

POPULAR MECHANICS

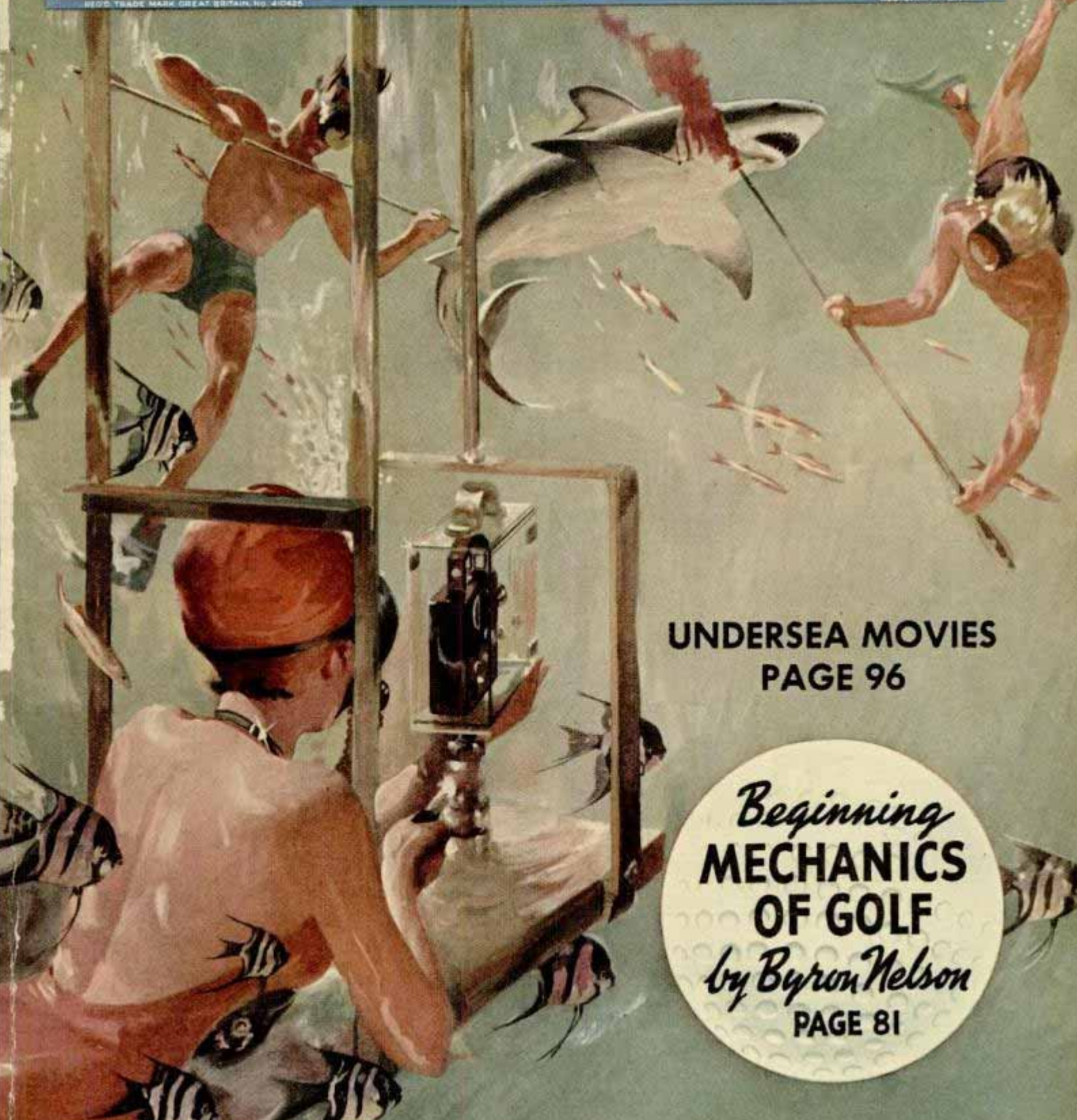
MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



REG. TRADE MARK GREAT BRITAIN NO. 410420

REG. U.S. PAT. OFF.



UNDERSEA MOVIES
PAGE 96

Beginning
**MECHANICS
OF GOLF**
by Byron Nelson
PAGE 81



look **SHARP**

You look **SHARP** because you get the best-looking shaves any man ever had!



feel **SHARP**

You feel **SHARP** because Gillette Blue Blades give you the quickest, most refreshing shaves of your life!



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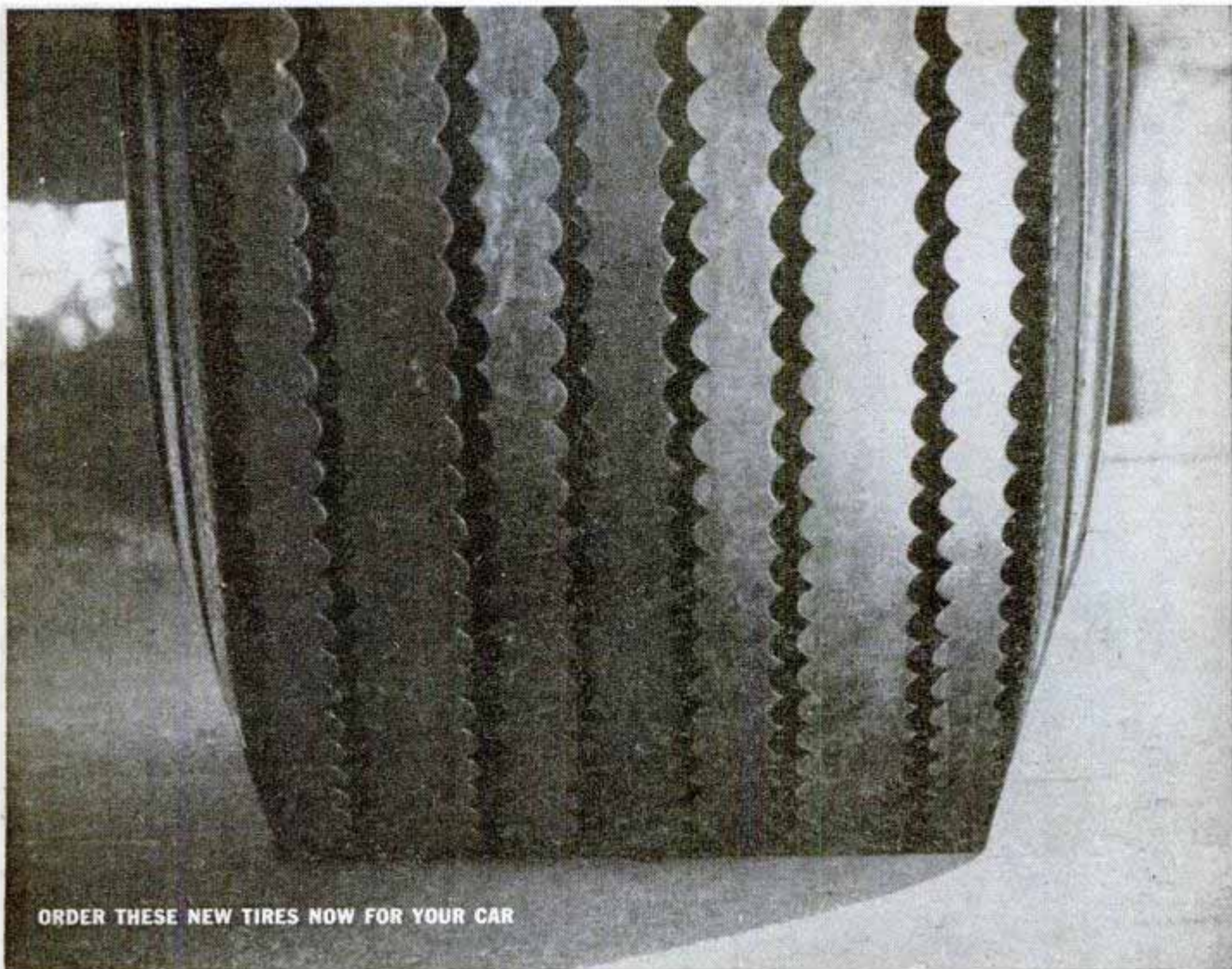
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with the **SHARPEST** edges ever honed!



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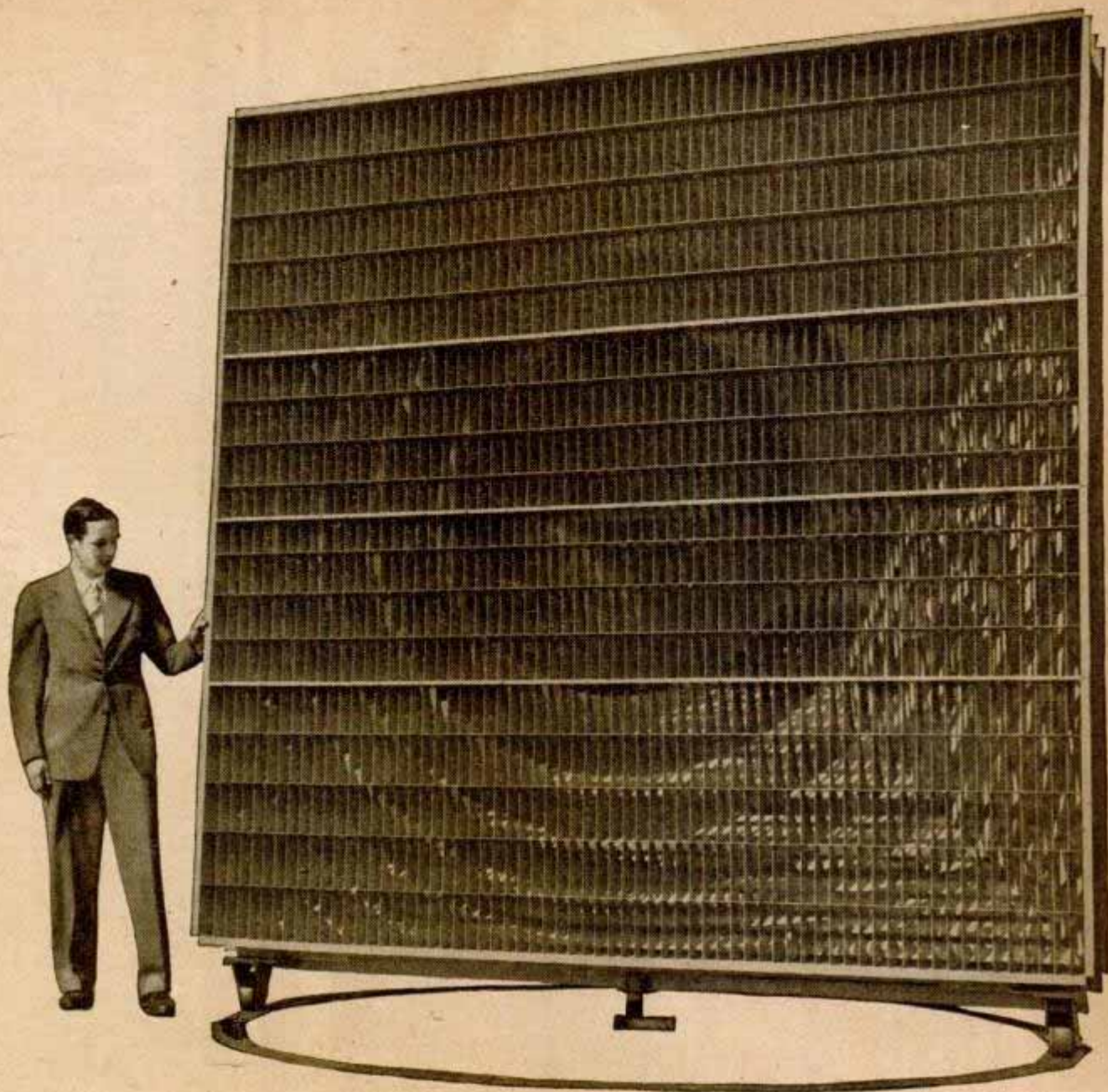
The demand for these new, bet-

ter tires is still running ahead of our ability to make them. But we are making tires and shipping them every day.

If your B. F. Goodrich dealer does not have these new tires in stock, let him take your order. He'll notify you as soon as they arrive. Meanwhile he'll help you get the most out of the tires you now have. *The B. F. Goodrich Co., Akron, Ohio.*

B.F. Goodrich

FIRST IN RUBBER



● A "SEARCHLIGHT" TO FOCUS RADIO WAVES

In the new microwave radio relay system between New York and Boston, which Bell Laboratories are developing for the Bell System, giant lenses will shape and aim the wave energy as a searchlight aims a light beam.

This unique lens—an array of metal plates—receives divergent waves through a waveguide in the rear. As they pass between the metal plates their direction of motion is bent inward so that the energy travels out as a nearly paral-

lel beam. At the next relay point a similar combination of lens and waveguide, working in reverse, funnels the energy back into a repeater for amplification and retransmission.

A product of fundamental research on waveguides, metallic lenses were first developed by the Laboratories during the war to produce precise radio beams.

But how to focus waves is only one of many problems that Bell Telephone Laboratories are working on to speed microwave transmission. The goal of this and all Bell Laboratories research is the same—to keep on making American telephone service better and better.



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

Next Month

PHOTOGRAPHS in full color in the June issue will bring the good news to the amateur camera fan—now he can print his own color photos! Ready for introduction to the home darkroom enthusiasts is a new dye transfer process by which any amateur can make the original color print from his own film in two hours and additional prints in a fraction of the time formerly required. The seven basic steps are outlined in next month's article, illustrated by full color photographs and pictures of the step-by-step process.

HOME gardeners can now grow seedless tomatoes, start transplants without wilting, prevent pre-harvest drop of fruit, and root new lawns and shrubs in a fraction of the time formerly required. A June article tells how you do it with synthetic plant hormones.

NYLON sleeping bags and electric gunsights are only two of many new items available for camping, fishing or hunting trips. How to "Stock Up for the Outdoors" is featured in June.

BYRON NELSON will be with us again in June with tips on how to handle long and medium irons—the second of his three articles on "The Mechanics of Golf."

RADIO amateurs will want to get on the new 2-meter band with the Hi-Efficiency Transceiver described next month.

BILLION-DOLLAR farm hand—that's "Mr. Watt," the farmer's electrical helper. A June feature tells what's ahead in rural electrification.

IT GLOWS in the Dark," a feature in the June Craftsman section, lets you in on the mysteries of "black light," tells you how to mix the paint, how to make signs that glow in the dark, how to cast your shadow on luminous paper.

Volume 85

MAY 1946

Number 5

Managing Editor.....	Roderick M. Grant
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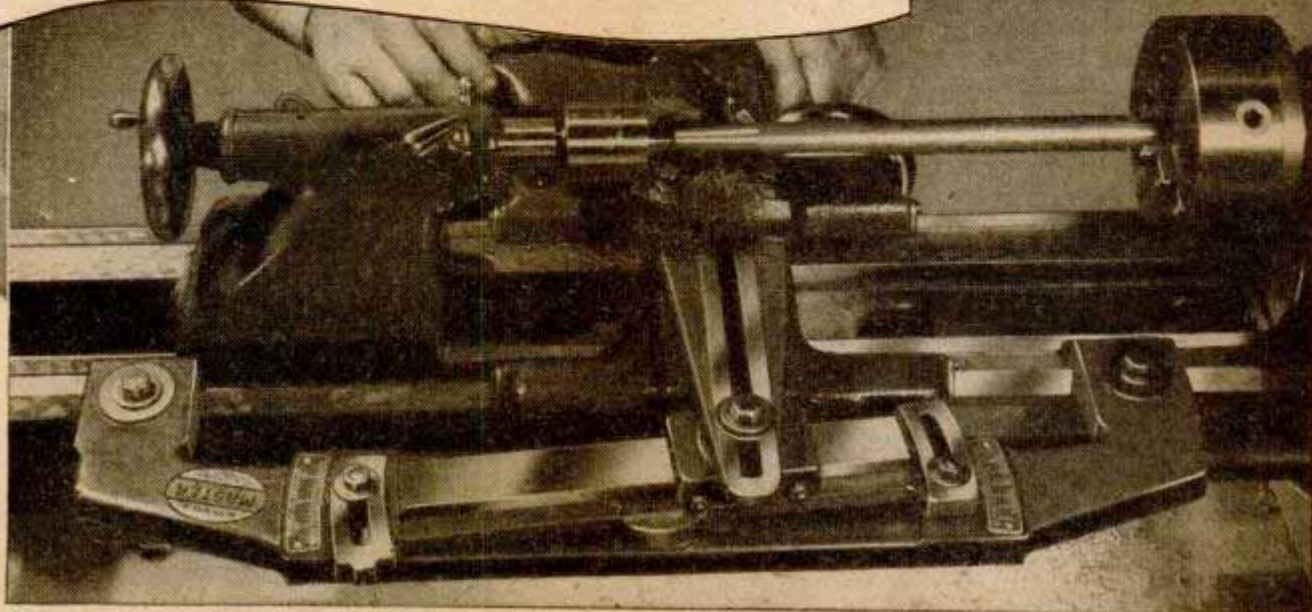
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Published monthly by POPULAR MECHANICS COMPANY, 200 East Ontario Street, Chicago 11, Ill. H. H. Windsor, Jr., president; Paul H. Dunakin, vice president and general manager; D. F. Windsor, vice president and secretary-treasurer; William Harrison Fetridge, assistant to the publisher; Clover L. Perkins, advertising manager; Alan M. Deyoe, circulation manager. Single copy in the United States, 25 cents; subscription rates in United States and possessions, and countries of the Pan-American Postal Union, 1 year, \$2.50; 2 years, \$4.50; 3 years, \$6.00. Single copy in Canada, 30 cents; subscription rates, 1 year, \$3.00; 2 years, \$5.50; 3 years, \$7.50. To all other countries add \$1.00 a year over United States prices for overseas postage. If you plan to move, notify us at least 60 days in advance so you will not miss an issue. Give both old and new addresses. Entered as Second Class Matter, September 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 3, 1879. Entered as Second Class Matter at Post Office Dept., Canada. Copyright 1946, by Popular Mechanics Company. Copyright under International Copyright Union. All rights reserved under Pan-American Copyright Union. Printed in the United States of America.

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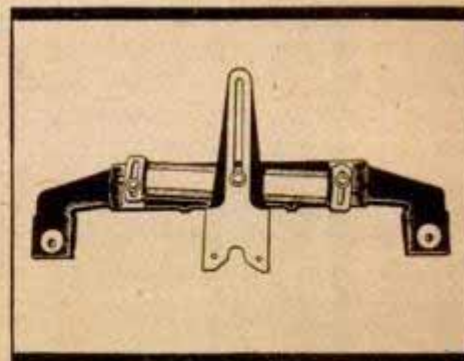
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*You can get complete information from the Keene Electrical Machinery Co.
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Model 710 Master Taper Attachment



AA-67

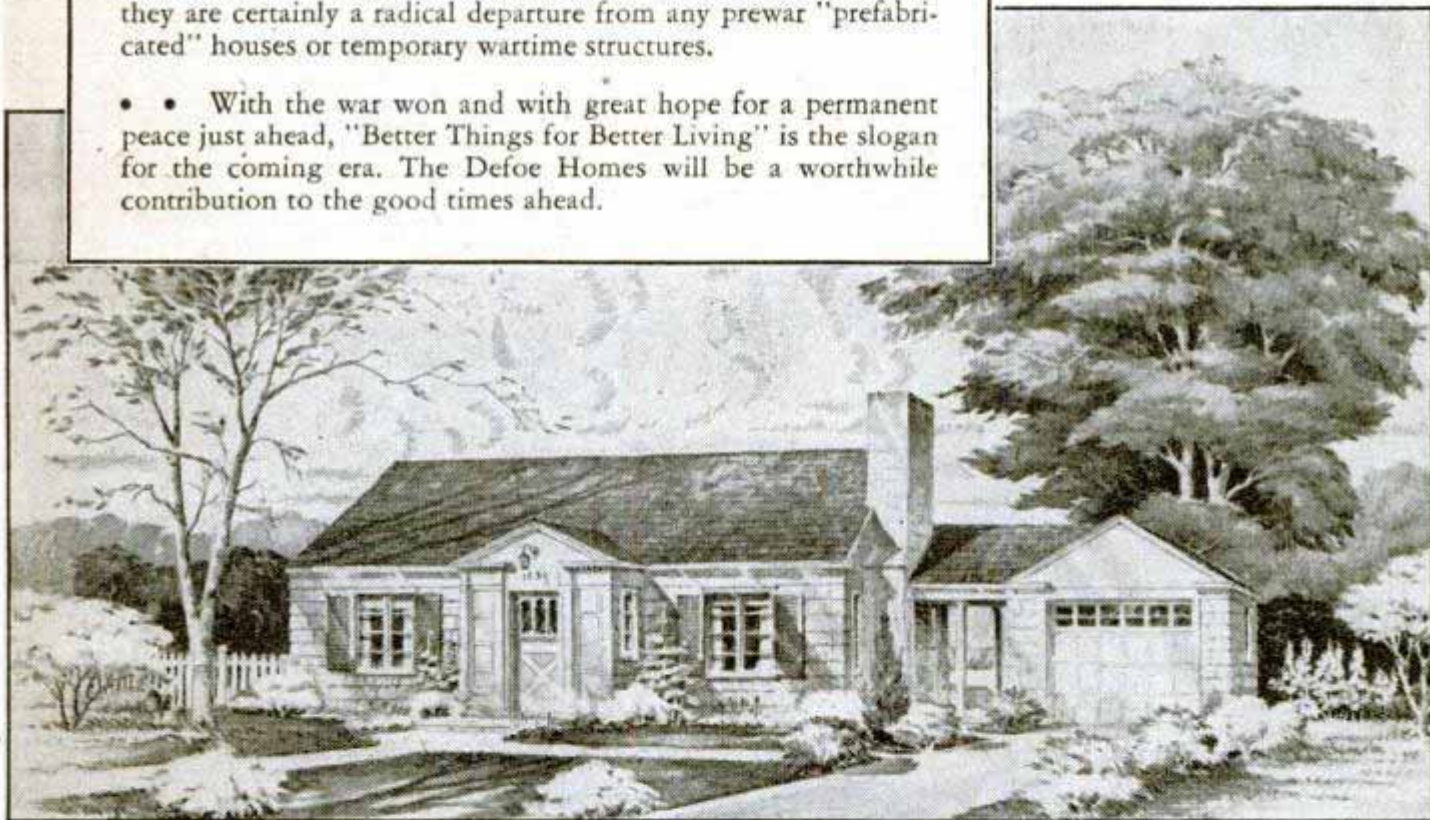
DEFOE HOMES CAN ANSWER YOUR HOUSING PROBLEM

THE Housing Division of the Defoe Shipbuilding Company was developed with a two-fold purpose—to maintain, as closely as possible, the wartime employment level upon which the people of the industrial area in which the plant is located had come to depend and to offer the public a new solution to America's housing problem.

- • With this in mind, Defoe designers and engineers were called upon to create a new line of homes which would bring to their owners the comforts of functional design, the ease of maintenance made possible by modern compact construction—plus the economies of mass production methods. In addition, they must be built to outlast houses of standard construction!

- • The Defoe organization has delivered. The skill and experience acquired by more than forty years of fine workmanship and adherence to the age-old traditions of the shipbuilder's art have brought into being an entirely new concept of gracious living. The Defoe Homes reach new highs in comfort and convenience. While there is nothing fantastic or extreme about them, they are certainly a radical departure from any prewar "prefabricated" houses or temporary wartime structures.

- • With the war won and with great hope for a permanent peace just ahead, "Better Things for Better Living" is the slogan for the coming era. The Defoe Homes will be a worthwhile contribution to the good times ahead.



This attractive Cape Cod home can be erected by the Defoe system. Variations in floor plan and exterior treatment can be made to satisfy individual requirements. This, like all Defoe Homes, can be purchased with or without the breezeway and garage.



HOUSING DIVISION
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This One



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In your Mind's Eye

The Secret of MENTAL CREATING

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All things begin with thought—it is what follows that may take your life out of the class of those who hope and dream. Thought energy, like anything else, can be dissipated—or it can be made to produce actual effects. *If you know how to place your thoughts* you can stimulate the creative processes within your mind—through them you can assemble things and conditions of your world into a happy life of accomplishment. *Mental creating* does not depend upon a magical process. It consists of *knowing how* to marshal your thoughts into a power that draws, compels and organizes your experiences into a worth-while design of living.

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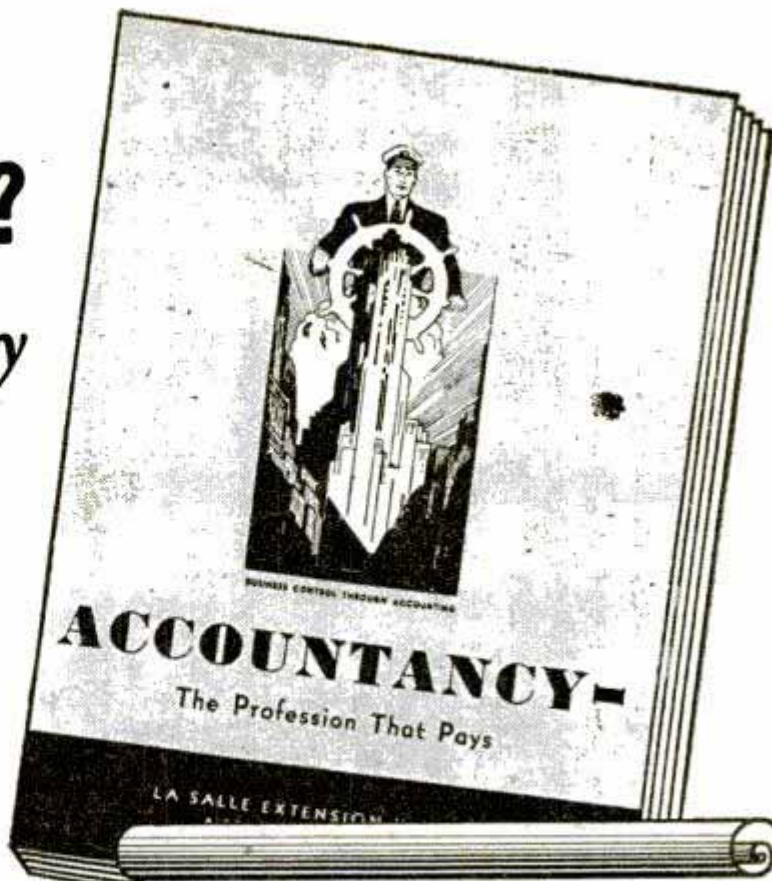
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Jerry, the talking dog, is entertaining hospitalized veterans, by courtesy of the PYROIL COMPANY. Picture of Jerry sent on request.

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FINISH YOUR HIGH SCHOOL COURSE

THAT'S the most important step you can take. Think back over your high school days, review the list below and supply the information in the coupon at the bottom of the page. Then fill in your own name and address and mail the coupon to us.

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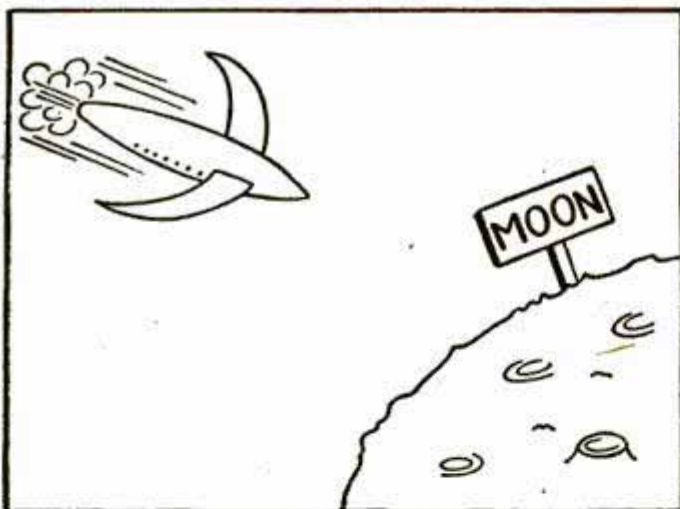
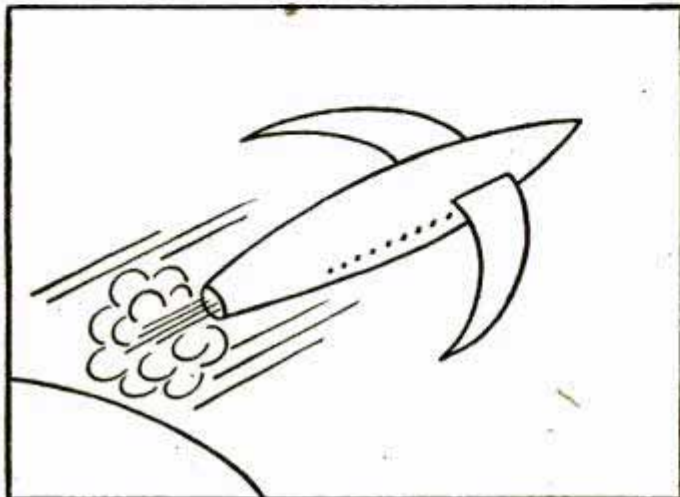
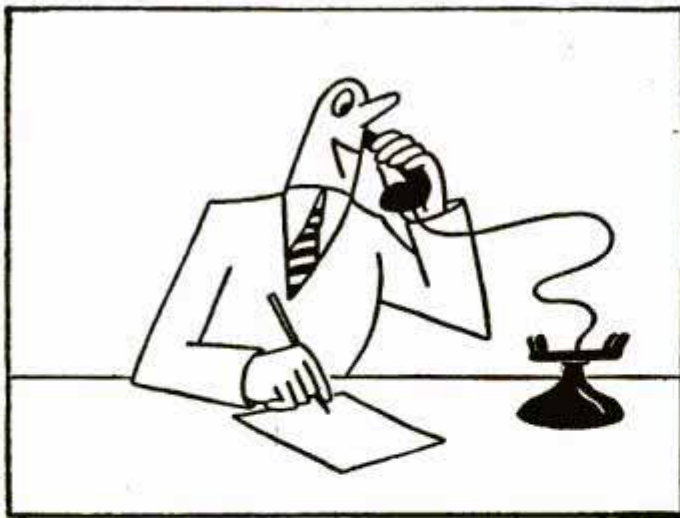
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High School of _____ from _____ to _____ 19____

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1a						12						23a						27c
1b						13						23b						27d
1c						14						23c						28
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3						16						23e						30
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7a						18						24b						35
8						19						25						36
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9						21						27						38
10						22						27a						39

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City _____ State _____ Present Position _____ Working Hrs. _____ A. M. to _____ P. M.



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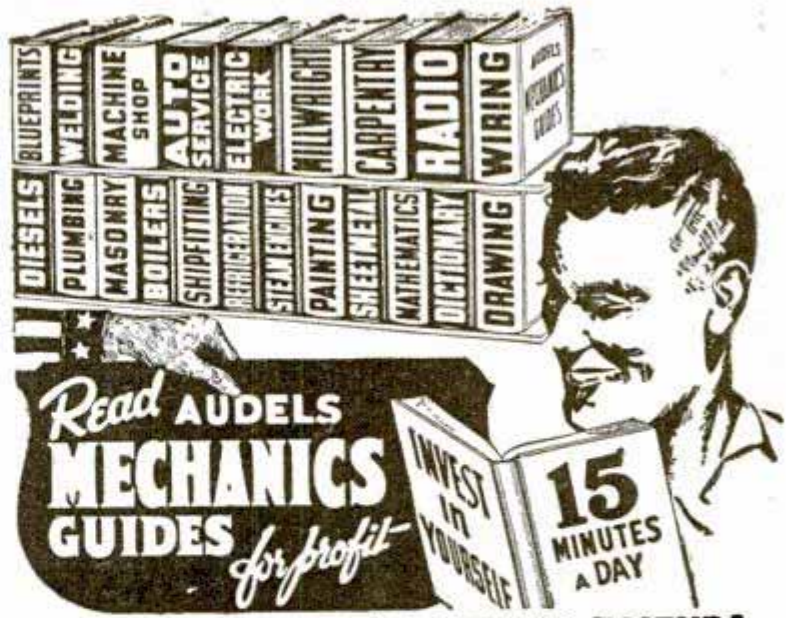
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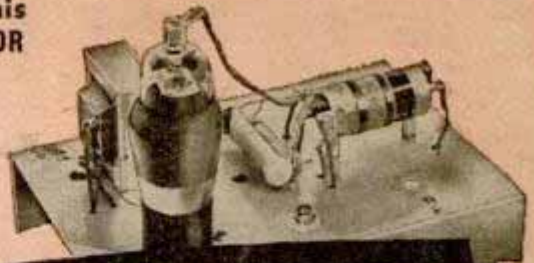
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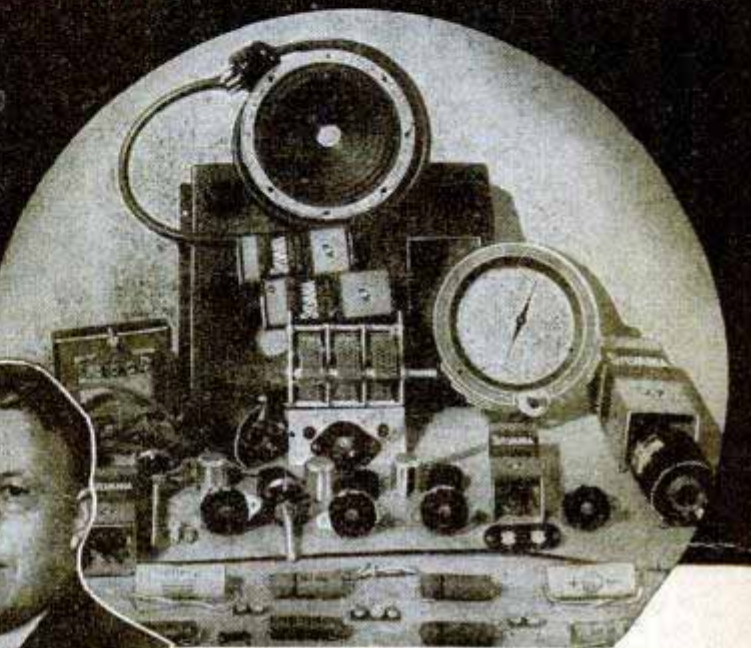
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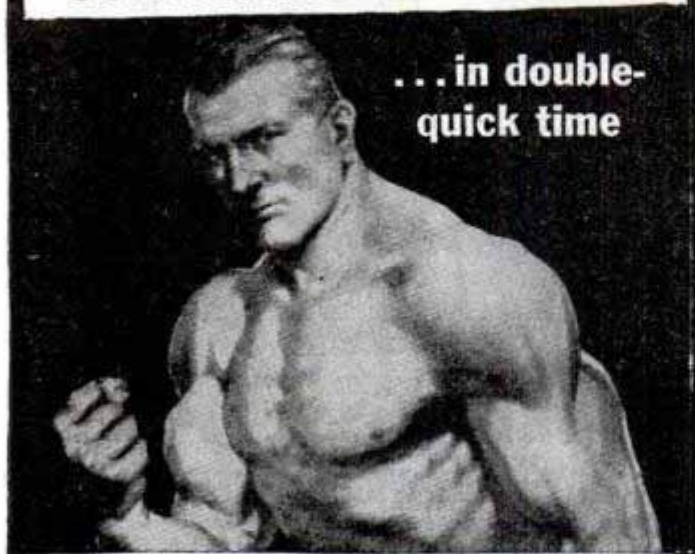
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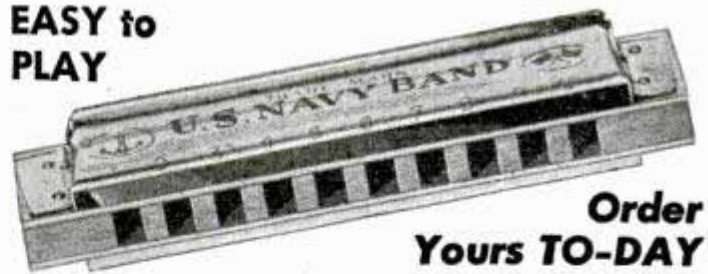
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By S. T. CHRISTENSEN
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"WELL, I guess I'm the fellow to see, for I've repaired thousands of refrigerators (home and commercial both), vacuum cleaners, radios, washing machines, irons, fans, lamps, 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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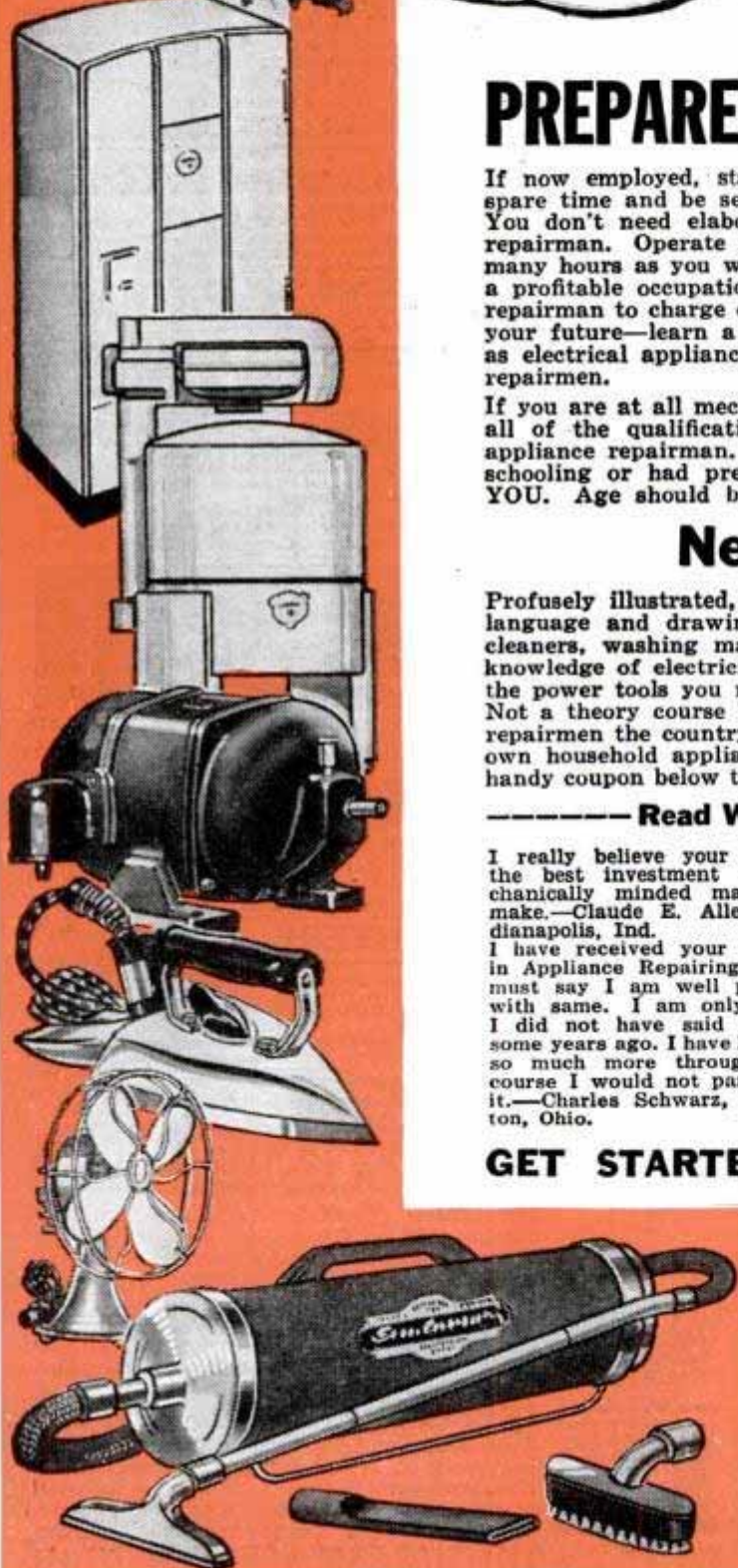
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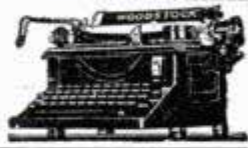
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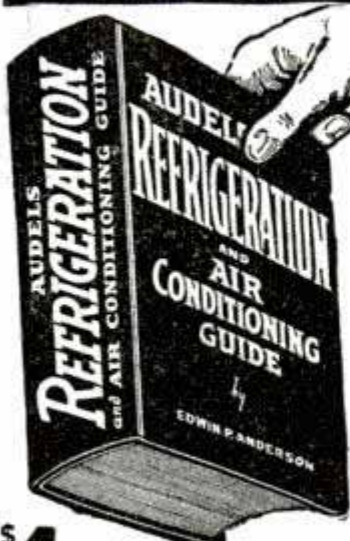
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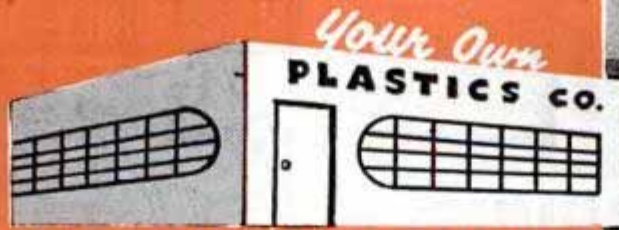
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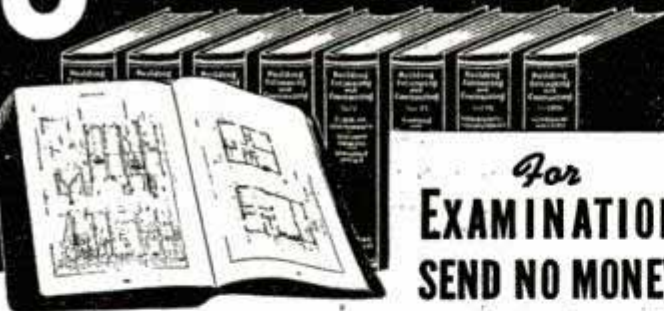
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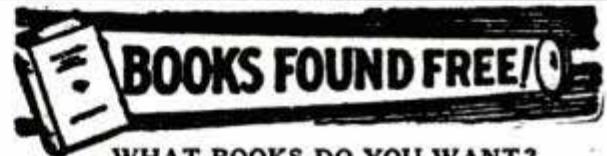
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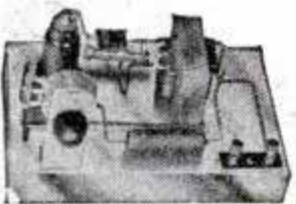
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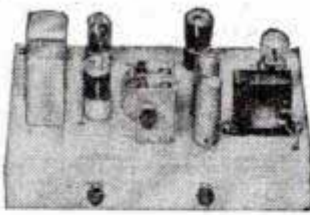
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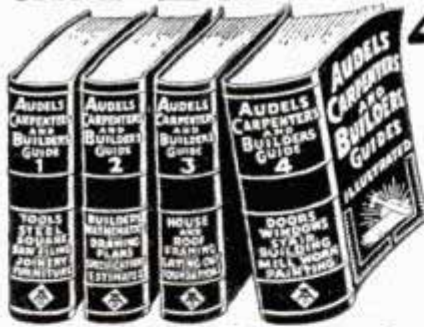
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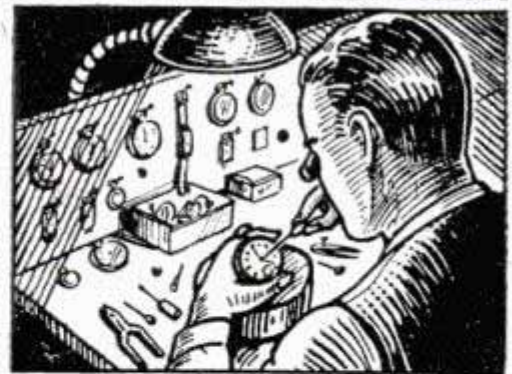
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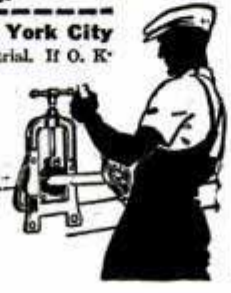
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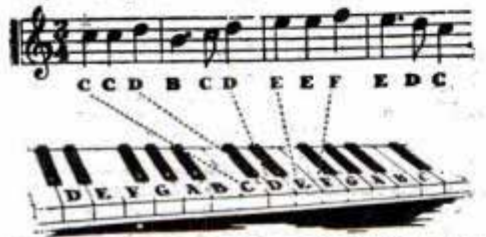
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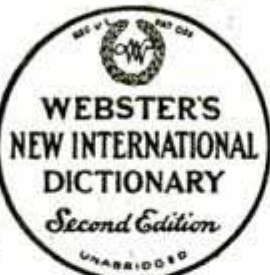


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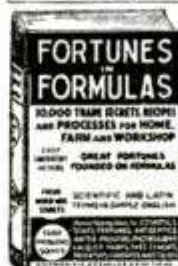
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WE Pay you \$25 for selling fifty \$1.00 assortments birthday, all occasion cards. Tremendous demand. Sell for \$1.00—your profit 50c. It costs nothing to try. Write for samples. Cheerful Card Co., 144, White Plains, N. Y.

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ABRAHAM Lincoln operated a saloon in 1833. We have reproduction of license issued him. Historic document. Every tavern will want some. Samples, agent's price 25c. Pioneer Publications, P. O. Box 1402, Philadelphia 5, Penna.

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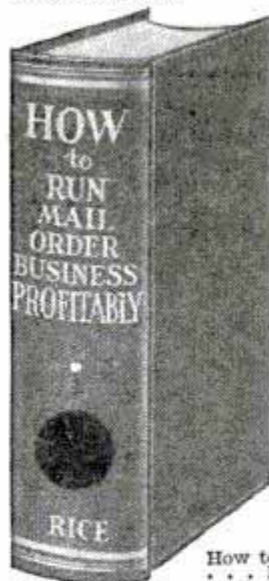
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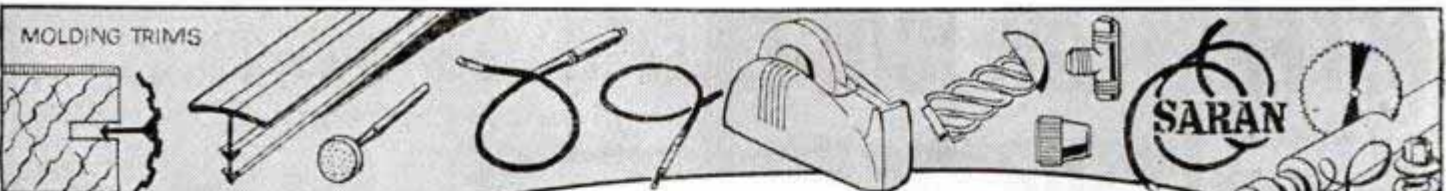
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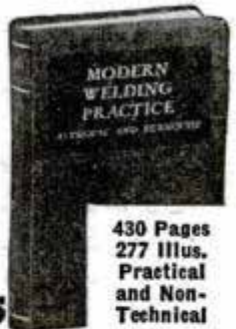


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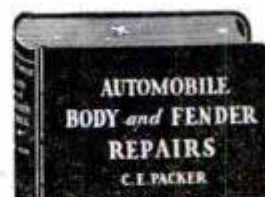
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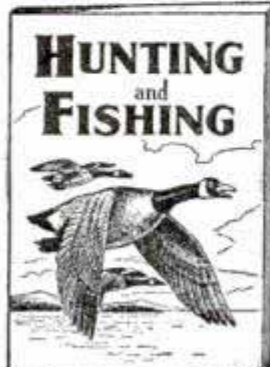
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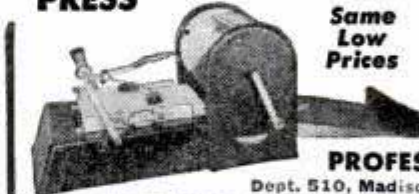
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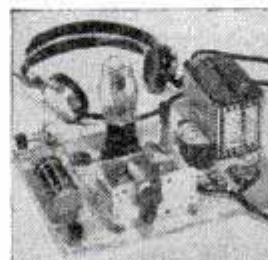


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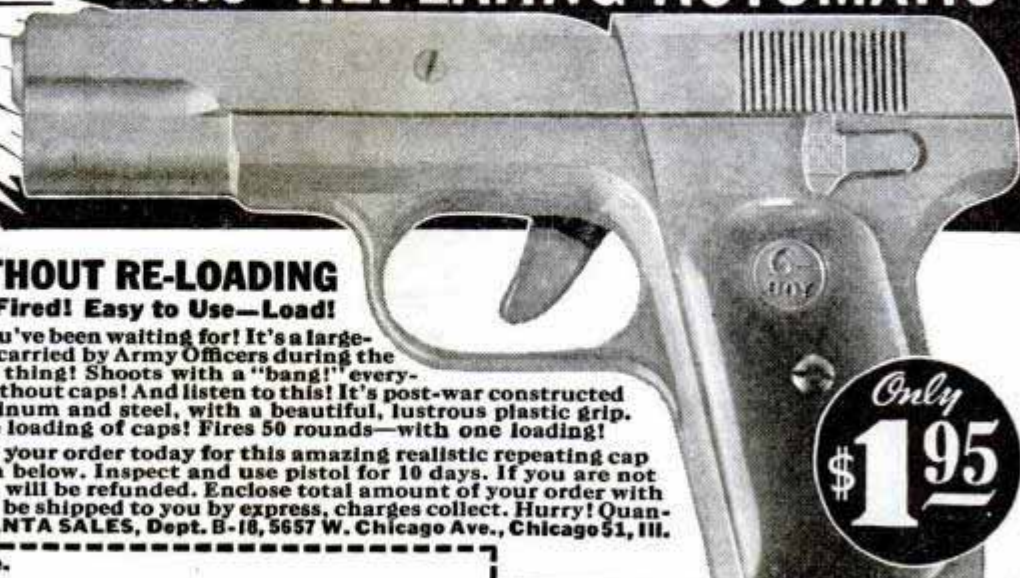
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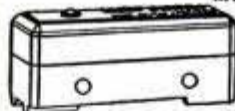
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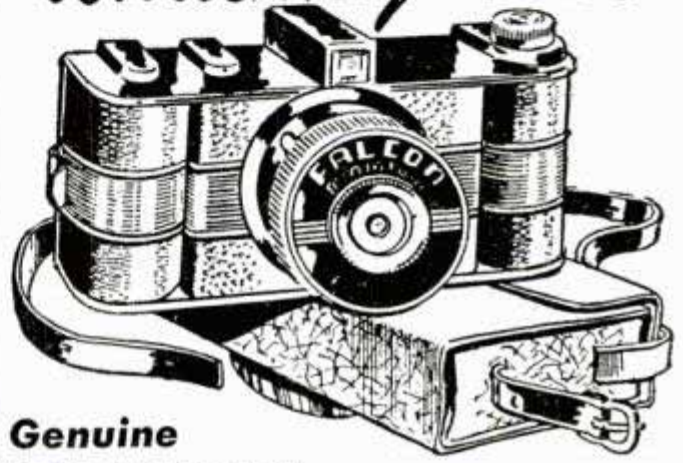


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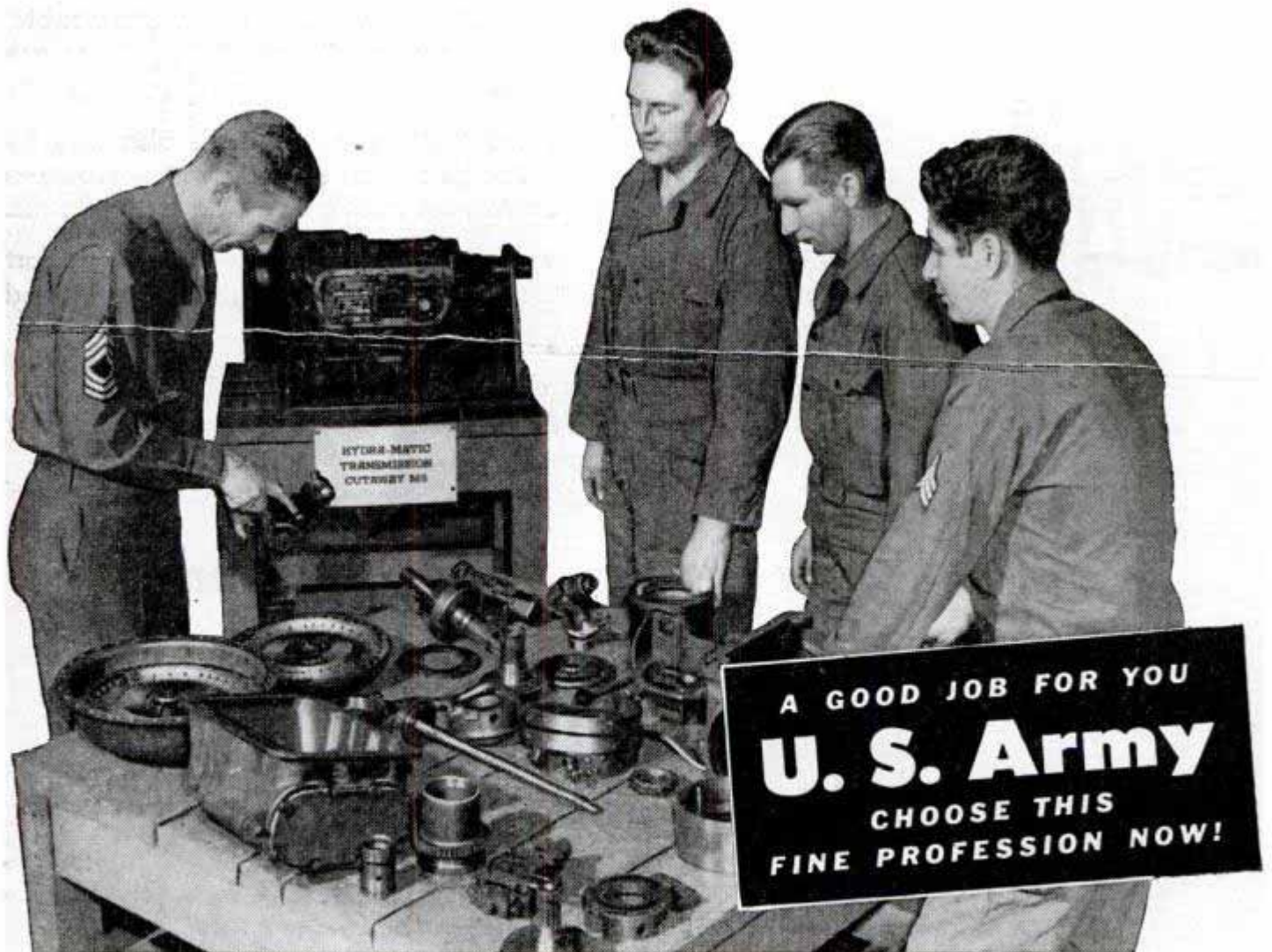
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ROAD OF THE Streamliners AND THE Challengers

The Mechanics of GOLF

by
Byron Nelson

Tee off with the greatest golfer of all time for a series of three lessons. In this he takes up wood shots

PART I

I was approached recently by a golf fan who queried, "Can you, in one word, describe the most important factor in developing your golf swing to its present efficiency?"

"Streamlining," was my answer.

In the case of my golf game, this streamlining process has been an extended one, going back about 20 years.

The original model left plenty of room for improvement. In my first competitive venture—a caddy tournament at the Glen Garden course in Fort Worth, Texas—I shot 118. The following year I tied my caddy pal, Ben Hogan, in the regular medal play, and then came through with a 39 to Ben's 40 to win the playoff. This taste of victory got me excited about golf. For several years thereafter I competed in amateur tournaments in the Southwest.

I turned professional at Texarkana on November 28, 1932, to shoot at some of the \$500 prize money in an open tournament there. I managed to win \$75—the most money I had ever had in my possession at one time. I've played for cash ever since.

Through the following 12 years my game was good enough to win the National Open, the P.G.A. national match play championship and a few major money events. However, my duties as club professional took too much time to permit me to concentrate on refining my game to the desired degree.

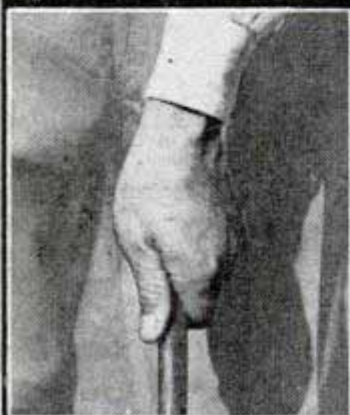
In September 1944, I resigned my position as professional at the Inverness Club



HOW NELSON GRIPS HIS CLUBS



Place handle of club at angle shown across forefinger of left hand. Note the exact position in which handle rests across first two fingers and palm. It has an important bearing on the grip's effectiveness



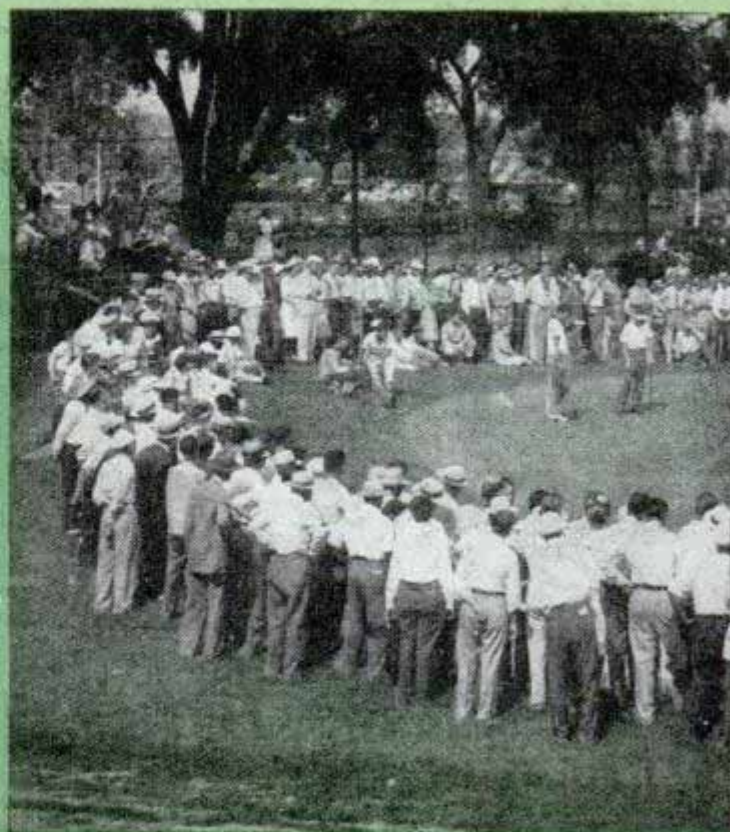
Next, you close the left hand, with thumb on the shaft, one fourth of the way around from a point opposite the body. The "V" formed by the closing of the hand over the handle points in the direction of your right shoulder. About half the back of your left hand should be visible



As you close your right hand on the club handle, be sure it is placed so that control of the club will be equally divided between the palm and the fingers. This is a very important feature



The thumb of the right hand now rests about one fourth of the way around the shaft after you have closed your hand. Notice that the "V" formed between the thumb and the forefinger is aimed at the right shoulder. The forefinger grips particularly firmly, giving feel and control as you swing



Nelson putting at Chicago's Tam O'Shanter

in Toledo and started working intensively from mental blueprints on my concept of the ideal golf swing.

This was the beginning of the most successful phase of my golf career. My goal was to take the waste motion out of my swing, and thus reduce the possible margin of error. I felt that if I could arrive at a compact, simplified swing, I could improve my efficiency and also my consistency.

The results of this improvement program showed during the 1945 season when I averaged 68.33 strokes for 120 rounds of competition in P.G.A.-sponsored tournaments.

The first part of my game to undergo detailed study (once my resignation from Inverness had made available the needed time) was my method of gripping the club.



This closeup shows the details of my overlapping grip. Note closely that the small finger of my right hand overlaps left hand's forefinger



Country Club, where he captured the rich All-American Open four consecutive years

To me a sound grip is the most important factor in playing good golf.

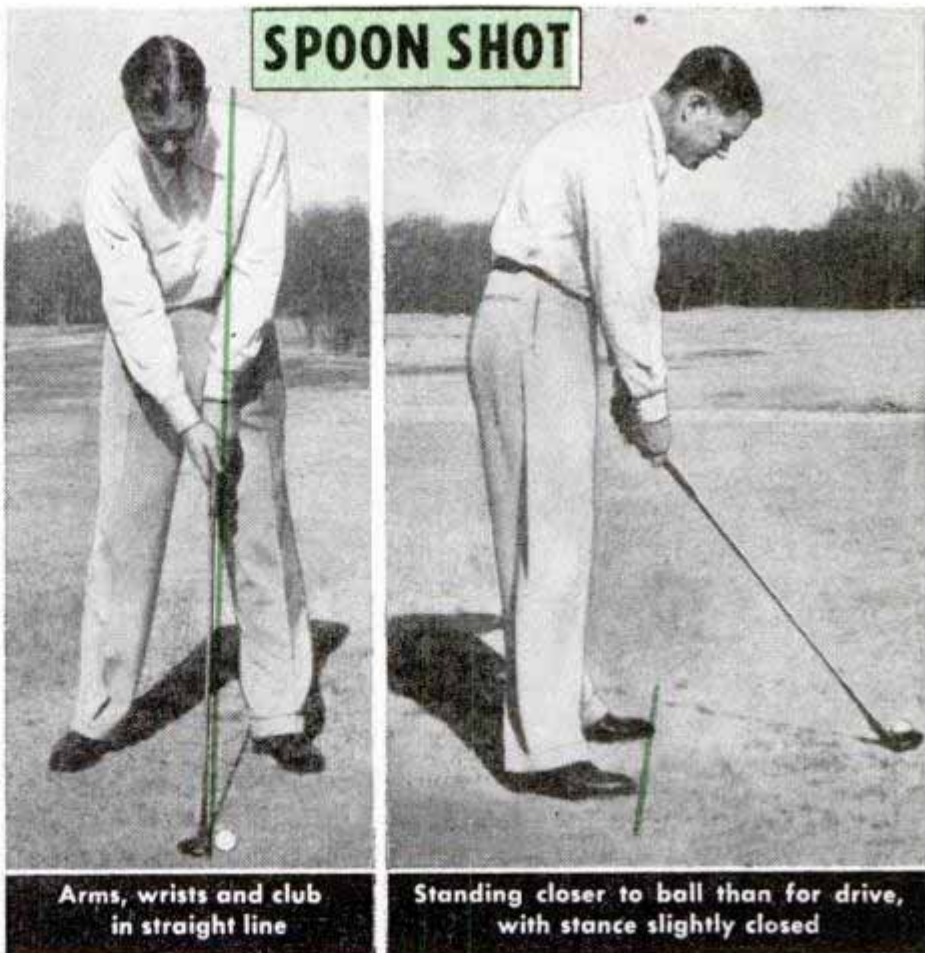
The most prevalent weakness in the grip is looseness. If your grip is lax enough to permit the club to turn or slip in your hand, even just slightly, you can't possibly hit a good shot. This flaw spoils both distance and accuracy.

With all this in mind, I experimented—trying to incorporate maximum firmness into my grip. In playing golf today, I grip the club very firmly in both hands, with emphasis on the left hand. By firmness I don't mean squeezing the handle so tightly that arms and hands are tense. Grip just firmly enough so that you have complete control of the club throughout your swing.

I favor the overlapping grip illustrated in the photos on page 82. The name is derived from the fact that the little finger of the right hand overlaps the forefinger of the left hand. The overlapping grip permits both hands to

work as one. It is this coordination that helps provide a smooth application of power to the club as you swing.

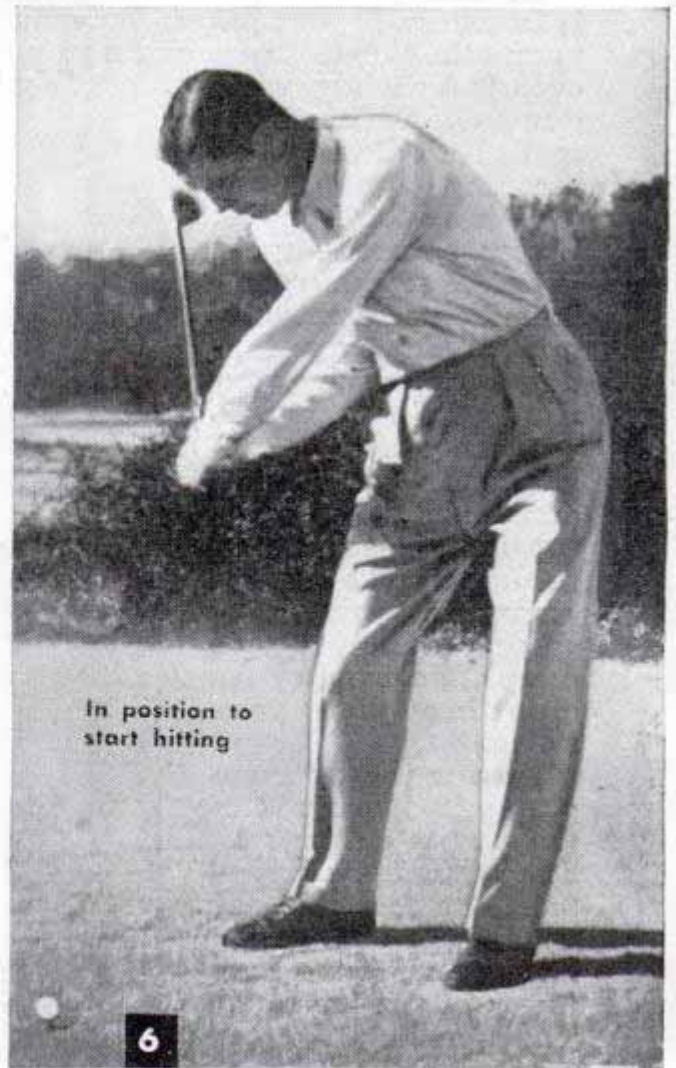
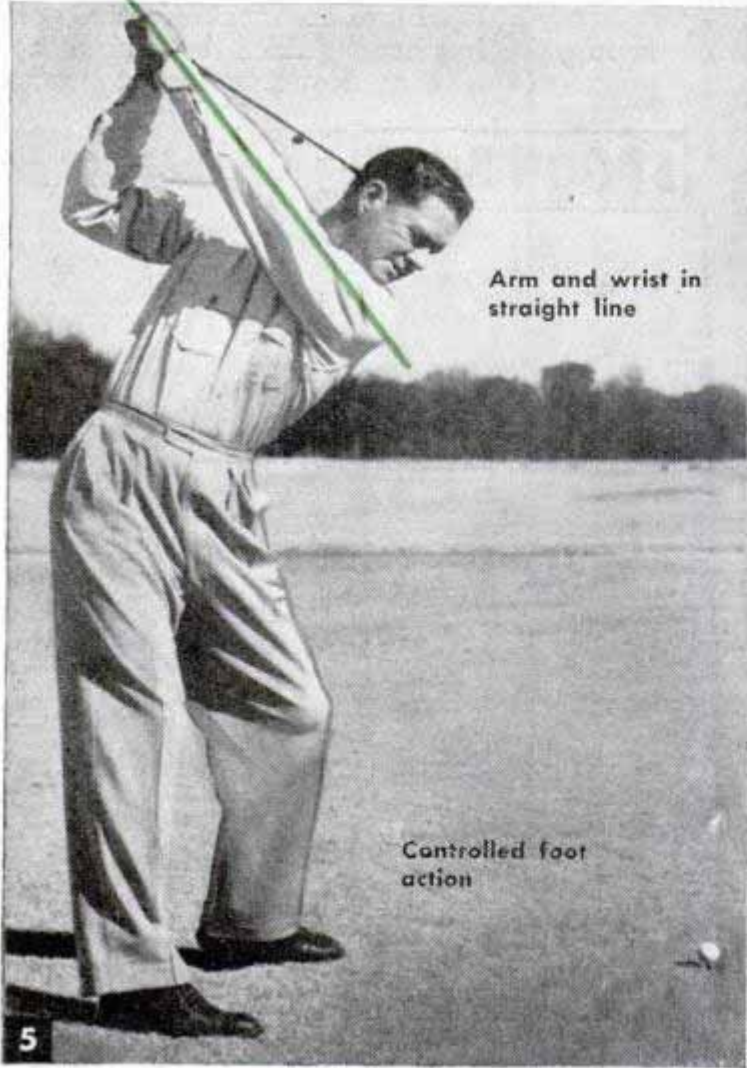
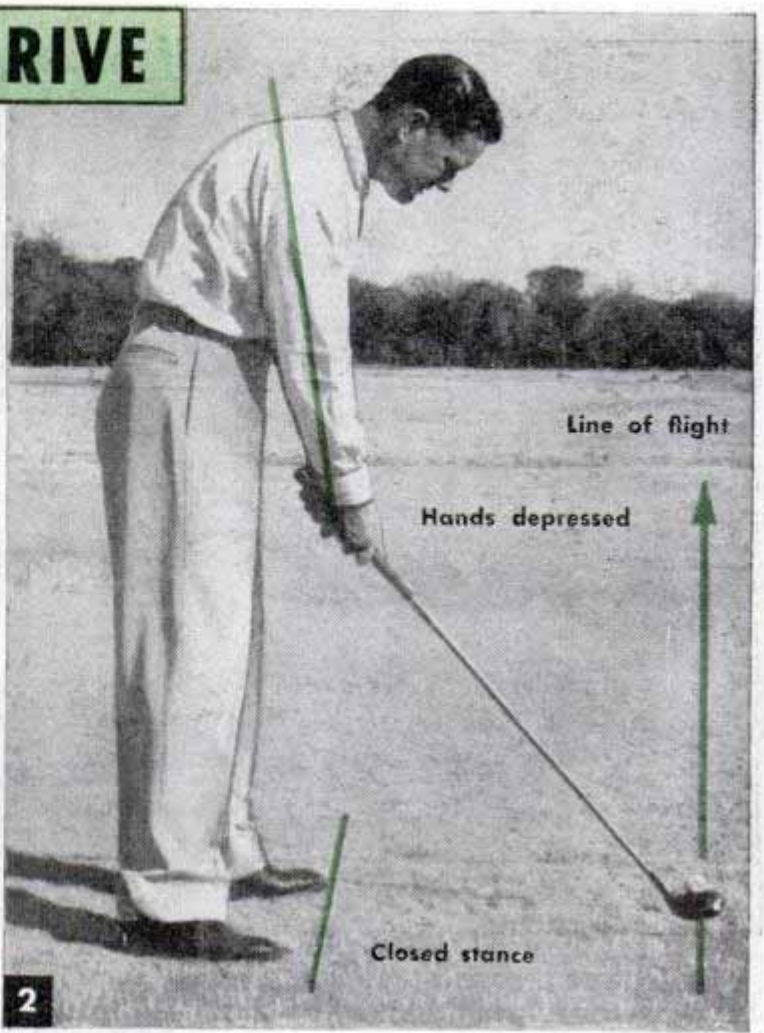
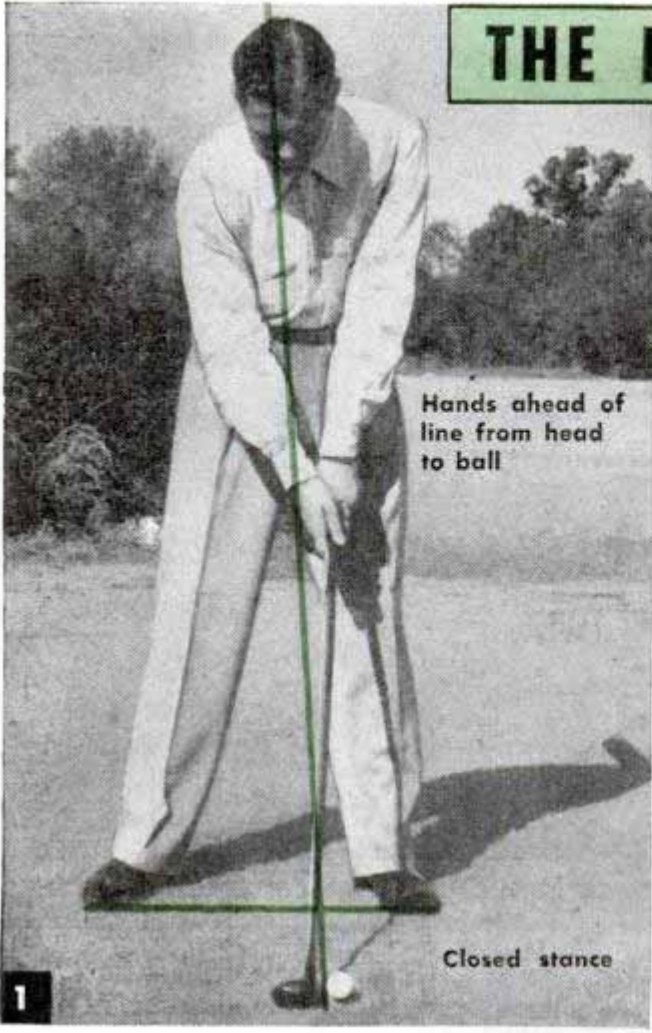
In my blueprint of the most effective golf swing, the left hand guides the club at all stages of the swing. You may have to make

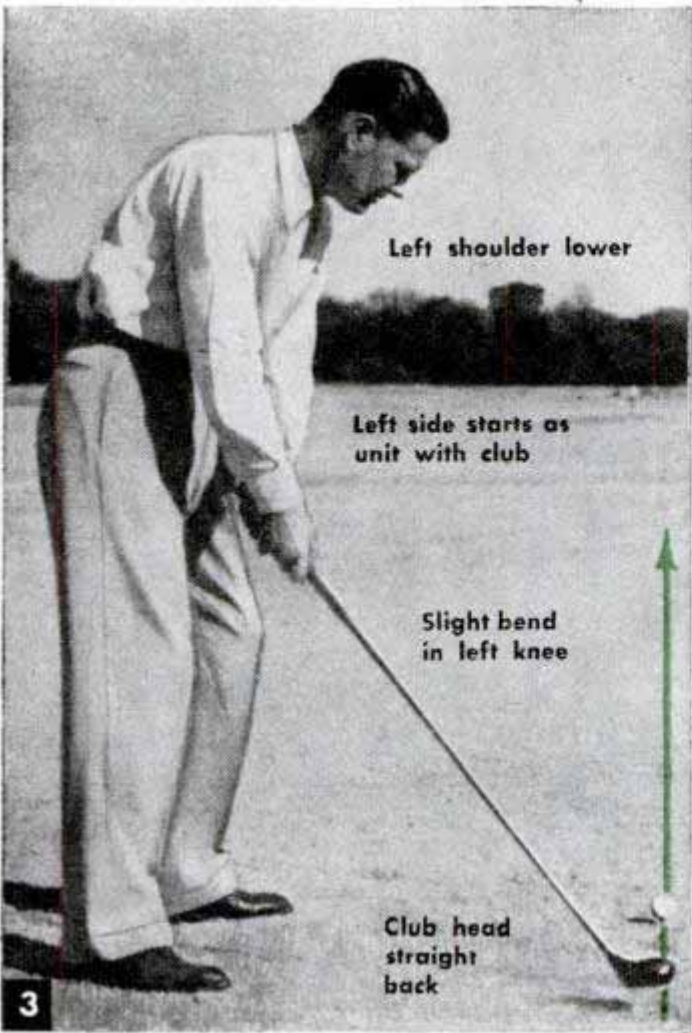


Arms, wrists and club in straight line

Standing closer to ball than for drive, with stance slightly closed

THE DRIVE



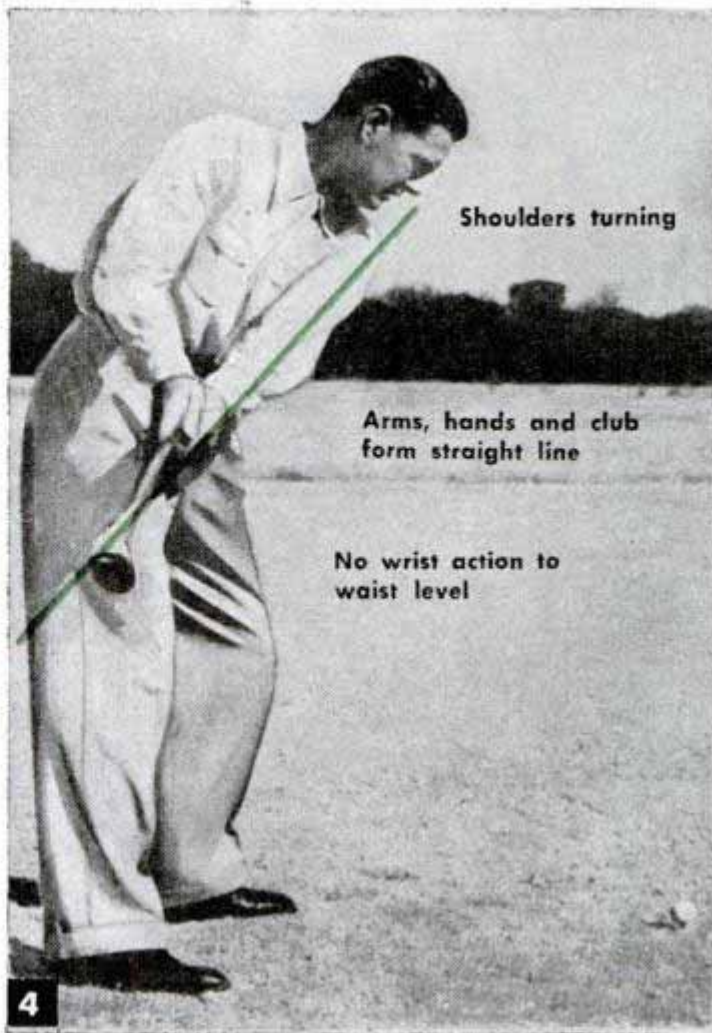


Left shoulder lower

Left side starts as unit with club

Slight bend in left knee

Club head straight back



Shoulders turning

Arms, hands and club form straight line

No wrist action to waist level



Weight on left side

a conscious effort to get this feeling at first, but it will become second nature after practice. Remember this: at no point in the swing should your left hand lessen its grip on the club. This is essential to proper control. The last three fingers of the left hand are particularly firm in their hold on the club.

Don't be the least bit discouraged if, at first, this overlapping grip feels awkward. After a few hours of practice it will seem perfectly normal to hold the club in that fashion.

As I improved my grip, I eliminated much of the grief I had encountered in straying into woods, heavy roughs and traps. Firmness gives me much better control. Control of the club means greater accuracy and consistency.

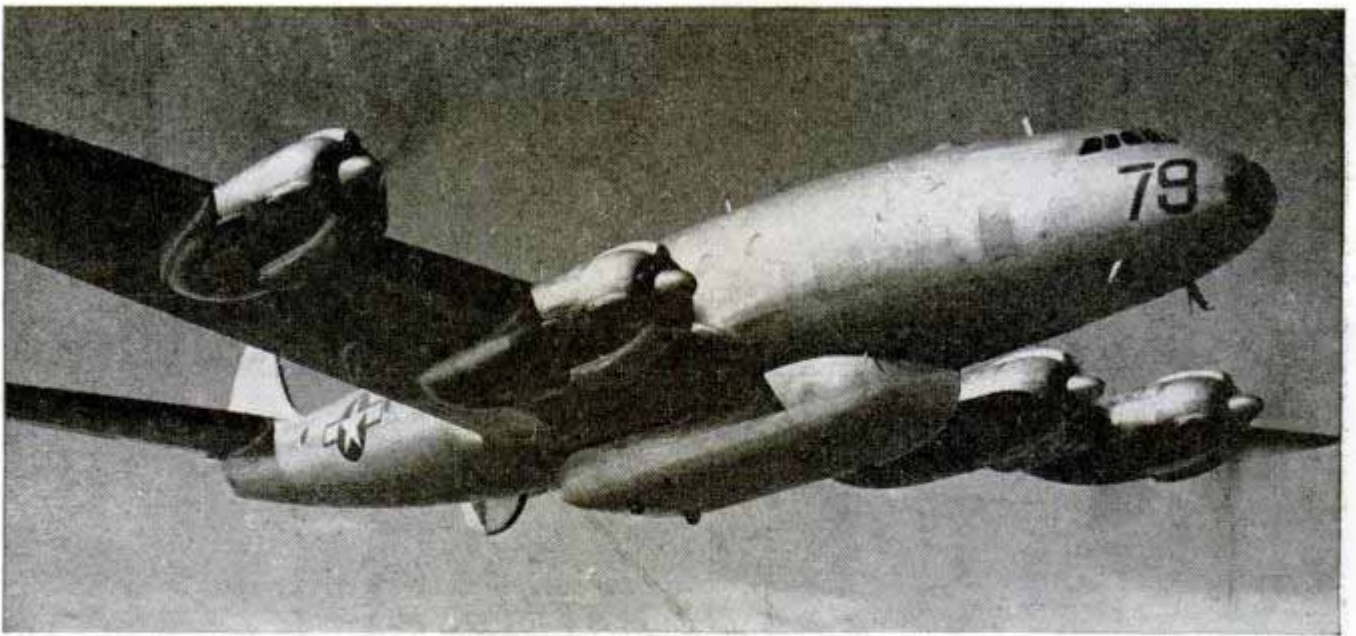
Satisfied that I had worked out a grip incorporating maximum efficiency, I looked next to my method of standing up to the ball for a wood shot.

I got my best results when assuming a stance (position) like that shown in photo 1, page 84. The distance between my feet corresponds closely to the width of my shoulders. The toes are pointing outward.

Your feet are the foundation from which you swing. Without benefit of surveyor's instruments you must learn to "line yourself up" accurately. Otherwise you cannot possibly make the ball go where you want it to.

The favorite device in getting properly situated to swing is the "line of flight"—an imag-

(Continued to page 244)



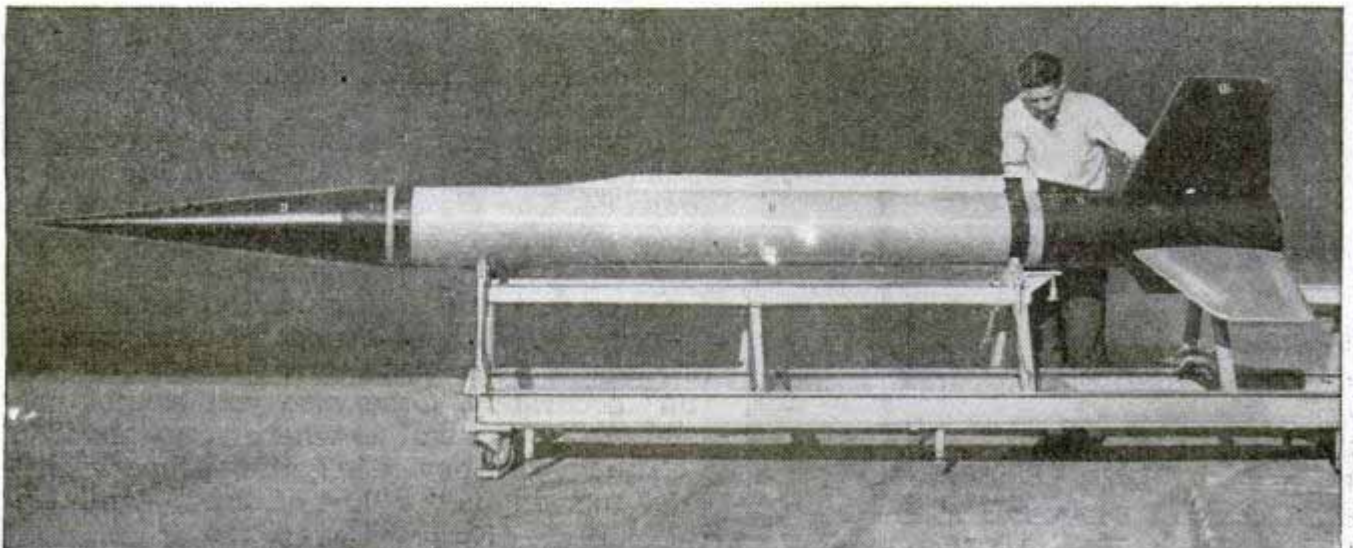
Cargo "Pouch" Holds 4 Tons

Payload of Constellation air liners is increased four tons with a detachable cargo container fitted snugly under the fuselage. The container, or Speedpak, can be removed or attached in two minutes. It is lowered for loading by a built-in electric hoist. The unit reduces cruising speed by only 10 miles an hour.

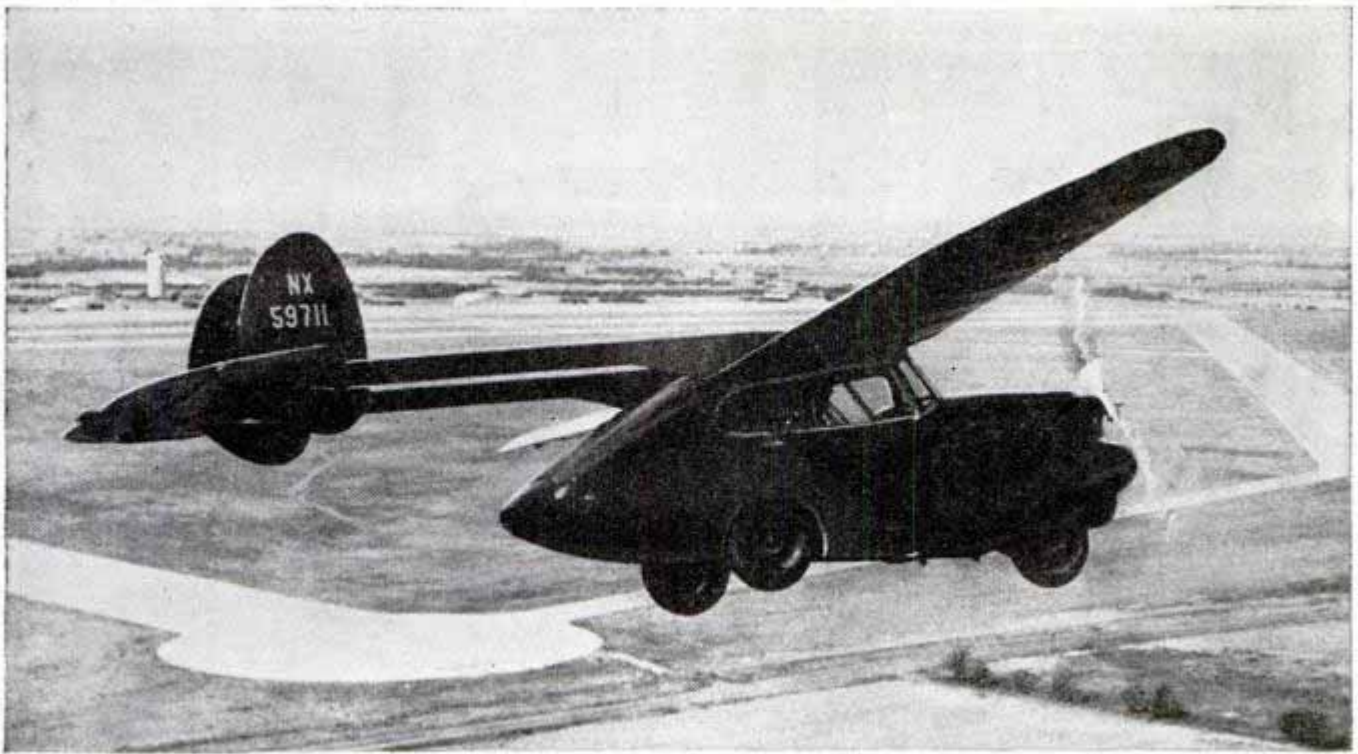
Two-Minute Blast From Jet Lifts Weather Forecast Rocket 43½ Miles

Scientists have pushed back weather frontiers by hurling a 1000-pound rocket 43½ miles into outer space. At the peak of the rocket's climb, a parachute opens and allows it to return gently to earth. Automatic weather instruments, similar to those which have been carried about 25 miles up by radio-sonde balloons, send out signals

giving temperatures, wind velocities and other important data. The needle-nosed rocket is 16 feet long, 12 inches in diameter and is made of steel, aluminum and magnesium. Its liquid fuel is said to be exhausted in two minutes. The rocket was developed by the California Institute of Technology and built by Douglas Aircraft.



Flying Automobile Sheds Wings in Five Minutes



Small enough to park in the family garage, a combination two-place automobile and airplane is known as the Roadable. It is an experimental craft using the auto's rear-wheel drive along with the propeller's power for speedier takeoff as an airplane. Once airborne, the gears driving the rear wheels are disengaged. The car-plane has all the conventional automobile controls and the steering wheel operates the ailerons and elevator when in the air. The 30-foot wing, tail and tail boom are in one section and, with the propeller, can be removed in about five minutes. Driven both in the air and on the ground by a 130-horsepower air-cooled six-cylinder engine, the plane cruises at 110 miles an hour and has a range of more than



600 miles. It has three wheels and weighs 1800 pounds. Southern Aircraft, the developer, announced it has no intention of marketing the plane in its present form.

Millionth-of-an-Inch Measurements Made With Varicolored Lights

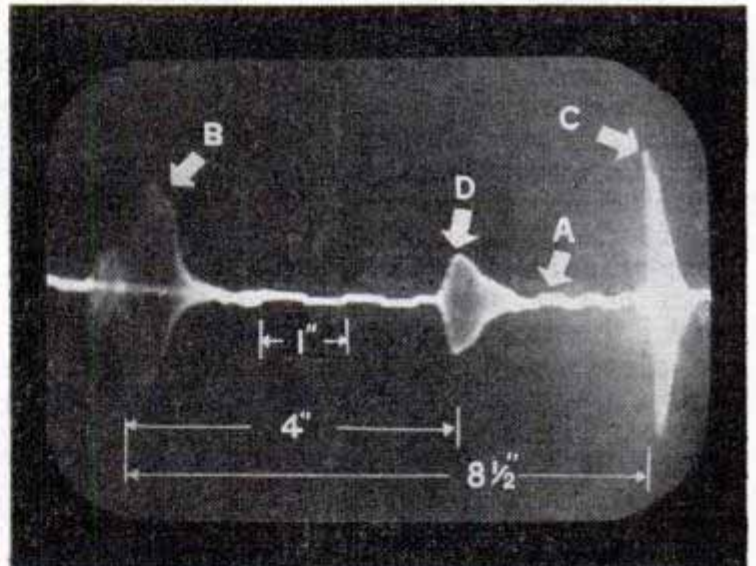
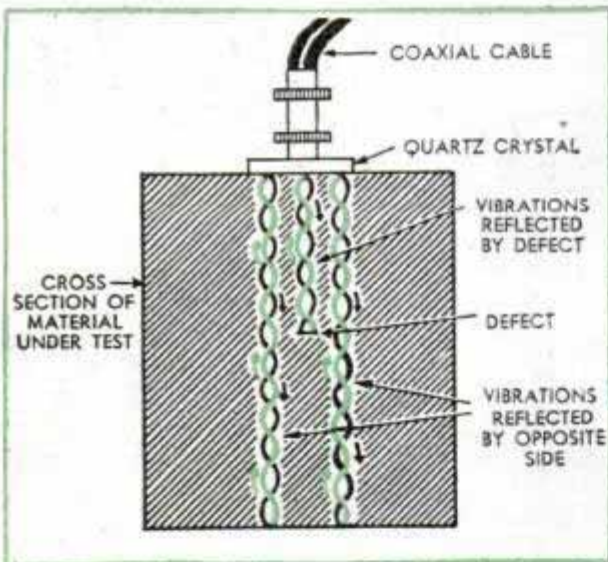
Particles of matter as small as two millionths of an inch can be measured by a new method that is both rapid and accurate. The tiny particles, too minute to be seen with an optical microscope, are suspended in a liquid. Light of various colors is passed through the liquid. The amount of light of each color that emerges is meas-

ured, as particles of different sizes transmit colors in different degrees. The average size of the particles is computed from this data. Proportionate amounts of various sized particles also can be found. The operation requires about two hours and can be accomplished by a nontechnical worker with relatively simple equipment.

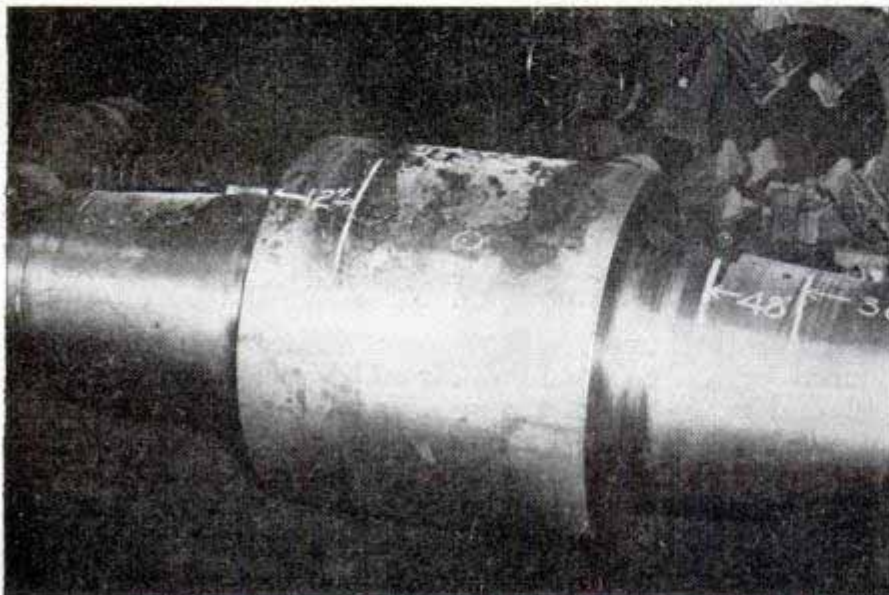
Eavesdropping Through 24



Reflectoscope operator on assembly line at left keeps sharp eye on screen where echo waves rise to a peak if defect is discovered in steel parts. Portable unit at right is used in railroad yard to test locomotive as protection against hidden flaws; the smallest crack is accurately detected and located by high-frequency sound waves



Drawing shows how high-frequency sound waves bounce back when they strike a defect recorded on screen at right as peak D. B is initial impulse, C is reflected vibration, and A is sweep line with inch mark waves. Below, defect indicated by arrow at right was found by reflectoscope 12 inches from shoulder of 14-foot steel part



Feet of STEEL!

By Bill Reiche

A GIANT steel billet, half again as long as an automobile, lies on blocks in the great mill that produced it. From the outside it looks perfect—its shape and surface texture are right—but nobody can swear that it is flawless, and this is what the industrial customer has to know.

Until recently there have been only two commonly accepted methods for testing metals, plastics, ceramics, glass and other commonly used materials: examination by taking a sample or bisecting the material, or X-ray examination. Both techniques have limitations and disadvantages.

Now science has provided a means of detecting most types of flaws—not by “looking” for them, but by “listening” for them. An ingenious instrument, no larger than a console radio, has been developed which sends high-frequency sound waves speeding through material under test and reports its findings instantaneously on a screen—as plain as the nose on Mickey Mouse.

This electronic eavesdropper, called a supersonic reflectoscope, operates on the principle that sound waves transmitted through an object will take a predictable time to penetrate to the opposite side and bounce back to the starting point—the time depending on frequency of the sound waves and character of the material.

The reflectoscope comprises a pulse generator and a coaxial cable with a quartz crystal searching unit at the end of it. The generator creates supersonic vibrations at frequencies of from one half million to five million per second (one half to five megacycles) which are transmitted through the cable to the crystal.

The crystal is placed against a relatively flat surface of the object under test, which has been covered with a light film of oil to improve sound transmission. Acting as a transmitter, the crystal sends out a burst of supersonic vibrations for a few millionths of a second. It then automatically becomes a receiver and transmits the reflected vibrations to a cathode-ray oscilloscope.

On the oscilloscope screen is a scale which has been adjusted to represent the distance from the near surface to the far surface of the test object. If the material is flawless, the scale will be marked by peaks at either end to indicate the transmitted sound waves and the bounce from the opposite side. But a flaw will reflect the vibrations back to the device sooner than the

(Continued to page 256)

Twin-Lens Reflex Camera Has Built-In Flash



Those who've been curious about new camera prospects in the medium price field will welcome a twin-lens reflex introduced by Eastman Kodak. It has seven shutter speeds from $\frac{1}{2}$ to $\frac{1}{200}$ second, built-in flash synchronization, and is equipped with “coated” taking lens which increases negative brilliance and color purity. Both taking and focusing lenses are fully color corrected and are f:3.5s of 80-mm. focal length. This easy-to-use camera makes $2\frac{1}{4}$ by $2\frac{1}{4}$ negatives. The camera is made of die-cast aluminum, finished in semigloss black lacquer and chrome. It makes 12 negatives on eight-exposure No. 620 Kodak film or nine negatives on six-exposure Kodacolor film.

TNT “Kick” Made From Air

Nitric oxide, an essential chemical in the production of fertilizers and explosives, can be made by a new method so simple and inexpensive it promises to replace all methods formerly used. Nitric oxide is made by chemically combining nitrogen and oxygen contained in air. To do this, air must be heated to a high temperature to combine the elements, then cooled almost instantaneously to keep them from dividing again. In the new process, air is preheated in a pebble bed, passed through an extremely hot gas-fired furnace, then quickly chilled in a second pebble bed. This second bed stores the heat that is released, in cooling, for preheating air when the process is reversed. The advantage of the process is that little of the heat used to combine the elements is lost in the cooling. It was developed by Prof. Farrington Daniels and William G. Hendrickson of the University of Wisconsin.

By Lieut. Comdr. J. Stewart Hunter, USNR
and Lieut. Max Hodge, USNR

ON a blustery November afternoon in 1910, Eugene Ely made the first flight from a ship, taking off from a specially constructed platform on the forecastle of the USS Birmingham at Hampton Roads, Va.

"Wonderful!" exclaimed a high Navy official, but added cautiously: "What good is it to fling flying machines off a ship in the middle of the ocean if the planes can't land on the ship?"

As a reply to that question, the same Eugene Ely announced that he would attempt to land a plane aboard ship. Another platform, longer than the one on the Birmingham, was erected on top of the after turret of the battleship USS Pennsylvania in San Francisco Bay. The sides of the platform had fitted guard rails, a huge canvas screen was erected at the forward end and canvas nets were stretched along the sides; still, after a conference was held, it was generally agreed that the provisions for stopping the airplane were insufficient. The plane would certainly take more than the 120-foot platform to come to a complete stop.

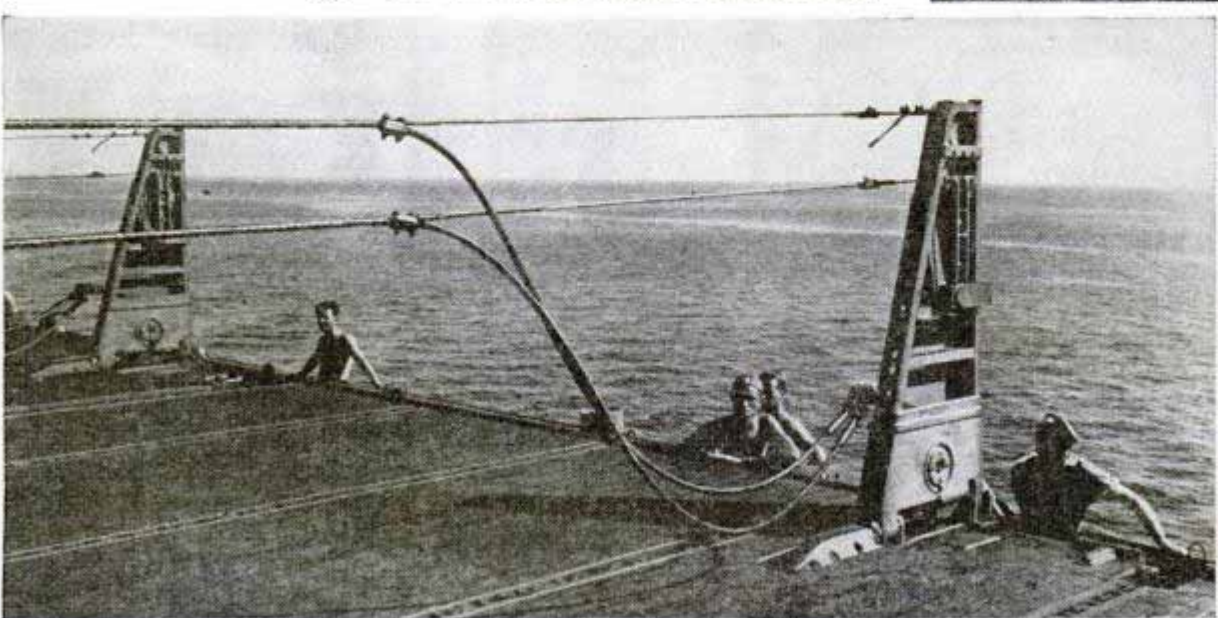
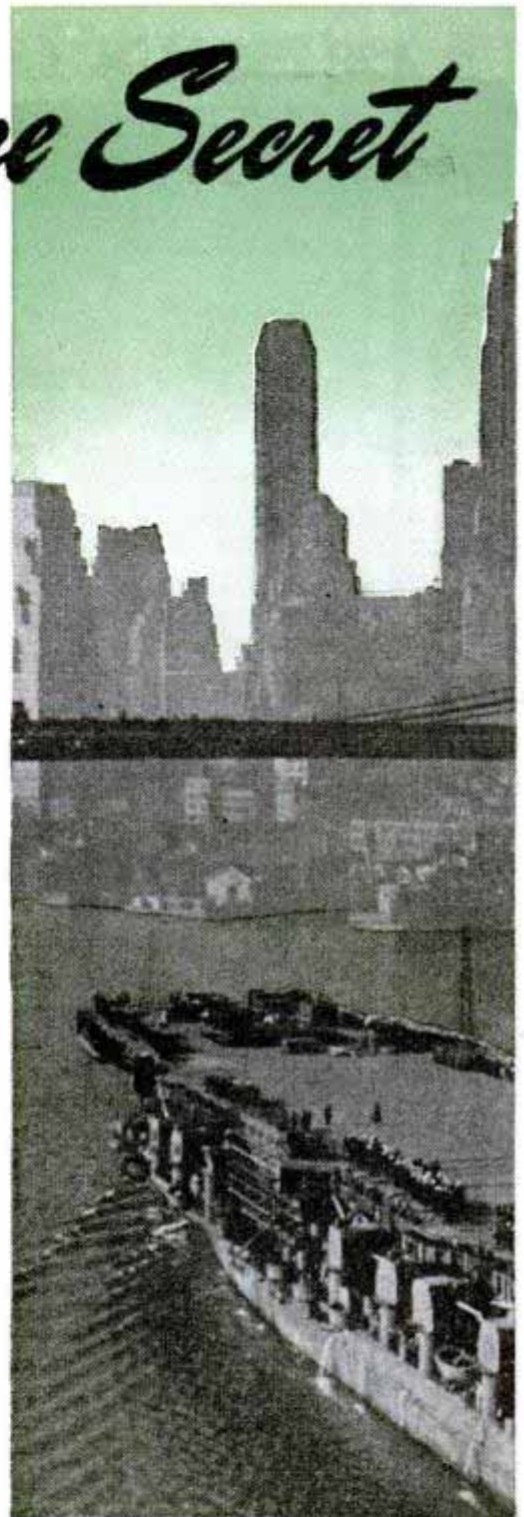
"If we could reach out and grab it," someone suggested—and an idea was born. A grab hook! That was the solution. But the plane couldn't be stopped too abruptly or it would break in two pieces. How about using a series of sandbags which would progressively add resistance to the plane's forward movement? This idea had been used successfully to stop racing automobiles.

Twenty-two carefully weighed 50-pound sandbags were lined up along each side of the platform at three-foot intervals. Manila lines were stretched taut across the platform, and to each end of every line was attached a sandbag. The lines were suspended a foot above the deck for the three steel hooks that were fitted to the tail of the plane to grab.

At a speed of 39 miles an hour, Ely landed on the platform, missing the first 10 lines but catching the 11th. Each yard of forward movement brought 100 pounds more drag until finally the thousand-pound plane puffed to a com-

The 45,000-ton aircraft carrier, Franklin D. Roosevelt, heads for Upper New York Bay. Below, cables held by stanchions at sides of deck catch plane if it misses arresting gear; stanchions are hinged to fold into deck

Prize Secret



of the Flattops

At last it can be told—the full story of the U. S. Navy's amazingly efficient arresting gear that stops planes cold when they hit the carrier deck



plete stop just as it picked up the 22nd—and last—line.

On that morning of January 18, 1911, was born the modern airplane carrier and the principle of the arresting gear. The principle has never changed—only refinements have been made. It started with sandbags and passed through weight lifting and friction drums to the present hydraulic type, the mechanics of which were one of the most guarded secrets of the war.

So many weapons—radar, the atom bomb, jet-propelled planes—have been tagged “secret weapons” that the term has been worn threadbare. But the present hydraulic type arresting gear in aircraft carrier warfare had a unique niche reserved for it in the top drawer of that confidential file.

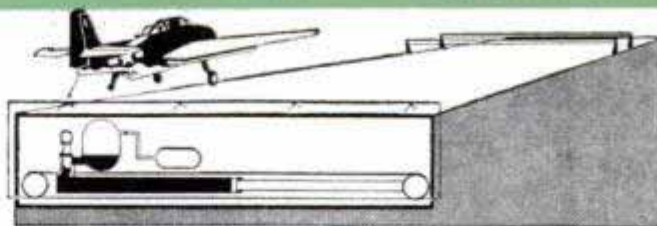
Unlike the atom bomb, for example, everyone—including the enemy, the 10-year-old neighbor boy and even yourself—was conscious of the fact that such a contraption as the arresting gear did exist. Planes landed on carrier tops and were stopped short. Everyone knew that the plane simply let out a hook that caught on a cable; yet all carrier photographs during the war had those cables blacked out and a big white-lettered “censored” stamp overprinted. Were we overcautious? Enemy secret files recently examined are proof that it was one of the smartest censorship rules of the war. Japanese carriers simply could not be operated with maximum efficiency because of their inadequate arresting gears.

They would have given their emperor with his palace tossed in for our Navy arresting gear plans!

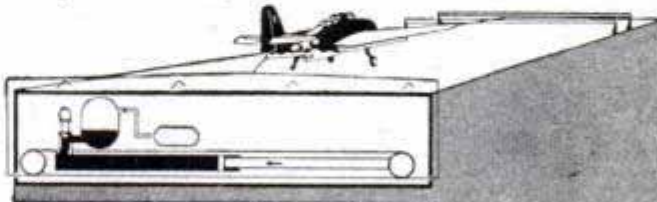
Without the arresting gear it would be impossible to operate modern aircraft carriers. Planes weighing upwards of 16,000 pounds that normally require a landing run of a quarter of a mile could not be taken aboard ships with their limited deck space unless those planes were stopped short by cables. At the present time the Navy has two types of arresting gear in use whose fundamental differences are in capacity only. Both are capable of stopping any carrier-type airplane for some years in the future.

Let's go aboard one of today's Essex-class carriers. You are standing on the flight deck watching a fighter plane several hundred yards away flying in the opposite direction of your own ship's course. Suddenly it turns toward the ship, approaching slightly from the rear or “fantail.” Once it is directly behind the ship it makes another 90-degree turn

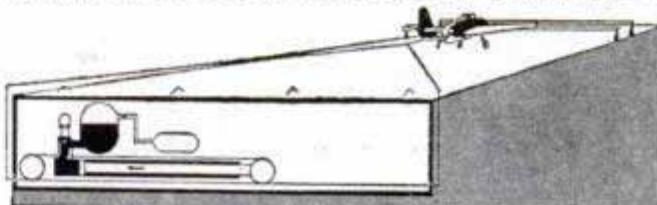
LANDING SEQUENCE



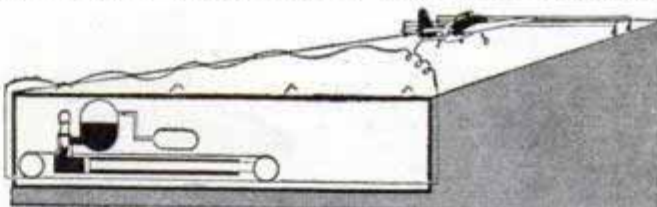
With deck pendants and barrier cables raised and landing area clear, the carrier is ready to receive the plane, coming in with the arresting hook down



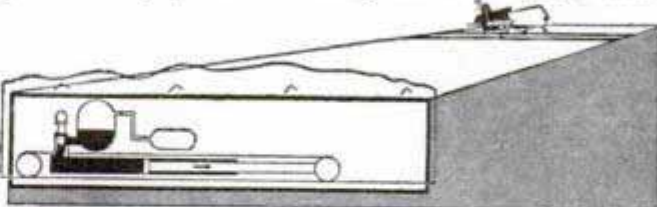
The plane's arresting hook engages the cross-deck pendant, pulling it forward, while purchase cable is being pulled out from the deck edge pulley wheels



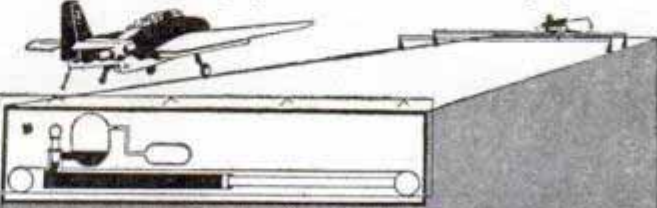
As plane travels, purchase cable is pulled out and engine ram forced into engine cylinder, displacing hydraulic fluid through control valve into the tank. This fluid metering process through control valve slows down the pulling out of the purchase cable



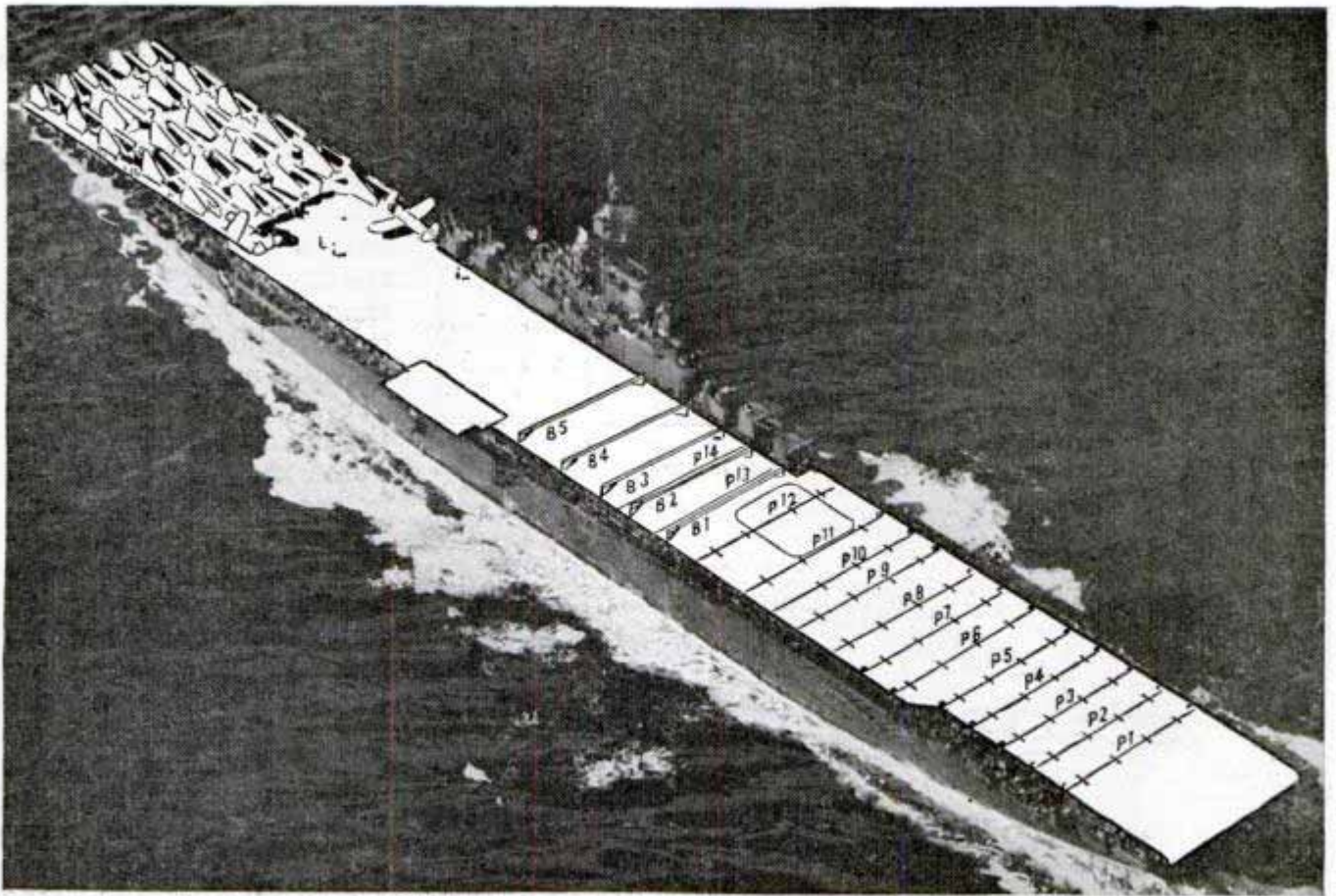
The restraining action halts the plane and on full stoppage the control valve closes, preventing the plane being pulled aft along the deck by pendant



The plane moves ahead over the downed barriers or is lowered to hangar deck. Fluid from tank flows to cylinder, returning pendant to its ready position



With plane No. 1 out of the way, barriers reraised, landing area clear and all arresting engines once more at battery, carrier is ready for plane No. 2

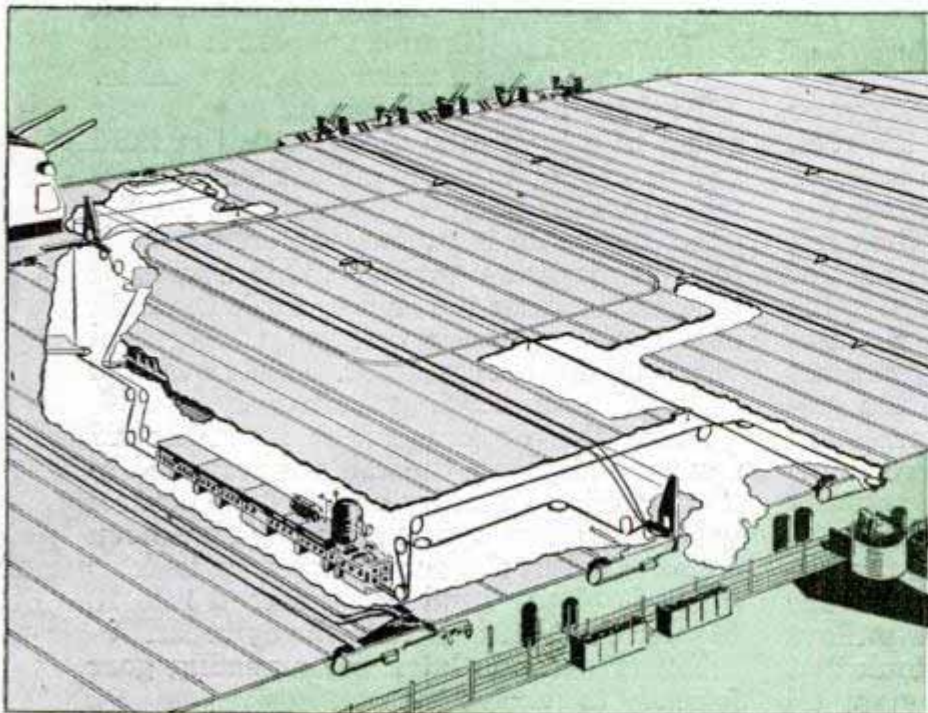


Arresting deck pendants and barriers on an Essex-class carrier are numbered for station assignments

and you see that it is now flying the same course you are making and is settling down to make a landing. The approach to the flight deck is almost identical to an approach made for a normal landing at your local airport.

Look at the stern of the flight deck. Stretched across the deck at 20-foot intervals are 12 single cables held about five inches above the deck itself by small inverted V-shape supports. These supports

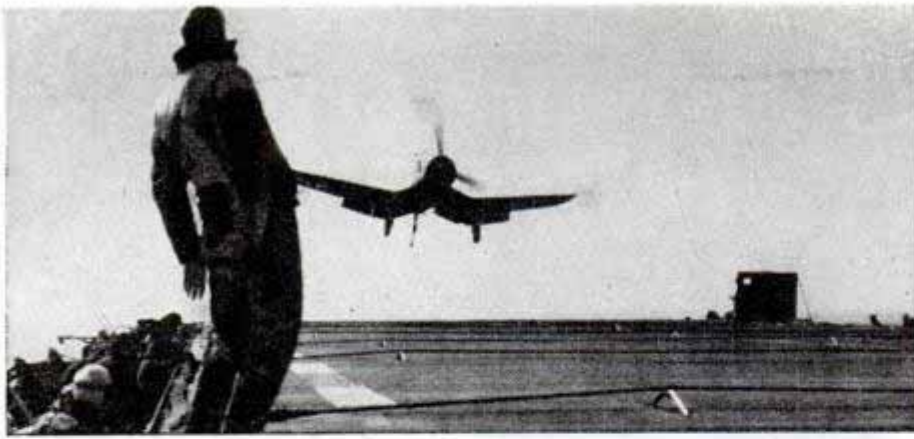
Machinery below deck controls stanchion cables and pendants



are known as yielding elements or deck pendant supports while the cables themselves are the deck pendants. In such a position, these cables can easily be caught by the arresting hook—a simple, solid steel hook—which trails from the tail of the airplane during the landing approach.

But just in case that landing hook doesn't catch—if through pilot error, mechanical failure or battle damage the plane threatens to come plowing into other planes that may be parked in the forward area of the deck—five "fences" five feet high, supported by stanchions on either side of the deck, are provided as protection. These barriers, each consisting of two cables, stop the plane in much the same way as the deck pendants except that they engage the plane itself.

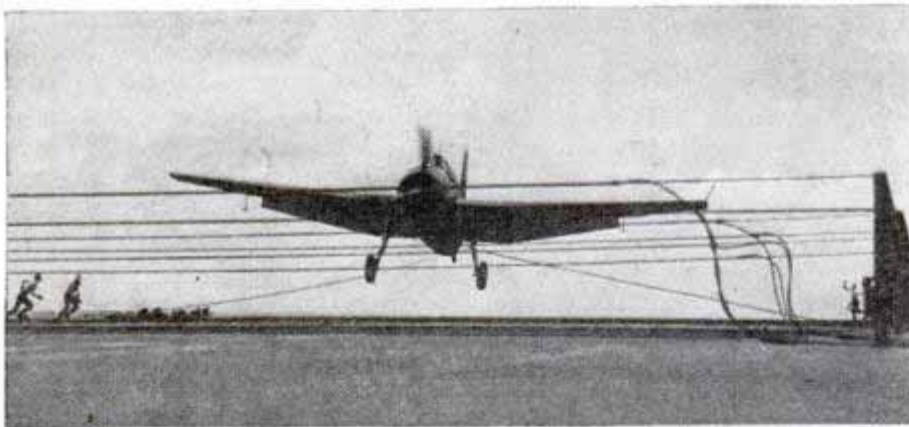
The landing plane slowly settles to within a few feet of the deck. Suddenly the hook catches and the cable or deck pendant seems to be stretching much like a rubber band. Actually what is happening can best be described by comparing the operation to a fishing rod. When the hook catches a fish, the weight of the fish pulls more line from the reel. The way you keep the line from completely unrolling from the



With flaps down and hook extended, plane drops toward deck; note cables



An F6F-3 is about to hook arresting gear cable five inches above deck



Double cable barriers will hold back fighter should deck pendants fail

reel is to exert gradual pressure with your fingers, thus slowing the speed of the reel. An arresting gear works the same way.

However, the giant finger that exerts the pressure is not on the flight deck. The deck apparatus is actually a very small part of the machinery that goes to make up this complex hydraulic system. To see the majority of the arresting machinery you must go down under the flight deck to the gallery deck where you will find the arresting engine, the control valve and the accumulator. This is the equipment that actually does the work of stopping the airplane.

Here are the heart and brains of the hydraulic-type arresting gear. What you see are long steel girders, with steel pulleys and cables, an engine and a steel tank that appears to be a miniature of a giant oil

storage tank. One of these arrangements is never connected to more than two deck pendants or one barrier cable and one deck pendant, which, in effect, results in a number of self-contained arresting systems rather than one system for all cables and barriers. This permits continuation of air operations even though some of the equipment may be damaged and out of commission. Thus on the modern carrier there are eight to 10 of these arresting engine units spaced at irregular intervals, usually near the port side along the gallery deck.

Here is what happens when a plane lands on the flight deck of a big Navy carrier:

The hook of the plane engages the deck pendant or cable, drawing the cable forward on the deck. The purchase cable, a continuation of the deck pendant, is pulled along with the deck pendant from the sheaves or pulley wheels at both edges of the deck. This purchase cable may be visualized as a continuous cable looped around a set of fixed and a set of movable pulleys in the arresting engine and with its ends coupled to a deck pendant or barrier cable.

To these fixed spools or pulley wheels is attached a hydraulic cylinder full of fluid and to a set of movable pulleys a ram is attached which fits into the cylinder. As the purchase cable is pulled out on the deck by the airplane through this series of wheels, it causes the ram to force the fluid out of the cylinder through the control valve to the accumulator. This slows the plane without stopping it abruptly.

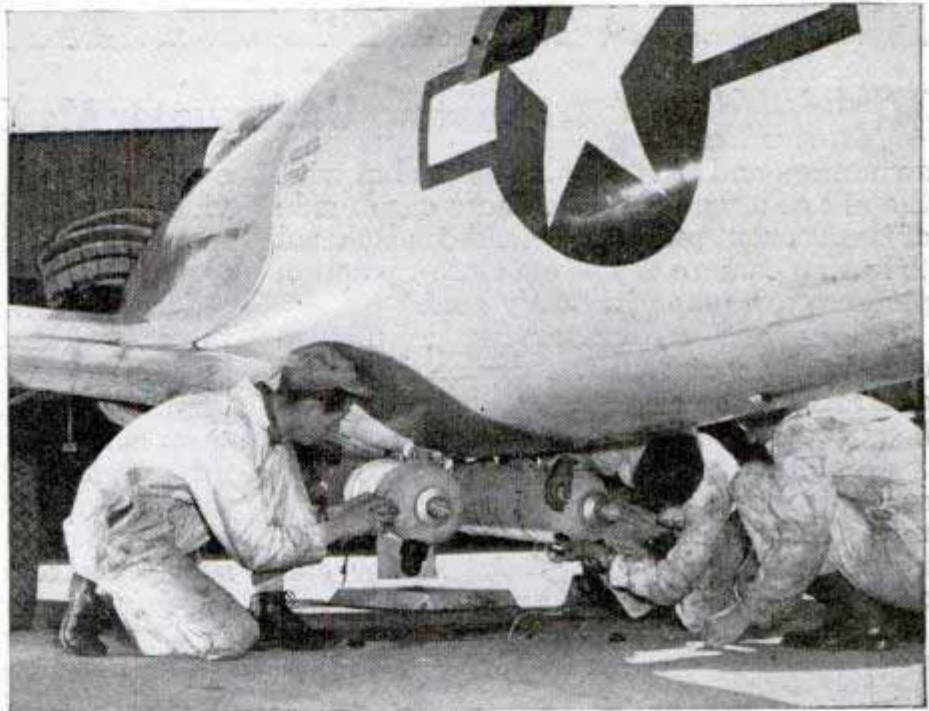
After the deck pendant is unhooked from the airplane, the cable is returned to its normal position by opening the control valve and allowing the air, which has been compressed in the accumulator or tank as a result of the fluid being forced into it, to push the fluid back into the cylinder.

Thirty seconds later the arresting gear is ready to receive the next plane.



Rocket-Assist Lifts P-80

Takeoff distances for the jet-propelled Lockheed P-80 have been halved by use of external rocket-assist units delivering a total of 2000 pounds of thrust for 12 to 15 seconds. In one test the plane was airborne at 1185 feet, about 40 percent of its normal requirement. The units make it possible for a fighter to use short emergency landing strips during combat operations. The two units, called JATO, are heavy steel tubes about eight inches in diameter and three feet long. They burn a solid rocket

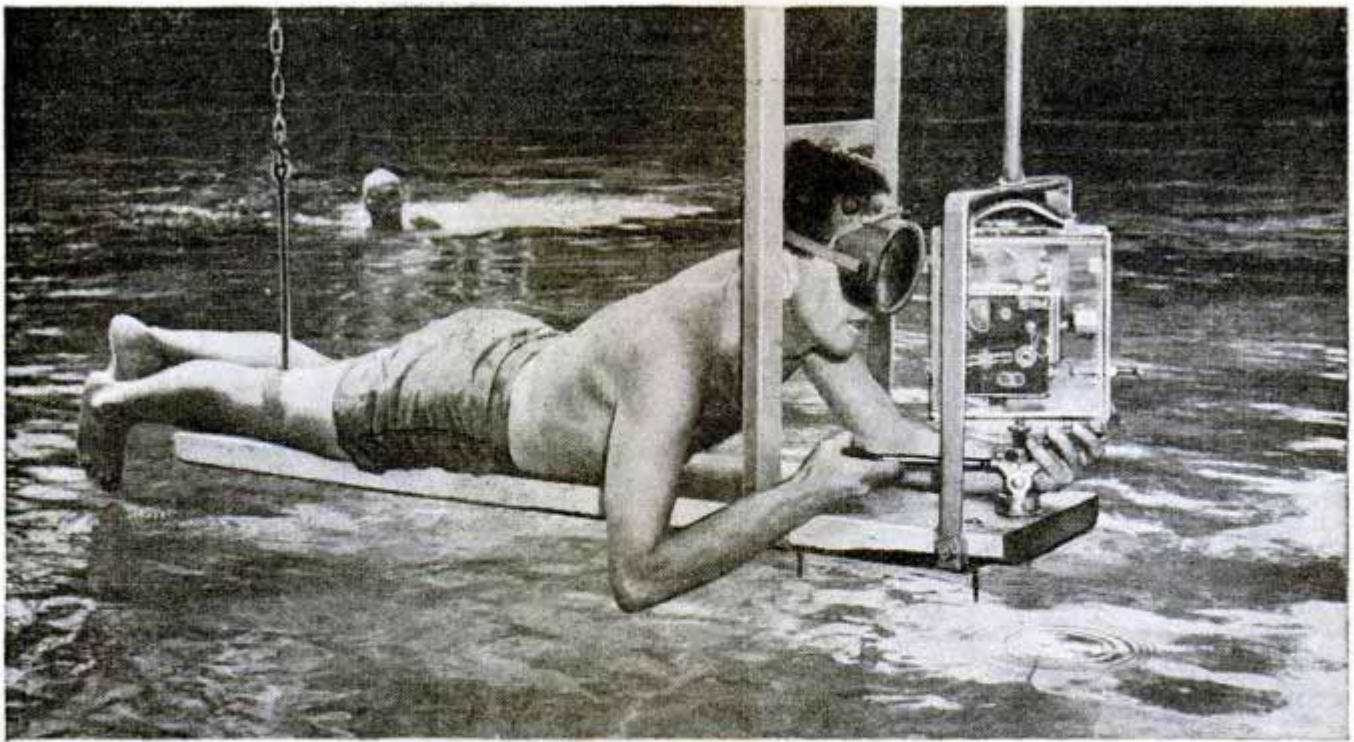


engine on the underside of the fuselage, the JATO units are electrically discharged by a gun trigger on the pilot's control stick.

Mine Ambulance Runs on Rails to Speed First Aid to Injured Men



Injured coal miners are insured a quick, safe and comfortable ride to the hospital in an electrically heated mine ambulance which has been put into operation at Piney Fork Mine in Ohio. The underground ambulance is mounted on rail wheels. It is equipped with first-aid supplies, medicine and a portable cot which can be rolled quickly into a regular ambulance at the mine entrance.



FISH-VIEW movies of underwater

Shooting Underwater Movies

swimmers and sea growth can be shot with the aid of a waterproof camera case made of transparent plastic. The case is also used to keep a camera dry when close-up action pictures are taken in heavy surf.

Ordinary 16-millimeter motion picture cameras will fit into the device. External controls on the case permit the camera to be started and stopped with ease.

Amateur underwater photographers use sea-dive masks to keep their eyes dry and thus give them normal vision while shooting their movies. The photographer can take short footage of film by diving beneath

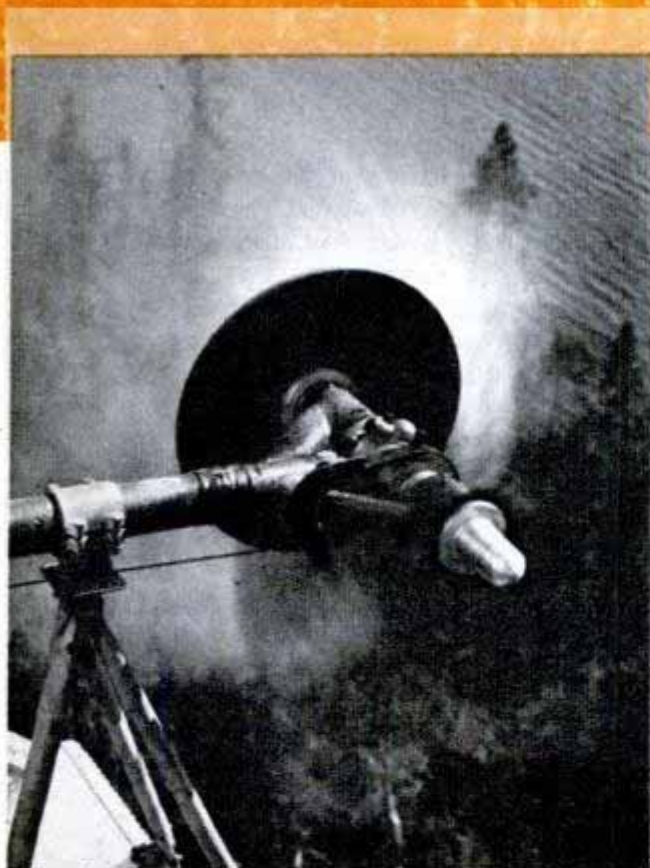
the surface and holding his breath. How-

ever, lightweight diving helmets that provide oxygen are available, enabling swimmers and photographers to remain underwater for half an hour or more.

Placed on a movable underwater stage, the camera and case aid swimming coaches by taking close-ups of a swimmer's action in the water. Natural color movies have been made of swimmers exploring the kelp forests along the coast of California. Photographers also have shot action sequences of swimmers using harpoons to catch small sharks and other fish, and have filmed "flying fish" views of paddle board races.



Do's and Don'ts of DDT



DDT is sprayed from a plane (top) to kill insects threatening Canada's forests. Above, close-up of sprayer

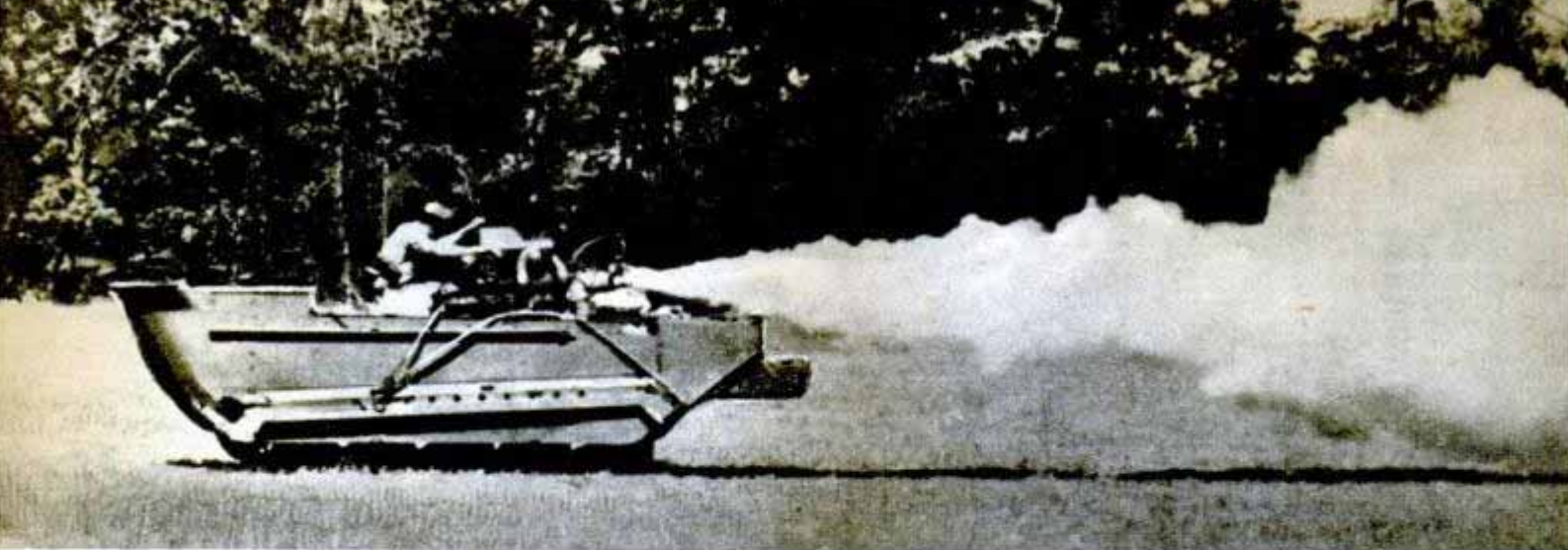
By John L. Kent

PUBLICITY given to DDT as an insecticide has created wide interest in its possible uses, and now that it is available for agricultural and civilian purposes, many inquiries regarding it are being received by the U. S. Department of Agriculture.

The Bureau of Entomology and Plant Quarantine, in cooperation with various State Agricultural Experiment Stations and other agencies, has conducted many tests with DDT during the past three years. The results of many of the preliminary small-scale experiments are already available, but the outcome of more extensive tests being conducted are still to be determined. Information at hand indicates that for certain purposes and under certain conditions DDT is effective and safe to use at the present time.

DDT is suitable for use as an insecticide only when properly prepared. It is not easy to formulate an insecticidal dust from technical grade DDT. However, many manufacturers are equipped to grind it with talcs, clays, sulphur or other materials into fine powders that contain DDT in various strengths. Pure DDT is a white, crystalline, synthetic substance resulting from the reaction between monochlorobenzene and chloral hydrate or chloral. The name DDT was officially adopted by the United States

- ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★
- ★ **DDT is wonderful. It will kill lots of insects.** ★
- ★ **But be careful how you use the poison—** ★
- ★ **it can't tell a cockroach from a honeybee** ★
- ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★



New York State Science Service photo

Mounted on an Army Weasel, a Todd insecticidal applicator shoots out DDT fog over Long Island marshes

and British armed forces to stand for the initial letters of its chemical name—dichloro-diphenyl-trichloroethane.

DDT is not a new discovery. It is more than 70 years old, and its recent "discovery" should be more appropriately called a rediscovery. The story of DDT goes back to 1874 when a chemistry student, Othmar Zeidler, attending the University of Strassburg, included in his thesis an account of a chemical compound he had discovered in routine experiments. The thesis was duly read and filed, and Zeidler, having received his diploma, went through life in comparative obscurity.

In 1939, 65 years after Zeidler first made the tiny white crystals in the university laboratory, a Swiss scientist, Dr. Paul Muller, began experimenting with dichloro-diphenyl-trichloroethane. He is generally credited with discovering its insecticidal use. He was issued patents on the compound by Great Britain, and these were assigned to his employer, the J. R. Geigy Chemical Company. In October 1942 this company introduced the insecticide in the United States under a trade name. Tests carried out at the Orlando, Fla., laboratory of the Bureau of Entomology and Plant Quarantine proved it to be sure death to body lice—just the sort of insecticide the armed forces needed. It was also found to be deadly to bedbugs, flies and fleas.

In the meantime, experiments showed that DDT was effective against malaria-carrying mosquitoes. Malaria was taking a heavy toll of our men in the Pacific and louse-borne typhus was threatening them in the European theater. All production of DDT therefore was immediately channeled to the armed forces.

DDT insecticides proved effective not only for killing the adult mosquito, but also for killing the larvae or "wrigglers" that hatch in swamps and other stagnant waters. By employing a large airplane and newly invented devices for distribution, it was possible to treat more than 500 acres

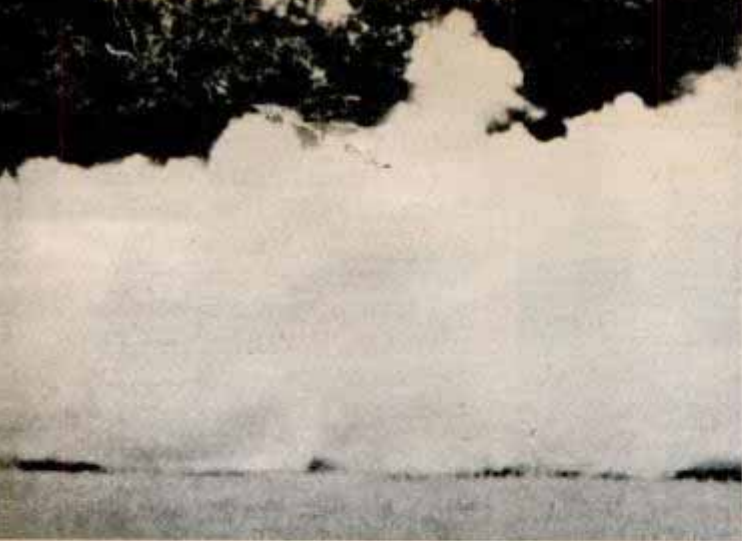
with 800 gallons of DDT spray in 30 minutes.

The successes scored by DDT against disease-carrying insects have been described graphically by newspapers and magazines. By the middle of 1944, the Department of Agriculture had received so many requests for supplies of DDT that officials were forced repeatedly to inform the public that DDT was not available for civilian use, and while it appeared promising for future control of many insects, many of the experiments to test its effects on insects, plants and higher animals were still in preliminary stages. Even today, entomologists agree that although it is the most effective mosquito control agent yet known, it must be properly prepared and applied to give satisfactory results.

But under proper handling DDT is bound to be a great aid to mankind. For example, DDT saved a giant fir tree in Clatsop County, Oregon, from destruction by loopers, swarming caterpillars which constitute a serious threat to timber. Believed to be the biggest tree in the Pacific Northwest, this tree has a diameter of 15 feet and is thought to be at least 1000 years old. DDT killed hundreds of loopers clinging to it.

The Department of Agriculture is conducting widespread experiments on increased use of DDT to destroy insect pests that plague the nation's forests. One 75-acre tract in Grand Mesa National Forest





in Colorado is the target for "attack" by aerial spraying. One pest in particular that the government men are "gunning for" is the spruce budworm. This pest is extremely prevalent in Colorado's 15 national forests which cover more than 15,000,000 acres, according to John W. Spencer, Rocky Mountain regional forester.

Canada, likewise, is experimenting with the use of DDT to fight budworms which attack forests. Both Canadian and American scientists are engaged in spraying 85,000 acres, aided by Royal Canadian Air Force planes and pilots.

DDT is used in aircraft for spraying over large areas to kill mosquitoes only when such use is found to be necessary and is directed by competent authorities. Improper application may upset the balance of nature by killing beneficial insects which aid the growth of trees and plant life. Also, there is the danger of destroying fish.

DDT acts both as a contact poison and a stomach poison. The toxic effect from either contact or ingestion is apparently exerted principally on the nervous system of the insect. Insects first display hyperactivity and tremors, followed by progressive paralysis of their locomotor appendages and death.

DDT has a great residual effect, and for

THE DON'TS OF DDT

DON'T use larger doses than specified in directions



DON'T use on cats and don't apply penetrating oil solution to any animal



DON'T use near fire; solution often contains kerosene



DON'T inhale DDT spray or powder; leave closed room immediately after spraying



DON'T use near food



DON'T leave oil solution on skin; wash off with soap



DON'T keep DDT within reach of children or pets



DON'T expect DDT to discriminate between a mosquito and a honey bee



several weeks or even a month after the original application in the form of a spray or powder, the deposit will kill insects which rest on or crawl over the treated areas. This prolonged action, while desirable from the point of view of insect control, introduces a possible hazard from residues left on plants.

DDT is also very workable—it may be used in water suspensions, solutions, emulsions, dusts and aerosols.

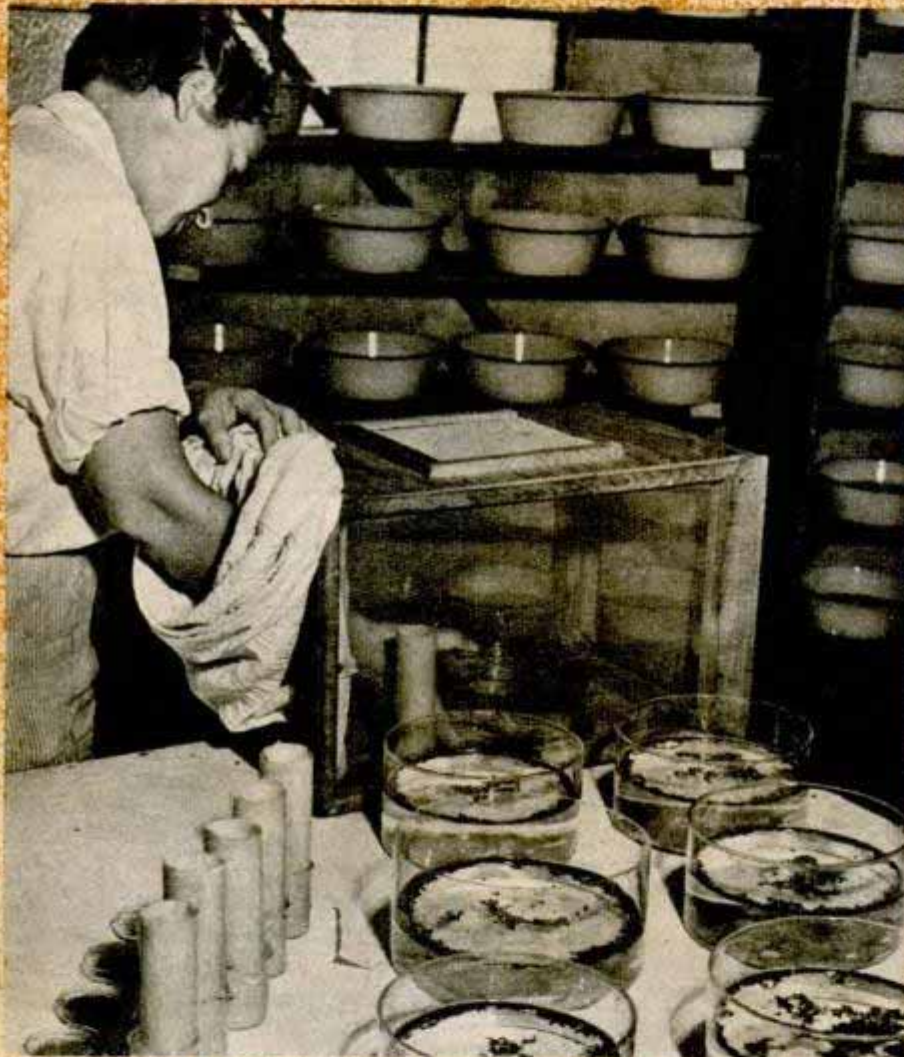
When used experimentally, DDT has been found promising for the control of several types of insects attacking cereal and forage crops. Corn borers, vetch bru-

DDT fog dispensers attached to trucks "de-bug" a weed-covered field next to Woodbine, N. J., hospital





Canadian Army chemist sprays liquid DDT insecticide into a spruce forest



Department of Agriculture entomologists raise mosquitoes with which to test DDT sprays. Cows are sprayed with DDT (below) to rid them of flies

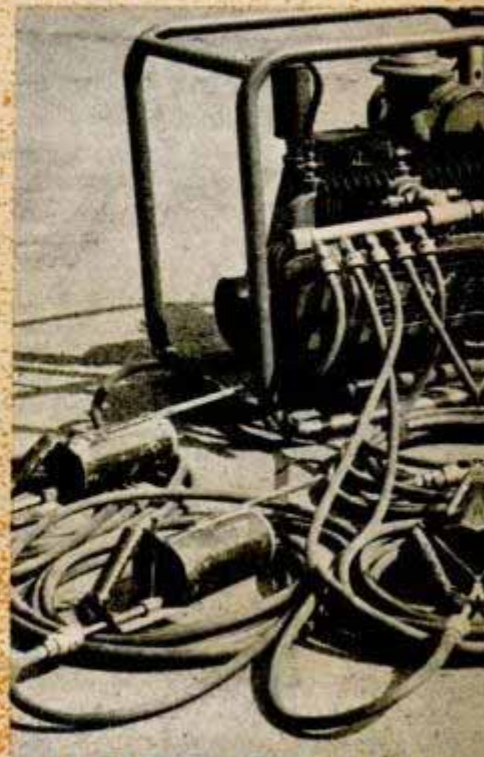


chids, white fringed beetles and velvetbean caterpillars become victims.

DDT has been found extremely effective against most of the common pests of stored seed, and its use for that purpose is recommended. It is best used in combination with a carrier dust to give it greater volume and insure a better distribution over the seed. A very effective combination is obtained by using magnesium oxide as the carrier dust. DDT alone does not repel insects, but magnesium oxide does. One half ounce of a three percent DDT dust per bushel of seed will give complete protection. Neither product has any adverse effects on germination, regardless of the moisture content of the seed.

Because of the poison hazard, the use of DDT is not recommended on stored grains or cereal products that are to be used for food by humans or animals.

Sprays, containing five percent or less of DDT dissolved in refined deodorized kerosene or in water suspension or emul-



sion, have been found very effective and are recommended for use on walls and woodwork of warehouses, flour mills and empty grain bins.

In one test at Corvallis, Ore., a ship bottom repelled barnacles for more than six months after being painted with a DDT mixture developed by Prof. R. E. Dimick of Oregon State College.

DDT has shown great promise in controlling insects affecting man's habitation and his person. Although conflicting reports have been received on its effectiveness against certain species of ants, cockroaches and spiders, it is potent against house flies, mosquitoes and bedbugs.

A five percent solution of DDT in odorless kerosene or a 2½ percent suspension made of DDT powder, a wetting agent and water may be applied as a spray to any surface where flies rest, such as walls, doors, screens and ceilings. These sprays are applied at the rate of two to four quarts per 1000 square feet. Flies die one to three hours after alighting on surfaces which received this treatment. The same method will kill mosquitoes. The material sprayed remains effective for two to six months.

The annoyance from sand flies in homes can be reduced by treating screens with a five percent DDT oil spray. The screens and wall or ceiling surfaces near lights may be sprayed or treated with a cloth. This treatment remains effective for several weeks.

For cockroaches a 10 percent DDT powder is about as good as sodium fluoride for treating their hiding places. It lasts longer than sodium fluoride, but, as in the case of

that material, about one week elapses before there is a marked reduction in the number of roaches present. A five percent spray containing DDT may be used on the underside of table tops, drawers, refrigerators and shelving as additional treatment.

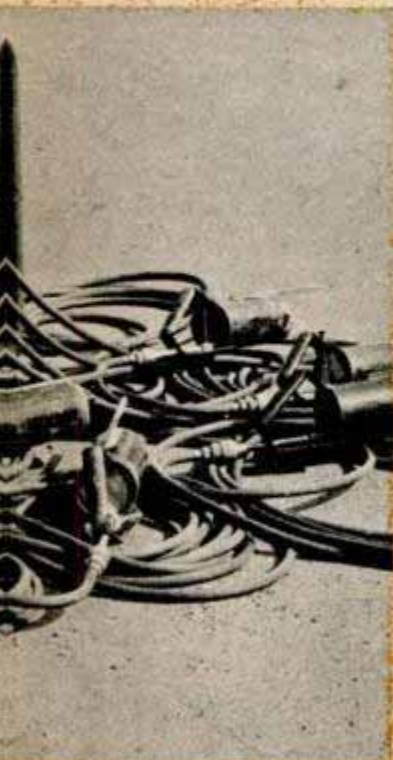
To get rid of ants in buildings, it is recommended that five percent DDT kerosene be sprayed behind and beneath baseboards, behind window sills and frames, to all table legs and chair legs, about sinks in the kitchen and bathroom and to any cracks and crevices leading to the outside of the building. Not all types of ants will be destroyed but a single application of the spray will kill most of them.

DDT is the answer to the bedbug problem. When properly applied as a five percent spray or as a 10 percent powder, beds and mattresses will remain free of bedbugs for six months or more.

House pets, too, benefit from this new insecticide, as a few applications of DDT will rid a home of such pests as brown dog ticks and fleas. For fleas in houses, 10 percent powder may be applied to the sleeping places of dogs and cats. It may be used beneath rugs and on floors visited by flea-infested animals. One half pound will treat 1000 square feet. A five percent DDT kerosene spray may be used on similar places as well as on the top surface of rugs. Use one quart to 250 square feet and apply as a thick spray; fine sprays will drift away.

DDT is a marvelous discovery. It does all that scientists say it will do. But DDT will not work its magic in all the preparations now being sold. Some preparations

Delousing machine (left) developed by the Quartermaster Corps dusts 600 persons per hour with DDT powder. Right, an American soldier delouses former slave laborers and political prisoners freed from a German camp





H. D. Hudson Mfg. Co. photo 587 E. TULLINIS ST
 DDT is applied to chair with electrical sprayer. Below, nurse at Arlington, Va., sprays a hospital bed



Westinghouse photo

DDT bug bombs developed for the war are now avail-

presumably containing this highly effective insecticide are actually far too dilute. Public demand, fanned by exaggerated claims, misleading advertising and incomplete labels, has skyrocketed sales.

The Insecticide Division of the Department of Agriculture is preparing to crack down on those who violate the Insecticide Act of 1910 by making false statements on labels. To avoid making statements which may later have to be changed, or which may result in legal action, manufacturers have been urged to submit copies of their proposed labels, together with formulas of the preparation, to the Department of Agriculture for approval.

On the other hand, users are cautioned by the Bureau of Entomology and Plant Quarantine that insecticides containing this new material will be suited to some of their needs, but not to all of them. Scientists at the bureau and at other private and government agencies are still occupied in mastering it. Used indiscriminately, DDT is a poison. Here are some precautions:

1. Do not use larger dosage than called for by the directions.
2. Do not use on cats and do not apply oil solutions to any animals. Also, DDT is definitely poisonous to warm-blooded ani-

ST CHARLES HILL



able for civilian use to combat flies, lice and roaches

imals when a considerable quantity is eaten.

3. Do not use near open flame or fire, as kerosene or "coal oil" is often used to carry DDT in solution. For the same reason, do not smoke while spraying.

4. Do not inhale considerable amounts of either solution or powder containing DDT. Therefore, do not remain in a closed room immediately after spraying.

5. Do not spray or use powders on or near foods.

6. Do not leave oil solutions on skin. In oil solutions or emulsions DDT is readily absorbed through the skin. In case of accidental spillage, wash hands or other parts of body immediately with soap and water.

When used in the home, keep DDT out of reach of children and away from household pets.

When used on the farm remember that there is the danger of destroying desirable insects, such as honeybees and insect-feeding birds. It is highly toxic to fish.

In many ways DDT preparations are superior to the older insecticides, but do not expect miracles. In fairness to yourself and to the product used, familiarize yourself with the particular spray or powder and find out how to use it and what results can be reasonably expected.



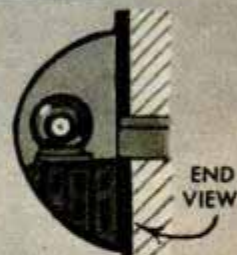
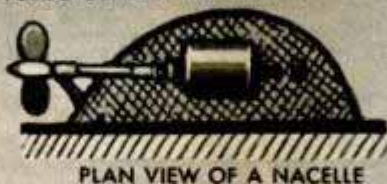
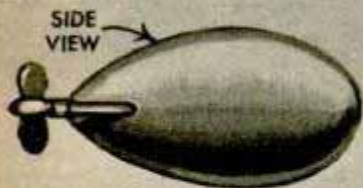
U. S. Dept. of Agriculture photos

Painting screens with DDT solution to kill flies and mosquitoes. Below, spraying DDT behind baseboards





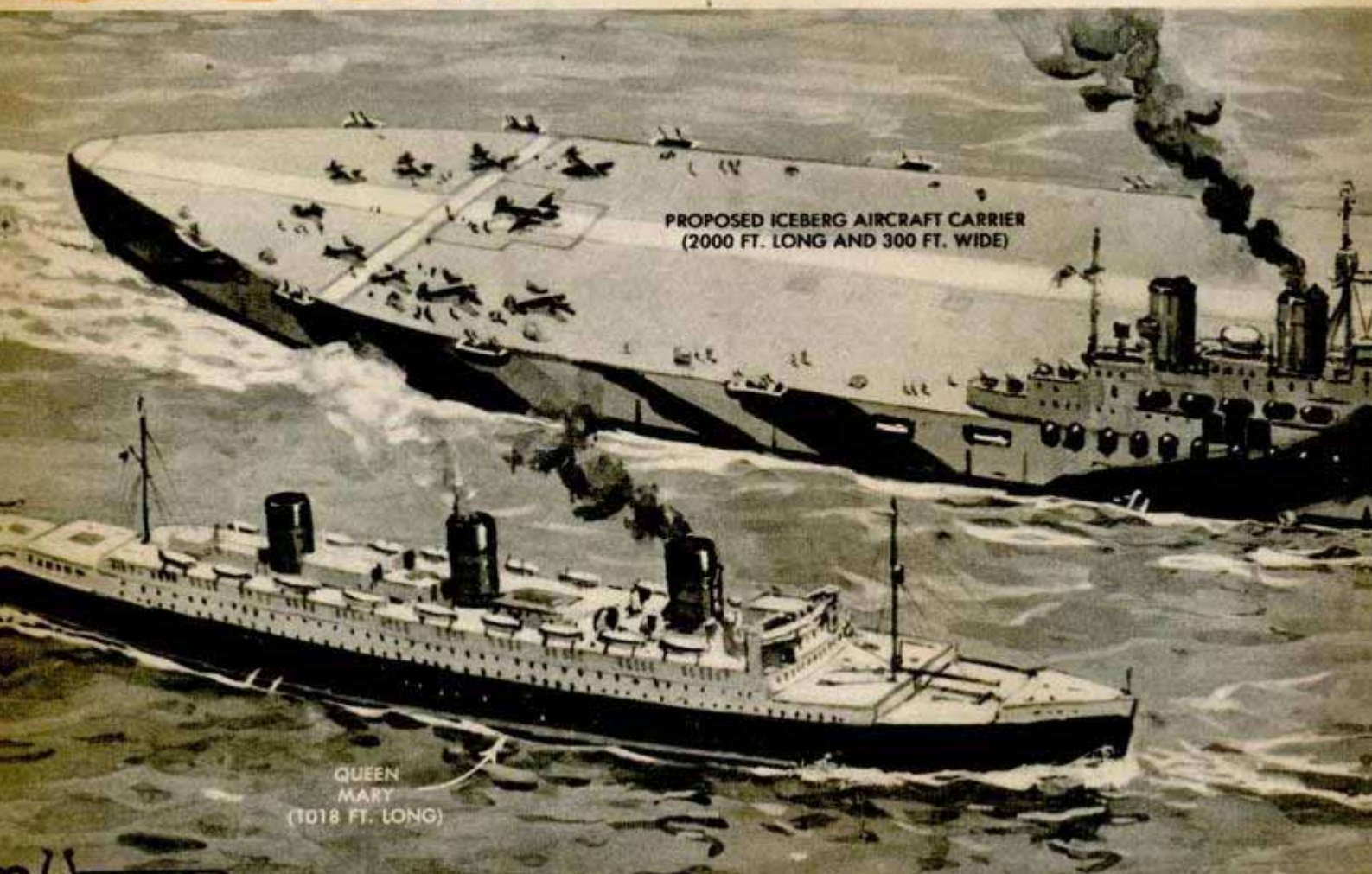
THIRTEEN MOTORS TO PORT AND STARBOARD, EACH RECEIVING POWER FROM A CENTRAL TURBO-GENERATING PLANT



ICE CUBE FLATTOP

Designed by British to Fight Subs

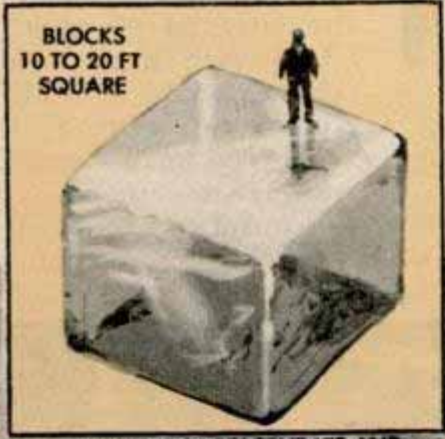
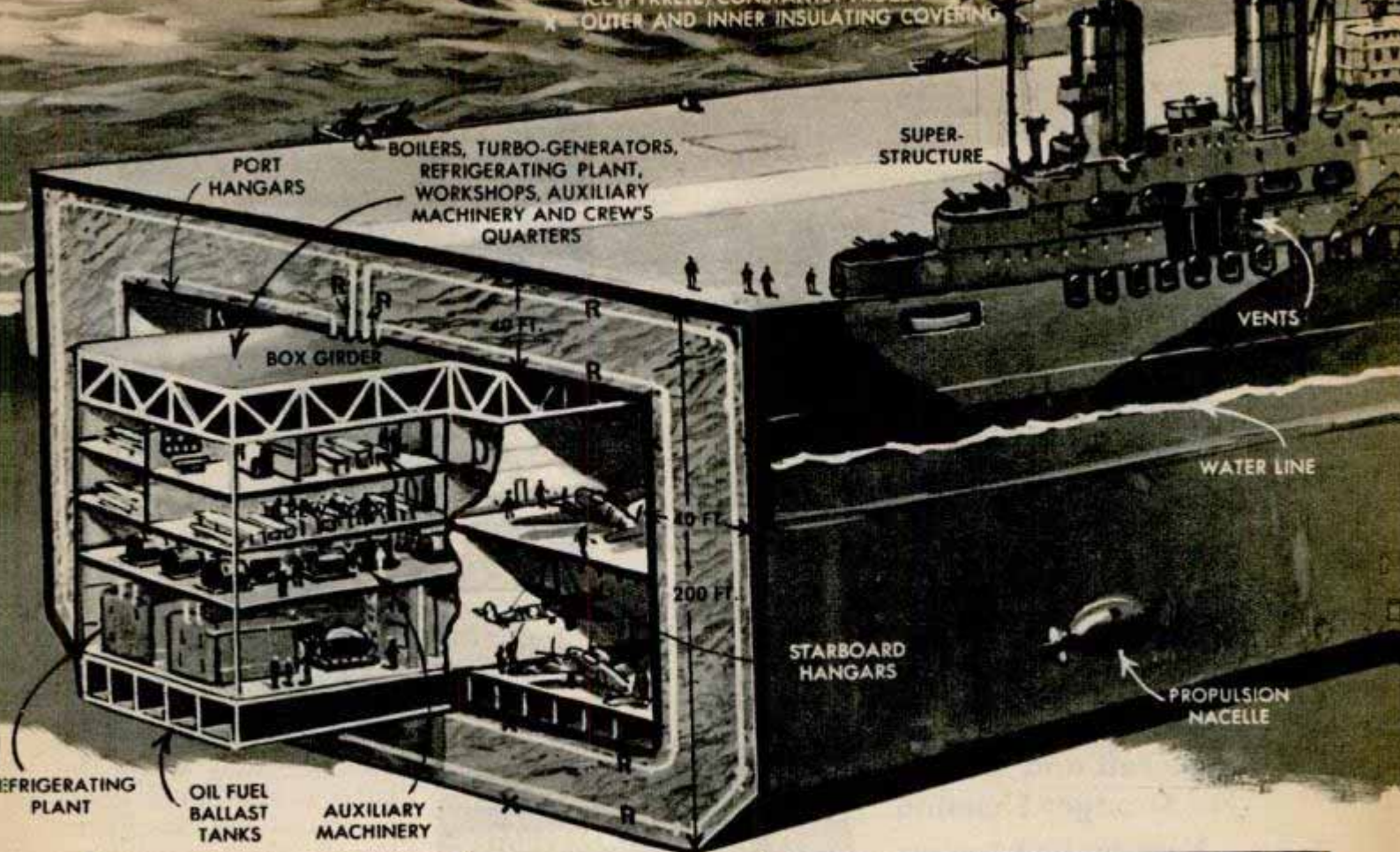
Habakkuk Project was the British designation for a 2,000,000-ton torpedoproof aircraft carrier to be built of blocks of reinforced ice. The iceberg carrier, more than a third of a mile in length, was designed to fight subs and to provide air cover for the invasion of Europe. Plans called for walls 40 feet thick, laced with refrigerating pipes and covered with insulating material. The ice blocks, dubbed Pykrete, were reinforced with 14 percent wood pulp because ice alone was too brittle. Thirteen nacelles on each side were to provide propulsion units with each propeller driven by an electric motor. A 1000-ton model was built on a Canadian lake. The project, sanctioned by Winston Churchill, was abandoned only after the war against the U-boats turned in the Allies' favor in 1943.



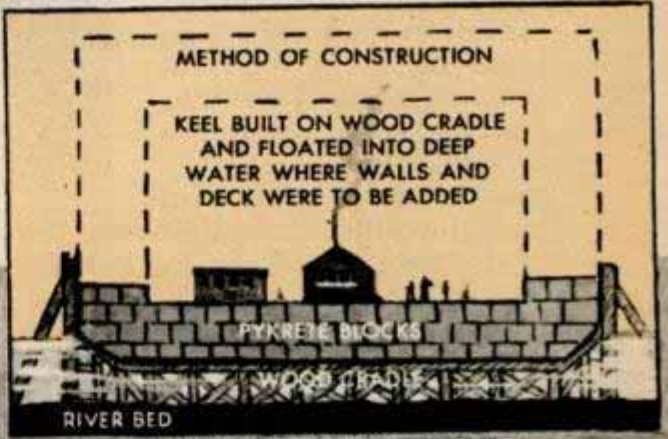
PROPOSED ICEBERG AIRCRAFT CARRIER
(2000 FT. LONG AND 300 FT. WIDE)

QUEEN
MARY
(1018 FT. LONG)

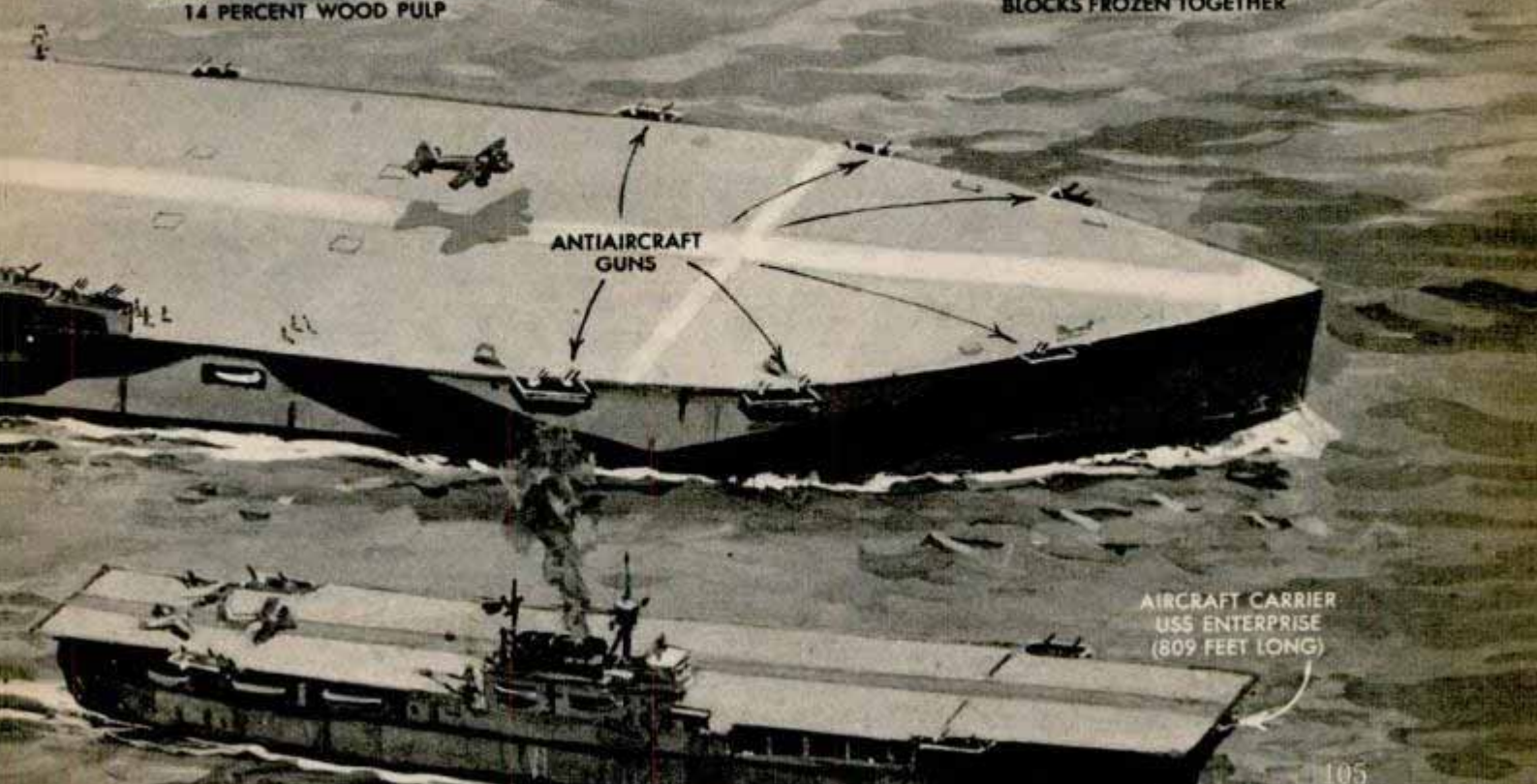
ICE WALLS
OUTER AND INNER INSULATING COVERING

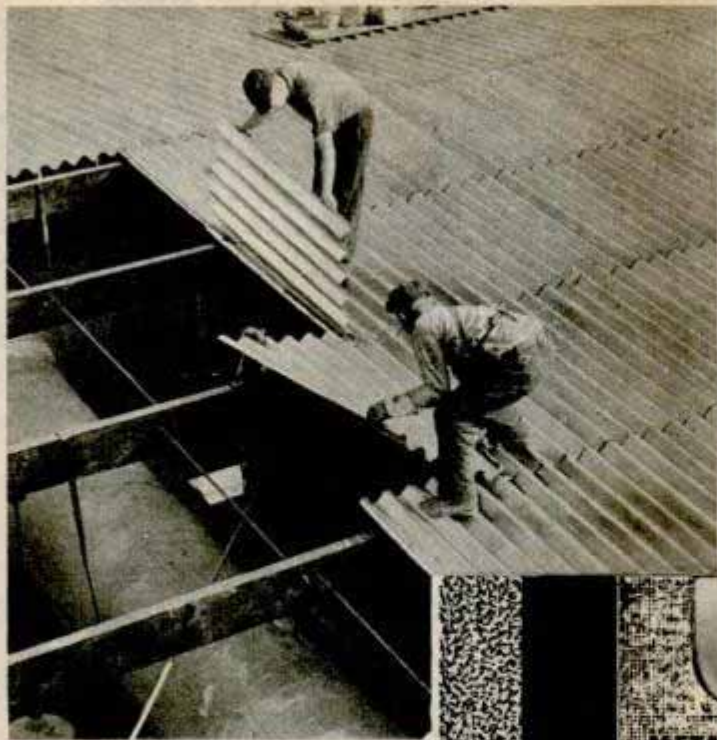


PYKRETE IS 86 PERCENT ICE AND 14 PERCENT WOOD PULP



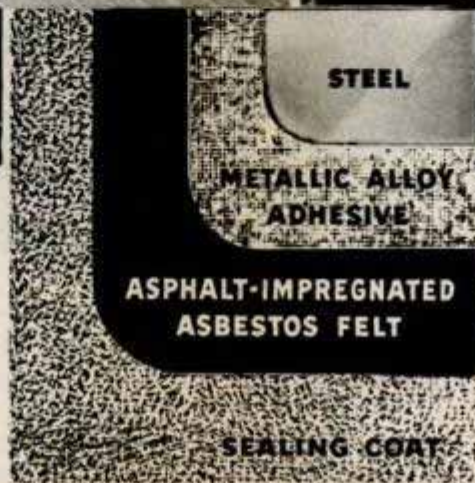
IT WAS TO BE BUILT OF PYKRETE BLOCKS FROZEN TOGETHER





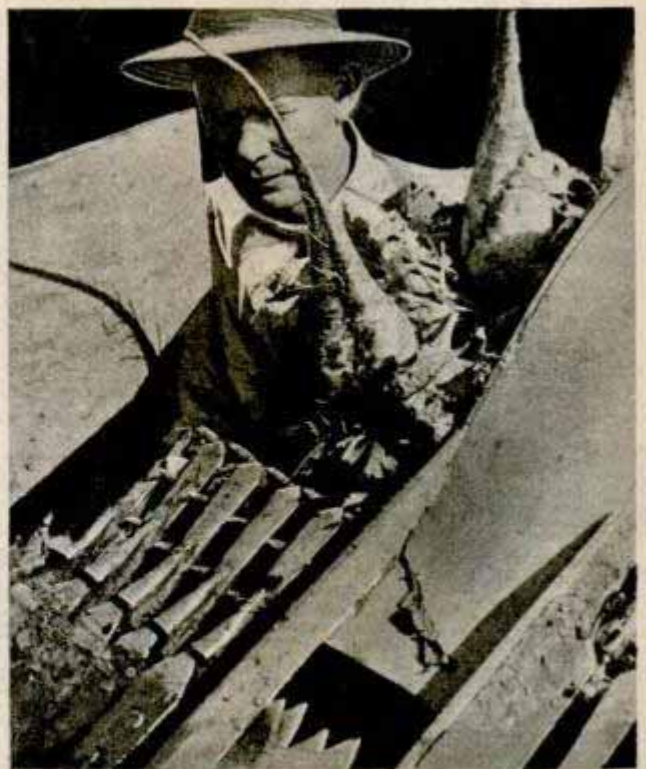
Fuse Felt and Steel For Stronger Sheeting

Made by fusing asbestos felt to steel, a sheeting material has a high resistance to wind, weather and the corrosive fumes of industrial areas. First step in the process is to add a metallic alloy adhesive to the surface of the steel core. Then the felt is squeezed



into the alloy while the latter is still liquid, deeply embedding the fibers. For further protection, the surface is impregnated with asphalt and coated with a sealing compound, giving it a black, leatherlike appearance. The sheeting, in either flat or corrugated form, can be worked on regular sheet metal shop equipment.

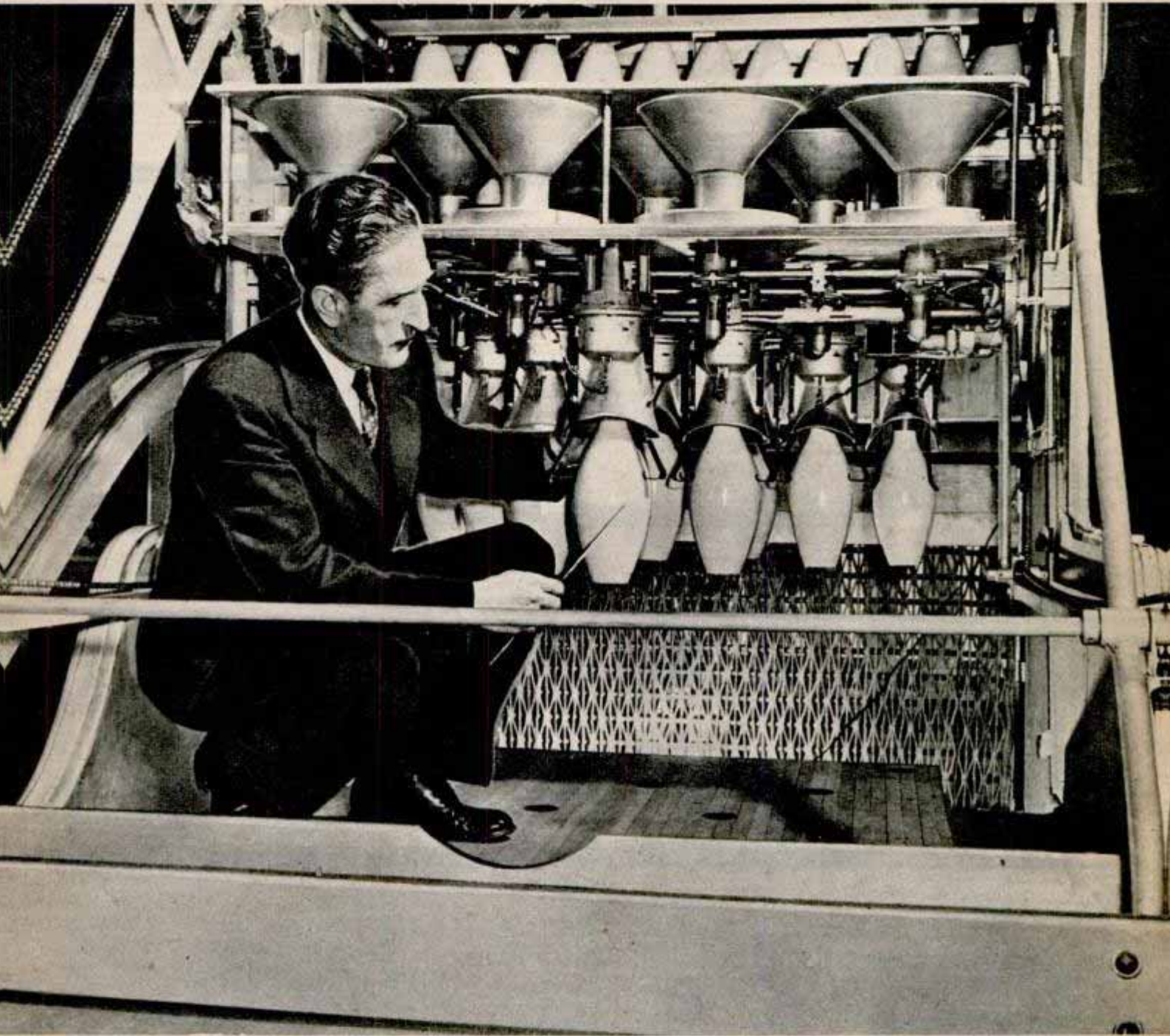
into the alloy while the latter is still liquid, deeply embedding the fibers. For further protection, the surface is impregnated with asphalt and coated with a sealing compound, giving it a black, leatherlike appearance. The sheeting, in either flat or corrugated form, can be worked on regular sheet metal shop equipment.



Beet harvester digs and slices the tops from 200 tons of beets per day. Sharp spikes jutting from the wheels unearth the beets and deposit them on stainless steel knives

which shear off the tops. A conveyor belt loads the produce into a truck or trailer moving alongside the machine. It formerly required 40 men a day to do the work.

How the Iron Pin Boy Works



Robot pin spotter is examined by its inventor, Fred Schmidt, who spent 12 years developing the mechanism

SOME DAY it may be unnecessary for 100,000 Americans to bend over about 30,000,000 times a day. An automatic pin spotter may replace the pin boys now toiling in 74,000 alleys serving some 15,000,000 bowlers.

The spotter, produced by the American Machine & Foundry Company, long-time producers of cigarette and cigar-making machinery, almost wholly mechanizes the most popular participant sport in the nation today. The bowler provides the only remaining human touch as this almost super-human gadget sets the pins with perfect accuracy; lifts standing pins after the first ball; sweeps away the deadwood and

returns the ball; resets the standing pins in their original positions; clears the alley after the second ball, and sets up another ten pins for the next bowler. All this in 17 seconds, if the man at the other end of the alley keeps pace, and it even keeps score!

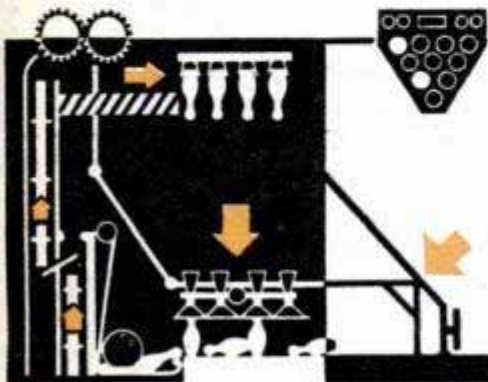
To begin the machine's cycle, we shall assume that the pins are spotted and the bowler is rolling his first ball. Six pins are felled and as the ball drops into the pit it sets the spotter's operation in motion. The ball is lifted by a cradle over the back of the pit and dropped into a track on which gravity returns it to the player. A triangular spotting table directly above the pin formation is lowered. On its underside are

5577 2nd floor

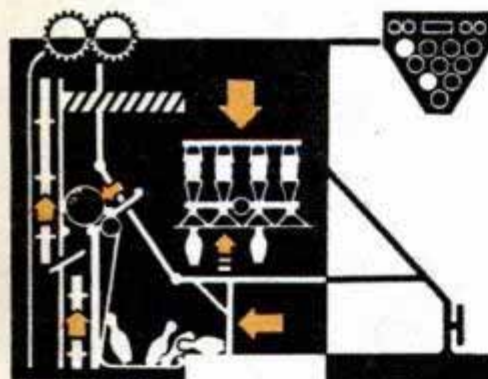
Steps in the Operation



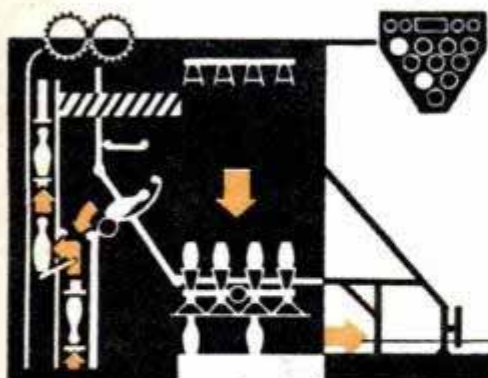
- 1** The machine has been started and the guard, which is kept down across an idle alley has been raised. The indicator shows ready for first ball. The first ball is bowled. Note the second set of pins stored in the loading station near the top of the machine



- 2** When the ball drops into the pit, the cycle of operation begins. The guard and sweep are lowered to the alley. The second set of pins is moved to the pin transfer. The spotting table descends and the respotting cups automatically locate themselves over the standing pins. Indicator registers pins standing



- 3** The standing pins are lifted off the alley and held out of the way while the sweep clears the alley and gutters of all dead wood. The pin transfer places the second set of pins in the spotting cups. The cradle has lifted the ball and placed it on the ball return



- 4** The respotting cups reset all standing pins in the exact position they were in after the first ball. The sweep returns to the front. The apron has been raised, delivering pins to the pin elevator through the track. The ball is returning to the bowler

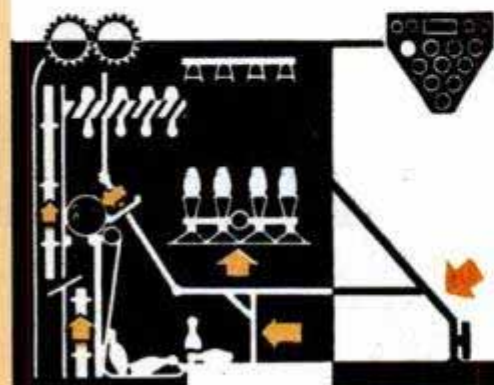


- 5** The pin elevator puts the pins on a belt conveyor which delivers them, upside down, to the loading station. Meanwhile, the spotting table has been raised and the apron restored to its original position





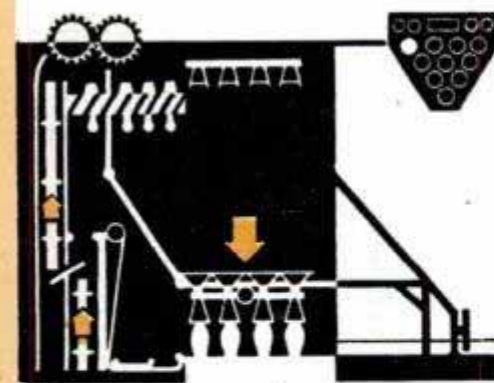
6 When the spotting table is out of the way, the guard and sweep are raised. The indicator shows ready for the player's second ball



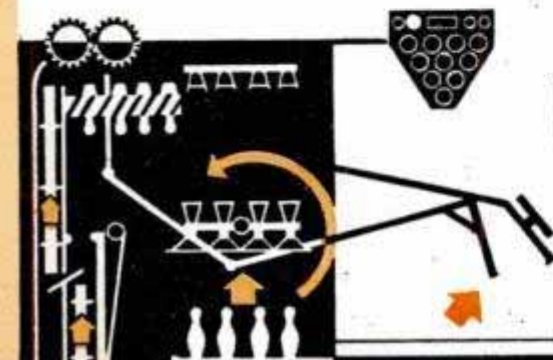
7 After player bowls second ball guard is lowered and the alley is swept, this time removing fallen and standing pins alike. Indicator shows one pin left



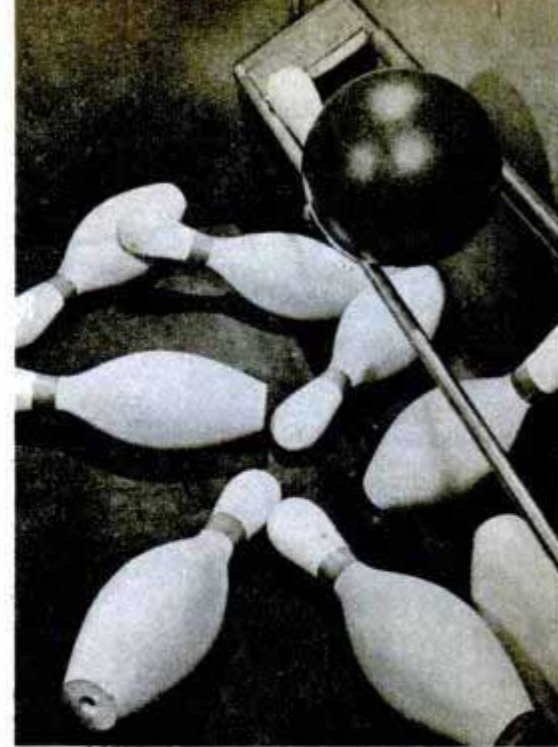
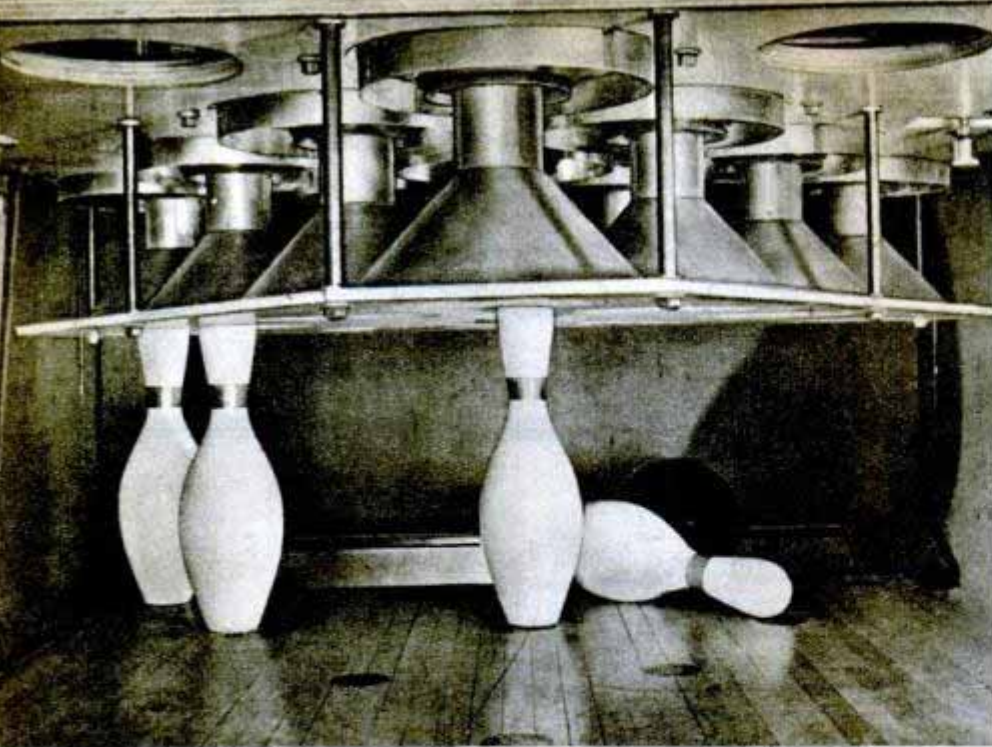
8 The entire spotting table, with the second set of pins now in the spotting cups, is rotated 180°, bringing the pins right-side-up over the alley. The sweep returns to the front. The cradle has returned the ball and the apron has delivered the pins as before



9 The spotting table deposits the second set of pins accurately upon the spots. The pins just used are now returning to the loading station



10 The table is raised and reversed. The guard is then lifted and the alley is ready for the next frame. The indicator shows ready for the first ball



Pins pushed to an off-spot position by the bowler's first ball are picked up by suction cups and returned to their off-spot position. Right, the mechanical pin spotter picks up ball and pins knocked into the pit

metal cups, shaped like the receiving ends of funnels, which settle over the standing pins and lift them from the alley. If a pin has "walked," or moved off its spot without falling, the descending cup "feels" the top of the pin in its new location and shifts so that the head can be grasped by suction, raised and later replaced in the position to which it "walked."

A wooden sweep, shaped to scrape both alley and gutters, which is suspended over the alley in front of the pin area, is lowered and sweeps back to remove all deadwood. The spotting table replaces standing pins and the floor covering of the pit raises to spill the fallen pins onto an inclined moving board, which shakes them into position to be carried up to the top level by an endless escalator. There they are conveyed in an inverted position between turning, ridged round rods into an in-line position at right angles to the alley.

Immediately following the rolling of the first ball, the alternate set of pins has been lifted by mechanical clamps from the line-up and placed—still inverted—in spotting position in the top of the spotting table.

The second ball is bowled and returned to the player; the remaining pins are sent "upstairs"; the spotting table rotates 180 degrees and deposits the ten pins exactly on ten spots and the whole procedure begins again.

The secret of the success of the AMF spotter is that it can locate and replace with unerring accuracy a standing pin which has been joggled off its spot—a quality necessary in any spotter which is to be accepted by bowling authorities.

Inventor of the robot pin setter is Fred Schmidt, a former patternmaker and fac-

tory engineer who is now a member of the AMF engineering staff. His talented brain child, seven feet nine inches high, can be installed in any regulation alley without alteration.

Schmidt became interested in the idea of developing a mechanical pin spotter about 12 years ago when he lived in Pearl River, N. Y. A friend asked him why, since he was always "monkeying around with new ideas," he didn't invent an automatic pin setter that would really work.

Accepting the challenge, Schmidt went to work in an old shed and welded together various pieces of scrap metal to fashion a rough model of a device he figured could do the job. Then, armed with enthusiasm, blueprints and a working model, he contacted the American Machine & Foundry Company, whose officials decided to back him.

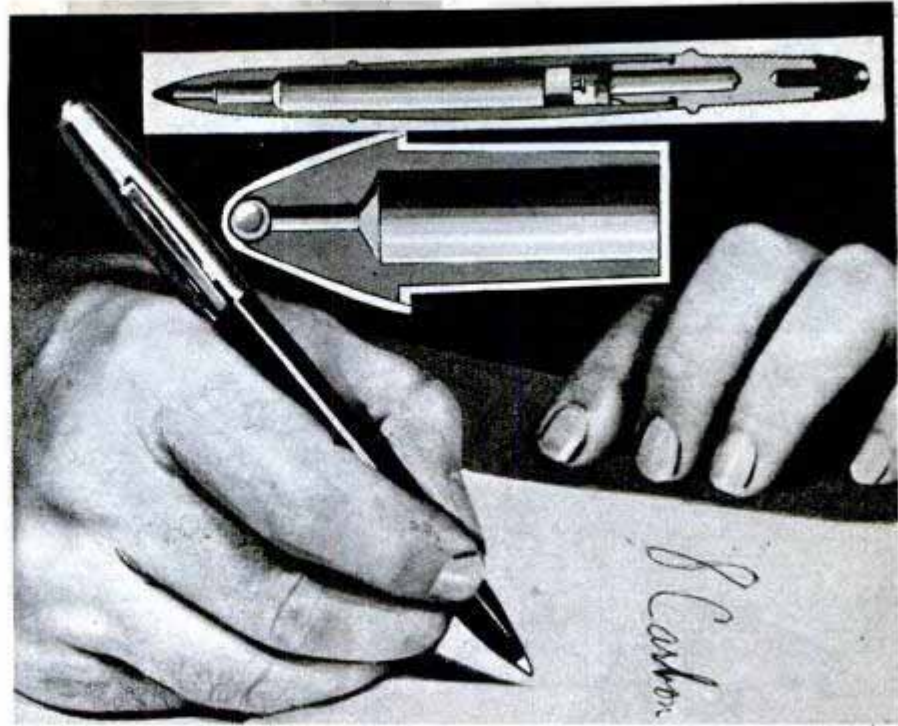
Actually, development work and manufacturing plans progressed to a point where the company was prepared shortly before the war to begin full-scale production. But those plans were halted by the war. Meanwhile, during spare moments, Schmidt added refinements to the device.

The latest model is lighter and more compact than the one originally planned for production. Also, an attachment has been added which detects fouls. If a bowler's foot slides across the foul line, the tireless pin spotter immediately sets up the pins for the bowler to try again.

An additional improvement is the use of new production techniques to create a more silent-operating machine. In the past 40 years many inventors have tried to develop automatic pin setting machines but noise had been one of the chief bugaboos.

Ball Bearing Pen Writes Under Water

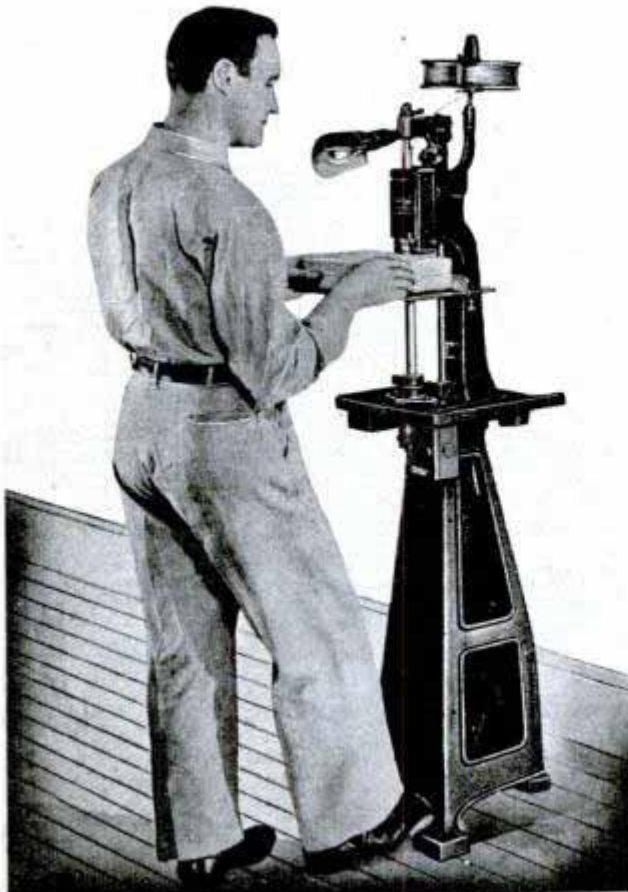
Instead of an ordinary pen point, a new fountain pen uses a tiny steel ball that revolves in a socket and spreads a thin line of ink on paper as you write. Because of its thriftiness with ink and its large capacity, one filling of the pen will write a line 21 miles long and serve the average user for two years. The pen will make up to eight carbon copies and will even write under water or on cloth and the ink dries immediately. Another feature is that the pen never leaks, even at high altitudes.



Tool Cuts and Drives Nails At Sewing-Machine Speed

Making and using its own product at the same time, an automatic tool cuts and drives three nails a second from a spool of wire. From three to nine times faster than hand nailing, the unit operates like a sewing machine when nailing in a straight

line. Pressure up to 500 pounds holds work to be nailed, assuring a tight joint. Adjustments can be made to drive nails flush or to countersink them. The machine cuts needle-point or blunt nails from $\frac{1}{4}$ to $\frac{3}{4}$ inch long, driving them equally well into wood, masonite or plastic.



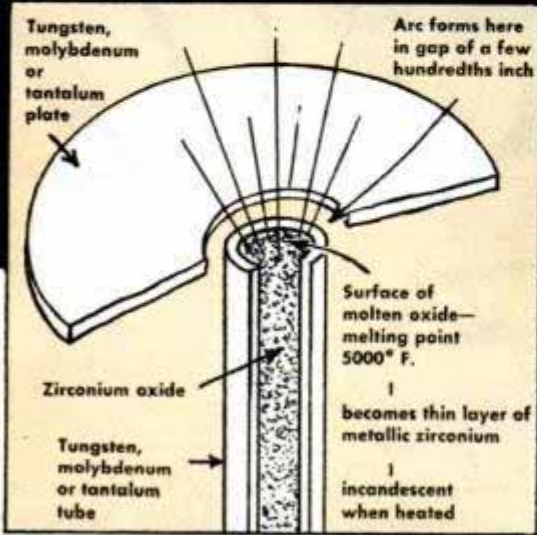
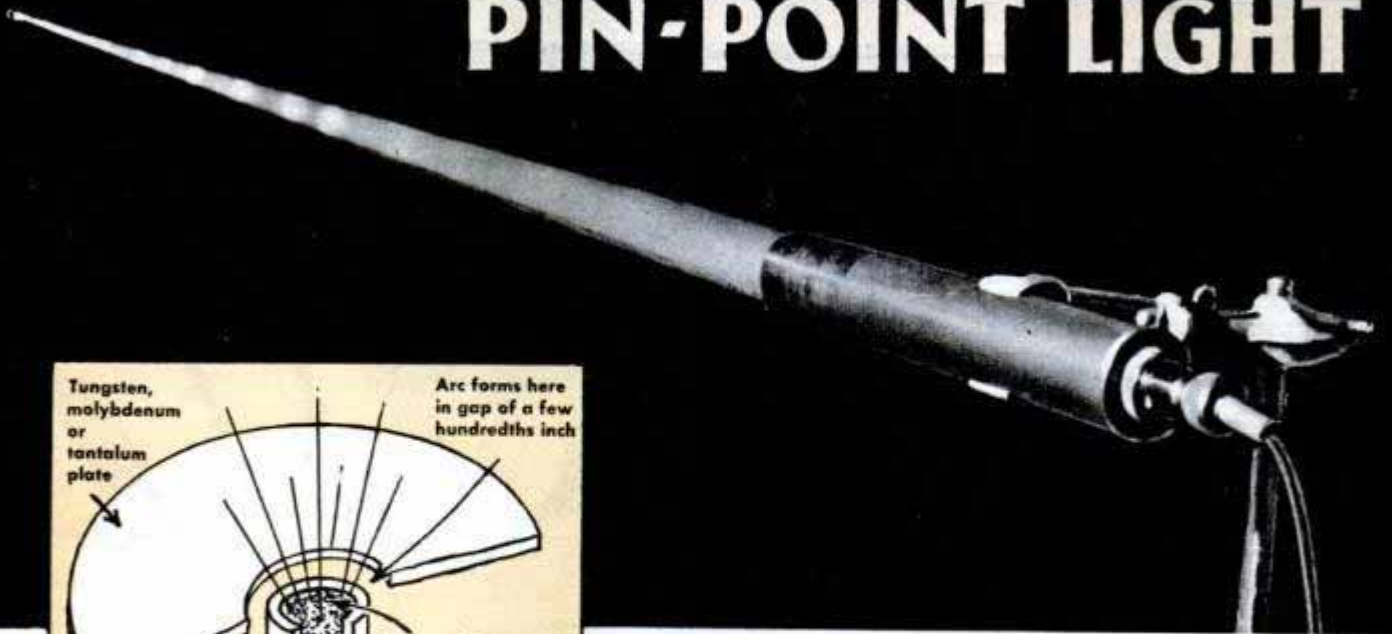
Handle Utilizes Old Saw Blades

Broken hacksaw blades no longer need be discarded. A tool now on the market holds almost any length blade, making a new saw out of a broken one. The device is a tubular handle with an extended grip for securing the working end of the broken blade. The handle is slotted to hold the broken blade rigidly in place. A saw formed in this way can be used in cramped quarters where bulkier saw frames prove impractical. The tool also can be used as a handle for knives or scrapers made from broken blades or pieces of thin file.

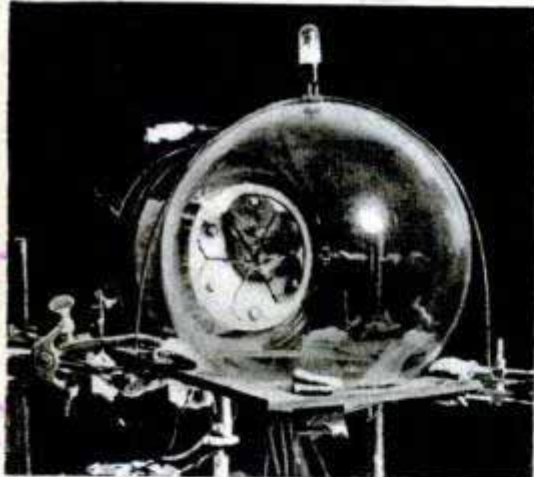


☞ Portable dance floors are built in sections by a Hollywood, Calif., manufacturer to accommodate from eight to 3000 persons.

PIN-POINT LIGHT

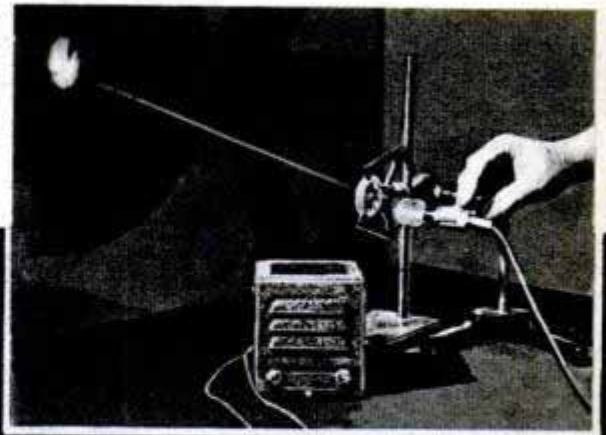


One sixteenth the surface brightness of the sun is produced by a concentrated-arc lamp which may revolutionize optical testing, motion picture projection and photographic enlarging. Developed by the Western Union Telegraph Company, this tiny spotlight creates 100 candlepower per square millimeter, compared with 1600 by the sun and 10 by a tungsten filament incandescent lamp. The new light achieves its results by projecting its rays in almost perfect parallel. Main parts of the lamp are two electrodes and a cathode, a wire or tube from 3/1000 inch in diameter for the two-watt size to 3/8 inch for the 1500-watt unit. The cathode is filled with zirconium oxide. When the arc leaps from the anode the oxide in the end of the tube melts, giving off a brilliant white light augmented by zirconium vapor combined with inert gas in the lamp. As the zirconium evaporates and flies from the cathode the particles are ionized by the arc and return to the cathode, giving the lamp a self-perpetuating action. A generator or well-filtered rectifier is used with the lamp, plus sufficient ballast resistance to limit the current to its normal value. In photographic enlarging, the pin-point light produces large prints of great detail, clarity and definition. The light also may make it possible to project 16-millimeter film in theaters with results equal to the showing of 35-millimeter film. And it may be substituted for klieg lights.



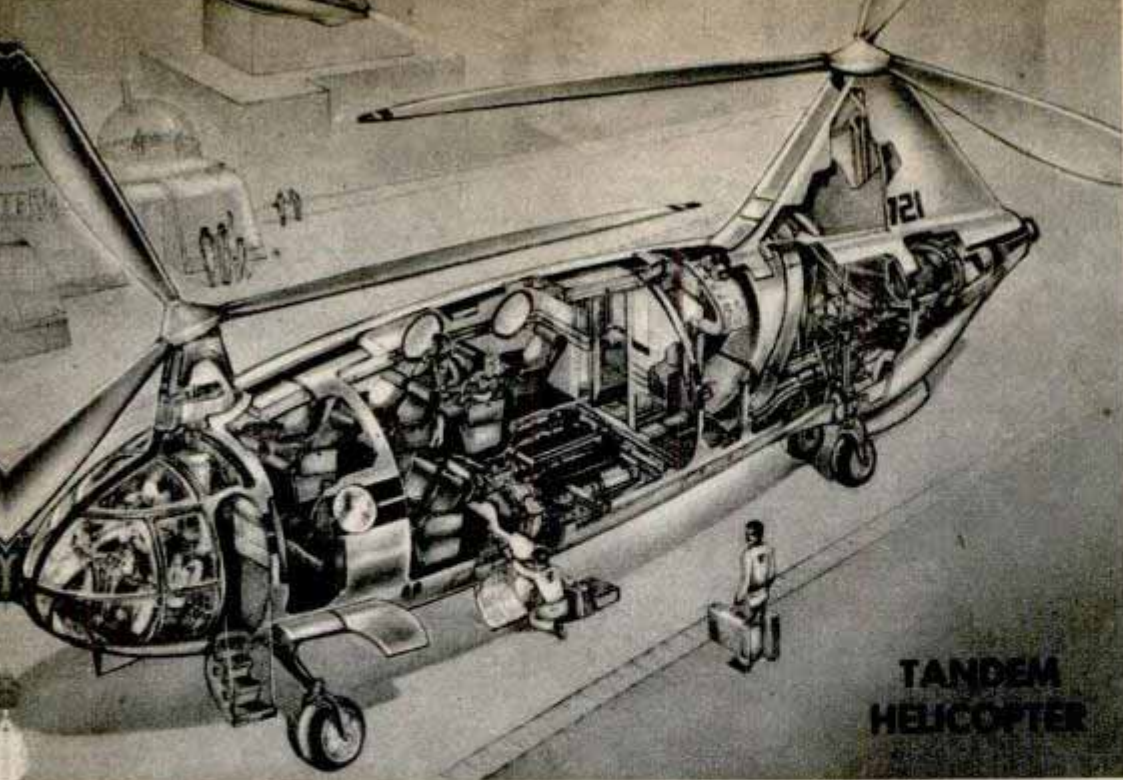
Knopf-PIX photos

Light beam from two-watt concentrated-arc lamp (top) is focused to a pin-point. Light source is shown in drawing of fan-shaped anode and tubular cathode. Tiny two-watt lamp perches atop 1500-watt unit (above). Testing optical lens (right) with light beam. Ten-watt lamp (below, left) resembles a radio tube. Casting an image of the light source (right)

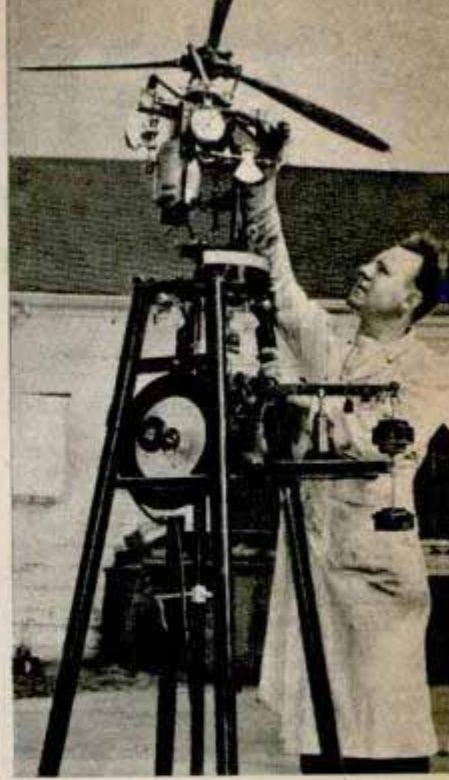


60 Hudson St
N.Y. N.Y.





**TANDEM
HELICOPTER**

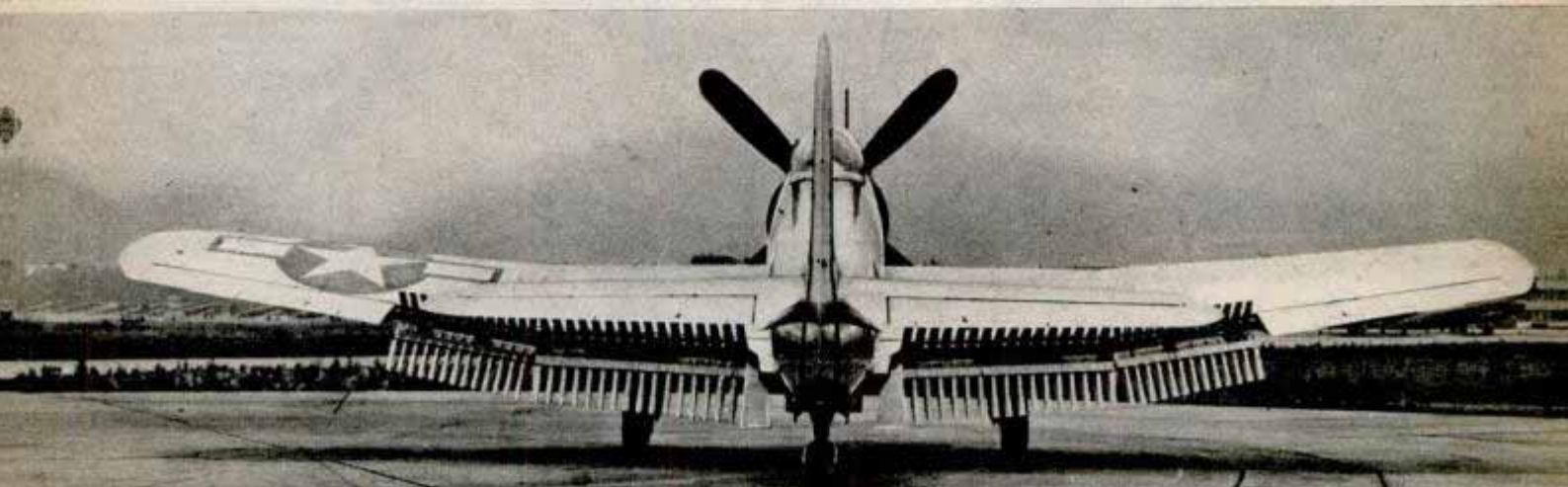


Cutaway of intercity tandem helicopter. Adjusting mechanisms, upper right, for a test run of quarter-size rotor blades. Right, flying rubber-band-powered model

Research on the rotor blades and driving mechanisms of a proposed 29-passenger intercity tandem helicopter is being conducted on an ingenious rotor test stand. Comparable to an outdoor wind tunnel, the stand is placed on a flat-bed truck for runs simulating a helicopter in flight. Rotor blades one fourth actual size are attached to the test mechanism and rotated by a motor. Measurements of lift, horizontal thrust, torque and pitching and rolling forces developed by the blades are computed from scales and balances on the stand.



"Finger" dive brakes on Mauler improve bombing accuracy—Intermeshing, finger-type dive brakes that slow the vertical descent of the Martin Mauler to 350 miles per hour are a significant feature of the Navy's newest dive-torpedo bomber. This permits a lower altitude pull-out and greater bombing accuracy. The Navy-designated BTM-1 is in the over-350-mile-an-hour class, with a Pratt & Whitney Wasp Major engine and maximum range of 1700 miles. It is built for dives of more than 500 miles an hour.



FISHERMAN,

Lead with the Right Hook



Playing a big bass, angler uses right hook, small enough for light tackle, large enough to catch in bass' mouth

BY RICHARD W. EMERY
PHOTOS BY RAY CHAPIN

Consider for a moment the lowly fishhook! Of all the trinkets and doodads in your fishing tackle kit, it's probably the smallest. It cost you little. It doesn't look like much. But what's the first part of your tackle to meet the fish eye-to-eye and challenge him to a tussle?

You're right—the hook!

So give the lowly fishhook a second thought and you'll agree that it's important, after all. Whether you're strictly a holiday and vacation fisherman, or a postgraduate angler who really goes at it scientifically, a speaking acquaintance with hook lore will help you land more fish.

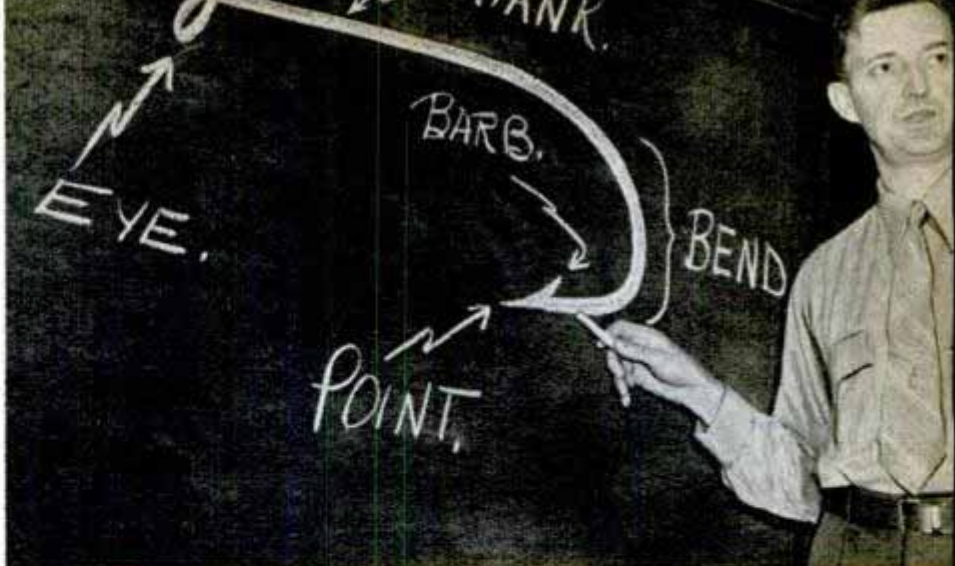
The modern fishhook didn't get its sleek lines and metallurgically foolproof interior through somebody's idle whim! Cavemen invented the hook because they were hungry. The first "hook" actually was a gorge made of flint which the fish could swallow with the bait but which it could not eject. The cavemen later invented the barb for the same reason. Primitive fishermen tried making hooks of stone, bone, seashells, horn, thorns and wood. When they learned to use metal, they made better hooks and caught more fish. Most of the features of modern hooks were tried out hundreds or even thousands of years ago.

To know how a fishhook works, you need to know about its various parts. Each part of the hook has a job to do. Each part can be designed to do a good job in very special circumstances.

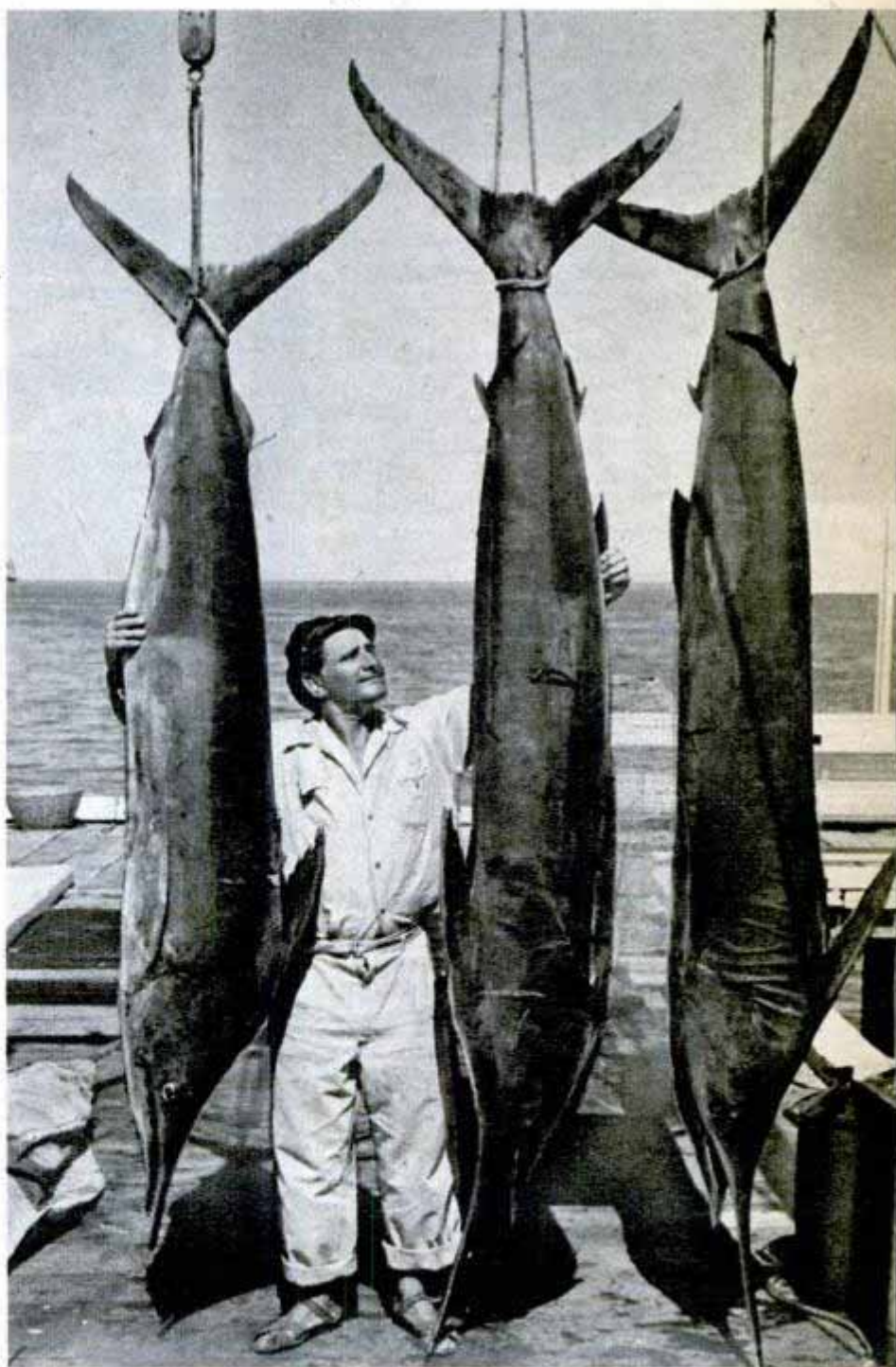
That leaves up to you, the fisherman, the problem of choosing a fishhook with features which will give you advantages in your effort to catch a certain kind and size of fish.

Here are the parts of a hook: the point, which reaches from tip to barb; the bend, which gives the hook its curve; the shank, which serves as a backbone; and the eye, which guides the leader and line down to the hook.

Scope of a hook—that is, its width between point and shank—is called its throat. And the depth



Blackboard diagram shows the principal parts of a fishhook. Below, to grab and stick with one of these marlins the hook must bite quick and deep. Once hooked, the marlin goes into a frenzy of action, leaping and plunging across the surface





Proper hooks put more "panfish" in the pan! Below right, these hooks, for catching trout to swordfish, are actual size. Note the differences in the points, barbs, bends and shanks

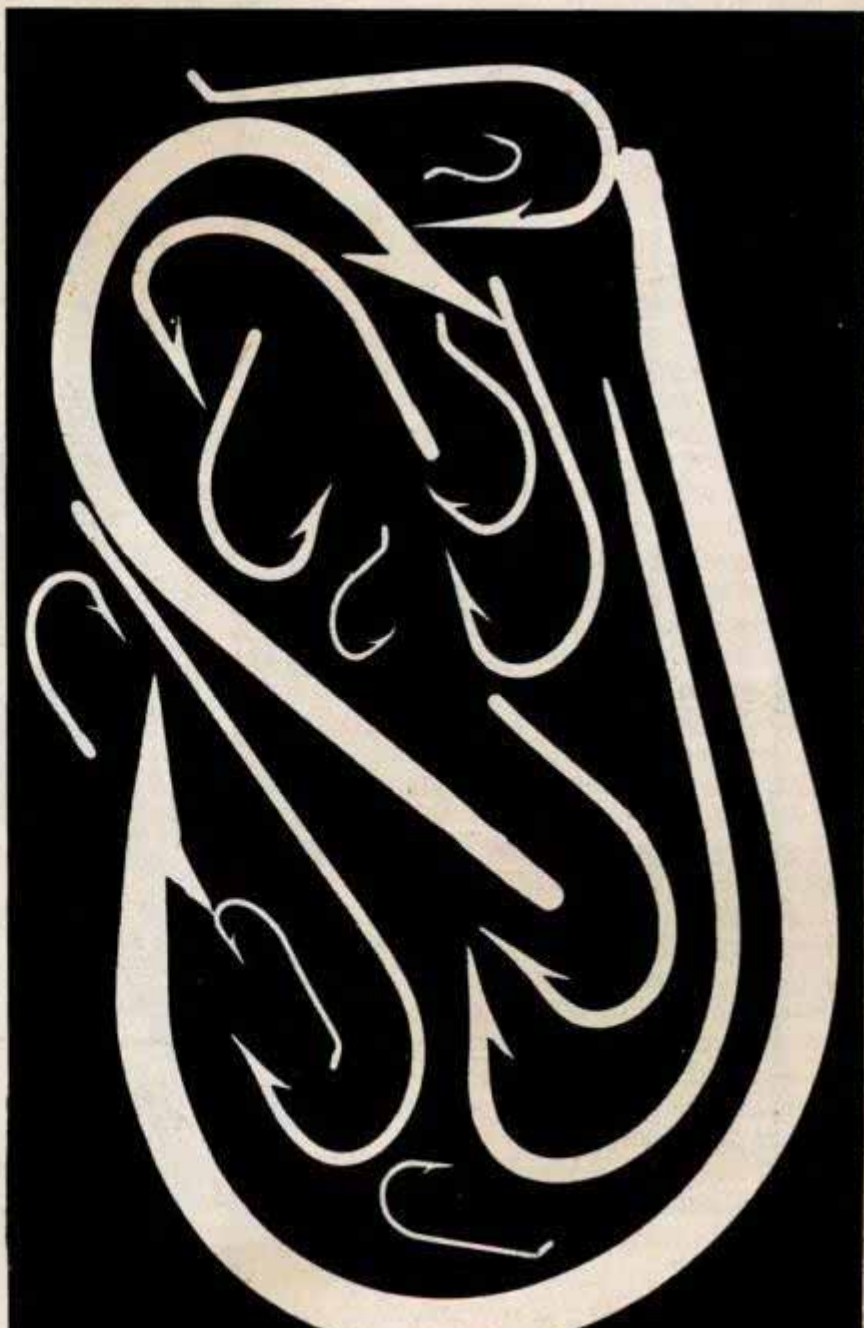
of the hook from throat to bend is called its bite.

Now, there are three qualities which are essential in any hook that lands a fish. The hook must be usable with the bait or lure that the fish will strike. The hook must be able to take hold. And it must be able to keep its hold despite the fish's struggles.

For thousands of years, anglers have been trying to devise a hook which will excel in all three qualities.

But, alas, no such hook exists! Modern tackle manufacturers are still trying to gaff an answer to the problem. Until some inspired fisherman comes up with the solution, you will have to decide which qualities to accent, in your hook, and which to sacrifice.

To illustrate: Suppose you want to catch a big, husky trout. If you use a big, husky hook, the trout will laugh at you. He's eating mosquitoes today! You must choose a tiny hook to suit the tiny fly, sacrificing holding power.





Above, angler holds up the record Oregon trout, almost 14 pounds, and the hook that landed it. Left, wise fishermen will have a well-chosen assortment of hooks in the tackle box



Or suppose you want to catch a big, savage marlin swordfish, which you know will jitterbug across the waves when he feels the hook. You know he'll shake and yank and turn somersaults. The biggest problem is to find a hook that will hold, even at a sacrifice of quick hooking. So you choose a heavy-gauge hook with a curve even closer than a half-circle, with loss of hooking power but gain of holding power.

Or suppose you're after a big black bass. He has a mouth like a coal scuttle and he'll hit a big bait or lure. You're willing to take a chance on holding him, if you can just get him hooked! So for maximum chance of getting him hooked, you use a large, wide hook of light



These giant sea bass call for a big hook that won't pull loose

wire, with a point that reaches deep for the bass' gullet.

Your problem of choosing the proper hook is tougher if you're after more than one kind of fish. The table manners of fish vary as much as their mouths, appetites and personalities. In size, game fish range from the fingerling trout which nips at gnats to the mighty broadbill which spends its leisure killing whales.

Fish mouths are small like the perch's, or big like the bass'; soft like the young brook trout's, or bony like the tarpon's; smooth like the corbina's or toothy like the pike's. In choosing your hooks, look for features that will overcome the main problem posed by your particular fish—don't just choose hooks that look rakish.

Hooks vary in hardness and temper. Your best buy in hooks is standard merchandise backed by a reputable maker.

Hooks are made in various sizes of wire, either standard, light or heavy. A light hook weighs less and penetrates easier, but is more likely to rip or spring. A heavy hook penetrates bone and holds better under heavy strain, but has disadvantages if used on floating lures or with live bait.

Points of hooks vary in two ways. The points differ in shape and the angle of penetration may range from shallow to deep. Needle point,

spear point and hollow point are most popular. The needle point is smooth, thin and round. When properly made, it is very strong and has excellent penetrating quality. The spear point, usually found on inexpensive hooks, turns slightly outward. The hollow point is a quick-hooker for fish with soft mouths.

By its angle of penetration, the point enters flesh or bone and enables the hook to take hold. A point that aims slightly away from the hook will penetrate quickly and at a deeper angle. A point that aims parallel with the shank will put maximum pressure on the point of penetration and is best for hard-mouthed fish. A point that aims slightly inward toward the shank loses some of its hooking power but gains in holding power. If turned more than very slightly inward, it loses depth of bite.

For general fishing, a long barb offers more advantages than a short barb, and if properly made it should not break. The short barb may bury itself quicker, but it is more easily dislodged.



Planning to fish for trout this summer? Your tackle box should contain some of these hooks. In upper left column are dry-fly hooks. Reading from top down, they are sizes 18, 16, 14, 12, 10 and 8. At upper right are dry-fly barbless hooks, sizes 8, 10, 12, 14 and 16. Other dry-fly hooks are in upper center. Below are four hollow-point hooks and at bottom is an assortment of wet-fly and bait hooks



In the open mouth of a 125-pound sailfish, a tricky hook-fighter, is lodged the barb that landed him



This crappie wrapped his mouth around a big bass hook

The bend of a hook not only aims the point, but gives the hook a bite or hold upon which the fishing line can pull. A hook may have a straight bend or an offset bend. A straight-bend hook is on a plane with point parallel with shank. An offset-bend hook is twisted at the bend so that the point's aim is askew.

Straight-bend hooks penetrate more nearly in the direction of pull from the fishing line than do offset-bend hooks. They drive harder into bone. The argument for

offset hooks is that they are less likely to be withdrawn from a fish's mouth without penetrating. Offset hooks give their best performance in still-bait fishing. Straight-bend hooks are your best bet for moving baits or lures.

The shank of a hook usually is made of rolled steel wire. Sometimes oval wire is used for extra strength. Occasionally the shank is flattened along the sides of both shank and bend to give greater strength. A shank may have several slices, or barbs, to help hold soft bait in place. Shanks of hooks intended for use with lures are frequently humped, to anchor the body of the lure. The longer the shank in proportion to the size of the hook, the shallower will be the bite of the hook. Rather than use an extremely long-shank hook for a streamer lure, use single hooks in tandem. You'll be apt to take more fish.

The eye of a hook may be straight or turned up or down. Hooks for dry-fly fishing have tapered eyes, for balance and lightness, at sacrifice of strength. Some eyes are looped or brazed to protect leaders from sharp edges of metal. Where great strength and hard-hooking qualities are needed, as in big game fishing, the straight eye—also called ringed eye—has been proved best.

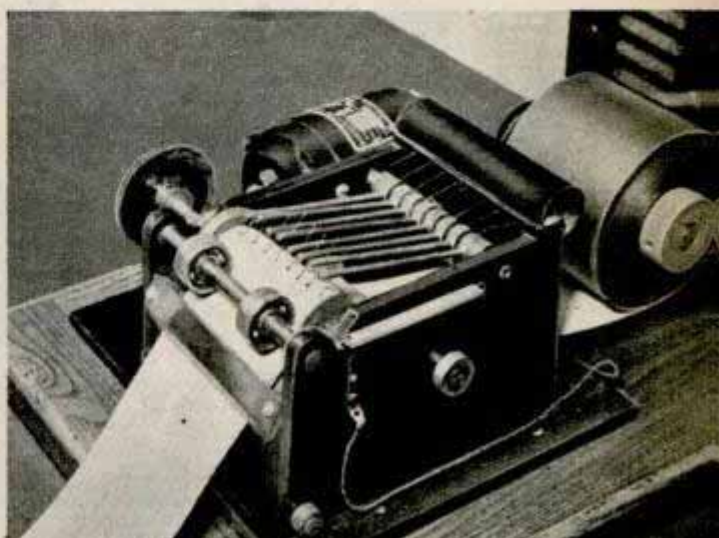
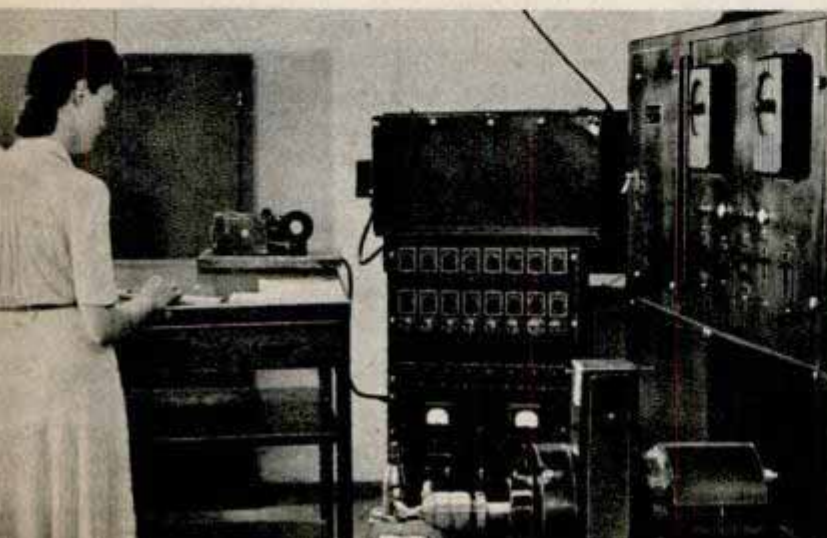
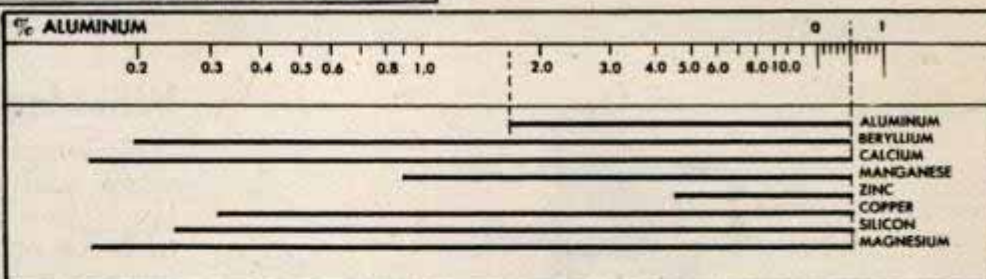
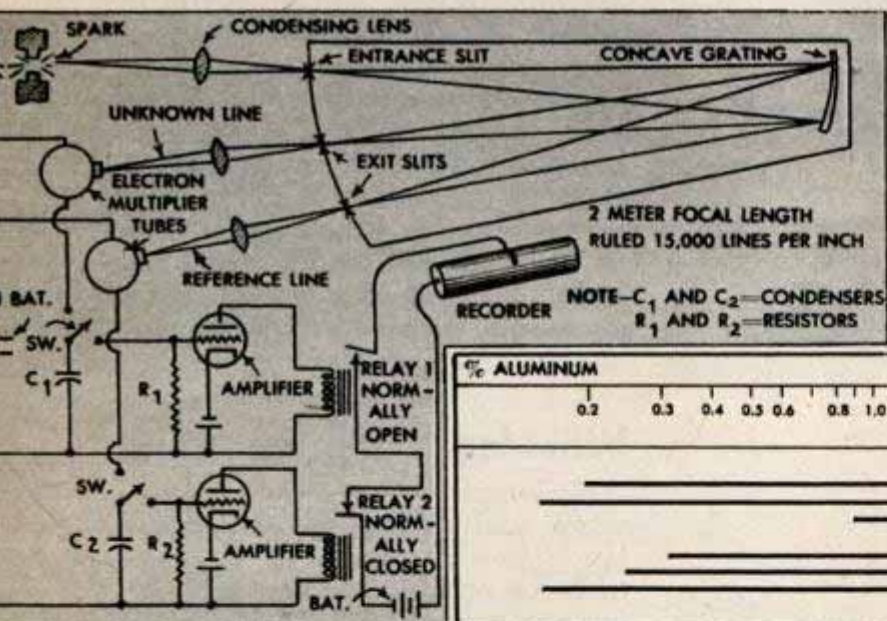
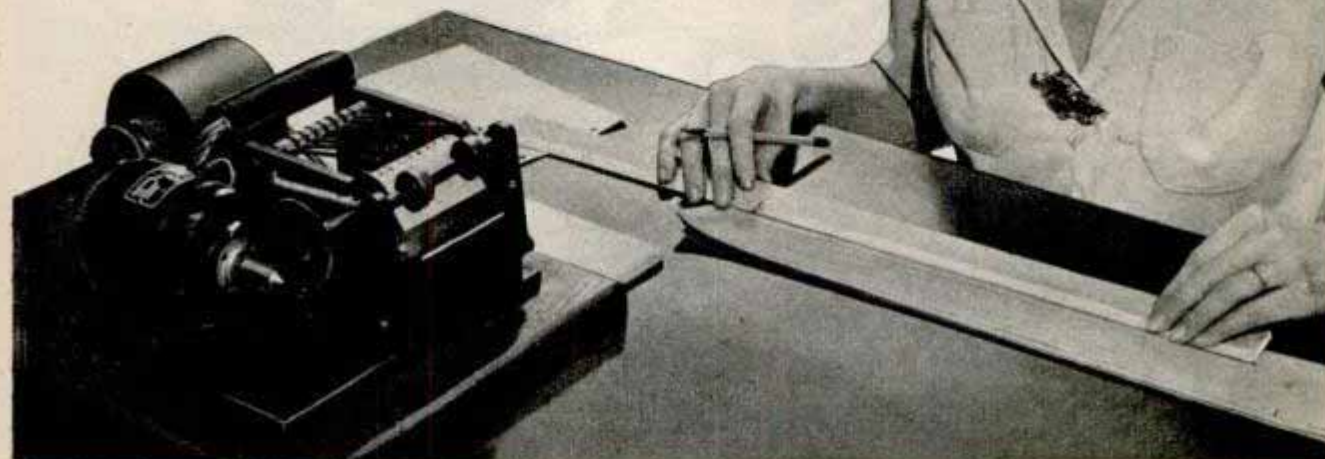
There you have a quick once-over on the subject of the lowly fishhook. If you know the table manners of any given fish, you can figure out the best hook for catching him. But the all-around perfect hook still awaits its inventor. In fishhooks, as in other things, you can't have everything!

Two primitive barbless hooks (with lines attached) are compared with a variety of efficient modern hooks. Right, catching the west coast yellowtail, a fish with a narrow bony mouth, requires a small, strong hook



ALLOY *Detective*

Concentrations of various metals in alloys are measured and recorded in 40 seconds by a direct reading spectrometer developed by Dow Chemical Company. Girl operators can be trained in a day to read the analyses charted automatically on paper





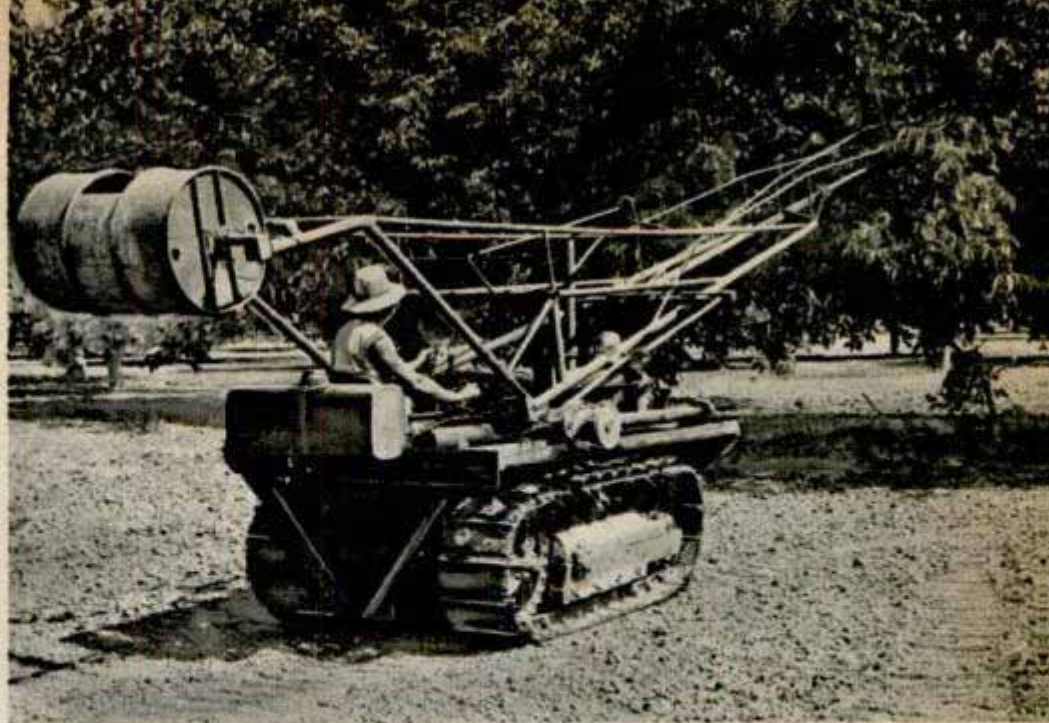
'Magic Carpet' for Cripple

Especially designed for maimed servicemen and poliomyelitis victims is the "Magic Carpet," a three-wheeled vehicle driven by a 3½-horsepower single-cylinder engine. Speed is from a "crawl" to 25 miles an hour. Clutch, brake and throttle controls are all on one lever, permitting the machine to be operated by any two members, such as a hand and a foot. By means of extra attachments it can be fitted for household tasks, like mowing the lawn. The engine is equipped with an impulse type magneto for easy starting.

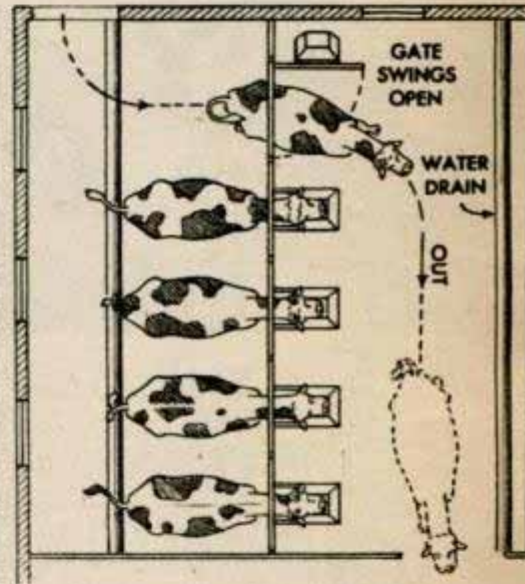
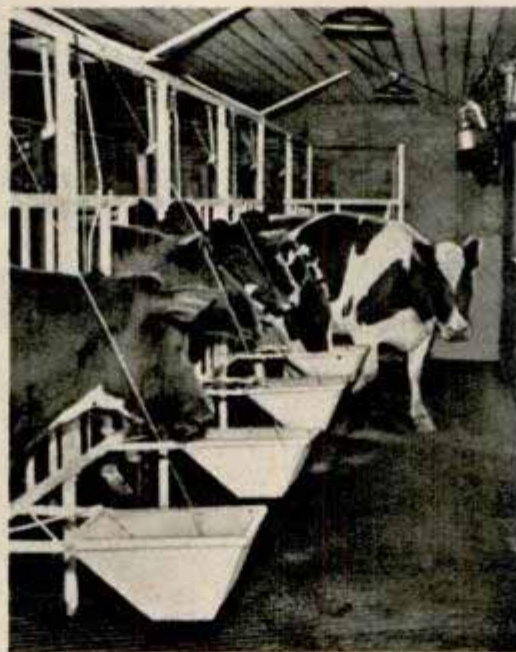


Wheeled Cane for Blind

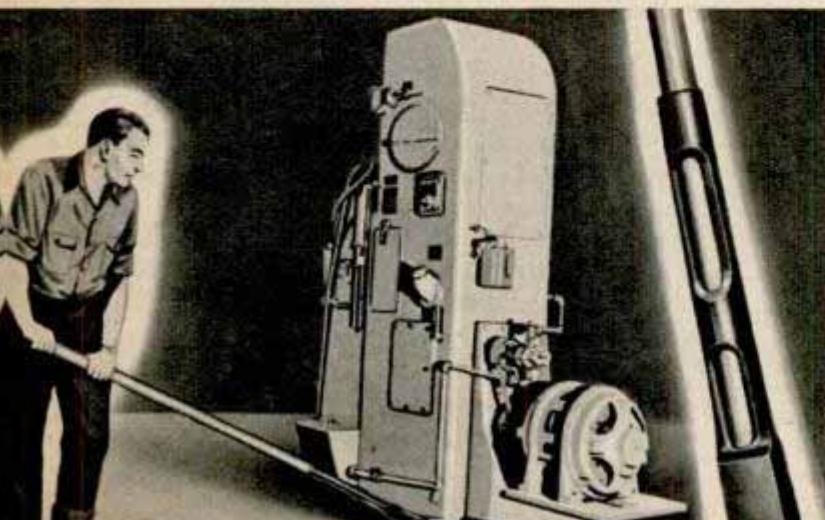
So sensitive that it actually can warn a blind person when there is a paper match on the sidewalk in front of him is a combination cane and wheel now being made for the sightless. The four-inch cast aluminum guide is attached to the end of a 36-inch softwood cane which has a metal pistol-grip handle. Completed, the cane weighs 15 ounces and has an overall length of 42 inches. The cane and wheel are banded a bright red and white to further safeguard the user. Made by a member of the Monterey Park, Calif., Lions Club, the wheeled canes are being distributed free of charge by that organization to blind persons in Southern California.



Rubber tired cart, above left, is equipped with hooks which fit under the collar of a milk can for easy handling of the heavy containers. Adjustable collar hooks fit any can, holding it in an upright position. At right, a home-built, labor and time-saving walnut tree shaker built by a California rancher is powered by a Diesel tractor



Automatic water heater, left, provides boiling water a few minutes after pail is hung on hook of portable electric unit. Photo and diagram at right show how "walk through" milking barn saves time at Fresno, Calif., dairy farm. After milking, front stanchion gate is opened, allowing the cow to walk out of the stanchion through second corridor and exit instead of turning around and going out the same way it came in. Below left, one man can lift and move loads up to five tons with a lifting bar which has a steel roller in the toe plate. Right, an Illinois farmer combined two two-row corn pickers into one four-row picker to save time and labor



HOW DEEP is the OCEAN?



Landing Ships, Tank, unload supplies into Amtracs on the edge of the Okinawa reef. Knowledge of the reef was essential in planning the campaign

By Lieut. Comdr. Cecil C. Snyder, USNR, and Lieut. Comdr. Richard R. Frame, USNR

LIEUTENANT Bill Davidson, USNR, taxied his Hellcat into position on the aircraft carrier Hornet's flight deck. The launching officer lowered the checkered flag and Davidson was on his way. He circled the carrier and joined up with the other planes assigned to the mission.

As they winged their way to the target, Davidson studied his instructions. In the fuselage of his plane was some unusual photographic equipment never before used in combat. It was his job, with the new camera, to record photographic information needed for a new landing against Japan.

This was tricky photography. He had been instructed to fly over the beach of the target island at an altitude of 200 feet at a speed of 300 knots, maintaining this altitude within the critical distance of 10 feet.

Ugly puffs of black smoke over the island showed ineffective anti-aircraft fire coming up from below. His altimeter registered 200 feet. This was the important test. The lights on the instrument panel indicated that the camera was functioning properly. He completed his run without incident, joined his fighter escort and returned to the ship.

Back at headquarters on Oahu and Guam the tension was as heavy as the rain-laden clouds hanging over the islands. Ahead lay the campaign for Okinawa, exposed southern flank of the Japanese home islands.

On March 5, just 26 days before the landings were scheduled to take place, the photographic interpretation officers at Guam received the rolls of film of the Hagushi beaches, taken by Davidson. This new type of photography had never been invasion-tested. What were the results?

Questions flooded the interpretation officers as they huddled over viewers and made computations.

"I want to land heavy artillery from an LST on Green 2 Beach on Love Day at H plus one hour. How far do you figure I can get her in before she goes aground?" asked a Marine colonel.

"You'll run aground 810 feet offshore," said Lieutenant Robert N. Colwell, USNR.

In the hectic days of planning for the Okinawa invasion only a few antiquated and inaccurate charts of the area were in the files. It was photographic reconnaissance that provided information that was vital



Pilots equipped with polaroid spectacles study a Sonne stereo strip that gives a three-dimensional effect. Right, a photo interpretation officer looks through a stereo comparator to measure height and depth

for the landing. This would not be another Tarawa!

For months, back in the states, the Navy's Photographic Science Laboratory and Photographic Intelligence Center in Washington had been experimenting with the "Sonne" continuous strip stereo camera for water depth determination. The story of this new photographic development goes back over 10 years to a man in Chicago named Fred Sonne. He was engaged in making aerial surveys and manufacturing equipment for use in this work.

Sonne was endeavoring to find some means of making large-scale photographs from low altitudes. To him the circuit camera, that venerable monstrosity responsible for many an old-time panoramic view, offered a principle of operation that could be utilized in aerial photography. The principle is a simple one—the film, traveling opposite to the direction of flight, is made to pass before a slit opening, which acts as a shutter, and the image is literally painted on the film.

Sonne's original camera was a single-lens model with an adjustable slit and a variable rate of film travel. It produced a continuous photograph nine inches wide by any length up to 200 feet, but it still did not meet military requirements.

With standard aerial cameras, overlapping photographs are obtained which, when viewed through a

stereoscope, give third dimension and make it possible to compute differences in height above the ground.

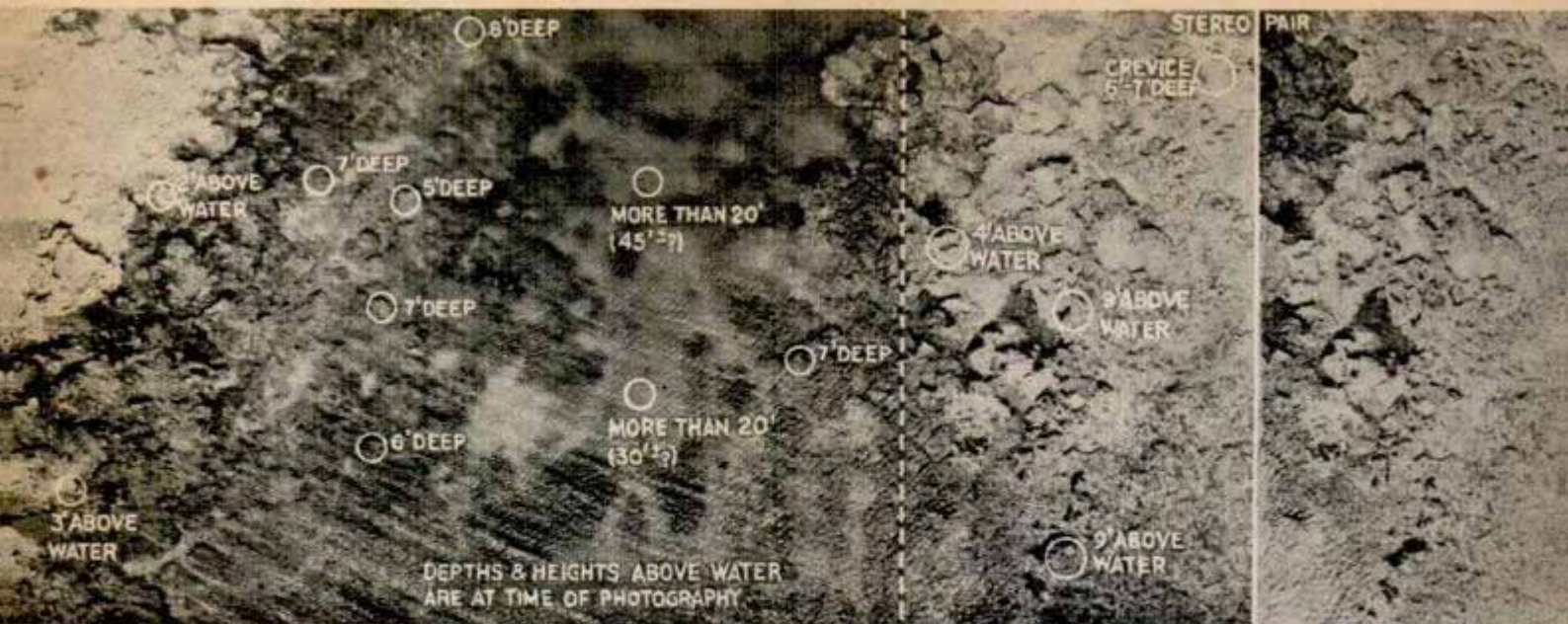
Even though interest lagged, Sonne continued the experimental work. Two lenses, in place of one, were mounted on the camera and made to rotate either slightly forward or slightly aft of the neutral position. With this modification, Sonne obtained stereo pairs on a continuous strip where large-scale detail was possible.

Meanwhile, Army Air Forces experts at Wright Field had also been working on the Sonne camera, helping to bring it to a high state of development by 1940.

The Navy awakened to the possibilities of such a camera when Commander Thorne Donnelley reported to Washington to head the Navy's Photographic Science Laboratory. He knew Sonne and was already a staunch advocate of his system. As work progressed, he obtained orders for Lieutenants F. K. Mansfield and Philip Kistler to go to Chicago and become familiar with the camera.

"With the Sonne camera





Notations on this Sonne photograph give height and depth measurements for planning amphibious operations

mounted in fast fighter aircraft we could reasonably expect coverage at a scale of 1 to 500, or 10 times larger than with other methods, still maintaining pilot safety," said Mansfield.

"The operation of the camera had to be made completely automatic," he went on. "It meant designing equipment that would synchronize the optical system and the film speed of the camera with the ground motion of the beach as the plane passed over it. The entire problem was eventually solved by employing electronic gadgets to do the work. The pilot turns on his camera and flies his course. Science does the rest." Many of the tests of the equipment were

made at Cat Cay, Bahama Islands, where reef conditions are similar to those found in the Pacific. Line soundings of depths from two to 14 feet were made, and buoys anchored at these points. Runs were made over the area and the film was interpreted and checked for accuracy against the original soundings. While these installation problems were being worked out, Sonne modified an existing stereo comparator, eventually producing an instrument which gave a high degree of exactness to underwater calculations.

For purposes of measurement, the water must be free from silt or other material which would obscure the reef. Detail on the bottom is necessary to provide reference for measurement. There must be ripples or slight waves on the water to catch the light in order to record the surface area on the film. This is the secret of water depth determination with low-level Sonne photography. The stereo comparator measures the distance between the surface of the water and the bottom.

The viewer was constructed so either the negative or a black and white print may be used for interpretation. The tests run at Cat Cay showed an average error of six inches with a maximum error of slightly over one foot in depth measurements.

Marine Corps personnel place a Sonne camera and equipment in a fast Navy fighter for a reconnaissance mission over a Jap-held beach





The height of this island sea wall was accurately determined by Sonne photography before the first man stepped ashore. Below, the photographs aided in spotting caves and mine fields

Such was the state of development of this new system of photography when the request for Sonne equipment and trained personnel arrived in Washington from Advanced Fleet Headquarters late in November. Mansfield had several men working with him who knew the operation of the camera and its installation. Kistler and a few other officers at the Photographic Intelligence Center were familiar with the interpretation technique.

Mansfield reached Pearl Harbor on December 1. Kistler followed two weeks later.

"Our first job was the designing of change kits to adapt the Sonne equipment to the camera mount in the F6F photographic plane," said Mansfield. "Then we were ordered to Ulithi to board the Hornet for its scheduled Okinawa strike."

Everything was in readiness

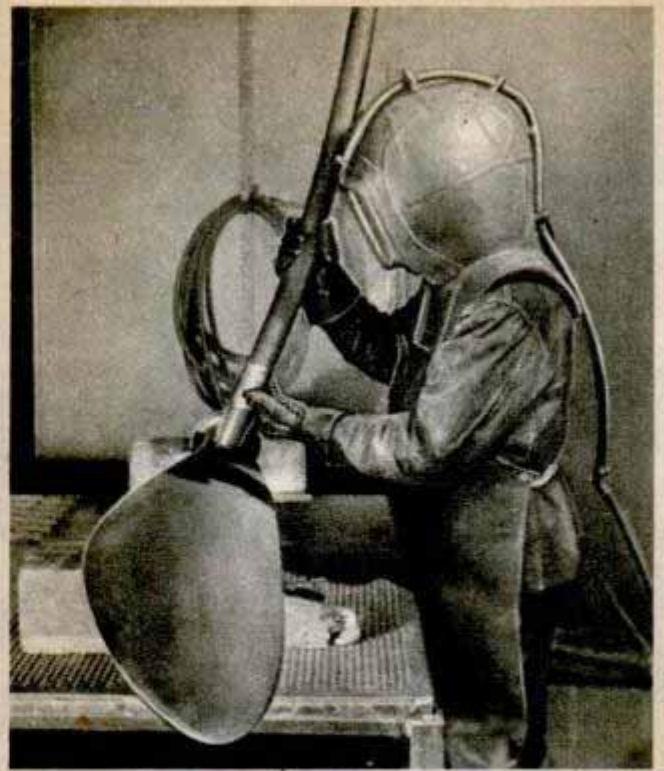
(Continued to page 228)





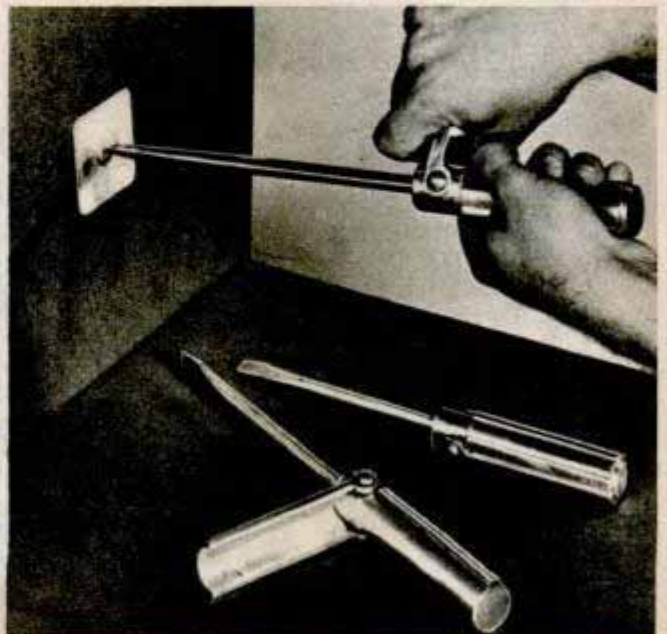
One-man airplane jack requires only light pressure on the extra long handle to raise the wheel of a light plane. It is slipproof and can be locked at any height. Made of lightweight tubular steel with a metal base, the jack can be fitted with a wooden platform for use on soft ground.

"Invisible" fish lures molded of transparent plastic tease salmon, muskies and other big game fish for the postwar angler. Fresh bait is thrust headfirst into the plastic and skewered by means of two projecting wires and two fishhooks. With tail free and head visible through the plastic, the bait wriggles through the water in a lifelike manner, and the tough plastic successfully resists the snapping jaws of even "the big one that got away."



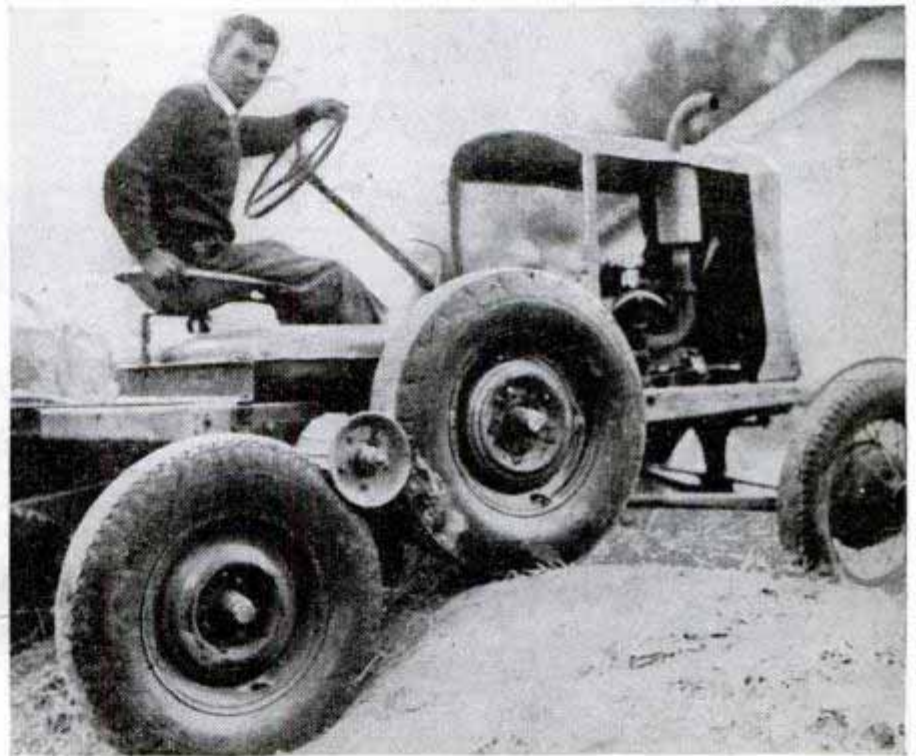
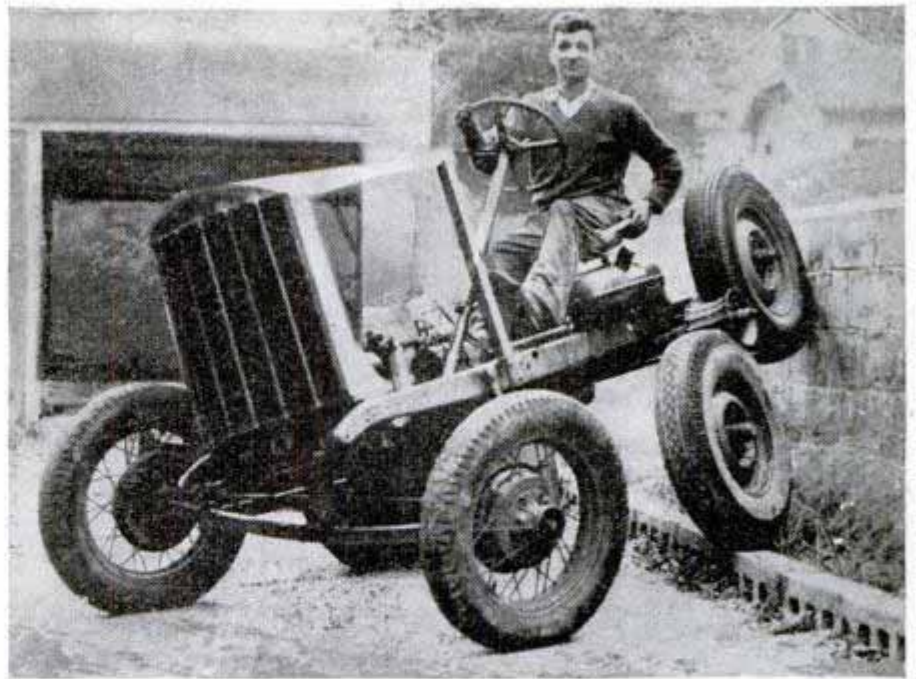
Thousands of pellets hurled against propeller blades under pressures up to 85 pounds increase stress resistance of propeller metals at the Hamilton Standard Propeller plant. A rubber apron, heavy work clothes and a rubber diver-type helmet protect shot-blast operators from the pellets, which ricochet from the blades and walls like an intense hailstorm. Water-cooled air is pumped into the helmet through a hose.

Screwdriver with power arm gives extra leverage for making screws tighter or loosening rusted screws. The power arm unfolds from the handle and allows pressure to be brought both against the screw and for turning it. The tool is available in 5, 6 and 8-inch lengths.



6-Wheel Tractor Can 'Climb Wall'

Rough terrain doesn't discourage a six-wheel tractor built by Charles Ferraro of Minneapolis. With the traction supplied by its unique rear-end construction the tractor will almost "back up a wall." Although both sets of the rear wheels are suspended independently, all four wheels provide power. Each hub of the rear axle is fitted with a cast iron cam that is wedged between the two wheels on that side. The wheels are suspended from an arm that projects across the axle. When power is supplied by the engine, the rear axle revolves the cams which in turn spin each of the four wheels by friction. Independent springing of the wheels provides a crawling action which reduces jars over rough terrain. The tractor was built on the chassis of a stripped-down automobile and uses standard automobile tires.



Tanks Swim Ashore Aided by Lifebelts

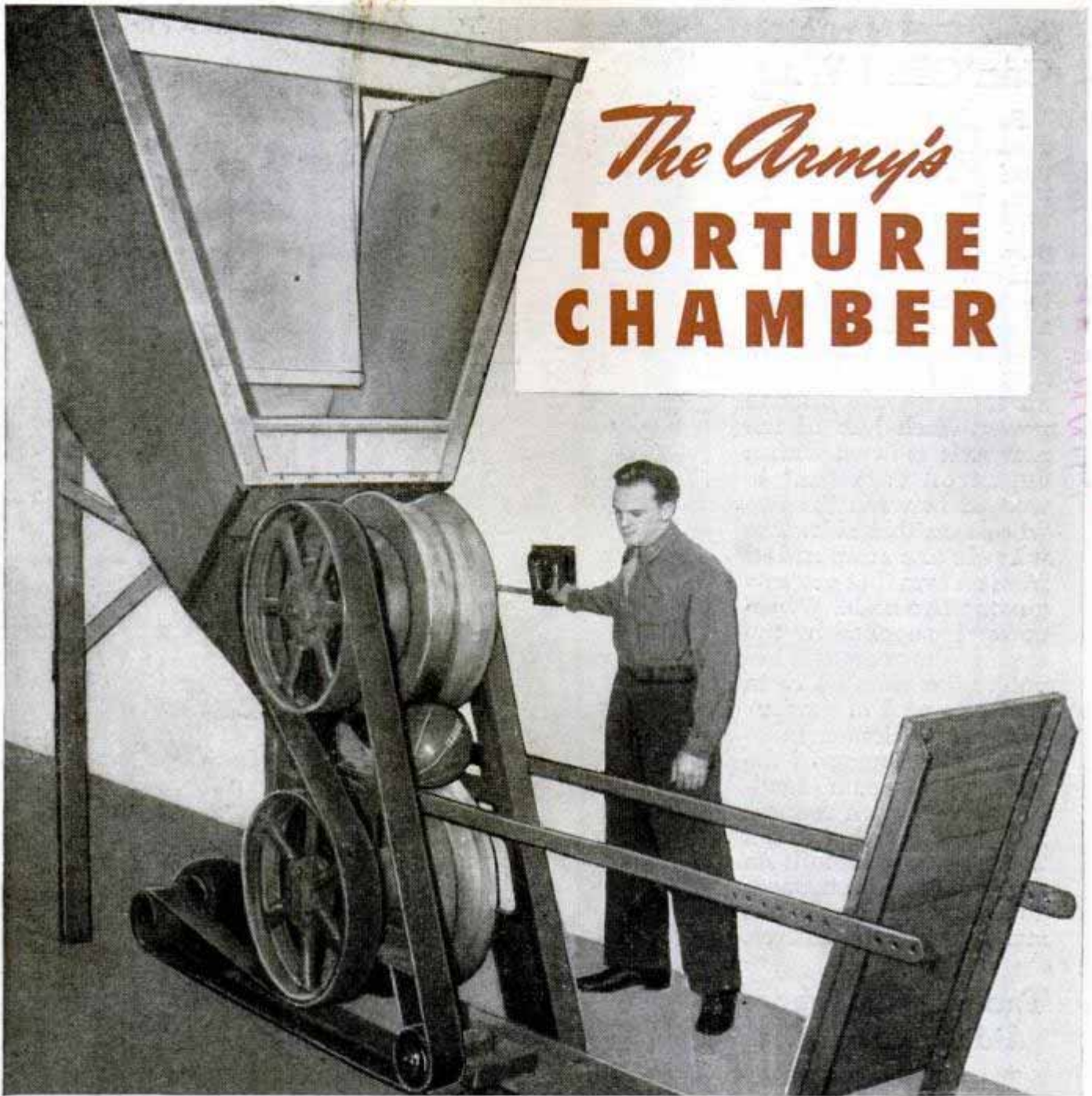
Thirty-ton Army tanks were converted into tiny warships which swam ashore from landing craft to furnish fire support to assault troops at Okinawa. Lifebelts of steel pontoons filled with rubber sponge to stop rifle and machine gun fire were attached to both sides

of the tanks to make them seaworthy even in rough water. Once on the beach, rivets holding the pontoons were exploded and the tank was freed of its amphibian girdle.



3838 N.E. POLK ST.
MINNEAPOLIS, MINN.

The Army's **TORTURE CHAMBER**



Years of wear are simulated in a few minutes by a compression roller which squeezes and bounces basketballs

Our enemies contrived tortures for their prisoners that were worse than medieval. Our Army has its own torture chamber—but the victims are footballs, tennis racquets and other sports equipment

BROTHER, if you sell a sports article to the Army, it had better be good!

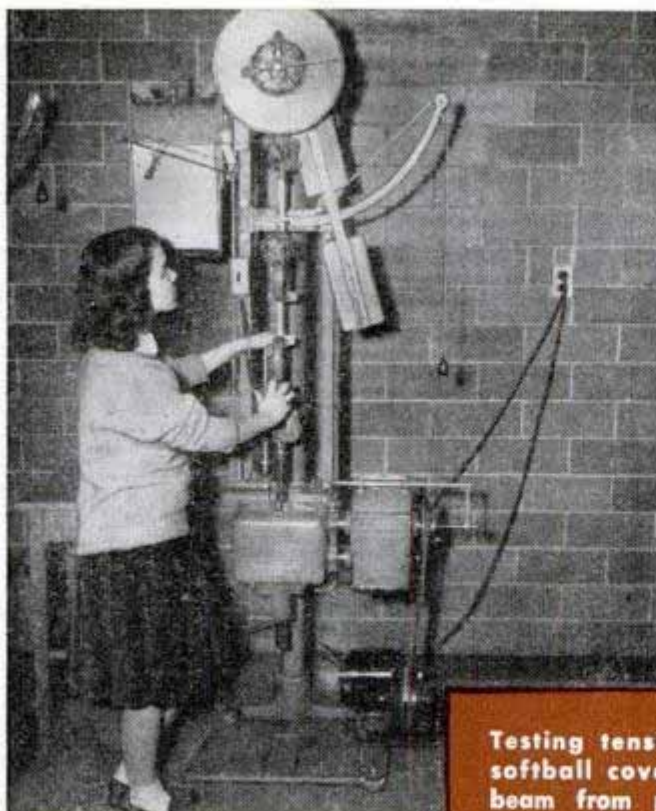
Take a baseball, for example. Here's what value-minded Army buyers do to test a baseball to be used by soldier players: they smack it with a 15-pound mechanical bat that makes Hank Greenberg's blows seem puny. They squash the stuffings out of it with a 390-pound press. They scuff it against a sandpaper sideboard for a day or two. Then, like mad puppies, the Army experts tear it apart to check such factors as the strength of the cover stitching or grease content of the wool yarn.

It's the Army's way of making sure that

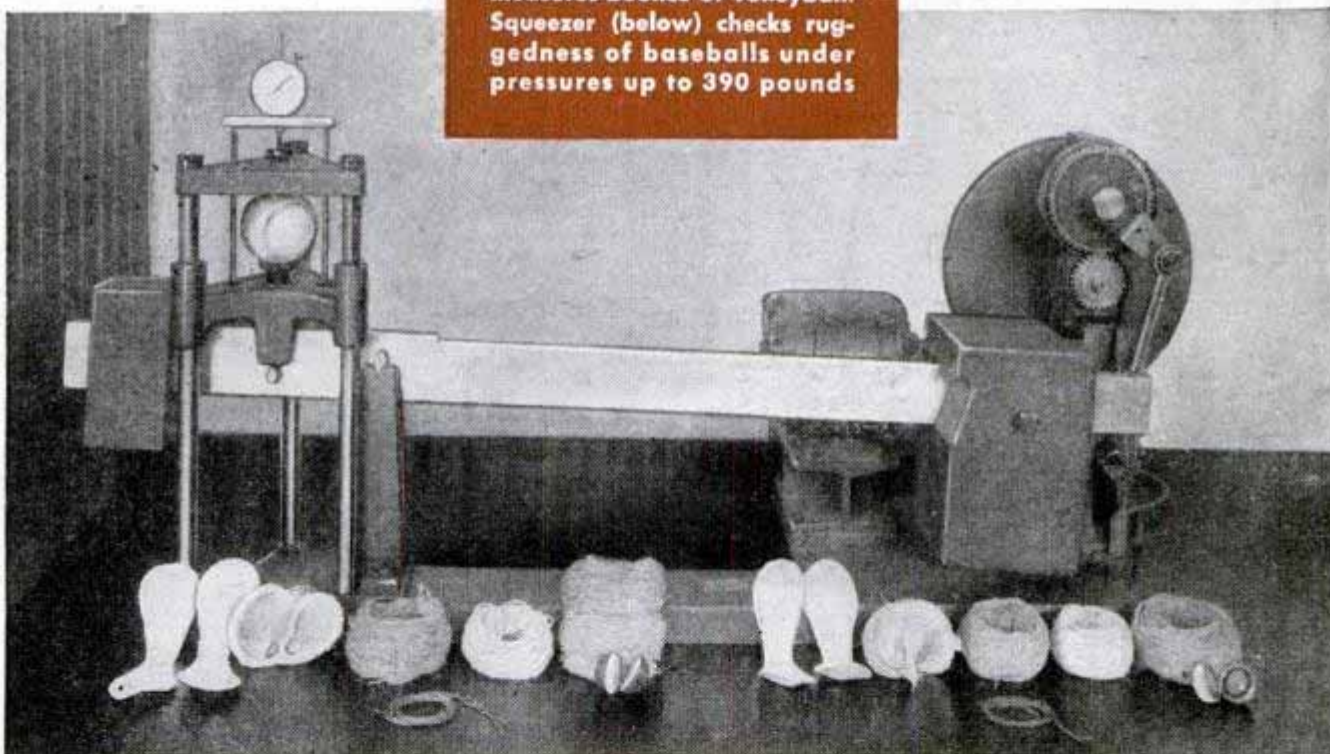
our soldiers get the finest sports equipment in the world. And if the Army testers decide an item could be made better, they contact the manufacturer about it.

Baseballs, basketballs, footballs, golf balls, bats, boxing gloves—in fact, 150 types of athletic equipment—go through a “torture chamber” at the Army's Jeffersonville, Indiana, Quartermaster Depot.

Every article has to demonstrate that it can take a beating. In setting up its stiff examinations for sports' equipment the Quartermaster Corps first went direct to the manufacturers to learn as much as possible about the products, what they were



Testing tensile strength of softball cover (left). Light beam from projector (right) measures bounce of volleyball. Squeezer (below) checks ruggedness of baseballs under pressures up to 390 pounds



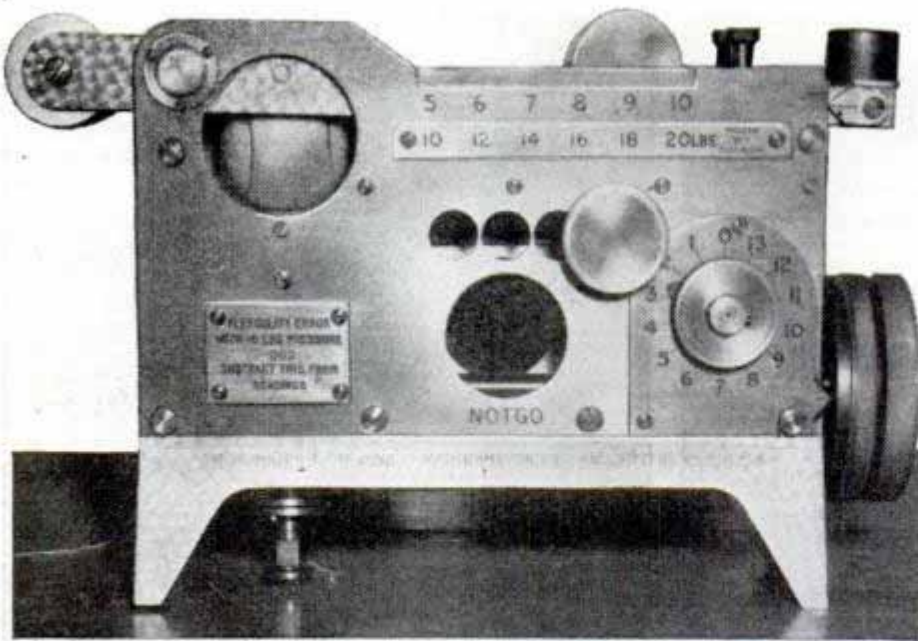
made of, how they were made and packed.

Then the research laboratories were established at Jeffersonville because of its proximity to the geographic center of the athletic goods industry and because of the Quartermaster Depot's long experience in procuring wood, leather, rubber, canvas, cork, twine, textiles, metals and plastics—chief materials for sports articles.

The Army had two main goals: (1) to draw up procurement specifications that would insure uniform products conforming with the regulations of various sports, and (2) to provide the Army with "the best that money can buy."

To put 150 types of athletic equipment through their paces, Army engineers devised various machines which, like untiring nerveless players, tested different items and obtained in a few hours the results that duplicated months and years of actual use.

For example, a whacking machine tests the fatigue of tennis rackets and the resistance of tennis balls; a guillotine finds out whether golf balls can "take it," a drop hammer simulates quickly the amount of abuse a baseball or softball receives in several games of real play; another robot determines whether golf balls go "true" when hit in the air or putted on a green; a roller-

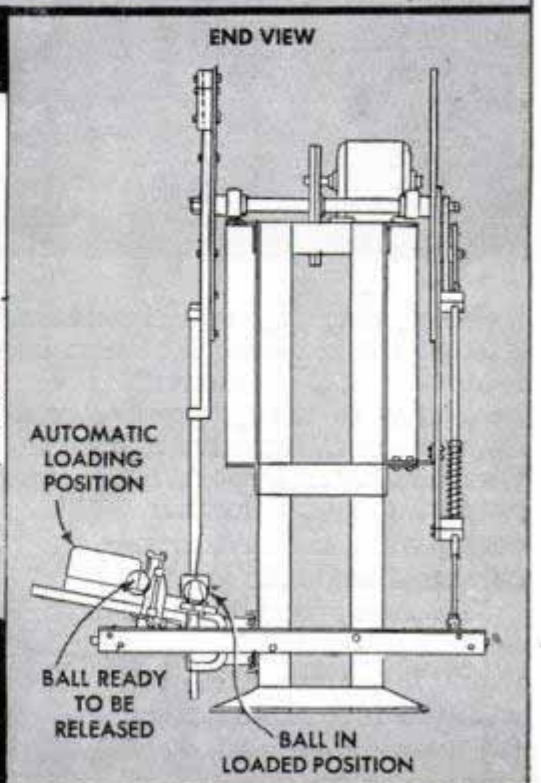
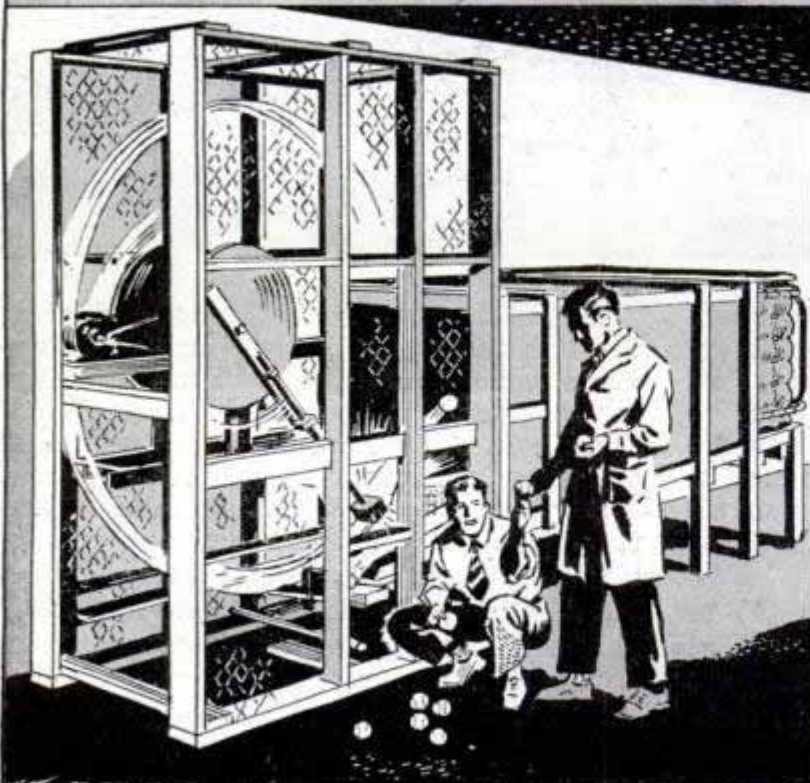
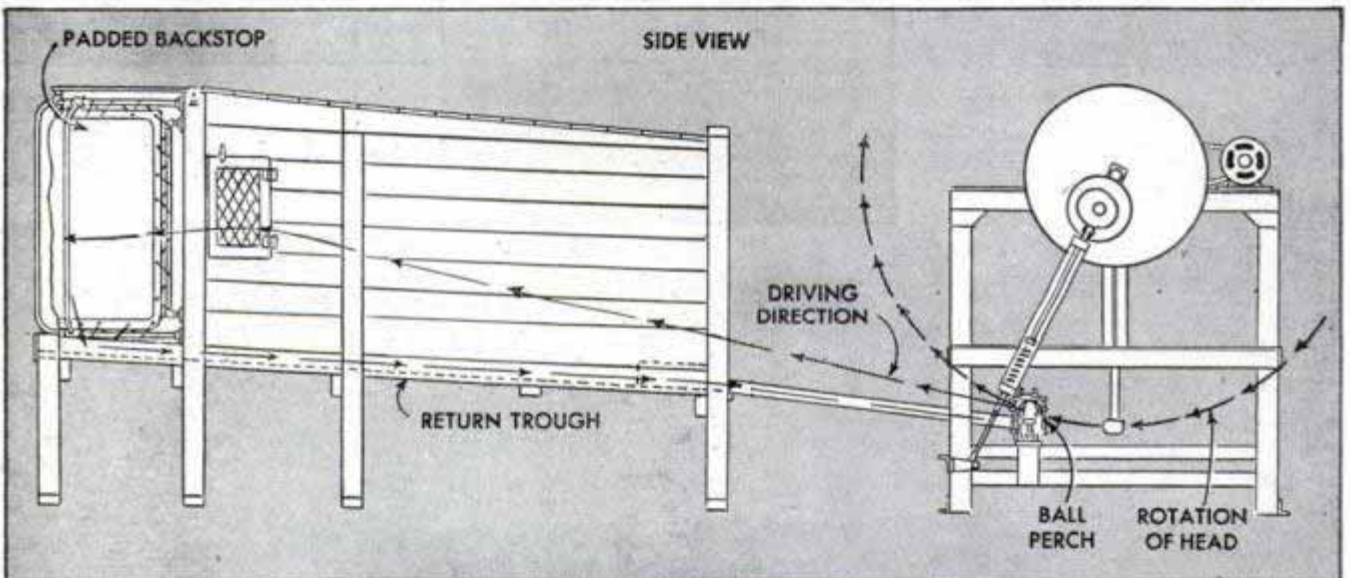


Compressibility of tennis balls is tested by the instrument shown above. Baseballs get a "whacking" test (below) to check durability, roundness

type machine dribbles basketballs and bounces them against a backboard to provide performance data in seven hours that corresponds to months of use.

In addition to these ruggedness tests, a salt spray apparatus duplicates atmospheric conditions aboard ships and at sea bases. Ovens, air-conditioned and humidity-controlled rooms copy the climate of far-away lands.

The artificial climates serve for such purposes as determining a tennis ball's ability to maintain its bounce in a lonely



Army post somewhere in the tropics. For this test, tennis balls are placed in an oven in which the temperature is kept at 100 degrees or more for months. Periodically, the balls are examined, bounced and given various other tests.

What has the Army learned as the result of all these tests? Well, for one thing, several items of athletic equipment were not being manufactured in compliance with the rules of sports. Footballs, the Army announced, were approximately one inch smaller around the minor axis than the rules called for. There was a wide deviation in the weight and size of table tennis balls. Softballs ranged from 5½ to 7½ ounces, whereas the official weight is 6 to 6¼ ounces.

But the Army found that most sporting goods manufacturers worked hard, cooperated in following specifications and gave our armed forces the best athletic equipment in the world.

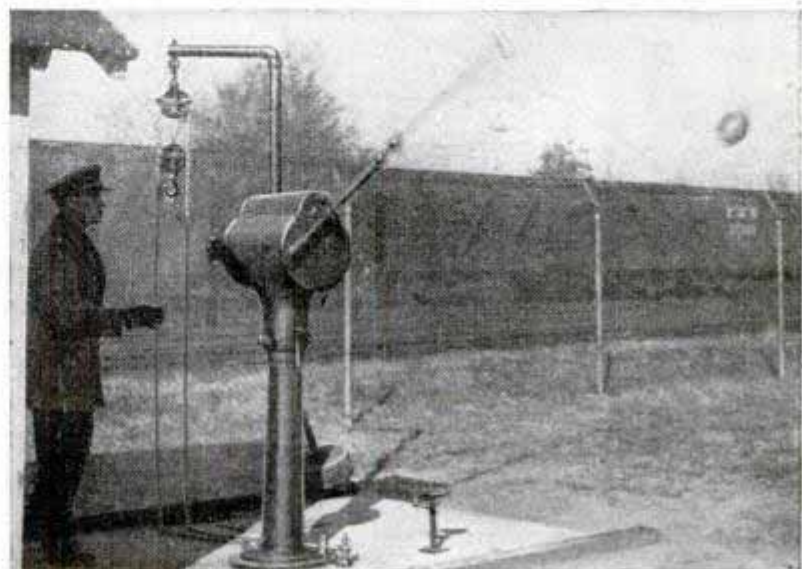
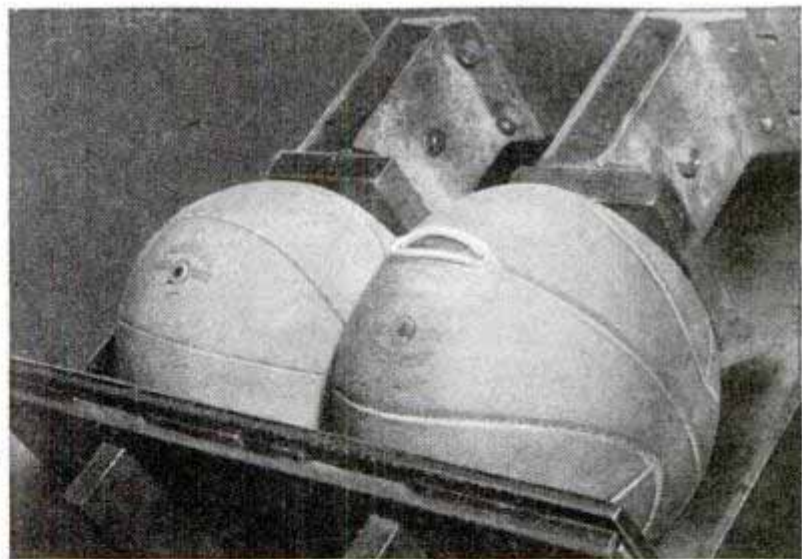
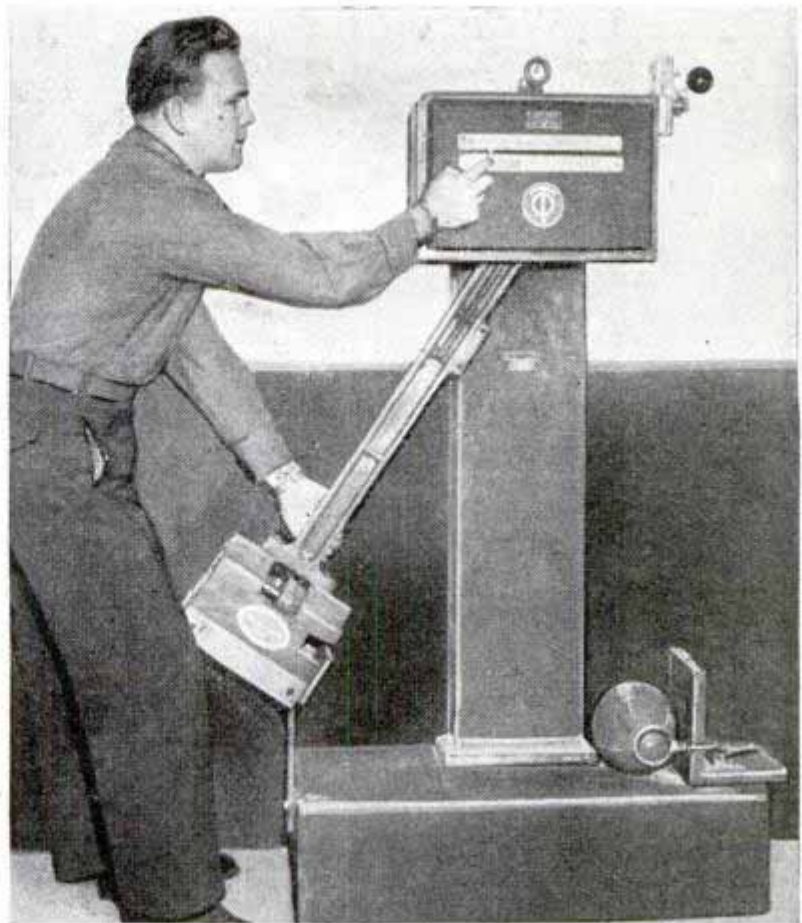
As the result of the Army's research work, several new materials and manufacturing processes are now being considered by the makers of sports equipment. One new material is typha, a product of cattail fluff that can be substituted for hard-to-get kapok as a softball core.

In a hot and humid section of Florida the Army is trying out the idea of using nylon for baseball stitching as an added resistance against mildew and fungus growth. Special studies also are under way to improve methods of moistureproof packaging.

As a possible substitute for leather coverings for basketballs and footballs, the Depot, with the aid of athletic equipment manufacturers and coated fabrics manufacturers, recently developed a heavy plastic-coated textile with a playing life equal to or better than genuine cowhide.

The "torture chambers" have assured flawless athletic equipment for our men in uniform. The tests undoubtedly will mean improved sports goods for you.

Automatic "toe" (top) measures rebound of a football in foot-pounds. A press (center) bears down on basketballs until they burst to test durability. Machine at bottom "kicks" football 100 yards



U. S. Coast Guard Washington 25, D. C.

Line-Throwing Gun and Rifle Designed by Gunner's Mate



U. S. Coast Guard photos

Two new types of firearms, recently announced by the Coast Guard, carry the name of Chief Gunner's Mate James E. Sieg of Baltimore, Md., who designed them in conjunction with the Coast Guard's Research and Development Division.

One is an automatic rifle of 30.06 caliber, 36 inches long, weighing 10 $\frac{5}{8}$ pounds. The rifle has a rate of fire of 650 to 700 rounds per minute with a magazine that holds 20 rounds. The double trigger is pivoted for either full or semiautomatic fire. A unique compensator is said to reduce recoil so effectively that the weapon may be fired with

one hand. The compensator does not interfere with the use of a bayonet, flash-hider or grenade-launcher.

Developed primarily for use by the U. S. Merchant Marine, the second firearm is a line-throwing gun. It promises to surpass all previous models in both range and accuracy. It is .50 caliber and weighs 25 pounds. The gun throws a four-pound projectile that carries a 150-pound-test nylon line to a range of 400 yards. A second type of projectile contains a mechanism for firing a CO2 cartridge which inflates a "donut" float upon impact with the water.

Self-Propelled Paving Breaker Does Work of Eight Men



Cuts are adjustable between six inches and five feet with a self-propelled pavement breaker which does the work of six to eight men. One man operates the machine. All controls are accessible from the driver's seat. The machine weighs 4200 pounds, has a 93-inch boom, six-inch bore

and 40-inch stroke. It is mounted on a 1 $\frac{1}{2}$ -ton running gear. A 210-cubic-foot air compressor is required for operating at full capacity. A 3 $\frac{1}{4}$ -horsepower air motor drives the swing gear and also propels the breaker forward or backward.

Rubberlike Plastic

"Marvinol" resin, new elastic plastic, will be used in swimming suits, infants' pants, purses, gloves, shoes, raincoats,

umbrellas and transparent garden hose, according to the manufacturer. In raw form the polyvinyl plastic is a granular white powder. When combined with other substances it varies from a rigid to a soft rubbery state. The manufacturer claims it resists chemicals and is durable.

Bottled Carbon Dioxide Fills Tires or Puts Out Flames

Carbon dioxide gas, used in wartime to inflate collapsible rubber rafts, now is being used to inflate flat tires. Ten ounces of gas, enough to fill three tires, are compressed into the three-pound nine-ounce steel cylinder. Because it quickly smothers fires, the lightweight non-toxic carbon dioxide cylinder can be used also as a fast-operating fire extinguisher. The cylinders can be refilled.

Film Records Talks Over Railway Radio

Automatic film type recorders jot down two-way conversations carried on over a high-frequency radio communication system now being tested by the Reading Railroad at Philadelphia. Designed by Maguire Industries, Inc., the recorder employs a voice-actuated relay to start the mechanism. The radio equipment makes it possible to conduct two-way conversations between the main railroad station and three Diesel-electric locomotives moving about the yards. Messages also can be exchanged between locomotives and to and from remote points in large offices.

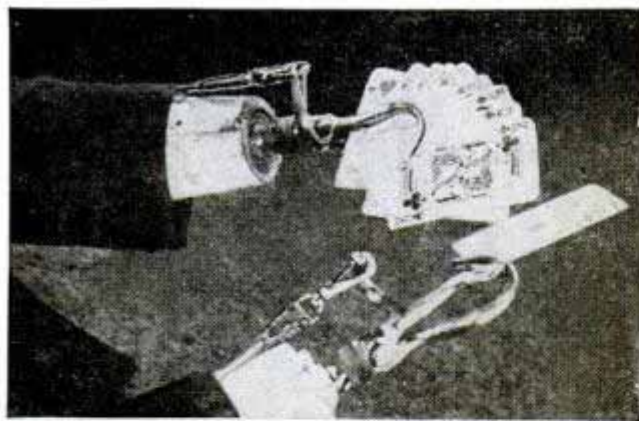


Water Bags Silence Tank Movements

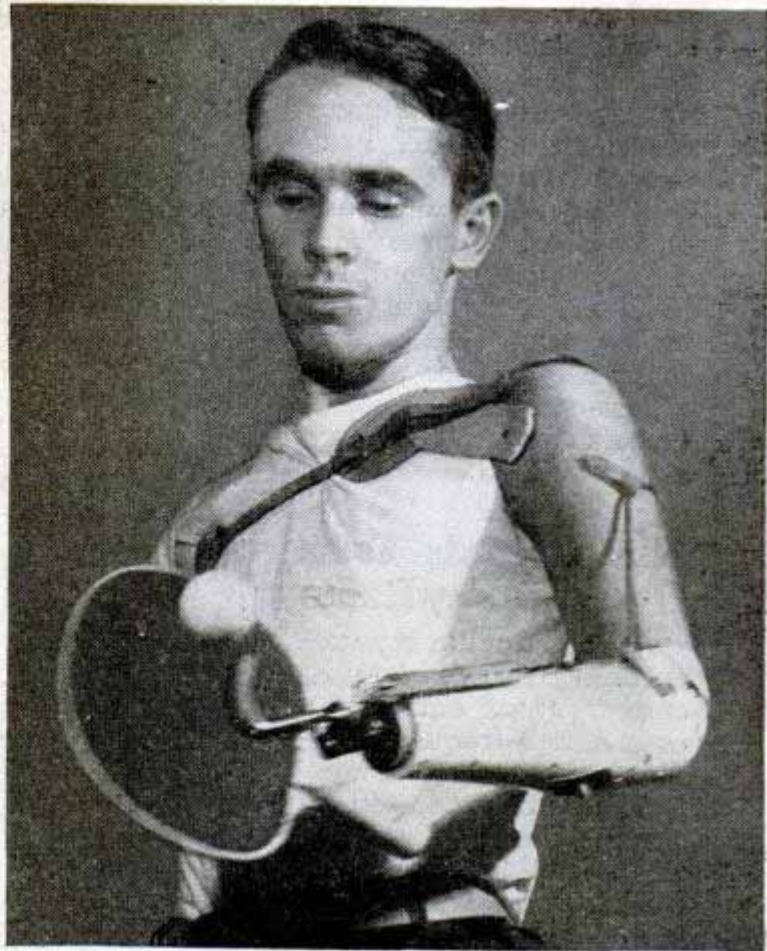
Bags which fit over the treads of this Japanese amphibious personnel carrier are filled with water for "silent" operation when the tank is operated on land.

☐ Airplanes scatter mustard seed over mountainous areas devastated by fire so the quick-growing plants will help prevent serious erosion.

HANDS FOR THE



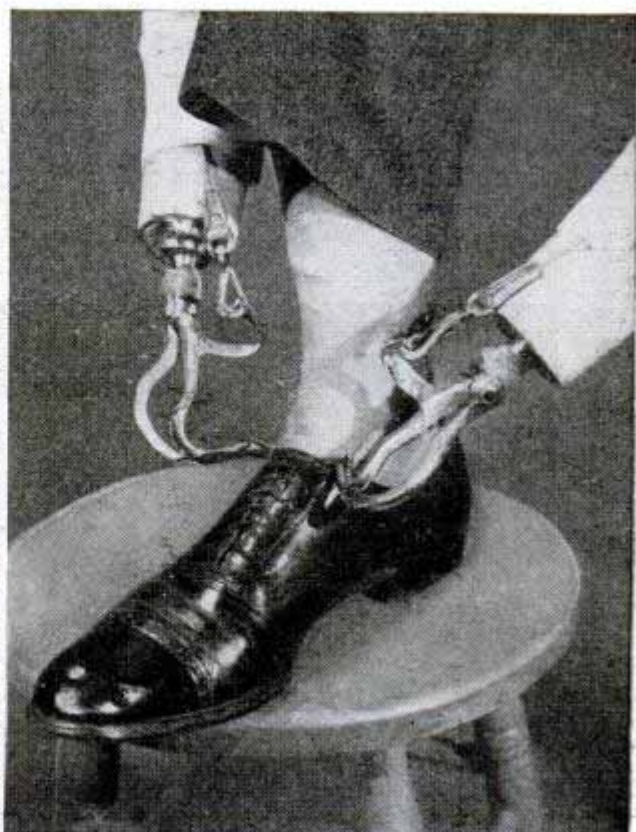
A veteran can handle cards with metal fingers which are operated by cables from the shoulder



Signal Corps photos

Although this veteran has had his new arm only one week, he can already play ping-pong, a game that develops coordination through sweeping arm movements. Below, two man-made hands demonstrate degree of dexterity needed to tie shoelace

Even the necessary everyday tasks seem insurmountable to the man who has lost both hands. But with practice he can learn to manipulate table utensils (above), dress himself, drive an automobile and do practically anything he could do before his injury. When he gains more confidence he can even teach his new hands how to typewrite



HANDICAPPED

FOURTEEN thousand men—the equivalent of one full Army division—are sweating out their discharges in Army hospitals. Each member of this “phantom division” wears the Purple Heart and at least one overseas theater ribbon. Many wear their country’s highest combat decorations, including the Medal of Honor.

But each member also bears a cross that is a lifelong reminder of service to his country—the loss of at least one limb.

More than 90 percent lost at least part of one limb, five percent parts of two limbs, nine men are triple amputees and two lost parts of all their limbs. Members of this “phantom division” can become self-supporting once more only if they are fitted with man-made hands, arms and legs.

Experimentation in the development of artificial limbs was given terrific impetus by the war. Private manufacturers are striving to market satisfactory limbs. Last January the Veterans Administration shouldered the research work for this important project.

Progress is slow and claims are cautious. All sincere experimenters warn the amputee not to lift his hopes too high. Yet limbs that “work” are being produced.

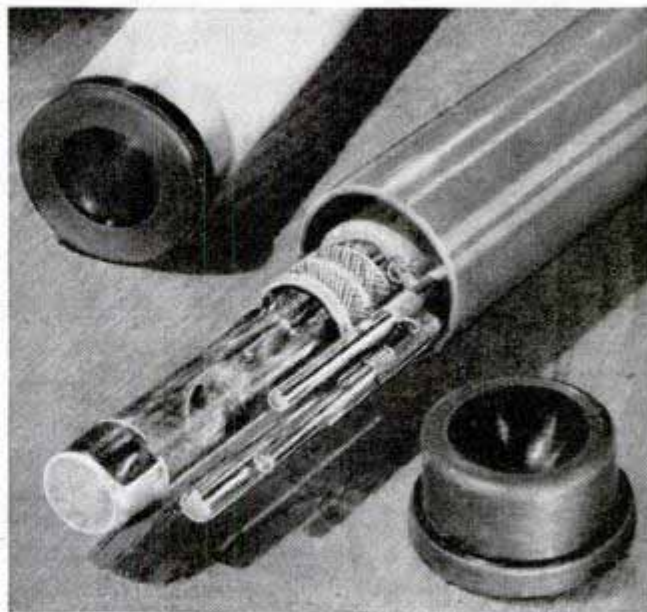
In 1943 the Army adopted the “Trautman” leg, which is far from perfect but is still the best of those available. Made of wood fiber, it is light, durable and can be adjusted easily to amputations of all types.

Development of adequate artificial hands has lagged far behind the production of legs. Movements of the fingers, thumb, wrist and elbow are too difficult to duplicate at the present time. The so-called “cosmetic” hand resembling a human hand can simulate only a few movements and is mainly a show piece. The “working” hand is a metal “claw” or “hook” hand. Compound joints have given it a greater range of motion and flexibility.

After an artificial limb is fitted, the amputee receives training in its use. Leg amputees are taught to march to music, walk over rough obstacles and up and down stairs. Claw hands, with practice, can be made to duplicate several simple motions of the human hand. The amputee can learn to eat and dress without help, play games and even typewrite.

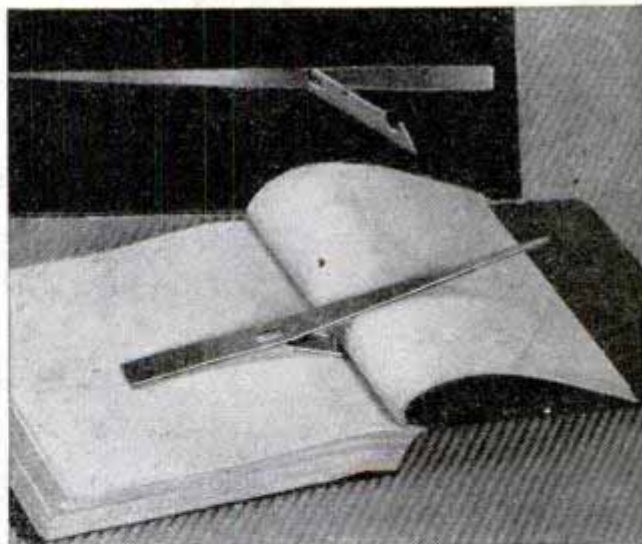
But the aim of the experimenters has not changed. It is to provide the best possible appliances so that amputees can resume their places in society with confidence and pride. The nation can do no less for men of the “phantom division.”

Plastic Container for Fishing Rod Prevents Tackle Damage

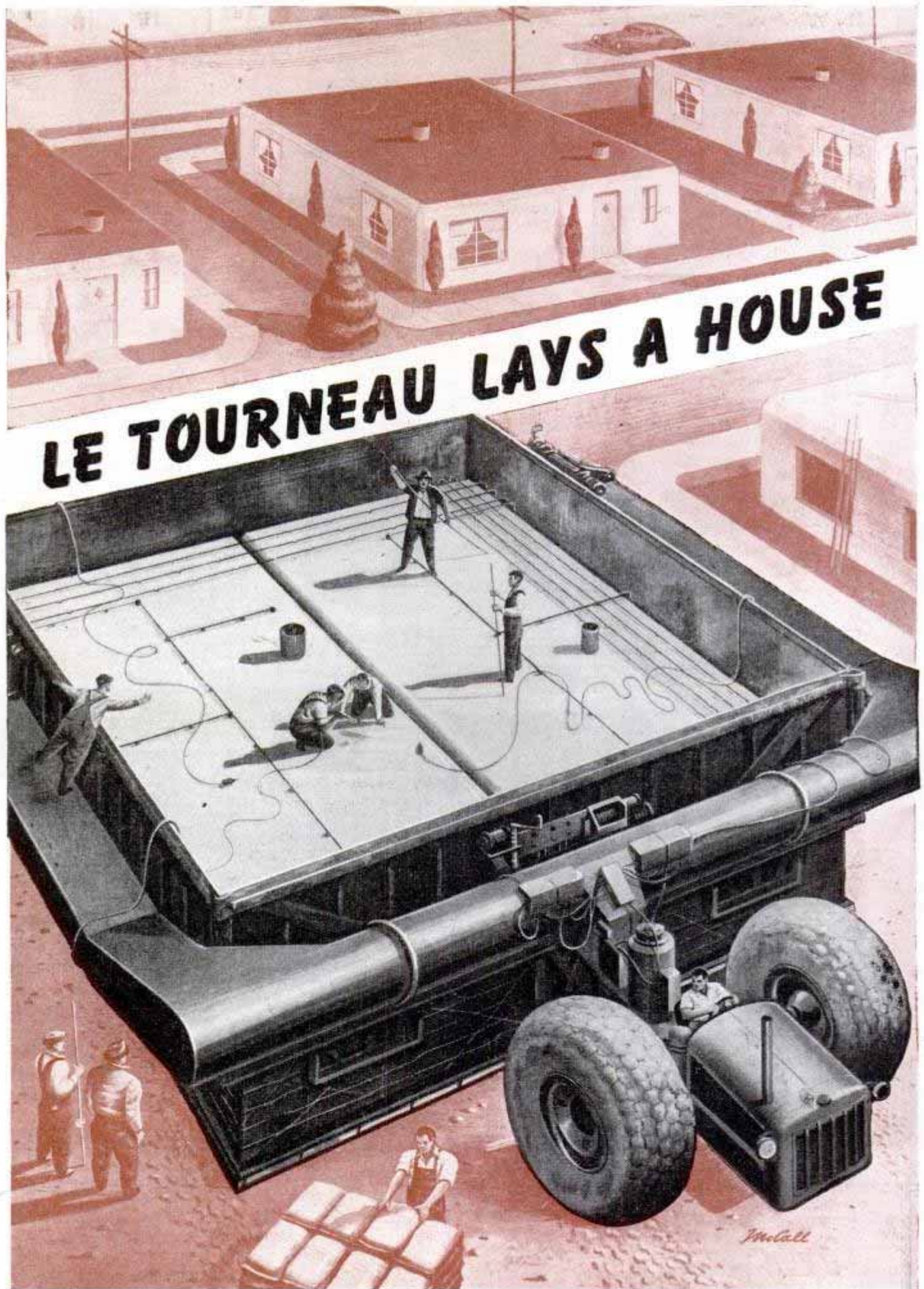


Shatterproof cylindrical containers of plastic afford full protection for fishing rods whether thrown in the back of the car with other fishing gear or in storage on crowded shelves. The lightweight containers are 1½ inches in diameter and a little over three feet long. One end is permanently sealed and the other has a rubber plug. The containers are made in several colors.

Page Holder Pins Book Open



Typists, bookkeepers and other office workers will find many uses for a knifelike instrument designed specifically for holding a book or notebook open at a certain page for copying. The bottom blade is inserted in the book’s binding while the upper part holds down the pages. The page holder comes in various models, some ruler-marked and others equipped with a small magnifying glass. It also can be used as a letter opener or as a knife for cutting cord from packages.



LE TOURNEAU LAYS A HOUSE

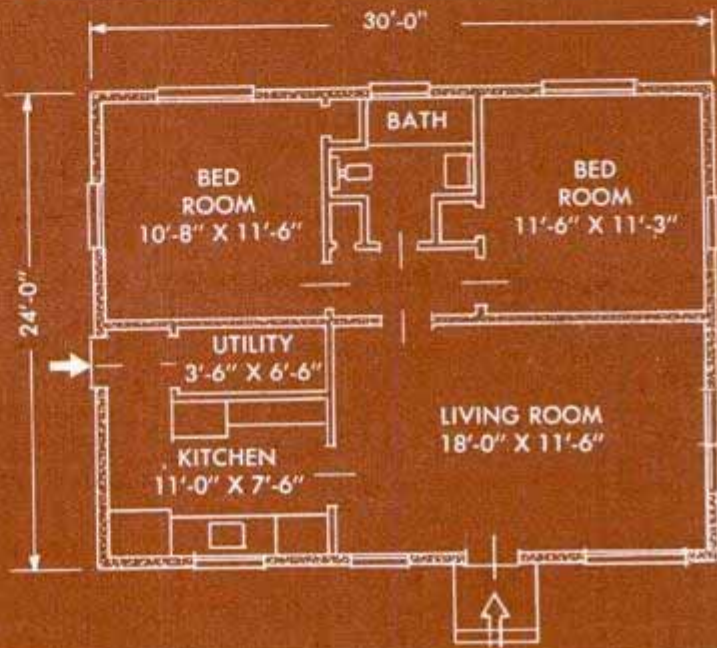
Like a giant chicken laying eggs, this huge machine forms and gently sets in place complete concrete homes. Roof and walls, with allowances for doors and windows, are poured after inner and outer forms are built and steel reinforcing is installed. After setting 24 hours, the house is carried to its site by the robot contractor

By William F. McDermott

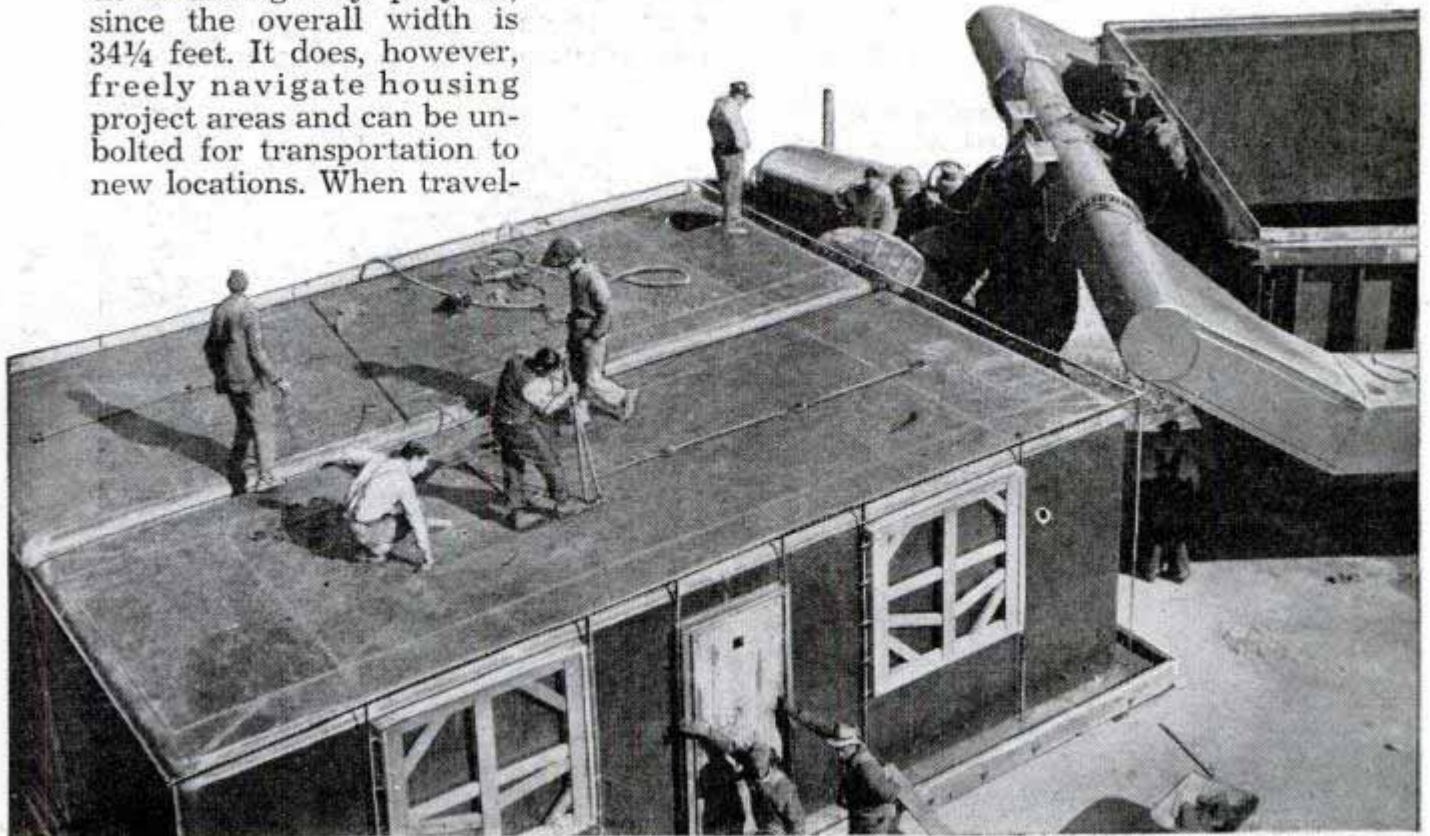
HUGE bombers that have laid "eggs" all over Germany and Japan now have a rival in a mammoth bulldozer-type machine that may some day "lay" houses all over America. It is the latest of many developments by R. G. LeTourneau, Inc., in the house-building field. It really isn't house building, but "house pouring," because this behemoth takes the flowing stream of cement and sets it into a complete house form.

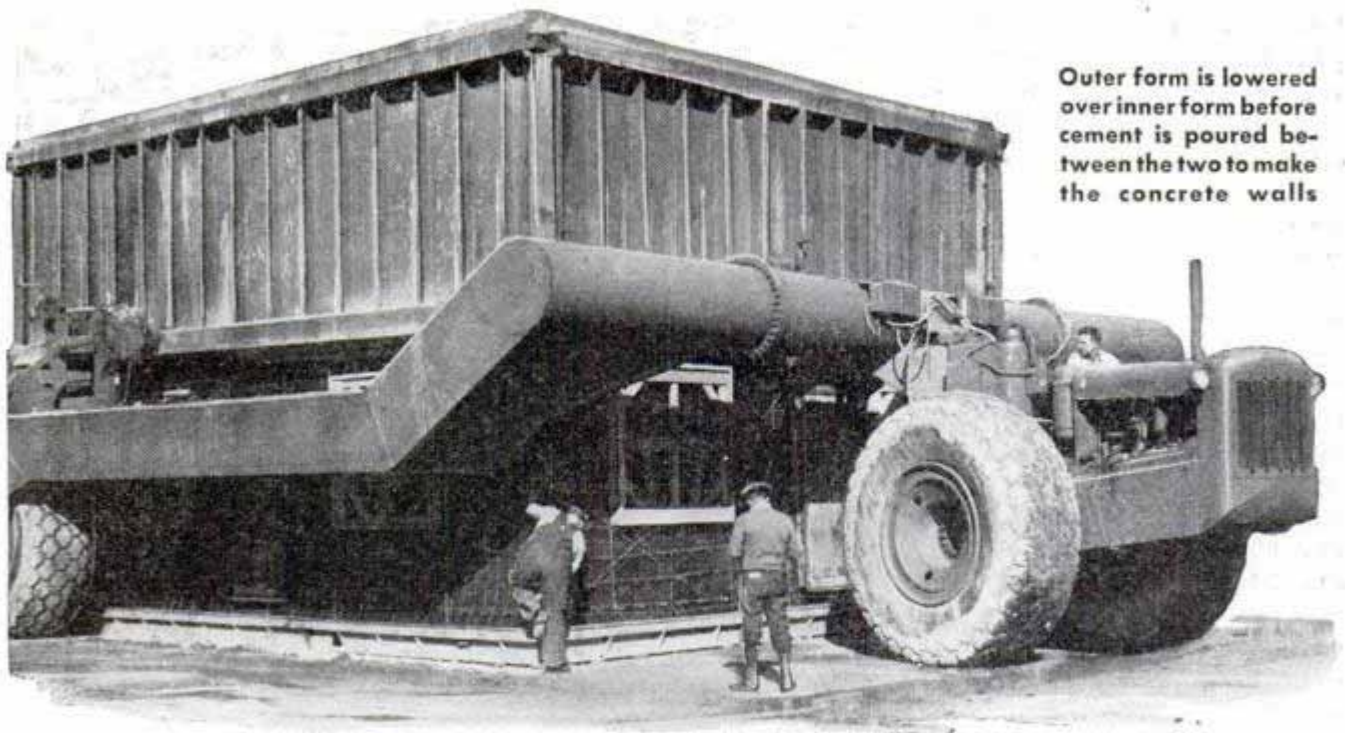
The revolutionary Tournalaid house is far beyond the blueprint stage. Several already have been constructed and are in use near Vicksburg, Miss. The need for housing the families of LeTourneau employees and for factory offices gave birth to the mammoth Tournalayer. Dimensions of the bowl of the vehicle are 24 by 30 by 9.5 feet—the earthmoving capacity of such a box would be 317 cubic yards, or 21 big scraper loads.

That is only for comparison, because it is not designed for earthmoving and is too wide for maneuvering on most highway projects, since the overall width is $34\frac{1}{4}$ feet. It does, however, freely navigate housing project areas and can be unbolted for transportation to new locations. When travel-



Laid in a day, the concrete home and its floor plan (above). Inner form (below) provides "nest" over which Tournalayer drops its load





Outer form is lowered over inner form before cement is poured between the two to make the concrete walls

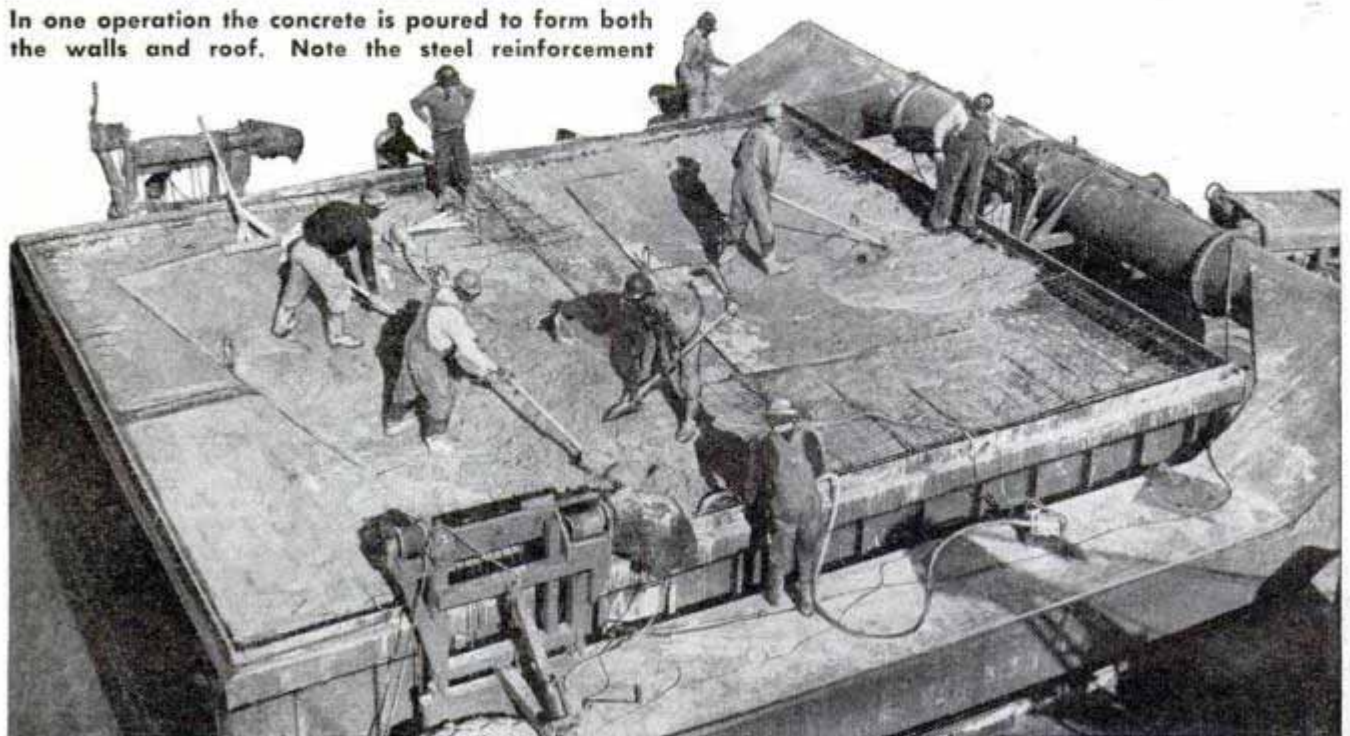
ing, this strange contraption has no bottom. After the concrete from a huge mixer has been poured within its form and has set, the Tournalayer transports it to the new site. After the exact spot for the new home has been determined, the operator presses a button and the bowl slowly lifts to disclose a rectangular concrete house, with doors, windows and partitions.

The Tournalaid house form is in three sections—one outside. The inside form is composed of two independent sections so spaced that a partition wall can be poured between them.

After the two inside forms have been covered with reinforcing mesh, the Tournalayer straddles them and lowers over them the outside form, which is the body

or bowl of the Tournalayer. The concrete is poured. After it has had time to set, the operator collapses the inside form walls away from the house by pressing an electric button. He presses another button and the outside form with the house is lifted up. Lowering its load to traveling level, the Tournalayer walks off to the house site. There it brings the form down to the ground, lays its egg, lifts the form off and struts back. The house is left standing on a broad foundation which is part of its walls. In the meantime the inside forms have been expanded by reversing the action on their walls and are ready for covering with reinforcing mesh. The operator or foreman takes a look at his print for the next structure, then spots doors and win-

In one operation the concrete is poured to form both the walls and roof. Note the steel reinforcement



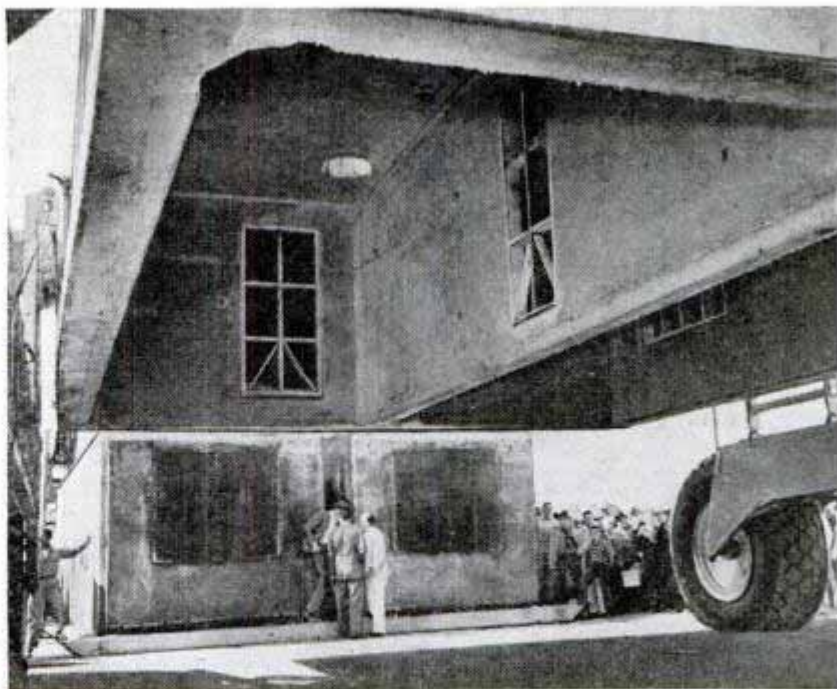
dows wherever they are required by pegging metal frames into the holes which are conveniently located all over the walls of the form.

All this work of the automatic house builder, however, takes place after a certain amount of hand work. The first step is to lay a concrete floor with quick-drying cement. Contractors may lay long rows of floors, opening the way for quick setting of entire blocks of homes. Floor-laying is done in the usual manner and does not require any help from the Tournalayer. All utility lead-ins are laid with the floor, as well as a system of hot water pipes which run through the floor to provide radiant heating.

Tourna-transit-mixers—which are in R. G. LeTourneau's mind, although not yet on the drawing boards—equipped with extra high dumping facilities, can bring concrete from the batch plant and pour 30 cubic yards of concrete—about five loads—at a cost of about \$10 a yard in place. When the house is poured and the concrete is sufficiently set for lifting it off the inside form and traveling, the Tournalayer will waddle off with it to the homesite.

The first LeTourneau pre-fabricated concrete houses were of a sort of intersecting tunnel design, which the designer referred to as clover-leaf, but most of the factory force called igloo. Curved walls presented problems. Appearance, to speak moderately, was a bit unusual. The Tournalaid house, however, is conventional in shape and with the form or forms now used can be poured in a wide variety of styles and for a multitude of floor plans.

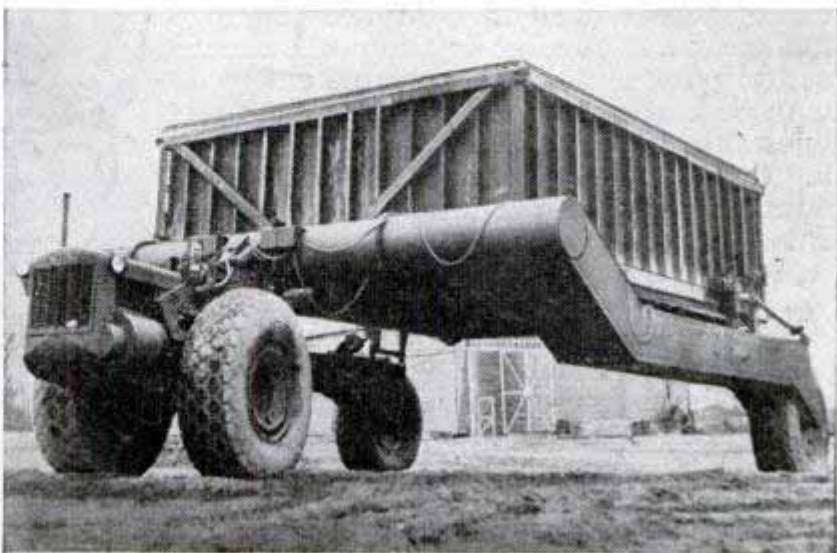
While there are no immediate plans for marketing Tournalaid houses—undoubtedly there will be considerable further development before any such plans will be made—the Vicksburg, Miss., plant and its employees are going to get more Tournalaid homes, offices and factory buildings.



Hardened concrete house is removed from the inner core by hydraulic lifts of the home builder. The home then is deposited on its site



At the site (above) the home is set down and the house layer prepares to move away for more concrete to build another structure. Below, Tournalayer containing another new house is on way to site



Speed Below-Zero Plane Starting



Cold weather starting of plane engines in two minutes instead of as much as six hours is possible with a new fuel developed by the Texas Company and now being tested by the Army Air Forces. It is expected to eliminate the cumbersome pre-heating equipment for subzero takeoffs when aviation gasoline will not start the engines. These gasolines cannot contain the low boiling fractions needed for starting in such weather because of the dangers of vapor locking in flight. The cold starting fuel is used in regular aviation carburetor and priming systems. A portable external tank or bottle is attached to regular fuel lines, shutting off main fuel lines and allowing the special fuel to flow for about two minutes. After the engine is warm the portable tank is disconnected.

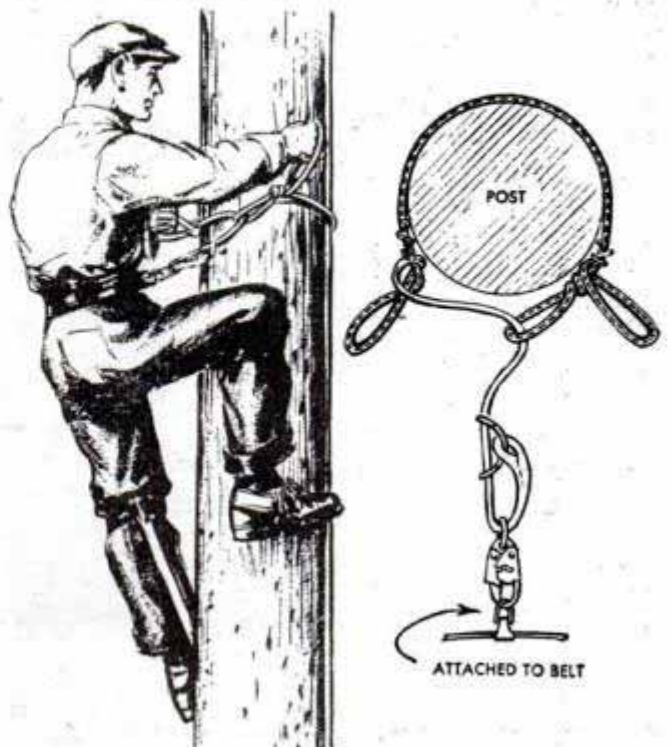
Find First New Gem Since 1909

Brazilianite, a mineral recently discovered in the country for which it was named, is suitable for cutting into gem stones. The mineral is yellowish-green with glasslike properties and has sufficient quality in color and perfection to warrant cutting it into

gems. The discoverers, Edward P. Henderson of the Smithsonian Institution and Frederick H. Pough of the American Museum of Natural History, believe, however, that it is not likely to become a popular gem because of its scarcity and because it is not hard enough to withstand long wear. Brazilianite is the first new mineral with gem-stone possibilities to be discovered since 1909.

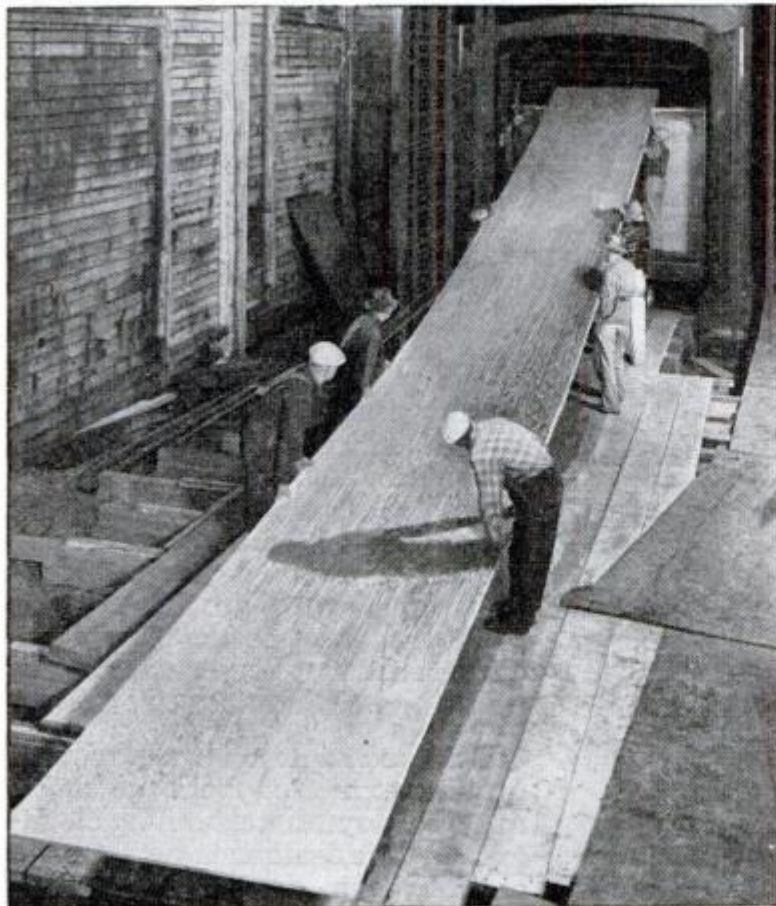
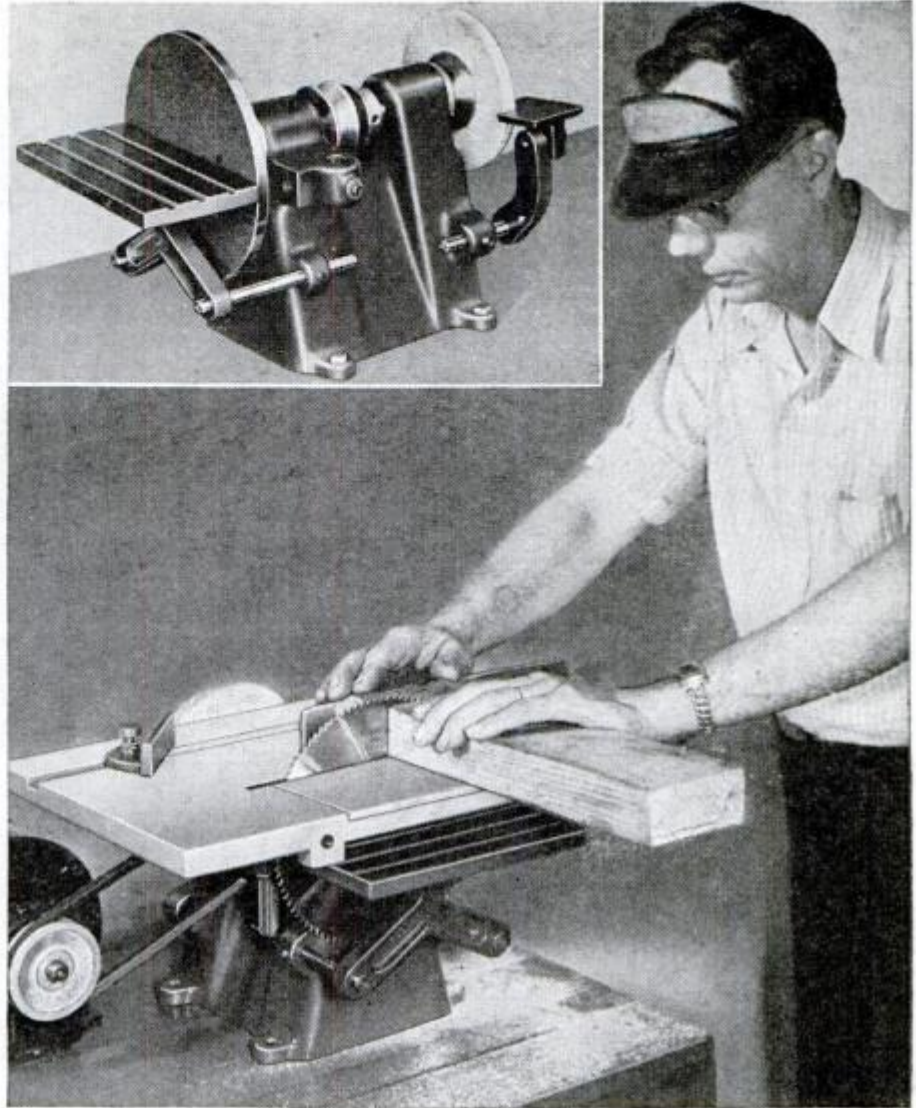
"Catch" Device on Rope Breaks Lineman's Fall

Telephone and electric linemen are assured safety from falling with a recently patented device that grips the pole immediately if the climber accidentally falls or his spikes fail to grip. A loop of rope is substituted for the lineman's arms in encircling the pole. A wire woven through the center of the rope keeps it stiff enough to be moved easily. At one end of the rope are two loops, one used as a hand grip. At the other end is a similar hand grip, with an extension of the rope which fastens to the climber's belt with a hook. The rope is placed round the pole and the free end is passed through one of the loops at the other end and fastened to the lineman's belt. The lineman lifts the rope with him as he climbs. Should his spikes fail, his weight immediately falls on the rope, which tightens around the pole.



Tool-of-All-Work for Workshop Saws, Grinds or Polishes

Grinder, sander, buffer and saw are combined into one power tool for home workshops, model makers and light manufacturing. The basic tool is an abrasive grinder on one end and a sanding disk with adjustable work rest at the other end. Either the grinding wheel or sanding disk may be replaced with buffing or polishing wheels for a second combination. A third adaptation makes up into an eight-inch power saw with tilting table. A fourth combination is provided in the design of the saw table so that dado heads may be used for routing. The base of the power tool is cast iron, machined to aircraft tolerances, with self-lubricating ball bearings used at the two bearing points. The saw table is cast aluminum, ground to accurate flatness. It is recommended that a $\frac{1}{2}$ or $\frac{1}{3}$ -horsepower motor be used with the tool.

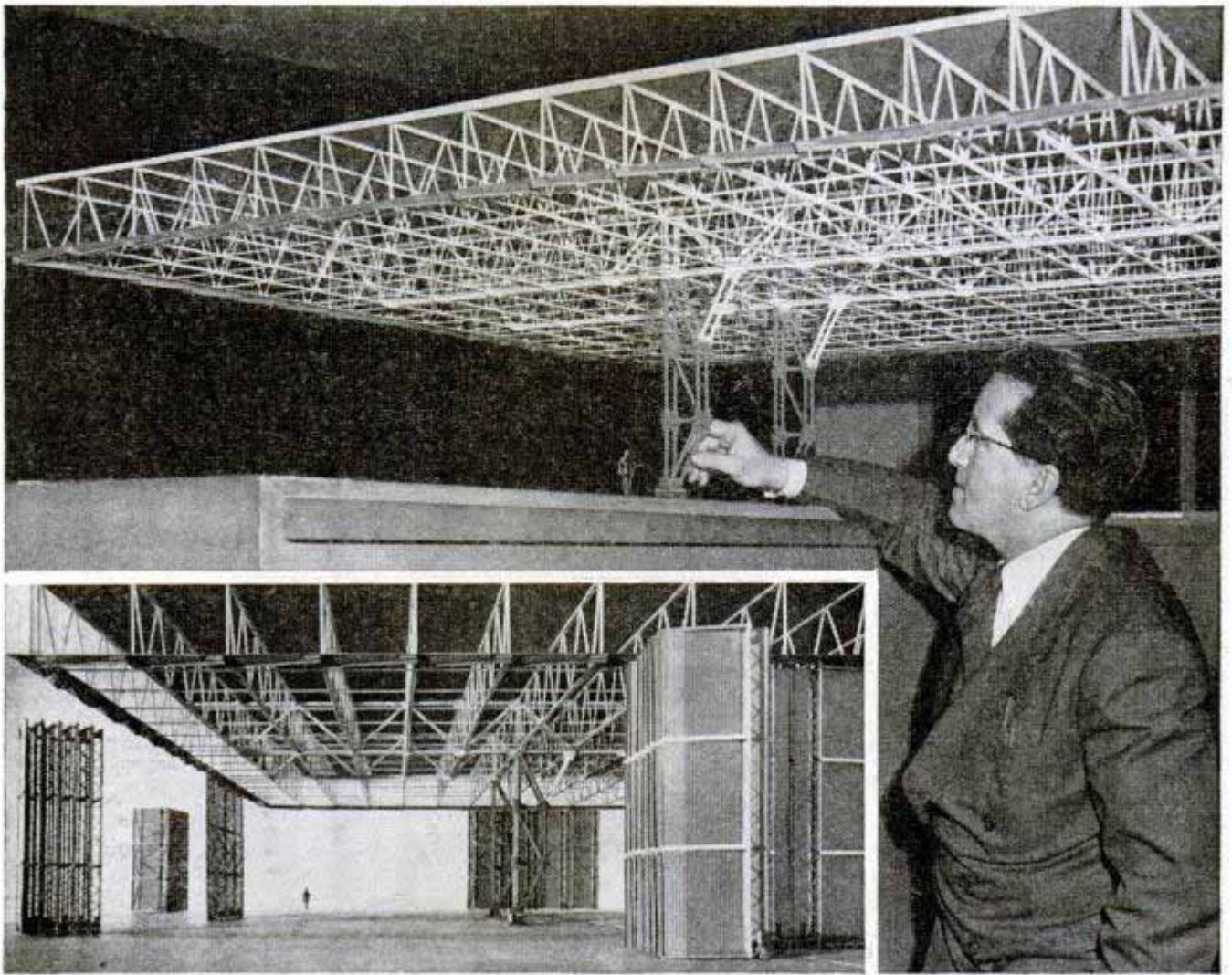


50-Foot Plywood Panels Made of Small Sheets

Plywood panels almost as long as a freight car are being made with production techniques developed during the war. The panels are 50 feet long, five feet wide, $\frac{3}{4}$ inch thick, and weigh 550 pounds each. They will be used in building boats, outdoor signs, structural beams and store fronts. To make the extra-large panels, the ends of standard-size sheets are tapered in a scarfing machine and then bonded together with waterproof adhesives. A new press, the largest of its kind, applies both pressure and heat to seal the bond. The joints then are sanded smooth. Waterproof adhesives enable the panels to be used in boat building.

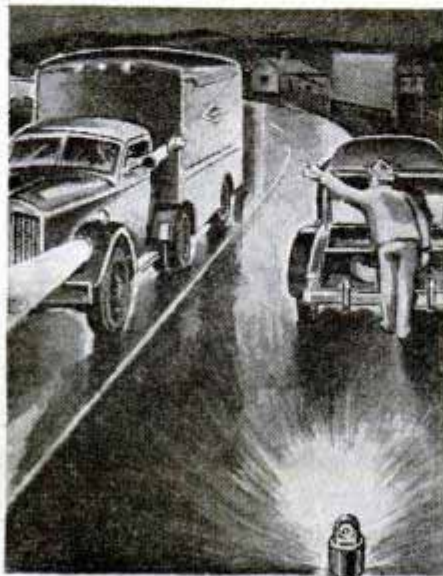
Write to the firms listed in the Where-to-Buy-It Index, page 8, to learn more about products described in this magazine. Say you saw it in Popular Mechanics.

Hangar With Removable Walls Eases Storage Problems



Hangars with all walls completely and instantly removable for exit or entry of planes anywhere along the building line are possible with a new method of prefabricated construction. The wall units double as doors and are completely independent of the hangar, without hinges, tracks or other permanent connections. They stand by themselves or can be rolled entirely away, since they carry none of the building's structural load. The new method also

utilizes a metal tube joint entailing no riveting, hand welding or other skilled operations. It will permit the owner to extend, modify or demount the hangar with 100 percent salvage after erection. According to the designer, the wall units are planned so they can be rigged horizontally to a dolly and a tractor and used as semitrailers to transfer the building materials from one site to another. This type of construction is adaptable to warehouses or factories.



Motorists' Electric Flare

Pint-sized electric red flares, which light by denting a metal blister on the bottom, can be used by motorists when stalled along the roadside at night. Depressing the blister sets up a chemical reaction which will light the bulb for 24 hours. The device is not rechargeable, but may be turned off by being placed on its side.

Believed superior to the natural product extracted from the chestnut tree, a synthetic tanning chemical for sole leather is being made entirely from domestic materials.



The Gold Bug Strikes Again

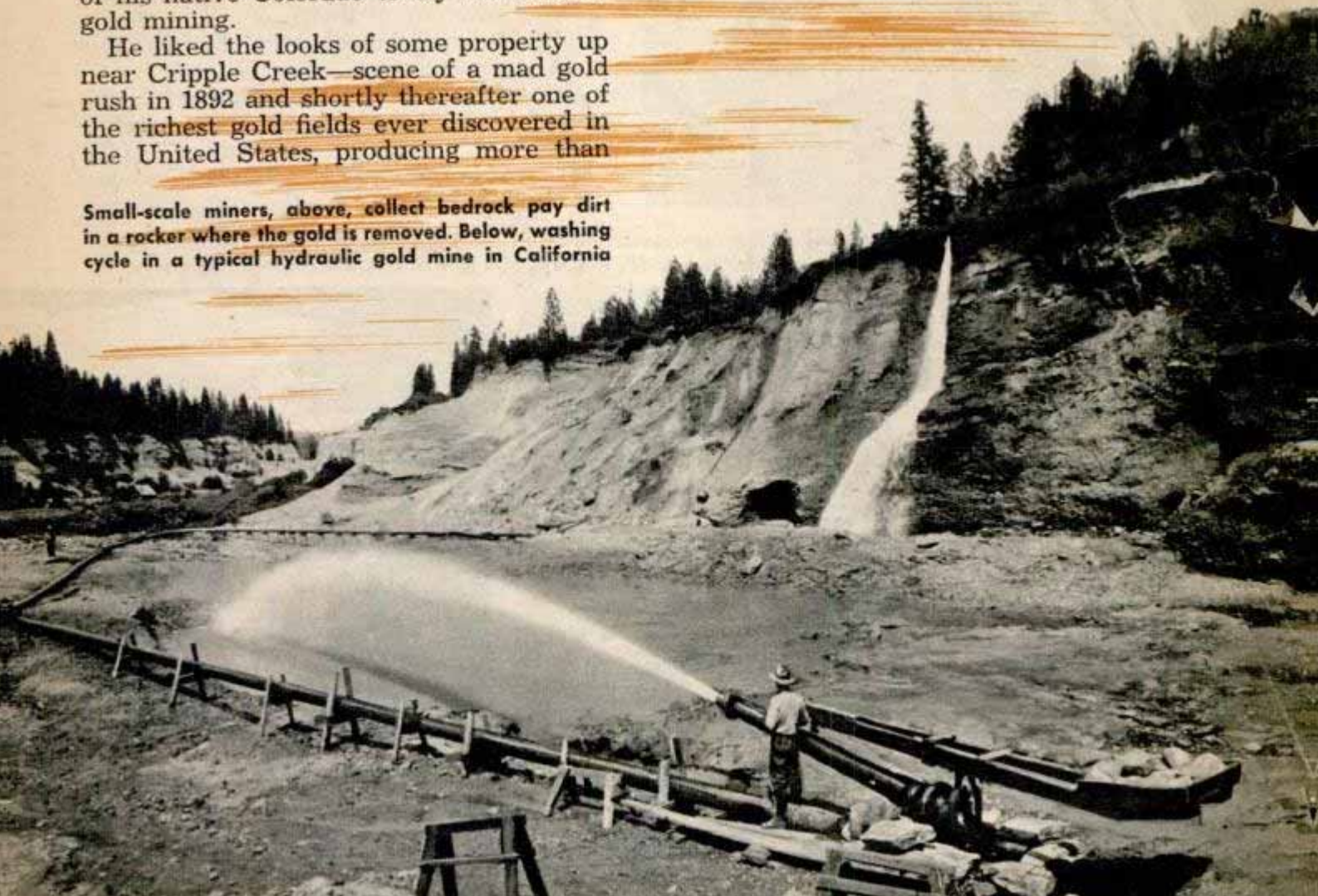
By **ANDREW HAMILTON**

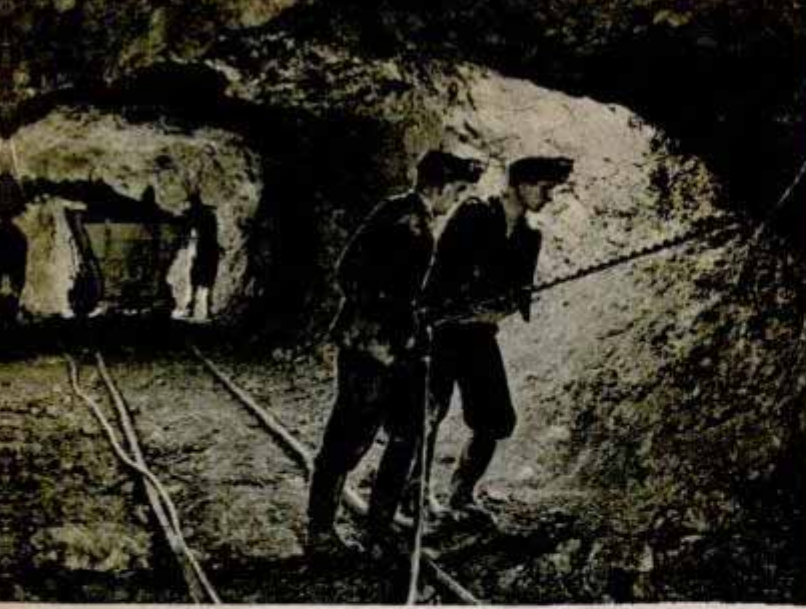
HERMAN CONROW, JR., 36-year-old discharged Army veteran, recently decided to return to the peaks and forests of his native Colorado to try his hand at gold mining.

He liked the looks of some property up near Cripple Creek—scene of a mad gold rush in 1892 and shortly thereafter one of the richest gold fields ever discovered in the United States, producing more than

Is history to repeat itself with a '46 gold rush? One GI got rich on foxhole technique

Small-scale miners, above, collect bedrock pay dirt in a rocker where the gold is removed. Below, washing cycle in a typical hydraulic gold mine in California

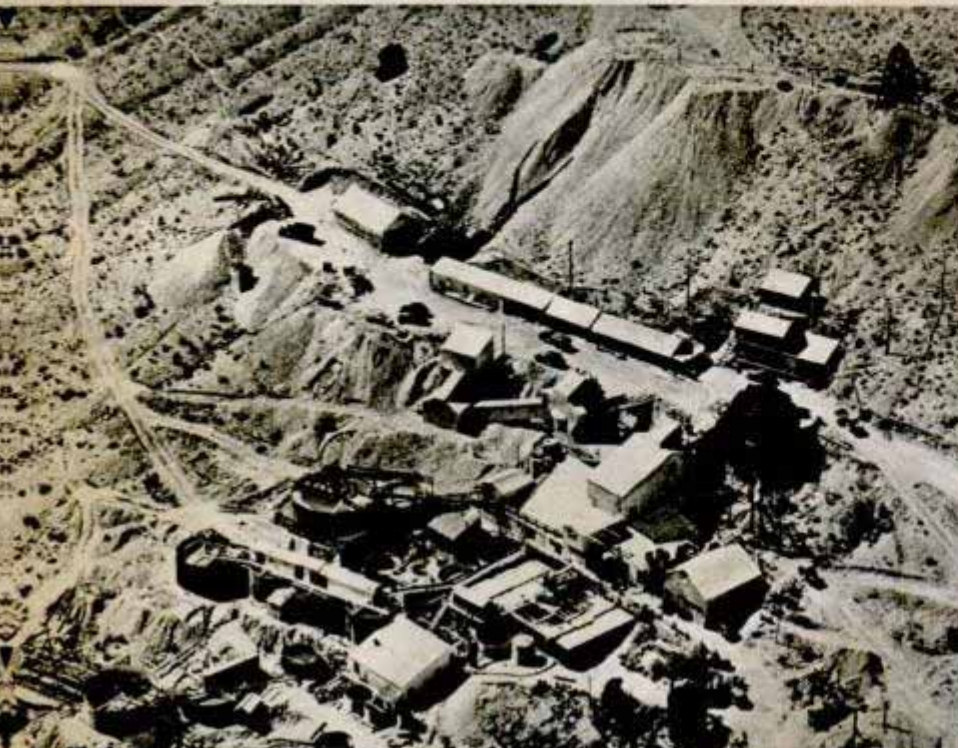




A far cry from the tools of '49ers is the mechanized equipment, above and below, which points to an upsurge in gold mining activity in the U. S. this year



Gold mine and mill. Lode operations of this type comprised 60 percent of the 3500 prewar mines, with the remainder placers



a million ounces of yellow stuff annually.

Using his foxhole technique, the ex GI struck a rich vein that ran 80 ounces to the ton. It was \$2800 ore compared to \$13 rock in the largest United States mines and \$20 to \$30 stuff in some of the richest Canadian mines. By the time Conrow had taken out \$25,000 his story was in the headlines.

For several months now, Conrow's lucky strike has been a hot topic of conversation among large mining companies, small-time operators, or "snipers," and veterans who have been bitten by the gold bug. And as the yellow metal comes up for Congressional debate, gold mining—1946 style—becomes of interest to the general public as well.

Another gold strike in the Cripple Creek district was reported this spring by the Golden Cycle Corporation. A rich lode that may be worth \$2,000,000 was discovered in the company's Ajax mine. It is said to be the biggest strike in the district in the last decade.

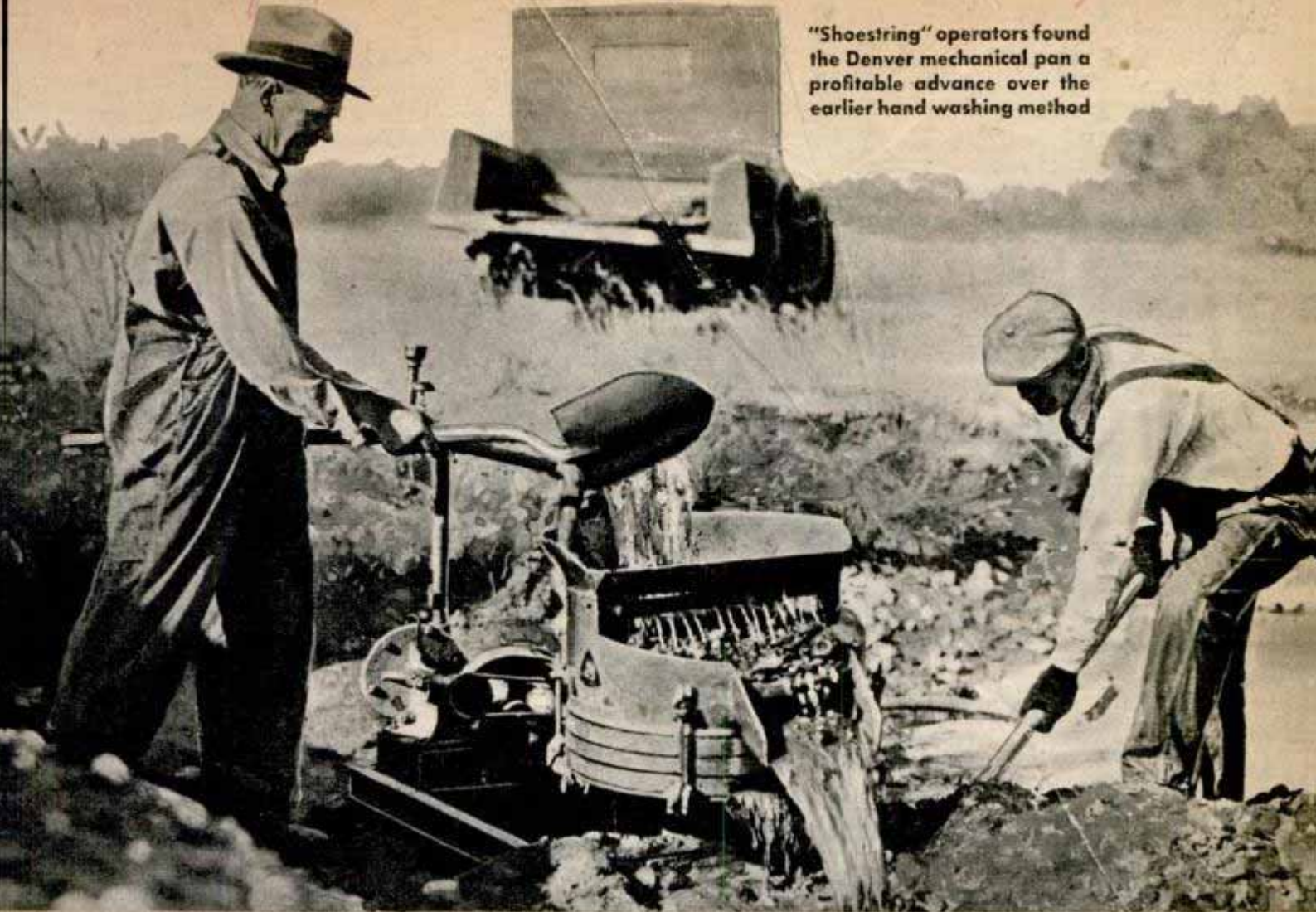
Gold mining was suspended in October 1942 when the government's famous L-208 order, designed to switch manpower, explosives and machinery into the mining of more essential metals, was issued.

America's gold mining industry, which had employed nearly 40,000 men in prewar days, quickly dropped off to approximately 6000. And many of these served merely as pump tenders, machinery maintenance men and watchmen.

In 1940 the gold mining industry produced 6,003,150 troy ounces of the precious metal with a value of more than \$210,000,000. In 1944 the yield was 1,022,238 ounces, worth only \$35,000,000—the lowest produc-

Pure 24 karat, this is the finest specimen of crystallized gold ever discovered





"Shoestring" operators found the Denver mechanical pan a profitable advance over the earlier hand washing method

tion since 1847, two years before the California gold rush days of '49. Now the L-208 order has been lifted and gold mining is getting under way once more.

Some are pessimistic about the future of gold mining in the United States. They argue that increased costs of labor and supplies, with narrower margins of profit, will

Bars of precious metal at a pier awaiting shipment



make it impossible to return production to the 1940 level. But others predict that gold mining is heading for a moderate boom. New equipment, plus possibility of a gold price boost, gives them reason for hope.

Gold on hand in the United States Treasury dropped from more than \$22,000,000,000 in 1940 to about \$20,000,000,000 last summer. Before the war the United States was importing gold at a rate of \$75,000,000 a month; today we are exporting it at the rate of \$100,000,000 per month. To make certain that our monetary system is founded on a solid financial basis and to cover federal issue of notes and currency, economists say the United States soon will have to replenish its supply of gold.

One suggested remedy to bolster our dwindling gold supply and to stimulate gold mining is an increase in the price of gold. Gold first became a medium of exchange in London in the 12th century and was priced at \$3.65 an ounce, valued in shillings. It rose steadily until the 17th century, when it leveled off at \$20.67 per ounce. Then in 1933 it was revalued at its present price of \$35 per ounce.

Representative Claire Engle of California, who calls himself a "one man gold bloc," has introduced legislation (1) to raise the price of gold from \$35 to \$56 per



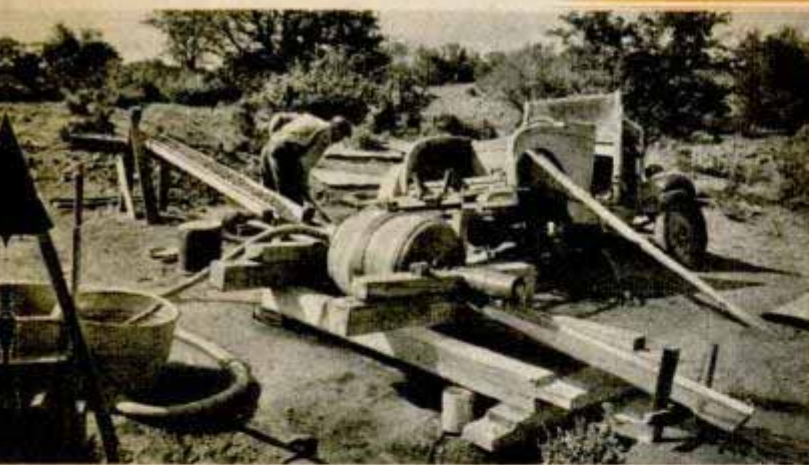
ounce, (2) to increase the amount of federal loan money available to gold miners, and (3) to reimburse them for losses suffered during the war when the government put them out of business. He would also have the Treasury Department mint a new \$50 gold coin to popularize the use of gold in our monetary system.

Most of the gold mined in the United States comes from the western states. For nearly a century the traditional leaders have been California, South Dakota, Colorado, Nevada, Utah, Arizona, Montana, Idaho, Oregon and Washington. During the war Utah rose temporarily to the top because of gold production incidental to copper mining.

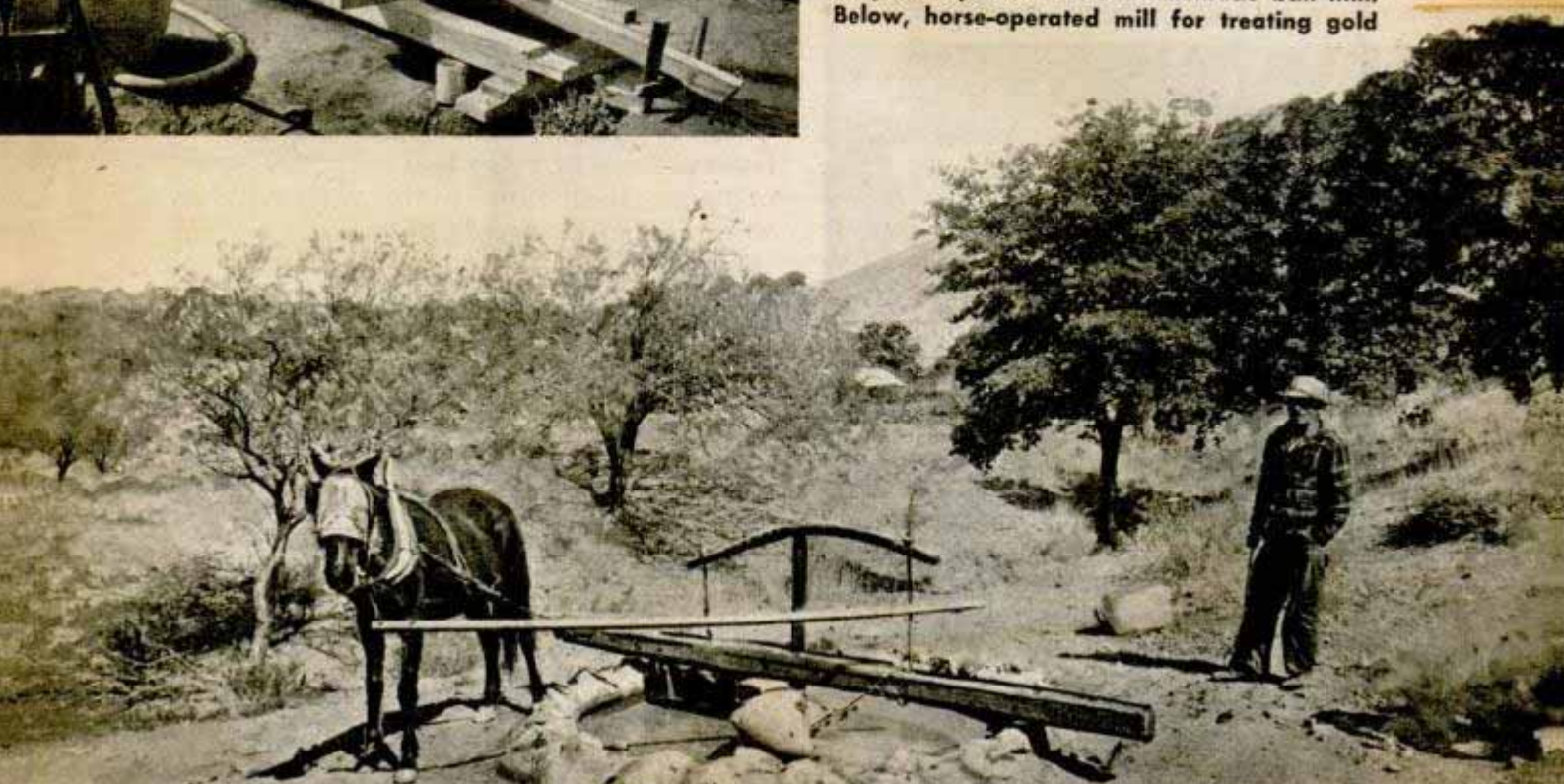
Alaska and the Philippines, in peacetime, were big producers and usually were included in United States statistics. With these two areas, the United States is said to produce about one seventh or one eighth of the total supply of the world's gold.

Before the war the United States had in operation about 3500 mines. Approximately 60 percent of these were lode mines and 40 percent placer mines. Lode mining refers to digging the ore out of veins in rock, usually underground. Placer mining refers to various techniques for scooping gold-bearing gravel off the top of the earth and washing the gold out of it.

Lode mining is expensive, requiring an extensive outlay of machinery and involving high labor costs. South Dakota's great Homestake mine, largest single gold mine in the world, is an example of a lode mine. Before the war some 2000 were employed



Upper left, small-scale dry placer mining in the desert. Left, the auto's rear wheel serves as power plant for this homemade ball mill. Below, horse-operated mill for treating gold



at Homestake. Its developed ore reserves are estimated at 19,183,783 tons—about 15 years' supply based upon 1942 production figures. Average recovery is about \$13.39 per ton of ore.

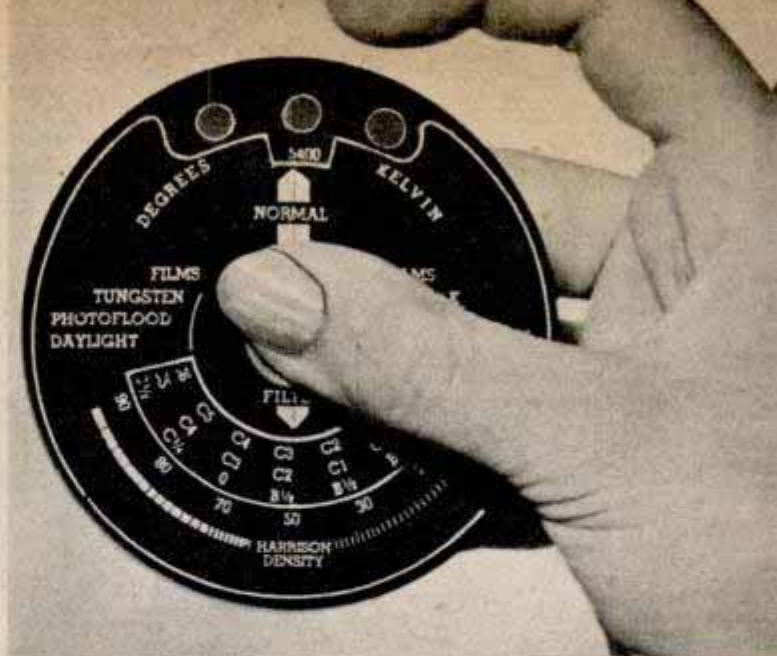
As a general rule the gold mining industry, and especially lode mining, is slow to adopt and develop new equipment because gold veins are narrow and hard to work with mechanized tools. Mining bureaus in several western states, however, have indicated that the greatest strides in lode mining will come with wider use of such electrically powered equipment as drills, hoists and pumps.

Placer mining, including various types of bucket-connected dredges and small-scale panning operations, should show a quicker postwar recovery. The effects of the shutdown will be less because labor costs are smaller. In addition, most placer equipment has remained virtually intact while some lode mining equipment has been dismantled and removed.

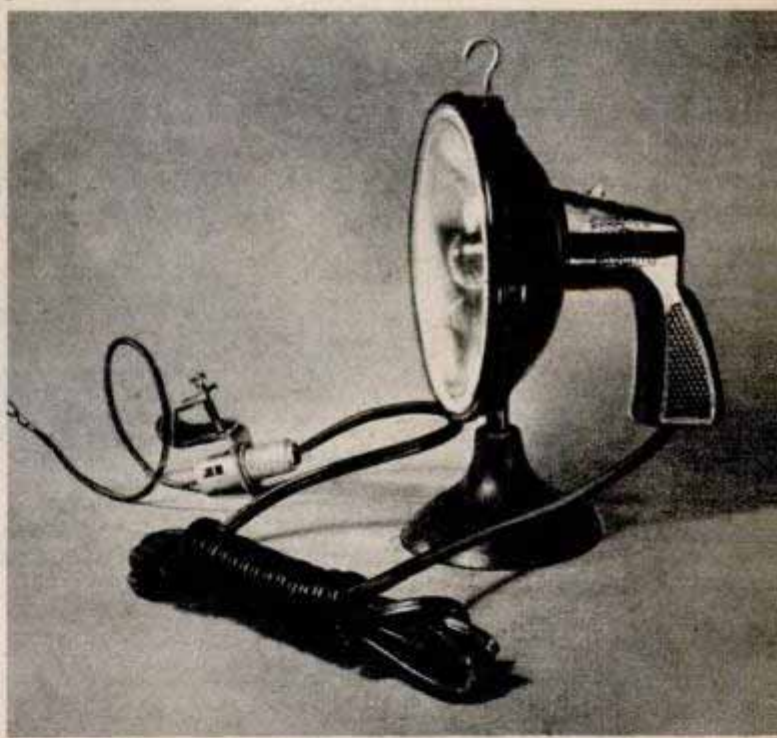
(Continued to page 232)

Monorail cars shuttle gold ore from a Death Valley mine to loading centers. Bottom, a 15-cubic-foot dredge used in placer mining





Left, baby chicks are kept warm in a brooder heated by conductive rubber, a product developed to keep ice from forming on warplanes. Inset shows chemically treated rubber pad which warms the brooder by radiant heat. Right, a pocket-size meter that measures color is now available for photographers. The user finds the degree of color in illumination by looking through the device to measure the light reflected from a white card



Left, a radio which forms the front section in a new radio-phonograph combination can be removed from the unit for use elsewhere. Right, an automobile spotlight for emergency repair work is equipped with a suction cup and hook to fasten it to any part of the car. A socket on the long wire plugs into any six-volt battery

Below left, built-in hydraulic jacks lift this combination tractor and bulldozer on to its own rubber tired wheels for high-speed transportation. Right, Hollanders make rafts of biscuit cans that were dropped from planes by the Allies to relieve the food shortage. The rafts are used to navigate the canals of Rotterdam



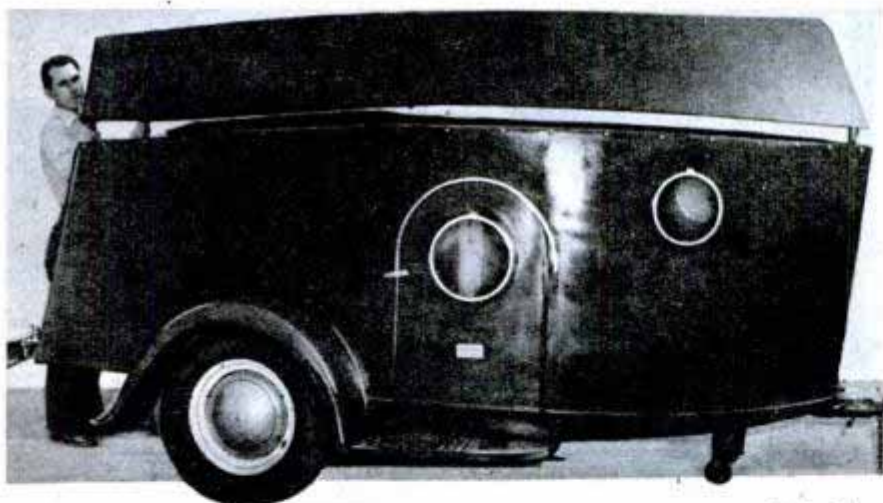
Golden Gate Span Proven 'Flutterproof' in Delicate Vibration Tests

Ten vertical vibration recorders, spaced 525 feet apart, are proving San Francisco's Golden Gate Bridge, world's longest single suspension span, to be "flutterproof." Engineering precautions were believed to have provided the 4200-foot structure with adequate protection against this hazard, but when a Tacoma, Wash., bridge fluttered itself to pieces in 1941, steps were taken immediately to double-check against such risk at Golden Gate. The delicately balanced instruments, some paired on opposite sides of the bridge, have indicated no movement in wind velocities under 40 miles an hour, while the Tacoma span had "waved" perceptibly in only an eight-mile wind. Greatest vertical movement recorded thus far at Golden Gate has been 14 inches dur-



ing a 48-mile gale, a safe margin under the span's allowable movement of 20 feet. The bridge is built to withstand a sideways movement of 27 feet in the center.

ing a 48-mile gale, a safe margin under the span's allowable movement of 20 feet. The bridge is built to withstand a sideways movement of 27 feet in the center.



Skiff Doubles As Trailer Roof

By using a boat as the roof for his trailer, Guy W. Patterson of Los Angeles has both land and water transportation within the same unit. The sportsman built the trailer so an 11½-foot skiff can be inverted over the top. The boat weighs 125 pounds and can be removed easily by one person

with the aid of a small jack under the stem that raises the bow about three inches. Two handles then make it possible to lower the skiff to the ground, one end at a time. When the boat is removed for fishing or duck hunting it is replaced by a heavy canvas canopy that buttons snugly along the sides and is supported by three steel bows. The 12-foot trailer is equipped with an innerspring mattress, a locker for guns and fishing gear, gasoline stove, icebox, water tank and food storage space.



IF YOU WANT TO BUY IT—

Write to the manufacturer or distributor listed in the Where-to-Buy-It Index, page 8, to learn more about commercially available products described in this magazine. Say you saw it in Popular Mechanics.

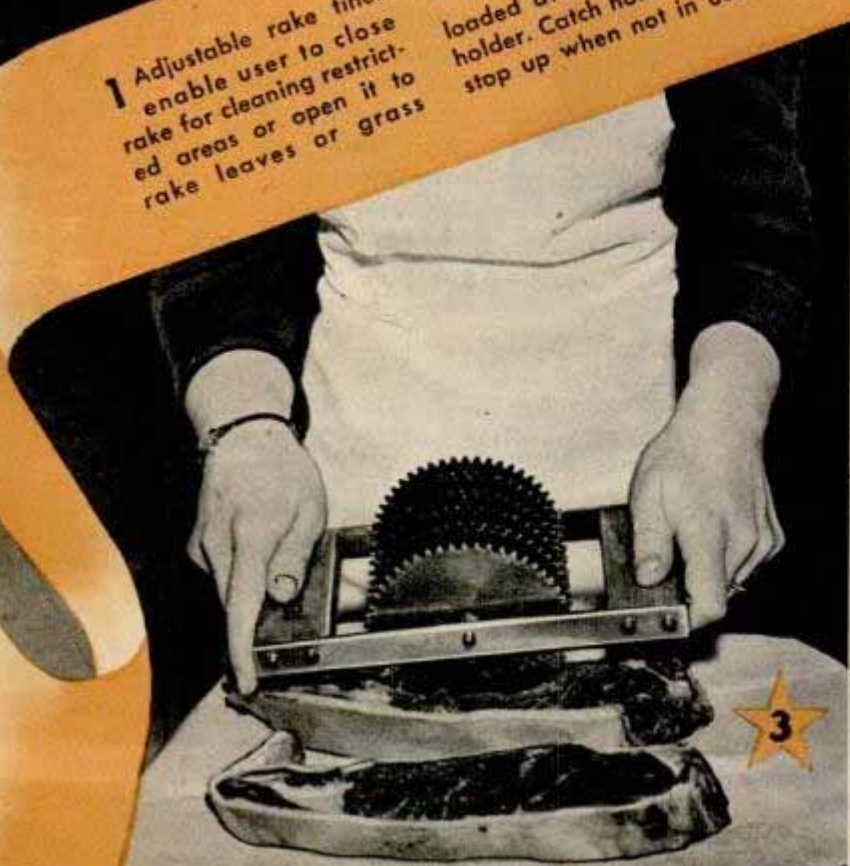
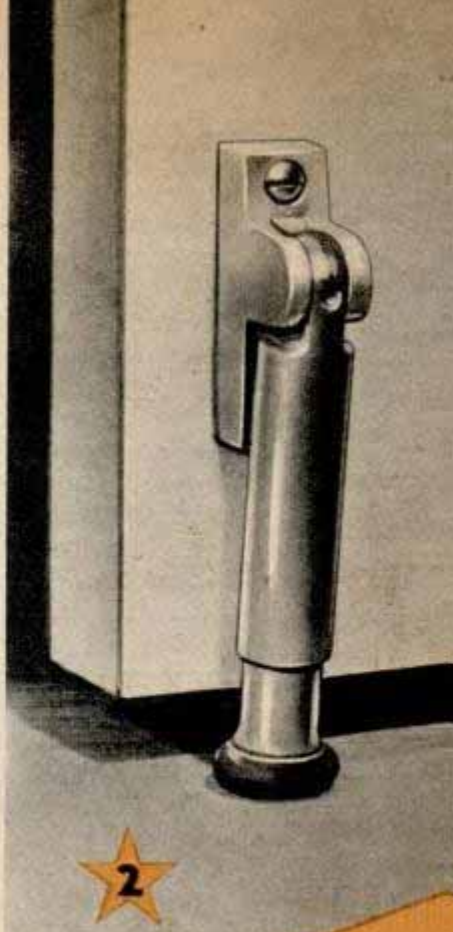


1 Adjustable rake tines enable user to close rake for cleaning restricted areas or open it to rake leaves or grass

2 Heavy doors can't slip when held by spring-loaded aluminum door-holder. Catch holds door-stop up when not in use

3 Tough steaks are tenderized by device which breaks down fibers with five spiked wheels without disfiguring meat

4 Electric stove unit attains full heat in 40 seconds, providing automatic temperature control for top-of-stove cooking



"Inside Stubb" for Your Home

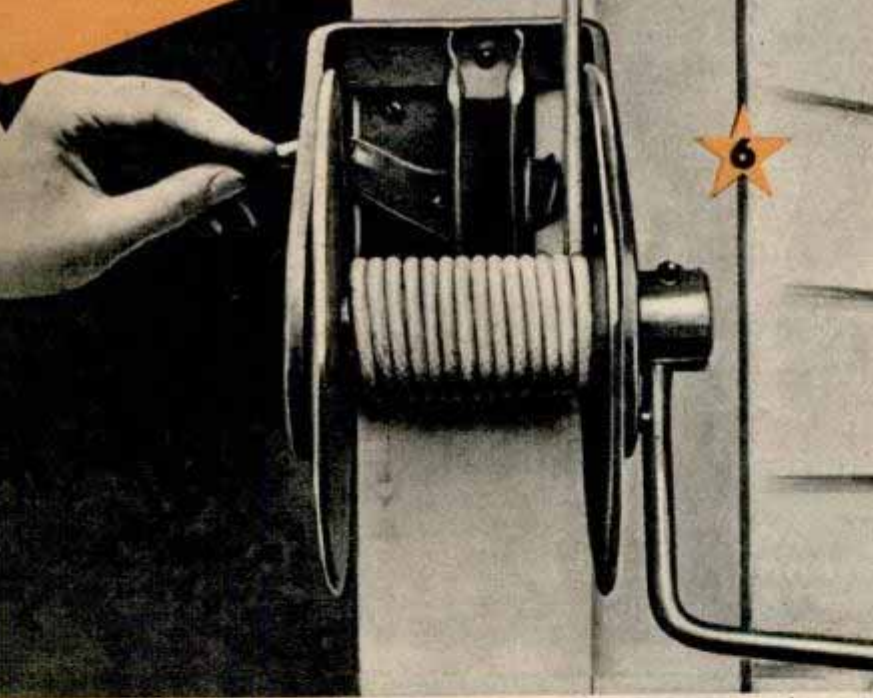


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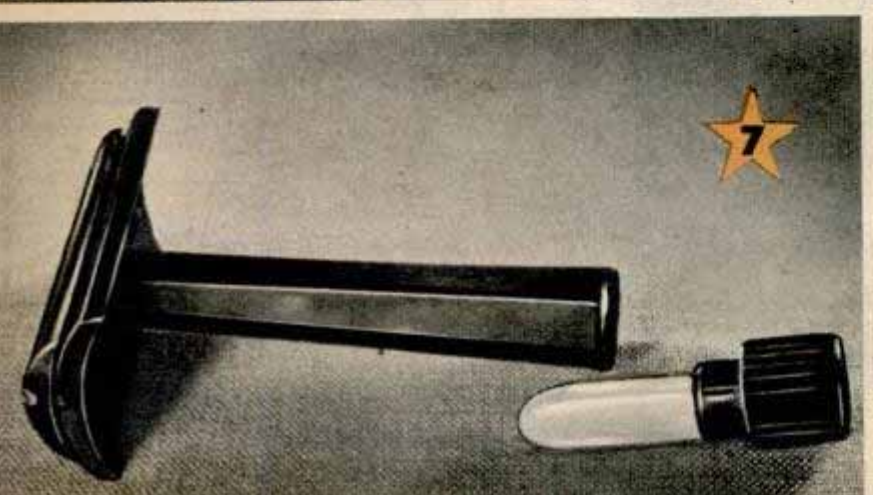
5 Air taken in at top is warmed, then blown from bottom of electric heater which never becomes too hot to touch

6 With one end of line looped over hook, handy reel mounted on bracket can be used to adjust tautness of line

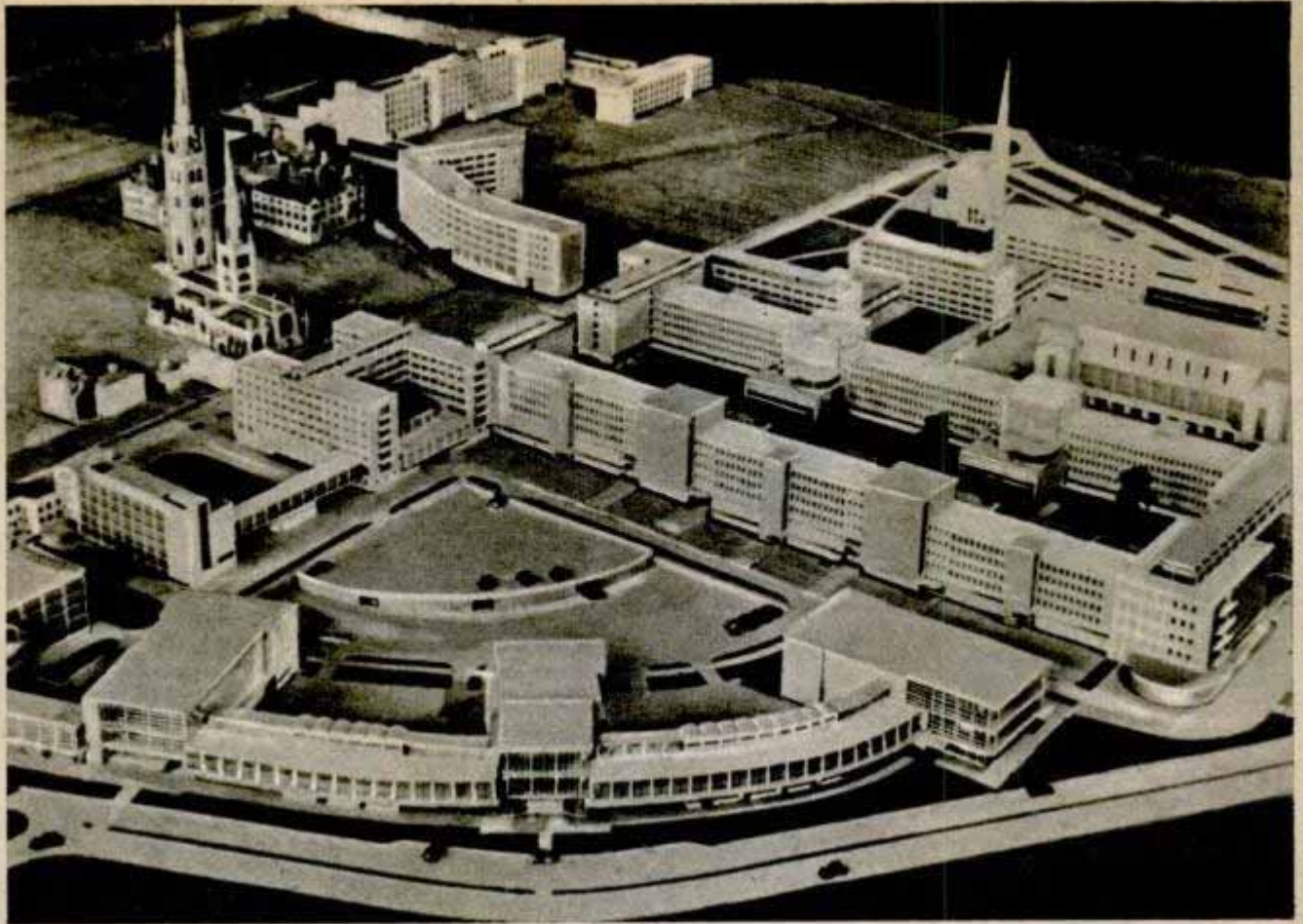
7 Razor holds styptic pencil in handle, ready for instant use merely by drawing the cap out. Razor is made of plastic



6



7



Coventry Rebuilt in Model Form

British engineers are making extensive plans for rebuilding war-damaged English cities. Scale models of proposed buildings

are often used by planners to aid their projects. Coventry, totally destroyed during the war, has already been completely rebuilt in model form including modern buildings as well as the cathedral.

Water Jet Kills Apple Worm Moths by Cutting Bark From Trees

Water under 500 to 600 pounds pressure is sprayed on apple trees in a new method of killing codling moth larvae, the ordinary "apple worms" which damage the trees. The spray is of such force that it removes

the rough bark, where the larvae establish winter quarters. The conventional method of hand-scraping the trees and burning the bark requires several hours' work on each tree. Regular spraying equipment is used

in the new process, which was developed by Dr. Dwight Powell, a horticulturist of the University of Illinois.



Radios May Signal to Subs

Submarines of the future may be able to communicate directly with control stations on land without surfacing in order to use their radios, according to D. W. R. McKinley, a Canadian physicist. Investigations show that powerful transmitting stations capable of radiating at least 500,000 watts should be able to send signals to submerged craft several hundred miles away. The physicist says that undersea craft may be able to reply with signals from below the surface.

Half a Billion in the Slot

What'll it be? A sizzling hot dog, a quick movie or a package of frozen strawberries? The new coin machines will dispense almost everything

COIN-OPERATED machines have come a long way since a fellow named Hero invented an automatic gadget in Alexandria about 200 B.C. that dispensed holy water for five drachmas.

Today, "robot-salesmen" plink out candy bars, soft drinks, cigarettes, peanuts. They snap your picture and give you a finished print. They dole out music, hot or classical. They send telegrams, check parcels, take subway fares, hand out stamps and even chunks of ice.

In one year: 250,000 cigarette machines sell about 750,000,000 packs for more than \$100,000,000, five percent of all sold. Candy machines unload \$23,000,000 worth of candy, seven percent of all candy sales. A million penny machines dispense peanuts in nearly every village and city in the country. Some 120,000 soft drink units satisfy people's thirsts the year 'round. And juke boxes to the tune of 400,000 pound out recorded music both day and night.

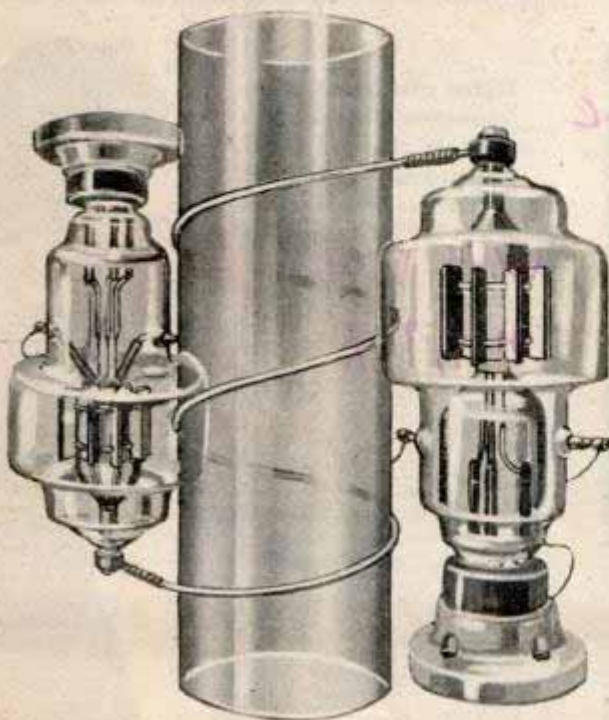
By **JOHN R. KINSEY**

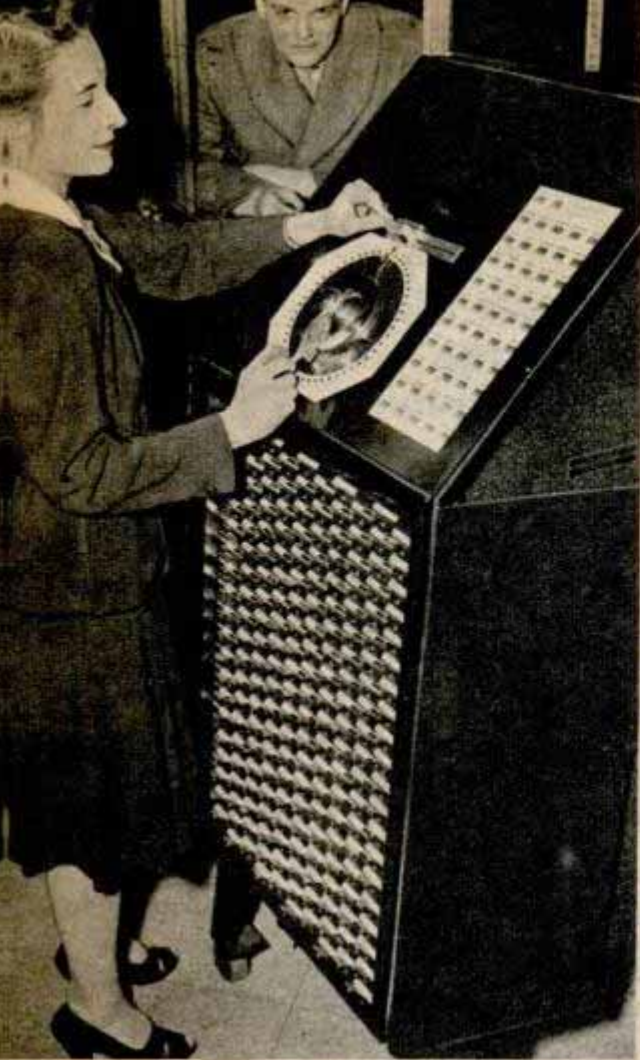
Adding it all up, coin machines sell the American public somewhere around \$500,000,000 worth of merchandise and service every year.

But that's just a warm-up compared to what's coming, according to the vending machine industry. Here are some of the new developments that shortly may become as commonplace as gas stations:

1. Hot sandwich maker which in 15 seconds electronically cooks a hot dog, hamburger or cheese in a bun for 10 cents.
2. Frozen food and canned goods dispensers installed in front of grocery stores to serve customers after closing hours.
3. Hot drink-o-mat to pour out steaming coffee (black, with sugar, with cream, or with both), hot chocolate and soup.

Magic electrons cook hot dogs and hamburgers in coin machine at right. Diagram shows the heating element that warms food without touching it





MR. J. KOSFIN 422 METROPOSTAL BLDG CHICAGO



Chicago, Ill.

Railroad tickets are retailed by trip ticket printer (left). Newspapers are dispensed by coin machine (right)

4. Combination ice cream maker and vendor that will make an ice cream "stick," spiral-wrap it and hand it to you in a jiffy.

5. Mechanical departments in grocery stores in which the housewife will select metal tokens representing standard packaged goods, then hand the tokens to an operator to insert in a device that mechanically conveys the packages to a central wrapping department.

6. Coin-operated gasoline dispensers to

serve motorists who run out of gas at night.

7. Vending machine stations containing nothing but coin-actuated dispensers supplying the usual things plus drugstore articles, special foods, etc.

For a closer examination of some of the new help-yourself gadgets, let's start with the hot dog machine developed by engineers of the Automatic Canteen Company of America and General Electric Company. Equipped with a glass window that enables



*Vendo Co.
1207 Grand Blvd
Hannover City &
Mo. 7400 E.
12 St.
K.O.
1/20*

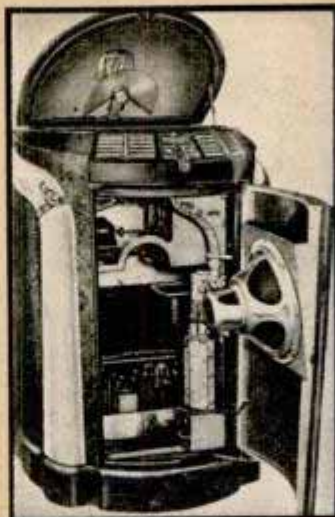
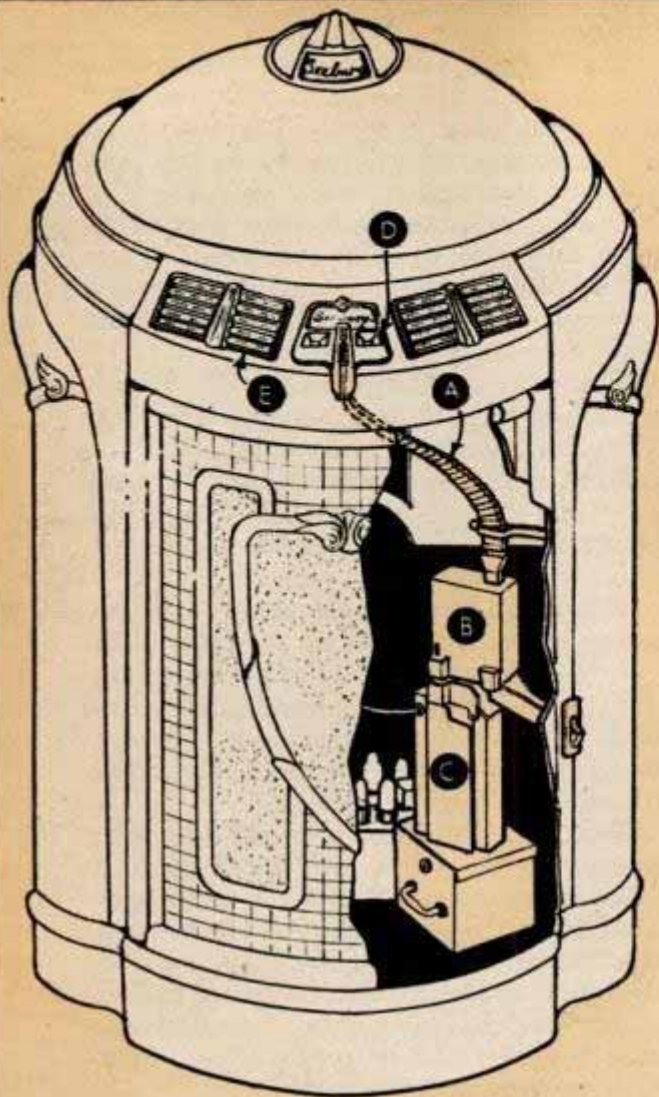


Dimes and quarters are converted into nickels by coin changer (left). Telegrams dropped into a slot are sent automatically by unit below

*W.V. Telegraph Co.
N.Y. N.Y.
277*

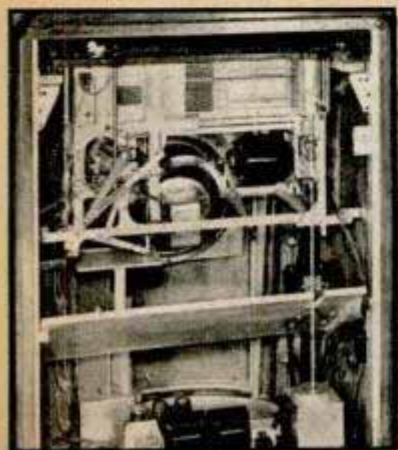
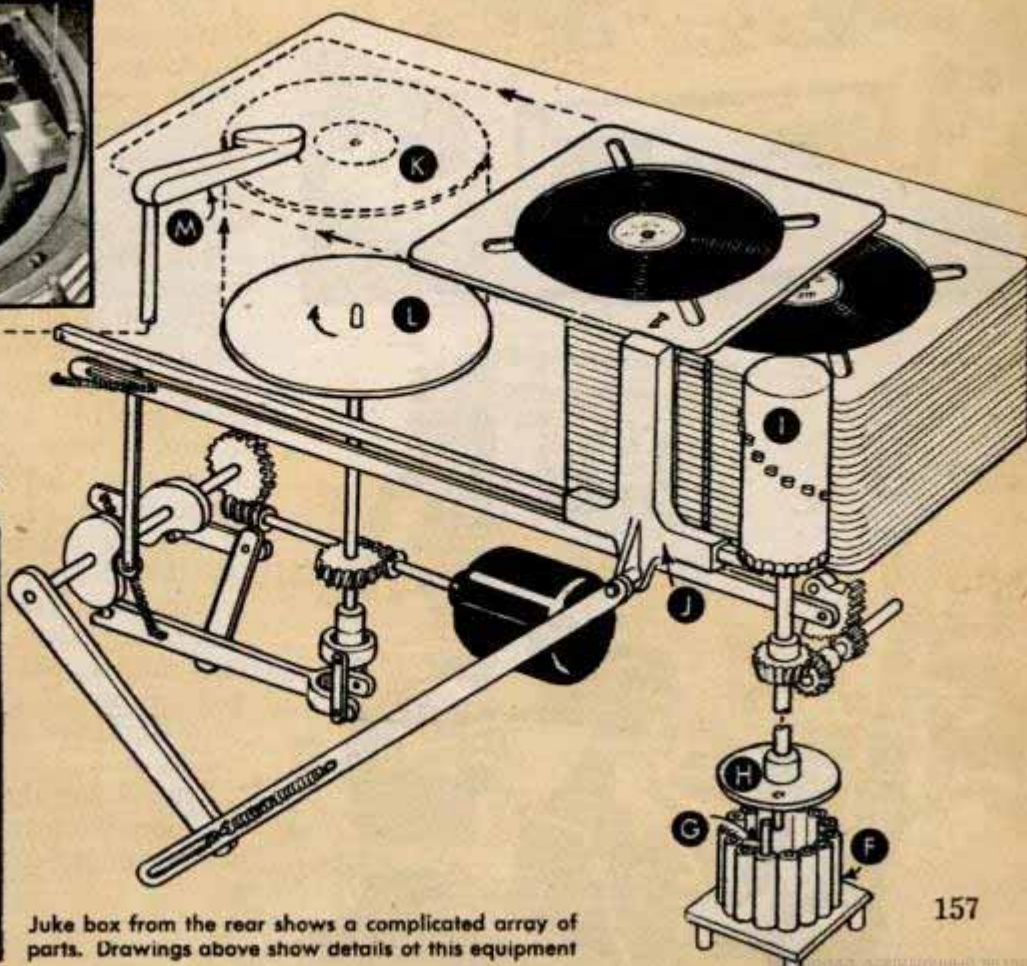
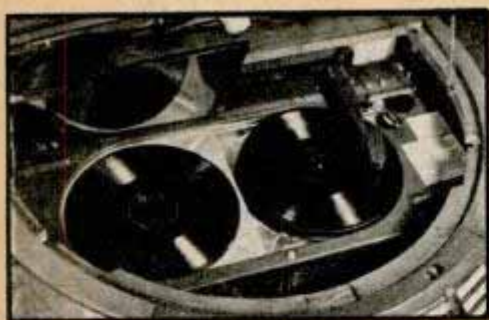
*W. Post Office
Chicago, Ill.*

HOW A Juke Box WORKS



When a coin—nickel, dime or quarter—is dropped into the coin slot, it rolls down flexible tube A and drops into slug rejector B. Here the coin is sized, weighed and its metal electrically analyzed. A legitimate coin will fall into selector unit C. This box relays the number of records to be played to the illuminated register D. Whenever a record is finished, it is subtracted from the register. The juke customer always knows how much of his investment is left. Meanwhile, the coin closes a relay, switching on the mechanical part of the juke box.

When a button is pushed on the selector panel E, the impulse is transmitted to a solenoid drum F (below) which has a selector for every record on the panel. For example, if button No. 1 is pushed, the No. 1 solenoid pin G will rise and stop a projecting pin on disk H. The helix I, coupled to this disk, has projections that index the tray of records. The slide J reaches over and picks up record tray No. 1 which has been indexed. It carries the tray to the lifting position K, where turntable L moves up, lifting the record out of the tray into playing position. The tone arm M moves over and plays the record. Eccentric grooves at the end of the record oscillate the tone arm tripping mechanism N, which reverses the action, fling record in its proper place.



Juke box from the rear shows a complicated array of parts. Drawings above show details of this equipment



Dancers in cabaret (above) deposit coin and telephone request for musical number to operators (below) who send recorded tune by wire. Bottom, coin box provides movies



the customer to see his food cooked by radio waves, the electrical chef dishes up a Cellophane-wrapped sandwich before you can say "yum, yum."

Here's how it works. You drop a dime in a slot and push a button. That moves a tray containing precooked frankfurters or hamburgers, or cheese, in hot dog buns and wrapped in Cellophane. The sandwich selected falls into a cooking tube powered by two electronic tubes which create radio waves, generate the necessary heat (150 to 160 degrees) and cook the sandwich.

What about the mustard? That's troubling the hot dog machine men, too. They don't want any messy mustard jars around their sandwich makers. So they may put a little mustard in a separate container and insert it inside each sandwich wrapper.

If you can build machines to serve hot sandwiches, it should be no more difficult to design automatic vendors to handle frozen foods and canned goods. And look at the potential business, particularly among people who find it impossible to shop during the day.

That's the thinking of one Middle West manufacturer of frozen food cabinets who is experimenting with coin-operated frozen food machines. He believes that grocery stores of the future will be designed so that frozen food and canned goods dispensers can be installed outside the stores but under cover, probably in the entrance way.

Past the development stage is the hot drink dispenser which supplies coffee, hot chocolate and soup. One machine which a western railroad plans to install on its trains employs a unique method to provide coffee with or without sugar and cream. In other words, you can have coffee in any of four ways: black, with sugar only, with cream only, or with cream and sugar.

It's all done by "pills" developed by one of the country's largest dairy concerns. The coffee is prepared in pellets; some are just coffee, others have sugar or dehydrated cream added, or both. When a coin is placed in the slot, the machine drops a pill into a grinder which grinds up the pellet at the same time that 140-degree water is added. To protect customers from grabbing the cup and being burned while the hot water is still pouring down, an electric eye device shuts off the machine if you put your hand too near the mouth. Another coffee maker will use powdered coffee.

This is simply a preview of a few of the more exciting vending machines that are either here or coming soon. Actual-

ly, the fields of merchandising to be invaded by mechanical self-service devices appear to be almost unlimited.

Harvey Carr, editor and publisher of Coin Machine Journal and one of the world's outstanding authorities on coin machines, sees the day fast approaching when virtually all types of stores, particularly drugstores, will install many mechanical vendors.

"Take a drugstore," Carr explains. "Many's the time a man walks in to buy some razor blades. That's all he wants and he knows just what brand he wants. But the clerk is waiting on some woman who spends maybe five minutes or more picking out a lipstick.

"Now if they had a coin operated machine to sell razor blades, the man would get his little package and be on his way in a matter of seconds."

Mills Industries, Inc., big producer of vending machines, is so optimistic about the future of this business that they set up a Special Merchandising Division to work closely with manufacturers of anything suited to help-yourself selling.

"Anything that can be packaged can be merchandised by vending machines," asserts Ralph J. Mills, chairman of the board. He points out that refinements in refrigeration, dehumidifying equipment and germ-killing rays make it possible for coin machines to vend almost any food product. Fruit, fruit juices and milk (whole or powdered) are kept in good shape by proper refrigeration, he explains, and buns for sandwiches are prevented from becoming soggy by dehumidifiers.

Such firms as Mills will

(Continued to page 236)



Coin-operated dispenser "rescues" out-of-gas motorists late at night



Drop a coin and get hot coffee, with or without cream and sugar.



Frozen foods may be dispensed by coin machines after stores close
Automatic grocery (below) with coin-actuated facilities is planned

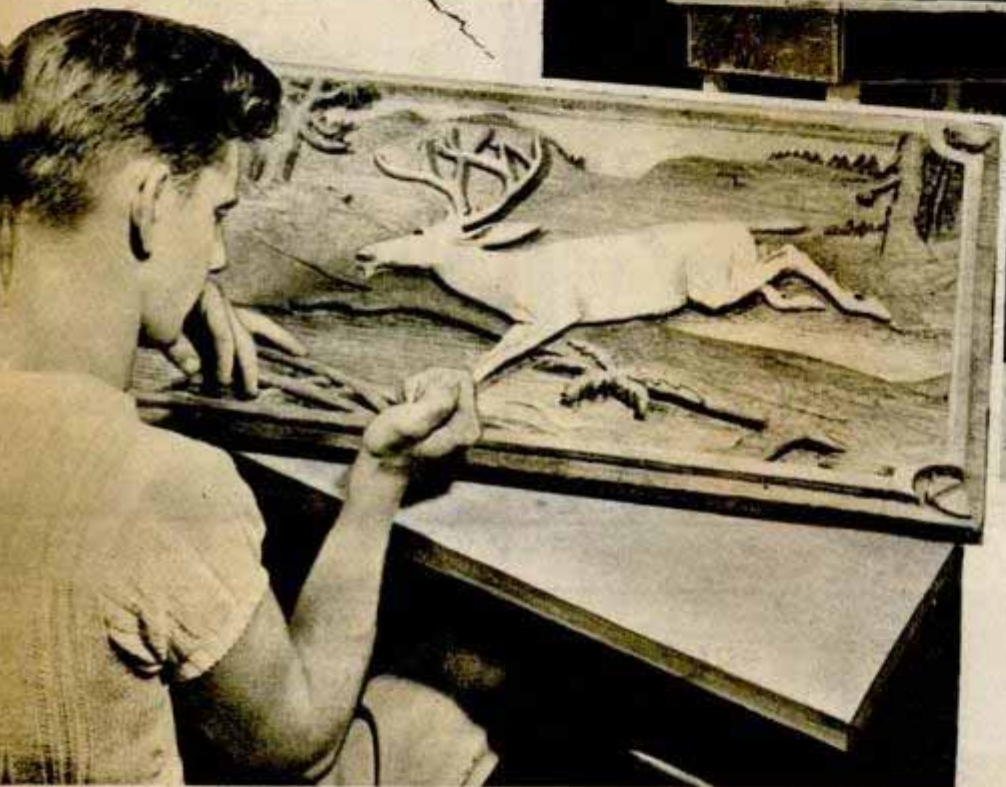


419 W. 11th St. Chicago, Ill.

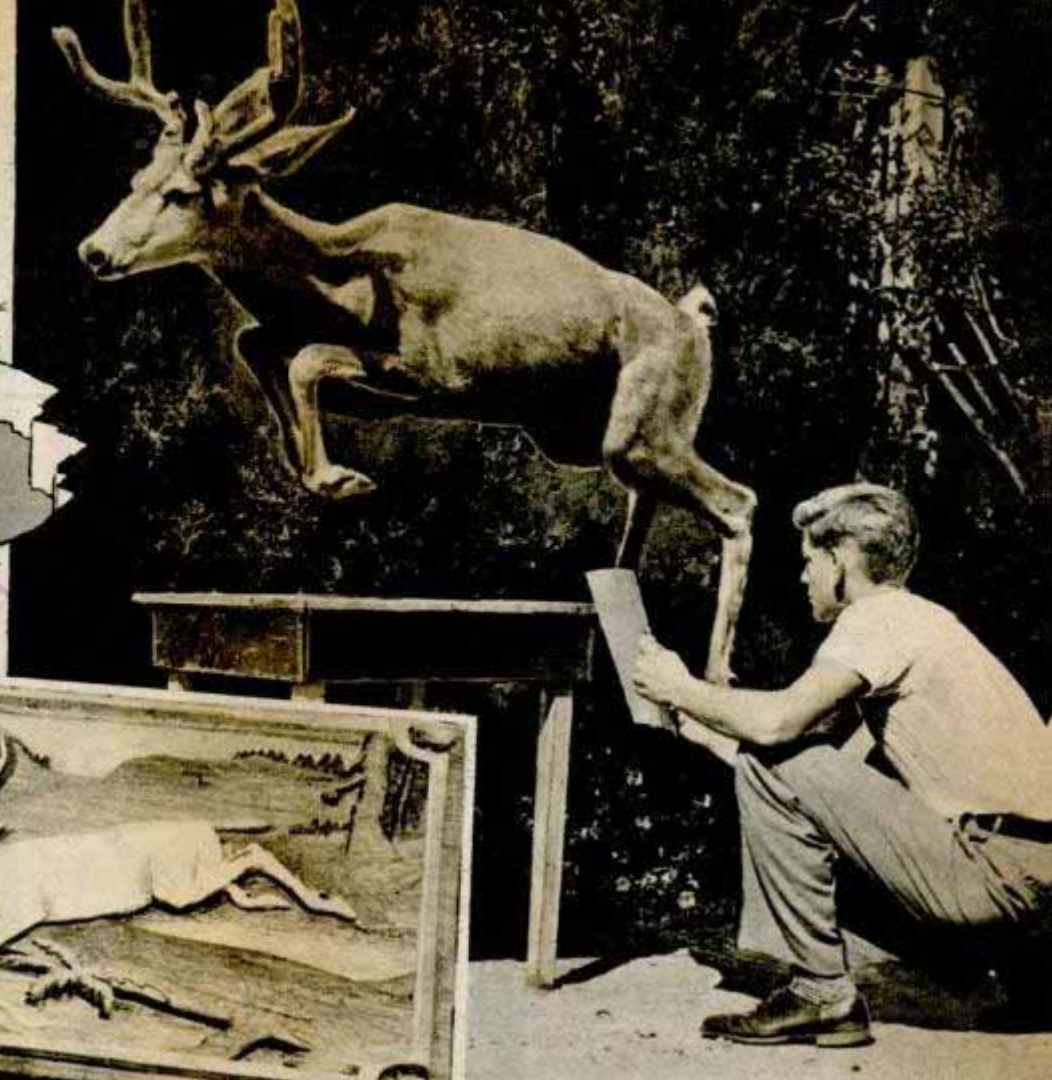
J.C. Lippincott & Co.

FROZEN

**WITH A
CHISEL**



Although only one inch deep, carving gives illusion of greater depth. Bill finishes by sandpapering knife marks



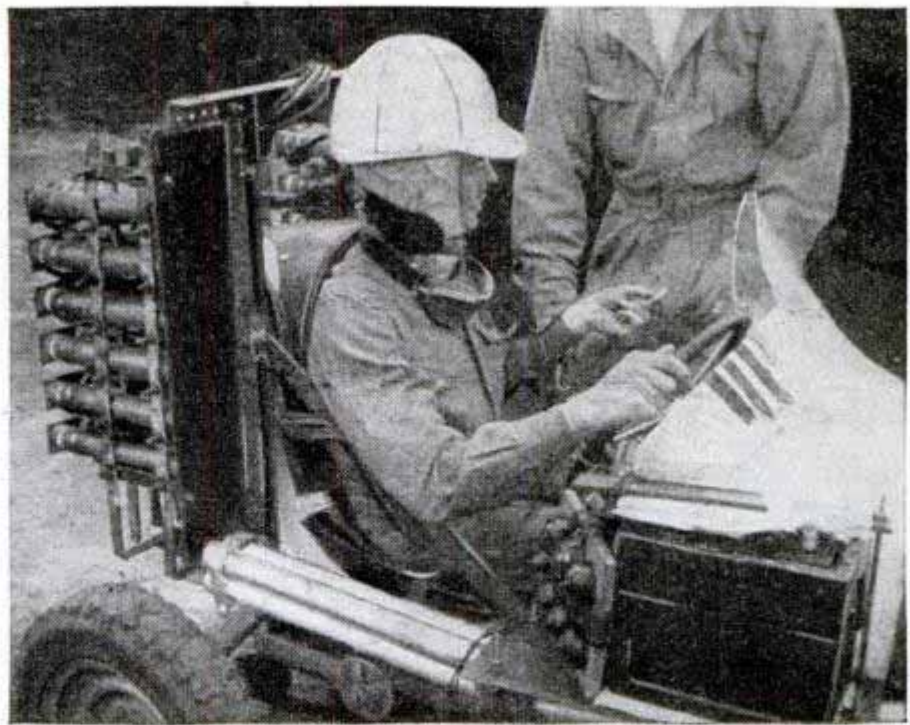
Seventeen-year-old Bill Burnham has three pet deer to model for wildlife studies he carves with chisel and knife in Philippine mahogany. Above, one of the pets "poses" for the artist

For accuracy in a carving showing a startled deer hurdling a log, above left, Bill made a sketch of one of his pets making a similar leap. His three pets follow him through the streets at Encino, Calif., without a leash. Below, one inquires into the progress of Bill's chiseling



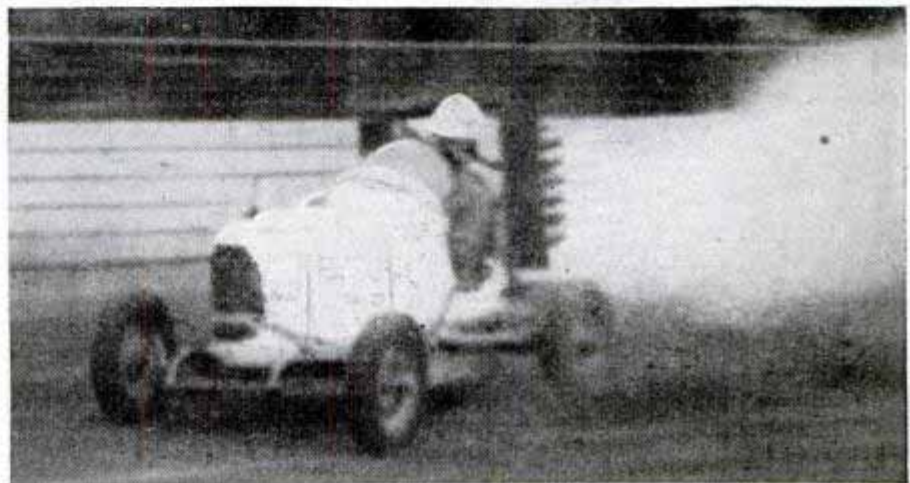
Rockets Assist Racing Car

Rocket power serves as an auxiliary to give extra speed to a racing car used by Bill Reynolds, Sidney, Australia, driver. The car runs normally on its gasoline motor, the rockets acting only as a booster for a quick start. A recent attempt to break the world's quarter-mile speed record did not succeed because some of the rockets failed to function properly. Reynolds says he will try again.



Fabric Lining Aids Drying of Concrete

Concrete dries with a satin finish that absorbs 40 percent less moisture when a new lining for concrete forms is used. Called Hydron, the lining resembles tough cardboard faced with a cotton fabric. It is manufactured in sheets 6 feet by 4 feet, is lightweight and flexible, and can be shaped easily to curved forms. The sheets are stapled to ordinary plywood facings in the forms. When the concrete has set, the form may be removed without removing the lining, which may be left on the concrete surface as long as two weeks to control drying. The lining promises surfaces of greater durability at less expense for some types of work. Tests with

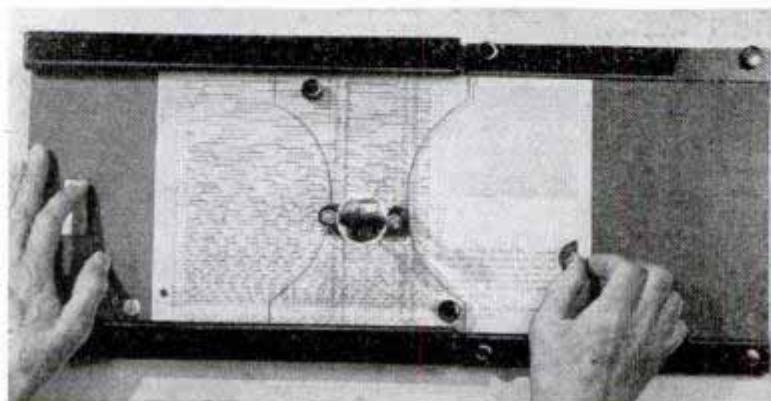


Battery of rockets behind driver, top, start him off in a cloud of smoke

steel shot indicate that concrete formed with ordinary plywood will chip much easier than that formed with Hydron. Surfaces that must be scraped periodically are less expensive when the lining is used, as sanding and polishing are unnecessary.

Computing Device Fitted With Magnifying Glass Permits Easy Reading

Small enough to fit into a brief case, a computing device is said to solve problems which would require a slide rule 36½ feet



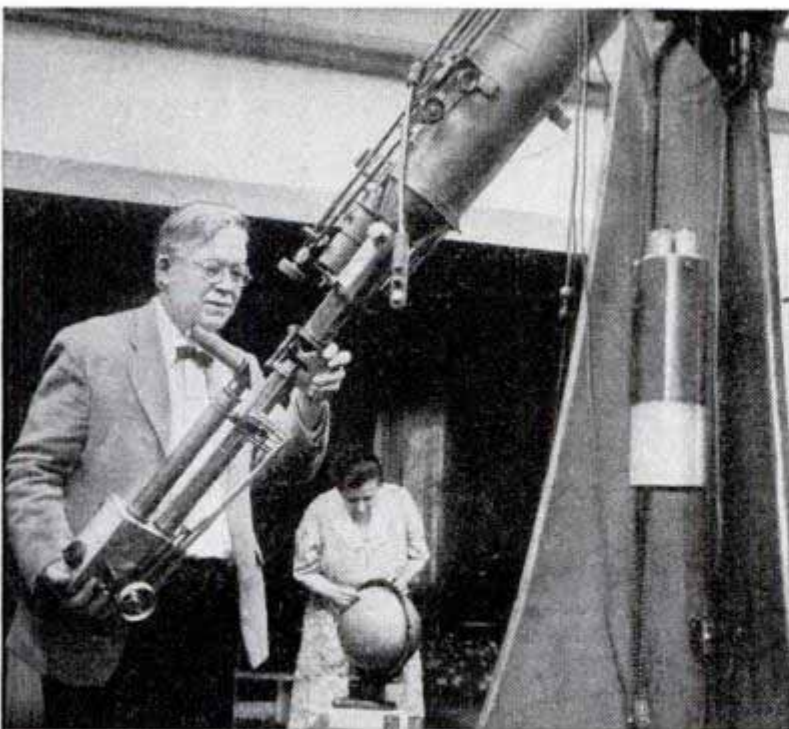
long. Although it handles ordinary multipliers and divisors as well as square-root quantities, it employs only half the number of scales used by a slide rule. Settings are simple and do not require reading scale against scale. A magnifying glass is attached for reading the square-root scale which is in small type. The principal scale is easily read and its major divisions are printed alternately on red and white backgrounds. All numbers on both scales stand in normal reading position in relation to the operator. The scales are printed on a nonwarping plastic.

ATOMIC POWER PLANTS *in the Sky*



Chemical action comparable to the creation of atomic power takes place in stars like these in the constellation of Orion. Below, an astronomer at Mt. Wilson Observatory collects data with a 10-inch photographic telescope





Using a telescope in his own home, Dr. Edison Pettit accidentally discovered the bright new star Nova Puppis

By Robert S. Richardson and Anthony Wausnock

YOU have heard of the atomic power plants built by the U. S. Government at Oak Ridge, Tenn., Pasco, Wash., and Los Alamos, N. M.

But have you ever heard of the atomic power plants in the sky? Of Y Cygni, Betelgeuse, Sirius B and Nova Puppis?

Long before the atomic bomb, astronomers believed the stars derive their apparently limitless supply of radiation from energy locked within the atom. For at least a quarter of a century astronomers have regarded the stars, not as mere twinkling points of light, but rather as mighty laboratories in which unique atomic reactions take place.

In the past the world has not always taken the astronomers' work too seriously. People often ask, with considerable reason, "Why build a 200-inch telescope to look at stars so distant that their light takes thou-

sands of years to reach us?" Yet prior to 1939 the same type of question could have been asked of nuclear physicists. "Why spend a million dollars building a cyclotron to convert microscopic quantities of hydrogen and lithium into helium?"

Today no one doubts the vital importance of planning great laboratories for atomic research. Unfortunately, however, the elusive atom refuses to perform many of its most remarkable antics except at temperatures of millions of degrees and pressures of millions of atmospheres. We cannot hope to create such extremes of temperature and pressure artificially. Where then shall we find them?

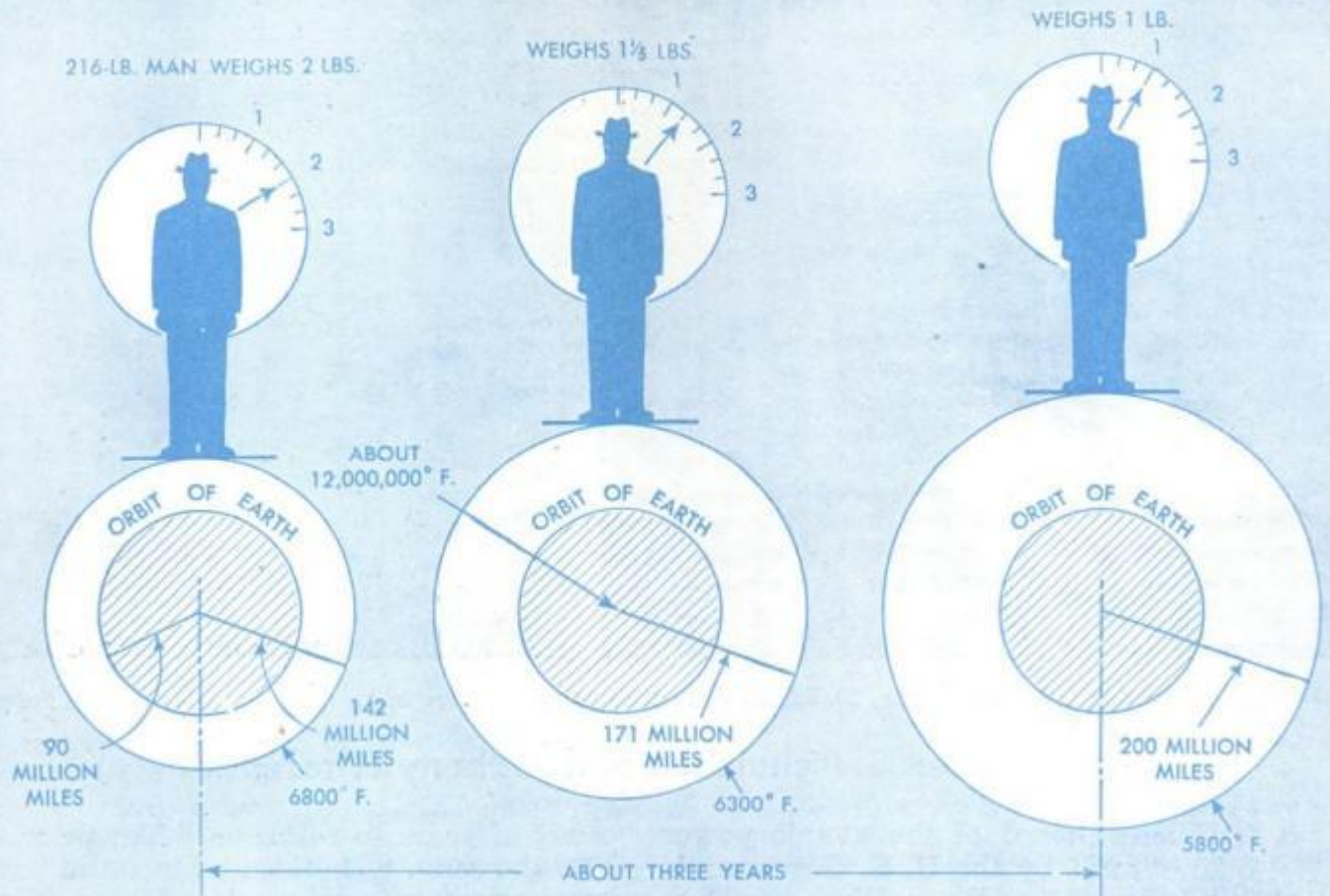
In the stars. They can serve us as celestial laboratories and as the atomic power plants of the future.

Let us consider the sun, an ordinary sort of star of moderate brightness. If we paid

Stages in the one-month growth of new star from slightly brighter than the sun to 300,000 times its luminosity



FORCE OF GRAVITY VARIES ON RED STAR BETELGEUSE...



Surface gravity on Betelgeuse is so little that a 216-pound man would weigh two pounds there when the star is smallest and shrink to a mere pound when star is fully expanded. Actually Betelgeuse has no surface; it is so tenuous that it has been called a "red-hot vacuum"

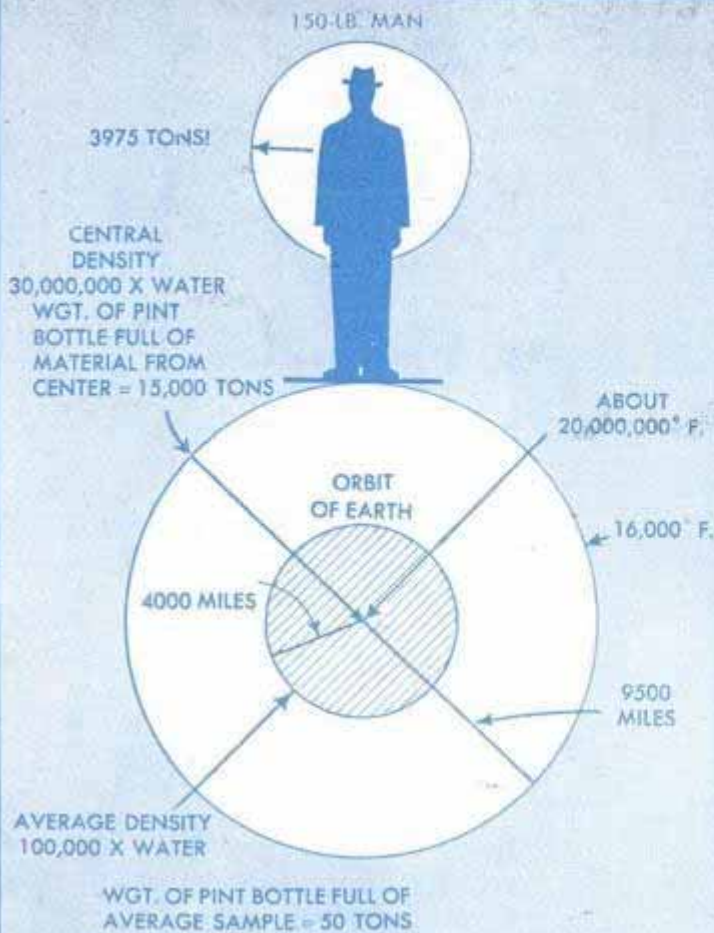
Rush job! Astronomer develops plate from 10-inch photographic telescope to see if picture will require another shot before morning



for the radiation the sun sends us at the rate of 2½ cents per kilowatt-hour the bill for a single day would come to \$100,000,000,000,000. How can the sun keep producing, year after year, such a stupendous amount of energy without diminution in amount? In 1900 astronomers could give but one honest answer to this question: "We don't know!"

Then in 1905 a physicist by the name of Albert Einstein, 26 years old at the time, published a paper about half the length of this article. In this brief paper he demonstrated the equivalence between mass and energy and gave a simple formula which told how much energy could be obtained by annihilating, for example, a pound of matter. The quantity so obtained surpassed the wildest dreams of scientists. They saw at once that if matter itself could

SIRIUS-B IS A HEAVYWEIGHT



Although hotter than the sun, Sirius B is much fainter because it is only 19,000 miles in diameter, or a little more than twice size of earth

somehow be converted into radiation, the source of the sun's energy was found.

For a long time the precise means by which the sun managed to accomplish the trick eluded us. Not until 1939 did we know enough about how matter behaves at temperatures of millions of degrees to decide which particular atomic reaction must work in the sun. By a process of elimination it became obvious that there was only one that satisfied all the conditions. It con-

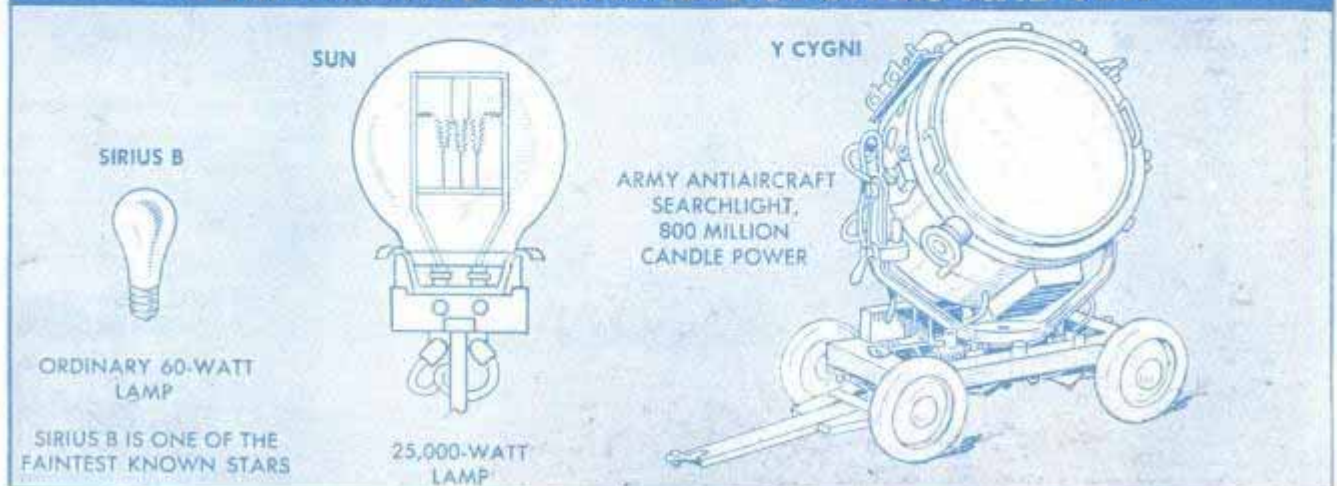
sisted of a series of reactions in which hydrogen, combining with carbon and nitrogen, is transformed into helium with the liberation of energy. That is, hydrogen may be thought of as "fuel" which, with the help of carbon and nitrogen, "burns" with the evolution of light and heat, finally ending as helium, the "ash."

The sun looks dazzling bright in the sky, but, as we have said, actually it is a star of only moderate luminosity. In the northern constellation of Cygnus a star called Y Cygni makes the sun look like a shadow by comparison. Too far away to be seen without a telescope, it outshines the sun 32,000 times. If the earth revolved around Y Cygni, it would have to move in an orbit extending out to nearly five times the distance of Pluto, the farthest planet, in order to receive the same light and heat that we do from the sun.

Y Cygni pours out energy at such a prodigious rate that it must be converting hydrogen into helium a thousand times faster than the sun. The age of the universe, determined from the uranium content of meteorites and from other sources, is about 2000 million years. It is hard to see how Y Cygni could have been stocked with sufficient hydrogen originally to have shone at its present rate for more than 100 million years. Thus, excessively luminous stars must be comparatively young. They seem to spend their precious store of hydrogen recklessly, heedless of the fact that if they keep it up they are headed for extinction in 70 million years or less.

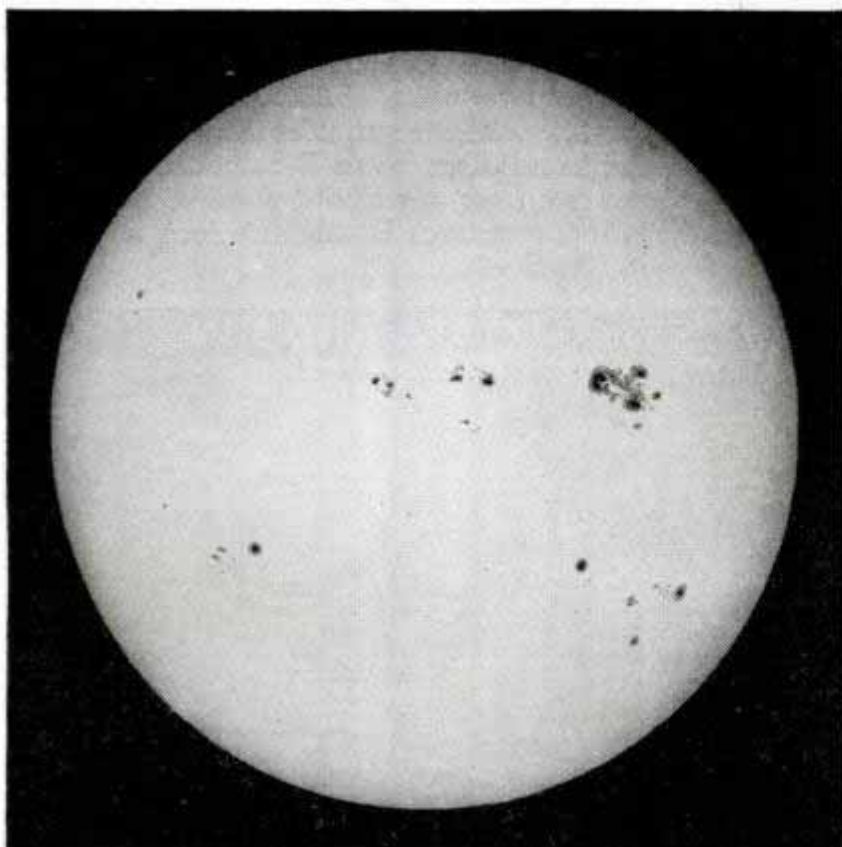
An atomic power plant different from Y Cygni is the brilliant red star Betelgeuse. Betelgeuse looks red because its surface temperature is 6000 degrees Fahrenheit as compared with 11,000 degrees for a yellow star like the sun. Yet if the sun were at the same distance as Betelgeuse we could not even see it without a telescope. What is it that makes Betelgeuse look so bright in the sky?

COMPARATIVE BRIGHTNESS OF STARS AND SUN





Photograph of a painting of the November meteors as they appeared in 1868. Below, the sun is apparently an inexhaustible atomic energy plant, although actually a star of rather moderate luminosity



The answer came in December 1920 when the diameter of Betelgeuse was first measured with an instrument called the interferometer. Later measurements showed that on the average the diameter of Betelgeuse is 400 times that of the sun. We say "on the average" because the measures showed that Betelgeuse expands and contracts like a giant balloon. Betelgeuse is so enormous that the sun could be placed at its center with room left over for the earth to revolve in its present orbit.

By a "mathematical boring process" the central temperature of stars like Betelgeuse has been found to be quite low, only about 12,000,000 degrees Fahrenheit as compared with 45,000,000 degrees for a star like the sun. Under such conditions hydrogen would be converted into helium so slowly that Betelgeuse must derive its energy from some other atomic reaction that operates at a low temperature, as for example those involving deuterium (heavy hydrogen) and the light elements lithium, beryllium and boron.

Sirius A is the brightest star of all in the sky, sparkling on a clear frosty night like a blue-white diamond. But Sirius A is interesting to astronomers chiefly because of its tiny companion, Sirius B, so faint that only under the most favorable conditions can it be detected with a powerful telescope. Most of the time Sirius B is hidden by the dazzling light of Sirius A.

Sirius A is a star not essentially different from many others. But Sirius B is about as massive as the sun although much fainter. Many faint stars are known, practically all of which are deep red. Sirius B, however, is white. In order for a star to appear white its surface temperature must be high. And stars of high temperature give out a lot of light per square inch of surface. Yet the observations show that Sirius B is only $\frac{1}{400}$ as bright as the sun.

We saw that Betelgeuse, al-

4-Wheel-Steering Jeep Turns in 12 Feet

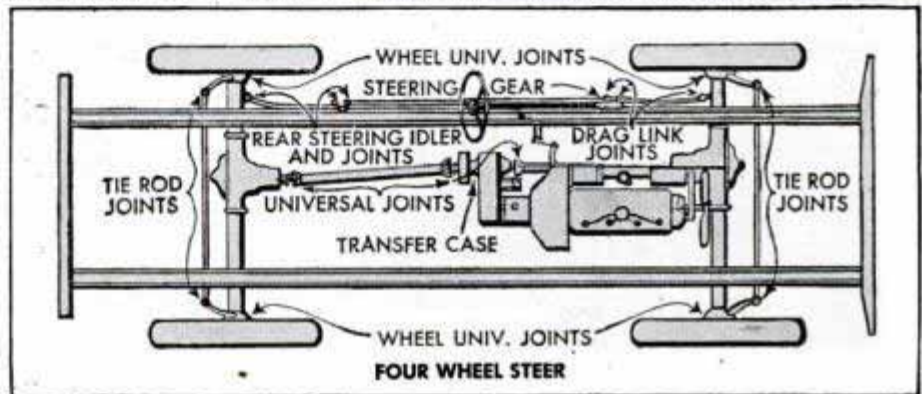
though cooler than the sun, appears very bright because it is so immense. Sirius B, hotter than the sun, is faint because it is so small, being 19,000 miles in diameter or a little more than twice the size of the earth.

Into this pygmy star is packed as much matter as our whole sun contains. As a result its density is incredibly high—on the average 100,000 times as dense as water. A pint bottle holds about a pound of water. Therefore, a pint bottle filled with a representative sample of material from Sirius B would weigh 100,000 pounds. And this is merely the average density. At the center of the star the density probably soars to 30 million times and a pint bottle full of material from there would weigh about 15,000 tons.

Gravity on the surface of such a body would be terrific. A 150-pound man would weigh 3975 tons on Sirius B. His muscles could never support such a weight. He would be instantly squashed by the weight of his own body. To attain such a high density, the atoms must be crushed into their separate components so they fill only a fraction of the space they ordinarily would occupy. Imagine a box loosely packed with 100 Christmas ornaments. By packing them carefully possibly 200 might be squeezed in. Now let us crush the ornaments to a fine powder until we can get thousands of them into the box, which then would be much heavier than when it contained only 100.

Another type of celestial power plant is the nova—a new star that suddenly flares up to thousands of times its former brightness. Nova Puppis, which appeared in November 1942, was a fine example of such a star. For three days Nova Puppis ranked among the 10 brightest stars in the sky. Then it faded rapidly and in a few weeks was barely visible to the naked eye. Now it can be seen only with a telescope.

Even more awe inspiring are the supernovae which have been photographed in



Redesigned jeeps have been made even more maneuverable than the Army models. One was converted to four-wheel steering by installing, at front and rear, axles equipped with steering knuckles. The rear wheels can turn sideways, with the result that the jeep can turn around in 12 feet.

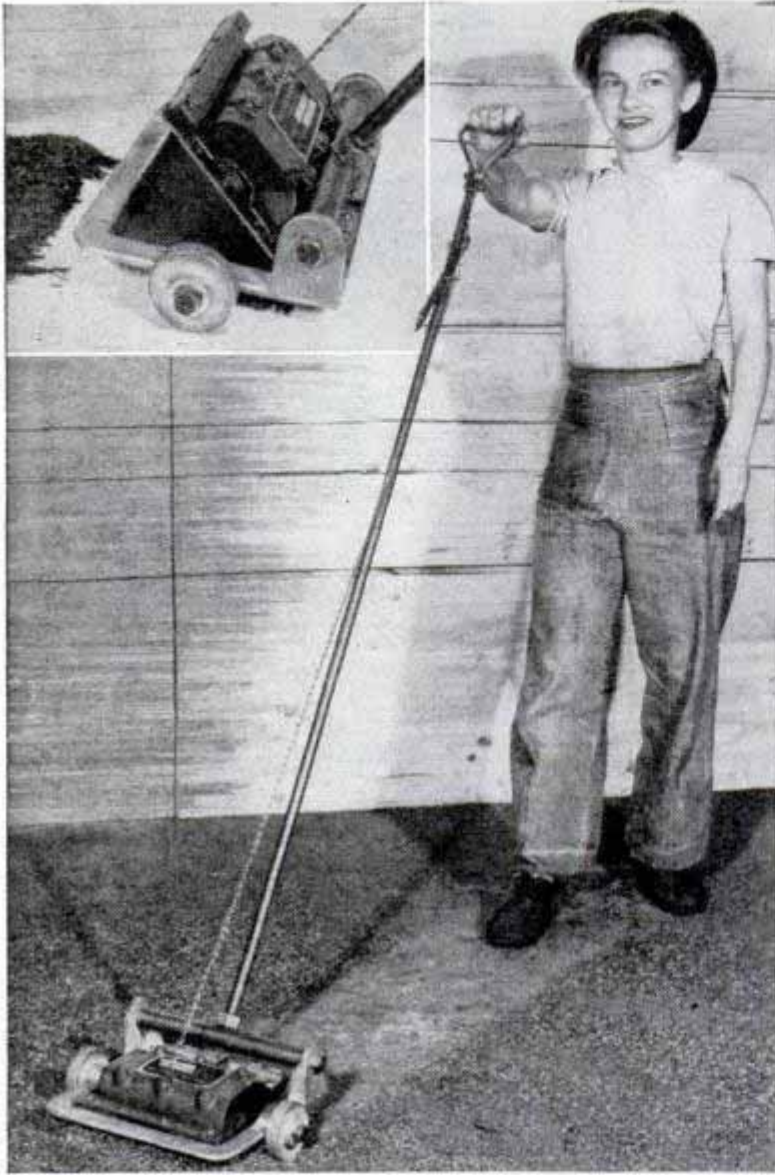
galaxies millions of light years away. One such star blazed with the light of 600 million suns—a hundred times as bright as the whole island universe of stars that contained it!

The brightest supernovae ever recorded shows on our plates as a faint speck of light. Yet they are the most spectacular example of the atomic power plants of the sky.

Vitamin A Produced Chemically

Vitamin A, previously produced from fish liver oils, can be made synthetically as the result of experiments conducted at Massachusetts Institute of Technology. Seven or eight steps are required to produce the vitamin. Potency of the artificially produced product—still not out of the laboratory stage—is $\frac{1}{10}$ to $\frac{1}{30}$ that of pure vitamin A crystals obtained from natural sources, but 50 to 100 times greater than that of cod liver oil itself.

Magnetic Sweeper Collects Chips



Metal particles under and around machines can be swept up quickly with a magnetic sweeper. Chips, filings, dropped screws and bolts all are picked up by a plastic plate over which is suspended a magnet. By pulling a chain attached to the handle the magnet is lifted and the clinging particles automatically are detached from the plastic plate. The magnet requires no electrical connection.

Water Yield Tripled In Compression Still

Scientists are studying a variety of peacetime uses for one war-developed method of extracting fresh water from sea water. Called compression distillation, this method produces approximately 175 pounds

of distilled water for each pound of fuel consumed, which is three to four times as much distilled water as obtained with previous distillation systems. The main difference between the old and the new way is that in the latest method steam is raised to a higher temperature and the resulting heat is used to evaporate more water in a still. Fuel is used to drive the compressor instead of to boil water in the still. This procedure may find many applications in industry.

Optical Gauge Measures Plastic Thickness

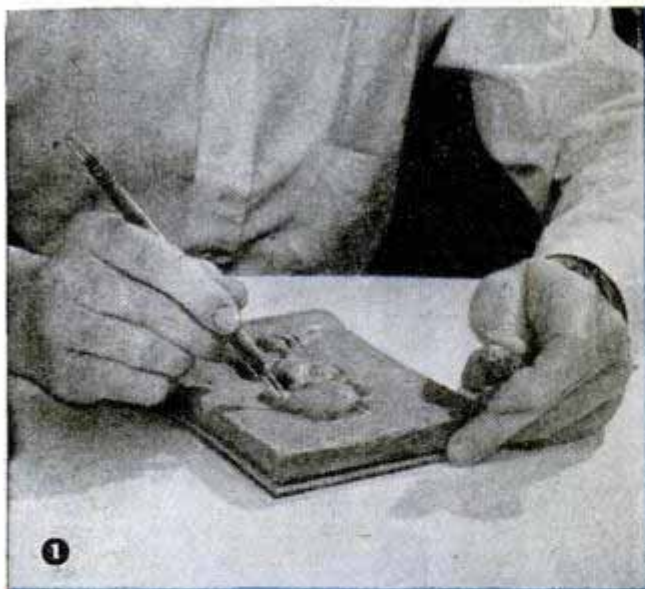
Measurement of the thickness of large or curved pieces of plastic sheet or glass is simplified with an optical micrometer which can be used in positions inaccessible to the ordinary micrometer. The instrument, which operates on the principle of apparent depth, "sees" through the plastic sheet to gauge its thickness by measuring the distance to a crayon mark on the underside of the sheet being checked. Measurement consists of sharply focusing the mark in the eyepiece of the instrument. Readings on the barrel and thimble, as in an ordinary micrometer, give the thickness of the material. A plastic nosepiece, held against the sheet to be measured, prevents the metal parts of the instrument from scratching the surface of material being measured.



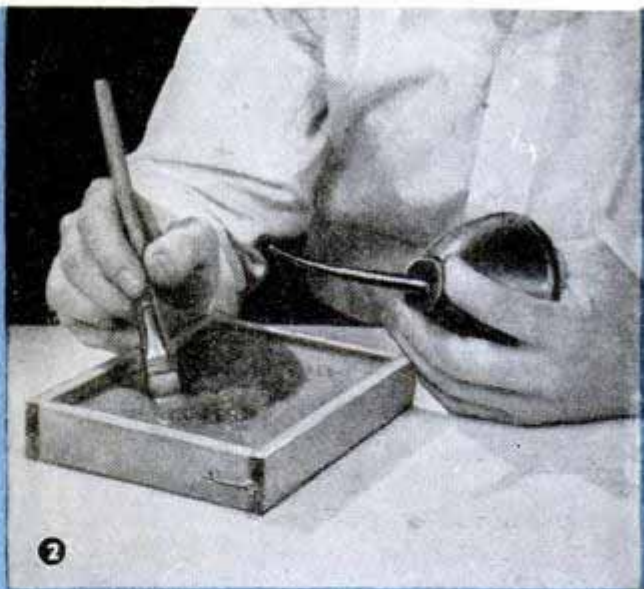


The Craftsman

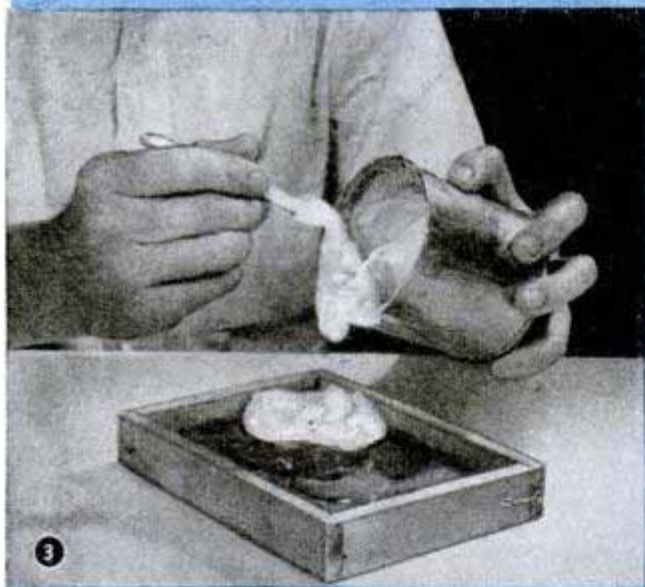
- Decorative Wall Plaques . . . 170
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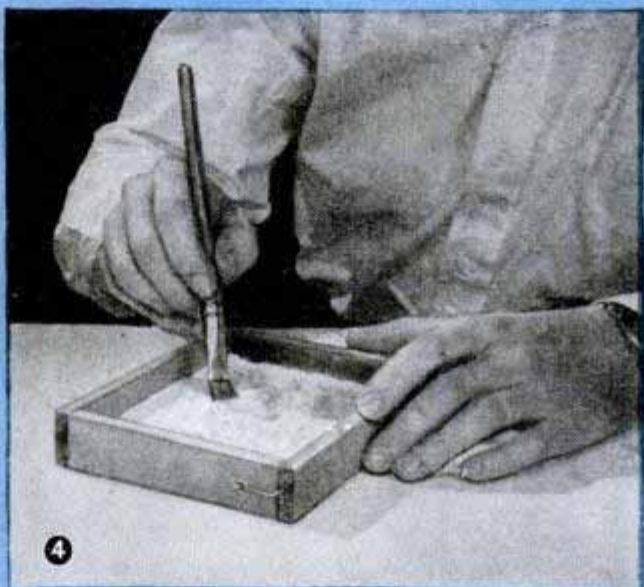
1 Outline the figure on a piece of clay and carefully pull away the material until the subject is in relief



2 Place the clay in a wooden frame and paint the frame and surface of the clay with ordinary motor oil



3 Mix a small quantity of plaster of paris to the consistency of pancake batter and pour the mold full



4 When thoroughly dry remove the clay model and give the surface of the plaster two coats of white shellac



5 Place the mold back in the frame, oil the surface and once again pour the mold full of plaster of paris



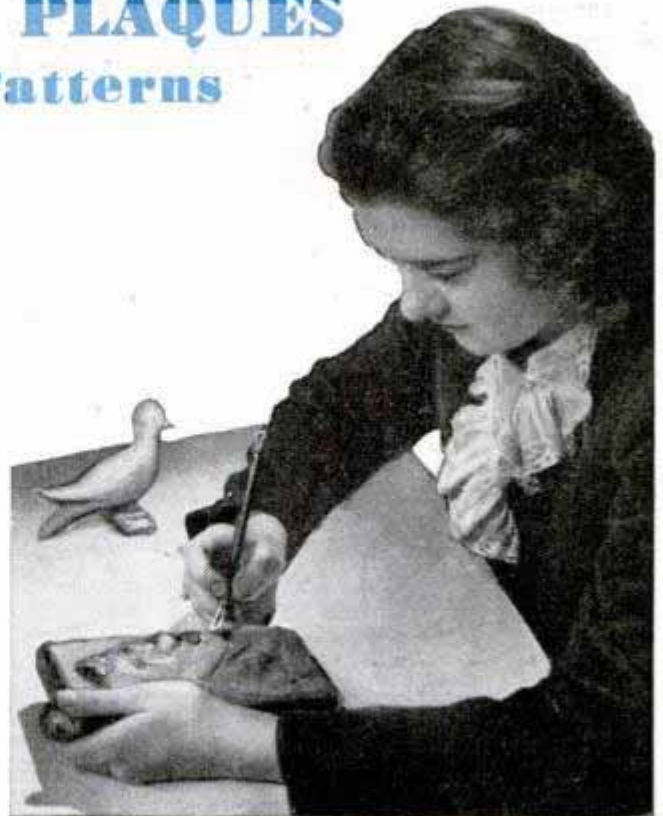
6 When the plaster cast has dried thoroughly, remove and shellac as before. Then paint with oil color

DECORATIVE WALL PLAQUES

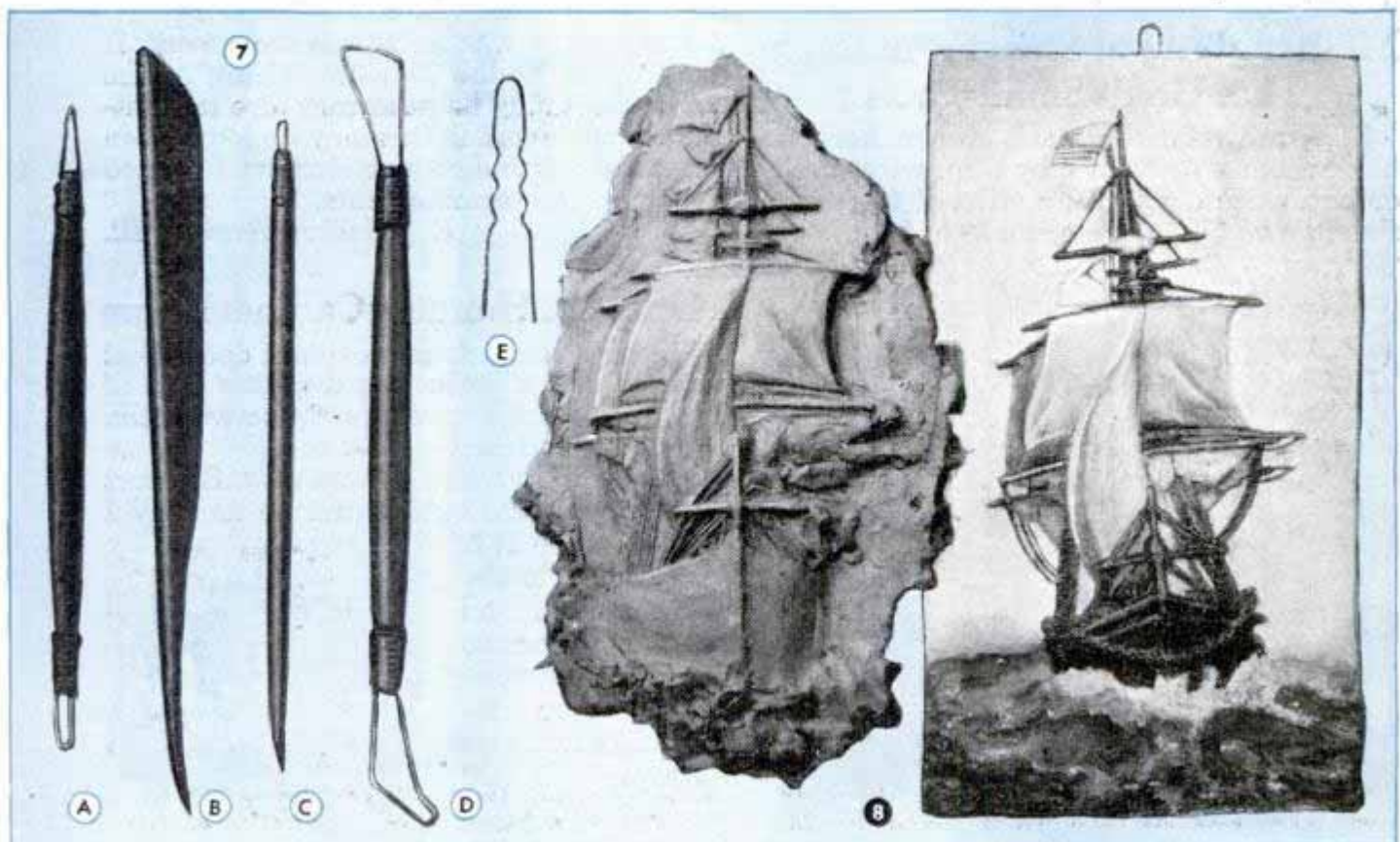
From Modeling-Clay Patterns

By Dick Hutchinson

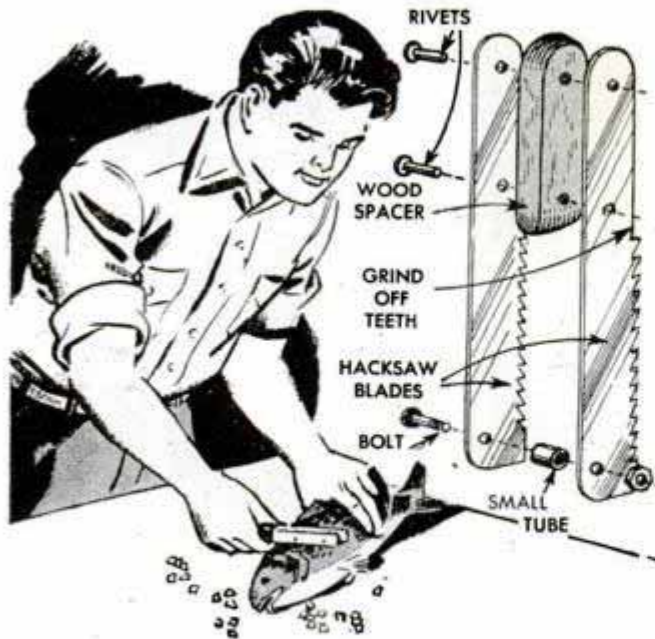
IF you begin with clay patterns it's easy to satisfy a desire to work in modeling clay without getting discouraged right at the start. Shaping a figure or object, such as a ship, in simple relief on a flat surface requires far less skill and effort than carving the same thing in wood. Figs. 1 to 6 inclusive show how a pattern is made from modeling clay and how it is used in casting a wall plaque from plaster of paris. First, you select a clipping or photo of the subject desired and from this determine the size of the plaque. Then cut a modeling board from $\frac{1}{4}$ -in. plywood to this size. Place a piece of the clay on the board, smooth it out to the edges and square up to a thickness of about $\frac{5}{8}$ in. Outline the figure in the clay, then begin modeling the relief by pulling away excess material as in Fig. 1. Professionals use the set of tools shown in Fig. 7, A to D inclusive, but for simple detail a hairpin, E, Fig. 7, does very well. You will see that the advantage of modeling clay is that if too much is removed or scraped away from any point on the surface, more clay may be added and the area gone over again to correct the error. Once the figure or shape is finished as desired, make a small bottomless box that will fit over the pattern and modeling board as in Fig. 2. Diagonally opposite



corners are held with small hooks so that the box can be removed without damaging the pattern. After the plaster of paris mold has hardened it is placed in the box and shellacked. When pouring the plaster plaque as in Fig. 5, a small hanger bent from wire is placed at the top end as indicated. Fig. 6 shows a plaque being painted, while the two views in Fig. 8 show a pattern and the finished plaque made from it.



Durable Fish Scaler Easily Made From Power-Hacksaw Blades

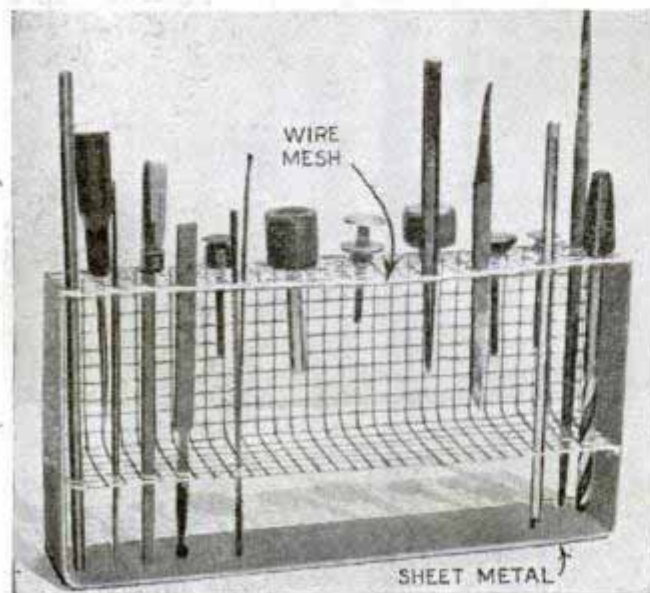


Discarded power-hacksaw blades are used by one fisherman to make a fish scaler. Two pieces of blade $7\frac{1}{2}$ in. long are required and the teeth are ground off for a distance of 4 in. to form a handle. Note, however, that the teeth point in the opposite directions so that the maximum scraping effect is obtained. A wood spacer, which is sawed and sanded to fit the contour of a handle, is riveted between the blades. To complete the scaler, a tube of a length equal to the width of the wooden spacer is inserted where indicated.

W. B. Townsley, South Bend, Ind.

Mesh and Metal Strip Form Rack That Holds Small Tools

The universal tool rack shown here is made from a piece of 6 by 8-in. wire mesh or hardware cloth and a strip of 18-gauge sheet metal $1\frac{1}{2}$ in. wide and 18 in. long. The



metal strip and the hardware cloth both are bent to a U-shape and soldered together to make a sturdy, all-purpose holder.

Container on Drill Catches Debris From Overhead Borings

You need not be bothered with shavings or bits of plaster going down your sleeves and shirt collar when boring overhead holes if you use a container as shown to catch the drillings. Punch a hole large enough to slip over the shank of the drill and fasten it with cellulose tape. Then put the bit in the brace and proceed to drill. The debris will fall into the container and save clean-up time.—Benj. Nielsen, Aurora, Nebr.



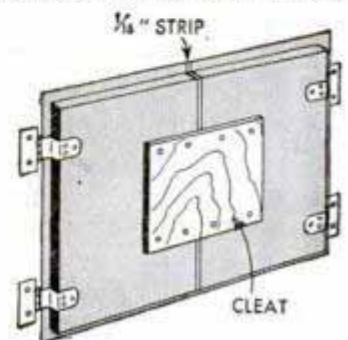
Remedy for Flickering Car Lights

Two frequent causes of flickering lights in an automobile are poor ground cable connections and loose wiring at the ammeter. On cars where the motor has a floating mount, the cables should be tightened every two or three thousand miles as they are subject to extreme vibration. One solution is to fasten the cable to a transmission bolt where there is less movement. If the trouble is due to loose wiring at the ammeter, it may be necessary also to tighten the inside nut as this may be loose even when the outside connections are fastened tightly to the terminal nuts.

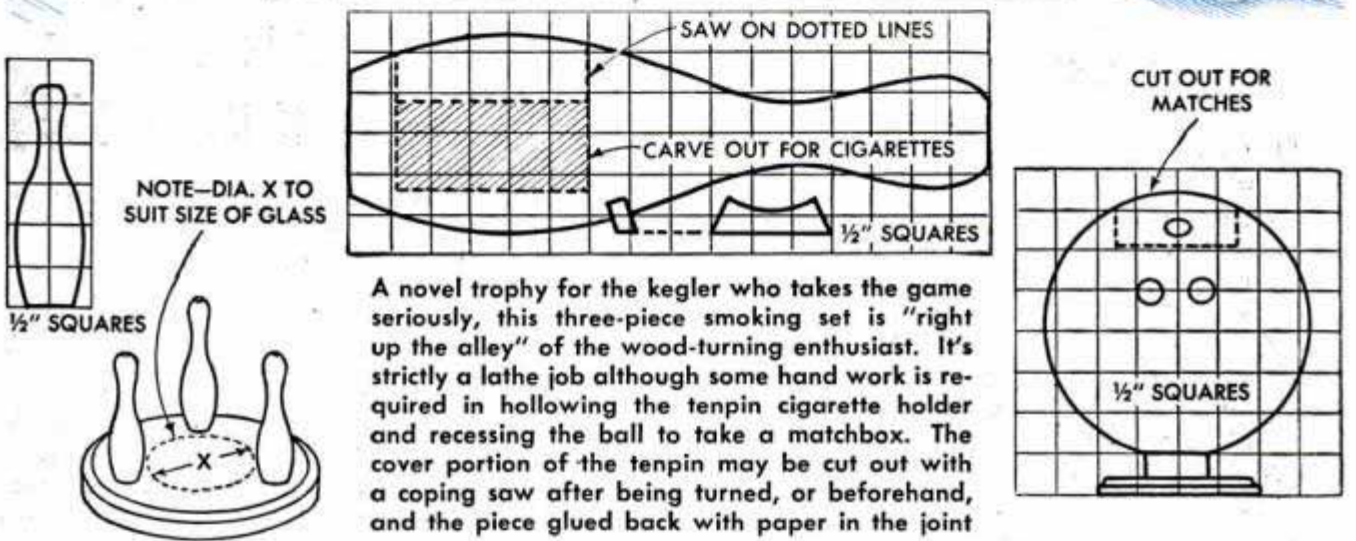
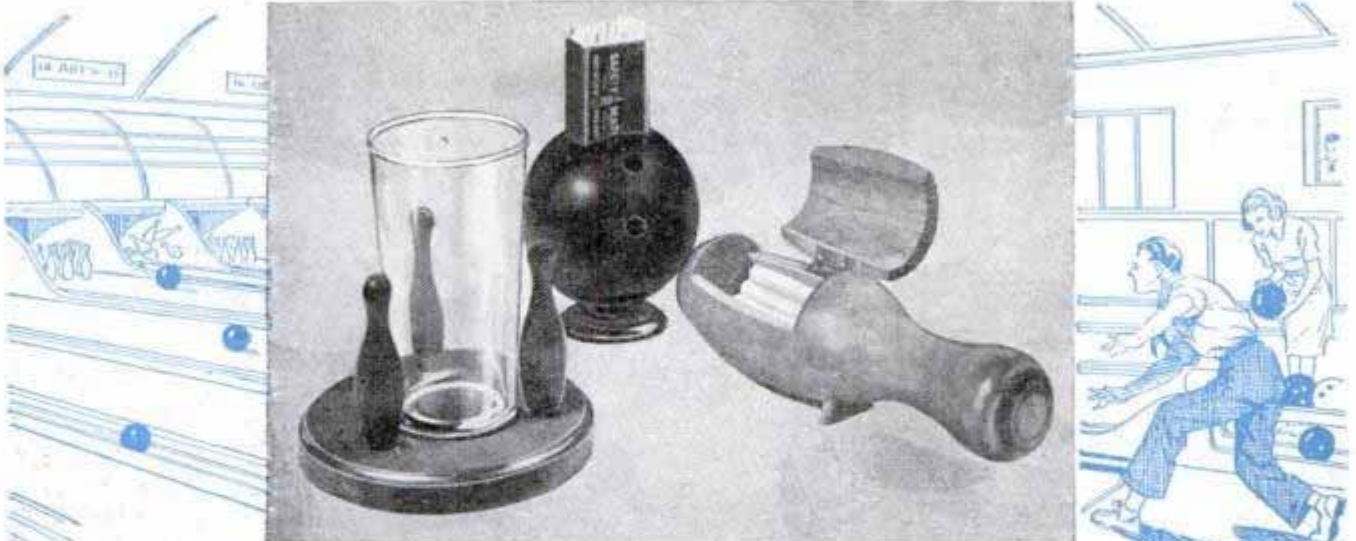
Hal Geihm, Aurora, Ill.

Method of Hanging Cabinet Doors

When hanging double cabinet doors that have an offset projecting over the face of the cabinet, put a spacing strip between the two doors and nail a cleat to the backs so they can be handled as one unit. Support the doors in the cabinet frame and level the top. Then it is easy to locate the hinge screws and hang the doors so the space between them will be uniform from top to bottom.—Harold W. Stanton, Lake Arrowhead, Calif.



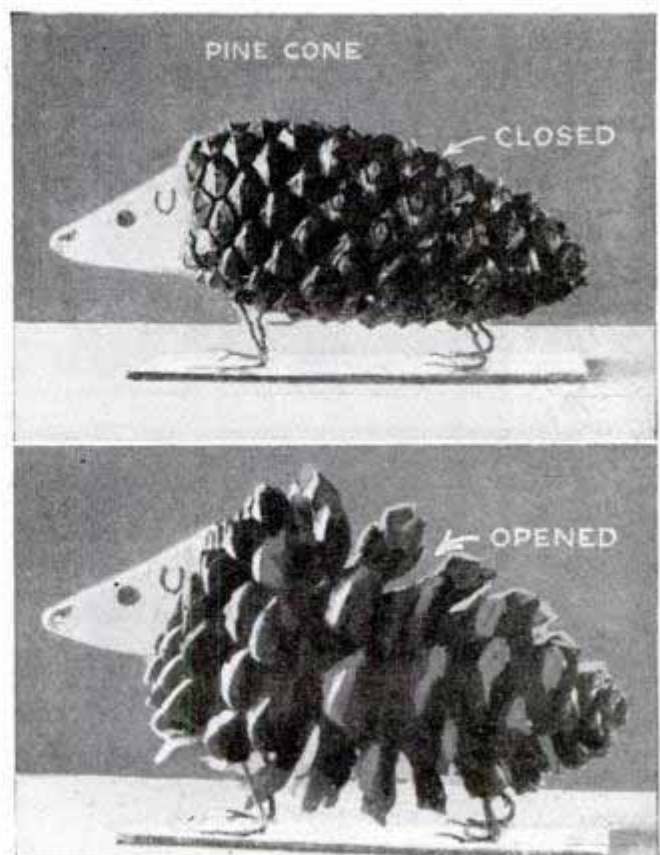
Novel Smoking Set Makes "Strike" With Bowlers



A novel trophy for the kegler who takes the game seriously, this three-piece smoking set is "right up the alley" of the wood-turning enthusiast. It's strictly a lathe job although some hand work is required in hollowing the tenpin cigarette holder and recessing the ball to take a matchbox. The cover portion of the tenpin may be cut out with a coping saw after being turned, or beforehand, and the piece glued back with paper in the joint

Pine Cone Will Indicate Humidity to Forecast Weather

Because the cones from pine trees tend to open when the air is dry and close when the air is damp, knowledge of this fact can be utilized in making this weather forecaster. The body of the animal is a pine cone; the head is cardboard and the legs are short lengths of wire resting on a cardboard base. During periods of high humidity when rain is more likely, the cones will be closed, but when the humidity is low and the weather probably will be fair, the cones will be open.—S. Leonard Bastin, Christchurch, Hants, England.



Cigarettes Used to Measure Fish

Not many fishermen carry a rule to measure their catch, but fish of doubtful length can be measured by using a cigarette. All standard brand cigarettes are 2 3/4 in. long and the "king" size are 3 1/4 in. For example, a fish having a legal length of 8 in. would scale three standard cigarette lengths with 1/4 in. over to be on the safe side.—R. A. Jenkins, Los Angeles, Calif.

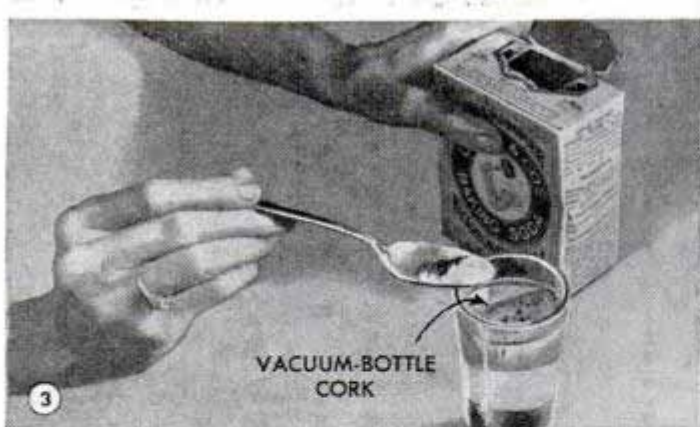
Solving Home Problems



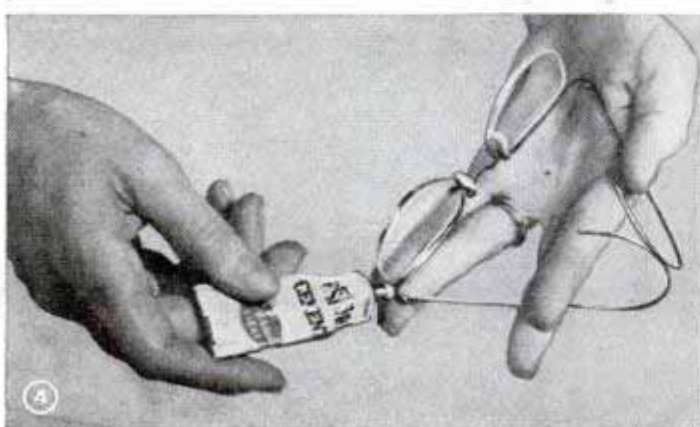
1 Extension cords for household appliances will not pull out of drop-cord receptacles when the end of the extension is looped and secured to the drop cord with a rubber band or piece of string while being used



2 Drawers will glide noiselessly and easily if thumbtacks are pressed into the runners on which the drawers slide. A thumbtack that has a rounded head and an enameled finish is better than a flat-head tack

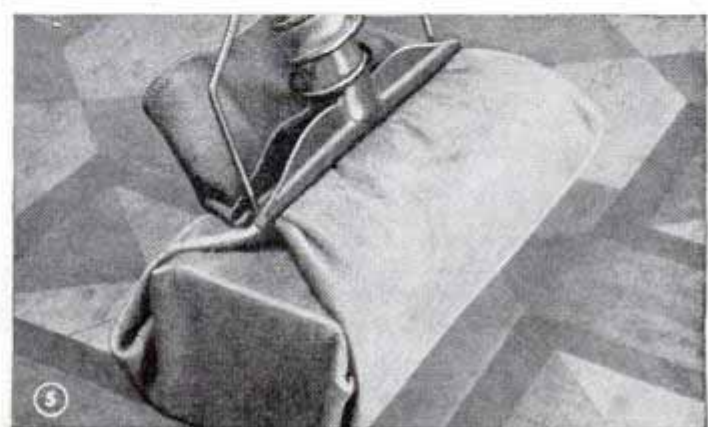


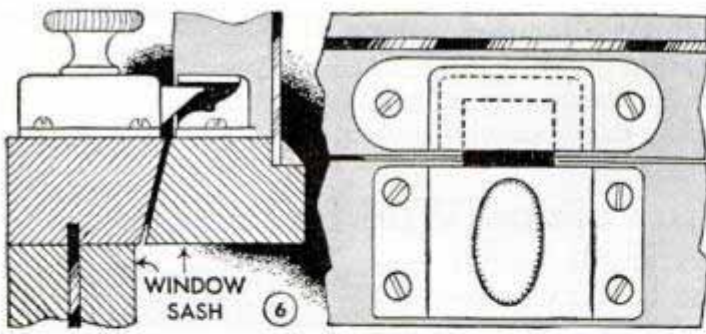
3 Keeping a vacuum-bottle cork submerged when soaking it in a baking soda solution to sweeten it is not difficult if the cork is wedged into a small glass. When this is done, the cork can be covered completely



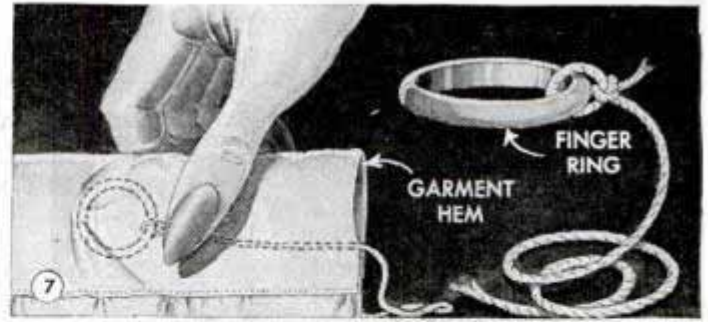
4 The small screws in eyeglasses that hold the temple to the frame are a frequent source of annoyance because they refuse to stay tight. The next time this happens apply liquid cement to the loose screws

5 A brick and a piece of soft cloth make an improvised floor polisher when the regular polisher is not available. Wrap the brick in the cloth, fold the ends as shown and fasten in the clamp of a floor-mop handle

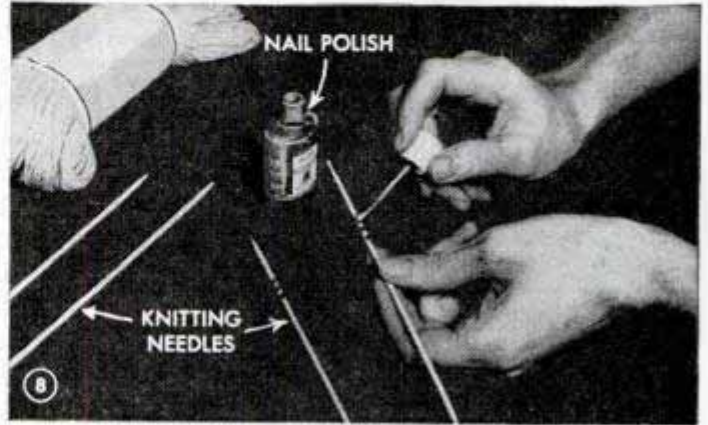




6 Because most window locks must be fastened by hand, they frequently are left unlocked. To insure having your windows locked when closed, install a latch that snaps shut



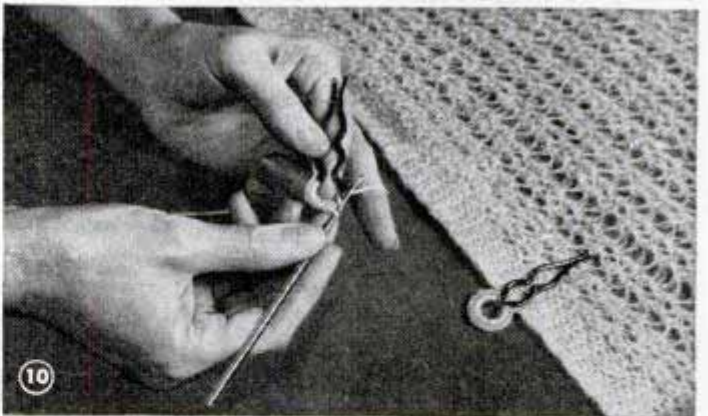
7 In an emergency, a finger ring is used to pull a draw string through the hem of a garment. After the string has been fastened to the ring, it is worked through the hem



8 To identify sock knitting needles, mark the size on the needle with colored fingernail polish. Those in the photograph are size 3 and are identified with three dots

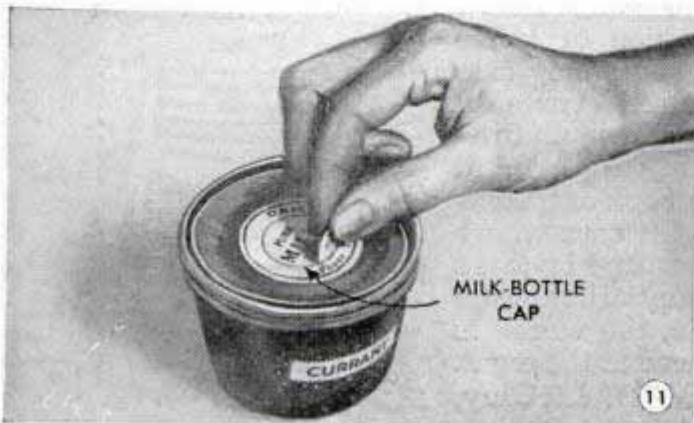


9 When space is at a premium, it is a good idea to store baking dishes with the lids inverted. This permits stacking dishes so the knobs on the lids are not broken easily

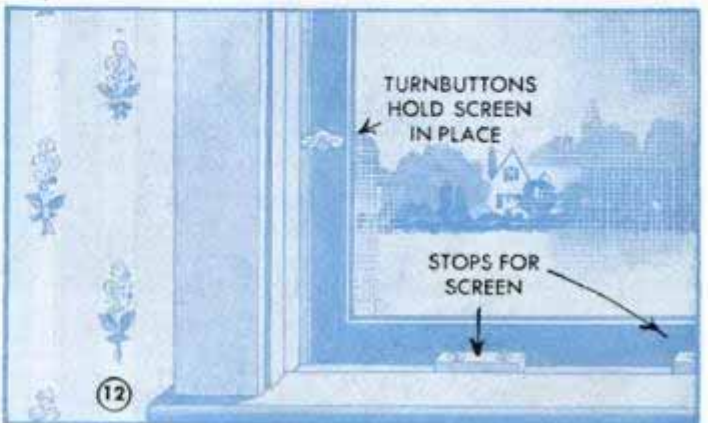


10 After crocheting your fascinator, use the same yarn to crochet around the tops of two bone hairpins. These make "invisible" holders to keep this head covering in place

11 Embedded in the paraffin while it is soft, a milk bottle cap provides a handy tab for easy removal of the paraffin, which can be reused as it will not break when removed



12 Here's one way to install half-screens. Small blocks serve as stops at the base; the screen rests against the sash at the top and turnbuttons on the sides hold it in place



Music Stuffs Are Drawn Quickly Using Multiple Chalk Holder



Teachers will find this multiple chalk holder convenient for drawing music staves on the blackboard. Five equidistant holes are drilled in a piece of hardwood and tapered lengths of chalk are pressed into the holes. The ends must be even so that all sticks are in contact with the board when drawing staves.—V. Palmer, Alleppo, Syria.

Reflector Aids When Parking Car In Small Garage at Night

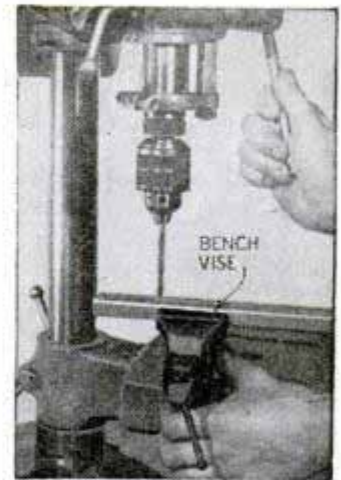
In a garage where space is at a premium, a large red-glass reflector attached to the rear wall in line with the center of the driveway will enable you to park your car



without difficulty. All that is necessary is to sight down the center of the hood, lining up the radiator ornament with the reflector, as the car is driven inside.

Vise Positions Work on Drill Press

A small bench vise of the clamp-on type is handy for holding light work on a drill press. Clamp the vise to the table of the machine and swing the table so that the work comes under the drill bit. This arrangement will be especially useful for such jobs as



drilling a large number of holes in aluminum strips used to protect the edges of stair treads and table tops, as shown here.

D. J. Bachner, Jackson Heights, N. Y.

Washing Rugs Without a Machine

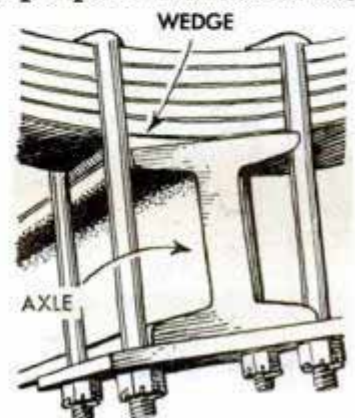
When you do not have a washing machine in which to clean such heavy articles as rag rugs or chenille and crocheted bedspreads, soak them overnight in the bathtub in thick soap suds. The next morning dip them up and down several times and, without wringing, hang them on the clothesline. Turn the hose on them until all the soap is rinsed out.

Ruth C. Buck, Jackson, Miss.

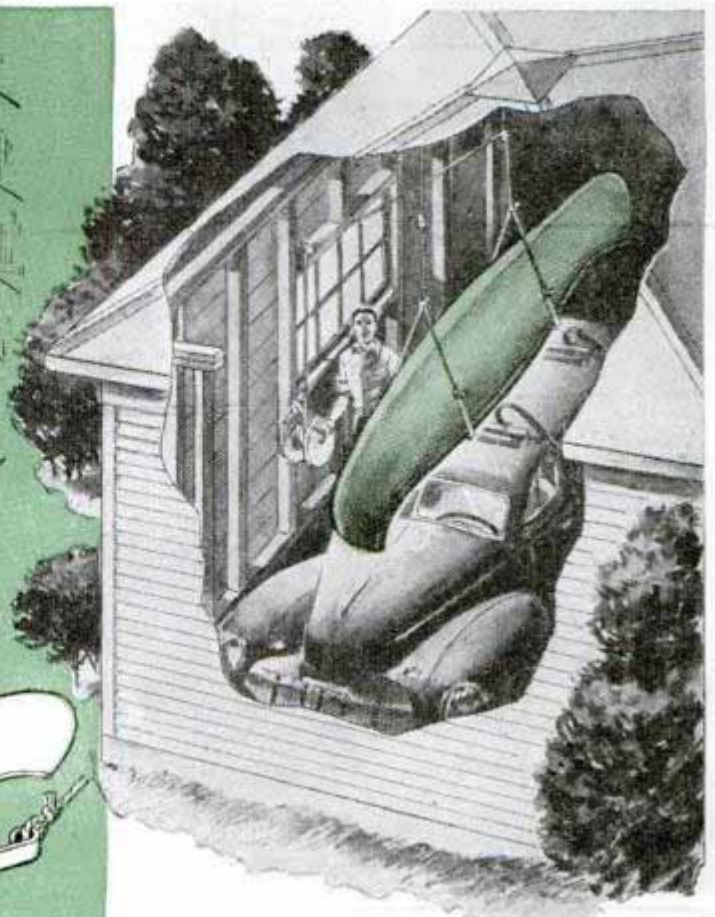
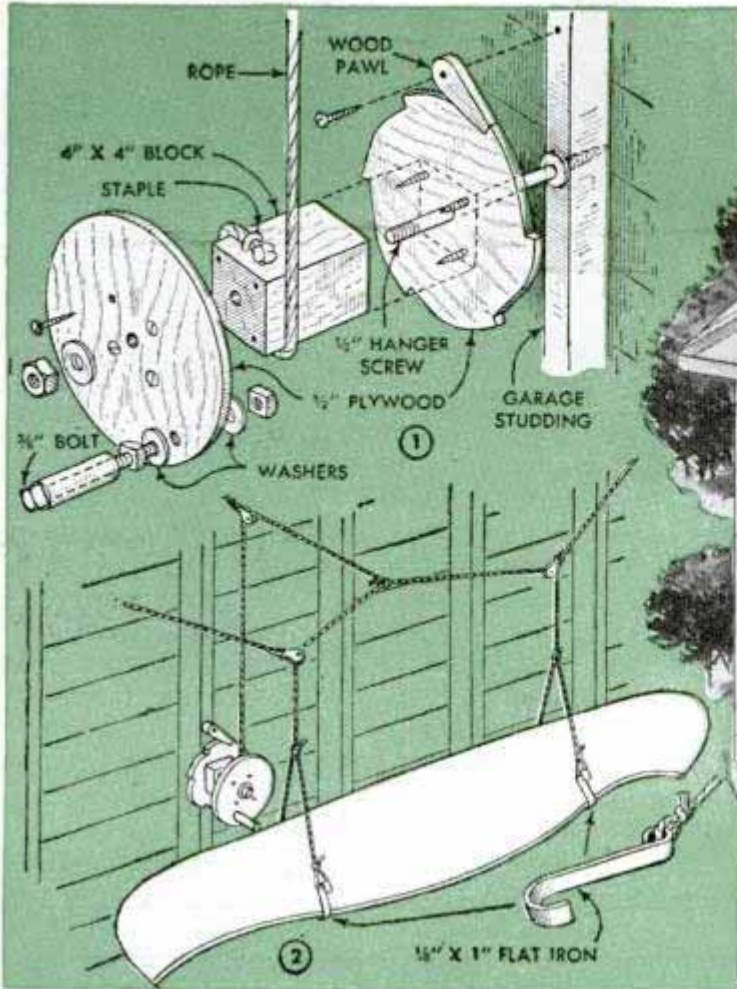
Wedge Tilts Front Axle of Car To Prevent Swaying

A car may have a tendency to "weave" over the road because the front axle is not tilted backward sufficiently. Often this trouble can be corrected by inserting a wedge between the axle and spring as indicated. Thickness of the wedge will be determined by the amount of tilt required. A good wedge for this purpose is made from a piece of knife file. On many cars the axle rests on the spring and the wedge is placed at the back of the axle. On cars where the spring is mounted below the axle, the wedge is placed at the front.

—W. H. McClay, Pasadena, Calif.



Reel Aids in Handling and Storing Small Boat



Canoes, small boats and kayaks can be lowered to or removed from the top of a car with little effort if the reel and pulley arrangement shown here is used. When the craft is raised above the car it is stored out of the way until ready for the water again. Two of the pulleys are attached to the roof by short lengths of rope, and the third pul-

ley, through which passes the rope attached to the hooks, is fastened to the side of the building. Size of the pulleys is determined by the size of the rope, and this depends upon the weight of the boat. The reel is made as indicated in Fig. 1 and is screwed to the studding at waist height. The hooks, Fig. 2, from which the boat is slung are bent to fit over the sides of the craft.—D. E. Horn, River Forest, Ill.

Pipe "Planted" With Young Tree Conducts Water to Roots



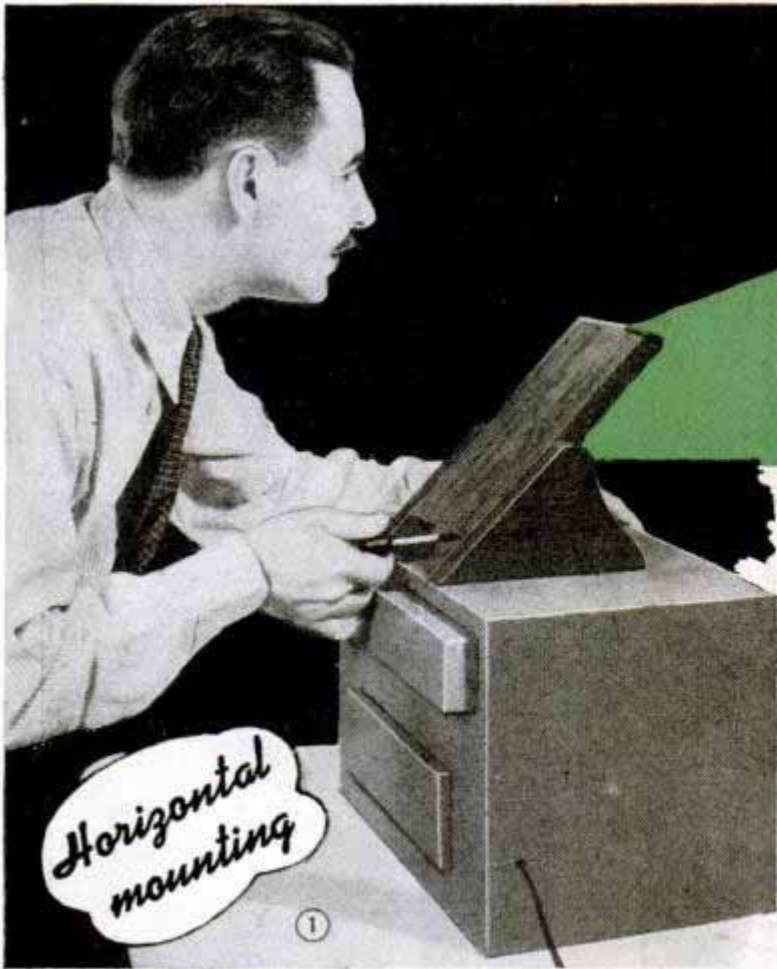
When a young tree is planted, its roots can be assured of a plentiful supply of water if a length of 6-in. pipe is placed in the hole near the roots. The pipe is filled with water, which will be fed directly to the roots instead of seeping through the ground to be absorbed by the soil.

B. G. Reams, Winter Garden, Fla.

Fan Belt Made from Inner Tube

If the fan belt on your car breaks and you're not near a garage, here's an emergency repair that will keep you going until you can get a belt. Cut bands from an inner tube into strips about 1/4-in. wide. Stretch several of these over the pulleys and bind them with cord, using a half-hitch knot. Care must be taken to avoid "bunching."

Arthur Drummond, Jr., Rye, N. Y.



By Sam Brown

A PROJECTOR is an optical device for enlarging opaque copy and projecting it on a wall, screen or sheet of white paper. Artists, sign writers and many craftsmen find a projector very useful. To use it, fasten the drawing, picture or clipping to a copy board, place the board in the projector box, snap the switch and there's your picture—any size you want it with only slight adjust-

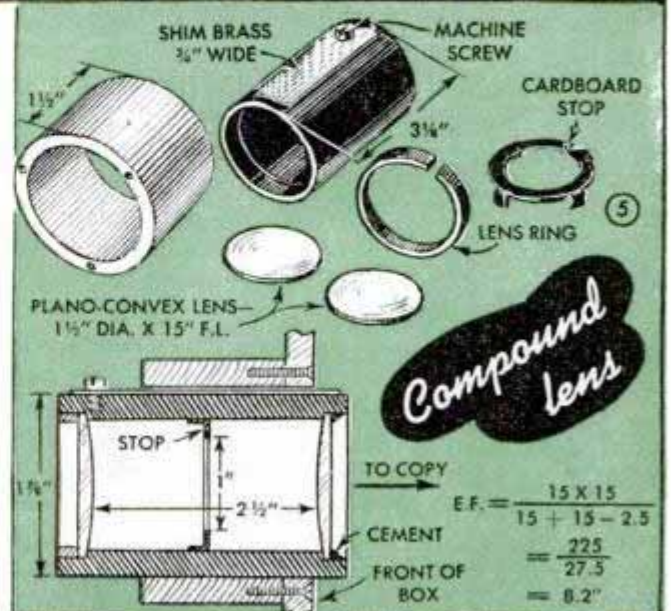
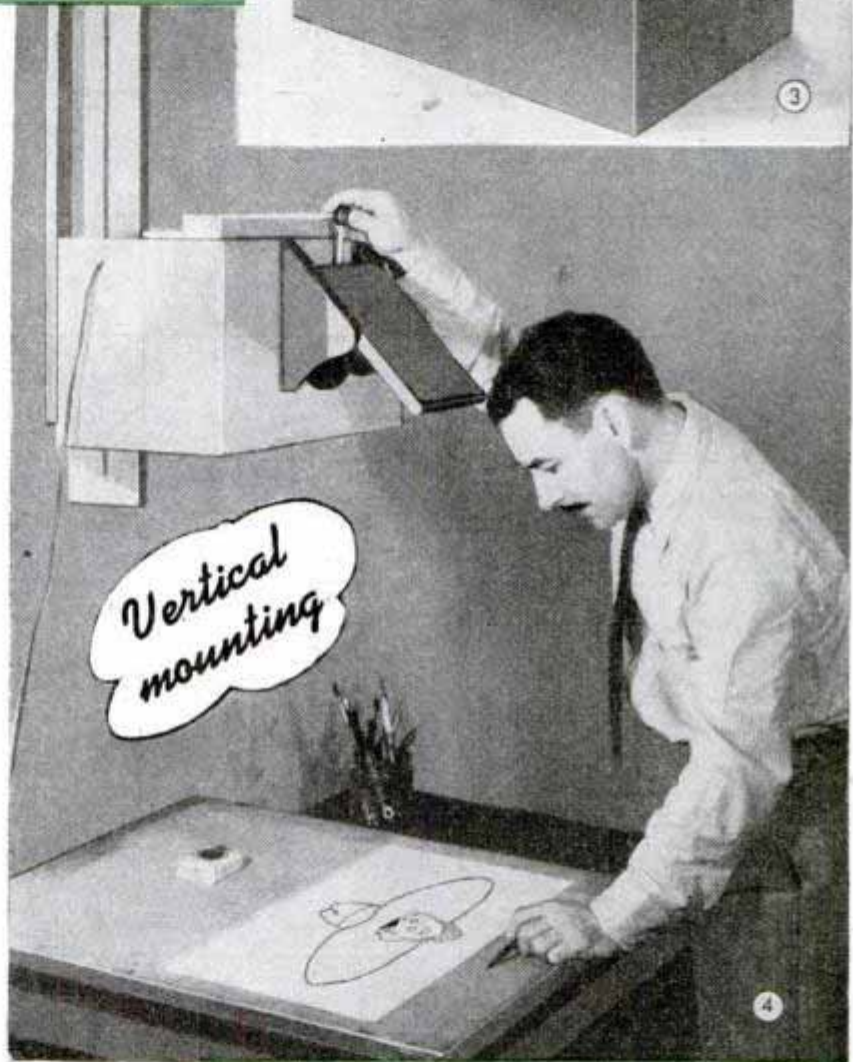
	SINGLE LENS	COMPOUND LENS	PROJECTOR LENS	CAMERA LENS
TYPE OF LENS	<p>PLANO CONVEX DOUBLE CONVEX ACHROMAT</p>	$E.F. = \frac{F \times F}{F + F - S}$		
FIELD	<p>TO COPY 20° PLANO-CONVEX LENS</p>	<p>20°</p>	<p>25°</p>	<p>50°</p>
DISTORTION	<p>HEAVY PINCUSHION DISTORTION—ABOUT 1/4" TO 3/8" IN 12" AT IMAGE</p>	<p>VERY SLIGHT DISTORTION—NOT OVER 1/32" IN 12" AT IMAGE</p>	<p>SLIGHT DISTORTION ABOUT 1/16" IN 12" AT IMAGE</p>	<p>NO DISTORTION</p>
ILLUM.	<p>FAIR ILLUMINATION. WORKS BEST AT F:11 TO F:16</p>	<p>GOOD ILLUMINATION. WORKS AT F:8</p>	<p>EXCELLENT ILLUMINATION. WORKS AT F:4</p>	<p>GOOD TO EXCELLENT. WORKS AT F:4 TO F:8</p>
REMARKS	<p>POOREST TYPE OF LENS AND SHOULD BE USED ONLY FOR JUVENILE PLAY PROJECTORS. SINGLE ACHROMATIC LENSES ARE NO BETTER THAN PLANO OR DOUBLE CONVEX</p>	<p>BEST INEXPENSIVE TYPE. ONLY FAULT IS NARROW FIELD. SHOULD BE ABOUT 8" EQUIVALENT FOCAL LENGTH (E.F.). COST OF LENSES 1 1/2" DIAMETER ABOUT 20c EACH</p>	<p>BEST TYPE FOR LONG THROWS OR WHERE STRONG ILLUMINATION IS NEEDED. COST IN RACK-AND-PINION MOUNT ABOUT \$15. FOCAL LENGTH SHOULD NOT BE SHORTER THAN 6 1/2"</p>	<p>BEST ALL-PURPOSE LENS. RAPID RECTILINEAR TYPE RECOMMENDED IN VIEW OF LOW COST (ABOUT \$3). OTHER TYPES (ANASTIGMATS) ARE TOO EXPENSIVE FOR GENERAL USE</p>

The OPTICS of the PROJECTOR

ments of the copy board and lens. With minor changes in design a projector works equally well when used in the horizontal position, Figs. 1 and 3, for projecting pictures on the wall or a screen, or in the vertical position, Fig. 4, where it is used for projecting images onto an easel or drawing board so they can be traced in outline or in full detail.

General lens terms: The lens is the heart of the projector. Before discussing lenses, a few general terms should be understood; first of all, the focal length. If you hold any lens in sunlight and over a piece of paper, you will find that at a certain distance from the paper, the lens projects a sharp image of the sun. The distance from lens to paper is the focal length of the lens. If you are checking a thick lens like the compound type shown in Fig. 2, the focal length should be measured from paper to about halfway between the two lenses. This is not exactly accurate, but is close enough for practical use. Lenses recommended for projectors run about 4½ to 10-in. focal length. The *f*: value of any lens indicates the ratio between the focal length and lens diameter, and is found by dividing the focal length by the diameter. For example, a lens of 12-in. focal length and 1-in. diameter is rated *f*:12. If you take a piece of cardboard with a ½-in. hole in it and place it over the same lens, the *f*: value then is 12 divided by ½ or *f*:24. It can be seen that the higher the *f*: number the less light the lens will pass. Such lenses are called "slow." Lenses recommended for projectors should have an *f*: value of 11 or faster because good illumination is important.

Lenses: Lenses are described graphically in Fig. 2. From a study of this table, you



Use this table to find

1. GENERAL DIMENSIONS OF BOX—as determined by distance from lens to copy and size of copy covered.
2. WORKING SPACE NEEDED—as determined by distance from lens to image.
3. THE SIZE OF COPY any lens will cover at any specified degree of enlargement.

LENS	CHARACTERISTICS	DEGREE OF ENLARGEMENT								
		1X	2X	3X	4X	5X	6X	7X	8X	10X
3" FOCAL LENGTH	TO IMAGE	6	9	12	15	18	21	24	27	33
	TO COPY	6	4½	4	3¾	3½	3½	3⅞	3¾	3⅞
	20° FIELD	2¼	1¾	1½	1¼	1¼	1¼	1¼	1¼	1¼
	25° FIELD	2¼	2	1¾	1½	1½	1½	1½	1½	1½
	50° FIELD	5¼	4	3½	3¼	3¼	3¼	3	3	3
3½" FOCAL LENGTH	TO IMAGE	7	10½	14	17½	21	24½	28	31½	38½
	TO COPY	7	5¼	4⅞	4¼	4¼	4½	4	3⅞	3¾
	20° FIELD	2½	1¾	1½	1¼	1¼	1¼	1¼	1¼	1¼
	25° FIELD	3¼	2¾	2½	2¼	2¼	2¼	2¼	2¼	2¼
	50° FIELD	6¼	4¾	4¼	3¾	3¾	3¾	3½	3½	3½
4" FOCAL LENGTH	TO IMAGE	8	12	16	20	24	28	32	36	44
	TO COPY	8	6	5½	5	4⅞	4⅞	4⅞	4½	4¾
	20° FIELD	2⅞	2¼	2¼	2¼	2¼	2¼	2¼	2¼	2¼
	25° FIELD	3½	2⅞	2¾	2½	2½	2½	2	2	1⅞
	50° FIELD	7	5¾	4¾	4½	4¼	4¼	4	4	3¾
4½" FOCAL LENGTH	TO IMAGE	9	13½	18	22½	27	31½	36	40½	49½
	TO COPY	9	6½	6	5½	5¼	5¼	5¼	5¼	4⅞
	20° FIELD	3⅞	2¾	2¼	2	1⅞	1¾	1⅞	1⅞	1¾
	25° FIELD	4	3	2⅞	2½	2½	2½	2¼	2¼	2¾
	50° FIELD	8	6	5¾	5	4¾	4¾	4½	4½	4¾
5" FOCAL LENGTH	TO IMAGE	10	15	20	25	30	35	40	45	55
	TO COPY	10	7½	6⅞	6¼	6	5⅞	5¾	5¾	5½
	20° FIELD	3½	2¾	2¾	2¾	2¾	2¾	2½	2	1⅞
	25° FIELD	4⅞	3¾	2⅞	2½	2½	2½	2½	2½	2¾
	50° FIELD	8¾	6¾	5¾	5½	5¼	5¼	5	5	4¾
5½" FOCAL LENGTH	TO IMAGE	11	16½	22	27½	33	38½	44	49½	60½
	TO COPY	11	8¼	7⅞	7¼	6¾	6⅞	6¼	6¾	6¾
	20° FIELD	3¾	2¾	2¾	2¾	2¾	2¼	2¾	2¾	2¾
	25° FIELD	4¾	3¾	3¼	3	2⅞	2¾	2¾	2¾	2¾
	50° FIELD	9¾	7¼	6½	6	5¾	5¾	5½	5½	5¾
6" FOCAL LENGTH	TO IMAGE	12	18	24	30	36	42	48	54	66
	TO COPY	12	9	8	7½	7¾	7	6¾	6¼	6¾
	20° FIELD	4¼	3¾	2¾	2¾	2¾	2½	2½	2¾	2¾
	25° FIELD	5¾	4	3½	3¾	3¾	3¼	3	3	2¾
	50° FIELD	10¾	8	7	6¾	6¾	6¼	6	6	5¾
7" FOCAL LENGTH	TO IMAGE	14	21	28	35	42	49	56	63	77
	TO COPY	14	10½	9¾	8¾	8¾	8¾	8	7¾	7¾
	20° FIELD	4¾	3¾	3¾	3¼	3	2¾	2¾	2¾	2¾
	25° FIELD	6¾	4¾	4¼	3¾	3¾	3¾	3¼	3¼	3¾
	50° FIELD	12¾	9¼	8¼	7¾	7¾	7¼	7	7	6¾
8" FOCAL LENGTH	TO IMAGE	16	24	32	40	48	56	64	72	88
	TO COPY	16	12	10¾	10	9¾	9½	9¼	9	8¾
	20° FIELD	5¾	4¼	3¾	3¾	3¾	3¾	3¼	3¾	3¾
	25° FIELD	7½	5¾	4¾	4¾	4¾	4¼	4	4	3¾
	50° FIELD	14¼	10¾	9½	8¾	8½	8¼	8	8	7¾

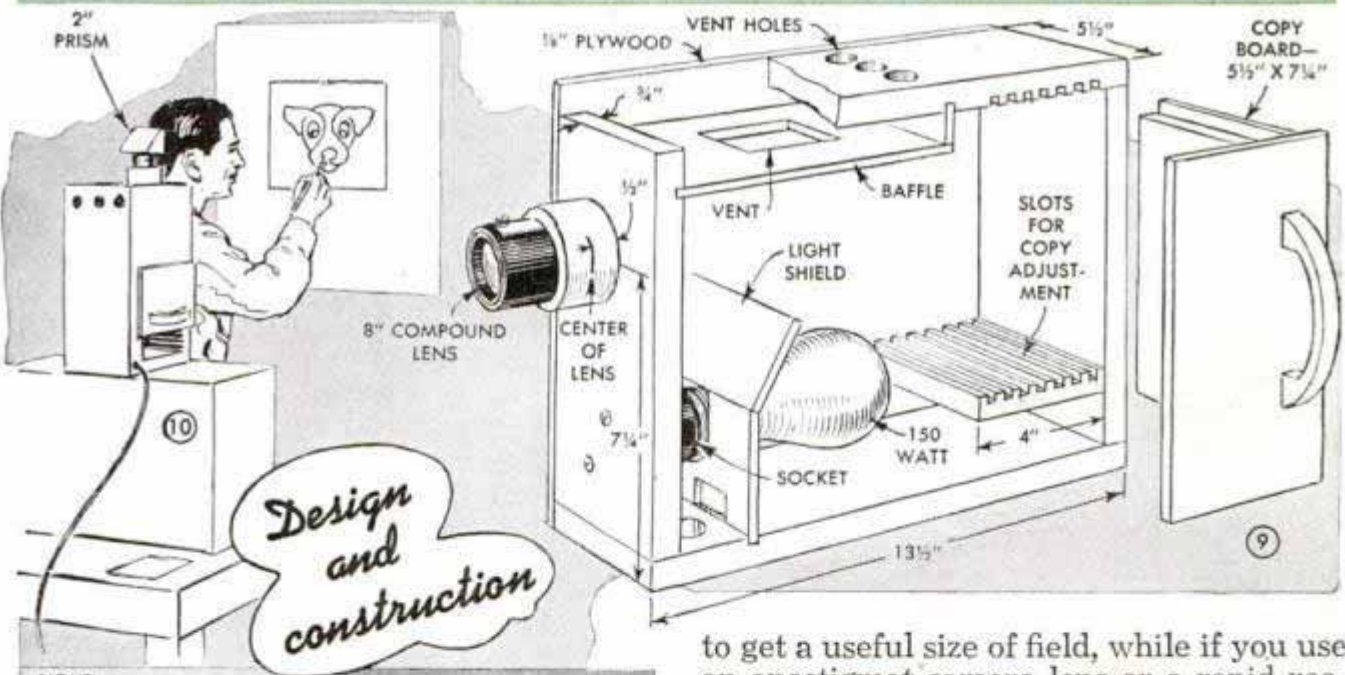
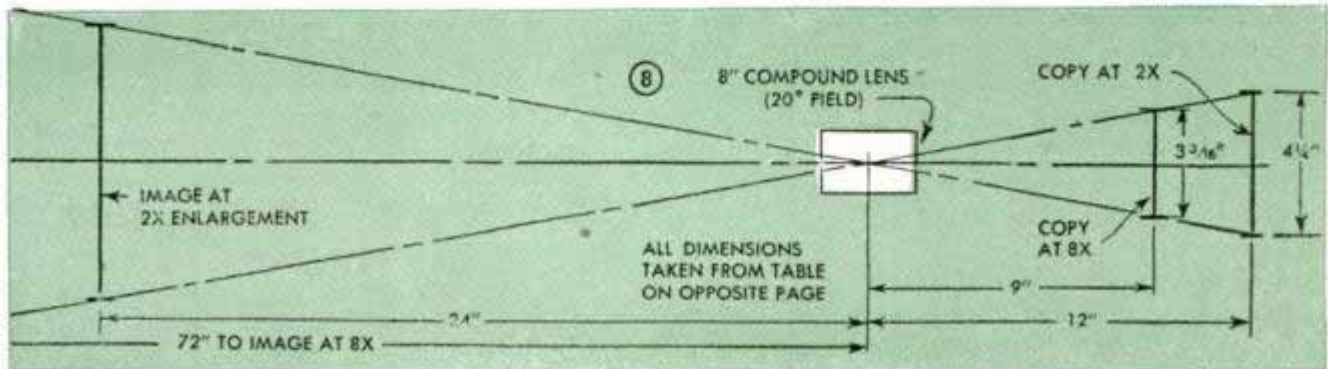
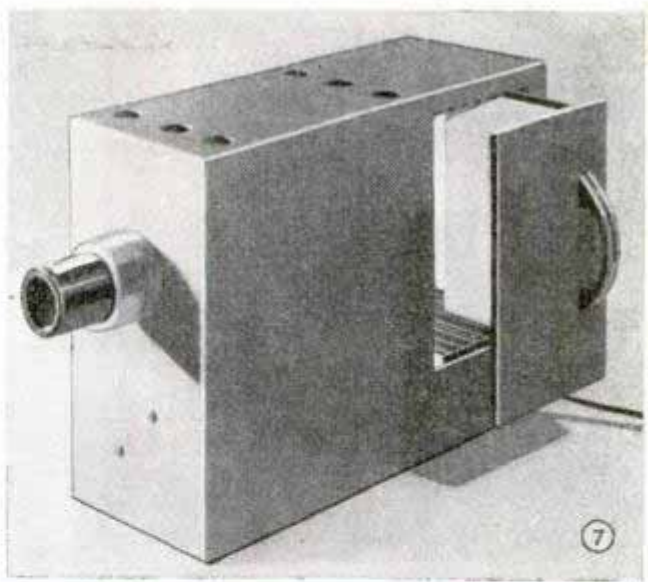
will note that the compound lens is the best lens for an inexpensive projector. Camera lenses are best if you want a large field, but the cost of a modern camera lens of suitable focal length is too high to make it practical for projector use. An earlier type of camera lens, the rapid rectilinear, or R. R., makes an excellent projector lens and usually can be located in second-hand photo stores. The projector lens is really an old-type portrait lens; in fact, one of the very first camera lenses. It is used extensively on movie projectors and gives excellent illumination because it can be worked at f:4. However, the field covered is small, and it is little better than the homemade compound lens, while costing much more. The compound lens is homemade from two plano-convex lenses which you can purchase for a few cents from any dealer handling chipped-edge lenses. It gives good

definition over a 20-degree field when stopped down to about f:8.

Making the compound lens: The compound lens in a slide-type mount is detailed in Fig. 5. Cylinders can be plastic or wood. The lenses should be about 1½-in. diameter by 15-in. focal length. The calculation for figuring the equivalent focal length of the combined lenses is given in Figs. 2 and 5. In this specific example, it works out at about 8 in. In order to favor the narrow field, the focal length should not be shorter than 7 in. Any lens of this type will give the best definition, or sharpness of image, if it is stopped down to about f:8 or f:11. To find the size of stop for any focal-length lens, divide the focal length by the desired f: number. In the example shown, Fig. 5, the focal length is 8 in., so the stop diameter would be 1 in. for a value of f:8.

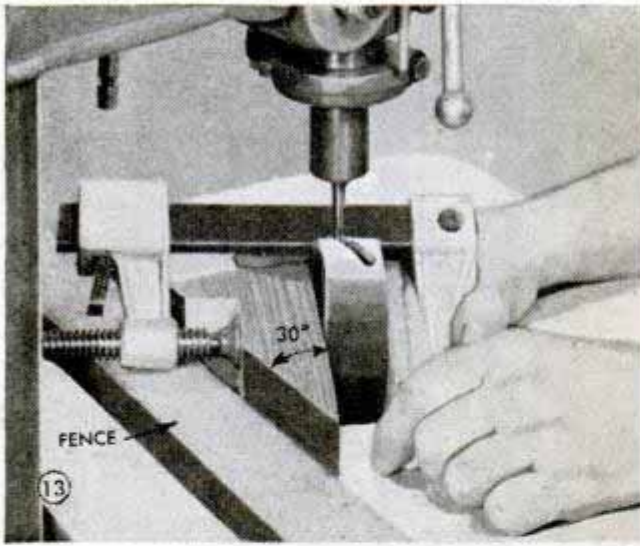
Lens table: The lens table, Fig. 6, gives

all the data you need in designing a projector for any particular lens or for any particular purpose. You will note that a long focal-length lens coupled with high magnification means a long throw from projector to screen, while a short focal-length lens means a short system. Also note that, for any specific lens, the longer the focal length the wider the field or size of copy you can cover. You will find that lens selection is a matter of compromise. You probably will want a fairly short system, possible with a short-focus lens, but at the same time you will want the large field obtained with a long-focus lens. If you use a single, compound or projector lens, you will have to go to at least 7 or 8-in. focal length



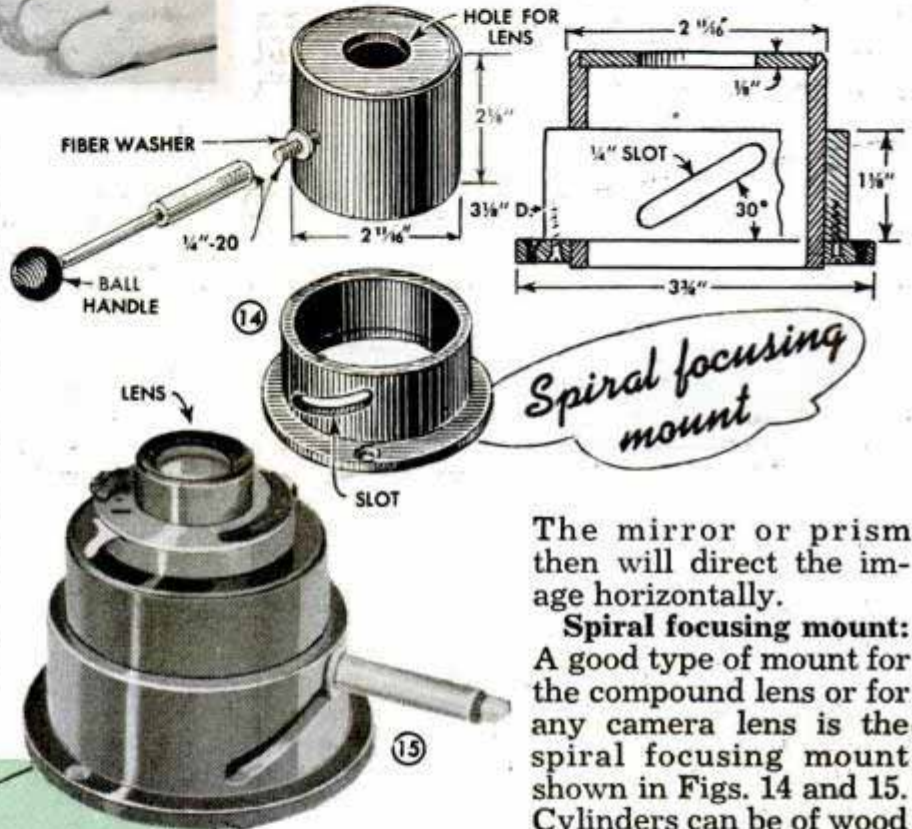
to get a useful size of field, while if you use an anastigmat camera lens or a rapid rectilinear, you can get a good-size field with a 4 to 6-in. focus lens. If you want data on focal lengths not shown in Fig. 6, simply double up; that is, figures for a 10-in. focal-length lens are double the figures for a 5-in. lens, and so on.

Designing a simple projector: Fig. 8 shows how the 8-in. compound lens previously described works out for a projector enlarging from 2 to 8 diameters. At 8X the copy will be 9 in. from the lens, while at 2X the copy will be 12 in. from the lens. These figures are taken from the table, Fig. 6. Also from Fig. 6, note that at 8X the



Erecting the image: A projector made as in Fig. 9 reverses the copy. This is not important for cutout work, but if you are working with lettering an erect image is needed. Erecting the image can be accomplished with a right-angle mirror, Fig. 11, or a 2-in. prism, Fig. 12. Both of these items can be purchased for about one dollar each from dealers handling surplus optical goods. When used with a mirror or prism, the box is mounted with the lens pointing toward the ceiling, as shown in Fig. 10.

distance from lens to image will be 72 in. The total length of the system would be 84 in. when working at 8X. Obviously, a system this long could not be worked vertically because the average room height would not accommodate it. However, it would make a satisfactory horizontal projector. Made up as such, the construction might be something like Figs. 7 and 9, although the box can be any of a dozen shapes as long as it incorporates the optical distances needed.



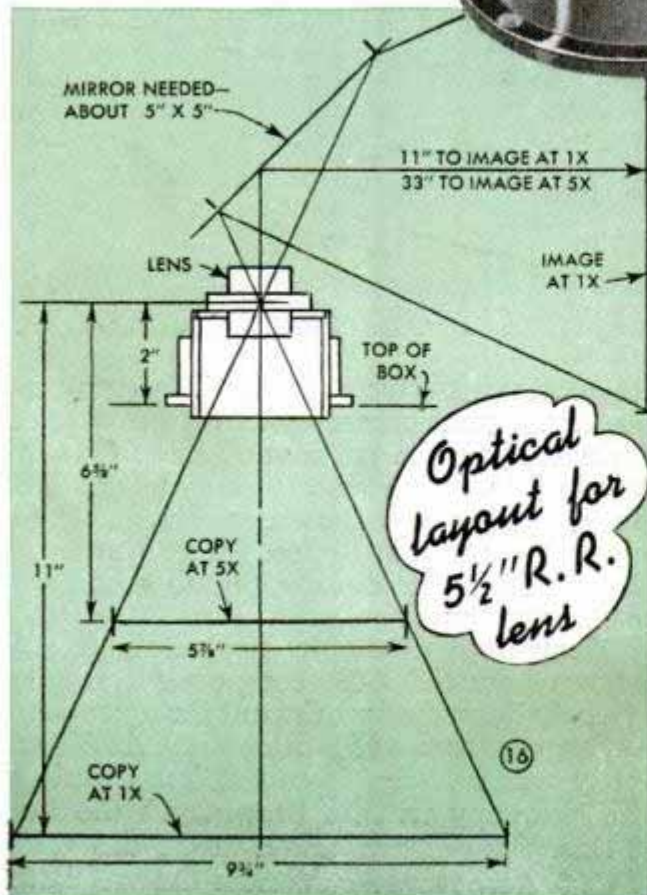
The mirror or prism then will direct the image horizontally.

Spiral focusing mount: A good type of mount for the compound lens or for any camera lens is the spiral focusing mount shown in Figs. 14 and 15. Cylinders can be of wood

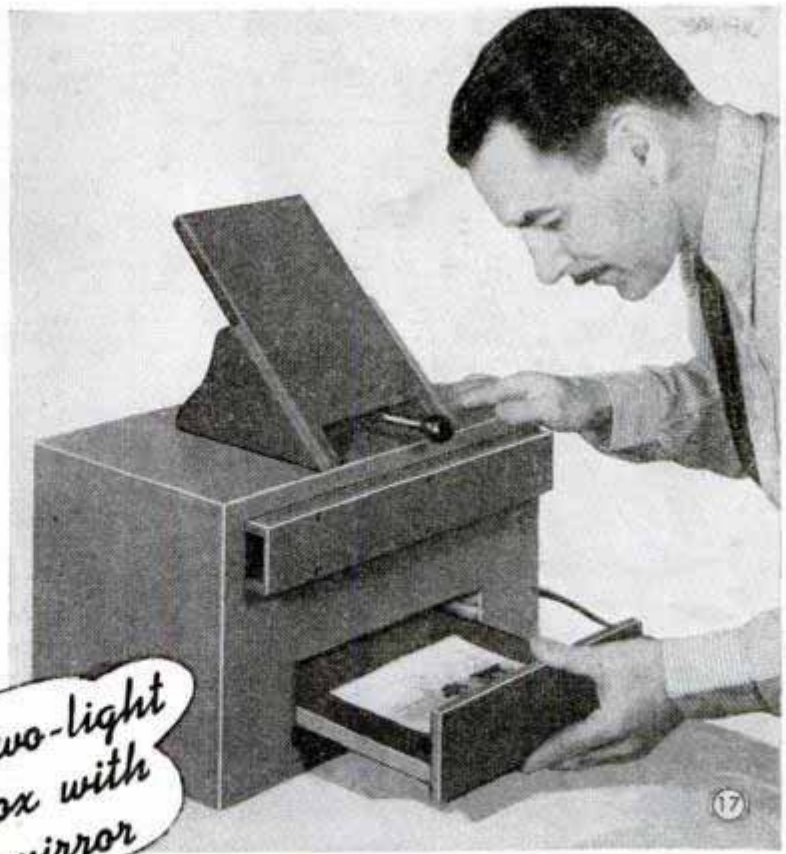
or plastic. Fig. 13 shows how the slot is routed in a drill press.

The erecting projector: The mirror for erecting the image can be mounted permanently as part of the projector. In designing a system of this kind, optical dimensions are taken from Fig. 6 as previously described. A typical layout showing a 5 1/2-in. rapid rectilinear lens in a spiral focusing mount is shown in Fig. 16. The R. R. lens covers a field of about 50 degrees. At 5X the lens shown will cover copy 5 7/8 in. square. Figs. 17, 18 and 19 show how the construction is worked out to accommodate the optical dimensions. Built as shown, the box is designed primarily for horizontal mounting, as indicated in Fig. 1, but it also can be mounted vertically, as shown in Fig. 4. However, if specifically for vertical projection, it would be better to have the copy slide in from the end of the box.

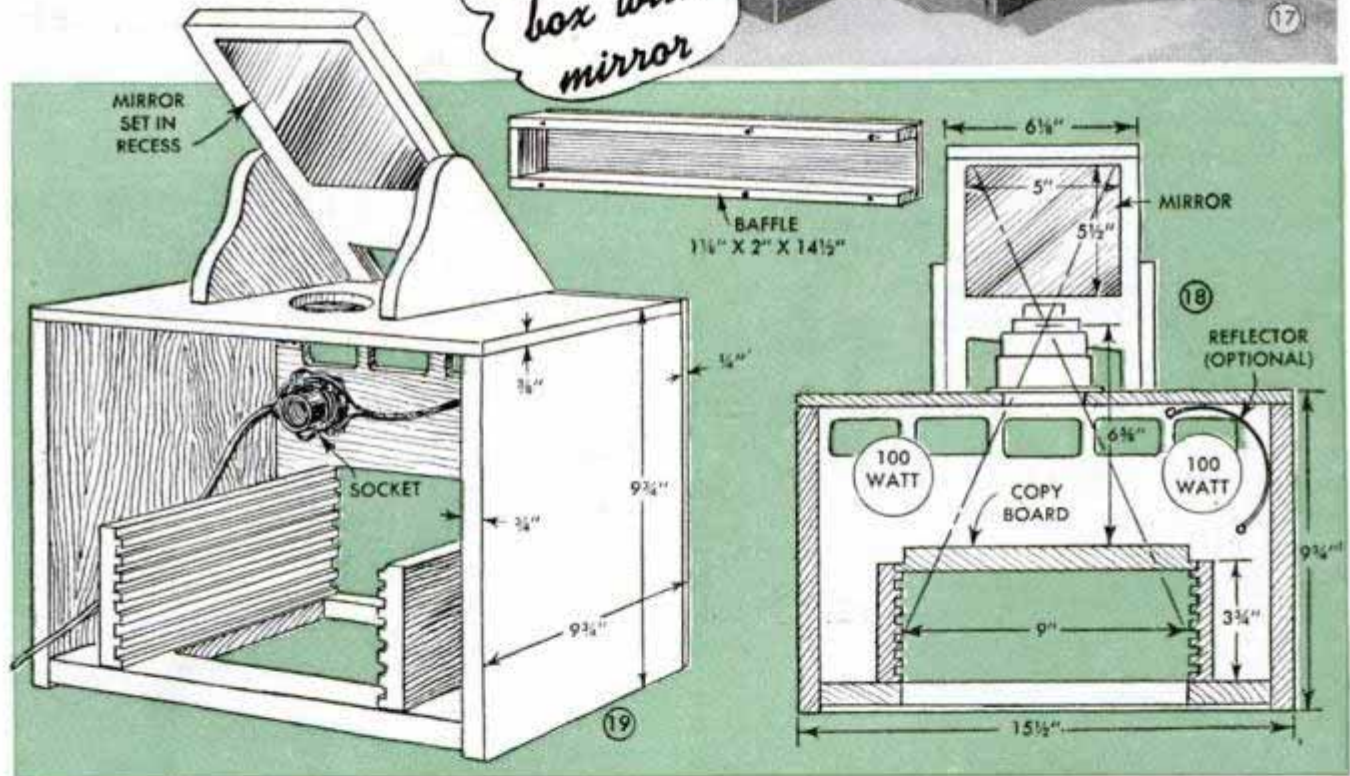
Building your own: Specific projector designs serve only to show the general construction. When you design your own, you must make the box to suit your lens and



the range of magnification you want. Repeating the process as already described, you first make an optical layout, taking dimensions from the table, Fig. 6. Over this layout you then draw the shape of the box which will accommodate the optical dimensions. If you use a permanent mirror, the field angle should be drawn in, as shown in Fig. 16, in order to determine the size of mirror needed. Almost any kind of wood will do for the box. If the projector is to be a more or less permanent affair, or if it is to be subjected to considerable hard use, a good quality of material should be used. A small box can be made almost wholly from $\frac{1}{8}$ -in. plywood, this thickness in 3-ply birch being about right for side panels, top, etc. Join the parts with



A two-light box with mirror



small screws. There's no need to use glue in the joints. Where the copy board is tongued to slide in grooves, the grooves should be somewhat wider than the thickness of the tongue so that the board will slide in and out without sticking. The manner of making the light traps and baffles shown in Figs. 9 and 19 should be followed quite closely.

Limitations: Some limitations are worth noting: Lenses of less than 4-in. focal length should not be used because they require placing copy too close to the lens. Also, if anything but a camera lens, the field covered by a lens of less than 4-in. focal length will be too small. Lenses over 10-in. focal

length should not be used because this places the image too far from the lens. The magnification limit of the simple compound lens is about 8X—over that, the image lacks sharp definition. With a camera lens or projector lens you can go as high as you like, but you will need strong lights to carry the image over the greater distance.

Finish: Paint the inside of the lens tube flat black. The rest of the box, inside and out, can be any color. There is no particular advantage in painting the inside of the box anything but a camera lens, the field cov- black. An ordinary oil paint should not be used in any case as heat from the lamps will cause cracking and peeling of the paint film.

Lever Attached to Block in Bowl For Novel Nutcracker



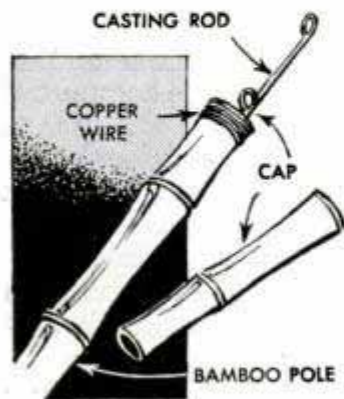
Attached to any conventional nut bowl, this lever cracks nutshells in the bowl so small pieces of shell are not scattered over the table. The cracker arm is sawed from $\frac{1}{4}$ -in. aluminum stock and has a wooden handle. The hinge is a $\frac{1}{2}$ -in. square rod screwed to a wooden base, as shown, and riveted to the arm of the nutcracker. For a base, oak or similar hardwood should be used.—R. L. O'Steen, Boca Chica, Fla.

Grit Number Identifies Sandpaper

When tearing sandpaper into small pieces for special work, it is best to identify it by marking the grit number on the back of each piece. As the number usually is stamped in only one place on the paper, it will be difficult to tell the grade of small pieces if they are not marked.

M. A. Carty, Mt. Vernon, Wash.

Bamboo Case for Casting Rods



There won't be any danger of your favorite casting rod being damaged when transporting it in a car with other luggage if you keep it in a carrying case made from a piece of large-diameter bamboo. Two pieces are required, one of a diameter large enough to take the butt end of the rod, and another of a size to take the small end of the rod and slip into the end of the large piece. The connecting webs in-

side the bamboo can be punched or burned out with a red-hot rod. The open ends of the case can be fitted with ferrules cut from thin-walled tubing, or you can wrap them with fine copper wire and flow solder over it. The solder should be smoothed down to make a snug fitting joint when the case is assembled.

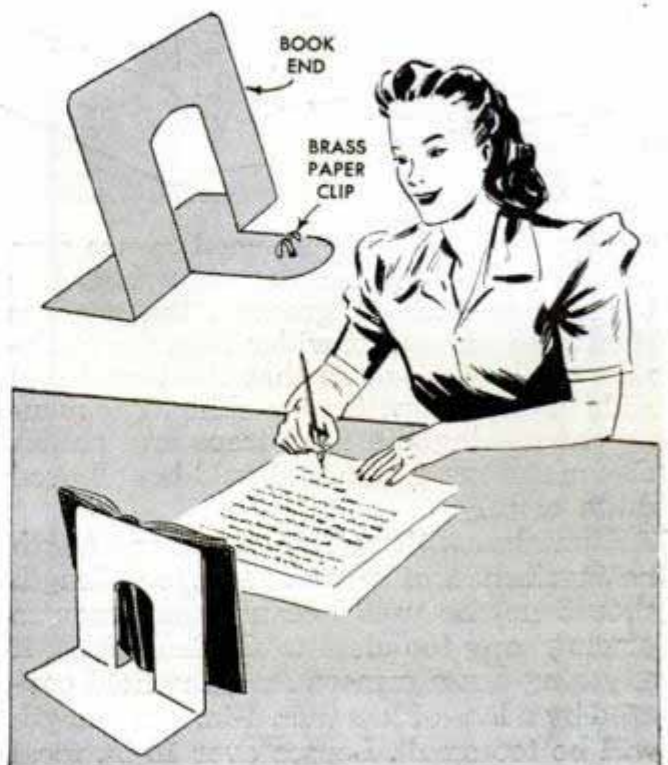
Nail in Pocket Protects Pencil

Workmen who carry a pencil in their pocket can prevent it from being broken when carrying a heavy object in their arms or when leaning against something by carrying a large headless nail in the pocket with the pencil. The nail acts as a reinforcement to take any unusual pressure or strain that might break the pencil.—Howard Johnson, Carter's Creek, Tenn.



Metal Book End Supports Text While Reading

A book support that is useful when reading or studying is made by punching a hole through the bottom of a pressed-steel book end and inserting a brass paper clip. The ends of the clip are spread to form a brace for the book. If the book stands too straight, the vertical part of the book end may be bent backward slightly.

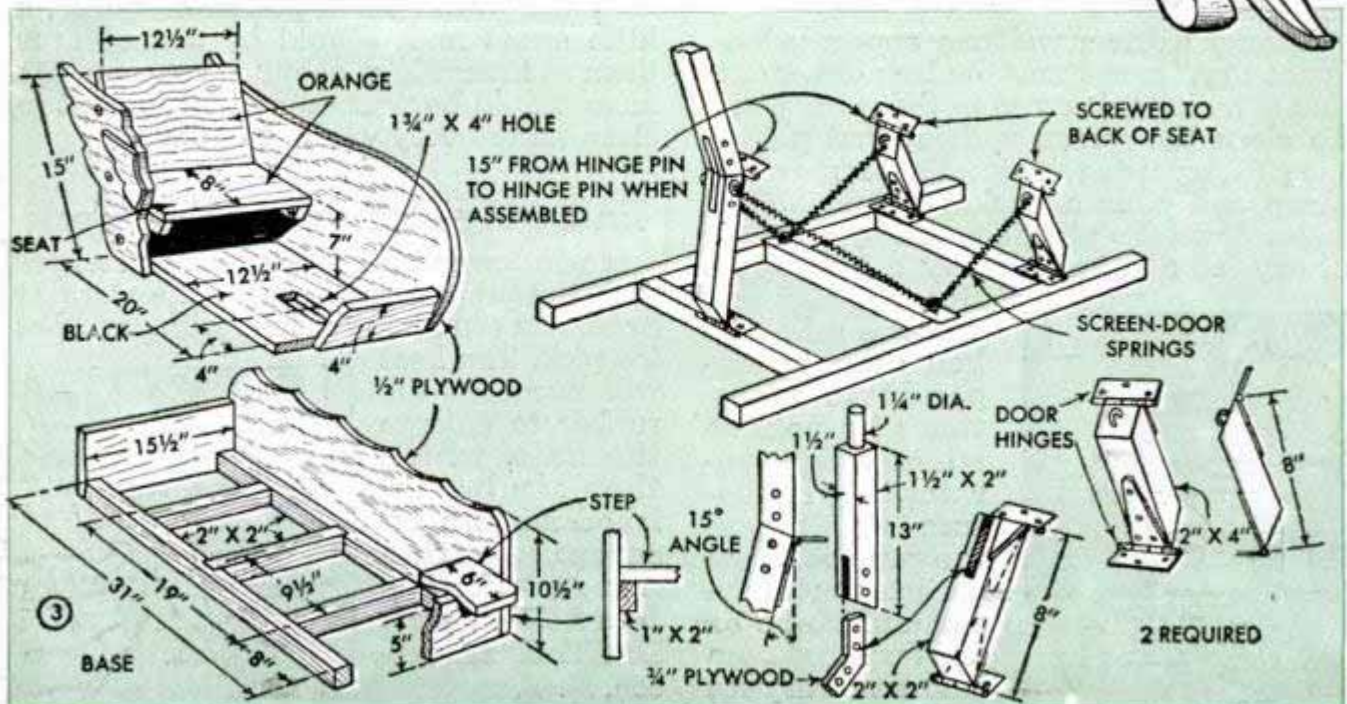
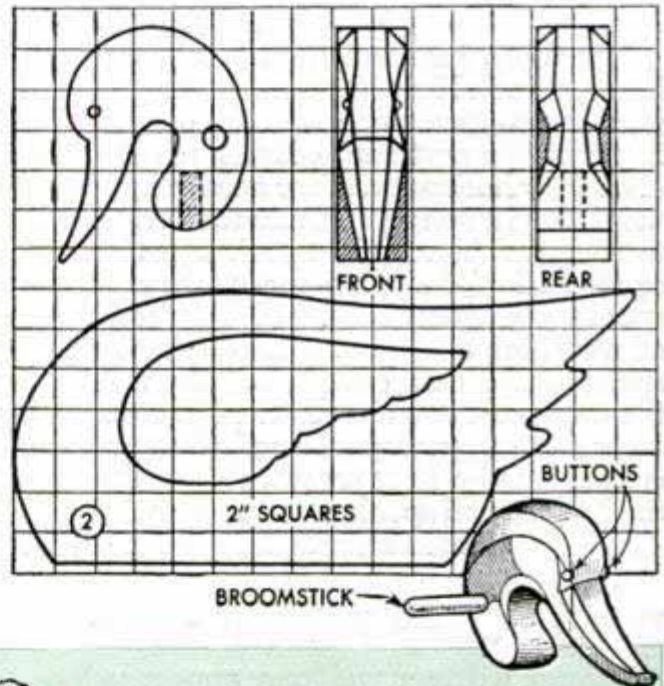


Child's Swan Rocker

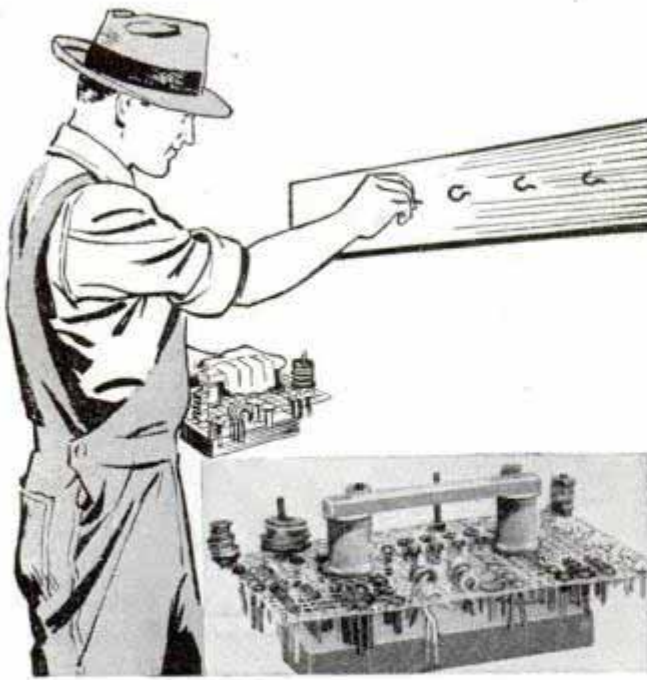
HOURS of amusement for small children are provided if this swan rocking chair is in the play-room. It is silent in operation and easy for young tots to use. As indicated in the drawing, Fig. 3, the sides, ends and other flat surfaces are $\frac{1}{2}$ -in. plywood, although any wood will be satisfactory if it is sufficiently rigid. These parts should be rough-sawed and then sanded to a smooth finish. The rocking mechanism, Fig. 3, is fastened to the base frame and to the chair proper with T-hinges so that the rocker pivots at these points. Although only one set of springs is shown attached to the three rocking arms and the base, larger children may require two or more sets if one is too weak to impart the proper motion.

The head of the swan, Fig. 2, is rough-cut from 4-in. stock and finished by hand. An old broomstick, sawed to the proper length, serves as a handle and the two eyes can be shoe buttons or any similar small, round buttons. To finish the rocker, the bill of the swan should be painted a dark orange. Other parts that are subject to wear, such as the step, Fig. 1, should be finished in a dark color also. Although the plumage of a swan is white, it would be better to paint the balance of the rocker a light tint that does not show dirt too easily.

Peter B. Horsley, Pembroke, Ont., Can.



Supplies for Home-Repair Jobs Carried in Wire-Mesh Rack



For those incessant odd jobs about the home, a rack like the one shown will be of great assistance since it is capable of storing a wide assortment of nuts, bolts, washers, screw hooks and other necessary equipment, thus saving you numerous trips back to the workbench. The rack consists of a square of $\frac{1}{4}$ -in. wire mesh, four thread spools, a wooden base and a narrow strip of wood for a handle. The spools serve as spacers, two being set under the mesh on the base, and two above. The handle is laid across the upper spools and the assembly is held by two long screws driven through the handle and spools into the base.

Ronald Eyrich, Milwaukee, Wis.

Dry Ice Clears Well-Spear Screen

Though a driven well may appear to have "gone dry," sometimes the lack of water is due to a clogged screen in the spear point. To clean the screen without first pulling the pipe, try using dry ice. First remove the pump and pour a bucket full of boiling water down the pipe followed by a bucket of dry ice and immediately cap the pipe.



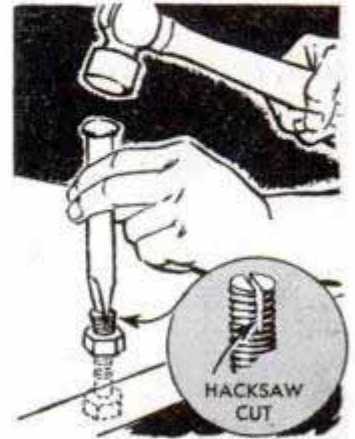
Because dry ice, which is solid carbon dioxide, expands to many times its volume when it evaporates, high pressure is built up in the pipe to force particles out of the screen. More or less than the stated amount of dry ice

may be required, but care should be taken not to use amounts that would develop pressure beyond the strength of the pipe. Gloves should be worn when handling dry ice.—Andrew Vena, Philadelphia, Pa.

Slotted Bolt Locks Nut Tightly

You won't need lock washers or cotter pins to keep a nut from coming off a bolt if you use this method of securing it. Just saw a slot $\frac{3}{32}$ in. deep in the threaded end of the bolt and screw the nut on tightly. Then, with a cold chisel, spread the slotted end and the nut cannot be unscrewed because of the enlarged diameter of the bolt.

—G. S. Hudson, Jr., Baltimore, Md.



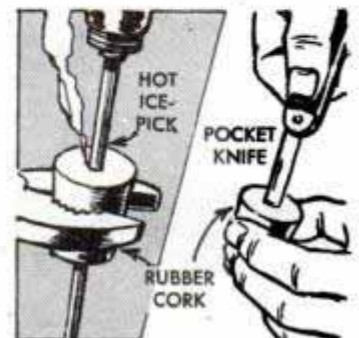
Livelier Worms When Bait Fishing

Although earthworms may be used when freshly dug from the ground, they will live longer on the hook and will attract more fish if well "scoured" before use. To do this, a quantity of sphagnum moss, such as is used by nurserymen in packing plants for shipment, is put into a stoneware crock or tight wooden box. The moss should be well moistened, but excess water should be wrung out before the moss is placed in the container. The worms should be kept in the moss in a cool place for at least two days, preferably three or four. At the end of that period they should be lively and almost transparent. Should it become necessary to keep the worms for a period of weeks, a little sweet milk should be poured over them at intervals of about a week and the moss should be washed and wrung out in clean water every week or 10 days.

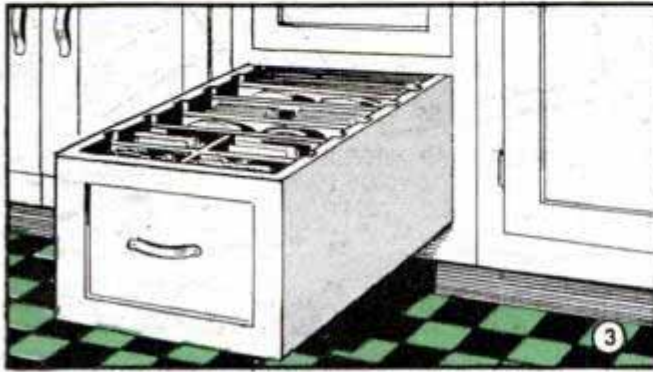
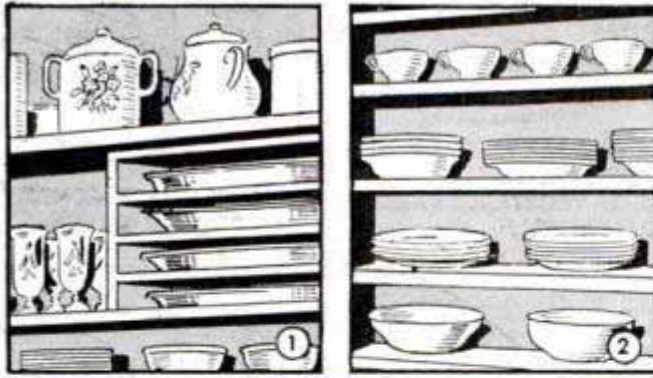
Enlarging Hole in Rubber Cork

If you haven't a rubber cork or stopper with the proper size hole for the work at hand, you can ream the hole with a red hot ice pick. The heat will burn out the rubber to enlarge the hole, which then can be finished smooth by scraping with a narrow knife blade.

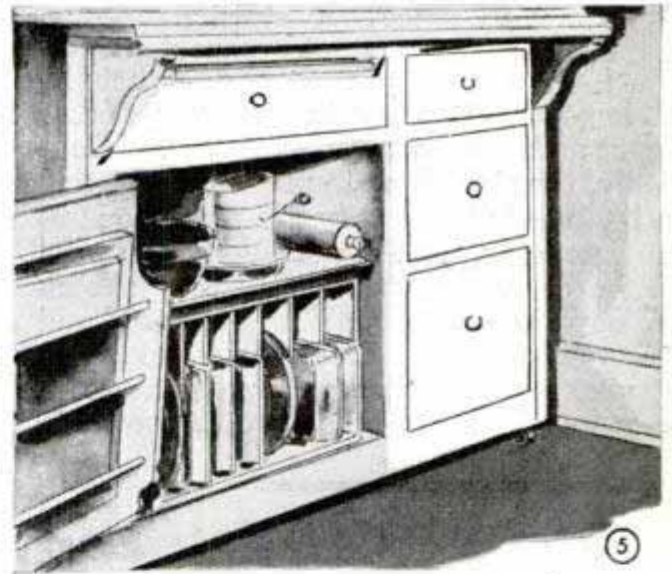
—Irwin Margiloff, Laurelton, N. Y.



"Filing" System Keeps Kitchen Utensils in Order



A utility shelf, a partitioned orange crate, a platter "file," and a deep drawer are handy storage units



The old rule of "a place for everything and everything in its place" can't have any more practical application than in the modern kitchen. To save time and steps you must know where things are placed. Stacked platters and odd-sized cups and saucers generally are a nuisance in a cupboard for there is the ever-present danger of breakage, and besides, the item you want always seems to be at the bottom of the stack. A platter "file," Fig. 1, and narrow shelves built into a corner of the cupboard as in Fig. 2, take care of this problem effectively. A deep drawer, partitioned as in Fig. 3, will hold a lot of necessary items that just won't fit anywhere else. The same thing is true of a partitioned orange crate, Fig. 5. And then, of course, utility shelves mounted on the wall near the stove or kitchen table, as in Fig. 4, are a "must" in most up-to-date kitchens. They are easily made from odds and ends of material and

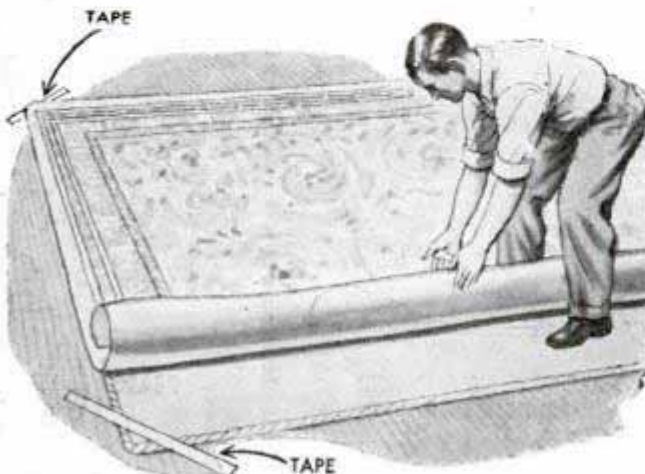
can be painted or enameled to match the general color scheme of the room.

Mrs. Vivien B. Dailey, Lowman, N. Y.

Rug Pad Will Not Slide If Taped Before Rug Is Laid

Laying a rug on a pad frequently is difficult because of the tendency of the rug and pad to slide on the floor. If the pad is taped to the floor first, the rug can be rolled over it and both will be in the correct position. Fairly long strips should be applied at the four corners. By using this method it is possible for one person to lay a rug. Usually two people are required if the job is to be done quickly and with minimum effort.

E. J. Wiczorek, Chicago.



Meats

MEAT SHOULD BE KEPT AT 0° F. OR LOWER



FEBRUARY						
S	M	T	W	T	F	S
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28		

BEEF SHOULD HANG 4 OR 5 DAYS BEFORE FREEZING



CARTONS FOR MEAT SHOULD BE LINED WITH MOISTURE-PROOF VEGETABLE PARCHMENT PAPERS



HEAVILY WAXED CONTAINERS ARE IDEAL FOR GROUND MEATS

Poultry



WHOLE FOWL IS DIFFICULT TO WRAP SNUGLY ...



... IT'S BETTER TO DISJOINT IT AND WASH PIECES IN COLD WATER ...



... THEN WRAP INDIVIDUALLY IN MOISTUREPROOF PAPER AND PACK IN CARTON



WRAP GIBLETS SEPARATELY

PREPARING FOOD for DEEP-

WHILE prompt handling has much to do with success in storing foods in home freezers, it's equally important that you know how to process and, especially, package them to retain as much of the flavor and nutritive value as possible. Generally, the right time to prepare fruits and vegetables is when they are ready for immediate table use. They should be gathered in the early morning before they absorb the day's sun and should be processed and frozen with as little delay as possible. Loss of vitamin value occurs rapidly at room temperature, and holding products over to

the following day should be avoided, especially after shelling, scalding or cutting. It should be remembered that freezing does not necessarily sterilize the product. Consequently, it is important that all utensils as well as the hands be thoroughly clean before preparing the food.

In most cases, a storage temperature of 0 deg. F. will give satisfactory results when just a few packages of food are to be frozen at one time. Large amounts will require a lower temperature of -10 deg. F., although it's best not to try to freeze too many packages at once. As it is not as cold near the

Milk

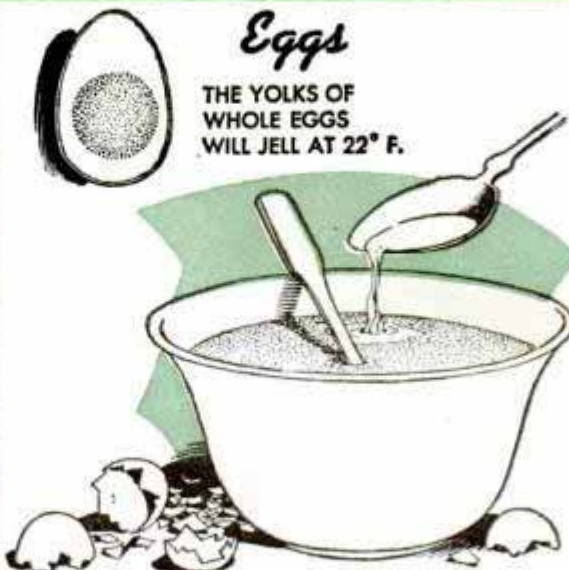
FROZEN MILK WILL KEEP ONE OR TWO MONTHS



CREAM IS NOT GOOD AFTER FOUR MONTHS

Eggs

THE YOLKS OF WHOLE EGGS WILL JELL AT 22° F.



IT'S BETTER TO BREAK THEM AND STIR YOLKS AND WHITES TOGETHER ADDING 5% CORN SYRUP, SALT OR SUGAR

THESE ITEMS REQUIRE

SNAP BEANS

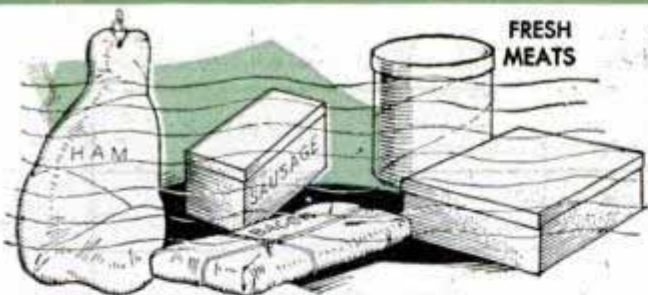


BANANAS



PEARS





FRESH MEATS

SMOKED MEAT WILL IMPART FLAVOR TO FRESH MEAT IF STORED CLOSE TO IT



IF STORED WHOLE, STOCKINETTES WILL KEEP THE MOISTURE-PROOF PAPER CLOSE TO THE FLESH



FREEZE STORAGE

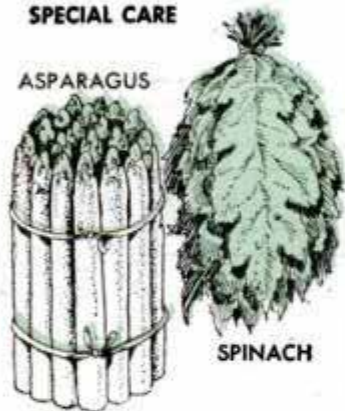
Label and date each package for future identification. A waxed school crayon or grease pencil is just the thing for marking packages

top of the freezer, always check the temperature at this point. A periodic check should be made to detect possible power failure or mechanical breakdown. Should such an event occur, little thawing will take place during the first 15-20 hours. After this time it is best, if possible, to move the food to a locker plant or use dry ice to prevent excessive thawing until freezing is resumed. As a precaution against lowering the temperature too greatly, use dry ice sparingly. The length of time that products may be stored depends upon the temperature maintained. At 0 deg. F. fruits and vegetables may be stored 10-12 months,

while at 5 deg. F. the period is shortened to 8-10 months. In the case of meat, much is dependent upon the length of time it is held prior to freezing. Beef requires at least 4 or 5 days in a cool place for aging before it is cut up and packaged. Lamb, pork and veal should be frozen as soon as it is thoroughly chilled. Pork, especially, should be kept at a low temperature as it oxidizes easily and becomes rancid at higher temperatures. Dipping pork cuts quickly in hot lard will seal them and help prevent drying out during storage. Frozen meats should always be thawed thoroughly before cooking, especially large roasts, oth-

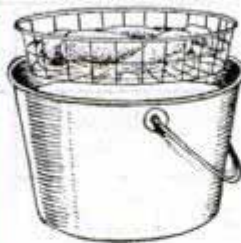
SPECIAL CARE

ASPARAGUS

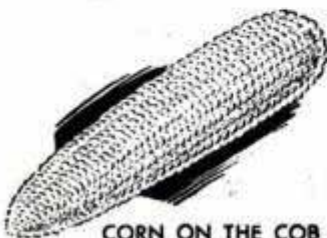


SPINACH

Vegetables



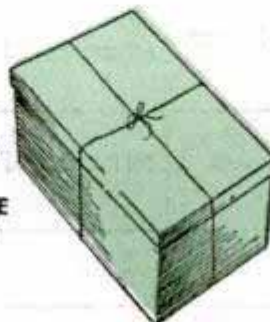
BLANCH IN BOILING WATER AND CHILL TO 50° F.



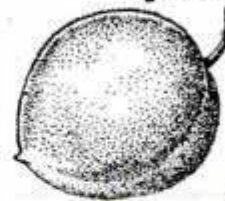
CORN ON THE COB



... THEN FREEZE AND STORE AT 0° F.



Fruits



FRUITS TO BE FROZEN SHOULD BE PICKED AT THE SOFT-RIPE STAGE



CHERRIES AND BERRIES SHOULD BE WASHED IN ICE WATER

A Guide for Freezing Fruits and Vegetables

Product	Maturity Desired	Preparation	Scalding		Type of Pack
			Boiling Water	Steam	
Asparagus	Tender tips best	Trim, wash, and discard all but upper 6 inches	Small stalks: 3 min. Large stalks: 4 min.	3½ min.* 4½ min.*	Without brine
Lima beans—bush or pole	Green beans best	Shell	Medium beans: 1½ min.* Large beans: 2 min.* Small beans: 1 min.*	2½ min. 3 min. 2 min.	Without brine
Soy beans	Green beans best	Scald pods, shell	2 min.*	3 min.	Without brine
Snap beans	Small beans best	Snip; cut into ¾-inch lengths	2 min.*	3 min.	Without brine
Beets	Young and tender	Cut off tops; mature beets should be cooked, then rub off peels; slice	1½ inches in diameter: 2½ min. Over 1½ inches: cook until tender	3½ min.* Cook until tender	Without brine
Peas	Sweet and not starchy	Shell, discard starchy peas	Small peas: 45 sec.* Large peas: 1 min.*	1½ min. 2 min.	Without brine
Spinach	Young	Cut and discard thick stems	2½ min.*	3½ min.	Without brine
Sweet corn, on cob	Before starchiness develops	Husk; don't use immature and overmature ears	Small ears: 6 min. Medium ears: 8½ min. Large ears: 10½ min.	6½ min.* 8½ min.* 10½ min.*	Without brine
Sweet corn, cut	Before starchiness develops	Scald on cob as directed above, cool, then cut off whole kernels; or cut whole kernels from cob, then scald	Not recommended	2½ min.*	Without brine
Swiss chard	Small leaves best	Cut off and discard main stem	2 min.*	3 min.	Without brine
Apples	Fully mature	Peel, slice in 12ths	Not recommended	1½ min.; cool	Dry (no sugar or sirup)
Blueberries	Fully ripe	Stem, wash, crush slightly	Not recommended	Not recommended	4 or 5 pounds fruit to 1 pound sugar
Cherries, sour	Fully ripe	Wash, chill, pit	Not recommended	Not recommended	3 pounds fruit to 1 pound sugar
Gooseberries	Fully ripe	Stem, wash, crush slightly	Not recommended	Not recommended	3 pounds berries to 1 pound sugar
Peaches	Fully ripe	Peel, pit, slice	Not recommended	Not recommended	Cover with 60 or 70 percent sirup**
Pears	Fully ripe	Peel, core, quarter	Not recommended	Not recommended	Cover immediately with 60 or 70 percent sugar sirup**
Plums	Fully ripe	Wash, pit, quarter	Not recommended	Not recommended	Cover immediately with 60 or 70 percent sugar sirup**
Prunes	Fully ripe	Wash, pit, quarter	Not recommended	Not recommended	Cover immediately with 60 or 70 percent sugar sirup**
Raspberries	Fully ripe	Sort, wash in ice water, hull; crush or leave whole	Not recommended	Not recommended	4 or 5 pounds crushed berries to 1 pound sugar; cover whole ones with 50 or 65 percent sugar sirup**
Strawberries	Fully ripe	Sort, wash in ice water, hull and slice one quarter inch thick or leave whole	Not recommended	Not recommended	4 or 5 pounds sliced berries to 1 pound sugar; cover whole berries with 50 or 65 percent sugar sirup**
Rhubarb	Early spring best	Eliminate leaves; cut into 1-inch lengths	1½ min.*	2 min.	Without sugar or sirup if desired

*Indicates preferred method.

**For preparing sirup see table page 191.

New York State Agricultural Experiment Station.

Preparation of Sirup For Freezing Fruits

Dissolve the sugar in boiling water or mix the sirup with boiling water; cool to room temperature.

50-percent sirup: 2½ cups sugar per pint of water; 3 cups water to 4 cups crystal white corn sirup; 3½ cups water to 4 cups high-grade confectioners' corn sirup.

60-percent sirup: 3½ cups sugar per pint of water; 1½ cups water to 4 cups crystal white corn sirup; 2 cups water to 4 cups high-grade confectioners' corn sirup.

65-percent sirup: 4½ cups sugar per pint of water; ½ cup water to 4 cups crystal white corn sirup; 1½ cups water to 4 cups high-grade confectioners' corn sirup.

70-percent sirup: 5½ cups sugar per pint of water; ¼ cup water to 4 cups crystal white corn sirup; 1 cup water to 4 cups high-grade confectioners' corn sirup.



A moderately hot household iron, applied for a few seconds, will seal "bag-in-carton" containers. Cellophane bags may be sealed with a curling iron, taking care not to burn them

erwise the meat will not cook uniformly.

The importance of doing a thorough and careful job of packaging cannot be over-emphasized. The wrapping material used not only must protect the food from loss of moisture, but also must prevent transfer of odors. Ordinary waxed paper is not sufficiently moistureproof to package meat satisfactorily. In addition to special moistureproof paper for wrapping frozen foods, there are Cellophane, Pliofilm and rubber-latex bags which provide excellent protection. Present recommendations are that the size of the packages should not exceed 2 lbs. per package for fruits and vegetables and a package weight of 5 lbs. for chilled meats is about right. Roasts and other cuts of meat should be wrapped tightly to make them as airtight as possible and securely sealed with cellulose tape or tied with twine. Two separate wrappings, of course, are better than one. An outer covering of mesh cloth known as a stockinette will serve to protect the wrapping. Small cuts of meat are stored best in containers lined with moistureproof paper. To exclude as much air as possible, containers should be packed to the very top. Vegetable and fruit juices must have room for expansion. Containers most commonly recommended for storing fruits and vegetables are heavily waxed cylindrical and square cartons, "bag-in-box" types and special moisture and vapor-resistant bags of Cellophane. In filling Cellophane bags the tops must be kept clean for later heat-sealing. This can be done with a household iron, or a curling iron if not too hot. There is less moisture loss with a double bag than a single one.

In blanching, or scalding, the vegetables are placed in a wire basket and lowered into boiling water for the required time as given in the table on the opposite page. They are chilled immediately afterward in running water 50 deg. F. and packed for storing. Fruits require a covering of sirup prepared according to the table above. The sirup should cover the fruit completely.

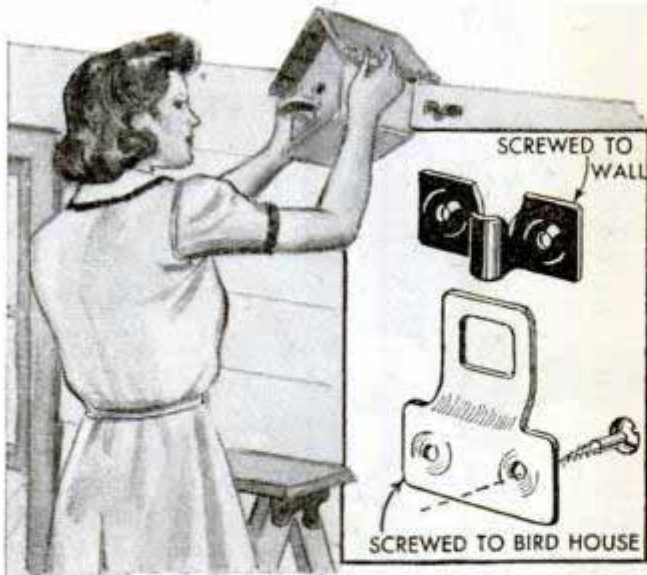
It's best to prepare poultry during the colder months as it is difficult otherwise to cool it properly before freezing. Unlike meat, poultry is more tricky to prepare because chickens, ducks and turkeys have a soft layer of fat directly beneath the skin that oxidizes quickly. It also is difficult to package the whole fowl because of the awkward shape which hampers wrapping it snugly. A stockinette, if available, helps to solve this problem, but it is recommended that the bird be cut up into smaller sections and each of these wrapped individually. As is true with meat, poultry never should be thawed for cooking by placing in water. Allow it to thaw gradually while in the package at room temperature.

Ammonia Cleans Greasy Oven

Usually difficult to remove, grease which has spilled in stove ovens and baked on the enameled surface is removed with household ammonia. Saturate several cloths with the solution and spread them over the oven racks. Allow them to remain overnight and on the following day scrub the spots with soap and water. In stubborn cases, several applications may be necessary.

R. F. Rothrock, Jr., Quonset Point, R. I.

Birdhouse Is Supported on Wall By Storm-Sash Hangers

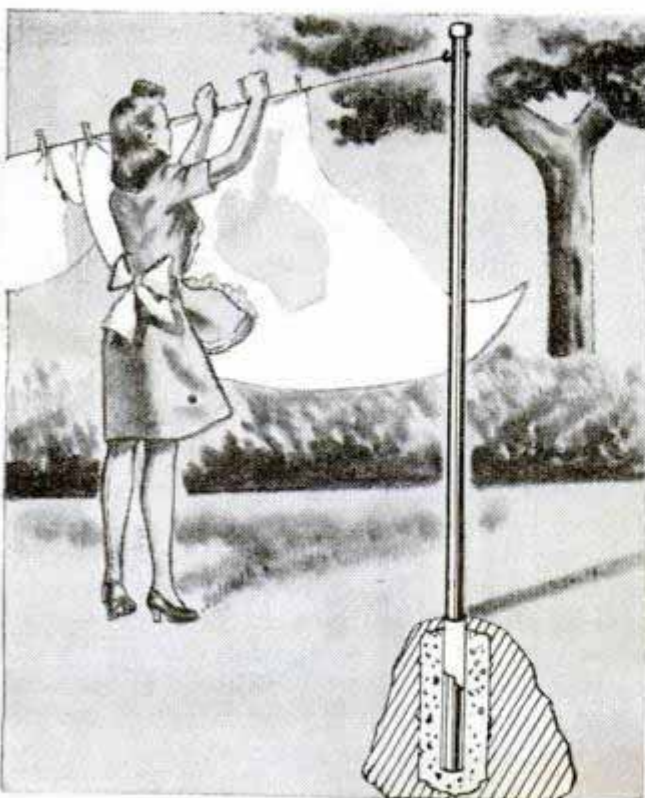


If a birdhouse is supported on storm-sash hangers, it can be taken down and stored indoors at the approach of winter, then replaced when the birds return. The hook part of the hanger is screwed to the wall or post against which the house is to be set, and the eye part is fastened to the back of the birdhouse close to the top edge. The weight of the house will keep it securely in place even in fairly strong winds.

Dick Sutz, Chicago.

Clothesline Pole Made of Pipe Is Easily Removed

From two lengths of standard pipe you can make a permanently installed clothesline pole that can be taken out of the ground



whenever necessary. A 3-ft. length of 2-in. pipe is cemented in the ground flush with the surface. A 10-ft. length of 1½-in. pipe then is used for the clothesline pole, being held firmly by the larger pipe. When the clothesline pole is removed, the pipe in the ground should be plugged to keep out dirt.

Deviled Eggs Carried to Picnic In Paper Carton

Deviled eggs will arrive at the picnic ground in good condition if they are carried in an egg carton as illustrated. After preparing the eggs, fit together and then wrap in waxed paper and place in the carton. The eggs are easy to pack, they will not



mash nor will they dry out for some time.

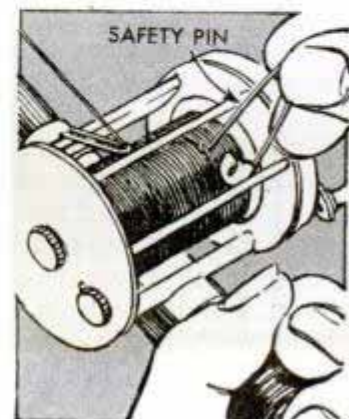
Lighter Wheel Cleaned With Tape

To clean the teeth of the wheel on your cigarette lighter quickly, run the serrated edge over the tacky side of a strip of adhesive tape several times. The adhesive will lift out dirt and bits of flint much more quickly than could be done by more tedious methods, such as digging out the dirt with a pin or other fine point.—Kenneth Murray, Colon, Mich.



Pin Untangles Backlashed Line

A safety pin having a small barb or hook formed on the pointed end is ideal for untangling fishing lines that have become backlashed. It is possible to get at small knots and tangled parts that are inaccessible otherwise. When the pin is closed the guard will cover the hook and prevent it from becoming misshaped.—H. L. Thompson, Sarnia, Ont., Can.





WEAVING RAGS INTO RUGS

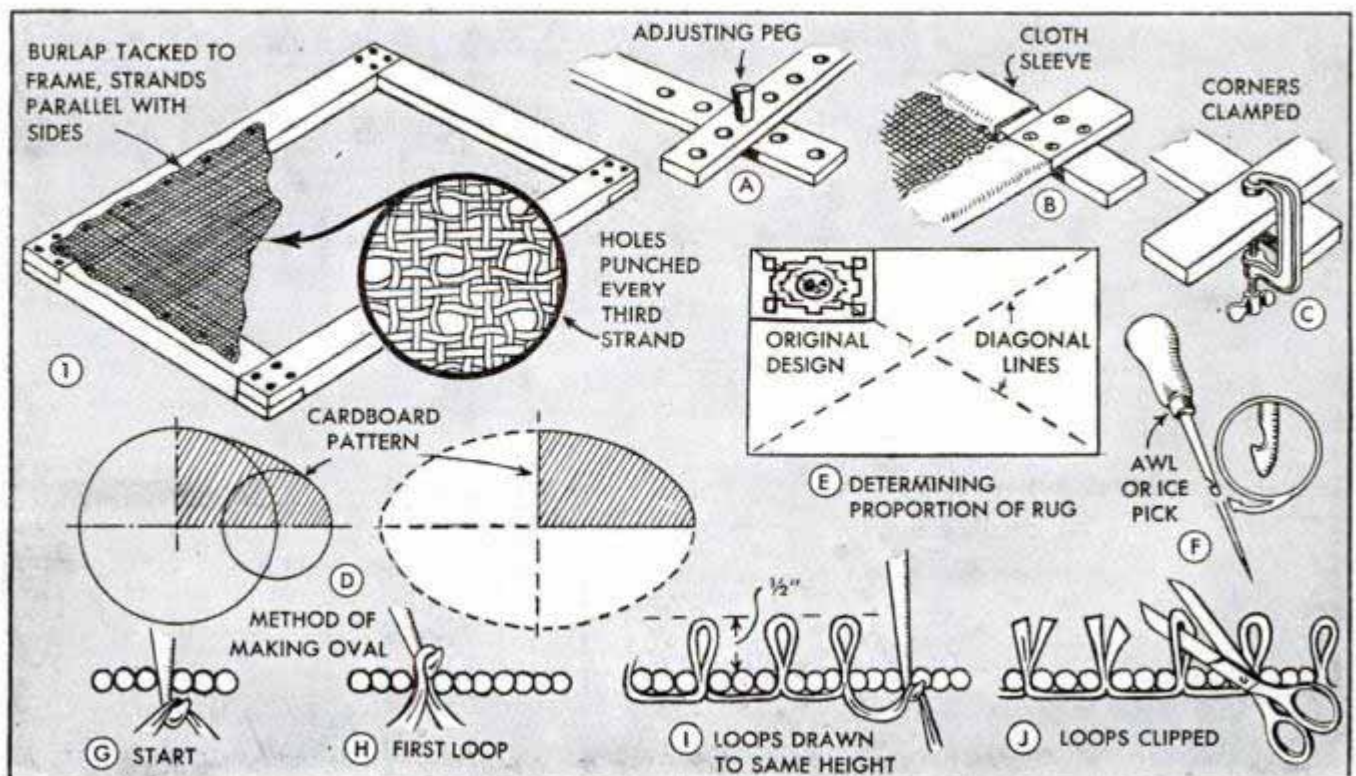
BESIDES providing an excellent way of using up accumulated scraps of cloth, there's a lot of fun and profit in weaving colorful and serviceable rugs from rags.

Hooked rugs: Here you need a wooden frame—an old window screen will do—and a suitable weaving hook. Details A, B and C in Fig. 1 show three ways of assembling a frame. The peg arrangement permits adjustment to take rugs of different sizes, while the clamping method makes it easy

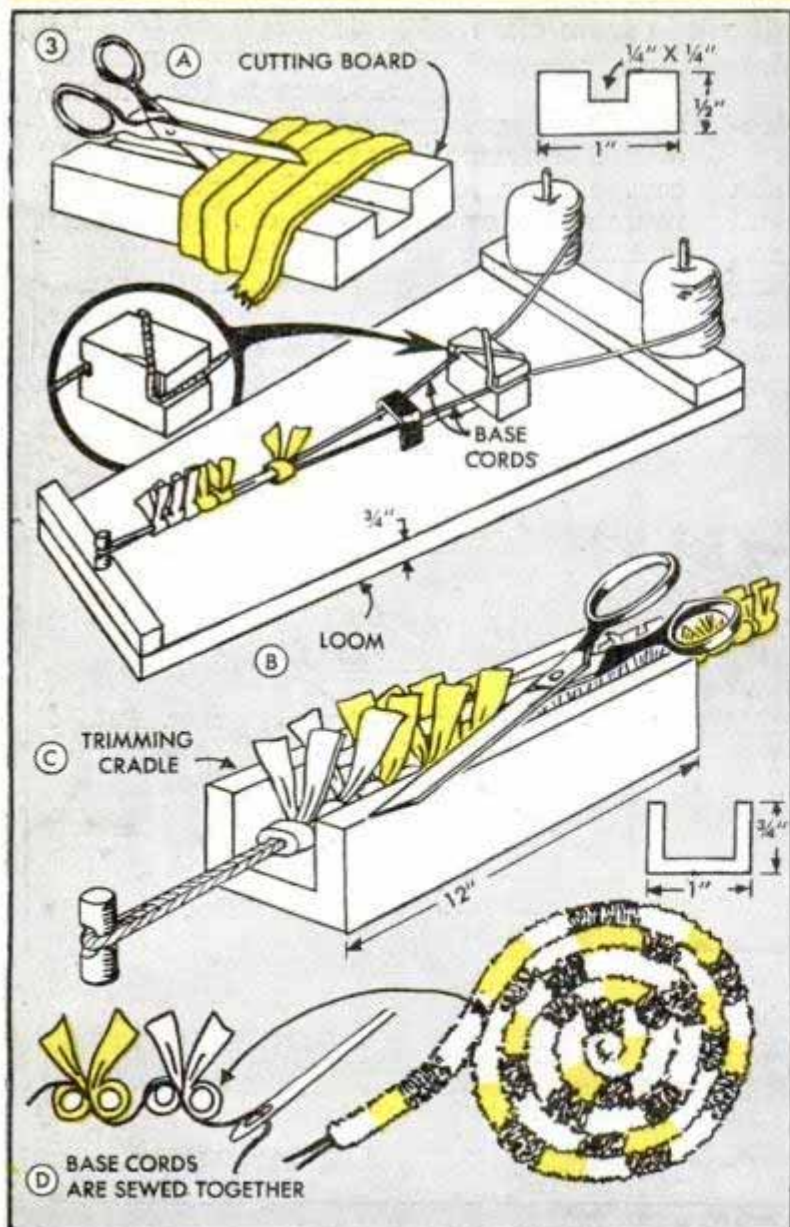
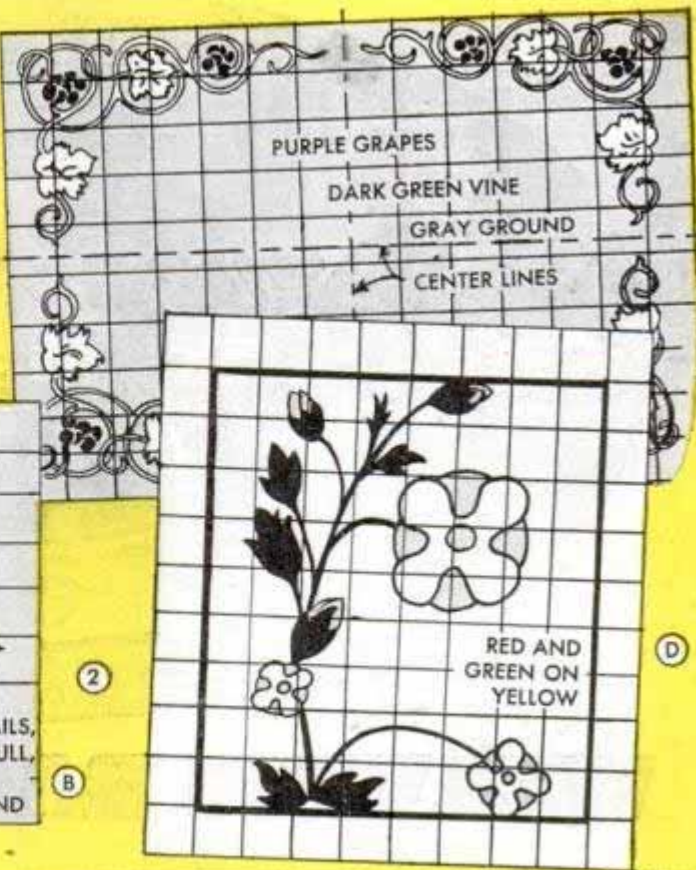
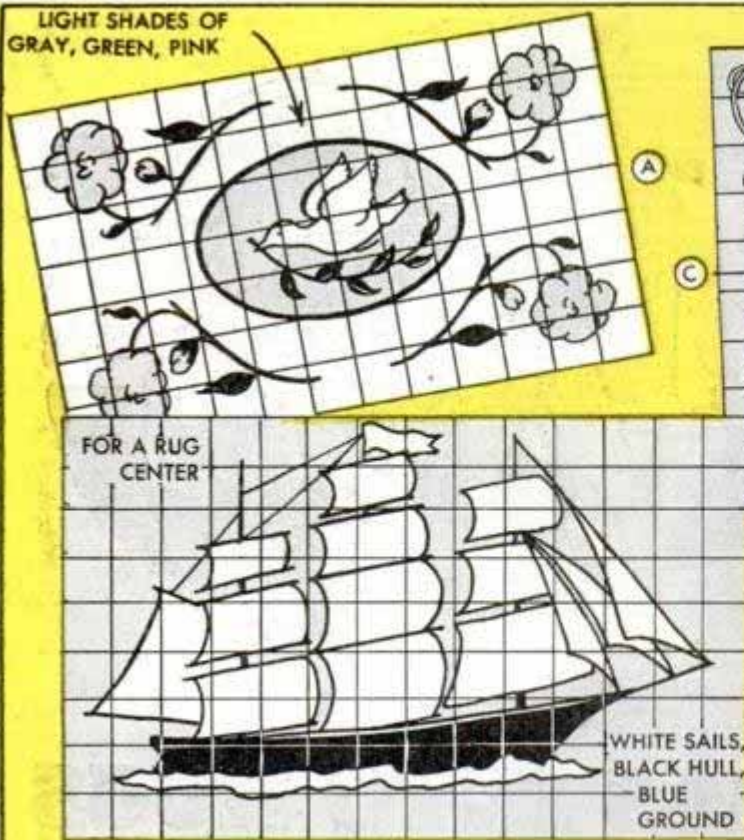
Three types — hooked, fluff, woven — all made from cloth scraps on simple wood "looms"

to take up slack as the work progresses. Detail E shows how to proportion the frame to the pattern

and D shows a method for laying out an oval. The frame is covered with burlap or coarse linen and either is fastened with thumbtacks or stitched to cloth sleeves as in B. Keep the threads of the burlap running parallel with the frame and allow sufficient material to turn under and hem later. A rug hook is made by shortening the shank of an ice pick and filing a hook like



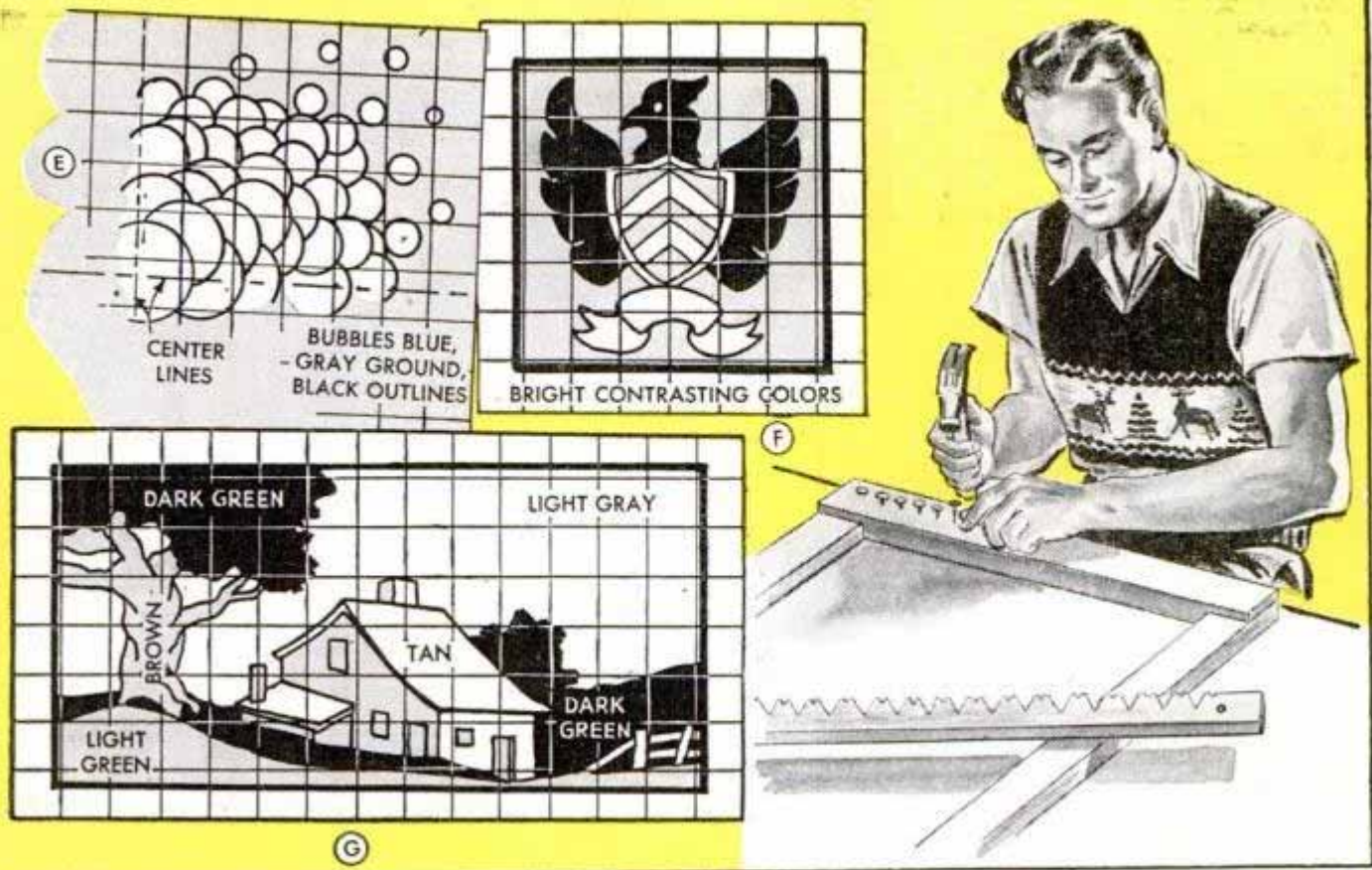
LIGHT SHADES OF
GRAY, GREEN, PINK



that shown in Fig. 1, detail F.

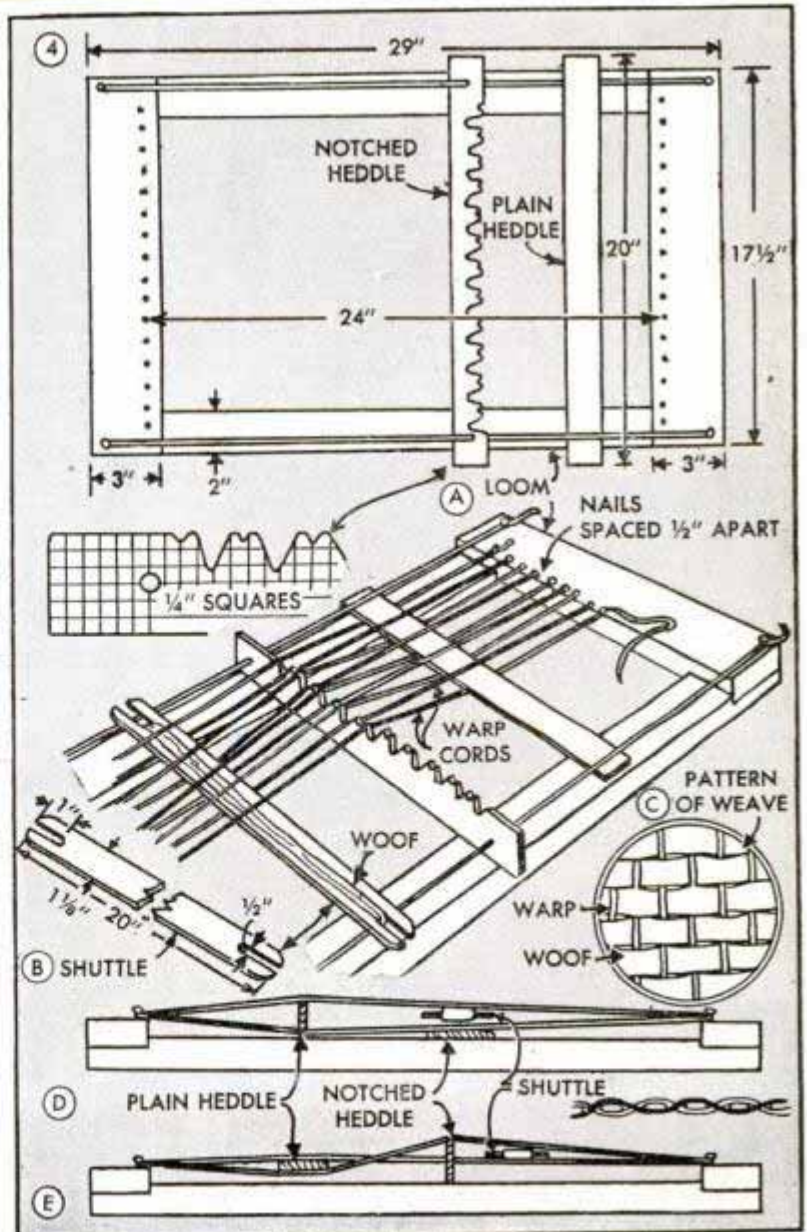
Suggestions for appropriate patterns can be found by thumbing through magazines. Enlarge the pattern to full size and draw it on the burlap with a crayon. Then, working outward from the center, push the hook through the burlap, G, and pull a strip of $\frac{1}{2}$ -in. cloth up through to form a loop $\frac{1}{2}$ in. long, H. Push the hook through again, three strands from the first insertion, and draw up another loop, I. When a row has been completed, the loops can be clipped, J, or they may be left uncut. From here on it is simply a matter of repeating as before. Certain portions of the design can be made to stand out in relief by allowing the loops to extend higher than the others.

Fluff rugs: Although similar to a hooked rug, the fluff rug is a continuous strip of material wound in a spiral and sewed together as in D, Fig. 3, to form a thick, soft rug. First, wind a $\frac{3}{4}$ -in. strip of cloth around a grooved board and cut as in A. Then with a loom made and rigged with carpet warp as in B, begin attaching the cloth strips to the warp. These are not tied but simply brought up between the cords as at D and pushed together as you

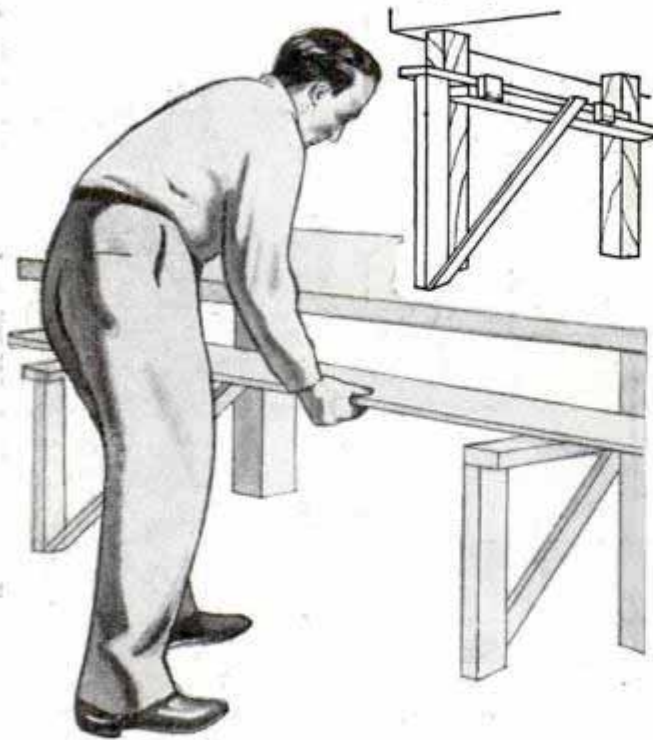


go. When the length has been built out to a foot or so, place a trimming board under the cord and snip the tops off evenly. Proceed as before until you have a length of "fluff" sufficient to complete the size rug desired. Strips of white, yellow and black will give a pleasing mottled effect.

Woven rugs: For these you'll need a loom such as the one at A, Fig. 4, on which you can turn out small throw rugs up to 16 by 24 in. The loom is rigged with regular carpet warp by running it back and forth and around the nail heads at the ends. Two heddles, one being notched, are used alternately to raise the warp strands. This is illustrated in details D and E. First, the plain heddle is set edgewise to raise one set of warps, then the shuttle is passed through, after which the heddle is placed flat. The same is done with the notched heddle which produces a pattern as at C. After each passing of the shuttle, the woof is crowded against the previous strand. Sample designs A to G inclusive, Fig. 2, can be enlarged to full size easily by ruling an equal number of larger squares on paper and transferring the design to each respective square.



Sawhorse Fits Under Workbench To Conserve Shop Space



For small workshops, the sliding sawhorse illustrated is a space saver. When not in use it fits under the workbench where it is out of the way. Slides for the top member of the horse are fastened to the inside of the legs of the bench. The distance between the two sawhorses is determined by the length of the workbench, and any convenient height may be used.

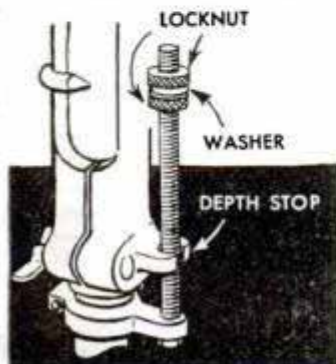
W. G. Peugh, Aberdeen, Miss.

Tape "Clamp" Mends Chinaware

Instead of cementing one piece at a time when repairing broken china, the whole mending job can be done at once if cellulose tape is used to hold each piece in place while the cement dries. It is best to fit all the pieces together first, using the tape only. In this way the job can be done more quickly and, since all the cementing is done at one time, the risk of having a last piece that does not fit is avoided.

G. A. Macaulay, Quarries, Ont., Can.

Washer an Aid in Adjusting Drill

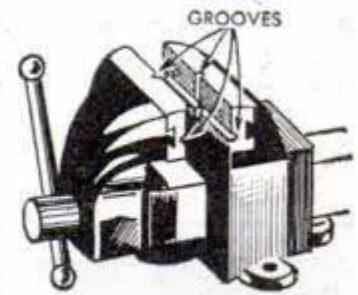


The depth stops on some drill presses are made adjustable by means of a lock-nut arrangement similar to the one which is shown here. If a flat washer is placed between the two

nuts, it will facilitate changing the adjustment as the "lock" will break more easily. Keep the washer covered with a light film of grease to aid in loosening the adjustment.

Grooved Jaws Hold Small Work

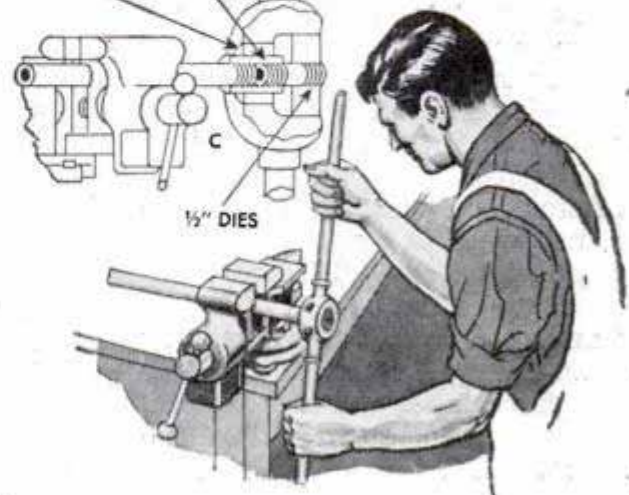
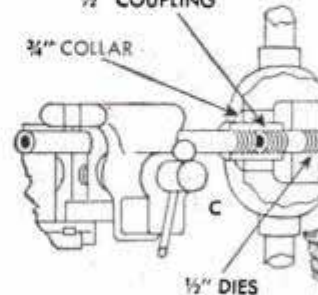
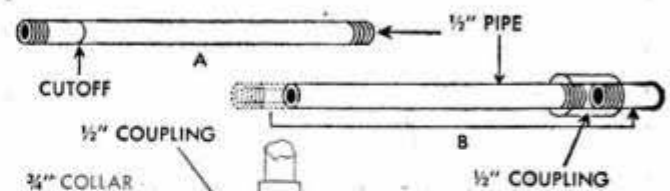
Bolts, small rods and other round work sometimes is hard to hold in a vise if the jaws are smooth. Or, if the vise is tightened enough to hold such work, the screws or rods may be flattened. To avoid this, one craftsman filed vertical and horizontal grooves in the jaws and found that he could hold small work easily.



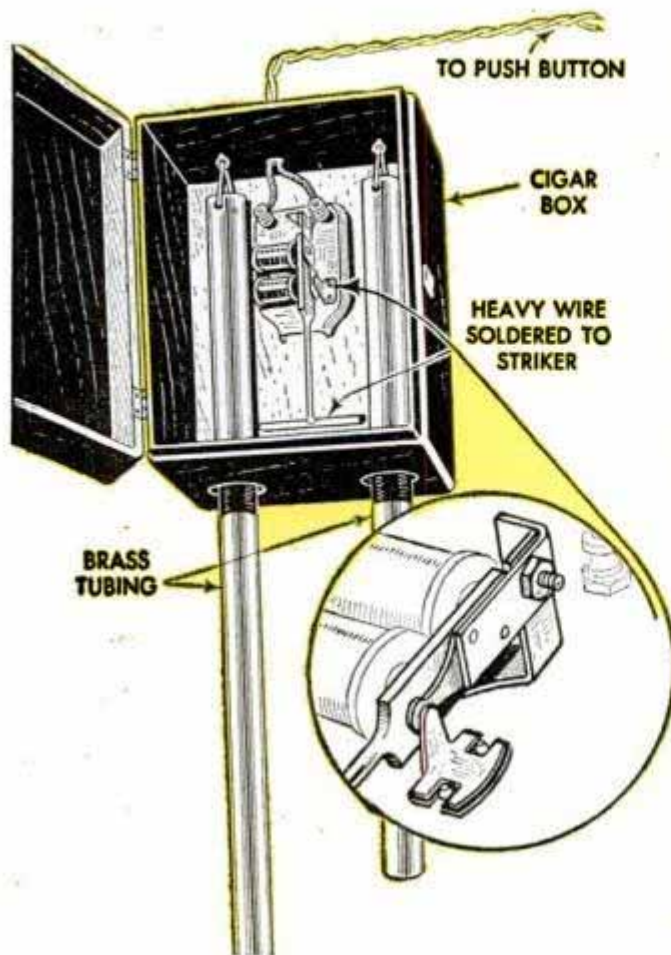
Short Nipples Can Be Threaded In Vise With Pipe Clamp

When making some plumbing repairs in my basement, I found it difficult to clamp short pieces of pipe, an inch or so long, in a vise for threading. But by using a longer piece of pipe I was able to make and thread short nipples. Detail A shows how the pipe is threaded at both ends and cut off at one end for a nipple of the correct length. Then a coupling is screwed on the threaded end of the longer piece and the short length is fastened to it, as indicated in detail B. The unthreaded end of the nipple can be finished now by using a die of the right size and the collar that is to be used is one size larger so it will slip over the coupling. For example, a 1/2-in. die will require a 3/4-in. collar.

William A. Walker, Indianapolis, Ind.



Two-Tone Chime Improvised From Doorbell



By a simple alteration of a doorbell-coil unit and the addition of two lengths of brass tubing you can make a two-tone door chime at very little cost. The bell is removed from the unit and the vibrating contacts are soldered together to transform the armature to single-stroke vibration. Then a length of heavy wire is soldered to the contact spring so that it projects at a right angle under the coils as indicated. The unit is enclosed in a case such as a cigar box, oversize holes being bored through one end of the box to allow the 1-in.-dia. brass

tubes to project without touching the wood. Variation in tone is obtained by cutting one tube 30 in. long, the other 38 in., but to get just the right pitch it may be necessary to file away the lower end of one or the other, or both, by a cut-and-try procedure until the tone is satisfactory. The tubes are hung at the sides of the coils by cords. Some care in assembly will be necessary to assure that the tubes hang free in their respective holes and do not touch the box when the case is mounted on the wall.

Fred J. Kammerer, New York.

Nail Polish Between Sheets of Plastic Will Color Novelty Jewelry

With nothing more than a few pieces of clear plastic and some colored nail polish you can make novelties, such as bric-a-brac, necklaces and other bits of jewelry that are striking in appearance. As an example, take a Scottie necklace ornament. To make it, cement two sheets of plastic together with black nail polish. Do this by coating a side of one piece and then pressing the two sheets together, being careful that no air bubbles are trapped between the pieces. Then scribe the outline of the dog and jigsaw around the outline. Finish by filing, sanding and buffing. An eye can be put in the Scottie by drilling a small hole and inserting a white bead held in place

with cement. The pattern for the Scottie can be cut from a picture in a magazine or newspaper, as can many other patterns.

Screws Held in Plastic With Cotton

If you find it difficult to assemble plastic parts with screws because they cause the material to chip or break around the holes, try this method of doing it. Drill holes in the plastic for the screws, then soak cotton in solvent and fill each hole with the cotton. When the screws are driven into this, they will form threads in the cotton which will harden and hold the screws securely.

G. James, Louisville, Ky.

" PASTE UP "

By Paul Hadley

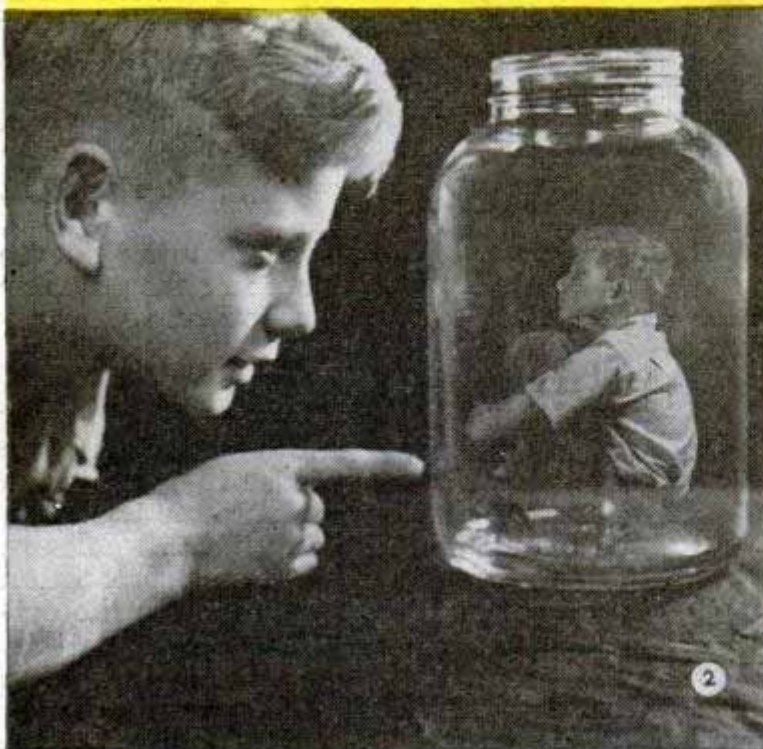
YOU can make "new" pictures from old ones and get photo effects that look impossible simply by combining parts of two or more prints in a paste-up composite from which a new negative is made. A look at Figs. 2 and 5 will give you an idea of what can be done in attaining realism with the more tricky compositions.

The process is easy. After the prints have been selected, desired parts of each are cut out carefully and the edges shaved thin so that when pasted together and photographed the edges will not show as a line. This is quite important, for by concealing the edges you avoid the appearance of a fake. After pasting up the composite, making sure that the edges adhere tightly to the base, any necessary retouching or spotting should be done with a retouching pencil or paint. From there on you make the new negative and develop and print it in the usual way.

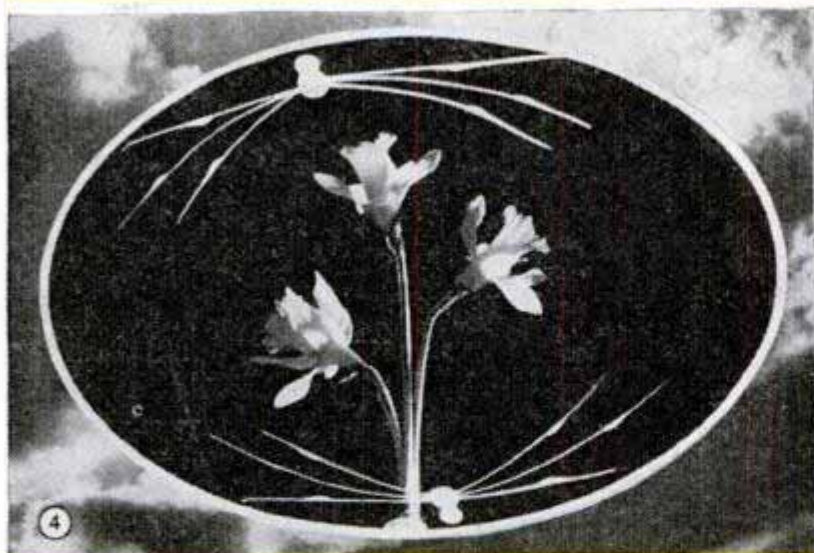
The composite picture in Fig. 1 was made from three prints, one each of the sky, the figure, and the



A composite of three prints: sunset sky, silhouette of the Washington Monument, and an indoor shot of the figure

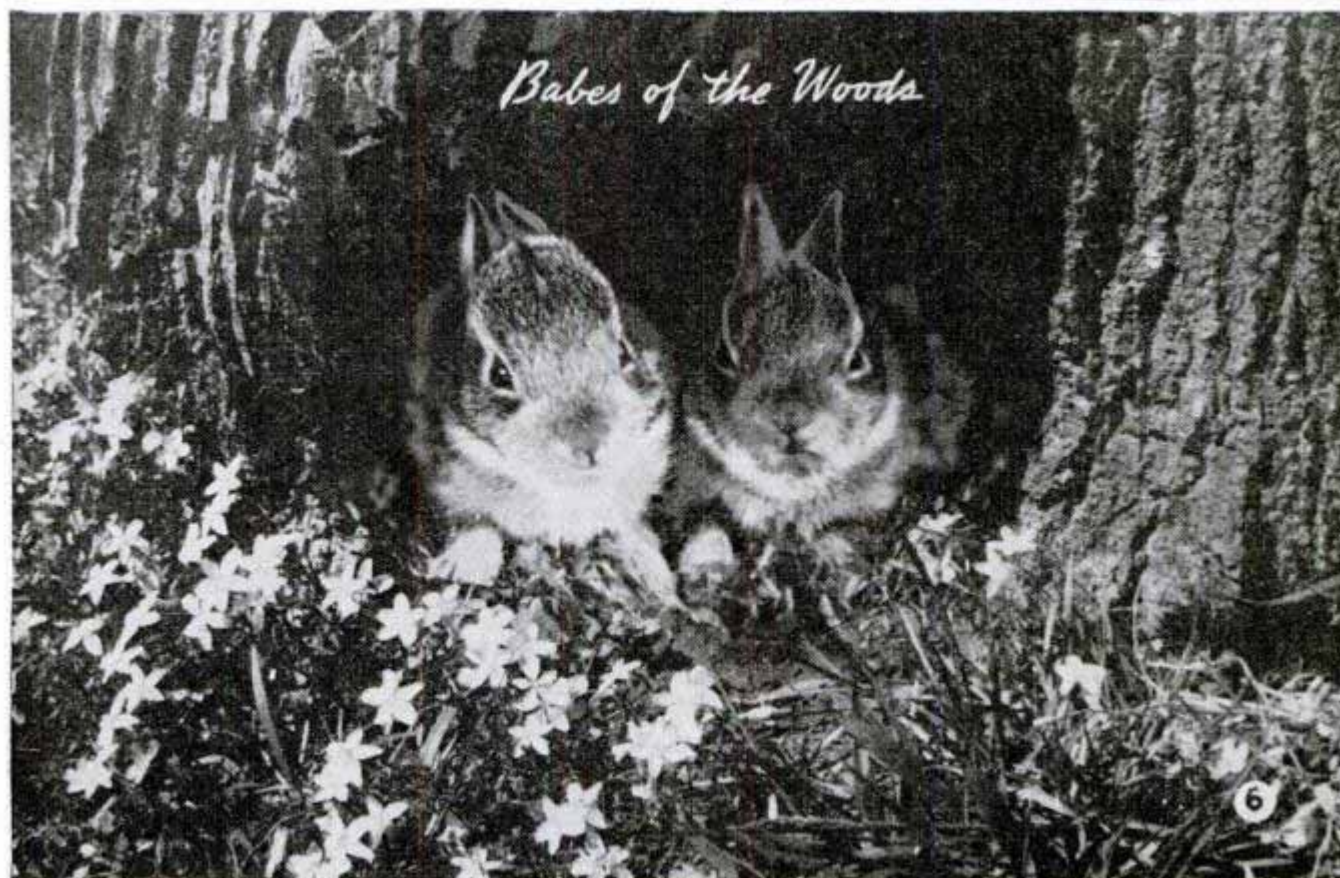


PHOTOGRAPHS GIVE NOVEL EFFECTS

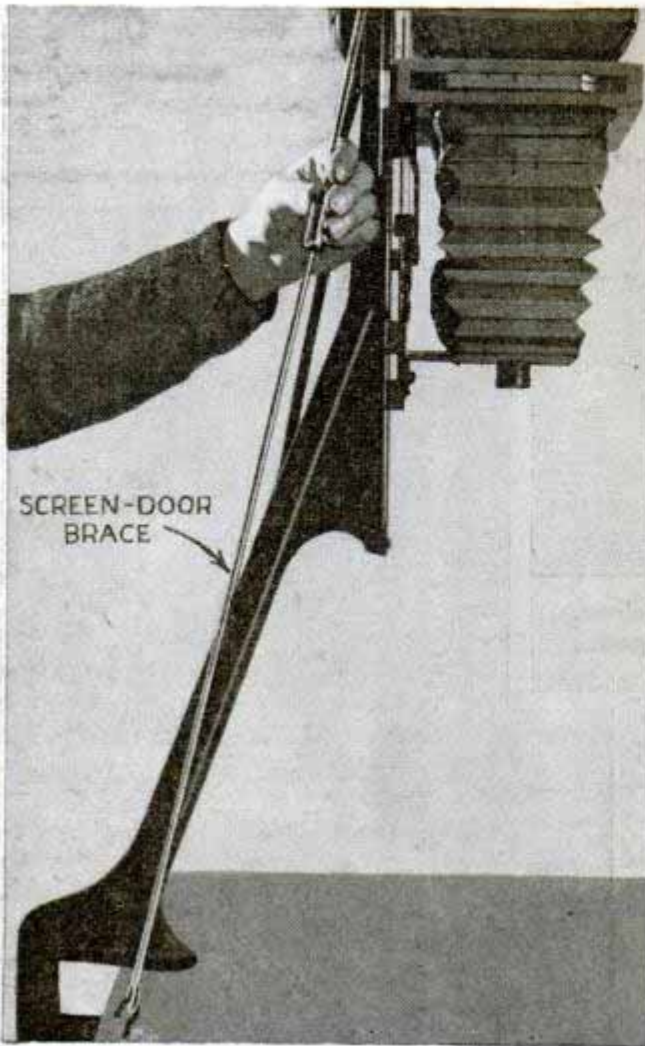


The first print is a "reflection" shot of flowers in a mirror. Then this is pasted to a print from a suitable cloud negative

Washington Monument. The novel "portrait" in Fig. 3 was made by cutting out the portion of the print showing the mirror glass and then using the opening in the print to frame a portrait of the girl in the paste-up. Photos in Figs. 4 and 6 were made in a similar manner, separate photos being taken both indoors and out to get the various prints necessary. By using the enlarger to make the prints, parts of any negatives may be used, making them the correct size by carefully measuring the image on the enlarging easel when printing.



Door Brace Holds Enlarger Rigid For Better Prints



If your enlarger is not steady, prints made with it will lack clearness. To correct this, fasten screen-door braces to the top of the enlarger column and to the table on which the prints are made, using one brace on each side. The turnbuckles on the braces should be drawn up tightly.

Improving Appearance of Tripod



An inexpensive wood tripod can be improved in appearance by attaching a strip of zinc linoleum binding tape around the head. The tape is held in place with small brads or it can be glued.

Quick Prints From Roll or Cut Film

A simple and quick way to make contact prints from roll or cut film without a contact printer is to secure a piece of heavy plate glass large enough to cover the nega-

tives. Using an enlarger table, or any table with an overhead light, place the paper emulsion side up and the negative emulsion side down over the paper. Then lay the glass over them. No clamping is needed as the weight of the glass is sufficient. Turn on the light for the needed printing time and, after exposure, develop in the usual way. If you use an enlarger, take the lens mount out for direct light. If you have a large piece of glass, you can print full sheets of paper rather than just strips cut from the paper.—C. C. Caswell, Clarinda, Iowa.

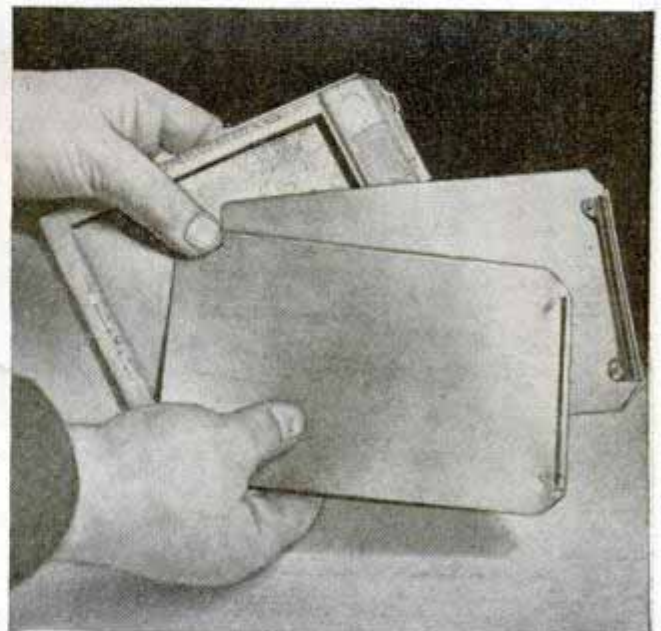
Saucer Used as Flash Reflector

When you wish to make flash-bulb photographs and a regular reflector is not at hand, a white china saucer will serve as a substitute. The saucer is held against the bulb and socket as shown. This leaves one hand free to operate the camera. Care should be taken to hold the saucer and socket so the hand will be protected if the bulb breaks when it is flashed.



Dark Slide Substitute Is Made From Notebook Cover

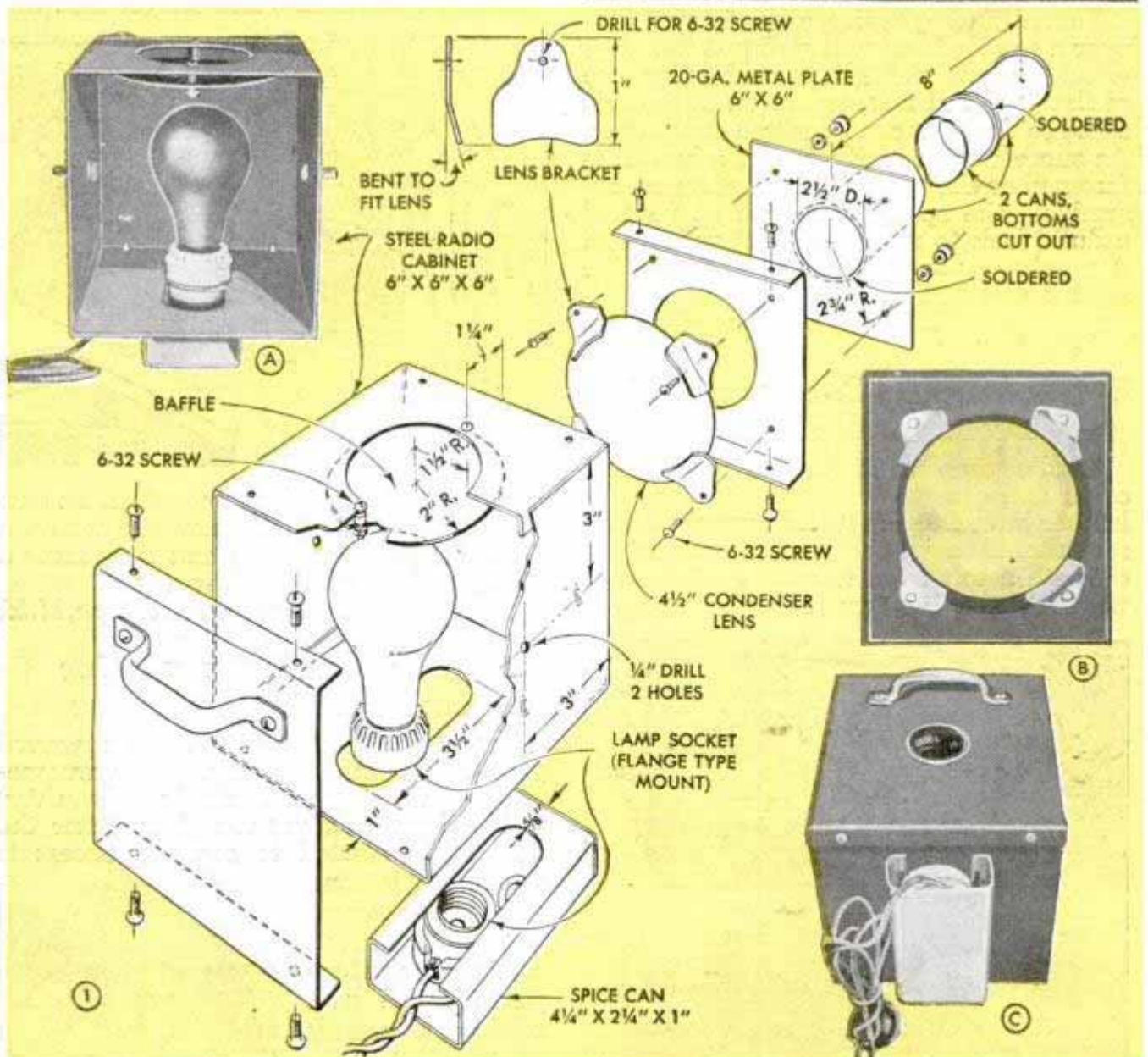
If you have lost the dark slide from a film holder, you can make an emergency slide that is light tight from the shiny, flexible covers that come on some notebooks. After the cardboard has been cut to fit, a pull, which is the rounded end of the spring device found in film packs, is added to complete the slide.—R. M. Roland, Chicago.

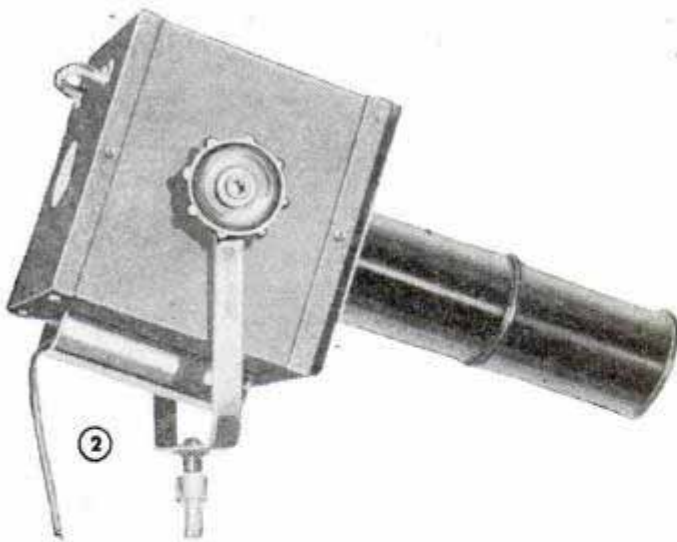


Focusing Spotlight for Indoor Photography

A focusing spotlight, Fig. 2, ideal for table-top photography or similar projects, where large areas need not be lighted, can be made using a standard 6 by 6 by 6-in. metal radio cabinet and a chipped condensing lens. Begin by removing the covers of the cabinet and draw diagonal lines on the top to locate the center. Cut a 3-in.-dia. vent in the top, Fig. 1, and fit a baffle to form a light trap. Then cut the slot in the bottom so the bulb can be moved for focusing. This slot also admits air for ventilation. A flange-type socket is fitted in the slot and slides back and forth in the light trap. A spice can, or a can of similar size, will serve the purpose, detail C of Fig. 1. Two $\frac{1}{4}$ -in. holes are drilled in the sides of the cabinet and 10-32 screws are inserted to hold the box in the cradle.

The opening in the front panel for the lens, detail B, Fig. 1, should be small enough so that it will cover any imperfec-





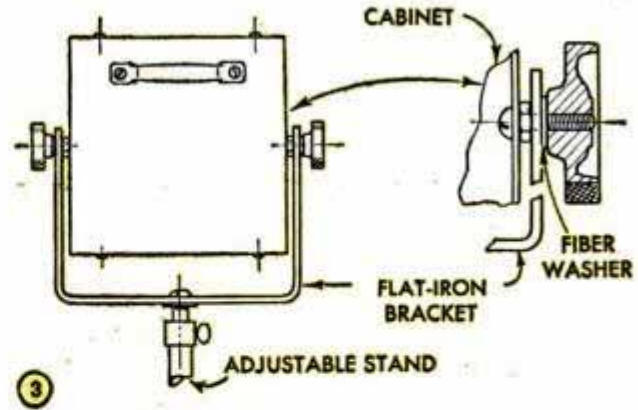
tions on the edges of the lens. The flat side of the lens is held against the panel with clips, as shown in Fig. 1. To make the light-control tube, cut the tops and bottoms out of two cans of the same diameter and solder them end to end. Then solder the tube to the plate which bolts on the front panel. Different sized tubes can be made to vary the size and intensity of the light beam.

For a diffusing device, organdy stretched over a sewing hoop will give just the right effect. The cradle, Fig. 3, is cut from a piece of flat iron and fastened to an adjustable stand so the light can be raised or lowered. As another aid to adjustment, a handle is fastened on the back. After all parts are assembled, the spotlight should be painted a dull black to minimize light reflections. A number one photoflood is shown in the light, detail A, Fig. 1.

Dan W. Damrow, Chicago.

Saddle Soap on Camera and Case Preserves the Leather

Saddle soap applied to your camera cover and case will not only preserve the leather but will keep it looking bright. The soap should be applied sparingly and wiped off with a soft cloth to remove dirt, after which another light coat is applied and pol-

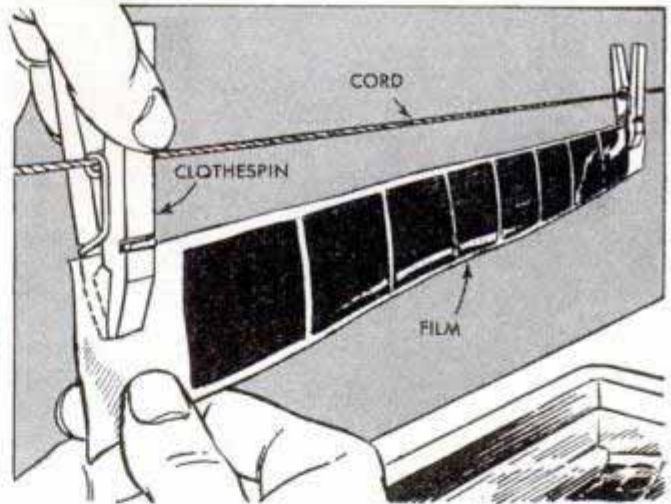


ished with a lamb's-wool shoe buffer to make the leather shine.

Herman Klein, Pittsburgh, Pa.

Roll Film Suspended Horizontally Will Dry Faster

Roll film can be dried much faster if it is hung horizontally instead of vertically, as is the usual method. When held in this position, there is also less danger that wa-

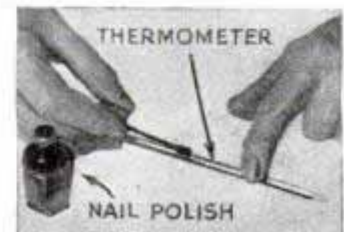


ter marks will streak the negative. To suspend the strip in this manner, clip each end with a spring clothespin and hang from a string which has been drawn taut.

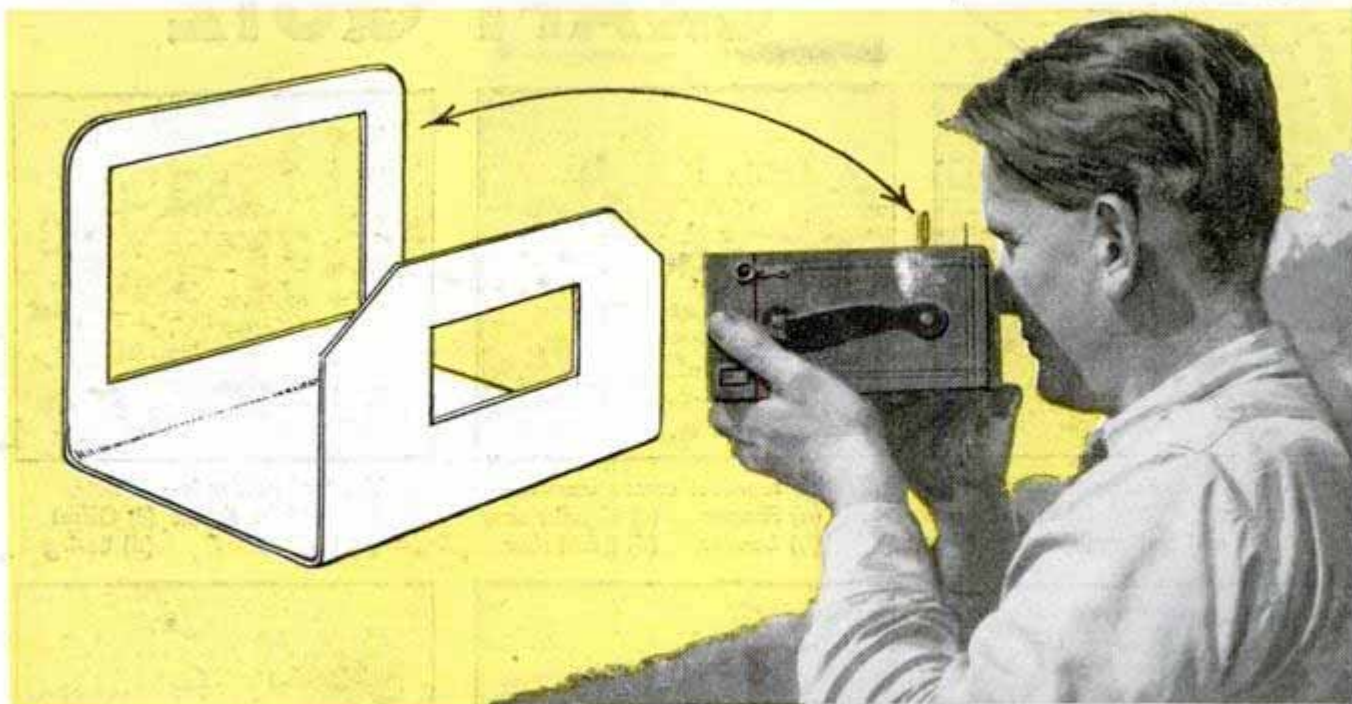
William Swallow, Brooklyn, N. Y.

Nail Polish Renews Color On Worn Thermometer

If the color is worn off the engraved graduations on your darkroom thermometer, it can be renewed quickly by brushing red nail polish along the glass. After the polish has started to set, the excess is wiped off, leaving only the graduations colored. Nail polish is waterproof and not readily affected by photo solutions.



Direct-Vision Viewfinder Is Used on Box Camera



Since most box cameras are fitted with a reflecting viewfinder, addition of a direct-vision viewer will add to the effectiveness of the instrument. Pictures taken at eye level differ from those taken at waist level; with the two finders, you will be able to get different angles and different effects. Construction of the viewfinder is simple, but you will have to proportion the front and

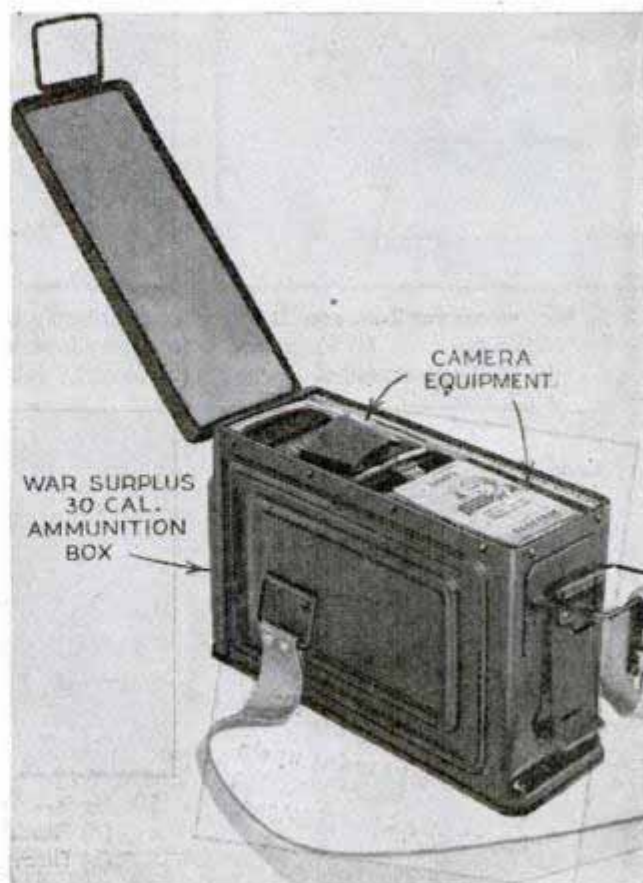
rear sights so they cover the same field as that covered by the reflecting finder. This is done by trial and error. A temporary finder can be cut from cardboard and experimented with until openings of the desired size are obtained. Then use the cardboard as a pattern and cut the finder from sheet metal. It can be fastened to the camera with screws after it has been painted.

Ammunition Box Can Be Converted to Case for Camera

A .30-caliber ammunition box makes an ideal carrying case for small cameras and accessories. This all-metal box is watertight and measures 10 in. long, 3½ in. wide and 7 in. deep. It is equipped with a cantilever spring catch and a collapsible metal handle on top. In addition, there are two swing loops, one on the front and one on the side of the box, to which shoulder straps may be attached. The inside should be well padded so that camera equipment will not be damaged. Sheets of sponge rubber which have been cut to size and fastened with rubber cement are ideal for this purpose.—Simon S. Palestrant, New York.

Removing Stain From Photo Tray

Developing trays can be cleared of stains with a 10-percent solution of laundry bleach, which should be left in the tray for several hours. Also, the acetic-acid solution used as a shortstop in developing prints can be used. However, the tray then must be rinsed to remove all traces of the bleach or acid, even a small amount of which will spoil developer used in the tray.



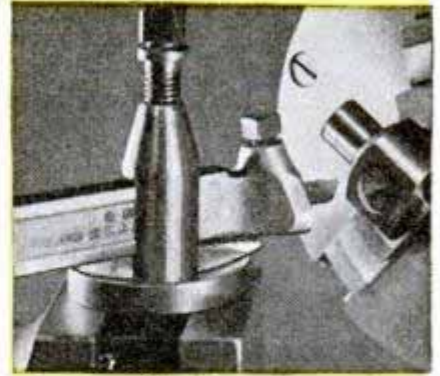
CRAFT QUIZ



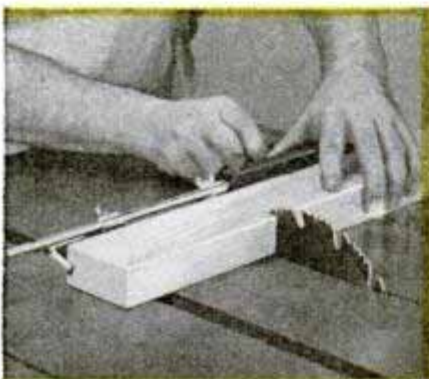
1. Method of building this model is—
 (a) Roll top (c) Frame
 (b) Bread and butter (d) Batten seam



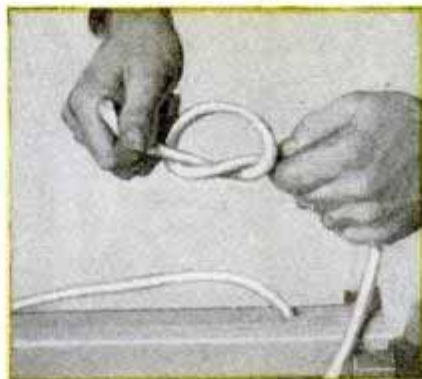
2. This "sawdust" comes from a—
 (a) Shaper (c) Circular saw
 (b) Sander (d) Band saw



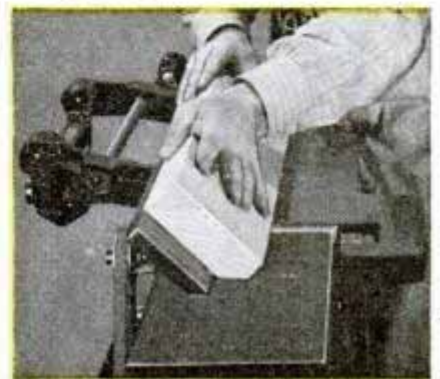
3. The tool holder is—
 (a) Straight shank (c) Offset
 (b) Duplex (d) Boring



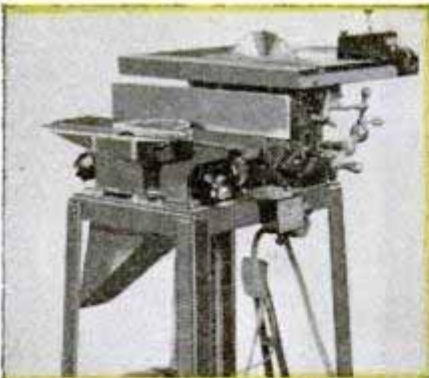
4. Wrong in this picture is—
 (a) Hands (c) Saw height
 (b) Kind of saw (d) Stop rod



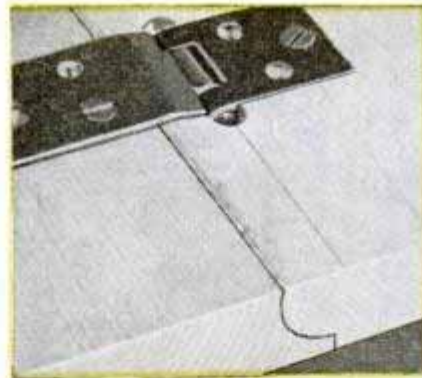
5. Knot he is tying is—
 (a) Overhand (c) Wall
 (b) Bowline (d) Square



6. This cut is a—
 (a) Bevel (c) Miter
 (b) Chamfer (d) Tongue



7. Best motor for 8-in. saw is—
 (a) 1/3 hp. (c) 1/2 hp.
 (b) Split phase (d) 3/4 hp.

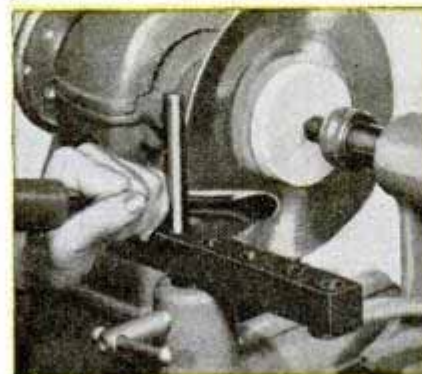


8. Eventually this will be a—
 (a) Draw leaf table (c) Folding screen
 (b) Butterfly table (d) Folding ladder

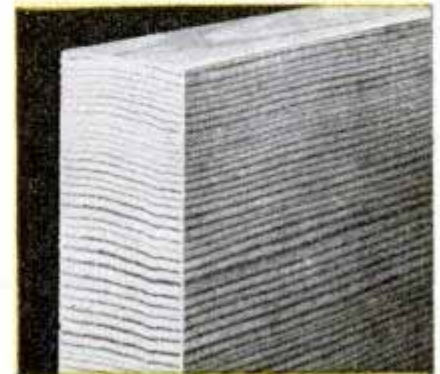


9. This spray gun is—
 (a) Pressure feed (c) External mix
 (b) Internal mix (d) Angle head

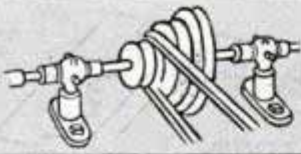
ANSWERS: 1-b (it is built up in layers like a sand-rod is never used on free end of work); 2-a; 3-c; 4-d (stop which); 2-a; 3-c; 4-d (stop up in layers like a sand-rod is never used on free end of work); 5-a; 6-b; 7-c (note horns on cop); 10-c; 11-a (end grain 45 to 90° with surface)



10. He is—
 (a) Planishing (c) Spinning
 (b) Throwing (d) Following



11. End grain shows this wood is—
 (a) Quarter-sawed (c) Sapwood
 (b) Flat-cut (d) Heartwood



"FEEJEE"

An All-Purpose Dump Truck

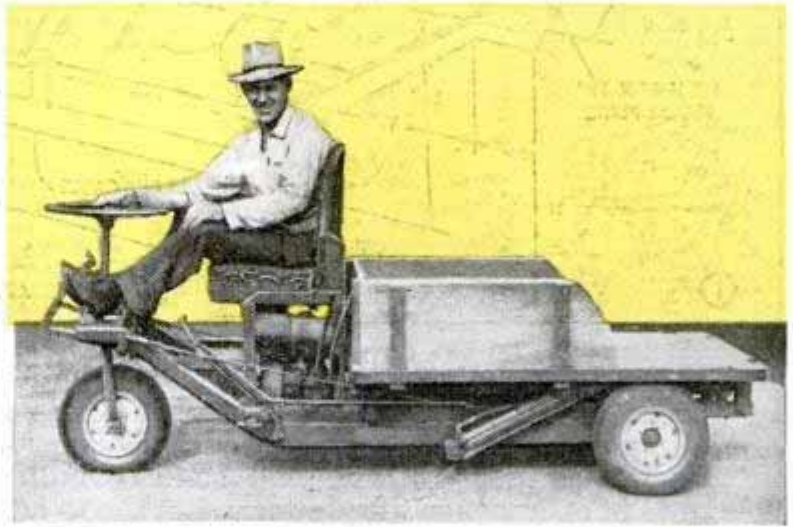
Feejee—Built by Don W. Street, a California poultry rancher, takes its name from a contraction of the words Feed and Jeep.

By Hi Sibley

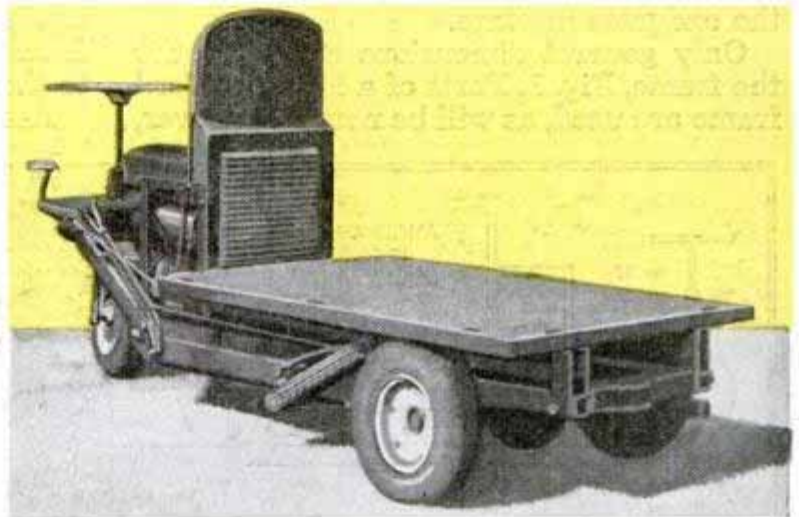
PART I

HANDY around the poultry farm, the dairy barn, in the feedlot and in industrial plants, this capable midget dump truck has the capacity for half-ton loads, weighs 600 lbs. empty and has a tread width of only 31 in. A 3-hp. air-cooled engine drives through two standard automobile transmissions hooked up in tandem, thus giving a wide variation in gear ratios for the heavy pulls. A power-driven hydraulic lift, separate foot brakes on the rear wheels and a foot accelerator combine to give a degree of control equal to that of any standard dump truck. The narrow width lets the midget through small gates and feed-bunk alleys and its ability to turn in its own length gets it around square corners and into and out of narrow driveways with a full load.

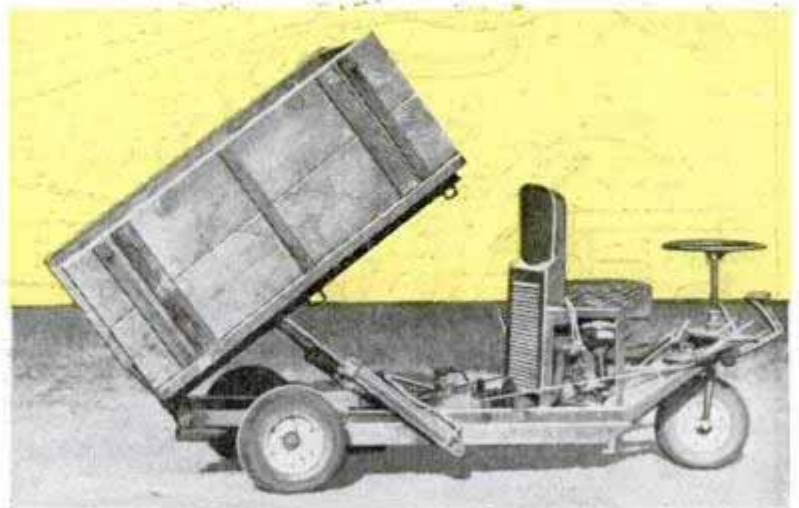
Some departures from the design as detailed are possible. A 3 or 5-hp. engine equipped with integral clutch will save building the spring-loaded clutch arrangement shown. Where the going is fairly level and there are no steep grades to negotiate regularly, a 3-hp. engine driving through a single transmission will give satisfactory performance. Two types of side panels are fitted to the platform to provide three body types: a half box, a flat bed and a deep double



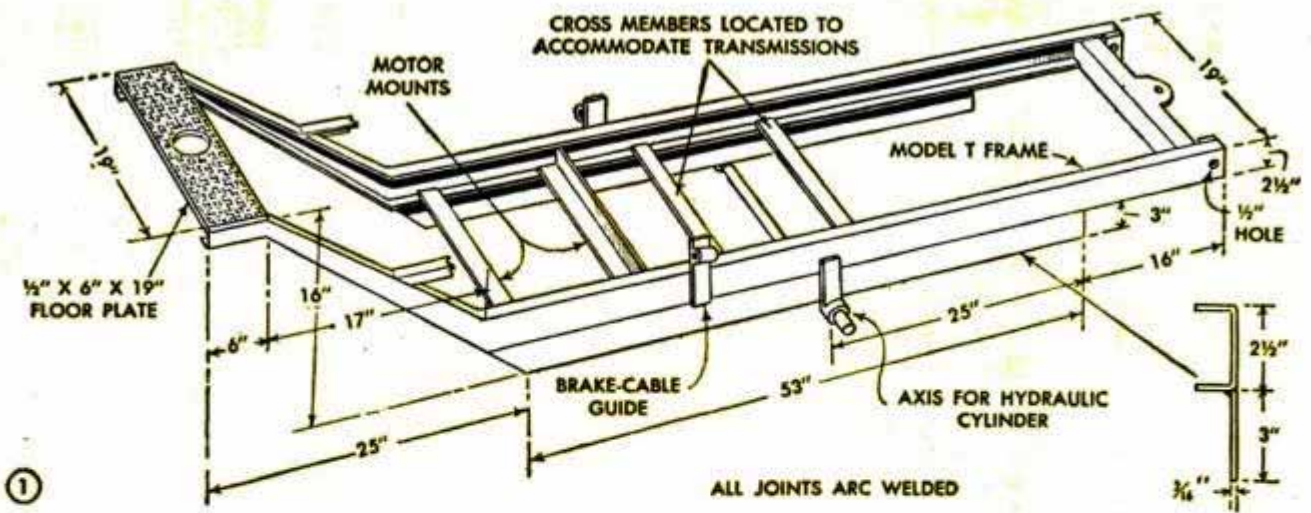
Comparative size of truck is shown by man in seat. Half-body is used for hauling sacked grain and items not in bulk



With the sides removed the flat bed can be used to haul bulky articles such as baled hay, lumber or large crates



With box-body half a ton of feed or fertilizer can be hauled. Hydraulic cylinders hoist the body to the dumping position

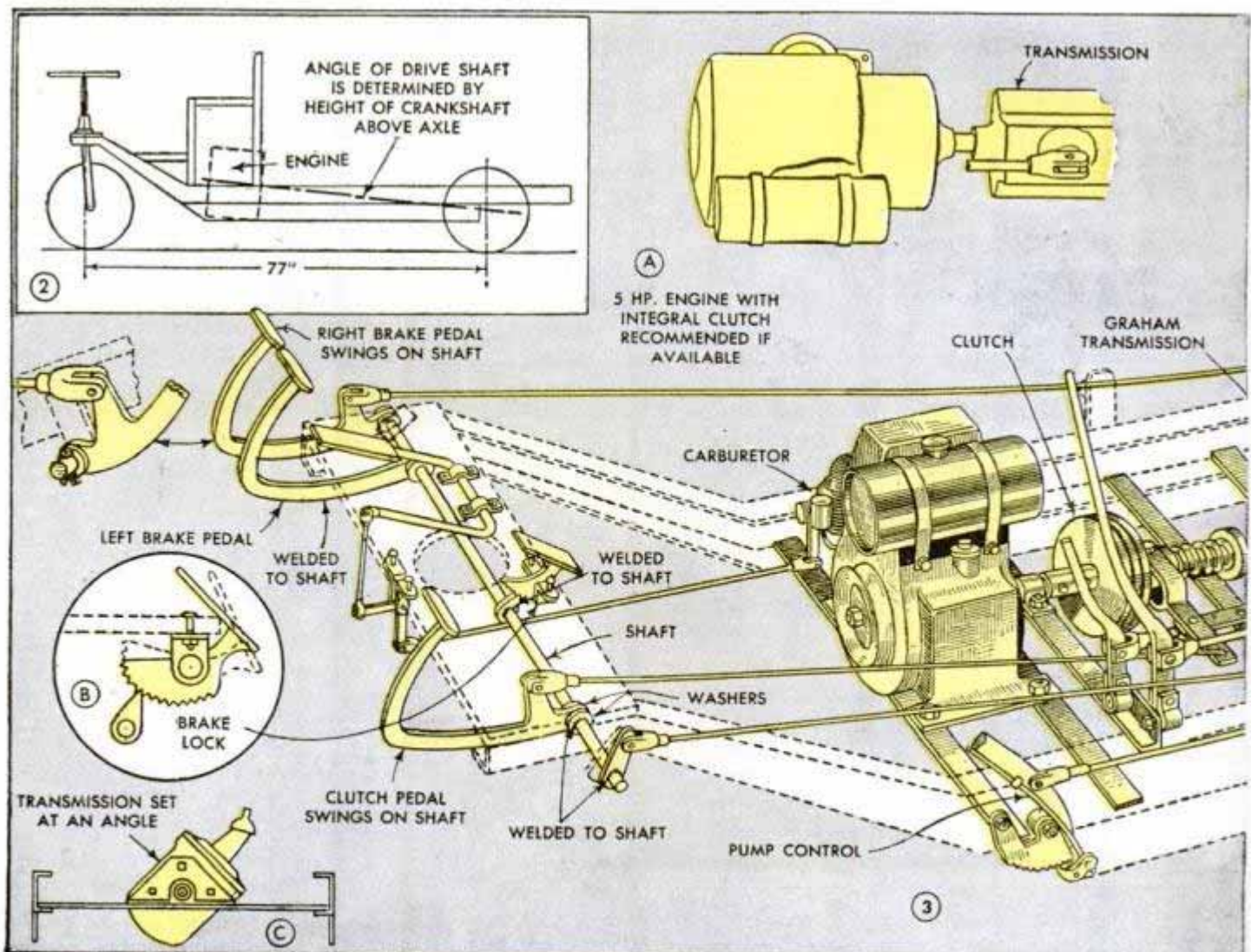


box, with endgates, for small grains, ensilage or ground feeds. Side panels are made of white pine or waterproof plywood and fitted with hardwood cleats and stakes spaced to fit openings in the platform. Both cleats and stakes are riveted to the panels for extra strength. Endgates are of the same construction and wagon-box rods cut down to the proper length are provided to hold the endgates in place.

Only general dimensions are given for the frame, Fig. 1. Parts of a Model T Ford frame are used, as will be noted. However,

you can use steel channels for the frame side members and save welding on stiffeners, which are called for in Fig. 1. In building the chassis frame it is necessary to adapt it to the parts and equipment you have available or at hand. The frame should be long enough to accommodate engine, clutch, two transmissions, hydraulic pump and the rear axle. If you use the same equipment as on the original vehicle, the frame dimensions will correspond closely to those given in Fig. 1.

Assembly of the driving parts is illus-



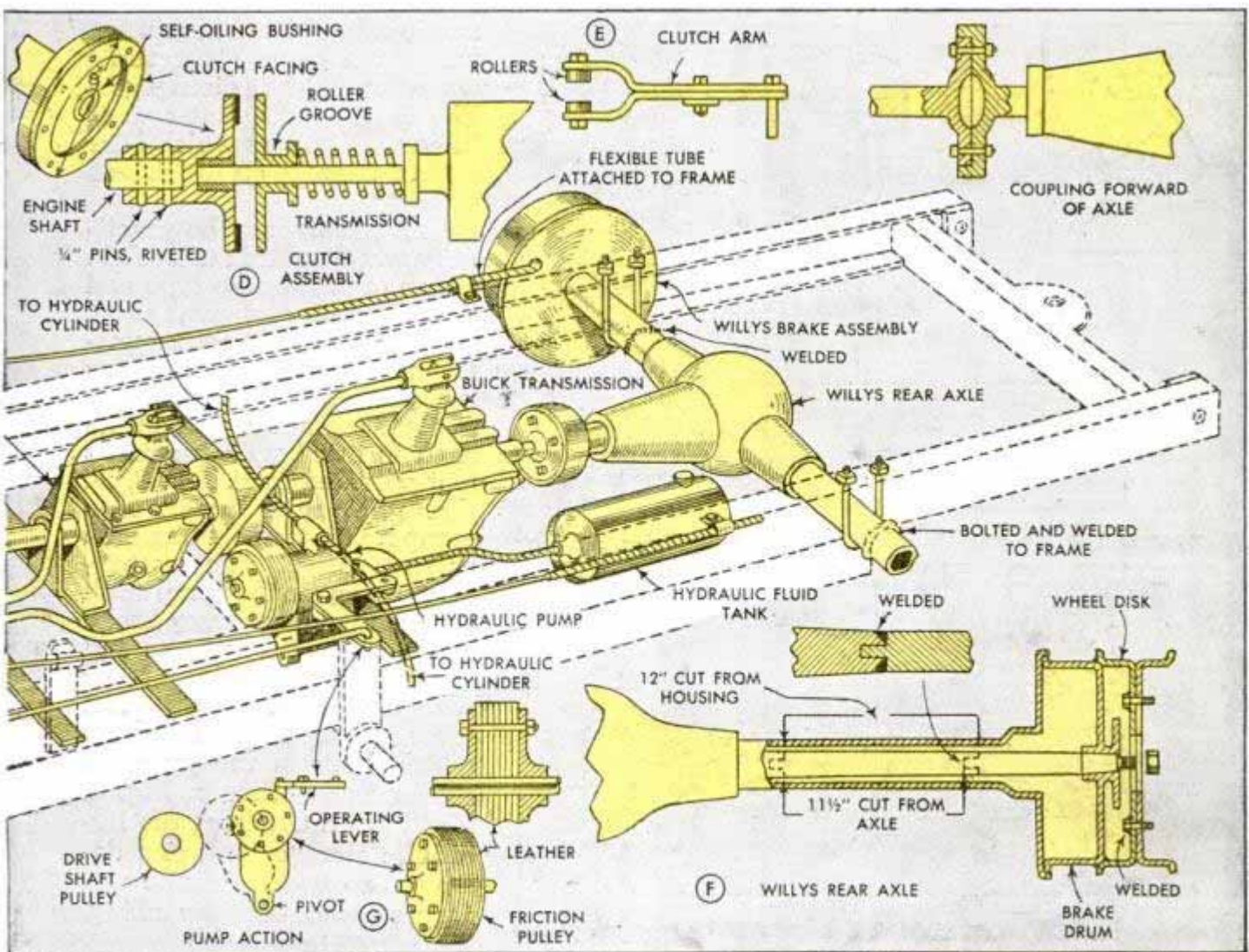
trated in the perspective view in Fig. 3. Main-frame channels are cut and welded to form the "kick-up" forward portion. Stiffeners of flat steel are welded along the bottom of the straight section to give additional rigidity. A steel floor plate is welded to the front end, with a round opening to receive the steering-post bearing. Seat frame is built up of $\frac{1}{8}$ by $1\frac{1}{2}$ by $1\frac{1}{2}$ -in. angle iron with all joints welded. This should be dimensioned to accommodate the cushions you will use.

Supports for engine, transmissions, etc., are located where required, and a shaft carrying the lower eye bearings of the hydraulic cylinders is supported by bearings welded to the side frames as shown. Place the transmissions, engine and other parts in position and from this trial set-up determine the location of supporting members on the frame. Don't weld frame cross-members in place until you make this trial assembly. Using an engine with an inte-



gral clutch, Fig. 3, A, will change the relative positions of these parts. Provide for a tow hook at the rear end of the frame and install guides for brake cables on each side. The cables should be located after brake pedals are installed. Holes are drilled in the extreme rear ends of the channel members to receive the bolts on which the dump body hinges.

Relative locations of the parts, when using a spring-loaded clutch, Fig. 3, D, can be worked out on the partially completed frame. Generally, it's best to begin by bolt-

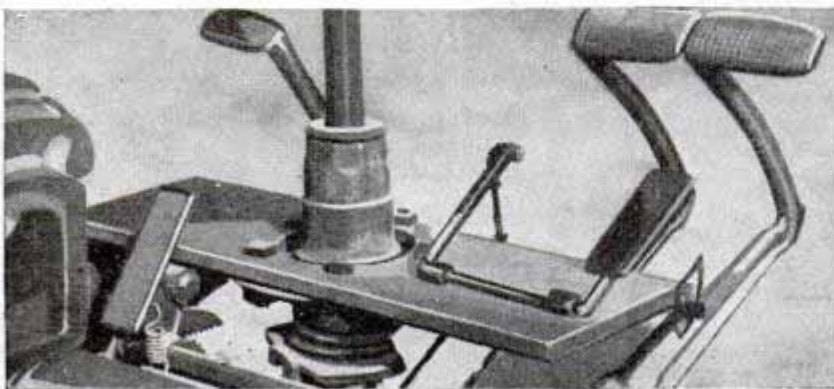




Narrow tread and single-wheel steering permits use in close quarters



All operating levers are within easy reach of the driver's seat



Independent brakes on rear wheels are operated by separate pedals which can be locked to hold truck on a grade

ing the rear axle in position and then work back to the engine. The angle of the drive shaft is determined by the height of the crankshaft above the center of the rear axle, Fig. 2. With the frame blocked up, the axle is bolted directly to the frame, under the channels and at the ends of the stiffeners as shown. U-bolts made from $\frac{3}{8}$ -in. round rods will serve to hold the axle in place. In the original job a Willys rear-axle assembly is used and the tread is narrowed to 31 in. by cutting out a 12-in. section of the housing and $11\frac{1}{2}$ in. of the live axles on each side as in Fig. 3, detail F. The ends of the axles then are turned in a lathe as shown in the detail and welded, as is the housing. A coupling to connect with the rear transmission—in this case a Buick transmission—is made as shown. Any similar coupling will be satisfactory if a different make of transmission is used. In order that the tops of the transmissions will clear the bottom of the body, it is necessary to mount them at an angle as in Fig. 3, C.

The second transmission, taken from a Graham car, was originally fitted with an emergency brake, the drum of which is utilized to drive the hydraulic pump through a friction pulley, Fig. 3, detail G. Next comes the clutch assembly, shown in Fig. 3, details D and E. On the original job this was made especially for the purpose. The driving disk is faced with

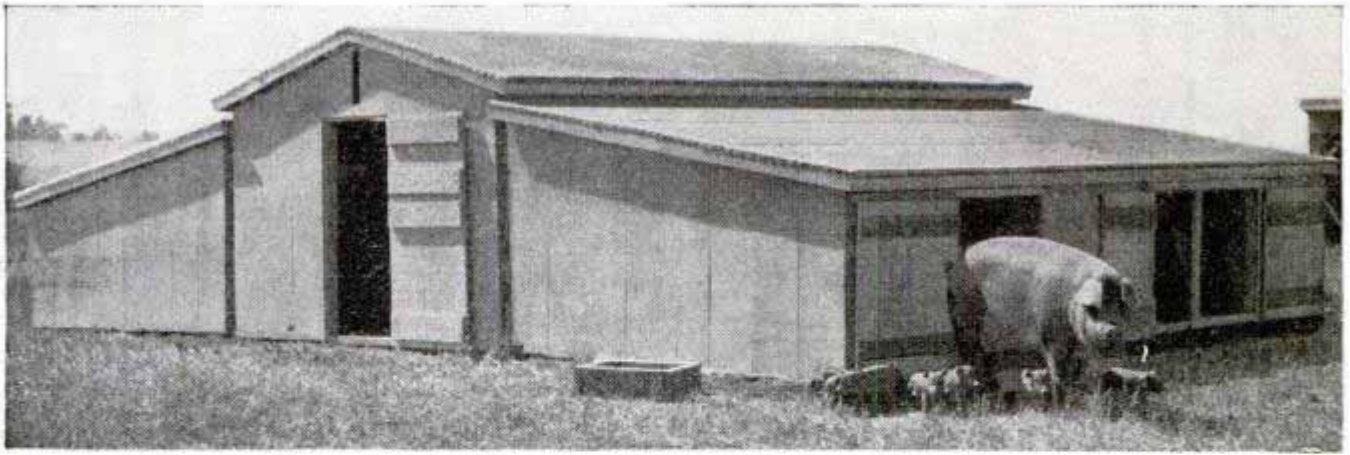
clutch facing and is fitted with an oil-impregnated bearing in which the drive shaft turns when the clutch is disengaged. The clutch throw-out arm is fitted with rollers which bear against a flange on the driven disk.

Foot pedals may be practically any standard automobile clutch or foot-brake type and are linked up as shown in Fig. 3. Gearshift levers are mounted on a frame crossmember as indicated. Link bars are bent to clear the body. The brake shaft is fitted with a ratchet foot-operated lock, Fig. 3, B.

A gear-type hydraulic pump is mounted on the frame as indicated. The leather-faced pulley on the pump shaft contacts the emergency brake drum, and is thrown into and out of contact by a hand lever with a ratchet. The ratchet lever and bell-crank linkage which controls the pump is shown in position in Fig. 3. Fluid is drawn from the hydraulic storage tank and delivered to two hydraulic cylinders through flexible tubing.

(To be continued)

Portable Hoghouse Is Made In Three Sections



All three sections of this hoghouse are on skids for easy portability, each section providing 8 by 18 ft. of floor space. The gable-roofed center section can be used as a pig creep, as a storage space for sacked feed, a sunshade, a general runway, or for additional pens. The lean-tos are divided into three pens each and doors to the pens are spaced along the low sides. Hinged half-doors in the ends of the center section make it possible to regulate ventilation, admit sunshine without letting the hogs escape, or leave the lower ends of the house open and the top half closed. The buildings also are handy for sheltering lambs, for feed storage units or as tool sheds for small farm equipment. The outer sheds may be slid together to make a six-pen single house or used separately. The lower photo shows



construction of the lean-tos. Runners or skids are 4 by 6-in. creosoted stock, 18 ft. long, with 4 by 4-in. cross sills and 4 by 4-in. corner posts and studding spaced as shown. End rafters are of 2 by 4-in. stock but the center rafters are cut from 2 by 6-in. material. The same material sizes are used in the center section.

A. M. Wettach, Mt. Pleasant, Iowa.

Babbitt in Handle Protects Chisel From Hammer Blows

Here's one way to keep wooden chisel handles from splintering or "brooming." Secure a heavy ferrule that will just fit over the handle and slip it halfway on so the top half forms a cup. Then extend this by wrapping several layers of heavy wrapping paper around the ferrule and pour babbitt into the mold until the metal is about $\frac{1}{2}$ in. above the ferrule. Then remove the mold. When the chisel is used the hammer will strike only the babbitt. In time the babbitt will wear down and it will be necessary to replace it. A rubber crutch tip will slip over the handle of some chisels, but this tends to cushion the hammer blows and does not wear as well as babbitt.

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



Metal Bag Filler Speeds Work When Filling Many Sacks

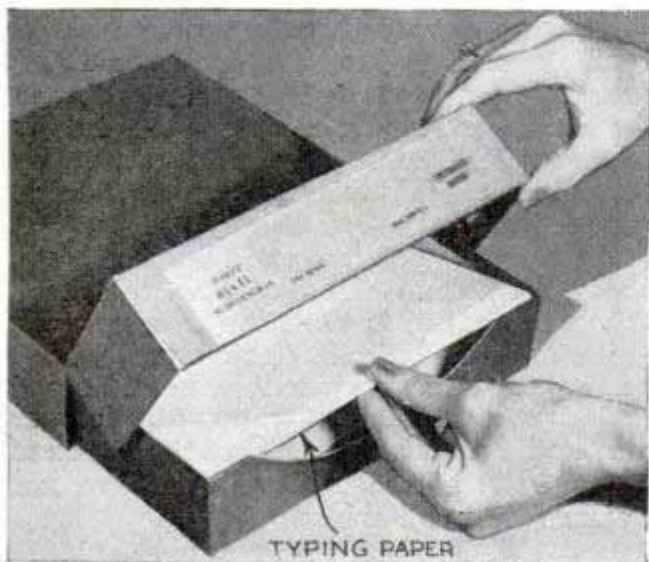


This bag filler will enable a clerk to fill a large number of paper bags without help in a short time. The cylindrical part should be large enough to be a close fit inside the sack, and the mouth should flare out so that vegetables and fruits will not spill. Note that both ends of the filler are beaded for reinforcement.

Carl J. Taber, Elmira, N. Y.

Typing Paper Is Removed Easily From Box With Hinged Lid

If the lid of a box containing typing paper is altered as shown, it will not be necessary to remove the lid to withdraw a few sheets. This is handy especially if the box is stored in a drawer. Frequently fingernails are broken when it is necessary to dig down in



the box to get the last few sheets of paper. The cutout in the lower half eliminates this difficulty. Wide adhesive tape makes a durable hinge for the lid sections.

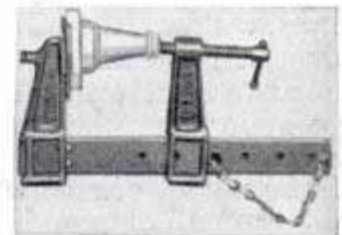
Substitute Wire-Stripping Fixture Utilizes Razor Blades

Two razor blades can be held, V-shaped, in a vise and used to remove insulation from wire if no regular stripping tool is available. Some makes of blade are extremely thin, and if this type is used it will be necessary to brace the blades with small pieces of metal as shown. To use the stripper, place the wire at the junction of the blades and rotate it once to cut the insulation through completely. Then press down and pull the wire through.—Wray Bell, Pattonsburg, Mo.



Pin in the Bar of a Speed Clamp Prevents Slipping of Jaw

To prevent the movable jaw of a speed clamp from slipping when the teeth become worn, drill a row of holes about an inch apart along the bar and insert a pin or heavy nail to hold the jaw. The pin is held by a length of light chain attached to the bar.



C. F. Bareis, Philadelphia, Pa.

Quickly Made Lettering Pen Rack

There is no need to search for lettering pens if they are kept in a convenient rack with the India ink bottle. A narrow strip of corrugated cardboard can be wrapped around the bottle and secured with a rubber band or a strip of adhesive or cellulose tape to provide a score of compartments which are just the right size and shape to accommodate a large number of lettering pens.



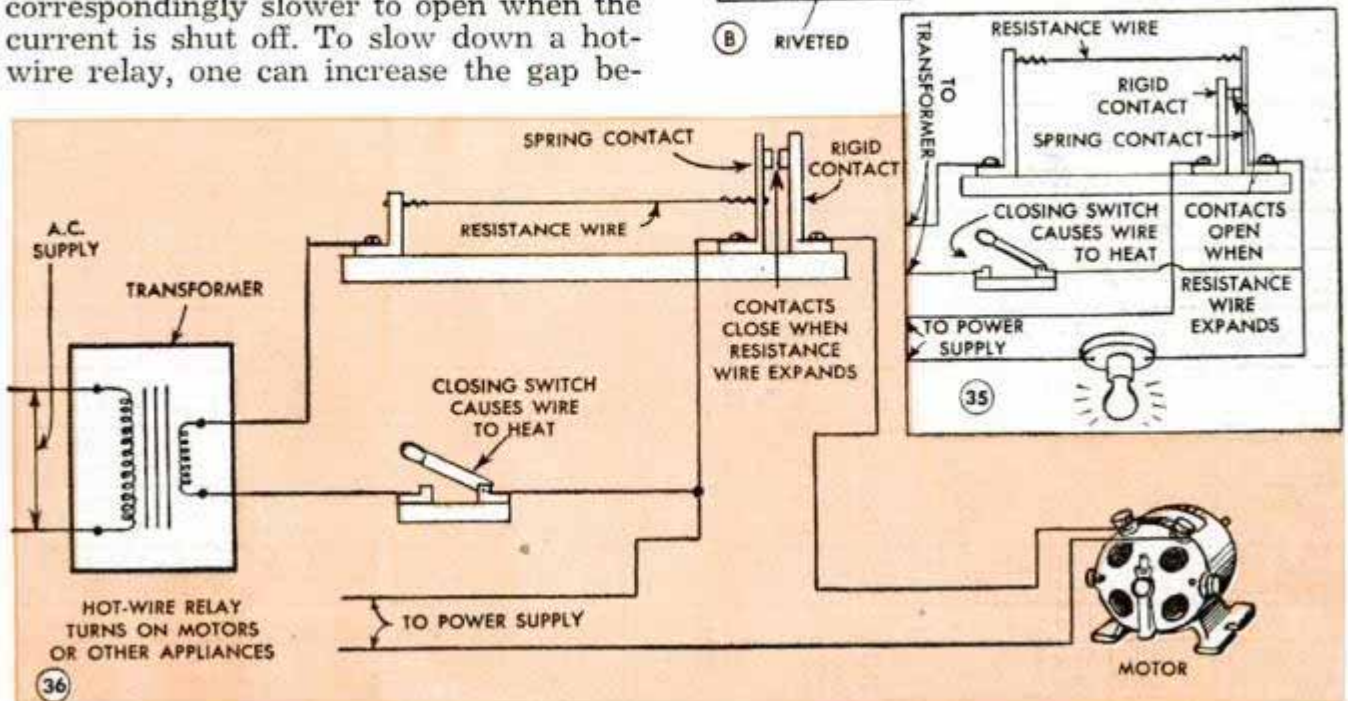
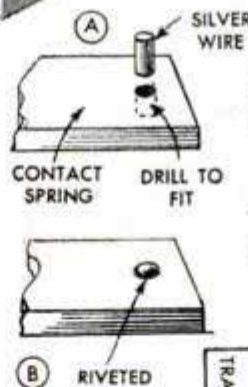
Build Your Own RELAYS

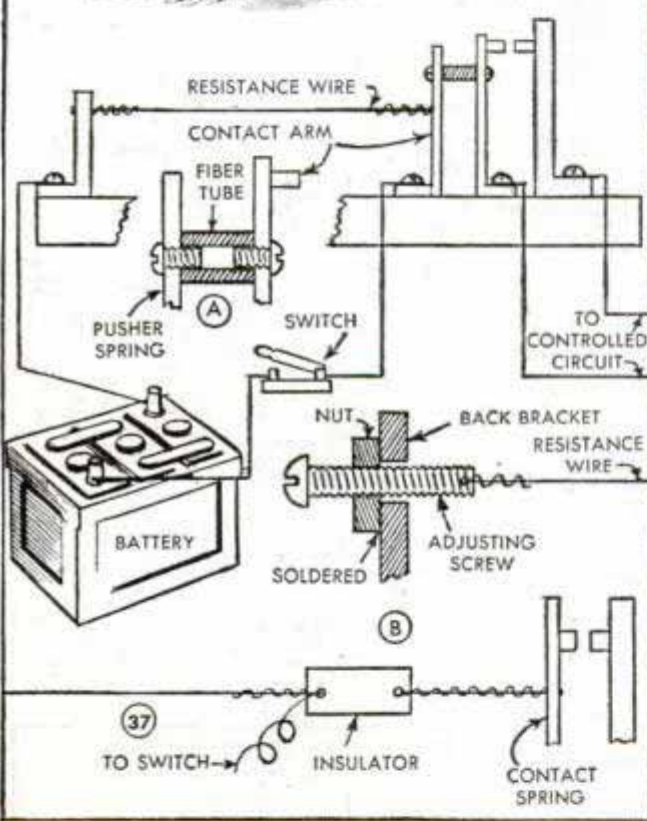
PART 3—THERMAL RELAYS

By C. A. Crowley

THERE are two principal types of thermal relays; the hot-wire type, Figs. 35 and 36, and the thermostatic or bimetal type, Fig. 44. The hot-wire relay consists of a resistance wire held under tension by a contact spring. When current from a battery or low-voltage transformer is passed through the wire it is heated and expands or stretches, permitting the contact to close or to open, depending on which type of relay is in use. Thermal relays can be used to control motors, lights, heaters or any other electrical apparatus. It is frequently desirable to insulate the low-voltage controlling circuit, which operates the relay, from the circuit that is to be controlled. A method of insulating the relay circuit from the controlled or operating circuit is shown in Fig. 37, A.

Both the hot-wire and bimetal types are actually delayed-action relays, since the contacts will not close until the wire has had time to heat and expand. The time interval between closing of the relay circuit and operation of the relay can be controlled by adjustment of the gap between the contacts, using a machine screw as in Fig. 37, B. Another method of speeding up the operation of a thermal relay is to slip a length of glass tubing over the resistance wire as in Fig. 40. This will retard heat loss from the wire and cause it to expand more rapidly. However, relays which are speeded in closing by this method will be correspondingly slower to open when the current is shut off. To slow down a hot-wire relay, one can increase the gap be-





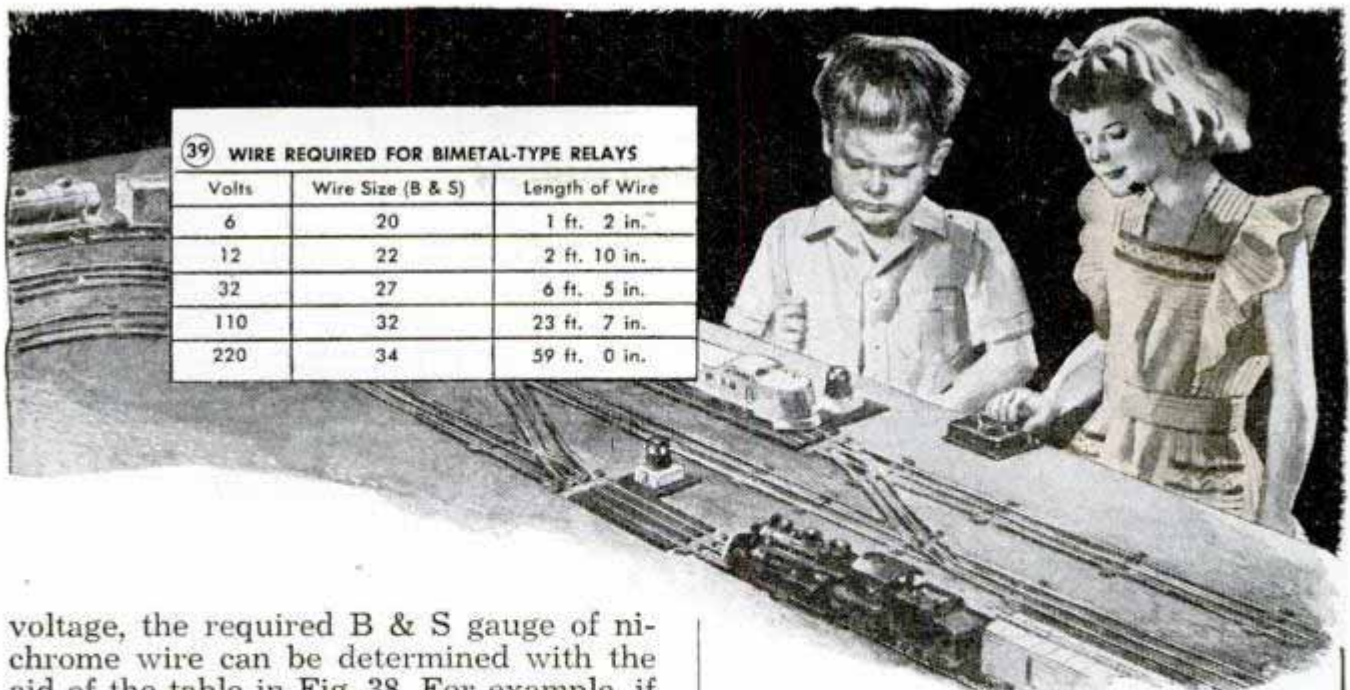
tween the contacts, but if the gap is too great the contacts won't close. Another method is to connect a rheostat in series with a hot wire as in Fig. 43. By increasing the resistance it is possible to increase the time interval to almost any desired extent. Fig. 43 shows how two identical relays can be made to operate consecutively by adjusting the control rheostats to different positions. Details A and B in Fig. 41 show, by comparison, how a short length of wire can be used to give a larger contact movement as indicated by positions L1 and L2. For example, by connecting the wire in the position shown in Fig. 41, B, the wire must expand only $\frac{1}{32}$ in. to move the contacts $\frac{1}{16}$ in.

The design of hot-wire relays is simple. Where alternating current is available, a low-voltage transformer with an output of 6 to 20 volts is the most convenient source of the relay current. By using low voltage, all relay wiring can be laid with bell wire. If a.c. current is not available, a 6-volt storage battery, Fig. 37, is a good power supply. After selecting the length of wire and the

38

DESIGN OF HOT-WIRE RELAYS

Voltage	12" Wire				6" Wire				8" Wire			
	B & S	Ohms	Amps.	Watts	B & S	Ohms	Amps.	Watts	B & S	Ohms	Amps.	Watts
6	20	.635	10	75	28	2.05	4	25	24	1.29	5	30
	22	1.017	7	50								
8	24	1.61	6	60	32	5.09	2	25	26	2.06	5	40
	26	2.57	4	50								
10	26	2.57	5	50	34	8.2	2	25	28	3.28	4	40
	28	4.10	3	40								
12	28	4.10	3	40	34	8.2	2	25	30	5.20	3	40
	30	6.50	2	30								
14	30	6.50	3	40					32	8.13	2	30
	32	10.17	2	30								
16	32	10.17	2	30					34	13.10	2	25
	34	16.4	2	25								
18	34	16.4	2	30					34	13.10	2	30
20	34	16.4	2	30								

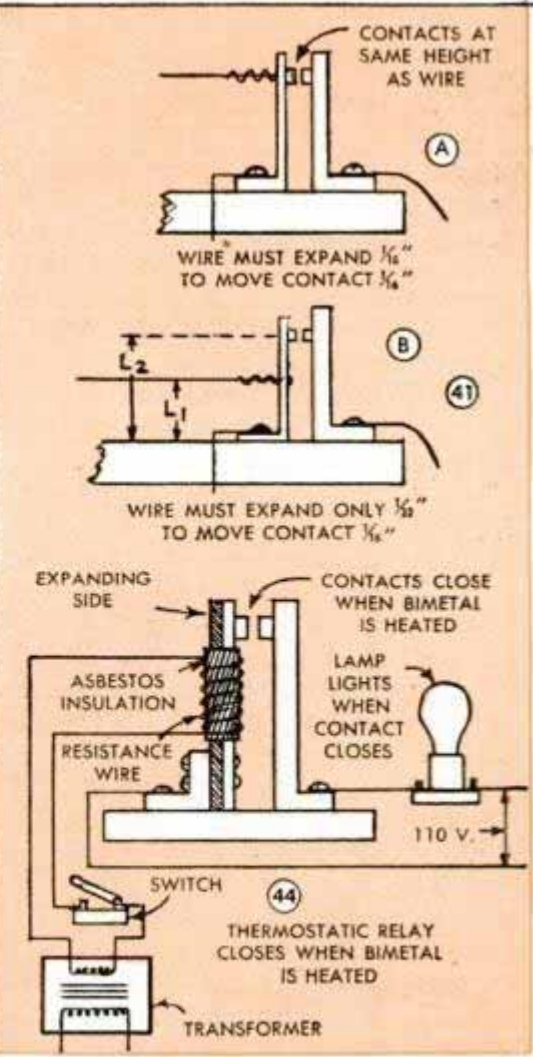
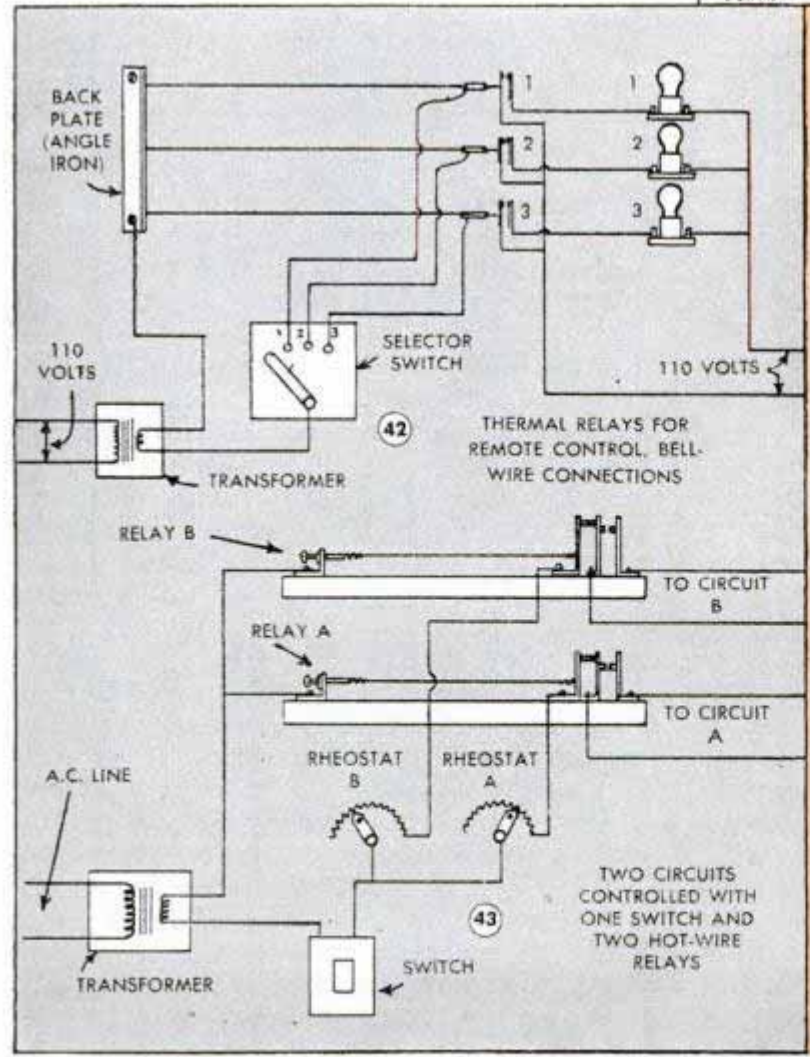
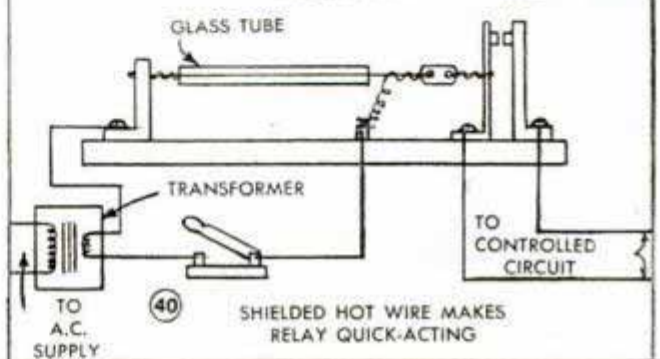


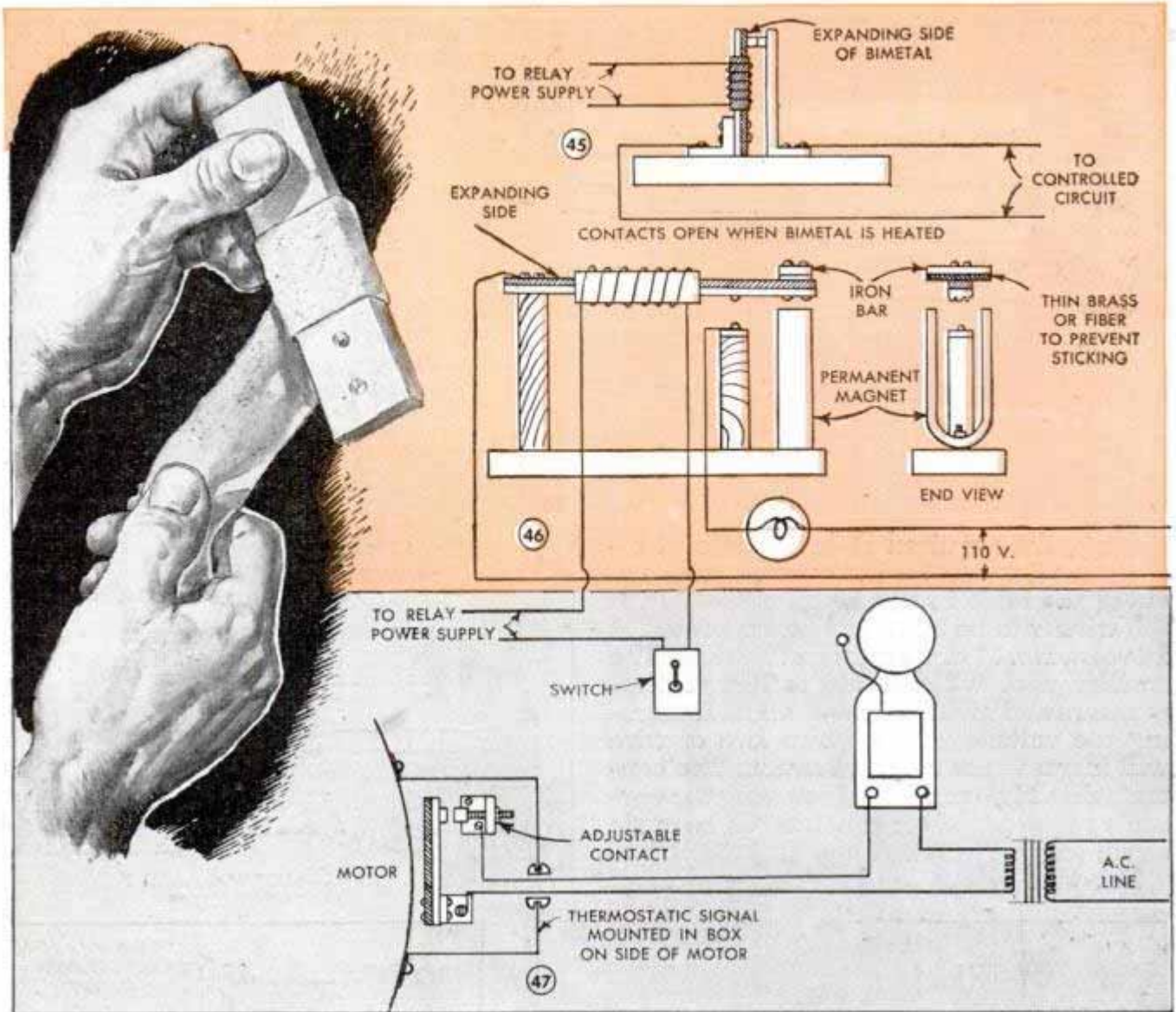
39 WIRE REQUIRED FOR BIMETAL-TYPE RELAYS

Volts	Wire Size (B & S)	Length of Wire
6	20	1 ft. 2 in.
12	22	2 ft. 10 in.
32	27	6 ft. 5 in.
110	32	23 ft. 7 in.
220	34	59 ft. 0 in.

voltage, the required B & S gauge of nichrome wire can be determined with the aid of the table in Fig. 38. For example, if the wire is to be 8 in. long and operated at 14 volts, No. 32 or 34 wire can be used. The smaller wire will operate at higher temperature and give faster operation. Increasing the voltage with a given size of wire will increase the speed of action. The contacts should be capable of carrying the currents required. Silver contacts can be made as shown in Fig. 34, A and B.

Hot-wire relays can be used in place of





magnetic relays in most cases except on emergency controls where rapid action is essential or where heavy sparking will occur when contact is broken. In Fig. 42 a group of thermal relays is used for remote control of a group of lamps. By setting the selector switch any one of the remote circuits can be controlled and time delay can be made short or long. In Fig. 43 two motors are controlled by one switch, but can be made to go on at any desired time interval after throwing the switch by adjusting the rheostat controls. The delayed action hot-wire relay also can be used to ring a bell if a door is left open for an appreciable period of time, Fig. 33. Normal use of the door will not cause annoying ringing, but warning will be given if the door is left ajar.

Bimetal-type relays, Figs. 44 and 45, consist of a strip of thermostatic bimetals about which a heating element of nichrome wire is wound. A thin layer of asbestos paper is wound around this, as shown in Fig. 44. When the resistance coil is heated, it causes the bimetals to bend and open or close the contacts. To lengthen the time delay, a heavier layer of asbestos is wound around

the bimetals strip. To shorten the time lag, the nichrome wire is wound over a thin layer of asbestos paper, and a layer of asbestos is wound over the coil. In either case, the relay will be slower to open. The time lag of bimetals relays also can be controlled by adjusting the contact gap and by connecting a rheostat in series with the heater coil, as already explained for hot-wire relays.

The design of bimetals relays often requires a little experimentation. Ordinarily, a strip of bimetals 0.030 in. thick, 1/2 in. wide and 4 to 6 in. long will be suitable for the element. The size of nichrome wire required then can be found by referring to the chart, Fig. 39, which also gives the approximate length of wire required. The ends of the nichrome wire must be fastened to the copper-wire leads with machine screws or by brazing. Figs. 44 to 47 inclusive show a number of applications of bimetals relays. In Fig. 47 the bimetals thermostat without winding is secured to the metal frame of an electric motor so that a bell will ring if the motor overheats. Fig. 46 details a snap-action type of bimetals relay.

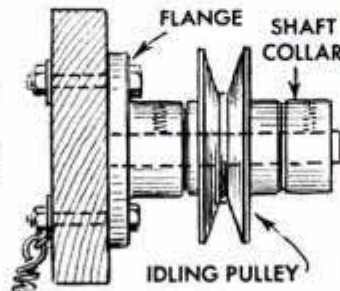
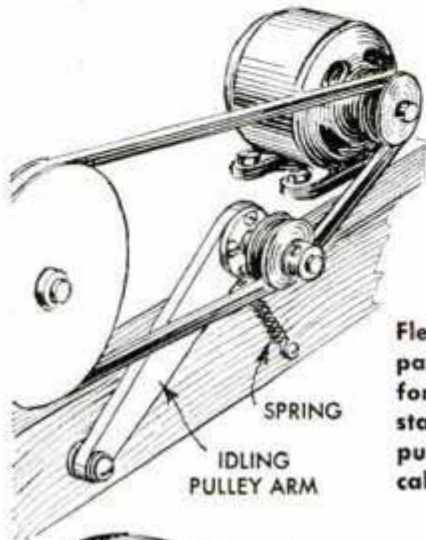
THE END

7 NEW USES FOR FLEXIBLE COUPLINGS

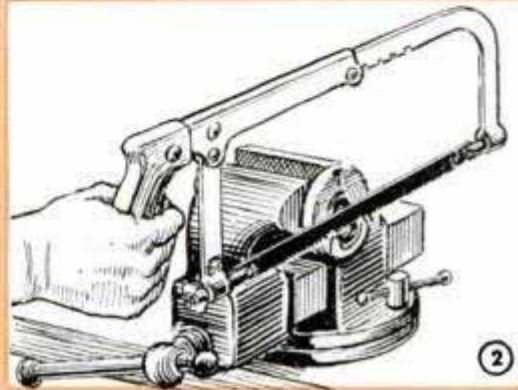
One of the handiest and most versatile items the home craftsman can have around his shop is a flexible coupling of the type used to drive machinery directly from a motor shaft. When taken apart and finished as shown in Figs. 1 to 4 inclusive, one of these couplings provides two flanges that can be used to mount numerous tools on shafts. The seven methods indicated are but a few of the uses that will suggest themselves to the worker after he becomes accustomed to them



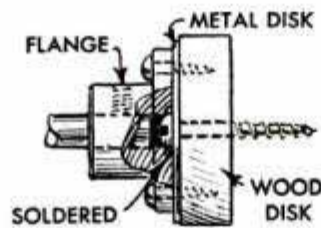
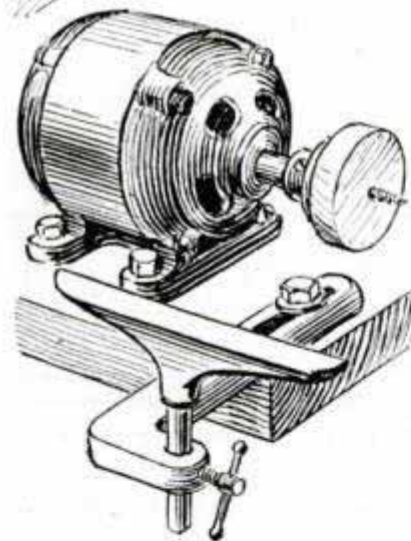
Couplings having a wide flange with room for bolt holes should be used. Remove the leather connector and . . .



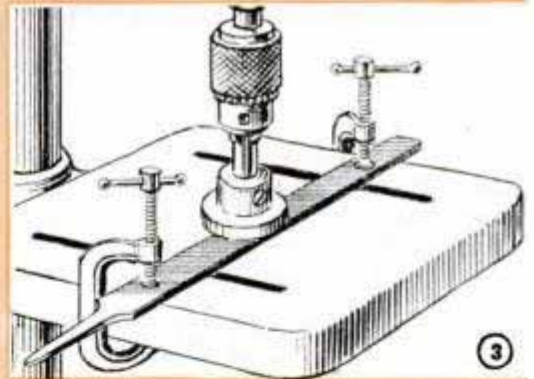
Flexible-coupling flanges are particularly useful as brackets for holding short lengths of stationary shafting. The idling pulley shown above is a typical application of this kind



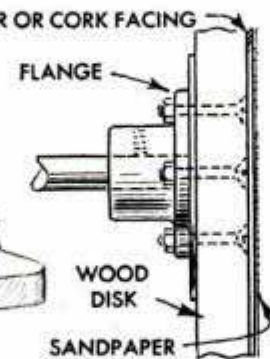
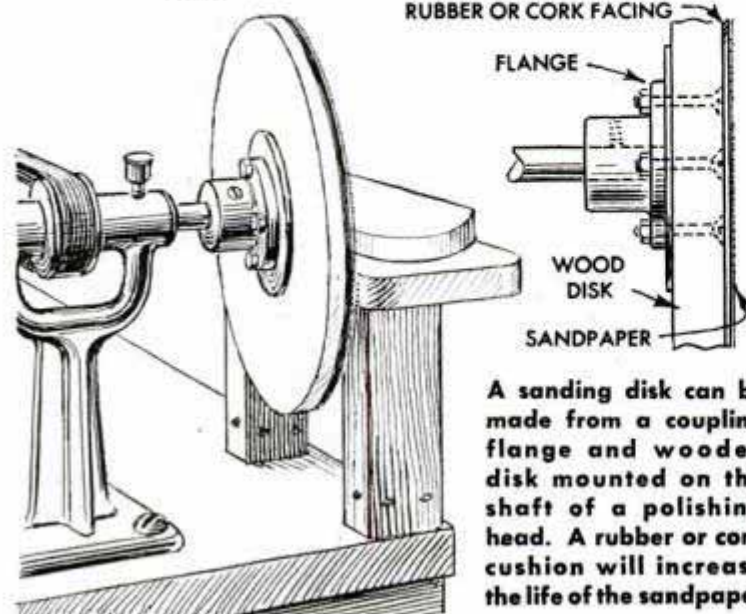
. . . saw off the projecting knobs on each flange. Then file flush with the flange surface to provide a perfectly flat base



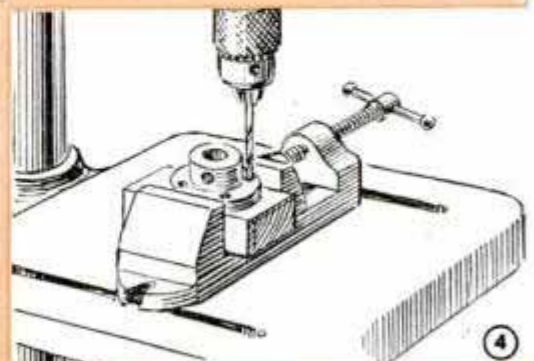
An improvised wood lathe for turning knobs and small parts can be made by soldering a wood screw on a metal disk and mounting it between the flange and a disk of wood as shown above. The assembly is then fastened to a motor shaft



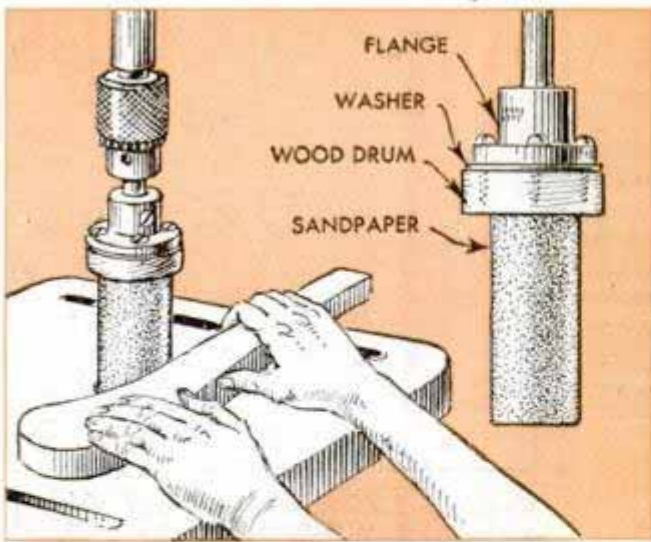
Flanges used to mount rotating tools can be trued up by spinning against a file clamped on the drill-press table



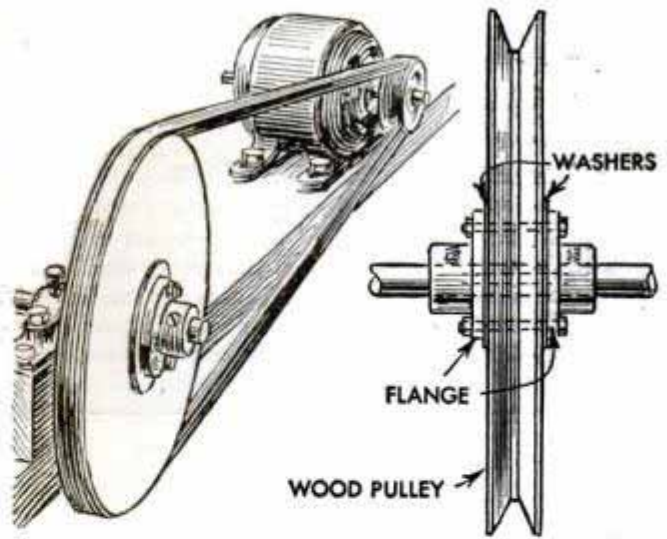
A sanding disk can be made from a coupling flange and wooden disk mounted on the shaft of a polishing head. A rubber or cork cushion will increase the life of the sandpaper



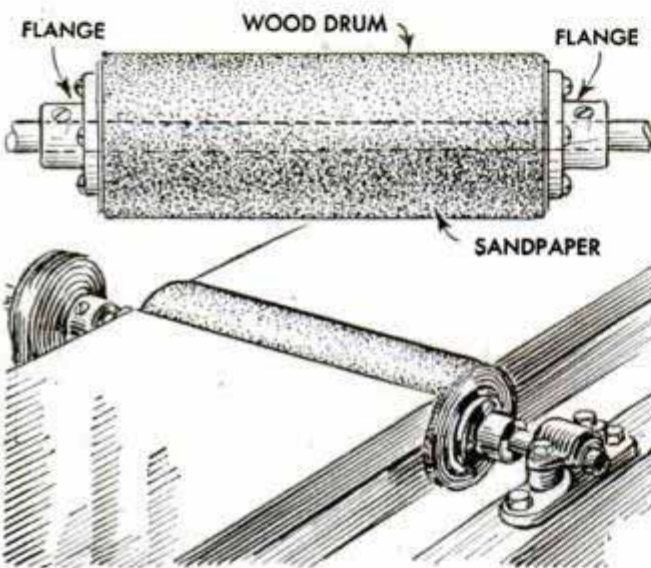
Four bolt holes, spaced to clear the set-screws, are then drilled 90 degrees apart and the flange is ready for use



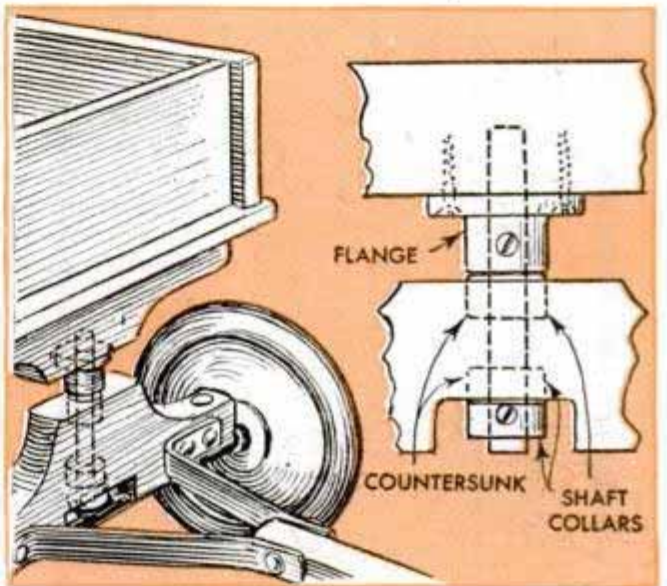
The sanding drum, pictured above, will speed up sanding of curved surfaces. A thick rim should be left at the top of the drum for fastening to the flange



Large slow-speed pulleys turned from wood and bolted between two coupling flanges are especially useful where a reduction of motor speed is desirable

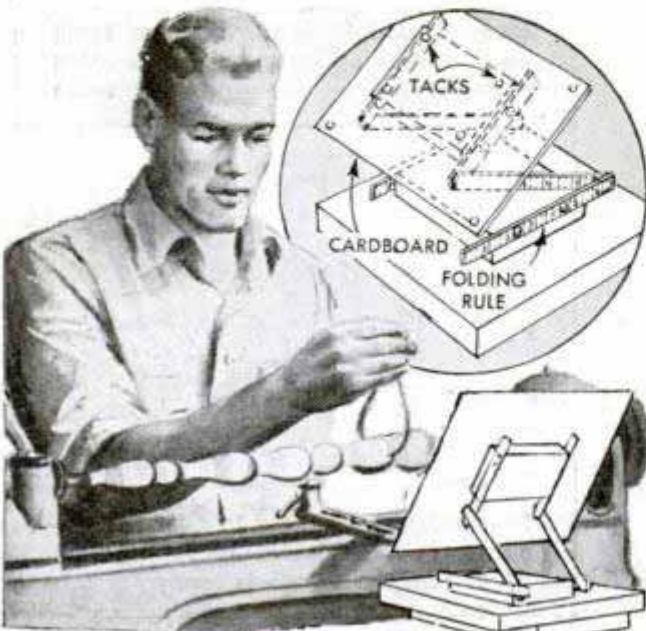


A table sander can be made by mounting a wooden drum, such as a rolling pin, on a shaft between two flanges. The drum can be trued up after assembling. A rear table surface should be flush with the top of the drum and the front table about 1/32 inch lower



The steering assembly of a child's wagon is another example of using the flange as a bracket. Two collars, with setscrews removed, are countersunk into the crossarm to serve as bearings. A third collar that has the setscrew tightened keeps the assembly together

Rack to Hold Shop Drawings Is Made From Broken Rule



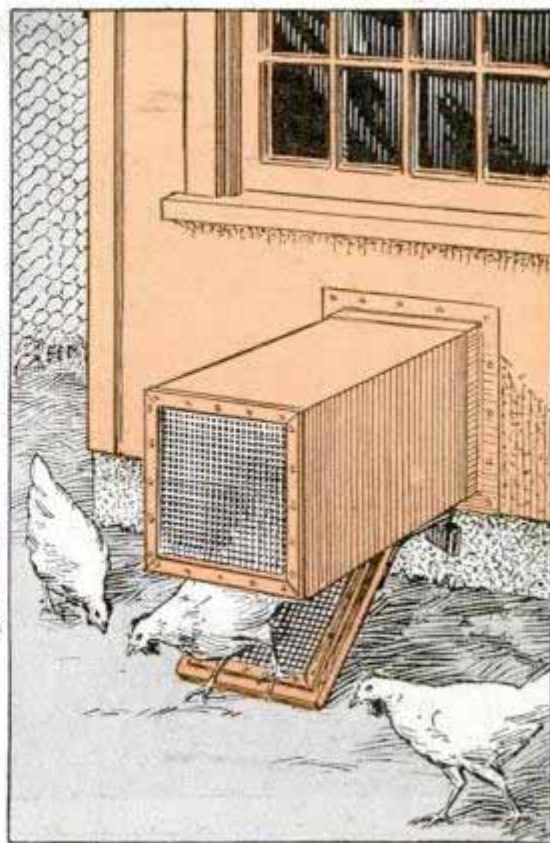
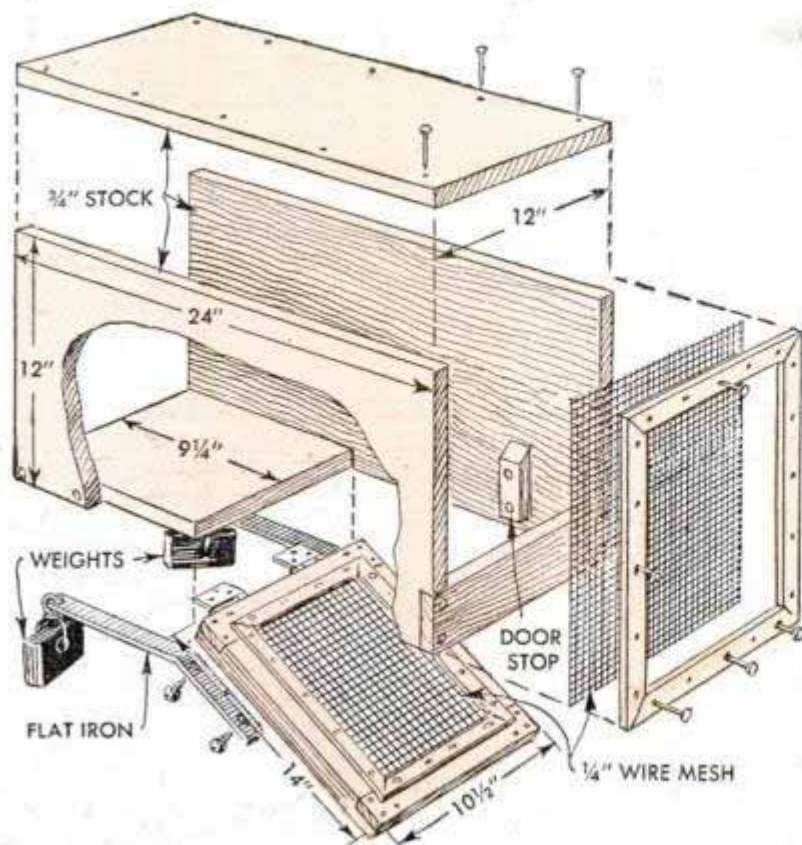
When you have a folding rule that is broken, you can make a holder for shop plans, using two three-section lengths. Dimensions can be varied to suit. The rack is adjustable to any angle and it is especially convenient for holding plans back of the machine but near the work.

Ralph S. Wilkes, Elbridge, N. Y.

Solution Will Remove Brick Stain

If powdered colors such as burnt sienna or Indian red are mixed with muriatic acid, the solution is ideal for washing brick surfaces that have paint stains. The acid dissolves the stain and deposits the color on the brick. The color used should match the original brick as closely as possible.—Richard Verbrugge, Grosse Pointe Park, Mich.

Tunnel Trap Releases Hens From Laying House



Every poultryman knows the advantages of releasing his flock from the laying house to the yard or range in the early morning at certain seasons of the year. To avoid the expense of a time clock and other devices for opening a door automatically at a given time, one poultryman built a simple trap that operates by gravity, keeps out marauding "varmints" during the night, and allows the chickens to release themselves at will as they come from the roosts. The parts are

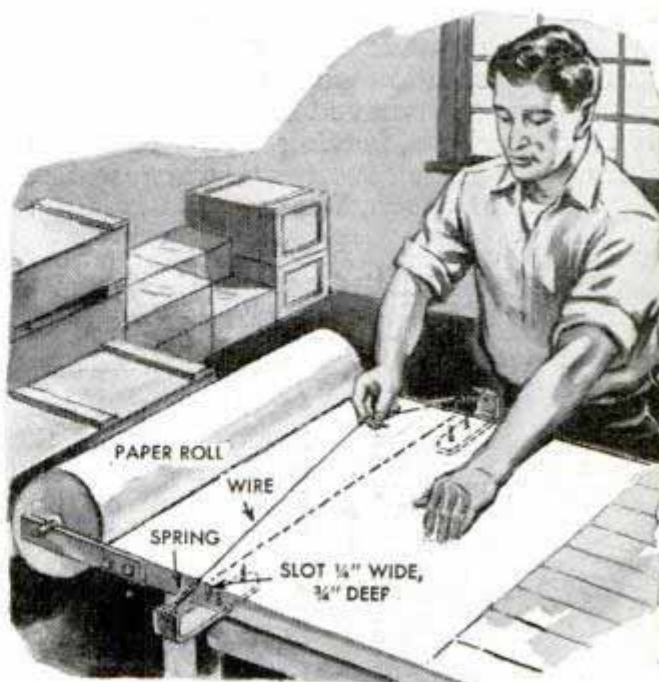
cut to the dimensions given from 3/4-in. white pine boards and after assembly the trap is attached to the side of the building slightly above the floor level. The opening in the side of the building should be the same size as the inside dimensions of the trap. The trap is attached to the building with light steel angles and screws and any cracks or openings around the angles are filled with putty or caulking compound to prevent water from leaking in.

Roll Paper Cutter Is Improvised From Light Piano Wire

Needing an additional paper cutter in a hurry, one shipping clerk improvised a cutter in the manner shown. The top of the table was slotted as indicated and two L-shaped metal brackets were screwed to the under side of the table top as in the detail. The length of piano wire is attached to the brackets with a coil spring at each end to provide the necessary tension. To cut the paper you simply grasp the wire at the center, lift it about 6 in. and let go. The down "snap" of the wire severs the paper neatly.

L. Meehan, Toronto, Ont., Can.

Ⓒ A peculiar noise sometimes heard in belt-driven equipment often is attributed to loose or dry bearings. In some cases the noise may be due to a loose setscrew in the driving or driven pulley. Should this noise occur, tighten all setscrews as well as oiling and checking the bearings.



Cement Is Held in Drain-Tile Joint By Wide Rubber Band



When laying drain tile, sometimes the seepage of water is so great that cement at the bell joints is washed away before it hardens. To overcome this, one contractor cuts wide bands from an old inner tube and slips one of them onto each piece of tile. Then after the tile is laid and the joints are filled with cement, the bands are pulled over the bell. The tile may be covered immediately and no damage will result if the rubber is left on the joint.

A. H. Waychoff, Phoenix, Ariz.

Ways of Removing Grease and Oil

Before painting, grease and oil can be removed from machinery by brushing the surface with slaked lime and water and letting the solution stand overnight. Oil and grease are removed from wood by applying whitewash, leaving it on for several hours and washing it off with warm water.

Nathan Bogoch, Winnipeg, Man., Can.

Number of Lines to Be Typed Shown by Indicator



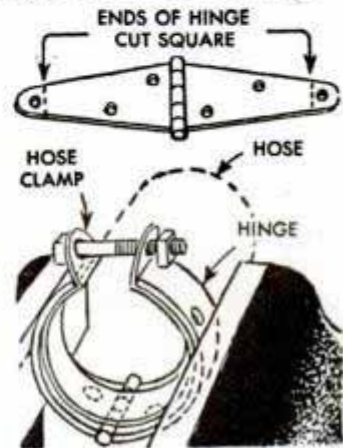
Here is a way of telling at a glance how many lines remain between the bottom of the page and the line being typed. Attach a strip of adhesive tape around the center of the

roller and type a number for each line. Then remove the tape and fasten it near the end of the roller. Start with number one when inserting a sheet of paper and roll the sheet through the machine to determine the number of rotations before the end of the sheet is reached. As an example, it may be determined that the roller rotates twice plus eight lines. Thus, if the roller has already made two complete turns and the indicator is at figure two, this means that six lines remain.

Frank Shore, New York, N. Y.

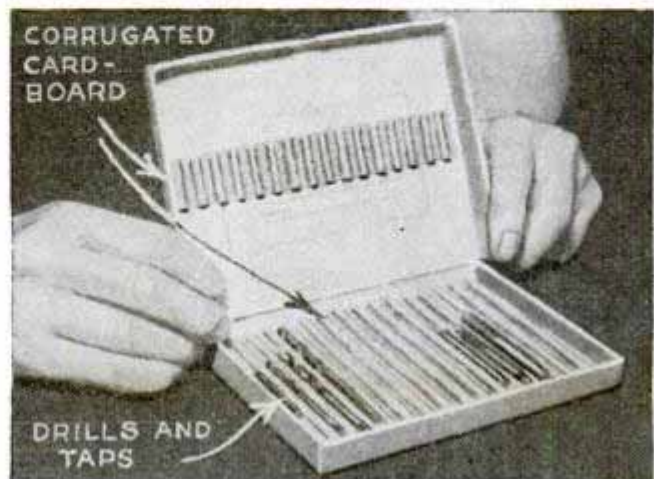
Tightening Large Hose Clamps

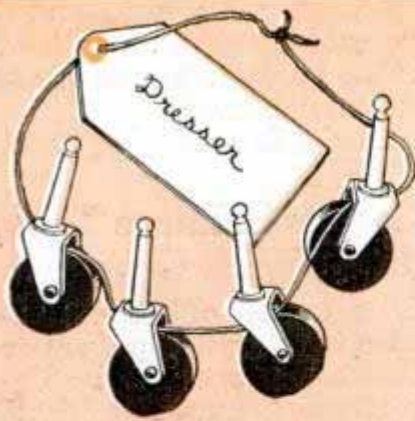
Finding it hard to tighten clamps on hose 2 in. and larger in diameter, one pipe fitter used a compressing tool made from a heavy strap hinge. The rounded ends of the hinge were cut square and the two leaves were bent in an arc to form a circle. This was fitted over the clamp and hose and tightened in a vise. Using this method, there is no danger of bending the clamp out of shape and it is compressed enough so that it can be bolted easily.



Small Drills and Taps Are Kept In Flat Cigarette Box

A handy box to hold small drills and taps can be made from a flat cigarette box and corrugated cardboard. A square of cardboard is cut to fit the box and a smaller strip is attached to the lid. The corrugations should match so that when the box is closed each drill or tap will be in a channel formed by the facing corrugations. Drill and tap sizes can be lettered on the inside of the lid at the proper grooves.



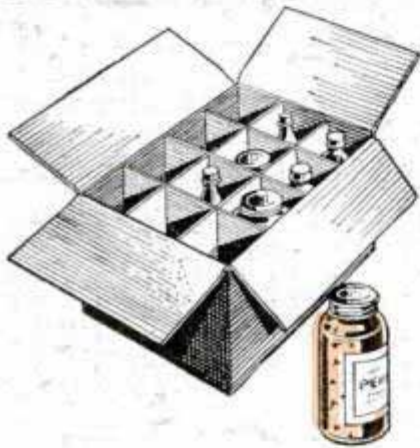


Loose casters may drop out and be lost in transit. Remove each set, tie the casters together and label with a tag



Covers on baking-powder tins, bottle caps, etc., can be secured with strips of adhesive tape to prevent spilling

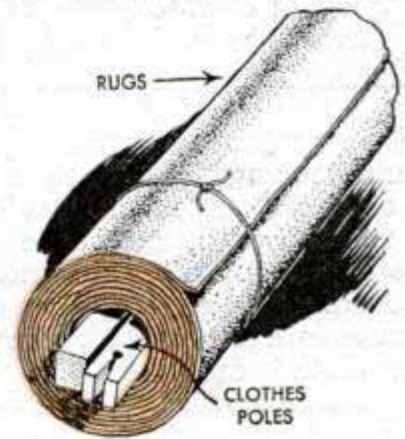
HELPFUL HINTS for MOVING DAY



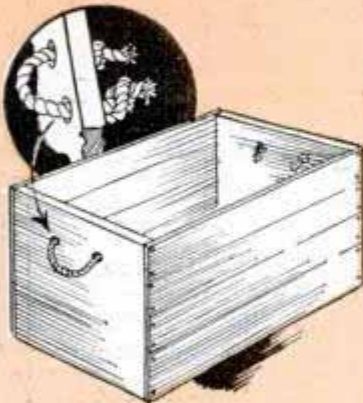
Bottled inks, preserves and medicines may be protected against breakage by packing in a partitioned paper carton



You can avoid a lot of stair climbing by lowering or hoisting boxes, small furniture and similar items with a rope



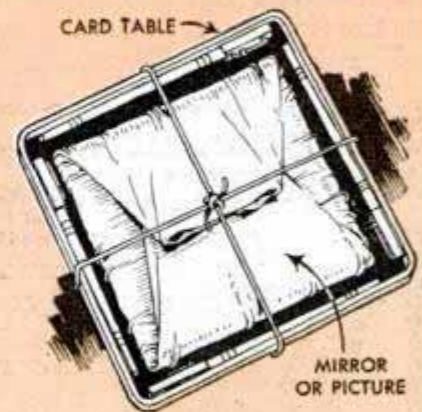
A clothes pole or section of a quilting frame in each rug aids in keeping the roll straight when you pick it up



Wooden boxes packed with tools or books need a handle at each end. Drill holes at the ends and tie in rope handles

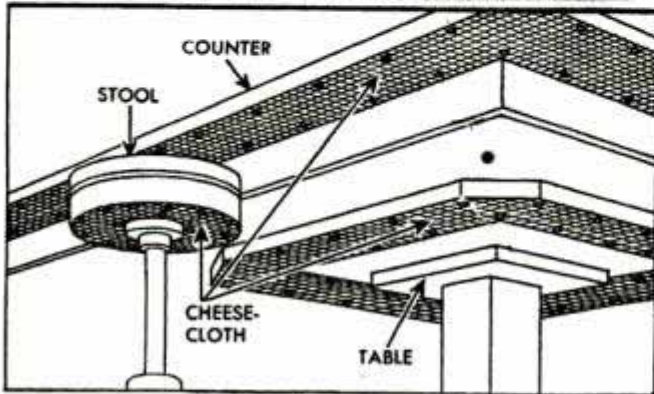


Pack records and magazines together. Insert the records between the magazine pages and tie the bundle securely



Wrap a mirror or picture with padding and tie it to the underside of a card-table top so that it cannot fall out

Cheesecloth Will Protect Fixtures From Chewing Gum



One restaurant owner found that by thumbtacking cheesecloth to the underside of counters, tables and stools, he was able to remove easily gum stuck there by the customers. A double thickness of the cloth is used. When cleanup time comes the old cheesecloth is removed, thrown away, and new cloth is tacked on.

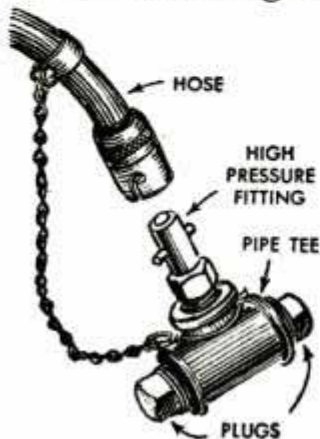
Peter B. Horsley, Brandon, Man., Can.

Roofing Paper for Storage Bins

If grain storage bins are needed in a hurry, temporary ones can be made of No. 12 wire fencing and asphalt roofing. The fencing is wired in the shape of a circle and is lined with asbestos-surface asphalt roofing. For the top the same paper is used, but the flooring is ordinary asphalt roofing.

Harold Melville Peer, Des Moines, Iowa.

Fitting Prevents Loss of Grease Out of High Pressure Hose



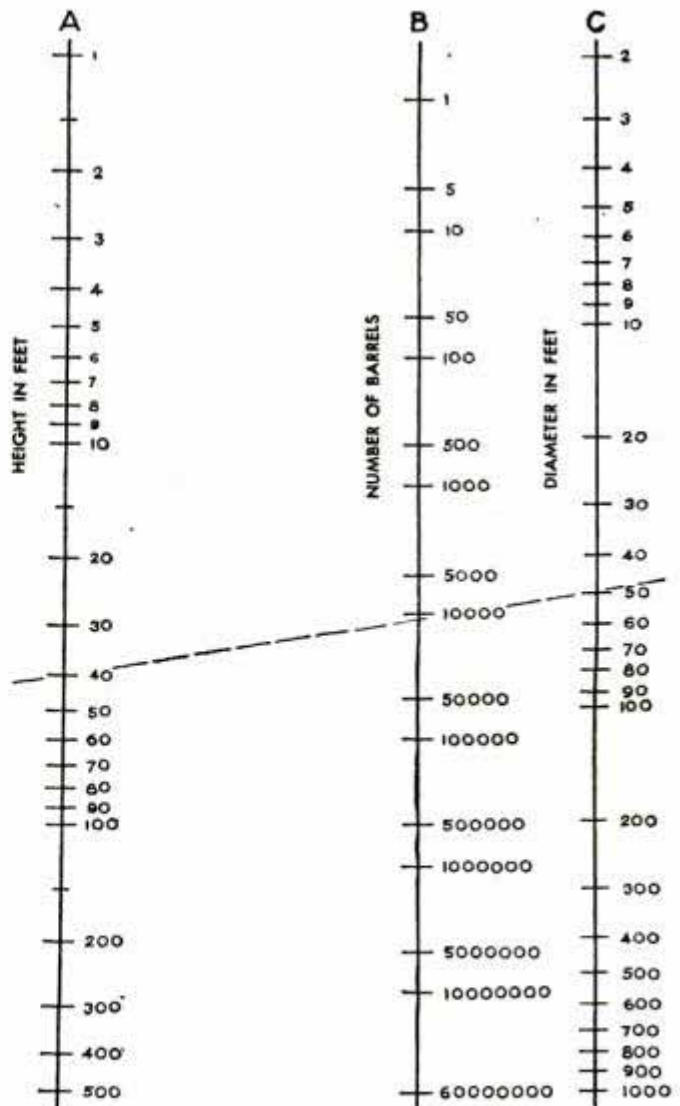
When the hose is removed from a high pressure fitting, grease sometimes leaks out of the hose and makes a puddle where the work is being done. This can be prevented by using an assembly similar to the one shown. It con-

sists of a $\frac{1}{8}$ -in. tee, two $\frac{1}{8}$ -in. plugs and a straight high pressure fitting. A length of chain fastened to the hose will prevent mislaying the plug when not in use.

Charles H. Hardy, Los Angeles, Calif.

Number of Barrels in Large Tank Is Calculated With Chart

Calculation of the number of barrels contained in a circular tank, standpipe, vat or other large cylindrical shape can be determined easily if the height and inside diameter are known. In the preparation of this chart a 50-gal. barrel was taken as the standard. To use the chart, locate the height of the tank on column A and the diameter on column C. Connect the two points. Where the connecting line crosses column B a third point is found which shows the number of barrels in the tank. As the example shows, a tank 40 ft. high and 50 ft. in diameter would contain approximately 12,000 barrels. To determine the number of barrels when a 50-gal. barrel is not the standard, find the number of gallons in the tank by multiplying the estimated number of 50-gal. barrels by 50 and divide this by the number of gallons in a barrel of different capacity.





Flat Screen Picture Tube

THERE are no rounded corners on the end of this cathode-ray television receiving tube to reduce the useful area of the screen. The face of the tube presents a perfectly flat surface upon which the fluorescent screen is deposited, therefore an undistorted picture is presented to the viewer when looking at it from any angle, as illustrated in photo A.

Conventional tubes, unless viewed from a position directly in front of the tube, show edge distortion because the image details are curved away from the viewer. The engineers of the Philco Corporation have solved this problem with the tube shown in photo B. Additional improvements eliminate a troublesome yellowish brown stain that often occurs in the center of the picture screen after a few hours' operation. This stain is caused by heavy negative ion impact upon the screen which cannot be focused and deflected by the usual magnetic deflection coils. Passing down the center of the tube, they concentrate on one central spot and destroy the fluorescent properties of the screen in that area. Diagram Fig. 1 shows how a "bent" electron gun permits a special bending coil to be adjusted so that the useful electron beam issuing from the cathode is bent to follow the axis of the gun. The unwanted ions thus are trapped and removed from the electron beam.

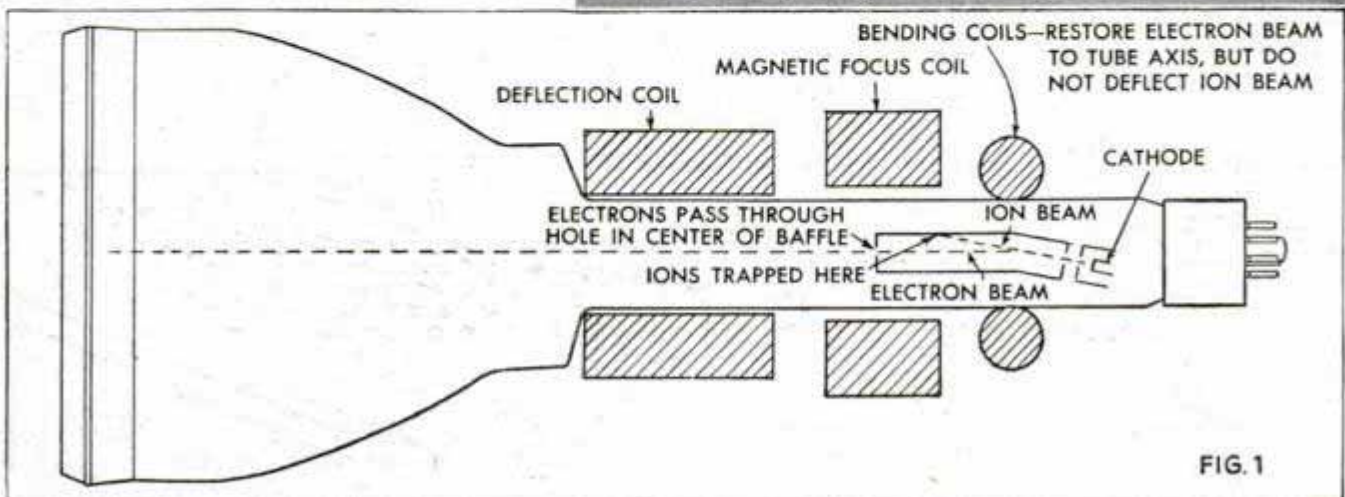
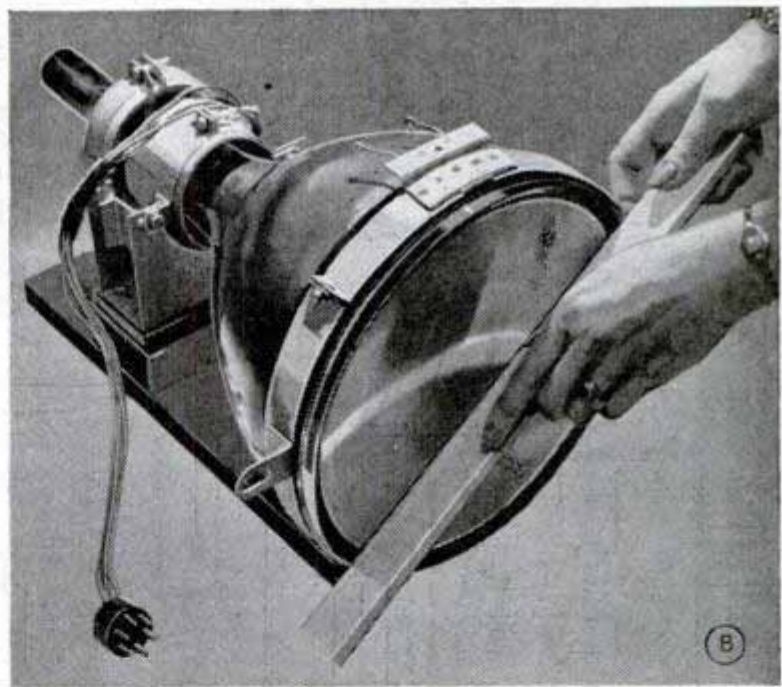
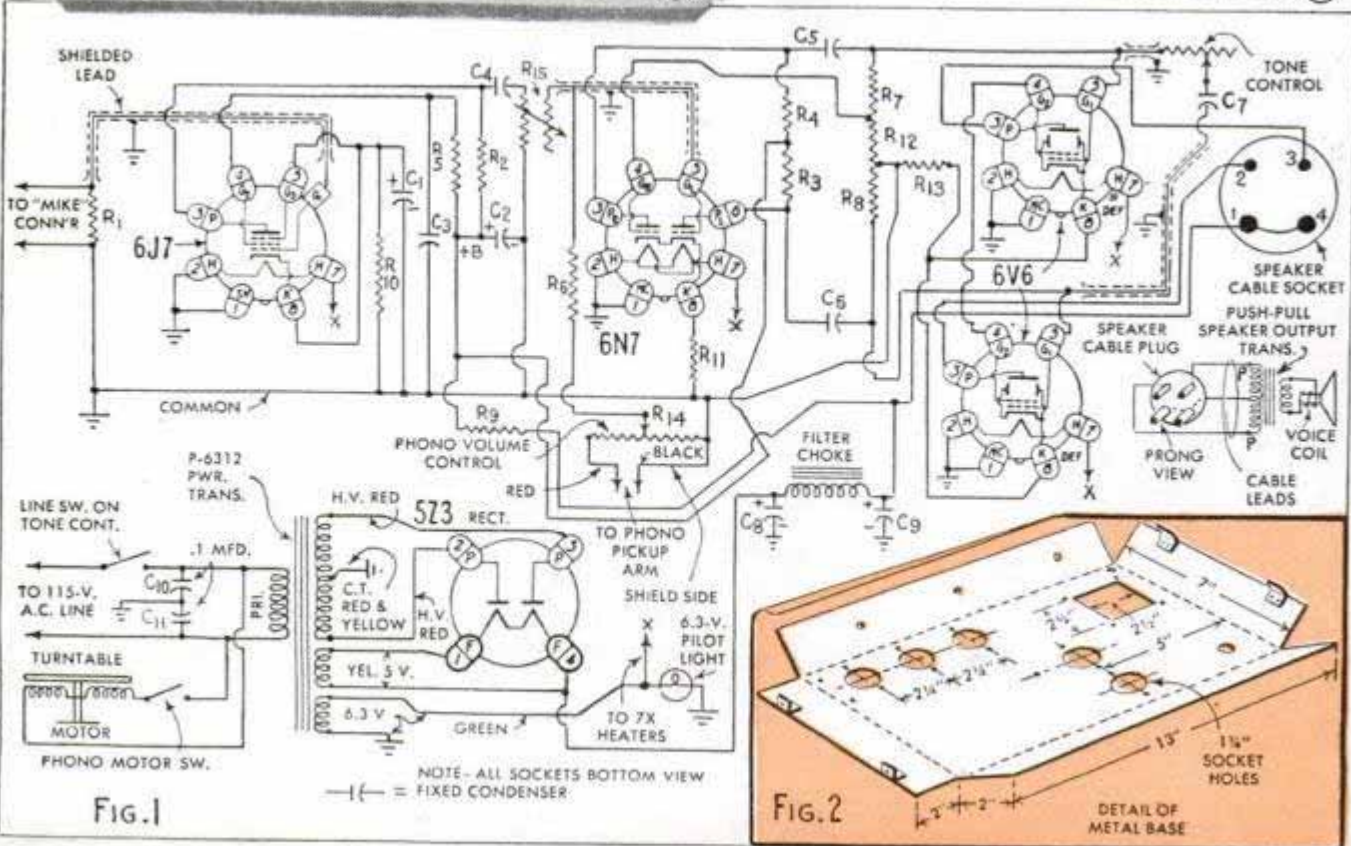
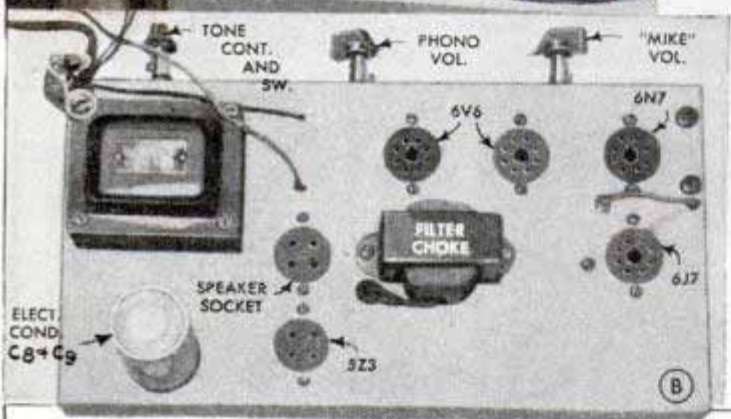


FIG. 1

UTILITY P.A. AMPLIFIER SYSTEM

By A. I. Rattray

THIS compact unit is a self-contained amplifier with speaker and record player combined within a standard metal case which also acts as the speaker baffle. The utility of such a piece of electronic equipment is immediately apparent as it is unnecessary to run speaker cables or connect a separate record player. All you have to do is plug into a 115-volt outlet and you are ready to operate. A microphone channel is provided and separate controls adjust the volume of "mike" and phono channels individually; a tone control is also included.

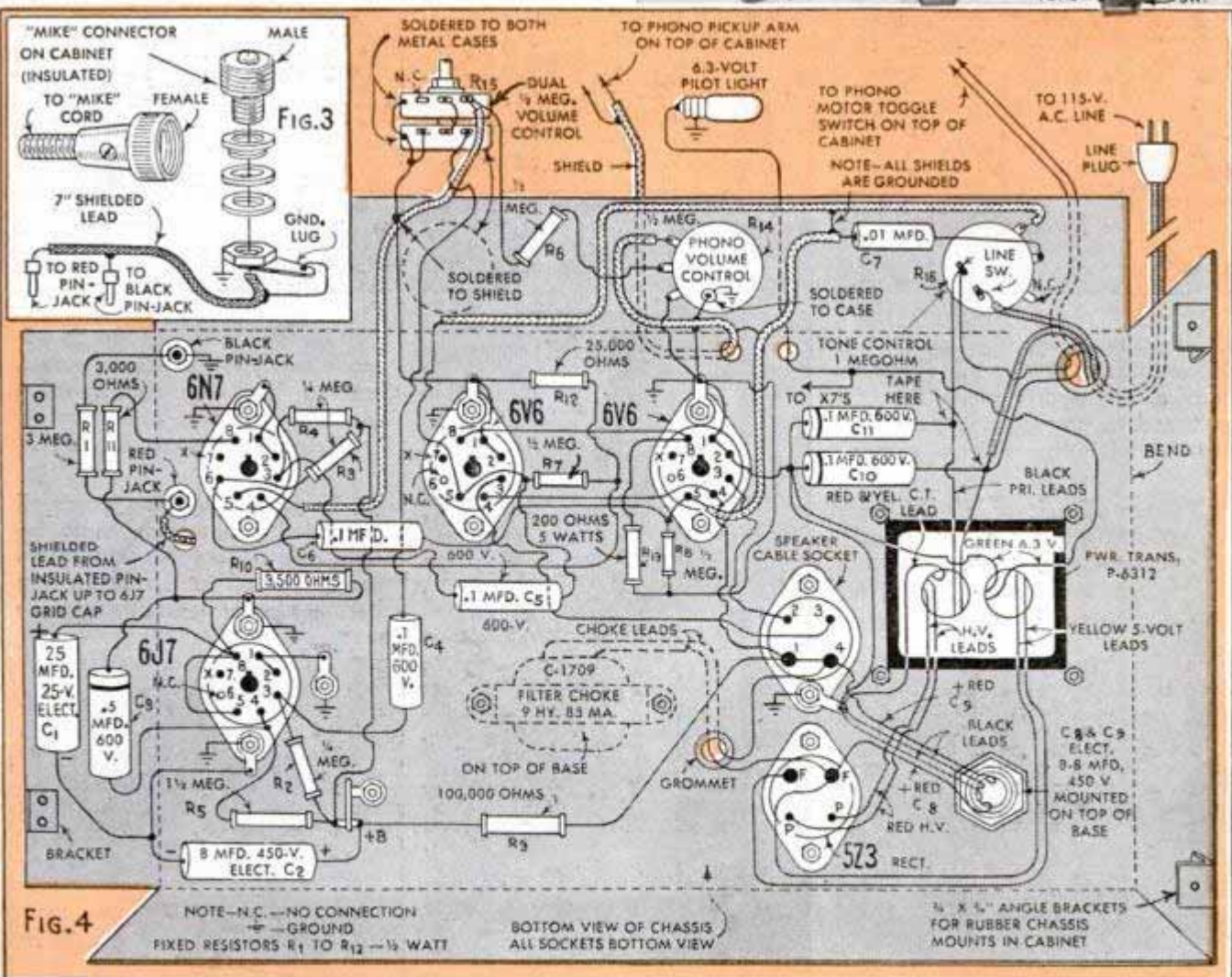


IS SELF-CONTAINED

Push-pull 6V6 beam power output tubes provide excellent quality and sufficient volume for dancing parties or audiences up to 500 without distortion. The amplifier chassis, phono motor and pickup are "float" mounted on soft rubber bushings.

Photos A and C show front and back views of the completed unit and it will be noted that a heavy duty 10-in. PM speaker is employed. A top view of the amplifier chassis appears in photo B and the schematic circuit diagram is given in Fig. 1. Fig. 3 shows the "mike" connector assembly which is mounted on the front panel. The metal cabinet is 16 by 16 in. and 8 in. deep; any a.c. phono motor and 9-in. turntable may be used. Wiring details and specifications are shown in the pictorial diagram, Fig. 4.

This highly efficient unit also may be used with a pickup microphone for amplifying stringed instruments. Detailed student material list R-344 is available from Popular Mechanics radio and electronics department upon receipt of ordinary letter postage.



Helpful AUTO RADIO SERVICE HINTS

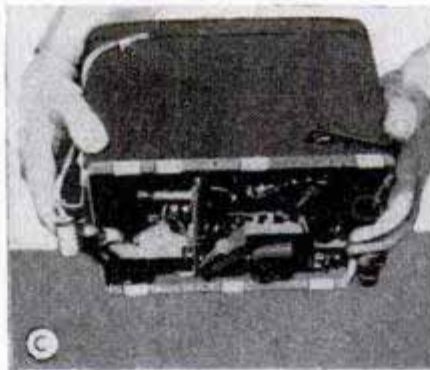
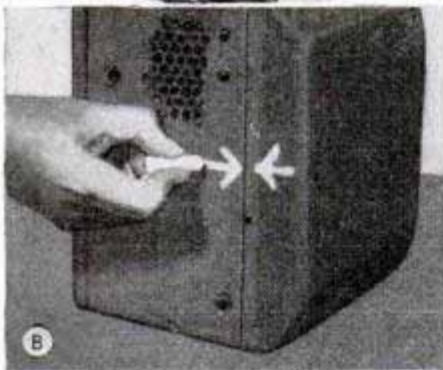


(A) Loose or corroded rod antenna connections in mounting insulators may cause weak reception. A simple test for this condition is to substitute a temporary antenna; a short length of No. 12 rubber-covered wire is taped along the side of the car and clipped directly to the set antenna terminal

(B) When opening the set for repairs, mark the case covers before removing, as usually only one correct position will prevent shorting of terminals

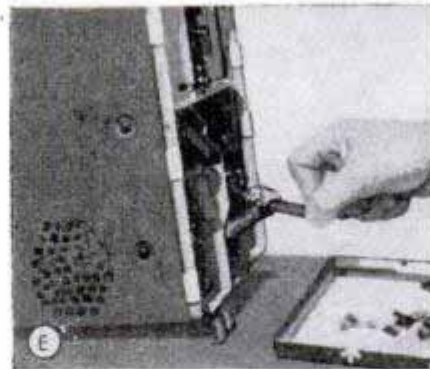
(C) After making repairs, such as soldering loose connections or replacing defective parts, shake out all loose particles of solder by jarring the set gently on the workbench as illustrated

(D) Intermittent reception often is caused by the shorting of tube grids to cover plate or speaker housing if attached to lid. Adhesive tape over tube-shield tops will solve this problem



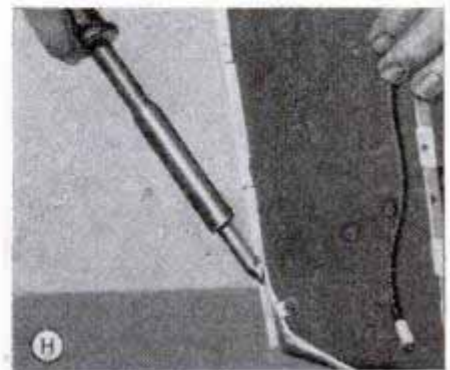
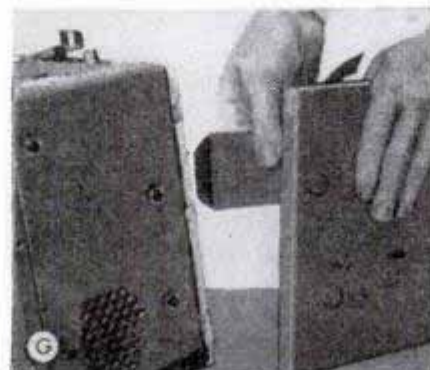
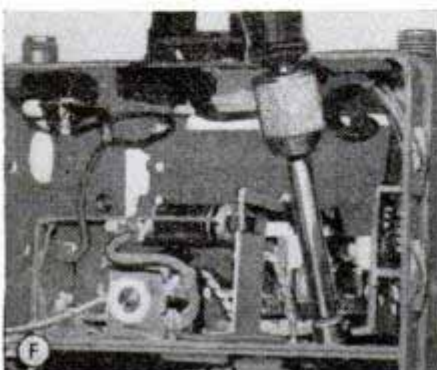
(E) When replacing fixed condensers or other parts having flexible leads, all exposed terminals should be taped to prevent any possible contact with the bottom cover

(F) Tighten all screws in shielding compartments after working on any auto radio as vibration loosens such screws and is a cause of troublesome humming noises



(G) Emery cloth is used to remove rust spots on cover plates, as the inside edges of these plates must make good contact with the case to avoid noise

(H) To prevent ignition noises all grounded connections must be good. Shielded cable with metal braid bonded to the case often becomes loose; clean and resolder



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KODAK VERICHROME (rolls, packs)—America's favorite snapshot film by a wide margin.



KODAK PLUS-X (rolls, packs)—all-round "pan" film; combines high speed, fine grain.



KODAK PANATOMIC-X (sheets, miniature rolls)—extremely fine grain, for big enlargements.



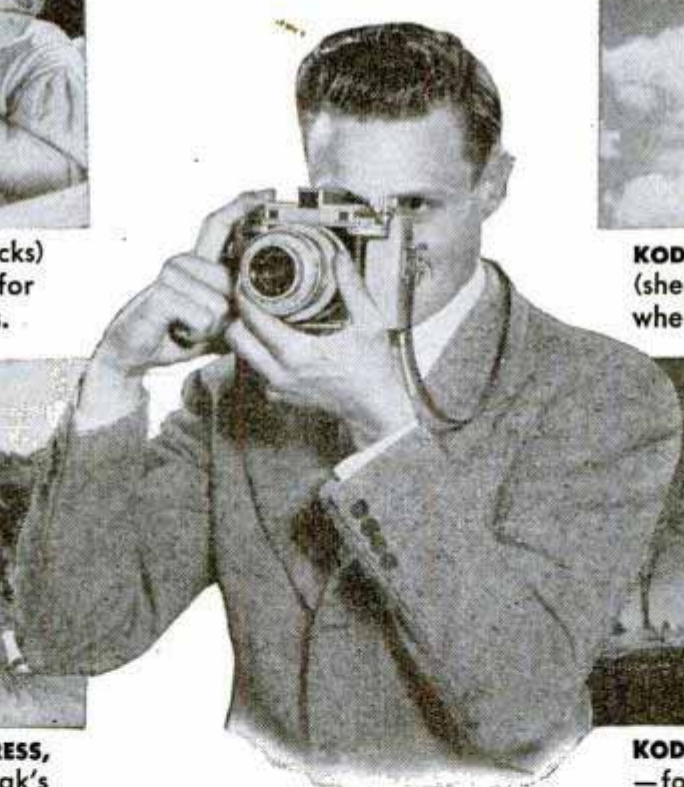
KODAK SUPER-XX (rolls, packs)—favorite high-speed film for both outdoors and indoors.



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KODAK SUPER PANCHRO-PRESS, SPORTS TYPE (sheets)—Kodak's fastest—for tough sports shots.

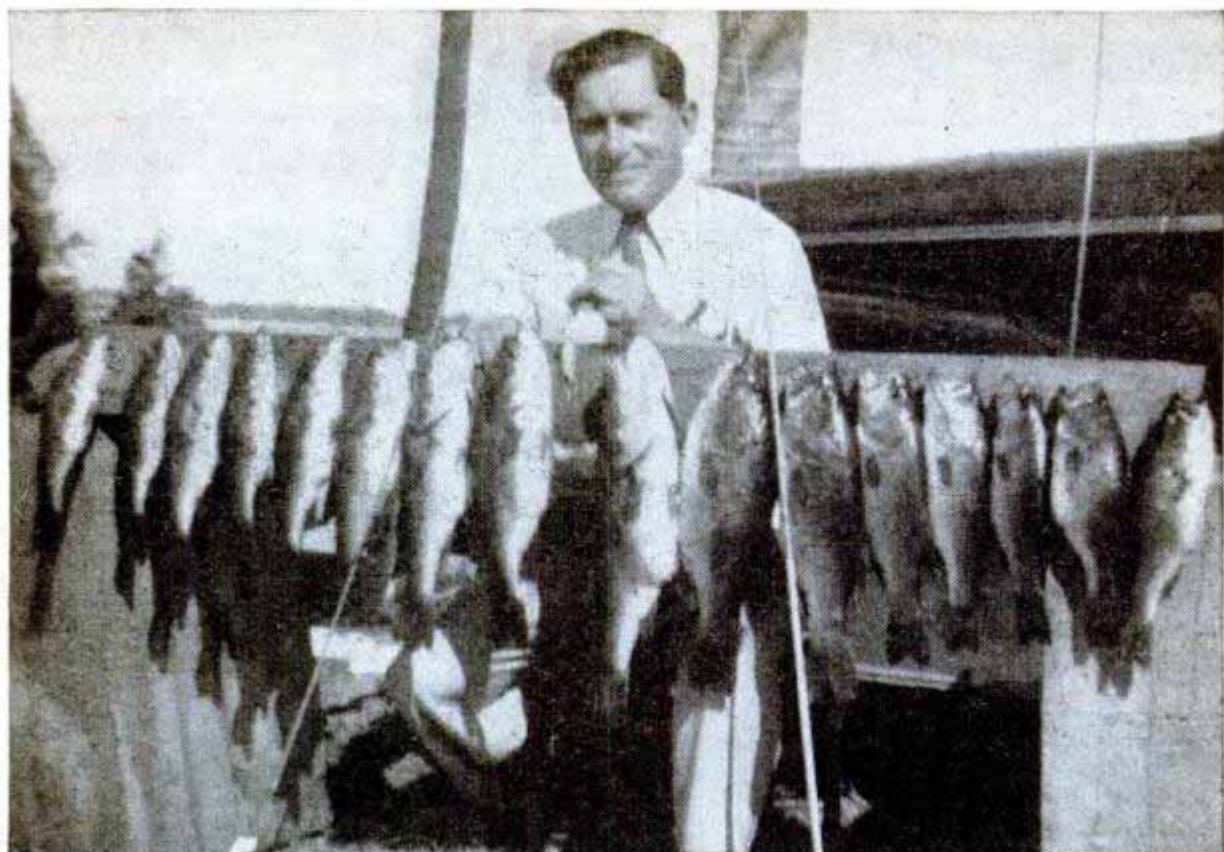


KODAK INFRARED (rolls, sheets)—for dramatic effects; cuts through haze.

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Got Two Man Limit in 3 Hours



Lake Okeechobee catch made by Dr. Field and friend on Hawaiian Wigglers

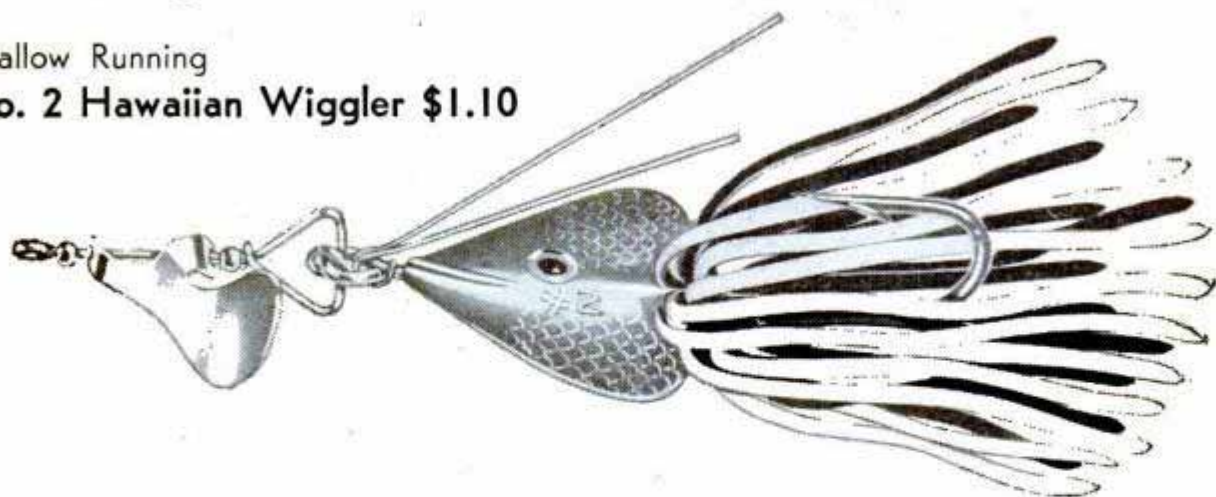
With No. 2 HAWAIIAN WIGGLER

Dr. J. J. Field, dentist of Washington, D. C., writes that he and Leroy Howard, Ft. Lauderdale, Florida, caught these bass with No.

2 Hawaiian Wigglers at South Shores, Lake Okeechobee. They got their limit of eight per person in three hours.

Shallow Running

No. 2 Hawaiian Wiggler \$1.10



Write for Free Catalog

It has all the latest information on where and how to use Hawaiian Wigglers, Jitterbug,

my famous surface bait, and also my new Hula Dancer just announced.

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How to CHANGE A TIRE AT NIGHT...

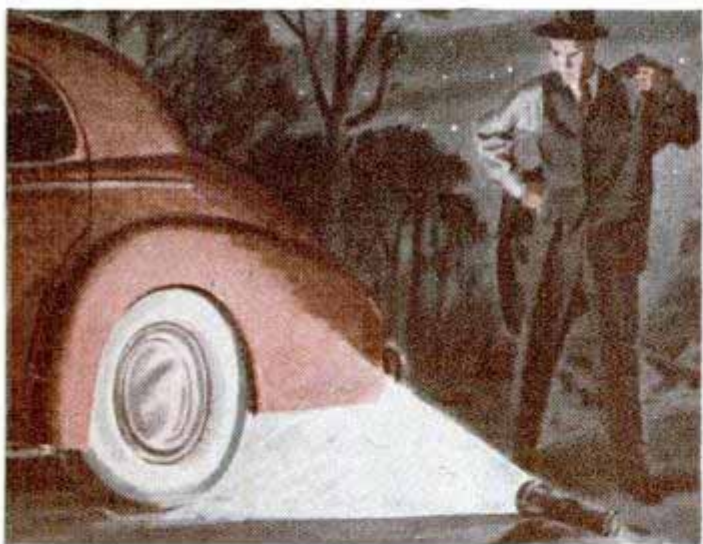
More Quickly—More Safely!



1 Most any motorist can change a tire. But few can change it at night with top speed, efficiency—and *safety!* Night-time tire-changing can be hazardous—but a little care and an "Eveready" flashlight can reduce the danger. First principle, says the American Automobile Association, is...



2 Park *off* the highway, if at all possible. Next best place is on a *straight* stretch of road where you can be seen for at least 500 feet. If you *must* park on a curve, a light should be set on the road some distance back. Be sure neither you nor a by-stander blocks off the view of your tail-light!



3 Keep all your tire-changing tools tied or boxed *together*, where you can pick them up without searching or fumbling. Remove your spare before jacking up car—tugging at it later might push car off jack. If alone, set flashlight on a stone in convenient position.

For

**EXTRA POWER,
EXTRA LIFE
—AT NO
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FOR BEST RESULTS PUT IN SERVICE BEFORE OCT. 1946

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EVEREADY

EXTRA LONG LIFE BATTERY

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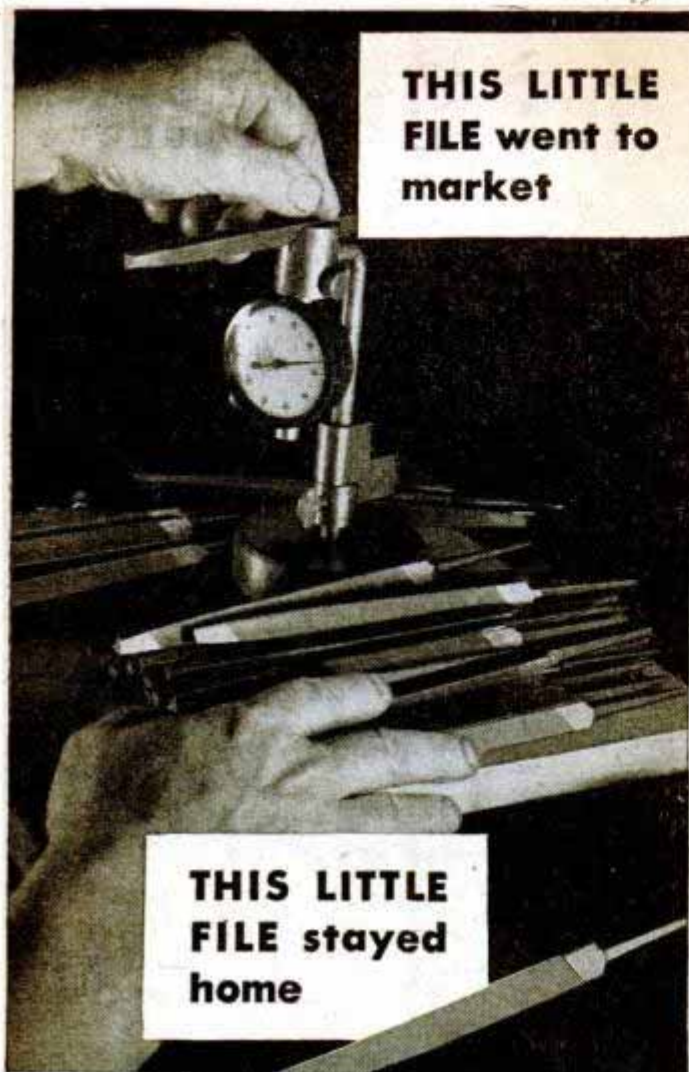
4 In your car or at home—wherever you need a flashlight—rely only on "Eveready" batteries. For "Eveready" batteries have no equals... that's why you'll find them in *more* flashlights than any other battery in the world! Now that they're available again, there's no need to accept a substitute!

NATIONAL CARBON COMPANY, INC.
30 East 42nd Street, New York 17, N. Y.
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FILE stayed
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THE little files that "go to market" under the world-famous Nicholson and Black Diamond trade-marks are only those which can uphold the long-standing Nicholson guarantee of *Twelve perfect files in every dozen.*

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The testing operation illustrated above is one of many. Here, triangular files are being checked, one by one, with a dial gauge to see that edges are uniformly correct in width.

The mechanic who asks the boss for Nicholson or Black Diamond brands shows that he knows files—and, most likely, that he is a worker of high talents.

FOR REPAIR SHOP, HOBBY SHOP, HOME OR FARM, get Nicholson or Black Diamond files from your hardware dealer. For information on kinds, use and care of files send for free book, "FILE FILOSOPHY"—48 interesting illustrated pages.

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(In Canada, Port Hope, Ont.)

**NICHOLSON
FILES** FOR EVERY PURPOSE

How Deep Is the Ocean?

(Continued from page 127)

when, at the last moment, the Hornet's orders were changed and instead of striking Okinawa the task force sortied for an attack on Formosa. Later the Hornet did hit Okinawa but by that time the pilots trained for the Sonne work had been switched to other assignments for tactical reasons. Still undaunted, Kistler took two green pilots, gave them hurried instructions and sent them off, hoping for the best.

Under these circumstances it is not surprising that the mission was unsuccessful. The first pilot flew a perfect course but was just above his altitude limit. The second pilot failed to open the camera doors in front of the lenses.

Last chance to get the coverage came on March 1 when the Hornet again hit Okinawa. Kistler had stuck with it. He now had his original pilots back with him and his hopes brightened.

The day of the strike broke bright and clear. The Hornet turned into the wind and launched a flight of Hellcats, among them Davidson and his Sonne equipment. Then followed the period of waiting for the planes to return to the ship, with nerves on edge and minutes dragging into hours.

Some of the group had landed when Kistler spotted the photo plane coming up the groove. The landing signal officer was giving Davidson the "come on," trying to get him into position. At the last moment, the plane was waved off.

Just as Davidson made his turn for the second approach, the engine coughed and sputtered. He inadvertently switched to a reserve gas tank which was already empty. The engine cut out and the plane headed for the drink with its equipment and film and undoubtedly the whole future of Sonne photography.

Davidson switched to another tank, this

(Continued to page 232)

**Model Builders
Attention!**

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

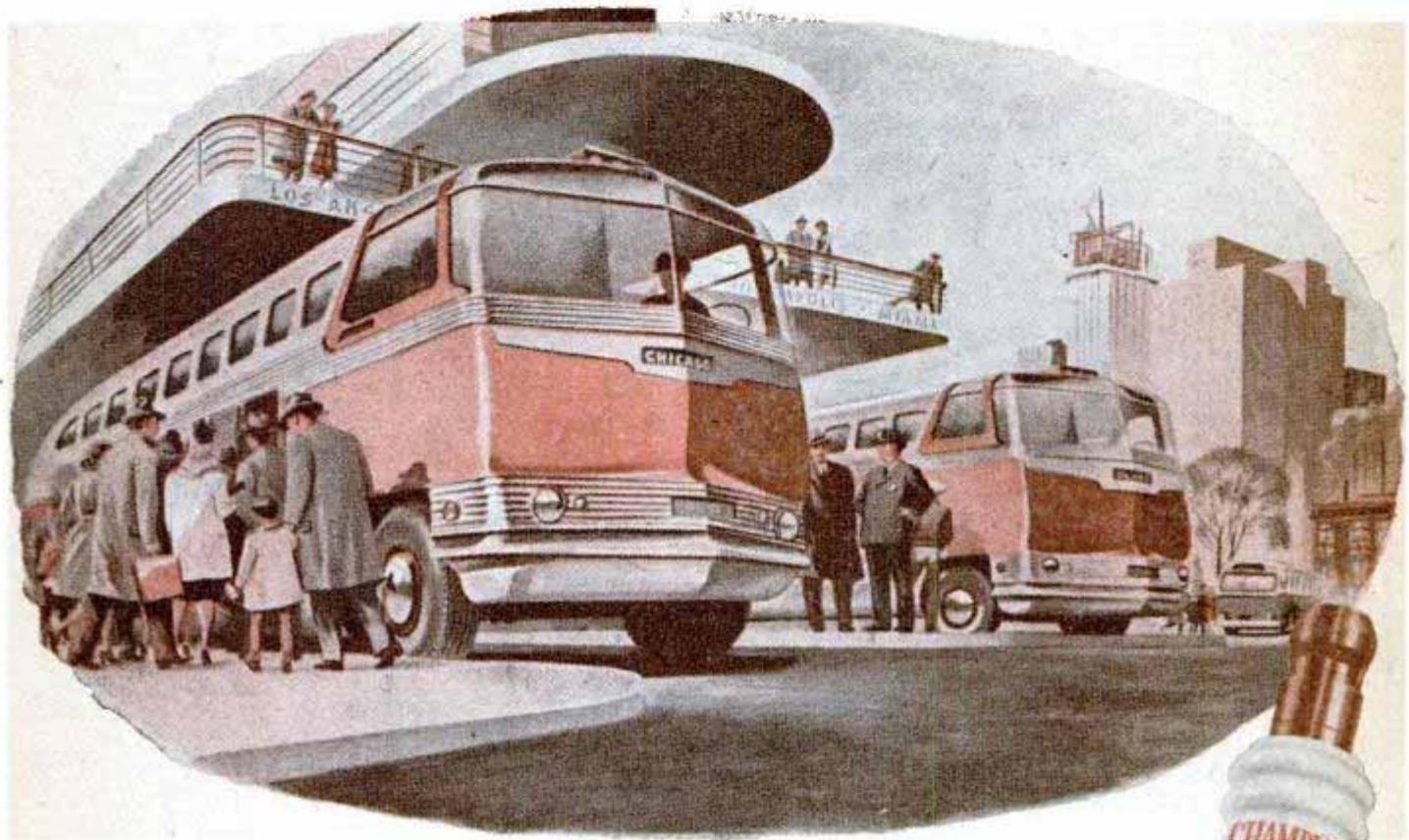
Actual Size V-Plug

Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Silliment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

CHAMPION

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Why Bus Lines specify Champion Spark Plugs

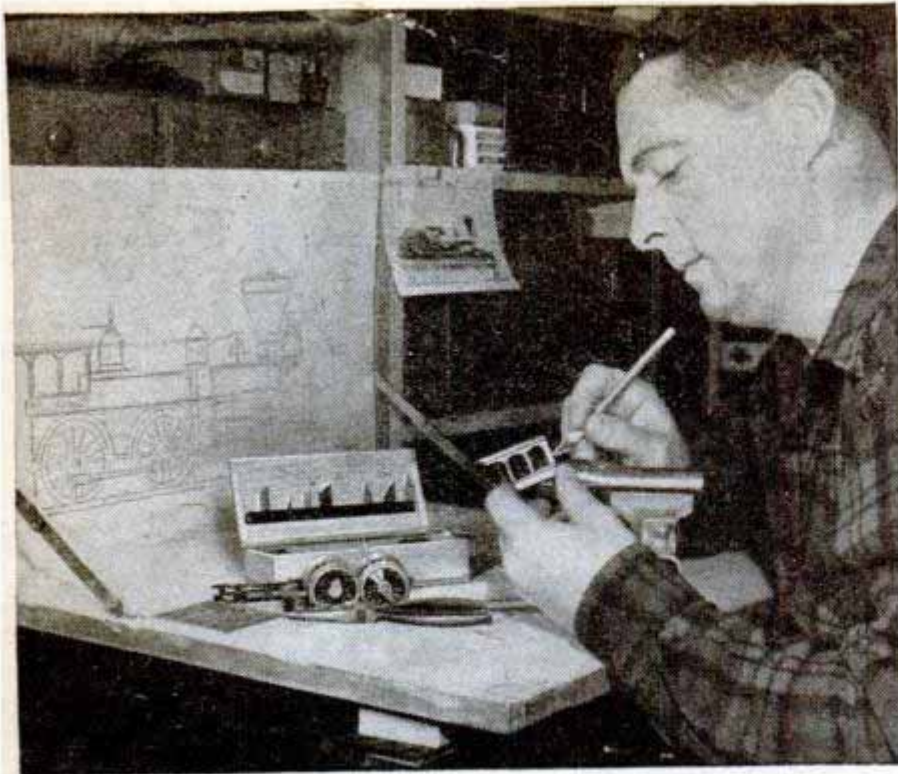


THEY'RE DEPENDABLE!

The bus lines of America are indispensable to our transportation system. They are experts on maintenance of equipment because efficiency and economy are absolute essentials to success in their business—no factor is too small to escape detailed study. That is why most bus lines with the best maintenance records specify dependable Champion Spark Plugs. This is another example of preference for Champions by experts—substantial evidence that they're better for your car. Champion Spark Plug Company, Toledo 1, Ohio.



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James W. Burbank, of Narrowsburg, N. Y., builds scale models of famous old locomotives. He's a perfectionist. When he finishes a model, it looks real enough to chug off under its own steam.

Here you see him finishing the in-laid walnut cab for his model of the Erie's old George C. Bernard, speed demon of the 1870's. You see, too, three good reasons why he turns out such beautiful work, i.e., the picture of the original engine; his own accurate scale design; and his *indispensable* X-acto Knife Set.

"X-acto Knives are tops," says hobby crafter Burbank. "They're so versatile. I can find a blade-handle combination for the toughest or most delicate jobs . . . And those little pin vises . . . their heads fit my hands

perfectly. I recommend X-acto to every model builder!"

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V is for Versatile

... as in

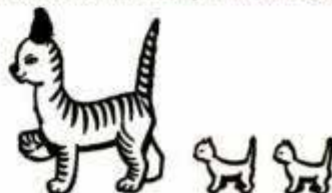
X-ACTO!



X-acto's 3 handle styles and 13 blade shapes fit every type of cutting job. But if you're a one-knife man, we recommend for all-round work . . .



X-ACTO No. 2 KNIFE, with solid duraluminum handle, made with new improved chuck collet. Knife alone, 50c. With 5 assorted blades, in #52 Set, \$1.



WHITTLE A LITTLE? Send 10c for a copy of "Whittling Is Easy with X-acto!" You'll be an expert in no time.



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OK, JUNIOR! Here's your X-acto Junior Knife, shaped like a Spitfire fuselage, with a two-edged blade. All-metal. Only 25c.

SPLIT SECOND SPEED



Savage Model 6— .22 cal. automatic rifle. "15 shots as fast as you can pull the trigger." Also, instantly adjustable as a bolt action repeater or single shot.

Fast? You bet! With a Savage .22 caliber automatic rifle you'll get off 15 shots as fast as you can pull the trigger. Here's the auto-loader you've been waiting for. It's light in weight, fine handling and brings you all the built-in features of accuracy, dependability and correct design for which Savage sporting arms are world famous. For the thrilling sport of speed shooting at small running game, rapid fire target work, or just plain and fancy "plinkin'," you'll double your shooting thrills with this great Savage rifle. Your dealer has—or will have soon—this Savage .22 automatic and a selection of other Savage sporting arms, including the sensational new Lightweight Automatic Shotgun.

SAVAGE ARMS CORPORATION, UTICA, N.Y.
Operating plants in Utica, N.Y. and Chicopee Falls, Mass.



Savage Model 29— .22 cal. hammerless, slide action repeating rifle. Extra long, "man's size" checkered fore-end gives perfect balance and permits easy, relaxed shooting position.



Savage Model 4— .22 cal. bolt action, clip magazine, repeating rifle. Easy to handle, accurate, priced moderately. Just the rifle for informal target shooting and small game hunting.



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**WORLD FAMOUS FOR
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**Manufacturer of
SPORTING ARMS, LAWN MOWERS AND ICE CREAM CABINETS**

RUB ON

Let dry a minute

WIPE OFF

*Clean em up
Shine em up*

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**Quick
ZECOL
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ZECOL's popularity with car owners is due to its Quality, its Quickness and Ease of Application.

ZECOL adds a brilliant lustre to all types and colors of leathers and enamels.

Keep your car looking shiny and new. It's so easy with ZECOL.

If your car has an accumulated road film, use ZECOL Scum Remover before applying ZECOL Wax.

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**ZECOL
COOLING SYSTEM
CONDITIONER**

Recommended to remove and prevent rust. Easy to use. No draining or flushing. Add to radiator—clean up rusty water while you drive. Lubricates water pump, bearings and seals. At service stations and garages.

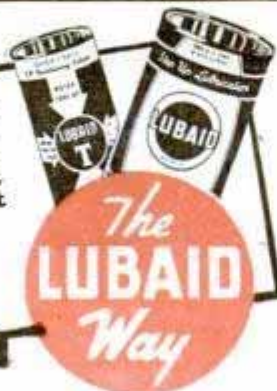
**ZECOL INC., Dept. 3
Milwaukee 1, Wis.**



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For smooth engine performance—pep and power—for stepped up lubrication—to free sticky valves—keep rings and valves free—ask for LUBAID. At service stations and garages.

**LUBAID CO., Dept. 3
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ly five feet off the water, the engine caught. As it turned out, the photography was excellent. Kistler flew the films to Guam on March 5. The results were so reassuring that the Army requested two Hellcats be assigned to Yontan Field to do tactical Sonne photography as the Okinawa campaign progressed.

Nine low-level Sonne combat missions were flown over Okinawa during the fighting. Large scale photos, taken at altitudes from 100 to 300 feet, provided ground support information that was not available by any other photographic means. As Colwell pointed out later, "the scale of the photographs was so large that you could see Japs, telephone wires and everything but the fleas on the sugar cane."

Although Japan surrendered before this new system of photography could be tested further in combat, it did arrive in time to prove its value. Reports from the fleet indicate that the Sonne camera is here to stay.

"With the camera able to procure photographs at air speeds even greater than 1000 miles per hour, it would appear that this is the only naval aerial camera adapted to ultramodern, high-speed warfare," said Commander Hutchison of Fleet Photographic Group Two.

Kistler and Colwell, who went ashore with the invasion forces at Okinawa, had the satisfaction of verifying many of their height and depth computations with actual measurements. Their average error on water depth and roughness of the reef was considerably less than one foot.

"Incidentally," reported Colwell, "the LST loaded with artillery went aground on the reef 800 feet from shore."

The Gold Bug Strikes Again

(Continued from page 149)

Highly mechanized, placer mining includes the use of such Rube Goldberg equipment as bucketline and dragline dredges and power shovels which scoop up gold-bearing gravel in huge bites. The gravel then is relayed to a processing unit and the gold washed or shaken out.

Dragline operation holds the most promise for the future. In the 11 years before operations closed down, dragline mining grew from a \$6000 to a \$6,000,000 industry and today there are from 300 to 400 such dredges in operation all over the world.

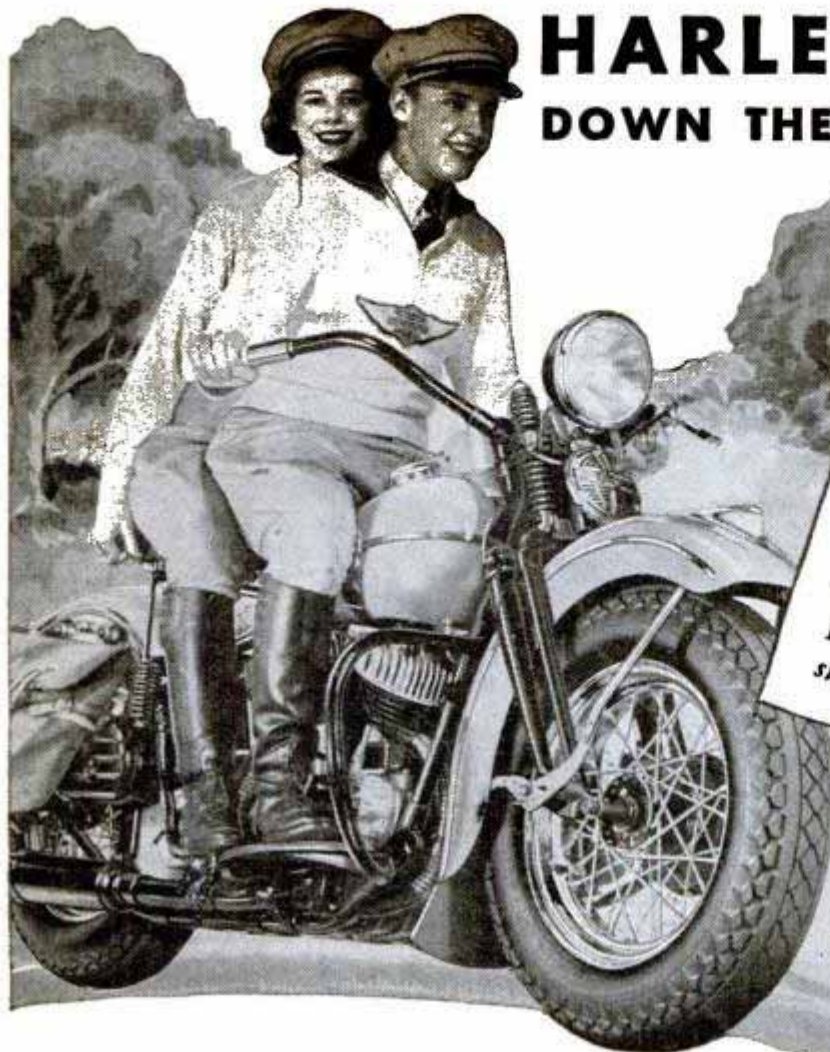
Draglines require a low initial investment, can be operated by three men per shift and are sectionalized so that they may be moved quickly by truck, train, ship or

(Continued to page 236)

RIDE A NEW

HARLEY-DAVIDSON

DOWN THE ROAD TO HAPPINESS



Here's a letter that's typical of many received:

"Have an order for a 610HV with my home dealer — for delivery about the time I hope to be discharged. Many pleasant memories were left behind when I entered the service. I know how anxious all riders are to get astride a dependable Harley-Davidson and start down the road to happiness."



THAT letter tells the whole story! Thousands of enthusiasts are eagerly looking forward to good times in the world's greatest sport — motorcycling! Be ready to ride *your own* NEW HARLEY-DAVIDSON on fun-filled vacation trips — or take in race meets, hillclimbs, endurance runs and other thrill-packed motorcycling events! See your Harley-Davidson dealer EARLY — and send the coupon NOW!

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HARLEY-DAVIDSON MOTOR COMPANY, Dept. P, Milwaukee 1, Wis.

Please send at once free copy of 24-page "Enthusiast" Magazine, filled with motorcycle action pictures and thrilling stories.

Name.....

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City..... State.....



★ **WHEN IT'S AN EXIDE... YOU START**

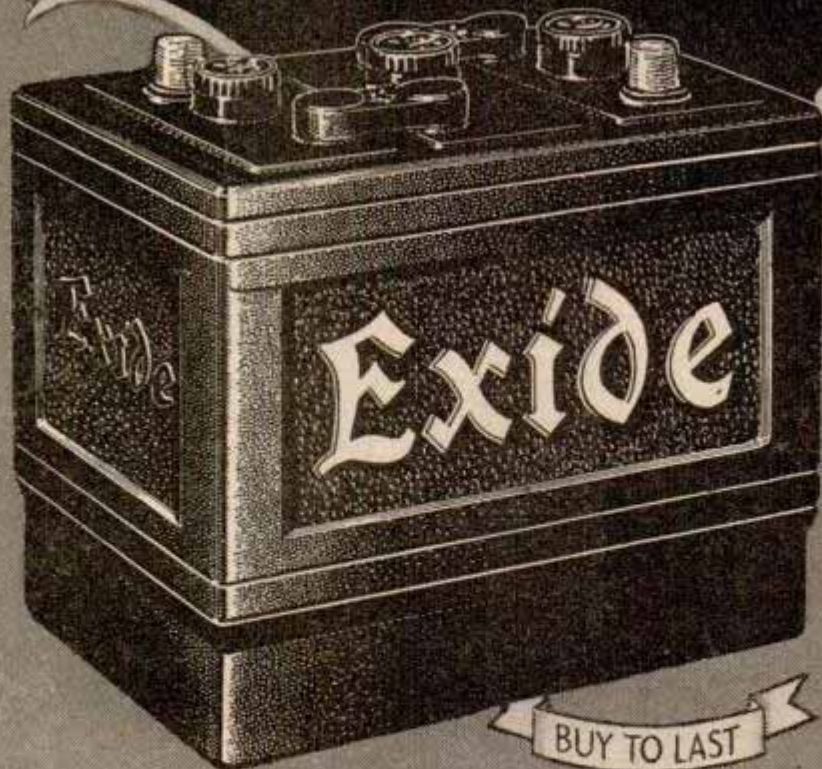


Expect good service from the dealer who features product brands of **KNOWN** high quality...and you'll seldom be disappointed.

THE ELECTRIC STORAGE BATTERY COMPANY

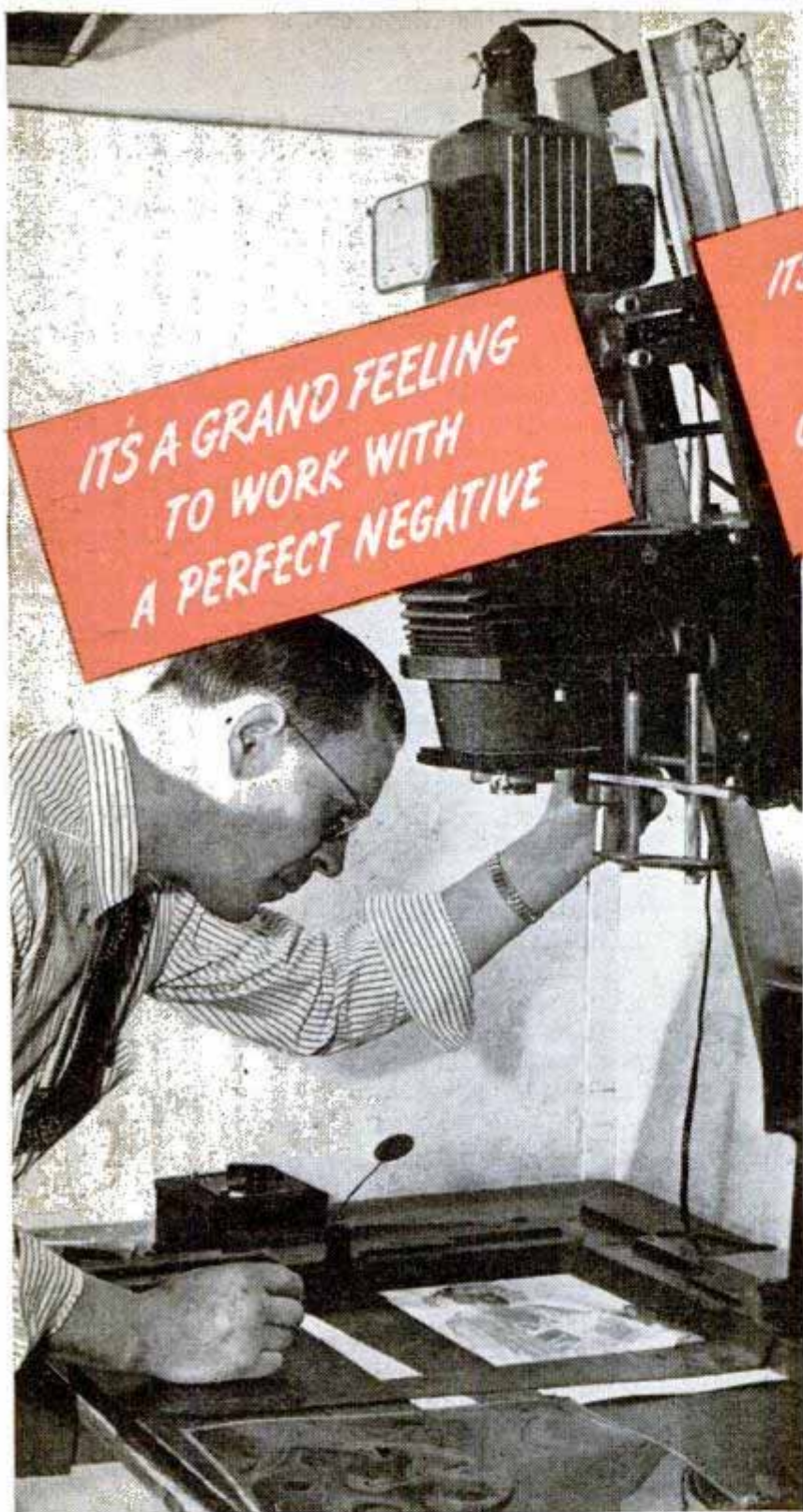
Philadelphia 32

Exide Batteries of Canada, Limited, Toronto



BUY TO LAST

Depend on the Exide dealer for good products, good service.



IT'S A GRAND FEELING
TO WORK WITH
A PERFECT NEGATIVE

IT'S A GRAND FEELING, TOO,
WHEN YOUR CAR IS
CUSHIONED WITH MARFAK
CHASSIS LUBRICATION

MARFAK makes smooth riding last longer . . . a thousand miles and more . . . tangible evidence that your car bearings are lubricated against wear.

You see, *Marfak* is scientifically designed to do the job . . . its special adhesive and cohesive qualities resist wash-out, jar-out and squeeze-out. *Marfak* clings to bearing surfaces . . . sealing out dirt and grime.

Yes, it's a grand feeling when your car is "cushioned" with *Marfak* chassis lubricant. See your Texaco Man today, and say: "*Marfak*, please."



With ordinary grease . . . you're taking the road shocks again after a few hundred miles.

Marfak stays on the job hundreds of miles longer—means more velvet smooth riding.

You're welcome at

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MARFAK
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THE
TEXAS
COMPANY

Tune in the TEXACO STAR THEATRE every Sunday night starring JAMES MELTON with his guest, ED WYNN. See newspapers for time and station.

NEXT TIME SAY BRIGHT STAR

and you will get a
FLASHLIGHT & BATTERIES
famous since 1909
for QUALITY,
STYLE and
SERVICE



BRIGHT STAR BATTERY CO. CLIFTON N. J.

plane. With widespread air transportation dragline mining should expand even more.

The outlook for small-scale operations, in which many veterans have expressed an interest, is difficult to determine. Certainly there is no lack of interest. Officials of the Colorado State Mining Association have had dozens of letters from veterans with a preference for the quiet of mining camps to the noise and confusion of a big city. Most mining areas are localities of picturesque beauty where battle-weary veterans can enjoy the values of recuperation.

But veterans are being warned that small-scale operations involve hard, back-breaking work and low return. Every man dreams, however, that he will strike it rich and Conrow is an example of how Dame Fortune bestows her favors. Such has been the lure of gold down through the ages.

Some veterans, like Conrow, are taking advantage of the split-check system. Under this arrangement, the small-scale prospector operates a lease with all equipment, air and hoisting expense, and even shipping costs, paid for him. All he does is furnish the labor and divide the profits with the landowner.

Some equipment has been developed especially for the small operator. One of these is the inexpensive Denver mechanical pan which can easily be rigged to a small motor or the rear wheel of an automobile. Essentially it is a gold pan with improvements that make it vastly superior to the old hand washing technique.

Gold will continue to play an important part in our way of life for many years to come. And gold fever—even in safe and sane 1946 style—will continue to excite a nation of pioneers.

Half a Billion in the Slot

(Continued from page 159)

move cautiously, however, before designing special dispensers for new products. For example, a manufacturer who suggested that a coin machine be made to sell combs only was turned down on the theory there would not be enough demand.

Mills is devoting considerable productive capacity to a machine that is an offshoot of the coin-operated sound movie "box" which presents three-minute musical comedies.

The offshoot is an improved motion picture machine, minus the coin slot, which is being used extensively for entertainment and rehabilitation work in Army and Navy hospitals. Pictures are even shown on the ceiling for bedfast patients.

Weighing only 185 pounds, the machines

(Continued to page 240)

POWER

BY CONTINENTAL

From the half-horse Tiny Tim to heavy duty Diesels, the Continental Red Seal identifies engines world famous for their stamina, economy, and all-round reliability.

The Continental line is complete. It includes a wide range of engines, each expressly designed to meet a specialized need in aviation, transportation, industry or on the farm. There are Red Seal engines for use with gasoline, natural gas, and distillate. And production has now started on Continental Diesels with "Cushioned Power" Combustion Chamber for greatest fuel economy, still further broadening the applications of Continental Power. Continental Red Seal Engines are on the job wherever there's work to do.



POWER BY



Engines
CONTINENTAL

CONTINENTAL MOTORS

CORPORATION — MUSKEGON, MICHIGAN

44 YEARS' EXPERIENCE BUILDING ENGINES FOR INDUSTRY, TRANSPORTATION, AVIATION, AND THE FARM

TWO FAMOUS LINES

- NOW BEING
MADE IN

Nylon



The Top in Casting Lines

World-famed Black-Oreno is back—in Nylon! Hard braided, water-proofed, exceptionally

smooth, it's easy to cast and has the great long-lasting quality for which this dependable line is famous. 6 tensile tests: 12, 15, 20, 25 and 30 pound.



The Top in Fly Lines

Excel-Oreno has always been known for long wear and dependable service. Now braided of

Nylon, finished with exacting, painstaking care, Excel-Oreno is now your best investment in fly lines. Level lines, H to C, in 25-yard coils. Double tapers—HEH, HDH and HCH—30-yard coils.

LINE-ORENO NYLON IS BACK, TOO!

This original South Bend Nylon casting line is an unusually serviceable line of exceptionally long life. 12, 15, 20, 25 and 30 pound test.



FISHING PHOTO BOOK — FREE!



Send for this 48-page book packed with fishing action photos—all prize winners in the South Bend Bait Company Fishing Photo Contest.

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SOUTH BEND

A Name Famous in Fishing

**\$1 RIDES YOUR LAWN
OF UGLY WEEDS!**



WEED-NO-MORE

Magic Weed Killer

Destroys Ugly Weeds but Won't
Harm Common Lawn Grasses!

NO MORE back-breaking digging! Destroy ugly leafy weeds with WEED-NO-MORE!

The 8-ounce lawn-size package treats 1600 square feet! Now you can enjoy a beautiful weed-free lawn for only \$1!

WEED-NO-MORE kills dandelion, plantain and other ugly weeds—yet won't injure soil.

Get it today! Rid your lawn of ugly weeds for only \$1. Just spray on... WEED-NO-MORE!

On Sale at Paint, Hardware, Garden Supply, Department and Drug Stores

WEED-NO-MORE

THE AMAZING NEW WEED KILLER

Made by **THE SHERWIN-WILLIAMS Co.** Cleveland, Ohio

MORE
WORK
IN LESS
TIME
with ..

HOLD-E-ZEE

AUTOMATIC GRIP
SCREWDRIVERS

Hold-E-Zees do the job better, faster. They excel wherever screwdrivers are used. Gripper instantly released by spring action, sliding up out of way when not in use. Highest quality materials throughout.

At Leading
Dealers Everywhere!



PATENTED



UPSON BROS., INC., 86 Exchange St., Rochester 4, N. Y.



Quilted

ASBESTOS MITTS

... they last twice as long

These asbestos mitts for handling hot metal molds and shapes are reversible to fit either hand. Both sides quilted, won't shred or fray on rough, jagged material. Double wear, double life. Wool lined. All seams double stitched. The answer to troublesome problems. \$2.20 a pair. Discounts for quantities. One of 4300 production-speeding,

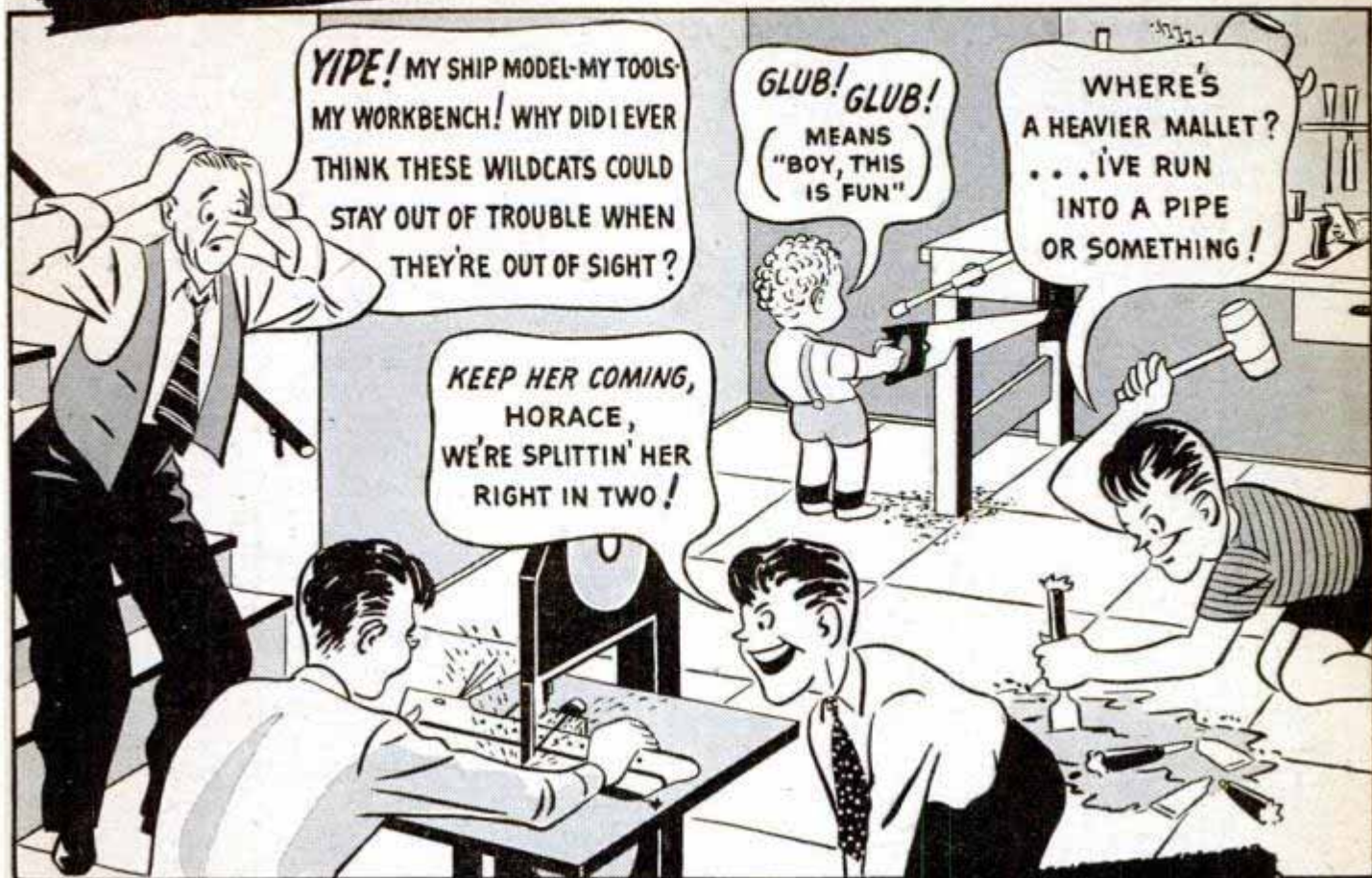
time-saving safety gloves, aprons, sleeves, spats, etc. Write for Free catalog.

INDUSTRIAL GLOVES CO.

6487 Garfield Blvd., Danville, Ill.
(In Canada: Safety Supply Co., Toronto)



YOU WERE WRONG THE TIME YOU LET THE KIDS "PLAY" IN THE BASEMENT



Everybody makes a mistake once in a while, but here's a chance to even up the score: Replace those worn-out spark plug wires in your car with

Packard Four-Forty ignition cable ... and you can be sure you're *right!*

You'll get a kick out of the new power, pep and performance your car delivers with Packard Four-Forty on the job. This longer-lasting cable is built with a tough protective sheath that withstands heat, cold, oil, moisture, corona and abrasion ... that safeguards the insulation against cracks and deterioration for tens of thousands of top-performance miles. You don't have to worry about wiring shorts or electrical losses when

But... YOU'RE RIGHT with PACKARD CABLE!

Packard Four-Forty ignition cable "carries the current" to your spark plugs.

As the original-equipment choice of leading car manufacturers ... the replacement choice of better service stations and garages ... Packard cable is *right* for your car. Always insist on Packard spark plug wires, lighting wires, battery cables and ground straps.

PACKARD CERTIFIED RE-WIRING SERVICE

This sign means cable service at its best—the right Packard cable and the right methods. Thousands of dealers provide better electrical service as a result of the Packard Certified Re-Wiring Program.



Packard
REG. U.S. PAT. OFF.
TRADE MARK

PACKARD ELECTRIC DIVISION
GENERAL MOTORS CORPORATION
WARREN, OHIO



FOREMOST BUILDER OF AUTOMOTIVE AND AVIATION WIRING

Not just a single tool...
IT'S AN ENTIRE Kit!

- ADJUSTABLE END WRENCH
- LOCK-ON WRENCH
- PIPE WRENCH
- GRIPPING TOOL
- PLIERS
- HAND VISE
- CLAMP



Fits
AS IT GRIPS
and it HOLDS
With One-Ton
Pressure

PRESSURE LOCK WRENCH

• You'll find a thousand uses for this handy, high quality wrench that was created by tool engineers in answer to the need for a one-hand tool that would accomplish more, in less time, and with less effort.

• Takes hold of nuts, studs, pipe, short, broken or irregular pieces—and holds them with a one-ton grip, even when the hand is removed. Released with the flick of a finger, it is ready to grab another piece of slightly different size or shape—without fussy adjustment.

JAWS ALWAYS PARALLEL

By an exclusive, patented device that moves the jaw end of the toggle to accommodate for varying sizes of grip, the jaws are always parallel when they close. That means you can use it on both round or flat pieces without rounding the edges or damaging the piece. No. 7 wrench has calibrated jaw openings to $\frac{1}{4}$ " ; No. 9 to 1".

TWO SIZES

No. 7—maximum jaw opening— $\frac{3}{4}$ in.....\$2.75

No. 9—maximum jaw opening—1 in.....\$3.50

At leading hardware, auto equipment, and mill supply stores

PAT. APP. FOR

BMC MANUFACTURING CORP.
Binghamton, N. Y.

can handle 1600 feet of film which is automatically rewound as it is run off. Mills predicts that future applications will include: travel pictures to be shown in railroad and bus stations and at airports to whet the public appetite for future trips; in schools for educational purposes; in factories to instruct new employees; in department stores to demonstrate appliances.

And speaking of appliances, automatic washing machines and clothes driers now are being equipped for coin-in-the-slot operation in some apartments and at a few self-service laundries.

Developed by the Westinghouse Electric Corporation and Automatic Laundry Distributors, Inc., the washers and driers have coin slots that enable the housewife to employ electrical "servants" for a nominal charge. At one self-service laundry in Mansfield, Ohio, a woman tosses a bundle of clothes into the automatic washer, adds soap, puts a quarter in the slot and 30 minutes later the clothes are thoroughly washed, rinsed and damp dried.

In general, the workability of all types of vending machines has reached such a high degree of efficiency that customers seldom have occasion to cuss or bang them to get money back.

Many new drink dispensers are equipped with devices that flash a warning when the last drink is consumed. Increased use of electrically operated mechanisms—electronic controls in particular—have made the automatic vendors practically fool-proof. One electronic regulator adjusts the volume of juke boxes to cope with surrounding noise.

Also, the "slugger" has little chance of gyping the latest models. This always has been quite a problem, with losses from slugs running as high as \$300,000 in one year. Even ice slugs have been used in some food plants to "beat" candy and drink dispensers. Sensitive controls that operate only by genuine coins of the prescribed size, weight and metallic content have just about removed the larceny element.

Yes, coin machines have come a long way. Back in 1846 about the only mechanical vendor in America was a complicated, hit-or-miss gadget that sliced off a hunk of chewing tobacco for a nickel.

Today, you can get your shoes shined by a contraption whose buffer goes into action when you put in a dime in the slot. Or you can use a coin-actuated electric razor sterilized by germ-killing rays.

About the only thing needed, according to one cynic, is a special slot for juke boxes that would give you three minutes of silence for five cents.

Rigid boring bar cuts bearing seat accurately. The cut is light, maintaining closer tolerances than are possible with ordinary drilling or reaming.



Precision-bored Bearing Seats help you enjoy greater accuracy ...smoother operation—with your

DELTA
MILWAUKEE
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POWER TOOLS

Other advanced engineering features include:

Lubricated-for-life Ball Bearings. You don't have to worry about oiling these bearings. They're *lubricated for life* when they leave the factory. And they are *double-sealed* against harmful dust.

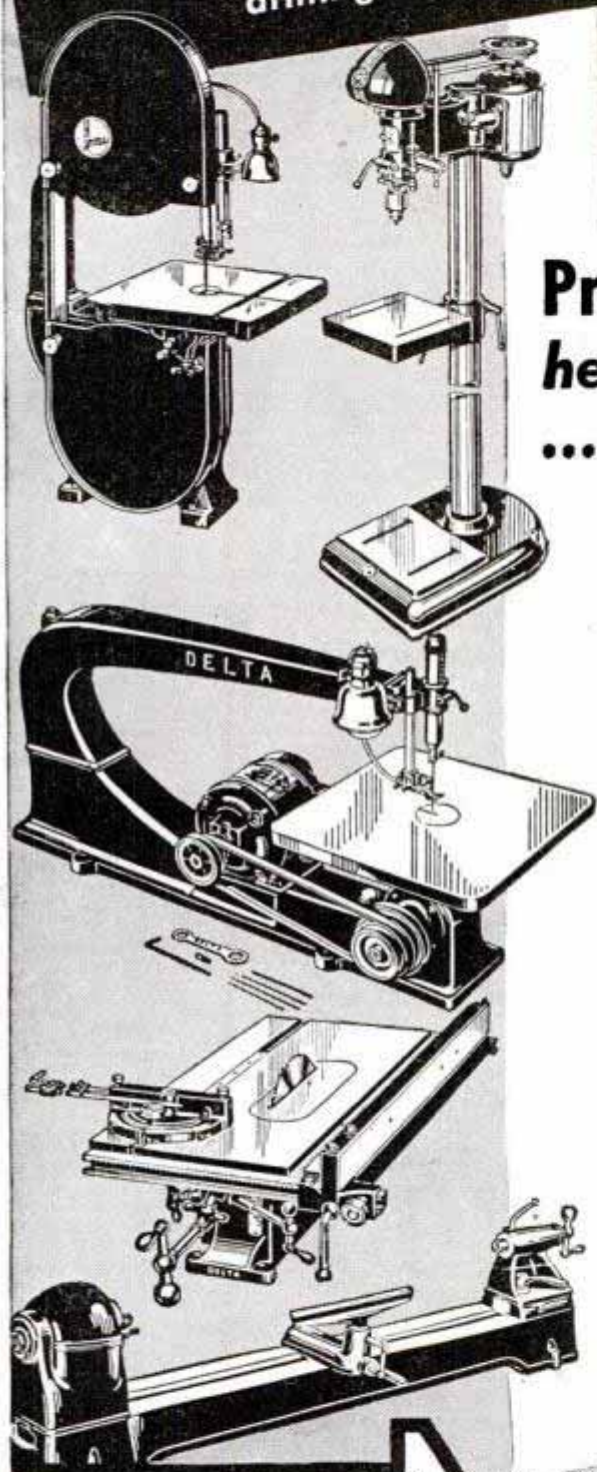
Pre-loaded Bearings. This is the result of an extra manufacturing operation that reduces the "play" in the bearings to help you enjoy long-time operating efficiency and accuracy.

Precision-ground Shafts. These are shafts built to run without any "wobbling" which may throw off measurements.

Dynamically-balanced Pulleys. The pulleys which transmit the power from your motor to your power tool are balanced to help eliminate annoying, damaging vibration.

The accuracy and precision *built into* Delta tools largely replace the manual skill of the old-time hand craftsman. Once you set a tool for the job, it takes care of keeping the work true and straight . . . helps you produce attractive, professional-looking work.

There's a store near you—perhaps right in your own neighborhood — that carries Delta tools. The people there are looking forward to giving you the complete Delta *quality* story. Drop in to see them.



FREE!

"Happiness Herald" — an illustrated tabloid newspaper with facts about woodworking as a hobby. Tells how this popular hobby aids mental health and happiness . . . how it can pay its way. Pictures typical shops and projects. Enjoy its inspiration and ideas. Use coupon.



Tear out coupon and mail today!

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Please send me my free copy of the "Happiness Herald."

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ANY WAY YOU LOOK AT IT...
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 IS A BETTER BUY!



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 CANDID CAMERA**

ESPECIALLY DESIGNED FOR COLOR!

CHOSEN BY HARVARD OBSERVATORY for supreme accuracy, the 1/1000 second rotary focal plane shutter is typical of the many advanced Mercury II features that assure you:

1. Sharper candid and action shots...
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NEW FILM ECONOMY—32 negatives on standard 35mm. 18-exposure color or black-and-white film cartridge, 65 exposures on 36-exposure cartridge.

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MERCURY II
 ...It's a UNIVERSAL

Mows and Trims Lawns



In One Simple
 Easy Operation
 8¼ Lbs.



Save Time
 and Labor with a
MONTAMOWER

New model. New type metal handle has special device to adjust cutting height. Drive shaft now mounted on free rolling, factory lubricated, and sealed ball bearings. No tired backs or aching arms. 8¼ lbs. of live precision made mechanism that first gathers, then cuts smoothly a clean 16" swath through grass, dandelions, spike grass and weeds. No noise or clatter. As modern and efficient as your electric razor. Cuts right up to walls, fences, trees or posts; leaves no fringes to be trimmed by hand. Cutters are self-sharpening. Built to last many years. Many thousands in use. Sold direct from factory. Costs little. Write at once for guarantee information and literature.

MONTAMOWER DISTRIBUTING CO.
 823 Keeler Bldg. GRAND RAPIDS 2, MICHIGAN

TURNER VT-73 DESK MICROPHONE

Here's the mike you want for your rig. It's got looks, it's tough, and man, oh man how it performs. It's a TURNER! Ask your dealer or write for Free Literature on other low cost Turner Microphones.



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 921 17th St., N.E., Cedar Rapids, Iowa

NOW AVAILABLE!

Crosman Silent Rifles—America's favorite compressed air rifles for indoor and outdoor shooting are back again! Available in 22 cal. single shot and Magazine Loading Types. At your dealer—or order direct. Ask for Crosman SUPER-PELLS too—the better ammunition for all compressed air rifles. .177 Cal.—\$1.80 per M. .22 Cal.—\$2.00 per M.

CROSMAN ARMS CO., INC. • Rochester 7, N. Y.

DO YOU WANT a permanent business profession of your own? Then **BECOME A FOOT CORRECTIONIST.** Earnings in this greatly needed profession run as high as \$50-\$100 weekly after a few weeks home training—not medical or chiropody—no further capital needed, no goods to buy. 50th year. Write for free booklet.

Stephenson System of Foot Correction
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ARMSTRONG TOOL HOLDERS

enabled American industry to change to war production "over night." For they are the permanent, multi-purpose tools used by 96 per cent of the machine shops and tool rooms, on lathes, planers and shapers—the tools used to make dies and jigs, to build production machines. They are the tools you will want for your own shop—**ARMSTRONG TOOL HOLDERS** for industry, ACE Tool Holders for home work shops.



ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"
 368 N. Francisco Ave., Chicago 12, U.S.A.



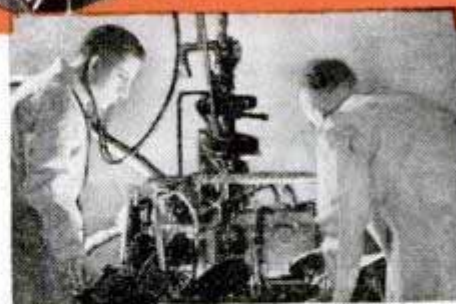
"Switch to Auto-Lite
... money cannot buy
a better spark plug"
Dick Haymes

"They put a song
in the heart
of your engine".

*Helen Forrest and
Gordon Jenkins*

*The Spark Plug
that's Ignition Engineered*

TREAT your engine to a new set of Auto-Lite Spark Plugs, ignition engineered for today's gasoline. If your spark plugs are faulty, you will restore gasoline mileage, get faster starts, smoother operation. And when so many of the nation's leading car manufacturers specify Auto-Lite Spark Plugs as original factory equipment, you can bet Dick Haymes is right . . . "Money cannot buy a better spark plug." So see your friendly Auto-Lite Spark Plug Dealer today.



Auto-Lite Spark Plugs are ignition engineered. They're designed by men who have designed complete automotive electrical systems for 35 years!

Toronto 1, Ontario • THE ELECTRIC AUTO-LITE COMPANY • Toledo 1, Ohio

TUNE IN THE AUTO-LITE RADIO SHOW STARRING
DICK HAYMES, SATURDAYS, 8:00 P.M.—E.S.T. ON CBS

Switch to -

AUTO-LITE SPARK PLUGS
"Ignition Engineered"

The Mechanics of Golf

(Continued from page 85)

inary line running from your objective back through the ball. (See photo 2.) Picture this in your mind. It will be referred to frequently.

As you can see in photo 2, my right foot is drawn back slightly from the line parallel with the line of flight. This means I am playing my drive from what is known as a "closed" stance. I prefer this stance for all shots played with woods.

In setting the clubhead behind the ball, which is teed up about one inch from the ground, the ball is a little toward me from the center of the club face.

Make sure that you do not reach out awkwardly for the ball. Your weight as you address (stand up to) the ball should rest evenly on the ball and heel of each foot.

Nearly everyone has a tendency to get tense and stiff just before starting to swing at the ball. During my search for improved technique and methods I found that the best way to counteract this tension is to make a few short, loose, wigwag motions with the clubhead along the same general path to be used in the swing.

One day, as I prepared to tee off before a large gallery assembled at the first tee of the Tam O'Shanter course in Chicago to watch the All-American tournament, I was going through my brief warmup "waggle" when an uninitiated feminine bystander exclaimed, "Look at him shake. My, he must be nervous."

Well, I wouldn't say that my nerves are perpetually quiet, but this particular little gesture was not a manifestation of the "shakes." Most of us who make the tournament circuits learn to keep our nervousness pent up inside.

So far we have considered the preliminaries to swinging a wooden club, in this case a driver. Next comes the swing, in which my streamlining program shows its effect most clearly.

Through the early stages of my playing career I followed the popular pattern—starting the backswing with a turn of the body. This movement caused the clubhead to pull up and curve back sharply away from the ball. Remember, the backswing describes the pattern for the downswing. The clubhead, coming through in the aforementioned arc, is quite apt to hit the ball a downward blow and start it offline. Only when using irons are you supposed to strike the ball a descending blow. I sought the cure for this difficulty.

I found the solution to lie in shifting the hips in a lateral motion (backward and for-

(Continued to page 248)



STOP DUST

It is no longer necessary to put up with a dirty room every time you sweep the floor. By sweeping with a Dustless brush, which makes its own sweeping compound as it sweeps, you can eliminate up to 97% of germ laden dust in the air between sweepings. You can also do away with costly sweeping compound and cut labor costs. Thousands of factories, shops, offices, schools, and stores now use Dustless sweeping. Get complete facts about this better method of dust control. Write today.

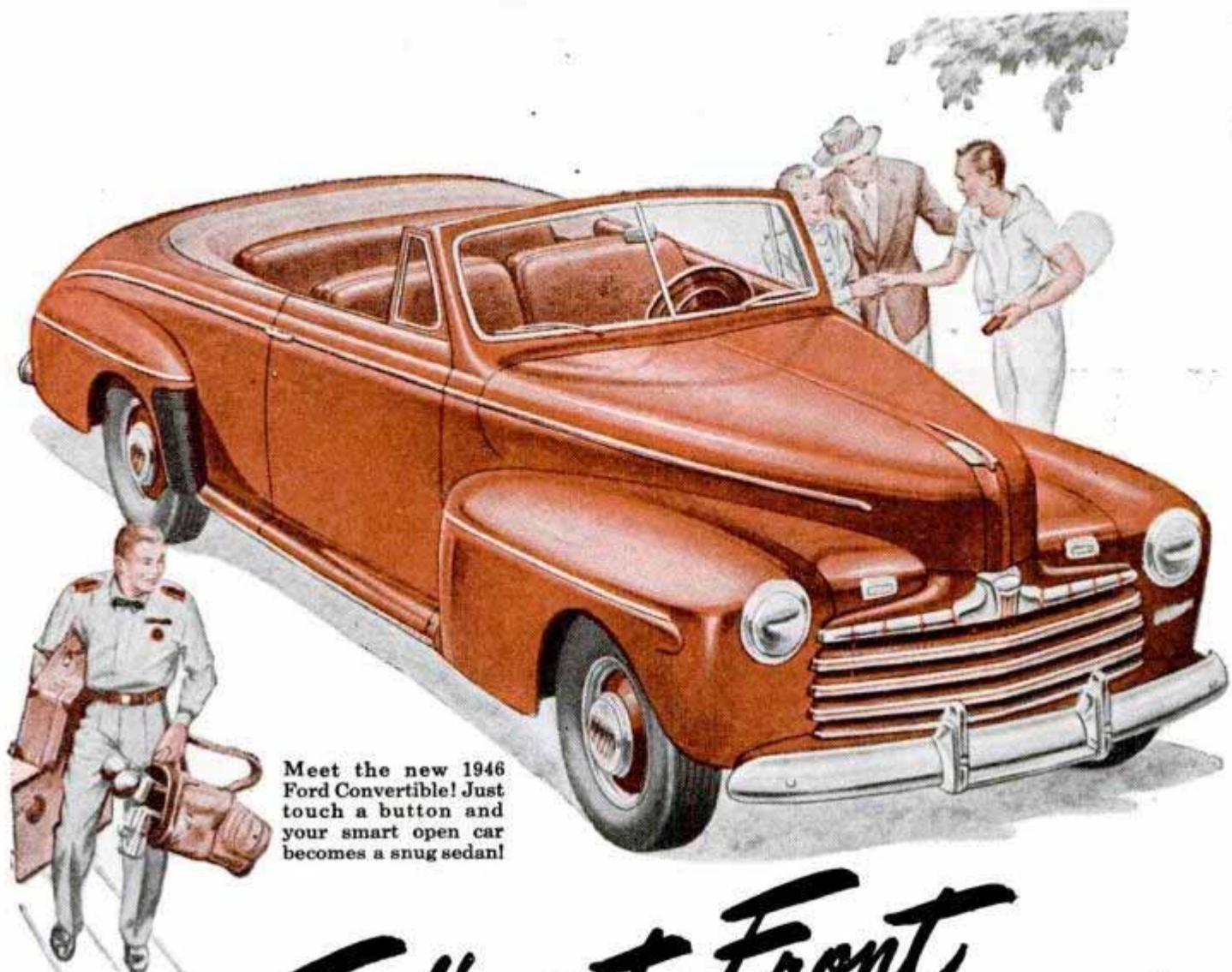


- Dustless
- Speed Sweep
- Speed Wash brushes

Dustless
DOES MORE FOR LESS

MILWAUKEE DUSTLESS BRUSH COMPANY

528 N. 22nd Street • Milwaukee 3, Wisconsin



Meet the new 1946 Ford Convertible! Just touch a button and your smart open car becomes a snug sedan!

Ford's out Front

WITH THE BIG 100 h.p. V-8 ENGINE!

• No other car in its price class performs like the 1946 Ford because no other has the V-8 engine . . . no other has 100 horsepower! The V-8 type of engine, you know, is used in America's most expensive automobiles!

The new Ford V-8 is thrifty on gas and oil because of new 4-ring aluminum pistons and new balanced carburetion.

With this engine . . . with new oversized hydraulic brakes . . . with wider, lower, handsomer appearance . . . and with dozens of other improvements, no wonder so many people say: "Ford's out front in the low-priced field!"



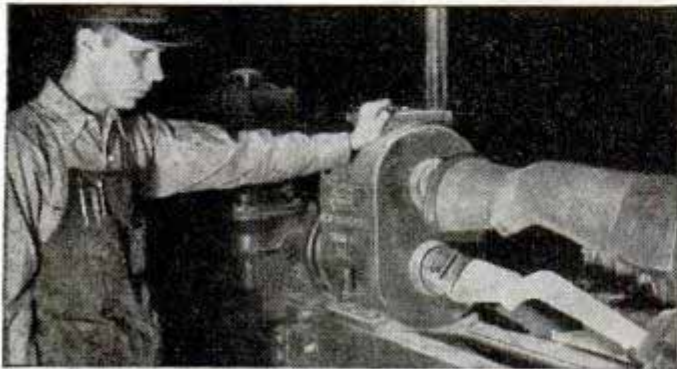
There's a **Ford** in your future

TUNE IN . . .

The FORD-Bob Crosby Show—CBS, Wednesdays, 9:30-10 P.M., E.S.T.
The FORD Sunday Evening Hour—ABC, Sundays, 8-9 P.M., E.S.T.

THE MAKING OF *Marlin* GUNS

Marlin brings to sportsmen, through this series of advertisements, interesting facts on gun-making... to enhance appreciation of fine sporting firearms and to encourage their thoughtful handling and care.



New automatic electric machines shape Marlin stocks

GUNSTOCKS • Functioning, balance and beauty of firearms are all affected by design and quality of gunstock. Only selected hardwoods go into Marlin stocks. Blanks are turned in new automatic machines which handle sharper, more intricate forms than any hitherto developed. The heavy, cast iron "master" accurately controls triple cutters as the lathe turns. After turning, the stock is "shaped" by skilled craftsmen; sanded, polished, stained and finished.



Final assembly demands fine craftsmanship

TARGETING • In the four modern ranges at Marlin, expert marksmen target every rifle before shipment. Sights are carefully adjusted until shots group in the center of the bull's-eye.

ASSEMBLING • Interchangeable parts make for efficient, economical production. Deft hands and experienced eyes, however, are needed for the accurate work of final assembly.



Expert marksmen target Marlin rifles

THE
Marlin
FIREARMS CO.
NEW HAVEN, CONN. EST. 1870

(The next advertisement in this Marlin series will reveal more interesting facts on fine gun-making.)

Be sure to see Marlin 1946 models on display at your dealer's

MOTORISTS!

BREEZO KAR KOOLERS



**DIRECT COOLING
BREEZE WHERE YOU
WANT IT IN YOUR CAR**

INSTANTLY attached to any General Motors or Chrysler-made car, 1939-46. Snaps on or off. Extension for other makes or older models. Triple adjustment feature permits accurate control of cool air flow to feet, lap or chest area, as you desire. Don't suffer — get this hot weather driving aid now. Set of two BREEZO Kar Coolers only \$1.25 postpaid anywhere in U.S.A. \$1.50 in Canada. Money back if not pleased. Give name and model of car when ordering.

**\$1.25
PAIR
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Send cash or Postal Money Order. \$1.50 in Canada

DEALERS: Car-owners buy Breezo on 10-second demonstration. Write for BREEZO "Extra Profits" OFFER!

ECONOMY SPECIALTIES CO. 407 SOUTH 4TH STREET, BOX 67, STURGIS, MICH.

**THE HEAVYWEIGHT OF BENCH MILLS
BEEFED UP FOR PRODUCTION — PRICED LOW FOR HOME SHOPS**

Diamond MODEL B-12

DIAMOND MODEL B-12, sturdiest, heaviest bench mill on the market. All engineering refinements for high precision and long life. Taper roller spindle bearings, 6 spindle speeds (100 to 400 r.p.m.), large hand-scraped vee ways. Table travel 12" longitudinal. Table surface 5 1/4" x 20". Price only \$372.00, f.o.b. Los Angeles, less motor. Full line of accessories. Free Folder!



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Manufacturers of the DIAMOND Line of Precision Milling Machines and Accessories



**CAPE COD CHAIRS
TRELLISES**

Arbors Fence Pickets

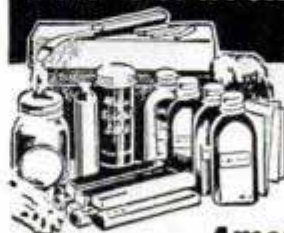
Chairs styles B-C-A Plans 50c ea. All 3 only \$1.00. 12 different trellis designs. Plan of all 12 only 50c. Beautiful 31-family Mt.

Vernon martin house. Large, fully detailed plan \$1.00. Four fine lawn figure patterns: Dutch Boy, Tulip Girl, Holland Pair and Sunbonnet Girl—all four patterns only \$1.00.

Send 10c for beautiful catalog illustrating many fine home and garden projects, plans, knockdown kits and completed projects.

CRAFTSMAN'S MODEL CO., Dept. P91, 2030 No. 4 1st St., Milwaukee 8, Wis.

Fix Scratches, Dents, Nicks the Professional Way!



Get This Handy Kit!

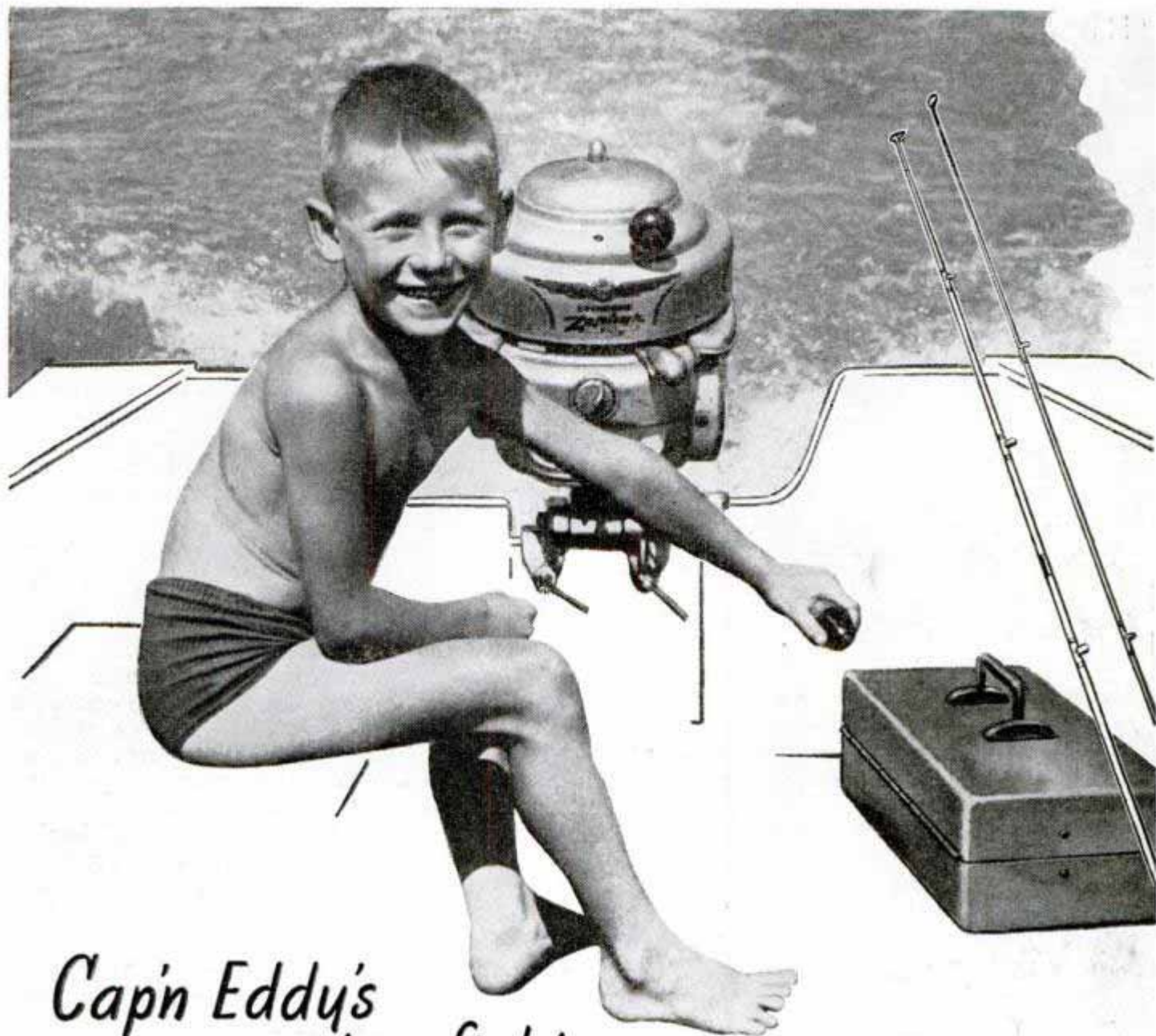
Repair damaged furniture surfaces with new practical kit. Enables anyone to do fast, easy touch-up jobs like a professional cabinet finisher. Makes furniture and cabinets look new. Every home and shop needs this remarkable kit. Pays for itself over and over!

Amazing Results—Easy to Use

Kit includes 23 different items—scratch removers for slight scratches, assorted shades of shellac sticks for deep nicks, bottles of light and dark stains, shading lacquer, alcohol lamp with fuel, stainless steel spatula, touch-up brushes, scratch sticks, steel wool, sandpaper, rubbing liquid. Packed in handy leatherette finish case. Send for it today. Best investment of lifetime. Fully guaranteed. Detailed instructions supplied.

**\$3.95
Postpaid**

AMERICAN HOUSEHOLD BUREAU
Dept. F, 520 N. Michigan Ave., Chicago, Ill.



Cap'n Eddy's going fishing

Cap'n Eddy may seem a bit youthful to be skippering all that horsepower! But Eddy agrees with his dad . . . it's a sound idea to start 'em young!

So Eddy is "an old hand" with Evinrudes, and revels in all the pleasures that go with them. A lot of happy miles have foamed in his wake, he has baited many a hook and "boats" his fish like an old-timer.

In thousands of family albums there are snap shots such as this one of Eddy*. Photographs of children running Evinrudes capably, easily, joyfully.

Each picture is a forthright testimonial to an Evinrude quality that users prize above all others.

The assurance of carefree performance, even in a youngster's hands. Performance that has been perfected step by step during 36 years of building fine outboards . . . trustworthy performance that is mechanically built right in, ready to go and keep on going!

It's waiting for you — see your Evinrude dealer! Look for his name under "Outboard Motors" in the classified section of your phone directory. Write for catalog of the complete Evinrude line. Address, EVINRUDE MOTORS, 5264 North 27th Street, Milwaukee 9, Wisconsin.

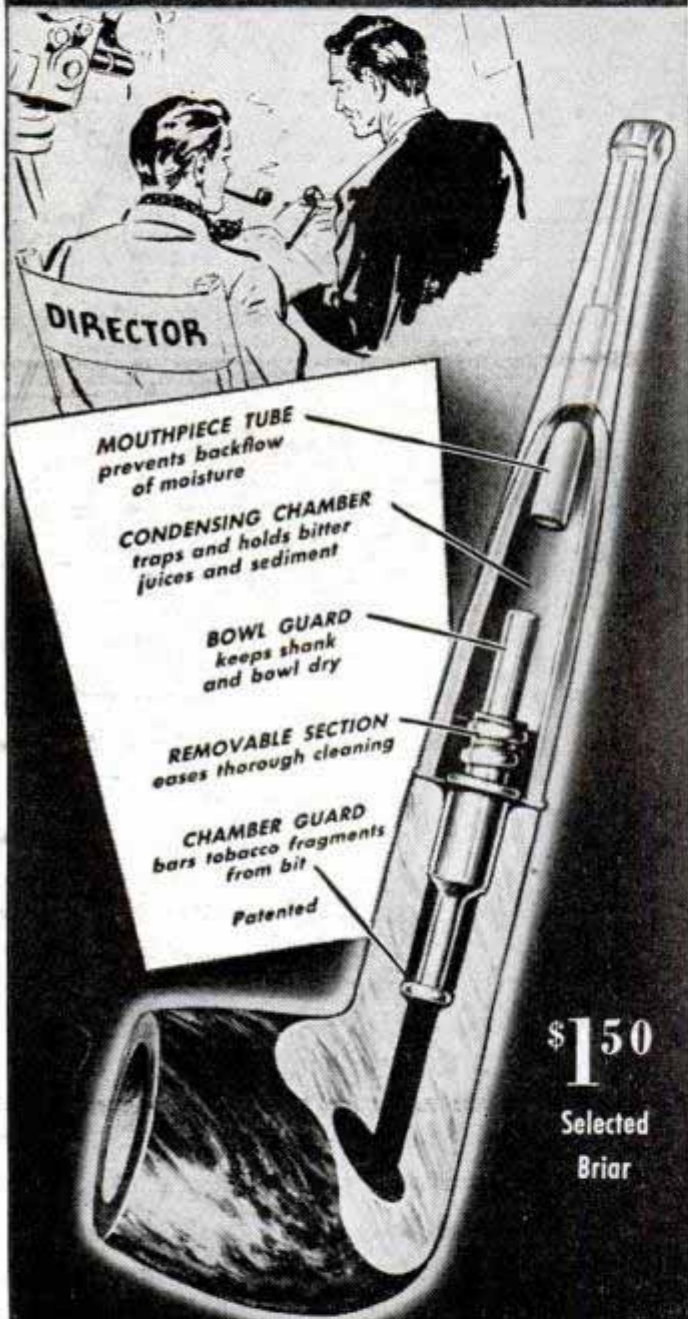
In Canada, Evinrude Motors, Peterboro, Ontario.

*Eddy Ogrodowski of Toledo, Ohio.

EVINRUDE
OUTBOARD MOTORS

Royalton CROWN

For Men who Really Know Pipes



ROYALTON CROWN PROVIDES EXTRA SMOKING SATISFACTION because its condensing well and other safety features protect you from irritating juices and bitter slugs. Every bowlful smokes so clean, so cool, so ever-dry. Enjoy the full measure of pipe pleasure with a Royalton Crown.

HENRY LEONARD & THOMAS, INC., OZONE PARK 17, N.Y.

ward on the line of flight). This enabled me to start the clubhead straight back from the ball and close to the ground (photo 3). It also shifted my weight back into position to add its force to the power behind the ball in the downswing.

This lateral motion was a tremendously important factor in taking "bugs" out of my game. Now I'm often called the "Mechanical Man of Golf" because I'm so consistently straight. To the best of my memory, I didn't get off the fairways once in four rounds during the 1945 Seattle Open as I set a new world's record of 259 strokes for 72 holes over the Broadmoor course there.

Photo 4 covers the next stage of the backswing showing the shoulders turning.

The top of my backswing (photo 5) also was subjected to revision as I continued my efforts to perfect my swing.

I observed that many golfers had a tendency to overswing at this point, believing that by doing so they could get a longer and more powerful stroke at the ball. This thinking is completely erroneous.

If you overswing, you loosen your grip on the club, and also force an exaggerated "break" or bend in the wrists. This means that the firmness is completely lost and the club gets out of control. Once you permit this to happen, you can't recover.

I discovered that if I took the club back to a point at which it was about parallel with the ground (refer to photo 5) I could (1) keep a very firm grip with both hands, (2) keep my wrists in firm position, (3) maintain a straight left arm and (4) retain the original position of my head.

In other words, I eliminated all surplus motion at the top of the backswing. Thus I streamlined my swing. I gained in accuracy and consistency and lost nothing in the distance the ball traveled.

A straight left arm, like a draftsman's compass, enables me to describe repeatedly the same arc with my hands. This means I have "grooved" my swing. The clubhead will, as a result, consistently follow the same path to and through the ball.

I made no effort to wind up or "cock" my wrists at the top of the backswing. A conscious attempt to do so leads to looseness. Looseness in a golf swing is a barrier to good golf.

Photo 6 portrays what I believe to be the most satisfactory way of starting the downswing. For the sake of emphasis, I repeat that you should make no conscious attempt to add the power of the hands to the force of the downswing until the clubhead is within 20 inches of the ball. Maximum clubhead speed provided by the combined effort of hands, wrists, arms, shoulders and

(Continued to page 252)

Snap-on Tools

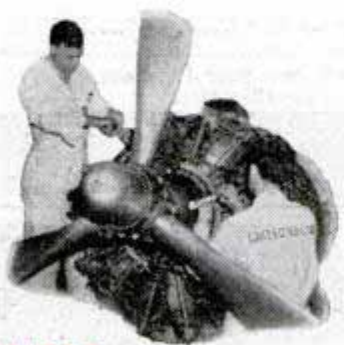
TOP CHOICE
FOR AIRLINE
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PAN AMERICAN



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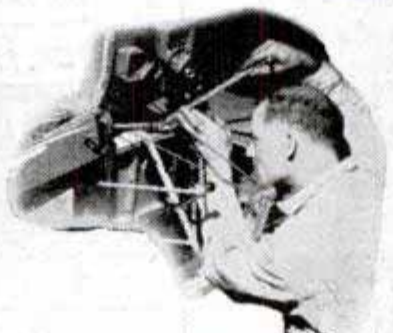
TRANS-CANADA



PENNSYLVANIA CENTRAL



CONTINENTAL



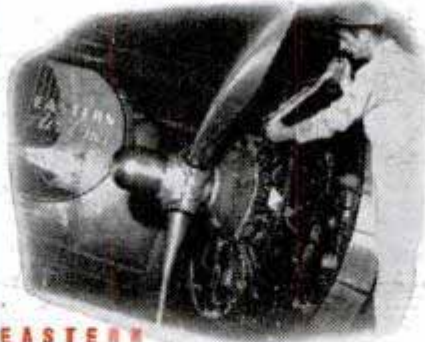
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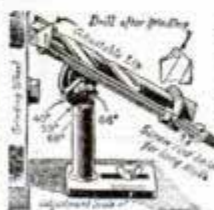


Kills the fleas QUICKLY!
Keeps others off for days!
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100,000 IN USE!

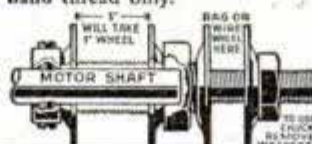
Grinds your drills like factory in 25 seconds. Gives perfect center and clearance. Saves drills, time and money. No shop should be without the Super Drill Grinder. Guaranteed to do the work or money back. The Grinder that gives a round point!

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(PATENT PENDING)

A combination drilling or grinding wheel attachment. For 1/2" motor shafts. Will take grinding wheel with 1" hole on shaft and 3/4" hole on small end. Extension can be used for rag or wire wheel, or 3/4", 24-thread drill chuck which holds drills from No. 60 to 3/8" in diameter. Right hand thread only.

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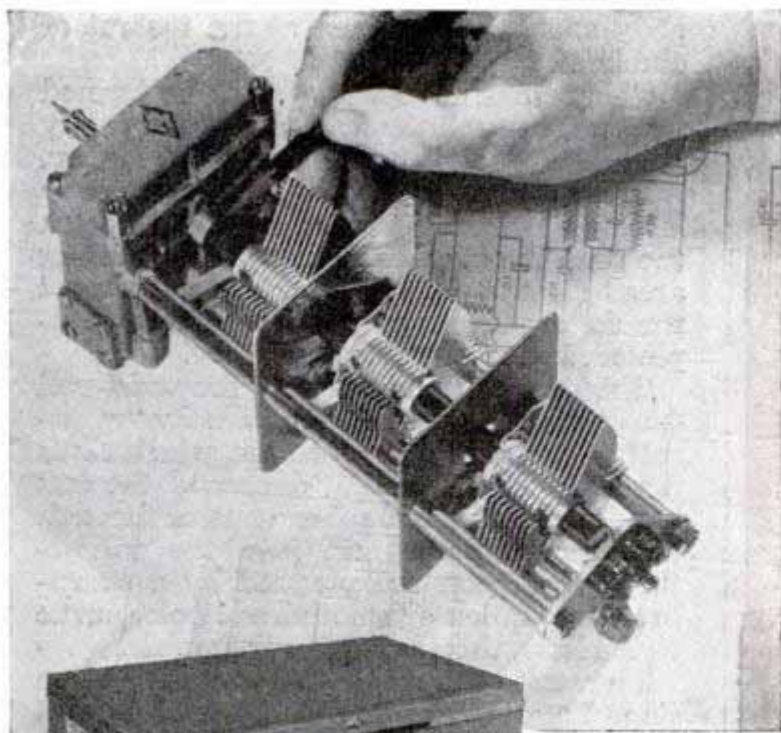
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NC-2-40C



NATIONAL COMPANY

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THE MOST DISTINCTIVE NAME IN RADIO COMMUNICATIONS



*The BIG THREE
of Outboard Motoring*

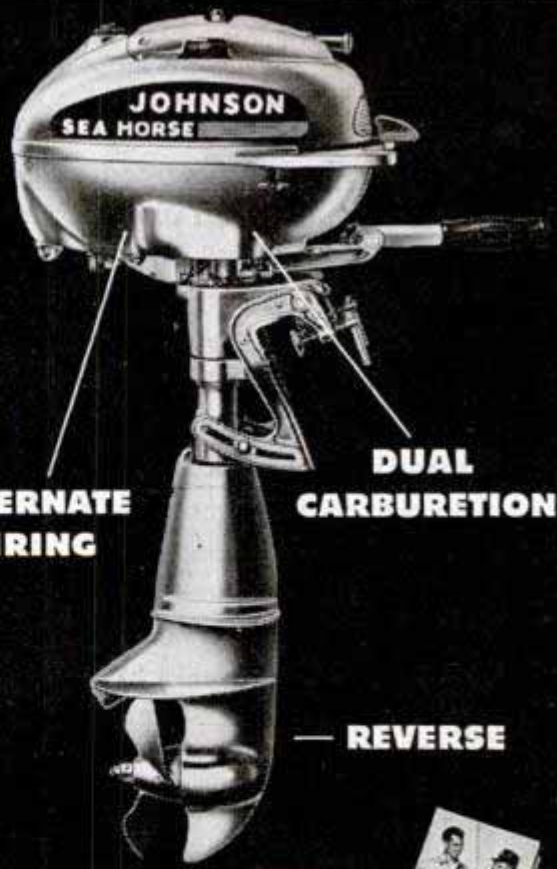
JOHNSON SEA-HORSES for DEPENDability

For utmost fun in outboard boating there are three "musts" to be considered in your motor. First, smoothness; second, reverse; third, full power at high speed with steady performance at trolling speed. You'll find all three in Johnson Sea-Horses.

Sea-Horses are strictly quality motors — built with dozens of refinements. And Johnson quality is backed by expert nation wide service — another Johnson "plus." See your Johnson dealer. Look for his name under Outboard Motors in your classified phone directory.

JOHNSON MOTORS, 400 Pershing Road, Waukegan, Ill.

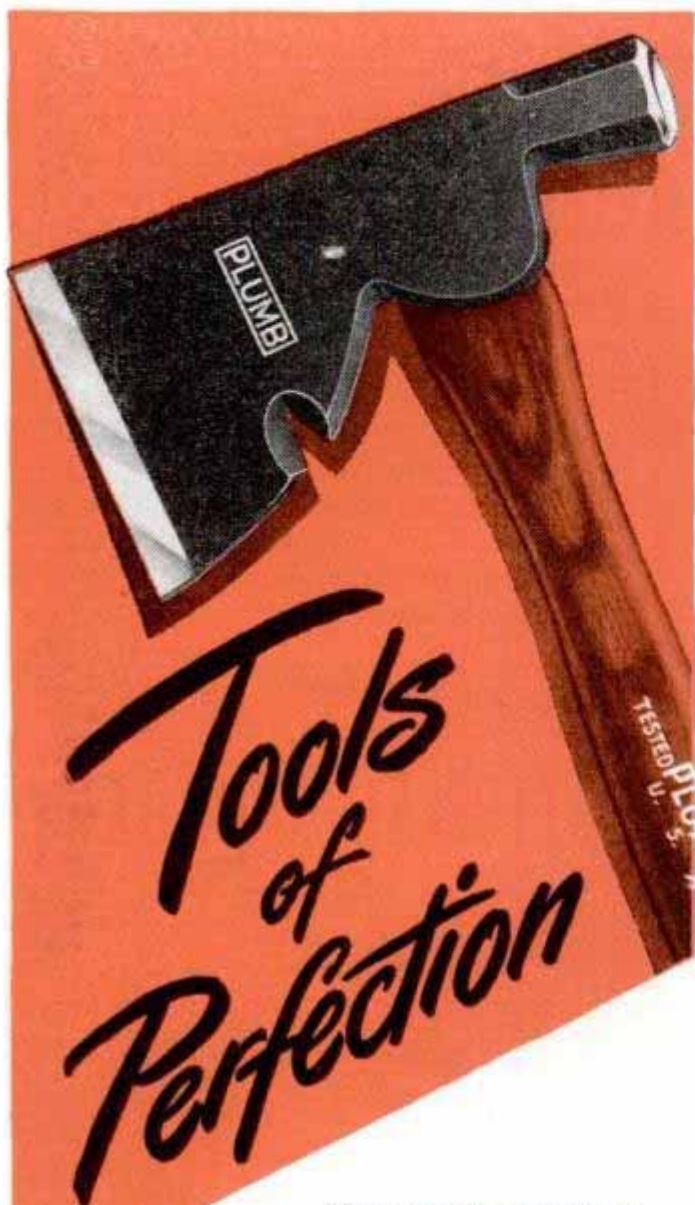
JOHNSON BUILDS SEA-HORSE MOTORS ONLY—NO OTHERS



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Tools of Perfection

How good should a hand tool be? Plumb's answer is "perfect". That's why no effort, time or research has been spared to make the Plumb name mean "tools of perfection".

Plumb hand tools last longer . . . do the work better, faster . . . are correctly balanced for comfort and ease. Head of one-piece special analysis steel . . . handles of tested second growth hickory. Each tool is easily identified by the red handle and the black head. Fayette R. Plumb, Inc., Philadelphia 37, Pa.

PLUMB

body should be reached at the instant of clubhead impact with the ball.

This brings us to what might be termed the "most revolutionary" discovery of my intensified search for maximum efficiency.

I found that by keeping the back of my left hand directly toward my target from the time the clubhead entered the "hitting area" (last 20 inches before impact) until the follow-through was one fourth completed, I gained greater accuracy.

This technique eliminated the wrist-roll—a prevalent source of trouble. By "wrist-roll" I mean the wrist action which finds the right hand turning over and the left hand under as the clubhead passes through the impact point and into the follow-through. If you are plagued by a sharp-breaking, quick or smothered hook (curve to the left), this may be your trouble.

I haven't been off the fairway very often since I started keeping the back of my left hand toward my objective throughout the bottom-most 50 inches of my swing.

Photo 7 gives you the essentials of properly finishing your follow-through. After all my power has been expended, my hands are still firmly in control of the club.

Notice particularly that my eyes are following the flight of the ball. Don't construe this to mean that I haven't kept my head down. My eyes were fixed on the spot where the ball was teed until the clubhead was almost parallel with the ground on the upswing and pointing at my objective.

From this point the turning of my shoulders has pulled my head around to the position in which you see it. This is a natural sequence. My head has turned, not moved.

THE SPOON

The difference in stances assumed for hitting a tee shot with a driver and a fairway or rough shot with a spoon is covered in the photos on page 83.

Because the ball is not teed up for a brassie or spoon shot, you must stand a little more closely to the ball. A brassie shot would not be played quite as far back toward the center of the stance as a spoon shot.

Don't try to use a brassie (No. 2 wood) unless the ball is sitting up enough so that you can get a good clean sweep at it with the clubhead.

The swing is identically the same for all wood shots.

* * *

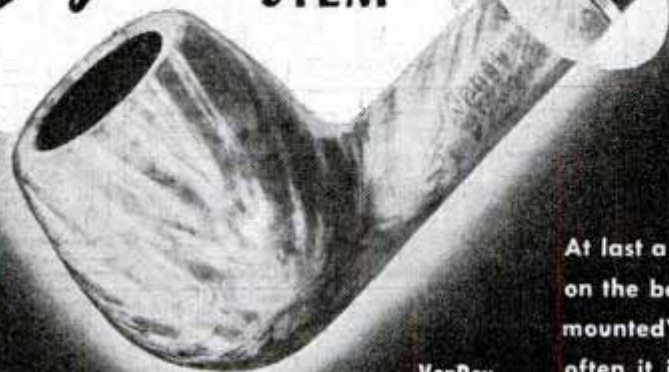
(Next month, in the second article of this series, Byron Nelson will tell you how he plays his medium and long irons. In the opinion of most experts, Nelson is the greatest iron player of all time. In the third article you will learn how he plays his short irons and chip shots; also how he explodes the ball out of a sand trap and how he putts. "Lord Byron" will conclude the third article by playing two typical holes for you.)

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Ajustomatic STEM



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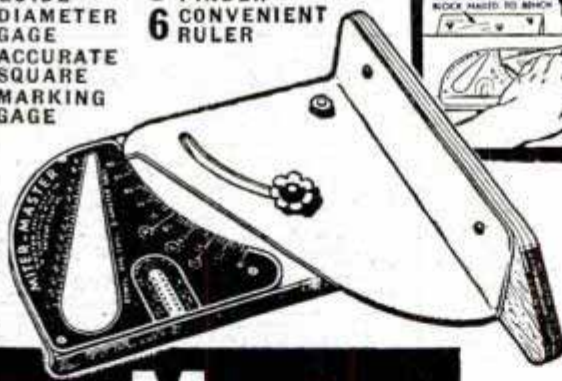
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Now available to you without Priority rating!

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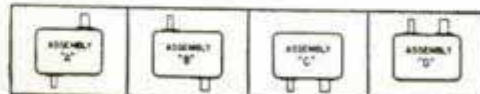
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Ceiling Price
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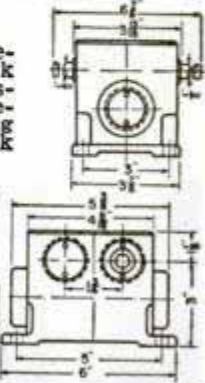
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10-1	40-1	80-1	400-1
16-1	50-1	100-1	600-1
20-1	60-1	150-1	800-1

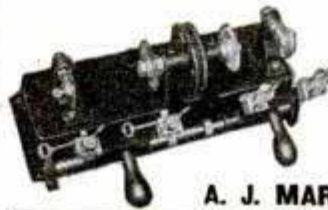
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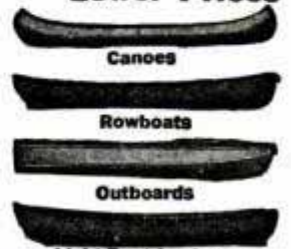
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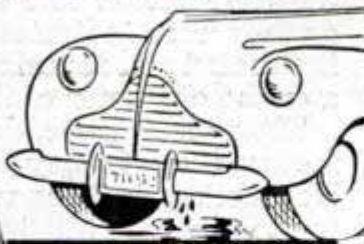
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Rivet materials that previously could not be fastened this way—brittle materials—soft materials. Action is gentle but firm. No hammering, pounding or bucking. It's all done with a steady, controlled **PULL**.

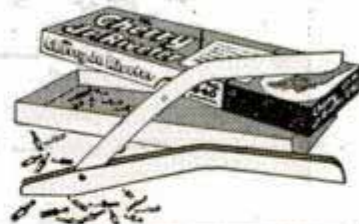


Send no money!

This kit, gun, or replacement rivets can be secured from your dealer. Or, just fill out and mail the coupon below. You can paste it on a penny postcard if you wish. Pay postman only \$2.48 plus slight C.O.D. charge and postage. Your Cherry Rivet Kit will be delivered complete with a generous supply of Cherry Rivets. Try it out on almost anything that needs fastening. Do *difficult jobs* with it. Satisfy yourself. Then, if you are not completely pleased with results, send the outfit back within ten days and every penny you spent for it will be returned.

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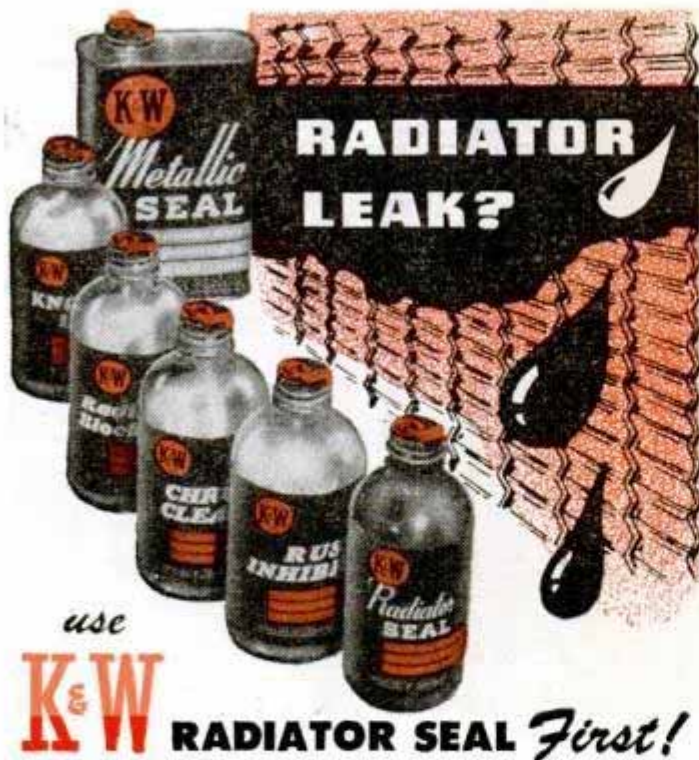
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K & W METALLIC SEAL AND MECHANICAL METHOD REPAIRS ARE GUARANTEED FOR THE LIFE OF THE ENGINE

If you cannot locate a K & W Service Shop in your community wire or write Kerkling & Company, Bloomington, Indiana for names of those nearest you.

Eavesdropping Through 24 Feet of Steel!

(Continued from page 89)

opposite wall, since it is of necessity nearer the transmitter. The location of the peak on the screen indicates how deeply the flaw is situated and reveals to a practiced operator the character of the defect.

The reflectoscope, developed and manufactured by Sperry Products, Hoboken, New Jersey, is being widely used in industry to examine billets, forged axles, tools, armor plate, heavy machinery, turbine blades, aluminum extrusions for aircraft, locomotive components and other materials in which quality control is vital.

Its advantage over fracturing a notched sample or cross-sectioning the material is obvious—it doesn't destroy what it only wishes to test. The comparison with X-ray inspection is not quite so clean-cut, but the reflectoscope has much in its favor.

The largest readily obtainable X-ray machine, of 5,000,000-volt capacity, will penetrate approximately 18 inches of steel. The largest X-ray unit, the 100,000,000-betatron type, will see through several feet of steel, its developers claim. Both types are extremely costly and hardly portable, in contrast to the "eavesdropper," which can be wheeled about on balloon tires almost as freely as a baby carriage and is operated on standard 110-volt alternating current.

X-ray is admittedly superior for giving great detail of surface defects but lacks the range of the reflectoscope, which will "listen" through 24 feet of steel, 28 feet of aluminum or magnesium, three to four feet of iron and widely varying distances in plastics depending on the resin content.

The distance which can be penetrated by the telltale echo depends on the inherent solidity of the material under examination. It passes through six times as much steel as iron, since the former is much less porous and porosity acts like an infinite series of defects, hindering the transmitted signal and clouding the return signal.

The device can detect flaws in objects so large that the signal cannot completely penetrate and echo. Forty-foot aluminum wing members for U. S. superbombers were examined and defects located without the bounce characteristic when a signal was reflected from a point 23 feet from one end and 17 feet from the other.

□ About the size of a grain of wheat and barely $\frac{1}{16}$ inch in diameter, the world's smallest incandescent light bulb signaled air bombardiers when missiles were released, and now—attached to surgical instruments—is aiding doctors.

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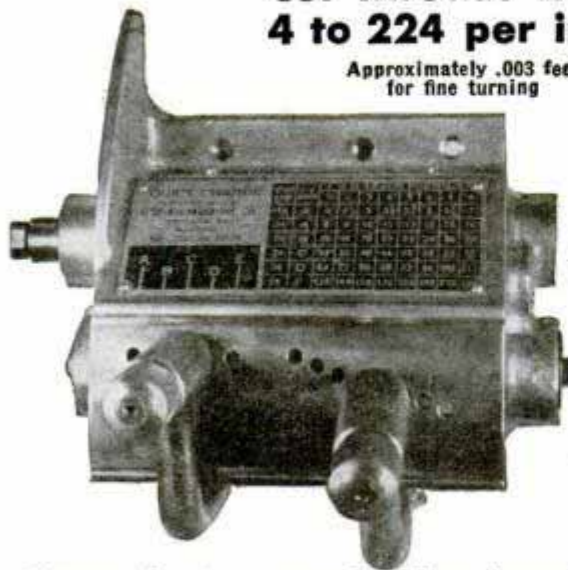
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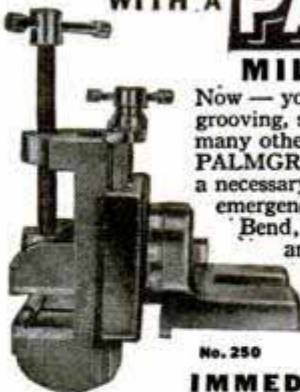
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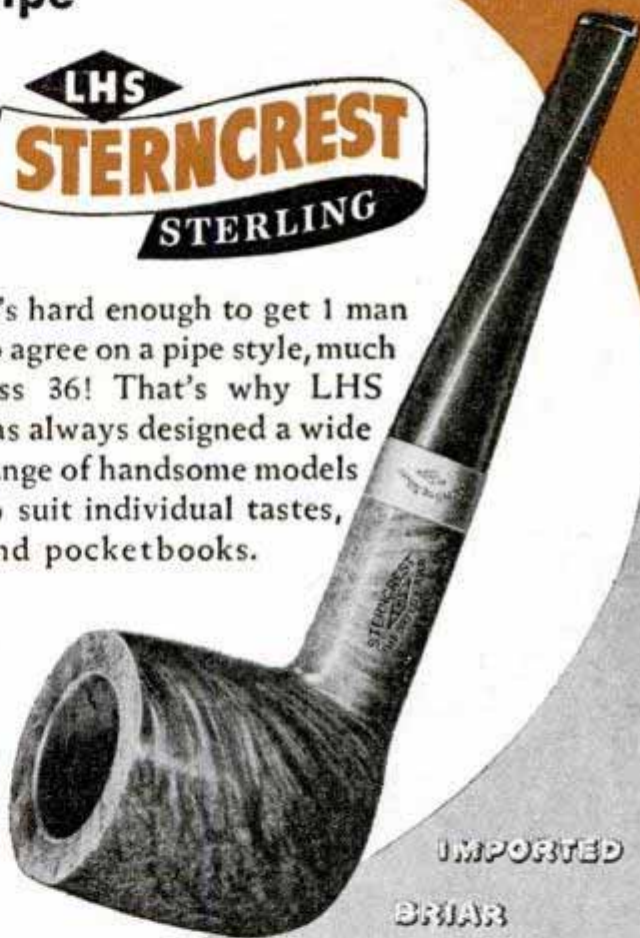
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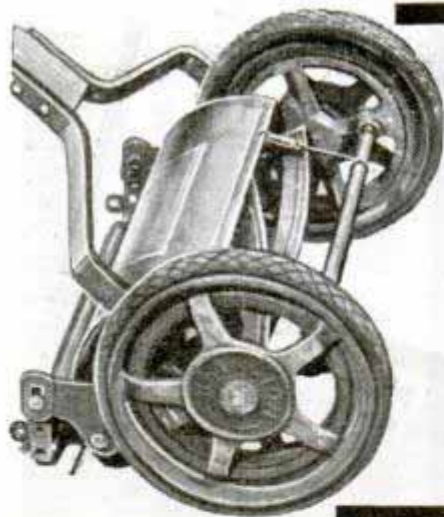
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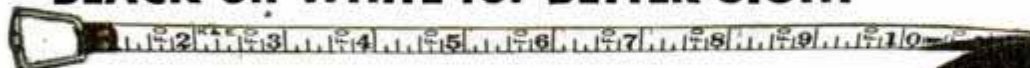


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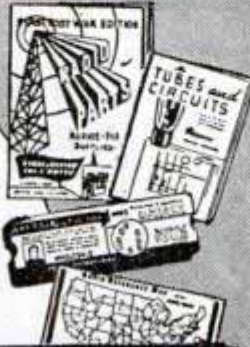
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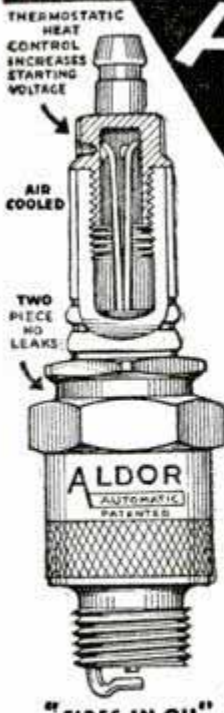
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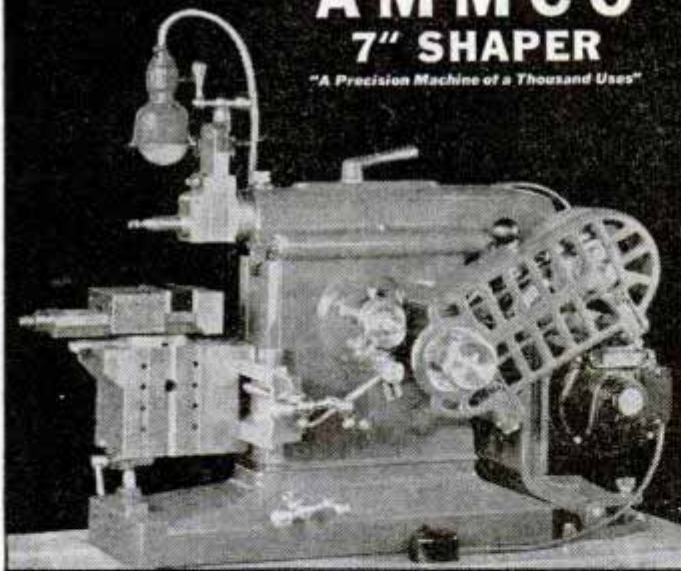
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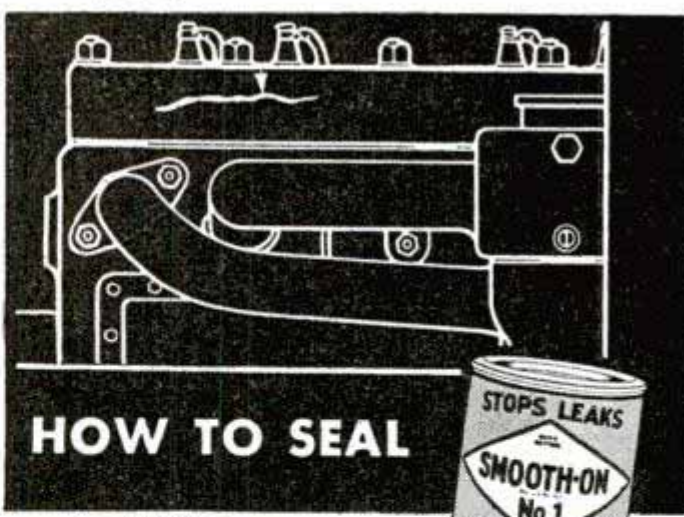
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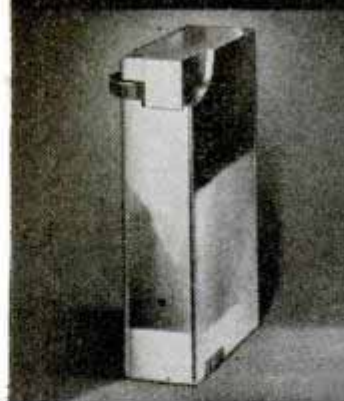


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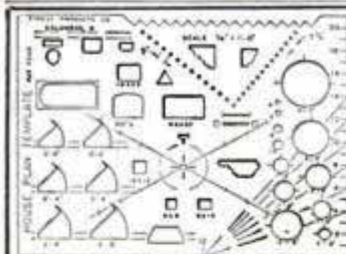


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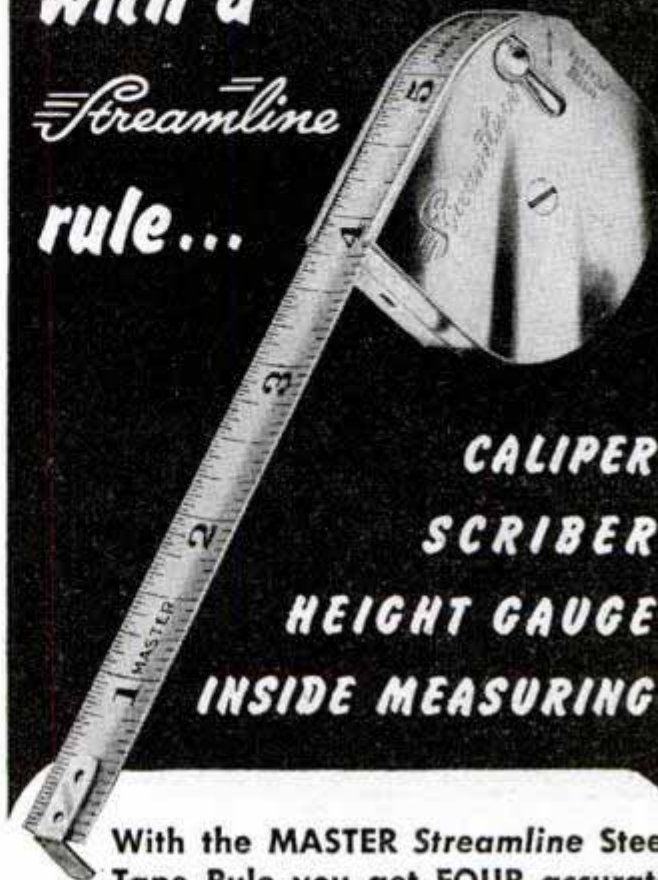
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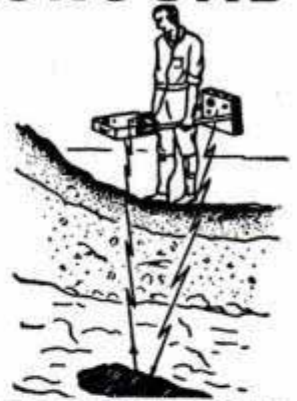
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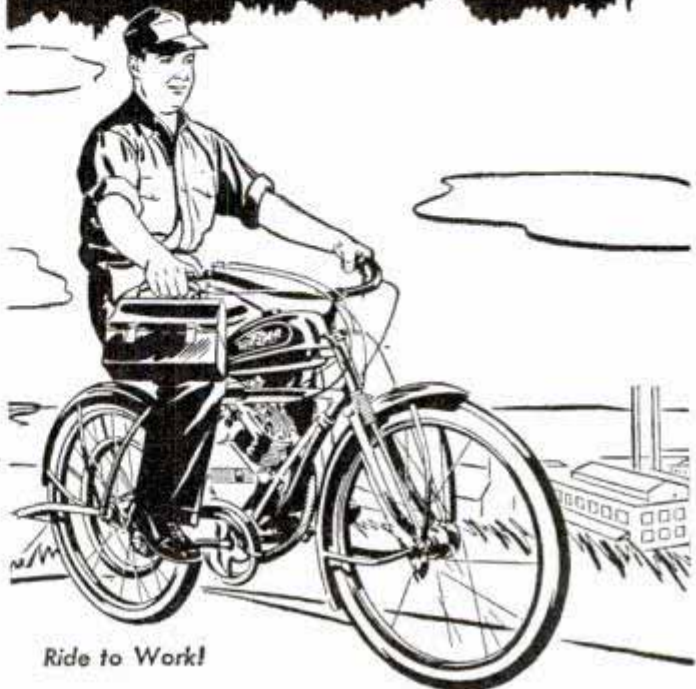
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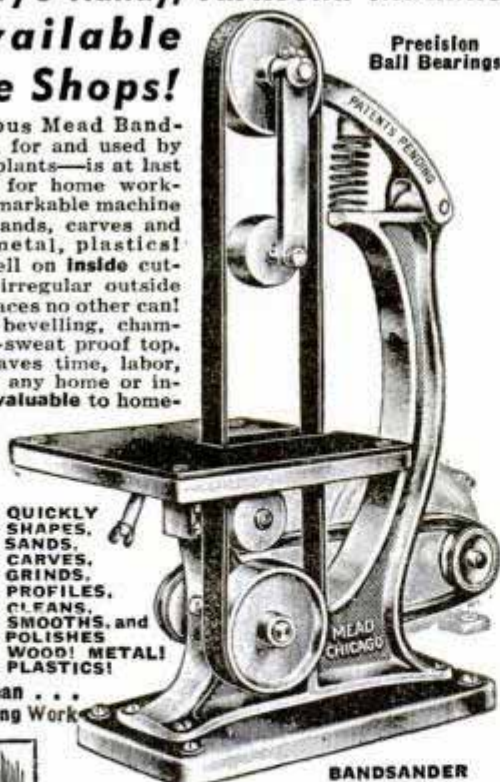
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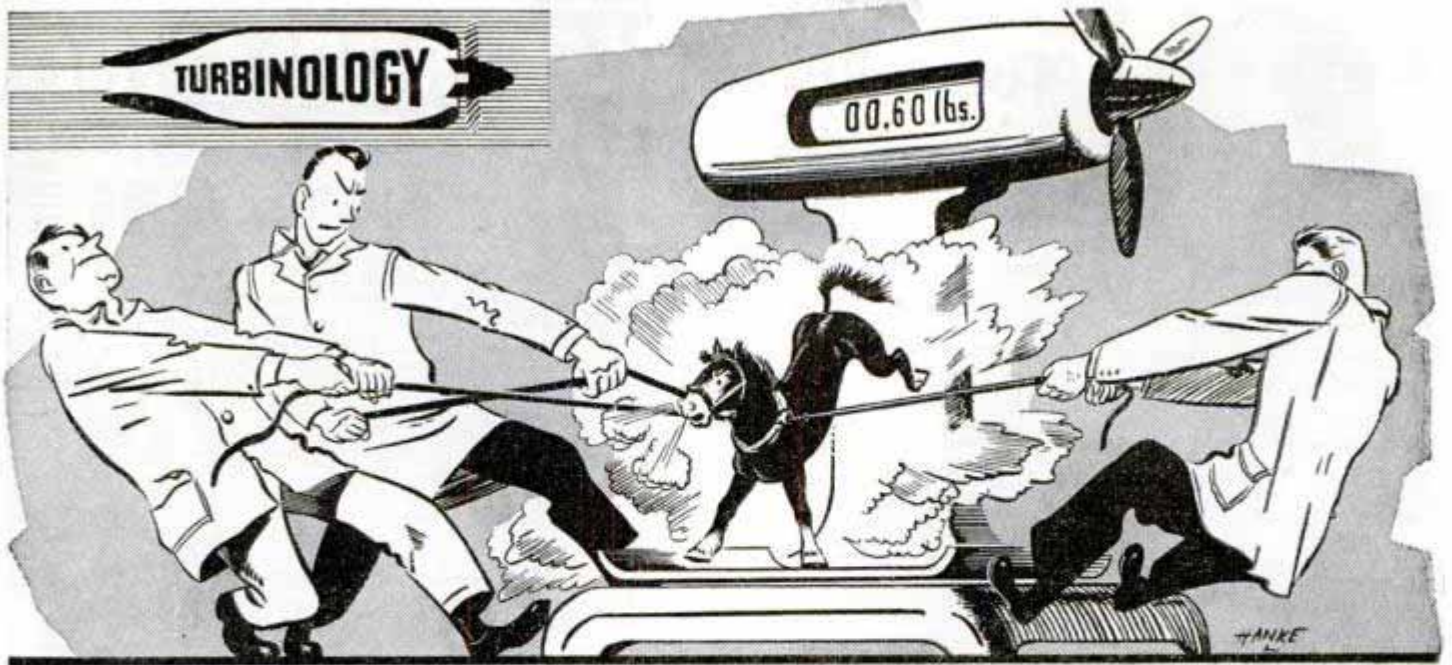
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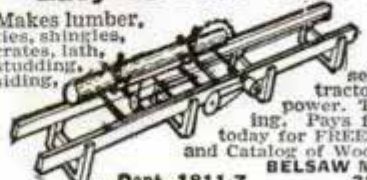
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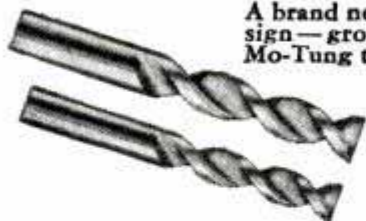
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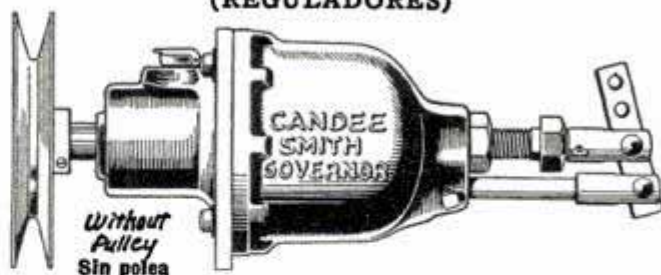
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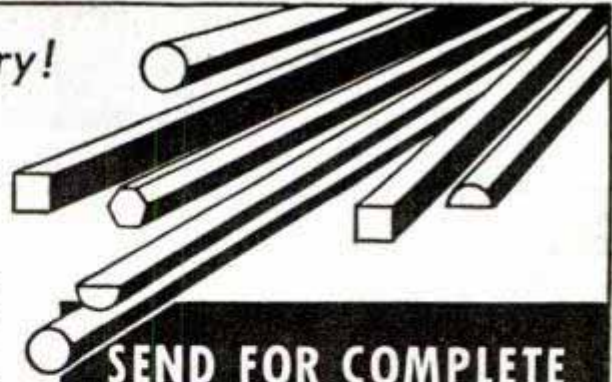
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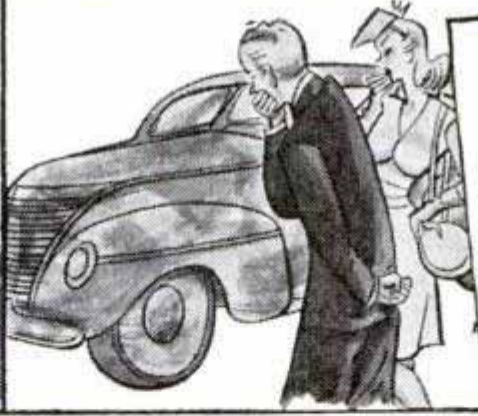
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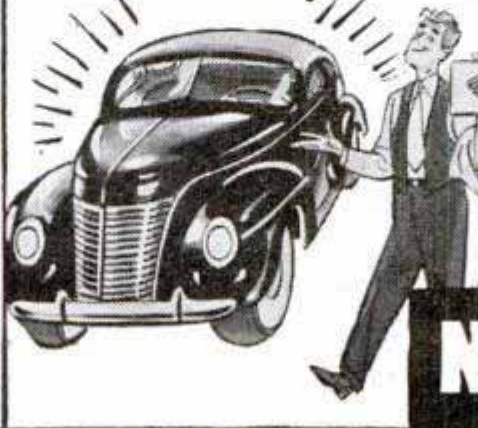
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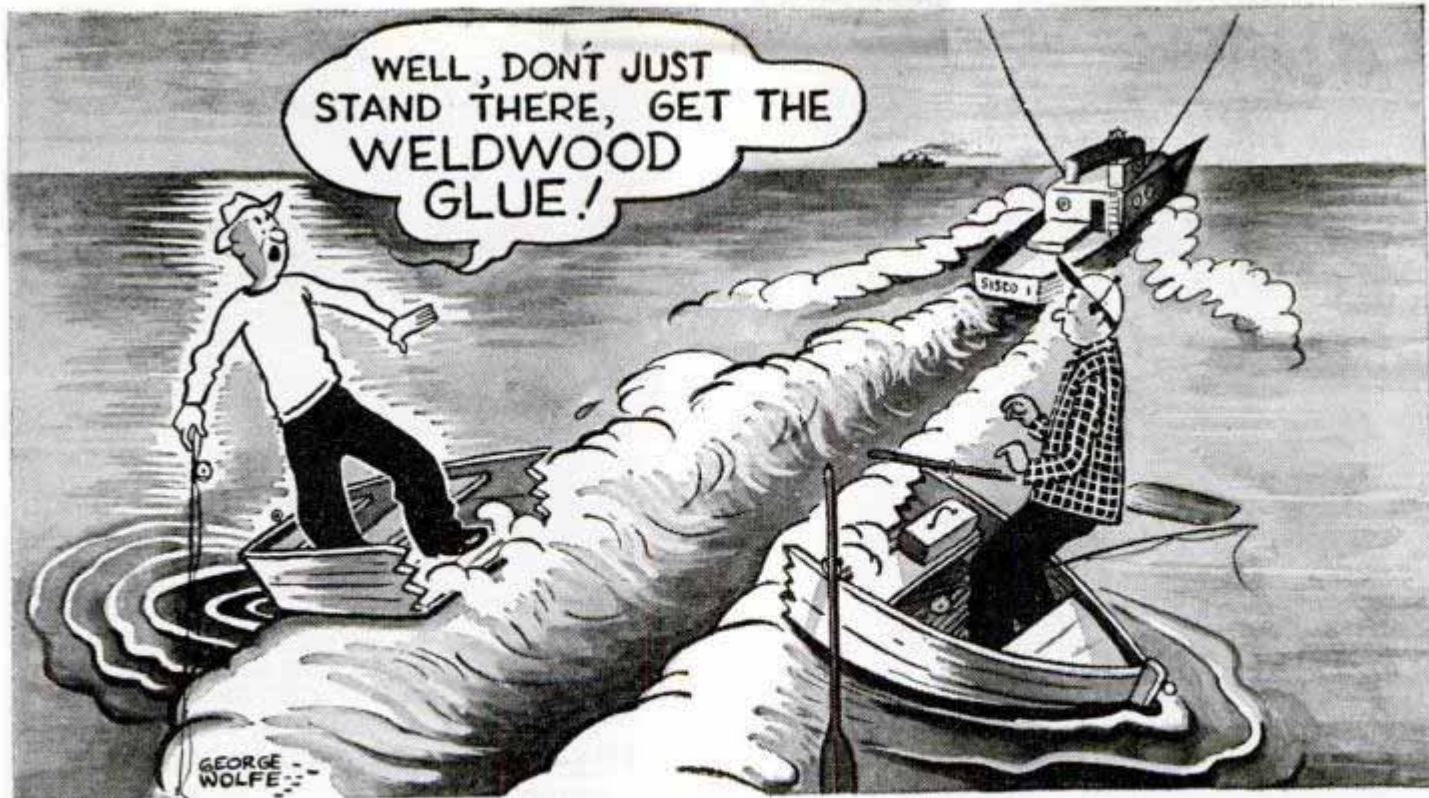
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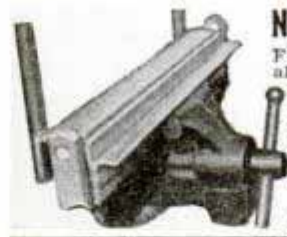


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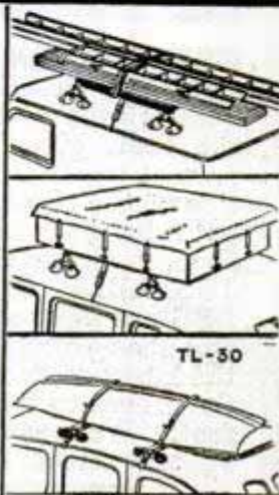
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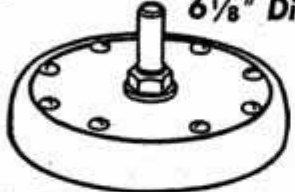
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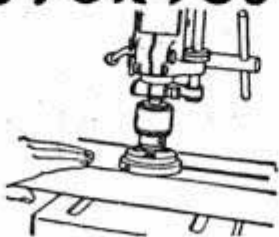
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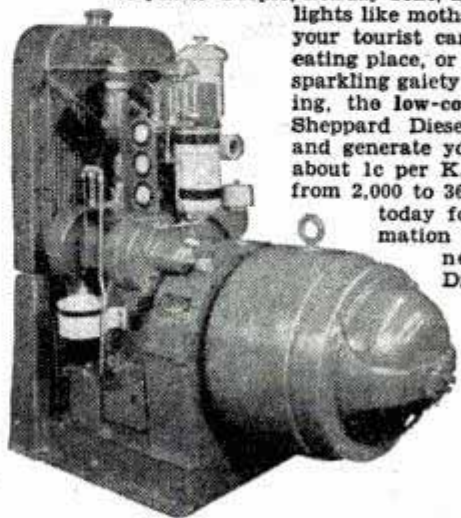


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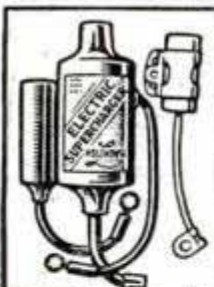


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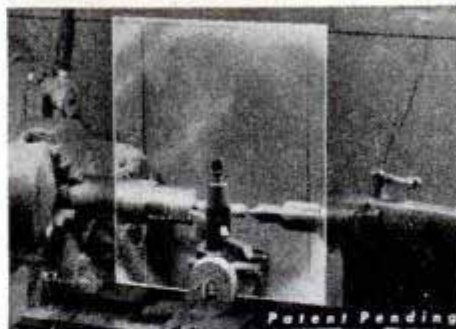
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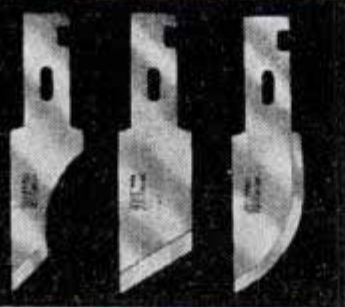
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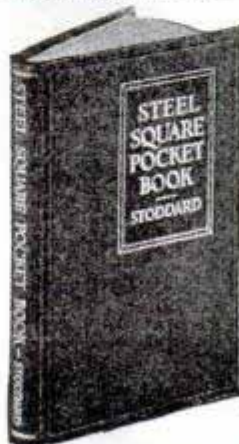
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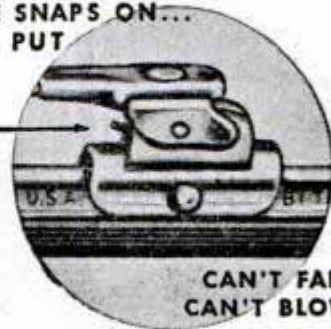
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Relief Models Help Blind Student



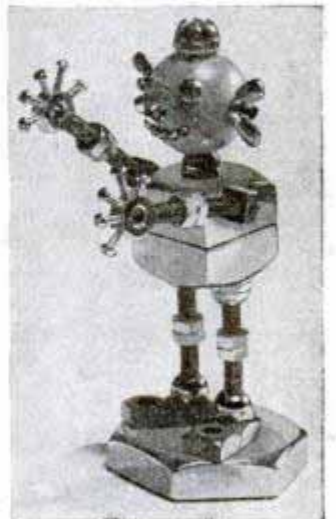
Models of campus buildings at Princeton University enable blind John K. Dupress, freshman from Fitchburg, Mass., to find his way without help. He lost his sight while serving with the Army in Europe. The models were made by G. Vinton Duffield, chief of circulation in the Princeton library.

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This fellow, known as "Nat," is waving for help because the editors slighted him in the January issue. Nat is a miniature "iron man," ingeniously fashioned of bolts and nuts, and is the trademark of the National Screw and Manufacturing Company, to whom belated apology is made here. His picture appeared without credit in a January article, "Modeling With Nuts and Bolts."



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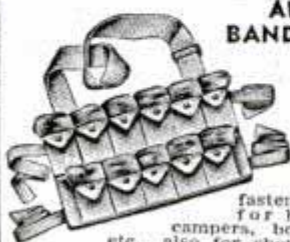
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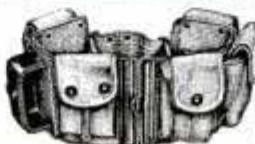


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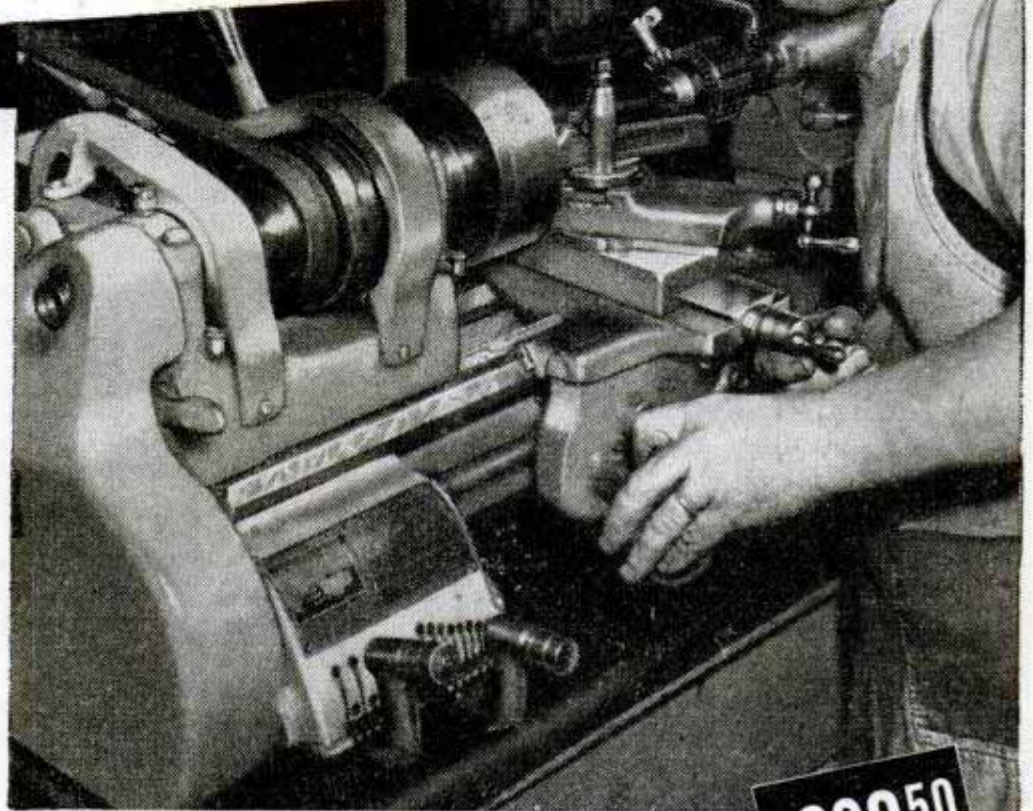
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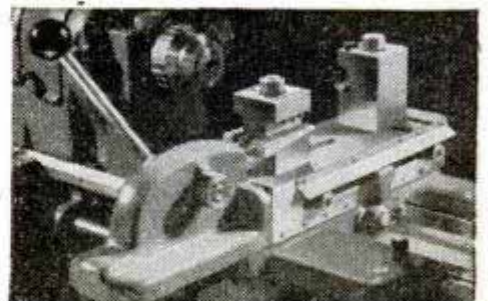
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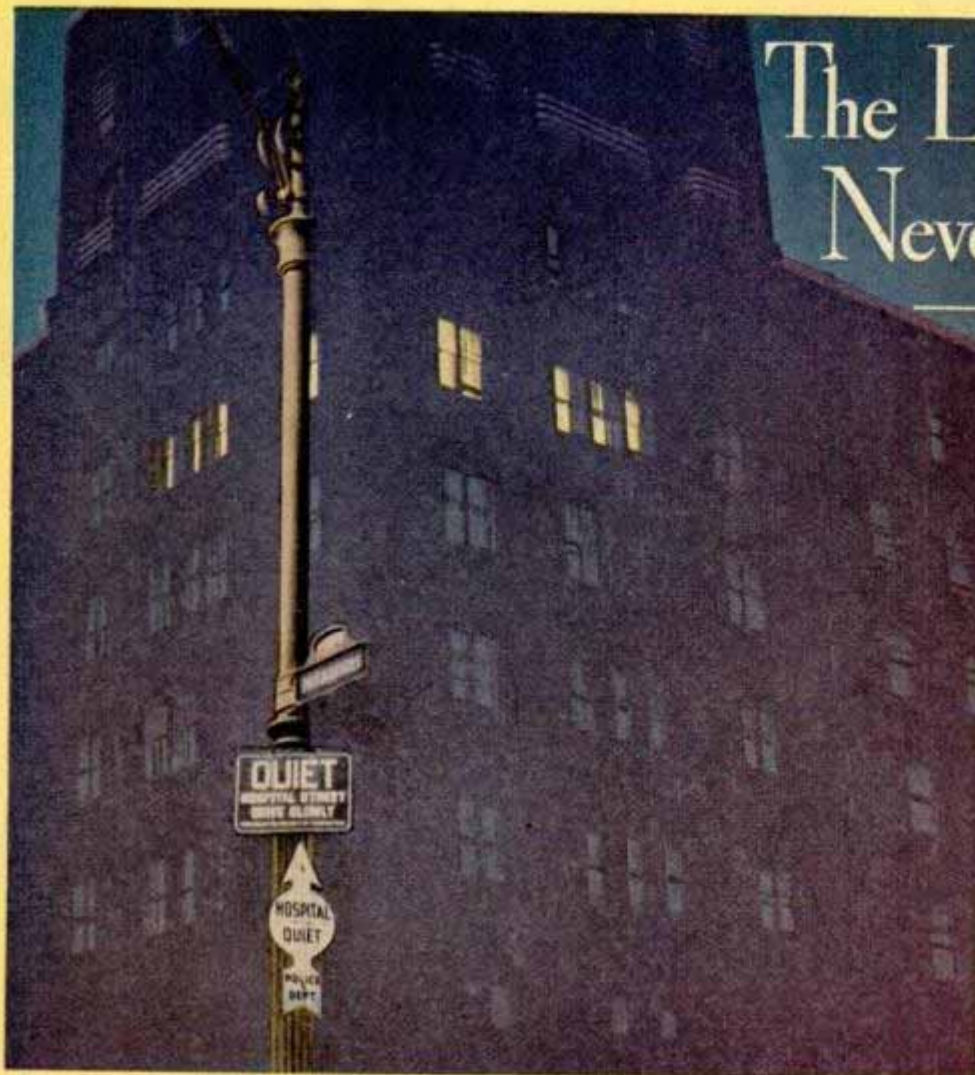
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