



# POPULAR MECHANICS

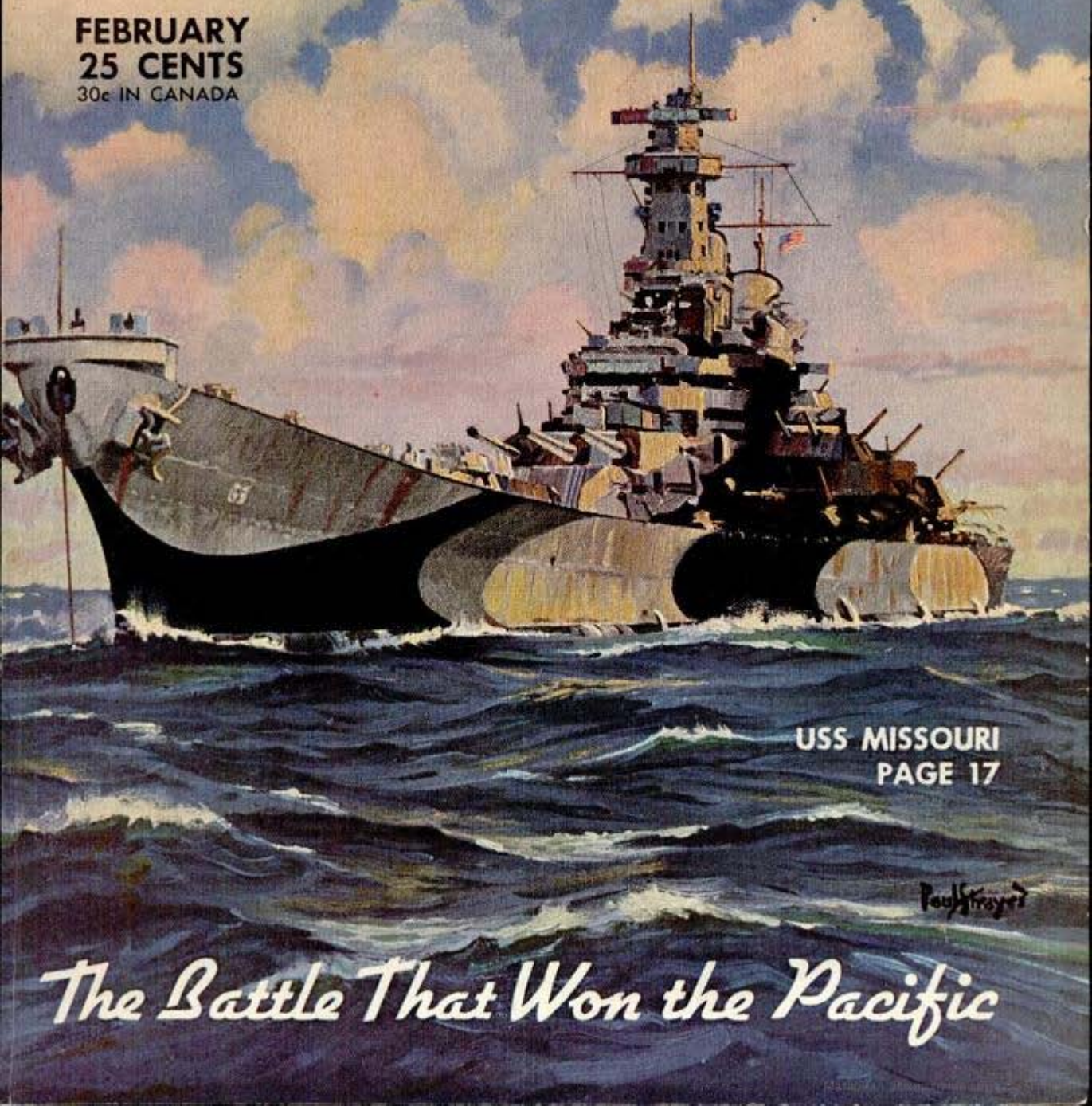
## MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REGD. TRADE MARK, GREAT BRITAIN, No. 40426

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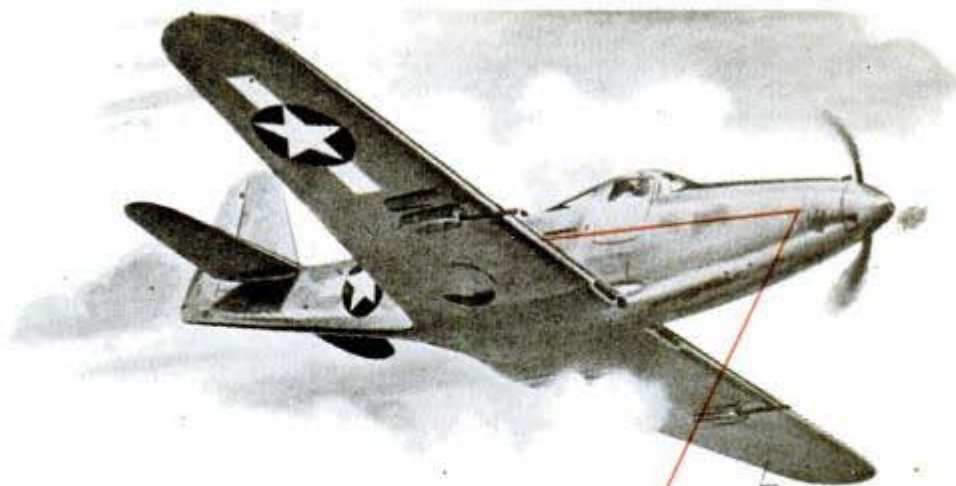
**FEBRUARY**  
**25 CENTS**  
30c IN CANADA



**USS MISSOURI**  
**PAGE 17**

*Paul Strayer*

*The Battle That Won the Pacific*



**FROM THE STRATOSPHERE . . . BETTER SPARK PLUGS**

**FOR YOUR CAR!**



For more than four years past, Champion Ceramic Aircraft Spark Plugs have been on active duty with our air forces, setting new records for long life and dependability. Extreme altitudes, extreme temperatures, 100 octane gas, and supercharging required new and revolutionary spark plugs, embodying materials and precision craftsmanship of an exceptionally high order. Today those same basic materials, fundamental design and exceptionally high manufacturing standards are yours, in Champion Spark Plugs, for your present car. Champions bring an extra measure of dependability to every engine. Champion Spark Plug Company, Toledo 1, Ohio.



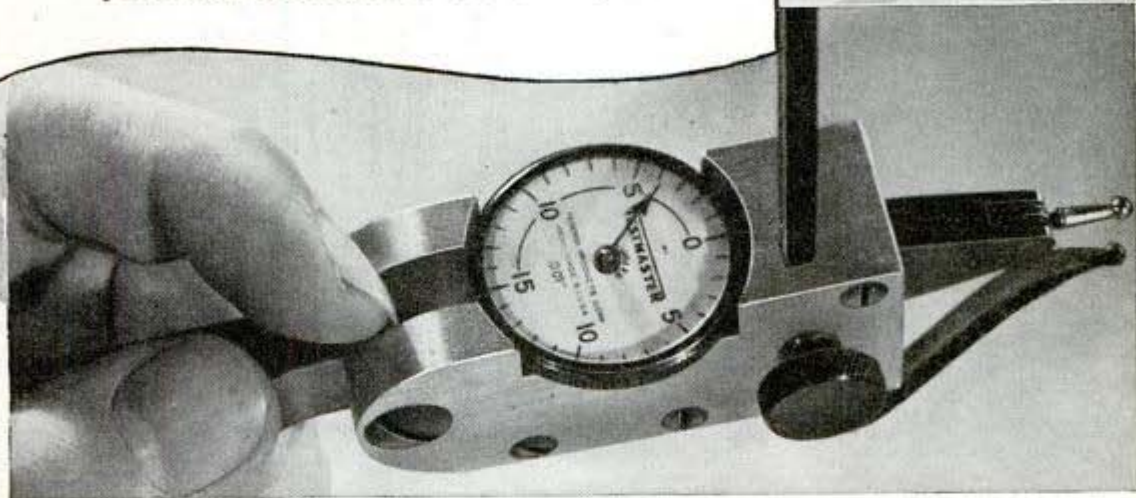
**DEPENDABLE**  
**CHAMPION**  
**SPARK PLUGS**



**Buy War Bonds  
More Than Before**

# Ingenious New Technical Methods

Presented in the hope that they will  
prove interesting and useful to you.



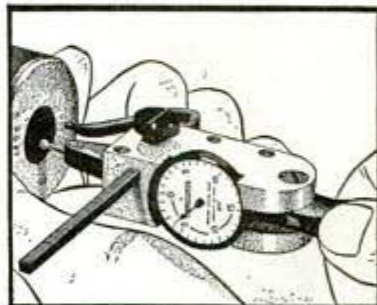
## New Internal Gage Avoids Over Cutting ... Saves Wasted Man Hours

At last a gage that takes the guess work out of checking internal diameters either machine bored, or close ground and lapped. It is called the Keene Internal Gage and is the first accurate method for fast correct checking of internal splines and gears on both minimum and root diameters. The gage is ideal for machining and inspection work, and proves its value in increased production. It can be used with either a master, or micrometers.

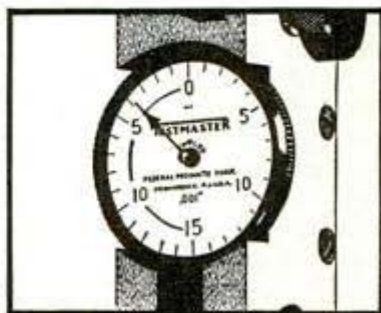
This time saving development is constructed of aluminum, is six inches long and weighs only five ounces. Available in models designed to read in thousandths (.001) or in tenths (.0001).

When your gage has been checked the thousandths left to bore, the actual job of machining may become tedious. It is then when Wrigley's Spearmint Gum helps keep you alert and watchful. Chewing gum seems to assist you over the dull spots in the day's work. And Wrigley's Spearmint will aid you in your peacetime job by helping to keep you wide awake and efficient during that part of your work that may seem unimportant, but which actually means perfection to the completed product.

*You can get complete information from Keene Electrical Machinery Co., 542 W. Washington Blvd., Chicago 6, Illinois*



Determining correct setting for gage.



Closeup of dial showing simplicity and fast visibility.





# A MICA MINE

## IN A LABORATORY

War shortages crop up in strange materials. Mica, for instance. Once seen principally in the windows of stoves, and in small boys' pockets, it is now used extensively as electrical insulation. In some war products, it is virtually indispensable: capacitors for radio, spark-plugs for airplane engines, insulators in electronic tubes.

With demand mounting, manufacturers were desperate.

A four-man technical mission flew to London to help ration the world's supply between the United States and Great Britain. The shortage was serious.

The War Production Board, convinced that much mica was classified too low when judged by appearance alone, asked Bell Telephone Laboratories to develop a new method of electrical tests. The Laboratories were able to do this quickly because

of their basic knowledge and experience in this field.

The new tests were made available to manufacturers in this country and abroad—the supply of usable mica was increased 60%—and a difficult situation relieved.

Skill to do this and other war jobs is at hand in Bell Laboratories because, year after year, the Laboratories have been at work for the Bell System.



**BELL TELEPHONE LABORATORIES** *Exploring and inventing, devising and perfecting for our Armed Forces at war and for continued improvements and economies in telephone service.*

# Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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

February, 1945

Vol. 83, No. 2

## Next Month

**T**HE "bridge game" played by Army engineers in Europe and on other fronts has far more variations than the Culbertson variety. They use wood, rubber, steel and lots of Yankee ingenuity to keep our armies on the heels of a retreating foe. In France, the engineers once used the locks of a canal to hold the waters back while they built a temporary pontoon bridge. When neither rubber pontoons nor assault boats were available in Burma, they lashed empty gasoline drums together and tied planking over them. "Bridging the Army's Water Hazards," a March feature by a staff sergeant, gives a new sidelight on mobile warfare.

## Black Gold Rush

**T**HERE'S a postwar frontier of about 500 million acres in this country that has never been explored for oil. This is territory containing rock formations favorable to oil deposits. Heralding the resumption of drilling on a prewar scale is the discovery of the 100-million-barrel Heidelberg field in Mississippi. Get in step with the world's most dramatic industry by reading "Black Gold Rush" in the March issue.

## Air at Work

**D**ID you know that it takes about three tons of compressed air to make one ton of steel? That air instead of steam can be used to drive a turbine? That air goes into battle on ships, tanks and planes doing such jobs as operating landing gear and ammunition hoists? It also milks cows. A March article tells how a nation is "Putting Air to Work."

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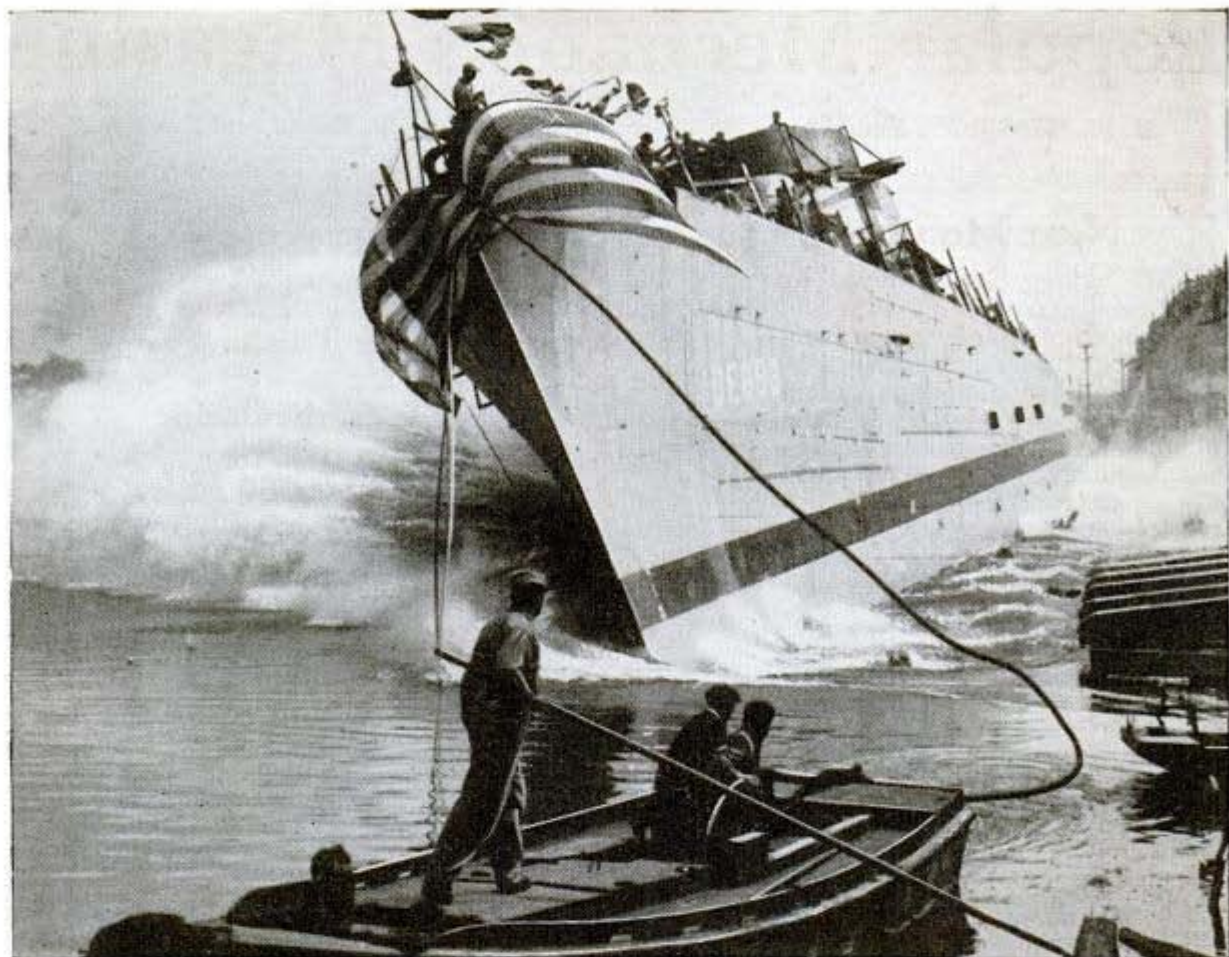
## The Art of Counter-Sniping

**S**OMEWHERE on the Western Front a U. S. Army officer speaks into a field telephone: "There's a Jerry up here sniping at our men. Send one of our experts to take care of him." The expert is a counter-sniper picked from the cream of our riflemen. He usually shoots only once, for he can hit a 6-inch disk at 500 yards. He is ambidextrous with his rifle, is an expert at camouflage, a good scout, and is calm in the face of danger. He has a bag full of tricks that make him the Nemesis of enemy snipers. Read "Sniping the Sniper," an outstanding March feature.

## Landscaping With Evergreens

**M**ANY an American has stared enviously at an evergreen tree growing out of a rocky mountainside, especially if he has a pampered and yellowed specimen in his front yard at home. The evergreen tree on the mountain thrives because the rocks conserve moisture and the slope gives perfect drainage. An authoritative article in next month's Craftsman section contains the "do's" and "don'ts" of evergreen selection, planting, fertilization and care the year around.

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*A Destroyer-Escort hitting the water from the Defoe launching ways*

## When We've Launched Our Last Warship

After the nations of the world stack arms and the last warship has been sent from our ways, this company, in stride with the leaders of American industry, will be ready for conversion to peace. More than that, we will be prepared to translate the advancements and economies taught by war into epoch-making new products for better living for Americans. As it has for more than 40 years, the Defoe Shipbuilding Company will construct large yachts and commercial vessels. But the major expansion will come in the new Housing Division which will manufacture and distribute low-cost units and component parts for American homes and farms. The industries of this country should turn the experience, new techniques and materials developed by war work toward advancing the standard of living throughout the world. The large-scale program of the Housing Division will be Defoe's contribution to mobilization of American war industries for peace time production and employment.

HOUSING DIVISION  
 DEFOE SHIPBUILDING COMPANY, BAY CITY, MICHIGAN

**Defoe**

SHIPS FOR VICTORY  
 SERVANTS FOR PEACE

BACK THE ATTACK  
 —BUY WAR BONDS

*Four White Star Renewal Citations  
 now decorate the Navy "E" Award  
 won by Defoe workers.*



When sending small coins thru the mails  
For samples, books and such,  
Use Texcel Tape to hold them fast—  
It sticks with just a touch.

*(Texcel holds and holds—the "stick-um's" bonded on!)*

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Will make it look like new.

*(Texcel mends securely—the "stick-um's" bonded on!)*



For bundling checks, for packaging,  
For holding scores of things,  
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With glue or bits of strings.

*(Texcel means no gummy edges—the "stick-um's" bonded on!)*



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A Division of  
Johnson & Johnson  
New Brunswick, N.J.

# Texcel Tape

REG. U.S. PAT. OFF.

CELLOPHANE TAPE — STICKS WITH A TOUCH

FEBRUARY, 1945

5A



**KNOWLEDGE  
THAT HAS  
ENDURED WITH THE  
PYRAMIDS**



## **A SECRET METHOD FOR THE MASTERY OF LIFE**

**W**HENCE came the knowledge that built the Pyramids and the mighty Temples of the Pharaohs? Civilization began in the Nile Valley centuries ago. Where did its first builders acquire their astounding wisdom that started man on his upward climb? Beginning with naught they overcame nature's forces and gave the world its first sciences and arts. Did their knowledge come from a race now submerged beneath the sea, or were they touched with Infinite inspiration? From what concealed source came the wisdom that produced such characters as Amenhotep IV, Leonardo da Vinci, Isaac Newton, and a host of others? Today it is known that they discovered and learned to interpret certain *Secret Methods* for the development of their inner power of mind. They learned to command the inner forces within their own beings, and to master life. This secret art of living has been preserved and handed down throughout the ages. Today it is extended to those who dare to use its profound principles to meet and solve the problems of life in these complex times.



**AMENHOTEP IV**  
Founder of Egypt's  
Mystery Schools

### **This Sealed Book—FREE**

Has life brought you that personal satisfaction, the sense of achievement and happiness that you desire? If not, it is your duty to yourself to learn about this rational method of applying natural laws for the mastery of life. To the thoughtful person it is obvious that everyone cannot be entrusted with an intimate knowledge of the mysteries of life, for everyone is not capable of properly using it. But if you are one of those possessed of a true desire to forge ahead and wish to make use of the subtle influences of life, the Rosicrucians (not a religious organization) will send you *A Sealed Book* of explanation without obligation. This *Sealed Book* tells how you, in the privacy of your own home, without interference with your personal affairs or manner of living, may receive these secret teachings. Not weird or strange practices, but a rational application of the basic laws of life. Use the coupon, and obtain your complimentary copy.

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## **The ROSICRUCIANS**

**SAN JOSE (AMORC) CALIFORNIA**





# WHITE COLLAR or OVERALLS—



## Which will YOU wear after the war?

**H**UNDREDS of thousands of white collar workers have put on war overalls for the duration. Millions of both white collar and overall workers have put on uniforms. Hosts of home women are patriotically taking jobs.

After the war, millions will be coming back from army, navy and air force to civilian jobs; great war materials factories will be re-converting to civilian production; old peace-time functions of business will be springing up—where will you fit in the situation?

If you are wise, you will look ahead and prepare. You will not wait on chance. You will analyze the probable conditions in peace employment, decide where your likes and aptitudes fit best, and get ready. You will decide whether your best opportunities lie in production or office or store. You will determine whether you wish to work for someone else or develop a business of your own. You will train now to be above the average and, therefore, surer to get the opportunity you want after the armistice.

Nor will you wait very long. Nobody knows when this war will end or how soon this problem will hit you in the face.

### We Can Help You Decide

If you have some question either about postwar opportunities or about your own fitness for some particular one, probably we can help you. In our 36 years, over one million adults have enrolled for our training, we have built training courses for many

major fields of commerce and industry, and we have gathered a wealth of information about job opportunities and requirements. That information is at your service.

### We Can Help You Prepare

And when you have decided what field of work offers most to you for a life career, we can help you prepare for it—quickly, economically, thoroughly, in your spare time and without any interference with your present work—if it is in the list below. A 48-page booklet on the field of your choice, discussing the field and our training for it, has been prepared to help answer your questions. The coupon below or your letter will bring it to you, without cost or obligation.

Do not delay. Whether the war lasts six months or three years, now is the time to make sure your preparation for postwar success shall not be “too little and too late.”

## La Salle Extension University A Correspondence Institution

DEPT. 264-R

417 S. Dearborn St., CHICAGO 5

I want to pick my career for after the war and get ready for it now. Send me your free booklet on the field I have checked below and full information about your training in that field.

- |   |  |
|---|--|
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| <input type="checkbox"/> Business English     | <input type="checkbox"/> Stenotypy               |

Name.....Age.....

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Address.....

# Here's How You Can **STOP** wearing out your Car with **COLD WEATHER** **"DRY STARTS"**



During cold weather low viscosity winter oil quickly drains off of hot cylinder walls. When you stop your car—cylinders and pistons quickly become cold and dry of oil. When you start—*metal rubs metal* causing rapid wear. A pint of Pyroil in the crank-case gives winter oil the property of clinging to metal surfaces. It reduces wear—it prevents rusting and corrosion and "gumming." Ask your service man for Pyroil!

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Kidder, Founder, 52  
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Wisconsin.

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ADDS LIFE TO YOUR CAR



### PYROIL COMPANY

52 Pyroil Bldg., La Crosse, Wisconsin

I want my car to last and run properly. Please tell me more about Pyroil and how it can accomplish this for me.

Name .....

Address .....

City or Town..... State.....

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

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**T**raining is essential to advancement in any field—and it's important to have it on record.

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- Radio Servicing

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- Steam Engines

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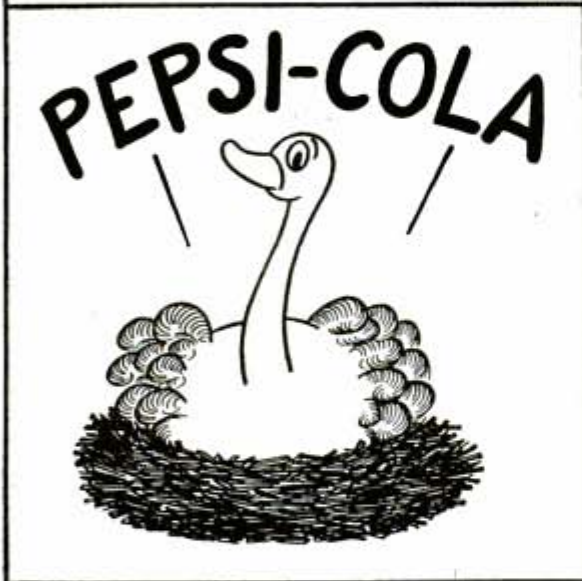
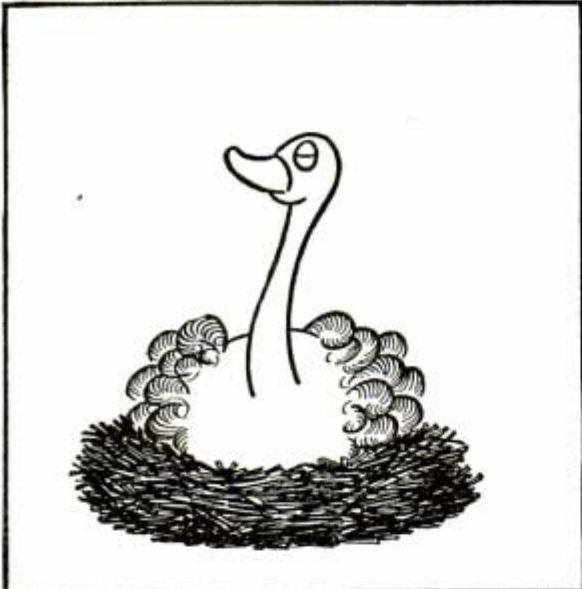
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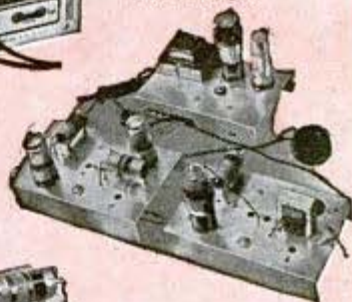
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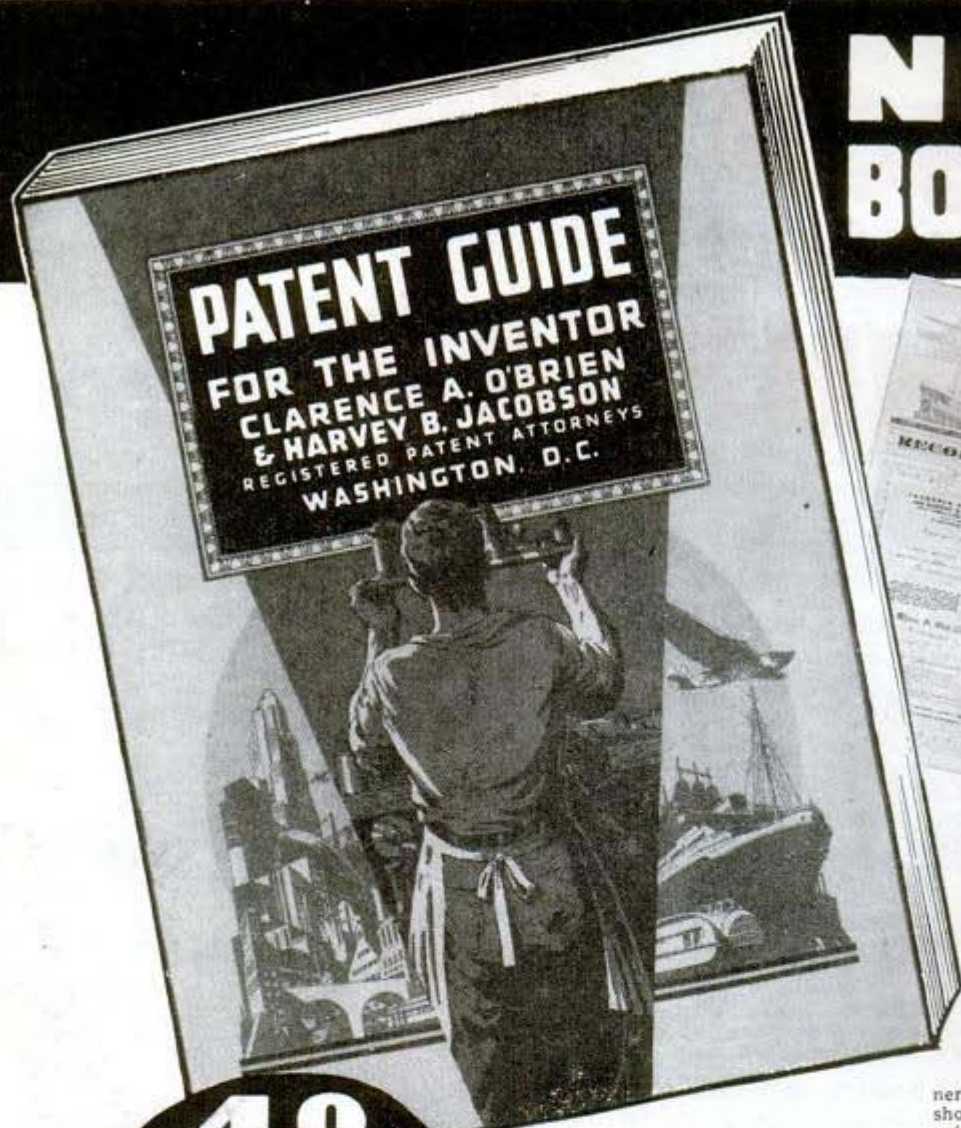


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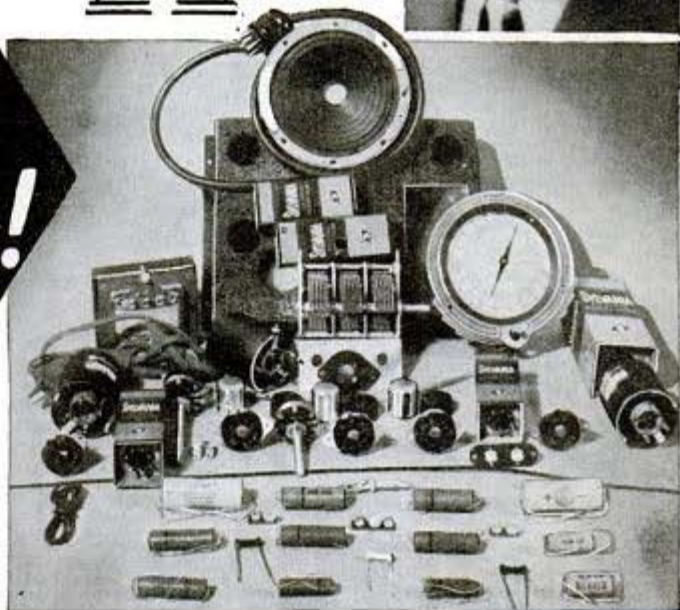
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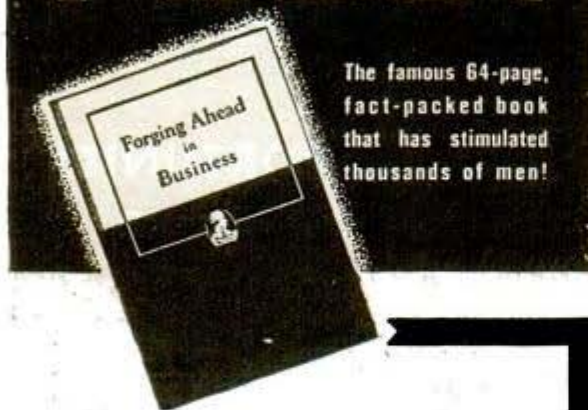
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**W**ELL, I guess I'm the fellow to see, for I've repaired thousands of refrigerators (home and commercial both), vacuum cleaners, radios, washing machines, irons, fans, lamps, mangles, motors, etc. In fact, many of my customers call me their "electrical 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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At first, I let the owner decide the charge and, frankly, I was amazed at what I earned per hour. But then, when one figures what initial costs are involved in buying most electrical appliances, one can readily see that spending extra dollars for repairs is well worth while. Before long I was making more in my spare time repairing than from my regular job. The result . . . I went into business for myself. When war came, business boomed, for new appliances were not available.

For a while, repair parts (needed on some

jobs) were a little difficult to get. But that situation seems to have adjusted itself for many repair parts have today the high priority rating of AA2. After all, we must provide for the health and well-being of our civilian population.

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Friends ask me about my future. And, I think I've got a grand one. Age is no handicap in repairing. I have in my files enthusiastic letters from repairmen ranging in age from 18 to 79 years. After the war, we're bound to see hundreds of new products on the market . . . products that the average person never dreamt of. These new products and our old appliances are all going to need at some time or other "fixing." Well, I'll still be the fellow to do it. The field open for appliance repairmen is unlimited. I don't worry at all about too much competition.

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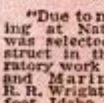
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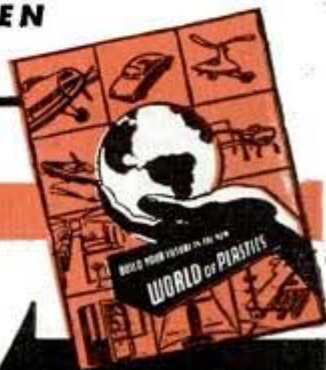
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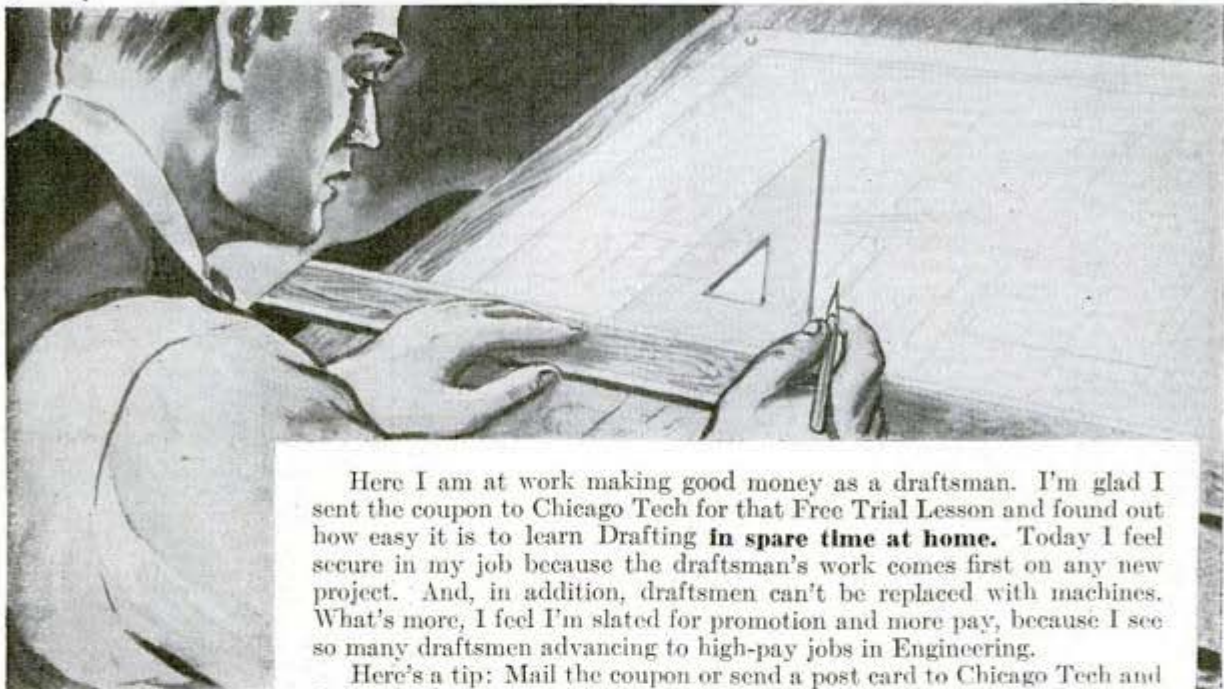
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**BEGINNERS** Beautiful British Colonies and South America on approval. Theo. Stevens, Box 3705 Kercheval Station, Detroit 15, Mich.

**WORLD Wide** approvals sent on request, references please. Juan Alexis, Box 141, Racine, Wisconsin.

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SONGWRITERS! Music composed, arranged. Billy Hannon, 6703 N. Oshkosh, Chicago 31.

SONGS Published—Liberal plan. Barnhart Publications, 1320 48th, Des Moines, Iowa.

SONG Poems wanted. Free examination. McNeil, Master of Music, 610-PM South Alexandria, Los Angeles, Calif.

ACCORDIONS. New and used at wholesale prices. Save up to \$100.00. Buy direct from factory. Del Principe, 307 So. Wabash, Chicago.

WRITE Songs. Big money and reputation. Write for information. J. Gordon Pub Co., 201 N. Hoyne Ave., Chicago.

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BUILD A radio, complete kit with tubes, \$9.95, details. Radio, 9418 Avenue "A," Brooklyn, N. Y.

TUBE Problems solved. 6SA7 or any 6-volt 3-amp in series with any tube drawing 12-amp as 12SA7, etc. 25L6 replaces 50L6 and 35L6. Transformer made of old speaker fields and audio transformer coils in 30 minutes. Sells for \$4.50 installed. Complete plans \$2. Mission Radio Laboratories, 204 Pine, Columbus, Kans.

CRYSTAL Radio receivers. Crystal detectors, crystals, coils, condensers, tuners, diagrams. Illustrated catalog sent free. Hulet, 29 East 39th, New York.

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MAKE Simple, tubeless, batteryless, distance-getting crystal radios. Crystal and illustrated instructions 25c postpaid. Allen, P-427, Clinton, Missouri.

JUST Out! Crystal set booklet of "Volume Increasing Tips." 45c. Amorose, R-4, Hungary Road, Richmond, Va.

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**BIG** Money being made selling sensational Colt cushion cradle arch supports to women, men. Flexible, leather-covered airform rubber cushions, supports tired, aching feet. Extra large profits, cash bonus. Free sales kit. Write Colt Shoes, 659 Atlantic, Boston.

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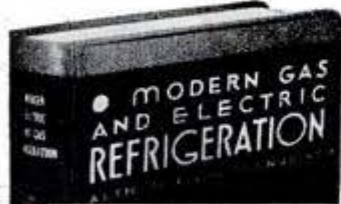
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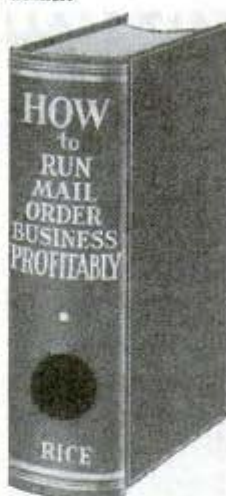
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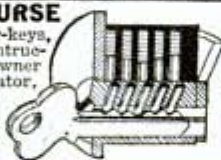
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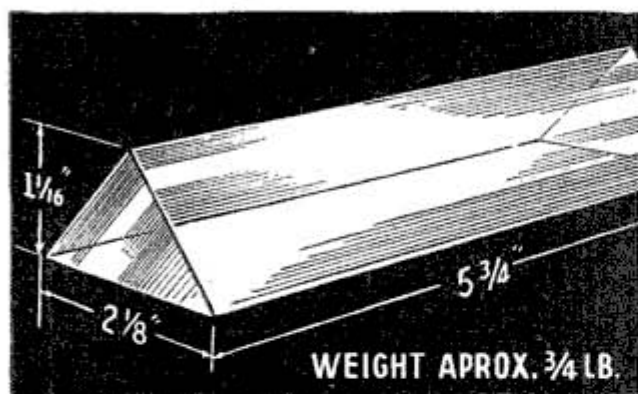
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# Popular Mechanics Magazine

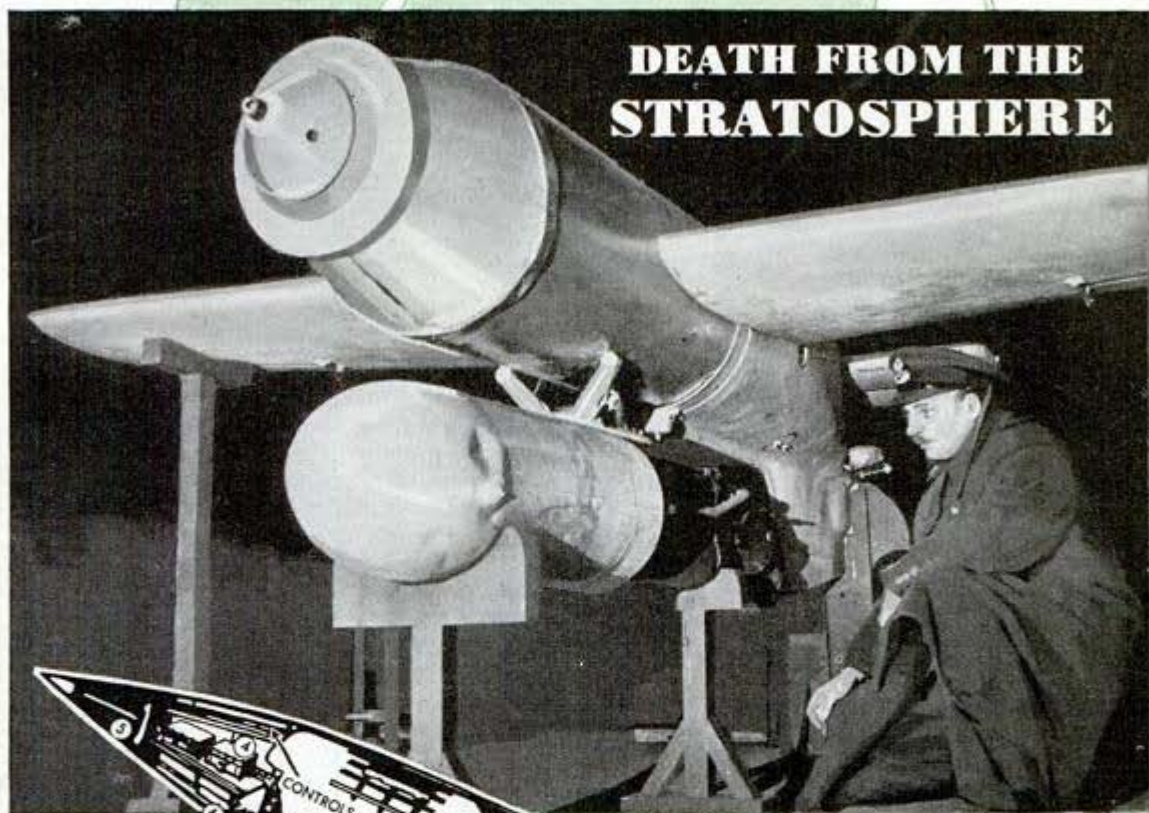
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Vol. 83

FEBRUARY, 1945

No. 2

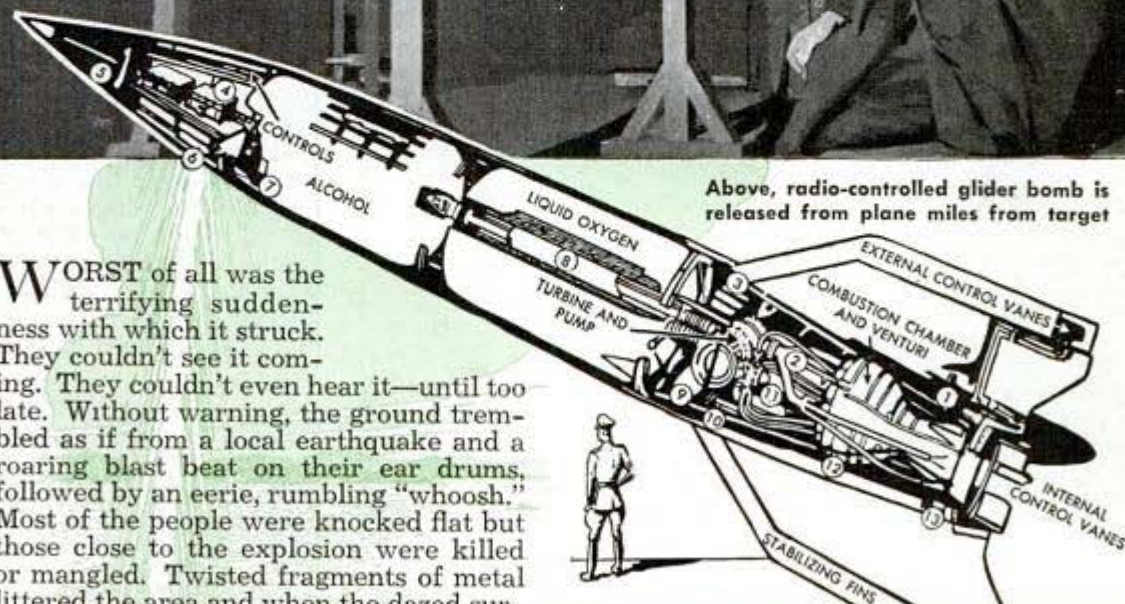


## DEATH FROM THE STRATOSPHERE

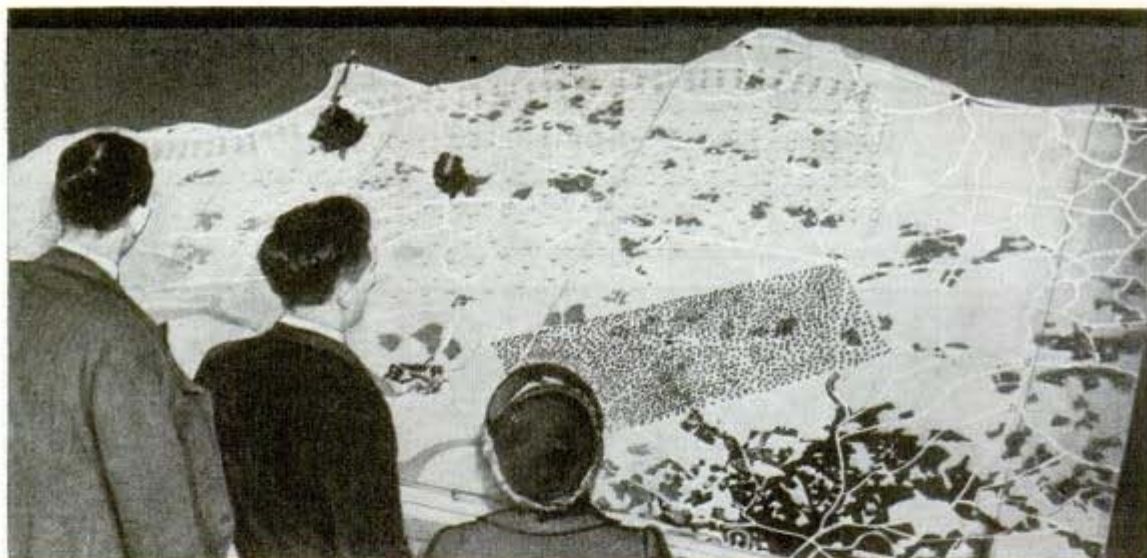
Above, radio-controlled glider bomb is released from plane miles from target

**W**ORST of all was the terrifying suddenness with which it struck. They couldn't see it coming. They couldn't even hear it—until too late. Without warning, the ground trembled as if from a local earthquake and a roaring blast beat on their ear drums, followed by an eerie, rumbling "whoosh." Most of the people were knocked flat but those close to the explosion were killed or mangled. Twisted fragments of metal littered the area and when the dazed survivors stumbled to the wreckage they found a deep crater, perhaps 30 feet in diameter, from which protruded the finned tail of a curious cylindrical missile the size of a small airplane fuselage.

A shudder rippled through the onlookers. They knew then that the fantastic stratosphere rocket, another monstrous perversion of German science, had



**DIAGRAM OF V-2:** (1) electric motor; (2) alcohol supply from pump; (3) air bottles; (4) radio guiding equipment; (5) central exploder tube; (6) nitrogen bottles; (7) pitch and azimuth gyros; (8) alcohol delivery pipe to pump; (9) hydrogen peroxide tank; (10) permanganate tank; (11) oxygen distribution from pump; (12) alcohol pipes for subsidiary cooling; (13) electro-hydraulic servo motors



Huge model of southern England coast defenses shows guns near shore, searchlights (white dots), and balloon barrage (rectangle of black dots) which lie between London and the coast

paid them a lethal visit. It seemed to be the handiwork of demons—a wingless, self-propelled projectile which, fired into space at supersonic speeds, would plunge at random like a vengeful meteor upon a peaceful countryside or city.

To Allied scientists this new manifestation of indiscriminate warfare—known as V-2—is a “considerable technical achievement” but less destructive than the Nazis must have hoped it would be. True, numerous civilians were killed and wounded after the bombardment began to rain on

England last autumn. And of the 1,100,000 English homes, hospitals, churches and schools reported damaged by “V bombs” since last June, many were victims of V-2.

But as to military effectiveness V-2 was regarded as no more destructive than V-1, the “buzz bomb” with wings. V-2 penetrates deep into the earth and thus concentrates much of its damage around its own self-made crater. V-1, which is cheaper and much less complicated to build, but carries the same amount of explosives (one ton), digs hardly any hole but scatters glass and shrapnel over a greater radius.

Recently, the Germans launched over the Western Front what is believed to be a new type of rocket. This barrage weapon has been called a V-1½ for it is said to combine features of both the V-1 and V-2.

The V-2 is the weirdest-looking of World War II's surprise weapons. It resembles a metal telegraph pole 46 feet long and five feet in diameter, and it behaves like a gigantic Roman candle gone berserk. Weighing 13½ tons at takeoff, it climbs upward to 70 miles above the earth before it starts its descent. When it strikes, it plows under more than half its length



Artist's conception of portable launching ramp for V-2

before it is detonated with a noise that can be heard almost 20 miles.

Unlike the gas turbine method of jet propulsion in airplanes, V-2 does not breathe air but derives all its power from the fuel it carries and therefore can travel outside the earth's atmosphere. It is made up of six principal parts: an explosive-packed warhead in the sharply pointed nose; a control compartment; two large fuel tanks, one containing about 7,000 pounds of alcohol and the other 11,000 pounds of liquid air; a turbine and pump assembly with a

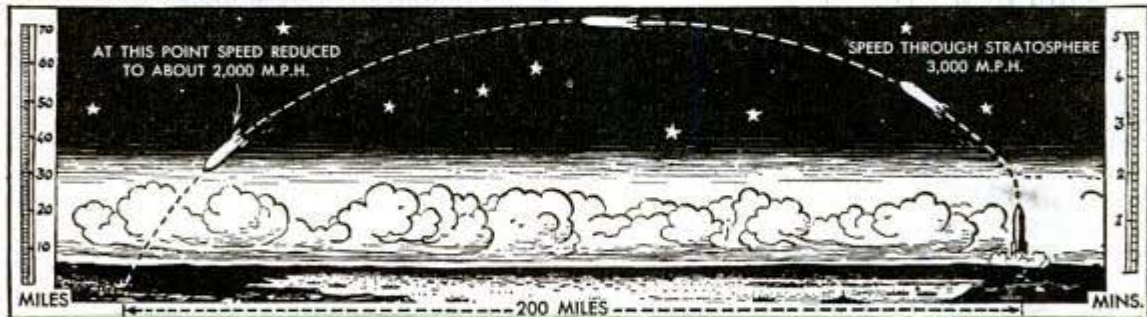


Inspecting turbo pumps of wrecked V-2; fuel pump is at left, liquid air pump right. Left, Allied soldiers remove parts of V-2 found in field in Belgium

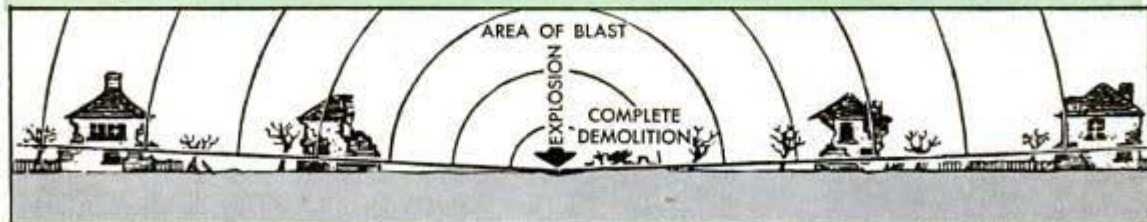


generator to drive the turbine; a large combustion chamber, and two sets of control vanes, one for the inside and one for the outside.

The V-2 is launched in a vertical position from a concrete platform or hard surface, according to the British Air Ministry. To keep the fuels from exploding, hydrogen peroxide and potassium permanganate

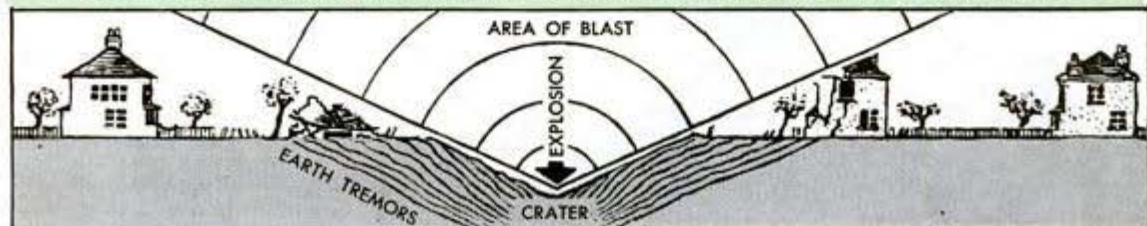


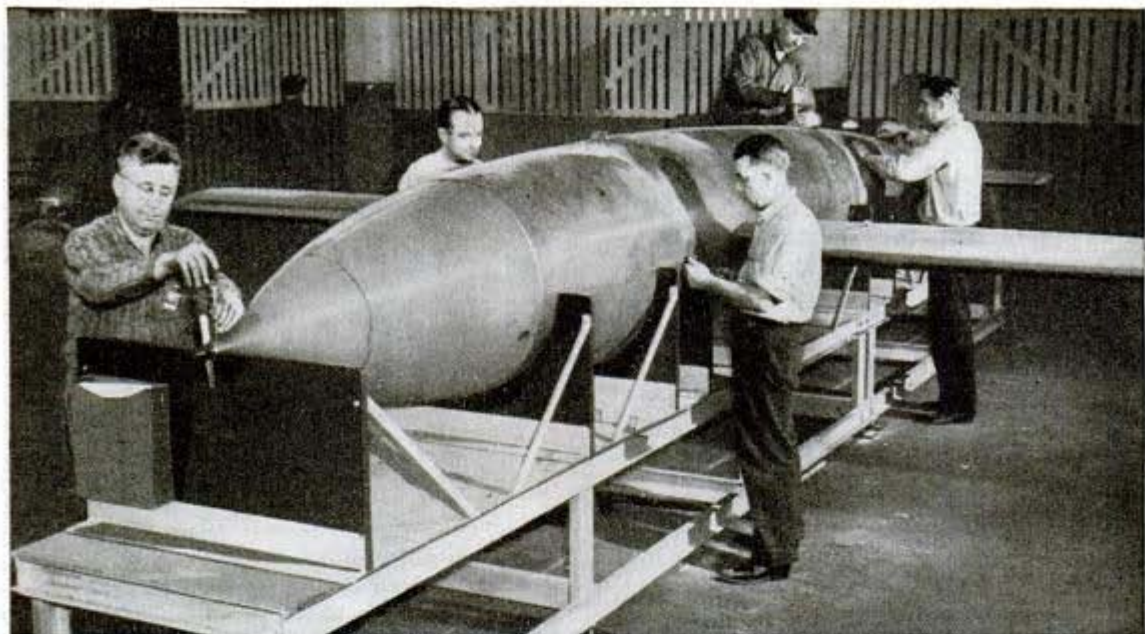
Stratosphere path of V-2 which travels 200 miles in about four minutes. At takeoff it weighs 13½ tons



Drawings from London Daily Mail

Blast area of V-1 (above) is greater than the V-2 (below) which digs deep crater when rocket explodes





This robot bomb built for the U. S. Army Air Force is 27 feet long and has a wing span of 17 feet

are mixed with the highly explosive combination of alcohol and liquid air. Pipes carry these four liquids into a turbine and pump assembly where they are blended and released under pressure through 18 jets into the forward end of the combustion chamber. The fine spray is ignited electrically from a safe distance and the hot gases rush out through jets at the rear of the chamber.

A gyroscope control within the rocket operates the control vanes. Photographs of the V-2's climb reveal a zigzag path which might be caused by a radio control that holds the rocket inside a set course for the first few miles.

About one minute after launching, the fuel supply is cut off, either by remote ra-

dio control or by pre-set automatic instruments. The point at which the fuel is cut off determines the range. Its maximum range is believed to be about 200 miles.

The speed of the V-2 is about 3,000 miles an hour during the climb into the stratosphere, and this probably diminishes to 2,000 miles an hour when the fuel is cut off. On its downward flight it becomes heated by friction to such an extent that by night it looks like a dull red comet. By day all that can be seen from the ground is the vivid flash that accompanies the blast.

Against V-2 ordinary air defenses are obviously useless. The specially built Bofors guns along the English coast, the balloon barrages girdling London, and the alert fighter planes—all of which were used successfully against V-1—simply cannot cope with this man-made bolt of lightning.

As a defense, Allied airmen attacked German oil storage deposits and what were believed to be the V-2 launching bases in the Netherlands and the railroads leading to them. Stories about secret launchings filtered through from the Dutch. In roped-off areas the Germans dug wells 80 feet deep and as large as tennis courts. Along the

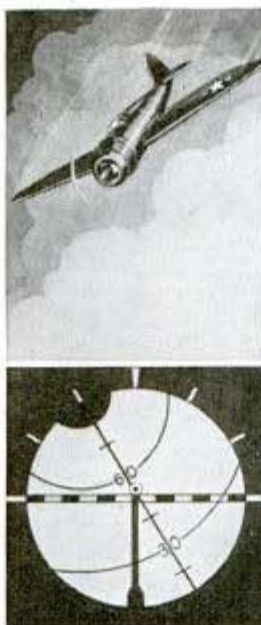
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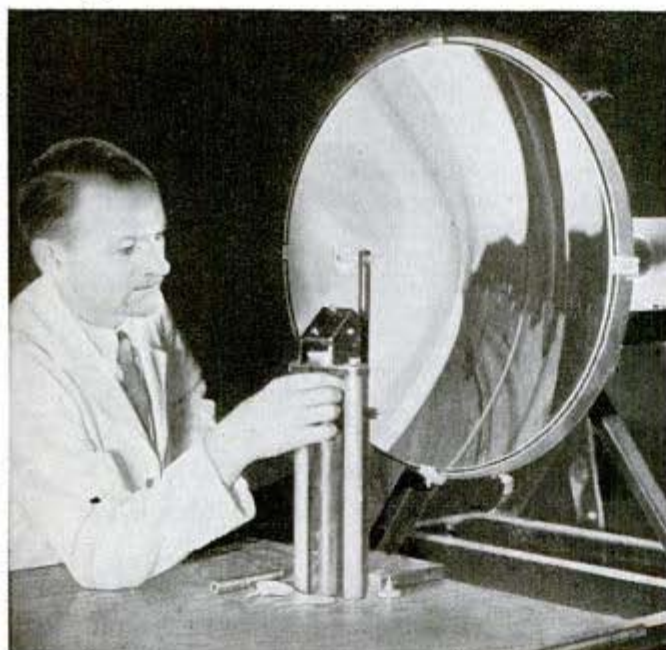
This Nazi V-1 robot bomb landed intact in a U. S. Army camp

## Gyro Loops With Pilot to Show Plane's Attitude

Aerobatic maneuvers, including loops and rolls, can be performed with a high degree of safety with a Sperry attitude gyro. The dial, which looks like a free-rolling ball in a frame, tells the position of an airplane with reference to the earth's surface throughout 360 degrees of roll and pitch. With this instrument, a pilot can perform complicated maneuvers on instruments alone without having to see where the ground is. The indicator is divided into hemispheres, the upper half white luminescent and the lower half black.



## "Super-Finished" Reflectors Throw Beam Twenty Miles



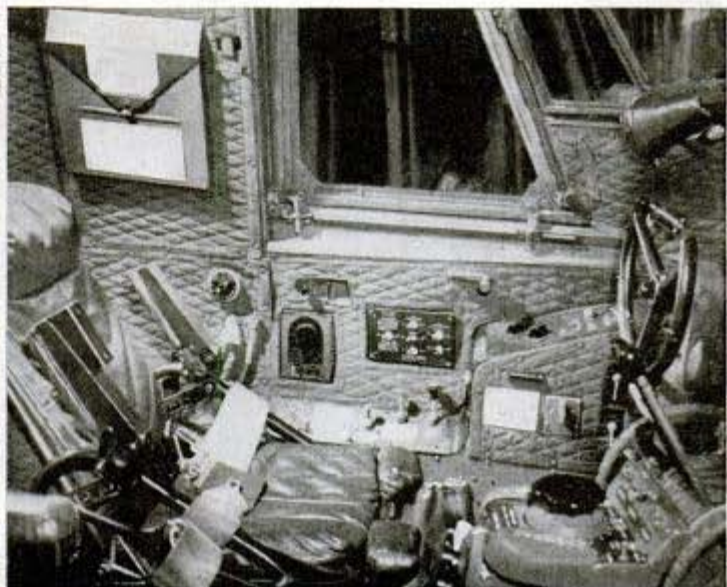
Reflectors built by the Chrysler Corporation are so precisely cut and polished from a tough metal alloy they are capable of throwing 30,000,000-candlepower Navy searchlight beams more than 20 miles. To accomplish this, a parabolic reflector must be shaped and finished to such a high degree of accuracy that it will gather the maximum amount of light directed at it and reflect this light in concentrated parallel beams. The Chrysler method of polishing the metal is known as "super-finishing." An electronically controlled machine produces a 24-inch parabolic shape which is polished until the inside surface is so accurate that a reflection from it will not deviate more than 8/1,000 inch in two miles. The reflectors resist corrosion or tarnishing.

## Gunpowder From Lower Grade Paper Pulp in New Sulphate Process

Smokeless powder can be produced from the same low cost wood pulp used in wrapping paper and bags, as a result of a new sulphate process developed by the Western Cartridge Company, East Alton, Ill. While wood is not a new source of cellulose in the production of nitrocellulose, basic material of rifle and cannon powder, the process permits the use of woods of a lower grade, faster growing and much more plentiful

than the type used in the older sulphite process. Chief difference between the two processes is that sulphite pulp is produced by treating wood chips with acids whereas sulphate pulp is produced by treating wood chips with alkalis. In the latter process the amount of pulp required to produce enough powder for a single carbine cartridge would make a piece of wrapping paper large enough to wrap a lemon.

# Glass Fiber "Blanket" Helps to Insulate Airliner



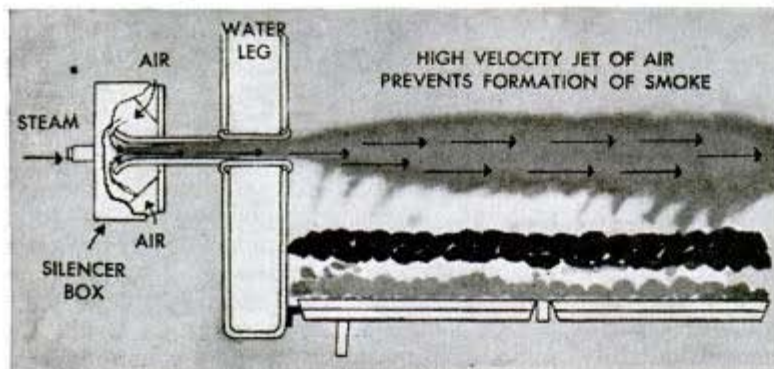
Top, right, pilot's seat in a C-46 next to quilted Fiberglas. Top, installing the cloth in a B-29 fuel cell. Above, insulating a window

Insulation against high-altitude cold by means of a glass fiber "blanket" has been perfected by Curtiss-Wright engineers. In the C-46 Commando cargo transports and their peacetime successor, the CW-20 commercial airliner, the insulation helps to keep the interior comfortable even when the outside temperature is 40 degrees below zero. The "blanket" consists of minute glass fibers, .0002 inch in diameter, fabricated into a soft, silk-like covering half an inch thick. The "blanket" results in a weight saving of more than 200 pounds per airplane of the Commando size over materials like kapok or other vegetable fibers. Resin-impregnated glass fiber cloth also is used as a protective lining for fuel cell cavities in the wings of the B-29 Superfortress. Because of its high impact strength, it prevents "flowering" of the metal walls of the fuel cell cavity if struck by a bullet, thus safeguarding the self-sealing rubber cell against jagged metal edges.

## Overfire Air Jets Quell Smoke in Coal-Burning Boilers

Plumes of smoke from coal-burning boilers may soon be a thing of the past, thanks to overfire air jets developed by the Bituminous Coal Institute, 60 East 42nd Street, New York City. The device eliminates al-

most all smoke and provides better fuel utilization. When jets of air, forced by steam, are mixed turbulently with the gases given off by the burning coal, the smoke that normally passes up the stack



is also consumed. Actual operational tests show a 20 percent saving in coal with the air jets; one home heater gave 50 percent more heat and one-third less ashes. Kitchen ranges utilizing the principle are in limited production. The \$110 unit cost of the air jets is low enough to encourage installation even on old boilers.



# THE BOMBSIGHT THAT THINKS



Nearing target, bombardier makes few simple adjustments—the Norden bombsight's "brain" does the rest

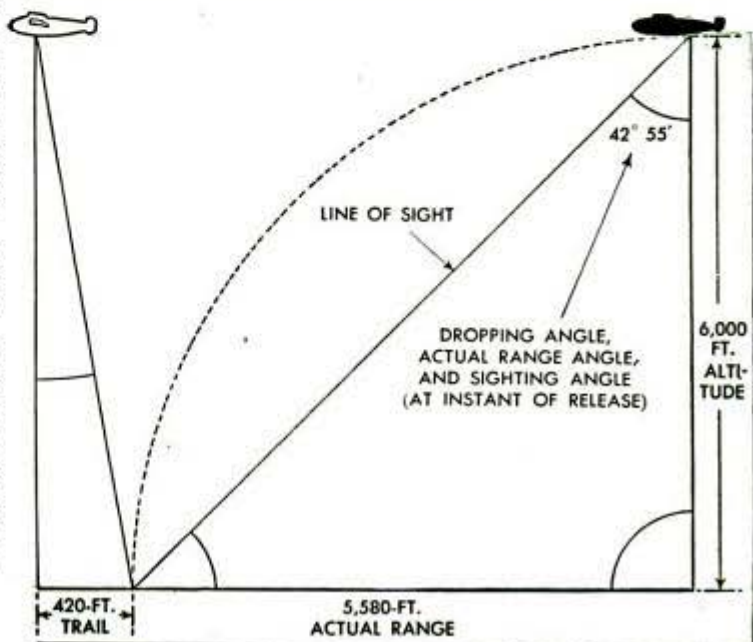
## By Wayne Whittaker

**R**ECENTLY, at one of the several plants in the U. S. which manufacture the Norden bombsight for the armed forces, one of these delicate instruments failed to pass its final test. This test is so exacting that allowance is made for curvature of the earth and the distance the earth travels between the time a bomb is released and when it strikes the ground.

The puzzled engineers sent the bombsight back for a recheck of some of its 2,300 parts. Finally the imperfection was located. One part was found to have a tolerance of  $1/3,000$  of an inch instead of  $1/5,000$ ! The Air Technical Service Command demands and gets perfection in its bombsight, of which photographs were released a few

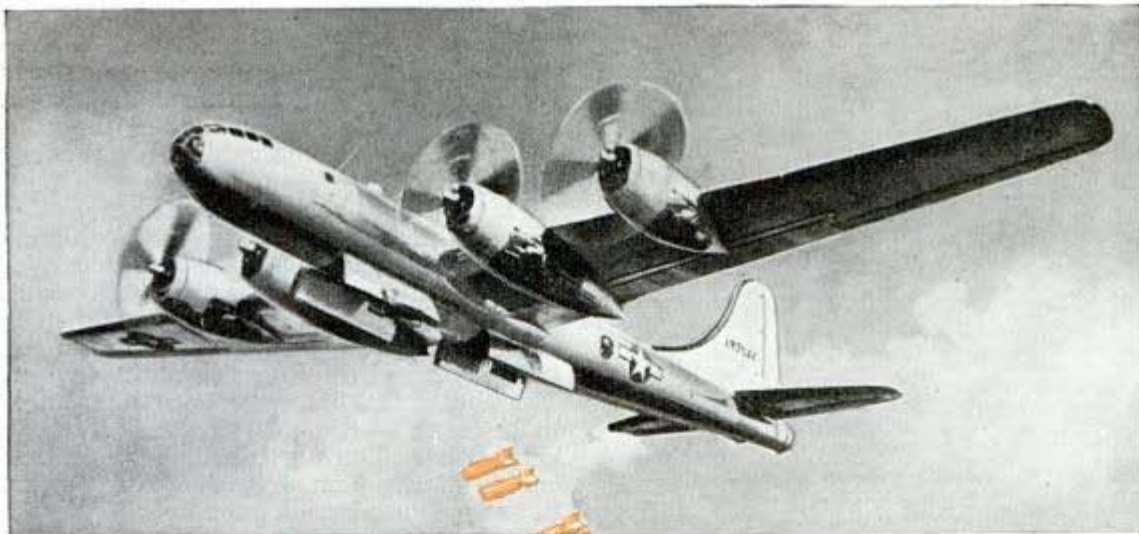
weeks ago. Every B-29 flying over Japan is equipped with the Norden bombsight.

On a bombing mission which consumes many hours of flying time, the bombsight is used for less than 30 seconds. But those



Here are elements of bombing problem solved by computer





This Superfortress and all of her sister ships now attacking Japan are equipped with Norden bombsights

is "fed" the proper information, it solves the mathematical problems of the bombardier and provides the correct answer by fixing the exact instant for releasing the bombs. Information which must be supplied to the bombsight includes air and ground speed of the plane, altitude, drift, wind velocity and weight of the bomb. Much of this information is set up on the computer long before the actual bombing run, so the bombardier has only a few last second vertical and horizontal adjustments to make to keep the crosshairs on target.

The type of bomb, whether a 500-pounder or a blockbuster, and the altitude of the bomber over the target determine the dropping angle. This is registered on a dropping angle scale on top of the bombsight. Another factor which must be set up on the bombsight is the "trail." This represents the horizontal distance between the actual trajectory and a theoretical trajectory in a vacuum.

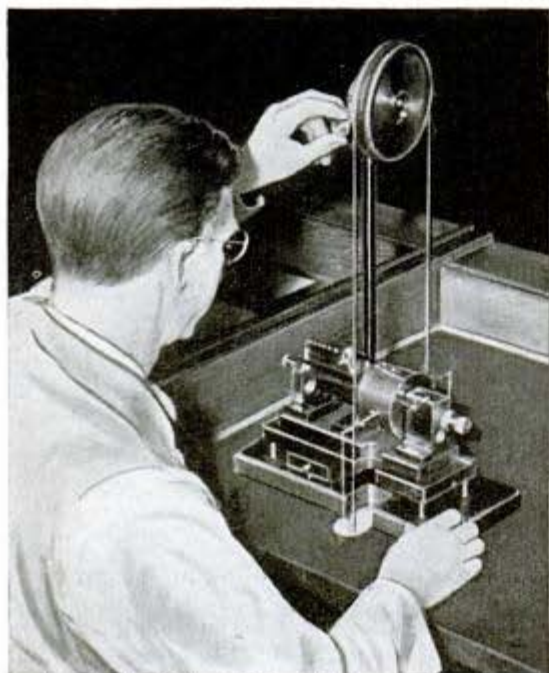
The stabilizer controls the horizontal flight of the plane, maintaining constant altitude, while the automatic pilot controls yawing and the bombsight gyro establishes a vertical line between the plane and earth. This provides a right angle triangle which enables the computer to determine the instant for releasing the bombs.

Let's follow a bombardier from the briefing at the base until "Bombs away!" over the target. At the briefing, he jots down the altitude from which the attack will be made, weight of the bombs that are to be dropped, possible wind directions and velocity. When he climbs into his station in the nose of the bomber he consults previously prepared charts and sets up the bombing problem on the computer.

Before reaching the target the bombardier checks

**Forty direct hits on aircraft plant at Nagoya testify to the accuracy of our famed bombsight**



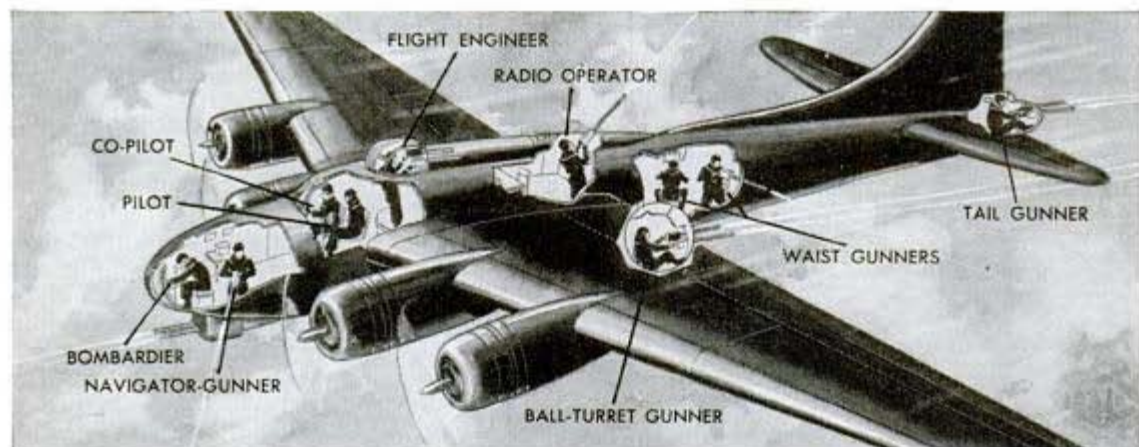


Courtesy Victor Adding Machine Co.  
Ball drop fixture with chain is used for spot check of ball bearings which are vital part of bombsight

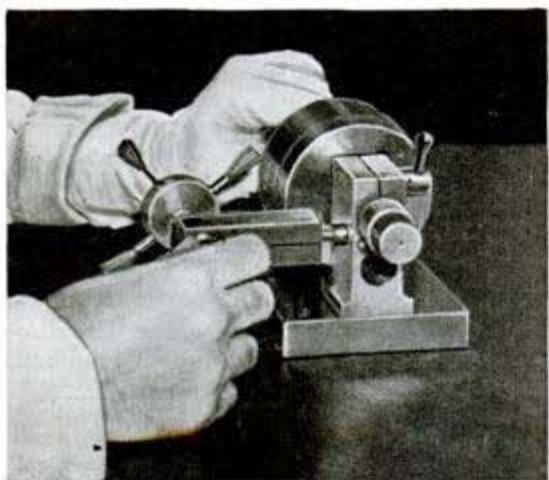
the settings by following an object on the ground to simulate the actual target. Adjustments are made to keep the crosshairs on the object. As the bomber nears the real target the flak gets heavier and the pilot changes the course of the plane about every 15 seconds.

Finally, the bombardier throws the switches for the bomb bay doors and informs the pilot that he is ready to take over for the bombing run. The pilot switches on the automatic flight control which then is controlled by the bombardier through the bombsight and the final run is under way. The time of this final run—ranging from 10 to 30 seconds—depends on the skill of the bombardier. During this time the steady course of the bomber makes it a perfect target for anti-aircraft guns below.

With the course knob, the bombardier directs the plane in a predetermined course toward the target. He hooks up the automatic release switch and clutches in the motor drive of the telescope which puts the computer into operation. This sets into motion a series of mechanisms which solve the bombing problem and release the bombs



Cutaway shows how 10-man "team" on B-17 functions during bombing run. Below, brush test for the bombsight ball bearings; brush must move the wheel



at the proper moment. This release takes place automatically when one fixed and one moving pointer meet on the dropping angle scale. The moving pointer is advanced by the computer in exact ratio to the ground speed, and before the two pointers meet the bombardier can make his last corrections. The perfectly synchronized movement of the telescope gives a bombardier the feeling that he is sighting at the target from a fixed platform instead of a speeding bomber. He knows that an error of one degree at 20,000 feet will cause the bombs to miss the target by 349 feet.

The seconds drag by until suddenly there is a click from the bomb release and the bombardier shouts into the interphone: "Bombs away!"

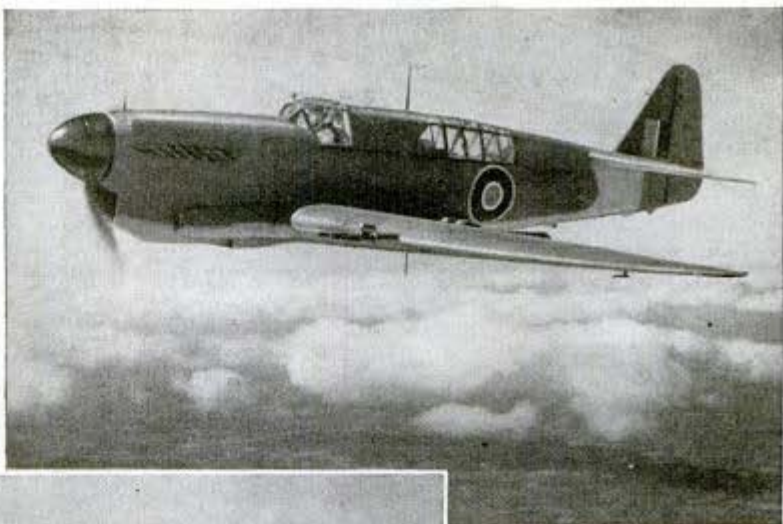
As the crew watches the bombs arcing

(Continued to page 160)

# Royal Navy's Firefly Is a Deadly Fighter-Scout

Armed with four 20-mm. cannon and a camera for vertical photography, the British Royal Navy's Firefly is used on aircraft carriers both for reconnaissance and pursuit operations. Powered with a Rolls-Royce Griffon engine which develops more than 2,000 horsepower, the plane has a hydraulically controlled wing

Right, Firefly in flight. Below, Firefly with its wings folded



flap which may be extracted from its position in the trailing edge of the wing and swung out to give varying positions for takeoff, cruising or landing. The Firefly, which carries a crew of two, saw its first action in the Atlantic. When Allied bombers attacked the Tirpitz in Norway, Fireflies shot down German aircraft attempting to interfere.

## Searchlight Under Wing of Plane Spots Subs at Night

Powerful searchlights attached to the wings of Liberator bombers of the Royal Air Force Coastal Command are used to hunt submarines at night. They light up the sea for miles, making it unsafe for U-boats, which usually surface at night, to recharge their batteries. So effective were these searchlights in the Battle of the Atlantic, they were long on the list of restricted secret weapons.

## Airplanes "Herd" Ducks Away From Fields

Small airplanes are used by the U. S. Fish and Wildlife Service to "herd" ducks away from grain fields to refuges. When the planes fly low over a field the ducks take to the air. The pilots drive them in the desired direction by swooping across the rear of the flocks.





Above, stern-steering iceboat hikes sharply. Hiking is the sailing trick of bringing the windward runner into the air. Below, iceboaters push their craft in preparation for leaping aboard when the sails fill. Both can easily fit into the roomy cockpit located in the rear of the mast



## By Ross M. Dick

**S**PEEDS up to 60 miles an hour, split second thrills, spills and bruises. When you've known all four, you've experienced real iceboating. It is a sport which goes back to the 18th century in this country and through the years it always has had its following. Only in the decade prior to 1940 did it begin to gain wide popularity. Then, an estimated 25,000 Americans went boating on ice surfaces in scores of localities.

While iceboats aplenty are being sailed today, the sport's devotees are storing up ideas for designs and regattas after the war, when the daring, physically fit men now in the armed forces or busy in wartime industry can

once more give week ends to whizzing smoothly over frozen ponds, rivers and lakes.

Iceboats are of two general types: the stern steerer and the front steerer. Both are three-runner boats. In the stern steerer, which was conventional for a long time, the single steering runner is at the stern, back of the runner plank on which the two parallel runners are mounted at opposite ends, while in the front steerer the steering runner is at the bow, ahead of the runner plank.



Above, sheepskin jacket and heavy mitts protect iceboater from cold winds. Left, front-steering racing boat hiking



Within the last decade there has been considerable experimenting with a four-runner boat—front and rear runners mounted parallel at opposite ends of two runner planks. The steering lines may be attached to the front runners, the rear runners, or all four. There also are the “scooter” boats, regular small sailboats on which runners have been mounted on the bottom planking; and motor powered boats, propelled by airplane propellers.

Below, children sail a simple boat with boxlike cockpit





Above, riders cling to runner plank as boat speeds over the ice



Debutante III (above), a champion with 610 sq. ft. of sail, is said to have hit 100 m.p.h. Below, "skeeter" boats



Iceboat construction basically is simple. Complexity of design and construction has developed from the desire to increase speed and maneuverability and reduce mechanical factors that contribute to accidents.

The "skeeter" boat, a development of the 1930's and influential in spreading the sport's popularity, may be built for as little as \$30 to \$40 by economizing on materials. The large racing yachts may cost several thousand dollars. Spruce, strong but lightweight, is recommended for the hull, runner plank, mast and boom. Stainless steel, hot rolled cast iron and aluminum are good runner materials. A yacht duck, close woven and of 10-ounce weight, makes a good sail, one that won't stretch out of shape too easily or be sluggish in a light breeze.

The size of iceboats may vary considerably. For racing, the sail area distinguishes them. The Northwestern Ice Yachting association, principal midwestern organization in the sport, specifies the following classes: Class A, sail limit of 350 square feet; Class B, 250 square feet; Class C, 175 square feet; Class E (skeeter), 75 square feet. While the skeeter hull ranges from 14 to 20 feet in length, Class A boats may run to 40 feet.

The sail area determines the power of a boat; the more sail, the more power. Large sail area, however, is not the sole guaranty of a boat's speed. The sail plan may



vary considerably. There may be only the one mainsail, or two sails—the mainsail and a jib. Some of the large yachts carry a sail spread of 750 feet. One man can operate the smaller boats, while it requires two for the more complex craft.

The sport can be extremely dangerous. A capsizing boat will pitch the occupant headlong across the ice or trap him under the hull or sail. An icy bath is the result if the rider is thrown clear upon hitting bad ice or a patch of open water. Bracing to stay in a rocketing boat in a high wind brings severe bruises.

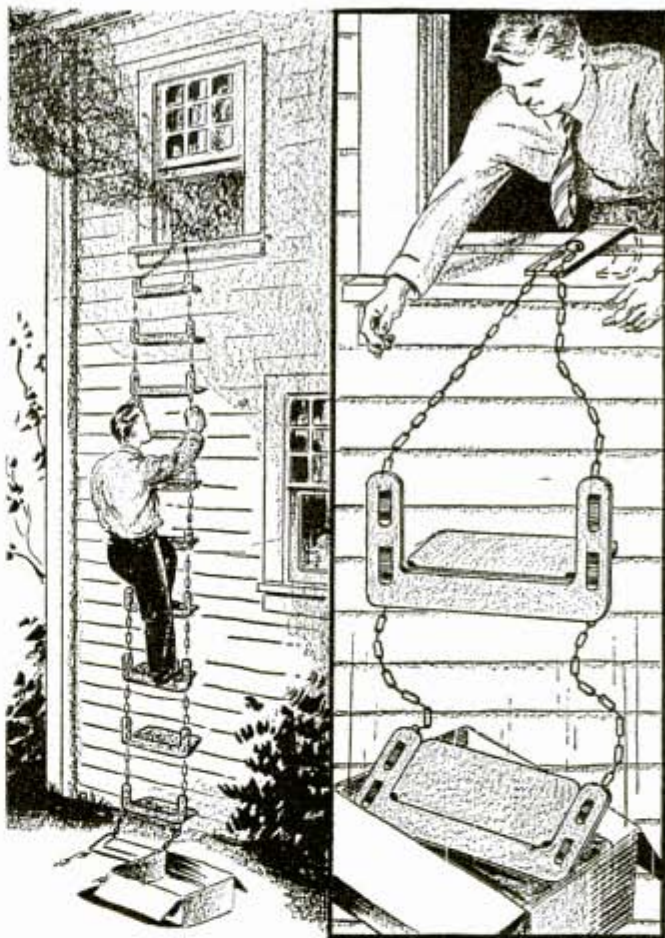
It is an established fact that iceboats will travel two to six times the wind velocity. In fact, wind velocity of 50 miles an hour is considered too extreme, as the frail craft cannot stand the strain. Iceboat racers of the late 19th century used to race trains along the shore of the Hudson river. The boats, at claimed speeds of up to 100 miles an hour, quickly would outdistance the trains. Iceboats have been officially recorded at 140 miles an hour, some authorities declare, although others scoff at claims above 60 miles an hour.

"Flickering" and "hiking" provide the greatest thrills of the sport. Flickering occurs when pressure is released from the steering runner, causing it to slip and the boat to go into a spin. This is common in a stern steerer when she "hikes" too far. Hiking occurs when the helmsman manipulates his craft so as to cause the windward runner to rise into the air. Without careful handling, hiking can result in capsizing.

Anyone adept at sailboating or driving an automobile should be able to learn to handle an iceboat with practice. While an iceboat acts many times as fast as a sailboat and has certain characteristics a sailboat does not have, fundamentally it goes through the same motions. Iceboat steering, especially at high speed, requires the same quick reactions needed in guiding a speeding automobile, and, as with other skills, can be learned best through riding with an experienced helmsman.

If you have never had a ride on the ice, put it down now as one of the "musts" in your postwar recreational plans.

## Portable Fire Escape Opens Up As Box Falls From Window



Capable of supporting 1,880 pounds, a portable, metal fire escape can be hung from a window with its hook anchored on the sill. The fire escape is stored in a carton. When needed, the top of the carton can be opened, the hook anchored to the sill, and the carton dropped to the ground, permitting anyone to climb down safely. The fire ladder consists of metal yoke steps 10 inches wide and 4½ inches deep locked to parallel chains. It is manufactured in three sizes suited to two, three or four story buildings.

## Oil Coating Adds Strength to Steel While Water Weakens It

With a micromachine and a photographic registering apparatus, Swedish engineers discovered that a coating of crude oil, paraffin or even gasoline increases the resistance of steel and other metals to rupture. Tests also revealed that water weakens both metals and glass. As a demonstration, three glass rods were weighted at one end with equal weights; a rod that had been moistened with water broke almost at once, a rod that was dry broke after a few minutes, while a third that had been dipped in paraffin withstood the weight without breaking.

## Black Widow 4-Gun Turret "Plugs Into" Nacelle Top



To give the P-61 Black Widow a deadly stinger, four .50-caliber machine guns are installed in a revolving drum in the crew nacelle. The turret, which costs approximately \$16,000, is electrically operated. The P-61 is the most powerful of the Army Air Force's night fighters.

## U. S. Railroads Set New Records For Freight and Passengers

Records that may stand for many years were set by American railroads in 1944. Freight traffic amounted to 740 billion ton-miles, an increase of 1.8 percent over 1943, and passenger miles were estimated at 96 billion by the Association of American Railroads. Leveling off of traffic during the latter part of 1944 indicates that the peak for World War II may have been reached. Freight car loadings totaled 43,500,000 cars with an average capacity of 50.9 tons, also a record, and the average load of freight per train was 1,144 tons. Passenger traffic increased 9.3 percent over 1943 and was four and one-fifth times

greater than in 1939. More than 10,700,000 troops were moved in special cars. The railroads set these records with about the same number of locomotives and freight cars they had before the war.

## Drafting Tools Made of Plastic Are Turned Out in Jiffy

Drafting instruments, which must have tolerances of from .001 to .005 inch, are now produced by thermoplastic molding. This process was devised in the face of threatened shortages in slide rules, protractors, scales and other instruments needed by the armed forces and war industries. A triangular relief facet scale made of celluloid-faced boxwood required two to three years for the wood to become seasoned and the celluloid to set. Some of the plastic instruments using Lucite, Plexiglas and Polystyrene, are made by an injection molding process in 24 hours.

## GI's Form-Fitting Sleeping Bag Covers Him Like a Tent

Even in the cradle, GI Joe never was bundled up as thoroughly as in the Army's weather-resistant, form-fitting sleeping bag. Only the face remains exposed when the big sack is sealed up. The bag is protection against rain, snow, cold, damp and other hazards of outdoor living.





*The BATTLE  
that WON  
the PACIFIC*

**T**HE Second Battle of the Philippine Sea last October, in which the United States Navy defeated the Japanese Imperial Navy as soundly as Notre Dame might beat Podunk Tech, can almost be reduced to football terminology. Perhaps Admiral "Wild Bill" Halsey, who played fullback for the Naval Academy years ago, thought of it that way.

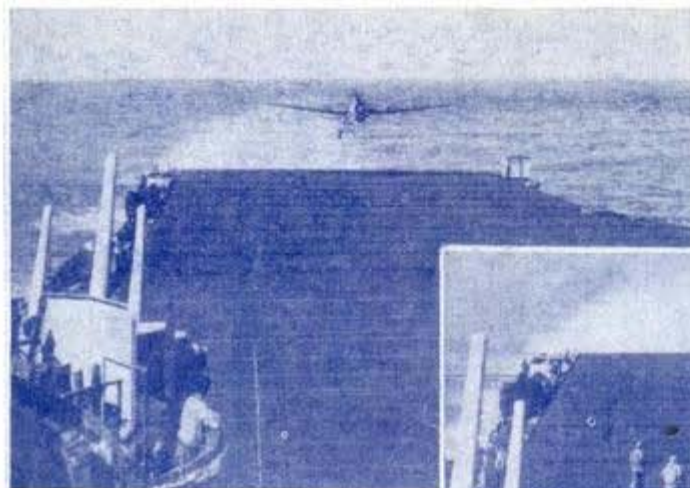
Stretching along a 1,500-mile front, the scrimmage line was marked by the thousands of islands of the Philippine archipelago and the blue water around it. West of this line were the Japanese warships with their strange, pagoda-like superstructures; east of this line were the

U. S. Navy photos

The image of a battleship painted on flight deck of doomed Jap carrier did not fool U. S. flyers

The mighty USS Missouri, our newest battleship of the Iowa class, fires salvo from 16-inch guns





With one wheel shot away during attack on Jap Fleet, torpedo plane pilot brings his ship in for landing on U. S. carrier. Below, flight deck crew rushes toward plane after successful landing by lucky pilot



powerful, sleek, fast ships of the United States Third and Seventh Fleets.

For weeks the two forces had been shifting into position—the United States Navy anxious to get on with the game, the Japs stalling for time, cautiously waiting for a moment most advantageous to themselves.

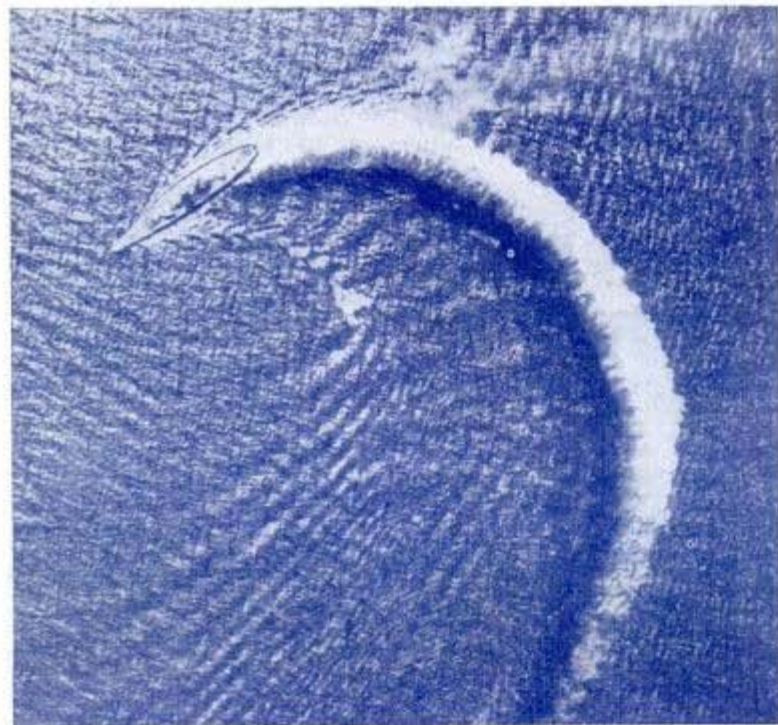
The Japs had been so well scouted that the United States admirals knew how the Nips would line up and what plays they would probably use. When and where they would try for a touchdown was not clear.

As it turned out, the Japs tried four plays—all of them failing in spite of the fact that the overall strategy was carefully planned, well timed and cleverly executed. First they threw a forward pass in the form of

land-based aircraft at our carriers, but this was batted down. They tried an end run around Luzon but were thrown for a loss by Admirals Halsey and Mitscher. They tried an off-tackle smash through Surigao Strait but this attempt was stopped cold by Admirals Kinkaid and Oldendorf. Finally they tried a straight power play through the center of the line, the San Bernardino Strait. This play was the most successful because the Japs found a hole and did some damage. But in the end this try also was thrown back to the line of scrimmage.

The results added up to a decisive defeat for the Japanese Navy. Final score in ships sunk was heavily in the favor of the United States Navy, and even more lopsided when ships possibly sunk or damaged are figured. Sports writers might have used such verbs as "steamrollered," "lambasted" or "crushed" in their descriptive "leads." Admiral Halsey called it "catastrophic."

The great sea battle of October, 1944, is probably the last full-scale naval battle to be fought in the Pacific for many years to come. Previous sea bat-



Jap battleship maneuvers desperately during Sulu Sea battle

tles in World War II in the Pacific set the stage for this final battle by somewhat reducing the Japanese Fleet and heightening the desperation of the Japanese high command. The Battle of the Coral Sea checked the Japanese advance toward Australia; the Battle of Midway saved the Hawaiian Islands from invasion; the Battle of Guadalcanal nailed our position securely in the Solomons; and the First Battle of the Philippine Sea insured the capture of the Marianas—thus giving the United States bases from which to launch further attacks against the Philippines, the China coast and the Japanese homeland.

But the Second Battle of the Philippine Sea overshadowed the other four in scope and import. Most of Japan's heavy ships—battleships, carriers and cruisers—have been either sunk or crippled. The Japanese Navy still possesses nuisance value but its strength is no longer

that of a first or even second-rate power.

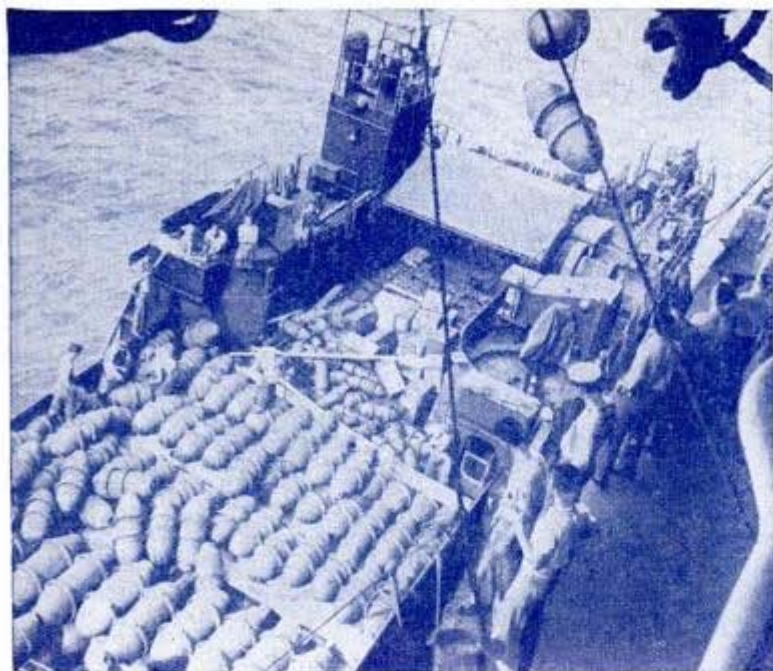
We are too close to the sweat and blood of battle to understand the full significance of this greatest naval engagement of World War II. There is no doubt, however, that history will rank it in importance with such



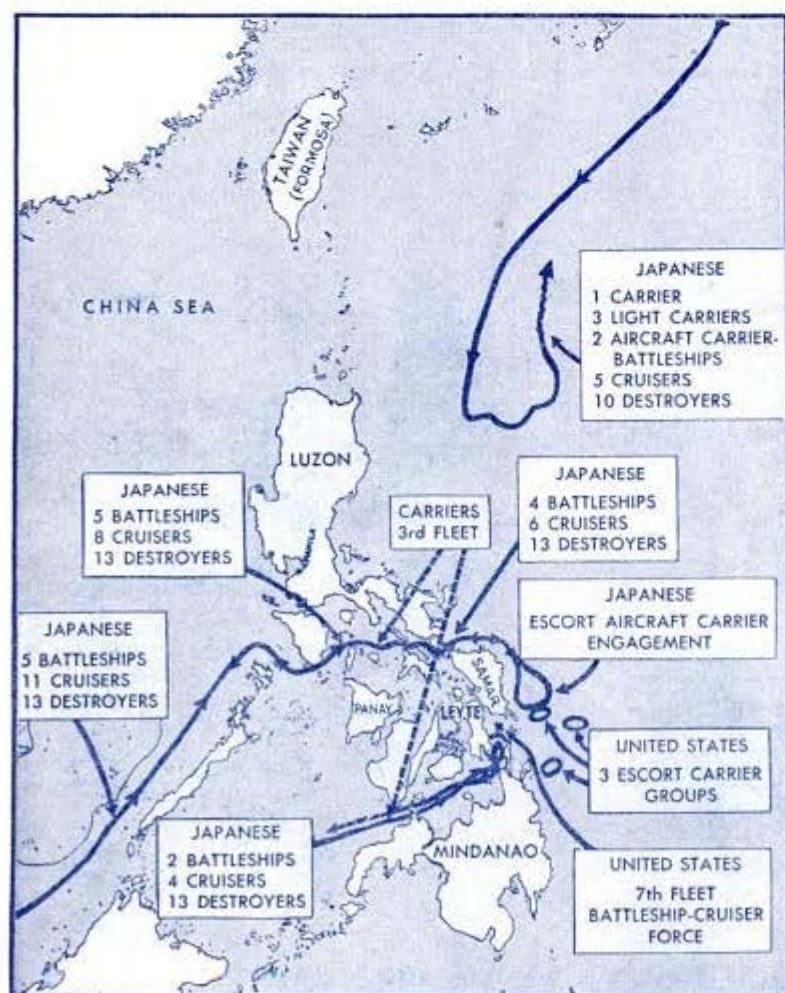
Avenger crew examines battle scars on fuselage and parachute pack

The Second Battle of the Philippine Sea paved the way for landing operations like this on enemy shores





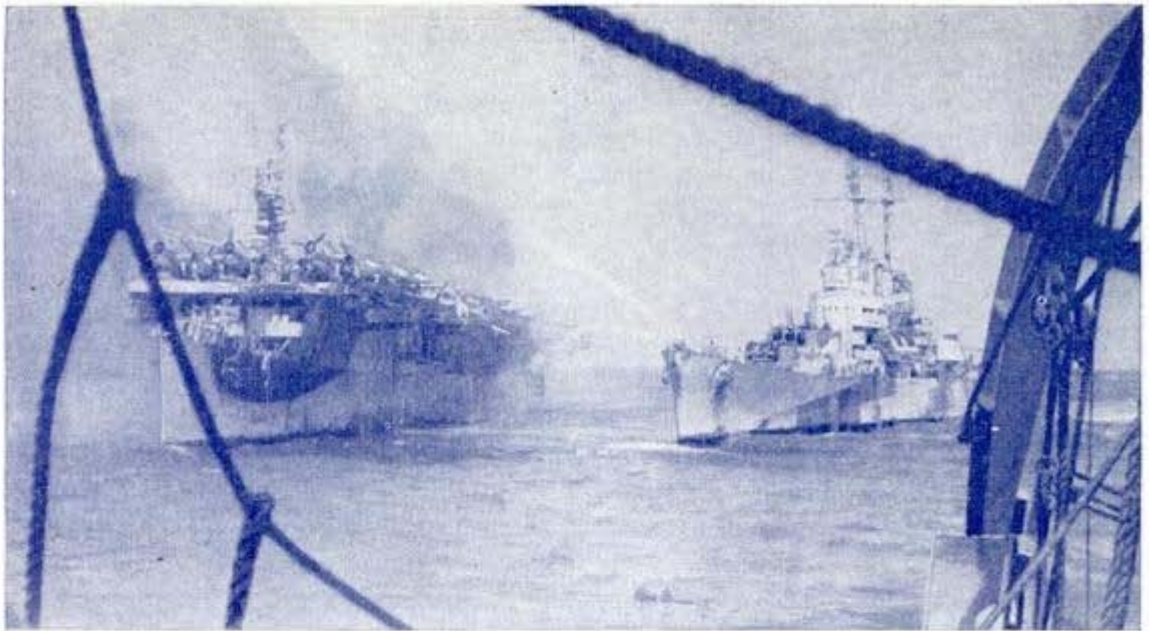
Bombs are loaded aboard an aircraft carrier at sea for delivery to the Japs on Formosa. Below, official Navy chart shows disposition of the U. S. and Jap fleets during the battle in and about the 1,000-mile archipelago



decisive sea engagements as Trafalgar and Jutland. At Trafalgar the British Navy licked a combination of the French and Spanish navies and paved the way for the defeat of Napoleonic France. At Jutland, even though it lost heavily, the British Navy crippled the German Navy and thus insured victory for the Allies. The Second Battle of the Philippine Sea, in which more ships were involved, vastly more fire power employed, new weapons used, and more ships damaged and sunk than in any other great sea battle, marked the beginning of the end for the Japanese Empire.

Even though the Japanese Navy was decisively defeated, the strategy and planning might have worked if we had been unlucky or unprepared. But our seagoing admirals were too experienced, our submariners too alert, our pilots too well trained, our gunners too keen eyed, our equipment too plentiful and too good. In sheer weight of iron and steel—plus skill, courage and experience—the All Americans of the Pacific league topped the best the Bushido bush leaguers could offer.

This is how the Japs figured: (1) General MacArthur had just made a landing on Leyte Island with vulnerable LST's and transports unloading men and supplies on the beach; (2) Admiral Kincaid's Seventh Fleet, which had furnished air cover and shore bombardment for the landing, was probably low on fuel and ammunition; (3) Admiral Halsey's mighty Third Fleet, which had been rampaging through the Philippines, Formosa and the Ryukyus, was also probably short of oil, bombs and torpedoes. It



**Cruiser pours water into USS Princeton, light carrier set aflame by Jap bombs and later sunk**

is even possible that the Japs may have believed some of their own outrageous propaganda which cackled that a sizable portion of the Third Fleet had been sunk off Formosa in September.

At any rate, the Japanese admirals figured that this was the time to shoot the works—literally and figuratively—using the classic Japanese naval maneuver of a pincer movement on its objective.

On October 21 or thereabouts, heavy

units of the Japanese Imperial Navy which had been based down around Singapore, out of range of American bombers, started moving north. Submariners reported what they saw in their periscopes and Admirals Halsey and Kinkaid lined up their fleets along the eastern shores of the Philippines in defensive formation.

The Japs received their first surprise on October 22 when an American submarine, stalking the Imperial Fleet, sank a couple

**Jap battlewagon Yamato shudders under direct hits from dive bombers of the U. S. carrier force**





**Ships stand by to rescue crew as fires explode magazine of the Princeton**

of heavy cruisers and damaged a third. Then and there the Japs must have known that a certain amount of tactical surprise had been lost. But the signals had been called and the plays were under way.

As the heavy Jap ships plowed northward and wheeled toward the Philippines,

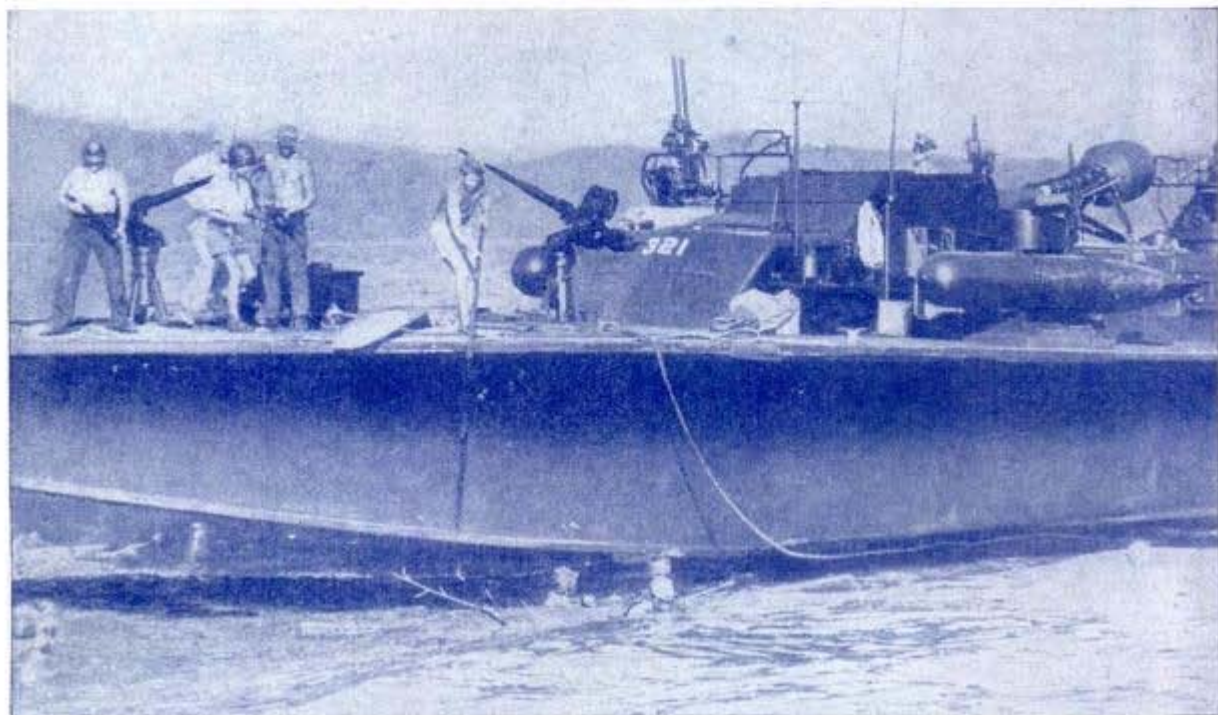
damaged that she was sunk by one of our own torpedoes. The Japs had figured on sinking not one but many United States carriers with their bombs and aerial torpedoes. Thus the first phase of the attack failed—the forward pass the Japs had attempted was incomplete.

Jap planes based on Luzon and the Visayan Islands attacked Admiral Halsey's carriers. This was a battle royal in which United States carrier-based planes fought off wave after wave of determined Jap planes. It was one of the strongest shore-based air attacks ever launched against our naval forces and more than 150 of the enemy planes were shot down.

Only one of our carriers, the USS Princeton, was sunk. And only then through a piece of tough luck. One of the Jap bombs crashed through the flight deck and started a bad fire below. Before the blaze could be brought under control, it spread to the magazine, which exploded with a terrific blast. The ship was so badly

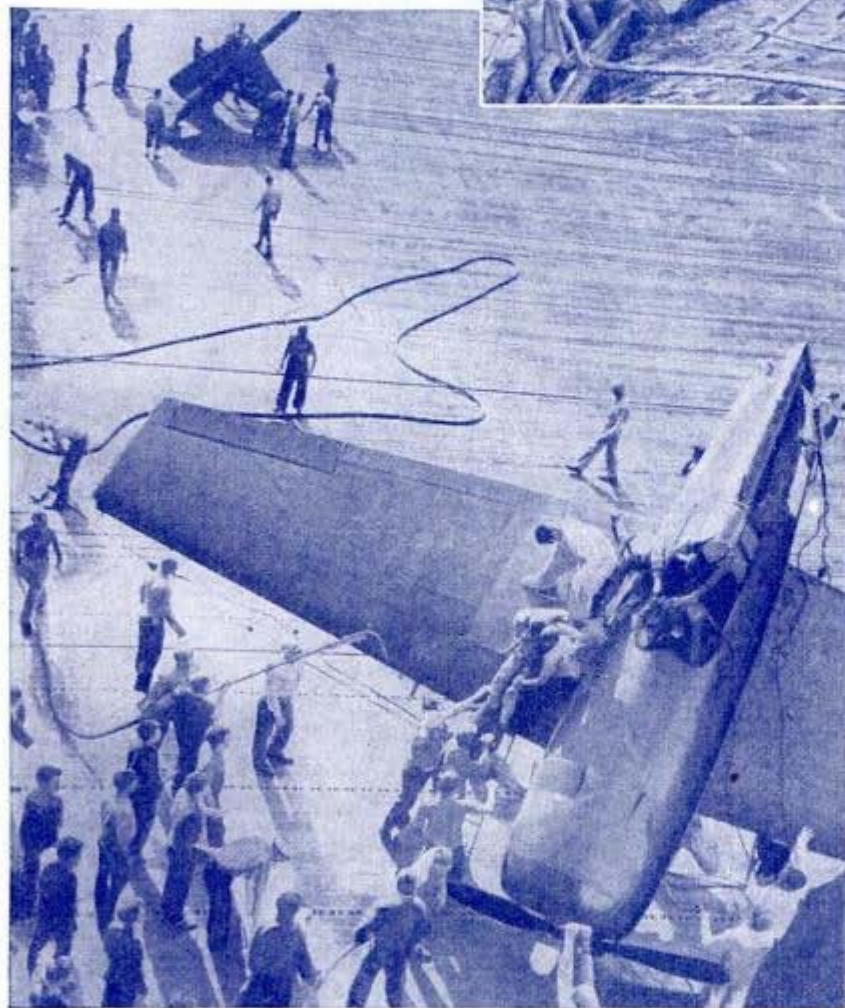
badly

**Jap survivors from battle in Surigao Strait cling to debris alongside PT boat. Note alert men with guns**





Meanwhile search planes from Admiral Halsey's carriers had picked up the Jap ships approaching from the South China Sea. The enemy force had been split into two groups—one in the Sulu Sea to the south, heading for the Surigao Strait; the other in the center, speeding through the Sibuyan Sea toward the San Bernardino Strait. The Japs had picked the two best east-west passages through the Philippine Islands.



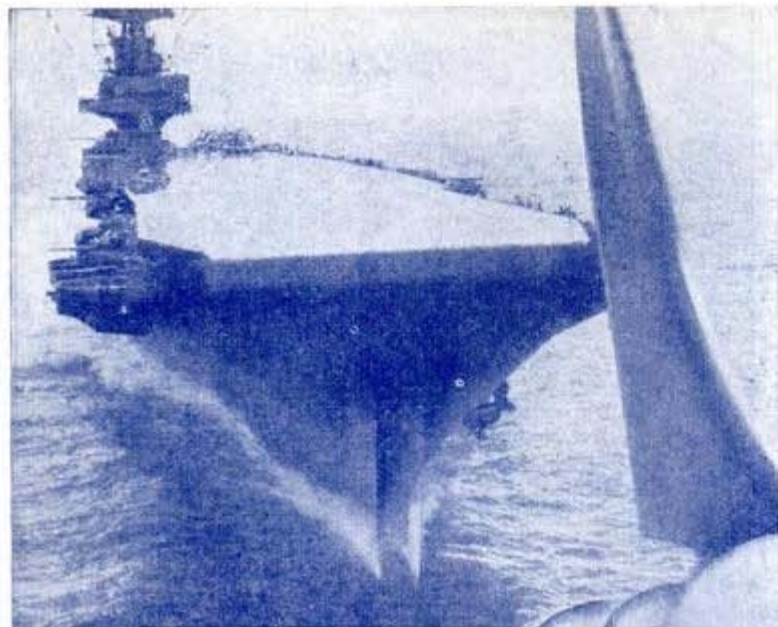
Natives help PT's pick up survivors. Left, assisting the pilot from plane after crash landing

cruisers and 13 destroyers. The two forces contained just about everything the Japs had in the way of fast, heavy, gun-toting warships outside their shipyards.

As a veteran carrier commander, Admiral Halsey knew that the best way to slow up such power was to tackle it before it reached the open water beyond the Philippine archipelago. Maneuvering through the green-fringed jungle islands and hidden reefs of the Philippines, even for Japanese officers who once swarmed through them disguised as fishermen, would be tricky business at best. So, on October 23, Admiral Halsey threw his Hellcats, Avengers and Helldivers at both enemy forces, inflicting damage on many ships.

The southern force was grouped for speed and maneuverability and consisted of two battleships (the Yamashiro and Fuso), two heavy cruisers, two light cruisers and seven or eight destroyers. The force in the center of the line bristled with heavy fire power and consisted of five battleships (the Kongo, Haruna, Nagato, Mushashi and Yamato—the two latter being big, modern, 45,000-ton battlewagons similar to our Iowa class ships), eight heavy

But where were the Japanese carriers? Six carriers had been either sunk or damaged by Admiral Spruance's Fifth Fleet in the First Battle of the Philippine Sea on June 19. But there were still a couple more running loose that had not taken part in that action and perhaps some of the cripples had been patched up. In addition, the Japs were supposed to have converted a couple of ISE class battleships into carriers by mounting flight decks aft



Tail gunner's view of flat-top USS Enterprise a moment after the takeoff

of the forward turret—making an odd-looking battleship-carrier. But where were they?

A Navy search plane, flying lonely patrol hundreds of miles from its base, radioed the answer. It had spotted a Japanese carrier force consisting of four carriers (the Zuikaku, Chitose, Chiyoda and Zuiho),

that they offered no effective air opposition.

"Just like sitting ducks..." was the verdict of United States pilots who sank the four carriers and bombed and torpedoed the other ships. The end run had been caught behind the line of scrimmage and thrown for a loss.

The new United States carriers Wasp,

two converted battleship-carriers (of the ISE class), six cruisers and six destroyers about 200 miles northeast of Luzon. Here was a serious flank attack, a hidden ball play, an end run.

Believing that the two enemy forces threading their way through the Philippines had been sufficiently battered and slowed down so that Admiral Kinkaid's Seventh Fleet could handle them, Admiral Halsey ordered the bulk of his strength to cruise north at full speed during the night of October 23-24. He met the astonished Jap carrier force at dawn the next day. The Nips were taken so completely by surprise

Escort carriers in thick of battle—fighters are rushed from deck to attack Japs blasting sister ship



Hornet and Lexington, named for gallant ships sunk in previous sea engagements with the Japs, were among the Halsey carriers that hit the enemy carrier force that morning.

Meanwhile, Admirals Kinkaid and Ouldendorf, with their Seventh Fleet battleships, cruisers, destroyers and PT boats, waited for the Japs to sortie through Surigao Strait. This was the attempt to get into Leyte Gulf and wreak havoc on General MacArthur's beachhead. It was an off-tackle smash and required precise timing and speed of execution.

The Japs decided to make a run for it on the night of October 23-24. As they came through the narrow Surigao Strait, in some places only 12 miles across, they ran into a withering cross fire from the United States warships that lay in ambush. The California, Pennsylvania, Tennessee, Maryland and West Virginia, all old battleships that were raised out of the mud at Pearl Harbor, got their revenge that night. The Japs could stand the concentrated hail of steel only 40 minutes and then turned tail and ran. Every ship was either sunk or badly damaged. The off-tackle smash had been stopped cold.

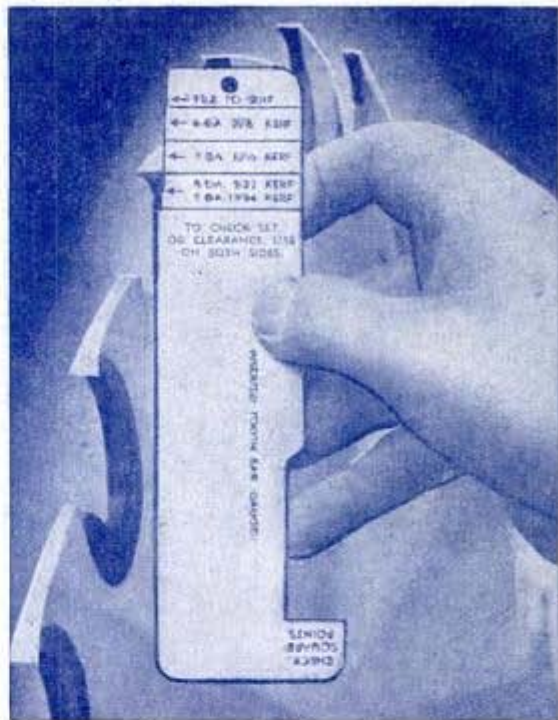
In the power play through the center of the line, where the Japs had concentrated their greatest surface strength and fire power, they were doing better. The force of Japanese battleships, cruisers and destroyers, which had been attacked by carrier planes in the Sibuyan Sea, had continued on through the San Bernardino Strait on the night of October 23-24 and the next day had attacked escort carriers of the Seventh Fleet which had been posted to guard the entrance to Leyte Gulf. This was the other prong of the pincer that hoped to crack open General MacArthur's beachhead.

It was a weird battle and one of the most unevenly matched in the history of sea power. Japanese 16-inch guns slugging away at little, thin-skinned CVE's whose heaviest armament is a 5-incher. Japanese heavy cruisers dueling with American destroyers half their size. But the CVE's had daring fighter and torpedo pilots aboard, and the destroyer skippers had guts. The CVE's and destroyers fought a losing battle but never before has American courage been displayed to better advantage.

The CVE's yelled for help. Elaborate Navy codes were discarded in the urgency of the moment and plain-language appeals crackled out across the Philippine Sea to Admiral Halsey. He immediately broke off his engagement with the Jap carriers—thus missing an opportunity to wipe out every ship in the force. He raced his ships

(Continued to page 150)

## Gauge Squares Bits on Saw To Avoid Marking Wood



To facilitate the checking of saw bits on inserted-tooth saws, a new gauge just developed squares the saw bits with the saw and shows immediately whether the bit is set to do the same amount of work as the others. Unless the bits are exactly uniform, the lumber will be marked and an inferior sawing job will result.

## Mechanical Jaws on Long Handle Remove Overhead Tube Lamps

Burned-out fluorescent tubes in overhead fixtures can be removed while standing on the floor by using a long-handled "changer." The one-man unit has cork-padded jaws which grip the lamp without damaging it. A twist of the handle clamps the jaws around the tube and disengages it from the socket, permitting it to be lowered to the floor.



# B-29 Gunnery "Brain" Aims Six Guns at Once



At a single sighting position in the pressurized cabin of a B-29, a gunner can direct the fire of six of the bomber's 10 .50-caliber machine guns by remote control. This central electrical control system made it possible recently for a lone Superfortress to win a four-hour battle against 79 Jap fighters. By shifting the control of gun turrets between the sighting stations, the bomber is pro-

Between gunner and turret is computer that aims B-29 guns

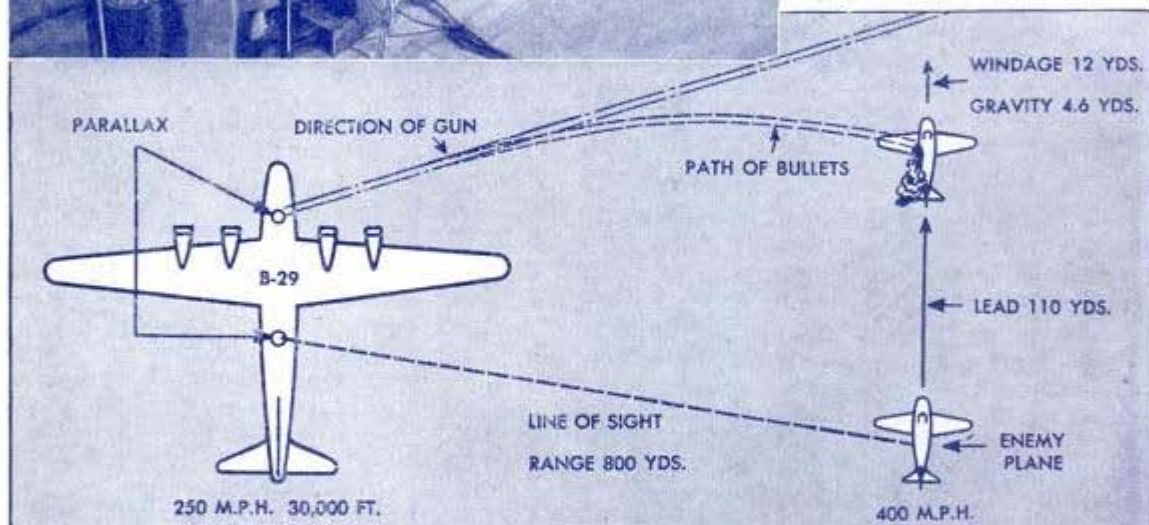
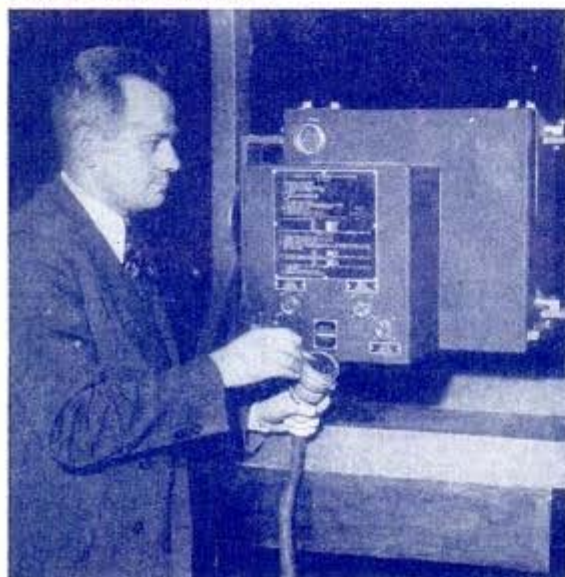


Diagram shows the problem solved by electronics and mechanical computer to hit speeding fighter plane. This brain-like computer (below left) is housed in the small black box. Right, sighting through B-29 nose  
Courtesy General Electric Co.



ected from all angles by concentrated fire.

The system permits a variety of combinations for the control of the B-29's five turrets, two of which are on top of the fuselage, two on the underside and one in the tail. The turrets can be controlled individually or in combinations of two or three under the direction of the chief gunner. There are two machine guns in each turret. Between the sighting stations are several computers—the electronic "brains" of the system—which aim the guns at a point in space where bullets and enemy plane will meet. Ballistic factors which are solved by the computer in a split second include lead, windage, gravity and parallax.

Information that must be relayed to the computer by electrical impulses includes range and speed of the enemy plane, its angle from the B-29, air density and speed of the bomber. First, the gunner catches an enemy plane in his sight and registers the size on an instrument. Then he focuses a circle of dots on the image of the plane and keeps it there by moving the sight. Range is computed by instruments from the size of the plane and the size of the luminous circle in the sight. Speed of the enemy fighter is estimated on the basis of range and the movement of the sight necessary to keep it within the circle of dots.

The altitude, outside temperature and speed of the B-29 are relayed to the computer by the navigator. The air density, used to figure windage, is determined from altitude and temperature. A bomber moving 250 miles an hour at 30,000 feet will curve the path of a bullet 12 yards.

The computer must also compensate for gravity. At 30,000 feet a .50-caliber bullet will drop 4.6 yards in a range of 800 yards. While the bullet is traveling this distance a fighter plane going 400 miles an hour would move forward 110 yards. The computer determines the lead, pointing the guns well ahead of where the gunner is focusing his sights.

The distance between the sight and the guns, necessitating a parallax correction, is compensated for by the computer which angles the aim of the guns toward the

## Car Driven Without Foot Pedal Has Controls in Steering Post



By replacing foot controls with a steering wheel device, Brooks Stevens and Harry Krueger, Milwaukee industrial designers, have modified an automobile so that the legless can drive. Instead of an accelerator and brake and clutch pedals on the floorboard, the car has a rod connected with the brakes and accelerator and operated through the steering column. The only restriction is that the car to which the device is attached have some form of automatic shift. When the wheel is slowly pulled up, the shift starts operating; when the wheel is slowly depressed, braking is effected. During this manipulation the wheel is never moved more than four inches in all.

gunner's position. Electrical parts that move the guns include electronic equipment and a series of motors which respond instantly and accurately to quick movements of the sight. Motors on the turrets are powerful enough to lift a 200-pound weight suspended from the ends of the guns.

Advantages of the remote control system include concentrated and accurately directed firepower, elimination of cumbersome oxygen masks and high altitude suits for the gunners, and reduction of aerodynamic drag caused by ball turrets. Also, if a gunner is wounded, it permits one of his teammates to take over his turret.

The electronic gunnery system, developed by engineers of the General Electric Co., Boeing Aircraft and the AAF, helped make it possible for the B-29's to fly 14 unescorted bombing missions against Japan before a single bomber was shot down.

## Rocket Boats Lay Smoke Screen for Landings



One of the highly effective members of that large World War II family—the landing ships—which has been little publicized is the Navy's LCS (landing craft, support). During amphibious operations the LCS is equipped to lay smoke screens for the protection of other landing craft. It is also capable of firing rockets.

Left, smoke pours from rear of LCS during maneuvers off Norfolk, Va.

## Telephone "Eavesdropper" Records Two-Way Messages

Electronic voice recorders speed up business transactions by taking down two-way telephone conversations. The telephone is placed on a plastic stand which contains an induction coil. The recorder may be equipped with two cylinders which operate automatically, one taking over a few seconds before the first is filled. With a hand microphone the machine can be used for ordinary dictation or for recording conferences. One company uses the telephone attachment for taking rush orders from salesmen.



## Sponge "Bank" for Scraps of Soap Gives Cleansing Foam When Wet

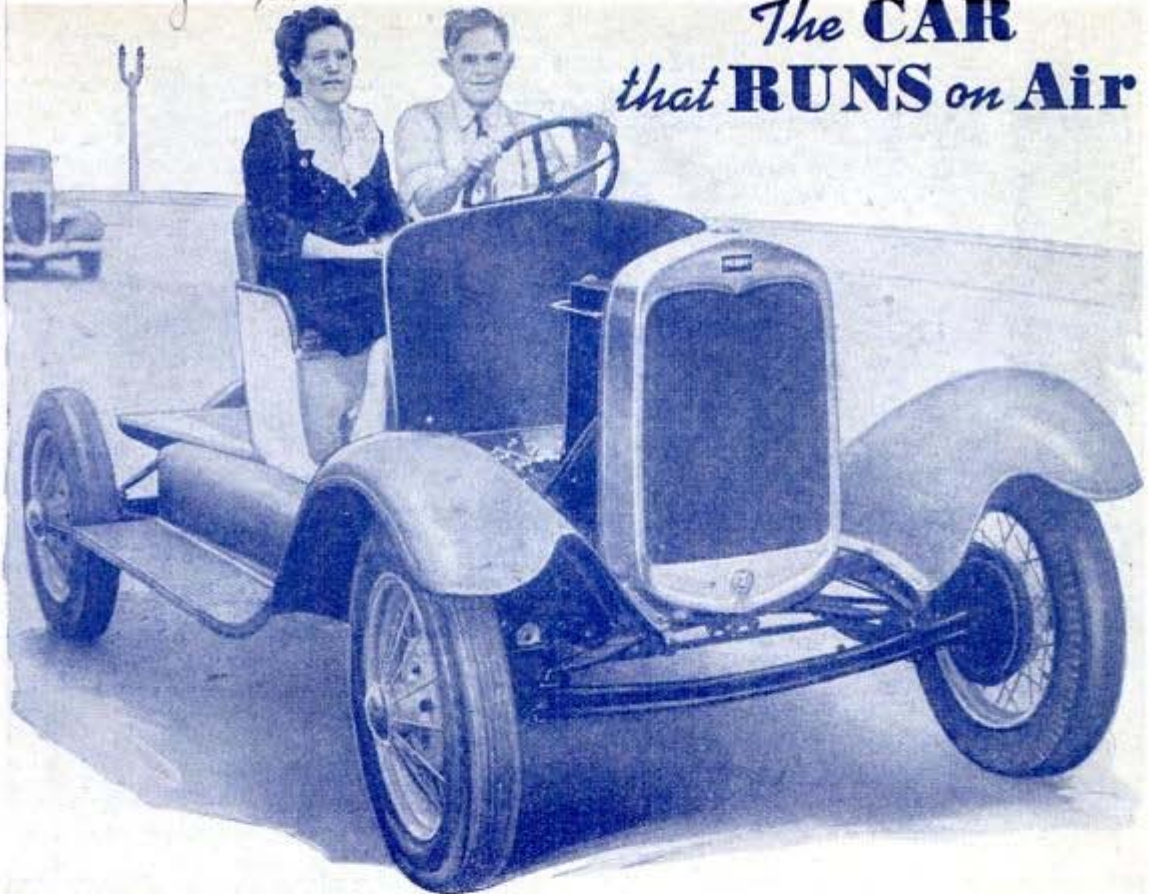


To utilize soap that has become too small for ordinary use, a sponge pouch now on the market acts as a "bank" for the scraps. The soap scraps or chips are put into a cloth lined pocket which prolongs the life of the sponge. When wet, the sponge releases soapy foam that may be used to clean walls, windows, rugs and upholstery or wash dishes, sinks, bathtubs and even pets. It is made of cellulose.

☐ The average American farmer has 27 acres of woodland, enough to grow lumber for a new six-room house every year.

*Perrymobile*  
*Los Angeles Inventor*

# The CAR that RUNS on Air



Compressed air and vapor supply power for the "Perrymobile" that travels 60 miles on a gallon of butane

**P**OSTWAR motorists may climb into their automobiles, step on the air instead of the gas, and glide away swiftly and silently at 60 miles to the gallon with never a gear to shift or clutch to shove.

That's the prospect presented by Frank R. Perry, Los Angeles inventor, who has built a revolutionary car called a "Perrymobile."

Untried commercially, it's a novel combination of steamer and compressed air powered automobile. The motive power comes from a secret liquid, which vaporizes at a much lower temperature than water, and compressed air which serves as an ever-ready starting and reserve source of power.

Perry says he has driven several thousand miles with his machine which is mounted on an old Ford chassis. The Perrymobile weighs only 700 pounds—about 1,300 pounds less than standard automobiles powered by the conventional internal combustion engines. The engine installation alone weighs only 140 pounds.

The 30-horsepower four-cylinder engine is turned over by pressures instead of by the explosions that move the pistons of an

ordinary auto engine. The Perrymobile engine is essentially the same as a steam engine. Inside each cylinder is a piston which moves up and down and is connected to the crankshaft.

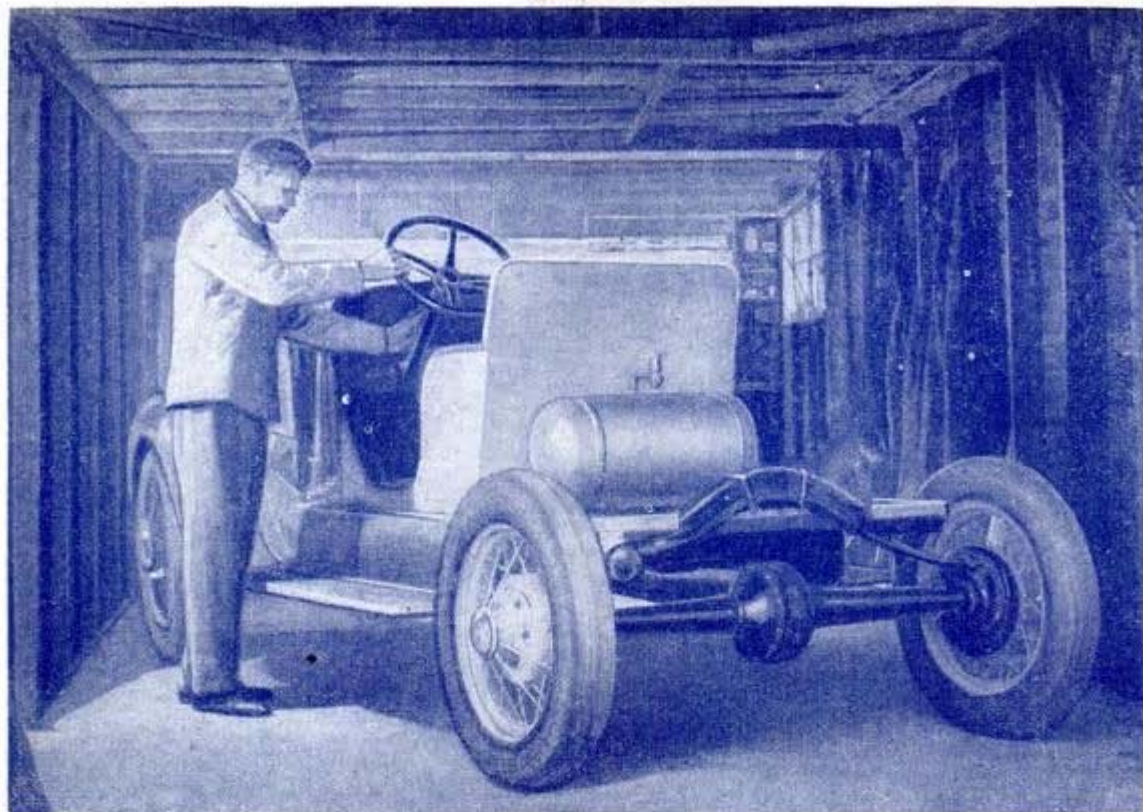
The secret non-inflammable liquid, which boils at about 150 degrees Fahrenheit, is heated by a burner which uses anything from butane gas to crude oil. The car will travel 60 miles at 30 miles an hour on



The only floorboard pedal is the brake; a control on steering column regulates both speed and power

FEBRUARY, 1945

*3506 W. 85th - Inglewood, Calif.*  
*L.A.*



Built on an old Ford chassis, the air-vapor car carries enough butane in its fuel tank to run 600 miles

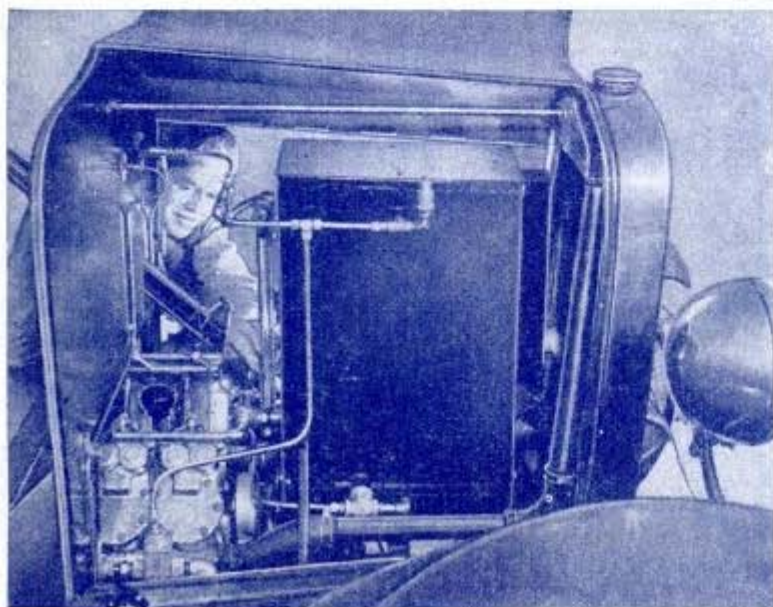
one gallon of butane, the inventor claims. He says this fuel costs about 8½ cents a gallon. (He sets the top speed at "better than 70.") Only one quart of the secret liquid is required in the boiler because it is exhausted as vapor into the radiator, condensed and returned to the boiler.

The vapor passes through an intake valve into the top of the cylinder, and with a pressure of about 150 pounds per square

inch pushes the piston down just as steam would do. At the bottom of the stroke the vapor exhausts through a port cut through the cylinder wall. As the piston starts up again a valve at the top of the cylinder lifts so the piston travels upward against no air pressure. At the top of the stroke more vapor is admitted which starts the piston down again.

Each of the four pistons supplies power to the rear wheels every time it is pushed down. This affords "two-cycle" operation instead of the conventional "four-cycle" shift in which each piston gets a shove only every second time it travels downward. Thus, Perry's four cylinders put out as many power impulses as an eight-cylinder auto engine.

The compressed air part of the power for the Perymobile comes from a tank under the seat. That tank is kept full of compressed air supplied by a small air pump connected



Oblong steel box houses boiler; four cylinders form a V



*Precision Parts, Ltd.*  
 2025 Gwynne St.  
**One-Man, Bow-Type Power Saw**  
 Is Light and Self-Contained

*Novel, Lumber Canada*

by a belt with the engine. The compressed air, which flows through the boiler into the cylinders, is used for a quick start and until sufficient vapor pressure has been built up to run the engine.

To operate this revolutionary automobile, you first open the fuel valve under the hood and the burners catch fire from a pilot light. Then you get in the car and pull down the throttle lever on the right side of the steering column. Compressed air from the tank flows into the cylinders and the car starts to move.

After you have driven a few blocks the flame in the boiler has built up sufficient vapor pressure so you can turn off the air. The pump quickly restores the pressure in the air tank. Heat in the boiler is regulated by an automatic valve.

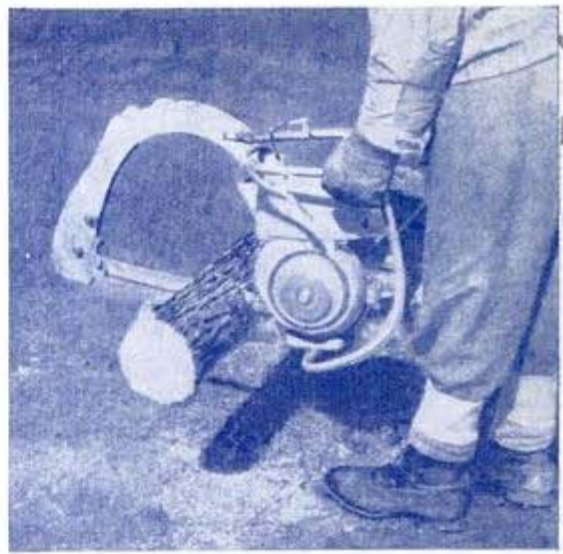
Suppose you are driving out into the country and come to a long sloping downgrade. You close the throttle, just as you would in an ordinary car, and the flame goes low in the boiler, for no pressure is being used. Even while the engine is idling, air is pumped into the tank to maintain a constant pressure. To back up, a control on the left of the steering column changes position of the cams for reversing.

The inventor compares his single control for regulating speed and power to the control lever of an electric motor. The smooth operation of the Perrymobile is due to the fact that the power output is the same at all speeds—from 1 r.p.m. to 2,000. On a gasoline engine the horsepower is in direct ratio to the r.p.m.'s.

Even at full power with the throttle valve wide open, Perry says his engine runs so cool that the paint has never blistered on the cylinders. This makes the car adaptable to extremes of climate for the liquids in it do not freeze unless the mercury drops to 30 below zero. The engine turns over slowly. At 40 miles an hour it revolves only 800 times a minute compared with 2,000 or more for most present-day cars.

Other advantages of the Perrymobile, according to the inventor, are the "parts it does without." These include clutch, carburetor, spark plugs, distributor, coils, battery, fan, gear box and self starter. The car, of course, is equipped with brakes. Perry estimates that it will require less than one quart of lubricating oil a year. The Perrymobile makes no noise, smoke or smell. So smooth is its operation, he reports, that in a blindfold test it is impossible to tell when the car starts moving.

It cost Perry about \$400 to build his lightweight automobile, but he says it should sell for much less if it gets into mass production—about \$250. He believes the air-vapor engine can be used on helicopters and boats as well as automobiles.



Self-contained and weighing only 38 pounds, a bow-type power chain saw which works equally well on soft or hard wood can be operated by one man. With an attachment for two-man operation, the saw can be used for felling or crosscutting. Its motor is air cooled and develops 3½ h.p.

### Dial Computes Withholding Tax On Nearest Dollar of Income



What you should have deducted from your paycheck for federal income taxes in 1945 is determined simply and quickly with a large circular dial. The calculator automatically gives the correct amount of tax for from one to 10 dependents. All that is necessary is to turn the outside dial showing the amount of salary to an indicating slot where the amount of tax is shown.

# Superdestroyer Packs Punch of Prewar Cruiser



Ready to help the Navy deliver a death blow to Jap sea power is a new 2,200-ton superdestroyer of the Allen M. Sumner class. This warship packs such a lethal

punch that it would have been classed as a cruiser in World War I. In addition to its superior firepower, the superdestroyer has higher speed and great maneuverability.

## 2,000-Mile-an-Hour Wind Tunnel Tests Aircraft Models

Wind velocities more than twice the speed of sound can be produced in the Army Air Forces' new supersonic tunnel at Wright Field, O. The largest supersonic tunnel for aeronautical research in the world, it is capable of a maximum airspeed that would correspond to about 2,000 miles per hour at sea level. The test section of

the tunnel is fitted with an assortment of scales, gauges and other measuring devices which record lift, drag, side force, rolling, yawing and pitching movements of any airfoil under test. The tunnel also has two concave mirrors 36 inches in diameter for making photographs of the "invisible" shock waves that form at high speeds.

## "Featherweight" Aluminum Drum Carries Gas to China



More than 30 pounds lighter than conventional drums, a 21-pound aluminum gasoline drum has been developed for the Air Transport Command of the China-Burma-India run. The container makes it possible to carry hundreds of thousands more gallons of gasoline per month to the 14th and 20th Air Forces fighting in Asia.

## Radio Beam Guides Germans Attacking Through Smoke

Captured German field manuals reveal that both a radio beam system and rockets are used to guide troops attacking under cover of smoke screens. A portable radio beam projector operated from the rear defines a path 65 feet wide, along which Nazi signal corps men with lightweight receivers move as guides to the riflemen and grenade throwers slogging blindly forward through the artificial fog. Rockets fired toward the objectives trail guide lines behind them for about 1,000 feet. When the attackers come to the end of the lines, they can launch more rockets to carry the guide lines another thousand feet forward and thus keep infantrymen from straying.

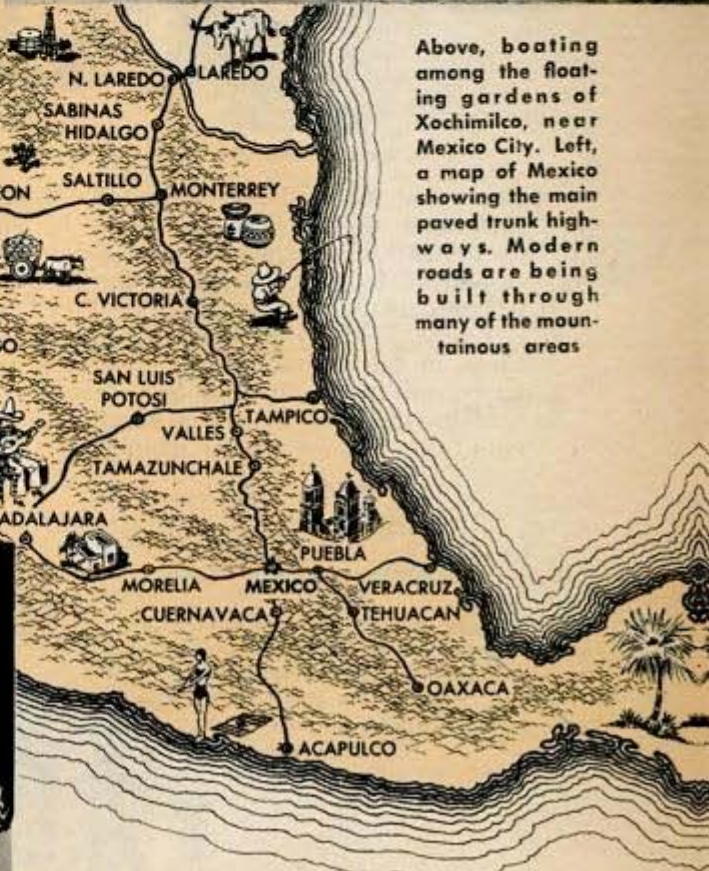
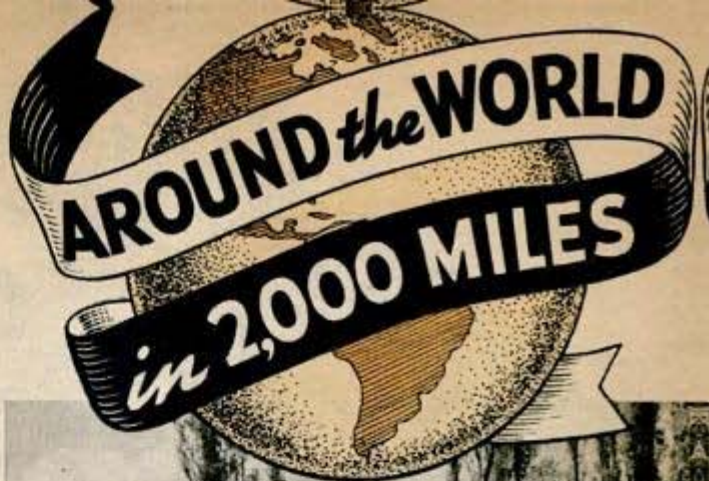
**H**OW about a trip around the world, or at least a reasonable facsimile of it, for your first vacation after the war?

Now wait a minute!

You don't need to be a millionaire, nor do you need to waste weeks in ocean crossings. You can drive your own car and be home again two weeks from the time you started. You need spend no more than you would spend while touring at home.

In two weeks you can visit steaming tropical jungles, play in the snow that covers the tops of extinct volcanoes 15,000 feet high, take pictures of pyramids that compare with those of Egypt, inspect cities that rival those of Europe in beauty and architecture, and drive through narrow, crowded streets that are reminiscent of the Orient. You can do all this and more on a jaunt through Mexico after V-day.

American vacationists were just becoming aware that a trip south of the border resembled a vestpocket journey around



Above, boating among the floating gardens of Xochimilco, near Mexico City. Left, a map of Mexico showing the main paved trunk highways. Modern roads are being built through many of the mountainous areas



Left, Mexican girl weaving a rug. Though many areas of Mexico show little of the influence of modern living, the country is expanding its industry rapidly



Above, stone carvings on the wall of the ancient temple of Quetzalcoatl, which is near Mexico City

the world when the war started. In the meantime Mexico has continued to improve its highway system and today you can drive to many parts of the republic without leaving pavement.

Traffic laws in Mexico are similar to those in the United States, distances are measured in kilometers, and gasoline is sold by the liter at prices about equal to what we are accustomed

to paying. Traffic signs, of course, are in Spanish. "Alto" means "stop," "camino sinuoso" means "winding road," and "conserve su derecha" means "keep to the right." Pamphlets that contain many useful phrases, including interpretations of highway signs, can be obtained at the border and at gasoline stations. Modern hotels and auto courts, at all of which English is spoken,



SCHOOL

Mexicans board a highway bus. The man at the left is carrying a grass raincoat on his shoulder. Some of the raincoats in Mexico are made of palm leaves



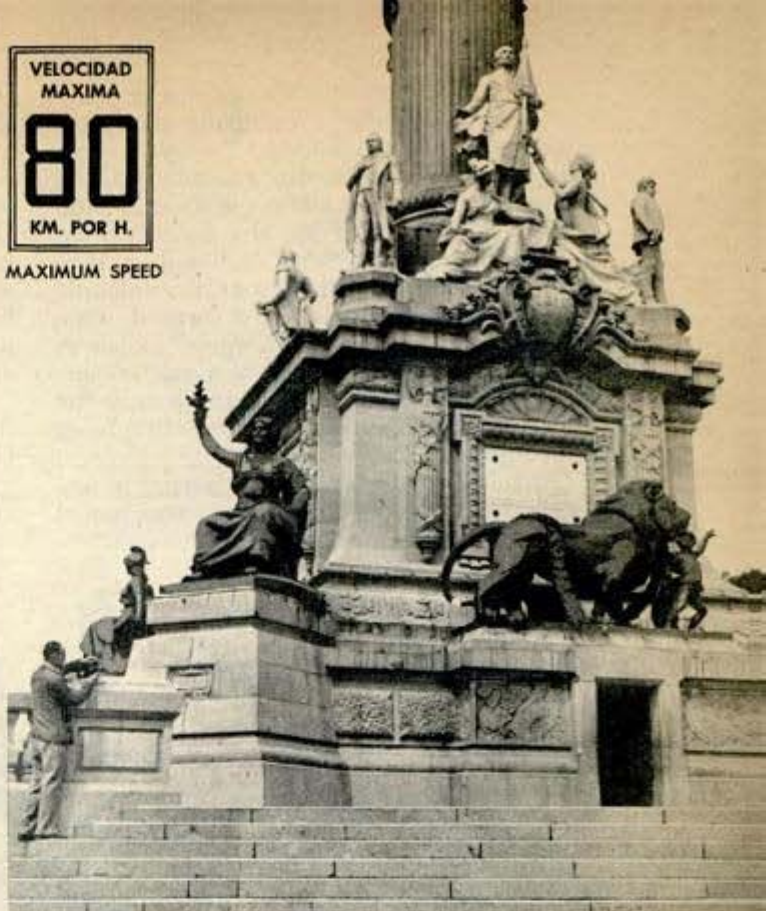
are found on the roads most apt to be frequented by tourists.

The peso is the Mexican equivalent of our dollar and one dollar in U. S. currency can be exchanged for \$4.85 in Mexican currency. Living costs have been quite low in Mexico in the past because of this favorable exchange but prices have been rising and today a visitor can expect to spend nearly as much as he would in the United States for comparable accommodations and services. All foreign goods are expensive in Mexico but goods of native manufacture, such as shoes and other leatherwork, silver jewelry, glassware and textiles, are quite inexpensive.

Mexico City is about as far from Laredo, Tex., as is Chicago from New York. You can make the drive in two days, although three days gives you more leisure to enjoy the sights. From Mexico City you can drive, still on paved roads, to Veracruz on the Gulf Coast, to Acapulco on the Pacific, south to Oaxaca, or northwest to Guadalajara. A round trip to Mexico City plus interesting side excursions is 2,000 miles or less from Laredo.



MAXIMUM SPEED



Above, a tourist photographs some statuary in Mexico City. The country is dotted with numerous landmarks worth visiting and photographing, including the two year old volcano at Paricutin



Above, Pyramid of the Sun in background of the old amphitheater near Mexico City. Right, wind charger at highway-railroad crossing in mountain pass charges batteries of electric train warning signal. Traffic signs are in Spanish; distances are measured in kilometers; gasoline in liters



STOP



A scientific curiosity that is worth visiting is the new Paricutin volcano about 150 miles west of Mexico City. Two years ago a native farmer felt the ground shaking under him, then ran when smoke and sand began shooting up from the field that he had been plowing. Sand and molten lava poured forth and within a month a volcanic cone 800 feet high had been formed. One river of lava, moving at a speed of seven feet per hour, flowed down to a small nearby village and covered it, leaving only the tower of the village church projecting from the cooling rock.

During the volcano's early period of activity the noise of its eruptions was heard

100 miles away, the ground shook constantly in its vicinity, and material amounting to some 10 million tons per day was erupted. A rain of cinders and ash fell over the adjoining country. In the city of Uruapan, 15 miles away, 80 tons of cinders were shoveled from the roof of one hotel alone. Now about 2,000 feet high, Paricutin has somewhat reduced its activity. It is under continuous observation by Mexican and American volcanologists.

Mexico is typical of most foreign lands in that it is not nearly as industrialized as the United States, even though it is rapidly expanding its industry. It has its own iron and steel mills, extensive textile mills, a

Below, a typical market scene in a small Mexican town. For many of these towns time seems to have little meaning. Life exists as it has for ages



Left, lava flowing from the Paricutin volcano has blotted out this village except for the church tower

large cement industry, and is preparing to become self-sufficient in many manufactured items. Primarily an agricultural nation, Mexico is busy with an agricultural education program by which it is hoped the production of some crops may be doubled. Large irrigation and drainage projects are being completed in some areas.

In keeping with its industrial program, Mexico is planning to utilize much of the petroleum tonnage that it shipped abroad in the past and it is also preparing to harness more of its rivers for additional electric power. One outstanding project is a hydroelectric plant that will generate



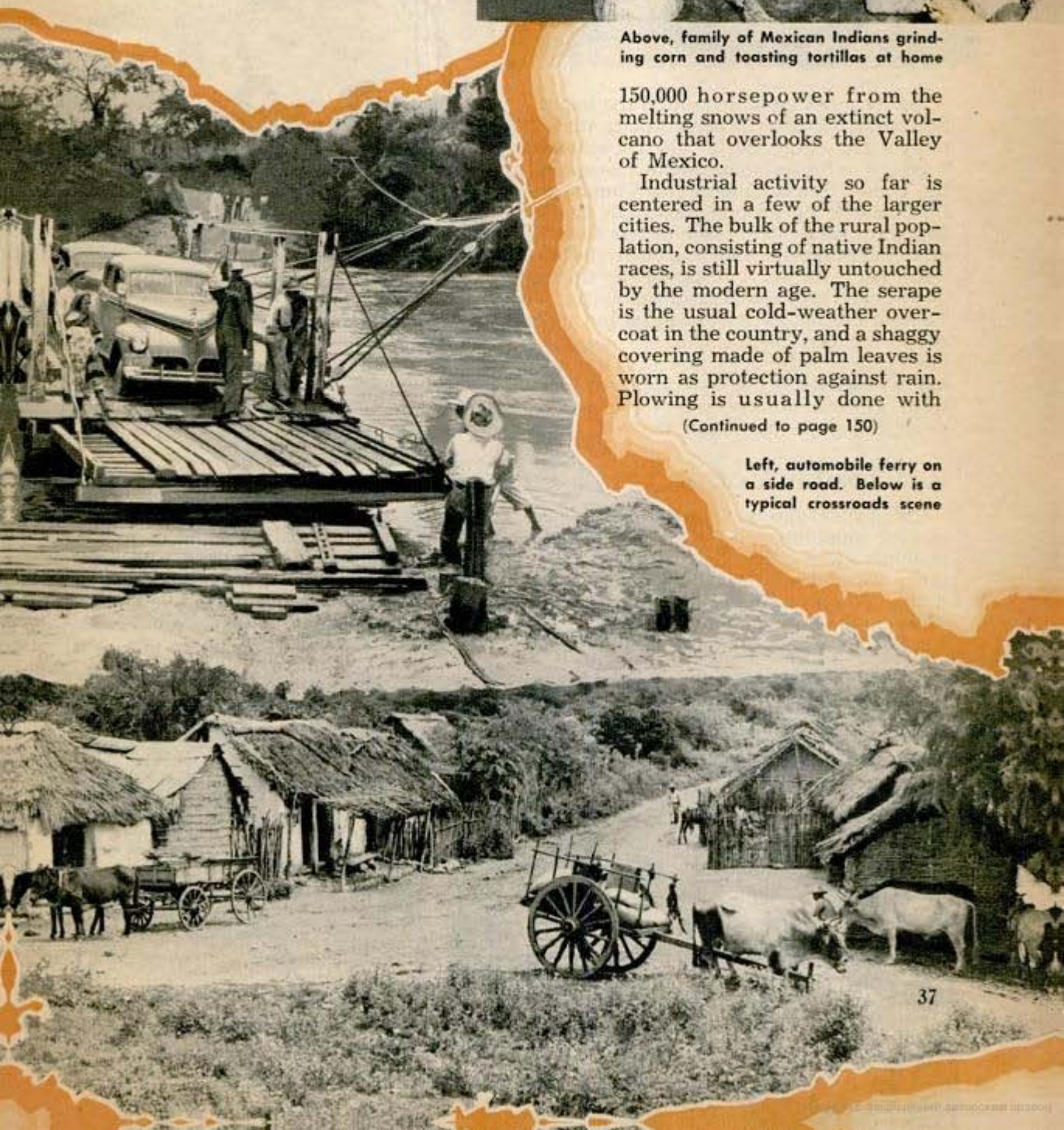
Above, family of Mexican Indians grinding corn and toasting tortillas at home

150,000 horsepower from the melting snows of an extinct volcano that overlooks the Valley of Mexico.

Industrial activity so far is centered in a few of the larger cities. The bulk of the rural population, consisting of native Indian races, is still virtually untouched by the modern age. The serape is the usual cold-weather overcoat in the country, and a shaggy covering made of palm leaves is worn as protection against rain. Plowing is usually done with

(Continued to page 150)

Left, automobile ferry on a side road. Below is a typical crossroads scene



# Spanish Train Goes 80 M.P.H. Around Curves



Left, the speedy Diesel-powered Spanish train viewed from rear. Below, the Swedish M-locomotive for use on steep grades

Eighty miles an hour around the mountain bends! That's the performance turned in by a low-slung, beetle-like Diesel train tried out in Spain, according to a report by the United States Chamber of Commerce. Besides roaring around mountain curves which ordinary trains take at less than 32 miles per hour, the train was clocked at 105 miles per hour on a straightaway during its test runs between Madrid and Zaragoza. To hold the lightweight train on the rails, Alejandro Goicoechea, Spanish designer, lowered the center of gravity until it is only half as high as any ordinary train. Axles were eliminated and wheels suspended separately with the result that car floors

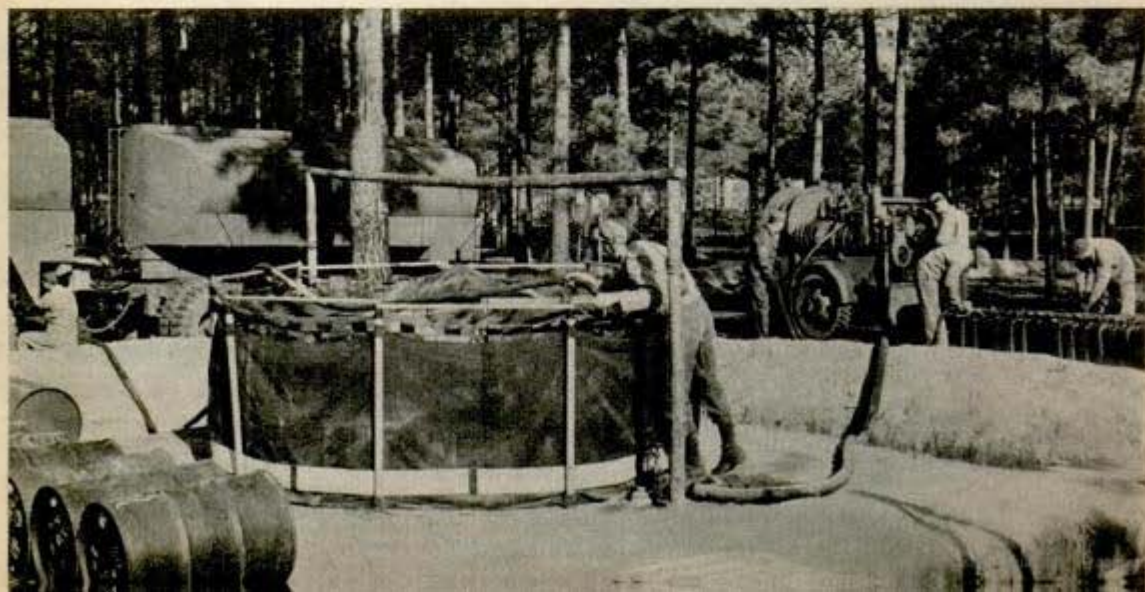


are only 12 to 14 inches above the rails. Another powerful foreign engine unveiled recently was the Swedish State Railways' new 3,600-horsepower electric M-locomotive, which was designed for pulling trains on lines with heavy gradients in the northern part of Sweden.

## Collapsible Cotton Duck Tanks Hold Fuel for Front Lines

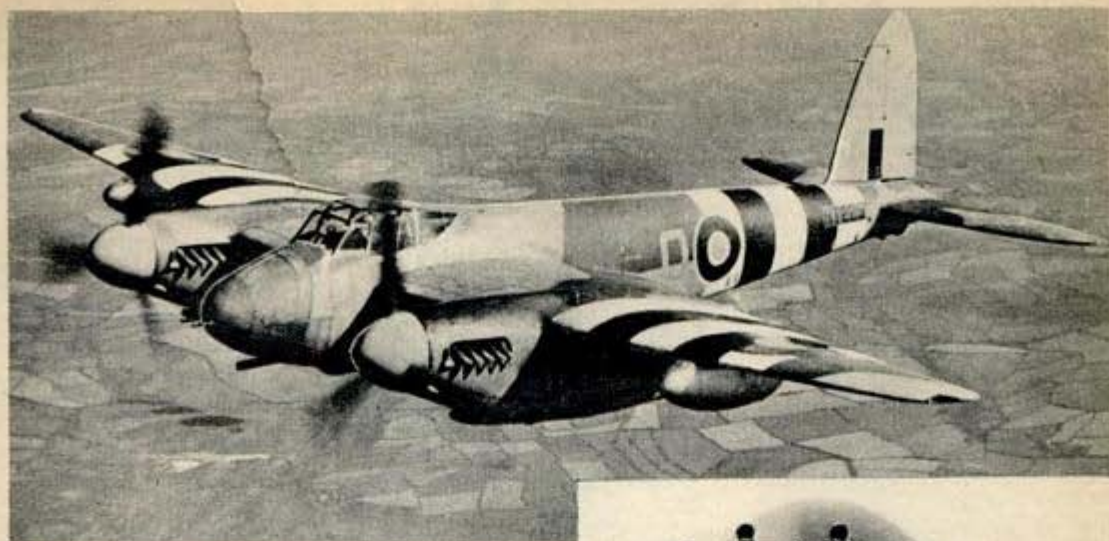
Collapsible gasoline tanks simplify the task of supplying jeeps, trucks and tanks pushing ahead to Berlin and Tokyo. The tanks are made of cotton duck impregnated with synthetic resins of the rubbery type. The containers come in 750, 1,000, 2,700 and 3,000-gallon sizes. The 750 and 1,000-gallon

tanks are transportable. Fitted with rigid plywood frames, they may be set up on the ground or mounted on flatcars when petroleum tank cars are not available. Four 2,700-gallon containers can carry approximately the same amount of gasoline as an ordinary tank car.





## Mosquito Wars on U-Boats With 6-Pound Shells



Top, a Mosquito in flight. Note 6-pounder under the nose. Right, crewman holds 6-lb. shell

U-boat commanders now have cannon from the air as well as cannon from the sea to worry about. The six-pounder cannon slung under the fuselage of the R.A.F.'s Mosquito plane can fire shells, at the rate of one a second, big enough to sink a submarine. It has proved so effective that U-boats now travel with an escort of flak ships, armed trawlers and fighter planes right up to their home port. Even there they are sometimes attacked by Mosquitoes as they lie at their moorings. The Mosquitoes likewise use their 6-pounders, which are sisters to the antitank gun employed against German Tiger tanks, to attack destroyers, tankers, and other Nazi craft, in one instance even making a direct hit on an enemy plane in the air. When the 6-pounder is fired, the aircraft suffers a slight jerk which does not affect the accuracy of the pilot's aim. The Mosquito also carries four .303-caliber machine guns.



## Plastic Tube Pipes Fumigant Into Insect-Infested Sacks

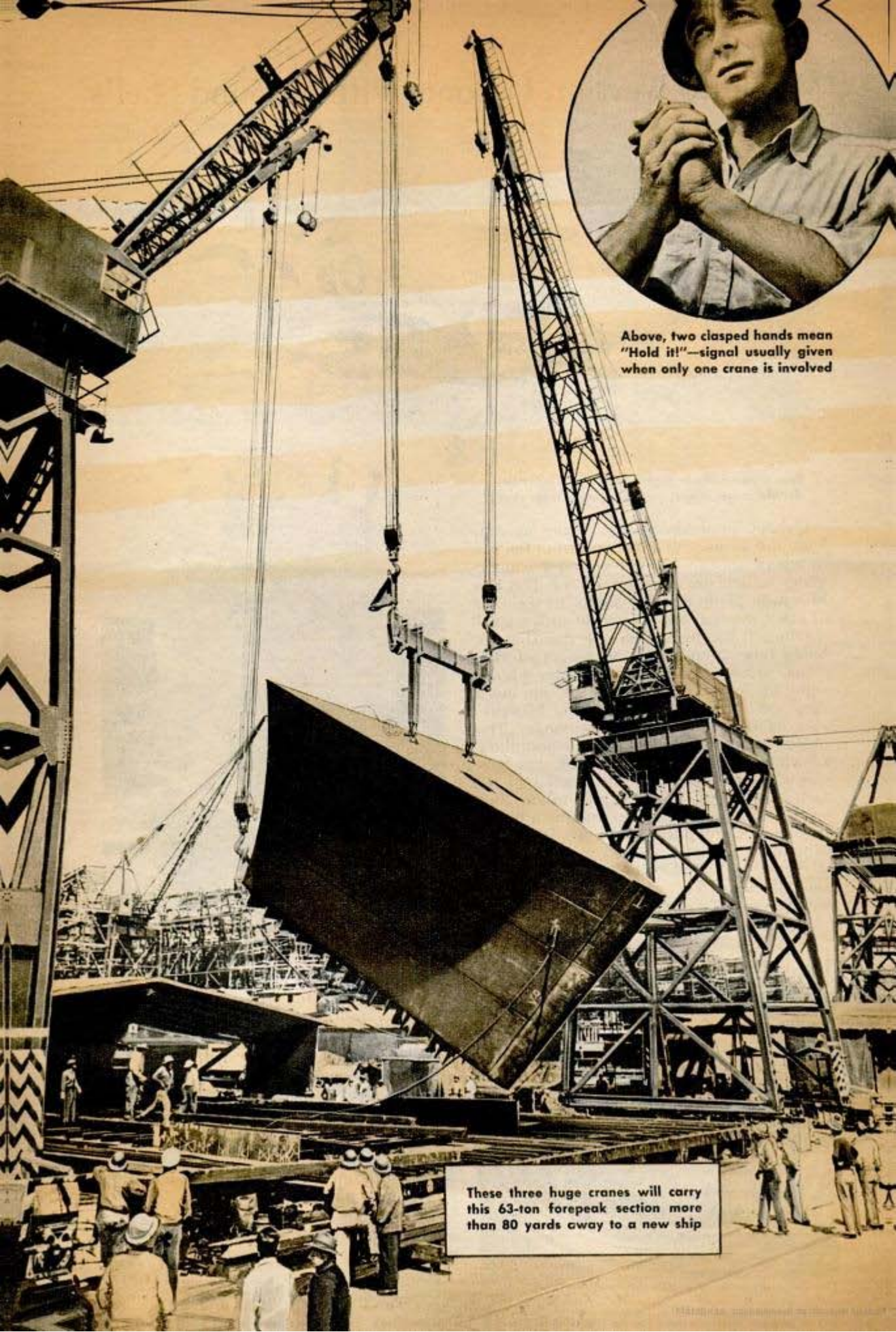


Dow Chemical Company photo

By creating a "death chamber" with a tarpaulin, large stocks of warehouse bags can be rid of insects without moving a bag. First, the end of a plastic tube is placed as close to the center of the pile of bags as possible, then the bags are carefully covered with a plastic-coated, gasproof tarpaulin. The plastic tube feeds gas from a can of methyl bromide under the tarpaulin, and under normal conditions the process should kill all insects in the bags in 12 hours. The gas does not affect the germinating power of seeds and the method is applicable to freight cars, ships and docks.



Above, two clasped hands mean "Hold it!"—signal usually given when only one crane is involved



These three huge cranes will carry this 63-ton forepeak section more than 80 yards away to a new ship

Right, complicated rigging gear like this at California Ship Corporation's Los Angeles yard makes it possible for huge gantry cranes to accomplish difficult lifts. Below, in shipyard sign talk crossed arms mean someone is injured and a stretcher should be lowered by the crane to pick him up



At right, a signalman's right hand means "swing to left." His left hand means "travel forward"



Below, by thumbs down, signal crane operator is told to lower boom



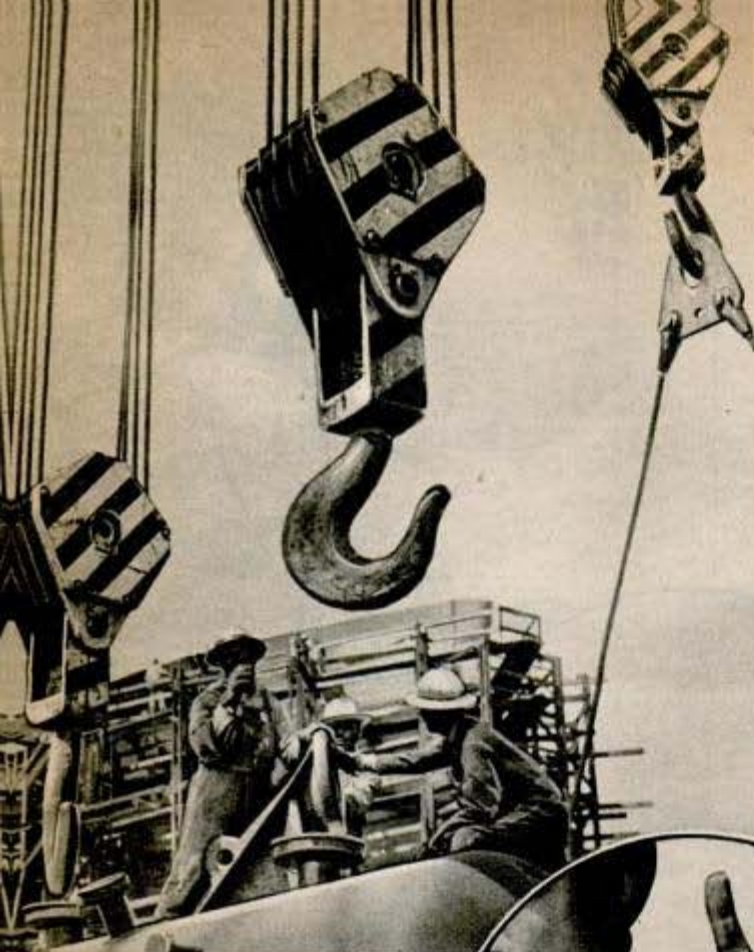
## Shipyard SIGN TALK

**A**LERT and nimble rigger signalmen have the dangerous job of acting as an extra pair of eyes for the men who operate the huge gantry cranes which facilitate the prefabrication of ship sections. The cranes carry the sections to the shipways, where they are assembled like giant jig-saw puzzles, instead of being laboriously fabricated on the ways. By a system of visual hand signals, the riggers tell the crane operators, who ordinarily can't see their loads or hear anything above the din, how to maneuver their loads safely into the ship being assembled.

Clenched hands, for example, mean "Hold everything!" while rolling the hands as if they were turning a wheel directs the craneman to travel forward or roll the crane on its tracks. If a worker

Crane operator (right) works speedily and safely by reading hand signals of workmen far away





stilt-legged cranes, each of which weighs 140 tons and has a 45-ton boom capacity. The cranes work singly or in pairs. The 85-foot boom can reach 120 feet above track level.

The riggers' work is heavy, fast and hazardous. They must tie and untie loads and, like deaf mutes, use their fingers and hands to guide the loads through tight places, usually leaping and climbing about with the agility of acrobats. Sometimes they must guide a cranky 10-ton load past a clutter of obstacles to the bottom of the hold.



Above, rubbing the palm means "take it easy." Below, riggers and machinists lowering turbine gear assembly into ship, coached by signals from above

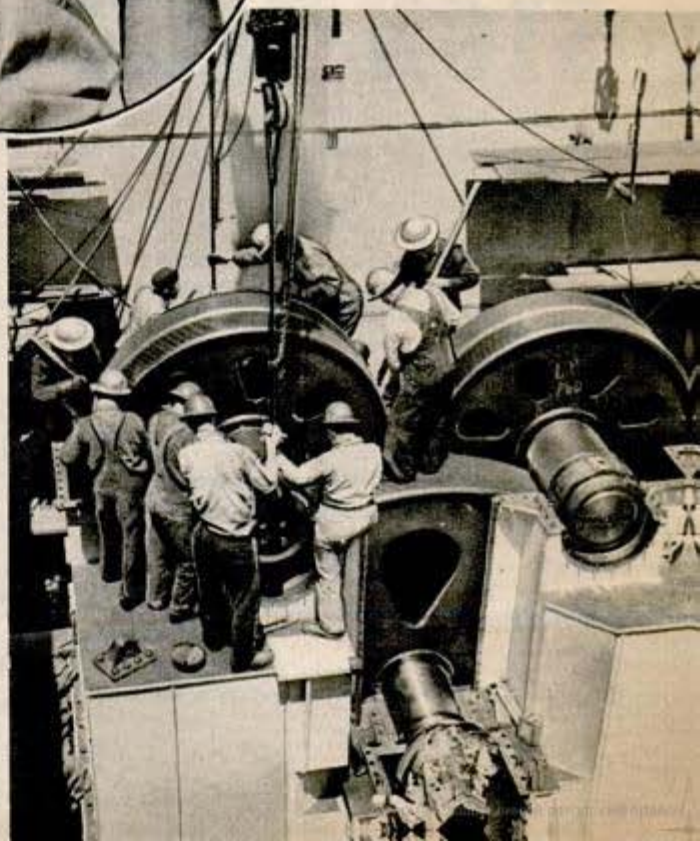


Above, crane hoists about to lift a ship's boiler. Right, circle means "hold" (of ship), three fingers, No. 3 hold. Below, "load-goes-to-deck" sign



is hurt on the ship, the signalman calls for a stretcher by crossing his arms over his chest. The crane operator lowers a steel stretcher into the ship and lifts out the injured man.

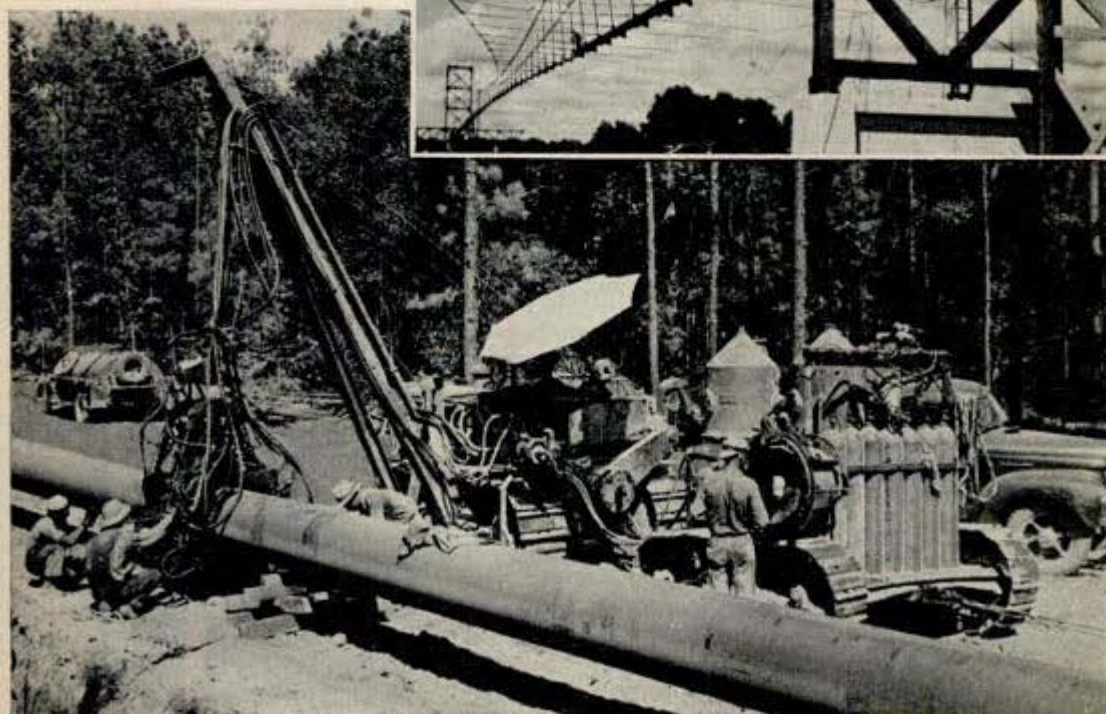
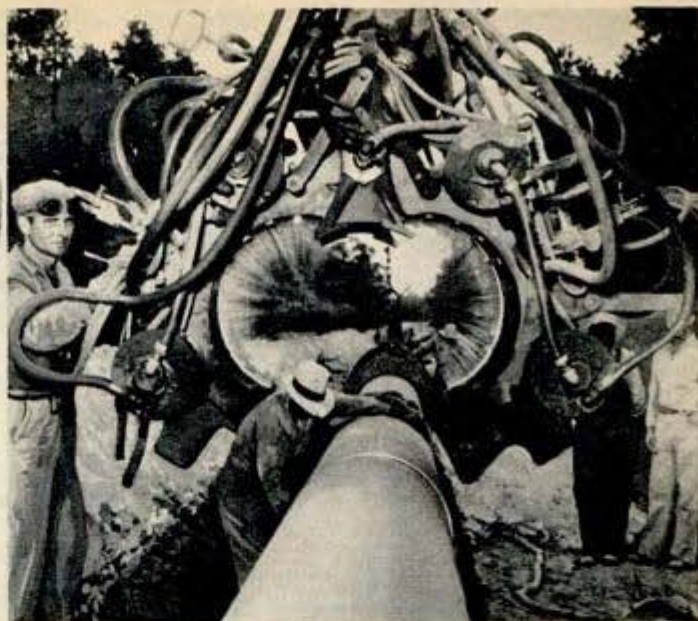
Steel decks, bulkheads and machinery, as well as bolts, paint, wire and pipe, are hoisted into place by the



# "Octopus" Welder Speeds Laying of Pipeline



Laying hundreds of miles of pipeline to carry natural gas from Texas to West Virginia was speeded up with a pressure-welding process to join sections of 24-in. pipe. Before welding, the beveled end is cleaned of rust with a portable grinder (above) mounted on a self-centering spindle within pipe. Top right, ring of fire from 365 burner jets in the welding head surrounds abutting ends of pipe when lowered. Hydraulic rams close twin clamps which seize abutting pipe ends. The hydraulic leads, gas and oxygen hoses, and connections for lines in water cooling system give the unit appearance of an octopus. Center, pipeline crosses a river. It has 24-hour capacity of 207 million cubic feet of gas. Below, welding head suspended from tractor's side boom



# They BRING 'EM OUT ALIVE



Above, rescue team enters experimental coal mine at Bruce-ton, Pa., after simulated disaster. The men wear electric cap lamps, protective caps, safety-toed shoes, breathing apparatus, etc. Left, the team emerging from the mine after practice rescue. An all-service gas mask is worn by the "vic-tim." This mine is a "proving ground" for engineers who specialize in mining safety. Below, reviving canary affected by gas in a mine. An oxygen tank is at the right. Bituminous Coal Institute photo

**T**HE war that never ends is the battle for life deep in the coal mines. There is no armistice with the underground forces of nature. Terrific explosives are set off in this war. Deadly poison gas imperils the miners. Booby traps in the way of rock falls and hundreds of other hazards beset their paths. The subterranean war has its thunder and crackle resembling distant shell fire and the miner, like the soldier, has trained ears which instantly warn him to seek safety.

Today Uncle Sam's army of miners, mine owners and safety technicians has achieved the immediate objective of keeping the mines working safely to produce the materials of warfare. But it is anxious to expand and intensify its campaign against mine hazards in peacetime, when worn or outmoded equipment can be replaced. The campaign will be led from the office of R. R. Sayers, director of the Bureau of Mines, Washington, D. C., and from the "proving ground" of the mine safety army—a novel experimental station at Bruce-ton, Pa.

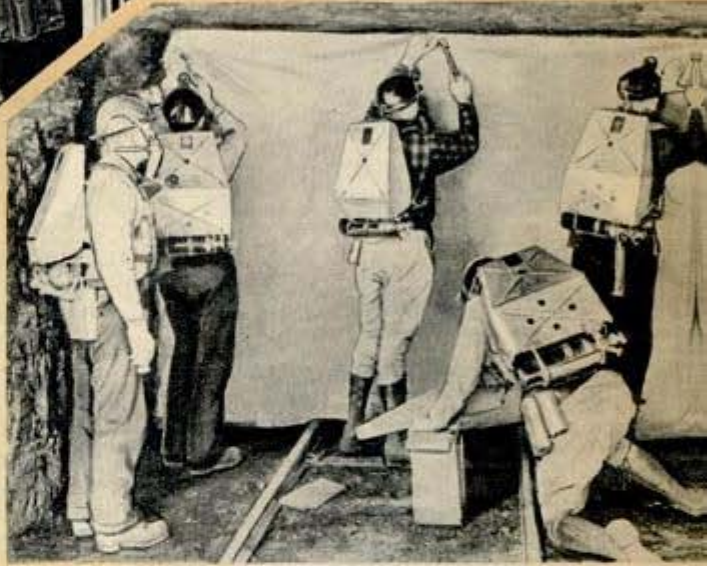
In the Bruce-ton "torture chamber,"





Wearing oxygen-breathing masks, men (above) come out of mine with samples of dust and poisonous gases created by blasting. Lower right, holding anemometer, safety man checks ventilating efficiency

Below, practicing building temporary blockade which is used if ventilating system is damaged  
Bureau of Mines photo



mine disasters are made to order. Great explosions are manufactured. Gusts of flame flash and clouds of choking smoke roll through subterranean chambers and passages.

Equipped with gas masks and other safety devices and employing test tubes, chemicals, axes, picks, muscles and brains, the experimenters live in constant peril. What they learn saves the lives of other soldiers in the army of miners scattered across the face of the nation.

Fires are set in veins of coal. Then barricades are erected against them, science, mathematics and chemistry are employed and soon the flames are smothered.

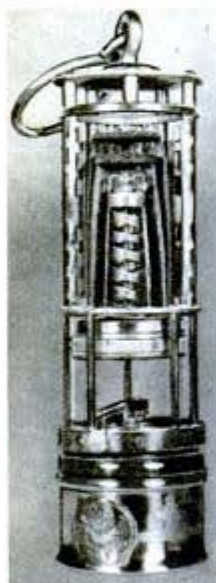
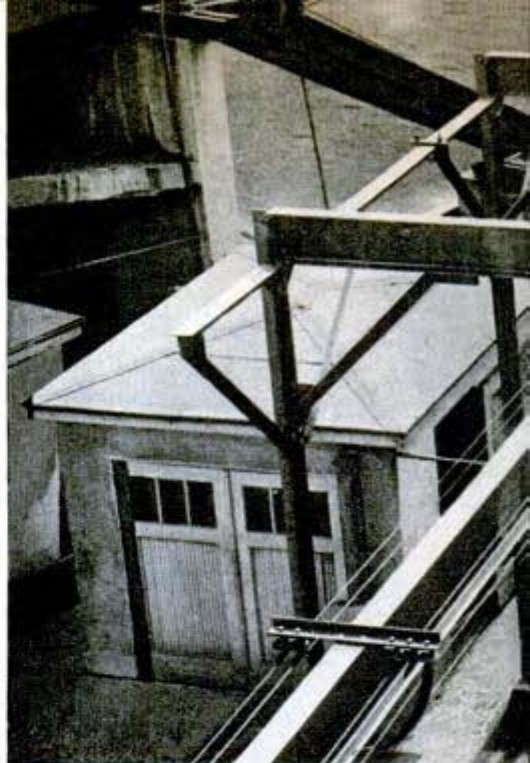
Electrical equipment is placed in a gas "death chamber" of steel. If a spark ignites the gas, a report goes from the Bureau of Mines to the manufacturer: "Not permissible." As mining mechanism develops in this country, so does the danger from sparks of electricity. The public thinks of a piece of coal as an object which burns slowly and provides heat. But to the mine safety expert it's dynamite.

Safety technicians point out that a teaspoonful of coal, powdered so as to expose its surface to a maximum of oxygen, can be converted to a blinding and often fatal blast if it is ignited by the flame of a match or candle.





Safety experts try out telephone used by mine rescuers after disasters



Research by the Bureau of Mines proves that the application of rock dust, or finely powdered rock, to the interior of coal mines helps prevent coal dust explosions and also lessens the chance of coal dust "picking up" or carrying forward a gas explosion to other parts of a mine. It also has been found that the application of water, or water plus a wetting agent, keeps coal dust from being thrown into a cloud. Many coal mines in the United States now are "rock-dusted" and many use water or wetting solutions to curb explosion dangers.

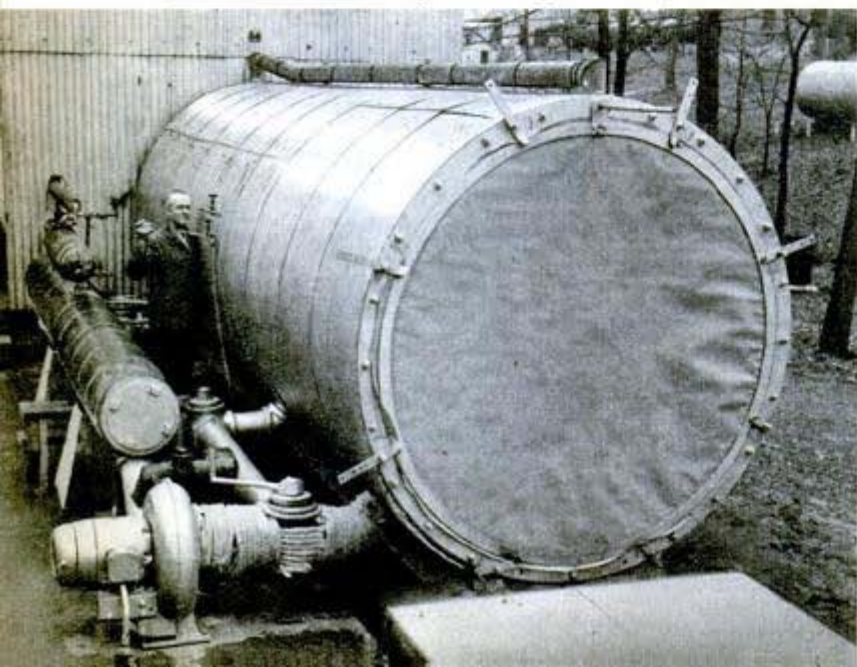
Thousands of dust samples from bituminous mines are tested annually by the Bureau of Mines to ascertain whether they contain sufficient rock dust to prevent their starting or spreading an explosion.

Various gases also are encountered in coal mines—carbon dioxide, hydrogen sulfide and methane; and, under some circumstances, carbon monoxide, sulfur dioxide and others. The most dangerous is methane, which is odorless, tasteless and invisible. This gas, liberated by coal beds, is found in thousands of coal mines of the United States and is highly explosive in certain concentrations in air—5 to 15 percent. Accumulations of methane in air generally are the source of explosions in coal mines.

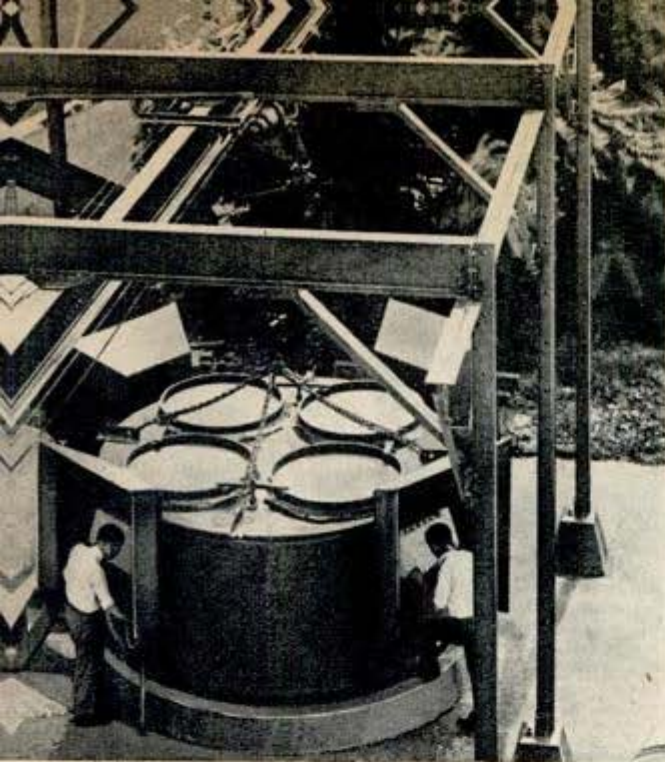
Left, cutaway view of flame lamp used for methane test. Safety of explosives is tested by detonating them in gas-filled chamber

When ignited, methane explodes with great heat and violence, killing men, destroying equipment and, in some cases, wrecking the interior of the mine. Once started, an explosion may be carried to many parts of the mine by stirring up and igniting coal dust.

Extensive tests by the Bureau of Mines have revealed that adequate ventilation will prevent methane from accumulating in dangerous percentages and amounts. Methane is detected by a flame safety lamp, tested and approved by the Bureau of Mines, or with a permissible methane indicator operated







dustrial plants. They have miles of electric wiring and haulage tracks, electric locomotives, and electrical switches. The Bureau of Mines constantly carries on research aimed at curbing shock, fire and ignition dangers created by the use of electricity underground and in combating hazards which accompany the operation of mechanical equipment.

Over a period of years, manufacturers of electrical equipment have developed coal cutting machines, drills, loaders and other machinery which will not ignite gas or

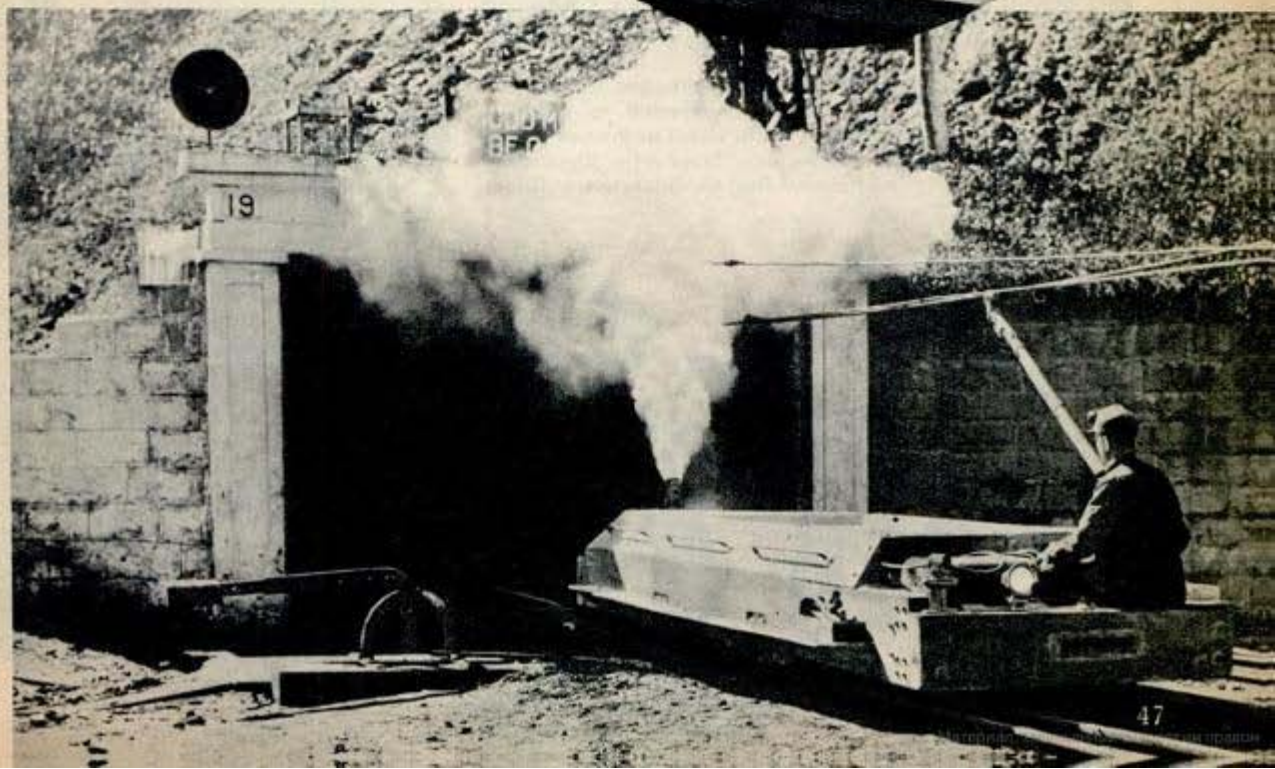
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Left, electrical equipment is operated in this chamber packed with explosive gas. If the gas is not ignited, and other tests are passed, equipment is "permissible"

electrically. The flame safety lamp roughly indicates the percentage of methane in the air through the varying height of a guarded flame—the higher the flame, the higher the percentage of methane.

The introduction of mechanical equipment to coal mines has increased production but it also has increased the hazards for workers. Modern underground coal mines are like surface in-

Right, testing a special "hard hat" for insulation against electrical shock. Below, rock duster dusting mine roof and walls

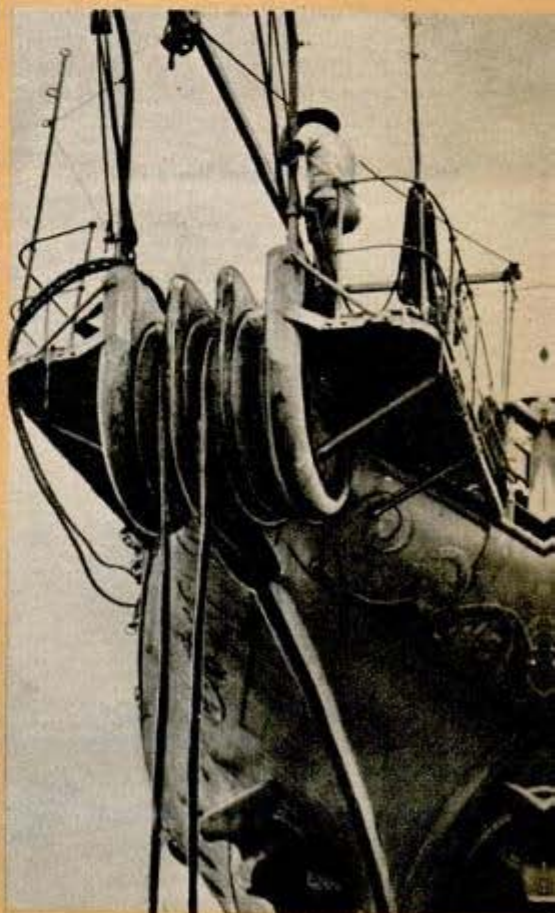


# GUAM IS ON THE WIRE

After a "blackout" of 2½ years, the Guam-Midway cable has been restored to serve the Navy's advanced operations base on Guam. The task involved hauling sections of the line (right) over the bow of the Restorer, cable repair ship, for examination. The 2,670-mile cable was severed before the Battle of Midway as a security step



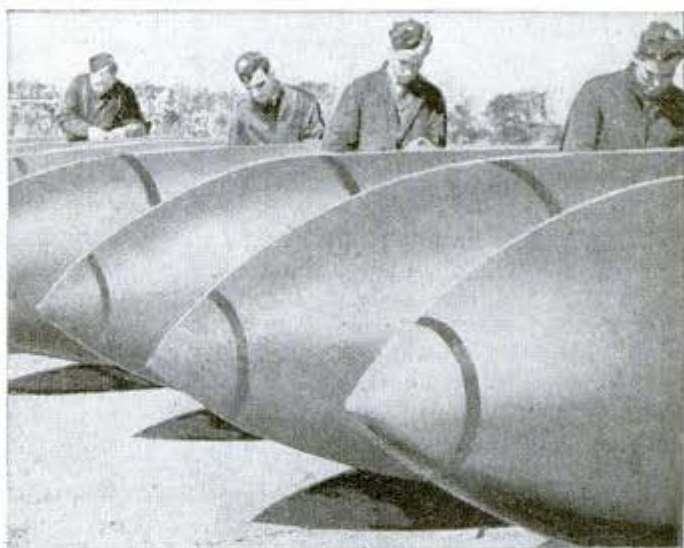
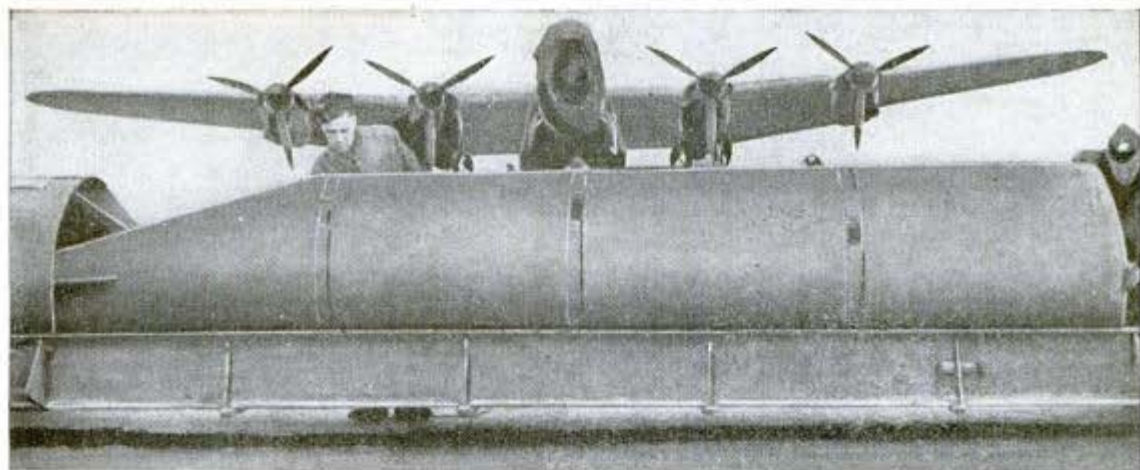
From this room (left) on the Restorer, engineers can localize a faulty spot in the cable to a five-mile area, though the ship may be 2,000 miles away. Below, bow of the Restorer with its large cable sheaves reeling in two separate cables. Grappling hooks were strung over these sheaves when the ocean was dragged to find the cable, which is world's second longest



After the cable was dragged ashore (below) enough was allowed to reach a Quonset hut which serves as the new Guam office for the line. Later Adm. Chester W. Nimitz moved fleet headquarters to Guam



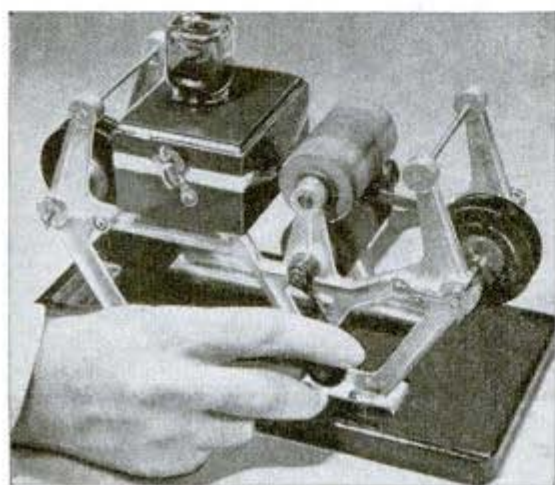
# Huge Bomb Drills Into Target Before Exploding



At top, one of the original six-ton "blockbusters" is readied for loading into a Lancaster bomber. The new six-tonner, lower right, has a sharply pointed nose and can pierce 12 feet of concrete before exploding

Described as the "most destructive air weapon ever used," a six-ton bomb which combines tremendous penetrating power with a blast like an earthquake is being

used by the Allies. The missile drills its way deep into the target, then sets off a giant charge of powerful explosive. The delayed action bombs pierced 144 inches of concrete in the Nazi submarine pens at Brest before they exploded; at St. Leu Desserant, where the Germans stored flying bombs, limestone caves were so completely collapsed they looked as if they had been undermined by an earthquake.



## Re-Inker for Typewriter Ribbon Makes Old One Like New

Typewriter and other business machine ribbons can be quickly and easily re-inked with a hand operated roller unit that doubles their life. The device was developed so that ribbons will not have to be discarded when they are only dried and not actually worn out. Both sides of the ribbon are inked simultaneously by the machine.

# MAPPING



WAVE at work on negative of ocean depths in hydrographic office. Right, placing floating signal marker for use by sounding boats

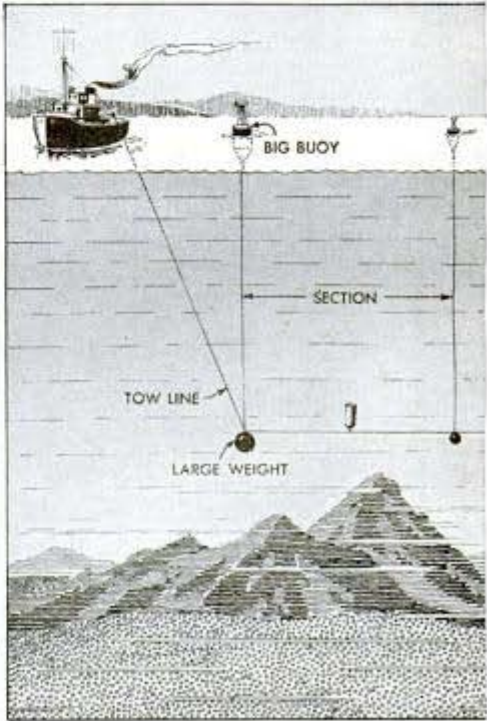
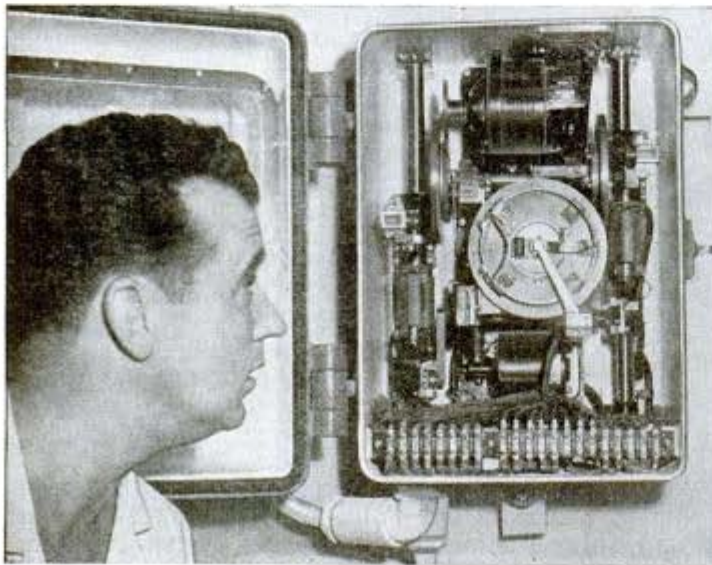
By Thomas E. Stimson, Jr.

THE South Seas are studded with islets and reefs that the world never got around to charting accurately, and this oversight became a serious matter early in the war when the Navy took up its task of helping kick the Japs out of the South Pacific.

Without reliable charts warships hardly dare to operate at high speeds, especially at night. Without precise information boards of strategy can't plan offensive operations. Not even a rendezvous for transshipping fuel can be scheduled ahead if sizes and depths of possible anchoring places are unknown.

Yet, miraculously, at the exact times that accurate charts of the waters off Guadalcanal or Tulagi or a dozen other areas were desperately needed, flag officers were able to distribute freshly printed charts to

Dead reckoning device makes record of courses and distances run



# the NAVY'S BATTLEGROUND

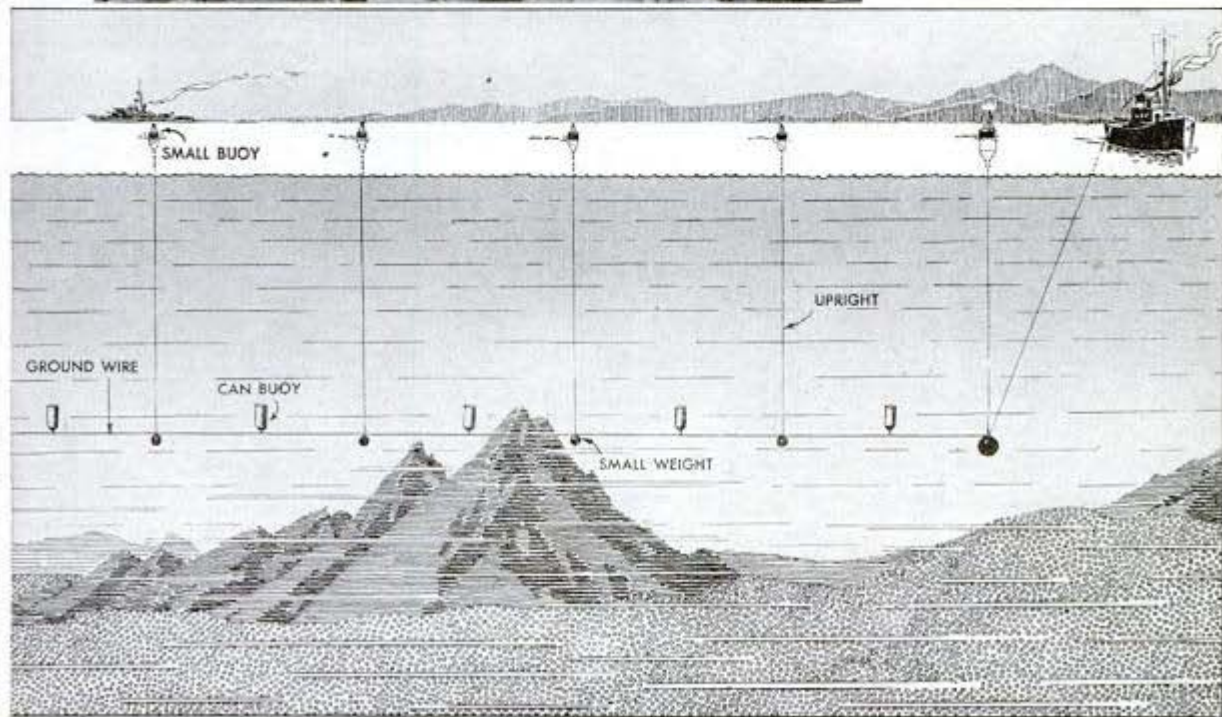
ship commanders. The story of how those charts were prepared, on the spot, makes a thrilling chapter in Navy history.

Details of the story are contained in the logs of the "Pathfinder," the "Oceanographer," the "Hydrographer," and other vessels of a special Navy squadron. These survey craft often poked their noses into Jap-held waters ahead of our fighting ships. They have been bombed, attacked by surface vessels, submarines and shore batteries, yet always they brought back information on which the advance against the enemy could be based.

The history of the "USS Oceanographer," now honorably retired from service, is typical of the work that the survey ships have been performing. Once the \$3,000,000 pleasure yacht of J. P. Morgan, the 300-foot ship began her naval career by sinking a submarine during the first World War. In the present war she was sent into the South Pacific and for 16 months performed dangerous and audacious solitary missions. The American attack on Bougainville was made with the aid of charts that her crew had compiled only a few days before. To gain necessary information, her

men often landed on Jap-held islands. During her duty 15 large navigational charts were completed on board, as well as a survey that covered 5,800 square miles of ocean. A representative task was the locating and noting of hundreds of coral heads and hidden dangers in the neighborhood of a 20-mile-long atoll. Once the "Oceanographer" discovered and surveyed a new channel that made possible a 120-mile shortcut.

Left, taking bearings on headland of island. Below, wire drag is towed by two small vessels





to be sure, yet the work must be done at the fastest possible speed. Sometimes a ship dares work only in the dark of the moon to escape detection by Jap aircraft or coastal patrols. During daylight hours she may lie camouflaged under the steep shore of some island. When running a line of soundings in deep water a survey ship often steers a zigzag course to minimize the possibility of a torpedo hit. On occasion the survey men have used a PT boat for a fast ex-

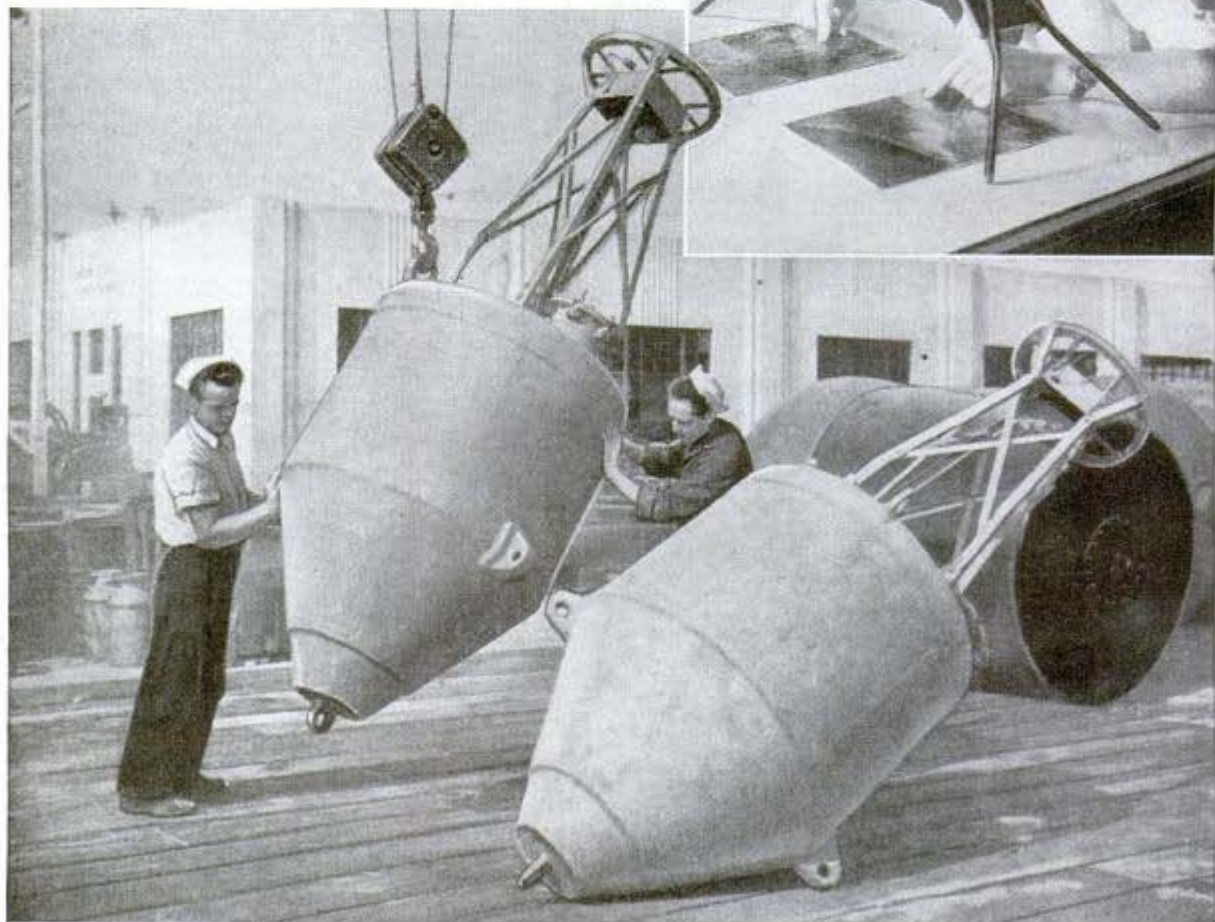
**Left, aerial photographs assist in making of chart. Below, examining photo with stereoscopic instrument**

(U. S. Navy Photos)

Ordinarily, underwater exploration is a leisurely and painstaking occupation. A survey vessel must proceed slowly to avoid wrecking herself among the obstacles she is charting. Measurements of depths and distances must be made with great care.

But the stress of war made the charting of the South Pacific an entirely different kind of adventure. Observations must still be made accurately,

These buoys are used by survey ships to mark danger spots



ploration trip right up to the entrance to a Jap base; other times they work from rubber life rafts, after dark, in shallow waters. An accepted hazard has been the possibility of being bombed by our own aircraft, for a pilot might disbelieve recognition signals flashed to him by an unknown ship deep in Jap territory.

When the war began, the best charts of some Pacific areas were mere sketches that had been made at the beginning of the century. Detailed maps had never been prepared because there was no commerce in the islands to attract



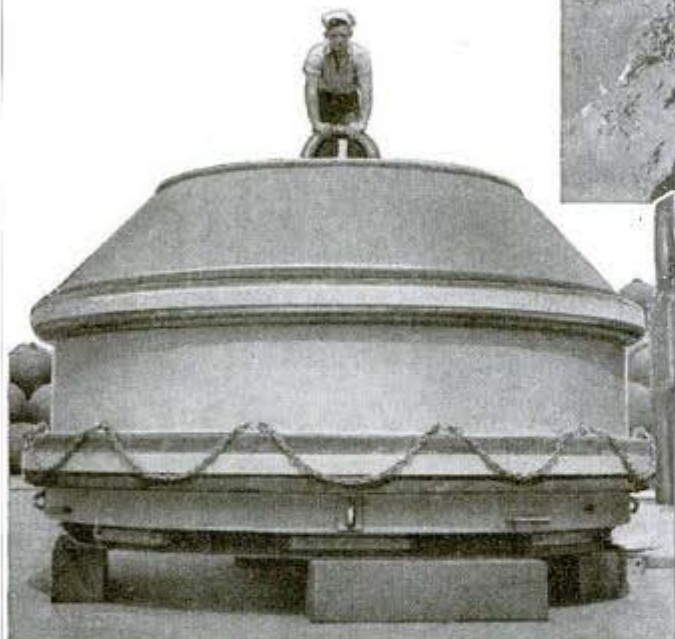
Divers on way to inspect underwater obstruction

the job was to place markers on reefs and rocks that couldn't be removed and to install other buoys for marking safe channels into protected anchorages. Sometimes old French buoys were salvaged and repainted but more often the men had to improvise their own markers from any materials that could be found. Many of the buoys that are now

in service consist of empty mine cases with sheet metal flags attached. Brand new amphibious "alligator" landing craft and weatherbeaten

native catamarans worked side by side in anchoring buoys.

(Continued to page 148)

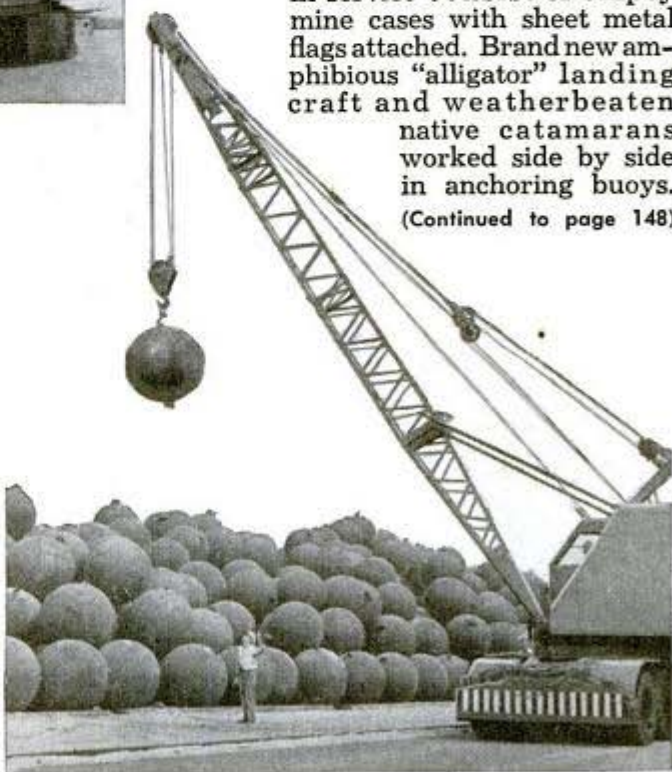


This giant buoy is now marking a channel in the Pacific. Right, crane picks up one of the steel ball floats that mark course

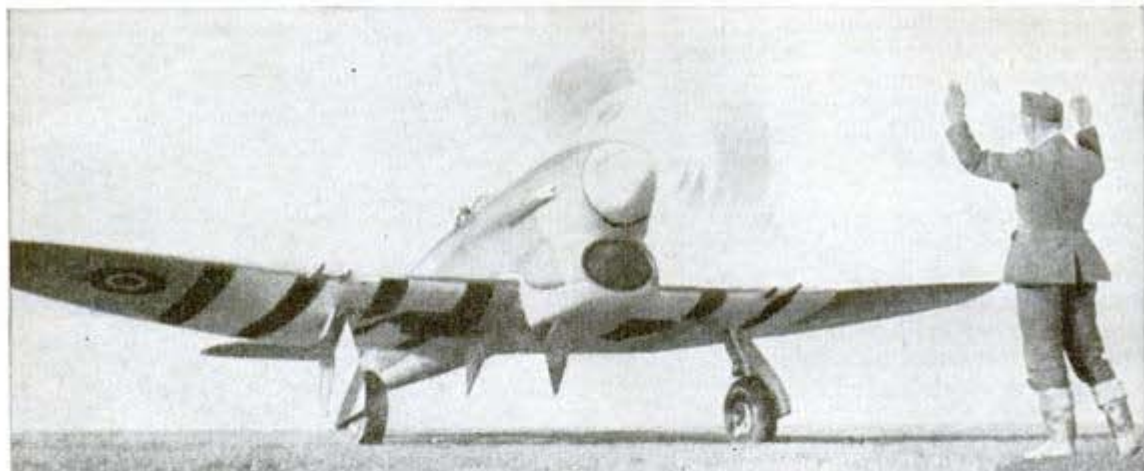
large ships. The main land masses were known and that was about all.

The Navy secured survey vessels in a hurry by taking over Coast and Geodetic Survey Service vessels, by building some, and by rebuilding others. Each was outfitted with drafting rooms so that cartographers could prepare their charts on board, and with photolitho and printing shops so that the finished maps could be reproduced in colors for immediate distribution to the fleet.

Each ship carried a deep-sea diver and TNT for him to use in blasting coral heads or submerged wrecks that might be blocking a channel. Each, too, was outfitted for buoy tending service. Part of



## 4-Cannon "Tempest" Chases Nazi Robot Bombs



Extremely fast, highly maneuverable and easy to fly, Britain's Hawker "Tempest" is known as the "dream fighter" among R.A.F. pilots. The Tempest, a successor to the Hawker Hurricane and Typhoon, broke into headlines when it was credited with knocking 600 flying bombs out of the sky, the best record for pursuit planes. Before D-Day it was hailed as an effective ground straffer when it softened

up German fortifications in France; later it operated successfully out of Belgian bases, specializing in fighting Messerschmitts and the Luftwaffe's swallow-tailed jet plane. The Tempest is a low-wing monoplane resembling the Typhoon but with the elliptical wing of the Spitfire and a high tail fin rising in a Flying Fortress curve. Powered by a 2,200-h.p. Napier Sabre engine, it carries four 22-mm. cannons.

## "Arabian" Water Bag Keeps Its Contents Cool and Pure



Borrowing an idea from the Arabs, U. S. Army engineers designed a collapsible 36-gallon water container. It is made of heavy duck covered with a synthetic plastic resin that permits a slight seepage of water through the bag. Evaporation keeps the water cool in the same manner as the Arabian desert water bag. A cone-shaped hood fits over the top to keep out dust and germs, and five faucets are located two inches above the bottom of the bag to avoid any possible sediment. The container, made by the United States Rubber Company, is 21 inches in diameter and 26 inches in depth.

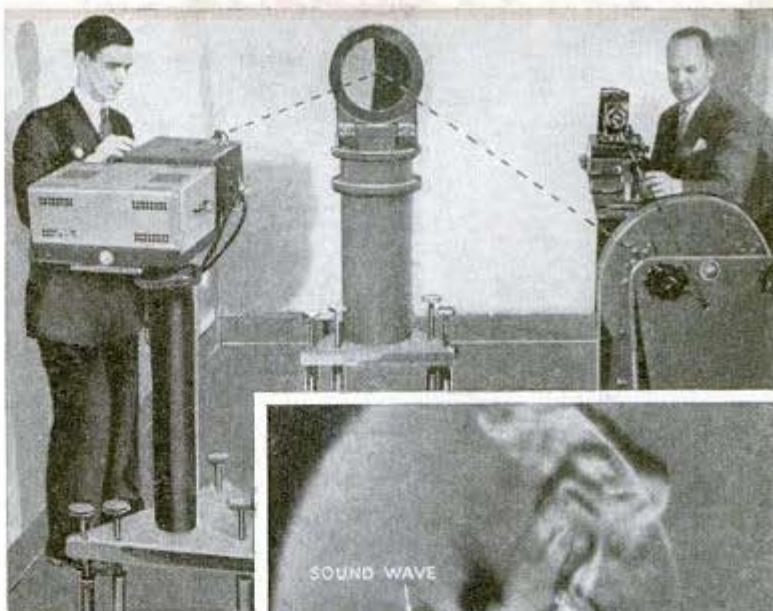
## Frozen Milk for Hospital Ships Tastes Like Fresh Product

Frozen concentrated milk, produced by research workers at Pennsylvania State College, can hardly be distinguished from fresh milk when diluted with hot water. The new product was developed for possible use on hospital ships. By adding an equal amount of water to a frozen block, coffee cream is produced; doubling the amount of water yields milk. The manufacturing process involves three steps: evaporation, preliminary freezing to a mushy consistency, then quick freezing at 10 degrees below zero after packaging.

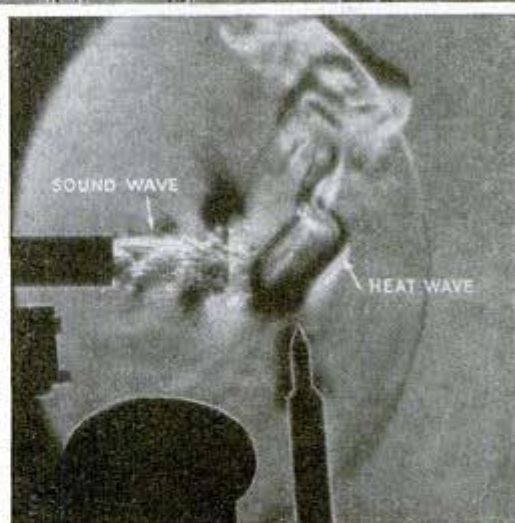


# Camera Photographs Waves of Heat and Sound

By means of a flash-light capable of exposures of four millionths of a second, a photographic technique which can take pictures of heat waves, sound waves and other invisible air disturbances has been developed by General Electric engineers. The technique depends on a new electronic device which not only supplies the illuminating flash at the right instant but also gives an exposure duration so brief that light from the flash has time to travel only a thousand feet. Two types of apparatus are used—the Schlieren method, in which photographs are made with a highly specialized type of optical system which requires infinitely fine manipulation and adjustment, and the shadowgraph method, in which shadowgraphs are made by using nothing more than a film holder, the disturbance to be studied, and a light spark source with extremely sensitive controls. The latter pictures show only the boundary conditions between regions of sharp variations in density or pressure, while in the Schlieren technique, where the sensitivity is many times greater, gradual variations can be recorded. The Schlieren apparatus



Above, in taking photo light goes from its source at left to mirrors and then to camera held by man. Right, sound wave from a gun blast as it is photographed passing amid heat waves generated by a soldering iron



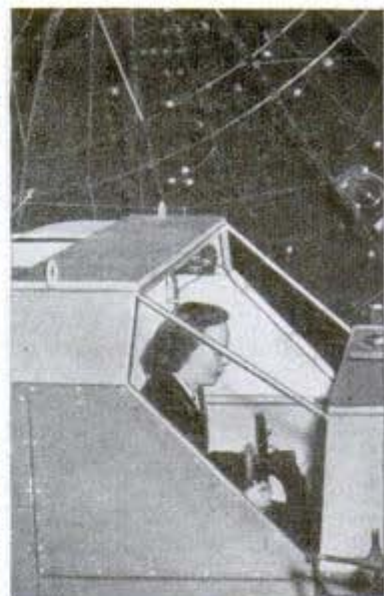
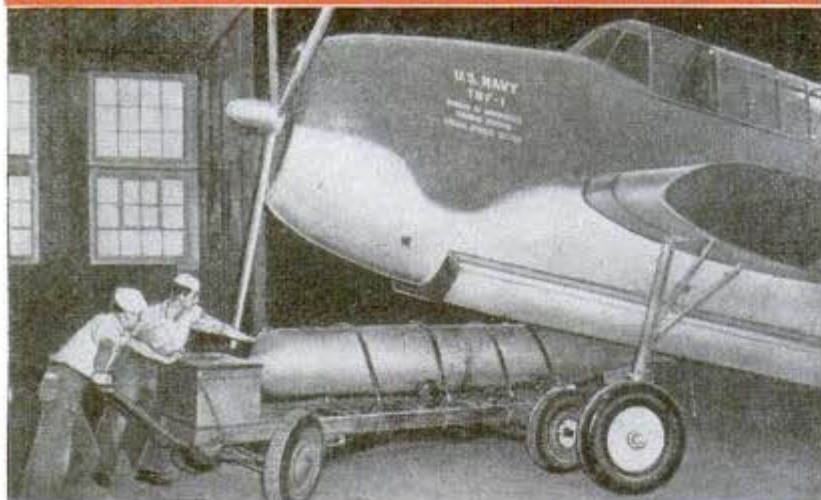
can show the breath coming from the nostrils, while the shadowgraphic method is usually adequate only for stronger disturbances. Either system can be employed to photograph sound waves or shock waves, provided an exposure of sufficiently short duration is obtained.



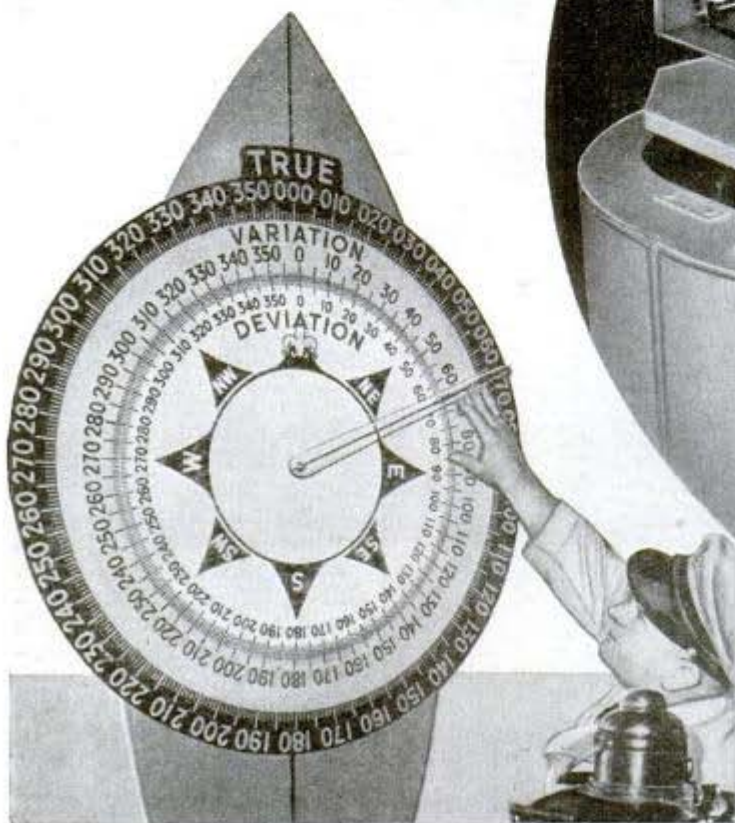
## Plug-In Conveyor Unloads Coal at Ton a Minute

Coal can be shifted from truck to bin at the rate of a ton a minute by a portable conveyor which plugs into any convenient electrical outlet and needs only two men, at most, to operate it. Its 15-inch width fits into any window. Powered by a 1-h.p. motor, the conveyor requires only two cents worth of current to unload 10 tons and can be carried on the fenders of a truck.

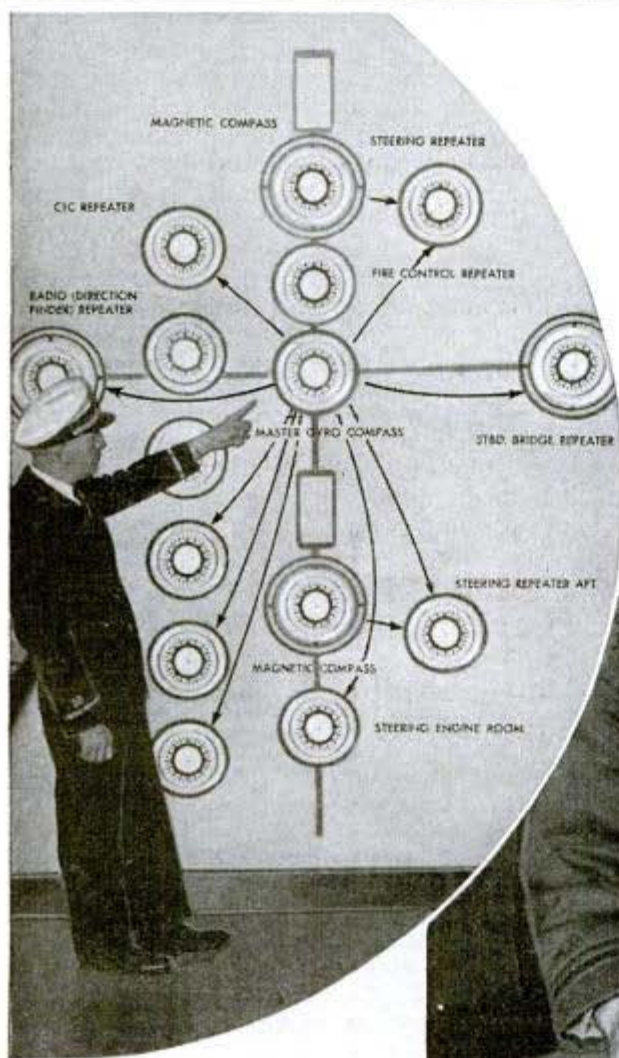
# LANDLUBBER *Air School*



Huge mock-ups and complicated devices are used to speed up the training of naval air crews under conditions which simulate the real thing. At Alameda, Calif., trainees (above) wheel a torpedo under a full-size wooden mock-up of a TBF. Right, to practice his accuracy on a moving target, overhead turret gunner looks through viewing window of a motion picture machine in which he sees a Jap plane coming in to attack him. His hand grips turn the trainer just as if he were operating a turret and the picture of the plane turns red when he is in position to score a hit



Left, cardboard compass on which corrections may be made so that a true steering course can be determined from magnetic compass

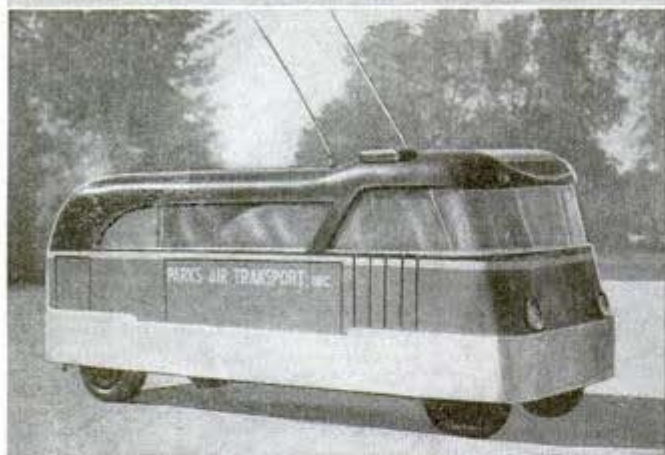
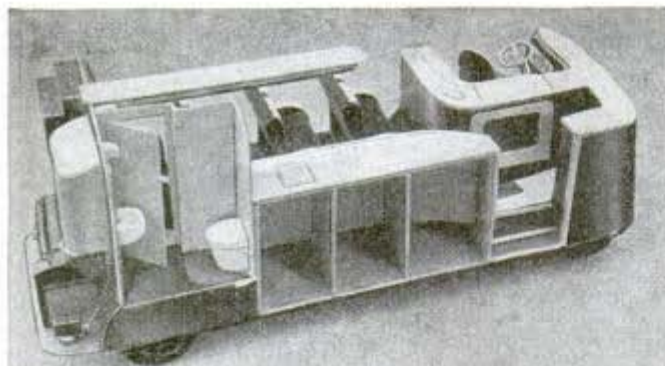


Upper left, student navigator takes a star sight in a navigational trainer, while a WAVE operates pilot's controls. The trainer is mounted high above the floor of a tall room and the ceiling contains lights which represent the stars. Student navigator gives his pilot courses to fly; their competence is recorded on a paper chart. Above them the stars rotate on a wire framework. Trainees attach spinner and arming-wire (above) to bomb secured to shackle under SBD's wing. Below, celestial compass that tells directions by stars is mounted on model plane base for a class lecture



Above, a diagram at Treasure Island Operational Training School shows types, number and location of compasses on warship

## Bus Acts as Mobile Terminal for Feeder Air Lines



A local bus which could double as a mobile terminal has been designed by Oliver L. Parks, president of Parks Air Transport, Inc., East St. Louis, Ill., for possible use in an air line feeder system. The bus would drive right up to the airplane wherever it stops, deliver and take off passengers, mail and cargo and in general serve as the air depot. The bus Mr. Parks proposes to install includes a two-way radio and everything from a ticket sales counter to toilet facilities. Among the special accommodations the design calls for are a loudspeaker and radio system enabling control of airport ground traffic or public announcements by the driver; a refrigerator for refreshments; recording floor scales to weigh passengers and baggage; an air conditioning unit; floodlights on roof to illuminate area between plane and bus, and a telephone plug-in. Chief purpose of the bus is to speed feeder air line schedules by eliminating delays at the airport, such as taxiing the plane into position.

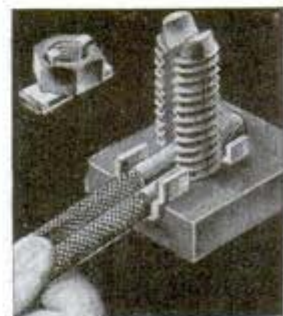
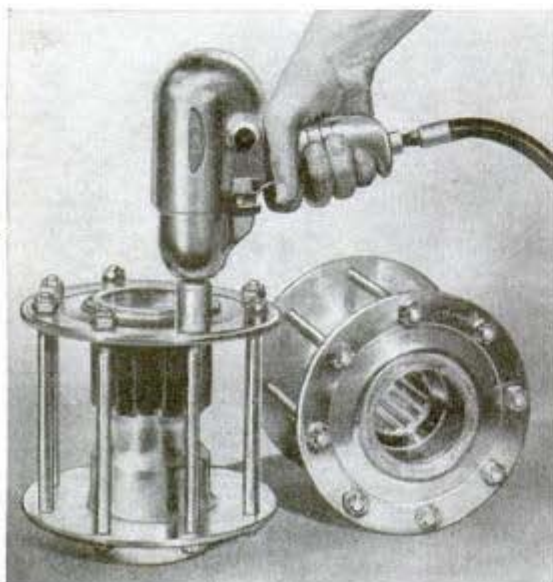
## Wrench With Torque Control Avoids 'Burning' Threads

To prevent stretching or "burning" of threads, a  $\frac{3}{8}$ -inch impact wrench which operates with controlled torque has been developed by the Aro Equipment Corporation, Bryan, O. This pneumatically powered tool is capable of both forward and reverse rotation and has a calibrated ad-

justing screw on the side of the motor which permits the operator to set any bolt or nut to any desired tension. The control is made possible by a roller clutch impacting mechanism having only four parts.

## Terminal Locks Wire to Wire In Non-Vibrating Connection

To save time, space and materials, an electric terminal block provides a solderless, vibration proof, wire to wire connection. The block is a connector strip with almost any desired number of terminal posts, each capable of handling from two to eight wires in the smaller ranges. The binding stud has a slotted channel, the wires being held in this channel between a top clamp or shoe built into the nut, and a lower clamp or shoe which is secured to the base. This arrangement locks every wire to a wire in a low-

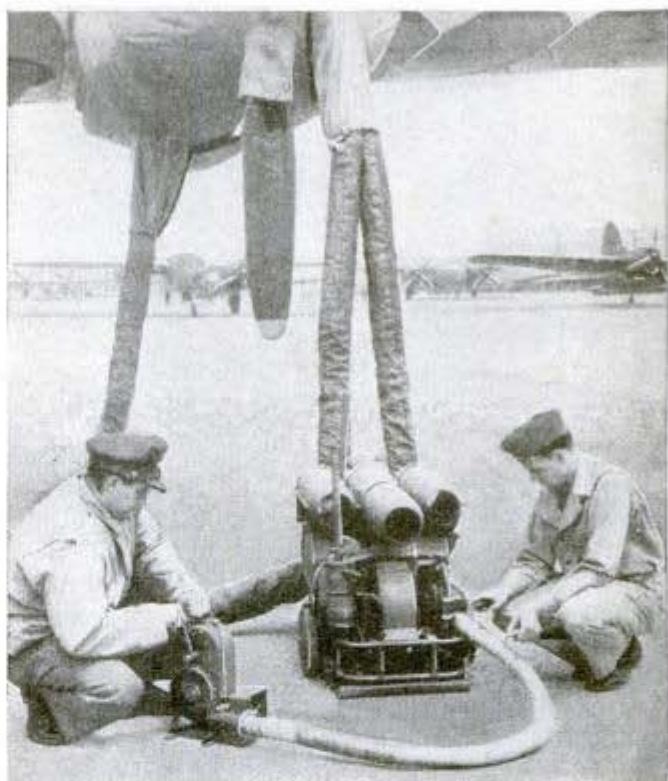


resistant connection, without danger of loose strands getting away. No lock nuts, lock washers, double nut arrangement, lugs or other accessories are required. The block obviates soldering, crimping, pressing or insulating, and no special tools other than the regular socket wrench or pliers need be used.

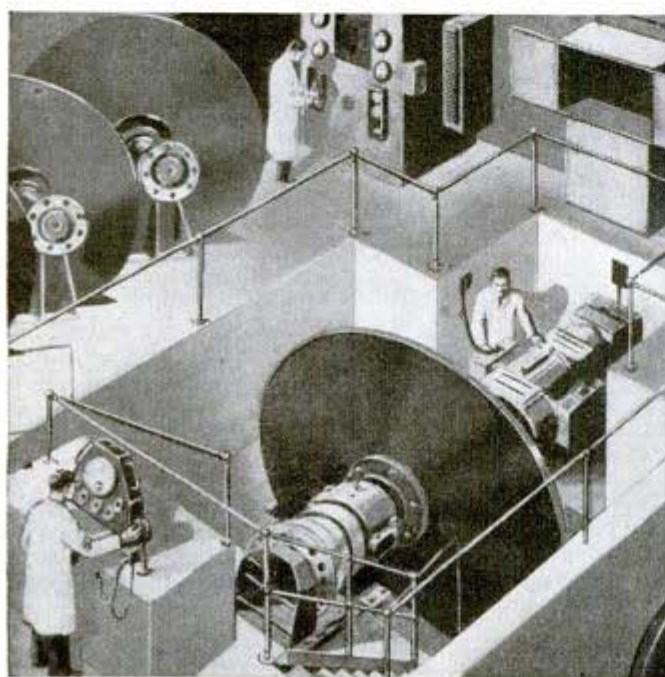
### Machine Prints Ticket While Customer Waits

To ease ticket problems of railroads, a machine has been developed which will print tickets automatically and do the company's bookkeeping while the ticket buyer waits. The invention eliminates the necessity of maintaining a stock of tickets for various destinations on the same road. Designed primarily for local or point to point tickets, it looks like a small cash register and can print up to 100 different stops. The tickets, two inches square, show the points between which they will be honored, the amount paid, whether it is one way or round trip, date of sale, identification of the salesman and serial number. Besides printing tickets, the machine tabulates all records for the ticket seller. The cost of printing 1,000 tickets, including paper, is less than 20 cents.

## Tiny Heater Warms Up Big One To Start Engines in Arctic



In the Arctic a tiny, manually operated heater is used by the Air Technical Service Command to heat up the big heater which in turn warms aircraft engines before they will start. The new heater was invented because the severe cold freezes up the large ground heater.



### Flywheels Test Brakes In Trial "Landing"

To try out the braking systems of the heaviest British aircraft, under all working conditions, the "landing" of a plane is simulated by flywheels in a laboratory. The test apparatus has a range of flywheels geared to shafts. A wheel corresponding to the size of the brake to be tested is fitted to the machine for each test. By using the largest size, the kinetic energy—40 million foot pounds—of a 53-ton airplane landing up to 100 miles an hour is reproduced. Decelerations, stopping times, temperatures, and rates of wear and tear are recorded during the braking runs. The machine has aided greatly in evolving the best braking systems for bombers, troop-carriers and transport planes.

## The LATEST in COLOR



Above, photographer checks lenses to be used in color camera. Below, comparing fidelity of finished color test prints with original shades of color on color wheel. Color film now can be processed in the home



**T**RUE-TO-LIFE color films and color papers that you can easily develop and print in your own home darkroom are on the market in limited amounts and will be available everywhere after the war.

With the new color films you can take natural color photographs with almost any camera, then process the film into positive color transparencies. These transparencies in turn can be used like negatives for making contact prints or enlargements on color paper. The results are astonishingly lifelike, reproducing all the colors and shades of the original scene.

Processing your own color photos is not difficult, although it takes a longer time and requires more precise time and temperature control than does the developing of

# PHOTOGRAPHY

black and white photographs. One hour is about the minimum time for developing either film or paper, the first 15 minutes being spent in darkness.

At present the color materials are more expensive than are black and white film or paper. A 4x5-inch sheet of color film costs about one dollar, as does an 8x10-inch sheet of the material on which color prints are made. With quantity production these prices may drop considerably.

Eastman's Kodachrome type transparencies and



Above, photographer uses four flash bulbs to make color picture. Left, cross-section of Gasparcolor printing paper showing layers of emulsion coating base materials. Below, making enlargements on color paper

YELLOW LAYER	(BLUE SENSITIVE)
YELLOW FILTER LAYER	
MAGENTA LAYER	(GREEN SENSITIVE)
CYAN LAYER	(RED SENSITIVE)
BASE	

papers are processed only in special laboratories. Gasparcolor, Inc., and Ansco are producers of the photographic color materials that can be processed in most home darkrooms. Ansco's materials include color film and "Printon" color paper, most of which is going to the armed forces. Gasparcolor printing material also is on priority.

These new materials, both transparencies and papers, all make use of a multilayer photographic emulsion, each layer of which is sensitive to a different part of the light spectrum. Such an emulsion may consist of blue-sensitive, green-sensitive and red-sensitive layers, or variations of these colors. The three colors and their combinations satisfactorily reproduce all of the colors of the spec-





Placing test strip of filter emulsion in spectroscope to analyze color

trum. A yellow filter layer below the top emulsion stops blue light from affecting the emulsion layers below it.

This idea was outlined in 1862 by the French researcher du Hauron, who visualized a "tri-pack" with filters in between, permitting red, blue, and violet-green light images of the same scene to be photographed in one exposure. Laid one over the other, the three dye images would reproduce the colors of the scene that was photographed. Practically all color photography has been based on some variation of this idea. Until the advent of the present "monopack" papers the most practical ways of making color prints were the wash-off relief process and the carbonyl process.

All of the color materials are of the reversal type; that is, each is developed first as a negative, after which additional processing converts or reverses the negative to a positive. This is why, after the first development step, the balance of the process can be done in subdued white light. This feature, too, permits partial processing and inspection, after which the material may be dried and then stored or shipped for completion of the processing at a later time.

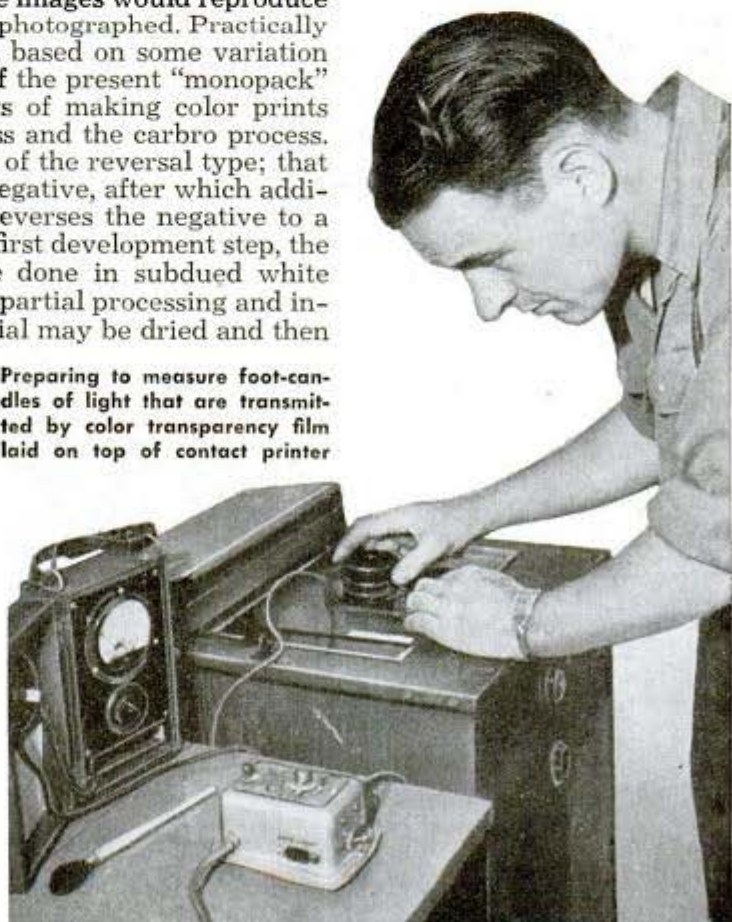
Overexposure on a reversal film or paper produces a light, thin image, while underexposure produces a heavy, dark image, just the opposite of ordinary black and white photography. Color prints normally have black borders unless the borders are especially exposed to white light at the time the print exposure is made.

Anso's Printon and Gasparcolor's paper are both of the monopack type but there the similarity ends. Printon employs the principle of dye-coupling. Dye-forming sub-

stances in the layers of emulsion produce separate color images in reaction to a color-developing fluid during processing. These layers of dyes form the finished positive color print.

Gasparcolor's process is based on dye-destruction. Azo dyes are incorporated into the layers of emulsion during manufacture. After a print has been made on the paper from any color transparency the paper is then developed like any black and white print, in darkness. A negative silver image is created in each of the layers of emulsion. A dye bleach bath is then used to remove the dye wherever the negative silver image occurs, followed by an additional bleach to remove the silver. The untouched dyes that remain form a positive color photograph.

Preparing to measure foot-candles of light that are transmitted by color transparency film laid on top of contact printer





The Gasparcolor method produces bright, brilliant pictures, which have exceptionally sharp detail and also create an impression of three dimensions. The dyes are permanent.

Ordinary darkroom equipment plus a few incidentals are all that is needed for processing color pictures. Film transparencies may be developed in tanks or trays. Dry chemicals for processing color materials must be mixed with distilled water, filtered, and should be used at a common temperature.

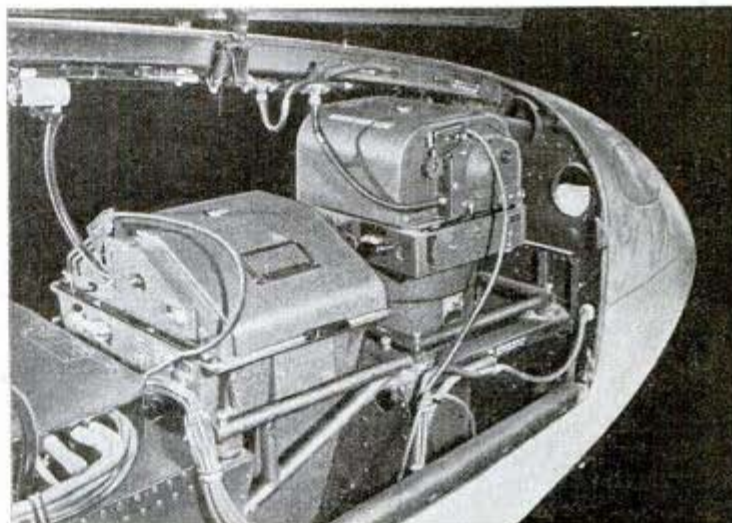
For making enlargements on color papers the best results are achieved with condenser-type enlargers. All of the color papers require the use of a filter pack in the enlarger to screen out ultraviolet light from the enlarger lamp and to correct the color balance of the light. Additional filters may be added to the filter pack to compensate for shades of color in the transparency that are not quite correct. A light meter that reads in foot-candles is recommended for gauging correct exposure.

Color photography has become an important tool in many branches of science and is widely used by the armed forces, especially in aerial photography for the detection of camouflage. Color pictures also are used in hospitals for studying tropical diseases.

The Gasparcolor process was developed by Dr. Bela Gaspar in Europe, principally in Belgium, before the war. Laboratory records and other details of the process were brought to the United States by microfilm before the war began. The Gaspar organization is continuing its research in this country and other domestic photographic material concerns are also doing considerable research. Improvements such as increasing the sensitivity of color emulsions and eliminating some of the processing steps may result.



Compact kit contains two cameras, film holders, bulbs, lenses, etc.



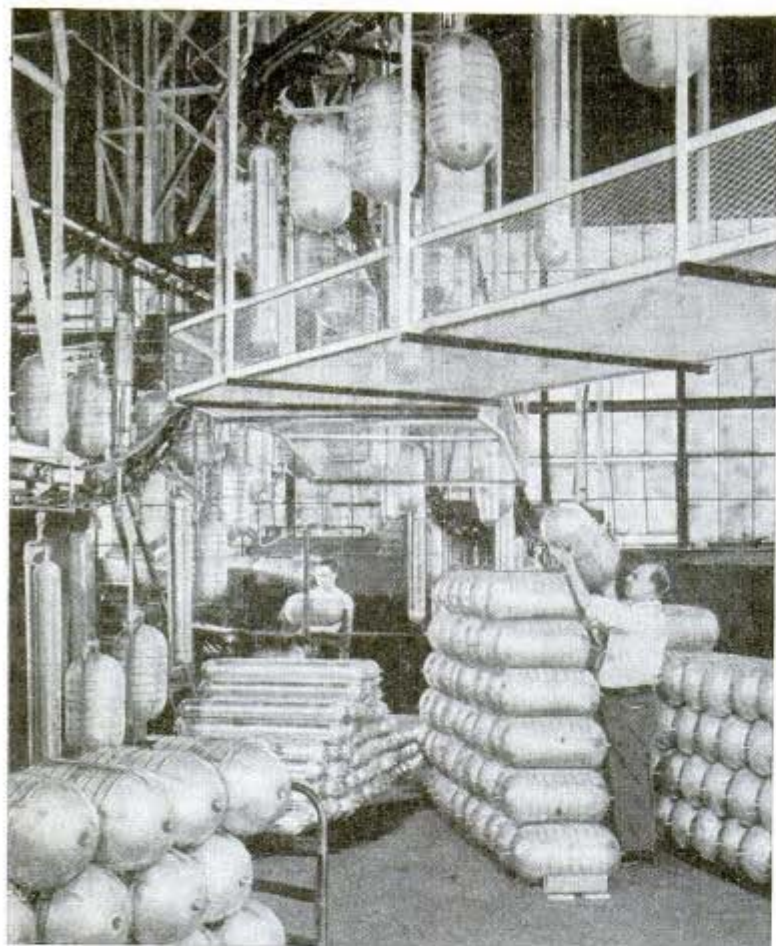
Above, installation of aerial cameras in nose of Lockheed P-38  
Below, floodlamps on lazy tongs are raised and lowered easily



## Steel Oxygen Tank Stands Up Under Cannon Fire

An oxygen cylinder for aircraft which will withstand cannon fire without exploding has been developed by the Firestone Steel Products Company. Some of these cylinders, made of stainless steel, are shaped like chubby watermelons, while others look like stovepipes with caps on either end. The first of their kind, they are applicable to planes from the B-29 to the smallest fighter. Earlier type cylinders were shatterproof against .50-caliber machine gun bullets, but the new ones won't explode even when pierced by a 20-mm. shell.

Left, oxygen cylinders hang like balloons from assembly line before being inspected and stacked by plant crew



## Spring Snubbers Ease Bouncing of the Seats on Trucks and Tractors

Snubbers for seat springs may eliminate most of the jolts and bounces in truck and tractor driving. The Monroe Auto Equipment Company, Monroe, Mich., worked out an experimental "suspension seat" by providing snubbers which check the compression and extension of the spring.

### Aluminum Economically Made From Clay

Aluminum can be made from clay by a new and economical process developed by TVA chemical engineers. After the clay is percolated with sulphuric acid, forming sulphate salts of aluminum and iron, manganous acid removes the iron which caused previous difficulties. Other impurities are then removed and the final product is electrolyzed to produce aluminum. Loss of chemicals by earlier methods made the production of aluminum from clay uneconomical.



# WAR WONDERS *for* YOU



Cutaway drawing shows what postwar summer cottages may be like, if modeled after sturdy Quonset huts (below) built by the Army and Navy Great Lakes Steel Corp.

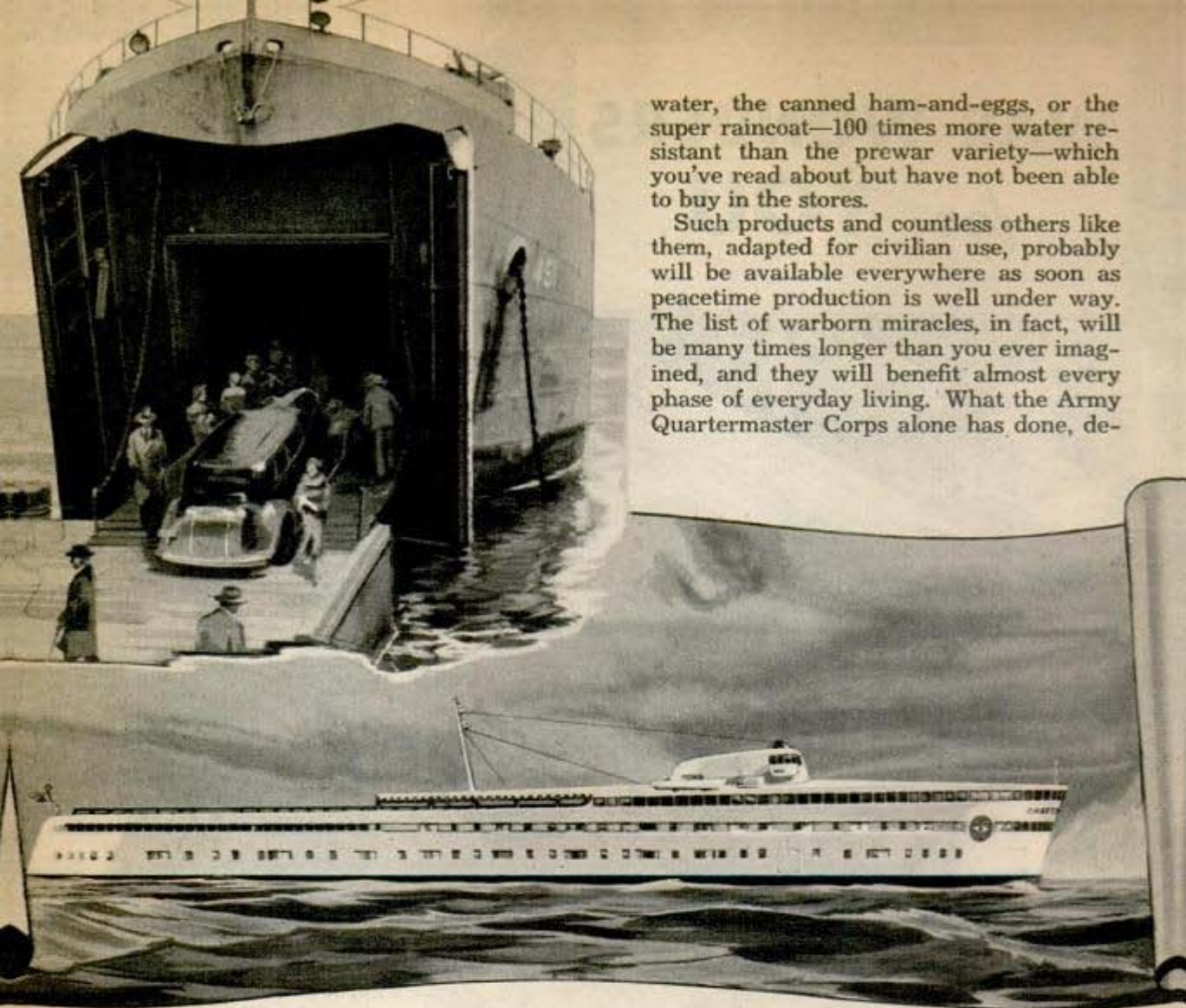
**P**ERHAPS you already have envisioned walkie-talkie radios, like those developed for the Army, in use after the war for home-office or field-home communication, or even as a convenience for the housewife who wants to summon her golf-loving husband home to supper just as he is sinking a tough putt on the 15th green.

Maybe you've heard about the way the tough Army jeeps are being tested for use on the farm, as fire engines and for a host of other peacetime purposes. Some of your friends right now may be thinking of buying, for duck hunting, fishing, boating, or as a swimming float, one of the air-filled rubber boats that were originally designed



and built especially for the Navy or AAF.

And undoubtedly you've wished for some of the waterproof matches, the shaving soap that lathers nicely in the coldest



Above, bow and side view of SS Chattanooga, cruise liner which will have Plexiglas pilot house and cargo doors like a landing ship. Below, instead of welding, metal is bonded to metal by resin cement  
U. S. Stoneware Co.



water, the canned ham-and-eggs, or the super raincoat—100 times more water resistant than the prewar variety—which you've read about but have not been able to buy in the stores.

Such products and countless others like them, adapted for civilian use, probably will be available everywhere as soon as peacetime production is well under way. The list of warborn miracles, in fact, will be many times longer than you ever imagined, and they will benefit almost every phase of everyday living. What the Army Quartermaster Corps alone has done, de-

clares Maj. Gen. Edmund B. Gregory, quartermaster general, will revolutionize the life of the average individual after the war, affecting his clothing, his food, his housing, his personal luxuries, and even his recreation.

Take, for example, just a few of the chemical items produced or procured by the Quartermaster Corps. The waterproof matches can withstand several hours of soaking in water and still be usable. A new germicidal rinse may be a boon in kitchens and restaurants; as it's now made for the Army, a few ounces will make a 25-gallon can of water into a disinfectant powerful enough to kill all the bacteria on the mess kits of a company of 200 soldiers when boiling water is not available.

The Army also has a new nontoxic, non-inflammable insecticide, sprayed from a handy dispenser under pressure generated by freon gas. Just four seconds of spraying will knock out all the insect pests in any confined space.

The Army's new all-purpose soap is



Portable stoves developed for the Army may be popular with campers after the war. Below, many civilians will want the GI soap which can be used for shaving and washing and is equally efficient in any type of water

equally efficient in hot or cold, salt or fresh water, and can be used for washing hands and face, bathing, shaving, washing clothes and even items of equipment. Another special preparation—cold climate “dubbing”—can be applied to shoes and other articles of leather apparel so that they will be soft, pliable, non-cracking and waterproof, regardless of low temperatures and bad weather. A newly developed square candle, made of wax mixed with sawdust, is an adequate substitute for a small stove or fire. It is used by soldiers where large fires would be dangerous or impracticable.

Some of the greatest advances have been made by the armed services in clothing and they are expected to be incorporated in post-war materials and fabrics. The Army’s “five-harness sateen,” which is woven five times, is probably the toughest cloth ever made, with other fabrics running close behind in wear and snag tests. Work clothes and children’s play

Below—will the hardy jeep become a farmer in peacetime?





Goodyear photo

Rubber life rafts similar to those used by Army and Navy flyers are already being sold for hunting and fishing. The boat rolls up into a neat package, as shown at the right

clothes, made of these materials, will have wide appeal. Composition Army shoe soles are said to outlast four ordinary soles. Then, there are unbreakable nylon shoestrings, plastic buttons, and even ambidextrous gloves. If you lose one, you buy only one to replace it.

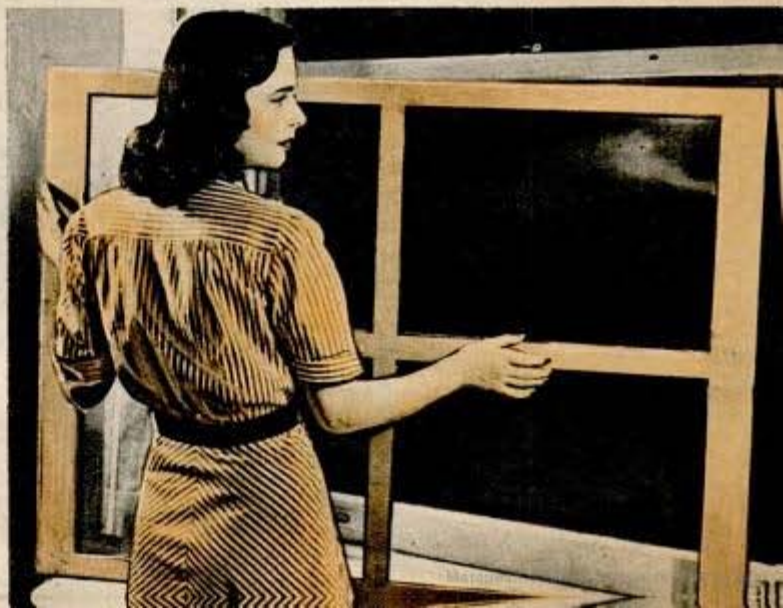
Development work by the armed services in cold weather clothing may have far-reaching effects on winter garments. It has been found, for instance, that several light layers of cotton and wool keep a man warmer than fur, and manufacturers already are reported to be styling coats made of this material for both men and women. Army raincoat material and cloth for windbreakers are better than any other fabrics ever made for these purposes.

Not only has the war fostered new foods, like precooked cereal with milk and sugar (just add water) and butter that won't melt or turn rancid, but it has speeded progress in dehydration, quick-freezing and concentrating. Before the war no combination foods with meat had been successfully dehydrated. Now such foods are fairly common on the menus of service men.

It is obvious that many vast improvements in all forms of



Below, featherweight plastic all-year screens will be available after the war. Made of Lumarith, they are said to transmit 90 percent of ultraviolet rays





Navy coats (above) will be adapted for civilians. At left is winter jacket with face mask. At right is a parka which is both overcoat and raincoat. Below, a Handie-Talkie radio relays golf score to press room

transportation will be direct results of wartime progress. Air lines already have ordered fleets of new four-motored cargo and passenger planes, with four and five-mile-a-minute speeds, that will have pressurized cabins, scientifically advanced soundproofing, and other new comforts.

There has been widespread speculation as to the effect war developments will have on water travel. Some authorities predict that vehicles like the Army's amphibious trucks will come into civilian use. Already the war influence is having a definite effect on shipbuilding design, an outstanding example being the completion of plans for a 250-foot, 300-passenger, streamlined, luxury cruise liner, the SS Chattanooga, which will be built by the Ingalls Shipbuilding Corporation for travel on the Tennessee River after the war.

Along with ship-to-shore tele-

(Continued to page 154)





## New Glass Made Without Sand Resists Acid Attack

Hydrofluoric acid, which disintegrates ordinary glass, corrodes most metals and produces dangerous burns, has met its match in a new glass made without sand. Since hydrofluoric acid instantaneously attacks and soon disintegrates sand, the major ingredient of the new glass is phosphorus pentoxide which by itself instantly reacts with water with almost explosive violence. To test its acid-resisting property, Dr. E. D. Tillyer, research director of the American Optical Company, which makes the glass, immersed a piece of the new composition in a bath of hydrofluoric acid for 500 hours. At the end of that time the glass was substantially transparent and to the naked eye showed no obvious attack. During the same period a piece of ordinary glass made of sand, lime and soda was converted into a chalky mass by the acid. The discovery is expected to simplify the handling of hydrofluoric acid, which is being used extensively in scientific experimentation, in many industrial operations and as a catalyst in oil refining and synthetic rubber manufacture.



Left, top, sandless glass lens at right stays transparent after acid attack but other lens turns opaque. Left, chemist spraying acid against a protective hood

## Pipe-Line Plan for Making Latex Increases Rubber Output 40%

Manufacturing rubber latex by a continuous polymerization process—that is, by connecting the tanks to one another by pipe-lines—has increased the output of synthetic rubber plants in this country 40 percent. The new method supplants the older so-called batch type of operation in making GR-S rubber, which results from

polymerizing or uniting the molecules of butadiene and styrene. Large glass-lined tanks known as reactors are used and their temperatures are carefully controlled. Instead of handling each reactor as a separate unit, the reactors are connected by pipe-lines to form a continuous chain. Pumps admit the ingredients in a steady stream.

## Mobile Cradles Up-End Planes for Better Use of Storage Space



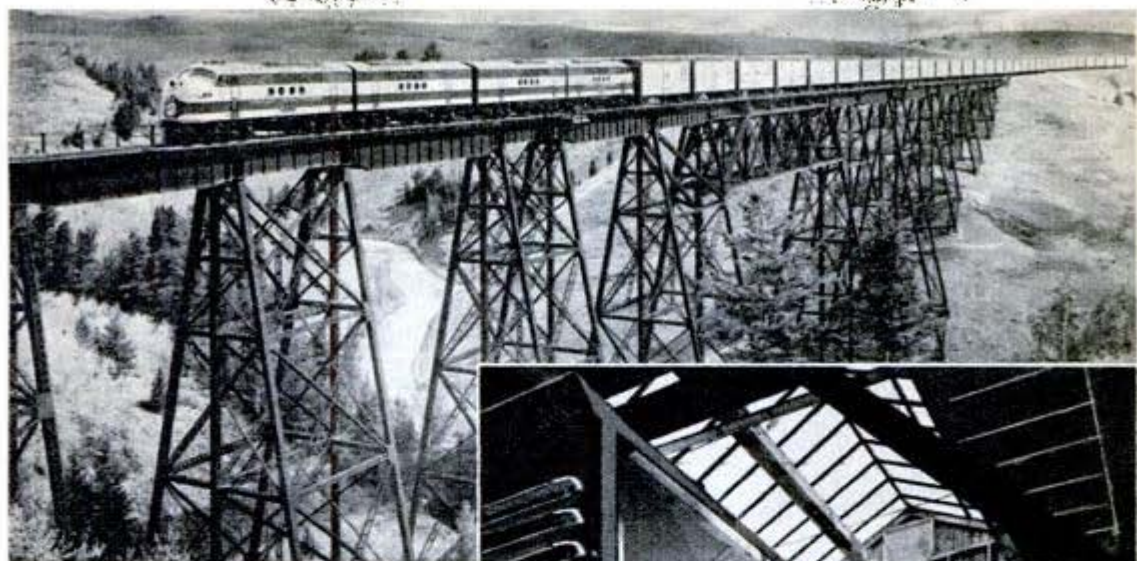
Using wheel cradles to up-end planes so they can be stacked closer together makes better use of storage space. The cradles, mounted on casters, also provide an easy means of moving planes, which can be loaded onto the cradle by one person with a small ramp which lifts up and forms a bar to lock the wheels into place.

### Save That Paper!

How many old magazines and dated newspapers and piles of other "useless" paper do you have lying around the house? Know who needs them badly? The army and navy men who package guns, equipment and supplies for shipment to the fighters across the oceans. Bundle up your paper scrap and turn it over to the salvage drive!

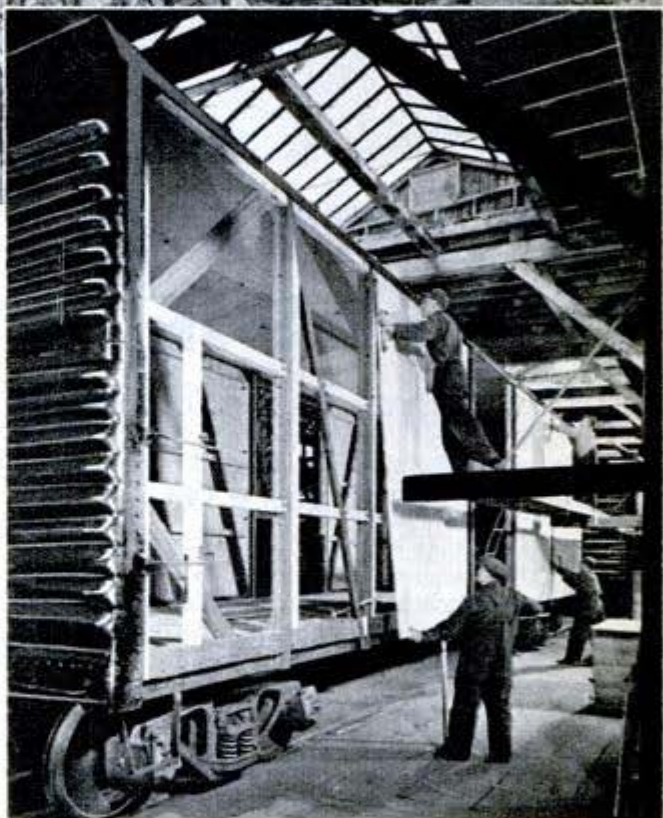


# Lighter, Sturdier Boxcars Have Plywood Walls



Above, train of plywood-steel boxcars crosses Montana bridge. Right, car is given plywood sheathing wall

One thousand boxcars made of plywood and steel have been built by the Great Northern Railway at its Duluth and St. Cloud, Minn., shops. They are a combination of steel, Douglas fir plywood and lumber, the steel comprising the underframe, end sills, roof ribs and bracings, and the plywood furnishing the sides of the car. The plywood is treated with a patented "sealer" before being applied to prevent warping. The steel used is lighter than that in ordinary cars and results in a weight saving of approximately two tons per car. On an average freight train this will reduce by at least 200 tons the weight pulled by the locomotive. The cars also are equipped with special high speed trucks, wrought steel wheels, and nonharmonic springs. Painted a brilliant orange to dis-



tinguish them from ordinary equipment, they will be used for the rapid transportation of lumber, newsprint and other high class heavy commodities.

## Colored Pictures Now Are Speedily Transmitted by Radio

Full-color pictures can be transmitted by radio with the same speed as black and white photographs by a recently patented process. The pictures are sent and received in the form of three-color separation films which are developed and printed in the customary way for making full-color prints. For transmission, a color picture is placed on a cylindrical drum for line by line scanning by a photoelectric eye. A

color disk, containing triangular sections of the three primary colors—red, yellow and blue—is placed between the scanning eye and the picture. Each color in turn is filtered out. The scanner selects and transmits impulses for the three colors, which are recorded in their proper order by the exposure of films on a receiving drum. The technique is basically the same as for sending news photographs or maps by facsimile.

Army rescue craft swings alongside raft. Soldiers on the rope net are ready to assist survivors into boat



## The **ARMY'S NAVY** to the **RESCUE**

THE CARIBBEAN division of the Army's Air Transport Command has its own small navy, a "Splinter Fleet," and operates Catalina flying boats on trips to bases from Florida to Puerto Rico.

On a houseboat named "Silver Wedding," it keeps headquarters for Army boatmen, and on dots of islands in the Caribbean Sea soldiers in sailor suits pursue a single duty of dissipating the dangers of a 1,000-mile flight over water.

When Air Transport Command planes, or planes of any other command or Allied nation or commercial company, drone the distance



Ship's captain directs rescue; injured flyer will be placed on a litter. Left, from a radio station on houseboat go emergency messages



from South Florida to Puerto Rico or Trinidad—first leg of air journeys to far continents—an ATC navy serves as convoy along the airways.

This miniature navy's system of "check points," rescue boats, PBY Catalina flying boats, grid charts and search plans makes the first overwater leg of the ATC southern route a journey over friendly territory. A forced landing is never far from immediate rescue. Below the northern border of Brazil the rescue system is taken up by ATC's South Atlantic division.

An unconventional but effective organization of air-sea rescuers has been fashioned by combining radio communications, boats, airplanes—and a method.

The method, based on co-operation with other services, carries out the idea of putting a series of life nets under men who fly the route—safeguards that provide psychological comfort as well as actual value. Between Miami, Morrison Field, West Palm Beach, and other Army, Navy and commercial fields in Florida, and Puerto Rico or Trinidad, the organization maintains four check points and one rescue station. At each place the Army has a rescue boat that can cruise about 600 miles at 21 knots to pick up survivors of any plane that ditched in the sea.

The four check points are so called because at each a radio operator is on duty constantly to “check” by voice every airplane that flies over the route. As a C-54 or a B-24 flies north or south above the small bare islands below, a GI radioman in his wood shack or tent listens for:

“Check Three. This is Army 3327 on course. Over.”

To which the solitary GI replies: “Roger. Over and out.” Then he makes a notation that Army 3327 has passed safely by.

If Army 3327 fails to report to Check Four or exceeds her estimated time of arrival or calls in distress, a radioman down the line notifies Station WZXD at Boat Company headquarters, and calls the solitary GI at Check Three to ask the check time of Army 3327. By determining when and where the plane reported last, headquarters localizes the search area.

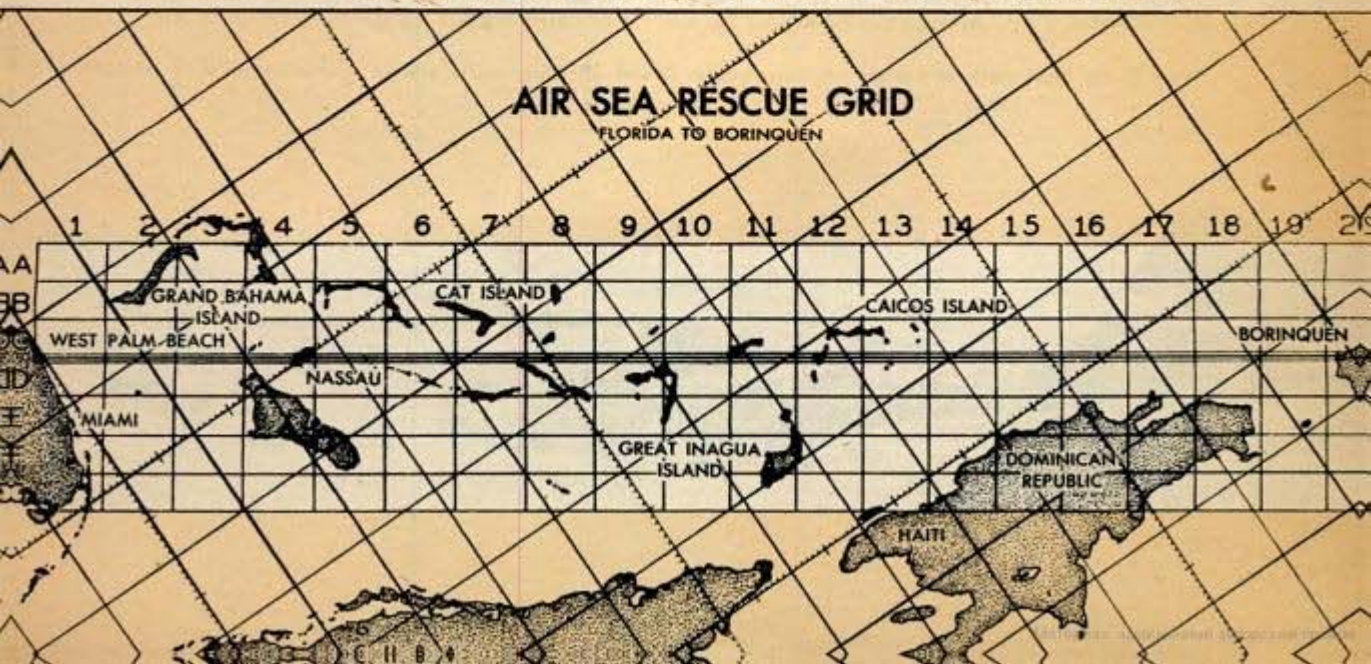


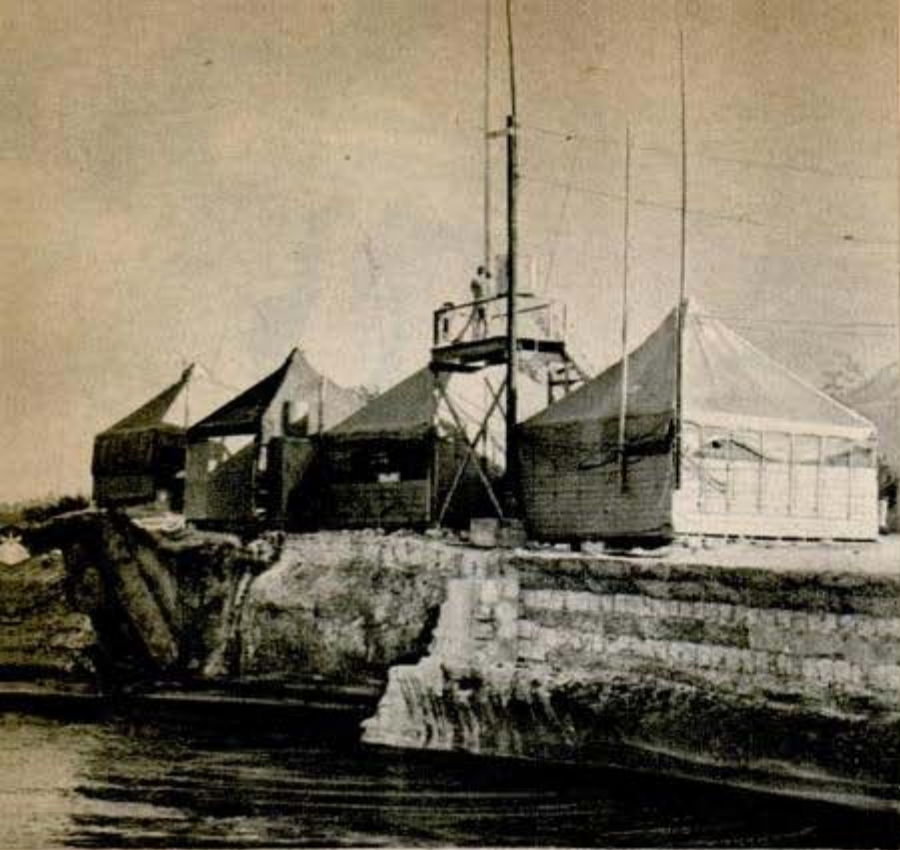
While he keeps glasses fixed on distant raft, lookout on PBY rescue plane reports find to pilot over the interphone

Thus, if a plane reports to Check Three, and fails to talk to Check Four, searchers know it must be down between those two points. In such instance, the division air-sea rescue office alerts all check points and other rescue agencies in the Caribbean and institutes by radio a search plan which is based on co-ordinated understandings between ATC, the Navy, Civil Air Patrol and Great Britain's RAF.

Search plans are exact. They are all based on a grid chart, which has been carefully superimposed on a map of the water and island area from Florida to Puerto Rico. Each grid square is designated by horizontal lettered lines and vertical and diagonal numbered lines.

Chart forms basis for rescue plans, each identified by code, so rescue units can cover specified areas





On South Caicos Island, rescue station is built on the edge of a cliff

A radio message is sent out: "Request you institute Aztec plan." Immediately each search agency examines its grid chart and learns which predetermined square area of the Caribbean it will cover. Each square is 26 by 42 miles. Should a plane ditch in another area, other plans such as Camel or Cobra would move the searchers to other squares of the grid.

As soon as a search plan has been put into effect, division headquarters asks Foreign Operations of all ports of aerial embarkation in South Florida to alert crews and to fly subsequent flights over the course taken by the missing aircraft at 1,000 feet altitude until the search is concluded. Radio operators of cargo planes and bombers are instructed to stand by on

the emergency radio frequency over the area.

When wreckage or survivors are spotted in a grid area, the air-sea rescue officer requests change of plans by a message such as: "Request you cancel Aztec plan and concentrate on Dog Three."

When survivors are located, the nearest rescue boats are dispatched to take them aboard. At top speed they follow instructions of a plane which circles the survivors. If the rubber raft that holds the downed airmen contains its "Gibson Girl" radio after the concussion and scramble of ditching, the boat takes a fix on the small radio's signal. Each ATC boat is equipped with a Bendix aircraft-type radio compass, which can "home" on a Gibson Girl radio 50 miles distant and speed

directly to that raft. The moment the tired airmen are spotted, soldiers throw a rope net over the side, ease up to the yellow raft and help the exhausted flyers up the net. Wounded men are fastened to a wire stretcher while still in the raft and hoisted aboard to a well appointed dispensary below decks. Then, while under way either to sheltered water where a PBY can land and pick up the wounded, or off to home base, the airmen are given food and first aid.

The system involves a bookful of occupational specialties from marine engine maintenance man to combination medical specialist and oiler, and all sorts of codes, numbers, mess and supply problems are natural with an Army organization that operates like a navy with its own air arm.

Army flying boat rests at anchor off Mayaguana Island awaiting radio call to search for ditched aircraft



At Palm Beach, the Army's navy headquarters is a houseboat donated to ATC by a Navy commander of that city. The houseboat holds a complete short-wave radio station in its forward wheelhouse, quarters for 40 men, a mess hall, PX, kitchen, officers' mess, orderly room, and tiled bathrooms. This is the center of the communications network.

Men of the air-sea rescue service are stationed on the islands of Cat Cay, Nassau, Great Exuma, Mayaguana, and South Caicos. At Cat Cay, about 50 miles south of Palm Beach, GI radio representatives live where the rich sported before the war. On the walls of its Casino are scrawled the names of princes and playboys. At Great Exuma, the Army sailors live with the Navy, eat Navy chow, and work in closest co-operation with the other service. Two sailors and two soldiers alternate shifts in the base weather station, and their readings are sent out for Army, Navy and civilian weather bureaus.

Each air-sea rescue station has its all-important weathermen, whose observations are indispensable for hurricane warnings and other weather forecasts of the fickle Caribbean.

Men on Mayaguana live in a half dozen tents. Fifteen to 18 of them constitute the white population of an island that has few natives. They are alert day and night to man their boat at the call of distress.

The morale problem could be serious, but it is not. A supply ship calls monthly with food stocks and heavy supplies. Weekly a PBY takes off from Morrison Field with mail, ice cream, fresh fruits, vegetables, eggs, and other perishable foods.

The air-sea rescue service has located several survivors of planes that have been forced down, and has picked up flyers forced down in the vicinity of the various check and rescue points.

Probably the most unusual mission undertaken by the ATC rescue boat concerned a plane that had ditched in shallow water near an island. It was spotted by scores of aircraft flying the route and was reported as a new crash. Finally, a boat was dispatched to dismantle and salvage the plane to reduce the overflow of false alarms from that area of the Caribbean.

American flying men have been lifted from yellow life rafts in rough tropic seas by ATC soldier-sailors. The rescue of one man is checked off as worth all the hardship and troubles.

The rescue service gets high praise from the crews who fly the route. One veteran ATC radio operator said: "Just knowing you can talk to somebody down there every hour to say you're doing fine helps an awful lot."

## Dehydration of Penicillin Speeded by "Radio Heat"



Production of penicillin, the life-saving drug, is speeded up with an all-electronic drying system that reduces a 24-hour operation to just 30 minutes. The dehydration of penicillin has been a stumbling block in its production because ordinary heat methods destroy the drug. The radio-frequency heating units, developed by Radio Corporation of America, consist of a vacuum chamber in which are placed rotators that spin at 3,000 revolutions a minute. Metal belts between the circling rows of rotators serve as electronic plates. The drug can be boiled in a moderate vacuum at 50 degrees Fahrenheit without harmful effects. It was formerly dehydrated by "freeze-drying" with Dry Ice in a vacuum chamber.

## Wool Fiber Made From Peanuts Yields Mothproof Clothing

Peanuts are the base for a textile which will yield warm, inexpensive, mothproof clothing, according to David Trail, research scientist for Imperial Chemical Industries in England. The company has developed a synthetic wool fiber made from peanut protein after oil for industrial uses has been extracted. The fiber can be mixed with real wool, cotton and rayon for manufacture of inexpensive textiles. Trail says the fiber has cold-resisting properties, is mothproof and will hold dyes.

# Lifting FATHER KNICKERBOCKER'S FACE



Photo by Edward Ratcliffe

A billion-dollar "face lifting" is in store for Manhattan (top). Proposed advertising sign for postwar uses balloon for orange

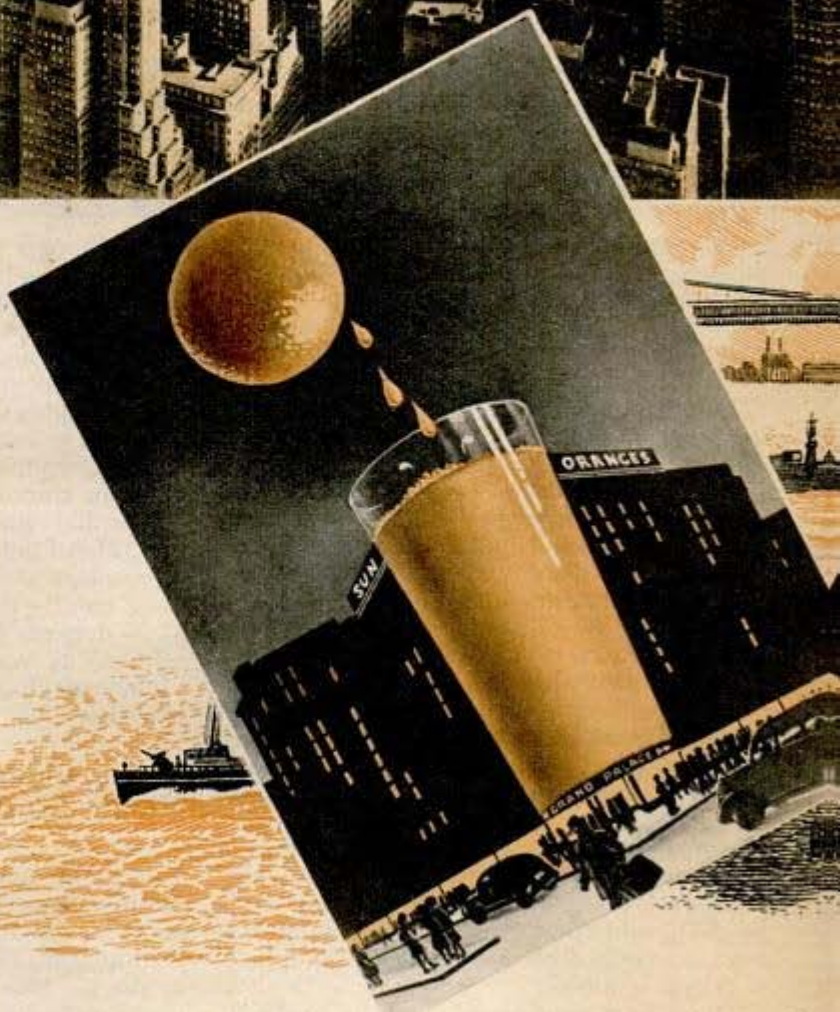
By Allen W. Elliott

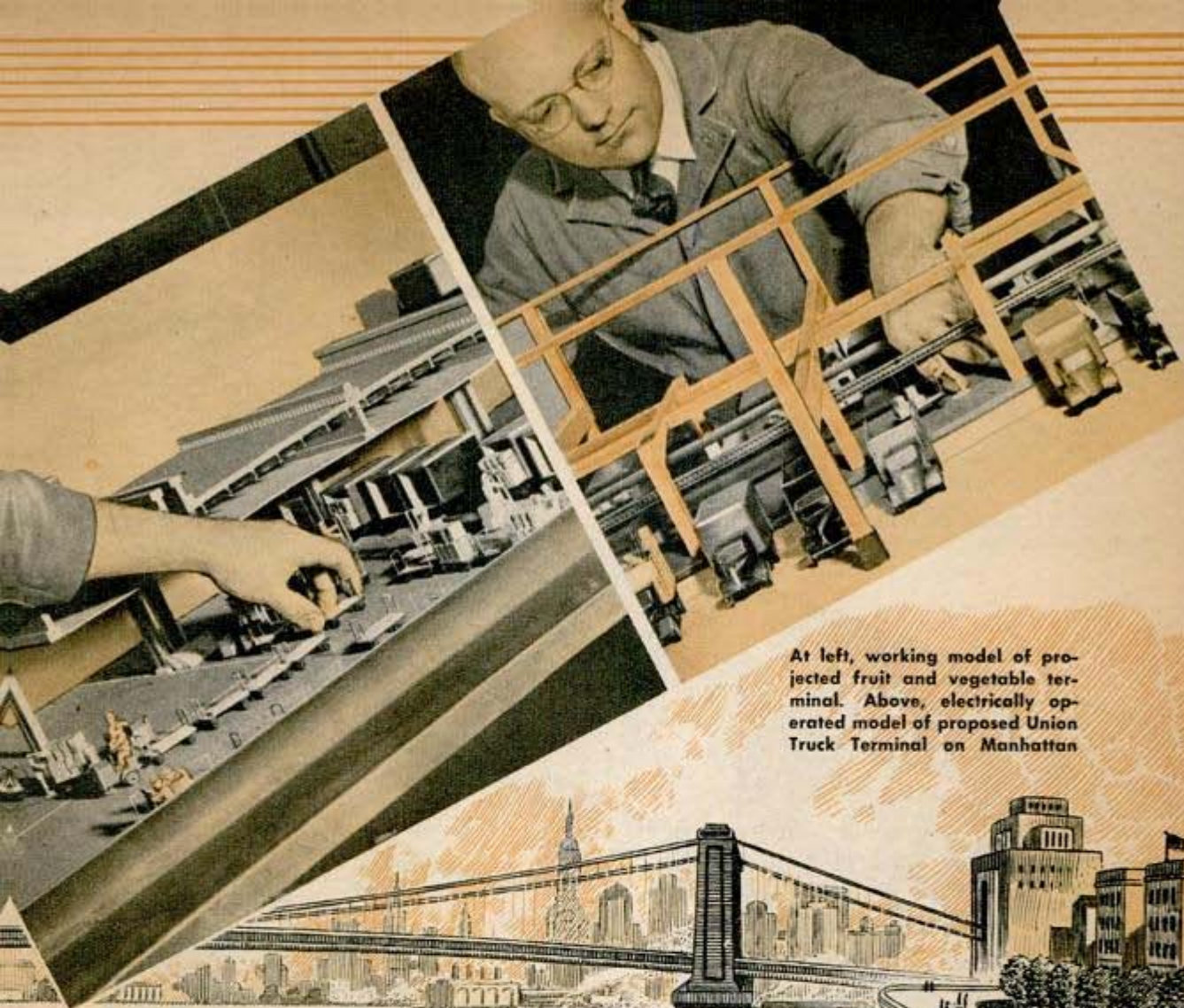
THE greatest single face-lifting job ever attempted on any city is scheduled for postwar New York City—in fact, it's already under way. More than \$1,270,000,000 is expected to be spent on new construction within three and one-half years from the day marking "all quiet" on the European front.

Father Knickerbocker, if his mythical spirit still haunts the skyscraper cliffs of the great city, would feel like Rip Van Winkle were he to witness the face lift that is in store. Broadway will become a fantastic canyon of color with huge signs enlivened by motion and three-dimensional effects.

Enough modern apartments will be constructed to house all the inhabitants of a medium-sized city. New roads, docks,

schools, hospitals, tunnels, airports and other projects, some single items costing tens of millions, will spring up, partly to keep returned war veterans working and

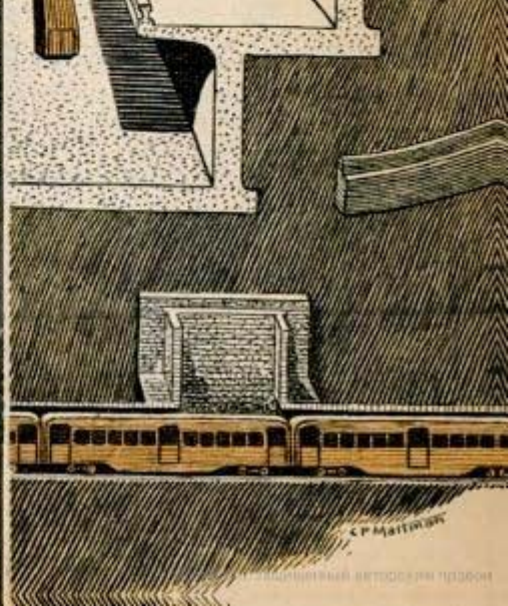
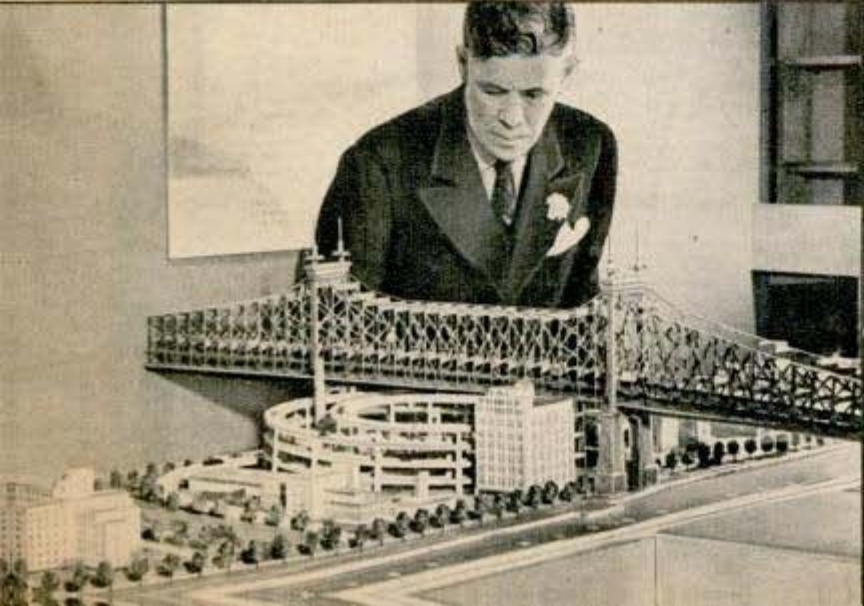




At left, working model of projected fruit and vegetable terminal. Above, electrically operated model of proposed Union Truck Terminal on Manhattan



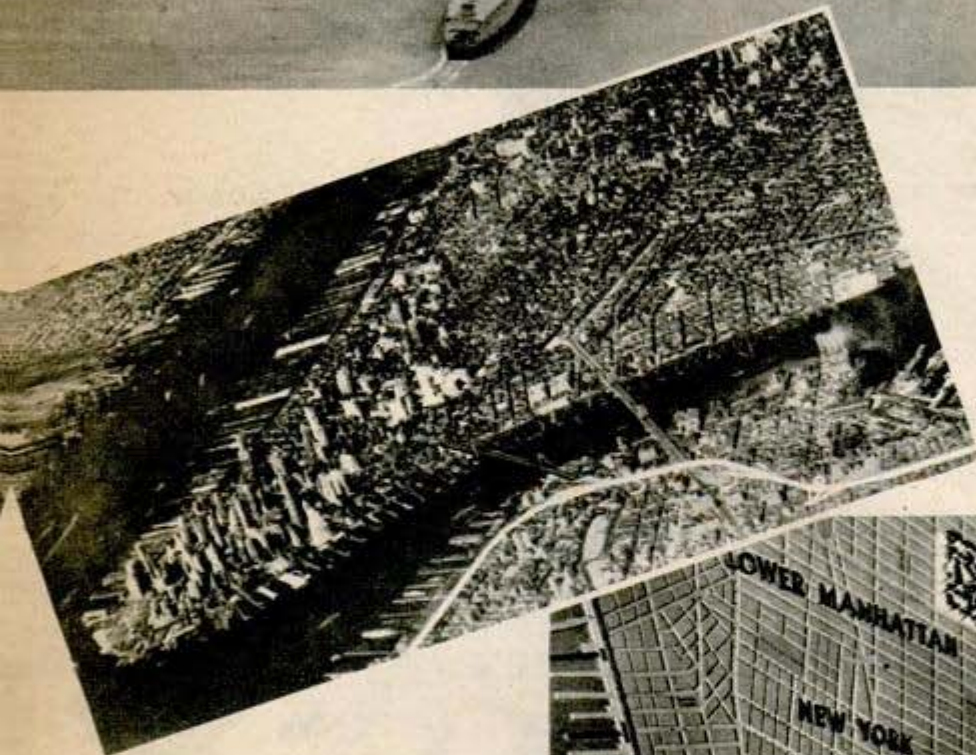
Right, section of Brooklyn-Queens connecting highway, part of postwar plan. Below, model of traffic ramp to replace 210-foot elevator for automobiles from Queensborough Bridge to Welfare Island



CP Maitland



Top, the tip of Manhattan as planned, with new ferry buildings and extension of recently finished East River Drive

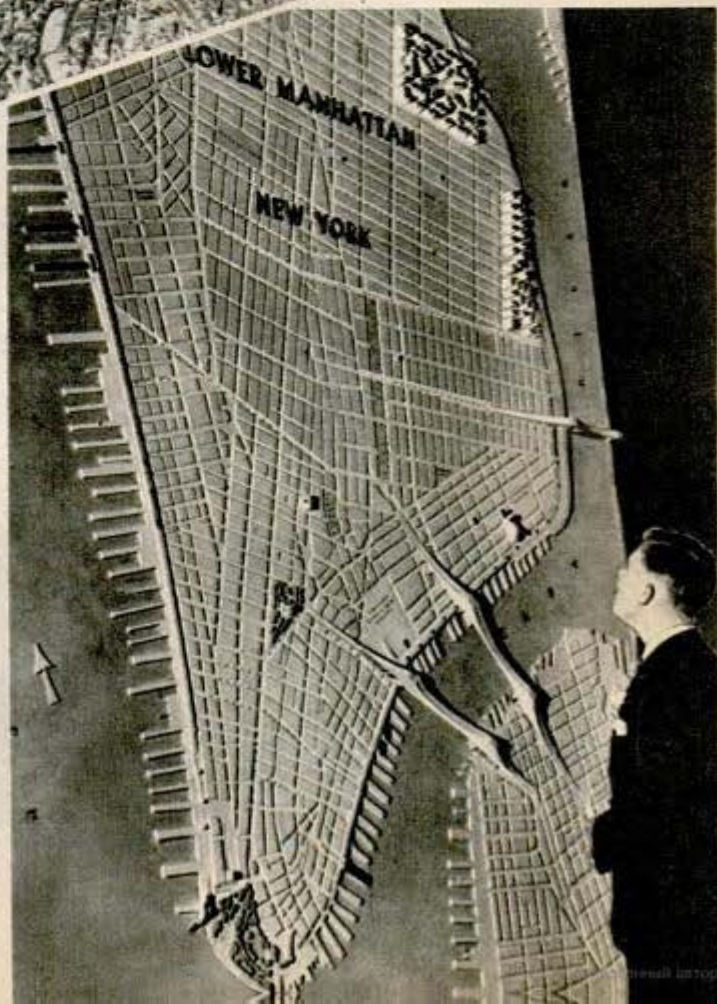


Arrivals by air may catch the view, at left, of lower Manhattan as it is today

At upper end of relief map is the \$50,000,000 "Stuyvesant Town" housing project, below it two other city house projects

partly to catch up with the wartime lag in civic construction which usually amounts to \$100,000,000 a year. The city planning commission has budgeted \$198,317,593 for 1945, and seeks \$147,308,861 more from the U. S. government.

One project alone will give an idea of the "city within a city" of apartments to spring up as soon as priorities on materials are lifted. This is the Metropolitan Life Insurance Company's \$50,000,000 "Stuyvesant Town" to be located in the lower East Side of Manhattan. A short distance away, the city will build its twin housing de-





velopment, Lillian Wald and Jacob Riis Houses, to cost around \$20,661,000. Other community and apartment projects raise the total contemplated expenditures well above \$100,000,000.

It is estimated that 1,250,000 persons will be kept busy producing materials for all this construction and about 250,000 will be employed on the construction work itself.

Private enterprises have filed plans since D-day in Normandy for over \$70,000,000 worth of building construction.

Mayor LaGuardia is battling to get construction going to complete the Brooklyn-Battery tunnel, halted by the war. Location of the Manhattan approaches and exits of this tunnel at the tip of the island has resulted in one of the most noticeable changes, the face lifting of ancient Battery Park, which got as far as wrecking of the old aquarium, a colonial-day fort. The changes mostly stopped there, because of the war emergency, but the picturesque spot will look a lot different at the end of the postwar works program. A huge sundial will occupy the site of the aquarium and, on the Hudson River side, a modern ventilating tower for the tunnel will rise above the entrance and exit of the tubes. New structures will house the Marine and Aviation divisions of the police department as well as a



Harlem River Drive, the white area above Triborough Bridge, will be one of first projects. Fragrant soap bubbles as big as a man are suggested for animated sign (left). Traffic at east end of Washington Bridge ravel in orderly threads below





*James Gallagher, Brooklyn Technical High School  
Custodian-Engineer, 29 7th Avenue St., Brooklyn, N.Y.*

## Robot Cook Makes Sandwiches on Mass Basis

To eliminate the "elbow grease" from sandwich-making on a mass basis, a high school in metropolitan New York put into operation a sandwich-making machine with a kind of assembly line system. This robot cook prepares 3,500 sandwiches for the students in an hour. Bread is fed into the machine at two points. The pieces pass under a container, which spreads butter, jelly, marmalade, or cream cheese, and out come sandwiches.

Right, two high school officials run the sandwich maker they devised



## Boxes Dropped 10,000 Feet Land With Contents Intact

Bottles of blood plasma can be tossed out of an airplane at an altitude of 10,000 feet or more, plummet down without a parachute and land intact, if they are packaged correctly. The bottles are surrounded by a packing material like excelsior and put in a wooden box which is tied together with a special kind of steel wire. The wire is made of a strong alloy steel and applied by a simple, hand operated machine which binds the wires together into a strong, twisted tie. When the box hits the ground,

it bounces end-over-end about 30 feet back into the air. Whether it has dropped 100 feet or 10,000 feet the impact and resulting bounce are about the same, since the wire binding acts as a shock absorber, giving a little and absorbing most of the bursting effect produced by the fall. In this manner plasma has been delivered to beleaguered troops by the Allies for more than a year; parachutes could have been spotted by the enemy or drifted into enemy hands. Each box weighs about 100 pounds.

## B-29 Model Lays Smoke Screen While It Rides on 100-Yard Cable



Troops at Camp Lee, Va., are trained to advance under a screen of smoke laid by a B-29 model equipped with spray tanks. The 12-pound model runs along a sloping 100-yard cable, and has been used for training units up to 250 men. Tear gas has also been used with the model, which was built by the camp's chemical warfare service unit. Experiments have been conducted with a smoke bomb dropped by a trip wire release from the miniature B-29.

☐ Only 14,000 patents were issued during the first six months of last year, a drop of about 7,000 patents from the same period in 1939. This was the lowest number of patents taken out since the first 10 years of this century.

# COMING DOWN

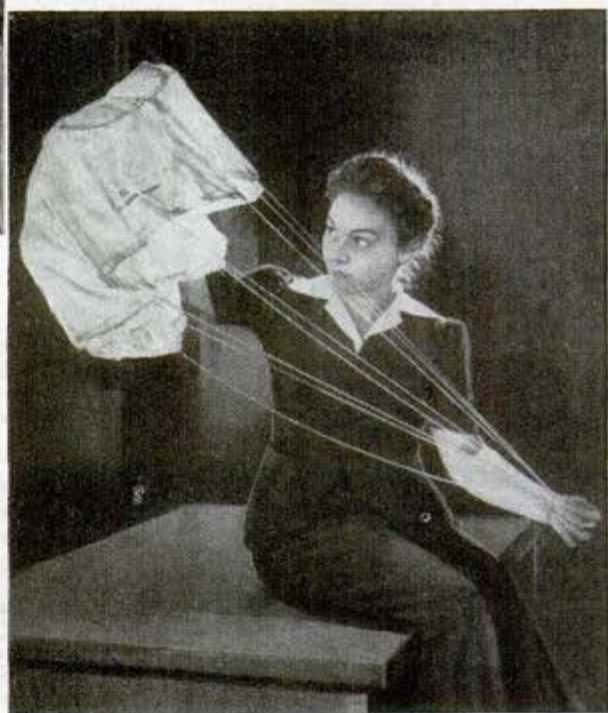


Above, paratroopers landing on Noemfoor Island. B-17 keeps watch overhead. Below, pilot chute which opens first, jerking open big chute

**P**OSSIBLY you have enjoyed second-hand thrills reading about the experiences of paratroopers and the thousands of daring airmen who parachuted to safety during the war. Perhaps you failed to realize that the parachute may have an important part in your own life before long.

The great, white floating blossom which spells safety in the sky is likely to be as familiar to the average American as a fishing pole, a shotgun or a picnic lunch basket.

The postwar years will greatly increase civilian plane ownership and sky riding. Parachutes have become so simplified and efficient in operation that Uncle Sam may require most civilians to wear them while in





Above, attaching shroud cords to the straps of a parachute

the air. "Hitting the silk" will be almost as commonplace as flying itself—only it may be called "hitting the nylon" because nylon has proved better in many ways than silk. "Hitting the nylon" is likely to become a sport or a diversion like skiing, skating or picnicking.

The parachute industry itself bloomed from four companies to 28 during the early months of the war. It made more chutes in a wartime week than a prewar year. The industry has established meticulous standards of manufacture and testing which have made the parachute safe and fostered scientific research which has condensed the chute from a bulky nuisance to a trim necessity.

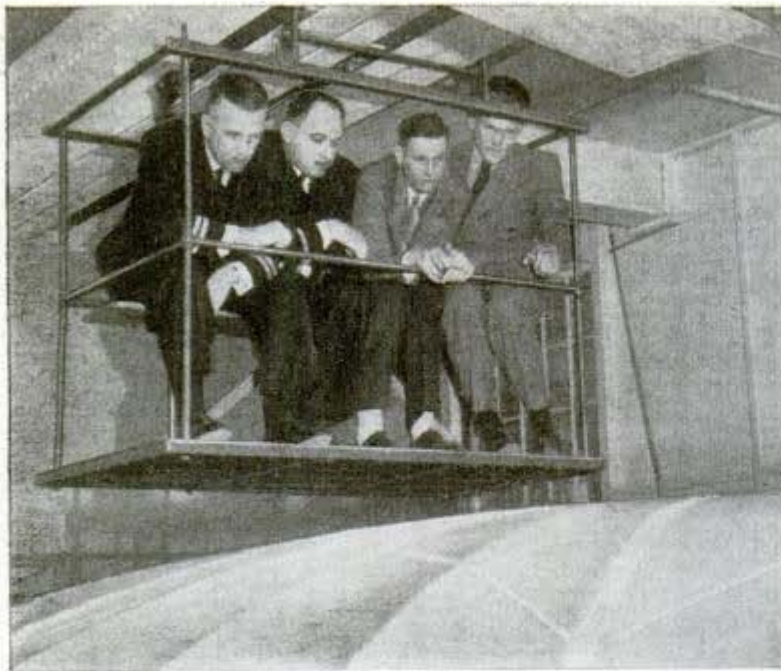
Before the war, a standard chute was a cumbersome, leg-banging or back-humping load of 26 pounds. Now, even with additional safety features, the Pioneer Parachute Company, Inc., of Manchester, Conn., has reduced the weight of a standard parachute to a snug 18 pounds.

FEBRUARY, 1945



Above, nylon threads are woven into parachute shroud lines. Below, suspension rig determines how harness innovations fit under body weight





the 185-pound man to the 105-pound wife or the 70-pound child. This will probably be a modified version of the standard 24-foot diameter military chute now in use. Above 225 pounds, a 28-foot chute may be required.

Small children may have diminutive chutes, but the standard, 24-foot job is generally necessary since a man might accidentally put on the adjustable harness of the smaller chute intended for a woman or child, with unfortunate results. It is interesting to note that in the event a family of three were to bail out because of engine trouble at 5,000 feet, the 70-pound child would reach the ground in about six minutes, 24 seconds and the 105-pound wife in five minutes, 12 seconds, but the 185-pound man in four minutes, 37 seconds.

In the case of the child, it is likely that a static line would be used to trip



RIGHT

WRONG

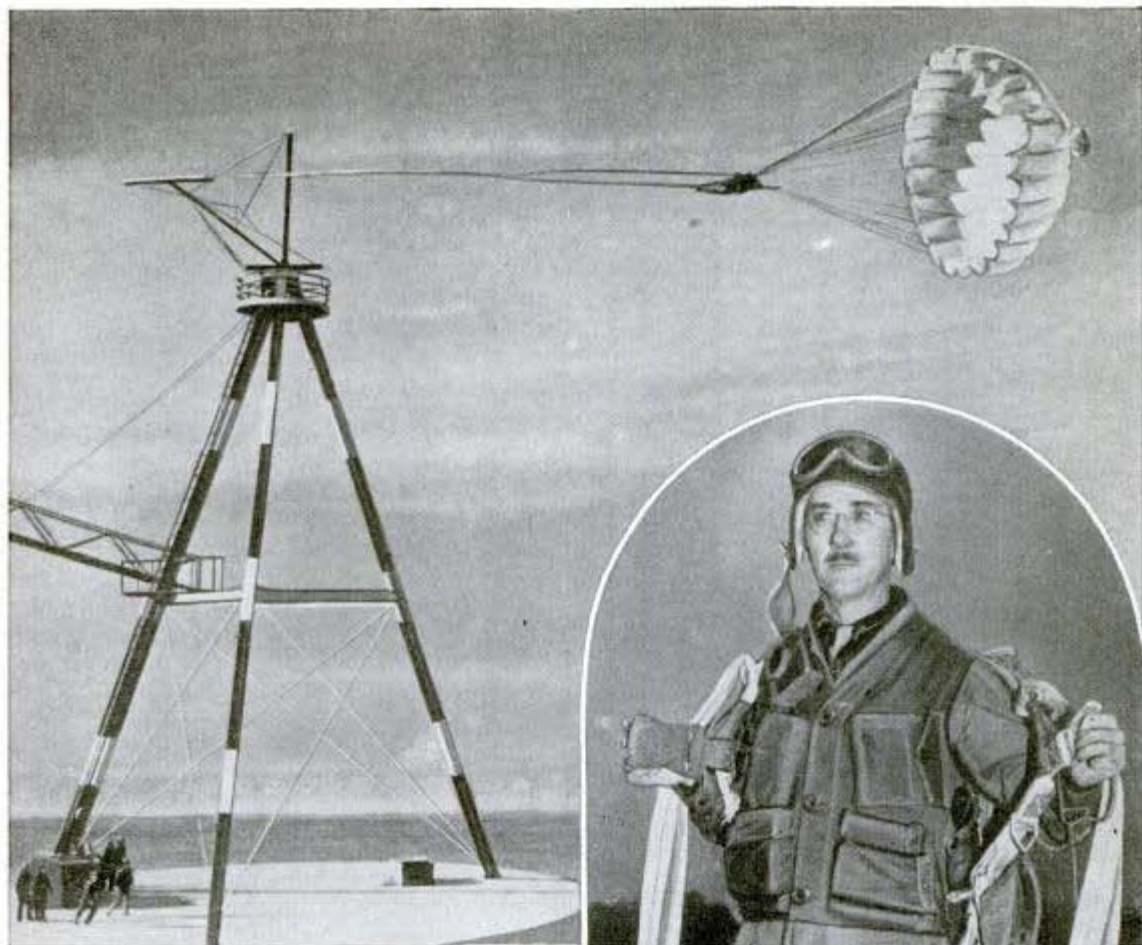
Above, watching the canopy tester and awaiting bursting of chute. Left, if chutist is oscillating during descent, correct way to land is with feet together to distribute shock. Below, nylon chutes ready to ship

According to Lyman H. Ford, vice-president of the company, the postwar civilian parachute will weigh around 15 pounds and will be no more of a burden to carry than a picnic blanket. Like the military parachute, it will be foul-proof and fool-proof.

"Today," he says, "any person who can step out of a plane and pull a rip cord can parachute safely. It isn't necessary to count 10 or any other number. You don't have to be an acrobat. Or a daredevil, either. Landing is just like jumping from a height of six feet or so. A bend of the knees, a roll and that's all there is to it."

There is likely to be only one size parachute in the civilian plane to care for the needs of ordinary passengers ranging in weight from





Above, a test tower at Pioneer plant whirls chute at 300 miles an hour before the rip cord is pulled

the parachute. A static line is a rope attached to the plane and to the rip cord device on the chute so the chute will be released automatically when the end of the line is reached as a person bails out. The same arrangement is possible for the family dog or cat, with the animal wearing a parachute on its back and a harness attached around its body and anchored by the four legs.

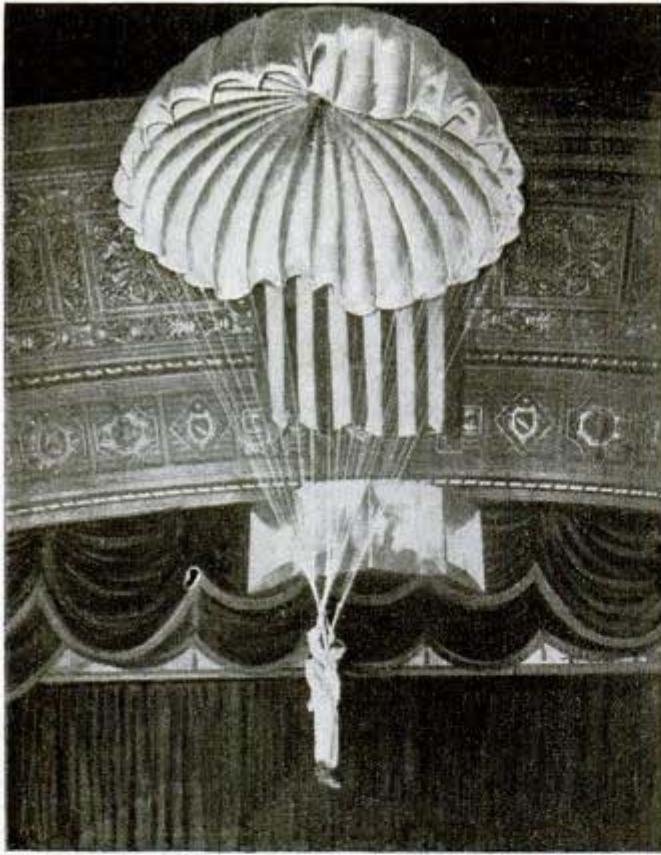
For very small children or babies, a parachute harness without a chute may be worn. Instead of the chute, there will be snaps and webbing attached which can be snapped onto the harness of the chute worn by mother, father, or older brother or sister. Such an arrangement would preclude the possible loss of an infant from the arms of an adult when the usual yank of the blossoming chute transmits itself into a jerk on the harness.

The 24-foot wartime chute, with its 65 square yards of fabric and 800 feet of cord, has been made of white nylon until recently when the camouflaged parachute was invented to evade Japanese jungle snipers. The camouflage patterns are so attractive that the family chute may be



Above, life vest for stranded flyers. Below, examining vent through which air escapes as chute descends





Above, world's record for low leap—82 feet by Carl Rupert in a theater. Below, modern chutes are repeatedly inspected. Here a completed chute is examined under fluorescent lights



colored to match plane interiors or to avoid necessity of repeated washings, since a chute is often soiled when it hits the ground.

If you have an idea that people are lucky to be alive after they bail out, consider Joe Crane, parachute expert for the Pioneer company. As a stunt parachuter and tester, Crane has made 688 jumps. In all this time he has broken his left ankle twice, sprained his right ankle and cracked a few teeth, although he has leaped with four parachutes open at one time, deliberately landed atop buildings, jumped at night, blinded by searchlights, and has taken chances no civilian will ever face.

Crane, who is president of the National Parachute Jumpers' Association, says that a jump in a modern parachute requires only a cool head, some common sense and the necessity of keeping your mind on your business.

"It's a lot more interesting than it looks from the ground," he says. "A parachute really bobs like a cork in the air currents. Some actually go up for a time, instead of down, if rising currents catch them.

"By pulling cords a surprising maneuverability can be attained and once, as a stunt, I agreed to land on top of a friend after bailing out 2,000 feet from where he stood on a flying field. I didn't do so, but it was because he sidestepped just as I hit the ground where he had stood. Another time I brought down a basket of eggs, unbroken."

Test towers, hydraulic canopies and mechanical "fabric detectives" are among the scientific devices which have put daring jumpers like Crane and Ford behind desks, serving our military flyers and preparing for the civilian needs of the future.

The test tower at Pioneer is a huge steel structure which whirls parachutes around at speeds up to 300 miles an hour or more, opening them with the tremendous force they are likely to meet when used by airmen on speedy warplanes. A high-speed motion picture machine, faster than the eye, records what happens when the rip cord is pulled, when the chute catches the air and when the great canopy blooms into graceful lines of safety.



To determine where a chute is most likely to fail under stress, it is spread over a canopy which uses hydraulic pressure to give even force. The strain is gradually increased until the fabric splits. Trained observers, stationed on a platform above the canopy, watch the fault develop. In another test, a parachute is laid flat on the floor and the strain is applied slowly to the ropes.

The "fabric detective" is a machine which tests the porosity of the material used in the parachute canopy. It automatically records the number of cubic feet of air per square foot per minute that flow through the fabric under a given differential in pressure. Before the fabric is approved for use it must meet rigid and specified maximum and minimum porosities.

Thanks to these men and machines, the time may soon come when you may be talking the language of parachutes—discussing bridles and cones, D-rings and drifts, fillings and flaps, oscillation and peaks, pull-offs and streamers.

But you won't need to remember all these things—just remember to pull the rip cord when the time comes.

### Paradoctor Jumps With First Aid For Isolated Crash Victims



Medical officers are trained as rescue parachutists with the Army's 2nd Air Force. Wearing a football helmet and a kind of catcher's mask, and weighted with bundles and first-aid kits, the paradoctors are prepared to jump into isolated places to minister to the survivors of crashes.

### Bag for Garbage Snaps Shut To Keep Out Insects



Garbage is neatly disposed of in a paper container suspended from a special metal frame which can be attached to a cupboard door or drawer. Equipped with crossbars and spring, the bag seals tightly to keep unpleasant odors in and insects out. It is made of heavy wax-covered paper, and the frame is available in either screw-on or hang-on models.

### Wrench Signals Eye, Ear, Hand On Reaching Desired Torque



A three-sensory wrench developed by the P. A. Sturtevant Co., Addison, Ill., operates according to sight, sound, and feel, with a trigger finger that can be set at any signaling point. When the desired torque is reached, the sensory action of the wrench sounds a loud, clicking signal, imparts a strong impulse to the hand, and visibly indicates the torque on a dial.

# Cloth-Paper Runway Is Rolled Out on Airfield

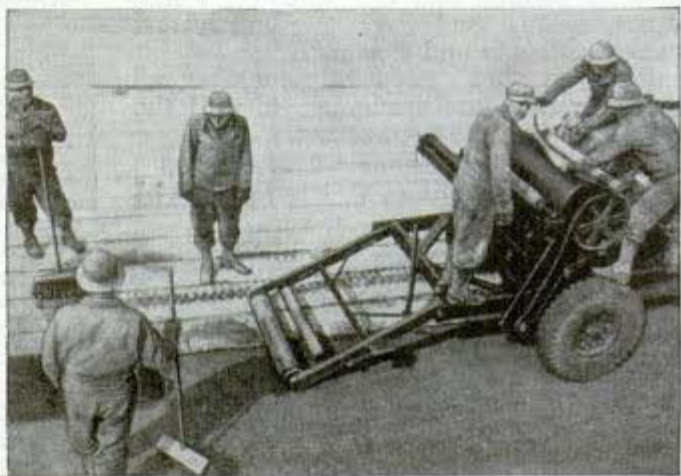


Above, the underside of P.H.S. Note black surface showing that the asphalt coating has been cut back. A new roll of P.H.S. is being started



Above, laying cloth-paper runway on a new landing strip. Below, threading "stamp licker" with new roll of P.H.S.

Air Force Engineers who seemingly worked miracles in building over 100 airfields in France between D-day and Oct. 12 were using P.H.S. (prefabricated Hessian surfacing), a new type of easily transportable runway which is laid by machinery in rolls three feet wide and 300 feet long. P.H.S. consists of a cloth layer between two paper layers, thoroughly impregnated with bitumen. It will only support a load that the original dry soil will take, but it excludes water and keeps the sub-grade dry. The sub-grade is graded, compacted with the sheepfoot roller, and then rolled smooth. Finally P.H.S. is applied by the "stamp licker" machine towed behind a truck. The material is unrolled, the under surface moistened by a solvent and passed



through rollers, the last one pressing it against the ground. Each strip overlaps and sticks to the preceding one. Rolling follows to keep the surface precise. After grading, the process takes about 15 hours for a runway 120 by 3,600 feet. This type of runway will carry planes up to fighter-bomber weight without undue damage.

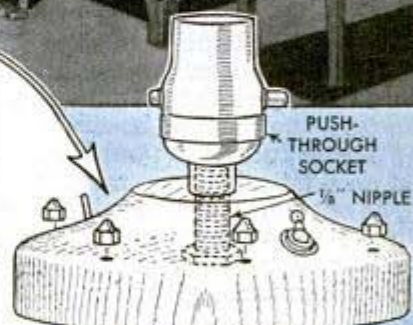
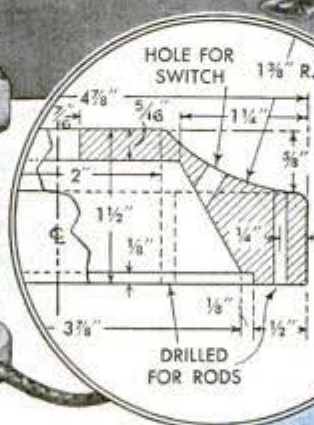
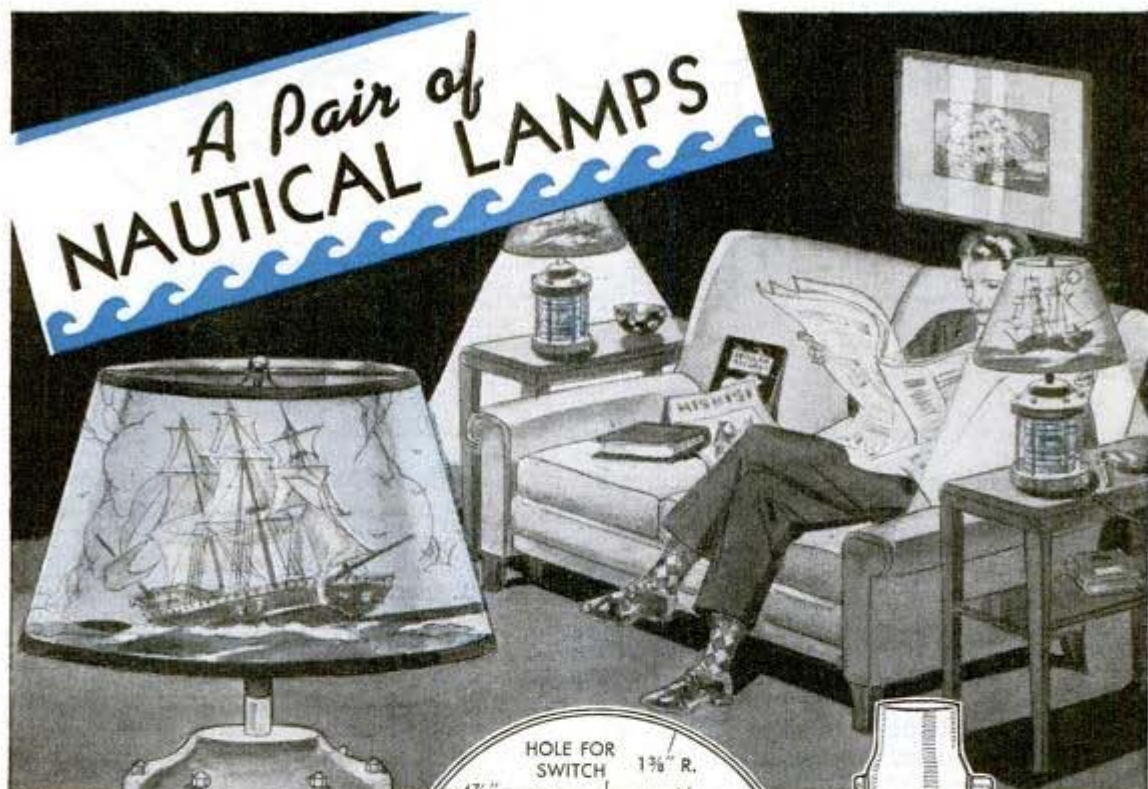
## Phone Wires Carry High Fidelity Television Broadcasts

High fidelity transmission of television over standard telephone wires has been developed by the Packard Manufacturing Corporation. For the new, simpler method of video transmission, coaxial cables are not required, according to Homer Capehart, president of the company. In a demonstration Capehart showed that when the coaxial cable customarily used is replaced with a twisted wire—a common lamp cord—there is no change in the clarity or definition of the picture. The same results were achieved when the twisted wire was

replaced with a single wire. Capehart said this development, still a technical secret, makes nation-wide television broadcasts practical via existing telephone lines and eliminates the need for installing coaxial cable systems at approximately \$10,000 per mile. A Capehart method of recording television programs for rebroadcast in the same manner that radio programs now are transcribed also has been developed. This was achieved by increasing the sensitivity of recording beyond the 8,500-cycle maximum attained by present methods.



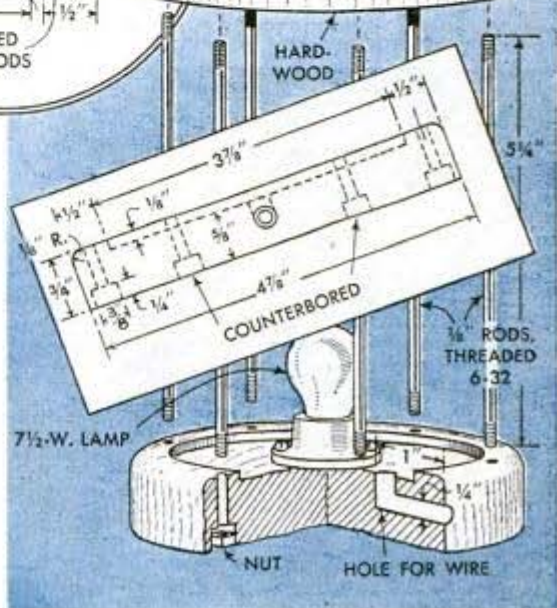
## A Pair of NAUTICAL LAMPS

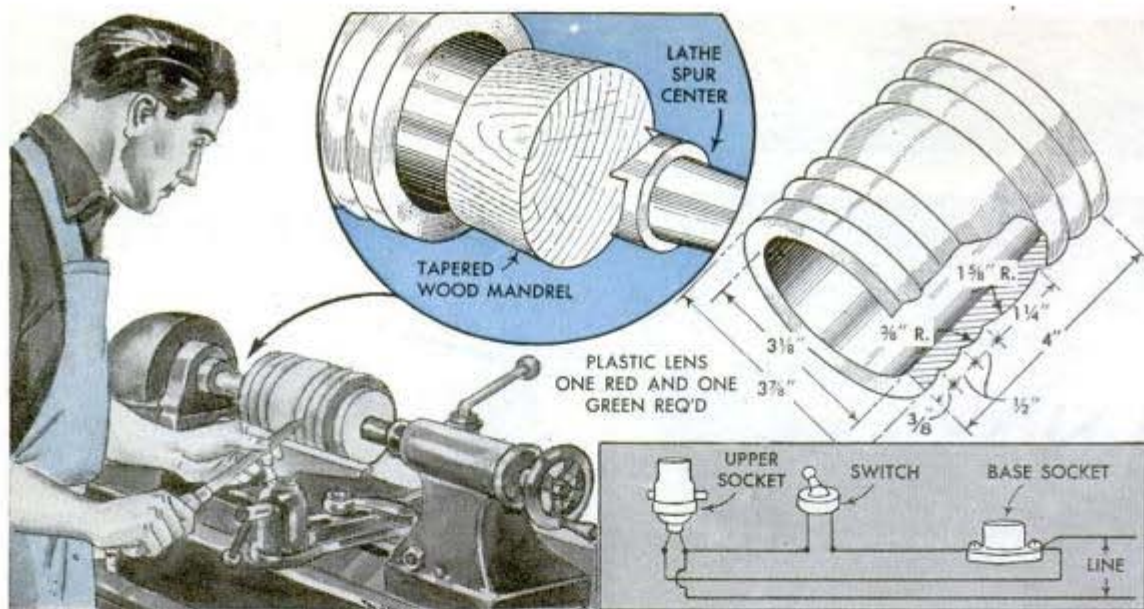


By D. C. Cline

**J**UST the thing for the nautical-minded craftsman, these lamps, of the lighted-base type, represent port and starboard running lights of a sailing vessel. Tops and bottoms can be made of metal, plastic or hardwood. The latter can be worked easily, is less expensive and takes various finishes to suit the individual taste.

First, the bottom is turned to the dimensions shown in the rectangular detail, and recessed to fit the edge of the lens. Then holes are drilled for the wire and the rods which hold the assembly together, the holes being counterbored for nuts on the rods. Dimensions of the top are given in





the circular detail. This, too, is recessed for the lens, and holes are drilled for the rods, toggle switch and the nipple that supports the lamp socket. Holes for the rods must align with those in the bottom.

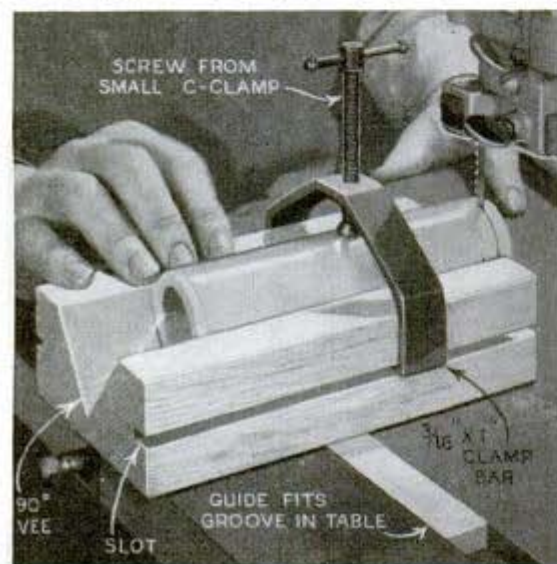
For the lenses, choice of material is varied. They can be made of translucent, colored plastic tubing, or glass lenses, known as Fresnel lenses, can be obtained in many sizes, shapes and colors from marine supply houses. If you intend to use glass lenses, you should get them first and then turn the top and bottom to suit.

If plastic tubing is used for lenses, it is held on a tapered wood mandrel for turning, as shown. When turning, care should be taken to avoid excessive heating of the chisels, which destroys their temper and edge. When turning some plastics, there is

more tendency for the chisel to dig in and spoil the work than in turning wood. After the lenses have been turned, they are sanded with 0/7-grit wet sandpaper and then polished to a high luster on a buffing wheel with plastic-polishing rouge. Then the inside is sanded—also with a fine-grit paper—to give a frosted effect so that, in use, the small lamp inside will transmit a glow without actually being seen.

Sockets now can be wired as shown in the wiring diagram. Note that a toggle switch controls both the lamp inside the lens and the one above, and that the latter can be controlled separately by a push-through switch which leaves only the lens illuminated as a night light. All parts now are assembled, and the rods are tightened in place with acorn nuts.

## Holder Clamps Round Work for Cutting Off on Band Saw



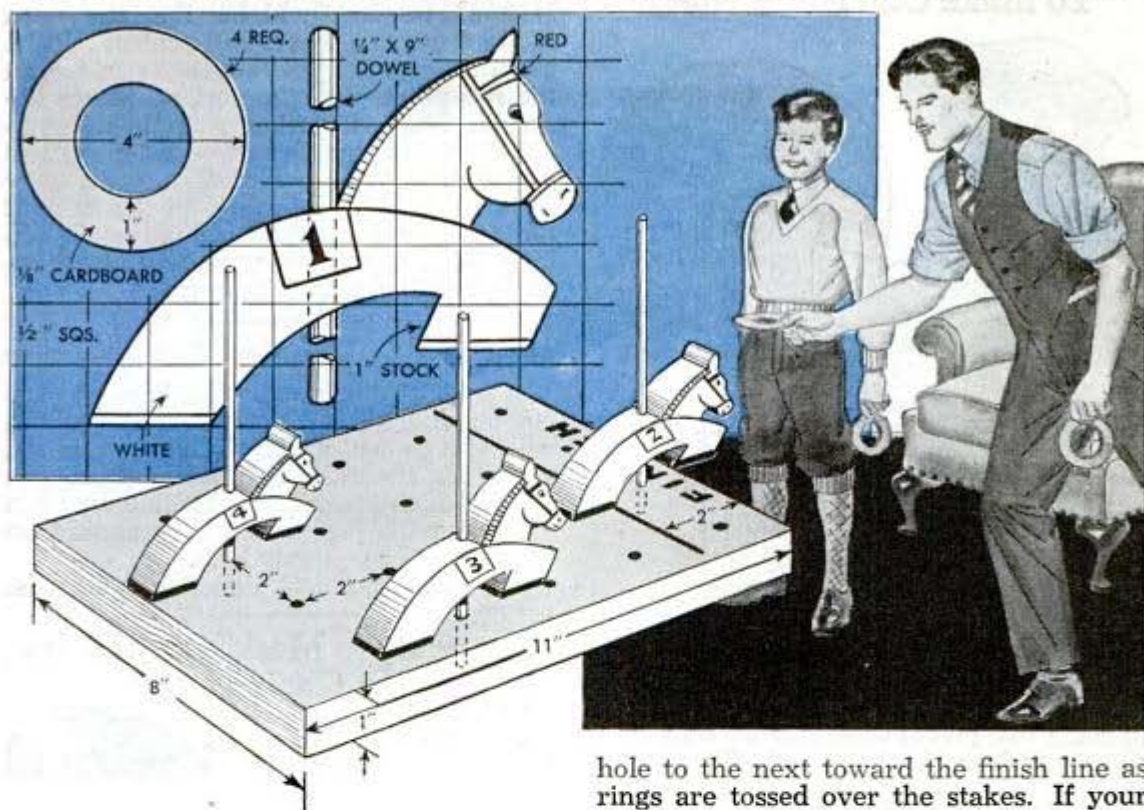
Metal or plastic cylinders and rods can be crosscut accurately with this jig. It is made from a hardwood block measuring about  $1\frac{3}{4}$  by  $3\frac{1}{2}$  by 6 in. A guide strip fastened to the underside fits in a slot in the band-saw table. The clamp is made from flat iron which is drilled and tapped to take a screw from a small C-clamp.

## Cellophane Protects Eyeglasses

Eyeglasses can be protected from splatters while painting if covers of Cellophane are slipped over the lenses. Wrappers of the type used on cigarette packages are convenient for this purpose. The same method also is effective to protect the lenses of goggles from damage by abrasive particles when using an emery wheel.

—E. M. Fellows, Morrison, Ill.

# "Horse Race" Adds Excitement to Quoits Game



This easy-to-make game, which combines the thrills of a horse race with the fascination of quoits, assures a good time at any party. Also, the game is excellent for stay-at-home evenings when members of the family can vie with one another. The horses are moved progressively from one

hole to the next toward the finish line as rings are tossed over the stakes. If your opponent rings your horse, you move it forward. Therefore, your chances of winning the game depend not only upon your own skill in tossing the rings, but also upon your opponent's poor aim. For a more exciting game, or to provide entertainment for several players, a larger board can be made to accommodate more horses.

## Elastic Bands on Heels Prevent Rubbers From Pulling Off

If your rubbers are so loose-fitting that they come off easily, especially in snow or mud, slip a couple of wide rubber bands over your shoes at the heels, as shown, before putting on the rubbers. In most cases sufficient friction will be provided between

the shoe and rubber, at the point where the pull is greatest, to keep the rubber in place.  
—G. E. Hendrickson, Argyle, Wis.

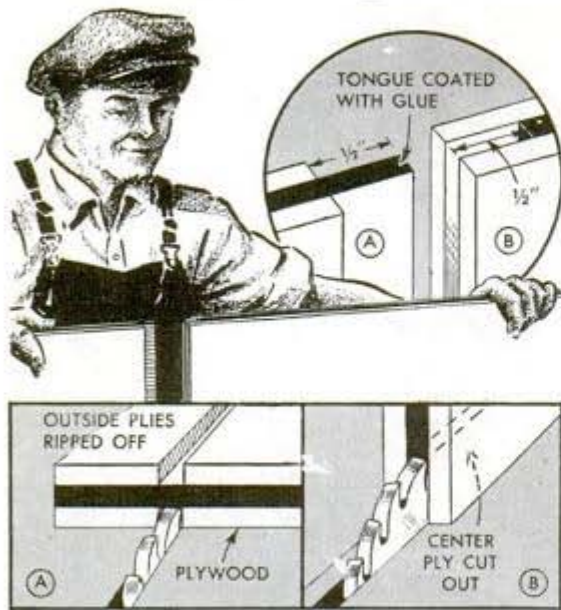


## Nails Prevent Birds Roosting On Beams in Barns

If you would like to keep birds from roosting on beams in your barn or garage, just drive three rows of nails in the upper surfaces of the beams as indicated. Nails in the center row should be driven vertically and those in the outside rows should be driven at an angle to overhang slightly the sides of the beam.



## Two Pieces of Plywood Spliced To Make One Large Panel

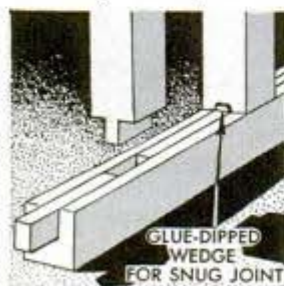


When a plywood panel larger than any available is needed, one can be made by splicing two pieces together. To do this, a tongue is formed on the end of one piece as at A, and the end of the other piece is grooved as at B. On  $\frac{1}{4}$ -in. plywood, the groove can be made by cutting out the center ply on a circular saw, and the tongue can be shaped by cutting away the two outside plies. The panel is assembled by coating the tongue with glue and pressing it into the groove. Wood plastic or filler can be used to fill any small cracks at the splice line. After the glue has dried, the joint is sanded smooth and the panel used without any danger of its warping or buckling.—Michael Ligocki, Gary, Ind.

## Replacing Broken Fuel Filter Bowl

On finding that the glass filter bowl between the fuel pump and the carburetor had been broken, one motorist used an empty cold cream jar as a substitute. The jar, stronger than the original, gives good service.—Jos. Schafsack, Long Island, N. Y.

## Easy Way to Mortise Railings



Where numerous small mortises for vertical strips are necessary in making railings for cribs, playpens, etc., you can do the job neatly and quickly by grooving both the

rail pieces. After this has been done, a thin filler strip is cut to fit snugly in the groove. It should be slightly higher than the depth of the groove so that it will project a little. Then the mortise positions are marked on the rail pieces and the vertical pieces inserted. Next, the filler strip is cut into lengths to fit snugly between the vertical pieces and glued or nailed in place, after which it is planed flush with the rail. If the tenons on the vertical pieces fit too loosely in some places, wedges can be driven in beside them as indicated.

## Nail Polish Repairs Pen Threads

Stripped threads on a fountain-pen cap often can be improved by coating them with nail polish, which should be allowed to dry for several hours before the cap is put on. If the ventilation holes have been plugged with the polish, they should be opened or the pen may leak.

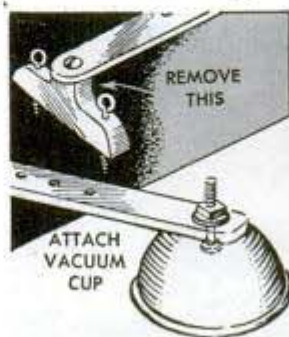
—C. J. Bennett, Vancouver, Canada.

## Template to Mark Rung Holes In Chair Legs

When boring rung holes in chair legs and similar turnings the holes can be located accurately in duplicate work by using a template like the one shown. It is merely a paper sleeve which slips snugly over the work and has the drilling positions marked on it. In use, hold the sleeve flush with the same bead or undercut portion of each duplicate turning. Then the drilling positions can be transferred from the template to the work with an awl or sharp nail.



## Vacuum Cup for Pantograph

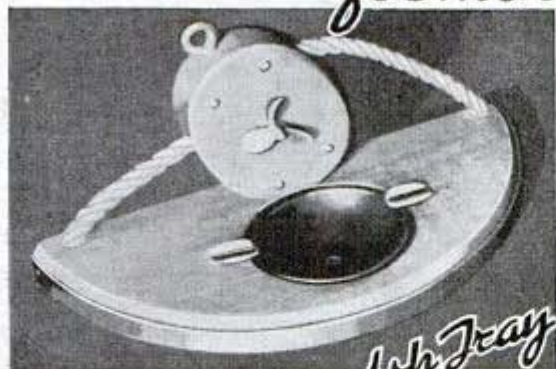


Often having occasion to use a pantograph on a surface where it was inconvenient or impossible to anchor it with screws in the usual way, one artist substituted a vacuum cup for the attachment cleat. The cup permitted

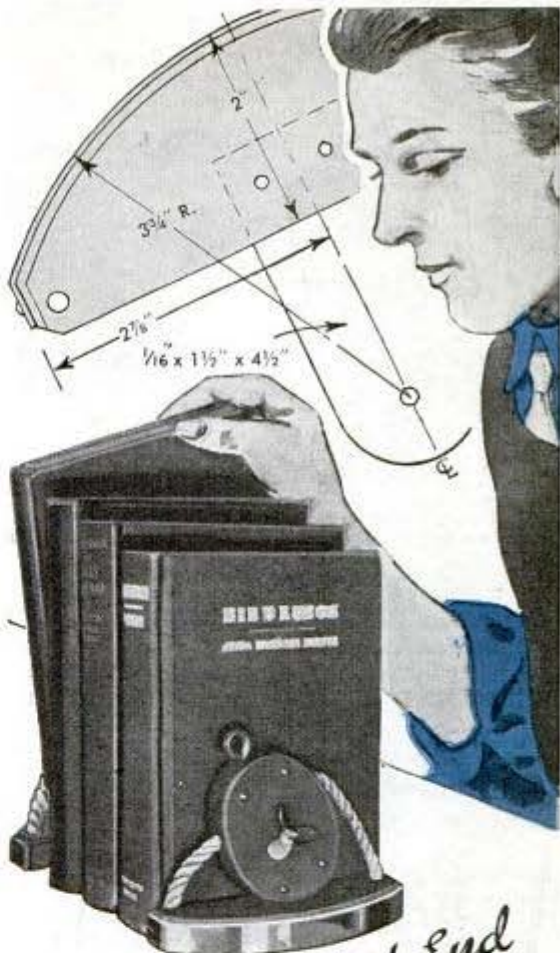
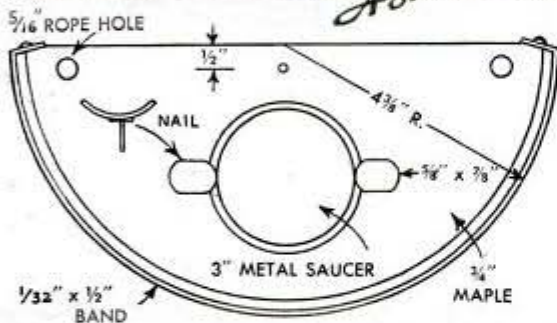
attachment of the instrument to any hard, smooth surface without marring it.

—A. H. Waychoff, Phoenix, Ariz.

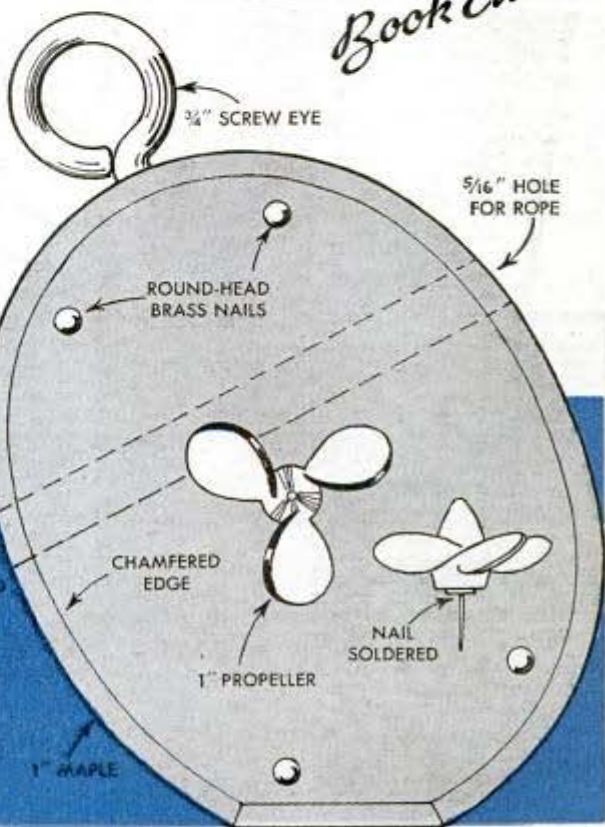
# 3 Navy-Style GIFTS for men



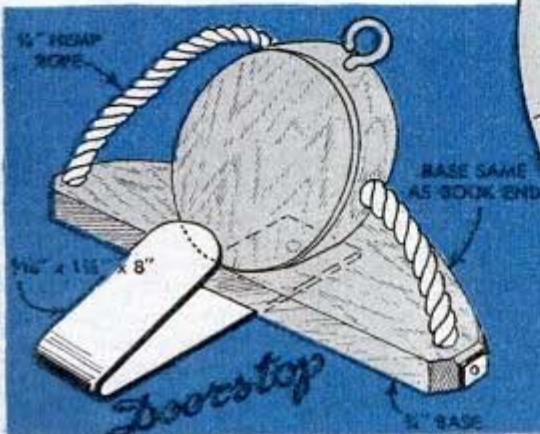
*Ash Tray*



*Book End*



These three gift items all have the same motif, and will add a distinctive nautical touch to any room. Although brass is preferable, other metal will do for trim, but nails and metal parts should match. Use hardwood having a close grain. If desired, you can match it to the furniture of the room in which the pieces are to be used. If you make all three pieces, be sure to use the same size rope. Felt should be glued to the underside of the bookends and ash tray as these may be placed on polished table surfaces

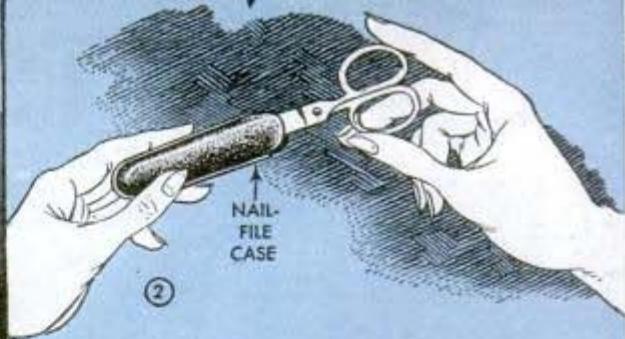


*Doorstop*

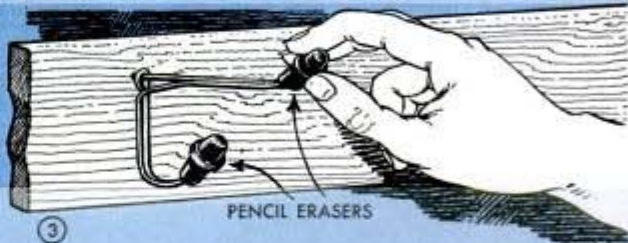
# Solving HOME



1—If you have no mixing faucet on your laundry tubs or kitchen sink, it is easy to improvise one from a length of garden hose which has an opening cut in the center. On faucets that have threaded ends, use hose connectors



2—To carry scissors safely in your bag, slip a nail-file case over the pointed end



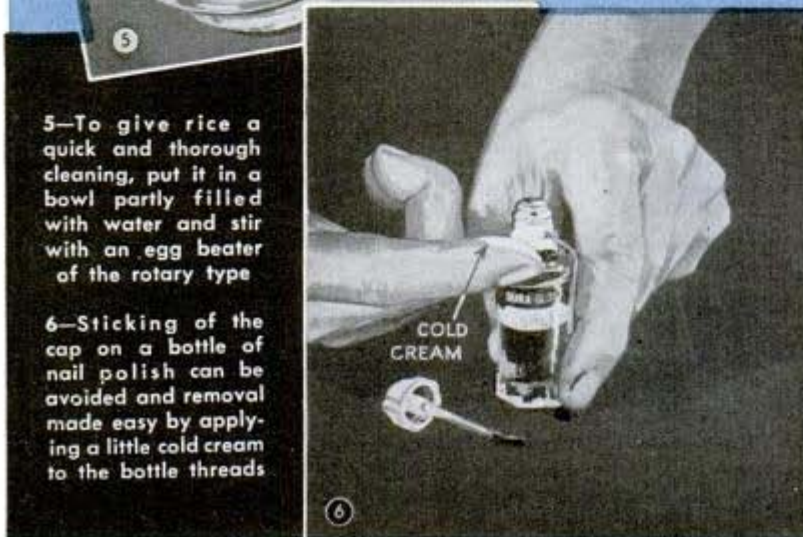
3—When it is necessary to hang several garments on a clothes hook, slip a couple of erasers over the hook ends and you can remove one garment without all of the others sliding off



5—To give rice a quick and thorough cleaning, put it in a bowl partly filled with water and stir with an egg beater of the rotary type



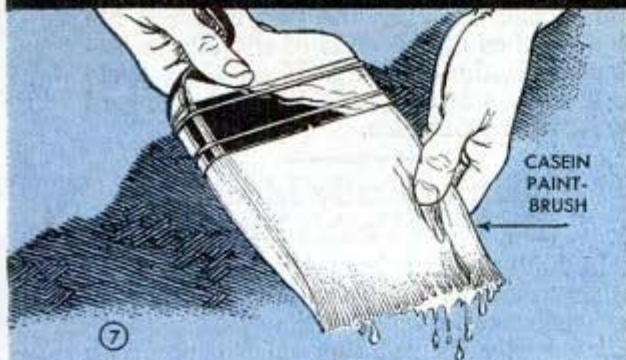
4—Clay flowerpots that have been broken can be repaired neatly by using an adhesive that consists of fine brick dust and ordinary household cement mixed to the consistency of a thick paste



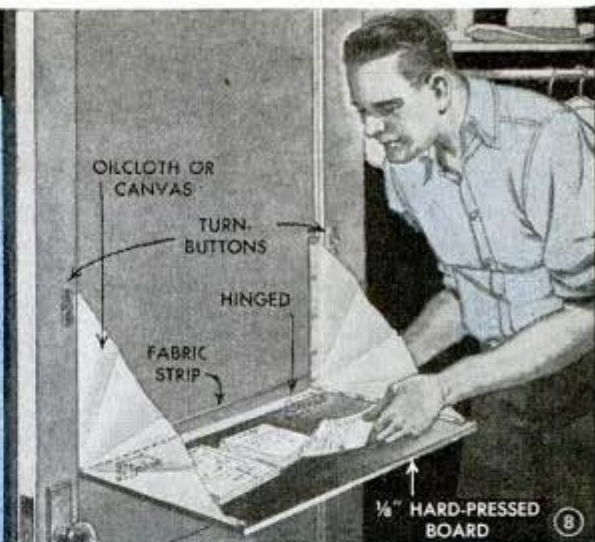
6—Sticking of the cap on a bottle of nail polish can be avoided and removal made easy by applying a little cold cream to the bottle threads



# PROBLEMS



7—Be sure a casein paintbrush is free of water, otherwise the first brushful will be diluted



8—Hinged to a closet or pantry door, and held with canvas or oilcloth at the ends, a shelf of hard-pressed board provides a handy compartment for bills and receipts, and serves also as a writing surface when making notes



9—If you have rubber casters on some of your furniture and they make black marks on the floors, just wrap adhesive tape (not friction tape) around the casters to act as tires

10—A small child in your home can be prevented from tampering with the fire in a heating stove or from getting burned against it if you merely set the play pen around it as indicated



11—An easy way to use soap scraps is to dry them thoroughly and then run them through a food chopper; resulting powder is handy in dishpan



12—To remove a cork from a bottle, pour in a little ammonia and leave it for 48 hours. The ammonia will eat away the cork so that it can be shaken out

## Hinged Bracket Supports Door For Planing the Edges



When trimming or rehanging doors you will find a bracket like the one shown a great help in supporting them for drilling or planing the edges. The bracket is made from two pieces of hardwood with a notch cut at a slight angle in the inner ends to form jaws, and the two parts are hinged on the bottom so that the weight of the door, pressing on the joint, will force the jaws tightly together. The bottom of the bracket is recessed so that the hinge pin will not mar the floor. By inserting a wedge between the door and one jaw, the bracket may be used on doors of various thicknesses.

## To Keep Dust Off Buffing Wheels

Oiled silk covers used on refrigerator dishes will serve as protective hoods for fine buffing wheels. One of these covers snapped over a wheel after use will prevent dust and oil from accumulating on it.

## Clip Keeps Pen on Ink Bottle



If you are troubled by having your penholder roll around and mar your work, here is an easy way to keep it right on the ink bottle where it al-

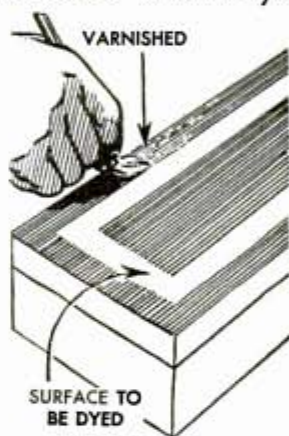
ways will be on hand. Cut a strip of spring brass or steel about  $\frac{1}{2}$  in. wide and bend it so that it will clip snugly to the sides of the bottle. To keep the pen in place file two notches at the ends of the clip as indicated in the drawing. If an old bicycle trouser clip is available it can be shaped to serve the purpose.

## Toiletries Easily Identified By Nail Polish Initials

In households where toothbrushes and other toiletries belonging to different persons often are confused, they can be identified easily by painting on the name or initials with colored nail polish. This method also is effective for cold cream jars, combs, hair brushes, powder boxes and other articles.

## Wood Inlay Simulated With Dye

An excellent method of imitating strip inlays on work is to use penetrating water dye. First the inlay is laid out in pencil and all but the part to be inlaid is "stopped out" with waterproof varnish. After this has dried, the wood is sponged with the dye. When dry the work is sanded to remove the varnish and smooth the surface. The "inlay" may be made with more than one color of dye, allowing each to dry before applying the next.—Ken Murray, Baltimore, Md.



## Proper Care of Razor Blade Keeps It Sharp Longer



The secret of making your safety-razor blades last longer is to keep them dry when not in use. Invisible rusting of the cutting edges dulls them more than actual shaving. Wiping them dry on a towel or dipping them in alcohol are good methods, but are time consuming and therefore often are not used. A better way is to dry them between two blotters. Hinge these together with a piece of tape at one

end. After shaving, remove the blade and place it between the blotters for a moment. Then move it to a dry place between the blotters and leave it there until used again.

—W. F. Schaphorst, Newark, N. J.

## Weighted Cap Protects the Point Of a Fountain Pen



When a fountain pen rolls off a desk or is accidentally dropped it usually strikes on the point, which then is damaged. To avoid this, cement a piece of lead to the inside of the cap as indicated. Then if the pen drops, the weight

is sufficient to make the cap end strike the floor first and protect the point. Be sure to see that the pen point clears the lead when the cap is screwed into place.

—Herman R. Wallin, Washington, D. C.

## Improved Valve for Blowtorch

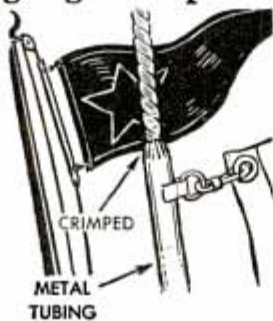
I made a handy blowtorch relief valve by cutting off a metal tire valve to a length of 2 in. and then threading the lower end so that it could be screwed into a hole drilled in the top of my blowtorch, soldering around the base of the valve for rigidity. Now I can fill the torch with air from a compressor, or release the air quickly and, at the same time, put out the flame without closing the needle valve.

—John D. Reynolds, Liberty, N. Y.

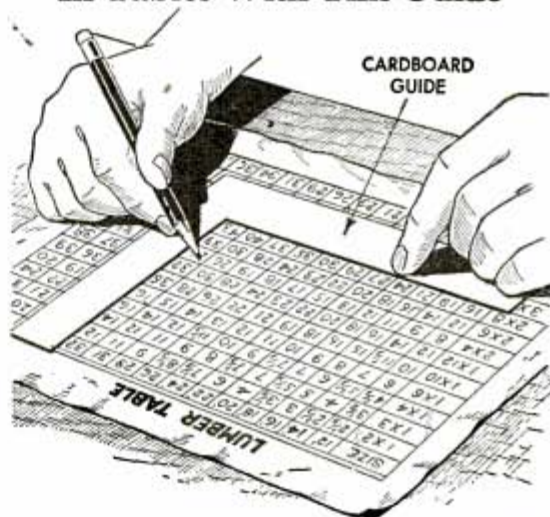
## Attaching Flag to Tube Support Prevents Tangling in Rope

Flags will be less likely to tangle in the rope on the flagpole if they are attached to a rigid support instead of directly to the halyard as is usually done. Such a support can be made from a length of light metal tubing slightly longer than the width of the flag. Two eyes, spaced to meet the grommets in the flag, are welded or soldered to the tube to take snap hooks as shown, and the ends of the tube are crimped to grip the rope.

—Bernard A. Peltier, Port Huron, Mich.



## It's Easy to Read the Printed Data In Tables With This Guide



Anyone who has to use printed tables will find this guide handy. Cut to an L-shape from cardboard and used as indicated, the guide prevents any possibility of accidentally taking data from the wrong line or column. If desired, a square piece of celluloid can be used by painting a band along the right and lower edges. Colored nail polish, which adheres well to celluloid and dries quickly, can be used for painting.

## Rounded Corner Improves Knife



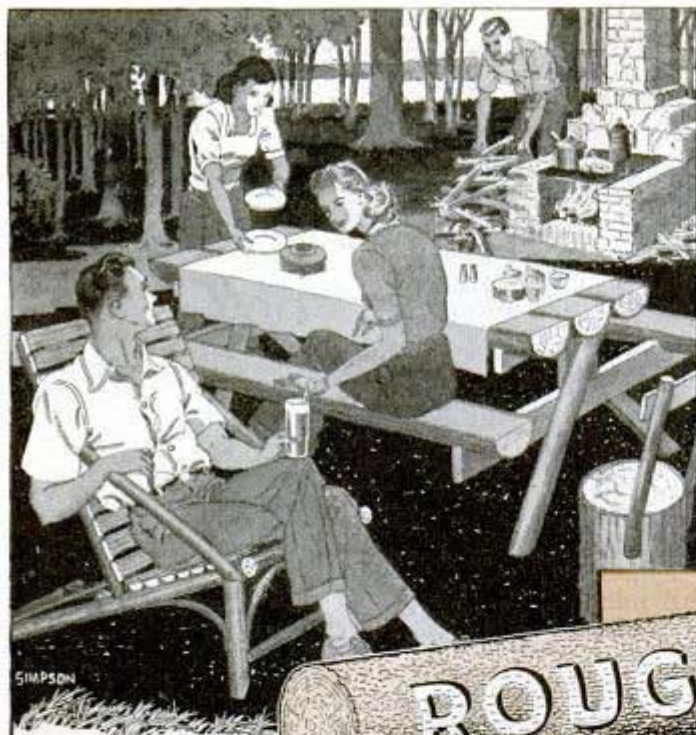
A knife used on paper, leather, cloth and similar cutting jobs will work better if the corner of the cutting edge is rounded and then sharpened. A right angle will gather and push particles

of the material ahead of it, resulting in a tear, or the accumulated particles are apt to cause the knife to skip and not cut.

## Photo Easel From Match Books

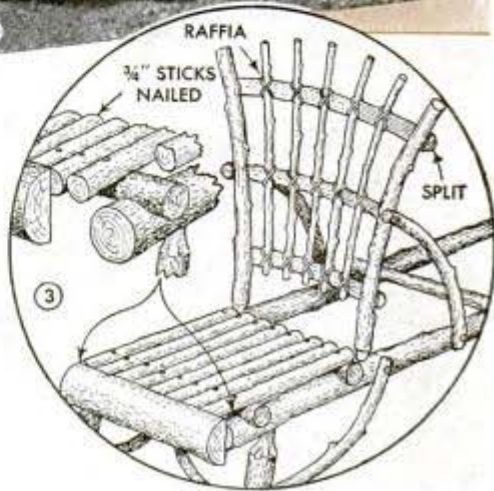
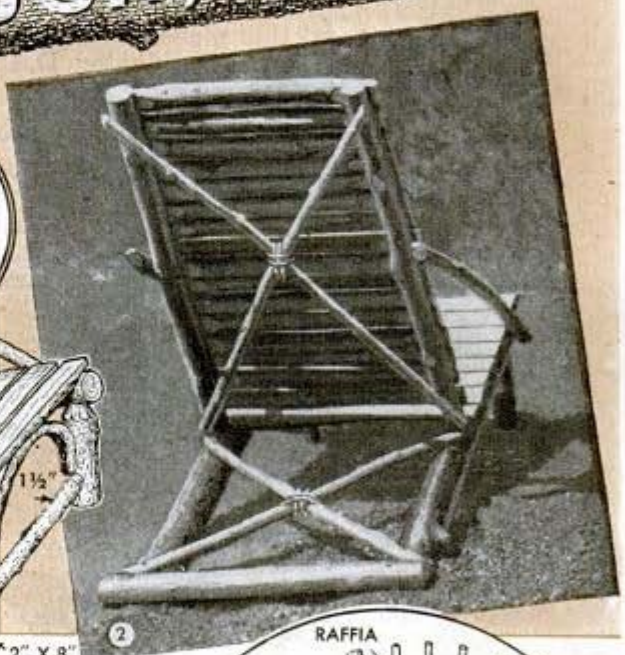
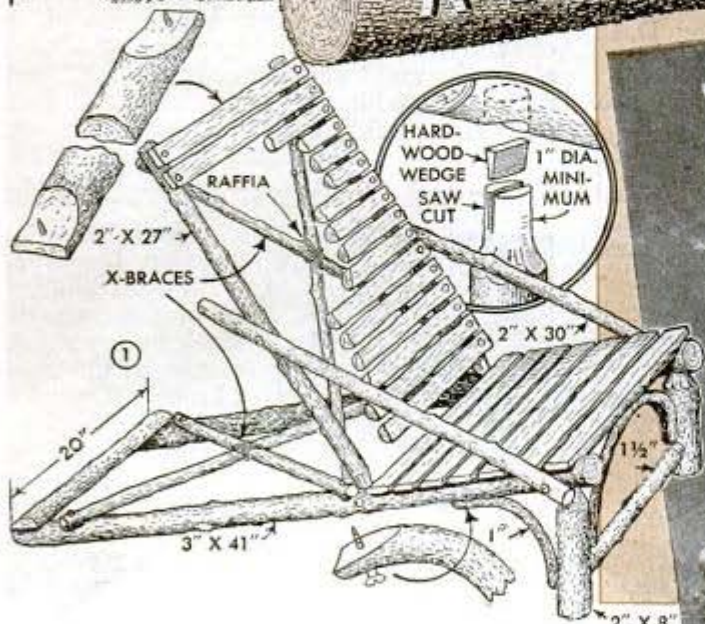
From the barracks comes this suggestion for making a handy easel for snapshots. Take two empty match books, fold the covers back to form a support, and insert the photo between the strike strip and the match stubs.





the furnace room in winter or a sunny spot in summer. Also, it's better to use screws than nails as screws are less likely to loosen and pull out. This is especially true in regard to slats used as seats and backs where constant flexing of the slats tends to loosen nails.

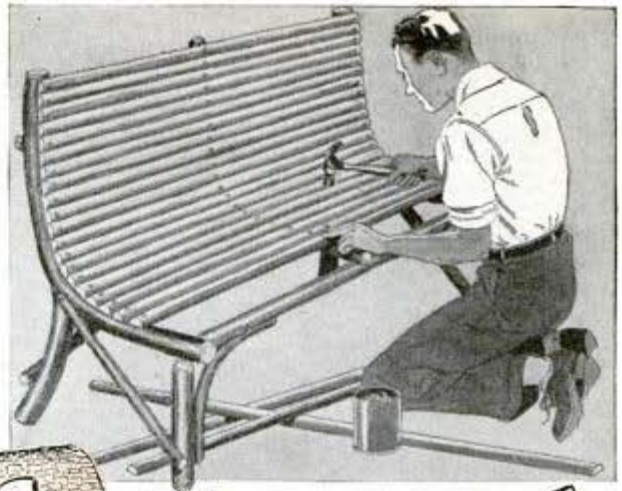
Fig. 1 shows a chair of easy but substantial construction. Two short legs are mortised into saplings that form the seat frame and serve as a rear support. To assure rigidity and tight joints, hardwood wedges are inserted into saw cuts in the tenons, as shown in the circular detail, to spread the tenons when



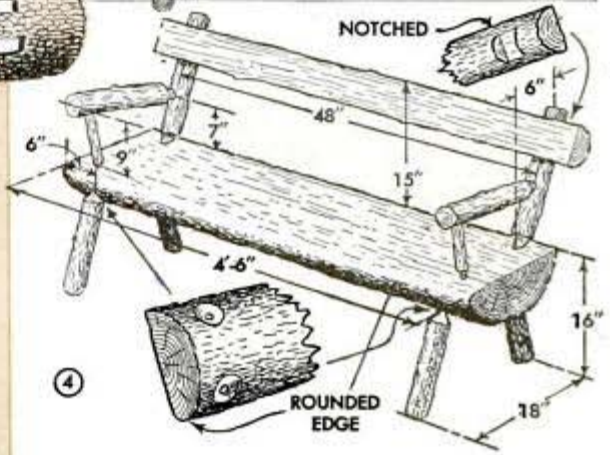
### Part I: Chairs, Benches and Tables

WITH the simple ruggedness of the tree trunks and branches of which it is made, rustic furniture is appropriate for lawn, porch or cottage, and will withstand the weather indefinitely. Additional protection can be provided by applying spar varnish not only over the raw wood but also over the bark to prevent moisture from seeping between it and the wood. As green wood shrinks considerably, which results in loosening of the joints, only seasoned wood should be used except where sticks or branches are to be bent. These should be curved around a form and left to season for a few weeks in a warm, dry place such as

they are forced into holes drilled in the frame. After the legs have been mortised, nails or screws can be driven through the frame and into the tenons. Seat and back are split saplings flattened at the ends to fit snugly on the frame where they are screwed in place. To provide concave surfaces for greater comfort, these pieces may be shaped with a drawknife before fastening in place, and left slightly roughened rather than plane-smooth for rustic effect. Two X-braces, shown in Fig. 2, are used as reinforcements to prevent twisting. These are bound with raffia,

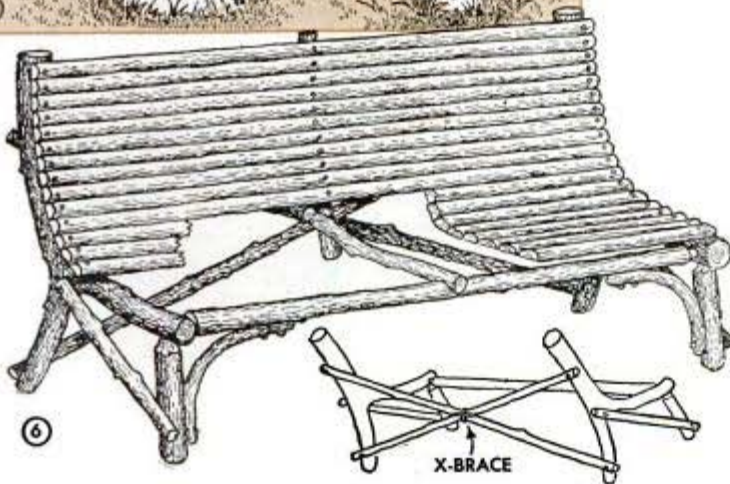
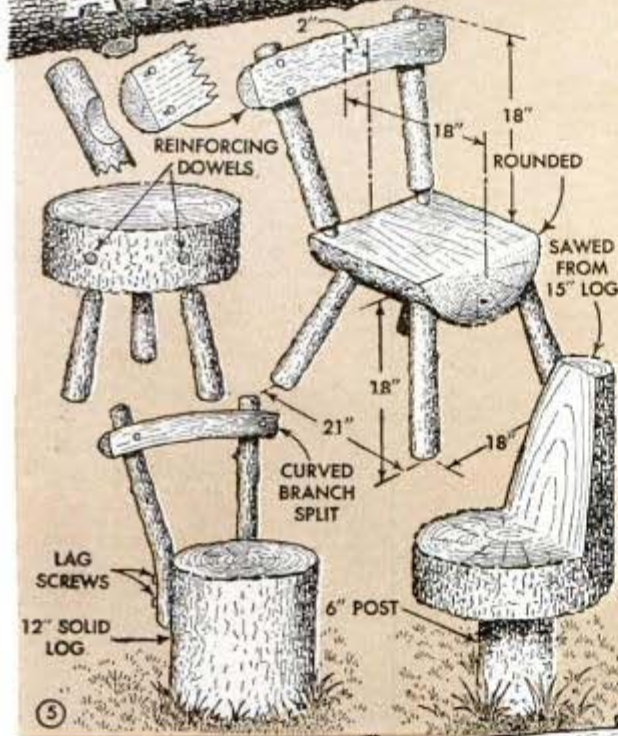


# AND RUSTIC



rawhide or stout cord at the intersections, and are screwed to the frame. Arms, which serve as additional supports for the back, are fastened with countersunk screws concealed with plugs.

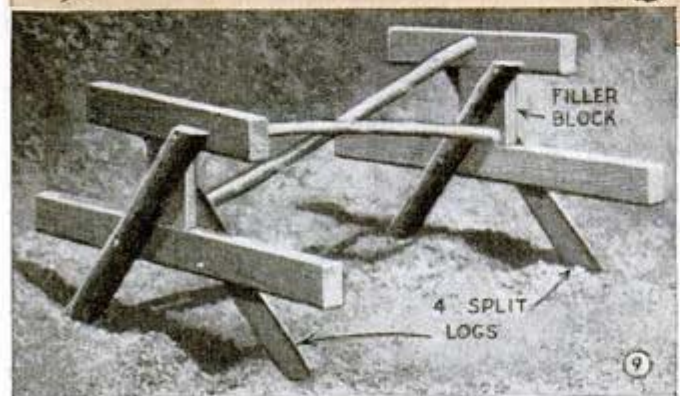
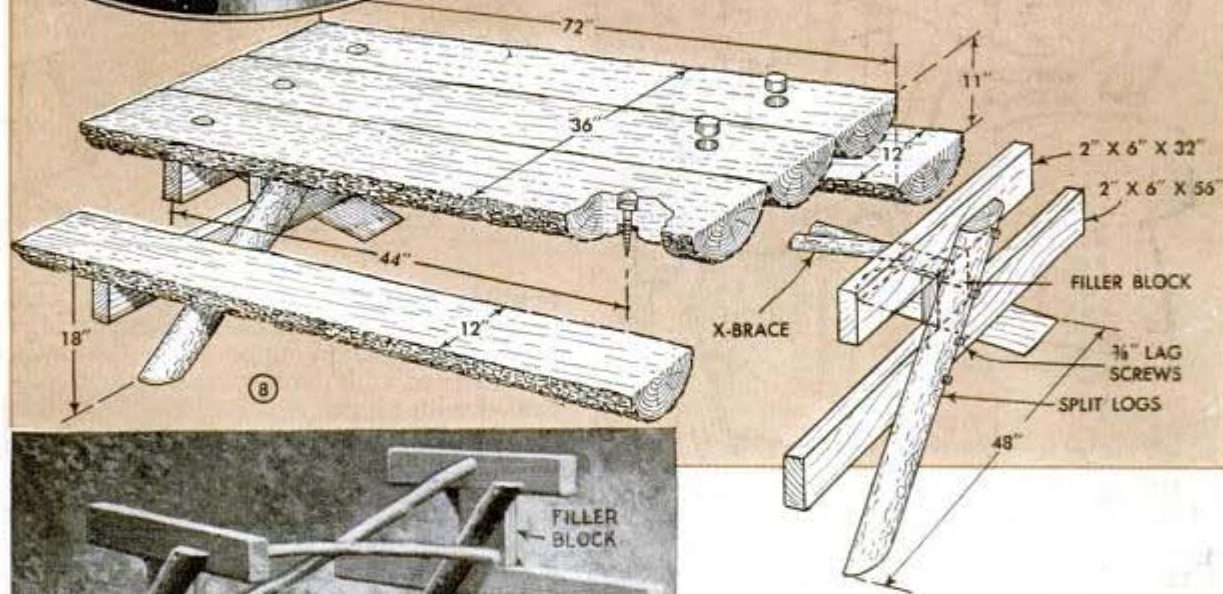
A similar chair is shown in Fig. 3. Saplings form the frame and, as in the chair shown in Fig. 1, two legs are attached by wedge-spread tenons and reinforced by curved braces on sides and front. Sticks forming the seat are nailed to cross members that fit notches in the frame, and split molding covers the ends. On this chair, arms are omitted, a brace being substituted on each side to support a fan-shaped back. This is made of narrow pieces bound with raffia or stout cord to cross members screwed on curved uprights. The chair shown in Fig. 11 has willow whips for the seat and back to provide resiliency. Net sizes of all parts are shown in the cross-hatched drawing, Fig. 10. Ends of the stretchers are cut concave to fit the round contour of the legs against which they are butted and screwed, as shown in the detail





screws driven into counterbored holes, which are plugged. Curved braces may be added for additional support if desired. A back rest is notched as shown and screwed to upright supports, which are drilled for tenons on the arms. For variation, the back and arms may be omitted to make a bench.

Chairs and stools to match the settee are shown in Fig. 5. On the four-legged chair, the back rest is set into notches in the uprights, but the same construction may be followed as for the settee. If wood used for the three-legged stool has a tendency to split easily when dry,  $\frac{1}{2}$ -in. wooden dowels may be inserted in holes drilled across the grain and secured with waterproof



of Fig. 11. A diagonal brace, attached to front and rear legs, wedges a center rail securely for attachment of willow whips. These are nailed to inside surfaces of the frame as indicated in the circular detail.

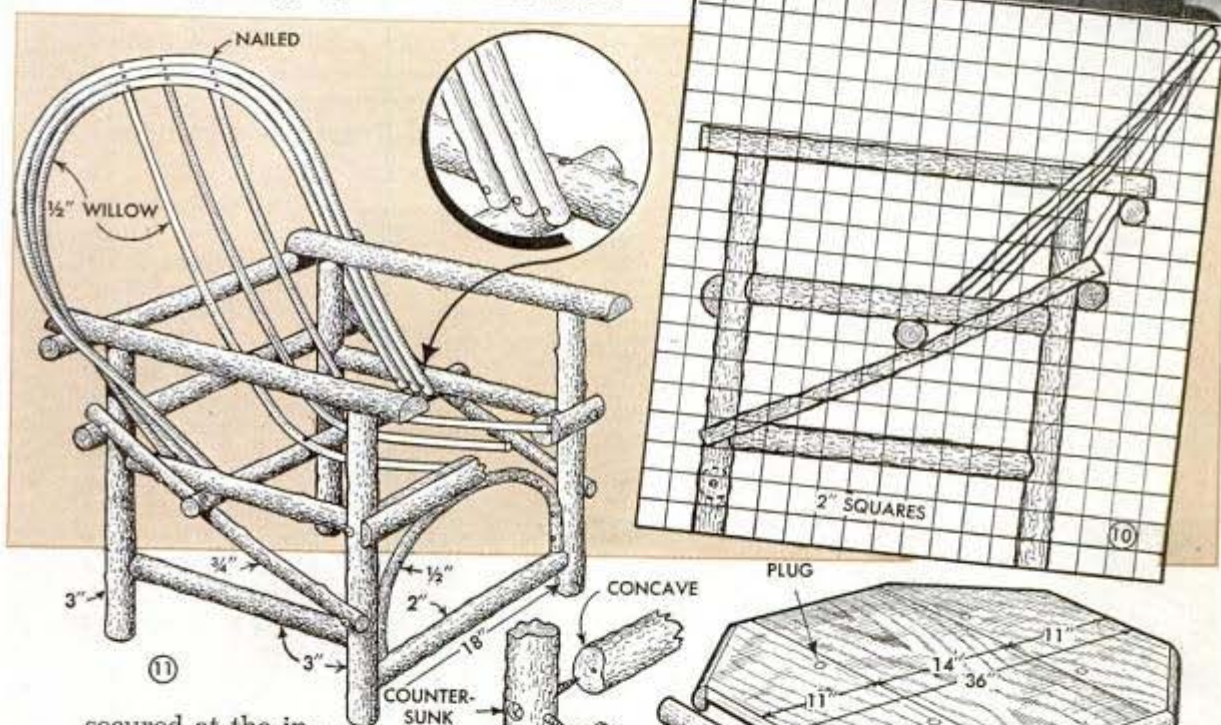
For the settee, Fig. 4, a large split log about 9 or 10 in. in diameter is rounded at the edge and smoothed for a seat. Legs are set tightly in holes drilled at the desired angle in the underside, and secured with

glue. The two chairs or stools shown at the bottom of Fig. 5 illustrate what can be done with conveniently situated tree stumps. Edges of seats should be rounded to prevent snagging clothes.

Another settee can be made as illustrated in Fig. 6. Crotched limbs, as nearly alike as possible, are cut for back supports and rear legs, and set aside to season. When the wood is thoroughly dried, holes are drilled for front legs, which are secured by wedges and screws as suggested for the chair shown in Fig. 1, and a suitable piece is inserted to form a front rail. Curved braces are screwed to front legs and rail, and an X-brace is attached as shown in the detail.

Before the seat slats are nailed on, holes should be drilled for the nails to prevent splitting the dried frame.

Split-log slabs are excellent for a fixed, outdoor table that will survive years of hard use. Large posts, well creosoted to prevent decay, are sunk into the ground below the frost line so that they will not heave. They are slotted as shown in Fig. 7 to take 2 by 6-in. crosspieces, which support half logs that form the top. Shallow logs or slabs are best for this purpose, and should be sawed or planed straight on each edge to fit together closely. Screws driven through the slabs into the crosspieces should be countersunk and plugged so as not to be noticeable. A similar table with built-on benches is shown in Fig. 8. The crosspieces that support the table and benches are mounted on split-log legs with a filler block

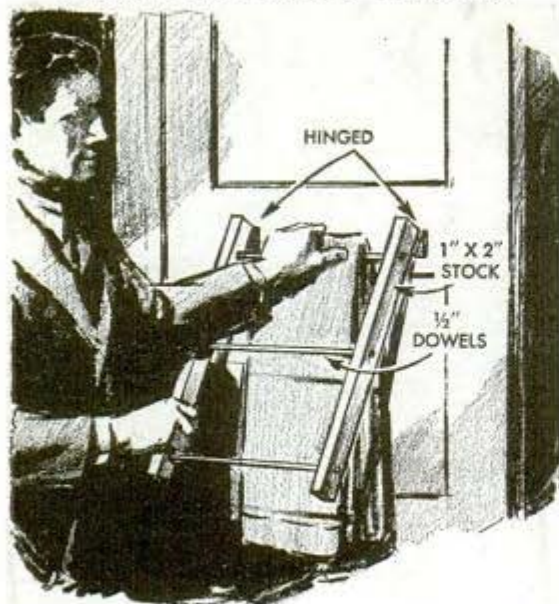


secured at the intersection by a bolt. An X-brace, consisting of 3-in. saplings, is screwed to the crosspieces as shown in the photograph, Fig. 9. Another table, of lighter construction, is shown in Fig. 12. As finished lumber is used for the top, this table is suitable for indoor use in cottages and camps. Legs are glued into holes drilled in a 1 by 3-in. frame. Then the top is screwed to the frame, holes for the screws being countersunk and plugged, and bark-covered, split pieces are nailed along the edge for a molding. Curved braces support legs and frame, and four short spreaders join the stretchers.

(To be continued)

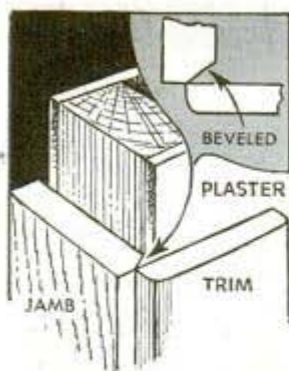


## A Folding Rack on Closet Door Holds Your Extra Trousers



Where closet space is limited, summer slacks or other extra trousers may be hung over the bars of a rack attached to the inside surface of the door. The rack is made by gluing lengths of dowel into holes drilled in side members, and is fastened to the door by small hinges at the top which permit the rack to be raised for hanging garments. The rack may be made as long as desired with as many cross bars as needed.

## Beveling Edges of Door Jambs To Make Casings Fit Tightly



In fitting door frames, here's a good stunt one carpenter uses to make the trim boards fit tightly against an unevenly plastered wall. Before nailing the jambs and header in place, he bevels the inner edges of them slightly, so that

when the trim is applied, the bevel will tend to draw it inward tightly against the wall.—Pvt. Wayne C. Leckey, Aurora, Ill.

## Welding Torch Removes Carbon From Stove Generator

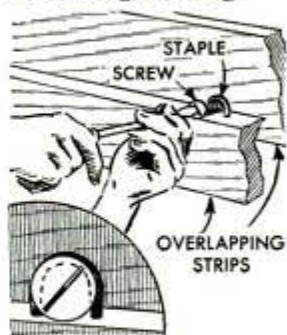
Having a job of repairing a gasoline stove on which the generator was clogged with carbon, I burned the carbon out with a welding torch. To do this, I first turned on enough flame to ignite the carbon inside

the generator and then turned off the acetylene gas and let the oxygen burn with the carbon until the generator was clean.

—Edward Harris, Hagersville, Ont., Can.

## Work That Has Narrow Overlap Fastened Without Splitting

When two pieces of wood are overlapped at the edges and the lap is not enough to permit nailing or screwing them at the lap without splitting, they can be fastened with a screw and a staple as shown. Drive the staple into the exposed edge of one piece and then drive a screw through the staple into the other piece.—N. G. Near, Newark, N. J.



## Rubber Cushions Glass Funnel To Prevent Breakage



Pushed over the neck of a glass funnel, a small inner-tube patch or similar piece of rubber will act as a cushion between the funnel and the container on which it is used to prevent chipping or breaking the funnel. The hole in the rubber should be a tight

fit over the funnel neck so that it will not slip off easily when the funnel is lifted.

—Herman Klein, Pittsburgh, Pa.

## Cellophane Protects Wrist Watch Against Perspiration

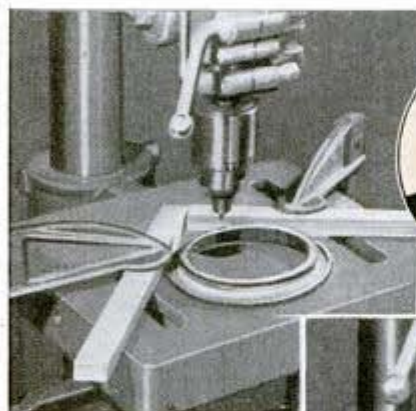
Finding that perspiration from his wrist was damaging his watch, one workman eliminated the trouble with a small piece of Cellophane, which he slipped between the watch and his wrist. The Cellophane projected slightly at each side of the watch and thus prevented moisture from coming in contact with it.





# Sand Box ASH TRAY

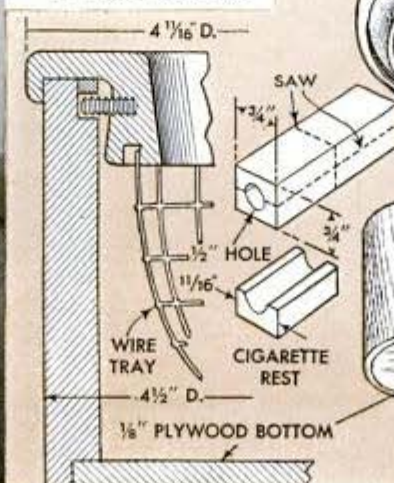
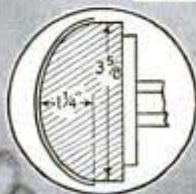
Convenient to clean, this attractive ash tray can be made from either plastic or hardwood. The body is cut from a 4½-in. plastic cylinder and the top is turned from a piece of ½-in. sheet plastic. Body is half filled with silica sand, which usually is obtainable at any building-supply dealer. Cigarette butts are removed by lifting the tray, and the sand itself needs changing only about every tenth cleaning. If desired, the sand can be cleaned by blowing on it to remove ashes while it is being poured from one container to another. Wire mesh used for the tray is spun or hammered to shape over a hardwood form, after which the surplus is cut off with a chisel as shown in the lower left photo



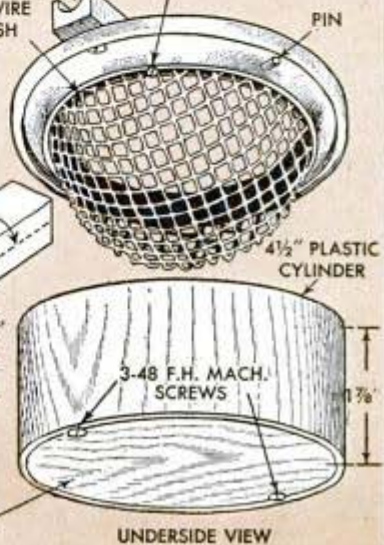
USE THIS SETUP FOR ROUTING TRAY GROOVE



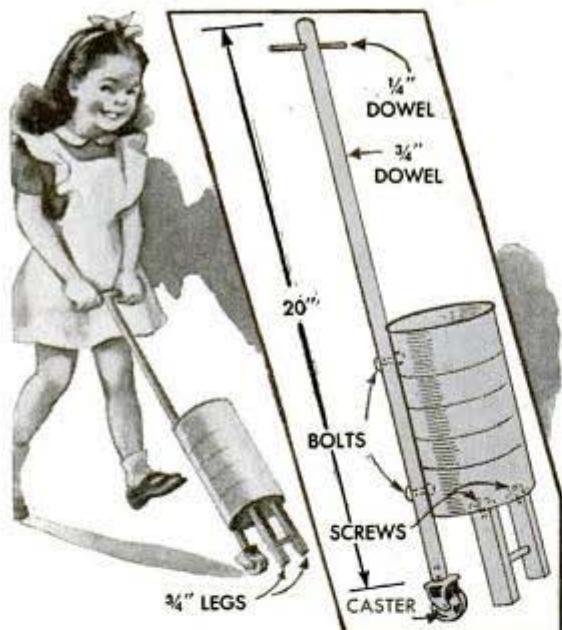
CUT SLOTS IN BOX BODY TO TAKE PINS IN LID



CIGARETTE REST 3-48 R.H. MACH. SCREW TO HOLD WIRE  
1/4" WIRE MESH PIN



## Shopping Cart for a Little Girl Made From a Tin Can



The little feminine member of your family will feel quite grown-up if she has this shopping cart when she goes to the store with mother. It is made from a large tin can which is bolted to a dowel handle having a caster at the lower end. A small dowel run through the handle at the upper end serves as a hand grip, and two short legs nailed to the bottom of the can help support the cart in a vertical position.

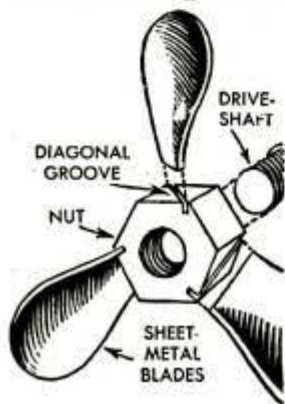
—Harold Gluck, Bronx, N. Y.

## Matchstick Provides a "Brush" To Clean Your Fingernails

Grimy fingernails can be effectively cleaned with a "brush" made by cutting off the head of a match and flattening the end. For best results, place the flattened end in warm water, rub against a cake of soap and dip it into powdered pumice.

—James Garmon, Los Angeles, Calif.

## Model Propeller Easily Assembled



Propellers for model boats can be made very simply as shown in the illustration. Saw a groove diagonally across three sides of a hexagon nut that will fit the boat's driveshaft, and insert blades cut from light sheet metal thick

enough to fit the grooves snugly. If very thin metal is used, or the saw cuts are wide, the ends of the blades can be folded over and tapped to form a slight bead that will hold the blades fast. The blades then can be bent out to give the desired pitch.

## Ammonia Frees Battery Terminal

For removing corroded battery terminals that are stuck tightly to the post, apply a small amount of ordinary household ammonia, letting it soak in for a few minutes. The terminal then can be lifted off easily, after which it should be wiped clean and dry.—Hal Geihm, Aurora, Ill.

## Paraffin Seals Gummed Paper Roll Against Effect of Moisture

Rolls of gummed paper are sometimes moistened by humidity so that the layers adhere in a solid mass that cannot be used. To avoid penetration by atmospheric moisture, coat the sides of the roll with a thin layer of melted paraffin, which seals the edges, yet allows the roll to be unwound as used.

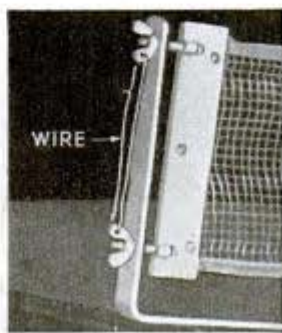


—Pfc. Andrew Vena, New York City.

## Mix Your Own Furnace Cement

A good furnace cement, which also can be used in fireplaces, is made by mixing wet fire clay, 100 parts, manganese dioxide, 3 parts, silver sand, 3 parts, and powdered asbestos, 1/2 part. After mixing, enough water is added to give the material a doughy consistency.

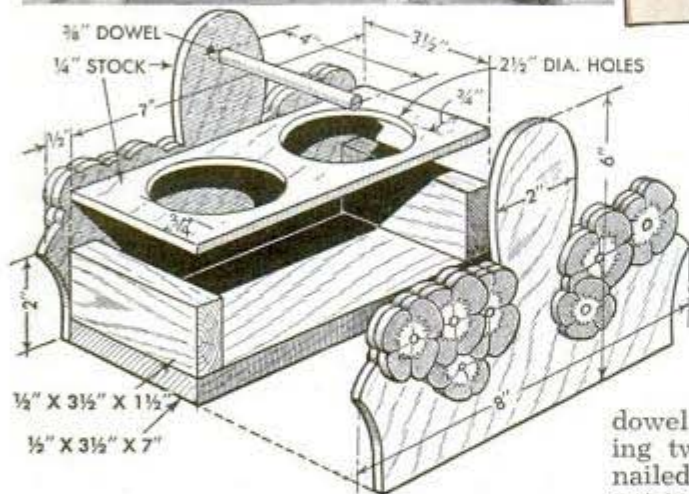
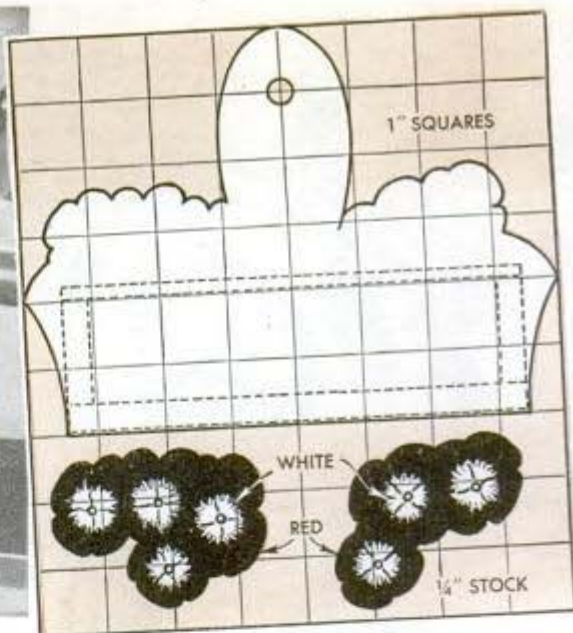
## Preventing Loss of Wing Nuts On Table Tennis Net



The wing nuts to tighten our table tennis net often were removed and lost or misplaced by the small children. To prevent this trouble, I drilled a small hole in one wing of each nut and wired the nuts together as shown in the photo. This prevented the children from disturbing them, but permitted an adult to remove them whenever necessary.

—R. F. Bertrand, Dearborn, Mich.





when bought, the designs on the wheel and handles should be painted to match it.

For the sandwich or cracker trough, hard-pressed board or  $\frac{1}{4}$ -in. wood is glued and nailed in a V-slot cut in a base of  $\frac{1}{2}$ -in. stock, as shown. The roosters are jigsawed

from  $\frac{1}{2}$ -in. stock according to the cross-hatched pattern. Their dowel legs are glued in holes drilled in the base as shown in the circular detail, so that their heads overhang the trough. Feet are painted on the base, and a triangular piece is nailed at each end.

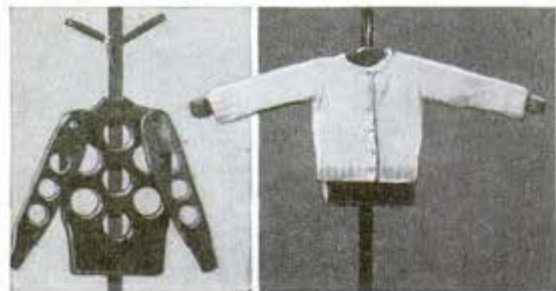
The sauce and dressing basket has two sides jigsawed to the size and shape indicated in the cross-hatched pattern and nailed to a base and end blocks. A length of dowel serves as a handle, and a tray, having two circular cutouts to hold jars, is nailed on the end blocks. Plywood flowers, cut to coincide exactly with the outline of the basket sides, are glued in place as overlays. Except for any painted decorations, all pieces may be left in natural finish by applying a coat of varnish or transparent lacquer. Or they may be painted in bright colors as suggested in the illustration.

## Ventilated Plywood Form Aids Rapid Drying of Sweaters

Sweaters will be less likely to lose their shape if they are dried on this plywood or pressed-board form, which permits air circulation and rapid drying. The arms, piv-

oted by bolts, can be moved down to put the sweater on the form and raised for drying. After sawing out the parts, sandpaper the edges smooth to prevent "snagging" and damaging the sweater, and apply a coat of varnish to make the form water resistant.

—Paul Komroff, Flushing, N. Y.



## Hints on Spinning Metal

The following suggestions will make metal spinning easier and more successful: For lubricating the disk, cook a half-and-half mixture of yellow soap and tallow, letting it harden before use. Yellow soap

applied to the edge of the shell when trimming it will give better results. Maple and gumwood make the best spinning forms, and when several shells must be spun on the same form, it will last longer if yellow soap first is applied and spun over it. Removing a deep-spun shell is easier if tallow is applied to the form before spinning. When spinning steel always use a brass tool and brass or wood back stick, but in spinning brass or copper, steel tools and steel or wood back sticks should be used, and these metals should be annealed before spinning. An old file ground and polished smooth makes an ideal back stick.

—Cpl. M. R. Baun, Randolph Field, Tex.

### Light Oil Film Applied to Shaft By Means of Wick in Can



When it is necessary to apply a very light film of oil, such as when lubricating a small shaft, the job can be done easily by using a wick in the oilcan spout. An ideal wick for this purpose is obtained by inserting

a pipe cleaner into the spout, allowing about a quarter of an inch of the cleaner to project. If the spout is too large to hold the wick in position the cleaner can be folded at the lower end to increase the diameter sufficiently so that the wick will be firmly wedged in the spout.

### Fruit Jar and Cardboard Carton Used as "Vacuum Bottle"

Here is a simple way to improvise an insulated container in which to keep beverages hot or cold. Set a ½-gal. fruit jar inside a large oatmeal carton and then pack crumpled paper or other suitable insulating material between the sides of the jar and the carton. Be sure to use a rubber ring on the jar so that there will be no possibility of the contents leaking out. If desired, some of the insulating material can be glued to the underside of the carton lid to provide better insulation.



### Dampness in Basement Removed With Calcium Chloride



When exposed in an open mesh bag, calcium chloride, due to its affinity for water, will readily extract moisture from the air and ultimately liquefy. It therefore is ideal as an aid in keeping basements and other damp places dry. A bag of 25 lbs. will last all summer in an average basement. An easy way of using the chemical is to pour it into a mesh bag, such as one of cheese-cloth, suspended from a simple frame like the one shown. A pan or other container should be placed under the bag to catch the drippings. The rate of absorption can be accelerated by using a small electric fan to blow air over the exposed chemical. Liquid from the pan can be utilized for sprinkling coal or ashes to help prevent dust in the basement.

—G. J. Issakoff, Sioux City, Ia.

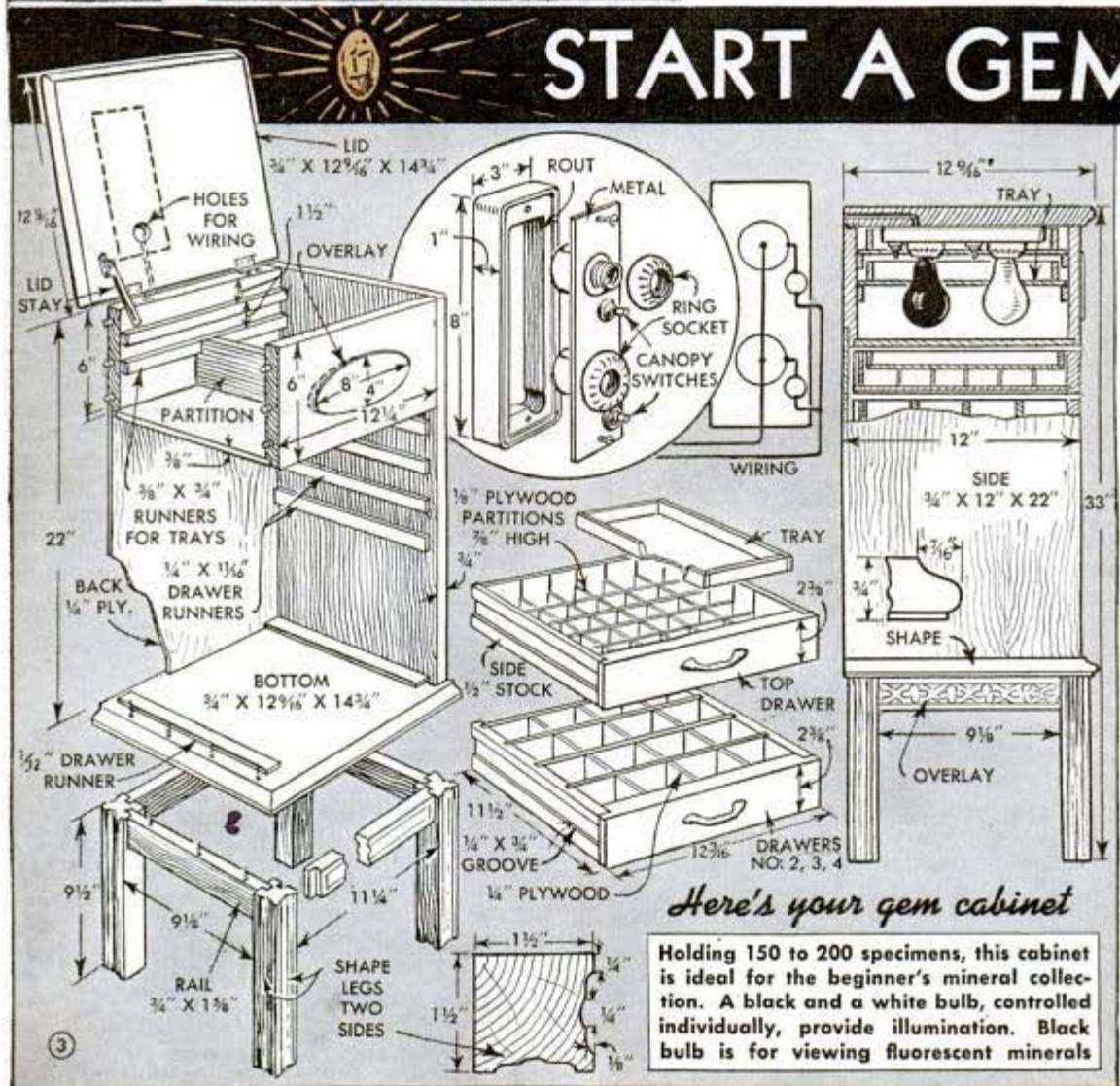
### Simple Repair for Water Pail

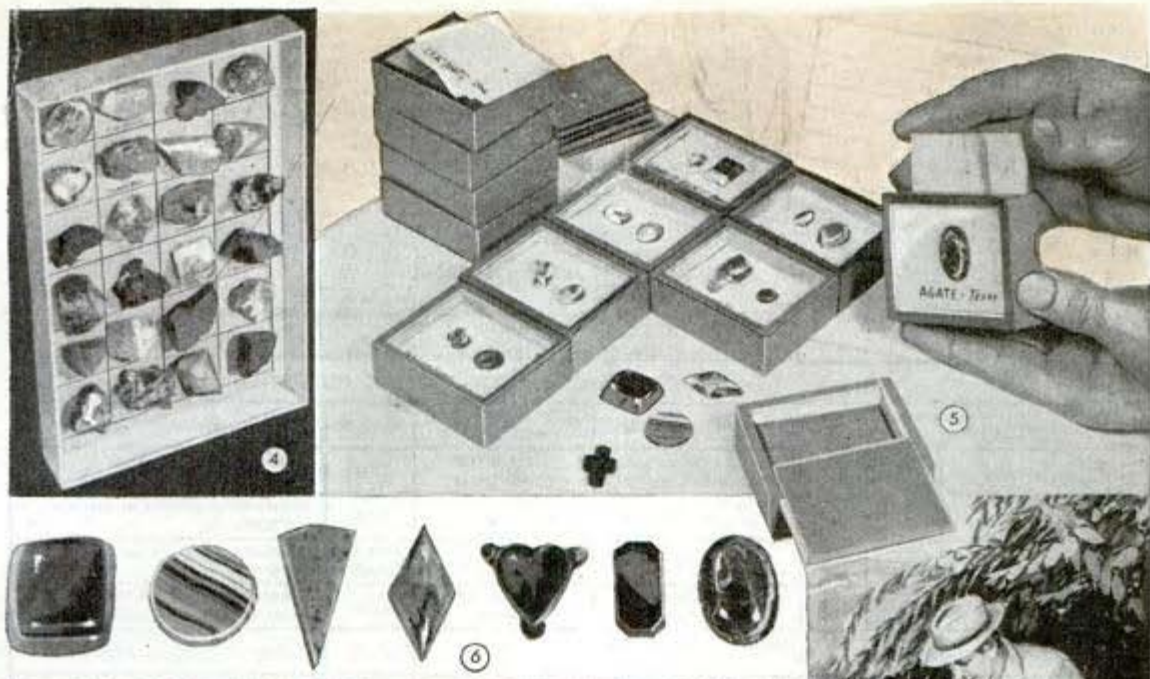
If one of the bail ears on a pail breaks, a repair can be made by using a window-shade fastener. Just bend the arm of the fastener back, shape the fastener to the curvature of the pail and attach it with rivets. Or, you can scrape and sand off any finish that may be on the fastener and solder it in place.—E. R. Gorton, Maryville, Mo.





# START A GEM





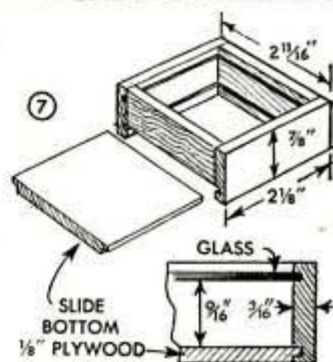
# COLLECTION

By Sam Brown

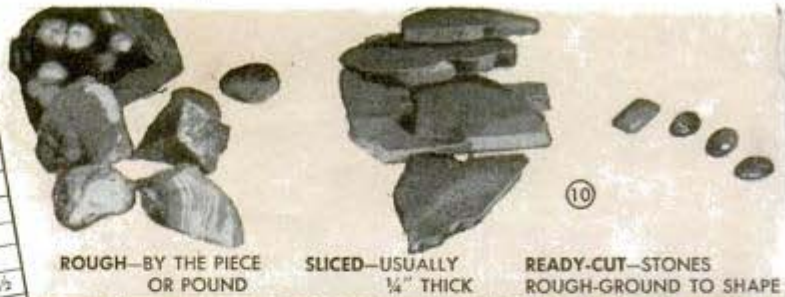
**I**F YOU are looking for a new hobby, try mineral collecting. You can go at it in one of two ways. You can merely collect minerals or you can collect and then cut and polish those rated as semi-precious gems. Stones are available at nominal cost, but it is more fun prospecting for your own. Almost any beach or river bed will yield stones suitable for cutting.

**The gem cabinet:** Like any other hobby, gem collecting is most enjoyable when you can display your work. A small cabinet for this purpose is pictured in Figs. 1 and 2, and is detailed in Fig. 3. The hinged lid carries a white bulb and a black bulb, the latter for viewing fluorescent minerals. Two sliding trays in the upper part of the cabinet provide room for 16 individual gem mounts. The top drawer has a tray and 36 compartments. The second, third and fourth drawers have 16 compartments each for larger specimens, and the large bottom drawer is plain. However, the arrangement can be altered to suit, but this plan will be found very satisfactory, as it provides accommodations for 150 to 200 specimens.

**Individual mounts:** Cut and polished stones look best in individual mounts and should be mounted on white cards together with a small piece of the raw material if available. A good type of mount is shown in Figs. 5 and 7. The slide bottom permits ready removal of the stone. Rubber cement is used to mount the stone on a white card, which then is pushed up from the underside of the mount until it is tight against



MOHS' HARDNESS SCALE		
No.	Mineral	Comparative Mat'l
1	Talc	Lead - 1½
2	Gypsum	Fingernail
3	Calcite	Copper coin
4	Fluorite	Iron - 4-5
5	Apatite	Knife blade
6	Feldspar	File - 6-7
7	Quartz	Garnet
8	Topaz	Steel - 5-8½
9	Corundum	Silicon carbide - 9½
10	Diamond	



Buy gem material any of three ways

11 SELECTED CABOCHON CUTTING GEM MATERIALS

Name of Mineral	Hardness 1	Spec. gravity	Color 2	Transparency and luster 3	Cost 4	Remarks
Agate, banded	7	2.7	Usually red-brown and white in bands	Translucent glassy luster	Low	Best known agate. Usually very attractive coloring
Agate, moss	7	2.7	Red, green or gray	Translucent glassy to waxy	Low	Shows moss growth in interesting patterns
Agate, scenic	7	2.7	All colors	Translucent glassy	Low to med.	Inclusions resemble flowers, trees, etc.
Agate, Sweetwater	7	2.7	Gray, with dark inclusions	Translucent waxy	Low	Sweetwater, Wyo. A moss agate—water worn pebbles
Amazonite	6½	2.5	Green, lightly streaked with white	Opaque glassy	Med.	Variety of feldspar. Nice color
Azurite	3½	3.7	Deep blue	Opaque waxy	Med.	Too soft for rings. Tends to undercut
Chlorastrolite	5½	3.2	Green with white markings	Translucent to opaque-glassy	High to v. high	Water worn pebbles. Often chatoyant 5
Chrysocolla	3	2.2	Green or green-blue	Translucent to opaque-glassy	Med.	Rather soft. Very nice blue color
Dinosaur bone	7	2.6	Usually red, brown or black	Usually opaque waxy	Low	Bone replaced by agate or jasper. Often nicely marked
Jade, American	6½	3.1	White to green	Translucent glassy	Med. to high	Oregon (grossularite). California (vesuvianite). Good cutting
Jasper, breccia	7	2.6	Mixture of various colors	Opaque waxy	Low	Attractive coloring. Also "puddingstone"
Jasper, poppy	7	2.6	Usually red with yellow markings	Opaque waxy	Low	Attractive coloring. Also known as orbicular jasper
Labradorite	6	2.5	Gray, with blue play of color	Opaque glassy	Med.	Excellent play of blue color. Labrador, Canada 6
Lapis lazuli	5½	2.6	Deep blue or green-blue	Opaque to translucent-glassy	High	Cheap specimens usually in gray matrix 7
Malachite	3½	3.8	Bright green	Opaque glassy	Med. to high	Often banded or with radial fibrous structure
Moonstone	6½	2.6	Translucent white	Translucent glassy	Med.	Usually double cut to display marked opalescence 8
Opal	5½	2.0	Various. Usually white or black	Translucent glassy	High to v. high	Precious varieties show beautiful play of colors 6
Petrified wood	7	2.7	All colors	Translucent waxy to glassy	Low	Also agatized wood. Interesting patterns, nice colors
Rose quartz	7	2.6	Pink	Translucent glassy	Med.	Often opalescent. Valuable when asteriated 9
Sagenite	7	2.6	Red-brown hairs in clear quartz	Transparent glassy	Med.	Also rutilated quartz or Venus's-hairstone
Smithsonite	5	4.2	Green or blue	Translucent glassy	High	Nice color. Green variety also known as banomite
Tiger-eye	7	2.6	Yellow-brown, sometimes red or blue	Opaque glassy	Med.	Chatoyant. Principal locality, South Africa 5
Thomsonite	5	2.3	White, gray, red or brown	Transparent to opaque-glassy	High	Popular with mottled or eye markings in red or green
Turquoise	6	2.6	Green to sky blue	Opaque waxy	High	Sky blue color is most desirable
Variscite	4½	2.5	Apple green to blue-green	Translucent to opaque-glassy	Med. to high	Cheap specimens in slate gray matrix 7

NOTES

- Based on the ability of one mineral to scratch another. See Mohs' scale above. No. 7 will scratch No. 6, etc.
- Some variation in color should be expected.
- Glassy indicates luster of glass; Waxy, somewhat lower.
- Most gems listed are inexpensive. Low indicates 2 oz. for 25 cents, from which you can cut three or four ring-size cabochons. Medium, 1 oz.; High, ¼ to ½ oz.; Very high, less than ¼ oz. for 25 cents.

- Chatoyant—a rippling play of light on the surface of the stone. Same effect often seen in wood.
- Play of color—a changing play of color on the surface or interior of stone. Most pronounced in opal, which shows flashes of red, blue, green and other colors.
- Matrix—the slate, shale or other material in which some gems are found. Sometimes attractive, usually not.
- Opalescence—a play of light without color inside the stone. Most pronounced in moonstone.
- Asteriated—showing starlike light when viewed under good light. Star rubies and sapphires are best examples.



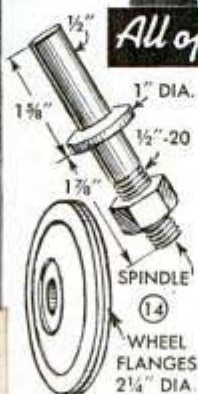


the glass. Corrugated cardboard is used as a filler. Two very simple mounts are shown in Fig. 8. One of these is a cigarette box with the top cut out and covered with black gummed tape after the stone is mounted; the second is an ordinary penny matchbox treated in a similar manner.

**Minerals:** Start your collection by purchasing two or three ordinary mineral assortments. Some of these are already boxed, Fig. 4, and can be obtained for as little as one dollar for 24 specimens. These usually are not cutting material, but are colorful and a worthwhile



1—Break large stone into small pieces. Further trimming can often be done by pinching off the pieces with a pair of pliers



*All operations can be done on drill press*

part of your collection. You will certainly want a set of eight or 10 fluorescent minerals. These are just ordinary stones when viewed under ordinary light, but under the black bulb they glow in brilliant colors. Likely, you will want a set of minerals illustrating Mohs' scale of hardness, Fig. 9. Then there are many unusual minerals that add considerable interest to any collection: natural stone crosses and beautiful masses of rock quartz crystals; lodestone



2—If diamond saw is available, trim stone by sawing. Use plenty of water. Hold stone steady. Speed 2400 r.p.m.



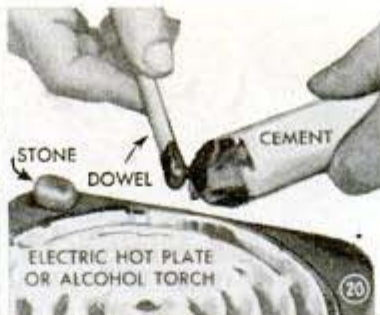
3—Grind base of stone flat on 100-grit wheel. Use plenty of water. Speed 1200-2400. Repeat operation on 220 wheel



4—Mark outline of stone, using pointed piece of aluminum



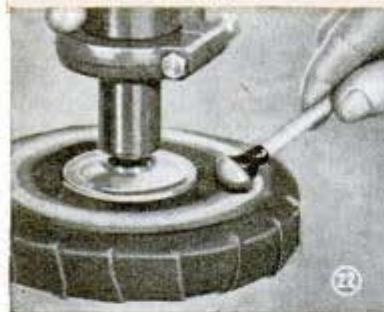
5—Grind outline and shape roughly on 100-grit wheel. Use plenty of water. Speed 1200-2400. Watch out for chipping (see text)



6—Cement the stone to a dowel stick. Use regular lapidary cement. Both stone and cement must be hot for good adhesion



7—Further smooth the stone, using 100 and 220-grit wheels in succession. Keep wheel wet to avoid burning. Speed 1200-2400



8—Dry-sand on 220-grit cloth backed with felt on wood wheel. Speed 1200. Use moderate pressure, but avoid getting stone hot



9—Mix polishing abrasives with clay flour and water to form a paste. Use F-grit silicon carbide for first polish; tripoli for final



10—Polish on felt wheels. Keep wheel wet with tiny trickle of water. Speed 1200. Use moderate to heavy pressure (see text)

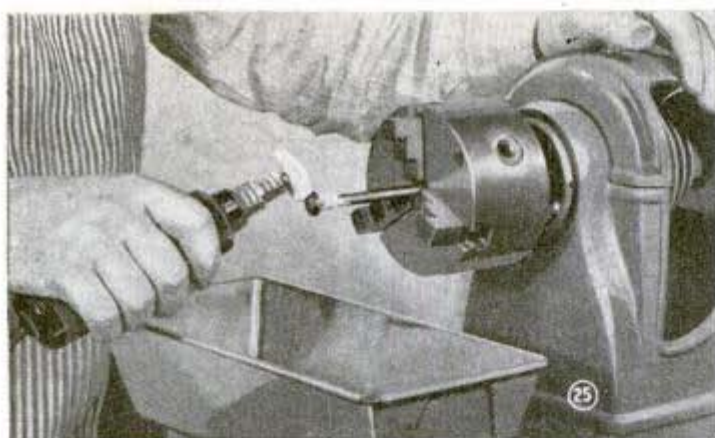
(magnetite), which is strongly magnetic; Iceland spar, which shows two images of anything viewed through it; selenite, which can be bent without breaking.

**Cutting materials:** Minerals suitable for cutting because of their color or sparkle are called gem stones. A selected list of cutting materials is given in Fig. 11; most of these are inexpensive and readily obtainable. These stones are intended for cutting en cabochon. Cabochon gems usually are round or oval, but may be almost any shape, Fig. 6, so long as they are not facet-cut like diamonds or other transparent stones. Cutting material includes all minerals which look attractive when cut and polished; you can pick up pebbles from any beach that will rate as semi-precious gem stones. Most popular with beginners are agate, petrified wood, tiger-eye and jasper. All of these except tiger-eye occur in a wide variety of brilliant colors and markings so that a good collection can be based on these alone. The most expensive stone in the list is opal. There are cheap varieties of this—common opal—but gem quality indicates a stone which flashes red, blue and green patches of color as it is turned in the hand. A few of the stones, such as variscite, turquoise and lapis lazuli, occur in matrix; that is, the actual gem stone is embedded in a valueless mass of slate, shale or other mineral.

Sometimes the matrix polishes nicely and the whole thing makes an attractive gem stone; usually, however, the matrix is not attractive.

You can buy cutting material in three forms, as shown in Fig. 10. Rough cutting stock averages one dollar per pound; sliced material costs about 50 cents for a 3 by 3-in. slice, and ready-cut gem stones about 50 cents each. It is a good idea to experiment with all three since each has its good points in money value or workability.

**Gem cutting and polishing:** Complete accessory equipment for gem cutting and polishing is illustrated in Fig. 12. Of these items, the diamond saw (diamond grains embedded in the rim of a copper disk) is the most expensive, costing several dollars in the 6-in. size. The rest of the items can be purchased at a total of about five dollars. The actual gem-cutting machine can be almost any type of motor-driven spindle. One of the best spindles for this work is a drill press. If this is fitted with a simple cooling system (water), it is ideal for the various cutting and polishing operations, Fig. 13. The only other extra equipment needed is a spindle as in Fig. 14, and even this is a standard drill-press accessory (grinding or shaping arbor). The feed pan used to hold and control splash of water can be obtained from any farm store for about fifty cents.



Figs. 15 to 24 inclusive show the cutting and polishing operations. With a little experience, it takes about 40 min. from rough stone to finished gem. Make your first job an agate. Break or saw the rough stock to get pieces suitable for gem cutting. In operation 5, Fig. 19, keep a bevel ground on the stone in advance of the side cutting. If you grind right down to the outline on the 100-grit wheel, you may chip the edges. In Fig. 20, use a stick somewhat smaller than the stone. Heat the stick and cement together over a hot plate or torch. When the cement begins to melt, twist it off onto the stick. Have the stone hot before you press it into the cement—it should be just as hot as you can hold. Good adhesion usually will be obtained if both stone and cement are hot. Moisten your fingers and mold the warm cement around the bottom of the stone, but keep it clear of the edges. Let cool 10 min. or dip in cold water to set cement. Operation 8—this is done dry. The sanding cloth should be backed with something that has a slight amount of "give." Felt is standard, but a piece of carpeting or several layers of canvas will do. Use moderate pressure, but stop frequently to avoid overheating the stone. Operation 10—use heavy pressure in the rough-buffing operation with F-grit silicon carbide grains. The felt buff must be fairly hard and of the proper combination to assure smoothness. The removal of tiny flats requires a hard buff and hard pressure. Don't try buffing with a loose muslin buff—you may get a mild degree of polish but the surface will be lumpy. Have the abrasive in a dish and apply to stone every 10 seconds. Get the stone as smooth as possible with the F-grit before you change buffs for the final polish. This can be done with tripoli or any of the special buffing powders formulated especially for this work.

It is easy to tell when the stone is pol-



*Gem cutting can be done with a wide variety of power tools*

ished perfectly. It has a glasslike appearance, you can see your face in it, and the image of a lamp bulb or window is bright and sharp. If it does not satisfy you, go back one or two steps and try again. Never rush the polishing schedule; never say, "I can take that out in the next operation." What you can do in a few seconds by sanding takes several minutes on the buffing wheel.

**Other tool setups:** You can grind and cut gems on almost any kind of spindle. The lathe, the bench grinder, and buffing heads can be used. If you have a belt sander, use it with a 220-grit belt, as in Fig. 26. Round cabochons are ground readily with a lathe; cement the stone to a metal rod, then grind with a hand grinder, Fig. 25, and polish with a rag and abrasive with the lathe in motion.

### Tiny Chisels for Model Makers

Tiny chisels for model work can be made by soldering small pieces of razor blades to iron nails after filing a flat surface on the nail for attaching the blade.—R. Salzer, Baldwin, N. Y.



## Workbench Kept From Tipping If Legs Are Set at Angle

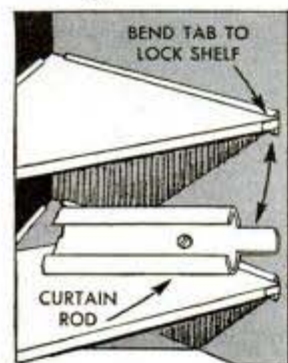


In building a workbench, if you set the two front legs inward at the top, the bench will not be so apt to tip forward when work held in a vise is pulled or pounded toward you. The legs should be tilted just enough so that the lower ends do not project beyond the bench.

## Production Jigsawing Speeded When Template Is Used

A handy template for jigsawing duplicate pieces may be made by placing a sheet of stencil paper or other heavy paper between two layers of wood before they are sawed. Use of this template eliminates the bother of tracing the pattern each time and shows just where the pattern is placed on the wood.—G. James, Louisville, Ky.

## Corner Shelves Supported Safely By Sections of Curtain Rod



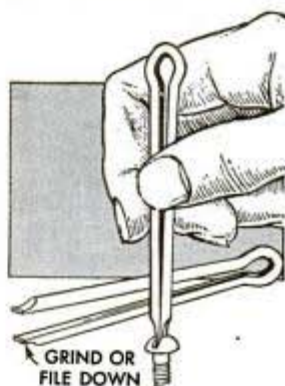
When you want to put up corner shelves of either glass or wood, sections cut from a flat, telescoping curtain rod will provide good supports or brackets. One end of each section is shaped to provide a projecting tongue,

then the sections are screwed to the wall, the shelves inserted and the tongues bent around the corners of the shelves.

—Ronald Eyrich, Milwaukee, Wis.

## Cotter Pin Used to Start Screws In Hard-to-Reach Places

When starting a screw where it is difficult to reach with the fingers, a cotter pin with the ends of the legs ground down as shown will hold the screw and serve as a driver to start it. If three or four pins of different sizes are prepared, you will always have a



driver for starting a screw of any size. If desired, you can fit handles to the pins.

—L. E. Shepard, Toledo, Ohio.

## Center Marked on Turning Blank With Hacksaw Blade



Centering the ends of lathe work can be done quickly with an old hacksaw blade. This is placed diagonally across the work and is tapped lightly with a hammer to make the two intersecting lines as indicated.

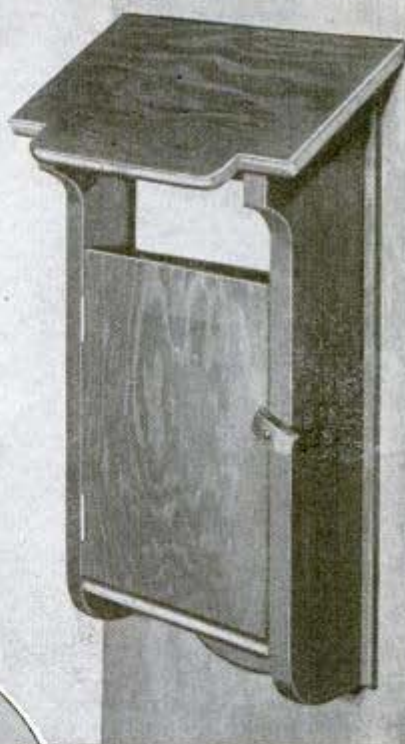
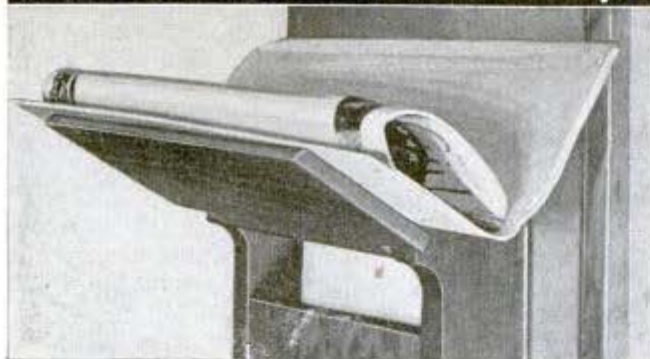
## Test Tube Fits in Pipe Rack To Hold Cleaners

Pipe smokers can keep cleaners handy with the rest of their accessories by inserting small test tubes in their pipe racks as indicated. In some cases, it may be necessary to enlarge the openings in the racks to take the tubes, or to make new openings in the racks. If desired, these can be corked to keep out dust and dirt.

—Kenneth Schwartz, White Plains, N. Y.

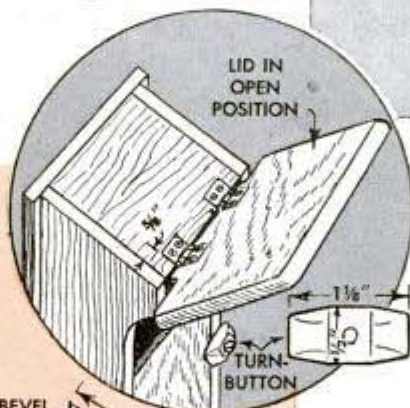


# Wood Mailbox Has Hinged Lid for Magazines



**S**IMPLE, neat appearance and a false, hinged lid that opens to provide a rack for holding small packages, newspapers and magazines, combine to make this wooden mailbox thoroughly practical as well as attractive. Wood used in its construction may be maple, white pine or waterproof plywood, but ordinary plywood will, of course, be unsuitable when exposed to rain or snow. All parts except the hinges are butted

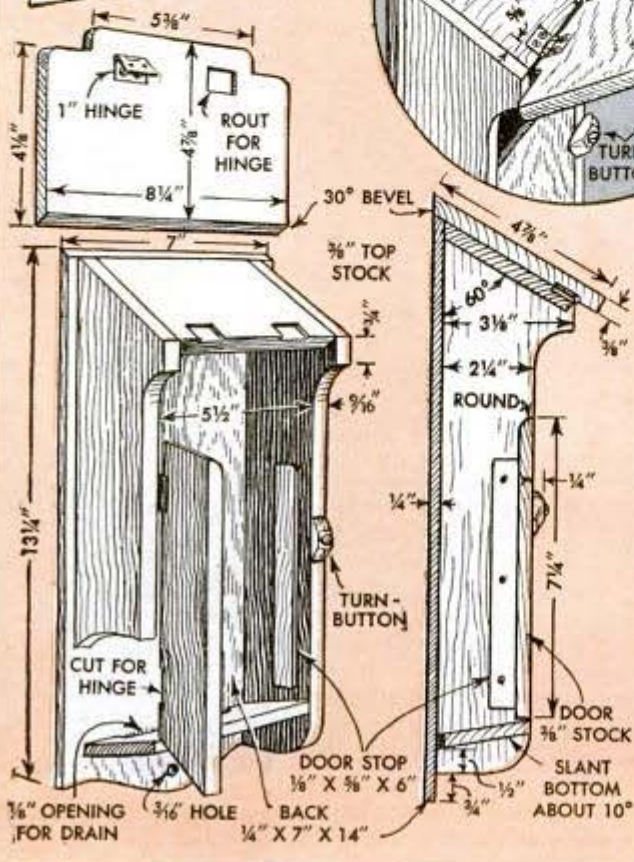
CUTTING LIST—NET SIZES	
BACK	—1 pc. $\frac{1}{4}$ " x 7" x 14"
SIDES	—2 pcs. $\frac{9}{16}$ " x $3\frac{1}{8}$ " x $13\frac{1}{8}$ "
TOP	—1 pc. $\frac{3}{8}$ " x $3\frac{9}{16}$ " x $5\frac{1}{2}$ "
LID	—1 pc. $\frac{3}{8}$ " x $4\frac{7}{8}$ " x $8\frac{1}{4}$ "
BOTTOM	—1 pc. $\frac{3}{8}$ " x $2\frac{1}{4}$ " x $5\frac{1}{2}$ "
DOOR	—1 pc. $\frac{3}{8}$ " x $5\frac{5}{16}$ " x $7\frac{1}{4}$ "



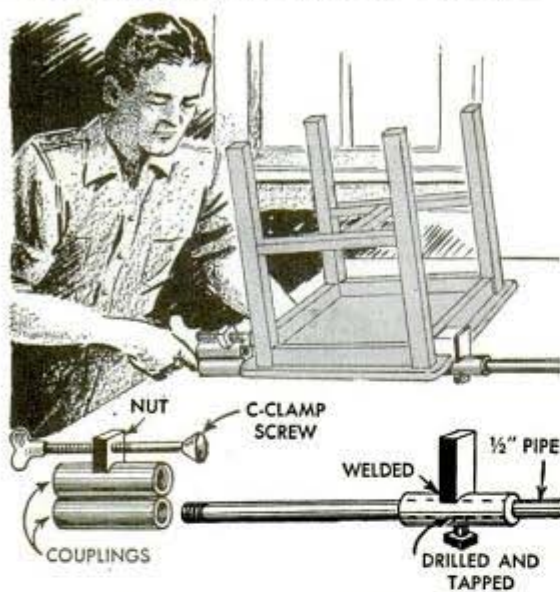
and nailed, with a little waterproof glue added here and there if desired for extra durability.

The various pieces are cut to the net sizes as shown in the cutting list. For ease in hand-sawing and sanding, the side pieces can be nailed together and worked as one piece. Hinge gains are mortised by chisel, or they can be routed on a drill press with a  $\frac{1}{8}$ -in. router bit. Notice that the lower edge of the lid is beveled inward to provide a stop for the false lid, which is hinged on it to swing down. A wooden turnbutton can be made, according to the dimensions in the circular detail, to lock the door.

If a bright finish is desired, a brown-orange stain should be used. This is followed by two coats of spar varnish or three coats of clear lacquer. Two screws driven through the back panel secure the box to a porch post or wall. Knobs, of course, may be fastened to the door and lid, but they are not necessary. Leave the false lid open the first day the box is installed to acquaint the mailman with its use.



## Pipe and Fittings Are Assembled To Provide Strong Bar Clamps



Inability to purchase a bar clamp need not bother the woodworker because a very strong one can be made from a length of pipe and a few fittings. First cut a piece of 1/2-in. pipe to the desired length and then weld two couplings together to screw on one end. To this assembly weld a large nut to take the screw from a C-clamp. Over the other end of the pipe slip a coupling from which the threads have been reamed. Weld a small steel block to the coupling, and drill and tap the coupling opposite the block to take a setscrew. This permits adjusting the clamp to any width.

—Sgt. Don Brooks, San Francisco, Calif.

## Tracing Designs on Dark Surfaces

The difficulty of tracing designs through carbon paper onto dark surfaces is overcome by using a "carbon" paper which makes light colored lines. This is done by going over the surface of a white sheet of paper with a yellow or other light-colored pencil, entirely covering the sheet, and then using it for a carbon in the ordinary manner.—Frank Shore, New York City.

## Repair Your Flexible Oil Line With Cloth Strips and String



If the flexible oil line on your car breaks and you cannot immediately replace it, a repair that will last for some time can be made easily. To do this,

wrap the line with several layers of cloth strips which have been dipped in varnish, preferably the Bakelite type. After several layers of the soaked cloth strips have been tightly wrapped spirally over the break and well beyond it, apply a spiral wrapping of strong string. This should be wrapped in the direction opposite that in which the cloth was wrapped. If there is any question as to the strength of the repair, apply additional layers of varnish soaked cloth strips and another wrapping of cord.

—Stephen J. Butler, Brighton, Colo.

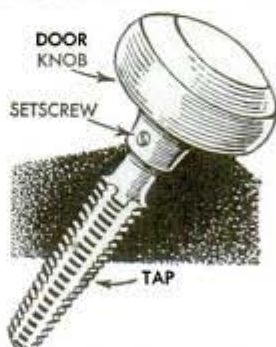
## Mouse Favor Made From Peanut

Realistically poised to run into a hole, this amusing mouse favor will attract immediate attention at your parties. Its body is a peanut and the tail and feet are pieces of yarn. The ears are shaped from paper and are glued in tiny slits made in the peanut shell. Eyes and mouth are inked on.



—Benj. Nielsen, Aurora, Nebr.

## Doorknob Used as Tap Wrench



If you have misplaced your small tap wrench, or do not have one, just use a doorknob. The squared socket in the hub will fit over the shoulder of most small taps and will provide a handle for turning them into the holes. If desired, the doorknob can be fastened to the tap by driving in the setscrew.

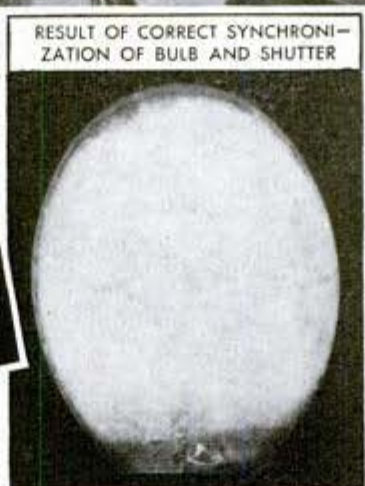
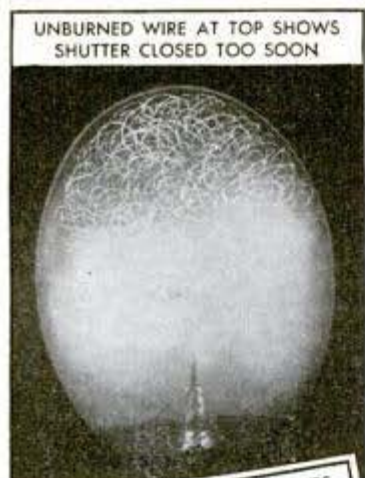
—M. A. Jacobson, Chicago.

## Simple Holder for Artist's Pencils

One artist who experienced trouble in keeping his pencils close at hand on the drawing board improvised a holder from a whisk broom. The broom was screwed to the edge of the drawing board and the ends of straws tied as shown.



# Camera Shutter Checked by Photo of Flash Bulb



Cameras having shutter speeds of 1/200 sec. or more can be checked for synchronization of shutter and flash simply by photographing the bulb while it is being fired. If the shutter closes too early, the resulting photo will show some of the fine wire inside the bulb unburned around the top and edges. If the shutter has closed too late, the photo will show the outer edges of the bulb filled with flame and the center burned out as indicated by a dark spot at the center. Correct synchronization is indicated when the photo shows the bulb completely filled with flame, with little or no unburned wire visible, and no burned-out spot in the center. To make the check, the flash gun, with the reflector removed and a bulb in place, is set up in front of the lens, and the bulb is focused sharply on the ground glass with the image as large as possible. After focusing, the shutter speed is set at 1/200 sec. and the lens opening is stopped down to f:32 or smaller if

possible. A red filter should be put over the lens to help reduce the extreme overexposure resulting from the bulb being fired so close to the lens. Any slow-speed film having good latitude and anti-halation properties may be used; one having a Weston rating of less than 64 daylight is preferable. Also it is a good idea to turn your face as the bulb is fired because there is always a possibility that the bulb might shatter. Any error in the synchronization of the shutter and bulb can be corrected by changing the small adjustment screw of the magnetic tripper that operates the shutter. This adjustment varies with different flash equipment, but as a general rule it will be found that tightening the screw will result in speeding up the shutter action.

—Duard Ferguson, Los Angeles, Calif.

## How to Clean Film Negatives

After a negative has been about two-thirds washed, pass it through a solution made by mixing 1 fl. oz. glacial acetic acid with 100 fl. oz. water. Dip the negative in this solution for a few seconds and then complete the washing in the usual manner. The film will dry without any scum or surface markings. The acid may be used repeatedly until no longer effective.

## Ferrotyped Prints Dried by Heat When Placed Over Gas Burners



Drying glossy prints can be speeded up considerably by the use of a dishwashing rack inverted over the lighted burners of a gas stove. Place the ferrotyping plate on the rack so that the heat will warm the prints. Of course, only a low flame must be used or the prints will be scorched.

## Photo Mount Serves as Substitute For Enlarging Easel

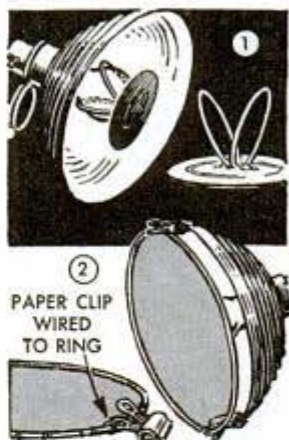
Inexpensive cardboard photo mounts, available in all print sizes, can be used as enlarging easels. The cutout portion allows a border of about  $\frac{1}{4}$  in. on all sides, and, being sealed at the top, prevents the paper from being pushed beyond the margins. Also, the white inner surface will serve as the focusing screen. Pencil or ink lines



should be ruled on it as a guide to show how far to either side the paper should be placed. The mount is cemented to a piece of wood for stability. After the enlarging paper is inserted, the open end or front of the mount is held by a thumbtack at each corner pressed into the wood so that the heads overlap the mount.

## Two Kinds of Photoflood Diffuser That Can Be Made Easily

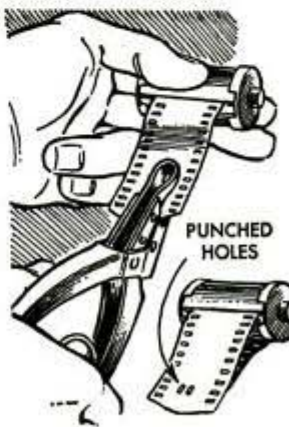
Here are two types of photoflood diffuser that can be improvised in a few minutes. The one illustrated in Fig. 1 consists of a tin can lid soldered to the wire clamp of a discarded lamp shade. The bright side of the lid should face the lamp so as to direct light back into the reflector.



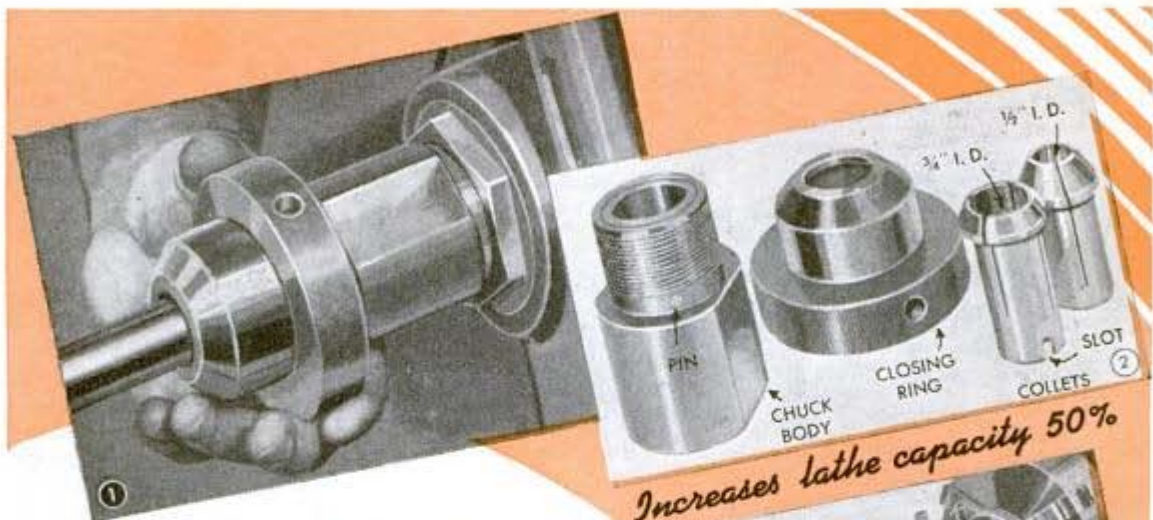
The diffuser shown in Fig. 2 is made by gluing a circular piece of cotton, silk or other porous material over a wire loop. The lower rim of a lamp shade will do, or a coat hanger may be bent into a ring. To avoid wrinkling the cloth, slits may be cut along the edge to facilitate folding it over the ring. Two spring paper clips then are wired to the ring to attach the diffuser.

## Roll-Film Emulsion Is Identified By Holes Punched in Leader

Holes punched in the leaders of 35-mm. film serve to identify the emulsion speed or type of film, especially when several kinds of bulk film are loaded on spools not otherwise marked. For instance, one hole may be used to indicate a specified film speed or a type of emulsion, as ortho, pan or infrared; two holes, a different speed or type; or holes can be punched according to a pattern, as one above another. By keeping a record of the code, the operator can tell in a moment what kind of film is contained in any cartridge not otherwise marked.







*Increases lathe capacity 50%*

## Front-Closing COLLET CHUCK

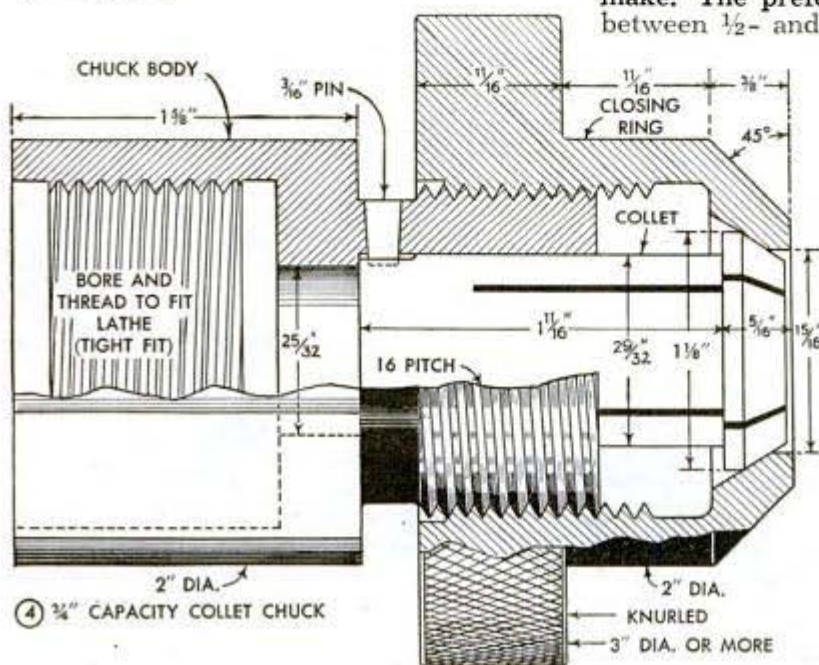
WHEN made accurately, this collet chuck is "on the nose" for precision. Also, it has the advantage of taking stock up to the full capacity of the hollow through a lathe spindle. Thus, while the familiar drawbar collet chuck has a maximum capacity of  $\frac{1}{2}$  in. when used in the average small lathe, the front-closing type will take  $\frac{3}{4}$ -in. stock.



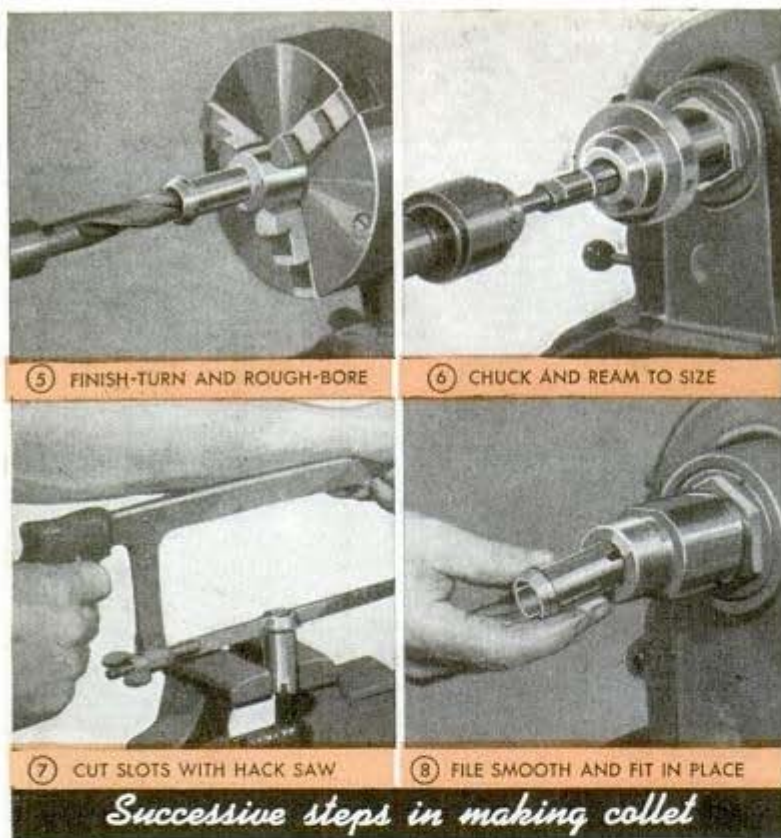
As can be seen in Fig. 2, the chuck consists of only two parts—body and closing ring—plus as many collets as you want to make. The preferable range of collets is between  $\frac{1}{2}$ - and  $\frac{3}{4}$ -in. internal diameter,

leaving the smaller sizes for the drawbar collet. To begin, first make the chuck body according to the dimensions in Fig. 4. Be sure that the spindle nose thread is a tight fit so that it will not come loose by the action of unscrewing the closing ring. Then fit the chuck body on the lathe spindle and bore and ream the collet hole.

In making the closing ring, first it is turned to external shape, then rechucked and the internal thread and 60-deg. included angle at the nose are cut. The



④  $\frac{3}{4}$ " CAPACITY COLLET CHUCK



flat reamer and use it to take a light finishing cut.

Make the collets from a good grade of tool steel. Turn the outside first, "miking" the straight stem for a close fit in the chuck body. Rough-bore the internal hole as shown in Fig. 5, then cut off. Cut a slot at the end of the collet to fit over the pin in the chuck body, then fit the collet in place, Fig. 6, and ream to net size. Remove the collet and slot with a hacksaw as in Fig. 7. Run the slots almost to the end for a 1/2-in. collet; less for larger sizes. Go over the hacksaw cuts with a fine file to remove burrs. Fig. 8 shows the finished collet being fitted in place. It is indexed by means of the pin, thus assuring that it fits in the same position in which it was bored. Screwing on the closing ring closes the collet and holds the work

internal nose angle can be worked by feeding the lathe compound at 30 deg. as shown in Fig. 3, using a conventional boring bar as cutting equipment. However, for a smooth finish, it is best to make up a special

firmly for turning, Fig. 1. Hand pressure alone is sufficient for average work. If stock is available, it is a good idea to make the closing ring somewhat larger at the knurl to obtain a better gripping surface.

## Handle for Opening Bus Door Held With Leather Strap

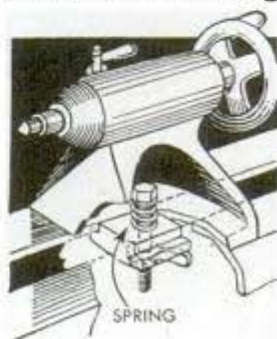
After having the bus doors accidentally opened by passengers who leaned on the operating mechanism or held onto the operating handle when the bus was overcrowded, one driver prevented this trouble

by securing the handle with a leather strap. This was attached to the bus as indicated and slit near the outer end to slip over the handle. A flip of the hand removed the strap to open the doors.



## Spring Prevents Tailstock Binding

Sometimes the tailstock slide plate of a small woodturning lathe binds under the ways and cannot be moved without much time-wasting effort. To avoid this annoyance, one workman fitted an auto valve spring over the clamping bolt as shown. When the bolt was loosened for moving the tailstock, the spring expanded and pushed down on the slide plate, preventing it from turning and binding against the ways.



## Lightweight Wedges for Splitting Made From Angle Iron

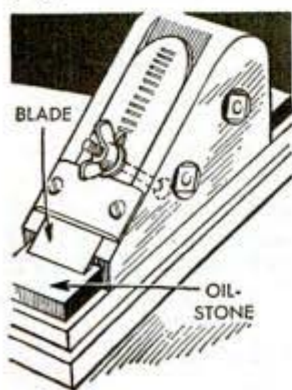


Disliking to carry a number of heavy steel wedges when splitting light logs in the woods, one workman made a number of lightweight wedges from angle iron. These were ground or sawed to the shape shown. When splitting large logs, these wedges are ideal to finish the split once it is started with a heavy wedge, and are much better than the usual wooden wedge.

## Locating Speedometer Trouble

When your speedometer fails to operate, you can locate the trouble by removing the cable at the speedometer head, jacking up one of the rear wheels, starting the motor and putting the car in high gear. If the cable does not turn, it should be removed for inspection. However, if it turns, the trouble is in the speedometer head, which then should be serviced.

## Jig Holds Plane Iron for Honing



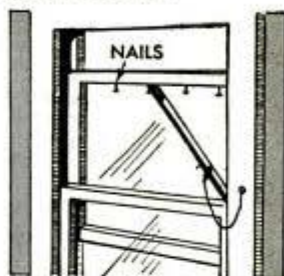
Assuring a keen, straight edge at the proper bevel, this wooden jig for honing plane blades fits over an oilstone. A recess as deep as the blade thickness is made on the sloping face, and a piece of flat iron is screwed across it to hold the blade,

which is secured by a wing nut on a bolt running through the block and counter-sunk into the underside. The jig, about 7¼ in. long overall, can be made of one piece of hardwood; or, if it is assembled from several pieces, these are reinforced by flat-head bolts through the body, the nuts being recessed and ground flush.

—Robert J. Gilmartin, Bronx, N. Y.

## Windows Held at Desired Level By Stick and Nails

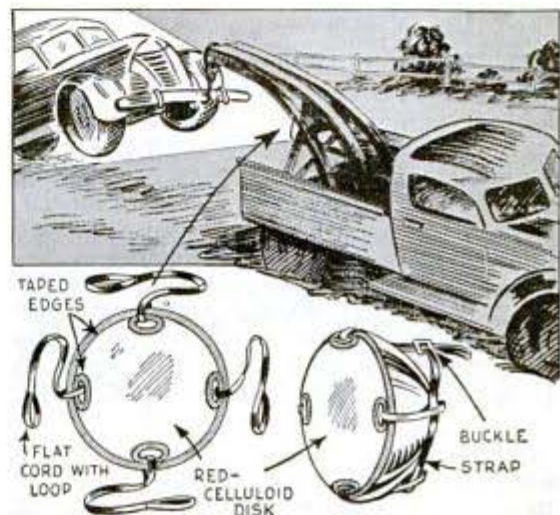
Rather than use props of various lengths to keep shed or poultry-house windows open at a desired position for ventilation, you can do it easily with one stick and a few nails. Just drive



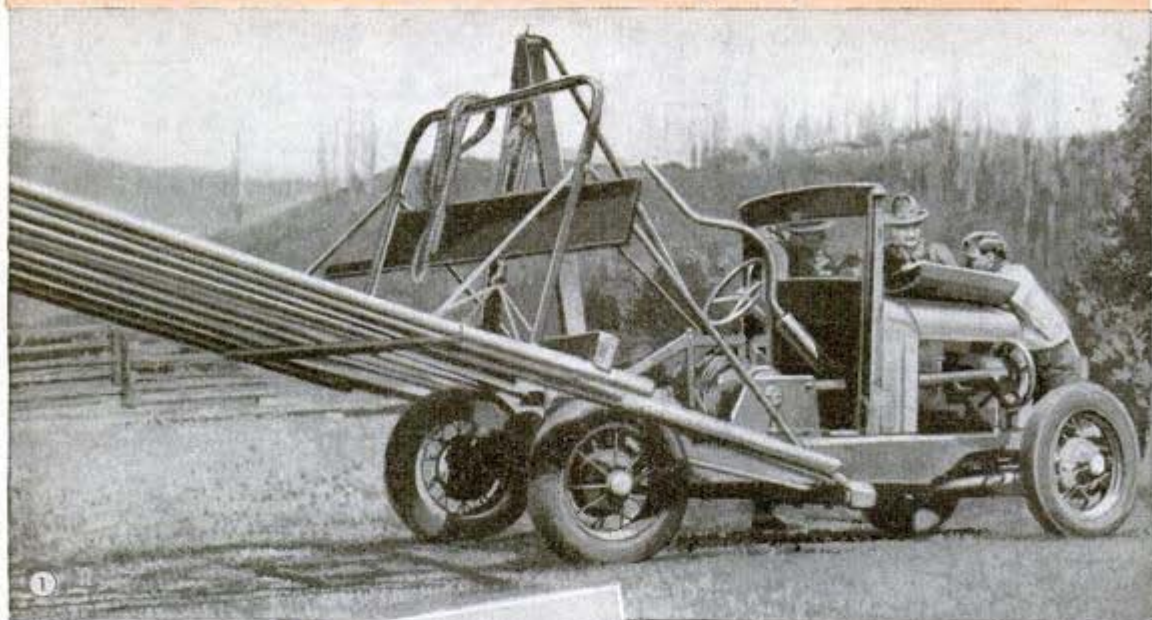
the nails into the underside of the top sash and prop the stick between any one of them and the lower sash as shown. The stick can be kept handy by fastening it to the frame by a cord.—Mrs. Pearl M. French, Norridgewood, Me.

## Tow-Truck Spotlight Converted To Taillight With Red Lens

When towing a damaged car at night, one garageman installs the tow truck's spotlight at the rear to throw light on the towed car so that it can be seen easily by motorists at the rear. The spotlight lens is covered with a red celluloid or Cellophane disk, which is fitted with four lengths of cord or small leather straps. These are looped at the free ends to take a strap and buckle which attaches the red disk to the spotlight as indicated. It takes only a moment to attach or remove the disk.



## Building Your Own



Photos courtesy  
Agricultural Extension  
Service, State College of Washington

**B**UCKRAKES mounted on old trucks and cars or on tractors are great time and labor savers, in many cases enabling one man to do the work of two or three men by the usual methods of haying. Thus they reduce labor and equipment costs. Besides being used in haying, the rakes are handy in many other harvesting operations, such as bringing grain shocks to a thresher, hauling corn shocks to a shredder, etc. And where distances are not too great they are used to take hay directly from field to barn, which reduces handling and results in less shattering of the foliage. Also, the hay is not bunched and twisted so that it is easier to mow. Some farmers put hay in the barn singlehanded with the

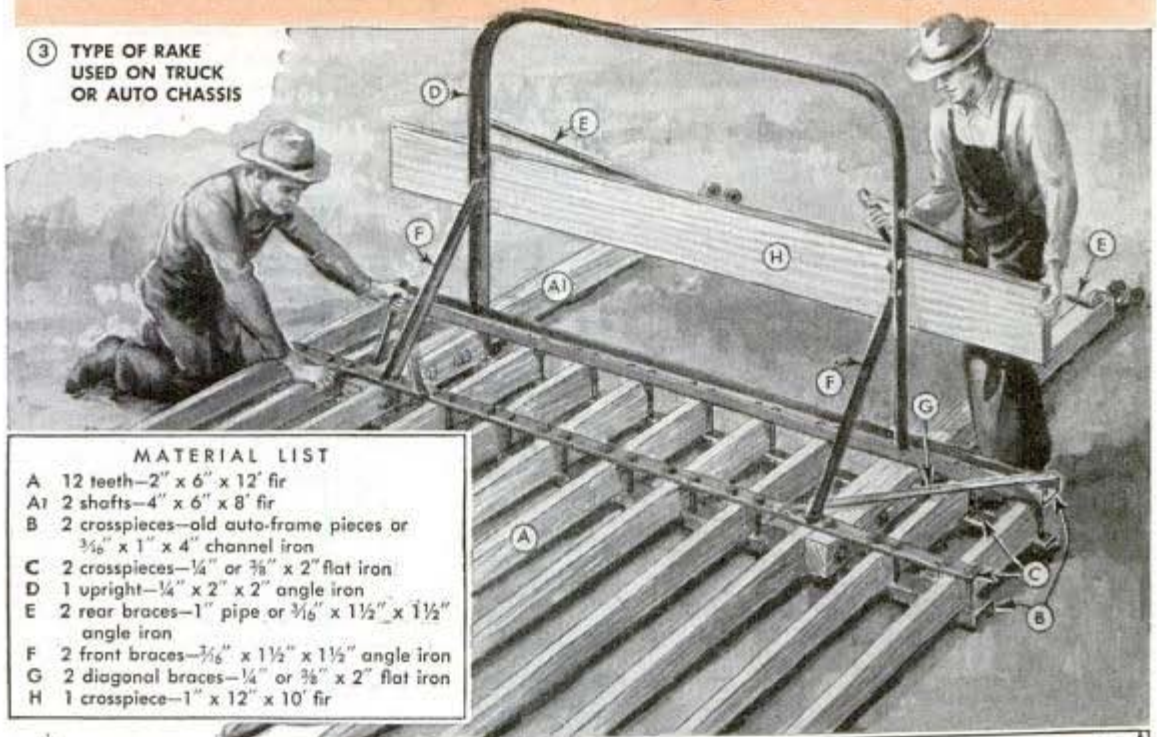
rakes. When this is done, slings are used instead of forks, taking an entire load at one operation. Usually, three or four loads are put into the barn between mowings. And some farmers even pull the hay into the barn with the rakes as they start their return trips to the fields.

A rake should have a capacity of 700 to 1,000 lbs. per load, a speed of at least 8 m.p.h., and a width to pass easily through average gates and lanes. Usually, a width of 10 ft. with 12 teeth is about right. A power lift is practically a "must" as it is very difficult to provide enough leverage to lift a load of 1,000 lbs. manually, especially as you should be able to raise the load at least 4 ft. above the ground at the ends of the rake teeth.

Choice of a power unit is a matter of using the type of unit most readily available. Old trucks are better than cars because they are stronger, but cars are used more extensively as they are easier to obtain. Tractors are used in some cases, but this work is hard on the front tires and wheel bearings, which in many tractors are not heavy enough to stand up under the loads. However, some farmers get around this trouble by mounting an old car chassis in front of the tractor to carry the load as shown in Fig. 14. Regardless of the unit selected, the motor and chassis should be in fair condition, or at least be such that it can be put in a good, usable condition at

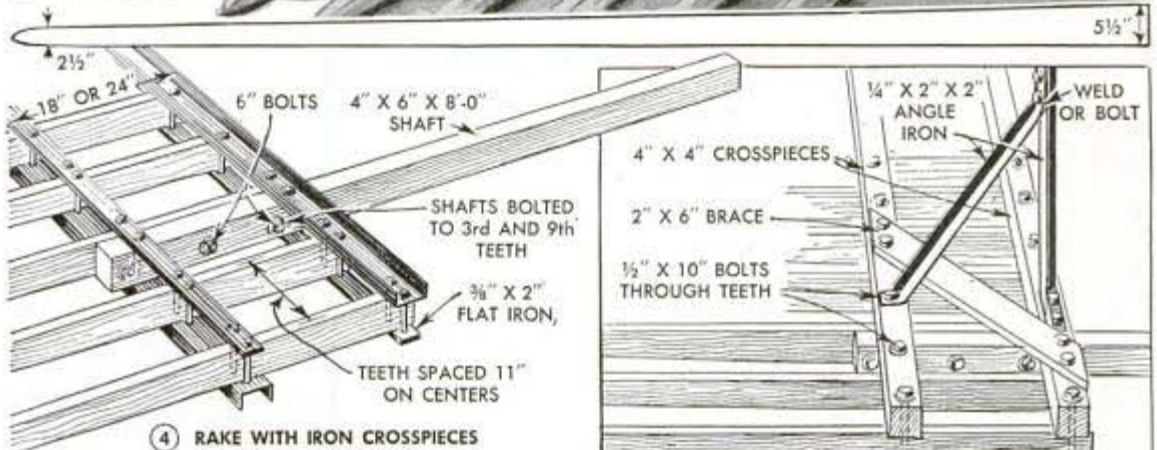
# BUCKRAKE or STACKER

③ TYPE OF RAKE USED ON TRUCK OR AUTO CHASSIS



### MATERIAL LIST

- A 12 teeth—2" x 6" x 12' fir
- A1 2 shafts—4" x 6" x 8' fir
- B 2 crosspieces—old auto-frame pieces or 3/8" x 1" x 4" channel iron
- C 2 crosspieces—1/4" or 3/8" x 2" flat iron
- D 1 upright—1/4" x 2" x 2" angle iron
- E 2 rear braces—1" pipe or 3/16" x 1 1/2" x 1 1/2" angle iron
- F 2 front braces—3/16" x 1 1/2" x 1 1/2" angle iron
- G 2 diagonal braces—1/4" or 3/8" x 2" flat iron
- H 1 crosspiece—1" x 12" x 10' fir

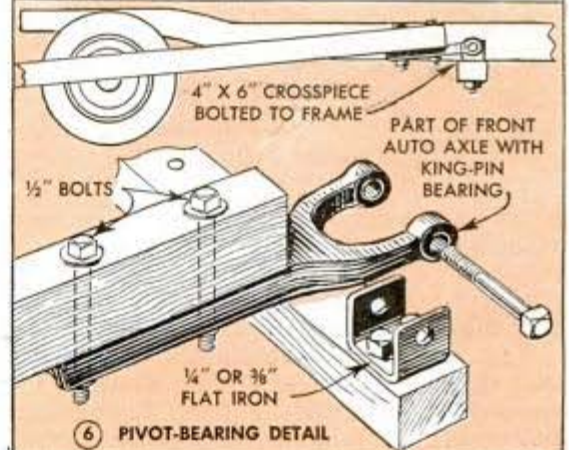


④ RAKE WITH IRON CROSSPIECES

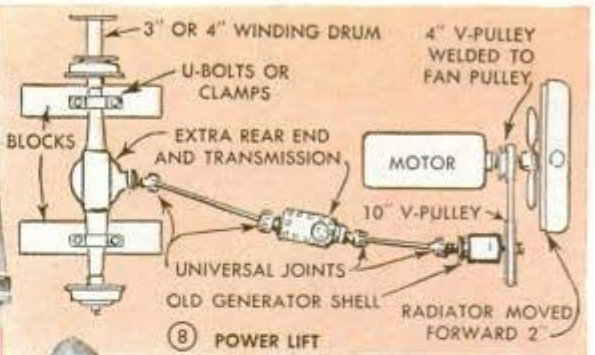
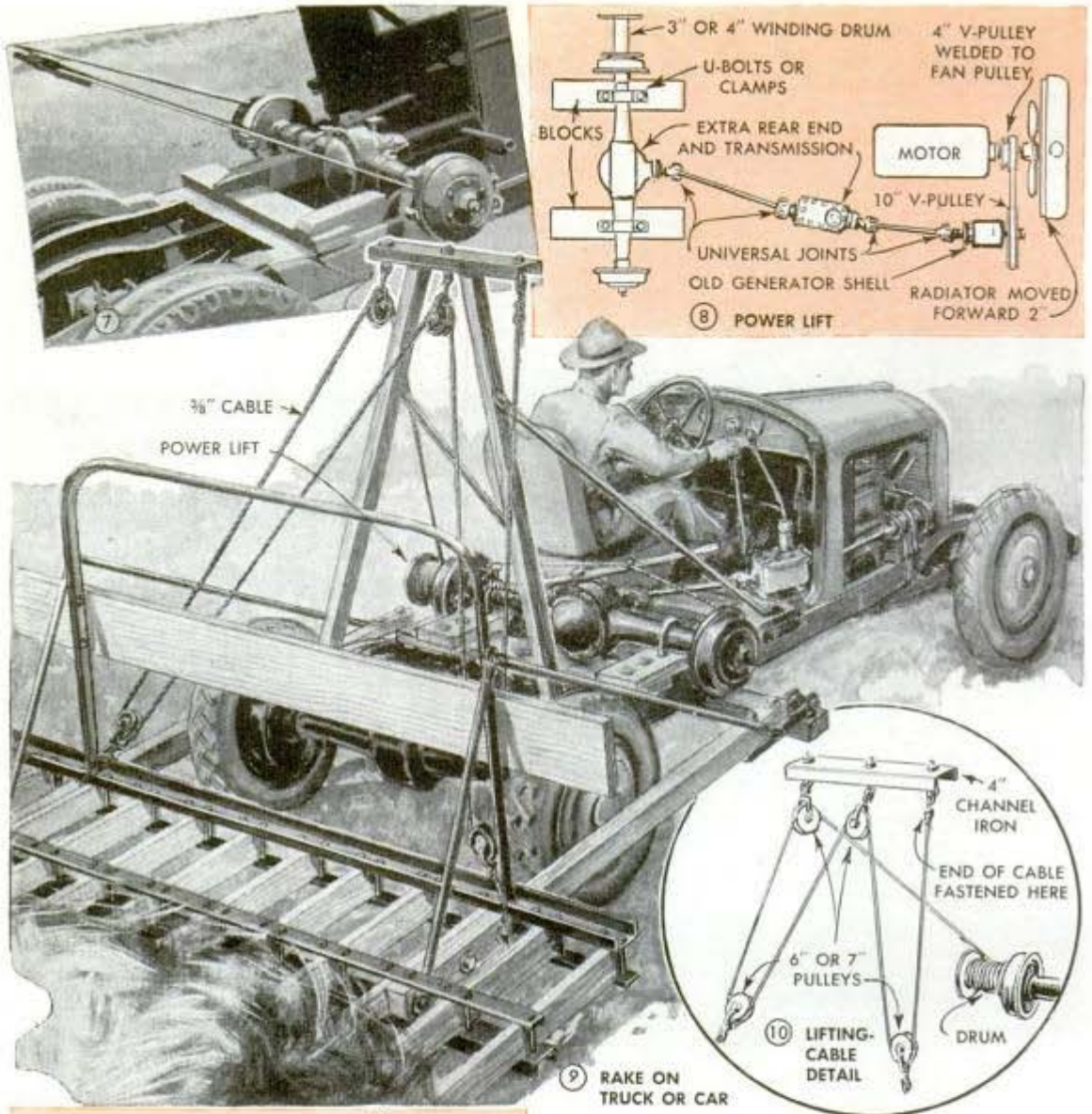
⑤ RAKE WITH WOOD CROSSPIECES

a reasonable cost. Also, it is best to select a make and model for which parts can be obtained easily. Although an "orphaned" car may be purchased cheaply, it may prove exceedingly costly if you experience a breakdown during harvest season and cannot obtain parts quickly.

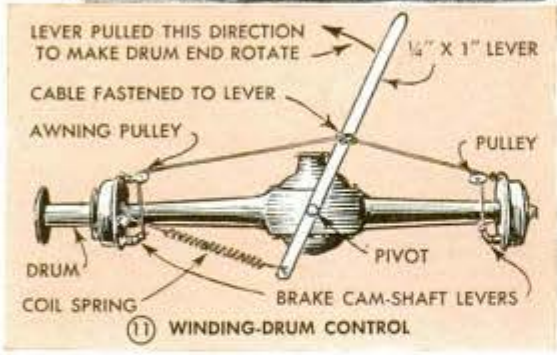
Since the rake is mounted on the rear end, the car is run in reverse to pick up the load, then driven forward to haul it. Some builders object to the slow reverse speed, and to avoid it change the gears so that the car can be driven backward. On some cars and trucks this is accomplished by merely turning over the rear axle end for end. This causes the differential ring gear to mesh with the drive pinion on the side opposite to its normal position and thus



⑥ PIVOT-BEARING DETAIL



9 RAKE ON TRUCK OR CAR

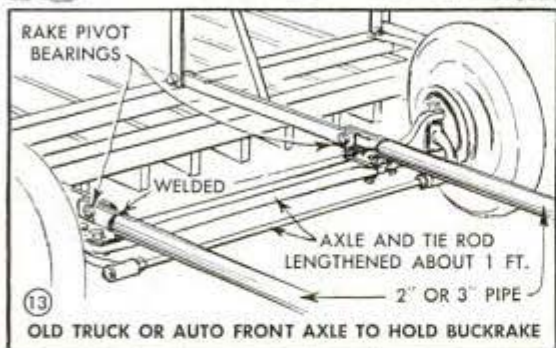
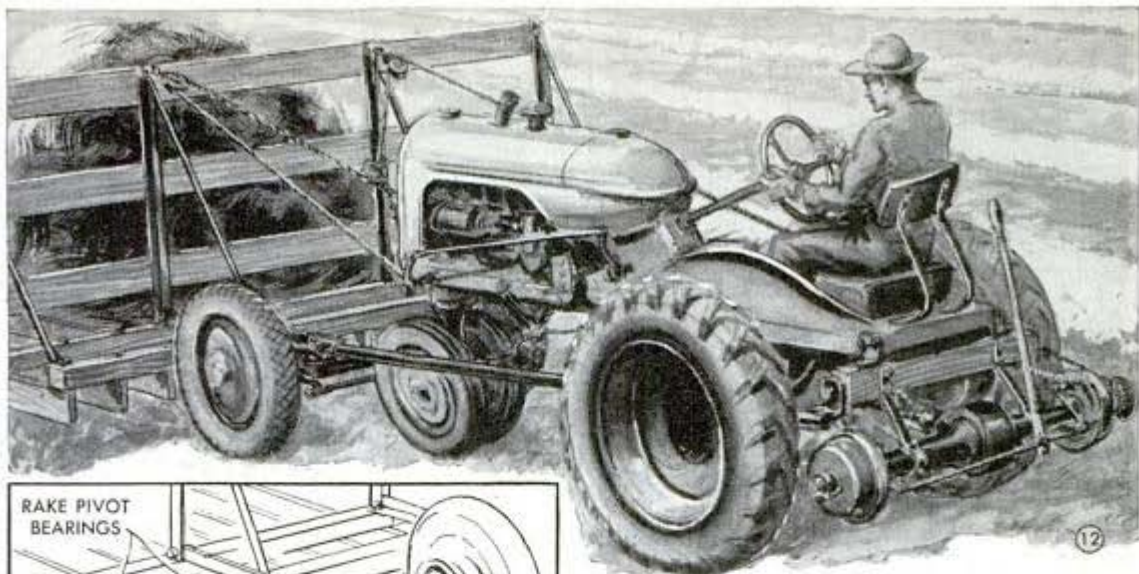


11 WINDING-DRUM CONTROL

reverses the rotating direction of the rear wheels so that the car has three speeds in reverse. When this change is made the steering wheel should be rearranged so that the driver faces the direction of travel.

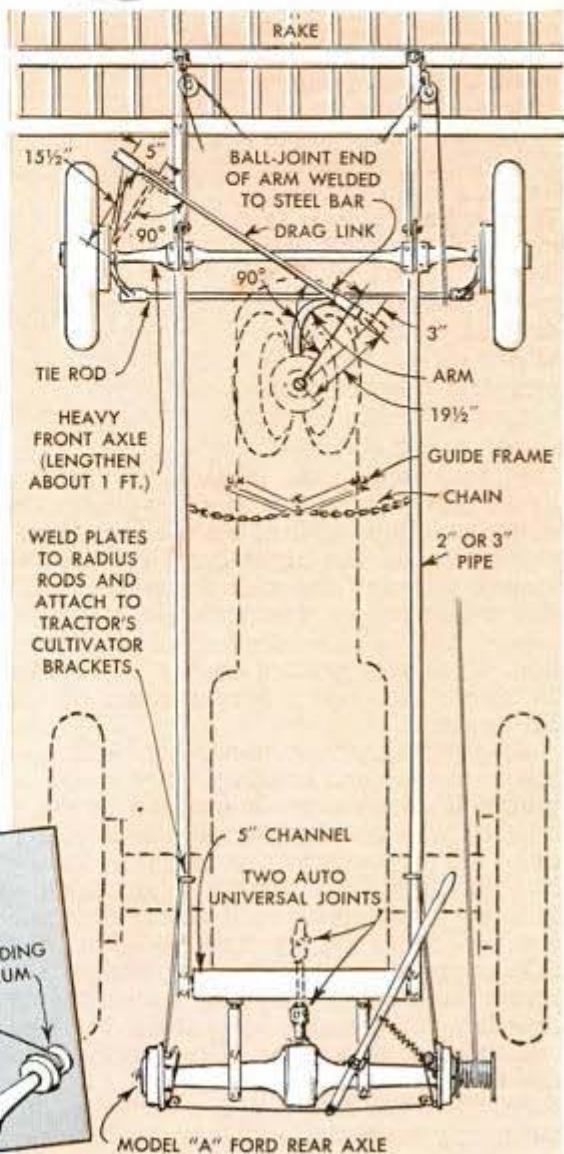
Figs. 1, 2 and 9 give general views of a unit mounted on a car chassis showing locations of the rake, hoisting tripod and power lift. Installation on a truck chassis

would be similar. General assembly of the rake is shown in Fig. 3. All bracing and supporting members should be of metal if available. Often, parts of old car frames can be utilized as in Fig. 4, although hardwood can be used as in Fig. 5, but makes the rake heavier and gives it a rather bulky appearance. The teeth should be made of strong, warp-resistant wood. Fir 2 by 6's are used for this purpose, and are tapered from full width at the back to 2½ in. at the front. Of course, other wood can be used, some farmers using poles cut from their own timber. If this is done, the poles should be stored in a dry place for several months and fastened down to avoid warping. In mounting the rake on the car, the load should be kept as nearly over the rear axle as possible by placing the hoisting tripod directly above it. The shafts that carry the rake should be of sound stock for

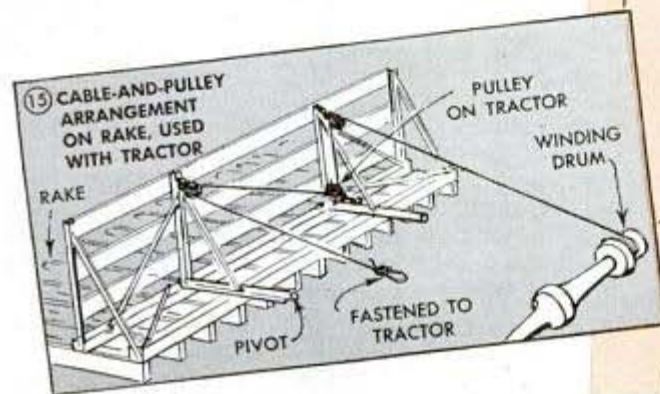


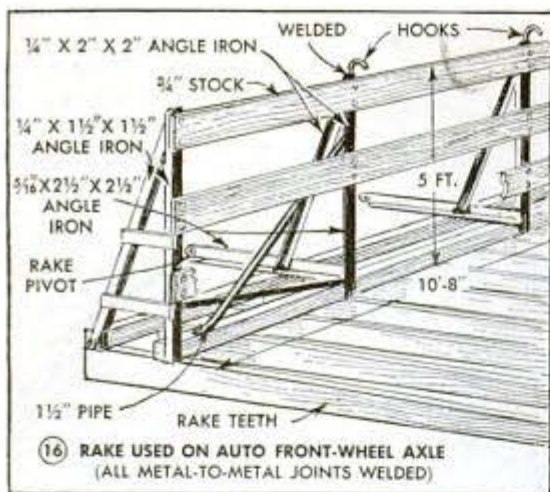
strength. They are pivoted to a crosspiece which is clamped to the underside of the chassis. Fig. 6 shows one way of using part of an old car front axle as a pivot bearing.

After completing and mounting the rake unit on the car, you are ready for a power lift. The most popular lift consists of an old car rear-axle assembly mounted just behind the driver's seat and driven from the fan belt at the front end of the car motor. The general arrangement is shown in Figs. 7 and 8. Likely it will be necessary to block up the axle on the frame to keep the drive linkage as straight as possible. A transmission in the drive gives variable lift speeds, and an old generator shell at the pulley end of the drive provides a good ball-bearing support. A small winding drum is attached to one of the projecting



14 PLAN VIEW OF TRACTOR BUCKRAKE

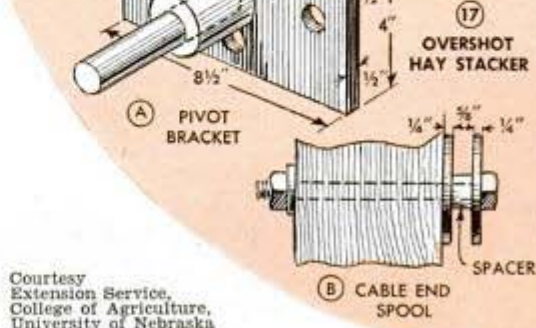
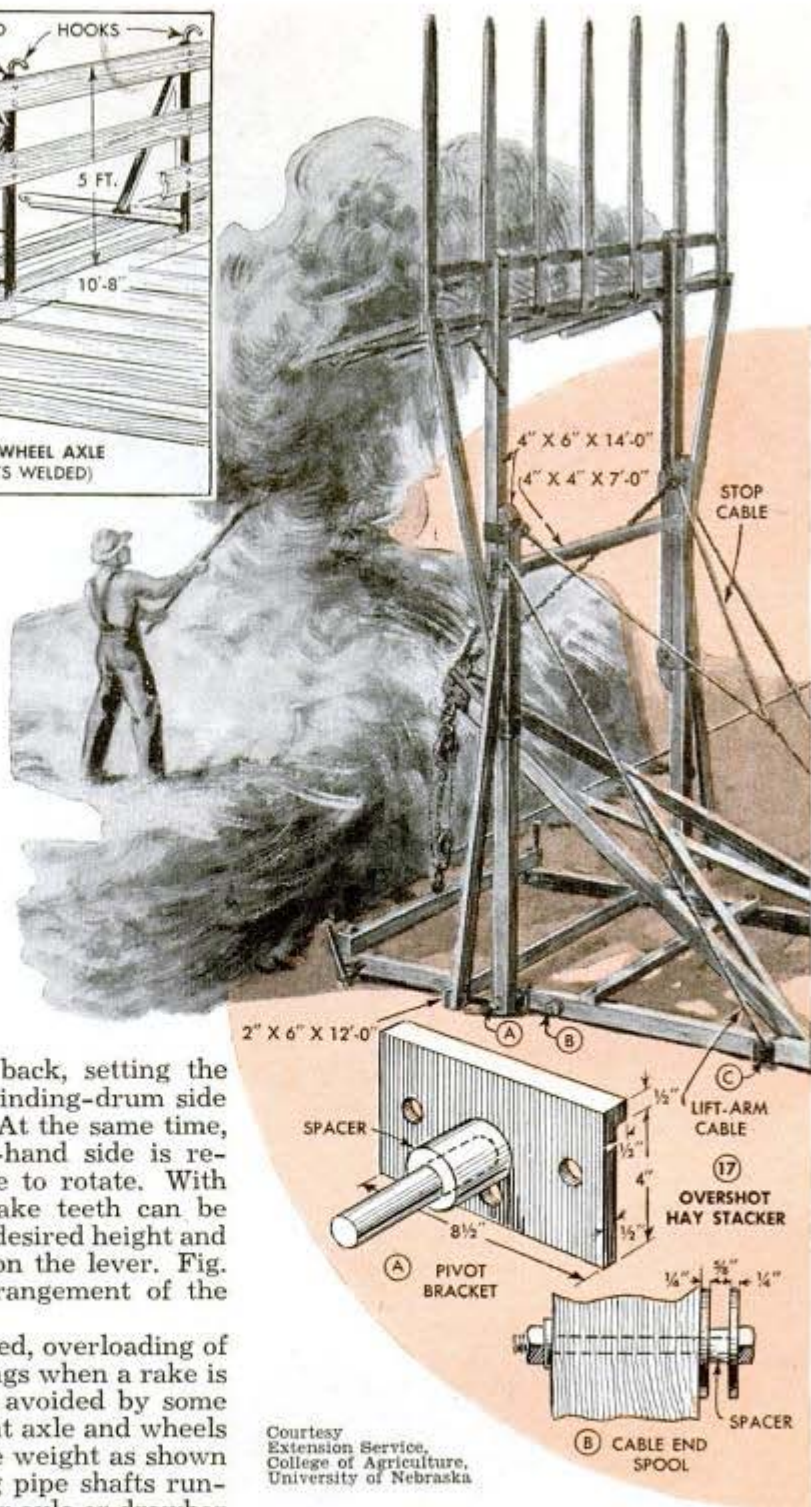




16 RAKE USED ON AUTO FRONT-WHEEL AXLE  
(ALL METAL-TO-METAL JOINTS WELDED)

axles. Fig. 11 shows how the drum is controlled. A lever is pivoted to the differential housing, and a small cable, run over pulleys fastened to the brake housings, is attached to the lever and to the brake cam levers. When the lever is moved to the left the brake is set in the right-hand brake drum, locking the axle, which causes the axle carrying the drum to rotate. When the lever is released a spring at the lower end pulls it back, setting the brake and making the winding-drum side of the axle inoperative. At the same time, the brake on the right-hand side is released, allowing the axle to rotate. With this arrangement, the rake teeth can be raised or lowered to any desired height and held by merely pulling on the lever. Fig. 10 shows the pulley arrangement of the lifting cable.

As previously mentioned, overloading of the front tires and bearings when a rake is mounted on a tractor is avoided by some farmers who use the front axle and wheels of an old car to carry the weight as shown in Figs. 12 and 14. Long pipe shafts running from the tractor rear axle or drawbar are welded to the car axle to which the rake supporting members are pivoted. On some tractors, it may be necessary to lengthen the car axle by cutting it in two and welding in a piece. The steering arm and drag link also are lengthened if necessary. Then the drag link is attached to the steering gear of the tractor so that the car wheels turn with the front wheels of the tractor. The method of doing this will, of

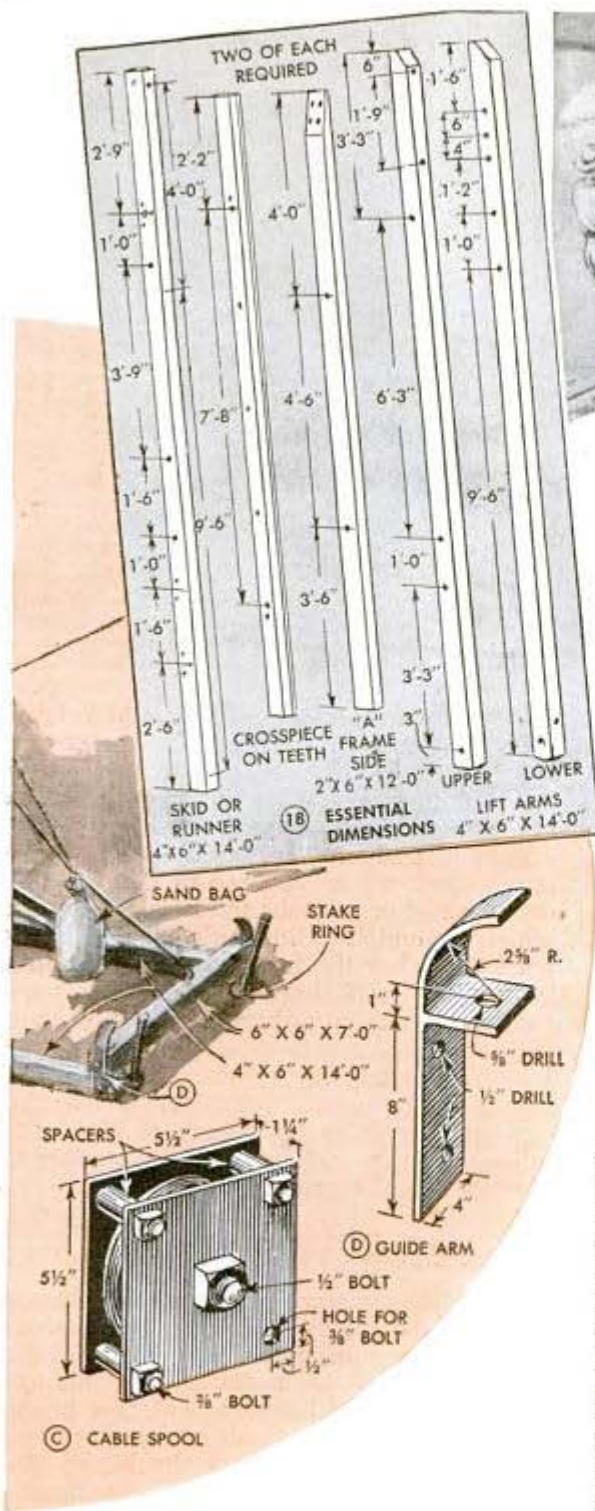


17 OVERSHOT HAY STACKER

Courtesy Extension Service, College of Agriculture, University of Nebraska

course, depend on the steering mechanism of the tractor. On the tricycle or dual-purpose type, it usually is possible to attach the drag link by means of a curved arm, which is welded or otherwise attached between the front wheels so that it turns with them. The various angles of this arm and the one on the car axle are given in Fig. 14. A V-shaped guide frame or stabilizer is attached to the tractor frame as in Fig. 14 to

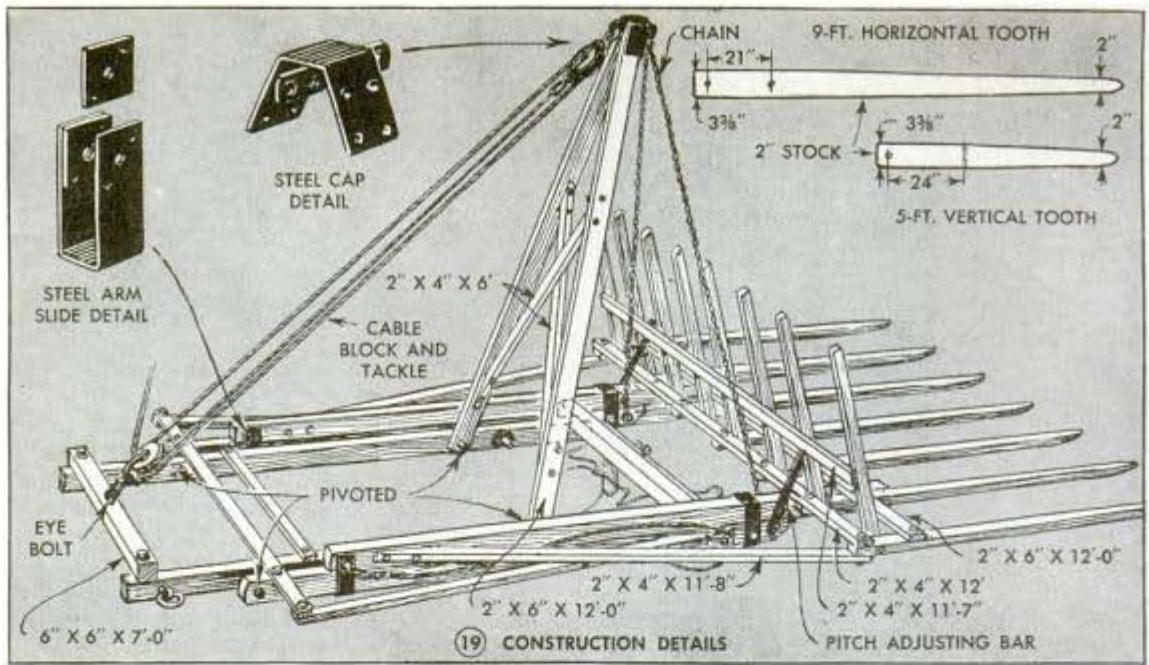




the axle is placed at the rear of the tractor, mounting it on the drawbar or other convenient place. This may make it necessary to use a couple of universal joints in the drive. Arrangement of the lifting cable and pulleys is shown in Fig. 15, the center pulley being fastened to some part of the tractor front. Notice in Fig. 13 that when mounted on a tractor the rake supporting shafts are very short. On this installation, the rake is not lifted bodily as on the car, but instead the teeth are merely tilted upward at the front. Fig. 16 shows construction of a rake for tractor mounting.

Since use of a buckrake usually means that hay is stacked, an overshot stacker will make the job much easier. The one shown in Fig. 17 is strong and fairly easy to make. Dimensions and bolt-hole locations of all wood parts except the teeth are given in Fig. 18. The teeth along with general construction details are shown in Fig. 19. Each lift arm consists of two pieces, which are held together by means of U-shaped slides, detailed in Fig. 19, at the end of each piece. These slide to permit extension adjustment of the arms. Use of lift-arm cables as indicated in Fig. 17 permits this adjusting to be done automatically. As the stacker rises with a load, the cables, being attached to each skid and to the lower end of each upper part of the lift arms, cause the latter parts of the arms to rise and thus extend the height of the stacker. Then, as the stacker is lowered, the cables let the upper parts of the lift arms work down to shorten the stacker in its lowered position. There are two advantages in using this automatic extension arrangement. It assures that the stacker will always be high enough to complete a stack of hay without making frequent adjustments, and it allows high stacks to be made without requiring excessive energy to lift the stacker in its extended position at ground level. The advantage of this latter feature is apparent when you consider that it is much easier to lift a given weight

keep the car axle centered when backing. The chain should be long enough to allow a movement up and down of at least 8 in. The guide should be attached just back of the tractor front wheels as indicated. On a tractor, the power take-off usually can be utilized to drive the lifting mechanism, which is an old car rear-axle assembly arranged as on the car installation. However,



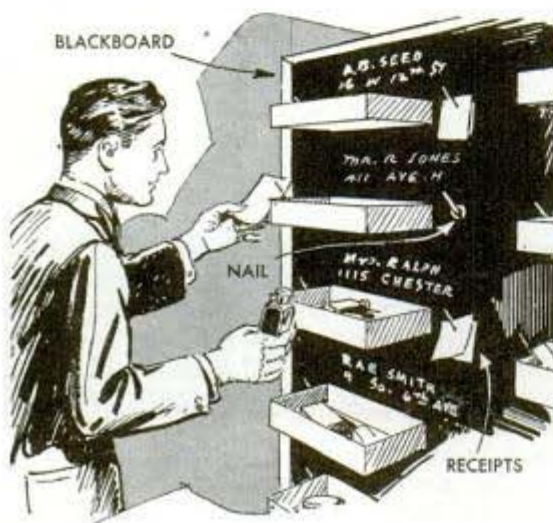
at the end of a short arm in a horizontal position than a long one. Notice how the lift-arm cables are run over pulleys, C, Fig. 17, and fastened at the ends to cable-end spools, B. Extended height of the stacker can be adjusted by shortening or lengthening the cables at the spools. Pivot brackets, A, attach the lift arms to the skids, and guide arms, D, prevent the arms from coming down on top of the skids. An old wagon tire will provide metal for the guide arms, which can be made by your local blacksmith or welding shop.

A stop cable to check travel of the stacker just past the vertical position is attached at the front end of the skid assembly and near the tops of the lower members of the lift arms. A sand bag near the lower end of

this cable serves as a weight to help in lowering the stacker. If available, a strong spring would be better as it would check the travel of the stacker with a snap action and thus aid in dislodging the load.

A block and tackle raises the stacker and is attached to the rear end of the skid assembly and to a V-shaped hoisting frame, which is pivoted to the skids, a chain being used to anchor the frame at the front end. Notice in Fig. 19 that the pitch of the vertical teeth can be adjusted by metal bars. This adjustment is necessary to control release of the hay at various heights of the stack. Large metal rings attached near the ends of the skids by means of eye bolts take long stakes with which the stacker is anchored to the ground.

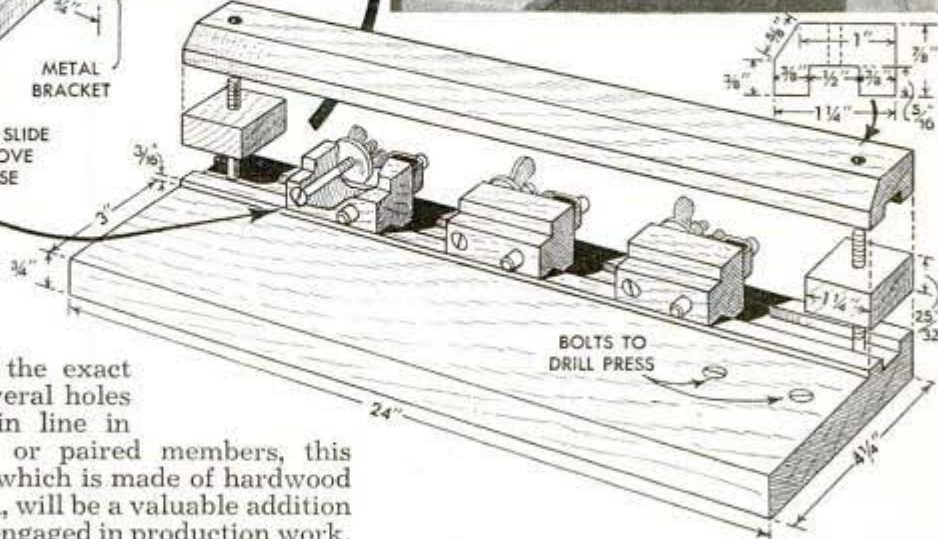
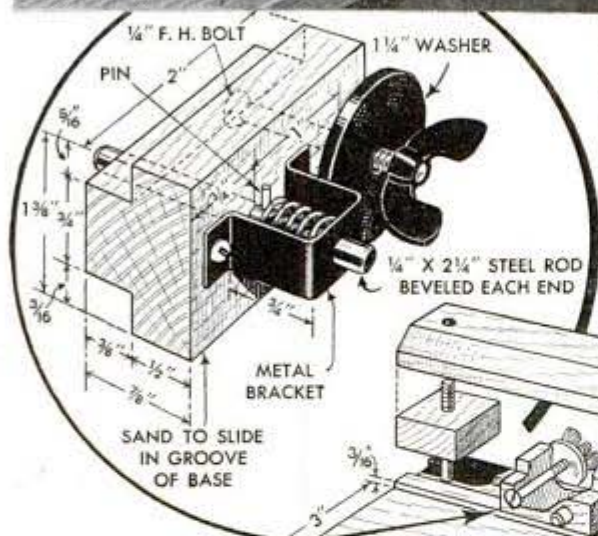
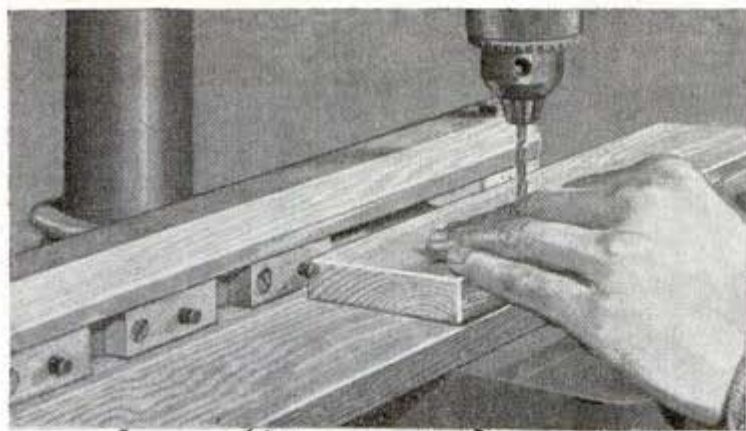
## Careful Check on Deliveries Is Possible With This Panel



This delivery panel keeps each delivery separate and shows at a glance whether an order is being delivered or the receipt for it is already in. A number of boxes are attached to a blackboard, and nails or hooks are placed on both sides of each box. When an order is put in one of the boxes, the customer's name is written on the blackboard above it and the receipt placed on the hook at the left. The delivery boy picks up the order and the receipt, then, on returning from the delivery, he hangs the signed receipt on the hook at the right.

When penning strange pigs together, spray them with a solution of dip disinfectant so that they all have the same odor and they will be less likely to fight.

# Holes Spaced Accurately With a Drill-Press Jig



For locating the exact positions of several holes to be drilled in line in identical parts or paired members, this drill-press jig, which is made of hardwood and scrap metal, will be a valuable addition to many shops engaged in production work. It can be installed or removed quickly as it is attached to the drill-press table with bolts and wing nuts. Consisting of a base and a rail as long as required, the jig is fitted with a number of stop blocks that can be moved along a channel and locked at any predetermined position. The blocks are locked in place by wing nuts that tighten large washers against the base and rail. Being extra large, the washers will have to be made specially. Each block has a sliding pin projected beyond its face by a light compression-type coil spring. In use, the work is placed against the fence so that all stop pins are pushed in. Then it is slid along the fence until the first pin is released, which provides a stop for drilling

the first hole, the work being pulled back to butt snugly against the pin. For the other holes, the work is advanced and butted against succeeding pins. The work may be moved either left or right according to the prearrangement of the stops.

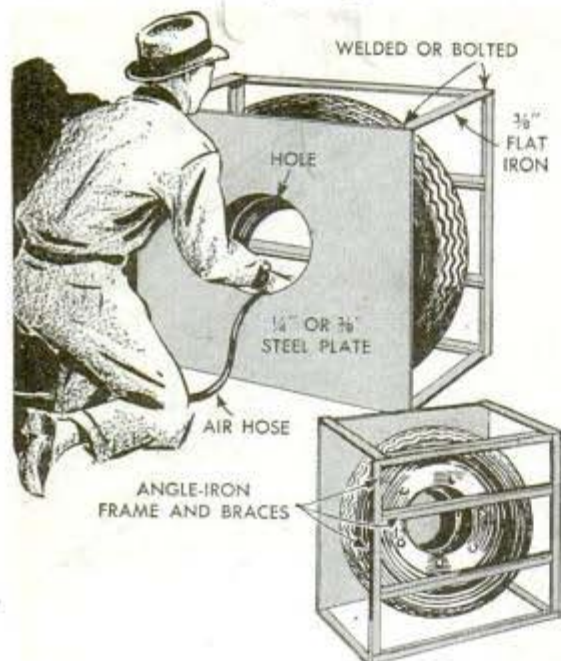
—Charles E. Troutt, Atlanta, Ga.

## Ammonia Removes Oven Scorch

Ovens scorched when pie or other confections run over may be cleaned by leaving a cloth saturated with ordinary household ammonia over the spot for a couple of hours, after which the scorched material will wipe off.

—Mrs. Hal Geihm, Aurora, Ill.

## Truck Tires Inflated Inside Cage To Prevent Injuring Workmen



After one of his tire repairmen had been seriously injured while inflating a newly repaired truck tire because one of the lock rims flew off, the owner of a fleet of trucks made a cage like the one shown in which to house the tire while inflating it. The cage is welded together from angle iron, the front consisting of a steel plate with a large opening through which the air hose is inserted.—John Krill, Youngstown, Ohio.

## Emergency Car Distributor Gasket

Rubber distributor cap gaskets of the Ford V-8 type can be replaced by ordinary canning jar rubbers. These are about the same size and are less expensive than the standard gaskets, which often are difficult to obtain.

## Hardening of Tool Steel Aided By Wetting Agent



Users of tool steels sometimes dip the pieces before hardening in a saturated solution of boric acid to reduce the amount of decarburization during heating. Unless the work is absolutely clean, wetting may not be complete.

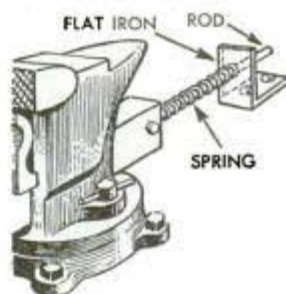
However, a few drops of some wetting agent in each quart of the acid solution will insure complete and uniform wetting. Such

agents are available at chemical-supply houses and photo-supply stores; or some hair-washing preparations may be used.

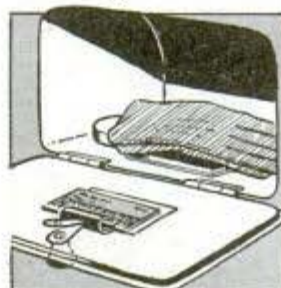
## Spring Used to Take Up Play In Worn Threads of Vise

Much of the time wasted in using a vise that has play in the movement of the jaw because of worn screw threads can be avoided by using a compression spring as shown.

The spring keeps the threads on the screw in contact with those inside the vise so that the slightest movement of the handle is transmitted to the jaw.—H. C. Kenly, Summit, N. J.



## Auto Records and Ration Books Clamped in Glove Compartment



One motorist who had trouble in keeping his car ration books and tire inspection records at hand in the car clamped them to the door of the glove compartment. To do this, a spring paper clip was fastened to the inside surface of the compartment door. On some cars this can be done by slipping one side of the paper clip under the nut that holds the knob in place. In this position, the papers are out of the way, yet are kept safely stored and conveniently at hand.

—Anson W. Tiffany, Kingsley, Pa.

## Oil Swab Carried on Tape Reel

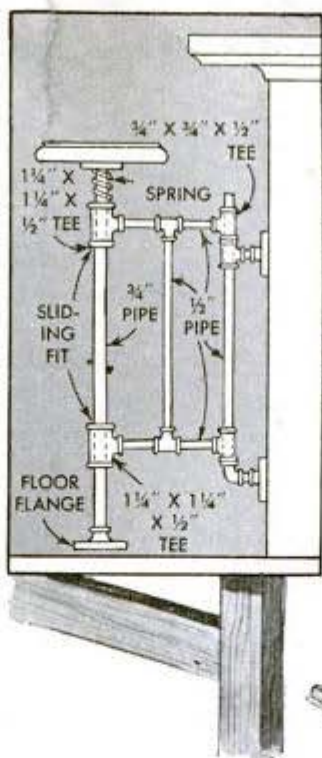
To keep a steel tape free of rust and in good condition under all working conditions, it should be wiped occasionally with an oil-soaked swab. To avoid carrying an oily cloth for this purpose in his tool bag, one carpenter

removed the threaded filler neck and cap from an empty oilcan and soldered it to his tape reel to serve as a housing in which to carry the cloth.—Opie Read, Jr., Chicago.



# Stool Pivoted on Bench Swings Out of the Way

Always at hand when needed yet easily swung out of the way when not in use, this workbench stool is comfortable, and it is easy to make from a few pieces of pipe and some fittings. Although different sizes of pipe are indicated, the stool could be made from any scrap pipe available. However, the tees through which the seat standard slides and those that pivot on the support pipe next to the bench will have to be large enough to permit a sliding fit. Floor flanges are used to attach the stool to the bench and the seat to the standard, the latter also having a flange at the lower end to serve as a foot. A spring under the seat raises the foot off the floor when not in use to permit easy swinging of the assembly. When a person sits on the seat, his weight compresses the spring, pushing



the foot to the floor. Thus there is no strain to pull the stool from the bench.

—Thos. H. Duffy, Altoona, Pa.

# “Tongs” to Remove Small Articles From Show Window

Removing small articles from the front of a show window without disturbing the rest of the display is a simple matter if you use this little gadget. It consists of a spring



clothespin, which has one leg screwed to the end of a suitable handle. The free leg is operated to pick up articles by a trigger at the other end of the handle, the trigger and clothespin being connected by a strong cord or thin wire. If desired, a pistol grip may be provided at the trigger end of the handle to make it easy to hold.

—Paul V. Repasy, Franklin Park, N. J.

# File-Card Holder From Envelope

When a number of small cards on the same subject must be filed together, a holder that will keep the cards grouped can be made easily from an envelope. All that is necessary is to cut the envelope from one



corner to another as indicated. This forms a three-cornered pocket for the cards. Either old or new envelopes can be used.

—J. Paul Stevens, Taos, N. Mex.

# Mass Inspection with Illuminated magnifier



when they subsequently develop. An incorrect analysis of the raw materials may cause uncertainty in machining operations and may result in incorrect heat treatment, which is highly critical. Although a few precision inspection instruments are entirely mechanical, most of them incorporate optical or electrical features, or both. In general, all are designed for ease of operation so that the average shop worker can learn to use them within a relatively short time. In this article the most commonly used devices for inspection will be considered.

**Illuminated magnifiers:** The small instrument shown in Fig. 1 is an illuminated magnifier having a wide field range with



by H. J. Chamberland

**Q**UALITY control in mass production assures that a hundred or a hundred thousand parts are identical in respect to internal structure, strength, resistance to wear, surface and dimensional accuracy. To be effective, quality control must start with raw materials because it simplifies locating and correcting troubles if and



③ *Shadowgraph*



④ *X-ray film magnifier*

either a 2 or 3-in. achromatic lens, which transmits light without decomposing it into primary colors. Two electric lamps, one on either side of the lens and under a shield that prevents glare to the worker, illuminate the parts being examined. The magnifier can be used for bench inspection as shown or may be taken to any machine or place where electrical connections are available. Such a low-cost inspection instrument is ideal to set cutting tools, observe cutting action and read fine graduations.

# Precision Instruments

With its 3-power lens, minute errors in welding and riveting, and cracks in hardened steel can be detected, after which more effective instruments may be used for further examination. The lens sets at a high eye point for convenience in working and relief of eye strain. Detail A of Fig. 2 shows a 7-power (7X) photomicrograph of a series of minute cracks. Detail B shows a 300X photo of a similar pattern.

The illuminated magnifier shown in Fig. 4 is strictly a bench model particularly designed to study X-ray films, technically known as "radiographs." Illumination in this case is a fluores-



⑥ Shop microscope

for observation. Although this instrument has many applications, in this case it is used to control the setting operation on bandsaw teeth. The machine that sets the teeth automatically stops if an error of .002 in. is exceeded.

**Shop microscope:** Fig. 6 shows a very popular shop microscope for inspecting routine work which is in process or has been finished. It magnifies 40X and may be carried in one's pocket. A self-contained battery supplies ample illumination. In use, the device is placed on a surface that is to be inspected and the illuminator but-



⑦ Toolmaker's microscope

cent light. A rheostat controls its intensity, the telescopic mount is adjustable to individual vision and the size of the equipment permits inspection of 14 by 17-in. films. While intended for a special purpose, the instrument has other applications within its range of 2½ magnifications.

**Shadowgraph:** The instrument shown in Fig. 3 is a shadowgraph. It consists of an illuminated microscopic lens of predetermined power. This directs the image of the object in its field onto a mirror which in turn reflects the image onto a white screen



⑧ Brinell hardness tester

## ⑨ Electric comparator

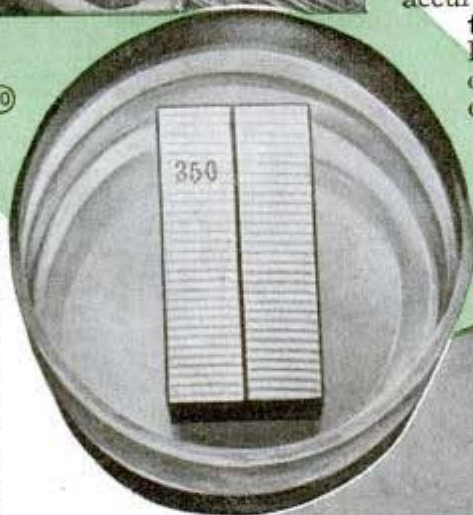


ton is pressed. The resulting light casts a deep shadow which is highly effective for the study of all surface characteristics. The instrument has a direct reading scale to measure cracks, flaws, impressions and projections to an accuracy within .00025 in. (one-quarter of a thousandth inch). It has hundreds of applications for extremely fine inspection, such as measuring impressions of Brinell hardness-testing instruments such as shown in Fig. 8. It is regularly used to inspect wear, blowholes in castings, welds, deposits of metals or paints, etc.

**Toolmaker's microscope:** The toolmaker's microscope shown in Fig. 7 is a somewhat finer instrument than the shop model in Fig. 6, and has about the same magnifying power, but a variety of objectives and eyepieces is available to meet individual requirements. Unlike laboratory-type microscopes, it shows the objects and movements in their natural aspect and direction, instead of being reversed. Fig. 5 is a 50X photomicrograph of the surface of a brass alloy. To use a toolmaker's microscope, the operator places the object to be examined on the microscope table and clamps it in position, then focuses on the part directly under the cross line in the microscope tube. The table can be moved longitudinally and transversely by two mi-

cometer screws with readings in .0001 in. By moving the object under the cross line in the tube, the distance between any two points is measured by the readings of the micrometer screws. This microscope is adapted to inspection of gauges, fine threads, complicated outlines involving radii and angles, etc. In reality the instrument is like a vernier micrometer, caliper or protractor, enlarged 40 times its normal size.

**Electric comparator:** The instrument shown in Fig. 9 is an electro-mechanical device for dimensional inspection on a production basis. It is finely calibrated and is in reality a high-production micrometer because it is from ten to a hundred times more accurate and is also much faster to use than any type of regular micrometer. Instruments of this kind are designed to calibrate in thousandths, ten



## Monochromatic light and optical flats

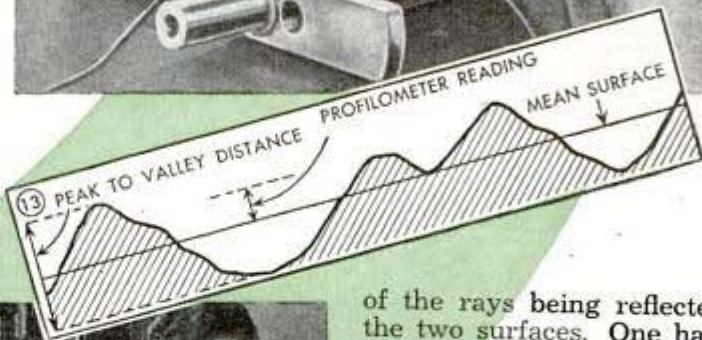


thousandths and one-hundred millionths of an inch. With the instrument shown, however, the change from one reading to another is instantaneous by the turn of a switch. Thus this special comparator does the work of several others of limited capacity. The operator can master precision measuring after a few hours of instruction.



**Monochromatic light and optical flats:** Measuring to millionths of an inch, monochromatic (one-color) light is used in connection with optical flats, Figs. 10 and 11. Although originally used in the laboratory, this equipment has become popular in many inspection departments and tool rooms. About a month of special training is necessary for an uninitiated worker to become proficient in measuring accurately with this equipment. Unlike white light, which contains all the colors of the spectrum—each one of different wave length—monochromatic light emits only one color having rays of the same wave length. When this light is directed through a

## ⑫ Profilometer



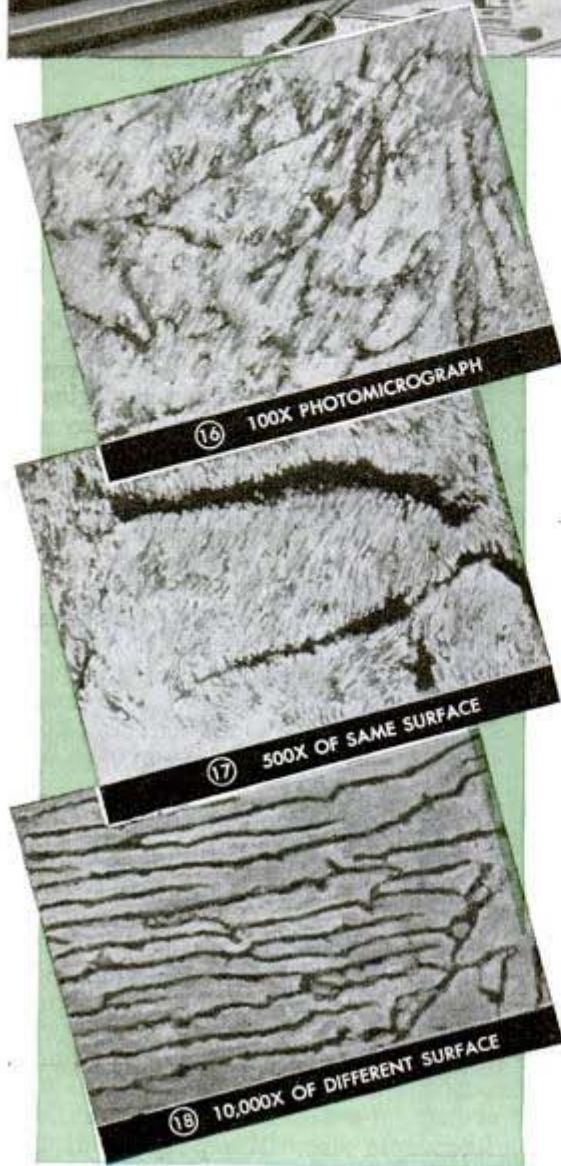
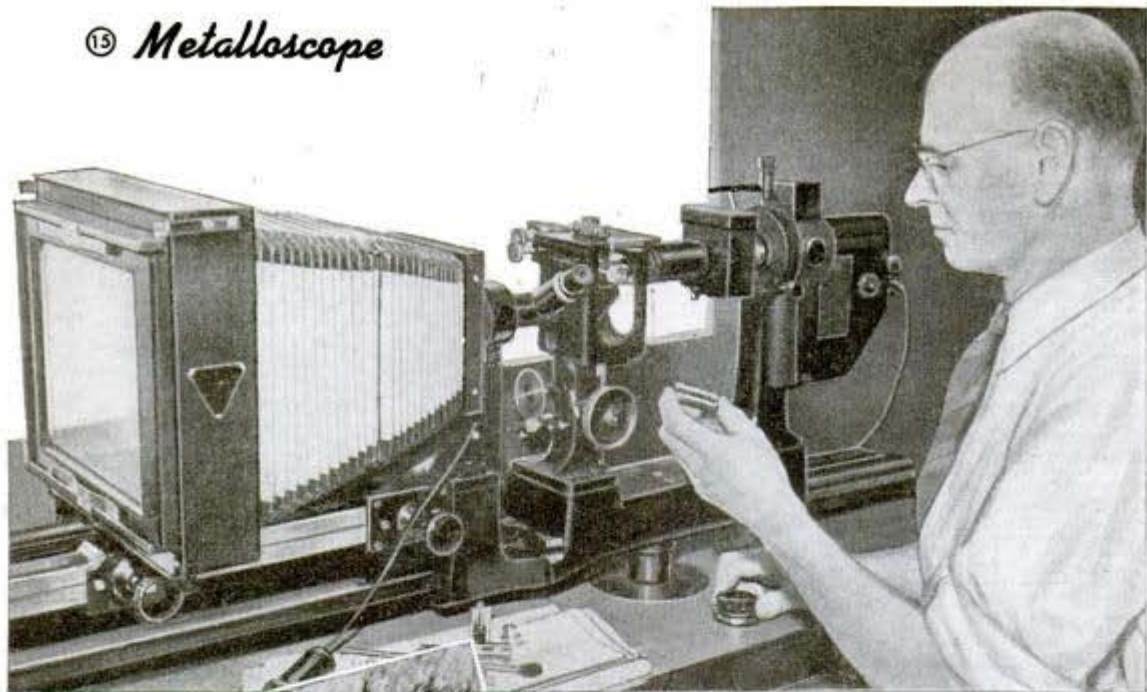
## ⑬ Mobile inspection unit

quartz optical flat placed on the work to be measured, the rays reflected from the bottom of the flat and the top surface of the work cause dark interference bands as shown in Fig. 10, owing to a thin "wedge" of air between the two surfaces. The bands repeat themselves each time the width of the wedge of air is increased by a vertical distance equal to one half the wave length

of the rays being reflected from the two surfaces. One half wave length of ray from a helium light source is about eleven millionths inch. If the wedge of air becomes narrower, indicating that the two flat surfaces are more nearly parallel, the distance between the bands increases—and vice versa. The bands are at right angles to the wedge; the straighter they are, the finer is the degree of flatness accuracy of the work. If the bands are concave or U-shaped when the point of the wedge is closest to the observer, the surface of the work is low in the center and high at the ends. If the surface is high in the center and low at the ends, the bands are convex. Thus it is relatively easy to determine the degree of accuracy of any flat surface when compared to a master part of known accuracy if both are observed simultaneously. Monochromatic light is produced by using cadmium, helium, sodium, etc., helium being generally used for the purpose.

**Profilometer:** The profilometer, Fig. 12, is an instrument used to study or inspect surface finish on a production basis. It performs electrically rather than optically, and is quite simple to operate after a few hours of practice. On any fine surface finish there still remains a range of peaks and valleys of microscopic size. The purpose of the

## 15 Metalloscope



16 100X PHOTOMICROGRAPH

17 500X OF SAME SURFACE

18 10,000X OF DIFFERENT SURFACE

profilometer is to measure these minute deviations rapidly in terms of micro-inches—millionths of an inch. The tracer member in the operator's hand is fitted with a fine diamond point. As this point travels over the surface being tested, the microscopic high and low spots cause vertical displacements of the point, which in turn cause similar variations of current in a coil located in a magnetic field inside the tracer head. As the varying current is too small to operate a meter directly, it is amplified so that it can be measured by the meter. Fig. 13 shows a profilometer reading.

**Mobile inspection unit:** Mobile inspection, Fig. 14, is a recent innovation in quality control. This practice eliminates placing instruments in many parts of a plant and also saves considerable time. The inspector can wheel the unit to any machine to check gauges and other tools as well as parts being machined. The one shown is a cabinet on wheels and is equipped with an illuminated magnifier, electric comparator, monochromatic light, master flat and several surface flats, a full set of gauge blocks, and various instruments to increase the value of gauge blocks. Pull-out desk space and drawers also are provided for keeping production records and making necessary notations.

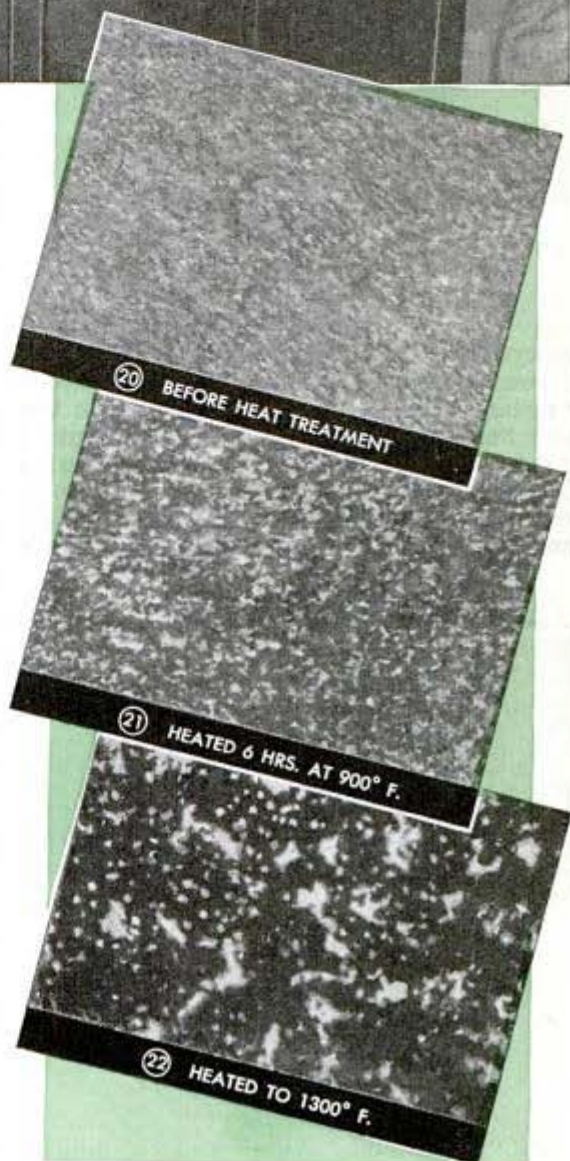
**Metalloscope:** The metalloscope, Fig. 15, is an instrument designed for visual observation and photography of internal structure or formation of metals and alloys. Basically, it consists of an inverted microscope and a camera with 40-in. bellows extension and a series of objectives and eyepieces, etc. The microscope may, of

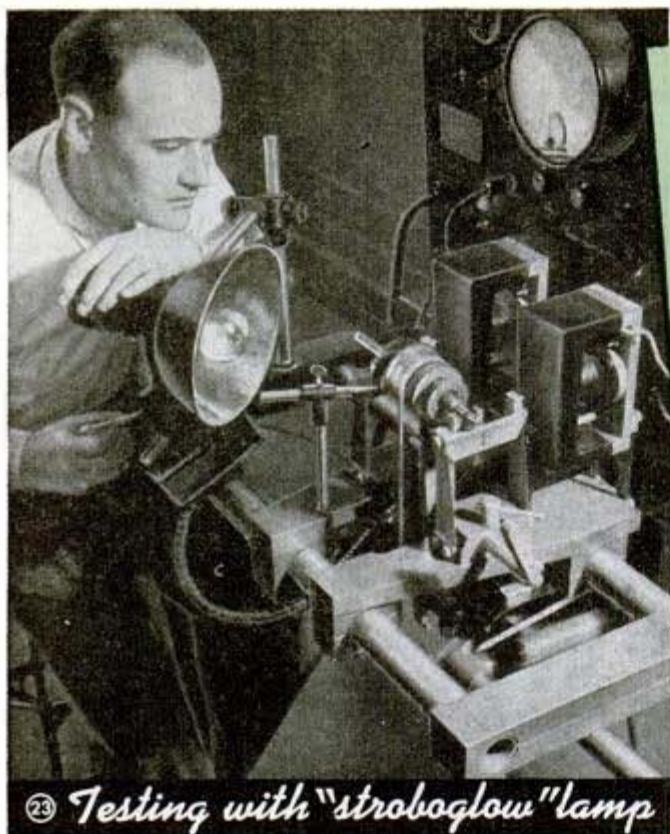
course, be used separately. Illumination is provided by an arc lamp and transformer for use with alternating current, or a motor-driven 10-amp. carbon arc for use with direct current. The metalloscope is so designed that any one fairly well trained in photography can do surprisingly effective research work in a reasonable length of time. Specimens may be examined or photographed from 25 to 2,000 times actual size.

Most important is the preparation of the surface to be examined; this work is called etching and is done as follows: Specimens of hardened steel must be tempered to a blue color to bring out the so-called carbide structure. With other specimens this step is disregarded. Specimens to be compared should be of identical size and are clamped together after being aligned in order to produce an even surface, which is first rough-ground with a coarse-grain wheel and then finish-ground with a fine-grain wheel. It is next dry-polished with No. 1 abrasive cloth at right angles to the grinding marks, then repolished with No. 00 cloth at right angles to the previous polishing operation. After this, the surface is finely wet-polished with 400 aluminum-oxide lapping compound and subsequently with lavigated alumina. After cleaning the finished surface with kerosene and wiping it dry with chamois, the specimens are ready to be examined or photomicrographed. Fig. 16 shows the appearance of a surface etched as above outlined and magnified 100 times and Fig. 17 shows the same surface magnified 500 times. Fig. 18 shows a 10,000X photomicrograph of another surface, and 100,000X magnification is within the range of the recently developed electron microscope.

**Cyclograph:** Shown in Fig. 19 is another production testing instrument, called a cyclograph, which is used to inspect or classify structures, depth of case, brittleness, castings, forgings, chemical content, thickness of tubing, plating, etc. It does the work of the metalloscope, but it is electronic rather than optical in operation and utilizes no photographic equipment. It is also a comparator instrument, and is as easy to operate as a radio. In use, a reading is made of a master specimen, this being etched as previously outlined. Then the instrument is calibrated according to the depth of case, structure, brittleness or other requirements, including allowable error. After such adjustments, parts by the hun-

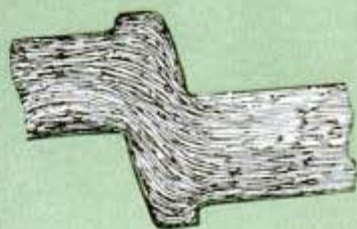
## 19 Cyclograph





23 Testing with "stroboglow" lamp

dreds or thousands can be inspected as fast as they can be handled, being placed in a purposely designed coil. The operator need only observe the slightly-enlarged pattern or cyclogram appearing on the cathode-ray screen, then compare this pattern with the master pattern. The cyclograph is an inspection instrument for the full output of production, whereas the metaloscope is for specimen inspection of less than 5 percent of total production. It is obvious that some of these precision testing and inspec-



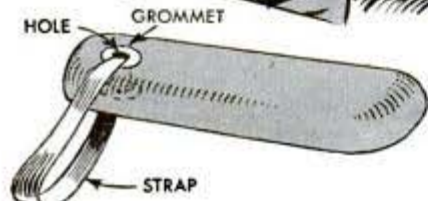
24

tion devices are not within reach of a small plant, but frequently private laboratories provide facilities so that production on a small scale can be controlled as efficiently as mass production in a large plant. Figs. 20 to 22 show how internal structure of steel changes with varying heat treatment and Fig. 24 shows how the

structural or flow lines in a forging look when highly magnified; note that they follow the bend in the metal as water follows a bend in the brook.

**Testing balance with "stroboglow" lamp:** Fig. 23 shows how parts rotating at high speed are electrically tested for balance, the amount of error and location thereof being indicated on a meter. In this case, the indicator point shows a piece of putty on the rotor, which a stroboglow lamp makes visible while the rotor is turning.

## Auto Door Is Pulled Shut by a Strap Through Arm Rest

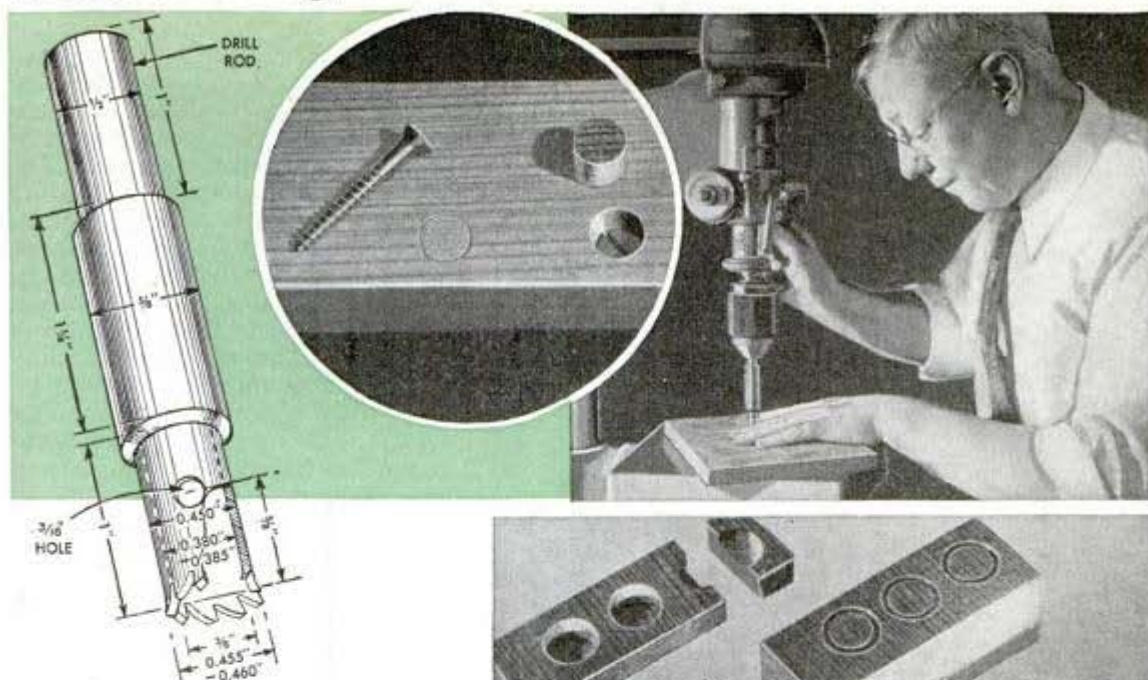


Grasping a strap inserted through the arm rest to close a wide car door is easier than reaching for the window crank or door lever. For this purpose a strap can be inserted through a hole drilled in the arm rest as shown. Metal or rubber grommets should be placed at top and bottom of the hole before attaching the strap.

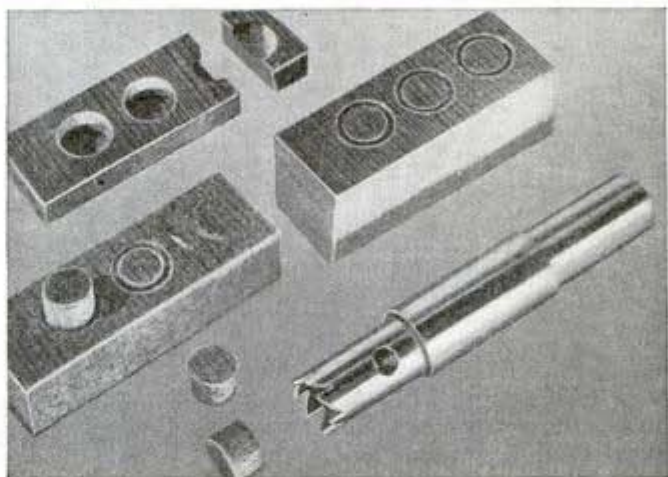
## Drill Press Set at Edge of Bench For End-Boring Long Work

End-boring long work can be done with a bench-type drill press mounted at the extreme edge of the workbench with the head swung out a quarter turn. The work is then rested on the floor and the drill brought to bear on the end.

## Wooden-Plug Cutter Is Turned From Drill Rod



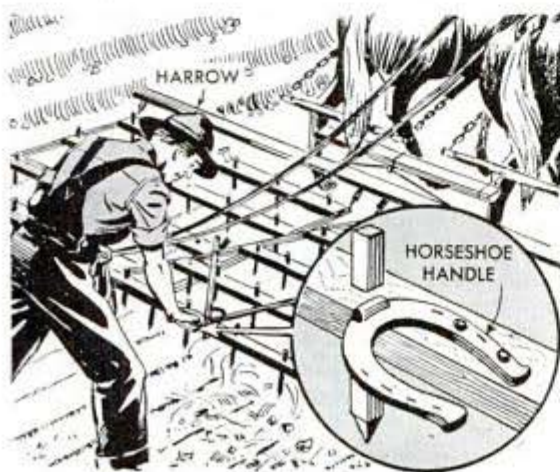
Wooden plugs for covering screws or dowel ends in fine cabinet work can be made by a cutter turned from drill rod. One end of the rod is turned to fit the drill-press chuck, and the other end is turned to suit the plug. Outside diameter for a  $\frac{3}{8}$ -in. plug would be .0455 to .0460 in. Next, a hole is drilled to a depth of 1 in. and is bored to the plug diameter as shown by the dotted lines. Then it is enlarged to within  $\frac{1}{8}$  in. from the end for plug clearance. The outside diameter is slightly reduced over the same distance for tooth relief. Teeth, cut with a three-cornered file, should be  $\frac{3}{32}$  to  $\frac{1}{8}$  in. deep and



slightly coarser than crosscut teeth. A hole is drilled crosswise for inserting a wire to push out plugs that break off inside the cutter. After machining, the cutting end should be hardened.

—Walter E. Burton, Akron, Ohio.

## Horseshoes on Sections of Harrow Make Them Easy to Lift

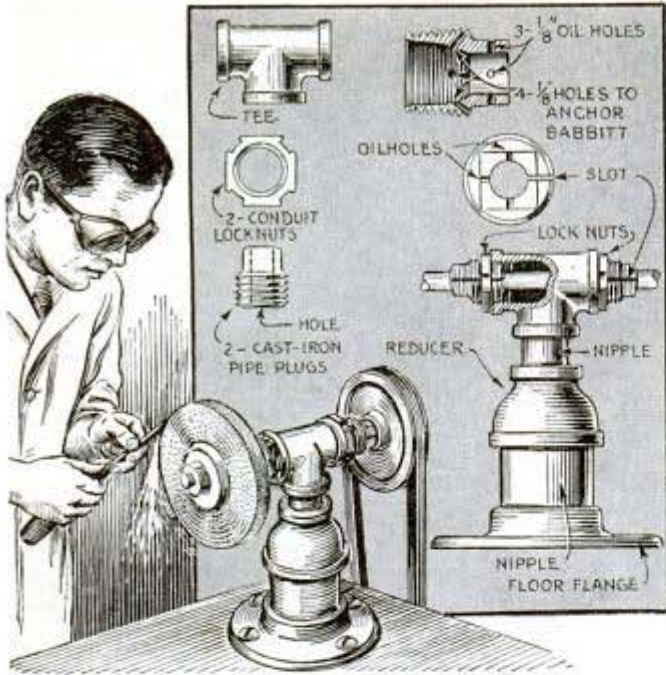


Lifting the sections of a harrow to free them of accumulated weeds and dry clods is made easier if a horseshoe is attached to each section to serve as a lifting handle. Nail holes in the shoes are enlarged to take bolts with which they are attached.

## Fitting Motorcycle Drive Chain

Fitting a new, secondary drive chain around the countershaft sprocket of a motorcycle can be simplified by fastening one end of the new chain to the end of the old one before removing it from the front sprocket. Then, as the old chain is pulled through, the new one will follow in its place.—I. J. Stretten, Detroit, Mich.

# Inexpensive Grinder Head From Pipe Fittings



A few standard pipe fittings can be assembled to make an inexpensive grinder head. Any size fittings can be used. After the base is assembled, the bearings are made from pipe plugs screwed into a tee at the top of the base. A  $\frac{1}{2}$ -in. hole first is drilled through each plug to take the spindle. Then, located around the plug, four  $\frac{1}{8}$ -in. holes are drilled for anchoring the babbitt. Also, oil-holes are drilled through the walls at the end of the plug. This may be done after pouring the babbitt; or, if the holes are drilled previously, the babbitt can be pierced later. The plugs then are slotted lengthwise along one side to allow for bearing take-up and secured in place with conduit lock nuts. These may have to be retapped to fit the plug threads.

—Roy L. Rhoades, Madison, Wis.

## Pipe Slipped Over Hammer Pulls Nails Above Your Head

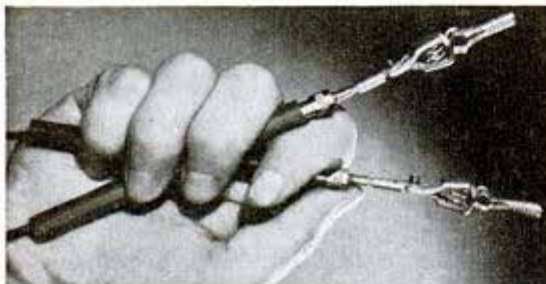
When one carpenter is dismantling a scaffold or doing some other job in which it is necessary to pull nails that are out of reach from the ground, he slips a piece of pipe over the end of the hammer, enabling him to pull the nail as shown. This method is particularly handy when nails are located so that a claw bar is ineffective.



## Solder Will Adhere to Cast Iron Coated With Blue Vitriol

Solder will adhere permanently to a cracked cast-iron cylinder head to seal it tightly if, after the crack has been cleaned thoroughly with gasoline and chiseled smooth along its full length, a small amount of blue vitriol is dissolved in water and applied to it. The vitriol will coat the surface with a fine film of copper, making a base to which solder adheres readily.

## Test Prods Are Handled More Easily When Clips Are Used at Tips



Electrical testers are much handier to use if detachable clips of the type shown are placed at the ends of the prods. Generally, at least one prod of the tester can be clipped to the object that is being tested while the other is used for probing, and on many jobs both of the prods can be clipped on, which will leave the hands free for other work.

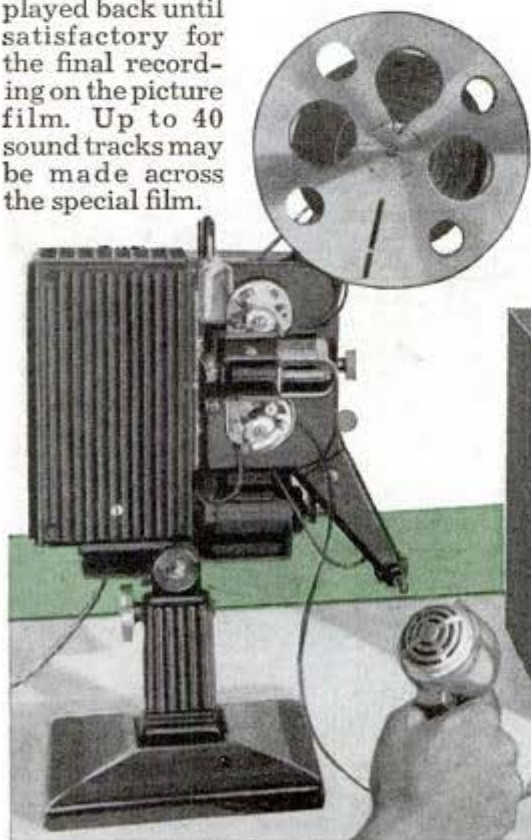
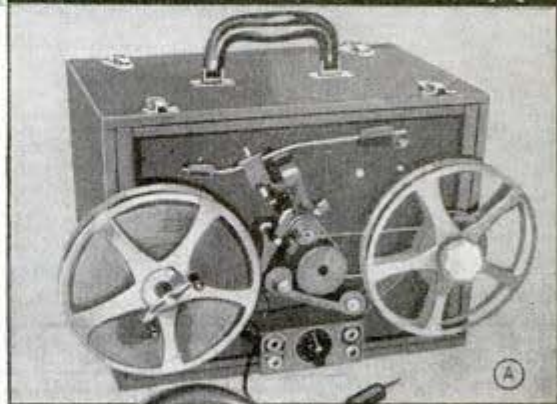
—R. Boettinger, Englewood, N. J.



## DIRECT RECORDING ON HOME MOVIE FILM

**R**ECORDING and reproducing sound on 16mm. film instantaneously without processing, just like you would cut a phonograph record on a blank disk and switch to playback, this portable unit provides synchronized sound for home movie films.

The unit includes a recording head, microphone, built-in audio amplifier, speaker, film reel mechanism and motor housed in a portable case. The "Filmgraph" unit is also supplied without amplifier and speaker for those who wish to employ separate equipment. To make a movie sound track, the picture is thrown on the screen and a script is written to explain and coincide with the action. The recording unit, placed near the projector, provides the takeup reel, as shown in photo B. A recording needle cuts a groove on the "shiny" side of the film close to the sprocket holes as it passes under the stylus. When used for straight recording on special auxiliary film, photo A, a number of script rehearsals may be made and played back until satisfactory for the final recording on the picture film. Up to 40 sound tracks may be made across the special film.



RECORDING SOUND TRACK ON 16MM. FILM

# HIGH-QUALITY TEN-WATT

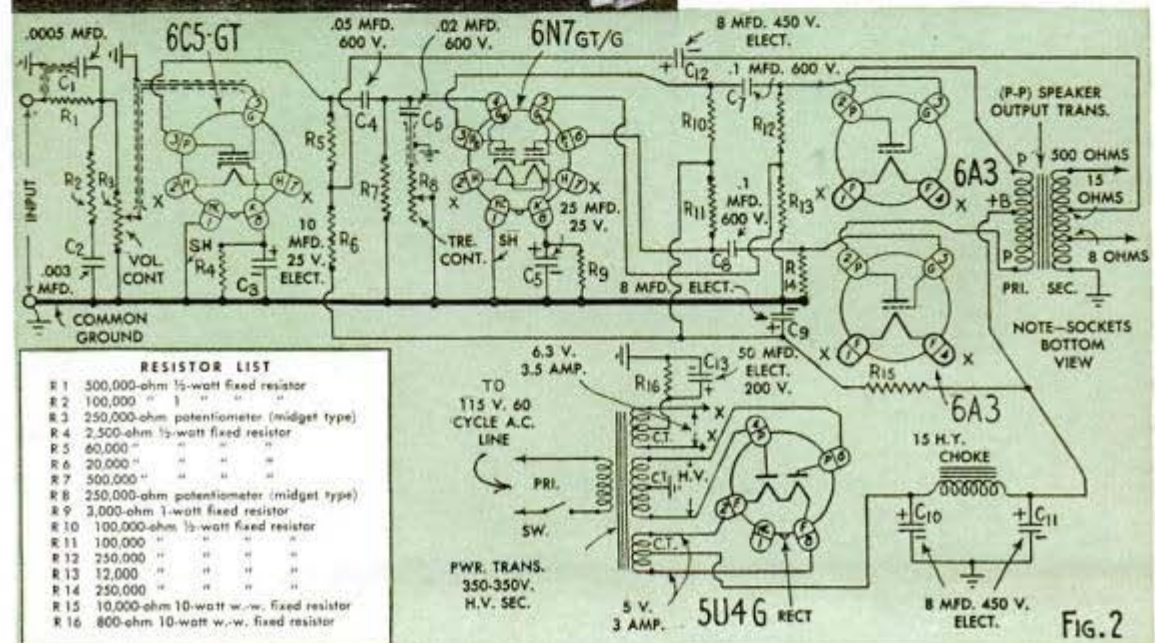
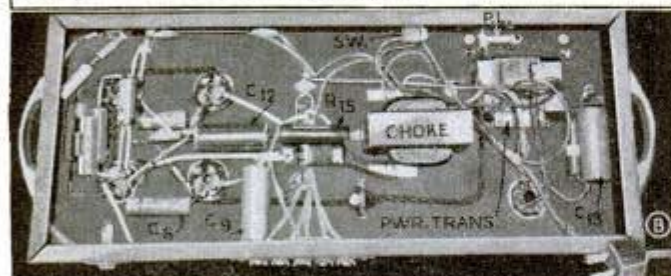
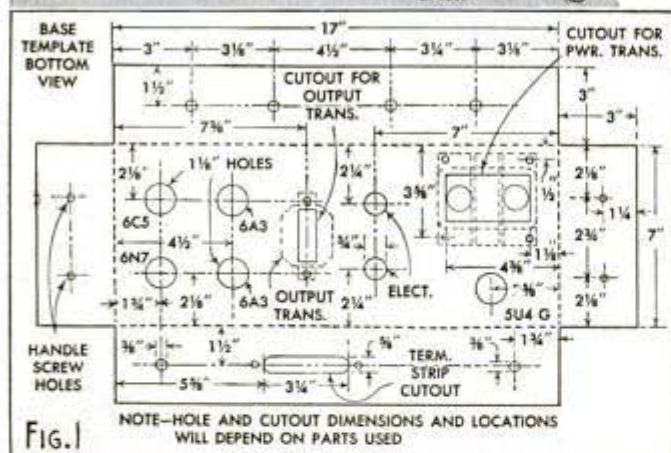
By C. H. Trapp



TONE quality often sought and seldom attained is an outstanding feature of this electronic power amplifier unit which has been designed for critical experimenters interested in the reproduction of high grade recorded music, and for use with FM as well as standard AM broadcast tuners.

Although the materials specified are parts that almost any advanced radio student or experimenter has on hand, they should be of good quality. Bass reproduction is built into the unit and is not obtained by the usual type of treble attenuation which results in a booming unnatural tone. With filament adjustment either 2A3 or 6A3 tubes may be employed in the push-pull resistance-coupled circuit, which includes phase inverter, and a simple form of feed back that prevents distortion and reduces hum level to a minimum.

The sheet metal chassis base is detailed in Fig. 1; many experimenters will have salvaged metal bases that will meet the requirements. A schematic circuit diagram appears in Fig. 2, and a simplified pictorial wiring diagram in Fig. 3. Check both diagrams for parts values. The unit is not difficult to build as all mechanical and

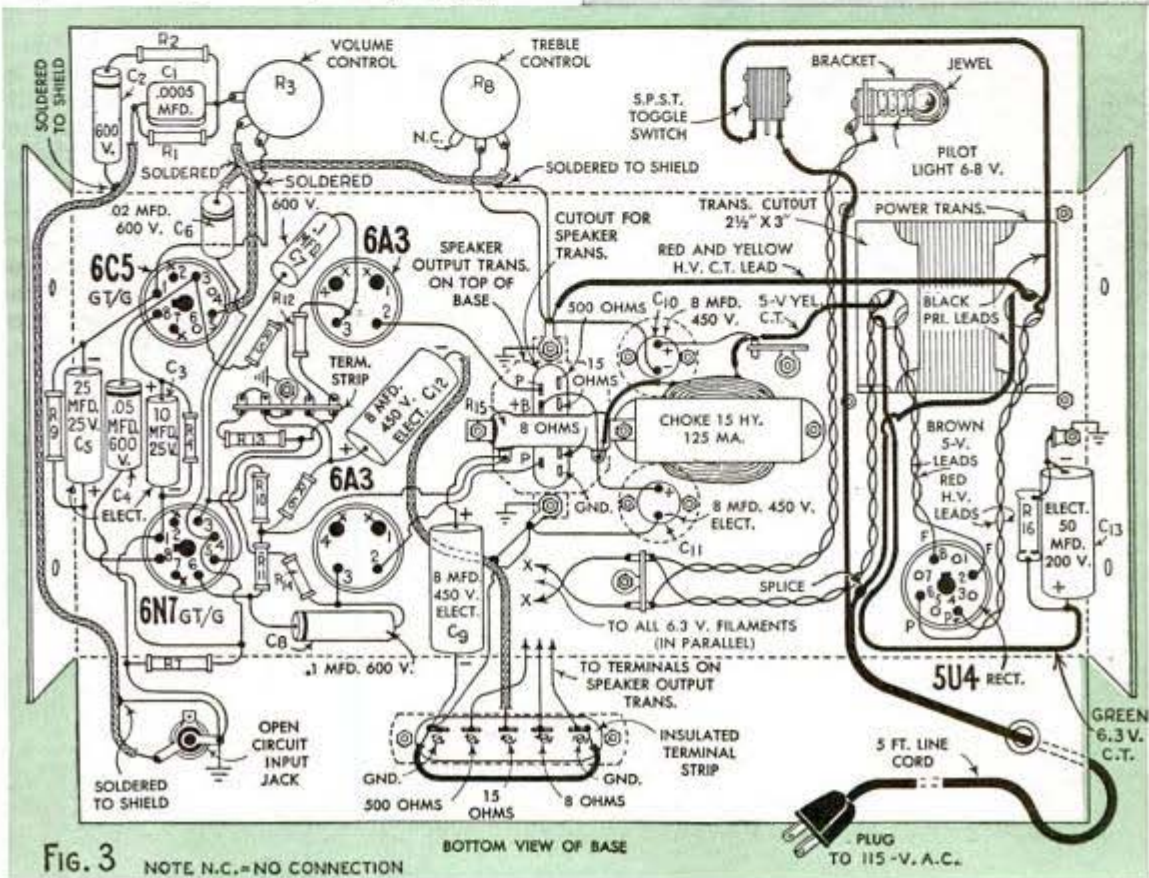
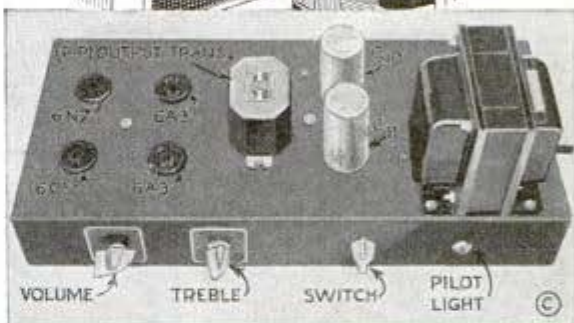




# PHONO-RADIO AMPLIFIER

electrical details are clearly shown in Fig. 3 and photos A, B and C. A large permanent-magnet speaker should be used for best results. The speaker output transformer shown happened to be a type with terminals out the bottom. Yours may have a different terminal arrangement that may necessitate bringing the leads down through the top of the base to the terminal strip shown at rear. The electrolytic filter condensers  $C_{10}$  and  $C_{11}$  can be of higher capacity and voltage rating if desired. The writer suggests two 24-mfd. 300-volt electrolytic condensers in series for each position, as this combination will carry a surge of 750 volts.

As in any electronic device, all connections should be well soldered. Use shielded single conductor wire where specified, and make all soldered ground connections to the metal shield just as indicated. The feed back loop from the 15-ohm secondary tap on the 5,000-ohm P-P speaker output transformer flattens out the frequency response curve, but it can be omitted for greater gain. Detailed student material list R-331 is available from Popular Mechanics radio and electronics department upon receipt of postage.



# Renewing the A-Battery in Portable Receivers

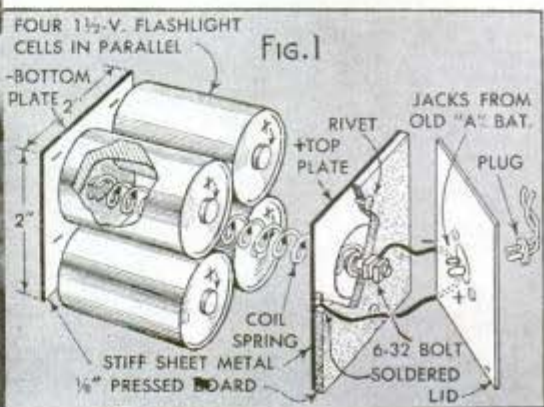
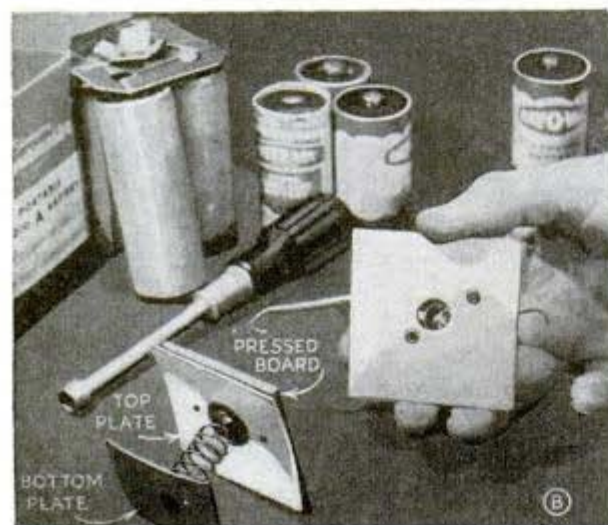
By Walter E. Burton



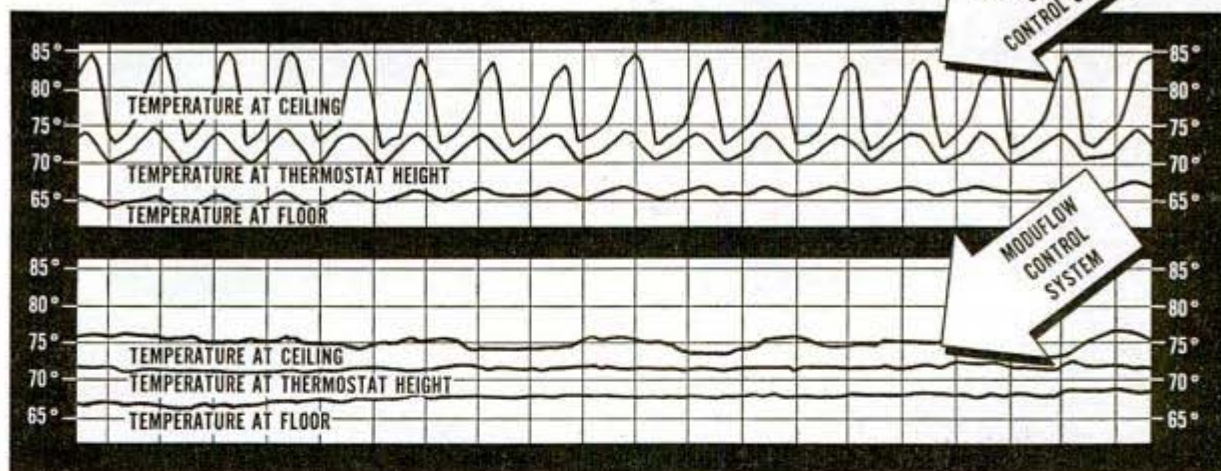
WHEN the A-battery in your portable radio receiver goes dead and you cannot buy a new one, you can substitute a homemade flashlight cell unit that will furnish the same voltage. The useful life of such a battery probably will not be quite as long as the standard A-battery but reasonable service will be obtained.

Take the dead A-battery apart and discard all but the cardboard jacket and the insulated top piece bearing the jacks into which the set wires are plugged. Four standard 1½-volt flashlight cells having about the same diameter as the old cells are connected in parallel to furnish the original 1½-volt output and approximate amperage.

A handy clip-in arrangement, detailed in Fig. 1, provides a simple means for quickly replacing the cells without making soldered connections. The top and bottom metal plates are cut from tin can material. The hole in the top plate should be at least ½ in. in diameter; a square sheet of ⅛-in. pressed board or similar insulating material slightly smaller than the inside of the cardboard jacket is riveted to this top plate. A small hole is drilled for a machine screw in the bottom plate, and a short coil spring is fastened to this bolt and to another bolt in the center of the insulating material as shown in photo B. The negative spring should not touch the positive top plate. Flexible insulated wires connect the positive and negative to the jacks. If necessary, remove the cardboard casings on the cells; the metal cell containers are negative, therefore the casings are not required. The complete assembly is illustrated in photo A and the sketch above.



# See the Difference..

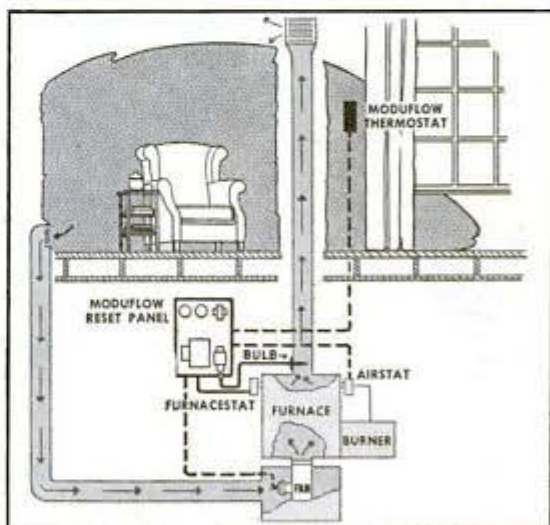


## BETWEEN MODUFLOW AND CONVENTIONAL HEATING *Control* SYSTEMS

THE CHARTS above are actual temperature recordings taken from two identical houses. One was equipped with ordinary "on and off" heating controls. The other was equipped with MODUFLOW, Honeywell's remarkable new heating control system. Compare the ups and downs of the old system with the smooth, even comfort of MODUFLOW. Moduflow eliminates wasteful overheating and drafty, cold floors . . . Every home can afford the greater comfort and efficiency of Moduflow.

### HOW *Moduflow* WORKS

Moduflow operates on an entirely new principle. It can be used with most automatic heating plants, either hot water, warm air or steam. Shown here is a warm air system. The heavy black lines show the simple additions required. Room temperature is controlled by the Moduflow Thermostat while temperatures of the warm air supply are governed by the bulb in the duct. The Reset Panel, operating at the command of these instruments, controls the burner and fan. Air at the right temperature is continuously circulated. Send coupon for the complete story of Moduflow.



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Another great day in railroading was heralded in January, 1888, when the Atlantic Coast Line ran the first de luxe vestibule Pullman train from New York to Jacksonville, Florida.

## IT'S A GREAT NEW DAY FOR RAILROADING

Today powerful GM Diesel locomotives on the Atlantic Coast Line whisk Florida's fresh fruits and vegetables to major American markets in a matter of hours. This is possible because these locomotives haul heavy trains faster and stay on their job longer with few stops for service.

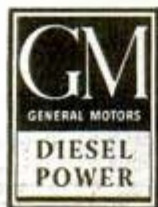
**O**NE thing is certain—Americans will have an entirely new level of transportation, post-war. Two factors will make this inevitable:

*The amazing achievements of the railroads under the stress of war.*

*The new and exciting prewar records for rapidity, regularity of service, safety and comfort the railroads had established with General Motors locomotives.*

American railroads are in a favored position to lead in this fine new service because a most vital tool which makes it possible is fully developed and thoroughly proved. Already General Motors Diesel passenger and freight locomotives are operating on more than 100 million miles, annually, of regularly scheduled service. Yes, it's a great new day for railroading—with even greater days ahead.

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You can prolong that faithful service indefinitely, if you insist upon an AC when you replace your present pump with a new or rebuilt one.

BUY WAR BONDS • BRING VICTORY QUICKER

## Mapping the Navy's Battlegrounds

(Continued from page 53)

Aerial photographs form the basis of modern cartography. After a mapping plane brings back photographs of an area that is under study, one of the survey boats moves into the district and determines the exact latitude and longitude of various prominent points on shore. Sometimes these fixes can be made by shooting the sun in the daytime; other times they must be made by means of star observations during the night, if Japs are suspected to be close. Concealment during survey operations helps prevent the Japs from suspecting where the Marines may land next.

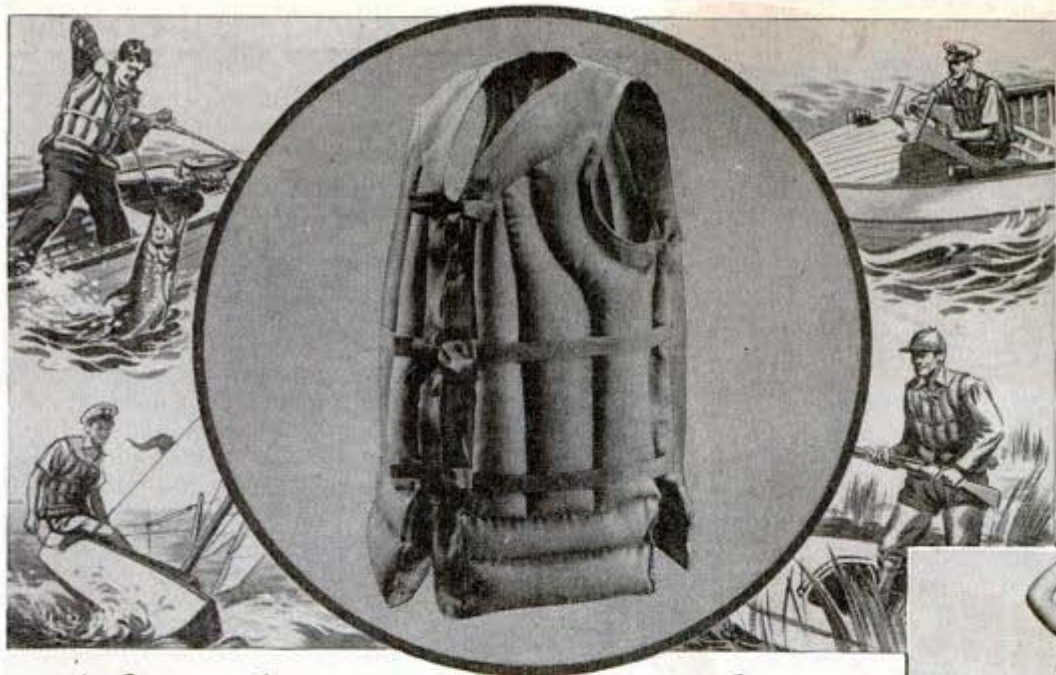
Learning the latitude and longitude of shore points provides an accurate scale for the aerial photograph and serves to orient the photograph with true north. Meanwhile the survey ship determines the depths offshore by means of fathometer readings, and it uses its underwater sound gear to detect underwater obstructions.

Approaches to anchorages and the channels leading into them are swept by means of a wire drag. In this operation a weighted cable is stretched between two small boats and is allowed to sink to a depth that would be safe for large ships. If the cable catches on an obstruction, a diver goes down to determine whether to blast away the obstruction or to mark it on the surface.

While this work proceeds a master chart that incorporates all the needed features of the original aerial photograph as well as the numerous notes and observations of the survey crew is being prepared in the ship's drafting room. Data is added to the chart as rapidly as the new information is obtained. Drafting a chart is a punishing job on a tropical night when every door and port is shut on a blacked-out ship.

It was assumed early in the war that the Japs had charted much of the Pacific years earlier in preparation for battle but this seems not to be the case. From evidence captured at their bases it appears that the Japs relied on old charts plus what local knowledge they could gather. In many cases this became a handicap to them and an advantage to us.

As the scene of battle shifts closer to the Jap homeland, American survey vessels are working far to the north and west of the areas in which they started to hang up road signs that point the way to Tokyo. These days they are charting waters that the Japs always regarded as their own, and are mapping islands that the Japs have held as secret, unapproachable possessions.



## After the war—more safety for all—in or on the water!

On the oceans of the world Ta-pat-co life-save equipment is doing its part in winning the war. Aboard fighting ships, transports and vessels of the merchant marine it is a protector of marine, sailor, and G. I. Joe.

What strange and dramatic stories these Ta-pat-co life-save vests might tell if they could speak. They are doing the job they were made to do.

After the war a Ta-pat-co life-save vest can be yours. Unique in their features of construction and built to "never let you down," all water sport can be more enjoyable — more safe. AMERICAN PAD AND TEXTILE COMPANY, GREENFIELD, OHIO.

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*Made as if our lives depended on it.*

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- build a fire without matches
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IN **BURMA**

this is the pipe they  
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... and this is the pipe  
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Our service men are in Burma, and on all the far-flung battle-fronts of the world—along with them have gone the same mellow LHS pipes they puffed in the states. That's the reason you may not always find just the LHS model or style you want, but if it's an LHS, it's "the sign of the perfect pipe."



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Sterncrest Ultrafine . . . \$10.00  
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Send for your copy of "Pointers on Pipes"—FREE  
L. & H. STERN, INC., Dept. Z, 56 Pearl St., Bklyn 1, N.Y.

## The Battle That Won the Pacific

(Continued from page 25)

south and drove the Japanese heavy units back into the San Bernardino Strait.

The Japs had sunk two of our CVE's, two destroyers and one destroyer escort. For a time they had threatened to break through to Leyte Gulf and it was nip and tuck. But this enemy thrust had been halted by the Seventh Fleet and thrown back by the Third Fleet.

By the morning of October 25 the surface action was over. The crippled Jap warships were fleeing for safety in the way they had come. Most of them had been hit or damaged, most of them had been slowed up and many were trailing oil. All day long, as the beaten enemy forces retreated through the Sibuyan Sea and the Surigao Strait, they were attacked again and again by United States carrier planes. On succeeding days the fleeing ships suffered further damage as they tried to find refuge in Philippine harbors.

When the Second Battle of the Philippine Sea was over, the official box score, as announced from Pacific Fleet Headquarters in Pearl Harbor, was as follows:

### JAPANESE IMPERIAL NAVY

24 ships sunk  
13 ships possibly sunk  
21 ships damaged

### UNITED STATES NAVY

6 ships sunk  
Several ships damaged

The figures do not tell the whole story. The Japanese Fleet is no longer a threat. It has a certain nuisance value, but that is about all. The United States Navy will be able to convoy its long lines of shipping to the forward areas with destroyers—releasing carriers, battleships and cruisers for raids in waters around Japan proper.

What happened at Pearl Harbor is about to be brought home to Japan's cities a hundredfold. The Second Battle of the Philippine Sea made it possible.

## Around the World in 2,000 Miles

(Continued from page 37)

oxen, the people in some areas using wooden plows, and burros are almost universally used for carrying farm products to market.

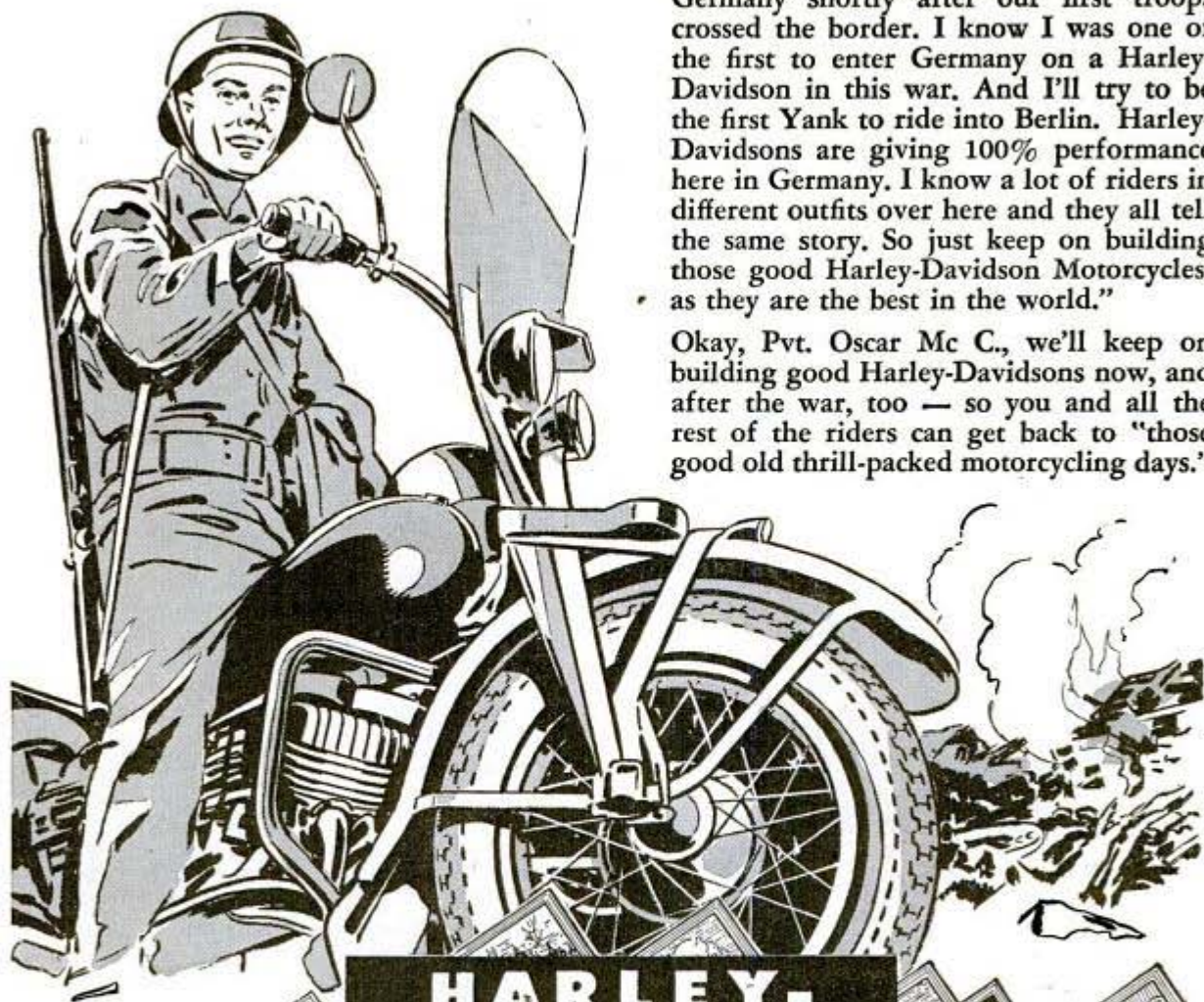
Much of Mexico is mountainous and in the past this rough terrain was a hindrance to travel. Communities have existed practically side by side for centuries with little interchange of ideas. Each community

(Continued to page 152)



**ONE OF THE  
FIRST YANKS**

**to Ride a Harley-Davidson  
Into Germany!**



Pvt. Oscar Mc C., writes: "I cannot state the date due to censorship regulations, but I rode my Army 45 Harley-Davidson into Germany shortly after our first troops crossed the border. I know I was one of the first to enter Germany on a Harley-Davidson in this war. And I'll try to be the first Yank to ride into Berlin. Harley-Davidsons are giving 100% performance here in Germany. I know a lot of riders in different outfits over here and they all tell the same story. So just keep on building those good Harley-Davidson Motorcycles, as they are the best in the world."

Okay, Pvt. Oscar Mc C., we'll keep on building good Harley-Davidsons now, and after the war, too — so you and all the rest of the riders can get back to "those good old thrill-packed motorcycling days."

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DAVIDSON  
MOTORCYCLES**

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Please send at once free copy of 24-page  
ENTHUSIAST MAGAZINE, filled with motor-  
cycle action pictures and thrilling stories.

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**SEND COUPON  
NOW**



**ARTIST  
with a  
FILE**

It is indeed an art to lathe-file a piece of work to proper dimensions; or to bench-file a precision part to micrometer measurements. Such skill is rarely achieved from practice alone . . . you've got to have *The right file for the job.*

That sound precept helps to explain why there are more than 3000 kinds, cuts and sizes in the Nicholson line of files—each of which can do a certain job on a certain type of metal better, faster or more economically.

An "M.F." (Master of Files) is a much sought "artist" these days!

**NICHOLSON FILE CO., 22 Acorn St., Providence 1, R. I., U. S. A.**  
(In Canada, Port Hope, Ont.)

**NICHOLSON**  
**FILES** FOR EVERY  
PURPOSE

NICHOLSON  
U.S.A.  
MADE IN U.S.A.

still builds its homes in its own individual way, still dresses in its own traditional costume, and engages in its own special kind of agriculture. A visitor may pass through three or four distinctly different kinds of civilization in a day of automobile driving. In one region the houses have brush walls and palm thatch roofs, while in another the walls of a house consist of sun dried adobe brick, with burned tile for roofs.

Mexico has been providing the United States with quantities of strategic war materials, including henequin and other fibers, minerals, rubber and castor beans, all of which flow north over Mexico's extensive railroad system. Portions of the Mexican railways are being improved by means of funds provided by the United States, one purpose of the rehabilitation being to insure dependable rail transportation all the way from Texas to the Guatemalan border.

The country still needs additional arteries of transportation and these are being provided by extending the highway system. The Pan American Highway is now completed as far as Oaxaca, 250 miles southeast of Mexico City, and the link from Oaxaca to Guatemala is scheduled for completion in 1945.

Another recently completed modern highway joins Guadalajara and San Luis Potosi and then continues eastward to connect with the Pan American Highway. Sections of the proposed west coast road from Nogales to Guadalajara are being worked upon and when completed this project will allow American tourists to drive to Mexico City over one highway and return north via another. The Mexican Health Department has undertaken a three-year sanitation program that would remove most health risks in the regions touched by the Pan American Highway and other major roads. At present some of the local water supplies are of dubious purity and tourists drink bottled water to be on the safe side.

## They Bring 'Em Out Alive

(Continued from page 47)

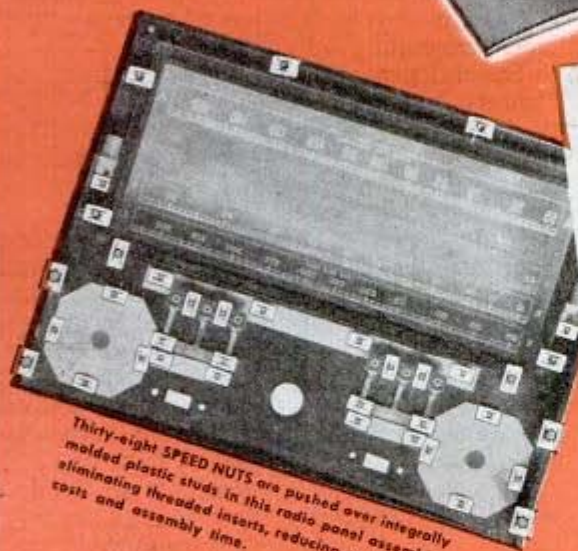
dust if the equipment is maintained properly. The Bureau tests this equipment in a gallery filled with explosive gas. If it fulfills all safety requirements, it is rated as "permissible."

Safety progress in mining has been speeded by the development of protective equipment such as a self-contained oxygen-breathing apparatus, which is worn when exploratory crews are examining workings which have been abandoned or

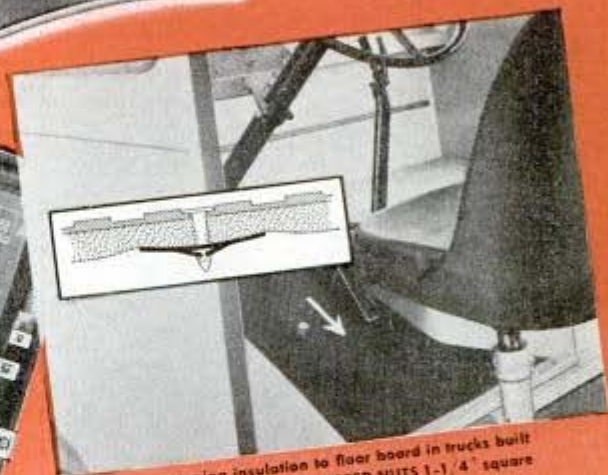
(Continued to page 154)

THE **NUT** THAT  
UNTHREADED

*Locks* ON  
STUDS!



Thirty-eight SPEED NUTS are pushed over integrally molded plastic studs in this radio panel assembly, eliminating threaded inserts, reducing mold costs and assembly time.



In fastening insulation to floor board in trucks built by the White Motor Co., SPEED NUTS 1-1/4" square pushed over No. 11 nails eliminate large washers or retaining strips.

● Just a push and it locks! It's just as simple and easy as that! For this unique spring steel fastener needs only to be pushed over rivets, nails, tubing, wire, integral die cast or plastic studs to lock parts firmly together. Threads are unnecessary because the spring prongs of the nut provide a friction lock on even the smoothest of chrome surfaces.

But easy attachment is not the only advantage gained by using Push-On type SPEED NUTS. Costly threaded inserts, drilling and tapping are eliminated—

molding costs reduced—assembly speeded up—and vibration loosening prevented. These fasteners are available in many sizes and shapes . . . rectangular, square, round, or they may be specially designed to fit your particular requirements.

If you want to improve the attachment of name plates, emblems, trim strips, grilles, or other light-weight parts, write now for samples of Push-On type SPEED NUTS, giving *stud diameter* and any other pertinent assembly details.



THE BASIC PRINCIPLE  
of Spring-Tension Lock is  
Embodied in all Speed Nut Designs

**TINNERMAN PRODUCTS, INC.**  
2023 FULTON ROAD, CLEVELAND 13, OHIO

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario  
In England: Simmonds Aerocessories, Ltd., London

*Speed Nuts*  
PATENTED Trade Mark Reg. U. S. Pat. Off.  
**FASTEST THING IN FASTENINGS**



**HE HAS  
YOUR BATTERY**

Men's lives depend on supplies by air when advance combat units are cut off in enemy territory! Battery-powered parachute lights quickly guide these fighting men to essential food, ammunition and medical equipment. Batteries help light the way to Victory on every fighting front—that's why they are not available here at home. Use your batteries sparingly... keep them cool and dry. Burgess Battery Company, Freeport, Illinois.

*Think Twice Before You Travel!*



**BURGESS  
BATTERIES**

IN THE NATION'S SERVICE



for some other reason may contain poisonous gases or are deficient in oxygen.

A self rescuer is carried by many miners. It gives the wearer protection against certain gases likely to be found after a fire or an explosion.

An all-service gas mask guards against limited percentages of a wide range of toxic gases, including carbon monoxide. It is a valuable aid in fire-fighting and other emergency work but is too bulky to be carried by miners in routine work.

Electric cap lamps are worn for underground illumination by miners. These lamps can be used safely in any atmosphere, insofar as ignition of explosive gas is concerned.

Special protective hats, "hard hats" or "safety hats," which have passed "drop" tests and other tests at the Bureau of Mines are recommended. Safety-toed shoes have special toe caps of steel which protect the wearer's toes from falling objects.

Safer types of explosives are becoming increasingly popular in coal mines. Black powder and dynamite, both of which generally are fired with flame-ignited fuses, have caused tragic explosions and fires. Better explosives, which have flames of short duration and less heat, are now fired electrically. Wartime explosive improvements are expected to prove valuable.

Obviously, any profession which depends upon the firing of explosives requires something of the courage and skill of a soldier trained for modern warfare. To illustrate what the miners face in their daily toil, consider this: They set off about 200,000,000 pounds of explosives in this country's mines every year.

## War Wonders for You

*(Continued from page 69)*

phones and other conveniences formerly found only in ocean liners, this ship will have a front end opening similar to that employed on the Navy LST's (landing ships, tanks) so that both automobiles and passengers may embark and disembark on electrically-operated gangplanks. The pilot house will be built entirely of transparent plastic in the same general design as used on the "blisters" of bombing planes. This will give the pilot a full 360-degree range of vision and is regarded as an important safety factor.

The use of prefabricated steel buildings by the armed services has resulted in numerous improvements, and a Detroit manufacturer, the Great Lakes Steel Corporation, already has a program for using

*(Continued to page 156)*

Delta Homecraft Power Tools illustrated are Delta Band Saw, Delta Lathe, Delta Circular Saw, and Delta Drill Press.



# Homecraft Happiness

...Why you enjoy more of it when you use

## Delta Homecraft Power Tools

Typical advantages that Delta quality construction gives you:

- 1 Double-sealed ball bearings you don't have to worry about oiling, because they are lubricated for life.
- 2 Precision-bored bearing seats that assure accurate alignment of parts.
- 3 Bearings that are pre-loaded — an extra manufacturing operation that insures longer bearing life.
- 4 Precision-ground shafts, to assure true, accurate performance.
- 5 Dynamically-balanced pulleys, to eliminate annoying, damaging vibration.

**"Hidden values" in construction help assure you of trouble-free performance**

In one word, *quality* is the reason why famous Delta Homecraft Power Tools help you enjoy a full measure of the fun homecraft offers you.

You can't always see Delta quality with your eyes. It doesn't make Delta tools look much different than other makes of power tools.

Yet, *quality is there!*

**Accuracy Tells!**

Because of quality, you can count on Delta Homecraft Power Tools for *accuracy*.

You enjoy greater assurance of parts that fit together according to plan, to form finished work that has a look of expert craftsmanship.

**Dependability Tells!**

Because of quality, Delta Homecraft Power Tools are dependable.

They're always ready to go at the flick of a switch—ready to give you the economical, reliable performance you have a right to expect.

**Safety Tells, Too!**

And, because of quality, Delta Homecraft Power Tools are *safe* — meeting the highest safety standards of schools and industry.

You feel free to let other members of your family share in the happiness of your hobby.

**Be Sure You Get Quality!**

Before you buy *any* power tools — when they are again available — be sure to learn about all the advantages of Delta Homecraft Power Tools that mean more for your money.

Right now, invest your money in War Bonds! When peace comes, reinvest your accumulated savings wisely in Delta Homecraft Power Tools.



HM-22

**Free Colorful Delta Book!**

"Happiness Is In Your Hands," shows you how to get started in homecraft. Contains a reprint of a Reader's Digest article telling how manual hobbies aid mental health. For your free copy, fill in the coupon and mail today.



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Please send me my free copy of "Happiness Is In Your Hands" picturing the ideal creative hobby and showing how to get started in it.

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Address.....

City..... (.....) State.....

THE EFFECTIVENESS OF  
**fluid power**  
DEPENDS ON  
**THIS**

**VITAL LINK**

ENGINEERED BY **parker**

Be sure of the Circuit—the “vital link” between the source of fluid power and the device that applies it.

The Circuit carries fluid power around corners and into tight places—wherever you want it to go. It must be leakproof, vibration-proof, able to stand high pressures and resist corrosion.

Engineering fluid power circuits is a Parker job. Years of experience have showed us how to design them, how to build the necessary valves and fittings and how to plan sure-working installations.



**THE PARKER COUPLING** is the key to the vital link, engineered and designed by Parker—protected against leakage and vibration, precision-made, quick to install, quick to service.

Ask a Parker Fluid Power Engineer how you can use this modern form of power on your machines of today or tomorrow. No obligation—just write to The Parker Appliance Company, 17325 Euclid Ave., Cleveland 12, Ohio.

THE  
**PARKER**  
APPLIANCE COMPANY  
CLEVELAND • LOS ANGELES  
**FLUID POWER ENGINEERING**

designs similar to the Army and Navy Quonset huts for farm and home structures. Easy to erect, strong and well-insulated, these units are expected to have a range of usefulness in several directions. Advances also have been made in central heating systems as a result of large scale tests in Army and Navy installations.

Sportsmen may live in their proverbial paradise in the postwar years, at least in regard to their equipment, if manufacturers adopt improvements and new devices found in Army and Navy paraphernalia. Some of these are mosquito-proof, featherweight pup tents; tiny, one-pound stoves that will burn for hours on a single filling of gasoline; Halazone tablets that purify river and creek water; new type sleeping bags, and floating match boxes.

In the medical field, there are warborn advances that range all the way from the Westinghouse “candid” X-ray camera, which has been used to examine as many as 2,000 WAVES per day, to bags which utilize a small vial of methyl bromide in sterilizing clothing and bed coverings in half an hour.

Nylon clotheslines, paint brushes with rayon bristles that won't wear easily, non-breakable milk bottles and plastic dishes are other warborn items likely to become familiar on the civilian market. Nylon rope has proved seven times as strong as hemp, easier to tie and untie, and fray resistant.

You can make the list include pianos that are 150 pounds lighter, as developed for Army camps, and plastic musical instruments that are lighter and cheaper, the first of which was the Army bugle.

In some cases, more or less serious difficulties may be encountered in adapting war products to civilian uses, but many of them, like the rubber boats, already are available and others will appear on the market rapidly.

## Lifting Father Knickerbocker's Face

(Continued from page 80)

the Hudson River, terminal for the largest transatlantic lines.

Among the novel features of the postwar program will be three terminals, two accommodating helicopters, planned by the Port of New York Authority. One is a bus terminal in the Times Square district, with elevated overpasses to clear traffic to and from New Jersey and the west side New York City highways. The other will be a 1,000-foot truck terminal with novel loading features for exchange of cargo near

(Continued to page 158)

# New Thousands Now Wear a Hearing Aid

*Thanks to the*

## NEW ZENITH NEUTRAL-COLOR EARPHONE and CORD



SO INCONSPICUOUS  
Another Zenith "First"

### ...Have you tried Its New "Look of Youth" on You?

**A**NOTHER great Zenith advancement is encouraging *new thousands* to discover the blessings of a hearing aid!

The Zenith Radionic Hearing Aid brought the *cost* of better hearing within reach of all. Now the new Neutral-Color Earphone and Cord brings a new standard of *smart appearance* that enables you to wear a hearing aid with poise and confidence.

This Zenith ensemble is actually *as little noticeable as eyeglasses!* Its streamlined, complexion-tinted plastic earphone is light in weight, comfortable. Its translucent plastic cord is perspiration-proof, fray-proof, kink-proof ... gives less friction or clothing noise than any fabric-covered cord.

Ask the Zenith dispenser near you for a *free* demonstration of the smart looking, superbly performing Zenith. No obligation! Send coupon below.

### Why Its Fine Quality Costs You So Little

If only a few Zeniths were made, each would cost many times more, yet have less precision quality—as Zenith proved when its precision mass production lowered the cost of a \$200 radio to \$29 and made it an *even finer* instrument. Now Zenith combines this production with a sales method which *eliminates* salesmen's huge commissions and other high sales costs ... to bring you an *even finer* hearing aid than our original \$50,000 model.

**CANADIANS!** The Zenith Radionic Hearing Aid (Air Conduction) with *Neutral-Color Earphone and Cord* is available in Canada—*direct by mail only*—at \$40 (Canadian currency). No extra charge for shipping, duties, taxes! Write Dept. PM-15, Zenith Radio Corporation of Canada, Ltd., P. O. Box 30, Windsor, Ontario.

**FREE! Illustrated Descriptive Literature** Gives complete information on advantages of the three new Zenith Radionic Hearing Aids. Mail coupon *now!*

### A New Zenith Model for Every Type of Correctable Hearing Loss

**1 Model A-2-A.** New improved model of the famous nationally popular standard Zenith for the person of average hearing loss. New, patented "Prentiss Tube" brings clarity and volume range with low battery consumption! Complete **\$40**—ready to wear, only . . .

**2 Model A-3-A.** New Air Conduction Zenith . . . A brand new, *super-power* instrument with tremendous volume in reserve to assure maximum clarity and tone quality even under the most difficult conditions! This special model **\$50** complete, ready to wear, only

**3 Model B-3-A.** New Bone-Conduction Zenith. A new, powerful precision instrument created specially for the very few who cannot be helped by any air conduction aid. Exclusive Zenith "Stator Mount" Headband automatically warns when headband pressure exceeds normal adjustment! **\$50** Complete, ready to wear, only . . .

#### NEW ZENITH RADIONIC HEARING AIDS

(All 3 models complete with Radionic Tubes, Crystal Microphone, Magnetic Receiver, Batteries and Battery Case)



BY THE MAKERS OF

**ZENITH**  
RADIO

RADIONIC PRODUCTS EXCLUSIVELY—  
WORLD'S LEADING MANUFACTURER

ZENITH RADIO CORPORATION, CHICAGO, ILLINOIS

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#### PASTE ON PENNY POSTCARD AND MAIL

ZENITH RADIO CORPORATION, Dept. PM-15  
P. O. Box 6940A, Chicago 1, Illinois

Please send me *free* literature about Zenith Radionic Hearing Aids—together with name and address of nearest Zenith dispenser.

Name .....

Address .....

City ..... State .....

Physicians check here for special literature.

# 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**

Holland Tunnel. In both cases the roof will have a landing area for helicopters.

The third terminal will be like nothing else ever devised. New-type car floats equipped with platform conveyors and tracks on both sides will dock with railroad express and freight cars at a quarter-mile terminal on Manhattan's lower East Side. Shipments will move to the bulkhead, to be picked up on portable conveyors. Then they will be sorted and moved quickly to hundreds of trucks. This terminal will handle mostly perishable fruit and vegetables.

Problems of cargo movements are being worked out by Port of New York Authority engineers on electrically operated, three-dimensional models. The same is true of the Manhattan Union Truck Terminal, first of four to be built.

Finally there will come the blossoming of Broadway. The trend toward cigarette signs which smoked, coffee pot signs which steamed and great neon-decked thermometers and weather forecasters will continue until roofs and building faces of the bright light district will drip with orange juice and flash with time-telling clocks. Cartoon figures in lights will put on animated shows, cats and dogs will scamper across signs and towers will be shaped like cigars and cigarettes until the canyon of color around which the theatrical center flourishes will be a show itself.

The proponent of the new Broadway is Douglas Leigh, now a navy lieutenant, who controls 65 percent of the sign space on Broadway. Leigh inaugurated the new trend toward three-dimensional, animated signs which was stopped by the blackout and lack of construction materials. He is ready with some startling postwar signs, notably rooftops shaped into gigantic perfume bottles, cereal boxes and so on.

Out-of-town visitors will unembarrassedly stretch their necks to see the sights overhead, for New Yorkers will be doing the same thing.

## Death From the Stratosphere

(Continued from page 4)

concrete sides they laid heavy steel rails almost vertically. Then they brought in what appeared to be giant artillery shells on wooden trailers drawn by horses. When the projectiles were set off, the blast sounded like a prolonged thunderclap. Immense heat was generated around the shaft and during some launchings it was said that the ground for acres around the site was scorched and a number of the launching crew killed.

(Continued to page 160)





Ralph Conrad and father with bass and walleyes caught on a Jitterbug in the Susquehanna River.

## "A Swell Surface Bait" say Sunbury, Pa., Anglers

"Dear Fred: Here are some pictures of bass and walleyes caught on your red and white Jitterbug in the north branch of the Susquehanna River. The largest walleye weighed 7½ lbs. and measured 29½ inches. My father caught the largest bass. It weighed 6 lbs. and measured 21 inches. We both think the Jitterbug is a swell surface bait. We also catch quite a few on the Hawaiian Wigglers. Yours for better fishing."

—Ralph Conrad, Sunbury, Pa.



Write for  
Literature

FRED ARBOGAST  
1622 North St., Akron 3, Ohio



QUALITY . . . WORTH WAITING FOR

### THERE WILL BE A SLIGHT PAUSE . . .

One of these days, restrictions will be lifted on outboard motor sales for pleasure use.

While Johnson has the facilities to build a major share of all outboard motors manufactured, there will definitely be some lag between the lifting of restrictions and full deliveries of all Sea-Horse models.

How long? That depends on many things, including army and navy requirements. There has been, there still is and there will be a large army and navy demand for *Sea-Horses*.

The qualities that make Sea-Horses suitable for war—ruggedness, smooth performance, and **DEPENDABILITY**—are qualities worth waiting for. To get these qualities, you may have to wait a while after restrictions are lifted; but you'll have them for **YEARS** of satisfaction thereafter.

**DEALERSHIPS:** If you are interested in selling AND SERVICING outboard motors after the war, write us now—no matter what your location may be. **JOHNSON MOTORS, WAUKEGAN, ILLINOIS**

DO YOUR DUTY

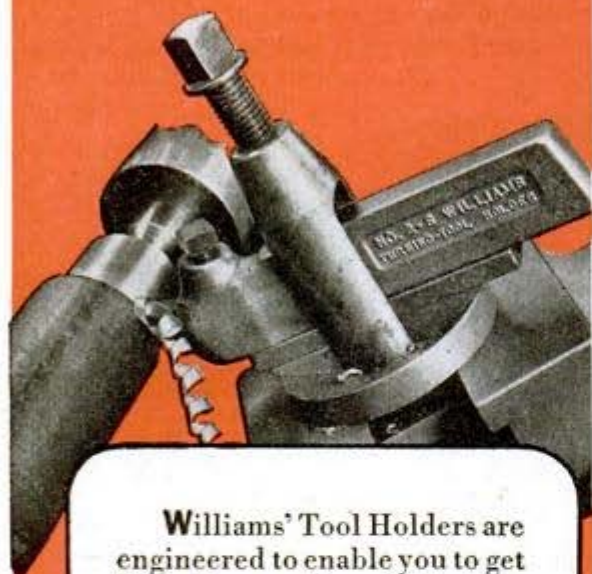


BUY WAR BONDS

THERE IS  
NO SUBSTITUTE FOR  
EXPERIENCE

# JOHNSON SEA-HORSES for **DEPENDABILITY**

## FOR IMPROVED LATHE PERFORMANCE



Williams' Tool Holders are engineered to enable you to get from the machine all that the builder built into it. There's a type for every regular operation of lathe, planer and shaper ... many incorporating design advantages found in no other holders.

Compare the performance you get with Williams' Tool Holders. Meanwhile, write Dept. M-2 for your free copy of Williams' Tool Holder Data Sheets, loaded with helpful information on grinding, set-up and use of cutting tools.

**J. H. WILLIAMS & CO.**  
BUFFALO 7, N. Y.



**DROP FORGINGS AND DROP-FORGED TOOLS**

Another source reported the Nazis also use a portable, adjustable launching ramp, consisting of a tracked vehicle towed by a big truck. The electric firing mechanism is housed within the armored flash shield. Hydraulic jacks on which the platform rests absorb the recoil. Jets of water cool the platform during the firing operation.

Swedish sources have indicated the Nazis were constructing launching sites high in the Norwegian skiing slopes, presumably for firing V-3, which is rumored to be a larger and improved version of V-2, intended for spanning the Atlantic Ocean. Most Allied scientists nevertheless hold that the stratosphere rocket, in its present development, cannot be used against the United States with enough success to make it worthwhile.

But if the rocket is only a spite weapon now, strategists admit that in a future war a super-rocket, carrying really heavy explosives, might not only prove to be the decisive weapon but could conceivably annihilate entire areas of civilization as well.

As for peacetime, big things are predicted for V-2 adaptations. G. Edward Pendray, secretary of the American Rocket Society, says that after the war giant rockets will swish mail and express across the United States in a matter of minutes and that rockets will be sent into the stratosphere to gather data which will enable meteorologists to forecast the weather two weeks in advance. J. B. S. Haldane, British scientist, believes that perfected versions of V-2 could be used to photograph the sun, the moon and other heavenly bodies.

Meanwhile, the United States has developed a controllable "buzz bomb" which is reported as highly successful. It is said to be a speedy, winged robot which travels on ordinary low-test gasoline but it will not be used in this war, the Air Force says, unless our inhuman enemy "asks for it."

### The Bombsight That Thinks

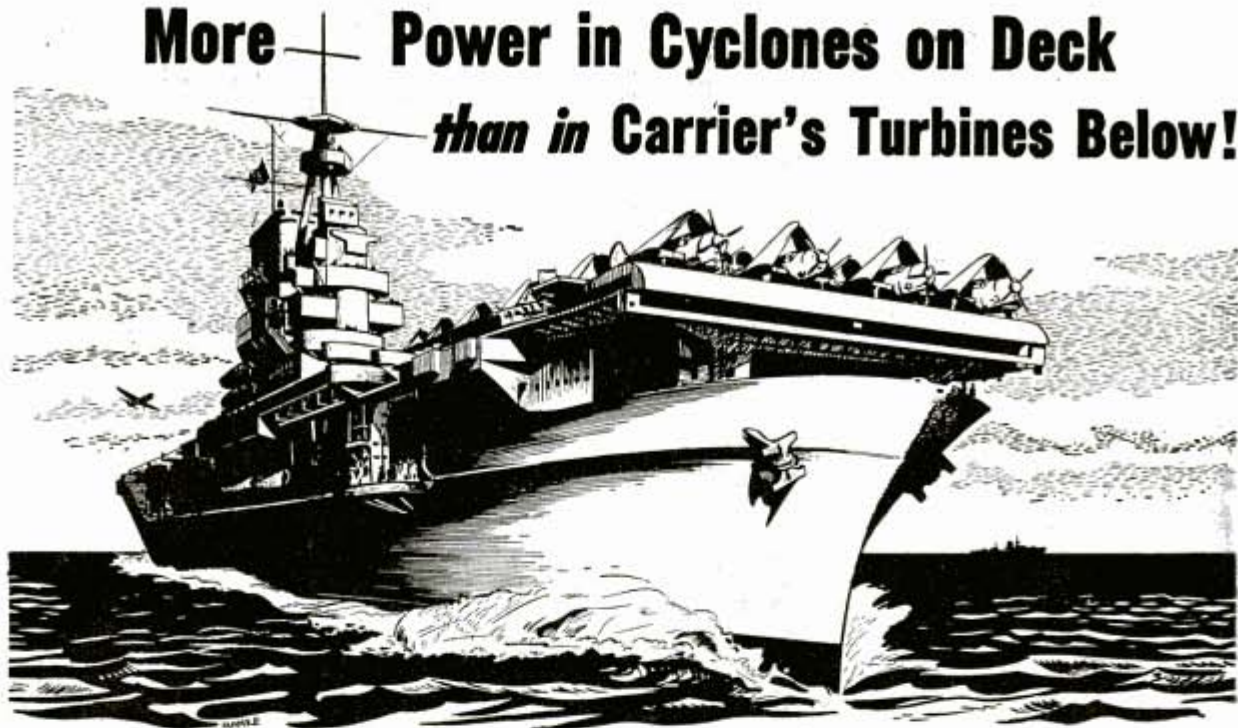
(Continued from page 10)

down toward the target, the pilot switches off the automatic controls and quickly changes the course of the plane. If everything has gone well, the happy report of "bombs on target" is echoed and re-echoed over the interphone.

That is when high precision workmanship pays off. The personal thrill of "bombs on target" is not for the crew alone, but for the workers back in the Victor Adding Machine Company plant in Chicago where Norden bombsights are made for the Army Air Force.

(Continued to page 162)

# More Power in Cyclones on Deck than in Carrier's Turbines Below!



Surging into the wind at 30 knots, this 20,000-ton carrier is driven by massive turbines which can turn up more than 100,000 horsepower. On deck, there's a 1,700 HP Wright Cyclone in each Curtiss Helldiver and Grumman Avenger. Mighty as the carrier is, a normal number of these single-engined planes aboard may total 50,000 more horsepower in combined form than the turbines below.

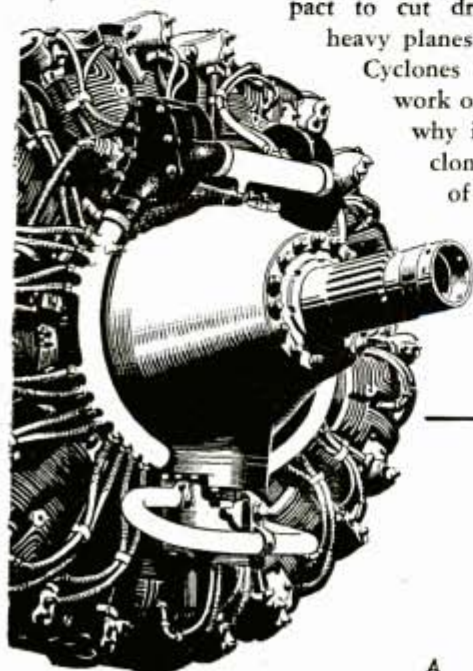
Weight, size and power are the three critical points of an aircraft engine. It must be light to permit flight, compact to cut drag, powerful to carry heavy planes at high speed. Wright Cyclones come from 25 years of work on such problems. That's why it takes such a few Cyclones to equal the power of a carrier.



**LIGHTEST:** The Cyclone 9 of 1,350 HP in new FM-2 Wildcat is first service engine under a pound per HP. It weighs only 0.97 lbs. per HP.



**TOUGH:** A Cyclone 9 in a Douglas SBD-3, with oil line and 4 of 9 cylinders shot out of action, kept right on running to bring pilot and plane safely home.



### Write for "ENGINOLOGY"

a 60-page booklet on the whys of engines

A complete, non-technical booklet on engines, propellers, and aircraft. Describes operating principles of engines and planes. Explains combustion, supercharging, ignition, carburetion. Just send twenty-five cents in stamps or coins to: Wright Aeronautical Corporation, Dept. P. M., Paterson 3, New Jersey.



# WRIGHT AIRCRAFT ENGINES

A DIVISION OF CURTISS-WRIGHT CORPORATION

## WOODWORKING IS FUN



...when  
you have a  
**GOOD  
PLANE**

A proper assortment of fine tools chosen from the Stanley line will put real fun into making things in your postwar home workshop. For example, the Stanley "Bailey" Plane—one of Stanley's 64 types of planes—will lend even your first efforts the touch of the expert. Like other Stanley Tools, this plane is better designed and balanced. It takes and holds a keener edge. And it is made to last!

### Expert Help in Selecting Tools

Stanley has a free booklet for you, "The Joy of Accomplishment". Crammed full of helpful suggestions, it contains: a primary list of tools, a list of tools to be added as needed, and a list of project plans. You'll also find the big Stanley textbook, "How to Work with Tools and Wood", mighty useful. It's yours for only \$1.00. Mail the coupon today.



**STANLEY**  
TRADE MARK

**THE TOOL BOX  
OF THE WORLD**

**MAIL NOW**

The Stanley Works  
125 Elm St., New Britain, Conn.

Please send by return mail—

- FREE booklet: "The Joy of Accomplishment"  
 The 188-page book: "How to Work with Tools and Wood". \$1 enclosed.

(In Canada: Send order to Stanley Tool Co. of Canada, Ltd., Roxton Pond, Quebec.)

Name.....

Address.....

City..... State.....

The precision with which this plant operates is a story in itself. Gauges, accurate to within 20 millionths of an inch, the shadowgraph which magnifies an image 100 times, and the watchmaker's care with which the parts are made and tested leave nothing to chance. The profilometer, for instance, measures the smoothness of surfaces within one tenth of a micro-inch—or the thickness of a human hair split lengthwise 30,000 times. The optical flats which employ the light wave measuring system show dark interference bands which are exactly 11.7 millionths of an inch apart.

Elaborate precautions are made to keep dust out of the parts. The spotless plant is airconditioned and the workers on the assembly lines wear special lint free coats. Ball bearings are handled with white kid gloves so that no perspiration shall mar their perfection, and they are oiled with drops from a hypodermic needle.

The fact that the Norden bombsight is being made on an assembly line and is today in mass production is a new high for American industry. To complicate this procedure, improvements are being constantly incorporated into the sight. One of the newest improvements on which engineers are now at work will increase the forward angle of the telescope.

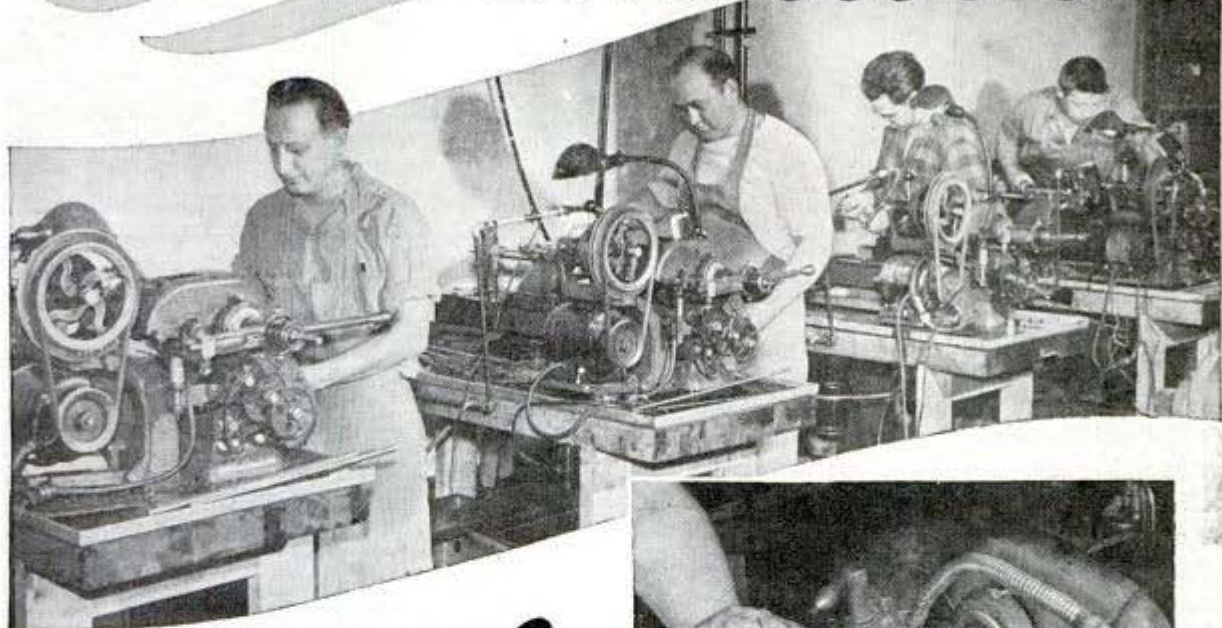
A high altitude bombsight made specially for the B-29s is now in production. The altitude at which the Superfortress attacks necessitated a few changes in the computer in gear ratios to compensate for height.

By this time our enemies probably have taken captured Norden bombsights apart and studied them, just as we have studied theirs. Our engineers, however, are confident that it would be impossible for them to get our sight into production before the end of the war. Besides, the Germans are conceded to have a pretty good bombsight of their own, particularly in regard to its optical system. But the computer and other refinements on the Norden make it the best of them all.

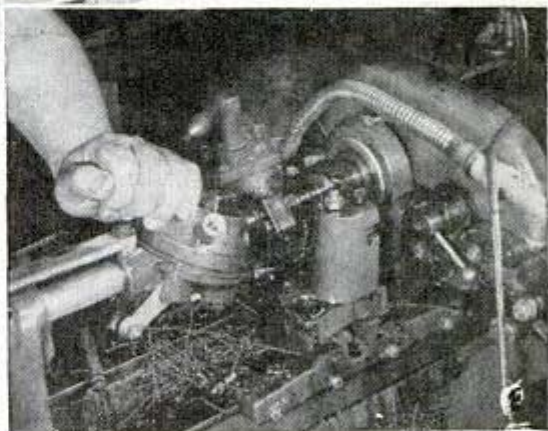
## Epsom Salts in Synthetic Rubber Makes Tires Run Cooler

Magnesium sulphate—well known as epsom salts—is the key material in a process which reduces the danger of heat failure of heavy duty synthetic rubber tires. Latex, to which zinc oxide had been added to make the tires cooler-running, could not be made to coagulate or harden until chemical engineers discovered a magnesium sulphate process which results in quick coagulation of equal parts of synthetic rubber latex and zinc oxide.

# Success WITH Atlas



**OVER 500,000  
VITAL WAR PARTS  
FROM  
PLANT STARTED  
WITH ONE ATLAS LATHE**



Poppit Valves for hydraulic controls in Mitchell Bombers and North American Mustangs and precision parts for oxygen regulating units are but a few of the 98 individual jobs handled by the Precision Machine Works, Chicago, where over 500,000 vital war parts have been made with Atlas equipment.

"Our shop started with a single Atlas lathe shortly after Pearl Harbor," reports Mr. L. W. Skuse, Pres. and Treas. "Since that time we have purchased about 26 lathes and 9 drill presses from

you. We have used your lathes as straight bench lathes, turret lathes, hand screw machines and have machined practically all types of material."

America always has been — and will be in the busy postwar days — a land of opportunity for men with vision and courage and mechanical ability. If you have thought of and planned for a shop of your own for commercial or personal use, you can build it soundly with Atlas lathes, drill presses, milling machines, and shapers. Send for latest catalogs.



**ATLAS PRESS COMPANY**

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NEW ATLAS PATTERN SERVICE FOR WOOD CRAFTSMEN — See ad on page 189



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On Any Job

● Carhartt Master Cloth overalls have been a big favorite with railroad men the country over for more than half a century—a great tribute to the better wear and fit of these famous work clothes—and to the traditions of the Carhartt family for building the best work garments money can buy. You'll find that, regardless of your work, Carhartt's give you those "extras" that make them a better buy on every count.

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and dealers.—Cal. .22 at \$2.00 M., Cal. .177 at \$1.80 M. Place your order now for a NEW Benjamin Air Rifle or Benjamin Air Pistol. Write today for illustrated folder of POSTWAR MODELS and POSTWAR PRIORITY PLAN. BENJAMIN AIR RIFLE CO., 812 MARION ST., ST. LOUIS 4, MO.



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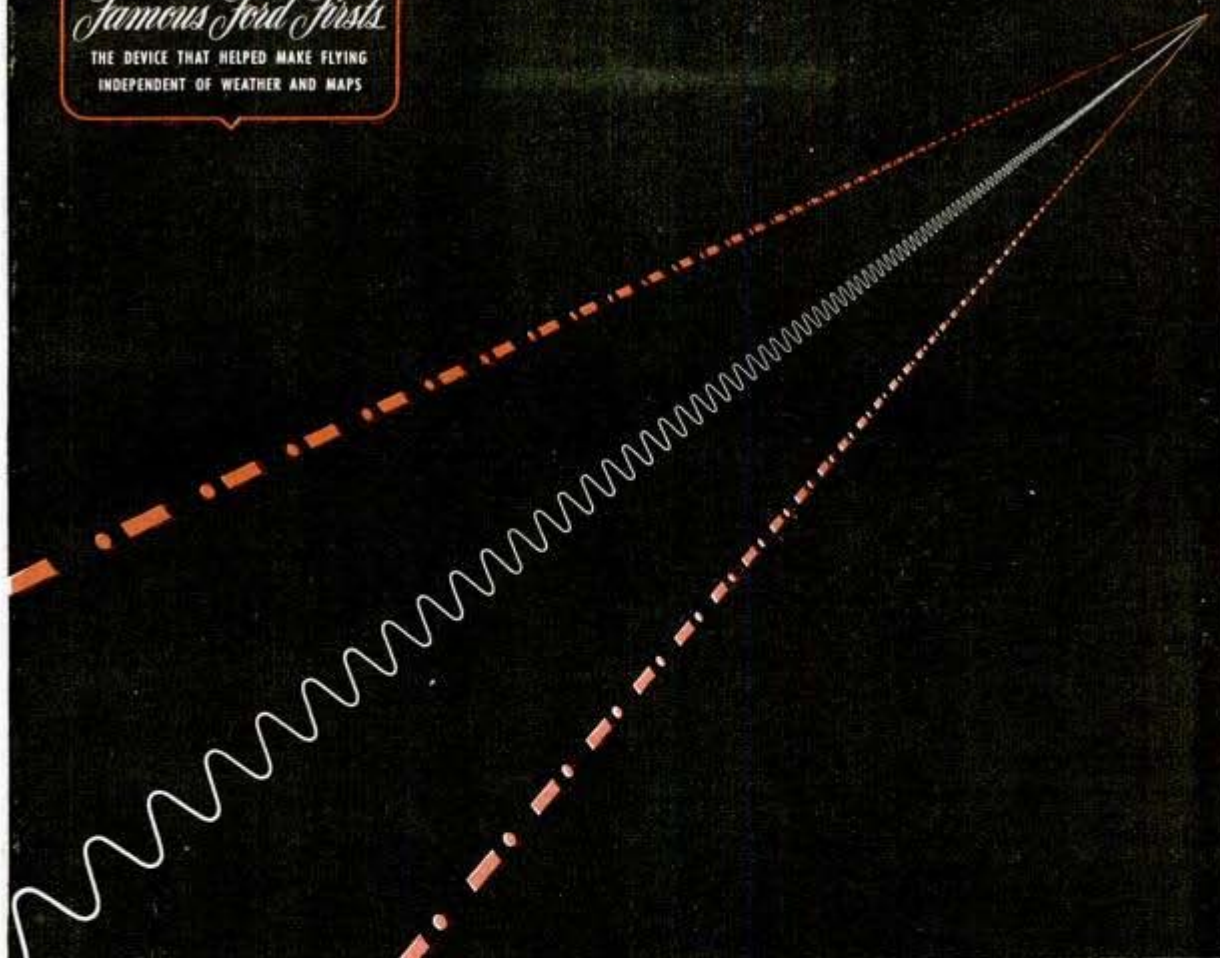
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THE DEVICE THAT HELPED MAKE FLYING  
INDEPENDENT OF WEATHER AND MAPS



**1<sup>st</sup>**

with a radio beam  
for planes!



Eighteen years ago the first radio range system was set up by Ford. And a Ford plane made a daring round-trip flight through a snow-storm from Dearborn to Dayton, guided solely by radio.

The original Ford radio beacon was essentially that in use today. Two sending loops were set at an acute angle, transmitting signals alternately. From one was beamed the letter "A" . . . dot-dash. From the other, the letter "N" . . . dash-dot. These signals interlocked to give the pilot's "on course" hum.

Basic patents have been issued

to Ford on this greatest navigation aid. But in the interest of safer air travel, Ford has made these patents available to the air transport industry without charge.

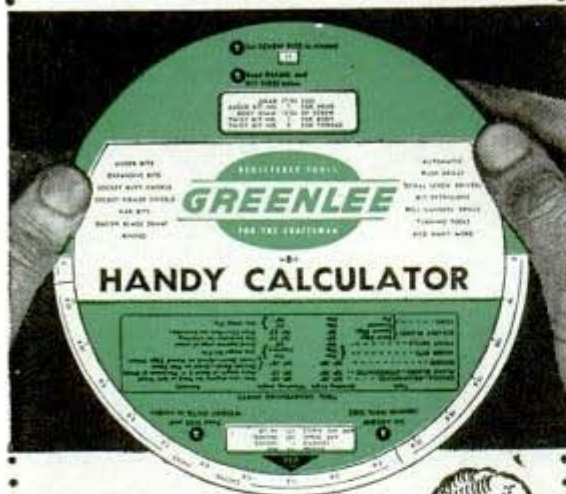
The radio beacon is just one of many important "firsts" resulting from the Ford desire to benefit the greatest number of people in the most effective way.

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FEBRUARY, 1945

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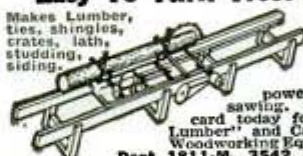


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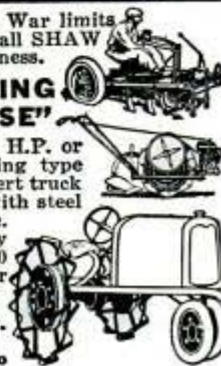
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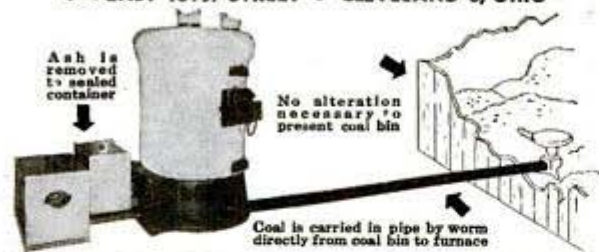




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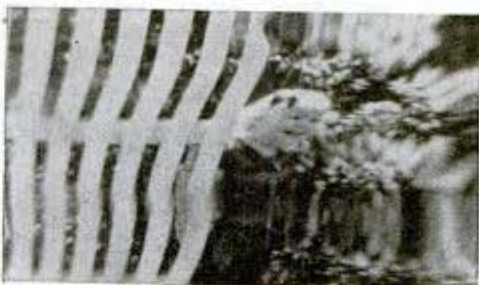
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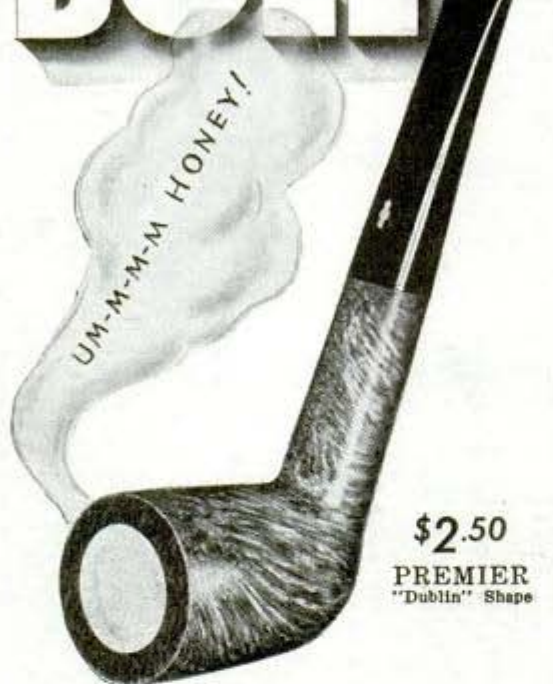
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A NAME TO REMEMBER, WHEREVER YOU ARE—  
AND WHEN YOU COME HOME

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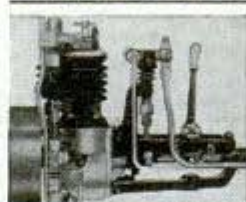
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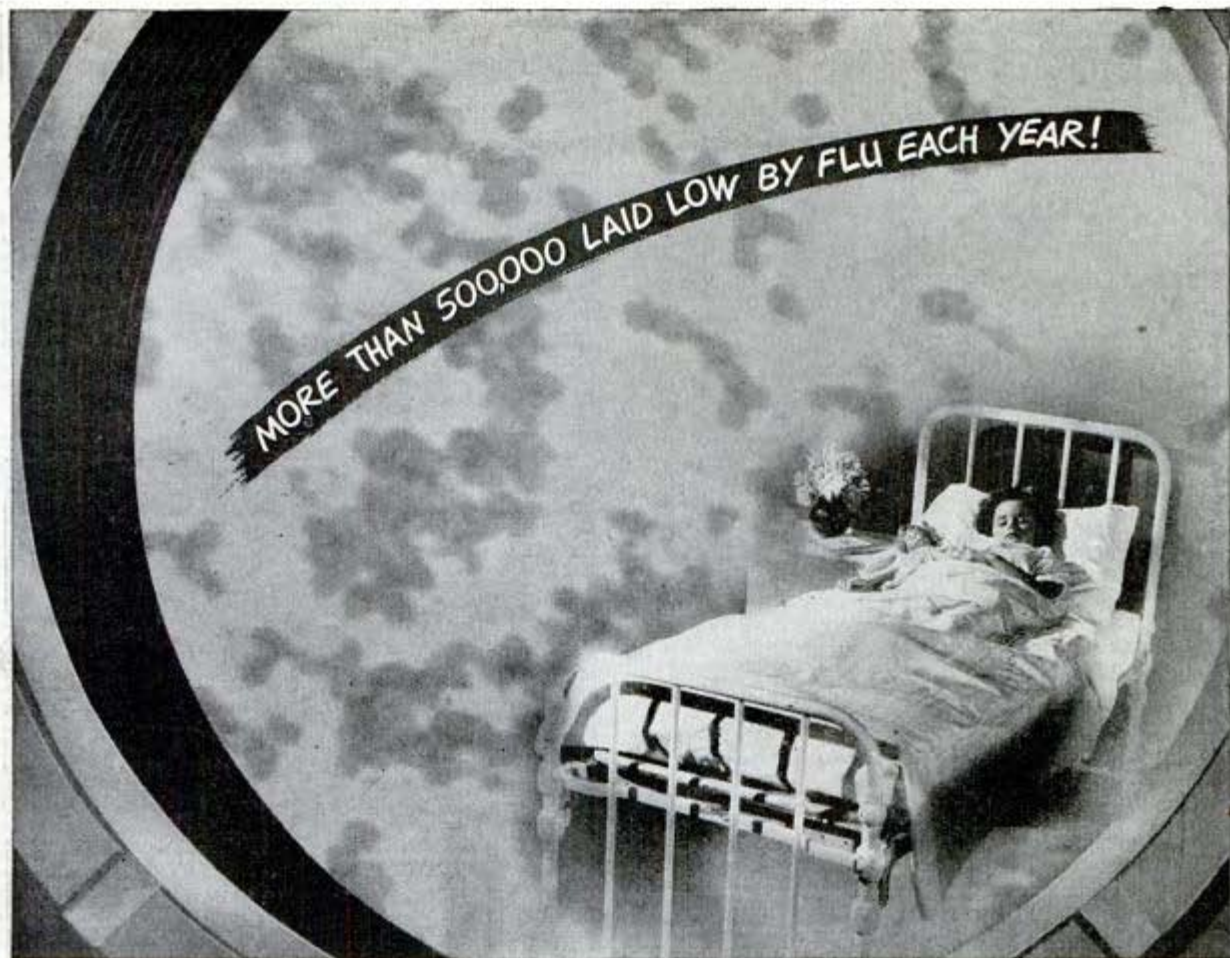
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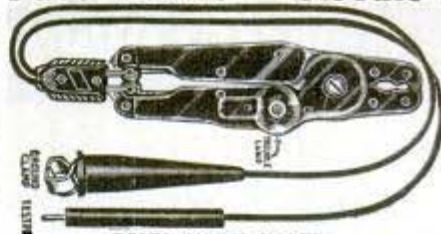
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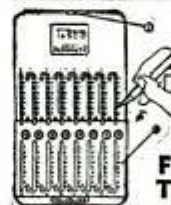


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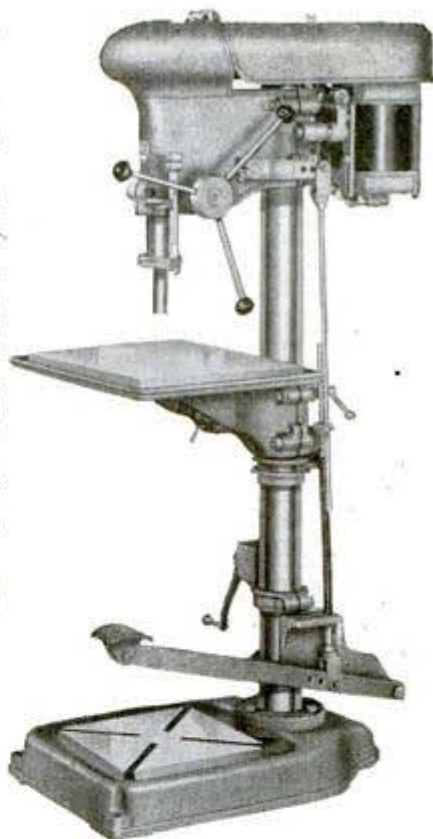
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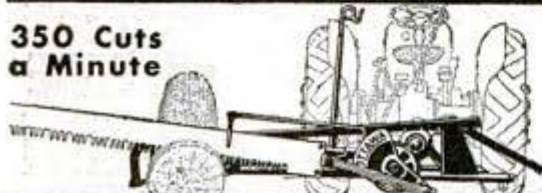
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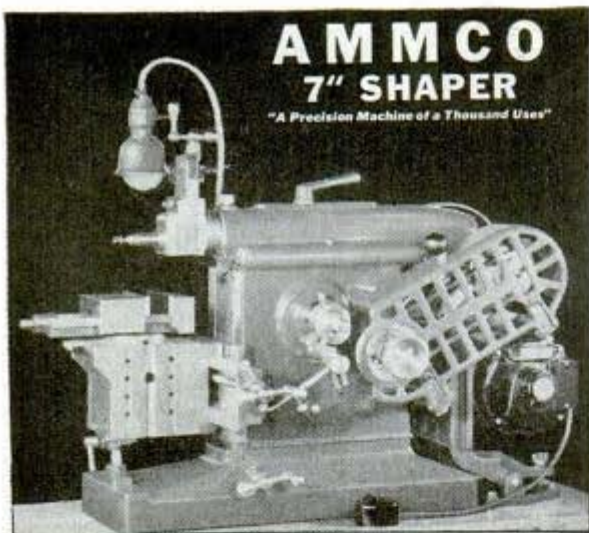


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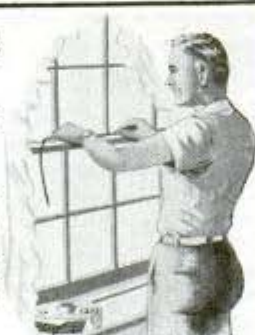
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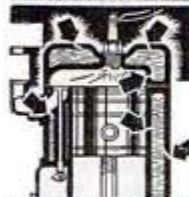


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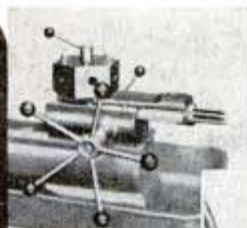
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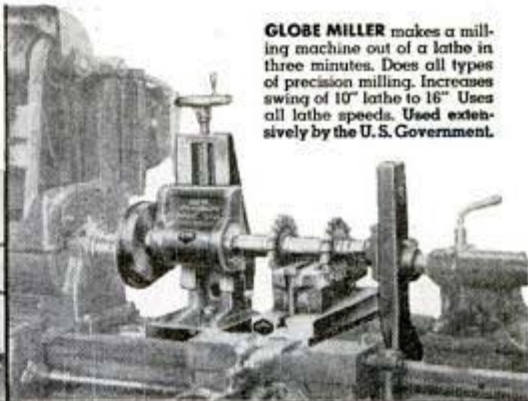
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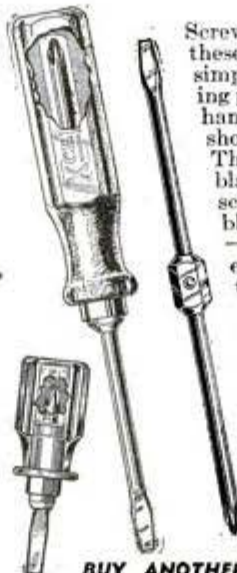
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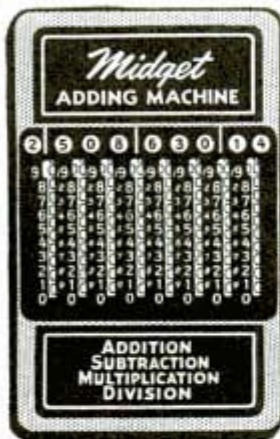
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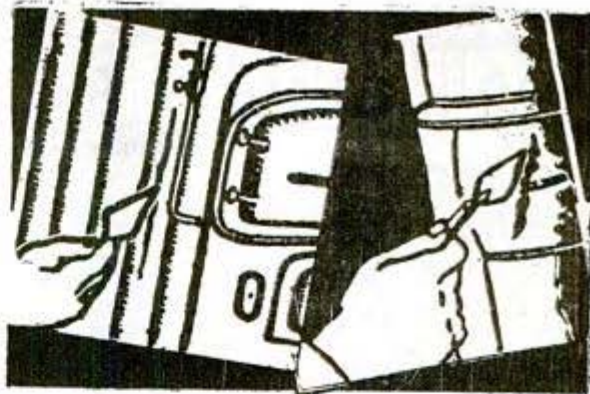
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FEBRUARY, 1945

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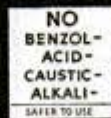
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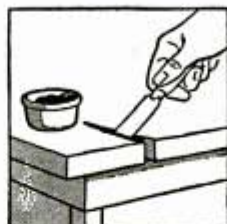
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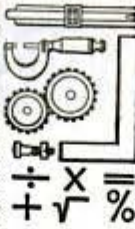
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Give Wings to Work

ASK YOUR  
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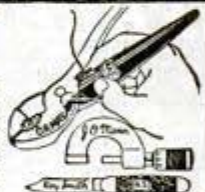
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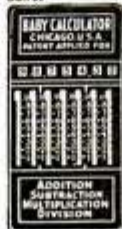
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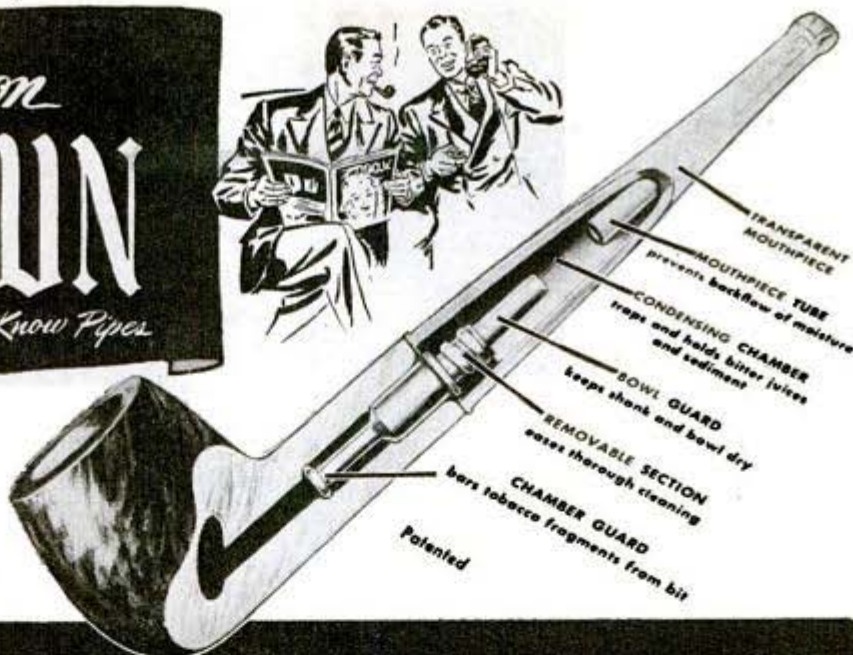
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For Men who Really Know Pipes



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USED BY FURNITURE MANUFACTURERS

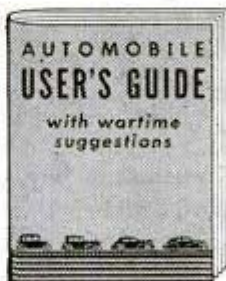
Ready to use, no mixing, no heating means no chilled joints. Choice of fine craftsmen everywhere.

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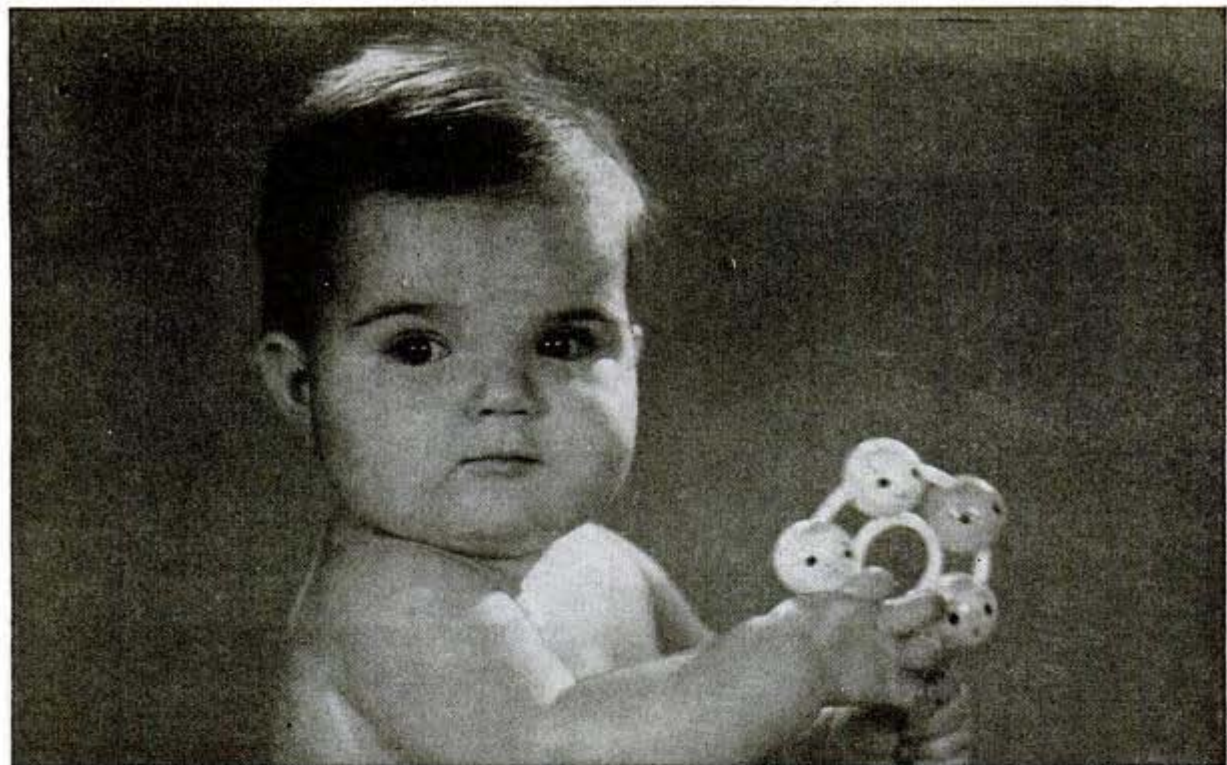
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Make of car now owned..... year model



# WAR BOND MAN — CLASS OF '63

**Someday you'll want** to see that boy, or girl, of yours off to college . . . and *right now* is not too early to start making plans.

Maybe your youngster, like so many other American boys, will work his way through school . . . but even in that case you'll want to be in a position to give him a little help if he needs it.

**By what you put aside** in War Bonds *today* you can help *make sure* he gets the same chance as other boys, *tomorrow*.

Chances are you're already on the Payroll Savings Plan. Saving as you've never been able to save before. This is fine *provided you keep on saving*.

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Try to buy more bonds than you ever have before. And *hold on to them* . . .

**For every three dollars** you invest today, you get *four dollars back when your Bonds come due*.

## POPULAR MECHANICS MAGAZINE

*This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council*

★

★

# HOW MANY TIMES HAVE YOU SAID . . .

*"Gee!*  
**I WISH  
I COULD  
PLAY LIKE  
THEY DO"**

● You *can* play a wind instrument, and play it well, as there's only one line of notes to follow! Don't be content to sit back and listen—*make music yourself* and be one of the popular group. Anyone who can whistle a tune can play a new Conn. The fingering is simple and the scale comes easily because of exclusive, patented Conn features and advanced design. Plan now to make music your hobby . . . and be sure you get a genuine CONN as soon as they are available.



## SEND FOR FREE BOOKS

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**PARENTS**—send for "Music, The Emotional Outlet for Youth." See your local Conn dealer, or write direct to C. G. CONN LTD., Dept. 231, Elkhart, Indiana.



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NEEDED IN EVERY SHOP—SAVE TIME AND MONEY—DO BETTER WORK, QUICKER.

No shop is complete without a small arbor press. Pressing and squeezing operations can be done better and faster on a KRW Arbor Press. Stop using vise and sledge hammer methods—they generally deliver spoiled work in the end. KRW Factory-To-You Prices give you greater value for your money. Order today.

**KRW Bench Type Arbor Presses, 3 sizes**  
 No. 37-P 1/2 Ton, \$13.25\*  
 No. 37-O 1 Ton, \$23.00\*  
 No. 37-N 3 Ton, \$33.00\*  
 \*Prices F.O.B. Arcade, N. Y. Slightly higher west of Rockies. Stand illustrated extra.



**KRW Hydraulic Presses** are built in 25, 50, 60 and 75 ton sizes. Prices start at \$198.00\*.



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 Builders of Shop Equipment for Ford Dealers Since 1916



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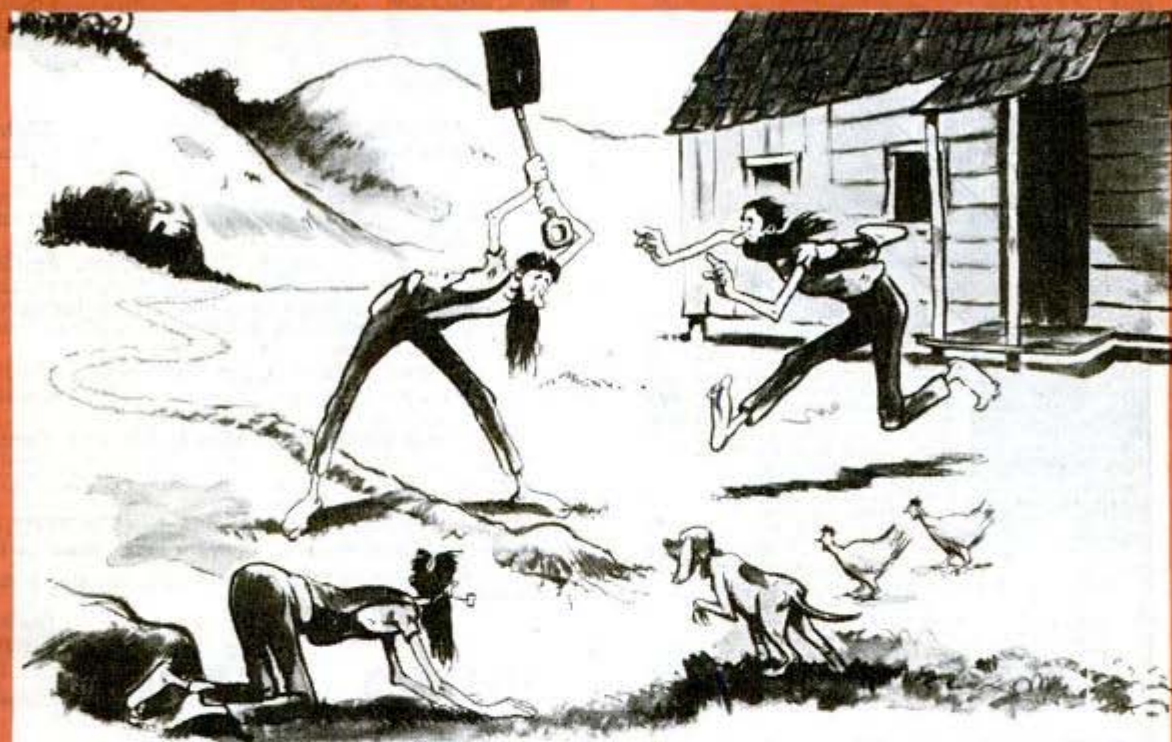
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IN SERVICE ON EVERY FRONT



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## "PLUG-CHEK" HELPS UNCOVER GAS WASTE QUICK

Gas-wasting plugs can be spotted quickly and accurately the "Plug-Chek" way. This Auto-Lite Inspection Service helps put the finger on faulty or improper plugs, may add as much as 12% to gas mileage, according to tests by the American Automobile Association.

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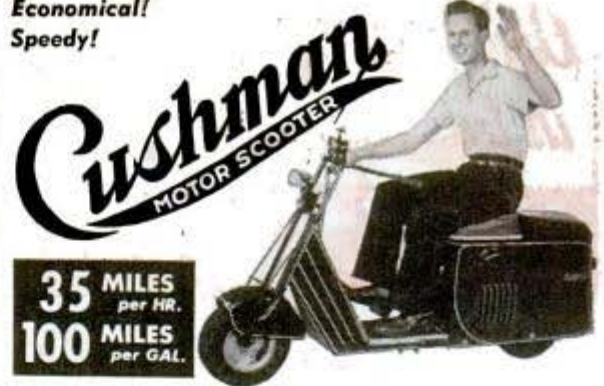
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Making practical things that work and save money is always fascinating, especially when you can do it in spare time and with spare equipment you may have in your own garage or workshop. If you need a welder, you can make that, too. In fact, the fifty basic plans in the LeJay Manual contain instructions that will enable you to make 100 or more individual items. Think of the extra money you can earn making and repairing things for other people.

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These plans were made for YOU and others like you, who are not in any sense electrical experts or mechanics. They are simple, yet efficient, and do not need a lot of expensive tools to carry them out. Thousands of amateurs are having fun or making profits with the many things these plans helped them to build. The illustrations shown are only a few of the many things you can make.

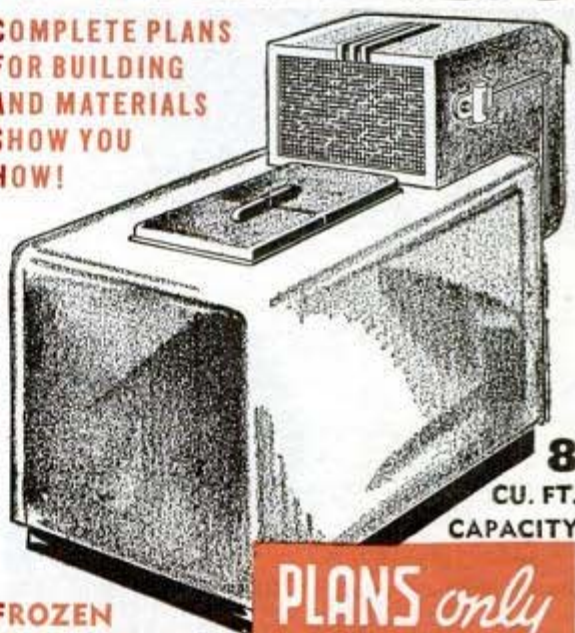
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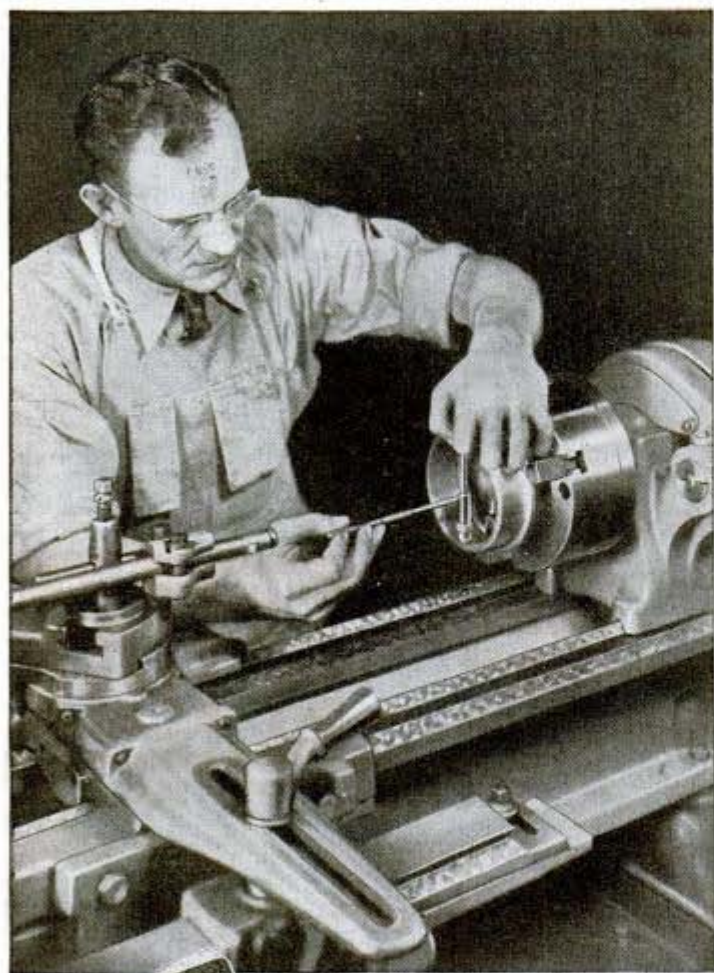
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Casite keeps oil from congealing . . . speeds oil flow. Result: a fast, sure start, even in coldest weather.

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