

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



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SEE PAGE 131

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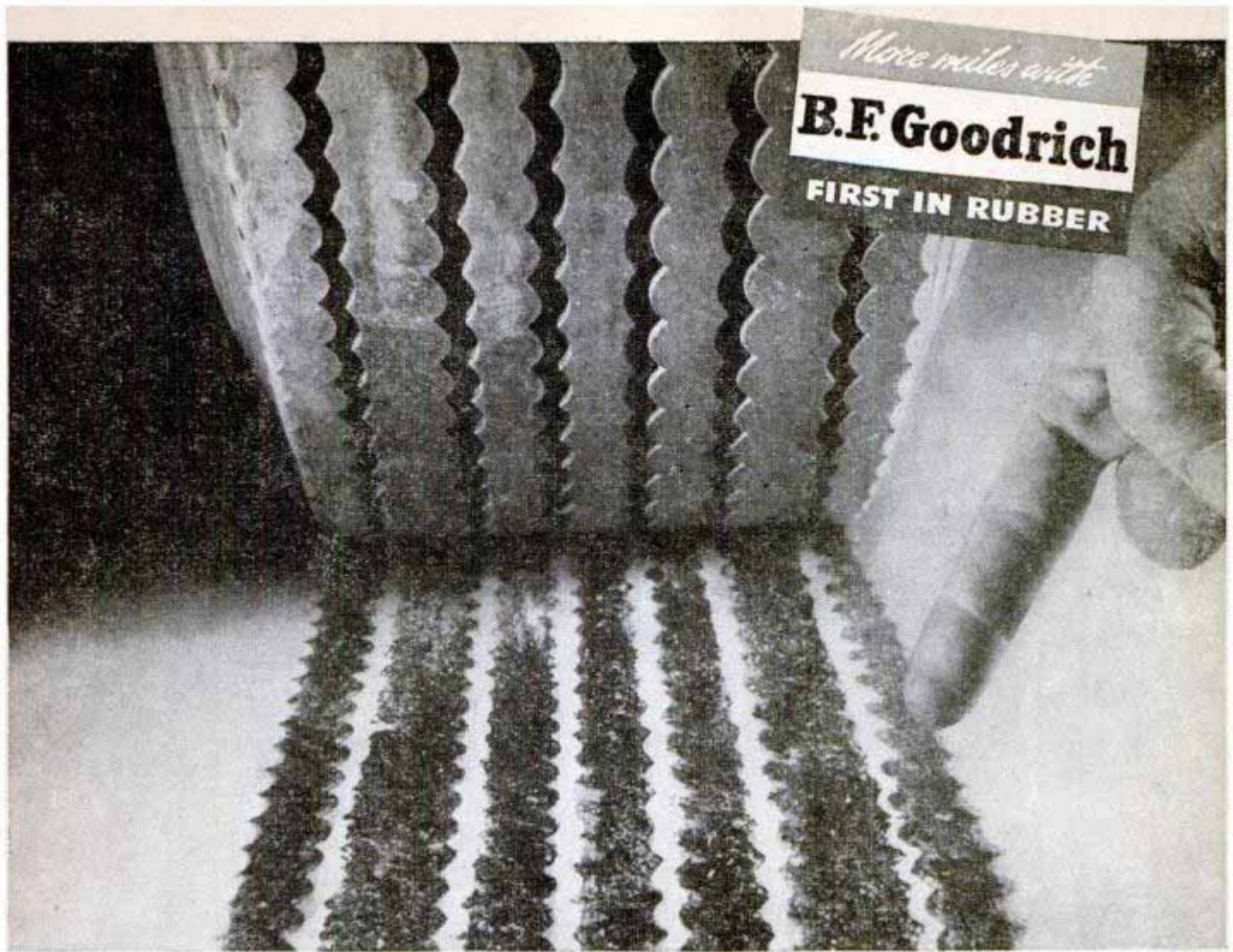
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LOOK twice at this picture. It's an introduction to our new French edition, MECANIQUE POPULAIRE, now being read in France, Switzerland and Belgium.

Director of this first foreign edition is Major Adrien Albarranc, a hero of French resistance and widely known in France as an engineer and scientist. He thrice escaped the Nazis and was decorated with the Legion of Honor and other medals. The major determined to publish a French edition of the magazine when he noted the enthusiasm of his American companions for our overseas edition. Paper is scarce in France, but the major was allotted a run of 50,000 copies to stimulate mechanical and scientific activities.



NEXT MONTH you'll look through "Window to the Unknown" at a miniature wonderland—germs as big as sofa pillows and a sheet of paper nine feet thick. The story tells of unknown worlds being disclosed by the electron microscope.

THINK your dog should be in the movies? Then read how "Lassie" and other animals are trained to steal scenes from the stars, how studios acquire everything from a singing owl to a deodorized skunk.

THE CRAFTSMAN section will feature a story that'll bring a tingle of taste to your mouth—how to build a smokehouse of any size for meat and fish. For camera fans there's an article on putting foregrounds to work in salon shots.

RADIO control for model aircraft, available to licensed amateurs, will be described in the Radio section.

Volume 86

AUGUST 1946

Number 2

Managing Editor.....Roderick M. Grant
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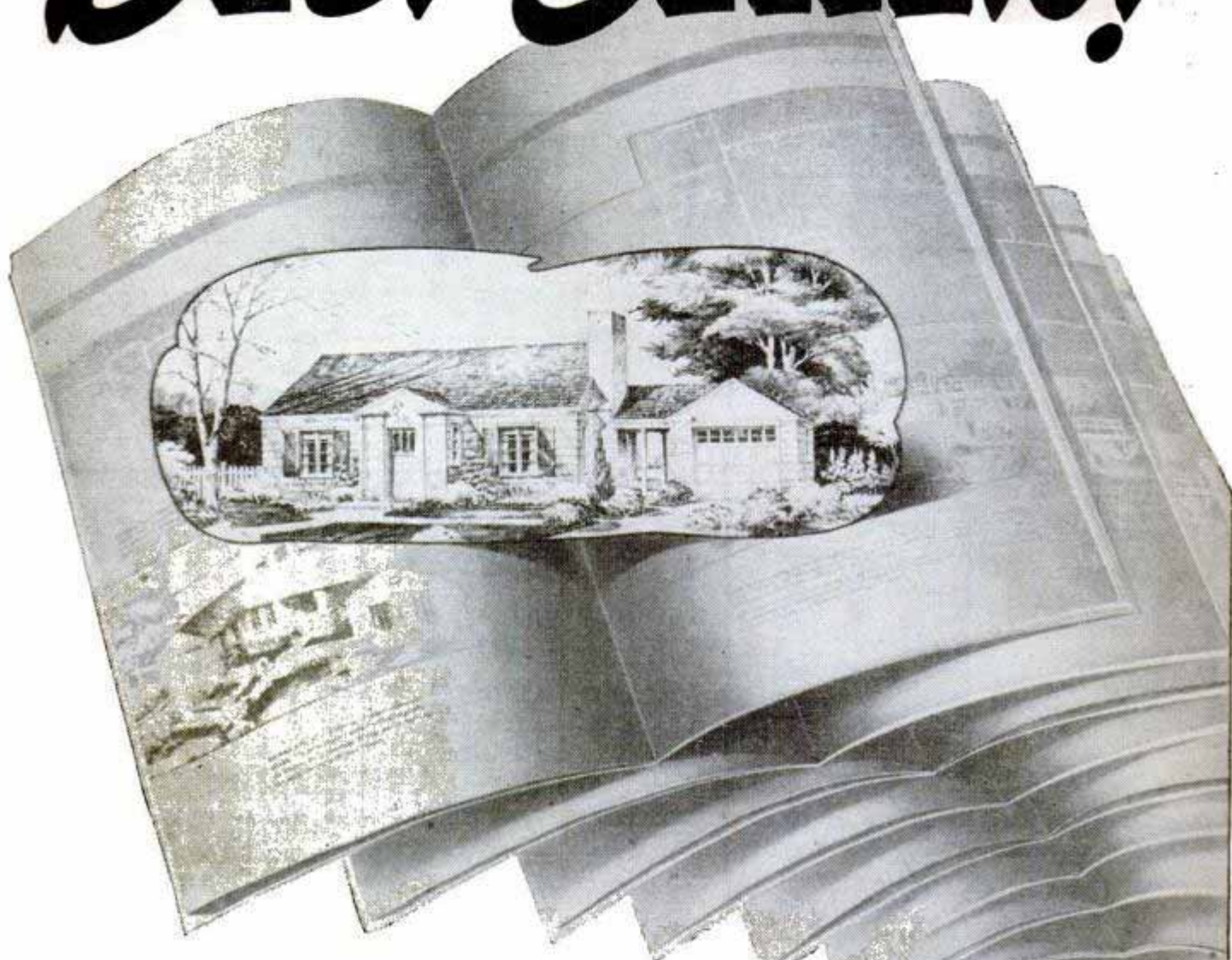
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It is time you realized that the rites; rituals and practices of the ancients were not superstitions, but subterfuges to conceal the marvelous workings of natural law from those who would have misused them. Telepathy, projection of thought, the materializing of ideas into helpful realities, are no longer thought by intelligent persons to be impossible practices, but instead, *demonstrable sciences*, by which a greater life of happiness may be had.

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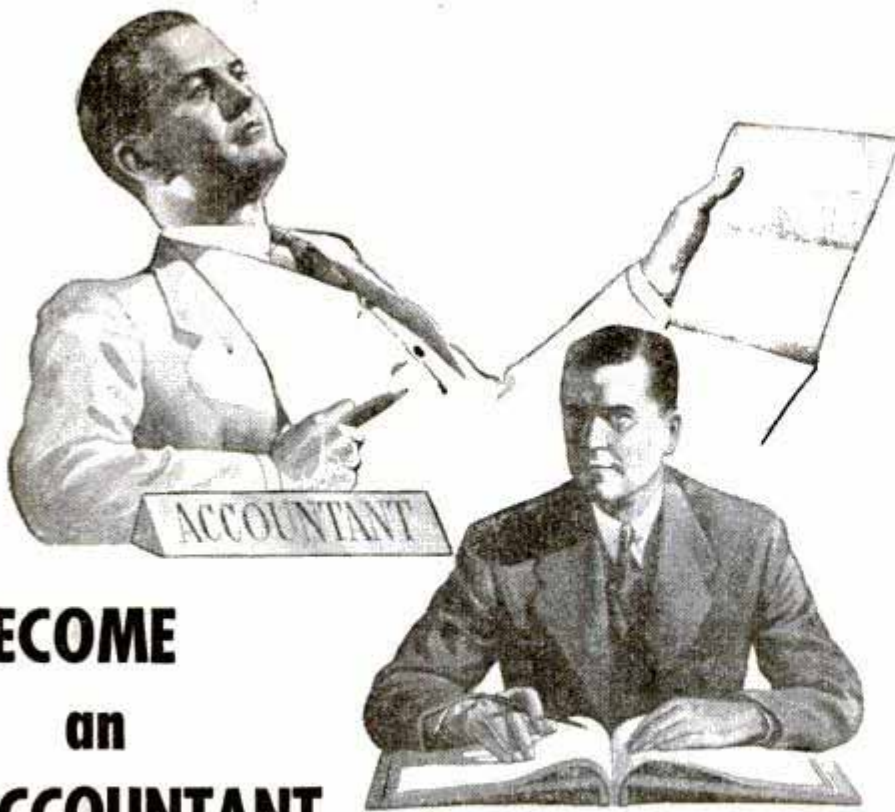
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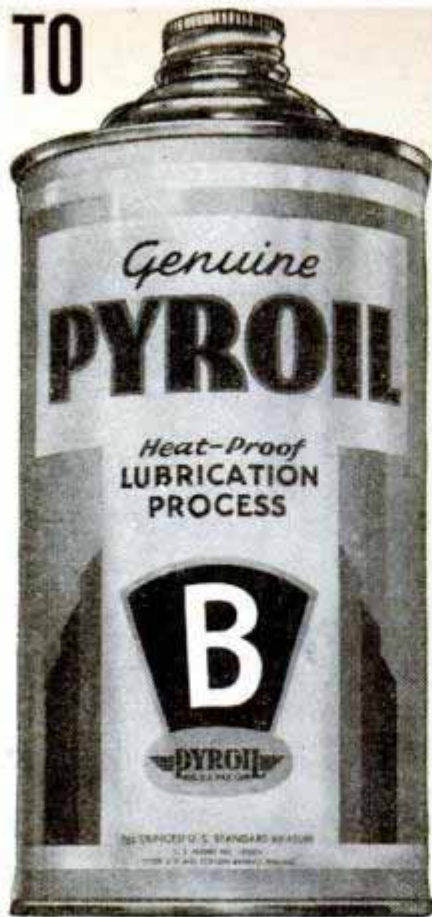
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RIGID CURVED TOOTH FILE with tang for accommodating conventional file handle.



SUPER-SHEAR FILE with wide-spaced short-angle teeth at right for fast cutting; narrow-spaced, long-angle teeth at left for smoothing.



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FOR EVERY PURPOSE

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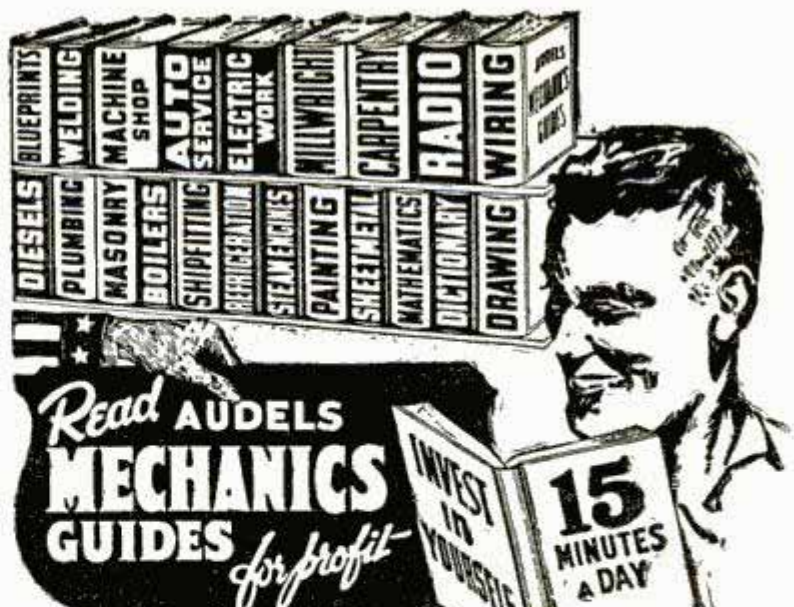
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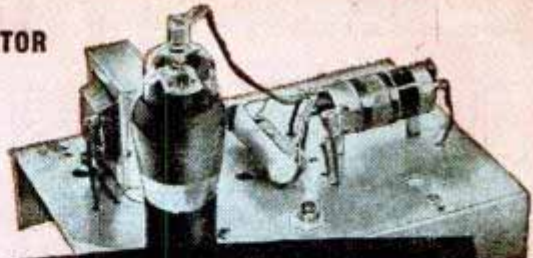
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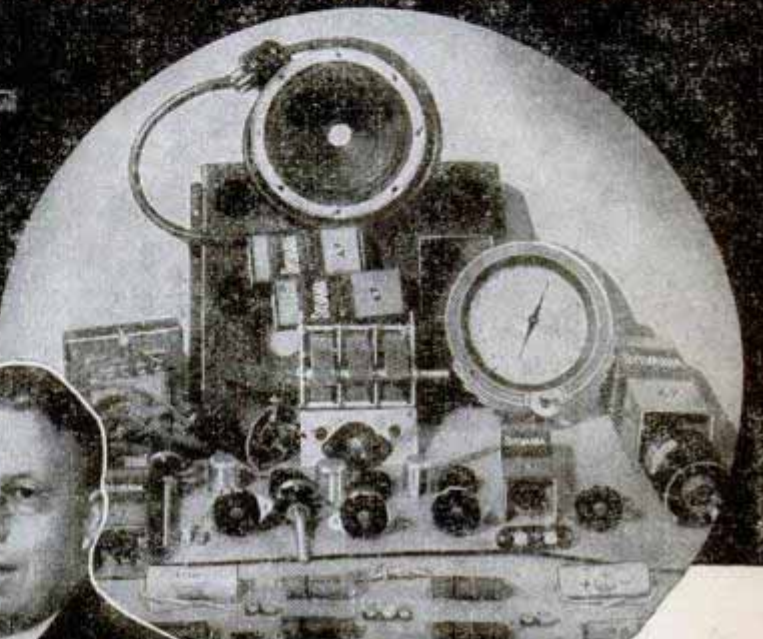
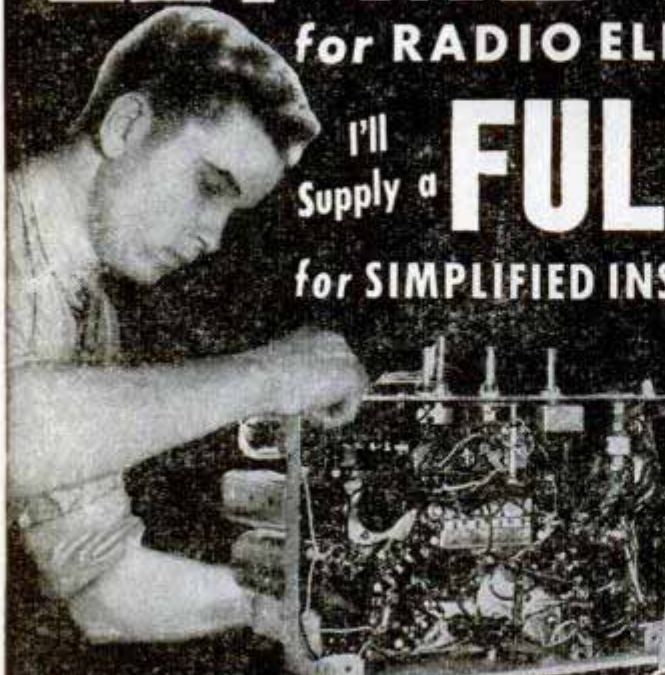
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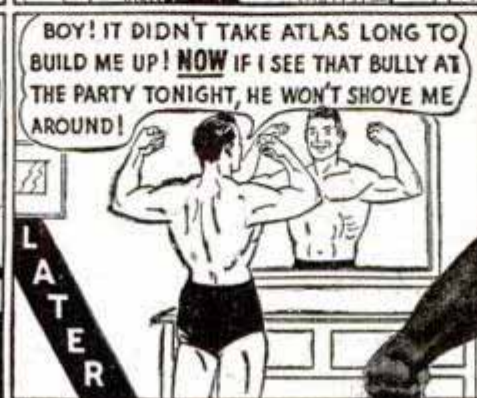
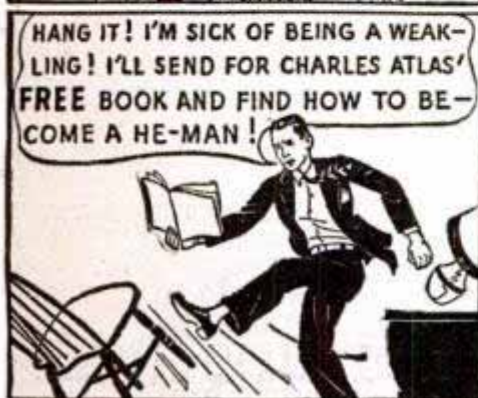
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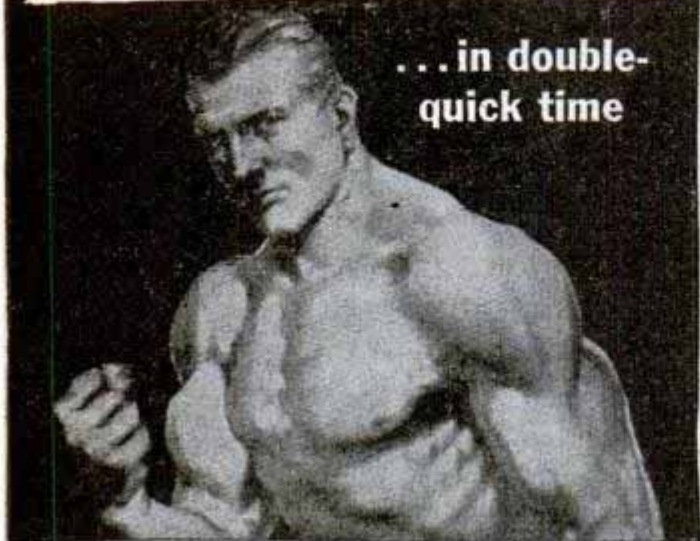
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SO IT NEEDS FIXING

By S. T. CHRISTENSEN
the "Fix-it Man"

WELL, I guess I'm the fellow to see, for I've repaired thousands of refrigerators (home and commercial both), vacuum cleaners, radios, washing machines, irons, fans, lamps, mangles, motors, etc. In fact, many of my customers call me their "electrical appliance doctor." And, "doctoring," I might add, has paid me a good substantial income for quite a few years. Funny, in a way, how I got started. Always liked to tinker and by experimenting around I found that most electrical appliances had many things in common. That, regardless of what the appliance was used for, or who the manufacturer was, the basic principles were much the same. From fixing my own appliances to fixing friends' and then for strangers at a fee, seems now to have been but a small step.

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For a while, repair parts (needed on some

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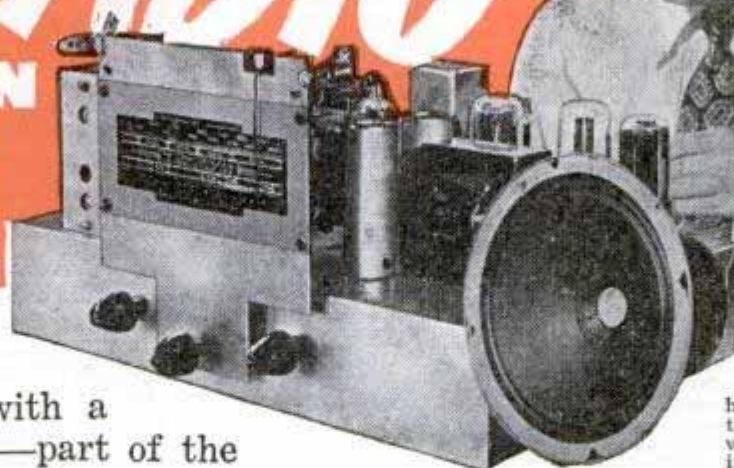
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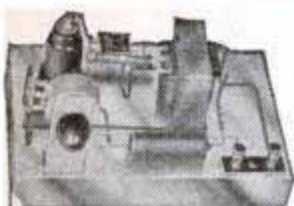
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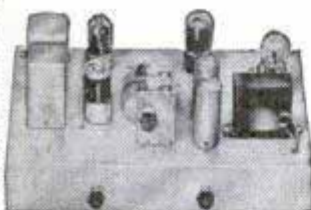
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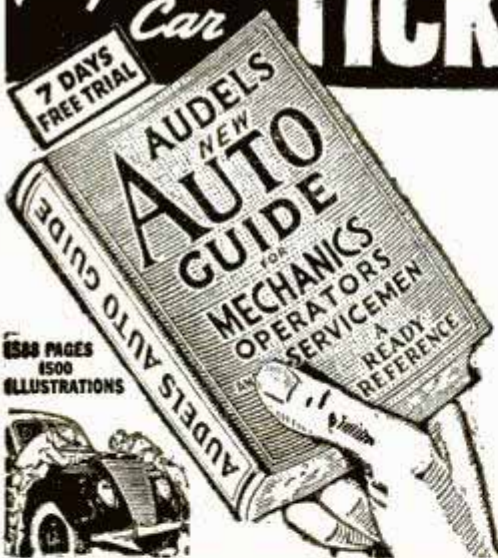
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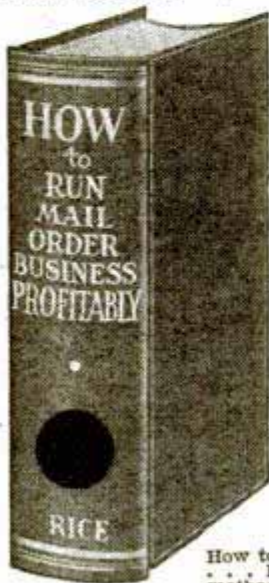
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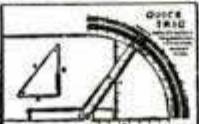
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INDIAN Relics, beadwork, coins, minerals. Catalog 5c. Sistersshop, Northbranch, Kansas.

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SELL Religious goods by mail. Big profits. Work spare, full time. Small capital. Everything furnished. Cleveland, 243-B5 White, Clyde, Ohio.

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START Home manufacturing business making Cleaning Compounds, Soaps, Insecticides (DDT), Cosmetics, Polishes. No machinery. Literature free. Kemix, Park Ridge, Ill.

OPERATE Profitable mail order business. Good opportunity. Details free. E. L. Dawson, Box 44, Summerdale, Penna.

UNPAINTED Wall plaques 2 1/2c up. Illustrated list free. Oman, 642-A Broadway, St. Paul 1, Minn.

MAKE Money making movies. Experience unnecessary. Book of plans, \$2.00. Information, stamp. World in Color Productions, Box 392X, Elmira, N. Y.

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SUB-MANUFACTURERS, Dealers, many territories still open. Build and service wooden composting cabinets for our customers to convert garbage, organic wastes, into valuable fertilizer. Permanent post-war business. Western Compo, 3614 S. E. Ninth, Portland 2, Oregon.

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MONEY For you. Start home business. Free leaflet describes 137 plans. Specialty, Box 43, Station N, New York 23.

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EARN Money with textile painting course. Details free. George Gundrum, LeRoy, Michigan.

SUCCESSFUL Moneymaking mail order opportunities. Free literature. Geele, 3754 North Port Washington, Milwaukee 12, Wisconsin.

FREE Literature. Tested money making business ideals. Kelly, 9544-AE Whitcomb, Detroit 27, Michigan.

SOMETHING New! Super X red liquid molding rubber. Hot or cold castings. Sample jar 25c. Quart \$3.00. Gallon \$10.00. W. Wooley, 115-A Donald, Peoria, Ill.

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FORTIFY Future, home mail order, \$5 required. Harry Punch, 1329 Grace, Cincinnati 8, Ohio.

1000 FRESH Names. Opportunity seekers. 10c. Amazing plan free. United, 305-West 8th, Los Angeles, Calif.

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RUBBER Molds \$1.00 up. Illustrated list free. Oman, 642 1/2 A Broadway, St. Paul 1, Minn.

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BIG Moneymaking opportunities. Free. Universal Sales, Box 1076, Peoria, Ill.

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FLEXIBLE Mold \$1.00 postpaid. Make gifts, novelties. Scotty dog mold, full manufacturing information, illustrated mold and material catalogue. Money back guarantee. Rubbercoat, 3873A California, San Diego, California.

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BULLDOZER. Power shovel, earthmover. Prints and specifications of above original toy designs in wood \$1.00. Others available. Earthmover Toys, East Lansing, Mich.

ARTISTS' Brushes, paints, instruction books available. Pioneer, 394AH8, Austin, Minnesota.

SHELLCRAFT Kits for beginners—shells and complete supplies for making pins, earrings, combs and novelties. Instructions free. Kits \$2.00 and \$5.00. Herbert Diamond & Co., 1121 North East First Avenue, Miami 36, Florida.

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CERAMIC Jewelry supplies, bar pins, ear screws, for ceramic and woodworkers; also glass and seashell assemblers. Free catalog. Philadelphia Badge Co., 1007 Filbert St., Philadelphia, Penna.

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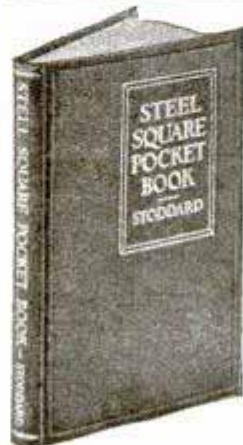


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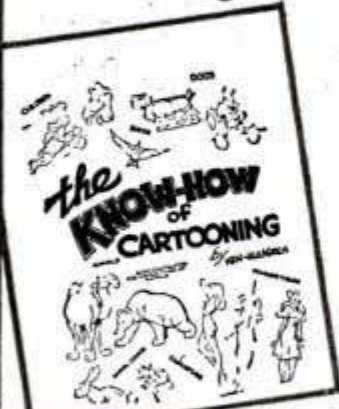
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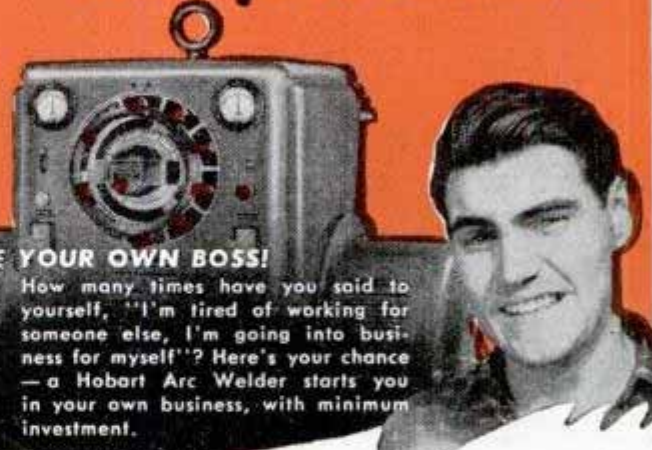
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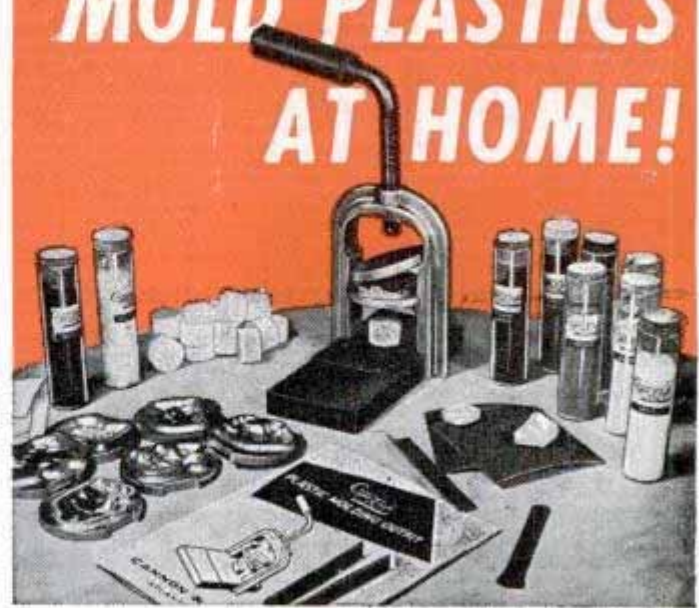
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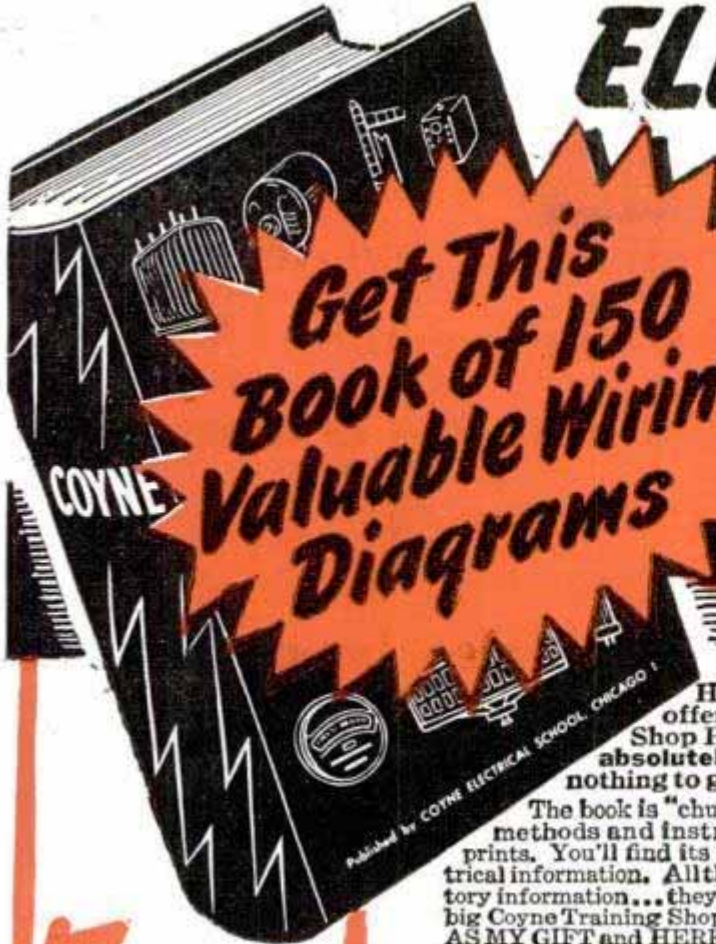
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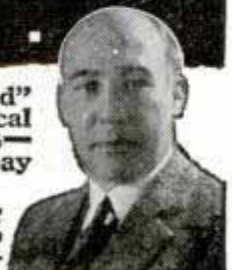
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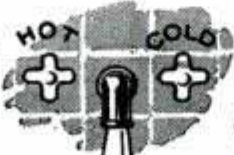

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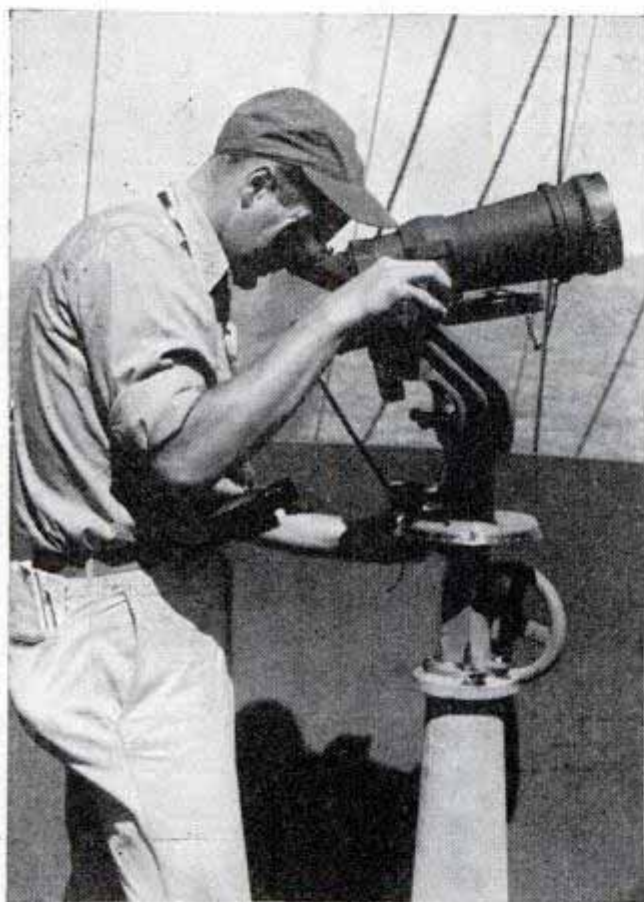
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For an eyewitness account of what happened at Bikini, *Popular Mechanics* sent its Aviation Editor, Aubrey Cookman, to the atoll aboard the USS *Appalachian*. During the war Mr. Cookman was a lieutenant colonel, U. S. Army Air Forces. Further accounts of the atomic bomb tests, how they were documented by the scientists, and their significance, will appear in future issues.

Here we present our first

Report From BIKINI

By Aubrey O. Cookman, Jr.



Official Photograph, Joint Army-Navy Task Force One
Here Mr. Cookman, acting as a special observer for Joint Task Force One, watches the atomic bomb burst over target on phosphor screen of Navy's Icaroscope

POPULAR AUGUST
1946
MECHANICS

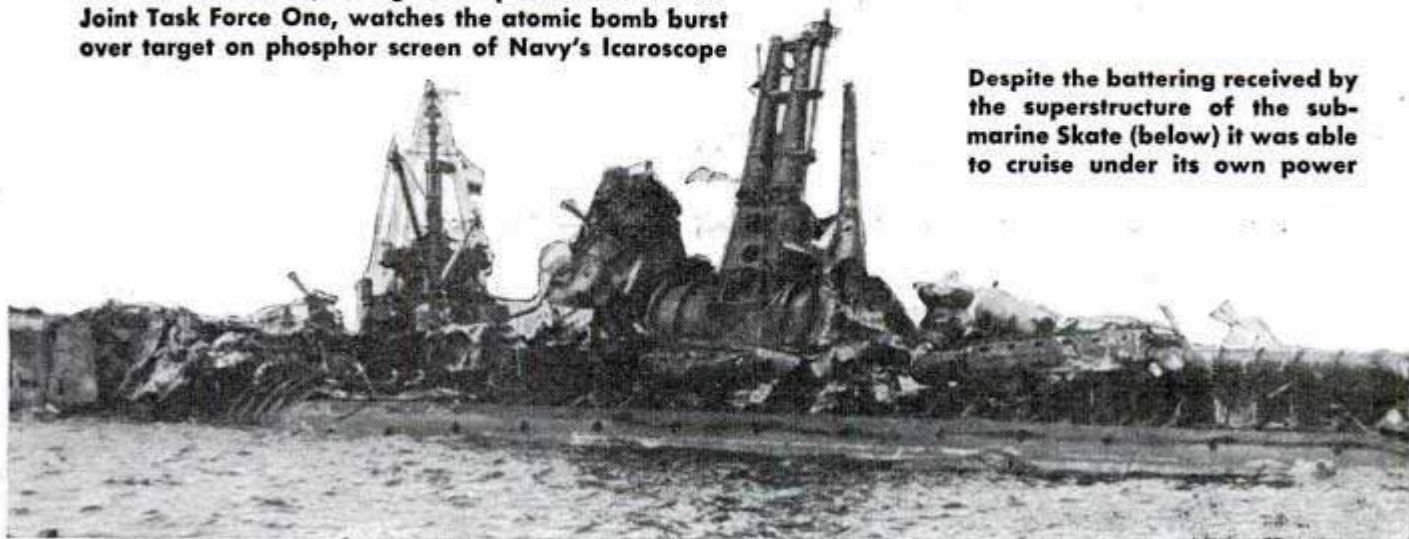
WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 86 NO. 2

BIKINI, Marshall Islands (By Navy Radio)—It has been a month since a single atomic bomb sank five ships and crippled a half dozen more, but the most important results from the initial Bikini test are only now beginning to fit together into a complete picture.

Precise score cards in the form of 10,000 measuring instruments, aided by the volunteer activities of scientific stations all over the world, are still rolling in for interpretations. Questions posed by scientists, militarists and John Q. Public since the first atomic explosion in the New Mexico desert more than a year ago are finally nearing experience-proven answers. The bomb, without losing prestige as the world's most powerful agent of mass destruction, is being eased out of the myth class and into the realm of human comprehension.

Considerably more is expected to be learned from the shallow water experiment and the deep underwater blast planned for later this year and next. The latter may also be held at Bikini, off the lee side of the island where the atoll shelf slopes sharply into the ocean. Both are potentially more significant than the first Bikini drop, particularly from the standpoint of influence on naval architecture. They also are expected to do greater damage to target ships.

As one of the first to enter the target area after the overwater explosion, I can testify to the terrific pressure of an air blast that



Despite the battering received by the superstructure of the submarine *Skate* (below) it was able to cruise under its own power

wrecked steel superstructures 1000 yards from the detonation point.

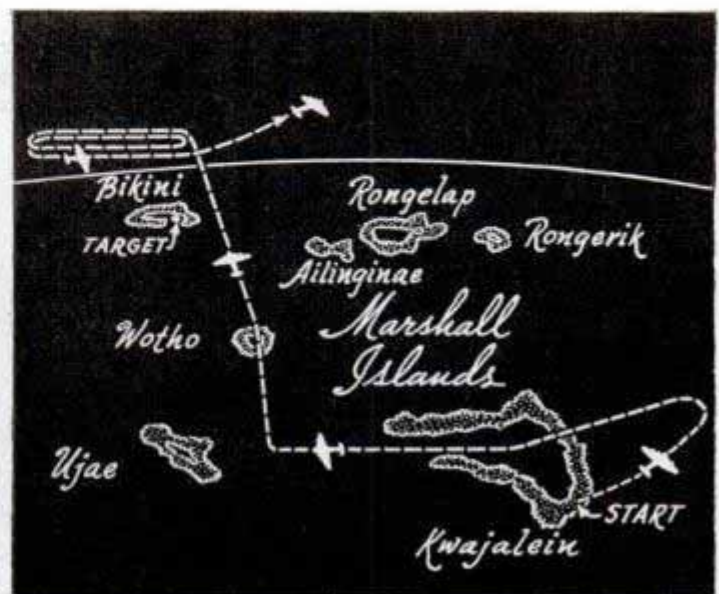
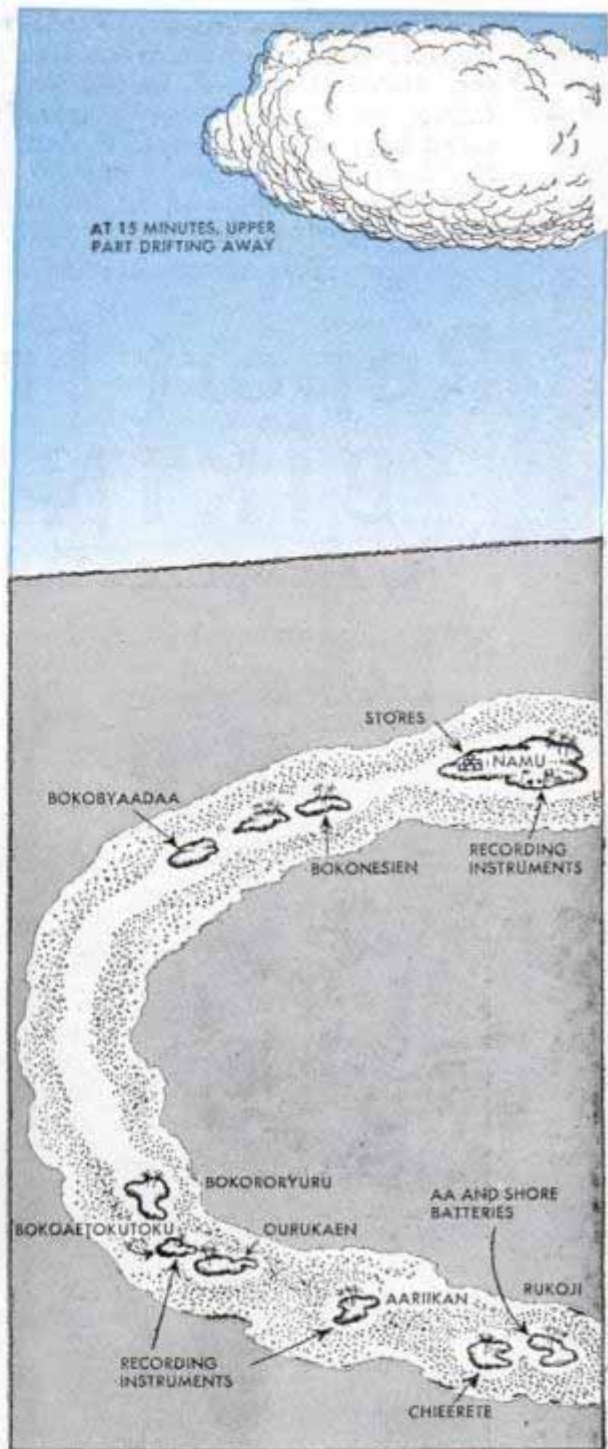
Two attack transports, a cruiser and two destroyers had already plunged to the bottom and at least six others were in no condition to fight. Of one, the badly battered and smoking USS Independence, Task Force Commander Admiral Blandy tersely commented: "She is no longer a carrier."

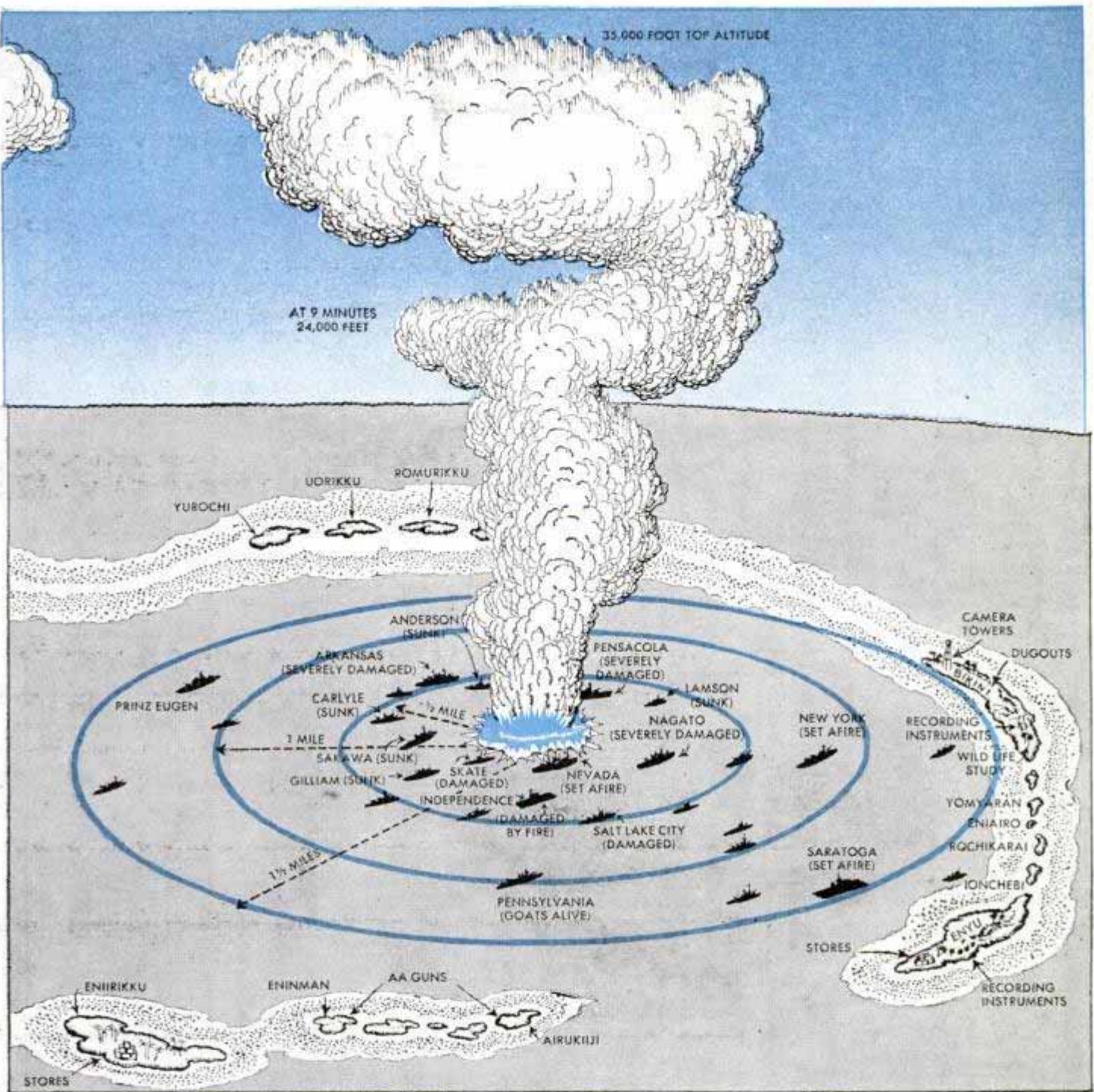
Tonnage totaling almost the equivalent of three of our largest new battlewagons had been laid low by a single bomb. Even vessels at the target's rim, 3000 yards away, in some freakish instances experienced minor damage. Estimates of the casualty toll from blast and radiation, had the ships been manned, ran upwards from 50 percent.

The bursts over Japan killed and injured over 300,000. How much the presence of crews to control the damage would have helped the stricken vessels is still a debatable point. Although the same type as the one used at Nagasaki, the bomb dropped at Bikini was described as proving less explosive than the blast at Nagasaki but more powerful than those at Hiroshima and New Mexico. It has thus far been impossible to make two atomic bombs of exactly the same strength.

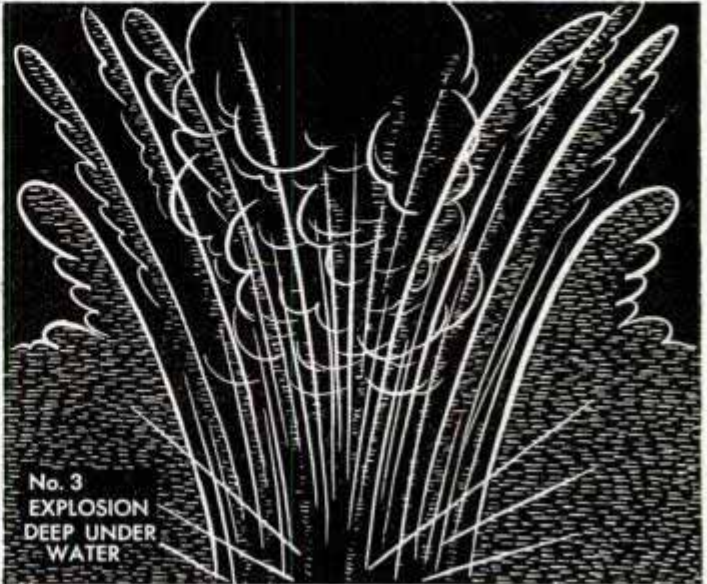
I had the good fortune to be able to witness the bomb drop through the Navy's Icaroscope, one of the most important and newest instruments used by the scientific observers at Bikini. It was developed late in the war to spot enemy planes attacking from the direction of the sun.

To eliminate glare, the direct image of the bomb burst was formed on a phosphor screen while the screen was hidden from the eye. This is accomplished by a double rotating shutter which permits outside light to reach the screen while the eye is shut off from the view, then permits the eye to view the screen from behind while the outside light is shut off. This operation takes about one hundredth second, so that the scene is viewed as though in a high-speed motion picture camera. A 110-volt 60-cycle motor drives the shaft on which the disks rotate. The image always appears a yellow-green. I watched the drop through the Icaroscope as a special observer for Joint Army-Navy Task Force One.

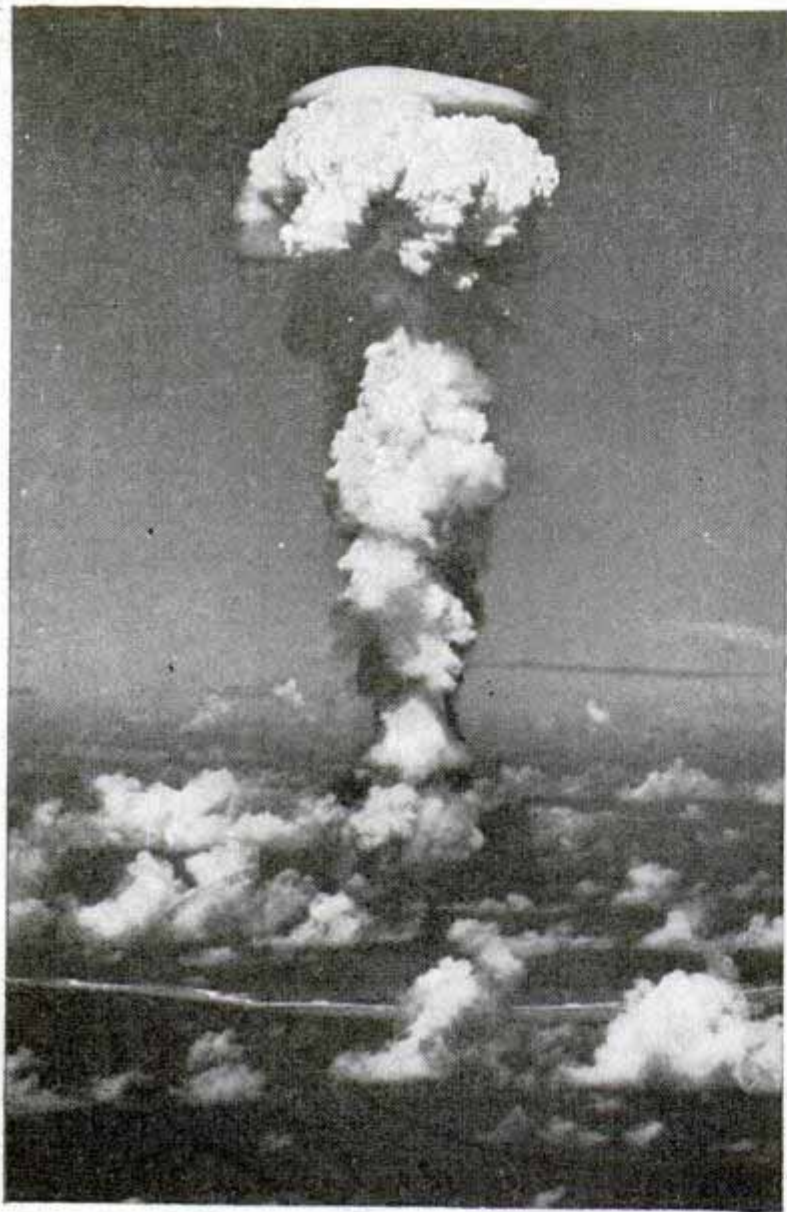




No. 2 EXPLOSION ON SURFACE



No. 3 EXPLOSION DEEP UNDER WATER



Over cumulus clouds and Bikini shore, atomic cloud mushrooms



The battered bow of the carrier Independence shows the crushing effect of the blast

While no official figure was given it is believed the bomb exploded about 500 feet above the water. The avowed purpose of the Bikini experiments is to test the effect of one atomic bomb against naval vessels in order to gain information on possible required changes in ship design, tactical formations at sea and anchoring distances in port, the number and location of operating bases and repair yards, and strategic disposition of ships. Secondary aims are to test the bomb against air and ground forces materiel, learn more about its effects on humans, compare the relative value of vessels and other types of bomb targets, and find out more about the phenomena accompanying atomic explosions.

While the bulk of the technical findings particularly linked with the elaborate instrumentation program, that in itself is costing between two and four million dollars, cannot yet be revealed for security reasons, some of the results were apparent. Before the smoke cleared from fires on the target ships, pressure gauges and heat-seared scars on the targets indicated the blast had a terrific straight-on effect but did considerably less damage just around the corner. In many places the hot blast left the imprints of chains and railings on surfaces several feet behind, and in one instance the sharp outline of a light bulb appeared on the background.

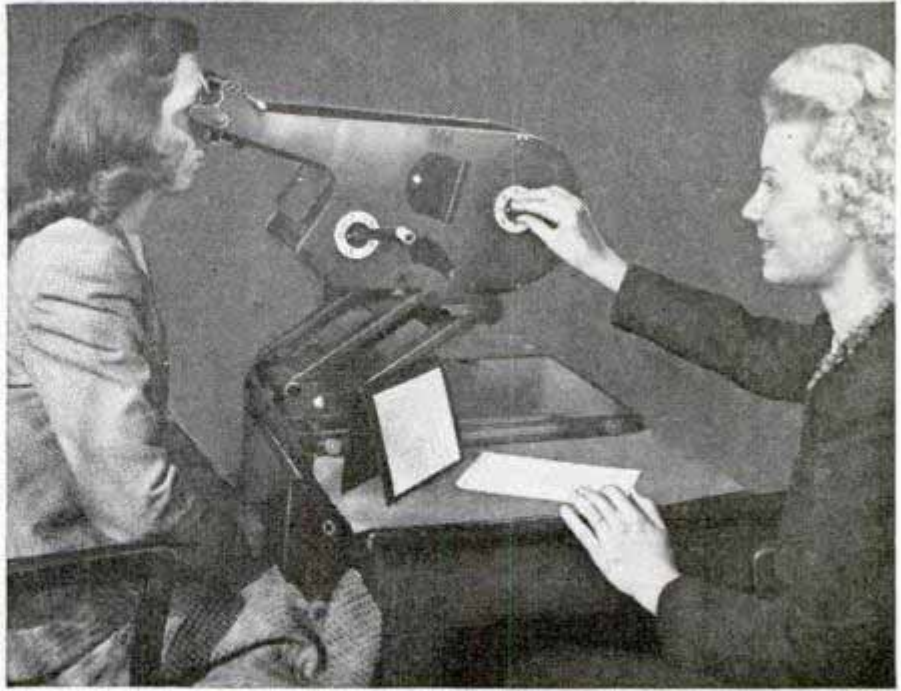
Two means used to test a human's ability to stand the blast pressure registered encouraging performances. Both the pigs, with a chest cavity similar to that of man, and empty five-gallon tin cans capable of withstanding the same proportionate pressure as the human chest, came through better than expected. Altogether, 150 goats, the same number of pigs and 3101 rats were left above and below decks on 22 of the targets, in place of humans, for medical experimentation which is not yet completed. About 10 percent were killed outright by the blast, and some predict eventual mortality from the after effects may be up to 75 percent. Even the initial effects, however, pointed to the need for improved protection of personnel, especially on transports.

(Continued to page 252)

Machine Tests Workers' Eyes to Help Find the Right Job

Visual performance of a worker's eyes is tested by a machine developed by the Bausch & Lomb Optical Company in co-operation with Purdue University's Division of Education and Applied Psychology. As a result of the tests, workers can be classified and placed in jobs for which they are visually fitted. Although two men both may have "good" eyesight, one may have visual ability well suited to the work of a watchmaker, the other a crane operator. A dye mixer requires still another type of vision, skill in color discrimination.

The new machine is intended solely for the measurement of such visual performance and is not used for refraction or diagnosis.



Heat Detector Finds Ship at Sea Or Man 1/4 Mile Away

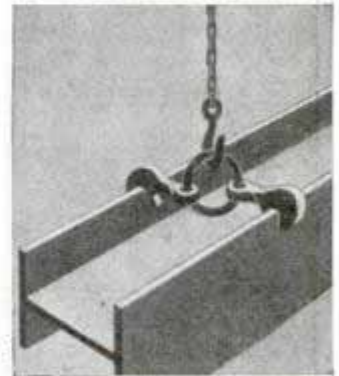


Super-sensitive heat detectors whose main part is no larger than a pin head "feel" the warmth from a man's body a quarter of a mile away or pick up the heat radiated by a ship far out at sea at night. Developed at the end of the war as a new secret weapon, the device is built around tiny elements called thermistors (thermal resist-

ors) which have such sensitivity to heat that they detect temperature variations as small as one millionth degree Centigrade. The Bell Telephone Laboratories originally developed the unit for use in telephone networks to control fluctuating speech levels. Metallic oxides and other chemical compounds are used for the "heart" of the detector and sealed in a glass bead. They vary their resistance to electricity in accordance with the heat radiation picked up from various objects. So fine is the perception that from high altitudes the instruments can indicate the pattern of rivers by the difference in heat radiation between land and water.

Nonslip "Torque-Action" Hook Grips Beams as It Lifts

As the load becomes greater the grip of a "torque-action" hook becomes tighter when lifting beams, girders and channel irons. The hook is anchored to a hoisting ring and slipped over the object to be raised. When the lifting power is applied the torque action causes the hook to bite against the surface with increasing force so the object cannot slip from the hook's grasp.



Names and addresses of manufacturers of new products featured in this issue will be supplied promptly by the Bureau of Information, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11, Illinois

SPEED PLANES



They go by so fast all you hear is a "whoosh" of the jet engines. Above, two views of the AAF's P-80, one with wing tanks on jet-assisted takeoff, the other without tanks. Below, Navy Phantom

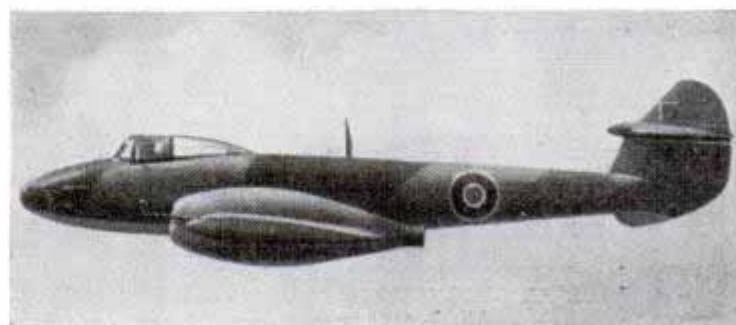


NEW world speed records, far faster than the British-held mark of 606 miles an hour, are likely over the Labor-Day weekend during the National Air Races at Cleveland. Racing pilots will be chasing gold

as well as glory. The richest pot of prize money in race history, nearly \$110,000, will be split among the winners. Stripped of heavy armament, souped-up versions of the fastest combat planes of the war will fly in competition, as will the newest and fastest jets of the services. Start of the speed trials comes in Los Angeles August 30 when pilots take off on the 2200-mile Bendix Trophy dash to Cleveland.

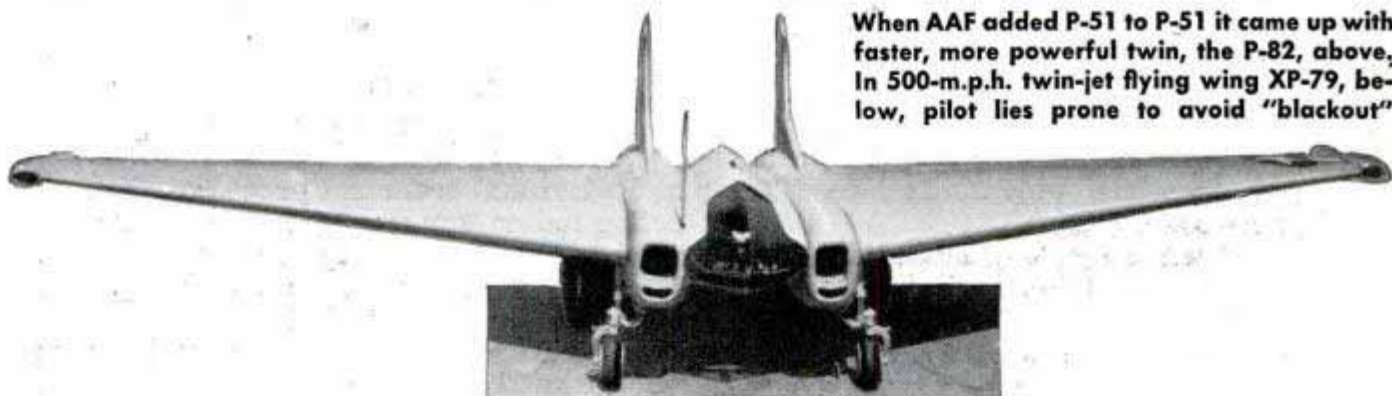


The British Gloster Meteor, below, holds the present world's record of 606 m.p.h. Left, the De Havilland Swallow is the first British jet-powered flying wing





When AAF added P-51 to P-51 it came up with faster, more powerful twin, the P-82, above, In 500-m.p.h. twin-jet flying wing XP-79, below, pilot lies prone to avoid "blackout"

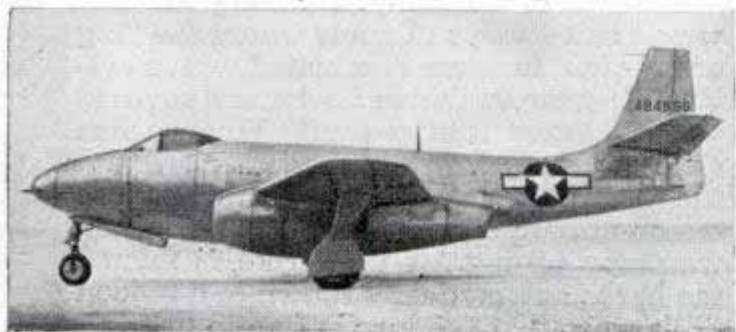


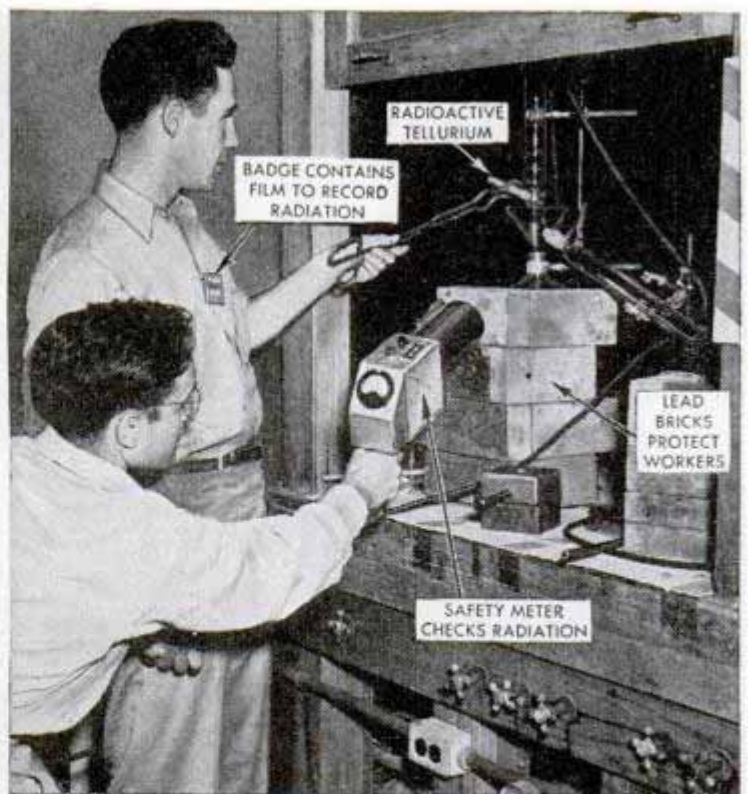
↓ New Thunderjet has speed of more than 590 m.p.h., service range of 1000 miles, ceiling above 40,000 feet

↓ Stripped of armament, with souped-up engines, P-38s will be among top contenders in National Air Races



↓ Recent addition to AAF line-up is twin-jet Bell P-83





Great advances in unlocking mysteries of human diseases and in treatment of certain ailments are expected to result from the War Department's decision to supply radioactive isotopes to accredited hospitals, universities, research laboratories and clinics.

As announced by the Manhattan Engineer District, the isotopes will be produced from the uranium chain-reacting "atom pile" of the Clinton Laboratories at Oak Ridge, Tenn., which conducted basic research in the development of plutonium atom bomb material. Distribution of radioactive isotopes constitutes the first peacetime benefits to result from the atom bomb program. Radioisotopes are radioactive

Atom Smashers Launch War On Disease

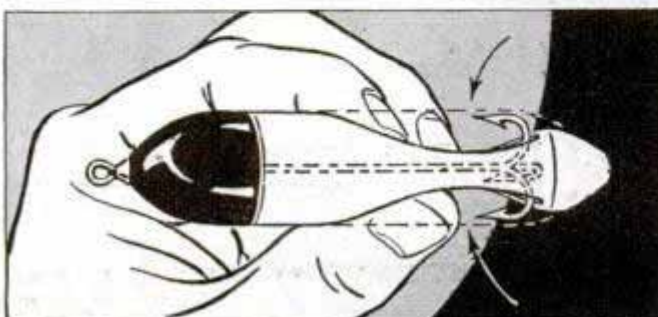
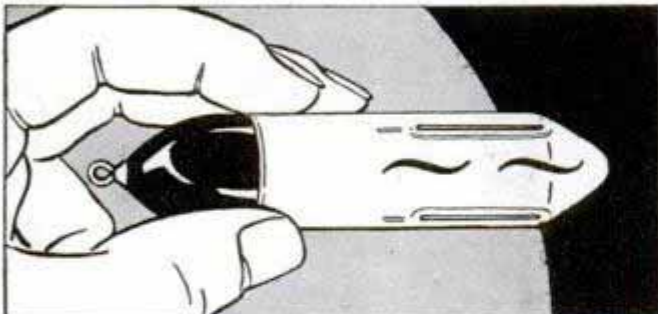
forms of common elements with the same chemical properties of the

element but with a different atomic weight.

They will be used in two important ways. The first is as "tracer" atoms in chemical, biological and technical processes. Radioactive iodine, for example, can be used to measure the functioning of a thyroid gland. The second use will be as therapeutic agents for treatment of diseases.

Approximately 100 radioactive isotopes will be available. They include Carbon 14, Sulphur 35, Phosphorus 32 and Iodine 131. Since carbon is one of the principal elements found in organic material, the isotope Carbon 14 is expected to give great impetus to the study of all organic processes including the mechanism and growth of normal and abnormal tissues.

Phosphorus also is expected to reveal many biological secrets through experimental use of its isotope. Sulphur 35 may be used in tracing reactions to sulfa drugs.

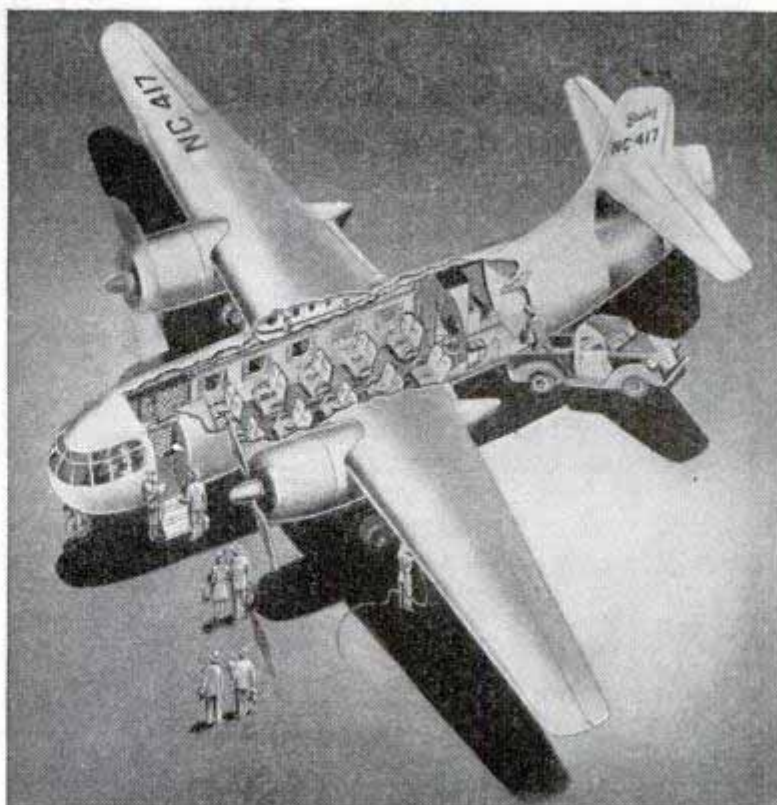


Nonsnag Lure With Hidden Barbs Exposes Hooks When Hit

Hazards of snagging a fishing lure on weeds and stumps in pools where the "big ones" often lurk are eliminated with a collapsible guard. Treble hooks are covered with a slotted rubber shell. When a fish strikes, the rubber shell is compressed and the barbs are exposed. The hooks are mounted on a sliding shaft and move forward for setting. If the strike is missed the barbs automatically return to a hidden position so that the lure is free to drift.

High-Wing Feeder Plane Gives Passengers Better View

For short-range intercity schedules connecting with trunk-line flights, Boeing is building a high-wing twin-engine transport designed to carry 20 to 24 passengers. It is powered by 800-horsepower Wright Cyclone engines. It has a wing span of 86 feet, is approximately 60 feet long, has thermal anti-icing of wing and tail surfaces and dual-wheel tricycle landing gear. Greater visibility is provided by the high-wing construction.



Bomber Tires Fit Tractor After Exchanging Rims

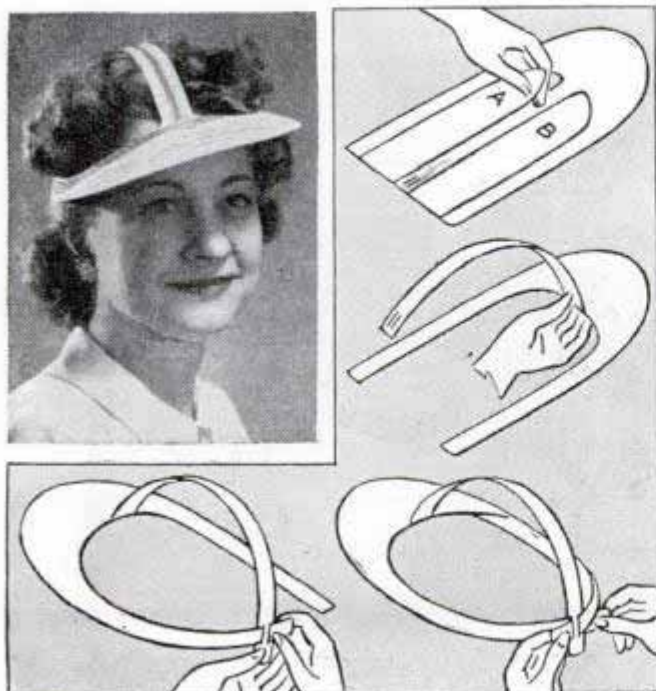
With a simple rim-welding job, surplus tires once destined for bombers and fighters now are filling equally important roles on earthmovers, hay balers, tractors and other farm vehicles. After the size to be used is determined, the original rim is cut away from the spokes or disk and the airplane rim is welded on. Tires intended for planes with 14-inch rims can be adapted for Fords, Plymouths, Chevrolets and other cars with

16-inch wheels. In some instances entire steel wheels, including the contact surface, have been changed over to make use of the largest size bomber tires.

Adjustable Paper Sun Visor Made From Single Sheet

While entertaining his young son by making paper boats and hats, a Chicago advertising man recently hit on an idea to make adjustable sun caps from a single piece of heavy paper. Starting with a paper about nine inches wide and 16 inches long and curved at one end for the bill of the cap, the inventor made perforated mark-

ings as guides for removing two sections from the paper. With these sections gone, there remain the bill, a strip for over the head and a strip for each side. The strips are joined together in a slot at the back. The caps, which are patented, are expected to be distributed as advertising novelties at baseball games and other outdoor events.



Shock Cases Treated by Dry Heat From Chemical Container

Dry heat for emergency treatment of accident victims is supplied in a minute by a special chemical compound in a small metal container. Heat is generated by releasing a spring lever, creating a chemical reaction which maintains warmth for an hour. The heat block, 1½ by 3½ by 4 inches and weighing 22 ounces, is wrapped in a towel or blanket for first-aid treatment of shock cases. A cylinder filled with the heat chemical fits inside the metal case and can be easily and quickly filled.



Sailing in the Sky

SAILORS are riding the heat waves above Elmira, N. Y., this month, intent on bringing to America some of the international records long held by European pilots of gliders and sailplanes.

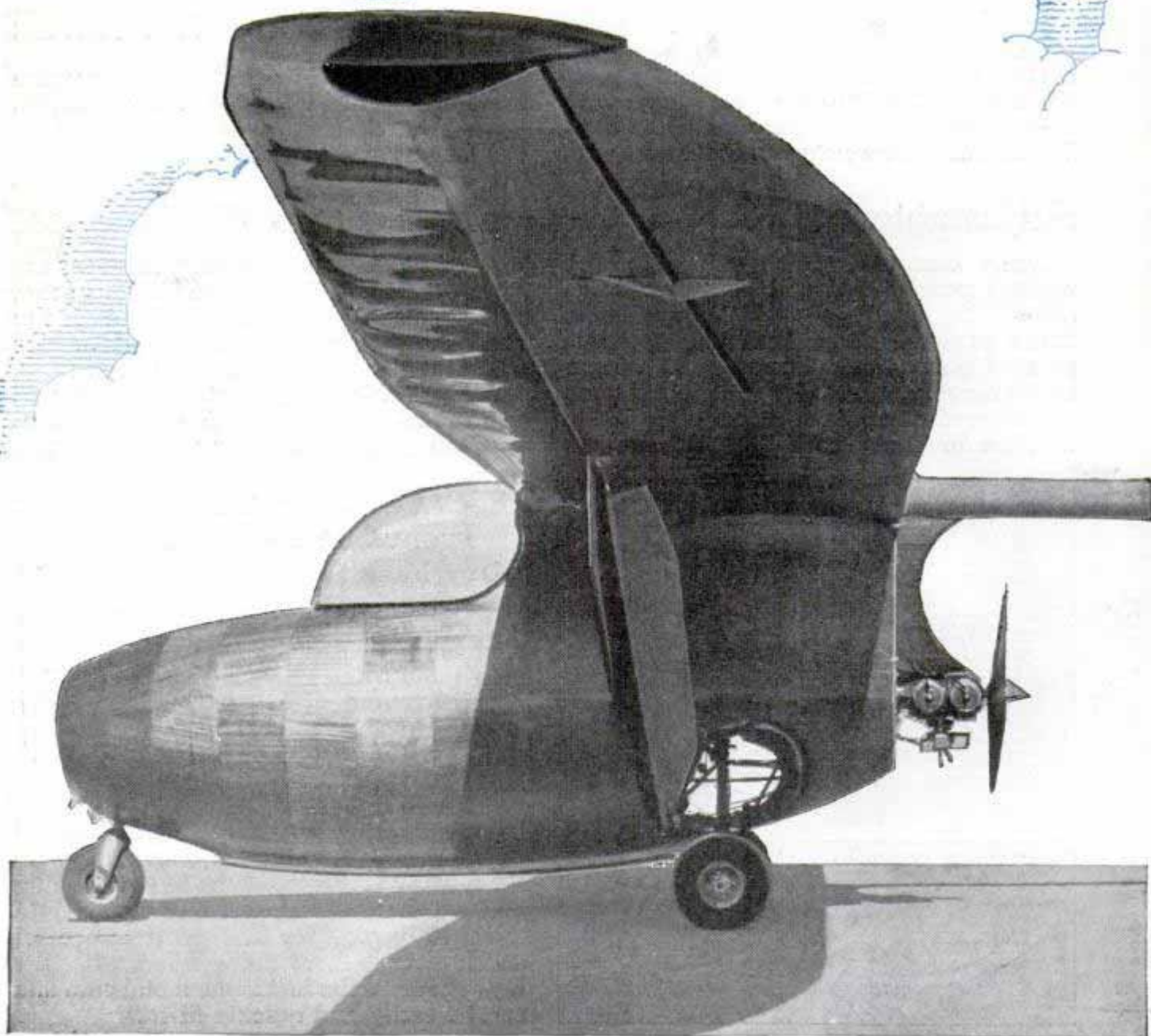
This is the time of thermals, of cumulus clouds and warm updrafts along the hillsides of south central New York state, scene of the National Soaring Contests. More than 100 gliders and sailplanes and twice as many pilots are searching out air currents to give them a lift in a sport where motors are generally scorned.

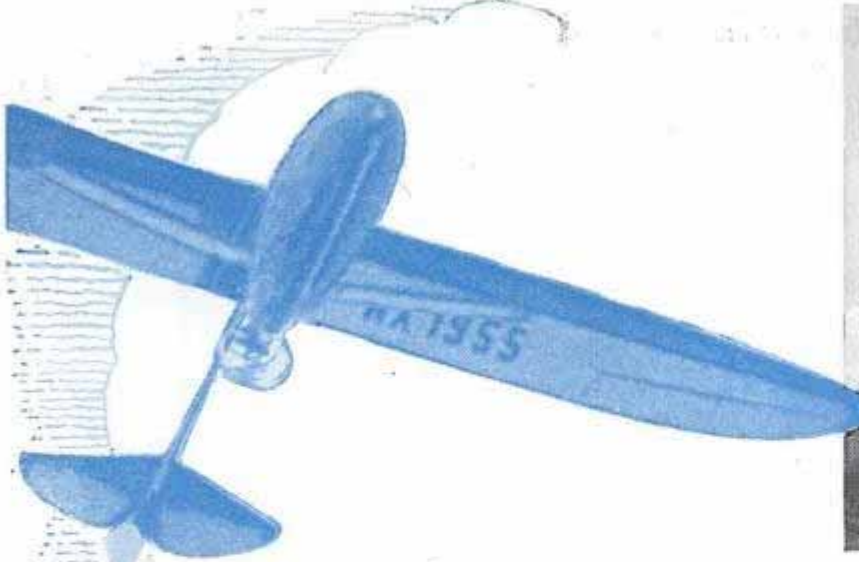
Its military pilot-training program restricted after the first world war, Germany took to the air in sailplanes. Interest in

America lagged, but now it is a growing hobby for men and women from the teens to the 70s.

A fraction the weight of an airplane and without its expensive engine, a glider can carry a man nearly 500 miles or gracefully ease him through clouds 20,000 feet high. A sailplane recently sped 37 miles at an average of 111 miles an hour. Add to this a comparatively low cost for the craft and no fuel expense or engine maintenance.

Such advantages are rapidly swelling the glider ranks. Many converts are young wartime airmen who've found even the light powered planes a notch beyond their civilian means, but who still want to enjoy



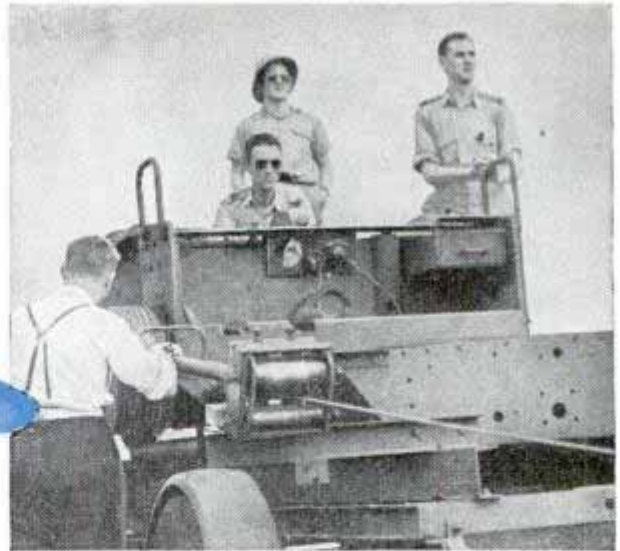


the thrills of flying. Many pilots recommend it for aviation training, pointing out that it gives the student confidence and a more intimate understanding of the art of flying.

The terms gliding and soaring are not interchangeable despite frequent misuse. Gliding is flying a motorless plane in a steady downward flight or glide. Soaring is an advanced form, using wind, heat currents, thermals and any energy of the atmosphere to prolong flight and gain altitude.

Primary gliders are comparatively crude

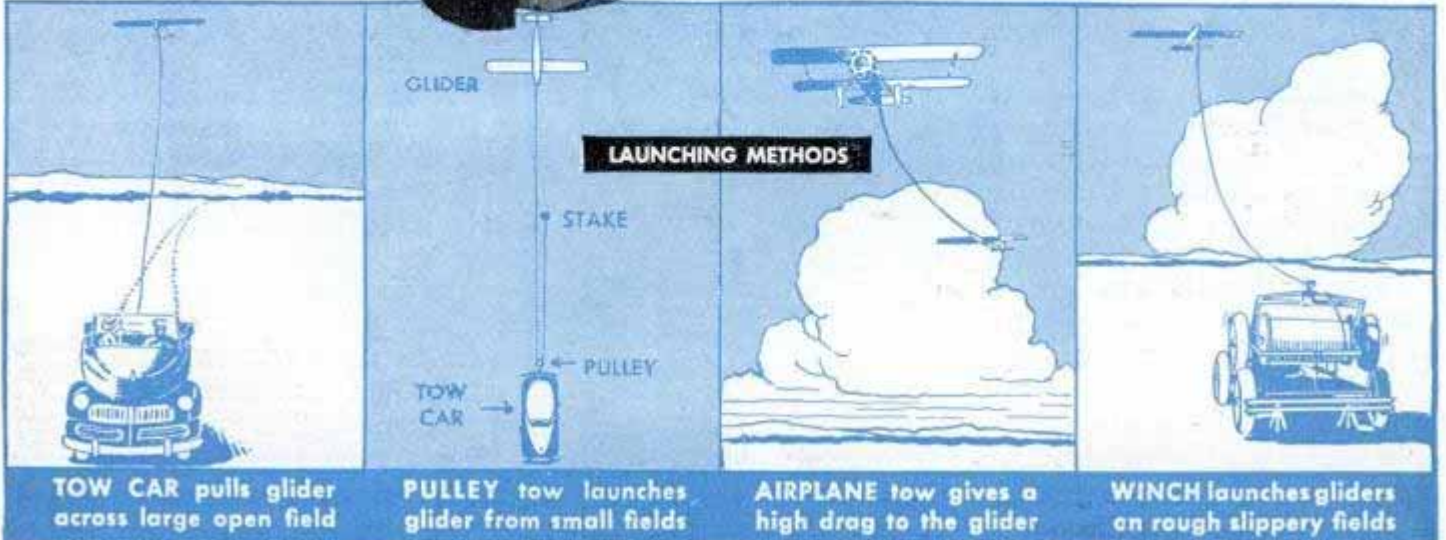
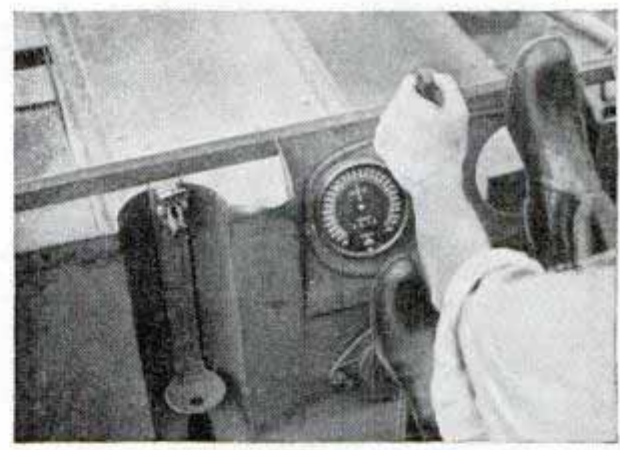
Latest development in gliders is this cabin craft with engine for power takeoffs

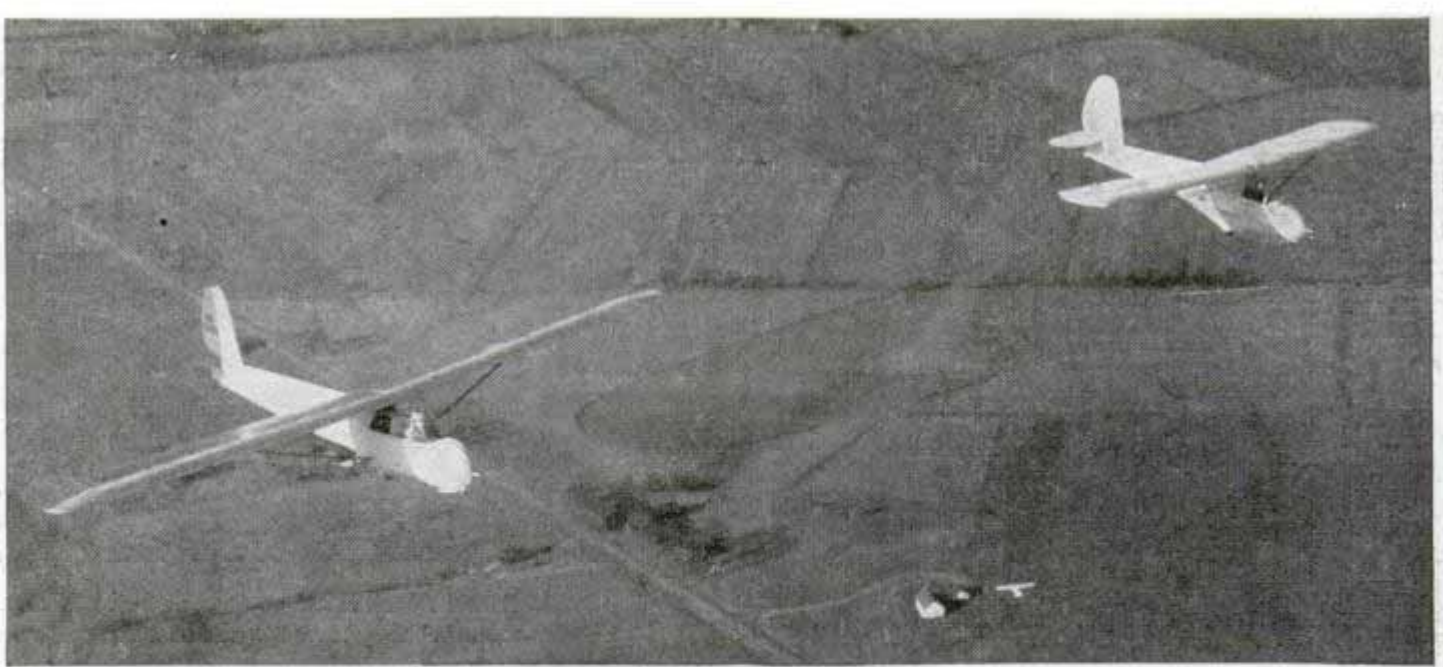


Drum of this winch revolves at constantly increasing speed to wind up towrope and launch the glider



H. A. Provisor photos
View from cab of the winch just before the glider becomes airborne. Below, operator of winch has hand on the accelerator lever to increase speed





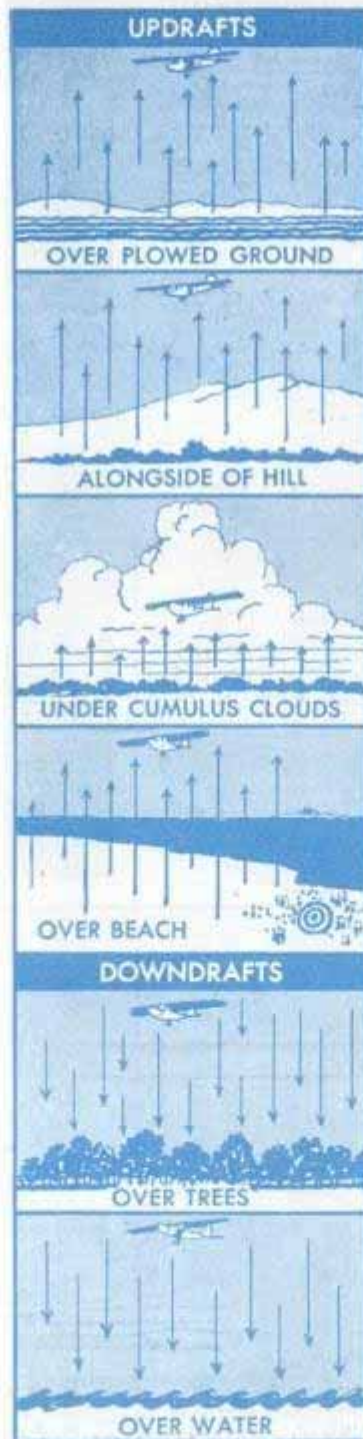
Schweizer Aircraft Corporation photo
 ↑ Left plane of these two ships is two-place sailplane, craft at right is glider

and simple, while the high-performance soaring or "sail" plane is streamlined and efficient. Between the extremes are utility gliders and intermediate sailplanes.

The average glider has a wingspan of 34 to 36 feet, weighs about 200 pounds empty and is built on a wooden skeleton. Sailplanes weigh 400 to 500 pounds and have a wingspan of more than 50 feet, almost twice that in some experimental models. Some are all-metal construction, all have enclosed cockpits.

Sailplanes have a higher stalling speed, 34 miles an hour in one new model, and a much slower sinking speed. They are much more sensitive to control than gliders. Primary gliders have no instruments, but a high-performance sailplane has an air-speed indicator, a climb indicator, an altimeter, turn-and-bank indicator, compass, thermometer and rubber-tired landing wheels with brakes.

Both types normally carry only one or two persons, though the military troop-carrying versions transported 20 or more fully-equipped soldiers. Conventional sailplanes and gliders are available either assembled or in kit form, with prices ranging from around \$200 for a primary to



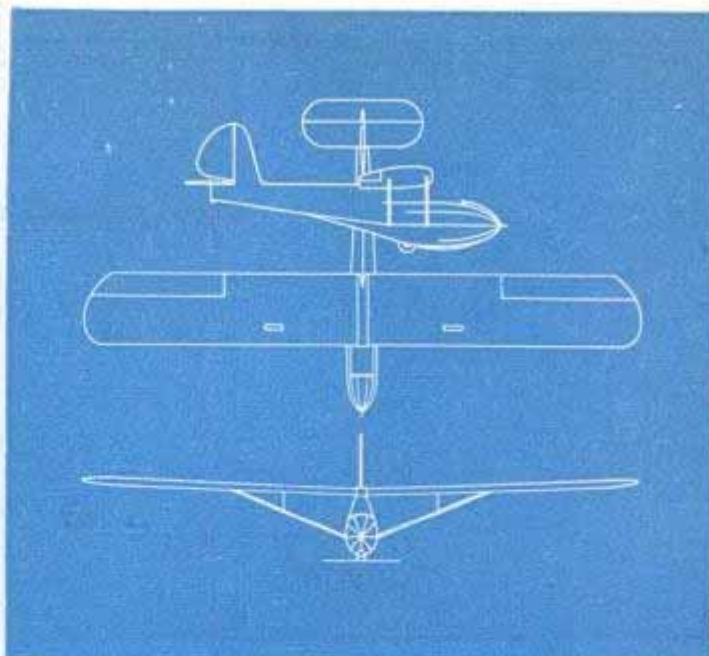
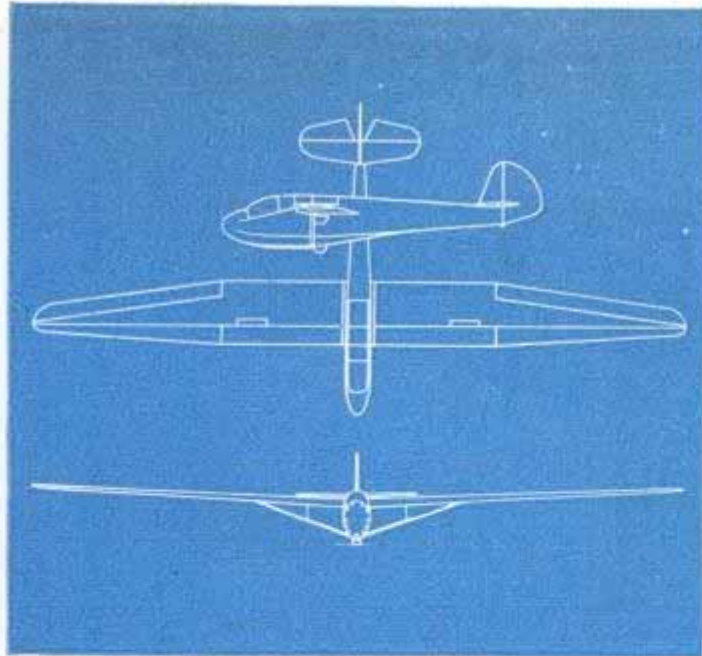
← Pilots must be masters at finding these updrafts, avoiding down currents

several thousand for a top-flight sailplane.

A glider stays in the air principally because it has lift, which in turn depends on the speed of the craft and the size and shape of the wings. Glider designers are constantly working to increase wing efficiency, with the better wings carrying the glider farthest with the least descent.

In the sport's early days slope winds were relied on almost entirely for duration flights. As a result most of the sites were in hilly rolling country like that around Elmira, the "Glider Capital of America." As the understanding of thermals grew, however, gliding shook its dependence on topography. Now there are popular sites on the plains of Texas and Illinois, as well as in western mountain and desert areas.

Thermals, or air bumps, result from unequal heating of the earth's surface. For example, the sun's rays striking a plowed field are radiated directly into the atmosphere above. Since hot air rises, this air breaks away from the surface in the form of a series of thermal bubbles when sufficiently heated. They rise until their temperature reaches equilibrium with the atmosphere above.



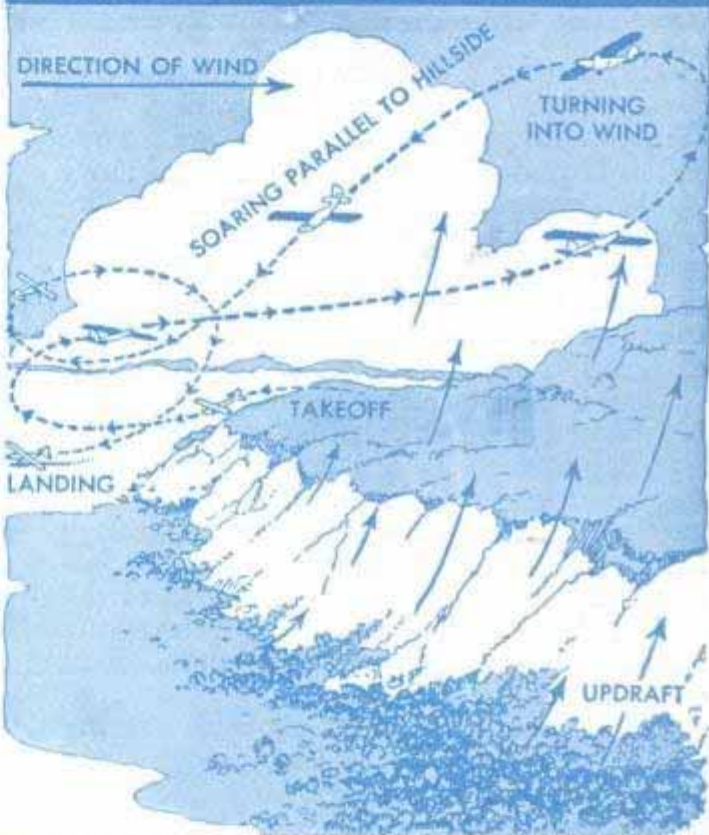
Two-place sailplane sketched above has 52-foot wingspread. At upper right is one-place glider. Method of coasting up thermals is shown at right

Woods or water will not radiate as much heat as a plowed field. As a result, air above these areas will be relatively cooler and flow downward, creating a downdraft. By careful use of thermals, or upcurrents, and by dodging downdrafts, a pilot can maneuver to great heights and sail long distances. Good thermals are generally not found on windy days because the wind scatters the rising air currents.

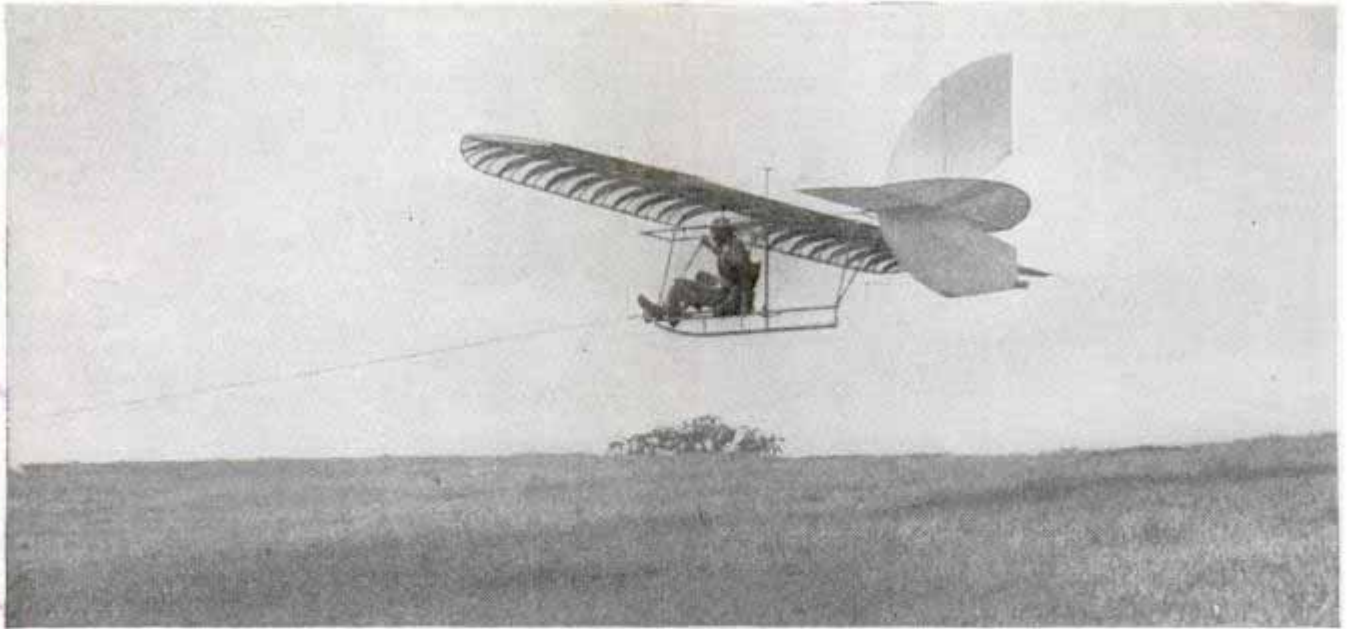
Storm flying in towering cumulonimbus clouds has boosted sailplanes over 15,000 feet. Now pilots are studying dynamic soaring, using the difference in wind velocity at various altitudes to promote lift, as another possibility for sustaining flight.

In launching gliders the four towing

Utility glider soars in the wake of its tow plane
Schweizer Aircraft Corporation photo



13755 Paton
San Fernando, California
"Bumblebee" made by Nelson Aircraft Co



Model of an 1883 glider struggles into the air during filming of a movie depicting life of early glider pilot

methods most generally used are the airplane, winch, auto and auto-pulley. The common towline is a strong manila rope several hundred feet long with metal rings at each end. Airplanes are used with the heaviest gliders or whenever a high tow is needed. The auto is most effective on a large field where there is a smooth path for the tow car, while the winch method is best on a rough or slippery launching area.

With the auto-pulley technique, the line is attached to a stake and threaded through a pulley at the rear of the car. The ring at the other end attaches to the glider. The auto-pulley works best on small, rough fields, or when wind velocity is low because the pulley doubles the speed of the glider. A wartime development, the flying "pickup" may prove especially valuable in cargo roles.

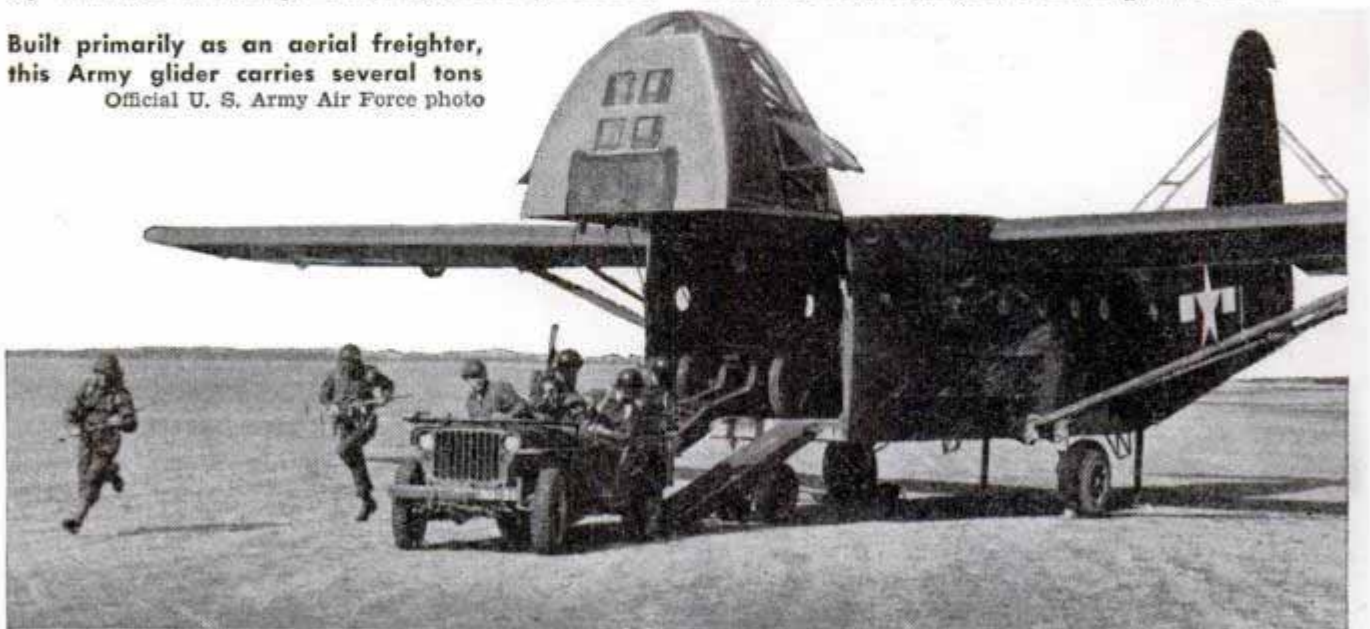
Development of a two-place soaring plane with a small auxiliary engine for takeoffs is exciting glider fans. Designed by William Hawley Bowlus, glider pioneer,

the Bumblebee is built of plywood, with a hollow duralumin tail boom. A small propeller at the rear is driven by a 16-horsepower air-cooled 4-cylinder two-cycle engine. The glider takes off under its own power at 38 miles an hour and climbs 300 feet a minute. Once aloft, the engine is switched off and it performs like a glider.

The glider's controls are the elevators, rudder and ailerons. Up or down direction is achieved by tilting the elevators, which normally lie in a horizontal plane at the rear of the fuselage. When they are raised, the tail goes down and the nose up, or just the opposite when they are lowered.

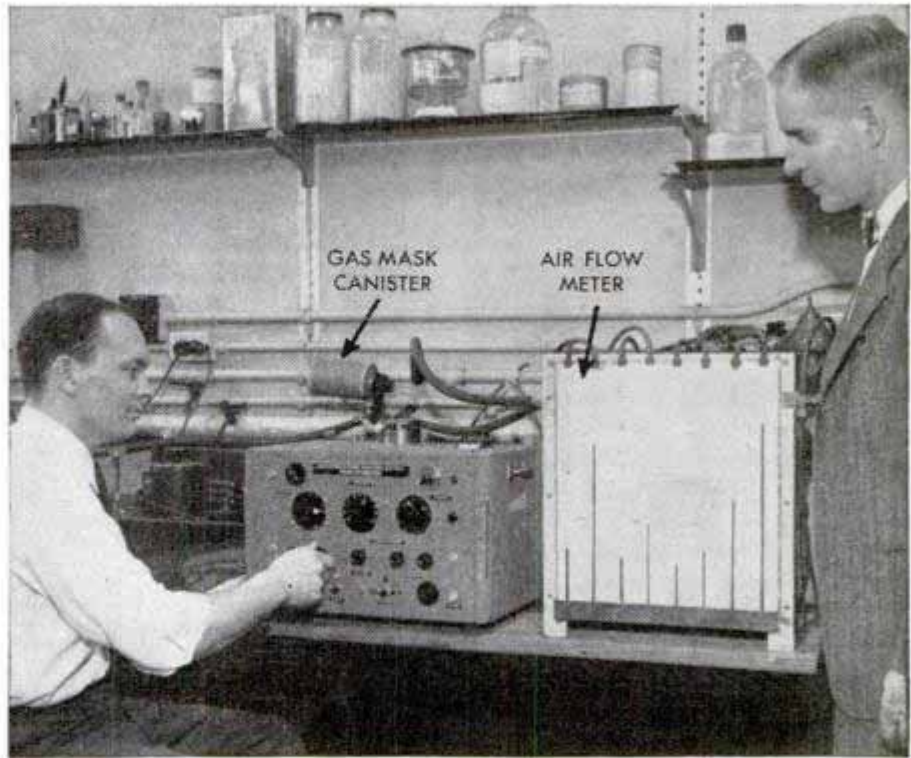
Ailerons are the two horizontal surfaces hinged to the trailing edge of each wing. They operate like the elevators, except that when one is raised the other drops to lower the wing on the raised side. Both elevators and ailerons are operated by a control stick. The rudder is worked by a rudder bar or pedals. A push with the left foot, for example, turns the plane left.

Built primarily as an aerial freighter, this Army glider carries several tons
Official U. S. Army Air Force photo



Gas and Smoke "Detectives" Find Millionth Parts in Air

Two new instruments, more sensitive for detecting minute quantities of gas or smoke than any ever devised, have been announced by Northwestern University. Both instruments were designed during the war in connection with the development of a more efficient gas mask. The "ultraviolet photometer" detects the presence of gases by means of ultraviolet light. It will find peacetime use in the measurement of toxic vapors in factories and mines. The instrument, capable of discovering as little as one part of gas in a million parts of air, was developed by Dr. Irving J. Klotz and Dr. Malcolm Dole, professors of chemistry. Another device, the "photoelectric smoke penetrometer," can detect 1/100,000 ounce of smoke in a room 30 feet square and gives similar readings of the amount of dust in the air. A puff of ciga-



rette smoke in a huge auditorium will deflect the indicator. The instrument will be used in studies of smoke elimination and air purification. It was developed by Dr. Hugh B. Pickard, Prof. Frank T. Gucker, Jr., and Chester T. O'Konski.

Mower With Circular Blades Cuts Grass of Any Height

Circular blades that whirl horizontally enable a new power mower to trim the edges of a lawn at the same time it cuts the

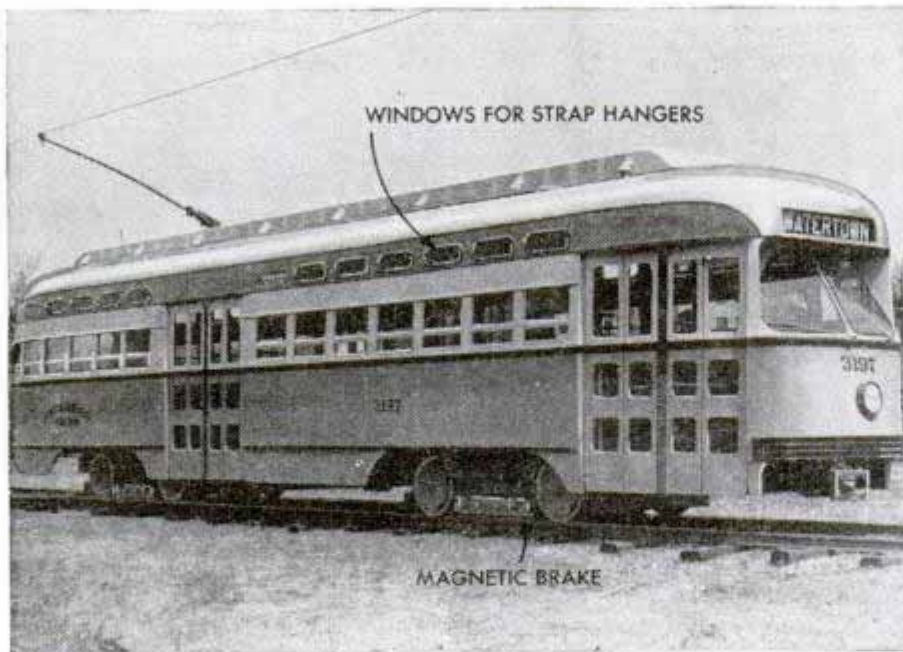


grass. The blades reach to the edges of posts and trees. The machine's rotary action is similar to that of two electric fans placed side by side face down above the grass. Because the blades are horizontal the machine will cut a 30-inch strip through grass or weeds of almost any height. An automatic safety clutch disengages the wheels and blades from the motor whenever the handle is released. The height of the blades is adjustable in quarter-inch intervals from 1¼ to 2½ inches. The handle can be collapsed and folded for convenient storage during the winter.

Foolproof Photographic Solutions Stop Overdevelopment

It's impossible to overdevelop photographic prints or negatives with new chemical solutions which eliminate the need for hypo or stop bath. The solutions develop negatives in 20 minutes and prints in two minutes. Prints and negatives can be left in the solutions for any length of time without danger. Also, prints can be exposed to light as soon as the image starts to appear. Two solutions are available, one for prints and one for negatives.

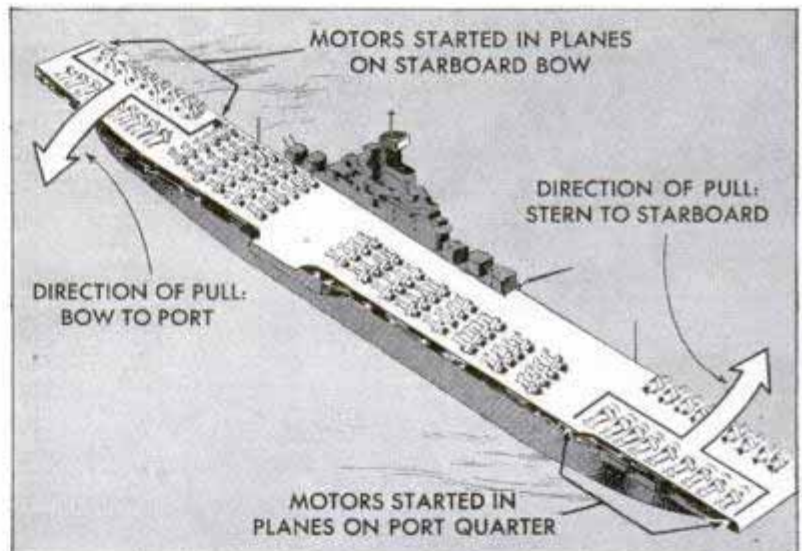
High Windows for Strap Hanger Prevent Riding Past Stop



Eye-level windows are built into each side of an all-electric street car so the strap hanger can pick out distinguishing landmarks to keep him from riding beyond his stop. No compressed air is used in the car. Electric motors open and close the doors and operate windshield wipers. The magnetic brakes are controlled from a 32-volt battery. For greater safety, windshield area has been increased so that the motor-man may have a better view of boarding and alighting passengers.

Planes on Deck Turn Carriers With Propeller Thrust

Carrier planes can maneuver their mother ship in confined areas by employing the thrust of whirling propellers to turn the floating base in a tight circle. Planes lined up crosswise at one end face the direction of turn and aircraft crosswise at the other end face the opposite direction. The forward tug exerted by the propellers of each group revolves the ship like a wheel. By facing the planes in the same direction, the ship can be moved sideways. Conceivably, the ship's speed could be increased by facing both groups of planes forward and racing their engines.



Dozer Clips Nine-Inch Trees to Clear 2½ Acres in Hour



With a giant Caterpillar tree dozer and brush cutter, brush and trees up to nine inches in diameter are cleared from 2½ acres of wooded land per hour. The machine, operated by the Iron Range and Rehabilitation Commission, Hibbing, Minn., is used for opening new areas for mineral development in the Iron Range area.

☐ In order to cool the engine of a tank in battle, a ton of air per minute was blown through the engine compartment at a velocity of a mile a minute. The amount of heat thus removed from the tank's power train was fantastic—enough to heat 20 homes on a cold day.

DON'T POUR *Coal* UP THE CHIMNEY



The University of Illinois has found how to "stretch" coal further and heat homes better

By Aubrey O. Cookman, Jr.

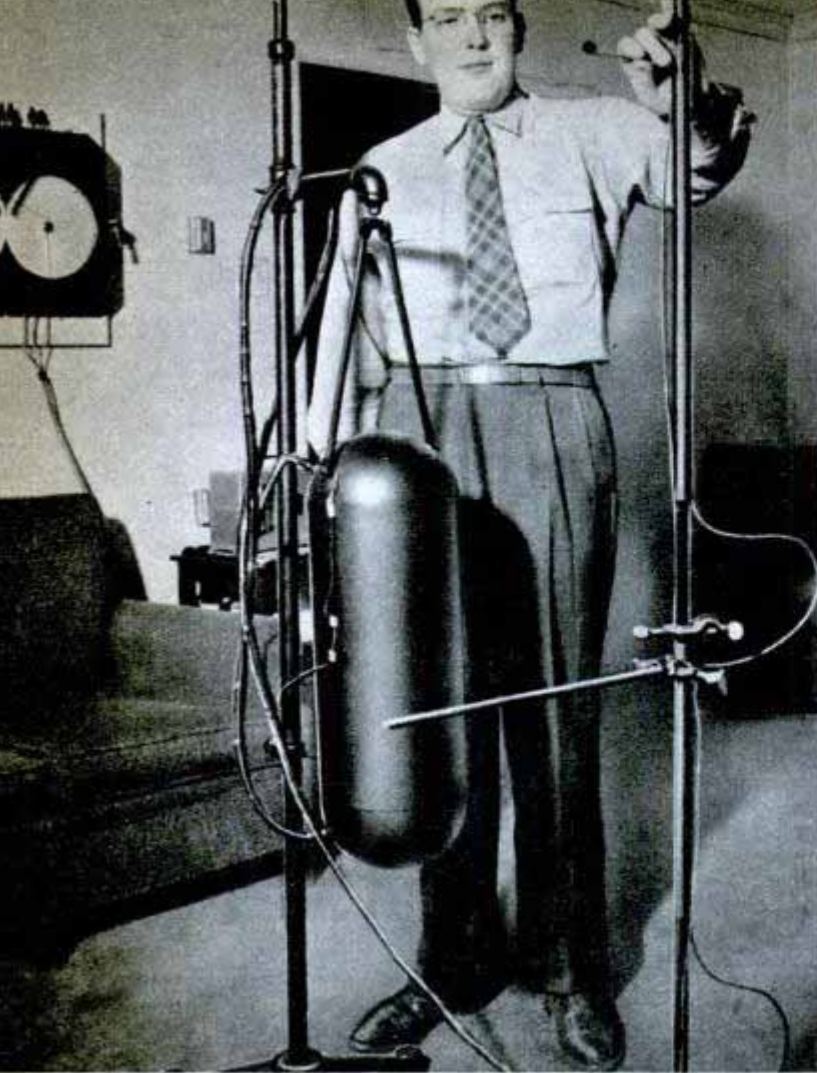
WHEN Mrs. Julian R. Fellows excitedly called her professor-husband home from class to fix a smoking furnace she didn't know she was inspiring one of the first major improvements in hand-fired home heating since Benjamin Franklin invented his stove more than 200 years ago. But from that summons, and a decade of research since, came the Illinois smokeless furnace, capable of burning any soft coal without smoke, providing even heat, and saving as much as 30 percent of the fuel pile.

Professor Fellows, a mechanical engineering instructor at the University of Illinois, shifted all his spare time attention to whipping the vexing soft coal smoke problem. He finally found the answer in a furnace built around a "downdraft coking principle."

This is a method for directing smoke and gases from newly added coal through an area of already burning coals. There they are heated to igniting temperature and mixed



Thermostats should be in the sitting zone, not at eye level, for comfortable heating

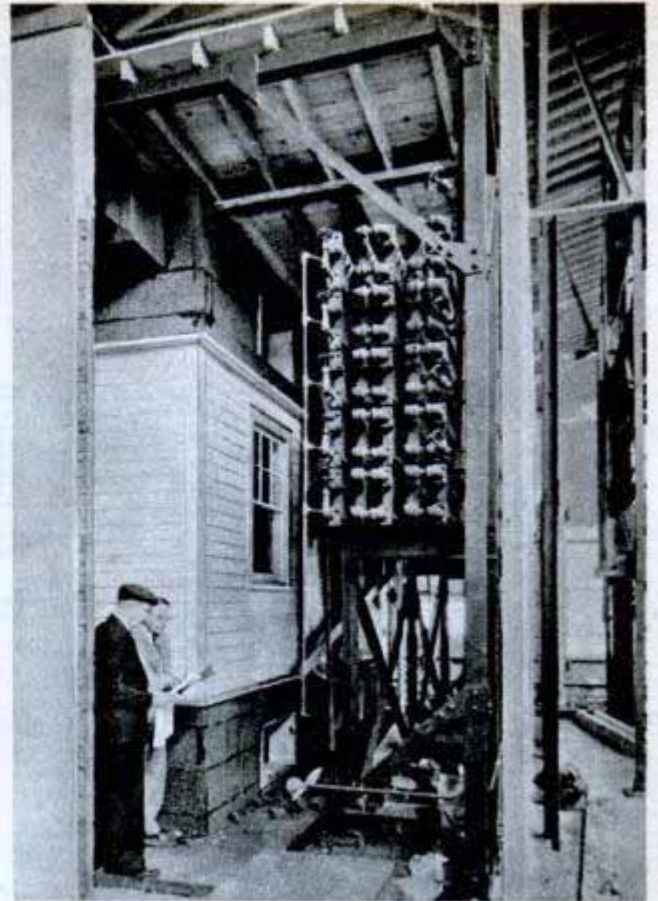


Thermometers record temperatures at high and low positions in University of Illinois heat-test home

with preheated auxiliary air coming in through a passage over the coking chamber. The gases burn completely. This releases much heat formerly lost and eliminates the smoke nuisance.

Tests of nearly 100 samples of soft coal indicate that virtually all kinds can be burned without smoke in the Illinois smokeless furnace. This opens the way to banish the smoke nuisance in cities without banning the use of plentiful and inexpensive soft coal. The benefits to health and cleanliness are as important as fuel saving.

A hundred "pilot" models of the Fellows furnace are under further test in private



Small house built in climate laboratory is subjected to temperatures from 5 below to 100 above zero

homes. A typical user reported a season's fuel consumption of eight tons, compared with 12 tons of the same kind of coal burned the previous year in a conventional furnace. The same operating principle applied by Fellows in furnaces is applicable to stoves.

The smokeless furnace is a recent development in the heating research program that started at the university in the early 1920s. This research was instigated by Professor Arthur Cutts Willard, then a member of the mechanical engineering department, but recently retired as president of the university. Willard was amazed by the lack of standards in heating equipment when he was in charge of purchasing for army cantonments during the first World War. Up until then furnaces were sold by the pound, without regard to their capacity to do a specific heating job. Willard saw no reason why a scientific yardstick couldn't be applied to gauging heating equipment.

Largely through his efforts, the National Warm Air Heating and Air Conditioning Association put up a two-story 10-room frame residence on the university campus in 1924. This was the first house ever built expressly for

Moisture in any part of a home is measured by electrical apparatus with a plug-in detector



Radiant baseboards made of hollow cast iron distribute hot water heat evenly throughout a home

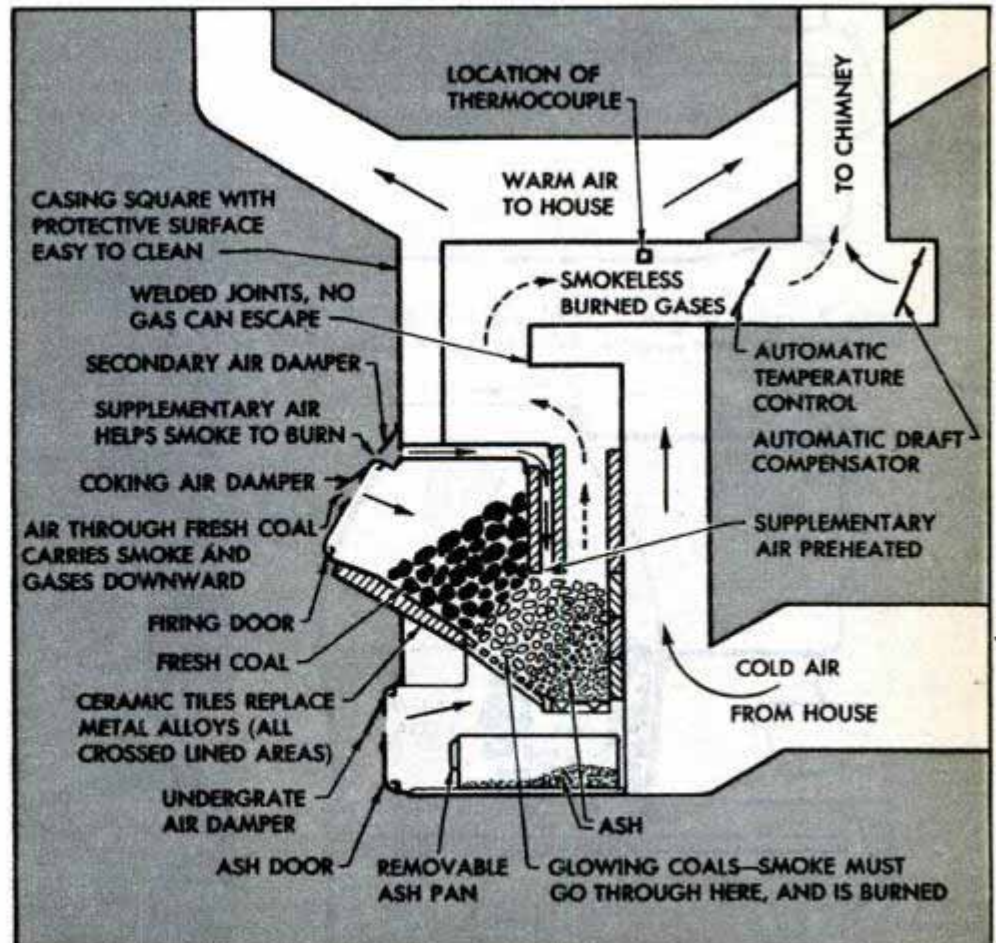
scientific research in home heating. A second home for heating research, built by the Institute of Boiler and Radiator Manufacturers, was dedicated in 1941. It is a six-room brick veneer house, typical of the trend to small homes. In each instance the industry provides the house and the equipment, and engineers from the university's staff conduct the tests. In charge of the warm air research house is Professor S. Konzo, authority in this field, while Professor Warren Harris supervises tests conducted in the boiler and radiator heating research home at the university.

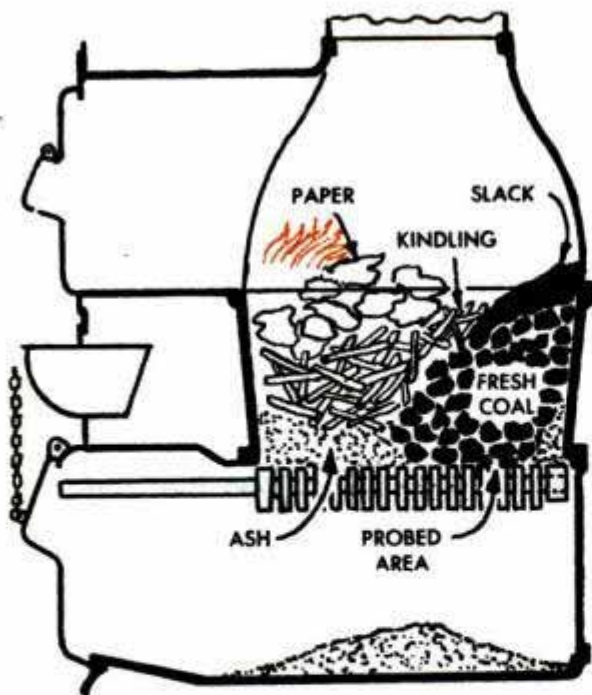
Few subjects are of more general concern than heating, involving the comfort and well-being of all of us either directly or indirectly. The most recent national housing census showed that more than 16,000,000 dwelling units were stove heated, almost 7,500,000 heated by steam or hot water and 7,000,000 by warm air furnaces. About 11 percent were reported using other kinds of heating or none.

Both research homes are fully equipped with all sorts of strange looking measuring instruments. One is the thermocouple, a wire device for measuring temperatures. Some 300 are in the radiator house alone. The thermocouples are attached to walls, ceilings and supports to measure air temperatures at various

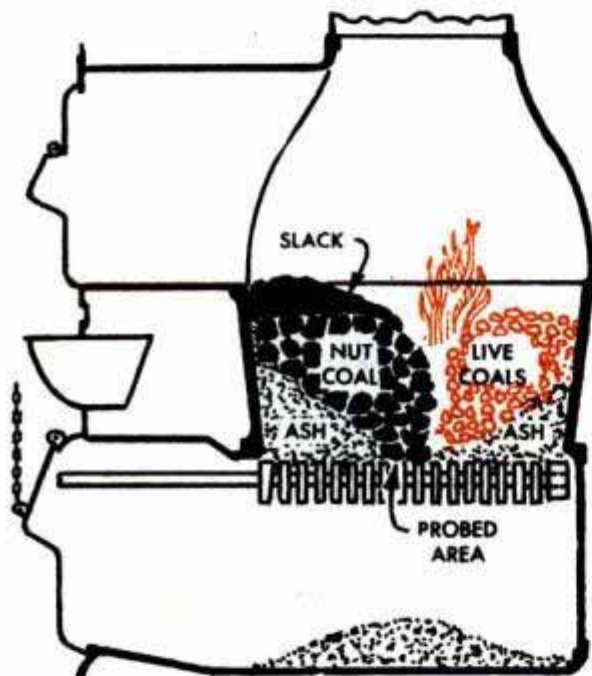


Smokeless furnace, fired by its developer, Prof. Julian R. Fellows of the University of Illinois, directs smoke and gases from new coal through coal already burning. Diagram below shows how the furnace operates

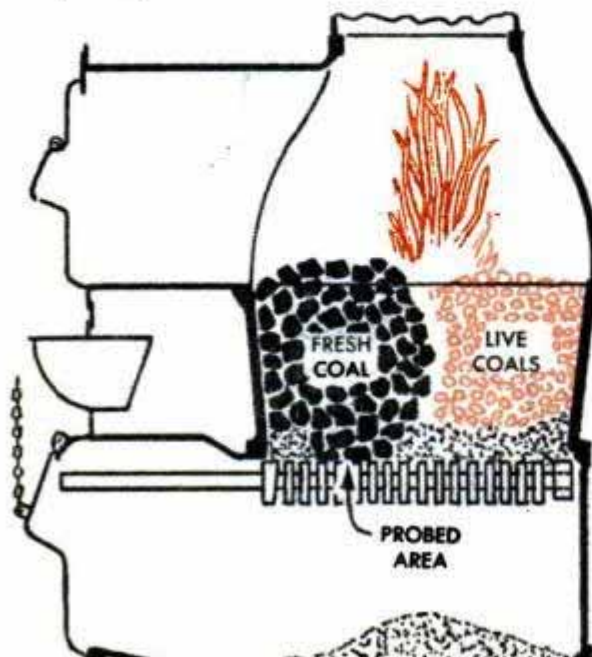




↑ Here's how to start furnace fire with soft coal



Keep it under control i mild weather by ash bed (above). Cold weather firing is shown below



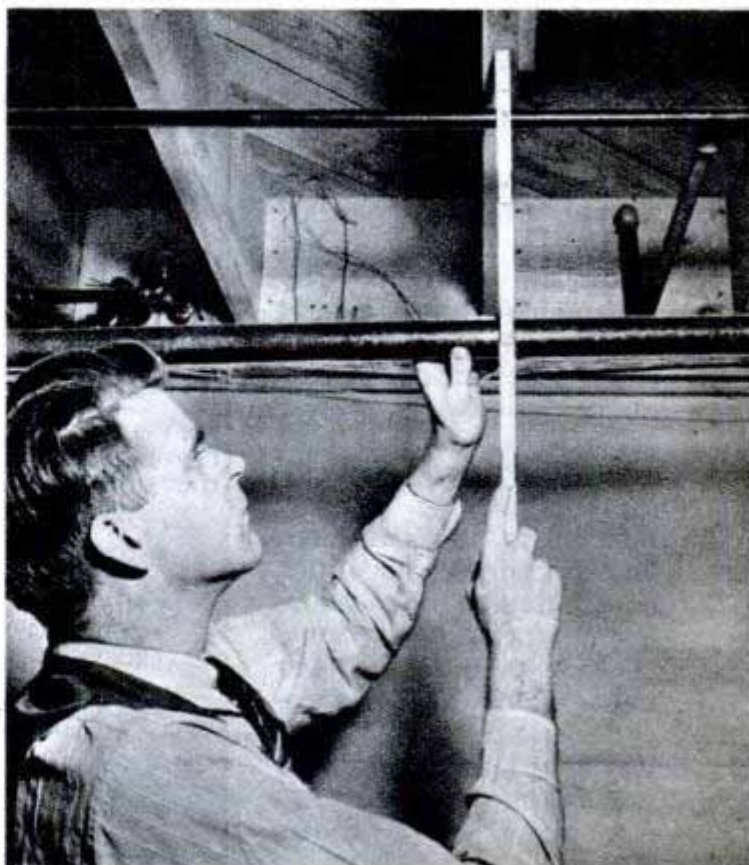
heights in the rooms. In some locations nine of them are grouped on and in a wall to measure the temperature at points three inches from the inside wall of the house, then at progressive stages through the wall structure, and finally ending at three inches outside the wall.

Recording thermometers in each room register a constant report of the air temperatures in the house at the floor, ceiling and in the "living zone" of a seated person. A bulky sausagelike instrument called a thermo-integrator reacts to the radiant energy, or lack of it, in the walls as well as to the air temperatures to indicate the comfort conditions of a room. Still other instruments measure moisture. Most of the equipment is connected to a central control board in the basement which can supply 100 to 125 readings every six hours.

The university's aim in this research is to improve home heating, set standards for heating equipment and pass along this information to those concerned. This includes manufacturers, the installers who are the industry's point of contact with the public, and the public.

Much educational work for the public is being done through the university's Small Homes Council, a coordinating agency to assemble and distribute, in popular form, information affecting the small home, from advice on selecting a lot and financing it to selecting a heating plant, planning the kitchen or installing storm windows. Thus far the council has prepared 12 nontech-

Hot water pipe $\frac{1}{2}$ or $\frac{3}{4}$ inch in diameter serves as well as $1\frac{1}{4}$ -inch pipe, university experts found



nical pamphlets on various phases of housing.

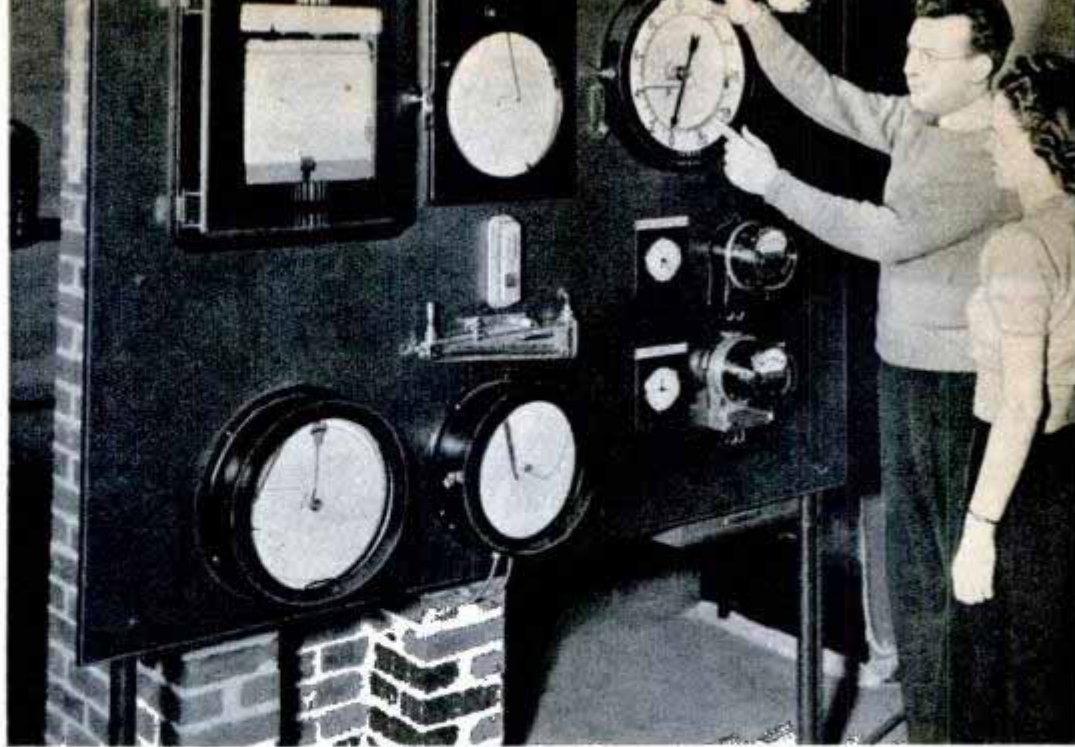
Authorities agree that good house construction is the first essential for efficient heating. The perfect heating plant will do only a fair job in a poorly built house, while even a mediocre unit performs fairly well in a tightly constructed home.

Experiments have shown, for example, that a plaster ceiling has high heat conductivity, and you can accomplish heat savings as high as 15 percent by insulating the attic floor above. Wall insulation can save 20 percent of the remainder, while tight storm windows and doors will slash away another 20 percent. Another recommendation for greater comfort is to locate heat-controlling thermostats 30 inches from the floor, in the living zone of seated persons, instead of at the 60-inch eye-level mark usually practiced.

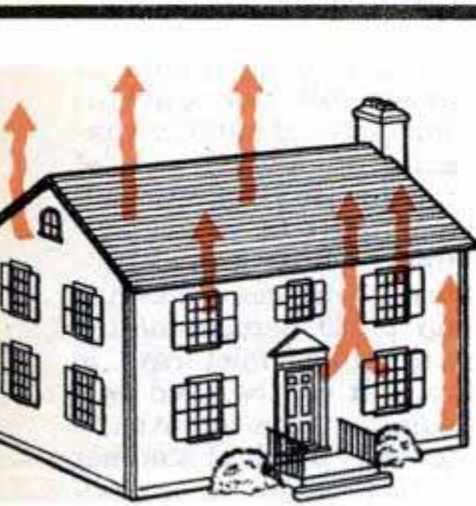
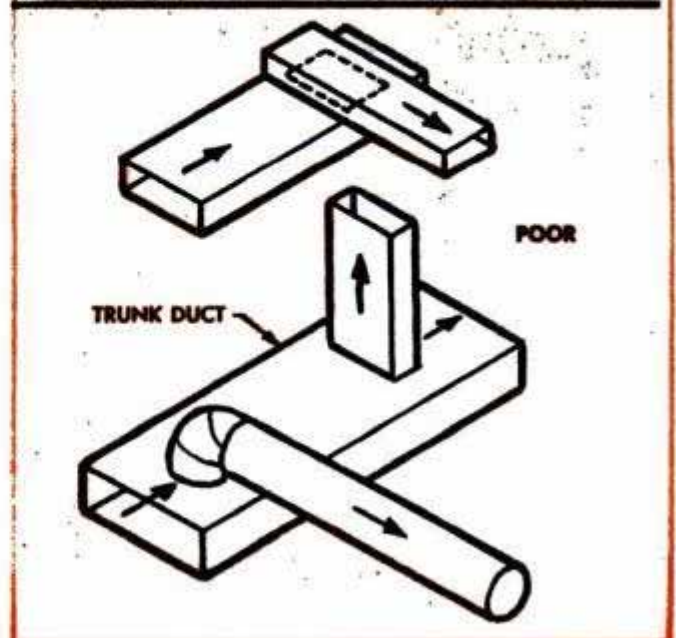
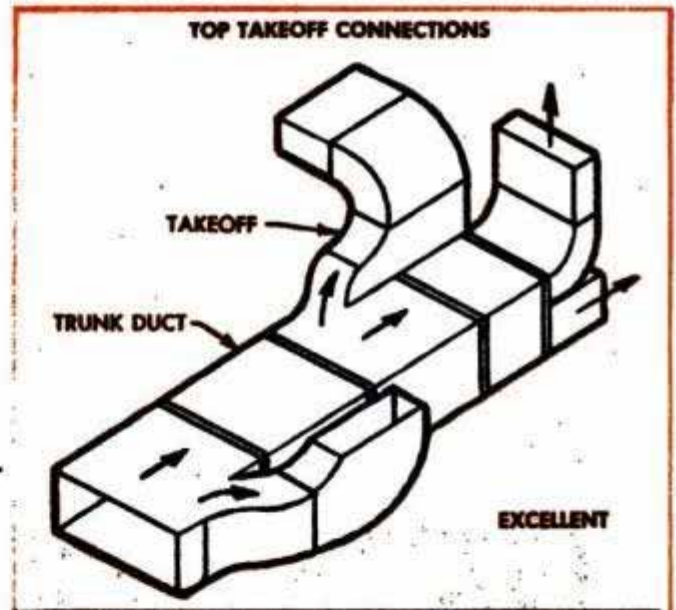
University research has shown, on the basis of exhaustive tests, that the sizes of hot water pipes from boilers often can be reduced from 1¼ inches to ¾ or ½ inch, saving both materials and space with no loss in heating efficiency. They found, too, that when radiators are located along exposed walls there is no perceptible floor draft, but when they are placed next to inside walls the floor to ceiling temperature difference jumps three to five degrees.

With recessed radiators, where some of the normal wall insulation has been sacrificed to gain the space for the recess, they learned that by insulating the recess with one inch of rigid

(Continued to page 248)

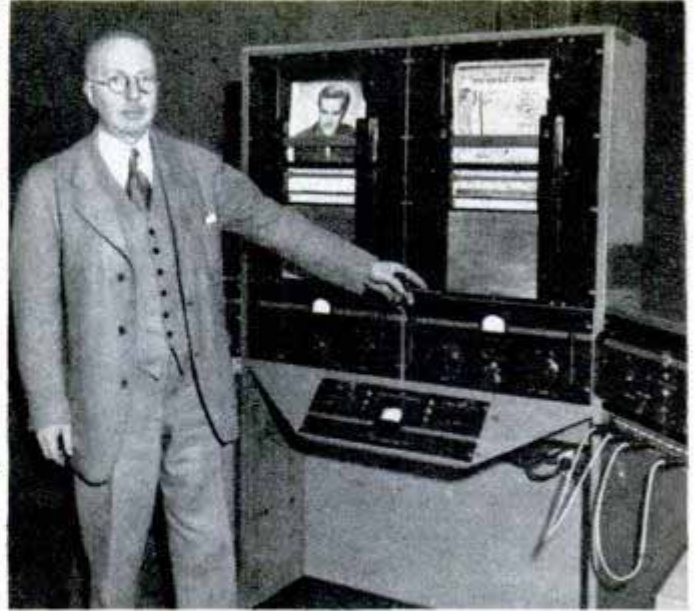


Instrument board in basement of test home registers performance of boiler and circulator and notes flue gas temperatures and current consumption. Below, drawings indicate efficient and inefficient designs for duct systems. Diagram at bottom itemizes heat lost from average two-story frame house



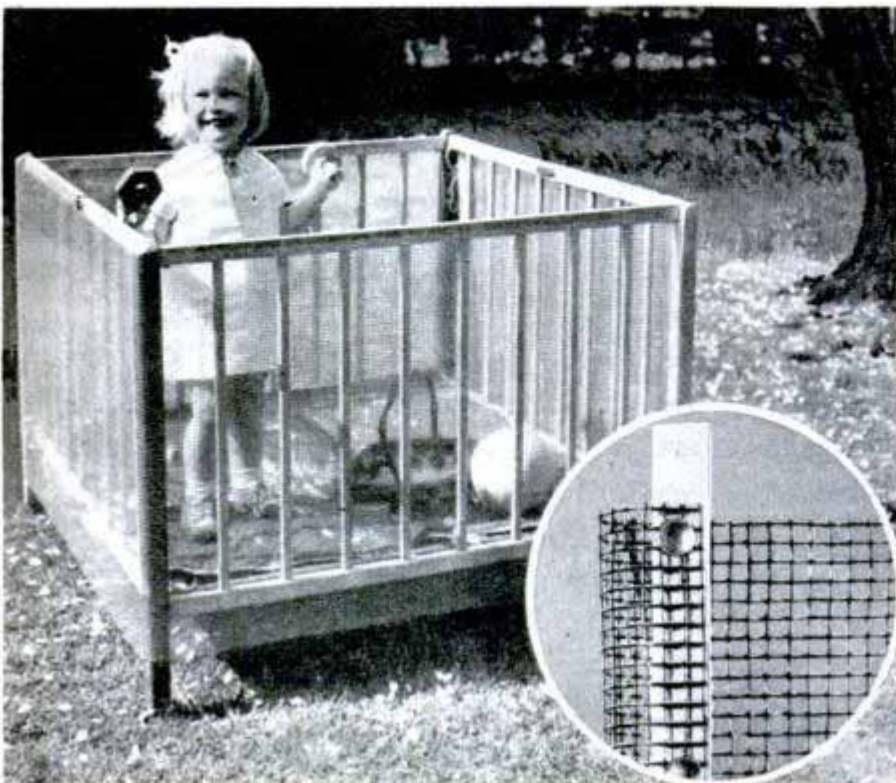
ROOF	16%
WALLS	27%
GLASS	26%
INFILTRATION	25%
DOORS	4%
FLOORS	2%
TOTAL	100%

Newspaper "Piped" to Home by Facsimile Broadcasting Equipment



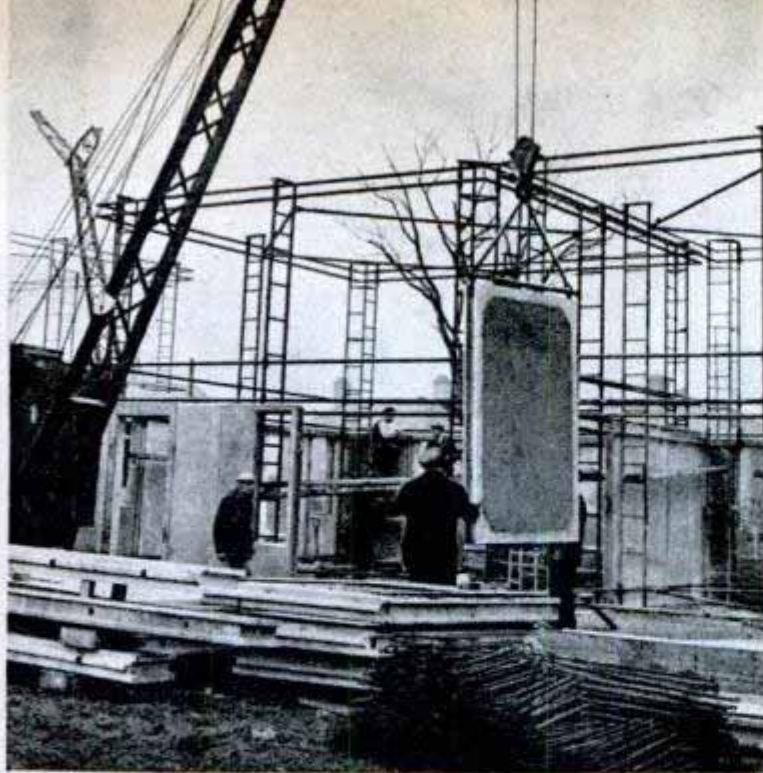
Four 9½ by 12-inch pages of text or photographs are printed by radio in 15 minutes by facsimile broadcasting equipment designed for home use. The recorder is built in two types: one to be attached to existing radio sets, and the other to be mounted in a radio console by manufacturers. Printed pages emerge from a slot in the top surface of the set at the rate of 28 square inches per minute, and a transparent window enables the owner to see the page as it is being recorded. In a recent demonstration, news and photographs were transmitted, in addition to such material as maps, charts, cartoons and crossword puzzles. At the broadcasting station, copy to be transmitted is placed on a revolving drum equipped with a scanning head. An electric eye scans each detail of the copy and

translates each graduation of black into an electrical impulse, which in turn is converted into a sound signal and sent over the air by an FM radio station. The signal is picked up by any standard FM radio receiver and relayed to the facsimile recorder connected to the radio set. A roll of white paper, chemically treated to make it electrosensitive, feeds through the recorder. The recorder (or printer), synchronized with the scanner at the radio station, passes an electrical impulse through the sensitized paper at every point where black appears in the original copy. The action of the electrical impulse on the electrolytic paper turns it black, and in this way an exact reproduction of the original copy is obtained. Radio Inventions, Inc., of New York developed the equipment.



Netting Shields Baby From Cold Drafts

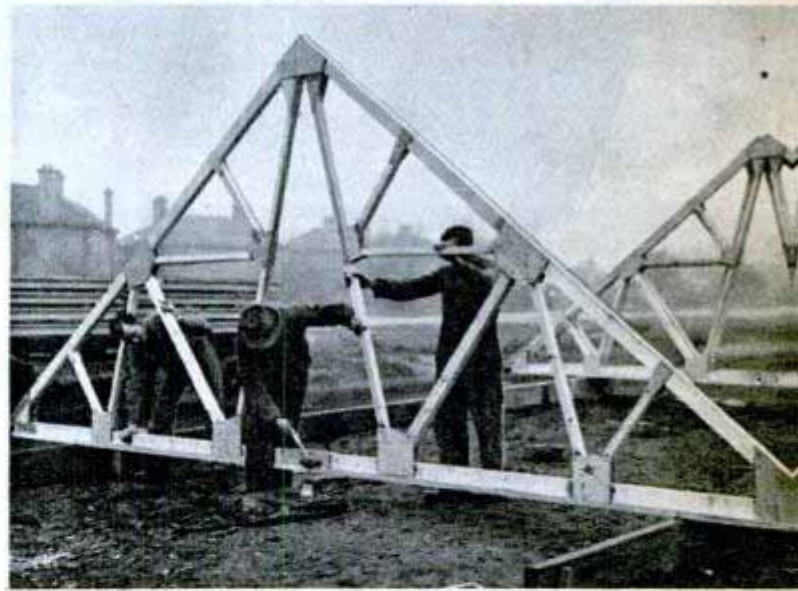
Wrapped around your baby's play pen, a transparent plastic-coated netting keeps out cold drafts, dust, dirt or stray animals and enables him to get his full quota of outdoor sunshine. Double layers of tough, clear plastic are laminated to cotton netting to form the wind-break. Since it permits up to 60 percent of the sun's ultraviolet rays to pass, it can be used as a window glass substitute for sun porches, summer cottages, hotbeds or poultry houses. It can be cut with a pair of scissors.



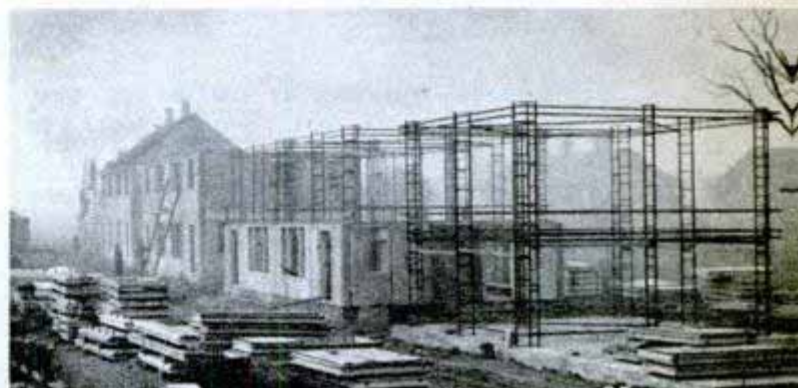
JIG-TIME SLAB HOUSE



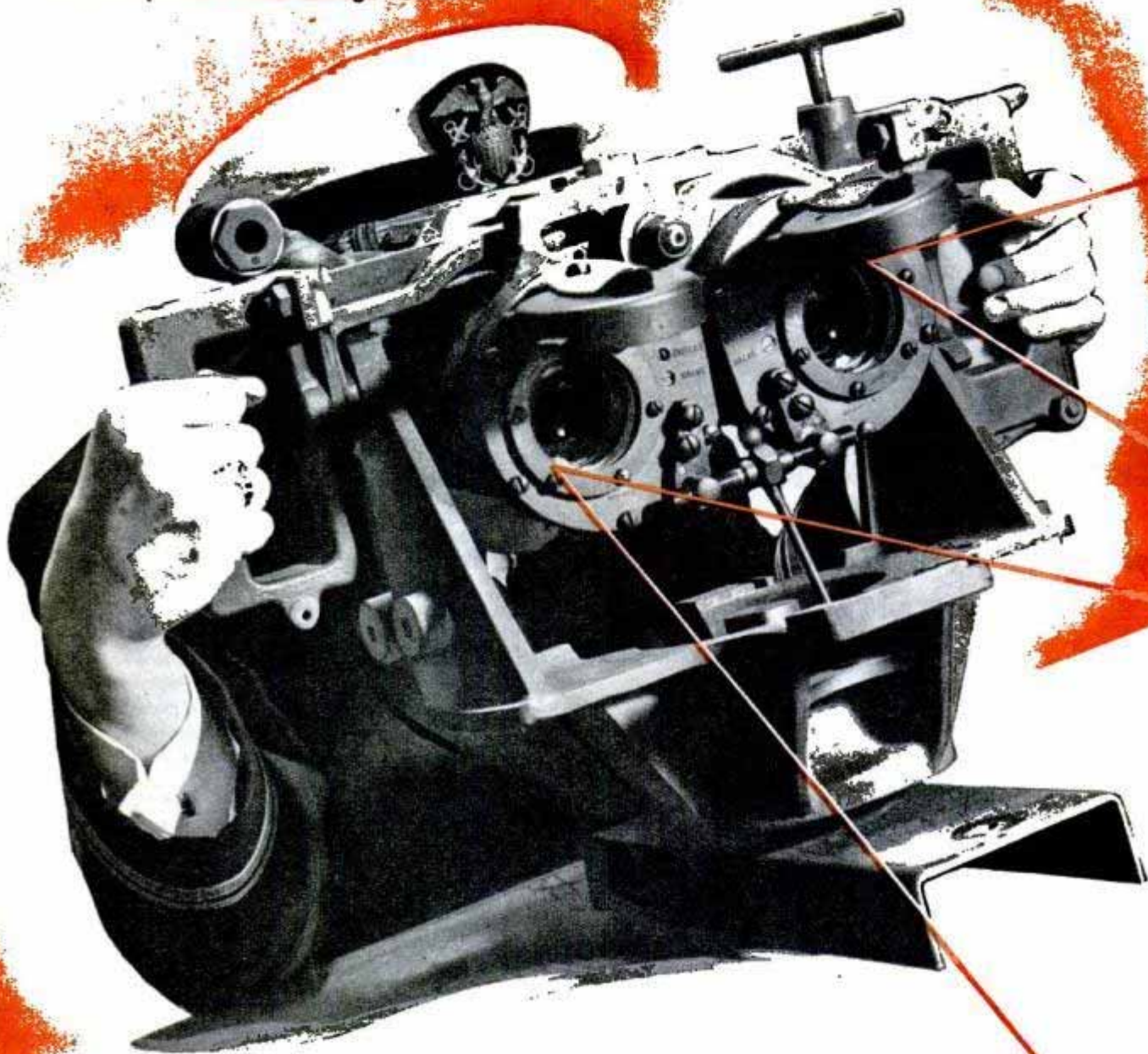
In England builders are using modified prefabrication to speed house construction. A skeleton of steel pipe is raised first, above, and mobile cranes lower concrete wall panels, delivered from the factory, into place in frames. Interlocking joints of the panels form a cavity which is filled with liquid concrete, left, to make a solid wall containing windows and doors



Sections forming the roof trusses, above right, are assembled on the ground and then the entire roof frame, below left, is hoisted into position. Steel-pipe skeleton then is dismantled, removed and erected again on another foundation. Wall panels are available in a variety of shapes adaptable to attractive small house design



Immune to shock from exploding depth charges, submarine binoculars provide sharp vision even through rain



By John R. Kinsey

Clearer VIEW AHEAD

★

Science is making it easier to see things. Better glass has been developed for lenses. And chemical "over-coats" make the lenses reflection-free

★

YOU'RE scooting down the highway in your car on a nice clear day. Your windshield is clean, yet you have to duck your head from time to time to dodge light reflections in order to see well.

Suddenly it starts to rain and your windshield wiper begins spreading a thin layer of water across the glass surface. Immediately you can see much better.

What happens is that the film of water makes the windshield more "transparent" by letting through about two percent more light and reducing the amount of reflection.

Science today is applying this principle to lenses for spectacles, cameras, movie projectors, binoculars and telescopes. But instead of water a chemical coating is used that stays put.

The results are amazing. By adding a four-millionth-inch invisible film of me-

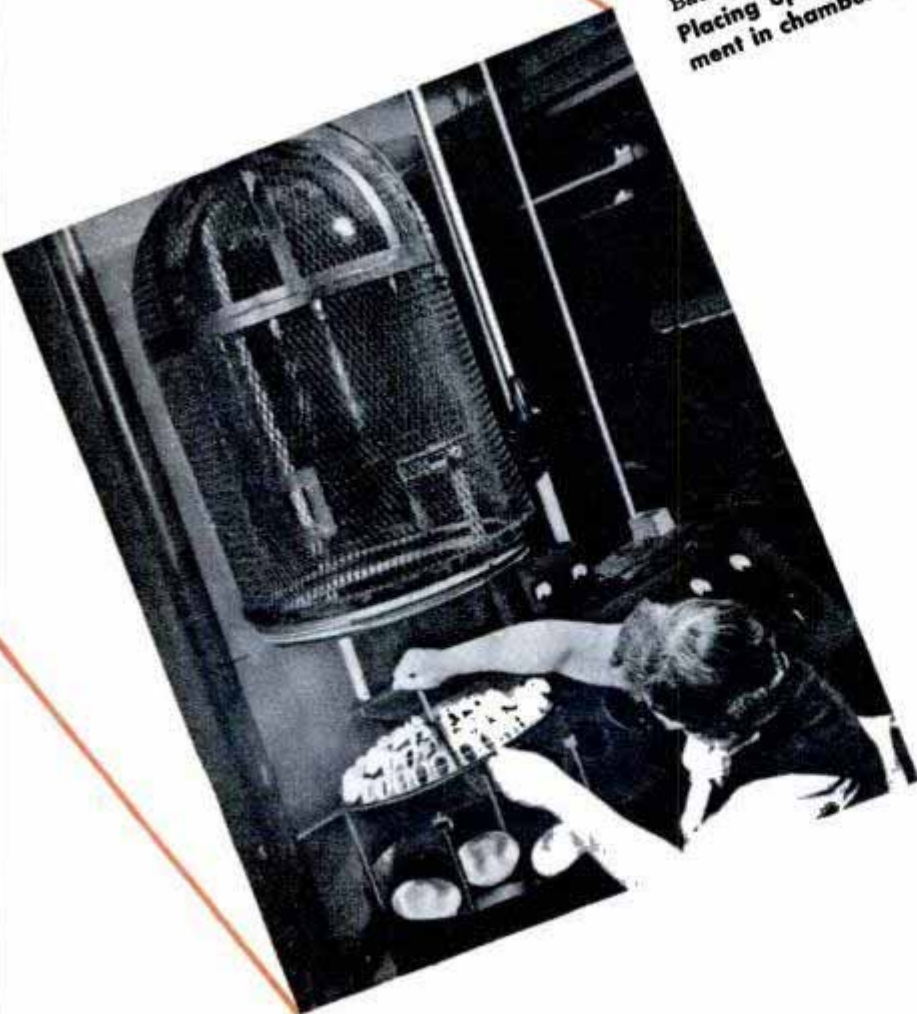
tallic fluoride—so thin it would take 4000 coats to equal a hair's breadth—camera lenses produce sharper photographs, movie projector lenses step up illumination 15 to 30 percent, spectacle lenses eliminate 80 percent of all reflections.

This, however, is only one of many improvements in optics. Better sunglasses are being made. Glare-removing visors are available for automobiles. A heat-absorbing, color-transmitting glass for projectors and floodlights improves color pictures and provides cooler working conditions for motion picture and television actors. A "sight checking machine" accurately measures factory workers' vision and establishes what jobs they are best fitted for. Advances also have been made in contact lenses that fit under a person's eyelids to take the place of glasses.

But of all the develop-



Bausch & Lomb photos
Placing optical parts on racks (above) for chemical treatment in chamber (left) which will make them reflection-free



ments, the chemical coating process promises the most diversified benefits. For example, in addition to present uses, glass manufacturers predict that as soon as it is economical the reflection "killer" will be applied to auto windshields, framed pictures and windows for stores, trains, busses, cars, buildings and homes.

The history of chemical "overcoats" for lenses goes back as far as 1852 to Grove's work on cathodic sputtering of metals in a vacuum. But a more tangible step was taken in 1892 when H. Dennis Taylor, British lens designer, discovered that certain types of photographic lenses were actually "faster" when tarnished through age than when newly polished.

In 1936 John Strong of California Institute of Technology demonstrated that a coating of metallic fluoride deposited on an optical surface reduced the amount of light reflected from



From a 379-pound piece of optical glass was produced a prism for an immense telescope at Puebla, Mexico, observatory. Below, new sunglasses absorb glare and dangerous light rays

the surface and increased the transmission by that amount.

Two years later C. H. Cartwright and A. F. Turner, while doing research work at Massachusetts Institute of Technology, developed this process further, finding more materials to use and pointing out the relationship between the effectiveness and the thickness of the film.

The first commercial application of the antireflection coatings came in 1939 when the Bausch & Lomb Optical Company coated projection lenses in many movie theaters throughout the nation for the first showing of the Technicolor production, "Gone With the Wind." This application of the chemical coating to projector lenses increased "on the screen" illumination about 30 percent and at the same time heightened the image contrast to produce the "snap" for which photographers are constantly striving.

During the war great improvements were made in controlling the thickness of reflection-reducing coatings and in increasing their durability. The microscopically thin film applied to lenses today is virtually as tough as the glass itself. It is as hard but no harder than the glass, which means that both the glass and the coating are subject to scratching.

Metallic fluoride is applied to lenses in vapor form under high vacuum. After

being thoroughly cleaned in detergents, chemicals and distilled water and spun dry in a centrifuge, the lenses are placed in a specially designed jig which holds them by the edges. Then the jig is placed in an

American Optical Co. photo



evaporator from which air is pumped to create a vacuum. The metallic fluoride, heated electrically to a temperature between 2700 and 2800 degrees Fahrenheit, turns into vapor which attaches itself to the lenses.

In some parts of the country you can buy "reflection-cured" glasses for about \$4.50 above the regular price. Or you can have old glasses treated for \$6.

If you talk to someone whose glasses have this coating, you'll never have any trouble seeing his eyes clearly. Undoubtedly you've had the annoying experience of chatting with a friend whose eyes at times were almost completely obscured by reflections dancing on his glasses. If you wear coated glasses, you'll no longer be bothered by "ghost images" because the treated lenses will reduce the brightness of the reflections.

The amount of light reflected from ordinary lenses is approximately eight percent; from properly coated lenses the reflection is less than three percent.

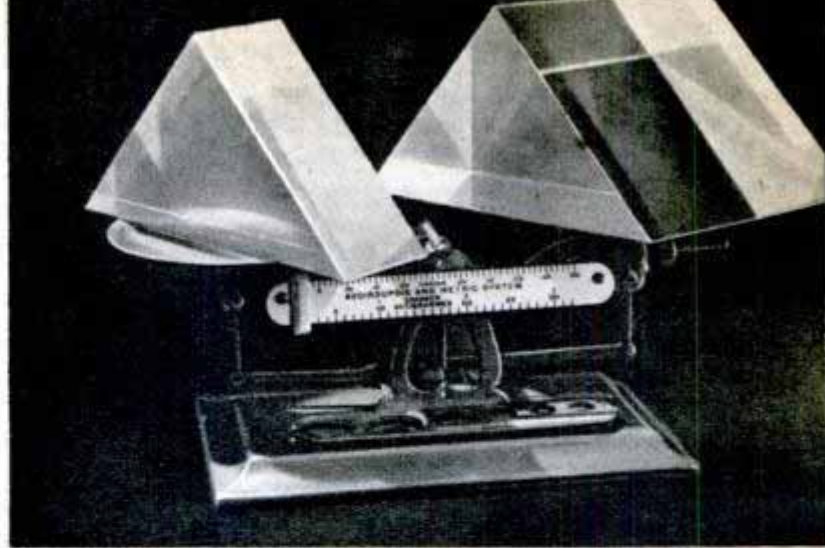
Since only two independent lenses are involved in spectacles, the increase in light transmission that results from reflection-reducing treatment obviously is a minor thing compared to the improvement that occurs in complex optical systems equipped with six or eight lenses. In such applications, coated lenses increase light transmission by 50 percent or more.

In World War II the coating process was a valuable fighting tool. Gun sights and range finders on tanks were treated to combat desert reflections. Binoculars used aboard ships were made reflection-free. By D-day all types of military optics had been given this protection.

To improve the efficiency of aerial cameras and flyers' sun glasses, Bausch & Lomb developed a process of applying a thin coating of stainless steel to serve as a shield against intense sunlight. For cameras, the coating is deposited on a special filter glass in front of the lens. Hot spots thus are eliminated and the resulting negative has uniform density. When applied in various thicknesses to sunglasses, the stainless steel coating enables the flyer to enjoy comfortable vision while looking directly at, or just off the edge of, the sun.

As mentioned earlier, metallic fluoride treatment of lenses for movie projectors adds greatly to the clarity and illumination of objects shown on a screen. A second development has further improved projection of pictures, particularly color pictures.

A new heat-absorbing, color-transmitting glass developed by the American Optical Company makes possible not only better projection of color pictures but also cooler working conditions.



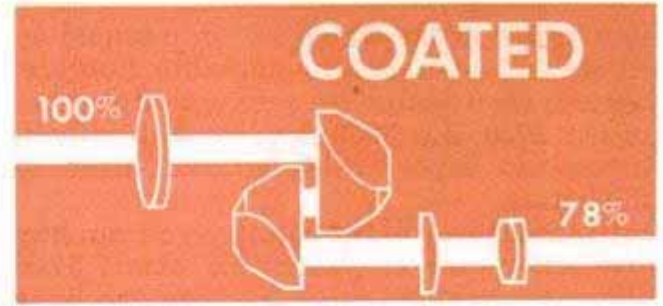
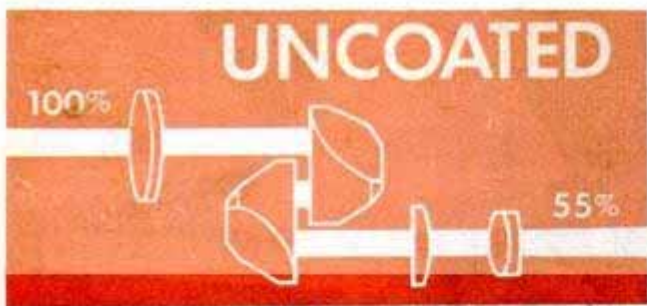
Plastic (right), weighing no more than piece of glass half its size, is used for optical elements in aircraft



Polaroid Corp. photos

Parts for some telescopes are made of plastic, as the spherical mirror (above) and the reflector below (rear). In front of the reflector is a gun-sight part





A lot of light is reflected by ordinary lenses, resulting in limited vision through spectacles and obscured photographs by some cameras. But by coating lenses with invisible metallic fluoride the amount of light lost by reflection is cut. Diagram above shows coated lenses admit 78 percent of light, uncoated only 55 percent



Photographers often blame themselves for fuzzy pictures when the trouble sometimes is a lens reflecting too much light. Look at the reflection in the lens (left) and the absence of reflection in the chemically treated lens (right). Then observe the photos below, taken by an untreated lens (left) and a coated lens (right)



When used as a heat screen in a projector, the new glass permits the projection of motion and still pictures in their original colors, with the result that pictures reproduced on the screen have the true colors of the original scene.

At the same time, the glass absorbs heat emitted by the light source, protecting films and slides against damage or burning. This insulating property enables film

editors and educators to study a specific projected scene by stopping the projector and relying on the glass to protect the film.

Another use for the glass is in spotlights and floodlights as a heat screen to protect actors against scorching heat generated by the powerful lights. Approximately 90 percent of the present almost unendurable heat is absorbed by the glass.

Dr. E. D. Tillyer, American Optical re-

search director, predicts the glass will make possible improved, safe color projection on an extended scale in homes, schools, theaters and stores. As a result of the glass, he believes projection of films, slides, printed works and color reproductions of art will become as common in schools and homes as radio broadcasts.

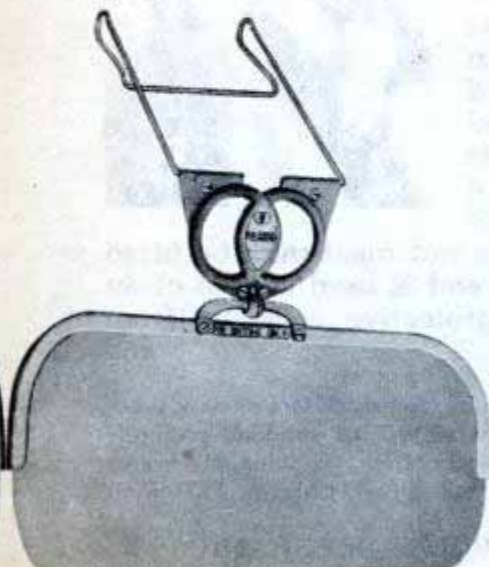
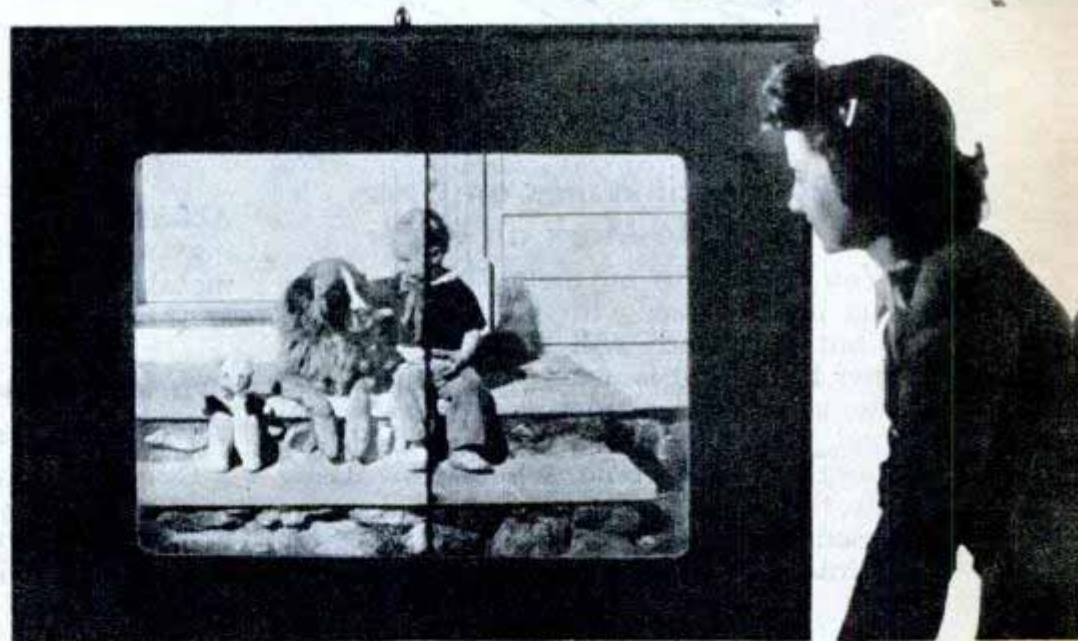
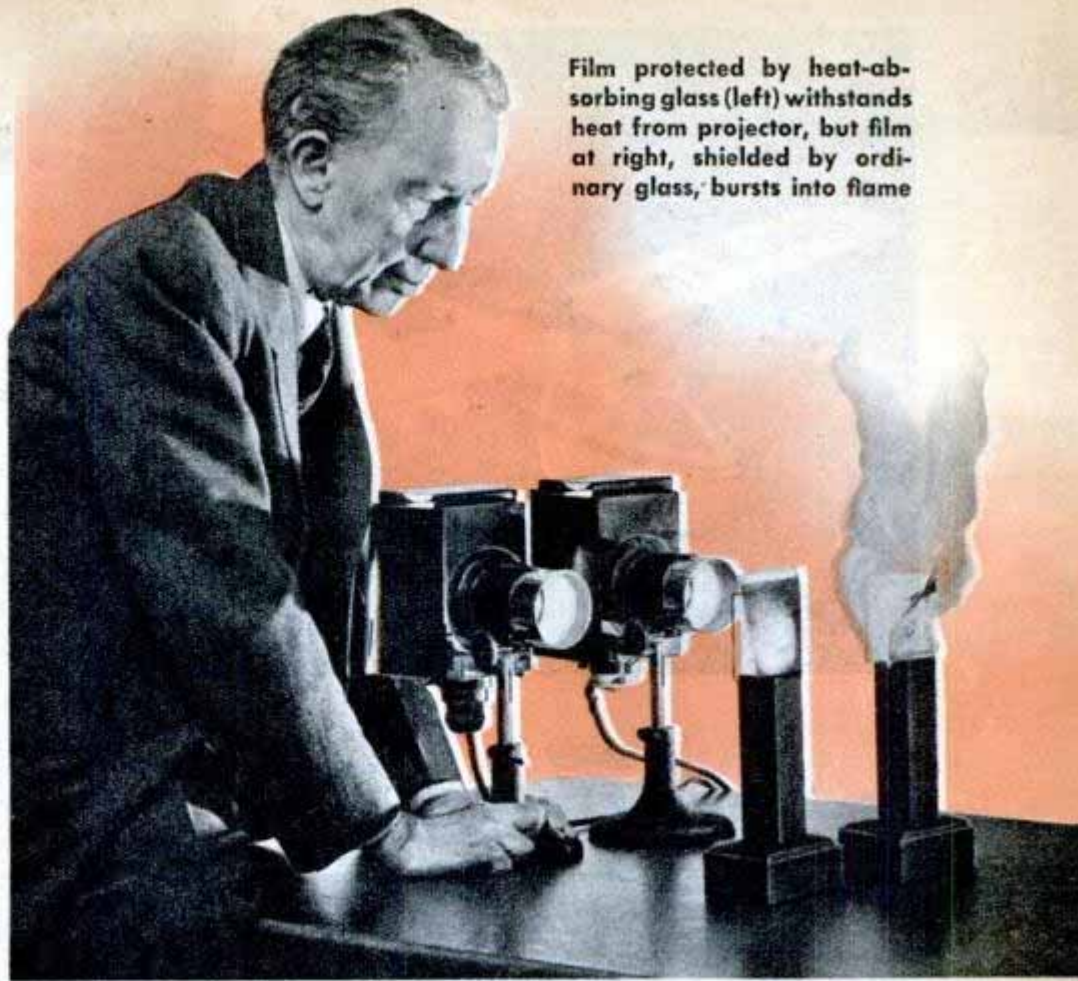
The new glass absorbs approximately 90 percent of infrared (heat) radiations and transmits about 85 to 90 percent of the light. It transmits colors accurately, is chemically stable, resists weathering without requiring a surface treatment, and can be molded, ground, polished and fabricated like ordinary glass. It is formed from carefully balanced proportions of phosphorus, aluminum and silicon oxides, supplemented by various conditioning ingredients, together with a ferrous compound as the heat-absorbing agent.

Before the war, most heat screens for color picture projectors were imported from Germany. Today, this new American-made glass is considered superior.

(Continued to page 228)

Left half of scene (right) was projected through improved glass; right half through ordinary glass. Below, Polaroid car visor eliminates sun glare from windshield

Film protected by heat-absorbing glass (left) withstands heat from projector, but film at right, shielded by ordinary glass, bursts into flame





Amphibian Plane Has Large Door In Nose

Greater ground safety and less noise for passengers is claimed for a four-place Republic Seabee amphibian plane, with both propeller and engine mounted above and behind the cabin. The new model also features a full-size nose door for unloading and anchoring, or fishing from within. The landing gear wheel wells have been eliminated. Equipped with a 215-horsepower Franklin engine, it has a range of 560

miles and cruises at 103 miles an hour. About 700 feet is required for water landings and less than 400 on land. The all-metal Seabee is 28 feet long and has a wing spread of 37 feet 8 inches.



Carbide Pencil Writes on Glass But Leaves No Mark on Paper

You can write on metal, glass or any other hard surface with an automatic pencil but the "lead" will leave no mark on paper because it is made of cemented carbide, a material almost as hard as a diamond. The Carboloy "lead" is made by squeezing the carbide, while in a plastic state, through a die. A silicon carbide stone is used to sharpen the point because it will cut into a grinding wheel or metal file.



Cracker Removes Nut From Shell Without Crushing Meat

Cracker and sheller are combined in a nut-cracker constructed like a pair of pliers to avoid crushing the nut meat. The nut is cracked between the heavy arms of the cracker and the bladed end is used to cut the shell around the center so that the nut meat may be lifted out. The bladed end is used also to clean the thin inner protective covering from the meat.



Names and addresses of manufacturers of new products featured in this issue will be supplied promptly by the Bureau of Information, Popular Mechanics Magazine, 200 E. Ontario Street, Chicago 11, Illinois



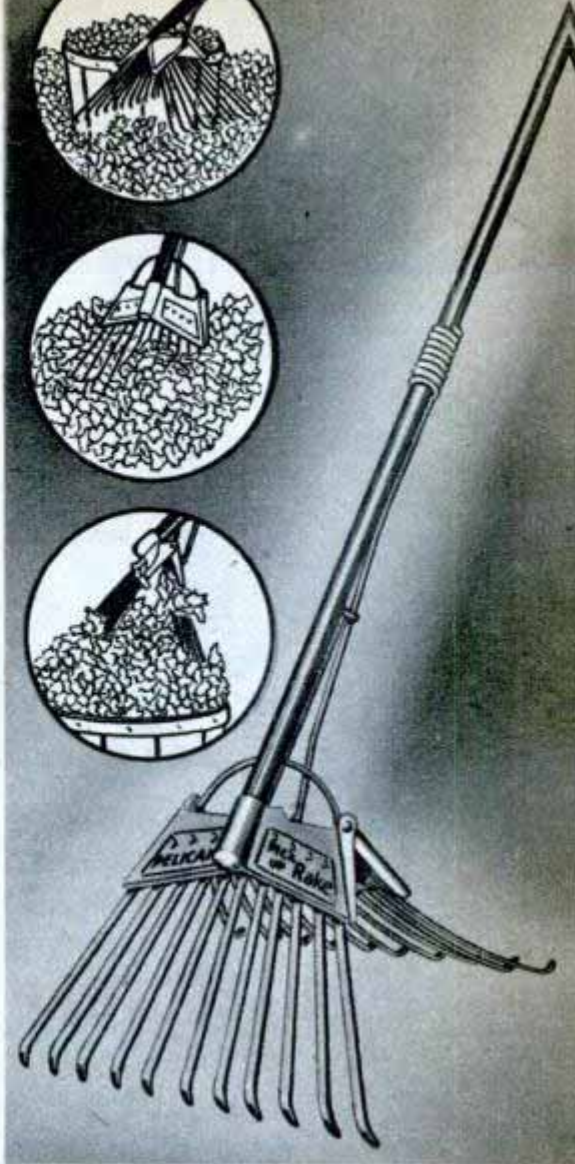
GRASS TRIMMER for tufts missed by mower operates by pushing down handle

WEEDER with a tooth that bites down into the plant easily removes weed roots

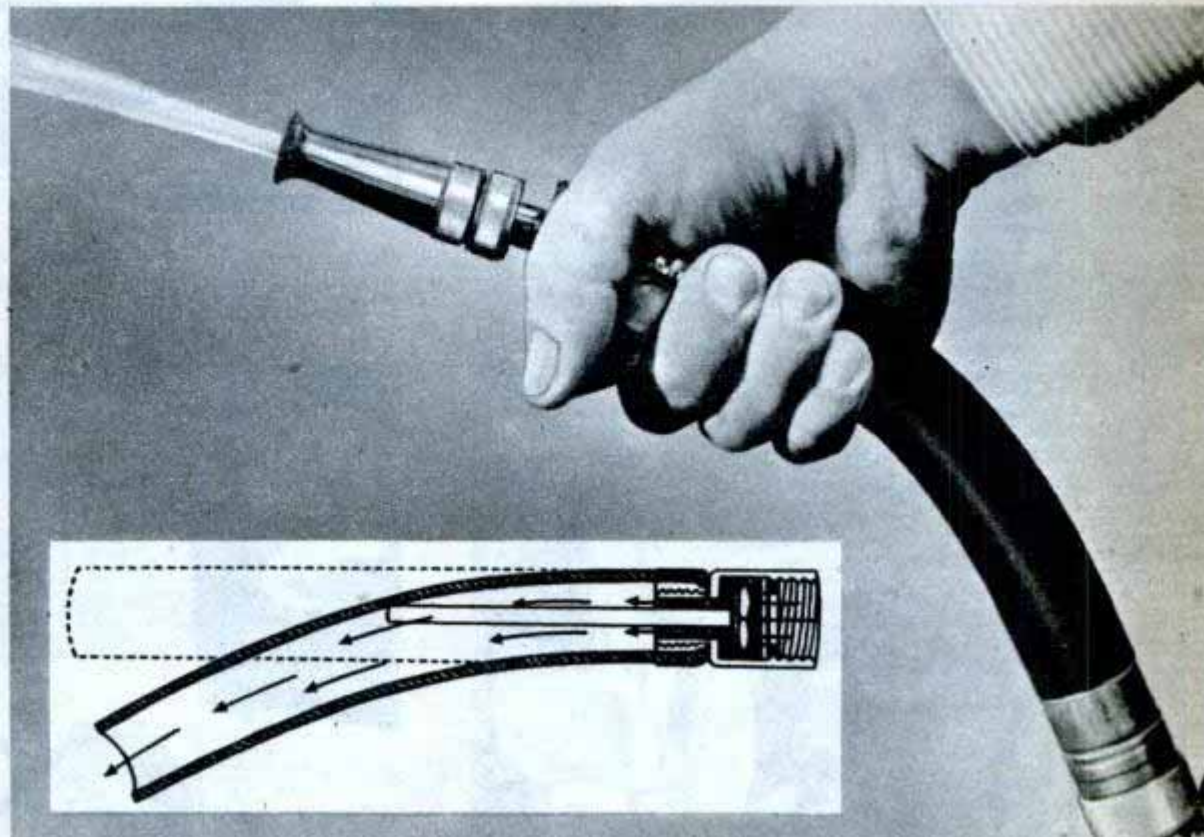


GARDEN TOOL HOLDER saves space and keeps tools conveniently at hand. It stores five tools or can be used to hold brooms, brushes and mops

HOSE NOZZLE regulates the flow of water by the way it is held. A short length of hose which contains a long pin is provided with the nozzle. When the hose is bent, the pin pushes against the inner wall to open the valve and permit passage of water



PICKUP RAKE has teeth that open wide to gather leaves, clamp down on them, then release over basket

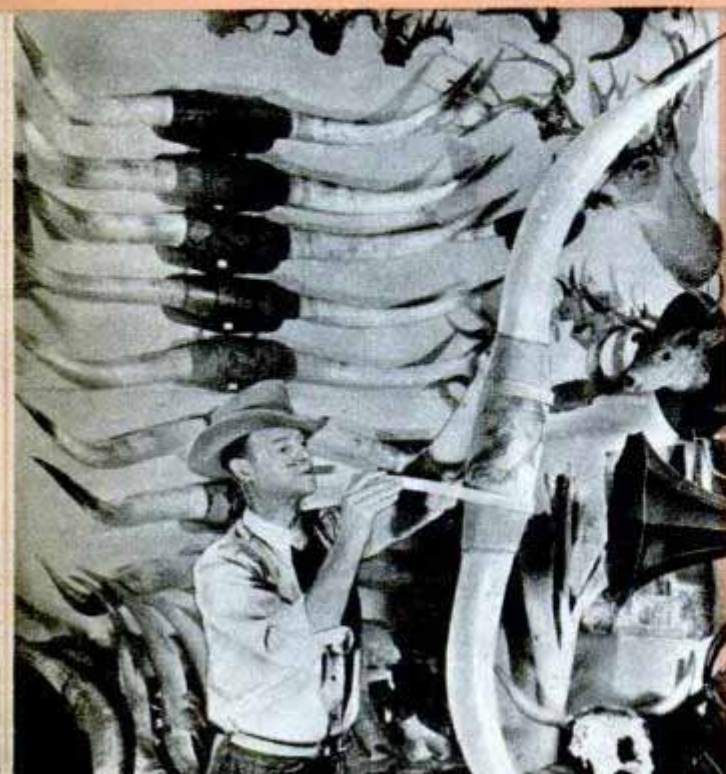




After sandpapering, Mayor Kimbrough polishes the horns on an electric buffer, above

Mantelpiece Longhorns

In Benson, Ariz., Mayor Val Kimbrough continues an old western custom of polishing and mounting steer horns. The horns he uses were taken years ago from Texas longhorns which once roamed western cattle ranges. A good sized pair may span six feet. Modern cowboys still like to hang them over either the entrance or mantel of many of their bunkhouses.



First step is to scrape the weather-beaten surface and uncover the delicate black and white pattern near the tip of the horn



Holes are drilled and the horn attached to a wood core, above, cut the breadth of a steer head. Hand-tooled leather covers the core, below. He adds final decorative leather strips, left



TREE FARMS

Restore an Empire

By Charles F. A. Mann

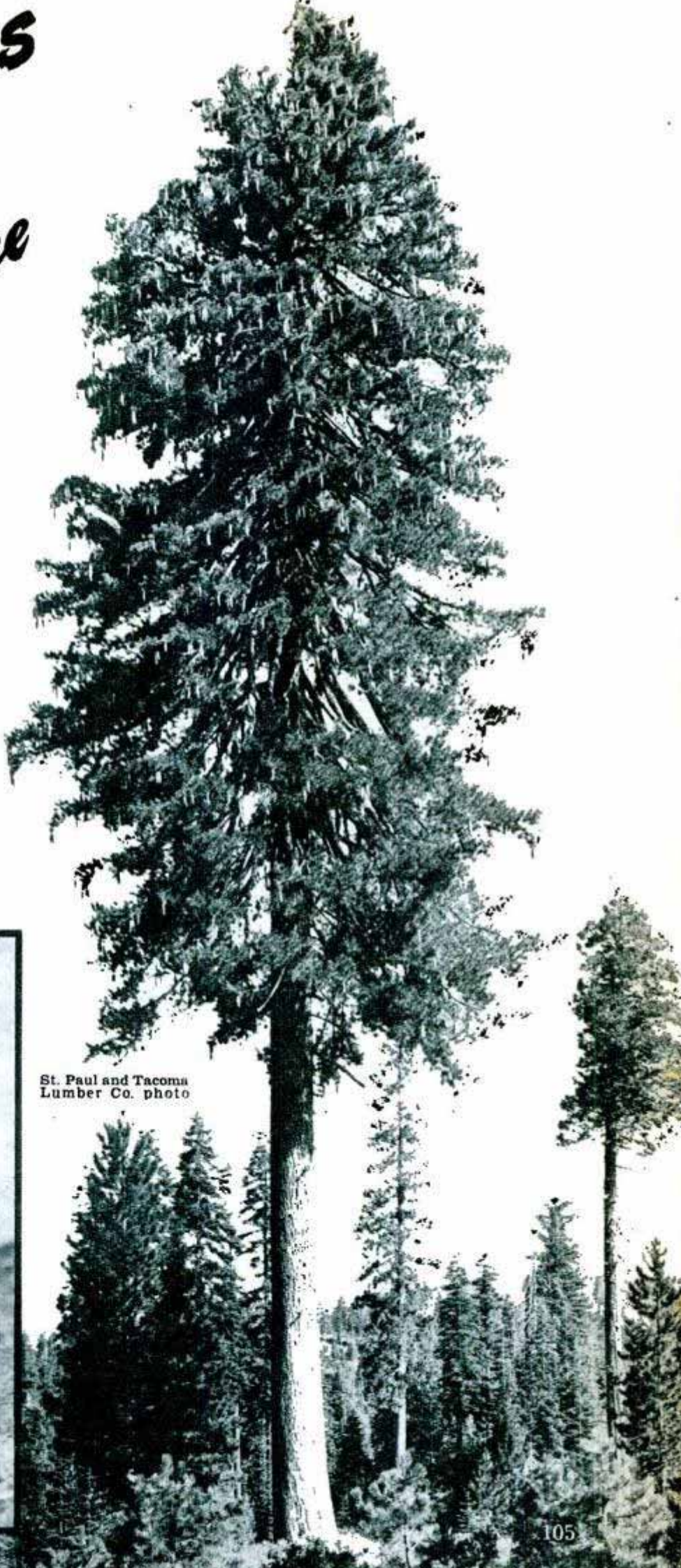
AMERICAN farmers are cultivating a crop as vital to our life as wheat and corn from the plains of the Middle West, as essential to the national economy as coal and iron from the nation's mines. They are turning to the serious business of growing trees as a crop—like corn or wheat.

Modern pioneer farmers are looking beyond their own lives. There will be no harvest of the tree crop, even a preliminary one, for 15 or 20 years. And

Loggers spare sturdy seed pines to perpetuate the forest. Below, a husky youth totes seedlings to the planting area



St. Paul and Tacoma
Lumber Co. photo





↑ A young planter examines delicate root system of a two-year-old seedling
↓ Planting crew works on exposed knoll that has been burned over repeatedly
K. S. Brown photos



the farmer's grandson likely will cut the full crop when it matures—about 80 years from now. The farming of trees requires business vision measured in decades, courage to work in forest fields now in anticipation of a heavy yield a couple of lifetimes later.

Tree farming has evolved as slowly as the growth of its wonderful crop. Before 1900 vast forests stretched across the United States in an unlimited sweep from Maine to Washington and through the South from the Potomac to the Mississippi. Trees were an obstacle to agricultural expansion. Lumber was cheap and apparently inexhaustible. America was housed by wood, the houses were heated by wood, and even cities with their miles of brick exteriors were built of sturdy wood construction beneath the brick. It was the material of furniture and bridges, toothpicks and telegraph poles.

Then came the realization that the nation was digging too deeply into its storehouse of timber, that the old forests were disappearing. The era of iron and steel did little to cut down the waste of the nation's lumber. American industry ate into the iron and steel supply—and demanded still more wood. The storehouse was becoming barren in spots and little was being done to turn the wastelands into crop lands where trees could grow to replenish the nation's timber. Lumber had been cut to the shores of Puget Sound, last stand



Chet Ullin photo

Here in the rolling foothills of mighty Mt. Rainier are four examples of what tree farming can do. The foreground is a logged-off section that has been restocked by seed trees. The middle is an area recently planted by hand, the upper middle a logged-off strip, and on the distant foothills is a stand of old-growth fir

of the mightiest softwood forest known on earth, the fir belt of the Northwest.

In 1903 the late George S. Long, Weyerhaeuser Timber Company's fabled manager, sensed that America might some day be lumber-poor. He decided that huge areas of the Douglas-fir forest in western Washington would be far more useful if the old overripe sections were carefully cleared. He was convinced that with proper slash burning and spacing of seed trees an even heavier crop of new trees could be grown. So he began developing huge areas of hillside land, most of it unfit for anything but trees, into workable blocks lying above the river valleys.

A campaign was inaugurated to tell the public the disastrous effects of over-taxation and the "cut-and-get-out" theory that had made parts of America's original forest an unproductive waste. In those days the new theory was called "conserva-

tion." Later it became "reforestation" and after the first World War it was "sustained yield" or "selective logging"—catchwords that slowly caught the imagination of the American people.

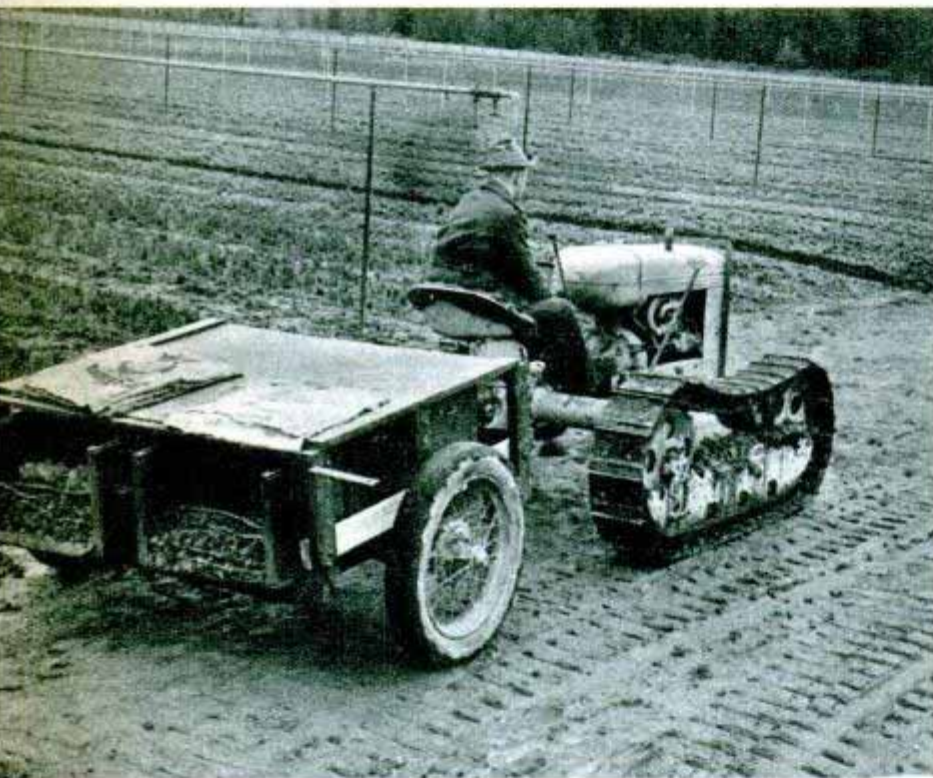
Pine grows rapidly in the South, land is cheap and so are the taxes. It was there that tree farming by individuals started. Then in 1934 the state of Washington noticed the movement. The government realized at long last that its real-estate tax policies had forced hundreds of small loggers and sawmills to redouble their reckless cutting. Rough lumber or "Japanese squares" (logs with but four slabs of bark

This stand of seed-bearing timber was left purposely on the knoll to reseed the logged-off land





Cultivating the seedlings is a delicate job. Trees from this plot are destined for areas where fire has destroyed seed stands



↑ Tomorrow's trees are hauled from the nursery. The sprinkler system is turned on during the dry season in July and August
↓ High school girls riding "weed buggies" keep the plots clean



removed, leaving a square to fit the hold of a ship) were being dumped at ruinously low prices on the world export market. The state, seeing its basic wealth float away in exports, decided to revamp its policies.

Washington passed a law that became a model for the nation—the Reforestation Act of 1934. The law gave a concrete incentive to any honest logger who wanted to keep his logged-off lands in production. The stimulant came in the form of low taxes—\$1 per acre—and a harvest or crop tax of 12½ percent only when the timber is cut, 50 to 100 years from now.

Immediately thousands of acres of logged-off lands went back on the tax rolls. Markers were erected throughout the state. Fire roads built by private companies penetrated hundreds of miles of young forests to connect with national or state forest service roads.

In the 12 years that have followed, over half of the logged-off lands, the wastelands of Washington, were put to work again. Sturdy Douglas firs, a new generation, climbed skyward from 12 to 30 inches each year.

The first actual farm, the great Clemons Tree Farm near Montesano, Wash., was born in 1940. The Weyerhaeuser Timber Company owns 65 percent of the farm. School districts, the state and individuals own the rest. The farm's 130,000 acres blanket a rich rolling hill country near the Chehalis River valley.

But the movement is not confined to large lumber companies. In Snohomish County, Washington, a dozen ranchers with a few acres of land behind their pastures, ideal for a tree crop but worthless for conventional farming, are now "Registered Tree Farmers." Eighty of these small operators have banded together to form the Washington Forest Products Cooperative Association. They plan to cultivate and market their crop of trees just as the cops handle dairy products.

All that was needed to convince the nation that trees can be made to grow like corn, that the annual yield per acre can be reckoned in dollars in the bank, was the magic of the name "tree farm." It has stimulated public interest in the

movement far more than any other factor.

In the short space of three years 10,690,000 acres of American forest land have been registered as American Tree Farms. More than 800 owners in 12 states have gone into the business of growing trees as a commercial crop. Each owner contracts to maintain a specified area for growing trees. He must provide roads and fire protection, prevent damage from disease and insects and cut or harvest the crop to maintain continuous forest growth. These foresters no longer relentlessly seek newer and bigger stands of old-growth timber. They have become farmers instead of loggers.

There are 461,000,000 acres of commercial forest land in the United States. Private industry owns about 202,000,000. Nearly half is in sound private forest management.

In the prolific Douglas-fir belt of western Oregon and Washington about 2,100,000 acres are now included in tree farms. There are 32 industrial forests and 17 small tree farms of about 120 acres each. The average annual production from cautious cutting is 600 to 700 board feet per acre.

There are 52 registered tree farms totaling 2,112,000 acres in the western pine belt that covers a vast area in 11 western states. All these farms are operated on a selective logging basis—only the mature trees are harvested.

But only a relatively small percentage of the nation's timber now grows on tree farms. The movement is young and great areas of forests are still being slashed away on the "cut-and-get-out" theory. Add to this the tremendous drain of the war on the gross visible lumber supply. Then include the vast cuttings made necessary by the housing shortage and the essential commercial building that was dammed up during the war. The total drain paints a sobering picture. Tree farms and a more intelligent harvest of timber by big operators are the only factors that can salvage our lumber reserves.

Although the American tree farms idea jelled only six years ago, it has spread like a forest fire



↑ Despite his age this lad is an expert at "heeling in" a seedling with the aid of a mattock. He plants about 540 trees each day

↓ Second stand of western hemlock and Sitka spruce dwarfs the stumps of the old harvest. These trees are about 50 years old
Stan Spiegle photo





↑ With modern logging practices this heavy forest of Douglas fir will reseed itself naturally and produce a perpetual lumber harvest
 ↓ Seedlings are sorted and packed at a nursery for shipment to a burned-over area. Roots must be kept moist or the plants will die



across the nation. Farm sizes range from 22 acres of Christmas trees near Kalispell, Mont., to the huge industrial tree farm at Klamath Falls, Ore., and a spreading Texas farm that covers nearly 700,000 acres.

Three organizations, the West Coast Lumbermen's Association, the Western Pine Association and the Pacific Northwest Loggers' Association, certify the farms and encourage the owners. Public dedications of new farms are impressive. West Coast schools and colleges are teaching the need for stewardship on the part of every citizen if the program is to be a success.

In the Great Lakes region and the South, tree farming by paper mill operators is a pronounced success even though the rate of growth varies widely. Many operators started too late to make their crop equal their annual consumption—but at least they have started.

Huge new areas now classified as logged-off lands soon will be embraced in the scientific plan. Farmers have distributed literature, exchanged ideas and tabulated statistics. Thousands of individuals are trained in forest-fire fighting. Sportsmen's groups learn the value of fire prevention. The public is being taught the folly of over-taxation and wasted forests. There is a personal interest in fire prevention in our wooded areas.

The end-objective of all tree farms is to grow annually an amount of timber that at least equals the total demands of industry. That objective is expected to be reached in about 15 years.

Tree farming, plus the exploitation of timber formerly considered worthless and the elimination of all waste, will give America an adequate annual supply of timber. No one doubts that tree farming will pay off as a business venture. In 15 years the timber harvest will be worth three times per acre the value of a cotton crop.

Harvesting that mythical crop of "second-growth forest"—the former name for "junior

forest"—has been going on for years. Half the paper, probably this very page, and a lot of pretty fair lumber on the market right now, comes from trees that were seedlings at the time of the gold rush to Alaska in 1899.

Let's visit a typical tree farm where both old and new-growth trees are systematically harvested. Some of the great-grandchildren of the lads in the accompanying photographs may visit the full-grown forest on the farm 100 years from now!

The vast farm of the St. Paul and Tacoma Lumber Company is an example. The company began cutting down trees in the heart of what is now the Allenmore Golf Course in the center of Tacoma, Wash., in 1888. It still is the largest of the "independents" of western Washington and with one possible exception the oldest. Through wise management and foresight the company has some second-growth timber from 50 to 125 feet high which will reach maturity in another 20 years. The farm spreads over some 200,000 acres at the foot of Mt. Rainier between the White River and Nisqually River watersheds. This wild foothill country can be reached by car in 50 minutes from downtown Seattle or Tacoma. Sons and grandsons of workmen who came to the coast in 1888 to work for the company still work and live on the farm.

Goal of the farm's operations is eventually to grow from 125 to 150 million feet of fir annually to balance the company's anticipated cutting. Odd tracts purchased at random are being consolidated with Northern Pacific land grants so they can be managed as an integrated unit.

Roads honeycomb the forests, largely rebuilt from railroad grades that were slashed through the timber. Snags and leftovers have been cut and burned. Some areas where the war rush for high timber left a lot of excellent wood on the ground that was later swept by fire are being relogged for salvage. Gates and markers have been constructed. The company has mapped and indexed all sections as to slope, soil, moisture, wind conditions and other vital factors. Seed blocks—groups of seed trees on high ground spared by the logger—reseed 90 percent of the ground naturally. The other 10 percent, mostly high knolls and hillside areas swept by repeated fires, poses a problem. These sections must be replanted by hand and carefully watched until the young trees cover

AUGUST 1946



Speed is essential in fighting forest fires. These back-pumps fight small blazes in virtually inaccessible places
American Forest Products Industries photos



↑ Standing guard over his second-growth forest, this tree farmer has a tank truck as insurance against fire damage

↓ Fire-control plans contemplate extinguishing small fires with water before they grow to a sweeping curtain of flame





Western Pine Association photo.

Pine grows fast to make tree farming profitable. One year's growth is shown above the hand of this logging superintendent

the ground with their spreading branches to keep the sun from drying out the thin topsoil. The company has had a forester at work on this problem for 20 years.

In areas where natural restocking has been a success, 12 to 30-inch trees are growing, 38 years after the original logging.

The company organized a planting system in 1944 that attracted boys from nearby high schools. They work in groups, 10 or 15 youths to a crew, under a trained foreman. The system has become a model for all other tree farmers and is receiving enthusiastic support from teachers and parents. The U. S. Forest Service can find nothing wrong with the plan.

Seedlings for planting come from a nursery that draws its seed from healthy 16-year-old trees carefully selected as to altitude. Trees that will be grown near sea level must come from sea-level parents, while those destined for the top of a 4500-foot mountain come from an equally high peak. One pound of Douglas-fir seed will produce 30,000 seedlings.

The West Coast Lumbermen's Association tree nursery at Nisqually grows the seedlings. High school girls operating specially designed "weed buggies" do most of the weeding and cultivation. Seedlings are packed 50 to a bundle in moist moss and wrapped in heavy oiled

(Continued to page 240)

Fire swept across this ridge years ago, leaving in its wake only a fringe of timber on the top. From these few trees came all the seeds that reforested the thick slopes. Note the skeleton trunks left by the fire





Jeep "Retriever" Chases Golf Balls

Protected by an enveloping wire netting, an Army jeep has been converted for use in peacetime sports at Camp Hood, Tex. It is used to retrieve golf balls on a driving range. The screens protect the jeep driver and make it unnecessary for golfers to stop practicing while the balls are collected.



Midget Fire Fighter for the Home

Small fires such as might start in a wastebasket can be stopped quickly with a small extinguisher which is nine inches long and weighs only 10 ounces. Its fire quenching chemicals are contained under 90 pounds pressure. It is simple to operate and its charge can be released by turning a hand screw at one end. About eight small fires can be extinguished before refilling.

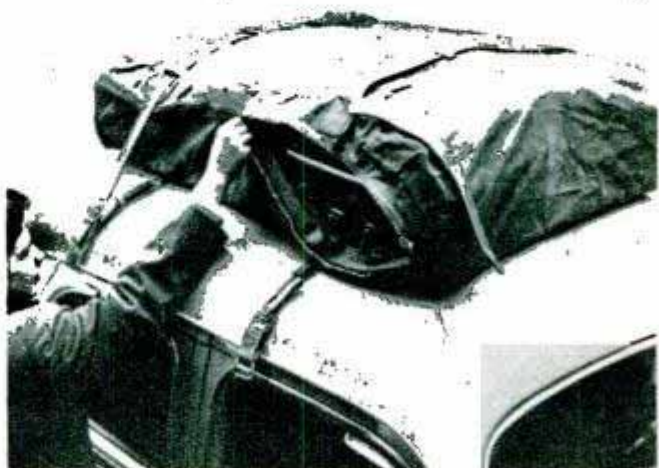
Radiant Energy Roasts Coffee

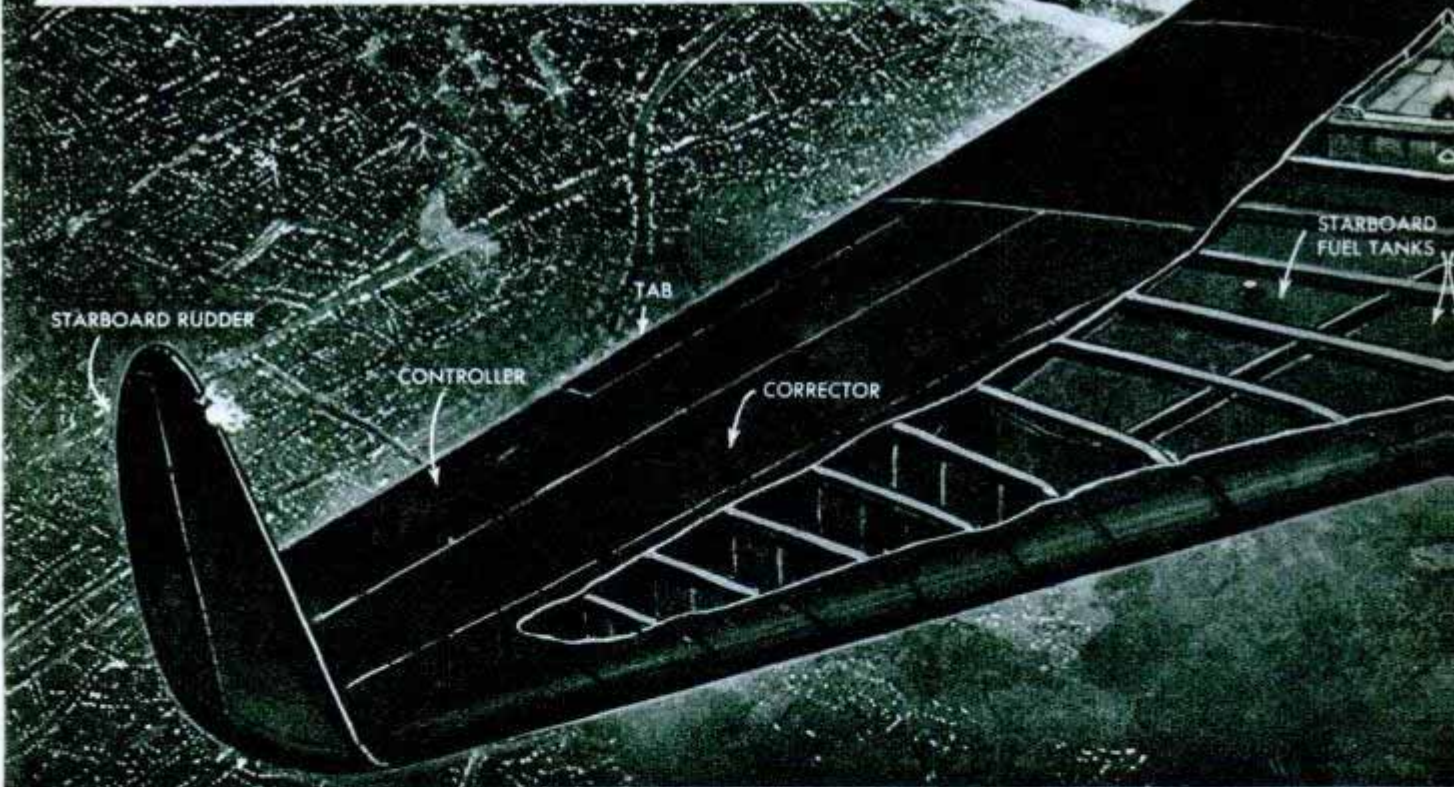
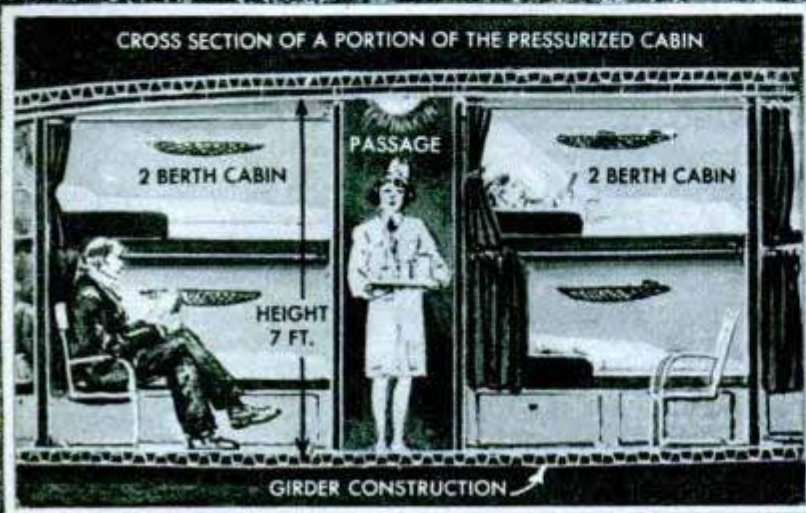
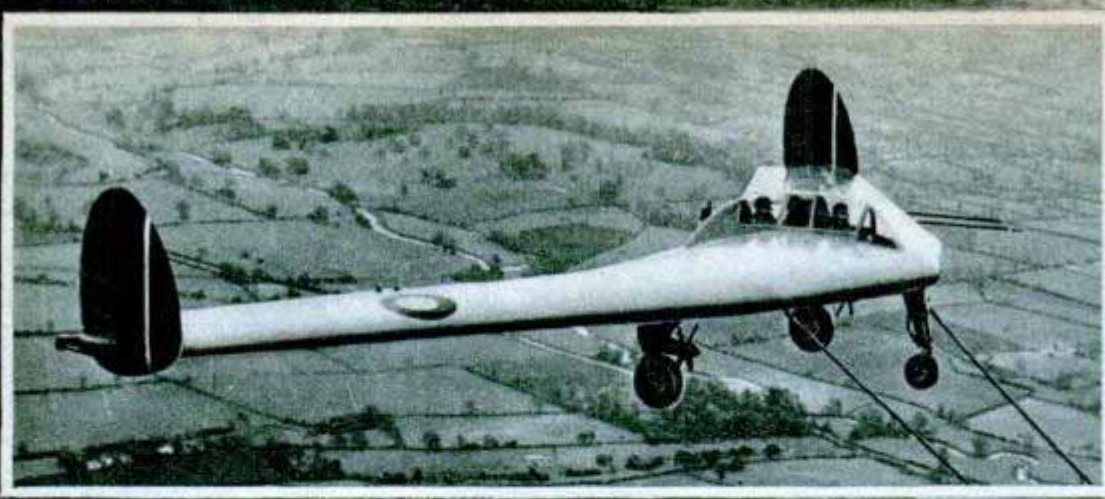
You may get your coffee fresh-roasted at the corner grocery store while you wait. Radiant energy produced by radio waves, already used to cook hamburgers and hot dogs in coin operated vending machines, will roast coffee completely and uniformly in just two minutes in an electronic roaster devised by August S. Torres of Medellin, Colombia, South America. The ordinary roasting process takes about 15 minutes.



Car-Top Bag Stores Extra Luggage

Extra luggage space for vacation-bent travelers is provided in a new luggage carrier that is attached to the top of the car. The carrier is a waterproof, dustproof canvas bag that closes with a slide fastener along one side. It can be fastened easily to any size coach or sedan and will not mar the finish of the car, according to the manufacturer. When not in use, the bag can be removed and packed into a small box.



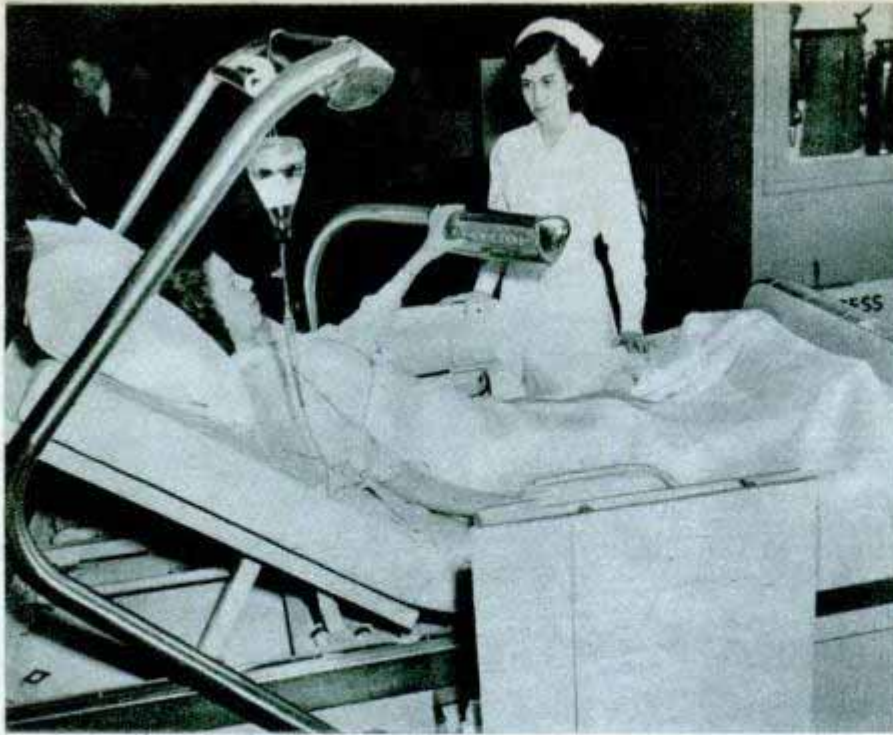


Transatlantic Flying Wing

PASSENGERS who want to drop off to sleep in their berths in England and awoken in America the next morning may soon flash across the Atlantic in a British-designed flying wing. The huge V-shaped

plane will be jet-propelled and will carry from 24 to 28 passengers, part of a pay load of 29,000 pounds. Top speed will be more than 400 miles an hour. Both the cabin and the cargo compartments will be pressur-

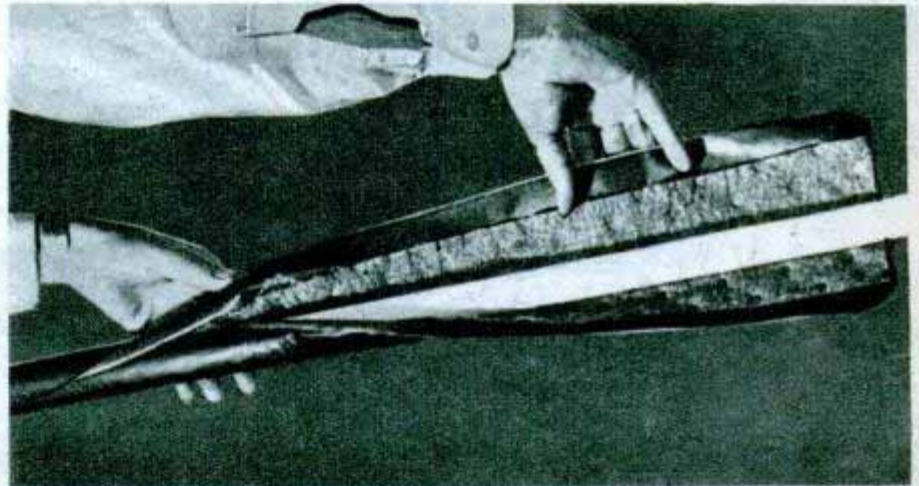
Push-Button Bed Provides Self-Nursing Service for Hospital Patients



If a hospital patient has the use of his arms, he can accomplish most routine nursing duties for himself with a push-button-controlled self-service bed. One set of push-button controls is located on an arm extending over the bed. By pushing them the patient can raise or lower the head of the bed, adjust the overhead trapeze bar and its ultraviolet lamp or raise or lower the built-in toilet and wash basin. A second control board at the foot of the bed can be operated by the nurse. The bed was invented by Dr. Marvel Beem of Los Angeles.

Adhesive Edges Hold "Sweat Shirts" Around Perspiring Water Pipes

Condensation of vapor on exposed cold water pipes, which causes them to sweat and drip during humid weather, can be stopped by covering them with an insulating jacket held to the pipe by adhesive edges. The blanket of thick, pliable insulating material has a moisture-proof outer backing which is a positive vapor barrier. It can be cut to fit with a pair of scissors.

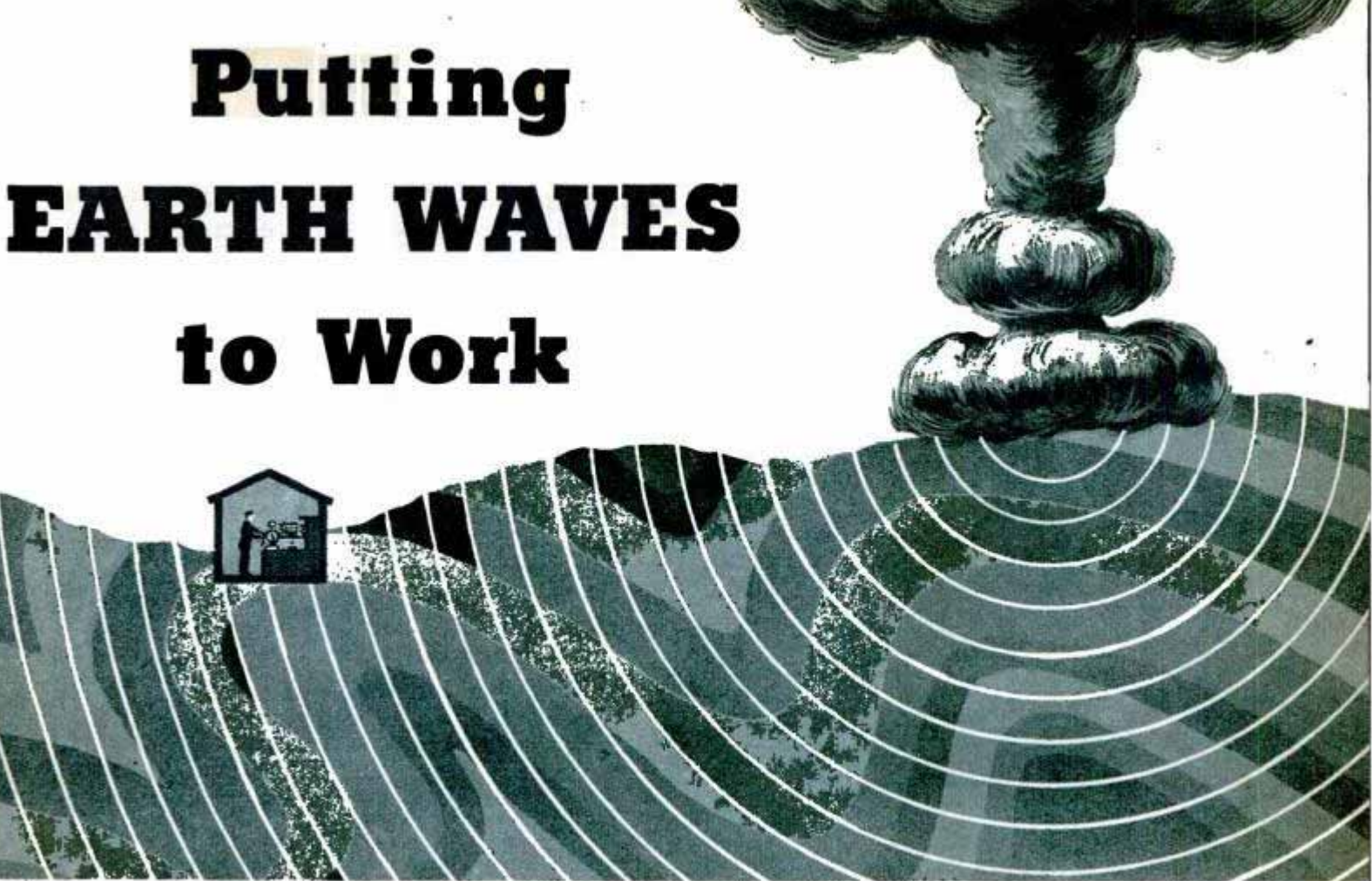


Houses Built of Aircraft Scrap Metal Ease Shortage in England



Four British aircraft companies are answering the challenge of England's housing shortage with aluminum homes. The plants convert scrap aluminum, much of it from crashed warplanes, into bungalows at the rate of one every three minutes. Each house is built in three prefabricated sections and it can be erected in only 45 minutes after its delivery at the homesite. The kitchen includes aluminum built-in cupboards, a modern gas range and a boiler for washing.

Putting EARTH WAVES to Work



Artist's sketch of atom-bomb tests in New Mexico interprets findings of seismological observatory (left). Downward concussion of bomb created earth waves (white circular lines). Wavy patterns represent rock strata

By Nathaniel Nitkin

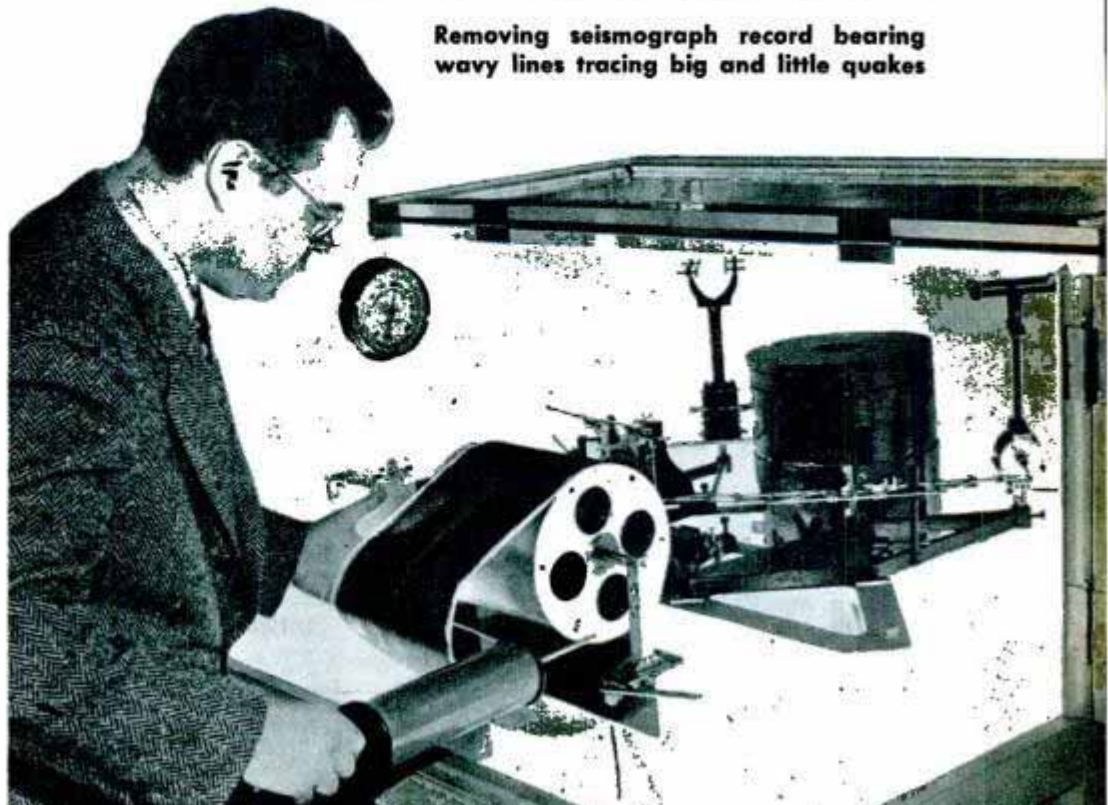
THE JULY 6, 1945, test in Jordana del Muerto, New Mexico, accomplished more than to introduce the atom bomb. It provided seismologists—students of earth movements—with a controlled laboratory to test their theories of earth waves. Many old ideas went overboard. The results led to the discovery that earth waves come in two types: coupled waves which were predicted in 1939 by Dr. L. Don Leet of Harvard University, and hydrodynamic waves.

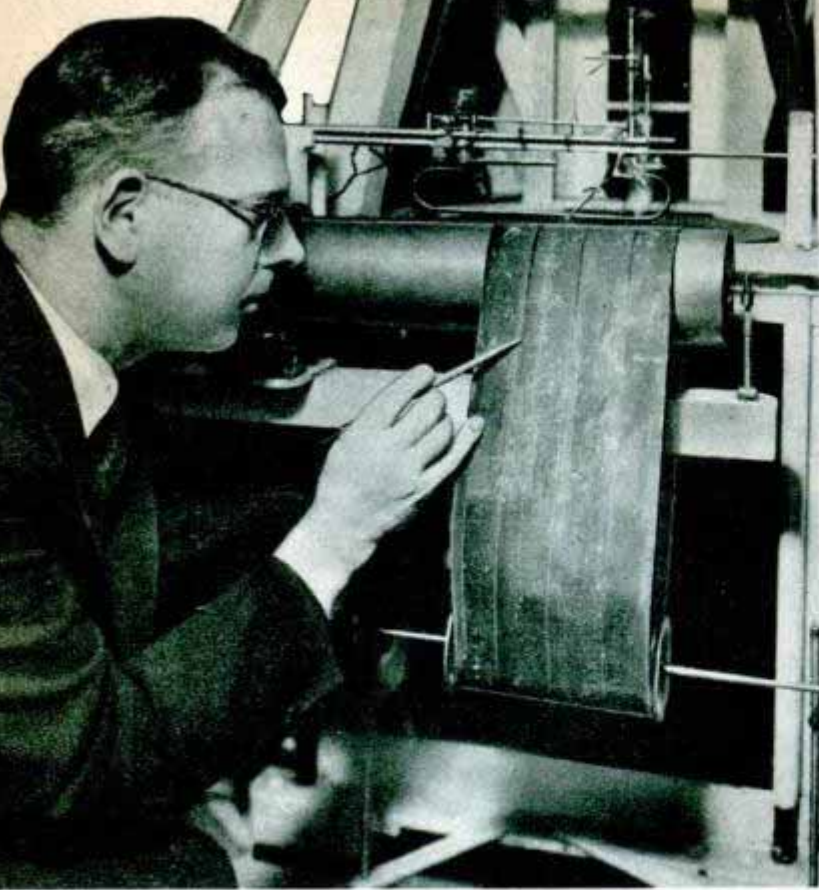
Whenever there is a disturbance on or below the earth's crust such as an earthquake, hurricane or explosion of dynamite, energy generates earth waves. They rush through the earth's strata at terrific speed, often following the warped contours of bedrock. Seismographs at scattered stations record these tremors. There is always a time interval between arrival of pre-

liminary and main waves at the seismograph. However, the first and second waves are sometimes reflected and refracted so that they are superimposed on the graph before the main waves arrive. Using a precision device to time incoming waves, scientists can locate the center of disturbance as accurately as radar.

Here lies a way of harnessing earth

Removing seismograph record bearing wavy lines tracing big and little quakes





American Museum of Natural History photo
Zigzag lines recorded during ocean bed earthquake
in 1934 were similar to graph of April tidal wave

waves, just as we have utilized electromagnetic waves in radio and other electronic instruments. Major earth waves are not necessary. Microseisms—small waves—will do just as well.

For instance, a hurricane originates off the Cape Verde coast of equatorial Africa. As the storm moves and gathers strength, it transmutes some of its violent energy into earth waves which race through the ocean floor to seismological stations. Man learns of the hurricane when it is still 1000 miles away and he traces its course. By the time the storm hits shipping lanes or inhabited areas, he is prepared for it.

Perhaps a better knowledge of coupled and hydrodynamic waves might have forewarned Hawaii and the west coast before the April 1946 tidal waves hit them. As a matter of fact, the U. S. Coast and Geodetic Survey had an advance warning of the sub-

marine earthquake in the Aleutian deep but it could not predict such destructive tidal waves accurately.

Hurricane warning is not the only possible use of microseisms. Geologists use portable seismographs in prospecting for oil and minerals. A few miles away a scouting party detonates dynamite, creating little waves. Since the geological structure and composition of rocks write their own record on the seismograph, the scientific prospectors know at once whether they struck a mother lode or a dud. In the same way, bedrock can be mapped for whatever engineering structure is planned for a site.

Little is known about earth waves, since most of our knowledge has come through the study of earthquakes. Though there are more than 10,000 minor earthquakes per year, they are bad subjects for scientific research since they cannot be controlled. The New Mexico atom-bomb test was the most important laboratory experiment in this field. Previously, controlled tests were confined to rock quarry blasts.

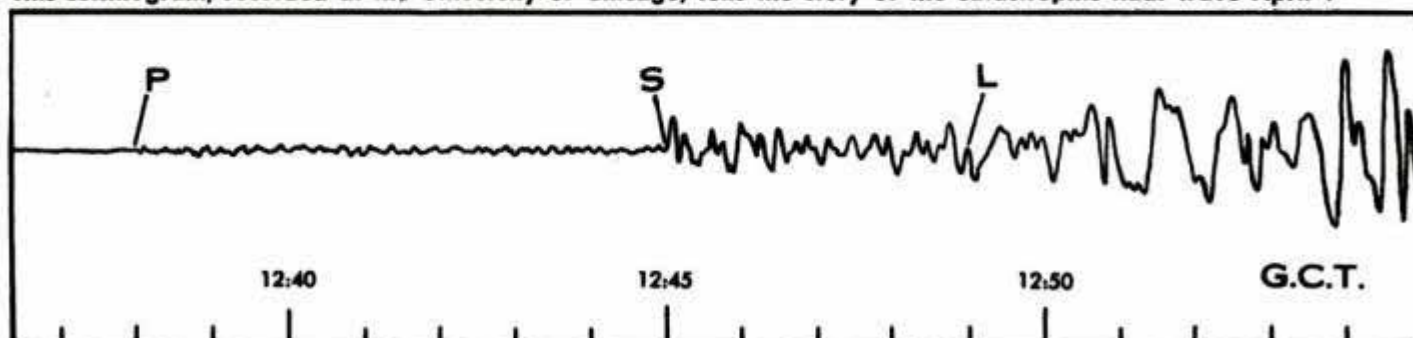
A seismological observatory looks like a small one-car garage. The basement houses the recording instruments. In a larger station like the Harvard University Oak Ridge, there is a lower level for the sensitive parts of the seismographs. They rest on a concrete pier anchored to bedrock. The pier is insulated from the building so that the house vibrations do not affect it. Observatory walls and roof are banked and insulated so that atmospheric conditions do not affect the instruments.

Since earth waves are mostly directional, the standard station has seismographs arranged at right angles to each other. In this manner, no tremor passes the station without etching its record on the graphs.

The principle of the seismograph is easy to grasp. Make a model gallows without the noose and set it on any table. Attach a long string and weight—a pendulum—to the model arm, so that it hangs loosely. In the standard seismograph, the pendulum is the so-called steady mass and since, like all pendulums it has an independent movement, it is steadied by a damping device.

Now strike the side of the table horizontally with a hammer or mallet to simulate

This seismogram, recorded at the University of Chicago, tells the story of the catastrophic tidal wave April 1



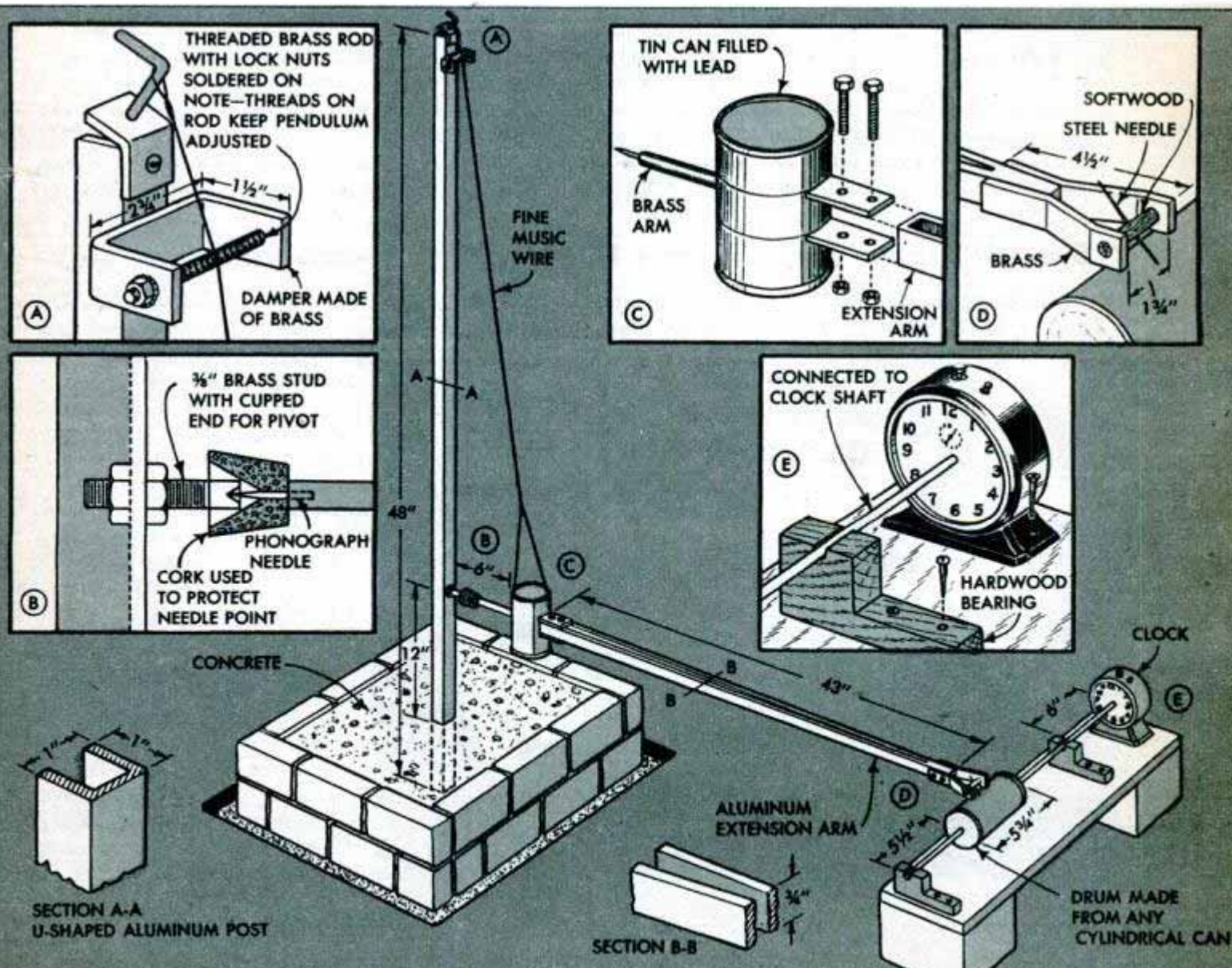
an earthquake. The stationary structure of your model will vibrate but your pendulum will not, especially if it is damped. An arm extending from the structure to the pendulum without touching it will magnify the vibrations. This is the basic principle of the intricate seismograph.

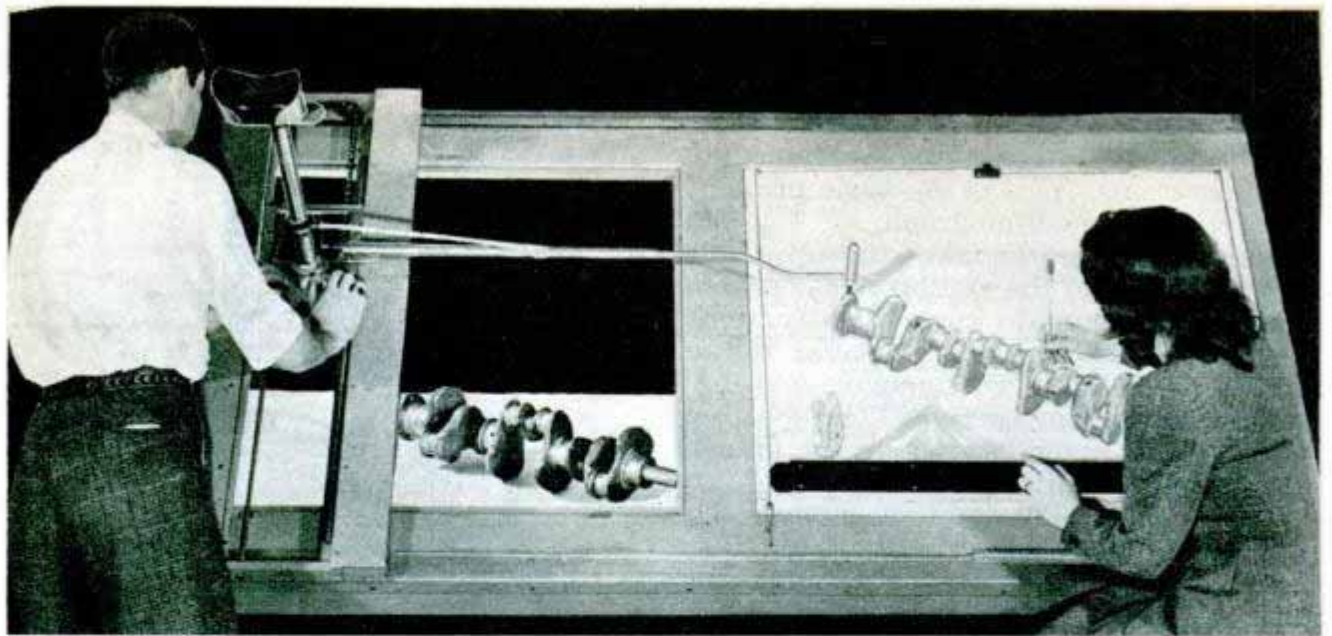
Suppose an earthquake stirs up a tidal wave. In one of the station seismographs, the needle begins to move slightly, registering the first or primary wave. It continues its small nervous movements until the secondary wave arrives. The speeds of primary and secondary waves are known; the primary is entirely directional and faster than the longitudinal secondary. The difference in time interval between them tells the distance of the disturbance from the station. Then the main wave hits the pier and the needle becomes violent. The direction of earth wave plus the time lapse between the primary and secondary waves locate the center of the earth's misbehavior.

A new type of seismograph is being built to record small earth waves such as those set in motion by hurricanes, typhoons and large storm areas. Once out of experimental stage, it will locate these violent storms long before they strike inhabited centers, saving many lives and millions of dollars.



Applying lamp black (above) to paper roll for use in a seismograph. Below, essential parts of a home-made seismograph which will trace earthquakes





Time required to make mechanical drawings is greatly reduced by a robot "draftsman" equipped with an electrically operated pencil point. Drawings are made by following the contours of an object or design with cross hairs in a sighting instrument. Each time the operator centers on a

Robot "Draftsman" Saves Time With Electric Pencil

point to be recorded he presses a control button and the pencil makes a dot on the drawing board. Dots are joined later and hand shading is applied, if necessary. Studebaker used drawing instruments of this type to speed the job of launching its 1947 model automobiles.

All-in-One Garden Pest Killer Combats Rusts, Blights and Insects

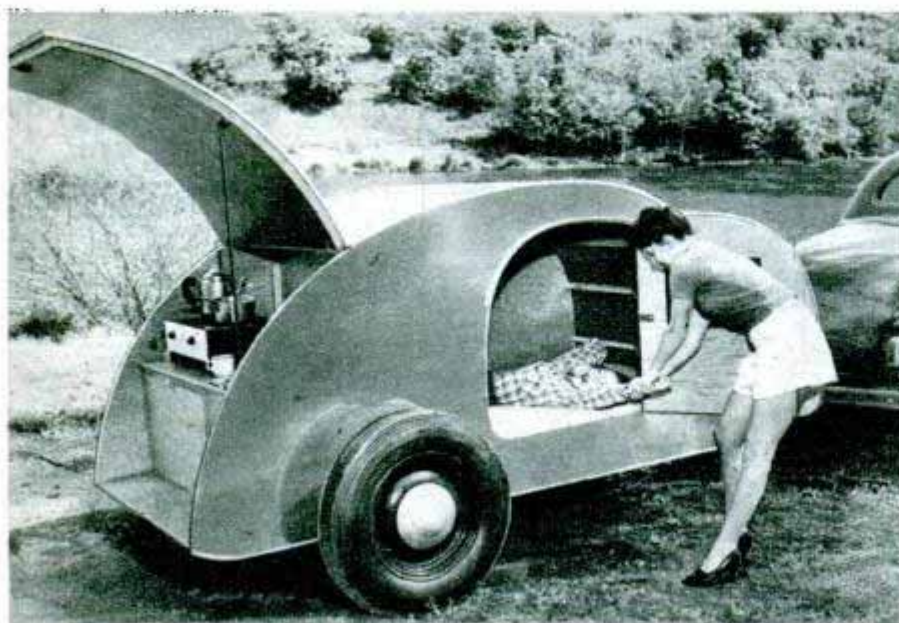
Two-way ammunition for the gardener is supplied with a chemical that kills both insects and such plant pests as rusts, blights and mildews. The mixture, concocted by Du Pont chemists, contains DDT and rotenone to combat insects in addition

to the necessary amounts of fungicides. This new pest control, known as Du Pont Garden Dust, can be applied in dust form or mixed with water and sprayed on plants. Applications are recommended every week or two until 30 days before harvest.

Sleeper Trailer for Two Has Kitchen With Icebox and Gas Stove

Sleeping space for two and a streamlined galley are included in a pleasure trailer that is covered with a sheet aluminum skin.

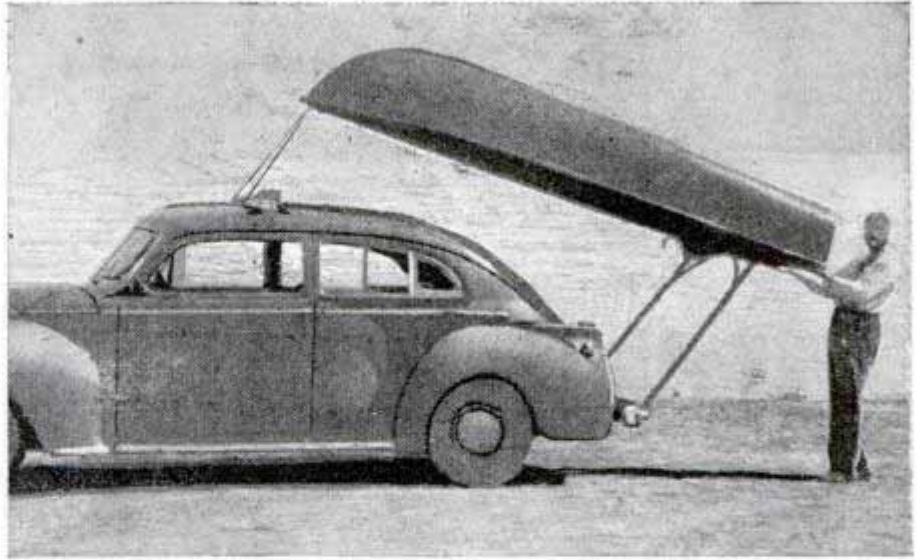
The trailer weighs only 525 pounds. The undercarriage is made of welded steel tubing and is so light that one man can lift it.



Shock absorbers and springs are eliminated through use of individual torque-bar suspension. The inside of the trailer is constructed of plywood and sealed with lacquer to make it dustproof. The sleeping compartment features a full-length innerspring mattress and a built-in hamper for clothing. A section of the roof swings open to reveal the galley with cupboard and drawer space, a 25-pound icebox and a gas stove. Screened windows in the bedroom can be opened from the inside.

Boat Has Carrier Attachment for Hoisting to Top of Car

Makeshift methods of strapping a boat to the top of a car are unnecessary when sportsmen use a new unit that includes both boat and carrier. The boat's molded hull is made of laminated plastic and special fabric. It is 18½ inches deep amidships, has a 52-inch beam and 12-foot gunwales and weighs only 110 pounds. The carrier can be fastened to the rear bumper of any automobile. Hinged supports on the carrier permit the boat to be

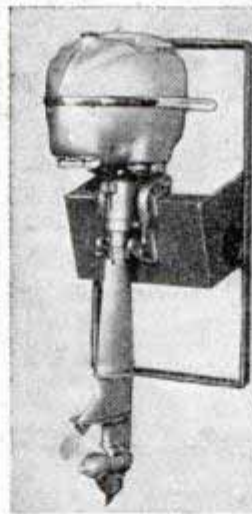
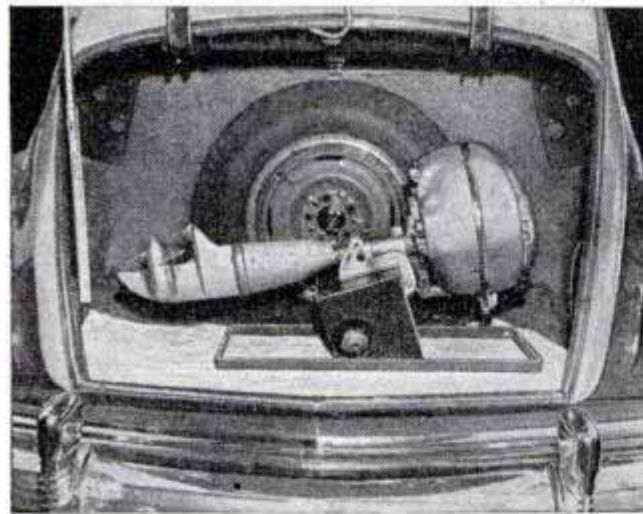


swung completely over after the bow lines are unfastened. The boat can be disconnected from the car and ready for the water

in about 15 seconds. The carrying device does not interfere with use of the car's trunk, doors, windows or rear-view mirror.

Metal Rack Protects Outboard Motor During Storage

Outboard motors can be transported or stored on a rack that guards them against dents, punctured gas tanks or other abuse.

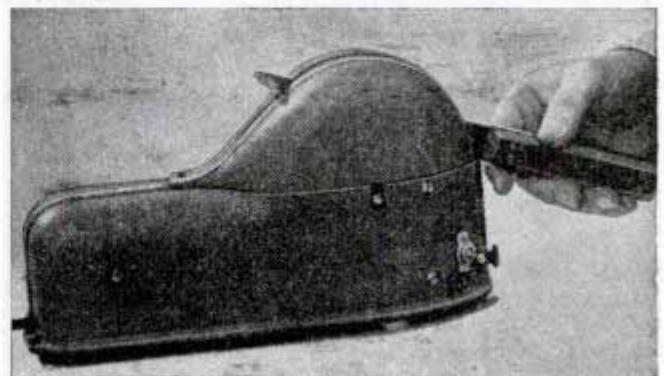


The metal rack weighs only nine pounds. It consists of a rectangular frame to which a U-shaped projection is electrically spot-welded. The motor clamps over one side of the projection. The dimensions are 27 by 12 by 7½ inches, small enough so the rack takes up no more room than the motor itself. Any motor up to 10 horsepower can be clamped to the frame. Grease, tools and other requirements fit into a built-in compartment. When the motor is to be stored, the rack can be hung on the wall or placed on the floor.

Four Adjustable Stones in Sharpener Permit Grinding Any Knife

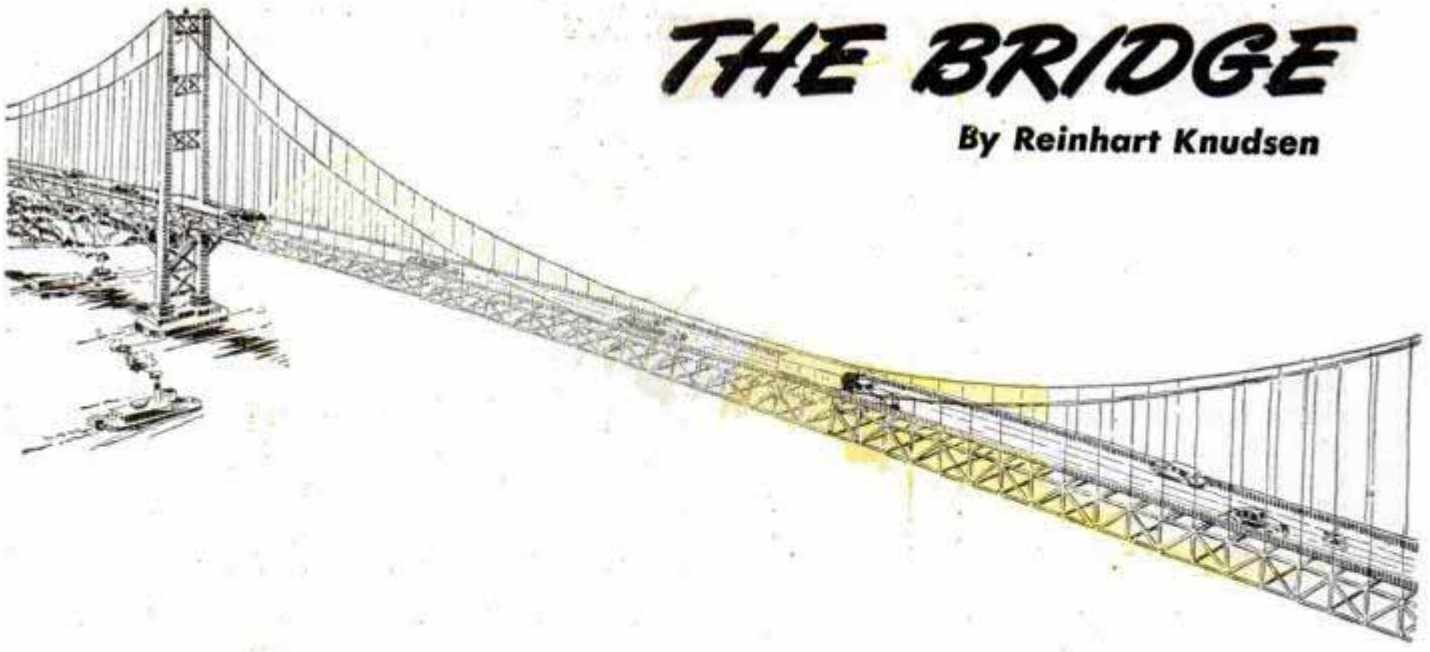
Four separate abrasive stones are used to grind the cutting edge of a knife blade in a new electric knife sharpener. The four stones are mounted on two wheel sections that rotate to bring the abrasive surfaces in contact with the knife blade 6000 times a minute. Because of the space between the stones, air circulates over the blade to prevent the knife from becoming hot and thereby weakening the edge. The angle at which the stones grind the blade can be adjusted to four different positions to fit the edge of any knife. A special device that holds the blade permits grinding of the edge as far back as the handle. The 120-grit abrasive carborundum stones can

be replaced easily. The sharpener gives a convex edge to a blade which is superior in strength to a concave or "hollow-ground" edge, according to the manufacturer.



THE BRIDGE

By Reinhart Knudsen



THE new Tacoma Narrows bridge, to link Tacoma and Bremerton, Washington, will be the world's first aerodynamically designed and shock absorber-equipped suspension bridge.

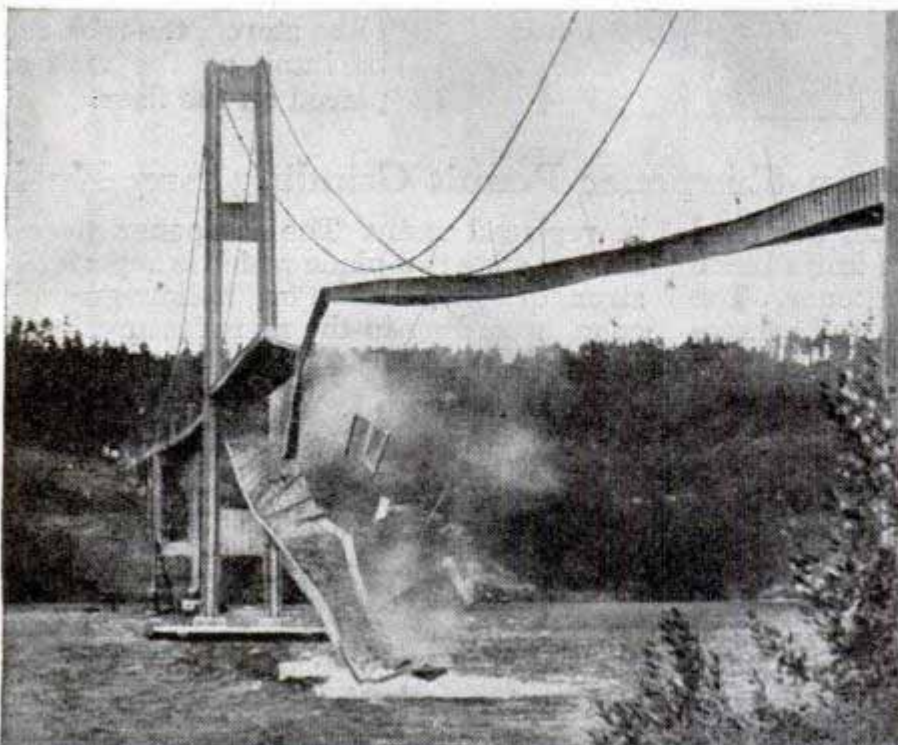
When the original span, built along traditional suspension bridge designs, dramatically collapsed on November 7, 1940, it carried down with it all ideas that the design of suspension bridges could ever again be made in terms of static forces alone. From now on, aerodynamic forces as well, and their resultant vibrations, must also be considered. Ever since that disastrous day, Washington State engineers, in cooperation with the federal Public Roads Administration, have carried on original research and continuous wind tunnel tests in an experimental laboratory at the Uni-

versity of Washington to arrive at a design for a new bridge which would not blow down. Last March these plans were approved by the Washington Toll Bridge authority. The new structure is expected to be built and in use by 1948.

The original 5979-foot span was exceeded in length only by the Golden Gate bridge and the George Washington bridge in New York. It cost \$6,618,138.53 and held up just four months and seven days. During that time, however, it became famous for its rising and falling motion and earned the name of "Galloping Gertie." When the winds swept across Puget Sound, tourists came out to watch the roadway rise and fall as much as 40 or 50 inches. The end came during a roaring 45-mile-an-hour wind when the roadway "galloped" up and down as much as five feet.

In its last agonizing moments the pavement was heaving in nine waves at the rate of 37 times a minute. When the center diagonal stays could stand it no longer the span began to twist and shake to pieces. In a little while only the towers and main cables remained standing and they were severely damaged.

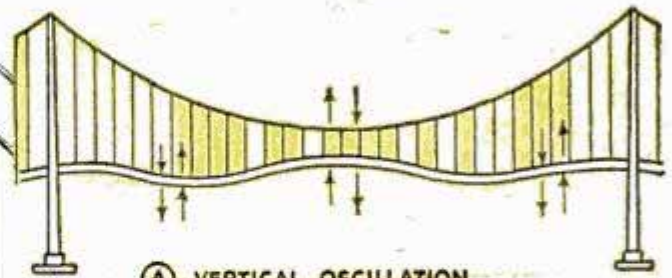
To find out exactly why the old bridge fell and to make accurate designs for a new one, a wind tunnel 100 feet long with a four-



Copyright Bashford-Thompson from Acme
Collapse of the four-month-old Tacoma bridge in 1940 demonstrated the need for new design

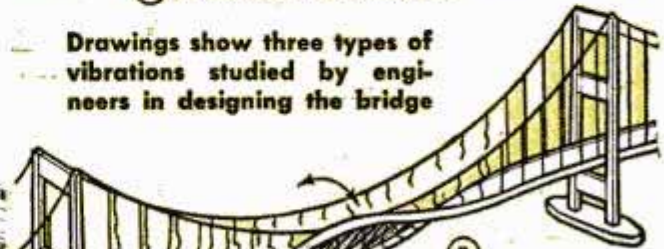
BORN IN A WIND TUNNEL

Let the wind blow. It won't topple over the new Tacoma bridge equipped with shock absorbers and air slots in the floor

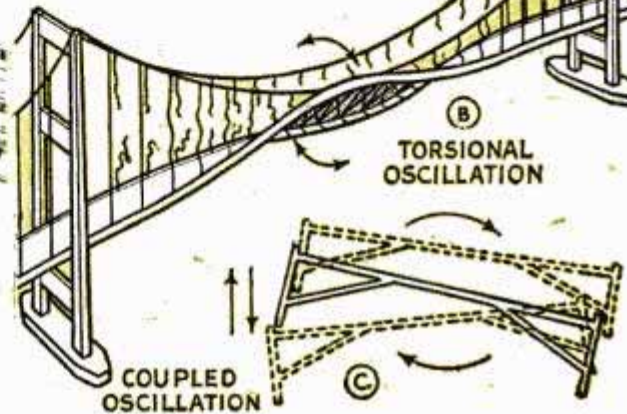


(A) VERTICAL OSCILLATION

Drawings show three types of vibrations studied by engineers in designing the bridge



(B) TORSIONAL OSCILLATION

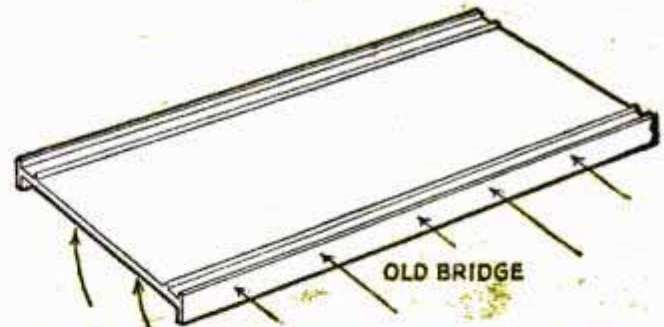


(C) COUPLED OSCILLATION

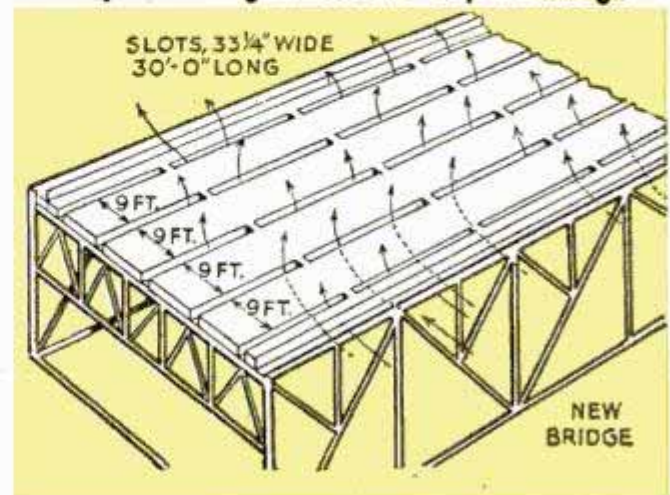
Wind tunnel tests with 118-mile-an-hour air blasts whipping through models of bridges showed engineers how to construct an aerodynamically designed bridge

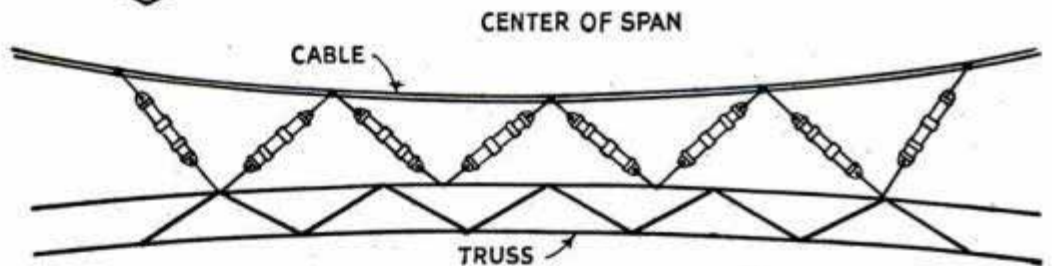
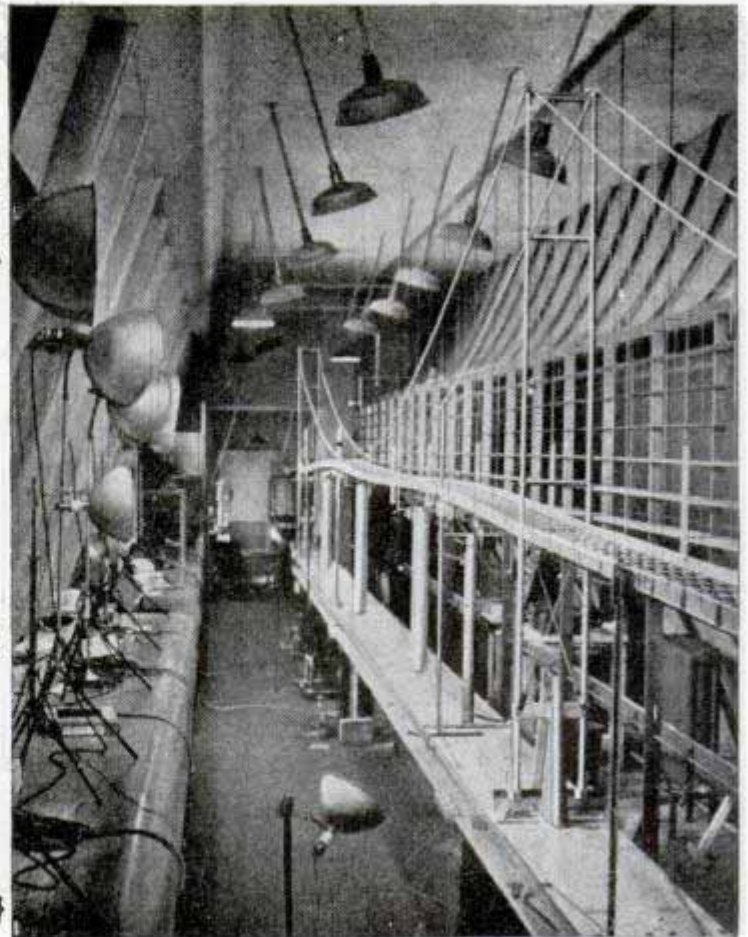
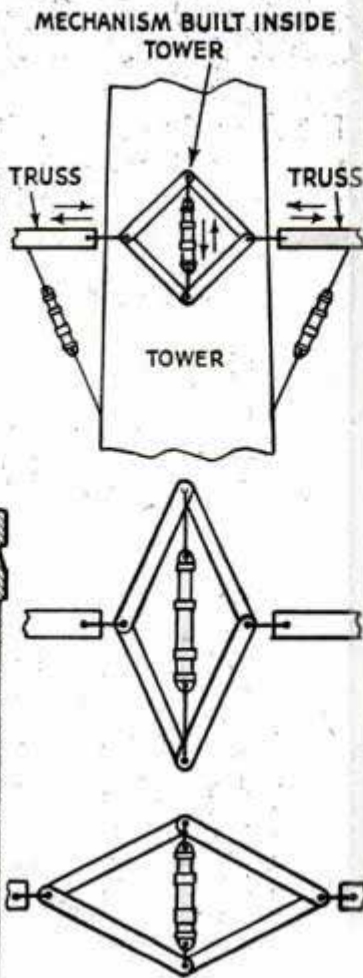
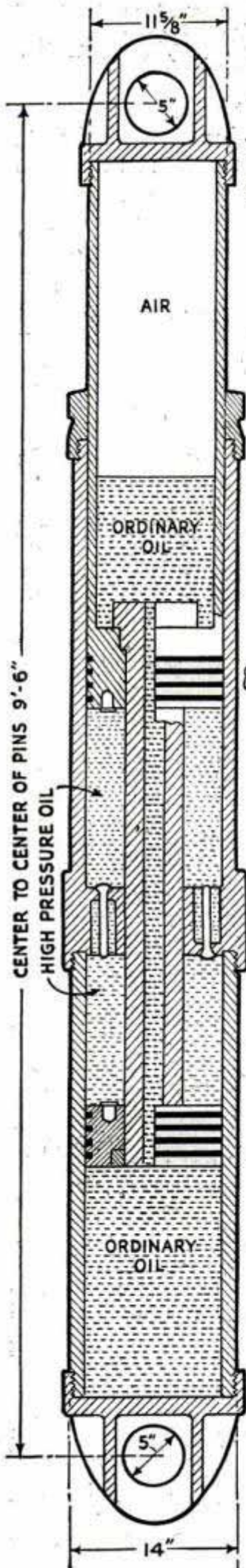
foot throat was built at the University of Washington. In this tunnel full scale models of proposed designs were built and tested. There was some doubt, however, as to the accuracy with which scale models could be used to tell what would happen to the real thing. Inasmuch as records were already available as to the exact actions of the original span in various winds during its brief life, a model of this original bridge was built first. When it reacted in precisely the same manner under the same types of winds, the engineers knew they were on the right track. Knowing their tests would be accurate they went ahead and built a model of the proposed new design. It was constructed to scale, one foot to 50 feet of the actual bridge, structurally, mechanically and aerodynamically.

In their studies the engineers produced the first organized data on various types of oscillations that might cause a bridge to collapse. With this knowledge they were able to incorporate changes in the design of the new bridge which would minimize



Unlike the solid roadway of the old bridge, the new structure will have a slotted floor to permit rising air currents to pass through



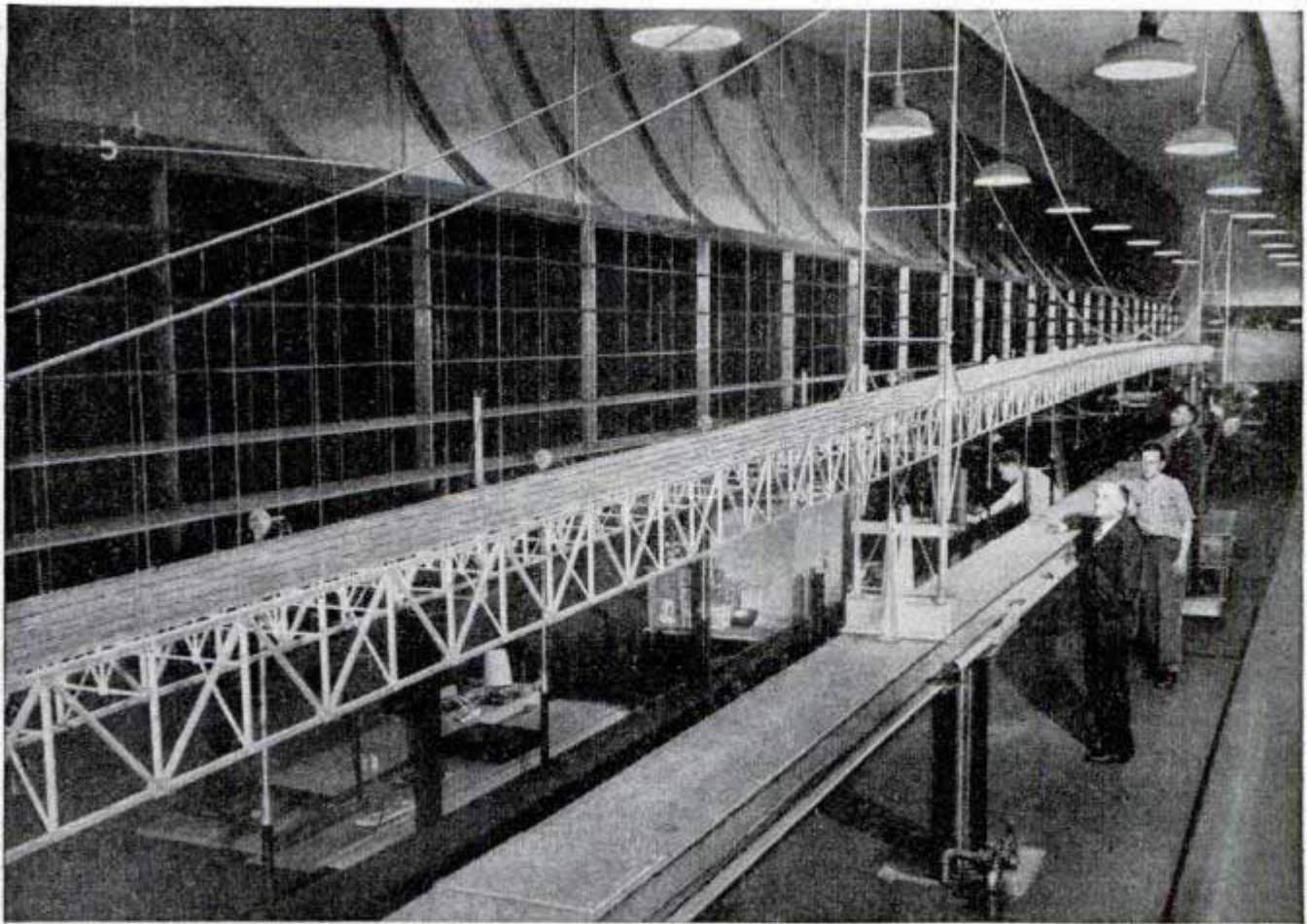


Installed at various points throughout the structure, 24 hydraulic jacks (cross-section shown at left) will absorb shock. Above, tests in the wind tunnel

such oscillations and then by use of the model and wind tunnel to actually test their design changes. Among the different types of oscillations that had to be minimized were the steady wavelike oscillations common to all suspension bridges, the twisting oscillations which brought about the collapse of the Narrows bridge, coupled oscillations which are a combination of both the steady and twisting types, and restricted oscillations, steady wavelike movements which develop at a certain wind velocity but tend to disappear at a higher velocity. None of these movements is exclusive in bridges. They are found in mechanical devices such as automobiles, railway cars and airplanes. They are readily observed in "wing flutter" and "galloping transmission lines."

Both the laboratory tests and the demands of a growing area required that the new bridge be larger and heavier than its slender predecessor. It must carry four lanes of traffic instead of two. The increased weight contributes substantially to absorbing wind shock and increasing resistance to various types of vibrations. Engineers call this "damping."

An immediately noticeable design feature of the new bridge is its openness of construction. Whereas the former span used an eight-foot solid girder to support the main deck, the new structure will be built with a 33-foot open-type truss. This will reduce wind resistance and also break up air currents which might start



A 100-foot model at the University of Washington withstood rugged tests leading to design of Tacoma bridge

oscillations. Floor beams will also be of open-type truss design, and a double-lateral bracing system has been incorporated to add to the stiffness of the structure.

The new bridge will be the first such structure ever to come equipped with "shock absorbers." These will be huge hydraulic cylinders similar to the recoil system of battleship guns, located at the centerline of the bridge where the cables come down to the roadway and at each tower. They will permit slow motion, such as might be caused by a heavy load of traffic on the bridge, but will resist rapid motion such as wind oscillations.

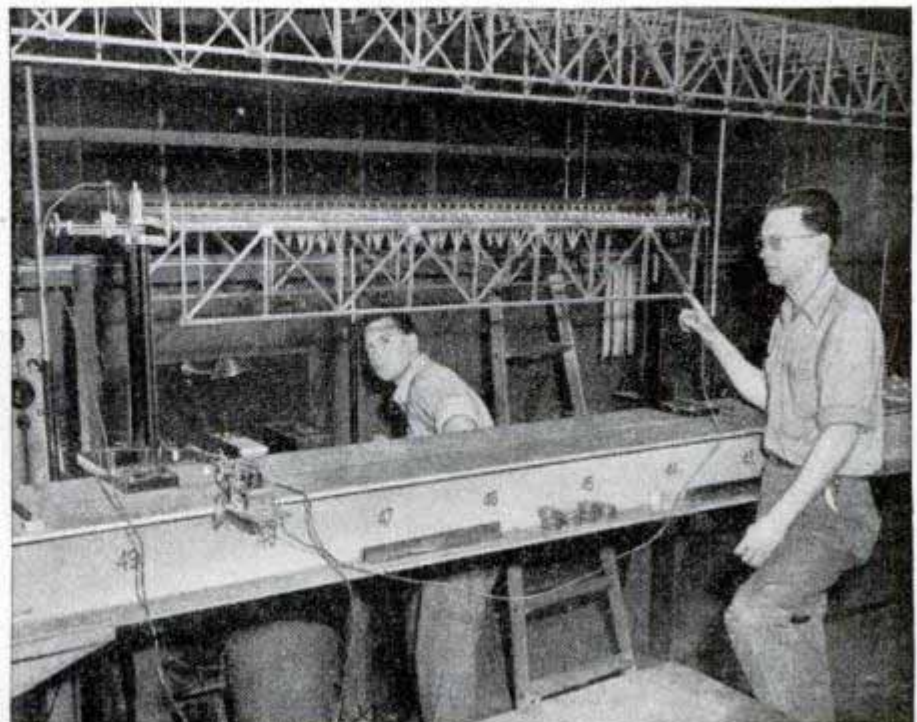
When engineers built their model of this preliminary design and subjected it to the wind tunnel test it worked perfectly in a steady horizontal wind stream. A gale equivalent to 118 miles an hour was whipped up by 10 big propellers and the bridge stood firm. However, when the wind stream was tilted upward at an angle of two degrees

serious oscillations developed at 78 miles an hour. Due to bluffs along the shore such upward slanting winds are quite common at the bridge site although not at such great velocities.

Nevertheless the engineers were not satisfied. They promptly built and tested a sectional model for the study of roadways

(Continued to page 224)

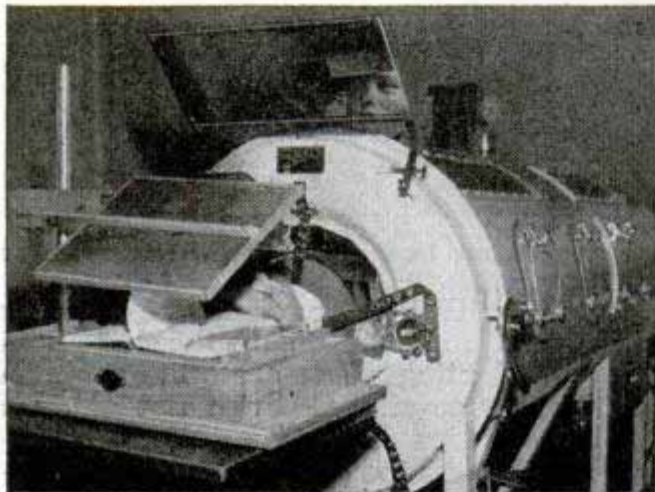
Measuring oscillations to test the roadway of a sectional bridge model



Nudge With Chin Activates Electric Book-Page Turner



After nurse attaches thread to book pages, an automatic page turner enables incapacitated boy and woman in iron lung to read the books



Armless persons and hospital patients unable to use their hands can turn the pages of a book with the aid of a motor-driven spool which pulls thread attached to the various pages by metal clips. The switch can be hung from a cord around the patient's neck and operated by a nudge from his chin or it can be placed near the foot of the bed for foot operation. R. F. Mallina of the Bell Telephone Laboratories designed the equipment at the suggestion of the American Red Cross.

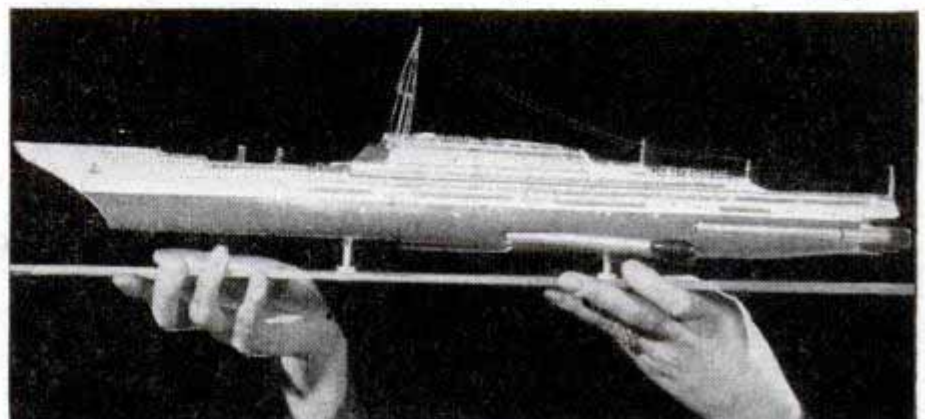
Outdoor Thermostatic Control Regulates Building Heat

Outside rather than inside temperatures actuate an automatic thermostat which regulates heat for homes, apartments, commercial and industrial buildings. Used to operate all types of heating systems, the outdoor thermostat shuts off all heat when the outside temperature rises to 65 degrees Fahrenheit. Continuous heating is supplied, night or day, if the outdoor tempera-

ture drops below zero. The times at which heating starts in the morning and stops at night are determined automatically in accordance with actual weather conditions. During the day, constant building temperatures are maintained by producing heat at regularly spaced intervals, with the length of heating periods automatically changing as the weather changes.

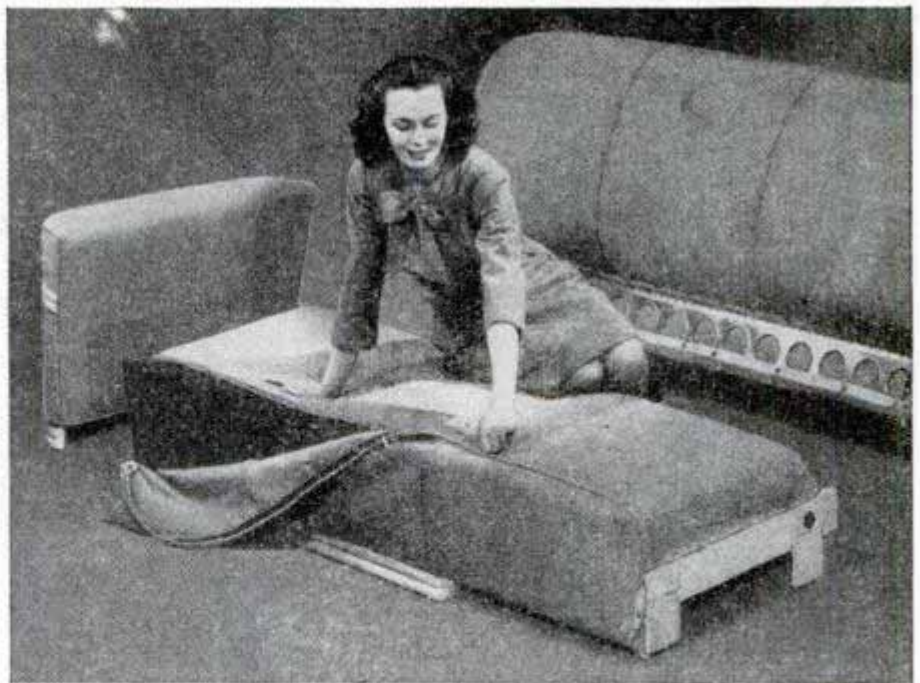
Jet-Propelled Ocean Liner of Future to Carry 10,000 Passengers

Jet engines will power passenger liners and merchant vessels of the future, according to designer J. Tomadelli. He has designed a scale model of a 1487-foot 10,000-passenger liner to be powered by four jet engines, two on each side of the hull. Estimated cost of such a 116,000-ton displacement vessel is \$60,000,000.



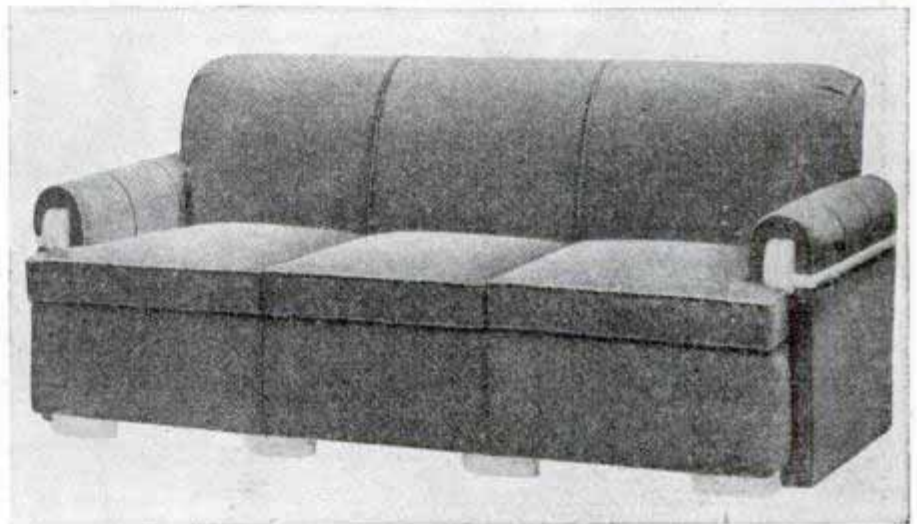
Davenport Frames of Aluminum

Frames of aircraft aluminum, one third lighter than the conventional wood, are being used in upholstered living room furniture. They are termiteproof, fireproof and cannot warp. To permit compact shipping and quick change of zipper-fastened covers, the pieces are built in four units, the back, two arms, base and cushions, which can easily be separated.

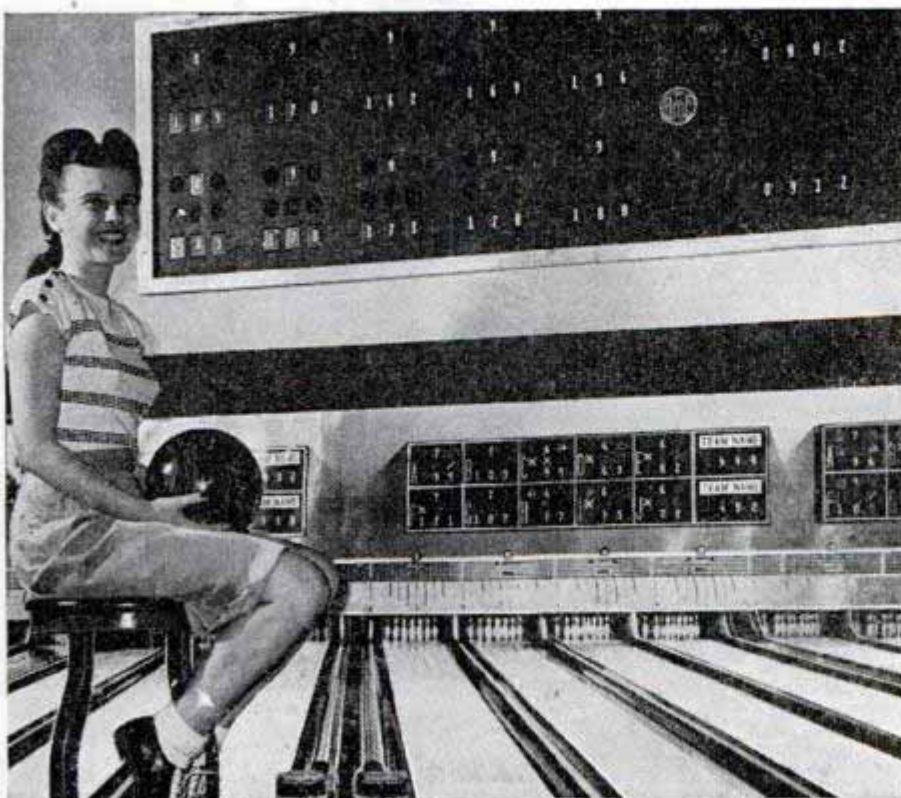


Pinhead 'Shadows' Are Counted

Objects as small as $\frac{1}{32}$ inch in diameter can be counted accurately at 1000 per minute with a counting device utilizing a short light beam sharply focused through an aperture in a perpendicular guide tube. As small objects drop through the tube they break the beam. A high speed electronic circuit counts the interruptions or shadows and actuates the machine.



Robot Tabulates and Records Bowling Scores by Electric Impulses



Bowling scores are tabulated and recorded automatically by an electrical scorekeeper used in conjunction with a mechanical pinspotter. Pins knocked into the pit are picked up by the robot spotter which creates electrical impulses, the number dependent upon the number of pins knocked down. These impulses are translated into running bowling scores—individual, team or both—which are posted on scoreboards facing the bowlers. The electrical scorekeeper has symbols representing strikes and spares which light up when a bowler makes one or the other.

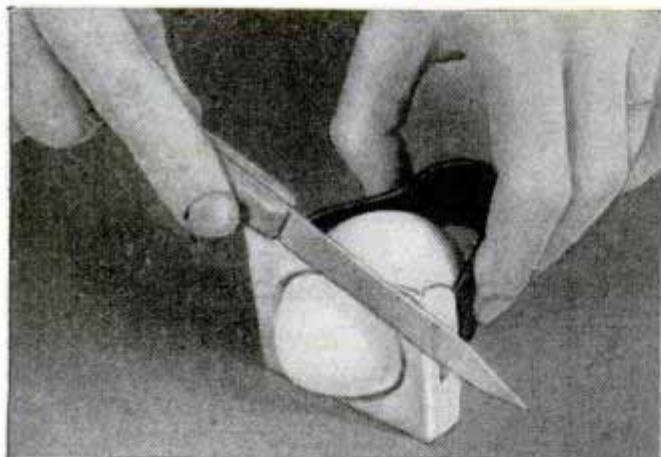


"Inside Stubb"

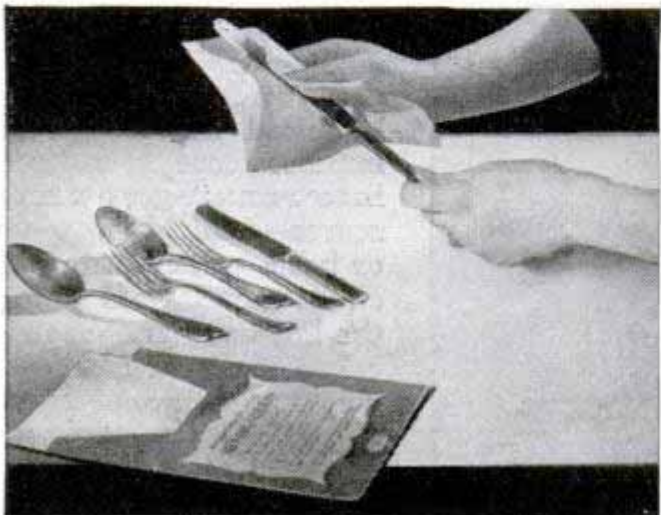
for Your Home



Hollow plastic garment hanger, filled with moth crystals, left, protects clothing. Below, electric frying pan is a one-piece cast aluminum unit and it can be immersed in water for cleaning

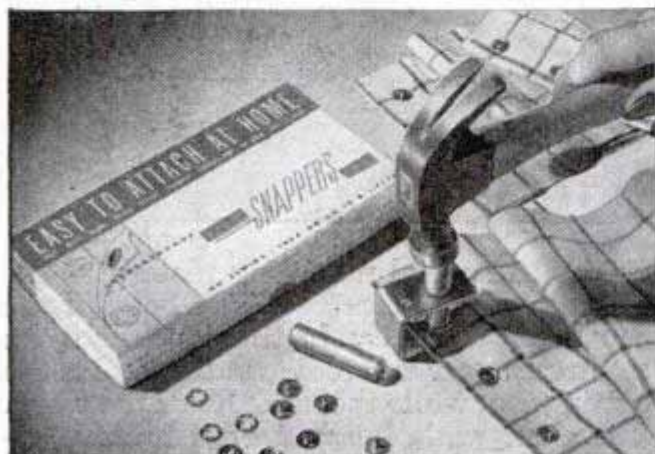


Holder for hot soft-boiled eggs is easy on fingers; squeezing end of loop holds egg firmly. Below, polishing silver is simple job with treated paper sheet





Electric unit in cover converts frying pan into broiler. Inverted on table base it becomes electric stove



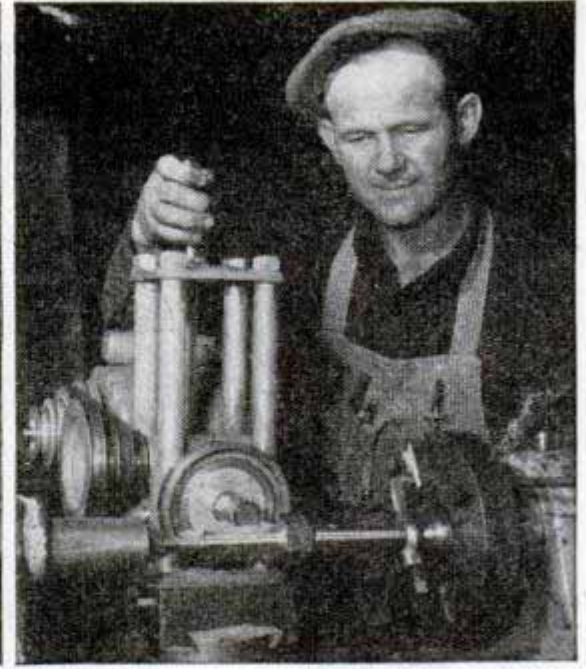
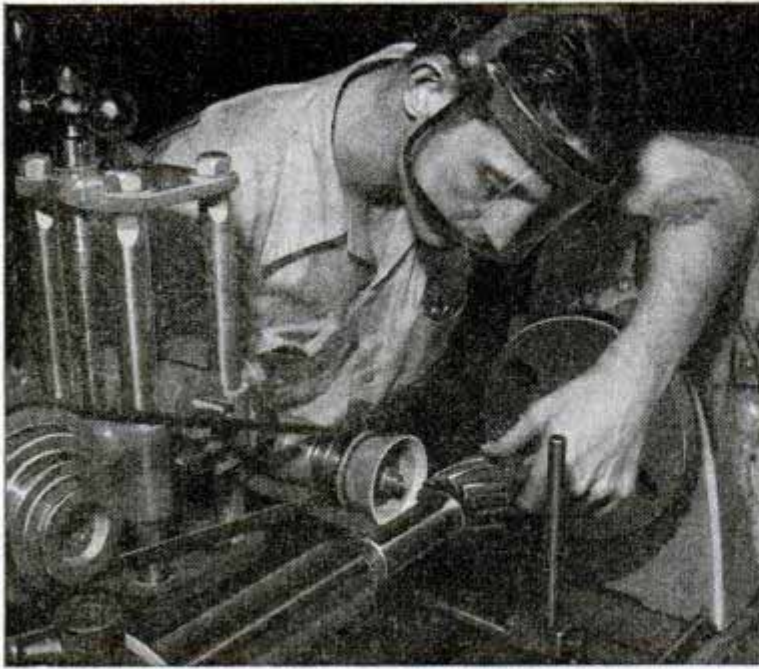
Snap-fasteners are "sewed" in place with hammer and U-shaped tool with hole for punch. Below, steel spring and rubber wheel muffle closing of a screen door



Agitator of this handy lightweight mixer is small enough to slip into bottles or glasses. Drop leaf on home freezer, below, serves as worktable or dinette



Lathe Converter With Universal Head Does Many Jobs



Ordinary lathes will perform almost any type of metal-working operation when used in conjunction with a lathe converter equipped with a universal head. The converter, which was used by the armed services in portable machine shops in combat zones, is available in three models that can be adapted to lathes from 9 to 36-inch

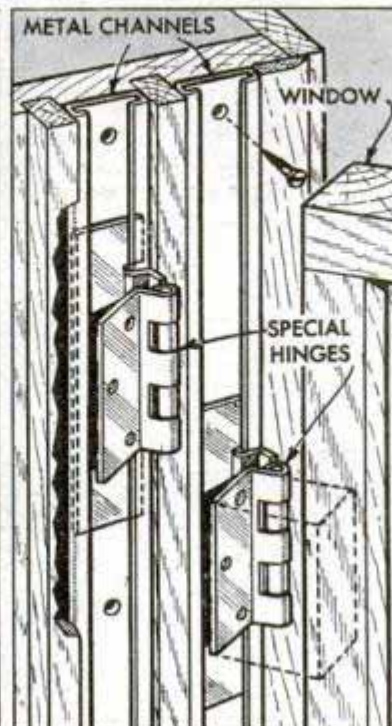
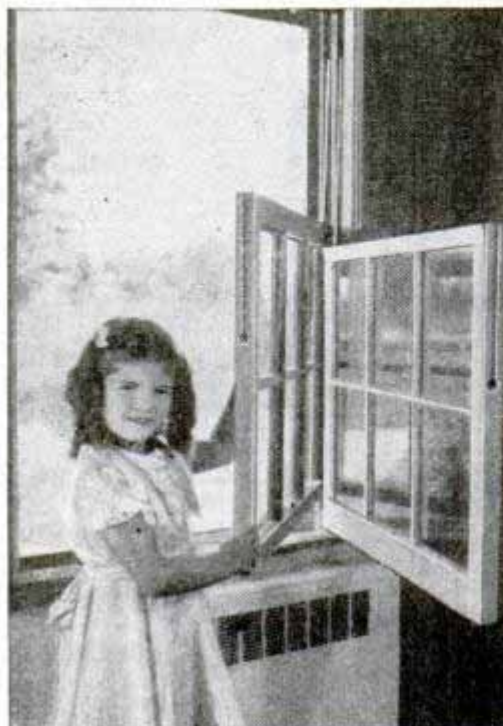
swing. A special mounting plate attaches to the tool-post carriage. The head of the converter, which can be tilted for such jobs as thread, gear and tool grinding, holds the cutting tool while the lathe holds the work. Interchangeable heads permit milling operations, various types of grinding, internal keyseating, routing, drilling and indexing.

Windows Swing Like Doors on Hinged Channel Device

Double-hung windows can be swung into the room like a door with a hinge and retainer channel device that can be attached to any wooden or metal window jamb. Windows already in service can easily be equipped with the device. A rolled metal channel is screwed to the window jamb.

The trim on the opposite side of the window frame is cut at an angle so that it can be removed and replaced easily. The hinge is fastened to the window, one end forming a slide which fits into the retainer channel. When the window is to be opened, the pre-cut trim is lifted out and the window

swings into the room on its hinges. The rope or cable on the opposite side of the window is fastened to the jamb when the window is opened. Both sections of a double-hung window can be equipped with the device, doubling the ventilation and making window washing an easy job. The attachment has no effect on the up-and-down movement of the windows, and weatherstripping may be used.



⚠ Danger of shocks from electrical outlets is eliminated by transparent plastic safety caps which are plugged in when outlets are not in use.

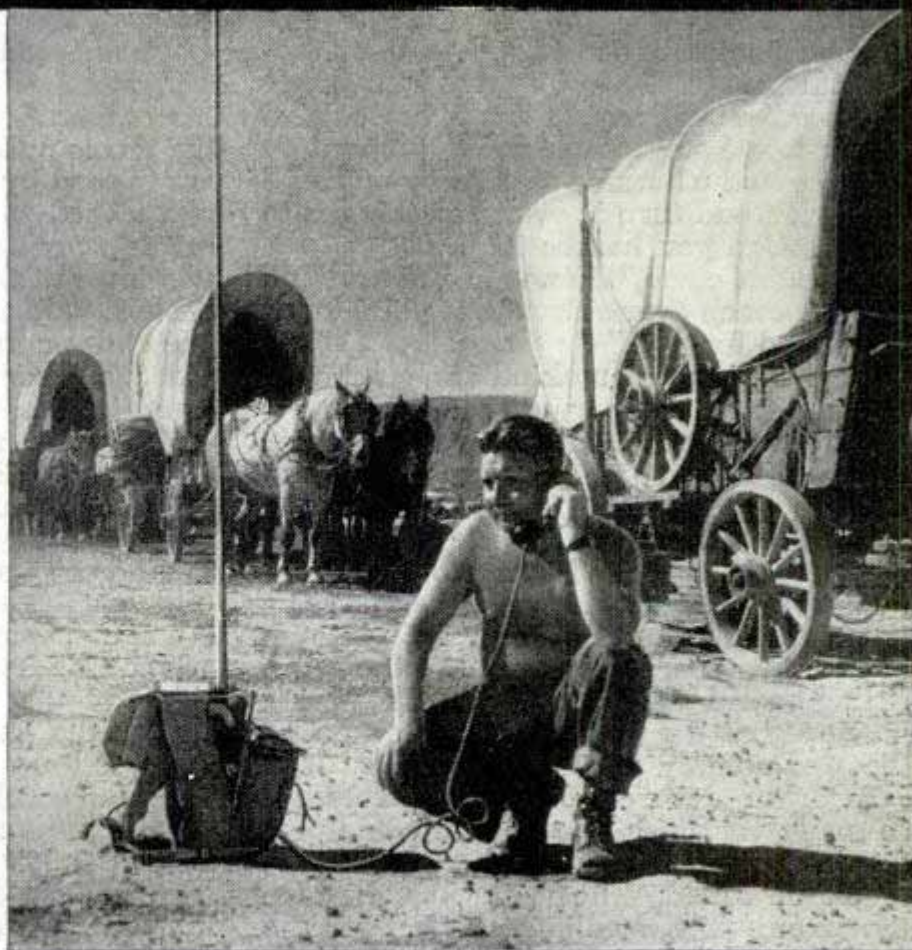


They Die a Thousand Deaths

MOST Hollywood stunt actors would have been killed years ago if it were not for elaborate precautions to protect them from injury. Accidents rarely happen even in the production of western movies that call for violent action every minute.

Men and horses shot down in a wild chase in the morning are ready to rehearse the next scene after lunch. Men and animals that participate in the spectacular smashup of a covered wagon will do it again with another wagon if the cameras missed the first shot. All such scenes are so carefully planned that hazards are at a minimum.

When "Pop" Sherman, veteran producer of westerns, is preparing a thrilling sequence for a picture he is apt to put in a call for Fred Kennedy, stunt actor who has reduced



Stunt men performing in Hollywood westerns (top) fall from fast-moving horses and wagons but scientific precautions minimize the dangers. Below, walkie-talkie radio receives instructions from distant cameraman



Harry Sherman Productions photo

Camera mounted on a truck moves along a smooth road to photograph cowboys chasing a gang of cattle thieves

the mechanics of smashups to a mathematical basis.

"Fred," he will say, "I want you to drive a four-horse stagecoach down a mountain road, have the horses break away and spill the coach and turn it over, smashing it to pieces. Can you handle it?"

"That's a cinch," Kennedy replies. "I'll roll the coach over sideways if you like or flip it end for end."

Kennedy stages any kind of a crash that the scenario writers can dream up, from a collision involving two stagecoaches driven at a full gallop to a simple thing like wrecking a buggy against a boulder.

Usually he rides the vehicle all the way, unless the script calls for him to jump clear at the last minute. If the driver is to be thrown headfirst out of the wagon into an adjacent ravine, a dummy takes the reins, sitting over a powerful spring. The spring is tripped at the moment of the crash and flips the dummy through the air.

In an "unprepared" crash there would be so many variables that no one could predict just what would happen. Someone might be killed. The vehicle might turn the wrong way, spoiling the shot for the cameras, or it might not turn over at all. Kennedy makes the crash occur according to a predetermined pattern.

In preparing to roll a stagecoach on a

mountain road, for instance, the stunt actor first attaches special crash equipment to the coach. The wooden tongue by which the teams pull the vehicle is removed and is replaced by a special iron tongue. This is attached to the vehicle by means of a break-away device that is controlled by a trip-lever at the driver's seat. A long steel cable is laid across the top of the coach, one end secured to the rear of the vehicle and the other end attached to the break-away tongue.

Ready for action, Kennedy drives the stage at a gallop toward the cameras and at the right instant trips the lever that releases the horses and the vehicle's tongue. The horses and the tongue pull away from the vehicle and this action releases an automatic mechanism that immediately cramps the front wheels of the coach to one side. By now the horses have reached the end of the long overshot cable and have tightened up on it. This automatically pulls the coach over in a terrific crash.

During the confusion Kennedy dives into a steel safety box alongside the driver's seat, padded inside with sponge rubber. Five seconds elapse from the start to the finish of an ordinary crash and the stunt actor needs only three seconds to get into his safety box, out of the way of flying debris. Kennedy spent months in working

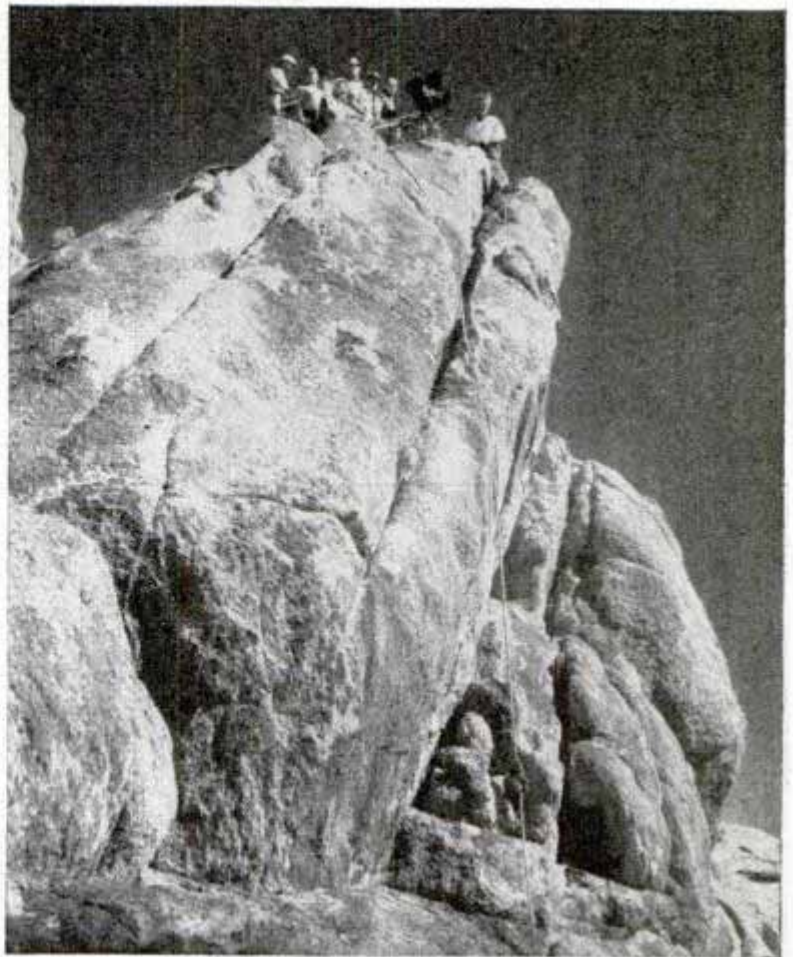
out the mechanics of his crashes, towing vehicles behind automobiles at speeds up to 25 miles per hour to perfect the equipment.

For an end-over-end crash the stunt actor rebuilds the vehicle so that the horses can pull the front axle and wheels from under the wagon when a lever is tripped. The front end of the wagon falls to the ground and two steel bars beneath the wagon bed dig their points into the ground, bringing the vehicle to a halt. The horses automatically complete the crash as they move ahead by tightening up on an overshot cable attached to the rear of the vehicle. The wagon somersaults through the air and slams to earth upside down. Kennedy in the meantime dives free of the wreckage or jumps into his safety box.

Special equipment, too, saves the life of the stunt actor when he is called upon to fall or be thrown down between the horses from the driver's seat of a moving vehicle. Without some protection the actor would be sure to be trampled by the horses or run over by a heavy wheel. The safety equipment consists of a long platform, called an "ironing board," that is firmly attached to the tongue between the two horses, out of sight of the camera. Pretending to be shot from his seat, the actor falls unharmed on this safety platform and hangs onto it while he lowers his body into the dust between the two horses, allowing his dragging heels to be caught by the camera.

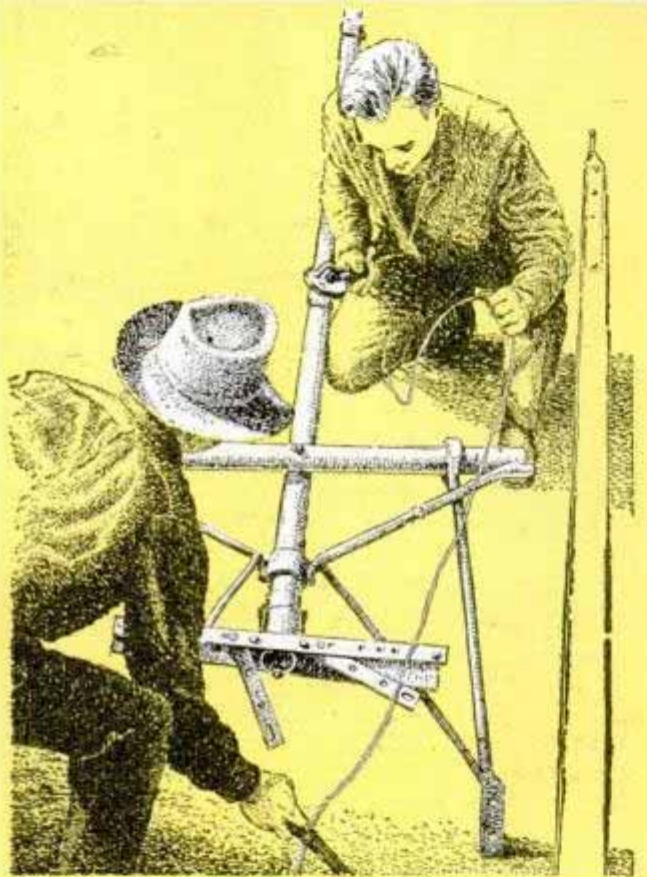
Extraordinary precautions are taken to avoid injuring animals in the making of a western. Teams of horses are turned loose by means of break-away devices just before something happens to the vehicle that the teams are hauling. Run-aways are staged under the control of a hidden driver concealed in the vehicle who has a small window in front of him through which he can watch the horses and guide them by special reins. A vehicle that has lost its horses and careens down a slope apparently out of control actually is steered by a hidden stunt man along the exact path the director desires.

The horses that take spills in a western movie are valuable animals trained to fall realistically for the camera. The ground on which



After hoisting their equipment by ropes to the top of a towering rock, a camera crew gets ready to shoot a movie sequence. Below, concealed steering wheel guides a runaway coach





the fall is to occur is dug up and padded with hay or straw.

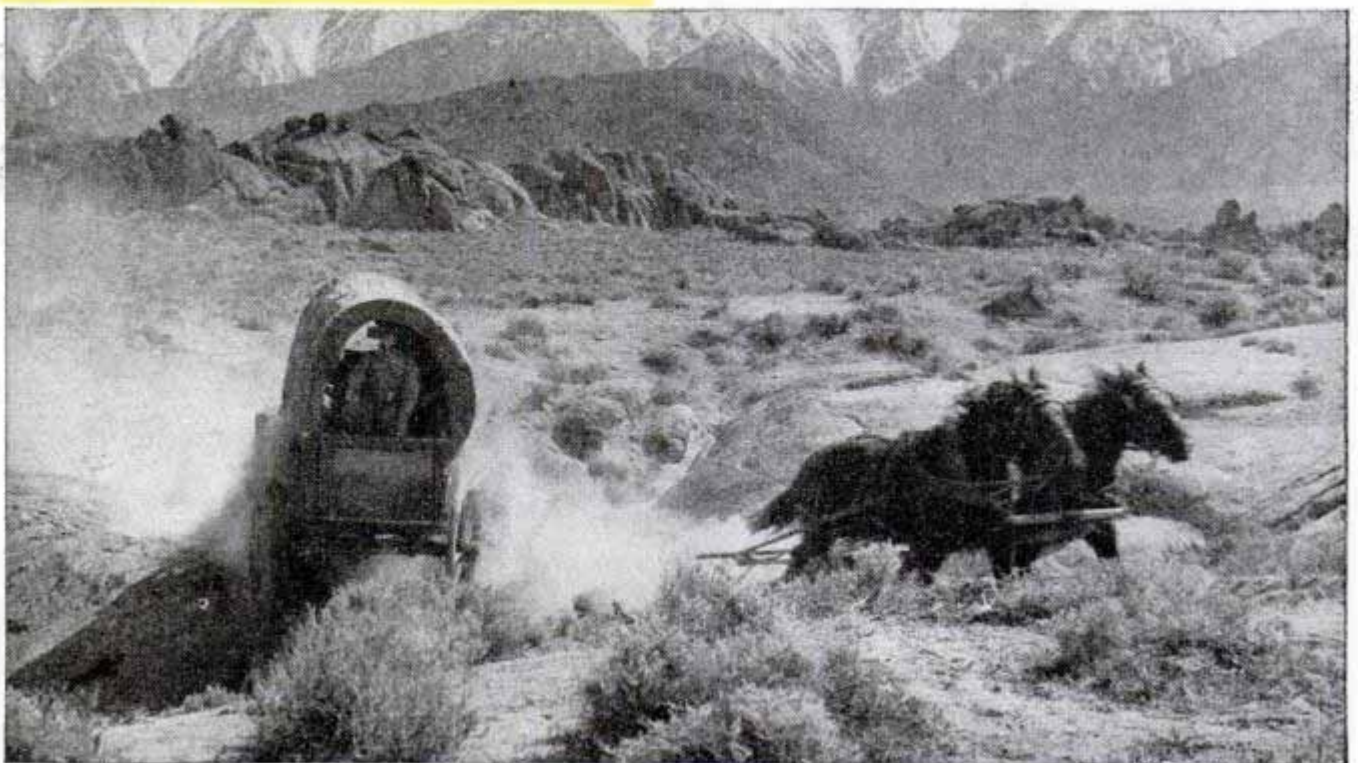
On the screen you may watch a horse and rider apparently being shot down by an outlaw's bullet, with the rider then crawling away and leaving his horse as dead. Actually, when the scene was filmed the camera continued to roll until the horse was allowed to regain its feet and walk away. This full scene is viewed by the S.P.C.A. as proof that the animal was uninjured by the fall; after the film is inspected it then is cut to conform to the story.

Shooting scrapes are fought with blank cartridges that produce only smoke and noise. Bullets that appear to land uncomfortably close to an actor usually consist of gelatin capsules filled with colored earth, aimed from a slingshot or air gun out of camera range. The capsule smashes realistically when it hits a rock, giving a convincing imitation of a bullet that has hit the rock and glanced off.

Chairs, bottles and guns used as clubs in a brawl are composed of break-away materials that do no damage. Chairs are usually made of balsa wood, bottles ordinarily of thin plasterlike material, and guns are usually of rubber. Even natural rocks and boulders are imitated in paper, cloth and paint when they are to be used as missiles in a picture.

The universal appeal of a wild west picture is based on its violent actions, thrills and scenic backgrounds. Generally the plots are simple and involve such things as the capture of villainous cattle rustlers or

Stunt actor Fred Kennedy (top) rehearses trick horse to fall and play dead. Break-away tongue (center) is used on wagon (below) occupied by a lifelike dummy

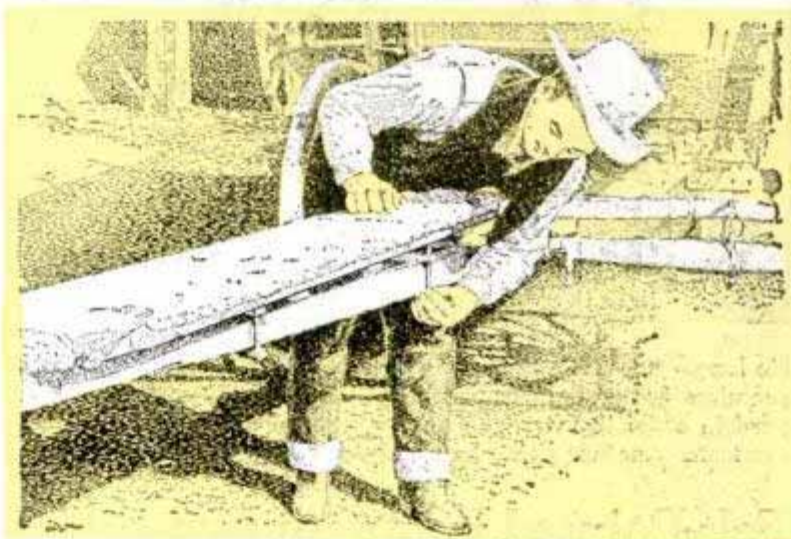


the winning of a gold mine from claim jumpers. Saddle horses and teams are invariably used and such vehicles as airplanes or automobiles rarely appear, even though the story is laid in the present. One minor Hollywood industry consists of riding stables specializing in western equipment and properties for the studios. Such a stable has barns crammed with buggies, surreys, coaches, wagons and miscellaneous vehicles and is ready to provide everything from saddles and harness to a score of horses and a herd of cattle upon demand.

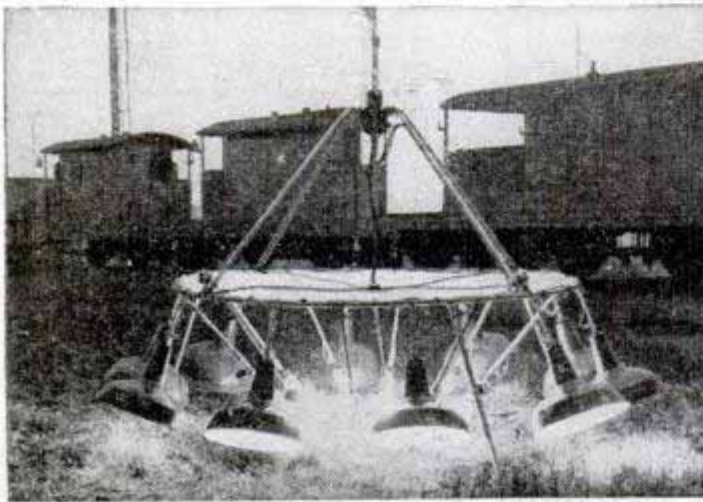
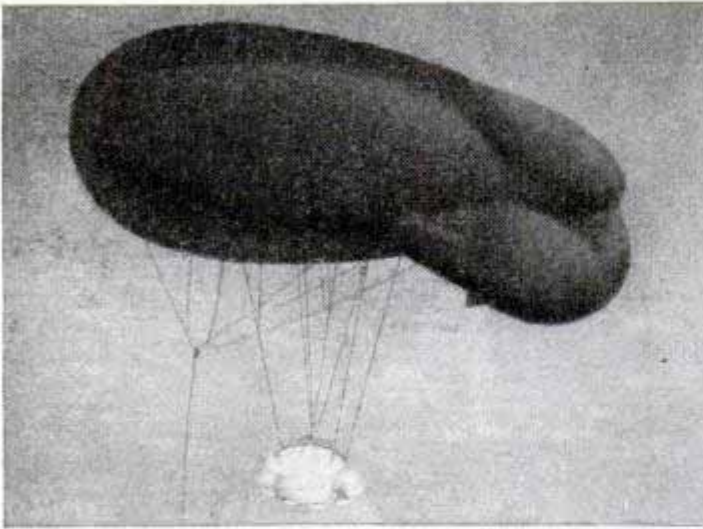
Roughly one fourth of all Hollywood motion pictures are westerns, most of them produced by small companies and costing in the neighborhood of \$50,000. Superduper westerns, usually written around some famous historical episode, cost as much as \$3,000,000. In Paramount's "California," 1000 actors performed and in one scene 600 horses pulled a 150-wagon train.

Western pictures are as popular in foreign countries as they are in the United States and a good western picture may continue to run a full decade after it was first filmed. Tom Mix and Bill Hart were among the early western stars; Roy Rogers and Gene Autry are two of half a dozen or more modern cowboy heroes.

Padded stunt man (top) takes a spill. Safety platform (center) catches driver who falls between team. Below, a crackup



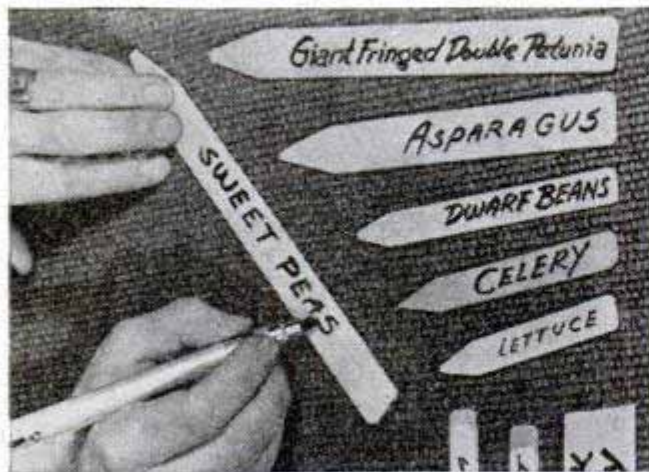
British Barrage Balloon Hoists Lights in Railroad Yard



No longer needed for air protection in England, a barrage balloon has been used in a lighting experiment that promises better light for railroad workers. Twenty 1000-watt lamps were hoisted 150 feet above a rail yard in order to increase visibility throughout the area. Permanent structures may be erected as a result of the tests. Another possible use of the balloon-supported lights is in illuminating the scene of railroad wrecks

Felt-Pointed Fountain Brush Has Nonleak Control Valve

Hard felt is used as the point of a new aluminum fountain brush designed to letter hard-to-mark surfaces such as glass,



wax and Cellophane. The brush, no larger than an ordinary fountain pen, has an automatic control valve that opens only when pressure is exerted on the felt point. This prevents flooding or leaking. A variety of points are available and each point can be cut with a knife to change the width or shape of the line that is to be drawn. Special quick-drying waterproof marking colors are used in the brush.

U. S. Steps Up Machine Gun Fire

If all the forward-bearing .50-caliber machine guns on a B-25 bomber were to be fired at once they would hurl 280 two-ounce slugs in one second. Rate of fire of the Army's .50-caliber aircraft weapon has been stepped up 50 percent by the use of improved metals and technical changes since the end of the war. The improved .50-caliber fires 1250 rounds per minute as compared with 850 for the wartime model.



Elephants ARE GOOD PUPILS



herd, once halted a stampede and probably saved the lives of hundreds of circus fans.

Big John, decked out in spangled headgear and harness, was at the head of the column as the band blared into the march for the grand entry. "Tailed up" behind him, trunks and tails swaying, came the rest of the herd. The whole procession, from the clowns to the royalty of the high trapeze, moved rhythmically along the track.

Suddenly, two young male elephants became panicky, frightened perhaps by a bit of paper or by a woman's queer hat. They charged trumpeting from the line. One of them brushed Big John and pushed his headgear down over one eye. The bull-boss shouted. Hastily the procession halted. Some-

how, the two crazed bulls had to be stopped before the herd ran amuck.

Big John seemed undisturbed. He moved over to the high railing around the arena and used it to shove his headgear back. Then he turned and faced head-on the charge of the runaways, now pounding the track on their second lap.

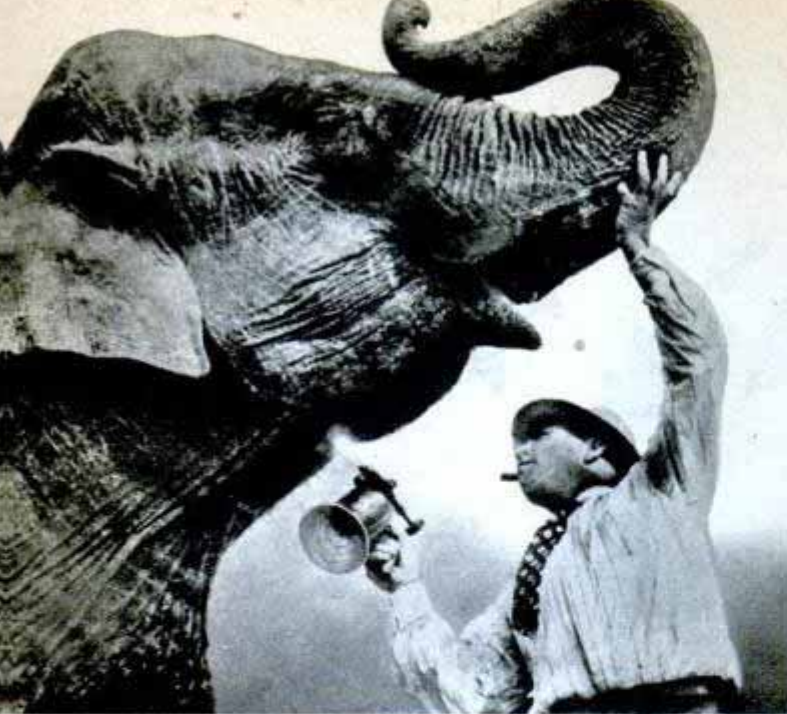
They collided with a thud. The youngsters were stunned and Big John was knocked through a half dozen already-emptied rows of seats. The stampede was over before it started.

Elephant trainers say the fabulous stories about their ability to remember are fiction. Most elephants would forget their routines from one season to the next if

ELEPHANT actors of the big top were not hiding in the jungle when brains were passed around. This is proved every day by the big gray wagon-pushers and star performers, most popular of all the multitude of circus attractions.

The important job of training elephants must be completed before they are 10 years old. Pachyderms abide by the canine axiom that an old-timer can't be taught new tricks. The average young elephant, who starts to school when he is three or four, is smart and adaptable. He takes a back seat in his "books" only for the chimpanzee and the orangutan.

An elephant can act quickly in an emergency, too. Big John, leader of a circus



The well-groomed elephant has no worries with five o'clock shadow. His barber tenderly burns off his whiskers with blowtorch, above, while manicurist does his nails with drawknife, below, before ring appearances



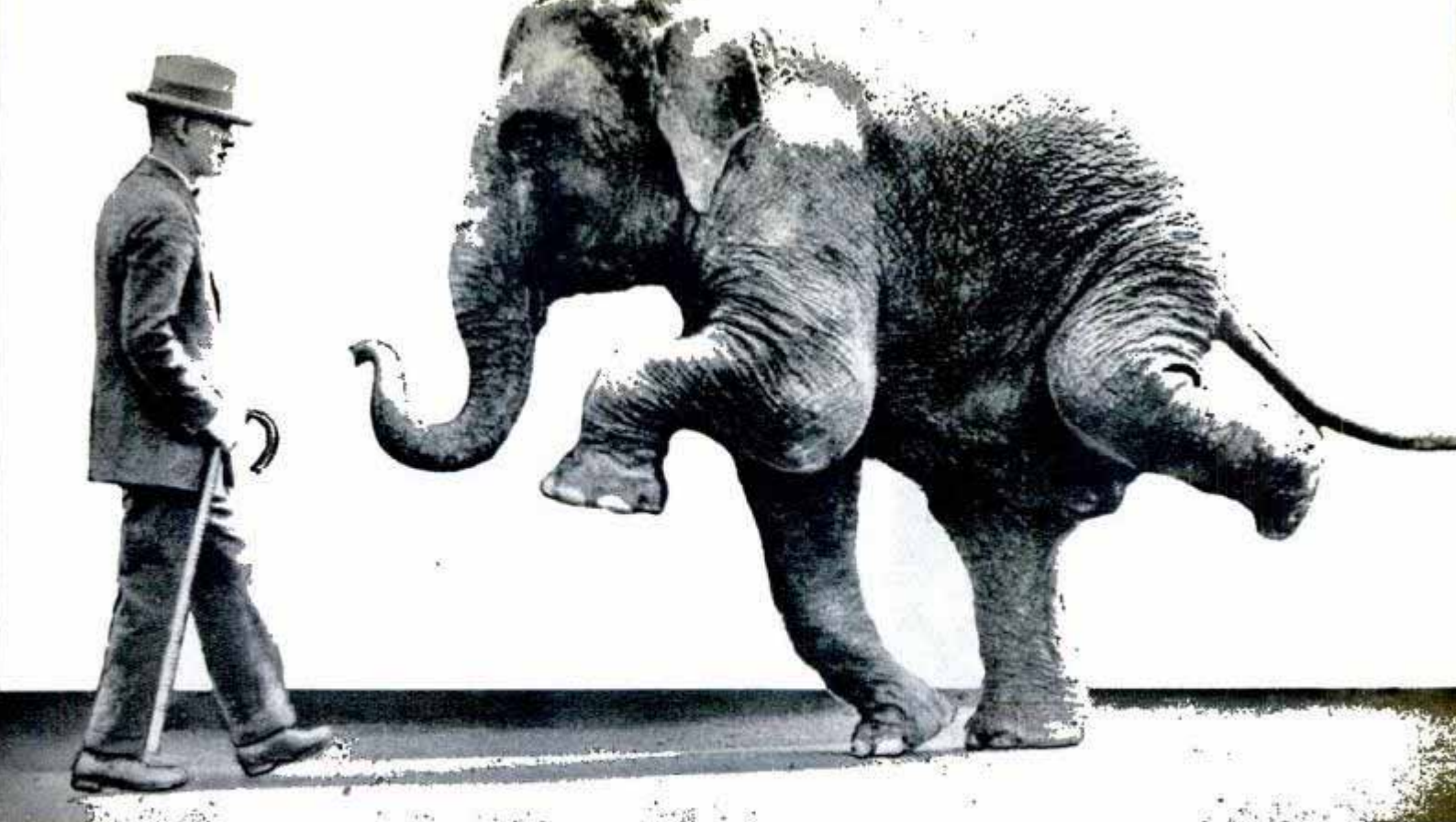
it were not for review in winter quarters. Like humans, all elephants do not have the same I. Q. This also applies to size. The Asiatic elephant, which can be identified by ears which resemble a map of India, is usually larger and more tractable than its African cousin. Few weigh more than four tons. The biggest and most famous was Jumbo, who was exhibited by P. T. Barnum. He was almost 11 feet tall and could reach to a height of 26 feet with his trunk. Incidentally, in that long proboscis there are 40,000 individual muscles and so sensitive is it that an elephant can pull a cork from a bottle with it. Jumbo died following a head-on collision with a freight train which derailed the engine and two cars. His hide alone, mounted after his death, weighed 1400 pounds.

All circus elephants come from the jungles. Only 12 have been born in captivity in this country since the first one was unloaded at Salem, Mass., in 1796, and none has lived as long as a year. The Ringling Bros. and Barnum and Bailey Circus owns half the elephants in the United States and carries about 40 on tour with the show.

Edward Allen, famous elephant trainer, says that patience and kindness pay big dividends to an elephant tutor. Simple commands are repeated over and over and the trainer must not permit his charges to be hurt or lose confidence. One elephant, frightened once by an unsteady ring tub,

Spectacular perhaps, but easy for an elephant because the trunk acts as an extra leg helping him to balance





Dance steps are taught with a harness. When the trainer tugs on it the elephant is forced to lift its legs. As soon as the beast gets the idea it will go into its routine when the trainer signals with the bull-hook

would assume the required sitting-down position when performing but invariably she would hold herself an inch or two above the tub-seat.

Hoists and swings help in teaching basic tricks. First the beast is taught to stand on its hind legs, a difficult feat because the stand requires the development of unused muscles and a high degree of balance. Ropes are looped around each foreleg and through an overhead pulley. At the trainer's command, an assistant pulls on the ropes and the elephant is hauled into posi-

tion. A tub-seat supports the beast, helps it balance and lessens its fear of falling. Similar rigging pulls the elephant's trunk into saluting position. Soon the elephant learns to respond unaided to the command.

(Continued to page 244)

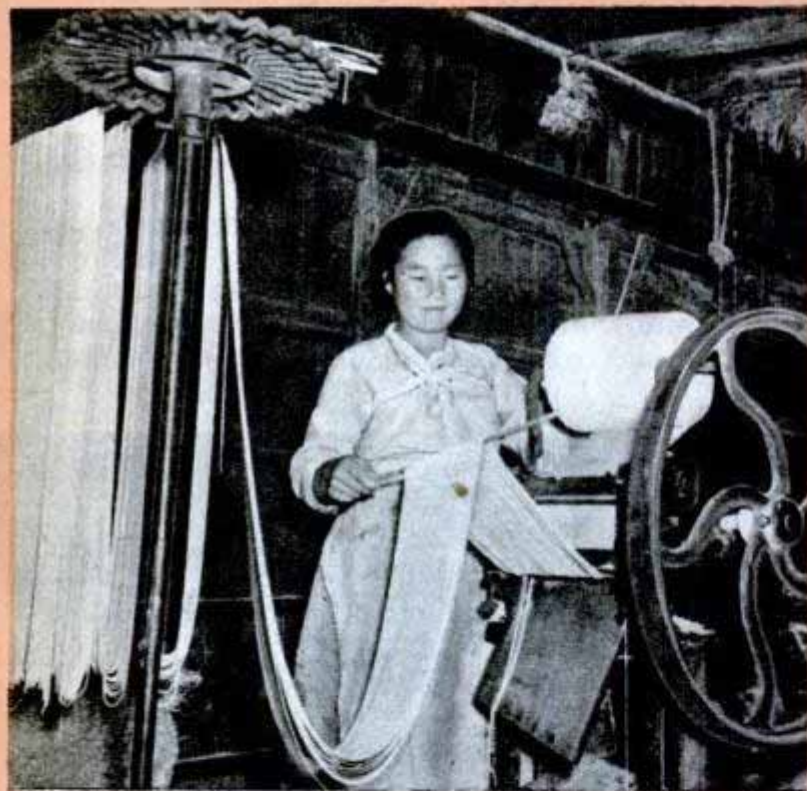
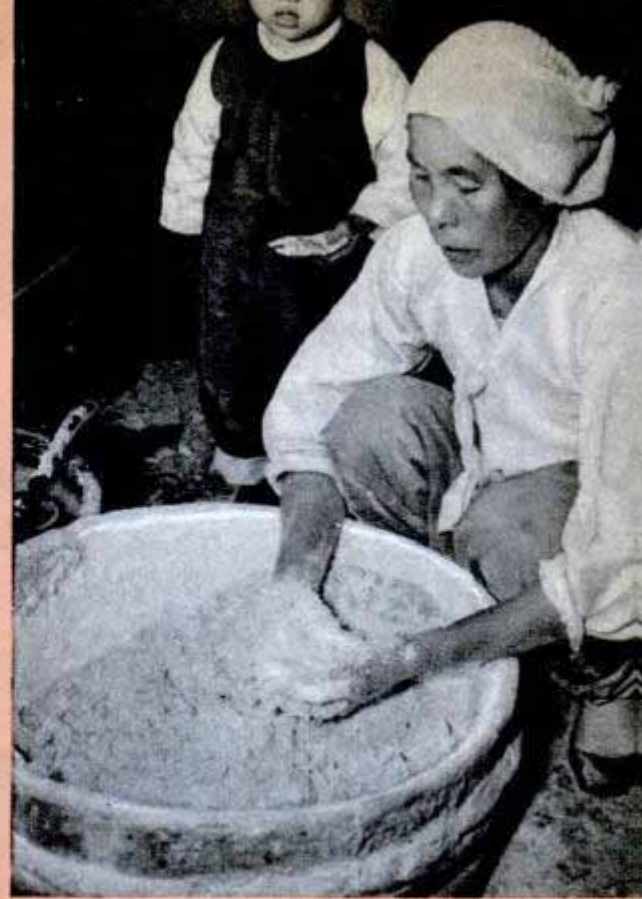
It takes as much training to break an elephant to working harness, below, as it does to teach it to go through its ponderous performance in the circus ring, right



AUGUST 1946



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Korean Noodle Factory

In Korea rice cakes, pastries, bread and noodles are produced in small household factories where most of the work is done by hand. But the first traces of the machine age can be found even in these one-family shops. In this small factory at Fusan the family makes noodles to be sold on a local street corner. Dough of flour and water is first mixed (above) in a great bowl and kneaded to the proper consistency. Then it is fed into the machine shown at the upper left—the most valuable piece of property in the household. Wringerlike rollers flatten the dough into a continuous strip that is wound on a spindle. At left the dough is fed into the rear of the machine where an attachment slits the roll into noodles several yards long. The noodles are cut into smaller lengths and hung in the sun to dry (lower left). Below, a woman cuts the noodles into one-foot lengths and ties them into bundles for the market



Auto Exhaust Heats Stove

Exhaust from an automobile supplies the heat for an outdoor cookstove invented by an Army ordnance man and now available for civilians. The stove fits over the rear bumper and a curved pipe hooks onto the exhaust pipe of a car to catch the heat which approximates 212 degrees Fahrenheit. Exhaust fumes are dissipated from the bottom of the unit. The small stove is fitted with a cover, hot plate, grate and oven to provide all types of cooking for campers.



Glass Fishing Rods Rival Bamboo

Fly rods made of glass fibers have been developed that show even greater elastic qualities than bamboo. The rods are constructed by placing long fibers over a tapered wood core, then bonding them with synthetic resins. Toward the tip of the rod the fibers are cut at varying intervals to give the pole taper and elasticity. The glass is highly elastic

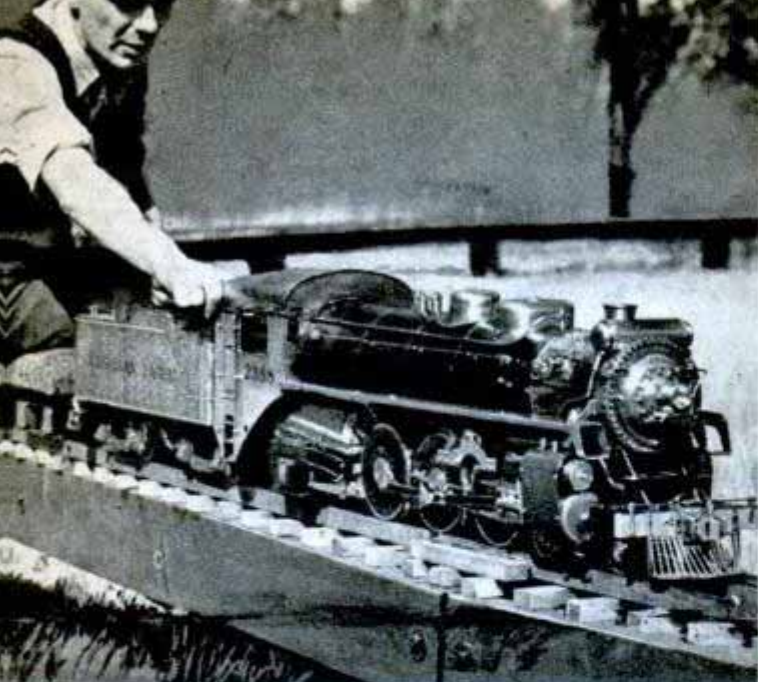
because of the extremely small diameter of each strand and is therefore ideal for making fishing rods. An estimated 538,000 individual fibers are used in making each rod. Advantages claimed for the new pole over bamboo rods are lighter weight, greater elasticity, higher breaking strength and immunity to the effects of salt water.

☞ You may wish to obtain additional information about the new products that are described each month in Popular Mechanics. If you want to know the name and address of the manufacturer or the distributor, just write to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Ill. Your letter will be answered promptly upon receipt.

DDT "Spider" on Lamp Kills Insects

Flies, moths, mosquitoes and other insect pests are killed by a spider-shaped wire frame coated with active DDT crystals. Inside the frame are two wire clips similar to those that fasten a lamp shade to a light bulb. At night the "spider" may be clipped to a bulb to kill moths and mosquitoes. During the day a piece of fly bait may be placed between the clips.





COAL-BURNING STEAM LOCOMOTIVE MODEL built by Charles Montgomery of Toronto, Canada, develops power enough to haul eight adults on a small track



THIRD DECK installed on Great Lakes Steamer Charles Donnelly increases ship's auto-carrying capacity by 90 cars. Now 432 cars are transported on three decks



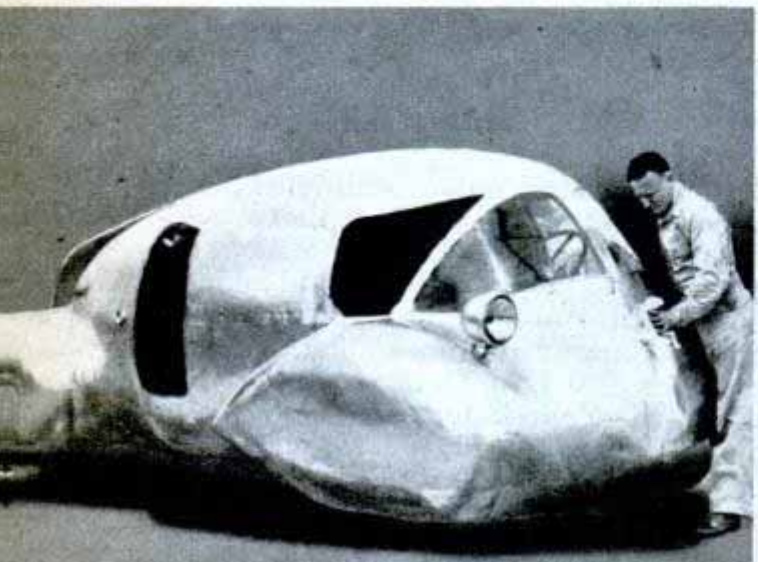
SEAGOING NAVY BLIMP is equipped with rubber pontoons for water landings. After coming to rest, the craft can be moored by throwing out a sea anchor



HAND-OPERATED AUTOMOBILE enables movie actress Susan Peters to drive despite the fact she lost the use of her legs in a hunting accident a year ago

STREAMLINED CAR built from spare aircraft parts attains a speed of over 130 miles-per hour. Assembled by Jack Norvell of Los Angeles, it is 18 feet long

GOLDEN ARROW, one of Great Britain's finest trains, recently made its first postwar run and now is on schedule between London's Victoria Station and Dover



Automatic Microfilming Camera Photographs Each Side of Check

Both sides of bank checks are photographed simultaneously by a microfilming machine. The lengthwise images of the checks appear side by side across the narrow width of 16-millimeter film. Reduced photographically 35 times, both sides of 10,500 checks can be photographed on 100 feet of film, or 100 checks per foot. The machine also endorses and face-stamps all checks, eliminating a separate operation in busy banks. Face-stamping proves that the check has been photographed and is on a microfilm file. The machine, developed by Recordak Corporation, subsidiary of Eastman Kodak Company, is expected to have wide application in offices where inactive file cards and record sheets occupy valuable floor space in file cabinets.



Silver Reclaimed From Hypo By Use of Wood Waste

Valuable silver floating around in used photographic hypo can now be reclaimed through the use of a wood waste product called lignin. Treated with an alkali, lignin is poured into the hypo solution to cause the silver to settle to the bottom of the tray along with the lignin. Next, the liquid hypo is poured off, the lignin is

burned and only silver is left. Firms that develop many films are expected to realize substantial savings by this method.

Platform Atop Mobile Crane Gives Photographs Desired "Angle"

To get proper elevation for a picture of new freight cars coming off an assembly line of the Pullman-Standard Car Manufacturing Company a photographer mounted his cameras on a four-foot-square platform and then commandeered a mobile crane to lift him into shooting position.

Rotproof Fabric Buried 90 Days Retains Full Strength

Improved chemical preservative protects fabrics against rot-causing fungi, prolonging the life of fish nets and lines, tents, tarpaulins, awnings, shoe liners, fire and garden hose and such clothing as overalls and military uniforms. Reformulated by the Monsanto Chemical Company, the long-lasting fungicide first was developed by a German chemist 66 years ago but its potentialities were discovered only recently. Known technically as copper 8-quinolinolate, the preservative is applied to fabrics at textile mills. In one test, treated and untreated strips of cloth were buried in a greenhouse where soil swarmed with destructive organisms. The untreated fabrics were destroyed in from five to seven days, while the treated samples retained full tensile strength after 90 days.



RAISING rabbits by the ton is the avocation of a Chicago oil man whose ultramodern "rabbit hotel" provides all the comforts of home for its 800 tenants and pays off in profits from fur and meat.

Whether it's meat for your own table or a money-making small business that happens to be your incentive, an efficiently operated rabbitry can pay dividends. Sheldon Clark, chairman of the executive committee of Sinclair Refining Company and a noted yachtsman, started his rabbitry as a hobby on his 87-acre suburban estate, then let the multiplication tables work for him. His 125 doe rabbits produce four litters a year, usually eight to the litter, and in 10 weeks each rabbit is a three-pound package of meat ready for market. Mr. Clark finds a ready sale for frozen rabbit, and a mail-order house absorbs his harvest of hides.

Rainbow Farm is one of the most efficiently designed and equipped rabbitries in the country, with running water and all the mechanical conveniences conceivable

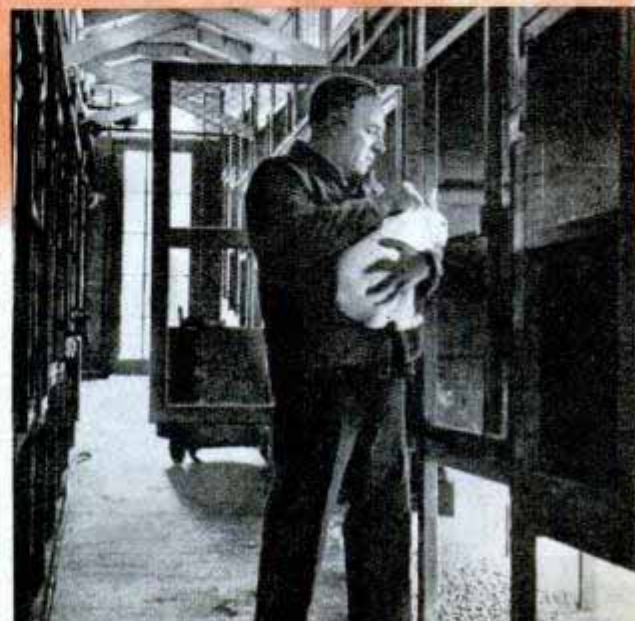
Live rabbits, frozen meat and hides constitute big business at Chicago's model Rainbow Farm rabbitry

for operation by a two-man crew which also has time to perform the maintenance work around the suburban farm home.

The GI starting a small rabbit farm can choose from a number of breeds according to the type of business that interests him. He can raise Angora rabbits to produce fluffy wool, or he can specialize in any of five other breeds (White Satin, Rex, Chinchilla, New Zealand, Flemish Giant) depending upon whether he wishes to concentrate on producing meat, felt for hats or fur for coats.

On the Clark farm New Zealand whites are the specialty. Charles Zundel, No. 1 maintenance man, designed the rabbit houses and the automatic and semiautomatic equipment so that a minimum of labor keeps the quarters clean and the rabbits well fed, watered, clean and healthy. Built on a grade so that the concrete floors slope to the rear, the houses have recessed concrete pits under each row of hutches. Daily washing by hose keeps the entire place spotlessly clean. Blowtorches re-

Double-deck hutches with wire-mesh bottoms house the rabbits. Concrete pits below are washed every day



Rabbit Hotel

move rabbit hair from the wire mesh used for the bottom of each hutch.

Wire mesh is used for two reasons: (1) rabbits kept off the ground provide tender meat, and (2) wire construction insures cleanliness and proper ventilation. Since the hutches—132 per house—are erected in double-deck fashion, a slanting sheet of metal separates the top and bottom hutches and directs droppings into the pit to be collected for fertilizer.

Automatic drinking fountains satisfy the rabbits' thirst. In each hutch a water pipe with a nipplelike valve emits drops of water when touched by a rabbit's mouth. Gravity-feed tanks at the top of the house supply the water.

Feed (a mixture of alfalfa pellets, oats and soybeans) pours out from a gravity-type storage bin when a small vertical gate is raised. A rubber-tired feed cart is used to wheel food from one hutch to another.

Oil stoves and long pipes keep the building warm in the winter, while fresh air is brought in by spinning ventilators turning



From a gravity storage bin, rabbit feed pours automatically. It's a mixture of alfalfa, oats, soybeans

Bunnies get water from drinking fountain that has nipplelike valve. Below, star boarder greets feeder





Placed on wire shapers, rabbit hides dry in about two days. Then they're sold for \$2 a pound for fur garments

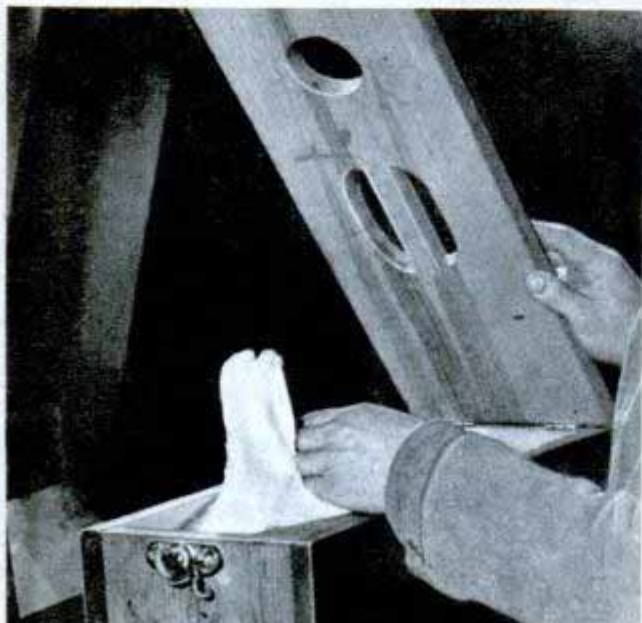
on oiled ball bearings. In mild weather additional air and sunshine are admitted by lifting hinged wall boards on the side of a rabbitry opposite the direction from which the wind is blowing.

Eight to 10-week-old rabbits are butchered and the meat—about three pounds per rabbit—is kept fresh in an electric freezing cabinet. The meat sells for about 50 cents a pound.

Hides are stretched and dried on wire shapers with the bottom of each skin held tight by clothespins. The skins dry in two days and are sold for approximately \$2 a pound, or 35 to 90 cents per hide, depending on the size and quality. The fur is used to line gloves, helmets and other garments and for some types of coats.



Tattoo box (left) holds rabbit securely while identification marks are applied to inside of his ears (right) which stick through slots in the box top. Above, rabbit meat is put in Cellophane-topped box and frozen

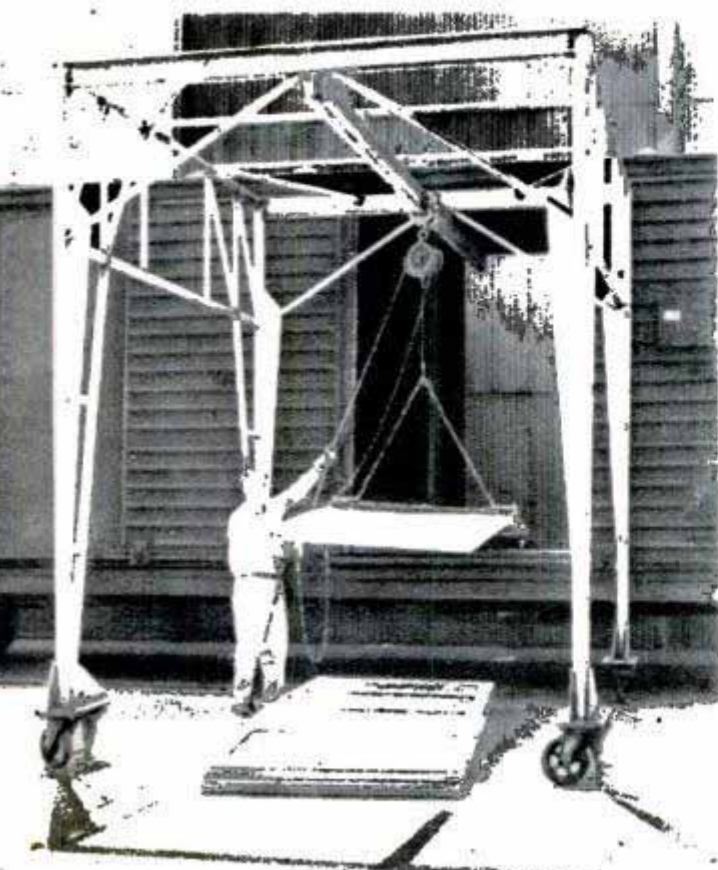




"Egg-Beater" Propeller Boosts Speed of Test Ship by One Third

Six-bladed propellers of revolutionary design were recently installed on a Navy landing craft and tests show promise that they may become standard on all vessels. The cycloidal propellers were developed by Prof. Frederick K. Kirsten of the University of Washington. They consist of giant rotors seven feet in diameter from which the blades project vertically into the water. Each of the blades revolves twice on its own axis during one revolution of the en-

tire rotor. Rudders have been removed from the test ship, as the angle of the blades can be changed to steer the ship. Tests show that the speed of the ship has been increased more than a third by the elimination of rudders and struts beneath the hull. Maneuverability is greatly increased, according to Navy officials. The test craft can spin in a complete circle without fore and aft movement, or can move directly sideways under its own power.



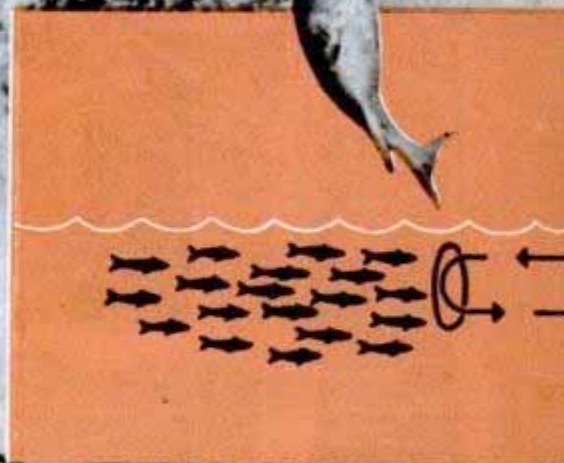
Portable Hoist Unloads Cars Where Cranes Are Lacking

Loading and unloading freight with a monorail hoist extended into the doorway of a boxcar is a technique devised by a Douglas Aircraft Company employee to speed operations and cut demurrage costs when cranes are not available. It also reduces the danger of heavy material falling on a worker inside the car. The monorail beam is mounted on a mobile metal frame.

Underwater Canyon 600 Feet Deep

Far beneath the surface of the lower Mississippi River is a mud-filled canyon five miles wide with walls 600 feet high. This underwater "Grand Canyon" was discovered by Walter J. Osterhoudt of the Gulf Research and Development Company, Harmarville, Pa., while studying the geological structure of the area south of Timbalier Bay in Louisiana.

THE FISHING FLEET



GOES *Scientific*

By Thomas E. Stimson, Jr.

DEEP-SEA fishing fleets of the Pacific are returning to port with bulging holds, hulls riding low in the water. Scientific methods of exploring the ocean are giving the ranging skippers "underwater eyes" for spotting bigger and better schools of succulent fish.

"Thar she blows!" is still the signal to the crew that a whale has been sighted. But next year the whaling fleet that works out of British Columbia expects to use sonar instruments as mechanical lookouts to detect a whale several miles away—while it's still submerged!

Developed during the war as a method of finding and tracking enemy submarines, sonar uses sound waves under water the same way radar uses radio beams above the surface. The new echo-ranging gear will make it possible for a whaling vessel to track a submerged leviathan until the crew can look straight down the spout when the beast comes up to blow.

Even the lowly sardine is now caught by applied science. Formerly purse seiners were always limited by their ability to spot schools of fish that happened to be at or near the surface after dark. Lookouts detected the presence of a school by peculiar phosphorescence that follows in its wake.

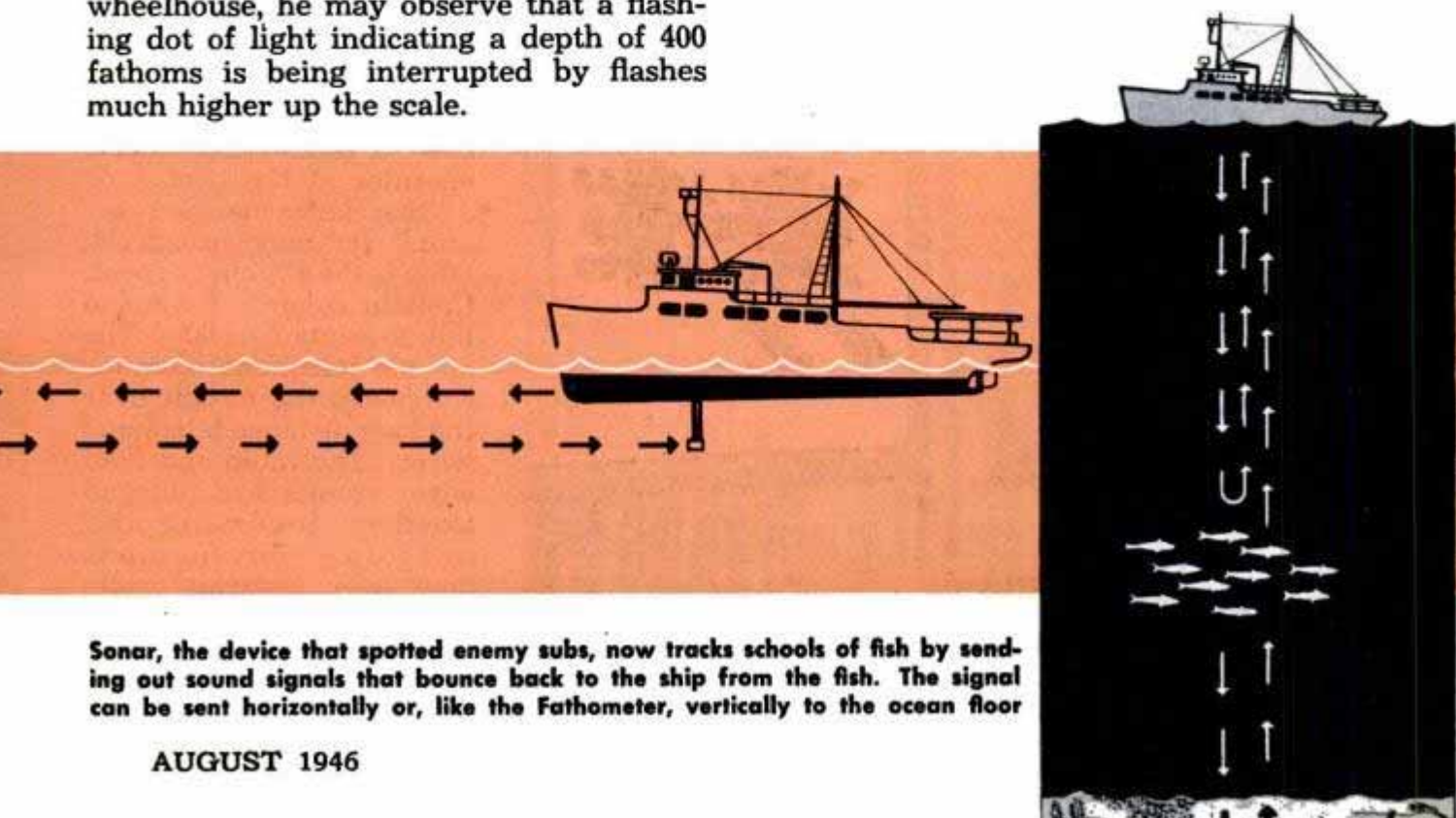
Now the skipper of a purse seiner can spot fish that are far below the surface. Watching the dial of the Fathometer in the wheelhouse, he may observe that a flashing dot of light indicating a depth of 400 fathoms is being interrupted by flashes much higher up the scale.



Navigator on a far-ranging tuna clipper swings the loop of his radio compass to "fix" a shore station

"There's a 'false bottom' at 100 fathoms," he tells his mate. "Might be sardines. We'll use the floodlights to try to bring them to the surface."

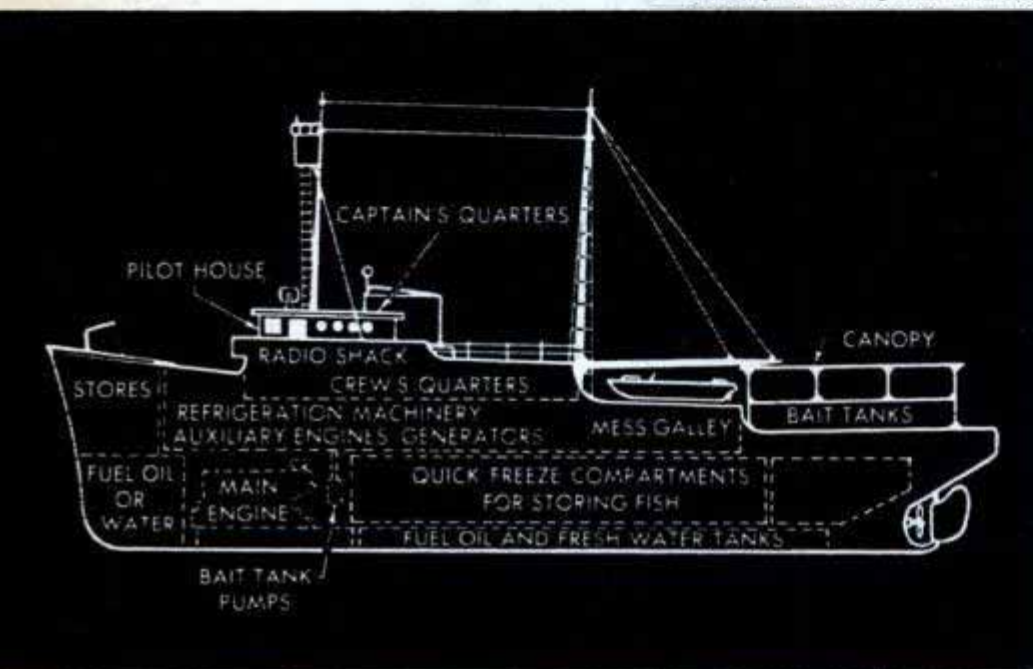
The Fathometer was a forerunner of the more complicated sonar instruments. It projects a sound signal down through the water from the hull of a vessel, measures the time required for the signal to strike bottom and be reflected back to the hull, and translates this interval into fathoms of depth. Fishermen use the Fathometer in place of the old lead line for ordinary navigation and for finding just the right depths at the fishing banks. A "false bottom" reading on the Fathometer simply may indicate a current of water of extremely different temperature or salinity some distance below the vessel. But similar indications are obtained when the signals are



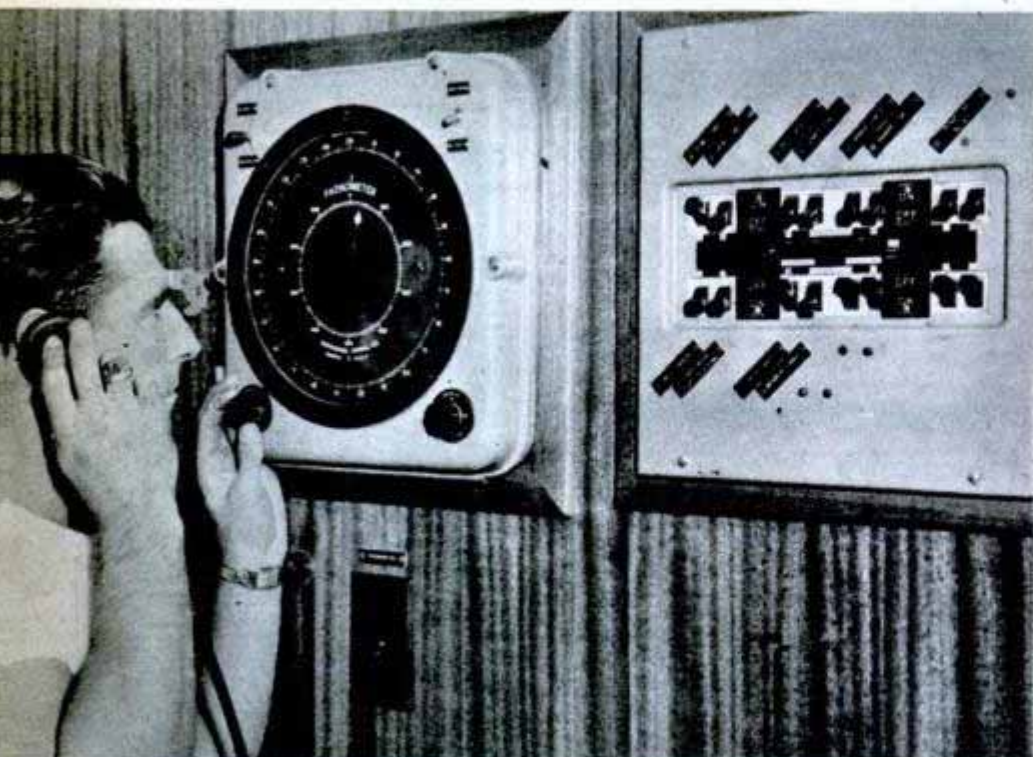
Sonar, the device that spotted enemy subs, now tracks schools of fish by sending out sound signals that bounce back to the ship from the fish. The signal can be sent horizontally or, like the Fathometer, vertically to the ocean floor



Complex tuna clippers like this modern ship can range far from home port and quick-freeze as much as 500 tons of fish during each trip
 Courtesy Van Camp Sea Food Co.



↑ Diagram of clipper shows freezing compartment where catch is stored
 ↓ Fathometer dial tells depth of the ocean floor and intervening fish



reflected from closely packed schools of sardines or mackerel or even from a whale.

Purse seiners employ floodlights as an attraction to keep a school of sardines close to the surface while a quarter-mile-long net is being drawn around the school. Another favorite trick is to use an underwater flashing beacon to prevent the school from escaping while the ends of the net are being closed. Hanging at the end of a 150-foot insulated cable below the boat, the beacon frightens the fish back into the enclosed area.

Commercial fishermen have used short-wave radiophones for a number of years for sending distress messages when the ship breaks down, and for reporting their positions and loads to shore stations. Gossiping back and forth with other boats over the radiophone, a fishing skipper learns what boats are having good luck and what boats are finding no fish. From their locations he decides where he should go to find his load.

Recently this phone facility has been hooked up to telephone circuits ashore. A fisherman who wants to report his load to his cannery or call his home to tell his family when he will return merely broadcasts a call to the marine operator at the port.

"San Pedro marine operator," he may broadcast, "this is the Flying Serpent, Captain Adams. I want to talk to Santa Ana 000." The marine telephone operator completes the circuit over the long distance telephone wires. The radio and land wire circuits are plugged together. Incoming and outgoing conversations flow over separate radio frequencies, each of which is "guarded" when not in use by intermittent tone signals similar to the busy

signal you hear on a telephone when the circuit is in use. This radio busy signal warns other stations off the frequencies and prevents interference.

During the war Navy blimps and Coast Guard aircraft often assisted the fishing fleet by reporting the locations of large schools of fish sighted from the air. This impromptu spotting service is to be continued by scout aircraft provided by some of the canneries themselves. One plane is to be based on the Galapagos Islands, two at Costa Rica. They will search hundreds of square miles of ocean daily, radioing to the clippers the latitude, longitude, size and direction of travel of the schools.

Most complex of all the Pacific fishing craft are the tuna clippers that cruise for

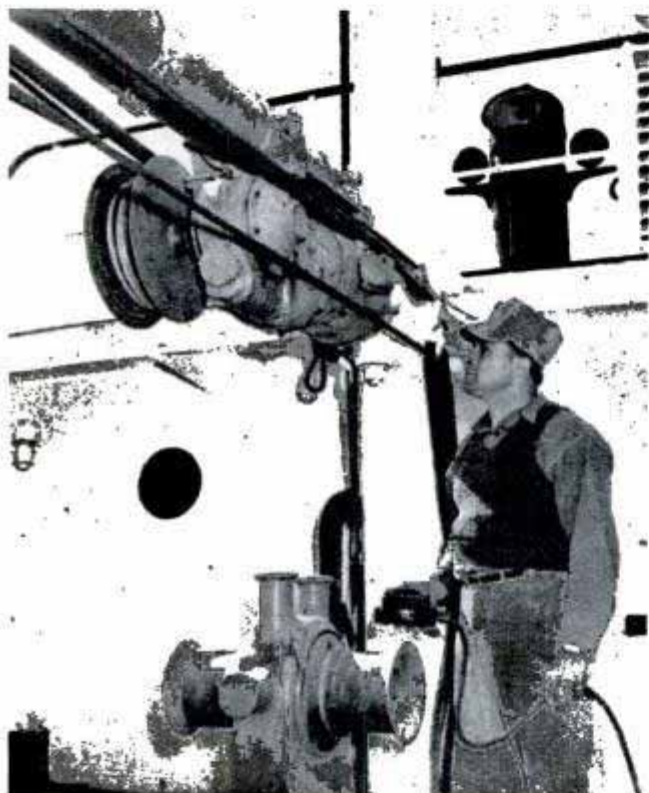


Various "teasers" and lures are used in commercial deep-sea fishing. This fisherman is examining a huge wrought iron hook and wire leader for catching sharks

although the hull at the stern may have a draft of 15 feet. The after deck is practically awash because the heavy fish are caught from the stern of the vessel and must be raised from the water. The low deck makes for easier, faster work.

Fishing crews stand on low metal racks that are swung outboard from the hull. Usually they receive involuntary baths when the vessel rolls and occasionally a man is swept overboard. He must be rescued at once because sharks may be in the area preying on the school of fish.

Live bait is thrown into the water from a large bait tank to attract the tuna to the boat. The fishermen use sturdy bamboo poles, short lines and feather lures that hide a barbless hook. When a fish strikes the lure a heave on the pole lands the tuna,

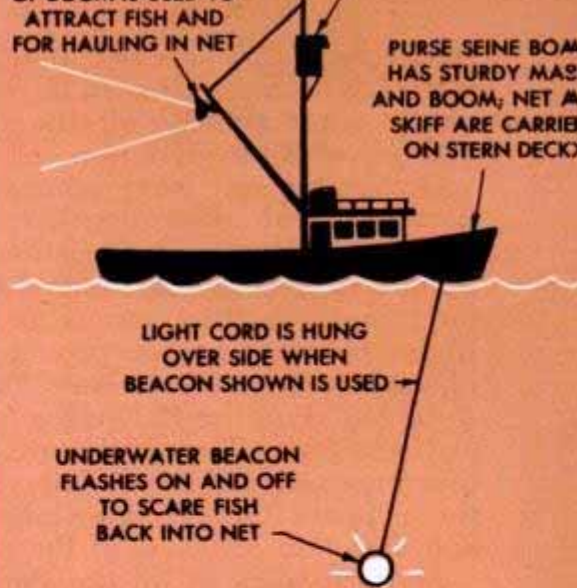
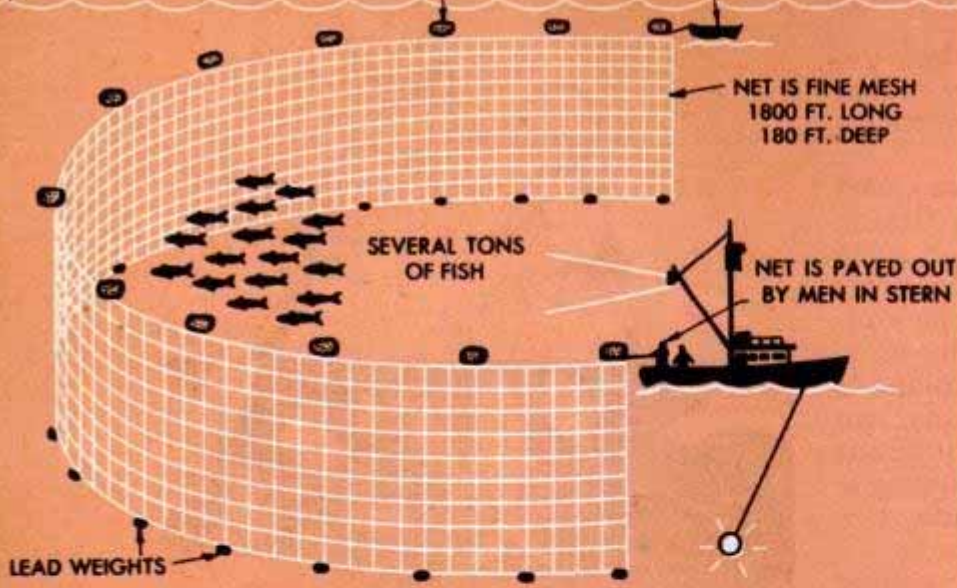


Portable switchbox in fisherman's hand controls a rugged electric motor on cargo boom. Right, wheelhouse governor permits remote control of main engine

thousands of miles in search of fish. Depending on the season of the year a clipper may get its load almost within sight of its home port or it may follow the fish all the way to the coast of South America, below the equator. The tuna pack, which had a value of \$50,000,000 last year, is the most valuable fishery on either coast. One record catch delivered recently in San Diego by the "Espirito Santo" after a 57-day round trip to the Galapagos Islands consisted of 445 tons of yellow-fin tuna. The prize load was valued at \$88,950.

Modern tuna clippers, because of their peculiar needs, look like no other craft in the world. A typical vessel has a high forward deck, with very little freeboard aft





Sardines for your table are trapped in cork-floated nets payed out in a great circle by the purse seiners

the hook flies free and the fisherman casts the lure back into the water.

Tuna vary greatly in weight. The fish in a school may average 20 pounds, 30 pounds or even as much as 60 pounds. The fishermen form "three pole" or "four pole" teams for catching the larger fish, working simultaneously with all the lines of a team attached to a common leader and hook.

Before the war freshly caught fish were iced down in the fish holds or stored in refrigerated brine tanks. Postwar clippers are equipped with quick-freeze units that spot-freeze the fish and keep them at below-freezing temperatures during the return trip. The fish must be thawed at the cannery before they can be cut up, cooked and canned, but this extra step in the canning process is more than offset by a lack of spoiled fish that formerly were found in most loads.

From the mechanical standpoint a modern tuna boat rivals an ocean liner in equipment. No expense is spared to provide every



Light on the boom attracts fish while undersea beacon shown at left frightens them into net

navigational device and working aid. A tuna clipper may cost as much as a quarter of a million dollars, one third spent on the hull and two thirds on equipment.

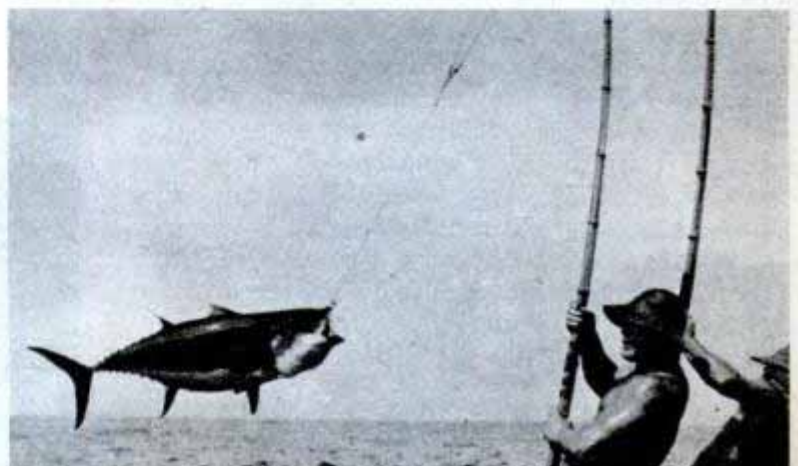
Typical of the latest clippers is the "Chicken of the Sea" that fishes for the Van Camp Sea Food Company of San Diego and San Pedro.

This 142-foot vessel is powered by a 1560-horsepower Diesel engine and has two 265-horsepower auxiliary Diesels that drive 175-kilowatt generators. Aside from its engines the boat is all-electric in operation. Electric motors operate the sharp-freeze refrigeration plant and drive the large pumps that circulate fresh sea water through the bait tanks. The vessel can carry 250,000 sardines or other small bait fish and is equipped with small boats and nets for collecting this bait.

The vessel has an automatic fire alarm system with carbon dioxide extinguisher

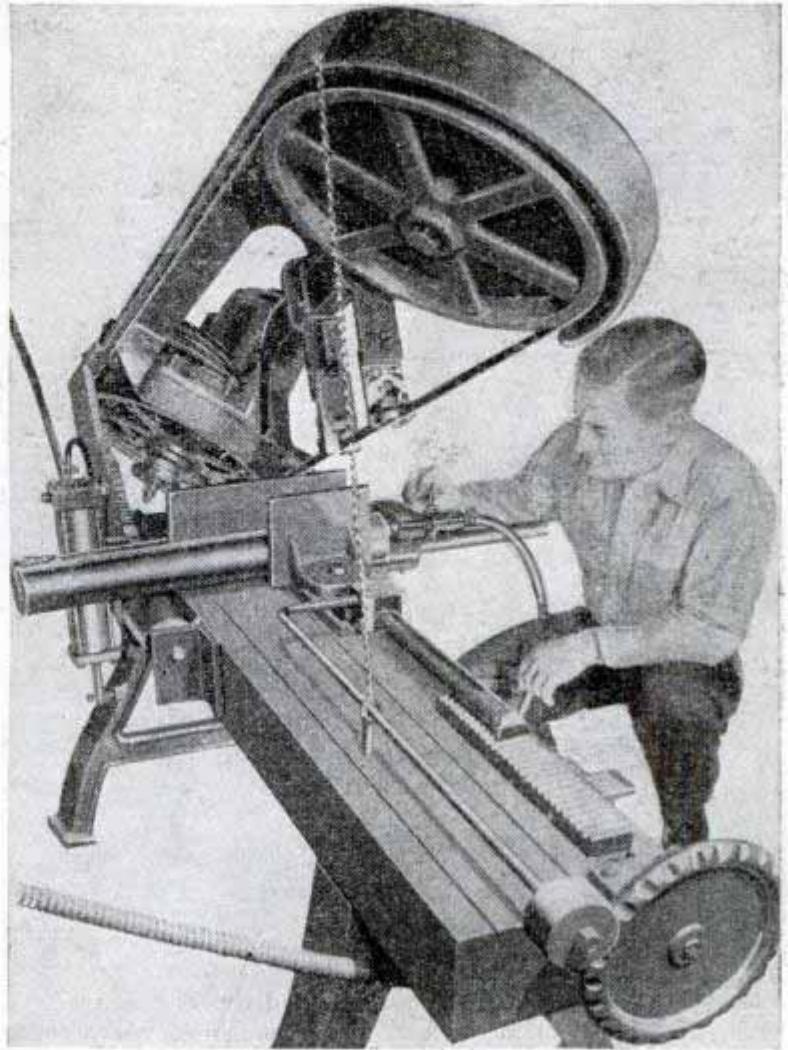
(Continued to page 236)

Left, lookout in this protected station on the mast can guide the steersman by telephone toward a school of fish. Right, fishermen of a "two-pole team" join forces to swing a tuna heavyweight aboard the clipper



Converter for Manual Saws Makes Operation Automatic

Manually operated metal cutoff saws can be converted to automatic operation with a device that is installed in a few hours. The converted unit will cut any length stock from $\frac{3}{16}$ inch up with a consistency of accuracy to .010 inch. The controlling element of the new device is a supersensitive air valve that is located at the length control stop, the block of metal that governs the length of pieces that are to be cut. When the saw cuts through a piece of stock, the piece falls, releasing the air valve which activates an air cylinder. The cylinder raises the head of the saw until the stock is cleared. At the same time the clamp that holds the stock during the sawing operation is released, and a chain operated by a friction clutch pulls the stock forward until it is again in position against the length control stop. This closes the air valve and lowers the blade to complete the cycle of operation. The saw can be changed back to manual operation simply by turning off the air valve. The life of the saw blade is said to be prolonged as much as 50 percent by an oversize oil-check cylinder that lowers the blade gently into the stock. Special units are built to fit each of the more widely used makes of metal cutoff saws.



Homemade Tom Thumb Tractor Built to Half-Size Scale

Children enjoy cultivating make-believe farms with a real though pint-size tractor built by Carl Huber of Colfax, Washington. Huber estimates that he spent 1500 leisure hours and about \$100 for materials in



building the model, which was started five years ago. The tractor is built to a half-size scale of a real tractor and contains individual steering clutches, a master clutch, gas throttle, greasing system and leather upholstered seat cushion. Most of the parts are constructed of wood. The track shoes are made of masonite, the cleats of maplewood and the track chain of rubber belting. The machine weighs about 200 pounds, is 48 inches long, 33 inches wide and 28 inches high. Top speed of the tractor is five miles an hour.

Paprika Makes Brook Trout Wild —At Least in Color

Hatchery-reared brown or brook trout are getting paprika in their diet. This brightens their normally pale pigmentation to the same color as wild trout. The diet is being fed by the U. S. Fish and Wildlife Service. Controlled experiments revealed that coloration of hatchery trout similar to that of wild trout could be produced by using two percent of paprika in food. The paprika colors only the exterior of the fish and does not affect the taste of the flesh. Anglers had objected to hatchery trout because of their pale coloration.

DRIVE TO THE



Signal Corps photo

Motorists, take your pick—from pines and snowy peaks of the Pacific Northwest to Mexican village near Pan-American route
Mexican Tourist Association photo



By Andrew Hamilton

NOW that the family car is rolling again you'll want to explore the possibilities of driving to the other Americas.

The international highways to adventure beckon whether you're the proud owner of a spanking new 1946 model or the driver of a patched-up vehicle whose vintage dates back to the '30s.

There's real news for the motor-ing vacationist in what lies ahead in 1947, 1948 and the 1950s. Get out your atlas and check these exciting prospects:

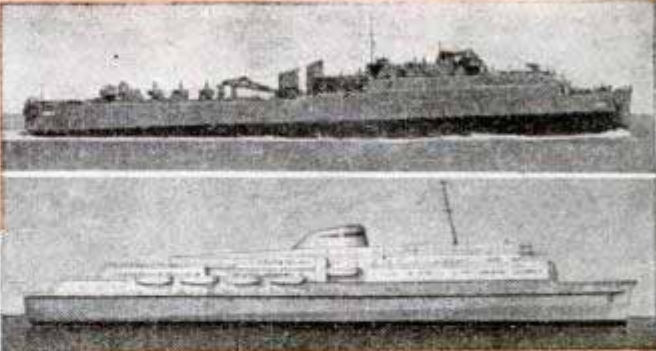
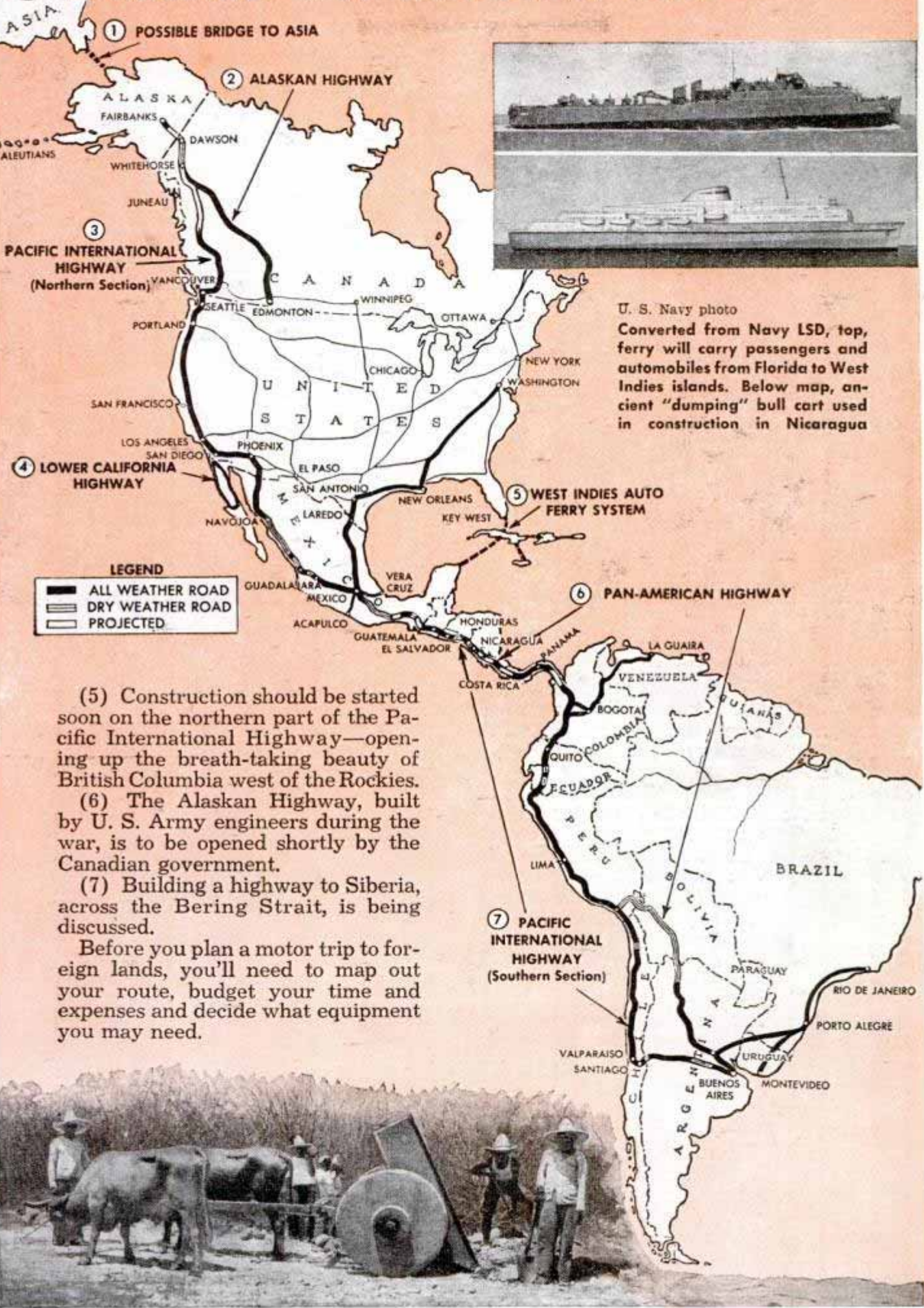
(1) By 1947 or 1948, the Pan-American Highway—almost all 13,000 miles of it—should be completed and you will be able to drive to Argentina or Brazil.

(2) An auto ferry is planned from Florida to the West Indies.

(3) A new round-trip highway into mysterious Lower California will be completed soon.

(4) Improvements should be well under way on the southern section of the Pacific International Highway down the west coast of Mexico.

OTHER AMERICAS



U. S. Navy photo
 Converted from Navy LSD, top, ferry will carry passengers and automobiles from Florida to West Indies islands. Below map, ancient "dumping" bull cart used in construction in Nicaragua

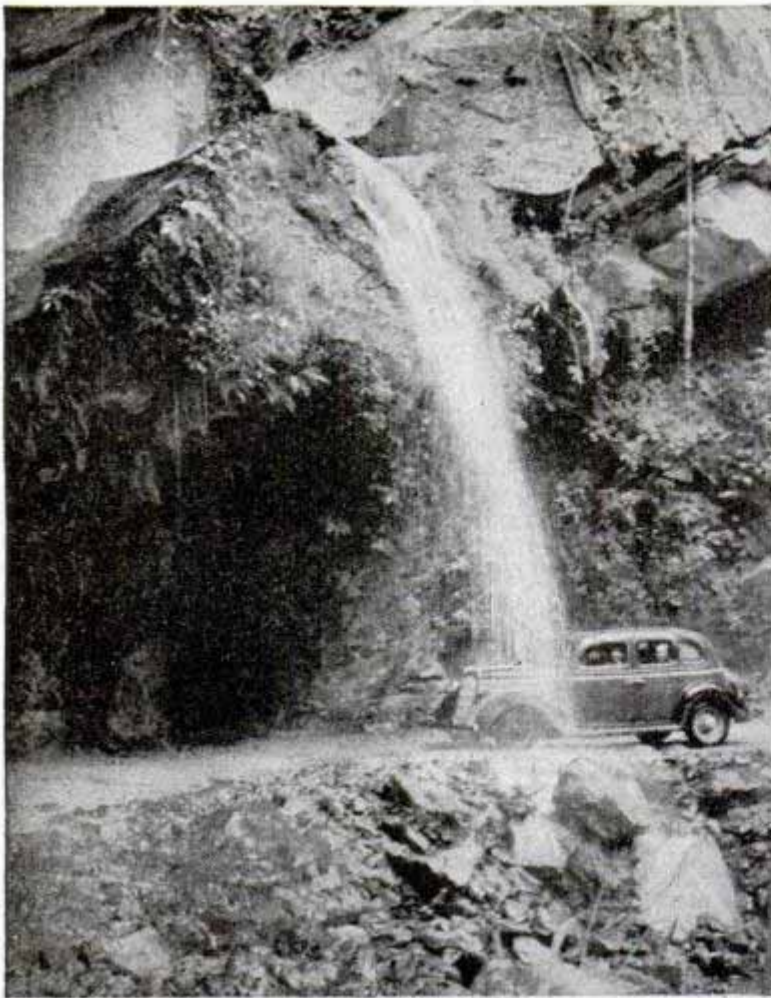
(5) Construction should be started soon on the northern part of the Pacific International Highway—opening up the breath-taking beauty of British Columbia west of the Rockies.

(6) The Alaskan Highway, built by U. S. Army engineers during the war, is to be opened shortly by the Canadian government.

(7) Building a highway to Siberia, across the Bering Strait, is being discussed.

Before you plan a motor trip to foreign lands, you'll need to map out your route, budget your time and expenses and decide what equipment you may need.





Construction of the new international highways was speeded by the war. In 1942 and 1943, when Nazi subs were sinking our ships and the Japs were making landings in the Aleutians, it looked as if our only link with Alaska and the Panama Canal might be overland highways. Army engineers performed herculean tasks on both the Alaskan and Pan-American Highways which now will tie the peoples of 21 nations closer together economically, socially and culturally.

The Public Roads Administration is carrying on where the army left off. American money, engineering skill and equipment have been poured into construction.

Waterfall over main highway, left, near Bogota in Colombia. Below, Pan-American route winds through the mountainous jungle



However, it's a two-way proposition because the countries of Central and South America are furnishing labor and materials—and they'll send their tourists to the United States.

As construction proceeds, gas stations, garages, motor courts and restaurants are beginning to flank the highways. Chile, Argentina and Peru have already embarked upon a program of hotel-building to accommodate the expected increase in auto travelers.

Safety has been carefully considered. The Pan-American Highway Congress, for example, has recommended a system of road signs and markers similar to those in the United States. The only difference is that of language. The highway signs of the near future will contain easily translated examples of "stop", "go", "steep grade" and "dangerous curve" signs in Spanish and Portuguese as well as English.

International highways will promote economic exchange of goods. Already, over incomplete portions of the Pan-American Highway in Central America, commercial trade is picking up.

Fine cattle raised in Costa Rica can be hauled to market in a few hours whereas before the long trip overland resulted in a 20 percent loss in weight. Guatemala will be able to produce rice and camphor superior to that of the Orient. There will be a "market road" for pineapples, hemp,



Mexican Govt. Tourist Dept. photo
Colorfully garbed caballeros greet visitors at a hotel in Mexico City

cashew nuts, coconut oil, cacao and other tropical products.

These are the international highways that you will be able to drive over in the near future:

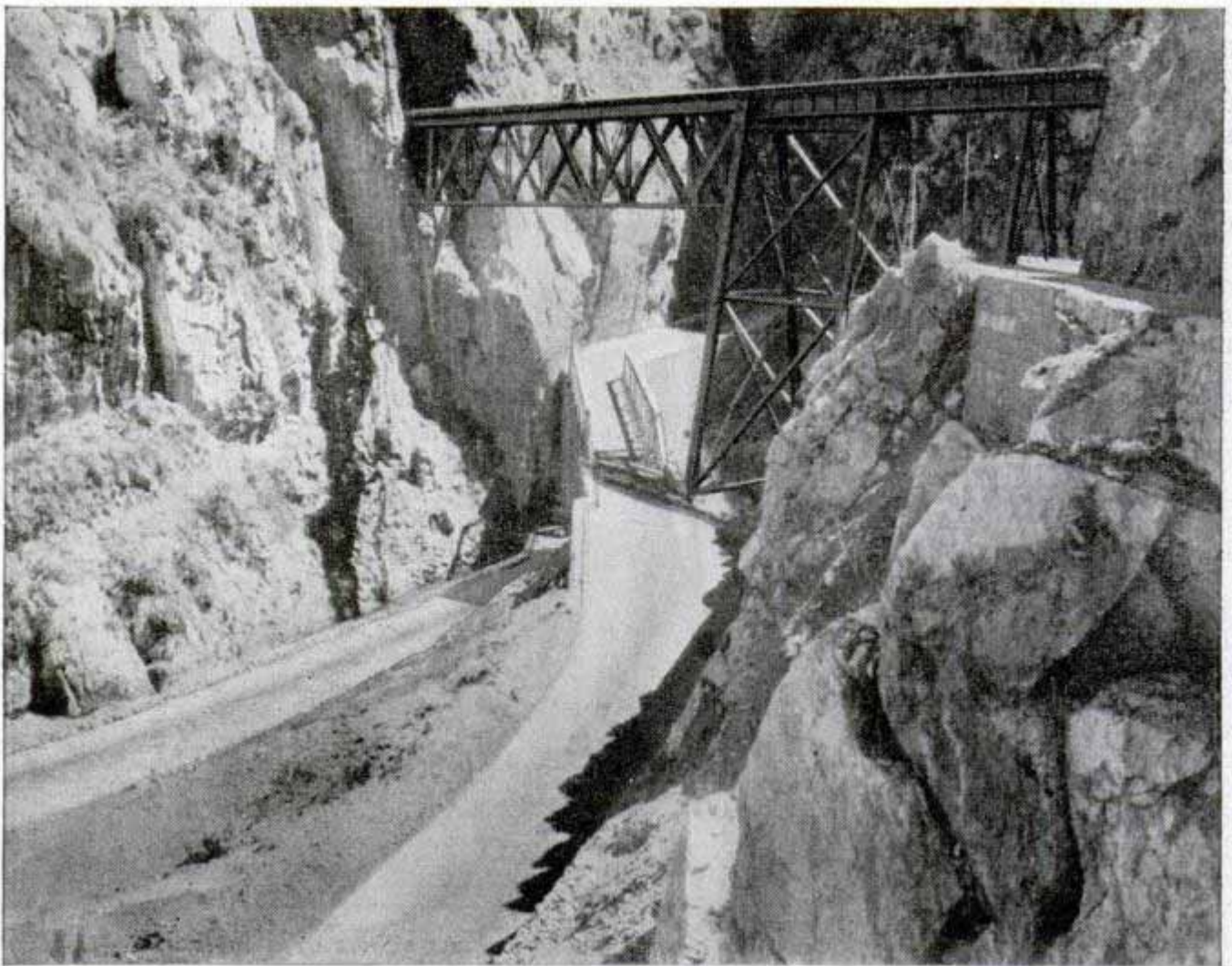
Pan-American Highway—Greatest of all is this highway which begins at Laredo, Tex., and extends for 3200 miles to the Panama Canal, continues another 6000 miles to Buenos Aires and then turns north for another 1900 miles to Rio de Janeiro.

This magnificent highway was the inspiration of a group of U. S. and Latin-American engineers meeting in Washington, D. C., in 1924. Built over trails and roads used by Aztecs, Mayans and Incas, it links the capitals of 17 nations and penetrates the last frontiers of the Western Hemisphere.

Work on the Pan-American Highway has averaged about 600 miles a year. Most of the South American part and much of the Mexican have been completed and are already in use. Between

Shy Bolivian natives in colorful dress turn their backs to camera





Three levels of winding highway and railroad bridge fill narrow gorge on Pan-American Highway between Lima and Oroya, Peru. Below, tourists awaiting U. S. customs inspection jam one of the many gateways to the south



is the stubborn "missing link" of Central America. Here, rank jungle, high mountains and tropical rains have presented engineering problems that are almost impossible to solve.

Costa Rica offers an example. Some 71 miles of construction required the handling of 17,000,000 cubic yards of excavation. This is nearly 240,000 yards per mile—as compared with 15,000 yards per mile on the Alaskan Highway. Most of the excavation is rock and many tunnels must be built.

Still under construction are some 400 miles from Oaxaca to Mexico's southern border, 150 miles in Costa Rica, 50 miles in northern Panama and 200 miles in southern Panama and Colombia. This latter stretch may not be completed for eight or 10 years and may be served by ferry.

West Indies Ferry-Highway System—Harold G. Williams, a Florida barge operator, has the blueprints and \$2,000,000 for a

superferry between Key West and Havana. This ferry, which may be in operation soon, will carry 300 automobiles and 900 passengers across the 90-mile Florida Straits in about six hours. Average cost will be around \$20 per car.

This is just the start of an ambitious plan to open up all the West Indies to automobile traffic. Other ferries will run between Cuba and Haiti (fare, \$40), and between the Dominican Republic and Puerto Rico (fare, \$30). A route between Cuba and Jamaica is also planned.

Still another ferry will run from Cuba to the Yucatan peninsula when a spur of the Pan-American Highway has been built into that area. This will save 800 miles of driving for motorists on the Atlantic seaboard who may wish to visit Mexico City.

Lower California Highway—Work on a round-trip highway, starting at San Diego and making a 500-mile loop into Lower California, is under way. Construction of this road began early in 1942 when it seemed possible that the Japs might land on the desolate coast of Lower California and march on San Diego or Los Angeles.

Originally a military necessity, this new international highway will become a popular tourist road into the mysterious, little-known peninsula that has seldom been seen by white men since black-robed Jesuit missionaries built a string of adobe-walled churches there 250 years ago.

Pacific International Highway—Not as well-known as the Pan-American Highway is the Pacific International Highway. It begins in Alaska and hugs the Pacific slope all the way down to Chile. From Mexico City to Vitor, Peru, it becomes a part of its better known relative, the Pan-American Highway.

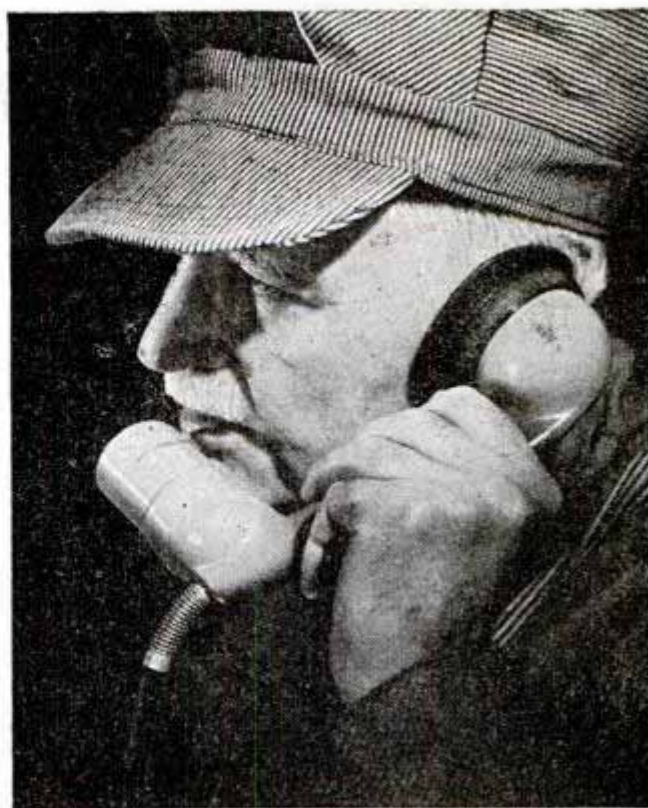
The Mexican section of this highway begins at Nogales, Ariz., and follows the west coast of Mexico through Guaymas and Guadalajara to Mexico City. The road has been completed south to Guaymas where California and Mexican anglers go for what is said to be "the best deep-sea fishing in the world."

As far back as 1930, a party of highway engineers, representing the Southern California Automobile Club, drove the entire 600 miles of the projected highway to Mexico City. Their cars followed cow-paths, forded streams without bridges and crept over the mountainous country of Mexico's "barrancas."

But they got through and pioneered the road that you some day will be speeding along at 50 miles an hour. Money for the construction of this highway has been appropriated. It is expected that construction will get under way soon.

(Continued to page 220)

Plastic Radiophone Sifts Sounds To Pick Up Voice Only



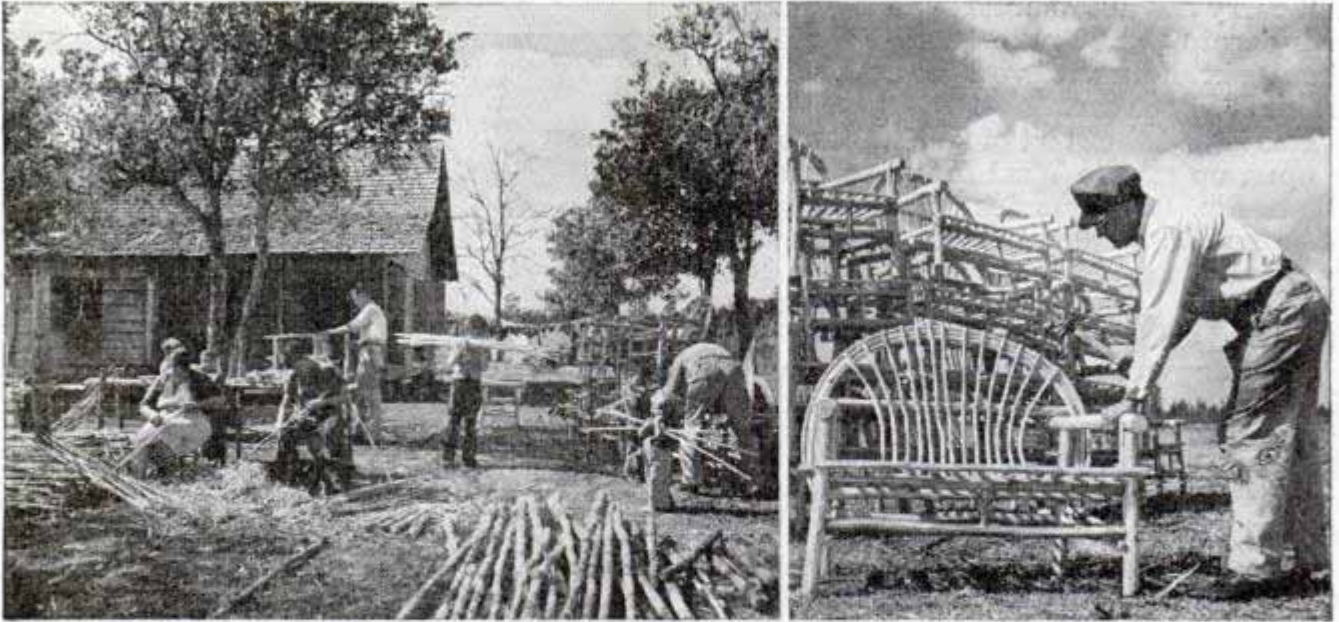
Two narrow slits on the cylindrical mouthpiece of a Tenite plastic radiotelephone handset pick up only the voice of the speaker and eliminate distracting sounds. The set is designed for two-way radio communication on railroads. The earpiece is fitted with a rubber attachment which cups tightly over the ear to aid reception. A red button on the middle section of the set operates the transmitter; it is pressed for speaking and released for listening.

Thermometers Gauge Jet Speed

New instruments have been developed to measure the extremely high speeds of jet planes and the slow movement of helicopters. Dr. Theodore Shedlovsky of Rockefeller Institute developed a method of using two thermometers to measure the speeds of jet planes. With two thermometers mounted on the outside of the plane—one shielded and the other exposed to full air flow—an electrical device records changes in temperature in the two thermometers as the plane's speed is stepped up. A comparison of the figures reveals the actual speeds. For measuring the speeds of helicopters and other slow-moving aircraft the National Bureau of Standards developed lightweight anemometer cups mounted on bearings which start rotating in less than two knots of wind.

Names and addresses of manufacturers of new products featured in this issue will be supplied promptly by the Bureau of Information, Popular Mechanics Magazine, 200 East Ontario St., Chicago 11, Illinois

Family "Furniture Factory" Grows Wood in Backyard



Raw materials are no problem in a furniture "factory" near Polk City, Fla. The nine-member family of J. H. Wilson cuts sturdy cypress poles in quantity from a

nearby swamp and turns them into three-piece sets of strong rustic furniture. All of the family participate in the enterprise. The sets are shipped to northern markets.

Building House Is Child's Play With British 'Prefab' Home

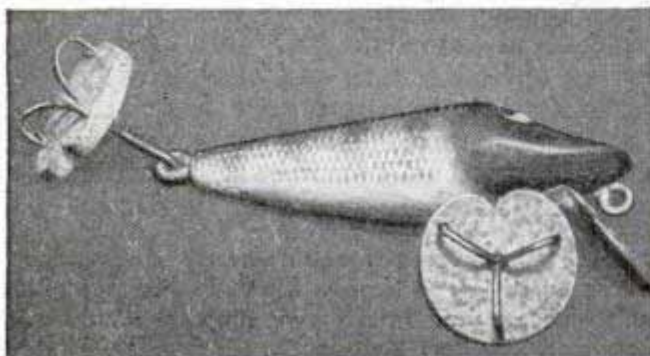
Even children are helping erect homes in England to solve the critical housing shortage. Aluminum prefabricated houses have been designed that are so simple in construction that children aid in assembling them. Each house is built in four sections. The lightweight sections are shoved together and bolted in place to form one unit.



Cork Disk for Hook Protects Angler

Cork disks are now available as a solution to the fisherman's age-old problem of how to prevent his fishhooks from snagging fingers when not in use. The disks are marketed in kits which contain

corks of various sizes from large ones for deep-sea hooks to smaller ones for lake and stream fishing. Disks with large holes in the center are included for hooks with feather lures. Both lures and plugs may be carried in the pocket safely when the points are imbedded in the guards. By pushing the disks onto a dowel, floats and bobbins can be improvised quickly.



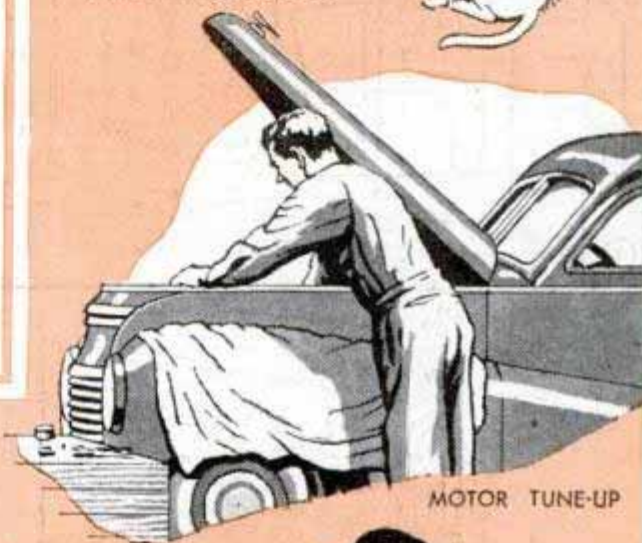
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The Craftsman

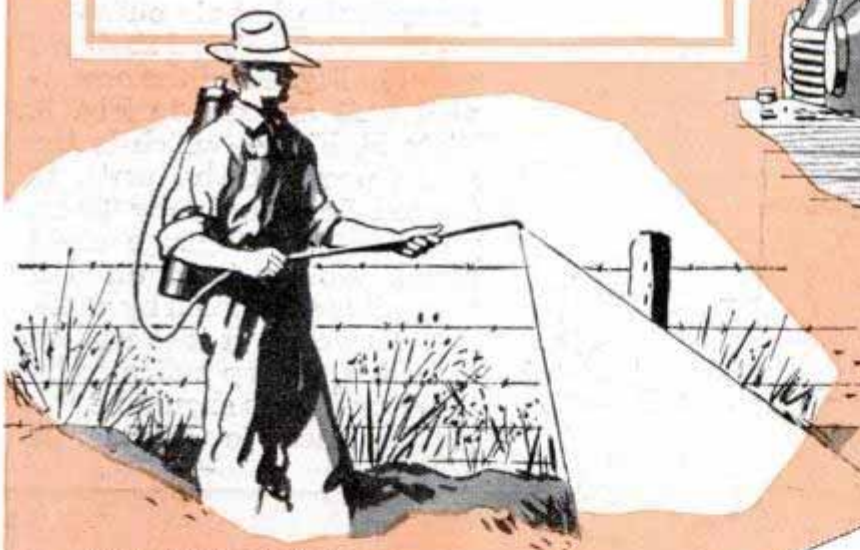
"Fine thing," your back-seat driver will say, "you get us halfway up Pikes Peak and then let the engine conk out. A fine thing! Didn't I tell you to take Popular Mechanics' advice and tune up the motor before we left home?" And so on and on. It may happen to you on the Pikes Peak road or in Death Valley or halfway through the Holland Tunnel. Wherever it happens it will be embarrassing, it will delay your trip, it will be—shall we say—a nuisance. So take a tip from the Old Craftsman and read about motor tune-ups on page 180 . . . The ancient jalopy is not the only hazard facing 1946 tourists; there is the matter of crowded hotels. On page 186 is one solution: convert the rear of your car into a comfortable roadside "sleeper." Here are other highlights of the pages following: a timely article on chemical weed controls (page 170) . . . an insulated "Quonset hut" for your dog (page 185) . . . and, for shop men, an article (page 203) tells how to build spot welders in three sizes



INSULATED DOGHOUSE



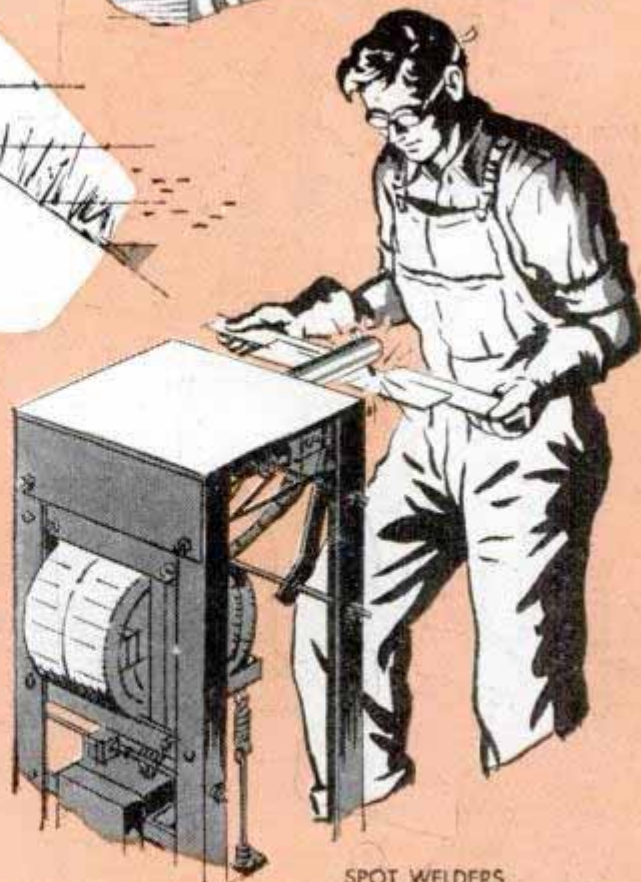
MOTOR TUNE-UP



WEED-KILLING SPRAYS



COUPE BED



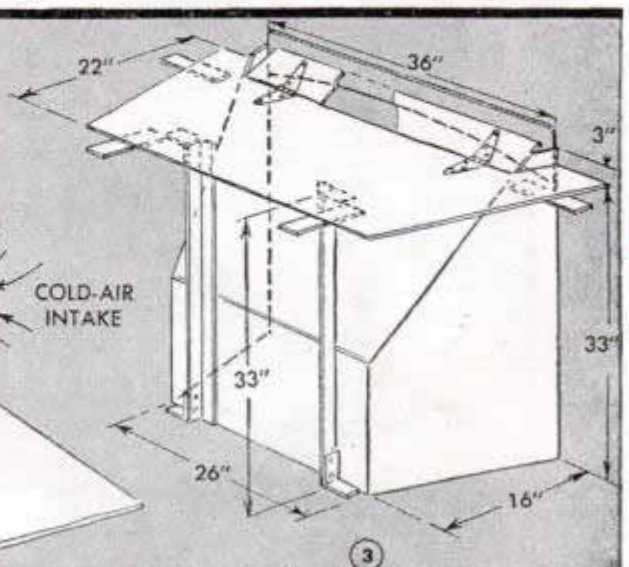
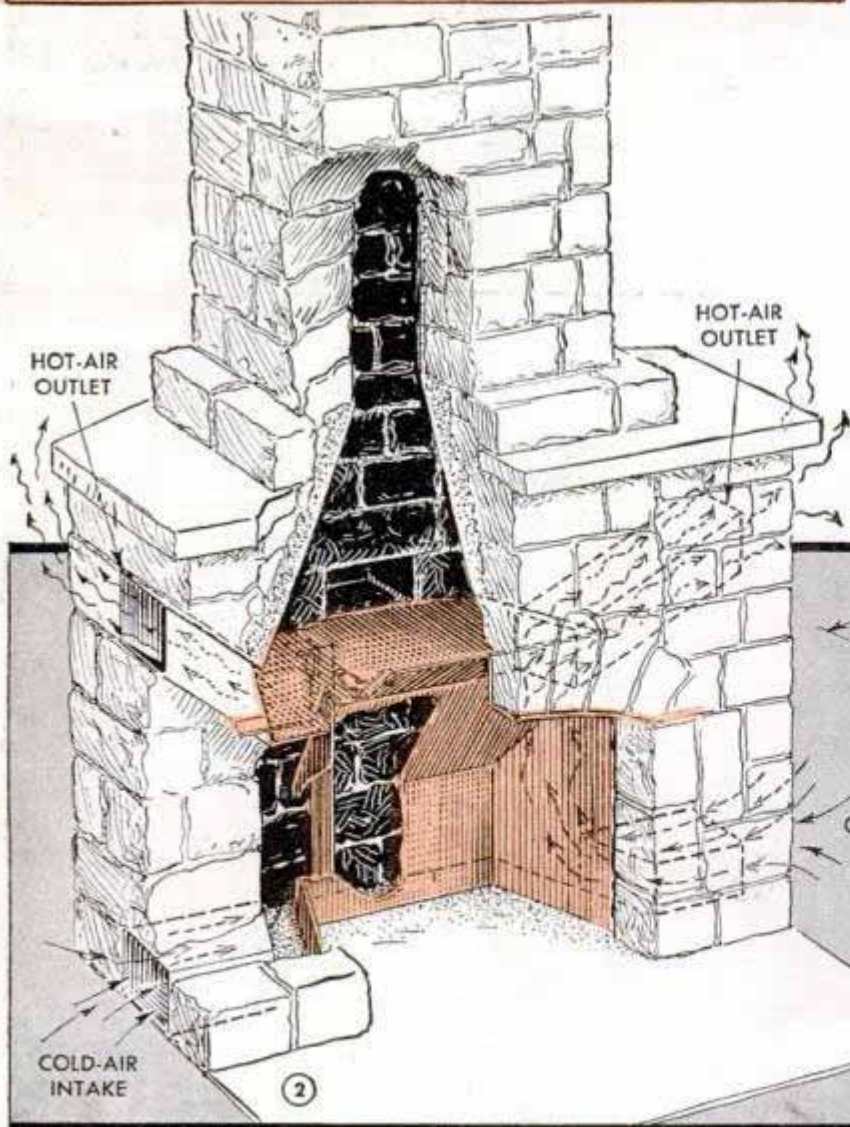
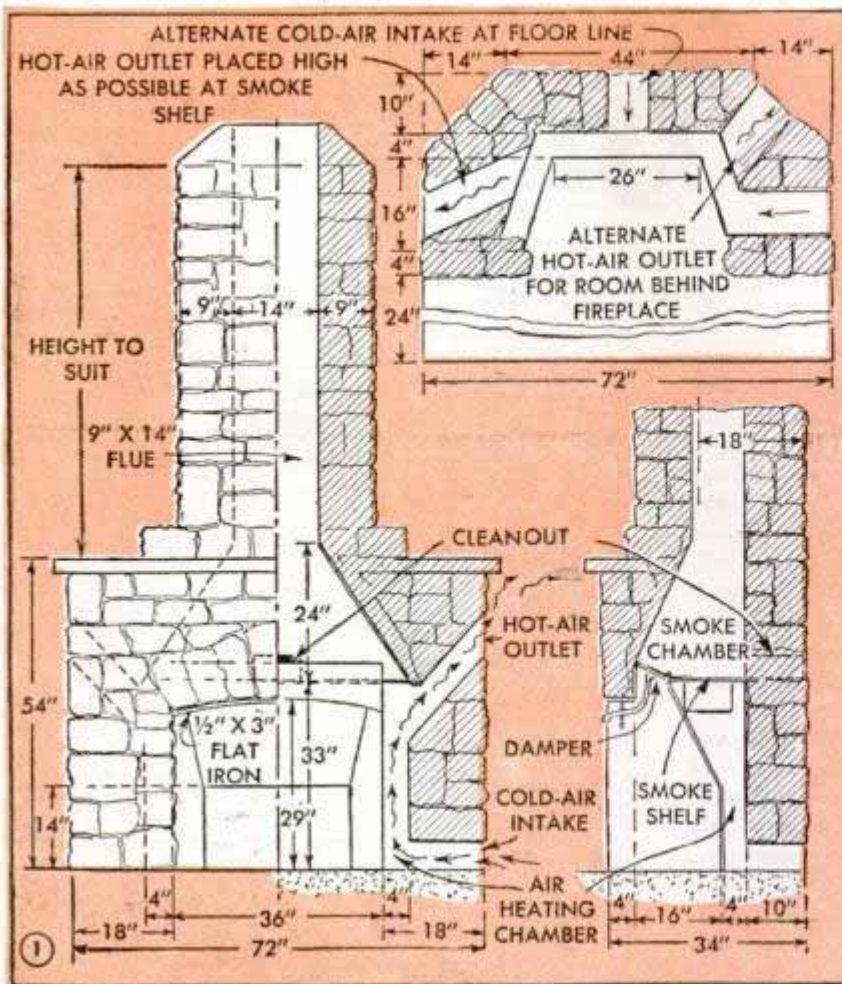
SPOT WELDERS

Fireplace

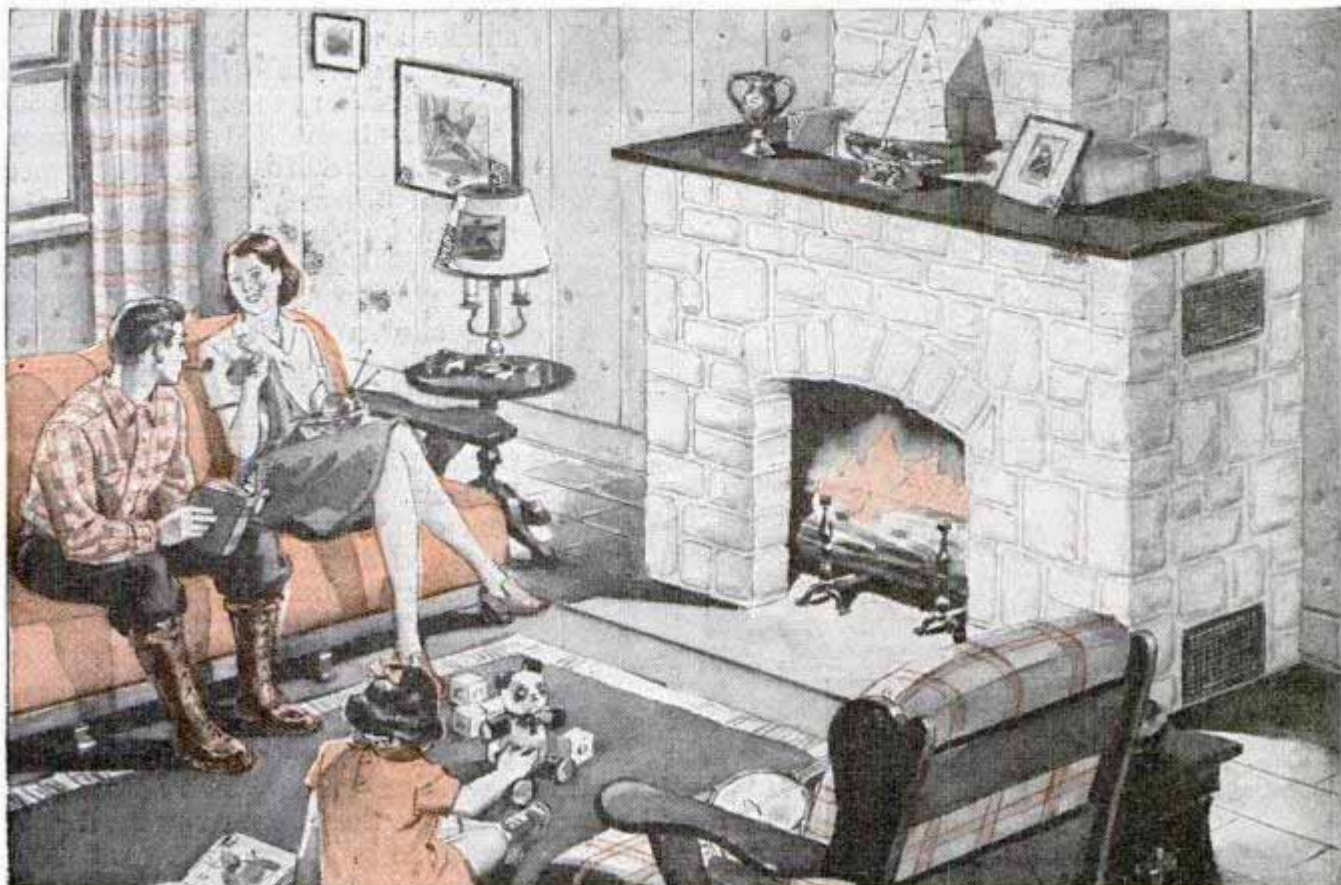
By J. B. Temple

THERE'S no need to worry about chilly evenings at your cottage or camp if you have this circulating fireplace. It's also equally effective in your home for cool evenings during late spring and early fall so you won't have to start the heating plant. And during the winter it will lessen the load on your furnace considerably on extremely cold days. Because it recirculates the air instead of sending most of the heat up the chimney, this fireplace is an efficient unit. The path which the air follows is shown in Fig. 2; it enters the cold-air intake, passes through the space formed by the metal shell and the masonry, where it is heated, and finally is discharged through the hot-air outlet.

Details of the steel shell are given in Fig. 4 and the assembled unit appears in Fig. 3. Plate E, Fig. 4, which is the main part of the unit, is formed from a 36 by 60-in. piece of No. 12-gauge sheet metal. No lap is required if the unit is assembled by welding. However, if it is riveted or bolted, the lap indicated by the dotted lines should be followed. These joints must be



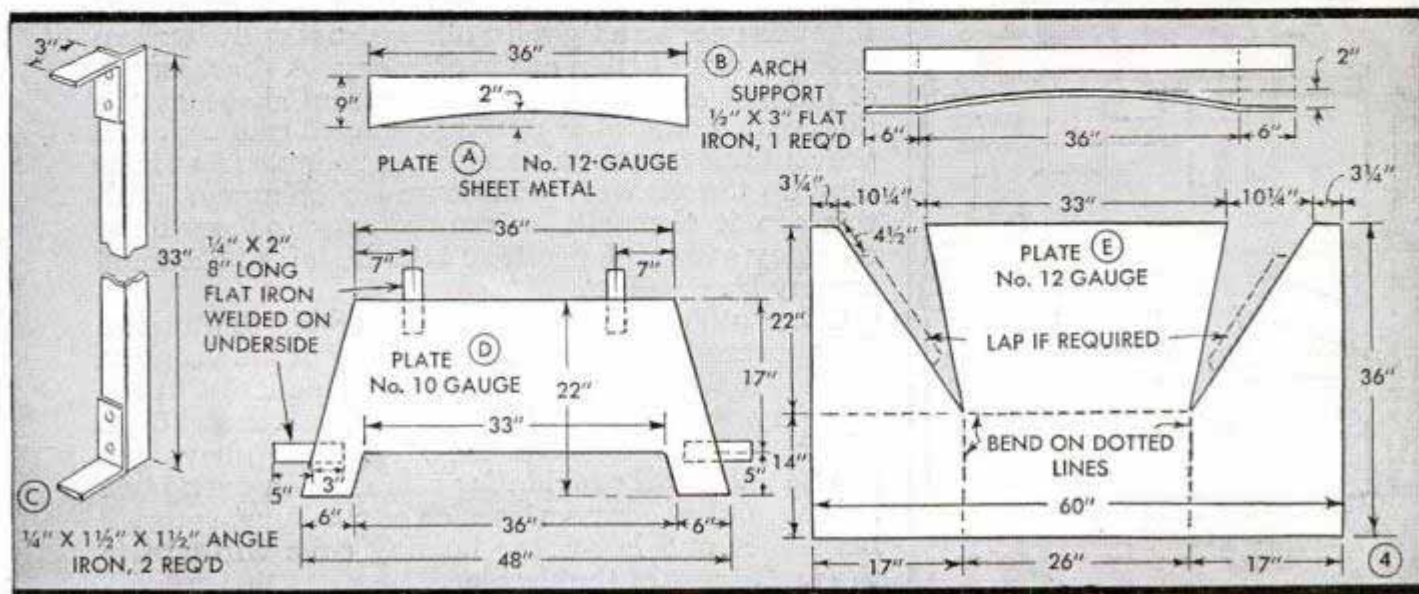
Circulates Warm Air

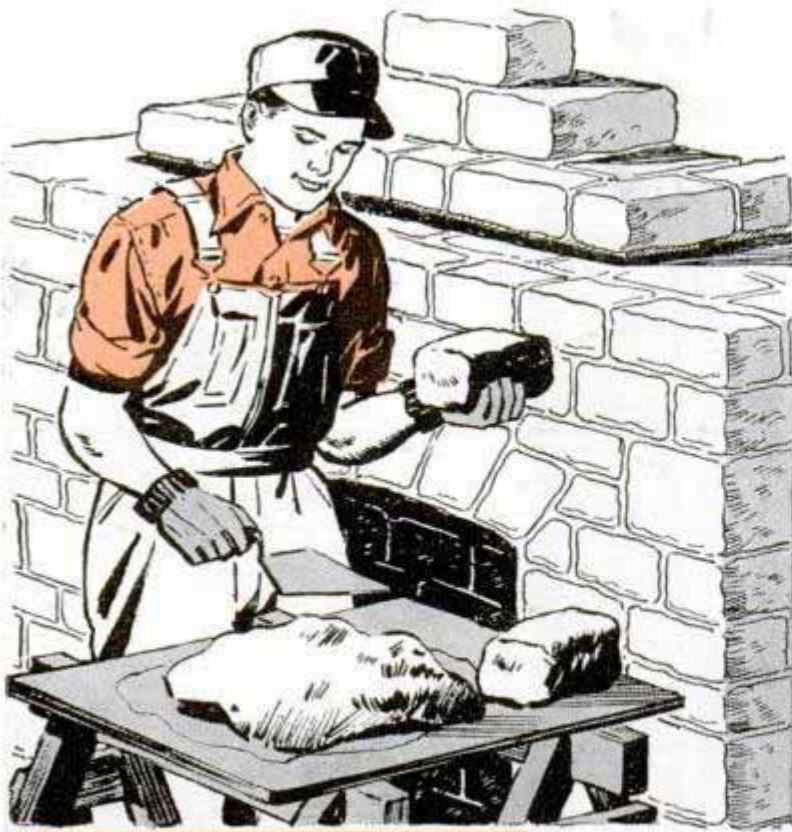


smoketight and may require the use of furnace cement. Plate A, Fig. 4, is cut from a 9 by 36-in. sheet and is hinged to the top front of the shell to act as a damper. The smoke shelf, Plate D, is a piece of No. 10-gauge metal 22 by 48 in. This is welded or bolted to the shell, Fig. 3, and supported at the rear by two $\frac{1}{4}$ by $1\frac{1}{2}$ by $1\frac{1}{2}$ -in. angles cut and assembled as shown in Plate C, Fig. 4. The edges of this plate are set into the masonry about $1\frac{1}{2}$ in., and, to give further support, flat-iron lugs are welded to the underside of the shelf.

The damper control, lower right-hand detail, Fig. 1, is a piece of flat iron cut in the shape of a gooseneck and hinged to the damper. Adjustment of the damper is obtained by engaging notches in the gooseneck with a catch set in the masonry. A $\frac{1}{2}$ by 3 by 48-in. bar is used to make the arch, Plate B, Fig. 4.

A stone, rubble and concrete foundation is carried to solid ground below the frost line. If the house has a basement, the floor is broken up and the foundation carried down in the same manner. When the foun-





dition has been completed to the level of the hearth, the steel shell is set in place. The masonry is built up 4 in. away from the sides and the back of the shell, with the smoke shelf, as mentioned previously, sealed into the stonework. When building the masonry, allow for cold-air intakes at the bottom, Fig. 2. The hot-air outlets are slanted upward, beginning under the smoke shelf. These are either standard 6 by 8-in. ductwork or 7-in. stovepipes. Besides the outlets shown in Fig. 2, additional outlets are suggested in the upper right-hand detail of Fig. 1. This would apply when the fireplace is not against an outside wall and it is desirable to heat a room at the rear of the unit. For every outlet installed there is a cold-air intake.

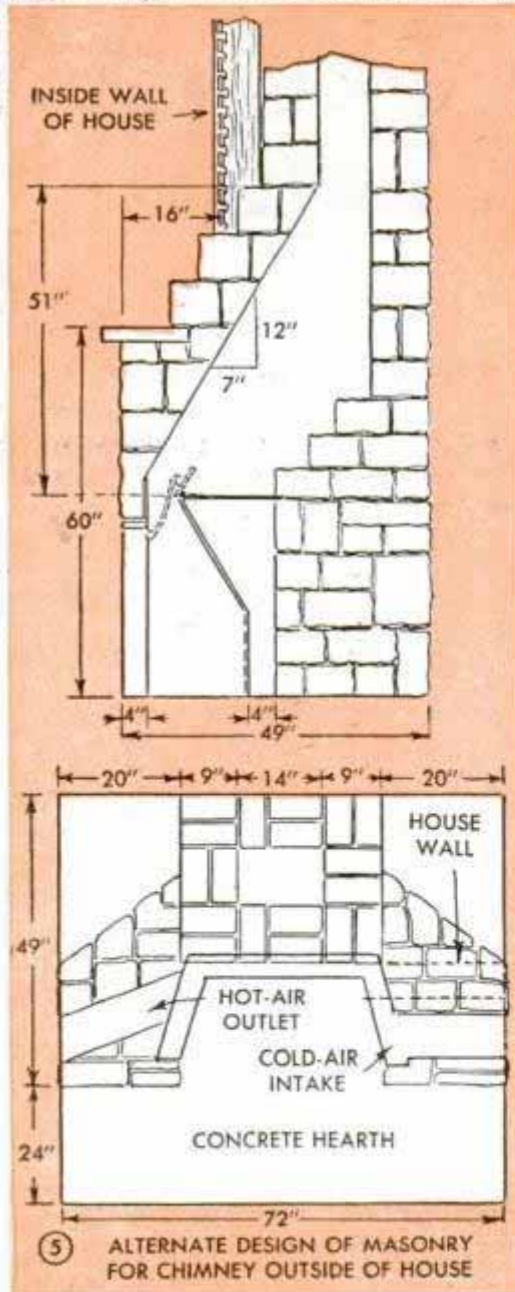
However, before the outlets are completed, the arch bar, Plate B, Fig. 4, is installed. This is done when the masonry has been carried

to the height of the damper. The smoke chamber part of the flue has a slope of about 60 degrees. It is built around a wooden frame which is knocked down and removed before the chimney is built. No attempt should be made to burn the frame out. The inside dimensions of the flue are given as 9 by 14 in., but these dimensions can be varied somewhat as long as the cross sectional area is over 100 sq. in.

Fig. 5 shows an alternate masonry design when it is desirable to have the chimney outside the house. This avoids cutting out a portion of the wall and roof of the house, but requires wider and heavier masonry at the base and a higher smoke chamber to obtain the proper bevels. In this case, since the chimney is not seen from inside the house, it can be built of brick.

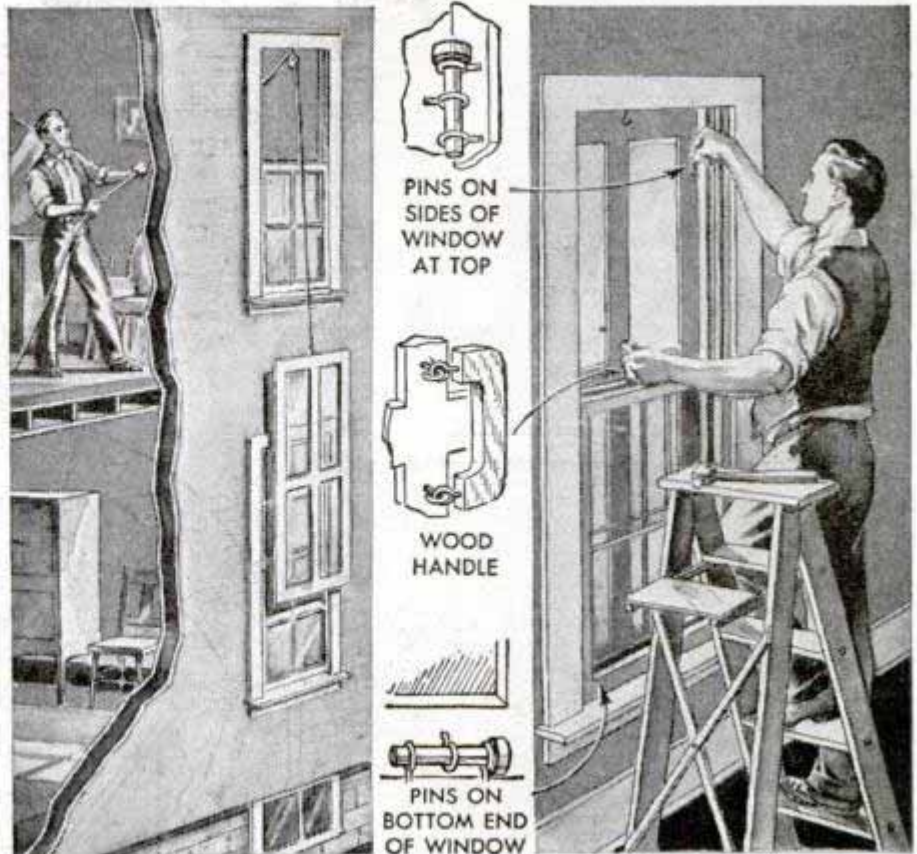
There are many refinements and conveniences that may be added to this basic fireplace. A cleanout door can be located above the smoke shelf at the back of the fireplace so that accumulations of soot can be cleaned out from time to time. It is important that this door be a tight fit; otherwise it will interfere with the draft action of the chimney. A short length of galvanized duct the same size and shape as the flue, with a conical or pyramid-shaped rain cap, will prevent mice, squirrels and other rodents from running up the masonry and down the chimney. With this cap it also will be unnecessary to board the chimney over if the cottage is to be left unoccupied for any length of time.

Other attachments that may be added to improve the appearance and add to the utility of the fireplace include a swinging arm or crane. This is set in the masonry at the front of the fireplace. A metal oven which extends through the stonework above the smoke shelf will provide for some Dutch oven style baking. Other accessories such as revolving spits for barbecues and hot-water heating coils will add to the usefulness of the fireplace.



Storm Windows Installed From Inside House

The difficult way of installing second-floor storm windows from the outside with an extension ladder can be eliminated by using a pulley and rope which attaches to fasteners on the window and sash. The hardware for each window consists of 12 screw eyes, 4 steel pins and 4 screw hooks. The assembly of the pins and the handle is shown in the center detail. Another hook at the top of the frame will aid in hoisting. To install a window, place a pulley on a hook that is in the top of the window frame and pass a rope through the pulley. Attach a window to the rope and hoist into position. Using the handle to hold the window in place, insert the pins and the job is done. If it is found that the window does not fit tightly against the frame, the screw eyes on the window are given



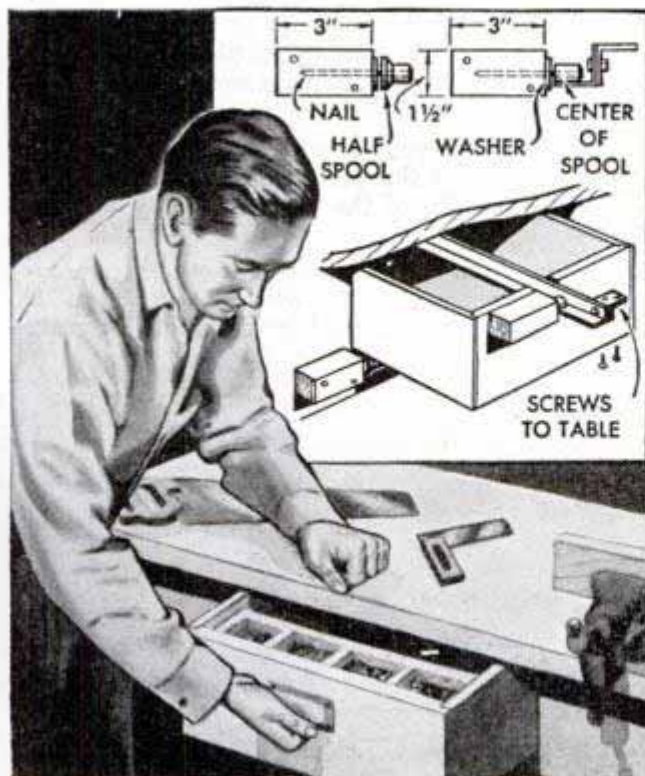
a turn or two. Care must be taken to keep all of the screw eyes concentric.

Frank H. Sutz, Chicago.

Spools Guide Workbench Drawer and Serve as Support

A drawer that rides smoothly on thread spools and an angle-iron track can be installed in a bench or worktable with little effort. For support, two spools are re-

quired. One is cut in two with halves pivoted on nails at the sides of the drawer opening in the bench apron so that the lower edge slides on them. The back of the drawer is cut out for a track, which is a length of angle iron attached beneath the bench top by means of corner brackets as indicated. Flanges or ends are cut off a second spool, which then is pivoted to a hardwood block screwed to the back of the drawer so the spool will ride on the track.



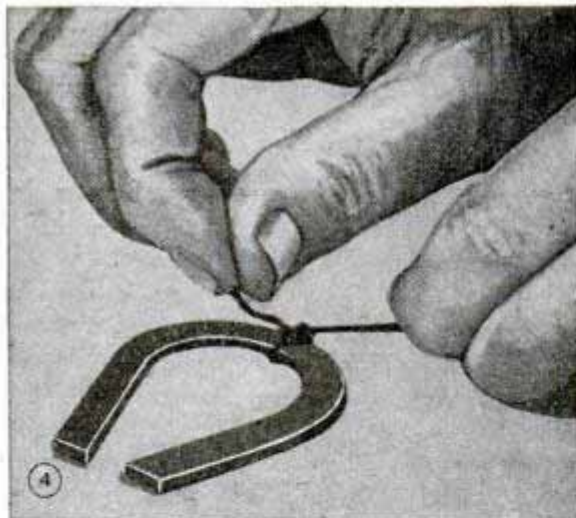
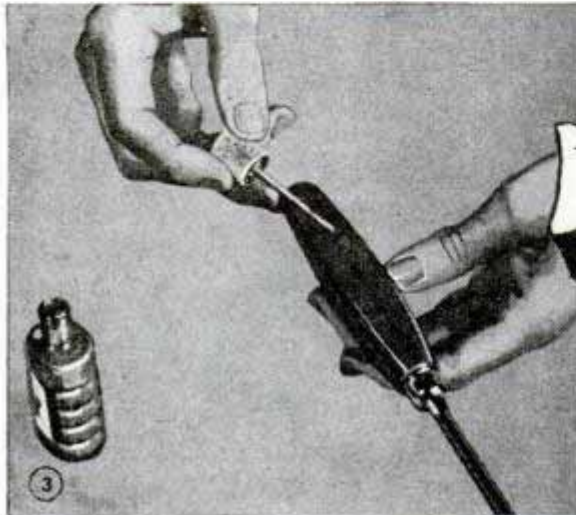
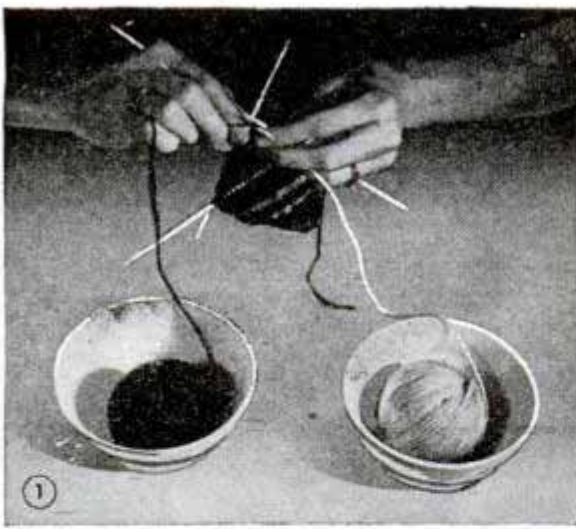
Many Uses for Wetting Agents

Beside their use in the darkroom, wetting agents have many other applications. The labels can be soaked off bottles more quickly if a little of the material is added to water. To prevent mirrors and spectacles from steaming, wipe them off with a rag to which a few drops of the agent have been added. The same treatment applied to car windows will prevent their steaming.

Hugh M. Gordon, Millgrove, Ont., Can.

☞ Before laying linoleum, always place it in a warm room or in the sun for a few hours. This makes the material much easier to cut and more flexible in handling.

Solving Home Problems

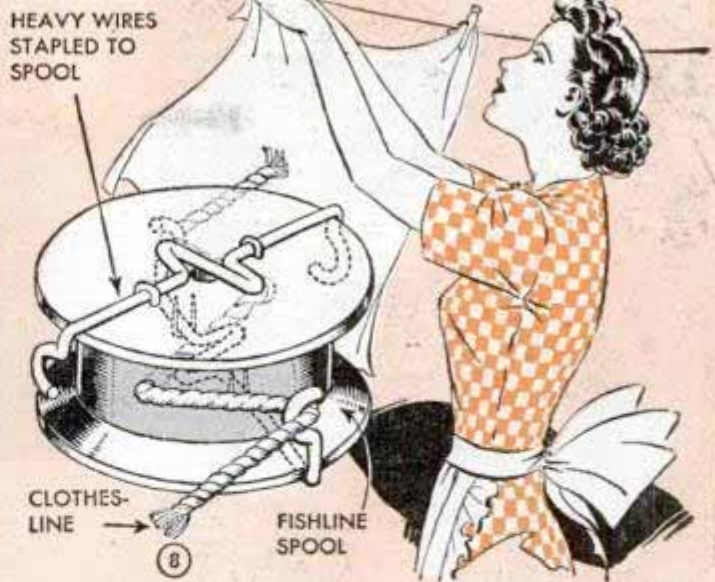


- ① When knitting with different-colored balls of yarn, it is difficult to keep the strands from tangling. If each ball is placed in a bowl, this will not happen
- ② Jar rubbers glued to the underside of a breadboard at each corner will keep the board from "skidding" when kneading dough or pastries on a smooth table
- ③ If colorless nail polish is applied to the painted handles of kitchen utensils, the enameled finish will not chip off, nor will the colors lose their luster
- ④ A small horseshoe magnet tied to your sewing basket is always at hand for picking up pins and needles. This arrangement is especially convenient for invalids
- ⑤ Put lids on all of your empty fruit jars. This will keep the inside of the jar free of dust, and also will protect the rim of the jar from being chipped
- ⑥ Cut to shape from small scraps of oilcloth, these easy-to-make labels are attached with rubber bands. If permanent paint is used, the labels will last for years



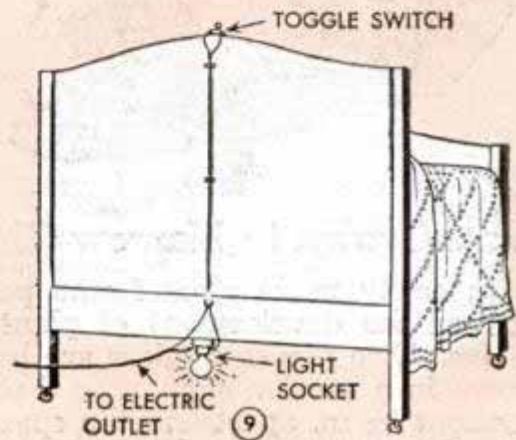


7 There's no need to worry about plants being pushed off your window sill if you build an attractive fence like the one shown here. It is made of light wood and painted in a color to match the trim of the building

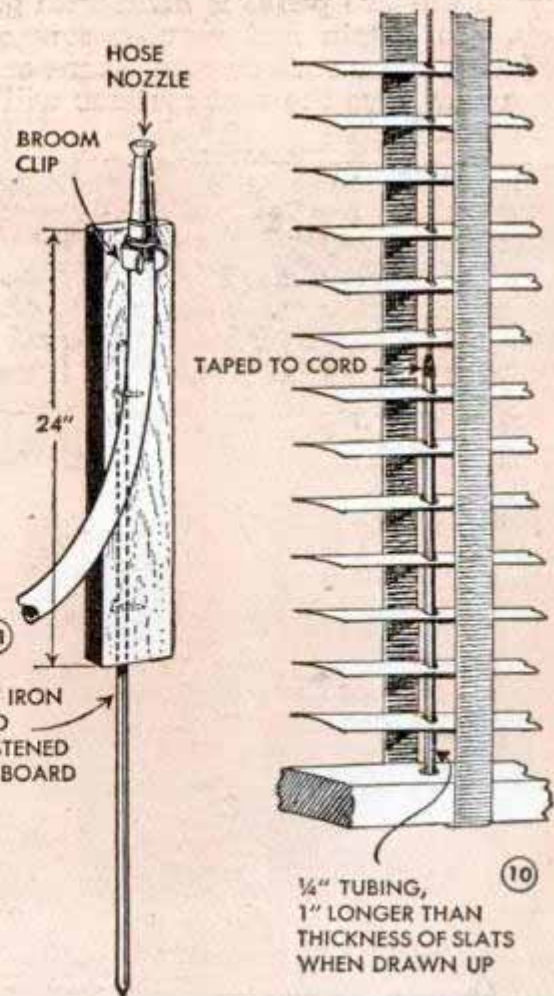


8 To take up slack in a rope clothesline, one housewife uses a reel made from a fishline spool. Hooks are formed as shown and stapled to the spool. The line is wound around the reel and caught by the hooks

9 Illumination in a bedroom at night is obtained by mounting the light beneath the headboard of the bed with a toggle switch on top of the headboard. Such a light will not disturb anyone who is in bed asleep

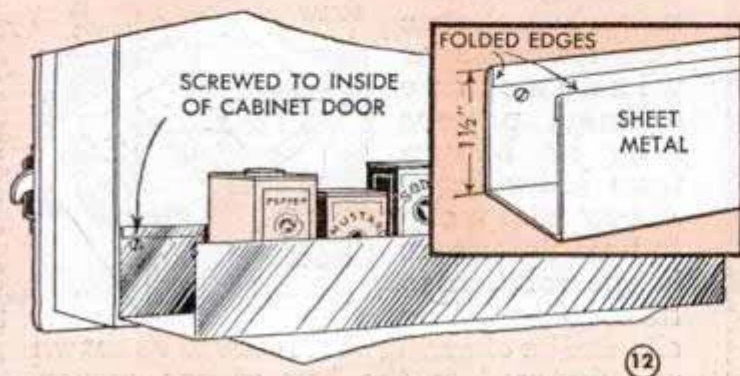


10 Protective tubing, inserted over the cords of metal venetian blinds, will prevent fraying due to the cutting action of the metal when the blind is raised or lowered. Tape wound around the tubing fastens it to the cord

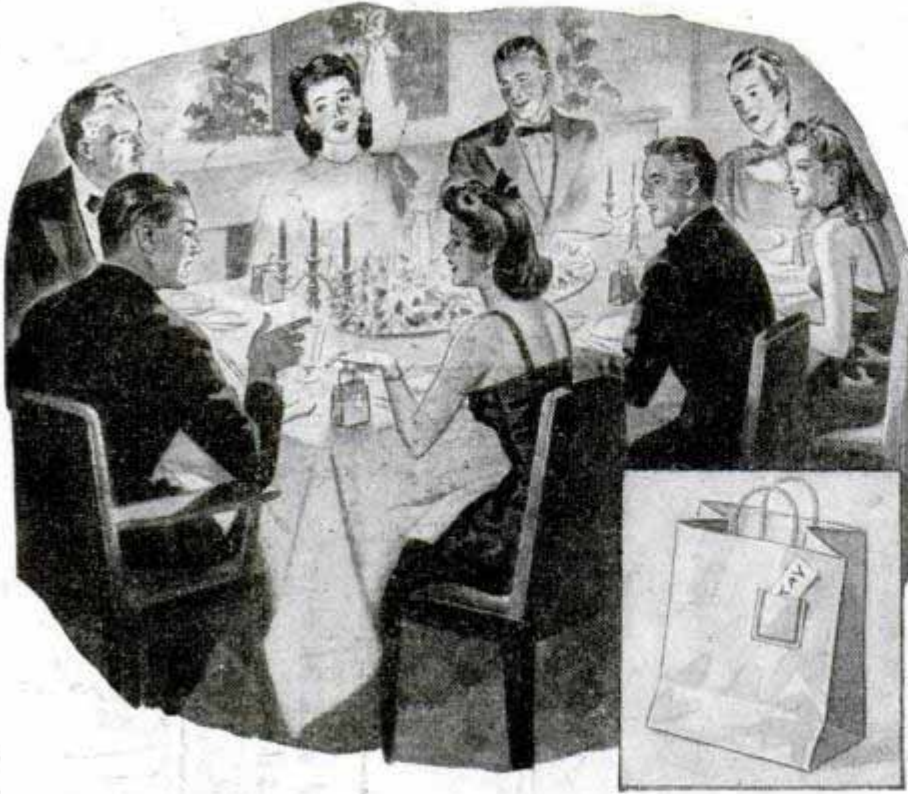


11 Better coverage by a lawn spray will result if the nozzle is raised some distance from the ground. A board is fastened to a rod which is driven into the ground and the nozzle is held securely in place with a broom clip

12 Spices and flavorings are always easy to find when kept in this shelf which is screwed to the inside of the kitchen cabinet door. If stainless steel is available, it is an ideal material from which to make the shelf



Miniature Shopping Bags Provide Unusual Party Favors



Inexpensive and easy to make, this clever place favor will add an unusual touch to your dinner party. To make it, use the smallest size brown paper bag available and cut down or turn under the tops to secure the right proportion. Cutting with pinking shears will give a novel and attractive edge. Then attach string handles to the inside of the bag with gummed tape. The miniature pocket which usually holds a shopping list is, in this case, a card holder for the guest's name. Candies, nuts or a small gift may be placed in the bag as a favor.—Benj. Nielsen, Aurora, Nebr.

Plants Grown in Narrow Glass Frames to Observe Growth of Roots

This easily made glass frame permits study of the development of plant root systems. Two pieces of glass are held in grooves in a wooden support so that they are about $\frac{1}{2}$ in. apart and the space between the two panes is filled with garden soil. To obtain fast results, sow quick-growing seeds such as corn, beans or peas. In a few days the root systems will have

developed enough to be observed and studied. One peculiarity of roots is that, unlike leaves, they avoid the light. Therefore, to get the roots to grow along the glass surface, it is best to keep the glass covered except when the cover is removed for observation. The plants shown in the illustration are bunch beans. The plant is one week old.—Paul Hadley, Philadelphia, Pa.



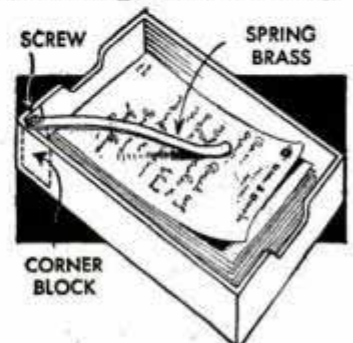
Making Wallpaper Waterproof

Wallpaper is rendered washable if you coat it first with sizing and then with clear shellac. This treatment is especially helpful in the kitchen, bath and children's room. It should be remembered, however, that the shellac will change the appearance of the paper somewhat. It may be best to try the treatment on a sample piece.

Joseph G. Cleveland, Minneapolis, Minn.

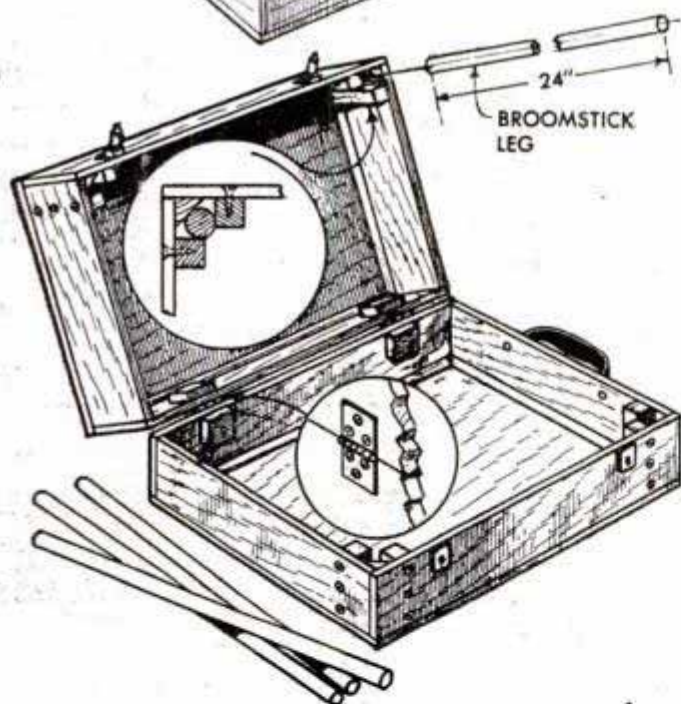
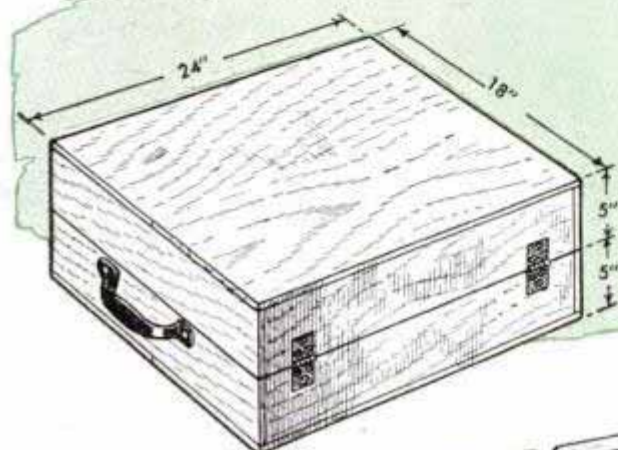
Metal Clip Holds Paper in Tray

During the summer when electric fans are used or windows are opened, papers may be blown from letter trays. A tray with a clip to hold the papers is one solution to this problem. The clip can be of spring brass curved as shown and fastened to the box at one corner.



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Picnic Hamper Opens to Make a Serving Table



When closed this picnic hamper is carried like a suitcase. Open it up, fit the four detachable legs, turn it over and you have a rigid, sturdy table. It's made of plywood in two thicknesses, $\frac{1}{4}$ -in. for the side panels and $\frac{1}{2}$ -in. for the ends, top and bottom. The halves are built as separate "boxes" with ends, sides and bottoms and then are hinged together with medium-sized brass butt hinges. Metal clasps of the type used on suitcases are provided for locking the

hamper closed and a leather or metal handle is attached to one end for carrying. All these parts are fastened with small screws or rivets. Triangular blocks are screwed in two corners of each half as indicated and then square blocks or cleats are screwed to the sides and ends as shown in the circular detail. This arrangement forms a socket into which the leg is inserted when the hamper is set up as a table. The dimensions given are only a suggestion. They can be altered to suit most any special requirement. Although fir plywood will serve for all practical purposes, the hamper will finish much better if birch plywood is used. Very little sanding will be necessary except across the ends of the pieces to eliminate saw marks and to round the outer corners slightly. Heads of all exposed screws should be turned in flush with the wood. Countersink the holes to prevent splitting. Then, to finish in the natural color, apply a prepared sealer and follow with a coat of spar varnish or use clear lacquer over a lacquer undercoater.

P. B. Horsley, Pembroke, Ont., Canada.

☐ A short drive over dirt or graveled roads is often much more wearing on tires and requires more gasoline than a much longer run on a smooth hard surface.

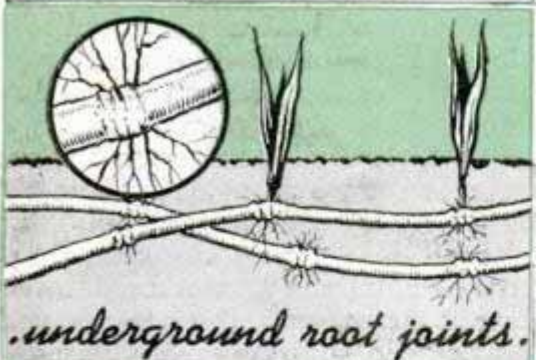
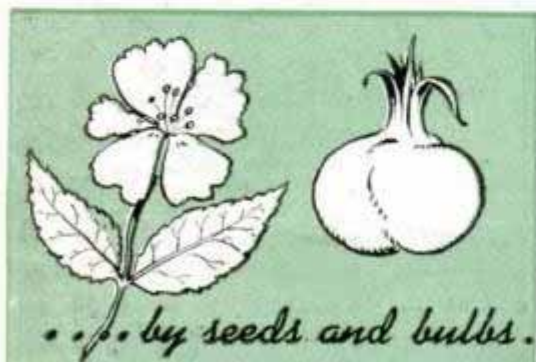


"Choosy" Sprays

New selective herbicides that promise complete control of some of nature's worst plant pests can be applied by anyone with the most inexpensive equipment

By W. Clyde Lamme

① How Weeds Spread



MIX a solution according to simple directions and then spray 'em—that's the new, sure way of killing weed pests on the lawn, in driveways and on farms and country estates. Not only the common weeds but such persistent perennial pests as poison ivy, poison oak, bindweed, dandelion, ragweed, plantain and many others of wide distribution are usually killed outright with just one application of the powerful herbicides which recently have been developed. Many of these new chemical killers are selective in action, which means that under favorable conditions certain weeds can be killed in a field of growing grain without damaging the crop, and dandelion plants can be eradicated from lawns without injuring the grass. Moreover, certain of the chemicals do not act as soil sterilants when applied as sprays in the solutions recommended for specific purposes. Others are only temporary soil sterilants, the time varying with the soil. Most of the solutions are free from fire or explosion hazards, many of them actually possessing fire-resistant properties. Residues from the spray solutions have not been found harmful to grazing stock, pets or humans. Some of the solutions have a slow corrosive action on galvanized metals, others do not. In any case it's always best to wash out the sprayer with soap and water or kerosene after the solutions have been used in it. If the same sprayer is used for applying insecticides to plants and shrubs all traces of the chemical must be removed.

Weeds spread over large areas by several natural processes, Fig. 1. Perennials, such as wild garlic and others, reproduce by seed and by bulbs; others, such as chickweed, by creeping above ground, still others by new growth from underground root joints. Johnson grass and quack grass perpetuate in this manner. Dandelion and others reproduce by seed and by a vegetation process. The latter method of perpetuation takes place when a root section is cut away in some manner, such as by hoeing, disk-harrowing or plowing. This piece, although cut away from the plant and perhaps carried some distance, sends out roots and stems and thus establishes itself as a new plant. Roots of some of the rapidly spreading perennial weed pests, such as bindweed, have been found to extend as much as 25 ft. into the subsoil. Eradicating these pernicious weeds over large areas by ordinary methods of soil tillage and cultivation has in many instances been proven hopeless. Once they become

That Kill Weeds



firmly established, there is no getting rid of them by common soil-tillage methods.

However, certain solutions of the selective weed killers administer a knockout punch to the most hardy of these pests of both the deep and shallow-rooted varieties. After the chemical has been applied as a solution to the foliage by spraying or, in some cases simply by sprinkling, it not only kills the plant tissues with which it comes in contact but it moves slowly downward throughout the root system of the plant by following the tiny conducting tubes in the stems and roots. The process is known as translocation and is shown diagrammatically in Fig. 4, although, of course, the drawing is purposely exaggerated. On certain plants this process may take several weeks, but the end result is a 100 percent kill. It should be remembered, however, that not all herbicides perform in this manner. Some effect a kill only by contact, others by a translocation process, and only certain of these are selective in action. Some still are being distributed only for experimental purposes. There are others that kill by diffusion of vapors, Fig. 3. On small areas the chemical is forced into the

soil by means of an applicator especially made for the purpose. The same type of applicator also is used to inject a soil fumigant lethal to insects such as nematodes, millipedes and others which inhabit the lower portion of the surface soil. One diffusion-type weed killer, carbon disulphide, acts as an effective weed eradicator and also is toxic in its effect on such soil organisms as nematodes, wire worms and certain other bacteria. It is only a temporary, partial soil sterilant and, inasmuch as the residues are eventually decomposed and oxidized to sulphates, it tends to correct any excess alkalinity, a process which usually favors the subsequent growth of higher plants, such as the grasses and cereals. Although very effective as a herbicide, carbon disulphide and carbon-disulphide emulsions find more widespread use in localities where large quantities are required. This chemical must be handled

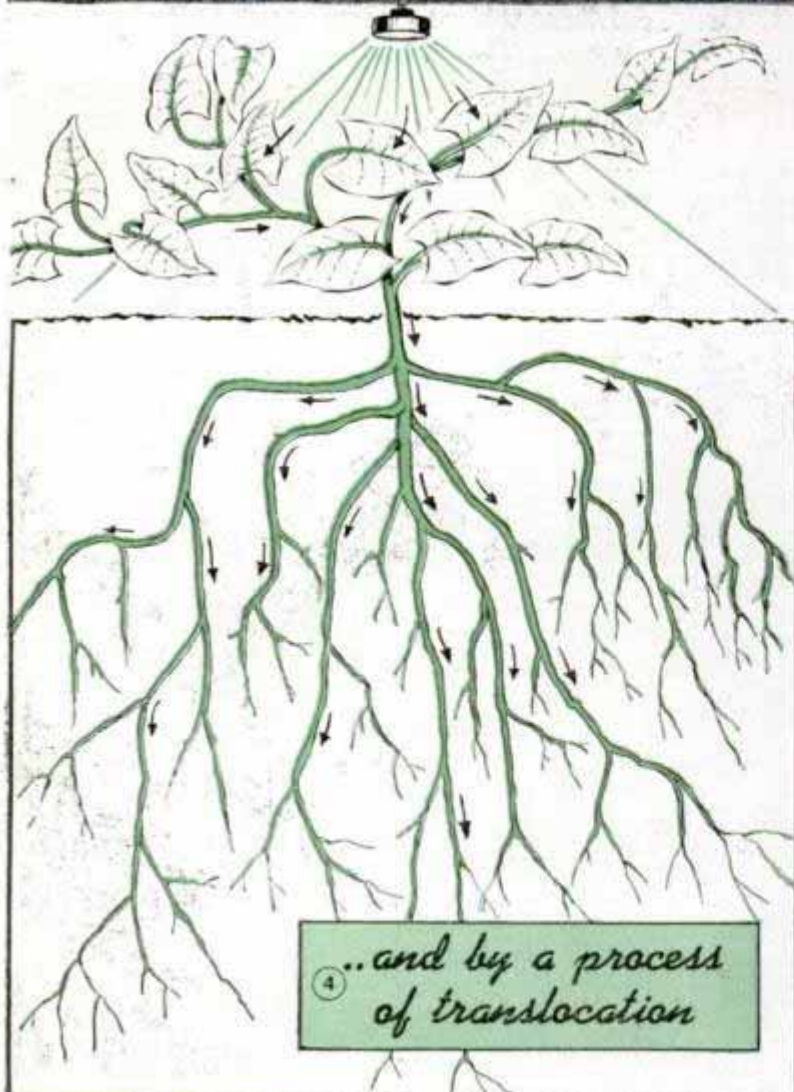


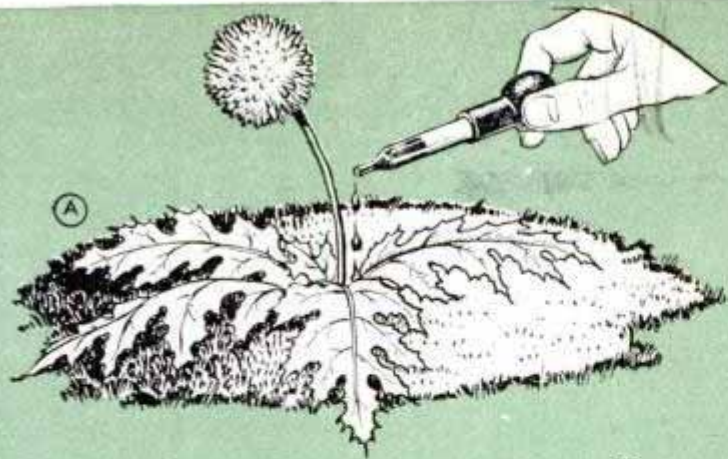


carefully, as the vapor is highly inflammable.

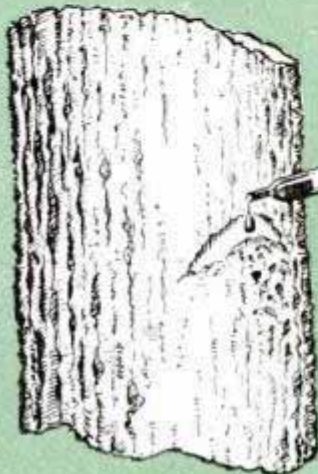
Herbicides applied as spray solutions usually are of more value to the individual user because of the ease of application and the inexpensive equipment required. Any light hand or power sprayer will do, even a sprinkling can will serve for very small areas, although sprinkling is not as effective as spraying. Most of these preparations contain varying amounts of the chemical, 2,4-dichlorophenoxyacetic acid, more popularly known as 2,4-D. These herbicides now are supplied in tablet, powder and liquid form. Another chemical, ammonium sulfamate, is coming into widespread use along with preparations containing 2,4-D to kill poison ivy and other woody plants and in the control of many common weed pests on lawns and golf fairways. Due to the extensive research now being carried on by manufacturers, the U. S. Department of Agriculture and state experiment stations, it is very likely that new weed-killing chemicals will be discovered, also new and more widespread uses for those already well known.

Fig. 5, A, and Figs. 6 and 7 suggest methods and precautions to be used in ridding your lawn of weeds with weed killers of the selective plant-growth-regulant type, such as those containing 2,4-D, in the various forms in which these are now supplied. A single tablet dissolved in a quart of water will make sufficient solution to cover about 100 sq. ft. when applied with a small sprayer of the hand-operated type shown in Fig. 6. Use soft water if available, or, if you must use hard water, warm it slightly. The temperature should be above 70 deg. F. for best results with the spray. The sprayer used should produce sufficient pressure to break the solution into a drenching spray. The solution should not be reduced to a mist. A nozzle that can be adjusted to produce a fan-shaped spray is best for most jobs. Always follow the manufacturer's directions for mixing the solution in any quantity as the recommended proportions vary somewhat for the various forms in which the chemicals are regularly supplied.

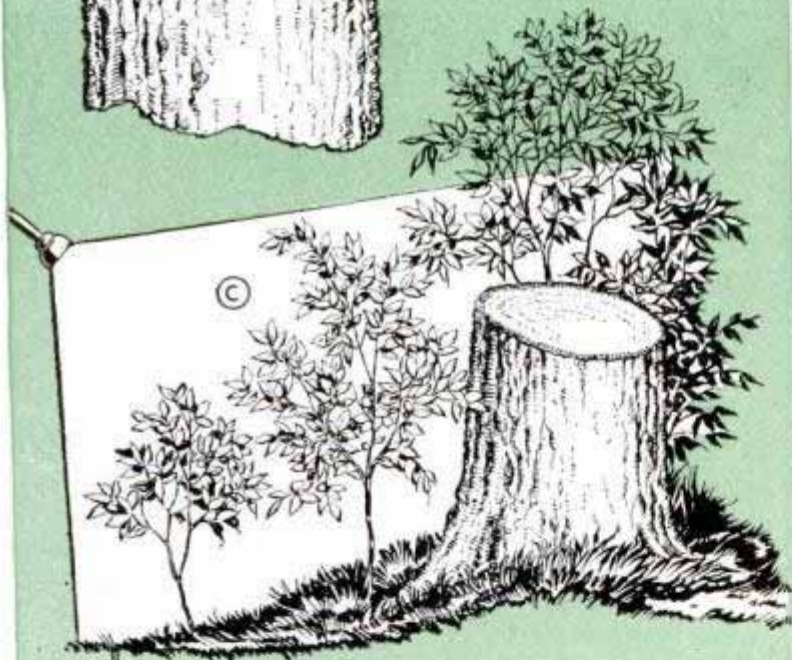




A



B

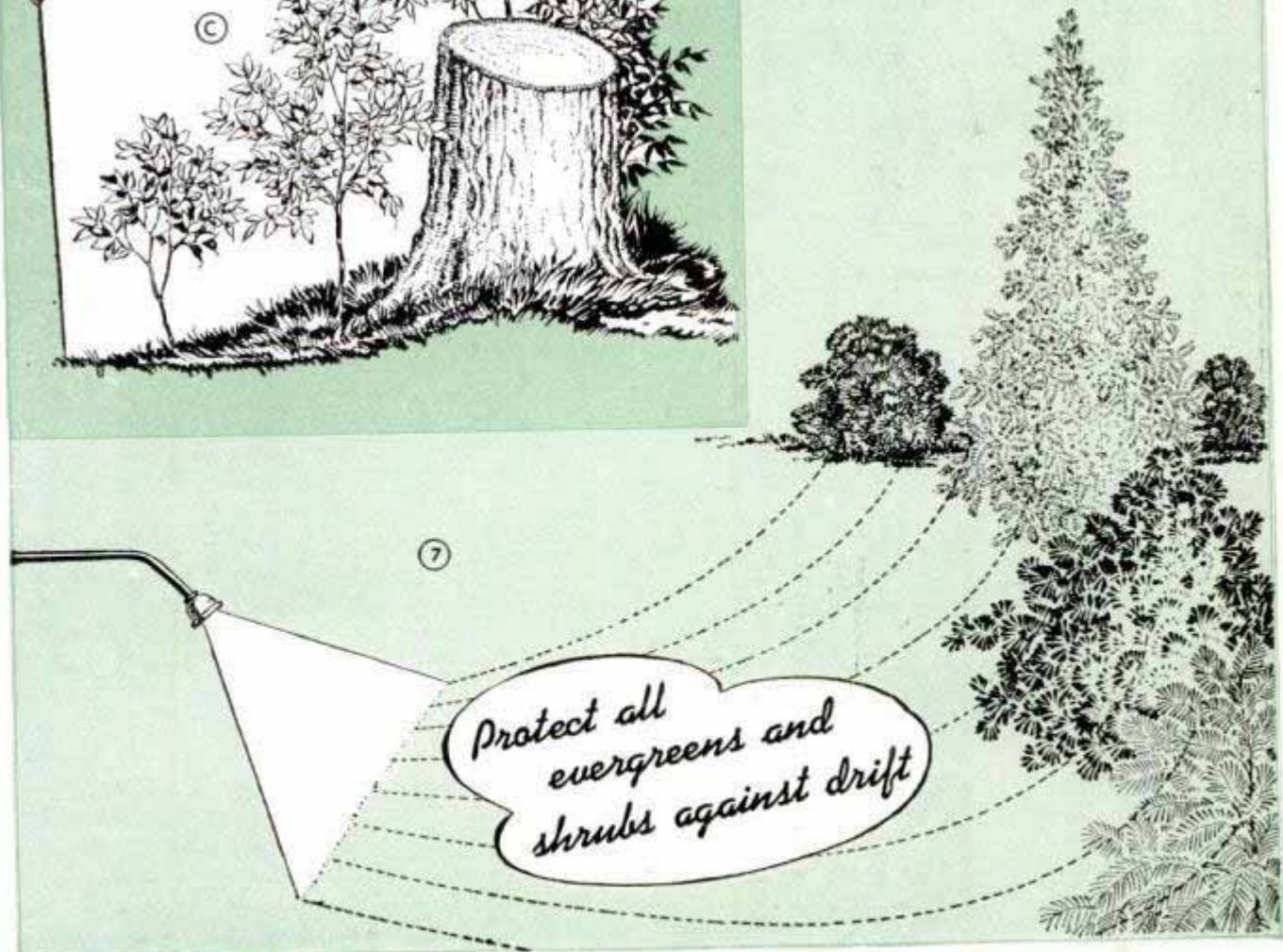


C



D

Spot spraying of lawns is effective where weeds are found in clusters. This treatment saves both time and material



E

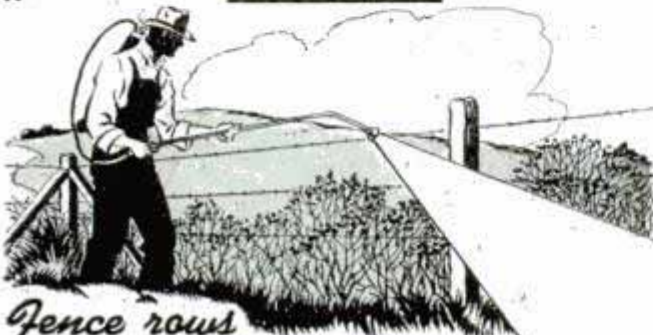
Protect all evergreens and shrubs against drift



Yards and grounds



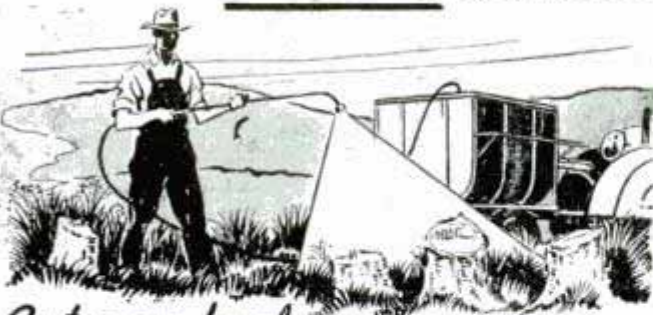
Ditch banks



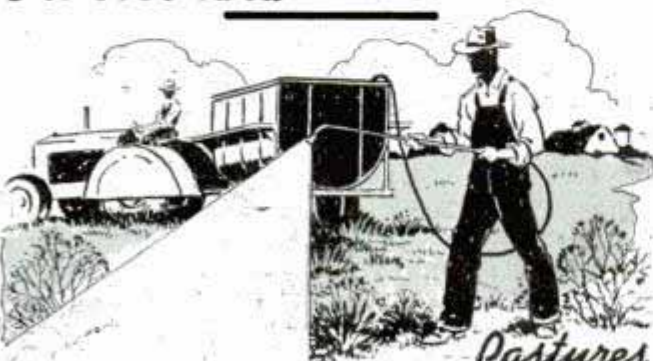
Fence rows



Farm roads



Cut-over land

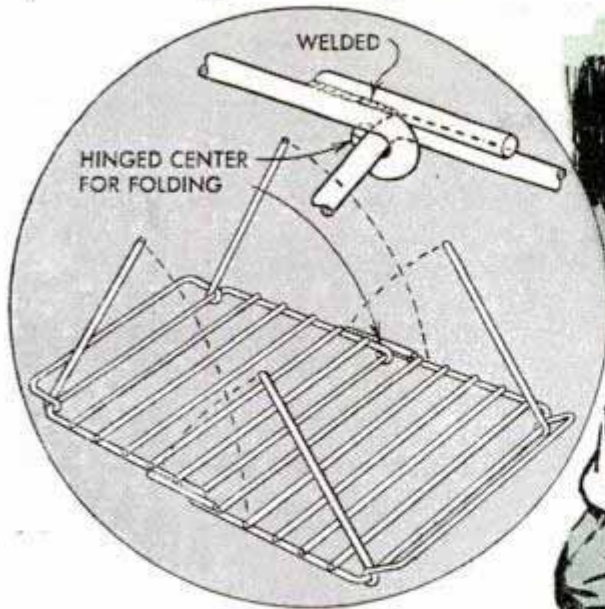


Pastures

Where weeds are in small patches or clusters, Fig. 6, spot spraying of lawns is more effective and saves considerable material. Where the weeds are scattered, only a few individual plants here and there, then the method shown in Fig. 5, A, is best. Here the chemical is used full strength. Only a single drop is required for most plants, such as dandelion, plantain, dock, etc. Certain kinds of trees in undesirable locations can be killed by gashing the trunk in several places with a hatchet or axe and applying a few drops of the chemical as in Fig. 5, B. Although under some conditions weed-killing preparations containing the chemical 2, 4-D will temporarily discolor the common lawn grasses, there is no permanent damage if the spray is uniformly applied in the solution recommended. However, concentrations sufficient to kill some common weeds that infest lawns will injure bent grass under certain conditions and also will kill white clover. With a solution of 1 to 100 there usually is no permanent injury to bent grass. If you wish to preserve a seeding of white clover, then the weeds can be killed by the method shown in Fig. 5, A. This procedure is far easier than digging out the plants one by one. In all-over spraying of a lawn, it is essential to protect flowers and shrubbery against drift of the spray solutions, Fig. 7. This can be done with heavy paper or some similar covering, but it's better to work on a quiet, windless day, or at night when there is no wind. Keep the spray nozzle close to the ground and avoid concentrating the spray. Newly fertilized lawns should not be sprayed for a period of two to four weeks.

Weed-killing sprays are fully effective only when the leaves are green and the plant is in active growth. Remember the temperature should be at least 70 deg. F. Cover the leaves of the plant thoroughly, especially larger growth such as the giant ragweed, Fig. 2, also poison ivy, poison oak, sumac and others. In spraying farm pastures, along fences and ditches, and along roads, keep in mind the precautions to be taken against drift of the spray. On cutover land the sprays are most effective in killing sprouts, Fig. 5, C, and Fig. 8, which may grow up from the stumps, also noxious weeds which infest cleared areas. In pastures, sprays containing the chemical 2, 4-D will not permanently damage the common forage grasses such as bluegrass, redtop and the various fescues but will damage the clovers common in pasture lands. However, where weed infestation is heavy spot spraying can often be done effectively without unduly injuring the forage crop.

Folding Campfire Grid Packs Flat for Carrying



The legs of this campfire grid, which is made of $\frac{3}{16}$ -in. wire, fold flat against the top, the latter being hinged in the center. When folded, the grid takes little space. No dimensions are given as they can be determined best by the builder.

When the unit is set up, a short length of wire welded to one of the halves rests against the other half to hold the top rigid, as shown in the detail. All joints should be

welded and the legs should be long enough to support the grid at the proper height from the fire when pushed firmly into the ground.—D. E. Horn, River Forest, Ill.

Hinged Hoisting Racks Speed Job of Washing Rowboats

The backbreaking job of cleaning, hosing and draining rowboats by tipping them on their sides is eliminated with this hinged hoist. The unit consists of two racks which are fastened to the dock. An electric motor mounted overhead raises and lowers the boats through a pulley and cable arrangement. In the upper view both racks are shown partially raised, while in the lower illustration, one rack is submerged so a boat can be floated in and the other rack is fully raised.—Ormal I. Sprungman, San Diego, Calif.

☐ A whisk broom will remove the silks from sweet corn. After removing the husks, just brush the ears toward the stem ends.



Masonry 'Drive Nails' Improvised By Using Discarded Bolts

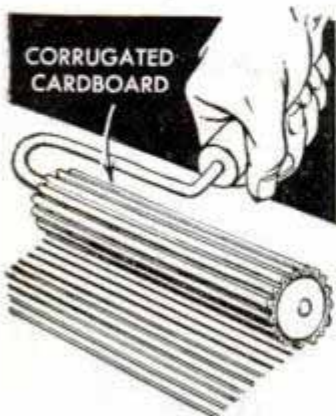


Good use can be made of discarded bolts by converting them into masonry "drive nails." As the drawing shows, the threaded portion is slit and then expanded in the hole by placing a small steel wedge so that it spreads the halves when the bolt is driven in place.

Boxes Are Rolled for Storage

Whenever she gets cardboard clothing boxes of the kind that are collapsible, one housewife takes them apart and rolls them into a cylinder. Kept thus, they require little space for storage and are easily identified.—D. S. Bucher, Philadelphia, Pa.

Ruled Lines Printed With Roller Secure Decorative Effects



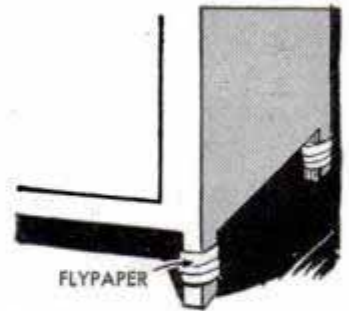
Decorative borders are imprinted easily and quickly by means of this simple roller. It can be used also to apply glue when the latter is intended only to "tack" two pieces together. Secure a piece of single-faced corrugated cardboard with ei-

ther large or small corrugations, depending upon the distance between the lines you wish to print. The cardboard is

wrapped around the roller and the joint is glued. Ink the roller by passing it over a sheet of glass or smooth wood on which the desired paint or glue has been spread in an even film; then transfer it to the surface to be treated.—Kenneth Murray, Colon, Mich.

Flypaper Is Barrier to Ants

If ants have been getting into your kitchen cabinet or other kitchen furniture, wrap narrow strips of flypaper around the legs with the sticky side out. The strips present



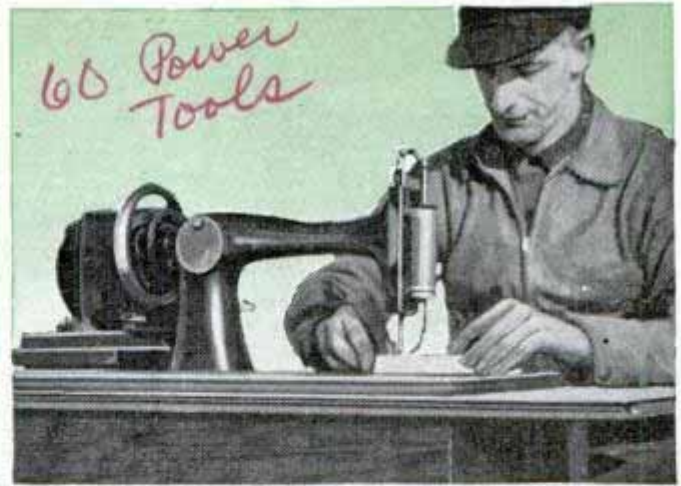
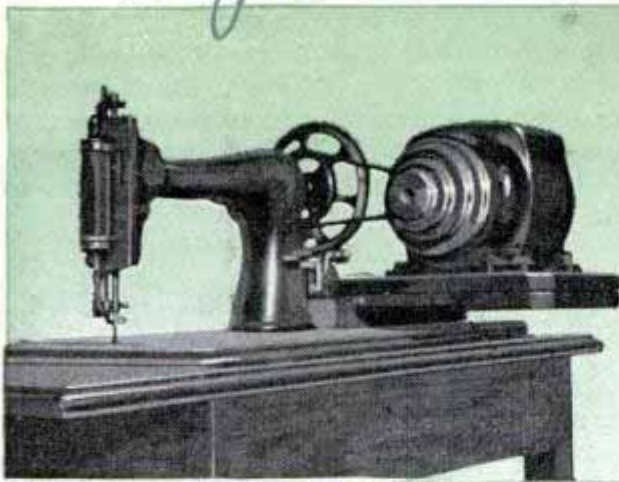
a barrier across which the ants cannot pass. When it becomes necessary, the strips of paper can be replaced.

Fishing Flies Are Tied Quickly With Drill Clamped in Vise

To speed the time required to wind the bodies on fishing flies, one sportsman uses a breast drill clamped in a vise. The hook is held in the chuck of the drill and the shank and eye are left free. The shank of the hook should be centered so that it does not wobble. After the body has been wound in the manner shown, the drill is dropped down in the vise so the crown gear cannot rotate. Then the other parts of the fly can be tied on the hook while it is still being held in a convenient position.

H. Leslie Thompson, Sarnia, Ont., Can.



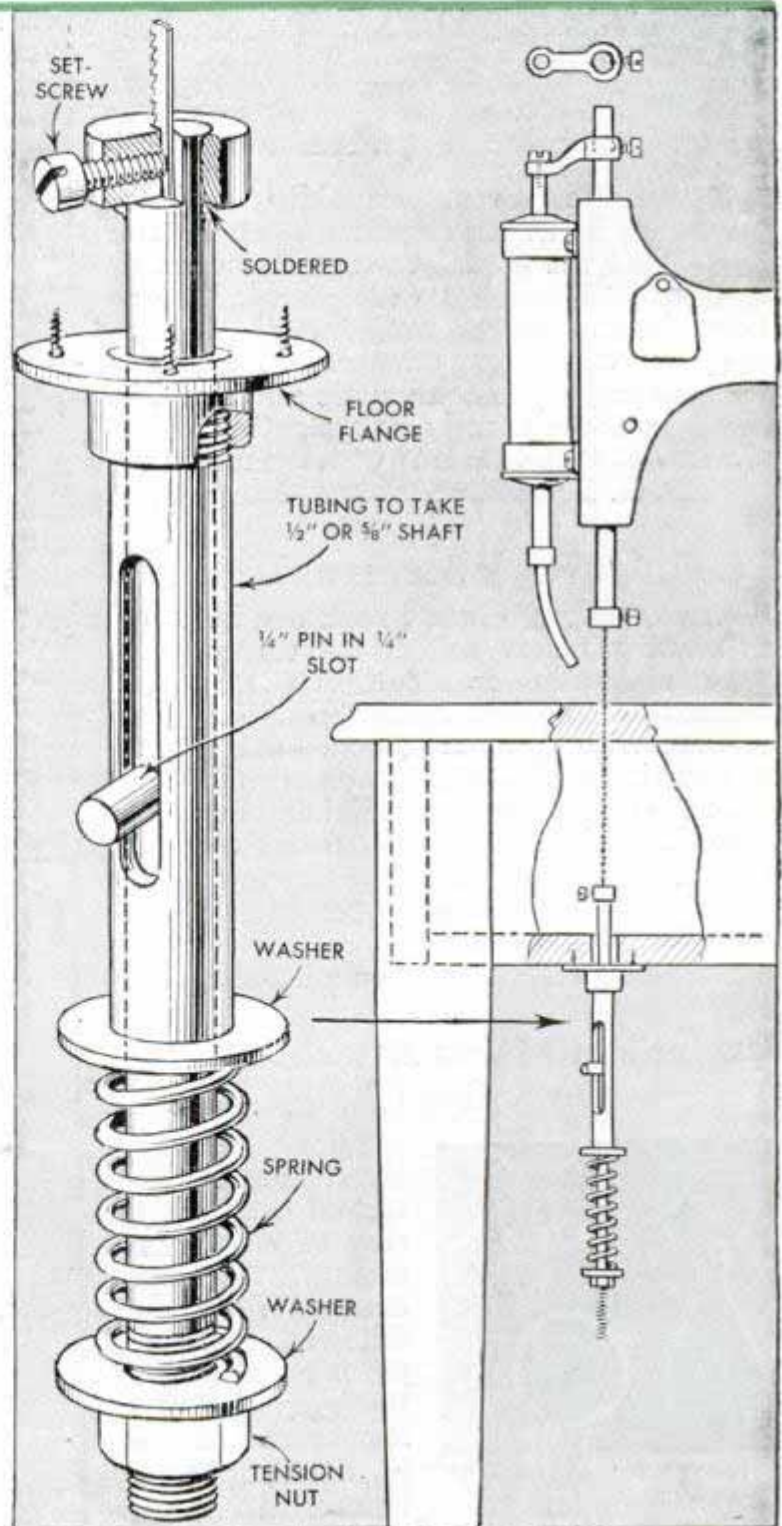


From SEWING MACHINE to JIG SAW

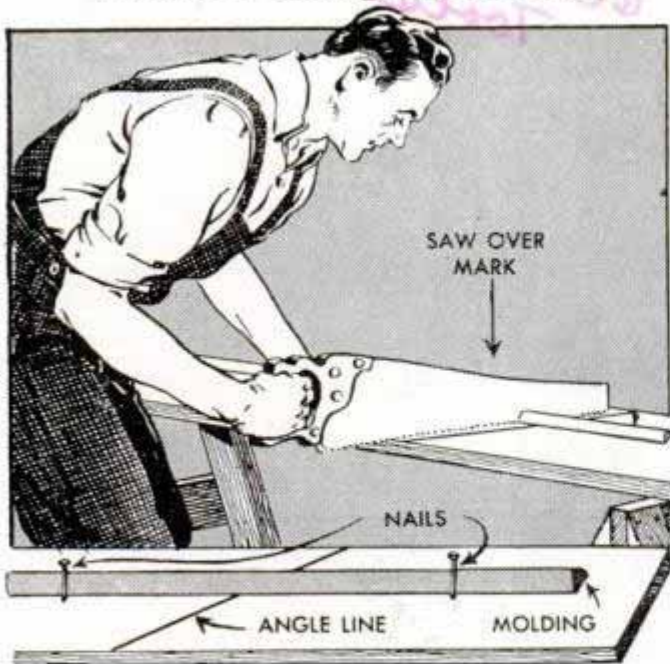
By GUST M. LARSON

THAT old sewing machine long relegated to the attic can be converted into an excellent motor-driven jig saw at practically no cost. All you have to do is strip the machine of its shuttle mechanism, located on the underside of the base, and install the blade-tension device shown at the right. Thickness of the stock that the saw will handle depends upon the stroke of the machine at hand, although it is possible to increase the stroke of most machines simply by raising the needle bar in the head. Drive is by a $\frac{1}{2}$ or $\frac{1}{8}$ -hp. motor mounted on a hinged base to bring it in line with the pulley on the handwheel. A small insect sprayer, attached by brackets to the cover plate, is operated by the needle bar to provide an efficient sawdust blower.

The machine can be left on its original stand, or you can set the head and base flush in the top of a sturdy bench. In either case, a board must be installed, as shown in the cutaway view, so that the tensioner can be screwed to it, directly below and in line with the needle bar. The tension device consists of a floor flange threaded to a slotted tube in which slides a spring-loaded shaft. The tension of the spring is adjusted by a nut at the end to suit the blade being used. A cross pin keeps the shaft from turning in the tube, and a collar and setscrew, soldered to the upper end of the shaft, form a blade clamp. The needle clamp will hold jeweler's blades but will require enlarging for saber-type blades.



Work Easily Sawed at Any Angle Without Using Miter Box



If you want to miter molding and no miter box is at hand, you can improvise one. Draw the angle at which the wood is to be sawed across a wide piece of scrap board and drive two nails into the board, parallel with the long dimension. Then hold the molding against the nails and saw directly over the pencil mark, sighting along the saw to keep it in line with the mark.

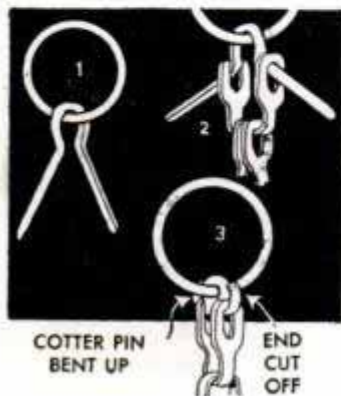
D. R. Brizendine, Forest Grove, Ore.

Cellular Rock Serves as Lighter

Any cellular, volcanic rock can be used to make a handy lighter for stoves, furnaces and fireplaces. The rock should be about the size of an egg or an apple. It is secured with wire and fastened to a length of dowel for a handle. To use the lighter, soak the head in kerosene, light it and place it in the fuel to be burned. Because of the porous nature of the rock, it will hold a fairly large amount of the fluid and will burn for some time.

Robert K. Smith, Klamath Falls, Ore.

Cotter Pin Makes Attaching Link On Safety Chain

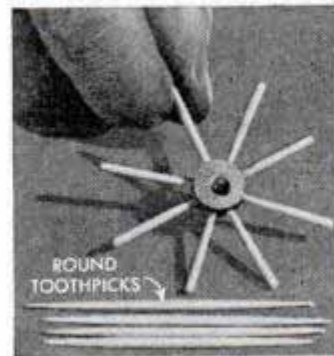


Safety or sash chain can be attached neatly to a ring or other fastening if the steps detailed here are followed. A cotter pin is hooked over the ring and the legs spread slightly, detail 1; then the chain link,

which has also been spread slightly, is slipped onto the legs of the cotter pin, detail 2. Finally, the legs are bent upward and over the head of the pin and the two ends cut off, detail 3. This makes a strong, as well as small and neat, attachment to hold the chain.

Toothpicks Form Neat Spokes In Model Wheels

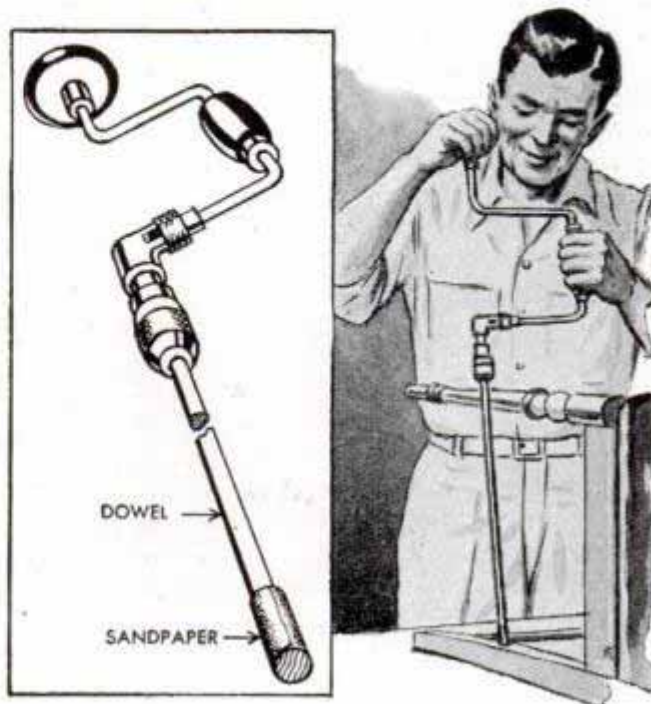
Modelmakers can save time and do realistic work when turning out miniature wheels with spokes by using round toothpicks and cutting them to the correct length. As the toothpicks are fairly uniform in length and perfectly round, little time is required to make spokes by this method and the work will be accurate and satisfactory.



Dowel Is Used for Sanding Stick To Remove Glue From Holes

When replacing the lower rail on a chair, the hole into which the round piece fits must be cleaned of glue so the new rail will fit properly. To do this make a sanding stick by wrapping a small piece of sandpaper around the end of a dowel which is slightly smaller than the hole to be cleaned. The stick is chucked in a brace. It is not necessary to cement the sandpaper to the dowel. It can be held until started and will stay on during the sanding operation.

Herman Klein, Pittsburgh, Pa.



"Seal-Beam" Your Old Headlamps

By Edward Zychal

USING parts of the original reflectors and a little ingenuity it's no trick at all to fit sealed-beam units in the headlamps of an older-model car. The first step is to check the outside diameter of the reflector with the diameter of the sealed-beam unit. This must be done carefully, using dividers to transfer the measurement to several points on the back of the reflector. Then the reflector is placed face down on a flat surface as in Fig. 1 and a line scribed with a pencil as shown. In most cases, the diameter of the scribed circle will be about $6\frac{5}{8}$ in., the diameter of the lens step on the sealed-beam unit. This should be stepped carefully with dividers to assure that the measurement is correct. Then the thin metal is cut through on the line with a 3-cornered file as in Fig. 2. After cutting around the reflector, burr off the rough edge with a file or emery cloth and round over smooth. Only the rim is used.

Next, the unit must be provided with a narrow cork gasket. This is attached with a quick-setting cement or shellac. Make a trial assembly to determine the distance from the rear curvature of the original headlamp housing to the rear curvature of the sealed-beam unit. Either a large coil spring of light tension, such as a chair-cushion spring, or a section of rubber hose, Fig. 3, must be fitted in the space between the unit and the housing so that there will always be sufficient pressure to prevent the sealed-beam unit from rotating. A section of $2\frac{3}{4}$ -in. radiator hose with one end slit at spaced points about the circumference as in Fig. 3 will serve this purpose. With old wiring, you'll get better lights if relays are used. Also, it may be necessary to take current direct from the battery.

Necessary plugs to fit the prongs of the sealed-beam units may be purchased from auto-supply stores. In assembling, the common lead is hooked up first. On many cars this corresponds to the ground connection so it will be necessary to bolt or solder a ground wire to the headlamp housing. The other two wires then are connected to the plug. Be careful to follow the wiring color code so that the high and low beams will work together. In assembling the sealed-beam units in the housings make sure that the tension is sufficient to prevent the unit from turning. After assembling the headlamps on the car, Fig. 4, they should be set, or aimed, in the usual way.



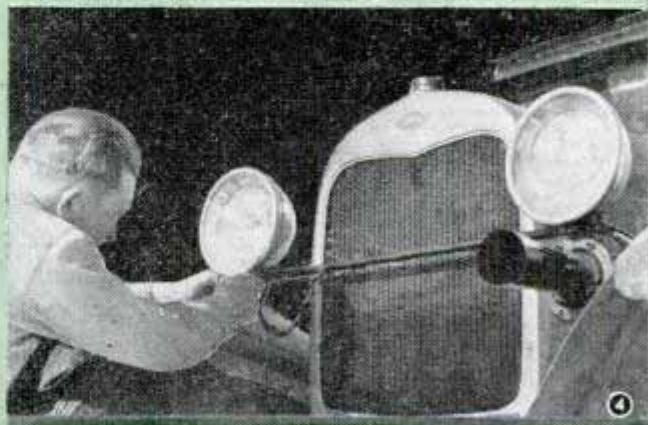
First, reflector is marked by holding pencil steadily and rotating reflector face down



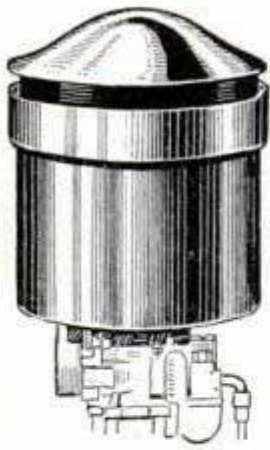
After rechecking diameter marked, reflector is cut through with a three-cornered file



Slitted piece of radiator hose provides pressure to keep the sealed-beam unit in place

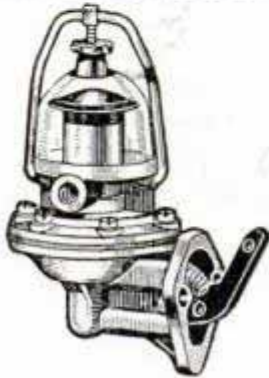


Reassembling the headlamps and fastening the retaining rims securely completes the work

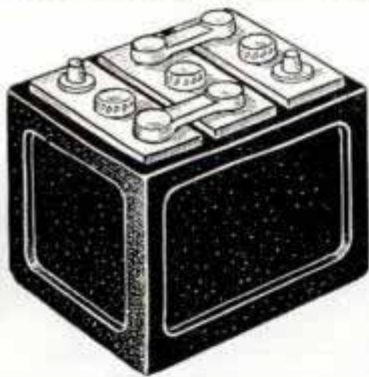


Give Your Engine

AIR CLEANER choked with dirt saps engine power and wastes gas. Remove the filter element and wash thoroughly in gasoline. Then dip it in light oil and allow it to drain before replacing. Make sure connections from cleaner to carburetor are leakproof. Watch oil level in oil-bath type cleaners



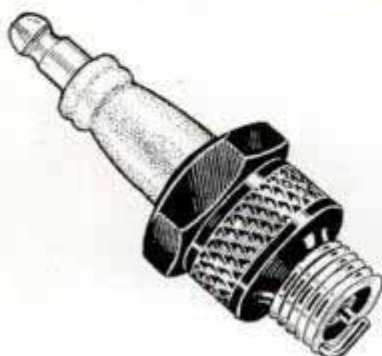
FUEL PUMP sediment bowl must be emptied of water and dirt regularly. Check the pump diaphragm, too. Sudden increase in oil consumption may indicate broken diaphragm is sucking engine oil from crankcase. If flow of fuel is weak, blow out the line with an air hose held at fuel pump (remove tank filler cap first), and check the line back to the tank for flattened spots



BATTERY neglect means short life. Check regularly at least once every two weeks and even more often in hot weather. Inspect each cell to see that water level is above plates at all times, and add only pure distilled water when needed. If terminals are corroded, scrape them clean and coat with vaseline. Soda-water application neutralizes acid on top of battery



DISTRIBUTOR check should cover inspection of housing for cracks that may retain moisture and develop shorts; cleaning sockets where high-tension wires enter the cap, and smoothing pitted points. Remove oil deposits, if any, and locate source, as oil on breaker points will cause excessive point burning. Over-oiled rotor wick or oil from grease cup may be the trouble



SPARK PLUGS fail in four ways: normal wear, broken insulators, dirty electrodes and excessive gap. Do not screw plugs tightly in place; future removal of a "frozen" plug may result in cracking the insulator. Scrape accumulated carbon from electrodes and check for excessive gap between them. In regapping, use a feeler gauge and always bend side electrode



a "Physical" Check-up!

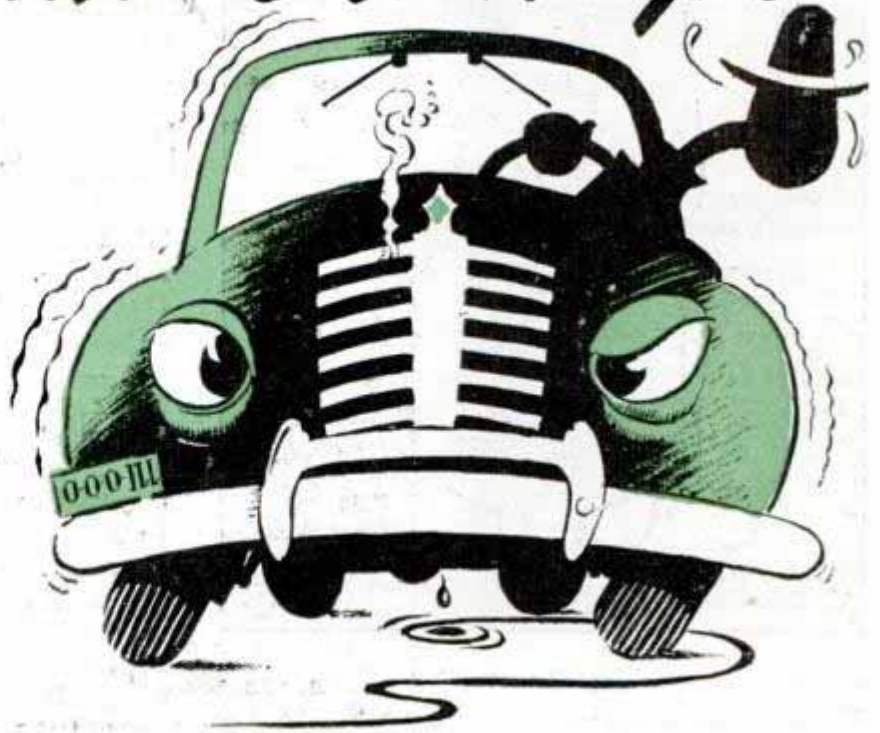
Minor things that you can do yourself to save both time and money and keep your car operating at top efficiency

By Phil Ruskin

AN HOUR or two spent occasionally in making minor adjustments and repairs on your car engine not only will be repaid in the pleasure of driving a car that gives peak performance, but also will help delay the time for a major overhaul job. Efficient fuel and ignition systems, Fig. 4, are a must if an engine is to deliver its power smoothly and economically, so start the check with the fuel system.

Fuel pump: This is the heart of the system and should be checked first. Disconnect the fuel line on the discharge side of the pump. Then turn the engine over a few times with the ignition off to see if the pump is delivering sufficient gas. If the flow is insufficient, blow out the fuel line and clean the pump sediment bowl. Be sure the tank vent is open. A weak flow of gas may indicate that the trouble is in the fuel pump itself.

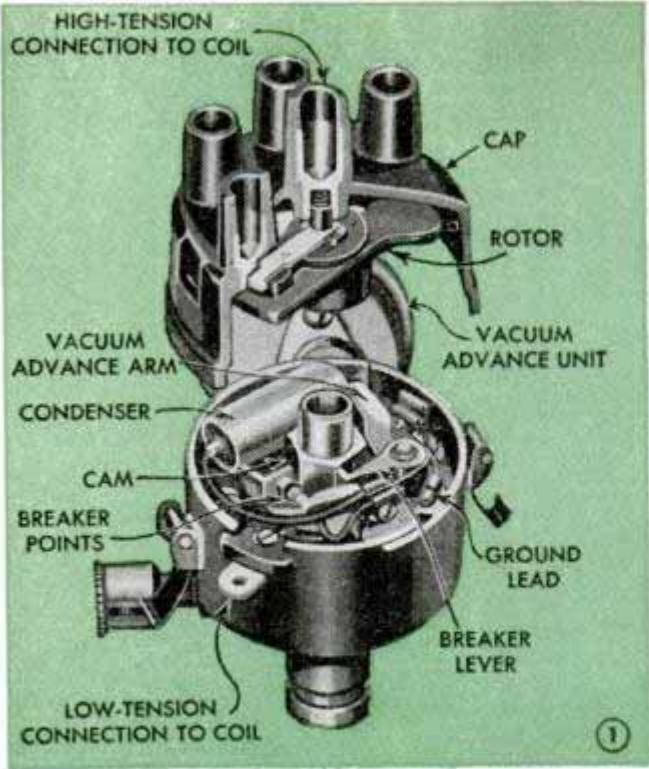
Carburetor: Aside from fuel pump failure, improper functioning of the carburetor is another primary cause of poor engine performance. Check the float and needle valve to see that the latter seats properly and that the fuel level is maintained at the correct height in the float chamber. This varies with the different cars. The correct level recommended for each individual make of car can be had by consulting a dealer or manual. However, in the absence of this information, the correct level can be determined, to some extent, in the following way: When the fuel level is too high, the carburetor will be flooded when the engine is not running. If it is too low, the engine will perform poorly, especially when attempting rapid acceleration. Be sure that all vents and jets in the carburetor are open and in working condition. Set all manual adjusting screws to give the best engine rhythm when it is idling at a speed equivalent to 20 m.p.h. If the engine has an automatic choke, be sure that it remains closed when the engine is



cold, and open when the engine is warm. All gaskets around the carburetor must be leakproof. Engine idling should be adjusted to the lowest speed at which the engine will turn over smoothly. Some carburetors have a screen in the inlet pipe that requires periodic cleaning.

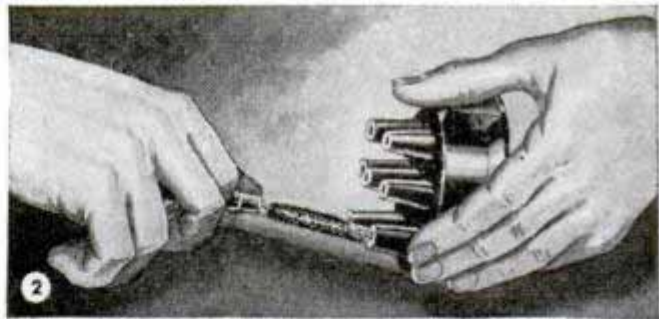
Air cleaner: A partially blocked air cleaner causes excessive fuel consumption and may be the cause of a sluggish engine. Remove the cleaner and wash all parts in gasoline. Reoil the copper-gauze filter and allow it to drain before replacing. If the air cleaner is an oil-bath type, refill the reservoir to the level mark. This usually requires about a pint of oil.

Battery: A faulty ignition system will cause an otherwise good engine to run poorly. Test the battery and see that the electrolyte covers the plates at least $\frac{3}{8}$ in. A fully charged battery should have a specific gravity reading of 1.280 and should never be allowed to fall below 1.250. Clean the corrosion from the terminals with a wire brush and wash the top of the battery with a solution of baking soda, rinse off with warm water and wipe dry. An application of grease or petroleum jelly to the terminals will help prevent corrosion. It's especially important that the ground cable connections be tight and clean. Replace broken and frayed battery cables. With the battery in good shape, ample voltage is assured. Next comes the ignition coil. It's best to have it tested at a garage, but you can make a fair test by pulling the high tension wire from the center of the



distributor and holding it $\frac{3}{8}$ to $\frac{1}{2}$ in. from the motor. If a spark jumps to the motor when the distributor points are broken, likely the coil is all right.

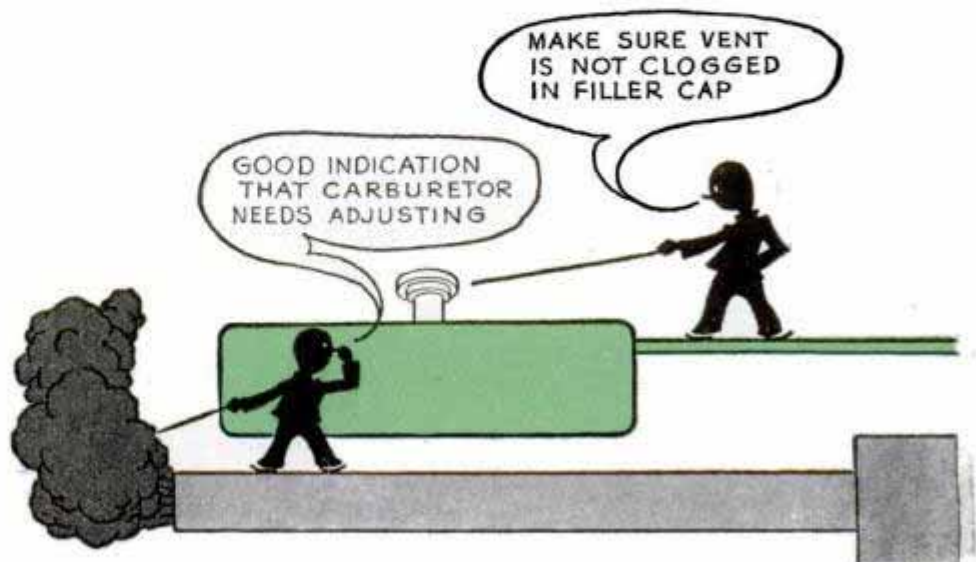
Distributor: Check to see that it is clean, that all parts are lubricated, Fig. 1, that the casing is not cracked and that the springs are in good condition. Also see that the breaker points are not unduly pitted and are timed perfectly. If the points are pitted slightly, use a coil file to smooth them. Or, better still, replace them. Badly pitted points that produce a long, hot arc when they break with the ignition on usually indicate a weak condenser. If this condition is apparent, both the points and condenser should be replaced. A mark on the flywheel of most cars permits timing the points to a close degree of approximation without the use of an instrument. When the mark is centered in an index hole in the housing, the points should begin to break for firing the No. 1 cylinder. Check with a dealer to obtain the correct firing order of the engine and the gap required between the breaker points when they are wide open. Use a regular feeler gauge to test the clearance. If the timing of the cam in the distributor is off, it can be adjusted by loosening the distributor on its shaft and turning it until the correct moment of "point breaking" is found. Check the ignition wires for breaks in the insulation, wipe them clean of oil and dirt and see that they do



not come in contact with hot engine parts. Also, it's a good idea to clean and polish the wire sockets in the distributor as in Fig. 2.

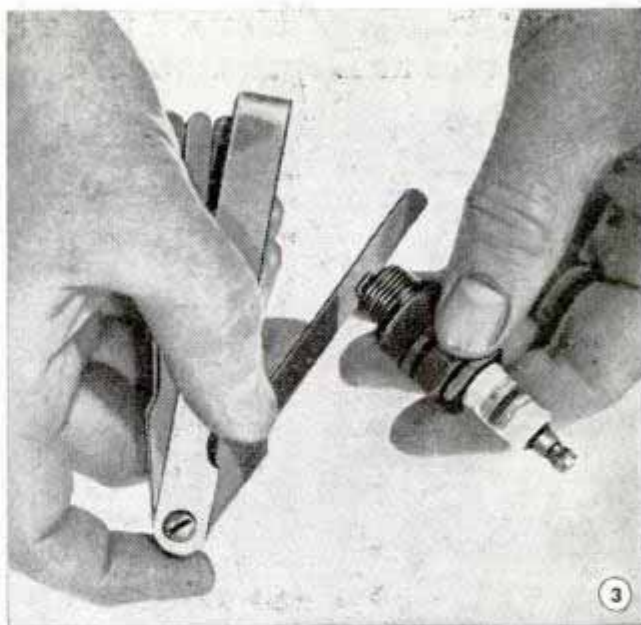
Spark plugs: Before removing the spark plugs, clean the walls around them so that dirt will not fall into the cylinder. Look for cracks in the porcelain insulation and adjust the electrodes, Fig. 3, to a gap of .025 to .029 depending on the maker's instructions. Adjust only the side electrode, never the center one. If the electrodes are badly burned, or if the plugs are very dirty and rusted, replace them. In replacing the plugs tighten them just snugly, do not draw them up tightly. The right type plug to install is important. Where you notice that the insulators of the plugs become a brownish color quickly and the electrodes burn away, they should be replaced with a cooler running plug having a short shank. If the plugs are wet, sooty and fouled all the time, a hotter running plug—one with a long shank—is needed.

Road test: When the tests so far have been made, give the car a road test. You may find the carburetor needs adjusting. If the engine "rolls" or it seems sluggish and black smoke pours from the exhaust following rapid acceleration, the carburetor mixture is probably too rich, that is, too much fuel in proportion to air. On the other hand, if the engine "spits" and lacks power, the mixture is perhaps too lean. During the road test, try hill climbing. Here you may find that the spark is

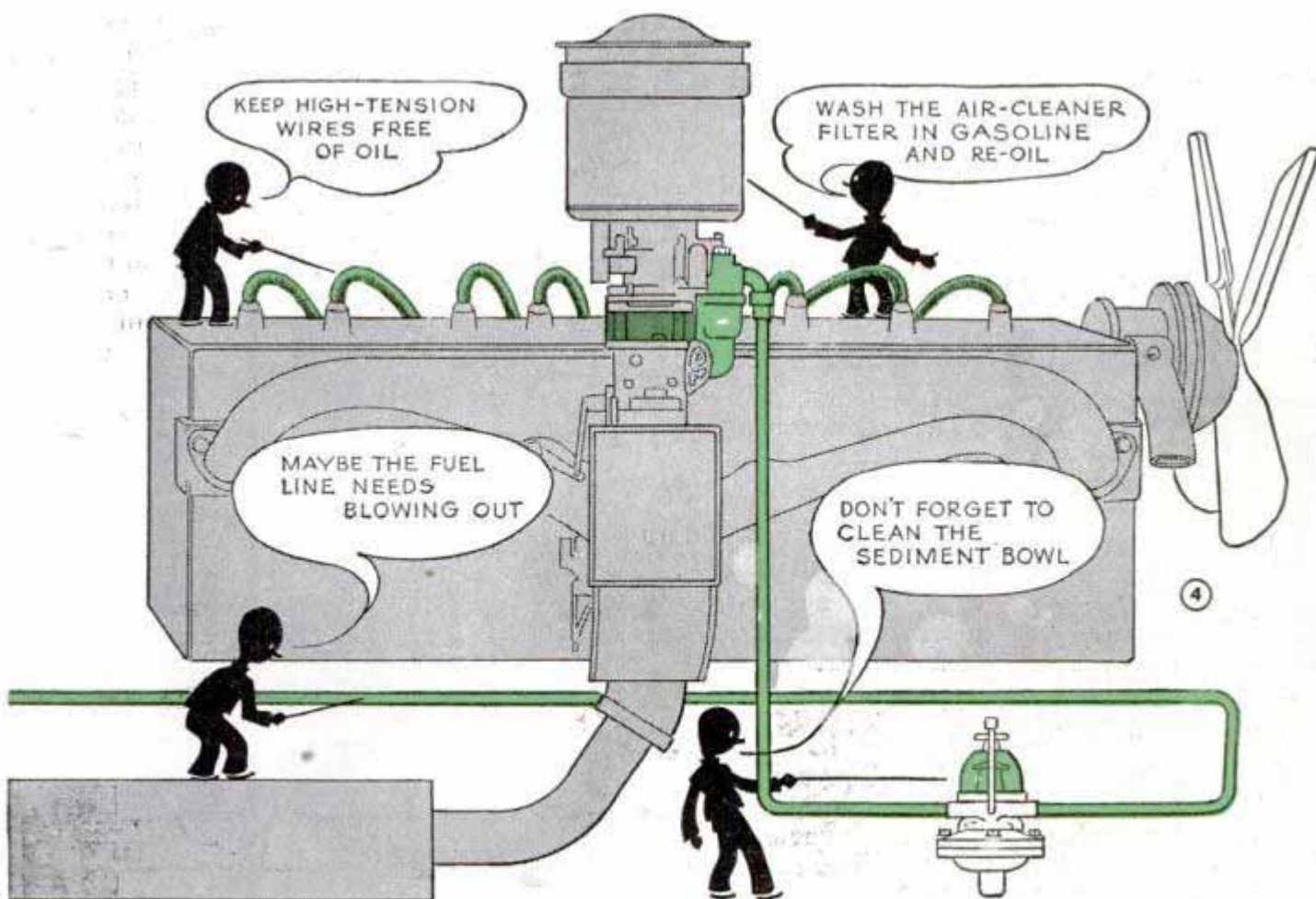


advanced too much for the type of fuel being used, causing the engine to knock and lose power. Recheck distributor and spark plug gap. Also, check engine compression by letting the engine idle downhill in high gear. Good compression should hold the car back fairly well. On level grade a good six-cylinder engine should be able to pull evenly at less than 5 m.p.h. in high gear. Another thing to check is the condition of the piston rings and cylinder walls. If blue smoke is observed from the exhaust during fast acceleration, it indicates that lubricating oil is passing the pistons, and the rings or cylinder walls need attention.

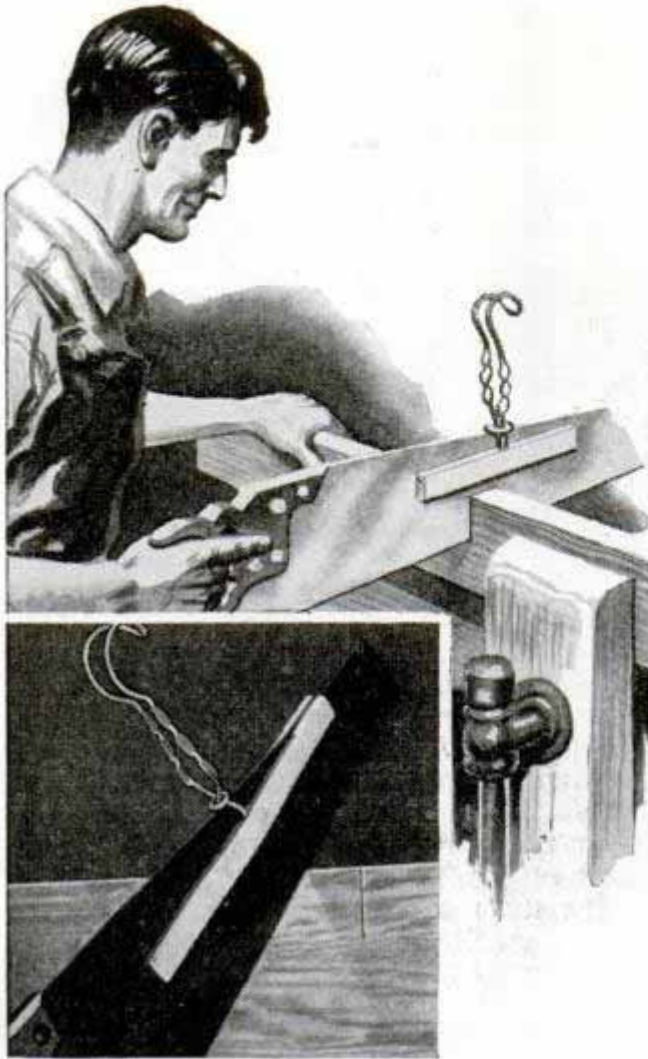
Engine compression: If the engine still performs poorly, look for faulty compression. First check the valve clearance with a feeler gauge placed between the valve stem and the actuating mechanism when the valve is fully closed on its seat. Examine the condition of the valve springs too. Testing engine compression accurately requires a special gauge, but by removing the plugs, one at a time, and holding the hand over the plug opening while the engine is being turned over, you'll be able to detect a weak cylinder. Another way is to "short" one or a pair of spark plugs while the engine is running. A weak cylinder will show very little if any decrease in engine speed when it is shorted out, which indicates that it is doing little work. A



third method of finding a weak cylinder is to crank the engine over slowly by hand, and count each cylinder as it comes up on its compression stroke. Less compression in cranking will be noted if a cylinder is weak. If regrinding the valves makes no appreciable improvement in compression, the pistons and cylinder walls need attention. This, however, amounts to a major overhaul job which should be done by a competent mechanic. Finally, it's a good idea to check the engine temperature during tests. If the cooling system is in good condition it will remain fairly constant.

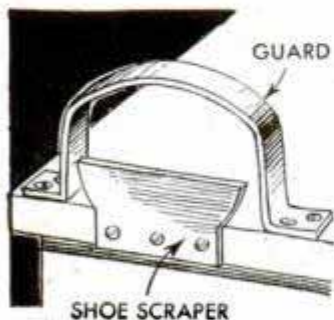


Trouser Hanger Clamped to Saw Serves as Depth Gauge



When you must make a saw cut in from the edge of a board to an exact depth and there's no suitable depth gauge at hand, just clamp a trouser hanger on the saw blade and measure the distance from the points of the teeth to the bottom edge of the hanger. Then adjust until the distance corresponds to the depth of cut you require.—William Swallow, Brooklyn, N. Y.

Guard Over Blade of Shoe Scraper



If a guard is placed over a shoe scraper, it will prevent injury should anyone trip and fall on it. The guard must be large enough to permit insertion of footwear.

Saving Gasoline in Storage

You'll increase your auto mileage and tractor acreage from a given drum of gasoline by the simple precaution of preventing its evaporation in storage. The sun's heat will volatilize gasoline even in mild

weather and waste much of the fuel. To avoid this, the storage tank should be shaded. Any kind of a simple shelter will do—just a roof is sufficient as long as it is wide enough to keep direct sunlight away from the tank.

Linotype Slug Impresses Name On Leather Goods

Personal articles made of leather may be stamped with a linotype slug bearing your name to identify them. Use the slug as you would a metal stamp and tap it with a hammer lightly to make a good impression. The slug can be obtained from any job printer for a nominal fee. A fairly large type should be used, and preferably a Gothic face, so that the impression is clean cut.—H. P. Cesary, Syracuse, N. Y.



Wire and Bolt Form Hose Clamp For Emergency Use

An emergency hose clamp having great strength can be made from a length of soft wire and a stove bolt. The two ends of the wire are twisted together to form a loop which is flattened. Then the double strand is twisted, with eyes left in each end to receive the bolt. In application the clamp is wrapped around the hose twice and pulled up tight with a screwdriver as shown.

John Krill, Youngstown, Ohio.



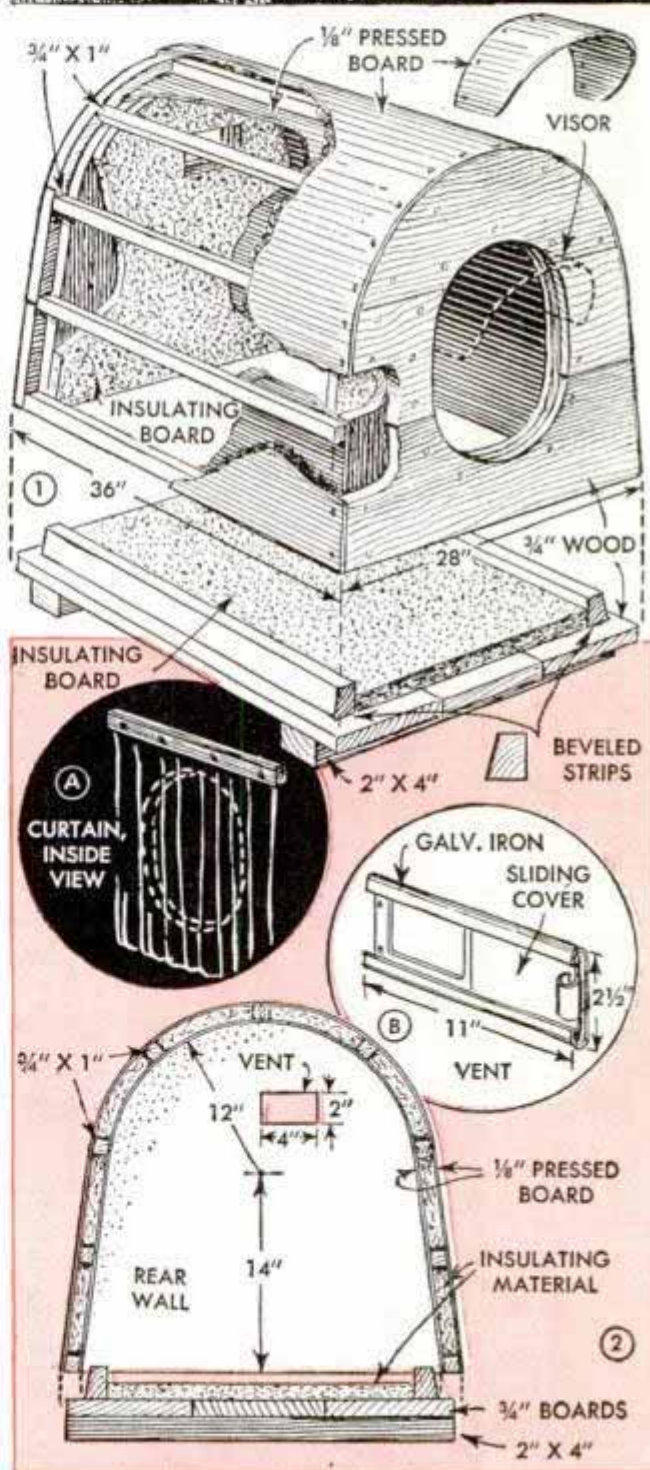
QUONSET HUT for your Dog

By Hi Sibley

IT may be that every dog has his day but until that time he should have a home of his own and it should be snug, warm, well ventilated and clean. If you think as much of your pet as he does of you, just any place won't do. So his home will have to be something extra special and here's a good suggestion—a house patterned after the well-known Quonset hut and retaining the essential features of the full-sized structure. The double walls are sheathed inside and out with $\frac{1}{8}$ -in. hard-pressed board. Linoleum can be used but is not so durable for this purpose. Space between the double walls is filled with $\frac{3}{4}$ -in. soft-pressed insulating board cut to fit between the supporting strips as in Fig. 2. Ends are triple thickness: $\frac{1}{2}$ -in. wood, two thicknesses, with insulating board inside, as in Fig. 1. Note that the ends are shaped to form a $\frac{7}{8}$ -in. step which takes the $\frac{1}{8}$ -in. inner wall plus the thickness of the insulating board.

Dimensions given in Figs. 1 and 2 are about average. The house can be made larger but not much smaller due to the shortened radius of the curved top. Hard-pressed board will not take the bend satisfactorily on a radius much less than 12 in. as given. Make the ends first, using strips of solid stock nailed or screwed together with the grain at right angles as indicated. Or use $\frac{1}{2}$ -in. waterproof plywood if available. No size is given on the door opening, as this is optional. Size of the ventilator opening and the sliding sheet-metal cover are given in Fig. 2, B.

Assemble by nailing the inner wall to the ends. Space the nails about 1 in. apart. Then follow with the strips and the insulation. Outside sheathing should be cut so that it overhangs the ends and lower edges about $\frac{1}{8}$ in. This will prevent water working underneath and onto the floor. It's a good idea to coat all joining edges with paste white lead or waterproof glue before nailing the outer sheathing in place. Bottom construction is very simple. Ends of the hut should overhang the ends of the bottom boards about $\frac{1}{8}$ in. when the parts are assembled. The canvas curtain, A in Fig. 2, and the visor of $\frac{1}{8}$ -in. hard-pressed board or light sheet metal finish the job ready for painting.

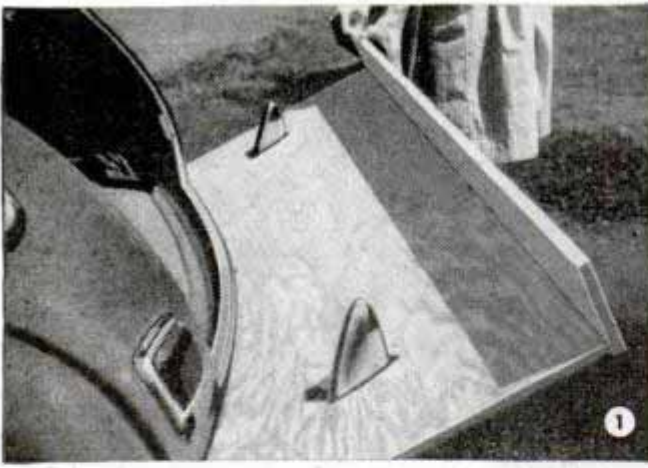


"Sleeper"

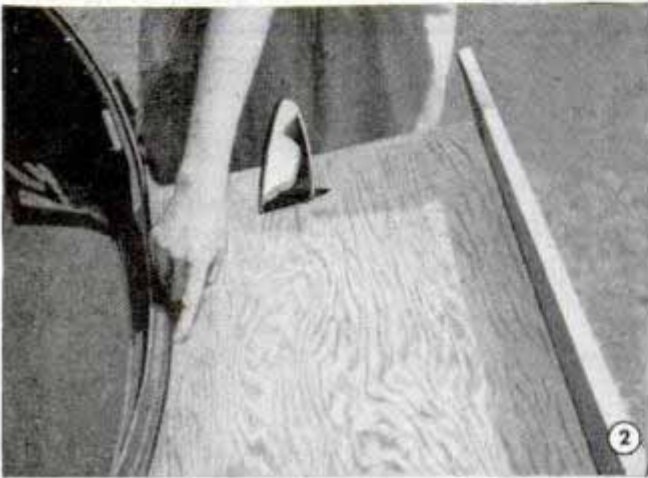
Rear-deck extension provides a comfortable bed for two, and a tarpaulin gives privacy. The entire outfit is stored in a small space in the rear of your car

By Jim Robinson

THE roadside is your bedroom when your car is equipped with this rear-deck "sleeper". The rear-deck compartment on most coupes and even some sedan-type cars is roomy enough so that, if a short extension board is added, it can accommodate a double mattress. Since the dimensions of the extension will vary with different cars, it might be well to cut a paper pattern first, being sure it fits and is large enough to support part of the mattress. Both the extension board, Fig. 1, and the tailboard can be cut from $\frac{3}{4}$ -in. plywood. Note in Fig. 2 that the curved side of the board follows the curvature of the car closely. If necessary, hinge a support at the rear of the extension board to keep it in place. As a precaution, make a wood brace that can be wedged between the rear-deck door or cover and the bumper guard, Fig. 3. Figs. 4 and 5 show the completed bed. Finally, a tarpaulin, Fig. 6, is thrown over the rear deck and lashed down.



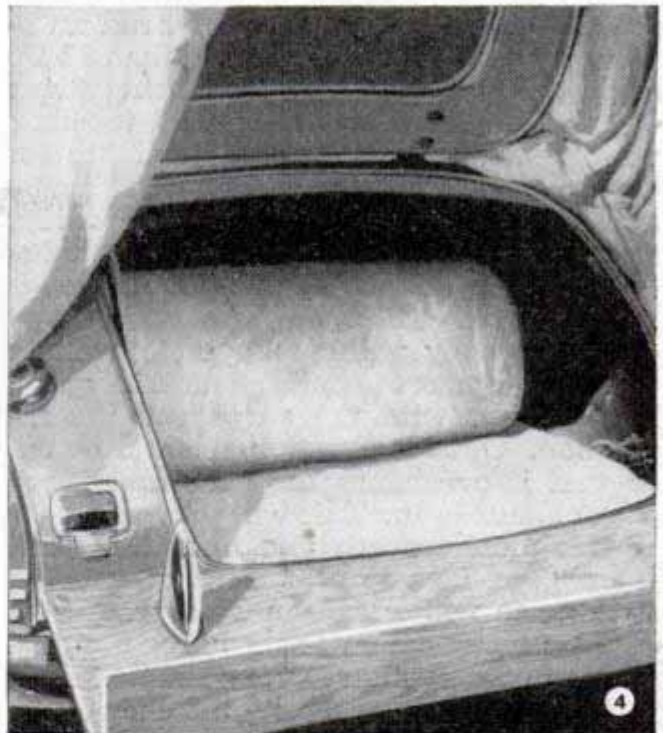
Slipped over the bumper guards to rest on the rear bumper, this extension board serves as support for the lower end of the double mattress



Although it is not necessary that the board carry a heavy load, for strength it should be a tight fit against the rear deck of the car

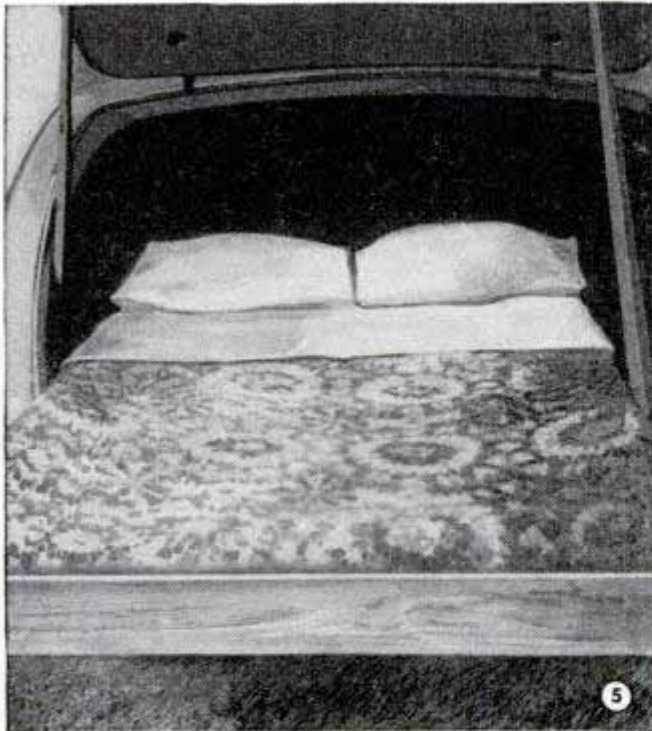
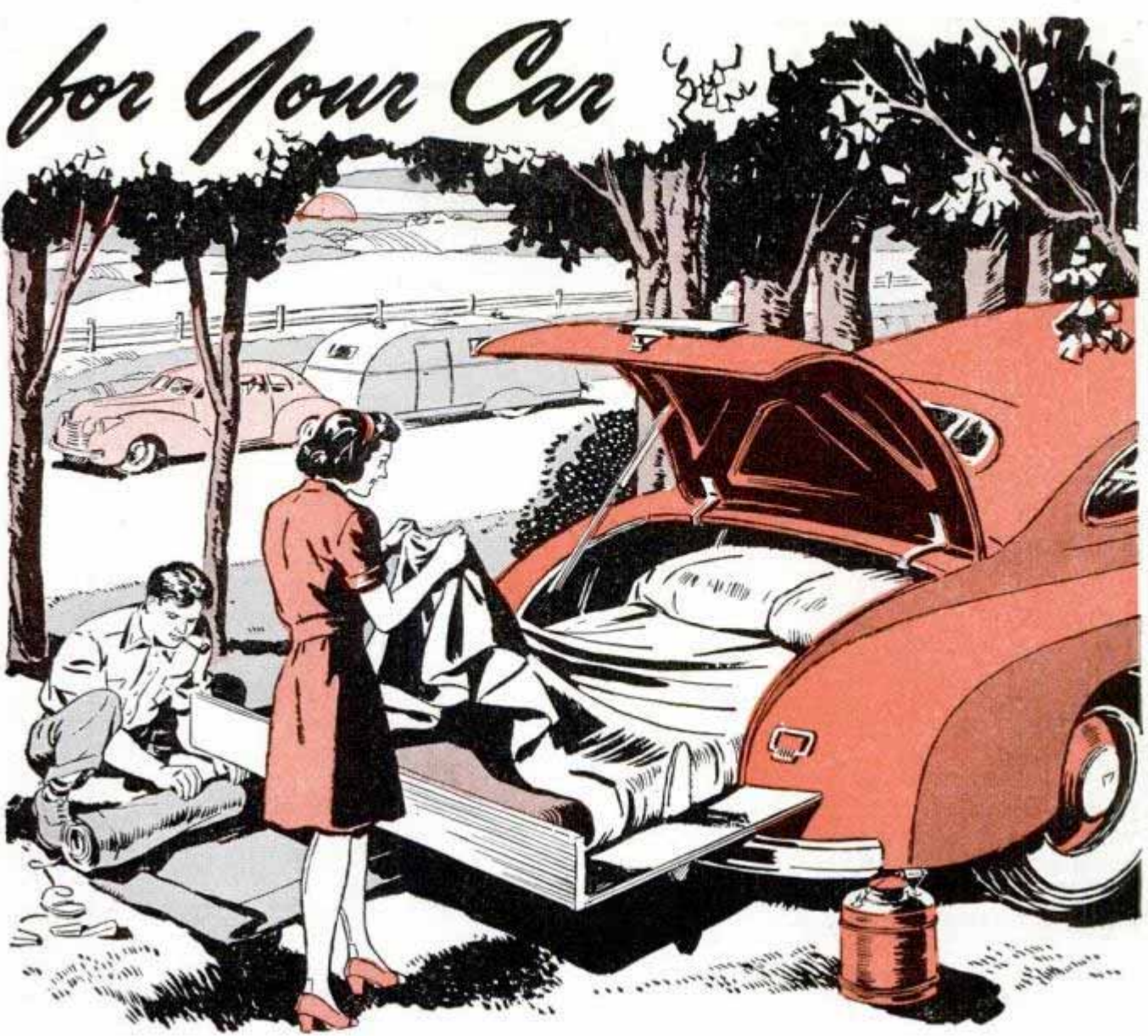


As a safety precaution, a wooden brace supports the rear-deck door. The base of the support is wedged tightly into the bumper guard



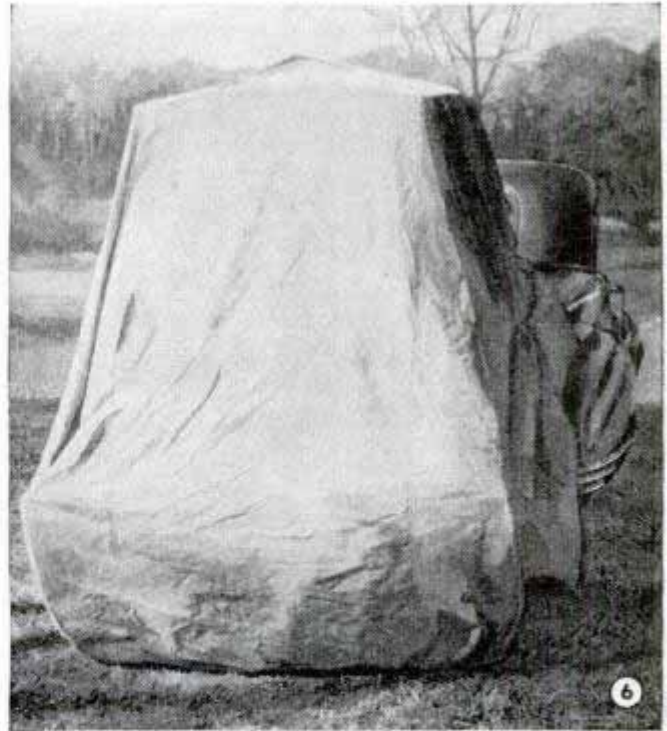
A pad placed on the floor of the rear deck protects the mattress, after which the latter is unrolled and the bed is ready to be made

for Your Car



5

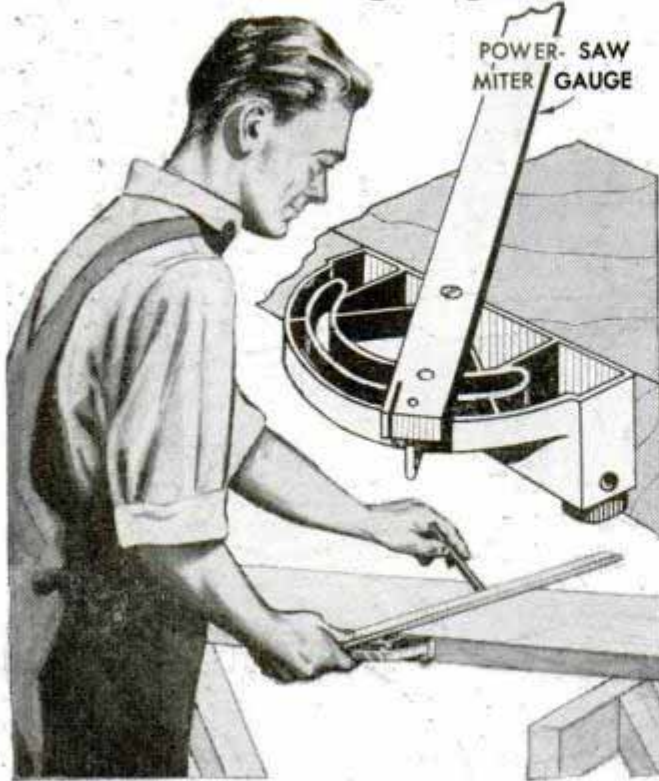
Bed is made up and ready for occupancy. The tailboard, fastened to the extension board, is an aid in keeping the mattress in position



6

As protection against weather and to insure privacy, a tarpaulin is thrown over the rear deck and tied to the bumper and door handles

Miter Gauge Used as Protractor For Marking Angles

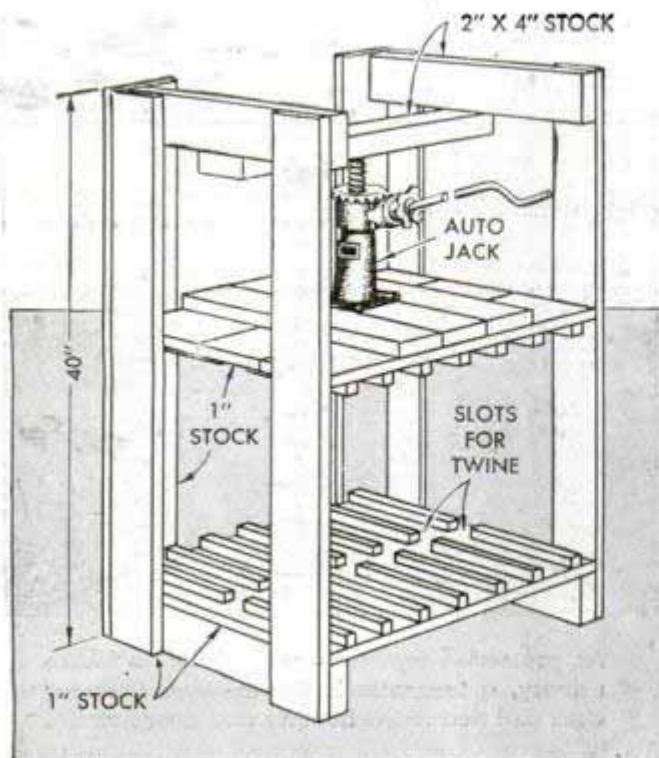


To use a power-saw miter gauge as a protractor, turn the gauge upside down with the face against the piece to be scribed. Then scribe the lines along the face of the bar that fits into the table groove. The angle to be drawn is set on the angle scale.

Robert J. Lux, East Aurora, N. Y.

How to Make Small Paper Baler

Constructed from odds and ends of lumber and an old auto jack, this paper baler will produce neat and compact bundles of scrap paper. Although width and depth

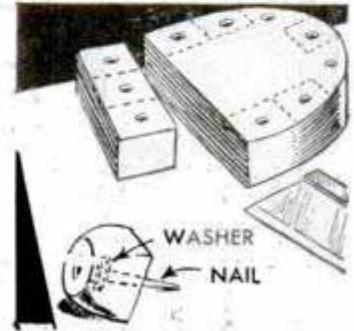


are not dimensioned and can vary to suit individual requirements, a width of 22 in. and a depth of 15 in. would be about average. Note that provision is made for slots in the top and bottom platforms so that twine can be passed around the paper when it is ready to be tied and taken from the press. The jack, which furnishes the pressure, is placed between the top platform and a 2 by 4-in. piece which is fastened to the side members.

E. A. Rerucha, Franklin Park, Ill.

Bumpers Cut From Rubber Heel

If you are unable to obtain rubber bumpers of the type used to protect furniture, they can be cut from a rubber heel. Using a razor blade, cut the heel into cubes so that a nail hole is in the



center of each cube. Each hole is fitted with a small washer through which a small nail is driven with a nail set for attaching the bumpers to the furniture.

Coins Used as Gasket Patterns

Whenever you want a round gasket of thin rubber, leather or heavy paper, hold the material between two coins of the same denomination and cut around them with a pocket knife. The diameters of coins are as follows: dollar, $1\frac{1}{2}$ in.; half dollar, $1\frac{3}{16}$ in.; quarter, $\frac{15}{16}$ in.; nickel, $\frac{13}{16}$ in.; penny, $\frac{3}{4}$ in., and dime, $\frac{11}{16}$ in. The hole in smaller gaskets can be punched and in larger gaskets it can be made by cutting around one of the smaller coins that is nearest the desired diameter.

Bob Hewitt, West Hartford, Conn.

Stop on Tap Prevents Breakage

Threading blind holes with an ordinary tap is a risky business because breakage is almost sure to result if the tap strikes the bottom of the hole. In most cases a



bottom tap is used for this purpose. But you can thread blind holes with an ordinary tap without danger of breakage if you first run lock nuts over the tap thread and adjust them so that the tap will cut the thread to the desired depth.

M. E. Frick, Evansville, Ind.

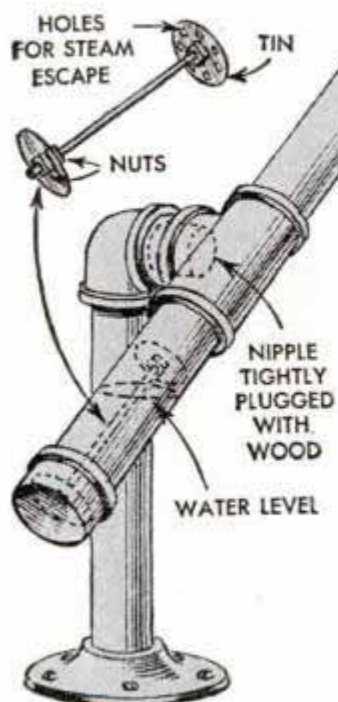
Rustic Wall Rack Has Shelves of Bracket Fungi



Everyone who vacations in the woods is familiar with the shelflike fungi often found growing on the trunks of large trees. When dry, these plant growths are of such a hard and woody nature that they can be carved, sawed and nailed without breakage. Most of the parasitic plants of this particular species, known as bracket fungi, are of a grayish-white color but some, more rare, are colored a brilliant red. Any of these growths can be made into attractive and novel wall shelves, or racks, for the summer home or woods camp. Fig. 1 offers one suggestion, using a small tree crotch as a supporting frame. The back of the crotch frame is planed flat so that it will fit neatly



against the wall. The shelves are fitted and nailed to the opposite side. Fig. 2 shows a combination wall plaque and tie holder. The flat surface of the dried fungus plant is decorated with an oil painting, which is protected by a coat of copal varnish after the oil colors are dry.



Steamer From Pipe For Modelmakers

Constructed of 1 or 1½-in. pipe and heated with a blowtorch, this compact steamer will be welcomed by modelmakers as a solution to their bending problems. Note that the upper pipe is removable and various lengths can be used to accommodate wood of different lengths. The unit which is shown in the upper left-hand detail keeps the wood out of the water. To keep steam out of the support, the nipple which connects the tee to the elbow is plugged.



White hollyhocks photographed against a blue sky, using a dark yellow filter. Such flowers always are good subjects for close-up photos

By Paul Hadley

REGARDLESS of size or kind, almost any garden—the one right in your own back yard—is full of interesting and lively subjects from which you can make salable pictures if the lighting and composition are right at the instant you trip the shutter. To be of interest and use to editors of farm and garden publications, photos of these subjects must have good composition. Composition gives a photo life, interest, action—tells a simple story at a glance, without words. Photos offered for sale must be crisp, sharp and clear, of good contrast in the light and dark areas, and above all they must be interesting. Take as examples the two simple shots, Figs. 1 and 8. There is nothing especially unusual about the composition of the photo in Fig. 1, except that it shows how onion sets are planted in the small home garden, but that is of interest to a great many people. The same is true of the photo, Fig. 8. It shows exactly how sweet potatoes are bedded, the first step in the propagation of the plants. Moreover, these two shots attract attention simply because they show people doing something.

On the other hand, Figs. 2, 3, 4 and 5 are examples of photo stills of familiar garden-plant blossoms. The important points to notice about these four shots are the crisp detail and the bold quality brought out by close-up focusing combined with unusual angles and a careful timing of the exposure.

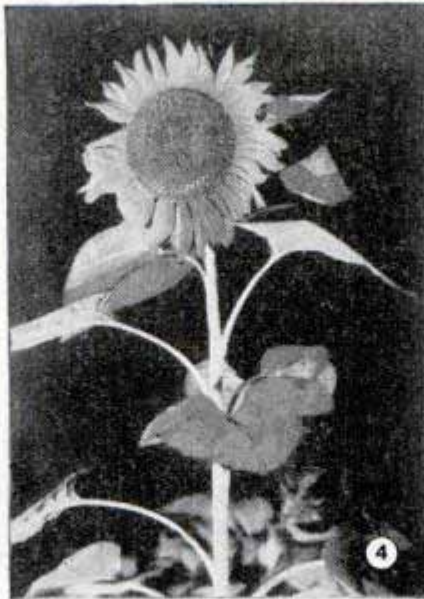
One, Fig. 4, is taken with flash lighting and instantaneous exposure, the lighting being so arranged that the undersides as well as the top sides of the leaves are illuminated. Thus the subject is made to stand out in bold outline against a dark background. Essentially the same effect can be achieved by using floodlights, Fig. 9 being a good example of the results that can be obtained by a careful prearrangement of camera and floodlighting.

Figs. 2 to 7 inclusive are examples of close-ups of garden subjects, literally hundreds of which are possible in any vegetable or flower garden. The two photos, Figs. 6 and 7, were taken on a table top, using a background of dark cloth. Notice how these shots give the feeling of a bountiful harvest of perfect specimens. This effect is achieved by the number and arrangement of the vegetables and the fact that the photos are taken with the camera close to the subject in each case. For this type of photography a view camera with a long bellows is usually best. Mounted on a steady tripod and equipped with the proper lens, a view camera can be focused at very short distances. The large image on the ground glass can be carefully studied for the most effective composition and placement of the subject before the picture is taken. A reflex camera of the long-bellows type also is useful for this close work. In the reflex camera the image is reproduced on the ground glass right side up. You see the subject just as it will

On GARDEN PHOTOGRAPHY



Low-angle shot of onion seed heads, using a dark yellow filter to strengthen color values. The photograph was taken against a cloud background



This flash shot of a sunflower was taken at night. In night photos taken by flash, detracting background detail is usually eliminated



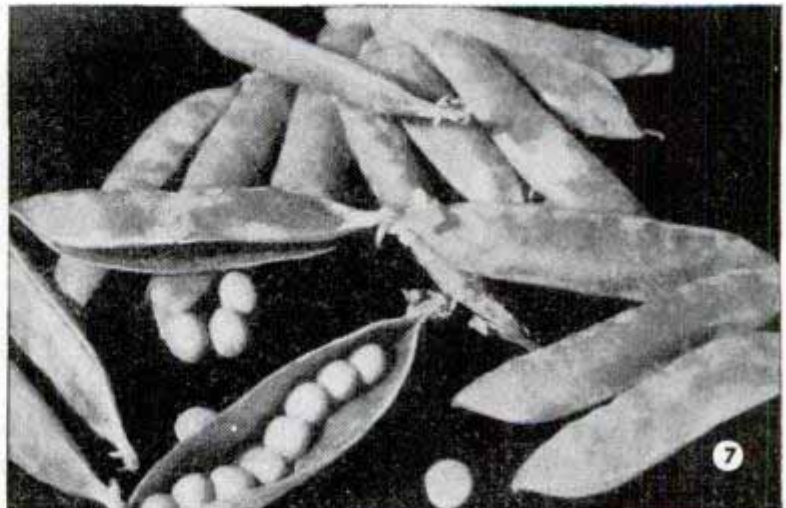
Flower of the lowly pumpkin given an unusual orchidlike delicacy by a close-up shot. The camera must always be supported on a steady tripod

appear on the print. In order to get fine detail in close-ups of such subjects as those in Figs. 6 and 7 you use a comparatively slow shutter speed and a small stop, and for extreme close-ups it often is necessary to use an auxiliary or portrait lens. This is simply an attachment that slips over the regular lens and makes it possible to focus on small objects only a few inches from the camera.

Film to be used on close-ups of the kind already described, in fact, any ordinary outdoor work, should be moderately fast and color corrected for best results. This means a fairly fast panchromatic film of the press type which generally gives better rendition of the red and yellow values. Size of the film is largely a matter of choice, but 4 by 5, 5 by 7 or 8 by 10-in. sizes give acceptable contact prints without enlarging. Many professional photographers prefer to work with the larger film sizes as a matter of speed, economy and quality of prints. Others regularly use the smaller film sizes and enlarge from the negatives to the print size desired. This method has the advantage that slightly under or over-exposed negatives can be corrected in the process of enlarging to give a final, large-

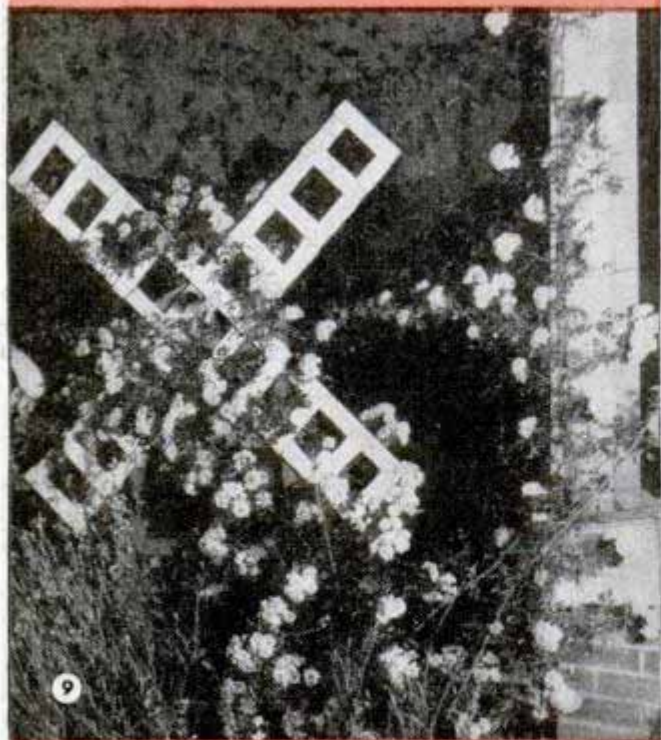


Above and below: Close-ups of vegetables are of interest to farmers and gardeners. These photos are typical dark-background shots that leave the impression of bounteous yields





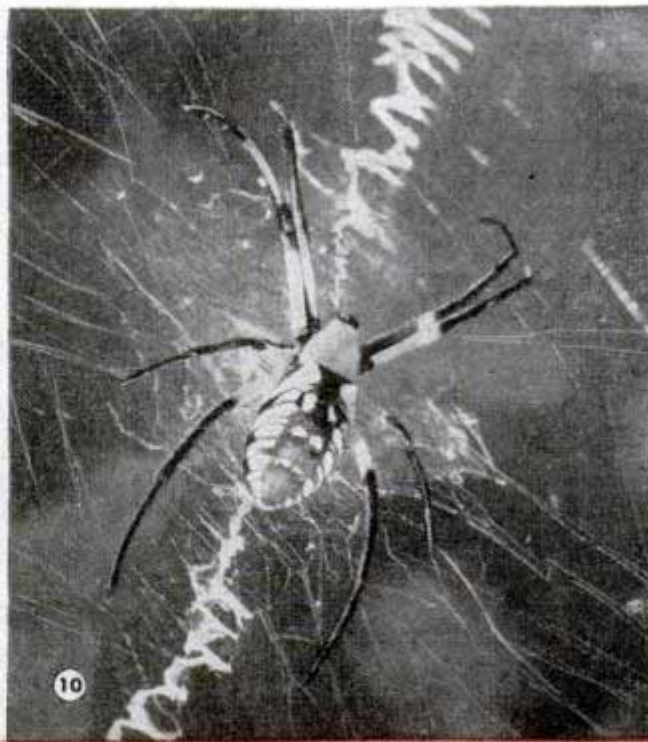
This photo is interesting because it shows how sweet potatoes should be bedded for propagation of plants in a hotbed. Note sidelighting



Another night shot having the effect of throwing the subject into bold relief against a dark background. Taken with floodlights and time exposure

size print of acceptable quality. Also, by using the various common grades of enlarging papers, other minor defects of the negative can be corrected or modified.

Close-up shots of insects are quite easy to make with the camera equipment described. They fit in well with stories on the control of garden pests. Figs. 10 and 12 are examples. Sharp focusing and correct timing of the exposure are the first essentials in insect photography. Careful selection of the subject and its surroundings—composition—is equally important to success. Although artificial lighting can be used, as a rule daylight is best. The large spider shown in Fig. 10 is quite brightly colored—hence it will be necessary to take careful note of the background. The camera must be placed so that there are no vines or edges of leaves which closely parallel the legs or follow the outline of the body of the insect. Such defects in the composition will spoil the picture. Use a camera with a long bellows extension and, if necessary, a portrait attachment on the lens so that the subject can be focused close up and the image enlarged several diameters. In this way the image covers the greater part of the ground-glass area and most or all of the unnecessary adjacent detail can be eliminated from the picture. If necessary to use direct sunlight, try to maneuver the subject or camera into a position where the former will be sidelighted or high lighted in such a way as to bring out the contrasting body colors in their true values.



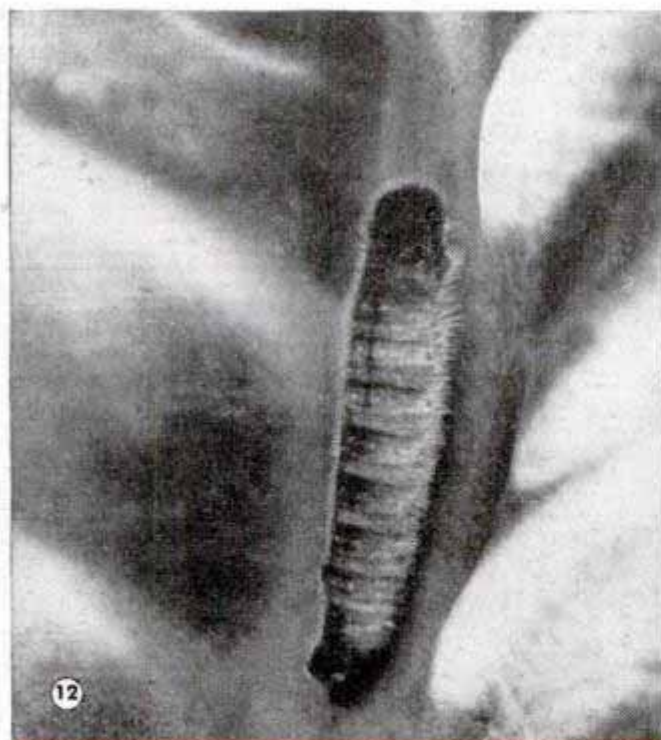
Although harmless to humans and plants, this garden spider seems none too pleased about having his picture taken in such a close-up fashion

Fig. 12 presents another problem along the same line. Here the subject must be photographed with parts of large plant leaves in close proximity. An enlarged image and needle-sharp focus are the first considerations. Then the camera is moved about by trial settings until the available light highlights the subject in sufficiently clear outlines. Proper location of the image on the ground glass and the correct exposure time complete the essential details preliminary to taking the picture. A good quality exposure meter is helpful in accurately measuring the available light and determining the proper exposure time. Be sure that the meter is set to the speed rating of the film you are using.

The photos in Figs. 11 and 13, like those in Figs. 1 and 8, effectively picture the human-interest angle of garden photography. The first, Fig. 11, emphasizes action and is taken fairly close with the purpose of registering fine detail and giving the feeling of movement. Often it is well to have the subject rehearse the action several times so that when the picture is finally taken the pose will be natural. In Fig. 13 the shot is taken at a low angle to emphasize height of the vine which is the point of pictorial interest. Notice that the figure has been purposely posed in the act of reaching upward, another detail serving to direct attention to the unusual feature of the picture. The composition of such photos as that in Fig. 13 should be carefully planned with these points in mind.



People like to see pictures of other people and this shot of the little girl gathering roasting ears is of interest to everyone, including editors

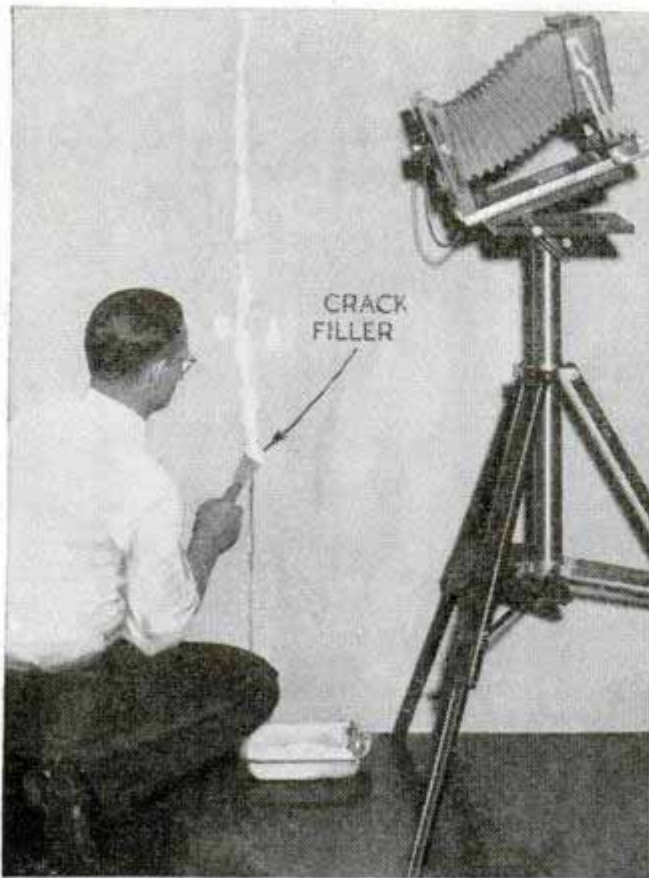


Entomologists rate this fellow a serious pest. Although he appears shy here, he's a voracious feeder and no gardener can overlook his depredations



Tomato vines 10 ft. tall don't grow in every garden. Anyone boasting a "green finger" will instantly feel the challenge of such a photo as that above

Basic Background Can Be Altered For Different Effects

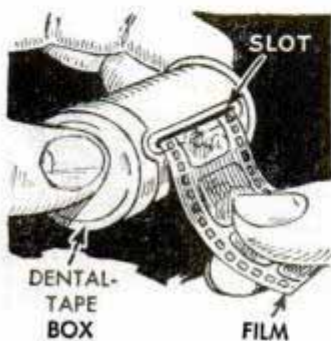


A background that can be altered to obtain a number of different effects is a welcome addition to the photographer's studio. Panels of heavy insulating board are used and should be nailed to furring strips that are fastened to the wall. The panels should be flush with the floor and ceiling. An aqua-colored water paint is ideal as a finish and a paste made of the paint should be applied before the second coat to fill cracks and nail holes. This color makes a proper background for most subjects, but variety can be obtained by attaching different colors of cloth, paper, netting, etc., with push pins.

Ivan Grosvenor, Richmond, Ind.

Short Pieces of Movie Film Stored In Dental Flat-Tape Boxes

I find that empty dental flat-tape boxes make excellent storage cans for titles and other short film cuts. In editing a reel, shots cut out can be stored for future use. When splicing on titles, just enough of the film is fed from the can to make the splice and the rest is not handled, eliminating the possibility of fin-



ger prints. A piece of adhesive tape wrapped around the can will seal it and the tape is marked for identification.

C. W. Philpot, Laurens, S. C.

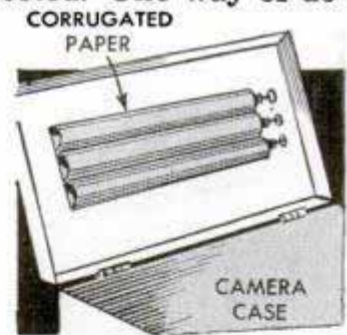
Safelight for Photographic Paper

Here's a safe-light that is made easily by using a small bottle in which photographic chemicals are kept. Cut a 1 1/8-in. hole in the cover and solder an extension socket in this hole. With a 7 1/2-watt bulb in the jar, and with the light properly placed in the darkroom, good illumination will be secured.



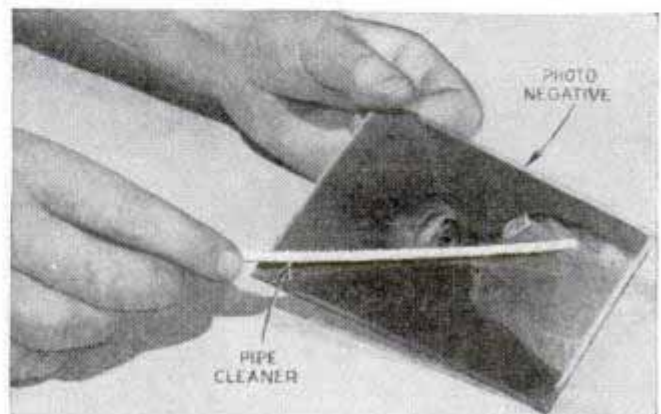
Protecting Extra Cable Releases

Because cable releases that have been kinked sharply are apt to be unreliable in operation, extras that you carry in your case should be protected. One way of doing this is to glue a strip of corrugated paper inside the lid of the camera case and coat the paper with clear lacquer. One cable release will fit snugly inside each corrugation.



Pipe Cleaner Will Dust Negatives Without Damaging Emulsion

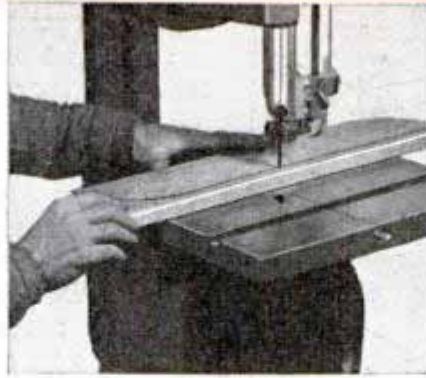
If nothing else is available for the purpose, pipe cleaners can be used to remove the dust from film negatives. The cleaner will not scratch the emulsion, as might be the case if the fingers were used.



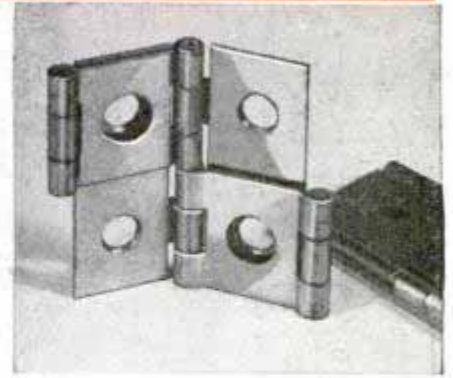
CRAFT QUIZ



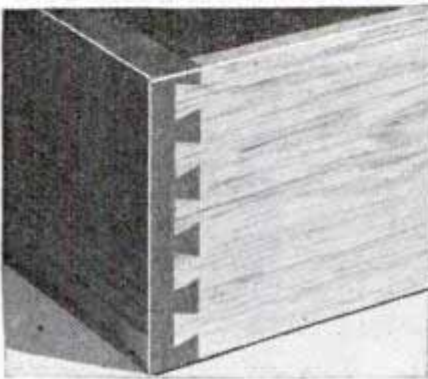
1. This wood turner is—
 (a) Indexing (c) Cutting off
 (b) Making sizing cuts (d) Inletting



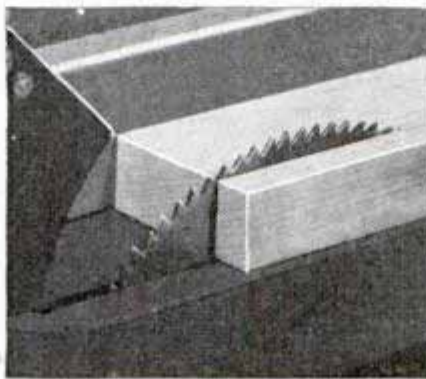
2. What's wrong here?
 (a) Hand position (c) Guide
 (b) Start of cut (d) Wood grain



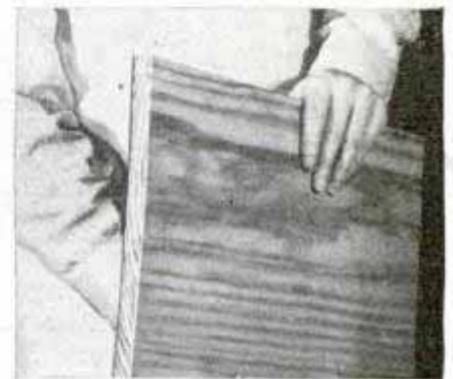
3. You'll find these on—
 (a) High chairs (c) Folding screens
 (b) Desk lids (d) Drop-leaf tables



4. This joint is named from a—
 (a) Tree (c) Fish
 (b) Flower (d) Bird



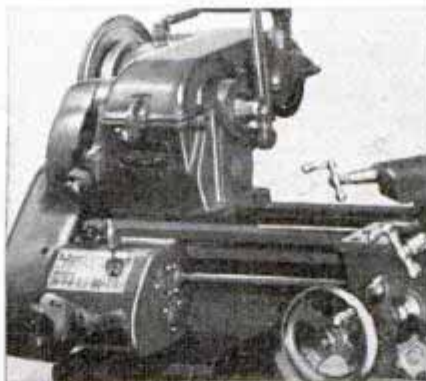
5. What's wrong here?
 (a) Grain of wood (c) Saw height
 (b) Kind of saw (d) Table insert



6. Heart side of this board is—
 (a) Top edge (c) Rear side
 (b) Face side (d) Bottom edge



7. Mast of this boat is—
 (a) Walnut burl (c) Snakewood
 (b) Spruce (d) Crotch maple



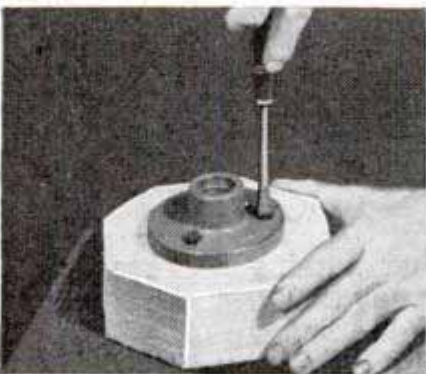
8. This lathe is called—
 (a) Gap bed (c) Quick change
 (b) Turret (d) Automatic



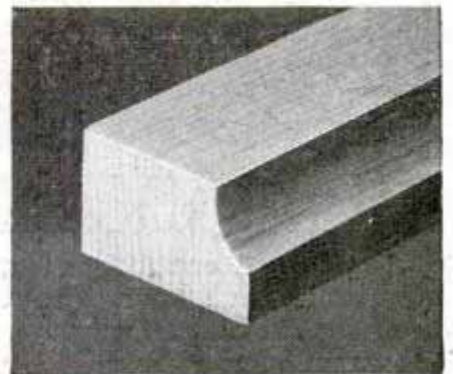
9. Motor of this electric drill is—
 (a) Constant speed (c) AC only
 (b) Universal (d) Split-phase



ANSWERS: 1—b; 2—b (work will strike column at end of cut); 3—c (double action hinge); 4—d (joint is a dovetail); 5—b (crosscut saw used for ripping—a would also be correct); 6—b; 7—b; 8—c; 9—b; 10—a; 11—a



10. Soon he will be—
 (a) Scraping (c) Knurling
 (b) Cutting (d) Tapering



11. This molding is a—
 (a) Cove (c) Dentil
 (b) Bead (d) Flute

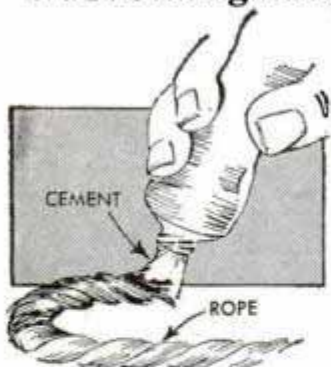
Wire Template Transfers Outline Of Intricate Shapes



Made from a few lengths of wood, a strong rubber band and a number of light wire rods, this adjustable template can be used for such jobs as fitting linoleum into awkward corners by transferring the outline of the corner to the linoleum. Or it can be used by artists and draftsmen to make drawings of unusual shapes without taking intricate measurements. The method of assembly is shown in the detail. To insure best operation of the template, the rods must be perfectly straight.

C. L. Meehan, Lakeview, Ont., Can.

Preventing Frayed Rope Ends



Rope ends may be prevented from unraveling by coating them with a cellulose china cement. Treated in this manner, the ends will withstand wear without chipping the cement.

Conserving Rubber Bathing Caps

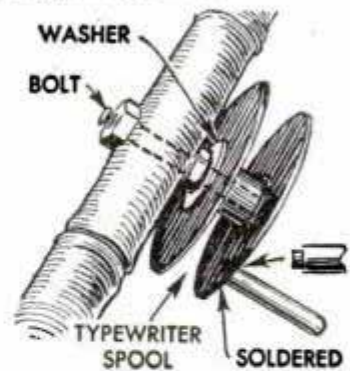
To prevent cracking of rubber bathing caps that have been stored over winter, they should be rubbed between the hands in warm soapy water to which a small amount of household ammonia has been added. This treatment will make the rubber soft and pliable and prevent splitting,

which may occur if the cap is forced over the head while dry and brittle.

Mrs. Virginia Arral, New York City.

Fisherman Uses Typewriter Spool As an Emergency Reel

One fisherman used an old typewriter spool as a temporary reel. For a crank he turned a shoulder on a short length of rod and soldered it in a hole drilled in the spool, which was attached to the pole by a bolt, a nut and washer being used as a spacer between the spool and pole.



H. Byt Werk, Grand Rapids, Mich.

"Flower Basket" for Lawn Shrubs Is Built With Barrel Staves

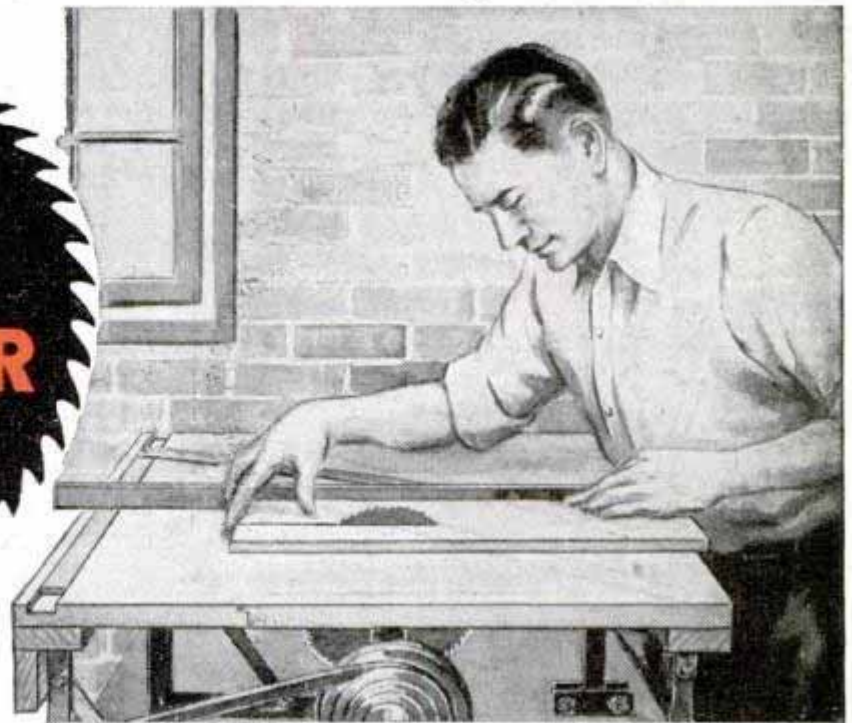
Unusual and attractive, this "flower basket" will command attention from passers-by. It is made with barrel staves which are turned outward and held together with bands of pliable wood. The handle is of similar material. The basket, minus a bottom, is filled half full of rich dirt. A rambling rose is ideal for the basket, but other plants can be used to obtain a "bouquet" effect.—R. Lee Sharpe, Carrollton, Ga.





LATHE Pinch hits for CIRCULAR SAW

By EARL D. TELLIN



YOUR woodturning lathe is quickly converted to a bench saw when equipped with this setup. All you do is mount an arbor and saw between the lathe centers as in Fig. 1, lower the table over the blade and you're ready to start sawing. When not in use, the table swings back out of the way against the wall as in Fig. 8. Such a setup naturally requires that the lathe be mounted on a stand or bench which can be pulled out into the center of the room to permit ripping long stock.

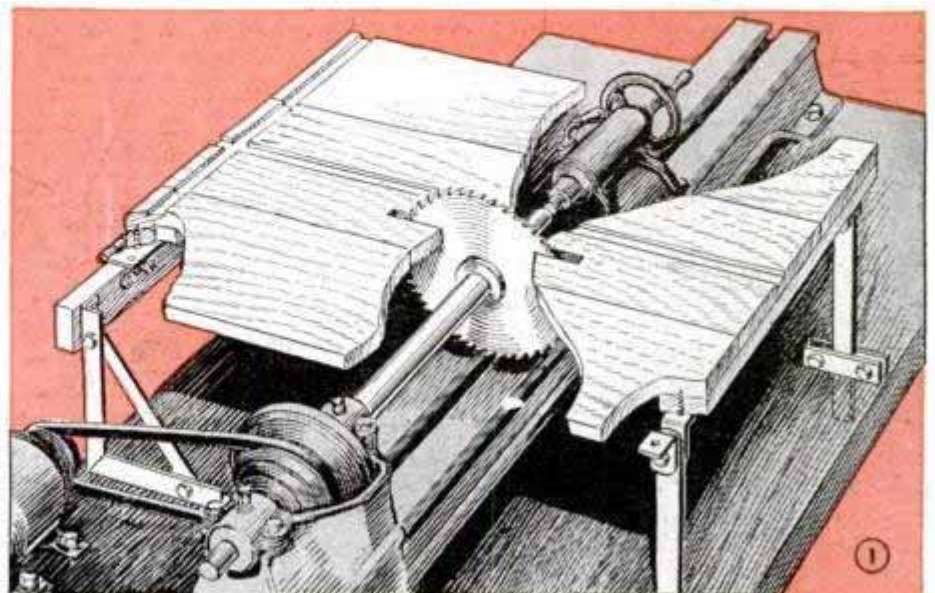
The original saw was made for a lathe having a 9-in. swing, although with a few changes in dimensions the idea is adaptable to any size lathe. The first step in construction is to make the saw arbor detailed in Fig. 2. This is machined from a length of $1\frac{3}{8}$ -in. cold-rolled steel to accommodate the bore of the saw blade. One end of the arbor is bored and threaded internally to screw onto the threaded lathe spindle, and the other end is fitted with a bronze bushing which is pressed in place to receive the tailstock center. In use, the hole in

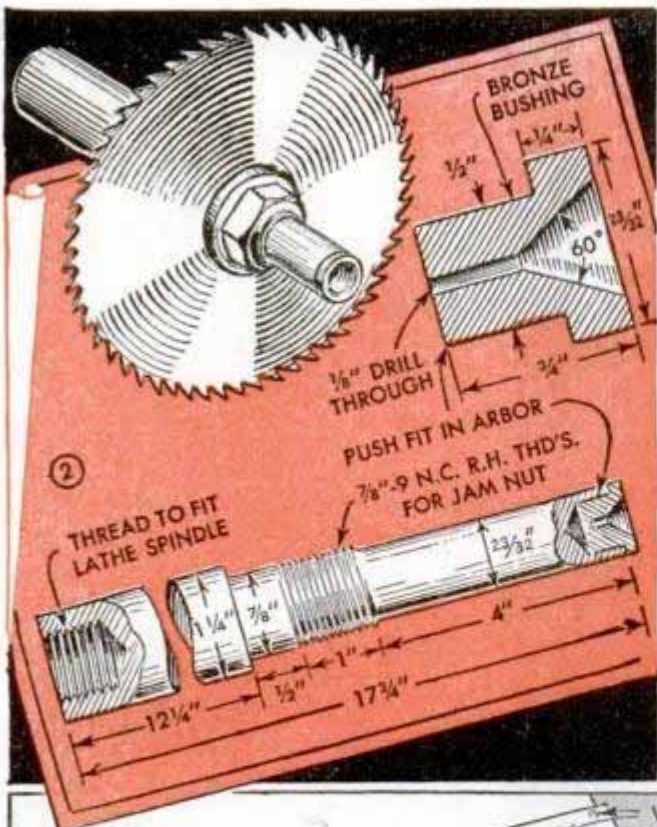
Hinged table that lowers over saw blade mounted between centers will convert a lathe into an efficient bench saw

the bushing is filled with grease before the center is engaged. If you wish, a ball-bearing "live" center in the tailstock can be substituted for the bronze bushing. For best results, the lathe speed should be approximately 4000 to 5000 r.p.m. for an 8-in. blade and proportionately faster or slower for a smaller or larger one. The saw blade should be mounted near the tailstock end of the arbor to reduce whipping and vibration to a minimum.

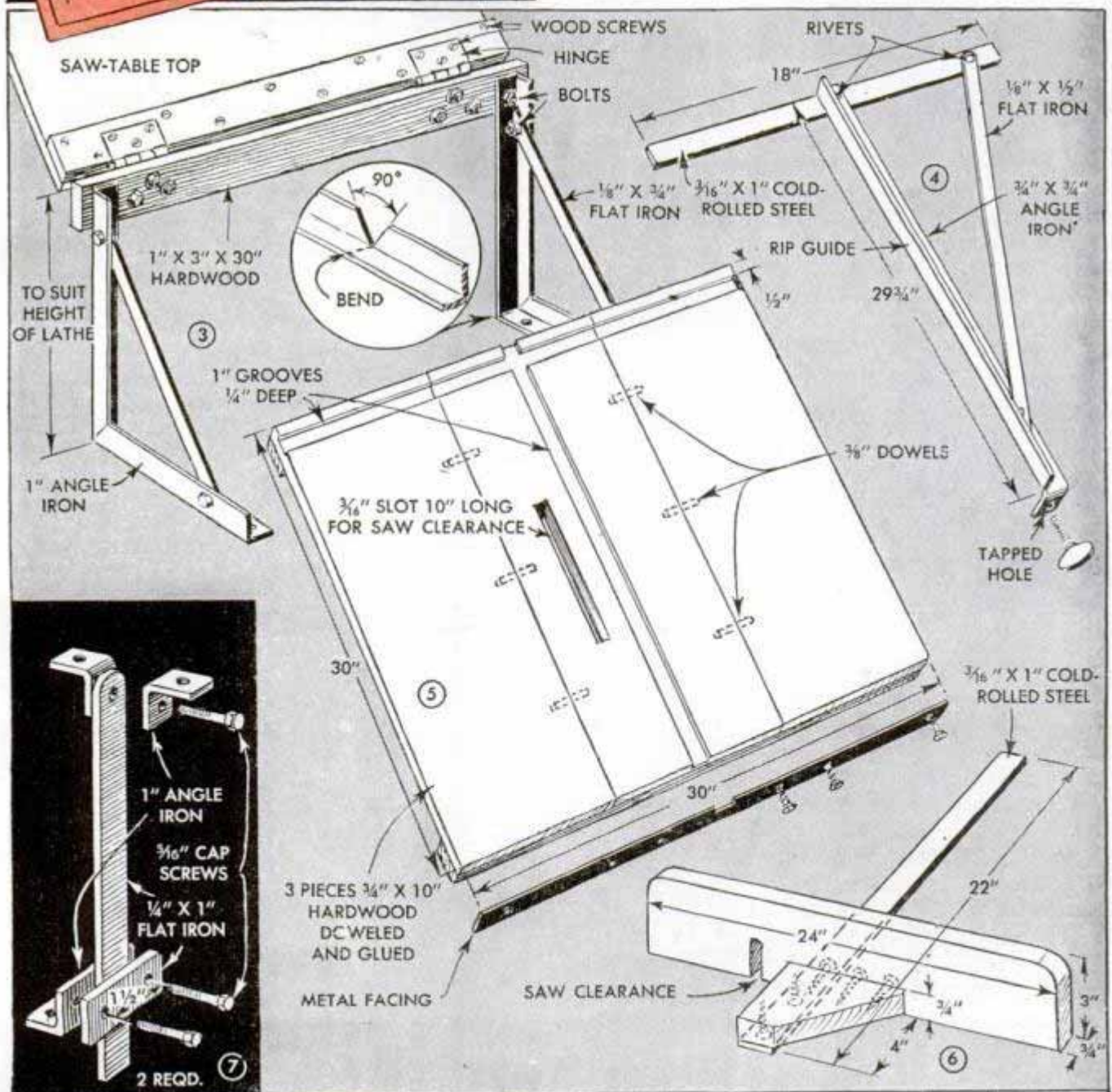
Fig. 3 shows the rear support to which the saw table is hinged. The support consists of two angle-iron brackets, of a size

Fig. 3 shows the rear support to which the saw table is hinged. The support consists of two angle-iron brackets, of a size



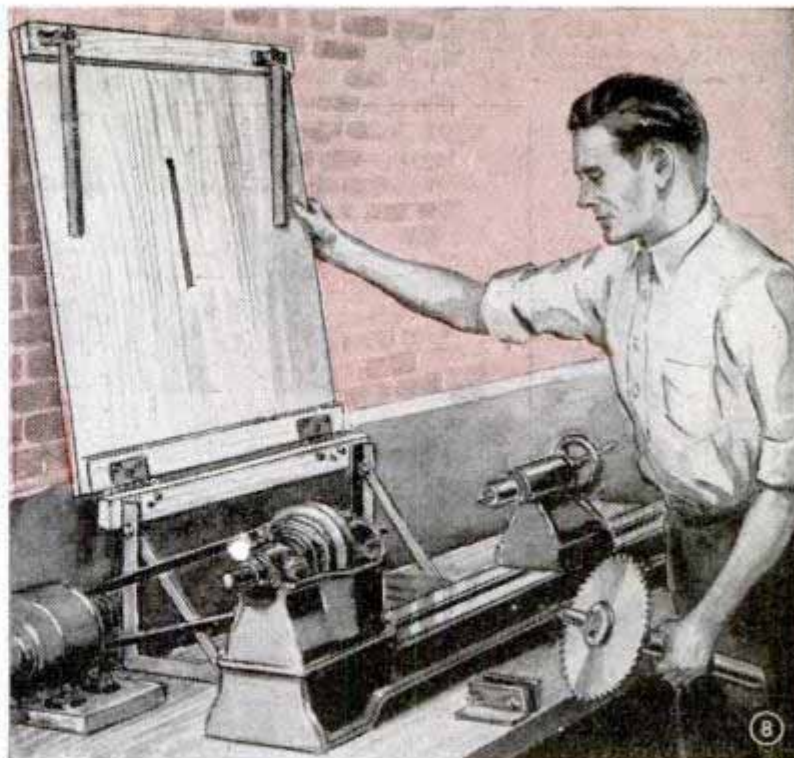


to suit the lathe at hand, bolted to a 1-in. hardwood strip, the brackets being bolted permanently to the bench top. The saw table is built up from three hardwood boards $\frac{3}{4}$ by 10 by 30 in., which are doweled and glued together edgewise as shown in Fig. 5. Several bar clamps are used to draw the pieces together tightly. Cleats 3 in. wide are screwed to the underside of the top at the front and rear edges to keep the surface flat. If you are able to obtain $\frac{3}{4}$ -in. plywood, the table can be from a single piece, 30 in. square, or a stock drawing board or a breadboard of a suitable size can be purchased and used for the table. Still another method, in some respects the best, is to rip 30 1-in.-wide strips from 1-in. hardwood and glue these together with waterproof glue. A top made in this way is exceptionally rigid and will not warp. Where it is desired to use the saw to make shoulder cuts, grooves, etc., the depth of cut is regulated by two flat-iron



legs as in Fig. 7. These extend through holes in the bench top and are made adjustable by a clamping device which consists of a section of angle iron fastened to the bench top and tapped to receive short cap screws and a plate. Tightening the screws locks the table at any set position and loosening them allows the legs to be withdrawn and moved with the table when not in use. The legs are pivoted to the front edge of the table with brackets of angle iron in the manner shown in Fig. 7.

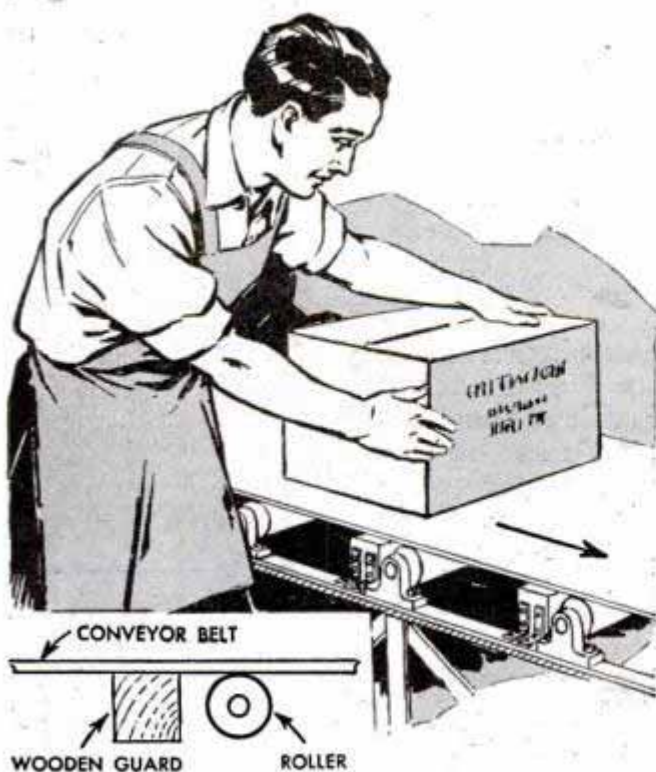
The rip fence, Fig. 4, operates in a groove across the rear of the table, and is locked in position with a setscrew which bears against a metal facing strip attached to the front edge of the table. A groove for the crosscut guide is run parallel to the saw slot and on the right-hand side of it. If you wish, the slot can be enlarged and provided with an insert so that a dado head can be mounted on the arbor. Both grooves should be cut about $\frac{1}{4}$ in. deep so that the guide bars are slightly below the table surface. The fence on the rip guide is a length of angle iron braced as shown. The crosscut guide is made according to Fig. 6, and it is important that the head be attached to the metal bar at 90 degrees. While its use is restricted to crosscutting only, miter cuts



Two tools in one—simply mount the arbor between lathe centers, lower the table and, presto!—you have an excellent circular saw

can be made with it by using a template block of the desired angle between the work and the guide. Or a trunnion of metal or wood, patterned after a commercial guide, can be attached to make the head adjustable for angle cutting. You even may be able to purchase a regular cutoff gauge and cut the groove in the table to fit it. Complete the job by sanding the table and applying a coat of thinned shellac. Then sand lightly and wax.

Guard on Conveyor-Belt Roller Prevents Injury to Hands



To prevent injury to his workers, one plant manager had wooden guards installed ahead of the rollers on the conveyor-belt system. Previous to this, several workmen had been injured by catching their hands between the roller and the belt. With the addition of this safeguard, such accidents were eliminated.

W. F. Schaphorst, Newark, N. J.

Use for Broken or Short Drills

For the mechanic who has a small high-speed grinder, here is a way to use short and broken drills, sizes 30, 31, 32, $\frac{1}{8}$ in., 41, 42, 43 and $\frac{3}{32}$ in. The 30, 31, 32 and $\frac{1}{8}$ -in. drills will fit the $\frac{1}{8}$ -in. collet while the other four will take a $\frac{3}{32}$ -in. collet. First grind the drills off square and then grind to give the cutting edge clearance. These altered drills will do well as cutting tools. The high-speed type drills will, of course, give the best service.

O. A. Nitz, Helena, Mont.

Battery Cable Is Repaired Easily With Copper Wire and Solder

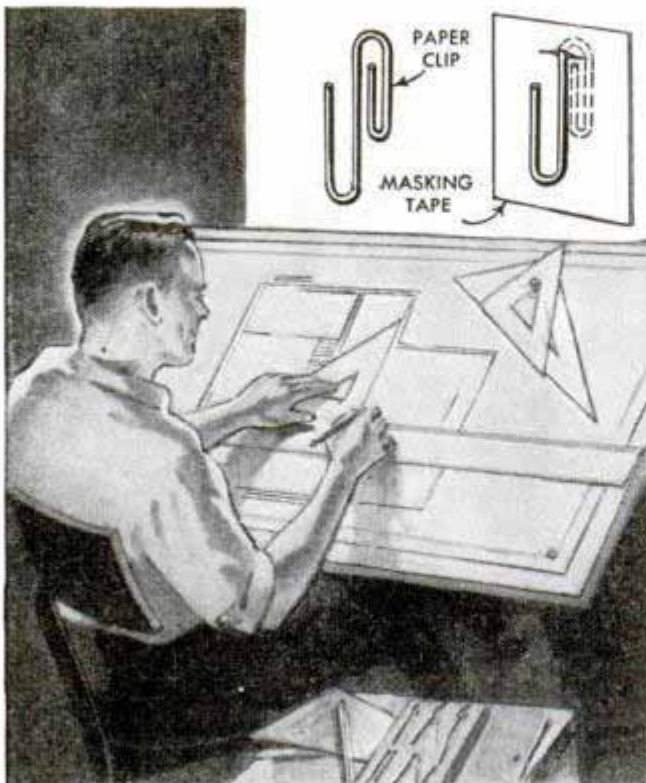


If battery cables become frayed or broken, they can be repaired by winding the ends together and wrapping the exposed area with bare copper wire of a medium gauge. Following this, flow solder onto the joint and then wrap with friction tape.

Jack Bronte, Grass Valley, Calif.

Paper-Clip Hooks Can Be Moved As Convenience to Draftsman

The draftsman who likes to work with his board set at a steep angle will find that these paper-clip hooks hold his instruments and triangles so they will not slide off onto the floor. The hook is formed by bending the clip and the short end is in-

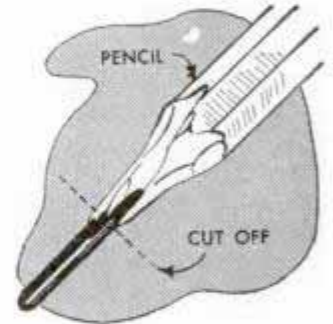


serted in a small square of masking tape. The tape holds the hook on the board, and since there would be no damage to the paper, when convenient the hooks may be placed on the drawing.

Louis Gilbert, Philadelphia, Pa.

Pencil Leads Used in Compass

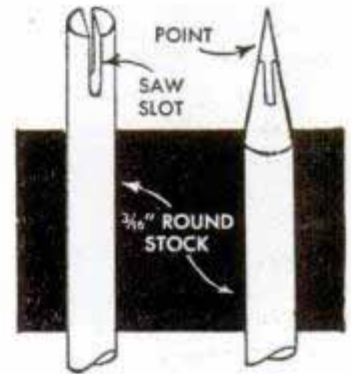
When I experienced difficulty in obtaining leads of suitable hardness for my compass, I found pencil leads made an excellent substitute. Leads having a hardness of HB and H are good for outline drawing and 2H does well for construction lines. Pencils that are too short for drawing can be used to obtain the leads.



Peter Shour, Montreal, Que., Can.

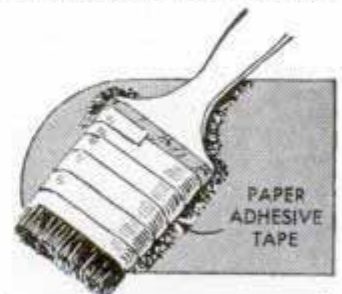
Carboloy Tip on Steel Scriber Prolongs Life of Instrument

A dull scriber on the layout bench could be the cause of a costly error. When your scriber slides over the surface without cutting a clean, true line, make a new one by using a length of $\frac{3}{16}$ -in. rod. Saw a slot on one end wide enough to hold a small piece of carboloy; pinch the rod to prevent the carboloy from dropping out, and then braze and grind the tip to a point. Dividers may be tipped in the same way by grinding the points down so the slot can be cut.—H. Peterson, North Troy, N. Y.



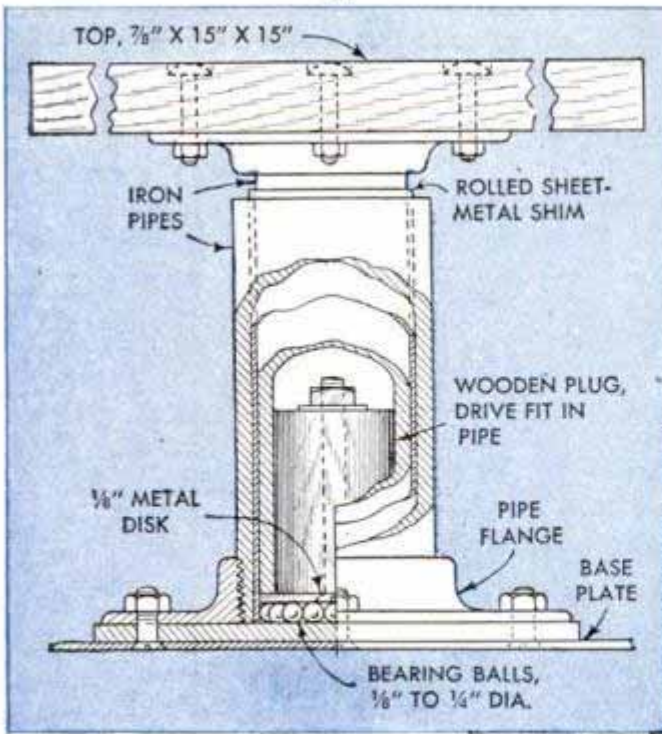
Bristles Taped for Stencil Brush

An ordinary paint brush can be used as a stencil brush if the bristles are bound with paper adhesive tape. This leaves only a short length of the bristles exposed and gives the necessary rigidity for stenciling. Since most brushes have a tapered point, the bristles should be trimmed evenly. The paper is removed by soaking the brush in water.



Frank Shore, New York City.

Ball-Bearing Turntable for Assembly and Repair



The turntable top, or platform, can be turned easily in either direction because it's mounted on ball bearings



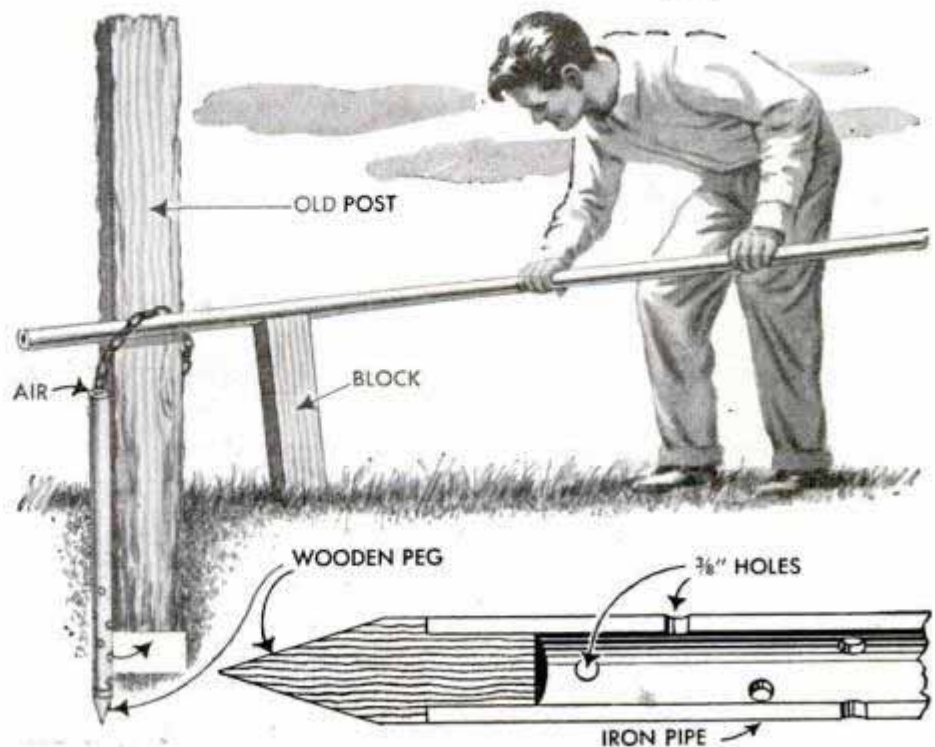
When repairing motors, typewriters, household equipment or other intricate mechanisms where it is necessary to get at all sides of the assembly, a bench turntable saves a lot of labor and time. With the type detailed above the motor or other unit to be disassembled is simply placed on the hardwood top and, if necessary, bolted or clamped in place so that it cannot shift.

Once in position all parts of the work can be reached by rotating the top in either direction. The turntable stand is made from pipe and fittings. All the weight is carried on an improvised ball bearing as will be seen from the cutaway view above. The column can be any length for either floor or bench mounting and the diameter of the column can be large or small.

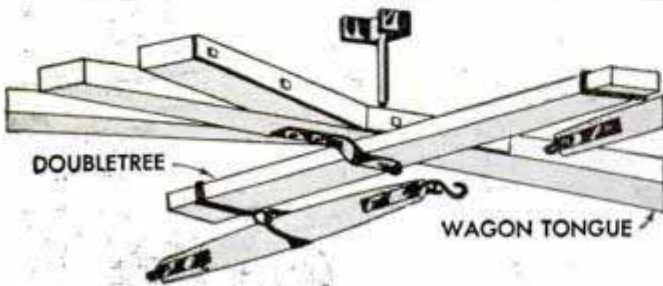
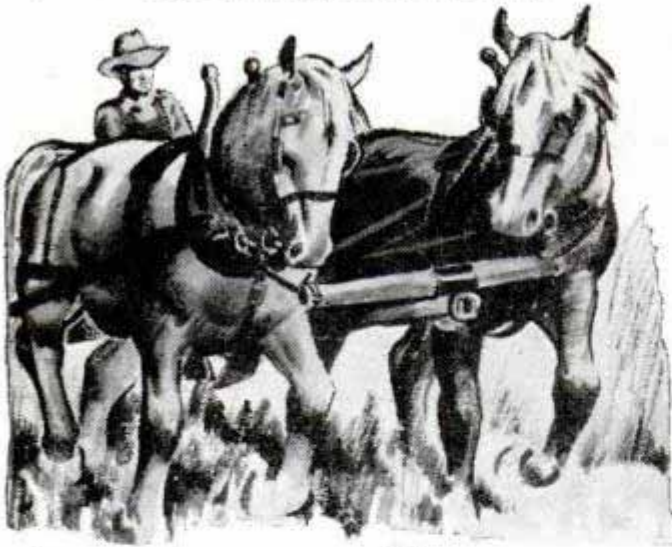
Pipe Vent Simplifies Removal of Posts From Soggy Ground

Pulling posts from soggy ground often is difficult because of the suction created by the vacuum at the bottom of the post. However, if a length of pipe is plugged and drilled as shown and driven into the ground beside the post, removal will be easier because air admitted through the pipe will tend to break the vacuum.

The tip of a soldering iron can be reshaped or cleaned on a coarse-grit disk or belt sander. This is faster than hand filing, and no time is wasted cleaning a file which has been used on copper.



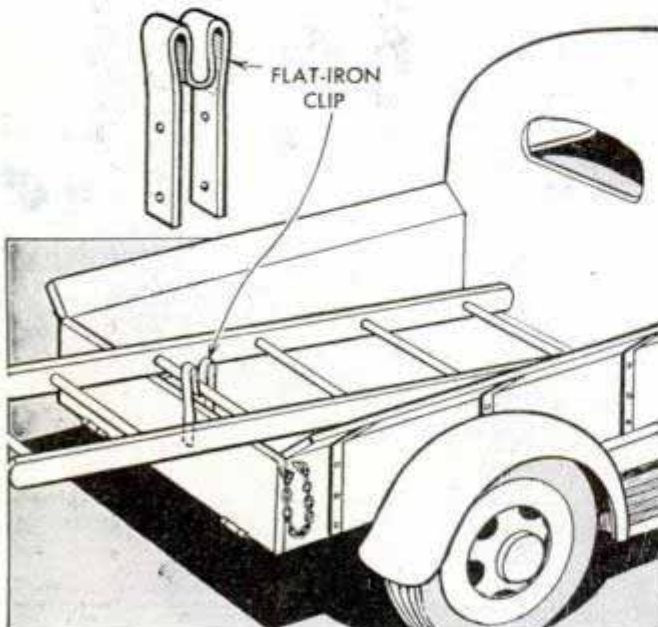
Reversed Doubletree Lifts Weight From Horses' Necks



To prevent the weight of a heavy field wagon or implement tongue from resting on the horses' necks, a frequent cause of sores and chafing, one farmer places the doubletree under the tongue instead of on top of it. In this position, the pull of the team on the traces produces a slight lift of the tongue, sufficient to remove weight from the animals' necks.

Flat-Iron Clip Secures Ladder On Painter's Truck

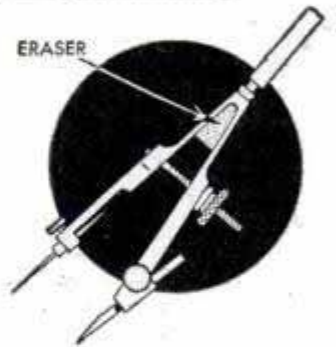
One painter keeps his light ladder from bouncing around or being lost from his truck by bending a strip of flat iron into a



clip and bolting this onto the tail gate. When the ladder is in place, one round is forced into the clip and held safely. After the ladder has been removed, the tail gate is swung down and the clip is out of the way.

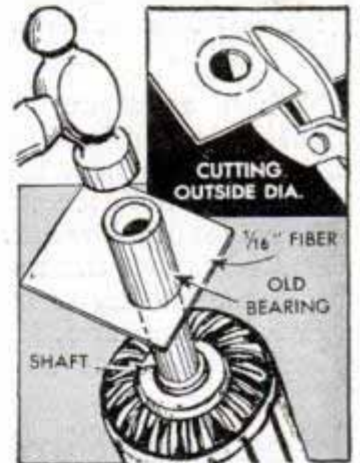
Wedge Corrects Loss of Tension In Drafting Instruments

Over a period of time bow spring compasses and dividers will lose their tension and will not open to the full width. To put new life in such an instrument, insert a wedge cut from a rubber eraser in the fork. This will keep the compass or divider in excellent working order.—G. L. Schrum, Akron, Ohio.



Easy Way to Cut Thrust Washers For Electric Motors

Washers for electric motors or similar equipment are cut quickly by using a sleeve bearing that is a few thousandths larger than the shaft over which the washer is to fit. The fiber material for the washer is placed on the shaft and the bearing is driven down over it to punch out the center. The outside diameter is cut with a pair of tin snips.



Neal Winchester, Kansas City, Mo.

Blueprint Record Identifies Keys

Identification of keys is easy when their outline is drawn on tracing paper and prints of the drawing are distributed to the operating personnel. Anyone new to the plant, such as a watchman or guard, will be able to identify the keys by studying the print. If end sections of the keys were drawn on the tracing also, locksmiths would be able to replace any lost keys by referring to the print on file.



TABLE A—APPROXIMATE ELECTRICAL CHARACTERISTICS

	Large 6.6 K.V.A.	Medium 3.3 K.V.A.	Small 2.3 K.V.A.
For 220 Volt Operation			
Power From Line	8250 Watts	4125 Watts	3290 Watts
Line Current (Max.)	37.5 Amp.	18.8 Amp.	15 Amp.
Line Fuses	60 Amp.	30 Amp.	30 Amp.
Welding Voltage	2.8 to 2.0 V.	2.8 to 2.0 V.	2.8 to 2.0 V.
Welding Current (Max.)	Over 2000 Amp.	Over 1000 Amp.	Over 750 Amp.
Power Factor	80%	80%	70%
For 110 Volt Operation			
Power From Line		4125 Watts	3290 Watts
Line Current (Max.)		37.6 Amps.	30 Amp.
Line Fuses		60 Amps.	30 Amp.
Welding Voltage	Do Not Operate on 110 Volts	2.8 to 1.6 V.	2.8 to 1.6 V.
Welding Current (Max.)		Over 1000 Amp.	Over 750 Amp.
Power Factor		80%	70%

**SPOT
WELDERS**
*for light or
heavy-duty
work*

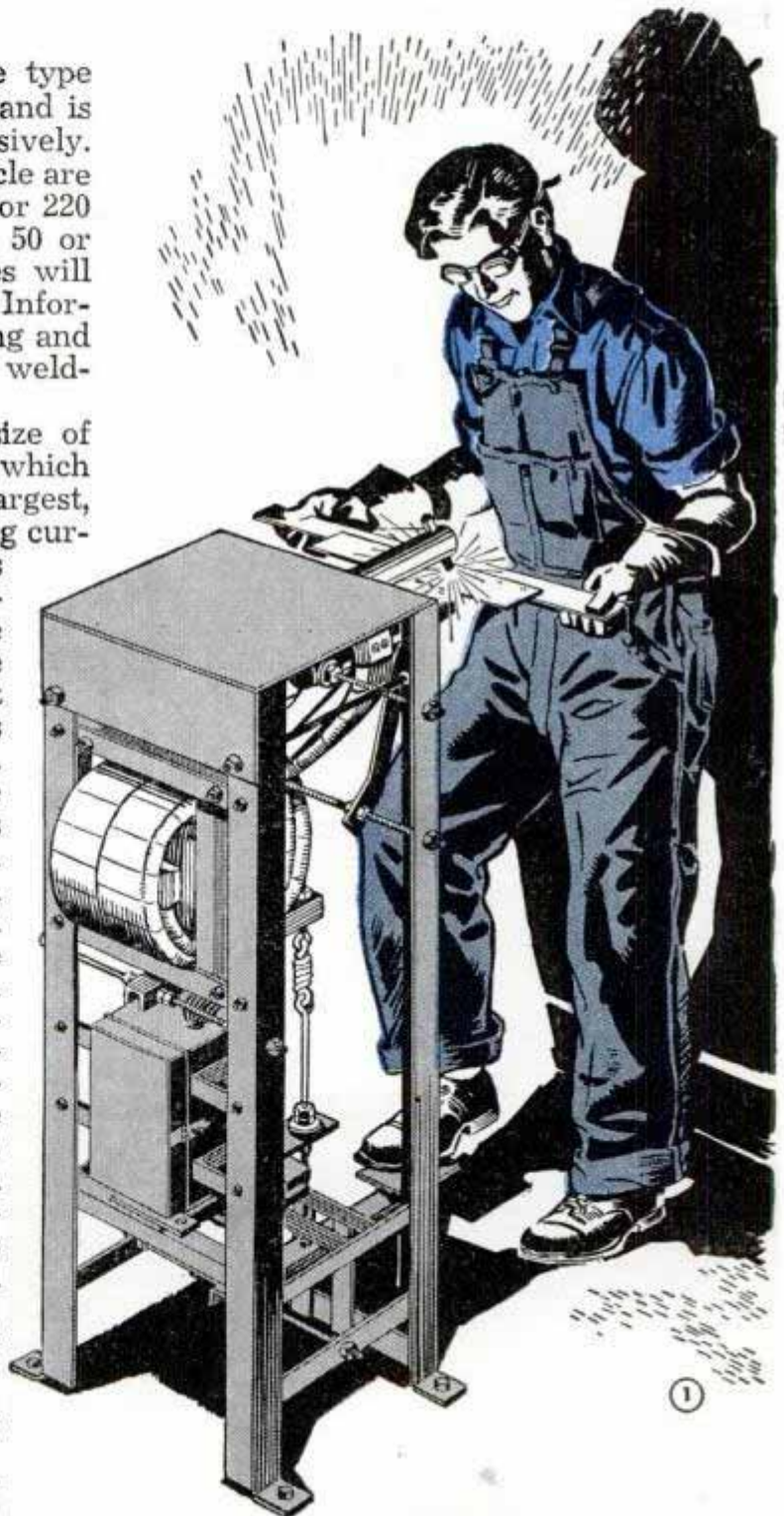
By C. A. Crowley

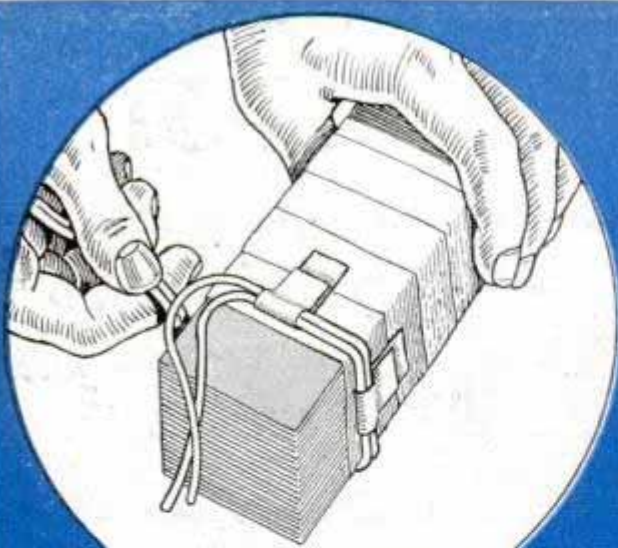
BUILDING a spot welder of the type shown in Fig. 1 is not difficult and is a good way to acquire one inexpensively. The three sizes described in this article are efficient, will operate on either 110 or 220 volts a.c., and can be made for 25, 50 or 60-cycle current. One for 60 cycles will operate satisfactorily on 50 cycles. Information relative to line current, fusing and other electrical characteristics of the welders is given in table A.

The first step is to decide the size of welder you need. The 6.6 k.v.a. size, which means 6.6 kilovolt amperes, is the largest, and is capable of delivering a welding current in excess of 2000 amperes. This size will handle sheet steel and equivalent parts up to $\frac{3}{16}$ in. thick. The medium size is useful where the thickest stock to be welded is not over $\frac{1}{8}$ in., and the small welder is for the thin gauges of sheet metal. All three machines are built alike except that some of the dimensions differ with the size of unit being built. Where a dimension is indicated by a letter, the exact size will be found under a corresponding letter opposite the welder size in the various tables.

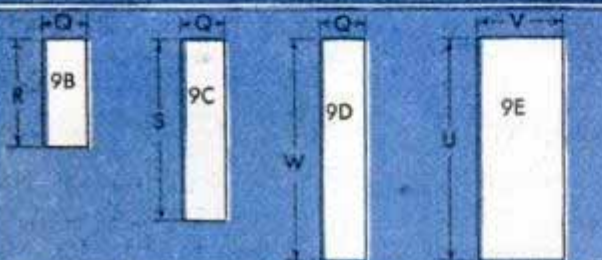
Start construction with the transformer. The core iron or plates are cut to the sizes indicated in the center detail and table B of Fig. 2. The lower detail and table C of Fig. 2 give complete assembly information for the transformer core. When assembled, the center leg of the core is taped tightly together, after which the other laminations are removed, thus leaving the center leg free for winding the coils.

First the leg is gripped tightly in a vise and rebound with a second layer of friction tape. The circular detail of Fig. 2 shows the appearance of the





TWO WIRES ARE WOUND TOGETHER



TRANSFORMER PLATES (No. 26-GAUGE SILICON STEEL)
TABLE B

Welder Size	Q	R	S	U	V	W
6.6 K.V.A.	1½"	4½"	6¾"	6¾"	3"	8¼"
3.3 K.V.A.	1¾"	3½"	5¾"	5¾"	2¾"	7¼"
2.3 K.V.A.	1¼"	3"	4¾"	4¾"	2½"	6"

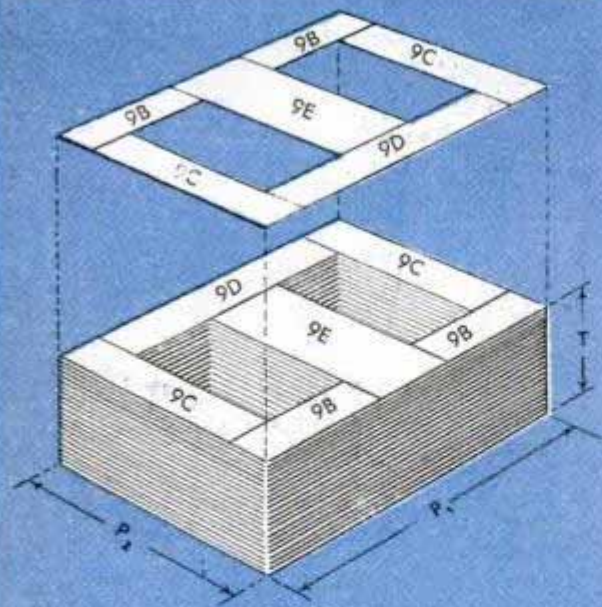


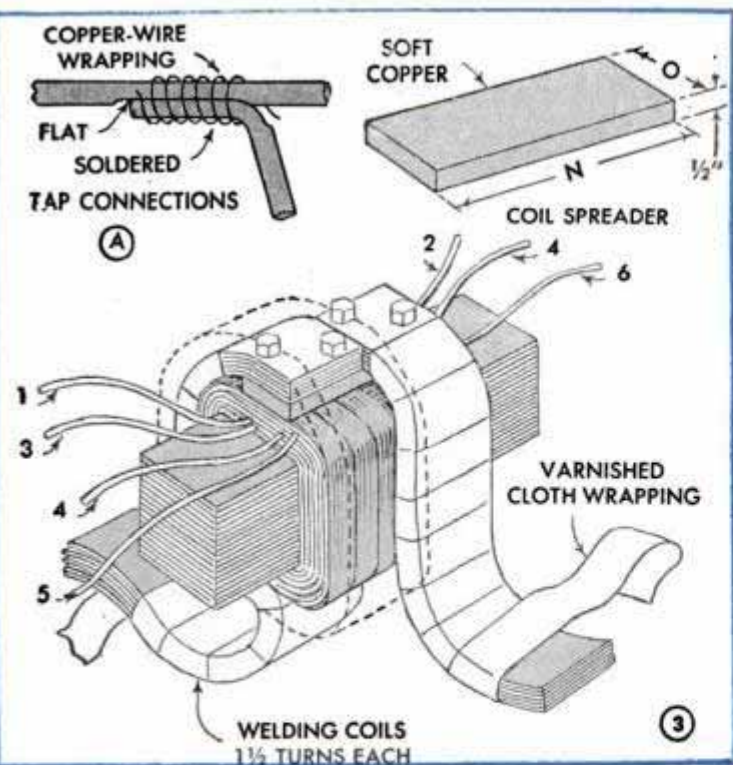
TABLE C

Welder Size	Cycles	Core Thickness (T)	Pile Thickness				P ₁	P ₂
			9B	9C	9D	9E		
6.6 K.V.A.	25	5"	10"	10"	5"	5"	11¼"	8¼"
	60	3¼"	6½"	6½"	3¼"	3¼"	11¼"	8¼"
3.3 K.V.A.	25	4"	8"	8"	4"	4"	10"	6¾"
	60	2¾"	5¼"	5¼"	2¾"	2¾"	10"	6¾"
2.3 K.V.A.	25	4"	8"	8"	4"	4"	8½"	6"
	60	2½"	5"	5"	2½"	2½"	8½"	6"

leg at the start of winding the wire onto it. Details for wire size and number of turns are given in table D. To start winding, procure two spools of wire of the proper size to wind the line coils. Mark the two start ends of wires 1 and 3 and then proceed to wind the indicated number of turns, two wires at a time, placed neatly side by side. In order to prevent the turns from slipping out of place when a second layer is wound on, use the taping method shown by three steps in one of the details of Fig. 2. After the required number of turns have been wound, the ends of the two wires should be left as long as indicated by the leads in table D and unmarked. How to identify these two ends for numbering when you are ready to make final connections is explained in Fig. 14.

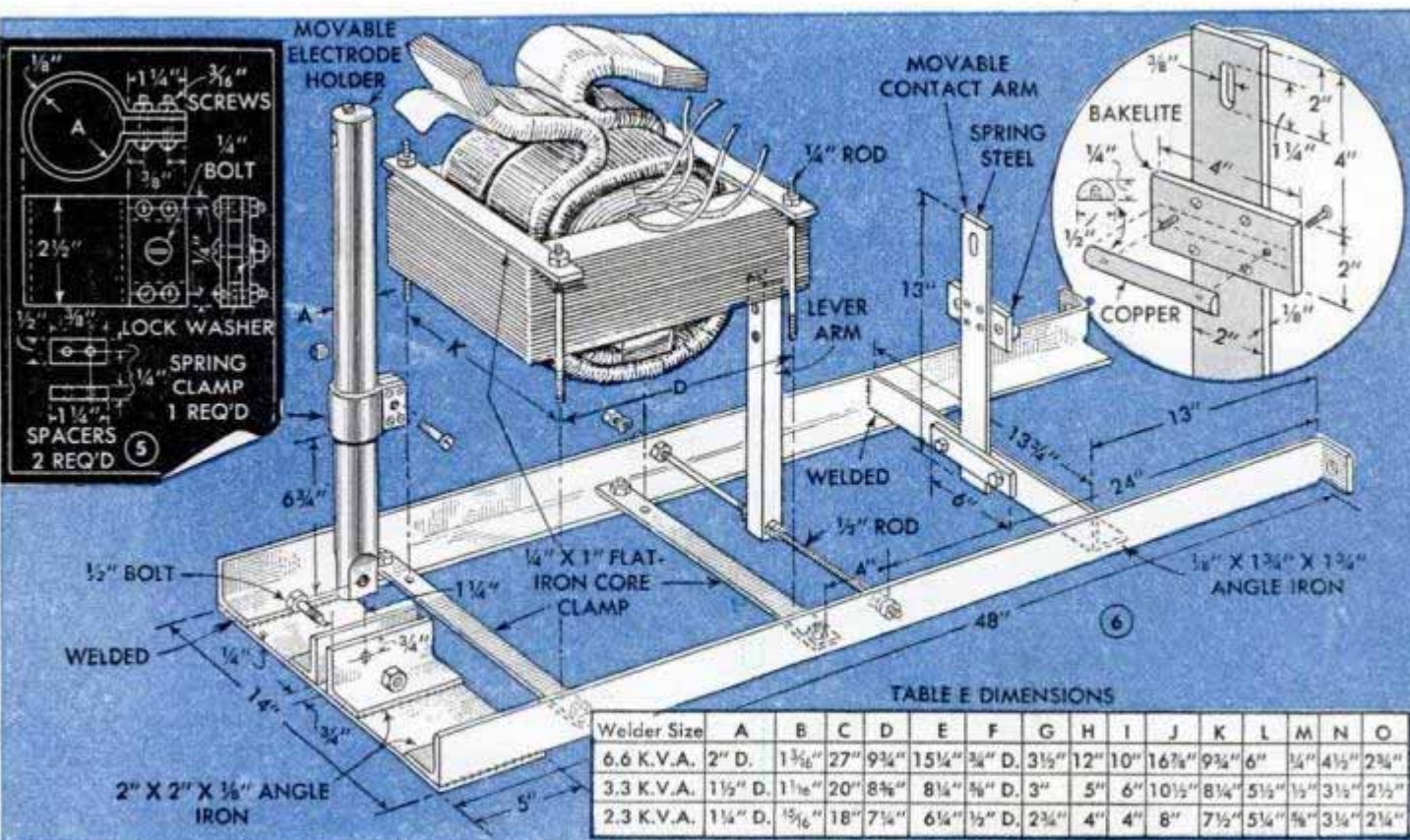
Next, the coil which is identified as the tap coil in table D is wound. The start of this coil is labeled No. 4. It should be wound in the same direction as the line coils. After winding sufficient turns, the tap connection is made as shown in detail A of Fig. 3 and labeled No. 5. It is important that this connection, as well as all others, be soldered carefully and taped thoroughly. After the tap has been made, the winding is continued until the required total number of turns have been wound into place. The finish end of the tap coil is labeled No. 6. The coils must be wound evenly and tightly in order to fit inside the assembled core. After completing these coils, they are covered with two layers of fiber board, which should be taped down tightly to hold them in place.

TABLE D—COIL-WINDING DATA			
LINE COILS			
6.6 K.V.A.	3.3 K.V.A.	2.3 K.V.A.	
2 Coils 115 Turns Each	2 Coils 115 Turns Each	2 Coils 115 Turns Each	
No. 10 D.C.C. Magnet Wire	No. 10 D.C.C. Magnet Wire	No. 12 D.C.C. Magnet Wire	
Leads 36" Long	Leads 36" Long	Leads 36" Long	
TAP COILS			
1 Coil 90 Turns No. 6 D.C.C. Magnet Wire Tapped At 38 Turns Leads 36" Long	1 Coil 90 Turns No. 6 D.C.C. Magnet Wire Tapped At 38 Turns Leads 36" Long	1 Coil 90 Turns No. 8 D.C.C. Magnet Wire Tapped At 38 Turns Leads 36" Long	
WELDING COILS			
3 Full Turns 9 Strips 12 Ga. Copper 2¼" X 70"	3 Full Turns 9 Strips 14 Ga. Copper 1½" X 70"	3 Full Turns 7 Strips 14 Ga. Copper 1½" X 70"	



The welding coil is next and is wound from strips of sheet copper, the dimensions and number of strips being given in table D. Fig. 3 shows how the two sets of copper strips are spliced to the soft-copper coil-spreading bar. The strips must be tinned and sweat-soldered together and then screwed and soldered to the copper bar as in Fig. 4. A poor connection here will prevent the welder from working. Each half of the welding-coil unit is wound exactly 1 1/2 turns, making a total of three turns for both. As the winding progresses, varnished cloth in tape form should be wound around

the two groups of copper strips and the spreader bar to assure complete insulation. It is best to wrap the varnished tape around the strips as the winding progresses since bending of the composite bundle of strips will cause slippage and deformation of the bundle. After completing the welding coil, it is tied securely in place with strong cord and the entire assembly coated thoroughly with shellac or impregnating varnish. When dry, laminations previously removed should be woven back into place so that the core is reassembled as shown in Fig. 6. Two sets of core clamps are required.

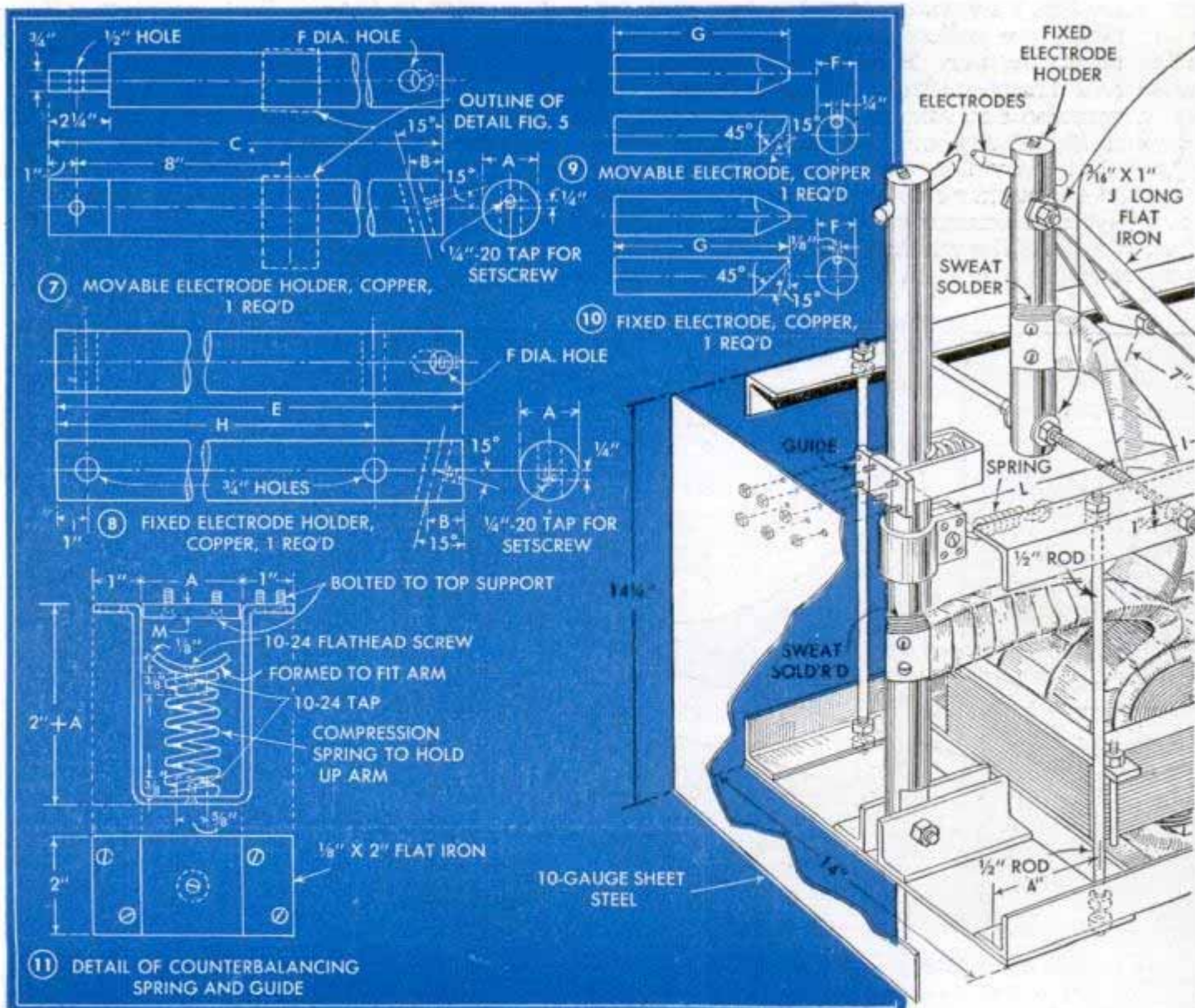


These are assembled on the core as in Fig. 6 and the unit later mounted on the two back angle irons of the frame. Studs with lock washers and nuts should be used to fasten the transformer in position.

The movable electrode holder is detailed in Fig. 7. One of the welding leads from the transformer is carefully formed around this holder, and both sides of each strip in the lead are tinned for a distance of 3 in. of its length. The electrode holder also is tinned where the copper strips will contact it. Then two holes are drilled through the strips and corresponding holes are drilled and tapped in the holder for brass machine screws. After attaching the lead, soften the solder with a blowtorch and, while the solder is still soft, tighten the screws and apply clamps to assure perfect contact between all the strips and between the strips and the electrode holder. It is important that this joint be made carefully, otherwise it will heat.

After completing the coil, make the frame members. These are mostly angle iron as indicated in Figs. 6 and 13, although some

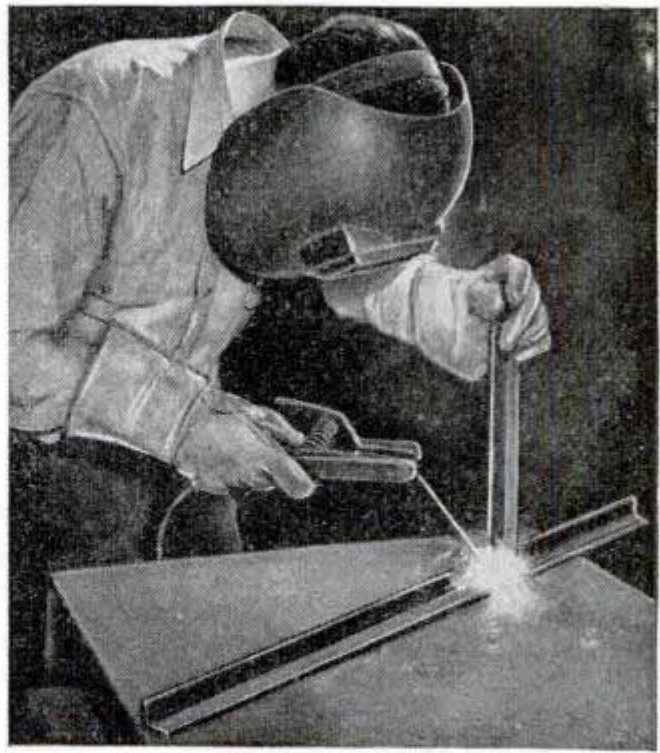
of the braces are rods, channel iron and steel plate. A study of Figs. 6 and 13 will determine the location of each brace and cross member. After the angle irons have been cut and drilled, a 1/4-in. steel plate, 5 in. by 14 in., and an angle-iron support for the movable electrode holder are welded in position on the back of the two rear angle-iron legs of the frame. For this job, as well as the other welded joints indicated, ordinary gas welding will be found satisfactory. If an electric arc welder is available, it may be used with equal satisfaction. On the other hand, bolts may be substituted for welding if more convenient. The 1/8 and 1/4-in. flat-iron strips, which support the lower switch contact plate, are then welded in place 11 in. from the floor end of the rear legs as shown in Fig. 13. Two 1/2 by 15-in. threaded tie rods are next installed 4 in. from the top end of the legs. The front legs are then placed in the assembly, nuts tightened on the rods, and welds made at the other joints to complete the frame assembly. Before welding the parts together, the dimensions should



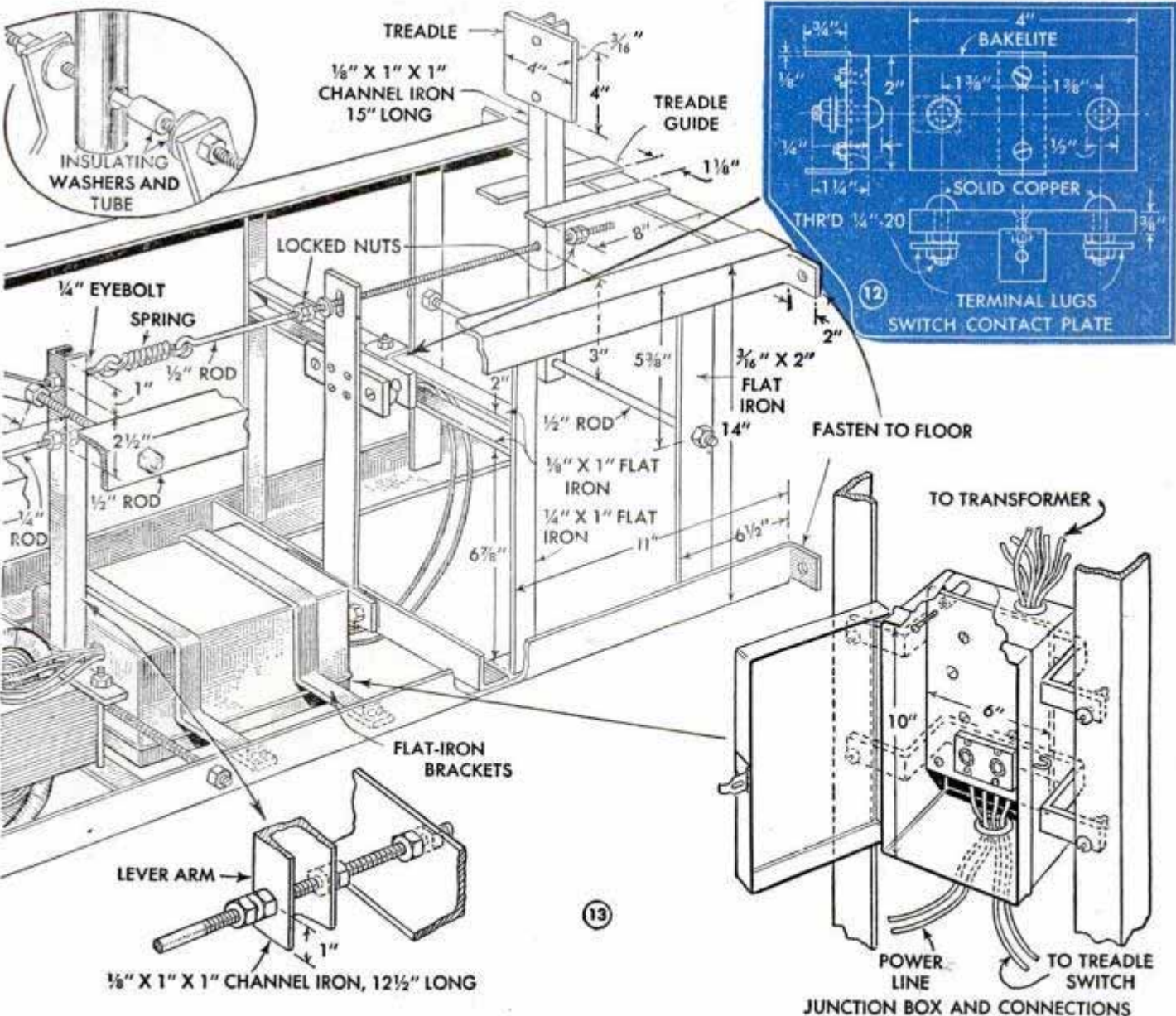
be checked carefully to make certain that the entire unit is exactly 14 in. on each side.

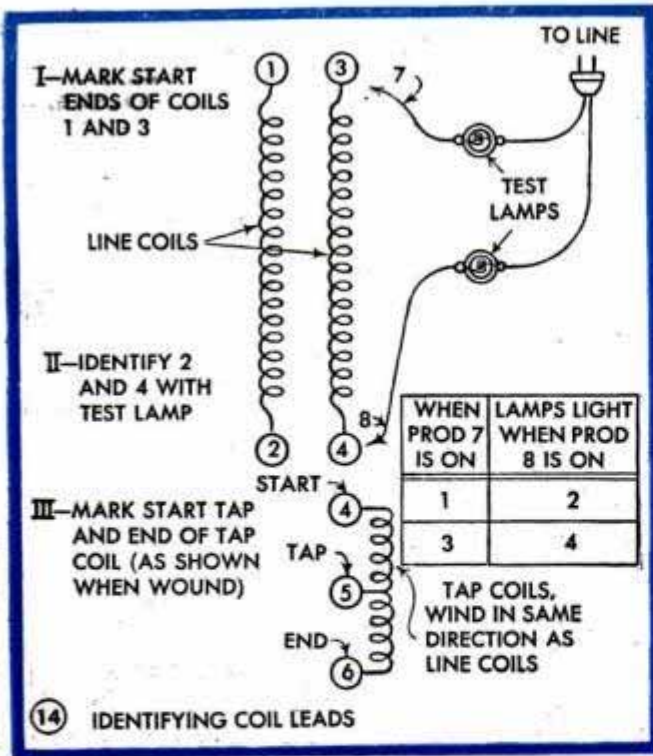
After completing the frame, weld on the $\frac{3}{16}$ by 2-in. flat-iron strips which support the treadle. These are shown located $6\frac{1}{2}$ in. from the floor end of the frame. The fixed electrode holder, Fig. 8, is installed as indicated in Fig. 13. Note that this holder is completely insulated from the frame with fiber tubing and washers as indicated in the enlarged circular detail of Fig. 13. The remaining end of the welding coil is sweat-soldered to the fixed electrode holder by the same method as previously explained for the movable holder. When both of the welding leads have been sweat-soldered into place they should be wrapped their entire length with friction tape, or, better still, with varnished cloth.

Next the lever arm shown in Figs. 6 and 13 and the treadle are installed. The movable contact arm shown in the circular detail of Fig. 6 is mounted on the rear angle iron directly above the switch contact plate detailed in Fig. 12. The $\frac{1}{4}$ and $\frac{1}{2}$ -in. pull rods and springs are now installed along with the spring clamp detailed in Fig. 5.



Although the welder frame can be assembled with bolts it is better to weld all the parts together and thus produce a rigid unit that will never loosen



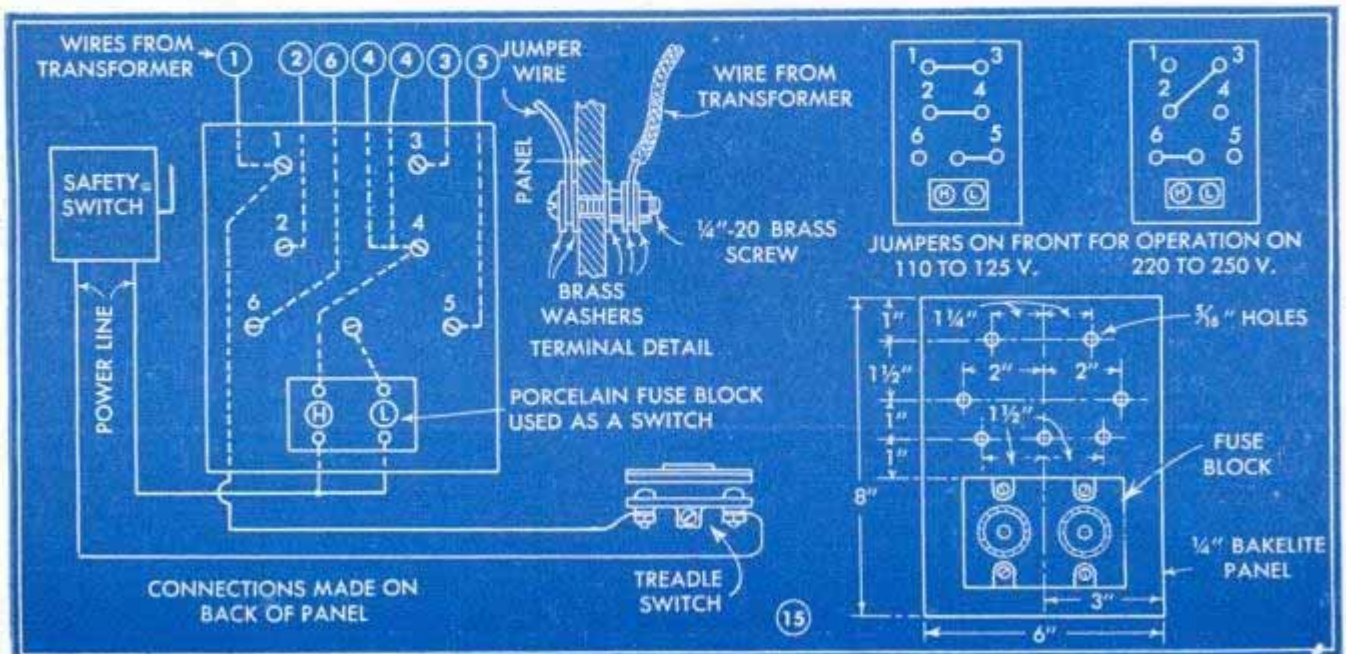


The electrode arm guide and counterbalance detailed in Fig. 11 is bolted to the top plate which is welded to the frame. This is shown pulled apart in Fig. 13. The electrodes as detailed in Figs. 9 and 10 are then installed in their respective holders. The pull rods should be adjusted so that the foot end of the treadle is approximately 3 in. higher than the supported end of this member with the electrodes apart. It is important that the spring in Fig. 11 be strong enough for this purpose so that there is no possible chance of the electrodes coming together when there is no work between them. On the other hand, the spring should not be excessively strong as this would make the switch control unnecessarily hard to operate.

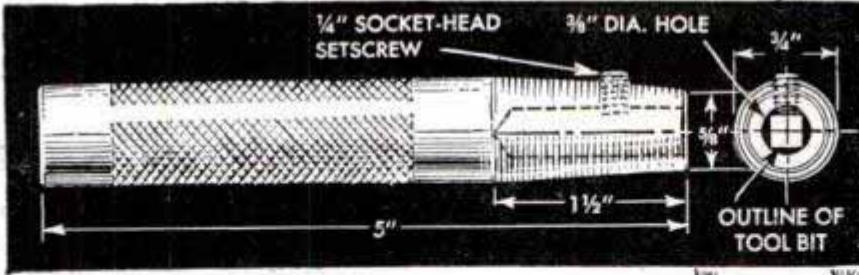
To adjust the treadle switch so that it closes properly, the treadle is depressed

slowly until the electrodes just close on a $\frac{3}{16}$ -in. spacer held between them. Then the treadle is depressed $\frac{1}{2}$ to $\frac{3}{4}$ in. farther and the lock nuts, just above the flat-spring switch member, are turned down against it until the copper bar or upper half of the switch, which is screwed to the underside of the spring member near the outer end, just makes a contact with two round-head copper bolts. These serve as the lower part of the switch and the two power-line wires from the junction box are connected to them. In making this adjustment, it is important that the electrodes close tightly on the work before the switch closes. This means that when the treadle is released the current will be turned off before the electrode pressure is released from the work. This is necessary to prevent arcing.

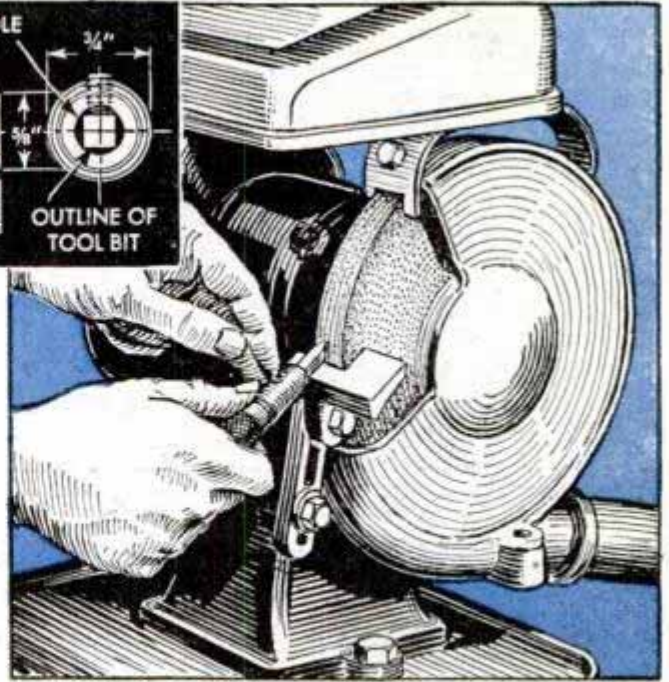
The wires from the transformer and the two from the switch are next run through porcelain bushings into the junction box as in Fig. 13. The two wires without labels should be tested as explained in Fig. 14 and labeled. Connections are made to the terminal board as indicated in Fig. 15. Jumper wires are placed on the front terminal connections to adapt the unit to 110 or 220-volt operation as required. The fuse block in the junction box is used for controlling the voltage at the welding electrodes. For the small units, one 30-amp. fuse is placed in either the fuse opening marked H for high current or in the opening marked L for low current. Under no condition should a fuse be placed in both of these receptacles. For the larger welding units, an ordinary 30-amp. fuse should be opened up and a heavy copper wire inserted in place of the fuse wire normally present. The line fuses give adequate protection, the only purpose of this block being to serve as a switch in changing from high to low current for welding purposes.



Knurled Handle Holds Tool Bits When Grinding



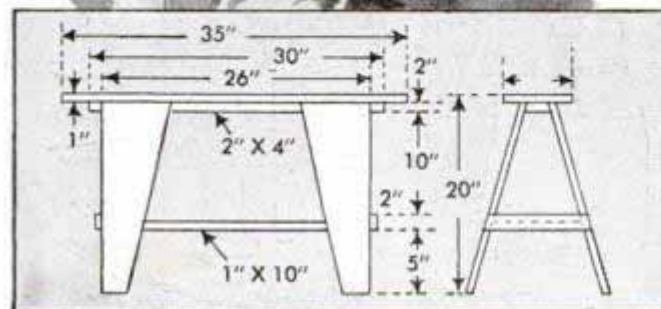
It's not necessary to discard lathe tool bits that are too short to hold in the fingers for grinding if you use this turned and knurled handle. It is made from a 5-in. length of $\frac{3}{4}$ -in. steel rod. A $\frac{3}{8}$ -in. hole is drilled in lengthwise from one end for a distance of $1\frac{1}{2}$ in. Then a second hole is drilled and tapped into the first for a $\frac{1}{4}$ -in. socket-head setscrew. The exact degree of taper on the handle is of no importance as this merely makes it easier to hold the handle. A deep, sharp knurl on the straight portion of the handle provides a secure grip. To use, simply insert the square tool bit in the hole and tighten the setscrew on one of the flat sides of the tool.—Fremont Wood, Ashtabula, Ohio



Sturdy Sawhorse Is Small Enough to Be Hauled in Your Car

Small and light enough in weight to be carried in a passenger car, this sturdy sawhorse has many uses. The lower shelf provides a handy tray to keep tools and small parts conveniently at hand, and the sawhorse is low and strong enough to be used as a support to stand on when working in places above your head. When used for this purpose, the shelf serves as a step to

reach the top member. The dimension for the width of this member can be varied, and for that reason is indicated by a blank arrow. If it is made about 6 in. wide it will provide a place to lay saws and similar tools as well as a flat working surface.



Simple Check for Ignition Lock

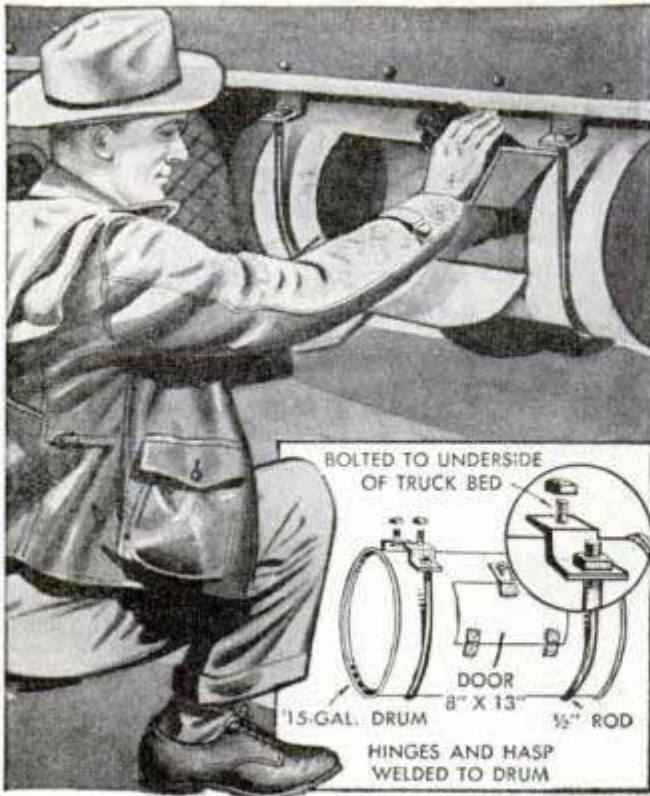
If your car is equipped with a lock that turns on the gasoline, temperature and other gauges as well as the ignition, the condition of the lock can be checked by noting whether or not the key has to be forced to its extreme position to turn on the gauges. If this is necessary, the switch is failing and should be replaced. The job is a minor one, and you may have the old ignition lock installed in the new switch, thus making it unnecessary to carry two keys.

Nail in Handle Supports Brush On Paste-Bucket Rim

Here's a stunt one paperhanger used to hook his paste brush to the rim of his paste bucket each time he was through using it. He drove a nail through the brush handle edgewise about $\frac{1}{2}$ in. from the base as shown. Held in this manner, the brush need not be removed when the bucket is carried about.—Harry M. Childs, Crichton, Ala.



Converted Oil Drum Holds Tools And Truck Accessories



An old oil drum suspended from underneath the truck body at one side makes a convenient container in which to carry tire chains, wheel jack and road flares on a truck. A door is cut in one side of the drum, the hinges and hasp for the door being welded in place.

Cleaning Agent Has Many Uses In Drafting Room

Ordinarily used as a dry cleaner, carbon tetrachloride has many applications in the drafting room. It can be used to erase guide lines after a drawing has been inked. It also will remove the gummy substance that is left by masking tape. Carbon tetrachloride also cleans scales and drawing instruments.—H. Schlossberg, Washington, D. C.

Extra Chuck Takes Small Drills



The mechanic who uses small-size drills occasionally and does not have a small press can use a regular drill press for No. 40 to 80 drills by fitting a $\frac{1}{4}$ -in. or smaller chuck with a straight shank that will slip into the larger chuck.

Since the larger presses are not designed for small drills, the highest speed should be used and the drill should be fed with care, using only a light pressure.

Wm. Riederich, Flint, Mich.

Substitute Spanner for Disk Nuts

Round disk-type nuts often are found on balances and other laboratory instruments. Usually they are made with two blind holes, one on each side of the center, which engage two pins on a special key for turning them. When the proper tool is not at hand, they may be loosened or tightened by using a pair of long-nosed pliers.



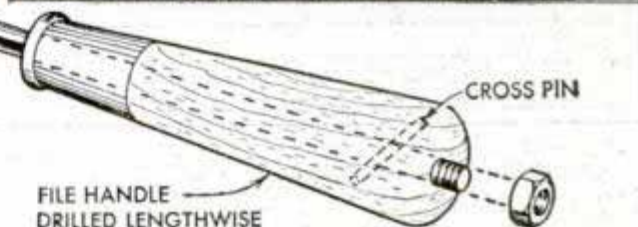
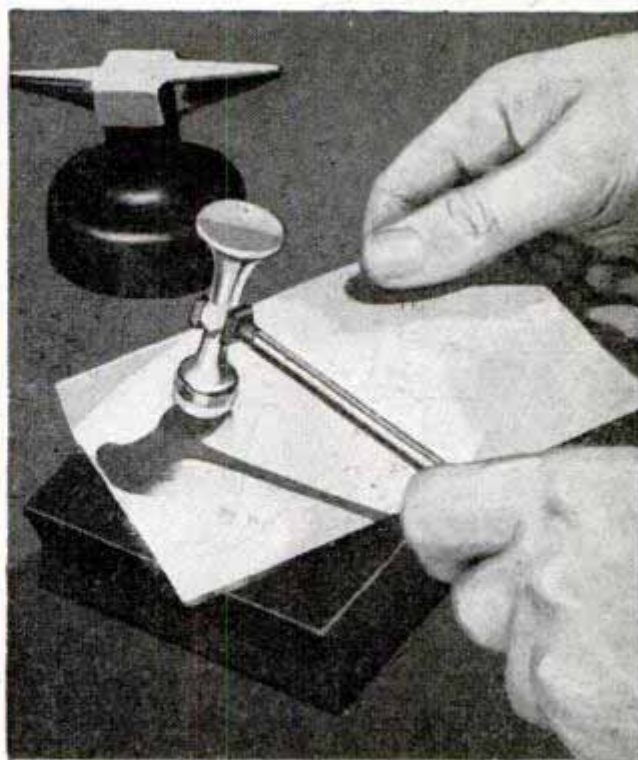
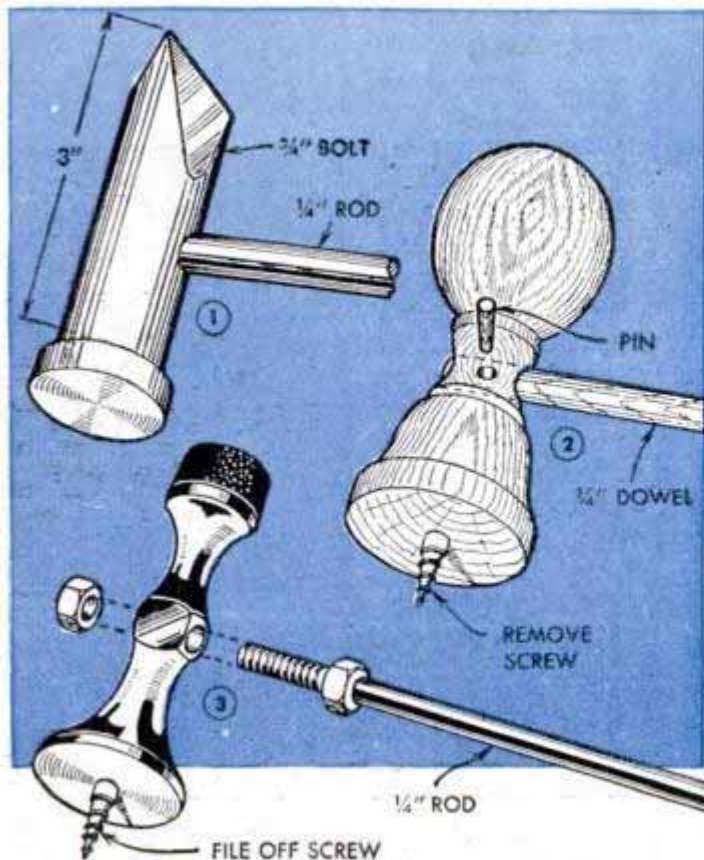
D. E. Kerr-Lawson, Swastika, Ont., Can.

Warehouse Hand Truck Is Built With Low Platform

A light hand truck with a low, flat platform is always handy in a warehouse, shipping room, or wherever there are smooth concrete floors. Little work is required to make this one and the only materials needed are a few boards, some sheet metal, two lengths of pipe, two casters and a few bolts and nuts. The pipes are bent and flattened, as shown, and the two casters are fastened to the pipe. Then the boards are laid across the flattened portion and bolted on. A lip for the platform and cross braces on the handles are added to complete the truck.



Three Small Hammers Useful to Modelmakers



Small hard and soft-faced hammers and wooden mallets are always handy in model-making for driving small wooden pins, brads, etc. Of the three hammers detailed above, two have heads made from ordinary doorstops of the type that screw into the baseboard. The third, Fig. 1, is shaped from a $\frac{3}{4}$ by 4-in. bolt having a hexagon head. This is ground to the rounded shape shown and the face is crowned slightly. The threaded section is cut off the opposite end, which then is ground wedge-shaped for light peening and riveting operations. Handles for the hammers in Figs. 1 and 3 are

made in the same way except that one is not threaded, but is forced into the head after the latter has been heated. The handle of the mallet, Fig. 2, consists of a $\frac{1}{4}$ -in. dowel fitted with a file-handle grip as in Fig. 3, the grip being glued to the dowel. Overall length of the finished hammers and the mallet should be about 9 in.

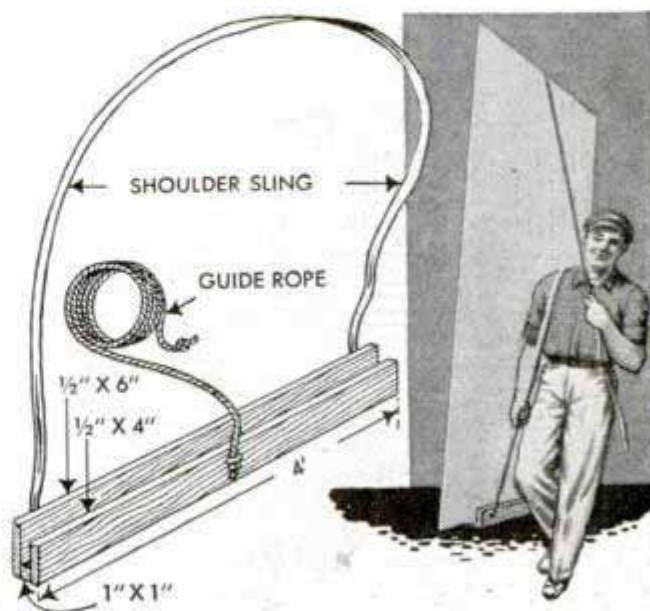
Simon S. Palestrant, Bronx, N. Y.

Large Wallboard Sheets Carried in Sling by One Workman

By using this sling, one workman is able to carry sheets of wallboard that are much larger than any he could ordinarily handle alone. In use the board is set in the grooved strip, a guide rope is thrown over the top of the wallboard and the sling is lifted to the shoulder. The guide rope serves to prevent the board from tipping.

Waterproofing Minnow Seines

Minnow seines and landing nets can be waterproofed if green cedar bark is available. The net or seine should be boiled for about an hour in a solution that contains this bark. This is not only a waterproofing treatment, but also it will serve to prevent rot and keep the threads of the net soft and pliable.



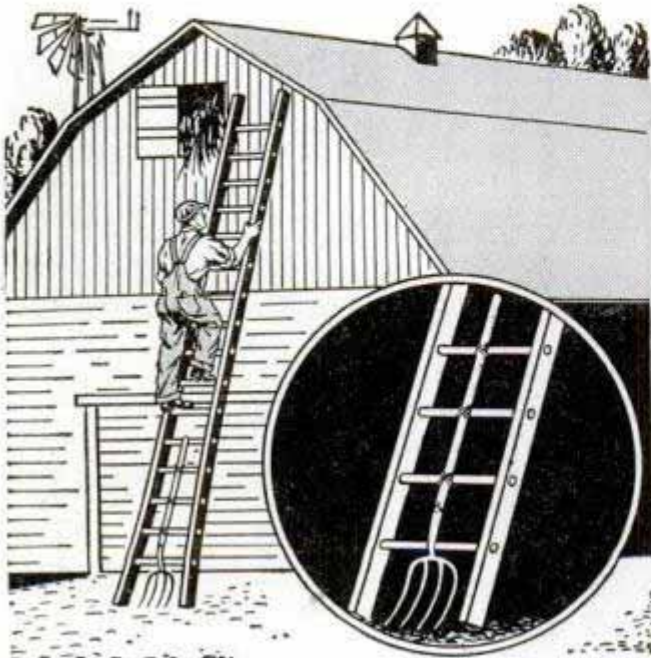
Adjustable Guide Bar on Square Aids in Marking Stringers



Once this guide bar is set, it's no trick to lay out stringers quickly and accurately with a steel square. Dressed lumber about 22 in. long is used and slotted to slip over the legs of the square. Two carriage bolts with wing nuts are used to clamp the bar in place after it has been set.

Ladder Secured by Pitchfork Fastened to Rungs

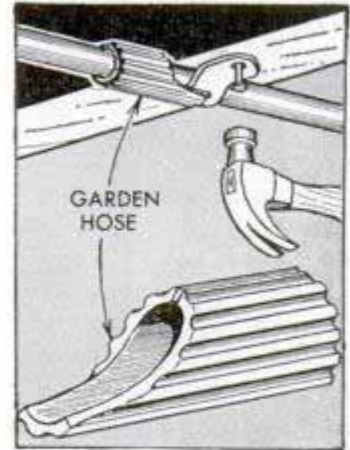
When you have occasion to use a ladder on a surface where the feet might slip, you can utilize a pitchfork in an emergency to



keep the ladder from sliding. The fork is wired to the ladder rungs with the tines set on the ground and bowed outward.

Hose Will Hold Conduit Clip

One electrician who found it difficult to hold metal clips over conduit when nailing it to overhead joists used a clamp made of garden hose to overcome this trouble. A short section of the hose is split lengthwise and one end is trimmed to leave a projecting tongue.



In use, the clamp is slipped over the conduit and the tongue slides over the clip to hold it for nailing.

Notches in Steel Rule Speed Work

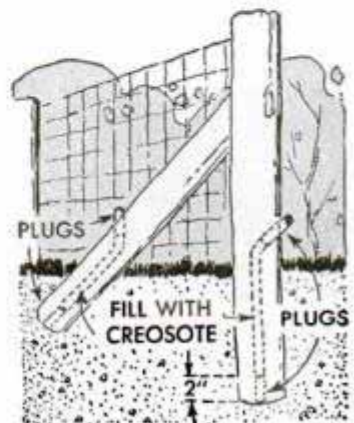
Notches may be made in a steel rule at convenient intervals if you have occasion to mark off duplicate measurements repeatedly.



Work of this nature will go faster, fewer mistakes will be made and there will be less eyestrain. A triangular file should be used to make the notches in the ruler.

Method of Saving Fence Posts

If fence posts are impregnated with creosote from the inside out, their life is increased greatly. To do this bore a $\frac{3}{4}$ -in. hole from the bottom to above the place where the ground line will be. Then drill from the outside of the post down at an angle to meet the hole in the center. Plug the bottom hole and set the post. Then fill the prepared cavity with creosote and plug it. Several fillings may be required to saturate the wood thoroughly and the creosote level should be watched. Post braces are similarly treated. —R. H. Fischer, Sterling Junction, Mass.



Radio and Electronics



HAMS RESUME—"CALLING CQ"

By F. L. Brittin—W9DCX

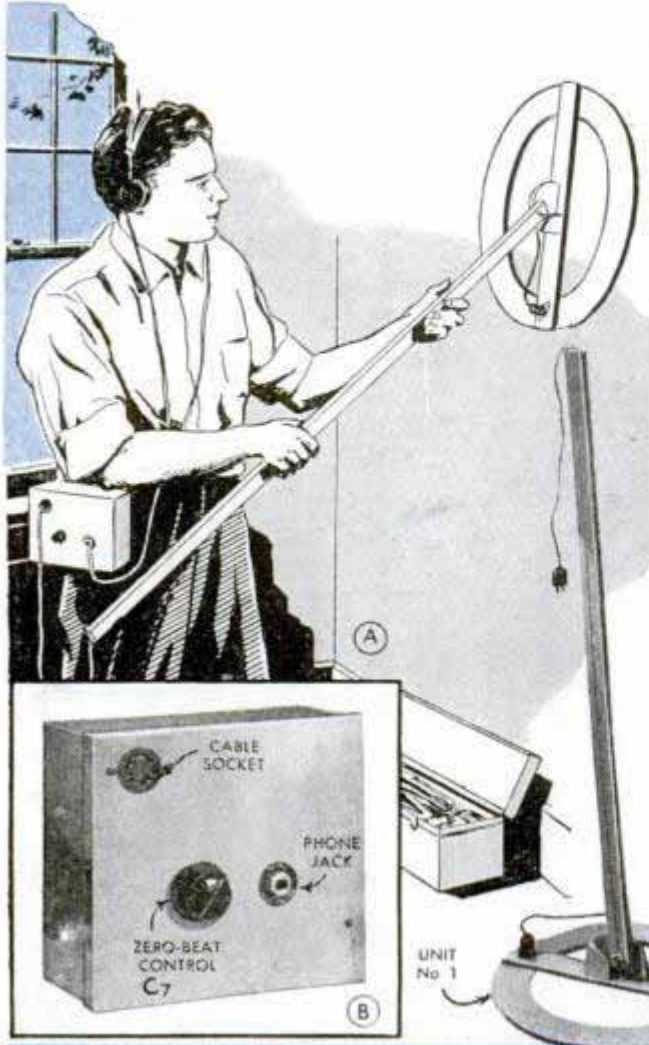
IF your receiver includes the recently restored amateur short-wave bands, you have again heard radio "hams" calling CQ. You may also hear the amateurs in California, New York, Canada or Mexico answer; they usually do if conditions are favorable. Prewar "air" acquaintances are being renewed and new friends made. About 60,000 hams were listed in the "Call Book" before the war; the publisher says there will be 100,000 by December. Nearly 35,000 went into the armed forces; today there are 250,000 veterans with radio training ready to qualify for FCC tickets. Amateurs have served in peacetime during many emergencies. Their outstanding value as a source of skilled radio personnel in time of war has now been recognized.

Annual prewar ham and would-be ham purchases amounted to a peak of about 20 million dollars; typical communications receivers are illustrated in photos A and C. Photo B shows a homemade two-way "rig" for the new ultra-high radio band. Arthur R. Koch (W9WHM/2), adjusting the tube, made the parabolic reflector from ordinary mesh screen; the bottom of a tomato can serves as a reflector on the end of the radar-type antenna. The mobile installation in photo D consists of a compact 2-meter transceiver powered with a new 6-volt vibrator-type unit.

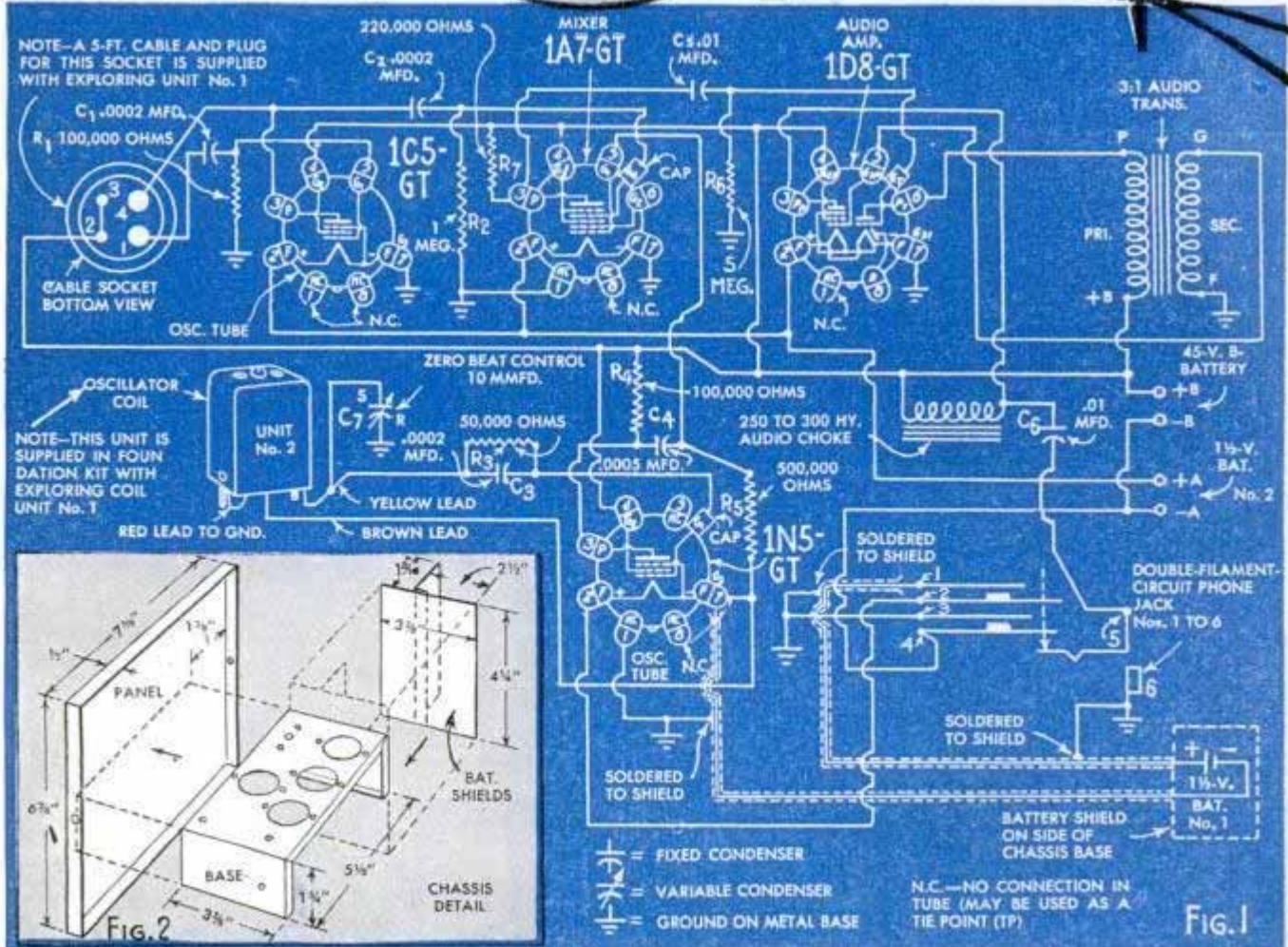
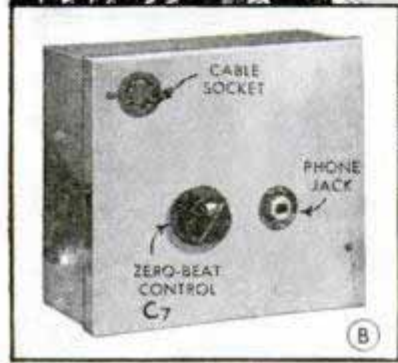


ELECTRON-COUPLED ZERO-BEAT

By Harry A. Fore



TREASURE finder enthusiasts looking for a "zero-beat" metal-detecting device that is an improvement over prewar instruments will find this electron-coupled unit definitely better. Designed especially for the readers of Popular Mechanics Magazine by the same engineers that built mine detectors used by the British Army in Africa, this compact model is intended primarily for the advanced experimenter, and as a replacement for the original zero-beat treasure finder that was described in the January 1940 issue. Although not as "sharp" as precision commercial locators,



METAL DETECTOR

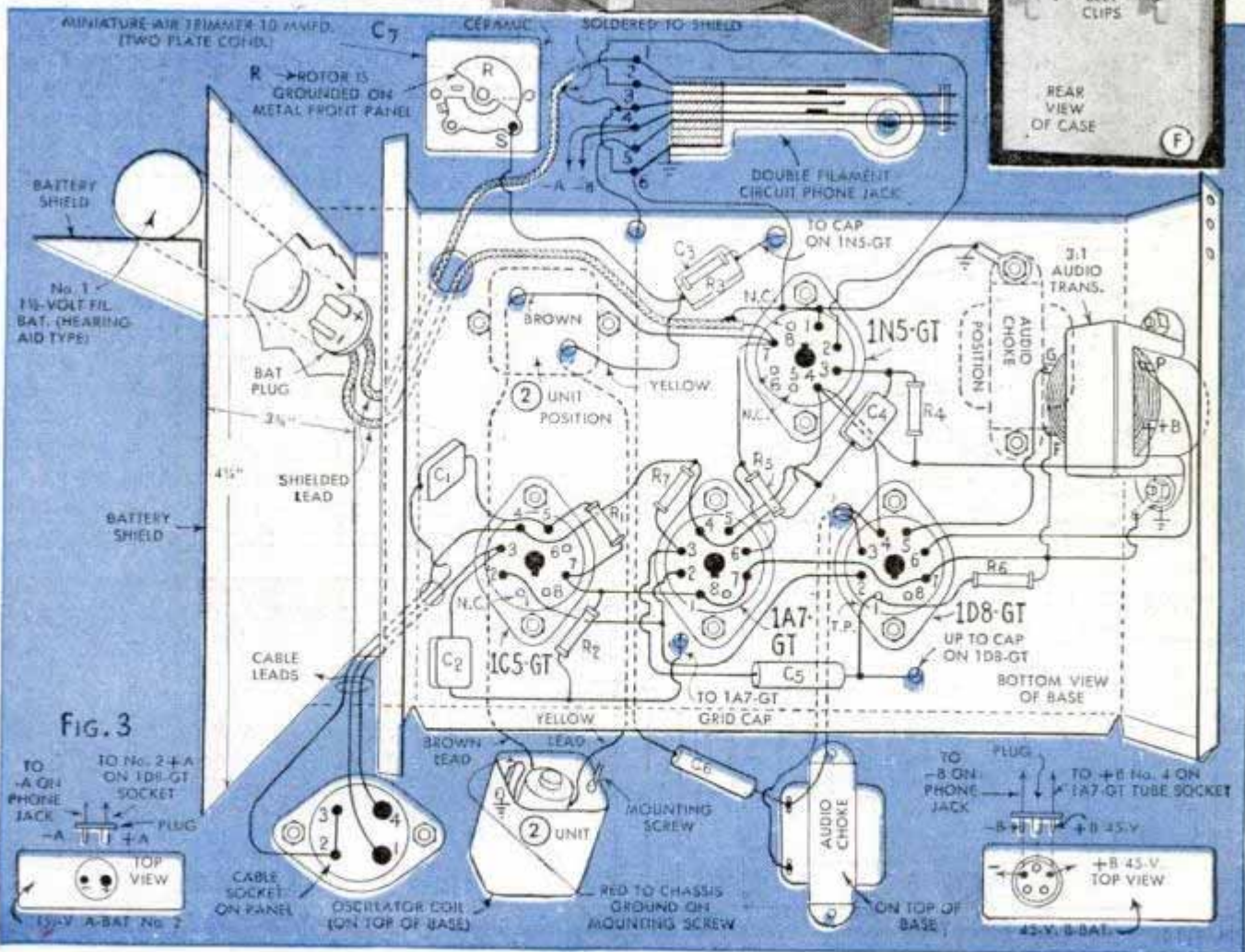
it retains all the excellent points of the original "Chilson" type metal detector, with many added refinements. Ideal for locating buried metallic objects, it also has other practical applications such as locating and tracing pipes in walls and masonry as illustrated in sketch A.

All parts specified are standard radio types with the exception of the exploring loop, unit No. 1, and the oscillator-mixer coil, No. 2. The manufacturer has made these units available through mail-order radio-parts houses in kit form.

A schematic circuit diagram is given in Fig. 1; the panel and chassis are detailed in Fig. 2. Photos B, C, E, F, and G show various views of the instrument. Filament battery No. 1, for the 1N5-GT tube, must be in the shielded compartment, and its leads are shielded as indicated in the pictorial wiring diagram Fig. 3. The case is 3 $\frac{3}{4}$ in. deep, 6 $\frac{1}{2}$ in. high and 7 $\frac{1}{4}$ in. wide.

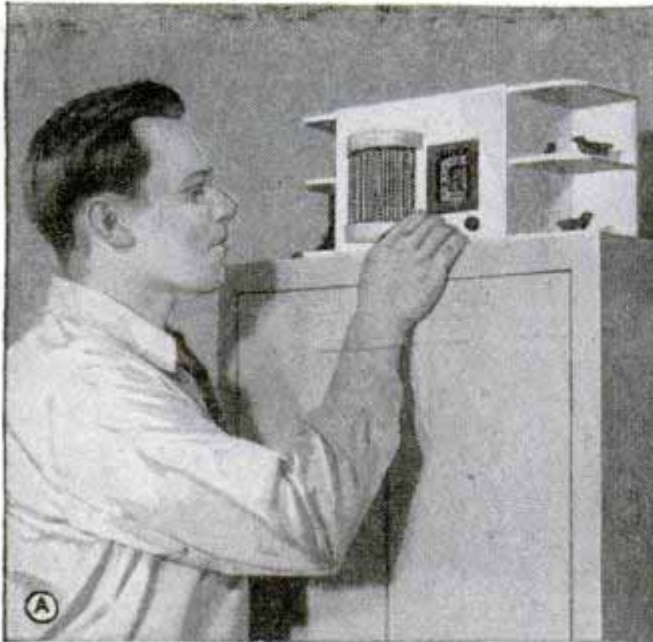
An audible note will be heard in a pair of 4000-ohm headphones when the phone plug is inserted in the "Yaxley" type

(Continued to page 220)



Replacement Cabinet for Table Model Receivers

By D. W. Damrow



AS REPLACEMENTS for many of the plastic radio cabinets in use today are extremely difficult to obtain, it is quite likely that you may have a set that is not in service because "little Rollo" knocked it off the table and the cabinet is broken beyond repair. If the radio chassis is still in good condition the receiver can be put back in operation with this attractive wooden cabinet. It may be placed on a table or large cabinet, and also looks well on a wall as the shelves provide space for displaying small knickknacks or figurines.

Complete construction details are given in Figs. 1 and 2. The top and bottom pieces "A" are cut from $\frac{3}{8}$ -in. fir plywood and these are fastened to the $\frac{1}{2}$ -in. pine stock uprights "B" with brads after glue has been applied to all joints. Both pieces "A" should extend $\frac{3}{8}$ in. at the rear to provide room to nail the $\frac{3}{8}$ -in. plywood back pieces "C" in position. Shelves "D" are cut from $\frac{3}{8}$ -in. fir plywood and inserted in the $\frac{1}{4}$ -in.-deep and $\frac{3}{8}$ -in.-wide grooves cut in uprights "B". These shelves are glued in position and then carefully tacked at the rear to the back pieces "C".

Front panel "E" also is made from $\frac{3}{8}$ -in. fir plywood and holes are cut for the speaker grille and dial plate, or escutcheon. The speaker hole should be slightly smaller than the speaker and is covered at the rear with coarse-mesh grille cloth. The unusual grille dowel rods and the dial plate are painted a bright red before they are mounted on the front panel which is white in common with the cabinet. A good grade of white and red enamel was used and the pleasing result is shown in photos A and B; the control knobs also are bright red.

It will be noted in Fig. 3 that there is no back cover as it is necessary to provide ventilation for the set. If the cabinet is mounted on a wall, a half-inch space between the wall and cabinet should be provided. Spacers made by cutting small wooden spools in half may be employed.

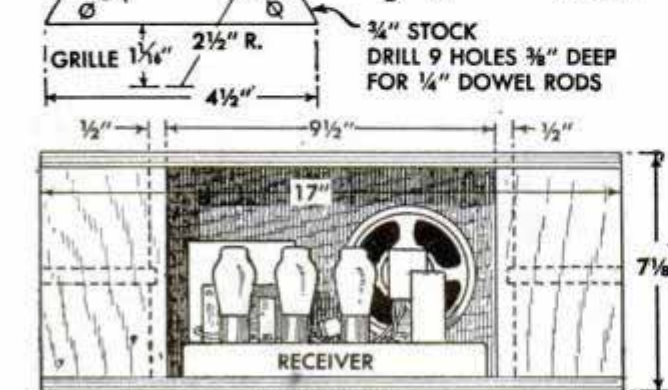
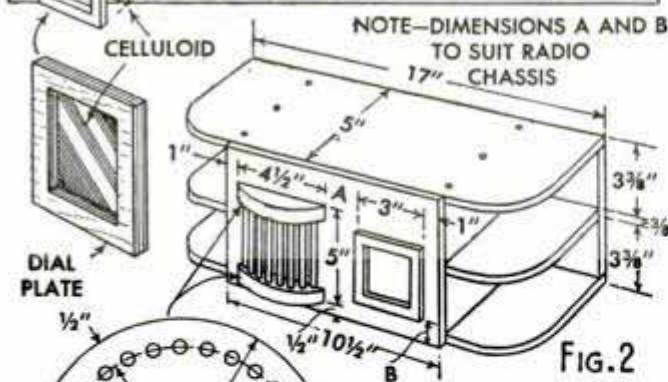
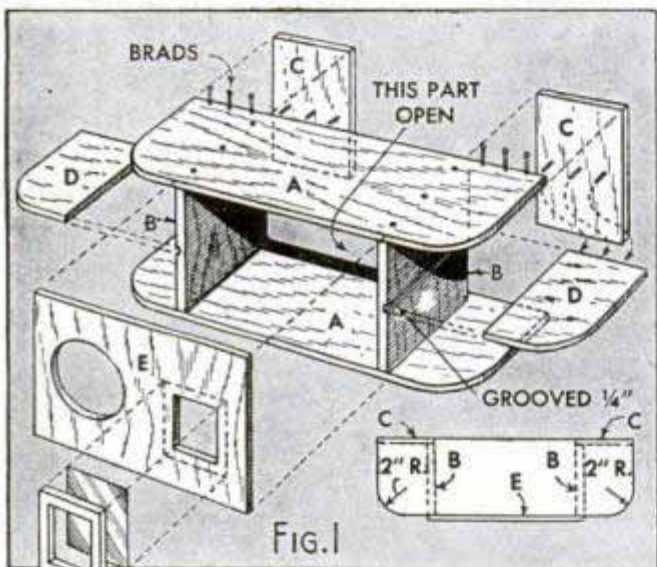
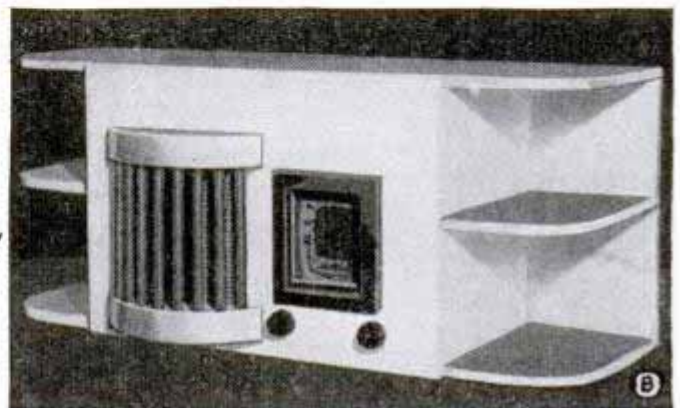
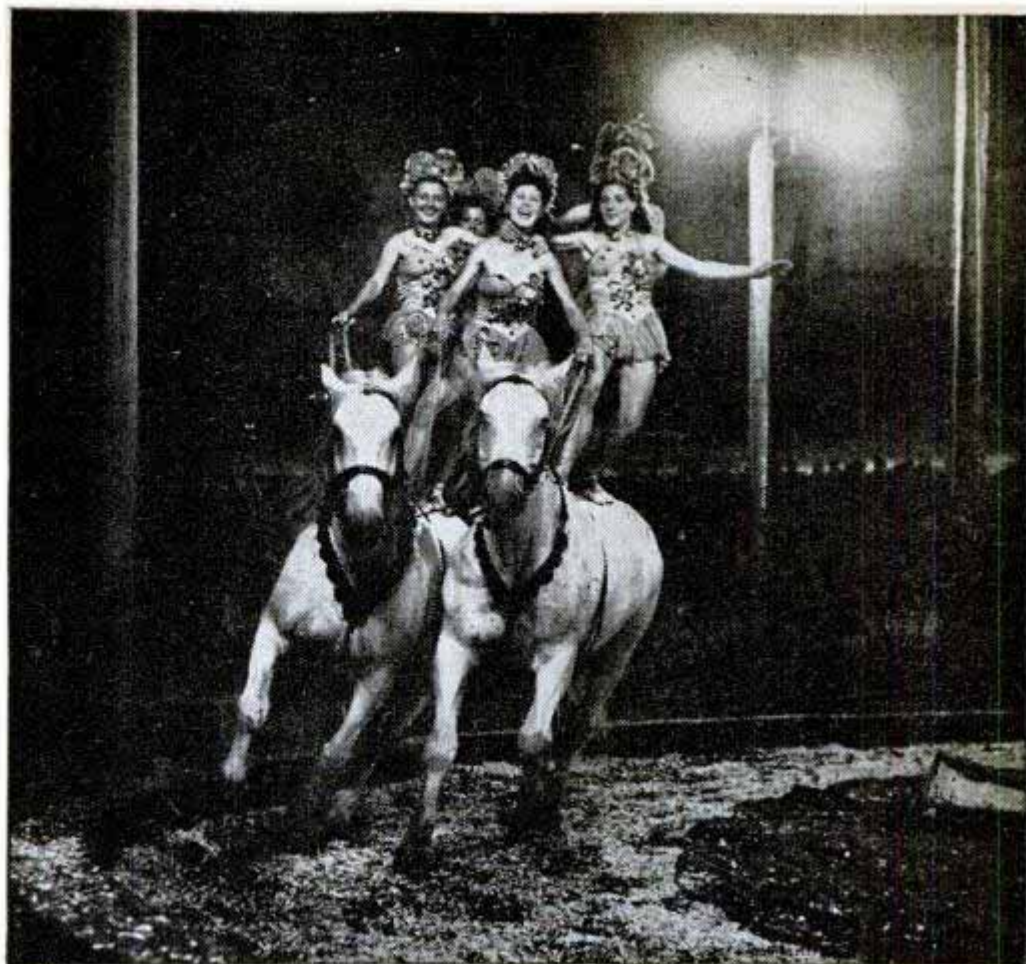


FIG. 3 BACK VIEW





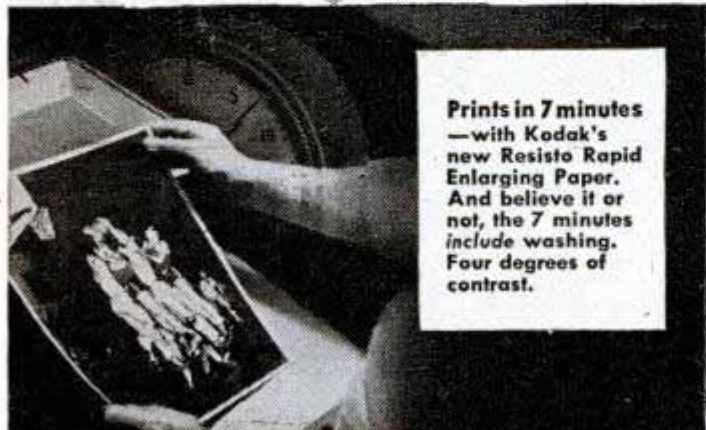
Poor light,
no flash—

but a good picture

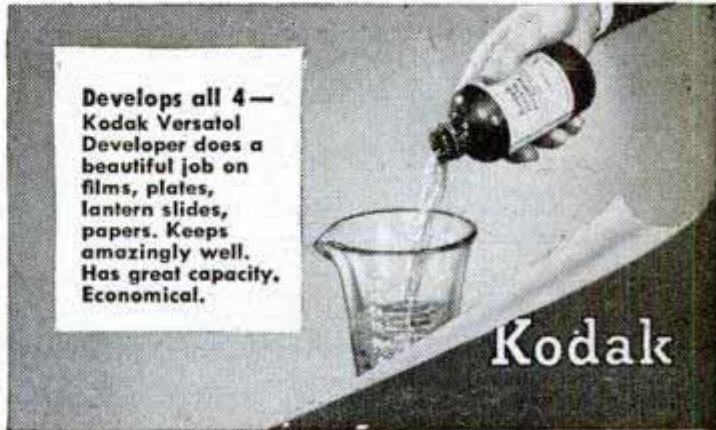
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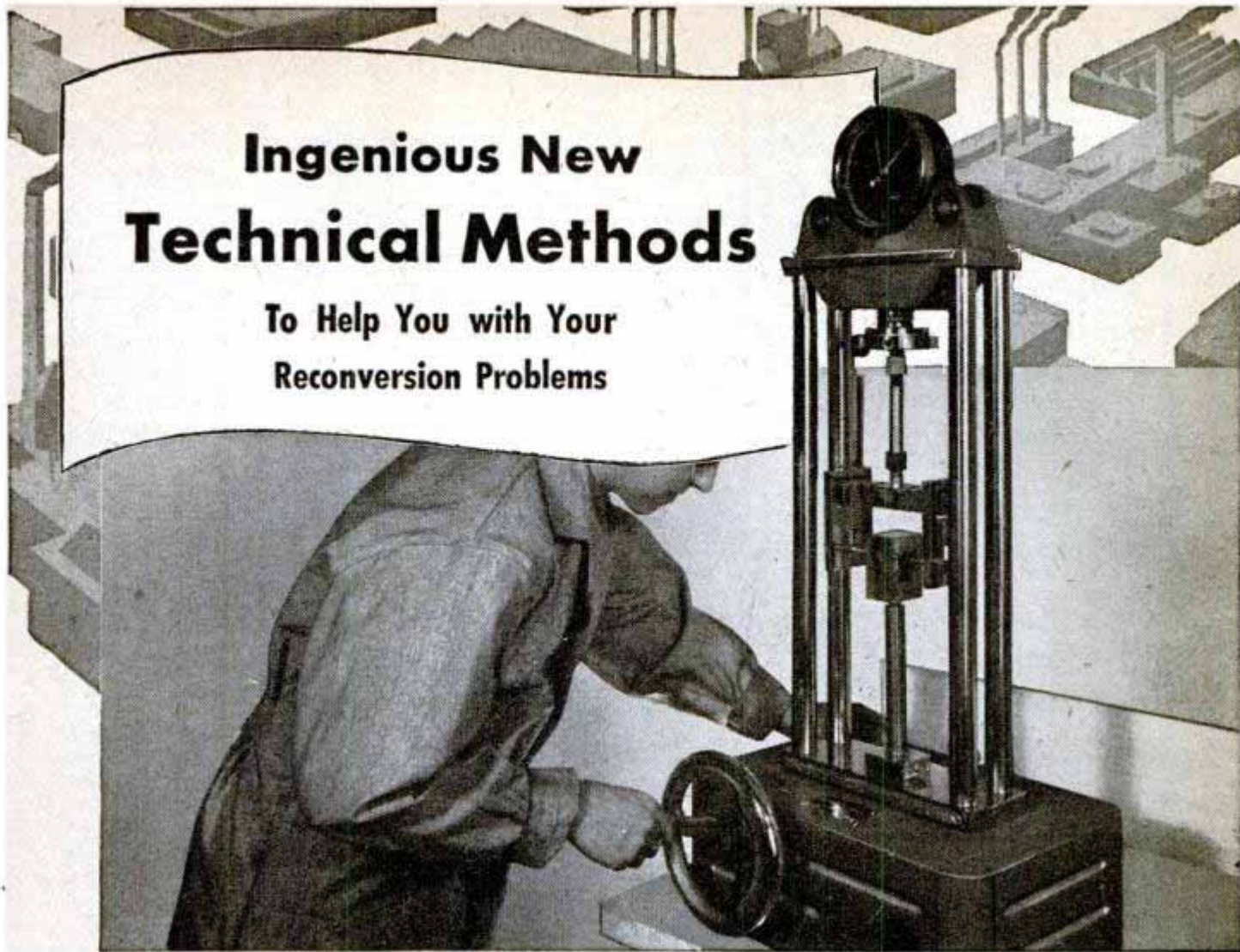
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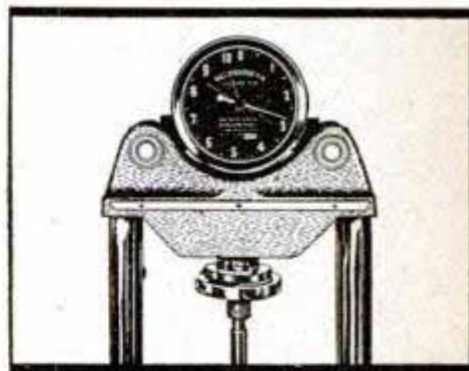
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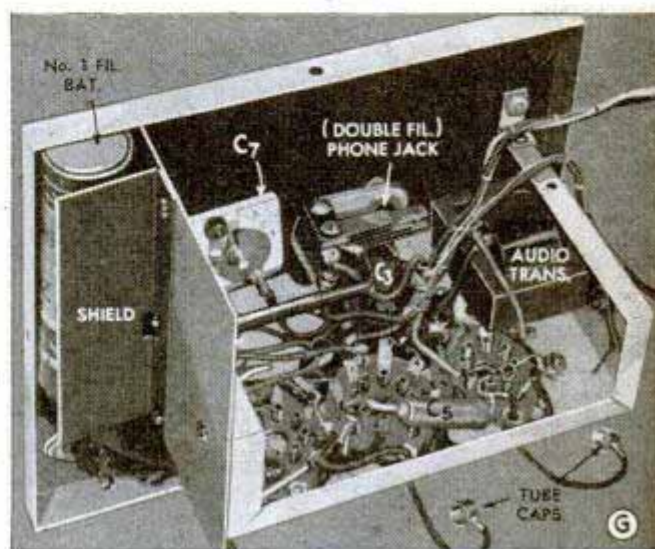
Electron-Coupled Zero-Beat Metal Detector

(Continued from page 215)

double filament circuit-control phone jack, then final adjustments can be made.

Turn C₇ variable condenser half in and make slight screwdriver adjustments of the screws in the top of unit No. 2 through holes in top of case to produce an approximately zero-beat note.

Place the exploring coil on a wooden table and adjust the C₇ control knob to



give the slowest "clucking" sound. Over average soil, as in photo D, its detection depth should be at least 12 inches on a 1-ft.-square metal sheet; greater depth range depends upon the bulk of the buried metal. Actual detection can be made with either increase or decrease of the clucking rate. Detailed student material list and blueprint number is R-346.

Drive to the Other Americas

(Continued from page 159)

Another section of the Pacific International Highway which is receiving much attention is a projected route from Vancouver to Whitehorse. At the present time it is completed as far north as Hazelton, but from there on is a 600-mile stretch still to be built.

Such a link, whose construction has been endorsed by President Truman and the governors of Alaska and Washington, could be built for about \$13,000,000. It would open up virgin land which is begging for settlement.

The Alaskan Highway—On the eastern side of the Rockies is the Alaskan Highway (formerly called the Alcan Highway). This 1600-mile stretch, from Great Falls, Mont., to Whitehorse, was built by Army

(Continued to page 224)

13 Different Blade Shapes

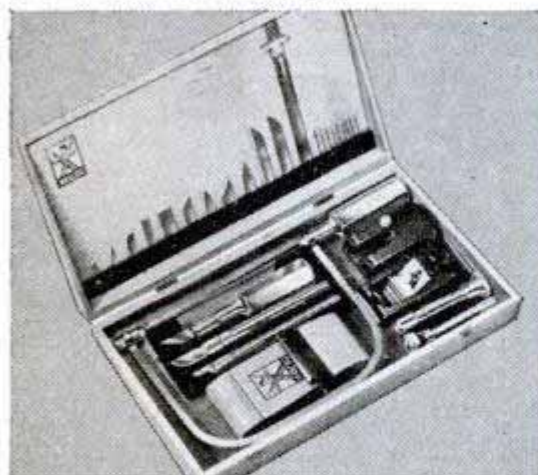
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Just look at them — there to the right are the thirteen scientifically designed blade shapes which make X-acto the ideal knife for every art and craft. Each of fine surgical steel, ground scalpel-sharp. With X-acto's three firm-grip, all-metal knives, and an assortment of these versatile, interchangeable blades, even an amateur can tackle any hobby job with confidence and gusto.



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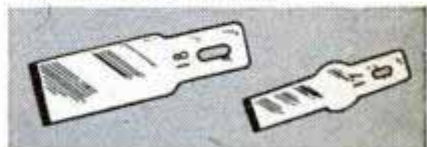
No. 10 — For all small, fine general work, including small concave or convex surfaces.



No. 11 — For fine angle cutting and deep cuts in narrow places, with less danger of splitting. Also for stencils.



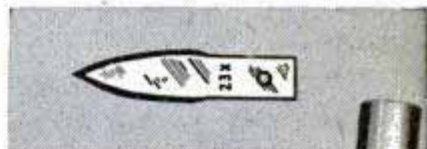
No. 16 — For small holes or notches. Ideal for templates, friskets, or stencils in thin materials, even tracing paper.



No. 17 — A chisel blade, 1/4-inch wide, for working those hard-to-get-at flat surfaces. No. 18 — Same, 1/2-inch wide.



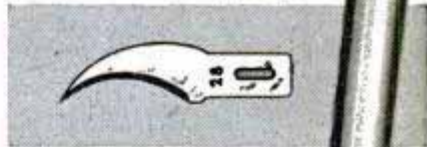
No. 22 — For long cuts along a template, or close corners. For whittling concave or convex surfaces.



No. 23X — Ideal for acute-angled corners. All purpose blade with 2 cutting edges.



No. 25 — The ideal blade for general carving and all outside heavier cutting. Use it with No. 2 or No. 6 Knife.



No. 28 — Hooked, for outside curved shaping. For leather, linoleum, whittling.



No. 24 — For light chiseling, close corners. Templates and mats of cardboard, paper, celluloid. Cross grain trims, etc.



No. 19 — A broader blade for general roughing, deep scoring and cross cutting.



No. 26 — 3-inch whittler's blade. No. 27 — 3-inch saw blade.

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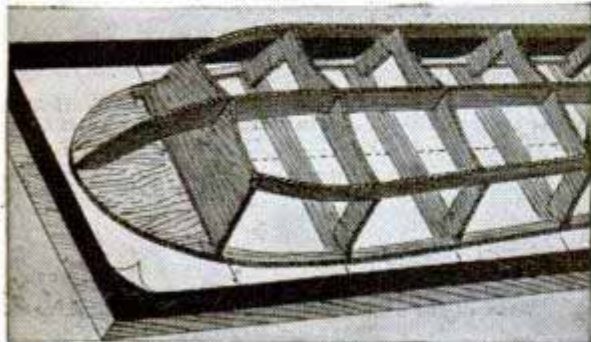
X-acto Crescent Products Co., Inc., 440 Fourth Ave., New York 16, N.Y. In Canada: Handicraft Tools, Ltd. Hermant Bldg., Toronto.

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Roll, enough for 7 feet of 1/2" pipe.

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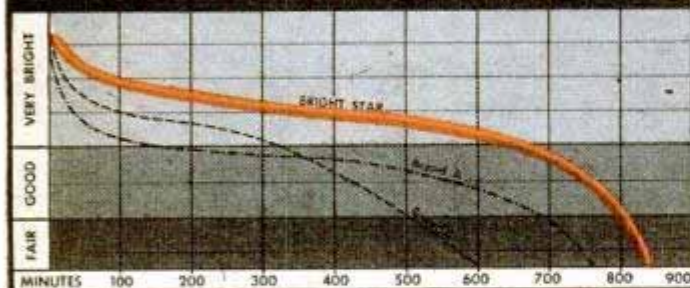
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BRIGHT STAR BATTERIES



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bright light
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These results of vital service tests* prove that Bright Star batteries give you more *bright light* longer than the two other leading brands tested. Insist on the best—it's Bright Star by test!

*Chart based on laboratory tests conducted under government standards.

BRIGHT STAR BATTERY COMPANY, CLIFTON, NEW JERSEY

engineers straight through raw forest wilderness, muskeg swamps and towering mountains. It is still a military road under the jurisdiction of the Joint Traffic Control Board. However, it is being widened for two-way traffic—in both winter and summer—and is expected to be declared open to tourists and civilians soon.

The America-Asia Bridge—Most intriguing international highway—even though not more than an engineering dream at the moment—is one which would link Alaska and Siberia by bridge or tunnel across Bering Strait.

This is not an impossibility. Bering Strait is only about 50 miles across and the water is quite shallow. A survey was made in 1916-17 by Army engineers. The feasibility of putting a railroad bridge across Bering Strait was favorably reported upon.

What may come of this idea awaits development of other international highways in the Western Hemisphere and the swing of political tides between Russia and the United States.

One of these days a major portion of the world may be linked by means of automobile highways across the Bering Strait.

The Bridge Born in a Wind Tunnel

(Continued from page 125)

alone. As a result, instead of the solid roadway originally proposed, the new bridge will have a slotted roadway. These slots are continuous longitudinal strips of open steel grating 33¼ inches wide running between the four traffic lanes. They will permit air currents to come through from beneath the bridge, thus breaking them up and reducing opportunity for oscillations to develop. The slots will also serve as lane markers for motorists.

Though the new bridge will be considerably heavier than its predecessor, existing piers, anchorages and one approach will be used with some alterations. Under maximum pressures the new structure is expected to produce an increase of only one ton per square foot on the piers, and this is considered safe. The towers will be of the same cellular-type construction but will be 60 feet wide all the way up instead of 50 at the bottom and 39 at the top as in the old bridge. Engineers claim the wider tower actually gives a better load distribution on the pier than before. The towers will also be 502 feet tall instead of 425 feet as in the old bridge. This is to allow for the increased cable sag caused by the greater weight.

(Continued to page 228)

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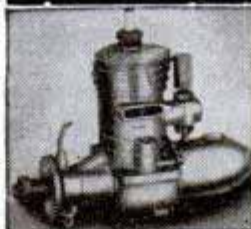
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Cables will be 20 $\frac{1}{8}$ inches in diameter instead of 17 $\frac{1}{4}$ inches.

Despite the fact that no new piers will have to be built, resulting in an estimated savings of \$2,500,000, the new bridge's estimated cost of construction is set at \$7,560,000 compared to \$6,618,138.53 for the old one. Incidental and financing expense will require a bond issue of \$8,500,000. The cost of operation of the bridge, maintenance and insurance is estimated at between \$55,000 and \$60,000 a year depending on the insurance rates.

Research work on the new design was carried on by an engineering consulting board headed by Charles F. Andrew, Tacoma bridge engineer. Wind tunnel experiments were directed by Professor F. B. Farquharson of the University of Washington. Altogether, the cost of the wind tunnel and the various models tested came close to \$100,000, of which almost 60 per cent was shared by the Public Roads Administration.

Because of the importance and pioneering nature of these studies, inquiries have come in from all over the world. As far away as Russia and Australia, bridge construction is being withheld until the results of these experiments are made known.

Clearer View Ahead

(Continued from page 101)

Silica sand, used for centuries in glass making, is left out of several new types of glass which may become increasingly important for use in optics, photography, special colored glasses and material which is transparent to ultraviolet rays.

The sandless glass is made from phosphates, borates or fluorides. It resembles silica glass but has different chemical and physical properties. Nonsilica glass has already proved its value in the photographic field, and Dr. Frank L. Jones of Bausch & Lomb says it offers certain advantages in optical instruments.

If and when beryllium glass is made more stable (at present it collapses into a puddle when exposed to air), it may be ideal for lenses. This is because it permits light to pass through it faster than through any other glass. Tests by the American Optical Company revealed that light travels through beryllium fluoride glass at 146,000 miles per second. Light goes through spectacle glass at 122,000 miles per second. Also, if this glass could be used in a lens it would produce less color aberrations.

With scientists probing into mysterious chemical mixtures to produce new kinds of

(Continued to page 232)



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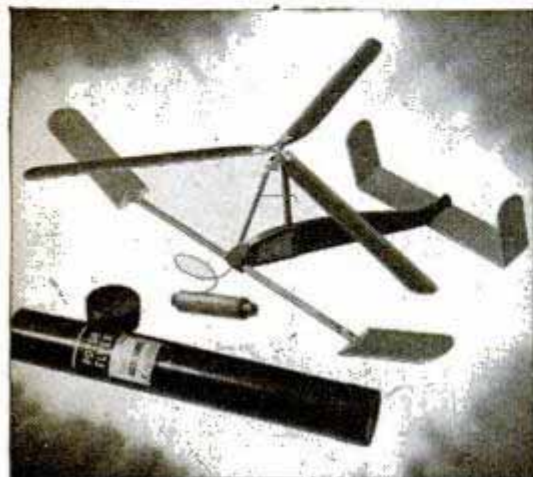
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glass, improved spectacles, sunglasses and lenses of all types are appearing on the market constantly.

There are new sunglasses which prepare eyes during daytime for speedy adaptation to the dark. This development should make night driving and flying somewhat safer. Developed by American Optical, the new lens transmits only 15 percent of visible light and absorbs glare and dangerous invisible ultraviolet and infrared rays. Thus, the glasses enable a person's eyes to adapt themselves to darkness within 30 minutes, the normal time required for complete adaptation to darkness. War pilots wore the glasses during daytime flights to condition their eyes for night missions. Lenses are a rose shade instead of the standard green previously worn by the Army Air Forces.

Another type of glare-reducing goggles developed by Professor Walter R. Miles of Yale University is useful for observing welding operations and for studying the sun. While most of the lens is coated with a "light smoke" color, a darker narrow patch covers the center, directly in front of the eye's pupil. By making the patches oblong and setting them at right angles to each other, both pupils are given complete glare protection, yet objects that appear close to the sun can be observed by at least one eye.

Use of special goggles is one way to protect a person's eyes. American industry is now going a step further by carefully checking workers' vision in order that they may be assigned to jobs for which their vision qualifies them. Both of two men may have good eyesight, but one may have the type of vision best suited for close inspection work while the other is a "long distance see-er" who would make an expert crane operator.

An eye testing instrument designed by Purdue University and Bausch & Lomb scientists supplies the information needed for assigning jobs to fit a worker's vision. Called an Ortho-Rater, the eye checker is a type of stereoscope which employs test slides in the form of transparencies mounted on rotating drums and illuminated by a centrally located lamp. A separate drum is used for the distance and near tests. Looking through the eyepiece, a worker views a wide variety of charts and pictures in both black and white and color. Results of the test give the job placement director a pretty accurate picture of the worker's capabilities with respect to his eye "power."

Glasses pose a serious problem for some workers whose jobs are such that lenses

(Continued to page 236)

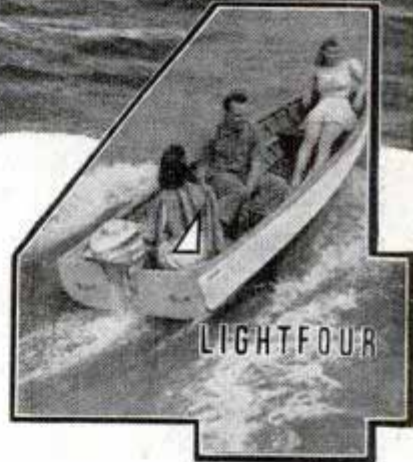
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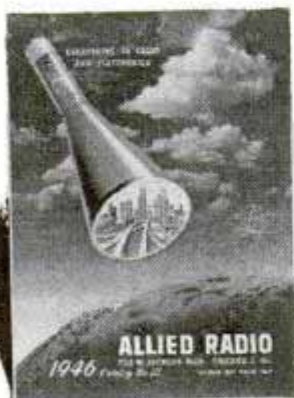


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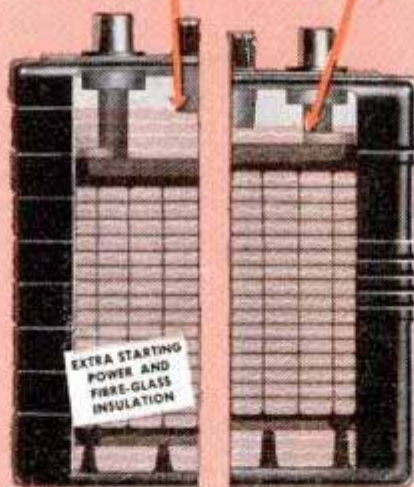
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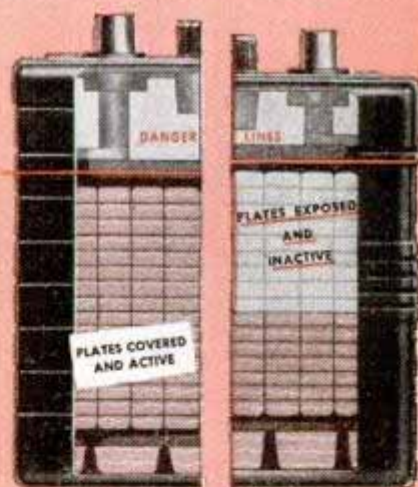
Unique new design and construction gives Auto-Lite "Sta-ful" more than 3 times the liquid reserve of ordinary batteries.

Both Batteries Filled

Liquid Level After Equal Evaporation



Auto-Lite "Sta-ful" Ordinary Type



Auto-Lite "Sta-ful" Ordinary Type

Illustrations above show the result of equal evaporation in the Auto-Lite "Sta-ful" Battery and other batteries. As shown by illustration on the far right, plates of ordinary batteries are exposed sooner by water loss and then become inactive faster.

For sale by Auto-Lite battery dealers everywhere



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AGAIN AVAILABLE

Luther
HAND AND POWER GRINDERS



FAMOUS FOR 50 YEARS
Luther Grinders — manufactured to the most exact specifications and chosen by those who insist on quality tools — are again available. Select your new hand or power grinders from Luther's complete line.

LUTHER
GRINDER & TOOL CO.
ESTABLISHED 1896
SHEBOYGAN, WISCONSIN

become covered with steam, fog, or perspiration, with the result that vision is clouded. One answer has been contact lenses—thin, saucer-shaped plastic lenses that fit under the wearer's eyelids.

So much improvement has occurred in the design, manufacture and fitting of contact lenses that today an estimated 85 percent of all persons wearing glasses can successfully use contact lenses.

Worn on and moving with the eyeball, the contact lens is invisible. It becomes part of the refracting system of the eye and produces the same correction regardless of the position of the eye. Some people wear them 18 to 20 hours at a stretch, others three or four. The average is about eight hours, according to a survey.

Dorothy Parker once said, "Men seldom make passes at girls who wear glasses." Makers of contact lenses like to quote this wisecrack.

The Fishing Fleet Goes Scientific

(Continued from page 152)

pipied to all vital parts. Motor-driven ventilation fans force fresh air throughout the ship, and various stations are connected by an intercommunication phone system. All deck winches and cargo hoists are powered by electric motors operated with push-button switches.

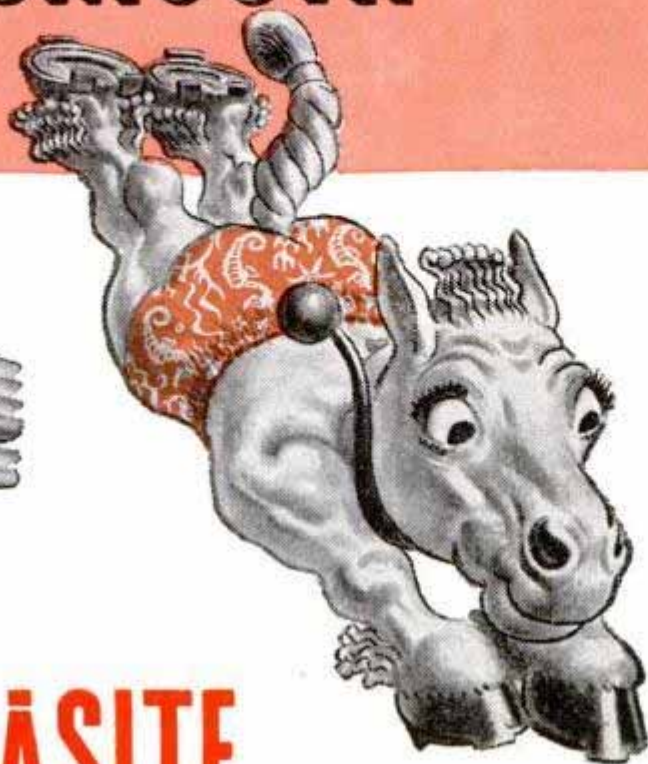
Traditional watches need not be stood in the engine room except for performing maintenance work. Normally the main engine is operated by remote control. From the wheelhouse the engine can be started, speeds changed ahead or astern, and stopped. Auxiliary controls on each bridge wing permit "remote remote" control of the engine so the vessel can move to keep up with a school of tuna while the man on watch stands outside.

Steering is performed by a "metal mike" gyro pilot that can be disengaged to permit electromechanical maneuvering in close waters. The entire steering apparatus is hooked to a large gyro compass below deck.

For smaller ships, the Sperry Gyroscope Company developed a compass combining features of a gyroscope and magnetic compass. This device allows the standard magnetic compass to be installed on the part of the ship that has the least magnetism—usually high on the mast. Deviation errors are minimized. A gyroscopic control averages the compass readings and transmits them to a repeater compass in the wheelhouse. The readings on the repeater are free from swing, regardless of rolling and pitching. The gyro magnetic compass can

(Continued to page 240)

SMOOTH HORSEPOWER



CASITE GUARANTEES BETTER AND SMOOTHER PERFORMANCE OR DOUBLE-YOUR-MONEY-BACK

★ New or old—your car will run better and last longer with Casite. Casite protects stiff new motors during the critical break-in period . . . gives older motors new smoothness, pick-up and power.

Casite carries oil quickly to the tight spots . . . reduces engine wear . . . retards formation of sludge and gum . . . *cleans motors—keeps them clean.*

Millions of motorists use Casite all the time. Service stations, garages and car dealers everywhere sell it.

Put a pint in the crankcase every oil change and a pint through the air intake every three months for *guaranteed* better and smoother performance all-year-round.

THE CASITE CORPORATION, HASTINGS, MICHIGAN • In Canada: Hastings Ltd., Toronto

NEW RADIO SHOW: "RIGHT DOWN YOUR ALLEY"
AMERICAN BROADCASTING CO. • EVERY SUNDAY AFTERNOON



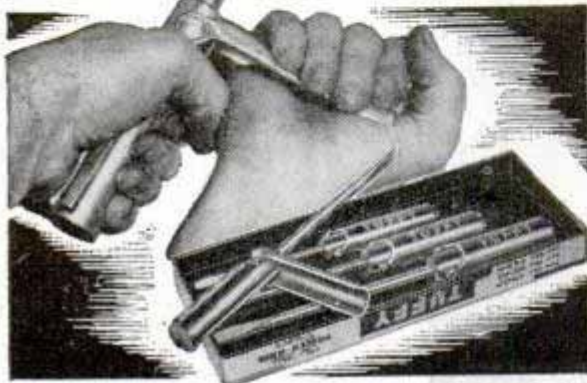
GUARANTEE

Add Casite to crankcase and run through air intake according to instructions, then drive your car 100 miles or for 60 days, whichever is first. If not convinced that Casite gives you better and smoother performance, you get double-your-money-back by filling out guarantee certificate and mailing it to The Casite Corporation, Hastings, Michigan. Maximum refund is \$1.30 per pint, twice the nationally advertised price of Casite.

Tuffy POWER-ARM DRIVER

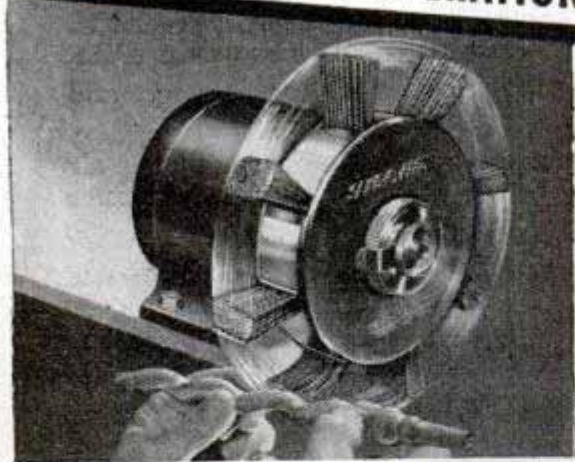
FOR LOOSENING TIGHT, RUSTED SCREWS

Tuffy's tremendous EXTRA LEVERAGE loosens tight, rusty screws easy; tightens screws so they stay put! Power-Arm closes for regular driving. Strong aluminum handle, forged steel blade. In 3 popular sizes from \$1.95 up; Kit Box of all 3 sizes, no extra charge. Ask your tool dealer or write us for free folder.



DEALERS: Write for complete merchandising details.
SWALLOW AIRPLANE CO., Inc., Wichita 7, Kansas

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The new Sand-O-Flex Contour Sander gets in and around curved surfaces. Replaces hand sanding, filing and scraping. The central magazine houses a strip abrasive that threads out in front of brushes. The brushes cushion the abrasive and force it into the hard-to-get-at places. Abrasives come in a wide variety of grits—one for every purpose. Sand-O-Flex adapts to any motor shaft, and now comes in three sizes for every type of home or production use. For complete information, write to

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	each
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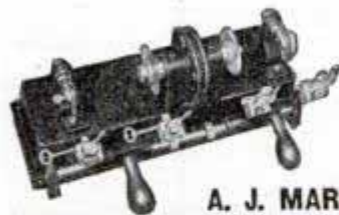


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Cleaves to wet or dry metal surfaces giving an amazing film of protection that displaces water, finger prints, all the causes of rust—Not messy or greasy—a light, free-flowing oil that acts like magic. You've never seen anything like it!

SPECIAL INTRODUCTORY OFFER—Your dealer may not yet have Sheath, so to those who act at once we will send our regular full 8-oz. \$1.00 bottle direct with all postage paid. Simply enclose one dollar bill or money order and forget your rust worries.

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A TOOLSHOP IN YOUR HAND!

- GRIND • DRILL • ROUT
- POLISH • ENGRAVE
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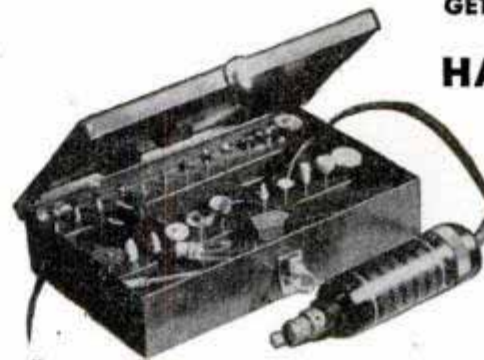
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Fill the Dustless brush reservoir with Arbitrin

sweeping fluid. In the process of sweeping, this fluid filtering through the tufts makes sweeping compound out of dust on



The result:



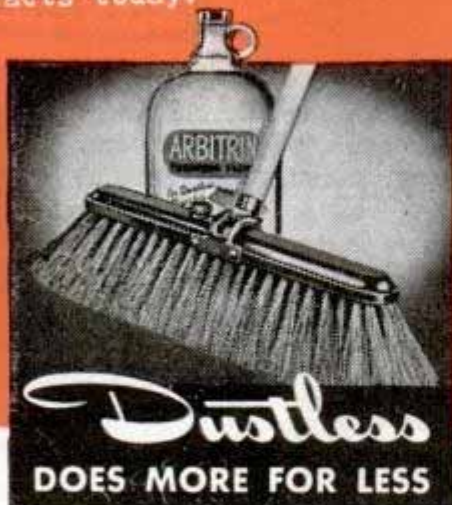
Germ culture after ordinary sweeping



Germ culture after "Dustless" sweeping

the floor. The result: You eliminate up to 97% of the dust in the air between sweepings. You also have cleaner floors and cut sweeping costs. Thousands of factories, shops, stores, and schools now use "Dustless"

sweeping. Write for complete facts today.



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be hooked to automatic steering equipment.

Like the rest of the postwar tuna clipper, the "Chicken of the Sea" is equipped with a supersonic Fathometer that indicates bottom at depths to 1000 fathoms. The vessel has a radio loop compass for taking navigational bearings. Its radio equipment also includes a world-wide code transmitter and a radiophone for short distance conversations and for communicating with scout aircraft.

Tree Farms Restore an Empire

(Continued from page 112)

paper to prevent drying. These are crated 1600 to 2000 per crate and cost \$4.26 per 1000 at the nursery. Anyone, an individual, commercial forest operator or small tree farmer, can purchase seedlings there. The Nisqually nursery raises about five million seedlings each year.

Trucks haul the seedlings to the remote end of a forest trail where planting operations are scheduled. Another truck picks up the boys at their homes. High school teachers who have been taught the work are sometimes called in as foremen. The boys are paid 75 cents an hour and are allowed one hour travel time from home and back daily. Men are paid 90 cents an hour with time-and-a-half if they are foremen. Each boy carries either a planting bag with two bundles of 50 seedlings strapped to his back, or a double-bit mattock—the sole and highly effective planting tool. Planting starts about the first of February and ends the last of April, depending on the weather. If the dry season starts earlier, planting must end earlier.

The trees are spaced eight feet from each other. Tall guide-poles keep rows straight and prevent spotty planting. Seedlings are planted in the shade of snags or rocks to protect them from sun and wind. The average boy plants 540 trees per day.

The boys planted 1324 acres on the Mowich Lake road in 1944, working only on Saturdays and during spring vacation. An additional 285 acres were planted by foremen. All told, the boys set out 572,550 trees and earned \$6400 in wages. It cost less than two cents per tree to plant the area. The men earned more per hour but did very little more work than the 15 to 17-year-olds. The slight difference proves the value of the boys to the program.

Daily planting records are kept for each boy and each crew. Down at forester Norman Jacobson's office at Tacoma Tidelands these records are transferred to maps, indexed and filed in a vault. Forty years

(Continued to page 244)

**FOR EVERY HOBBYIST
FOR EVERY WORKSHOP**

1002



Pat.
Pend.

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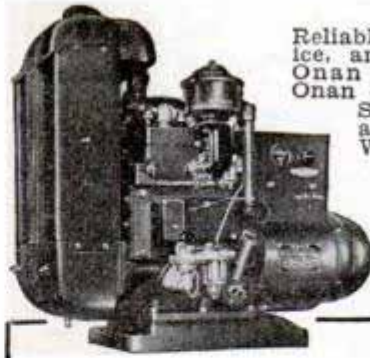
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Appliance \$10⁹⁵ Tester

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FOR BIGGER PROFITS FROM SMALL LATHES!

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UNIQUE BED TURRET...TAPER ATTACHMENT...TAIL STOCK TURRET...ADJUSTABLE KNURLING TOOL... AND OTHER UNIQUE PRODUCTION EQUIPMENT WILL MAKE YOUR BENCH LATHES PAY OFF BETTER.

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Only RIGID offers you this money-saving guarantee

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If this Housing ever Breaks or Distorts we will replace it Free

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● You get powerful I-beam handle so comfortable you can give it all the pull you've got—*barehanded*. Precision-cut alloy jaws take-hold and let-go instantly—full-floating hookjaw has handy pipe scale, heeljaw is replaceable. Adjusting nut won't bind, spins freely in all sizes. And the guaranteed housing means long expense-free service—most for your money. Buy **RIGID** at your Supply House.

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WORK-SAVER PIPE TOOLS

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DRIVER
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MILLERS FALLS *Automatics* can handle any job

With only one screw driver—the Millers Falls Spiral Ratchet—you can do *any* screw driving job quickly and easily. It can be used as a regular rigid screw driver, a right or left hand ratchet, or as a complete automatic. Changes are made simply by shifting the knurled control sleeve and the spiral lock nut.

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One Thing in Common—QUALITY!



MILLERS FALLS COMPANY
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from now, when the boy is a middle-aged man, the company will invite him to return to the forest at the company's expense to see what he did in his youth!

Alder is being cut off old lands at present and thinning cuts will be made in the fir stands in 15 and 30 years. All logging roads are now permanent. In 1994, when the company starts cutting trees planted in 1944, about 70 percent of the trees probably will be utilized instead of today's 50 percent and yesterday's 3 to 35 percent. The new hydraulic barker adopted in 1944 by the northwest pulp mills raises visible northwest pulpwood supply by 20 percent. In 1890 Douglas fir brought 50 cents per 1000 board feet on the stump in the woods. Today it is from six to ten times that expensive. Tomorrow it may be twice today's values. Some authorities claim an acre of growing trees, by 1960, will be worth \$25 each year as a source of plastics and chemicals alone.

The owner of a tree farm of 640 acres can look forward to a comfortable old age, utilizing his carefully managed timber crop as a source of permanent income, like the milk from a dairy farm. If he can't realize a return on the work during his lifetime his son will harvest the profit.

Elephants Are Good Pupils

(Continued from page 139)

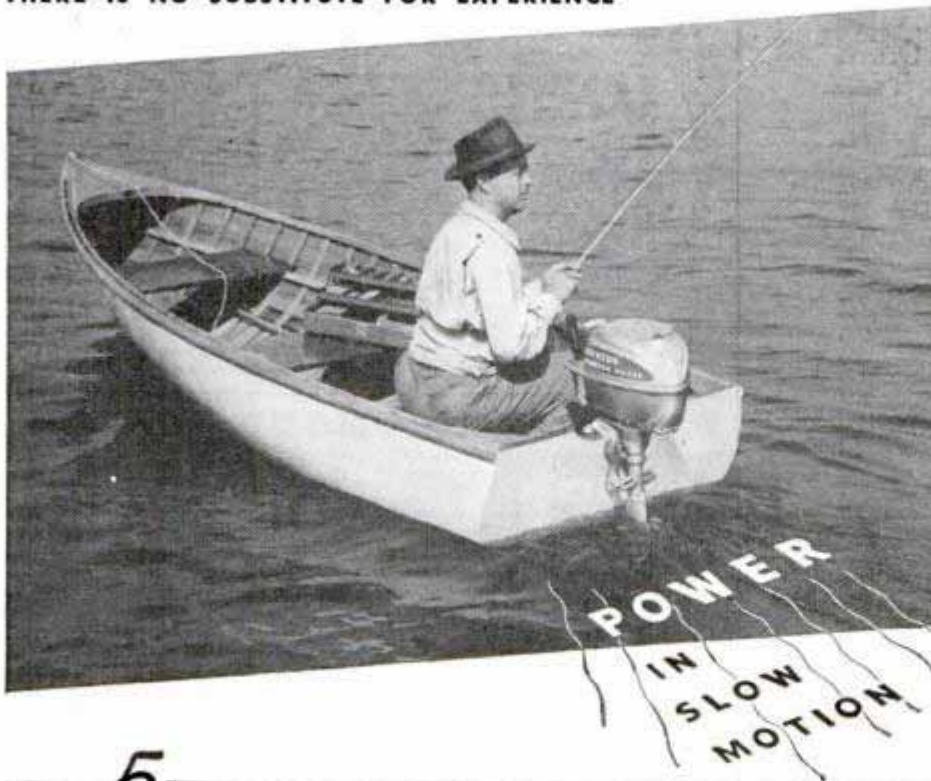
Because many elephants remain standing even when asleep (one elephant did not lie down in nearly 20 years) a rigging may be used to pull them off balance and to teach them to "hit the dirt" upon command. Sitting up is simple as the beasts need only to roll to a sitting position with the front feet held up.

The headstand, most spectacular of the elementary tricks, is quite easy because in that position the trunk serves as an extra leg helping the elephant to balance.

Trainers teach circus elephants to "tail up" trunk to tail to keep them in line. It also keeps them from using their trunks to belabor the cash customers in the front rows. The "shimmy" is another popular trick, easy because elephants have naturally loose skin. To teach it the trainer ties a rope loosely around the animal's body. At the command the trainer and his assistant shake the rope. Another way to teach this trick is to place a sack of sand on the elephant's back. All elephants like to throw objects on their backs and then shake them off. Soon the beast shakes upon command.

A famous circus elephant, Rajah, learned to read. His trainer put a blackboard in

(Continued to page 248)



There's *power* under that hood. But as long as you want to go slow, *you go slow!*

That's control—the result of Johnson Dual Carburetion and Johnson precision. A rotary valve cuts in automatically at low throttle and you purr along as sweetly as at full speed.

Dual Carburetion, Reverse with 360° Steering and Perfected Alternate Firing (for liquid power flow) are the "big three" of outboard motoring. You get them all in a "Sea-Horse."

And just as important as any feature is Johnson SERVICE. With Johnson's experienced, nation-wide dealer-service organization, you *know* that you can always keep your "Sea-Horse" in tip-top condition.

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5
GREAT
MODELS

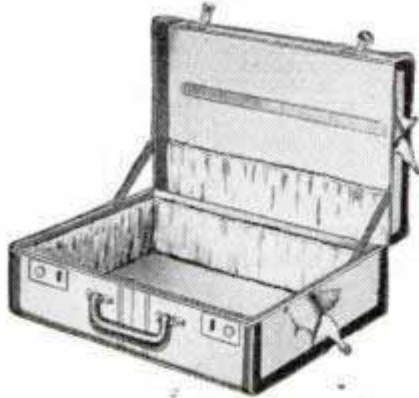
Small Alternate Firing Twin	31 lbs.	2.5 H.P.
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Johnson Makes "SEA-HORSE" Motors Only—No Others



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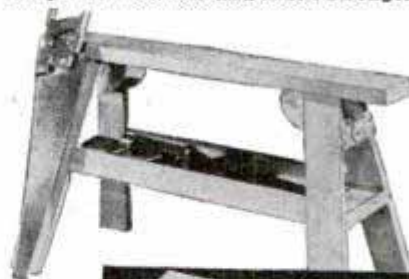
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FOLD-HORSE

(Patented)

—folds away into most any out-of-the-way corner in a jiffy when you are not using it. You'll want this sturdy saw-horse if your home workshop has only limited room, because the Fold-Horse folds down to the neat, compact size of only 8" x 9" x 42" in a matter of seconds. And—it's built to last a lifetime. It's so simple to assemble and much stronger than most horses. All



metal parts are 14 gauge steel, cadmium plated to prevent rust. The top is standard 2" x 6" x 42" and made of clear pine. Tool tray is 9" x 36". Only a limited number can be manufactured for a while—so, get your order in today!



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Watch out for Athlete's Foot!



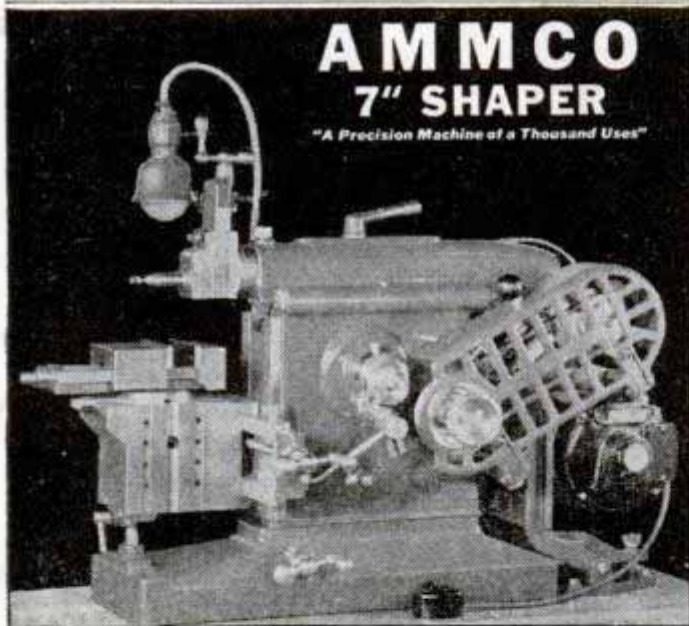
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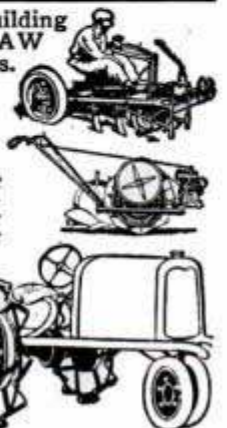
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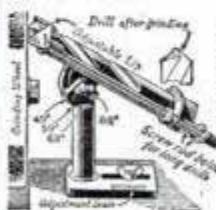


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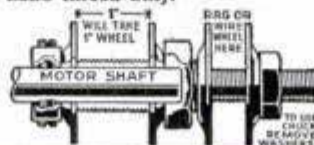
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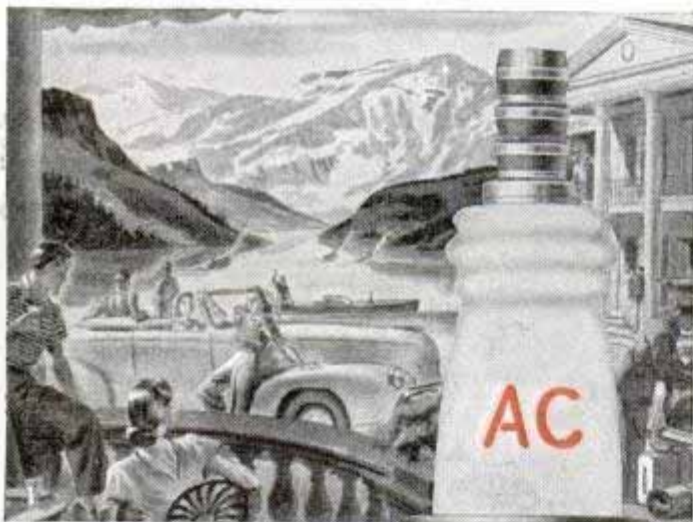
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front of him and chalked on it the word "March." As he completed lettering the word, he shouted the command at Rajah. Before long Rajah would start to march as soon as his trainer completed printing the word. Rajah also learned to read "Stop."

Elephants like to play and sometimes bedevil their keepers. One Sunday afternoon while on tour, keepers let their herd plunge into a small lake near the circus grounds. Soon it was time to get the animals back to the lot but the elephants played on, squirting water at their frantic keepers. Only when they were completely exhausted did they emerge and permit themselves to be taken back to the show grounds.

Don't Pour Coal Up the Chimney

(Continued from page 93)

insulation and one thin metal reflective surface the heat loss through the recess is reduced to a value corresponding to that of a fully insulated brick veneer wall back of a free-standing radiator. The new radiators, incidentally, take up about 40 percent less space than those made a few years ago.

Another interesting discovery was that less than 50 percent of the required heat is supplied by the radiators. The remainder comes from the chimney, uninsulated pipes and the boiler, with a small amount supplied by lights and occupants. Long ago the university proved that oil paint increases the heat transmission of radiators by 10 percent as compared with metallic paints which provide unwanted insulation.

They found also that the ducts of warm air furnaces are best left clean and shiny. The once-common practice of placing a single layer of asbestos paper over the ducts actually increases heat loss. A half inch of air-cell asbestos is necessary to restore the heat-turning qualities of the bare metal.

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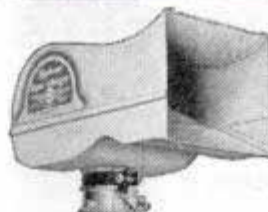


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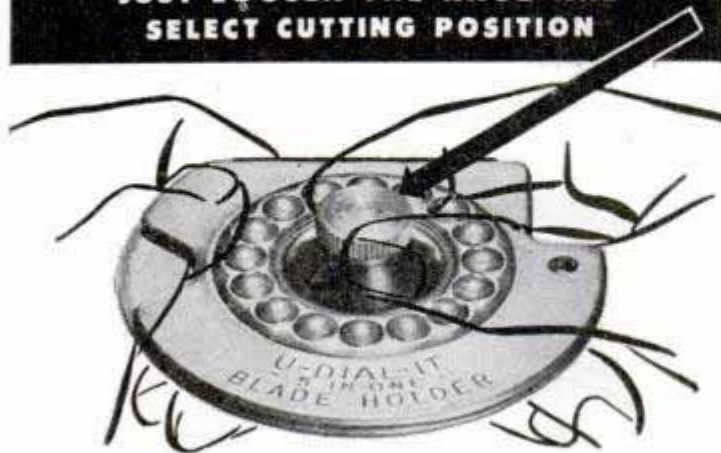
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Blade is fully guarded, cutter safe to carry in pocket.



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U-DIAL-IT Blade Cutter(s),
each complete with blade.
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Report From Bikini

(Continued from page 76)

Incidentally, one tough porker found swimming in the radioactive waters 24 hours later was identified as the lone survivor of a sunken cruiser.

The light steel construction of the radar and radio gear topside on the ships offered little resistance to the blast. Twisted and toppled stacks gave additional evidence along the same lines, adding momentum to present plans to redesign superstructures in view of the heavy wartime damages wrought by kamikazes. The explosion also exerted a surprisingly strong downward pressure, crumpling light steel deck sections hundreds of yards distant. In one of these instances it oddly left a nearby Teletype machine, a comparatively delicate instrument, unscathed, perhaps because of the equality of the blast pressure from all sides.

Oceanographers reported no perceptible disturbance of the lagoon's floor from the first test and there was no wholesale extinction of marine life, according to preliminary studies. Nor was there any major effect on birds in the area.

The most fruitful phases of the oceanographic study are expected from the second and third bomb tests. Knowing the point of release for the bomb, its detonation time and the amount of energy released, scientists will be able to make measurements of the heights of the waves, their movement, their action in shallow water and their effect on the sea bottom and the beaches, in terms of both time and distance. Supersonic echo sounders or fathometers on 16 ships scattered throughout the target fleet will record large waves through the rise and fall of the ships. Eleven fathometers on buoys will monitor the shorter waves. There also will be maximum water height recorders and water level meters on the nearest islands. The water height indicator consists of a pipe, a contractor strip and a dry cell and a series of fuses which burn out as the water passes up the pipe. An alternative and simpler type employed in the air burst test used water-sensitized paper. Photographs made serially from just prior, to several minutes after the explosion, when analyzed will provide measurements of the height, length, velocity and position of the waves at precisely recorded times. The necessary stopwatch timing for the operation will be effected by radio controlling links consisting of transmission equipment in one of the aircraft and ground installations. As each control pulse is received cameras will make an exposure and cycle forward ready for the next pulse.

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Multi-Purpose WOOD PLANER..\$7.50

Fits ANY drill press. Planes, panels, rabbets, routs, tenons, beads, grooves. Machined and balanced. Hi-Speed tool steel cutter knives. Thousands now in use. 10 Day Money Back Guarantee.

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BARRON PRECISION WORK SHOP TOOLS

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Does your dog constantly scratch, dig, rub and bite himself—often until his skin is raw and sore? He may be perfectly clean and flea free, but suffering from an intense itching irritation that has centered in the nerve endings of his skin. He is in torment and can't help scratching—unless you try to help him. Try giving him Rex Hunters Dog Powders, once each week, and note the quick improvement. One owner writes: "If my dog could talk I know he would say thanks for Rex Hunters Dog Powders. He was raw and sore from scratching and just lay around. Now he plays and is full of pep." Ask for Rex Hunters Dog Powders at any good drug store, pet or sport shop. Only 25c. Economy size box only \$1. If dealer can't supply send 25c or \$1 to J. Hilgers & Co., Dept. 218, Binghamton, N. Y.

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Lubricates - Prevents Rust - Cleans Metal

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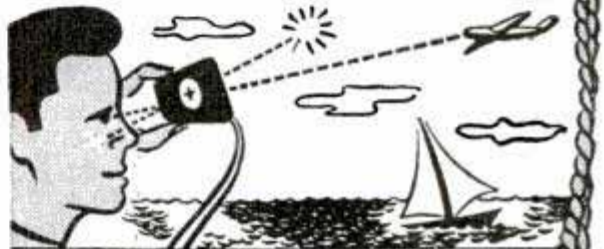


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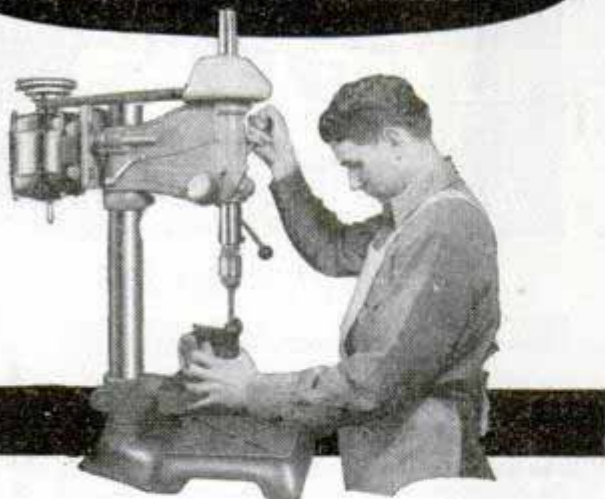
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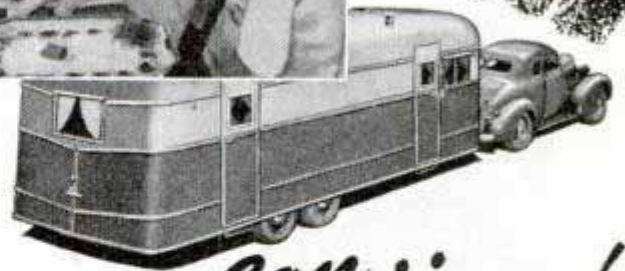


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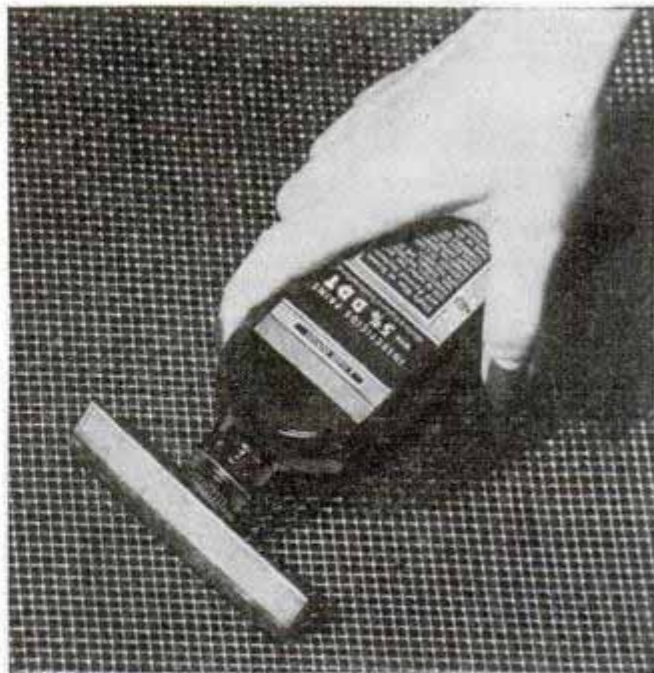
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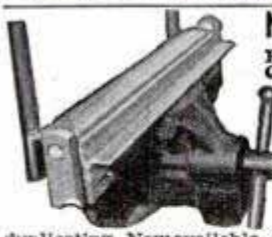
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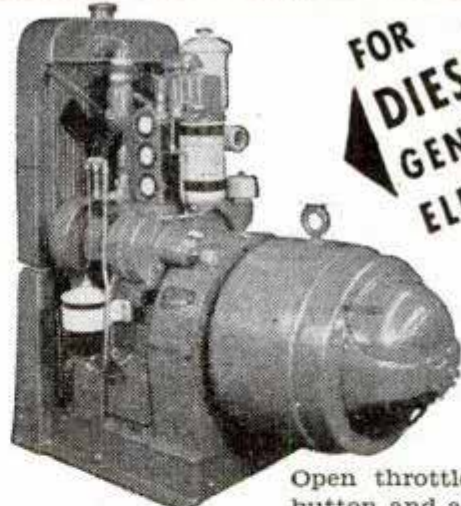
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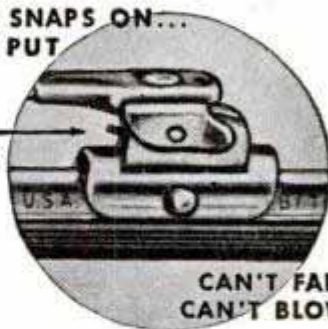
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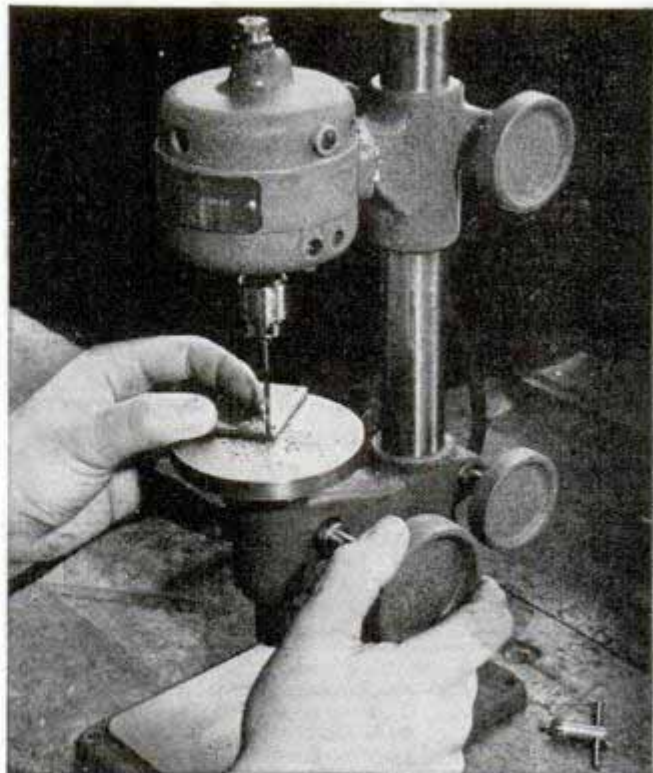
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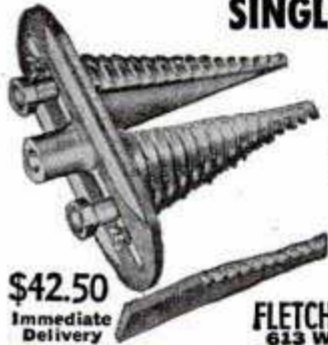
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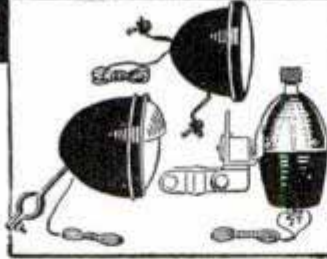
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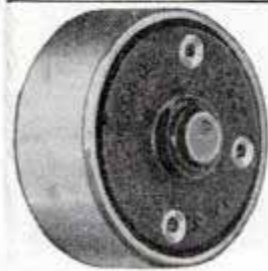
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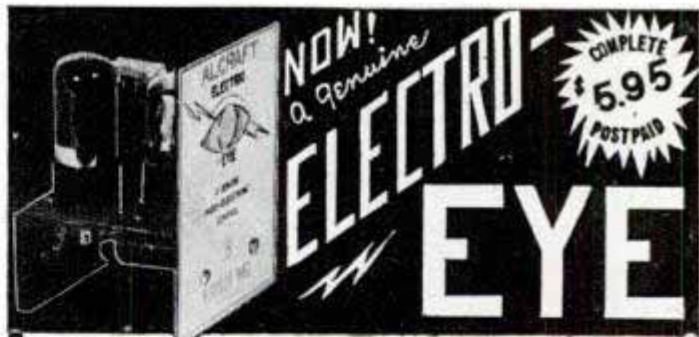
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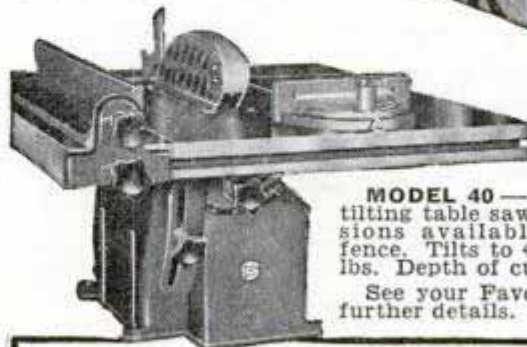
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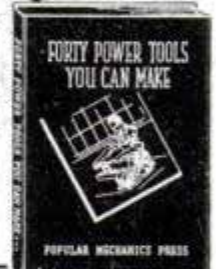
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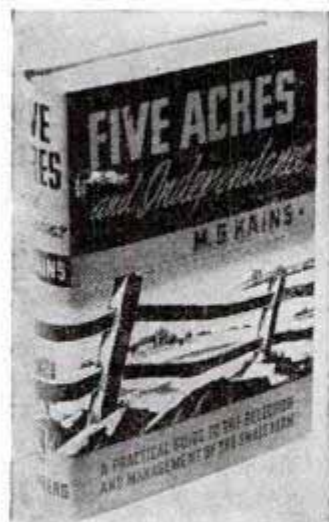
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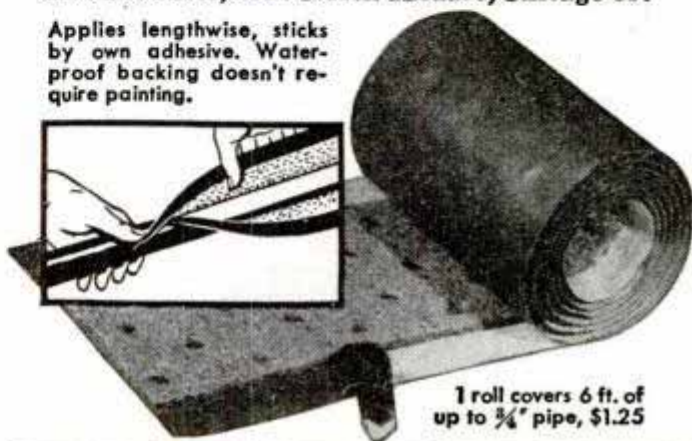


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COST TO U. S. GOV'T OVER \$500

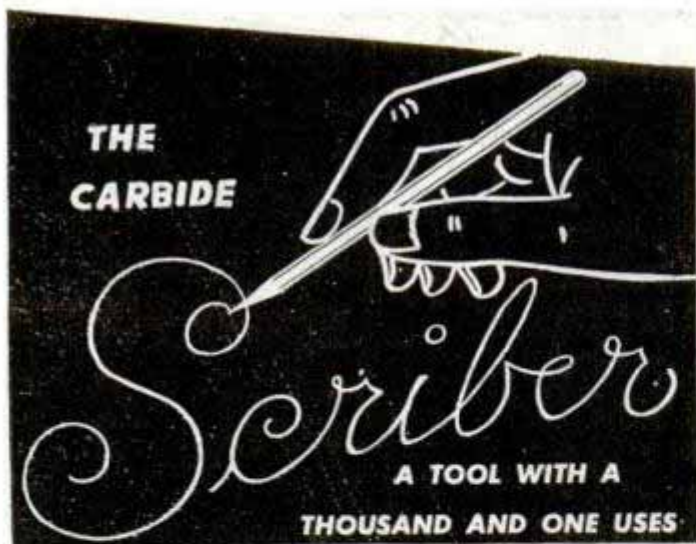
The set, as packed, cost the government over \$500. Manufactured by Minneapolis-Honeywell and Jack & Heintz. Every part is precision manufactured to the high standards demanded by the government's war inspector.

A CHALLENGE TO INGENUITY

This is really a parts "grab-bag." The readers of Popular Mechanics are the type who can capitalize on this surplus war materials bargain. Some will find value in the parts alone—others will want to keep the units assembled for experimental purposes. Whatever it is, here is a "grab-bag" opportunity. Shipped to you in sealed containers just as they were delivered to the government—ready for overseas shipment. Sent, express collect, on receipt of remittance.

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corrective aids were toys for his eight-year-
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are dislocated. Parents of other handi-
capped children heard about his work and
requested many special devices from Block
for their own youngsters. He soon quit his
job as an aircraft worker to devote his full
time to making the appliances. Each cor-
rective aid is designed after a close con-
sultation with the physician attending the
child for whom it is intended. Walking skis
invented by Block impart the correct mo-
tion to a paralytic's legs and provide play
for the child at the same time. Another
device is a tricycle with special leg clamps
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correct movements, while a high-backed
seat corrects posture. A Chicago school
recently installed Block's equipment in a
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To prevent rugs from sliding on highly
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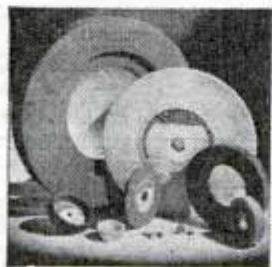
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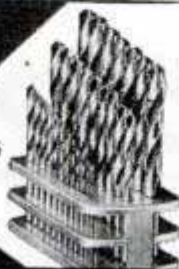
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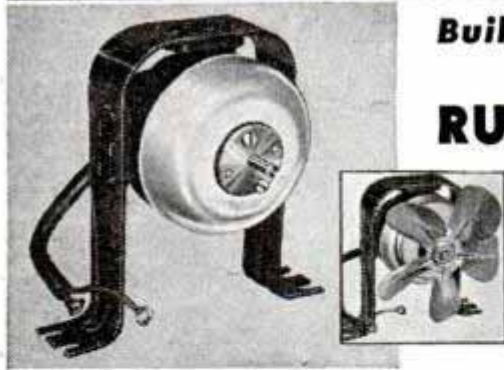
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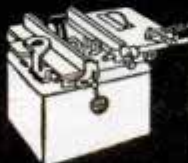
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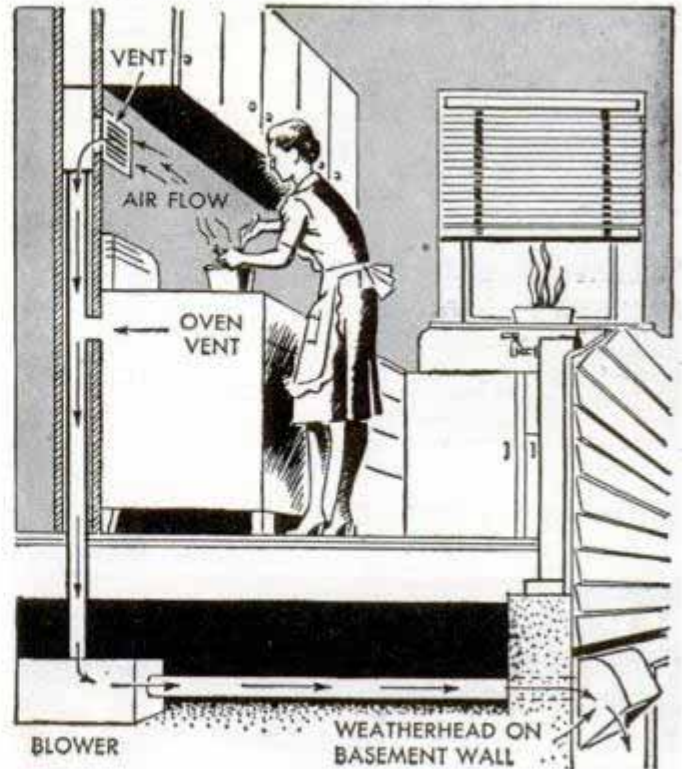


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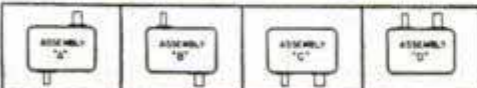
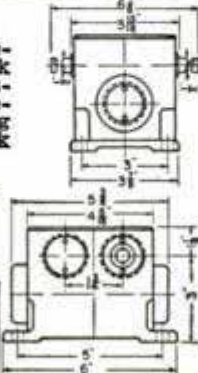
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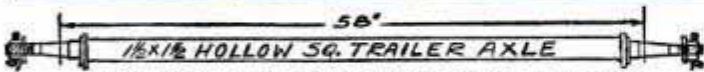
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Inventors Note

Your Sketches Prepared for Patenting, Selling and Manufacturing

Come First

Our drawings accepted and approved by Patent attorneys for filing in Patent Office, Washington, D. C.

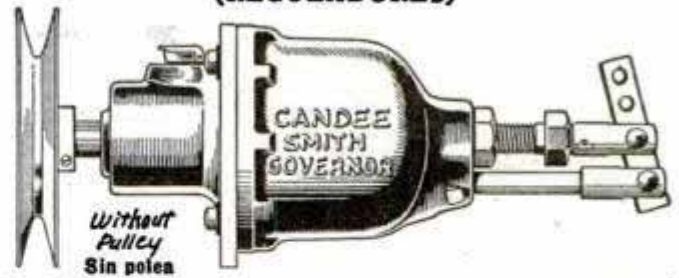
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| <input type="checkbox"/> Sharpening | <input type="checkbox"/> Burring | <input type="checkbox"/> Cleaning |
| <input type="checkbox"/> Finishing | <input type="checkbox"/> Grinding | <input type="checkbox"/> Routing |
| <input type="checkbox"/> Touching Up | <input type="checkbox"/> Polishing | <input type="checkbox"/> Cutting |
| <input type="checkbox"/> Sanding | <input type="checkbox"/> Burnishing | <input type="checkbox"/> Rasping |
| <input type="checkbox"/> Drilling | <input type="checkbox"/> Inlaying | <input type="checkbox"/> Carving |
| <input type="checkbox"/> Mortising | <input type="checkbox"/> Sawing | <input type="checkbox"/> Brushing |
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Kit No. 2 with 23 high grade accessories and Model 2 Moto-Tool, in hardwood case. \$23.50
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Straps over your back for toting luggage, camping equipment, etc. Has tubular steel frame. Made of heavy duty U.S. ARMY duck with adjustable shoulder and waist straps. Has four compartments. A real value for campers, hikers, etc. Wgt. 7 lbs. R501—Used, Each Only **\$2.15** Fed. Tax

Total Cost **\$2.48**

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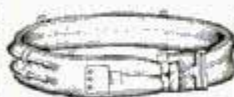
For inventors, experimenters, research workers, etc. This delicate instrument consists of hundreds of accurately machined parts, including eye objective, reflecting mirror prism, many fine calibrated adjustments, electric bulbs, polaroid filter, calibrated scales for its many adjustments, etc. Packed in all metal box 15x21 x12 inches with lock. Weight 100 lbs. **\$35.00** Stock No. 214—Ea.

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Worth many times this low price. Consists of a polaroid filter, top surfaced prism mirror, actuating motor, compensating adjustments, calibrated dial for air speed, drift, straining range, etc. Inventors and experimenters will find many valuable parts in this assembly. All brand new in orig. export packing. Weight 7 lbs. No. 215—... **\$18.50** Each only

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Regulation two-piece Army Mess Kits with folding handle. Used, but perfect. Weight 2 lbs. No. A116—Ea. **69c**

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Eleven pocket army bandoleer. Big pockets with snap button fasteners—shoulder and waist straps. NEW. Wgt. 1 lb. No. 129—Each **49c**

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Brand new. For radio, electronics and other experiments. Full 2 1/2 inch diameter. Wgt. 1 lb. No. 512—Each **98c**

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Army cot size. Fine mesh netting, taped seams. Set-up rods included. New. Wgt. 8 1/2 lbs. No. A104—Each **\$5.95**

NEW ARMY COTS
Brand new. Folding type, opens to 27x78 inches. Heavy canvas top. Wgt. 26 lbs. No. 232—Each **\$5.95**

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100% wool, regulation O.D. Army blankets. Class B—perfect. Used but renovated for re-issue. Wgt. 5 lbs. No. 233—Ea. **\$4.89**

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Brand new! Of fine top grain cow hide with hair girth. Complete. Guar. value. Wgt. 22 lbs. No. 145—Each.. **\$13.95**

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Of fine top grain leather. Each bag measures 12x13 inches. Makes fine motorcycle pouch. Used, but perfect. Wgt. 6 lbs. No. 151—Each **\$6.95**

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Fifty records of modern dance, race, blues and hillbilly selections. No two alike. Famous name bands and artists included. Used in juke boxes, but guar. perfect. Shipped exp. collect only—no exchanges or refunds. Wgt. 28 lbs. No. A303—50 records **\$9.64**



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Reg. U. S. issue canteens. Plastic screw top chained to body. Slightly used but perfect. Wgt. 1 lb. 117—Metal **69c** 118—Plastic—Ea.

CANTEEN CUPS, COVERS
All metal with folding handle. Fits over canteen listed above. Wgt. 1 lb. No. A120—Each **69c**

CANTEEN COVERS
Of heavy O.D. canvas with taped edges and snap button fasteners. Wgt. 1/2 lb. NEW A530—Ea. **35c** USED A119—Ea. **25c**

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U.S. Cavalry Spurs. Bright metal. Wgt. 2 lbs. No. 102—Pair **98c**
Set of 4 leather straps for above. No. 103—Per set... **50c**

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Similar to above but smaller. Designed for one man use. Each boat complete—packed in a special parachute bag. Wgt. 15 lbs. No. 526—Each .. **\$17.95**

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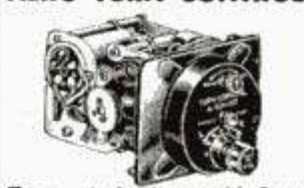
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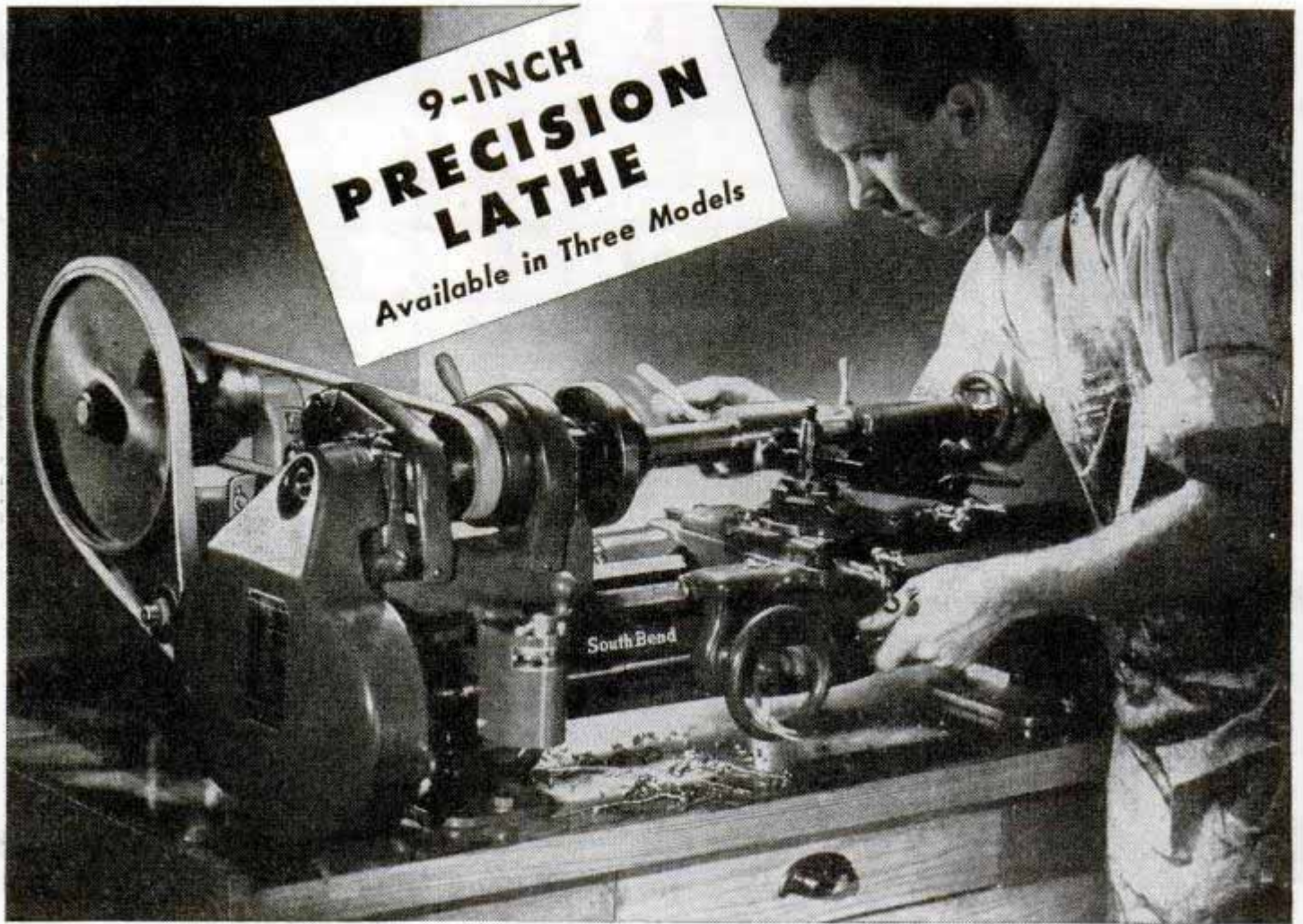
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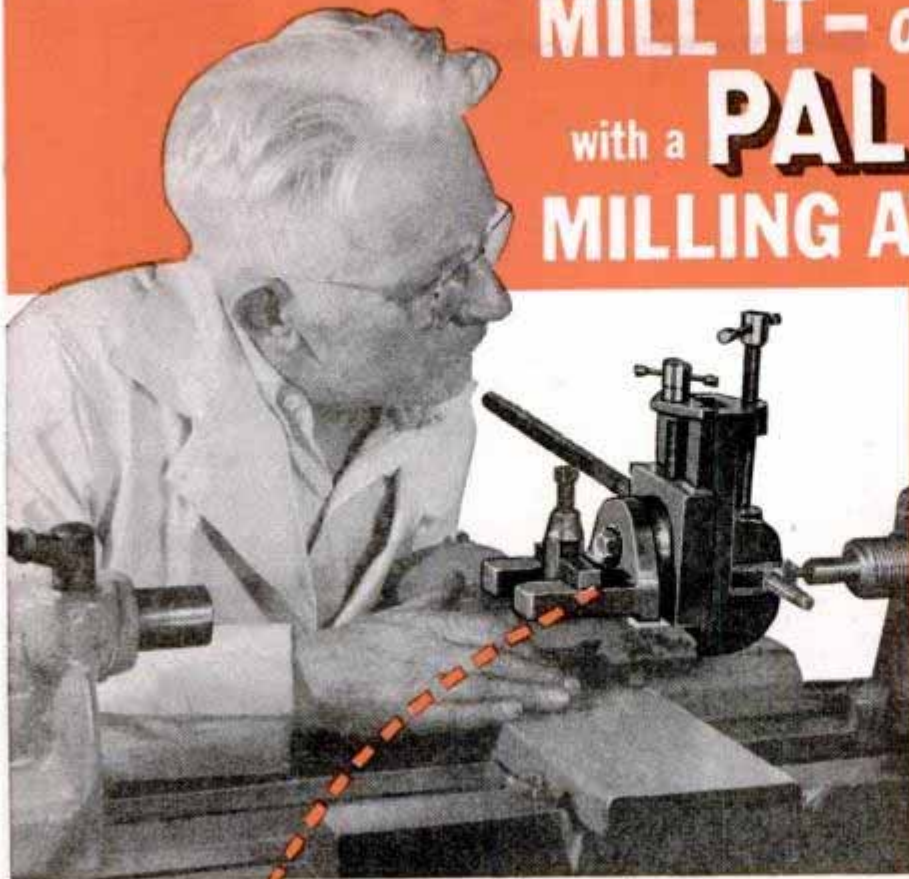
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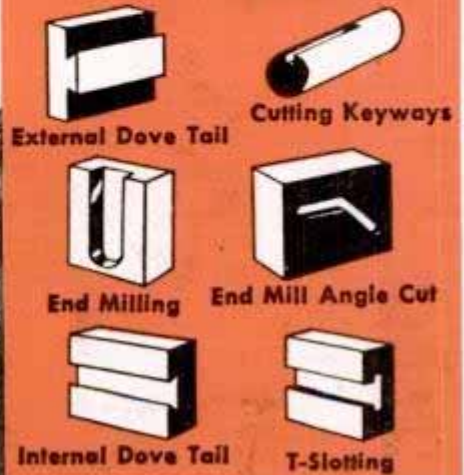


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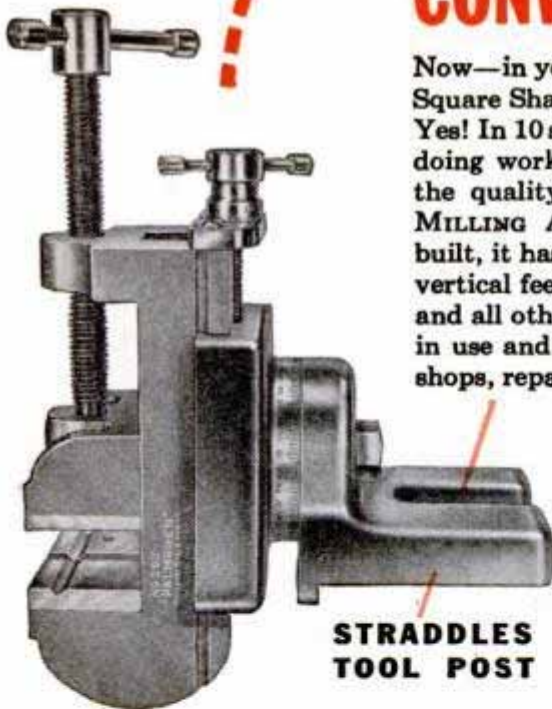


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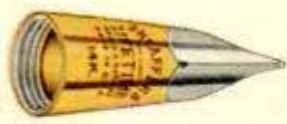
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