

POPULAR MECHANICS

MAGAZINE



WRITTEN SO YOU CAN UNDERSTAND IT

REGD. TRADE MARK GREAT BRITAIN NO. 40426

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FEBRUARY
1946
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SEE PAGE 40

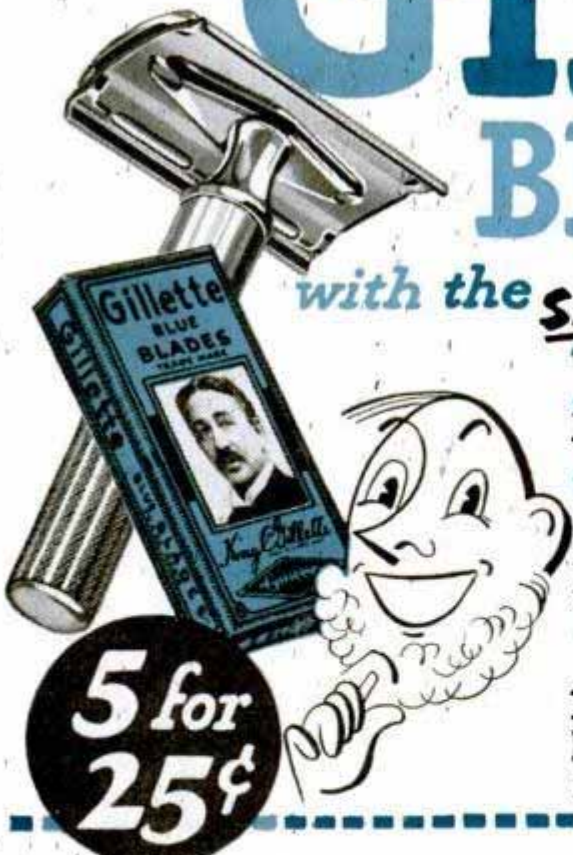


...look **SHARP**.....
...feel **SHARP**.....
...be **SHARP**.....



use **Gillette**
Blue Blades

with the **SHARPEST** edges ever honed!



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

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You are SHARP when you buy Gillette Blue Blades with the **SHARPEST** edges ever honed, because you get more shaves per blade and save money!

Copr. 1946 Gillette Safety Razor Co.

GILLETTE'S CAVALCADE OF SPORTS presents the major boxing event of the week every Friday night over American Broadcasting Company stations at 10 o'clock E.S.T.
Gillette Safety Razor Company, Boston 6, Mass.



Even at high speeds these new tires

OUTWEAR PREWAR TIRES

It's the new B. F. Goodrich tire for passenger cars

THE new B. F. Goodrich tire is made from synthetic rubber, but it is not a "wartime" tire. It has passed nearly 17 million miles of tests...on taxi fleets...on police cars (like the one above) and on the B. F. Goodrich test fleet.

Many of the tests required constant running, day and night, at sixty miles an hour. Few, if any, drivers are ever going to ask this kind of wear of a tire.

Yet the new B. F. Goodrich synthetics not only outlasted prewar tires—but they did better than new tires of natural rubber built

to prewar specifications!

These tires are made from a new kind of synthetic rubber that runs cooler, wears better, than other types. The tread is made wider and flatter so that the tread wear is distributed over more tire surface.

The tire body, or carcass, is stronger, too! By using a new kind of stronger cord—and by using more cords in each tire, B. F. Goodrich has perfected a stronger tire body.

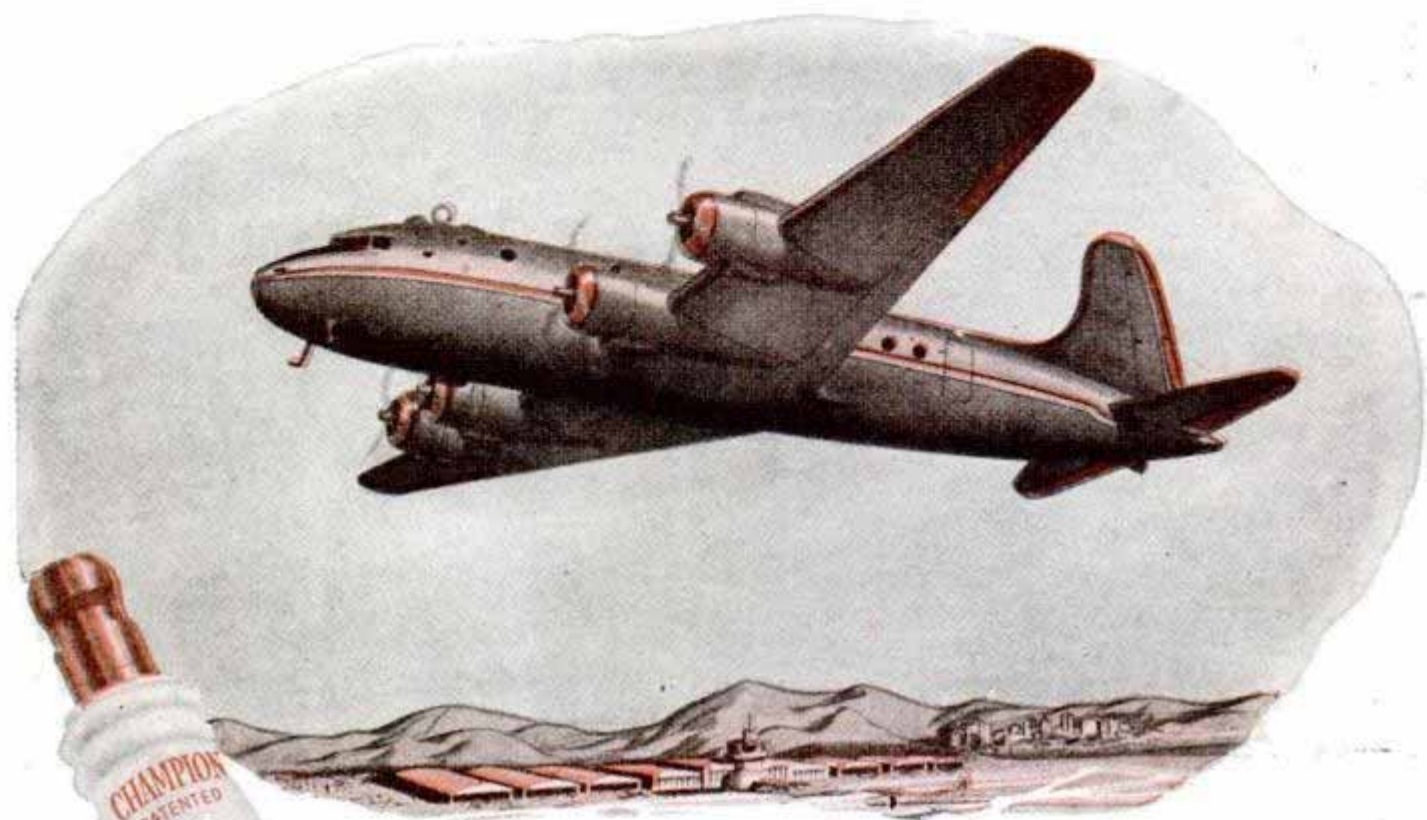
B. F. Goodrich started making synthetic tires 18 months before Pearl Harbor, and offered tires containing synthetic rubber to Amer-

ican motorists three years ahead of any other tire manufacturer.

They were the first such tires ever sold in America. This extra experience is reflected in the best tire for your car today . . . B. F. Goodrich *Silvertown* that actually outwears prewar tires. *The B. F. Goodrich Company, Akron, Ohio.*



Here's why most Airlines specify Champion Spark Plugs



THEY'RE DEPENDABLE!

Your choice of Champion Spark Plugs is made easy and sure if you follow the judgment and experience of men who know spark plugs best—men to whom spark plugs are a vital factor in their business. Most airlines find in Champions those indispensable qualities of maximum performance and dependability so essential to the better performance of your car—your own motoring satisfaction. Champion Spark Plug Company, Toledo 1, Ohio.

FOLLOW THE EXPERTS . . . DEMAND DEPENDABLE CHAMPIONS FOR YOUR CAR

Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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



Lt. Col. Aubrey O. Cookman, recently released from the U. S. Army Air Forces after nearly five years of service, has joined the staff of Popular Mechanics as Aviation Editor.

Next Month

COSMIC rays are not, at the moment, for hire. But potentially they may pack more useful power than the atom, and scientists are busily trying to solve their mystery. They hit the edge of our universe with the energy of 15 billion volts, and can penetrate 1600 feet of rock. A March feature tells how the cosmic ray researchers are "Unlocking the Universe."

RAINBOW trout, bass or pan fish are very fastidious. They won't bite on any old bait you toss at them. With new tackle to be available soon, fishermen will find a handy guide to follow in "Tips on Tackle," appearing next month.

A GOOD house-painting job isn't just an accident. It's the result of using high-grade materials on a surface painstakingly prepared. An article in the March Craftsman Section tells how to do it right.

YANKEE ingenuity is nowhere more at home than on the farm. It always will be hard work to operate a farm, but between the ingenious farmer and the implement manufacturers the business of producing food is heading as rapidly as it can toward a push-button industry. "Mechanics Are Popular on the Farm," featured next month, is a report of progress.

FOUR tubes do the work of seven in the "Little Giant" A.C.-D.C. Super Broadcast Receiver described in the March Radio and Electronics Section.

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Managing Editor.....Roderick M. Grant
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Radio and Electronics Editor.....Frank L. Britton
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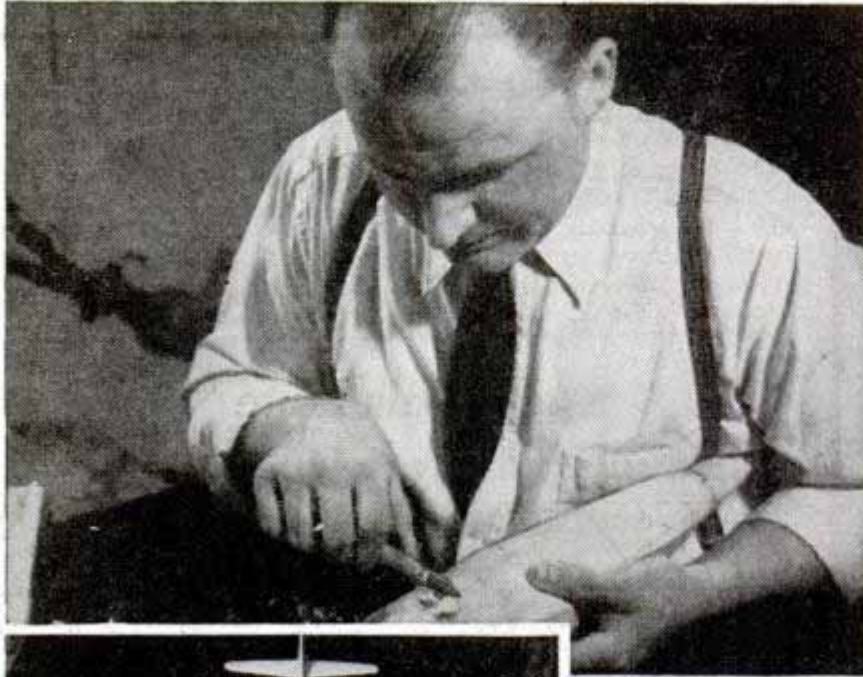
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Planes That Made History!



Above: Adolph Esbrandt of Baltimore carving a miniature Boeing Clipper.

Left: Esbrandt's scale models of the Wright Brothers' first plane; the first plane to fly across the English Channel; the famous B-29.

Baltimore Hobbycrafter Builds Scale Models of Famous Planes — With X-acto Knives

SAYS X-ACTO IS INDISPENSABLE

Not everybody who likes to build scale model planes can be as expert at it as Adolph Esbrandt. But you'll come a lot closer to it if you use the knife the experts choose . . . a super-sharp X-acto!

"I find X-acto indispensable," says Mr. Esbrandt. "With its variety of blades and handles, it's the perfect tool for every job from tiny braces to the big, solid fuselage section."

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KNIVES & TOOLS

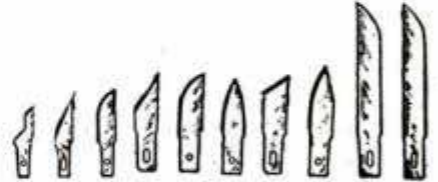
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INGENIOUS COLLET DEVICE locks in blades securely, so they can't fold under on curves or heavy cuts.



CHANGE BLADES in about 5 seconds. A twist, a twirl, and there! X-acto's always sharp, always ready.




X-ACTO TOOLS, TOO! Scientifically accurate, each perfect for its purpose. Sander, 50c; Balsa Stripper (without Knife), \$1; Planer, \$1. Drill Holder and Pin Vise, 75c; Hobbycrafter's Saw, \$1.25.

Read what Home Owners say about MODUFLOW*^{comfort}

ACTUAL EXCERPTS FROM USERS' LETTERS

(Names available on request)

- "Would not take a thousand dollars for mine if I could not get another."
- "This is the first winter season we have been able to enjoy our home."
- "Moduflow results have far exceeded the most extreme statements made in your advertising."
- "Since the installation of Moduflow, the temperature does not vary over one-half a degree."
- "In effect, Moduflow has added a room to our home during the heating season."
- "Next to the purchase of war bonds, I consider the purchase I made from you of a Moduflow control system as my best buy."
- "Since our new Moduflow system was installed, we have enjoyed a more comfortable home than we thought possible."
- "We are getting steady, even temperature at all times all over the house. It is the last word in house heating."
- "Since Moduflow has been installed the same floors are warm enough to allow the baby to play on them, and we are able to set our thermostat much lower."
- "I am delighted with Moduflow and take pleasure in recommending it as being the perfect heat control system."



During the past two years, Honeywell's remarkable new MODUFLOW Control System has been installed in thousands of homes. Hundreds of enthusiastic letters have poured in telling about the amazing improvement in heating comfort.

Here are some typical quotations taken from a few of these letters. They stamp Moduflow as the greatest advance in heating comfort since the invention of automatic controls.

FOR YOUR PRESENT HOME

Best news of all is that Moduflow can be easily and inexpensively installed in your present automatic heating plant. You don't have to wait until you remodel or build a new home.

FOR YOUR NEW HOME

If you are planning to build, make sure that your new home is *really modern* with a Moduflow Control System. Get the complete story of Moduflow without delay. Mail the coupon for your free copy of "Heating and Air Conditioning the Postwar Home".

* Moduflow is the name of Honeywell's newest heating control system for homes. It means heat *modulated* to just the right comfort temperature, with a uniform, continuous flow. Moduflow is a heating control system — not a complete heating plant. It can be installed in any type of automatic heating plant, whether warm air, hot water or steam.

SEND FOR THIS BOOK 

Minneapolis-Honeywell Reg. Co.
2749 Fourth Avenue South
Minneapolis 8, Minnesota
Please send my free copy of "Heating
and Air Conditioning the Postwar Home"

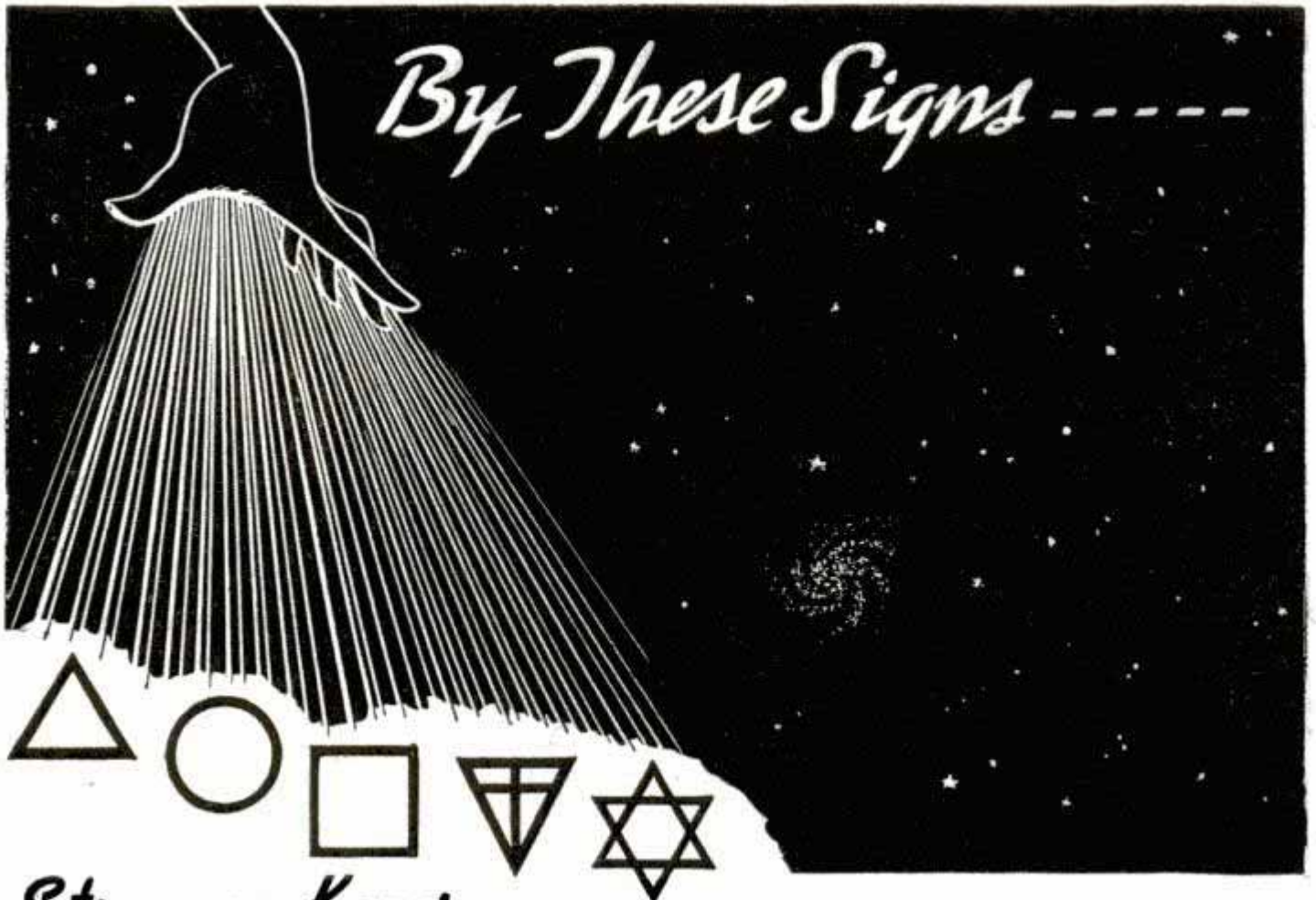
Name

Address

City State

Tomorrow's Apartment will have Personalized Heat Control . . . with Moduflow

By These Signs -----



Strange Keys to the Powers of the Universe

"GOD GEOMETRIZES," said an ancient sage. Within the straight line, curve, and angle—and their combinations—exist the forces of creation. These *secret symbols* contain the mysterious laws of the universe. Upon their right use—or the neglect of them—the success or failure of every *human enterprise* depends.

Have you a desire, *something you wish to accomplish* in life? Put your finger on a dot. In whatever direction you move your finger from the dot, you have made a beginning. Thus a dot is the symbol of *one*—or a beginning. Your desire then is also symbolized by *one*. If you follow the *proper method* or way to accomplish what you want, you have arrived at point *two*. Whenever these two symbols are brought together—the idea and the right way—you produce point *three*—the success of your plan. Success, therefore, is symbolized by the three equal sides of a *triangle*.

In planning your personal affairs—business, domestic, or the welfare of your family—do you use a *Cosmic formula*? Do you determine whether your acts are in accord with Divine truths eternally expressed in symbols? Why does the circle represent completion? Why is it said that a man is on the square? These

symbols are used by astronomers and scientists to prove the physical laws of the universe—why don't you apply them to the problems of your everyday world? Learn what symbols, as powers and forces of nature, you can simply and intelligently use in directing the course of your life.

Let the Rosicrucians (not a religious organization), a world-wide brotherhood of learning, reveal to you *the symbolism of successful living*.

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If you want to prepare yourself through understanding for the greater rewards of life, write for the fascinating *free Sealed Book*. It explains how you may receive this age-old wisdom. Use the coupon below.

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**Are YOU
doing
bookkeeping
"chores"?**

**CLIMB
HIGHER!**

**BECOME
an
ACCOUNTANT**

IF you are doing the "chore" work of accounting as a bookkeeper, ledger clerk, cost clerk, billing clerk, or in one of the other many record keeping jobs—

You should consider climbing higher—becoming an accountant.

Why be satisfied all your life with a small salary and an ordinary job when there is such a large future for the man or woman who understands accountancy in all its forms and phases?

One big difference between you and the successful accountant is that he doesn't do the chores. He bosses those who do the drudgery and he gets the money and prestige. And he does that because he knows the principles behind the records you keep—can plan those records and interpret them to management. He knows what you know—and a lot more.

There are two ways in which you can get this knowledge which will qualify you for an accountant's position.

First—the old way of day-by-day experience on the job. This is the long route—taking many, many years, sometimes a lifetime. Most people taking this way never get anywhere. Why sacrifice years of success—lose time and money—when there is a better and easier way?

Second, the LaSalle way of learning in your spare time—studying and preparing for the step ahead. You learn by doing—you study accounting principles and solve accounting problems. You cover accountancy from the basic principles right up through Accounting Systems and Income Tax Procedure—C.P.A. training if you so desire.

As you go along you absorb the principles of auditing, business law, statistical control, cost accounting, organization, management and finance, etc.

This way is not magic. It is not easy. It requires giving up certain spare time to serious study. How long will it take you to acquire

this accountancy training is strictly up to you—you can go as fast or as slowly as you choose. But after you have gone part way (you need not wait until you are clear through the training) you will find yourself stepping up to better positions.

And once you have mastered this fascinating profession—once you have become an accountant—then you will have the money and the standing to make your dreams come true. You will be a respected member of the best paying profession and equipped to go out into public accounting or to climb to a top management position.

Our free 48-page booklet, "Accountancy, the Profession That Pays," tells you what you must know to be an accountant and how you can prepare in your leisure time at moderate cost. The coupon below will bring this booklet quickly without cost or obligation. You already have a start in this field; now find out how you can go all the way. Do it today.

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City & Sta.



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WHERE-TO-BUY-IT INDEX

Manufacturer's name and address appear in parentheses directly after items believed by us to be commercially available

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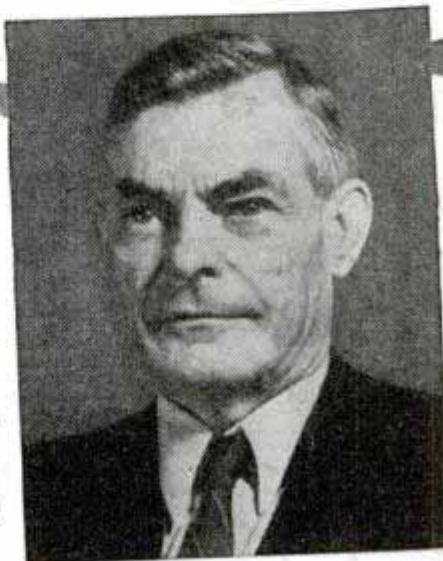


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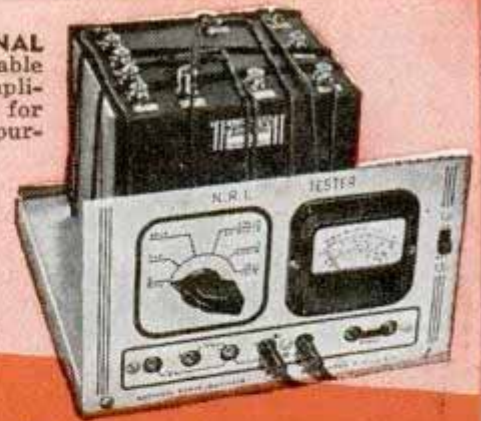
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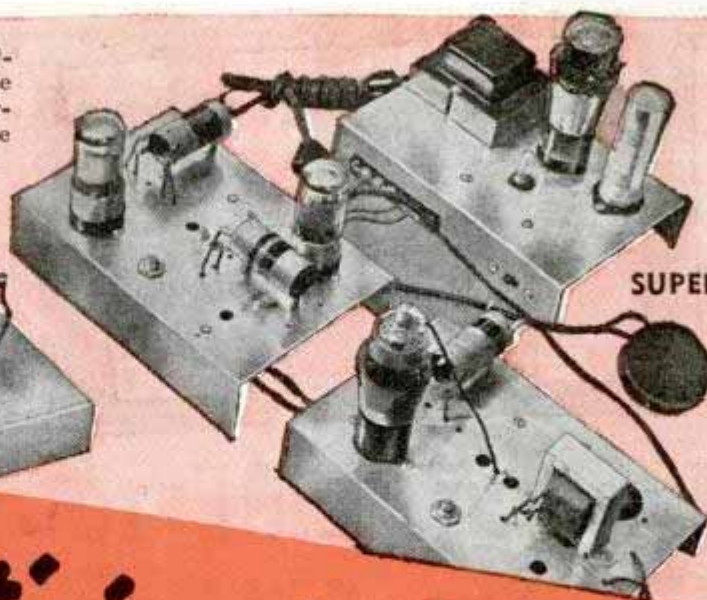
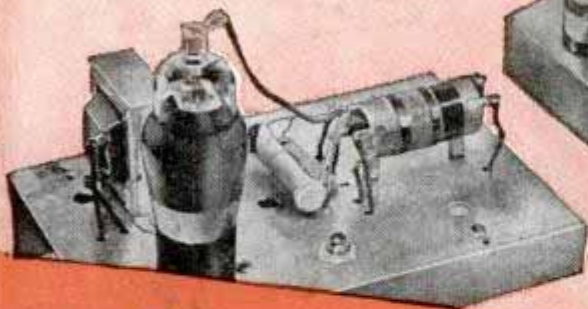
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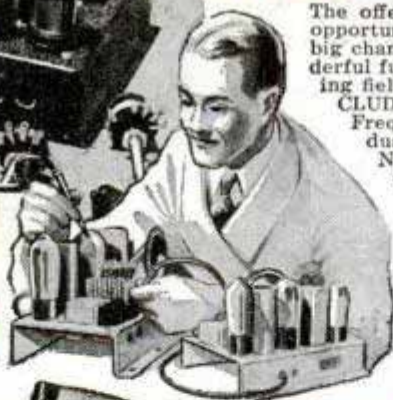
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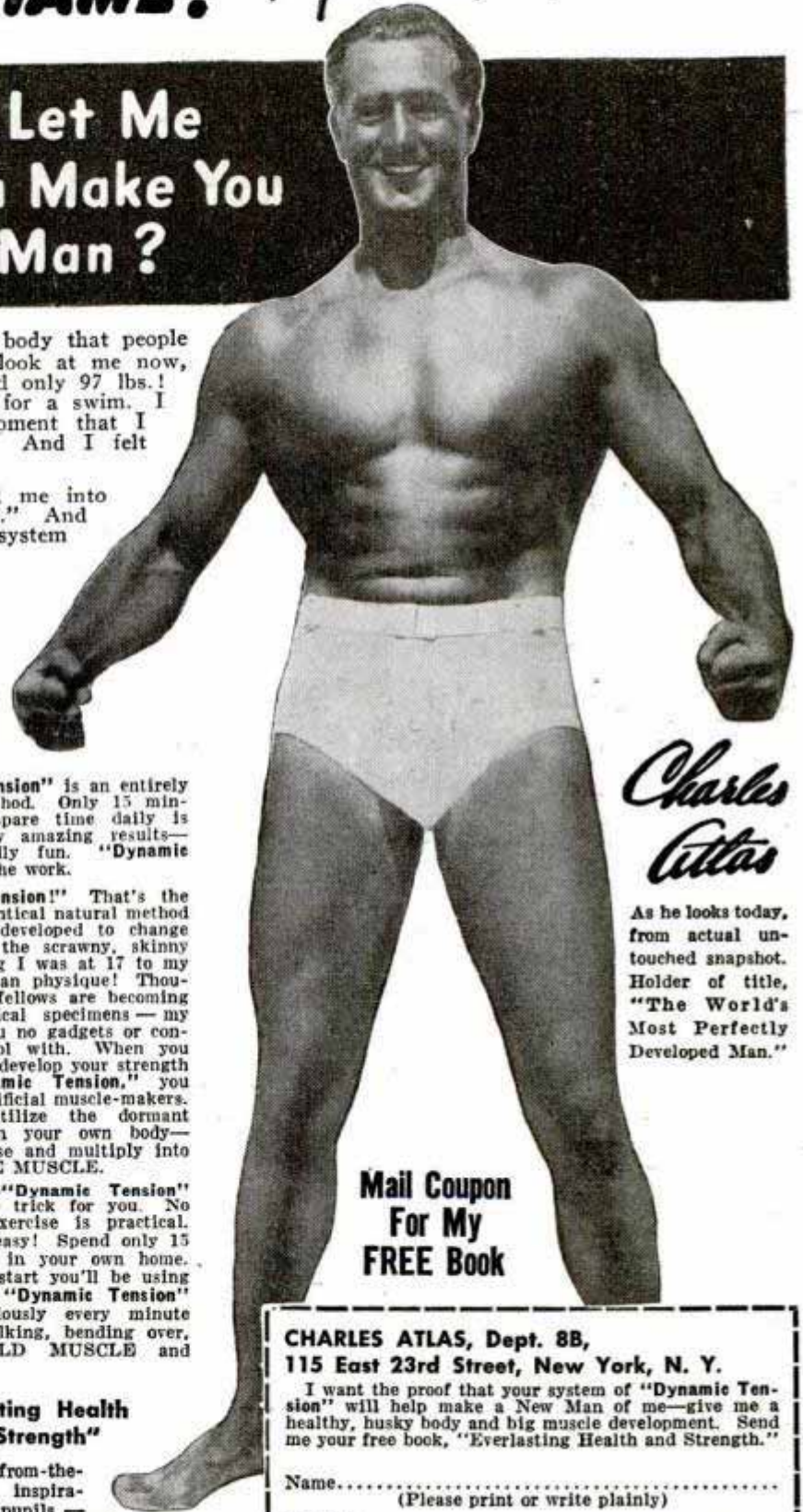
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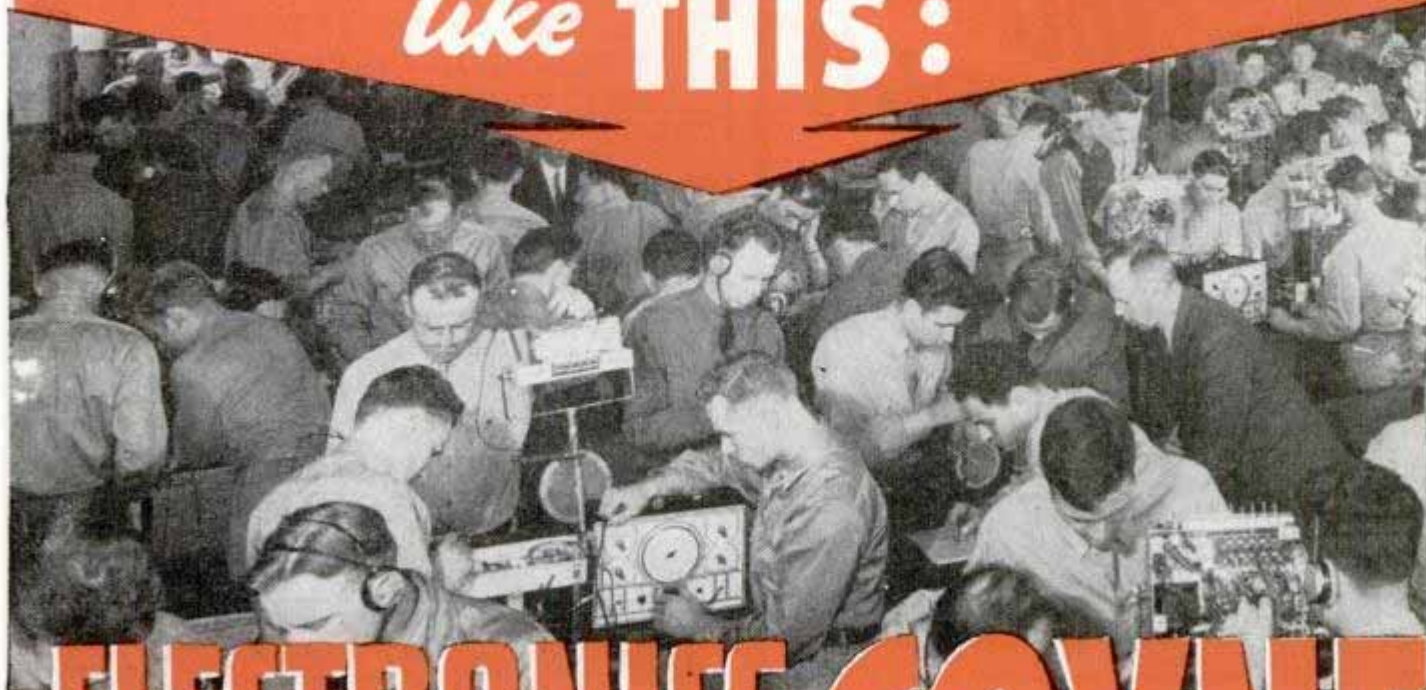
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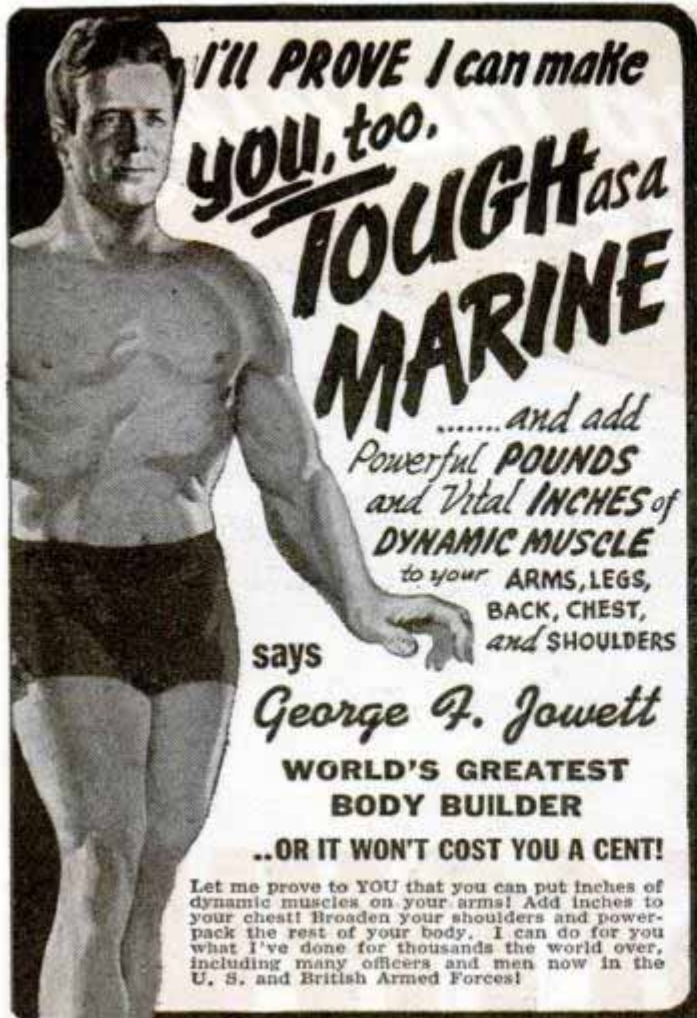
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By S. T. CHRISTENSEN
the "Fix-it Man"

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

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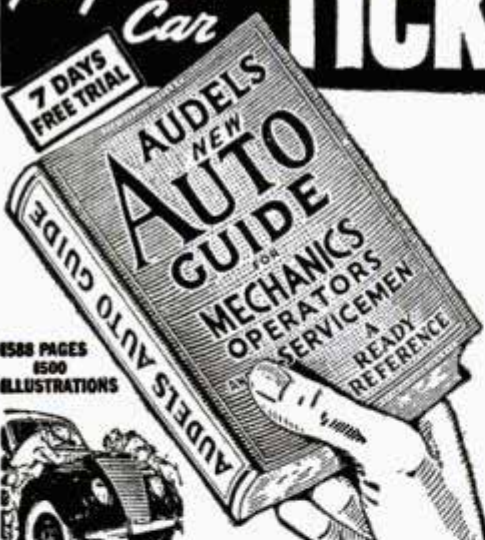
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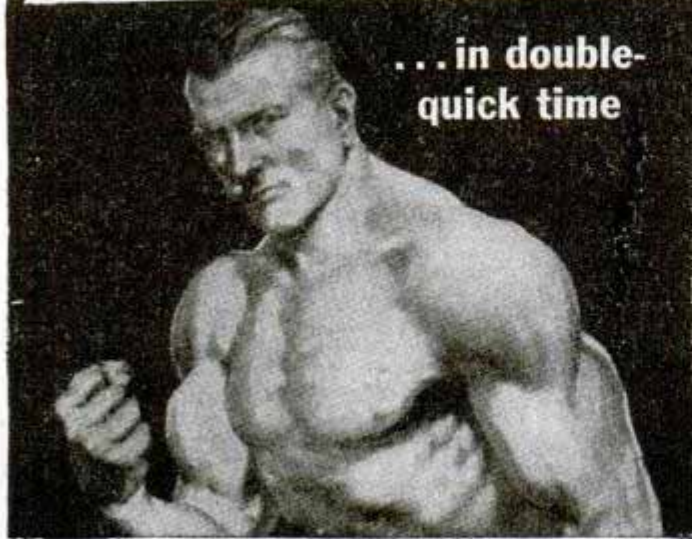
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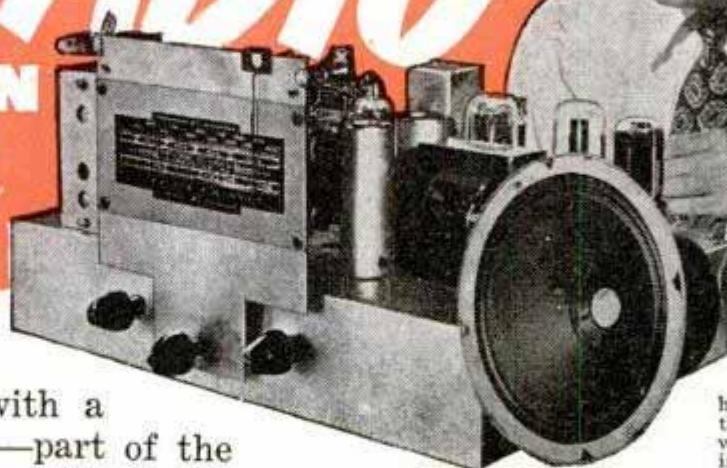
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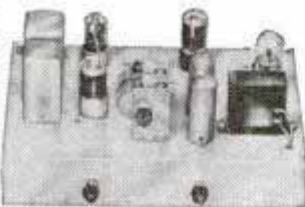
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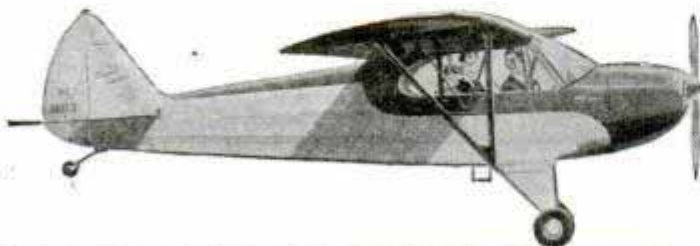
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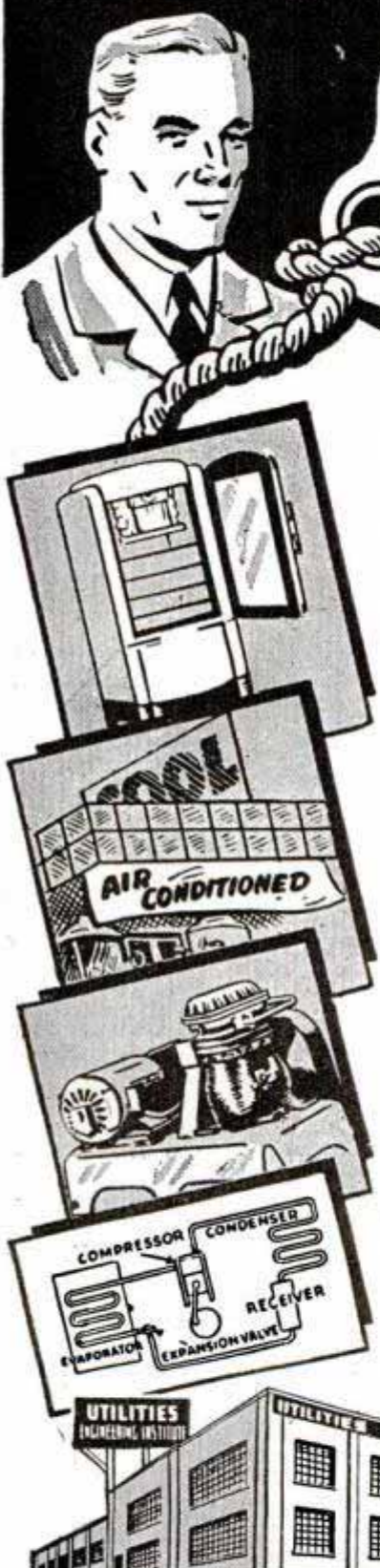
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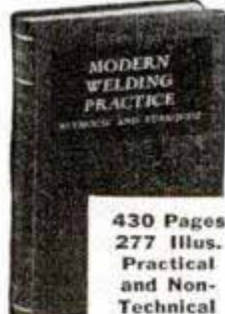
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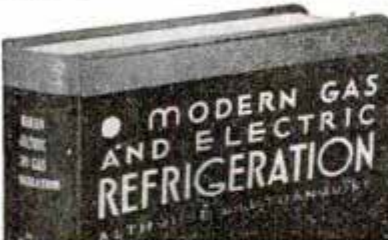


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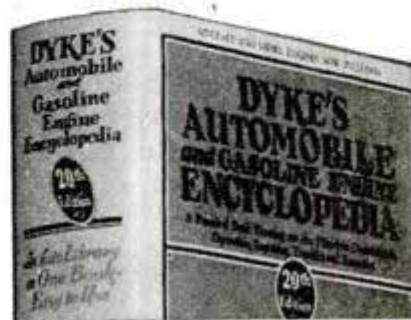
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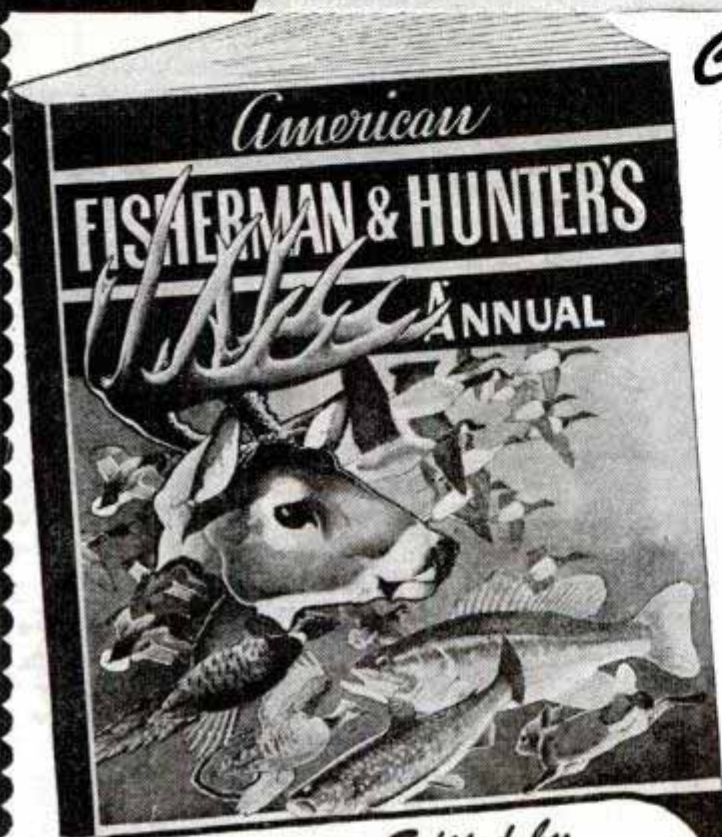
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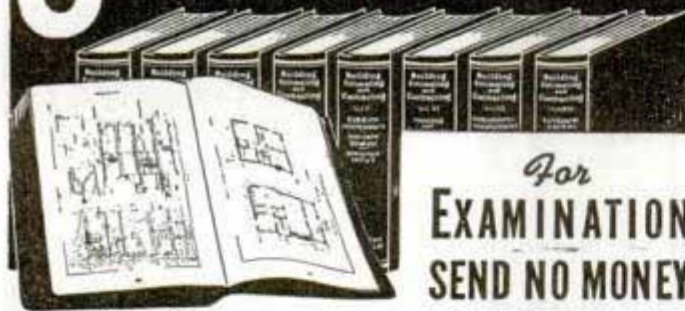
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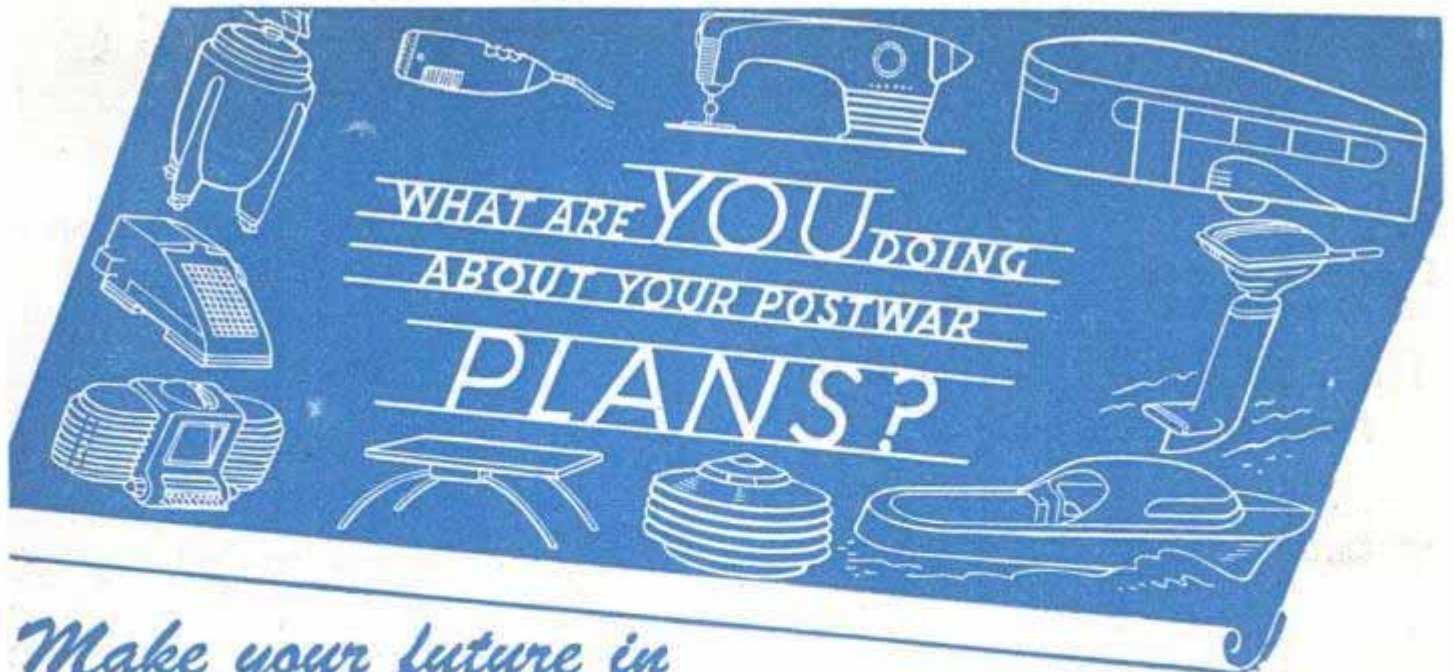
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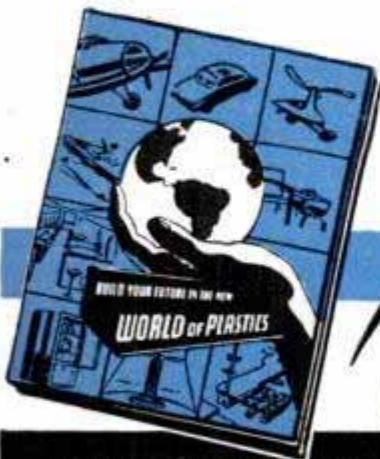
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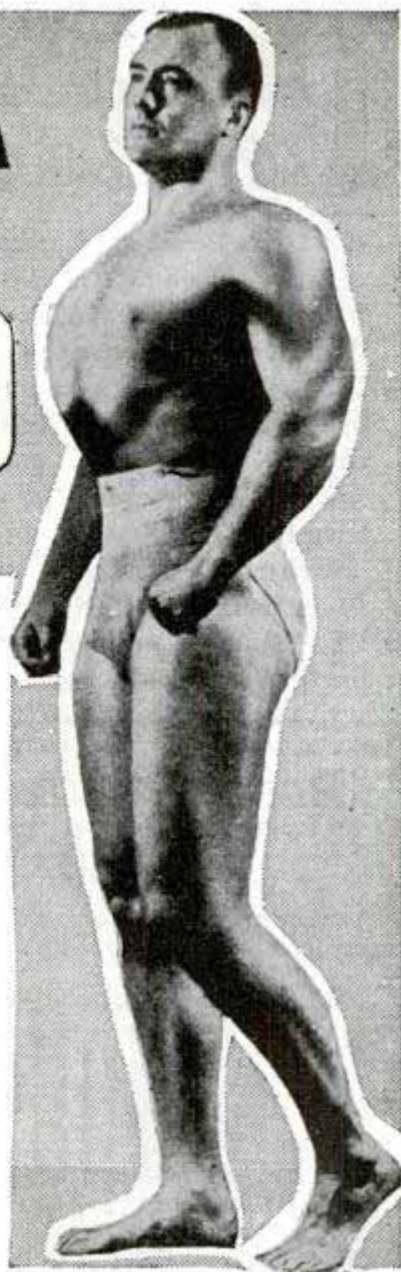
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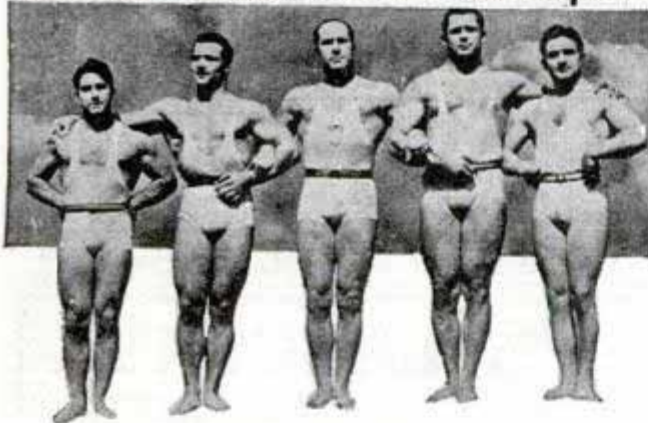
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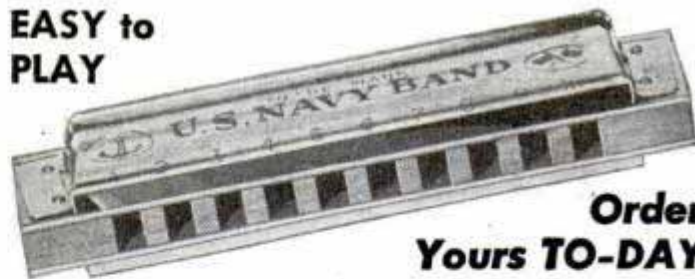
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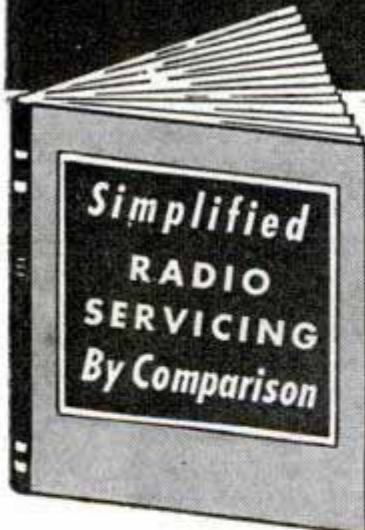
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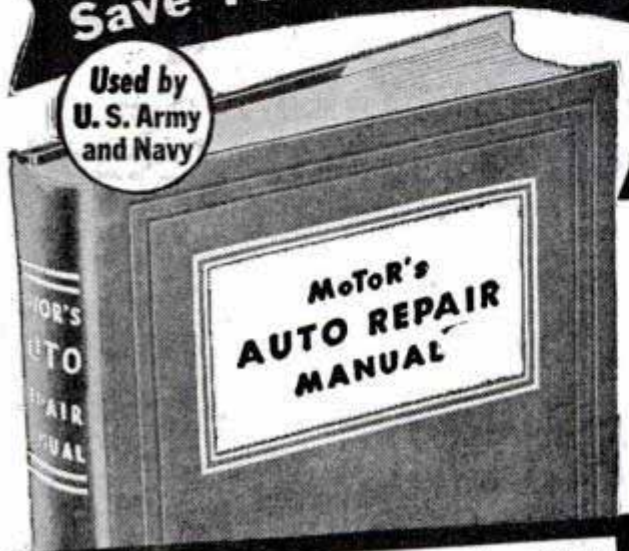
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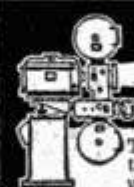
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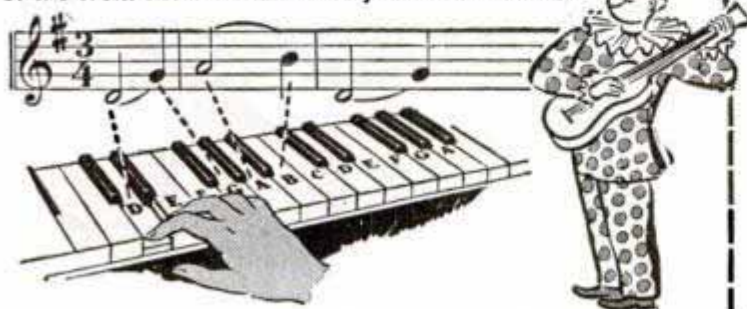
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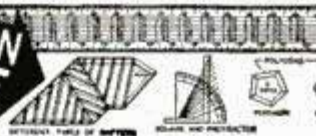
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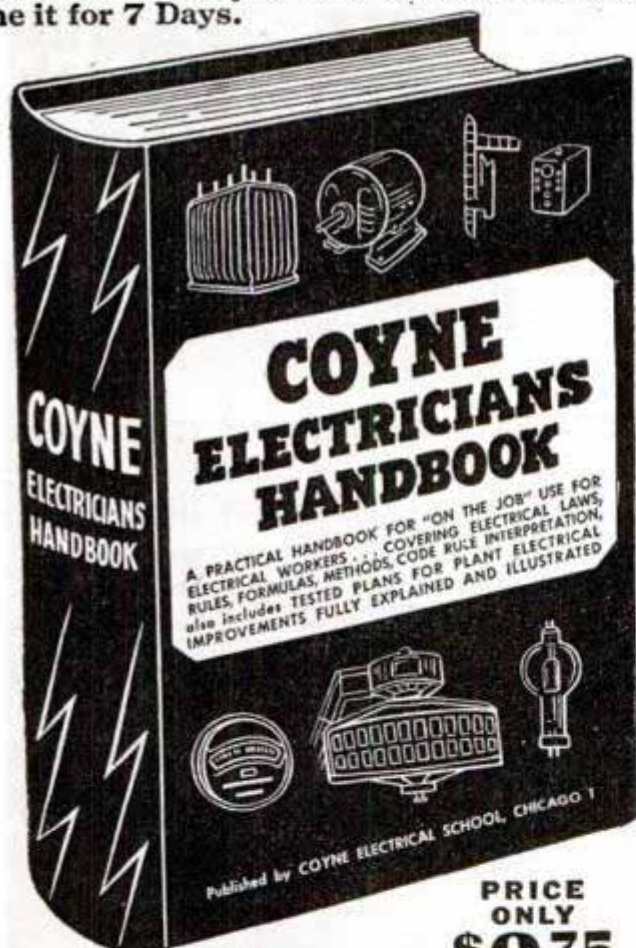
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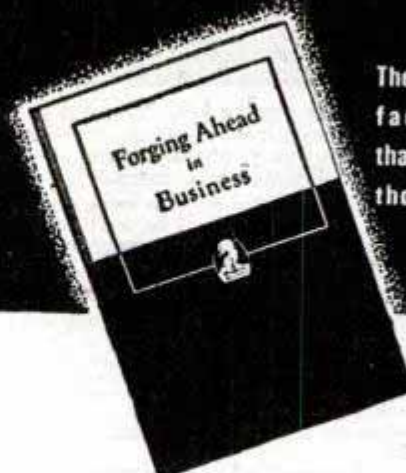
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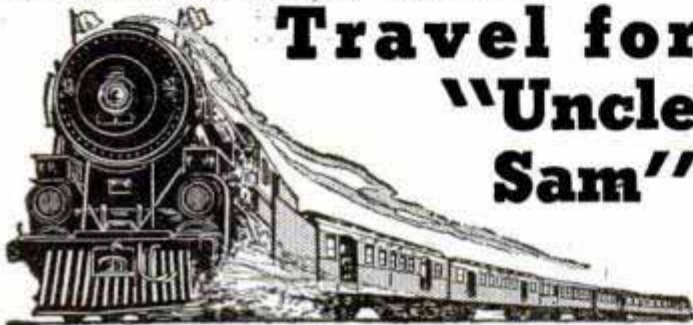
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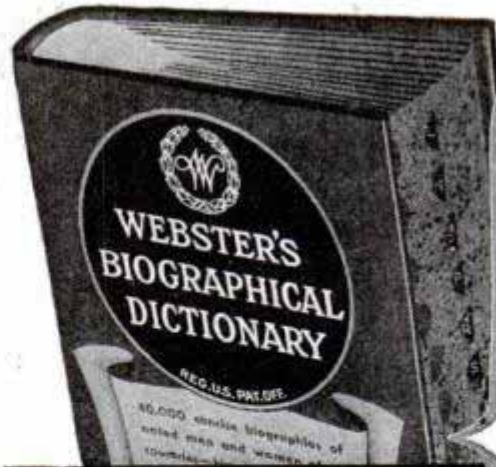
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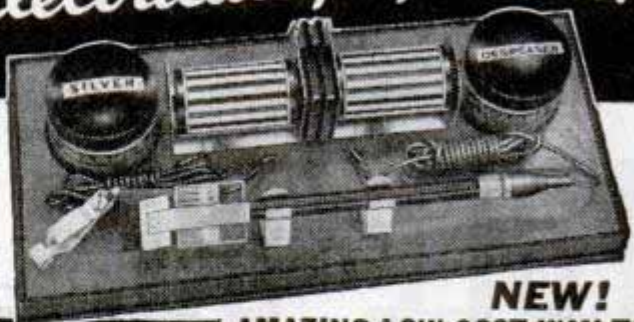
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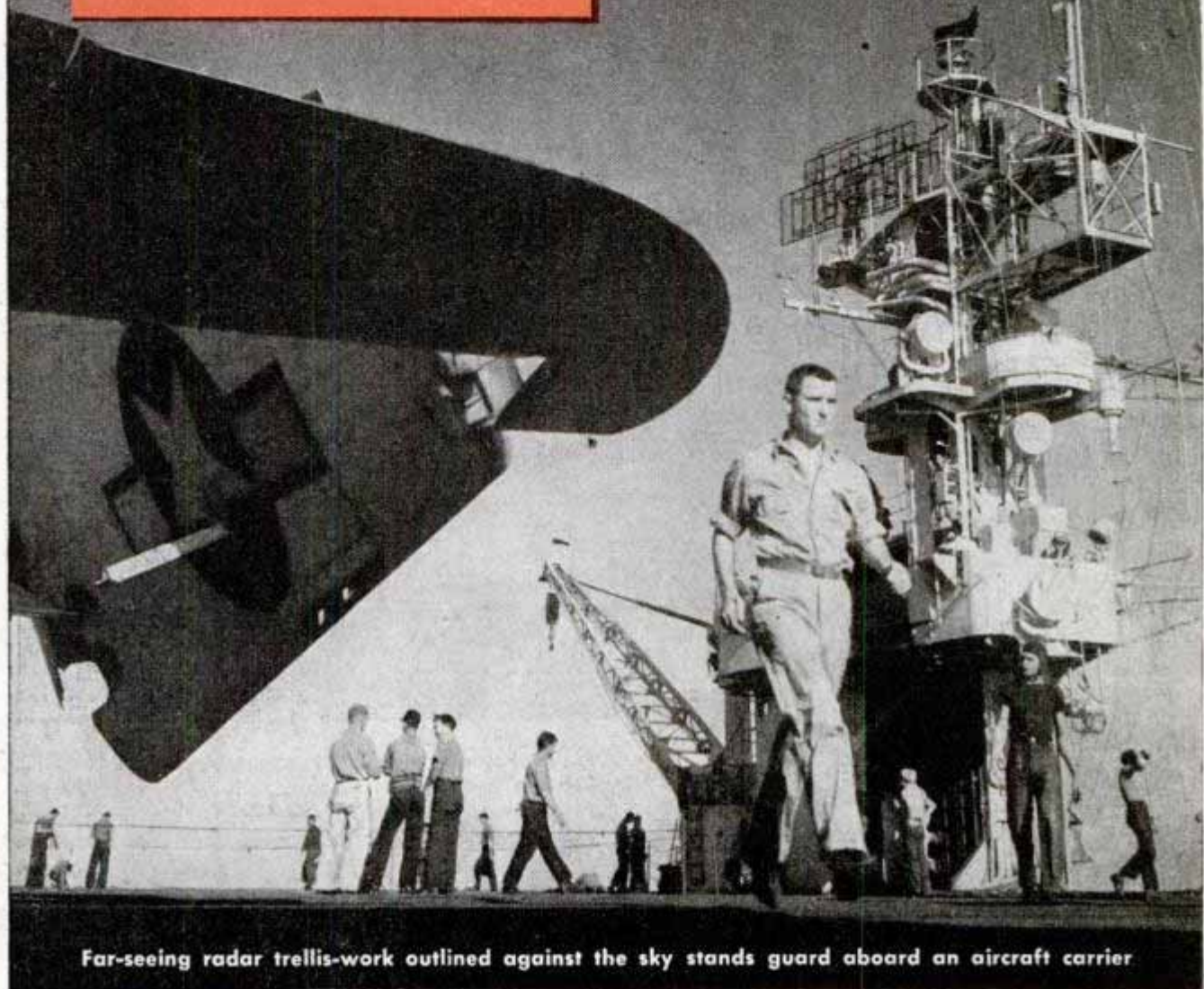
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Far-seeing radar trellis-work outlined against the sky stands guard aboard an aircraft carrier

PART I

RADAR *Cues the Navy Fighters*

THINK of one of those model ships in a bottle, then stretch your imagination a bit. Picture, if you will, a city-block-long modern aircraft carrier, complete with a hundred planes, resting neatly in a huge bottle exactly like the ship model, except that this bottle is coated with lamp black making it impossible for you to see the ship.

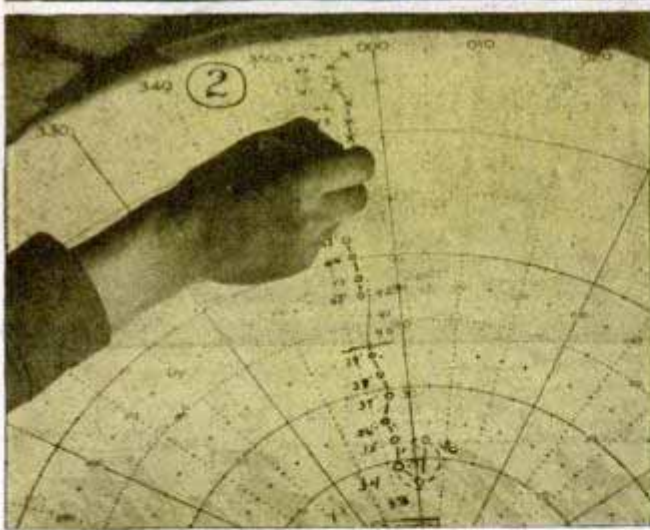
Now place yourself in the position of the officer-of-the-deck, conning the carrier from the bridge—inside that bottle! Strain your

good weather eye; still you can scarcely make out the straightedge of the flight deck and certainly nothing past that.

This ship-in-a-black-bottle business is exactly how you feel on the black nights as you churn through Pacific waters, yet there is one big difference. Unfortunately you don't have a protective bottle around you, and somewhere in that black, forward, abeam and aft, are more ships—dozens, perhaps hundreds—making up the force. A miscalculation in

**By Lieut. Comdr. James S. Hunter, USNR
and Lieut. (j.g.) Max Hodge, USNR**

During the past 3½ years, Comdr. Hunter has been a fighter director officer of the Casablanca, the Wasp and the Hoggatt Bay. Lieut. Hodge spent 21 months in the same capacity in the Gilberts and the Marshalls



Four observers maintaining a surface plot in CIC. Left, raid plotter notes approach of a bogey, carefully recording time to the left of the track path. The small "o"s mark the course of a friendly plane

wheel against the reddish glow of the gyro-compass:

"Come right to one-six-zero."

The quartermaster nods: "Right to one-six-zero, sir!"

Ahead you note the far, dim straightedge of the flight deck tilt slightly to the left as the ship heels over to the new course. Below decks in the still, close air of the bunk-rooms a few hundred men stir slightly in their sleep.

You didn't see the guide ship closing. But down below in a compartment no larger than your dining room back home is the Combat Information Center. Here eyes were focused on a glass covered black disk, the size, shape and color of an ordinary phonograph record, with small dots or blobs of light moving over the black surface. Each blob of light is a ship in the formation. In your own Combat Information Center, or CIC, your drift was noted, and in the CICs on the guide ship and all the other ships of the group your drift off course was watched closely. For instance, a watch officer in CIC on the battleship off your bow has been watching the small

speed or compass check by you or any one of the officers-of-the-deck could bring one of those ships plowing into your carrier. Collision at sea is a constant nightmare, for you, as officer-of-the-deck, or OD, are responsible for the safe "steering" of the ship. How to avoid collision? Come to think of it, you do have a protective bottle:

"Bridge from combat," blares out from the squawkbox on the bulkhead.

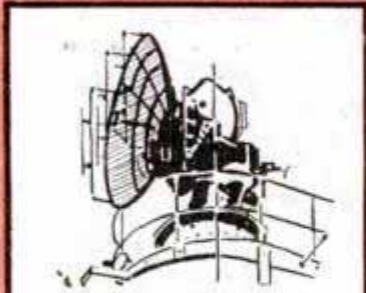
You, as OD, reach over, flip a switch, and talk into the squawkbox: "Bridge, aye, aye."

"Guide has closed to one-double-o, sir!"

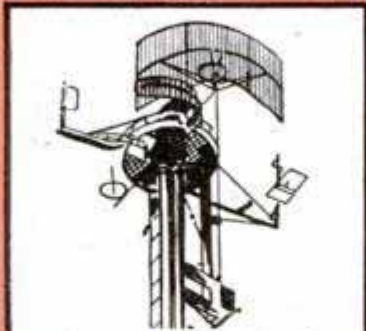
"Bridge, aye, aye."

You turn from the squawkbox to the quartermaster, faintly silhouetted at the

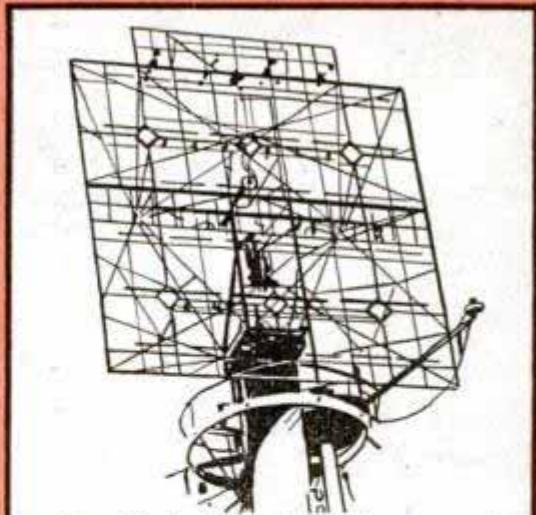
RADAR "EYES" ON AN ESSEX CLASS CARRIER



Air search radar, used to determine altitude, range and bearing of aircraft



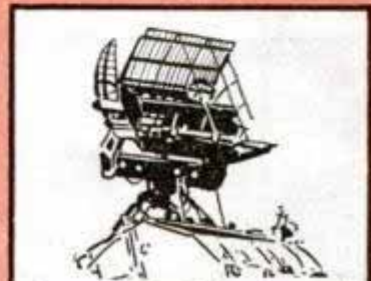
Surface search radar for navigational purposes and to detect surface vessels



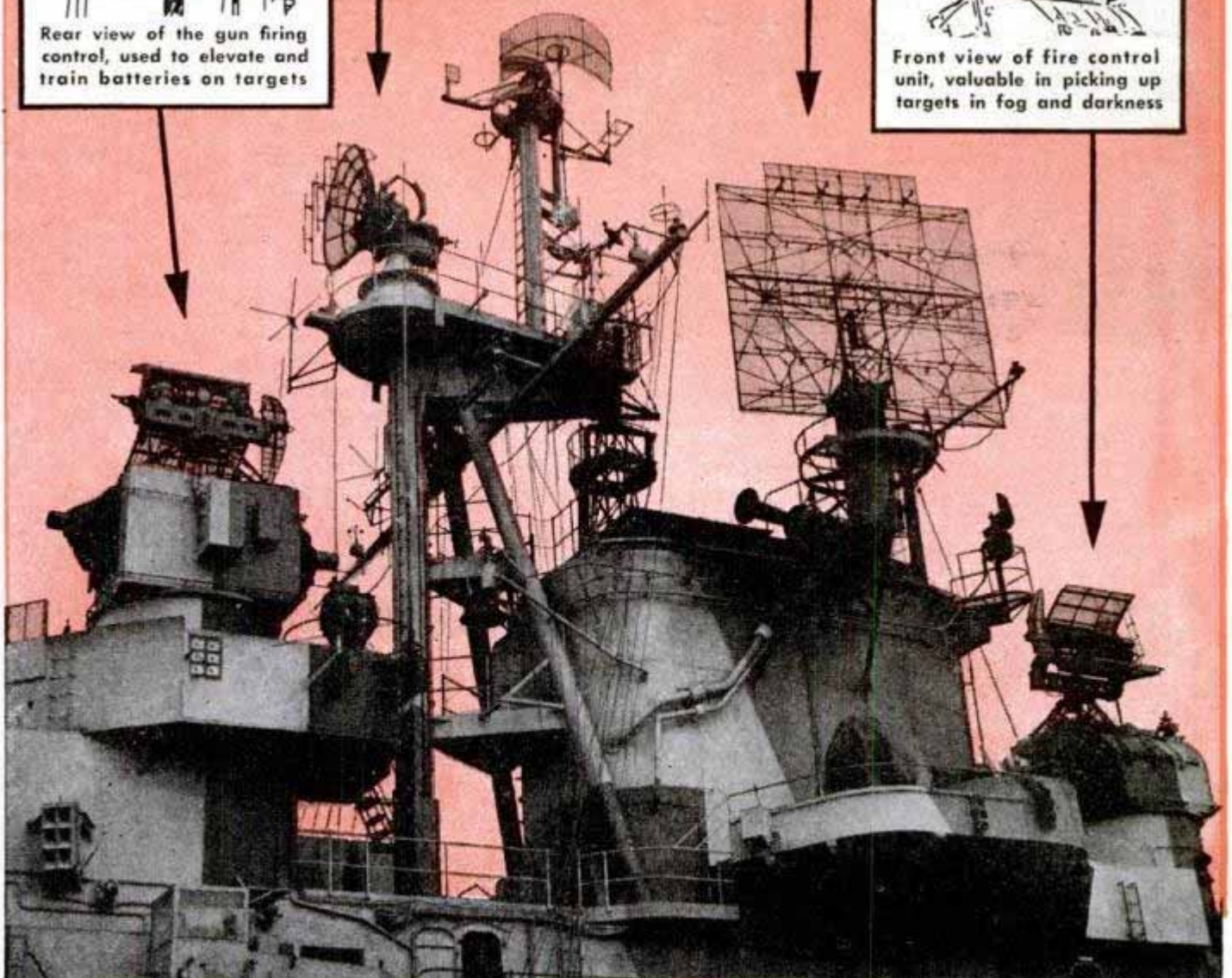
SK, or "bedspring," air search gear used to give warnings of enemy planes above 5000 feet and more than 100 miles away



Rear view of the gun firing control, used to elevate and train batteries on targets

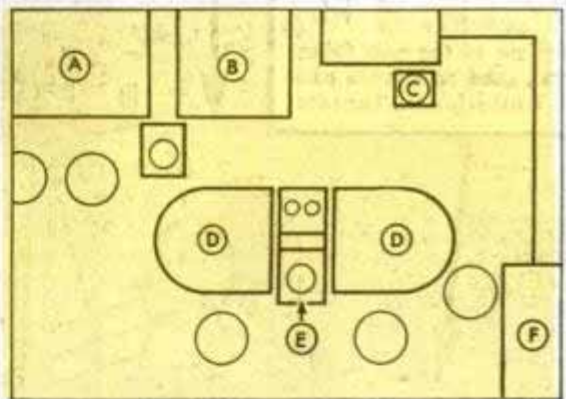


Front view of fire control unit, valuable in picking up targets in fog and darkness





"CIC"
BRAINS OF A
FIGHTING SHIP



(A) Radar console. (B) Plexiglas plotting "window" shows positions of all planes as taken from radar scope. (C) "Squawkbox." (D) Plotting table. (E) Plan Position Indicator, or PPI, contains darkened disk on which planes appear as blobs of light. (F) Dead Reckoning Tracer, or DRT, automatically records ship's course

blob of light—your carrier—move slowly towards its rightful position among an ordered symmetry of blobs of light. He turns away from the disk, or PPI, to a petty officer bent over a plotting board on which are penciled symbols showing where every ship should be according to the cruising plans. The plotting board and this black disk with the blobs of light now match up.

"She's back on station, sir," the petty officer says, grinning.

The watch officer nods.
 Thus, reenacted, is a minor drama of radar—guide and guardian of today's ships and aircraft, potent right arm of the Fleet and the shore-based Navy. Certainly the atomic bomb is the greatest miracle of this war, but its entrance was made just a few moments before the final curtain was rung

down on World War II. The star of the show during the six-year run was radar and its tactical use.

Like television, radar has given rise to many a tall story. The facts themselves are genii's brew enough, as a matter of fact. Our purpose is to give a general idea of the role radar played in this war.

The explanation of what radar actually is—the physical laws which govern it, its eccentricities, limitations and complete capabilities—is a job for the physicist and the mathematician. As fighter director officers—FDOs in the Navy's nomenclature—our concern at sea and ashore has been with radar's function as a tactical weapon.

A word of explanation, however, will help. It is a new thing; the word itself is made of the initials of the phrase "Radio

Detection And Ranging." Actually the word "radio" is a misnomer. For radar is certainly no more than a thrice-removed cousin of what we ordinarily think of as radio. It has dials, tubes and circuits, true enough. But it is not a device of communication. It is a piece of apparatus—exceedingly complex and delicate—which projects a beam of electrical energy that permits the operator to determine the range, bearing and sometimes the altitude of distant objects.

Think of it this way. Suppose you toss an ordinary rubber ball against the wall and it bounces back into your hand. With a stop watch you could measure the time it takes for the ball to leave your hand and return. For instance, if it took one second, and you knew that the ball travels at the rate of 20 feet per second, you would know the wall is 10 feet away. The ball actually covered 20 feet in the round trip; therefore, to get the "range" this distance must be divided by two.

The beam of energy released by the radar acts in the same fashion. You know the beam travels 186,000 miles per second. Perhaps the most amazing thing about radar is the fact that it is possible actually to measure the time it takes for the electrical impulse to reach an object and "bounce back." Therefore, we know the distance from the object to ourselves.

The same principle, generally, applies in the computation of bearing, or direction. Our radar beam, projected toward the object, has characteristics of width and depth. Thus if your beam is narrow in the horizontal plane, you can determine the relative direction of that object from yourself. Put range and bearing together and you can say with certainty that an object is at a noted range and bearing from yourself.

With some sets an even more complete picture can be obtained—not only of distance and direction but also of the height of an object above the earth's surface. The importance of this information not only for the control of aircraft but for radar-directed antiaircraft fire is now so obvious that it is hard to imagine what the Navy did before radar came along.

There are other important characteristics of radar as a weapon. It can distinguish between friendly ships and aircraft and those of the enemy. It will supply a pretty accurate estimate of the size of a ship or the number of aircraft in a flight. Under some circumstances, it also can detect, in advance, changes in the weather, spotting cloud-clear areas or noting the advance of a rain squall. Its ability to pick up buoys, headlands and other landmarks is employed routinely in navigation of ships through crowded waters.

Bare to the eye, the outlines of the coast of Honshu or the islands of Bashi Channel lie before the navigator's eye—white irregularities of light which skilled observers can translate readily into the convolutions of bays, peninsulas and mountain peaks inland. Norfolk buoys, stretching on either side of the channel, are small dots of light sliding past on the face of the scope. Even the flight of a shell, arcing redly through the night toward an enemy target, can be noted and clocked!

Still, little has been told of one of radar's most fascinating tales—its use in the direct control of aircraft in the defense of the Fleet and those island bases—Tarawa, Kwajalein, Saipan, Iwo Jima, Okinawa—that we fought for so hard . . . and won. Yet of all of radar's uses none is perhaps more dramatic or, as far as the Navy is concerned, none exerted more influence on the ultimate outcome of battles than the employment of radar in fighter direction.

Readers of Milt Caniff's *Terry and the Pirates*, that mine of military lore and operations, are aware of the fact that the Army, Navy and Marines used fighter direction with the aid of radar to repel air raids. Small boys in a hundred American suburbs may be heard martially shrieking the jargon of Lieutenant Charles and the marine controllers charged with the defense of Mr. Pyzon's island:

"Roger, boy."

"Wilco, out."

"Trigger four, this is Copper base, over—"

Mr. Caniff's students know fighter direction for what it is: the control of aircraft from ground or ship by radio communication between the pilot and a ground controller whose information is derived principally from radar. What they have not known is the extent of the role fighter direction has played in World War II, involving thousands of Army, Navy and Marine officers, tens of thousands of enlisted radar operators, not to mention a half dozen high pressure training schools and experimental stations.

We—an ex-college professor and an ex-advertising man—were fighter directors, so it is understandable that in its essence the art or craft of fighter direction is quite simple. Keep in mind that radar is a kind of television and that it is possible through a special kind of gear known as IFF to distinguish between enemy and friendly aircraft. Remember your radar PPI scope or darkened disk shows your air contacts as small blobs of light. This disk is ruled off in degrees like an ordinary gyrocompass—360 degrees with a "bearing line" at every 10 degrees. The range is ruled off in circles representing 10 miles each. You may have eight to 10 range circles which means you

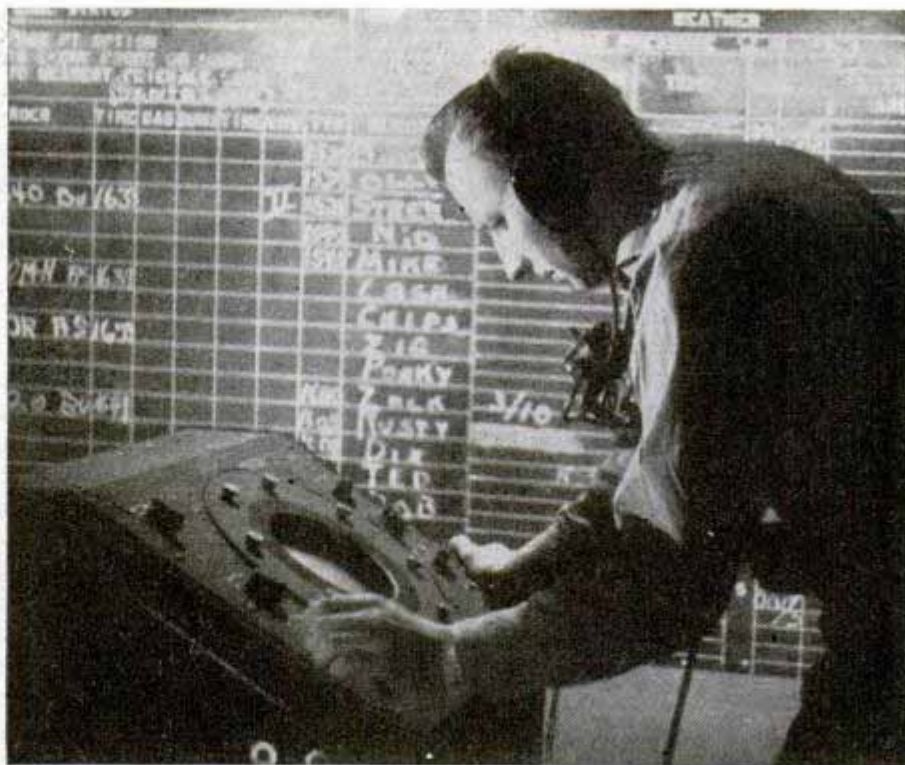
may pick up a contact 80 to 100 miles from your base or ship.

One small blob of light, looking exactly like a small, constantly glowing firefly, hovers within the 10-mile range. That is your CAP or Combat Air Patrol which the fighter director controls. Thus he has before him a picture of the territory for 80 to 100 miles around him, and he can see the exact location of his friendly planes and any enemy planes that come within 100 miles of the ship or ground base. Equip your fighter director with high-frequency radio with which he can talk to the pilot, and he can direct his CAP to "intercept" any enemy aircraft that shows up on the screen or disk, noting both the path of the enemy and his own planes so that he can order whatever changes in direction or altitude are necessary.

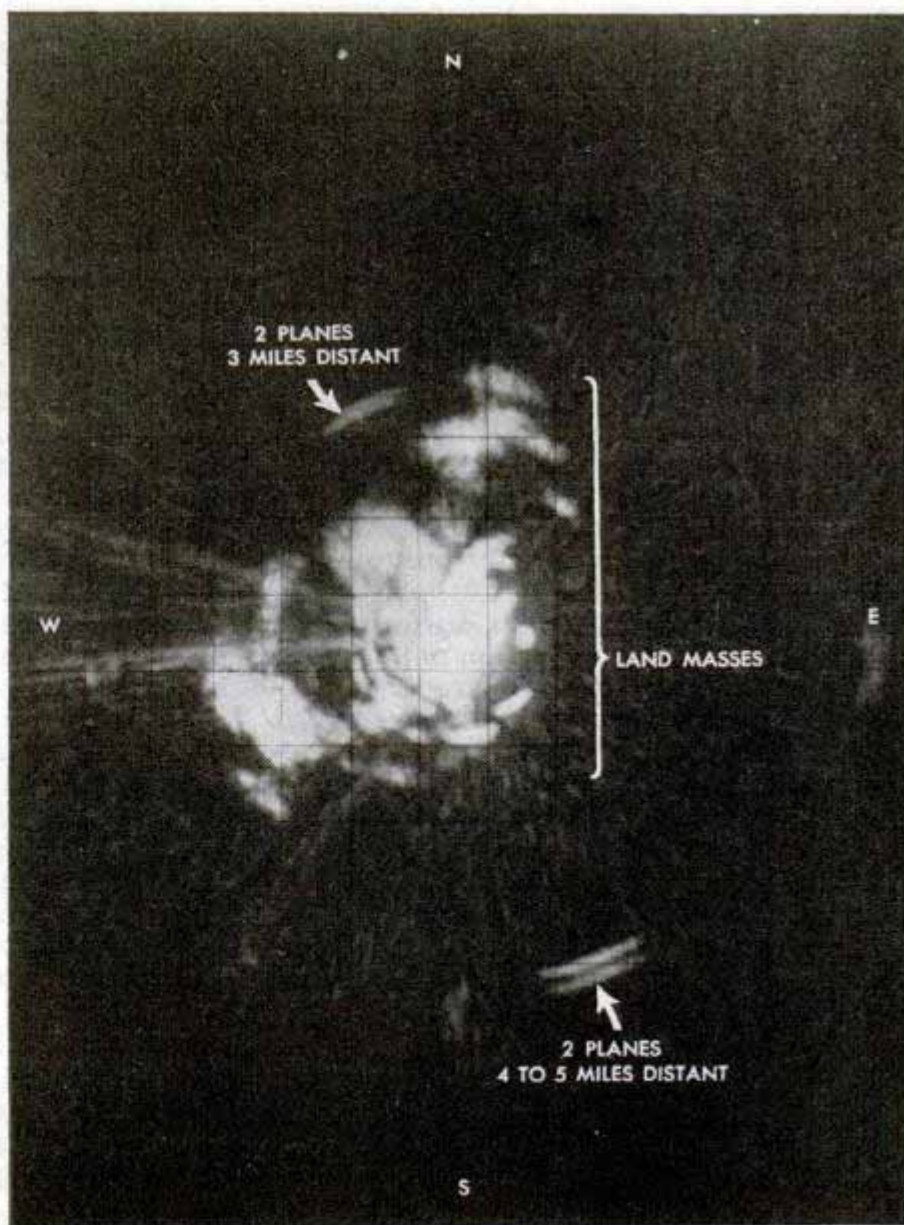
To get an idea of how fighter direction works and how it is employed, let us imagine that our carrier is operating off the coast of the Philippine Islands.

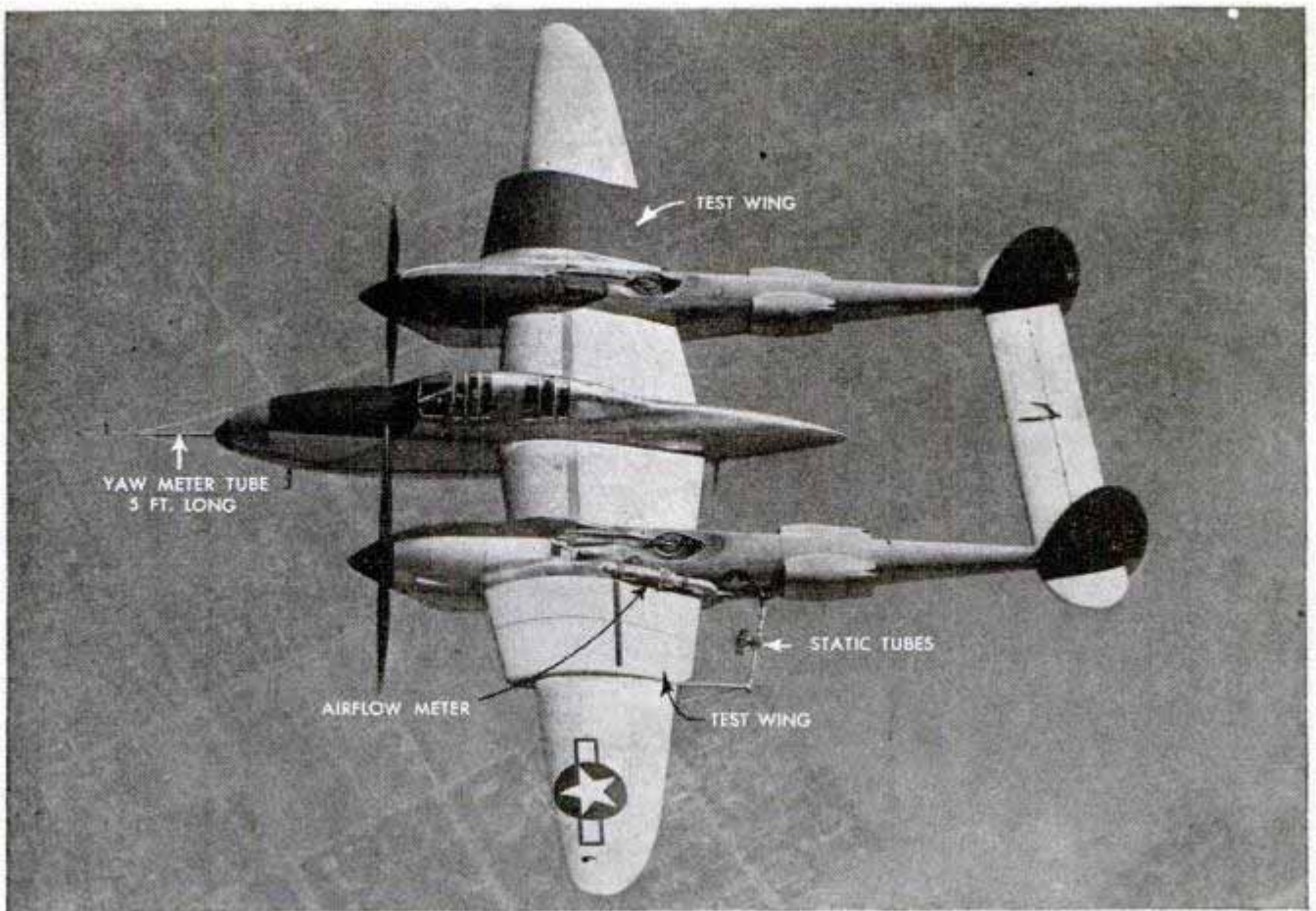
Come with us down into the CIC or Combat Information Center. Hatches are battened down to keep the room in semidarkness. As you enter, the first impression is one of confusion; in fact, in the parlance of the personnel, CIC stands for: "Cripes, I'm Confused." Here is a weird jungle of electronic gear, illuminated tables, shining dials and gadgets which, at first glance, makes Flash Gordon look like a piker and Buck Rogers an anachronism. Here are officers and enlisted personnel, most of them stripped down to their skivvie shirts, wearing earphones and talking strange jargon into microphones, telephones and

(Continued to page 168)



Interceptor officer scans his PPI scope. Status board at rear has takeoff times, raid numbers and other pertinent data. Below, view of PPI scope





"Flying Wind Tunnel"

Removable "envelopes," or false wings, fitted over inner portions of the regular wings, enable the Lightning Swordfish to function as the world's fastest "flying wind tunnel." The plane, a modified version of the Lockheed P-38 fighter, is used to test wing designs of all sizes up to transport types and can gauge drag, lift and airflow characteristics of any airfoil under actual flying conditions. The false wings are constructed with contours in exact proportion to an experimental wing and in flight react

to the plane's special instruments exactly like a full scale model. Tests already have been made at dive speeds in excess of 525 miles an hour. A motion picture camera records the performance during flight to supplement the pilot's visual observations. Other distinguishing features of the Swordfish are a five-foot yaw meter, or "sword," that protrudes from its nose to indicate skidding or side slipping, an observer's station back of the pilot and rows of static tubes that trail the wings to measure airflow drag. Pressure distribution through small holes in the wing envelopes is used in calculating lift.

Four-Passenger Rear Seat Features the New Frazer Car

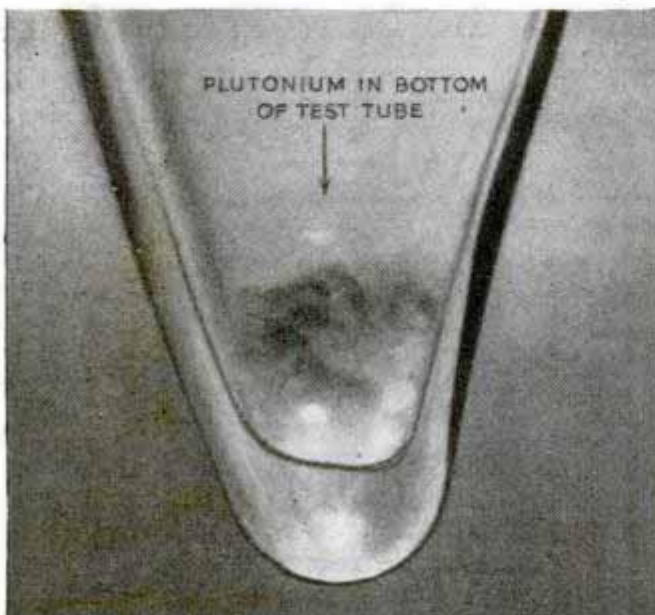
Flowing fender lines, increased visibility, room for four persons in the rear seat, and low height (64½ inches) are features of the new medium-priced Frazer automobile, produced by Graham-Paige Motors Corporation. A six-cylinder, 100-horsepower engine powers the car, which was designed by Howard A. Darrin, automobile stylist. The rear seat is located in front of the rear axle to provide smoother riding. Pillar posts are moved back from the conventional position, increasing front and side



visibility. Outside door handles, attached at both ends to eliminate clothes snagging, are operated by trigger-action at the touch of a finger. Inside recessed door controls are the push-button type.

Two New — — BUILDING BLOCKS

The smashing of the atom has turned up two unexpected by-products—elements 95 and 96—which may play a big role in harnessing of atoms



By Nathaniel Nitkin

WHEN Dr. Glenn T. Seaborg collaborated in creating plutonium, one of the elements used in the atom bomb manufacture, he had no idea he was on the threshold of other startling discoveries in the same line of atomic research. The results of his latest findings are, first, that both of the new elements, neptunium and plutonium, which had been unknown before 1939, exist in natural state though in small amounts; and second, the creation of two new unnamed elements to which he attached numbers 95 and 96. Plutonium is number 94 in the atomic scale.

Dr. Seaborg's researches may bring nearer the day when atomic energy will be harnessed to general use. According to present scientific knowledge, the higher the atomic number of an element, the less the force holding each individual atom together, and the easier it is to split.

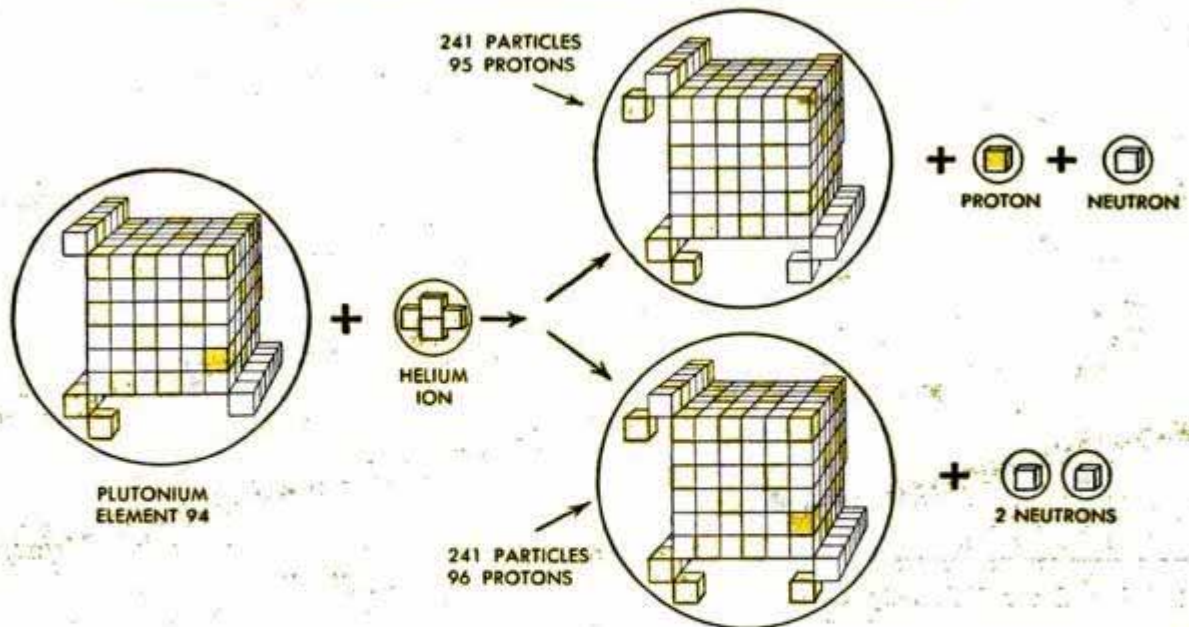
The story of the elements goes back to 1869 when the Russian scientist, Dr. Dmitri Ivanovich Mendeleef, published his famous periodic classification table. But first consider what an element is. Oxygen, hydrogen, iron and gold are familiar examples, yet they are made of the same basic ingredients: protons, particles of positive electricity; electrons, bits of negative electricity; and neutrons, which are neutral particles. The chemical and physical properties of an element depend on how many protons there are in the atom's nucleus. And the number of protons is balanced by an equal number of electrons revolving around it. For instance, an atom of oxygen has eight protons in its nucleus, around which eight electrons revolve like a miniature solar system of one exceedingly small sun and eight large but featherweight satellites.

The proton has mass and weight while the electron's weight is negligible. On the other hand, oxygen has an atomic weight of 16, each proton having a weight unit of one. The answer is simply that eight more particles in the nucleus make up for the difference in weight, and these particles are neutrons.

Suppose we experiment with a hydrogen

Dr. Glenn T. Seaborg examines a specimen of plutonium after it has settled in bottom of a test tube

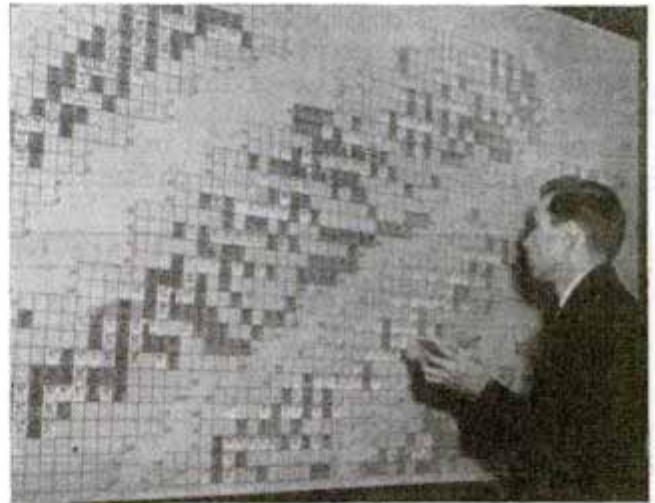
FORMING ELEMENTS 95 AND 96 BY BOMBARDING PLUTONIUM WITH HELIUM NUCLEI



Artist's "building-block" conception of the forming of two new elements with complex atomic structure

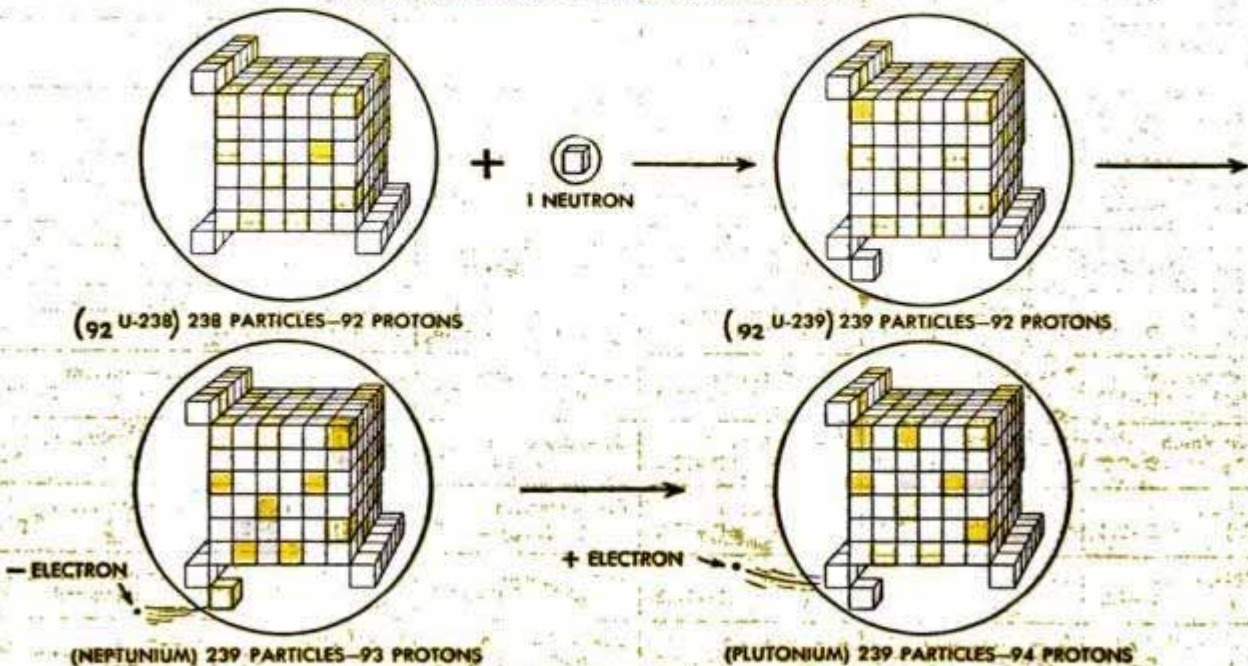
atom, made of one proton with one electron revolving around it. If we add another proton to the hydrogen atom nucleus, we get a positive electrical charge of two instead of one; it has become the nucleus of a helium atom. The new nucleus would capture a free electron to counterbalance the added positive charge. Thus we have a helium atom but for one thing; helium has an atomic weight of four. The other two particles are simply neutrons.

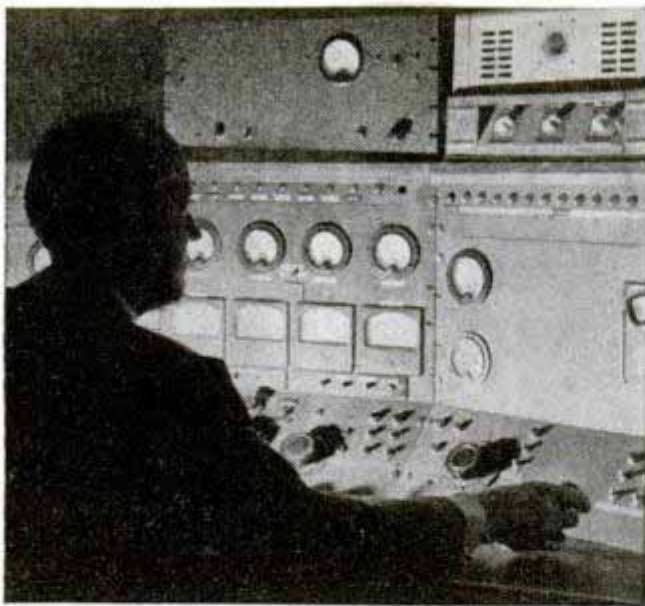
In nature, the jump in weight is not so abrupt. Heavy hydrogen has an atomic weight of two; that is, a proton and a neutron in the nucleus, the revolving electron not counting for practical purposes. If we add still another neutron to the nucleus, we have triple-weight hydrogen. Ordinary helium has a weight of four, yet there is a



Dr. Seaborg takes notes from chart of isotopes. Below, a slight atomic change creates a new element

MODE OF FORMATION OF PLUTONIUM FROM URANIUM





Control board for University of Chicago cyclotron

lightweight helium atom with one less neutron; that is, there is only one neutron instead of two in the nucleus of a lightweight helium atom. But triple-weight hydrogen has only one proton and one electron while lightweight helium, like ordinary helium, has two protons and two electrons. That makes a different element. Yet in the laboratories it has been found that the neutron

can change into a proton, and vice versa.

The change of hydrogen into helium is not theoretical. Astronomers believe the sun gets its energy by transmuting hydrogen into helium, using ordinary carbon as a catalyst. The power generated by this atomic change is infinitely greater than splitting uranium 235 and plutonium, as is done in our atom bombs.

The structure of the atom and theories of atomic change were unknown when Mendeleef published his periodic table. He showed that when all chemical elements were listed in order of their atomic weight, there were periodic recurrences of elements that are similar to each other. As an example, starting with lithium and counting eight elements down the list, we come to sodium. Counting another eight, we arrive at potassium. Lithium, sodium and potassium are soft, white metals which, when dropped into water, react violently.

Counting eight elements from carbon, we have silicon. Carbon and silicon are found in various forms, but think of carbon as a diamond. The silicon counterpart would be quartz, a very hard mineral.

Dr. Mendeleef listed 92 elements and there were many gaps in his chart. However, from his table he was able to foretell

TABLE OF ELEMENTS						D—Density
1—Hydrogen (H) D—.00009	17—Chlorine (Cl) D—.0032	33—Arsenic (As) D—5.7	49—Indium (In) D—7.3	65—Terbium (Tb) D—8.3	81—Thallium (Tl) D—12.0	
2—Helium (He) D—.00018	18—Argon (A) D—.0018	34—Selenium (Se) D—4.5	50—Tin (Sn) D—7.3	66—Dysprosium (Dy) D—8.56	82—Lead (Pb) D—11.3	
3—Lithium (Li) D—.5	19—Potassium (K) D—.9	35—Bromine (Br) D—3.1	51—Antimony (Sb) D—6.6	67—Holmium (Ho) D—8.76	83—Bismuth (Bi) D—9.7	
4—Beryllium (Be) D—1.8	20—Calcium (Ca) D—1.5	36—Krypton (Kr) D—.0037	52—Tellurium (Te) D—6.1	68—Erbium (Er) D—9.16	84—Polonium (Po) D—?	
5—Boron (B) D—2.5	21—Scandium (Sc) D—2.5	37—Rubidium (Rb) D—1.5	53—Iodine (I) D—4.9	69—Thulium (Tm) D—9.35	85—Element not isolated	
6—Carbon (C) D—2.2	22—Titanium (Ti) D—4.5	38—Strontium (Sr) D—2.5	54—Xenon (Xe) D—.0058	70—Ytterbium (Yb) D—7.0	86—Radon (Rn) D—.0099	
7—Nitrogen (N) D—.00125	23—Vanadium (V) D—5.8	39—Yttrium (Y) D—3.8	55—Caesium (Cs) D—1.9	71—Lutecium (Lu) D—9.74	87—Element not isolated	
8—Oxygen (O) D—.0014	24—Chromium (Cr) D—6.9	40—Zirconium (Zr) D—6.4	56—Barium (Ba) D—3.8	72—Hafnium (Hf) D—13.4	88—Radium (Ra) D—5.1	
9—Fluorine (F) D—.0017	25—Manganese (Mn) D—7.4	41—Columbium (Cb) D—8.4	57—Lanthanum (La) D—6.2	73—Tantalum (Ta) D—16.6	89—Actinium (Ac) D—?	
10—Neon (Ne) D—.0009	26—Iron (Fe) D—7.9	42—Molybdenum (Mo) D—9.0	58—Cerium (Ce) D—6.8	74—Tungsten (W) D—18.8	90—Thorium (Th) D—11.5	
11—Sodium (Na) D—1.0	27—Cobalt (Co) D—8.8	43—Element not isolated	59—Praseodymium (Pr) D—6.8	75—Rhenium (Re) D—21.5	91—Protoactinium (Pa) D—?	
12—Magnesium (Mg) D—1.7	28—Nickel (Ni) D—8.8	44—Ruthenium (Ru) D—12.0	60—Neodymium (Nd) D—7.0	76—Osmium (Os) D—22.5	92—Uranium (U) D—18.7	
13—Aluminum (Al) D—2.7	29—Copper (Cu) D—8.9	45—Rhodium (Rh) D—12.4	61—Rare earth	77—Iridium (Ir) D—22.4	93—Neptunium (Np) D—?	
14—Silicon (Si) D—2.4	30—Zinc (Zn) D—7.1	46—Palladium (Pd) D—12.2	62—Samarium (Sm) D—6.9	78—Platinum (Pt) D—21.4	94—Plutonium (Pu) D—?	
15—Phosphorus (P) D—2.2	31—Gallium (Ga) D—5.9	47—Silver (Ag) D—10.5	63—Europium (Eu) D—5.24	79—Gold (Au) D—19.3	95—Discovered but unnamed	
16—Sulphur (S) D—2.0	32—Germanium (Ge) D—5.5	48—Cadmium (Cd) D—8.6	64—Gadolinium (Gd) D—7.95	80—Mercury (Hg) D—13.6	96—Discovered but unnamed	

the properties of then unknown elements and when they were discovered his predictions were remarkably accurate.

Element 92 is uranium. In laboratories, physicists have added elements 93 and 94—neptunium and plutonium. Now Dr. Glenn T. Seaborg not only has discovered the existence of these in a natural state but also has developed elements 95 and 96.

This briefly is the story of the new elements. An uranium atom has 92 protons in its nucleus and 92 electrons in its orbits, no matter what its weight. Ordinary uranium has an atomic weight of 238, the rest of the mass in its nucleus being made up of neutrons. The nucleus of uranium 235 has three neutrons less than the ordinary kind and is unstable. When smashed by a free neutron, uranium 235 breaks into barium and krypton with a loss of matter in weight. The lost matter is changed into energy—as predicted long ago by Dr. Albert Einstein—and the release of energy is 200,000,000 electron volts per atom. An electron volt is the energy possessed by a hydrogen atom moving 600 miles per second.

When bombarded by a stream of neutrons, uranium 238 behaves differently. It captures a neutron, incorporates it into its nucleus and becomes uranium 239. But the latter is unstable. One neutron in the nucleus changes into a proton and we have a new element, neptunium—93 protons—number 93 in the periodic table.

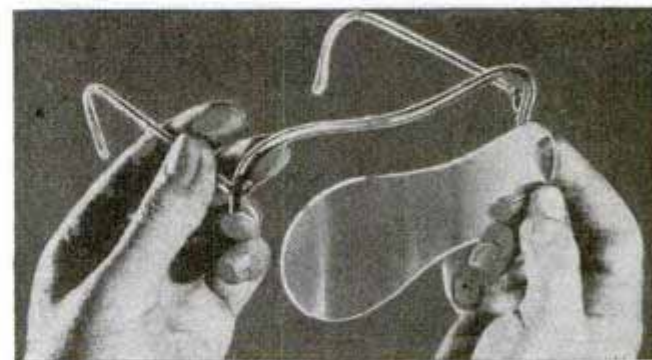
A strange thing takes place at the same time. When a neutron changes into a proton, it throws off an electron. Conversely when a proton changes into a neutron, it ejects a particle of positive electricity—not a proton but a positron—the positive electrical opposite of the electron, each having negligible weights. Proton and neutron are counterparts, but a proton has a positive electrical charge, a neutron has none.

Neptunium is an unstable element and gives off an electron, which means another neutron in the nucleus has changed into a proton. Now we have 94 protons in the nucleus—a new element, plutonium—number 94 in the periodic table.

All the changes described are made under bombardment of a stream of neutrons slowed by a wall of paraffin or heavy water or anything rich in hydrogen. A fast stream of neutrons only passes through atoms. There are several methods of generating such a flow of neutrons. Dr. Seaborg used the cyclotron—a huge electromagnet which whirls particles with increasing speed to build up power before releasing them through a slit to the target.

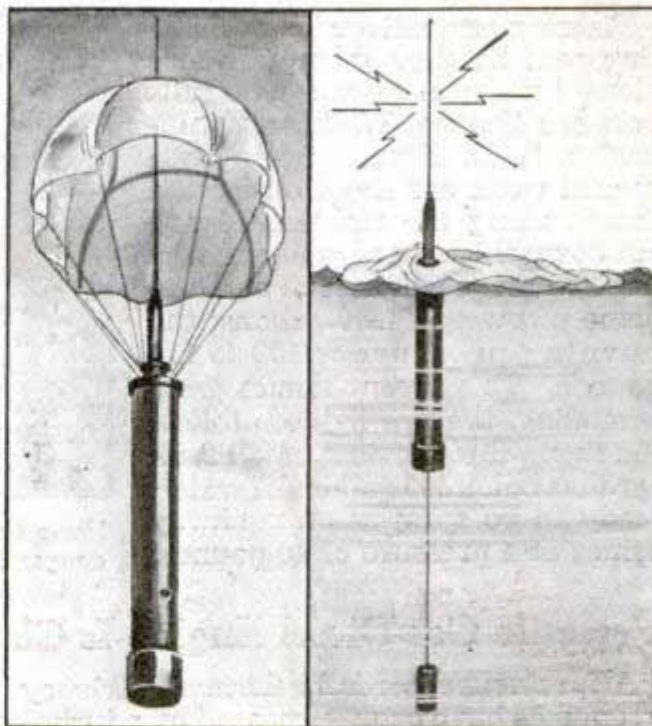
Time will tell what value Dr. Seaborg's new elements have; but his work represents a long leap toward the eventual harnessing of atomic energy for general use.

200
Reading, Pa.
One-Ounce Eye Shield of Plastic



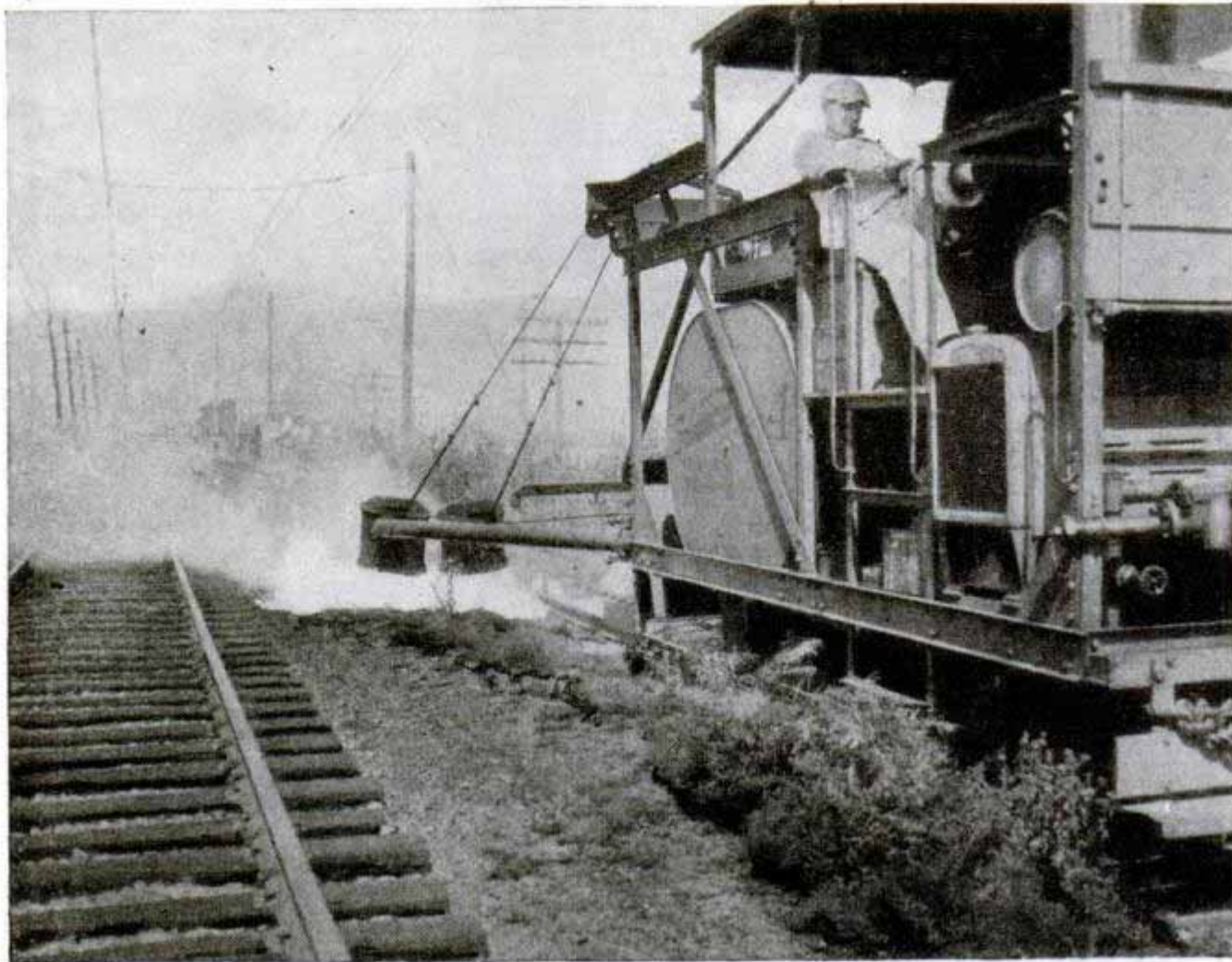
An eye shield weighing just one ounce is suitable for spot welding, light grinding and woodworking. The one-piece lens, or shield, is held tightly in a suspension-lock frame. If work requires shielding the eyes from glare, the lens may be removed quickly and a colored one substituted. The shield can be worn over regular glasses.

Buoys Radioed Warning of Subs

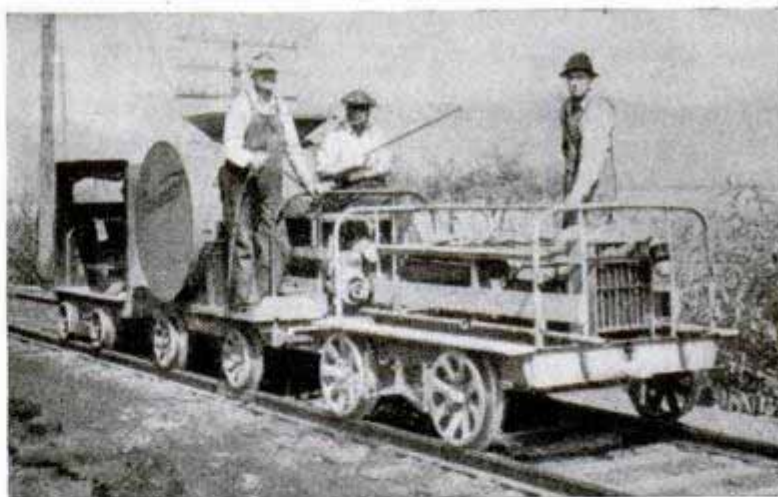


Parachuted into the ocean from U. S. planes, radio-equipped buoys served as "watch dogs" to broadcast the presence of Nazi submarines. The buoy had an antenna above water to send out a warning message when its hydrophone—24 feet under water—detected an enemy sub.

Rail-Riding Flame Throwers Kill Weeds Along Tracks



Firemen on a rail car follow flame throwers as they destroy weeds along hundreds of miles of rails between Seattle, Wash., and Mobridge, S. D. Five blowers on a special work car shoot oil-ignited flames along the right-of-way to cut down thick weeds that menace fast trains. Fuel capacity of the flame thrower is 1500 gallons; the burning pressure is 100 to 115 pounds. To prevent flames from spreading, the fire fighters follow the flame thrower in a small tank car that holds 500 gallons of water, ready to be sprayed on runaway flames at a pressure of 40 pounds.



Flame throwers find postwar use in destroying weeds that endanger fast trains. Firemen extinguish flames from tank car

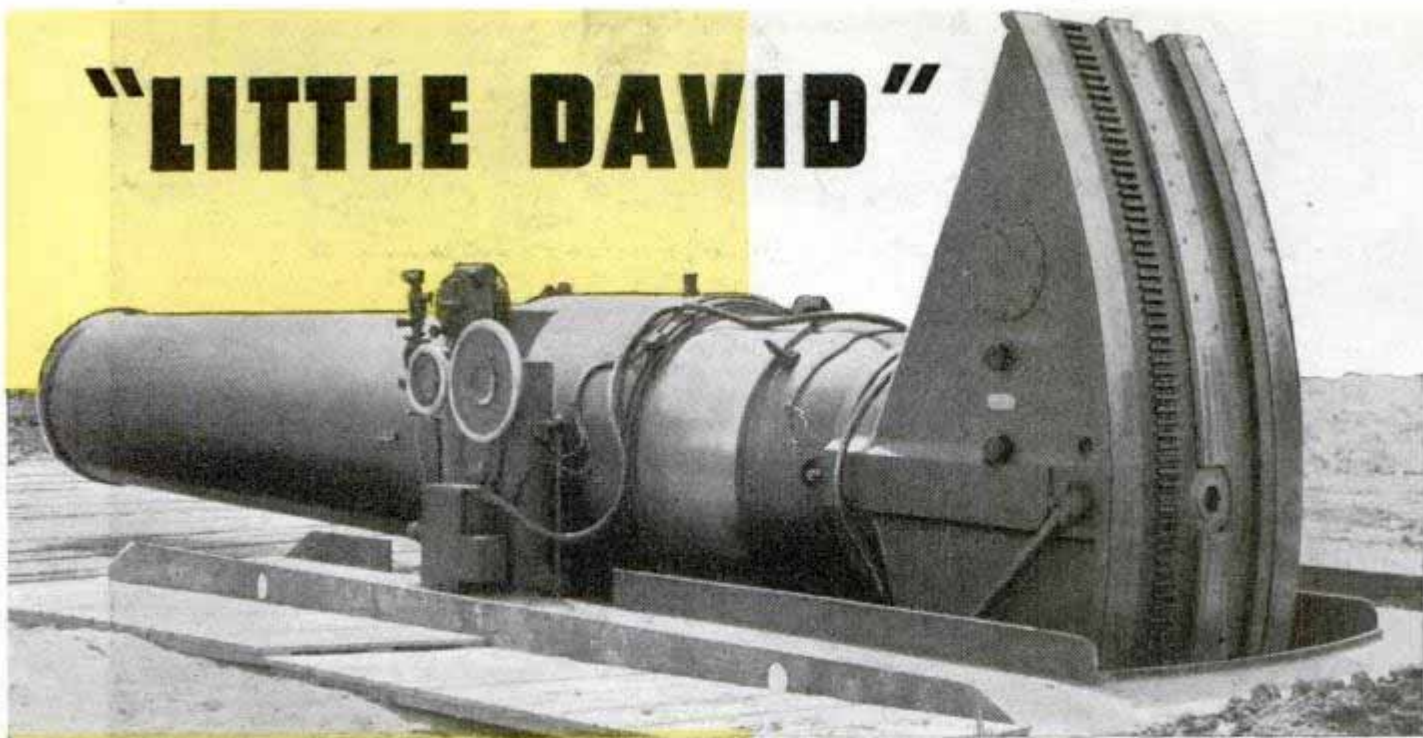
Versatile Gas-Diesel Engine Is Claimed the Most Efficient Ever Built

All previous records for thermal efficiency in engines have been surpassed by a turbo-charged gas-Diesel engine, according to the manufacturer. Thermal efficiency is the ratio of fuel consumed as compared with horsepower developed. The thermal efficiency of the engine was reported "in excess of 40 percent—higher than ever accomplished by any steam, gas, gasoline, gas

turbine or Diesel engine." The designer states that the engine's efficiency will cut fuel consumption of gas engines by 20 to 25 percent. Resulting from experiments begun in 1928, the engine is claimed to be so versatile that it can operate on a wide variety of fuels, including fuel oil, natural gas, manufactured and coke-oven gases, sewage gas and refinery by-products.

The Cooper-Bessemer Corp.

"LITTLE DAVID"



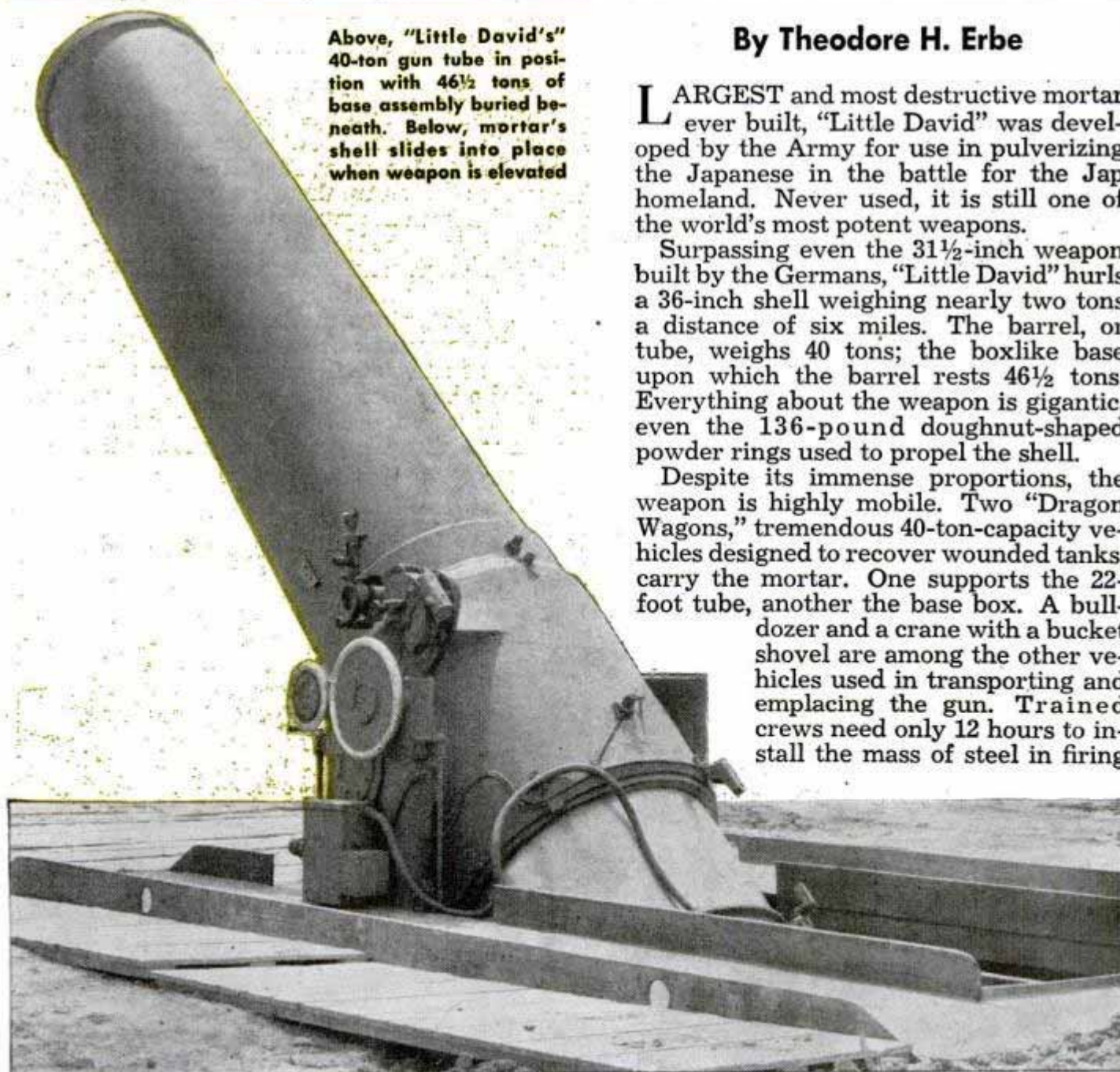
Above, "Little David's" 40-ton gun tube in position with 46½ tons of base assembly buried beneath. Below, mortar's shell slides into place when weapon is elevated

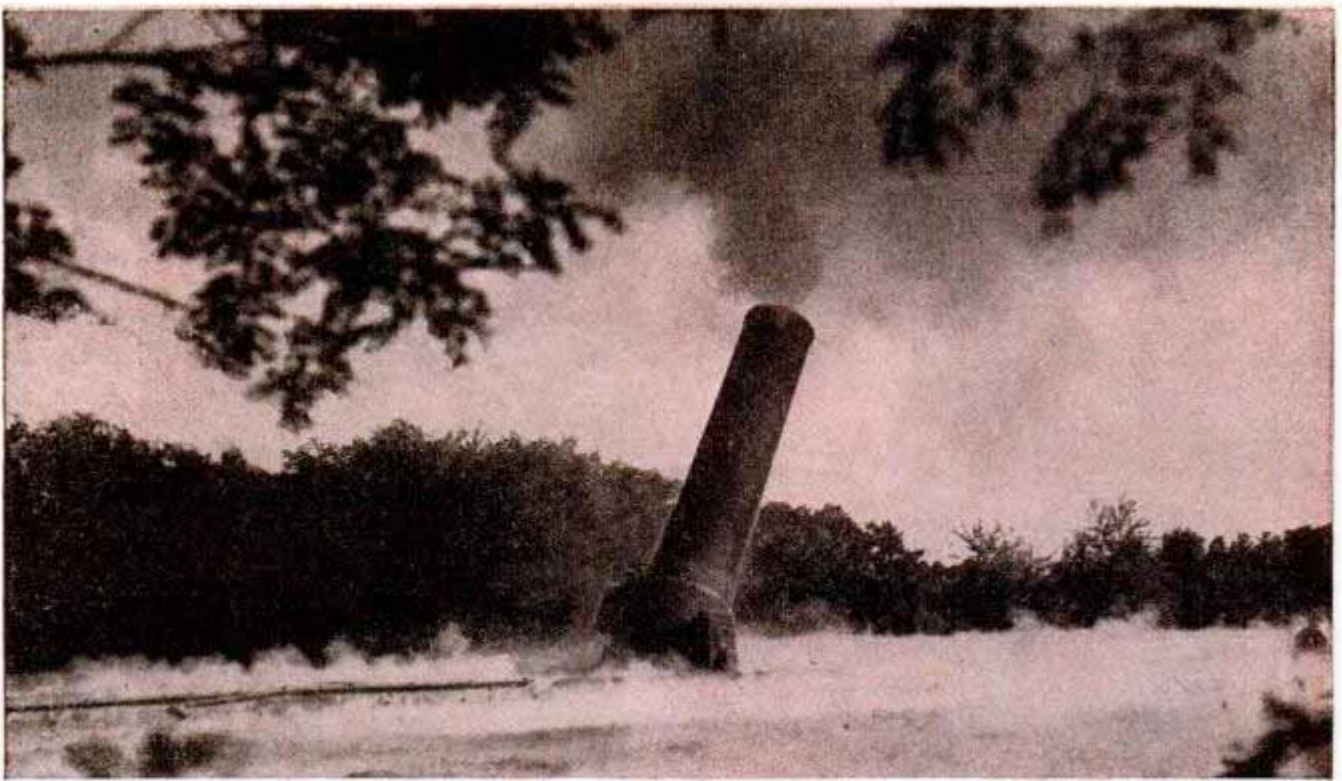
By Theodore H. Erbe

LARGEST and most destructive mortar ever built, "Little David" was developed by the Army for use in pulverizing the Japanese in the battle for the Jap homeland. Never used, it is still one of the world's most potent weapons.

Surpassing even the 31½-inch weapon built by the Germans, "Little David" hurls a 36-inch shell weighing nearly two tons a distance of six miles. The barrel, or tube, weighs 40 tons; the boxlike base upon which the barrel rests 46½ tons. Everything about the weapon is gigantic, even the 136-pound doughnut-shaped powder rings used to propel the shell.

Despite its immense proportions, the weapon is highly mobile. Two "Dragon Wagons," tremendous 40-ton-capacity vehicles designed to recover wounded tanks, carry the mortar. One supports the 22-foot tube, another the base box. A bulldozer and a crane with a bucket shovel are among the other vehicles used in transporting and emplacing the gun. Trained crews need only 12 hours to install the mass of steel in firing





With an earthshaking roar "Little David" launches nearly two tons of explosives six miles through the air

position. The German "Dora," a slightly smaller mortar, used 25 railway cars as transportation, and required three weeks' work on the emplacement before a shot could be fired.

Biggest obstacle to overcome in emplacing the giant is installing the base box. This 93,000-pound unit containing all control mechanisms is 18 feet long, 9 feet wide and 10 feet high. Sinking it into the ground until the top is flush with the surface of the earth requires the movement of 1620 cubic feet of dirt. The job is done by bulldozing a large cut in the ground with a ramp at each end.

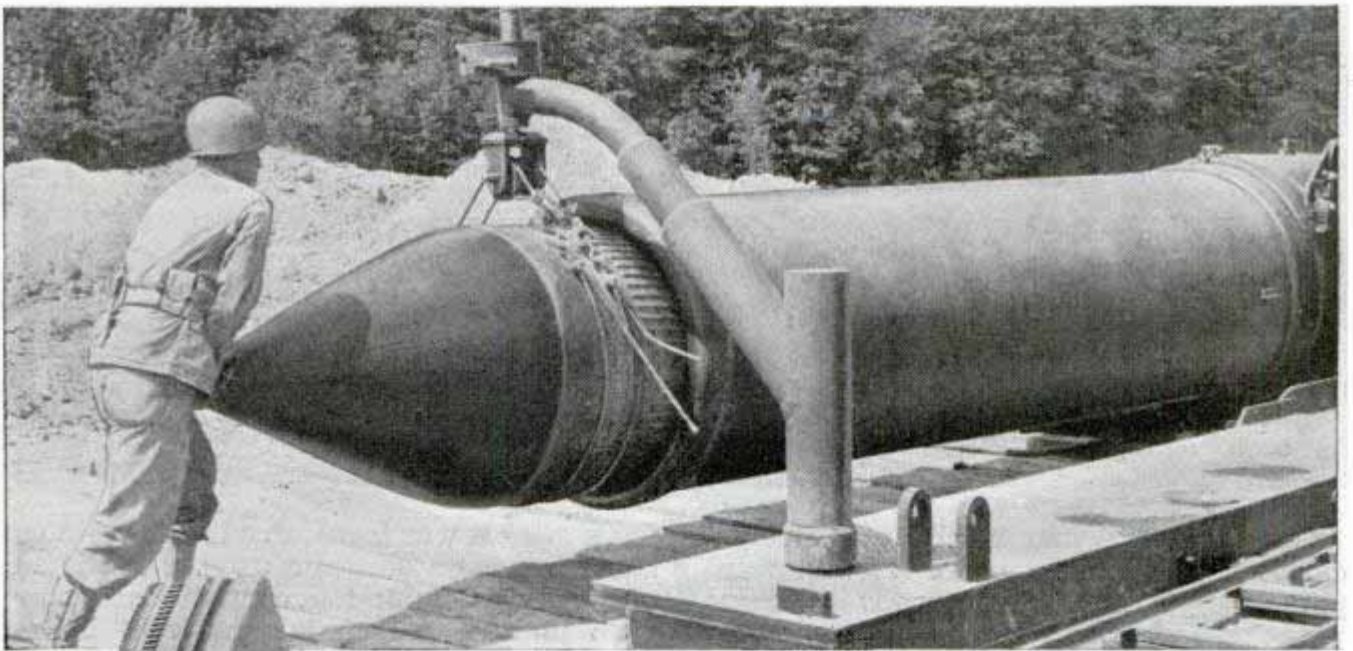
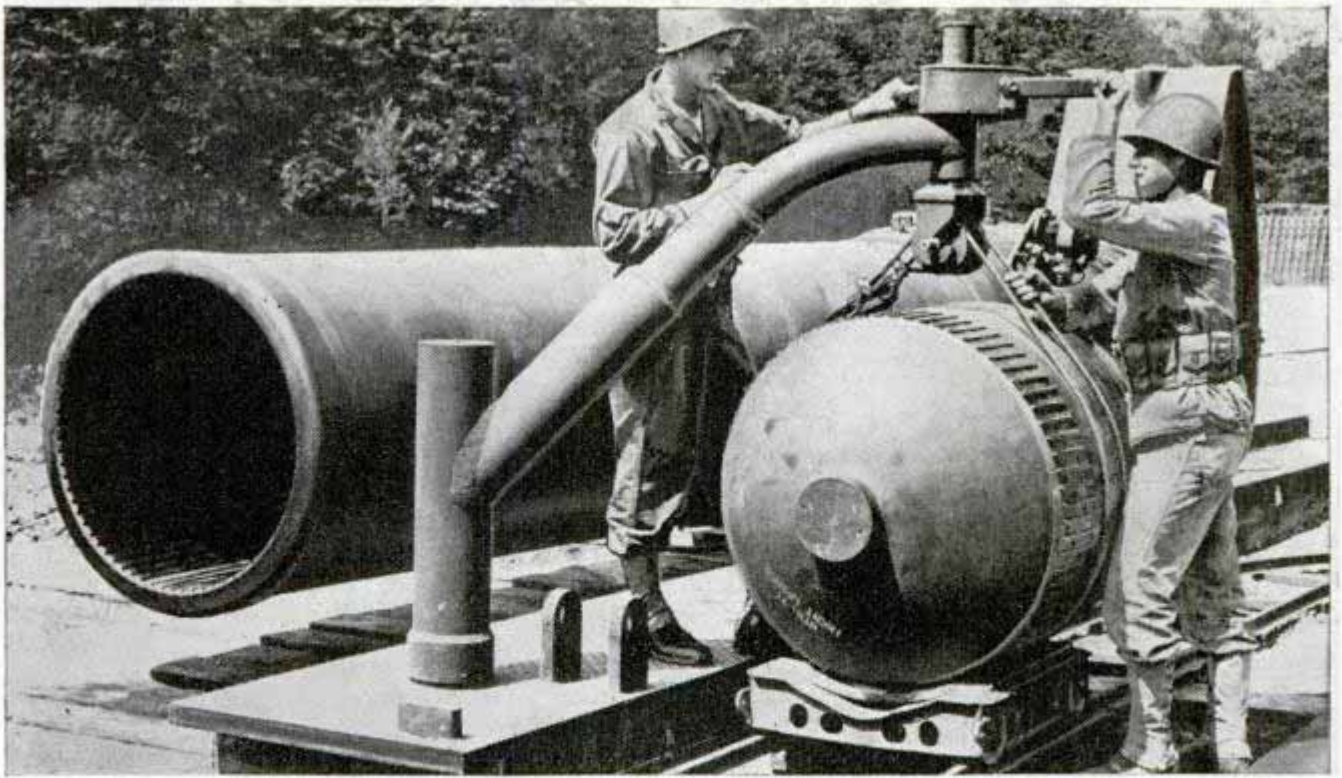
After the cut is prepared, the "Dragon

Wagon" carrying the base box is driven down one ramp into the hole. Six built-in hydraulic jacks then lower the base from the truck into the excavation. The "Dragon Wagon" is driven up the other ramp, electric cables from the generator are attached, drainage pipes are installed, and the truck-mounted crane and bulldozer fill in the trench, packing dirt around the firing base.

Similar ingenious methods are used to install the gun tube above the base. Crew members fasten steel runners across the top of the base box. The second "Dragon Wagon" hauls the 40-ton gun across the runners. Hydraulic jacks gently lower the

(Continued to page 166)

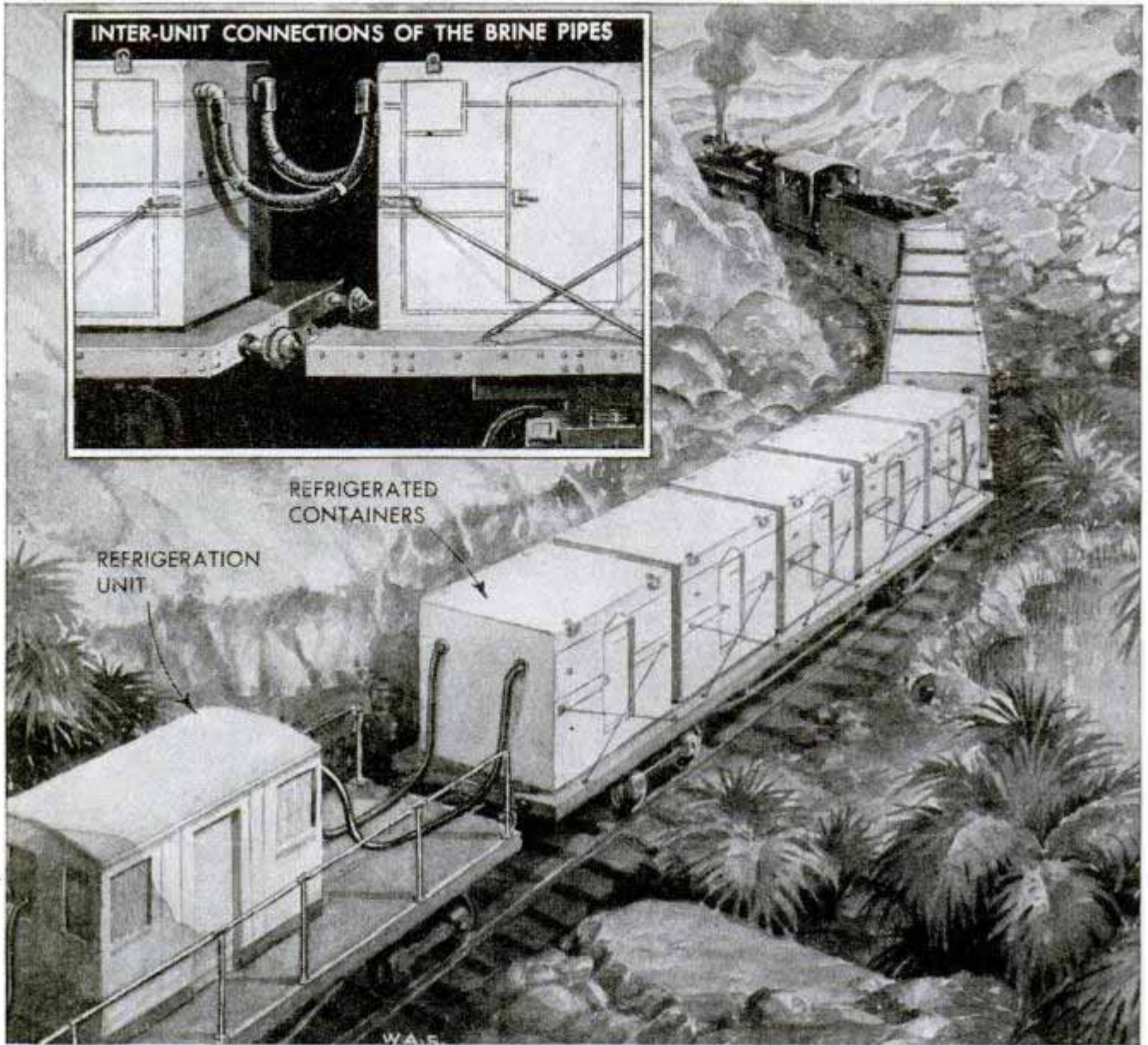




Signal Corps photo
Top, gigantic shell is lifted by davit from special trolley. Above, base of shell is pushed into muzzle until grooved band engages rifling. Below, "Dragon Wagon" hauls monster to gun emplacement. The 46½-ton base assembly is carried on a similar truck



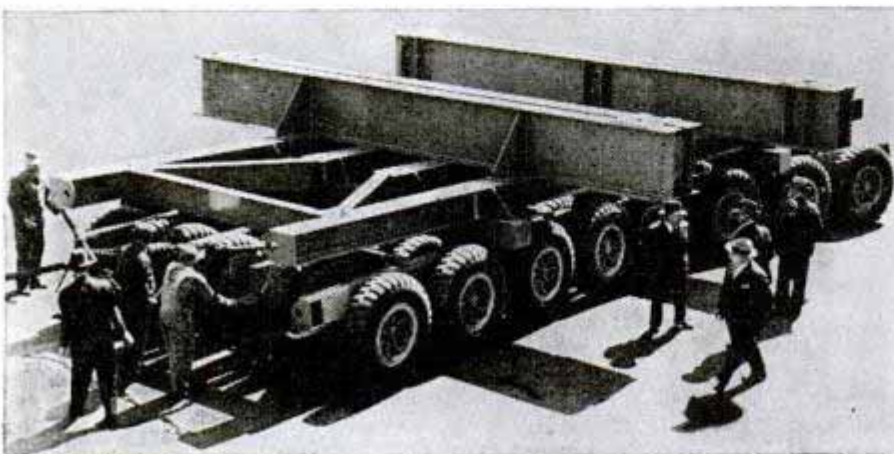
Refrigerated Jeeps and Trains Carried Food in Burma



Specially designed refrigerated freight cars, jeeps and barges played an important part in supplying British troops in Burma with fresh meat and vegetables. Ammonia brine was used as the refrigerant, the brine being circulated through coils. Small refrigerators carried the food on mules or in

jeeps after it was transferred from train or boat. Refrigerated trains usually consisted of twenty 170-cubic-foot containers, five for each flatcar. All containers were interlocked to the refrigeration unit by flexible brine pipes to keep the cooling system operating during journeys of hundreds of miles.

Giant Trailer with 64 Pneumatic-Tired Wheels Hauls a 300-Ton Load



Three hundred tons of secret military equipment—heaviest load ever moved on pneumatic tires—were carried on a giant 64-wheeled trailer built by Rogers Brothers Corporation of Albion, Pa. The trailer was 39 feet long, 17 feet wide and weighed 73 tons. The 14.00-24-inch Goodrich synthetic rubber tires weighed 220 pounds each.

ARTIST WITH A POCKETKNIFE

Ernest Warther trims a bit of wood from one of his elaborate hand-carved canes. Below, he chats with his brother, Fred, at his workshop in Dover, Ohio



By Walter E. Burton

WHEN the roadside signs along the country pikes near Dover, Ohio, began disappearing one by one some 54 years ago, people wondered about it. Eventually they learned that any missing bit of wood could be traced to a youngster with a pocketknife—Ernest Warther, who was just beginning a lifetime of whittling.

His career of carving probably reached its zenith in a series of ivory, ebony, black walnut and pearl models recreating in miniature the history of the locomotive. The task took him 32 years, and between times he has whittled an amazing variety of objects of art, novelties and museum pieces. His wartime specialty was commando knives.





did this happen that the neighbors began to kid them about it. This kidding got under Warther's skin. He got some wood, whittled two 14-inch perch, dressed them up with penciled-on scales, and carried them, concealed under his shirt, out to the fishing spot. That afternoon there was no kidding, for he and his companion each toted through the streets a tasty-looking perch, dangling from a string. Arriving home, Warther tossed the fish into a tub of water in his yard, an action that almost earned him a spanking. His mother, seeing the perch, got out the frying pan and a knife, and discovered the ruse only when she picked up one of the fish with the intention of scaling it.

This "bush" is 511 pairs of interlocking pliers fashioned by this pocketknife artist from a walnut block similar to the one he holds in his right hand. He can carve a single pair of pliers in one minute

Warther's carving skill developed rapidly. He got a job in a local steel mill as a shear operator, a task not noted for its gentle treatment of hands, for it involved the handling of as much as 15 tons of steel a day; yet after a 10-hour shift he would go home and carve, often keeping at it until long past bedtime. Somewhere he heard that it is possible to make, with a keen, slender knife blade, a pair of wooden pliers that work like the real thing, yet being cut

Young Ernest's chief occupation, at the age of five, was convoying cows along the roads around his home town. That didn't keep his hands busy, so he acquired a pocketknife and started whittling.

Every day Ernest and a boy companion would trudge out to Sugar Creek to go fishing; and in the evening they would trudge back again, always empty-handed. So often

from one piece cannot be taken apart without breaking the wood. He could find no one who knew how to do this, so he decided to work out the process by himself. "I used up a lot of wood and time," he says, "but the pliers would split or break before I had succeeded in separating the halves at the joints. After dozens of trials, I finally made a pair that worked. Then I attempted to

Shaping a commando knife blade on a grinder. Right, measuring an ivory-toothed gear wheel for a locomotive

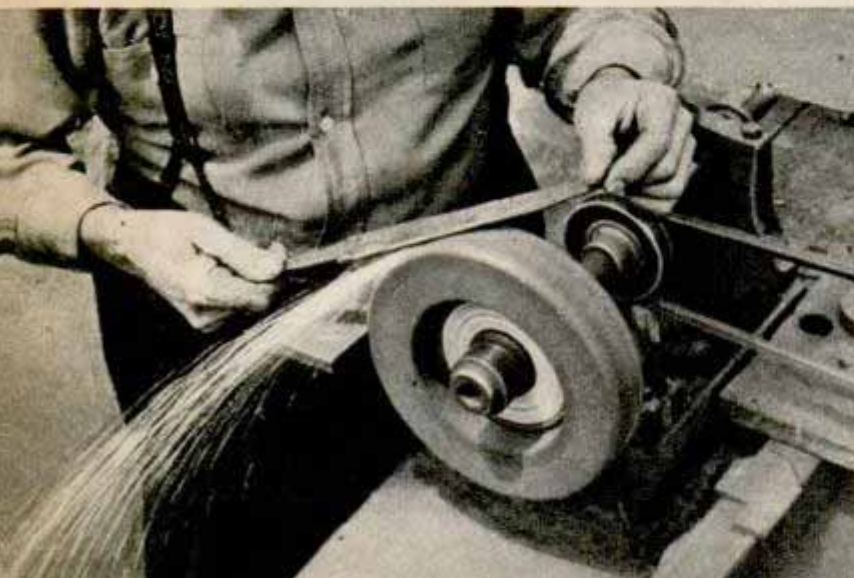


figure out why I had succeeded this time after so many failures, and I finally decided that it was because the wood had come from an old well bucket. Maybe the long soaking in water had something to do with it. So I started out to gather up wooden buckets."

Warther perfected the art of plier-carving, and then tackled group arrangements, in which several interlocking pairs of pliers are fashioned from a single block of wood. His ultimate triumph was the carving, from one piece, of 511 interlocking pairs. This tree-like cluster has been exhibited in museums and at world fairs, and now resides in his private collection. He still likes to amaze visitors by whittling a pair of pliers from a stick of white pine in one minute flat, but he declares he never will attempt again to fashion 511 pairs from a single block. The plier tree and other items of his home display are kept in his museum, at the rear of his home.

In 1913 Warther undertook a task that would make a less enthusiastic man hesitate for a lifetime: he started to carve a series of scale-model locomotives depicting the entire history of the iron horse. His principal tool was a carving knife of his own design and make, supplemented by micrometers for measuring to thousandths of an inch, and a drill press for forming holes. He used no lathe, even though each model contains dozens of wheels, shafts and other round parts. In the 32 years that have elapsed since he started the series, he has completed 34 locomotive models, each representing an outstanding step in the evolution of railroading. Starting the parade is a model of an engine designed by Hero at Alexandria, Egypt, in 250 B.C.; and ending it are models of the latest giants of the rails. There is one missing link, a locomotive said to have been designed or made by Leonardo da Vinci in the 15th century. Warther has been trying to locate the plans for this engine, but so far has

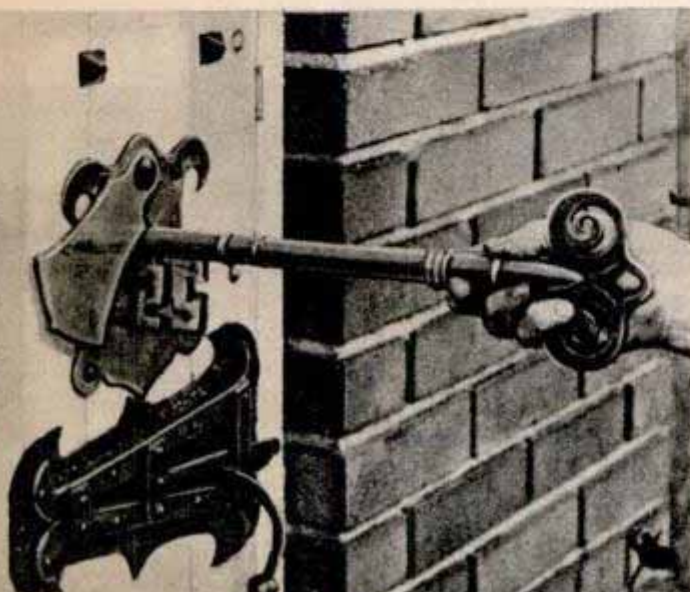
Museum has lock and key from ancient sailing ship

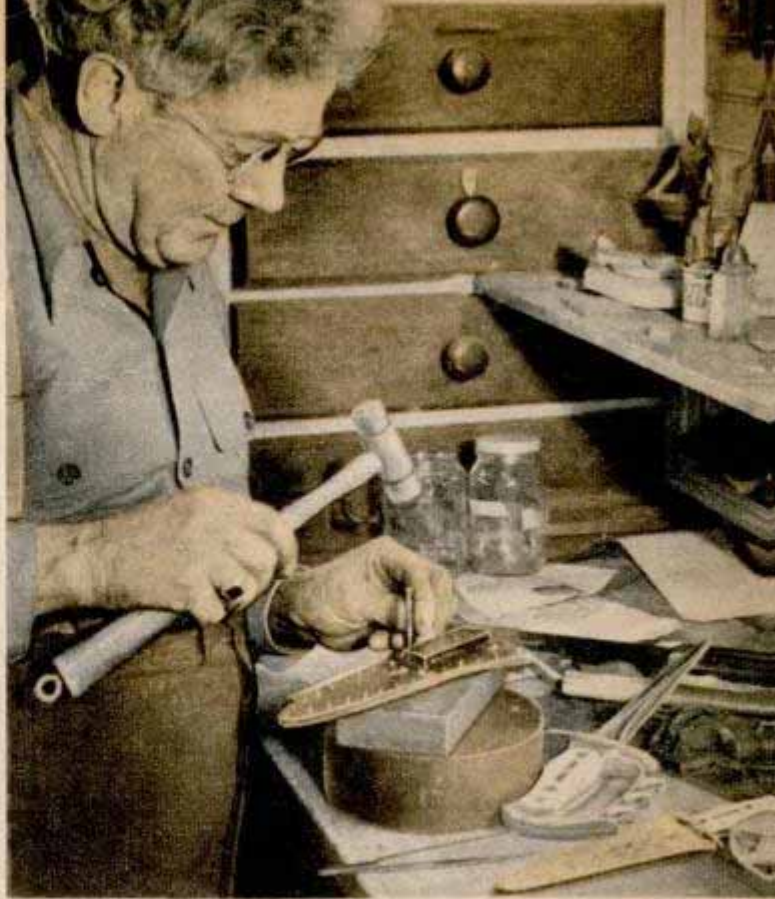


Elephant tusk provides ivory for tiny locomotive parts

not succeeded. He refuses to start work on a model until he has complete, reliable blueprints or other drawings. Most of his engines were built from full-scale blueprints furnished by the Baldwin Locomotive Works.

In 1923 Warther, in a specially fitted Pullman car, took 15 of his models on a 13,000-mile tour of the New York Central Lines. Attendants counted 786,000 visitors through that car. The models then were placed on display in Grand Central Station in New York City.





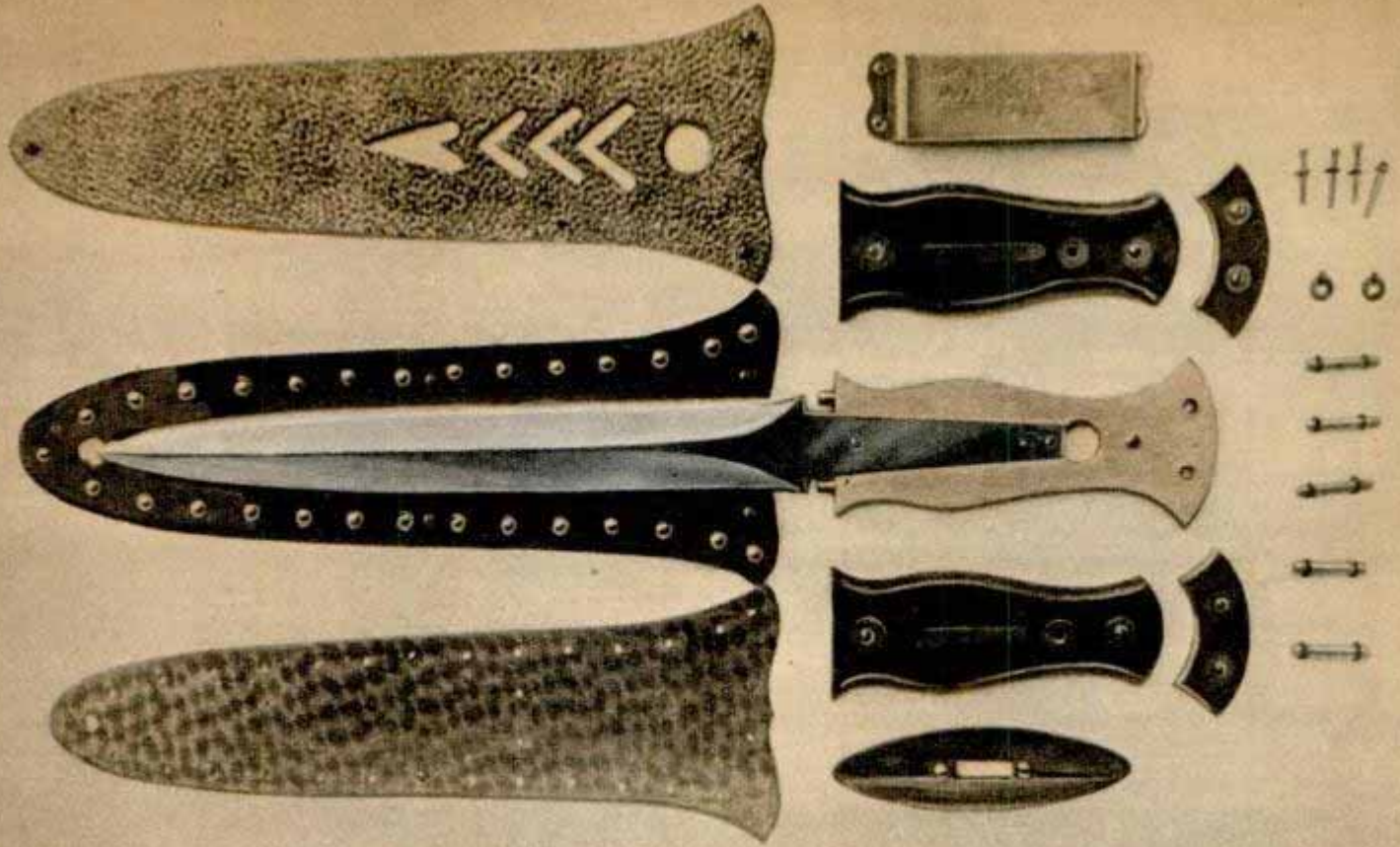
Warther rivets together sheath for commando knife

For the past 18 years Fred Warther, Ernest's brother, has piloted the Warther show truck around the United States, displaying 17 of the locomotive models, a working model of the steel mill in which Ernest toiled for more than two decades, and miscellaneous exhibits of arrowheads and other curios and commando knives.

The locomotives in the private museum, like those in the truck, all are running when exhibited. They start when the room lights are switched on. Electric motors drive the wheels, pistons and other moving parts at a rate of about 30 drive-wheel revolutions per minute. Each model is elevated enough above the track for the wheels to revolve freely; the model does not move around the track, but remains stationary.

Carved from one piece of wood, cane has two "cages" containing wooden balls. Below, ivory parts for trains





The 59 parts that make up one hand-made commando knife fashioned by the Ohio craftsman are pictured here

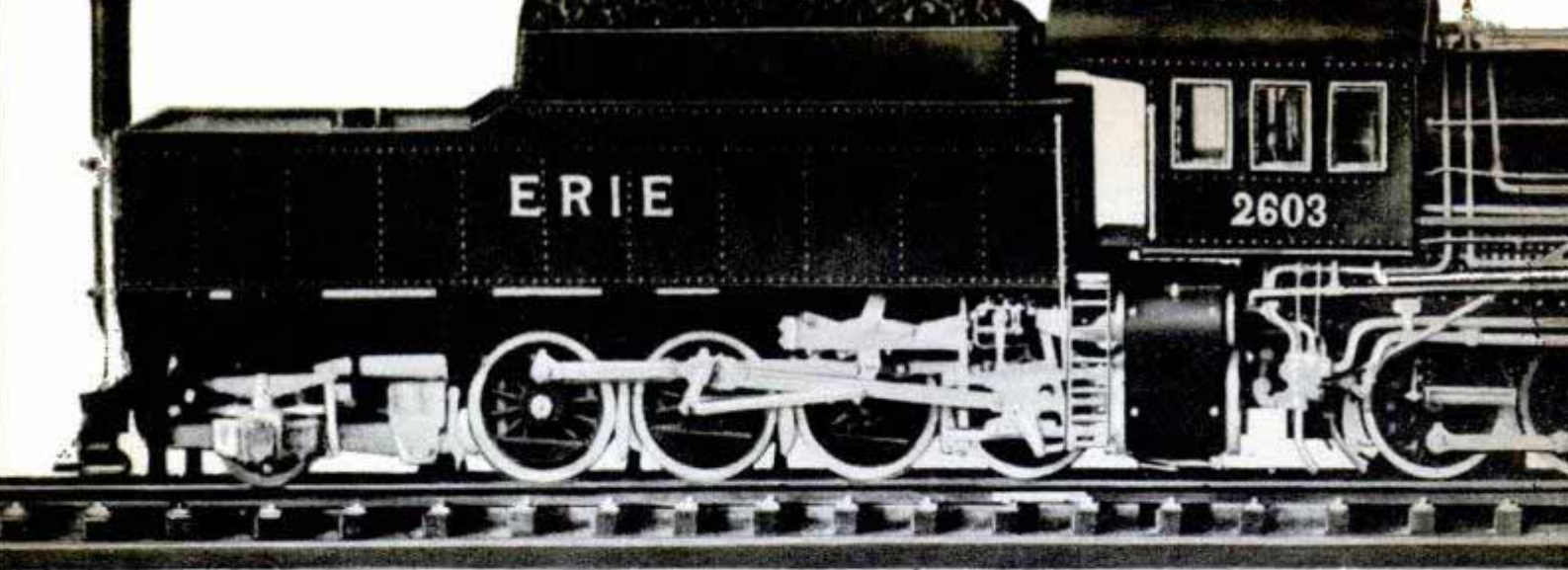
One of the models in the museum will serve as an example to illustrate the intricate work involved in building the locomotive series. This is a scale replica of the Great Northern mountain type locomotive built by the Baldwin Locomotive Works in 1930. The model of No. 2577 is 58 inches long and weighs 74 pounds. It took Warther 1600 hours of carving to create it, and the ivory, ebony, pearl and other materials cost \$302.50.

Like all the other locomotive models, everything is built to scale, and every moving part works as in the full-sized prototype—yet no metal parts are used. The ivory steam pipes are curved exactly like the original ones, yet ivory cannot be bent. Warther had to carve the pipes to their exact curves. On a locomotive equipped with a bell, the ivory bell rope is carved to

the exact curve of a real rope supported at both ends. Ivory bolts have nuts that screw on their threads and help hold the model together, yet Warther used no tools other than his carving knife and small files to produce these. Likewise, he carved the driving wheels to exact scale and roundness with micrometer accuracy, without the use of a lathe. The bearings in which the ivory shafts rotate are made of arguto wood, an imported material containing a natural lubricant that has found numerous applications in industry and war. Models that have been running for 20 years show no appreciable wear of shafts or bearings. An inspection of the Warther locomotives, and consideration of the hours of patient labor that went into each one, will explain why the collection is valued at more than \$500,000.

Equipped with ivory handle and fancy sheath, a deluxe commando knife made by Warther was priced at \$100





It took Warther 1½ years to build this model locomotive; it has 1004 ebony and ivory parts, weighs 78 pounds

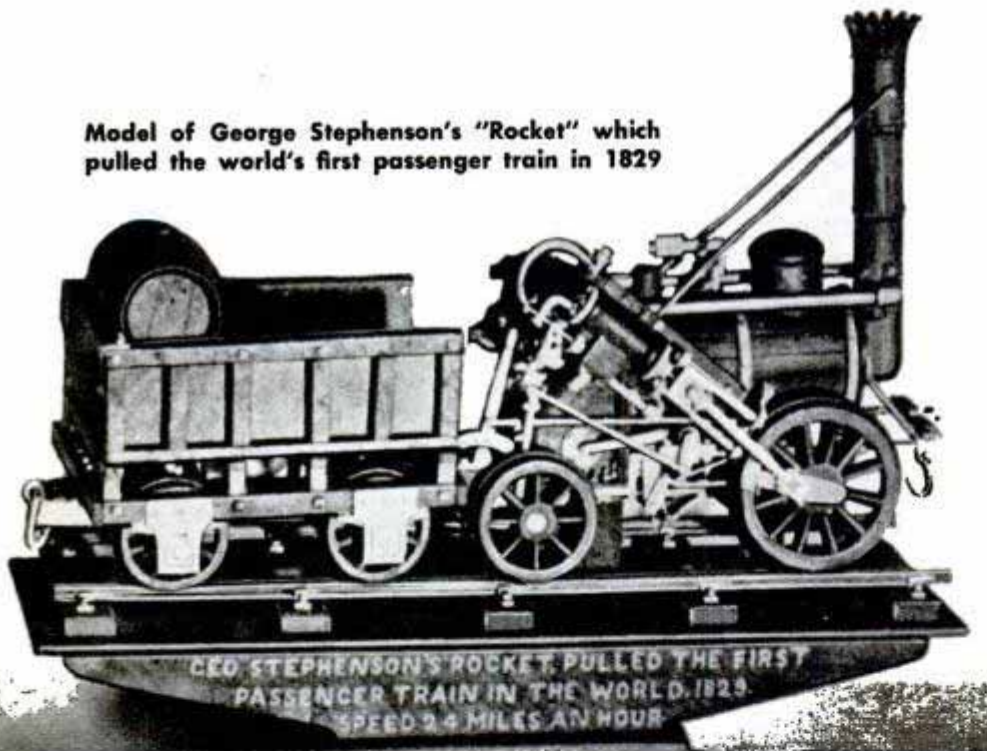
The Warther brothers turned their attention during the war to making knives for servicemen. It all started shortly before Pearl Harbor when a Dover serviceman wrote from camp to his wife, asking whether Warther could make him a com-

mando knife. As a sideline, the Dover carver had been making various items of cutlery almost as long as he had been whittling. First of all, he has had to make all of his carving knives to get the kind he wants. Then, when tedious carving became

tiring, he developed the habit of pounding scrap pieces of steel into knife blades, the anvil work serving as a form of relaxation. More than one Dover housewife will attest to his skill as a knife-maker. In the museum is a well-worn paring knife that was in daily use for more than 20 years. Once he gave a similar knife to a woman as a wedding present, and a generation later she presented the same knife to her daughter as a wedding gift.

Warther didn't even know, when the request came, what a commando knife was. But he got out a piece of tool steel and some odds and ends of wood and metal, and set to work designing a knife

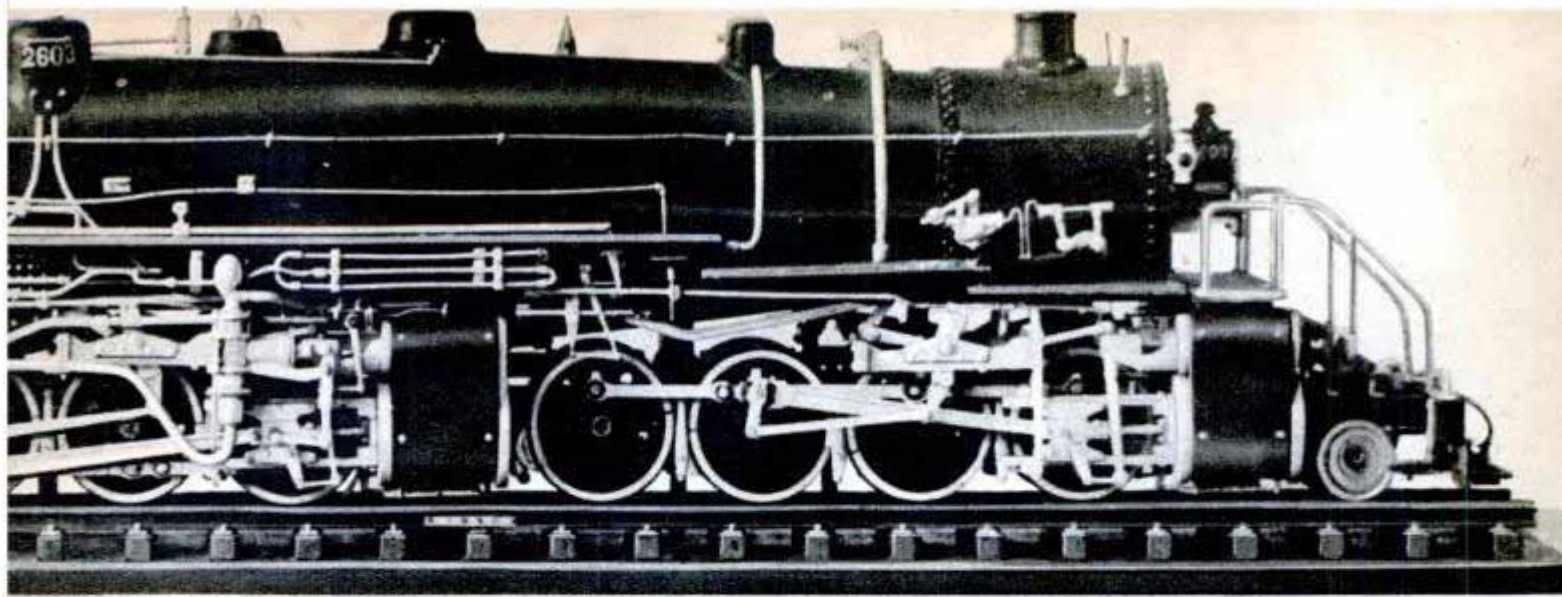
Model of George Stephenson's "Rocket" which pulled the world's first passenger train in 1829



Representing 1600 hours of hand carving, this model of a mountain type locomotive weighs 74 pounds



Great Northern mountain type locomotive
Designed and built by the Baldwin
Locomotive works 1930



that, in his opinion, ought to be useful for combat carving. He turned the finished knife over to the soldier's wife, and she relayed it to camp. Back came a letter asking for eight more for the soldier's buddies.

From that day until the war ended Warther had more combat knives to make than time to make them. His knives were declared by many to be the most beautiful in the Army, Navy or any other fighting organization, as well as being highly useful when occasion demanded. The Warther line included several different grades, ranging from the basic 7-inch model and the 8-incher to a superdeluxe, ivory-handled stabber.

The blade of a commando knife was made from high-quality carbon or alloy tool steel. After forging the blade, Warther brought it to virtually final shape on an electric grinder he keeps under a box on a terrace of his garden. Grinding in the open prevents his tiny, chaletlike workshop from being filled with gritty particles. He hardened and tempered the blade by a process involving a secret quenching solution containing, among other things, sperm oil. "I guarantee that my knife cannot be broken on anything that walks, swims, flies or crawls," he tells his customers.

The blades were equipped with aluminum alloy guards, and handles were made of ebony, cocobolo wood or ivory. The higher-priced models were equipped with aluminum alloy knuckle guards. The ivory-handled ones had inlaid decorations whose elements were so shaped and inserted that they couldn't work loose. Inlaid in each handle were two metal plates, one for the owner's name, the other for his serial number. On the deluxe models, these plates were engraved by a jeweler.

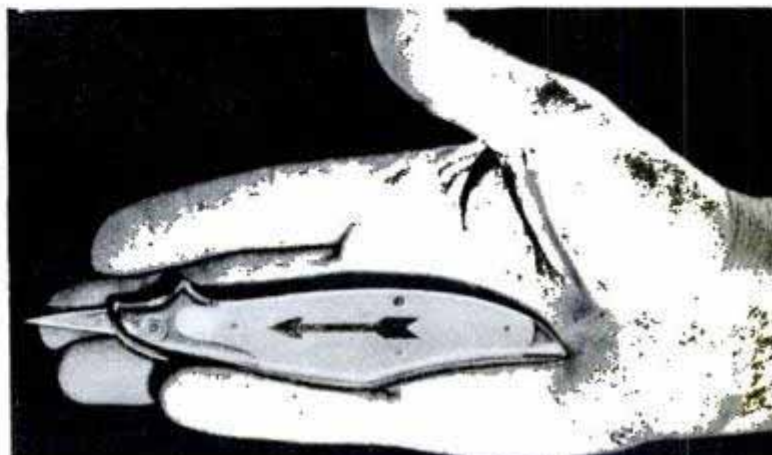
Warther encased his knives in all-metal sheaths, made of surplus and scrap metals, that were highly decorative as well as useful. The back was stainless steel that was given a watch-case finish. The front was

(Continued to page 162)

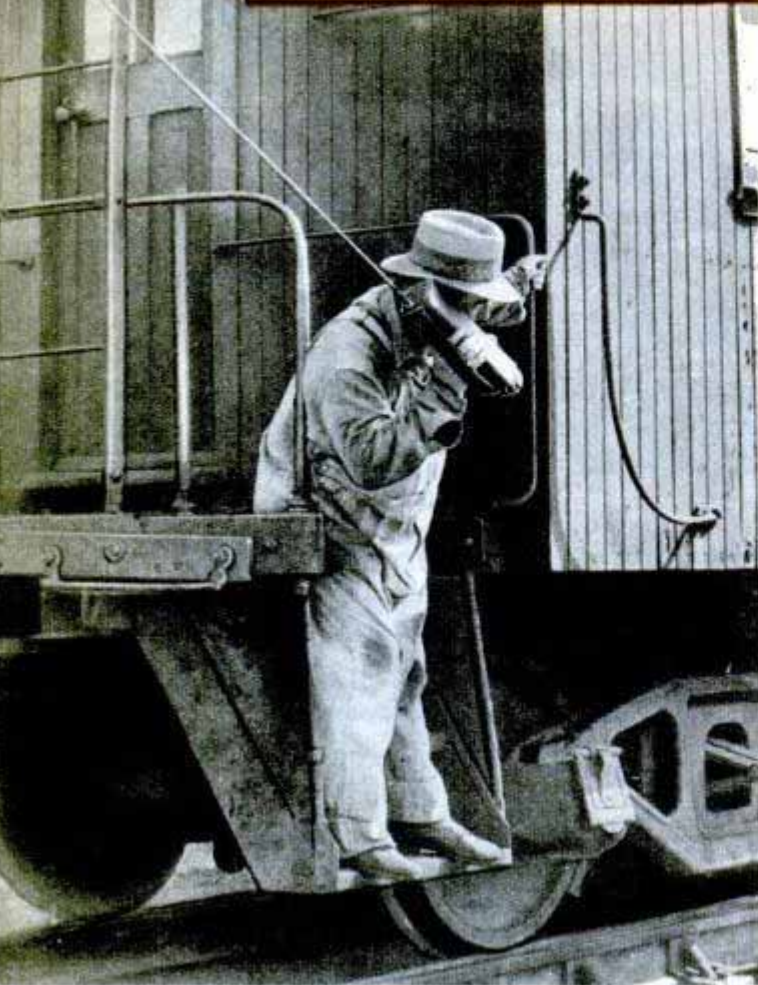
Even the "wood" in one locomotive's tender is ivory



Warther's intricate carving is done with a small knife

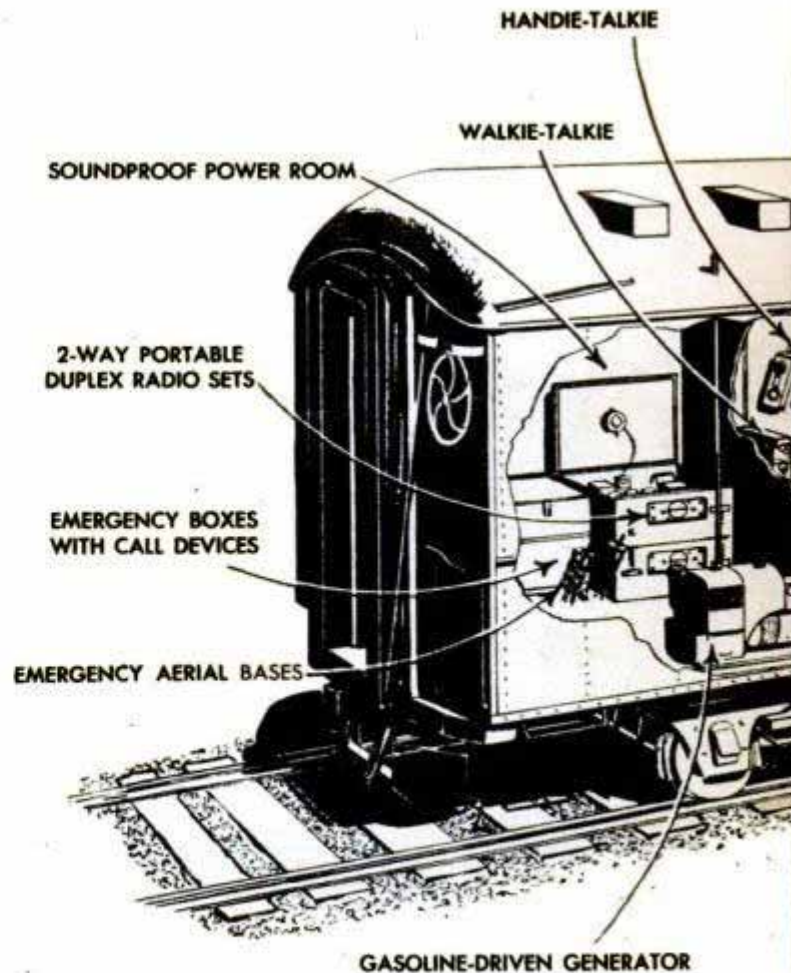
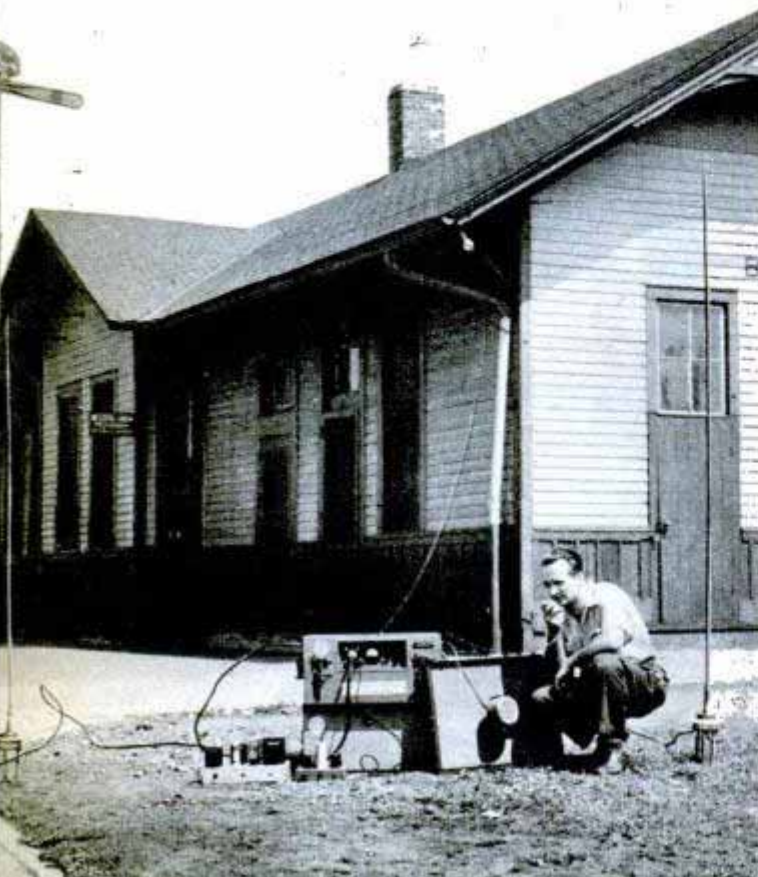


RADIO LAB ON RAILS



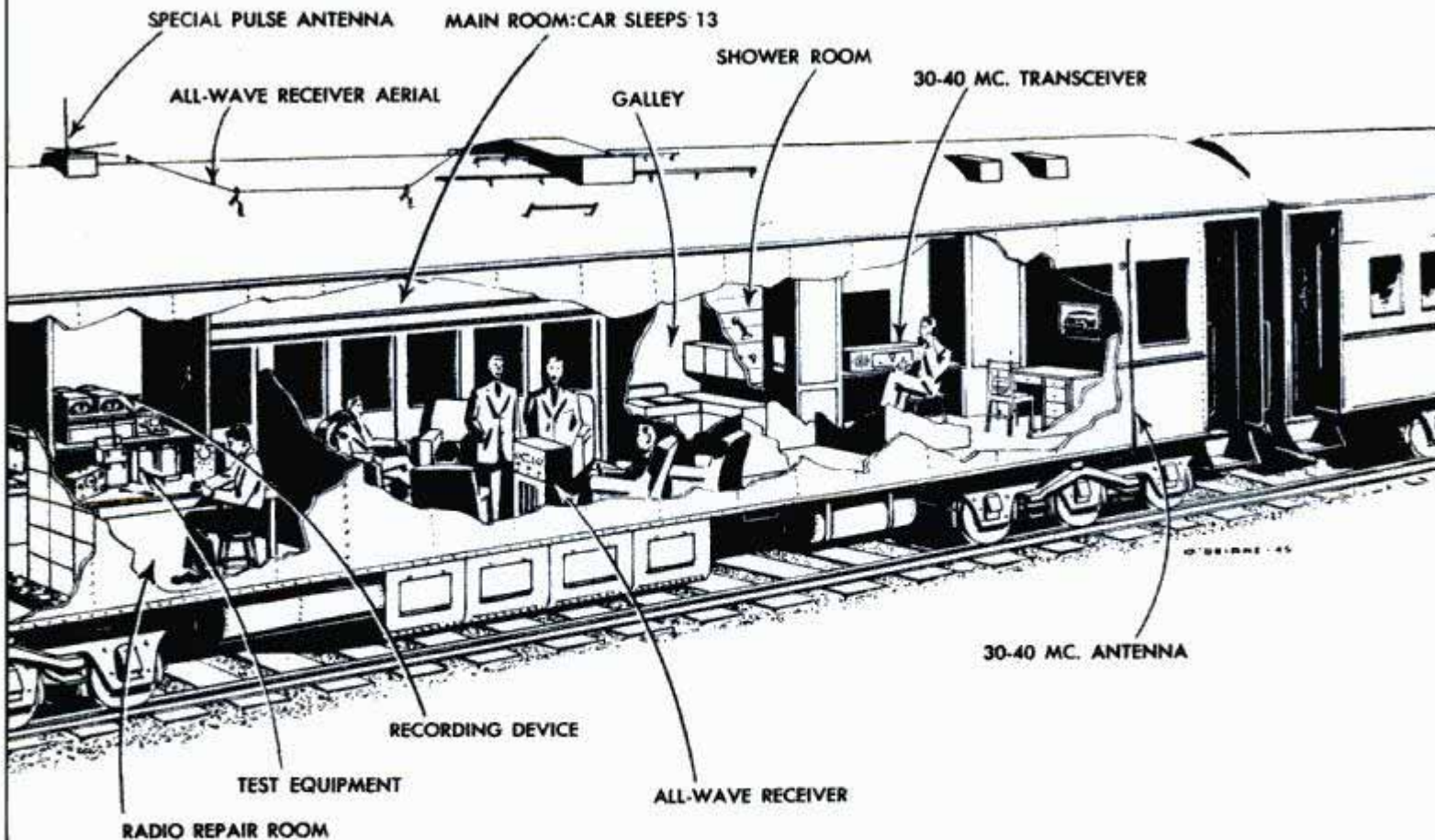
Galvin Mfg. Corp. photos
Trainman uses handie-talkie to facilitate switching. The set is one of many radio devices on laboratory car. Below, portable FM transmitter-receiver bridges gap in wires

The job that radio can perform for the railroads is being determined in a traveling electronic laboratory on the Rock Island railroad. It started life in a caboose, but moved into a Pullman car to keep pace with fast passenger trains and fast-moving developments in train communications. Cramped with radio apparatus for tests and emergency work, the car contains living quarters for a 13-man crew. At the front is a combination radio room and office with an FM transmitter-receiver. It is used for ordinary communication with the company's stations and operates while the car is in motion or standing still. In the center of the car is the bunk-living room with adjoining galley and shower. Back of this is the electronic laboratory proper with a complete assortment of instruments, meters and trouble-shooting equipment. On one table is a portable recorder that can be "patched" into any radio or telephone circuit. A telephone handset permits remote control of the radio equipment up front. A closet in the laboratory holds two handie-talkie and two FM walkie-talkie sets which take the place of hand and flare signals in emergencies and are otherwise useful in maintaining contact with the car. At the extreme end of the car is the power plant, a soundproof room containing a gasoline-driven generator which supplies electricity for the main radio equipment. Stored in this end compartment are two self-contained portable FM transmitter-receiver units which are set up to bridge gaps (up to about 35 miles) where wires are down. The units are "duplex" FM—that is, they can receive on one frequency and at the same time transmit on another. The car has three antennae. It is entirely air-conditioned and is equipped with fluorescent lights

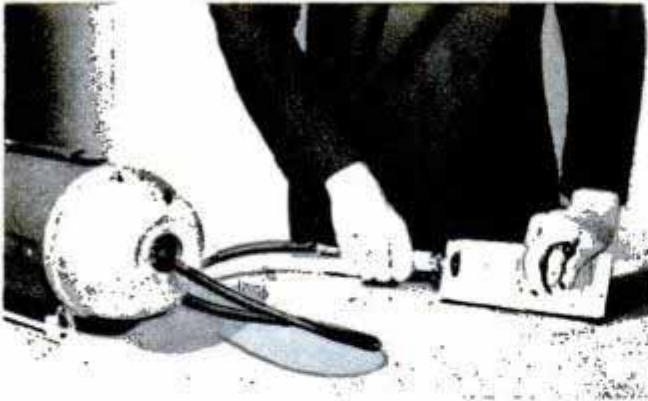




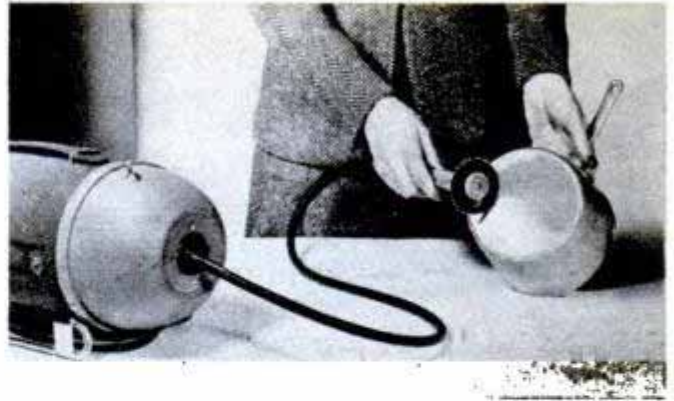
When lines are down, radio "patching" solves communication problem. Left, operator of portable transmitter-receiver spans gap in telephone line by putting signals on the air. At other end of gap similar unit receives message which is put back on wire. Right, testing walkie-talkie for use on handcar to keep repairmen informed of approaching trains. Below, cutaway drawing shows layout of Rock Island's rolling radio laboratory



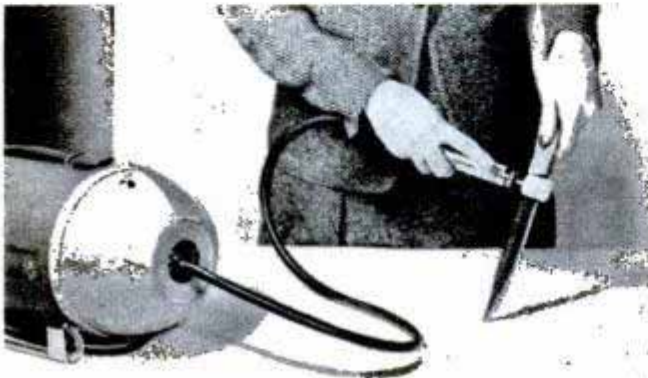
VACUUM CLEANER SAWS, GRINDS, DRILLS AND POLISHES



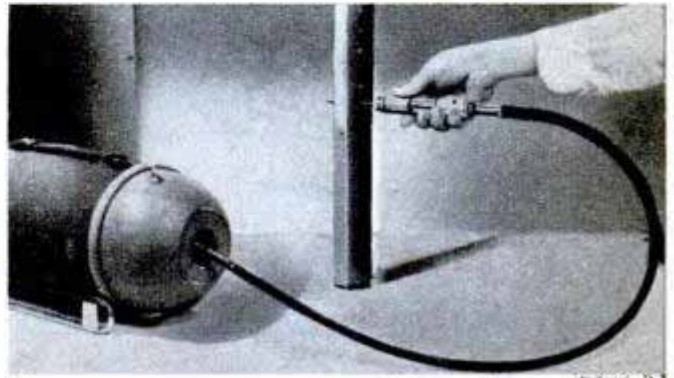
Circular saw at the end of vacuum cleaner's flexible shaft cuts wood, metal or plastic; below, grinding.



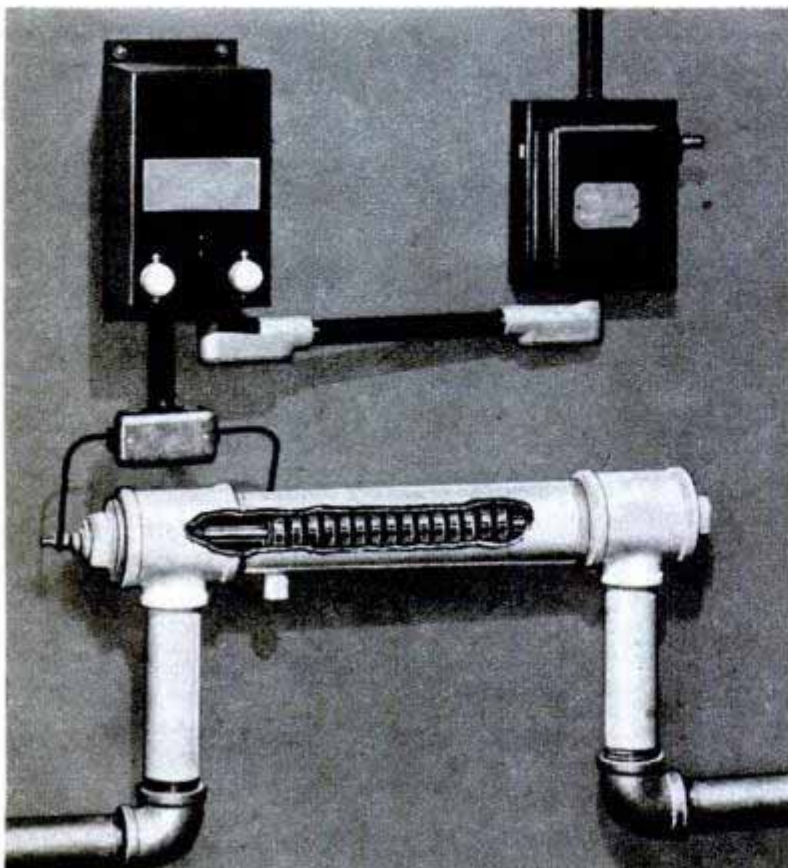
Buffers or steel brushes scour and polish utensils; below, drilling holes up to 1/4 inch in wood or metal



Sawing, grinding, drilling and polishing, as well as cleaning, can be done with a vacuum cleaner to be marketed soon. Designed as a portable power tool, the jack-of-all-trades cleaner can be plugged into any standard electric outlet. A hand grip holds accessories including circular saw blades, grinding and buffing disks, wire brushes, and drills up to 1/4 inch in diameter, in addition to the cleaner attachment.



A clamp binds the hand grip to a bench when the cleaner is used for grinding or similar work. Brushes, either fixed or rotating, are unnecessary in the cleaner because of the high suction provided by the blower. A 1/2-horsepower motor provides speeds of 2500 or 15,000 r.p.m. regulated by snapping the flexible shaft into a worm reduction gear on the side or into the top-speed socket on the end of the cleaner.



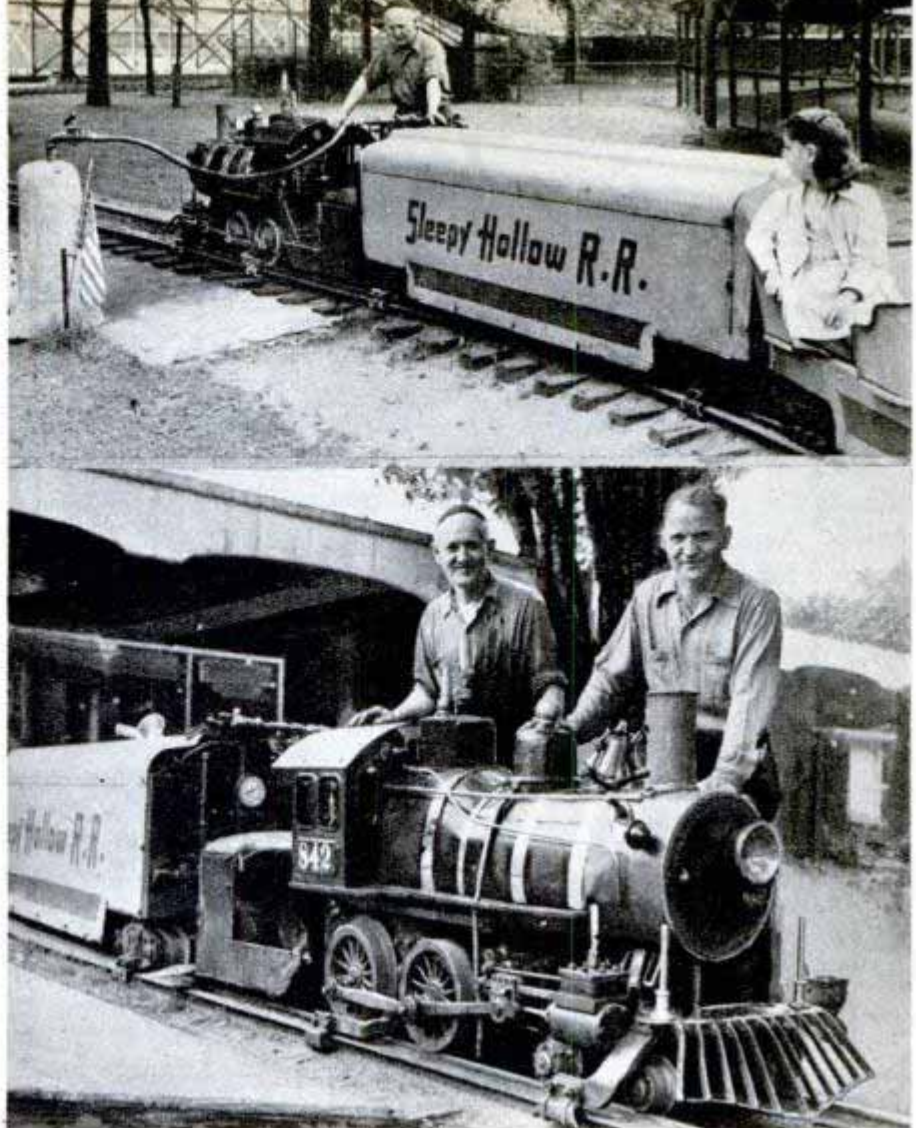
Electrified Water Salts Eliminate Corrosion

Salt particles in water are electrified in a water treatment system designed to reduce the huge bill American industry pays in cleaning boilers and replacing pipes corroded by "hard" water. When water is passed through an electrically charged cylinder, the salts pick up a charge which prevents their being attracted to hot boiler tubes. The process also prevents oxidizing and neutralizes acids and poisonous gases, according to the manufacturer, thus removing the causes of corrosion.

¶ All American countries now conform to the rule of driving on the right side of the road, Uruguay being the last to adopt the practice in September.

Compressed Air Powers Engine of Miniature Train

Puffing like a real steam engine, and equipped with cylinders, driving rods and drive wheels like its big brothers, a miniature railway locomotive in Cleveland's Euclid Beach Amusement Park eliminates cinders, dirt and delay in starting by using compressed air instead of steam power. As many as 50 children can ride at one time behind the engine. Compressed air is stored in the "tender" before each trip. Two air compressors power the train. One boosts pressure to 100 pounds per square inch. After the air has passed through an inter-cooler, the second compressor builds up the pressure to 350 pounds. One "load" of air in the tender will drive the train over its half-mile route.



Oxygen Tents Are Made of Plastic

Oxygen tents, often the deciding factor in crucial medical cases, now are being made of Vinylite, a translucent plastic. Tents of this material will not crack easily or develop holes, and are lightweight, flexible and easily sterilized. A drawstring at the bottom holds the tent close to the waist of the patient. Oxygen enters from an aperture at the top. A transparent window of rigid plastic, sealed to the flexible film, allows the patient to see and be seen.

"Sand Blast" for Drilling Teeth Is Painless

Operating somewhat on the principle of a sand blast, a new dental instrument may replace the conventional drill. It applies an abrasive to a cavity with an almost pinpoint stream of compressed air. The "air-brasive," as it is called by the inventor, Dr. Robert B. Black of Corpus Christi, Tex., operates swiftly without pain or noise. No pressure is exerted against a tooth during the process. Tooth debris and the abrasive, aluminum oxide, are withdrawn from the cavity into a vacuum hood on the instrument by a secondary stream of air. Softer abrasives might be used for cleaning teeth.

Running Water for Saipan

Moses smote the rock and water gushed forth. Army and Navy engineers got the same results on Saipan in a modern way

SIX days after D-day at Saipan there were over 5000 Japanese fighting in the mountain wilderness of that island—Japanese soldiers, well-armed, who still firmly believed that their brothers were fighting in California. The hills of Saipan were far from safe, but men of the 101st Naval Construction Battalion joined with Marine Guards and went into the hills with construction equipment. Their job was to tap a stream of fresh water with which to augment Saipan's scanty water supply.

When the Seabees with their Marine escort reached Atchugo Spring they went to work, putting the mountain stream into a 200-foot tamperproof concrete vault to discourage thirsty Japanese who roamed the nearby hills.

At Donnay Springs, chief water source of Saipan's great Mount Tapotchau, the Army Engineers and engineers of the Second Marine Division took over Japanese installations. Donnay Springs, true to the Nipponese sense of beauty, was landscaped and provided with retaining walls, cisterns and pumps. The American engineers immediately improved the water source by

capping the open cisterns to discourage bacteria, adding larger pumps and establishing a high-capacity water treating plant. Today, almost two years after the invasion of Saipan, many Japanese water mains are still in use on the island.

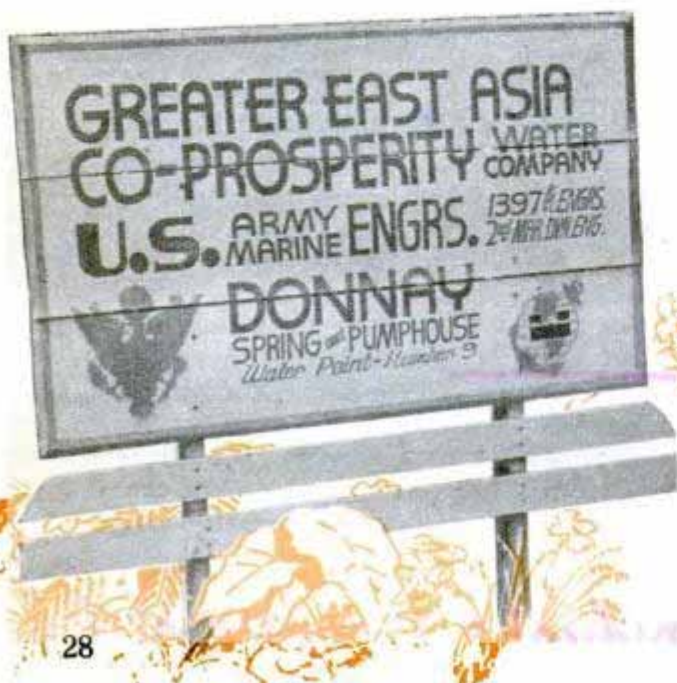
Spring water on Saipan provides 2,200,000 gallons daily, but is only one fourth of the total water supply. Most spring water comes from four high-level artesian springs that come to the surface of their own accord. This water requires careful treatment.

But Saipan's spring water, God's gift to the thirsty, must be supplemented by artificial water sources. Along the seafont distillers transform the brackish water of swamps and shore streams into water for use only in laundries; engineers have drilled deep wells to tap subterranean water sources, and at various points on the island elaborate rainwater catch systems are in operation.

Naval base units throughout the Pacific war have been equipped with large batteries of distillers. At Saipan, distilled water was an important item to invasion and early garrison forces, but now is a minor source, hardly used at all for drinking or cooking.

When Saipan's naval base reached the semipermanent construction stage, a city of two-story steel Quonset Huts stretched from the sea-flats to the top of a tall hill. These round-domed huts were provided with eaves troughs, two-story-tall rain barrels and a maze of rainpipe to provide naval personnel with ample soft water for laundry purposes. Saipan's Naval Hospital catches its own water and purifies it for all hospital uses.

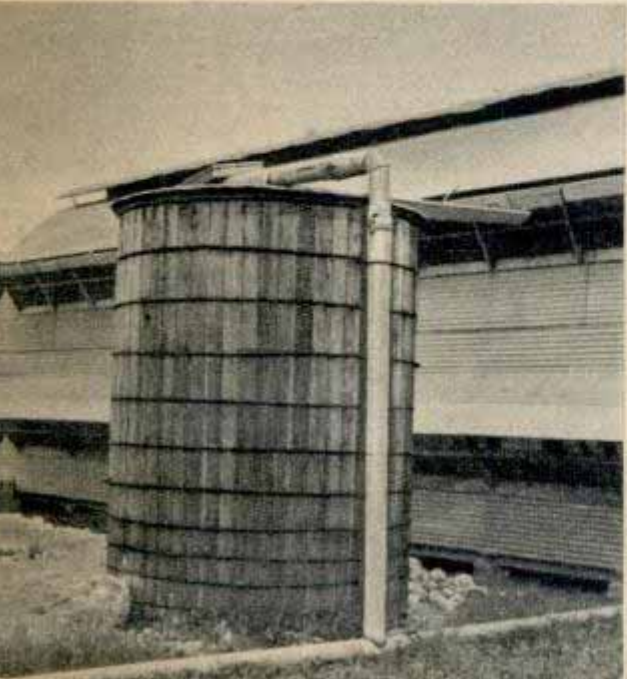
Most amazing of all Saipan water projects is an infiltration tunnel just above Tanapag Harbor. The 101st Seabees began this tunnel soon after water of fairly low salinity had been discovered in the vicinity, from which geologists inferred that there must be an underground source of fresh





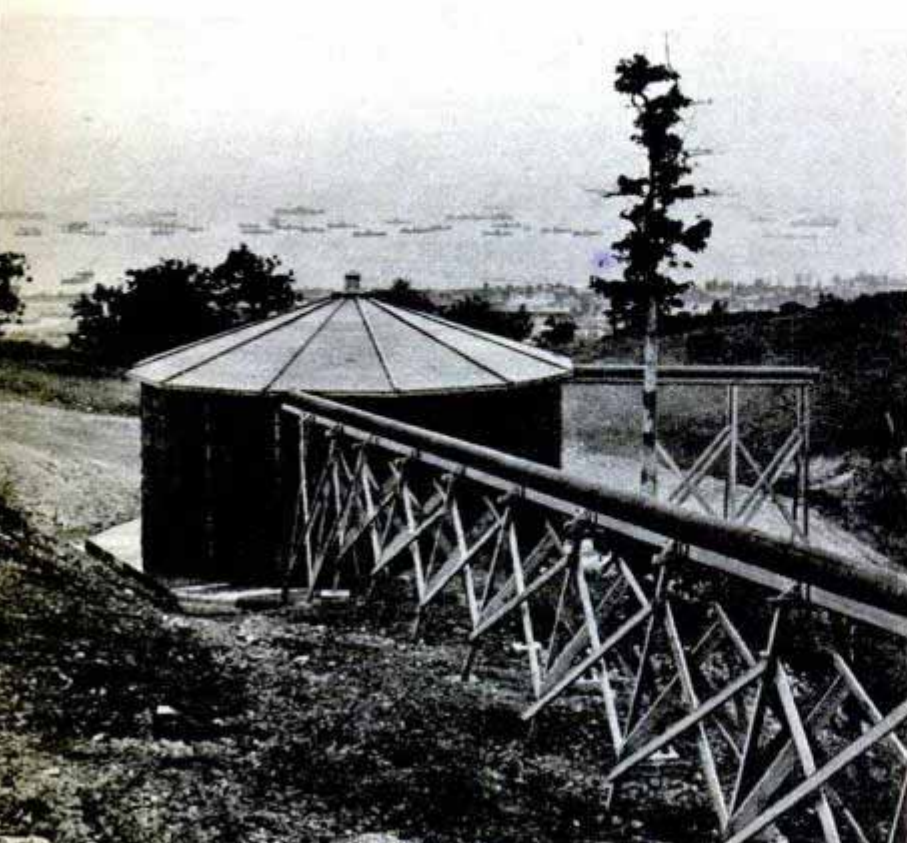
Infiltration tunnel was drilled through 800 feet of coral rock to tap underground water source. Three huge caverns were found

Giant rainbarrels catch water during tropic storms. Below right, tunnel workers drill holes for dynamite





Seabees dig virtual mine in search of fresh water source. Japanese railway carries rock away. Below, "eavesdropper" tank collects water from hospital roof for the patients' use



water nearby. The tunnel was drilled 800 feet through solid coral rock to follow the underground water to its unsalty source.

During the drilling three subterranean caves were entered. Within the caves are enormous stalactite and calcite structures. The caves are just above sea level. Salt water, by a sort of osmosis, comes up through porous rock into these caves at high tide. From their ceilings drips fresh water. One of these caverns has an immense room with reddish and white "icicles" of stone hanging from its ceiling. Its floor is covered with crystal clear cool water—excellent for lamplight swimming, say the water workers, the first human beings ever to set foot in these caves where the inner workings of the earth have been going on undisturbed for centuries.

Now the Tanapag tunnel project is in the hands of civilian employees of the U. S. Army Engineers who have worked the tunnel close to the main spring and will soon have it producing fresh water in quantity. The project often is referred to by Saipan GIs as the "New York Subway." A narrow-gauge railroad built from tracks salvaged from Saipan's cane-field railroads runs through the tunnel carrying air-compressors for drilling and cars for removing broken rock.

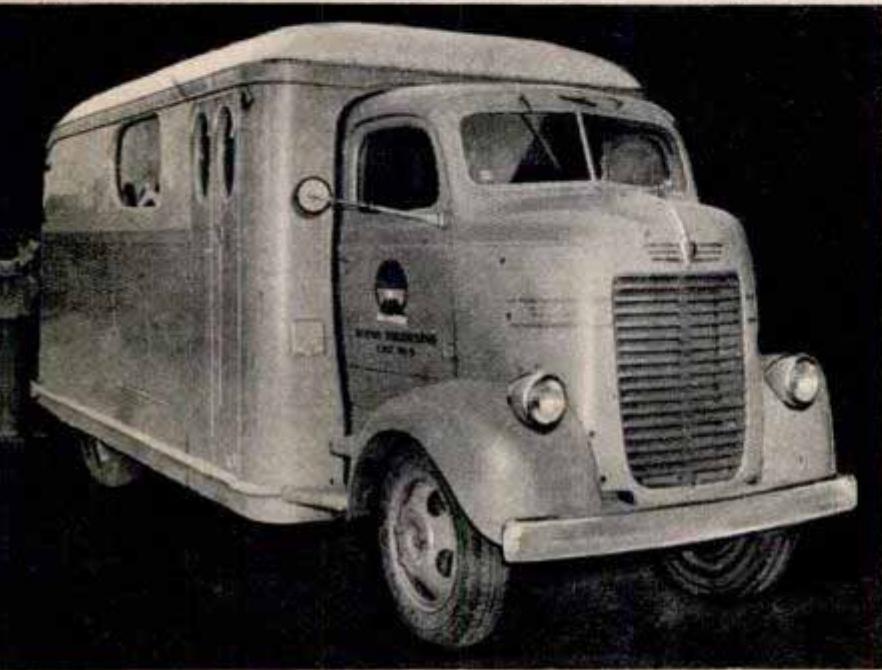
Instrumental in locating water sources on Saipan and in planning their development were three noted scientists and geologists. One of them who landed soon after the invasion was Dr. Harold Stearns, foremost Pacific geologist of the United States Coast and Geodetic Survey. From Honolulu came two experts at solving problems of island water supply, Dr. Chester K. Wentworth, senior geologist of the Honolulu Board of Water Supply, and Dr. Frederick Ohrt, manager and chief engineer of the Honolulu Water Supply.

Much of Saipan's water system is modeled after that of Honolulu and the Hawaiian island of Maui. On that island, a type of well was developed which now is known professionally as the Maui Well. Such wells are made by drilling an open shaft deep into the earth. At the bottom of the shaft tunnels are dug in all directions to tap all possible water sources. Saipan boasts one

(Continued to page 162)



Engineer has necessary controls at fingertips. Left, unit is mounted on truck



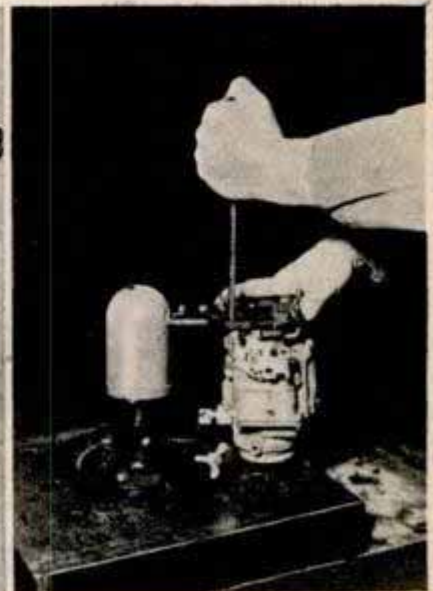
Movable Booth for "Mixing" Sound

Many difficulties formerly encountered in recording sound for motion pictures have been overcome by Paramount Pictures with the development of a mobile sound recording unit to take the place of a stationary "mixer's booth." Moved in a truck

from one stage to another and to field locations, the equipment enables the sound engineer to be on the scene of action rather than in a booth some distance away to which the sound previously was transmitted via lengthy cables. The new system helps the engineer to do a better job of controlling sound recording because he can see as well as hear. A short and simplified cable system "pipes" mixed sound into the truck to be recorded. There the engineer has all necessary controls within reach. As the sound is recorded on blank film, the motor which runs the film magazine in the truck is synchronized with those of the cameras.

Rotating Work-Holder for a Vise Clamps Parts in Convenient Positions

New versatility has been added to the old-fashioned vise. A hydraulic work-holder now on the market has a clamping fixture that can be rotated in a 90-degree arc from horizontal to vertical. This tool is especially useful for holding, in any desired position, such engine parts as carburetors, magnetos and fuel pumps for repair by garage mechanics. The largest model will support up to 225 pounds.





On Guard Against

University of California scientist adjusts oscillator tube that regulates the power to operate atom-smashing cyclotron

By Thomas E. Stimson, Jr.

THE CHANCES are that you never will drive an atomic automobile or fly in an airplane powered by nuclear energy. Scientists don't know when, if ever, those dreams will come true.

The difficulty is not a matter of dollars and cents, for the men closest to the picture believe that in our lifetimes it may become cheaper to "burn" uranium than coal.

The trouble is that atomic power packages radiate vast quantities of deadly, invisible rays. The emanations are destructive to living tissue and there is no human sense that can warn against them. Their presence can be detected only by special instruments.

Our only protection is to enclose radioactive substances in thick walls of insulat-



Atomic researcher reads meter which determines if he has absorbed a dangerous amount of radioactive rays

Death Rays

ing material, among the best of which are water, lead and concrete. Adequate insulation for an automobile's atomic engine would consist of concrete walls four to six feet thick, weighing in the neighborhood of 100 tons. Any such handicap makes an atomic automobile or passenger-carrying airplane an absurdity.

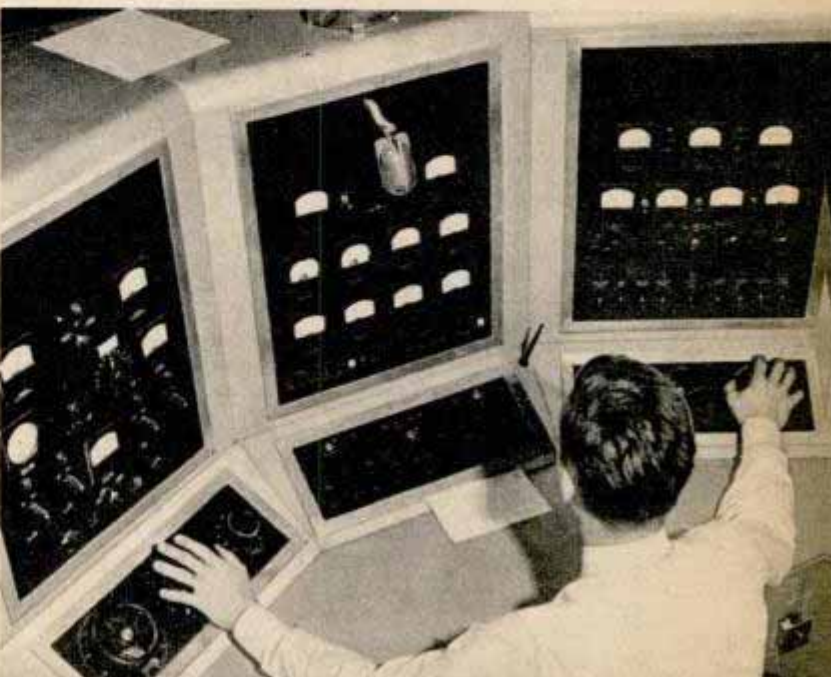
That deadweight, however, would not be much of an obstacle for an atomic locomotive. It will be no handicap in powering ocean liners. Steam plants and electric plants that use atomic heat will have built-in protection in their structural walls.

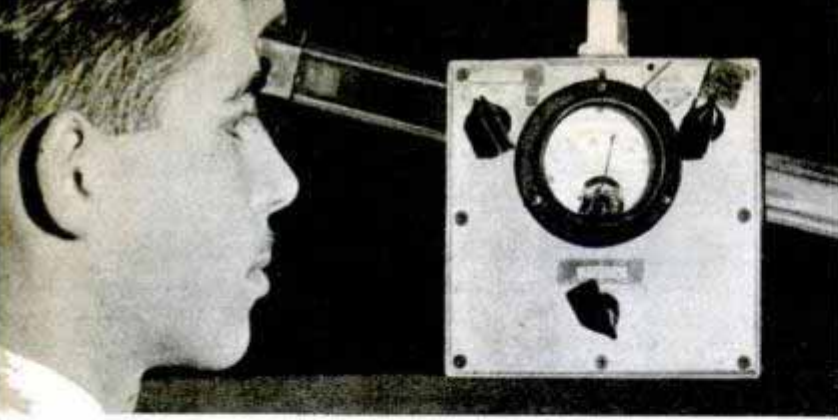
The deadly rays produced by radioactive materials consist of infinitesimally small fragments of energy and matter that are shot out at high speed in all directions. Neutrons, hard and soft gamma rays, alpha particles, and X-rays, depending on the type of activity, are among the rays produced. They cause deep burns comparable to X-ray burns or the burns suffered from overexposure to radium. Paralyzed bone marrow, nonclotting blood and a reduction in the blood cell count, all lumped together under the general term "X-ray poisoning," occur in addition to the burns. Depending on the degree of exposure, a radioactive source could destroy a person in a second or insidiously over a period of years.

That is not to say that even the slightest exposure is deadly. We all are being bombarded, all the time, by cosmic rays from outer space. The earth, water and air all contain small amounts of radioactive materials. Radium salts and other radioactive

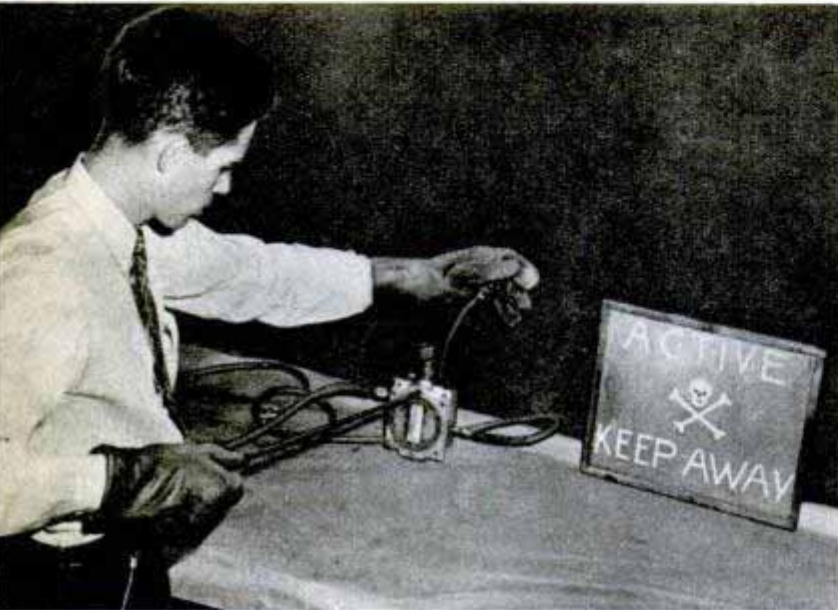


Measuring radioactive "trace elements" fed to tomato plant to learn rate of food absorption. Below, cyclotron control is insulated by water and concrete

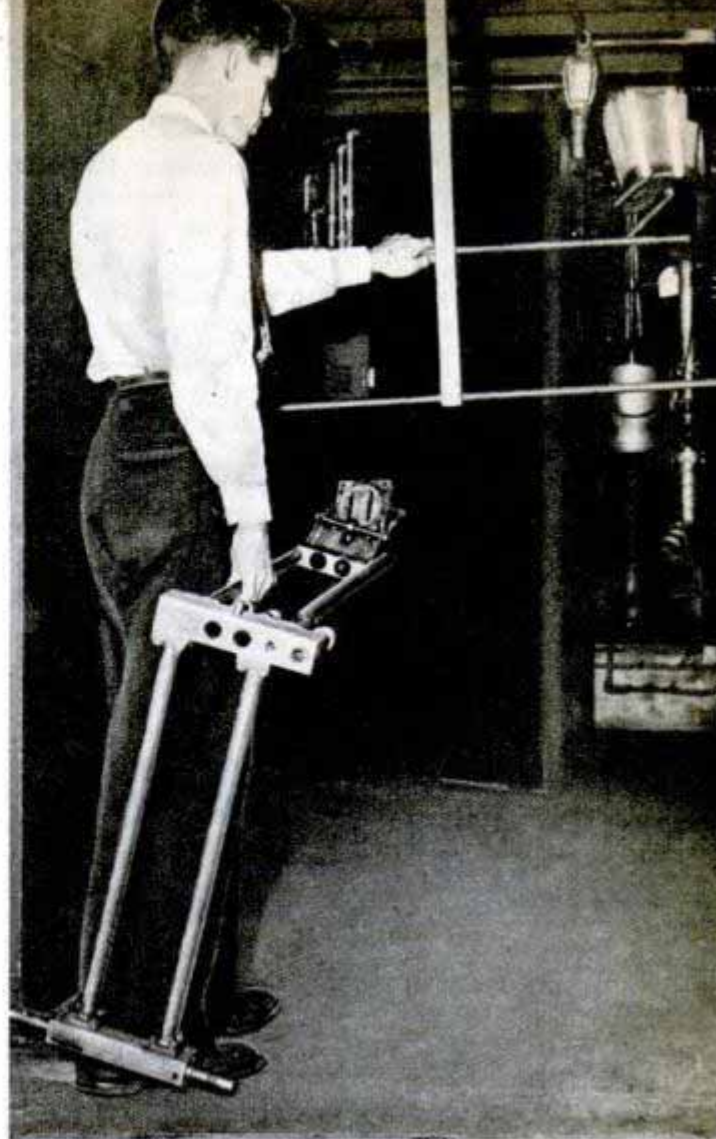




Measuring radiation from metal bar (held behind meter) which has been exposed to stream of neutrons



Heavy lead gloves and a long screwdriver protect physicist against rays from atom smasher equipment. Right, when scientist lifts barrier to enter cyclotron chamber a switch shuts off the power as a safety precaution



substances are used safely in the treatment of disease. The doses are controlled carefully to avoid any chance of overexposure. Slightly radioactive substances are used as "trace elements" in nutrition studies of plant life without hazard.

At the University of California where Dr. Ernest O. Lawrence and his staff of physicists are working with a 60-inch cyclotron, elaborate precautions are taken to avoid harm from the radiations that the machine gives off.

The Berkeley cyclotron was an important tool in the research that led to the atomic bomb. The new element plutonium was discovered with the aid of the cyclotron. Plutonium is created from hitherto useless uranium 238 and increases by about 100 times the atomic energy obtainable from a given amount of raw uranium.

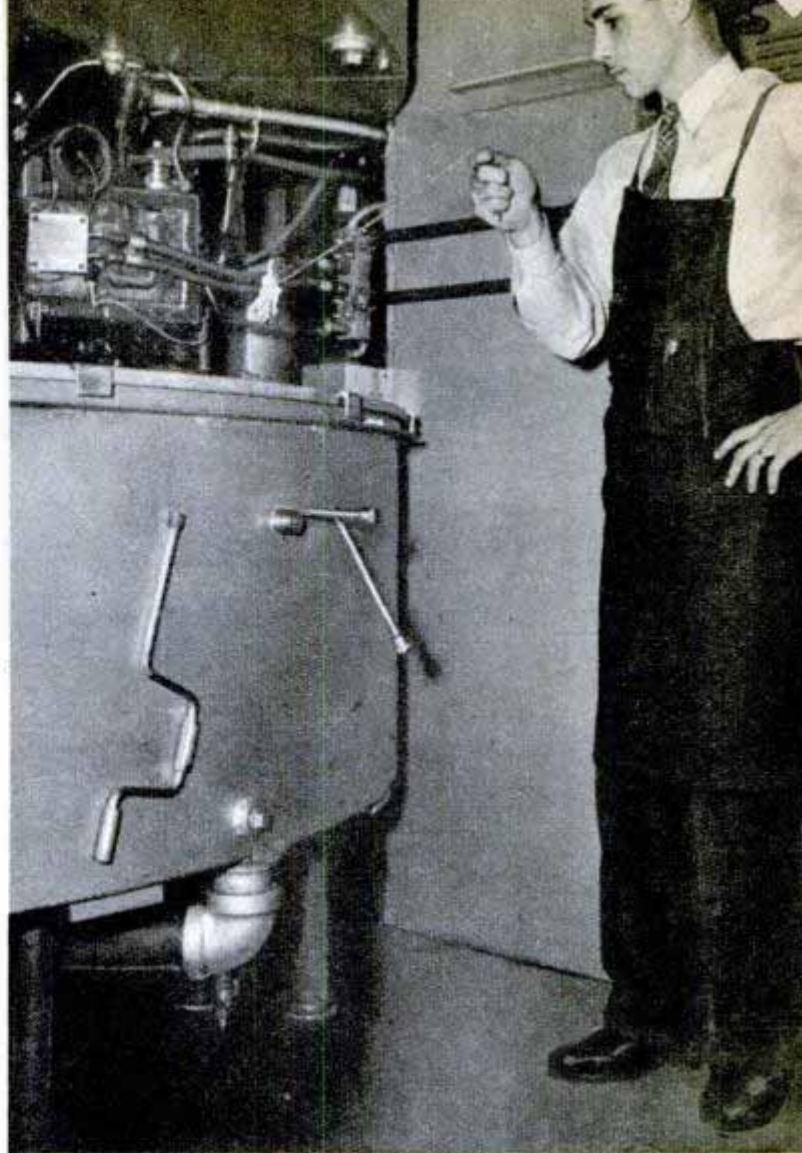
In operation, the cyclotron produces a neutron radiation at its target that is equal to the radiation from several hundred pounds of pure radium mixed with beryllium. To appreciate what this means it should be understood that even a single gram of radium must be encased in a lead safe weighing several hundred pounds to

protect nearby persons from the effects of its radioactivity.

The cyclotron, accordingly, is surrounded by five-foot-thick walls of water contained in large movable steel tanks. This protection is increased to 10 feet of water plus two feet of concrete on the side directly exposed to the target. Water, instead of lead or concrete, is used as the principal protection because the tanks may be moved out of the way when major changes are to be made to the cyclotron. Overhead radiations are absorbed by four feet of water in tanks installed in the reinforced ceiling.

To make sure that no one can enter the cyclotron chamber while the instrument is in operation, the passageways leading to it contain barrier gates that must be swung upward for entrance, and this action throws a switch that turns off the power supply.

The cyclotron itself has become radioactive from use and precautions must be taken against this radioactivity in making changes or repairs to the instrument. Distance is an important factor in the degree of protection and so most work on the cyclotron is done with the aid of three-foot-long screwdrivers and wrenches. But



Lead and brick safe (left) stores radioactive materials. Powerful magnet (right) of cyclotron attracts key chain

no staff member is allowed to work on the instrument until he has measured the radioactivity of the actual part that is to be worked on. He uses a meter that shows whether an exposure of only a few seconds, a few minutes or an entire hour is safe.

Targets that have been bombarded by the cyclotron as well as other equipment that has become radioactive are stored in separate compartments of a lead-walled safe. Portions of the machine that have become worn out from use are buried, for safety, in a special burial ground.

As a final precaution, each member of the cyclotron staff wears on his clothing a badge that contains a strip of X-ray film. Worn for a week and then developed, the film shows, by its degree of darkening, the amount of radiation to which the worker has been exposed. Each member of the staff also carries a pocket ionization chamber resembling a thick lead pencil. In case of doubt while working close to the cyclotron the staff member can go outside and measure the amount of discharge of the ionization chamber. This tells him whether he safely can return to the dangerous area that day.

At the mammoth Hanford Engineer

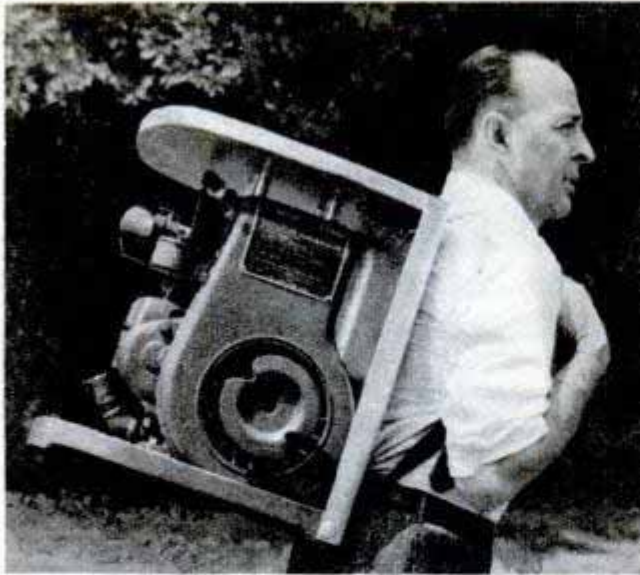
Works, Richland, Wash., where atomic power has been harnessed for manufacturing the new element plutonium, comparable precautions on an even greater scale are taken to safeguard workers from the lethal rays. Designers of the safety features of the plant were extremely cautious because no one ever had dealt with such tremendous quantities of radioactivity before. No one could predict what the effects would be. As a result of the safety program, exposure to workers is negligible.

There are two main types of protection: elaborate physical safeguards to absorb the rays produced by radioactive materials, and multimethod checks on the workers and the surrounding area to make certain that no one can be harmed. In all, possibly \$50,000,000 was spent on protection at Richland although a considerable part of this money went into massive airtight concrete walls that serve for structural purposes as well.

Radioactive materials that are stored at Richland are planted in huge storage basins where they rest under many feet of water. Special railroad cars are used for transporting the materials around the plant.

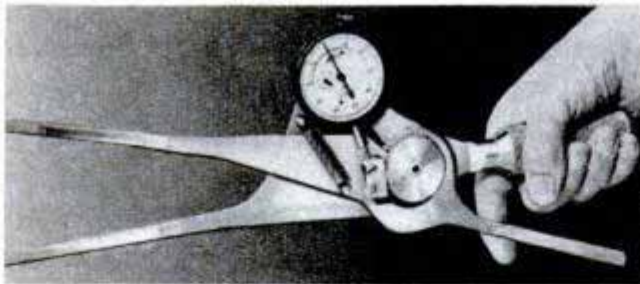
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Back-Toted Fire Fighting Pump



Small enough to be carried on a man's back, an 85-pound portable fire fighting pump can be rushed to the scene of a blaze to deliver 40 gallons of water a minute at 100-pound pressure. The power source is a compact one-cylinder engine. In combating forest fires one man carries the pump unit while another carries the fuel tank and hose. The tank holds 5½ gallons of gasoline, sufficient to operate the pump for about eight hours. Special rubber impellers enable the apparatus to pump dirty water as well as clean.

Dial Indicator on Inside Calipers

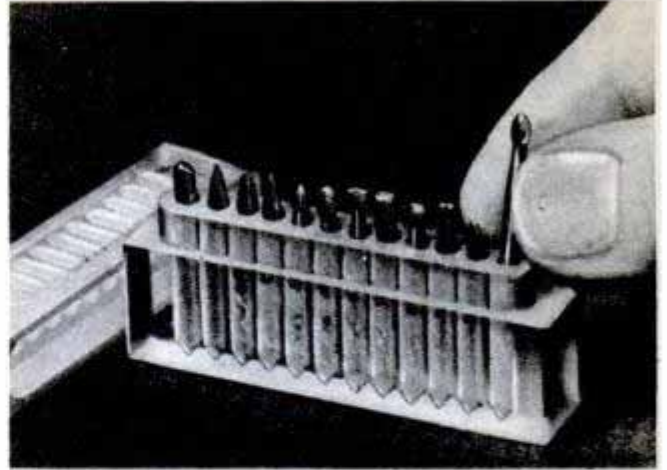


Inside diameters can be measured quickly and accurately—and registered on a dial—by using a caliper gauge recently placed on the market. Equipped with long jaws, the gauge can be thrust deep into tubes or other objects to provide inside diameter measurements at various depths. Gauges of this type are available to make measurements from 7/8 inch to 4 inches.

Protective Resin Coating on Food Wrapper Acts as Self-Sterilizer for Foods

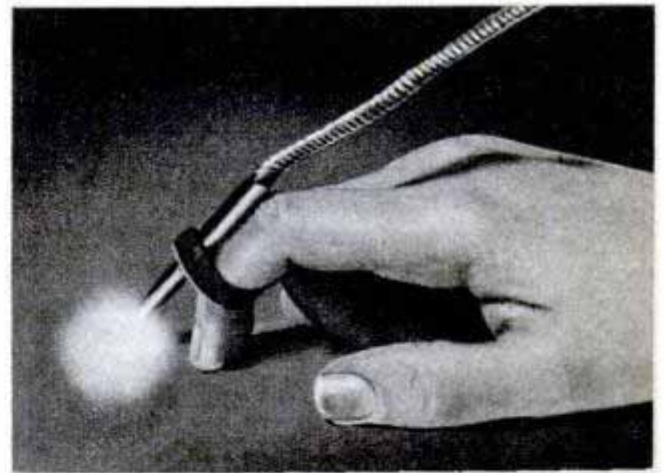
Cheese, dried fruits and other foods may be protected in the future by a self-sterilizing wrapper with an inside coating of resin. This coating, developed at the California Institute of Technology, can be used on metal foil, plastic films or paper. It ster-

Tiny Files Spin at 100,000 R.P.M.



Lasting many times longer than steel files, a set of cemented-carbide rotary files is now available in midget form. Furnished in 12 assorted shapes, the files, measuring 1½ inches in length and 1/8 inch in diameter, are for use in power tools, taking the place of hand files and mounted grinding wheels. The tiny files are said to cut faster than grinding wheels as they are designed to operate at 65,000 to 100,000 r.p.m.

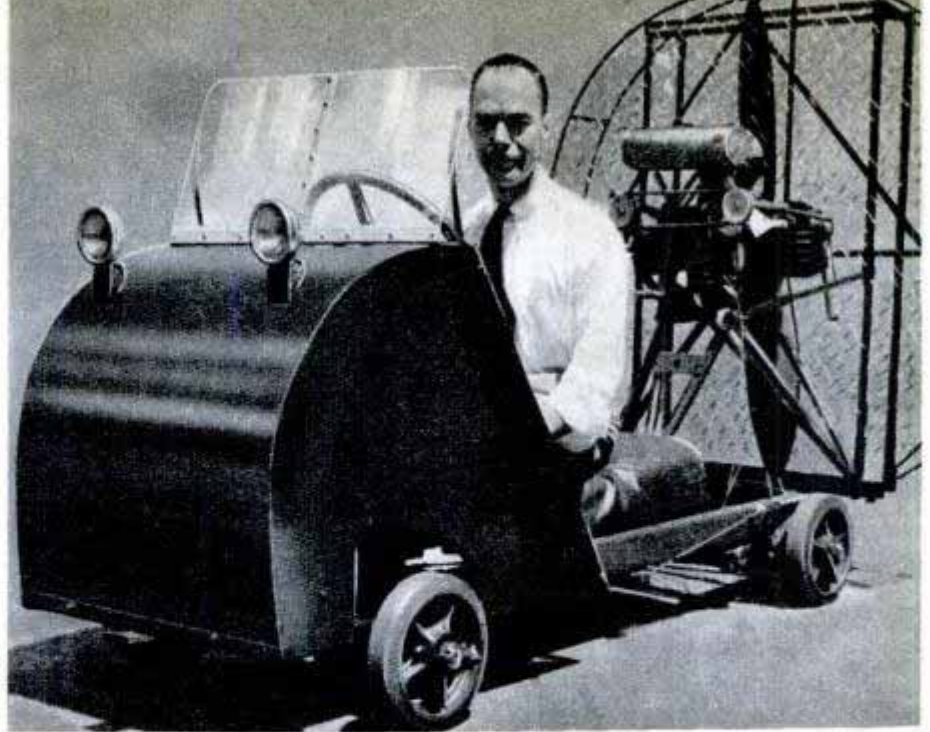
Finger Flashlight for Mechanics



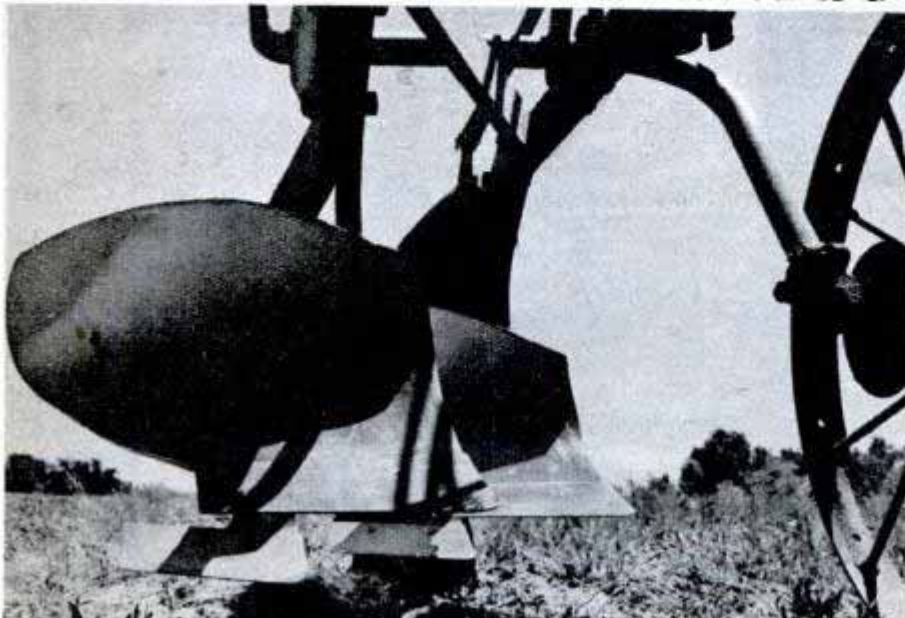
Mechanics probing for obscure troubles in airplane, locomotive or automobile engines are aided by a tiny flashlight that can be attached to a tool or clamped on the worker's finger. Equipped with an acorn-sized 2.5-volt bulb and a midget mirror, the light comes in two types, one operating from batteries and the other from standard lighting sockets.

Plane or Scooter— Which Is It?

When Guthrie Mitchell of Passaic, N. J., applied for a license for his latest invention, the State Motor Vehicle Commission was stumped. Several inspectors examined the vehicle to determine whether it moved forward or backward, in the air or on the ground. Mitchell, a Civil Air Patrol pilot, calls his midget car the Windjammer. It is driven by a pusher propeller powered by a two-cylinder engine that develops 12 horsepower. The frame was made from a cut-down Model A Ford and it has a shortened Ford steering gear. The Windjammer has neither clutch, transmission, differential or drive-shaft. A license was granted after the in-



ventor attached a heavy propeller guard and four-wheel brakes. Mitchell, an engineer for a division of Raybestos-Manhattan, Inc., also has built a power scooter and a "snow jeep" for clearing walks.

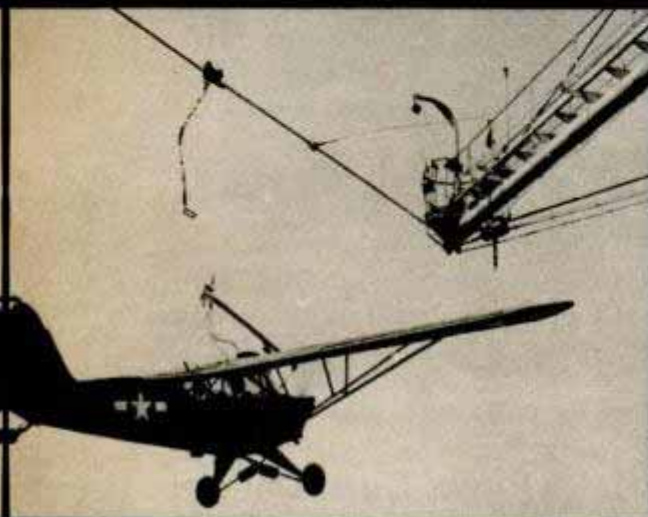
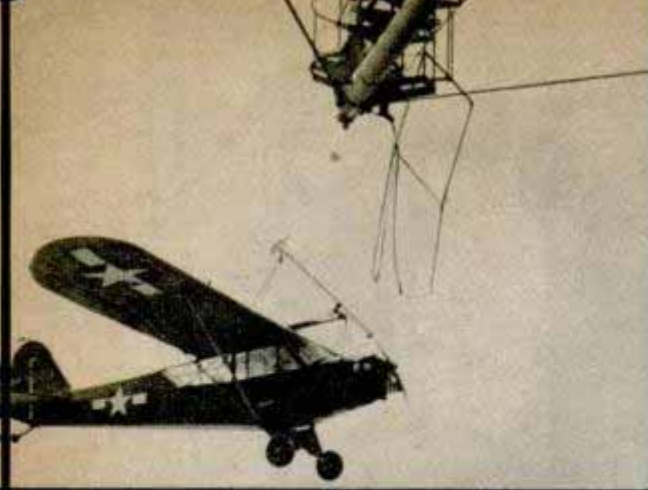


Plow Cuts Deeper With Extra Blades

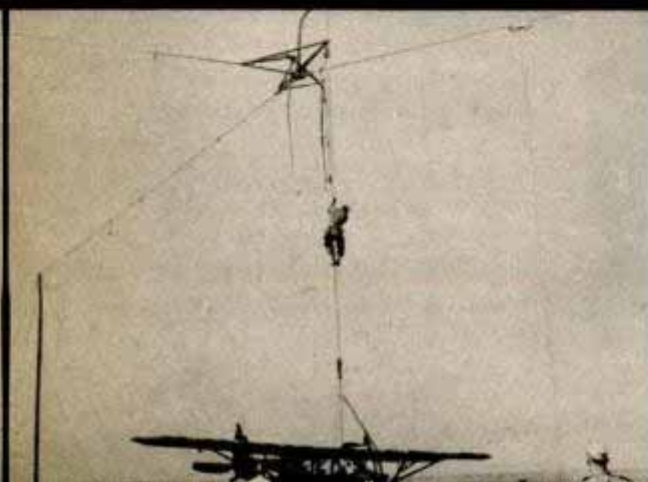
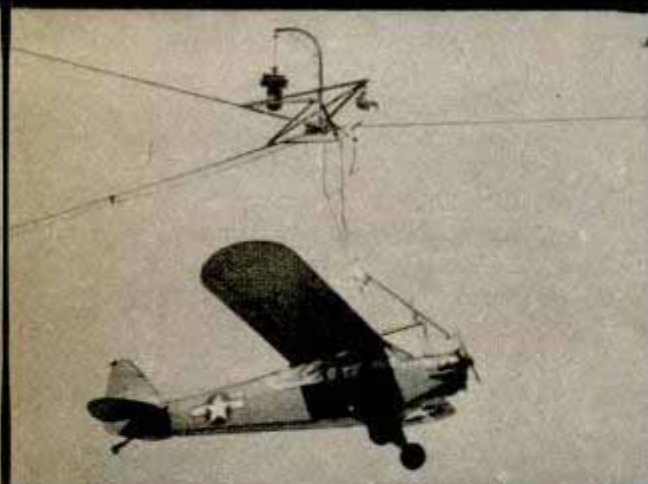
Furrows four inches deeper than the usual cut are dug by a plow equipped with two additional knifelike blades which work below, behind and slightly to one side of the conventional plowshare. Thus the ground's hardpan is broken up, permitting plants to go deeper for food, minerals and water, and more air, light, water and warmth penetrate to the roots of the crops. Beside reducing the amount of harrowing and disking necessary in soil preparation, the extra-bladed plow protects the soil against erosion, according to the manufacturer. Subsoil that has become packed by years of ordinary plowing is restored to use, topsoil is rejuvenated and crops develop more vigorously. The plow already has undergone extensive tests at various university experimental farms.

Nylon Airport

Like tightrope walkers, light planes now hook-land and take off from a 500-foot steel cable equipped with nylon loops 65 feet above the ground. Called the Brodie system after its inventor, Captain James H. Brodie of the AAF, this "trolley wire" airport demonstrated its practicability aboard ships and on battlefields during the war. Now it is ready for possible use for landing aircraft atop buildings in the heart of big cities or in wooded sections and other areas where it is difficult to construct landing fields. Brodie predicts eventual handling of 7000-pound planes



Its hook ready to snag a nylon loop, a plane (top) comes in for a landing. Take-off is demonstrated in other picture above. After the hook engages the loop (below), a braking system halts the plane which is lowered to ground (bottom) by derrick



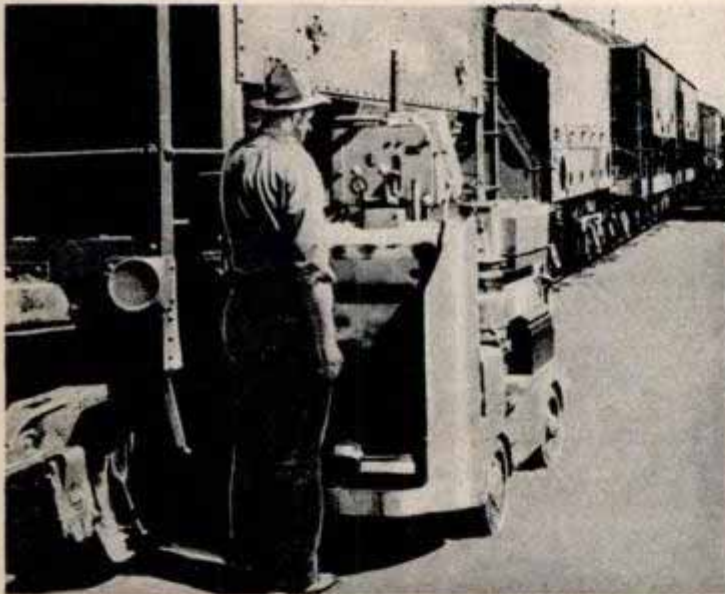
Navy photos

Getting ready for a takeoff (above), a hoisting bridle is attached to a plane to lift it to the steel cable "air strip." Below, Piper Cub gets a "shove" from a smoky catapult



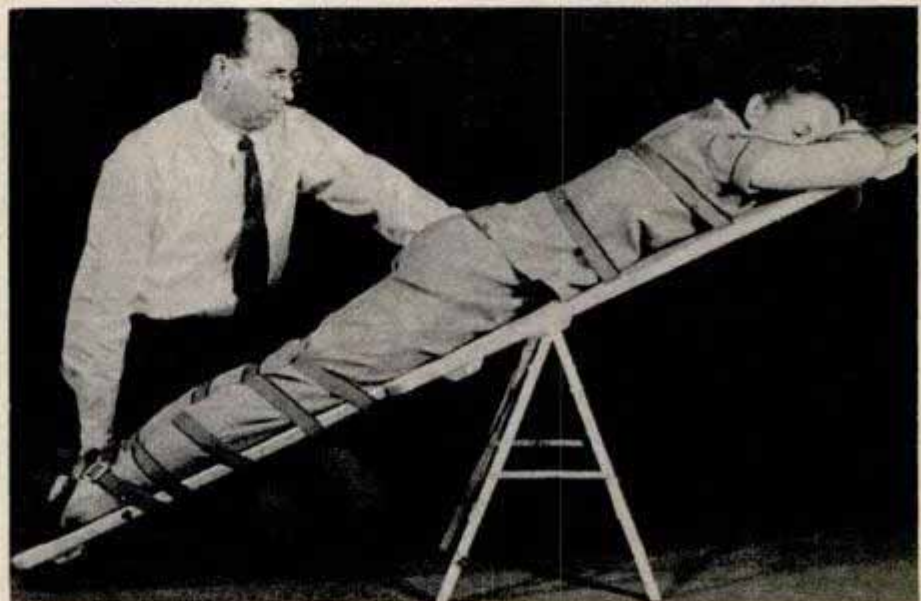


CRASH TRUCK originally built to salvage wrecked bombers and fighter planes was put to work laying gasoline burner pipes along the edges of an airfield at Arcata, Calif., in connection with FIDO fog-lifting equipment



PLUG-IN ELECTRIC TRUCKS speed up the job of unloading hopper cars filled with iron ore. Powered by electricity from outlets along railroad docks, the trucks' motors turn four-foot-long wrenches which open and close bottom gates of hopper cars. One operator can do the job now in a fraction of the time previously required for two men to wield a 55-pound wrench. The truck has three-phase, 220-volt AC motor connected with a generator

SEESAW RESPIRATOR equipped with a simple attachment on a folding stretcher induces breathing by the "rocking chair" or seesaw method. The attachment supports the stretcher, converting it into a respirator in a few seconds. It is operated by gently rocking the patient back and forth. The motion restores breathing and aids circulation. This method of artificial respiration affords a quick, uninterrupted change from manual to mechanical means and is less tiring than the former method



SCIENCE PINS DOWN THE WEATHER

At last we're doing something about it—wartime techniques of forecasting by radar and robot balloon are mapping the weather accurately on a worldwide scale

DOWN through history, weather has been winning victories for the admirals and generals. **By Andrew J. Hamilton**

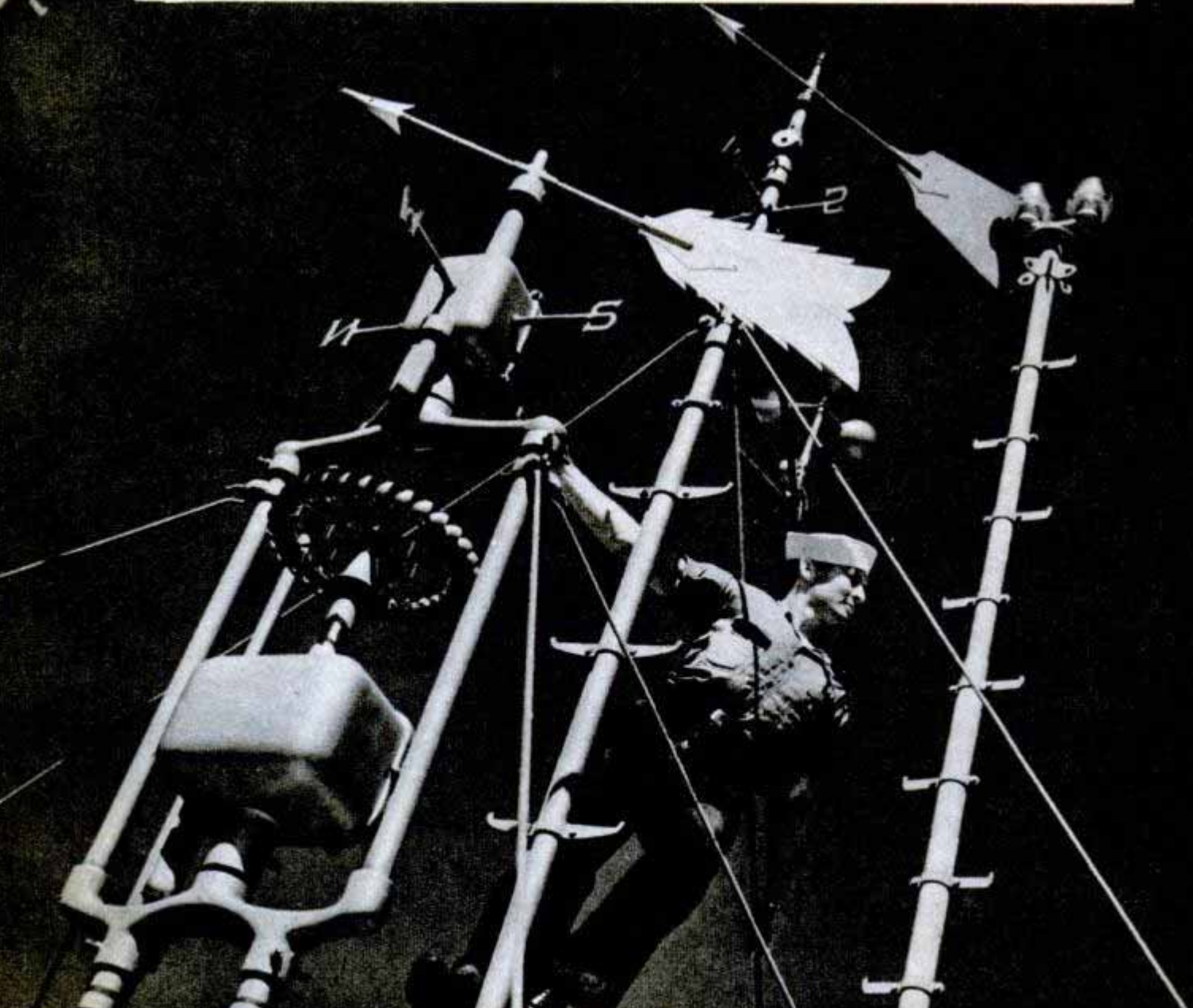
Strong westerly winds wrecked the so-called "Invincible Armada" of Philip II of Spain in 1588 and halted the invasion of England. Napoleon failed to take into account the severity of winter snows in Russia and was forced to retreat from Moscow. Winston Churchill's daring Gallipoli adventure in 1915 proved a failure because of adverse weather conditions.

Weather played an even more important role in World War II and was a decisive factor in almost every

phase of the conflict. Hitler chose a long dry spell in September 1939 to drive his tanks onto the Polish plains. A pea-soup fog in the English Channel helped the British Army escape at Dunkirk. The Japs took advantage of a weather front to sneak into Pearl Harbor. General Eisenhower looked at a weather map before he gave his famous Normandy invasion order, "Let 'er rip!" Admiral Nimitz consulted his fleet aerologists before each task force raid and amphibious landing in the Pacific.

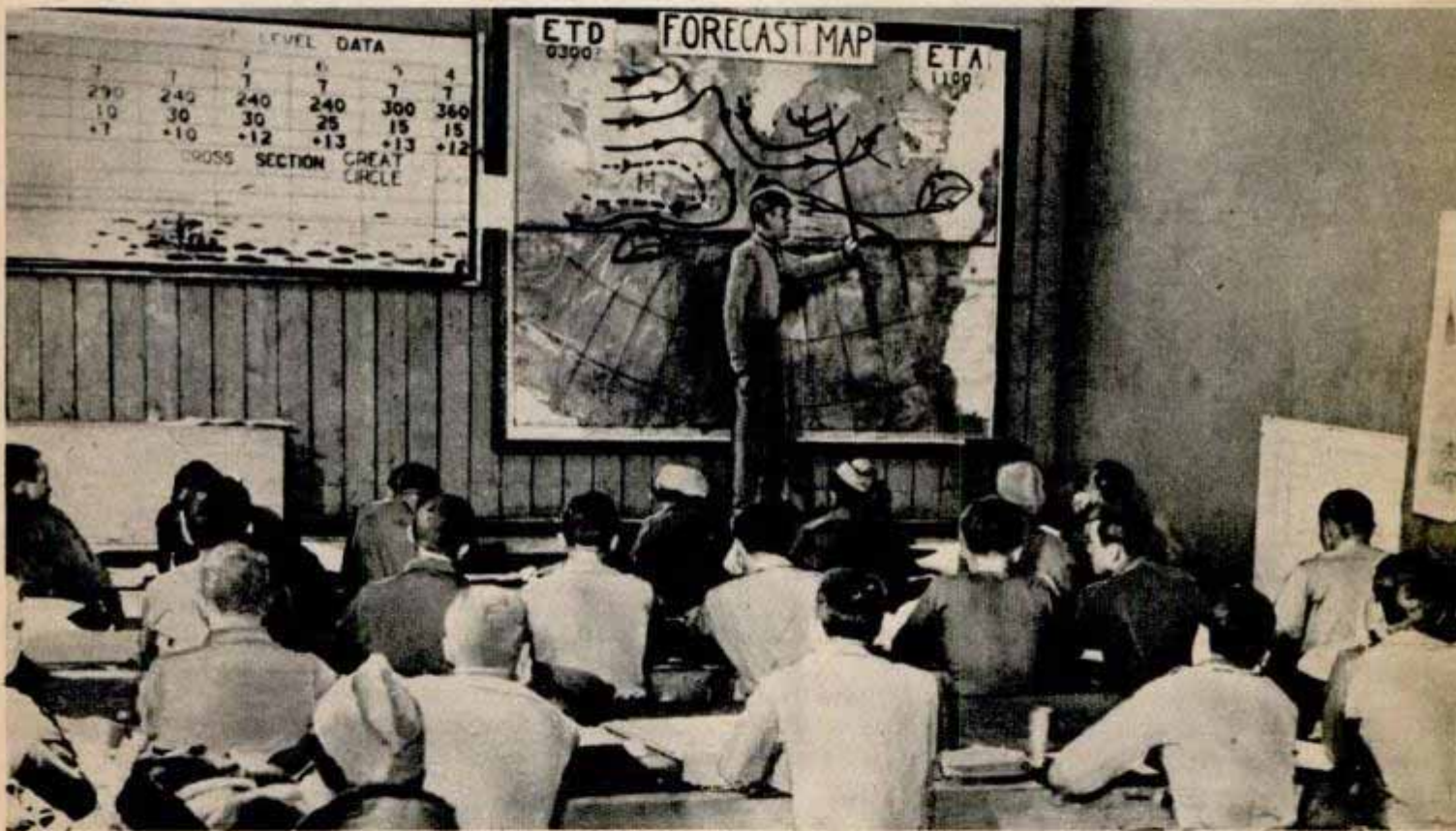
Weather knowledge was vital to victory—and, what is more important,

An aerologist at one of the U. S. Navy's shore stations climbs up to take a look at the weather

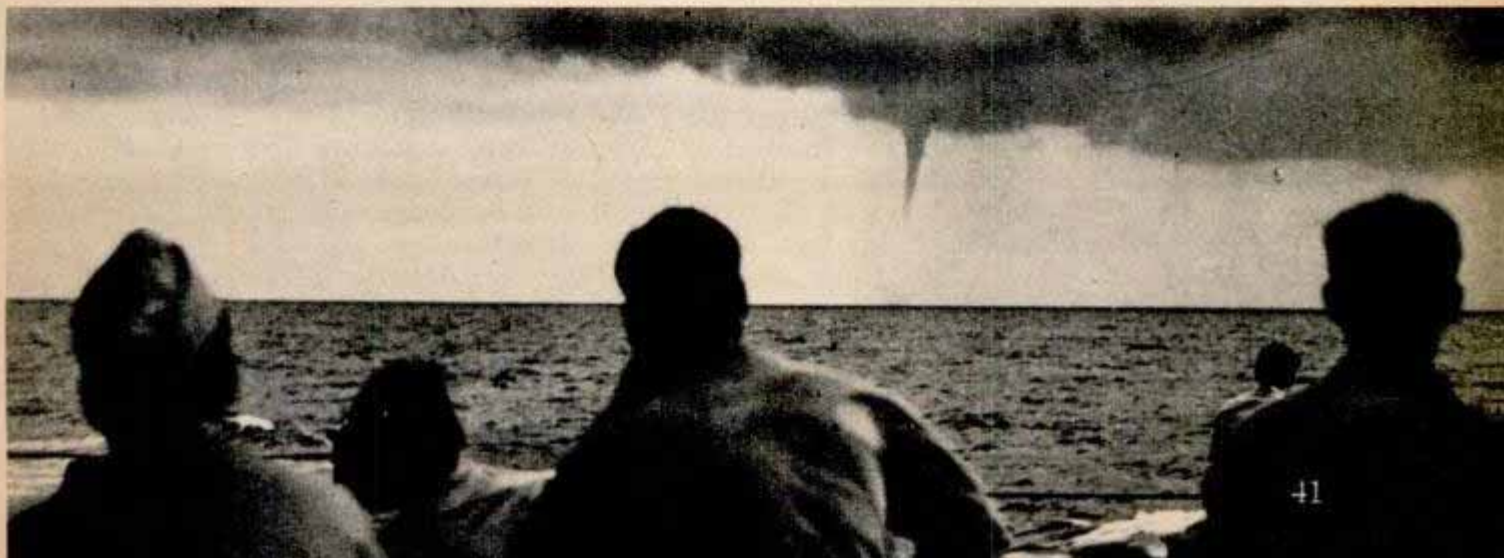


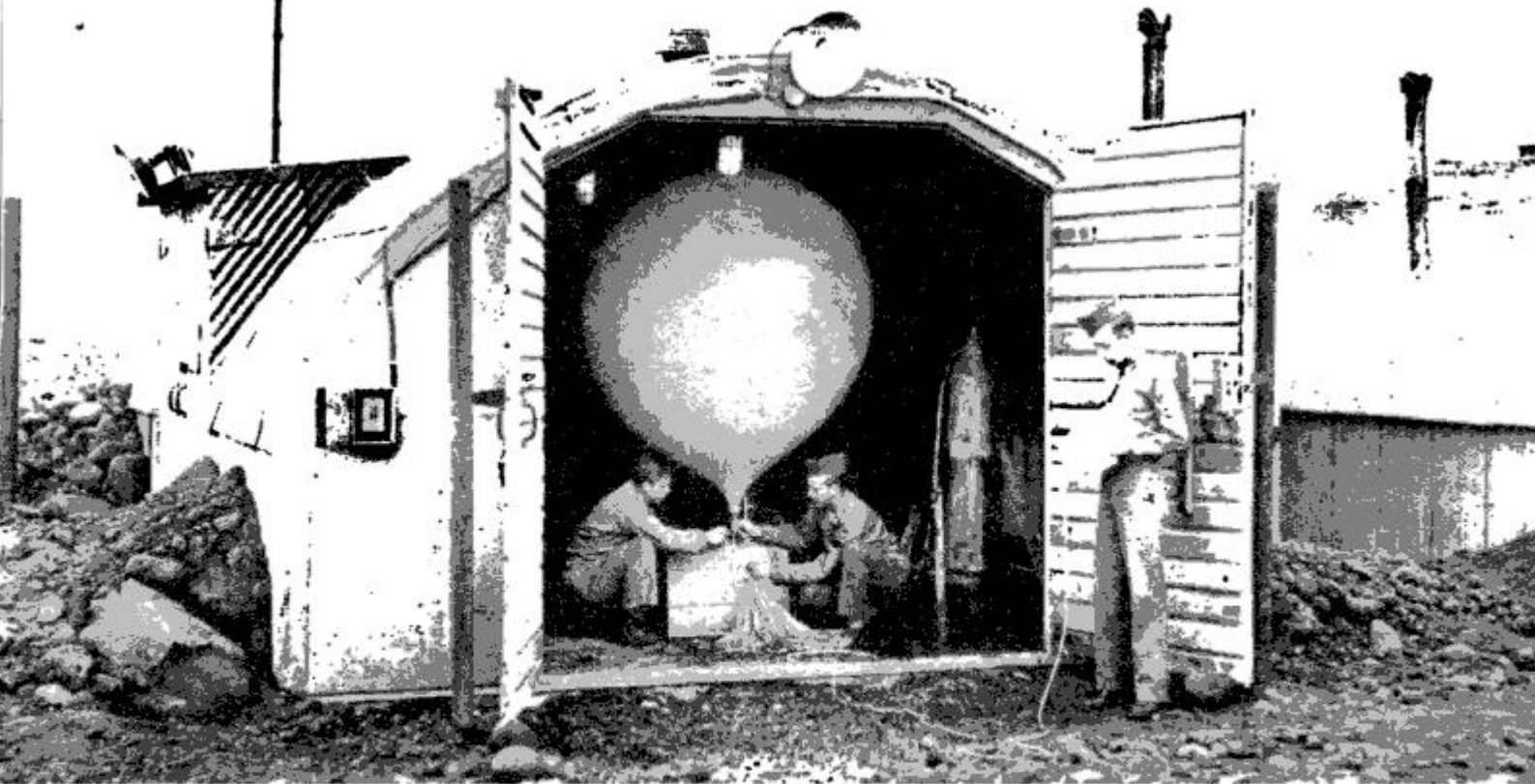


Army glider unit sets up airborne weather station; wind vane is at right, theodolite and balloon at left



Pilots listen intently while AAF weather officer briefs them before transatlantic hop. Tail winds may cut ETA (estimated time of arrival). Below, sucking up tons of water, a waterspout moves across the Pacific





Air corpsmen inflate a balloon to carry aloft a radiosonde transmitter at Meeks Field, Kleflavik, Iceland

it now can be turned to peaceful pursuits.

In World War II, the United States suffered more than 1,000,000 of her young men killed, wounded or missing, and spent nearly \$300,000,000,000. This blood and treasure were not squandered in vain. German and Japanese militarism were crushed, and the by-products of scientific achievement will save millions of lives and billions of dollars in property in the future.

New techniques in weather forecasting, new scientific equipment and a trained force of nearly 10,000 weathermen will be of the greatest importance to air lines, railroads, steamship lines, farmers, forest rangers, telephone and telegraph companies, department stores, sports promoters and others whose lives and investments depend upon the vagaries of the weather.

Meteorology, in spite of its universally popular interest, was slow in emerging from the "old wives say" stage. It got its biggest shot in the arm during World War II, and the bill for meteorological services cost Uncle Sam a cool \$1,000,000,000. Today it is a recognized science, based upon known laws of physics and mathematics.

The Army Air Forces trained more than 5000 weathermen and stationed them all around the globe—from Adak to Australia, Greenland to Guadalcanal. The Artillery, the Chemical Warfare Service, General Headquarters and other Army activities used hundreds more. The Navy placed aerologists at all shore bases and aboard major ships. Army and Navy flyers acted as weather observers when they went aloft. Weather "commandos" were dropped behind enemy lines in China and France

to furnish valuable information. Never in history has there been a more complete observation of the world's winds, clouds, fogs, temperatures and storms.

Weather experts are confident that this vast web of weather stations and trained observers will be maintained during peace. Weather is not limited by national boundaries and global air travel is already with us. Proposals have been made to place weather stations and airway communications systems under international control—possibly the United Nations Organization. This would standardize weather forecasting procedures and insure adequate world-wide coverage. Each nation would pay for the service in proportion to the size of its foreign air operations.

This world-wide network of weather stations would be augmented in local areas with special "airspionage" groups—such as those developed during the war—to keep track of local disturbances.

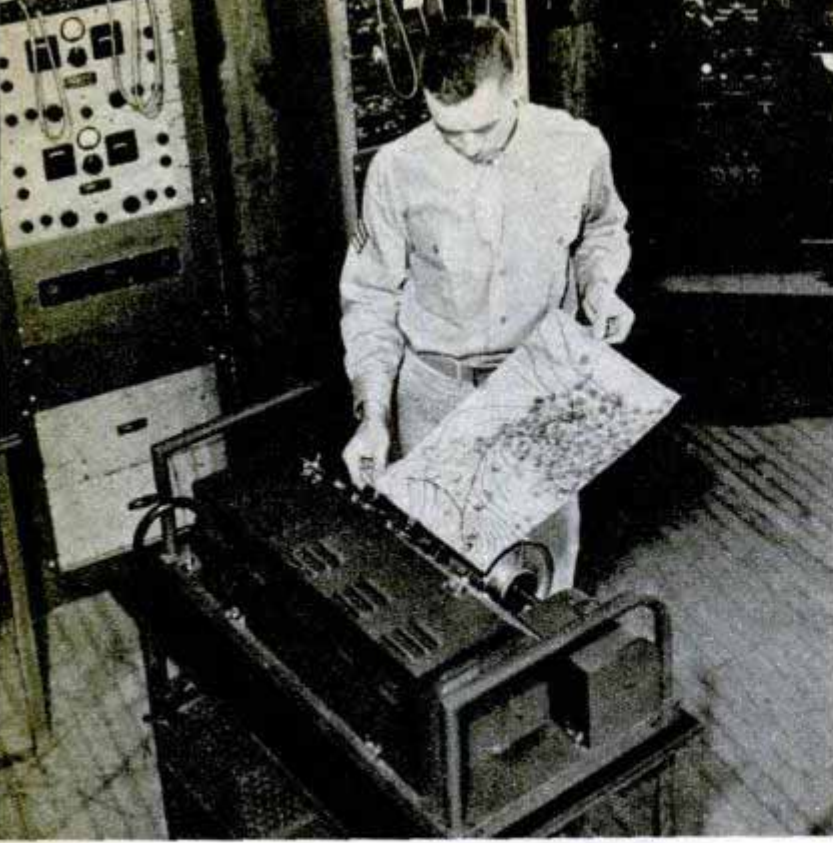
The U. S. Weather Bureau for many years has maintained a Hurricane Warning Service. But in 1944 the Army Air Forces organized its own Hurricane Warning Service at Miami, Florida, to forewarn Army installations of the comings and goings of tropical storms. Special B-25 weather planes were sent aloft when a hurricane gathered to measure its strength and probable direction.

The great Atlantic hurricane of 1944 was "fixed" in its initial stages by the AAF's Hurricane Warning Service and its movements radioed all over the West Indies and South Atlantic seaboard. An estimated \$250,000,000 worth of property was saved.



Bomber crew in Marianas studies map showing tropical fronts. Chart in left background traces typhoon; curving arrows on other map indicate wind directions. Wooden observation tower (below) in China-Burma-India theater mounted antiaircraft guns behind sand bags. Aerograph being attached to plane "reads" atmosphere





Facsimile transmission of analyzed weather maps has increased both the scope and speed of forecasting

A leading roofing material manufacturer recently took advantage of hurricane information in Texas to follow the storm and provide roofing materials to homeowners whose roofs had been blown away.

In the Middle West, Severe Storm Warning Nets were established by the Army Air Forces and the U. S. Weather Bureau, assisted by civilian volunteers. Thunderstorms and tornadoes were kept under constant observation. In other parts of the world, weather warning squadrons have been suggested to watch Western Pacific typhoons, violent Arctic storms and Afri-

can sandstorms. Such advance information would allow preparation to safeguard lives and property.

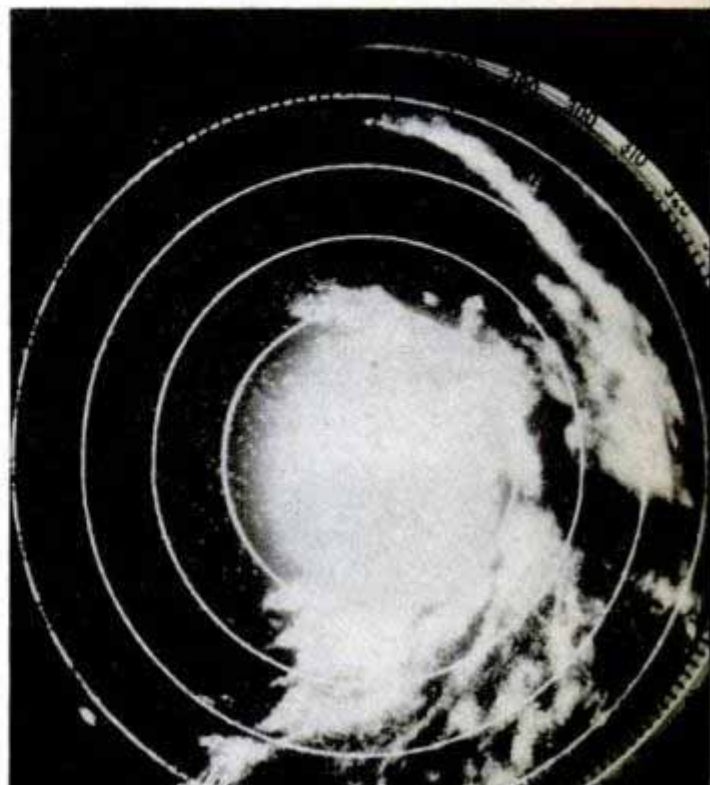
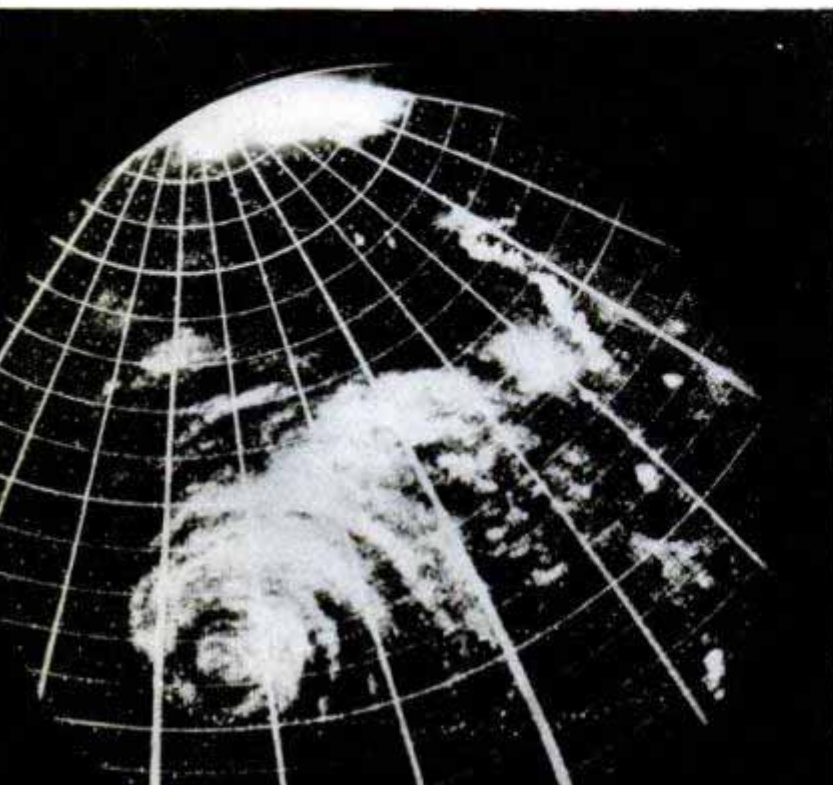
In 1941 the U. S. Weather Bureau made weather forecasts on schedules of 48 hours and five days. Some meteorologists, like Dr. Krick of the California Institute of Technology, ventured as much as two weeks ahead. The time range of forecasts has not been materially increased but weathermen say that today's forecasting is more accurate "than even the most optimistic meteorologist would have declared practical a few years ago."

Modern mechanical sorting machines have been employed in a new type of "analogue" weather forecasting, developed in the last few years. For example, a ground force commander in Europe would want information on what the weather would be like the following week. For a quick 20-minute forecast, weather maps for the past 40 years would be run through a sorting machine. The one that most closely resembled the map of that day's weather would indicate to a fair degree the type of weather to follow during the next week.

Such weather prognostication will be of special value to farmers. Advance notice on heavy rainfall, frosts or dust storms will allow them to harvest crops or protect their fields, orchards and barns before disaster strikes. Citrus orchardists in Florida and California rely heavily upon forecasts.

Improved weather forecasting also will aid the U. S. Forest Service in its year-round battle against forest and range fires. "Catch 'em young and treat 'em rough" is the slogan of the new program in which the Forest Service and the U. S. Weather Bureau cooperate.

Radar scope detects hurricane approaching station (white area at top) and, right, as it passes within 10 miles



Fire weather forecasts are regarded by the Forest Service as one of its major weapons in preventing or suppressing fires in timber and brush watersheds. Advance news on probable wind velocity, humidity, visibility and temperature gives the Forest Service fire fighters a chance to plan their strategy. Turnabout, many ranger stations and forest lookouts act as weather observers and send reports to the Weather Bureau.

If forest fuels are dry and fire weather forecasts indicate that dangerous conditions will prevail the following day, road crews and other personnel are held in readiness. Trucks are stationed at convenient points to transport fire fighters and equipment. If the forecast indicates poor visibility, additional fire lookouts are manned at temporary stations and airplane spotters are sent aloft. If conditions become more critical, warnings are issued to logging operators to shut down.

Radar is expected to play an ever-increasingly important role in weather forecasting. The Air Technical Service Command at Wright Field recently revealed that radar reconnaissance planes gave prompt and accurate data on preflight weather in Europe for bombing flights.

A 450-pound piece of radar equipment that was originally developed for blind flying was adjusted to provide meteorological information as well as navigational data. With his set trained on the air around him instead of on the ground, the radar operator simply pushed a switch marked "weather" and received a picture of advance cloud formations on a specially designed detecting screen.

Tracking clouds instead of a target, the microwave screen indicated approaching storms 100 to 200 miles away. Even greater distance in forecasting storms has been achieved by triangulation of electrical disturbances in a storm area. Lightning



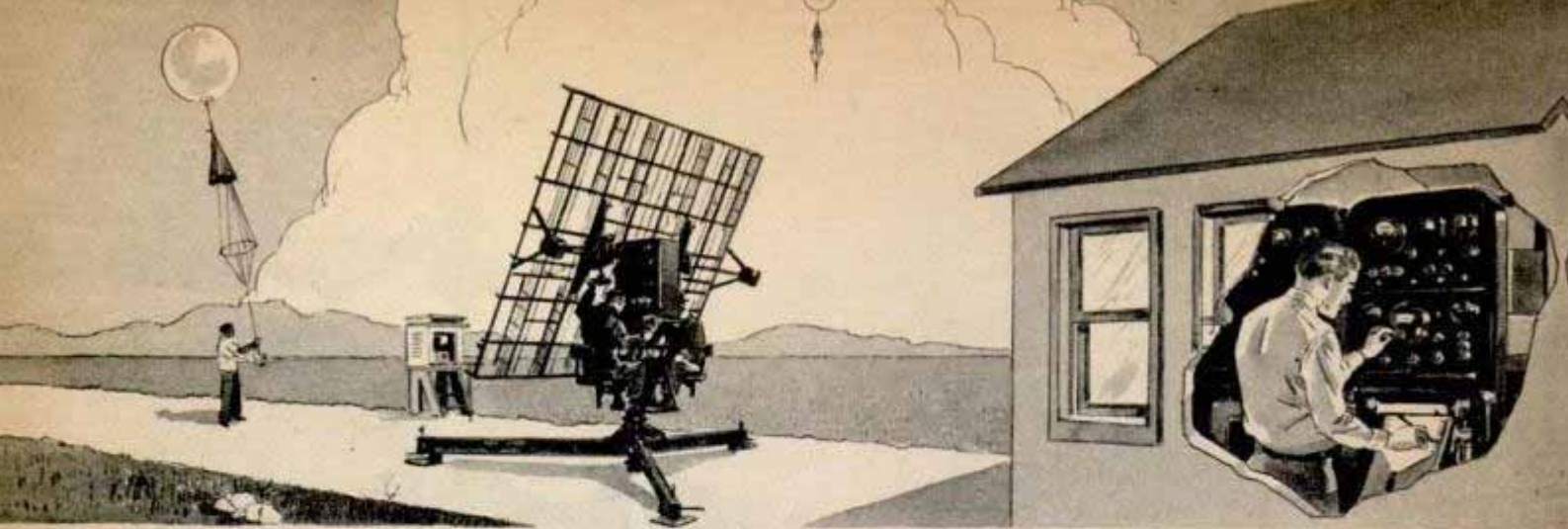
Aerographer using anemometer to check wind velocity aboard a carrier

flashes give off 200-kilowatt radio waves. Three thunderstorm locaters, equipped with radio direction finders coupled to cathode-ray tubes (similar to those used in television), can "fix" such flashes at distances of 1000 miles and more. The spread and direction of the storm can be followed hourly and new outbreaks detected. This technique is especially important in covering oceans and polar regions, where maintenance of weather stations is difficult.

Such advance information on rainstorms will be invaluable to promoters of outdoor sports events or community pageants. Large department store sales managers also

Navy weathermen plot a balloon sounding at Alameda, Calif., air station





Radiosonde unit, with balloon, parachute and radiosonde at left, receiver set in center and recorder at right

will be able to consult the weatherman before planning a large clearance sale.

A national sunburn lotion manufacturer times his advertising according to weather forecasts. In the Middle West, a large construction company waited to pour concrete on a million-dollar job until the weatherman said O.K., saving hundreds of dollars.

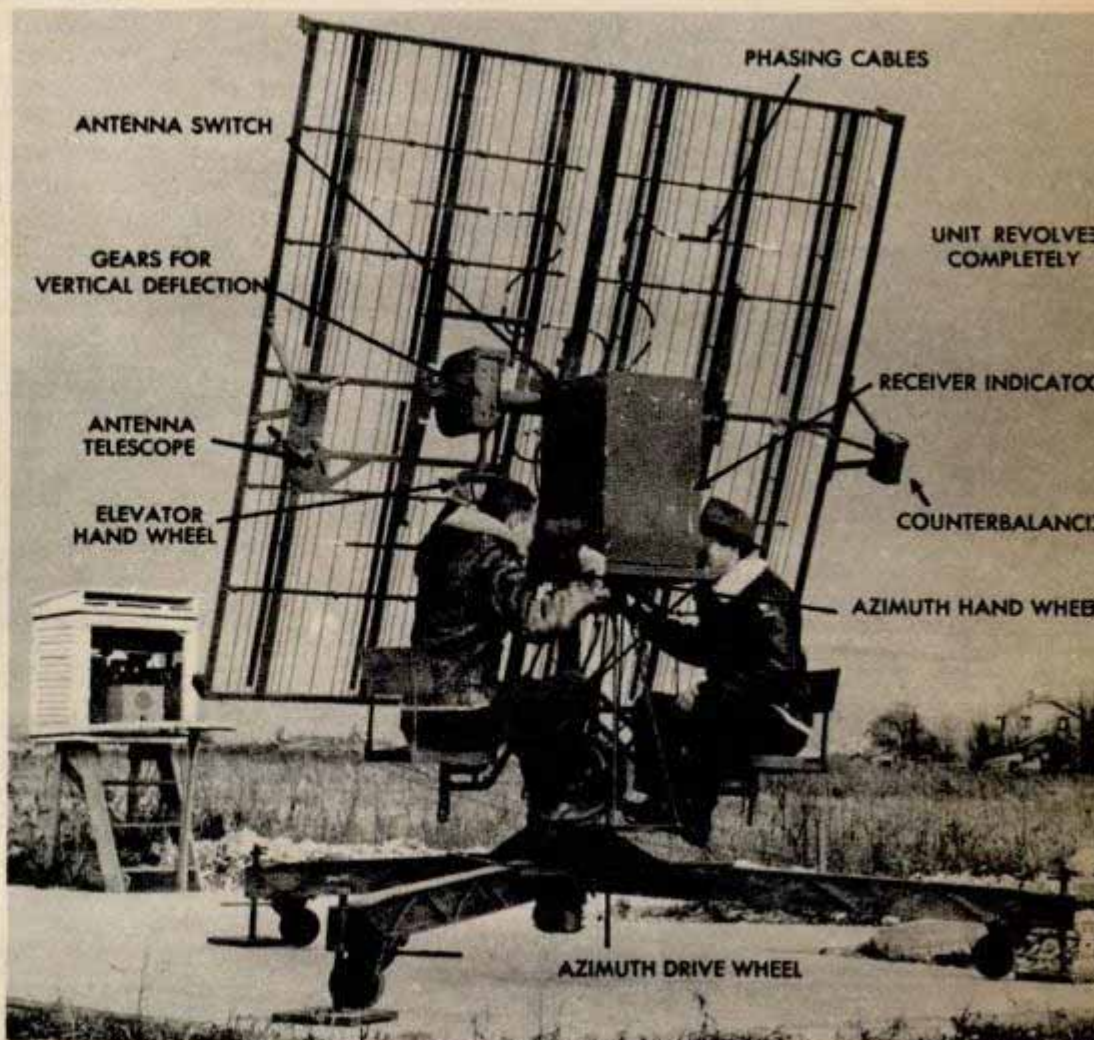
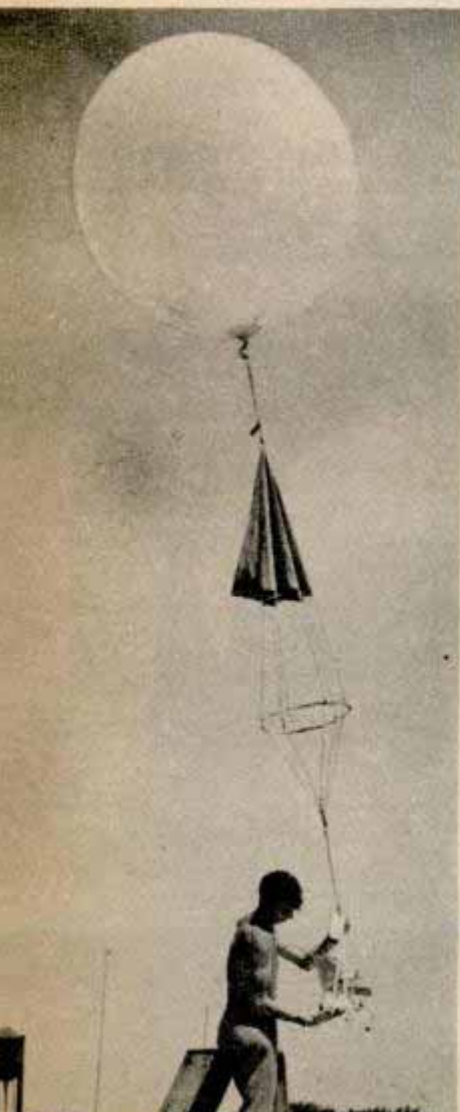
Before the war, the weatherman's standard instruments for ground observation consisted of a thermometer, a barometer, a rain gauge, a psychrometer to measure moisture content of the air, the thermograph and barograph to record continuing

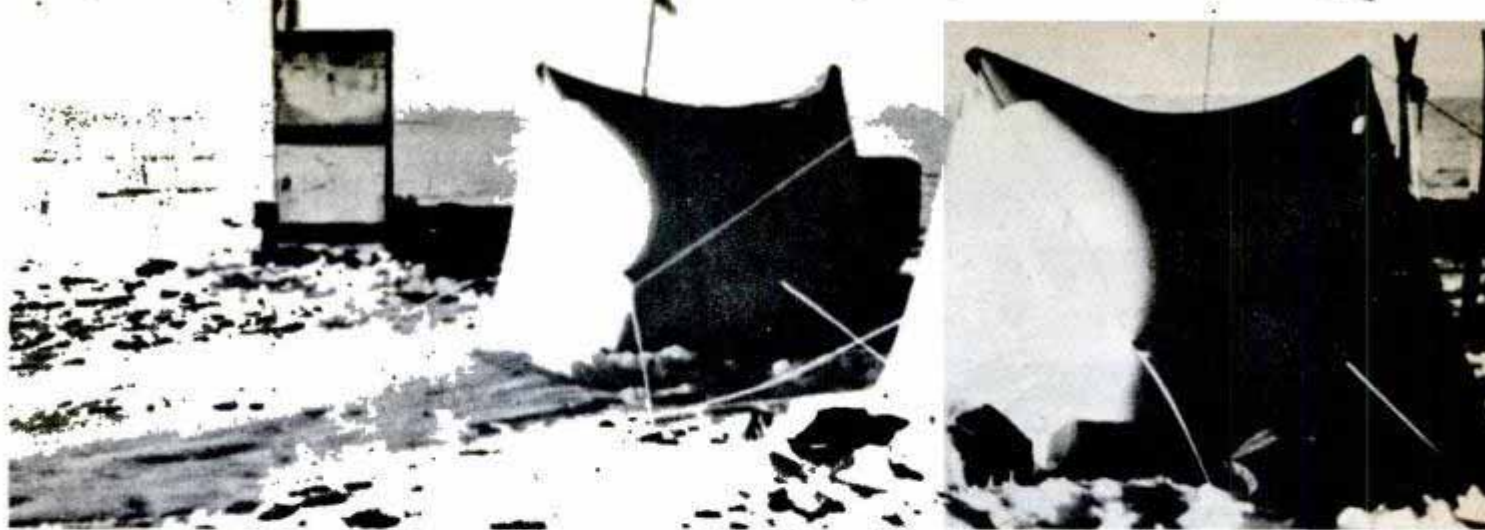
temperatures and atmospheric pressures, and an anemometer to measure wind speed. World War II provided many refinements of this equipment.

Radiosonde, a small lightweight radio sending set that transmits data on temperature, air pressure and humidity after being carried aloft by a balloon, was in use at the beginning of the war. New improvements have made it amazingly accurate.

One of these, called the "Weather Sleuth" and built by the Farnsworth Television and Radio Corporation, employs direction finding at the ground receiving station (shown

Radiosonde, left, transmits data on upper air conditions to the receiver unit, right, which tracks balloon
 Courtesy Farnsworth Television & Radio Corp.





Arctic gales constantly beat down on the AAF's pioneer weather station on the crest of the Greenland Ice Cap

on the cover of this issue). Also, its radiosonde is equipped with a parachute, permitting the continued sending of reliable weather information after the balloon has burst at its usual ceiling of about 60,000 feet. This type equipment helps determine ahead of time the direction and velocity of the wind at various levels so that planes can fly with greater operational economy.

At the present time, the limit of radiosonde observation is about 20 miles. Experiments have been made by which meteorological instruments were carried by rockets. This gives a possible range of from

This unit graphically records data from radiosonde



20 to 500 miles in the upper atmosphere.

Techniques in weather-map making also have been improved. The world-wide spread of American military aviation during the war brought forth new three-dimensional weather maps. Such maps are made of weather at the ground and at heights of 5000 to 30,000 feet. With this knowledge, pilots not only can dodge storms and weather fronts but duck above or below them.

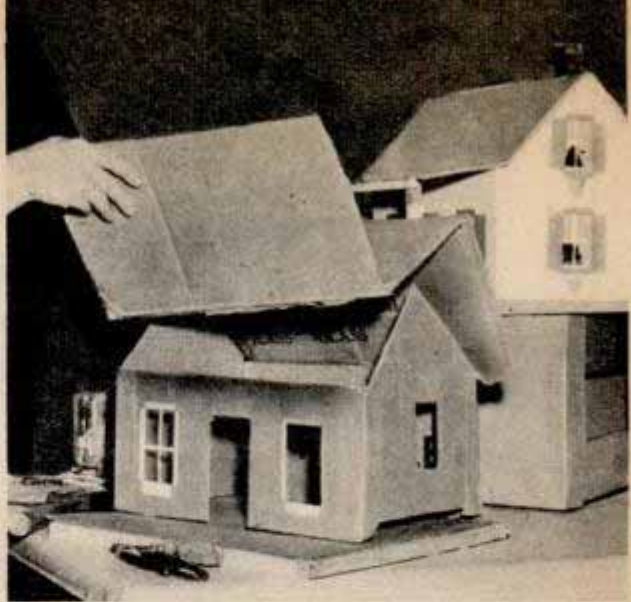
Facsimile map transmission—similar to newspaper wirephoto—enables weathermen to transmit weather information faster, more accurately and to more stations.

Mobile weather stations may find a place in the peacetime world for special aerology observation problems. During the early days of the war, "packaged" weather stations were mounted in the rear ends of jeeps and followed the troops into action. Later, improvements were made on this "weather-wagon" when equipment was installed in one-ton six-wheel trucks, known to the Army as "six-by-sixes."

Automatic "robot" weather stations—in reality small radio transmitting sets similar in construction to radiosonde—have been developed which can be placed in lonely Arctic, jungle or desert areas. Without human assistance, they relay valuable information on temperatures, humidity and barometric pressure. They need servicing only about every six months.

The last four years have shown how valuable world-wide weather observation can be—in war or peace. The Army and Navy both intend to maintain extensive meteorological services and continue a program of training new men. Private industry—air lines, agriculture, chain stores and governmental agencies—will require the services of weather experts.

Mark Twain remarked that "everybody talks about the weather, but nobody does anything about it." Well, Mark lived in the age of the steamboat—not the age of radar, globe-girdling planes and the atom bomb.



Doll Housing Shortage, Too?

Discarded cardboard packing cases and bits of glass, wallpaper and wood are utilized by Mrs. Frank E. Vanderhoof of Suitland, Md., to build colorful doll houses as presents for neighbor girls. For tools she uses scissors, glass cutter, pen-knife, small saw, hammer and pliers, and to add brightness to shutters, window boxes and other trim she employs paints of gay colors. Mrs. Vanderhoof started her hobby when illness forced her to stay in bed

40 - Cardboard House Building



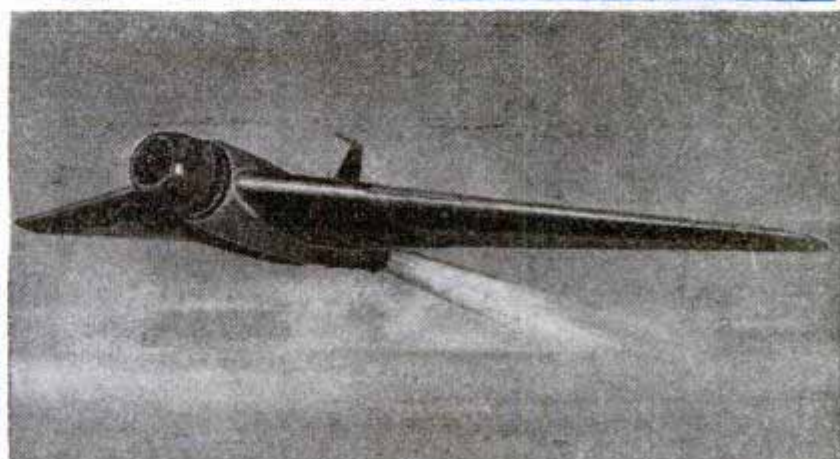
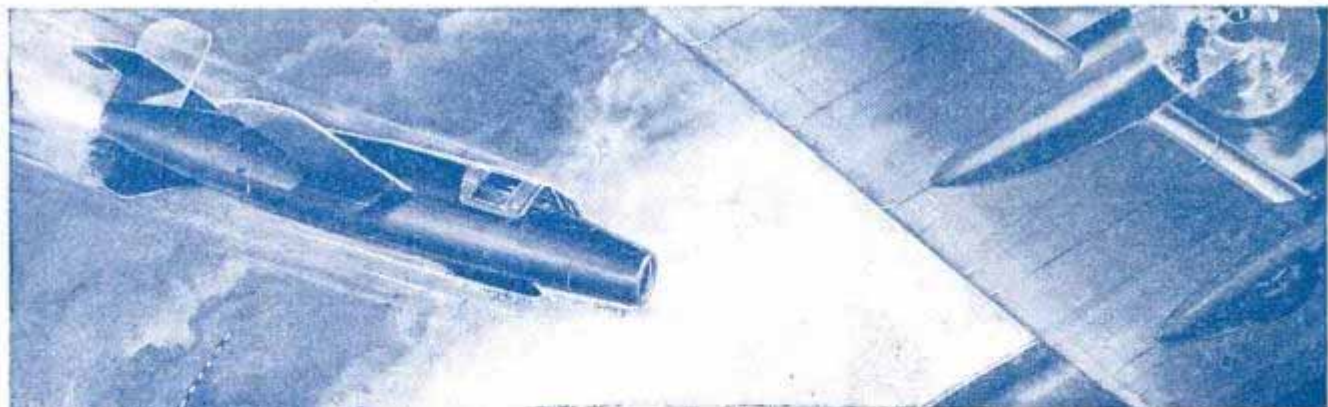
Diving Helmet Made From Nose of B-17

Salvaged war equipment furnished the materials for a diving helmet made by Lieutenant Richard C. Walter of Akron, Ohio, while convalescing at Wakeman General Hospital, Camp Atterbury, Ind. The helmet itself was made of transparent plastic from the nose of a B-17, giving it 360-degree visibility. The air pump is a discarded DDT sprayer, and the air line was a hose for an acetylene torch. Six strands of combat telephone wire serve the communications system and spotlight, the latter taken from a B-29 along with throat and hand microphones. "It worked like a charm when we tried it in a swimming pool," Lieutenant Walter said.



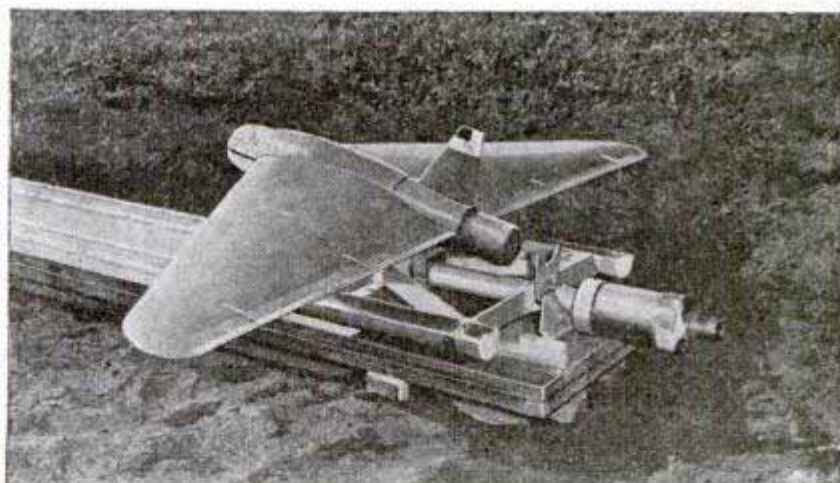
Names and addresses of makers or sellers of commercial products described in this magazine are listed in the Where-to-Buy-It Index, page 8A. Write to them for additional information and be sure to say you saw it in Popular Mechanics.

More Deadly Buzz Bombs Were on the Way



The U. S. Army's 7000-pound Northrop Flying Wing bomb in flight

The German Viper, a piloted missile built to attack Allied air opposition with either cannon or rockets or by ramming, is illustrated above. Its top speed is 620 miles an hour. The pilot ejects himself mechanically prior to the ramming attack. It is rocket-powered



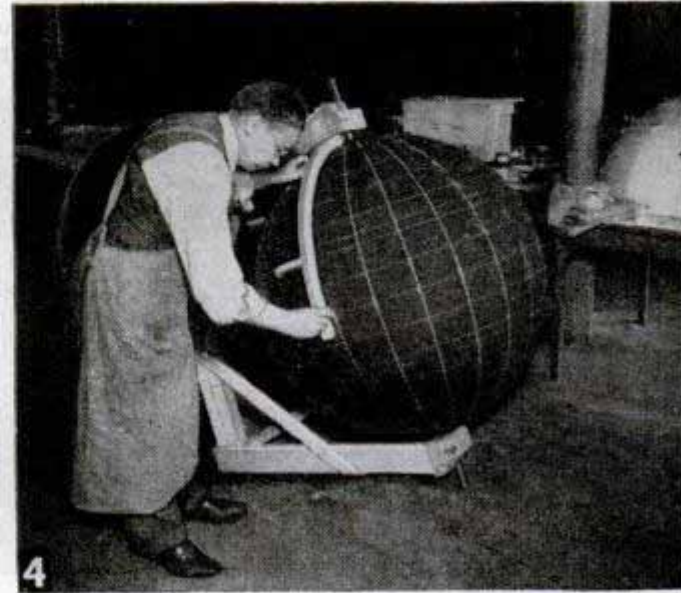
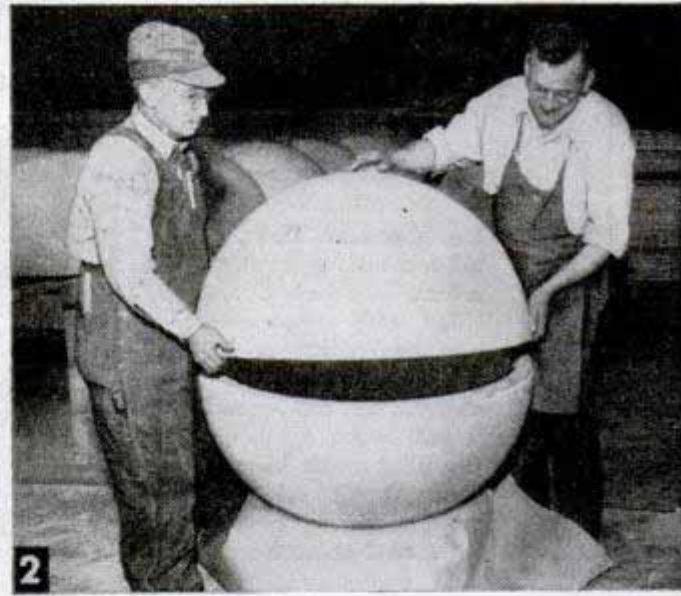
Wing model on new launching sled that cuts takeoff from 300 feet to 50. Below, the Nazi X-4 missile, equipped with a proximity fuse





Dr. Louis H. Powell, director of Science Museum at Saint Paul Institute, traces an air line route on the concave surface of a spherical map made for school use

- 1** Papier-mache hardened in plaster mix forms segments for a globe
- 2** Grooved edges of the two "hemispheres" assure a smooth fitting
- 3** After assembling the two halves, workmen point and paint globes
- 4** Numbered horizontal and perpendicular lines — grids — are added



for a Shrinking World

TOO OFTEN in the past, geography bogged down in the classroom in an uninspiring recital of capitals, lakes and rivers or states bounded by this and that.

Things are different now. Faraway countries are brought almost next door as the world shrinks in the air age. Geographic knowledge is more essential than ever for tomorrow's citizens. Geography has become glamorous.

Contributing tremendously to today's keen interest in the subject are new advances in geographic tools—maps, charts and globes which unfold the world before eager eyes. Some of these ingenious mechanical and scientific developments already have appeared in the classroom and the response has been so enthusiastic that alert educators everywhere are adding them to their stock in trade.

Making great strides in the new approach to geography is the Science Museum of the Saint Paul Institute, St. Paul, Minn. In 1940, the museum displayed to the public an exhibit of various types of maps and their uses. The reaction was so favorable that in April 1941 another exhibit, using large spherical maps, answered a question uppermost in many minds then: "Can America be bombed?"

A nonprofit organization devoted to increasing interest in the sciences, and working closely with the St. Paul schools, the Science Museum has a workshop in which it prepares material for its various activities. Most of its exhibits are housed in the museum's own building, the mansion of a former governor of the state.

Construction of the large globes required for the air exhibit was a new venture for the workshop, but Dr. Louis H. Powell, museum director, and his staff put all their energies into the task, with surprising results. For instance, before long they found themselves producing a vast quantity of 40-inch blackboard surface globes for the Navy, which were used to train aerial navigators. The classroom demand for globes with a patented mechanical mount, which

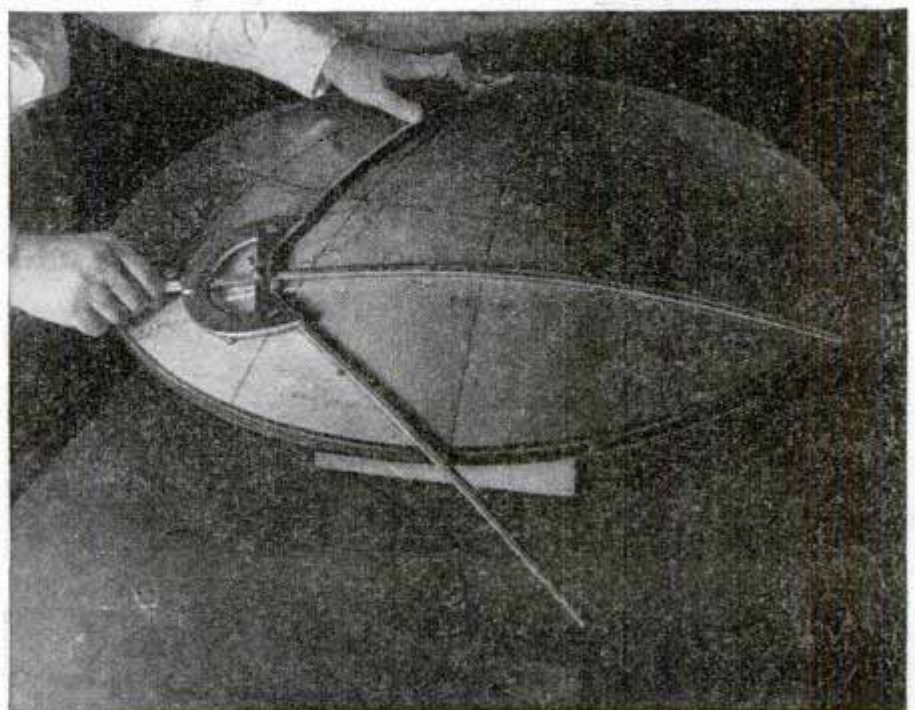


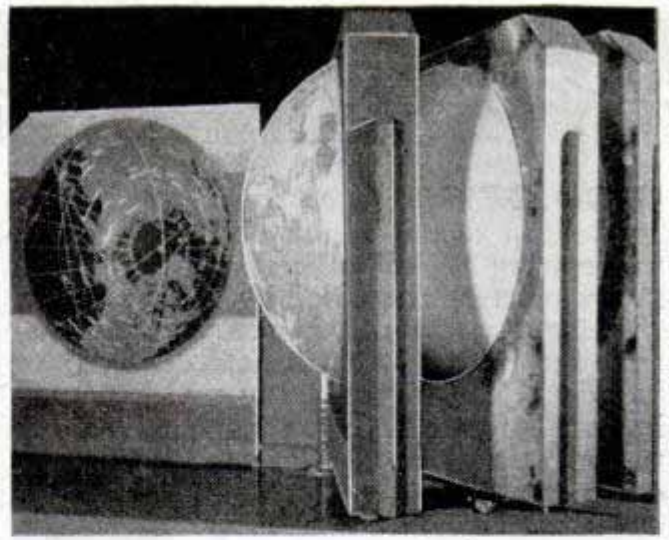
Space-saving mechanical mount supports globe on a padded ring suspended on roller responding to touch

can be revolved by a fingertip and installed in recesses of a wall, became so great that a separate corporation had to be set up to handle the business. The mount and globes both were developed in the workshop.

Experimentation with concave spherical maps for use in the exhibits also had interesting results. Concave maps enable a per-

Curved three-arm protractor accurately measures bearings on spherical map

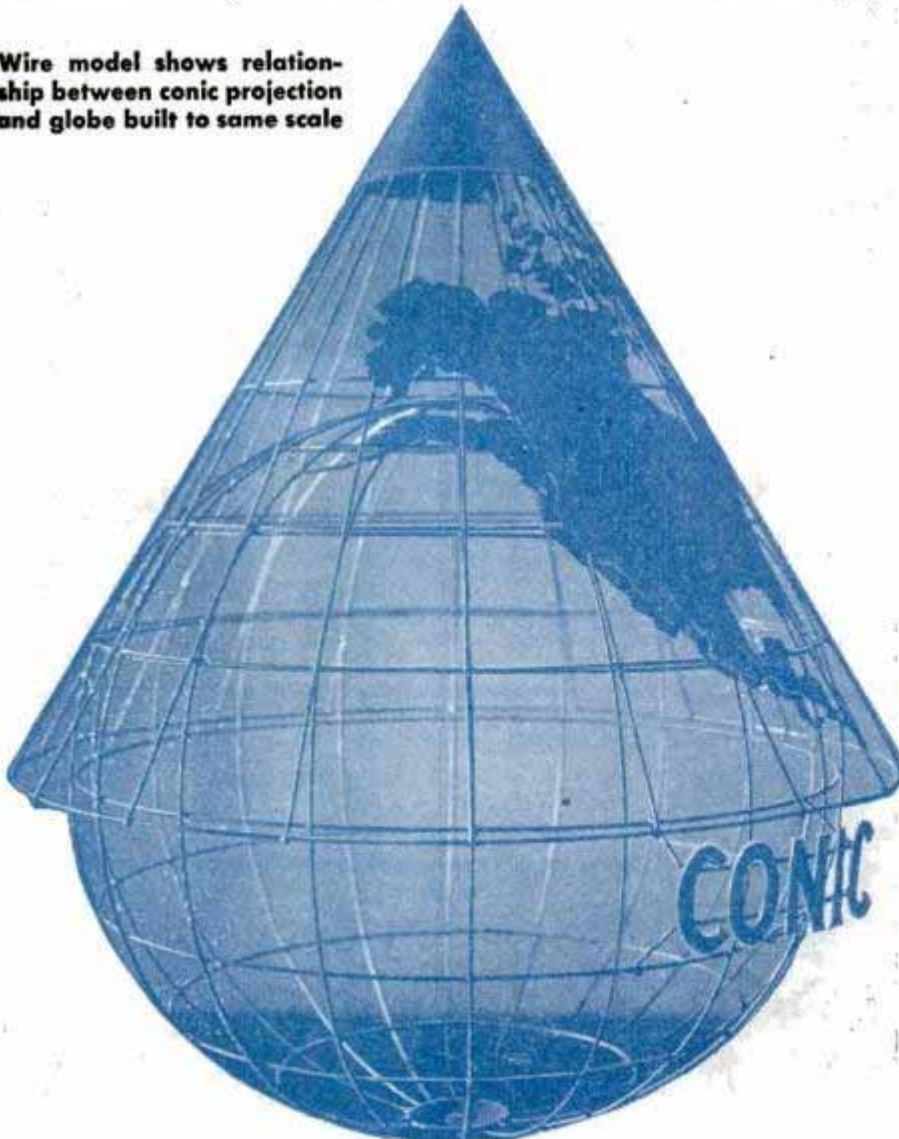




Student locates point on a globe. Right, spherical maps fit together in "book" containing world in segments

son to see any point on the surface clearly. With an ordinary globe, points at the far areas from center can't be seen unless you stand directly over them. Globes take up much room, too, so from this experimenting came an idea. Why not a nest of segments of concave and convex spheres, fitting into each other? The "Atlas of Spherical Maps" was the result. A desk unit already has been designed in which each leaf is 22 by 26 inches.

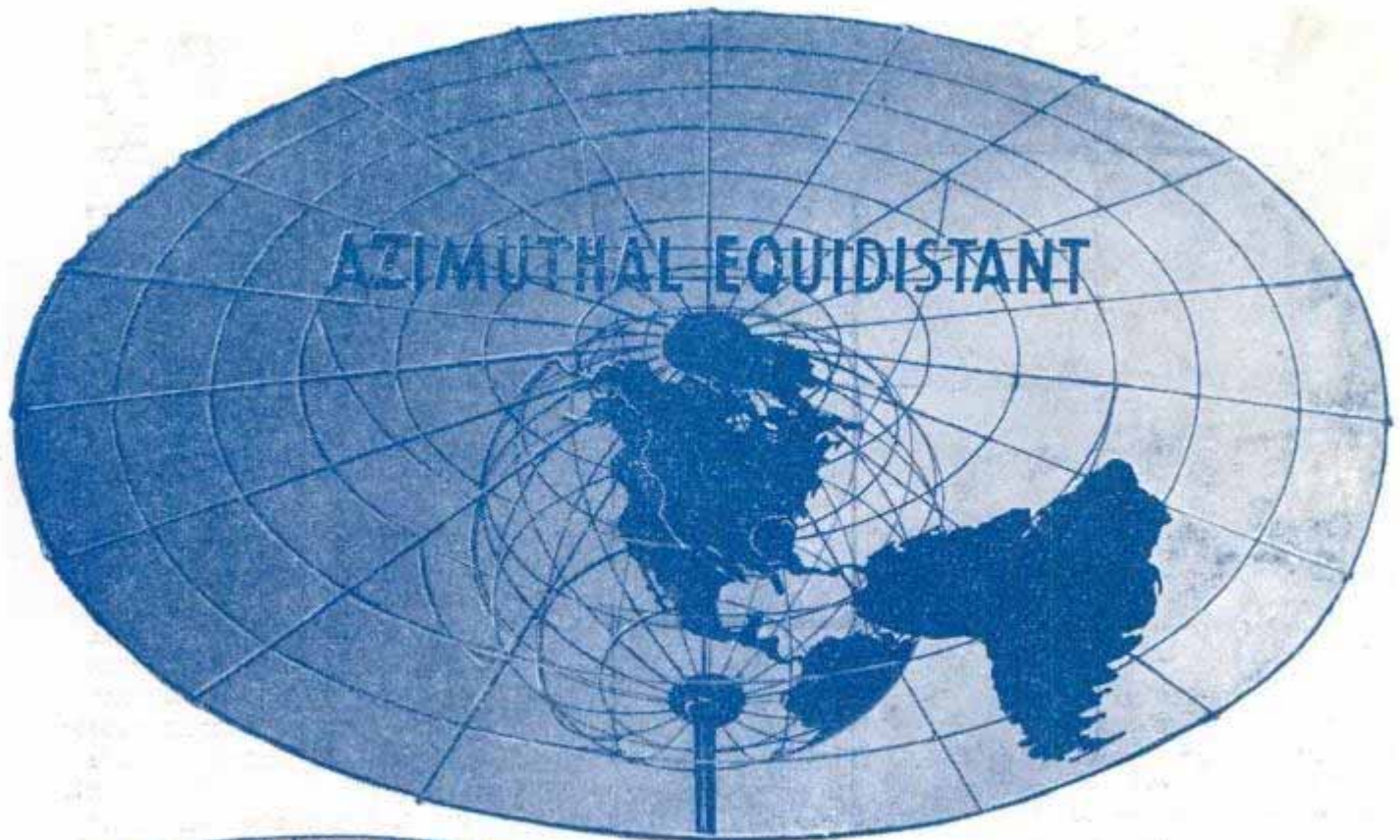
Wire model shows relationship between conic projection and globe built to same scale



Main objective of the maps has been to abandon the old flat-plane methods, with their attendant distortions, and to substitute globes, global segments of large size, and the concave spherical maps. Globes for classroom purposes aren't dotted with thousands of finely printed names that can't be read at a distance. Instead, the lines of the continents and principal islands are outlined on the blackboard-finished surface. The pupils themselves insert national boundaries and other locations with chalk, or the instructor may write in data or draw air line routes between capitals of the world for all to see.

Use of large-size segments of a globe permits detailed attention to areas. Gores for these globes are prepared carefully in the museum workshop from best map sources, and accuracy is carried to a degree rarely touched before. Some segments of globes prepared in the workshop would require globes 10 feet in diameter if fully carried out.

Size of globes in use until the museum came along had been limited generally to the size of the doorway through which the globe had to pass. The museum staff developed a globe made up of two hemispheres which can be joined together easily, thereby doubling the size of globes which can be taken through an ordinary 32-inch doorway.



Relationship between azimuthal equidistant projection and a globe made to the same scale is demonstrated above. Similar comparison (left) between Mercator projection and a wire globe



Largest globes made in the workshop are 5.2 feet in diameter, split at the equator, and scaled 1:8,000,000.

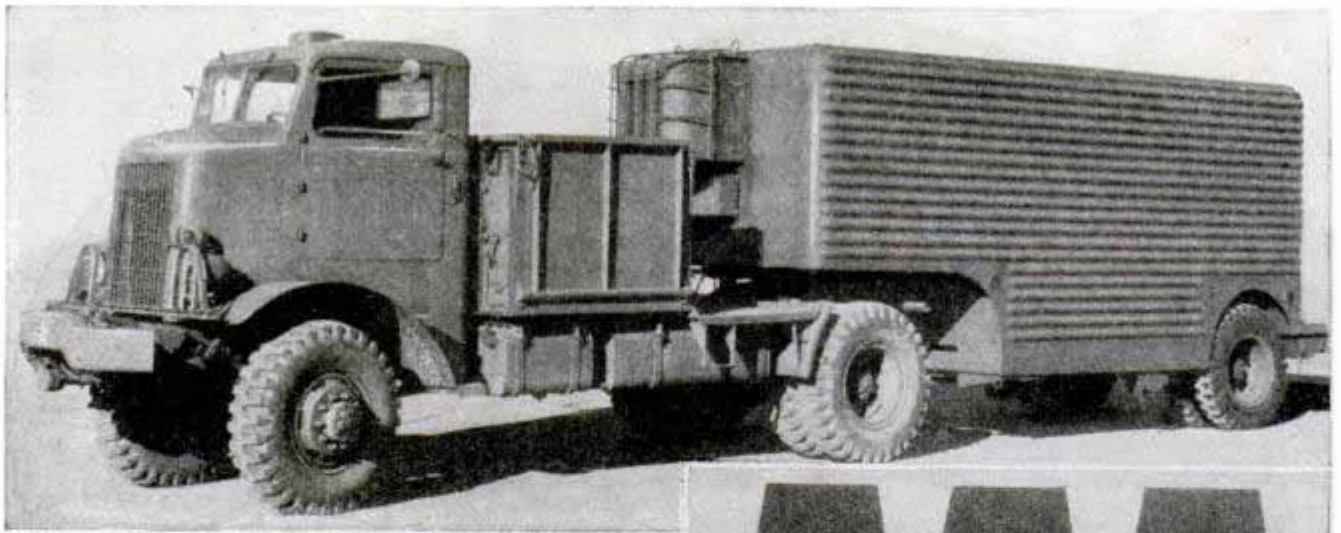
The mechanical mount which abolishes the usual axis and ring of conventional globes consists of a ring base which revolves on four small rollers to provide motion from right to left or left to right. Four larger rollers mounted beneath the ring operate in pairs controlled by a hand lever and cam. Moving the lever raises one pair of large rollers to bear the weight of the globe and permit fingertip rotation of the sphere from top to bottom or bottom to top. Another shift of the lever raises the other large rollers for clockwise or counterclockwise horizontal motion of the globe.

Working principally with large globes, the museum workshop found it necessary to develop a material stronger than the usual cardboard of small globes or plaster of paris of larger globes. This problem was solved by creating a plaster-of-paris master form of extreme accuracy. Basin molds are prepared on the master form and from them are cast the large globes, segments and spherical maps.

Many compounds were tried before a satisfactory material was worked out for casting the globes. Best results were obtained with papier-mache built up of small squares of brown paper dipped in a dextrin-tempered plaster mix. A thin layer of the mix is brushed on the mold before laying the paper to assure a smooth outer surface.

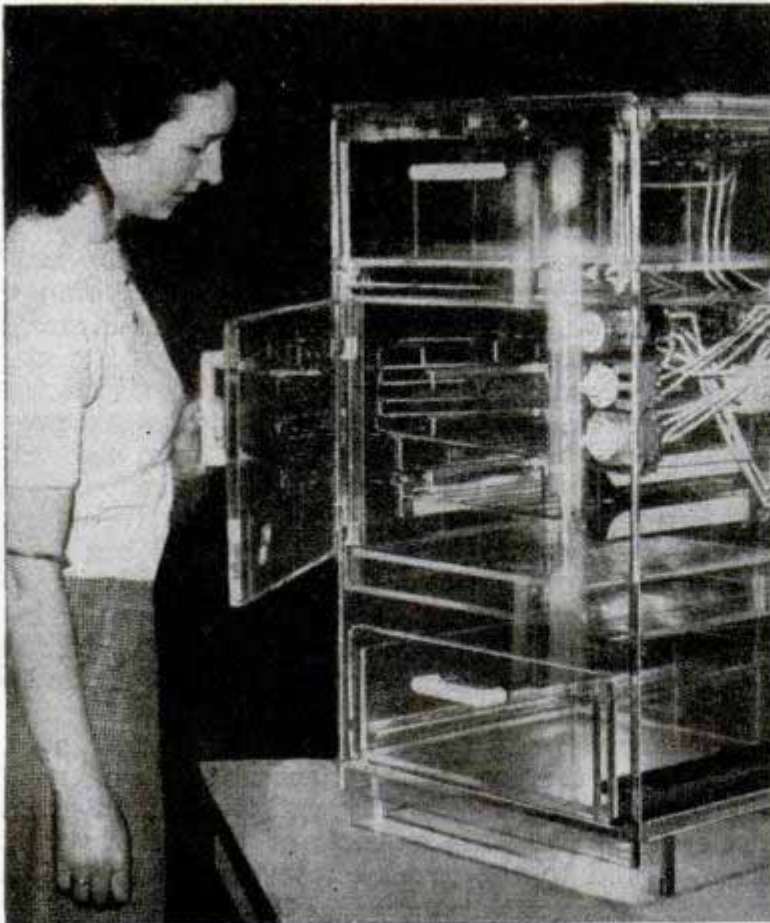
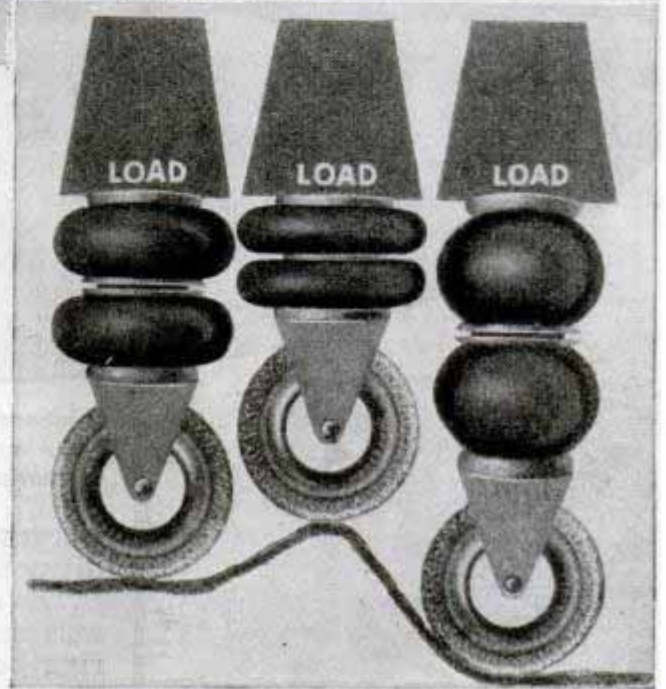
Another development is a spherical protractor, designed by the museum to measure spherical map bearings directly and swiftly, and to measure great circle distances. This consists of two fixed arms, each curved to the great circle curvature of the

(Continued to page 156)



"Bellows" for Heavy Trucks Cushions the Ride

Smooth riding in heavy trucks is provided with an air spring suspension developed by the Firestone Tire & Rubber Company. Installed in a new Army refrigerated trailer built by Fairchild Aircraft, the novel shock absorption device consists of a rubberized fabric bellows inflated with air to carry the desired load. The air system communicates with an air reservoir through a valve which provides almost any type of shock absorption action desired. In a recent test over "torture roads" at Camp Lee, Va., an air spring equipped trailer carrying a 6000-pound load was reported to ride as smoothly as a passenger car.



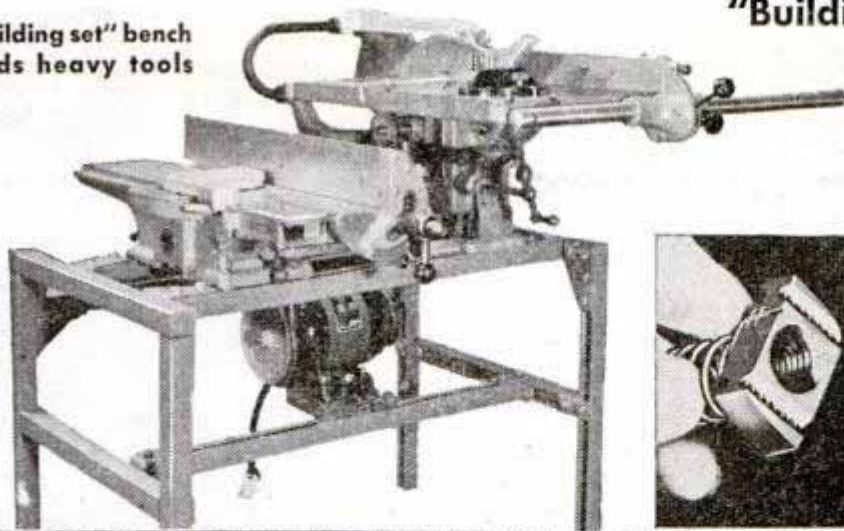
Transparent Oven Walls Give Cook 'X-Ray' View

Opening oven doors and pulling out hot baking pans to view or test their contents are eliminated by a new electric oven that has transparent plastic walls. Housewives look right through the walls to see that steaks, fish, fowl, cakes, bread and other foods reach exactly the right "doneness." The oven was displayed at an electrical exhibition at London.

Laundry Label Is "Set" With Hot Iron

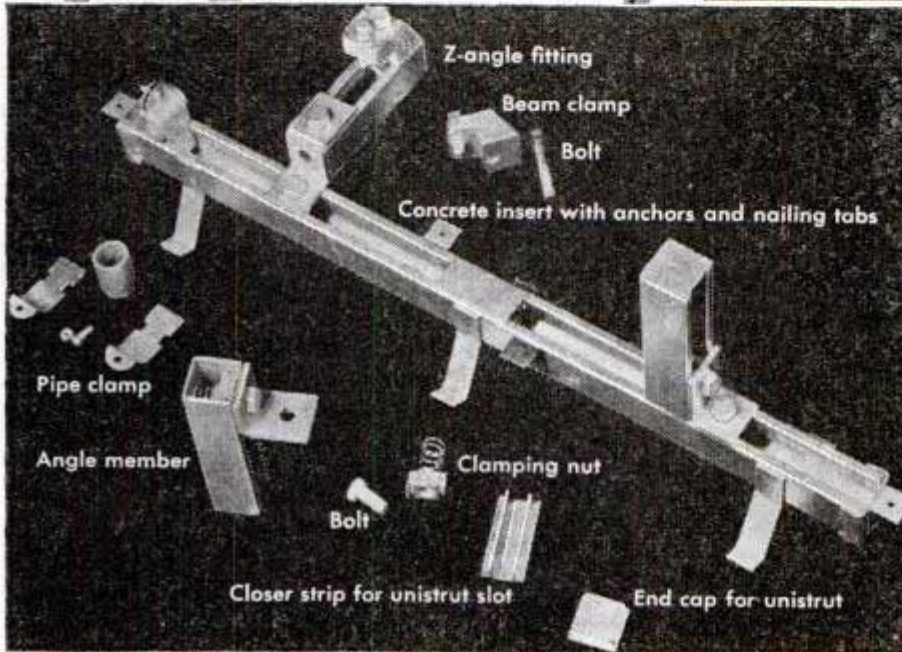
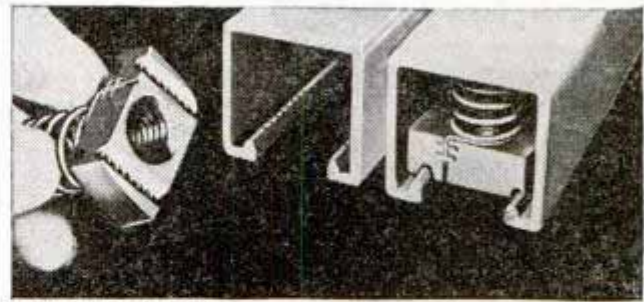
Stamping names on clothing to avoid laundry loss no longer requires application of special inks. Labels are available that can be pressed into clothing with an ordinary iron. Manufacturers claim the label withstands laundering and dry cleaning. Names and addresses or telephone numbers can be stamped with the labels.

"Building set" bench holds heavy tools



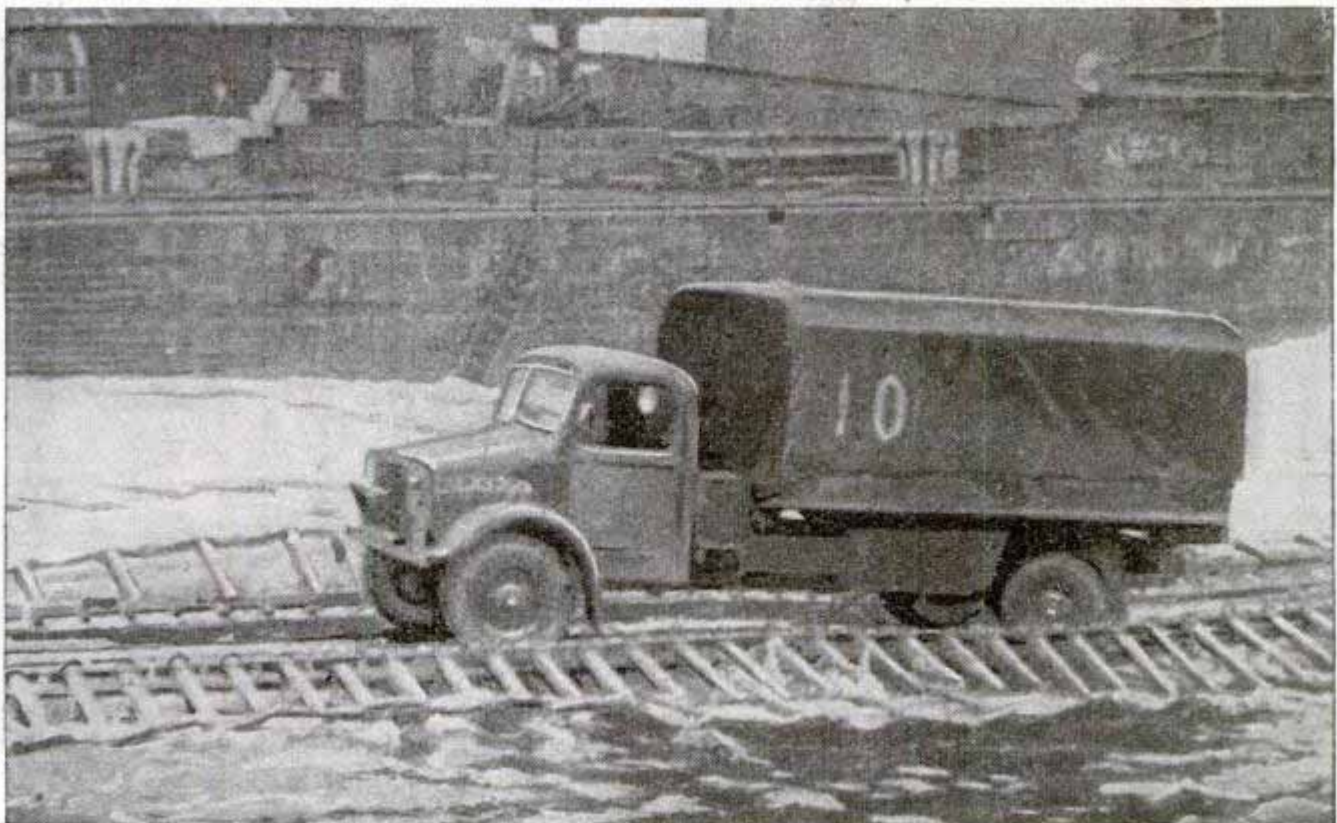
"Building Set" Makes Frames Without Drilling or Welding

Spring-held nut bites into ridged inner edge to hold frame securely

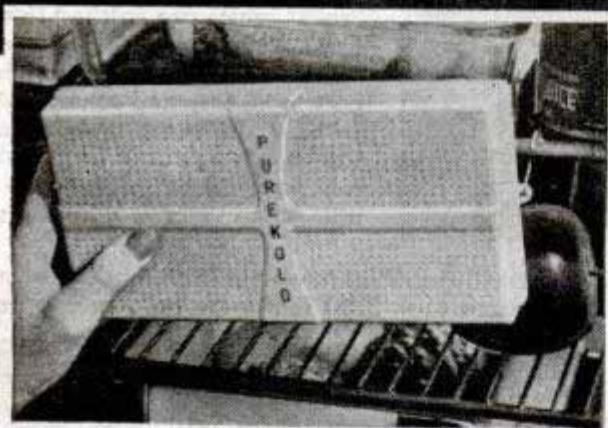
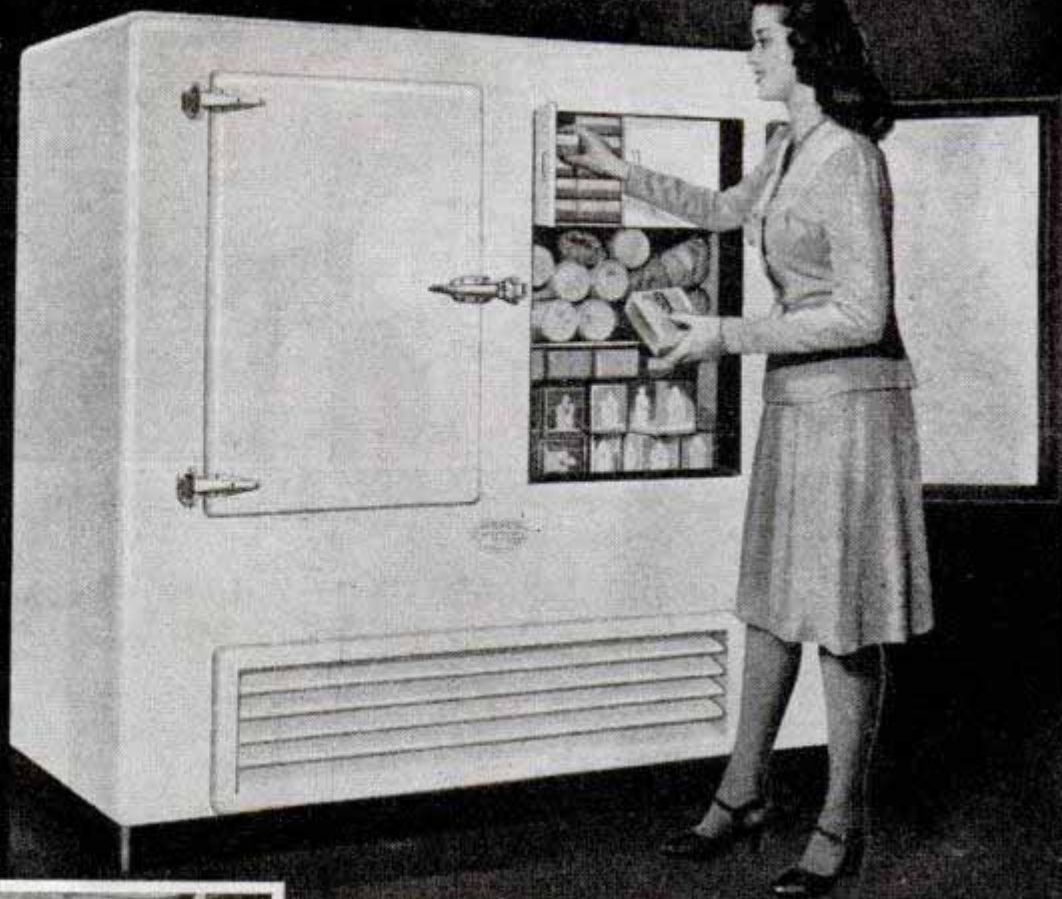


Metal frames to serve as racks or work benches can be constructed with a man-sized "building set." It eliminates drilling or punching holes and welding. Frame pieces come up to 20 feet long and can be reassembled for varied uses. There is no waste in rebuilding. Called Unistrut, the frame consists of a hollow square steel channel with one side open forming a slot. Inside edges of the slot are turned back to form "rails" which are notched to engage teeth of a spring-held nut attachment. This permits another part to be fastened at any point without drilling a hole. Parts can be cut to desired length with a hacksaw. A complete range of fittings is available with the set

FLOATING PIERS of wood and canvas developed by the British helped the Allies move equipment ashore along the coast of France. The GIs called the piers "Swiss Roll" and more than 2700 feet were used at one port



"Inside Stuff" For Your Home



This 18-cubic-foot locker is made in two models. One is entirely for frozen food; the other is half for frozen food and half for normal temperature storage. Left, plastic block filled with chemicals prevents foods in refrigerator from drying out. It also eliminates odors



Sink, dishwasher and washing machine are combined in unit above. When the dishwasher is in use, the clothes washer is stored under the sink, and vice versa. Left, portable washer has motor in base



Waterproof clothesline of tinted plastic won't rust or rot and can be left up; soap and water clean it. Right, portable washing and rinsing tubs mounted on one frame have gravity drains

Vacuum cleaner purifies and removes dust from air in the room of a sick person. Same cleaner has a "tattle tale" light which flashes on to warn the user that the dust bag needs emptying

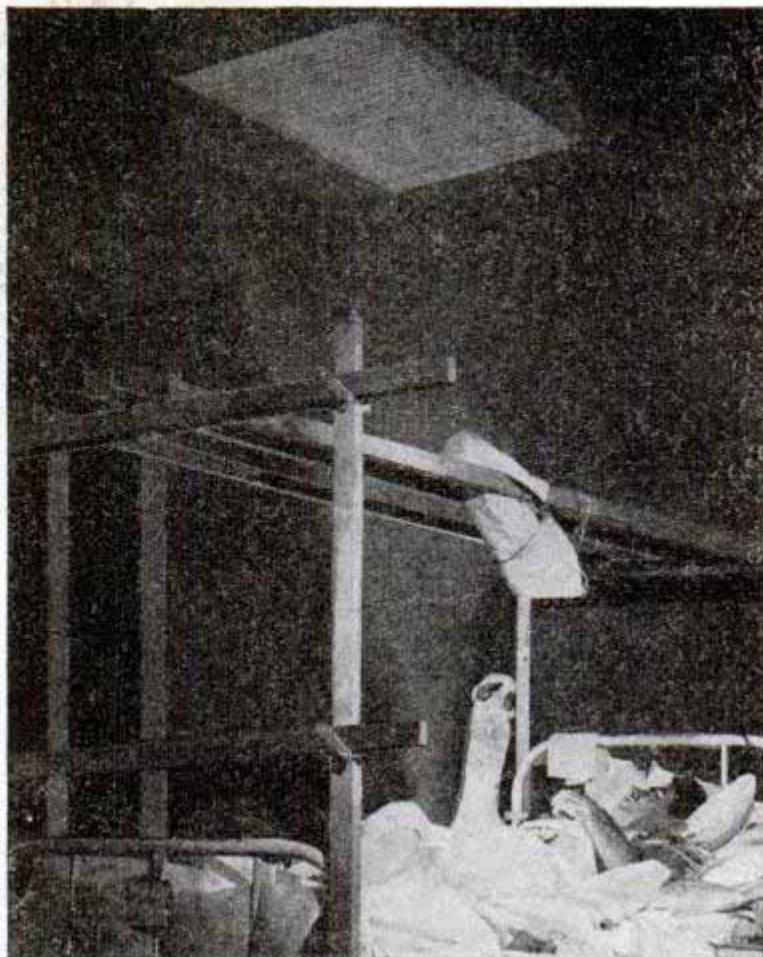
Invisible heating units for the home (not illustrated) resemble typical baseboards. Hot water flows through two pipelike channels of iron fixture. It can be painted to match the woodwork



Patients Read Book on Ceiling With Microfilm Projector



Text and pictures in magazines and books are reproduced on hospital ceilings by a microfilm projector for the benefit of bedridden patients. The patient can "turn the pages" by means of special switches that move the microfilmed material in the projector. Projected Books, Inc., of Ann Arbor, Mich., a nonprofit organization, was established to promote this new method of reading and distribute the projectors and films.



Portable 'Accordion' Conveyor Holds Package on 'S' Turn



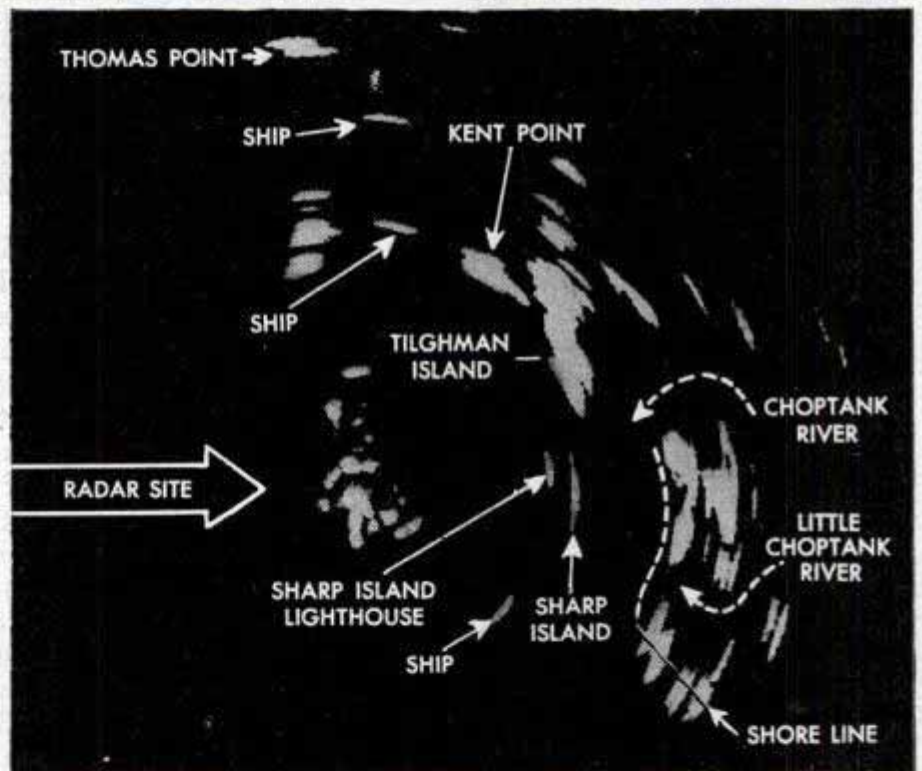
Built like an accordion, a portable conveyor recently introduced has sections which can be compressed from 100-inch lengths to 21 inches. The legs, likewise, can be lengthened or shortened to provide various work heights. This lightweight system, which can be set up by one man, also is equipped with special "split" rollers which enable material to make "S" turns without falling off and without the need for siding. Because the conveyor can be set up and taken down quickly, it is suitable for such uses as transporting cartons of food from storage rooms to store shelves.

"Fire Fighting" Valve Shuts Off Gas

"Fire fighting" valves cut off the gas supply in burning homes and thus decrease explosion hazards. High temperature caused by fire moves a Vinylite plastic link in the safety valve, causing the valve stem to shut off the flow of gas instantly.

Radar Camera Built To Map World Air Transport Routes

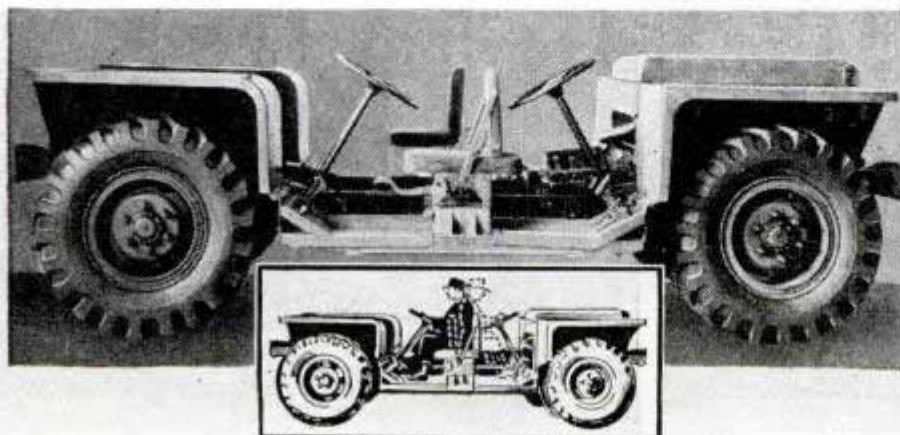
It now is possible for a flier operating a radar scope to view a luminous picture of the terrain below at the same time that a camera photographs the scene on 35-millimeter motion picture film for a permanent record. An automatic radar recording camera makes this possible. Used with all types of airborne and shipboard radar, the unit consists of a camera, magazine, beam splitter, adapter casting and control box. The camera, equipped with an interchangeable magazine which holds 100 feet of film, can be operated at extreme temperatures and altitudes up to 35,000 feet. It has a range of 100 miles on a frame as compared with the standard aerial camera's usual range of five miles. Peacetime uses predicted for the camera include making radar maps of worldwide air line routes and as an aid in determining safe navigation paths.

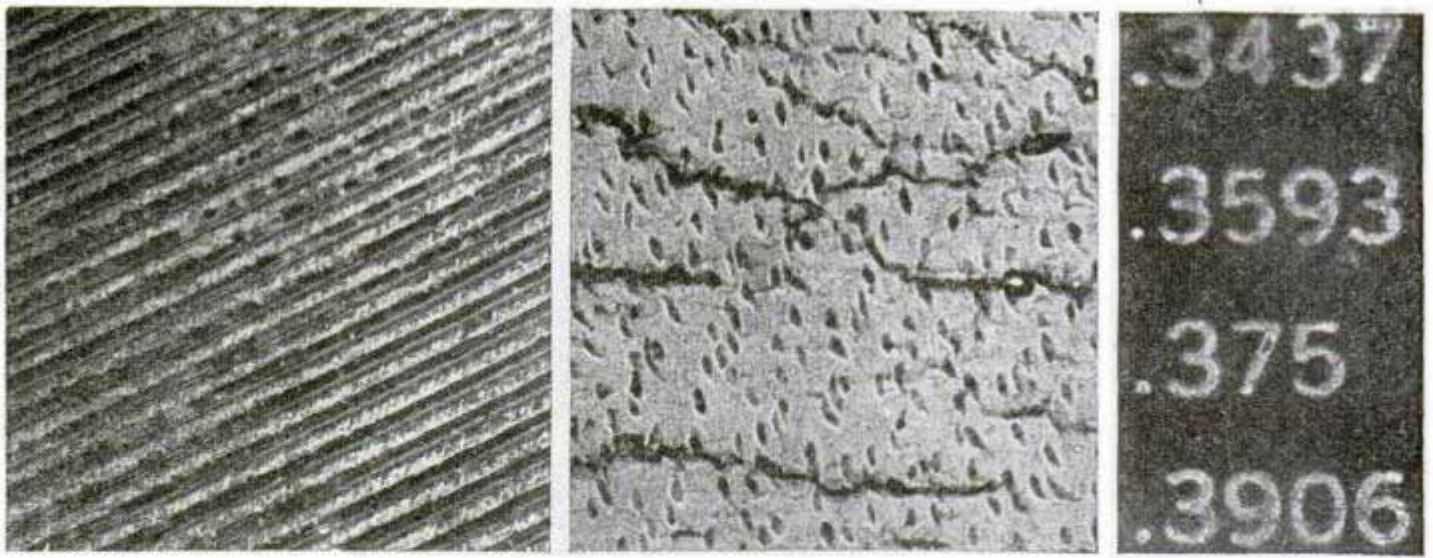


"Two-Faced" Auto Designed for Army

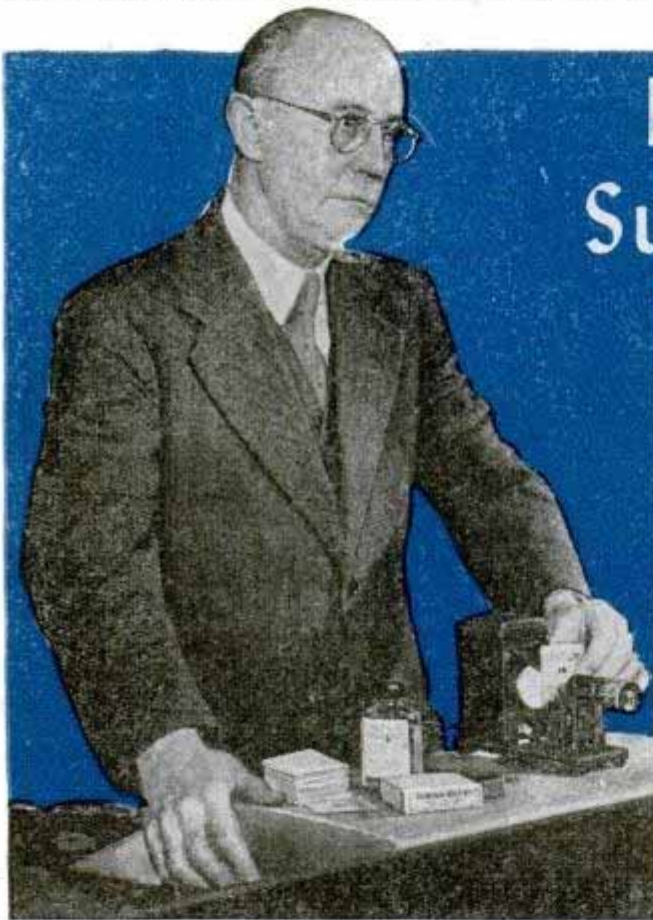
Experiments with a gun-carrying automobile that had steering wheels at both front and back were being conducted by engineers of the Studebaker Corporation when the war ended. In theory, the driver would dash into position, blast the enemy with a few

rounds of gunfire and then make a speedy getaway by hopping behind the duplicate steering wheel and controls facing the rear of the armored car. Another novelty that Studebaker experimented with was a tank trainer designed to instruct drivers early in 1942 when the vehicles themselves were just starting to roll from production lines. Mounted on a six-ton, 24-foot-long chassis, the trainer was equipped with an imitation tank cab, an engine control and a movie projector to give the illusion of a moving tank.





Magnified many times, these photographs reveal (left to right) the teeth of a file, surface of leather and figures engraved on a micrometer. Rex D. McDill (below), inventor, projects film showing magnified surface



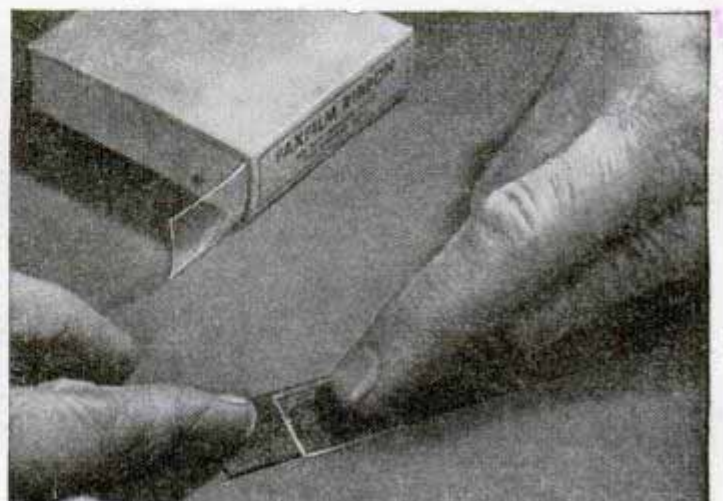
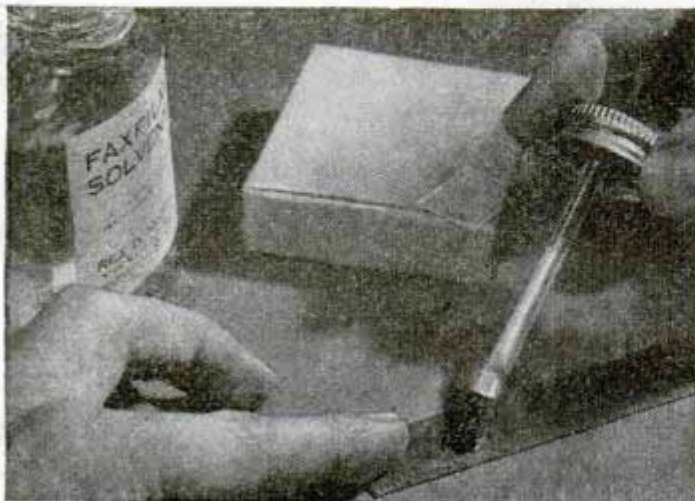
Fingerprinting Surfaces On Film

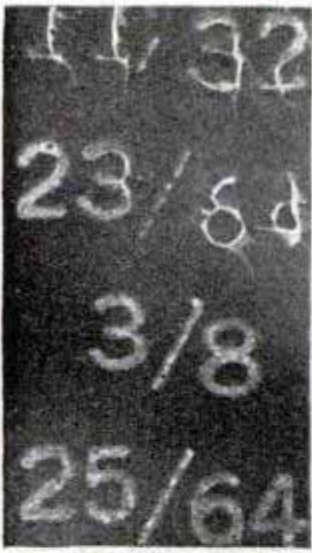
AN ENGINEER studying emulsion scratches along the sound track of motion-picture film was having trouble. He wanted to collect specimens of the scratches for transmission to other technicians, but he couldn't cut bits of the sound tracks from numerous films, and to make photomicrographs of dozens of specimens was out of the question.

One evening he visited a friend who was making records of metal surfaces with the aid of a simple embossing process that has been adopted widely by industry during the past two years. The engineer had a scrap of sound film in his pocket, and asked his friend to make a replica of it.

He found what he wanted—a way to pre-

To "fingerprint" a surface, solvent first is applied (left), then a strip of blank film is pressed on top (right)





Resembling ripples in water, these circles are tool marks on metal faced on a lathe. Right, wrinkled enamel

serve surface scratches. All he had to do was apply a drop of liquid solvent to the sound-track emulsion, place over it a piece of clear plastic film, and hold it in contact for 20 seconds or so. When stripped off, the plastic carried the imprint of every scratch and other surface detail.

This simple method saved countless precious hours for wartime industry, and promises to be even more useful in peace. It has speeded up inspections. It has given engineers and scientists a cheap, quick way of making permanent records of metal and other surfaces. It offers a means of measuring surface smoothness quickly and accurately when no profilometer is at hand.

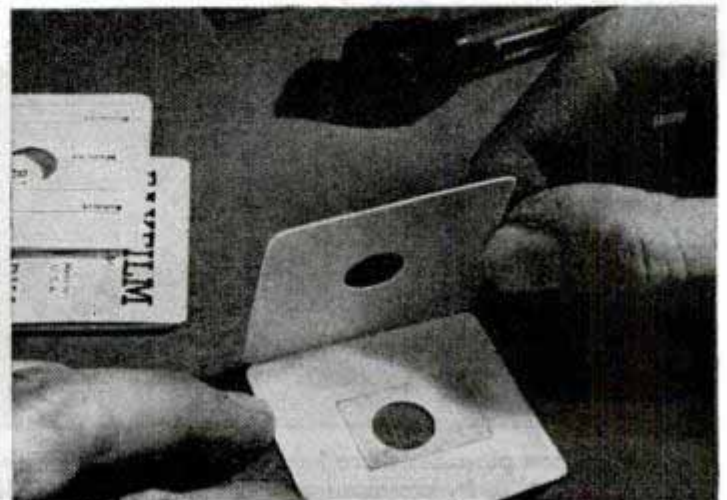
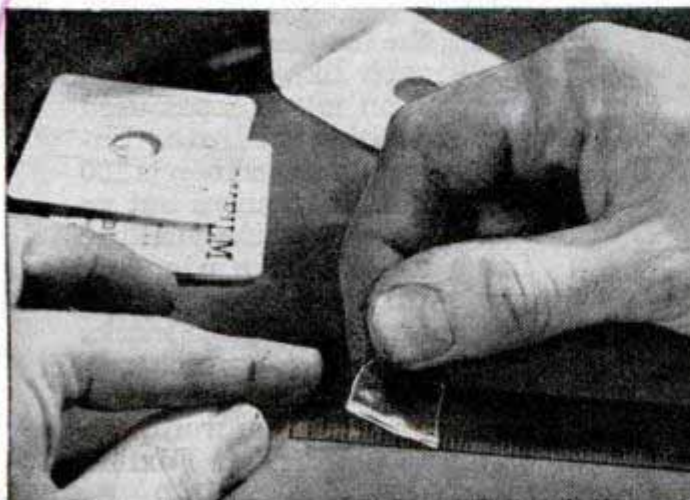
The film is the invention of Rex D. McDill, Cleveland, Ohio, engineer, holder of more than 40 patents on electronic equipment and other devices and processes. One of McDill's specialties is inspection equipment, and one day he ran into a problem that couldn't be solved by ordinary methods. It involved the structure of a metal surface. He got the idea that, if the surface details could be transferred to a transparent film which could be projected on a screen or examined on a microscope slide,

his troubles largely would be over. He knew that biologists sometimes flow liquid collodion over mother-of-pearl or other surface, let it dry, strip it off, and mount it on a slide for microscopic examination of details the collodion has picked up. But for industrial use, this is too messy and slow.

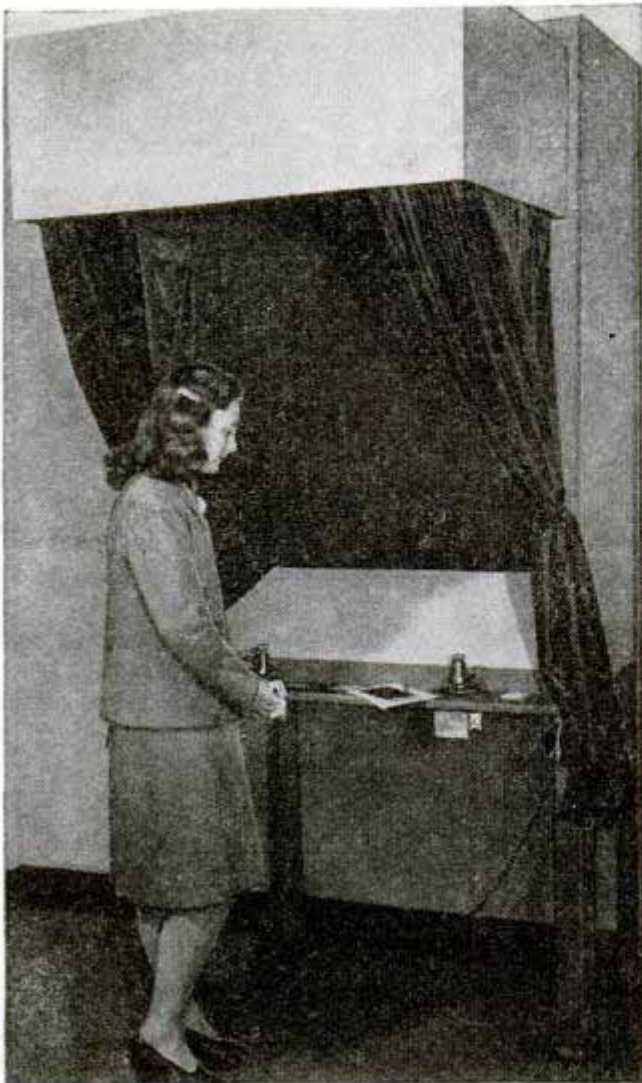
So, over a period of two years, McDill tested dozens of plastics and solvents until he finally worked out a combination that gives satisfactory results. McDill dubbed his discovery "Faxfilm," and assembled kits consisting of a roll of transparent film, bottle of solvent, two by two-inch cardboard mounts for the film specimens, a moistener for wetting the mount adhesive and a hand magnifier for viewing the film.

The blank film is a strip of clear plastic material .0055 inch thick and $\frac{3}{4}$ inch wide. The solvent softens one side of the film so it penetrates every scratch or other unevenness of the surface being recorded. After the replica is stripped off, the excess solvent evaporates, leaving the embossed details as permanent as the film itself. Usually about one inch of film is used for each record. This is mounted by sandwiching it between two 2-inch squares of card-

Film bearing the imprint of metal surface is removed (left) and placed over a $\frac{1}{2}$ -inch hole in cardboard



5199 Mansfield Road



Finish of a machined part is compared with a master sample in this instrument of mirrors and projectors

board with half-inch holes in their centers. Data concerning the replica may be written on the mount. The two by two-inch size enables the specimen to be projected in an ordinary slide projector, as well as in special projectors McDill has designed. Ordinarily a magnification of 100 diameters on the screen is sufficient to reveal the desired details.

When a record is to be made of the sur-



For comparison purposes these images were flashed on the screen of the instrument. Left, corrosionproof coating. Right, halftone plate

face of a hard substance such as a metal specimen etched to reveal its grain structure, the solvent is applied first to the specimen. When the record is to be of something soft, like a rose petal or plant leaf, the solvent is applied to one surface of the film, and the specimen may be oiled lightly to prevent sticking.

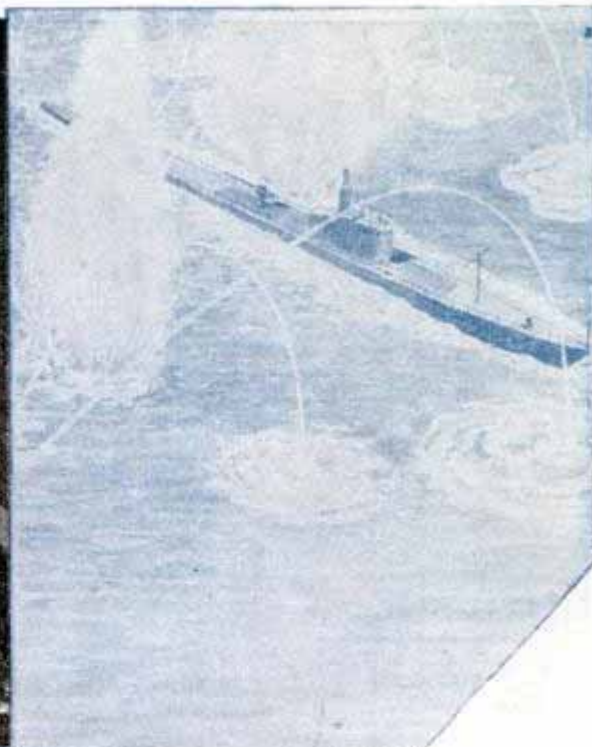
The ways in which Faxfilm has been used have surprised even McDill. For example, it is helping solve an important problem in the operation of ocean-going ships. When the surfaces of turbine gear teeth develop undue roughness and wear, trouble is likely to result. One manufacturer of turbine equipment heard about McDill's film, and tests showed that it could be used to make periodic records of gear tooth wear. By studying such records, trouble can be detected and corrected early enough to prevent costly breakdowns. It is planned to equip ships with kits for making film replicas.

In one factory, unrest among workers began to develop because of a rumor that finish inspection standards were being upped. That is, work that seemed to be as well finished as in the past was being rejected. Company officials called union leaders together and had a piece of work produced in strict accordance with the blueprints. A film record was made of this work and compared with similar replicas of the finish on rejected pieces. It was obvious that the rejected work had an inferior finish. The union stewards passed this news on to the workmen, and everything settled back to normal.

The need for a quick way of comparing surface finishes with a standard led McDill to develop a comparator outfit. This is a curtained booth housing a rectangular screen, two optically flat mirrors and two film-slide projectors. The projector beams shoot upward, strike the mirrors, and are reflected downward on the screen in such

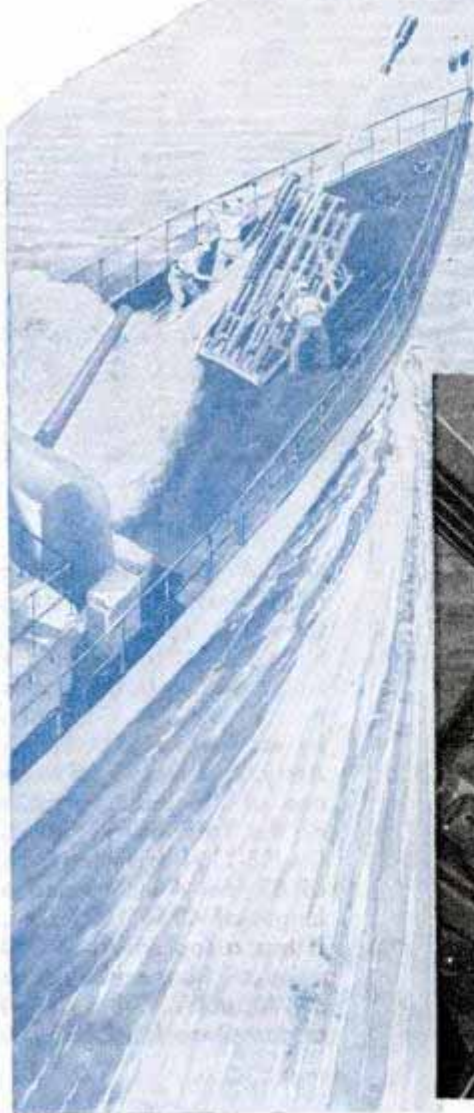
a way that the twenty by twenty-two-inch images are side by side. By adjusting the relative positions of the film slides, the images can be lined up — much like those in the comparison microscopes used for examining bullets. Enlargement on the screen is 100 diameters. It requires but an instant to determine whether finish marks on a piece of work are finer, coarser, or equivalent to the finish marks on a standard. A purchaser, in specifying finish requirements for a piece of work, can staple to the order a Faxfilm

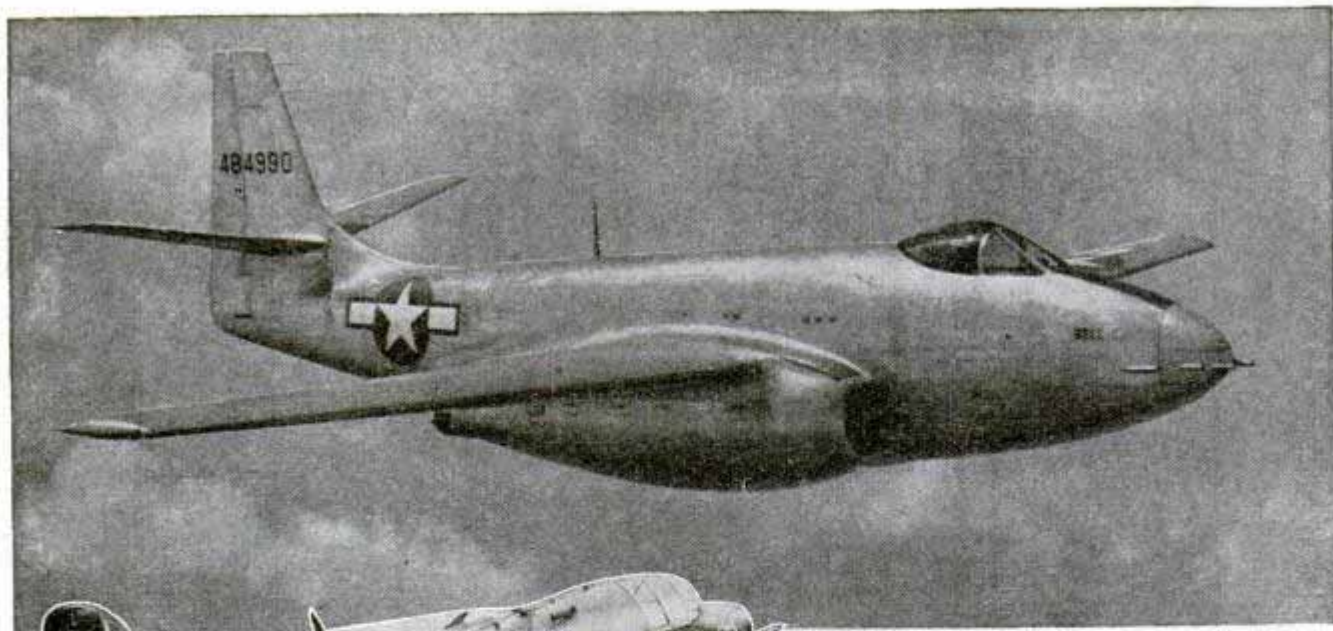
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HEDGEHOG AND MOUSETRAP

Two rocket launchers used by the Navy in whipping the submarine menace were the Hedgehog, above, and the Mousetrap, below. Both are known as "ahead thrown" weapons because they are affixed to the bow of vessels, whereas depth charges are hurled or dropped off the stern or from projectors in that vicinity. The Hedgehog can be trained horizontally on a target and its 24 projectiles are propelled by a cartridge charge, while the Mousetrap is immobile and must be aimed by heading the ship on the proper bearing, and its eight rockets are self-propelled. Both lay their missiles in a pattern that covers the target area, where they sink immediately, exploding only on direct contact.





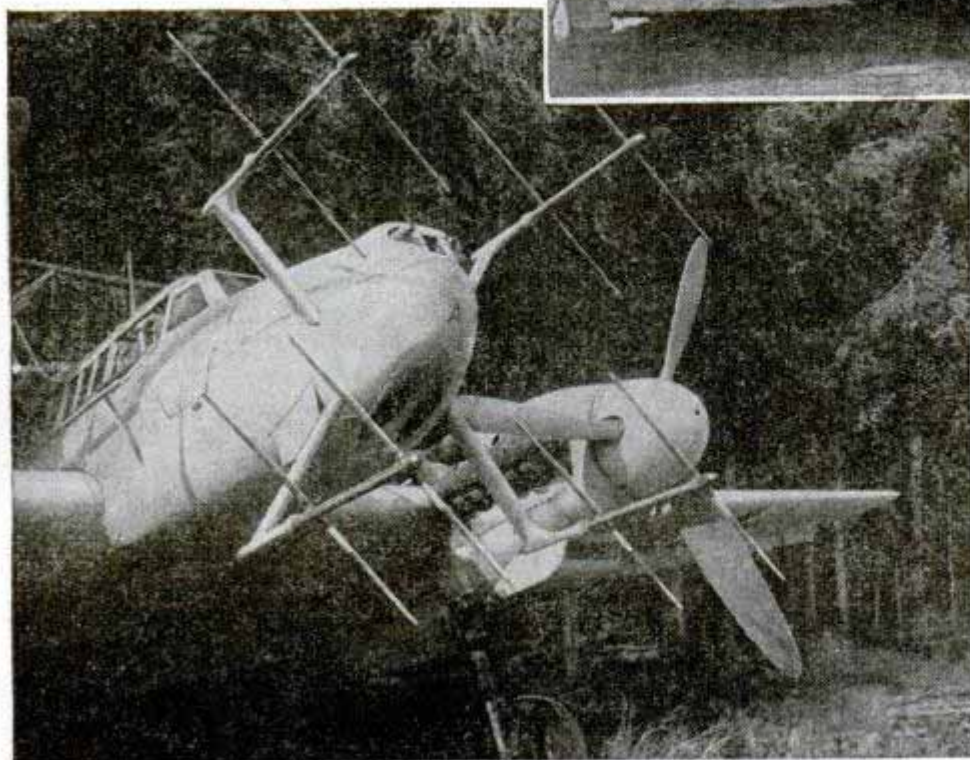
Above: Twin General Electric engines power the XP-83, built by Bell for the AAF and reported to be the longest ranged of the jet-propelled craft. Its top speed is "in excess of 500 miles an hour"



Like a Manx cat, the Handley Page Manx is tailless. The pusher type propellers are driven by twin de Havilland 140-hp. engines. Eighteen feet long with a wing span of 40 feet, the 4000-pound airplane cruises at a speed of 150 miles an hour



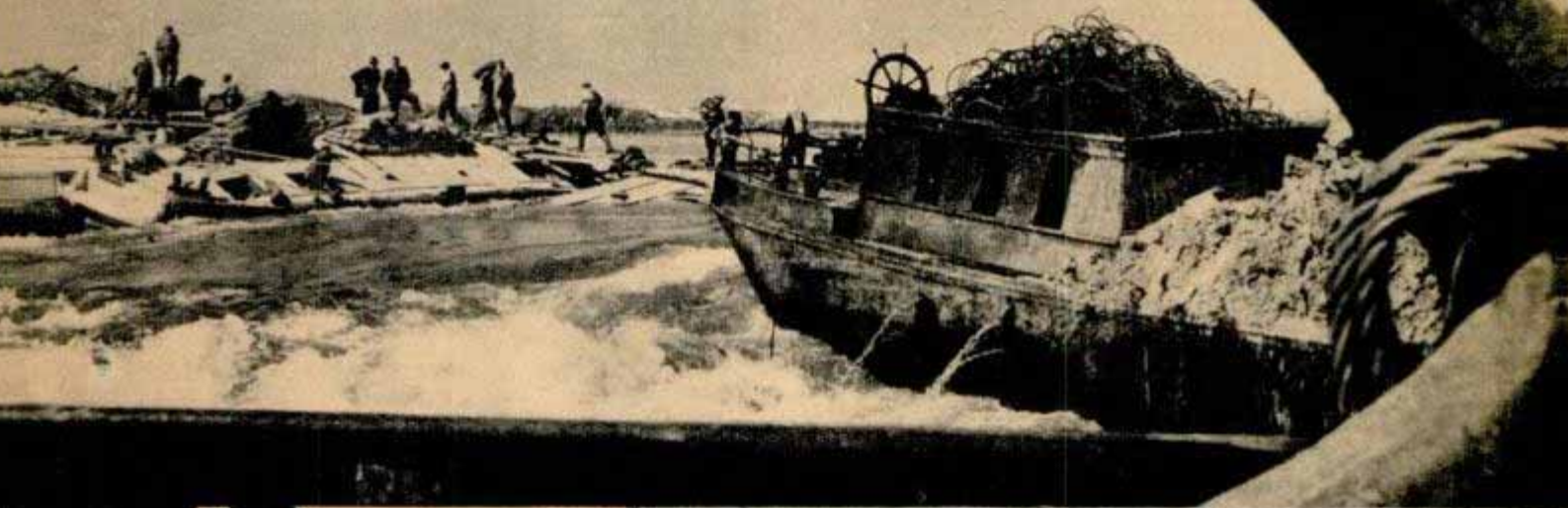
Right: Used for tank and gun-carrying assignments, the Arado 232-B, a British transport plane, has 23 wheels to ease the strain of moving its heavy loads



Left: A grotesque looking radar installation marks the nose section of this Nazi ME-110 night fighter found hidden in the woods near Unt Aching, Germany, by scouts of the U. S. 7th Army. Acknowledged to be one of the most versatile of the Luftwaffe's planes, the ME-110 has a wing span of 53 feet 4 inches and a length of 40 feet 4 inches. It has a top speed of 340 miles per hour and a range of 1300 miles. Gross weight of the plane is 22,100 lbs.

Plugging the Dikes of Holland

Framed by anchor, old barge closes breach in dike. Tons of clay filled the gap later



Paderborn
• Munster Kassel

DUTCH engineers are winning the greatest battle in the history of the Netherlands. Walcheren Island, flooded during the war, again has been lifted from the bottom of the North Sea.

Walcheren, "the fruit basket of Holland," disappeared in November 1944 when accurate RAF bombers breached four dikes surrounding the island. Walcheren was an important fortress in the German West Wall. The land previously had supplied Hollanders with a large share of their food. Last year its 50,000 farmers were homeless.

Time was a greater enemy than the sea during the great battle.

Frankfur

Mannhei

Metal hoops covered with rope are used as washers in joining huge sand pipes. Right, young engineer makes soundings to check possible sea damage to breach



All four of the breaches had to be sealed before the severe winter storms raged across the island. If the island had remained beneath the sea another winter, it would have disappeared forever. German mines, countless and uncharted, increased the hazards of the work.

Work began in December 1944, a month after the dikes were bombed. Engineers at Delft University near The Hague built models of the dikes, complete with rising tides and foaming water, to solve engineering problems. Broken ends of the four gaps were reinforced to prevent the restless sea from stealing more land. Allied officials promised supplies. These arrived in June.

Work to close the breaches actually started in July.

Foreign workers have tried and failed in building dikes. It is a craft, centuries old, passed from father to son. Modern engineering can produce few improvements. But the project became truly international. American "Ducks" carried workers through flood waters to the dikes. Navy barges and LCTs carried materials. Britain sent engineering equipment, clothing and a million sandbags. Royal Engineers carried out demolition assignments. Barracks for 2000 workers were built by the Swiss. Belgium gave a narrow gauge railway.

(Continued to page 69)

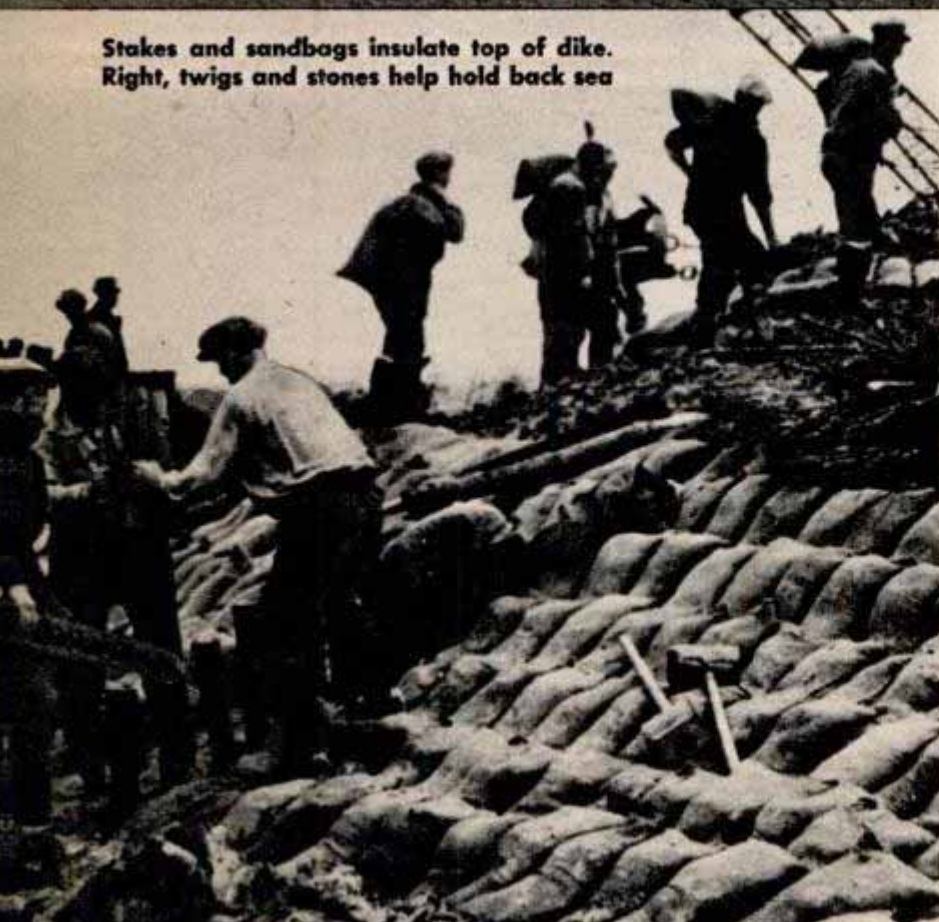
Workers sink concrete pontoons in position to close dike. Later a storm drove several of them out to sea



The first gap is filled. Three more had to be completed before winter storms. Below left, Dutch scientist solves engineering problem on scale model of dike



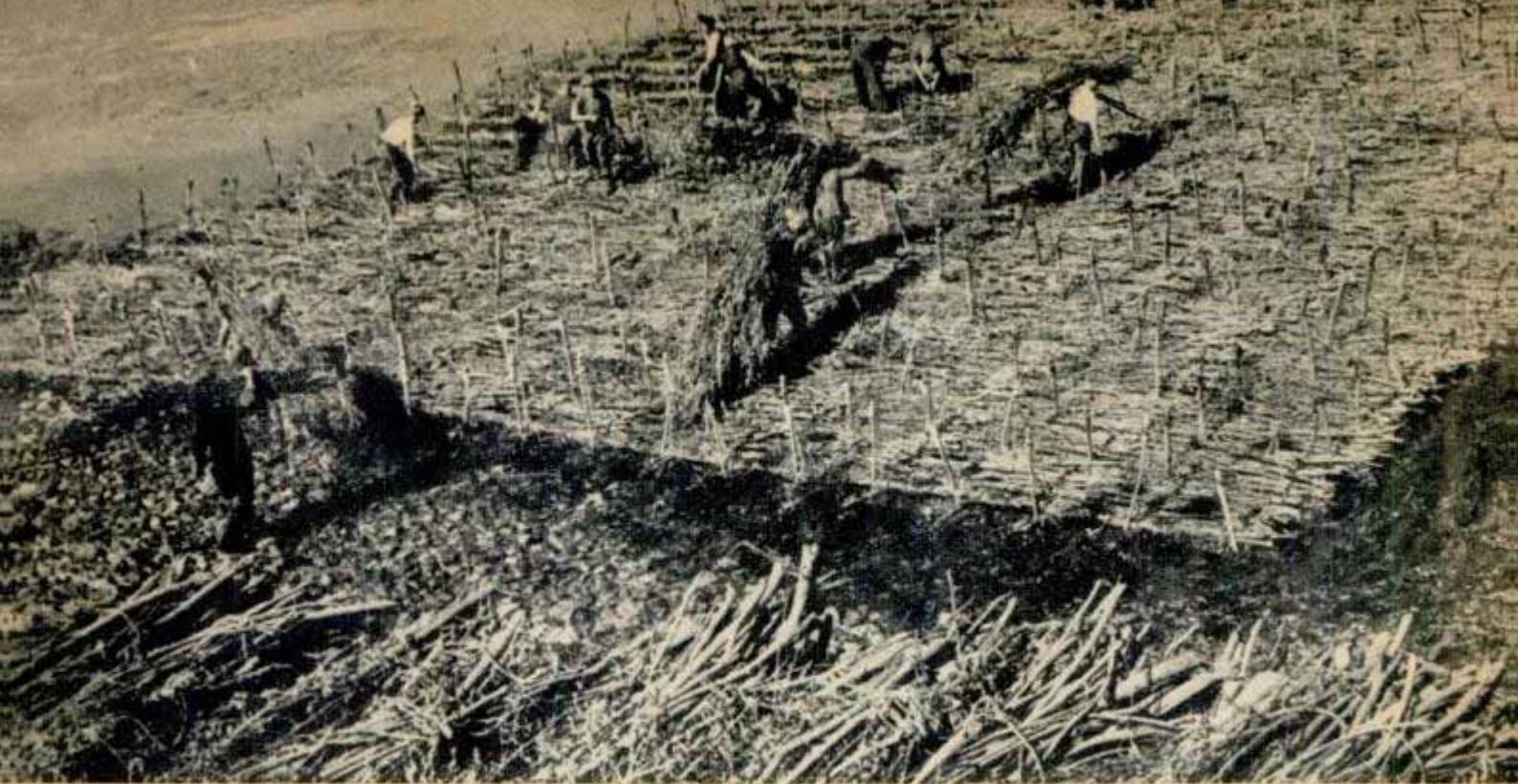
Stakes and sandbags insulate top of dike. Right, twigs and stones help hold back sea





Above, a thousand tons of sand pour through giant pipe each hour to form core of dike. Left, huge dredge drops antisubmarine net and scrap into German barge that was sunk to seal final gap successfully





Black Star photos

Great willow mattresses patiently hand-woven by Dutch specialists prevent sea from carrying away sand

Engineers first worked to close a breach at de Nolle, on the west side of the island, where the seething North Sea was claiming more land. Great woven mattresses of willow twigs were threaded through the dike. A thousand tons of sand, pumped a mile and a half through a giant pipe, poured in each hour to form the core.

As the breach grew smaller it channeled the titanic force of the sea into a narrow hissing flood. "Beetles," concrete pontoons built by the British for the artificial harbor used in the invasion of Normandy, were towed into position across the gap. Before they could be sunk a sudden squall tore many loose and rushed them out to sea. A hundred feet of dike disappeared.

Again the heartbreaking work was started. A leaky German barge, filled with submarine nets and other scrap, was sunk in the channel. Water, rushing through port-holes and leaks, was dammed quickly. A

thousand workers packed black Belgian rock and blue Klundert clay against stakes across the top. It held. The battle for one breach had been won.

Tireless, the engineers turned to the three remaining breaches. As the shortening days passed, the breaches at Westkapelle, at Veere and Rammekens, were locked in the same manner. They were sealed just before the winter storms.

But time remains the enemy of Walcheren farmers. Six long months will be required to pump flood waters from inside the completed dikes. Normally crops could not push through the salt-scoured earth of the island for at least five years after it is lifted from the sea. However, Dutch engineers have discovered that gypsum will cleanse the soil, so fertility may return to the island's fields by 1947. Then the old Dutch motto will live again on Walcheren: "I fight and emerge."

The sea, once barred from Walcheren, laps roof of a farm home. Salt-laden soil must be treated to produce



British Try Out Captured V-2 In a vertical firing position and surrounded by fuel lorries, a 45-foot-long V-2 rocket captured from the Germans is prepared for a trial flight at Cuxhaven under supervision of the British

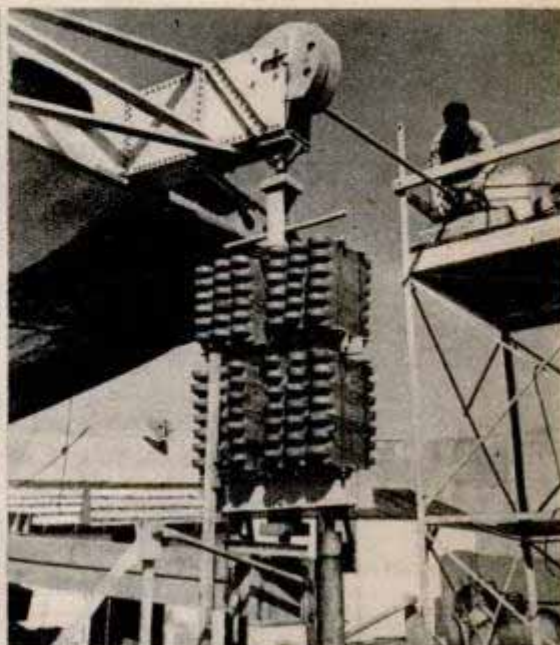
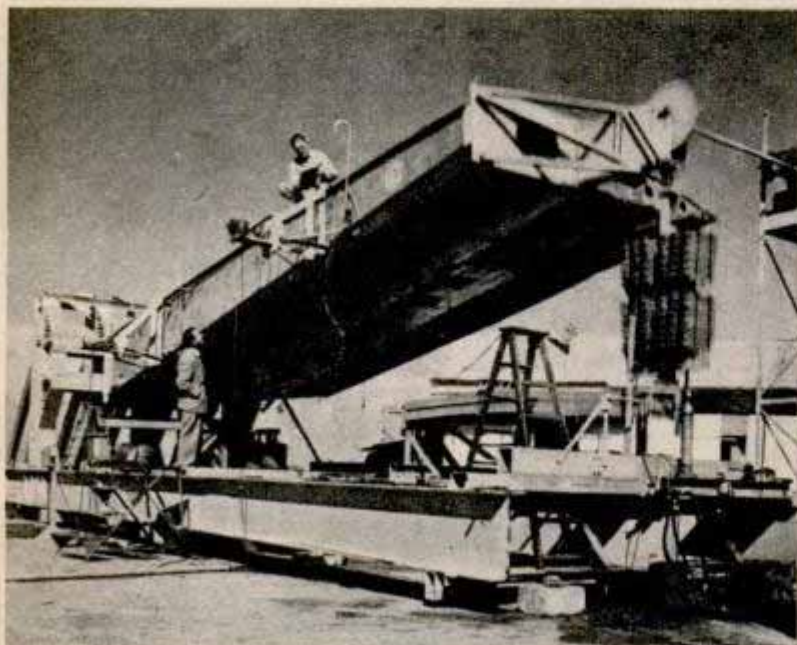


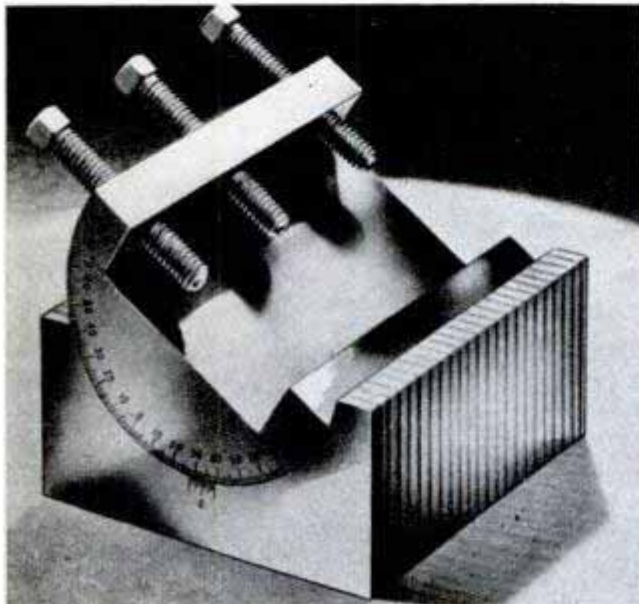
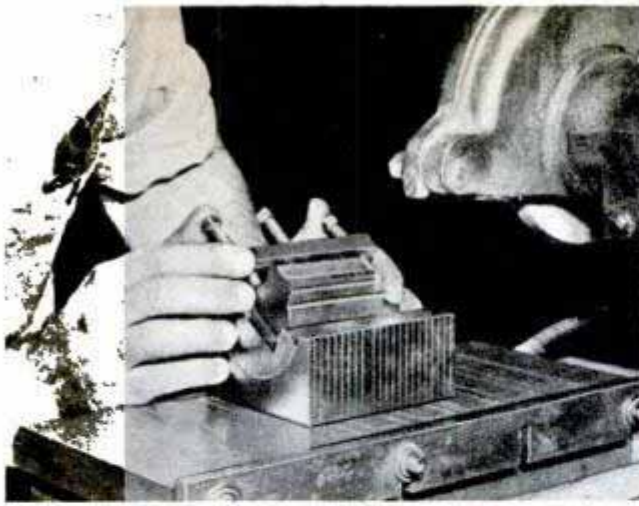
Straight up goes the 12-ton flying bomb for observation by English scientists. Carrying a ton of explosives, the V-2 is believed capable of reaching a height of 70 miles above the earth and a speed of 3600 miles an hour. In the tests, all explosives were removed

By "flying" new airplane wings on the ground, a vibration test machine used by Lockheed Aircraft Corporation compresses the stresses and strains of a 350-mile-an-hour transcontinental flight into a 20-minute period. Engineers observe and measure at first hand the effects of flight on internal wing structures as a shaker jig, using an off-center wheel, vibrates the

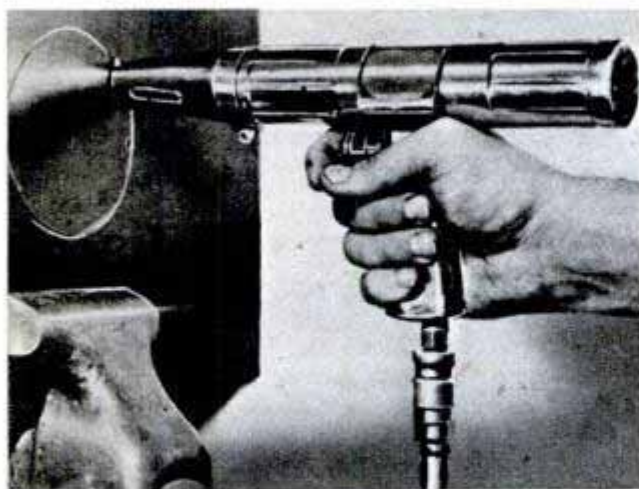
Ground Test for Airplane Wings

wing at 170 times per minute. Smaller devices spin at 1800 r.p.m. to simulate engine vibration. Lead weights up to 50 tons bend the wing 18 inches out of line to increase the strain. Electronic gauges at strategic points measure variations in ribs, spars, beams and skin surfaces. The machine also enables engineers to test methods of sealing leaks in wing fuel tanks





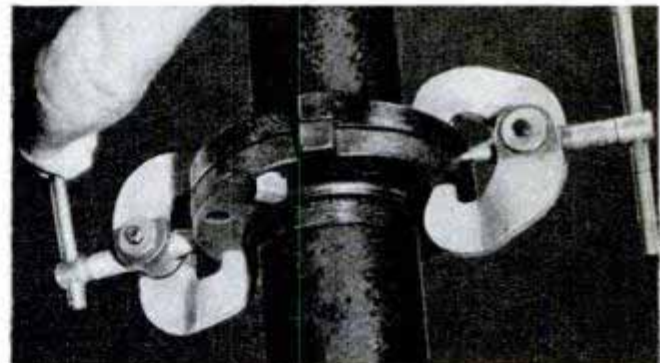
PARALLEL ANGLE VISE is held by magnetism in exact position for precise grinding operations. After the vise is set at the desired angle by calibrations, it is placed on a magnetic chuck and when current is applied the vise is set rigidly. Base of the vise consists of copper and steel laminations permanently fused into a solid unit in which a semicircular recess is machined to receive the rotating work holder



POWER SAW driven by compressed air facilitates sawing and filing in cramped quarters and also permits circular sawing of metals and wood as well as "dead end," keyhole or scroll work. The tool weighs 3½ pounds, has fingertip speed and power control and a cutting stroke adjustment from ¼ to 1¼ inches



LENSES FOR GLASSES, insulators and control knobs for electrical equipment and jewel-like pins for dresses are applications predicted for a plastic called Kriston. Its transparency and high refractive properties make it suitable for optical lenses, while its resistance to electricity makes it useful to the electrical industry. It can be made in translucent or opaque colorings for decorations in the fashion field



FLANGE JACKS simplify replacement of worn gaskets that cause leaks in flanged pipe lines. Used in pairs, the jacks gradually open the flanges without the use of hammer and chisel. Turning the handles forces the pointed tool to separate the flanges without disturbing the alignment of the bolt holes

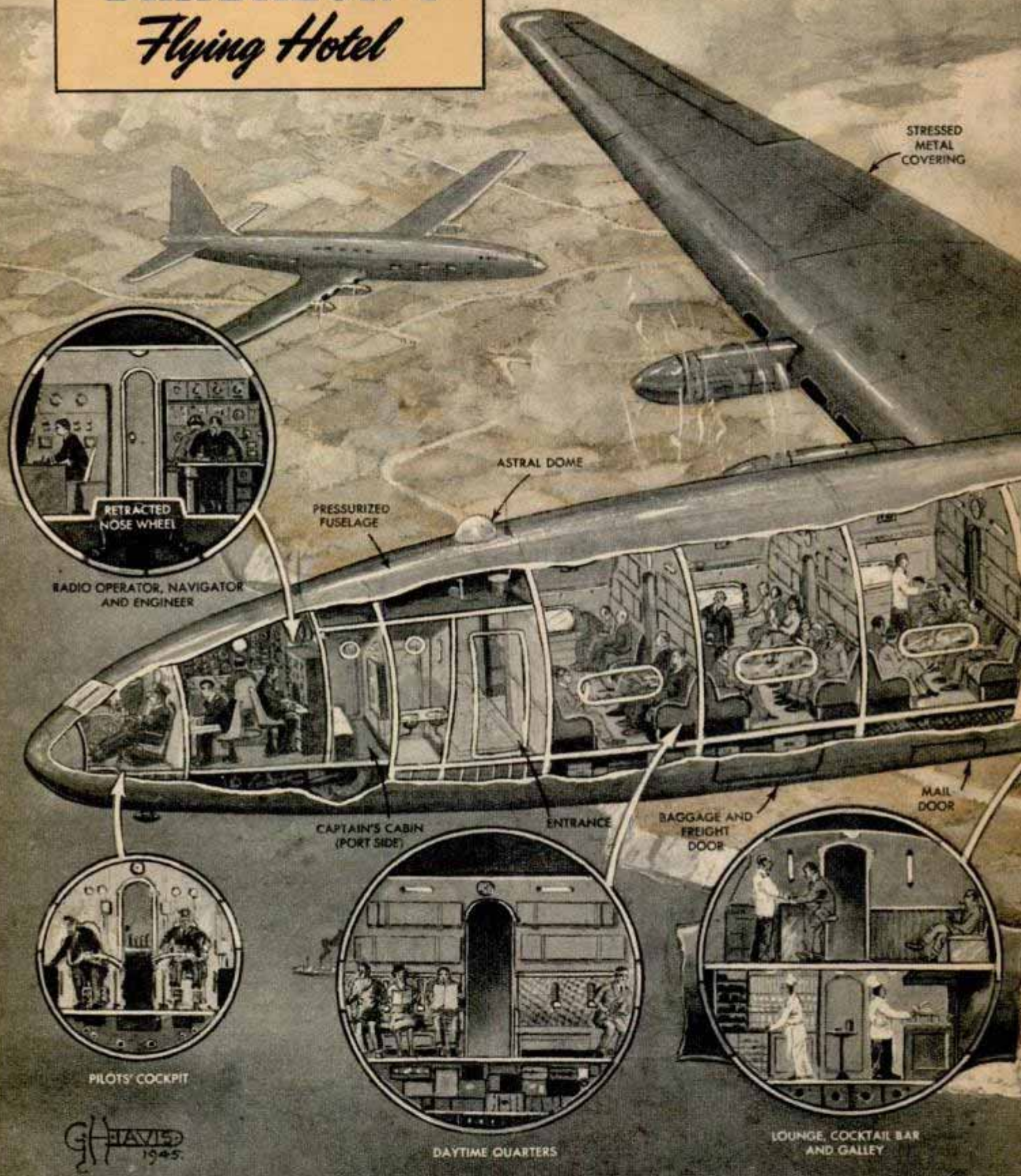
HAMMER designed for use in aircraft plants has a head made of a special lead alloy that gets tougher the more it is used. It will not blemish metal surfaces and is said to eliminate danger from flying chips and splinters. The shaft is made of two steel rods with welded cross members to absorb shock. A serrated plastic handle assures a firm grip. The head weighs five pounds. The hammer has an overall length of 16 inches and is adaptable to many industries



The hammer has an overall length of 16 inches and is adaptable to many industries

"BRABAZON 1"

Flying Hotel



STRESSED METAL COVERING

ASTRAL DOME

PRESSURIZED FUSELAGE

RETRACTED NOSE WHEEL

RADIO OPERATOR, NAVIGATOR AND ENGINEER

CAPTAIN'S CABIN (PORT SIDE)

ENTRANCE

BAGGAGE AND FREIGHT DOOR

MAIL DOOR

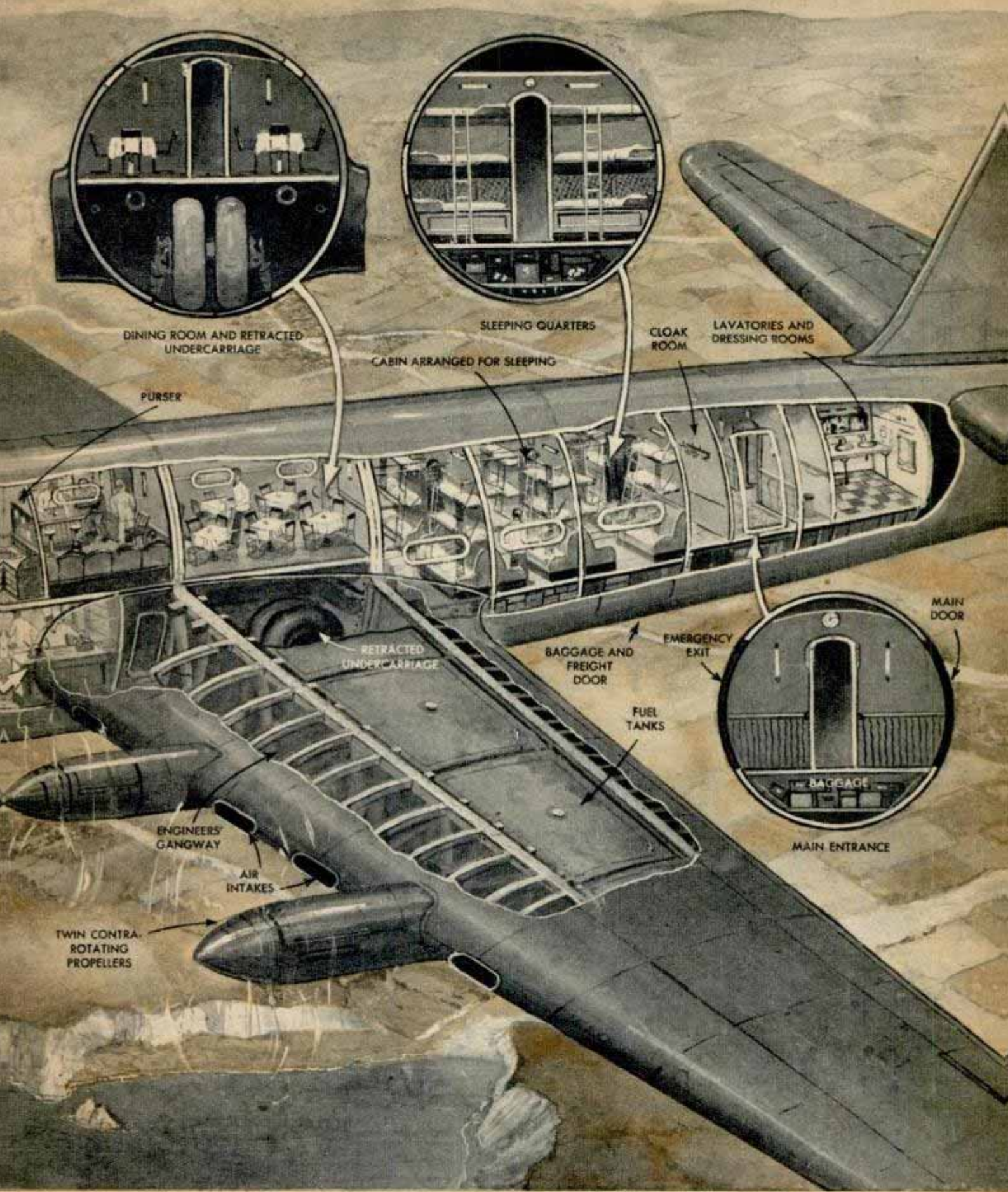
PILOTS' COCKPIT

DAYTIME QUARTERS

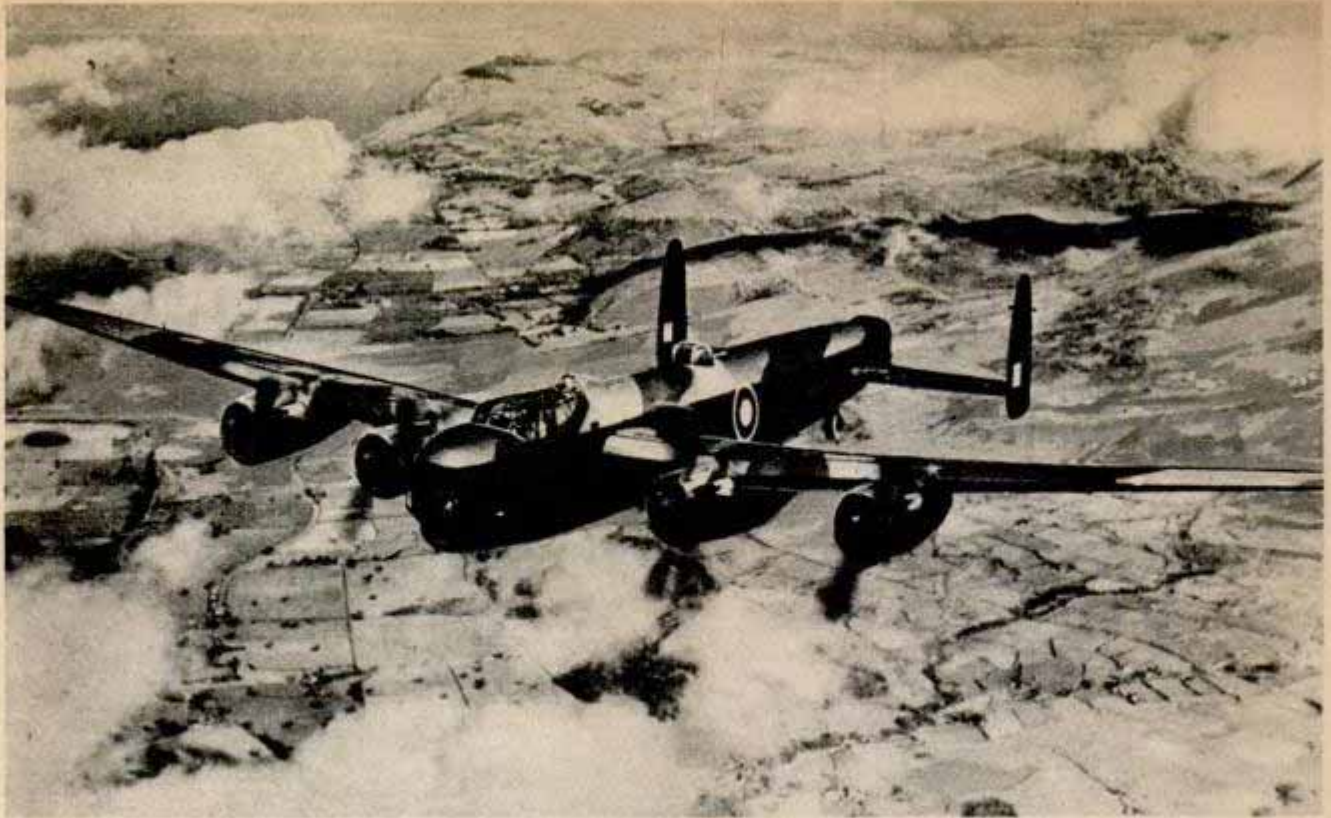
LOUNGE, COCKTAIL BAR AND GALLEY

G. HAVIS
1945

Nearing completion at Bristol, England, is a plywood mockup of Great Britain's largest airliner, the 110-ton Brabazon 1. Although its dimensions have not been officially announced, the wing span is reported to be approximately 270 feet and the overall length nearly 160 feet. It is estimated that the four 2500-horsepower engines, with contrarotating propellers, will give the plane a range of 5000 miles at a 250-mile-an-hour cruising speed. Flights between Australia and England in 48 hours are expected for the plane. One hundred and thirty feet of the fuselage's length will be pressurized. A short-haul version of the Brabazon, named after



a pioneer English airman, Lord Brabazon, will carry 224 passengers. The long distance type illustrated above will sleep 72. There will be two main passenger salons, separated by a full-height double-deck section housing a cocktail and snack bar, lounge and dining room above and a galley, purser's office and part of the auxiliary gear below. Each main salon will be divided into three compartments, with seats accommodating three passengers facing forward and three to the rear on either side of the aisle. A triple-decker berth arrangement will take care of each compartment's 12 daytime occupants at night. The plane is expected to be ready in 1947



Shortly before the end of the war the British developed a new heavy bomber, the Lincoln, which was specially designed to drop 11-ton "de-penetration" bombs on Japan. The RAF plane, built by the makers of the famous Lancaster, carries a crew of seven men, has a wing span of 120 feet

Latest British 4-Engine Bomber Carries 11-Ton "Penetrator"

and is powered by four 1750-horsepower Rolls Royce Merlin engines. Its maximum

speed is approximately 320 miles per hour. Armament consists of .50-caliber machine guns—two in the nose turret, two in the mid-upper turret, two in the tail turret and one under the fuselage.



Radio Director Uses "Blister"

When the director of a radio show works from a control room at a distance from the stage, nearsighted actors have to wear glasses in order to follow him. This difficulty was solved at the Vanderbilt Theater in New York by building a glass-enclosed "blister" for the director in front of the stage. The actors, facing the theater audience during a broadcast, can see him with ease. At the same time he can communicate by telephone with the control room in the balcony.

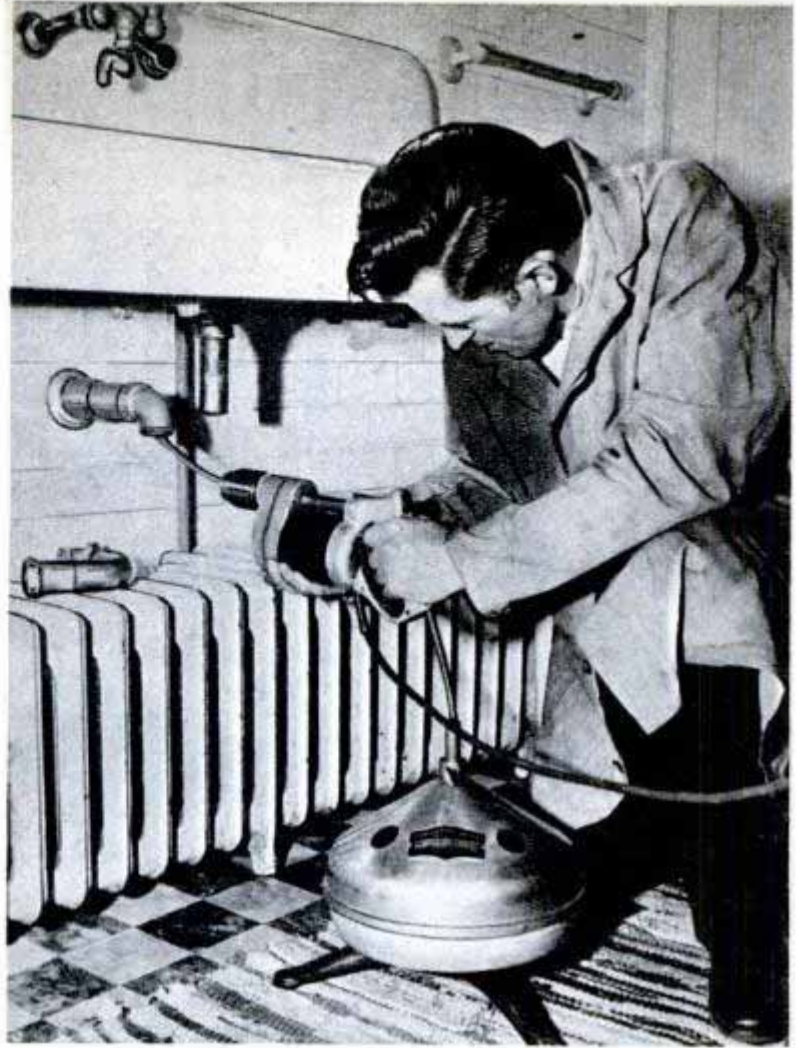
Radio show director in soundproof glass "blister" can be seen by nearsighted actors and heard by man in control room

Electric "Drill" Cleans Clogged Drains With Cable That Turns Curve

Equipped with 110 feet of flexible steel shafting to which cutting tools are attached, an electrically driven device permits easy removal of obstructions in drain pipes. The driving mechanism resembles and operates like an electric drill. The cable automatically coils and uncoils as it is fed through the electric "drill." The flexible cable permits the cutting head to round "S" curves with ease to get at obstructions. The tool has attachments for cutting, scraping or polishing the insides of pipes and tubing.

Gauge Checks Fuel Injector To 10 Millionths of an Inch

When the Army Air Forces decided to use direct fuel injection for the aircraft engines, this equipment required supersensitive gauges to guarantee dimensional accuracies as fine as 10 millionths of an inch. If you could split a human hair lengthwise into 10,000 slices, each slice would be about 10 millionths of an inch "thin." The answer to this problem was a flow-type air gauge called the Precisionaire. Applicable for checking either internal or external dimensions, this gauge is so simple to operate that untrained inspectors learned in a few



hours how to make accurate measurements in less than two seconds. Engineers predict the gauge will have extensive peacetime applications for precision inspection.



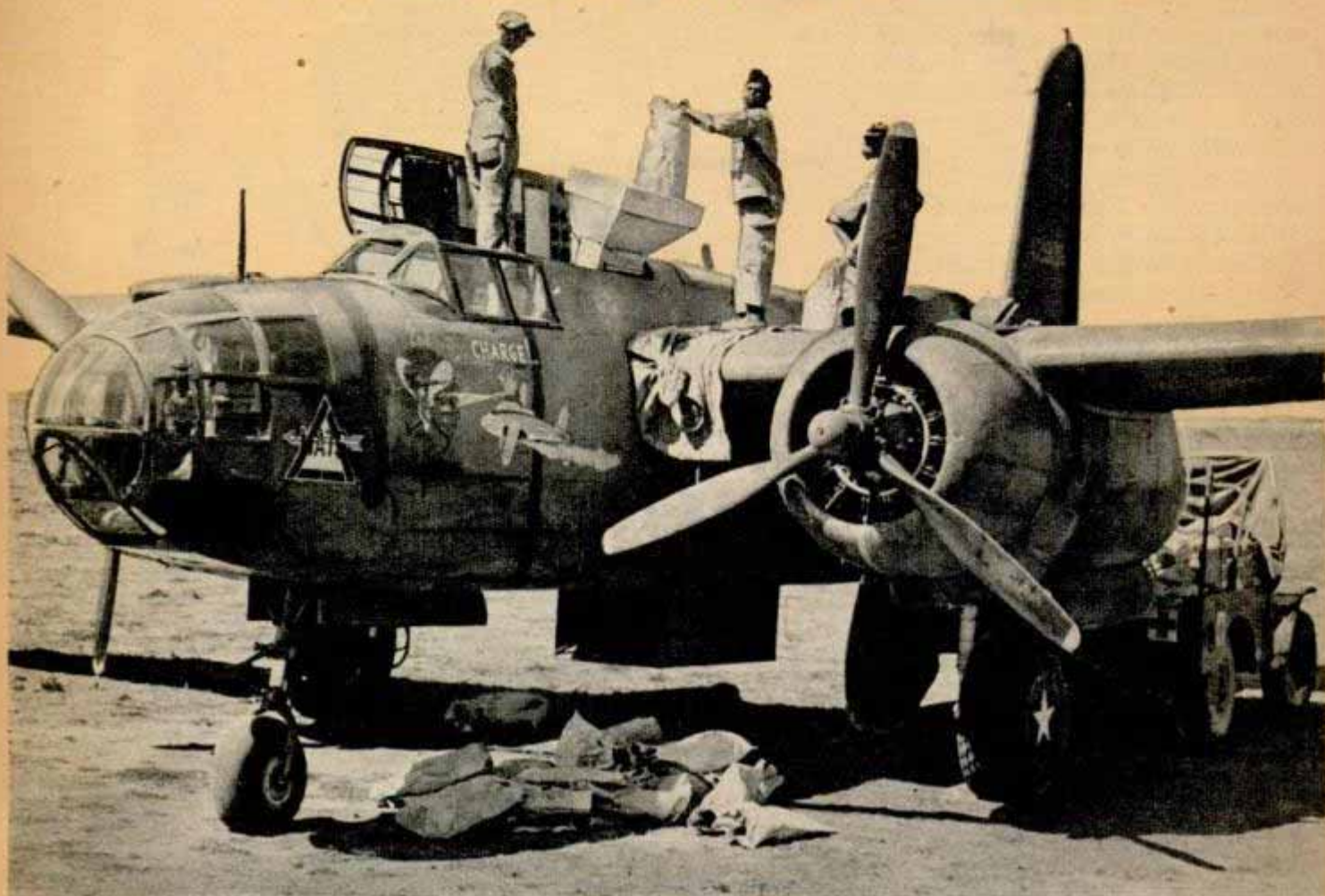
Indicator Tells Time Anywhere in World

Setting a disk at the time in your own zone will give you the correct time for any other part of the world on a cardboard indicator. The world is divided into halves on each side of the indicator, with the various times showing in circular openings along the round edges. The indicator has special value for short-wave radio enthusiasts who tune in broadcasts from all over the world.

☞ Test pilots at Willow Run flew 5,000,000 miles in four years without an accident.

Will Malaria Strike at Home?

Thousands of boys are returning from the tropics with the mosquito-borne disease. There is danger of its spreading—but our scientists back in 1940 began a fight to prevent an epidemic



Antimalaria larvicide is loaded into an Army bomber and (below) dusted over a mosquito breeding area



As this goes to press word comes from Washington of a new synthetic drug, SN-7618, superior to quinine or atabrine. A second drug, still experimental, offers the promise of a positive cure for malaria



Officers volunteer as "guinea pigs" to learn whether bites of malarial mosquitos carry filar'asis infection

MALARIA is still, as it has been for some 2500 years, one of the most important diseases in the world. Today it is responsible for some three million deaths among three hundred million victims a year. Most of it occurs in areas where American soldiers fought in World War II—the Mediterranean, India, Burma, China, the Dutch East Indies and nearby islands in the Pacific.

It was inevitable, then, as the Army pointed out, that large numbers of our troops returned to this country would be infected with malaria. But responsible agencies, both civilian and military, were prepared to cope with an epidemic of malaria. In addition, all measures were taken to prevent such an epidemic.

The Surgeon General of the Army, for example, began as far back as 1940 to expand the Army's malaria control program, creating a new Commission on Tropical Diseases within the Board for Control of Epidemics. He obtained the best medical men of the country as consultants, organized a subcommittee on tropical diseases in

By **John L. Kent**

the National Research Council, established a research program on all phases of the disease, and set up a division of tropical disease control in the Preventive Medicine Service of the Surgeon General's Office. Lieutenant Colonel O. R. McCoy, chief of this division, says there is little danger of any serious epidemic of malaria in the United States traceable to returned soldiers.

Fear due to lack of information can cause more harm than malaria itself, reports Major General Norman T. Kirk, the Surgeon General of the Army. With the prospect of thousands of soldiers returning to this country from malarious regions, General Kirk made an appeal for a better understanding of the problem so the public will realize that, with a few simple precautions, malaria is not a disease that should give undue concern either to infected servicemen or to their families.

There are a number of types of malaria, but the two that concern American troops are benign tertian malaria, which is rarely a serious disease, and malignant tertian

TO GET RID OF MALARIA...



Decontaminating huts of natives in India by spraying DDT from a power sprayer mounted on an Army quarter-ton amphibious truck

Another preventive method shown at left is to mount a can over a mosquito-breeding ditch and let oil drip steadily upon the water

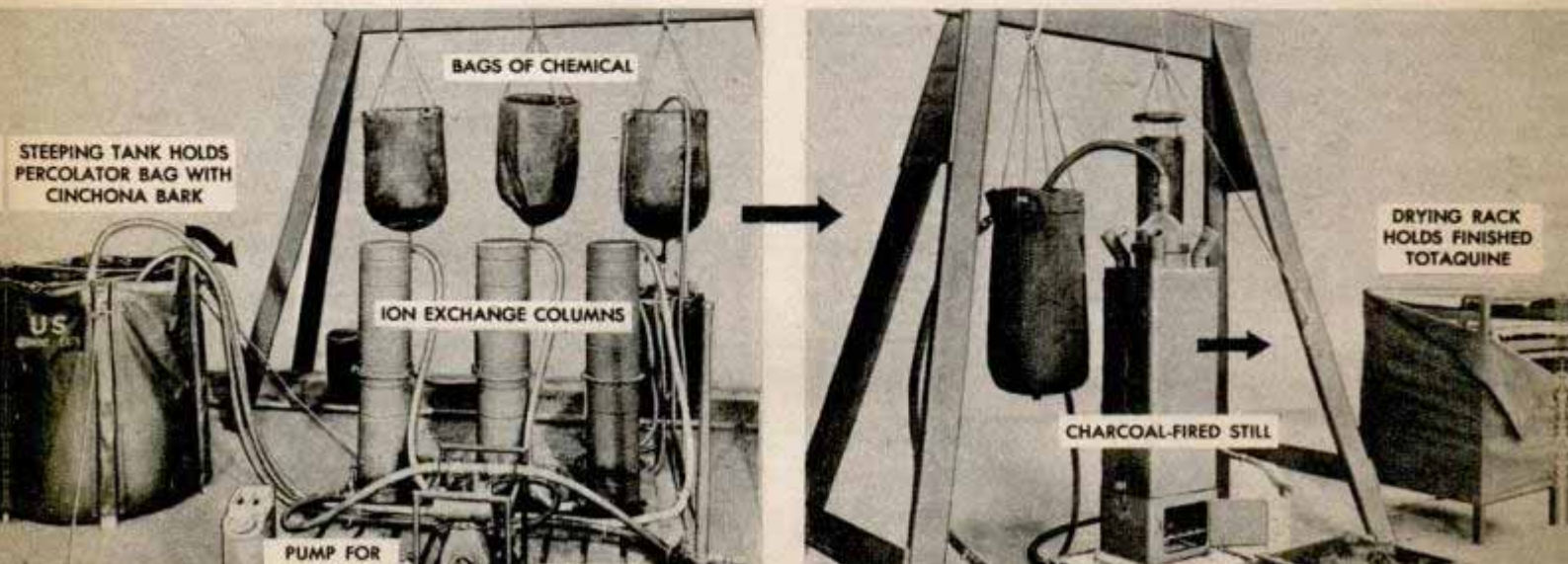
malaria, which without treatment may be fatal. The latter type is cured by atabrine so that it is not a problem when properly treated. Servicemen infected with benign tertian malaria continued their arduous combat duties as long as they took the necessary small doses of atabrine. Benign malaria, however, rarely is cured by atabrine, but the drug prevents the appearance of symptoms of malaria, or, as is more commonly said, suppresses the disease. When a man who has benign malaria stops taking atabrine, the usual symptoms—chills,

fever, headache and nausea—may return.

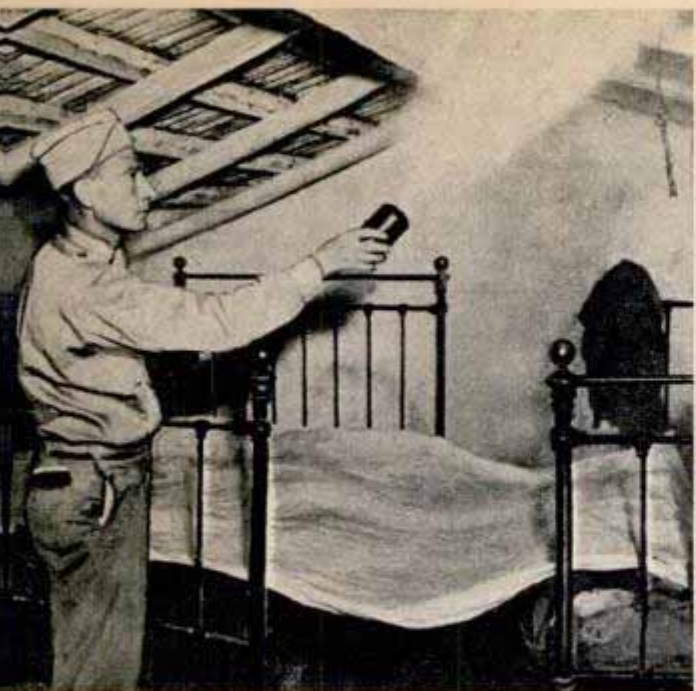
Contrary to what is generally supposed, the Army's experience reveals that relapses occur with the same frequency in the north as in the south.

General Kirk stressed the point that malaria can be spread only by the anopheles mosquito. Even if a man is infected, the anopheles mosquito cannot transmit the disease unless it has bitten the victim during a relapse and before medical treatment has been secured. In most parts of the United States there is little likelihood of

"Production line" of the portable plant which concentrates quinine from wet cinchona bark out in the field



..GET RID OF MOSQUITOS



An Arab home in Algiers is rid of malarial mosquitos by an American soldier loosing an "aerosol" bomb to fill room with insecticide



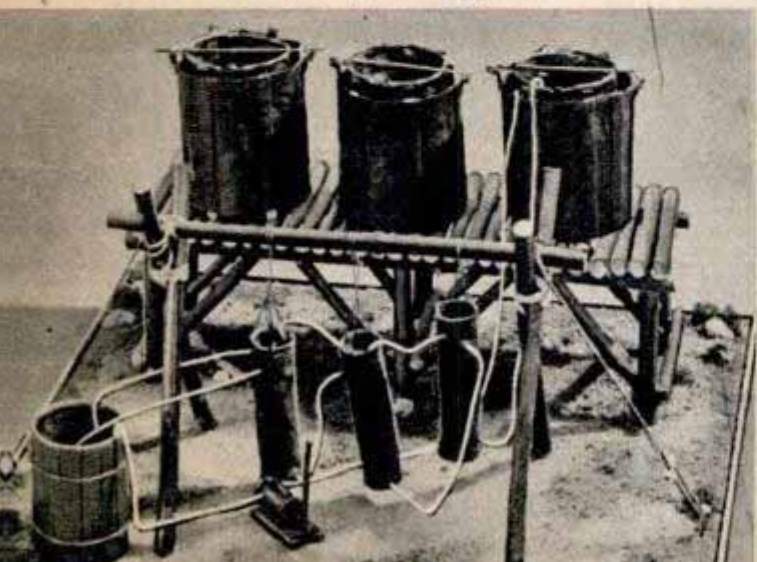
At right, a Yankee uses a rotary duster to spread paris green on an Italian swamp, ridding area of the disease-bearing mosquito

this, since mosquito control is adequate. But it was not like this in the Pacific.

Protection of overseas troops in forward areas and in combat involved many difficulties. Mobility of troops, difficulties of supply and presence of the enemy made the use of permanent control measures impracticable. Reliance had to be placed largely upon the individual methods of protection, using repellents, nets, protective clothing and insecticidal sprays.

Early in the war, the Army and Navy used liquid sprays containing pyrethrum.

Model of a hand-operated quinine extraction unit



Such sprays were only moderately effective. In 1942 there was developed an aerosol method of distributing pyrethrum insecticide, using freon, an inert gas, to propel the material from a small container now known as the "mosquito bomb." It can be used in forward areas, and soldiers equipped with these "mosquito bombs" had a weapon with which they killed mosquitos in shelter tents, foxholes and dugouts, even under combat conditions.

An outstanding advance in control of mosquitos was made during the war with the discovery of the remarkable insecticidal properties of DDT. Sprayed on interior surfaces, DDT will kill insects alighting on the treated areas for several months. Mixed with oil, DDT was distributed from aircraft for large-scale control, and was so highly effective that on some islands in the Pacific where it was used visitors reported they did not observe any mosquitos at all.

Where the risk of malarial infection was substantial, atabrine and quinine were used to keep men on their feet during the campaigns. Although neither drug can prevent infection, they do suppress the recurrent chills and fever of malaria.

When war cut off the quinine supplies



Digging flume to drain malarial lagoon into ocean. Nearby is camp

from the East Indies and before the large-scale production of atabrine made a substitute available, the Army turned to South America as a possible source for quinine. In Colombia, Ecuador, Bolivia and Peru are many wild stands of cinchona trees from whose bark quinine is derived. But bringing the bark out of the jungle presented a transportation problem.

Dry bark had to be gathered, tied and transported by mule pack and oxen-drawn wagons over winding trails to the permanently located extraction plants.

But American science and mechanical ingenuity came to the rescue. Suited especially for use in South America, a new process of quinine extraction was developed, and a completely portable plant using this process to produce quinine at the

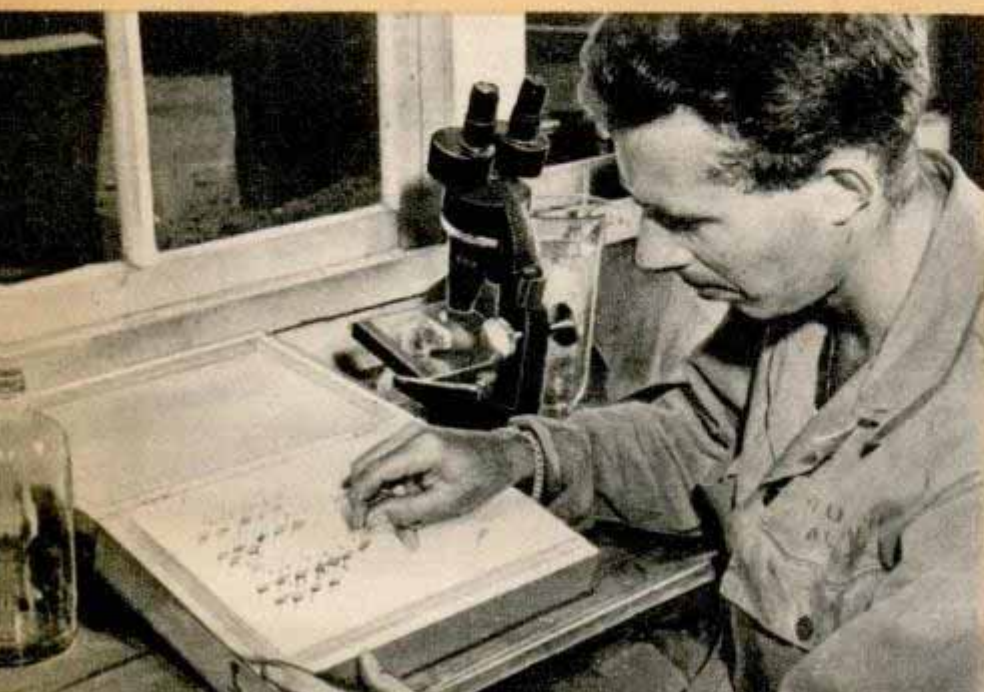
Lee Kaye of Newark, New Jersey, commanding officer of the Army's Cinchona Research Unit. In 1940, Major Kaye, then a civilian, began experimenting with acid extraction for quinine. After joining the Army, he was ordered to continue the research that finally resulted in the new process. The Army encouraged the development mainly for the purpose of providing a solution to the pressing problem of wartime cinchona procurement. Assistance to Latin American countries in their efforts to rid their countries of malaria was a secondary plan. To this end, three types of plant, involving two methods of extraction, have been developed.

Two of these plants use the ion exchange principle. Besides the engine-pumped model, which is designed to process from 500 to 1000 pounds of bark per day, there has been assembled a similar hand-pumped gravity-flow model. This plant operates in a manner identical with the engine-powered model, except for the gravity flow. Agitation of the bark mass is obtained by stirring with a paddle or other hand-operated device. Its capacity is about one half that of the engine-powered plant.

The third plant does not use the ion exchange principle. Instead, the alkaloids are precipitated from acid solution by the addition of strong alkali.

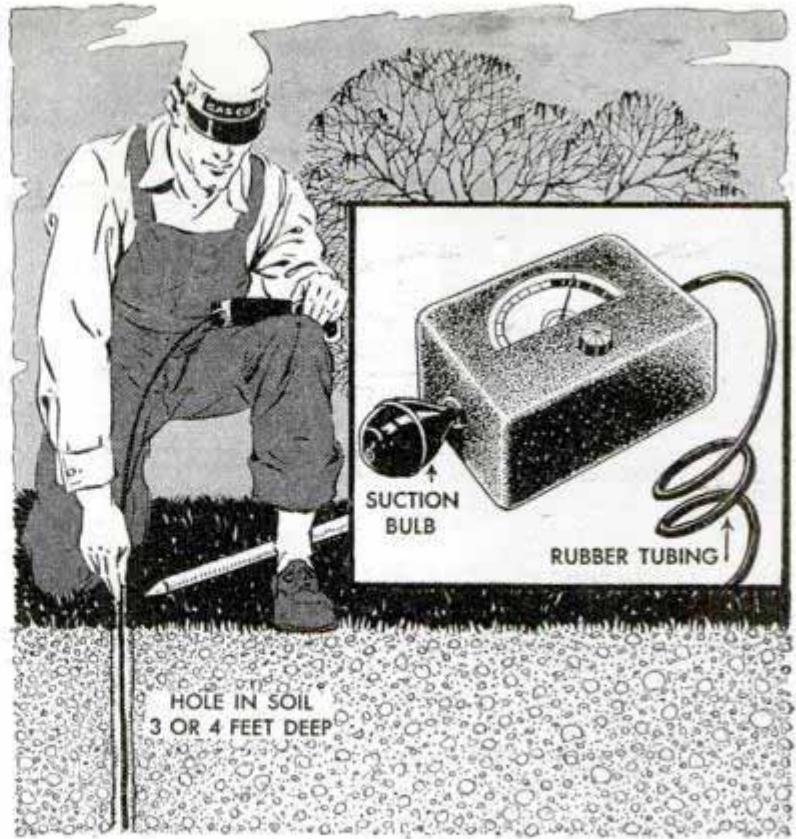
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An assortment of Okinawa mosquitos is mounted for classification



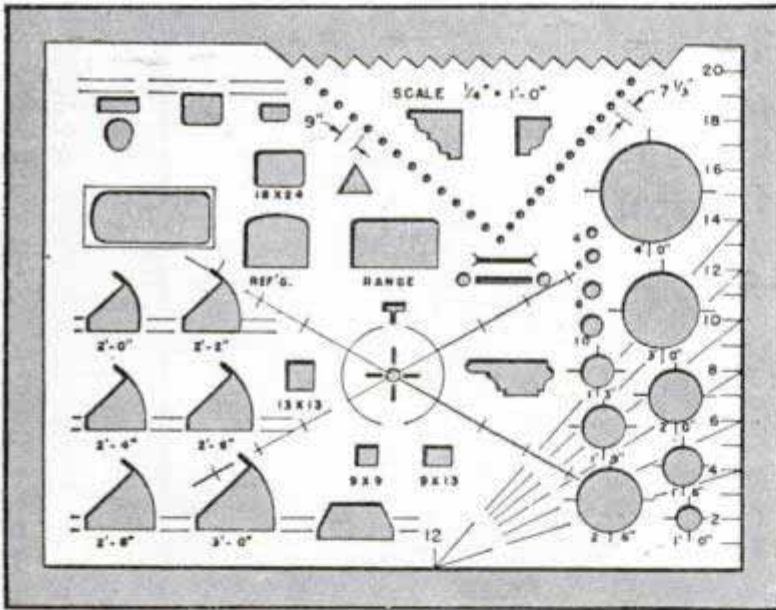
Gas "Detectives" Trace Underground Leaks

Gas companies often receive calls from excited customers saying they think gas is escaping from pipes beneath their yards, causing grass to wilt and threatening the lives of trees. Gas "detectives" dispatched to the scene quickly find out if escaping gas is the trouble maker. Using a bar to make a hole about one inch in diameter in the ground, the gas men insert a rubber tube and draw up a sample of underground atmosphere. The sample passes over a tiny electric wire in a special testing instrument which analyzes the atmosphere. If the sample contains gas, it burns and causes the wire to get hot. This change registers on a dial and tells the "detectives" positively if gas is escaping and in what quantities it is present.



Plastic Cutouts Help In Drawing Plans

Professional or amateur architects drawing plans for new homes will find many uses for a house plan template made of clear plastic $5\frac{1}{4}$ by $6\frac{3}{4}$ inches. Containing cutouts for drawing various parts of home plans, the template is scaled $\frac{1}{4}$ inch to one foot. Of particular help to home planners are cutouts for often-repeated items such as electric outlets. The template also has roof pitch markings for use in laying out the correct pitch for new designs and in checking roof pitch on drawings.

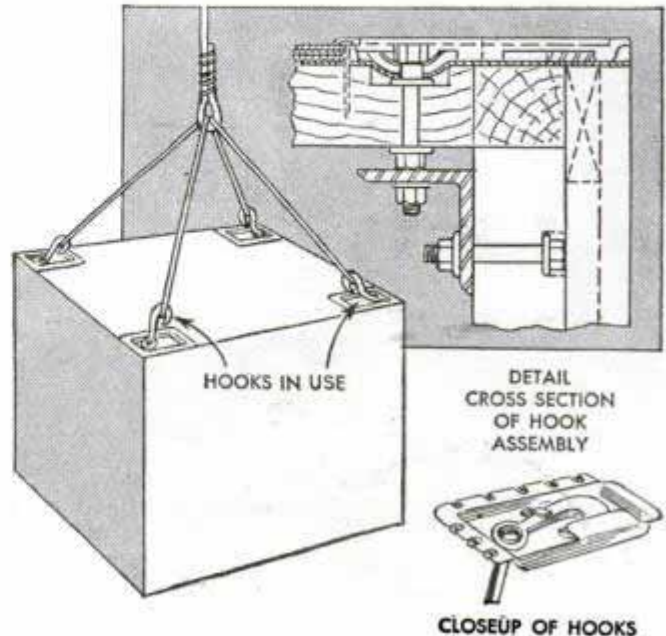


Lift Hooks Made as Part of Box

Loading of cargo for shipment to the Air Forces overseas was simplified by devising a box with lift hooks permanently installed on the four top corners. Capable of lifting 5000 pounds, the hooks fit snugly in frames flush with the top of the box when not being used for hoisting.

"Mirror" Insulation Fights Heat

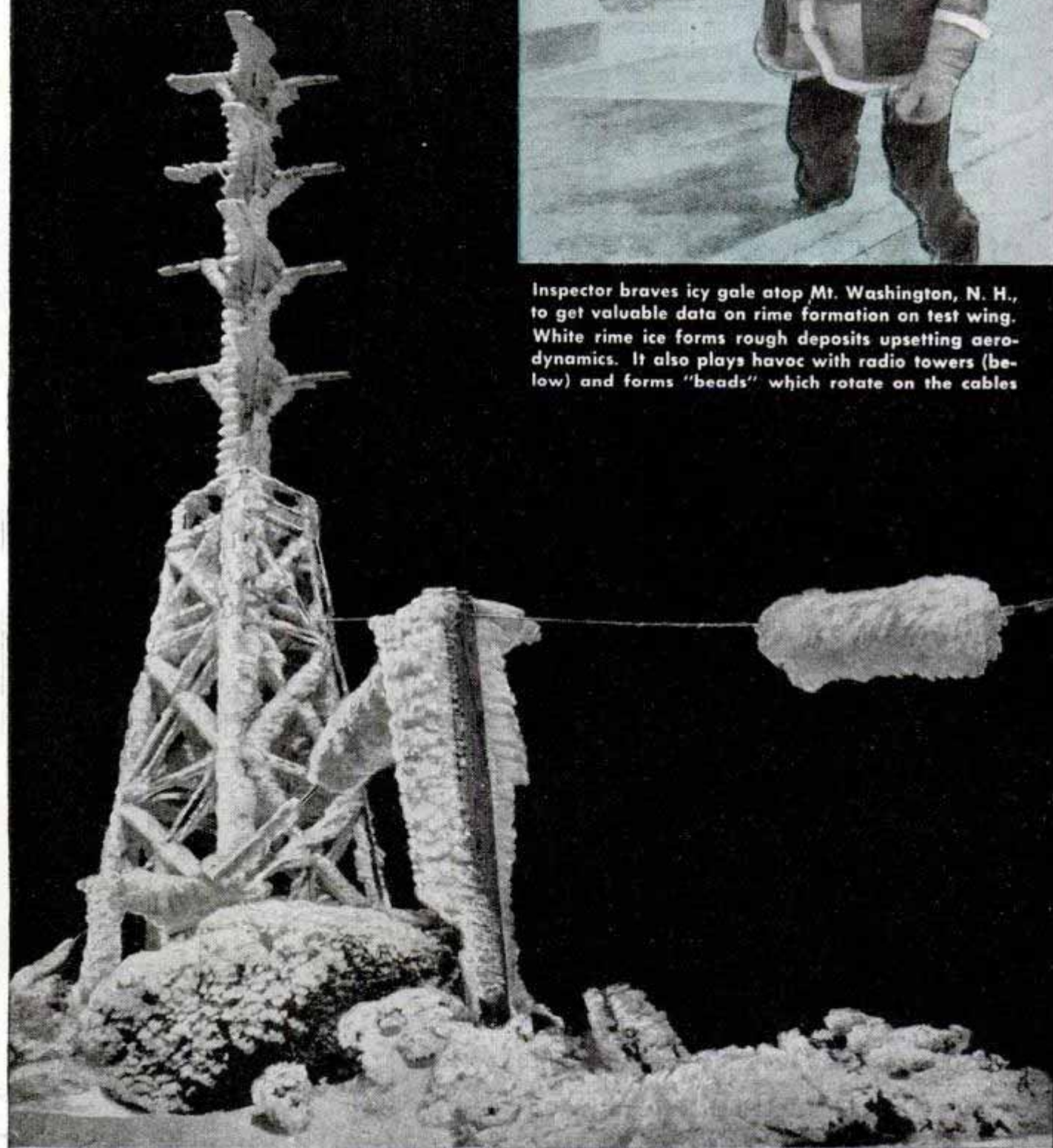
Heat waves bounce from the mirrorlike surface of a new material now used to insulate homes. Consisting of cross-meshed fibers embedded in specially treated asphalt and sealed under heat and pressure between two sheets of "wet strength" paper, the material is installed in sidewalls and on the underside of roof rafters.

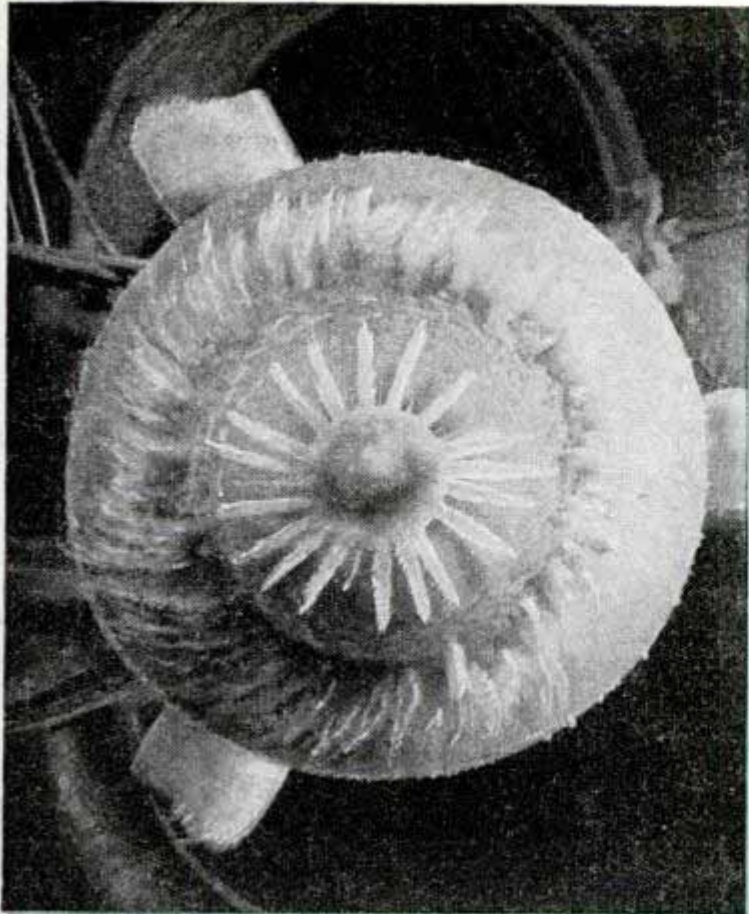


FIGHTING FLYING ICE



Inspector braves icy gale atop Mt. Washington, N. H., to get valuable data on rime formation on test wing. White rime ice forms rough deposits upsetting aerodynamics. It also plays havoc with radio towers (below) and forms "beads" which rotate on the cables





Refrigerated wind tunnel freezes ice formations on propeller spinner and stub blades

on sample airplane parts and De-Icer installations. Much was learned, but certain icing conditions encountered in actual flying could not be duplicated. An exhaustive study of natural icing and de-icing was needed.

So Dr. D. L. Loughborough, senior physicist of the research department, and his associates, Dr. E. G. Haas and H. E. Greene, started to work. Airplanes flying at high altitudes often encounter natural icing conditions severe enough to serve the purpose of research; but long and detailed observations by such flying would be costly and hazardous. So the trio set out in search of the world's worst ground weather that was not too far from the home base at Akron, Ohio.

They found it on top of 6293-foot-high Mount Washington, tallest peak of the White Mountain range in New Hampshire. There, from late September to May, the wind may blow 231 miles per hour, and the temperature slide to 46 degrees below zero, Fahrenheit. Ice-forming conditions may exist as many as 28 days a month.

Dr. Loughborough's crew took along a test section of airplane wing, fitted it with fins, mounted it like a wind vane atop an old water tower near a weather and radio station, and hooked it to control equipment housed in a shed nearby. Throughout the first winter Dr. Loughborough and Greene took turns fitting experimental De-Icers to the wing and observing their behavior in the severe weather.

At the end of the first winter the tangible results were mostly in the form of several square yards of facts and figures understandable only to a physicist. Ultimately this material will be translated into ice-fighting improvements that the ordinary air traveler can see and understand; but at this stage the results of the mountain-top studies are scientific data not yet available for general circulation.

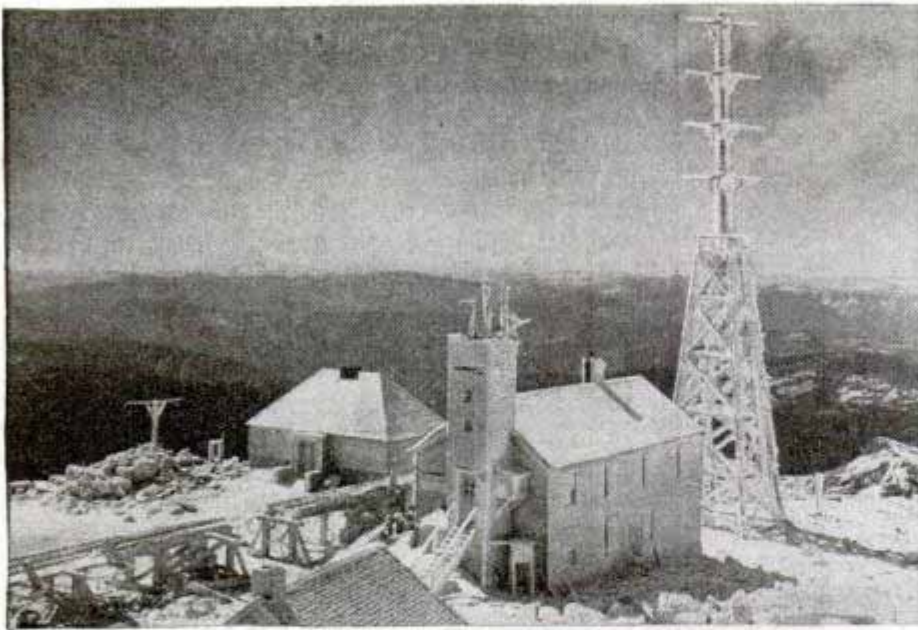
To gather this information, the physicists watched various kinds of De-Icer units operating in the minus-36-degree and 200-m.p.h. weather encountered. They studied placement of the boots with respect to wing and weather. They tested boots with different surface treatments to reduce adhesion of ice. And they gathered some cold facts about ice itself—where it starts to form,

ON A MOUNTAIN top where the world's worst weather howls, a section of airplane wing pivots on its mount like a wind vane. By keeping its leading edge pointed into icy gales, it ferrets out facts that, added to those gathered in laboratories and in actual plane operation, promise safer flying of military and civilian aircraft.

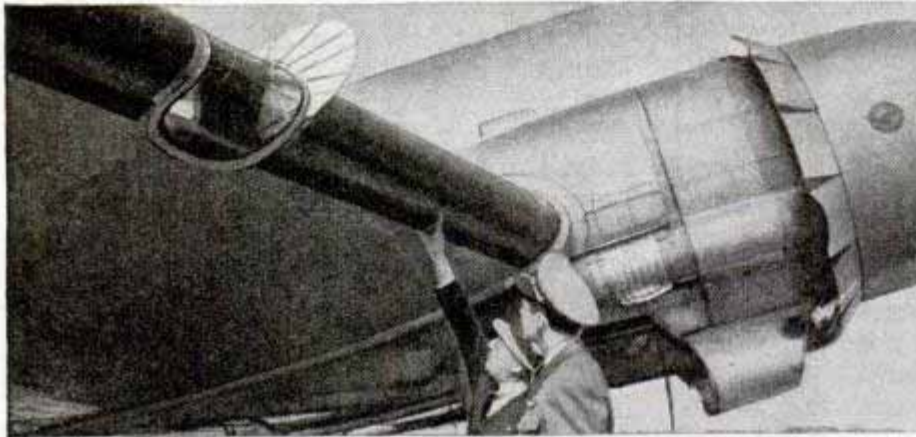
Back in 1929 Dr. William C. Geer, commissioned by the Daniel Guggenheim Foundation to study flying problems encountered in ice-forming weather, conceived the idea of letting ice collect on an airplane, then cracking it so the air stream would carry the pieces away. B. F. Goodrich engineers converted the idea into a workable rubber installation that was named the De-Icer. A De-Icer system includes "shoes" of natural and synthetic rubber attached along the leading edges of wings, tail assemblies, radio antennae and other projections.

When ice begins to form on these shoes, tubes running through them are expanded with air and then deflated. The timed pulsations first crack and then lift the ice film, permitting the air stream to get beneath the ice and peel it off. The De-Icer, by performing this simple chore, has helped make possible year-round operation of both commercial air liners and warplanes.

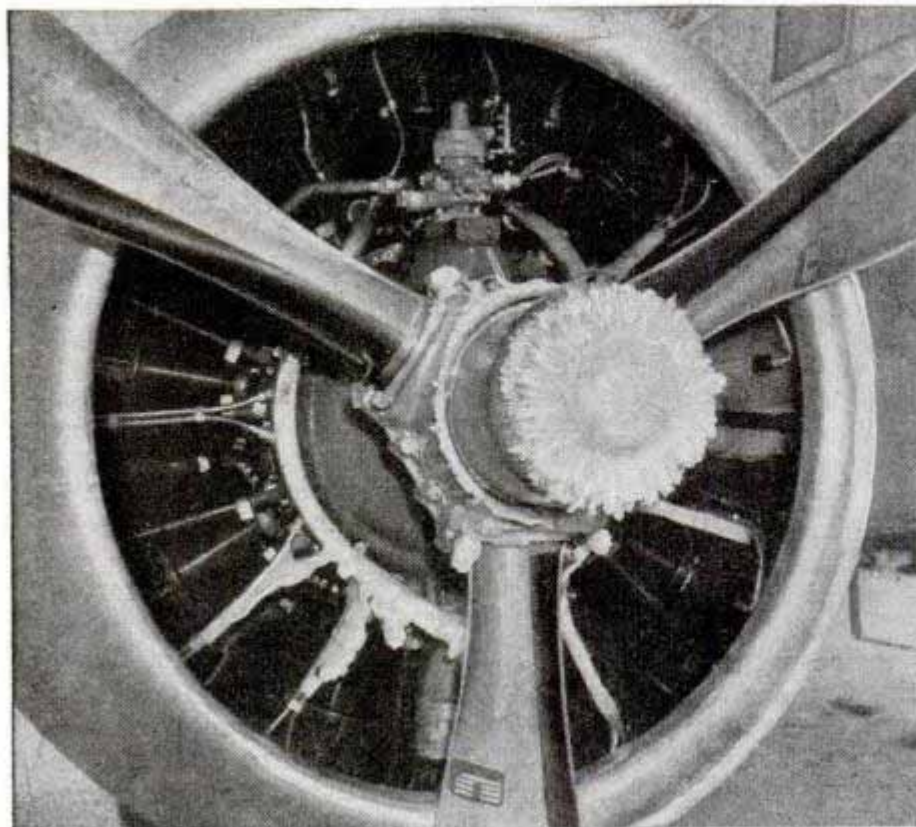
To develop improvements in ice-fighting equipment, Goodrich built the first refrigerated wind tunnel in the United States. By mixing temperature, humidity and air velocity, researchers caused ice to form at will



Ice-covered weather station and FM radio tower near the scene of the experiments. The end of the Mt. Washington cog railway also can be seen



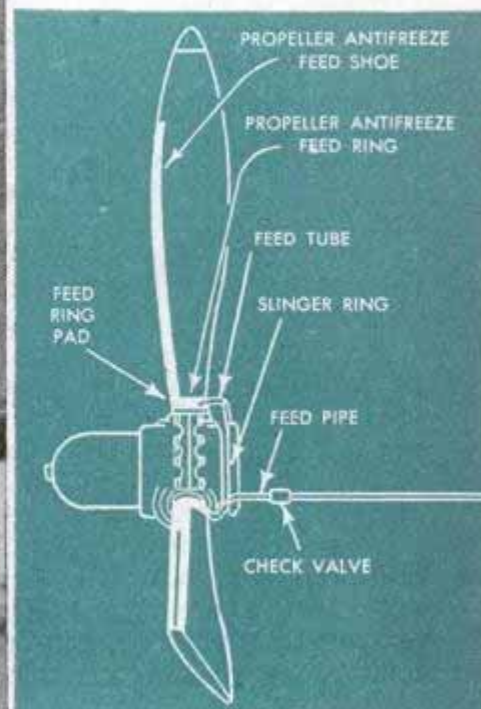
T.W.A. Airline photo
Inspection of De-Icers on wing of a commercial air line plane. Below, propeller equipped with feed shoes to distribute antifreeze over blades

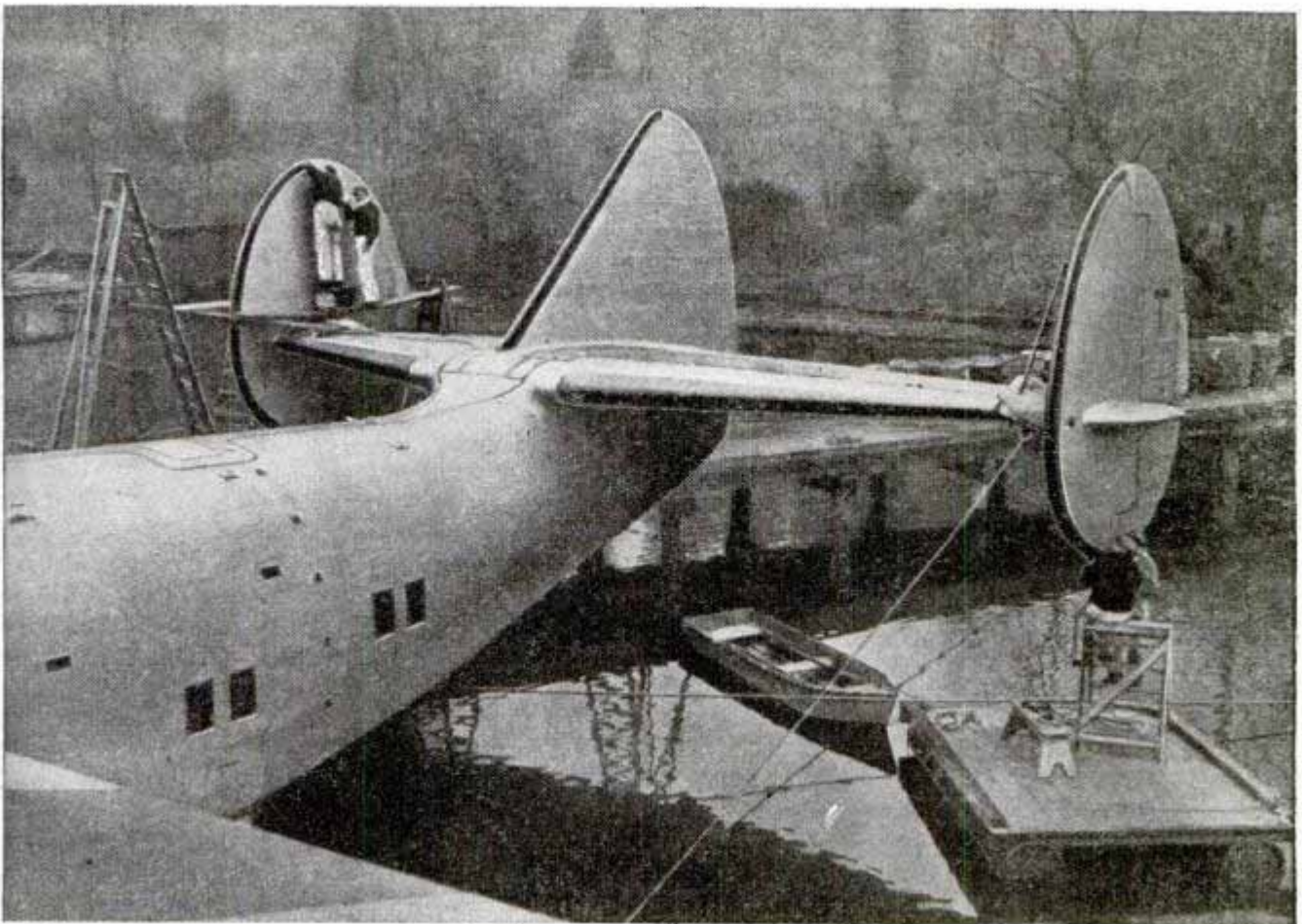


where it sticks most tightly and under what conditions it collects most rapidly.

Not long ago one of the most important advances in the fight against ice was discovered—the chemical treatment of a rubber surface so that ice will not stick to it readily. First step in the treatment is performed at the factory, the final step after the equipment has been installed on a plane. Occasionally the treatment may be renewed in order to maintain high efficiency. By treating part of a test De-Icer and leaving the other part untreated, the effectiveness of the process under different icing conditions is observed easily.

Experience has shown that ice is more hazardous on a propeller than on the leading edge of a wing, pitot mast or radio antenna. Propeller ice, by changing the aerodynamic shape of the blades, may seriously reduce efficiency. It can throw the prop so far out of balance that damaging vibration is set up in the engine and other parts. But perhaps worst of all





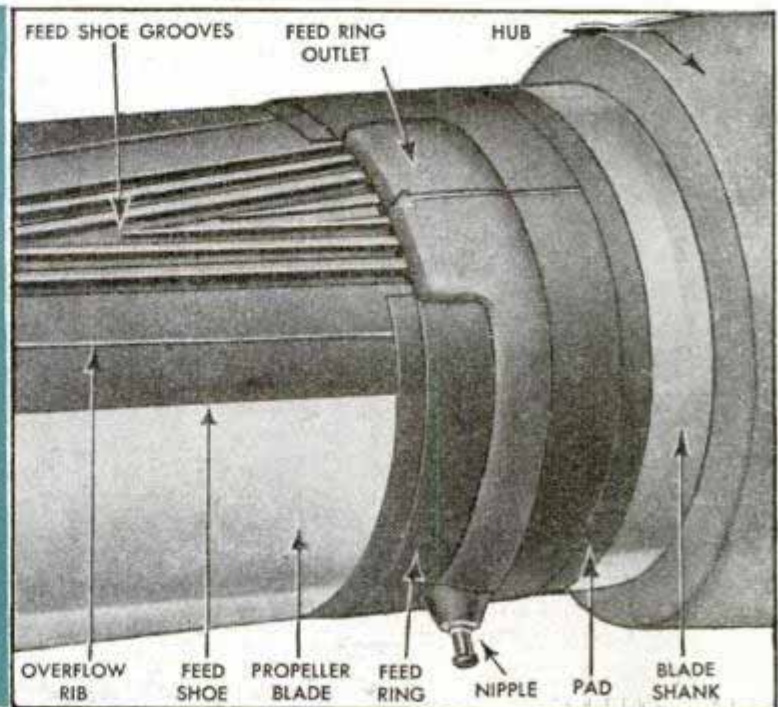
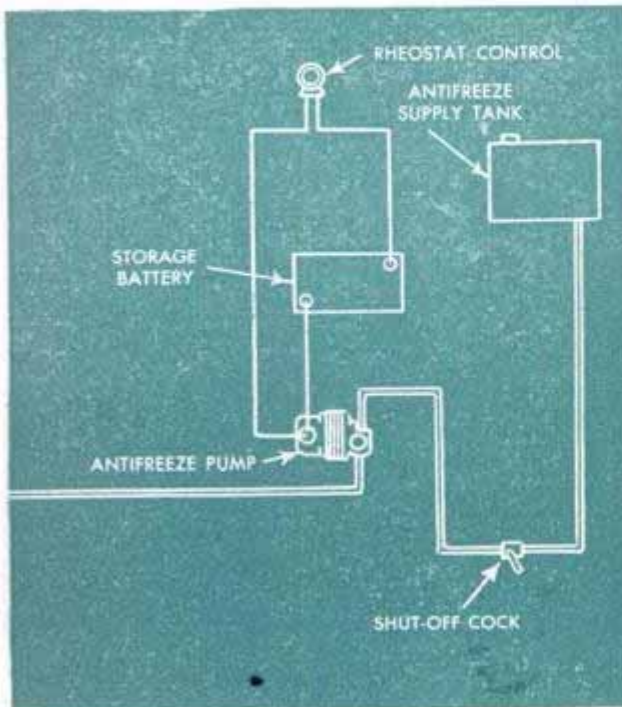
Applying De-Icers to tail assembly of Boeing Clipper. Rubber shoes crack ice off surface after it has formed

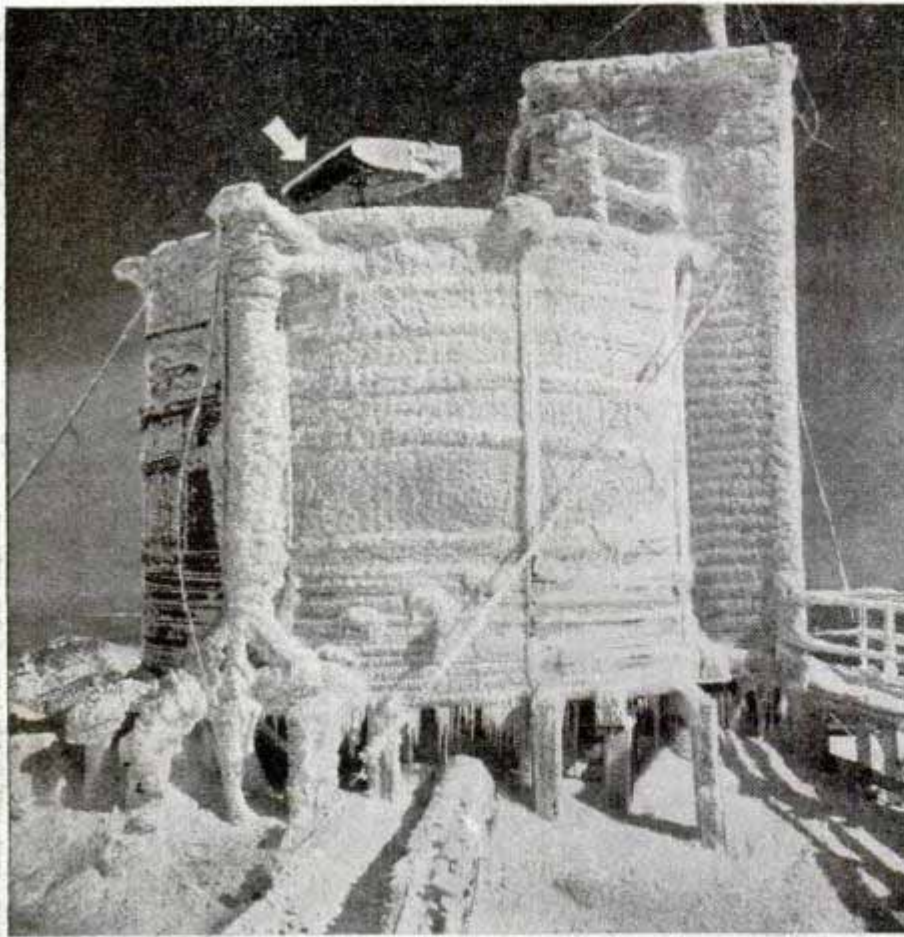
is the disturbance caused when accumulated ice suddenly breaks loose and is thrown off the spinning blades. The sudden unbalancing of the prop and the projectilelike action of the ice easily may prove disastrous.

While ice always is allowed to form on wing and tail before de-icing, it is not desirable to permit any to form on the pro-

PELLER blades. So methods of heating blades and of applying antifreeze solutions to them were developed. Ice fighters worked out a widely used method of feeding antifreeze through a rubber shoe cemented to the leading edge of each propeller blade. The fluid is fed into a rotating ring behind the propeller hub, then through tubes to the shoes. Grooves in the shoes distribute

Diagram in color shows complete assembly for de-icing propellers. Below, shoe and ring on propeller blade





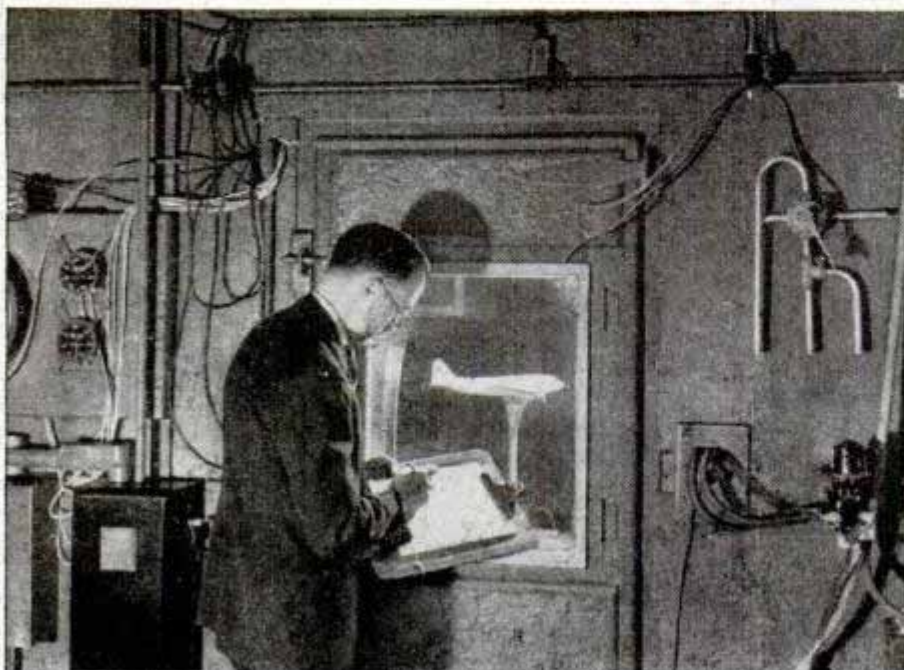
Test wing section mounted atop ice-bound water tower pivots with wind

the fluid over propeller blades for most effective ice prevention.

At the start of the battle against flying ice, knowledge of ice itself was believed to be fairly complete. But since then a lot of new facts have been added, and there still is much to learn.

In most cases, ice forms on aircraft when two conditions are properly related. First, temperature must be less than 34 degrees above zero, Fahrenheit. Second, there

Research staff member observes rime formations on wing of airplane model



The rapidity with which ice can form on a plane sometimes is surprising. Ice may form rapidly when a plane is flying through a layer of cold air and there is, above it, a layer of warm air from which rain falls. The drops of water, striking the cold plane, freeze almost instantly.

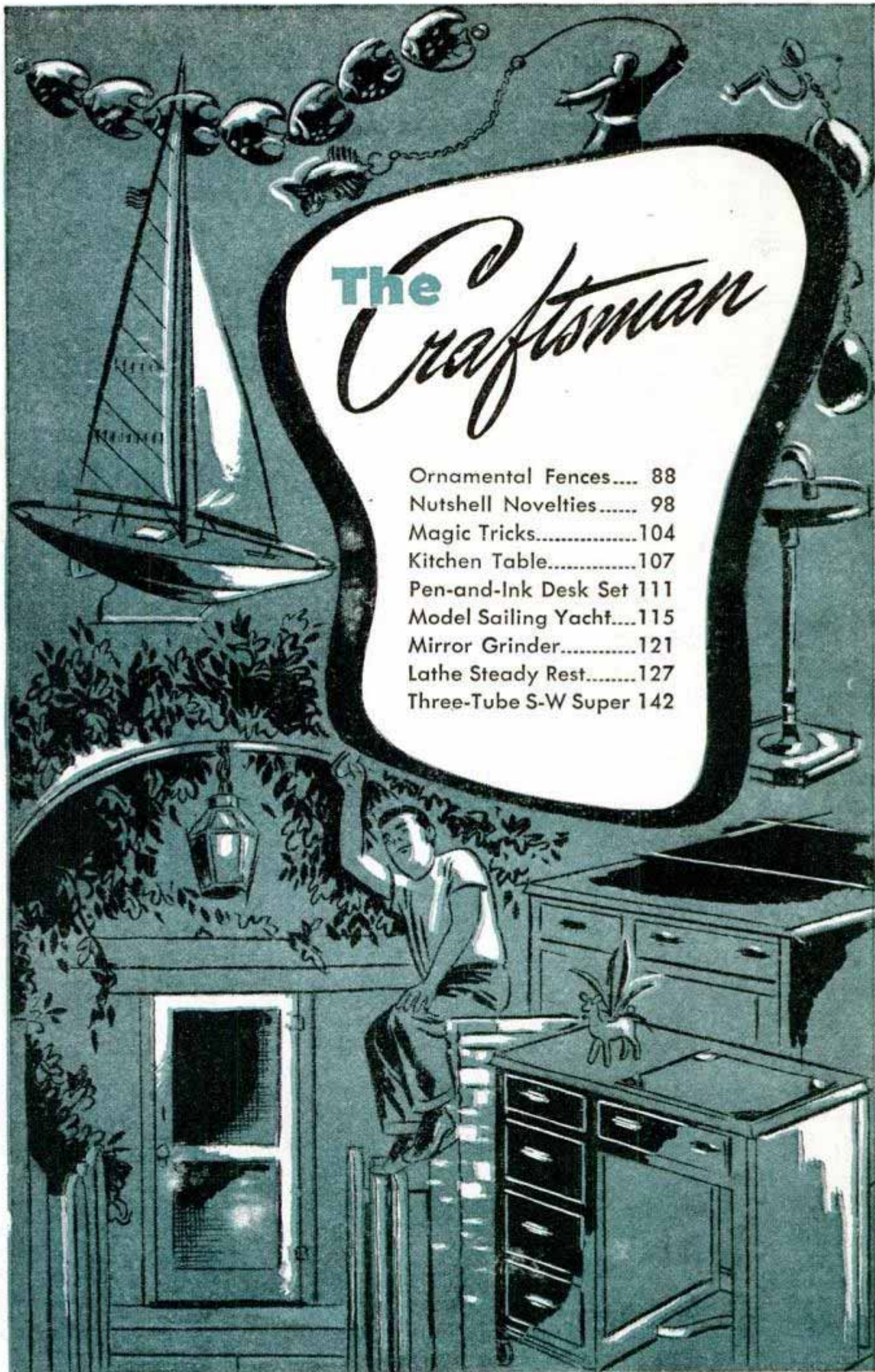
When a plane that has been flying through air below freezing temperature suddenly enters a warm cloud, ice forms very quickly, but doesn't last long enough

to become more than a thin film. Warming of the plane by the higher temperature air melts the ice before long.

Most rapid icing occurs when the temperature is just below freezing and fog particles are large. The fastest accumulation observed during the mountain-top studies was at the rate of five inches per hour.

Ice often forms very rapidly on a thin collector such as a radio mast at right-angles to the direction of flight. For this reason radio antennae wires are strung in a direction parallel with the

(Continued to page 148)



The Craftsman

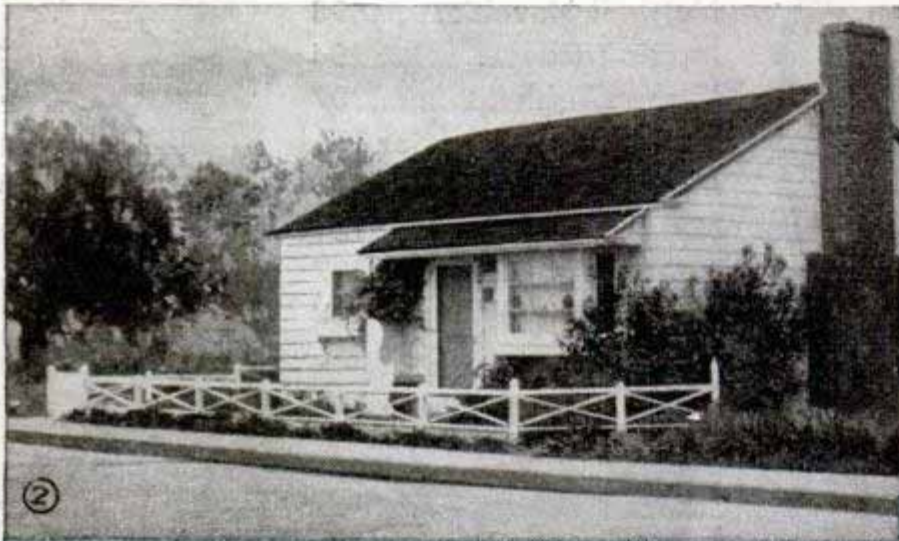
Ornamental Fences.....	88
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Pen-and-Ink Desk Set	111
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FENCING FRAMES THE HOUSE

By Hi Sibley

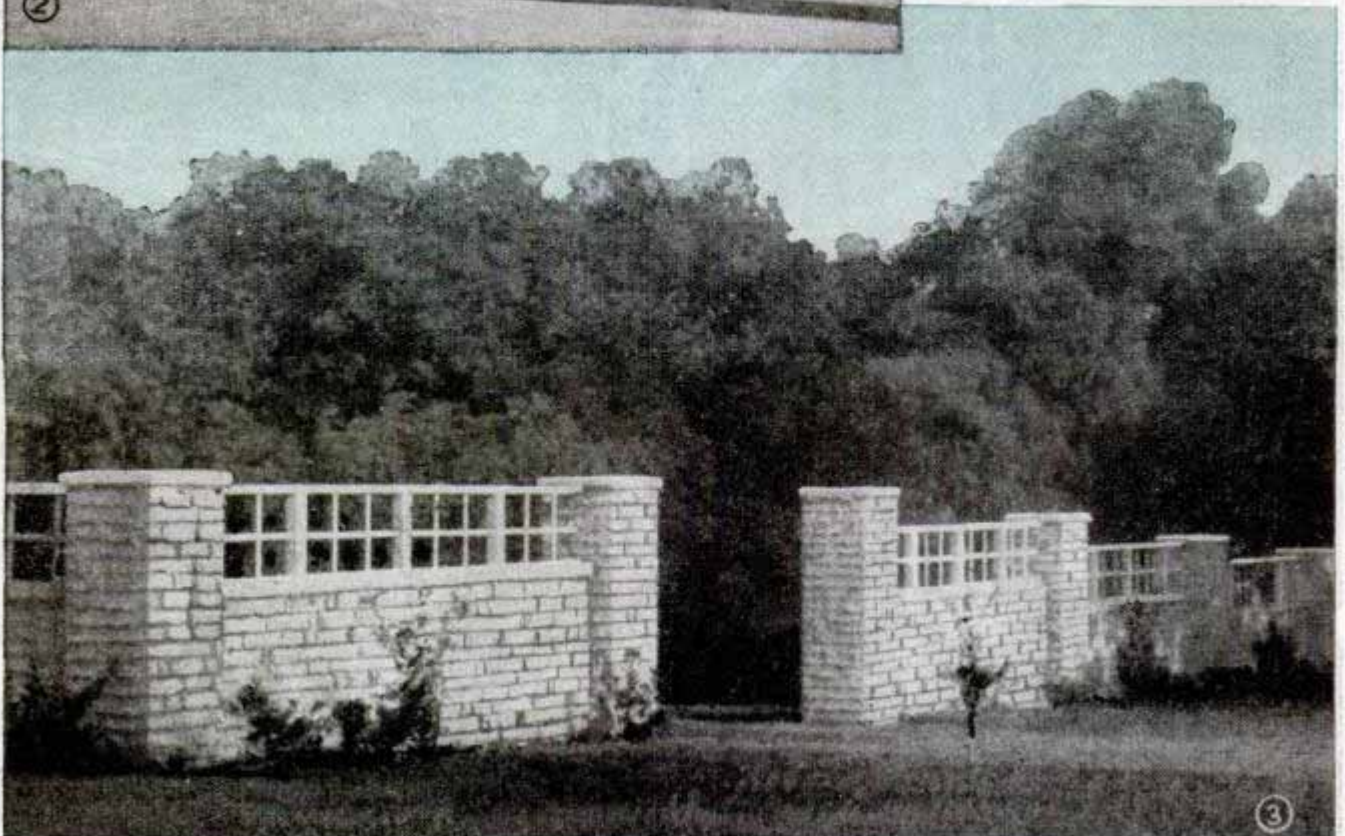


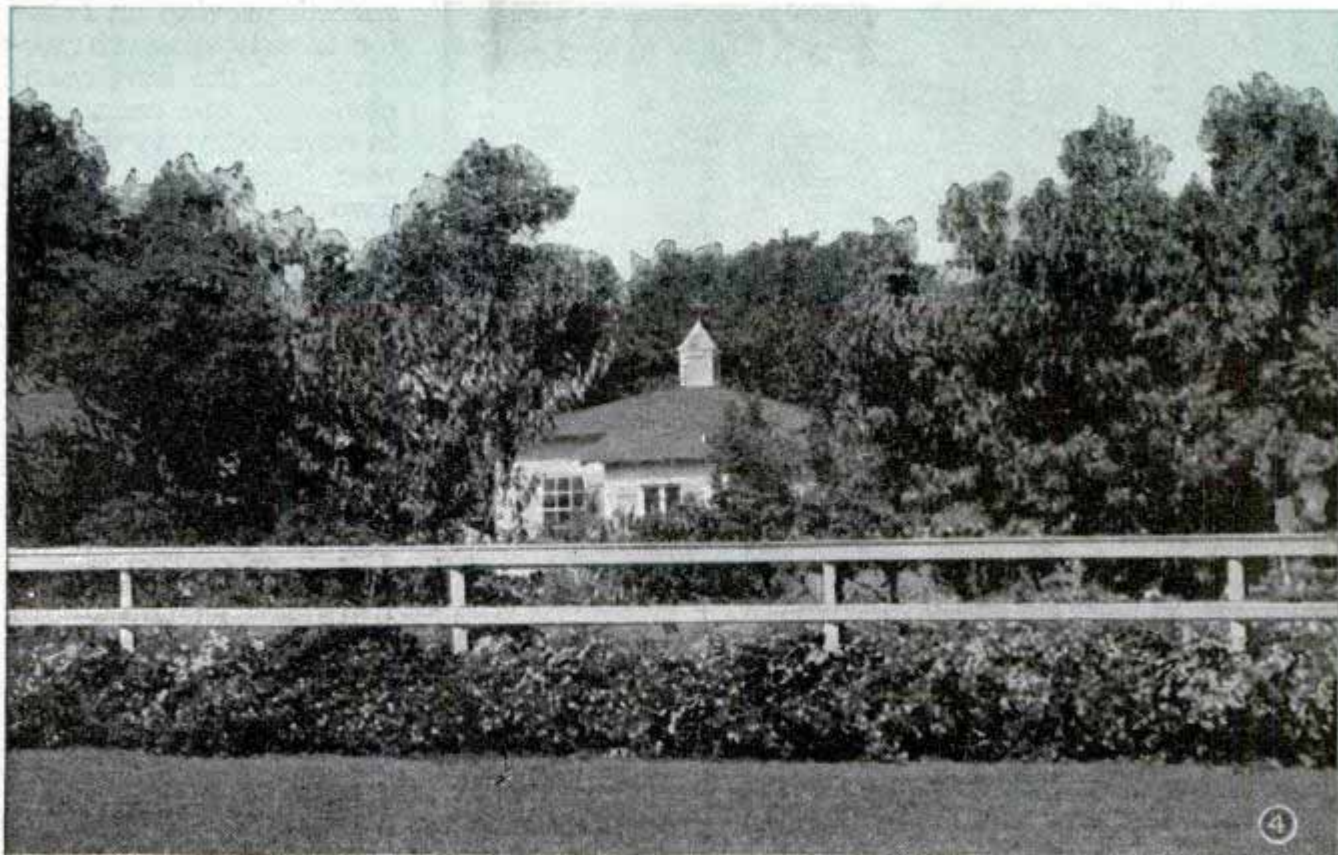
Above, this "rail" fence is made of square stock with hewn or adzed edges. Below, a low X-brace design frames a small cottage effectively



A FENCE does for the house what a frame does for a picture. It bounds the area, and just as a frame may add to or detract from a picture, so may the fence do much to improve or impair the appearance of a house. The style chosen should blend with the general architecture. To use extreme examples, a Georgian house would not look well with a split rail fence, nor would a log cabin appear natural surrounded by a brick wall. However, many of the styles shown here will blend with most types of architecture.

When building a fence, the posts should be spaced an even number of feet apart; 6, 8 or 10 feet, for example. The reason for this is that the 2 by 4-in. lumber that forms the top and bottom rails of most fences comes sawed in such lengths, or multiples of these dimensions, and can be cut without waste.



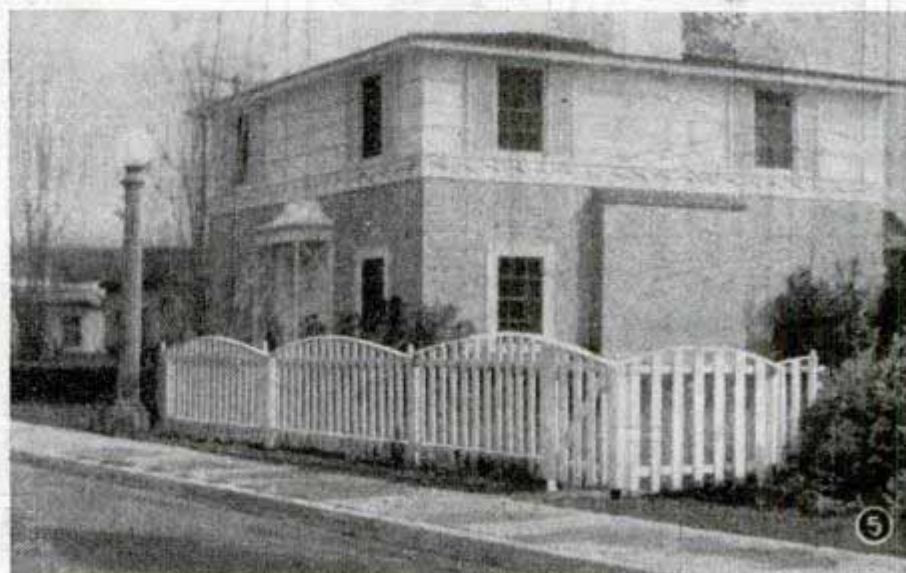


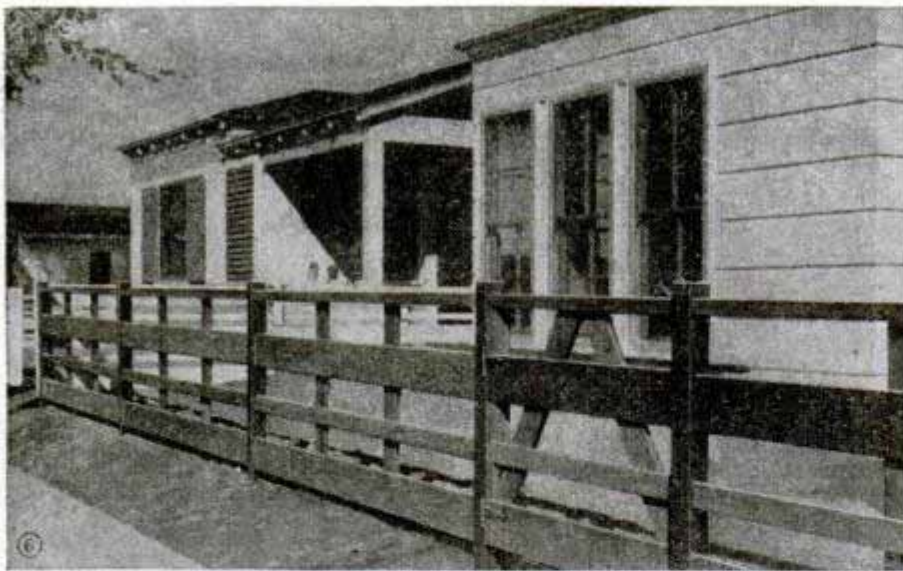
But if the design is best with the posts spaced an odd number of feet, as shown in the details of Fig. 7, a 7-ft. length can be cut from a 14-ft. piece and a 9-ft. span cut from 10-ft. stock without much waste due to the lap past the posts. Figs. 1, 2 and 3 show wide variations in the design of fencing which has been adapted to the setting. In Figs. 1 and 2 notice how the fence has been especially designed and located to complement structural details of the house in both cases. In Fig. 3 the heavy, massive architecture of the wall-and-fence combination borders a large landscaped area most effectively. In Fig. 4 the simple lines of the board fence unobtrusively supplement a landscape largely natural in its arrangement and add a foreground detail that is pleasing to the eye at any season. Moreover, the fence serves the additional dual purpose of defining the boundaries of the property and providing a backdrop detail for the low, flowering shrubs bordering the grassed area in the near foreground.

Fig. 5 shows how another fencing problem has been worked out with the architecture of the house and the boundaries of the property in mind. To break up the geometric pattern formed by the vertical and horizontal lines of both the picket

fence and the house, tops of the pickets have been cut and fitted on a radius and the regular curve thus formed is further accentuated by nailing a thin wood strip over the curved ends. The gate in this particular fence is so constructed that it forms part of the major curve, as you can see from the photo and the detail in Fig. 7. Thus the long sweep of the curved strip has the effect of lengthening the spans between the posts and makes the area enclosed appear larger and more spacious. Such a design is especially effective where the fence must be near the house, as on a small lot.

Other examples of the application of complementing designs are those shown in Figs. 6 and 8, both of these following to a certain degree the lines of the building. Both houses are of the rambling "ranch-





Long horizontal spans are broken up by adding the vertical lines of two uprights which are equally spaced between the main supporting posts

house" styling and in each case the character and nature of the property made it necessary or desirable to locate the fence near the building. In the first design, Fig. 6, note that the long horizontal spans are broken by the addition of two uprights equally spaced between the posts and that the gate is clearly defined by an inverted "V" formed by slanting uprights framed into the panel of the gate. There being no shrubbery nearby, the fence was stained with creosote to a weathered brown color which gives pleasing contrasts.

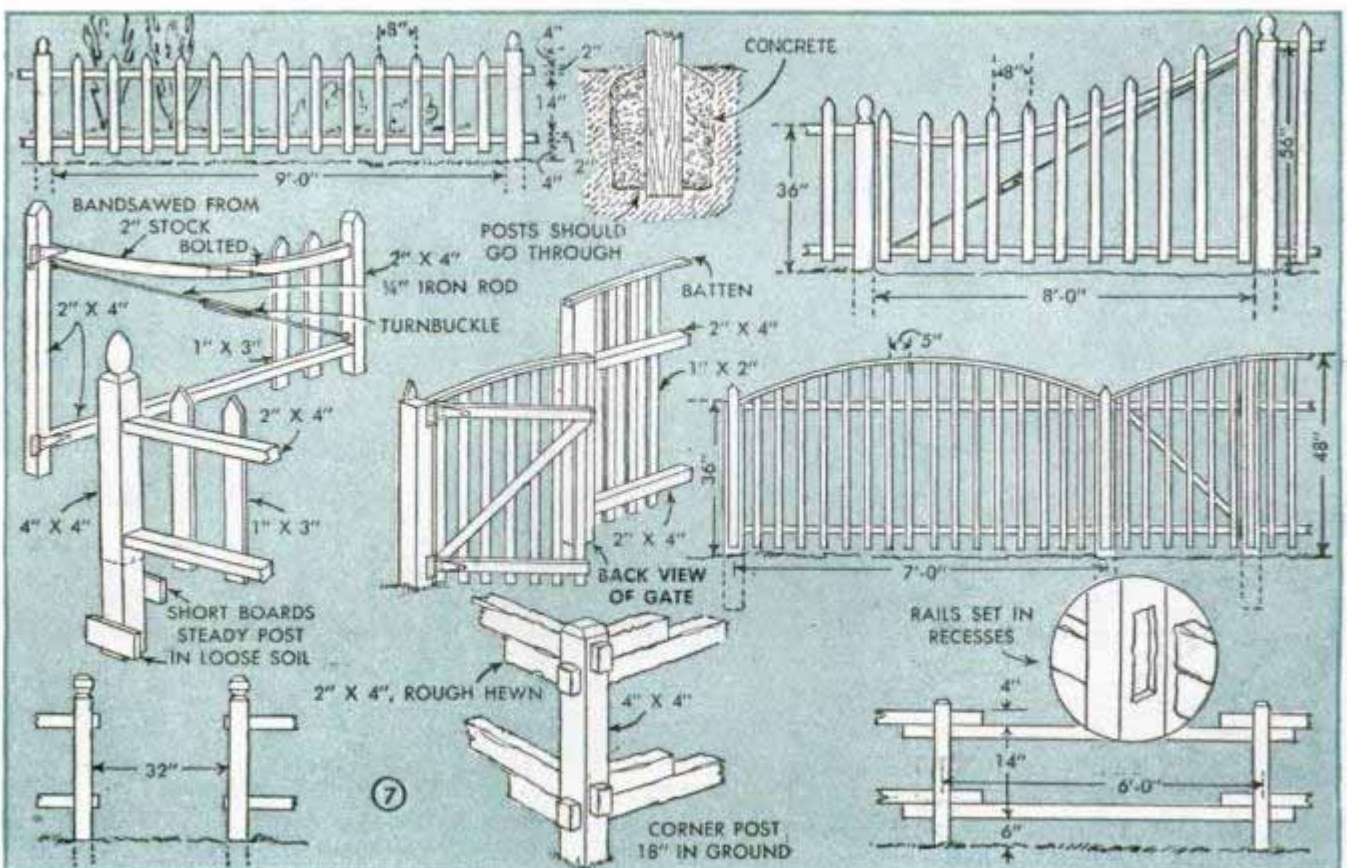
In Fig. 8 the fence is more nearly a part of the architectural plan, inasmuch as it serves only as a partial enclosure. The horizontal boards, of equal widths equally

spaced, provide an arbor for intertwining shrubbery and the long spans obviously are calculated to complement the low roof lines of the house. Two other designs, not pictured but detailed in Fig. 9, not only are of wide utilitarian application but are particularly effective when judiciously arranged with frame homes of the colonial or Cape Cod styling located on medium to large landscaped grounds.

Notice that the fence detailed in the lower view, Fig. 9, features a

wide board in the center between top and bottom boards of approximately half the width of the center member. The design detailed in the top view, Fig. 9, is of the popular X-brace style with a bottom board below the lower horizontal stretcher. This particular styling also is effective as a background for low, dense shrubbery due to the angular lines of the X-brace design, which give an open-panel effect.

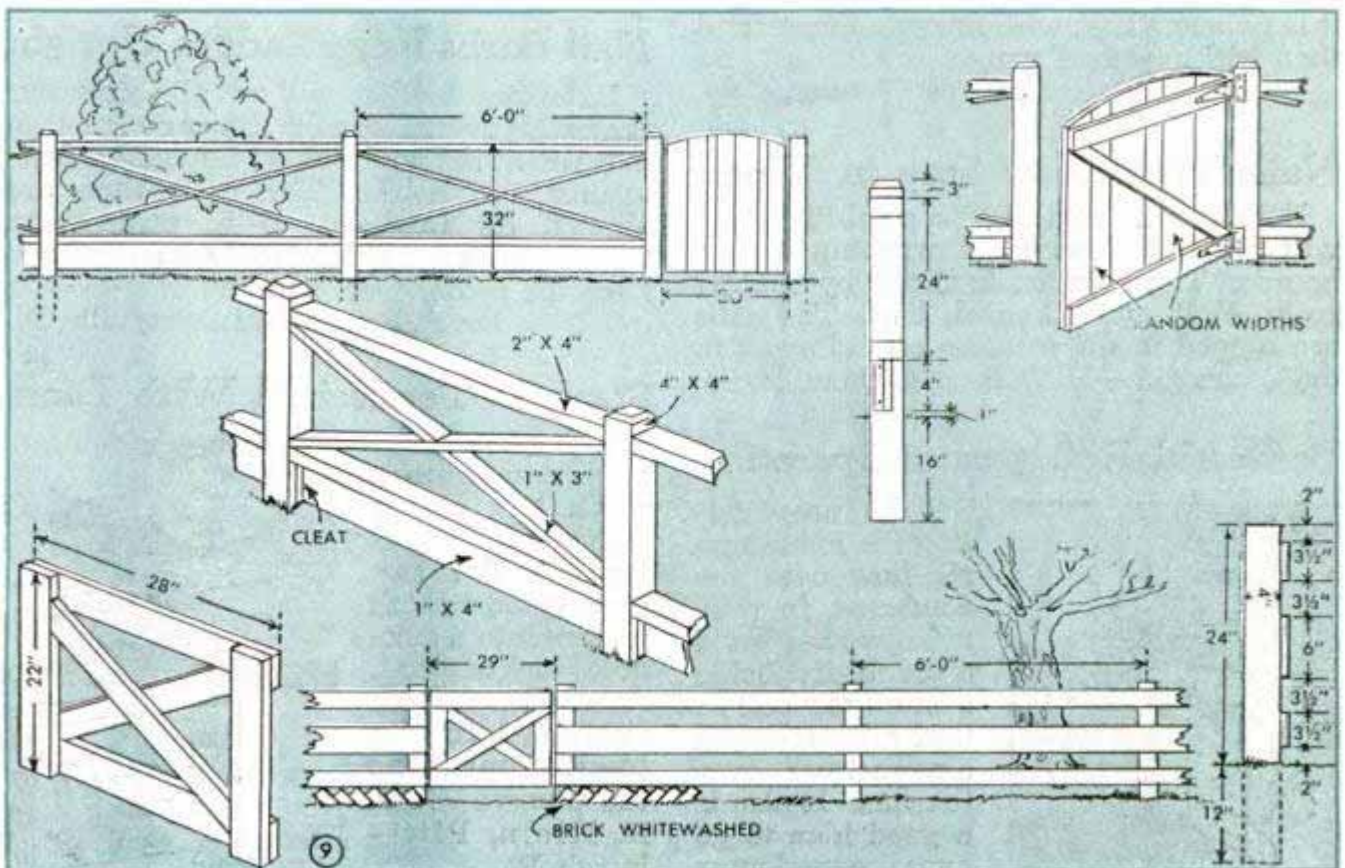
In building fences of the types pictured and detailed the selection of suitable materials and fastenings is quite important. Posts should be of enduring woods such as red cedar or oak, and the boards, pickets and rails may be of cedar, white pine or cypress. Either rough-sawed or surfaced



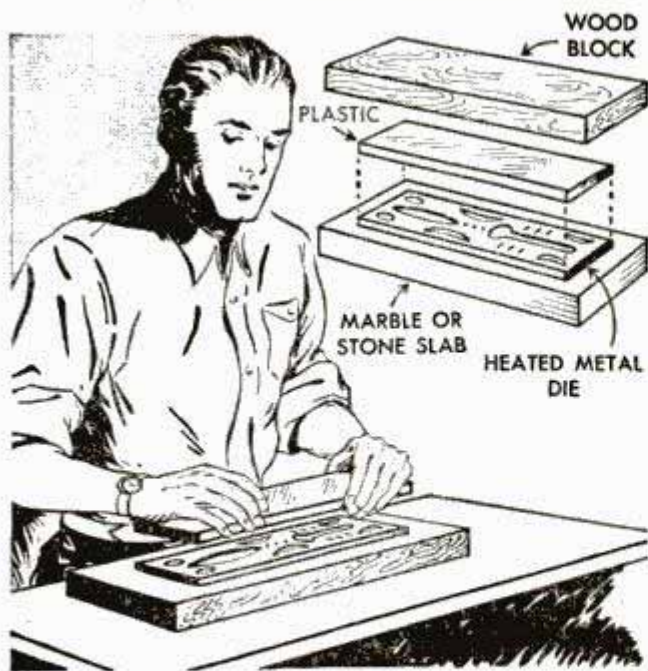


boards can be used, although those of the former grade are much more difficult to paint. In setting posts permanently first creosote the lower ends up to the ground line and then set in concrete, making sure that the lower ends project as shown in the upper center detail of Fig. 7. Fasteners, such as nails, screws, bolts, hinges and hooks, used in assembling any of the fences shown should be zinc-coated or otherwise made rust-resistant. In any case, always use coated nails as they not only resist rust for long periods but hold much better in soft woods. Unless colors are demanded by some special outdoor decorative scheme, fences are commonly painted white, using an outside lead-and-oil paint, or are stained with creosote which also acts as a preserva-

tive. The fence will be much more enduring if you take the time to apply paint to the surfaces of all joining parts. If you assemble the fence first and then paint it you leave a portion of the surfaces unprotected. Moisture works into the joints and is absorbed through the uncoated wood. This causes swelling, loosening of the nails and eventual checking and decay. The best way is to prime the wood and then apply one finish coat before assembly, but if you're in a hurry apply the priming coat to the joining surfaces as you assemble the parts. It's advisable to do this when finishing with either lead-and-oil paint or creosote. The primer should be thoroughly dry before applying a second coat, otherwise peeling is likely to result.



Embossed Metal Is Used as Die To Decorate Plastics



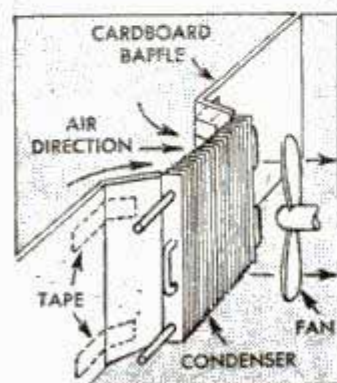
By heating a piece of metal having an embossed design and using it as a die, thermoplastics can be decorated for use as costume jewelry, vanity and cigarette boxes. The heated metal is placed on a marble or stone slab and the plastic is laid on it under a wooden block, which is tapped with a mallet to make the impression. When embossed, the plastic is filed to remove the ridges of material formed by the die, then the depressions are colored with nail polish and a second piece of plastic is cemented over the impression with acetone to cover the design. When the piece is cut to shape, it is polished first with fine sandpaper and then with jewelers' rouge.

Cpl. Walter Lessick, Denver, Colo.

Nails Treated to Stay in Wood

Nails can be coated with a solution that will prevent them from working out of boards. The solution is made by mixing rosin, ¼ lb., with benzol, 1 qt. The nails are dipped in the solution and allowed to dry overnight.—H. W. Swope, Danville, Pa.

Baffle Aids Refrigerator Operation



To be sure of getting the maximum air flow over the condenser in your refrigerator, build a cardboard baffle around the coil so that all entering air must pass over the fins. It also is a good idea to go over the condenser

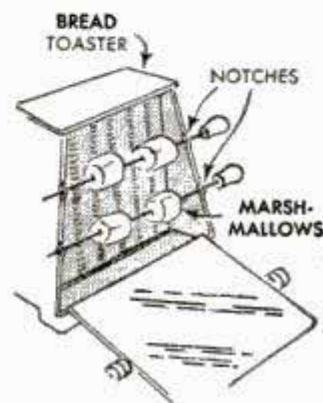
occasionally with a small brush to remove dust or any other obstructions. Dust or dirt will act as insulation and retard the transfer of heat from the condenser to the air.—C. D. Bassett, Ypsilanti, Mich.

Patch for Holes in Linoleum

Holes in inlaid linoleum can be patched so that they are hardly noticeable. To do this, small chips or shavings are scraped from a scrap piece of linoleum of the same color and pressed tightly into the hole, a little waterproof household cement being used as a binder. After the cement is dry, the patch may be smoothed with fine sandpaper.—Ralph Mayer, Woodbridge, N. J.

Marshmallows "Done" in Toaster

An open-type bread toaster of the kind shown is excellent for preparing marshmallows indoors. Holders are made by fitting one end of a straight piece of wire with a drawer knob to serve as a handle. The free end is pointed with a file. Also, notches should be filed in the sides of the toaster frame to hold the wires so they can be rotated until the marshmallows are an even golden brown.



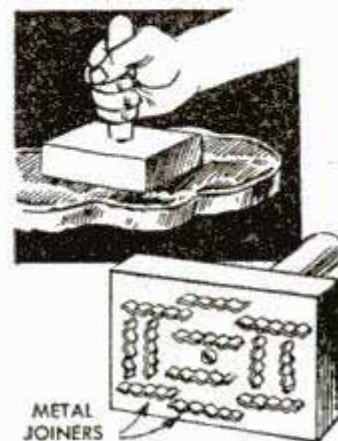
Nail Barbs Keep Ladder Upright

Extension ladders will not slip sideways if a nail is driven into the upper end of each side rail at the point where the ladder rests against the house. The nails then are clipped off to leave ½-in. projections. These are filed to a point and act as barbs to keep the ladder from slipping.

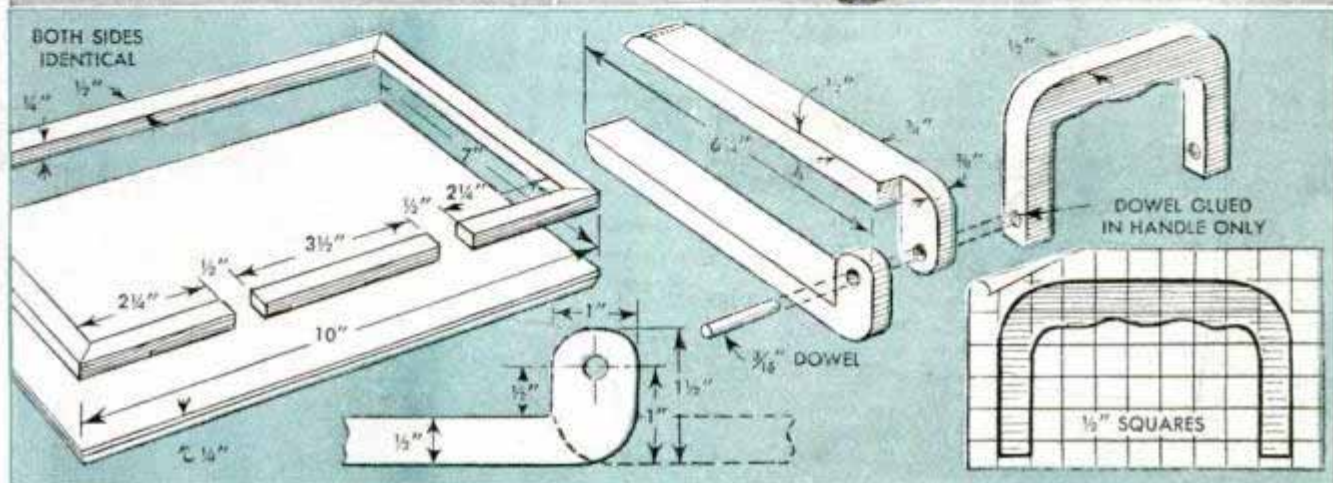
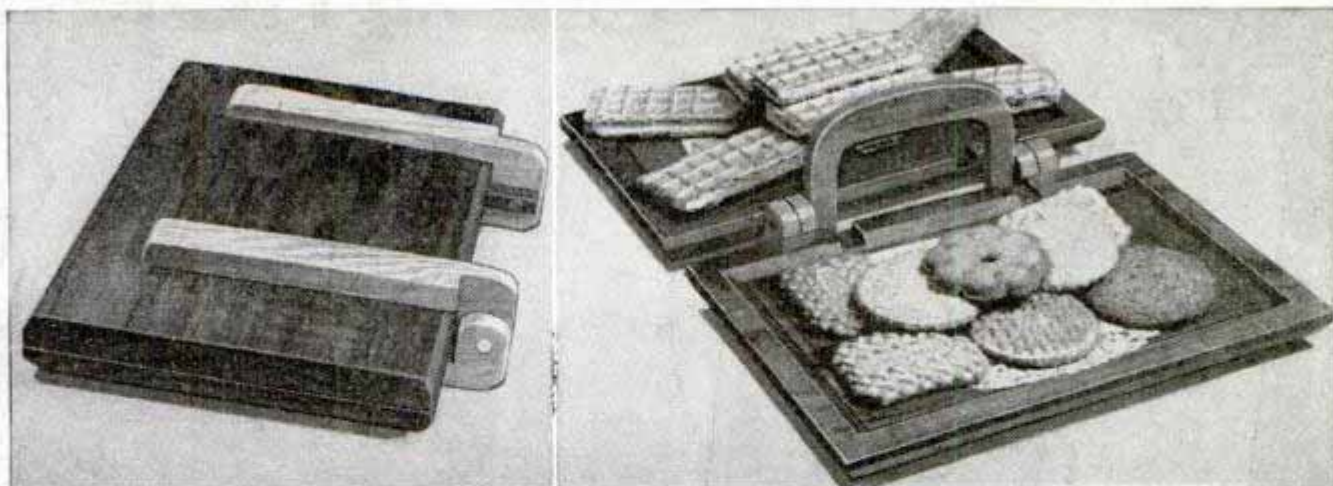
Dr. R. E. Sayers, Libertyville, Ill.

Steak Is Tenderized With Dicer

You can tenderize your own steak with the dicer shown here. It is made by driving corrugated metal joiners into a suitable block of wood. A wooden handle fastened to the block completes the utensil.—Mrs. R. Klein, Pittsburgh, Pa.



Snack Server Folds Into Small Storage Space



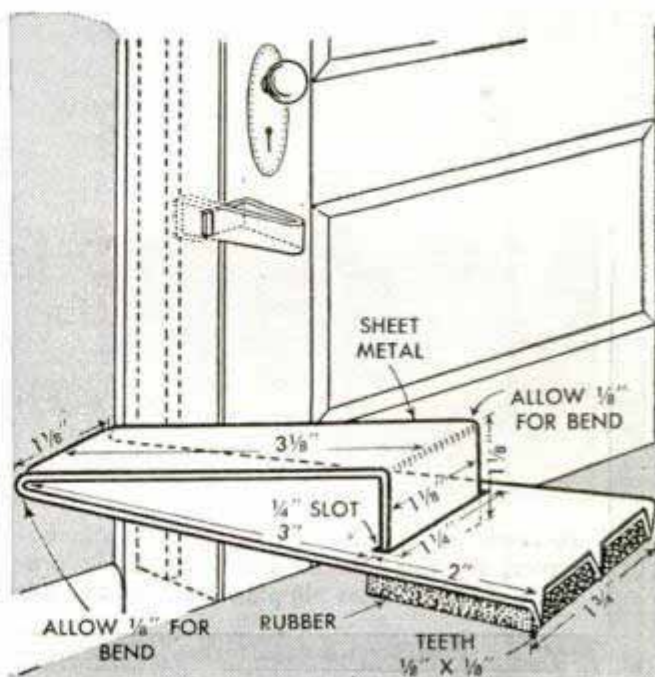
Built of maple and walnut, this snack server folds like a book and does not require the storage space that most trays do. The two halves of the tray are made of walnut which is cut to the dimensions shown on the left side of the detail. Construction of the maple hinges is indicated

in the center and the walnut handle is shown at the right. After assembling the hinges and the handle, glue the hinges to the halves of the tray, using casein glue. To finish the server attractively, apply several coats of shellac rubbed with steel wool and then wax.—Elma Waltner, Hurley, S. D.

Snap Lock Can Be Substituted for Tumbler Type Device

One traveler found this snap lock useful when staying in a room where the door did not have a tumbler type lock. It is cut from light sheet metal and bent to the dimensions shown in the detail. A pad of sponge rubber 1 3/4-in. square is glued to the underside of the longer arm. To use the lock, press the teeth against the jamb and close the door. The shorter arm will snap out and hold the door closed against the short lip of the lock. Pressing the two arms together will allow the door to be opened.

Joseph E. Sullivan, Jackson, Mich.



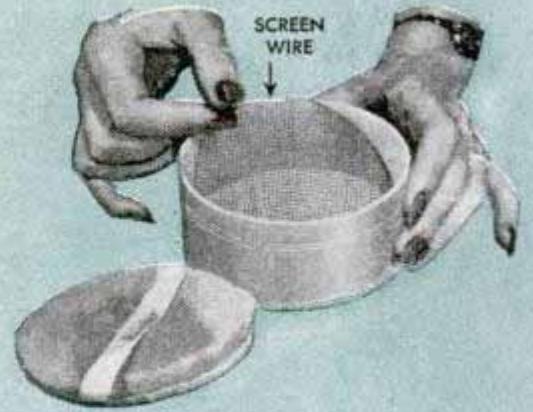
Lacquer Will Preserve Linoleum

If linoleum shows signs of wear, a coat or two of clear lacquer will help preserve the surface. If solid or liquid floor wax is applied over this finish, it will, in turn, act as a further preservative.

Solving HOME

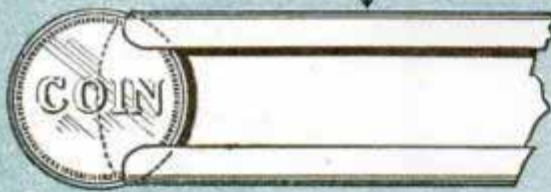


Kept in the supply pipe of a kerosene stove, a screen door spring is worked in and out to clean the line. It is left in after the pipe is capped



If screen wire is cut to fit inside a powder box and laid on top of the powder, only the proper amount will sift through when the powder puff is used

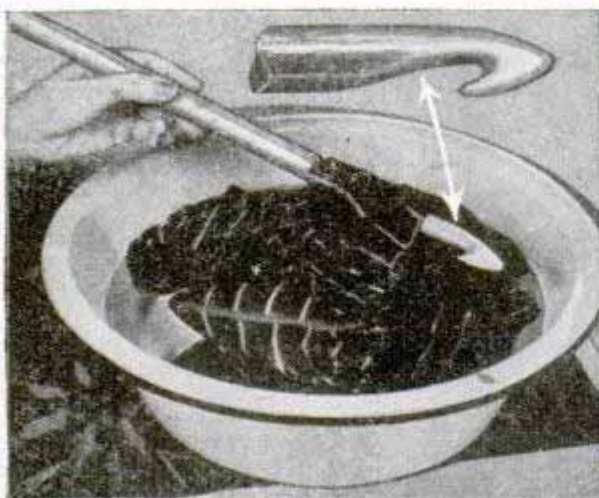
FLAT-TYPE CURTAIN ROD



By wedging a coin into the edge of a flat-type curtain rod, curtains may be slipped onto the rod with a minimum of difficulty



One housewife uses an empty egg box for a spare sewing kit. Scissors and a pin cushion are secured to the lid with cellulose tape



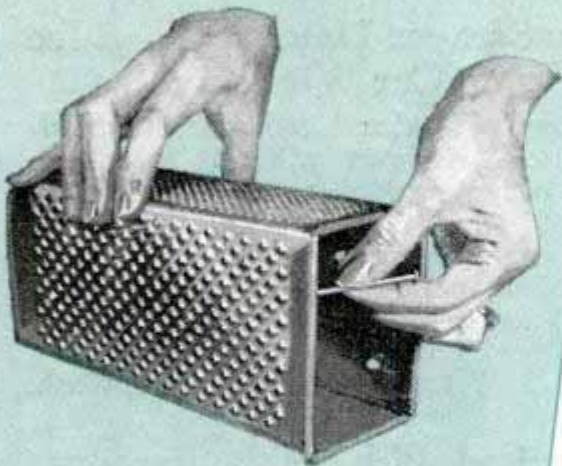
To avoid burns when handling clothes in hot water, try this hooked stick. The hook prevents clothing from slipping back in the tub

ADDITIONAL HOLES PUNCHED



A rubber nipple, punched with extra holes, can be slipped over the neck of a beverage bottle and then be used to sprinkle clothes

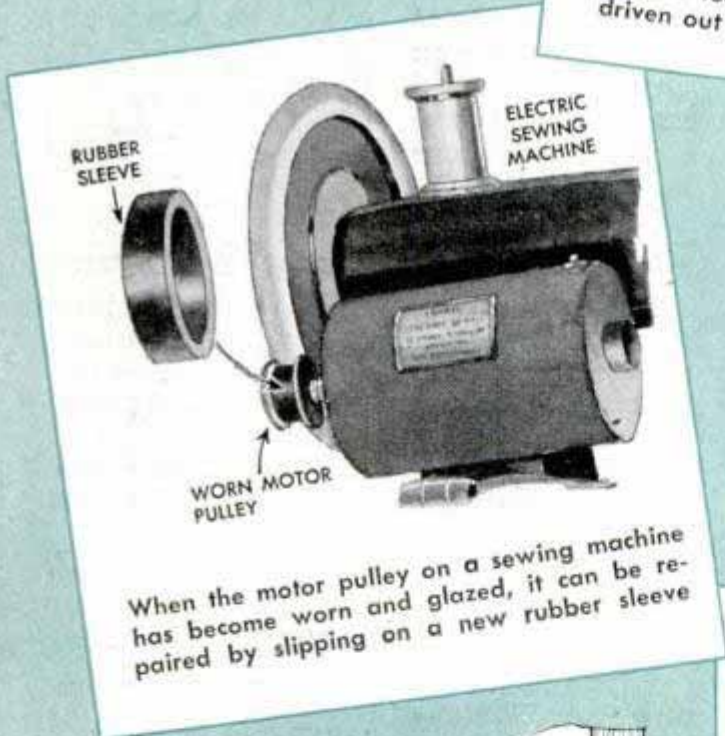
PROBLEMS



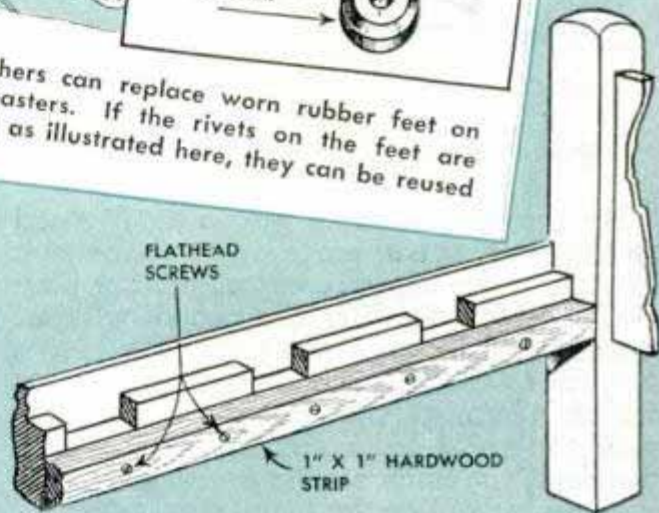
The perforations on a food grater may be so clogged the grater will not work well. It can be cleaned by forcing a sharp-pointed nail through the holes



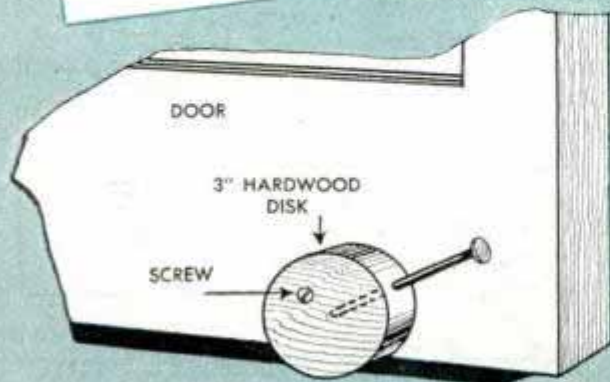
Bib washers can replace worn rubber feet on electric toasters. If the rivets on the feet are driven out as illustrated here, they can be reused



When the motor pulley on a sewing machine has become worn and glazed, it can be repaired by slipping on a new rubber sleeve



Hardwood strips screwed to the inside of bed rails will hold the slats in place. The strips should run the length of the rails

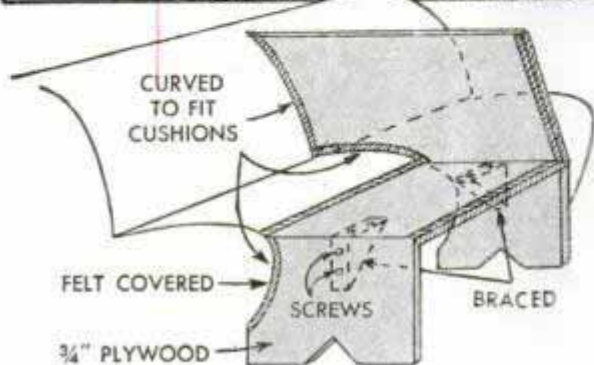
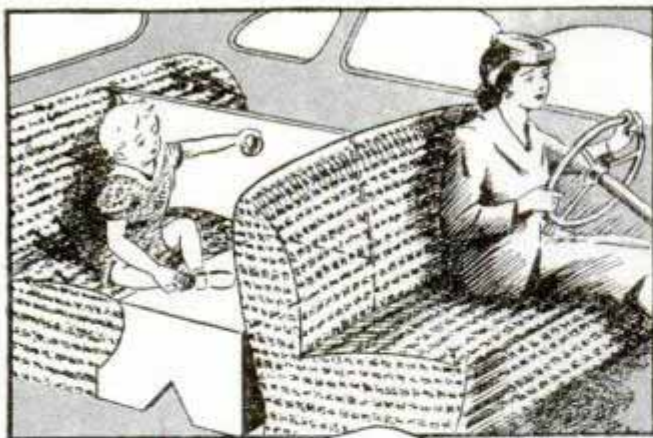


With this disk, a door can be held in any desired open position. The disk is made to fasten, off-center, to the bottom of the door



Grease spots can be removed from wallpaper by rubbing a cube of laundry starch over the soiled area and brushing to remove the starch

Wooden Partition in Rear of Auto Forms "Play Pen" for Child



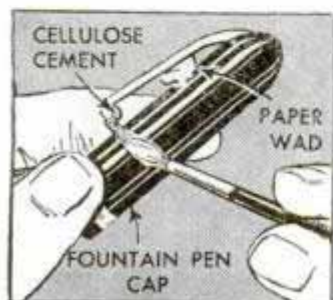
By assembling three pieces of plywood as shown, you can partition the back seat of your car to form a compartment or play pen in which a small child can sit without danger of falling off the seat. The pieces are cut to fit the cushions and are edged with felt to protect the upholstery. To prevent the child from accidentally opening the door, the latch can be reversed so that it opens by pulling the handle up instead of pressing it down.

How to Tell Age of Dressed Fowl

In selecting dressed chickens, you can tell whether a fowl is young by pressing the breastbone, which is pliable in chickens less than a year old. Another method of determining the age is to lift the wing so that the skin under it is stretched tightly. If the skin tears readily, the bird is young.

Ruth Peck McLeod, Knoxville, Tenn.

Fountain Pen Clip Is Smoothed With Cellulose Cement



When the tip of the pocket clip on your fountain pen is sharp and tends to tear your pocket, you can remedy this condition by smoothing the rough edge with

cellulose cement. Wedge the clip away from the cap with a wad of paper and apply a drop of thick cement. This will dry and become a plastic ball in a few minutes.

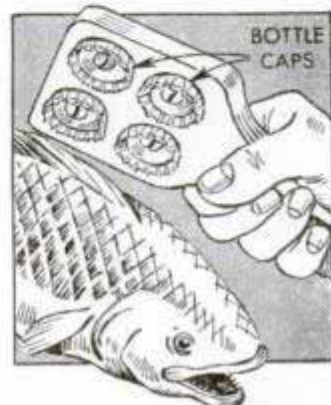
Plastic Scraper Used to Clean Ice From Car Windshield

Removal of frost and ice from a car windshield and windows, after it has been parked out overnight, is made easier by using a sheet of flexible plastic. One side must be straight and the scraper should be six to eight inches wide for ease in handling. The plastic will not scratch windshields or windows.

J. W. Langham, Jr., Seattle, Wash.

Improvised Fish Scale Remover

If you are on a fishing trip, and have no scaler, one can be improvised from a wood block and four bottle caps. Just shape a handle on the block and screw or nail the caps to it.—Isadore M. Fenn, Chicago.



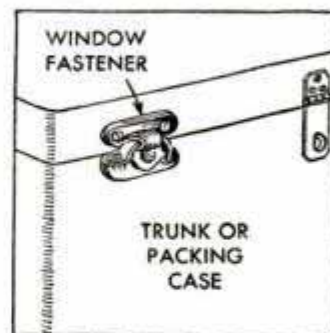
Rubber Fingers Save Manicure

Housewives who dislike wearing rubber gloves, but who wish to protect their manicure while washing dishes, can solve this problem by buying a pair of rubber gloves a size smaller than required and cutting off the finger tips. If the tips are slipped over the nails, the manicure will be protected while doing housework.

Ann-Marie K. Ortman, Somerville, N. J.

Latch Keeps Baggage Closed

Window latches make good fasteners for trunks when installed as shown. They are easily obtained and cost less than latches usually found on luggage.—R. Gordon, Seattle, Wash.

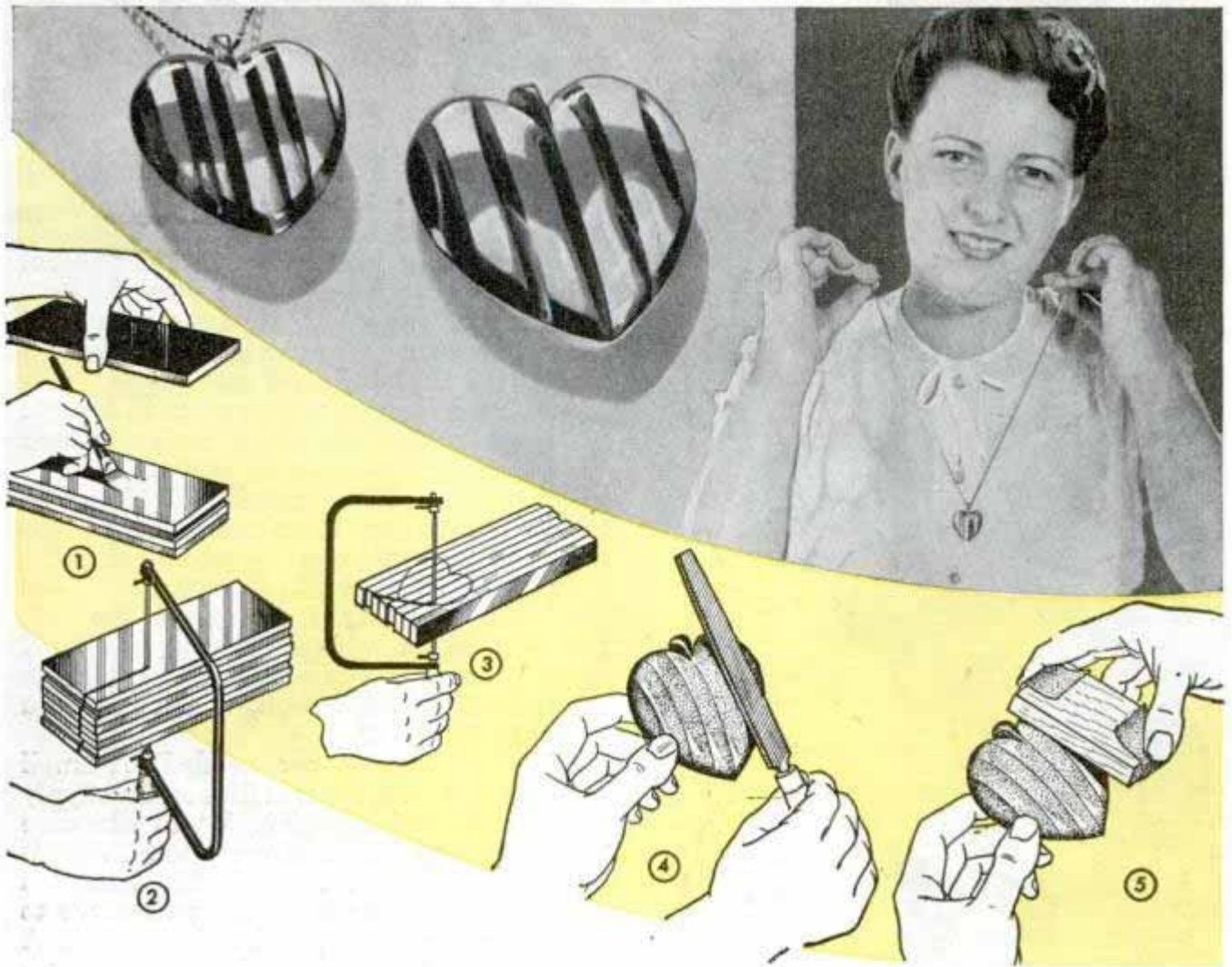


Toothbrush Is Fast Comb Cleaner

A comb can be cleaned in a hurry if a toothbrush with stiff bristles is worked between the teeth of the comb. This is faster than washing or soaking the comb.

F. Valenzuela, Durango, Mexico

Striped Heart Is Built of Laminated Plastic Sheets



When viewed from the front, this plastic heart shows a few fine vertical lines of color which widen into stripes as it is rotated slowly, and when viewed from the side the heart appears to be a solid color. The blank from which the heart is cut is built up of laminations of transparent thermoplastic cemented together. The plastic sheets may be of the same thickness, or of varying thicknesses from $\frac{1}{4}$ to $\frac{1}{8}$ in. to provide different patterns. The plastic first is washed with acetone and then the surfaces to be joined are coated with colored fingernail polish. After the polish has dried, it should be sanded with No. 400 wet or dry sandpaper and wiped clean. When building up the laminations, use glacial acetic acid for a binder, Fig. 1, wiping off any air bubbles. Press the sheets together with the fingers when the surfaces become tacky, but do not use clamps as this will press the polish out from between the sheets, leaving a weak color or no color at all. Allow the block to set for at least 24 hours and then cut lengthwise strips, Fig. 2, about $\frac{3}{8}$ to $\frac{1}{2}$ in. thick. Using a template with the shape of a heart, saw the rough, Fig. 3, and round with a file, Fig. 4. If a few extra minutes are spent with the filing, it will

save much sanding time. Final sanding is done with No. 320 emery cloth, Fig. 5, followed by No. 400 wet-or-dry sandpaper. While any fine abrasive polish can be used, one made with a paste of tin oxide and water spread on a tightly stretched cloth works well. The heart is rubbed briskly over the cloth, rotating and turning it in the process. When the heart has the required polish, the hole for the chain is drilled with a No. 50 drill. This should be at an angle from both sides to avoid marring the polished surfaces. To complete the piece, polish the hole with a cotton string to which the abrasive has been applied.

Edward Lopkoff, Seattle, Wash.

Cretonne Pockets in Drawer

Cretonne pockets, thumbtacked to the inside of a dresser drawer, will make handy receptacles in which to keep bobby pins, costume jewelry and other odds and ends. The pockets may be sewed separately or in groups, similar to shoe bags.

Mrs. M. R. O'Connor, Washington, D. C.

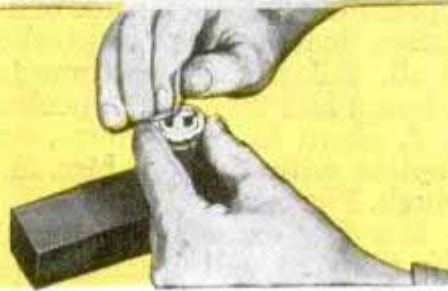
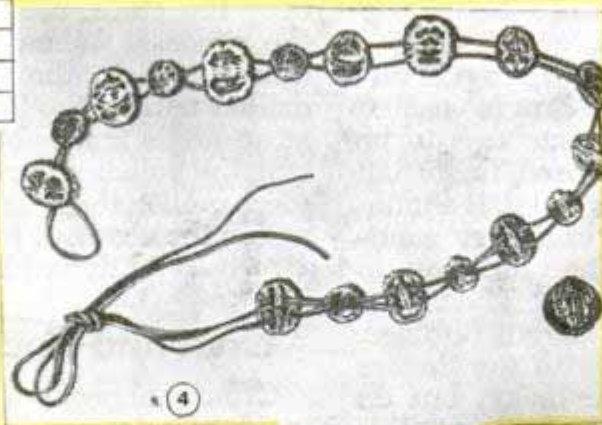
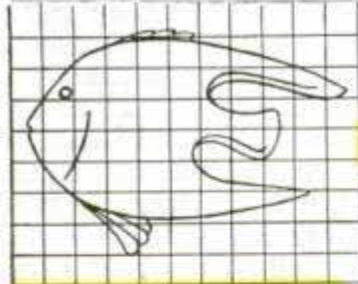
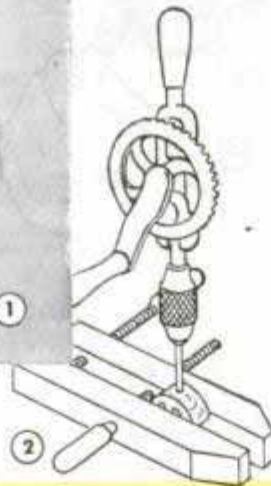
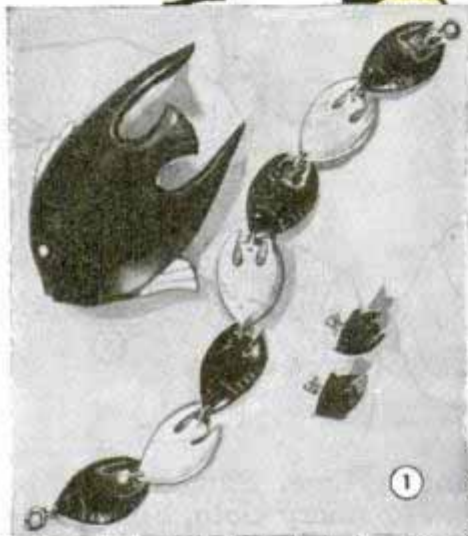
☞ Nail polish remover will clean small daubs of paint from the hands.

Nutshell

By E. N. Moore

THE hobby of nutcrafting offers many new possibilities for craftsmen who like unusual novelties. Servicemen especially will find it an intriguing test of manual skill. Costume jewelry and other objects made from nutshells always are prized highly as gifts. In nutcrafting you're not limited to the hard and soft-shelled nuts alone. Plum stones, which grow in several different colors, including red, tan and brown; date stones, generally mottled in effect, and pits from cherries may be used. Shells from more than one variety often are used in working out designs for necklaces, such as shown in Figs. 6 and 9, and the bracelet in Fig. 7, as well as the belt, Fig. 4. An ensemble consisting of a lapel pin, bracelet and earrings, Fig. 1, can be made from coconut shell, which is sawed easily as in Fig. 13.

Only a few tools are needed. A small hand drill, Fig. 2, several files and a supply of fine-grit sandpaper, Fig. 5, will take care of most of the finishing operations. A special clamp, made from light flat iron and hacksaw blades as in Fig. 8, will serve to hold the nutshells in place while sawing. A coping saw with an assortment of fine-toothed blades is a necessity. The cross-hatched patterns such as that at the left of Fig. 2 and those just below Fig. 10 are included merely for the purpose of enabling you to trace the outlines and transfer these



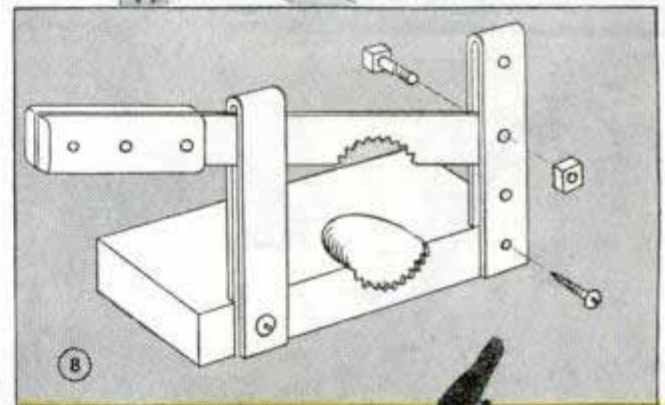
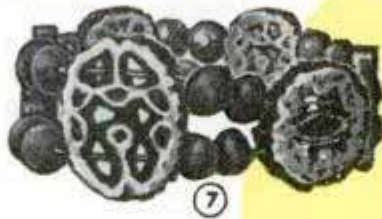
Novelties

to the surface of the work. The exact size or detail will be determined by the area of the shell or whatever design suits your fancy.

Small holes, either for stringing or for ornamentation, can be drilled through the "slices" or other parts of the shells as in Fig. 2, using a carpenter's wood clamp as shown. For stringing the finished parts of shells, use fine jewelry chain, leather thong or elastic cord.

If you use fine-toothed coping-saw blades in the slicing operations you won't have much trouble removing the saw marks from most shells. However, this must be done with care, for in nutcrafting the finish is the thing. The polished surfaces of most of the shells used in this work will take a beautiful finish even in the natural color, so it pays to do a thorough job. Producing a suitable surface on the flat-faced slices, such as those in the belt, Fig. 4, is simply a matter of persistence with file and sandpaper in successively finer grades, preferably of the "wet-or-dry" type. Sometimes the finishing operation can be speeded up by tacking a sheet of 8-0-grit paper to a flat surface such as a table top, then rubbing the slice back and forth on the abrasive. This will produce the desired smooth surface with uniform sharp edges.

Working down curved or convex surfaces can be made much easier if you take





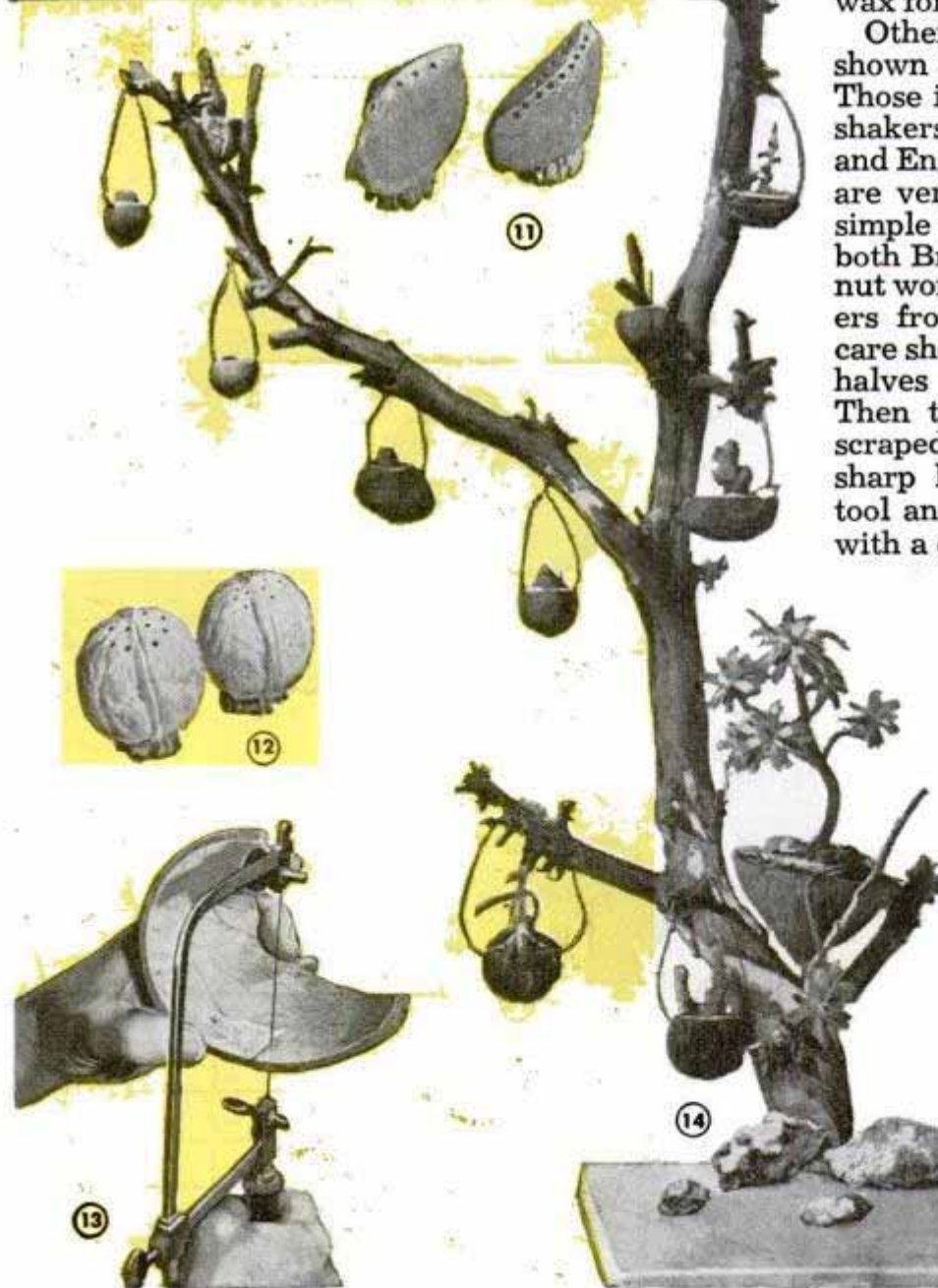
time to make the small fixture shown in Fig. 3. By pressing the edge of the nutshell against the heads of the nails you can work on any part of the curved surface clear down to the edges with either file or abrasive paper.

Carving nutshells is, of course, something else. However, if you have the skill and inclination, much can be done in the field of nutshell carving either by hand with a sharp pocket knife or with an electric grinder of the hand type, using wood-cutting burrs. Usually the final polishing is done with a very fine abrasive paper known as "granite" paper, and also with jeweler's rouge.

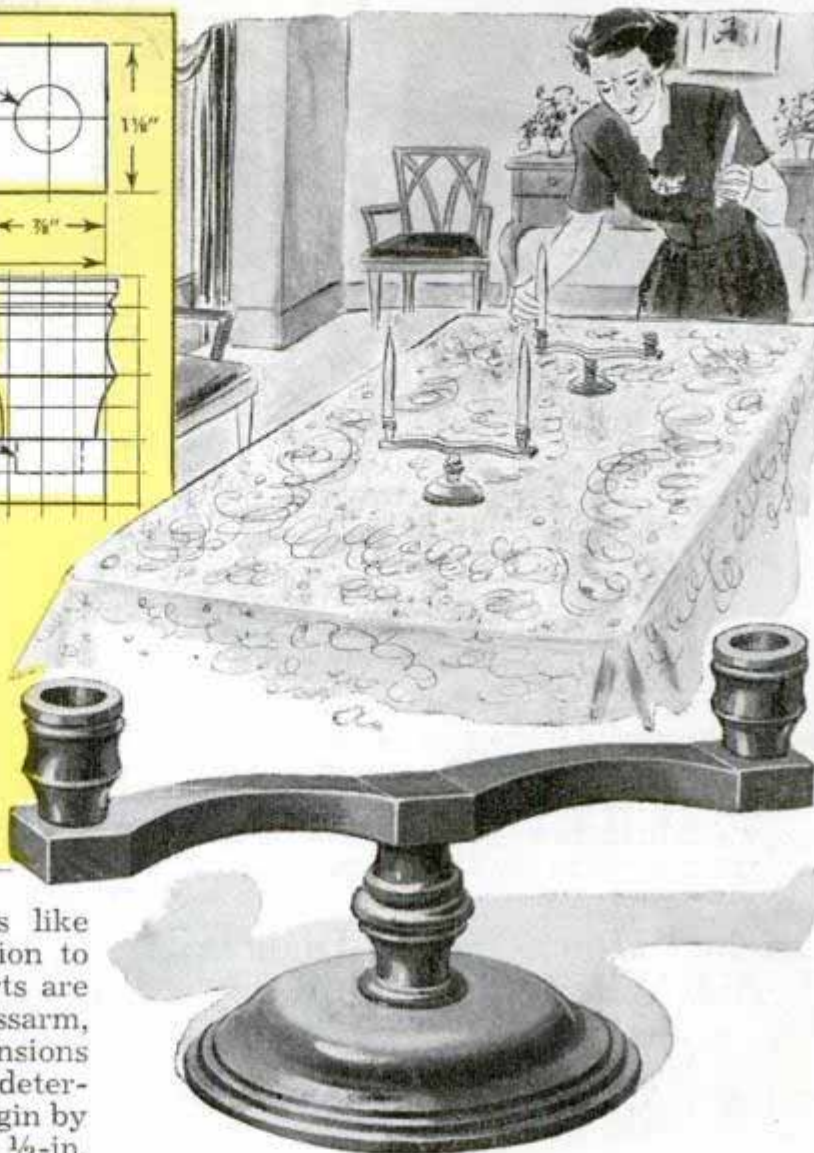
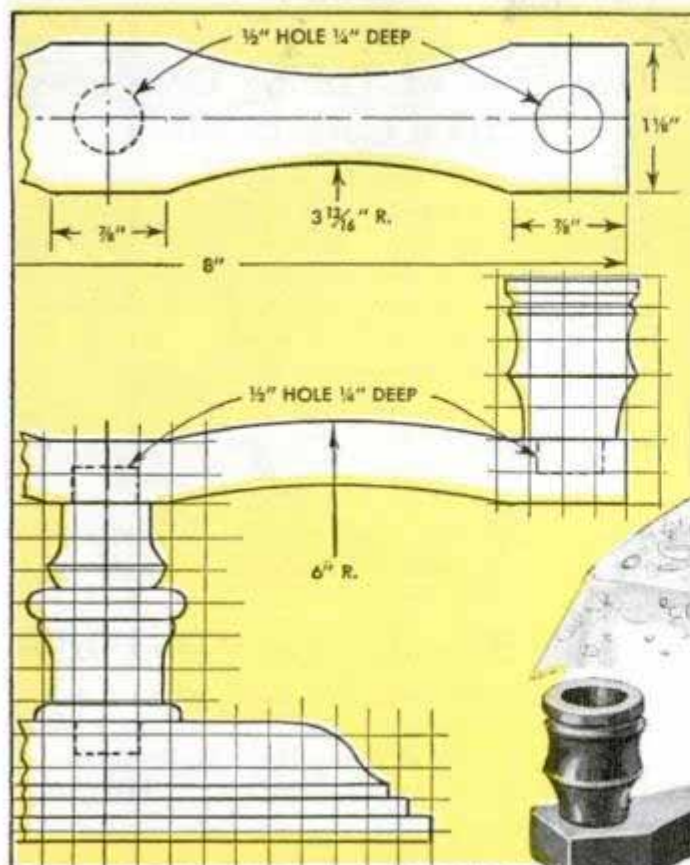
As a finishing material some nutcrafters work the oil out of the nut meats with a mortar and pestle and use this oil as a stain and polish, rubbing it on with the fingers to give the polished surfaces color and tone. Others use wax for a natural finish.

Other nutshell novelties are shown in Figs. 10, 11, 12 and 14. Those in Figs. 11 and 12 are salt shakers made from Brazil nut and English walnut shells. These are very popular items and are simple to make as the shells of both Brazil nut and English walnut work easily. In making shakers from English walnut shells care should be taken to break the halves apart without cracking. Then the inside of the shell is scraped and smoothed with a sharp knife or a wood-burring tool and the halves reassembled with a quick-setting adhesive. A

single large hole is drilled in the bottom to take a cork which serves as a base. With shakers made from irregularly shaped shells such as those of the Brazil nut, it is necessary to make a base from a shell of contrasting color. Fig. 14 shows an unusual novelty display made up by using a tree limb on which are hung several nutshell baskets made from various kinds of small shells, the principal feature being a flowerpot made from a coconut. Of course, other arrangements are possible.



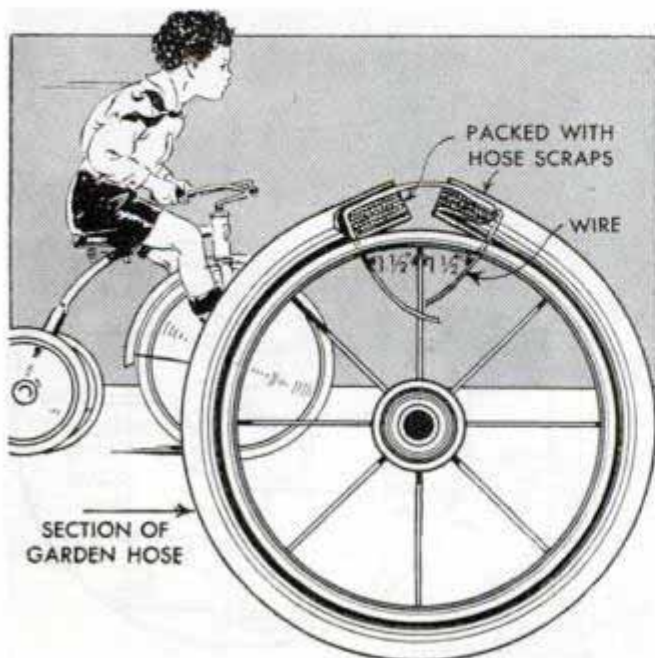
Walnut Candelabras Decorate Dinner Table



A pair of walnut candelabras like these will be an attractive addition to your dinner table. All of the parts are turned on a lathe except the crossarm, which can be bandsawed. Dimensions not given on the drawing can be determined from the 1/4-in. squares. Begin by turning the base and then bore a 1/2-in. hole 1/4 in. deep to hold the standard, which has a round tenon 1/2 in. in diameter and 1/4 in. long at each end to fit into the base and the crossarm. The cups also have a similar tenon to fit into the crossarm. To hold the candles, holes are drilled 1 in.

deep. After these parts have been turned, the crossarm is cut and all pieces are sanded and finished. The assembly then is glued together.

Wm. H. Freeman, Baldwin, N. Y.



Garden Hose Makes Sturdy Tires For Wagons and Tricycles

Tires for wheels of children's wagons and tricycles can be made from lengths of garden hose. First drill two small holes in the rim equidistant from a spoke and fit the hose to the rim so the ends will meet. Then mark and cut holes in the hose corresponding with those in the rim. Finally, insert wire in the ends of the hose after the openings have been plugged with scraps, pull the wire through the holes in the hose and rim, and twist it to draw the tire tight.

Fred Pennoyer, Bremerton, Wash.

☞ Glass tumblers that have stuck together may be separated by putting cold water in the top one and setting the bottom one in warm water.

Sandpaper Held on Workbench For Finishing Small Parts



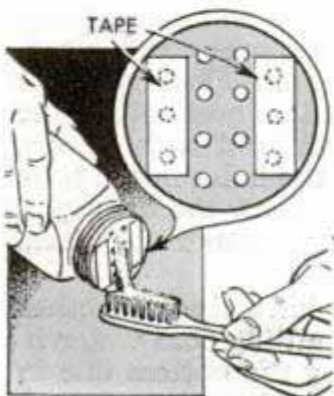
You can save time when sanding small parts by rubbing them over a piece of abrasive paper fastened to the top of a workbench. An ideal method of attaching the paper is to hold the ends with sticks pressed into grooves cut in the bench top.

Original House-Wiring Diagram Aids When Adding Outlets

When you build a new home, obtain a plan or diagram of the electric wiring installation. This will enable you to know the circuit layout later if you add outlets or extensions after the interior walls are finished. When adding extensions, it should be remembered that most branch circuits are No. 14 wire and that the maximum safe load is 1650 watts. Determine from the drawing how many outlets the branch circuit feeds and then add the wattage used at each outlet. Lights and appliances usually are rated in watts so the total load is determined easily. Generally, circuits should not carry more than 1200 watts.

Mrs. R. E. Berry, Decker, Ind.

Shaker Is Economical Dispenser

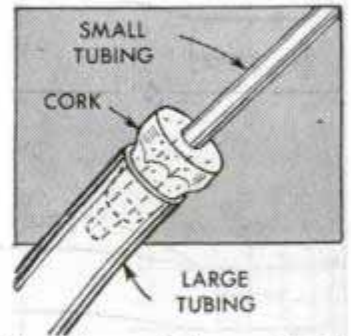


Users of tooth powder will find that a large salt shaker with a flat top will make an ideal dispenser. If two narrow strips of adhesive or cellulose tape are pasted over the top of the lid, leaving a double row

of holes exposed, the powder then can be sifted onto the toothbrush and there will be very little waste.

Two Sizes of Tubing Connected With a Cork Bushing

To connect two sizes of tubing, use a cork as a bushing. The cork should be a tight fit in the larger tube and is drilled to receive the smaller one. If the connection is subject to vibration or has too much play, an application of household cement will help to make the joint tight.



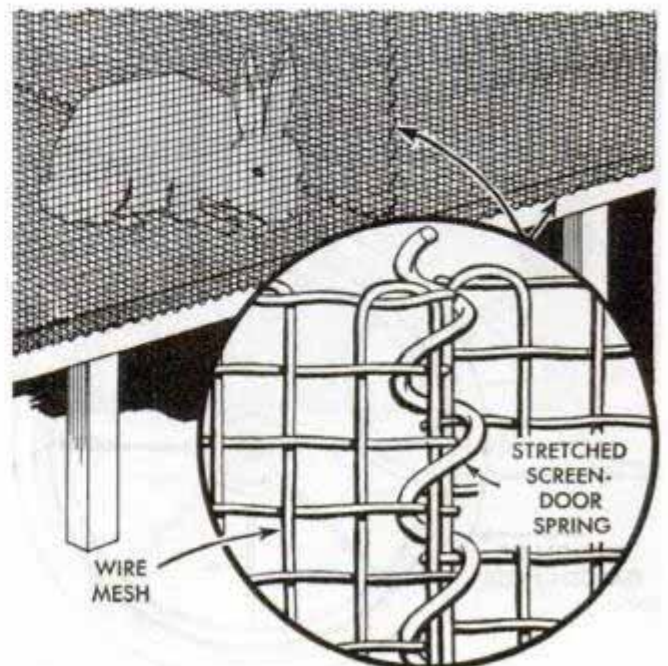
Dental Burrs Used as Wood Drills

Dental burrs can be chucked in a hand grinder and used for drilling wood or plastics. Such burrs may be obtained from dentists after they become too dull for a dentist to use.

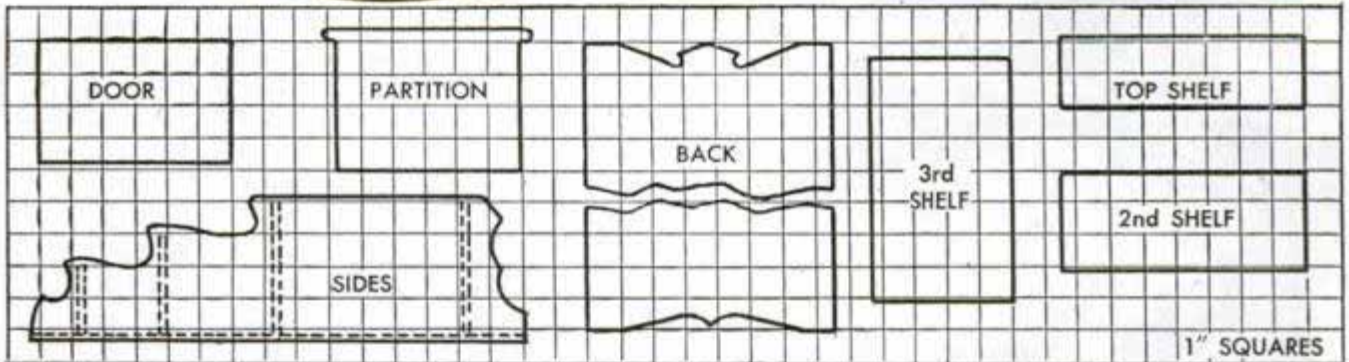
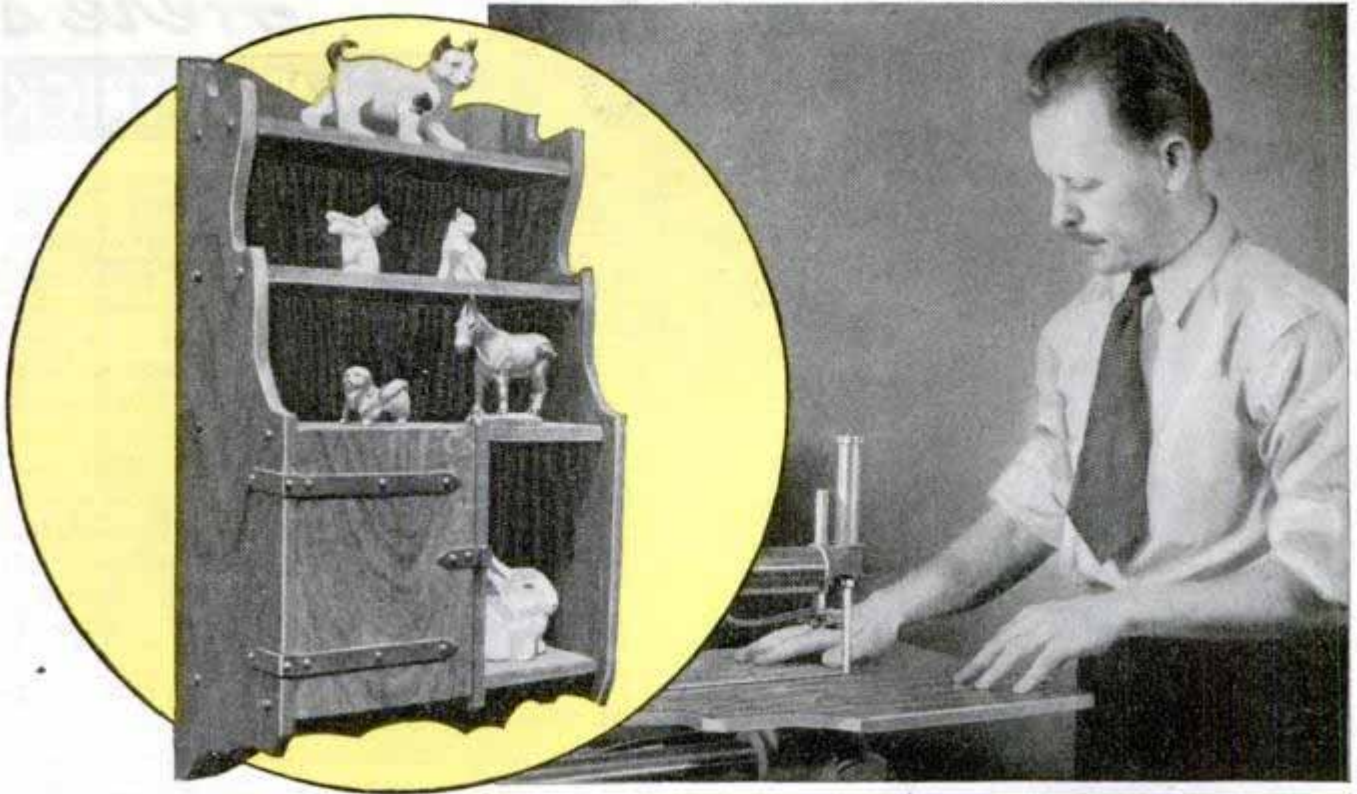
Rabbit-Hutch Partitions Joined By Screen-Door Spring

When building or enlarging rabbit hutches you can use a screen-door spring to connect pieces of wire mesh for partitions. The spring is stretched into a loose spiral and then wound through two pieces of the mesh as indicated in the circular detail. By this means, wooden cleats and nails are unnecessary, and the partitions can be removed quickly whenever desired merely by unwinding the spring.

E. G. Pophal, St. Pauls, N. C.



Bric-a-Brac Wall Cabinet Has Antique Design



Scrap wood is just the material for a bric-a-brac cabinet like the one shown, which is trimmed with strips of hammered metal, and can be given an antique or weathered finish if desired. All pieces are $\frac{3}{8}$ -in. stock, planed and cut to the dimensions indicated in the cross-hatched detail. Although not shown on the drawing, the bottom shelf is the same size as the third shelf. The height of the back is $15\frac{1}{4}$ in. There is only one door, which swings on two butt hinges and

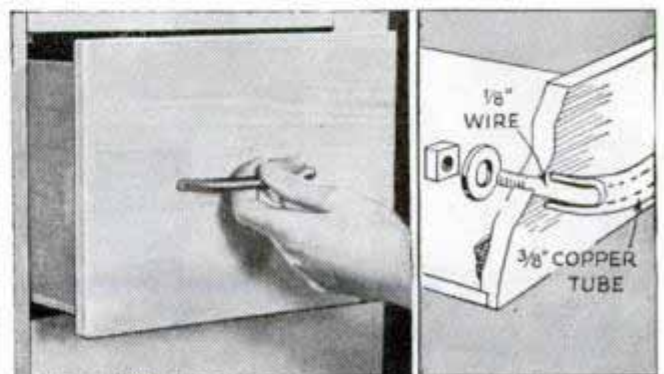
is closed by a hasp. This and the metal strips, which simulate ornamental strap hinges, can be formed from 22-ga. sheet copper indented with a ball-peen hammer, or strips cut from a sheet of tin will do. The metal should be polished with fine steel wool after hammering, then lacquered to prevent tarnishing or rusting. The cabinet is assembled with round-head wood screws and finished after assembly.

Dick Hutchinson, Ithaca, N. Y.

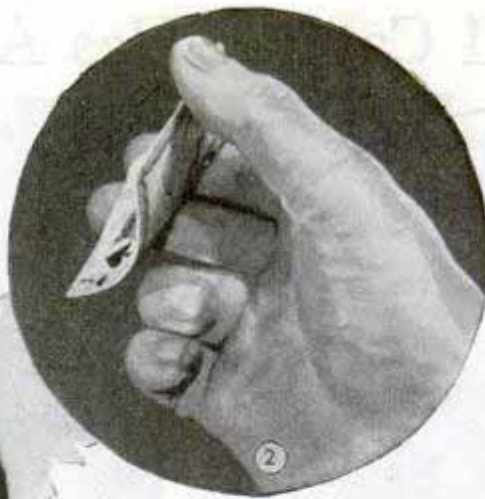
Drawer Pulls Fabricated From Copper Tubing and Wire

Neat drawer pulls can be made from $\frac{3}{8}$ -in. copper tubing polished with steel wool and formed around a large cylinder. The tubing is cut to length, the ends being cut at an angle to fit flat against the drawer. To attach a pull, a length of wire threaded at both ends and similarly formed is inserted through the tubing and through holes in the drawer. A nut and washer at each end holds it in place. The pulls should be lacquered to prevent tarnishing.

Pfc. Gordon P. Jones, Seattle, Wash.



Here's SIMPLE TRICKS



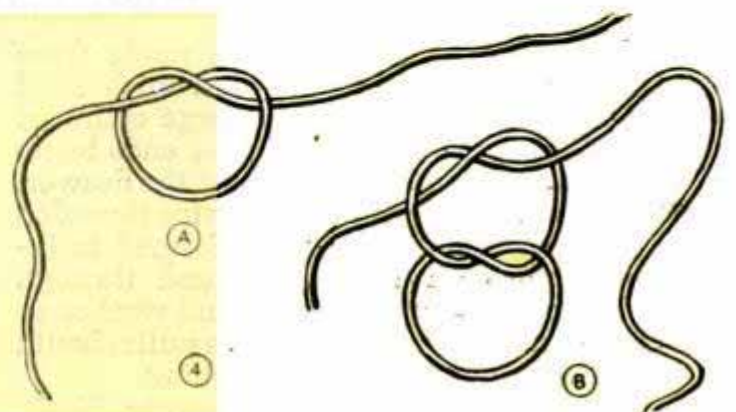
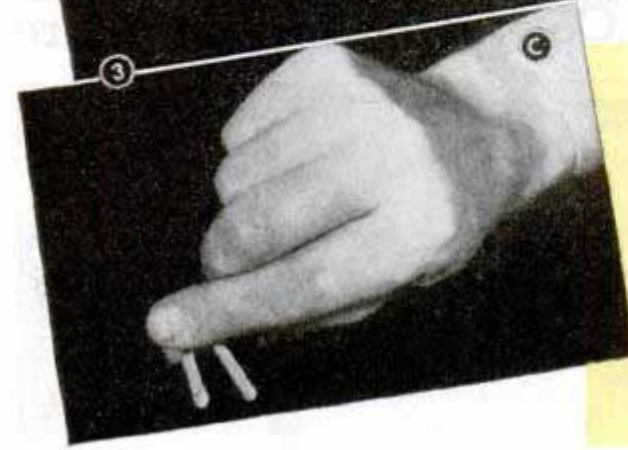
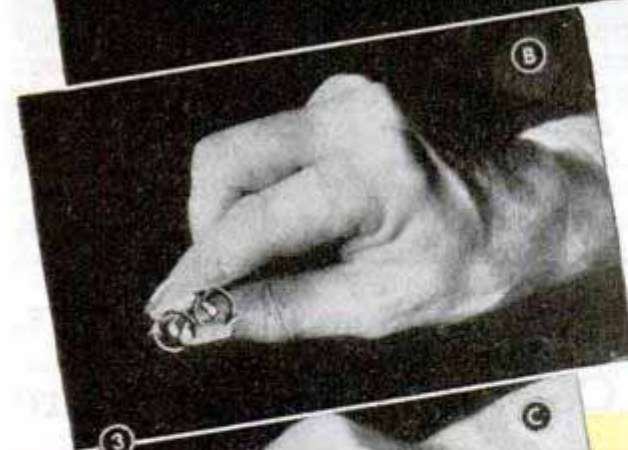
ALTHOUGH mystifying in effect, most magic tricks are easy to execute and depend mainly on the skill and dexterity of the performer for success. The illusions shown here do not require elaborate paraphernalia, but they should be well rehearsed before they are tried out. In addition to manual ability, a line of patter is considered a necessary accompaniment as it serves to distract the observer's attention as well as add to the amusement value of the occasion.

Effect: The first trick, Figs. 1 and 2, is card reading. The performer shuffles the deck and asks someone to select a card and place it on the bottom of the deck. Then, without looking at the card, he tells the audience what it is, in this case the jack of spades. As a variation, instead of putting the selected card on the bottom of the deck, it can be held in the left hand while the rest of the cards are held in the right hand. Then members of the audience can continue selecting cards from the deck which are read as the performer places them in his left hand, face toward the audience.

Method: The secret, of course, is the way in which the cards are held. If held as shown in Fig. 1 and tilted, Fig. 2, it is possible to see one corner of the face of the card while seeming to glance elsewhere.

Effect: Two paper matches of the kind that come in matchbooks are held between the thumb and forefinger, detail A of Fig. 3. A flip of the wrist and the matches, which had white sticks, now have black ones.

Method: The matches must be prepared beforehand. One side of each is blackened with a pencil. When they are shown to the audience as in detail A the white side is



How It's Done

TO AMAZE YOUR FRIENDS

toward the observers. Then the hand is snapped down, details B and C, meanwhile rotating the matches, detail B, so that when the hand is returned to its original position, the black side is seen.

Effect: This is the knot that unties itself! Starting with an overhand knot, the magician proceeds to make the knot increasingly complex until, tiring of the whole procedure, he grasps the ends of the cord, pulls, and the knot unties itself.

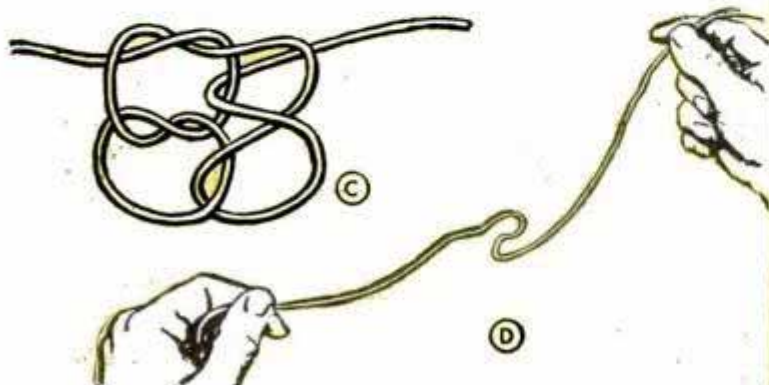
Method: The manner in which the knot is made is given in details A, B, C and D of Fig. 4. Start with an overhand knot, and following, tie a square knot. Keep the knot loose so the additional figure eight shown in detail C may be made. When this is done the knot can be untied by pulling on the ends.

Effect: You can be "laughing up your sleeve" while blowing up your sleeve. In this trick a lighted wooden match is held in one hand and extinguished by blowing up the sleeve of the opposite hand, Fig. 5.

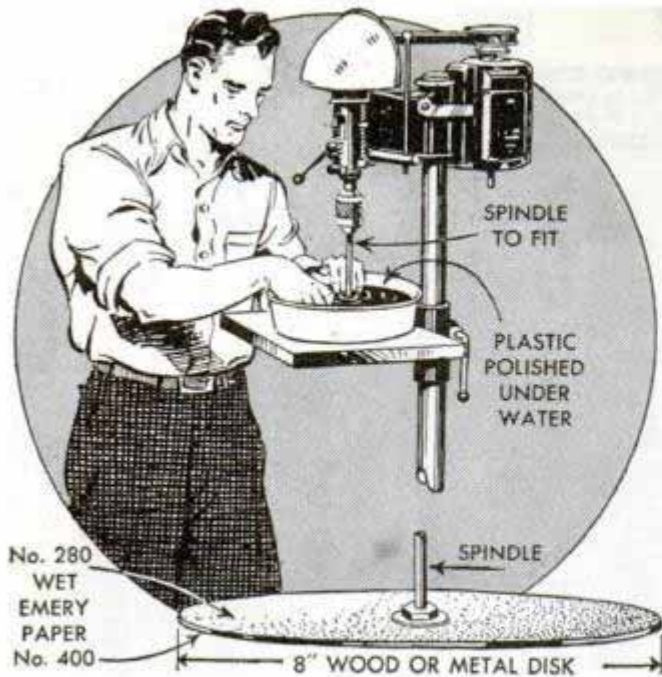
Method: Fig. 6 shows how the match must be held to accomplish the trick. When held between the two fingers with the thumbnail against the end of the match, it's easy to flick the match slightly, just enough to extinguish the flame, while pretending to blow up the opposite sleeve.

Effect: Take an apple with an unblemished skin and offer to bet that there is a coin inside. When sufficient interest is aroused the fruit is cut with a table knife to reveal a coin.

Method: The knife is prepared previously by fastening a coin to the blade near the handle with beeswax. This side of the knife is not seen. When cutting the apple, wedge the two halves apart and quickly slip the coin off the knife onto the apple. Then complete the cut and show the fruit and money.



Plastics Can Be Polished on Drill Press With Sanding Disk



Plastics used for making novelties can be sanded with the aid of a drill press if no sander is available. An 8-in. disk of metal, or plywood of the type used in exterior construction, is drilled for a spindle, which can be a length of rod. One end of the rod is left-hand threaded to take two nuts and washers which lock the disk on the spindle. The disk is covered with No. 280-grit wet emery paper on one side, and on the other with paper of No. 400 grit, shellac being used as an adhesive. After the disk is mounted in the chuck, it is lowered into a pan of water set on the drill-press table and the plastic is rough-ground with the coarse paper. The disk then is removed and inverted on the spindle to polish the plastic with the fine-grit abrasive. A slow speed should be used for both the rough and the fine polishing.

Alfred T. Marles, Santa Monica, Calif.

Stamp Moistener Applies Cleaner To Two-Color Shoes

A postage-stamp moistener, consisting of a glass or plastic tube stoppered with a piece of sponge rubber, makes an excellent applicator for liquid white-shoe cleaner, especially for two-color shoes on which it



is difficult to apply a white cleaner without spreading it over the colored part of the shoe. The tube is filled with the cleaner and rubbed over the shoe so the flow is directed only where desired.—Allan Abramow, Rochester, N. Y.

Weights Will Straighten Records

When phonograph records become warped, they can be straightened by weighting them with books or other objects that cover the entire disk. Before attempting to straighten them, however, it should be made sure that they are at room temperature, since a cold record may crack. Add a few weights at a time at intervals of one hour. Usually it takes about 24 hours to straighten the records, but there is no harm in continuing the process longer.

Jean Brickman, Champaign, Ill.

☐ To remove chewing gum from clothing, place the garment in a refrigerator to chill and harden the gum thoroughly, and it can be scraped off easily with a knife.

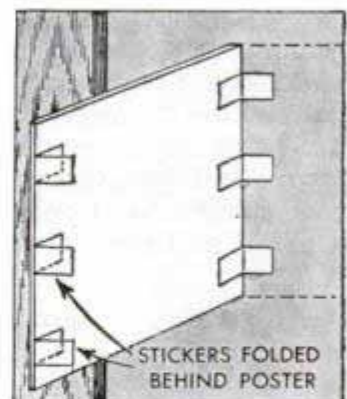
Clothespins and Rubber Bands Hold Baby's Crib Covers

Instead of pinning a baby's crib covers to the mattress you can use spring-type clothespins over which rubber bands are slipped. These will stretch and allow the baby to turn freely, yet will hold the covers securely. When in use, a wide rubber band is slipped between the jaws of two clothespins, over the spring joints. One pin is clipped to the crib spring, while the other is fastened to the covers. Two sets of pins are used on each side of the crib.

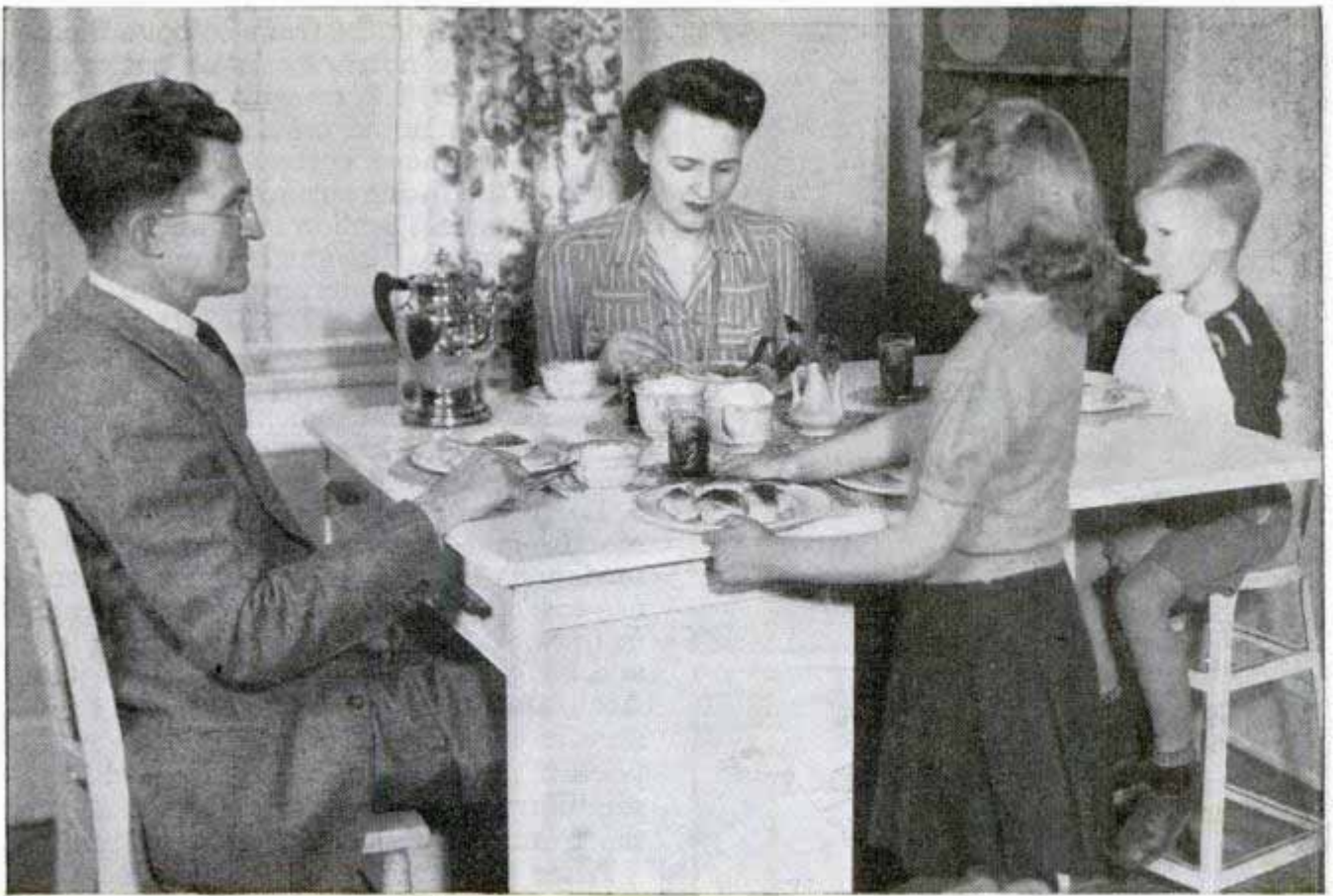
James D. Callahan, Lincoln, Nebr.

Posters Attached to Bulletin Board By Concealed "Stickers"

It is easy to attach a poster to a bulletin board or wall with "stickers," or pieces of gummed-paper tape, so that these are not visible. The stickers are applied to the back of the poster, allowing half of each sticker to project beyond the edge. Then they are folded back, moistened and pressed against the wall or bulletin board.



☐ Use a mixture of table salt and lemon juice for brightening copper vessels that have become blackened by contact with fire. Rinse them with tepid water.

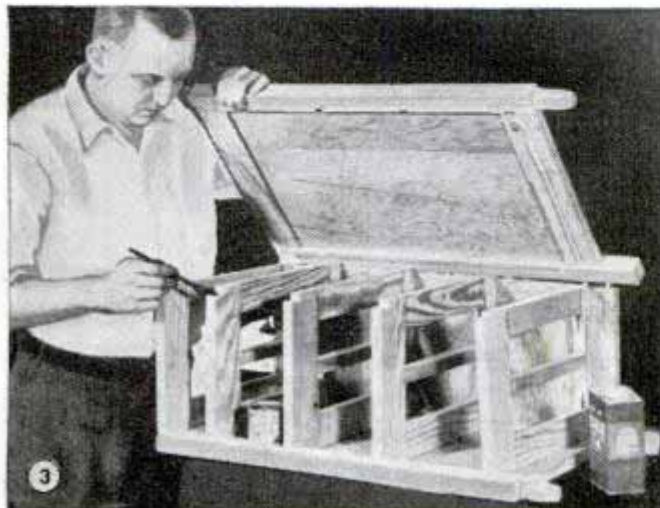


Kitchen Desk and Breakfast Table

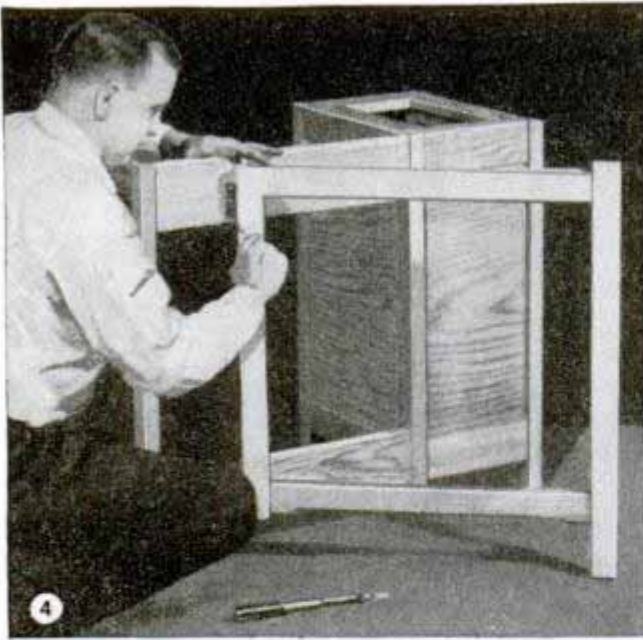
By Charles E. Troutt

FINISHED in enamel or lacquer with brightly colored handles, this table adds a note of cheer to a room, and offers the utmost in utility and space saving. When used as a breakfast table it will seat four persons comfortably with ample space for coffee percolator, waffle iron, etc. By dropping the back leaf it becomes a kitchen desk, Fig. 7, and thereby folds to less than half its former size. The five drawers provide storage for kitchen linens and utensils. Fine cabinet woods are unnecessary, although the posts should be made of wood that can be turned satisfactorily.

Making the legs: Only the three front legs have feet turned on the lower ends.



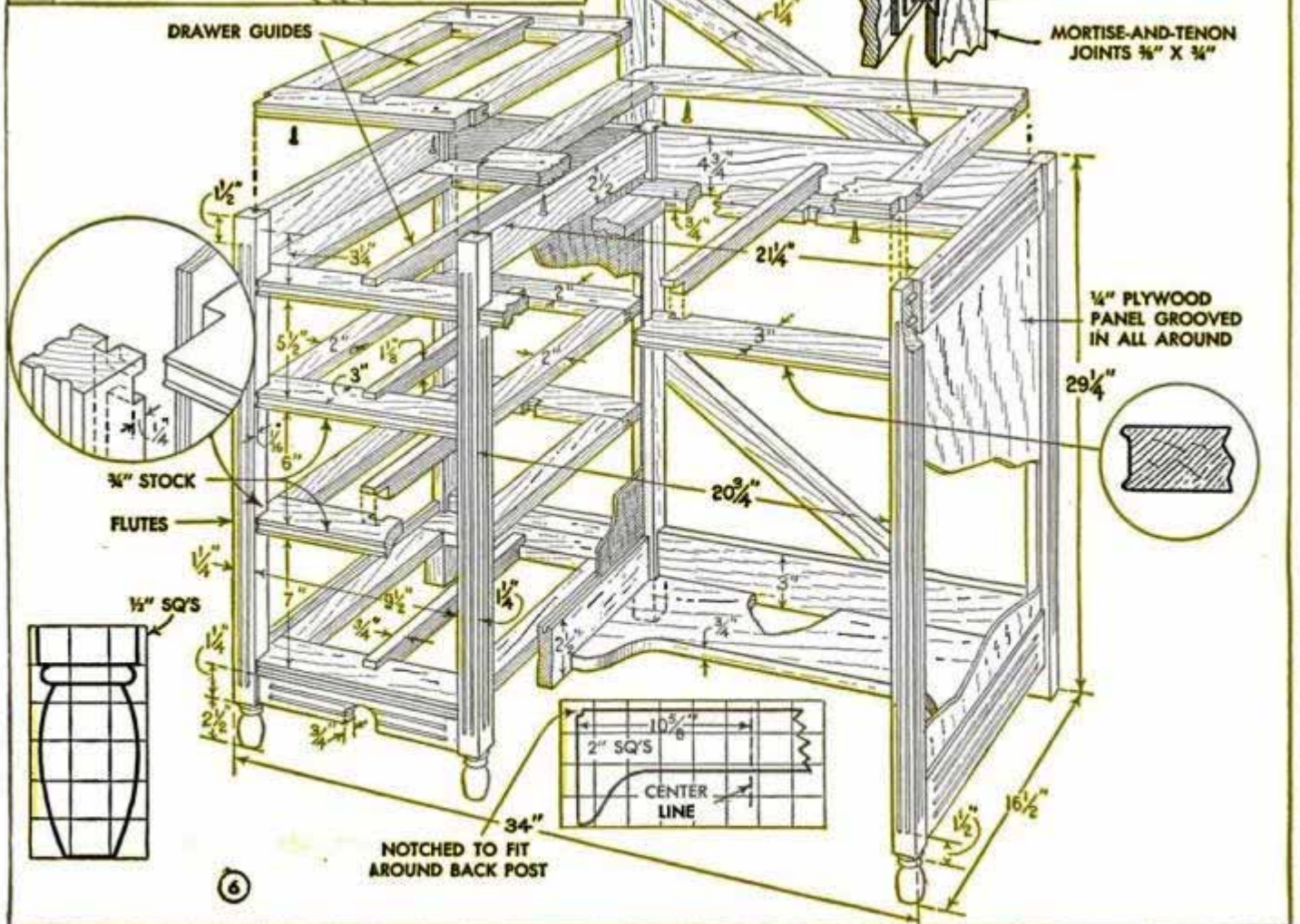
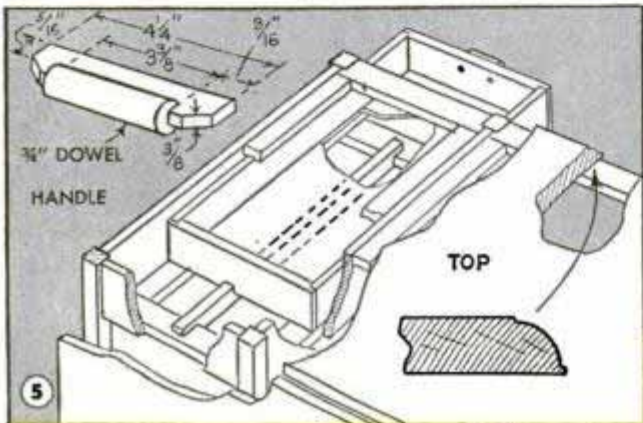
The back legs are square. Care should be taken to center exactly the legs that are to be turned, otherwise you will not be able to turn them to the dimensions given. Fig. 1 shows the bead being cut with a shaper cutter in a homemade holder. All legs are grooved $\frac{1}{4}$ by $\frac{5}{16}$ in. to receive the panels. The cuts should be stopped before reaching the turned feet and the ends of the grooves squared with a chisel. Also, all legs must be notched to receive the drawer



frames, including the frames above the top drawers. The notches can be cut with a router as in Fig. 2, or with a hand chisel. The legs are fluted on a shaper, using a 1/4-in. round-nose cutter. Note that the flutes on the inside surface of the legs next to the kneehole section stop before reaching the drawer. The single front rail at the bottom of the drawer section should have two flutes as shown in Fig. 6. It is necessary for the top back rails to be 4 3/4 in. wide to cover the back opening of the kneehole drawer. With the exception of the two back rails of the kneehole section, all rails are grooved on one side for 1/4-in. panels.

The drawer frames: These are of open mortise-and-tenon construction, 1/4 by 1/2-in. tenons being used. Before the frames are assembled, cut a notch 1/2 in. deep and 3/4 in. wide in the center edge of each front and back rail to receive the drawer guide. Accurate centering of the notch is necessary as any discrepancy would be multiplied if the rail ends were reversed in assembling. The molded shape on the edge of the front rail also is cut before assembly.

After the drawer frames are assembled and before the guides are glued in, notch each corner as indicated in the circular de-



tail of Fig. 6. The drawer guides also will serve as drawer stops if they are notched to come within $\frac{7}{8}$ in. of the front edge of the front rail. Detail for the bottom knee-hole brace is given in the plan. The back corners are notched to fit around the legs.

The drop leaf and support: In making the support, note that the top rail is mortised into the outside stile $\frac{1}{2}$ in. down from the top, but that it is flush with the top of the inside stile, Figs. 4 and 8. These mortises are best cut with a hollow chisel on a drill press. In joining stock for the top, warping can be minimized by using pieces not over 4 in. wide and reversing the end grain in alternate pieces. To assure a close butt joint between the drop leaf and the desk top when the leaf is raised, it is necessary to cut a shallow recess for the hinge pin in both pieces. Mold all edges except those where the top and drop leaf are butted together.

Drawers and pulls: No exact dimensions are given for the drawers as the pieces vary with the type of joint used. Dovetail joints are preferred, although a simple rabbeted joint will serve the purpose. Regardless of the type of joint, the drawer bottoms should set up $\frac{1}{2}$ in. from the bottom edge, and there should be a notch $1\frac{3}{16}$ in. wide by $\frac{1}{2}$ in. deep cut in the bottom edge of the drawer back to fit over the guide. Fig. 5 shows how this notch fits over the drawer guide. Details for a simple and attractive drawer pull also are given. Holes for attachment screws should be drilled in the base before the pull is assembled. The top part of the pull is a $\frac{3}{4}$ -in. dowel grooved to fit over the base. After cutting the four panels you are ready for final assembly. Note that one panel must be sound on both sides. In the event plywood is not available, hard-pressed board can be substituted.

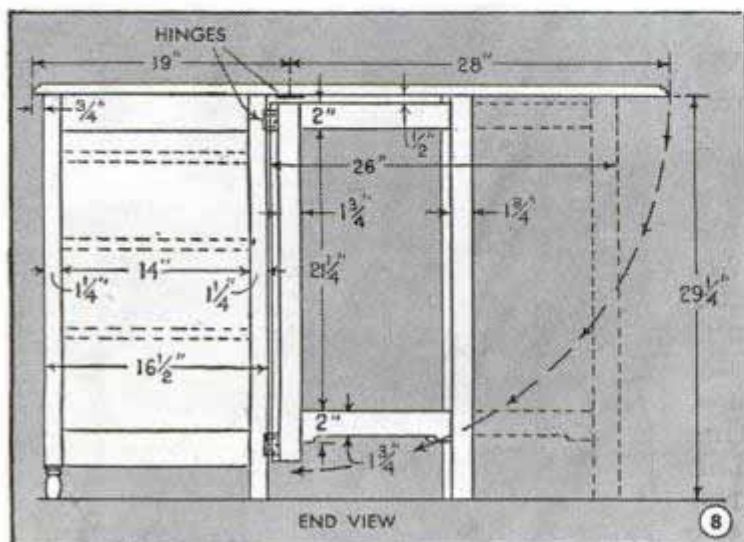
Final assembly: Sand as many of the pieces as possible before assembly. All rails are doweled to the legs. It is advisable to improvise a jig to hold the rails rigidly up-



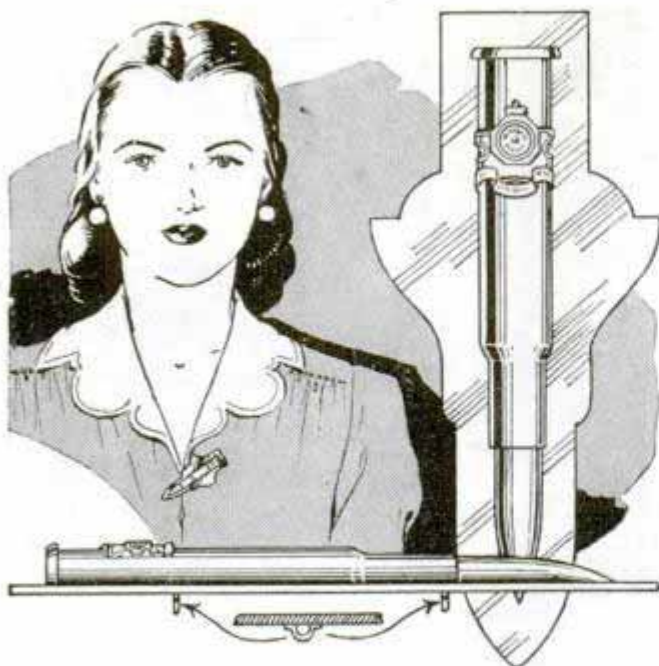
right while drilling the dowel holes in the end grain.

Glue the two side panels and the center panel first, Fig. 3. The panel that is good on both sides goes between the right-hand legs. The drop-leaf support and the drawer frames should be glued at this time. Be sure to drill the dowel holes for the back rails, as well as the dowel holes for the bottom knee-hole-section brace, before this gluing operation. Since the top is screwed in place, the holes should be drilled and countersunk on the bottom side of the top drawer frames. These two frames are doweled to the side rails for extra strength.

The drop-leaf support is hinged to the back rails, and filler blocks must be used under the hinges to align the support with the posts. Attach the top, leaving a $\frac{3}{4}$ -in. overhang on the front and sides. A block should be screwed to the underside of the drop leaf to stop the support when it swings out to the center of the leaf. Sufficient sanding with the proper grit of paper is necessary for a good finish. Use a very fine grit for the final sanding and slightly round the corners of the legs. Follow with a sealer to prevent the grain from raising and showing through the finishing coats. Apply lacquer or enamel as it comes from the can and be careful that it does not sag on the vertical surfaces. Use a quick-drying enamel.



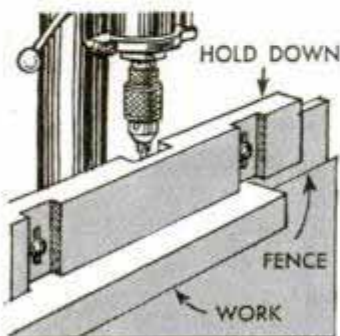
Novel Brooch Is Cut From Bullet And Cartridge Case



Decorative and attractive, this novel brooch is made from a .30-caliber cartridge case and bullet. The case can be either the rim or rimless type, but be sure that both powder charge and primer have been removed from the case before sawing or otherwise altering it. Don't remove either the powder charge or the primer from a "live" cartridge unless you are thoroughly familiar with this operation. Both the empty case and the bullet are sawed in half longitudinally and the rough edges are smoothed on a sheet of emery cloth laid on a flat surface. Then one half of each piece is soldered to a strip of brass filed and finished to the shape shown. If desired, the brooch can be decorated with an emblem shaped from thin brass and soldered in place. Polished surfaces should be coated with clear lacquer to prevent tarnishing. Two wire loops on the back of the brooch are for small safety pins used to attach it to the wearer's clothing.

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

Adjustable Wooden Hold-down



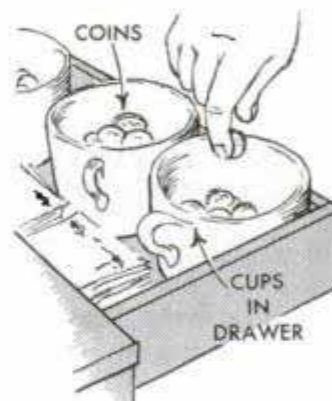
To hold work flat while being surfaced with a drill-press shaping tool, an adjustable wooden hold-down bolted to the fence will assure smooth, even cutting with no danger of gouging the work. The hold-down, which is made from a length of 2 by 4-in. stock or similar material, is recessed in the center to fit around the cutter-

head, and near each end for bolts inserted through slots that allow adjustment of the hold-down. The lower edge is rubbed with paraffin to permit work to slide freely.

E. West, Berkeley, Calif.

Cups Serve as "Cash Boxes"

When serving as cashier at a club social, if no cash register is available you will find that cups are better than biscuit tins or cigar boxes for holding coins. The rounded bottoms of ordinary coffee cups make it easy to remove the coins. Since the cups occupy little space in a table drawer, one can be used for each denomination.



Lard Cleans Tar from Cloth

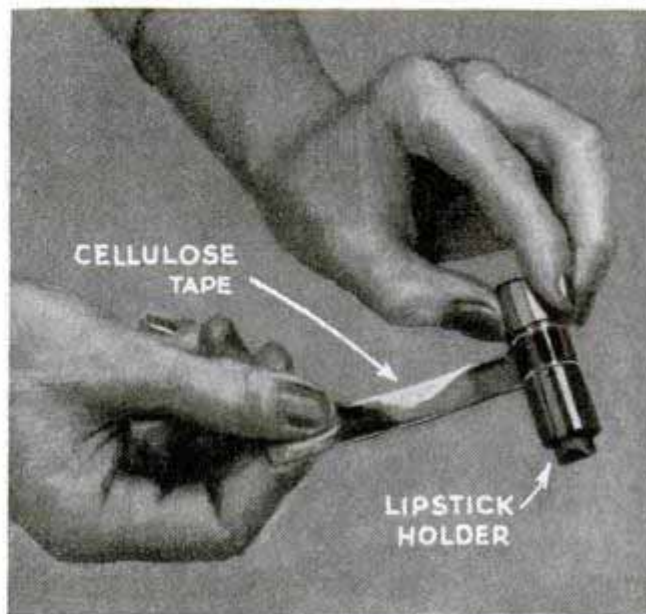
Tar usually can be removed from washable fabrics by rubbing lard over the spot and scraping it off as it becomes discolored. More lard is added and scraped off until the tar is out. After this, the cloth is washed in heavy suds to cleanse it of lard.

Joseph G. Cleveland, Minneapolis, Minn.

Cellulose Tape on Lipstick Holder Prevents Cap from Falling Off

If the cap on a lipstick holder is so loose that it drops off, this annoyance can be overcome by wrapping a piece of cellulose tape around the holder at the edge. The tape is hardly noticeable, and will pad the holder enough to keep the cap secure.

Benjamin Nielsen, Aurora, Nebr.



CARVED DESK SET

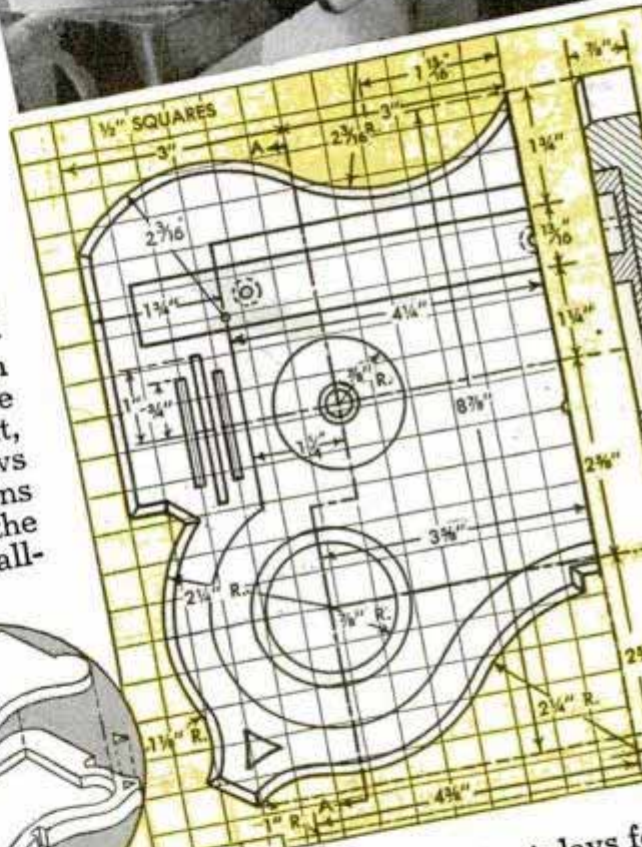
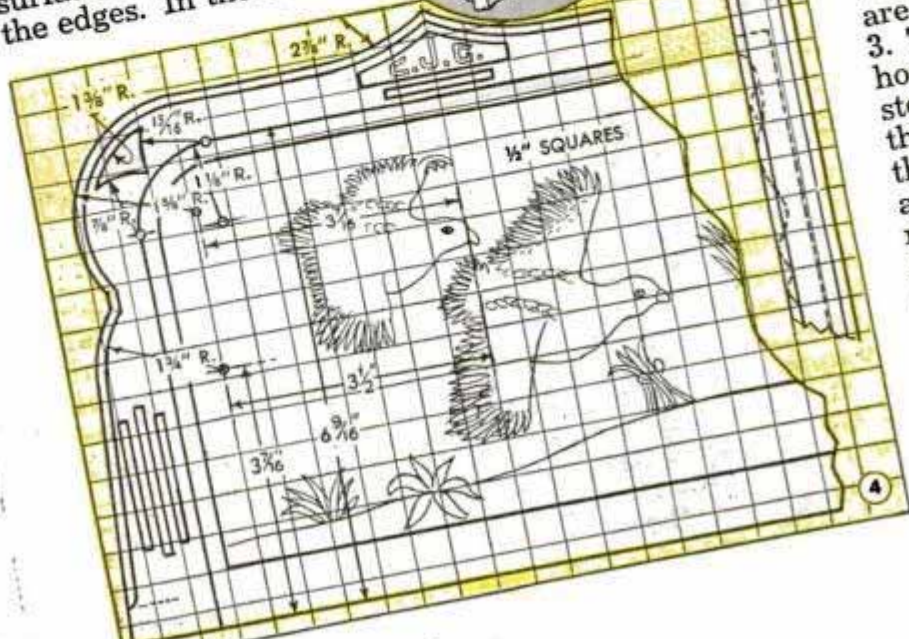
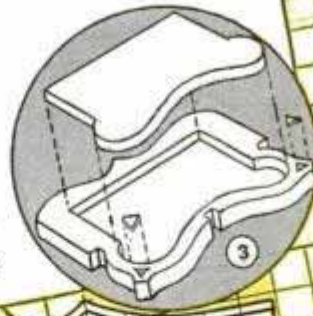
Decorative Inlays



By Carmen J. Gentile

WITH the exception of a few small items, such as the ivory used for initials, this desk set is built of either holly or birch and inlaid with walnut. Although carving the panel that forms the back-ground may seem difficult, if done with care the result will be satisfactory. The back panel, which can be a starting point, is inlaid and sawed to shape. Fig. 1 shows the panel being routed to the dimensions indicated in Fig. 4. The inlay for the carved part is $\frac{1}{2}$ in. thick, while the smaller inlays are $\frac{1}{8}$ in. for both panel and base.

After the walnut has been glued in and the panel cut to the dimensions indicated in Fig. 4, plane and sand the surfaces and chamfer the edges. In the same

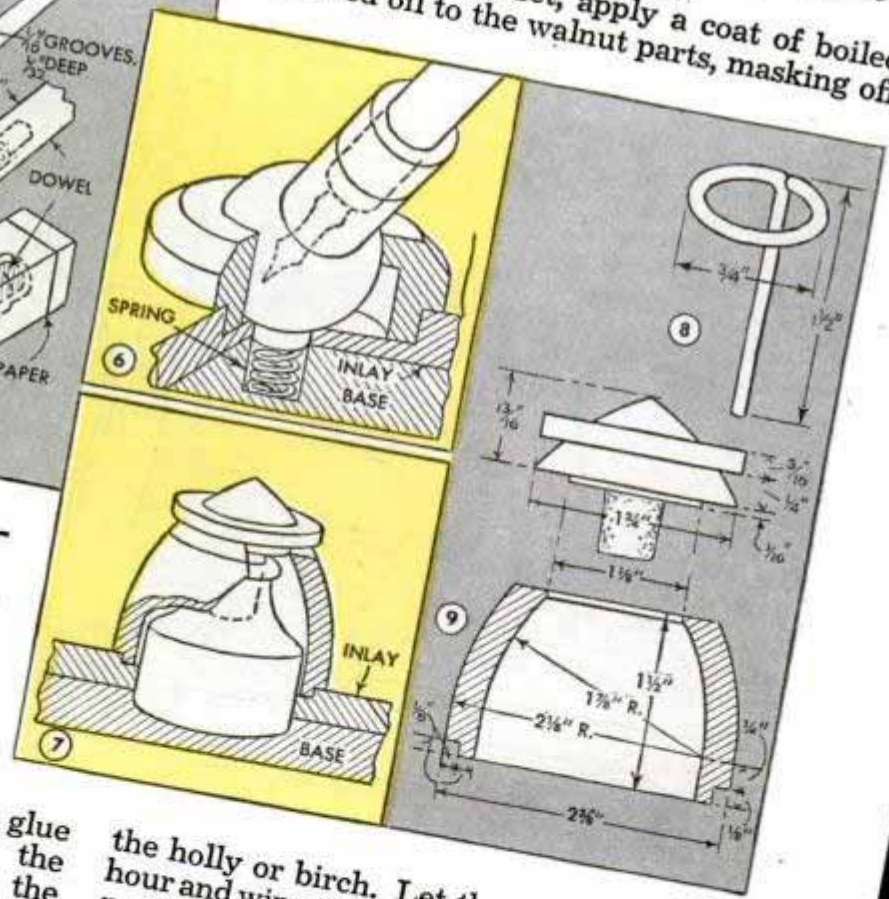
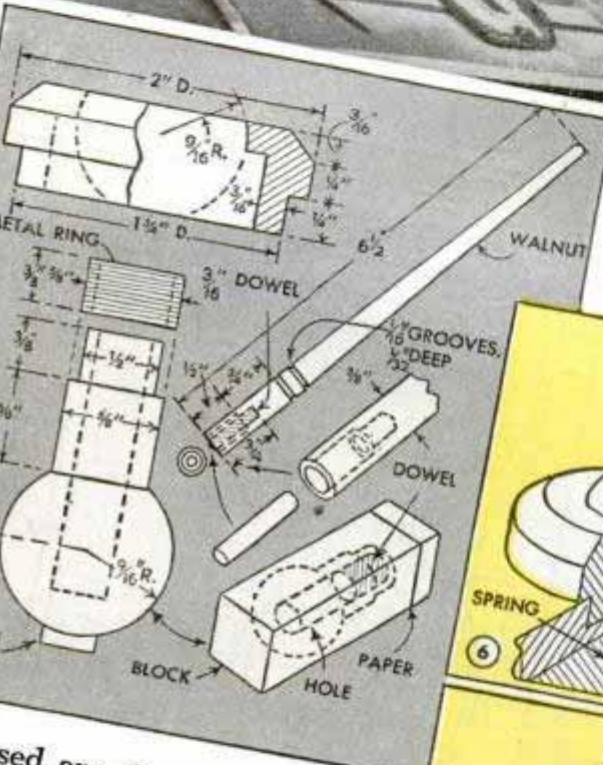


manner, the inlays are cut and finished. 3. The larger inlay, however, is only $\frac{3}{8}$ in. thick, as in the panel. Referring to the recesses for the inlays, they are $\frac{1}{4}$ in. deep, as is the recess for the back panel. The inlays are drilled and finished in the same manner as detail A, for the inlays in the panel. The inlays are approximately $\frac{1}{2}$ in. deep.





cessed and glued into each cap. To hold the caps when ink is being used, a wire ring, Fig. 8, is bent as being used, a wire ring, The birds carved on the sign base on paper and transfer a carbon paper. Then cut a gouge or small inlay can be cut from the piece of walnut. Just before assembly, give the holders and collars a coat of shellac rubbed down with fine steel wool. Assemble the holders as shown in Fig. 6 and glue and clamp them to the base. The panel then is glued and screwed to the base, after which the covers for the ink bottles has glued and clamped. When the adhesive with fine sandpaper, except for the carving which can be high lighted with steel wool. To finish the set, apply a coat of boiled linseed oil to the walnut parts, masking off

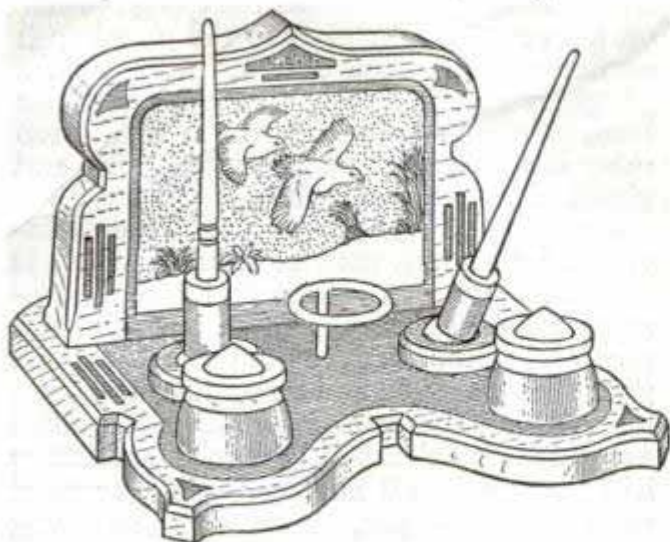


ed are those which con- ink. nut collars for the pen- upper left-hand detail of turned on a lathe, using to check the curvature into which the balls fit. ng the holly-ball pen- t drill 3/8-in. holes for g them with dowels and glue ck with paper between the d. Then turn the ball to the dicated in the lower details complete assembly is shown buttons on which the balls Fig. 5. Shown in the upper il of Fig. 5, the pens are diameter sanded down to The ink-bottle covers and 9, are built of walnut and 9, respectively. A cork is re-

the holly or birch. Let the oil stand for 1/2 hour and wipe with a cloth dampened in turpentine. Then, using thin shellac, brush all surfaces except the inside of the carved panel. Rub down the shellac with fine steel wool and apply a light second coat of linseed oil to the panel, working it in well. Let the set dry for about 24 hours and finish with two coats of furniture wax. To prevent scratching the desk, felt should be glued to the base. The metal ring or ferrule for the penholder and the wire cork holder are added after the set is finished.

CARVED DESK SET

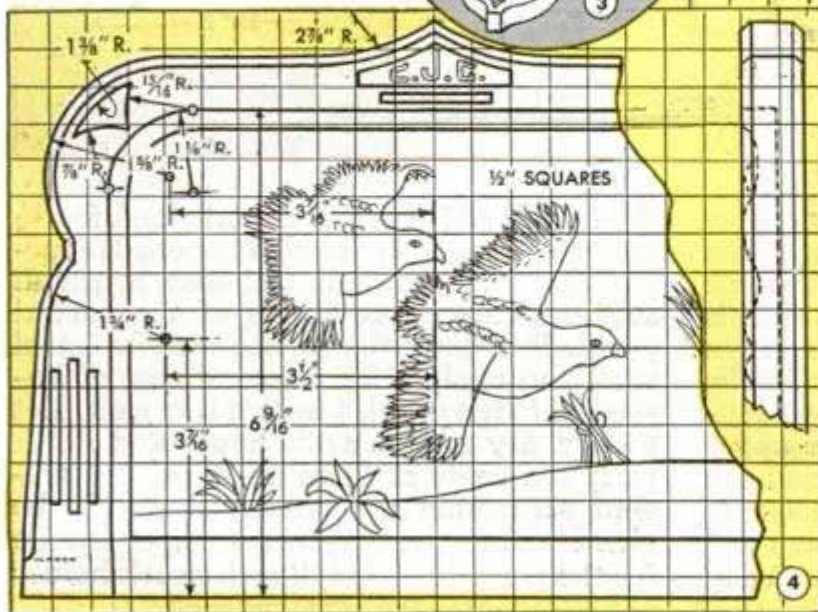
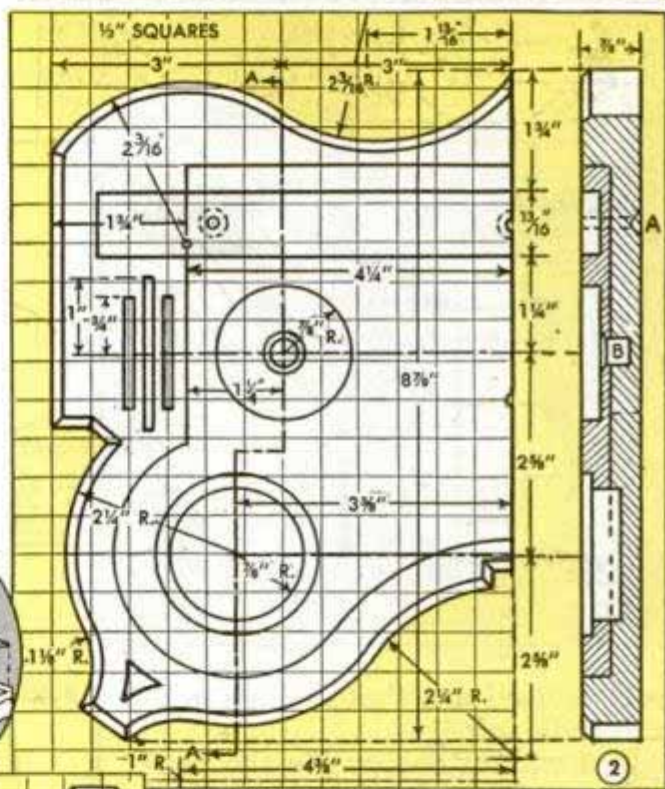
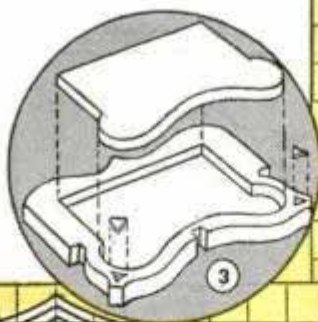
Has Decorative Inlays



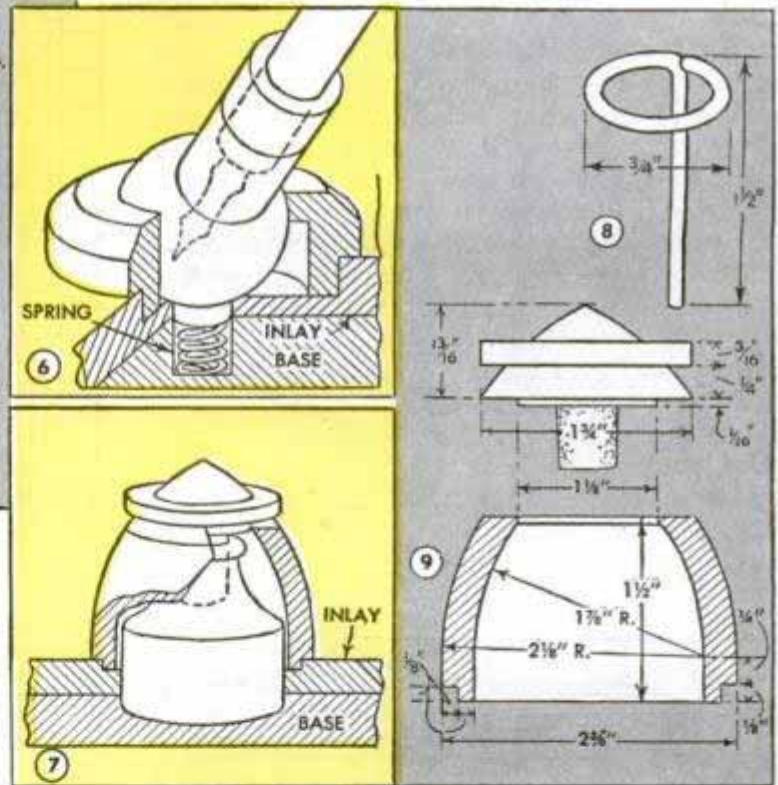
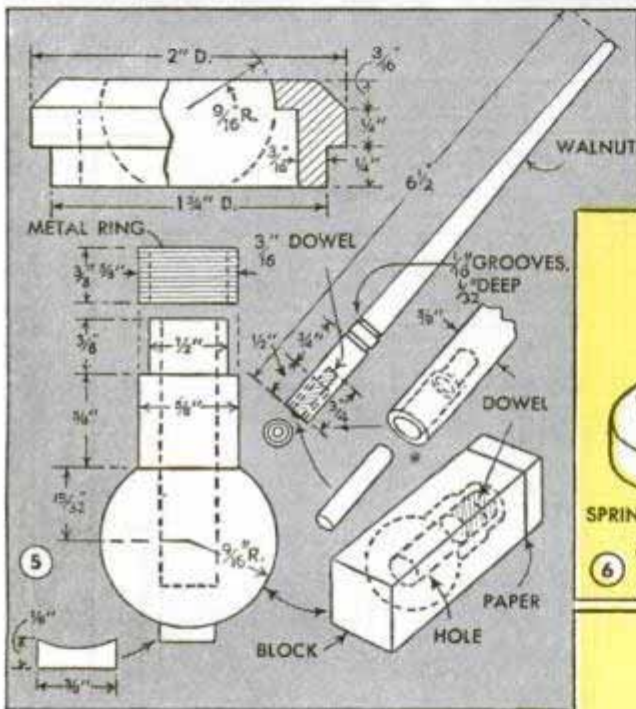
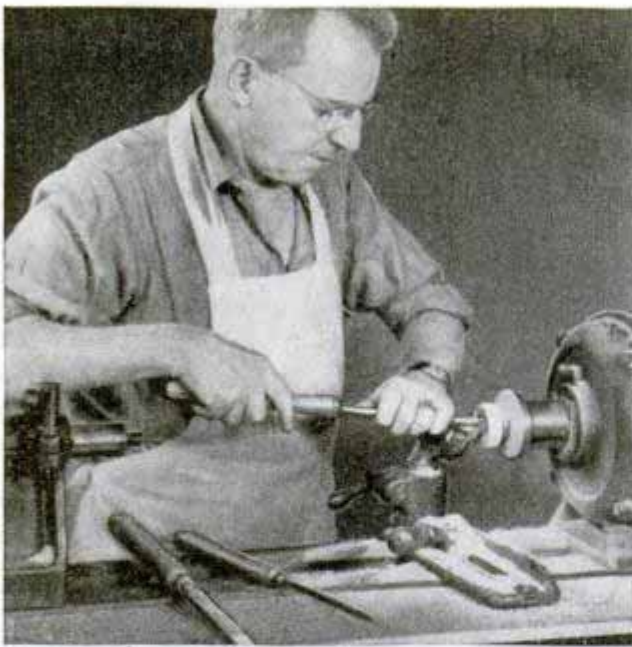
By Carmen J. Gentile

WITH the exception of a few small items, such as the ivory used for initials, this desk set is built of either holly or birch and inlaid with walnut. Although carving the panel that forms the background may seem difficult, if done with care the result will be satisfactory. The back panel, which can be a starting point, is inlaid and sawed to shape. Fig. 1 shows the panel being routed to the dimensions indicated in Fig. 4. The inlay for the carved part is $\frac{1}{2}$ in. thick, while the smaller inlays are $\frac{1}{8}$ in. for both panel and base.

After the walnut has been glued in and the panel cut to the dimensions indicated in Fig. 4, plane and sand the surfaces and chamfer the edges. In the same



manner, the inlays for the base are cut and finished, Figs. 2 and 3. The larger inlay for the base, however, is only $\frac{3}{8}$ in. thick instead of $\frac{1}{2}$ in. as in the case of the panel. Referring to Fig. 2, the recesses for the penholders are $\frac{1}{4}$ in., as is the groove that receives the back panel. Holes are drilled and countersunk, detail A, for three No. 12, 1-in. flathead wood screws to hold the panel. The spring compartments, detail B and Fig. 6, are approximately $\frac{3}{4}$ in. deep and the recesses for the inkwells $\frac{1}{2}$ in. deep. Note that the ink



bottles used are those which contain India ink.

The walnut collars for the penholders, upper left-hand detail of Fig. 5, are turned on a lathe, using a template to check the curvature of the rings into which the balls fit. When making the holly-ball penholders, first drill $\frac{3}{8}$ -in. holes for the pens, plug them with dowels and glue on waste stock with paper between the pieces of wood. Then turn the ball to the dimensions indicated in the lower details of Fig. 5. The complete assembly is shown in Fig. 6. The buttons on which the balls ride also are dimensioned in the lower left-hand detail of Fig. 5. Shown in the upper right-hand detail of Fig. 5, the pens are about $\frac{3}{8}$ in. in diameter sanded down to fit the holders. The ink-bottle covers and caps, Figs. 7 and 9, are built of walnut and holly or birch respectively. A cork is re-

cessed and glued into each cap. To hold the caps when ink is being used, a wire ring, Fig. 8, is bent as shown to set in the base.

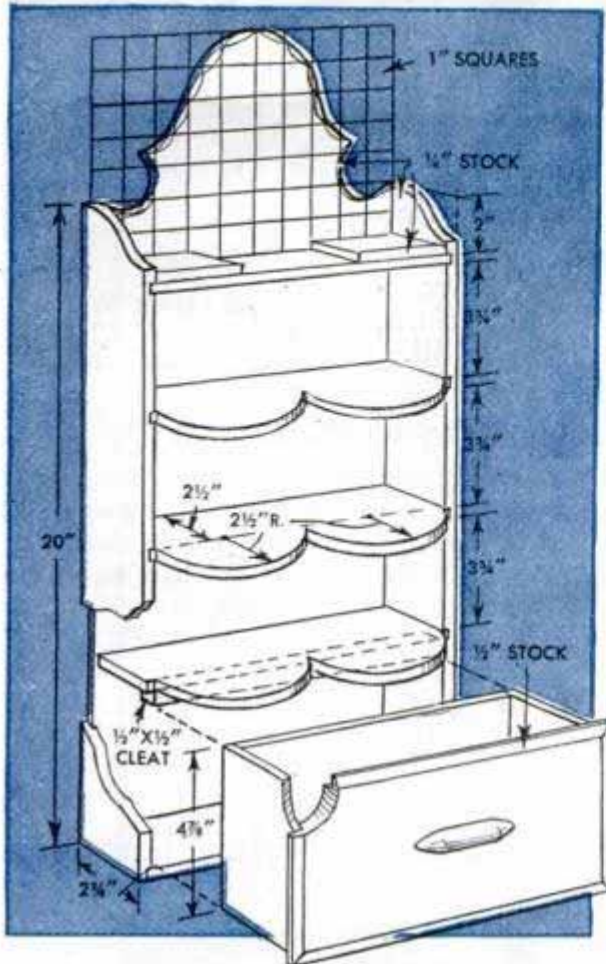
The birds carved on the back panel are bobwhites in flight. Draw the design to size on paper and transfer it to the panel with carbon paper. Then cut the relief with a gouge or small chisel. After the panel has been carved, the initials shown in the top inlay can be cut from a strip of ivory and glued in the piece of walnut.

Just before assembly, give the penholders and collars a coat of shellac which is rubbed down with fine steel wool. Assemble the holders as shown in Fig. 6 and glue and clamp them to the base. The back panel then is glued and screwed to the base, after which the covers for the ink bottles are glued and clamped. When the adhesive has hardened, all surfaces are smoothed with fine sandpaper, except for the carving which can be high lighted with steel wool to give an antiqued effect.

To finish the set, apply a coat of boiled linseed oil to the walnut parts, masking off

the holly or birch. Let the oil stand for $\frac{1}{2}$ hour and wipe with a cloth dampened in turpentine. Then, using thin shellac, brush all surfaces except the inside of the carved panel. Rub down the shellac with fine steel wool and apply a light second coat of linseed oil to the panel, working it in well. Let the set dry for about 24 hours and finish with two coats of furniture wax. To prevent scratching the desk, felt should be glued to the base. The metal ring or ferrule for the penholder and the wire cork holder are added after the set is finished.

This Spice Chest Holds Coffee-Can Containers



This step-saving spice chest provides storage for all the food-seasoning ingredients right within arm's reach of the kitchen range or work table. Shelves are so arranged that each one supports two coffee cans of the 1-lb. size side by side. These serve as containers for coffee, raisins, powdered sugar and other items. Two aluminum shakers for salt and pepper occupy the top shelf and the small drawer at the bottom easily holds five or six spice containers. All parts are cut from 1/4-in. plywood except the drawer front which is 1/2-in. stock.

Before you cut any material, save six coffee cans of uniform size and figure the dimensions from these. Note that the cans overhang the shelves slightly and that the edges are cut to the contour of the cans. Groove the side pieces about 1/8 by 1/4 in. to take the shelves, which are glued in. The drawer is of ordinary construction, sides being joined to the front with rabbeted joints. Enamel the chest to harmonize with the kitchen cabinetwork and decorate with colored transfers to suit your taste.

L. H. Young, Pismo Beach, Calif.

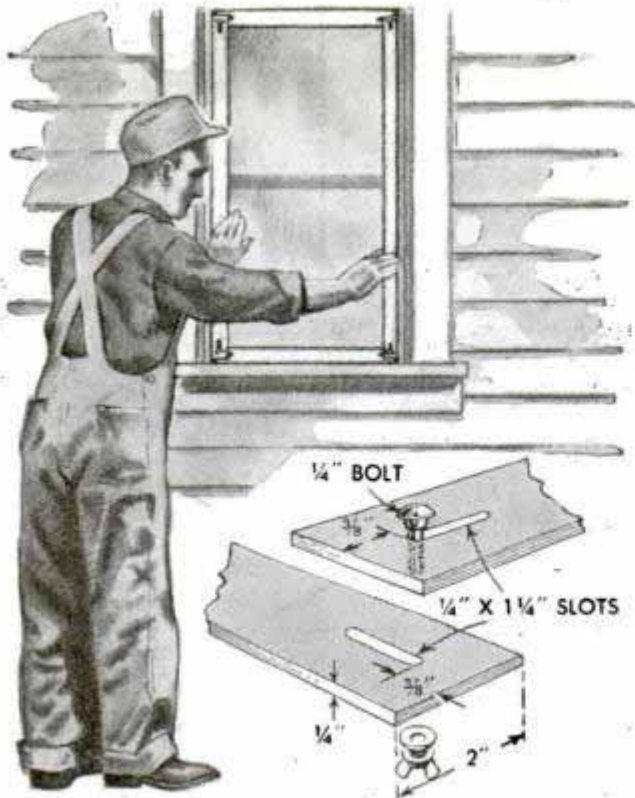


100 W.P. Adjustable Fixture Clamps Work For Fine Engraving

Small work such as wood blocks and signet rings that are to be engraved can be held firmly in an adjustable fixture like the one that is shown here. The fixture, which can be made of any convenient size to fit the work, consists of a 3/4-in. hardwood frame screwed to a sheet-metal base, several spacers and two wedges, also of hardwood. Screws are driven through holes countersunk in the base into the underside of the frame to form a tray for the spacers. In use, the spacers are positioned on either side of the work and the wedges are driven in to clamp the latter securely.

Samuel Bergman, New Rochelle, N. Y.

Gauge Measures Warped Frame To Fit Storm Sash Exactly

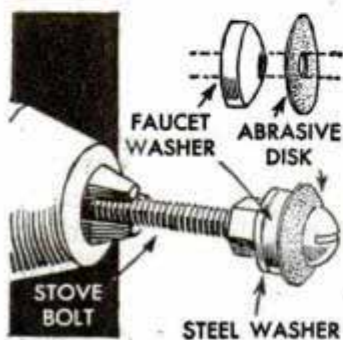


With an adjustable gauge made of light wood, storm windows can be fitted exactly into old sash frames that are out of square. The gauge consists of four strips of $\frac{1}{4}$ by 2-in. stock cut $\frac{1}{4}$ in. shorter than the dimensions of the largest window to be fitted. The strips are assembled to form a frame that fits into the window, a slot being cut near the end of each strip to take a bolt, which is held by a washer and wing nut. The gauge is fitted to the sash frame and used as a pattern for the storm sash which is cut to fit exactly. After using the gauge on the largest window, the strips are shortened to fit loosely into the next largest window frame and so on until all windows have been fitted.

E. V. Briceland, Toronto, Ont., Can.

Disk Will Reface Faucet Seats

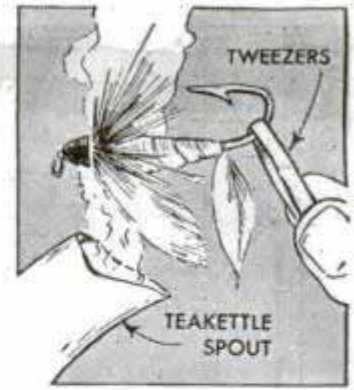
If a nonrenewable faucet seat becomes rough or corroded so a new washer will not stop the leak, it can be refaced with this tool. Backing up an abrasive disk are a faucet washer and a steel washer. The



whole assembly is tightened on the bolt with a nut and the jig is ready for action. Used in a hand drill, a few hundred revolutions will serve to reface the seat.—William G. Campbell, Duluth, Minn.

Steam Bath Restores Fishing Flies

If your favorite fishing flies are matted and bedraggled, you can restore their fluffiness by steaming them. This is done by holding the fly over a teakettle spout with tweezers.—D. E. Horn, River Forest, Ill.



Easy Way to Rehang a Door

When rehangng a door that has been taken down for repairs, you will be able to slip in the upper hinge pin more easily if you first loosen the screws holding half the lower hinge on the door jamb, then join the parts and insert the pin. Loosening half the lower hinge permits the door to be tilted slightly to align the halves of the upper hinge for inserting the pin.

E. L. Reynolds, Bronxville, N. Y.

Zipper Key Purse Holds Fishhooks



One fisherman found that a very serviceable fishhook container can be made from a key purse. The key clips are removed and three small holes are punched in the leather lining for each hook.

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

☛ An easy way to stop the blowing of a car horn that is stuck is to strike the relay a sharp blow with a hammer or wrench to separate the contacts.

Kiltie Model RACING YACHT Of the Wee Six Class

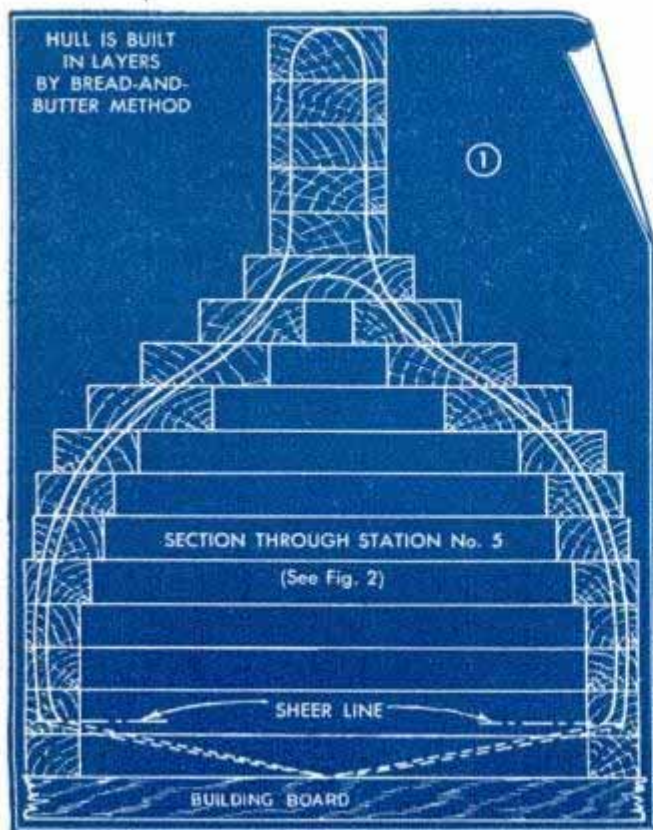
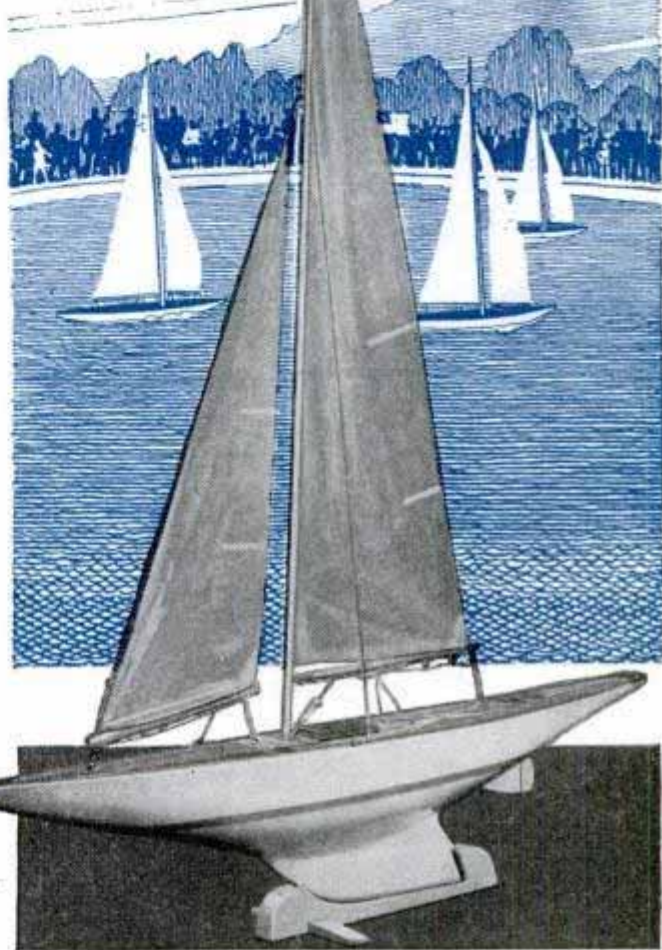
By John Black

Ex-President International Model Yacht Racing Union

KILTIE was built to a scale of $1\frac{3}{8}$ in. to the foot. The Wee Six, as this class is called, ranges in size from 36 to 40 in. on the waterline with overall lengths between 56 and 65 in. The minimum displacement varies from 19 lbs. on a 36-in. waterline to 25.5 lbs. on a 40-in. waterline, and the sail area varies between 1150 and 1300 sq. in.

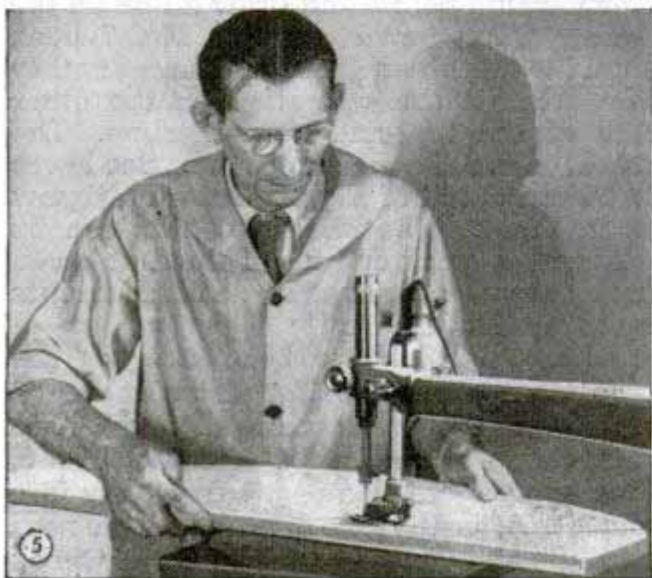
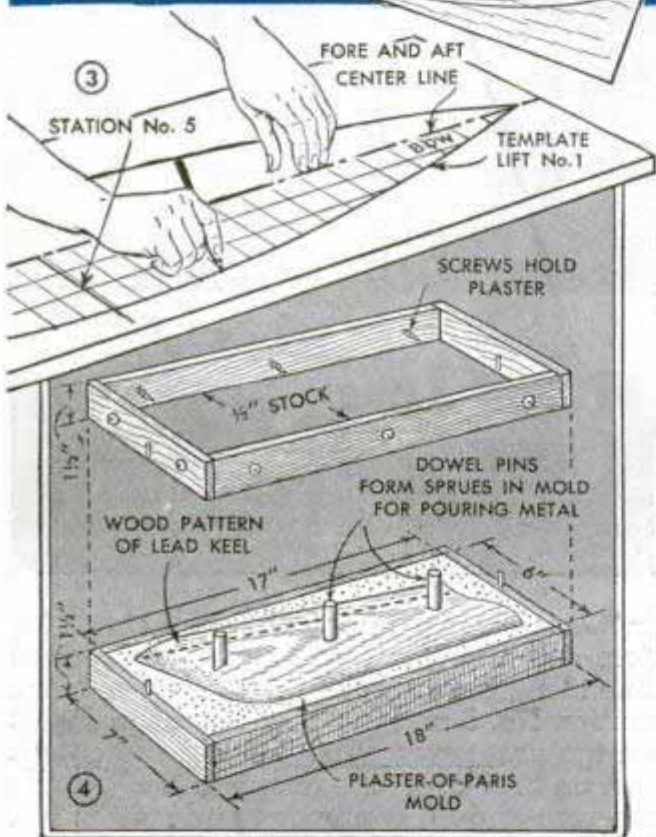
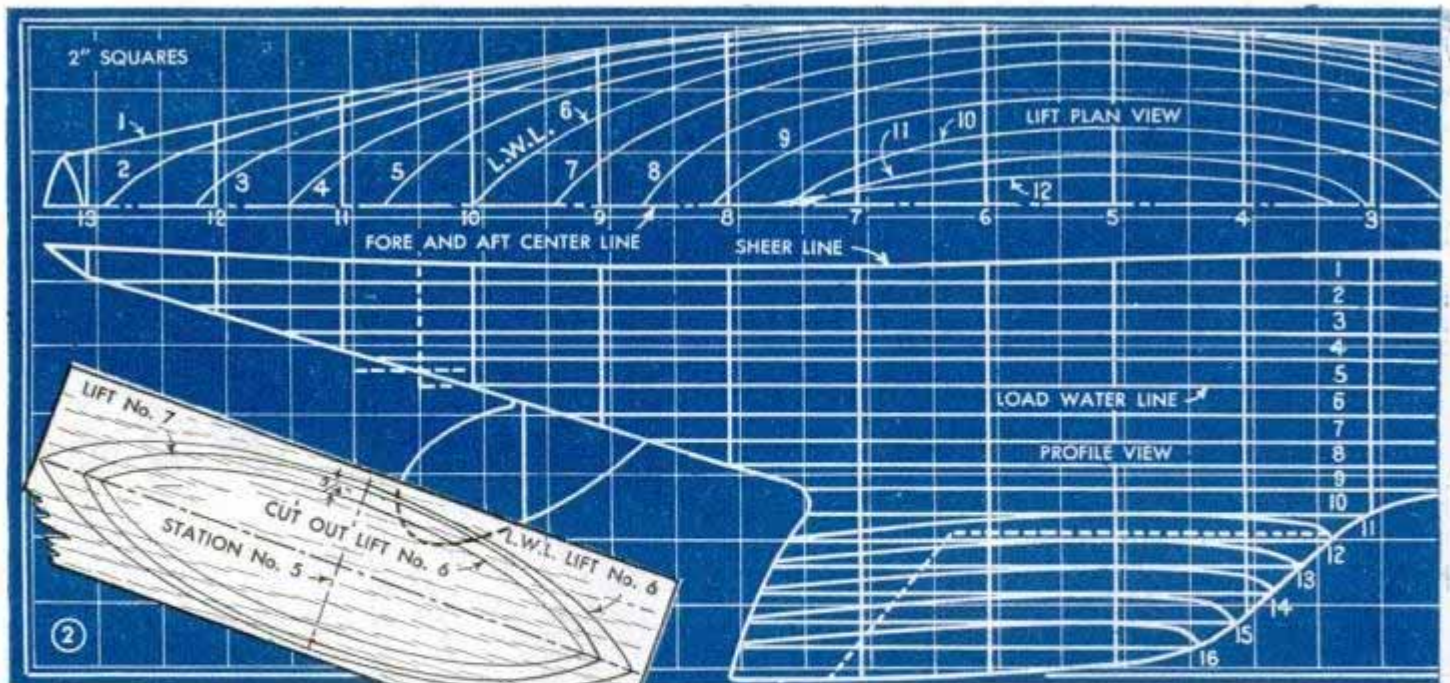
To begin construction, make a full-size drawing of the lift plan in Fig. 2, in the center of a 24 by 72-in. building board. Extend each of the station lines across the width of the board and number them. The other side of the board is used to lay out the profile view, in Fig. 2. Transfer the fore-and-aft centerline, station No. 5 and the curve of the various lifts to $\frac{1}{8}$ -in. plywood from which templates are cut. Only one side of the lift need be made as the same template can be used on either side of the fore-and-aft centerline.

As the greatest beam of Kiltie is $11\frac{1}{4}$ in. use stock $\frac{13}{16}$ in. thick and 12 in. wide. Start by laying out lift No. 1. Lifts 1, 2 and 3 should be cut to extreme beam. Tumble-

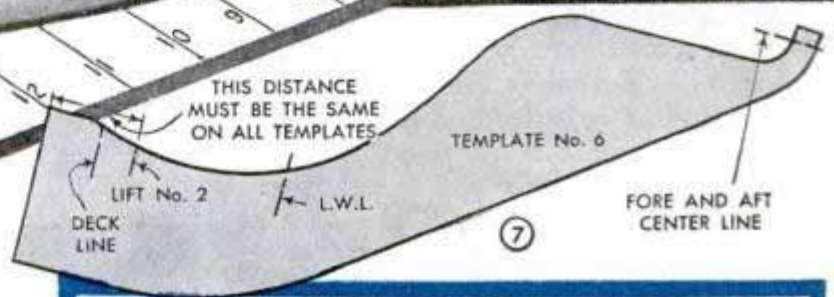
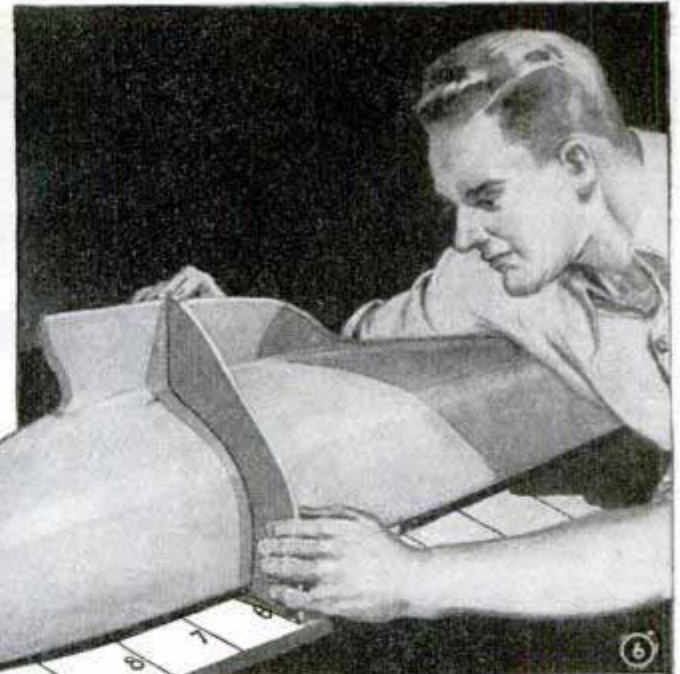
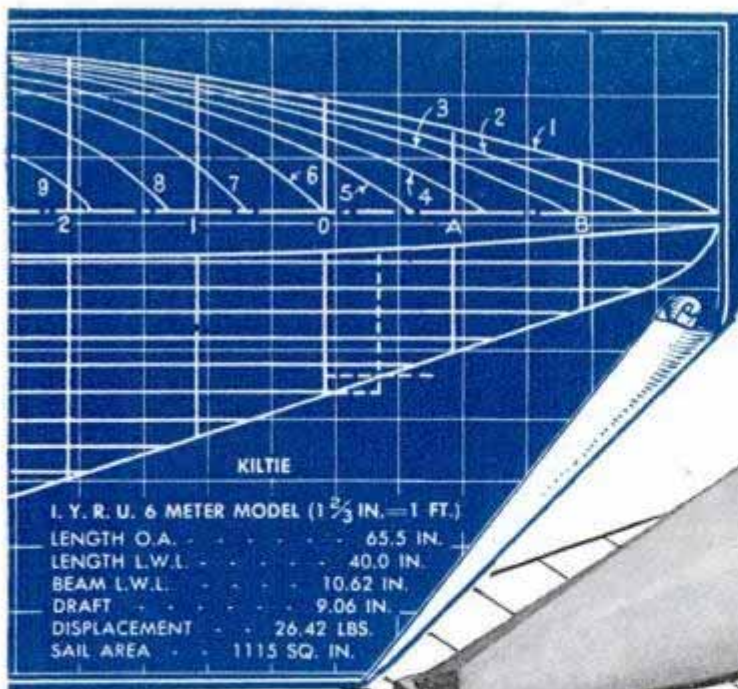


home is shaped later. On each side of a fore-and-aft centerline make a sharp pencil line along the curve of the template. Mark station No. 5 and the bow end as in Fig. 3 on the first seven lifts. To find the cutout line on lift No. 6, take template No. 7, using the fore-and-aft centerline and station No. 5 as locating points and draw a line on the board. Then move template No. 7 back from the line about $\frac{3}{4}$ in. and make another line. Repeat this operation on the other side of the fore-and-aft centerline. The third line will be the cutout line. See lower left-hand detail of Fig. 2. Cut on a jigsaw as in Fig. 5. The remaining lifts can be made from stock cut out of the first seven lifts. Cutouts should be made in all the lifts up to No. 10.

When all lifts have been cut you are ready to start gluing. Use waterproof glue and prime each coat. Glue the first three lifts, clamp at both sides of station No. 5, then apply more clamps progressively fore and aft. After the glue dries, apply the next two lifts and repeat the procedure. Check

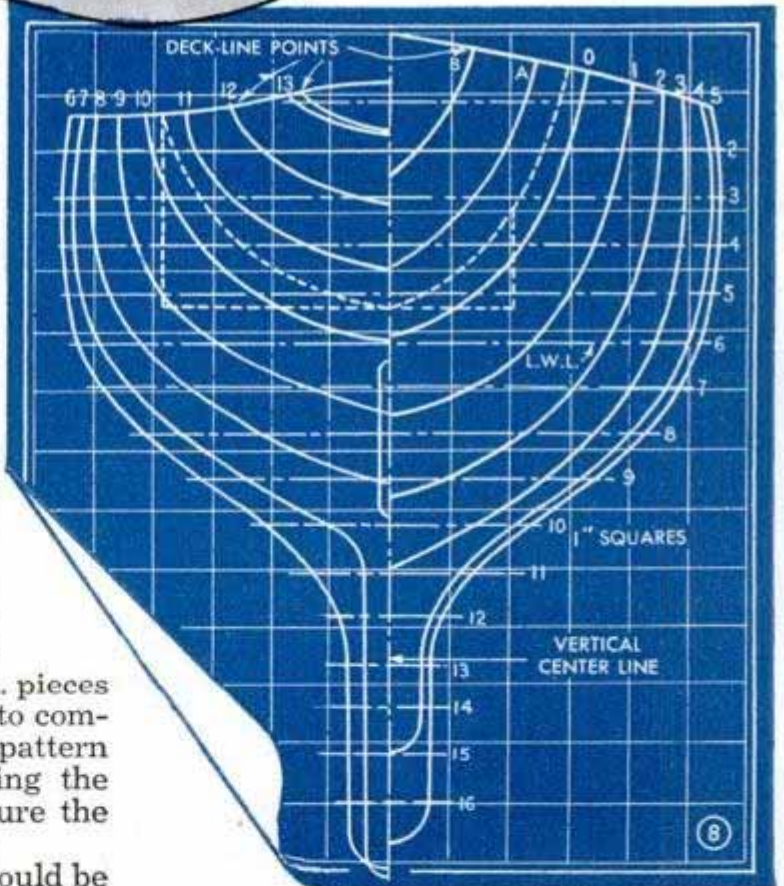


center lines carefully. Two short lifts $\frac{3}{4}$ in. wide and about 25 in. long are added to the forward end of lift No. 1 at each side. From the profile drawing on the building board, measure the distance from one of the water-lines to the sheer line at each station point and transfer to the hull. Draw the sheer line on each side of the hull through all these points and plane down to shape. To obtain the proper tumblehome, a true check line must be transferred to the top of the hull. The best method of doing this is to measure the distance between the vertical centerline and the deck-line points of each station from a full-size drawing of Fig. 8 made on cardboard. Then measure off and mark these distances on their corresponding station lines of the lift plan. Draw a curve connecting all these points and make a template from this curve to mark the deck line on the top side of the hull. The next step will be to cut away the bow and stern lifts. Make two templates from the profile drawing, one for the forward profile from station No. 5 to the tip of the bow, and one for the after profile from station No. 5 to the stern. Mark the load water line and station No. 5 on each template. Then cut away the corners of the forward lifts. Colored chalk rubbed on the edge of the template will locate the high spots. Repeat this operation on the after profile. Check to see that both the fore-and-aft load water lines on the templates line up with the corresponding lift line on the hull. Draw a centerline on the hull from the tip of the bow over the edge of the rudder and down to the stern or transom. The hull now is ready for rough shaping. Cut away the corners of the lifts to within $\frac{1}{8}$ in. of the glued joint at each lift. Then mount the hull on the building board in line with the drawing of the lift plan view with L.W.L. parallel with the sur-



face of the building board. Now make a complete set of templates from the full-size drawing in Fig. 8 and mark these as shown on template 6 of Fig. 7. The distance from the line of lift No. 2 to the end of the template can be measured from the hull. Begin shaping the hull by fitting No. 5 template. Use a block plane and locate the high spots with colored chalk on the template. Proceed to fit the other templates as in Fig. 6 then sand off remaining high spots. Use a rolling motion when smoothing with fine sandpaper. The hull then is hollowed out to a wall thickness of $\frac{3}{16}$ in. as in Fig. 1. Note that the wall widens to $\frac{1}{2}$ in. at the sheer line. Mark and saw off the pattern to be used in casting the lead keel, but leave the line on the hull as a guide in fitting the casting. Nail two $\frac{1}{2}$ -in. pieces of wood to the pattern as in Fig. 10 to compensate for shrinkage. Shellac the pattern to keep out moisture when forming the plaster-of-paris mold, Fig. 4. Be sure the mold is dry before pouring the lead.

The after edge of the lead keel should be beveled slightly and fitted to the hull. Locate and drill the holes for the keel bolts and counterbore on the bottom edge for the nuts. Two floor timbers, Fig. 9, are fitted in the hull directly above the keel bolts, which pass through the floor timbers. Use white lead in all joints of the hull, keel and floor timbers. Flow solder over the coun-



tersunk nuts and smooth with a file. Next make the cradle or stand detailed in Fig. 11.

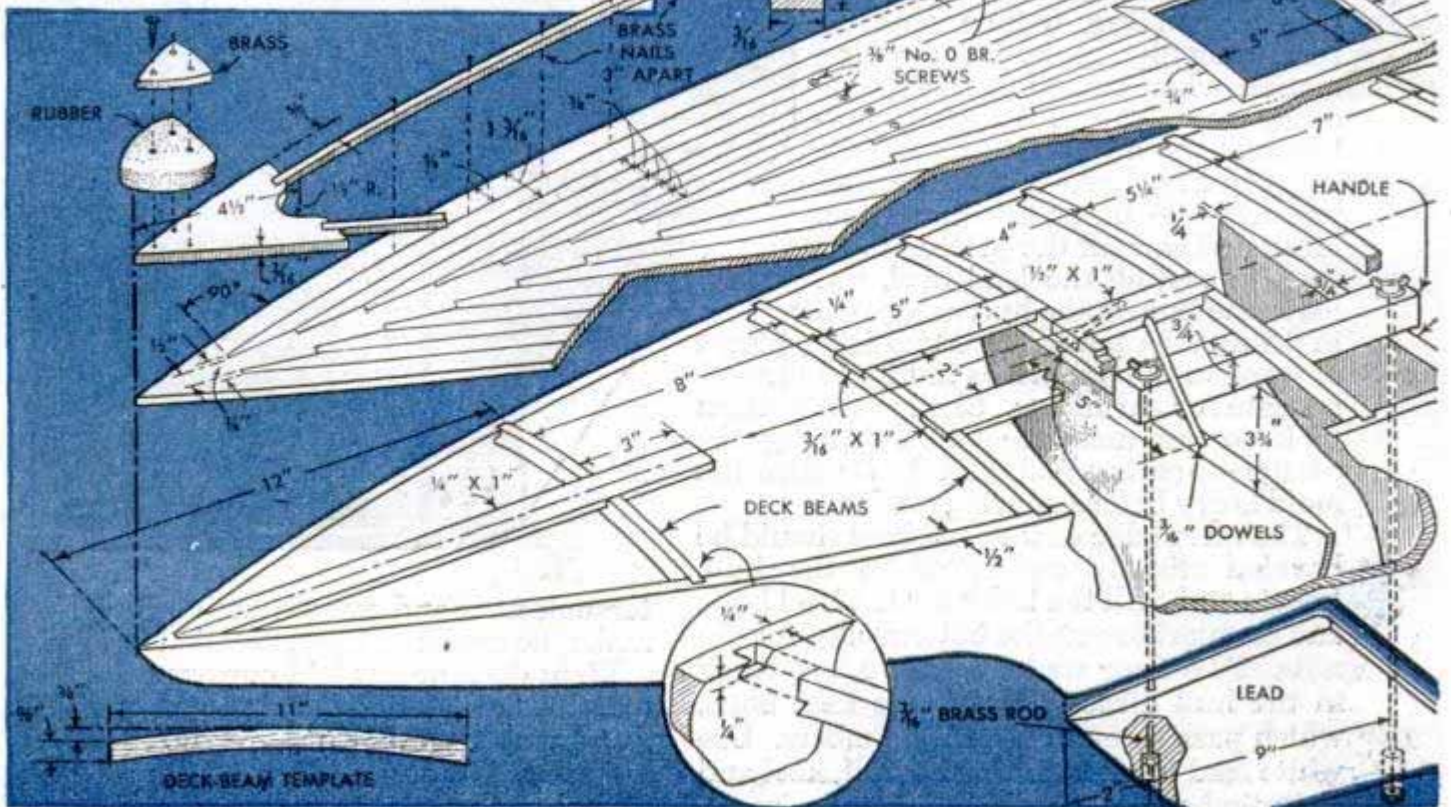
Eight deck beams laid out from the template at the lower left-hand corner of Fig. 9 and spaced as shown in the hull drawing, are jointed and glued in the hull. Lengthwise supports are set in the deck beams



pine or basswood. Before laying the deck, the supports, deck beams and the sheer-line edge of the hull should be trued and checked with a template for the proper camber. Lay the deck on the hull, then mark and drill a hole for the rudder tube and fasten the deck to the bow and each side amidships with a $\frac{3}{8}$ -in. No. 10 screw. Mark the shape of the deck, remove from the hull and saw just outside the line. Then fasten temporarily to the hull and trim flush. Mark the location of the hatch opening which should be cut flush with deck beams 4 and 5. To mark the imitation planking, remove the deck and score lines with a marking gauge as in Fig. 9. When all lines have been cut darken them with a chisel-pointed pencil and apply white shellac. Before attaching the deck, give the inside of the hull and underside of the deck three coats of paint or varnish. Then apply a light coat of white lead to the edge of the hull and

flush with the top. The support directly above the forward keel bolt is $\frac{1}{2}$ in. thick and is braced laterally with dowels. The support between beam No. 7 and the transom is fitted now, but not glued in until the skag and rudder are in place. The latter are made of mahogany patterned from the full-size profile drawing. Care should be taken to fit the rudder tube and skag in the exact center position. The skag should join the hull with a tight, flat joint. Apply white lead to the underside of the rudder-tube plate before fastening permanently. The rudder is screwed to a $\frac{1}{4}$ -in. brass rod with two brass screws which are countersunk, soldered and filed flush. The rudder should be tapered so the after edge is $\frac{1}{8}$ in. thick. Material for the deck may be $\frac{1}{8}$ -in.

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screw the deck securely in place.

Make and fit the mahogany bow and stern plates and small deck rail. As the top of the deck outside the rail is painted the same color as the hull, mark a line along the deck at the edge of the rail then remove the plates and rail.

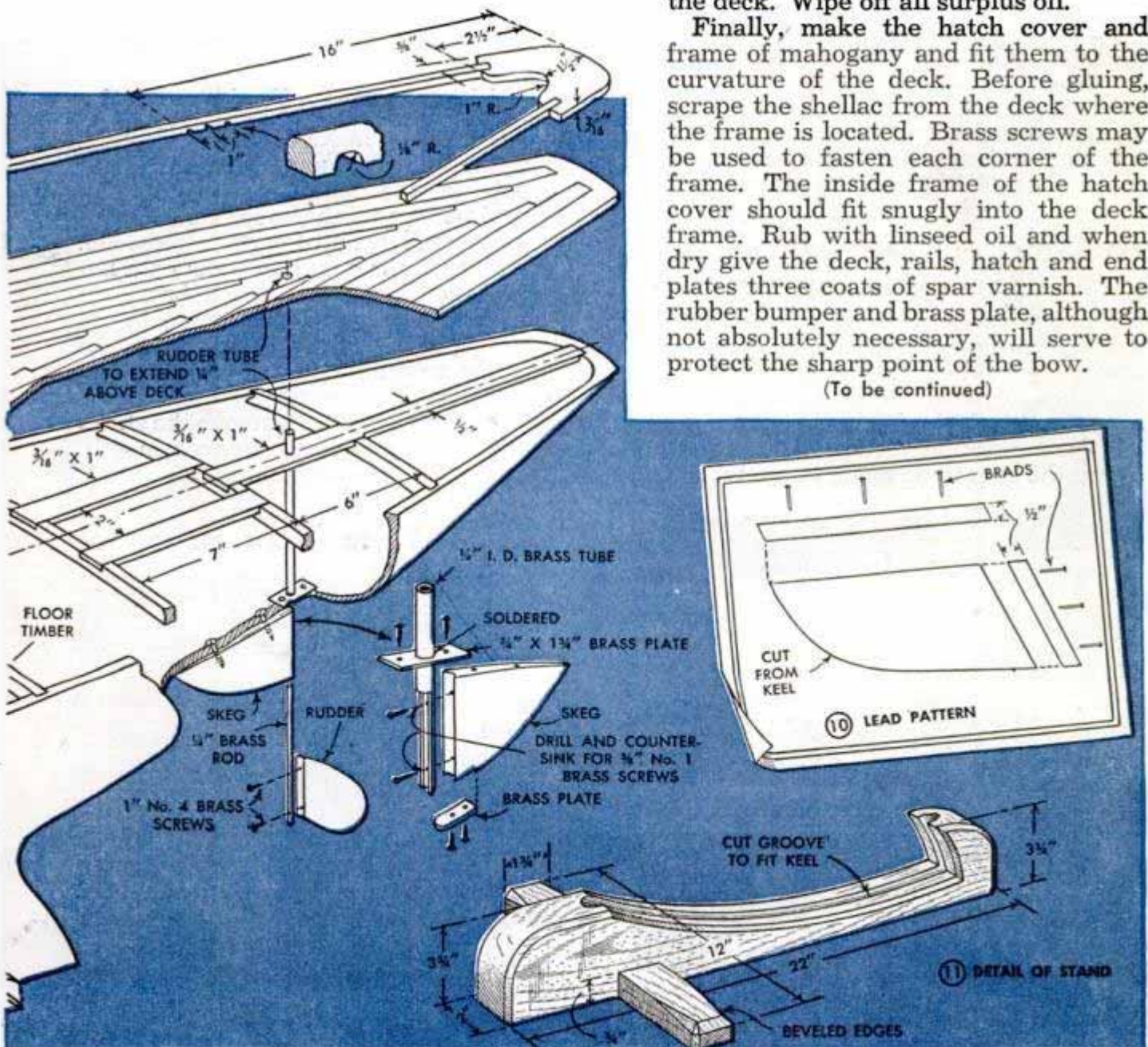
Apply three coats of gray enamel on the topsides and bottom with a $\frac{3}{4}$ -in. bright red stripe, called a boot-top, at the waterline. Smoothness of the surface will depend upon the time spent in sanding and puttying the first coat. Allow two or more days for the second coat to dry. Sand with wet-or-dry 6-0 sandpaper, rubbing lightly until the surface is smooth. The third and last coat should be allowed to dry for several days before rubbing down with sandpaper and steel wool. For a glass-smooth finish and also a semigloss, rub the



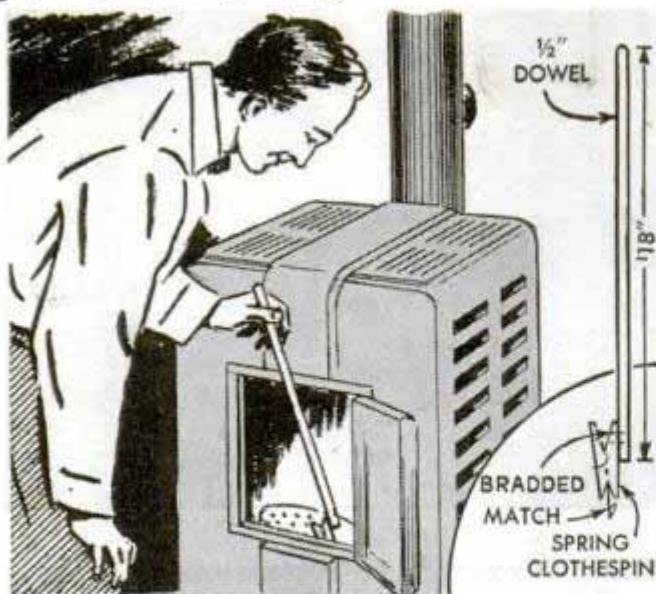
hull with powdered rottenstone. The bow and stern plates and rail are given a coat of boiled linseed oil to darken the mahogany and add contrast to the natural finish of the deck. Wipe off all surplus oil.

Finally, make the hatch cover and frame of mahogany and fit them to the curvature of the deck. Before gluing, scrape the shellac from the deck where the frame is located. Brass screws may be used to fasten each corner of the frame. The inside frame of the hatch cover should fit snugly into the deck frame. Rub with linseed oil and when dry give the deck, rails, hatch and end plates three coats of spar varnish. The rubber bumper and brass plate, although not absolutely necessary, will serve to protect the sharp point of the bow.

(To be continued)



Match Held in Clothespin Jaws For Lighting Oil Heater

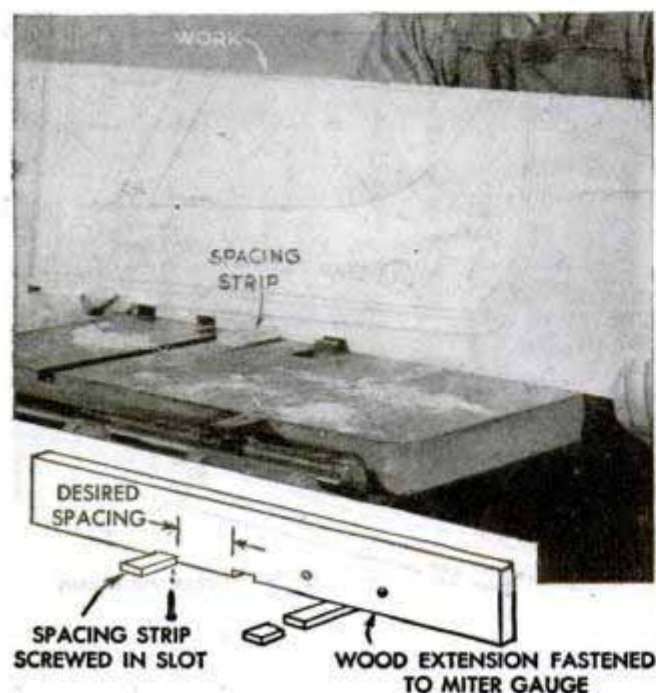


Instead of using a wad of twisted paper for a torch when lighting an oil heater, you can hold a match in the jaws of a spring-type clothespin that is bradded to a length of dowel. This method is especially useful for heaters that are lighted through an opening in the top, as it eliminates ashes and charred paper that otherwise would drop to the bottom of the heater.

T. E. Fallin, Sunnymead, Calif.

Backstop on Saw Miter Gauge Spaces Cuts Equally

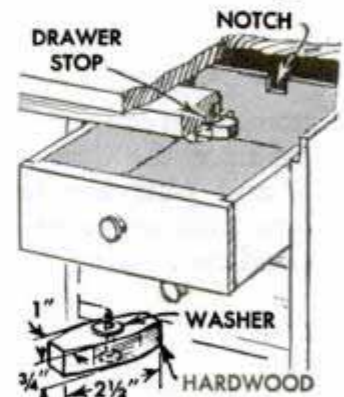
When you have to make a series of equally spaced cuts along the edge of a board, try this method. Screw an auxiliary backstop to the miter gauge of a circular saw, then push the backstop over the cutter. Now mark off the spacing desired between the cuts to be made in the work and



cut a slot at the mark. A wood spacing strip screwed into this slot will serve as a stop to position work on the saw table, each cut in the work being fitted over the spacing strip to set the work for the next cut.

Drawer Fitted with Rotating Stop Is Removed Without Lifting

Screwed to the underside of a table or desk, a drawer stop like the one illustrated rotates to permit removal of the drawer without raising the front end. The stop is a block of hardwood shaped as shown in the detail. A notch is cut in the rear panel of the drawer to pass the stop when the latter is turned parallel with the drawer sides.



George Sperry, Detroit, Mich.

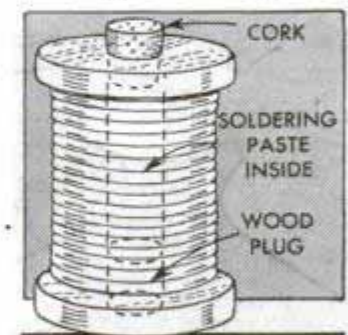
Easy Way to Make Buffing Sticks

If you want to make your own buffing sticks, you can do so by using the following materials in the stated proportions by weight: 4 parts naphtha soap, 1 part beeswax, 2 parts tallow and 4 parts rottenstone. First melt the tallow and beeswax on a hot plate and add the soap, which has been shaved into fine particles. Then stir in the rottenstone, being sure that all parts are thoroughly mixed. Pour the ingredients into molds made of cardboard and allow them to cool. When hard, remove the sticks from the molds and cut to desired length.

G. J. Issakoff, Sioux City, Iowa.

Soldering Paste Kept in Spool

Soldering paste can be kept in the core of a spool around which wire solder is wound. To do this, close one end of the spool with a wooden plug and cork the other end to retain the paste.



With this arrangement, the wire and paste are in the same container and either is easily accessible.

When adhesive tape or plaster will not adhere because of cold or because it has dried out with age, just heat it for a few seconds to renew its adhesiveness.

POWER GRINDER

for telescope mirrors

FOR the amateur astronomer who would like to build a telescope, but dislikes the work of hand grinding and polishing a large concave mirror, this power grinder will solve the problem. It also is an excellent group project for an astronomical society as it can be moved to the workshops of the various members.

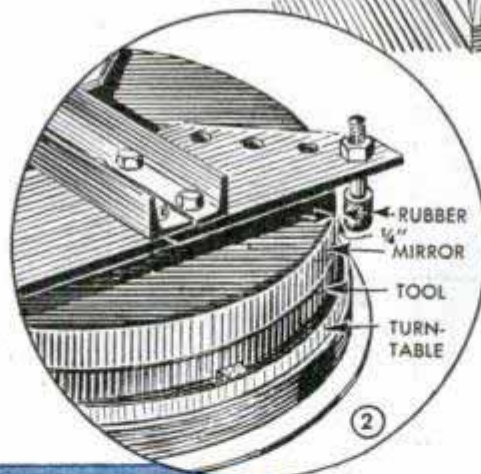
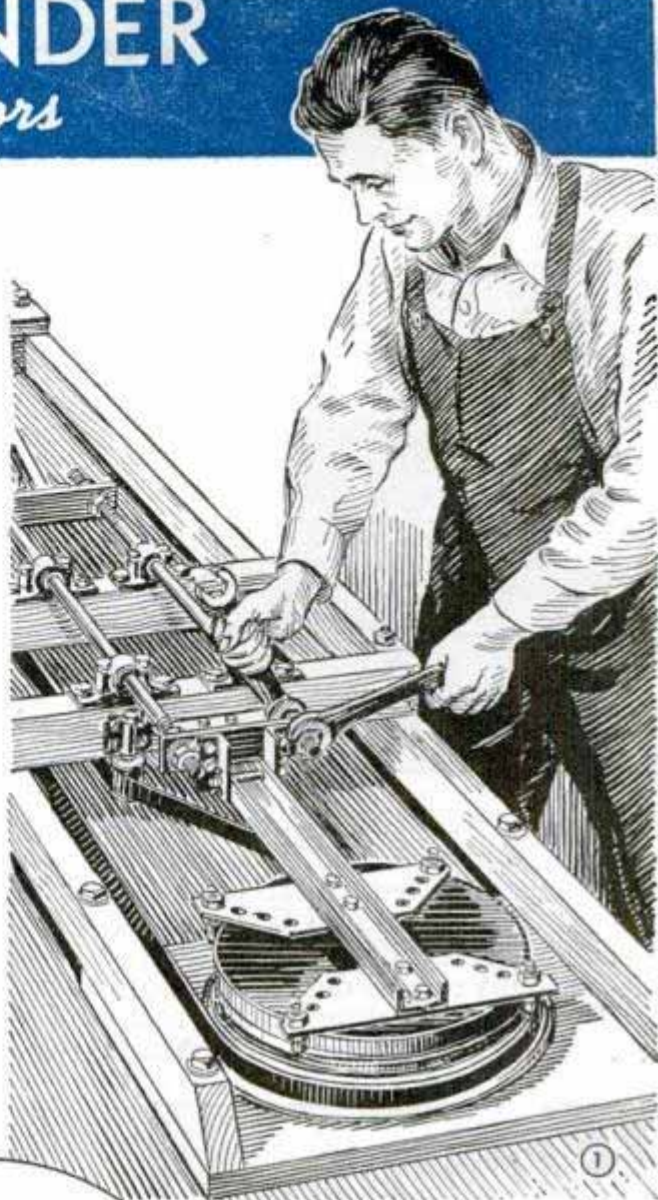
The machine automatically carries out the three correlated movements of hand grinding; namely, the back-and-forth motion, the slight turn of the upper disk at the end of each stroke and the short step around the barrel or pedestal every few strokes as is necessary in hand grinding.

As shown in Fig. 7, the frame or base of the machine consists of 2 by 4-in. stock bolted together with a short length of 2 by 12-in. plank across one end to support the turntable. A 1-in. board is bolted to one side of the other end to mount the motor. Straight, seasoned lumber should be used.

Use a 1/4-hp. motor of 1750 r.p.m. Two four-step pulleys of 4 1/2, 3 3/4, 3 and 2 1/4 in. dia. steps are used as the first stage in the speed reduction. Further reduction is accomplished by using two 14-in. pulleys and two 2-in. pulleys arranged as shown. For the fine polishing operation, reduce the speed to about 27 r.p.m.

at the crank drive shaft. All rotating and sliding shafts are mounted in 1/2 and 3/4-in. pillow-block bearings. The motor and pulley-shaft assemblies can be bolted in position after the belts are in place. This will assure proper belt tension.

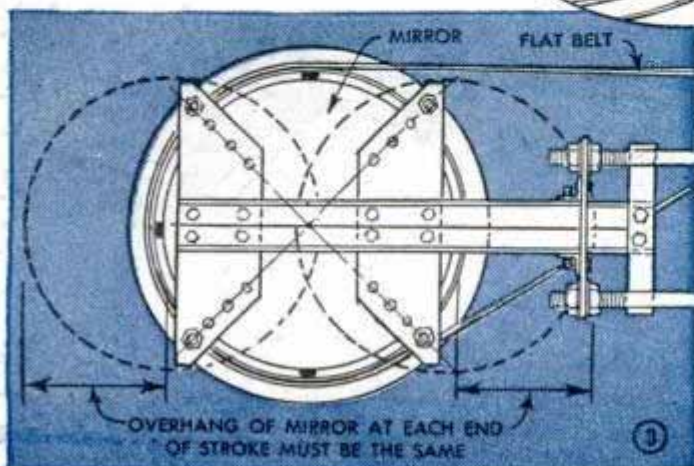
The crank arm, shown in the lower right-hand detail of Fig. 7, is made of



steel-bar stock, drilled and tapped as indicated. Two 1/2-in.-13 tapped holes provide for changing the length of the stroke. The long stroke, which is used for rough grinding, will move the center of the upper disk from one edge almost to the other of the lower disk. The short stroke is used for fine grinding and polishing and

will give the required 1/3 stroke for the particular size mirror to be made. A pin secures the crank arm on the shaft and permits easy removal when changing arms for mirrors of different sizes.

The connecting rod, Fig. 7, is drilled and reamed on one end to take a bronze bushing 1/32 in. longer than the width of the rod. This provides a clearance between the rod and the brass washers. The other end of the rod pivots on a 3/8-in. pin, which is attached to one end plate of the horizontal slide. The slide

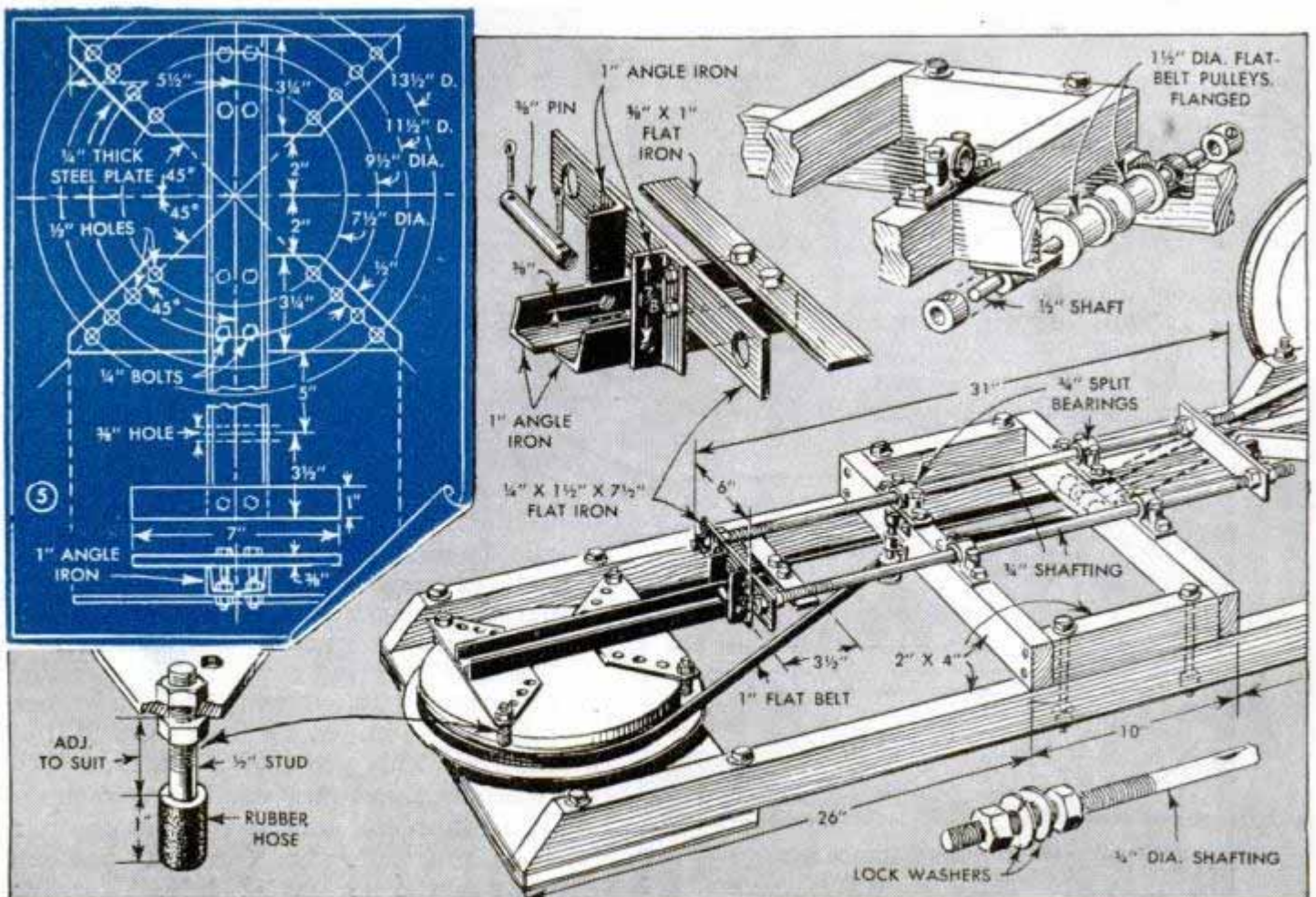




consists of two pieces of $\frac{3}{4}$ -in. shafting threaded on each end, and two flat-iron end plates drilled to accommodate the shafts. Care should be taken to keep the center-to-center distance the same on both pieces. This can be done as shown in Fig. 6. When constructing the turntable, detailed in Fig. 8, you will find that the $1\frac{1}{4}$ -in.

pipe will have to be dressed down to slip into the $1\frac{1}{2}$ -in. pipe. Surfaces of the pipe floor flanges that bear against the brass ring also should be finished smooth.

The turntable pan is made from a piece of 20-gauge sheet metal, 14 in. in dia., onto which a band $1\frac{1}{4}$ in. wide is soldered to make it watertight. The pan is mounted on the $1\frac{1}{4}$ -in. pipe flange with flat-head bolts. The rubber gasket material used on the bottom of the pan is cut in four parts resembling pieces of pie, with space between the pieces. This cushions the tool and provides a place for the water to drain off the tool. A hole drilled in the center of the pan provides a drain for water and sludge. When mounting the $1\frac{1}{2}$ -in. pipe and flange in the frame, care should be taken to have the center exactly in line with the center of the slide. A flat belt driven by a $1\frac{1}{2}$ -in. pulley on the crank drive shaft rotates the turntable. Two idler pulleys on a $\frac{1}{2}$ -in. shaft are fastened on the frame as shown in the upper left-hand detail of Fig. 7. Another idler pulley, to guide the belt, is mounted vertically on the front crosspiece. The grinding arm, Fig. 5, is hinged to the end plate of the slide as indicated in Fig. 7. Holes, $\frac{1}{2}$ in. in dia., are drilled in the $\frac{1}{4}$ -in. plates of the grinding arm to take four studs, long enough to extend about $\frac{3}{4}$ in. below the top surface of the mirror. A piece of heavy rubber tubing is slipped on the lower end of each stud in order to pro-

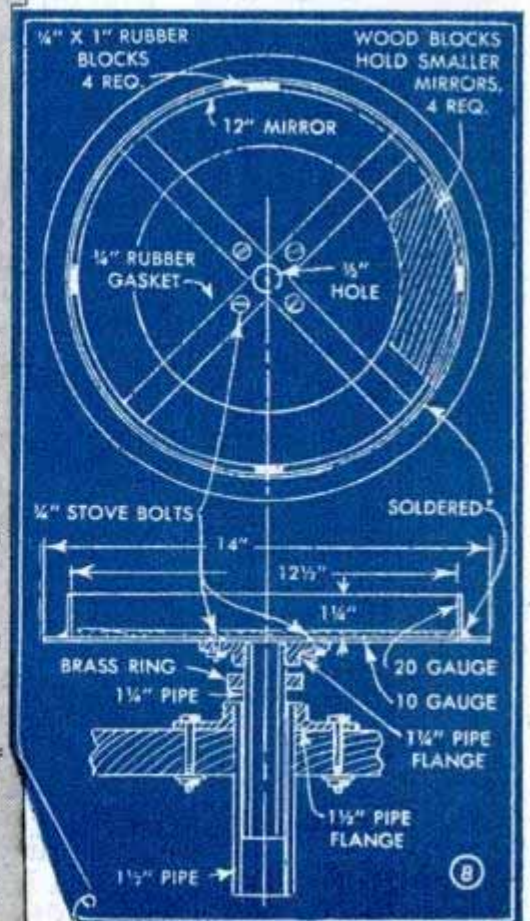
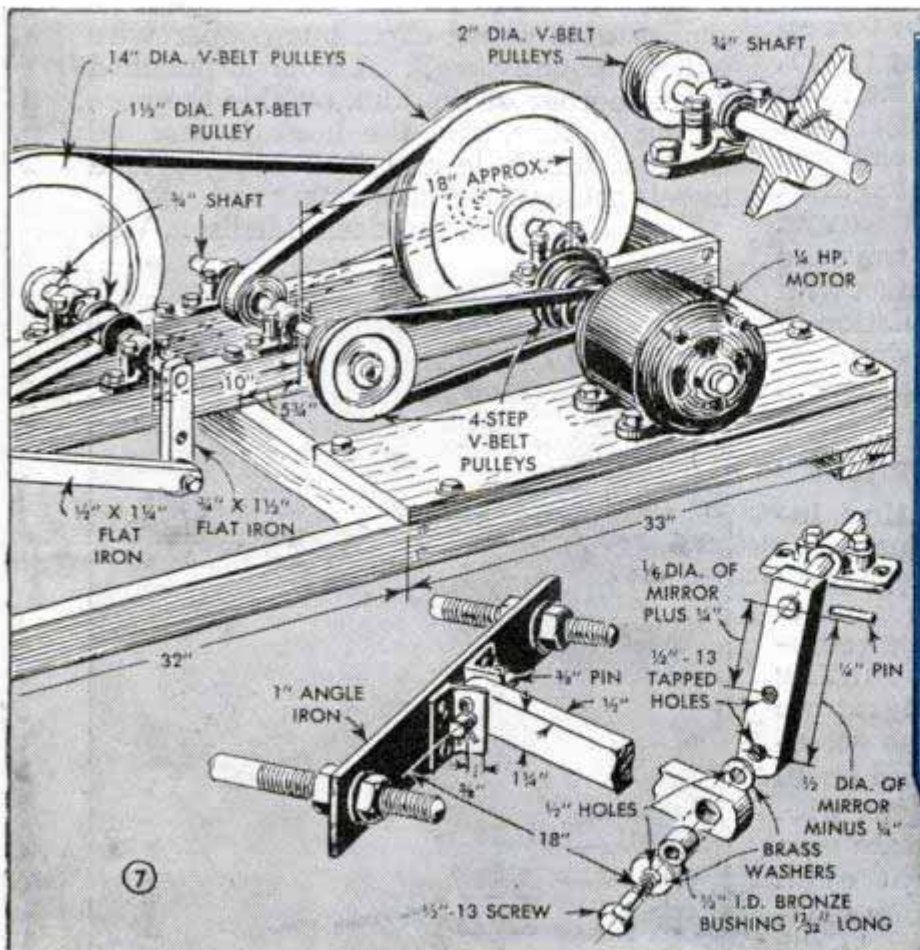


vide a better grip on the edge of the mirror.

The $\frac{1}{2}$ -in. holes in the $\frac{1}{4}$ -in. plates of the grinding arm are located so that a 6, 8, 10 or 12-in. mirror may be ground merely by changing the four studs to the proper set of holes. When the studs are adjusted and tightened in place there should be about $\frac{1}{4}$ in. clearance between the mirror and the rubber hose on each stud. See Fig. 2. Glass to be used as the tool is placed in the turntable and four small pieces of rubber are inserted between the turntable band and the tool to center it and hold it tightly in place. If the mirror to be ground is less than 12 in. in dia., use blocks of soft wood. Place the mirror glass on top of the tool and lower the grinding arm, which then is adjusted until the overhang of the mirror is exactly the same at each end of the stroke, as in Fig. 3. This can be done by turning the machine slowly by hand and adjusting the nuts, Fig. 1, that hold the end plate. As an added precaution, place a small table against the frame in front of the turntable to prevent the mirror from dropping to the floor when adjusting the overhang. If everything is working properly, the arm moves the mirror back and forth across the tool, while the turntable revolves slowly. At the end of each stroke the moving turntable will rotate the mirror approximately 1 in. because of the clearance allowed between the rubber-covered studs and the mirror. This causes the mirror to cross the



tool in a different position on each stroke. The speeds of the tools and mirror are not important; it is important only that their relative speeds are different. When changing sizes of grit, remove the belt and take the entire turntable, tool and mirror to a drain and wash thoroughly, using a stiff brush. Then rinse as in Fig. 4, using a hose with low water pressure.



Hairs Aid in Bringing Enlarger To Sharp Focus



As a help in focusing dense negatives sharply in his enlarger, one photographer replaces the negative with a few hairs in the negative carrier. The hairs make it easy to obtain sharp focus, after which they are removed and the negative placed in the carrier again.

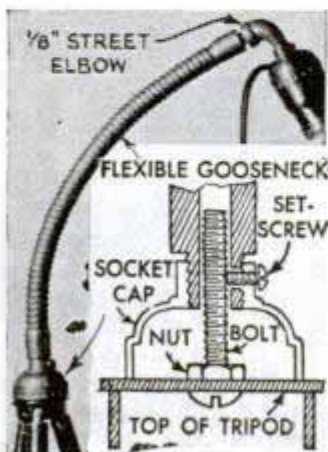
Powder Puffs Cushion Trays



Powder puffs placed between developing trays, when nesting them for storage, will prevent chipping and thus lengthen the life of the trays. Since the trays are not in contact with each other, there is a better circulation of air to dry them and prevent corrosion.

H. Klein, Pittsburgh, Pa.

Lamp Mounted on Gooseneck

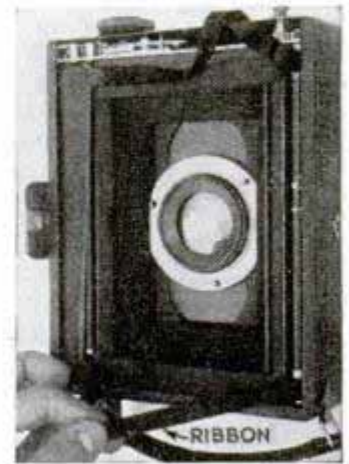


Permitting instant adjustment which "stays put," a flexible gooseneck makes a serviceable mounting for photographic lamps. The gooseneck should be 10 or 12 in. long with a $\frac{1}{8}$ -in. male pipe thread at each end. A lamp socket is fitted to the

gooseneck with a street elbow, running wire direct from the socket to an outlet, or through a hole drilled in the street elbow. A neat mounting on a lightweight tripod is made by using part of a light socket, as shown in the detail.

Shutter Repaired With Ribbon

If the fabric straps on a focal plane shutter wear through, they can be repaired by using a piece of satin ribbon. The ribbon is placed over the worn part of the old strap and the two then can be sewed together.—Sidney Pott, Victoria, B. C., Can.



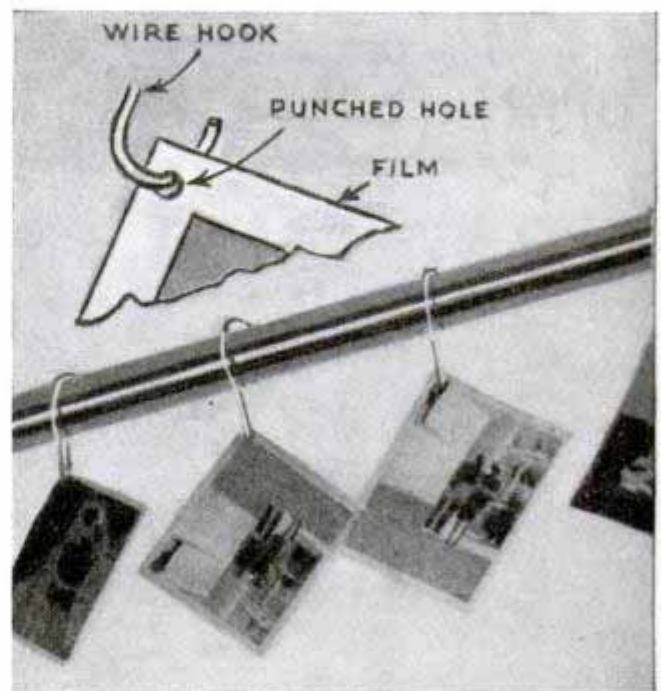
Shaving Brush Cleans Lenses

A shaving brush that has been softened by use makes a good dusting brush for camera lenses. Before it is used, the bristles should be trimmed to a uniform length.

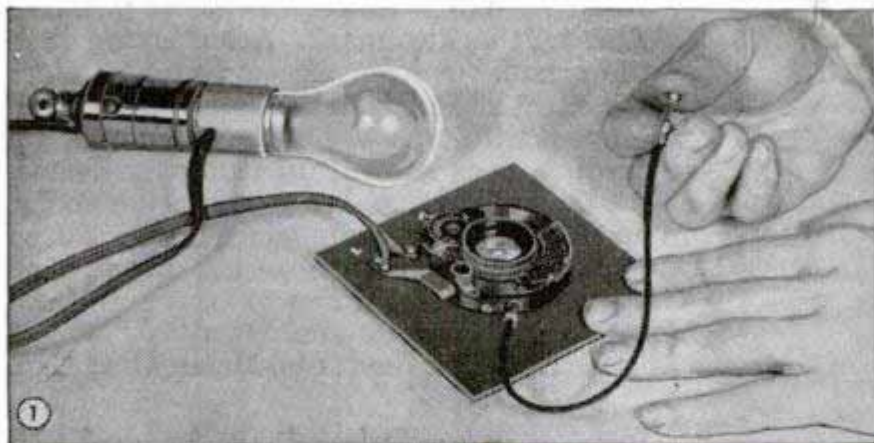
Wire Hooks Substitute for Clips

Film clips are unnecessary when drying sheet film if a few short pieces of wire and a paper punch are available. One photographer uses paper clips, but copper wire will do equally well. A hole is punched in one corner of the film, outside the area of the picture, and the hook is inserted through this hole and then hung over a towel rack or other supporting rod.

George T. Lundeen, Madison, Wis.



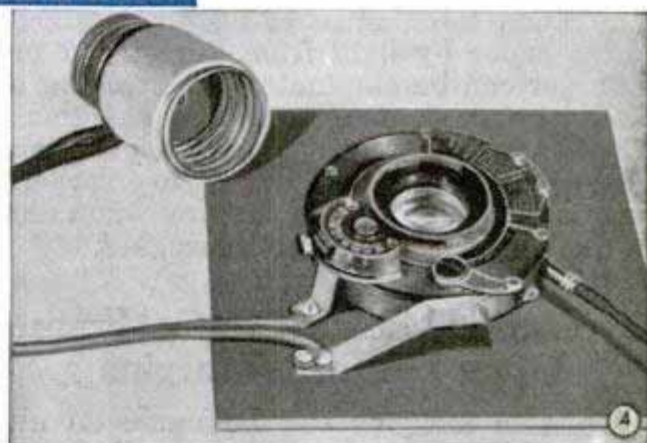
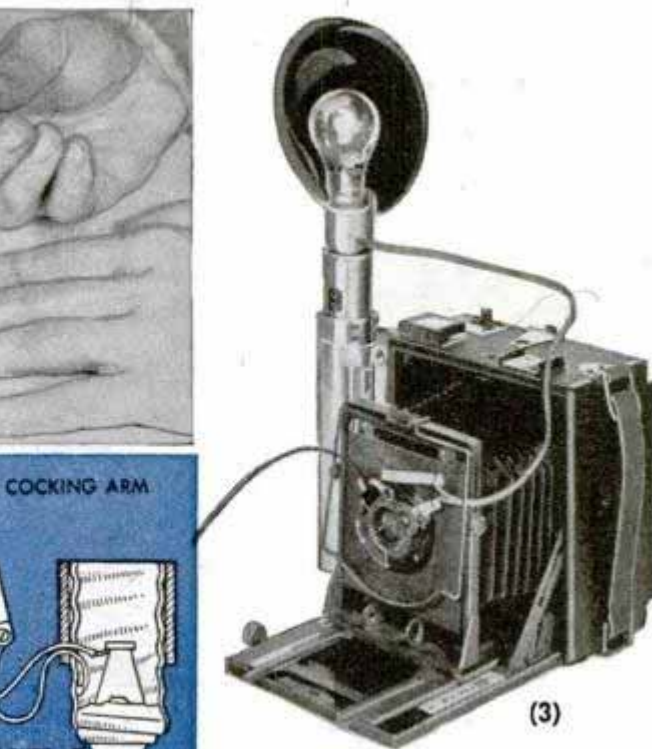
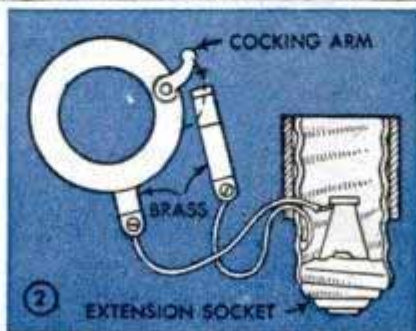
Simple Synchronizer for Auxiliary Lens Mount



Auxiliary lens equipment with the cocking type shutter can be synchronized for flash bulb photography by using the cocking lever of the shutter as a contact switch. Two strips of brass about $\frac{5}{16}$ in. wide make up the switch, as can be seen in Figs. 2 and 4.

The shorter piece is clipped under the timing scale, or some other part of the shutter body, while the longer piece, which is fastened to the lens board, is bent and fitted so the cocking lever will brush over it and make contact when the shutter is operated. Wires from the switch terminate at an extension socket on the flash gun. A hole is drilled through the insulation and shell of the socket, permitting the wires to be soldered in place, as indicated in the wiring diagram, Fig. 2. Adjustment of the switch must be set so the cocking arm closes the electrical circuit and flashes the bulb at the same instant that the shutter diaphragm opens.

This is easily checked by making a tester using a 15-watt bulb in the socket which is screwed into another socket connected to the house current, Fig. 1. To avoid a shock when the lever brushes the spring during cocking, do not connect the socket to the outlet until this operation is complete. By watching the shutter, or by looking through the lens, it is easy to determine when the switch arm is properly located. The bulb should light when the shutter is open. The finished setup with a camera is shown in Fig. 3, the extension socket fitting into any standard type of flash gun. Good results are obtained with this switch up to a speed of $\frac{1}{25}$ second. For this reason, fast-action pictures cannot be secured. At faster speeds, it is not wholly reliable since the contact is so momentary that the bulb sometimes fails to go off. Do not put the bulb in the socket until the shutter is cocked as the lever touches the

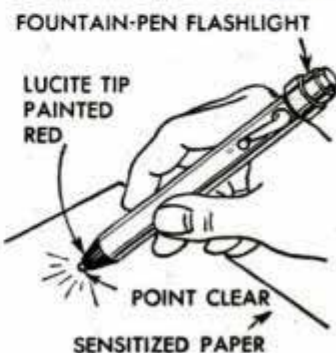


switch arm during this operation and completes the circuit. This would flash the bulb when the shutter was closed.

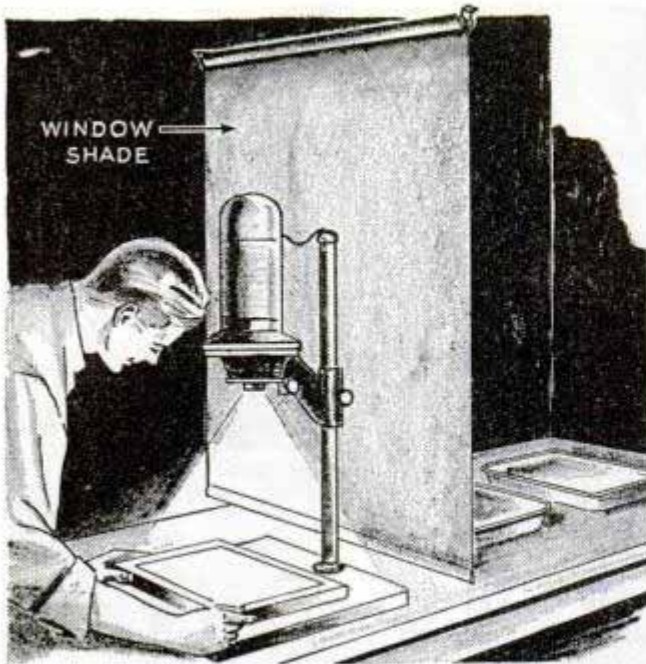
Sam Brown, Marion, Ohio

Flashlight "Writes" on Photoprint

When making photoprints, it's easy to write your name with light on the print so that the inscription is developed with the picture. To do this, fit a tapered piece of Lucite into the end of a fountain-pen flashlight and opaque the plastic with red nail polish. Then sand the color from the tip so that light will shine through, and use the flashlight as a pen. The writing should be done on a light portion of the print. —Michael Donner, New York.



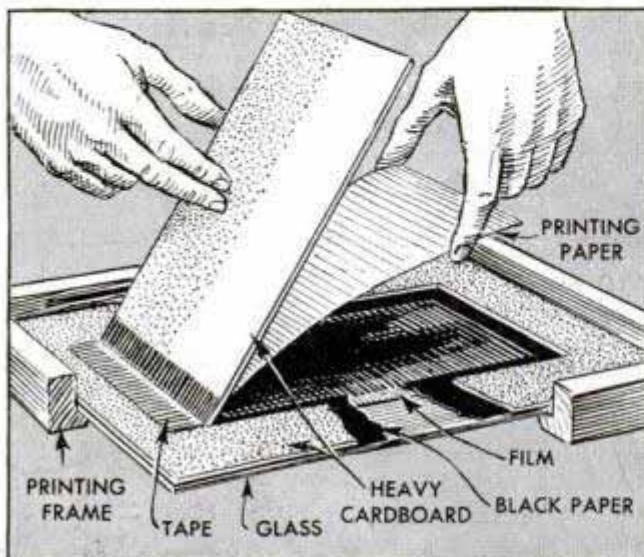
Window Shade Serves as Partition Between Enlarger and Paper



Where enlarging, printing and developing are done at the same time in a small darkroom, the chance of fogging unfixed photo paper by light from the printer or enlarger can be eliminated by attaching a dark window shade to the ceiling as shown. The shade is lowered to form a partition that will stop stray light from the enlarger, and can be raised out of the way when not in use.—Ken Murray, Baltimore, Md.

Cardboard Mask in Contact Frame Gives Uniform Margins

Uniform margins can be made on all prints of the same size without setting any easel guide strips, which are difficult to adjust in the dim light of a darkroom. All you need is a printing frame of the desired size, a piece of heavy cardboard and a sheet of opaque paper, both of which are cut to fit snugly within the frame. First remove the

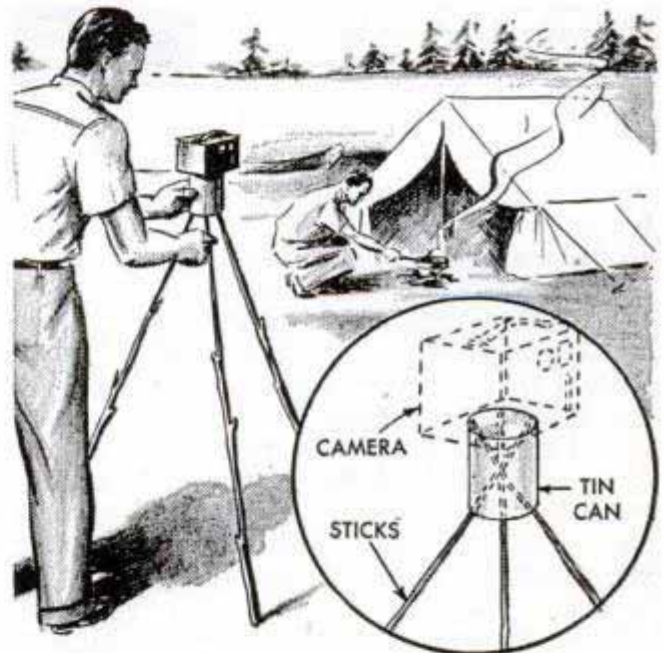


hinged back of the frame, then cut a rectangular opening in the opaque paper slightly smaller than the negative you use. This will be the mask. After laying it in the frame, cut from the cardboard a piece the exact size of your sensitized paper and hinge it with tape within the opening in the cardboard as shown. In using the frame, lift the hinged flap, lay the negative on the mask emulsion-side up, place the sensitized paper over it emulsion-side down, and press on the hinged flap to assure uniform contact of the paper and negative.

D. H. Jones, Sault Ste. Marie, Ont., Can.

Emergency Tripod Is Assembled From Sticks and Tin Can

Wishing to take some time exposures of his camp, and having no tripod to hold the camera, one sportsman solved the problem by using three sapling sticks and a tin can, assembled as indicated. Of course, with

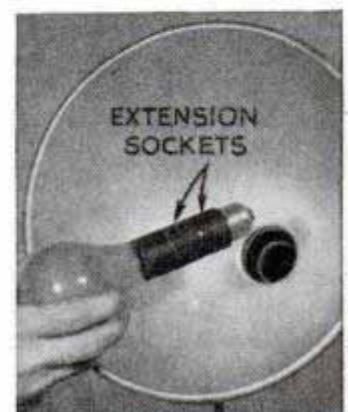


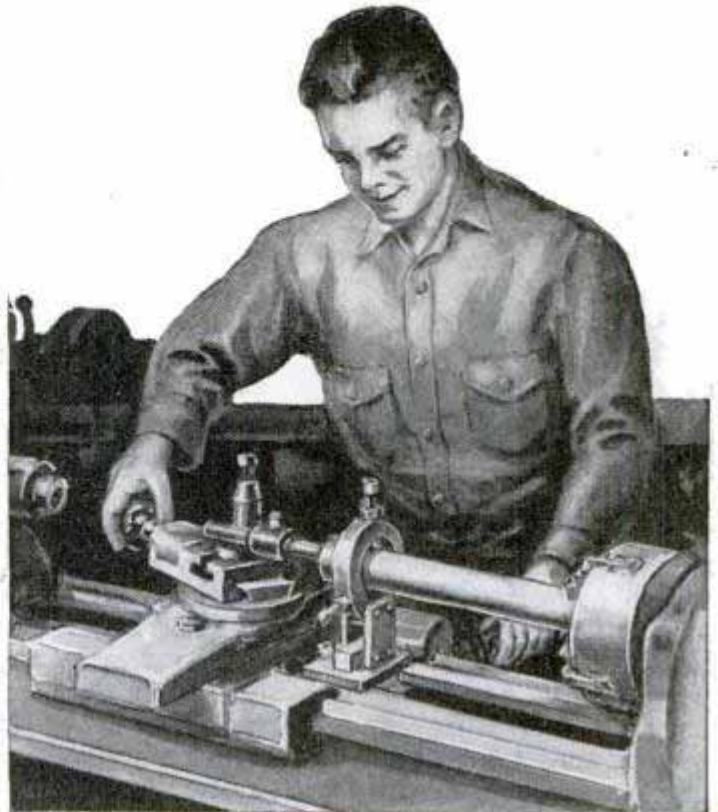
this arrangement the camera is not secured to the can, so it should be held to prevent it from falling.

G. E. Hendrickson, Argyle, Wis.

Effective Use of Small Bulb

If occasionally you have to use a small photoflood bulb in a deep reflector, you can get better light distribution by setting the bulb forward in the reflector. To do this, use two or three inexpensive extension sockets.



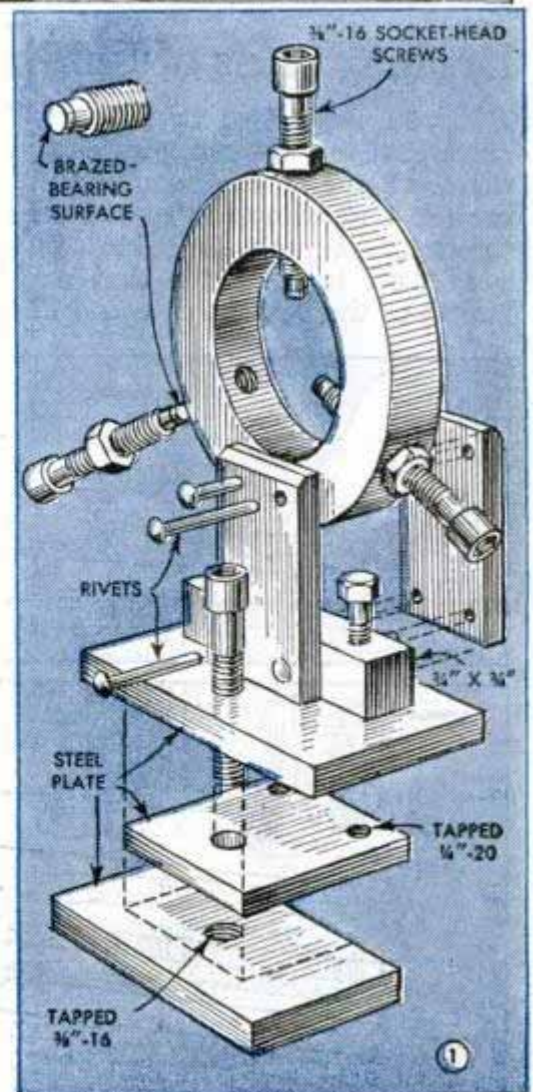


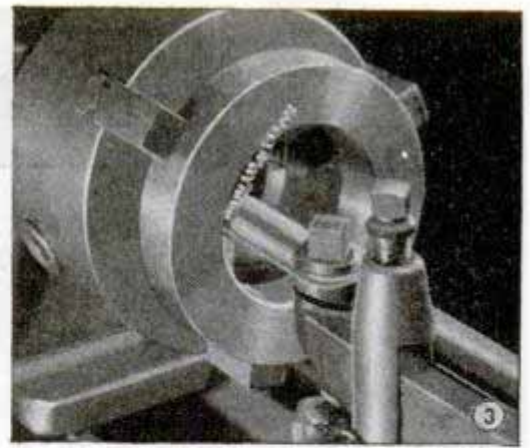
Make Your Own Steady Rest

By Gary Moore

WHEN turning long shafts of small diameter and when boring or threading spindles it usually is necessary to support the work in a steady rest. Where the lathe is not equipped with this accessory one can be made easily from small pieces of standard cold-rolled stock.

Only general dimensions are given in Fig. 1 as the rest must be dimensioned to fit the lathe on which it is to be used. Sizes of the parts are determined largely by the swing of the lathe, the type of lathe-bed ways and the nature of the work. The particular rest shown was designed for a 10-in. lathe with flat ways. The work support consists of a steel ring fitted with socket-head setscrews, located 120 degrees apart and provided with locknuts. Ends of the setscrews are built up by brazing on a bearing surface with bronze welding rod as in Figs. 1 and 2. The ring is chucked as indicated in Fig. 3 and turned, faced, bored and indexed in the chuck. It then is drilled and tapped for the setscrews and also for two $\frac{1}{4}$ -in. rivets, Fig. 7. These latter holes must be located carefully so that when the rest is assembled the ring will be positioned with one setscrew at the top. Assembly of the rest is shown in Fig. 1. The base is built up from pieces of flat steel stock cut to the sizes required. The upright members which support the ring are riveted to a square of steel attached





Principal part of this steady rest is a steel ring machined all over as shown above. Dimensions of the ring depend on swing of lathe and size of work

to the top part of the base with cap screws as indicated. The smaller of the two parts which comprise the clamp must be a free sliding fit between the lathe ways and must be located carefully so that the rest sets perpendicular to the lathe centers when the clamping bolt is tightened. Ends of the set-screws that bear against the work should be rounded over slightly with a fine file and

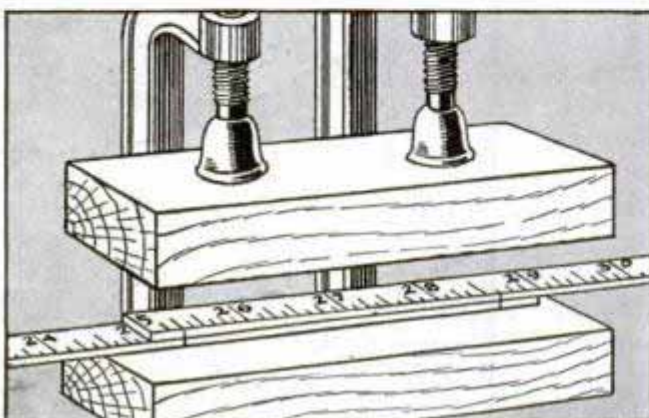
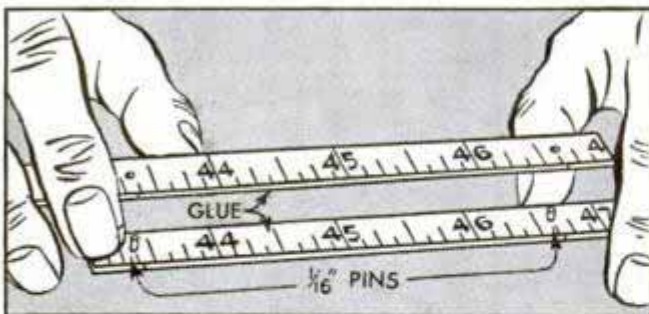
finished smooth with emery cloth. After the long tube or shaft has been set up in the rest ready for machining, place a few drops of light machine oil on the work at the point where the screws contact the surface. During prolonged turning operations, particularly on thin-walled tubing or shafting, check frequently to see that the work does not heat and bind in the rest.

Broken Ends of Folding Rules Are Joined to Make Repair

If you have two or more 6-ft. folding rules that are broken, you can join two of them to make one complete rule. The broken end of one is sawed off square at the nearest inch line, and the other is sawed off to a length that added to the length of the other will equal 72 in., allow-

ing for a 4-in. overlap. For example, if one rule is broken between the 47 and 54-in. marks, it is cut off 47 in. long. A second rule is sawed at the 29-in. mark and lapped under the other a distance of 4 in. In this way the end of the top rule meets the other at the 25-in. mark to total 72 in. Two holes are drilled through the overlapping sections for pins, and the paint is scraped from adjacent surfaces of the lapped sections so that they may be glued. While the glue is drying, the rules should be clamped together firmly. Care should be taken in making repairs of this kind to glue one rule to the other so that the sections may be folded normally.

George B. Taylor, Jacksonville, Fla.

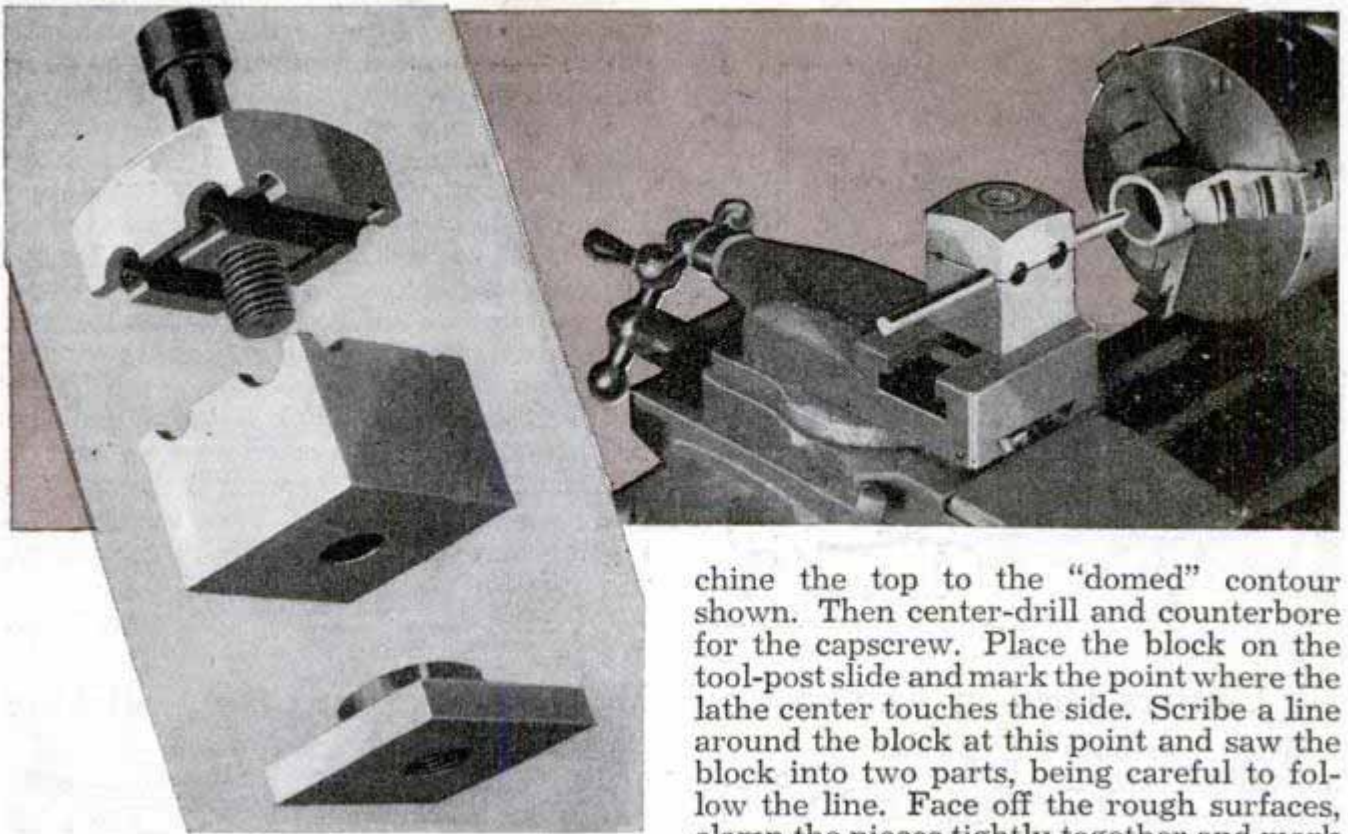


Work Is Rotated in Drill Press To Keep Holes True

When drilling in metal, one machinist found that, because of a slight tilt in the table of the drill press, the holes were from .002 to .010 in. out of round. This he remedied by rotating the work as the drilling progressed, turning the work at regular intervals so that when the drilling was completed the work had been turned around once.

John Eichberger, Franklin Park, Ill.

Boring-Bar Holder Adjustable to Four Tool Sizes



Simplicity and rigidity are the features of this boring-bar holder which can be made to fit almost any lathe and take bars of four different diameters. It consists of a two-part square of steel which bolts to the tool-post slide. The first step in making it is to measure the distance from the top of the lathe carriage at the tool-post slot to the center of the spindle. Then add for the thickness of the bar-holder cap to get the overall height. Square the block and ma-

chine the top to the "domed" contour shown. Then center-drill and counterbore for the capscrew. Place the block on the tool-post slide and mark the point where the lathe center touches the side. Scribe a line around the block at this point and saw the block into two parts, being careful to follow the line. Face off the rough surfaces, clamp the pieces tightly together and mark the centers of the boring-bar holes, centering these a distance from the nearest edge equal to the diameter of the largest hole. The hole size should correspond to the diameters of the boring bars. Care must be taken in drilling the first hole so that the drill bit does not "run." After the first hole has been drilled you can use a short steel rod as a key. Finally, mount each half of the holder separately in the chuck and take off a light facing cut, about 0.010 in., to provide clamping clearance.

Farm Tools Stored in Oiled Sand to Prevent Rusting

To keep his spades, pitchforks and other tools clean and free from rust, one farmer sets them in a container of sand, where they always are ready for use. This also prevents the possibility of accidentally tripping over or stepping on tools left standing against a wall. A large basket, box or cut-down oil drum will do for the container, which is filled with sand mixed with a small amount of waste crankcase oil. The sand not only prevents rust, but also cleans the tools after use.

Caulking Cotton Seals Windows

When windows of the casement type fail to keep out drafts during cold weather, try sealing them for the season with marine caulking cotton. The same treatment can be applied around the edges of doors.

A. S. Goodwin, Port Stanley, Ont., Can.



Glass Tube Inserted in Bottle Permits Free Flow of Liquids

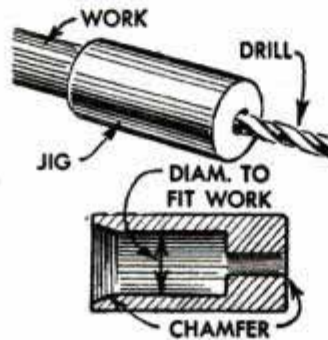


Laboratory workers who use distilled water or other liquid from a large bottle which is supported in an inverted position will find that a glass tube inserted through the stopper to project above the liquid will allow the latter to flow freely. A rubber cork or stopper with two holes is needed. In one of these a short piece of curved glass tubing is inserted and fitted with a length of hose, which can be held by a hook screwed into an adjacent wall when it is not being used. A tube long enough to extend to within 1 in. of the bottom of the bottle is inserted in the other hole. When the bottle is filled and inverted over a stand or platform, air enters through the long tube and rises to the top of the bottle. By raising the hose above the level of the water, the flow will be stopped.

Jim Beaber, Denver, Colo.

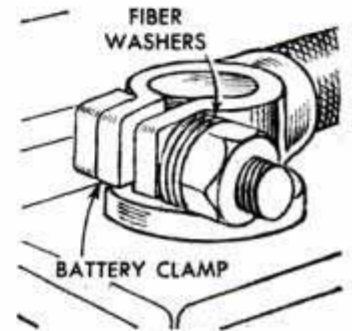
Jig Centers Drill in End of Rod

When you have a number of rods to be end-drilled in the center, a jig like the one shown will position the drill properly. The jig is made from a short length of cold-rolled steel or similar stock. First a hole to serve as a drill guide is made through the steel, after which the hole is counterbored about halfway through to slip over the work. The edges of both ends of the hole then are chamfered slightly.

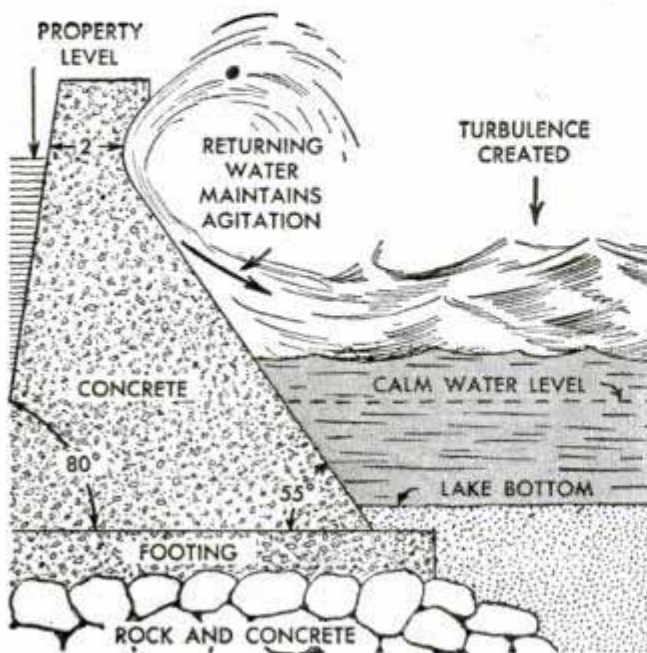


Washers Prevent Clamp Sticking

If fiber washers are inserted between the nut and clamp when connecting the cable to a battery terminal, the cable will be easier to remove later. Corrosion tends to make the nut stick to the clamp but the washers will prevent this. When the battery is removed, the washers are pried outward to loosen the clamp. It may be necessary to use a longer bolt and acid resistant washers.



Breakwater Has Curved Face to Minimize Pounding Effect



By making the design of a concrete breakwater such that it breaks up the impact of waves, lake-front property owners can prevent damage to their land and save money otherwise spent in repairs. The walls of the breakwater are sloped as indicated to give maximum support and to dissipate the pounding of the water. A curvature at the top returns the water and sets up a secondary turbulence that lessens the impact of onrushing waves.

L. Meehan, Toronto, Ont., Can.

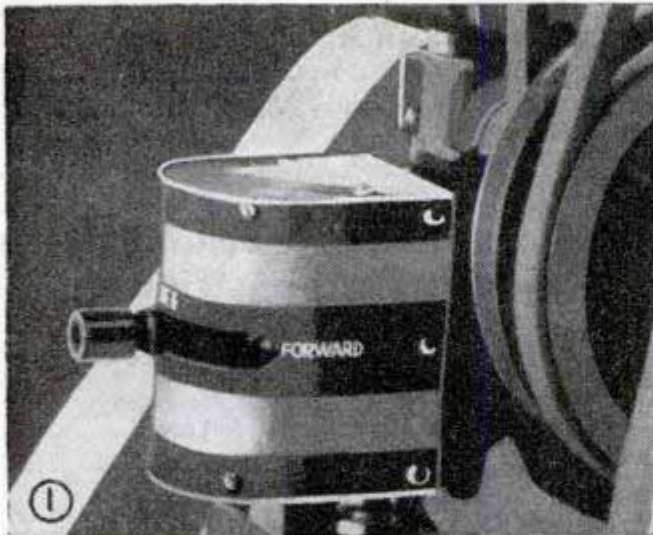
Wet Chalk Will Mark Oily Surface

In marking rough cuts for acetylene burning, one welder found that wet chalk will leave a mark on oily sheet-metal plate while dry chalk will not. Using wet chalk saves time that otherwise would be wasted wiping oil off the plate.

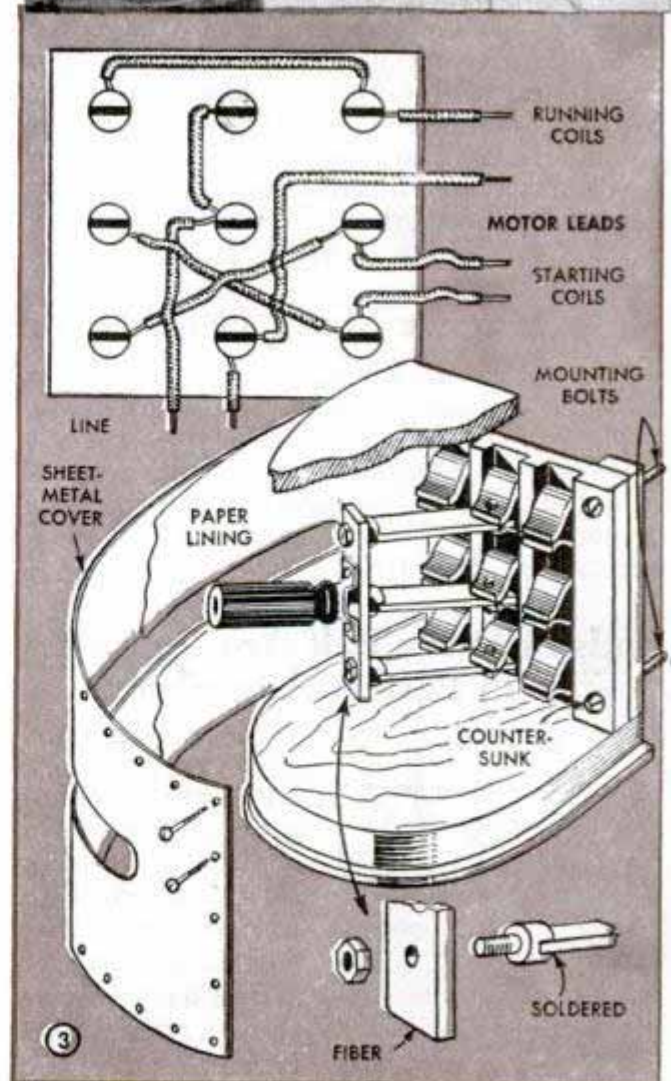
W.T.M. Concrete

SAFETY REVERSING SWITCH

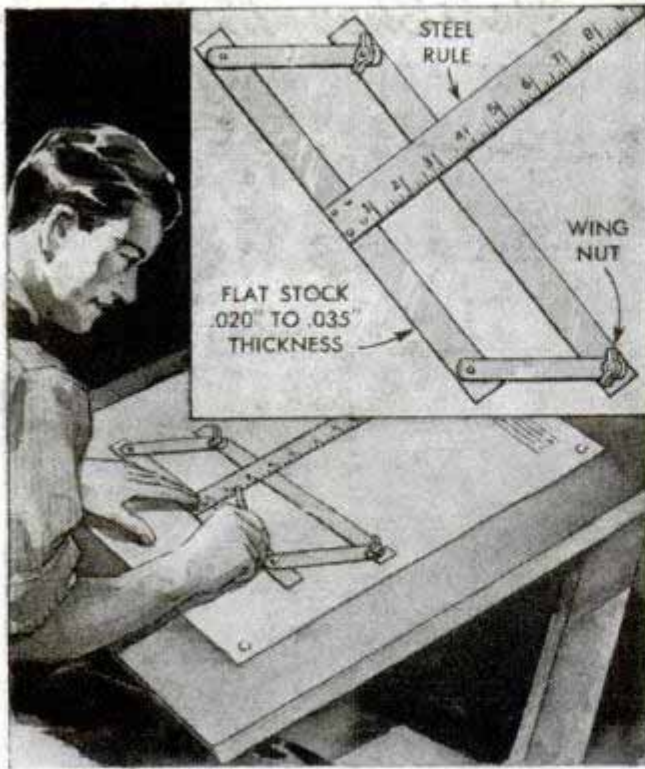
For Shop Motors



IF YOU use a split phase or capacitor type motor in your workshop, you can make a safety reversing switch, Fig. 1, that will enable you to change the rotation of your lathe or drill press without crossing the belt, and in addition you have the protection of an enclosed switch. The unit is made from a t.p.d.t. switch which is cut down to make it more compact. Since the dimensions of switches as manufactured vary, no measurements are given and assembly will have to be by the cut-and-try method. The blades and contacts are removed from the original base and the blades are shortened by cutting them, Fig. 2. To secure the blades to the crossbar, fillister-head screws are slotted and soldered to each blade as shown in the lower detail of Fig. 3. Holes are drilled in the fiber-board crossbar to receive the screws, and the handle is attached by fastening it to a strip of metal which, in turn, is mounted on the crossbar bridging the center blade. The base also is made of fiber board grooved to fit the contacts. These should be spaced as closely as possible, but not so closely that there would be possibility of a short circuit. Also, keep in mind that the location of the contacts must fit the throw of the switch. Top and bottom are of wood curved so the crossbar has clearance to swing within the cover and rabbeted as indicated in the lower detail of Fig. 3. For a cover, sheet metal lined with paper for insulation is used. The slot for the handle is made by drilling a hole at each end and completing the cut with tin shears. When the unit is assembled, label the two closed positions of the switch "Forward" and "Reverse," with the open position marked "Off." Do not change rotation without allowing the motor to stop. The switch can be given the finish as shown so that it is easily seen. A wiring diagram is shown in the upper detail of Fig. 3.



Folding Parallel Rules Are Set With Aid of Built-on Scale



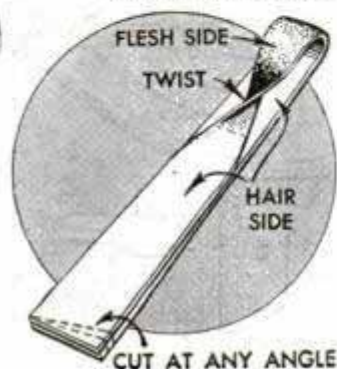
Layout work on a drafting board or workbench is easier if folding parallel rules like these, which are made of flat iron, have an attached steel rule to set the distance between parallel lines. Holes are drilled and countersunk in one of the rules for rivets, and in the other for bolts, the holes being spaced the same distance from the ends of each. The rules then are joined by two arms, also of flat iron, and tightened by wing nuts screwed on the bolts.

Hugh A. Wells, Parkville, Md.

Shop Magnet Made From a File

A worn rattail file can be magnetized to draw chips, screws, bolts and small metal objects from holes and otherwise inaccessible places. The teeth first are ground off to smooth the surface, and after this the file is magnetized. This tool will hold its magnetization a long time.

Ends of Drive Belt Are Cut to Fit With Perfect Alignment



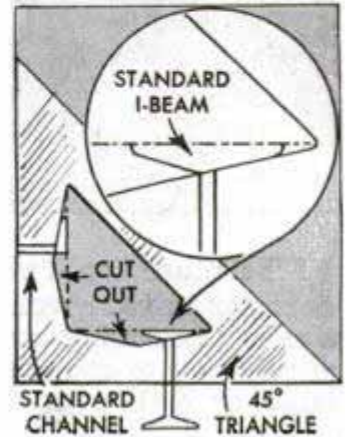
Drive belt ends need not be square with the sides in order to fit exactly if they are cut as illustrated. The belt first is twisted and laid with the sides aligned as shown, after which the ends may be

cut square or at any other angle. The cuts must be straight, however, so that when the belt is untwisted and the ends are joined they will align. Although it is best to cut the ends square, this system will prevent possible errors in marking and cutting and will result in a joint that will have perfect alignment.

W. E. Schaphorst, Newark, N. J.

Method of Drawing Beam Sections Saves Drafting Time

When drawing detailed sections of standard channels and I-beams, the time required to detail the beveled edges of the work can be greatly shortened by cutting the inside of a triangle to the correct bevel.—Michael Vidos, Inglewood, Calif.

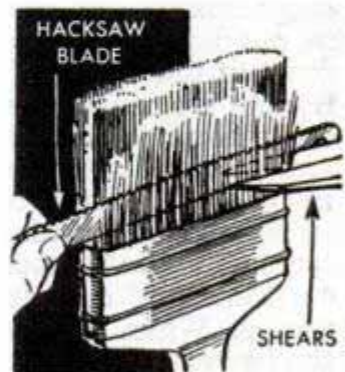


Locating Opening for Wall Outlet

To install electrical wall outlets, drive a brad through the plaster to locate the space between laths. When the space is located, the box is centered over the hole made by the brad and the outline of the box is scribed on the wall. An opening cut along the scribed lines will locate the box so that the screw tabs will project over strips of lath, where screws can be driven to hold the box securely.

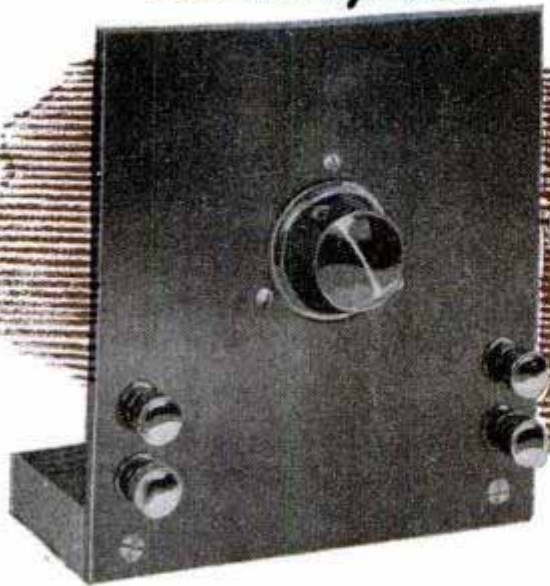
Hacksaw Blade Serves as Guide In Trimming Paint Brushes

If the outside bristles of paint brushes become frayed and worn, they can be trimmed by using a hacksaw blade as a guide. Insert the blade between the worn and the good bristles and trim with shears or snips, as shown. Be sure to press the blade firmly against the base of the brush.—Jack Bronte, Grass Valley, Calif.



ⓘ Since hard composition boards dull circular saws quickly due to the abrasive substances they contain, it is well for this purpose to use an old saw or to use your best saw as sparingly as possible.

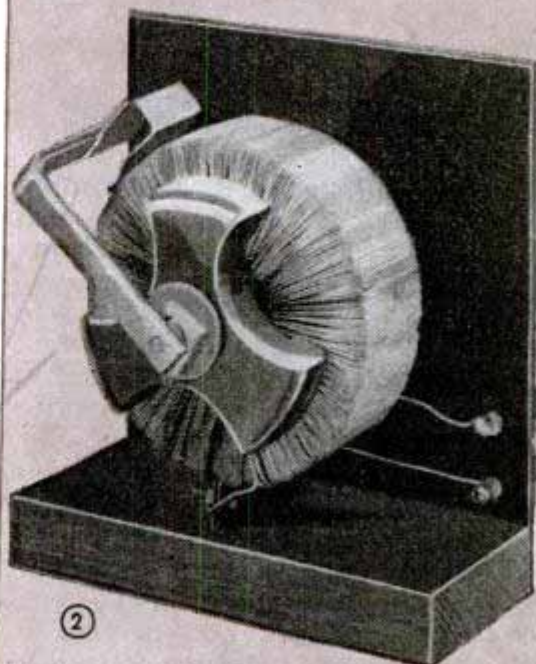
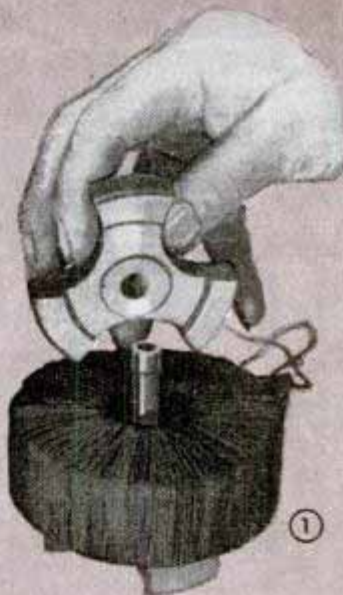
Variable VOLTAGE REGULATOR *has many uses*

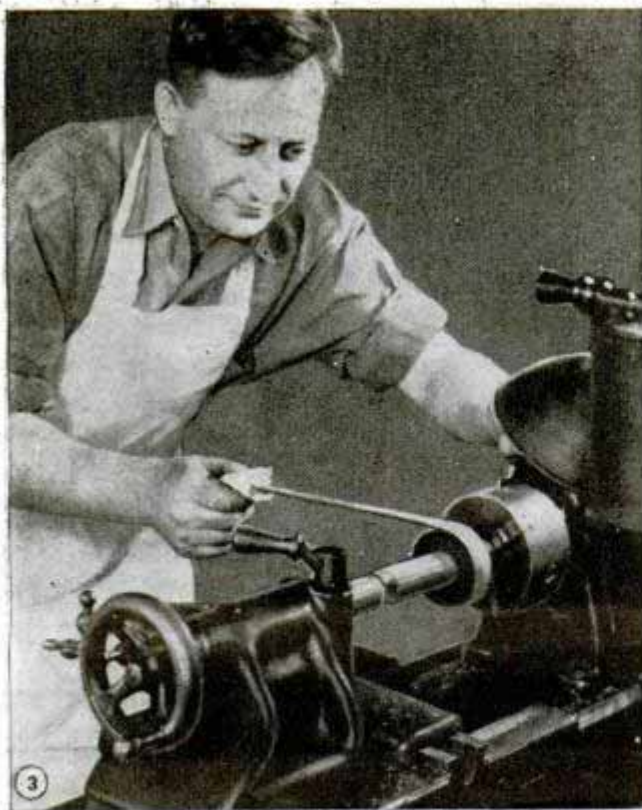


By Alexander Maxwell

THIS A.C. current regulator gives a smooth and continuous voltage control from zero to maximum and can be used as either a step-up or step-down transformer to increase or reduce voltage. The transformer is of the "doughnut" type, mounted on a panel, and is designed to carry a 100-watt load continuously, but easily is constructed for higher voltages by increasing the transformer core and wire sizes proportionately. The panel is fitted with two sets of binding posts, Fig. 6, those marked "high" connecting to the two ends of the coil, while those marked "low" connect to the slide and one end of the coil. When used as a step-down transformer, the electrical source is connected to the "high" terminals and the slide is adjusted to get the desired voltage. If the regulator is used as a step-up transformer, the electrical source is connected to the "low" terminals. It's best not to build up the voltage to more than twice that of the input, because of the loss by heating.

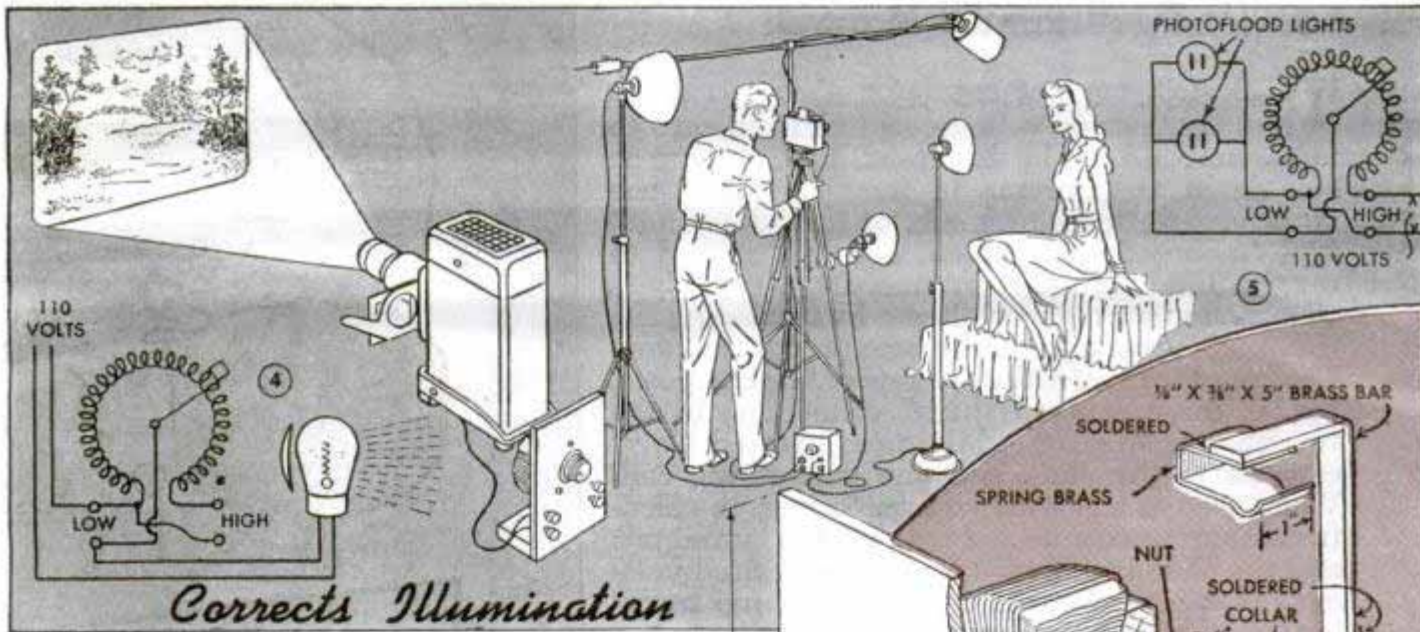
In making the regulator you begin with the transformer core which is wound on a wooden mandrel in the lathe as in Fig. 3, using transformer iron of the "ribbon" type. Start the winding by cutting a shallow groove lengthwise in the mandrel. Then bend a hook in one end of the iron ribbon and insert in the groove. Run the lathe at the lowest speed with the back gears engaged. It's advisable to wind and unwind the ribbon several times to soften the metal so it will bend easily and fit snugly. When the winding is finished the core should be about 4 in. in diameter. It then is fitted with a compression band of the same material, as shown in Fig. 10. This band should reduce the diameter of the core to about $3\frac{3}{4}$ in. The band is left in place under the windings as it holds the core securely and reduces the





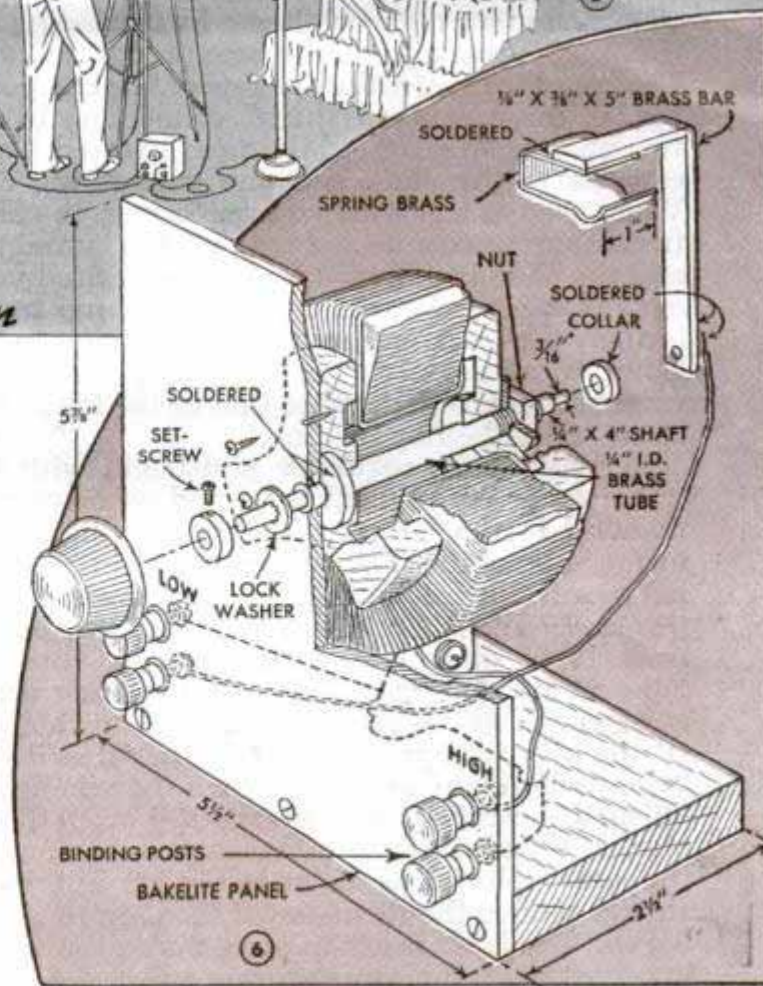
wire also can be bared with a fine scratch wheel as in Fig. 7.

The finished coil is mounted on the panel as in Figs. 1, 2 and 6, the latter showing in detail how the mounting is assembled. First turn two hardwood end plates to the dimensions given in Fig. 11 and mount the coil and end plates on a sleeve made from brass tubing as in Fig. 6. Be sure that the coil is centered on the sleeve, then draw up the nut to grip the coil between the end plates and hold it securely in place. Next, the $\frac{1}{4}$ by 4-in. steel shaft carrying the slide is cut to length and turned down to $\frac{3}{16}$ in. in diameter at one end to take the slide arm as indicated. The slide and arm are made as in the upper right-hand detail of Fig. 6, and are soldered to the shouldered end of the shaft against a collar as shown in Fig. 2. The slide must be adjusted carefully at the point of contact so that it touches only one wire at a time, as indicated in the upper left-hand detail of Fig. 10. An adjusting knob completes this assembly. The bake-



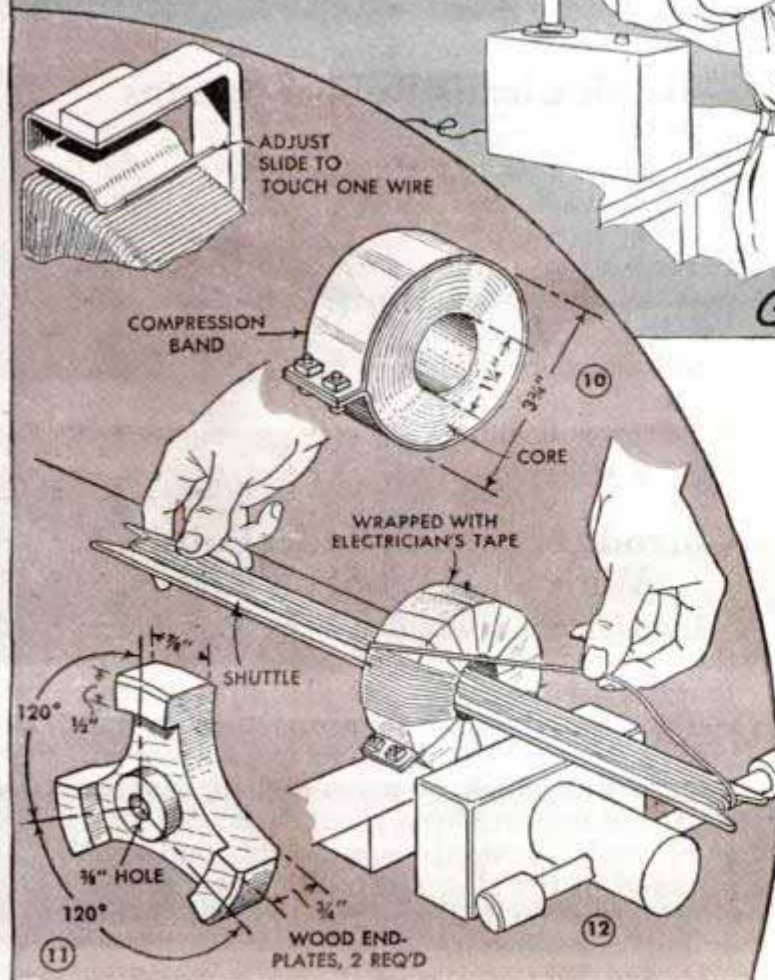
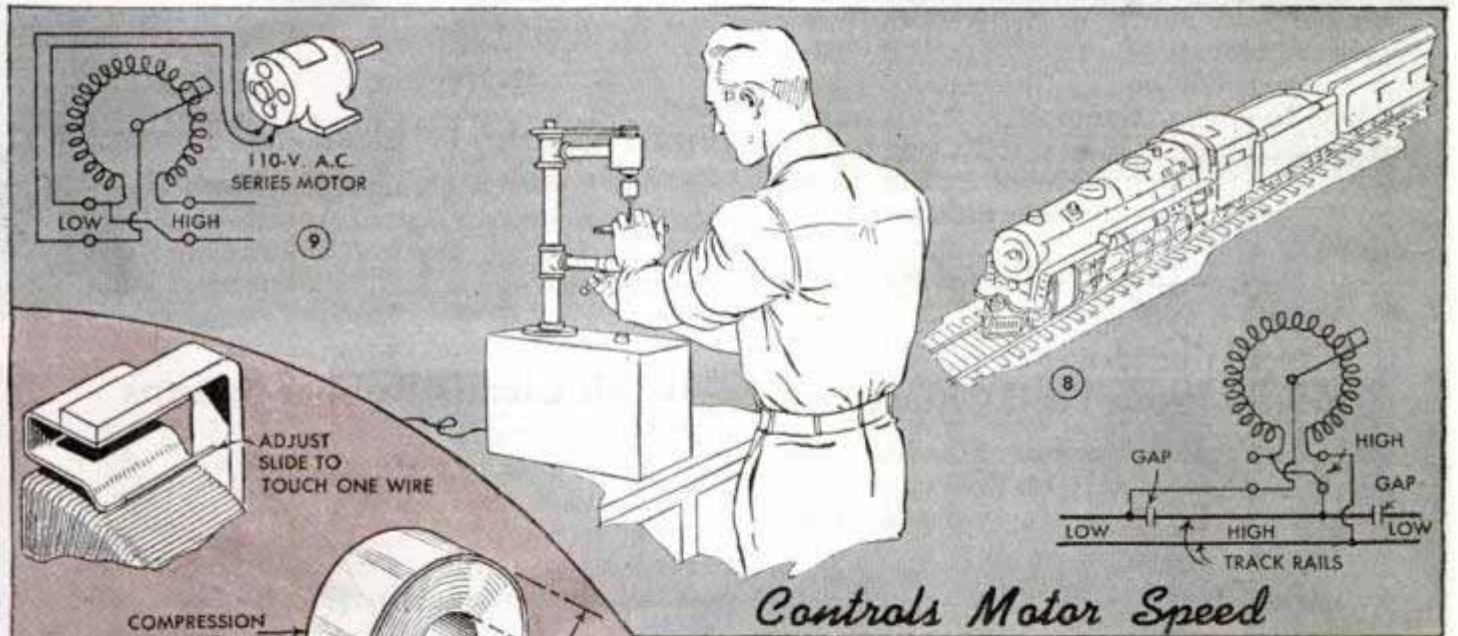
tendency of the regulator to create a hum.

The load-carrying capacity of this type transformer is primarily determined by the amount of iron in the core and the size of the wire used in the coil. This one is wound with 400 turns of No. 14 enameled antenna wire, the windings being in one layer at the circumference of the core, three or more layers at the center opening of the core. The winding is done with an improvised "shuttle" as in Fig. 12. Care should be taken to keep the wire under uniform tension and to wind the turns tightly together side by side. When the winding is finished coat with a baking enamel and dry in an oven. To bare the wire for the slide contact, use fine emery cloth and be very careful not to damage the insulation between the windings. The



lite panel is screwed to a hardwood base and, after fitting and wiring the high and low terminals, the unit is ready for use.

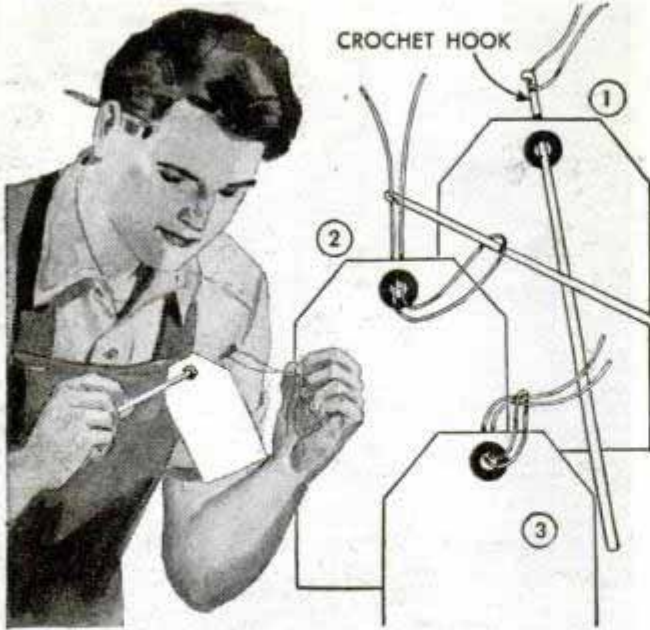
Figs. 4, 5, 8 and 9 suggest a number of uses and give the wiring diagrams for each application. For these particular purposes a smooth, positive change from one voltage to another is especially desirable. For example, regulating the output of a projection bulb as in Fig. 4, or controlling the brilliancy and illumination factors of photo lights as in Fig. 5, are common applications of this type of voltage regulator. In both instances the light intensities can be varied to emphasize delicate detail on the screen or on the subject to be photographed. And, of course, by cutting down the voltage when posing the subject for an indoor shot as in Fig. 5 you prolong the life of high-intensity bulbs as the lights can be raised to full brilliancy for the short interval of the exposure and then immediately decreased in brightness. Be sure that the combined wattage of the lights does not



exceed the capacity of the transformer.

The regulator also can be used to control a small series motor through a range of speeds without the current loss due to heat, as is the case where a rheostat is used. Often, on large model railway layouts, there is a portion of track where a number of factors combine to slow the speed of the train. This portion of the track can be insulated from the rest and the regulator used as a step-up transformer to feed it. Current for the regulator is taken from the section just ahead. As the train enters the "slow" section the regulator slide is advanced until the train maintains the desired speed. When the train reaches the end of the section the locomotive again receives power from the regular source.

Shipping Tags Strung Quickly By Using a Crochet Hook

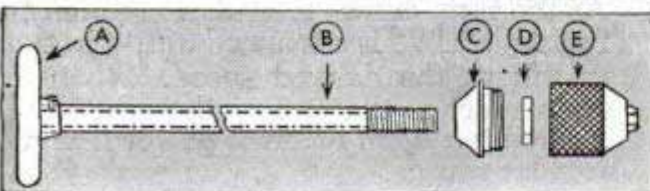
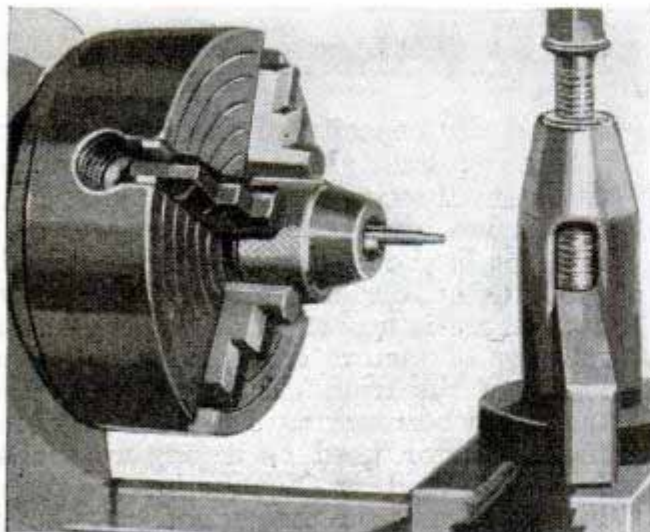


Shipping tags of the type having strings inserted through holes in the tags can be strung quickly and easily if an ordinary crochet hook is used. The string is doubled and the crochet hook is inserted through the hole to engage the loop, which is pulled through the hole as in Fig. 1. The hook then is advanced to catch the strands, Fig. 2, and pulled back, bringing these through the loop as in Fig. 3.

Leo A. Chartier, Danielson, Conn.

Lathe Collet for Small Work Made From Drill Chuck

Lacking a collet attachment for his lathe, one machinist used a 1/2-in. drill chuck and altered it to take stock of any diameter up

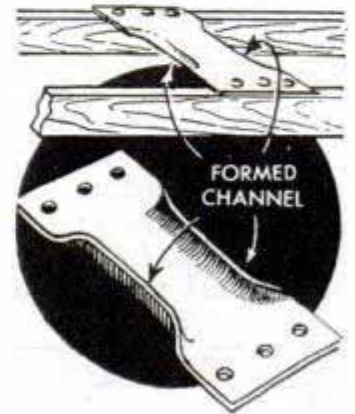


to 3/8 in. One advantage of this chuck is that once it has been centered in the lathe, any number of pieces can be machined without further centering. When making the attachment, drill a 3/8-in. hole in disk D to allow long work to pass through the chuck E. One end of tubing B then is threaded to fit piece C of the chuck and the other end is threaded for handwheel A.

Gerald S. Seidel, Norristown, Pa.

Sheet Metal Braces Strengthened By Forming Channels

A flat sheet-metal brace can be made more rigid by hammering down the free edges so they are at right angles to the brace. In effect, this forms a channel that will be much stronger than the flat piece of metal.



Small Bottle Is Used as Trowel

When laying a cement floor in a basement, you can use a small round bottle instead of a trowel. The bottle is used to form neat concave corners where the floor joins the wall.

Brush Cleans Rubber Stamps

Rubber stamps can be freed of thickened ink and other clogging material by being passed lightly over the bristles of a small scrub brush screwed to a workbench or wall within easy reach.



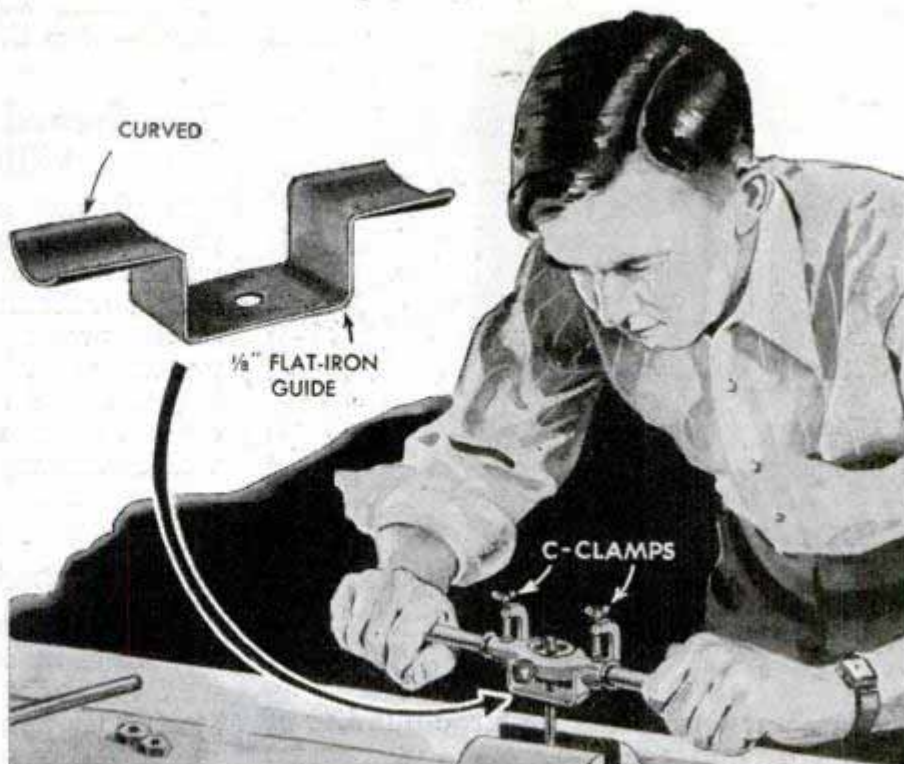
Corroded Brake Cylinder Polished With Steel Wool on Rod

If no hone is available for dressing down the interior of a hydraulic-brake cylinder that has become corroded, a length of metal rod and a wad of fine steel wool will do the work. The rod should be of a diameter to fit into the chuck of a hand drill, and is slotted at one end for a short distance. The steel wool is wrapped around this end and engaged in the slot, after which the rod is chucked in the drill and rotated inside the cylinder to polish it.

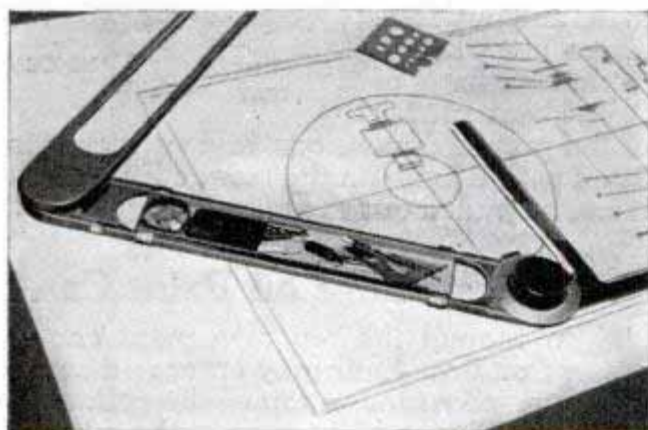
Cpl. Wm. R. Biglin, Cape Charles, Va.

Metal Fixture Guides Die When Cutting Threads

When cutting threads, this guide can be clamped on a die stock to start the die properly so that clean, straight threads will result. It is made from a strip of $\frac{5}{8}$ -inch-wide flat iron formed with right angle bends. To be sure that the guide will not slip when clamped to the handle, the two ears are curved for a better fit. The hole in the fixture should have the same diameter as the rod or pipe which is being threaded. As the illustration indicates, C-clamps are used to fasten the guide to the handles of the die stock.—Geo. Tee Boon, Rochester, N. Y.



Lower Arm of Drafting Machine Holds Instrument Tray



If you use a drafting machine of the type that is illustrated here, you can fashion a tray for your instruments that will be an integral part of the machine and thus avoid sweeping tools off the table when moving the arms. As can be seen, the tray fits between two rods that comprise the lower arm. It is cut from stiff cardboard to fit between the rods. The length of the tray is immaterial as long as it does not interfere with the action of the machine. The cardboard is held in place with drafting tape.

G. L. Dillon, Tecumseh, Ont., Can.

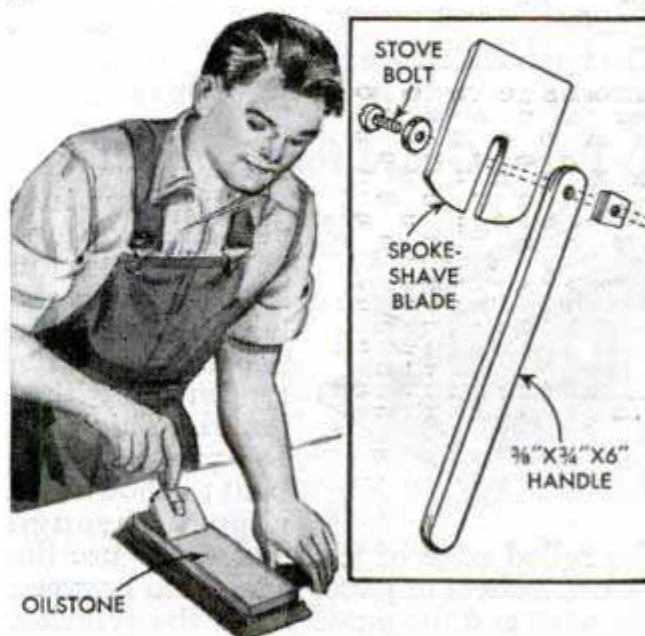
Removable Handle Will Position Spoke-Shave Blade for Sharpening

To obtain the proper angle when sharpening spoke-shave blades, one carpenter made the handle shown here so he could hold the blade more easily. The handle can be of steel stock $\frac{3}{8}$ in. thick and $\frac{3}{4}$ in. wide by 6 in. long. If such heavy material is not available, a lighter steel can be substituted. A hole is drilled for a round-head stove bolt to hold the blade to the handle.

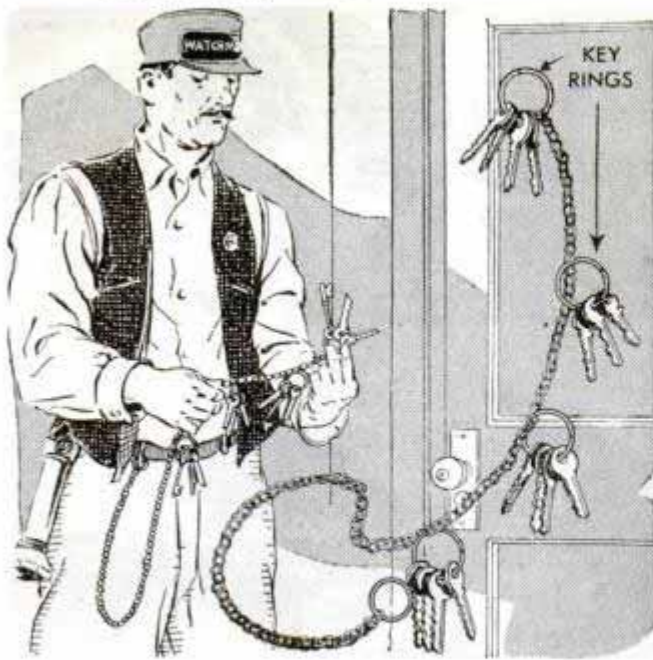
C. C. Pickering, Montreal, Que., Can.

Smoked Blade Aids Saw Filer

Saw filing is greatly facilitated if the blade is coated by passing it through the flame of a candle or other open flame. After this is done, each fresh file cut will show up plainly, eliminating guesswork as to which teeth have been filed.



Keys Can Be Selected Quickly When Spaced on Chain



Watchmen who carry a large number of keys will find that any one key can be selected more easily if the keys are separated into groups according to the location of the locks on the route of inspection. Each group of keys is held by a ring and the rings are spaced along a chain attached to the trouser belt.

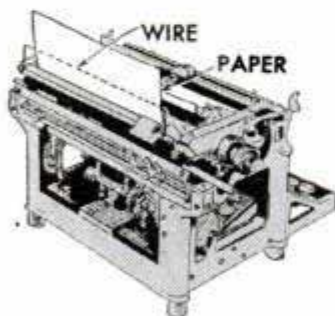
Wedge Fastens Handle to Head



A serviceable wedge to hold a hammer or hatchet head on its handle can be made from an ordinary wood screw. Before being driven into the handle, the screw is flattened so that it has a triangular shape.

The teeth which are formed by the flattened threads serve to hold the wedge in place.

Paper Guard for Typewriter



When typing, you can prevent the paper from falling over the keys by fitting the paper guide of the typewriter with a guard. This is a length of wire bent as shown and slipped through

the rolled edge of the guides. To use the guard, a sheet of paper is inserted between the wire and the guide under the cylinder.

After about $\frac{1}{3}$ of the paper has been typed, the top of the sheet is slipped under the wire. This will keep it from falling forward.—Don C. Higbee, Downey, Calif.

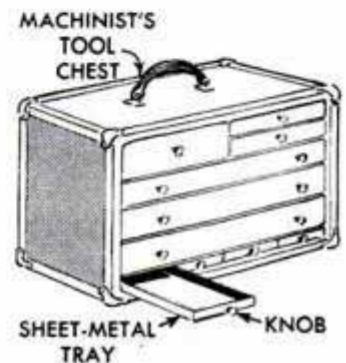
Roughened Surface of Photostat Will Take Writing

Draftsmen and others who work with photostats frequently find it necessary to make corrections on the photostat. Usually this is difficult to do because the surface of the paper is glossy and will not take pencil or ink. If the area on which the writing is to be done is roughened with an eraser, it then will take pencil or ink as well as tracing paper does.

Bernard Sachs, New York

Toolbox Capacity Increased

The space at the bottom of machinist's toolbox for storing the removable front cover is an excellent place for keeping small tools such as taps, drills and punches. These are placed in shallow trays of light sheet metal



of the proper dimensions, and each tray is fitted with a knob on the front edge so that it can be pulled out easily.

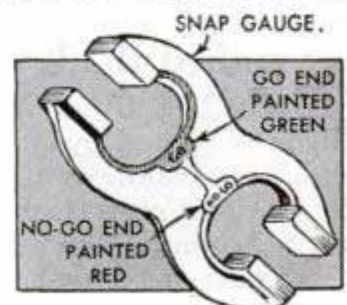
Wax Seals Edge on Paint Can

Even though the top of a paint can is pressed on firmly, air may enter and cause formation of a film on top of the paint. To prevent this, one painter seals the edge of the lid with candle wax. This is done by holding a lighted candle at an angle so the drippings fall on the seam between the lid and the can.

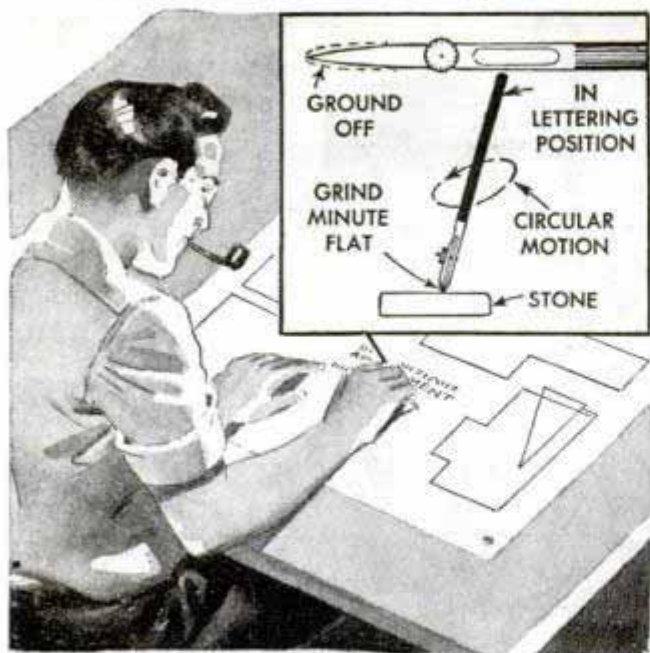
F. F. Walden, St. Petersburg, Fla.

Colors Identify Ends of Gauge

To save time in checking parts with a "go no-go" gauge in a production shop, one foreman painted two bands of color on the gauge to distinguish the "go" end from the "no-go" end. A red band was painted on the "no-go" end and a green one on the "go" to correspond to the "stop-and-go" system of colors used in traffic lights.—Emil Wittmann, Philadelphia, Pa.



Blades of Ruling Pen Are Ground To Form a Lettering Pen



A lettering pen that will hold a large quantity of ink and produce letters of uniform density can be improvised from a ruling pen. The blades are ground to a gradual taper having a circular cross section. Then burrs are removed on an oilstone and a minute flat is ground on the extreme tip of the pen. This is done by holding the pen in a nearly vertical position and rubbing the tip against the stone with a circular motion. For best results when using the pen, it should be held almost perpendicular, with the nibs adjusted for a smooth flow of ink to make lines of the desired thickness.

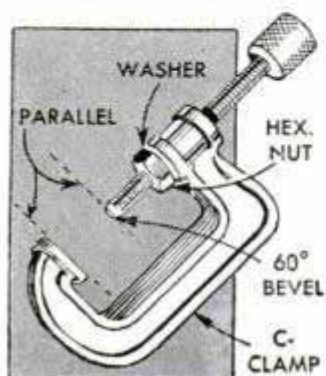
Henry Zave, Chicago

Lack of Fluid Reduces Gas Mileage

In cars equipped with fluid drive, one cause of low gasoline mileage which can be overlooked easily is slippage in the coupling due to an insufficient amount of the fluid. This should be checked at regular intervals, but only after the car has cooled, since the fluid expands under heat.

Hal Geihm, Aurora, Ill.

Snap Gauge Built From C-Clamp

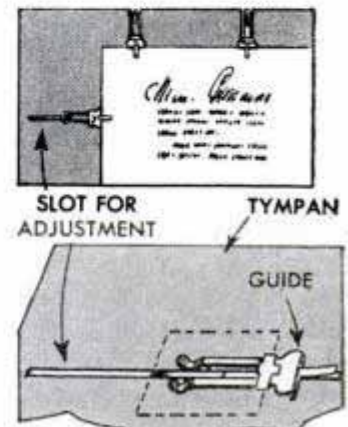


To speed inspection of identical metal parts in a production shop, a "go no-go" snap gauge can be made from a C-clamp. This can be adjusted for testing work of various sizes and will gauge tolerances

as close as .001 in., being more accurate than spring calipers for this purpose. To make the gauge, remove the tip from the clamp screw so that the screw can be chucked in a lathe. Turn the end square and chamfer it slightly. The screw then is reassembled on the frame and a flat steel washer and hex nut are added to complete the assembly. When set at the required distance, the screw is held at this setting by tightening the nut against the clamp.

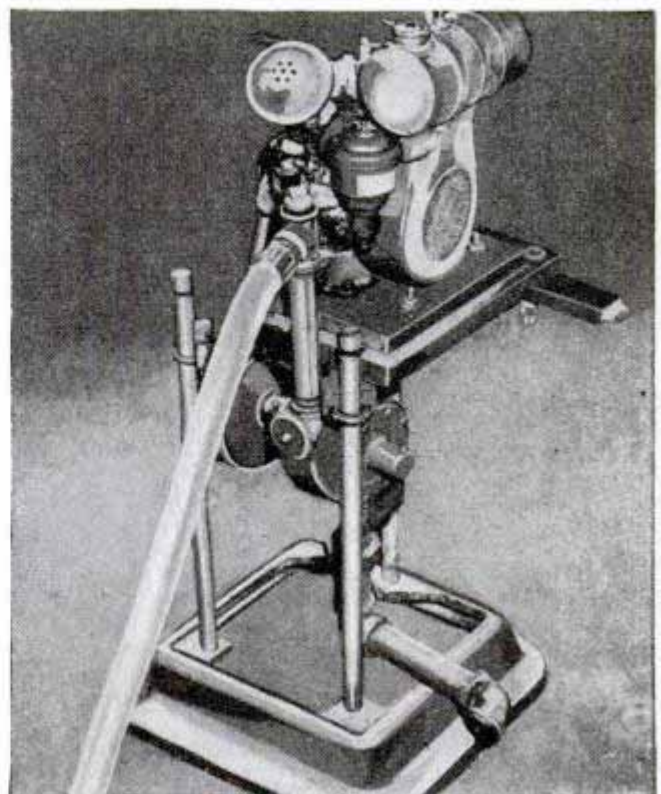
Slot in Tympan Sheet Saves Time In Setting Guides on Job Press

When printing cards of various sizes on a job press, time is saved in adjusting the side guide by slotting the tympan sheet. This allows the guide to be set at various distances without making a new slot for each size of stock to be printed.



Engine-Driven Pump Is Portable

Used to draw water from lakes and streams, this portable pump is powered by a small gasoline engine through a V-belt drive. The pump, which is a positive displacement type, is supported by two up-rights that rest on the lower base and the engine is mounted on top of the pump.

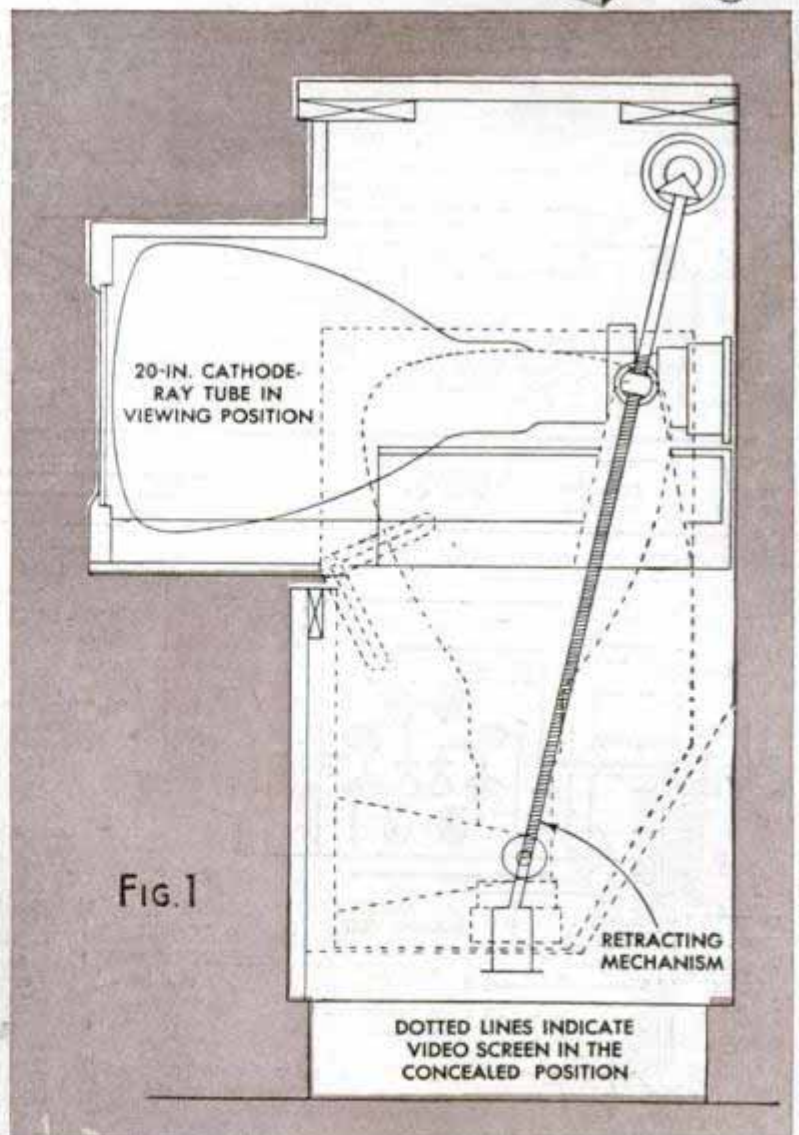
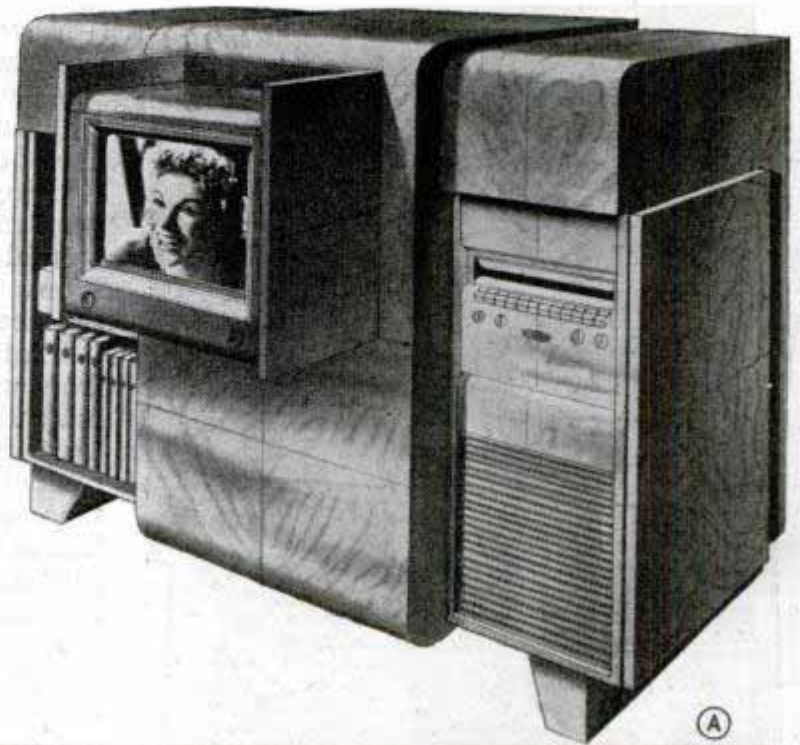




Disappearing Video Screen in "Teleset" Cabinet

ALTHOUGH this modern styled cabinet is only 24 inches deep, it houses a 20-inch direct-view television receiver, FM, standard broadcast and phonograph equipment. In the center is an ingenious disappearing screen which can be tilted back into the cabinet automatically merely by pressing a push-button control which starts a small silent motor. The record player and storage space for phonograph albums are at the left in photo A; beneath the screen is housed the mechanism of the set. At the right are the controls for the television, FM and AM receivers and their associated speakers. Photo B shows the cabinet completely closed when not in use.

Sketch Fig. 1 illustrates the space-saving mechanism which permits the use of a 20-inch cathode-ray tube which has greater length than the cabinet depth. Heavy lines show the screen in the viewing position. Dotted lines indicate the position of the video screen in the concealed position to which it is retracted mechanically when the television set is not in use. When activated by the push-button the motor-operated mechanism brings the tube into the viewing position in 10 seconds while the set is warming up. The tube is retracted by pressing the push-button a second time.



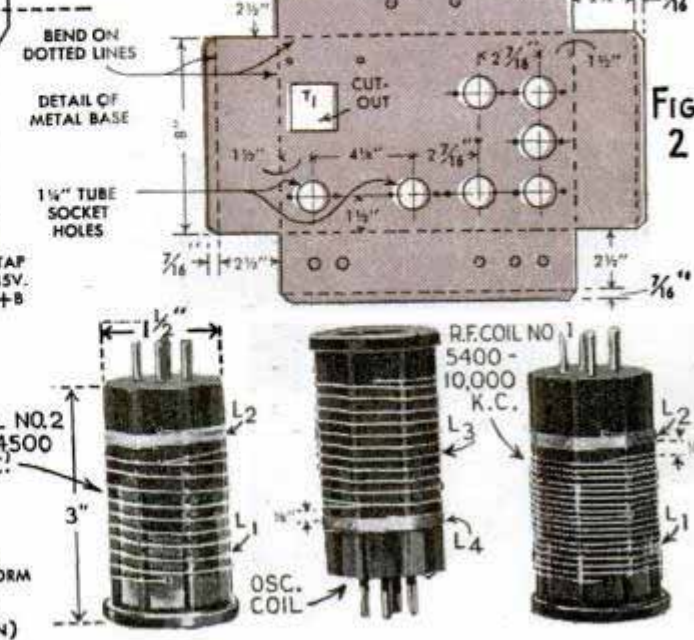
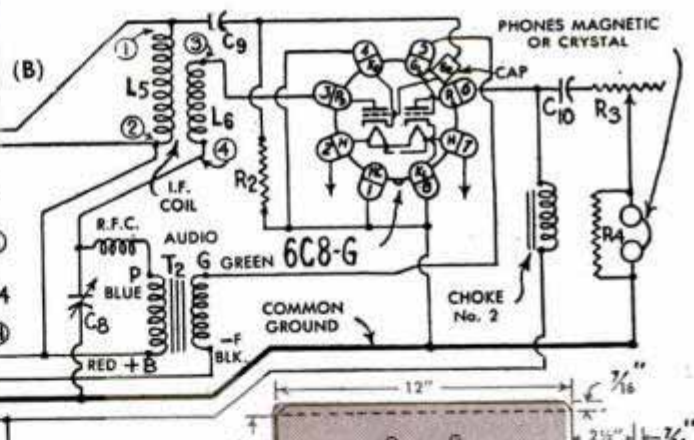
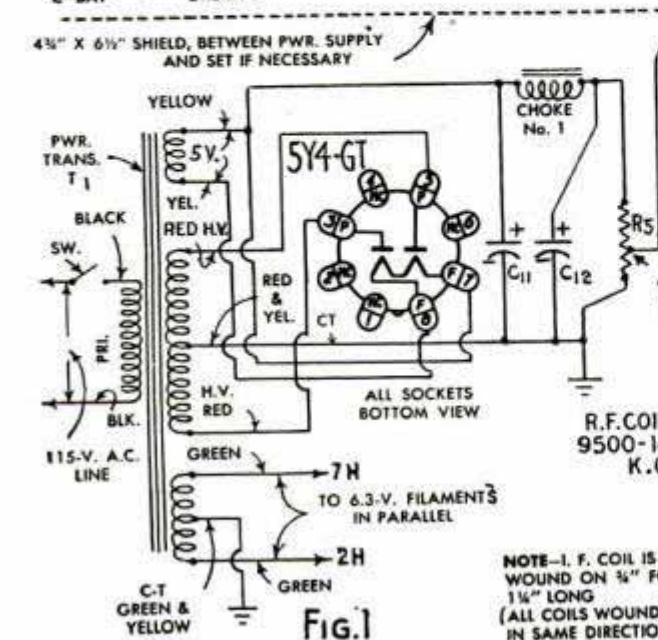
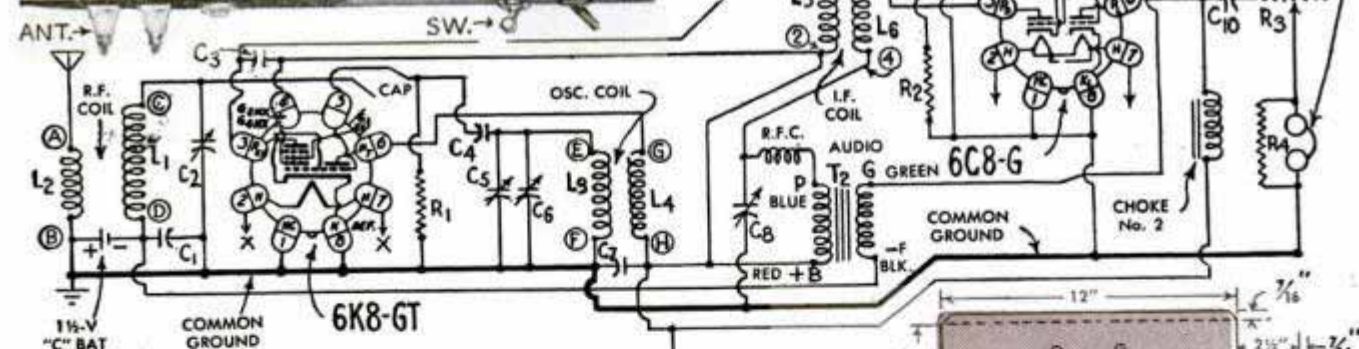
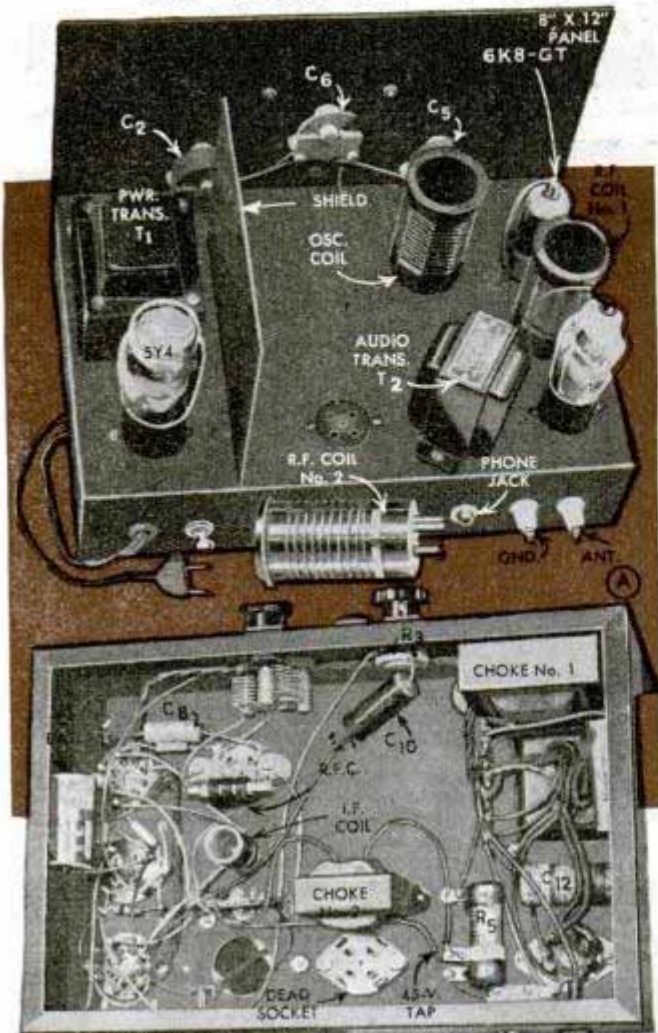
THREE-TUBE SHORT-WAVE

By C. H. Trapp

SOMETHING new has been added to a favorite circuit of many amateurs and experimenters. Originally a two-tube short-wave super, it has been improved by doubling the volume and providing for the use of crystal headphones.

Using a 25-ft. antenna and no external ground, Australian and African stations were logged without effort in the Middle West. The power supply section may be replaced with batteries if desired.

Photos A, B and C show top, bottom and front views. The schematic circuit diagram is Fig. 1 and pictorial wiring diagram Fig. 3. Two R.F. coils cover the complete frequency range from 5400 to 14,500 kilocycles. One oscillator coil covers the entire range. These coils are wound on standard 4-prong plug-in coil forms. Windings L2 on the R.F. coils and winding L4 on the oscillator coil consist of seven close-wound turns of No. 24 enameled wire. Winding L1 on R.F. coil No. 1 consists of 18 turns of No. 22 enameled wire space-wound over a length of 1½ in. L1 on R.F. coil No. 2



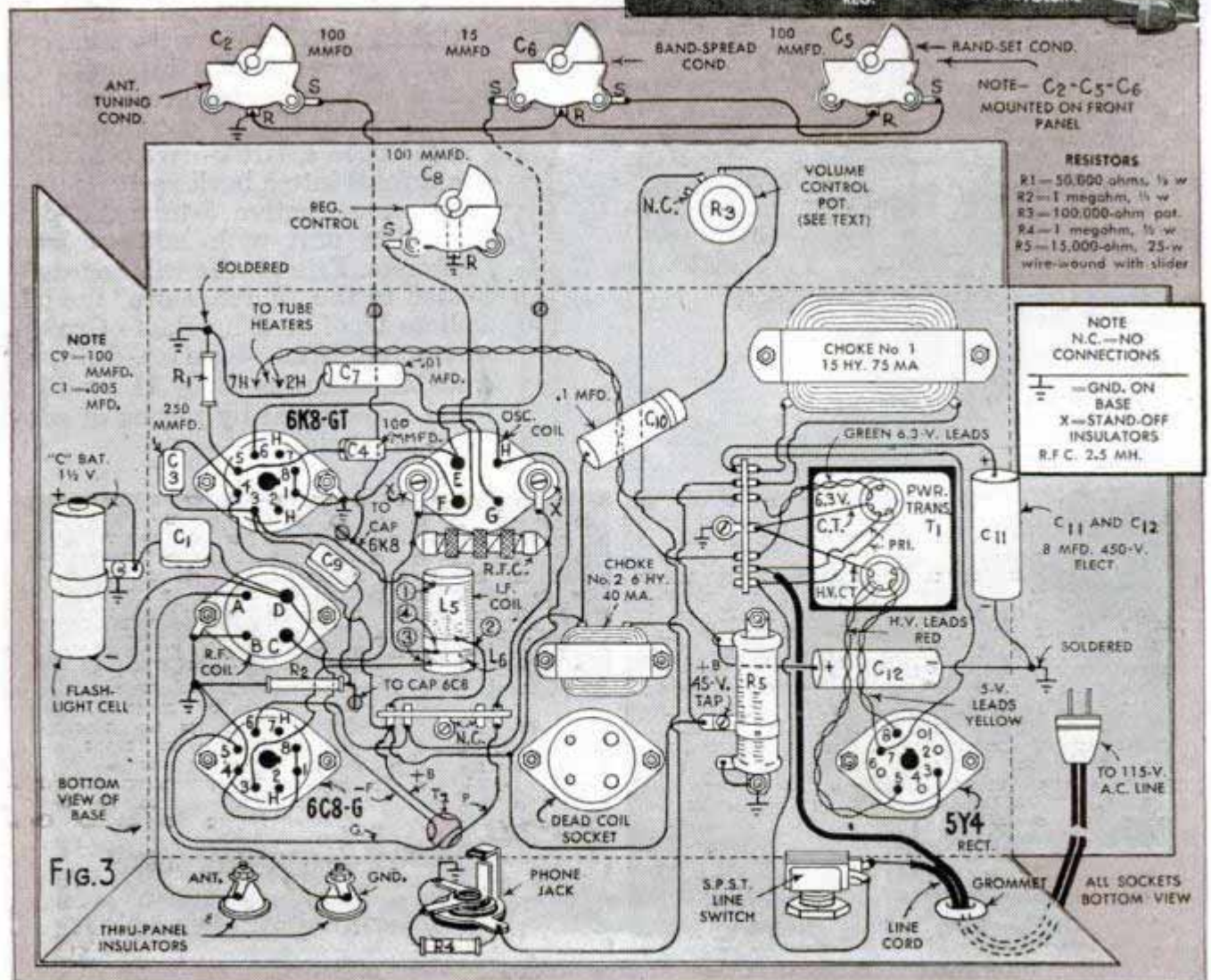
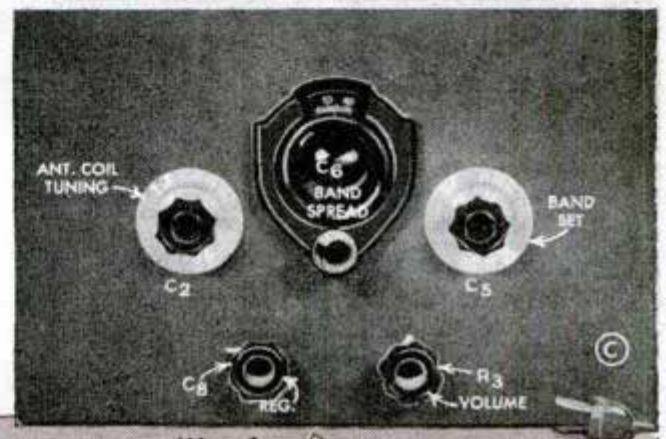
NOTE—I. F. COIL IS WOUND ON ¼" FORM 1½" LONG (ALL COILS WOUND IN SAME DIRECTION)

SUPER of ADVANCED DESIGN

10 turns of the same size enameled wire space-wound to a length of $1\frac{1}{2}$ in. Winding L3 on the oscillator coil consists of 12 turns of No. 22 enameled wire also spaced to a length of $1\frac{1}{2}$ in. Make sure that all coil ends in prongs go to the proper socket terminals.

The I.F. coil, mounted under the base, is wound on $\frac{3}{4}$ -in. plastic or Bakelite tubing $1\frac{1}{4}$ in. long. Winding L5 consists of 55 turns of No. 28 enameled wire close-wound; winding L6 is 18 turns of the same wire close-wound. The total length of wire required to wind L5 is 130 in.; 43 in. are required for L6; spacing between L5 and L6 is $\frac{1}{8}$ in. The power transformer T1 may be any small receiver type. Audio transformer T2 is a 3-to-1 ratio shielded type mounted at a 45-degree angle to the power transformer. To operate the receiver, set C2 at about half scale; now turn C5 slowly until a signal is heard. Next adjust C2 and C8 for maximum volume; once set for maximum sensitivity C8 may be left alone.

Potentiometer R3 controls tone if crystal phones are used. Detailed student material list R-341 is available if desired.

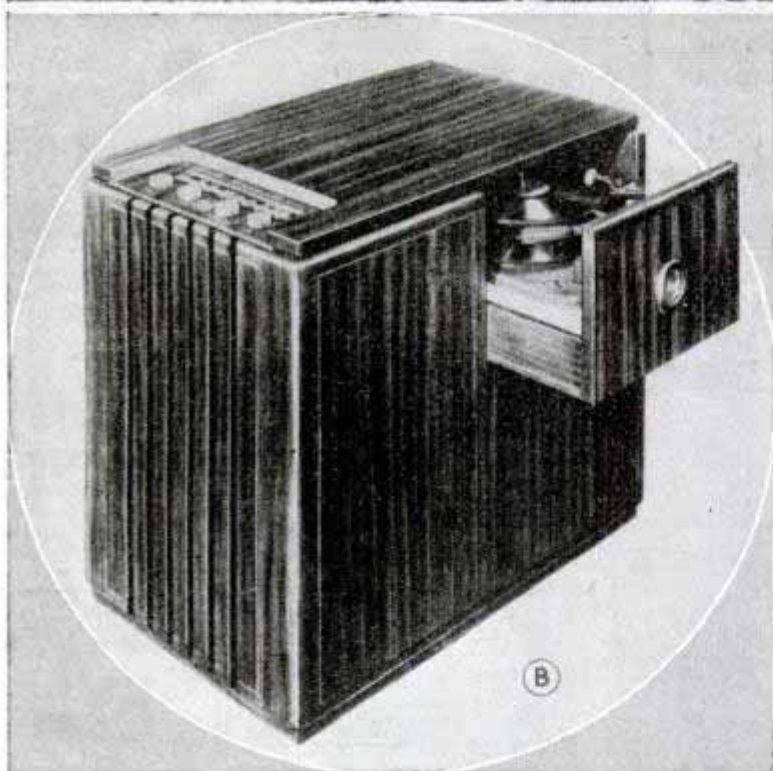


1946 Portable and General Purpose Home Sets

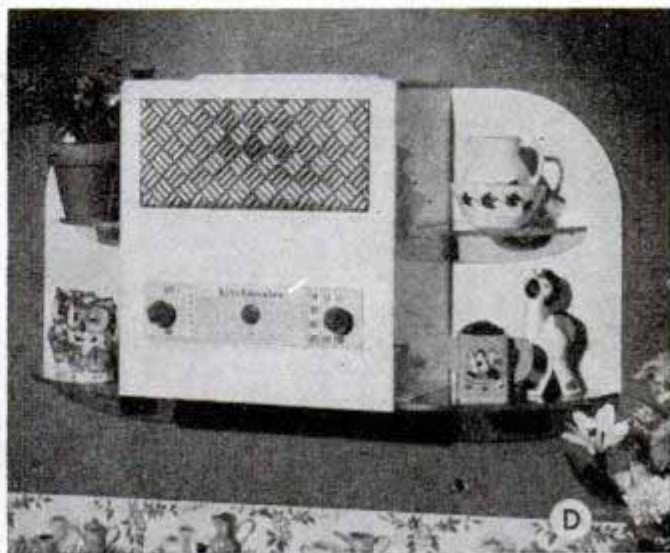


ACCENTUATING practical applications, and including many improvements in design gained by wartime manufacturing experience, the new receivers reaching the market should satisfy pent-up civilian demands and needs.

Outdoor enthusiasts will find portables of several types that will outperform anything they used in prewar days. The "three-way" battery or line-powered compact unit shown in photo A covers standard broadcasts and short waves with band-spread tuning on five foreign broadcast bands. It features the Zenith detachable loop antenna and also has a rod antenna that "pops up" at a touch of the finger. The 7-tube chairside radio-phonograph combination in photo B, built by Electronic Corporation of America, includes a record changer and provision for convenient servicing through the top of the set. The full vision illuminated slide-rule dial is equipped with a "bomb sight" indicator.



Westinghouse introduces the ultramodern 6 by 6 by 9-in. carry-about model shown in photo C. Available in pastel green plastic and gold and ivory combinations, it features a tuck-away handle that folds into a back recess, making an attractive 5-tube a.c.-d.c. portable unit with built-in loop antenna. Friend wife will be interested in the "Kitchenaire" model, photo D, offered by Radio Craftsmen, Inc. This 5-tube a.c.-d.c. wall model measures 22 by 11 by 6 in. and is mounted by means of special brackets.





“Gee, Dad, you sure need new Sealed Power Rings!”

SMOKE from the exhaust always means oil burning, inefficient combustion, an engine that's growing old too fast. It's a sure sign of worn piston rings. Get your favorite repairman to install new Sealed Power Piston Rings now—restore original power, lengthen engine life, save oil, save gas.

Sealed Power Individually Engineered Ring Sets are selected from twenty-six basic designs of piston rings. Whatever the make, model, and cylinder-wear condition of your engine, there's a Sealed Power Set specifically engineered to do the best possible job in it. Sealed Power Piston Rings have been the choice of major engine builders for 34 years, a record of which Sealed Power workers are extremely proud. For maximum power, say “Sealed Power.” Sealed Power Corporation, Muskegon, Michigan and Windsor, Ontario.

KEEP YOUR WAR BONDS! GET \$4 FOR \$3!

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For better results 26 Basic Ring Designs

No one piston ring design can meet all replacement needs. Sealed Power Individually Engineered Ring Sets are made up from twenty-six (26) basic ring designs, which permit each set to be specifically engineered to do the best possible job in a particular make of engine.

These ring sets are engineered to save gas without sacrifice of oil economy, to save oil without inducing friction and cylinder wear. Each set gives *balanced* performance in a particular engine.

*Piston Rings
Pistons
Cylinder Sleeves
Valves
Water Pumps
Chassis Parts*

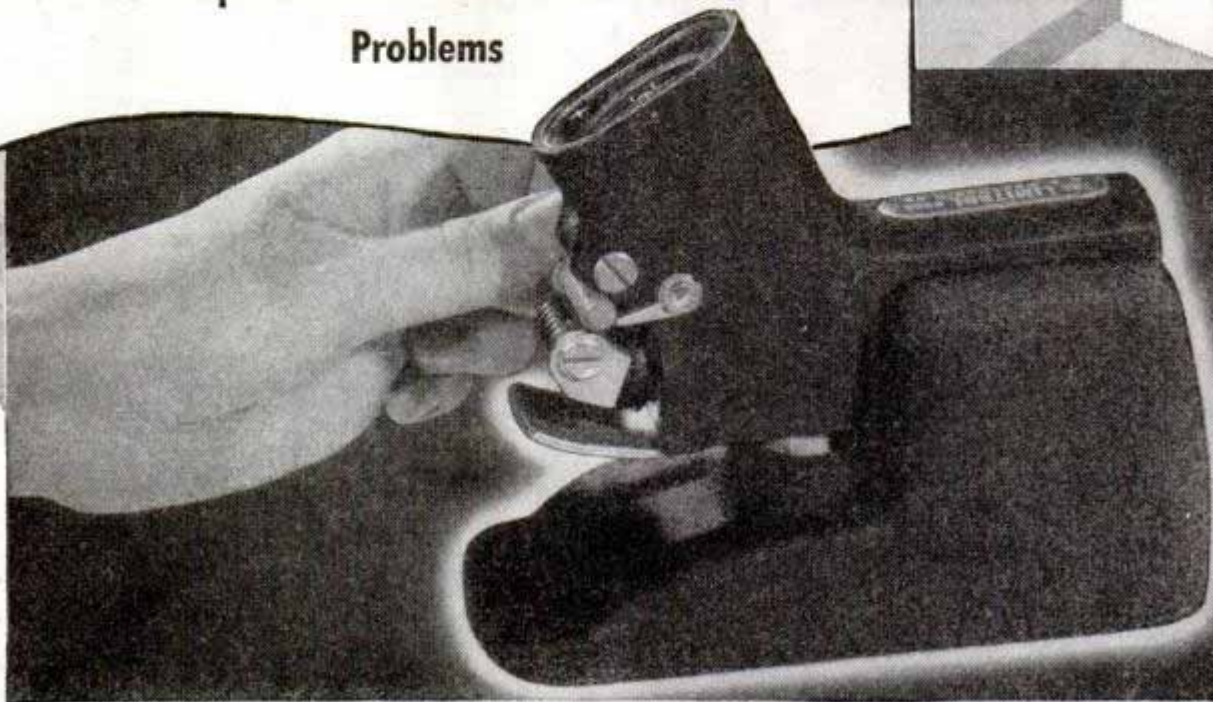


SEALED POWER PISTON RINGS

BEST IN NEW CARS! ★ BEST IN OLD CARS!

Ingenious New Technical Methods

To Help You with Your Reconversion
Problems



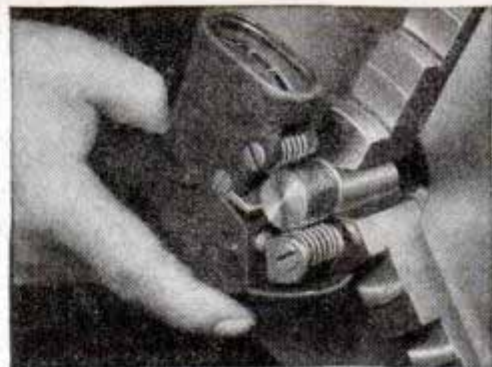
New Comparator Gage Saves Time— Gives 6 Inspections in One!

Even the most inexperienced operator can obtain accurate inspection of externally threaded parts, with the Limitrol Comparator Gage—in many instances, increasing the rate of inspection as much as 400%! The Limitrol, proved in hundreds of war plants, permits 6 visual checks in one: pitch diameter, lead, taper, out-of-roundness, angle, and straightness. Its use reduces inspection and production costs, cuts scrap waste while increasing speeds of operation. If a part passes the Limitrol, it will assemble accurately.

Graduated dials are furnished as standard equipment. These dials are graduated in increments which approximate .0005 inch when the magnification is 250 to 1, and serve as a guide in determining just how far over or under the limits the part might be.

Another "help on the job" is chewing gum. Chewing seems to make work go easier, time go faster. Good chewing gum is available, but there's still a shortage. That's why we at Wrigley wish we could make Wrigley's Spearmint now, to help increase the available supply. You may be sure we will, just as soon as sugar restrictions are lifted. Meanwhile, chew any good available brand, because it's the chewing that really does you good.

*You can get complete information from
N. A. Woodworth Co., Sales Division, 1300 E. Nine Mile Road
Detroit 20, Michigan*



Hand Model used for "in process" gaging




AA-54




IT'S A GRAND FEELING
TO GET
A PERFECT FIT...

IT'S A GRAND FEELING, TOO,
WHEN YOUR CAR IS
CUSHIONED WITH MARFAK
CHASSIS LUBRICATION



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.

MARFAK Chassis Lubrication gives your car that "cushiony" feeling and for more miles. And here's why:

Marfak is scientifically designed for the job — is given special cohesive and adhesive qualities that resist washout, jar-out and squeeze-out. Because it clings to bearing surfaces, it seals out dirt and grime. In addition, *Marfak* is unusually resistant to heat.

Yes, it's a grand feeling when your car is cushioned with *Marfak* Chassis Lubricant. See your Texaco Man and say: "*Marfak*, please."

You're welcome at

TEXACO DEALERS



**FIRE-CHIEF
GASOLINE**



**SKY CHIEF
GASOLINE**



**HAVOLINE AND TEXACO
MOTOR OILS**

Let us
MARFAK
your car

**MARFAK
LUBRICATION**



**THE
TEXAS
COMPANY**

Tune in the TEXACO STAR THEATRE with JAMES MELTON Sunday Nights ★ METROPOLITAN OPERA BROADCASTS Saturday Afternoons

KNOW your handsaw files



*The right file for the job is the file whose width, or flat side, is equal to a little more than twice the depth of the saw tooth.

SAW FILING is an "art." And half the art lies in the ability to select *The right file for the job**—plus the resolve to use none but the tops in quality.

There are nearly forty shapes and sizes of triangular files for sharpening or reshaping worn teeth of handsaws and other saws having 60-degree or wider tooth angle. Taper, Blunt and Double Ender are the groups of shapes—with the first mentioned by far the most widely used. They are usually single cut, with corners, as well as sides, cut to deepen the gullets between the saw teeth.

Make Nicholson or Black Diamond files your choice. They're the products of the world's foremost file maker and are sold under the sweeping manufacturer guarantee of *Twelve perfect files in every dozen.*

FREE BOOK, "FILE PHILOSOPHY." Contains useful information on saw filing, plus 44 additional pages on kinds, use and care of files.

NICHOLSON FILE CO., 22 Acorn St., Providence 1, R. I.
(In Canada, Port Hope, Ont.)

NICHOLSON FILES

FOR EVERY
PURPOSE

NICHOLSON
U.S.A.
MADE IN U.S.A.

Fighting Flying Ice

(Continued from page 86)

normal movement of the plane in flight.

Research engineers found all three principal kinds of ice that are encountered in flying in their Mount Washington studies. Clear or glaze ice, which easily is produced in a refrigerated wind tunnel, forms a transparent, glasslike sheet. It is encountered in flying through freezing rain or when large water drops are suspended in air at freezing temperature. Such ice, being smooth and dense, does not appreciably change the aerodynamic properties of a plane, but covers large areas and is likely to increase the plane's weight rapidly.

Ice encountered in flight is most likely to be the type known as "rime," and is formed when water particles are of average size and supercooled, or when glaze ice is diluted with sleet or snow. Rime ice, because it is porous, is an opaque white. It forms rough, often fantastically shaped deposits and causes loss of stability and lift by upsetting the aerodynamic characteristics of a plane.

Rime frost, or simply frost, is not of great importance in flying except in the landing of a plane. It develops when water particles are minute and the temperature very low. It is porous like rime, usually smoother and whiter, and on a wing it often forms a deposit that tapers forward to a point.

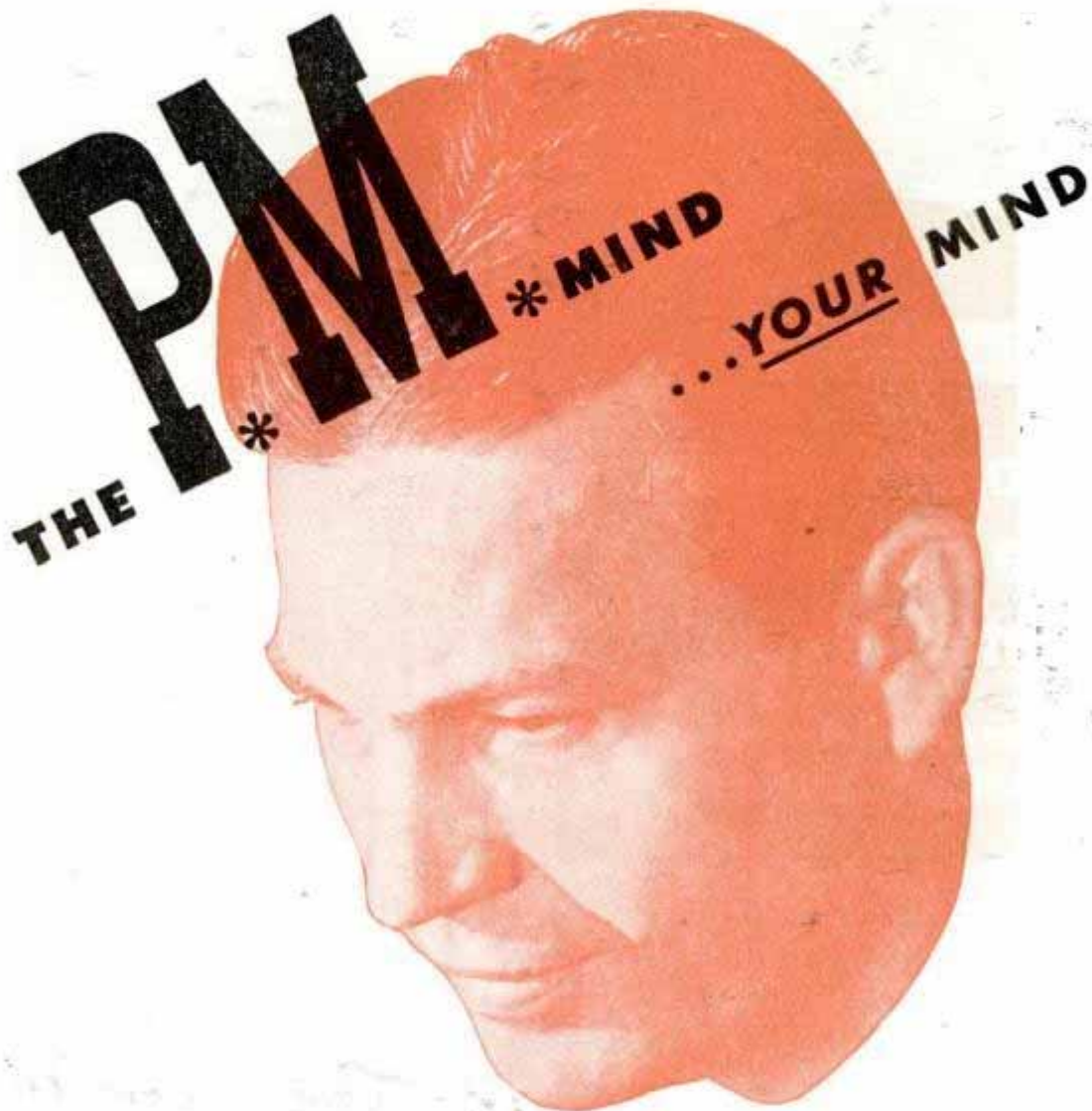
Observers encountered many problems in their Mount Washington studies. Freezing temperatures and 120-mile winds drove them into the control shed to record observations of their test wing. Making photographs to record their experiments was difficult. Camera shutters froze within a few minutes. Lens filters accumulated ice.

But engineers are winning the mountain-top battle against ice. Tests today will provide safer flying tomorrow.

Wax Emulsion in Family Wash Makes Clothes Waterproof

When a wax emulsion developed for the armed services goes on the market, anything in the family washing can be made water resistant. The milky liquid, neither poisonous nor inflammable, is merely added to the rinse water or can be used with starch. It consists of small particles of paraffin wax in a solution of an aluminum salt and water. The invisible wax does not fill the spaces between fibers, thus retaining the porous qualities of clothing. Treated garments are less likely to wrinkle and spot. The emulsion also can be used on awnings, window shades, draperies and other fabrics.

Your Hardware Dealer Knows . . .



YOUR hardware dealer especially likes to serve you.

Why? Well, for one thing, readers of **POPULAR MECHANICS** *know* tools... they *know* hardware... they recognize quality. Readers of **POPULAR MECHANICS** have "the P. M. Mind" . . . the inquisitive, exploring, enthusiastic mind that is always active, alert to new ideas, and always doing something about them.

Your hardware dealer likes to serve you . . . whether you need a handful of brads or a home workshop lathe. He carries 40,000 to 60,000 items for men who like to do things . . . men just like you.

So depend on your hardware dealer. Consult him. He will help you with your home projects and home repair jobs. From his knowledge and from his huge stocks he can come up with the answer to almost any problem you have.

Visit your hardware dealer. He'll be especially glad to see *you* . . . because he has "the P. M. Mind," too!

**POPULAR
MECHANICS**



SIMONIZ



Simoniz Protects the Finish for Winter Driving!

Saves your Car's Beauty and Trade-in Value.

Until you have that new car... be proud of your old one. SIMONIZ it for protection against winter weather... against slush, mud and freezing cold. Saves car trade-in value, too. Simoniz Kleener, liquid or paste, restores dull finishes to shiny newness... SIMONIZ keeps it sparkling, eliminates frequent washings. Easy to use... gives beauty and protection months longer. Don't let winter ruin your car's finish... SIMONIZ today!

THE SIMONIZ COMPANY, CHICAGO 16, ILL.

Sold by grocery, hardware, drug, paint 5¢ to \$1, auto accessory, department stores, garages and service stations.

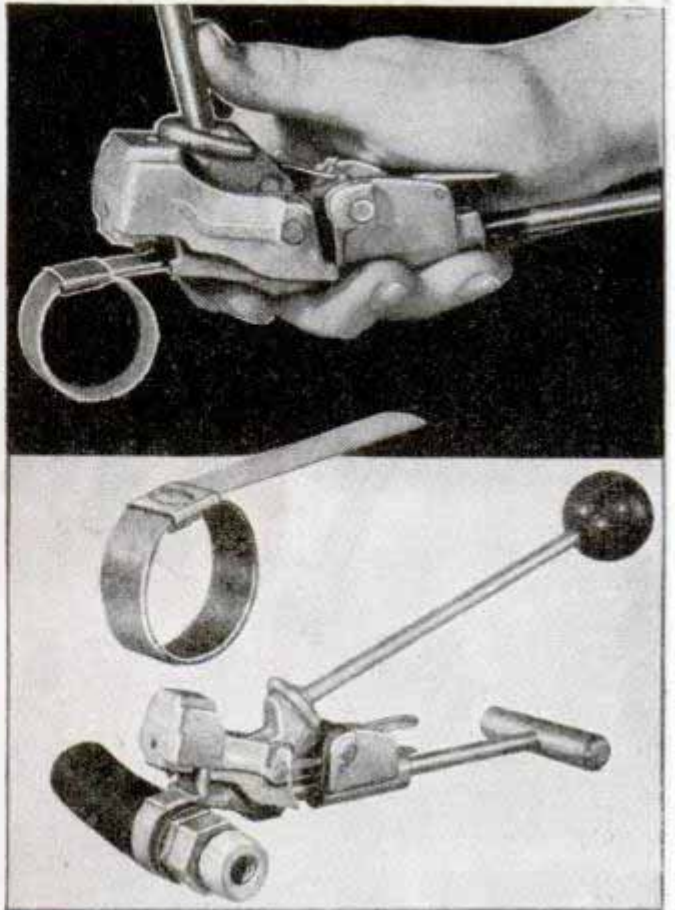


MOTORISTS WISE

SIMONIZ

HOUSEWIVES DO LIKEWISE

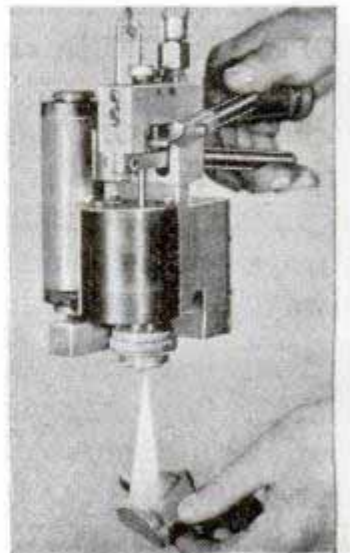
Tool Connects Hose to Pipe Line



Flexible hose can be attached to rigid pipe lines with a special clamping tool. Galvanized steel bands are wrapped twice around the joint and clamped tight under high pressure. The clamping tool locks a clip into place. This tool also can be used to connect various types of fittings, to splice electric welding cables and to stop leaks in steam and water lines.

Portable Gun for Spraying Metal

Compact and easy to use, a portable sprayer for low temperature metals and alloys can be plugged into any electrical outlet and connected to an air line or to bottled air or nitrogen. It operates on pressures of 20 to 60 pounds. Metals and alloys are melted at 100 to 600 degrees F., and the spray can be adjusted to fine, coarse or pour. In pouring, no air pressure is needed and the metal flows like solder. A thermostat controls the pot.



Alloy-Sprayer Co. 602 First National Bldg. Ann Arbor Mich. Punch-Lok Co. 321 N. Justine St.

RIDE A NEW HARLEY-DAVIDSON



HAPPY TOURING AND FUN DAYS AHEAD

The new Harley-Davidsons are rolling off the production line — ready to thrill more and more riders who want the power, rugged dependability and proved performance of "The World's Champion Motorcycles." Get set for fullest enjoyment of glorious, fun-

packed days ahead — as you ride *your own* Harley-Davidson on pleasure-filled tours and exciting endurance runs, or take in race meets, hillclimbs and other motorcycling good times. Get your order in early — see your Harley-Davidson dealer NOW!

HARLEY-DAVIDSON *Motorcycles*

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Please send at once free copy of 24-page "Enthusiast" Magazine, filled with motorcycle action pictures and thrilling stories.

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and you will get a
FLASHLIGHT & BATTERIES
famous since 1909
for **QUALITY,**
STYLE and
SERVICE



BRIGHT STAR BATTERY CO. CLIFTON N. J.

Fingerprinting Surfaces on Film

(Continued from page 62)

record of the finish he desires, and this replica can be used for checking the finish on the completed work.

An engine manufacturer uses the film to make porosity checks of the chromium plating inside cylinder liners, and finds it quicker and easier than the visual observations and photomicrographs formerly employed. Some critical parts for B-29 bombers were rejected because of "scratches" eight inches down inside a cylinder. A check with Faxfilm showed that the marks were not scratches but were a succession of tiny pits, and indicated that the parts might be salvaged.

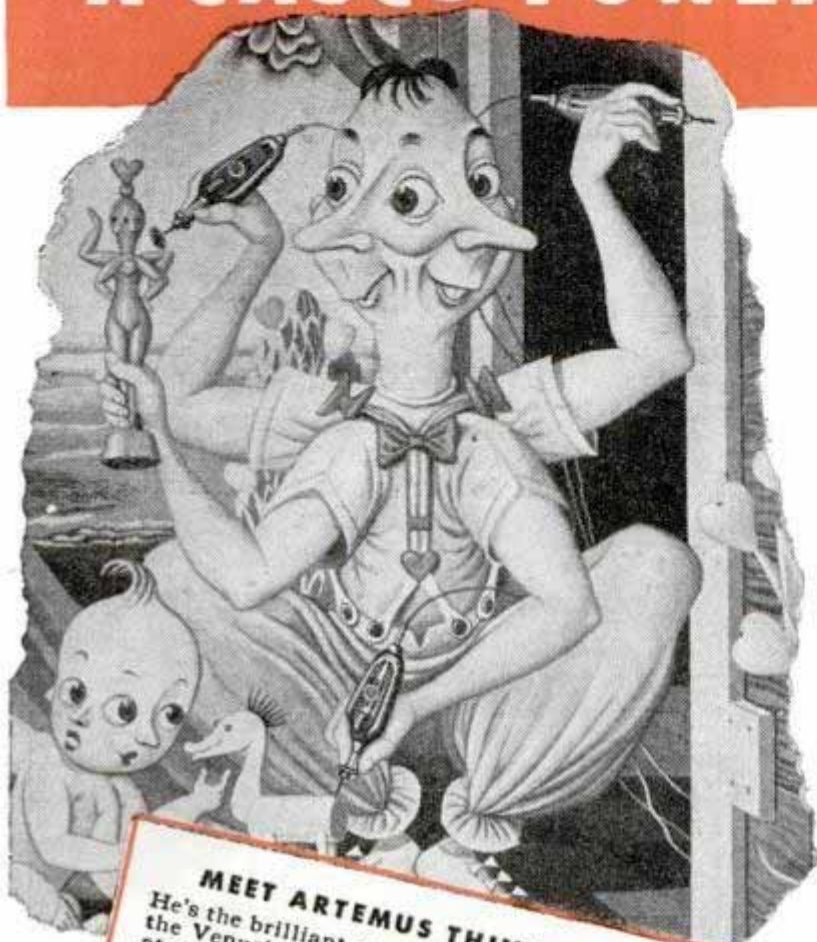
Even dentistry has found a use for the new film. A dentist doing research work on extracted teeth found that he could use the film to reveal fibrils pulled out of the tubules of dentine.

Students of biology are finding various applications for McDill's film. The surface of mother-of-pearl exhibits an interesting microscopic structure, but is difficult to observe directly. A film replica, being a transparency, is easily projected on a screen or studied with a microscope. The outer surfaces of sea shells and various other hard materials may be similarly studied. In a matter of seconds, permanent film records may be made of plant leaves, petals and stems, of insect wings and other body parts, and of textile fibers. The replicas often reveal as much detail as permanent specimen mounts requiring days of preparation. It is not a very easy matter to focus a microscope on a human hair in such a way that the scaly structure of the surface is seen clearly. But if the hair is pressed against the solvent-softened surface of a piece of Faxfilm, it will leave a faithful imprint of its surface structure. The film may be studied like any transparent microscope slide at magnifications up to several hundred diameters.

Powerful Rat Poison Harmless to Humans

One pound of Antu, a new rat poison, could kill 300,000 rats but is not dangerous to humans. The name stands for alpha-naphthyl thiourea, the chemicals in the potent rodent killer. A fine gray powder with little odor or taste, the poison can be mixed with ground corn or wheat, sprayed or dusted on fruits, vegetables, floors and runways, blown into rat holes or placed in water where rats drink. Antu was discovered by Dr. Curt P. Richter of the Phipps Psychiatric Clinic at Johns Hopkins Hospital when using rats in an experiment.

SEE WHAT YOU CAN DO WITH A CASCO POWER TOOL KIT



MEET ARTEMUS THINKLE OF VENUS

He's the brilliant concept of artist Boris Artzybasheff—the Venusian you'll meet and like as soon as the new atom-drive space ship is completed. Mr. Thinkle's four hands (notice they're all right hands) give him a slight edge—but you can do everything he's doing with a Casco Power Tool Kit—and more!

35 ATTACHMENTS DO ALL THESE JOBS BETTER AND FASTER

- Sanding
- Carving
- Sawing
- Finishing
- Drilling
- Engraving
- Grinding
- Sharpening
- Burring
- Burnishing
- Inlaying
- Cleaning
- Polishing
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- Rasping
- Brushing
- Touching Up
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... and many other machine and hobby uses

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for new and unusual contributions to better living

- **It's hand-sized—handles as easily as a fountain pen!**
- **Gets into small places—does fine detail work**
- **Works on metal, glass, wood or plastic**
- **Acts as both a repair and a hobby tool**



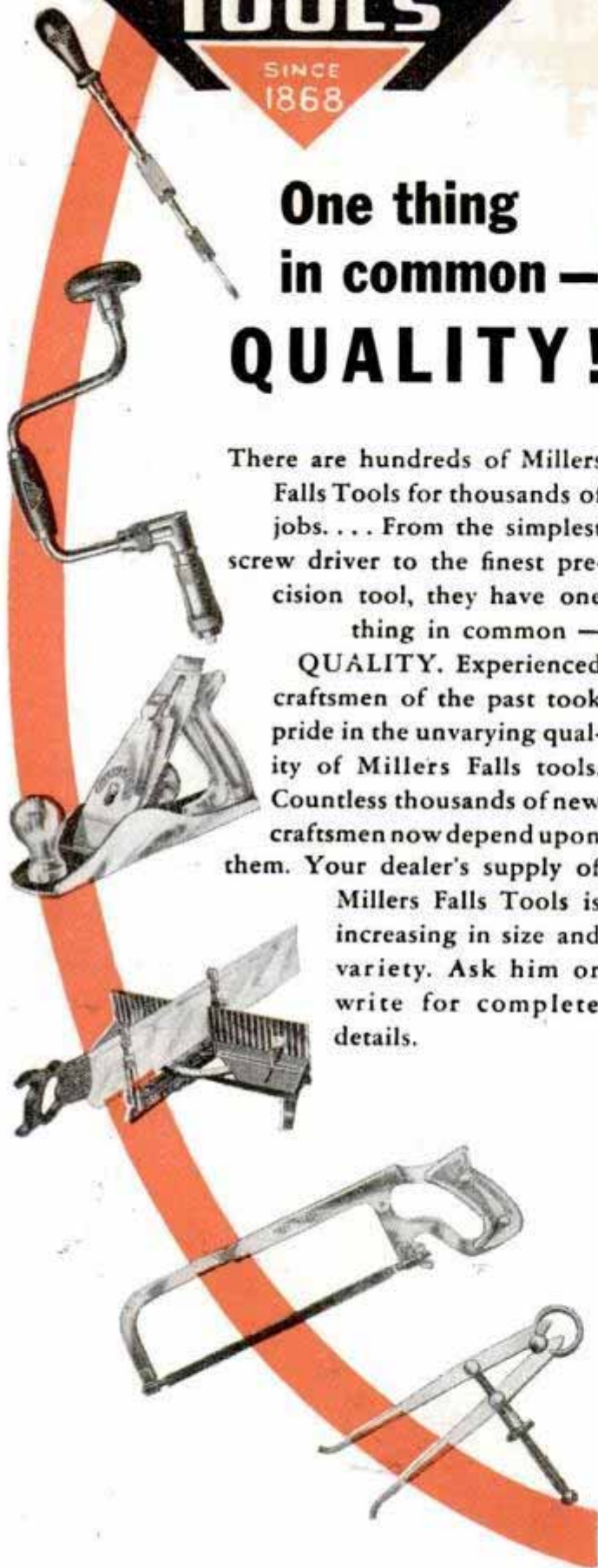
The Casco **ELECTRI-CRAFT** Power Tool Kit—now in production, available soon! Casco Products Corp., Bridgeport 2, Conn.

MILLERS FALLS TOOLS

SINCE
1868

One thing in common — QUALITY!

There are hundreds of Millers Falls Tools for thousands of jobs. . . . From the simplest screw driver to the finest precision tool, they have one thing in common — **QUALITY**. Experienced craftsmen of the past took pride in the unvarying quality of Millers Falls tools. Countless thousands of new craftsmen now depend upon them. Your dealer's supply of Millers Falls Tools is increasing in size and variety. Ask him or write for complete details.



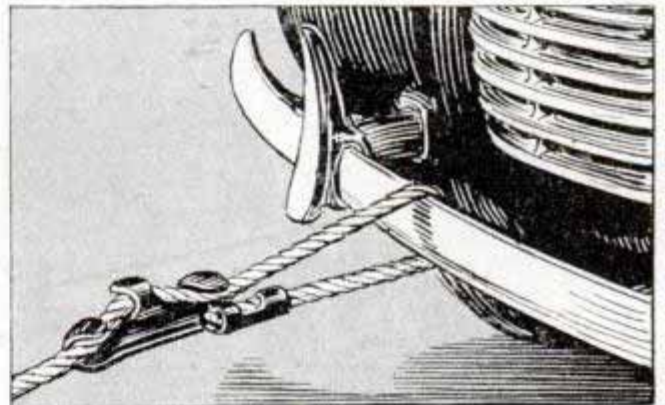
MILLERS FALLS COMPANY
Greenfield • Massachusetts

Grease Gun Gives 5-Ton Pressure



Plugging into any electric outlet, a seven-pound grease gun delivers approximately 10,000 pounds pressure. Shooting 40,000 tiny shots of grease per minute, one filling of the gun is sufficient to lubricate from three to five automobiles.

Towline Gripper Eliminates Knot



Capable of pulling up to 4900 pounds, a knotless towline has been developed for towing automobiles and for use as a boat line, tent rope, clothesline and hammock rope. Taking the place of a knot is a metal fastener equipped with prongs through which the rope is looped. The fastener is so devised that the "grip" of a $\frac{3}{4}$ -inch rope becomes tighter as more and more pull is exerted. The rope is unfastened easily.

Glass-Plastic Fracture Bandage

Lightweight bandages of Fiberglas and plastic are being substituted for heavy, bulky plaster-of-paris casts in the treatment of hospital patients. Weighing one sixth as much as a plaster cast, the knitted glass-plastic bandage is flexible, permits X-ray examination, is cool to wear and does not absorb water, thus enabling the patient to bathe while wearing his cast.

JITTERBUG

Irresistible at Night!



*Arthur Koss
of Detroit and
some of his
fishing party*

"I Cast Eight Times and Caught Five Bass!"

"Dear Fred:

"We got these largemouth black bass in two nights from Carp Lake with your red and white Jitterbug. They were caught at night in shallow water, casting among the weeds. One night I cast eight times and caught five bass inside of 10 minutes with my Jitterbug. I certainly intend to try some of your Hawaiian Wigglers, too, when I get a chance to buy them."

— *Arthur Koss, Detroit, Mich.*

Fascinates Fish and Fishermen

Jitterbug makes a loud, gurgling, paddling noise, especially noticeable to bass on calm days or nights. It is as fascinating to fishermen as it is to fish, for being on the surface makes it possible to hear and see the strike as it's made. Write for free catalog on Jitterbugs and Hawaiian Wigglers.



\$1.21 ea.

FRED ARBOGAST & CO., 1622 North St., Akron 3, Ohio

Choice of 6 colors

"DUSTLESS" SWEEPING SIMPLE AS THIS



Fill the Dustless brush reservoir with Arbitrin

sweeping fluid. In the process of sweeping, this fluid filtering through the tufts makes sweeping compound out of dust on



The result:



Germ culture after ordinary sweeping



Germ culture after "Dustless" sweeping

the floor. The result: You eliminate up to 97% of the dust in the air between sweepings. You also have cleaner floors and out sweeping costs. Thousands of factories, shops, stores, and schools now use "Dustless"

sweeping. Write for complete facts today.



- Dustless
- Speed Sweep
- Speed Wash brushes

MILWAUKEE DUSTLESS BRUSH COMPANY

528 N. 22nd Street - Milwaukee 3, Wisconsin

Maps for a Shrinking World

(Continued from page 53)

spherical map and calibrated out from a thrust pin at their intersection in nautical miles to the scale of the map. Pivoting about the pin is a swinging arm, moving between the fixed arms. A bearing is found by placing the thrust pin on the point of the map at which the bearing is to be read and adjusting one of the fixed arms in a north-south position. Moving the swinging arm over the desired point for which the bearing is sought gives the bearing on the calibrated scale at the thrust pin base.

Many new advances in map making have been made during the war, of course, not the least of these being clothing almanacs prepared by the Office of the Quartermaster General. These were designed to show the soldier at a glance what clothing he required month by month for any region all over the world. The clothing maps now can help travelers decide on what to pack for vacation or business trips anywhere on the globe.

New paper for maps developed by the Army Map Service retains all its strength when wet or greasy. It can be folded many times without tearing, and when wet can be written upon with pencil or grease crayon. Of minimum weight, the paper is virtually shrinkproof and stretchproof. Folding strength specifications call for a minimum of 700 double folds, 700 percent higher than before.

Another valuable map developed by the Army Map Service is the fluorescent map, which glows under "black light" but is not visible to the enemy. This was made by printing map paper with an overall coating of weak reacting fluorescent ink and a strong fluorescent ink in the body, with regular lithograph inks over all. The light source was a small ultraviolet light attached inside the plane or worn on the airman's forehead.

Cloth maps to guide flyers forced down on missions were made of calendered acetate rayon taffeta, which could be folded into a packet with no more bulk than a handkerchief.

In fact, the war brought Italy something she never had before, thanks to the Army Map Service and its British associates. That is a complete, accurate map of every inch of Italian terrain. These maps were prepared six months before the Italian invasion.

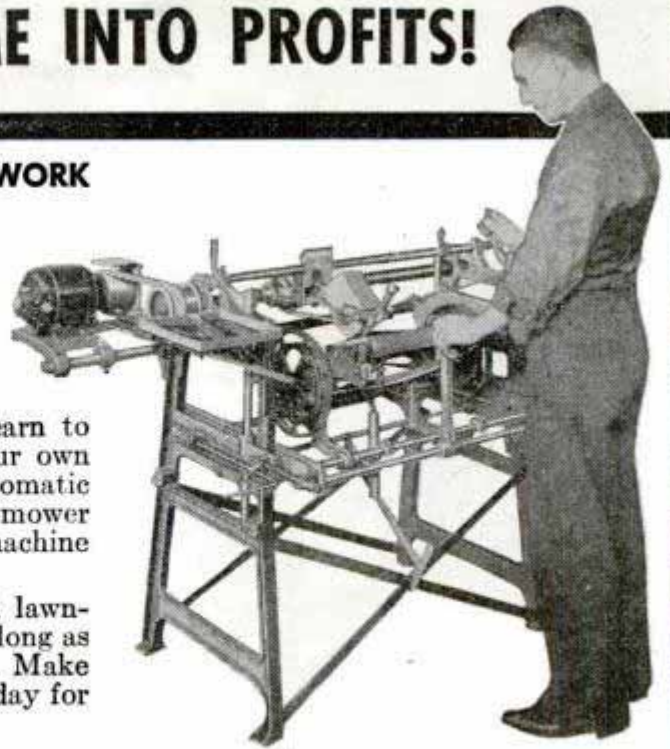
Three-dimensional movie effects are achieved by a Russian inventor by projecting a double row of images on a screen made of 2000 matched pieces of mirror glass.

TURN YOUR SPARE TIME INTO PROFITS!

**NO EXPERIENCE REQUIRED • LIGHT, CLEAN WORK
STEADY, PROFITABLE INCOME
BE YOUR OWN BOSS
WORK RIGHT IN YOUR OWN HOME**

Here's the way to make big profits in your own business! Clean, easy work that pays *all* the profits to you. Without any experience, you can quickly learn to operate the Ideal Lawnmower Sharpener right in your own home, or as a sideline in your shop or garage. Automatic operation assures a perfect job every time. Just place mower in sharpener, make a few simple adjustments and the machine does the rest!

The Ideal Sharpener takes any make or size hand lawnmower. Every community needs this service. Work as long as you like . . . you're the boss, running your own business. Make those evenings at home pay cash profits now. Write today for complete information, without obligation.



THE FATE-ROOT-HEATH CO. • 1246 BELL ST., PLYMOUTH, OHIO

SEND FOR THIS FREE BOOK!

**"HOW TO BUILD
A PROFITABLE BUSINESS
OF YOUR OWN"**

MAKE MORE MONEY

Applying or Selling **ROOF COATING**
Lasting

Extra profitable, easy to apply. Exclusive new formula makes this America's best roof coating for felt, composition, steel, slag, iron, gravel, concrete and metal roofs. Definitely superior in all climates, at all temperatures. Act at once!

DEALERS & AGENTS WANTED
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LASTING PRODUCTS COMPANY
MANUFACTURERS OF PAINTS, PUTTIES, PLASTICS
FRANKLINTOWN ROAD PLANT, BALTIMORE 23, MARYLAND

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HEADQUARTERS!

Make Belts, Moccasins, Purses,
Gloves and other useful things
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**Useful
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T-52
Deluxe
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Ignition
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Radio Set**

All For \$13.00
List Price

See your dealer or write us

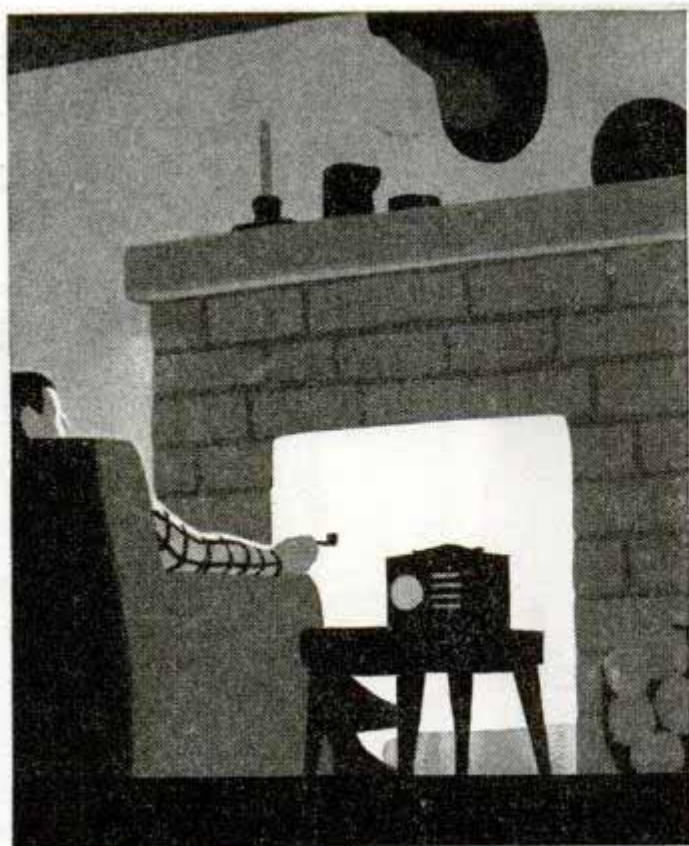
SPINTITE SET
A Positive Need in Every RADIO,
HOME and ELECTRICAL SHOP.

Contains Chuck Type Handle, Reamawl, 3 Screw Drivers,
2 Pliers, 7 SPINTITES and Insulated, **WALDEN**
Neutralizing Alignment Wrench.

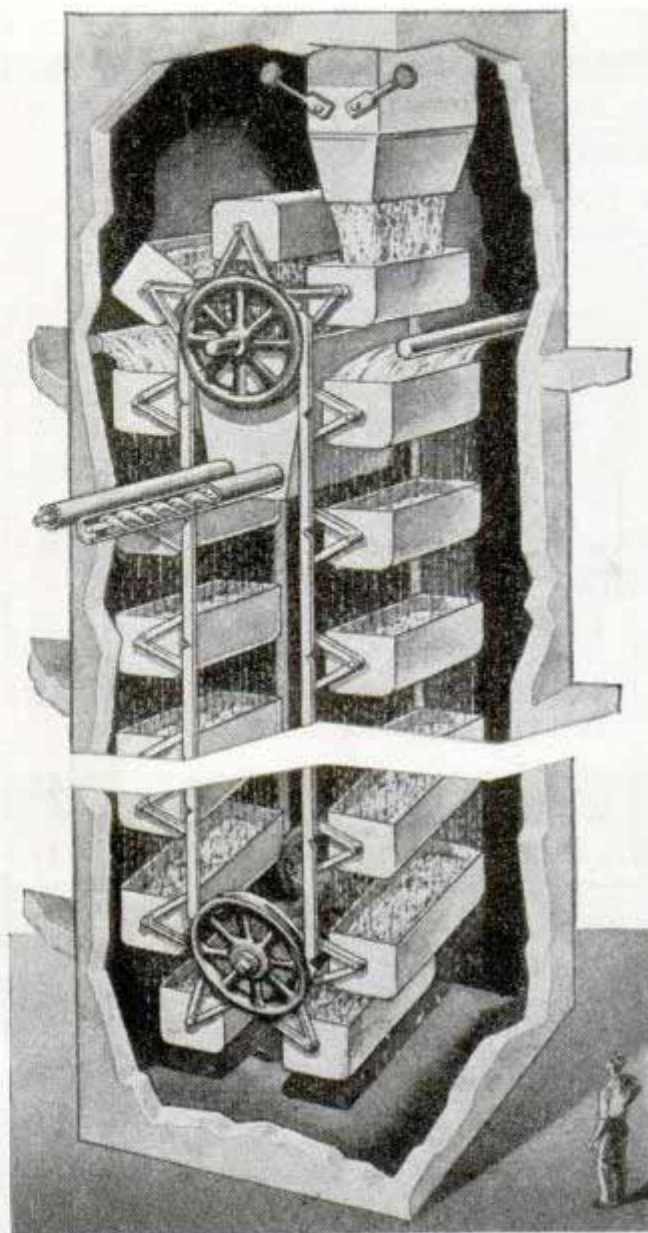


STEVENS WALDEN, INC.

WORCESTER 4, MASSACHUSETTS



Soybeans Ride Conveyor Tower In Oil Extraction Process



Soybeans are taken for a ride to remove their oil content in a new \$2,000,000 extraction mill at Decatur, Ill. The cracked and flaked beans are placed in baskets on a conveyor tower, and as each basket reaches the top it is flooded with a solvent. This removes all but about one percent of the oil in the meal and drains through the perforated bottom of each basket to the one below. The oil-laden solvent collects at the bottom. Solvent and oil are separated by a special process and the oil is carried away for refining or shipment as crude oil. Engineers at the A. E. Staley Manufacturing Company report that the solvent extraction process produces three percent more oil than with other methods.

Yellow pine planks covered with a layer of special plastic-impregnated wood remain sound and firm after 18 months in a solution of sulphuric acid at 180 degrees F.

FOR
YOUR RADIO

BURGESS BATTERIES

RECOGNIZED BY THEIR
STRIPES • REMEMBERED
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Big Demand for Wood! Prices Never as High! QUICK PROFITS with OTTAWA

Log Saw of
the Future
TODAY!



OTTAWA 6 H-P LOG SAW

FELLS TREES • SAWS LOGS Buzzes Up Poles and Limbs

Unbeatable combination! 3 in 1 machine. Does everything you need fast and easy. You can turn wood lot into cash quickly and profit by present high prices.

USE ENGINE FOR BELT JOBS—When not sawing wood, use the engine to grind feed, pump water, etc. Pulley furnished.

THOUSANDS IN USE EVERYWHERE

Speed Up Production!

Thousands NOW making more money with an OTTAWA LOG SAW. You can beat the labor shortage with this powerful machine. Saws the human way, only many times faster. Starts easy in any weather.

350 Saw Strokes per Minute

Air cooled motor—a blessing in winter. No shut-downs or strikes. Many exclusive OTTAWA features. Uncle Sam needs you to help relieve the nation wide fuel shortage. No priority needed when you buy an OTTAWA. Plan to get yours at once!

What Users Say "My 6 H-P Ottawa is a mighty magnet of power and energy. It is always ready to work in any kind of weather and makes log sawing a pleasure. It is easy to operate profitably and economically."—Edward Androus, California.

FREE Big Catalog Write today for your FREE copy of the Ottawa Catalog. Contains complete information of the "6" and other Ottawa Saws.

OTTAWA MANUFACTURING COMPANY, 227 PINE STREET, OTTAWA, KANSAS

SOON THE WORLD'S SAFEST ELECTRIC JIG SAWS will again carry the name

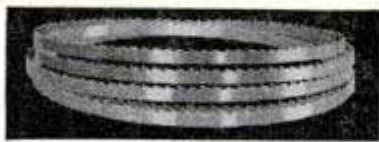
SYNGRO

SYNGRO DEVICES, INC.
Ferndale 20, Michigan

Electrically Welded Endless

Paramount

BAND SAW BLADES



Made in widths from 1/8" to 1 3/4"

Make your band saw do more work for you. The proper width of blade will extend the scope of this important machine. Burrill's Paramount Blades are made from tough Nickel Alloy Steel properly tempered. Teeth accurately set and filed, and all saws carefully straightened. Send order and check today. Delivery will be made as promptly as war conditions permit, from a few days to a week or two. You can obtain these saws at the following prices:

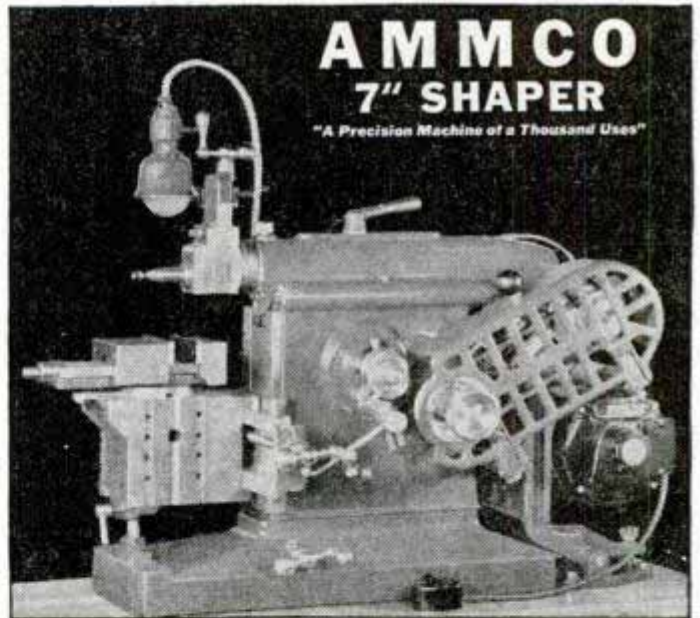
1/2"-3/16"-1/4"-3/8" wide, 5'6" long.....	\$.90 each
1/2"-3/16"-1/2"-3/8" wide, 6'6" long.....	.95 each
1/2"-3/16"-1/2"-3/8" wide, 7'6" long.....	1.10 each

Other sizes at proportional prices

Your satisfaction is guaranteed
BURRILL SAW & TOOL WORKS
407 E. Main St., Ilion, N.Y.

AMMCO 7" SHAPER

"A Precision Machine of a Thousand Uses"



A wide variety of jobs can be done accurately, quickly, easily, and economically on the AMMCO Shaper (7" stroke). Construction incorporates many features you would expect to find only in larger, more expensive machines... For example: WAYS of ram, tool head, and front face of the main frame are of the "VEE" type, hand scraped to insure accuracy and long life. Available for stationary installation or as portable unit.

Write today for specifications and prices

AMMCO

2140 Commonwealth Ave. North Chicago, Ill.

*Quick! Permanent!
Sticks to all surfaces!*

CASCO

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the best news to homecrafters in years!



Just look at what this new product does!

1. Bonds a wide variety of materials, such as:

WOOD		METAL
WALLBOARD		PLASTICS
PLASTER		GLASS
FABRIC	TO	ENAMEL
LEATHER		FOIL
FELT		LINOLEUM
CANVAS		SHEET RUBBER
PAPER		ETC.

2. Can't Crack Loose: Casco keeps joints flexible—absorbs shocks and expansions.

3. Resists Moisture: Makes heat- and moisture-resisting joints in bathrooms, kitchens, etc.

4. Convenient to use: Does not stain or discolor surfaces. It's white! Non-inflammable, too! No heating necessary. Easy to work with.

Get a large (2-oz.) 25¢ tube at local hardware, paint, or building supply dealer's.

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Also 1/2-pint, pint, quart, and gallon sizes.

CASEIN COMPANY OF AMERICA
(Division of The Borden Co.)

Dept. PM-26, 350 Madison Avenue
New York 17, N. Y.

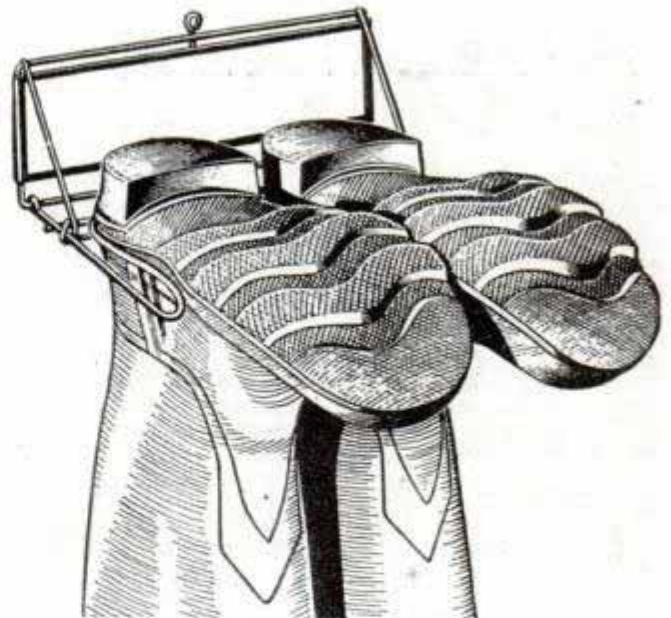


Hanger for Skirts Is Adjustable

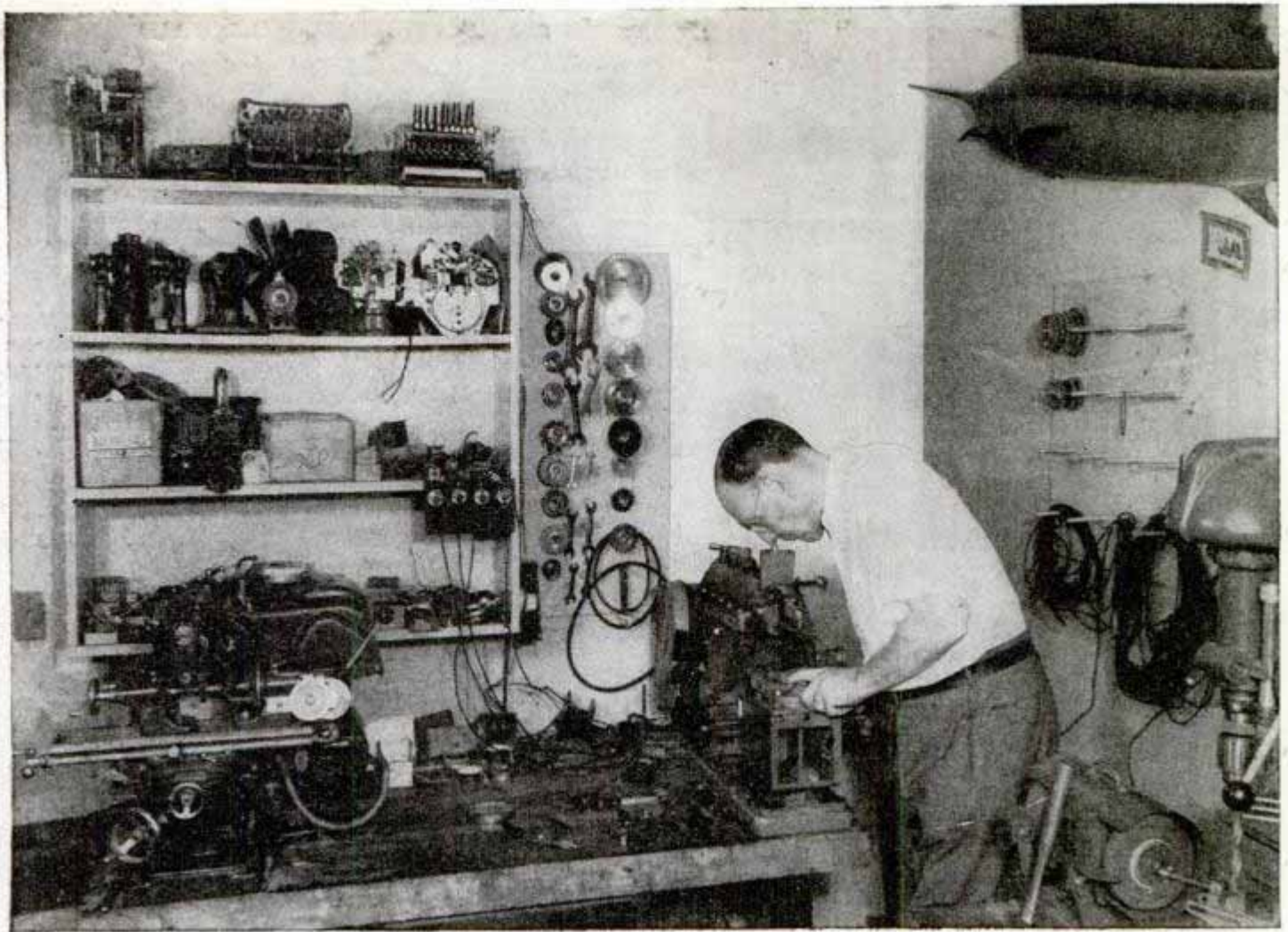


Slipping over a regular wire clothes hanger, a simple new skirt hanger can be adjusted to the proper width by sliding its ends along the wire. The skirt hanger consists of two curved pieces of metal with an interlocking fastener on each that holds the device firmly in place once it has been set in the desired position.

Folding Rack Holds Rubber Boots



Boots, overshoes and high shoes are kept dry by a metal rack that holds them with tops pointed downward and thus permits warm air to rise into the boots while the cool, damp air flows out. The folding hanger can be carried in a hunter's pocket and attached to the wall of his cabin.



WORKSHOP in the SKY

One never knows, in this great mechanized nation of ours, where you'll find men who love to work with tools.

Who would imagine, for example, that Basil Ruysdale, famous opera star and Lucky Strike announcer had a shop like this! Yet here he is, happily at work in his New York skyscraper home with the Atlas tools he has used to make important contributions to the science of electronics.

Any man is fortunate who has such a fascinating and practical hobby. Atlas tools, with their engineered pre-

cision and rugged construction, will help you make the most of your mechanical skill and ability.

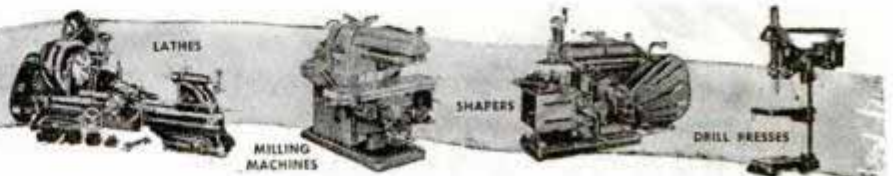
Atlas' industrial reconversion orders are rapidly being filled. Ask your distributor to let you know when you can see and operate Atlas tools in his showroom.



SEND FOR FREE CATALOG

You can begin making your shop equipment plans now with this 64-page profusely illustrated catalog. Send for your copy today. Atlas Press Company, 243 North Pitcher St., Kalamazoo 13D, Mich.

Atlas 4 TOOL TEAM



meet the watch that
runs **without** winding!



**Croton Aquamatic . . .
the Waterproof Watch
that winds itself!**

This wonderful 17-jewel watch seems specially designed for busy people. You never have to wind a Croton Aquamatic. It keeps going just by the natural motions of your wrist. Revolutionary? Yes! And practical besides! Recently, in a 30-day wearing test, 3 Aquamatics proved to be 13.5% more accurate than the average of 9 other famous hand-wound watches.

It's CERTIFIED Waterproof!

You can leave the Aquamatic on when you wash your hands, bathe or swim—even in hot, cold, fresh or salt water. This 17-jewel Croton is sturdy and dustproof. It resists shocks, doesn't tarnish and the crystal can't break. Other features:—sweep-second hand, radium dial, waterproof strap. The ideal man's gift for only \$49.50!

P. S. If not now available at your dealer, write for Free Booklet.
Croton Watch Co., 48 W. 48th St., N. Y. 19

Croton

WATERPROOF AQUAMATIC

Artist With a Pocketknife

(Continued from page 23)

of hammered brass. The spacer between these parts was made of aluminum alloy, and the assembly was held together by brass rivets.

Although Ernest and Fred used jigs and patterns for shaping and drilling parts, the knives were by no means production-line items. Each one was carefully put together and finished and was decidedly hand-made.

People who view Warther's work are often curious about his sources of materials, particularly ivory. He buys whole elephant tusks, and uses many other articles made of ivory, such as piano keys, billiard balls and old ivory-backed brushes. From admirers of his work he receives many gifts of ivory articles.

When Warther was married in 1910, he made a windmill for the garden. "We'll see which runs longer, it or I," he told his wife. Both are still going strong. "But," the carver adds, "both the windmill and I have had to have some repairs." The windmill has bearings of arguto wood and a shaft of Monel metal.

Warther put aside a half-finished commando knife the minute the war ended and put it in his museum. Now he is building a model of a Pennsylvania locomotive.

Running Water for Saipan

(Continued from page 30)

of the finest and most productive Maui wells in existence. It is in the center of a basic water table that lies 97 feet in the earth. From the well, water is boosted 100 feet into a renovated Japanese reservoir. The reservoir holds one million gallons. When the new well goes into full operation the reservoir will be filled and emptied daily.

Producing water has been a major problem on Saipan, but almost as complicated is the system used to distribute it. Because of Saipan's rugged terrain and many hills and mountains the water must pass through an arterial system of pumps, sumps, stage tanks and gravity tanks.

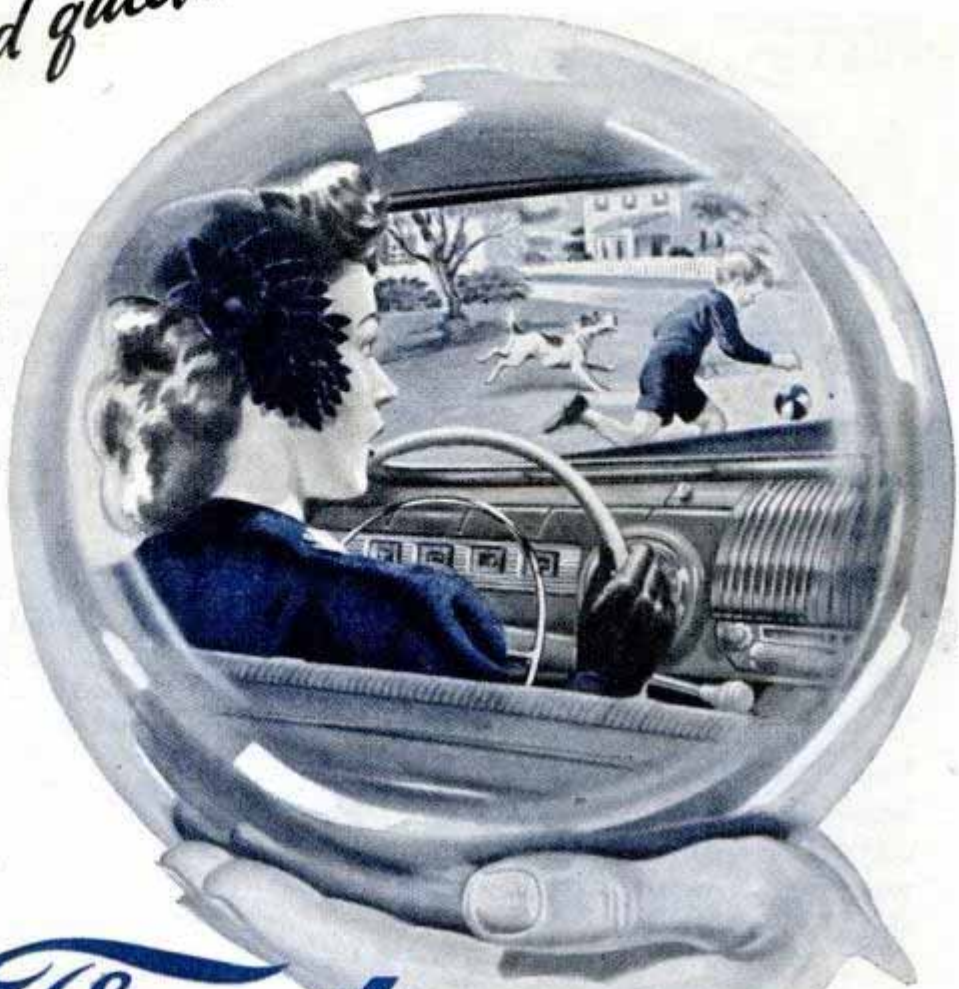
Water ships run day and night carrying Saipan's fresh water to ships in port. Some large warships take almost half a million gallons in one load. Water from the springs and wells of Saipan played an important part in the invasion of Okinawa.

Fresh water baths and drinking fountains at every turn of the road are no longer idle dreams at America's Pacific fortress of Saipan. Every hour of the waking day, GIs on Saipan drink a toast to the water engineers—with water!

*Brakes to trust
... quick and quiet!*

The big 1946 Ford is the smartest ever built. It offers increased power, too—with more economy . . . New oversize hydraulic brakes assure quick and quiet stops . . . New slow-action springs provide a ride that's smooth and gentle . . . Inside you'll find new richness. Colorful fabrics are smartly tailored to the broad, deep seats . . . There's a choice of engines—both with new thrift features. The V-8, stepped up from 90 to 100 horsepower—the 90 horsepower Six . . . See your Ford dealer now!

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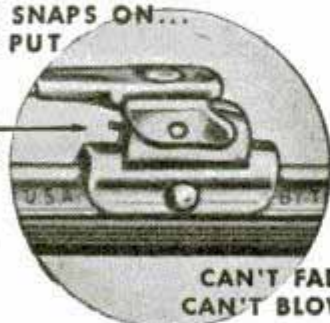
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STAYS PUT

FINGER-
TIP
RELEASE



(A war-born invention—by ANCO—first)
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DON'T SHOOT YOUR GAS-PUMP MAN!

He's doing the best he can. Sure, he knows how dangerous it is for you to drive your car... in stormy weather... with your dull old windshield wipers that smear and smear. He'd gladly put on for you quickly a pair of keen new ANCO RAIN-MASTER Wiper Blades and Arms. He has them—Newest Models! But he forgets to remind you? Too busy? You can't shoot him for that!



After all, it's *your* car to protect. So *you* remind *him*. Get RAIN-MASTERS... patented features... original equipment on many makes of high grade cars and trucks... used in war—on our fighting tanks and trucks and ships and bombers too... because ANCO RAIN-MASTERS clean quicker, clean cleaner... last longer. May save you a costly smashup.

Ask for RAIN-MASTER Windshield Wiper Arms and Blades next time you buy gas.

THE ANDERSON COMPANY
Established 1918
GARY, INDIANA

On Guard Against Death Rays

(Continued from page 35)

Cranes lift materials into and out of the cars, eliminating the need for workers to approach too closely.

There are no doors or entrances to the parts of the plant that are most highly radioactive. Routine operations in these regions are done by remote control. Certain maintenance work, however, must be performed periodically in some of these dangerous areas, work that ordinarily would be done by hand. The plant designers had to invent mechanical robots that could move around, unaffected by the penetrating rays, and unthread pipe connections, remove and replace lengths of pipe, remove screws, change electrical fixtures and install new pieces of apparatus.

The robots include special cranes whose long booms reach through a slot in the thick concrete wall around the area which no human may enter. Electrically operated wrenches and tools are attached to the end of the boom or to its cables.

Each worker at Richland carries two electroscope "pencils" in his clothing, one to check the accuracy of the other. Each worker receives a periodic health check with special reference to his blood cell count. A final precaution is an automatic bell over each of the plant's exit gates. The bell sounds an alarm if anyone with an "overdose" of radioactivity approaches.

As part of the precautionary program the amount of contamination to laboratory coats is measured after they have been worn and again after they have been laundered. Smoke from the plant's stacks has been investigated for possible toxic gases and materials, and surveys are made of adjacent wells and streams for possible increases in their natural radioactivity.

This description of the precautions that must be taken when working with atomic power suggests that future power plants will be confined to large stationary installations. Nor is there much hope, scientists say, of materially reducing the bulk and weight of the insulation that must be placed around such a plant. Neutrons, for instance, must actually collide with other matter before they are stopped, and to a neutron a quarter-inch-thick shield of lead or concrete has as many open spaces as the solar system. Only when the wall is of massive thickness is there certainty of insulation.

That is not to say, of course, that atomic power never will be used indirectly for powering light vehicles. Power transmission by radio, long talked about but never practical in the past, may be possible when large central atomic power plants are built.



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This is the motor that *experience* built—the finest in Johnson history. Sparkling in performance, **DEPENDABLE** in operation and more beautiful than ever in appearance! Shipments to dealers are being made now. *Full* production schedules should be reached soon. Look for the name of your Johnson Dealer under Outboard Motors in your classified phone book. See him. In the meantime write for a copy of the new Sea-Horse Handy Chart, with illustrations, features and specifications.

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OWNERS BRAG ABOUT

Twinplex

BLADE STROPPER

USED BY MILLIONS SINCE 1915

Will Malaria Strike at Home?

(Continued from page 80)

Alkali precipitation is not well adapted to commercial operation, since, even under laboratory controls, some 25 percent of the alkaloids remain in solution and are lost. Since none of the chemicals used is recoverable, no advantage in transportation requirements is realized. However, the method is peculiarly adapted for small scale operation, since it can be carried on with the very simplest sort of equipment and a minimum of technical knowledge.

In line with our country's efforts to maintain a strategic supply of quinine within the American hemisphere, the War Department has cooperated with the Foreign Economic Administration in establishing a cinchona plantation in Costa Rica. This plantation is being developed from seed of high grade cinchona trees which produce bark running over 10 percent in quinine alkaloid content. These seeds were produced in the Philippines and flown out while the Japanese were occupying the islands.

Quinine and atabrine are still the most important suppressives for malaria. More than 8000 medical compounds have been tested by American research laboratories in the aggressive hunt for a drug that will either prevent malaria or cure it. As Brigadier General James S. Simmons, Chief of the Preventive Medicine Service of the U. S. Army, and president of the National Malaria Society, said:

"We are now armed with exact knowledge about malaria. We know its cause, its local vectors, and we have proven methods for its control under the conditions that exist in the United States.

"It is my belief that under the leadership of Public Health Service and the various state and private facilities organized to wage war on malaria, it may be possible not only to prevent the spread of this ancient enemy of mankind, but ultimately to banish it completely from our country."

"Little David"

(Continued from page 14)

gigantic tube into position. Crews make a few simple attachments and "Little David" is ready to work—a half-day after installation was started.

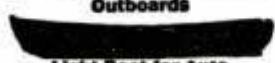
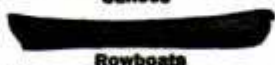
The 3650-pound shell is hauled to the gun site by a bomb service truck. There it is lifted with a monorail device and swung to a dolly. Crew members push the dolly along a two-rail trolley until it is beside the gun's muzzle. Meanwhile, huge doughnut-

(Continued to page 168)

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Write today for new descriptive literature to help you make your power tool shop plans. Keep in touch with your Power King dealer to see the new tools when they arrive.

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shaped bags of powder are shoved into the tube, the number of powder charges varying with the range at which the gun is to be fired. Using a davit, the crew lifts the bomb from the dolly and lowers it into the muzzle until it engages the rifling, or spirals, inside the tube, which spin the shell to improve accuracy when the gun is fired. The tube then is elevated, the shell sliding the rest of the way to the bottom of the tube in about 20 seconds.

Several electric switches operate a maze of motors and power equipment to elevate and traverse the gun. The mortar can sweep an arc of 13 degrees horizontally and will elevate to plus 65 degrees. A simple lanyard fires the mammoth weapon. The shell leaves the gun in an earthshaking explosion, traveling at 1250 feet per second.

Effects of the exploding shell are gargantuan. Upon striking the ground, the 1550-pound picratol charge blasts a hole 38 feet in diameter and 14 feet deep, a crater big enough to conceal a large Army truck. The shell can break up concrete seven feet thick. It can finish off a strong pillbox or bunker with a single shot. Trained crews fire six shells an hour, a rapid rate for such a herculean gun.

"Little David" is not a freak weapon, according to ordnance experts. Rigidly tested, it has shown itself capable of producing a tremendous effect against the most resistant targets.

Radar Cues the Navy Fighters

(Continued from page 6)

squawkboxes that seem to be flashing red lights constantly. Here is the nerve center of the ship, as important to today's operations as the bridge or the engines.

"We have a bogey, captain—" one officer is saying into the squawkbox on the overhead.

"Red One airborne," says an enlisted status board keeper who prints RED ONE—0934—on the luminous Plexiglas board.

"'nother bogey—two-seven-five," says a towhead sitting beside a round "plotting table" with a frosted glass top lighted from underneath. He makes a small cross on the board and taps the board with his pencil. An officer bends over the board. "Ten-twelve planes in that raid," the towhead says as he prints on the glass top table: 10-12p.

Everyone's lips seem to be moving—talking to unseen people listening in on the other end of the "line" . . . talking to lookouts standing exposed topside who are straining to see what CIC personnel "see"

(Continued to page 170)



MOTO-TOOL ★ THE "POCKET-SIZE" MACHINE SHOP

PUT THIS "WAR VETERAN" TO WORK *Approximately 27,000 R.P.M.*

READ MOTO-TOOL'S RECORD

Long before Pearl Harbor Dremel Moto-Tools had won their spurs in tool rooms, machine shops, home workshops. Now they have the respect of every branch of the armed forces. And thousands of them helped establish production records at General Electric, Westinghouse, Remington Arms, Ford, Nash-Kelvinator, Consolidated Aircraft, Douglas and others.



MOTO-TOOL KIT

Kit No. 2 with 23 high grade accessories and Model 2 Moto-Tool, in hardwood case. \$23.50
Model 2 Moto-Tool, with 1 accessory. \$16.50

Now that priorities have been lifted, Moto-Tool can work for you. Moto-Tool owners daily discover new jobs that can be done more expertly in less time. In fact, new purchasers find dozens of uses in addition to those they had in mind. So great is the saving of time and labor with Moto-Tools, thousands of mechanics and craftsmen would find it difficult to get along without their "mighty little midgets."

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A Model 2 Moto-Tool develops a speed of approximately 27,000 rpm. Weighs only 13 oz. Shaped to fit the hand. Sturdily built with shock-proof bakelite housing. Balanced for vibrationless operation. Uses 110-120 AC or DC current.

10 DAY TRIAL—MONEY BACK GUARANTEE

Ask your dealer today about Dremel Moto-Tools and Accessories. If he does not handle them, order direct from factory on 10 day trial. We ship post-paid if cash in full accompanies order. If you prefer to send only \$2.00, Moto-Tool will be shipped C. O. D. for balance plus postage. Catalog sent FREE.



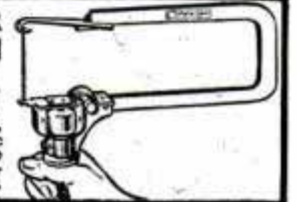
Model 2 Illustrated

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| <input type="checkbox"/> Drilling | <input type="checkbox"/> Inlaying | <input type="checkbox"/> Carving |
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Engineers All Metal Army Type Hand-Sighting

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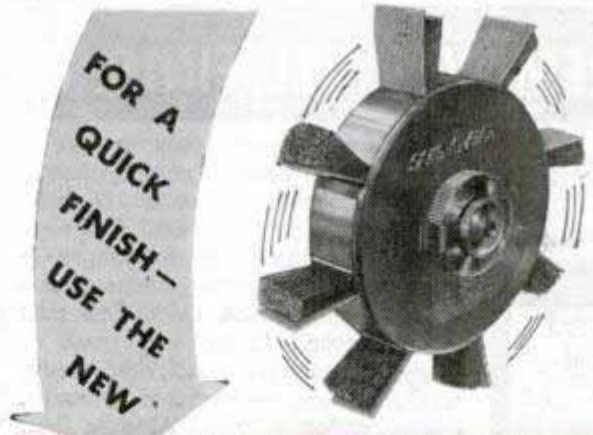


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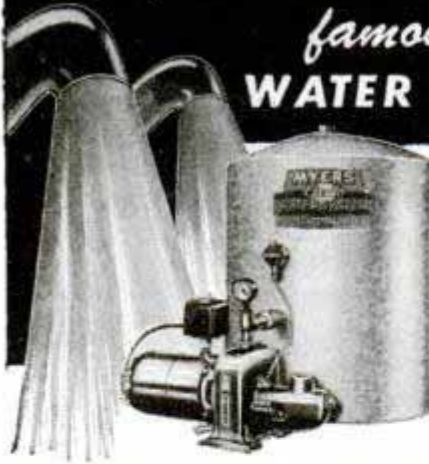
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"How to Remove Paints, Varnishes, Lacquers, etc." Also describes other Savogran Products: Heavy Duty Cleaner, Crack Filler, Wood Putty, Remover & Bleacher (renews floors), Paint Brush Cleaner, Coldfoam Soapless Soap Powder.

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SAVOGRAN STRYPEEZE

IN EVERY WELL-EQUIPPED HOME WORKSHOP

so well in the small compartment in the bowels of the ship . . . talking to the captain on the bridge . . . talking to the gunnery officers who are ready to open fire when the word is passed . . . talking to the destroyers that screen the carrier . . . talking to the pilots in the planes over the ship.

A six-foot circular Plexiglas "window" dominates the compartment. It is marked out with bearing lines, radiating from the center of the board, and range circles, exactly as the PPI scope or disk; in fact, this is an enlargement of the picture seen on the radar screen or disk except instead of blobs of light to indicate planes, symbols are being plotted by men stationed behind the board. These symbols, due to special side lighting, show up exactly like small neon figures and can be seen from any position in the compartment. In the center of this—tagged by everyone else on the ship as the "madhouse"—sits the fighter director officer on a raised platform. In front of him is his own PPI scope. At his fingertips are pushbuttons and controls that make it possible for him to listen and talk to every key post on the ship and to other ships.

As you entered the CIC, you heard one plotter report, "bogey, two-seven-five." A bogey is an unidentified airplane or planes. Immediately after a bogey contact is picked up by the radar it is plotted and evaluated in CIC. Within minutes—seconds even—the word goes out, first to the admiral and captain, then over the task group radio nets to the other ships:

"Hello, Columbine. This is Babyface. We show bogey two-seven-five, fifty, over—"

"This is Columbine. We concur. Looks like ten to twelve. Out."

"This is Bridget. We concur."

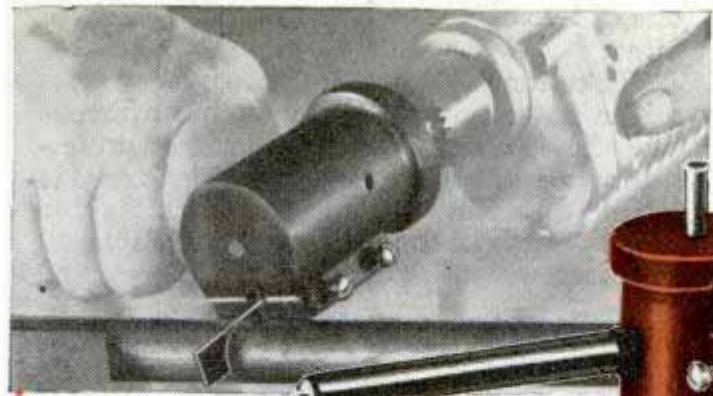
"This is Blueboy. We concur."

Swiftly the task force fighter director officer, representing the admiral, begins to deploy his forces. Certain ships are assigned to follow the raid with their radars. Others are directed to continue their complete 360-degree sweep to detect, as is often the case, whether other raiders are coming in from another direction.

Now you are caught in CIC for General Quarters. More men pour into the compartment to take battle stations. On all ships of the force bugles sound through bull horns: "Torpedo Defense" or "General Quarters"—the brazen throats of alarm bells (and bosun's mates) summon all hands to battle stations. AA guns point skyward in the direction of the raid. Deep inside the hulls steel doors slam shut as the ships button up for action.

In our carrier CIC here, which is the flagship, the fighter director officer speaks to

(Continued to page 172)



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 Makes a reciprocating saw or filing machine out of your drill. Will saw irregular shapes in wood or metal.

All three tools operate in 1/4" electric drills with speeds of 1600-2500 rpm. Illustrations shown are 1/3 actual size. Weight 2 lbs. each.

Standard files and hack saw blades may be used with the ROTO-VERT. Various accessories, chisels, star drill and adaptor, center punch, available at \$1.00 each for the ROTO-PEIN.

3 ROTO-PEIN **\$12.50**
 PAT. PEND.
 For peining small aluminum, copper and brass rivets. Also for chipping, chiseling and gouging wood; bumping metal; and drilling 1/4" holes in brick, concrete, etc.



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one of two officers who sit on either side of him:

"Take the raid—use Babyface 1."

The intercept officer nods his affirmative. He is a lieutenant, perhaps, or an ensign who has been specially trained for this job of directing the Navy's crack fighter plane patrols in the defense of the ship and the force.

On the PPI scope the intercept officer notes the position of the raid—the small blob of light 50 miles due west, altitude 10,000 feet. Overhead, at 12,000 feet, he knows there are two divisions of Combat Air Patrol, eight planes, flying a three-mile orbit around the task force. They are Babyface 1 and 2 and are joined to each other. He speaks into his microphone to the senior division leader of the CAP overhead:

"Hello, Babyface 1. This is Babyface. We have a customer for you. Vector two-seven-zero, buster, angels twelve, over."

From 12,000 feet above the ship, the senior division leader replies for all eight pilots: "Wilco vector two-seven-zero, buster, angels twelve, out!"

At 240 knots (buster speed) on a due west course at 12,000 feet (angels twelve), the eight planes swing to their course, arrowing out in the direction of the raid.

Below, the intercept officer concentrates on his scope. He notes the two blobs of light, one the enemy, the other his fighters, slowly approaching each other almost head on. He looks up at the six-foot Plexiglas board where plotters are charting the course of the fighters and the enemy, carefully and methodically noting course, speed, number.

"Bogey ahead forty . . . appears to be ten to twelve planes, over—" the intercept officer says into the microphone.

"Roger, out," comes from the senior division leader in the air.

The two blobs of light are moving toward each other.

" . . . estimate altitude of bogey 10,000—" blares out from the speaker on the bulkhead. That was Columbine reporting. Columbine is code for another Essex-type carrier just off the starboard beam.

" . . . concur—" Blueboy speaking over the intership communication.

An officer in our CIC is talking into the squawkbox to the captain: ". . . bogey is closing on course zero-nine-zero, speed two-eighty. Babyface 1 and 2 have been vectored out for the interception—"

Look up at the large Plexiglas board. The raid is heading directly towards the center of the board and our planes are go-

(Continued to page 174)

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ing out from the center. Thirty miles apart now.

"Bogey ahead thirty . . . enemy height 10,000," the intercept officer tells the division leader in the air.

"Roger, out," is the reply.

High in the blue, clear air the pilots in the eight fighter planes are peering ahead, searching for the enemy planes, each realizing that today he might become an ace.

On the scope in the CIC the two blobs of light creep closer and on the big Plexiglas plotting board the symbols draw toward each other. Then suddenly through the intercept officer's earphones, sounding above the high crackle of static:

"Tallyho! One o'clock, ten miles, eight fish, down—"

The intercept officer throws a thumb up toward the fighter director officer, who has been supervising the whole operation from his perch at the desk, and "rogers" the pilot's message.

Now the information is being printed on the Plexiglas board and the status board. A slight murmur goes up:

"Eight fish—"

"Eight fish—"

Everyone seems to be muttering this information to himself. Eight fish—that's eight torpedo planes. If one gets through—?

"Splash one fish," one of the pilots up there calls in over the very-high-frequency radio.

One down, seven to go.

"Splash a fish," that's the division leader calling. Another bandit in the drink! But it only takes one of those enemy planes to get through to sink a ship. Minutes creep by. One of our planes is in trouble, which shows up on our radar screen. Everyone is noting carefully the position of the stricken plane in case it goes down so that a destroyer or destroyer escort can be dispatched to pick up the pilot.

"Splash two fish," the report comes in.

Only one blob of light on the screen now—that one blob representing our planes and the enemy at the same range and bearing from the ship—that one blob of light constantly closing on the ship.

Over the phones, a lookout reports to CIC that he can see the sky battle.

Guns are trained in the direction of the planes—everyone alert for the possibility of an enemy plane breaking through.

Then, finally, the most welcome call from the division leader in the air: "Grand slam!"

That's it. All enemy planes downed. Our pilots can return to their CAP position over the ship.

(Continued next month)

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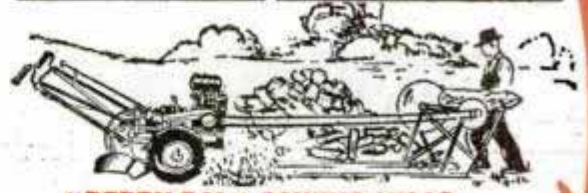
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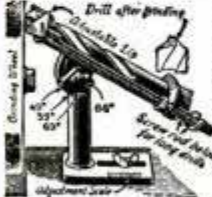
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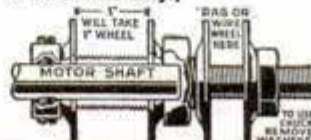
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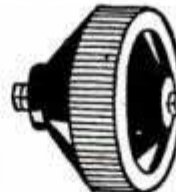
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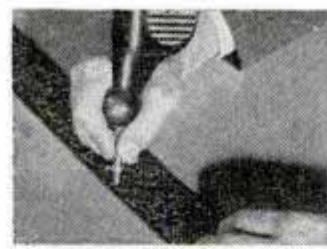
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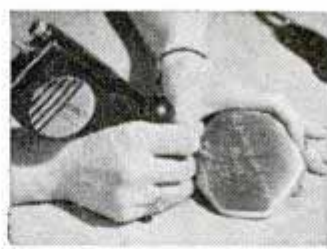
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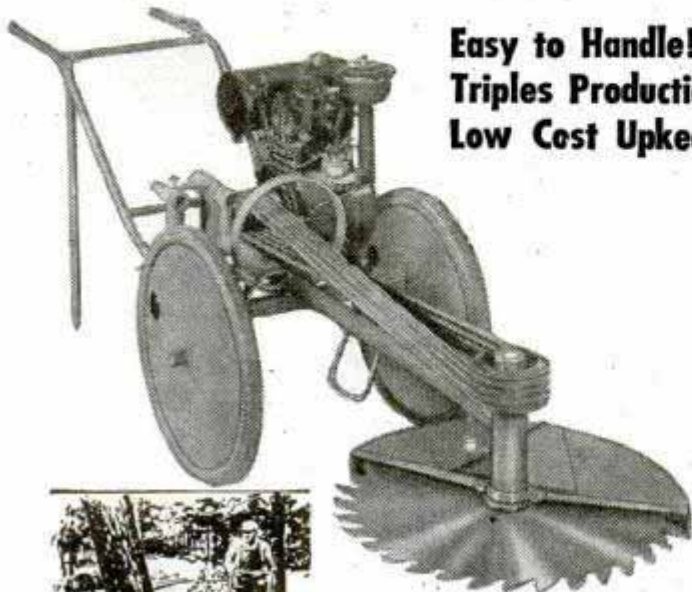
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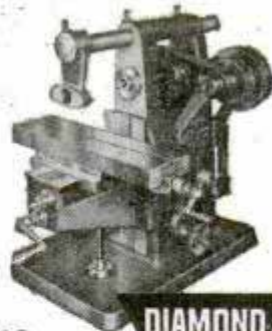
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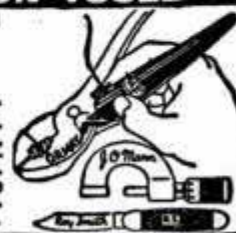
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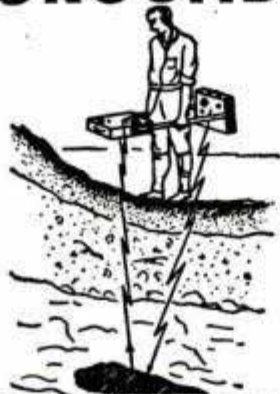
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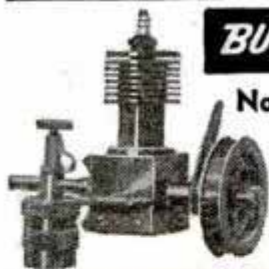


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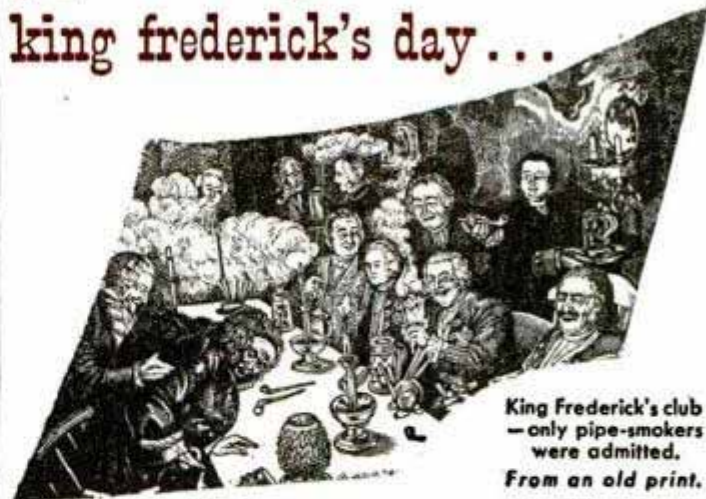
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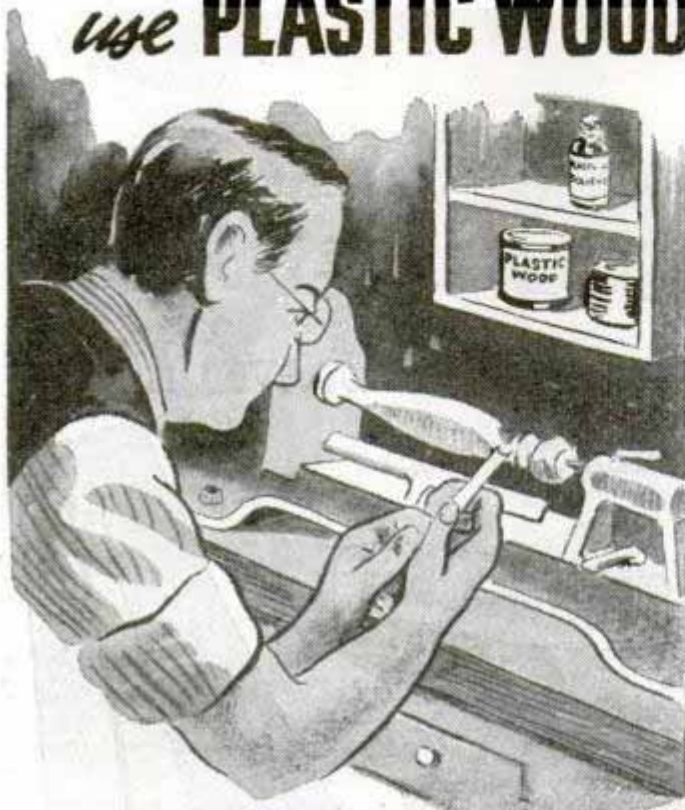
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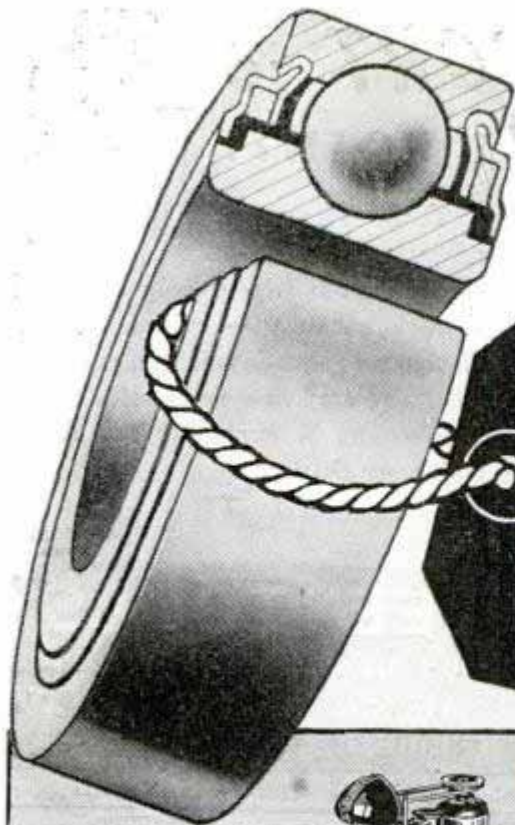
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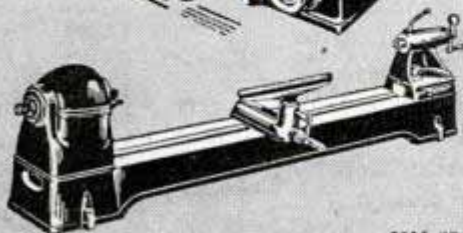
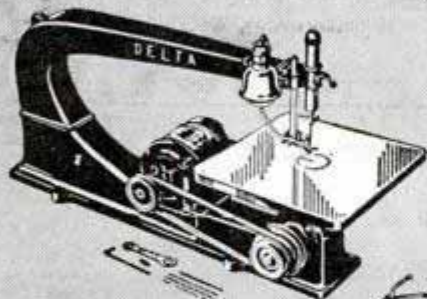
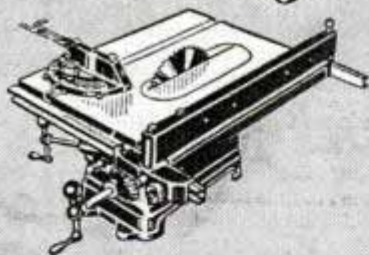
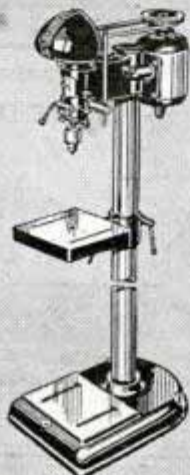
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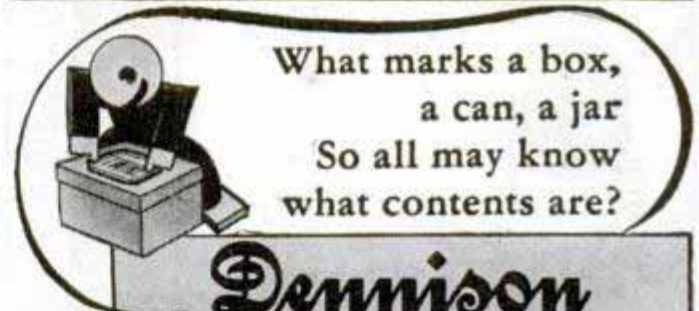
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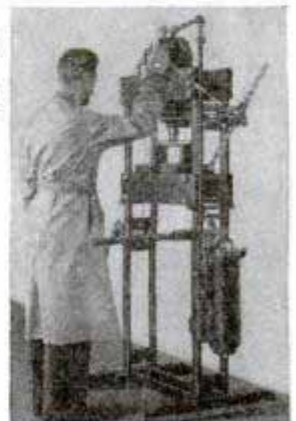
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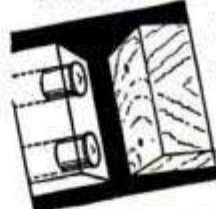
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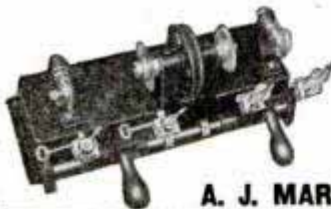
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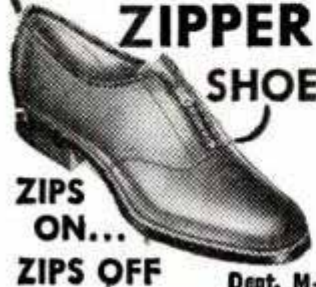
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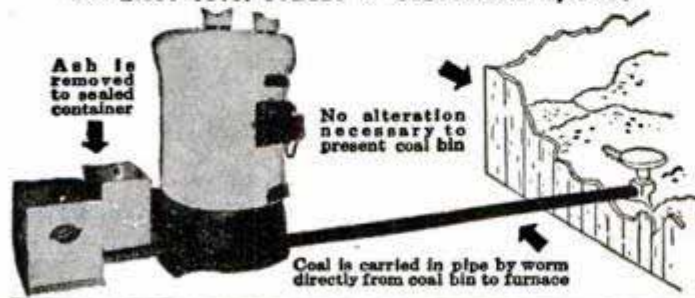
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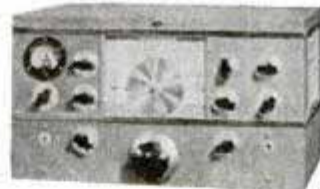


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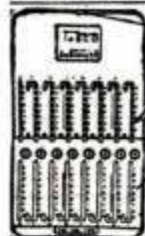


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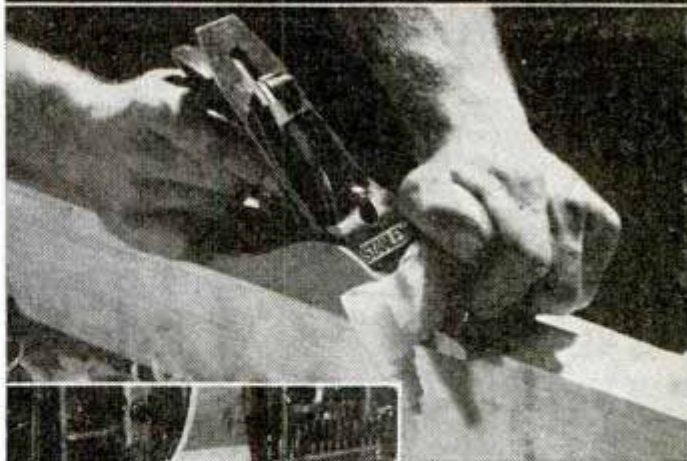
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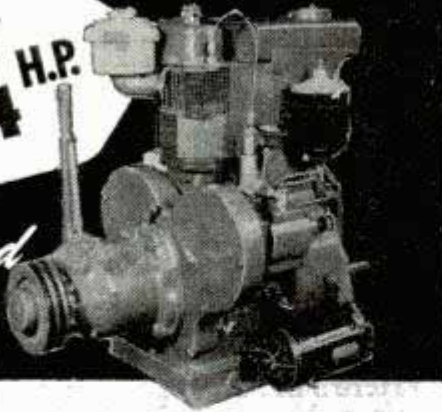
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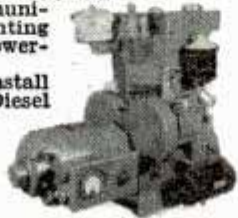
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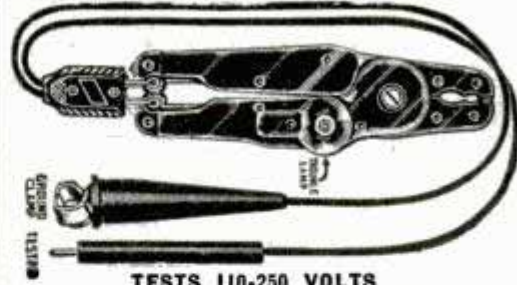
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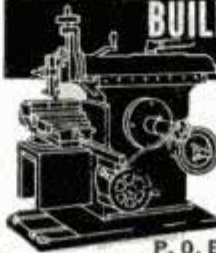


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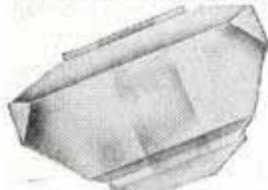
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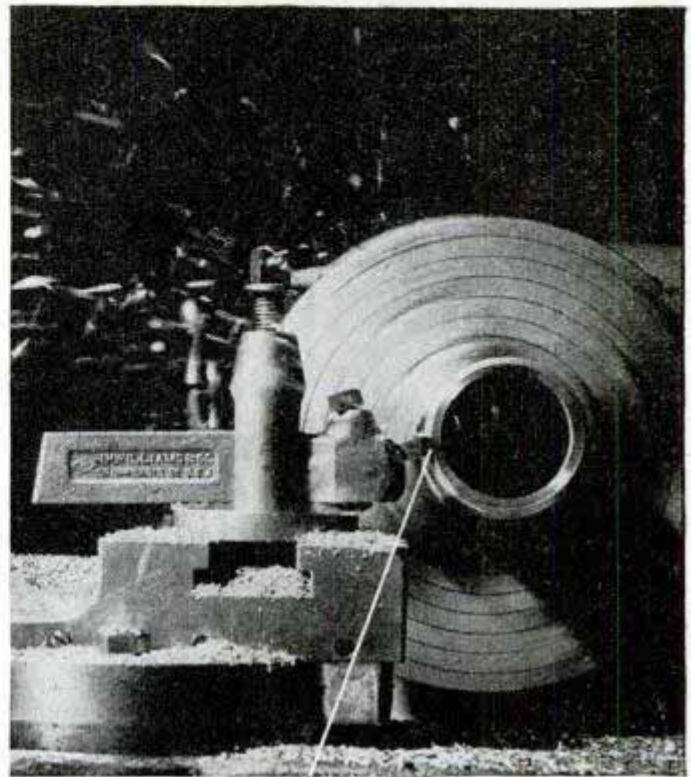


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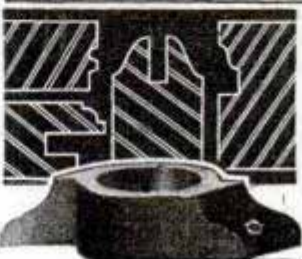
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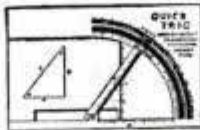
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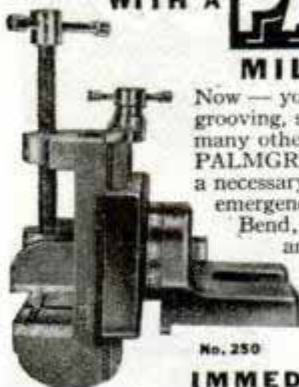
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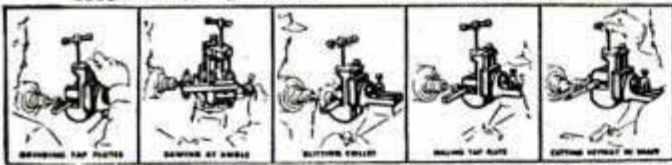
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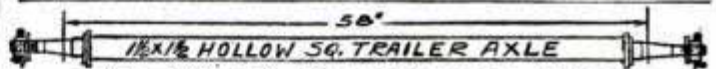
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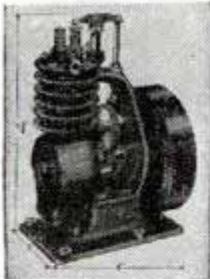
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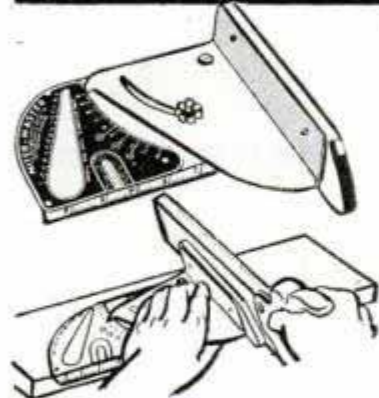
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Many with tired, aching feet have found happy relief! So comfortable—LIKE WALKING ON A PILLOW! Made of fine, soft spongy material, leatherette covered. So light, flexible—cushions and helps relieve your feet from heel to toes. If you suffer from metatarsal callouses, corns, foot pains or fallen arches, try Dr. Barron's Foot Cushion. Wear in any shoes—helps make walking a pleasure. Doctor says: "I recommend Foot Cushions to foot sufferers." Send only \$1.98 for A PAIR—or will ship C. O. D., plus postage. STATE SHOE SIZE AND IF MAN OR WOMAN, 30 DAY TRIAL GUARANTEE. Money back if you don't get blessed relief! ORTHO CO., 111 W. 83rd St., Dept. 49-B, New York City 24

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- Mitering Guide
- Diameter Gauge
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For mitering, set at desired angle. Place material against bench stop. Hold saw firmly against Miter-Master guide board. It's that simple!

Miter-Master takes the place of an expensive miter box accurately set to any angle. Sturdy steel construction. Set any point from 45-90°. Scale marked for mitering 5, 6, 8 sided frames. Satisfaction guaranteed or your money back. Ask your dealer or order direct.

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Enclosed is \$1.50 for Miter-Master, postpaid in U.S.A. (Foreign \$1.75)

NAME.....
(Print address in margin)

DOES

Gray Hair Handicap YOU?



• M. HERBOLD, A.B., M.S., the Hollywood Chemist, creator of Herbold Pomade, who says: "I have such confidence in my pomade that I want it sold only on the basis of complete satisfaction or money back."

WHEN ONE'S HAIR looks faded, dry and streaked with gray, one may be severely handicapped. It may even threaten a man's position in trade or business. And, in the past, most correction methods have required so much bother, mess and waste of time!

Now, however, the Hollywood chemist, M. Herbold, has developed an answer to this problem. His preparation, *Herbold Pomade*, adds deep, rich color to faded, gray-streaked hair, and does it easily, without muss or bother! Once each day take a little of this clean, fragrant *Herbold Pomade* on your finger tips and massage it into your hair. It is as easy as that! That is all you do. Yet, this simple process adds color from hair root to hair end... lustrous color you will be proud of!

IMPARTS COLOR GRADUALLY

Furthermore, *Herbold Pomade* imparts color so gradually that usually not even close associates will suspect. In fact, it largely appears to others that one is simply using an excellent daily hair dressing, which is literally true, because *Herbold Pomade* counteracts dryness, and grooms the hair and helps keep it in good form, while adding lustrous color at the same time.

It will not rub off or stain one's pillow or clothing, and can be used in less than a minute a day in the privacy of your bathroom. So get *Herbold Pomade* and take pride in the lustrous color and splendid grooming it will impart to your dry, faded or gray-streaked hair.



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USE HERBOLD POMADE exactly as directed on package. If, for any reason, you are not completely satisfied after using the entire contents, simply return the empty jar to us and your total purchase price of \$1.00 plus tax and postage will be refunded. HERBOLD LABORATORY, HOLLYWOOD, CALIFORNIA.

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LOOSENS!

TIGHTENS!

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Now with the new Tuffy power-arm driver you can loosen those rusted-over screws the ordinary screw driver can't budge . . . for tightening, Tuffy gives you that extra quarter-turn pressure to make screws stay put. Tuffy's durable aluminum power-arm does the hard work for you—allows full hand and body pressure without slipping or gashing screw head—puts that extra leverage where it counts. The power-arm folds up when not in use, making Tuffy a regular screw driver.

Tuffy is available in 3 sizes: 1/4" dia. 5" blade \$1.95; 5/16" dia. 6" blade \$2.25; 3/8" dia. 8" blade \$2.65. Complete set of 3 sizes specially packaged in attractive kit box, \$6.85. If your dealer can't supply you, send check or money order direct. Shipped postpaid. Satisfaction guaranteed.

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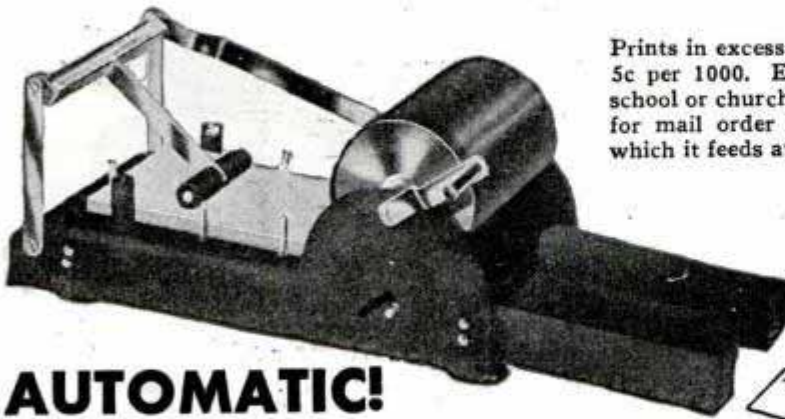
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FOR HARDEST STEEL, GLASS, ETC.

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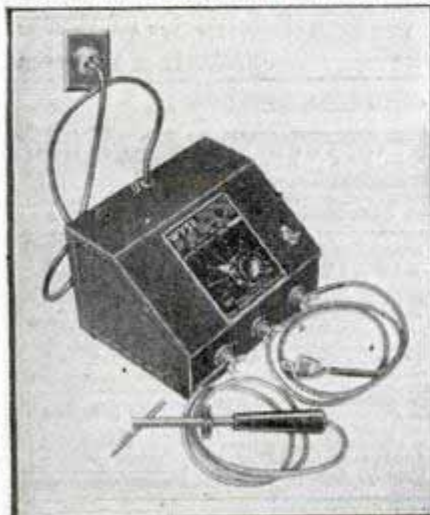
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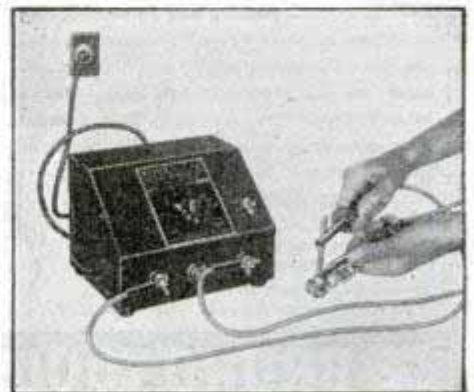
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Quickly and easily cleans rust or corrosion from steel, iron, chromium, copper, aluminum and nickel. Cleans enamel and porcelain as well. It is non-inflammable, contains no dangerous acids. Four years' test proves it tops for tools and equipment. Buy it NOW at these amazingly low prices. Send coupon today.

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A new product that quickly and safely cleans oil, grease, paint, varnish, carbon deposits, etc., from metals, porcelain, stone or wood. Also removes oxides from copper, zinc and zinc alloys. Saves time, labor, expense. Non-corrosive. Harmless. Rub, dip, brush or spray.

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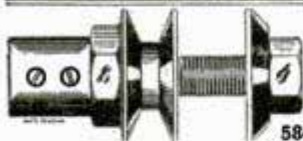
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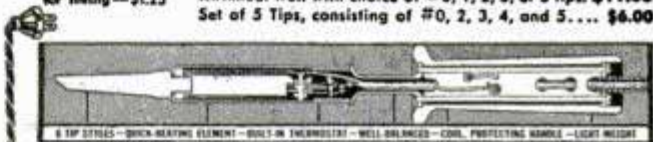
HOT, READY FOR USE ONLY 90 SECONDS after plugging in! Kwikheat is the only soldering iron with a thermostat built into the tool itself*—maintaining the proper level of heat for most efficient, economical operation. **SAFE!** ... Cannot overheat—**ECONOMICAL!** ... Lasts longer—saves tips and requires less retinning. **POWERFUL!**—225 watts—yet exceptionally light weight (14 oz.). Well-balanced with cool protecting plastic handle. Modern streamlined design. Six interchangeable tip styles adapt one Kwikheat iron to all your soldering jobs. You will be proud to own America's finest and most versatile soldering tool... from tip to plug Kwikheat is in a class by itself. Ask your dealer to demonstrate the quick-heating feature now!

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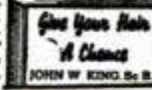
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BRADNER PUBLISHING CO. (EST. 1933) Dept. 27, Cambridge 42, Mass.



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Extra heavy. For farm, home or jungle use. Blade of Gov't. formula cutlery steel. Walnut riveted handle. 3 1/2 inch hilt. 10 1/2 inch blade. You'll find hundreds of uses for a Bolo knife. Blade will take and hold a keen cutting edge. Wt., 2 lbs.

- A112—with Army Sheath..... **\$4.95**
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Regulation Army Pup Tents of durable, brown canvas. Used, but in good condition. Fine for campers, outdoorsmen, boy scouts, etc. Grand Xmas gift for children.

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Purchased from the gov't. Finest design and construction. Base measures 3x4 1/2 inches. Original value \$2.50. All parts of instrument brass. Adjustable.



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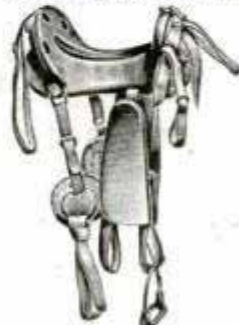


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Brand new! McClellan model saddles. Top grade cowhide with hair perth, fender and 12 inch seat. Has straps for blanket roll and knapsack. Buckles, girths and sabre loops. A splendid value.

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For experimental work in optics. Consists of 27 precision ground and polished prisms and lens elements in assorted diameters and focal lengths. Big variety, positives, negatives, etc. Actual value over \$100.00.

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Lenes similar to above but not polished. All are blanked and formed ready for polishing. Negatives, positives, and prisms in Crown and Flint glass. Worth many times this low price.

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Of heavy canvas. Adjustable waist size. Each with 5 pockets and metal recoil fitting. Brand new. Fine for hunters, boy scouts, etc.

- A107..... **98c**



MICROPHONE BUTTON

Brand new! For experiments in radio, electronics and other electrical apparatus. Used in telephone, amplifier and detectaphone work. Diameter 2 1/2 inches. New.

- A512—EACH..... **98c**

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Fine for storing valuables, carrying lunches, etc. Of heavy gauge 7 1/2 x 11 x 4 inches. Fireproof. Hinged lid with folding handle. Olive drab finish. Used, but perfect. Shipping wt. 4 lbs.

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Extremely sensitive with 4000 ohms resistance. Brand new and fully guaranteed. With moisture-proof cord and phone plug. A splendid value for the radio serviceman and experimenter.

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Made of finest top grain leather. Rivet reinforced seams. Bottom and side gussets. Each canvas lined bag measures 12x13 inches. Fine for motorcyclists. May be separated to make two duffel bags. Used, but perfect.

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Fine for boy scouts. Blades include knife, bottle opener, screw driver and reamer. All metal handle 3 3/4 in. long. Weight 1 lb.

- Stock No. 107—Each..... **\$1.95**

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In sheet form. Good workable sizes. Transparent. For costume jewelry, etc. Easy to work and polish.

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Extruded shapes, rounds, half rounds, etc. Easy to machine. Furnished in assorted colors, shapes and lengths.

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Right for the invasion beaches. Consists of two air chambers. May be inflated automatically with "sparklet" cartridges or manually by attached hose. Adjustable in waist size. One air chamber guaranteed air tight—other may need a tire patch. All belts are used and slightly soiled but a bargain at this low price.

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Of fine heavy khaki. Big roomy pockets with snap button fasteners. Fine for hunters, campers, boy scouts, etc., also for shop work in carrying small parts, etc. Material alone is worth this price.

- 11 Pocket Type No. 129 Each.... **49c**
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Distill your own water with one of these fine portable stills. Purchased from the Gov't. Completely self contained. Has 1 gallon capacity; output 1 1/2 gal. per hour. Fitted with genuine Coleman double burner stove. Operates 5 to 7 hrs. on one filling. Heat output 20,000 BTU's. Stove alone is worth this price. All new and guaranteed. Instr. included. Weight 109 lbs.

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MAKES ALL PLATES FIT PERFECTLY OR MONEY BACK PERMANENTLY

ONE APPLICATION LASTS FOR LIFE OF PLATE

PLASTI-LINER is a professionally developed re-liner for home use that ends forever the mess and bother of temporary applications that last for only a few hours or a few months. It is NOT a paste, nor a powder; but a strip of genuine dental plastic!

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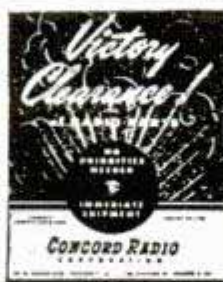
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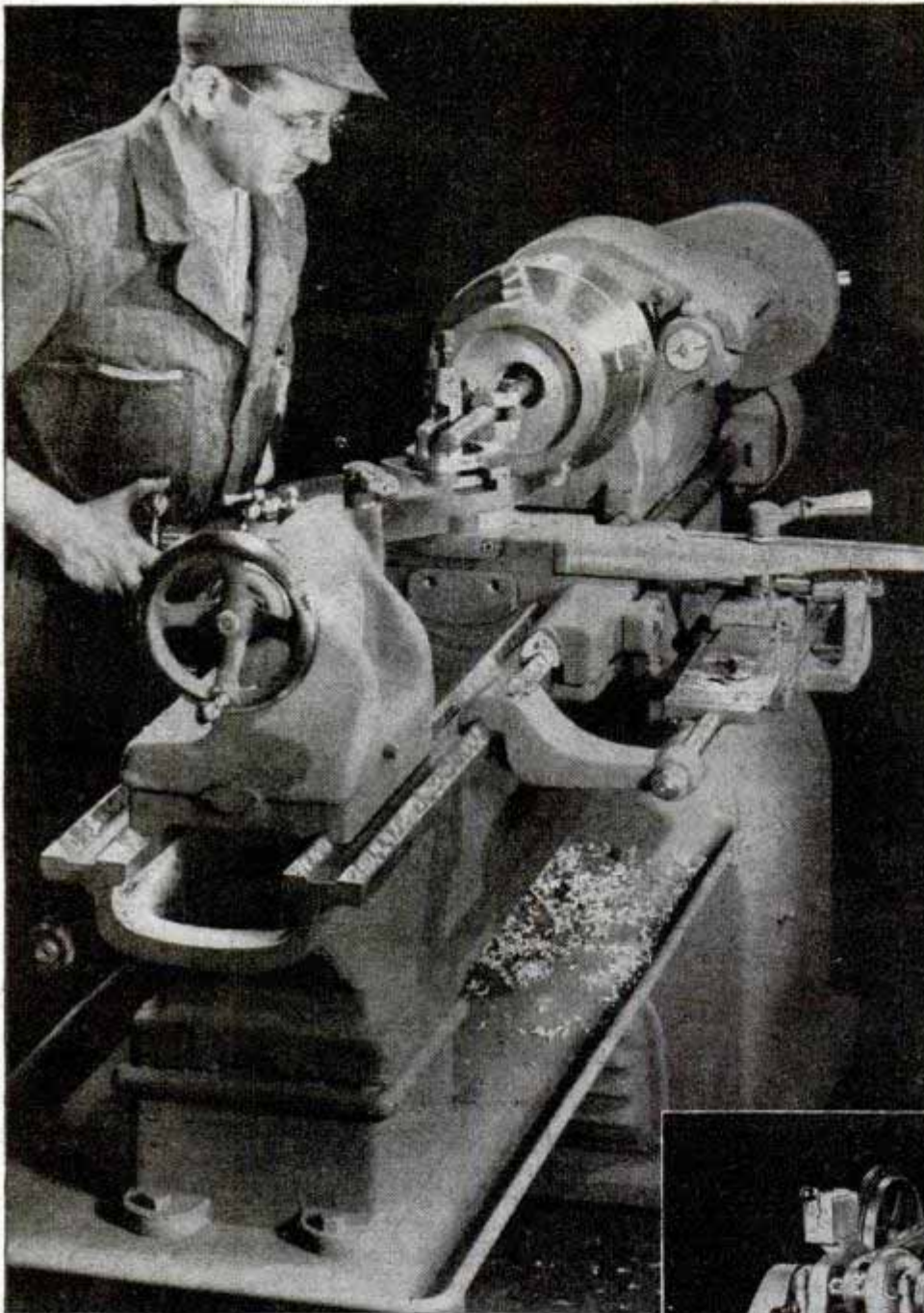


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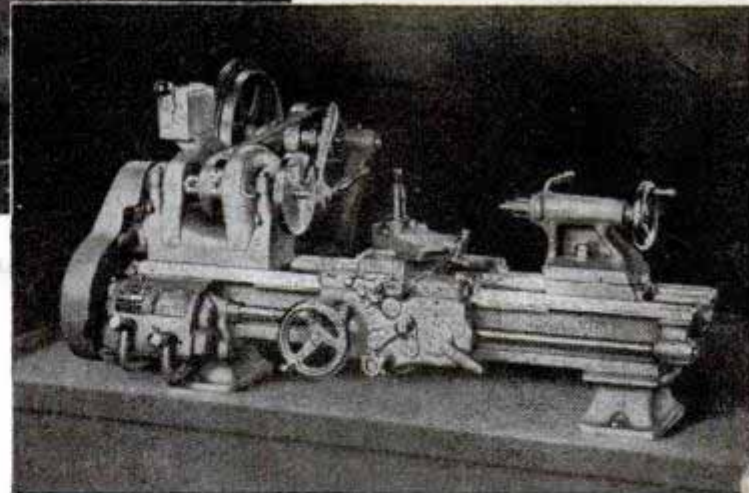
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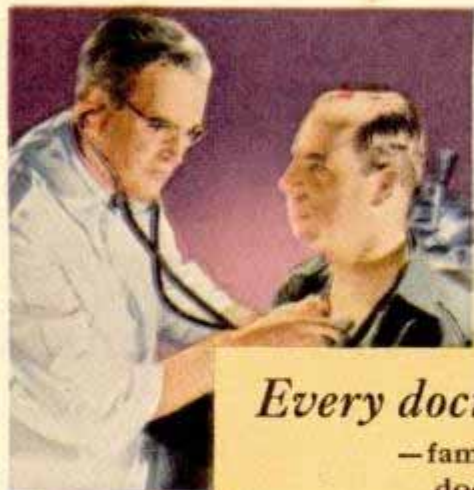
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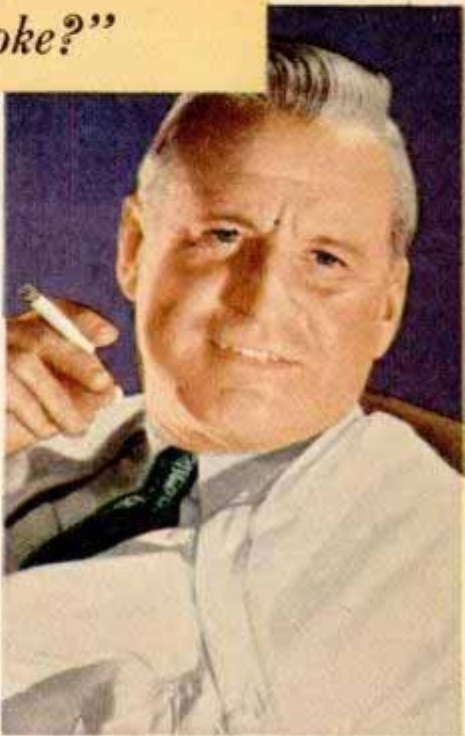
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