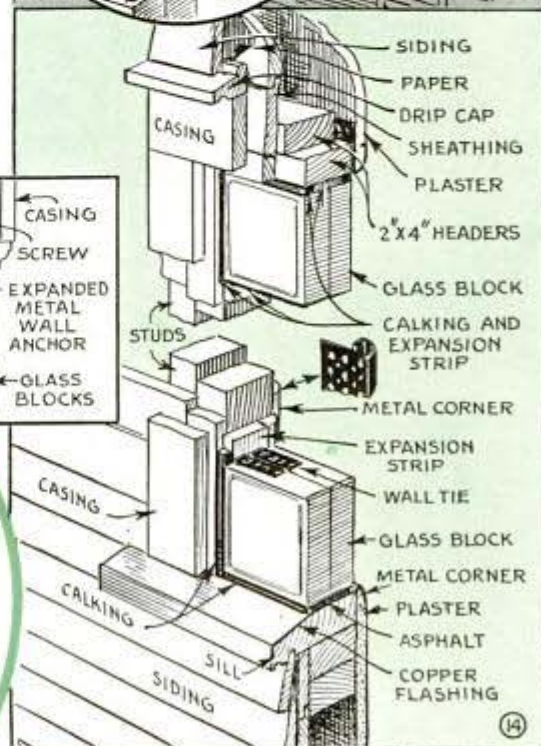
Perhaps the simplest use of the blocks is for cellar windows where light and privacy are desired, but no ventilation need be provided. Fig. 11 is a typical installation. Side lights flanking the front door, Fig. 12, are another example. They provide light for the hall without sacrificing privacy. The kitchen is another place, also a stair well. An exterior view of the popular corner window arrangement is shown in Fig. 8. It should be remembered that glass blocks are not a load-bearing material and cannot



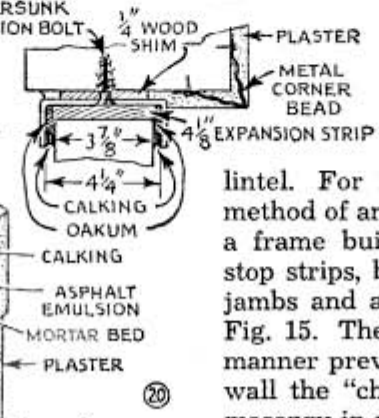
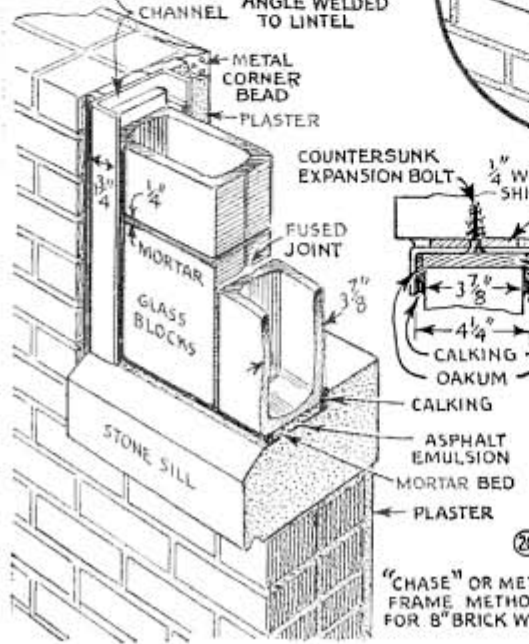
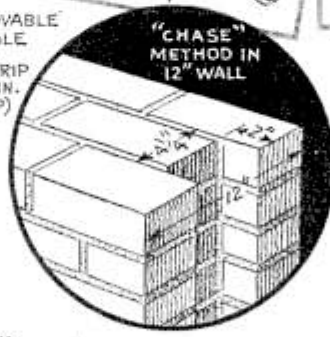
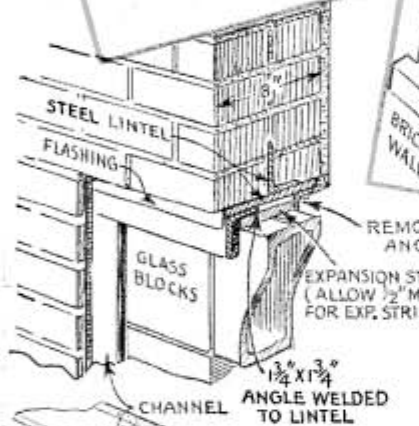
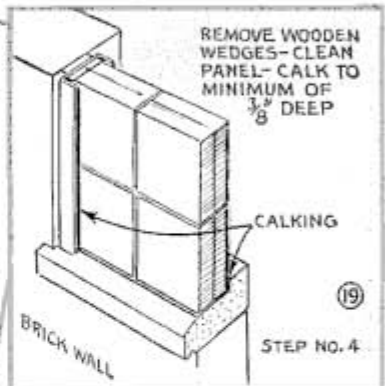
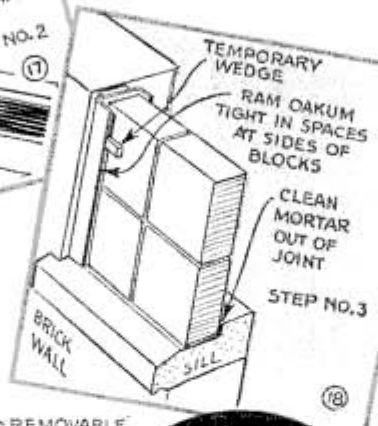
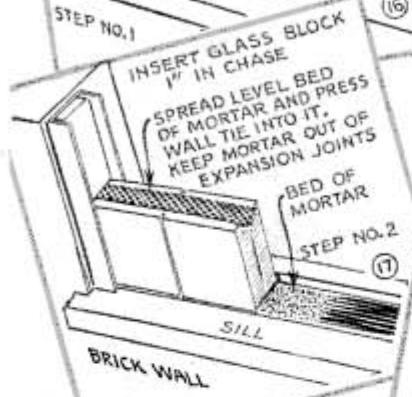
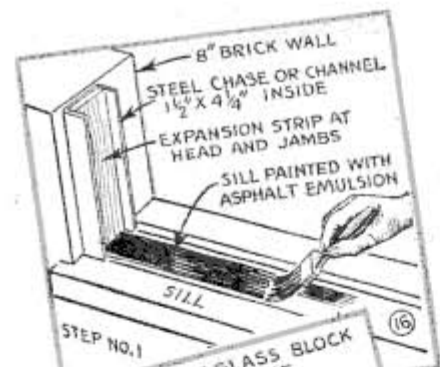
perforated metal. The two smaller sizes of blocks require ties every fourth course, while the third largest size requires them every third course and the largest size every course. The same number of anchors are used but are staggered rather than placed in the same joint. Ties should run continuously, lapping 6 in. where required.

Fig. 14 shows the simplest form of installation and should be used only on small panels. In this example, the building is of frame construction but the method applies equally well to brick or veneer. The opening is made 1 in. wider and higher than the area of the panel, figuring a $\frac{1}{4}$ -in. mortar joint between each block. At the jambs and across the top a strip of spun glass or similar material formed into an expansion strip is cemented with asphalt emulsion to cushion the blocks from the structure and to provide for expansion. Slits must be cut in this material for the wall anchors. The sill is covered with a coat of the asphalt also but the expansion strip is omitted. Wood sills should be flashed with copper before applying the asphalt.

Mortar used for glass blocks consists of waterproof Portland cement, 1 part, hydrated lime, 1 part and clean, well graded sharp sand, 4 parts, all measured by volume. Sufficient water is added to produce a consistency so that the mixing hoe is clean when withdrawn from the mixture. Mortar must be mixed in a water-tight box and "hoed" from end to end until all ingredients are completely incorporat-



The simple method above of installing glass blocks can be used on either brick or frame construction, but it is suitable only when filling in small openings

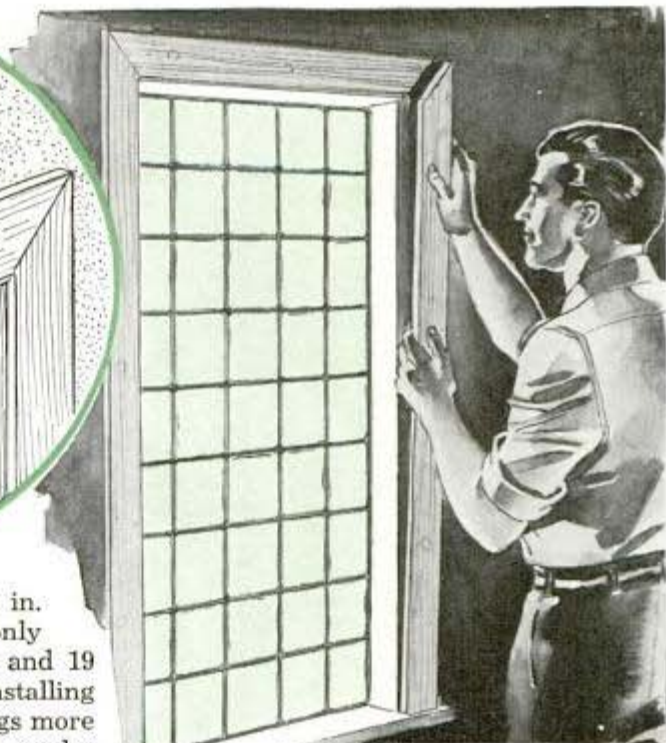
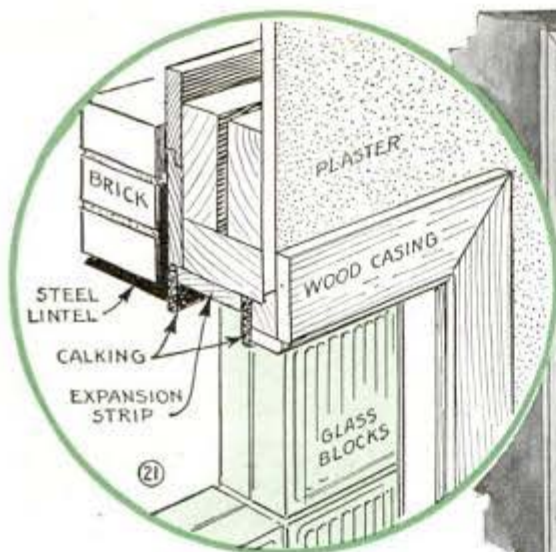


ed. Start by applying a level bed of mortar about 1/2 in. thick on the sill. Beginning at one end, lay the blocks across the opening, taking care that all joints are completely filled. The mortar should be about 1/4 in. thick. Care must be taken not to strike the glass blocks with metal tools. Blocks are laid by working them into place with the hands, shoving one against the other to compress the vertical joints. After the mortar has passed its initial set, the exposed edges of the joint should be tooled and thoroughly compressed with a round jointer, leaving the finished surface slightly concave, smooth and nonporous. Final cleaning is done after the mortar has set completely.

The next step is the calking which should be about 3/8 in. deep. Nonhardening, waterproof calk-

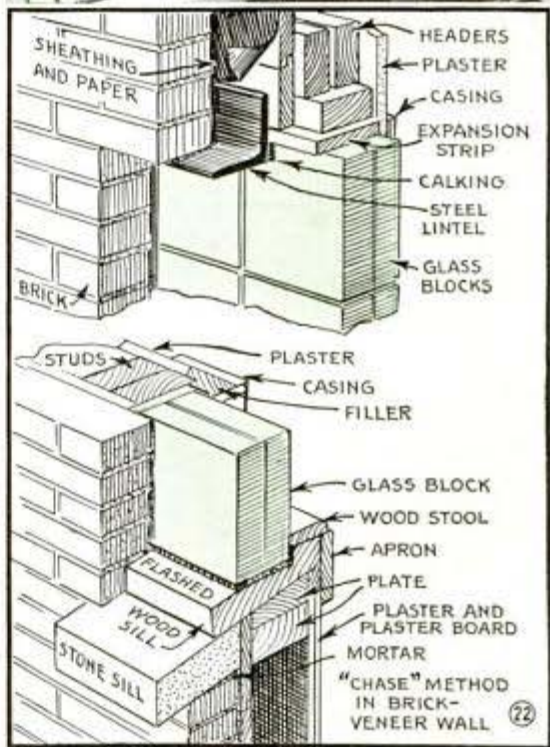
ing material, which is best applied with a calking gun, is used to seal the panel completely on both sides and all around, against wind and moisture. On very small openings using not more than six blocks, glass panels are sometimes set flush with the face of a brick wall and the sill is omitted. In such cases the same procedure is followed including the steel

lintel. For large openings the "chase" method of anchoring is recommended. In a frame building this consists of wood stop strips, both inside and out, up both jambs and across the head as shown in Fig. 15. The sill is treated in the same manner previously described. In a brick wall the "chase" may be formed in the masonry in new work, or a steel form or channel may be bolted to the wall in the manner shown in Fig. 20. Masonry chases



must be a full 2 in. deep and $4\frac{1}{4}$ in. wide, but a steel chase requires only $1\frac{1}{2}$ in. of depth. Figs. 16, 17, 18 and 19 show the progressive steps in installing panels in a brick wall. For openings more than 10 ft. across, 2 by 2-in. stop angles should be used across the head, both inside and out. Care must be taken that bolt heads, gobs of mortar or other obstructions do not extend into the expansion joint, as cracked blocks may result.

Panels in brick-veneered houses may be installed by the chase method in Figs. 21 and 22, which utilizes the brick for one side and wood framing for the other. Or, if desired, the panel may be brought out against the brick and secured with a metal chase such as used on solid brick. When the panels have been laid and the mortar has set, nonstaining oakum is rammed between the sides of the brick and the chase with a calking iron. Oakum should be rammed back $\frac{3}{8}$ in. from the finished surface to provide space for the calking material. The oakum wedge supports the panel against wind pressure, and the calking seals the joint against both wind and moisture. For panels larger than 144 sq. ft. in area or longer than 20 ft., reinforcing is required. Such panels are either braced by intermediate stiffeners or are subdivided by mullions. Advice should be sought from the manufacturer in such cases. Steel door and casement window frames are available to use in conjunction with glass blocks and may be obtained together with all of the material described from the dealer supplying the glass blocks.



☛ If you will make a covering for your washing machine from heavy unbleached cotton cloth, you will find that it will keep dust and dirt from collecting on the motor and wringer, as well as save the time of cleaning these parts. Keeping dust out of bearings prolongs the life of your washer.

Quick Method of Dividing Work Into Equal Widths



If it is necessary to divide a board or other work into equal widths, it can be done quickly with a ruler. Just lay this across the board at an angle so that the angle measurement is divisible by the number of widths desired.

—Clarence Breitenfeldt, Marathon, Wis.

Bottles Set in Wet Concrete Provide Holes for Railings



When pouring a concrete porch or steps which are to be fitted with a metal railing, holes for the railing supports can be provided by sinking bottles in the wet concrete.

After the latter has set and the railings are ready to be installed, the bottles are broken out.—Opie Read, Jr., Chicago.

Plant and Tree Insect Control

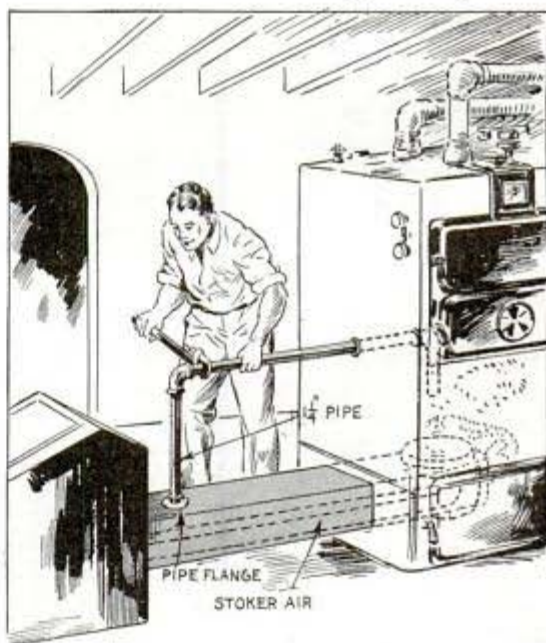
An inexpensive, non-poisonous spray which will destroy most plant and tree insects consists of an emulsion of water, kerosene and soap. The concentrated solution, which is diluted just before use, is made by dissolving any good laundry soap, 1 lb., in water, 1 gal., with the aid of heat. After

the soap has been dissolved thoroughly and is still boiling hot, pour it slowly into kerosene, 2 gals., while stirring. The stirring should be continued until the white emulsion has cooled to room temperature. For use on plants, one part of the emulsion should be diluted with 20 parts of water and stirred thoroughly immediately before using. Any kind of spray gun may be used. Fruit trees and vines also may be sprayed with this insecticide by diluting one part of it with ten parts of water. The concentrated preparation will keep indefinitely if protected from freezing.

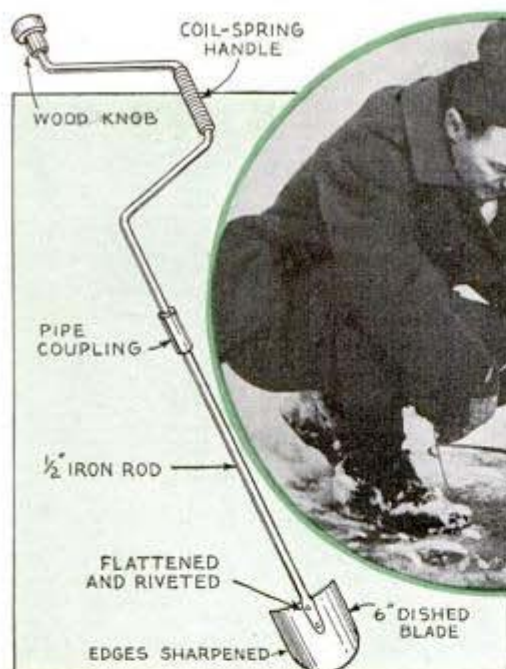
Air Blast Above Stoker Fire Gives Good Combustion

We have found that by directing a stream of air over a stoker fire, gases ordinarily lost up the flue are burned and fly ash is reduced to a minimum. Before installing the air stream, we were disposing of a bucket of fly ash and tiny fuel particles daily. The air stream is produced by the stoker fan, and is directed above the fire by means of a 1¼-in. pipe assembled as shown, the pipe being connected into the stoker air stream. This is done by cutting a hole in the air duct and attaching a floor flange over it, using small stove bolts for the purpose. The pipe should terminate about 16 in. above the fire, and the amount of air can be controlled by a damper located conveniently in the pipe.

—D. L. Hardman, Denver, Colo.



Tool for Boring Through Ice Aids Fishermen

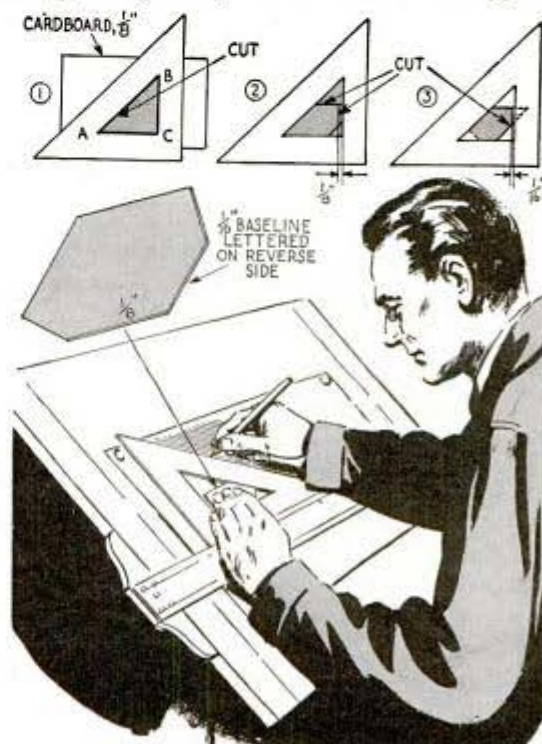


Ice fishermen will find this tool a time and labor saver as it will penetrate ice of any thickness quicker than the customary ice pick. Designed by Elias Wiklund of Barre, Mass., the tool is a large jointed

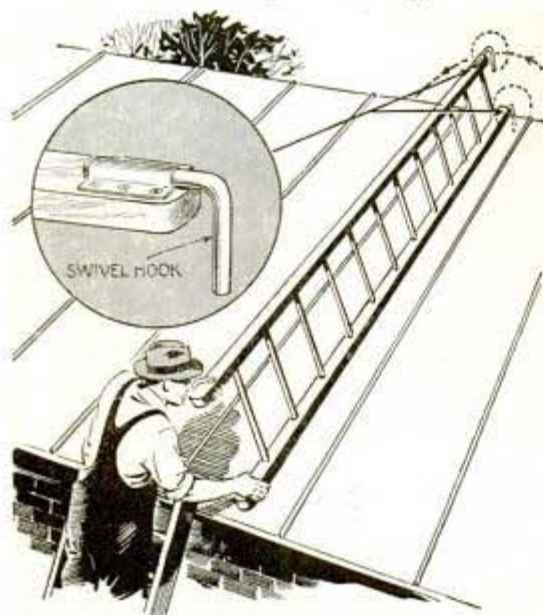
auger with a dished cutting blade that shaves a hole through the ice with a circular motion. The auger handle is about 5 ft. long; the blade is sharpened on sides and bottom.—P. E. Bassett, Springfield, Mass.

Template Aids in Cross Hatching Rapidly With a Triangle

Uniform cross hatching is done rapidly with the aid of this simple accessory. To make it, mark the center opening of a drafting triangle on cardboard, lettering the corners for reference as in Fig. 1. Cut out the outline very carefully. Then cut a $\frac{1}{8}$ -in. strip off the side BC, Fig. 2. Also, cut off the top half on the corner C, making the angle one half of the original side BC. Mark the base line permanently $\frac{1}{8}$ in. The cardboard can now be used for $\frac{1}{8}$ -in. spacing. Next turn the cardboard over and mark AL on the reverse side of the corner A. Lay it within the triangle, Fig. 3, and cut off the projecting corner AL $\frac{1}{16}$ in. inside the triangle. Mark the present base line $\frac{1}{16}$ in. When this base is used, the lines will be spaced $\frac{1}{16}$ in. In use, draw the first line of the cross hatching. Then hold the triangle and slide the cardboard to the far side. Now hold the cardboard and slide the triangle back against it, and make the second line, repeating this procedure for each line.—H. W. Walrath, Westfield, N. J.



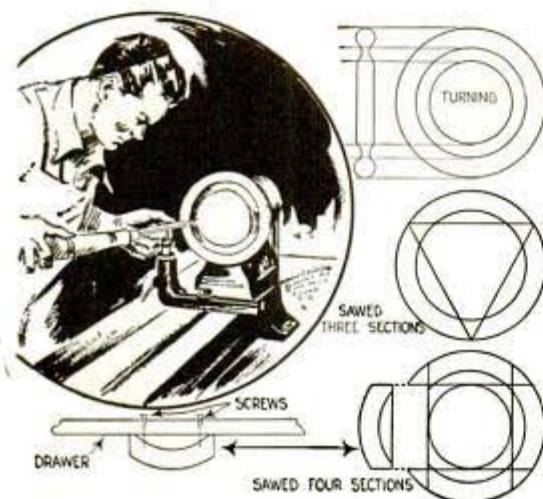
Swivel Hooks Hold Ladder Safely When Moving It Along Roof



To increase the ease and safety of moving a ladder along a roof, one workman used swivel hooks. These rest flat on the roof as the ladder is slid into place, automatically dropping over the ridge. In moving the ladder along a roof, it is easy to roll it over and over, one hook engaging the roof at all times so there is no danger of it slipping or falling.

Make Your Own Drawer Pulls From Lathe Turnings

Curved, decorative drawer pulls can be made easily on a lathe. Just turn a disk to any desired shape and then saw it into three or four equal parts as indicated in



the details. The diameter of the disk and the number of pieces into which it is cut will determine the length of the pulls.

—Martin Mittermiller, Marshfield, Wis.

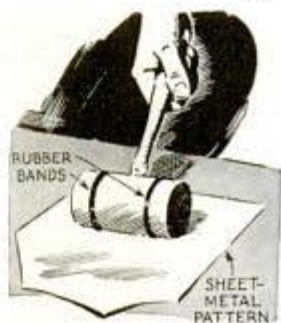
Watch Crystal Holds Specimens On Microscope Slide

You will find that the small crystal of a wrist watch is handy for holding specimens on the glass slide of a microscope. It does not interfere with your vision, and it enables you to remove or replace the specimens in a jiffy.

—G. E. Hendrickson, Argyle, Wis.



Rubber Bands on Mallet Aid In Handling Sheet Metal

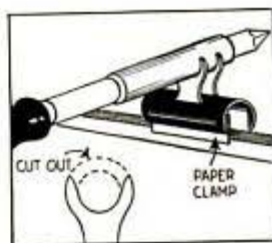


When working with pieces of sheet metal on a bench, a couple of wide rubber bands snapped around your mallet will aid in moving the work about. The bands provide the necessary friction

for moving or turning the metal easily.

Soldering-Iron Holder Clamps To Any Surface Edge

A large paper clamp makes a good support for a small soldering iron and has the advantage over other supports in that it can be clamped to the



edge of any surface for rigidity. The support is made by grinding the top part of the clamp handles to take the soldering iron.

After opening a jar of jelly, rub butter on the jar top to keep the lid from sticking.

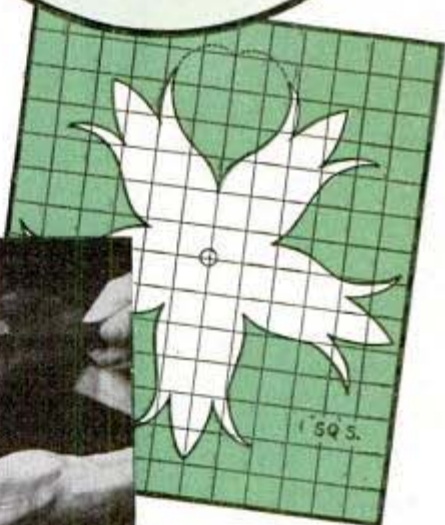
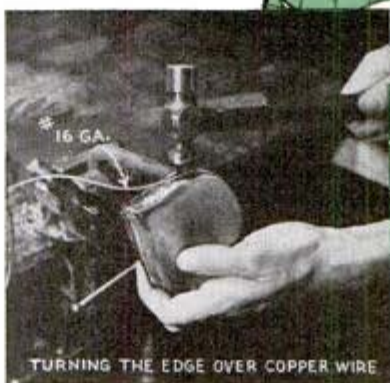
REVOLVING CANDY TRAY

in leaf design



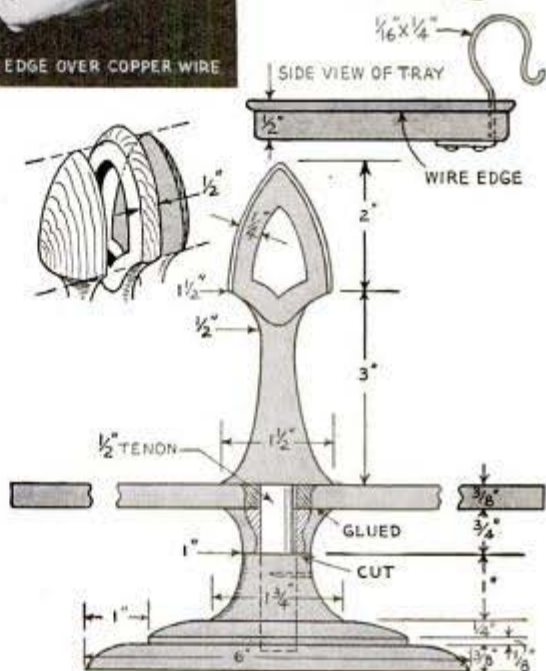
Gleaming metal trays in sharp contrast to a walnut stand go to make this attractive tray a smart accessory at bridge

THIS revolving stand with five individual trays formed of sheet copper in the popular leaf design provides a stunning piece for serving candy, relishes or canapes. To make it, first draw an enlarged paper pattern of the tray platform, and jig saw it from $\frac{3}{8}$ -in. plywood. The turned parts between which the platform revolves consists of a two-part base into which a tenoned handle is pinned to the lower half, the upper half being glued to the bottom of the platform, but not to the tenon. The center of the handle is cut



out after two sides have been flattened as shown. Ample clearance is left between the handle and the platform to allow the latter to rotate easily after the finish has been applied. Either sheet copper or brass of about a No. 16 ga. is best from which to form the leaf-shape trays. These are hammered to fit the platform openings, the edges are turned over soft wire, and completed by riveting small bent handles to the bottom and edge. A block of hardwood, over which the trays are formed, is cut slightly smaller than the opening in the platform. Buff the trays and apply a thin coat of clear lacquer to keep them bright.

Wash mirrors with clear water to which a little starch has been added, let them dry, then rub with a cloth and they will sparkle.



Boilers and Furnaces Cemented Easily With Pressure Gun

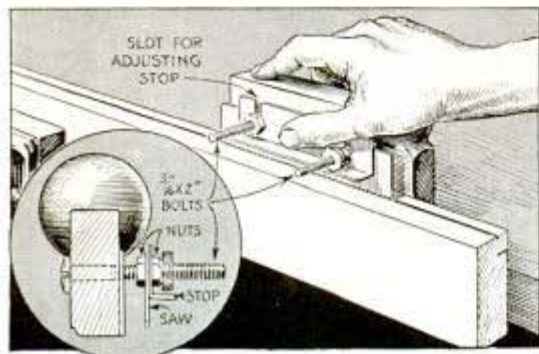


When a boiler or furnace has to be cemented you can do a better job with a pressure gun than you can with a trowel. With a gun, the cement is driven deeply into the joints to produce a lasting job. An old grease gun will do for the work, but if you have many jobs to do, a regular calking gun will be more satisfactory. If hairpins with the legs bent outward near the ends, are pushed into the cement on boilers before it hardens, they provide a convenient means of fastening the wire mesh used in anchoring plastic insulation.

—Andrew Vena, New York.

Hand Grooving Tool From Saw

Here is a simple hand grooving tool that will enable you to get into places where a regular grooving tool cannot be used. As shown in the circular detail, a piece of saw blade is fitted to a block, which is provided with a suitable grip. The saw blade is



locked on two bolts by nuts, which also lock a depth stop in place. The tool is adjusted for width by running the nuts in or out.—Charles Lehre, Roxbury, Mass.

Iron Shields Over Ladder Ends Simplify Pushing It Up Wall

The difficulty of pushing a long ladder up the wall of a building because the ends catch on the siding or on pieces of mortar projecting from between bricks, can be avoided by using these iron shields.

They are bent from pieces of $\frac{1}{4}$ -in. flat iron and bolted to the ladder rails in the positions indicated.



Valve Spring Makes Good Wiper For Paint Brush in Shop



A wiper to remove excess paint from a brush can be made from an auto-valve spring. An end coil of the spring is slipped over the edge of the paint can, as indicated in the drawing, after

which the brush bristles are drawn through the coils to squeeze out the paint.

Lubricating Paper Stapler With a Lead Pencil

If the staple groove or any of the moving parts of an office stapler need lubricating, just rub a soft lead pencil over them. The graphite in the lead provides a good lubricant, and it will not collect dust and soil papers and hands like a liquid lubricant.



TOM-THUMB GARDENS

in Jugs, Jars and Bowls



①

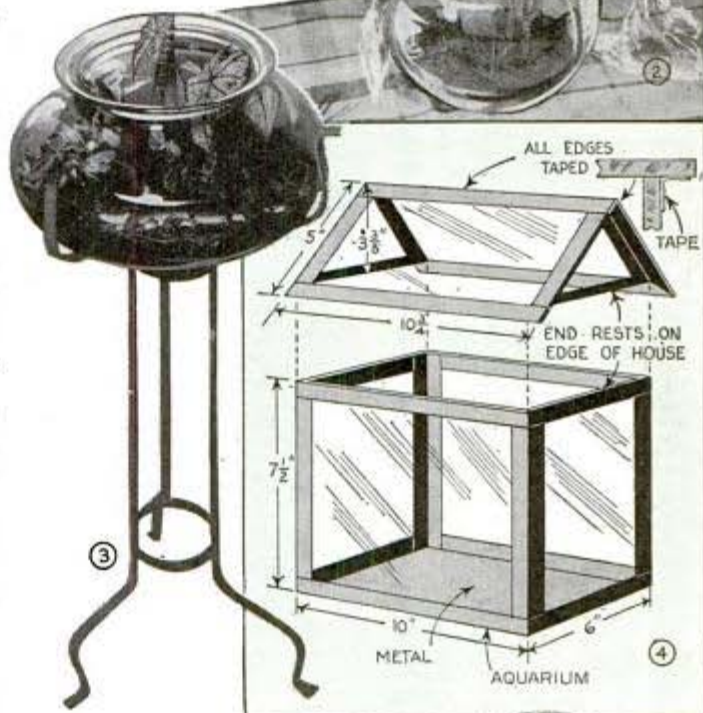


By Bess Livings

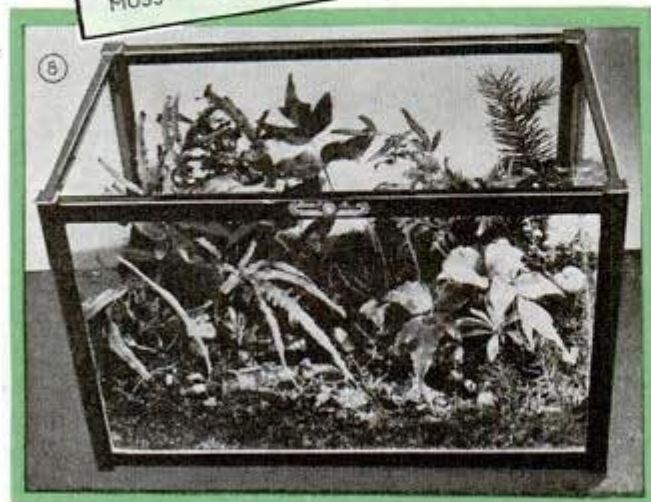
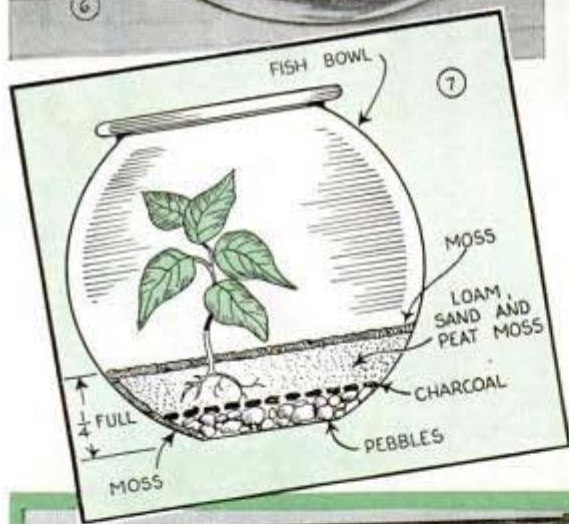
PLANTS that do not grow well in dry air of the average home can be cultivated successfully in glass enclosures. Natural woodland beauty, tropical jungles, Japanese gardens and desert scenes are easy to reproduce in miniature. Keeping everything to scale and combining plants of similar types that require the same temperature and humidity will simplify the care.

Any kind of container that can be closed tightly with a transparent cover to keep moisture in is satisfactory. If the container has no cover, you can use a piece of glass cut to fit the opening, or Cellophane held in place with a rubber band.

Fig. 1 shows a novel arrangement of a glass house with landscaped lawn, which can be made from a small aquarium, or panels of glass assembled with adhesive tape, Fig. 4. Square-mesh fence wire is used to form the two porch-side trellises. Porch posts extend into the ground $\frac{1}{2}$ in., and airplane cement is used to hold the roof and floor in place. All tape and metal parts, including the cake tin in which the lawn is made, are painted green. Small pebbles form a drainage layer in the bottom of the tin and grass seed is sown in a mixture of soil, sand and peat moss. Flat



⑤



slivers of stone laid from the porch to gate form a walk. Plants with small leaves, and twigs of evergreens set in the lawn simulate shrubs and trees, while tiny vines such as Kenilworth ivy adorn the trellises and window box.

A combination of small greenhouse plants is used inside the house. Begonias, African violets, lantana, heliotrope and primrose are suitable flowering types. Coleus, philodendron, fittonia, caladium, wandering jew, pepperonia, croton, house ferns and ivies all have decorative leaves. Small bulbs such as scillas, crocus and snow-drop grow fast and produce small, colorful blossoms. A carpet of helixine (baby tears) is a delightful addition.

An interesting glass garden is one in which native materials from the woods are used, Fig. 8. Hills built up at the sides and back, slope down to a stream made from a piece of lead, bent to hold water and sunk in the soil. Sand is sprinkled in the bottom and moss or creeping vines cover the edges. A few moss or lichen-covered branches represent logs. Ferns and feathery plants grow along the sides and rear, little seedlings being planted on the hills. Spring flowers suitable for such a scene are potted in summer or early fall and left outdoors until late November. After slowly thawing in a cool place, they will bloom in a short time in glass gardens. Hepatica, spring beauty, violet, early anemone, trailing arbutus, Dutchman's breeches and phlox subulata all bear tiny flowers; and wood ferns, partridgeberry, wintergreen and seedling evergreens are particularly attractive in moss-covered ground.

Only a few specimens of cacti are needed to make an attractive desert scene, Figs. 2 and 5. The adobe house is a block of wood with recessed door and windows painted Mexican blue. Short pieces of matchsticks stained brown are pushed into holes at the house top to simulate rafters, after which a mixture of plaster-of-Paris and sand is daubed over the house. A branched cactus, resembling the giant sahuaro, a few heavily spined specimens, a small agave or century plant and tiny clumps of wiry grass suggest the real desert.

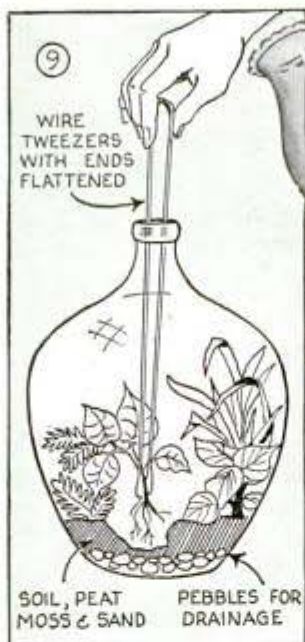
A tropical garden lush with

ferns, moss, exotic foliage and flowers also thrives in a glass enclosure. The swamp scene, complete with alligator, in Figs. 3 and 6, is easy to arrange, using greenhouse plants such as fancy-leafed caladiums, begonias, African violets, striped wandering jew, ivies and ferns, together with a few seedling dates, oranges, lemons or grapefruit, and some moss.

In a graceful Japanese garden, small sedums represent bushes, and evergreen twigs the trees. Such twigs will root if the needles are removed from part of the stem below ground. Budded twigs of wild plum, English currant, forsythia and others soon blossom and leaf out. A tin-foil or mirror pool, tiny figures, bridge and pagoda complete the picture. In a miniature rock garden, Fig. 9, the mixture of soil, peat moss and sand is first piled high around the edges. If a jug-shaped container is used, long wire tweezers will be found convenient to aid in setting the plants. Succulents are ideal for this kind of a garden as their roots require little soil. Select small specimens of echeveria (hen-and-chickens), aloe, crassula, various sedums and cacti, some to stand high at the sides and back, and some to spread over the stones. Another novel container for tall, slender plants is shown in Fig. 10. It consists of a pottery bowl and ordinary lamp chimney.

All containers should be provided with a layer of pebbles in the bottom for drainage as in Fig. 7. Charcoal is sprinkled over the pebbles to keep the soil sweet, after which the container is filled one-fourth full of

Miniature gardens made in jug-shaped glass containers are arranged with long tweezers bent from a piece of wire, flattened on both ends to provide a firm grip on plant stems



garden soil, peat moss or leaf mold and sand. The sides are lined with sheet moss, green side out, and a layer is placed on top of the soil after planting is complet-

ed, except in cactus and succulent gardens, which require less moisture. More sand and gravel should be used in these gardens.

Plants in gardens of this type are watered moderately. Covers should be kept on the containers except when ventilation is needed. If little moisture is allowed to escape, the garden will not require watering for months. Cacti and succulents prefer dry air so need more ventilation. Most plants in glass gardens flourish in a temperature of 65 degrees, with plenty of light, but no direct sun. Tropical plants, cacti and succulents can stand more heat than woodland plants.

Flashlight Taped to Screwdriver Illuminates the Work



When working with a screwdriver in dark corners there is no need to chance misplacing a screw or driving it in at an angle because of improper illumination. Just tape a pen-type flashlight to the shaft of the screwdriver. This will provide illumination right where it is needed and leave both of your hands free.

Altered Line-Spacer Stop Permits Triple Spacing on Typewriter



On some portable typewriters that permit only single and double-spacing of the lines you can triple space them by altering the spacer stop. The alteration consists of filing away the spacer stop so that the adjusting pin can be moved farther back as shown in the drawing.

Piece of Hose With End Notched Cleans Washing-Machine Drain

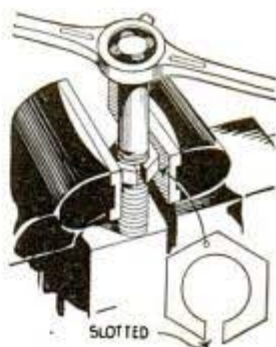
For removing lint that frequently clogs the washing-machine drain, cut long notches in the end of a length of garden hose and use this as a cleaning tool. When the hose is inserted into the drain opening



with a twisting motion, the notches in the end will engage the lint and it can be removed by withdrawing the hose.

Slotted Nut Holds Stud in Vise For Threading

When a stud has to be threaded at both ends, one threaded end can be gripped in a vise by using a slotted nut. The nut is turned onto the threads and then clamped between the vise jaws, the slot permitting it to be squeezed tightly against the threads to grip the stud and hold it while the threads are being run on the other end.



—Fred Scarboro, Galena Park, Tex.

Handle of Glue Brush Kept Clean By Clipping It to Bottle



To keep a glue brush from sinking to the bottom of the bottle and getting the handle sticky, just clip it to the mouth of the bottle. A bobby pin will serve as a clip, and is attached by pushing one leg down inside the hollow handle of the brush, letting the other leg project on the outside.

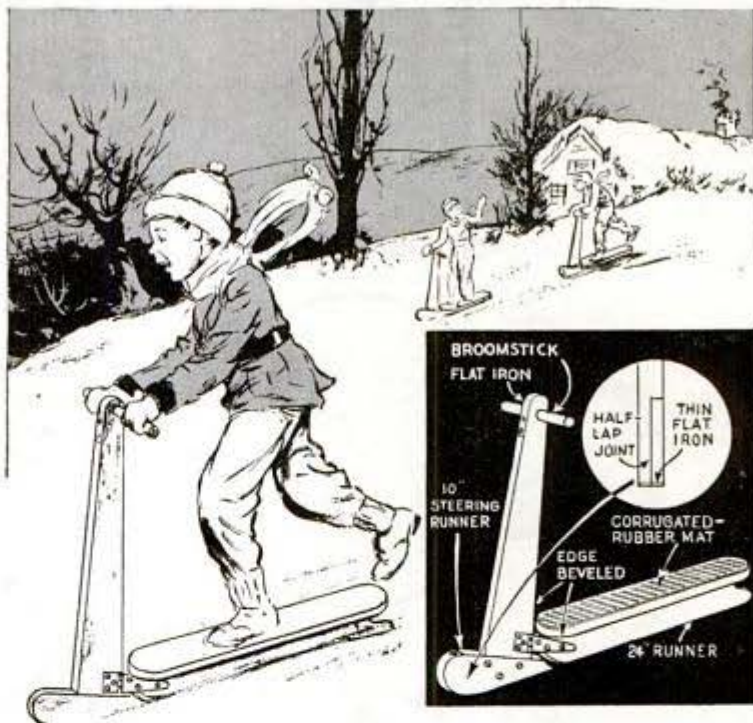
Loose-Riveting a Hasp Hook

The difficulty of re-riveting a hasp hook so that it will operate freely can be avoided with a sheet of paper. This is placed between the hasp and hook before clinching the rivet, after which the paper is torn away, thus spacing the two parts so that they work freely.



Simple Snow Scooter Is Used Also as a Coaster

You can coast downhill on this scooter, or you can push it along flat surfaces with one foot. It consists of two runners, a short one and a long one, which are pivoted together by means of a hinge. It can be made of $\frac{3}{4}$ -in. white pine, or even scrap wood that you have available. The undersides and rounded ends of the runners should be covered with flat iron to provide a smooth, long-wearing surface. The iron can be attached with screws, countersinking the heads into the metal. A length of broomstick serves as a steering handle. The top of the steering post also is bound with flat iron.



Washing Machine Emptied Into Drain Pipe of Laundry

To solve the problem of easily draining our washing machine, which was not fitted with a pump for the purpose, I used the method shown. I removed the nipple just above the gooseneck on the laundry tub drain, put in a tee, and installed a sill cock.



A short hose running from the cock to the washing machine provides a positive drain. The outlet is convenient in the event of a stopped drainage system, as the water can be removed from the tub without dipping. Also, it furnishes a connection to attach a water hose to force out material that has caused the stoppage. Be sure that the drain hose is long enough to permit moving the washing machine about.

—Tom E. Dougherty, Torrance, Calif.

Wood Strips Stiffen Stairs

If your basement stairs are weak and tend to spring up and down when you walk on them, they can be stiffened by nailing 1 by 3-in. strips along the lower edges of the supports.



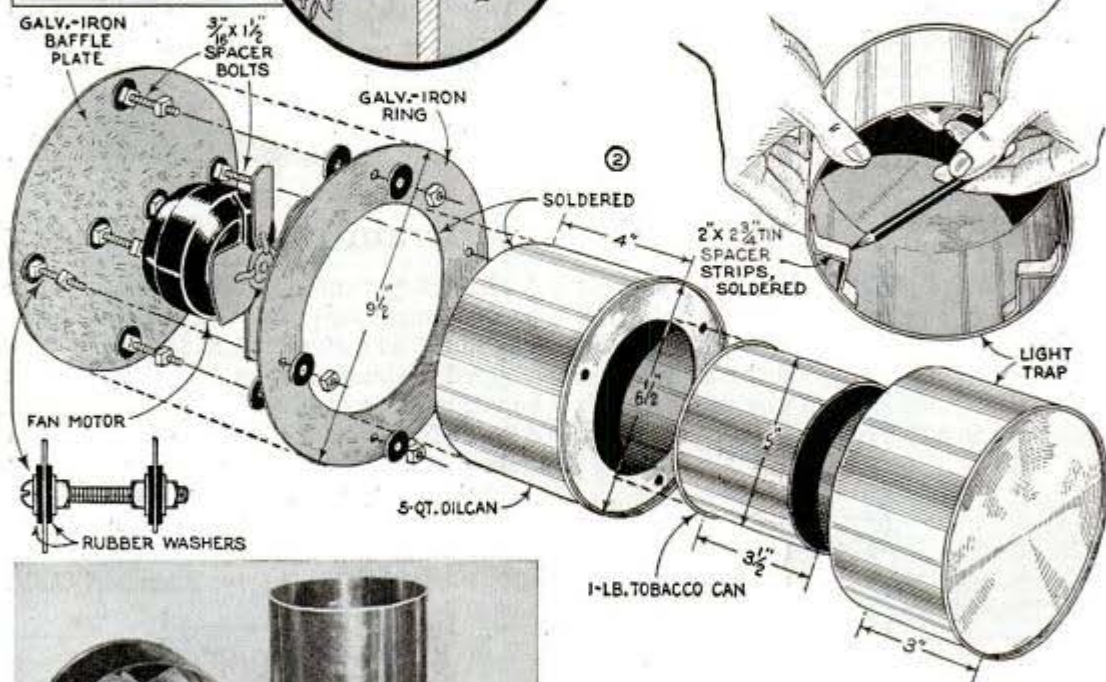
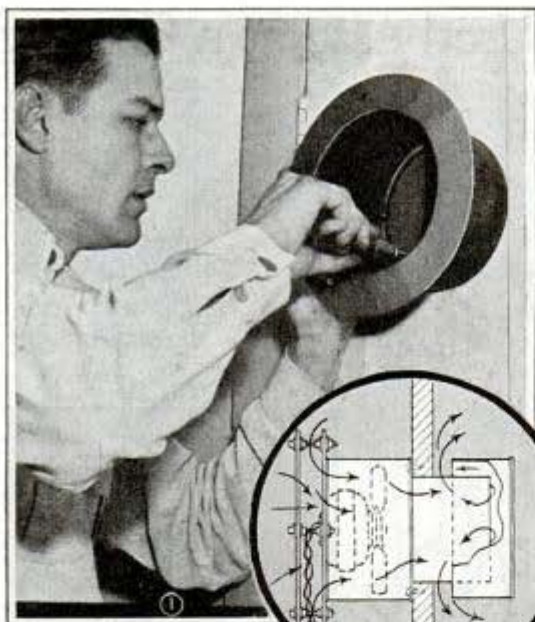
The strips will take part of the bending strain and add much rigidity to the stairs. Nails used in fastening these strips should be staggered about 10 in. apart to help avoid splitting.

FRESH AIR *in*

By Hugh Smiley, Jr.

THIS efficient electric ventilator is readily constructed from inexpensive materials, and will provide plenty of clean air for your darkroom without admitting light, Figs. 1 and 4. Only the simplest of hand tools are required, and the only purchases necessary are a few bolts, a small electric fan and some galvanized sheet iron, available at your local store.

Referring to Fig. 2, the fan housing is made from two containers, a 5-qt. oilcan and a 1-lb. tobacco tin. After cutting the two cans down to the lengths given,



Turn on the fan and check the unit to see if there are unnecessary noises or vibrations that can be removed before mounting the ventilator and don't forget the rubber washers under the nuts of the spacer bolts used in assembling the ring-and-baffle unit

the smaller one is soldered over an opening in the end of the larger one, first drilling three holes equidistantly for bolts to mount the ventilator as shown in the circular detail of Fig. 1. The opening in the end of the large tin can be cut with a pair of heavy dividers, first marking the circle lightly and then bearing down heavily as you work around the line. Keep the cutting point of the dividers sharp with a file and you will have a neat hole cut quickly. The ring and baffle plate on which the fan is mounted are next. These are assembled with spacer bolts and nuts, Figs. 3 and 5.

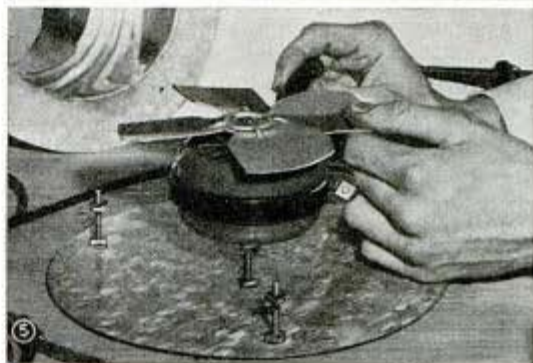
the DARKROOM

The opening in the ring is best made by drilling a number of small holes around the scribed circle and then cutting out between the holes with a chisel. Note that rubber washers are used on the bolts on each side of both the baffle and ring to help insulate the motor from the rest of the assembly, and to dampen vibration. The motor is mounted on the baffle with spacer bolts also. It may be necessary to drill and tap the motor base or housing to take the bolts. Now, you can solder the two-can assembly over the opening in the ring.

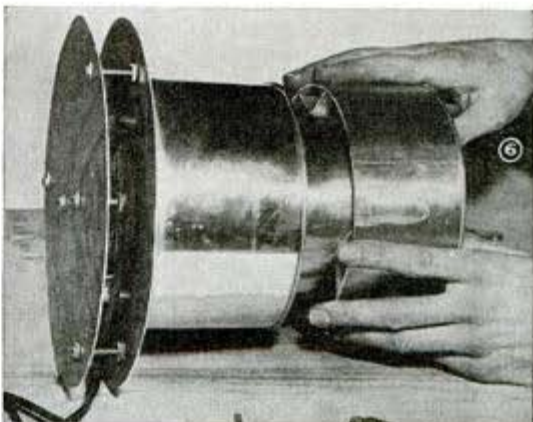
Another 5-qt. container is cut down to a length of 3 in. for the light trap. This slips over the end of the small can, Fig. 6, and is spaced from it by means of tin strips bent as shown in Fig. 2. These are soldered only at one end so that they may be adjusted to fit the housing. Slip the trap all the way on the housing then withdraw it about an inch for air space. Plug the motor in and see if there are any stray noises and vibrations that need checking. If not, you are ready for painting. The inside of the housing, light trap and baffle, as well as the fan, are given two coats of flat-black paint. The outside surface of the ventilator was finished in crackle black over a gray undercoat of enamel.

The mounting problem is an individual one, although the darkroom door is usually the most satisfactory. If there is heat in the adjoining room, and none in the darkroom, the ventilator will solve the problem nicely. Make this test to determine if your darkroom is porous enough to allow stale air to escape. Before closing the door note how much air is coming through the ventilator by holding a lighted match near the light trap. Then close everything up as you would normally, and after a minute or two, make the match test again. Should there be much difference in the volume of air coming through the ventilator, it will be necessary to install an outlet.

If you find that an outlet is necessary, it can be made easily from a length of 5-in. stovepipe with a mounting ring soldered to it and a light trap on each end. Before assembling it, paint all inside surfaces flat black. The outlet should be located as far from the ventilator as possible to allow a good circulation of air through the room.



Be sure that the fan blades are balanced to run as quietly as possible before bolting housing to baffle



Negative Reflected in Mirror Is Enlarged for Examining



Miniature negatives, so small that it is hard to distinguish detail by holding them up to a light, can be enlarged for viewing with a concave shaving mirror. Hold the negative between a light and the mirror, moving it up or down until the image in the glass is in focus. The same idea can be used for viewing miniature color transparencies.

—Bob Hurst, Chicago.

Delayed Firing of Flash Bulb Lets Photographer in Picture

You can include yourself in indoor flash pictures by using a flasher button—the



kind used for flashing a light bulb on and off. The flash reflector is plugged into a 110-volt outlet with the switch off, the flasher button is placed in the bulb socket

and the flash bulb screwed in on top of it. When everything is set, the operator turns off the room lights, opens the shutter on "time," turns on the reflector switch and takes his place in the group. The flasher

button will warm up in about 20 seconds, at which time the flash bulb will fire. The shutter is then closed and the room lights can be turned on again.

—William Swallow, Brooklyn, N. Y.

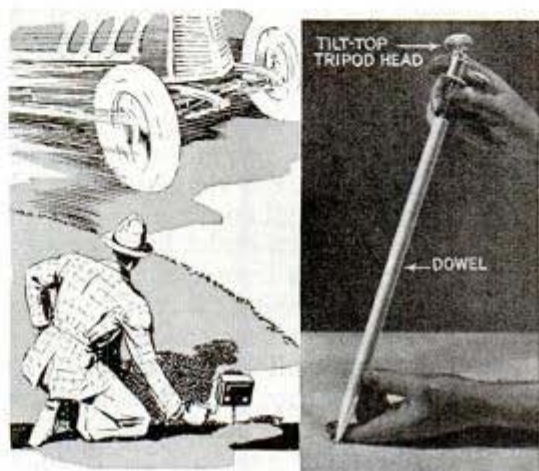
Loose Lid on Developing Tank Held Tight by Rubber Band

The lid of a plastic developing tank may become loose-fitting after the tank has been used considerably, and some means of holding it in place during the developing process must be found. One of the best methods is to cut a 2-in. section from an inner tube and slip it around the tank and the lid. A slit in the rubber allows the solutions to be poured in and out as usual.

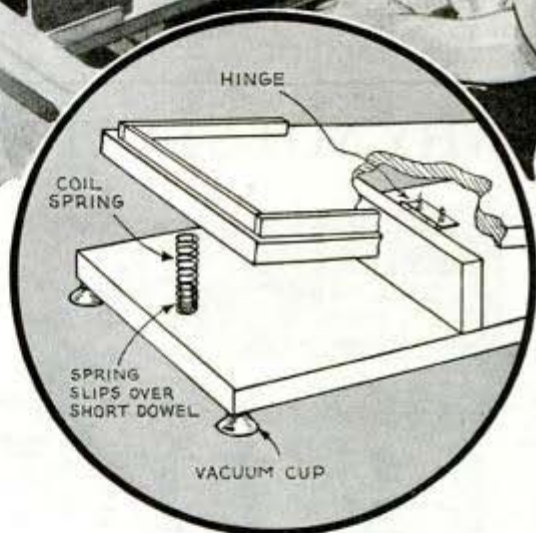
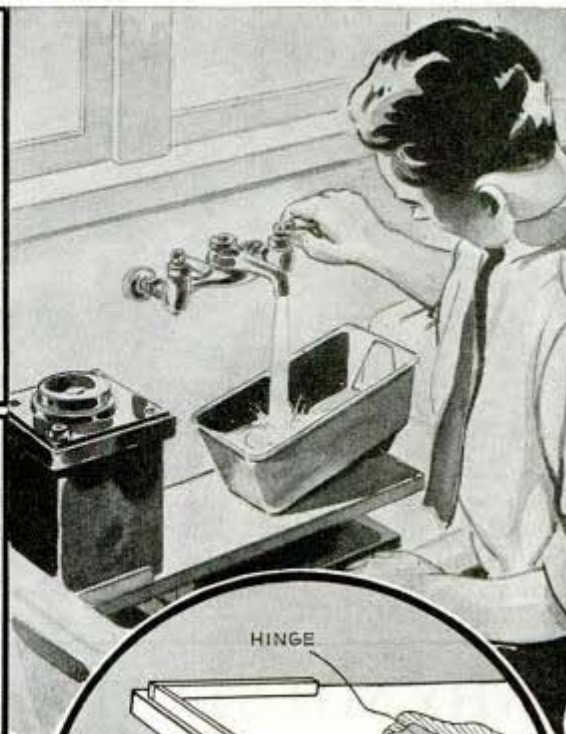
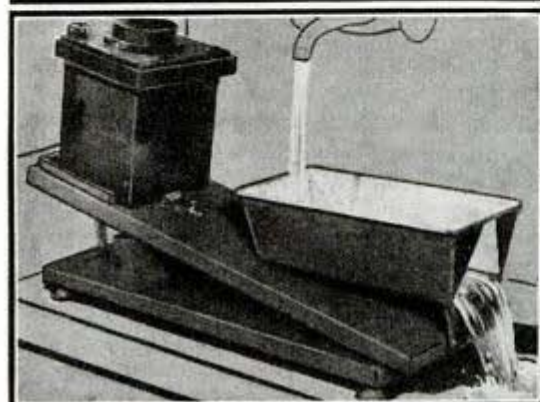
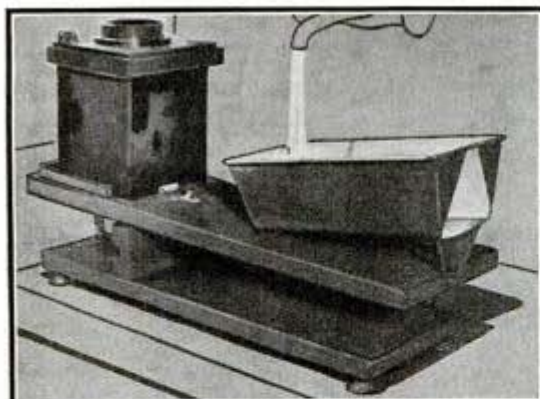


Stake Tripod Holds the Camera For Low-Angle Outdoor Shots

Convenient for making low-angle outdoor shots, this "monopod" or camera stake is made from a 12-in. length of $\frac{5}{8}$ -in. dowel. One end is sharpened and the other drilled to receive a headless bolt that will fit the camera tripod socket or a small tilting top. After pushing or driving the stake into the ground, screw the bolt into the camera or the tilt-top and fit it into the hole in the top of the stake.



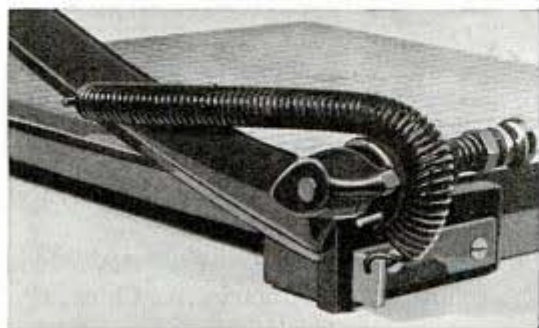
Tank Agitator Powered by Water From Faucet



Water running from a faucet operates this agitator, which rocks as a pan fills and dumps itself automatically. The rocker is hinged to a base so that the weight of the tank overbalances that of the pan when empty. The pan is open at one end and is mounted with the open end high. A spring under the tank causes a rebound as the rocker comes down, increasing agitation.

Spring on Paper-Trimmer Blade Raises It After Each Cut

Older paper trimmers can be given the safety and convenience of the newer models by attaching a coil spring to the blade to pull it up out of the way after each cut.



One end of the spring is fastened in a hole in a short piece of flat iron which is bent and drilled as indicated to fit under the screws that hold the blade assembly on the trimming board. A short pin about six inches from the pivoted end of the blade holds the other end of the spring. To keep the blade from swinging all the way back, another pin is placed at the back to stop the swing at about a 45° angle.

—William C. Vestal, Redlands, Calif.

☛ A flashlight with red Cellophane over the lens is handy for locating articles on shelves or in drawers in the darkroom without turning on the white light.

Paraffined Egg-Carton Covers Serve as Darkroom Trays



Coated with paraffin, covers of egg cartons of the type shown can be used as trays in the darkroom. The paraffin, which is not affected by photographic solutions, can be melted and applied with a brush or a larger amount can be melted and the cover dipped

into it. The cover from a one-dozen-size egg carton provides a tray with inside dimensions of about 5 by 6½ in.

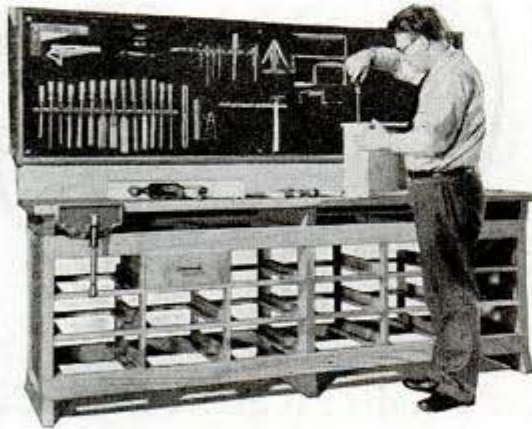
Flashlight Mounted on Desk Lamp Illuminates Table-Top Photos

Clamped in the shade holder of a gooseneck desk lamp, a flashlight is a good source of illumination for table-top photographs. The regular set-screws in the shade holder will grip most flashlights, but if they should be too short they can be replaced with longer machine screws. Mounted in this way, the flashlight can be raised, lowered or tilted.



—Arthur Trauffer, Davenport, Ia.

WHY NOT START A HOME WORKSHOP?



Cabinet Bench—898

CABINET BENCH—898: Nearly 8 ft. long, 27 in. wide, 35 in. high. 20 drawers—25c.

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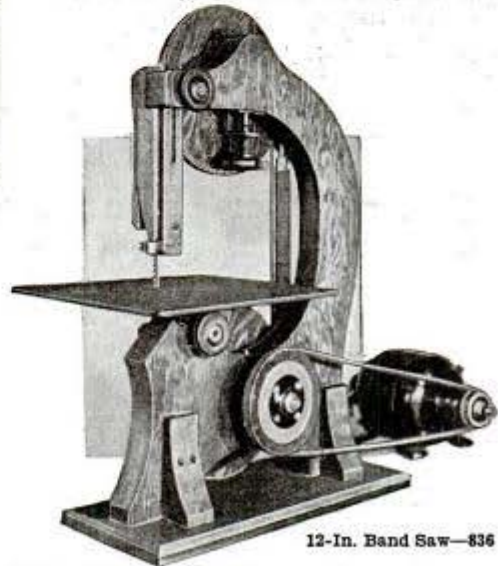
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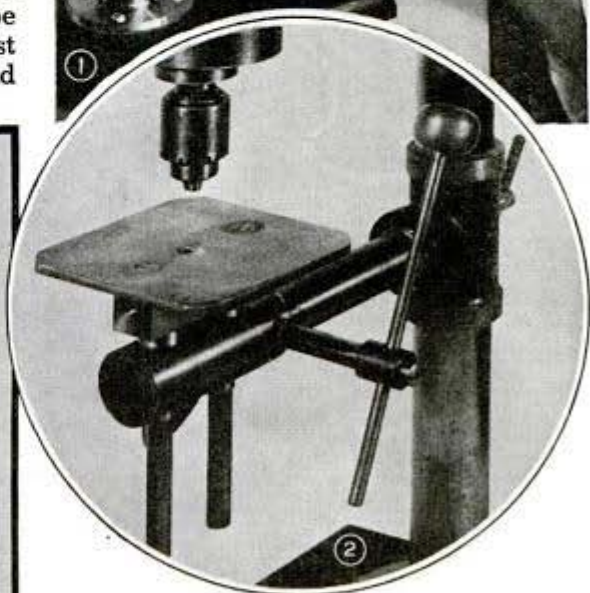
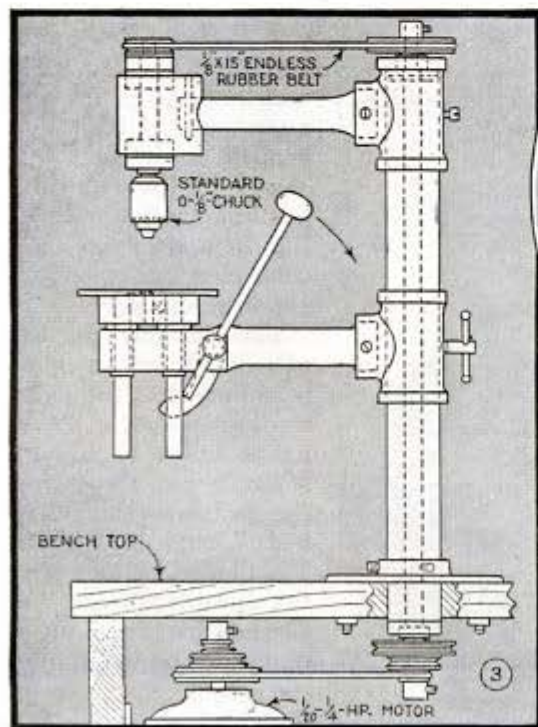
SHOP NOTES

PRECISION DRILL PRESS *for the modelmaker*

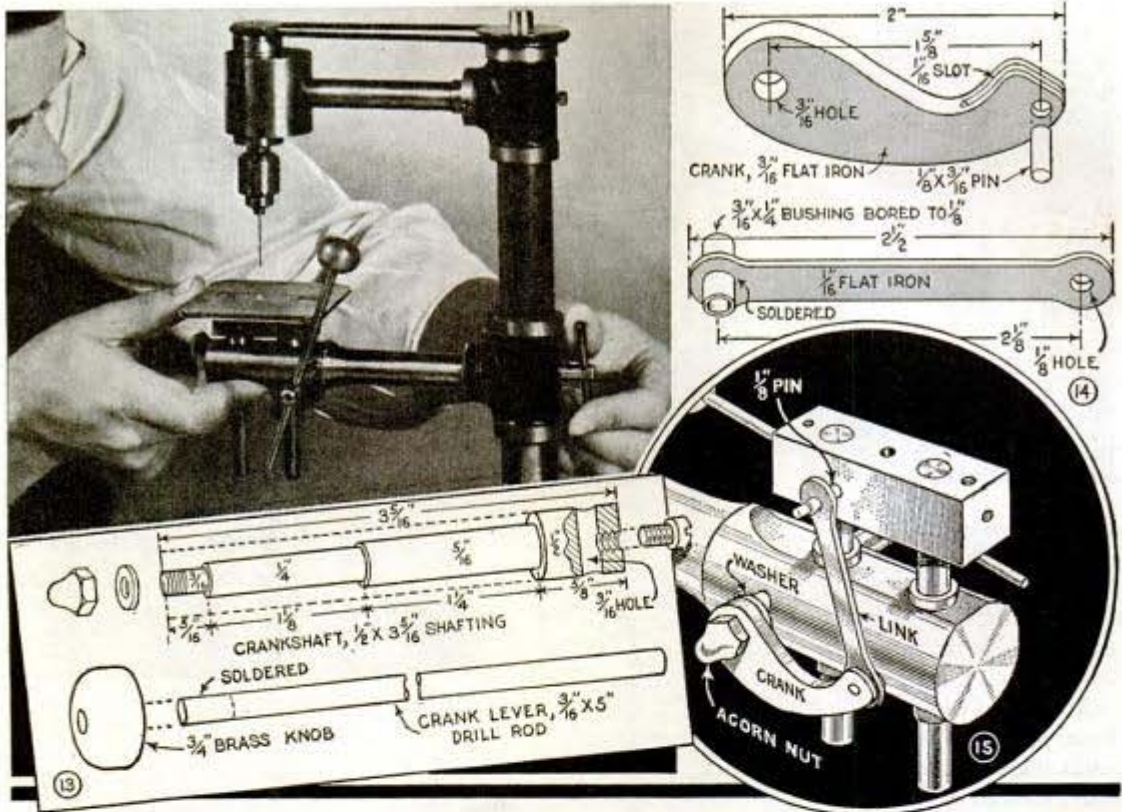
By Alexander Maxwell

Table is elevated with hand control to feed work against drill held in stationary chuck

BY HAVING the table travel up and down instead of the chuck, the construction of the little drill press shown in Fig. 1, is simplified to the point where all the parts can be machined completely on any small screw-cutting lathe. Standard stock materials are used—namely, the pipe fittings, bearings and chuck, while the rest of the parts are turned to size from odd



pieces of steel, brass and flat iron. Any small utility or sewing-machine motor will do to drive the press, although it is advisable to use a motor of the induction type having end thrust bearings, if it is to be mounted in a vertical position beneath the bench as shown. From Fig. 3 you can get a general idea of how the parts fit together,



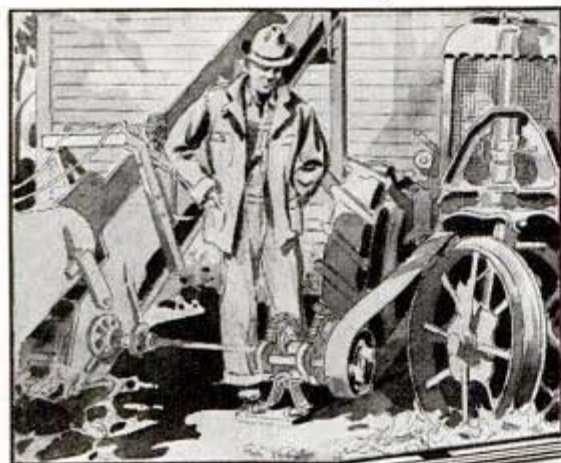
exact length of the shoulder cut must be found by a cut-and-try method. The $1\frac{5}{8}$ -in. dimension given is only approximate. You will have to cut back the shoulder a little at a time until the point is reached where the shaft seats perfectly and runs freely without end play. Every 100 hrs. or so of operation, the bearings should be removed, washed in kerosene and repacked with grease.

The threads on the head and the table bracket should be lathe-cut to make a wringing fit in the tee fittings. Setscrews through the sides of the tees lock the brackets in place. The head, detailed in Figs. 5 and 9, may be turned from a mill end of mild-steel rod, or from a piece of 2-in. shafting. Chucking the head for boring the bracket hole is done best with a four-jaw independent chuck as shown in Fig. 8. Start the hole with a drill and then use a boring tool to cut a force-fit hole for the bracket. A rawhide mallet is used to drive the two together, after which they are pinned. When properly bored and counterbored to receive the bearings and the spindle, the head should look like the sectional view in Fig. 9. The 1-degree taper on the lower end of the spindle must be cut accurately to seat the drill chuck perfectly.

The chuck, which should be of the high-speed balanced type, is pressed on the spindle by hand. The preloading nut is screwed down to provide constant pressure on the bearings. Tighten it until the bearings bind, then loosen it slowly until they will just turn freely.

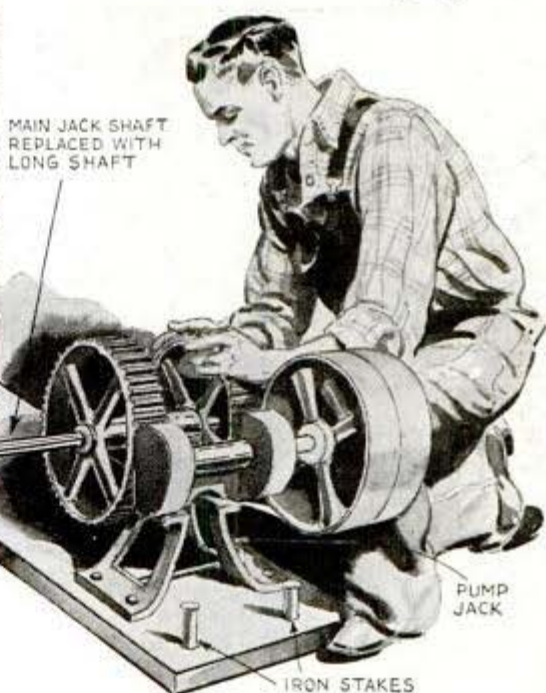
If your lathe is large enough to swing the table bracket, drill the holes for the bronze sleeve bushings with a drill held in the tailstock chuck. The front bushing is a press fit in the bracket, while the other one can be left slightly loose to compensate for any slight offset in drilling. Fig. 12 shows how the table may be held at the corners with screws and surfaced, both sides, on the faceplate. The best way to register the holes in the carriage with those in the bracket is to bore one hole first and insert the rod. Then with one end of the other rod pointed slightly, pass it through the bushing and center punch the underside of the carriage. The parts for the table raising mechanism are detailed in Figs. 6, 13 and 14, while Figs. 2 and 15 show how they will look when assembled. The drill-rod washer should bear against the shoulder of the crankshaft and not the end of the bushing, so that the acorn nut when tightened will hold the crank in place.

Farm Elevator Jack Made From a Pump Jack



MAIN JACK SHAFT
REPLACED WITH
LONG SHAFT

2 X 10 X 5 PLANK



PUMP
JACK

IRON STAKES

A power jack for running an outside farm elevator can be made from a pump jack by removing the shaft which carries the gears that drive the pump arms, and replacing it with a longer shaft shaped at one end to fit in the knuckle of a tumbling rod. Two irons to serve as legs or supports should be attached where the jack is usually fastened to the pump. These should be shaped at the lower ends so they can be

bolted to a platform. This is set in place and firmly staked to the ground with the jack shaft attached to the elevator tumbling-rod knuckle.

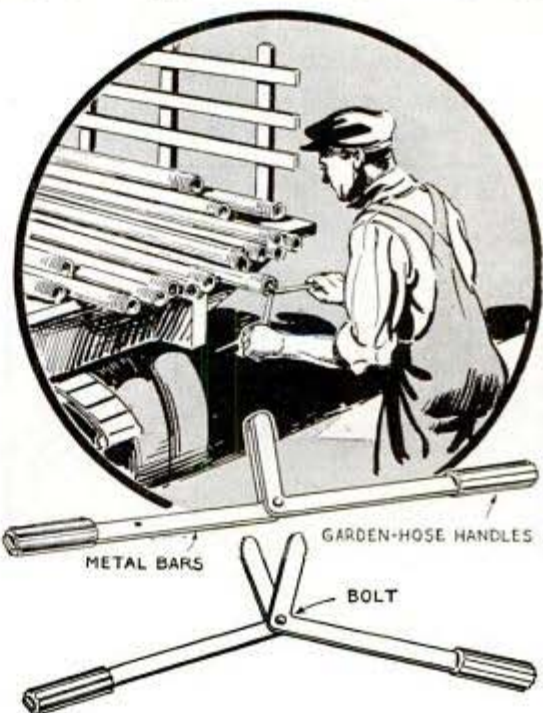
—A. F. Miller, Sabetha, Kan.

Tongs to Handle Long Lengths of Pipe Will Fit All Sizes

In a large plumbing shop where a lot of pipe is handled, tongs like the ones shown are used. Especially handy for unloading pipe, where hands of the workmen are sometimes injured on burrs left by threading dies, the tongs are made of two pieces of flat steel bent to the shape shown and pivoted together. The jaws are serrated at the rounded ends to provide a good grip on the pipe, and pieces of garden hose serve as handles. In use, the closed jaws are inserted into the pipe end, after which the jaws are spread by closing the handles.

Inexpensive Calking Compound

An economical calking compound that shrinks very little can be made by mixing equal parts of fine sand into common plastic roof cement. If the mixture is too stiff to use in a calking gun after being mixed thoroughly, a little turpentine can be added to reduce the consistency.



METAL BARS

GARDEN-HOSE HANDLES

BOLT

Multi-Holder for Welding Rods Assures Ample Supply

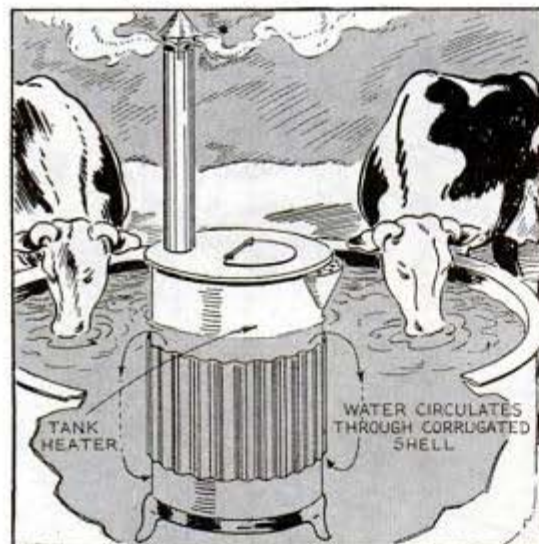


Welders who use a simple rod holder like the one shown can save themselves many steps as they can always have at least four different sizes or kinds of rods at hand. The holder consists of a three-tier case of plywood, the two upper tiers being bored near the corners to take lengths of rain pipe. The lower tier or base serves as a bottom for the rain-pipe rod holders. A handle screwed to the top of the holder makes it easy to carry.

—John Krill, Youngstown, Ohio.

Corrugated Shell on Tank Heater Speeds Circulation of Water

To increase the efficiency of his tank heater by speeding up circulation of the



water, one farmer wrapped a piece of corrugated sheet metal around the heater. The top edge should always be below the usual water line.

Fowls Kept Off Water Fountain By Swinging Horseshoe

Annoyed by having chickens roosting on the water fountains in the poultry house, one man suspended horseshoes on lengths of twine so that they hung directly over the tops of the fountains. Now, when one of the birds tries to perch on the top, it strikes the horseshoe, which swings back and forth and frightens it off.



Nuts Are Removed From Bolts With Special Chuck in Lathe



Recently we received a large supply of carriage bolts that were to be used on a rush job. As these are shipped with a nut started on each bolt, the job of removing the nuts was done in a lathe. A wood cup turned as indicated was chucked in the lathe, after which the bolts were fed into the rotating cup to remove the nuts at a rapid rate.—Arthur Jennings, Derry, Pa.

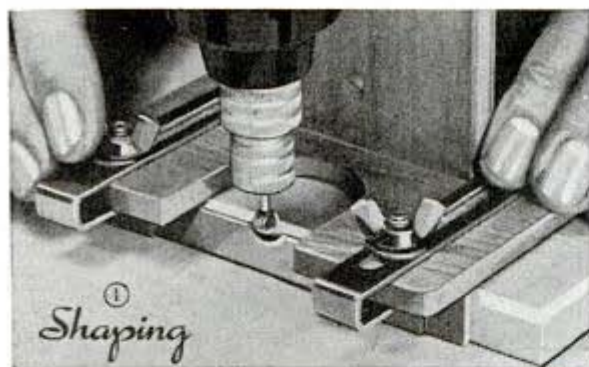
Removing the nuts was done in a lathe. A wood cup turned as indicated was chucked in the lathe, after which the bolts were fed into the rotating cup to remove the nuts at a rapid rate.—Arthur Jennings, Derry, Pa.

Bottle Cap Tightens Handle On Plumber's Force Cup

When the handle works loose on your plumbers' force cup, simply remove it and nail a bottle cap on the end as shown. The sharp edges of the bottle cap will bite into the rubber and hold it tightly.



Use your HAND GRINDER for SHAPING and ROUTING



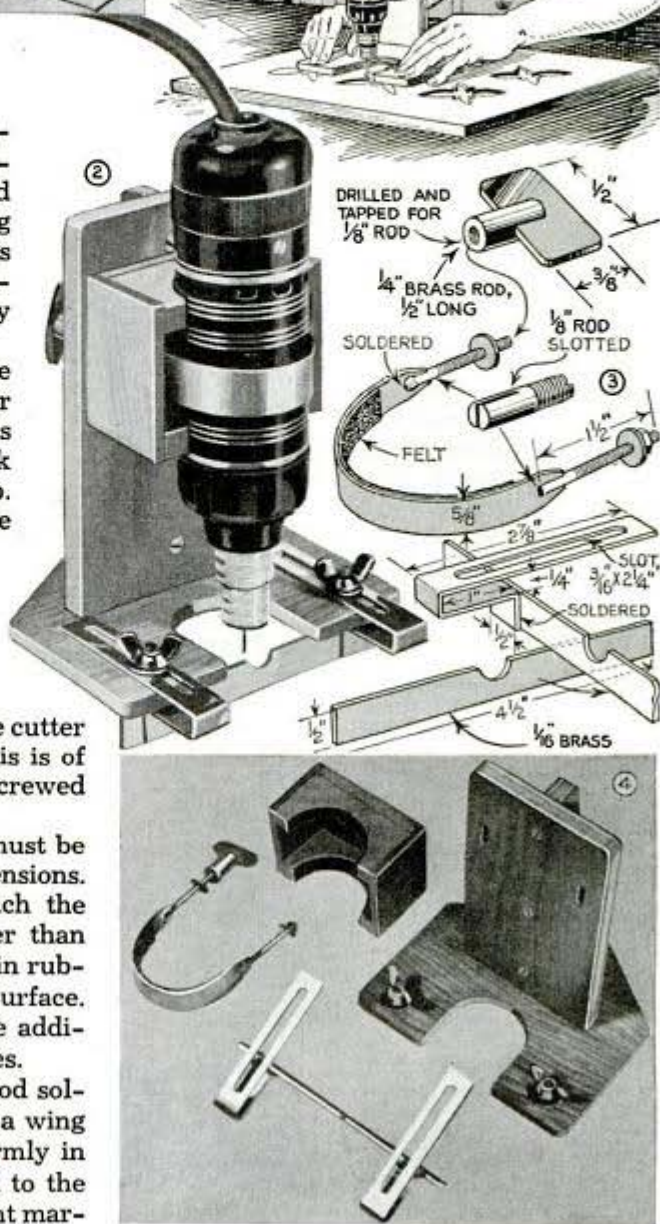
By Richard Hanscom

BY FITTING a small hand grinder in this rack, accurate operations such as routing, shaping and fluting may be performed. Routing for intricate inlay work, Fig. 7, is done easily, and use of the adjustable guide fence assures accuracy in banding and shaping.

Fig. 6 shows the assembly of the rack and Fig. 2 shows the grinder clamped in it. Five-ply birch is used for the main upright, the back brace and ends of the grinder clamp. Slots for vertical adjustment of the clamping unit are cut in the upright before the pieces are assembled. The length and position of these slots will vary according to the size and style grinder used, but they should be of sufficient length to permit the lowering of the cutter at least $\frac{1}{2}$ in. below the base. This is of $\frac{1}{4}$ in. three-ply birch, which is screwed to the upright members.

The shape of the motor clamp must be determined from the grinder dimensions. The half-circular notches in which the motor rests are cut slightly larger than the motor diameter to allow for thin rubber to be glued on the contacting surface. The unit is then completed by the addition of thin plywood back and sides.

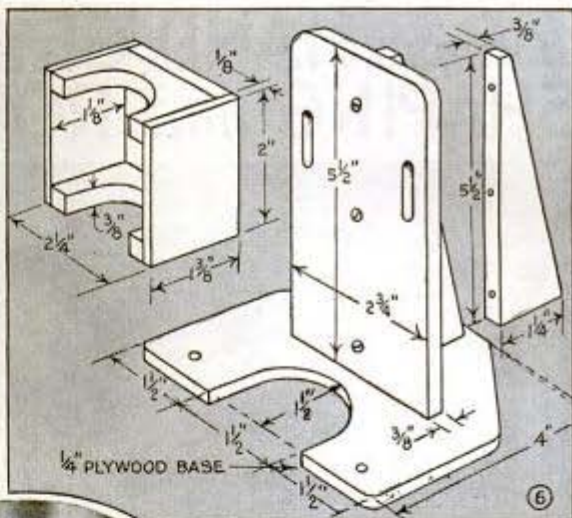
A metal band with a threaded rod soldered to each end and fitted with a wing nut, serves to clamp the motor firmly in place, Figs. 3 and 5. Felt is glued to the inner surface of this band to prevent mar-





ring the grinder. Adjustments are made by loosening one of the nuts and raising or lowering the entire unit.

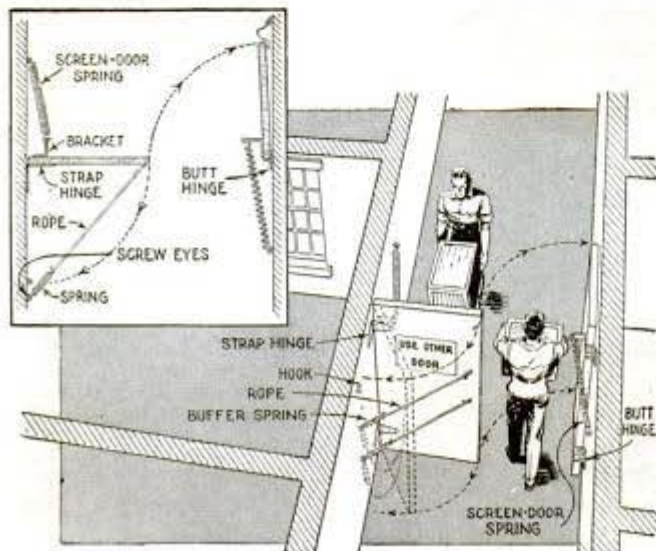
Shaping, Fig. 1, banding, fluting, etc., will require an adjustable guide fence, Fig. 4. This is made of three pieces of $\frac{1}{16}$ in. brass or iron. Two of these pieces are identical, being first slotted and then bent to fit around the wooden base.



The third piece connects the slotted strips and serves as the guide. A small notch is filed in this guide strip directly below the cutters to eliminate any possibility of them striking the fence. This unit is fastened to the base with two stove bolts fitted with wing nuts. After making sure that all parts operate smoothly,

the entire unit is given two coats of shellac and is smoothed with steel wool. If desired, however, you can use paint or other finish instead of the shellac.

Accidents at Double Doors Are Avoided by Buffer Ropes

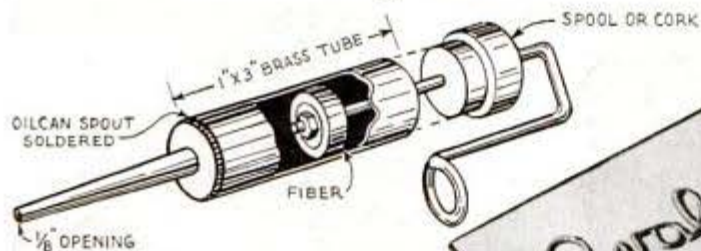


In passageways of factories, warehouses and other places where double doors are used, accidents caused by having two people try to pass through the same door at the same time can be avoided by using ropes and buffer springs. These are attached as indicated so that anyone opening the doors must always go through the one to his right.

—John Brabec, Chicago.

Ⓛ Breakage of small wire bits in a drill press is sometimes due to lack of speed. Therefore, don't be afraid to speed up the drillpress spindle to its full capacity for these drills.

Raised-Letter Signs Written With Gun-Type 'Pen'



Sign painters can turn out work with the lettering in bold relief by using this "pen." Instead of ink, the lettering is done with an inexpensive compound consisting of equal parts of flour and whiting mixed with water to form a thick paste. Coloring can be done with dye powder or show-card color. In use, the pen is held as you would a lettering brush, with your thumb on the plunger to force the compound from the tip evenly. It is best to keep the tip a short distance from the sign board, allowing the compound to drop into place uniformly. Use only heavy card stock for signs of this type, as the lettering compound may crack if bent after drying.

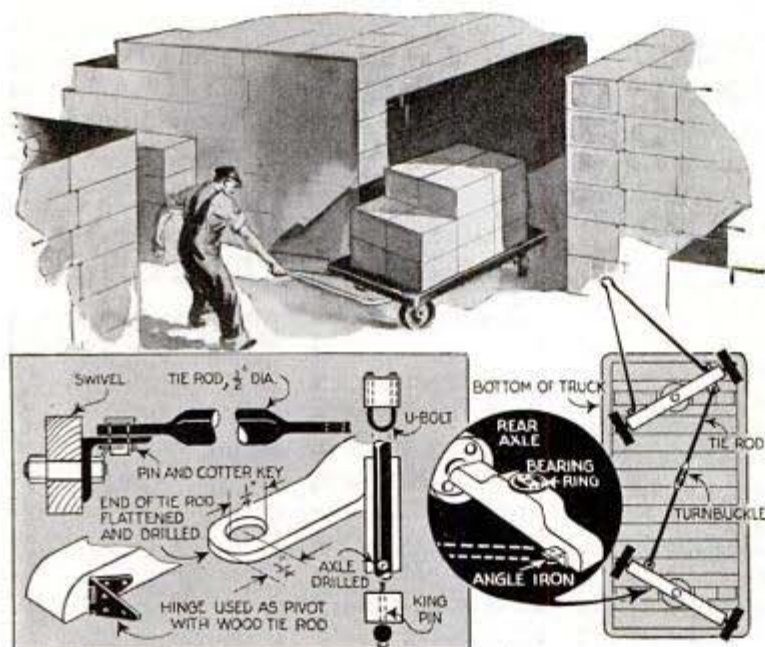


Four-Wheel Steering Improves Shop Truck or Trailer

Providing shop trucks or trailers with four-wheel steering greatly increases their flexibility and increases aisle space in stock rooms and other places where trucks are used. The first conversion step is to

swivel the rear axle of the truck in the same manner as the front one. If the rear-axle mounting is of wood, it need only be sawed in two horizontally and a bearing ring added to each half. Then the two

axles are connected by an adjustable tie rod, which is pivoted to the front axle near one end and to the rear axle near the opposite end. The tie rod should have a turnbuckle in it to provide a tracking adjustment for the wheels. A metal tie rod can be pivoted to angle brackets screwed to the axles, or you can use wood and attach it to the axles with hinges.



☞ Sand ash trays, used in halls of office buildings, can be cleaned by pouring off the sand on top and straining it through a piece of screen.

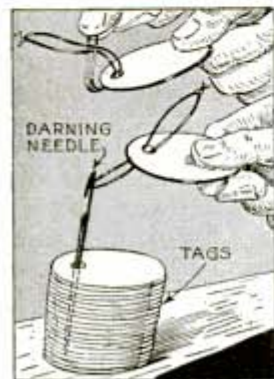
Removable Grips to Carry Barrels, Heavy Boxes and Drums



In factories and other places where barrels, drums and heavy boxes must be moved about, a pair of grips like the ones shown will be handy. Made from steel, they consist of two parts pivoted together. Teeth filed on the curved portion of the handle part provide a good grip on the object to be lifted.

—C. H. Willey, Penacook, N. H.

Easy Method of Attaching Strings On Printed Tags



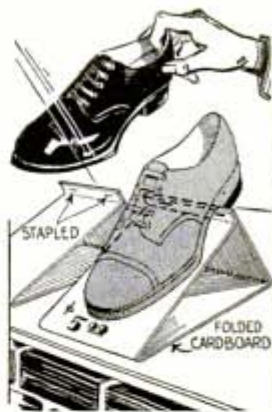
Printers who have occasional jobs of making tags to which loop strings must be attached, will find this method of attaching the strings a time saver. The tags are merely stacked with the string holes aligned, after which a large

darning needle is inserted into the holes. A portion of one side of the needle eye is broken away. In use, a string loop is slipped into the needle eye and the tag

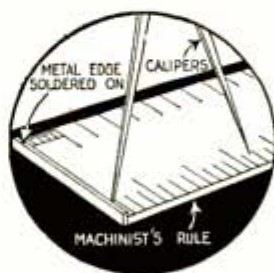
pulled up over it, after which one end of the string is inserted through the other to complete the job. With a little practice, the strings can be attached very rapidly.

Simple Display Easels for Shoes Made Easily From Cardboard

One merchant made combined easels and price cards as shown, in order to display shoes neatly in his show window. The cards were folded and stapled, and the style and price of the shoes were lettered on the exposed portions.



Metal Edge Soldered to Rule To Set Calipers Accurately



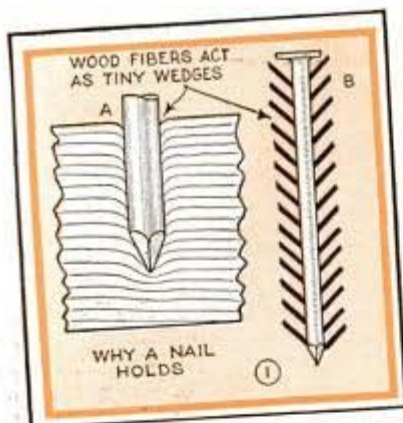
To avoid errors when setting a pair of calipers or dividers with a machinist's rule by having the calipers slip unnoticed, one workman soldered a piece of metal to

the end of the rule. The metal projected slightly above the surface of the rule so that a leg of the calipers could be rested against it. —A. H. Waychoff, Phoenix, Ariz.

Old Shoehorn Is Handy Wedge When Ripping Long Boards

Instead of whitening a wooden wedge to use each time you rip several long boards with a handsaw, keep an old shoehorn handy for the purpose. It can be flattened slightly at the broad end.



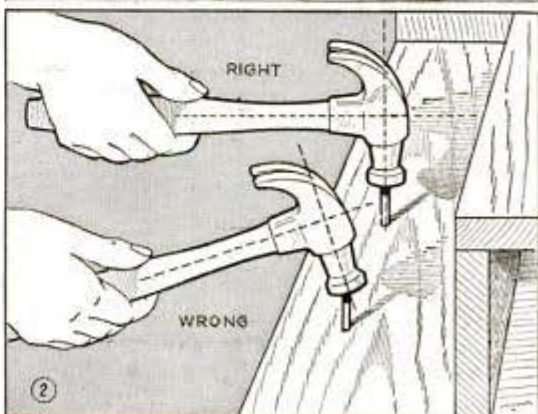
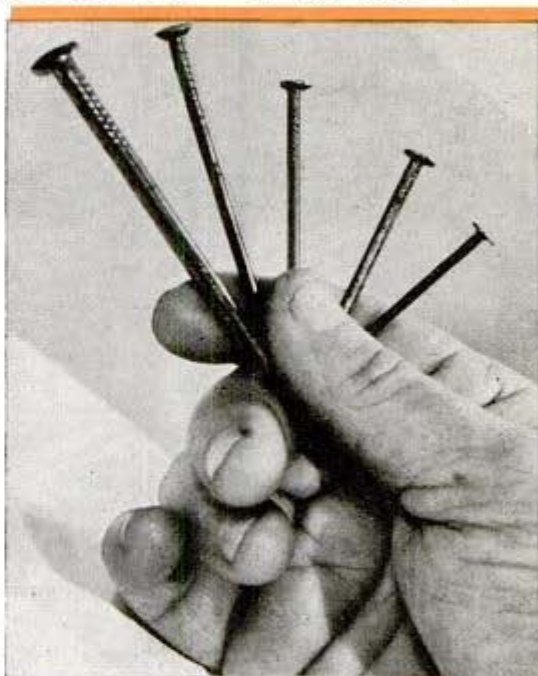


USE THE RIGHT NAIL

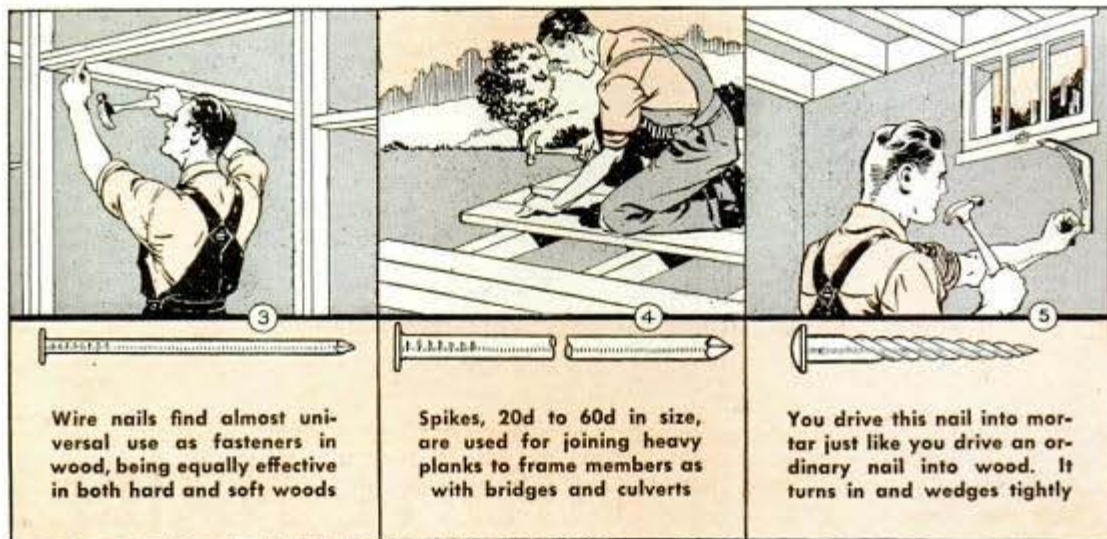
By W. Clyde Lamme

WIRE-NAIL sizes within the practical driving limits of a claw hammer range from a 1/2-in. brad to 20d spikes. Although the d-sizes run on up to 60d, which is a large, heavy spike, nails from 4d to 20d are the most common. This is largely because the size, thickness and nature of the materials determine to a certain extent the proper type, length and diameter of nail to use. For example, in joining a 3/4-in. board to another of the same thickness, there is little reason to use a heavier wire nail than 8d and probably in most cases a 6d size would do. On the other hand, if the same thickness is joined to a heavier piece such as 2 by 4 or 2 by 6-in. stock, then a 10d nail is best, one reason being that a greater portion of the length of the nail will be in the holding piece. Unless you use them for hooks or hangers you ordinarily drive nails into two or more pieces of wood in order to hold them together. The first or top piece is, of course, the one held in place, the other is the holding piece and a measure of the resistance of the nail to being pulled from the second piece is a measure of the holding power of the nail and also of the strength of the joint. From this you get the general but by no means rigid rule that for maximum strength at least two-thirds of the length of the nail should be in the second or holding piece when the nail is fully driven home.

What makes a nail hold? Fig. 1 shows, in exaggerated details, what happens when you drive a nail into wood. In detail A you see how the fine, silklike wood fibers are



Handle or axis of hammer must be at right angles to the nail as in upper detail, or the nail is likely to be bent over to one side



Wire nails find almost universal use as fasteners in wood, being equally effective in both hard and soft woods

Spikes, 20d to 60d in size, are used for joining heavy planks to frame members as with bridges and culverts

You drive this nail into mortar just like you drive an ordinary nail into wood. It turns in and wedges tightly



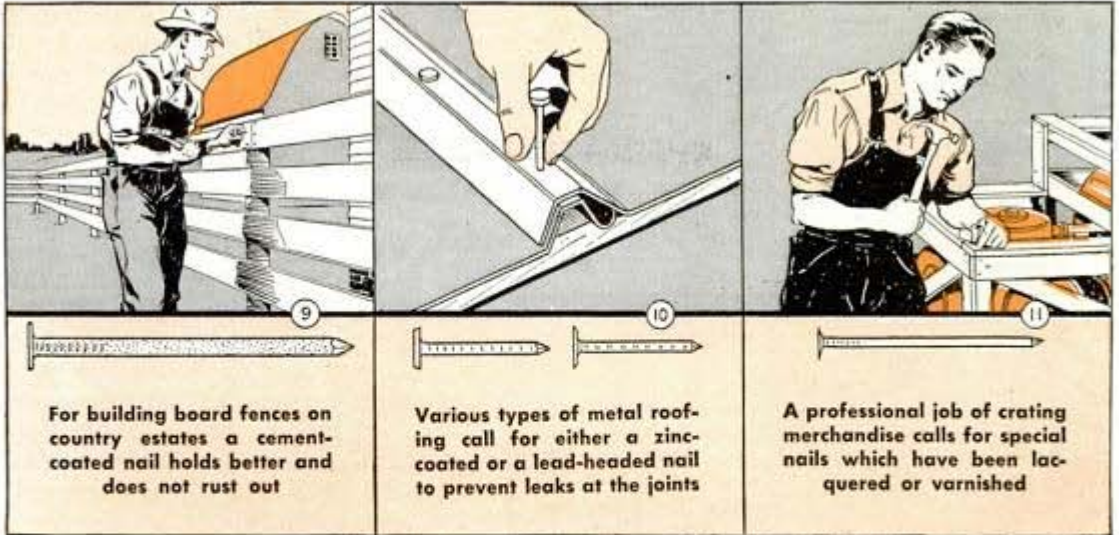
bent downward; some are severed by the nail point while others are forced aside. After the nail has been driven home the tiny fibers act as wedges, graphically shown in detail B. However, only those which are severed by passage of the nail act as true wedges; those forced aside act on the body of the nail in much the same way as wire or rope looped about a dowel or broom handle and then twisted tightly. Although a high degree of skill in handling a hammer comes only with considerable practice, the relatively simple business of driving a nail is something you do more or less instinctively like throwing a stone or ball. The handle or axis of the hammer must be at right angles to the nail, or very closely, at the instant the blow strikes, or the nail will be bent. See Fig. 2.



Cut off the tip to prevent nail from splitting wood

Wire nails in sizes ranging from 6d to 20d are universally used for joining the wood framing for houses, Fig. 3. The average five-room house requires approximately 500 lbs. of nails. In all work requiring large quantities of nails, accepted practice in different localities will vary the number used in each piece of lumber. To be on the safe side most builders use plenty of nails. Of course, the kind of wood and its condition has something to do with the number of nails required. Heavy planks, Fig. 4, will need additional nailing if they are warped or "cupped." For outdoor work such as building board fences, Fig. 9, and crating, Fig. 11, cement and varnish or lacquer-coated wire nails are widely used because they hold better and resist

COMMON WIRE NAILS				
Size	Length In.	Gauge No.	Dia. in Inches Approx.	Approx. No. to One Lb.
2d	1	15	5/64	876
3d	1 1/4	14	5/64	568
4d	1 1/2	12 1/2	3/32	316
5d	1 3/4	12 1/2	3/32	271
6d	2	11 1/2	7/64	181
7d	2 1/4	11 1/2	7/64	161
8d	2 1/2	10 1/4	1/8	106
9d	2 3/4	10 1/4	1/8	96
10d	3	9	5/32	69
12d	3 1/4	9	5/32	63
16d	3 1/2	8	5/32	49
20d	4	6	3/16	31



For building board fences on country estates a cement-coated nail holds better and does not rust out

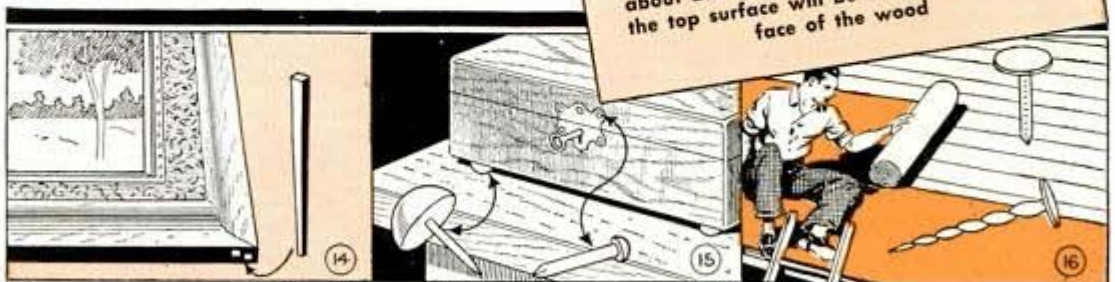
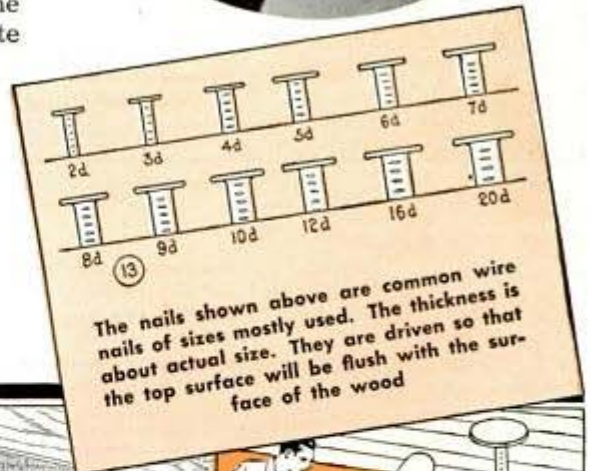
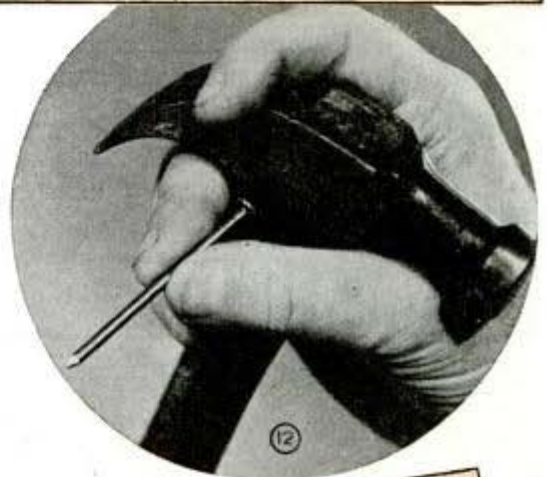
Various types of metal roofing call for either a zinc-coated or a lead-headed nail to prevent leaks at the joints

A professional job of crating merchandise calls for special nails which have been lacquered or varnished

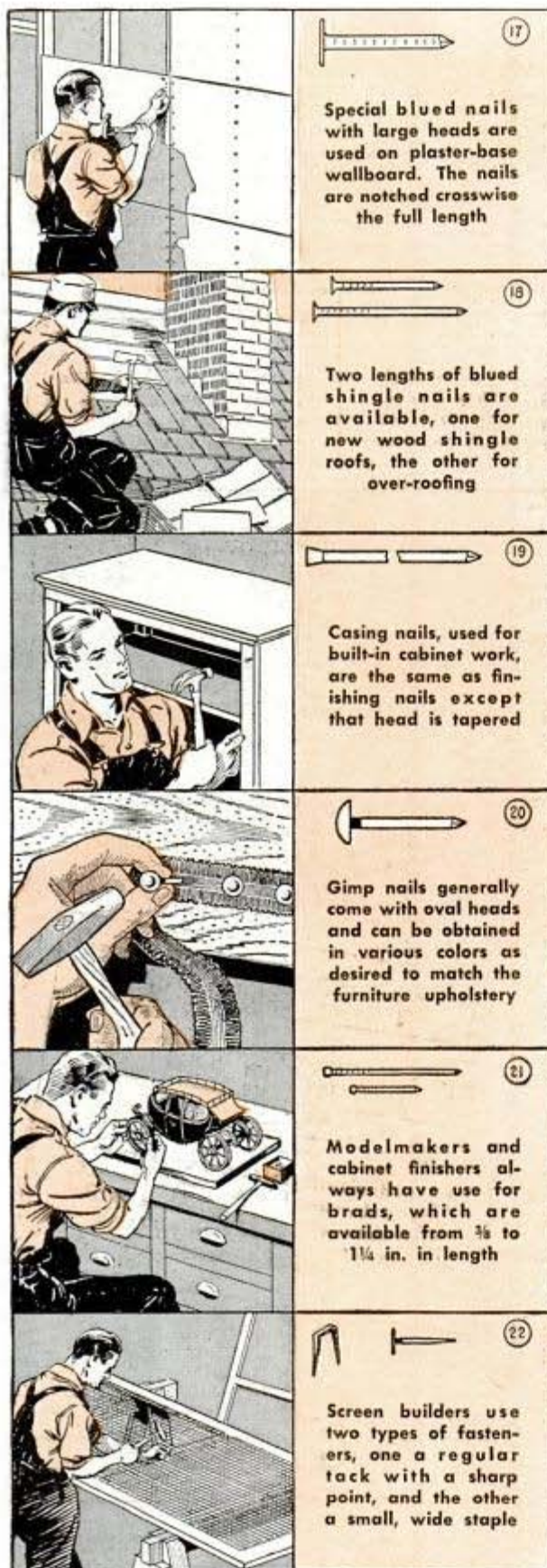
rust. Generally, wire nails are not set into the wood but driven so that the head comes flush with the surface of the wood.

Beginning with Fig. 5, there are a number of special types of nails which are simply variations of the common wire nail and are made for specific uses. The masonry nail, Fig. 5, is designed to be driven into masonry joints. It is driven into mortar just like you drive an ordinary nail into wood. It turns and wedges tightly. It drives easily and holds well. The numbered nails, Fig. 6, are used chiefly for numbering screens and storm sash. They are used in pairs, one nail driven in the window sill and another of a duplicate number in the screen or storm sash. This makes it a simple matter to relocate the sash or screen in its respective window frame at any time. Other special nails and their principal uses are shown in Figs. 10, 14, 15, 16, 17, 20 and 28.

Fig. 7 details a method of altering a nail so that you can drive it into hardwood or near the edge of a board without splitting. Simply saw off the point

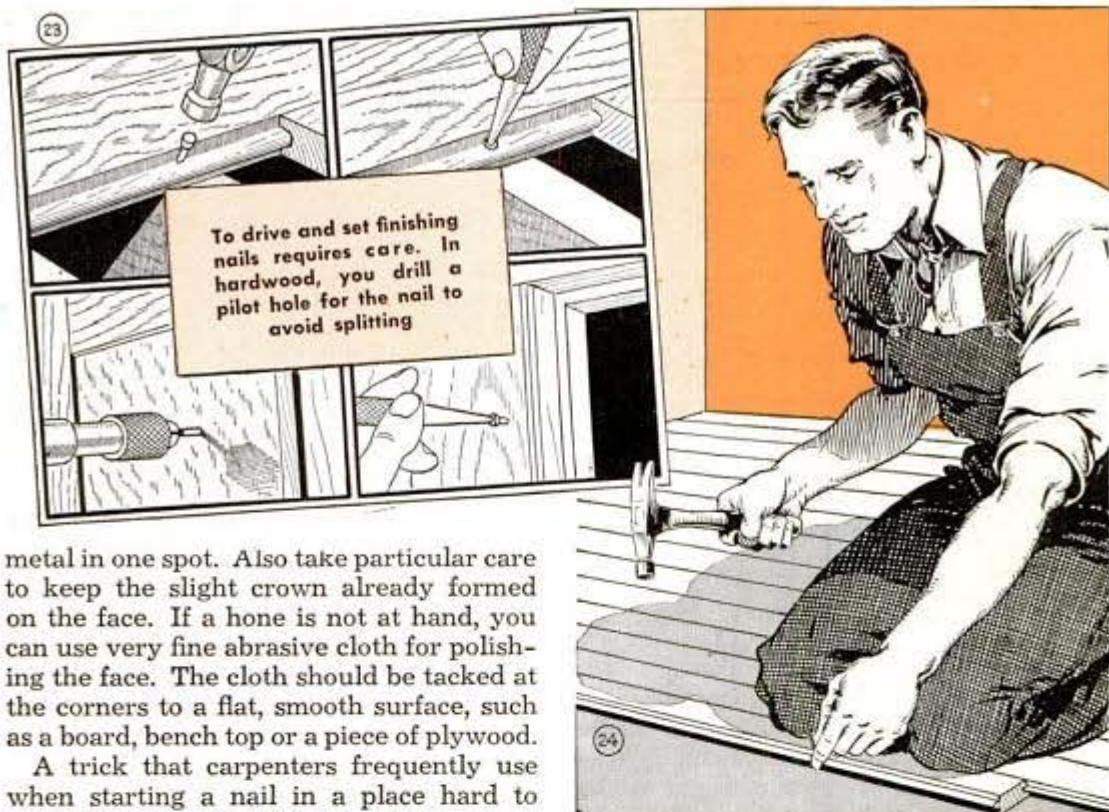


For picture frames, use a special brad as shown in Fig. 14. Rubber-headed tacks provide soft feet for small boxes, Fig. 15. Roll roofing calls for a zinc-coated or a spiral nail, Fig. 16



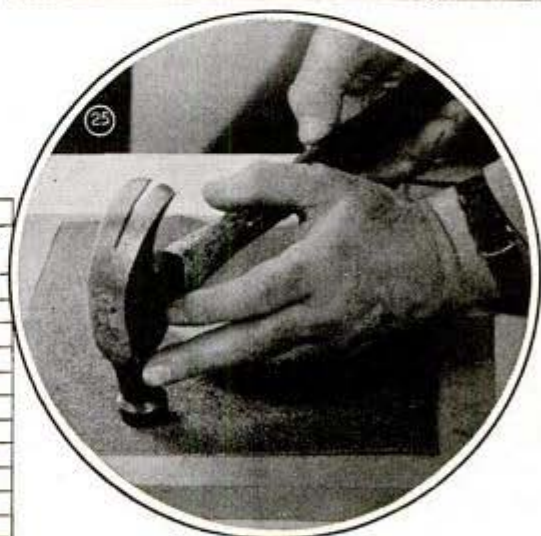
and then drive with light hammer strokes. Such an altered nail will not hold as well, however. Fig. 8 gives the data on wire nails up to 20d, while Fig. 13 gives actual thicknesses of the common wire nails to the 20d size. Data tables on other common nails are given in Figs. 26 and 27. Notice that in all three tables the lengths for the d-sizes are the same but that the diameters vary and consequently the number per pound. In all cases the diameters given in inches are only an approximation. Fig. 18 shows two kinds of blued shingle nails. The shorter length is used in new shingling directly over the roof boards. The longer nail is intended for over-roofing, that is, new roofing over the old. The casing nail, Fig. 19, is chiefly used by cabinetmakers and is the same as the finishing nail except that the head is tapered, or wedge-shaped. In Fig. 21 is the common brad, which is simply a tiny finishing nail. Modelmakers and cabinet finishers always have use for brads, which are available in lengths from $\frac{3}{8}$ to $1\frac{1}{4}$ in. Two types of fasteners are used in attaching screen wire to frames, a small staple and a sharp pointed tack, Fig. 22. The staple is perhaps best for general use, although the tack is somewhat easier to drive. Laying hardwood flooring and fitting interior trim calls for special care in nailing. The best work requires that each nail in flooring be driven and set as in Figs. 23 and 24. Care must be taken not to set the nail too deep and split off the tongue of the flooring piece. In putting on hardwood trim it's best to drill a pilot hole slightly smaller than the nail before driving and setting it as in the lower details. This will prevent splitting the wood.

Keep the face of your hammer crowned slightly and polished smooth for easy driving. If the face is rough, pitted, or if there's a depression in the center grind and then hone it as in Fig. 25. These imperfections, even though slight, can cause the hammer to glance off the head of the nail, bending the latter and endangering your fingers as well. When grinding, touch the hammer face lightly to the wheel to avoid removing too much



metal in one spot. Also take particular care to keep the slight crown already formed on the face. If a hone is not at hand, you can use very fine abrasive cloth for polishing the face. The cloth should be tacked at the corners to a flat, smooth surface, such as a board, bench top or a piece of plywood.

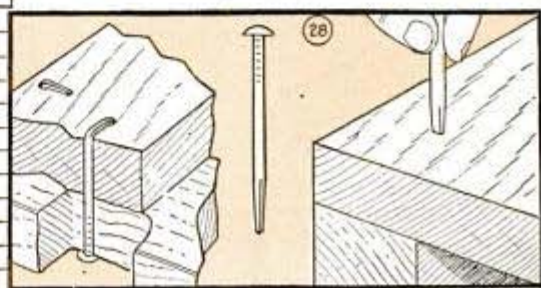
A trick that carpenters frequently use when starting a nail in a place hard to reach is shown in Fig. 12. The head of the nail is held against the cheek of the hammer with the thumb and middle finger as shown. In this way you can easily start a nail any place you can reach with one hand.



26 CASING NAILS, SMOOTH AND BARBED BOX NAILS				
Size	Length In.	Gauge No.	Dia. in Inches Approx.	Approx. No. to One Lb.
2d	1	15½	1/16	1010
3d	1¼	14½	5/64	635
4d	1½	14	5/64	473
5d	1¾	14	5/64	406
6d	2	12½	3/32	236
7d	2¼	12½	3/32	210
8d	2½	11½	7/64	145
9d	2¾	11½	7/64	132
10d	3	10½	1/8	94
12d	3¼	10½	1/8	88
16d	3½	10	9/64	71
20d	4	9	5/32	52

27 FINISHING NAILS				
Size	Length In.	Gauge No.	Dia. in Inches Approx.	Approx. No. to One Lb.
2d	1	16½	1/16	1351
3d	1¼	15½	1/16	807
4d	1½	15	5/64	584
5d	1¾	15	5/64	500
6d	2	13	3/32	309
7d	2¼	13	3/32	238
8d	2½	12½	3/32	189
9d	2¾	12½	3/32	172
10d	3	11½	7/64	121
12d	3¼	11½	7/64	113
16d	3½	11	1/8	90
20d	4	10	9/64	62

The clinch nail has a tapered point and is used in making sliding doors and gates



Globe Is Held Safely on Funnel While Cleaning It



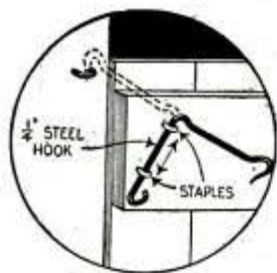
Fastened to a stepladder by means of a large rubber band, a funnel is used by a janitor to hold lamp globes safely while cleaning them. The rubber band is fastened with tacks at opposite edges of the ladder top so that it can be snapped over the mouth of the inverted funnel.

Sickle-Bar Guard for Idle Mower

After having a valuable horse injured by running against the sickle bar of his mowing machine, one farmer wires a piece of angle iron on the bar when the mower is not in use. A steel fence post can also be used.



Angle-Hung Door Hook Swings Out of Way



A homemade hook that will swing out of the way when not in use can be made easily for your barn door by bending a piece of $\frac{1}{4}$ -in. rod as indicated. The hook is pivoted inside of the door by means of a couple of large staples. The space between

the lower staple and the loop on the hook permits it to be lifted and dropped into the latch in such a way that it is almost impossible for an animal to nose open the door.

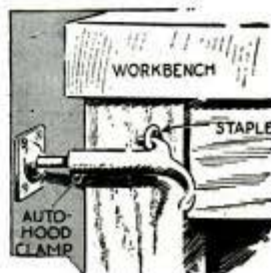
Finishing Trowel Used as Handle On Mason's Clothing Pack

Masons who carry work clothes to and from the job will find that a finishing trowel makes a good handle for carrying them. The trowel is slipped under the cord binding the clothes.



Auto-Hood Clamps Hold Bench Securely Against Wall

Two auto-hood clamps and a couple of staples are all you need to keep your workbench anchored securely against a wall. Just screw the clamps to the wall near the bench top and drive staples in the bench legs at each end in corresponding positions to take the hooks of the clamps.

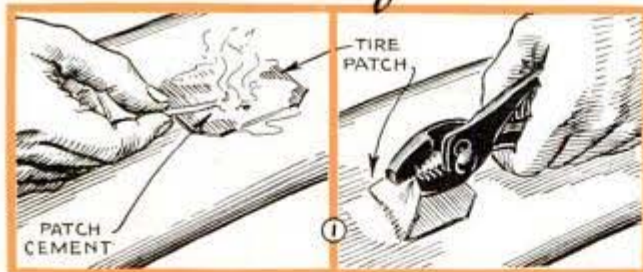


Rabbit Guards for Fruit Trees Are Easy to Remove

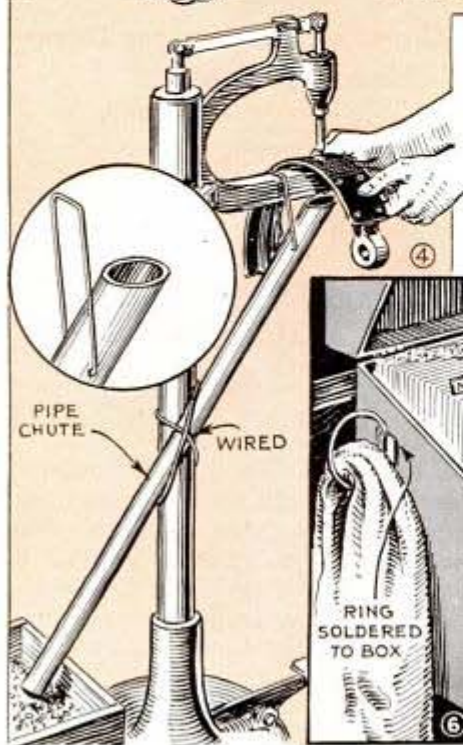


Tacked to pieces of broomsticks or other suitable stakes, lengths of chicken wire provide good guards to prevent rabbits from gnawing off the bark of trees during winter months. In use, the guards are merely placed around the trees and the pointed sticks or stakes pushed into the ground. It takes only a moment to remove each guard when not needed during the summer months.

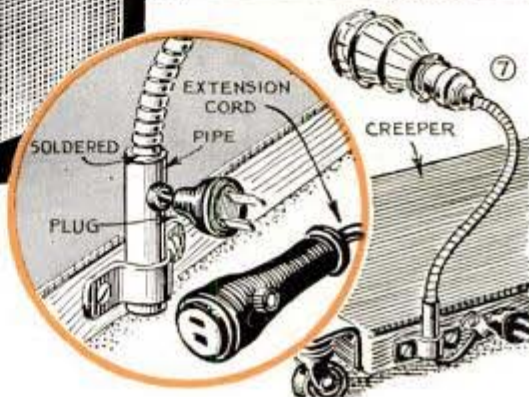
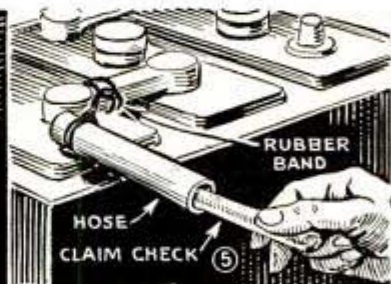
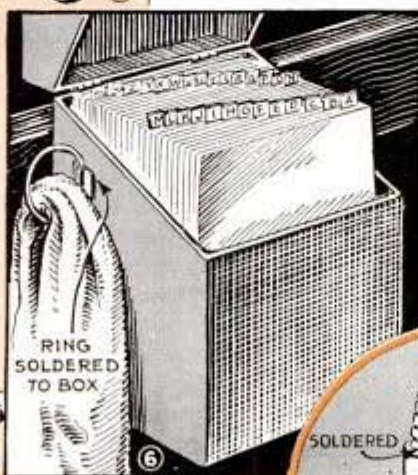
SHORTCUTS *for the* GARAGE MECHANIC



(1) To remove a cold patch from a tube, first apply rubber cement and ignite it. When the flame goes out, you can peel off the patch easily. (2) A grease gun is refilled with little trouble if you provide a cap screw in the barrel to let out air trapped as grease is forced into the barrel. (3) One man can rivet a differential ring gear on an anvil if an axle is run through a hole in the bench top next to the anvil to hold the gear in position while working

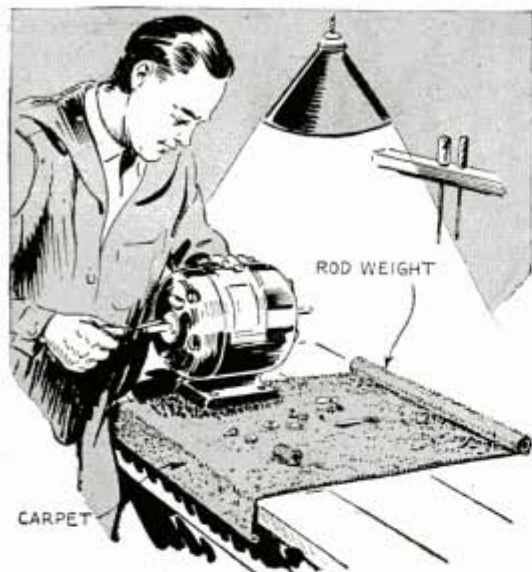


(4) A chute of pipe or tubing running from the anvil of a brake-ripping machine to a box under it will dispose of rivets, as they are punched from old brake lining, and keep them off the floor. (5) Claim checks for batteries being charged are kept safely with their respective batteries if they are inserted into short lengths of garden hose, which are fastened to the battery straps with rubber bands looped around both the hose and the straps



(6) Work charts and other data cards that must be handled frequently in a garage can be kept clean by wiping the hands before picking them up. A towel slipped through a ring in the chart file box is always at hand for the purpose. (7) Trouble lamp on flexible standard attached to creeper is always at hand for directing light where needed under car

Rug Prevents Small Parts Rolling Off a Workbench



When working on generators, distributors, etc., a piece of rug on the bench on which to place screws, bolts and other small parts will keep them from rolling around. The rug is weighted at both ends with iron rods, which hold it in place and make it easy to roll up when not in use.

Skid Hooked to Body of Truck To Hold It in Place

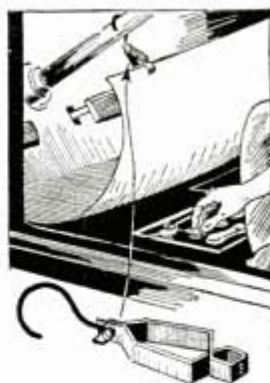
Accidents caused by a skid slipping when moving a heavy box or barrel down it can be avoided by hooking the skid to the truck body. The eye of a large hook is



slipped over the top rung of the skid so that the hook will engage an eyebolt on the back of the truck.

Holding Floor Mat Out of Way While Inspecting Battery

The annoyance of having a rubber floor mat drop down in the way while inspecting or changing a battery located under the floor boards, caused a mechanic to improvise this clamp to hold the mat out of the way. The clamp consists of a wire



hook attached to a battery clip. In use, the latter is slipped over the mat, which is then lifted so that the hook can be put over the steering-wheel column.

Handkerchief Pocket on Door Handy for Driver



Sewed to the upholstery cloth on the inside surface of a car door, a small cloth pocket will keep a handkerchief within easy reach of the driver. Such a pocket is also handy to keep a cloth for drying the hands if they have a tendency to perspire while holding the wheel on long drives.

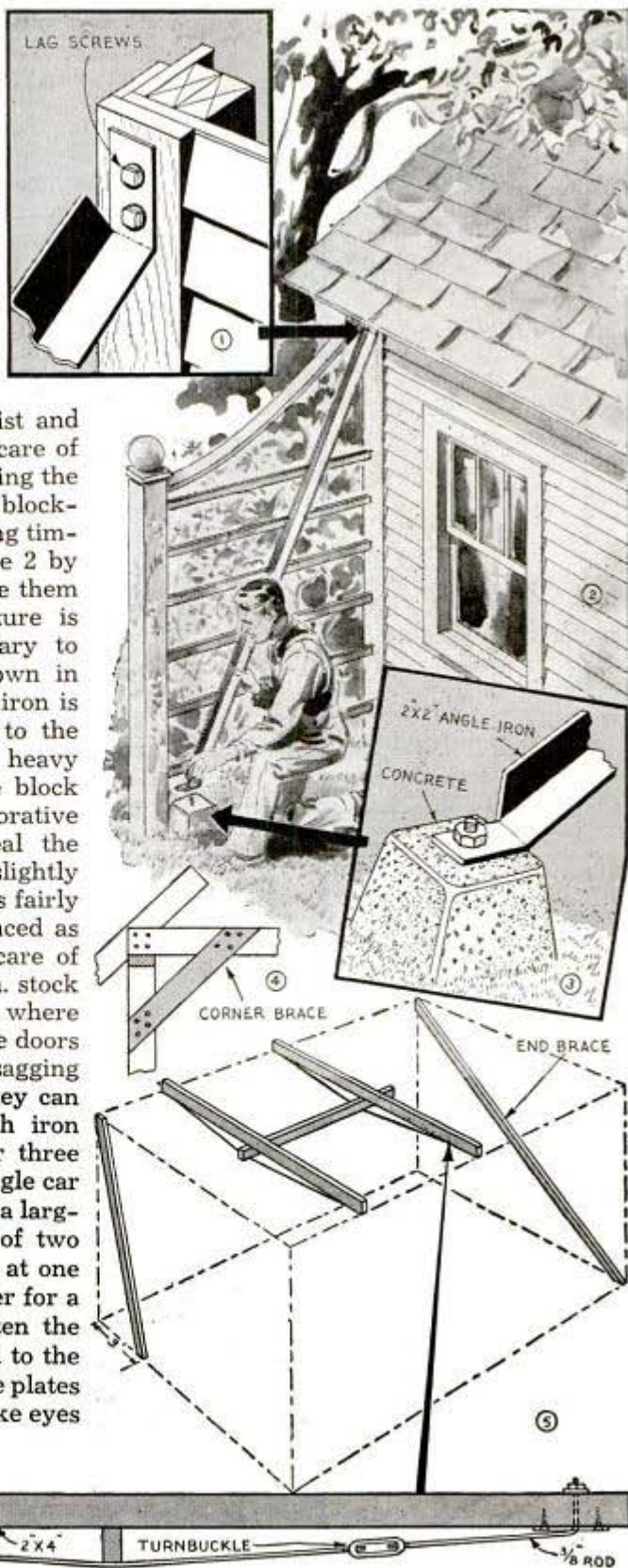
Water Kept From Running Board

Motorists who find that water forms puddles on their running boards where the fenders join them can avoid this trouble by drilling $\frac{1}{8}$ -in. holes near the inside edges where the water collects. If the water is not drained, it is likely to ruin the paint on the fenders.

Bracing Your Garage to Remedy Sagging Doors

By RICHARD E. BUCK

If your garage is leaning, or if the doors drag at the bottom, the trouble can be eliminated by one or more of the simple cures shown here. First, check up to find what is causing the trouble. Probably the structure was not braced well enough when it was built, or maybe the joists or horizontal bracing members are sagging because of articles stored overhead on them. If the building is leaning, a brace at each joist and stud as shown in Fig. 4 will take care of the trouble in most cases. First, bring the structure back to plumb with a block-and-tackle, or with a jack and a long timber arranged to push it back. Use 2 by 6-in. stock for the braces and spike them carefully in place. If the structure is badly racked, it may be necessary to brace it from the outside as shown in Figs. 1, 2 and 3. Here 2-in. angle iron is used as a brace and is fastened to the corner timber of the building with heavy lag bolts and to a large concrete block set deeply in the ground. A decorative trellis or latticework will conceal the brace. Where a garage is only slightly out of plumb and the framework is fairly strong, a couple of end braces placed as shown in Fig. 5 likely will take care of the trouble. Use at least 2 by 6-in. stock and fit the pieces tightly. In cases where the garage walls are plumb and the doors drag, you will probably find that sagging joists are causing the trouble. They can be strengthened by trussing with iron rods as shown in Fig. 5. Two or three trusses should be sufficient in a single car garage, but more will be needed in a larger building. Each truss consists of two lengths of iron rod, each threaded at one end for a large nut and at the other for a turnbuckle. This is used to tighten the truss. The trusses can be attached to the timbers as indicated, or you can use plates with hooks forged on one end to take eyes formed on the ends of the rod.



Hand Truck Serves as a "Hoist" To Move Heavy Motor



Having no hoist or crane with which to lift and carry the block of a heavy auto engine, a mechanic used a hand truck and oil drum as shown to move the motor. By pulling back on the truck handles, the motor was lifted a few inches above the floor, after which it could be wheeled about the shop with ease.

Replacing Ford Crankcases

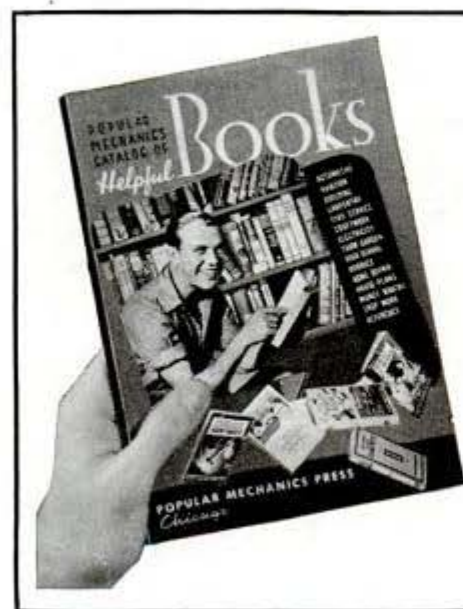
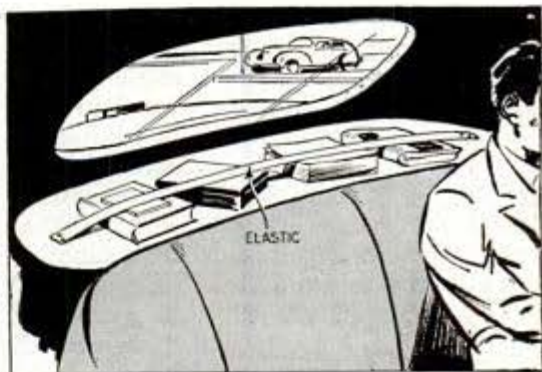
When replacing a model-A crankcase, the rear end that seals in a cork gasket, which is impressed into a groove in the bottom of the rear main-bearing cap, has

pan on to keep the corners of the latter to be guided carefully when putting the from catching and breaking the gasket. I have replaced the crankcases and never had a gasket break or an oil leak from it. I cover the cork gasket well with grease for a distance of about 2 in. down from the top on both sides. In this way, the corners of the pan will slide easily over the greasy surface of the cork and slip right into place without catching on the gasket and chipping or dislodging it.

—Robert Brazier, Valley Forge, Pa.

Elastic on Shelf of Rear Seat Holds Packages and Papers

Papers, books and small packages carried on the shelf back of the rear seat can be kept in place easily with a length of elastic. After stretching the elastic slightly to keep it taut, it can be fastened in place with thread or tacks.



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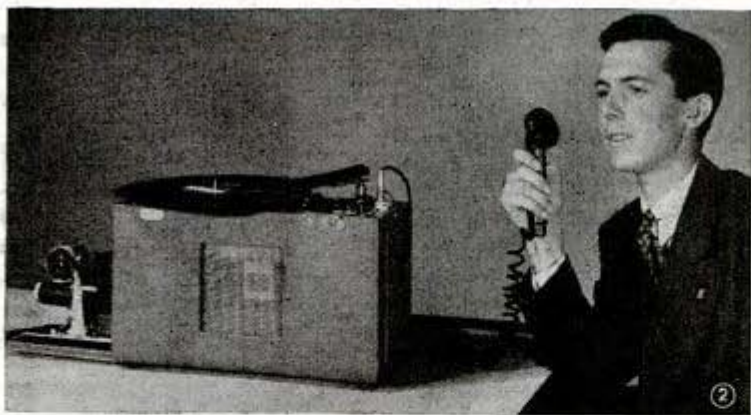
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Dept. 323, 200 East Ontario Street, Chicago



Radio

Sound-Slide Film Projector

SYNCHRONIZED with sound effects, fast changing slide films are now made to produce animation heretofore unobtainable in slide pictures. This instrument is a combination automatic projector, record player and 6-watt audio amplifier. An impulse is recorded in the record disk which actuates the film-changing mechanism of the projector with no break or sound in the continu-



ity of the message being projected. Recordings made for this unit reproduce a tone signal when played on nonautomatic machines, thus enabling them to be played also on manually operated sound slide film equipment.

The talking slide film is a series of pictures on a strip of film synchronized with a recording of narration, dialogue and

sound effects. Changing the pictures automatically, up to several a second when necessary, the advertising or educational story is kept alive and interesting.

It can be set up quickly for sales stories as indicated in photo No. 1. A plug-in connection in the amplifier permits the use of a separate 10-in. speaker if required. Provision is also made for using a crystal microphone as shown in photo 2, for narration with silent slide films. Furthermore, an extension cord with push button is available for use with nonautomatic bell signal programs or personal lectures with silent strip films. The compact and easily portable unit is shown in photo 3.



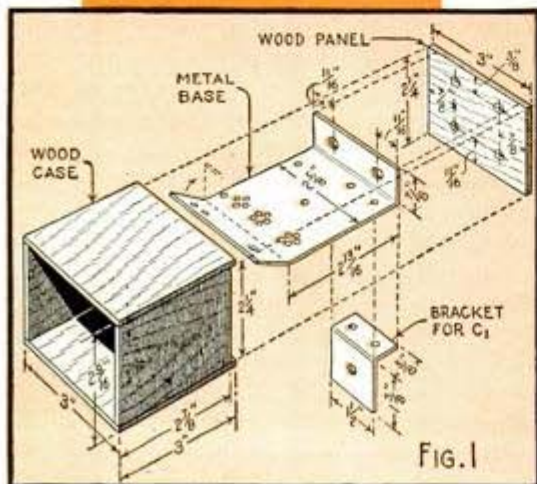
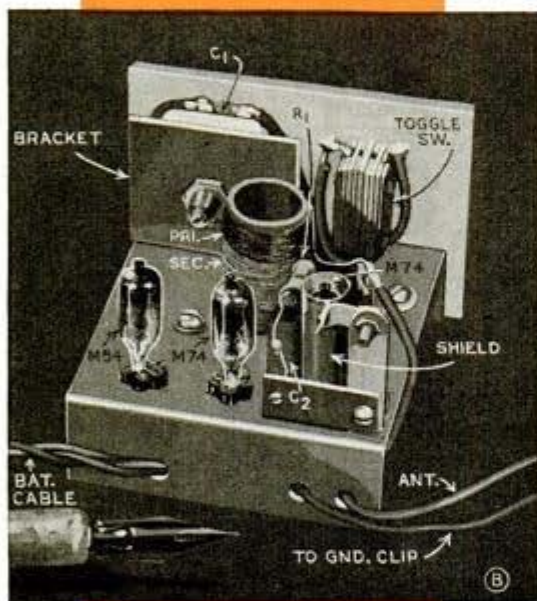
DECEMBER, 1941

Sub 6750

*Talking Sales Pictures, Inc.
155
317 E. Ontario
Chicago*

MINIATURE PORTABLE

By L. M. Dezettel

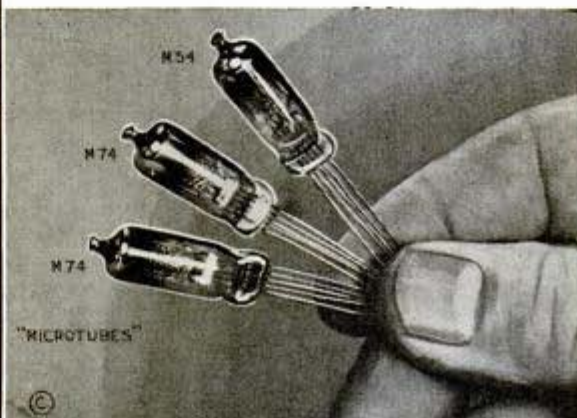


PROBABLY the smallest 3-tube broadcast receiver ever designed for home construction, this tiny set employs three of the new "Microtubes" that are actually no larger than the pilot lamps used in ordinary receivers. All radio parts are standard, and the tubes, shown in photo C, are available in matched sets of three. These tiny tubes require no sockets, operate with low battery drain and have excellent gain.

The receiver is housed in a simple case made of cigar-box wood which measures only 3 in. wide, 3 in. deep and 2½ in. high. It is powered by a small 45-volt B-battery, and an ordinary 1½ volt flashlight cell for the A-battery. The A-battery current drain is only about 40 ma.; the B-battery drain is about 1¾ ma. for all three tubes. If a 20,000-ohm ¼ watt resistor is connected in series with the M54 P lead and the phone jack, this drain can be reduced to 1 ma. or less. In fact the set will operate satisfactorily on a tiny 30-volt hearing-aid type B-battery of the variety shown in photo F, if an ultra-compact 2-unit assembly is desired for pocket use.

For local stations a short antenna wire and a good ground give excellent results. A rod-type auto antenna may be used for a bicycle installation, and the set can be housed in a compact unit in a small 1-unit case clamped to the frame. When used in this manner the ground lead is clipped to the bicycle frame. On a long antenna, the little set really steps out for distant stations.

The panel and case are detailed in Fig. 1, also the simple metal chassis and bracket



Locating 'Hidden Stations' With a Loop Antenna

By Milton J. Hall—W9QXJ

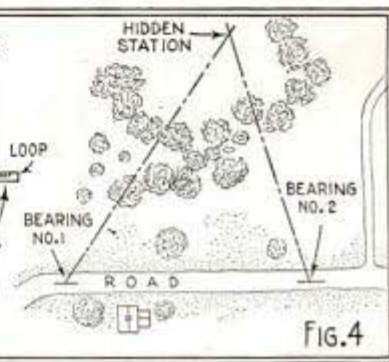
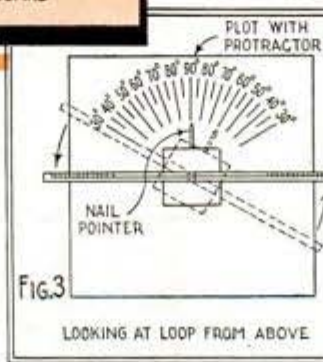
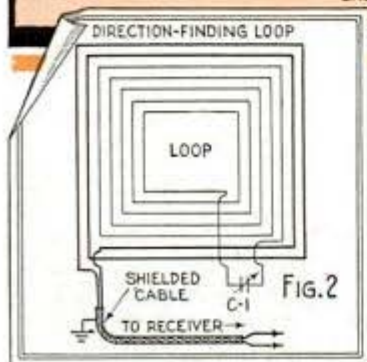
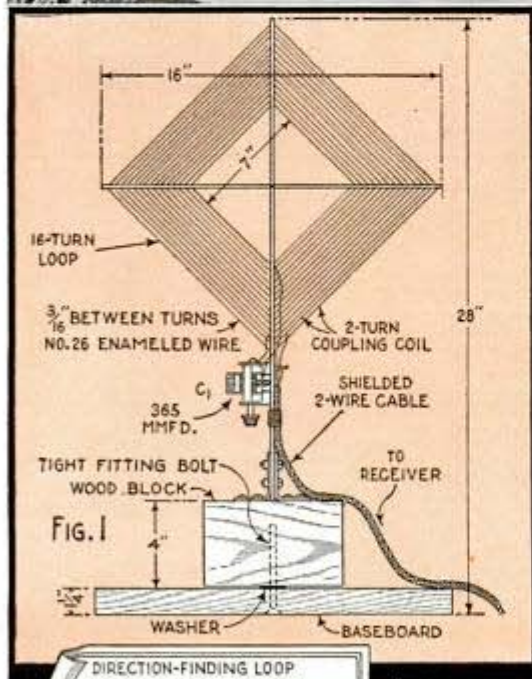


ANY RADIO experimenter can build this simple direction-finding loop antenna and have a lot of fun with it, and at the same time learn a technique which may prove valuable in national defense.

The loop is designed to tune the upper half of the broadcast band and all of the 160-meter amateur band. This latter band is the most popular with the radio amateurs that stage "hidden transmitter" hunts. The loop, detailed in Fig. 1, may be used with any commercial short-wave receiver or homemade short-wave set that has a metal case and provision for a doublet antenna. The loop connects to the doublet terminals of the receiver with a 2-wire microphone-type shielded cable, the shield of which must be grounded to the receiver chassis. This cable is connected to the outer 2-turn pick-up coil on the loop.

Wound on a light frame made of 1/4-in. plywood strips 1 1/2 in. wide; the 16-turn tuning coil and 2-turn coupling coil are wound clockwise in slots cut in the cross members, starting from the middle. The frame is mounted by means of metal angles on a block of wood which is pivoted on a baseboard with a bolt and washer so that the loop block may be rotated. The ends of the 16-turn tuning coil are connected to the variable condenser (C₁). The original loop was used with a "Sky Buddy" short-wave receiver powered by a genemotor from the automobile storage battery. Other receivers, with different types of antenna coils, may make it necessary to modify the 2-turn coupling coil on the loop in order to insure maximum pickup, this is done by trial merely by increasing or reducing

(Continued to page 184)



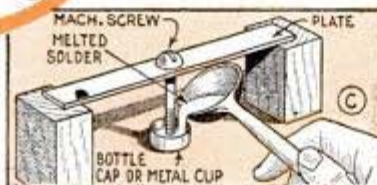
*Drake Electric Works
3654 Lincoln
Chicago*

Hints for RADIO EXPERIMENTERS

(A) Map for spotting stations heard or worked may be conveniently mounted on a roller shade instead of installing a large map on needed wall space. Unroll shade of required size on a table and paint with warm mucilage; place the map on shade immediately and smooth down carefully, working from the center out to remove trapped air pockets. Any remaining blisters may be removed with a pin point. The small magnifying glass on pull cord, is easily carried to any point on map for locating markers



(B) Extra small soldering iron for close work in midget sets, hearing aids and test meters; ideal for connections near chassis, and coil shield mounting

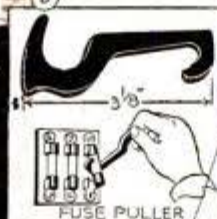


(C) Emergency nut made with solder casting serves temporarily where mechanical strain is light. Hole is drilled in piece of metal which is supported on wood blocks to hold screw so that end rests on bottom of cup. Coat threads and inside of cup with shellac and pour in melted solder. When solder cools, screw can be unthreaded from casting.

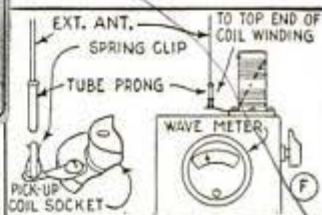
(D) Fuse puller made from strong horn fiber prevents replacement shocks on crowded panels and fuse boxes. Pulls all fuses from 1/4 in. to 13/16 in. diameter



(E) Highly sensitive a.c.-d.c. test set for radio and electrical measurements. (G) Quick change plug-in electrolytic condensers for use where continuity of service is important. Installed by merely plugging in standard octal tube socket



(F) Old tube prong and socket clip used to add short antenna wire to wave meter
(H) General tester for portable radio batteries



*Herbert Mfg. Co.
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Cleveland, Ohio*

*Littlefuses Inc
14757 Parkside
Chicago*

*Triumph Mfg Co
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Chicago*

General Electric Co. Bridgeport Conn
Radio for Modern Kitchens



Housed in an ivory plastic cabinet designed to harmonize with modern kitchen equipment, this 6-tube a.c.-d.c. receiver has built-in antenna, 5-in. dynamic speaker and iron-core IF transformers.

Portable Receiver Inverter

This compact unit permits the operation of 3-way portable receivers in cars, without "A" or "B" batteries. Working directly



American Television and Radio Corp. Paul Harris

End Radio Dept 5215 Cedar Ave
 from the 6-volt auto storage battery it delivers 110 volts a.c., 60 cycles, at 35 watts. Will also operate small a.c.-d.c. sets from auto battery.

Cleveland Ohio
Wireless Phonograph Oscillator

Designed to convert any standard record player quickly to wireless operation, this unit makes record reproduction possible through a regular radio receiver without the necessity of cumbersome interconnecting wires. It measures 4½ by 2½ by 2 in. and may be mounted inside the case of practically all record players.



Multi-Speakers on Light Circuit

Realistic movie-theatre sound effects can be duplicated in the home with this radio which feeds a portion of its audio output



back into the lighting circuit. Extra speakers may be plugged in anywhere in the room or in other rooms on the same meter circuit without additional wiring.

Blueprints covering simplified radio construction articles in this and past issues are available for 25c each. Many popular tested circuits to choose from. Original detailed parts lists with names of supply sources, can be obtained from Popular Mechanics Radio Department upon receipt of postage.

Chicago Radio Corp 6001 S. Jackson

NEXT MONTH—Two-Band Miniature-Tube Battery Receiver and Phono Oscillator. An improved 3-tube version of the popular 2-tube flashlight battery set. A switch quickly converts this new receiver into a "wireless" oscillator for playing records through any radio. Also—**A.C.-D.C. Code Practice Set for Large Groups.**

Snapshotting

the Winter sport of millions



AMERICA takes its pictures when and where it finds them—winter and summer...indoors and out. (Millions of winter snaps last year.)

Winter picture takers are getting grand results—summertime results. For America now knows its film. Knows that

Kodak Verichrome Film gets the picture winter and summer. Knows that Kodak Super-XX Film has speed to spare—so snapshots indoors at night turn out as splendidly as daytime pictures.

Step up your picture-taking fun; snapshot right through the winter.

Outdoors

Use Kodak Verichrome Film outdoors in winter. It brings extra assistance—helps overcome small exposure errors, lets you get swell snapshots even in dull weather.



Indoors at Night

Use Kodak Super-XX Film with Photoflood bulbs and inexpensive reflectors for snapshots at night. **Booklet free at your dealer's.** Also covers flash pictures. Eastman Kodak Co., Rochester, N. Y.



Winter and Summer—you can always count on KODAK FILM

Magic Plastic

(Continued from page 89)

is charged with static electricity. Friction against cloth generates the static, and so heavy does the charge become that, after a few swipes across a coat sleeve, the whiskbroom will make a neon spark-plug tester flash five or six times.

The story of the electric whiskbroom, the painkilling film, selftightening shoelaces, and violin strings that stay tuned, goes back to a simple stunt of heating ordinary sheet Pliofilm to 140 to 180 degrees Fahrenheit and at the same time stretching it four or five times its original dimensions. This increases its strength 10 times, and gives it other surprising properties.

Stretched in one direction, the film gains strength only in that direction. Ribbon stretched lengthwise, and having a thickness of 2/10,000 inch, is useful for weaving rugs, cloth, shoe uppers, lamp shades, and evenings gowns. It can be crocheted into durable, gaily-colored handbags and doilies. When the film is stretched in two directions, it makes a tenfold gain in over-all strength. Its thickness drops to 1/10,000 inch. It carries an almost constant static electric charge, generated mostly by the mere act of moving it about. Reed believes the heavy static charge may have something to do with the ability to alleviate pain.

"Tests have shown that it reduces pain if wrapped around a joint inflamed by arthritis," he says. "It has a similar effect on cuts and other wounds; but such application can be only temporary because the film seals the wound. But for use during the period between injury and treatment by a doctor, the material has possibilities."

The film has a preservative action on fruit wrapped in it. It prevents evaporation of moisture but allows the fruit to breathe. Boats have been equipped with sails made of the plasticized film. The material, which is transparent, very light, and windproof, stands up well.

Reed has an idea for an invisible Pliofilm airplane trap. Here is how it would work: An enemy bombing squadron is approaching. Fighter planes above the line of the bombers' flight drop hundreds of parachutes made of transparent blue, stretched film. Dangling from each parachute is a long, tough cord of the same material. The bombing pilots fly into the descending chutes because they cannot see them, even

when only a hundred yards or so away. The cords can be made with tensile strength sufficient to entangle propellers and control surfaces badly enough to bring down a plane.

Cords and threads are made by a machine that twists Pliofilm ribbon, heats and stretches it, then removes residual twist. The cords can be made soft or hard, and slightly elastic; solid or in the form of a tube; as fine as a strand of spider web or as heavy as spaghetti.

The static-generating ability of the thread makes it useful for whiskbrooms, dusting brushes, and air filters that trap dust and pollen. The thread has a tendency to shrink back to its original length. Pliofilm shoe laces, to take one example, are tied in the usual way, and not too tightly. During the day they become, not looser as ordinary ones do, but just enough tighter to make them hold well. The lace material also can be used for caning chair bottoms.

Plasticized Pliofilm tennis-racket strings become tighter instead of looser, and give the racket a lot of snap. Selftightening thread is used for decorative and reinforcing windings of racket frames, and for binding handles of baseball bats, fishing rods, golf clubs, and hand tools. The binding is unaffected by oil, water, acids, and alkalis. The shrinkage is caused by heat, vibration, and sudden shock.

Even music has not been overlooked. An ordinary violin string, quickly tuned, soon loses its precise tension. A violin string made of rubber hydrochloride may require one and one-half hours for tuning, but it will remain in tune indefinitely.

Stretched Pliofilm ribbon and cord can be used in craft work. A basket woven rather loosely can be placed in hot water and shrunk into shape over a form. Automobile seat covers, cushions and carpeting made of the material wear well. Lamp shades are woven and formed to various shapes by heating and shrinking.

Reed foresees silklike stockings that will withstand soap or ordinary chemicals, that under the heat of the body become form-fitting, and that can be made runproof. He anticipates sport shoes woven of his ribbon or thread, having latex-sponge insoles that pump cooling air around the feet as the wearer walks.

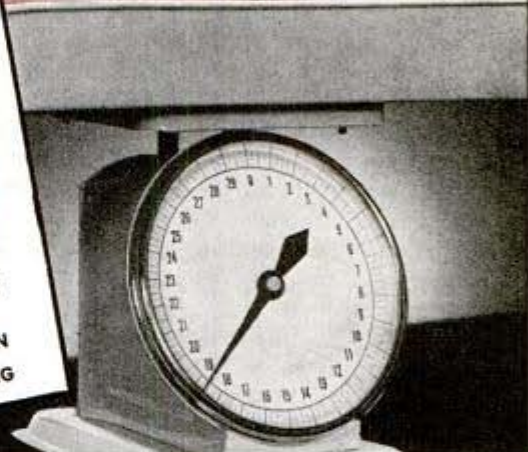
BABY SCALES TELL VITAL FACTS ABOUT HEALTH



The Auto-Lite "PLUG-CHEK" Tells Vital Facts About Your Motor's Health



- Checks Spark Plug Performance 5 Ways!
- 1 CORRECT HEAT RANGE
 - 2 PROPER INSTALLATION
 - 3 EFFICIENT OPERATION
 - 4 POSITIVE CLEANING
 - 5 ACCURATE REGAPPING



WHAT'S going on in the motor of your car? Why are some cars sluggish, hard to start, slow on pick-up? "Plug-Chek," a new service for car owners, reveals vital facts about engine performance.

The new, scientific Auto-Lite "Plug-Chek" Indicator helps show you whether your spark plugs are operating efficiently—or whether they are wasting gas, robbing your car of power. Check your spark plugs against the Auto-Lite "Plug-Chek" Indicator. The color and condition of the "business end" are revealing indications of what's happening *inside* the motor.

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THE ELECTRIC AUTO-LITE COMPANY
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Auto-Lite Engineers, through countless tests and experiments, have developed the amazing Auto-Lite "Plug-Chek"—a new, money-saving service for motorists.

AUTO-LITE *Ignition Engineered* SPARK PLUGS

Gas Bags on Patrol

(Continued from page 53)

bag with its gondola suspended beneath in various kinds of weather, mooring to permanent masts or to one attached to a tractor, and all the other fine points of flying a blimp.

Director of the Goodyear training course is Karl L. Fickes and one member of the ground school faculty is Ward T. Van Orman, internationally famous free balloonist.

Among the newer developments worked out by the U. S. Navy is a method for taking on water ballast at sea. As the blimp grows lighter through consumption of fuel, the pilot swings down within 100 to 150 feet of the water and lowers a hose. At the extreme end of the hose is a small scoop made of metal. It is three inches long and only an inch wider than the hose itself, to lessen drag. Twenty-five feet up from the scoop is the "fish," a streamline cylinder shaped like a blimp and carrying an electric pump inside. The "fish" is 22 inches long, eight inches in diameter and has tail fins to keep it from spinning in the water. The "fish" skims along the water or jumps out like a porpoise, but the scoop is heavy enough to trail beneath the surface and stay directly in the ship's wake. Thus the blimp can pick up water at cruising speed in a few minutes, no matter whether the surface is rough or smooth.

Taking on fuel is accomplished in a novel manner. Informed by radio that the ship approached can spare some gasoline, the blimp pilot drops on the ship's deck two rubberized fabric spheres connected by 14 feet of rope. One sphere, the smaller, is an air-filled buoy, the larger, about three feet in diameter when filled, is the fuel bag. The surface ship fills the fuel bag, then drops both bags overboard. The airship flies over the bags, drops a hook between them and retrieves the bags, then pumps the gasoline into the blimp's tanks.

Sick or wounded men can be rescued—taken off surface craft—by means of special gear that also may be employed for picking up supplies or transferring crew members at sea. A cone-shaped rubberized fabric bag, ten feet long with a diameter of 2½ feet at the top, is lowered 50 feet below the airship by cables, two in number, with rungs across them to form a ladder. Half of the cables consist of heavy extension cord to dampen the effect of wave move-

ments. On top of the cone is a wire mesh cover which allows the water to pass through and which is strong enough to act as a platform, supporting the man. As the cone is filled with water, the airship drops enough ballast so that the "mooring mast" is only half submerged, making for stability even in a high sea. The airship then may either shut off the engines, or remain under way with engines running slowly. The surface ship sends a small boat alongside and the transfer of crew members or supplies up and down the ladder, or by winch, can be effected. In the same manner a sick passenger may be picked up and hurried ashore. When the blimp is ready to leave its anchorage, the cone is tripped, spilling the water and the crew hauls the gear up by a line attached to the bottom of the cone.

If a blimp wishes to remain in a certain area without using fuel, either to employ its listening devices against submarines or to make repairs, it drops a newly devised sea anchor. This consists of a flat metal disk, or a steel ring with a fabric center, which is dropped into the ocean at the end of 200 feet of cable, with a small buoy to keep it afloat, and a weight below to hold it several feet below the surface. The cable is attached to the disk by a three-point bridle to get correct down pull and to facilitate lifting the anchor when desired. Landing on the sea—in calm water, of course—is possible when flotation gear is attached to the car, or gondola, or when the car is built watertight. The car floats on the surface with some anchoring device holding the blimp.

With the aid of these devices, a blimp could go out with the fleet for a month, perhaps several months, picking up ballast and fuel once or twice a day and changing crews every 24 hours. Thus it might be employed for reconnaissance, convoy work or as a listening post. Even alone, a military airship might operate away from its base for months at a time if need be, picking up fuel and supplies from surface ships, while it kept watch for enemy craft approaching America's shores.

(See index, page 4-A, to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

**THEY WHISTLE
THEY'RE ALL-ELECTRIC**

Built with No. 8½ Erector Set

Built with No. 9½ Erector Set



THEY BUZZ WITH ACTION

The COLOSSAL ALL-ELECTRIC ERECTOR

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ALL-ELECTRIC NO. 8½ ERECTOR

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HELLO BOYS! Look at all the fun and action you get with my new Erectors

It's colossal, boys . . . that towering Erector army training parachute jump. You build it yourself. Piece by piece—with your own hands—you fit the long gleaming girders together—attach the rigging for the four parachutes—and install the powerful Erector reversing electric engine . . . And now for thrilling fun. Give the action signal by blowing the Erector whistle . . . throw your engine into gear and your parachutes are hoisted up and up until they strike the release mechanism. Then, like a flash they plummet downward—unfold—and lazily float to the ground.

Now get a load of that mighty Ferris wheel. It whistles—twinkles with light—operates in either direction at slow or high speed.

You can build hundreds of spectacular, realistic mechanical marvels with one Erector set. And how the Erector electric engine makes them buzz with action! See my new All-Electric Erectors at your nearest toy store today. Take Dad along. A. C. Gilbert, President.



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Boys, getting this book is as exciting as going to the movies. Over 100 illustrations showing all of the new Erector sets and the gigantic, realistic action models they build. Mail coupon or post card.

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Here's my name and address. Rush big book.

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2713

Movies That Mimic Life

(Continued from page 69)

The problem of creating an illusion of depth on the screen is still to be solved. Clever backlighting in some current pictures makes the actors stand out from their backgrounds and is a partial solution, but what the experts want is a three-dimensional effect so perfect that birds flying toward the camera would, in the theater, appear to almost fly out over the heads of the audience.

Optical glasses or red and green glasses that have been worn by audiences in some three-dimensional experiments don't seem to be the answer. A Russian system that seems to have promise is now being studied. In this arrangement, stereoscopic film is made by means of reflecting mirrors,



This realistic tank was built in a studio shop

through a single camera lens, and the two images are superimposed in projection. This has been tried before, but the Russian system also includes a perspective grille, set up in front of the screen, that consists of 30,000 copper wires so fine that they can hardly be distinguished. The stereoscopic images, projected against the grille, are supposed to give a true illusion of depth.

Because of technical difficulties most cameramen shoot scenes with their lenses practically wide open in spite of the fact that this gives them a very shallow depth of focus. In the past they have made a virtue of this by focusing first on one actor and then on another as a means of directing attention to the character who is speaking. The rest of the scene is out of focus and fuzzy.

The new method of coating lenses with transparent material in microscopic layers for the purpose of allowing more light to

pass through the lens instead of being reflected from its surfaces, plus the new "high speed" films, plus the penetrating light from twin-arc broadside lamps, now permits a cameraman to attain a practically universal focus in which objects close to the camera as well as objects hundreds of feet away are all equally sharp and clear. This new technique is demonstrated in R.K.O.'s "Citizen Kane," a picture in which many scenes were shot at a camera aperture of f 16 instead of the more usual f 3.5. The result is that for the first time the motion picture camera sees a whole scene with the same depth of focus and clarity that the human eye sees it. In this picture, for the first time, audiences see the ceilings of some of the sets. Most Hollywood sets have three walls and a floor but no ceiling and the ceiling space is taken up by lights pointed down into the set. In this picture the cameraman wanted to shoot upward from the floor for some scenes, so muslin ceilings were constructed and the overhead lights were moved out to the sides.

So-called "trick photography" plays an important part in picture making because by the use of miniatures and the projection of motion pictures on a screen to form the background for action in front of the camera, effects that are too dangerous, too expensive, or impossible to obtain in real life may be created. Most such tricks of the profession are secret but one device recently patented is a "water ripple and wave illusion machine" by which Warner Bros. are able to create on a background screen a perfect reproduction of sunlight sparkling on the ocean, the action of waves, and similar effects. The same studio recently built a revolving mountain in one of its sound stages. The mountain has six sides, each showing a different scene.

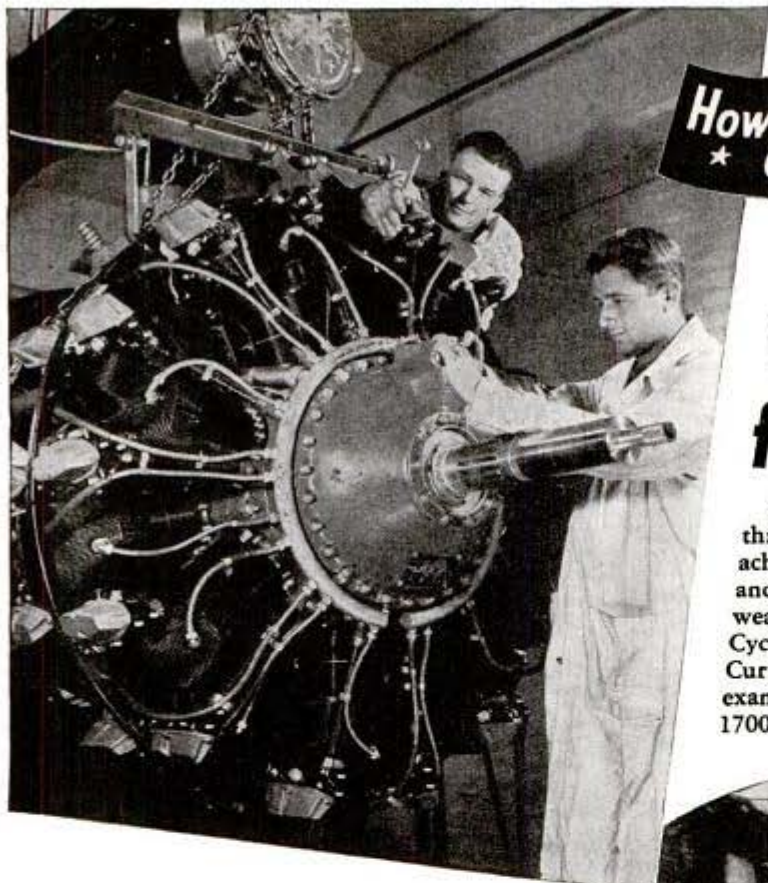
The same technical skill that has harnessed light and sound for your entertainment is turning its attention to the problems of defense. One cinema photographer is using all his spare time to create a new and simple photographic system for stripping the veil from camouflage. A sound engineer is hard at work on a revolutionary aircraft detecting and sound ranging system and other experts are tackling similar projects that may play their part in modern warfare.

How *Atlas* **SERVES THE NATION**

No. 2 in a Series of Messages showing how Atlas helps in the Defense Program.

CYCLONES for DEFENSE

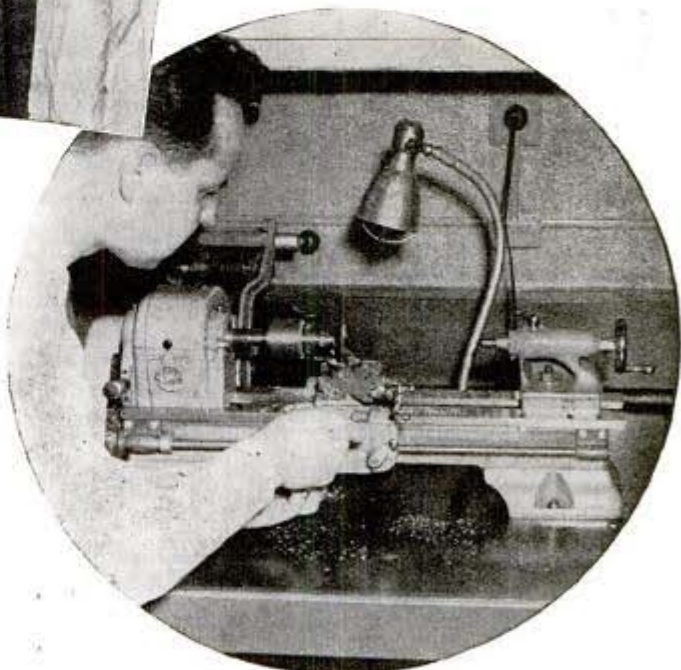
Every mechanically-minded American thrills with justifiable pride at the achievements of the nation's engineers and craftsmen in building mighty weapons for defense. This Wright Cyclone 14 that powers the famous Curtiss Dive Bomber is a typical example—a 14 cylinder double-row 1700 HP radial-type air-cooled engine.



Other engines of the Wright Aeronautical Corporation power Navy Trainers, Army Tanks, Boeing Flying Fortresses, and the huge Douglas B-19.

Unvarying exactness for absolute dependability is the keynote of Wright production—to insure safety of pilot and equipment and to maintain the reputation of Wright engines for unfaltering service through millions of flying miles year after year.

With *precision and production* as the goal, America is building an impregnable defense. We are proud of the many helpful ways Atlas machine tools are serving the nation.



The Atlas Lathe is in regular use in the materials testing laboratories of the Wright Aeronautical Corporation.

ATLAS PRESS COMPANY
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Adventures of the Deep Sea Fishermen

(Continued from page 31)

2647
The radio has saved a number of fishing vessels and their crews, although many emergencies are so unexpected that the radio is of little use. Calling for help doesn't save the day, for instance, when a fire breaks out. The crew must fight the fire unaided or the vessel will be lost before help can reach them.

Once a short circuit in the wiring started a fire on the tuna fishing boat, Yankee Clipper, but no one knew it because the boat was anchored off a desert island and the crew was all below asleep. A couple of them woke up when there was a crash on deck, and got up to investigate. The ship was afire and some extra drums of fuel oil, on the after deck, were glowing in the heat. The whole crew fought the fire and finally got it out before much damage had been done aside from that to the deckhouse. The flames had burned away the rigging, released the boat boom, and it was the crash of the boom on the deck that had awakened the men. The vessel would have been doomed in another 10 minutes but it stayed at sea and fished for another three weeks before returning to port.

For both the live-bait boats and the purse seiners, sharks are one of the chief dangers. On a live-bait boat the men fish from metal racks outside the rail and just above the water. Hungry sharks are apt to snap at their rubber boots, so they have to stand back against the hull. Barracuda sometimes jump into the air after bait that is being thrown from a vessel, with such force that they may land on deck and knock down anyone who happens to be in the way.

The great whale sharks of Lower California waters, weighing up to 20 tons, tangle themselves up in the great tuna nets and may do thousands of dollars worth of damage in a few minutes. The main desire of the fishing crew, once a big shark has trapped himself, is to get him free at once and unharmed. If the shark dies they will have the long task of cutting him up and getting him free of the net piece by piece. One way of getting him loose is to tie a line to his tail and then tow him away. If he is too tangled up for that, one of the men climbs onto the shark's head and with a long knife at the end of a pole saws the net free in front so that the shark can swim out.

A tuna net costs something like \$6,000 and one crew thought that a big shark had gotten away with their net for good. The great animal, tangled in the meshes, dove for the bottom and carried down the entire net and a 20-foot skiff that was lashed to it. The fishing vessel cruised around but not a sight was to be seen of the shark, net, or skiff. Three hours later the shark finally worked himself free and the skiff and cork-buoyed net rose to the surface again.

There is always a chance, after a purse seiner has captured 50 tons of fish or more in its net, that the school will sound and drag the seine and the skiff attached to it under water. The gear always floats up to the top again after the fish escape, of course, but there will be no more fishing for a day or two because the net must be overhauled and repaired before it can be used again.

All of the big sea boats are now owned by citizens of the United States and in the past, before this was true, some newspapers speculated as to whether some of the tuna clippers might not be converted into mine layers and used against the United States in case of war. The fact is that the fishing fleet will be used to protect the country instead of to fight against it.

Thirty purse seiners have already been taken over by the Navy and are being refitted for duty as mine sweepers and anti-submarine-net tenders. Small caliber guns are being mounted on the erstwhile tuna clippers and depth bomb chutes built in the sterns. The British fishing fleet has important patrol and mine sweeping duties in the present war and today, on both coasts, American vessels are being prepared for similar service.

W. R. Neff

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2914

Slide, Brother, Slide

(Continued from page 43)

The first of the action maneuvers which should be mastered by the average skier is the "double stem," or "snow plow" stop. "Stemming" simply means turning inward of the point of a ski. To accomplish the double stem stop, turn the points of both skis inward until they practically meet. Your body should be in a crouched position, your ski poles clear of the snow and behind you, and your weight in your seat.

The double stem is also used to decrease speed without coming to a full stop. In this case the skis are not turned inward as much as for a stop. The more the ski points are turned inward, the greater the decrease in speed. When you have decreased your speed sufficiently, it is simple to come out of the double stem by bringing your skis back to a parallel position. Through the use of the double stem a speed of 60 miles an hour can be decreased to four or five miles an hour.

Another maneuver which utilizes the double stem technique is the "stem turn." In this case, one ski is turned inward more than the other. The ski opposite to the direction in which you want to turn is the one which is turned inward at a greater angle—if you want to turn right, the left ski is turned in more sharply. In making a double stem turn, the weight is more heavily on the outer ski. The double stem turn is used when you wish to decrease speed and turn at the same time.

If you wish to turn with only a slight decrease in speed, you should use a "stem Christiania." This is accomplished as though you were riding on one ski and steering with the other. The shoulder opposite to the direction of the turn is thrust forward. Turn only one ski, keeping the turned ski slightly forward.

The "pure Christiania" is a still faster turn than the stem Christiania. The skis are not turned inward at all, but are kept perfectly parallel. The twisting motion which generates the turn is given from above the waist. To turn right you swing your left shoulder sharply forward; to turn left the right shoulder is thrust forward. The body is bent slightly at the waist and the normal crouch is maintained. The Christiania is also used by expert skiers as

(Continued to page 173)



• • • Which is another way of saying that millions of files in the hands of millions of patriotic workers are doing a tremendous bit toward National Defense—on ships, planes, tanks, trucks, guns, shells and what not.

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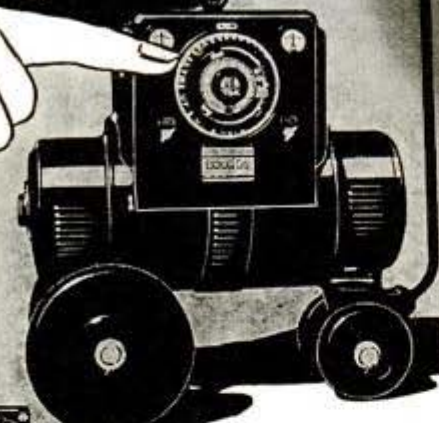
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a method of stopping after a downhill run.

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When you have mastered the double stem turn, the stem Christiania, the pure Christiania and the Telemark, you will be able to turn at any speed and in the most efficient manner relative to the terrain which you are covering.

The next step is to learn the few fundamental jumps which are required for general cross-country skiing. The first of these is the "jump turn." This is really a combination jump and turn, as the name implies. It is used when the snow is either too heavy or too mushy for any other type of turn. The poles are not employed in this maneuver, except for balance. They should not touch the snow. The turn is achieved by simply jumping off the snow and at the same time changing direction. There is nothing complicated about this jump, it being exactly the same as when a person without skis jumps over a log or other low object. There is no point in jumping high. Just be sure that your skis clear the snow.

As you jump, swing your skis in the direction in which you want to turn. This maneuver can be practiced in your own living room. In fact, I have my classes practice it indoors before going out in the snow.

An all important use of the jump turn is to stop when you come to an unexpected obstacle. This usually occurs when you are skiing down a steep hill and suddenly see a log or rock immediately ahead. In such a case, jump turn at a complete right angle to the direction in which you are skiing. This results in the most positive possible stop. Land first on your skis, and then if the situation is dangerous enough, don't be afraid to fall and let your body aid in the stop.

The "obstacle jump" is similar to the jump turn except that there is no change

(Continued to page 174)

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in direction. Its sole use is to clear a low obstacle without turning. The jump should be higher than for a jump turn. Obstacle jumps should be begun with the body in a low crouch. The arms may be in any position, except that the ski poles must be behind you. To jump with your ski poles in front is extremely dangerous. Let me repeat that there is nothing at all complicated in such jumps, the jump being simply the ordinary jump with which all human beings are familiar.

For all practical purposes, the most extreme jump necessary for normal skiing is the "Gelandesprung." This is simply an obstacle jump which is aided by the ski poles. It is used for clearing obstacles which are too high for a plain jump. For the Gelandesprung, the grip on the ski poles must be altered. The strap is twisted around the wrist and the end of the ski pole rests in the palm of the hand. The index finger, or the index finger and the second finger, should lie along the side of the ski pole.

To execute the Gelandesprung, extend the poles in front of you, plant the points in the snow, and jump, at the same time boosting yourself with the poles. The skis should be kept absolutely parallel.

Although the Gelandesprung is the best of all methods for clearing obstacles which are too high for plain jumping, it should not be used at extremely high speeds. Before using this maneuver in unknown terrain, the skier should practice it at extremely slow speeds and over some known obstacle. Once mastered, it is invaluable for all types of skiing.

As in any sport, good skiing requires practice. However, skiing is fundamentally simple and does not demand extensive training. I am referring, of course, to ordinary skiing, not to exhibition or other highly technical competitions. Naturally, there is nothing which will take the place of personal instruction by a competent professional skier. However, if you will follow the simple advice given in this article, you will increase your skiing pleasure immensely and you will be able to cover any type of country with your skis under you, rather than the reverse.

(See index, page 4-A, to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

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2854

America's Newest Birds of War

(Continued from Coloroto Section)

Soon to emerge from the Glenn L. Martin plant will be a 140,000-pound battleship of the air, the largest flying boat in the world, which the Navy will use. Powered by four 2,000-horsepower Cyclone engines, it will have a top speed of about 200 miles per hour, a cruising speed of 150 and a fuel capacity sufficient for a flight across the Atlantic and return. Gun turrets protrude from the hull at a dozen places and the flying boat will carry both bombs and torpedoes. The flying battleship is intended for high altitude operations, being designed to stay far above the effective range of anti-aircraft fire. It is an experimental ship,

metal, mid-wing monoplane and is manned by a pilot and a gunner. It carries a 1,000-pound bomb entirely enclosed within its fuselage, a feature that results in more speed because air drag is reduced. The plane, which has been subjected to extensive flight testing, is powered by a Wright double-row Cyclone motor rated at 1,700 horsepower.

Research work by aviation and military engineers has been in progress for several months on the subject of high-altitude combat and bombing operations. Almost daily dispatches from Europe have indicated that zones of air action are moving upward, with fighting at 25,000 feet and higher. Greater heights are expected to become common as specially equipped types of aircraft come into wider service. In this research, the Boeing flying fortress, which has turbo-superchargers enabling it to operate efficiently at high altitudes, has been employed to take groups of engineers to the threshold of the stratosphere—35,000 feet—where the air is so thin a man will become unconscious in less than a minute without an artificial air supply. On these flights, the engineers, as well as members of the crew, breathe oxygen after having reduced the nitrogen content of the blood by breathing pure oxygen and exercising mildly for 30 minutes before taking off. At high altitudes nitrogen expands into tiny bubbles and produces a painful effect similar to a diver's "bends." A test chamber on the ground simulates conditions of the upper air and permits the airmen to practice every step of a proposed flight.



This is a "flying fortress," which can operate efficiently seven miles above the earth

the Navy depending for the present upon the Consolidate patrol bombers—both twin and four-motored—and the Martin bi-motored planes.

Dive bombing is recognized by the Army Air Forces as one of the important phases of aerial warfare and organization of six squadrons of the American version of the German Stukas has been completed recently. Initial deliveries of a new dive bomber—the Douglas A-24—have been made to the Army to equip this force, which would operate in actual warfare in connection with armored divisions. The plane is a two-place, single-motor ship which will out-perform dive bombers now used by other nations. It is designed to be highly effective against moving targets, especially when defenses are not thoroughly organized.

A new-type, long range Brewster dive bomber being developed for the Navy is said to be 100 miles an hour faster than the German Stuka. Designed for operation from aircraft carriers, it is a large, all-

metal, mid-wing monoplane and is manned by a pilot and a gunner. It carries a 1,000-pound bomb entirely enclosed within its fuselage, a feature that results in more speed because air drag is reduced. The plane, which has been subjected to extensive flight testing, is powered by a Wright double-row Cyclone motor rated at 1,700 horsepower.

Just how fast are the Army and Navy going to get the latest types of warplanes? That is entirely dependent upon the number that the United States government considers necessary to release to England. Present plans call for delivery of between 40,000 and 50,000 planes of all types to this country's armed forces by the end of 1942. Aviation manufacturers agree that the job can be done and some predict its completion ahead of schedule.

☐ You can obtain additional information about products described in this magazine by writing to the firms listed in the Where-to-Buy-It index, page 4-A. Say You Saw It in Popular Mechanics.

**"Look, Sarge! He's
scuttled himself!.."**



SERGEANT: *Now ain't that just too bad! Think we ought to give him a hand?*

CORPORAL: *Naw! That's too strenuous. Let's just give him some good advice.*

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(Right) LIFE-SAVER SILVERTOWN. No tire can stop you quicker, or keep you safer from skids.

Battling the Red Monster

(Continued from page 59)

You can't blow out many types of fire in your home, but you can often separate the flames by beating them off with a small rug, a blanket, or a wet towel, or if they are in a garment, by whipping the garment against the bare wall or floor.

But the most common type of fire in the home is one where wood, paper, rubbish or textiles are burning. Here, cooling with water is most effective. Or you might have a rapidly burning fire caused by the ignition of gasoline, grease or oil. In that case the preferred treatment would be smothering—cutting off its oxygen supply. A third type is the fire in electrical equipment. Here either smothering or cooling could be employed, provided you did not use water or any other extinguishing agent which will conduct electricity and shock yourself, but first of all, disconnect the appliance, if possible.

Sometimes a fire may need a combination of two extinguishing methods. Let's take an imaginary trip through a house with one of the experts from Underwriters' Laboratories and find out just what might happen.

And let's presume that as we reach this house the engine of our car catches fire. He would stop the car, grab a one-quart extinguisher, open the car hood and direct the stream against the engine so that it could splash against the hot surfaces, evaporate and form gas. The gas would smother the fire.

If there were no extinguisher in the car, he would throw dirt on the engine, or sand or snow, again smothering the flames, or beat the fire out with a hat or coat, separating the flames from the burning material.

If the car caught fire in the garage and the fire spread to grease and oil on the floor, he would try to get the car out of the garage, put out the fire in the car first with the extinguisher, and then attack the fire in the garage floor with the remaining liquid. And if there were no extinguisher on hand, the expert would use sand, dirt or even a broom.

Many fires start in basements, so we go there next. Fires in the basement are dangerous because they are below you and can spread throughout the house. A good extinguisher to have in the basement to fight oil fires or rubbish or wood fires, the

expert explains, is the two and one-half gallon foam type. Suppose we have a leaking oil line and the floor around the furnace is covered with flaming oil. By inverting the foam extinguisher and directing the stream upon the surface of the flaming oil, the fire may be extinguished. If it is not possible to put the fire out completely, at least the smothering blanket of foam will greatly reduce the fire's intensity and retard the spread of the flames.

If we do not have an extinguisher, a good quantity of sand which can be shoveled or thrown on the flaming oil is effective. And a garden hose adjusted to a fine spray can be used to cool the fire and to wet down the area surrounding it. Under no conditions should a forceful water stream be directed into flaming oil. That would spread the fire. With a rubbish or wood fire the hose can also be used and a strong stream is effective here. Buckets or pans of water may help if a hose is not available.

Remember, the expert cautions, when there is a fire in the basement, or anywhere in the house, the whole house is in danger. Call for help and have someone call the fire department. And if you're alone, phone the fire department immediately, unless you have extinguishers or other equipment and are certain of being able to put out the blaze without help. If the fire gets out of hand and you have delayed calling the fire department, the damage may be great.

Now we go to the kitchen, where, he says, we usually have grease fires. Frying doughnuts in a large kettle of grease sometimes causes fires if the grease is allowed to get too hot. An excellent device for putting out kitchen fires is a two-pound carbon-dioxide extinguisher that can be handled easily by a woman. It smothers the fire with carbon dioxide gas and snow which is at a temperature of one hundred and ten degrees below zero. The next best thing is a large pot lid to put over the kettle or skillet and smother the flames.

In the rest of the house we are mostly concerned with a fire in cushions, bedding, or rugs which does not usually spread rapidly and can generally be put out with buckets of water if discovered soon enough. For that sort of fire, any kind of extinguisher would be helpful. But a two and

(Continued to page 180)



How to Become a Model Railroader! CASH PRIZE CONTEST

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LIONEL

2746
one-half gallon soda-acid extinguisher, or a water pump type would be best.

The expert tells us that for ordinary fires, attack from the windward side, and extinguish the flames from the bottom up, or from the front back. Try to keep the fire from flashing back over the area which has been extinguished. In the case of burning liquids in open containers, the stream from the extinguisher should be directed against the inside wall of the container so that it will spread back over the liquid.

Never turn the stream into the flaming liquid; it may spread the fire. Carbon dioxide and some other types of extinguishers should be used with a sweeping motion for they separate the flame from the burning material. Using the extinguisher correctly may make the difference between success or failure. Above all, do not give up. One instant it may look hopeless, the next you may have the fire out. The important thing is to keep a clear head and act quickly.

2683

They Steer by Ear

(Continued from page 36)

or gravel, and a forked headland yields a double echo to the expert ear. A lone rock or small island yields a short echo, when most of the whistle's noise goes past it without bouncing back, and a long shoreline naturally returns a long echo.

Thus the echo serves instead of the eye as a final verification of the vessel's position in close quarters. Its approximate position is based on its logged course, just as a train's position is dictated by the tracks. Every day in all kinds of weather, the pilot logs each change of course to the minute and second, including the compass bearing and tachometer count. Then, when the fog sets in, he turns back his log two weeks to catch the tide at the same stage; he puts his boat in the same groove, and follows the groove until a narrow passage or threatening point makes him "feel around" with the whistle to get his bearings exactly.

Echo-navigation is even used in groping past a sister-ship on the same run, for her familiar whistle identifies the sister-ship and her course is known from familiar experience. The only "scares" come from rare broken whistle-cords and from the fog itself, for a dense bank of it will return a fairly solid echo. A strange skipper would be in a panic, but the veteran knows he can't believe his ears.

Diesel boats, with their electric rudders and air-horns, are sweeping steam from the ferry lanes and pioneer skippers don't like it. They say the "hooters" don't produce such good echoes as the old steam chimes, and that the rumble of the exhaust blurs them. A few motorships carry steam-chests on their exhaust manifolds which generate enough steam for the whistle and for heating the cabins, but even

these are disappearing. So, for that matter, is echo-navigation.

The main arteries of travel among the scattered islands and sprawling peninsulas of Puget Sound are thickly sprinkled now with bellbuoys, whistles, foghorns and other aids to navigation. Echoes still are used to confirm these modern safeguards, but as "the eyes of the boat" they're losing ground.

Even the echo-boards are growing scarcer. These were like four big billboards in the shape of a cross; they were built on spits and shoals where the natural echo was insufficient for safe navigation, and they rapped back an echo like a gunshot. Now a whistle wails where the echo-board once stood, or a bell jangles, and boats slam past with silent whistles.

Puget Sound has drained San Francisco Bay of its ferries, since the two great bridges were built. A migration of motorships has been towed through storm and wind to serve out their usefulness in waterways too wide for bridges, and they are standardizing the Seattle ferry fleet. Most of them hold from 40 to 80 cars, but there are sturdy little craft that hold less than a dozen and connect little-used roads.

Queen of the fleet is Black Ball's streamlined Kalakala, which was in service for months before she was ever "designed." She was built with templates "blown up" from a small scale model, and her streamlining has been more valuable in advertising than in actual service, although she holds her schedule in high winds better than vessels of conventional design.

(See index, page 4-A, to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

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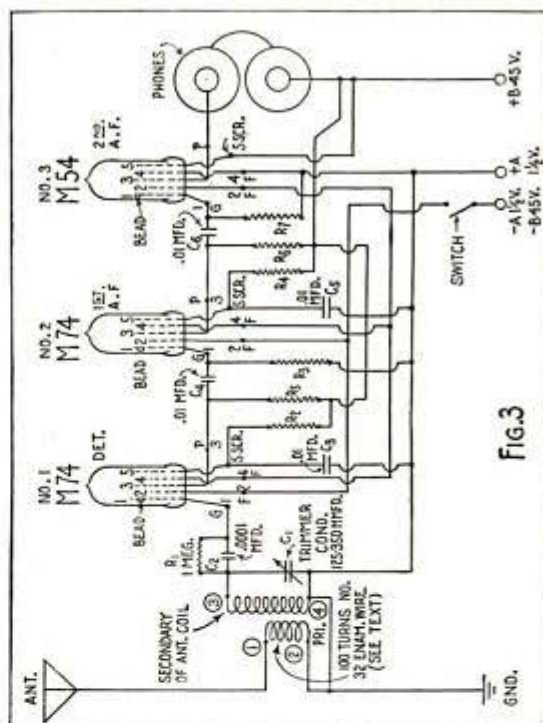
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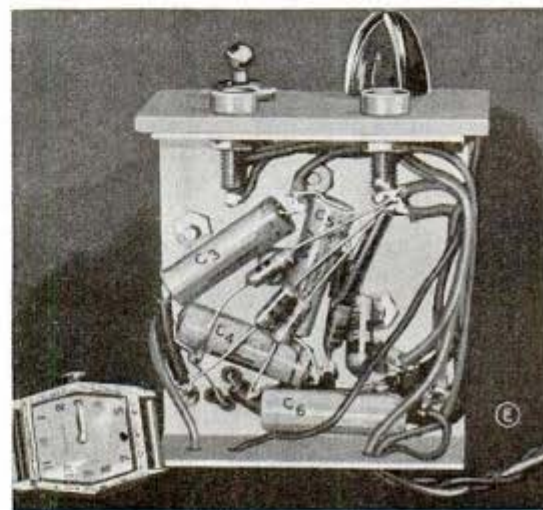
"Microtube" Three

(Continued from page 157)

type as both are the size shown in photo E. The variable tuning condenser (C_1) is a mica compression type ordinarily used as a trimmer or padder in large sets. The ca-



capacity range given covers practically all of the standard broadcast band except the high frequency end. If your local stations tune in at this high end, use a 75 to 225 mmfd. of the same type. In order to tune (C_1) from the front panel it is necessary



(Continued to page 184)

How "DYNAMIC BALANCING"

makes Better Drill Presses



To insure true running of revolving parts, such as pulleys and wheels, Delta uses a special operation known as Dynamic Balancing.

Many drill presses have the pulleys Statically Balanced, a method by which the pulley is mounted upon a shaft and then placed between two horizontal parallel knife edge supports so that the heavy part of the pulley will naturally swing to the bottom. The "heavy" part of the pulley is thus found and by means of a drill the excess metal is removed so that the pulley is better balanced. Static Balancing is not good enough for Delta drill presses because it does not balance accurately enough.

Dynamic Balancing, done with the special delicate electrical apparatus shown in the photograph above, locates and corrects *all* heavy spots—so that the revolving part is in perfect balance.

Therefore, in Delta drill presses you are assured of absolutely true-running, vibrationless operation which means lifelong accuracy for you.

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to solder a 1-in. length of $\frac{1}{4}$ -in. brass rod to the head of the adjusting screw, so that the shaft will extend through the panel. A detailed list of the original parts used is available from Popular Mechanics radio department without charge.

A Carron "Pee-Wee" antenna coil is used, and slightly altered to make it even smaller. The regular primary and all the sol-



dering tabs are stripped from the coil and both ends of the coil form are cut off leaving only $\frac{3}{8}$ of an inch at each end of the secondary winding. A spade lug is fastened to one end of the form for mounting, and a 100-turn primary is random wound with No. 32 enameled wire clockwise on the top end as will be noted in photo B. The entire coil is then dipped in coil dope such as Amphenol "912." The blueprint number for this article is R-297.

Locating "Hidden Stations"

(Continued from page 158)

the number of turns on the coil. A nail driven in the loop block acts as a pointer for the scale on the baseboard, Fig. 3.

Finding a station with the loop is surprisingly easy, as illustrated in sketch Fig. 4. Try your hand with a broadcast station first. With the station tuned in on the receiver, turn the variable condenser on the loop until the signal is loudest. Then rotate the loop block until the signal drops to the weakest level. When this condition is reached, the pointer on the block points along a line running directly to the transmitter. Plot this line on a map. Now move to another point some distance away. Just how far depends upon the distance from the transmitter, half a mile or so is enough if the station is within 10 miles. Take another bearing now, and plot the line on the map. The point where the two lines cross is the approximate location of the "hidden" transmitter.

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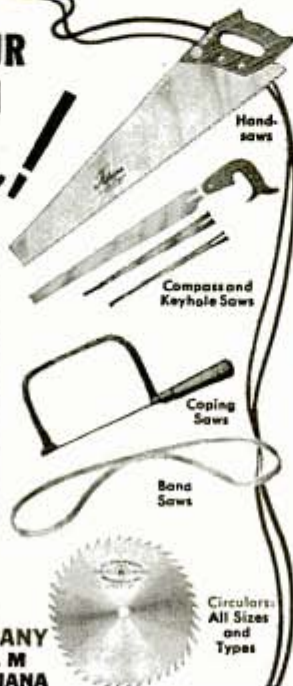
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KUEMPEL CHIME CLOCK CO., Bldg. 55, Guttenberg, Iowa.

2719
No Supermen Wanted

(Continued from page 85)

instrument that determines whether the applicant's indirect vision—from out of the "corner" of his eye—is normal. Still another eye test is that for color blindness. If the applicant has trouble in distinguishing the "stop" light from the "go" light, he probably will have difficulty at this point.

Another odd instrument looks like a homemade telescope. It tests the visual acuity—sharpness of vision—of the applicant with a low degree of illumination. Stepping up and down on a two-foot stool doesn't look like violent exercise, but it changes blood pressure and pulse rate sufficiently to give the flight surgeons a good indication of the condition of the heart. Blood pressure reclining, pulse rate reclining both are checked against the same readings taken while standing up and also after exercise. A numerical value is given each reading and all combine to give a final result. An 18 is perfect, the doctors say, but potential pilots need only a plus eight.

Research goes on constantly at the School of Aviation Medicine in order that the flight surgeons may determine more accurately the precise requirements for all types of fighting pilots. For instance, medical officers at Randolph Field subject themselves to practical tests to learn more about oxygen starvation as the result of high altitude flying. So they climb into a plane and don oxygen masks as the ship soars into rarefied air. Blood pressures and the ability to solve arithmetic problems quickly are tested. The results are recorded electrically—and they may come in handy if any pilot ever is forced to fight 25,000 or 30,000 feet above the earth. In another direction, the medical officers study electrically recorded brain waves in an effort to determine what it takes to make a military aviator.

But all in all, a "good little man" and a "good big man" are all equal when it comes to flying an airplane, so Uncle Sam's examiners simply look for the "normal" man, not the superman.

Write to the firms listed in the Where-to-Buy-It index, page 4-A, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

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2077

Wonders of Modern Metallurgy

(Continued from page 95)

be floated off at a time and thus each metal can be collected separately. Many common materials including fluorspar, manganese, tungsten, and sodium and potassium salts, as well as a number of nonmetallics, are now being extracted efficiently by selective flotation.

Hand in hand with improvements in extraction methods has come efficient mechanization all through the mining industry. Jumbo drilling rigs, power shovels, and mechanical muckers are taking the place of hand labor with the result that in one big mine, 2,500 men are producing much more copper than the 7,000 men employed 10 years ago. Another tendency is the change away from shaft and tunnel mining to open pit quarrying because modern machinery handles such great quantities at low cost that low grade material can be mixed with high grade and still produce a profit.

One of the most prodigious mining developments in history is taking place at Morenci, Ariz., where \$28,000,000 has been spent in developing a copper mine from which not a pound of metal has yet been mined. Now that 42,000,000 tons of rock have been removed from a mountain top, exposing the ore body, actual mining can begin. Two million tons of pure copper are buried in the mountain and although the existence of the metal has been known for years, until recently no one has done anything about it. The trouble was that the ore is so low-grade that no way of extracting it at a profit could be devised. Its recovery had to wait for the development of today's gigantic mining machinery. Power shovels that pick up a roomful of dirt at one bite and six-wheel trucks that carry 42-ton loads have solved part of the problem of extracting the copper treasure. There is only one pound of copper in every 200 pounds of ore and dirt that is moved, and the material is being mined at the rate of 25,000 tons a day. It will take 50 years to exhaust the enormous deposit. The ore is being mined by the open pit method and standard gauge Diesel-electric trains are used to transport it to the concentrator.

The west is being prospected once more, now that low-grade deposits that no one

(Continued to page 191)

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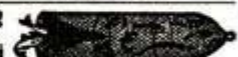
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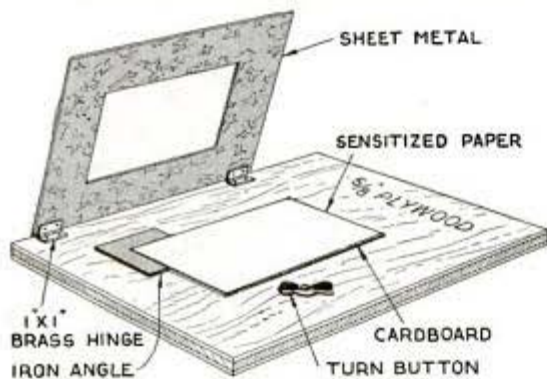
SAW 10 TO 20
CORDS A DAY

2697

could use in the past are being found to be valuable after all. Likewise, rare metals that were no more than curiosities in the past are being sought eagerly because science is finding uses for them. One such metal is beryllium, which imparts remarkable properties to other metals when alloyed with them. A small amount mixed with copper gives copper the strength of steel and produces heavy-duty bearings and nonsparking tools. Alloyed with chromium, nickel, and iron, it may be used for high-temperature springs, and resists corrosion like stainless steel. So far no worthwhile deposits of massive beryl, from which beryllium is obtained, have been found in the United States but there is a good chance that such deposits will be found, now that prospectors are learning what to look for.

Small Frame Replaces Big Easel In Making Album-Size Prints

Album-size enlargements from miniature negatives are easy to make on your regular enlarger if you replace the large easel with this small one. The base of the miniature easel is $\frac{5}{8}$ -in. plywood. To this is hinged a piece of sheet metal which holds



the paper flat while printing. To provide a $\frac{1}{4}$ -in. margin all around, make the opening in the sheet metal $\frac{1}{2}$ in. smaller each way than the size of enlarging paper to be used. A thin angle brace screwed to the base serves as a paper guide and a turnbutton holds the metal top down tightly on the paper while the exposure is made. The sheet-metal top is coated with flat black paint to eliminate reflections and a piece of white cardboard is placed under the enlarging paper to bring it almost even with the top of the angle which serves as a guide. The cardboard can be used also for focusing.

How to "antique" a piece of furniture



● A Carborundum Brand Garnet Abrasive Sleeve fitted to a drum rotated by a flexible shaft becomes sometimes more useful than a disc sander.

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2562

Guarding the Health of the Defense Army

(Continued from page 75)

this lung is expected to be a mighty boon. It consists of two iron shells, made to fit around the torso, and rendered airtight by large rubber bands around the openings. A hose attaches, and runs to an electric motor, which forces air in and out of the shell at regular intervals, producing artificial respiration. The motor is so light that it can readily be carried by the patient, and is adjustable so that breathing may be fast or slow as exertion requires. Electrically operated, it can obtain power from any light socket, wet or dry batteries, and in an emergency, even from flashlight cells.

Another boon to gas casualties is the oxygen tent. Some experiments were made with administering oxygen in high concentrations to gassed soldiers late in the last war, and results were astonishing, but lack of experience and equipment stood in the way. No such lacks exist now. Oxygen tents are plentiful, and so simple is their operation that it can be entrusted to nurses and internes.

Other important advances have been made in the X-ray. Barely in its infancy when the last war closed, it no longer is a cumbersome array of sputtering tubes, but a sleek, streamline machine that varies in size from the compactness of a suit case to the bulk of a grand piano. It can reveal every organ in the body simultaneously to the eye or to a photographic plate, or it can confine its inspection to the smallest tissue.

An extremely important X-ray development from a military standpoint is the stereoptical viewer for examining negatives. Like the stereoscope granddad used to have, it observes two images simultaneously, permitting three dimensional study of internal organs and the exact location of embedded bullets or shrapnel. Probing for a hidden bullet is no longer necessary.

The X-ray has also proved useful in treating many wound complications, especially gas bacillus, called gangrene, which once necessitated so many amputations. But in the Spanish Civil War, another and apparently better method of treating this infection was evolved. Dr. J. Trueta, faced with thousands of casualties, dug up an old medical journal with an article by an American, Dr. Hiram W. Orr, which outlined a technique that had never had sufficient trial to prove its worth.

It consisted of cleaning any flesh suspected of infection completely out of a wound, and perhaps a little more to be doubly sure. Then the wound was thoroughly cleansed with soapy water and antiseptic, after which it was packed with sterile gauze, soaked in vaseline. Then a cast was applied, and allowed to remain untouched, even for re-dressing, until the wound was healed.

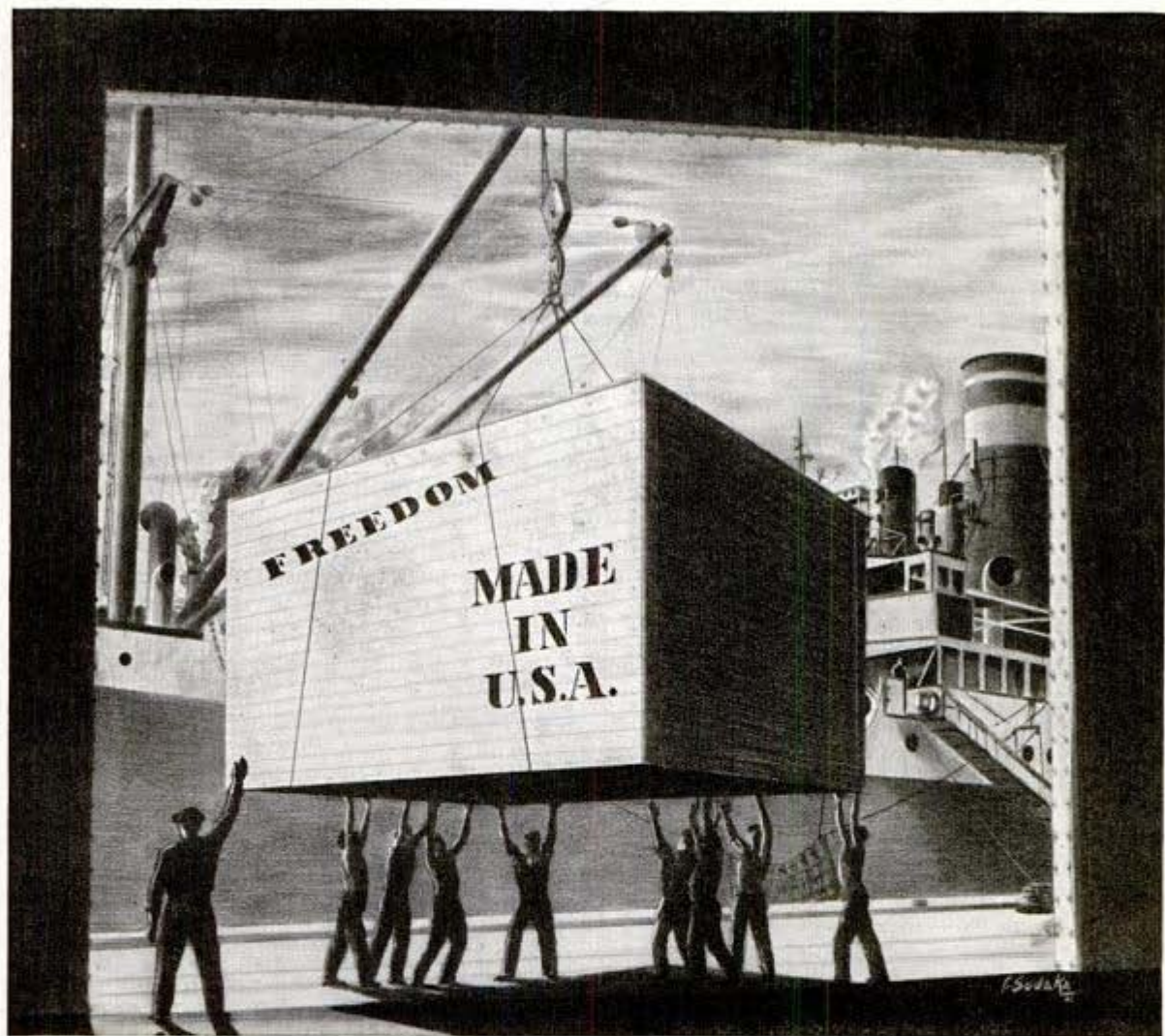
Dr. Trueta treated over 1,000 patients by this method which was practically the reverse of old procedure in every respect. He lost only six, all very advanced cases.

Gas bacillus is also responding to the miraculous "sulfa" compounds, so it seems that a still further advance has been made. Indeed, had these drugs—sulfanilimide, sulfapyridine, and sulfathiazol—been known during the World War, dead and crippled lists would have been but a fraction of what they were. Pneumonia alone claimed 83.6 percent of all the 23,000 who died of illness, and eminent doctors, using the sulfas to treat pneumonia, have gone on record with statements that they have the dread disease definitely beaten. Strep-tococcic infections, dreaded perhaps as much by soldiers as gas bacillus, is also in full retreat before the sulfas.

One of the most important things in treating the wounded is promptness; then gangrene, "strep," and other complications have no chance to start. The airplane is causing many wounds, but it is also rendering them less deadly by providing prompt hospitalization. Germans have been quick to adopt ambulance planes, using great transports with stretchers for eight. In the World War, a wounded soldier went first to the regimental first aid station, then to the first aid station, then to the casualty clearing station, before he could be transferred to a base hospital. Hours elapsed, sometimes days. Ambulance planes cut hours to minutes, days to hours.

Recent experiments in nutrition indicate that doctors may be about to banish an ancient army tradition—the lazy private, about whose broad shoulders the sergeant was forever threatening to wrap a gun barrel. Gun barrels could never cure laziness, but hypodermic needles often can, for it

(Continued to page 194)



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Fillman Perfected Chesapeake

2562

seems only a mild case of pellagra—that is, hunger. This seems strange, for American soldiers have always been well fed, but amount of food has little to do with pellagra. It is caused by the lack of certain vitamins and chemicals in the diet. Pellagra specialists, known to the medical profession as "famine fighters," have taken countless weak, tired, listless persons, and changed them almost overnight into bright, happy, sparkling individuals who wanted nothing more than to tackle a good job. Their techniques, barely in the beginning stage as yet, are being carried into the army. A more vigorous and tireless personnel will surely result.

The dental profession, too, has made important advances that will benefit soldiers. Examining physicians are not so insistent upon perfect teeth as they were in 1917. One reason is the improvement of amalgam fillings. Although easier, cheaper, and quicker to install than inlays of gold or porcelain, amalgam tended to shrink and permit additional decay. New materials are said to overcome this difficulty.

Another extremely useful dental innovation is the mass production of artificial teeth. An unknown process in 1917, many potentially good soldiers were rejected because they could not readily chew food without expensive artificial dentures. Now, after long and careful study, all teeth have been classified into several groups, and it has been found that a tooth of a certain classification in one person's mouth is strikingly similar in size and shape to all other teeth of the same classification.

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☐ You can obtain additional information about products described in this magazine by writing to the firms listed in the Where-to-Buy-It index, page 4-A. Say You Saw It in Popular Mechanics.

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home electroplater of Chicago says: "I bought my electroplater to experiment with during my spare time. In a few evenings I earned the cost of the machine by plating jewelry, silverware, headlight reflectors, etc., for friends and neighbors. Now I have all I can do. I recommend this machine to all who want a profitable business."

This man apparently finds business easily. So can you. Besides the articles he lists there are electrical appliances, surgical and dental instruments, restaurant silverware, boat hardware, musical instruments and many automotive parts.

J. J. Wilson, Slidell, La., writes: "After I received my electroplater I practiced for about an hour. I made up four samples and went out after business. One of the large chain restaurants now has me do all their silverware."

Max Hemmert, Idaho Falls, Idaho, states: "I am now spending all my time in plating work. I purchased a brush plater last summer and have worked up a very promising business."

Frank Welde, Philadelphia, goes after garage business. He writes: "I electroplated a few brass strips for samples. I then showed these strips to different people and that's how I got plenty of jobs. I have all the work from a big garage. The owner gets 10% of what is charged his customers, and the rest goes to me for my work."

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Riding the Gargantua of the Rails

(Continued from page 11)

see a big truck ambling across the track a quarter of a mile ahead. Well, it's a big truck when you see it on the highway, but somehow it seems puny in front of this 530-ton monster, which feels very safe and stable. No. 6100 rides like a Pullman, runs like Whirlaway.

Beyond Gary the train rumbles into the straightaway that makes the Chicago to Fort Wayne division the fastest stretch of rails in the land—so fast that the first Burlington Zephyr came here to try out its speed. Engineer Kilpatrick pulls the throttle back a couple of notches, adjusts the cutoff with the reversing gear to shorten the valve travel—rather like shifting your car into overdrive—and settles back on his cushions. In six minutes No. 6100 steps up from 40 miles an hour to 85. Kilpatrick hasn't a lot to do. He watches the gauges, adjusts the valve of the boiler feed pump as the water drops in the glass, keeps an alert eye on the block signals and Fireman Cartwright's raised hand, accompanied by a shout "Clear board," as each clear signal shows ahead. But most of the time Kilpatrick is pressing the brass key that lets loose the warning blast of the horn at highway crossings. Once or twice the fireman opens the butterfly doors of the firebox and you avert your eyes from the inferno, yet somehow he can peer in and see that the fire bed is even. So accurately are those stoker jets adjusted that not one shovelful need be hand-fired.

Midway to Fort Wayne Kilpatrick regards the throttle and slows the train down to a crawling 45 miles an hour. The fireman steps back to the tender, and at a signal from Kilpatrick jerks a lever lowering the water scoop into the 2,400-foot pan between the rails. In a moment it's up again, and the gauge shows 6,000 gallons picked up. No. 6100 has the appetite of a growing boy. She'll consume 24 tons of coal, evaporate 36,000 gallons of water on her daily 280-mile run to Crestline, O. It takes a pound of coal to turn six pounds of water into steam.

After the drink, No. 6100 steps out again. The needle is at 85 miles when Engineer Kilpatrick reaches up and moves the throttle one tiny notch, then another. Steadily

(Continued to page 199)

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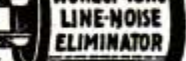
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the needle creeps around to 90, 95, then rests at 102 miles an hour. Yet here in the cab, 75 feet back of the pilot and unable to see the track unless you peer out from the engineer's or fireman's seat, you have no impression of terrific speed.

"She's a wonderful engine," says Kilpatrick, turning around to grin at you.

But that wasn't the way they talked at first. When No. 6100 first came out from the east, the crews were a bit shy about riding her. Charlie Wappes, shouting in your ear, says "It was like changing over to a Cadillac after you've driven and tinkered and taken apart and put together a Model T for years. But now they've found out how smoothly she rides and handles, and they like it."

The big engine is mechanically lubricated while running, and at terminals pressure guns shoot grease into her joints at 350 points. But men are creatures of habit, and you'll still see an engineer wandering around her with a three-foot oil can looking for some place to use it.

A curve is an event on this line. You see one ahead out of Valparaiso, but you take it without a lurch at 95. The last 19 miles into Fort Wayne you coast along around 100, the throttle only partly open. Two miles from the division point Kilpatrick eases the throttle and applies the air. Five, ten seconds elapse and then you feel the train begin to pull back, as the air is applied to the car brakes. All the way to the station the train is kept stretched out, braking against the pull of its engine; then, just before the full stop, train brakes are released and locomotive brakes alone applied, letting the cars close up the slack. Thus the starting load is lightened as the engine, taking up the slack, gets one car after another under way.

The home stretch is a two hour, 131-mile sprint to Crestline. And Crestline is home, for there a special stall has been built for the big engine which can get into no other engine-house. Nor is there any turntable west of Harrisburg long enough to take it. A special Y was built at Crestline to turn it around, and at Chicago No. 6100 has a new big pit of its own for greasing, and for cleaning the fire. The engine has been assigned for life to the Fort Wayne division, where she can negotiate the slight curves and long straightaways


(Continued to page 201)



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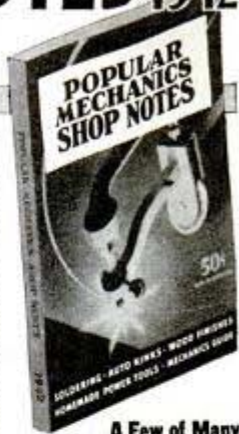


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No. 6100, like the rest of us, gets one day off each week. On that day at Crestline they give her a light going-over, and blow the mud left by treated water from her boiler. As for heavy servicing, she'll go twice as far as the "K4" engines that pull the other trains of the fleet; she is docketed for a general overhaul at 150,000 miles, but they don't believe it will be necessary before she rounds the 225,000-mile point.

The big engine has had a strange life. Since she settled down to business for the Pennsylvania she has traveled about 40,000 miles. But before that she probably rolled up 50,000 miles without getting anywhere. The prize exhibit of the American Railroads for two years at New York's world fair, her wheels spun continuously on the treadmill there while Pennsylvania engineers impatiently cooled their heels waiting to put their big investment to work.

It was at the fair that an onlooker turned to a Pennsylvania official and inquired: "What's it made of?"

The thing was so unbelievably big he thought it was a papier-mache mockup.

Pinch Hitters for Defense

(Continued from page 3)

stockings, intent on making attractive a silk substitute of which there have been burdensome oversupplies for years. Today's cotton hose are more durable than silk, far more gossamer and form-fitting than the cotton stockings of bygone years. And from the Soviet Union comes word of a new clothing fabric that is half wool and half fiber from the albumen found in the seeds of the lupine, the desert flower.

You still find aluminum kitchenware in the stores, but when it's gone there won't be any more, for a while. One sales organization for aluminumware saw the coming "drought" and is now selling sterling silver. But in place of aluminum pots and pans you find utensils of glass and iron and enamelware and other substitutes—and the fricassee cooked in them tastes all right.

You can buy a shower stall made of pressed wood or a plastic based on cotton-wood pulp, impervious to water. Your refrigerator, which has always had some plastic parts, will have a lot more in 1942.

(Continued to page 202)

UNCLE SAM

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Two leading manufacturers are saving 6,000,000 pounds of aluminum this year by using other metals or plastics in refrigerators, and another big appliance maker is conserving enough aluminum to build 130 twin-engine bombing planes, besides saving 150,000 pounds of nickel and 100,000 pounds of zinc. Incidentally, the conservation of zinc may affect face powder, in which zinc is commonly used as an adherent element.

Discussing the hunt for new materials, A. W. Robertson, chairman of the Westinghouse Electric & Manufacturing Co., said that "to our surprise, we have found that many of our substitutes proved to be better than the originals. While we have



A hot, dry, urea-impregnated stick of swamp oak is shaped by twisting in the hand while in plastic state

been looking for one thing, we often found an improved material or device that we weren't even trying to find."

Agitators for washing machines are being molded of plastics or shaped from Masonite hardwood, vacuum cleaners will have molded nozzles, and even the kitchen towels, shelves and aprons will feel the impact of a world at war. Metal cabinets give way to wood. Cotton and other domestic fabrics will replace the imported linen dish towels. Cotton and oilcloth aprons will appear on the hook where the rubber apron used to hang.

Around the new bungalow you'll find glass door knobs and hardware of transparent Lucite. In place of the stainless steel or aluminum molding that decorated the kitchen sink you'll see panels and trim of Tenite, a shatterproof plastic that comes in any color and is extruded from a die in long strips much as toothpaste is squeezed from a tube. The radio set and the camera are likely to have plastic cases, and prob-

(Continued to page 204)



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See write up on page 96 October 1941 Issue Popular Mechanics Magazine

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ably there will be fewer and fewer of those bright metal accessories in which the camera enthusiast glories. Uncle Sam comes first, and he not only wants the metals that went into photographic supplies but he's buying a vast amount of camera equipment himself.

However, this business of substituting plastics for steel and other defense-precious metals can't go on indefinitely. The plastics themselves are becoming precious. There is still an infant industry, and piling new demands for plastics as substitutes upon already heavy demands for plastics for their own intrinsic beauty and utility has created one more shortage. Annual production of plastics is about 160,000,000 pounds, while steel production is above 80,000,000 tons. Formaldehyde, one of the principal ingredients of plastics, is required in the making of munitions, phenolic compounds are also under priority orders and thus the supply of plastics for your home is limited. An end result is almost sure to be rapid expansion of facilities for the manufacture of plastics, and an age of plastics after the war.

The first of the 1942 automobiles still glittered with trim of chromium and stainless steel, but as the year 1942 opens the bright metal begins to vanish and plastic trimmings or fewer trimmings appear. Some cars which had aluminum pistons are going over to iron. A carbon-molybdenum steel alloy of which the ingredients are plentiful is replacing nickel steel. One automobile has a glass tail light, silvered inside so that you'll think it's all chromium unless you're told. The car builders assure you the 1942 models will run longer at lower operating and maintenance cost in the face of the fact that they are saving 81 percent of the nickel steel formerly required, 93 percent of the primary aluminum and 30 percent of secondary aluminum, 97 percent of the magnesium, 71 percent of the zinc, 29 percent of the chromium, and 74 percent of the tungsten. A ban on white sidewall tires, which after all were only appetizers for your pride and aesthetic taste, will save 6,000 tons of crude rubber a year, plus some zinc oxide.

When Henry Ford recently unveiled his plastic car, result of 12 years of research, he gave the world a glimpse of the automobile of tomorrow, its tough panels

(Continued to page 207)

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molded under hydraulic pressure of 1,500 pounds per square inch from a recipe that calls for 70 percent of cellulose fibers from wheat straw, hemp and sisal plus 30 percent resin binder. The only steel in the car is its tubular welded frame. The plastic car weighs a ton, 1,000 pounds lighter than a comparable steel car. Manufacturers are already talking of a low-priced plastic car to test the public's taste by 1943.

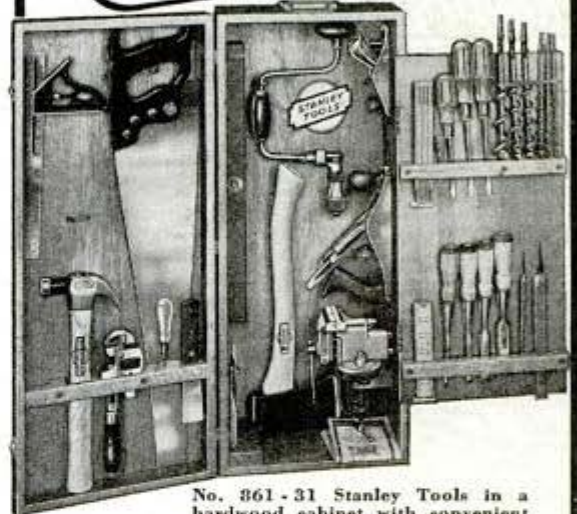
Plastic fuselages for aircraft have already had their flight tests, and the U. S. Forest Products Laboratory has developed a plastic (phenol) impregnated wood to replace aluminum in planes. The Canadian air force is understood to have ordered a number of training planes built of plastics. Construction of great new shipyards and hundreds of giant airplane hangars has been accomplished at high speed by the use of prefabricated timbers instead of steel, the timber joints being held together by special connectors. Unlike minerals, wood is a replaceable material and there is no shortage in sight. The experiments going on at the Forest Products Laboratory forecast increasing use of plasticized wood. Utilizing mill run lumber and waste sawdust, plastic wood products of great strength, waterproof, can be molded into structural panels or an infinite variety of shapes.

Everywhere the spirit of economy in vital materials is the order of the day. It will hit you but it will probably not hurt. Alabama has withdrawn its aluminum tax tokens and substituted zinc, but what care you? Sound recording disks are being made of plate glass instead of aluminum. The Western Electric company is saving enough aluminum in telephone instrument manufacturing to make 150 airplanes, enough zinc to make nearly 12,000,000 three-inch cartridge cases. Your candy bars and chewing gum soon will come wrapped in waxed paper or Cellophane instead of tin and aluminum foil, and if war strikes at shipping in the Pacific your food may come in glass jars and plasticized paper containers instead of the traditional tin can. One engineering firm is working on a vegetable oil from sunflower seeds to pinch-hit for imported olive oil. In Canada you can't get sliced bread, but it's no great hardship to cut it yourself. Spices and flavors and drugs that used to cross

(Continued to page 209)

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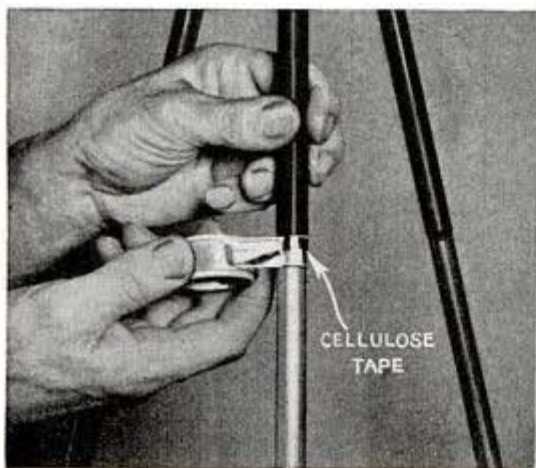
21072

the ocean to your table and your medicine cabinet are being replaced by home-grown products and synthetics. Department of Agriculture scientists are busy finding new uses for domestic crops: candy and starch products from sweet potatoes, a new reaper that may make pyrethrum daisies—used for insecticides—a profitable crop, polishing waxes from a green variety of cotton, plastics from Louisiana sugar cane.

Chemists and inventors, metallurgists and research scientists are having a "field day" hunting substitutes, often finding materials that were better than the originals. In many cases the pinch-hitter will make the regular lineup, and from the sidelines you'll watch a new world emerge.

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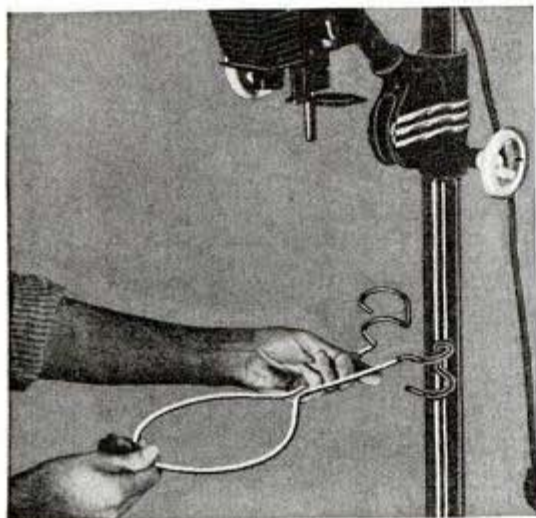
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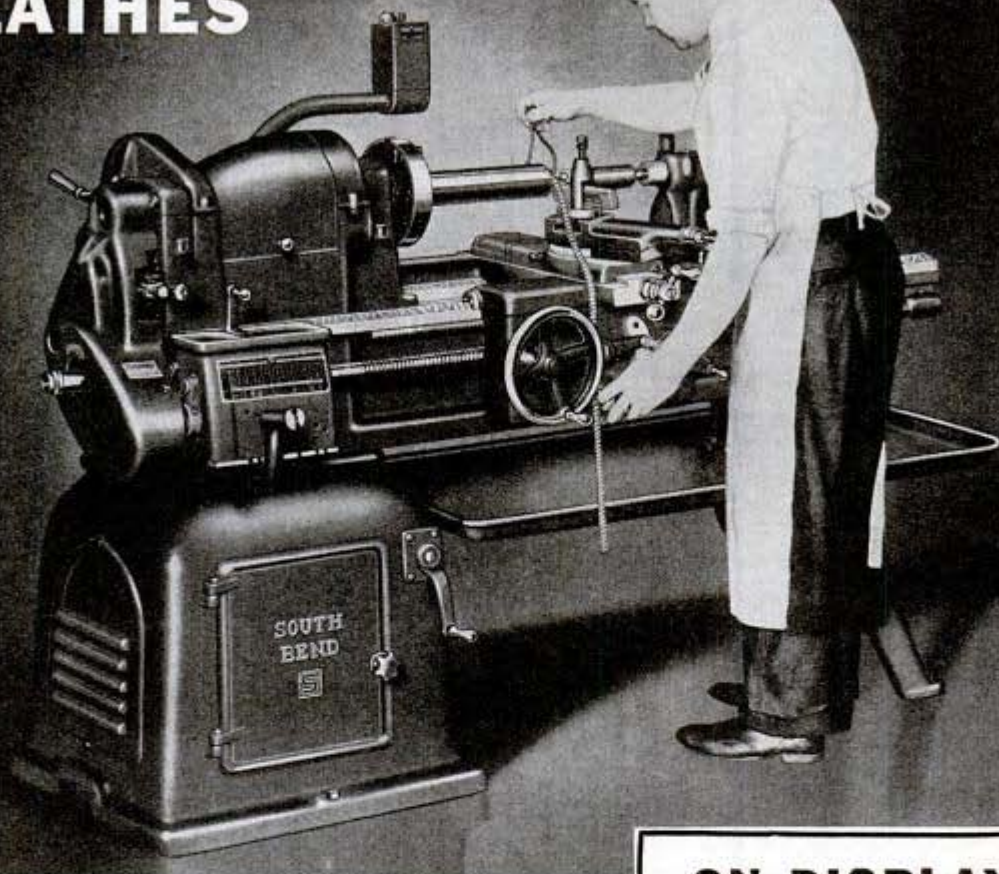
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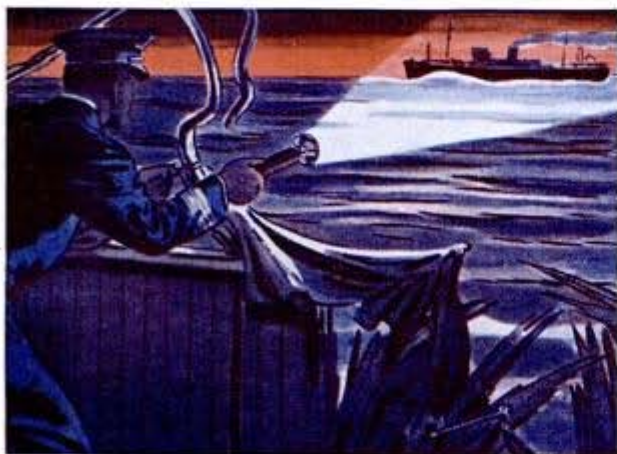


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