

# POPULAR MECHANICS

## MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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REG. U.S. PAT. OFF.

JULY  
25 CENTS  
30c IN CANADA

SEE PAGE 1

A detailed illustration of a train car's interior. The perspective is from the back of the car, looking forward. Several passengers are seated in brown upholstered seats. In the foreground, the back of a person's head and shoulders is visible. Further back, a man in a brown suit and a woman in a yellow top are seated. On the right, a man in a grey suit is standing and looking out the window. The large, curved windows offer a view of a train on tracks curving through a landscape with mountains and a river. The ceiling of the car features a circular light fixture with concentric rings.

LET'S FINISH THE JOB

Buy Extra War Bonds



## "ON TARGET" *by Fisher*

The Army-Navy "E" flies above ten Fisher Body plants for excellence in aircraft, tank and naval ordnance production.

**H**OW do American bomber crews get on their targets so accurately?

They're trained flyers. Born fighters, too. But they also have a number of amazing instruments that work from take-off to landing to help make every mission a success.

Two of them are the Gyro Horizon Indicator and the Directional Gyro Indicator, designed by Sperry and built by Sperry and Fisher Body. These help to keep "on target" in precision bombing, and on a true course in blind or night flying.

Another is the Air Position Indicator designed by Bendix and built by Bendix and Fisher Body. This gives the navigator, virtually at a glance, the latitude

and longitude of his plane.

Fisher Body has built more than 400,000 of these instruments with the skills and techniques inherent in the Fisher Body organization.

Tanks, big guns, bomber assemblies or flight instruments—the "Body by Fisher" emblem stands for the same fine craftsmanship in war as it does in peace.

Every Sunday Afternoon  
GENERAL MOTORS SYMPHONY OF THE AIR  
NBC Network



armament  
BODY BY

*Fisher*

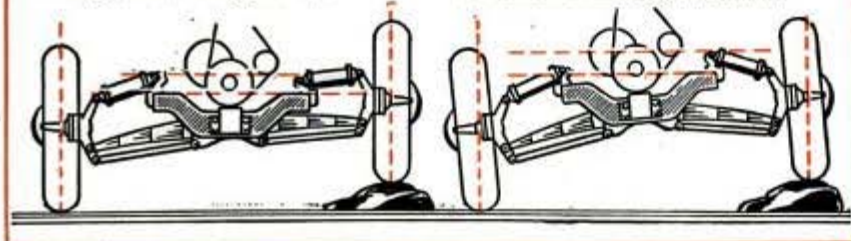
# LIFE SPAN OF LUBRICANT VITAL in making your car "feel" better

Chassis lubricant can rapidly grow old on the job. Time and the effects of oxidation can gum it up or dry it out to the point where it's useless as a lubricant. Then your car no longer rides smoothly — a sure sign of the onset of wear. And no wonder! Here's what happens:



Proper lubrication permits independent vertical motion of wheel riding a road irregularity.

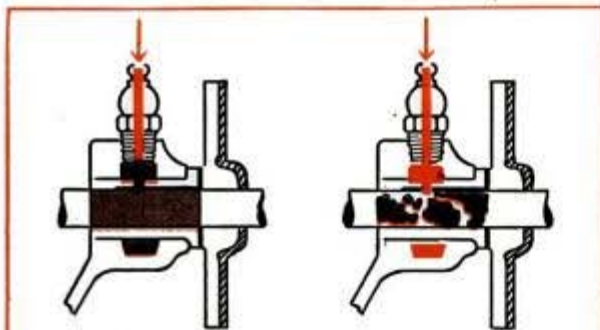
Improper lubrication tends to bind shackles, causing wheel and chassis to move vertically as a unit.



You can avoid the danger of prematurely worn bearings by having your car chassis lubricated with Marfak because this Texaco

lubricant has an exceptionally long life span.

The drying of lubricants also results in clogged bearings that resist the injection of fresh lubricant, or bearings that remain partially caked with dried-out lubricant, as illustrated at the left.



A clogged bearing can not take in fresh lubricant. Unless it is cleared, the bearing will bind and eventually freeze.

Dried-out lubricant caked on portions of a bearing will cause uneven wear, chattering and eventual destruction of the bearing.

However, Marfak chassis lubricant is scientifically designed to remain fresh over long periods, to resist oxidation, and to stick to the job. You can *feel* its cushioning effect as you drive — assurance that your car chassis is protected against wear. Marfak is both cohesive and adhesive; that is, it clings to bearing surfaces and, in addition, resists any tendency to wash out, jar out or squeeze out.

Protect and economize by changing to Marfak today! It will help keep your car on the road!

THE TEXAS COMPANY



Don't miss the **TEXACO STAR THEATRE** on Sunday nights with **JAMES MELTON** and famous guest stars. See your newspaper for time and station.

Let us  
**MARFAK**  
your car



*You're welcome at* **TEXACO DEALERS**

This One



LHK6-S8L-UNQ8

JULY, 1945

1A

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## DUPLICATING A GERMAN VACUUM TUBE IN 3 DAYS

Just behind the battlefield, a telephone system lay dead. The retreating enemy, hoping to return, had not blown it up, but had taken with them its vacuum tubes. To put it back to work, the General ordered 1000 new tubes — spot delivery.

A sample tube was flown back to the United States and brought to Bell Telephone Laboratories. It was of German design, different from any American tube in both dimensions and characteristics. Could it be duplicated soon? The job looked feasible. Within three days, try-out models were on their way to Europe. Three weeks later, Western Electric Company had made and delivered every tube. They were plugged in; vital communications sprang to life.

Vacuum tubes are an old story for Bell Laboratories scientists. Back in 1912 they made the first effective high vacuum tube. Three years later, they demonstrated the practical possibilities of tubes by making the first radio talk across the Atlantic, pointing the way to radio broadcasting. Since then, they have developed and utilized the vacuum tube wherever it promises better telephone communication — there are more than a million in your Bell Telephone System.

Today, Bell Telephone Laboratories is solving many of the toughest tube problems faced by the Armed Forces. When the war is over, it goes back to its regular job — keeping American telephone service the best in the world.



**BELL TELEPHONE LABORATORIES**

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



• This electrical replica of a heater-type pentode was made for use in German telephone repeaters.

# Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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

## Next Month

**V**ACATION trips to our famed national parks will be few this summer, but we thought you might enjoy a report on the activities of veteran rangers (over 38) who are guardians of some 11 million square miles of wilderness. Aside from fighting fires and other routine jobs, the rangers are busy planning for postwar mechanization. Motor sleds, walkie-talkies, jeeps, "snoplanes" and parachutes for "smoke jumpers" will help preserve our 27 national parks without taming their wild beauty.

**W**HEN our California correspondent wrote that he had seen a rocket attack on a Jap warship near Death Valley we were somewhat concerned until he revealed it was at the Navy's desert proving ground for rockets. The "warship" was an armor plate target. An outstanding August feature explains why the Navy is spending \$100,000,000 a month on rockets.

**"A**LL aboard for the Backyard Express!" That's the cry of "live steam" enthusiasts of the model railroad fraternity. They have built more than 1,000 miniature locomotives which are chugging realistically about backyards pulling engineer and passengers. This fascinating outdoor hobby is the subject of an August article.

**D**IESELS marched off to war last year to the tune of 35 million horsepower in trucks, tanks, ships and subs. "Diesels to the Front" tells how wartime improvements put this engine in 1-A and promise a postwar rating of A-1.

**F**ERRY pilots can fly 20 to 30 different types of planes from Cubs to four-engine bombers. An August feature, "Ride 'Em, Ferry Pilot," tells the story of the most versatile flyers of World War II.

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Managing Editor.....	Roderick M. Grant	
Assistant Managing Editor.....	Wayne Whittaker	
Shop Notes and Crafts Editor.....	E. R. Haan	
Radio and Electronics Editor.....	Frank L. Brittin	
Art Director.....	Frank Beatty	
Associate Editors: James R. Ward • Paul F. Healy • William E. Taylor		

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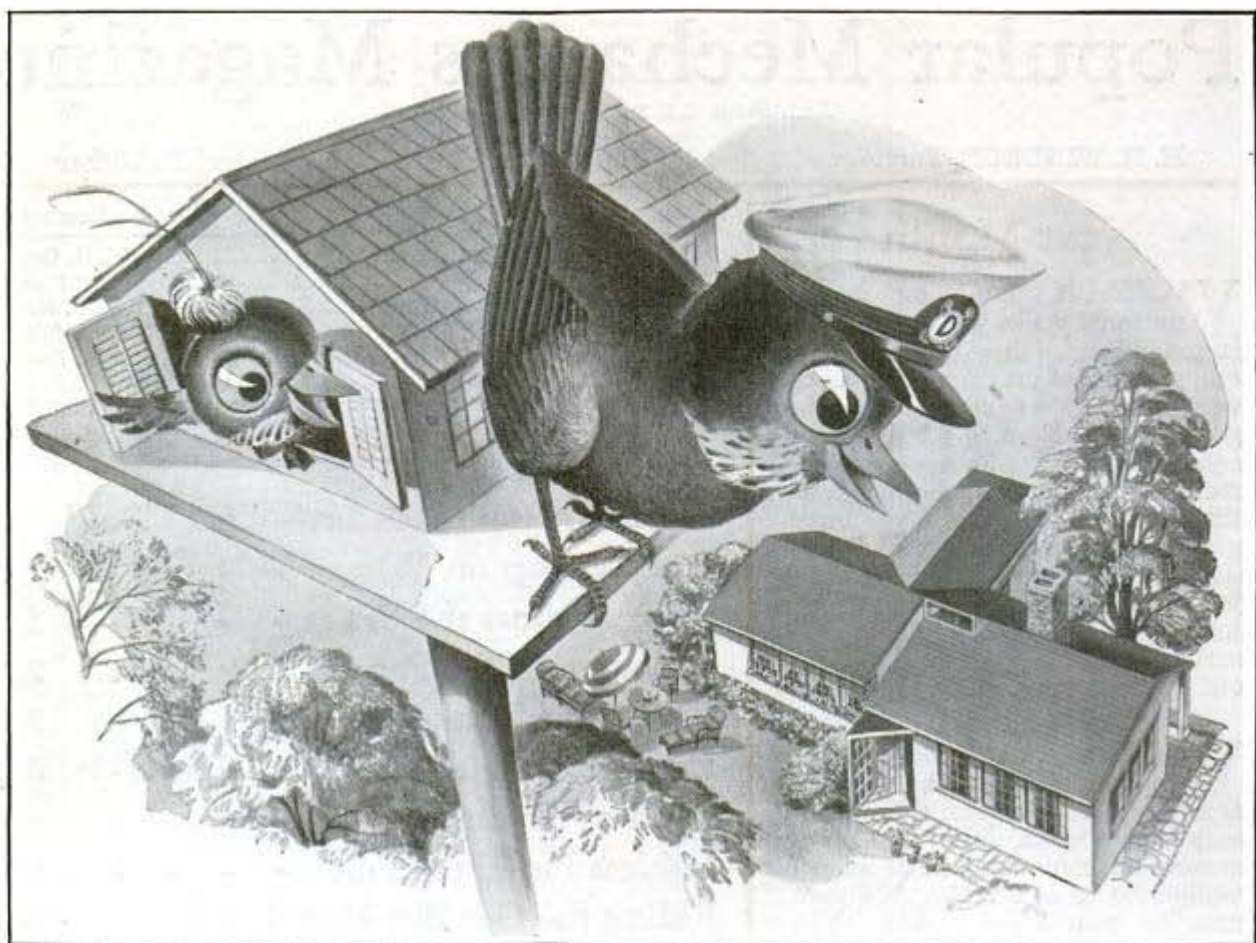
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## Bird's Eye View . . .

JUST looking at the outside, as Defoe's little feathered home-builders are, can't possibly convey any idea of the comforts and advantages which are being perfected for your postwar home!

● ● Many new features that will save hours of tiresome housework are among the advancements in functional design, planned by Defoe's Housing Division for homes of tomorrow, large and small. These scientific-

cally planned Defoe home-units will offer not only beauty and individuality of design but also the financial advantages made possible by modern mass production methods.

● ● And remember that today, while you're investing in War Bonds to do your part in winning final Victory . . . you're also steadily adding to the nest-egg that will help to finance your future home, when you're ready to buy or build it!

COPR. 1945 DEFOE SHIPBUILDING CO.

HOUSING DIVISION-DEFOE SHIPBUILDING CO., BAY CITY, MICHIGAN

BACK THE ATTACK  
—BUY WAR BONDS

# Defoe



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

SHIPS FOR VICTORY  
SERVANTS FOR PEACE



## UNTIL THE WHOLE JOB IS DONE

**I**t takes ships and planes and guns and men . . . and millions of items of precision equipment, not one of which must fail.

It needs precision *optical equipment*.. eyes that seek out the enemy, find him, range him, help to destroy him.

This need, for all operations in this war, is still tremendous. Universal Camera Corporation, furnishing such instruments for the armed forces continuously since Pearl Harbor, now

makes binoculars in quantities hitherto thought impossible, as well as other vitally important high-precision optical instruments.

Universal will continue to devote its efforts and facilities wholeheartedly to the manufacture of these instruments as long as needed. But when the war job is done, the production of hundreds of new Universal Cameras, Photographic and Home Movie Equipment items will begin immediately.



**UNIVERSAL CAMERA CORPORATION**

NEW YORK • CHICAGO • HOLLYWOOD

Wartime Manufacturers of Precision Instruments for the Armed Forces

Peacetime Manufacturers of Mercury • Cinémaster • Corsair Cameras and Photographic Equipment

### UNIVERSAL CAMERA CORPORATION'S WAR RECORD

**1941** . . . Started War Work  
(before Pearl Harbor)

**1942** . . . Over 80% Essential  
War Work

**1943** . . . Over 99% Essential  
War Work (Army-Navy "E"  
March 13)

**1944** . . . Over 99% Essential  
War Work

**TODAY** . . . Over 99% of our  
facilities are devoted to pro-  
ducing essential precision  
instruments for the Armed  
Forces, and will continue to be  
while the need exists.

**You'll still have to wait for the  
wonderful new photo and home  
movie equipment we promised you**

Designed to Cut,  
Cut Fast and  
*Keep cutting*



Whether you use snips or sell them . . . cutting ability is their prime virtue. Crescent Snips are well known for their fast, easy cutting. They should be because they were designed for that purpose alone. Special methods of grinding are used to assure absolute uniformity with the master pattern. Balance and proper leverage are also part of Crescent Snips appeal to experienced mechanics . . . they "feel" right as well as *cut right*.

Crescent Snips . . . like other famous Crescent Tools . . . have been "off to the wars," but some day soon we hope, they'll be back in the hands of good mechanics and readily available over the counters of good hardware dealers everywhere.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.



**CRESCENT TOOLS**

*Give Wings to Work*





# What's the DIFFERENCE between them ?



## WHICH ONE ARE YOU?

That chap on the next street or in the corner office whose income is twice yours, whose wife has the clothes and household conveniences your wife dreams about, who has the job and authority you'd give your eyeteeth to have: how much does he differ in knowledge and ability from you?

Surprisingly little; so little, in fact that you'd be amazed if you investigated thoroughly.

But that little is all important. He knows what is behind his job—the why, what and how—and he knows how to tie in his work with other phases of the business and factory. He knows, too, how to manage others, an ability which business rewards highly.

You don't—except in very special circumstances—get that knowledge and ability by day-to-day experience. You get it by study of principles and methods, from the boiled-down experience of others—and by becoming skilled in the application of those methods to actual problems.

Fortunately for ambitious men and women, LaSalle has, for 37 years, specialized in gathering,

organizing and teaching these success elements. Working with over a million student members, LaSalle has perfected simple and practical spare-time training which has just one aim, to help its members become more able and successful.

Do you really want larger success? If you do you will use the coupon below to find out what this training is like and how it can help you quickly and at moderate cost. Don't delay. The coming of peace will bring sharp job problems and unusual opportunities to millions—the man or woman who prepares now will win the real rewards. Mail the coupon today.

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Position..... Age.....

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City, Zone and State.....

# LA SALLE

## EXTENSION UNIVERSITY

*a Correspondence Institution*

# DON'T WAIT until it's too late . . . ADD PYROIL NOW!



Yes, there is such a thing as adding Pyroil too late. Pyroil cannot help recover the wear that has already taken place. It cannot restore life to your car that is already lost. But it can very definitely add length of service to a car that still has service to give. It can reduce wear due to friction by preventing oil from draining off piston and cylinder walls. It can prevent corrosion. It can reduce carbon formation, free away sludges and gums. Pyroil *cleans* your motor. Pyroil *keeps your motor clean*. Pyroil *lubricates* your motor. Ask your gas station attendant to add Pyroil.

Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 57 Pyroil Building, La Crosse, Wisconsin.

**PYROIL adds life to your car!**



**PYROIL COMPANY**  
57 Pyroil Building, 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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  - Reading Shop Blueprints
  - Sheet-Metal Drafting
  - Sheet-Metal Worker

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- Ship Fitting
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- Tool Designing
- Welding, Gas and Electric

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  - Locomotive Fireman
  - Railroad Section Foreman

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  - Engine Running
  - Marine Engineering
  - Steam Electric
  - Steam Engines

- Textile Courses**
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  - Rayon Weaving

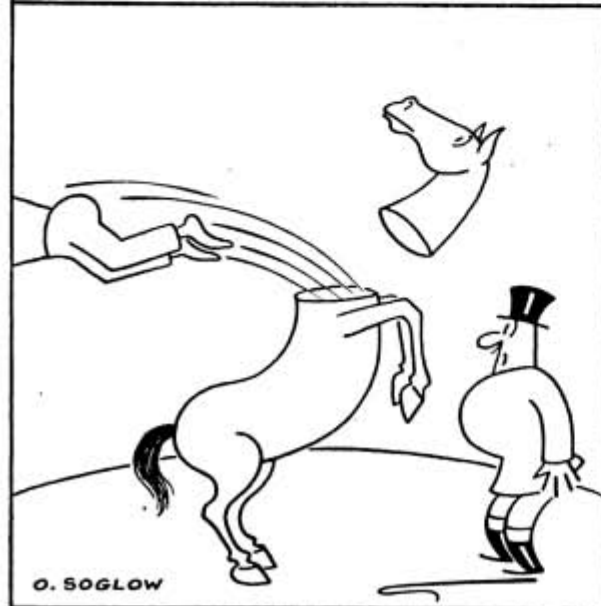
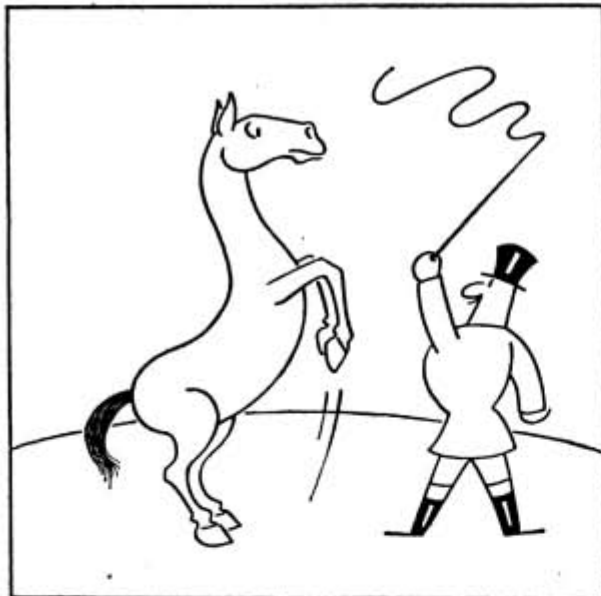
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 British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England.

DISCOUNT TO DISCHARGED VETERANS—SPECIAL TUITION RATES FOR MEMBERS OF THE ARMED FORCES



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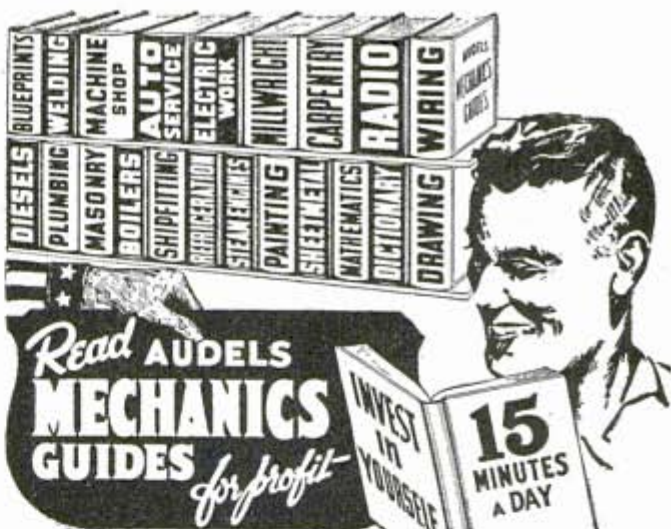
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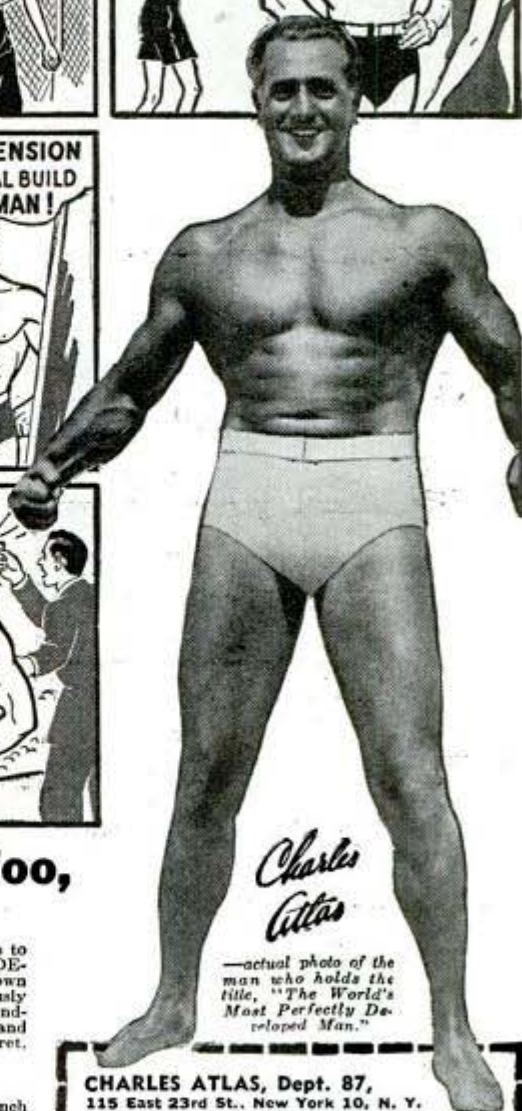
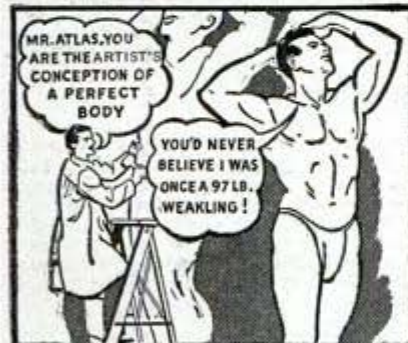
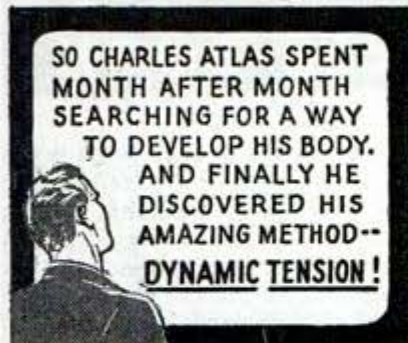
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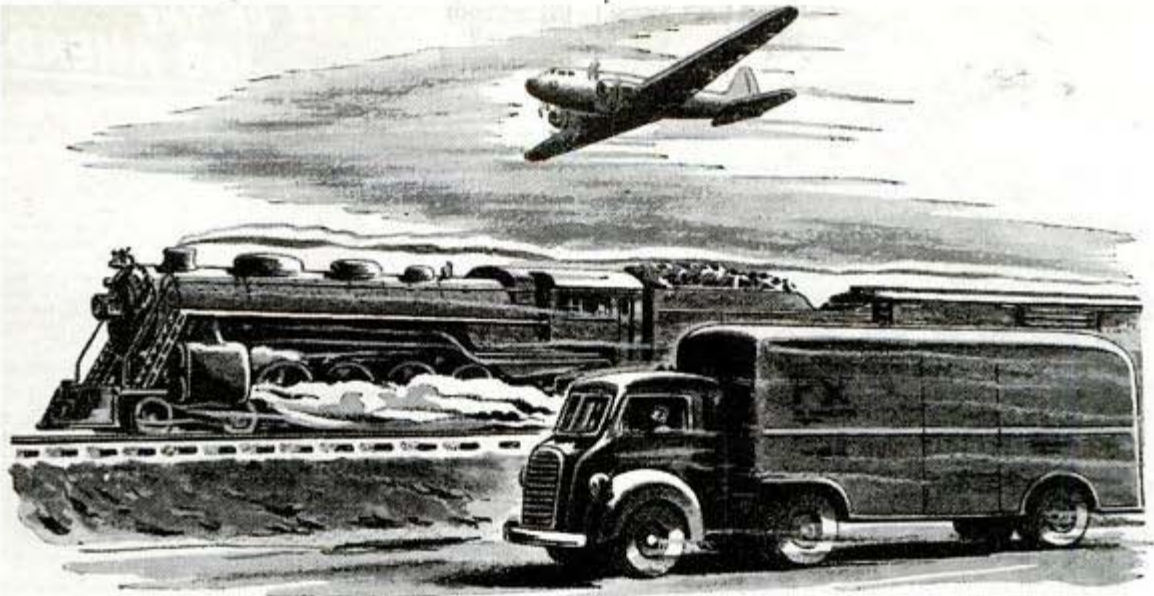
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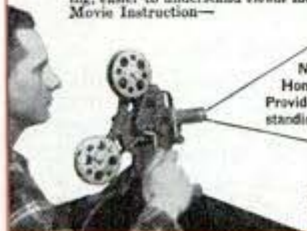


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By S. T. CHRISTENSEN  
*the "Fix-it Man"*

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

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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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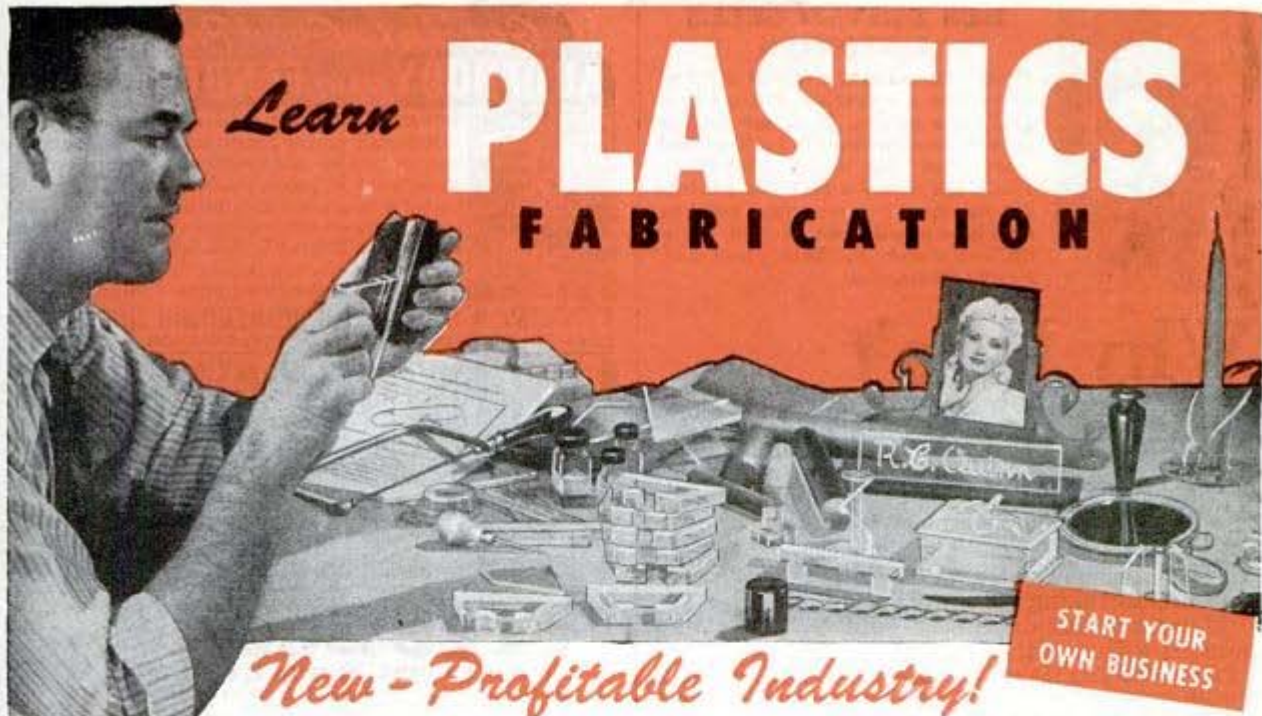
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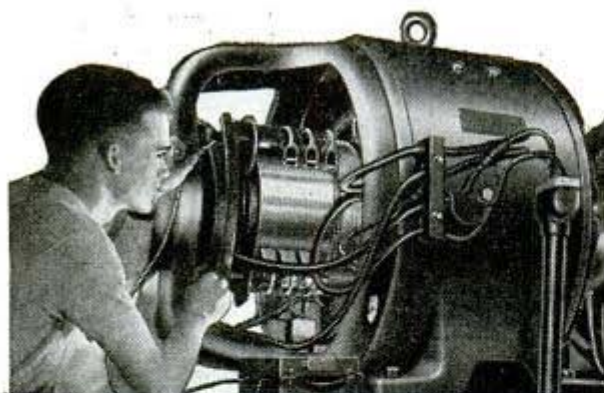
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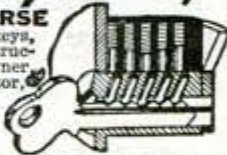


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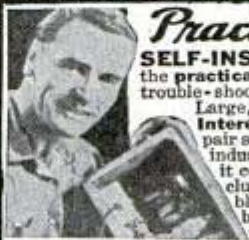
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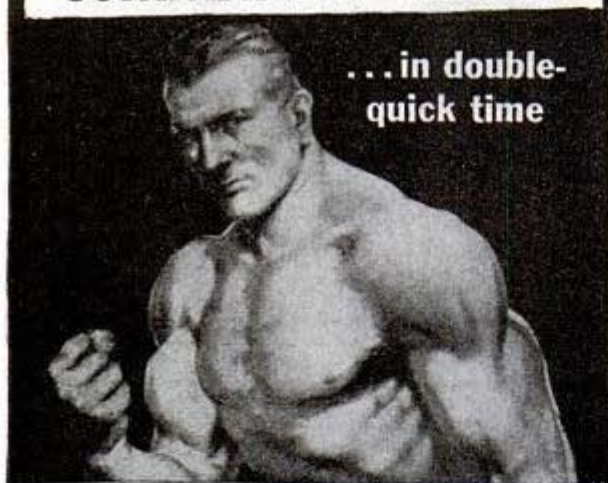
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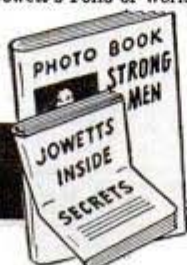
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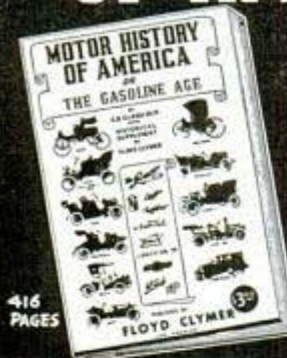
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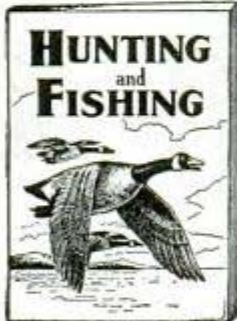
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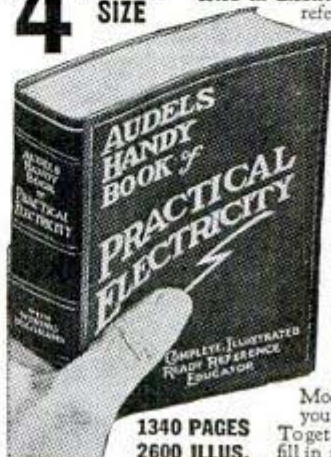
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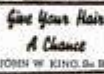
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**PROFESSIONAL** Midget racer, motor-scooter, midget car and midget motorcycle. Plans and specifications for all these contained in new illustrated handbook, 25c. Big list used motors, motorscooters, Servicycles, etc., included free! Midwest, 2242 Beaufort, Toledo, Ohio.

**HORSELESS** Age 1895 issue reprint America's first automobile publication. 76 illustrations gasoline, kerosene, electric, steam and spring engines. Lists entries, map America's first automobile race. See balloon tires used fifty years ago. Historical, authentic, educational, amusing. Postpaid \$2.00. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**CUSTOMIZE** Your automobile. Illustrated, new restyling ideas, instructions, suggestions, specific model changes by simple methods. \$1. Speed Wheel, Box 723-E, Arcadia, California.

**MOTOR** Books. Most complete automobile, motorcycle selection in America. Historical, technical, racing. Send dime for book catalog. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**AB JENKINS**, World's greatest endurance driver. New book "Salt of the Earth" describes his world's record events and historical Bonneville, Utah salt flats. Fine illustrations, famous drivers, racers. Specifications Jenkins' famous monster "Mormon Meteor." Postpaid \$1.50. Deluxe cloth bound edition \$2.50. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**BUILD** Midget racer from castoff parts! Plans, specifications, construction information, \$1.00. Motor Supply, Box 1682-CS, Toledo, Ohio.

**POWER** And speed! World's most famous motor book. 110 large pages. 200 illustrations racing automobiles, motorcycles, airplanes. World's speed record chart, articles by world famous speed kings Cobb, Eyston, Campbell, Bonneville record details, photos British racers. Describes cams, compression, valves, superchargers, international racing teams. German Auto-Union, Italian, French, British racer specifications, drawings. \$2.50 postpaid. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**SEE** Our advertisements under Motorcycles classification. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**STEAM** Automobiles! Send 25c for literature listing names 90 different makes steamers once manufactured. Illustrations, descriptions, specifications, Stanley, White, Doble, Lane, Ross steamers, boilers, engines, also photos famous White Racer "Whistling Billy" and world's record holder Stanley Racer. Interesting, educational, ancient steamer history. No cars for sale. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**FLOYD** Clymer's Historical Motor Scrapbook. This humorous, educational, historical scrapbook illustrates, describes hundreds antique and early automobiles, motorcycles. Reo, Oldsmobile, Hupmobile, Metz, Orient, Knox, Winton, Carter, Maxwell, E-M-F, 2-cylinder Ford and Buick, air-cooled Chevrolet, Stanley, White, other steamers, electric. Unusual and steam motorcycles. This is the scrapbook Time Magazine said is a "must." Editions one and two now available but entirely different books. Postpaid \$1.50 each, deluxe edition \$2.50. We mail overseas any time without request and pay postage. Delivery guaranteed. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**AUTOMOBILE** Racing book, fifth edition, well illustrated. Instructions on building bodies, frames, engines. Ford A and B conversions. Plans. AAA rules, specifications. Roadster racing, Indianapolis cars. \$1.00 postpaid, \$1.30 C.O.D. Ray Kuns, Dept. 47, Madisonville, Cincinnati 27, Ohio.

## AUTO SUPPLIES AND EQUIPMENT

**ACE** Motor conditioner—vaporizing lubricant. Power, fuel economy. Dollar. Ace Products, Wilkes-Barre.

**DUAL** Mufflers, Ford V-8, Mercury. Pleasing tone, steel packed. Reduces back pressure, increases power. Complete, E-Z install. Deluxe \$20.00. Give car model. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**AMAZING** New Moto-Vator injects water-vapor into motor just like newest fighter planes. Burns 15% water; saves 20% to 30% gas; prevents carbon; increases power! Eliminates carbon and valve jobs. Not a gadget. Sensational performance keeps motor like new. Wonderful postwar possibilities. No investment. One low price includes license to install Moto-Vator in your locality. Send 10c for booklet giving complete details. Dept. M, SX Laboratories, P.O. Box 37, Middle Village, Long Island, New York.

**GARAGE** Doors, all types, controlled from dashboard pushbutton. Simple, dependable. Materials inexpensive, obtainable everywhere. Complete "Build Yourself" plans \$1.00, refundable. Free particulars. Kaytor Lab's, Lynwood, Calif.

**UNIVERSITIES** And oil corporation tests prove Whirlgas Turbinator, \$3, increases mileage and horsepower. Users report savings high as 40%. Wrench installs 15 minutes. Give auto make, year. John Hanley, 5719 Loraine, Detroit 8, Mich.

**PASSENGER** Car reliners \$2.50. Discount to dealers. Allied Rubber Co., East St. Louis, Ill.

**1,000** MOTORISTS Needed to make gas saving test. Up to 30% savings. For trial test offer write Vacu-matic Carburetor Co., 7617-1244 W. State Street, Wauwatosa, Wis.

**EXTRA** Miles. 50 for each gal. gas used. Proven method. Hundreds users. Equip your car inexpensively. Simplified diagrams \$1.50. Geller, Dorris, Calif.

**GASOLINE** Saving, center flow carburetor throttle. Instructions \$1.00. Walert Company, 3429 N. 10th St., Milwaukee 6, Wisconsin.

**SAVE** Gas. Up to 50 miles from each gal. Complete guaranteed instructions \$1.00. Ritter Sales, Sioux Falls, So. Dak.

**SEE** Our advertisements under Motorcycles classification. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**OPERATE** Cars, trucks, tractors, motors, with wood or coal gas, 1/2 cost of gasoline. Extensively used in Europe. Complete detailed instructions \$1.00. W. M. Cross, Lone Rock, Wis.

**INVENTION** Uses kerosene to run motors. Circular on plans. Rush name. Houston Maupin, Tipp City 56, Ohio.

**HAVING** Car trouble? New, used, guaranteed auto, truck parts save money. Transmission specialists. Describe needs; immediate reply. Victory, 2439 1/2 Gunnison, Chicago 25.

**PLATING** Outfits for auto parts. Connect to a battery. No tanks used. Free particulars and proofs. Gunmetal Co., Ave. J, Decatur, Ill.

**SANDEE** Mufflers, see our advertisement on page 164 of this issue.

## AUTO TRAILERS

**BUILD** Your own trailer! Save money! Have every feature you want! Plans for house, sport, camp and utility trailers. Catalog describing 9 models 10c. 15c in Canada and overseas. Jim Dandy, Box 125-A, Wausau, Wisconsin.

## MOTORCYCLES, BICYCLES, MOTOR-SCOOTERS AND SUPPLIES

**BUILD** America's lowest priced motor-scooter speedster! Complete plans, specifications, \$1.00. Big list used motors, etc., included free! Motor Supply, Box 1682-CS, Toledo, Ohio.

**SEND** 25c For complete motorbike plans and parts list. Motorbike Service, 1304 Indiana, New Albany, Ind.

**TIRES**, Tubes, wheels, for industrial trucks, carts, wheelbarrows, scooters, midget cars, coaster wagons. Nationally known makes, first-line quality. Sizes 8" to 18" o.d. in 2, 4, and 6 ply tires, separate inner tubes, heavy duty demountable wheels. Also caster forks, straight and swivel types. Free illustrated circular and prices. Jahant Co., 625 East Exchange Street, Akron 6, Ohio.

**WE** Carry moto-scooter parts for Lauson and Briggs-Stratton motors. Write for folder on new Amco centrifugal clutch usable on most moto-scooters. American Moto-Scooter Company, 1323 W. Carroll Avenue, Chicago, Ill.

**FLOYD** Clymer's Motorcycling Manual. 144 pages. 120 illustrations. Complete information, specifications, descriptions dozens motorcycles. Engines, transmissions, carburetors, square four, two piston singles, sleeve valve engines, overhead camshafts, water-cooled motorcycles, spring frames, hydraulic forks, side-cars, riding instructions. Two cycle engines and power bicycles described, illustrated. Just out, \$2.00 postpaid. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**HARLEY** Davidson parts, accessories, supplies, expert service. Send \$2.25 for army motorcycle instruction book and bulletins or 10c for bulletins only. Knuth's, 2491 Fondulac Ave., Milwaukee 6, Wis.

**FLOYD** Clymer's Historical Motor Scrapbook \$1.50 postpaid. This is the book Time Magazine said is a "must." 250 early motorcycles, automobiles illustrated, described. See our advertisements under Automobiles. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**TIRES** And industrial wheels, suitable for scooters, wheelbarrows, farm equipment, etc. All sizes. Bicycles and accessories. Largest assortment in America. Send dime for list. Cycle Transport Company, 1241 So. Michigan Ave., Chicago 5, Illinois.

**MOTOR** Books. Most complete automobile, motorcycle selection in America. Historical, technical, racing. Send dime for book catalog. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**"MODERN** Motorcycle Mechanics" manual, enlarged, revised, second edition, 560 pages, 300 illustrations. The most up-to-date and complete motorcycle book published. Extensively covers design, operating, maintenance, and reconditioning. Harley-Davidson, Indian and British makes. "A book no motorcyclist can afford to be without." Immediate deliveries. Price \$3.00. Nicholson Brothers, Motorcycle Engineers, Saskatoon, Canada.

**CONVERT** Bicycle into motorbike. Complete illustrated instructions 50c. L. D. Blythe, White City, Kans.

**MOTORCYCLE** Parts, new and used. List 10c. Balak, 811 N. 9th, St. Louis 1, Mo.

**MOTORSCOOTERS** \$50 Up; motorbikes \$40 up; motors \$5 up. Tires, parts, plans. Mailorder only. Send 25c for big war-bargain catalogue Number Eight, listing hundreds of bargains in motorscooters, motorcycles, midget cars, etc. (35c by first class mail). Midget Motors Directory, Athens, O.

**PARTS**, Accessories, pistons, chain Harley Davidson motorcycles. McCann's, P.O. Box 114, El Paso, Texas.

**MOTORBIKE** Blueprints welding unnecessary with engines, movies. Lists 50c. Lists dime. Standard Novelcraft, Atlanta, Ind.

**MOTORBIKE** Kit includes all parts to make motorbike, less bike and motor, \$15.00. Send card for details. Variety Enterprise, P.O. Box 124, Evansville, Ind.

**ELECTRIC** Motorbike built from your bicycle. \$1.00 brings instructions-specifications. Mowery, Box 994, Lancaster, Pa.

**MOTORBIKE** And motor manual. Contains motorbike and scooter plans. Motor tune up information. \$1.00. Variety Enterprise, Post Office Box 124, Evansville, Ind.



**SWORDS, Rapiers, daggers, pistols, armor, illustrated catalog 25c. Robert Abels, 860-A Lexington Ave., New York.**

#### **DOGS, PETS, BIRDS, RABBITS**

**RAISE** Giant Chinchilla rabbits. Valuable fur. Delicious meat. Easily raised. Pleasant pastime. Large profit. Free booklet shows amazing profits from small investment. Willow Farm, R15C, Sellersville, Penna.

**ENGLISH** And Boston Bull puppies. Catalogue 10c. Challenger Kennels, Jackson Center, Ohio.

**\$12.00 POUND**, Angora rabbit wool, we supply good rabbits and buy wool. Particulars free. House of Angora, Springfield 5, Illinois.

**RAISE** Moneymaking Angora rabbits. Wool \$10 pound. Plenty markets. Particulars free. White's Rabbitry, Marion, O.

**METAL** Dog tags. Your name, address, 25c coin, 5 for \$1.00. Collar plates (3/8x2") 35c. Key tags 25c. Mail Products, Box 97E, Mendota, Ill.

**RAISE** Guinea pigs. Make money at home. Big demand. Free booklet. Taylors Guinea Pig Farm, Hapeville, Georgia.

**STANDARD** Rabbit Journal, Milton, Pa. 3 years \$1.00, sample dime.

**ANGORA** Rabbits—Wool brings \$10.00 pound! Book "Angora Care-Management" tells everything. \$1.00. Self-cleaning scientific hutch (for all rabbits), plans, specifications \$1.00. Automatic feeder plans \$1.00. All three \$2.50. Catalog pedigreed Angoras free. Grinsteeds, Dept. 15-A, Edwardsville, Illinois.

**RAISE** Giant Chinchilla rabbits, Willow Farm, R15C, Sellersville, Penna.

**A LIVING** With rabbits and caviae. Markets waiting. Magazine 10c. Book describing twenty breeds and magazine 25c. Book and magazine (monthly) one year 50c. Address Small Stock, Dept. 2, Pearl River, N. Y.

**POINT** Free meat—Raise delicious domestic rabbits. Small space needed. Ready market. Largest magazine in the industry tells you how. \$1.00 per year. Send dime for sample—no stamps. Small Stock Magazine, Lamoni 2, Iowa.

**SHEPHERDS**, Collies, terriers, airdales, trained dogs. Edmond Stone, Chariton, Iowa.

**RAISE** Your own meat—also make money raising pigeons. Booklet dime. Gebhardt Farm, Muscatine, Iowa.

**PUPPIES** And supplies; also pedigreed Flemish Giant meat rabbits and supplies; what do you need? Royal Kennels, Chazy, N. Y.

#### **FARMS, FARM LANDS, REAL ESTATE**

**WEST'S** Summer catalogue. Hundreds farm bargains and business opportunities in Penna., New York, New Jersey, Ohio, Delaware and Maryland. Free copy West's Farm Agency, HE, Pittsburgh 16, Penna.

**160 ACRES**—Ozarks—200,000' finest hardwood timber, 5,000 locusts, log house, well, springs, 2 miles village, 20 miles university. Free stock range. Timber worth more than price. Bob Pace, (Owner), Combs, Ark.

**WISCONSIN**, Minnesota water frontages \$7 acre. 3505-A So. Hope, Los Angeles 7, Calif.

**GOVERNMENT** Land \$1.00 acre up. Information all states 25 cents. National Tax Service, 1037A Majestic Bldg., Detroit.

**OZARK** Farms, ranches, resorts. List free. Farm Finders, Lonsdale, Arkansas.

**OZARKS** Guide, Lonsdale, Arkansas. Magazine for homeseekers, sportsmen, year, \$1.00.

**\$5.00 MONTHLY** Buys 40 acres near town; price \$175.00. Free list, Box 425-P, Carthage, Mo.

**HOMESITES** \$300—Low terms. California's finest garden spot. On Morro Bay's wooded shores. Wonderful fishing, hunting, boating, etc. Fertile soil, soft water, temperate climate, congenial community. Free literature. Richard M. Otto, 6560 Hollywood Blvd., Hollywood 28, Calif.

**STROUT'S** Farm catalog—Bigger than ever! 132 pages—1,263 bargains in 25 states from Maine to Florida, west to California and Oregon. Rock-bottom prices. Free. Strout Realty, 255-P 4th Ave., New York 10, N. Y.

**GOOD** Farms—Ranches. Washington, Minnesota, Montana, Idaho, Oregon, North Dakota. Dependable crops, favorable climate. Write for literature, lists describing typical farms. Specify which state. J. W. Haw, 119 Northern Pacific Ry., St. Paul 1, Minn.

**FREE** Catalog, farm bargains, 7 mid-west states. Many fully equipped for convenient quick start. Many pictures. Special service to help you locate quickly. If you state requirements, payment plan and general location desired in first letter. United Farm Agency, 7-MP South Dearborn, Chicago 3, Ill.

**OZARK** Farm bargains, 5 to 5000 acres. Frank, Mountain View, Mo.

#### **POULTRY AND FARM SUPPLIES**

**RAISE** Turkeys the new way. Write for free information explaining how to make up to \$3000.00 in your own backyard. Address National Turkey Institute, Dept. 3, Columbus, Kansas.

**KNOW** How to raise poultry for profit. Read Northeastern Poultryman. Every issue packed with helpful hints and practical suggestions. Latest articles on breeding, feeding, and management. Read nationally. Subscribe now. 1 year 65c; 2 years \$1.00. Northeastern Poultryman, 378 Boylston St., Boston 16, Mass.

#### **PROFITABLE OCCUPATIONS**

**ELECTRIC** Clocks are everywhere you go, buildings, homes, parking lots, factories. Repairs increasing. Our easy to learn course with pictures and drawings teach you how to repair these clocks. Electronic Supply Co., Dept. A, P.O. Box 2350, Houston 1, Texas.

**MECHANICALLY** Inclined mind—Own and operate general appliance repair shop. Complete, illustrated course shows you how. Welding, refrigeration, motor repair, how to get business, etc., all phases covered. Free literature. Christy Supply, Dept. 454, 2835 N. Central Ave., Chicago.

**BABY** Shoes preserved. Complete instructions. M. E. Watson, Bellefontaine, Ohio.

**WELDING** Pays. Learn with 1942 trade school text manual. 516 pages. Over 500 photos. \$2.00 copy. Money-back guarantee. Hobartweld, Box M-753, Troy, Ohio.

**TYPEWRITER** Repairsmen urgently needed. Earn \$40 to \$50 weekly spare time. Our easy to learn home study course teaches you how to repair typewriters. Write for free information. Houston Typewriter Repair Service, P.O. Box 5357C, Houston, 12, Texas.

**LEARN** All about mink ranching. Send 25c for booklet, The Year on a Mink Ranch. John Ludwig, Mohnton, Penna.

**MAKE** \$300 To \$3000 a year in your spare time in your backyard, raising our Owe meat and fur rabbits. Outdoor War Efforts Industry, Owatonna, Minn.

**A LOCOMOTIVE** Engineer or railroad conductor is interesting work. Information on how to obtain these positions 50c. The Student Railroader, Box A53, Elmhurst, Ill.

**\$40.00 WEEKLY** Made growing mushrooms, fresh, dried. Dominion patent 231583. Free spawn. North American, 189P Yonge, Toronto, Canada.

**BIG** Money, thrills, adventure—trapping wild animals. Enormous demand. Complete guide, 50 cents, postpaid. Aer-Trade, PM2, Adams, Mass.

**PAINT** Brushless pictures instantly. Free details. Weidler, 1321 Wellesley, Los Angeles 25, California.

**TYPEWRITER** Repairing—Original course, simplified home study. Weber Typewriter Mechanics School, Box 269, Osborn, Ohio.

**GOLD** Panning, occupation, camping expenses. 160-page beginner's book and three large blueprints modern equipment \$3.00. Eight pages literature, pictures free. Old Prospector, Box 21544, Dutch Flat, Calif.

**MUSHROOMS** Grown; boxes, barrels. Instructions 50c. Spawn \$1.00. Gordon, 553 William, Winnipeg, Manitoba.

**GOLD-STAMPING**. Exceptional post-war opportunity. Free booklet. Home City Specialties, Dept. 1273, Springfield, Massachusetts.

**LEARN** Wood carving. Instructions 25c. Karving Kraft, Box 221, Clovis, New Mex.

**HOMEWORKERS**, Make, sell, shell novelties. Beginners samples, instructions, \$1.00. Temple, 234-6th Ave. S., St. Petersburg, Fla.

**ANNOUNCING** Home study course in commercial baking. Practical basic training. Good field for those with aptitude. Nearly depression proof. Send for free booklet, "Opportunities in the Baking Industry." National Baking School, 1315 Michigan Ave., Dept. 3431, Chicago 5, Ill.

**LOCKSMITHING**—Profitable business or hobby! New course teaches you how to pick locks, fit keys, de-code, masterkey, etc. Easy self-instruction lessons. Bargain price. Free details. Write—Nelson Company, Dept. 7-02, Chicago 4.

**"TATTOOING"**—Pleasure! Profit! Details, 3c. Steele, 626-G 17th, Los Angeles, Calif.

#### **BOOKS, PERIODICALS, PICTURES, POSTCARDS**

**RADIO** Book catalog. Out soon; new complete catalog of radio books and manuals for beginners and experienced radio men. Write for your free copy of Catalog 4. Radionic Equipment Co., Dept. D-7, 170 Nassau St., New York 7, N. Y.

**MAGAZINES**—Business, vocational, diversion. Profit by keeping posted on conditions, developments and opportunities in your line through magazines devoted to it. Write now for free price-list. Current single copies only—over 200 fields. Commercial Engraving Publishing Company, 34C North Ritter, Indianapolis 1, Indiana.

**VICTORY** Gardeners. Read leading books on home gardening. Write for free cut-price catalogue. Dunbar, New Brunswick 18, N. J.

**SMALL** Investment—Big opportunities! All technical, homecraft, games, sports, farming, languages, music, photography, occultism, astrology, etc. Free literature, specify subject. Modern Technical Book Co., Dept. MMC, 55 West 42nd Street, New York 18.

**FOR** Sale: Boxes beautiful all-occasion cards, \$1, 10c postage. Sunshine Shop, Bartlett, Tennessee.

**SAVE** Money by writing for our lists of special cut-rate books, many at less than 50% of original price. Pines, Box 32, Flushing, New York.

**REBINDING**: We bind magazines, old books, Bibles, hymnals. Heckman Bindery, Dept. D, North Manchester, Indiana.

**WE** Can supply you with almost any book or phonograph record album. House of Berbeck (Book Dealers), P.O. 2662, Detroit 31, Mich.

**MAKE** 70 Life's prime. Write: Bookmaster, Box 588-B, Stillwater, Oklahoma.

**BACK** Issues magazines supplied. Reedmore, 841 Intervale Avenue, New York, N. Y.

**MONEY-MAKING** And self-help books. Buy three, get one free. Details free. Johnston, 257-PM N. Washington St., Tiffin, Ohio.

**MODERN** Steam car \$2.00. Floyd Clymer's Historical Motor Scrapbooks \$1.50 postpaid. See our advertisements under Automobiles and Motorcycles. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

**MAGAZINES**—All different—Latest, 3c. Excel, 2149 Jackson, Chicago 12, Illinois.

**MEN** And women anxious to prepare for larger earnings. Get powerful prescription for achieving personal and business success. Stamp brings details. J. Scholtens, Muskegon, P5, Michigan.

**"100,000 Post-War Jobs Abroad"**—South America, China, India, Burma, Japan, Russia, Malaya. How, when and where to apply. Post-war U. S. participation in world reconstruction and trade demands thousands of American-trained mechanics, salesmen, technicians, engineers, foremen, laborers and business representatives—every trade needed. Our 15,000-word copyrighted forecast—compiled from business, professional and government sources—lists over 200 big U. S. firms with foreign interests, gives job information, salary brackets, contract tips, application letters, passport information, climatic conditions, etc.—everything needed for your immediate application. \$1.00. Return for refund in 7 days if not satisfied. Pacific Industrial Research Bureau, 202-E Studio Building, Portland 5, Oregon.

**BEAUTIFUL** Colored, U. S. airplane pictures, 8x10. Details free. Nebs Bargain Store, 205-A, O St., Rock Springs, Wyo.

**WRITER'S** Instruction books. World's largest collection. List free. Humanity Press, 220 West 42nd St., New York 18.

**TAILORED** Homes—the modern plan book. Ad under Miscellaneous heading.

**LOVE** Horses? Free list 44 horse magazines. Magazine Mart-PM, Plant City, Fla.

**WHO** Put the tack on the deacon's seat or tried to make a rooster lay eggs? "Sam From Neberkanook." An excellent short story for 25 cents. Earl Schlegel, Publisher, Pennsburg, Penna.

**A RATIONAL** View of Life \$1.00. Benjamin Seibert, Urbana, Ohio.

**MAGAZINES** (Back dated)—foreign, domestic, arts. Books, booklets, subscriptions, etc. Catalog 10c (refunded). Cicerone's, 863 First Ave., New York 17, N. Y.

**LIBERATOR**, Humorous and informative medium for writers and swappers. Sample dime. Coin only. Liberator, 905 5th Avenue, Moline, Illinois.



SCARCE Papua coronation—30c. Approvals. Utechs, 1143-C North Keeler, Chicago 51.

MEXICO—Packets, Mixtures. Stamps mint or used. Price list free. Diener, Box 10411, Mexico, D. F.

20 DIFFERENT! Early Turkey stamps given to approval applicants sending 3c stamp. Premiums with purchases. Brand-wein Stamp Company, 167 West 33 Street, Bayonne, N. J.

INTERNATIONAL Junior album has place for McNeil's approvals, 439 W. Washington, Phoenix, Arizona.

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

PENNY Approvals, that satisfy. Neil Gronberg, Box 5441-P, Philadelphia 43, Penna.

55 CACHED! Envelope 25c with approvals. Large pictorial stamp packet 10c. Herget, 2644 Bailey, Buffalo, New York.

FRESHLY Mounted approvals for collectors using Scott's International Junior Album. Phoenix Stamp, Dept. 3M, 120 W. 44th, New York.

FINE Foreign approvals for International Junior Albums. Vogel, 5174 Lakeshore, Port Huron, Michigan.

EXCHANGE Your duplicate stamps. Details free. C. Bishop, Route 8, Kalamazoo 88, Michigan.

DESIRABLE New Falkland Island dependency stamp, MacArthur stamp from Australia, Abyssinian wild elephant issue, plus host of others from New Caledonia, Indo-China, Russia, Cuba, Wallis and Futuna, Dutch Indies, China, Philippines, etc., only 5c to approval applicants. Big dime packet list free! Methuen Stamp Service, Inc., Dept. 36, Lawrence, Mass.

FRESHLY Mounted approvals for collectors using Scott's International Junior album. Wlaschim, 55 Nagle Ave., New York 34.

SPECIAL—Airmails, 19 different, including zeppelin, triangles, Latin-America, 5c with approvals. Continental Co., (Dept. B), Box 606, New Rochelle, New York.

SCARCE 1880 U. S.—Hussey local carrier stamp listed at 15c. Also Costa Rica No. 65 listed at 40c. Both sent free to approval buyers sending 3c postage. Pladon Stamps, 1717-M Idaho, Toledo 8, Ohio.

TURKS Caicos, Grenada, Seychelles, Dominica, Caymans; everything 3c with approvals. Viking, 130(Z) Clinton St., Brooklyn, N. Y.

ZOWIE-E-E! A barrel of fun for only a dime. 500 United States—absolutely un-picked and unsorted—just as received from church missions. Many varieties, including large commemoratives, airmails, high denominations up to \$5.00! Stampdom's biggest package of fun—and you might find something really valuable! Price only 10c to serious approval service applicants. Money back if not delighted. Illustrated bargain lists with each order. Mystic Stamp Company, Department 80, Camden, New York.

WORLD'S Largest diamond and triangle stamps, free stamp magazine, stamps from fighting Free French, 20 stamps from 20 different countries, pictorials, airmails, big bargain 5c with approvals. Capital Stamps, Dept. 2, Little Rock, Ark.

118 DIFFERENT Stamps including commemoratives, charities, airmail sets, etc., only 3c to approval buyers. We buy collections. Badger Stamp Co., Milwaukee 3, Wis.

FREE! The Stamp Finder! Send today for the big new edition, fully illustrated, enabling you instantly to identify all difficult stamps! Also fine packet strange, fascinating stamps from Bosnia-Herzegovina, Monaco, Patiala, Cyprus, etc., including maps, ships, animals and strange scenes. All free to approval applicants including 3c postage. Garcelon Stamp Company, Box 900, Calais, Maine.

FREE! Canadian sets, royal visit, George VI, George V, coronation, jubilee, others, to approval applicants. Ensign, Box 118-M, South Orange, N. J.

CANADA 100 Different 25c—approvals all countries. Lists. Victoria Stamp Co., London, 4, Canada.

DANDY United States approvals. Write immediately. Sullivan, Endicott Arcade, St. Paul, Minnesota.

VICTORY Packet free—Includes stamps from Tanganyika, British Cayman Islands, animal, scarce babyhead, coronation, early Victorian, airmail, map stamps, with big catalogue—all free. Send 5c for postage. Gray Stamp Company, Dept. PM, Toronto, Canada.

FREE! Leeward Is., Cayman Is., Turks and Caicos plus 60 different mint Geo. VI coronation poster stamps, to approval service applicants sending 3c postage. Tatham Stampco, Springfield-30, Mass.

#### HOBBIES AND COLLECTIONS

EXCHANGE Match covers, stamps, etc. Selected lists, swappers, 25c (coin). Hobbies, Box 212, Ft. Wayne, Ind.

GENUINE Obsidian stones—Cut, polished, many uses. 25c each. C&K, 5448 Fountain Avenue, Hollywood, California.

25 SHELLS \$1.00. Free book. Variety, Box 1420G, Sarasota, Fla.

MINERAL Sets. Select specimens. 12 varieties quartz \$2.00. 12 ores \$2.00. 30 minerals \$2.00 postpaid. Kenneth Knapp, Montrose, Calif.

WHITTAKER'S—20 Patterns, instructions, X-acto knife, wood, \$1.00. "Old Whittaker," 1402 Charles, LaCrosse, Wis.

EXCHANGE Duplicates. Swappers everywhere. List free. Box 2166-M, Denver 1, Colorado.

WANTED: Old cigarette cards. Write Charles Bray, East Bangor, Penna.

FOOL'S Gold—From famous gold camp. 10c per sample. Also mineral specimens from famous local mines. Martin's Snap Shop, 506 Harrison Ave., Leadville, Colo.

NEW—15 Different match covers 10c. Box 202, Rochester 1, N. Y.

JEWELRY Stones removed from rings, etc., 100 assorted \$2.40; 50 large ones \$2.40. Lowe's, Box 311, St. Louis 1, Mo.

RADIO Control—the hobby of tomorrow. Send 25 cents for Instruction Manual to Radio Control Headquarters, Box 214, Deal, New Jersey. No stamps.

COLLECTOR Wants antique guns, brass powder flasks. Fred Braucher, Canfield, O.

COLLECT Colorful army patches. Latest picture book and catalogue only 15c. Insignia Mart, 703 Broadway, New York

#### CAMERAS AND PHOTO SUPPLIES

THERMOPLASTIC Photo ring kit, makes 12 rings, complete \$1.00. Beck Manufacturing, 224 Thirteenth, Huntington Beach, California.

WAR-BARGAIN Used cameras. Candid camera \$4.98, Kodak \$7.00, Graflex \$27.50, enlarger \$15.00, 35mm. Reflex cameras—and many others. Movie camera \$5.00, projector \$8.00, roll film. Send 25c for latest list and descriptions. Used Camera Directory, Box 1031-M, Canton, Ohio.

CANDID Camera. Build your own. Kit of parts \$3.50. Easy assembly plan free. Hollycam Company, Box 272-B, La Jolla, California.

USED Photo equipment. Directory, 25c. Advance Distributors, Box 495-P, Lebanon, Penna.

60 PRIZE Winning photographs—brochure. With complete data on how they were made, 50c. Wolf, 2786 Jerome Ave., Bronx 58, N. Y.

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1000 3x4 **ATTRACTIVE** Shipping labels \$2.60. Rizzo, 2051 W. Forest, Detroit 8.

**QUALITY** Printing at lowest cost. Samples, price list, free. Adams, 30 West Washington, Chicago 2.

100 **TYPED** Post card sales messages duplicated \$1.00. Send cards. Reed Printing, 124 W. 4th, Los Angeles 13.

500 3/4 x 2 1/4 **FOUR** Line gummed stickers, 25c. Moritz Printery, Saginaw, Mich.

**EMBOSSED** And plain business cards. Spada, 10 Lexington, Wethersfield 9, Conn.

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**INEXPENSIVE** Home-made printing press. Details free. Novelty Shop, Downsville, Louisiana.

**PRESSES**, Type, cutters, paper, supplies. Bargain bulletin 3c. Export orders acceptable. Levinson, Box 918, New York 8.

**CUTS**, Sample and catalog, dime. Soden, Box 581, Des Moines, Iowa.

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**GOT** A hot idea, or a new gadget? Folio 100 manufacturers anxious to buy inventions, all kinds, \$1.00. Alfred Novak, 2560 Loop, Cleveland 13, Ohio.

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**INVENTORS:** You can now make your own patentability searches without disclosing your ideas to anyone. Write Raymond L. Smith, 302 Bond Building, Washington, D. C. (Former U. S. Patent Office employee.)

**SELL** Your invention direct to manufacturer, says successful inventor. Postwar products are in demand. If your idea has merit, industry is looking for you. We list all manufacturers in United States, any classification. Average list \$3.00. Get action, results. Inventors Guide Service, Joseph Woods, Director, 1249 Vicente, San Francisco 16, California.

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**INVENTORS**, Manufacturers! We have inventive ideas for new post war products. Details of 10 new, original, practical, patentable and unpatented ideas sent post paid \$1.00. Address Research Bureau of Inventions, 835 Ardmore, S.E., Grand Rapids, Mich.

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**INVENTORS**—The Lion Manufacturing Corporation of Chicago, a highly rated concern employing 1,400 people, is interested in inventions for their plant and affiliated companies. Our interest is in patented or patentable electrical or mechanical devices for post-war development in the following fields: Radio and television, sound and recording, household appliances, vending machines, coin operated amusement devices, in fact almost anything of metal or plastic. We invite inventors to send us details concerning their patented inventions. If your invention is not patented, tell us in a general way what you have to offer. If we are interested, we shall inform you how to communicate details without endangering your rights. Lion Manufacturing Corp., 135 S. LaSalle St., Dept. AB, Chicago 3, Ill.

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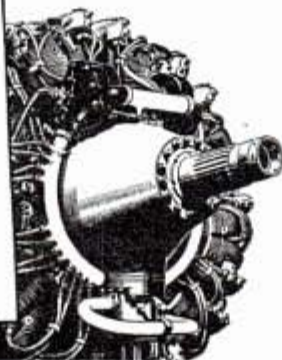
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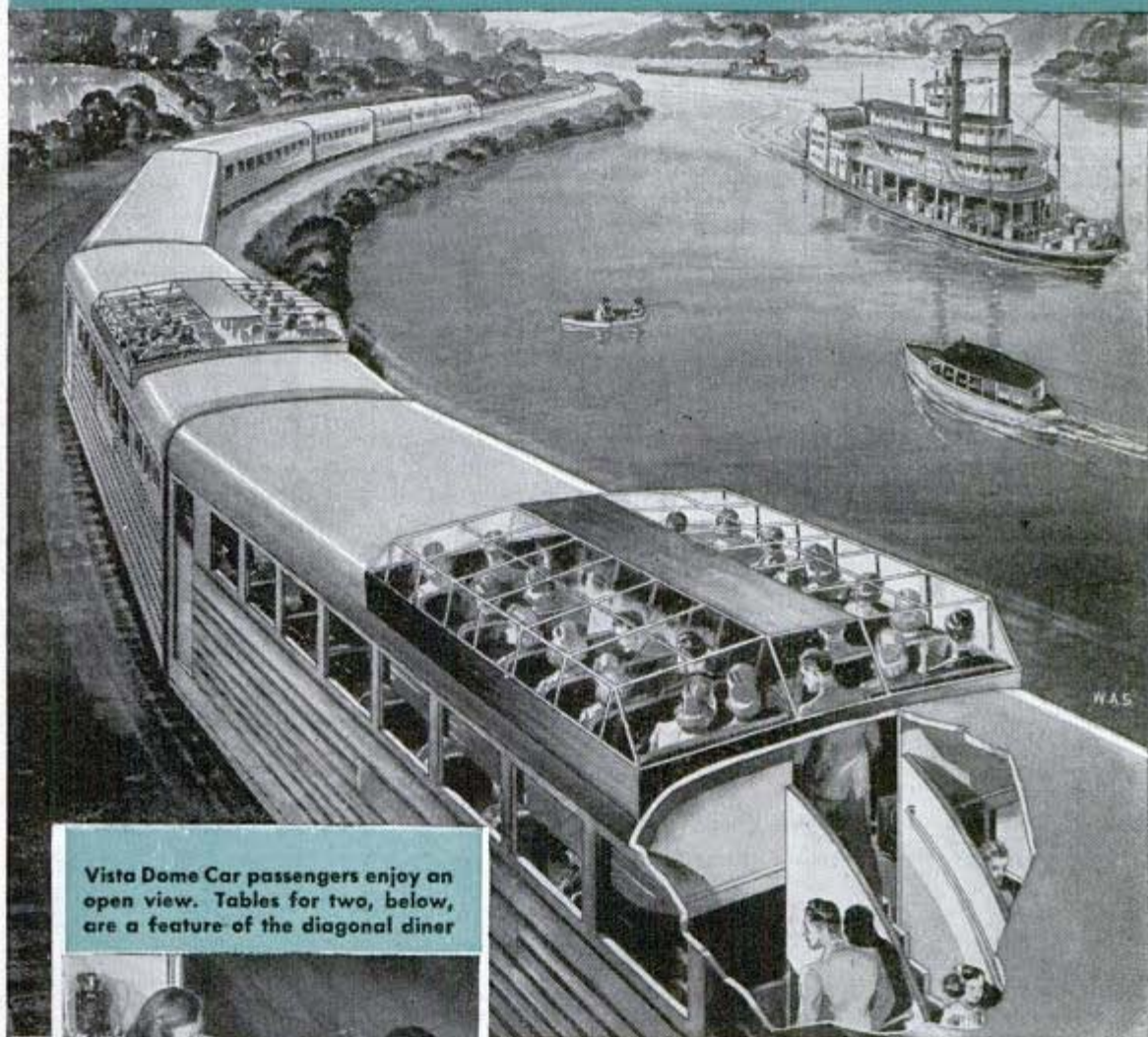
WRITTEN SO YOU CAN UNDERSTAND IT

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No. 1

## WHEN THE RAILROADS SAY "LET'S GO!"



Vista Dome Car passengers enjoy an open view. Tables for two, below, are a feature of the diagonal diner



By William E. Taylor

**T**HERE'S a great day coming when the \$64 travel question won't be "Is This Trip Necessary?" but rather, "Let's Go—And How?"

Keenly aware that competition from air lines, buses and waterways is going to be even tougher than before the war, the railroads don't intend to be left at the post when the travel barriers come down. They rely on the new concept of railroading—comfort for the ordinary passenger—to keep sparkling new cars filled with satisfied riders.



**Standardized equipment of streamliners speeds their servicing in special yards built by the North Western**

The research departments aren't missing a trick in their quest for the last word in cars and locomotives. Streamlined transportation was just swinging into high speed when the war knocked everything out of the window except the movement of fighting men and materiel—leaving civilians to scramble for what space was left.

Considering the tremendous increase in traffic, the shortage of labor and difficulties in replacing equipment, everyone agrees that the railroads are doing a grand wartime job. But the railroads haven't forgotten that their permanent passenger business is built on swift, safe, comfortable and economical transportation for the people. Comes peace and the Trail Blazers, Challengers, Pacemakers, Silver Meteors and the rest will have to move over and make room for a vast fleet of new streamliners providing luxury travel at coach rates.

A new development is the Vista Dome Car, originated, strangely enough, by the

General Motors Styling Section. From a glass-enclosed dome in the roof of the car, passengers will have an unobstructed view of the countryside from all sides as well as overhead. New types of glass, developed for bombers, and lower roofs of modern cars combine to make the dome practical.

To build a Vista Dome Car the floor of the middle section of a coach is lowered slightly, and the dome constructed over the depression. This permits two seat levels, making the ride more attractive and adding to the capacity of the car. The Burlington Lines already have remodeled a coach to provide a dome accommodating 24 passengers and have put it into service to test riders' reactions.

The dome car is only one of many revolutionary conveniences embodied in General Motors designs for passenger cars of every type, from day coach to deluxe sleeping and lounging accommodations. Although the Electro-Motive Division of GM

**Seats of Triple-Deck sleeper are transformed at night into separate berth sections, each with own lavatory**





is a pioneer in manufacture of Diesel locomotives, GM has not built any railroad cars.

But regular railroad car manufacturers have not been idle. Pullman-Standard is pouring out a flood of plans for both the low-cost and deluxe travel markets—Triple-Deck sleepers, Duplex-Roomette cars, Day-Nite and Threedex coaches, club-cinema car, diagonal-seat diner and even a junior club car, a children's playhouse on wheels.

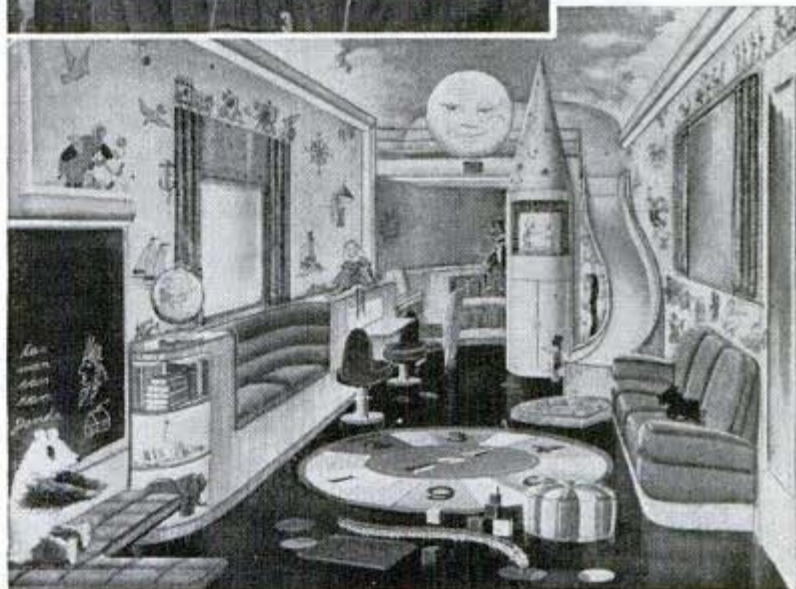
The playhouse will be 20 feet long, about a fourth of a car's length, and will be combined with other accommodations. There'll be a curving slide entered through a concealed stairway, a marionette show, miniature piano, blackboard, desk and chairs, and loads of toys. "Kneeling" sofas, parallel with the windows, will let the kiddies press their noses against

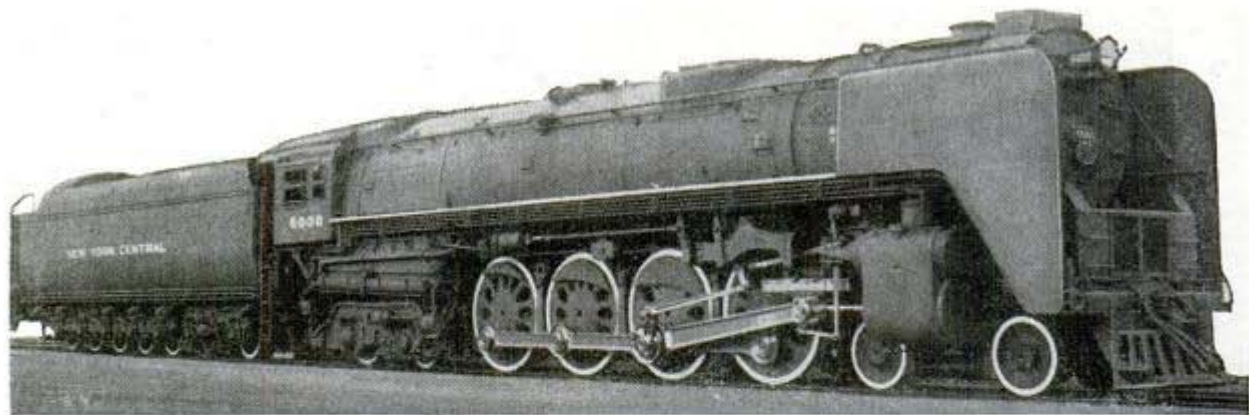


Polaroid windows as in Hollywood Car of City of Los Angeles will keep out glare

At long last, upper berth riders get a luggage rack, at left

Curving slide and a blackboard feature the junior club car





Designed for high speed passenger and freight service, New York Central Niagara develops 6,000 horsepower

the window panes and gaze out to their hearts' content.

Chaise-longue sleeping comfort is promised for the Day-Nite coach, with an extra degree of recline for the seats. An upholstered leg rest will pull down from the back of the seat ahead to provide a full-length sleeping surface for the overnight passenger. Window drapes on hinged rods will swing out at right angles to the wall to become night curtains separating each pair of seats. There'll be individual spot-type

lights and three private dressing rooms for women and three for men in each car.

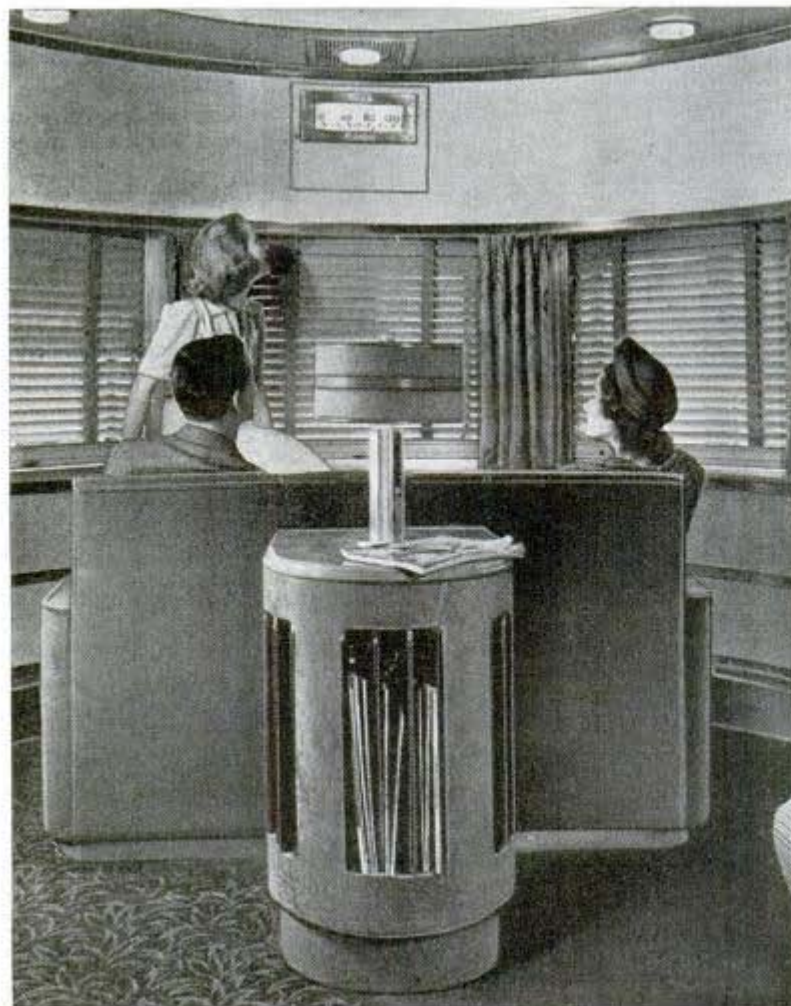
Already in experimental service, the Triple-Deck sleeper provides 42 berths, compared with the 14 upper and 14 lower of the conventional sleeper. Marked reductions in berth fares are foreseen with the coach-sleeper. Its seats in the daytime are all on one side of the car, somewhat in continental fashion. Each triple tier of berths forms a section at night, all berths running crosswise. Each section has its own lavatory facilities.

The streamlined, light-weight diagonal diner is expected to speed service by removing obstructions which cause delay in conventional diners. Vibrationless tables are placed diagonally and seats set at a 45-degree angle. Tables for two as well as four are provided. Other features are spot-ray lights bathing the surface of each table, intercar telephone communications and triangular wall shelves for water bottles, creamers and sugar bowls. Each person will be able to take or leave his seat without disturbing his neighbor.

Dancing and movies will be a double feature in the club-cinema car. The forward end is an ultramodern club car during the day and a night club after dark, the rear a luxurious lounge in the daytime and a movie theater at night.

Destined to bring pri-

Passengers get thrill watching speedometer in observation car  
Chicago & North Western photo



vate, single-bed, air-conditioned rooms to lower berth fare levels is the Duplex-Roomette sleeper. By an ingenious interlocking arrangement, one car provides 24 accommodations. Pullman plans to introduce many of these cars after victory. Only one was built just before the war and has been in constant use since—with the addition of 106 improvements and refinements that were devised in the course of operation. Contrast this attention with prewar days, when the only improvement often was a coat of paint!

Commuters haven't been forgotten, either, with the Threedex coach designed for seating 112 persons on three levels and with the added provision of game room facilities at either end of the car.

Perhaps some of your postwar traveling will be in the Ultraliner, which its designer, the American Car and Foundry Company, calls "a great forward step in luxurious mass transportation." Plastics, polished metals and sleek woods predominate in fittings. More space and greater comfort are emphasized in the individual reclining seat coach. A glass-partitioned smoking room features the chair car, while the diner offers alcoves for seclusion. A sweeping expanse of windows, the observation car is designed to give the effect of a solarium. Fluorescent lighting eases strain on passengers' eyes and will be widely used in postwar cars.

Engineers and designers agree generally that weight of car structures is about at a minimum consistent with safety and that further weight reductions will come through use of plastics and lighter metals for fittings and equipment. Cortlandt T. Hill, president of the Pacific Railway Equipment Company, expresses some provocative thoughts on modern railway

Soft action coil springs of truck, right, extend up into sides of pendulum car for "banking" on curves

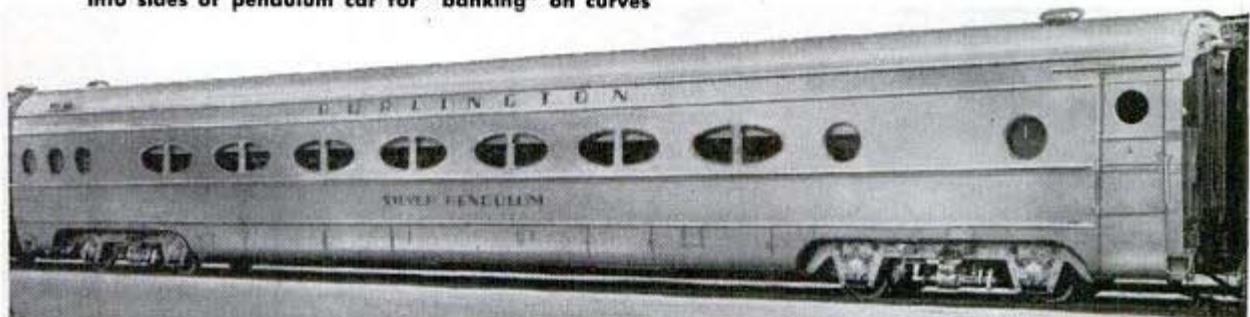
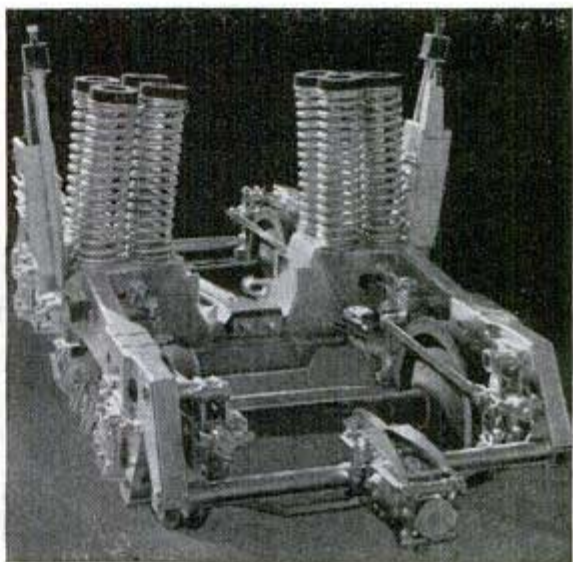


Leg rest released from seat ahead by button provides Day-Nite comfort

equipment. A grandson of James J. Hill, creator of the Northwest's railroad empire, he has railroading in his blood.

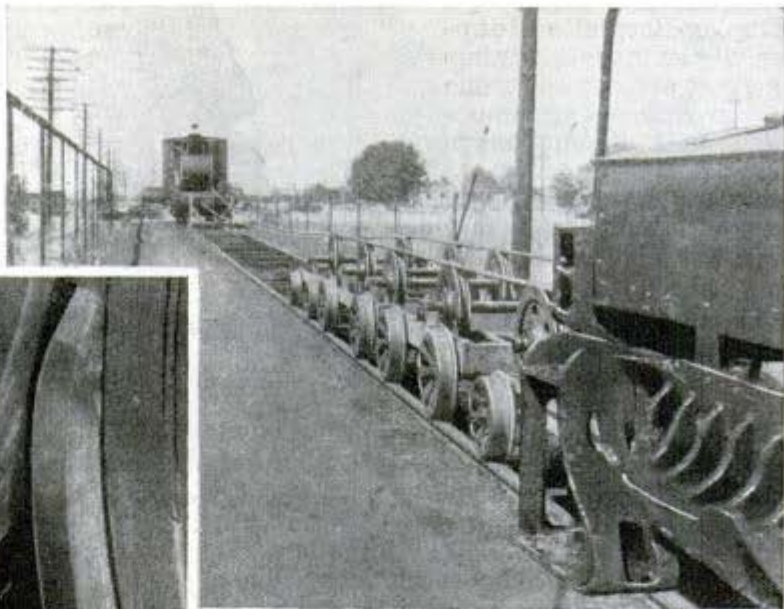
"In attempting to improve the ride, railroads have made a common error," Mr. Hill told the writer. "They have spent much money on improving rails and roadbed and on luxurious car equipment. But they mount that costly equipment on what amounts to an 1870 truck. For an easy ride

(Continued to page 160)



# Iron Horse Smooths Own Tires Right on Track

To avoid wasting valuable time in repair shops, the Southern Pacific Railroad lets a locomotive smooth the worn-down, out-of-round tires on its own driving wheels right on the track. The iron horse is pulled back and



Above, tire cutting tool replaces the brake shoes. Cable tows engine on 800-foot siding, above right

forth on a well-ballasted, 800-foot tangent track set on a slight grade. Cutting tools replace the brake shoes and shape the tires while the locomotive is in motion. The flat tire can be reshaped in about 14 passes. A winding engine with drums and a 1½-inch cable does the towing; by pulling the locomotive against the grade, it has a much steadier pull than it would on level track. Several wheels can be cut at the same time and they do not have to be removed, turned down on a giant lathe and reinstalled as they did with the former method.

## Electrically Heated Clamp Seals Packages After Air Is Sucked Out



Vaporproof packages bound for the battlefronts are sealed in a jiffy with a vacuum cleaner and a heated scissors clamp. First the vacuum cleaner draws all the air out of the package. Then a vise-like clamp which is equipped with electric heating elements on both sides is pressed on the open edges of the specially processed bag, sealing it effectively in a few seconds. The hand-soldering method formerly used took from five to 10 minutes.

By using a thermocouple made of wires only 5/1000 inch in diameter, General Electric research laboratories have discovered that the lighted end of a cigarette registers between 1,200 and 1,325 degrees F., which is slightly above the melting point of aluminum or magnesium.



# Superfort's 2,700 Decals Tell All Rules for Crew



There's a lot of reading matter involved in operation of a B-29 Superfortress, so much that the Boeing Aircraft Company has added decal making to the complex process of building the giant bomber. Each plane bears 2,700 decals, or decalomania transfers, consisting of diagrams, instructional procedures and other advice ranging from "No Smoking" in the bomb bays to "Danger—Air Operated Doors" on the bomb doors. In making a decal, the finishing shop prepares a paste-up layout from an engineer's blueprint. To obtain sharper images, the layout is a trifle more than five times the size of the desired decal. The layout then



Above left, finishing touch to rescue decal. Above, decal layout compared to finished decal. Left, final decal-making steps

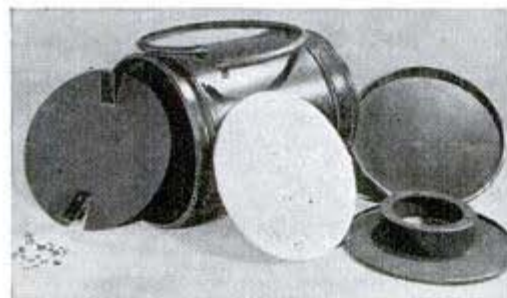
is photographed by a six-ton camera in the photo template department. Contact prints are made from the resulting negative, the same size as the finished decal. Images of the prints are transferred to a silk screen through a sensitized gelatin paper. Containing as many as 40 small images, the silk screens are laid over special decal paper and three or more coats of lacquer are applied. The finished decals then are trimmed to proper size. The Boeing shop has turned out 17,000 decals in a day through this process.

## Plane Engine Parts Are Canned for Overseas Shipment

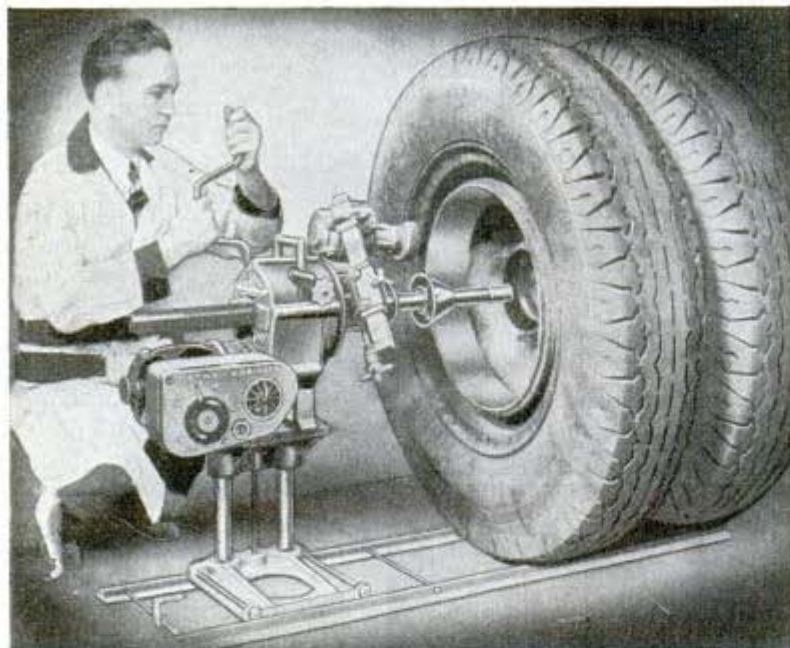
Airplane engine cylinders are being shipped overseas in cans which guard against moisture, dust and breakage, reports the Air Technical Service Command. First the cylinder is placed on a steel disk which forms the bottom of the "can." Another disk is placed

on top of the cylinder. Bolts keep the part from moving. The side piece of the steel drum then is fixed in place and its steel cover hermetically sealed.

Left to right, parts of steel drum, plane cylinder in place, and "can" ready to ship



## Portable Drum Grinder Plugs Into Light Socket



Operating from an electric light socket, a portable brake drum lathe is versatile enough to grind drums for motorcycles as well as Flying Fortresses. The lathe has 10 cutting speeds with rheostat control and can be operated with the wheels on or off. It may be used to machine, grind and hone brake drums and the manufacturer says it leaves the drum with a mirror-smooth finish without tool marks. There are several types of bases available to support the lathe for stationary work; after dismounting the lathe can be moved anywhere to the job.

## Putting the Squeeze on Impure Water Helps Make It Fit to Drink

Drinking water is freed of biological contamination by a new patented process in which it is first filtered to remove solid impurities, then passed through a pump which applies a pressure of 1,000 to 4,000

pounds per square inch. Heated to 125 degrees Fahrenheit, the water is sprayed through a nozzle into a vessel maintained at nearly a perfect vacuum. Palatable water free of micro-organisms results.

## Self-Loading Trucks Carry Hoist Powered by Own Engines



Dump trucks can load themselves in scraping jobs with a hoist attachment powered by their own engines. The unit utilizes the motive power of the vehicle through a winding drum attached to the rear wheel. The scraper bucket is filled when the truck goes forward; when the truck backs up, a ratchet on the drum automatically takes hold and hoists the load, swinging it over the truck's body where it is dumped. The loading attachment folds so the truck may be parked in a garage. According to the manufacturer, the device triples the output of trucks.

## Electric Log Maps Rock Far Down in the Earth

Geologists can identify rock layers never seen in drilling wells by means of an electric log, which records on photographic film water and mineral secrets far down in the earth. A metal electrode attached to a cable is lowered to the bottom of the well, while a

wire grounded at the surface forms the other pole. A generator at the surface supplies the current and the earth is the conductor. At a slow, constant speed the electrode is drawn to the surface, meeting a resistance that varies according to the stratum through which the electrode passes. By studying the records the geologist can tell whether the strata are sand, shale, limestone or other mineral and whether they contain fresh or salt water, oil or gas.

## Magnets on Steel Map Tab Police Radio Cars

Headquarters officers of Missouri's State Highway Patrol can tell the position of their 112 patrol cars by a quick glance at 112 magnetized buttons on a new steel map. They devised the steel map and magnetic buttons after wearing out several cardboard maps on which cars were designated by pins. The steel map has 14 green lights depicting weigh stations and seven red lights for radio stations. The patrol has painted numbers atop its cars to identify them from the air, and has used planes in manhunts on several occasions. Operating on one frequency for voice, the seven patrol fixed radio stations also have radio telegraph equipment for other messages.



## U. S. Cruiser Modeled in Plastic Contains 1,000 Parts Built to Scale

Plastic miniatures of the United States Navy's 10,000-ton Cleveland class cruiser are being turned out in mass quantity for seamanship, gunnery and communication classes. Produced in exact detail, the model

requires nearly 1,000 parts and is made with 40 dies by injection moldings of cellulose acetate. It is 6 feet, 4 inches long, weighs 8 pounds, 6 ounces, and is built to a scale of  $\frac{1}{8}$  inch to one foot. In planning the assembly the molder followed the system of prefabricated units used in major shipyards. The plastic models are superior to wooden ones in that they are all exactly alike.



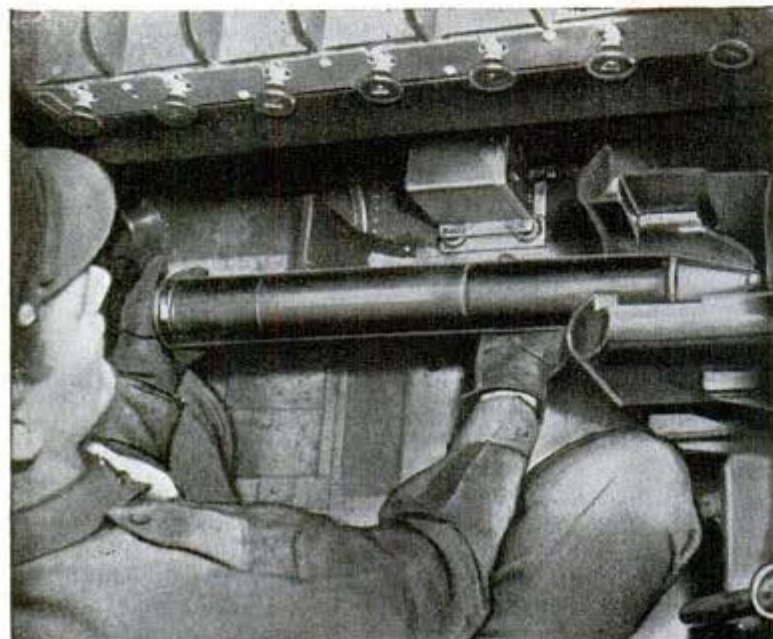
☐ The Army Air Force Training Command in six years—from 1939 through 1944—trained 184,394 pilots, 43,274 navigators, 41,403 bombardiers and 264,603 aerial gunners—more than half of these in the year 1944 alone.

# OUR WALLOP



Package guns on P-47 are easily loaded or repaired through removable side panels. Flexible feed chutes wrap around guns. Below, loading 75-mm. shell into nose cannon of Mitchell

**I**N A four-hour running battle which began over Kyushu, Japan, and continued to the China coast, a single B-29 fought off 79 enemy fighter planes. After shooting down seven and seriously damaging two others, the Superfortress landed at its base in Western China with hardly a scratch. The 275-mile chase was officially described as the severest test yet made of a Superfortress' defenses, and proves the contention of Major General Curtis LeMay, formerly of the 20th Bomber Command, that "the big boys can take care of themselves anywhere."



To "take care of themselves" with more effectiveness, B-29s and other bombers, as well as fighter planes, now have the greatest possible offensive and defensive power packed into their aerial armament and bomb loads. More guns, faster shooting, greater sighting accuracy, precision gunlaying, remote turret control, new-type bombs and release mechanisms and new electronic devices which permit bombing by precision instrument through overcast have been perfected and incorporated in AAF warplanes. The 75-mm. cannon has been converted

# ON WINGS

from single shot to rapid fire; many gunnery stations now mount double their previous number of .50-caliber machine guns and fighters can carry four extra guns in droppable containers. In addition, high-velocity rocket-launching devices have been improved to the point where Thunderbolt pilots are referring to them as airborne artillery.

One of the most effective armament developments in recent months has been the central gunnery control system, first announced on the B-29 and now modified for use on several other planes, including the Black Widow night fighter. By remote sighting and operation, a gunner is able to lash out at enemy planes without being



P-38 fighter takes on load of "ammo" for four guns in nose

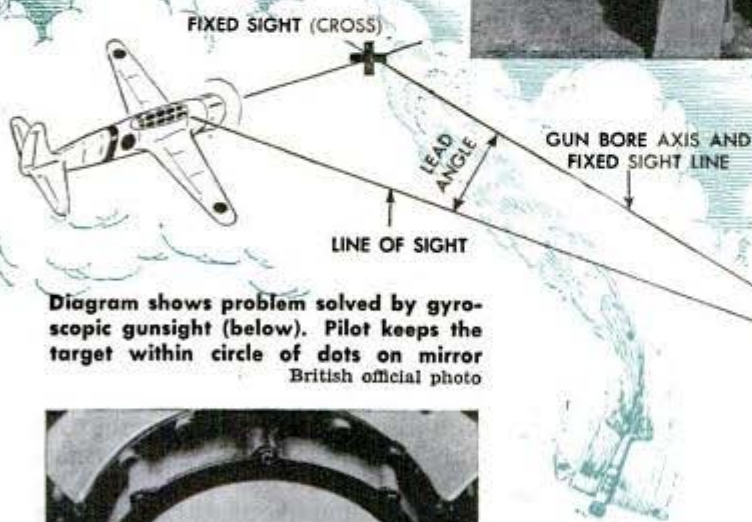
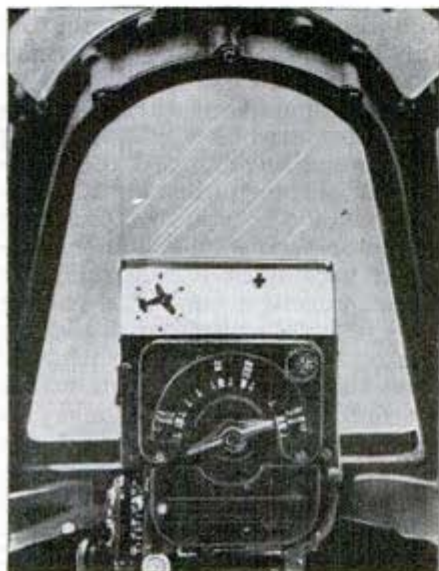


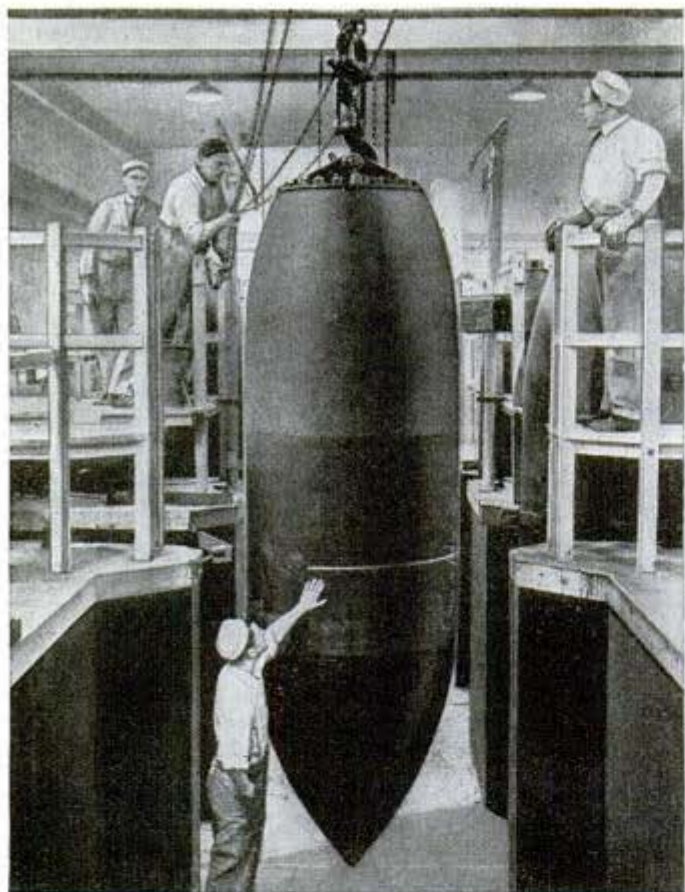
Diagram shows problem solved by gyroscopic gunsight (below). Pilot keeps the target within circle of dots on mirror  
British official photo



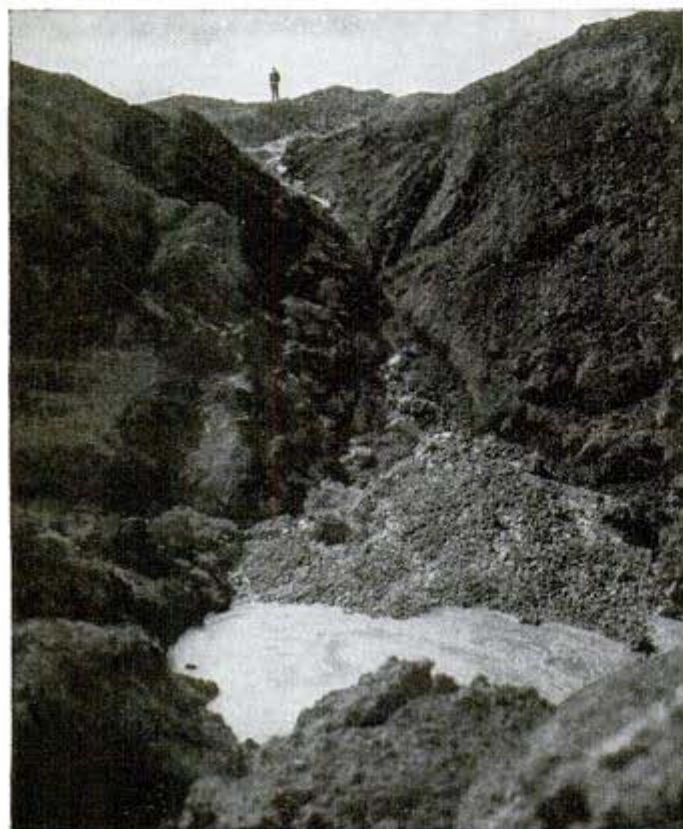
blinded by the muzzle blasts of his own guns, without exposing himself in a Plexiglas turret and with no fear of hitting parts of his own plane.

The turrets of the B-29 can be manned from interior sighting stations individually or, if need be, shifted to another station by the flick of a switch so that one gunner may control several guns.

When a gunner catches an enemy plane in his sight, he focuses a circle of luminous dots from tip to tip on the image of the fighter and keeps it there by manipulating the sight. Speed of target is arrived at by gyroscope and range is calculated by special instruments. These factors are then relayed by electrical impulses to the computer and there combined with data transmitted by the navigator on altitude, outside temperature and indicated air-



Dwarfing its handlers, world's largest bomb weighs 22,000 lbs. and is 10 times as powerful as V-2; its crater is shown below  
British official photos



General Electric Co. photo

Beneath remotely controlled P-61 gun turret, engineers use model to show how concentrated fire protects plane in combat

speed. The brainlike computing mechanism then instantly determines where the enemy plane and bullet will meet and corrects the pointing of the guns.

As adapted to the P-61, the remote control installation enables either the nose gunner, the tail gunner or the pilot to blast away with the four-gun revolving turret. Primary control rests with the gunner in the forward station, but by means of an action switch the turret automatically takes a position in line with the pilot's or tail gunner's sight. Pilots report that the cone of fire is so great that only one pass at a plane is normally required to destroy it.

For independent turret operation, new sights and gunlaying techniques have upped the accuracy of aerial gunfire by 100 percent since the start of the war. Reflector-type sights, which mirror a tiny sight reticle onto the target, permit a gunner to change his eye level without introducing aiming error—a big improvement over ring and bead sights which required that the eye be held perfectly stationary in line with the sight. Revamped tail gun mounts in B-25s and B-26s have hydraulically driven guns using compensating sights, and at waist gun po-

sitions on late-model B-17Gs and B-24Js, a new gun mount—a torsion spring counterbalanced assembly with all parts enclosed in a sheet metal housing—provides the required stability for the automatic computing sight. A fire interrupter device has also been added which prevents the gun from shooting whenever its line of fire comes within three degrees of any part of the aircraft.

For fighter planes, a new gyroscopic gunsight, invented by the British and manufactured in the United States, is now helping to bring down increasing numbers of enemy planes and is especially deadly against the jet aircraft the Germans used in their desperate endeavor to beat back Allied bombing attacks. In operation, a circle of six diamond-shaped lights with a dot in the center is reflected from a spinning gyro mirror up to a transparent reflector before the pilot's eyes. The pilot looks through the circle of diamonds at the enemy aircraft and sets a lever to govern the diameter of the circle according to the plane's wing span. He then twists the grip of his throttle, which widens the circle as the plane be-



B-29 gunner is "waiting at window" with gunsight to greet Jap fighter. Below, good evidence why Japs avoid Superfort's tail



comes larger on approach, and the gunsight automatically computes the necessary lead for the enemy target, keeping it within the circle until the flyer can get in a burst with his .50-caliber machine gun.

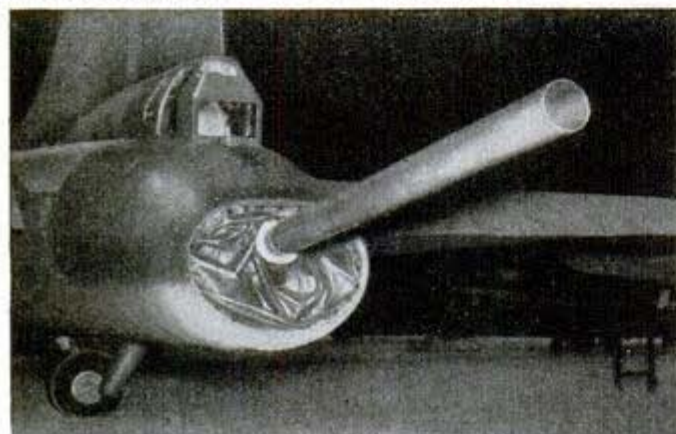
To feed these guns properly at high altitudes and speeds, a more efficient ammunition booster has been developed, while improved



Hudson Motor Car Co. photo  
 This B-25's wallop consists of six forward-firing machine guns (four in nose, two hugging fuselage) and three rocket launchers



Nine hundred pounds of .50-caliber ammunition are required to load machine guns of P-38—including package guns on wings. Below, rocket gun in B-17's tail has power of 75-mm. cannon



ejection systems and five flexible feed chutes now eliminate the difficulties encountered under increasing pressures and pull loads. Also, a more satisfactory location of firing switches is provided by a new control wheel of the figure 8 design with grips similar to present pistol-grip switches on fighter control sticks.

These and other advances, including a muzzle booster and a spring buffer to replace the hydraulic buffer, have given the .50-caliber machine gun a tremendous lift in its rate of fire. And when two of these guns are contained in a compact package and slung under a wing like a droppable fuel tank, the plane's firepower is considerably augmented.

Such externally slung package guns are self-sufficient units weighing 500 pounds each, and contain two .50-caliber machine guns in recoil adapters, "ammo" boxes, boosters and flexible chutes—all housed in a streamlined aluminum container which is hung from a standard two-lug bomb rack and is wired to operate along with the normal complement of guns from the standard trigger switch. With this arrangement in use, the slugging capacity of the A-26, for example, may be increased to fully 14 machine guns, since it already mounts six in the nose and two each in top and bottom turrets.

Cannon in aircraft, however, have not been neglected, and a new 20-mm. gun now uses more powerful ammunition, including armor-piercing shells, tracers, incendiaries and HE shells with matched trajectories. A simplified method of feeding has speeded up muzzle velocities far in excess of the 2,500 feet per second in standard cannon of this type, while a modified version of the "flying 75" shoots harder, farther and faster and, by means of intricate sighting and ranging devices, can register accurately at 10,000 yards. In addition, a vertical stack-type automatic feeder (one shell above the other) features a clip which can be refilled in flight and which enables a cannon-toting Mitchell or Invader to hurl as many as five 20-pound projectiles at a target in a single pass.

(Continued to page 156)



## Electric Broom Mops, Sweeps or Sucks Dirt

Weighing about one third as much as the average vacuum cleaner, an electric "broom" designed to ease housecleaning problems is ready for introduction when manufacturing of civilian goods reopens. It has a changeable, flexible floor nozzle with attachments for brushing, mopping or suction. A quick-emptying plastic dust cup replaces the usual fabric bag. The cleaner weighs only 6½ pounds, and being light and slender is readily hung on a closet hook when not in use. It can be carried from floor to floor with ease, and its streamlining permits the cleaner to be moved around and under furniture without difficulty. The accessories can be changed quickly.

**Quick-emptying plastic cup, inset, is substituted for the usual fabric bag in a light cleaner**



## Power-Operated Welding Table Can Be Tilted to 135-Degree Angle

Seven hundred pounds can be rotated on a powered welding positioner equipped with handwheel control. The unit will accommodate table speeds up to 180 inches a minute with a work radius of one foot. Linear speeds at all radii are set from a scale on the side of the frame. The table can be tilted through 135 degrees from horizontal by a spring-centered handle and includes automatic limit stops. The positioner has a built-in variable speed transmission and hydraulic cylinder with a single half-horsepower electric motor. Originally designed for use as a support for parts to be welded, and only 28 inches in diameter, it can be used as a basis of power in moving fixtures and work across machine tool tables in sequence operations.

## Tubes to Fit Nazi Phone Lines Built in Three Days in U. S.

In just three days American engineers reproduced a complicated German radio vacuum tube which permitted the Allied armies to use strategic telephone lines abandoned by the Nazis in their retreat. The Germans left their communications equipment intact but expected to foil the Americans by removing radio tubes of a type never made in this country. The tube differs from our tubes in electrical characteristics, heater voltage, dimensions and



arrangement of pins for the socket. Within three weeks all the 1,000 tubes ordered by the Army had been built by Bell Laboratories and Western Electric engineers and delivered to the front lines.

## Liquid-Cooled Engines on B-29 Increase Its Horsepower



With in-line liquid-cooled engines of the type used on fighter planes, an experimental B-29 Superfortress recently took to the air over Wright Field. The giant bomber's four radial air-cooled engines had been replaced with liquid-cooled Allison engines which power such fighters as the P-51, P-38

and P-40. The experiment provided additional data on the use of liquid-cooled engines in heavy bombers built for operation at high altitudes. Allison engines on the modified B-29, known as the XB-39, develop 2,600 h.p. each compared with the 2,200 h.p. of the radial engine now in use.



### Polio Patients Use 'Cobra Cockpit' For Exercise

Exercising their limbs in a portable replica of a P-63 Kingcobra cockpit provides both diversion and education for polio patients at the Children's Hospital Annex, Buffalo, N. Y. The cockpit, which is complete with pilot's seat, stick, rudder pedals, instrument panel and circuit breaker board, was built by the Bell Aircraft Corporation from salvaged materials to encourage the patients to take the light muscular exercise which speeds recovery. Test pilots come to the hospital regularly to explain the cockpit to the children. Appreciative polio victims named their Boy Scout unit the Kingcobra Patrol.



# YANKS OF ALL TRADES



One of the trades of the Army Ordnance man is fighting. The other 999 include the trades of tinker and tailor and candlestick maker, and doctor to all manner of broken down GI equipment from wrist watches to locomotives. At the top, for example, you see these Yanks of all trades fashioning a balance staff for a watch, patching a ragged inner tube and performing a bit of leather craftsmanship on a holster



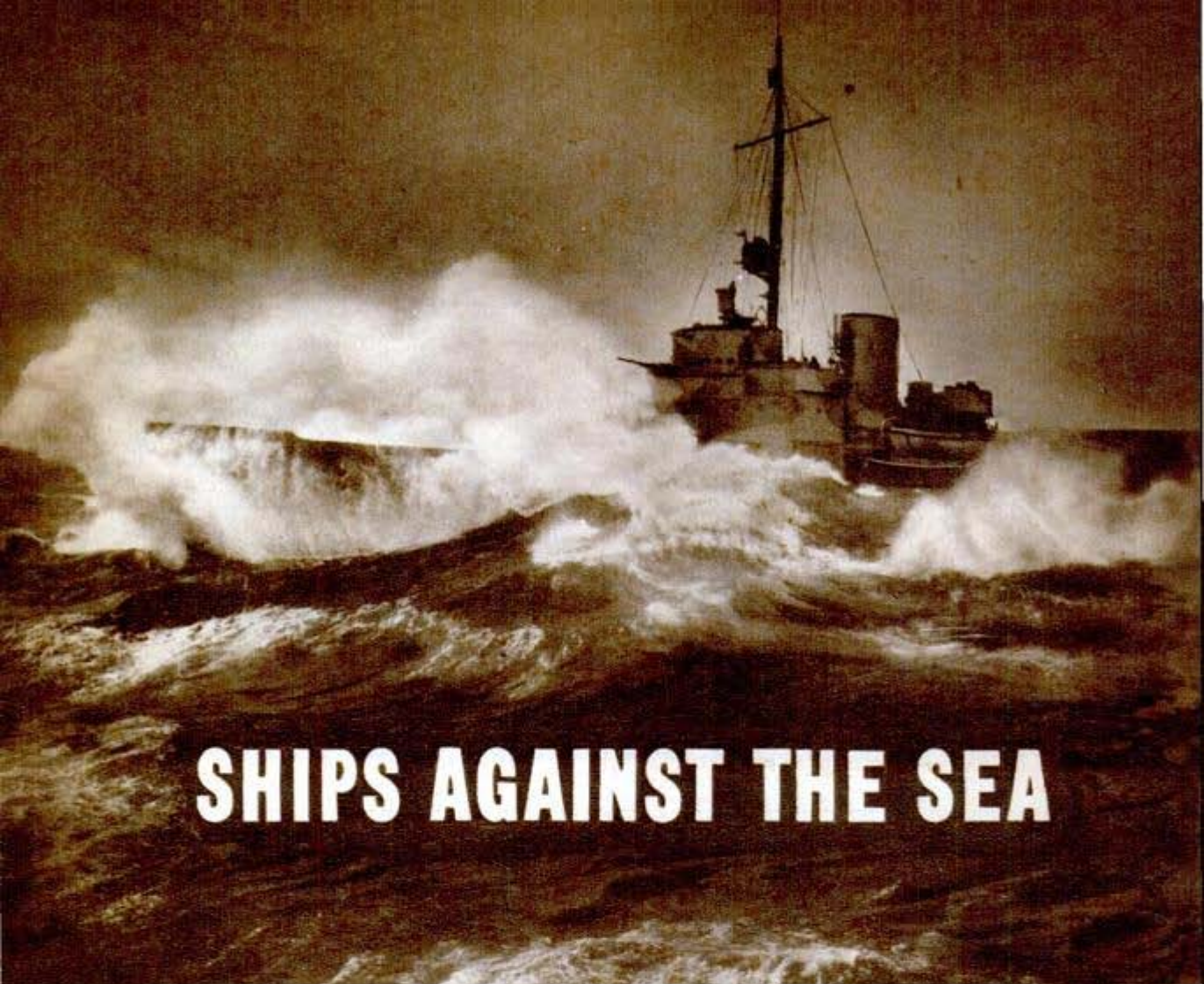
Soldier "seamsters" above do a bit of mending on a war-worn tarpaulin. Below, a gunsmith overhauls a rifle barrel; center, assembling weapons carriers on a Calcutta dock



U. S. Army Signal Corps photos

So the boys want cake? Very well, an Ordnance man of genius converts a mechanic's drill into a cake mixer, seen in action above. GIs' "village smithy" below heats a jeep spring at Ordnance company forge taken from Japs in New Georgia





# SHIPS AGAINST THE SEA

Coast Guard photo

Combat cutter fighting North Atlantic gale typifies thousand such battles that never make the headlines

By Allen Warren Elliott

ONE of the most tragic American naval reverses of this war wasn't a blow delivered by the Japs. It was a terrific lashing by a typhoon during the Philippine operations. Within a few hours after the wind struck, three U. S. destroyers and a number of smaller craft were at the bottom of the Pacific and 600 men were dead.

Once more the fury of the sea had taken its grim toll in the unceasing battle of ship against storm which goes on in war, as in peace, but is obscured by more exciting military engagements. The Philippine typhoon was a reminder that sailors must fight the elements as well as human foes.

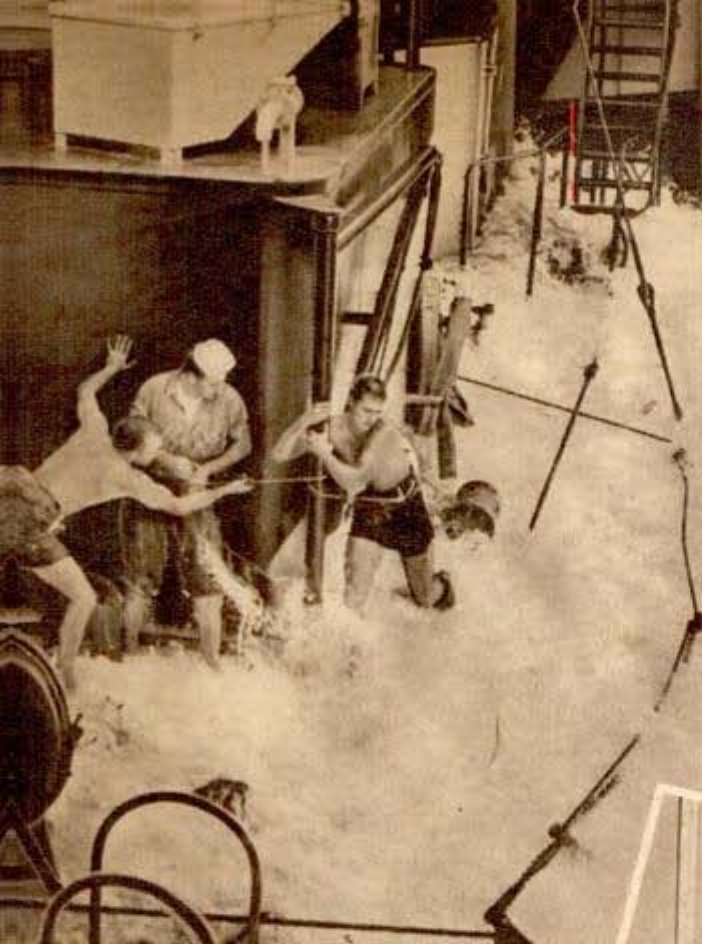
The whole story of the Philippine tragedy will never be told because so many men involved didn't live to tell the tale. But enough is known to illustrate how the tricky forces of nature can outwit man's scientific safeguards.

A carrier task force, including smaller, screening warships, was refueling amid

tossing seas in winds whipping across leaden skies. With oil tanks almost empty, the ships were riding high, especially vulnerable to strong winds, since the surface of any ship acts as a sail, with tilting effect. A storm had been building up overnight and ships' officers, meteorologists and aerologists had been watching signs carefully while necessary fuel was being pumped aboard.

At 10 o'clock in the morning it was definitely decided that a typhoon, as our hurricane is called in the Western Pacific, was raging—but at a safe distance. At 11 the storm veered suddenly and struck the task force with gusts over 100 knots. Within about two hours the destroyers Spence, Hull and Monaghan were gone, along with the other craft.

The pattern of tragedy on the smaller ships was similar. Mountainous waves rose and smashed across decks, ripping loose depth bombs, rafts, railings and ammunition box covers. Men tried to secure loose gear on decks obscured by blinding spray. Many heroes went overboard. Fueling



Coast Guardsmen on tanker (above) pit their strength against sea as vessel battles 60-foot waves and 90-mile winds of hurricane off north coast of Cuba. Top right, tanker's decks are stripped of gear after fighting storm for three days and nights. Right, high sea spills down the hatch of a Coast Guard manned troop transport. Below, with decks awash, U. S. aircraft carrier rides out a storm. As wind and waves lash this high-riding craft, crewmen on slippery deck must crawl on hands and knees or hold onto lines





Navy photo

Foul weather can't stop this Armed Guard crew on merchant ship; below, handy fuel hose saves man's life



hoses were torn loose. Lifeboats were ripped away. Radios went out. Water poured through vents thousands of gallons at a time, faster than pumps could expel it. Men drowned below deck. Windows crashed on bridge housings. Stacks were torn off. Steering gear became damaged or useless under the pounding of the waves. Accumulated water extinguished fires, halting engines. Lights and communications went out, adding to the confusion. The sea now had the ships ready for the kill.

As the vessels went out of control they swung themselves broadside to 60-foot rollers and 100-knot winds. When waves and winds struck at the same time the ships heeled over 50, 60, 70 and 80 degrees. As the water accumulated below it sloshed with the ship and on each swing recovery was slower. Finally came the combination of forces which laid one vessel after another on its side. In a minute, or less in some cases, they filled and sank. Nature had triumphed over the best that man had.

The standard practice in the expectation of a storm of typhoon strength is to shift water and fuel in tanks to ballast the ship

properly. This tends to counteract the extent of the roll. But to fill the tanks time is required and to be caught with a partially filled tank is often fatal, for it adds to the heeling effect.

"We never had a chance," said Lieutenant Commander James A. Marks, skipper of the destroyer Hull. "The ship was on her side, but we stuck to the ship because it didn't seem possible anyone could live in those waters. Finally she began to sink. We all shook hands, thinking it was the end for us. Then as many of us as could make it stripped off into the water.

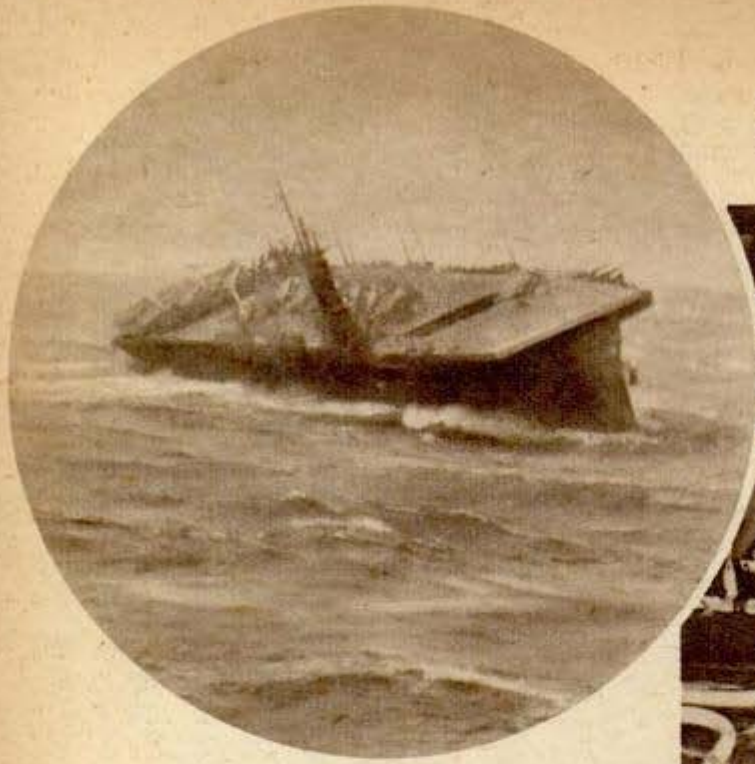
"Miraculously, some life rafts did survive the sea but many men just tossed around in the water. That night a lookout on a destroyer escort spotted some of our men, who told of the ship's sinking. The destroyer escort searched all night and, with other ships in the area, picked up survivors of the Hull who were strewn over a 25-mile area. Some of the men were nibbled at by sharks. Early the next morning, after 20 hours in the water, I was picked up by the destroyer escort."

For the next two days the rest of the task force fought wind, sea and sharks to rescue survivors who had managed to stay alive with the help of life jackets or rafts. Some drowned. Some were killed by swallowing too much sea water. Injuries proved fatal to many. Exhaustion



Exhausted Coast Guardsmen cling to pipe lines on tanker. Below, nearby ships peril transport in fog





Aircraft carrier rolls sharply as sea pounds giant ship. Below, crew quarters are "snafu" as waters reach lower decks of big transport



claimed the lives of more. Others lost the battle to sharks, even though tommy-guns were used from decks and rescue boats to drive off the voracious fish.

It is common knowledge that no ship of destroyer size, or less, is certain to withstand a hurricane or typhoon. This was proved by the Philippine case when none of the carriers was lost, though heroic measures were necessary to save some of them and men were snatched to doom from their high flat decks. In the case of one carrier 300 crewmen were grouped as human ballast on the hangar deck. As the big ship would lurch over, the 45,000 pounds of fleshy ballast would be shifted to the upper side of the deck, men running, scrambling, falling, crawling and yelling as they helped the gallantly struggling craft return to a more even trim.

Three times fires broke out on one carrier and asbestos-clad firefighters clung to slippery, slanting, spray-drenched decks while they fought the fires.

Because of their high hulls and overhanging flight deck some of the advantage of mere size and power is lost to carriers in a high wind, which readily heels them over. In the case of one caught in the Philippine typhoon men found it impossible to walk the decks even before the full force of the storm broke. They either crawled on hands and knees or held to emergency safety lines. With the rise in violence chairs, cabinets, tables, instruments and other equipment began to tear loose, crushing men against bulkheads.

On the flight deck planes were torn from moorings and hurled about by the wind.

One landed atop the carrier's stack, its gasoline catching fire. Another roll of the ship sent the plane overboard. Rain and spray put out the flames. When the storm abated, the ship's steering apparatus was out of commission. It was controlled by reversing port and starboard propellers so it could head somewhat into the wind, and the dangerous side roll was replaced by a more tractable pitch and toss.

The Philippines tragedy was simply an enlarged version of the situation in which any naval vessel finds itself when wind, sea and circumstances combine to provide extra hazardous conditions.

The same scientific improvements, such as the motive power, which have enabled man to conquer time and distance at sea, have placed modern naval craft in danger as vital as Columbus faced in his tiny craft. The sailing ship, made of wood and often lightly loaded, was sometimes so buoyant it could ship enormous quantities of water and still stay afloat. Center of gravity could





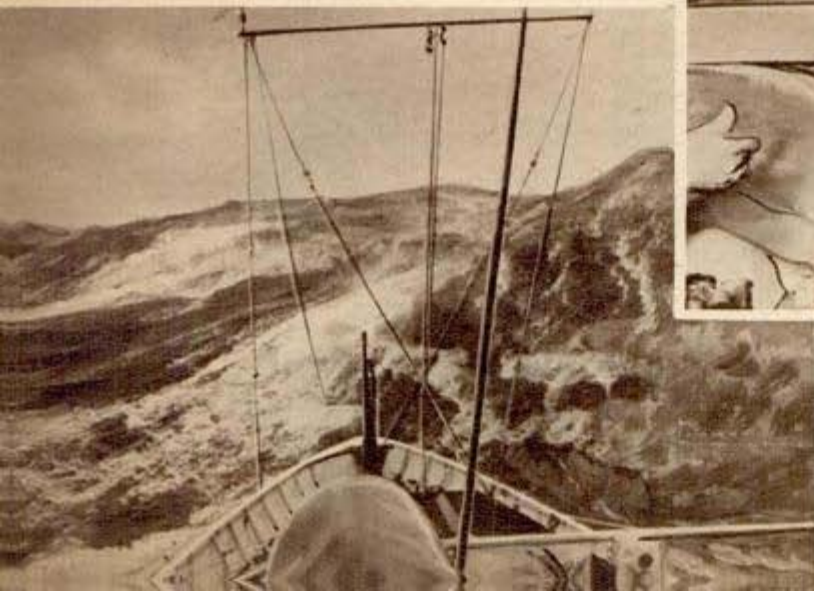
Almost hidden by mountainous waves, Coast Guard combat cutter guards merchant ships visible on horizon

be quickly lowered by cutting away masts and sails in a high wind. The ship, though crippled, could ride out almost any storm if tightly battened. The modern naval vessel, however, is made of steel with tons of steel machinery and equipment packing her interior to reduce her buoyancy.

In a hurricane, destroyers and tankers are especially endangered by their low freeboard which permits waves to sweep over some areas. With below-deck passage cut off by closed bulkheads the forward and aft sections of a destroyer were often completely isolated from each other until,



Coast Guard photos  
Survivors of cutter which capsized in hurricane are transferred from wing of rescue plane to vessel for quick trip to shore. Left, "roller coaster" moving in on small craft





Spray hides bow of British cruiser during speed test in heavy seas. Below, men have rough going in small boat as they transfer from ship to ship during storm. Note "life line" on vessel

on new type ships, catwalks were built high above the deck.

The submarine is in a precarious situation in a bad blow because of its low decks, the lack of stability which permits it to roll easily, its low power as compared to its weight and the danger of acid fumes from batteries. To avoid the effects of a storm of hurricane force a submarine must seek quiet at a depth of about 100 feet. Often the water is too shallow to do so and the need for air always limits the length of its stay at such calm levels.

Nowhere is the judgment of a skipper more important than when his craft is facing a severe storm, according to Captain James E. Maher, USN, of the Third Naval District, New York, who has commanded ships ranging from the ancient submarine N-1 to the battleship Washington.

"We have gadgets for nearly everything," he asserts, "but none has been invented which tells the skipper that now is the time to take this or that precaution for this or that storm condition at sea. It's entirely a matter of judgment and the wise skipper takes all reasonable precautions even if they later prove to be unnecessary."

In this war the ship commanders have more weather facts upon which to base judgment than ever before in the history of our Navy. Yet an approaching storm

often means not only three or four days constantly on the bridge with only short naps, if any, but days of calculation, speculation and preparation.

If you were a captain of a warship at sea this is more or less what you might do. You would certainly consult the monthly weather chart issued by the Hydrographic office in Washington



which predicts storm conditions with remarkable accuracy. You would scan weather reports radioed by area stations. You would confer with your weather observer aboard and examine reports from other ships and planes at sea. You would also watch the log in which the quartermasters record the condition of sea, sky and wind every hour, day and night. In addition you would watch the barometer and the wet and dry bulb thermometer.

From all of these facts you might become aware that a heavy storm is brewing in your area. By recording each bit of information on a map you would soon get an idea of the location of the storm, its expected direction and its probable intensity.

At this stage, the barometer will usually give you an idea of the force of the storm; a drop of 8/100 inch per hour, for example, might indicate that winds of 100 miles an hour will be encountered unless avoided.

Up to this time your course has been fixed by previous orders, but if you felt the safety of the ship was involved you would change course to go to right or left of the raging storm center, depending on the hemisphere in which you are sailing, since storm winds travel clockwise or counterclockwise.

Having set your course you would shift your water ballast and fuel oil to lower the center of gravity and reduce or equalize the roll. You would fill completely as many tanks as possible so the weight would remain fixed.

Next you would batten down hatches, fasten the dogs on all doors possible, secure all portable equipment, strip movable objects from decks, dispose of depth charges if practical, rig safety lines, jettison deck planes if it appeared necessary and rig life lines. If heading away from the center of the storm became impossible due to heavy rolling, you would steam slowly, headed into the sea, to reduce rolling.

You would probably forget the danger from enemy ships because they would be too busy preparing for the storm to start a fight from here on.

As wind and sea built up you would issue instructions to the crew to keep clear of the weather side of decks and to rope off all dangerous ladders and passages. Later on the same instructions probably would apply to the lee side.

From then on, as the swells grew to mountainous size, as the overcast thickened and as the whitecaps came to the top of the waves, only to be whipped off by the howling wind, you would get yourself set for a long and tough battle against the fury of the sea.

And maybe, about now, you might pray a bit for your crew and your ship.



### Portable Light Pyramid in C-54 Has Air and Electric Outlets

Pyramidal light towers simplify the job of bringing air and electric service to the interior fuselage of C-54 cargo planes at Santa Monica, Calif. Each tower is 47 inches high, 10 inches in diameter at the top and 18 inches at the base. Forty-watt fluorescent tubes are held vertically in the conical reflector and protected by a wire screen. Each fixture has air and electrical outlets in its base, making it possible to use short hoses to the rivet guns and short cords on drill motors. This saves hose and cord and eliminates a tripping hazard.

### Electric Eye Dims Headlights At Approach of Other Car

To eliminate danger of blinding oncoming motorists with your own lights, an automatic headlight dimmer will be put on the market as soon as materials are available. The dimmer is operated by an electric eye attached near the headlight of an auto, truck or bus. When the vehicle approaches another, the eye transmits a current to an electronic control which dims the headlights.





## Glider Flaps Wings Like a Gull to Gain Altitude

A glider which can gain altitude at will by flapping its wings like a bird has been tested successfully at Reynolds Field, Jackson, Mich., by Belford Maule, its inventor. The ornithopter's gull-shaped wings are moved through a vertical arc of 32 inches by supporting struts connected to a lever

manipulated by the pilot. Maule says the trick of sustaining flight is to combine vertical wing movement with simultaneous manipulation of control surfaces. The ornithopter becomes airborne after being towed by an automobile. Weighing 385 pounds, it has a wing span of 54 feet.

## Food Fired to Isolated Troops in Fuseless Artillery Shell



Firing food from the mouth of a cannon at the front may sound like a waste of precious calories but sometimes it is the only way the Army can supply rations to a patrol cut off by the enemy. An emergency assortment, usually chocolate bars and halazone tablets with which to purify water, is inserted in an empty artillery shell which has been painted white for the occasion. The cartridge is reassembled with a light charge, but without its fuse, and is shot to the location radioed by the isolated troops. Whenever the bright-colored dud lands close enough to the hungry infantrymen, it is retrieved successfully.



Westinghouse lamp engineers say fluorescent lamps last longer if they are allowed to burn continuously, since frequently turning the tube on and off causes electrons to eat away electrodes until the tube burns out.

## WOOD AND GLUE FORM A NEW TEAM



**T**HE building contractor was ordering materials for a new house over the phone.

"And," he finished up, "send me out a couple of handfuls of nails and a barrel of construction glue."

Sticking a house together with glue sounds absurd and yet, using a minimum of nails, it has been a wartime practice so successful that glues of various types are now standard construction materials. New and improved glues developed during the last few years are so strong, so permanent and so waterproof that a wide variety of items ranging from plywood "angle irons" for wooden aircraft to huge laminated wood and glue structural beams and arches are now in use.

Nine million square feet of interior wall-

**When these timbers of laminated wood and glue are paired up they form a full arch with 92-foot span**

board were attached to studding with glue during the construction of Vanport City, Ore., a war housing project with a population of 40,000. One third the usual number of nails were used and these served to tack the wallboard into place until the glue had set. Exterior plasterboard also was affixed by means of glue.

Ninety-nine tons of glue were used in the fabrication of 5,000 homes for war workers at Portsmouth, Va. Window frames and door frames were glued in jigs, glue was applied to studding and joists, and glue was used for attaching wall panels. Glue saved construction time and also saved 100 pounds of nails per house.

Wooden desks, wooden chairs and wooden plywood filing cabinets are now put together with strong glues that largely eliminate mortising and nails. Hardwood floors are being prefabricated and prefinished in 3 by 6-foot sections by means of glue. Glue goes into the manufacture of knock-down wooden wheelbarrows and it is glue that makes possible the use of hollow laminated wooden cargo booms for ships. Plywood storage silos for farms are put together largely with glue. The wing spars, ribs and veneer surfaces of wooden aircraft are assembled by means of glues that are stronger than the wood itself.

Thousands of prefabricated glue and plywood huts for use as sleeping quarters, offices and hospitals have gone overseas. Plywood and glue house trailers, bus bodies and even forest rangers' lookouts are in use. PT boats and other small naval craft are fabricated largely of plywood that uses waterproof, boilproof and fungusproof glue. A 27-foot airborne rescue boat, developed by the Higgins Plastics Corporation, has a molded plywood hull made strong by resin glue. This 3,100-pound craft can be fastened to the undercarriage of a large bomber.

Prefabricated plywood farm buildings, supported by wooden structural members that are tied together with glue, may be widely used after the war. Grain bins, milk houses, brooders, feeders and barns of this construction were built experimentally just before the war and appear to have a number of advantages. Such farm buildings, it is expected, would be built and packaged by lumber dealers and assembled by the purchasers.

Using few metal connectors aside from ridge bolts, 70-foot dairy barns have been built entirely of wood and glue. The curved plywood roof of one of these barns is supported by plywood arches, leaving the interior entirely free of posts and supports. The arches, of 40-foot span, are shaped as I-beams and obtain extra strength from webs and gussets that also are composed of plywood.

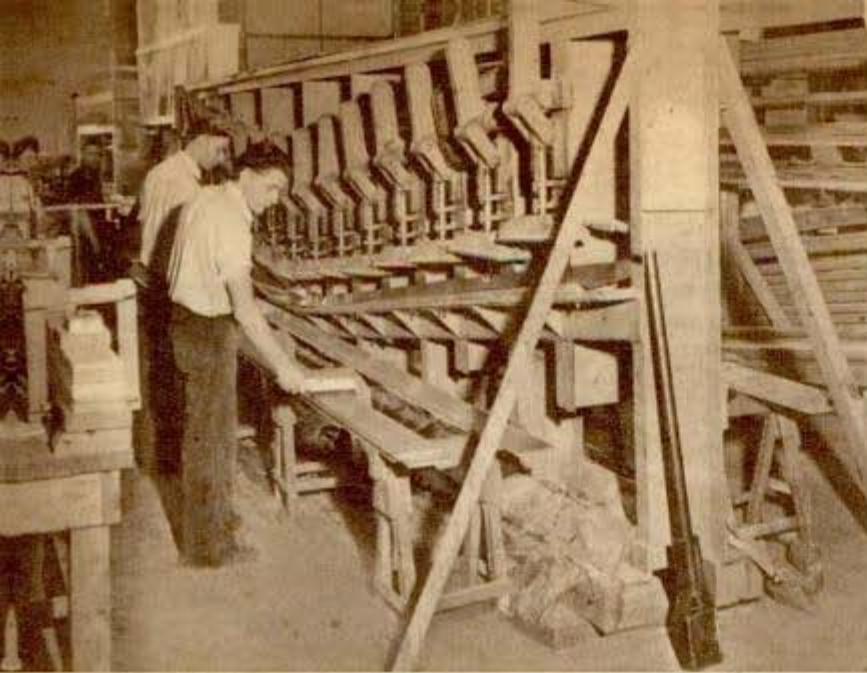
**First layer of veneer is wrapped over form for an aircraft part**

Doak Aircraft Co. photo



After arch is built up of plank laminates, clamps are used for shaping. Below, glue wheel takes guesswork out of applying correct amount to wood





Brushing glue onto wood that will form sturdy spar for wood airplane. Below, short-wave "spot welder" joins strips for airplane drop tank



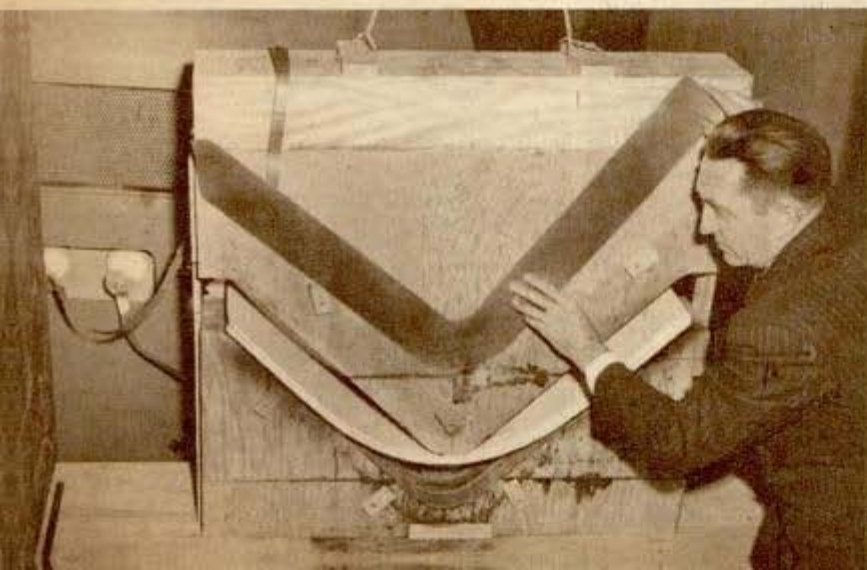
inch planks, glued together under controlled heat and pressure.

Making big pieces out of little pieces this way allows the manufacture of beams or arch members that are larger or longer than normally may be available as single pieces, it permits removal of weak spots and defects in the lumber without reducing the strength, it avoids the checking and warping that often occur in large single pieces and it permits the economical use of lumber from small trees that otherwise might be wasted.

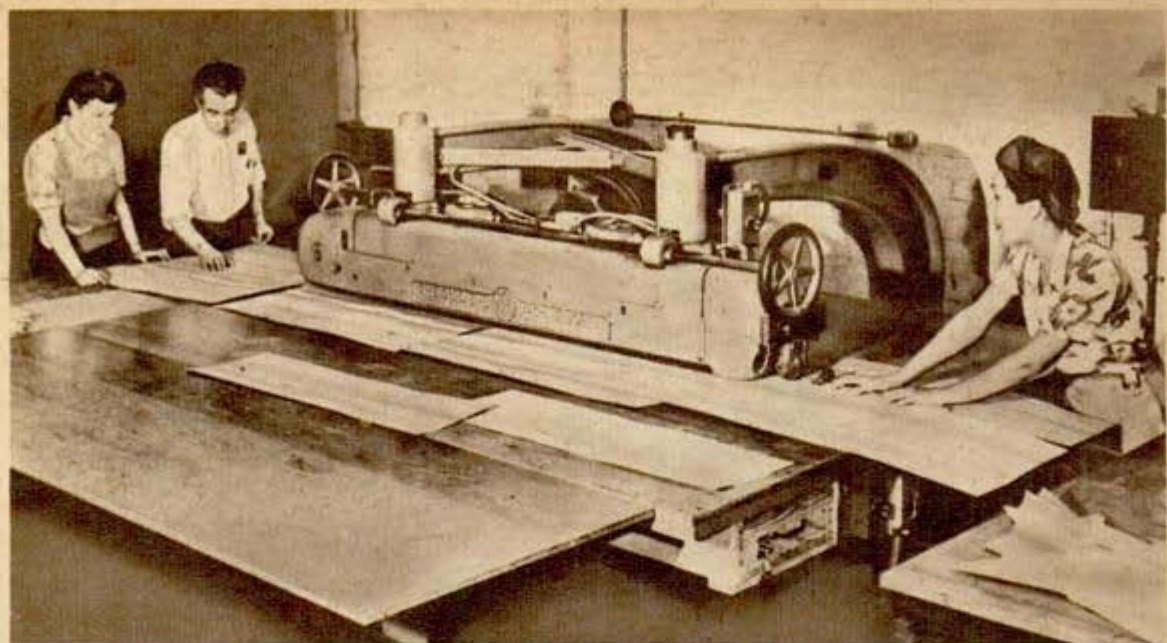
The modern glues that have been developed recently have little in common with old style adhesives. Some of them are synthetic resins that are similar to some members of the plastics family. Casein glues, made from a milk protein, are widely used in residential construction and in wooden aircraft. These glues set at ordinary temperatures. They are not waterproof and are protected by sealing compounds when used in wet or humid places.

Of increasing importance are two new types of synthetic resins. The phenolic resins are formed by the partial condensation of carboic acid or a related compound with an aldehyde such as formaldehyde.

Similarly, urea resins are formed by the partial condensation of urea with an aldehyde. Condensation or setting of either type is completed by the application of heat or pressure or both. Neither glue is affected by salt or fresh water at ordinary temperatures although the urea glues are not suitable as adhesives if



With "radio heat," glued strips in forming press are made into elbow-shaped unit in 4½ minutes. Drying used to take 6 days



Doak Aircraft Co. photo

Splicing machine for wood aircraft veneers trims, glues and applies heat and pressure in one operation

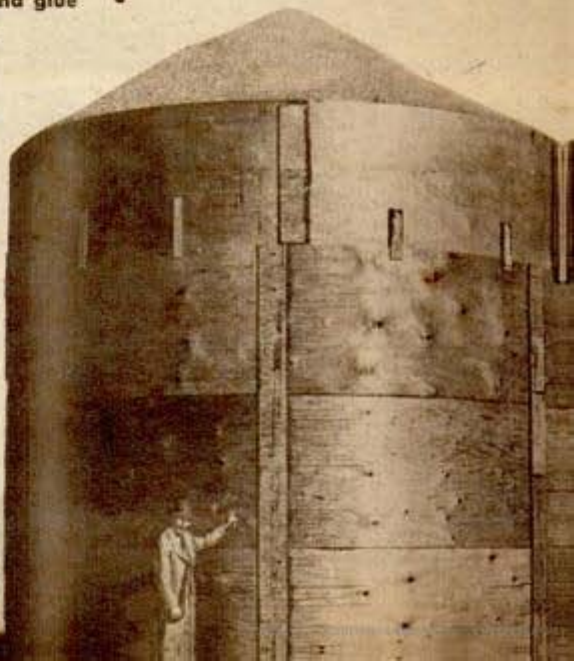
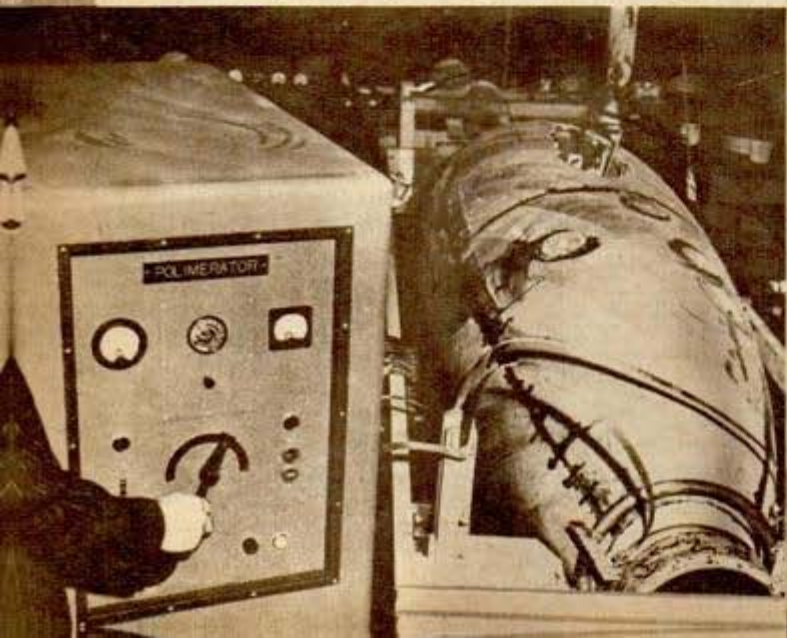
they are to be subjected to boiling water.

Numerous variations and combinations of synthetic resin glues have been developed by I. F. Laucks, Inc., a subsidiary of Monsanto Chemical Company, to fulfill special requirements in some industries. Multiple purpose glues, likewise, are being developed. One new urea glue is adapted to three different kinds of work, each of which formerly required a separate glue formula.

Glued members of an assembly are clamped together until the bond is complete, the time ranging from a number of minutes to several hours. Plywood, for which the glue is furnished in dry sheet form or as a liquid, is bonded by placing in

a hot-plate hydraulic press. Pressure is applied to such a complicated shape as a wooden seaplane pontoon by any of several ingenious methods, one typical way being to place the finished assembly inside a large rubber bag which in turn is placed in a steam chamber, with the opening of the rubber bag open to the outside air. When steam is turned on inside the steam chamber, steam pressure pushes the bag evenly against all parts of the assembly that it holds, pressing the parts together at the same time that it heats them. Air inside the bag exhausts out into the atmosphere. A reversal of this method uses steam or other pressure to inflate a bag that is placed inside some types of assemblies,

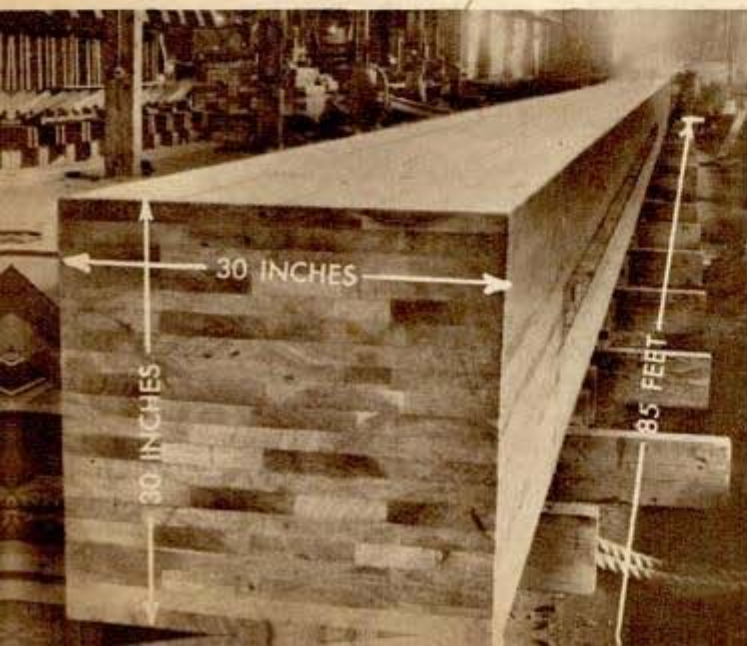
Turning on heat with short-wave diathermy machine to seal glued nose section on drop tank. Right, storage bin is made of plywood and glue







Wood and glue hold this city of 40,000 together—housing project at Vanport City, Ore., built with minimum of nails. Below, huge beam made of two-inch planks and construction glue will not warp and eliminates weak spots of big timber Timber Structures, Inc., photo



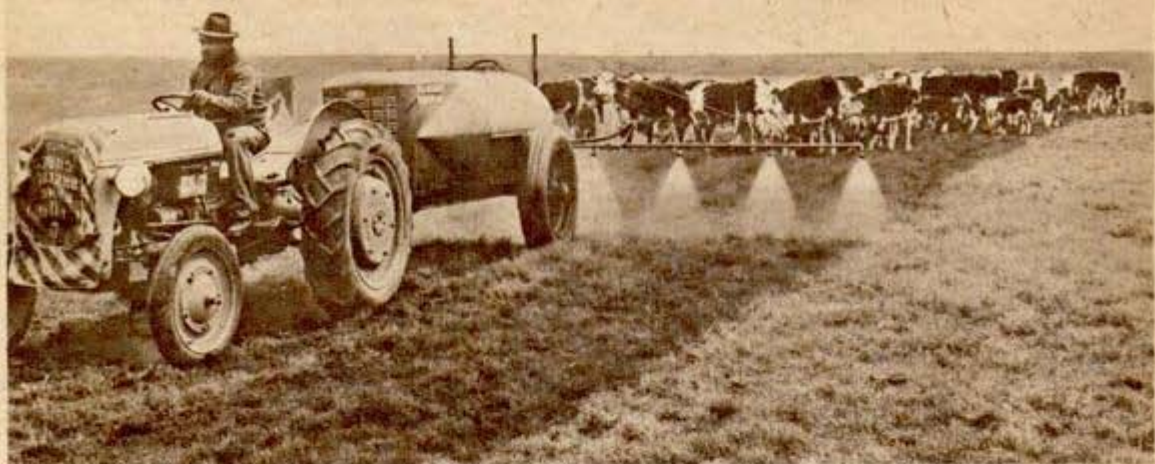
pressing all its parts with equal pressure against an exterior mold.

Cold-setting resin glues complete their bond at a temperature of 70 degrees. Some high temperature resins require up to 340 degrees of heat to effect the chemical change necessary. One method of applying almost any degree of heat, useful with nearly any kind of glued structure, is high frequency electricity. A short-wave diathermy machine is used similar to the "fever" machines that induce high temperatures in the human body.

A diathermy machine is essentially a short-wave radio transmitter to which two electrodes are connected in place of antenna and ground connections. Heat is generated in a structure when the structure is placed in the high frequency

(Continued to page 156)

## Power Sprayer Scours Cattle and Sweetens Hay



Everything from giving cattle a bath to spicing their food is done rapidly with a versatile power sprayer. The machine-gunlike nozzle is directed at the backs of the cattle at a pressure of 250-400 pounds, blowing away dirt or grease and penetrating far enough into the hide to kill parasitic grubs. By spraying salt grass and old hay with a mixture of water and cane mo-

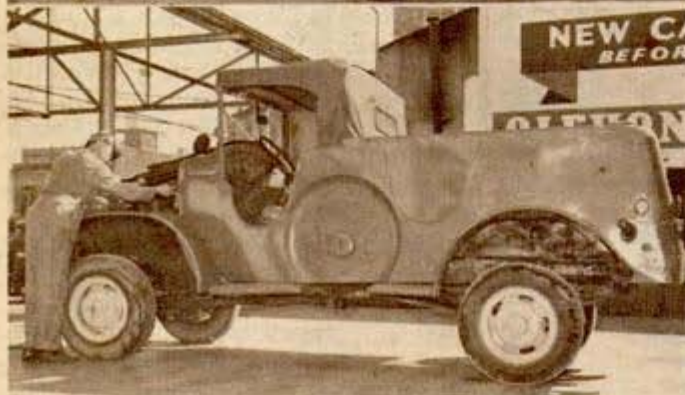
lasses, ranchers whet the cattle's appetite during the dry season and thus increase weight or production of milk. With a paint gun attachment the sprayer can paint a barn of ordinary size in a few hours; when filled with water it becomes a private fire department. It also can be used for whitewashing, disinfecting, weed killing and fly and mosquito control.

## "Face Lifting" for Command Car Converts It Into Truck

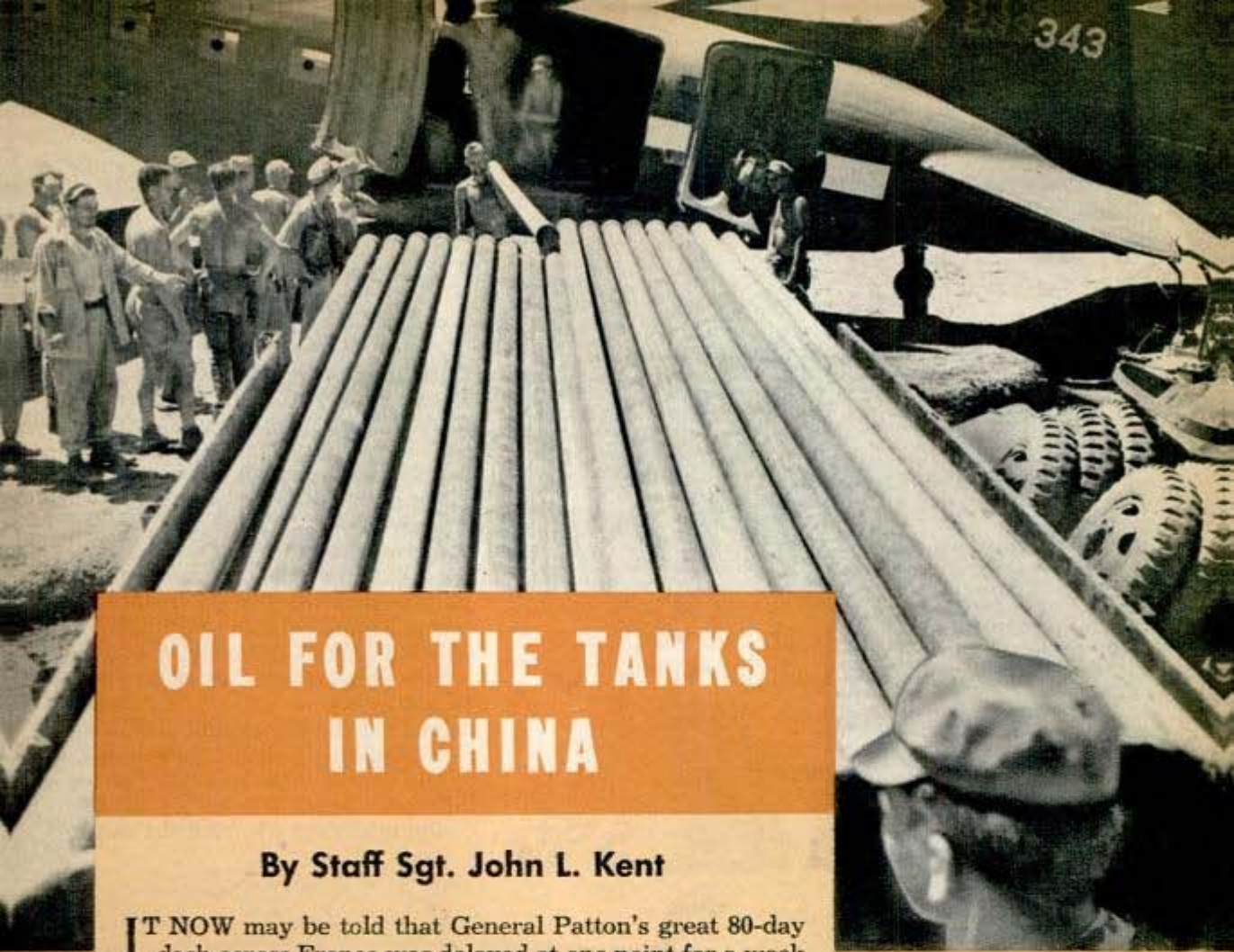


After a useful career in the Army, "ugly duckling" command cars sold at auction to private firms get their "faces lifted" prior to being put into civilian use. One Texas firm cuts away the rear seat with a welding torch and fills the opening with a U-shaped piece of metal; a new top of canvas, new parts where needed, a paint job, fresh tires and a general tune-up complete the job. The machine is adaptable to oil field, bulk materials and farm delivery uses.

## Lubrication Color Code Assures Right Service



Unskilled workers can be sure they are applying the right grease or oil to machinery by consulting a system of matching colors developed by the American Standards Association. The lubricating gun or can and the mechanical fitting to be serviced are marked with the same color, either by paint or decalcomania, and the worker merely matches colors to make certain the proper lubricant is being used.



## OIL FOR THE TANKS IN CHINA

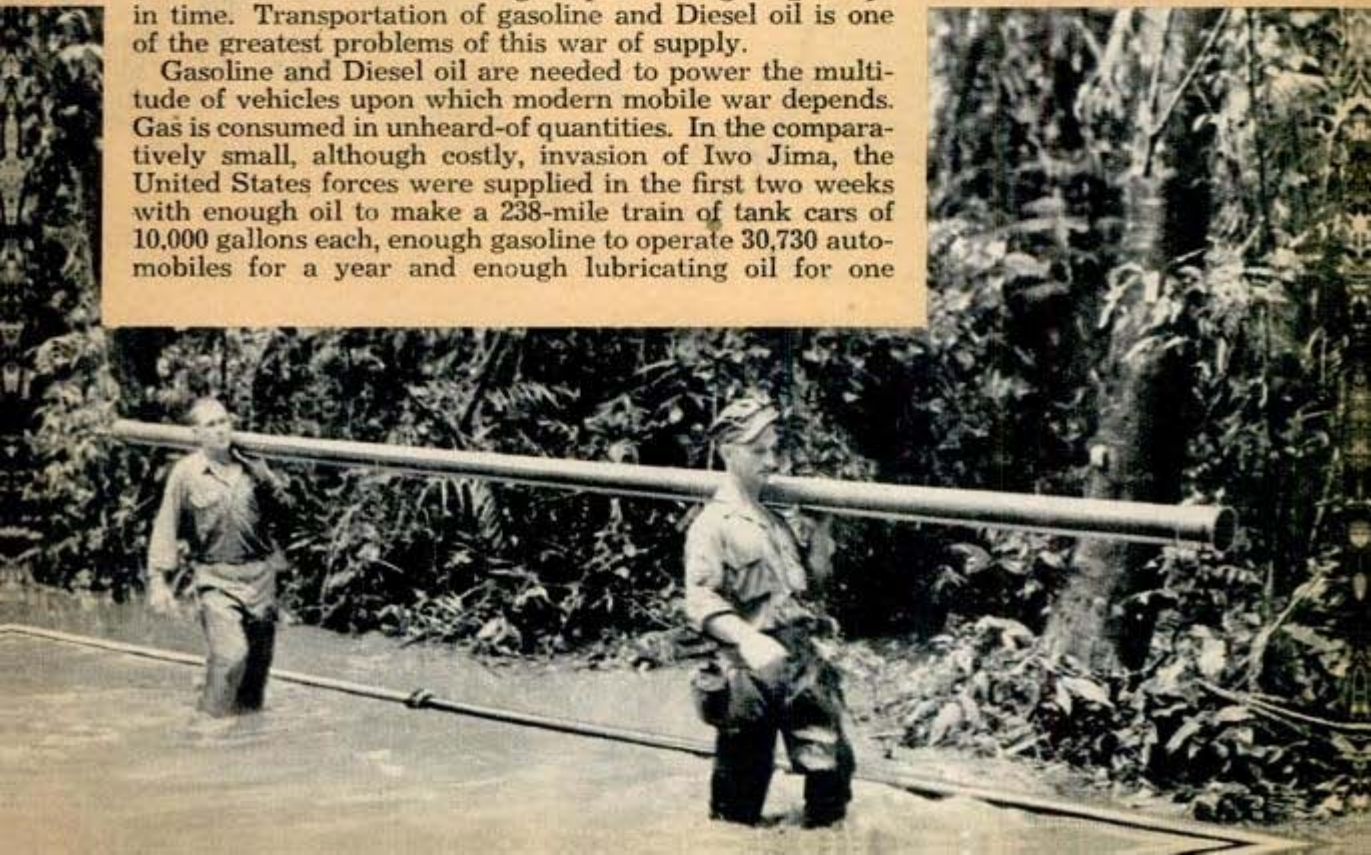
By Staff Sgt. John L. Kent

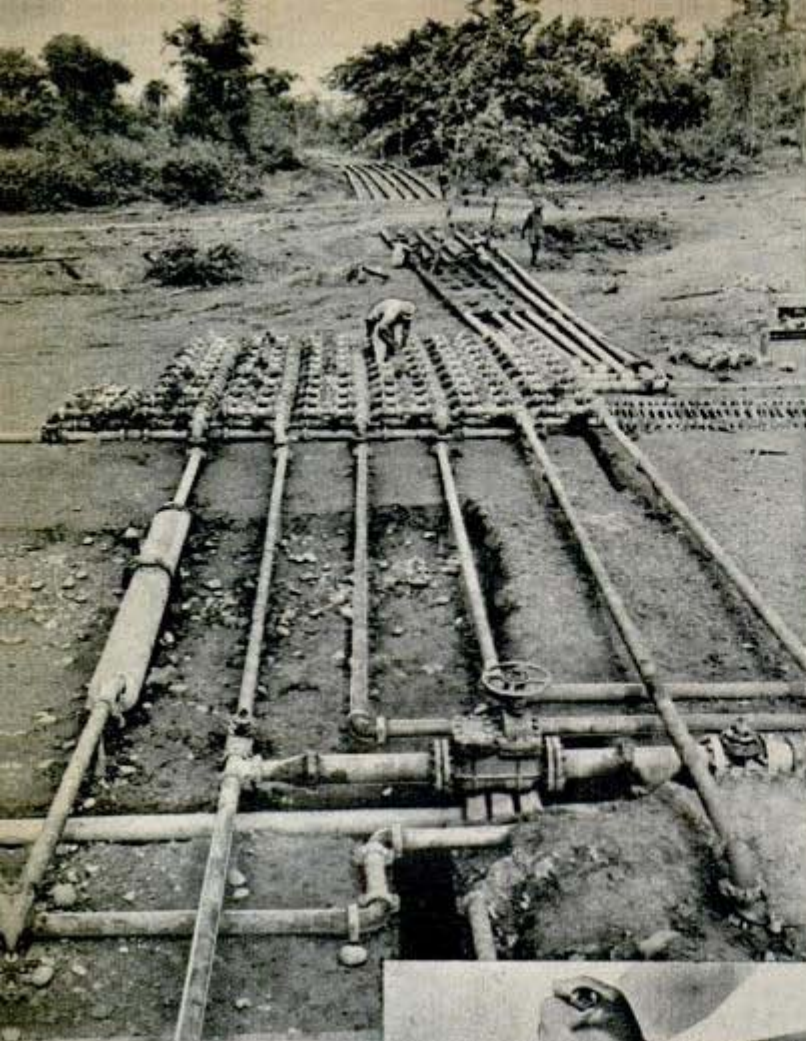
**I**T NOW may be told that General Patton's great 80-day dash across France was delayed at one point for a week because of lack of gasoline for his armored vehicles—gasoline of which there was plenty in the depots in the United States and England, and even at the captured French ports, but which could not be brought up to the fighting troops in time. Transportation of gasoline and Diesel oil is one of the greatest problems of this war of supply.

Gasoline and Diesel oil are needed to power the multitude of vehicles upon which modern mobile war depends. Gas is consumed in unheard-of quantities. In the comparatively small, although costly, invasion of Iwo Jima, the United States forces were supplied in the first two weeks with enough oil to make a 238-mile train of tank cars of 10,000 gallons each, enough gasoline to operate 30,730 automobiles for a year and enough lubricating oil for one



U. S. soldiers in Burma load 4-in. pipe on trucks. Below, toting pipe through jungle  
U. S. Signal Corps photo





Above, "switch yard" for pipe line from India was installed by U. S. Army Engineers. Right, bolts on the completed joint are tightened after rubber gasket ring has been slipped over end of pipe. Below, GI takes "pulse" of line at pressure gauge



complete change for 466,000 cars.

In China and Burma our Army is faced with supplying oil and gasoline in astronomical quantities for the coming showdown fight on the Asiatic continent. Truck supply could never take care of the needs even if roads were available—and they aren't! To move the gasoline from our bases in India over the only existing road—the newly built Ledo-Burma connection—more gas would be consumed by the truck than it would deliver.

To get gas to our troops in advance bases, a number of B-24 Liberator bombers were converted into gas cargo ships known as C-109s to fly a shuttle route from India to Myitkyina, Burma. From there the gas and oil is delivered by truck to forward areas, or used to fuel the planes at the Myitkyina air base.

Superfortresses, too, have been converted into fuel carriers. Without their turrets or waist windows, they fly from the sup-

ply depots in India to camouflaged fields in Burma and China.

Transportation of gasoline and oil by this method is not only extremely expensive, but the amount of gasoline and oil so delivered is the proverbial "drop in a bucket." It is a makeshift method born of the necessity of getting any amount, no matter how small, to the Chinese infantry and our Air Forces in southern China. The Army finally decided that the problem could be solved only by pipe line.



Army Air Force photo

Precious gasoline is unloaded from C-109 (Liberator converted for fuel cargo) on airstrip at Myitkyina, Burma

The Army had built small pipe lines in France which helped to power the invasion forces driving into Germany but no pipe line thus far built compares with the giant link now nearing completion in China-Burma-India theater. No one knows exactly how long the pipe line will be ultimately. It may cover 2,000 miles and stretch from Calcutta, India, north and east to Kunming.

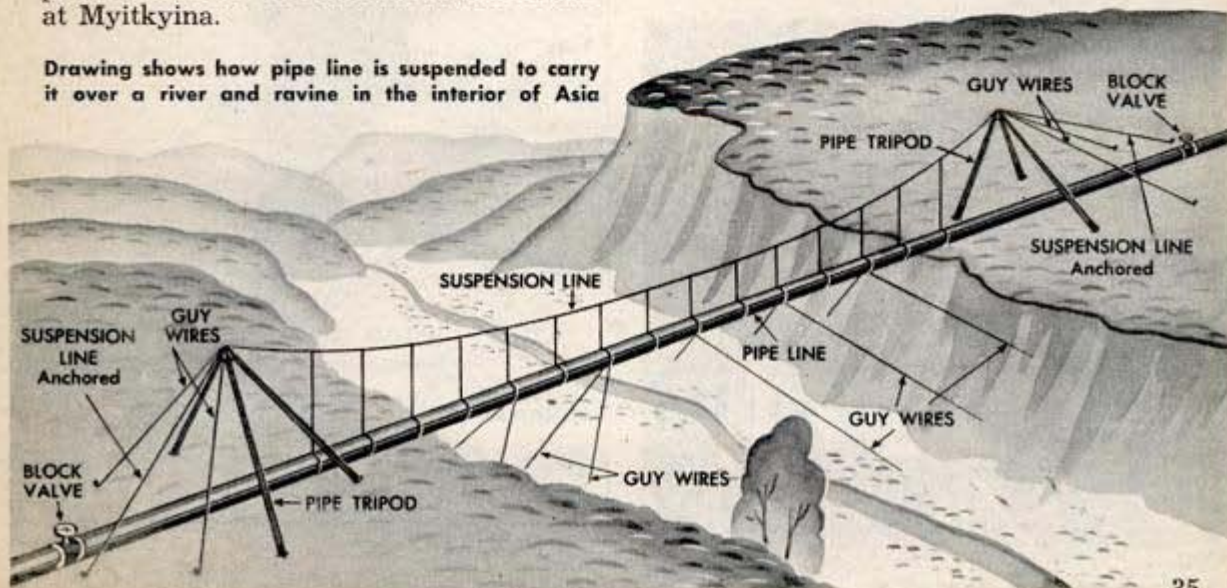
Material for the part of the line being built in the Assam area began to arrive at the Allied base of Ledo in early fall of 1943. By early December, 1944, one third of the line was in operation, and by January, 1945, motor gas, aviation gas, and Diesel fuel were being dispensed at all required points between Ledo and the advance base at Myitkyina.

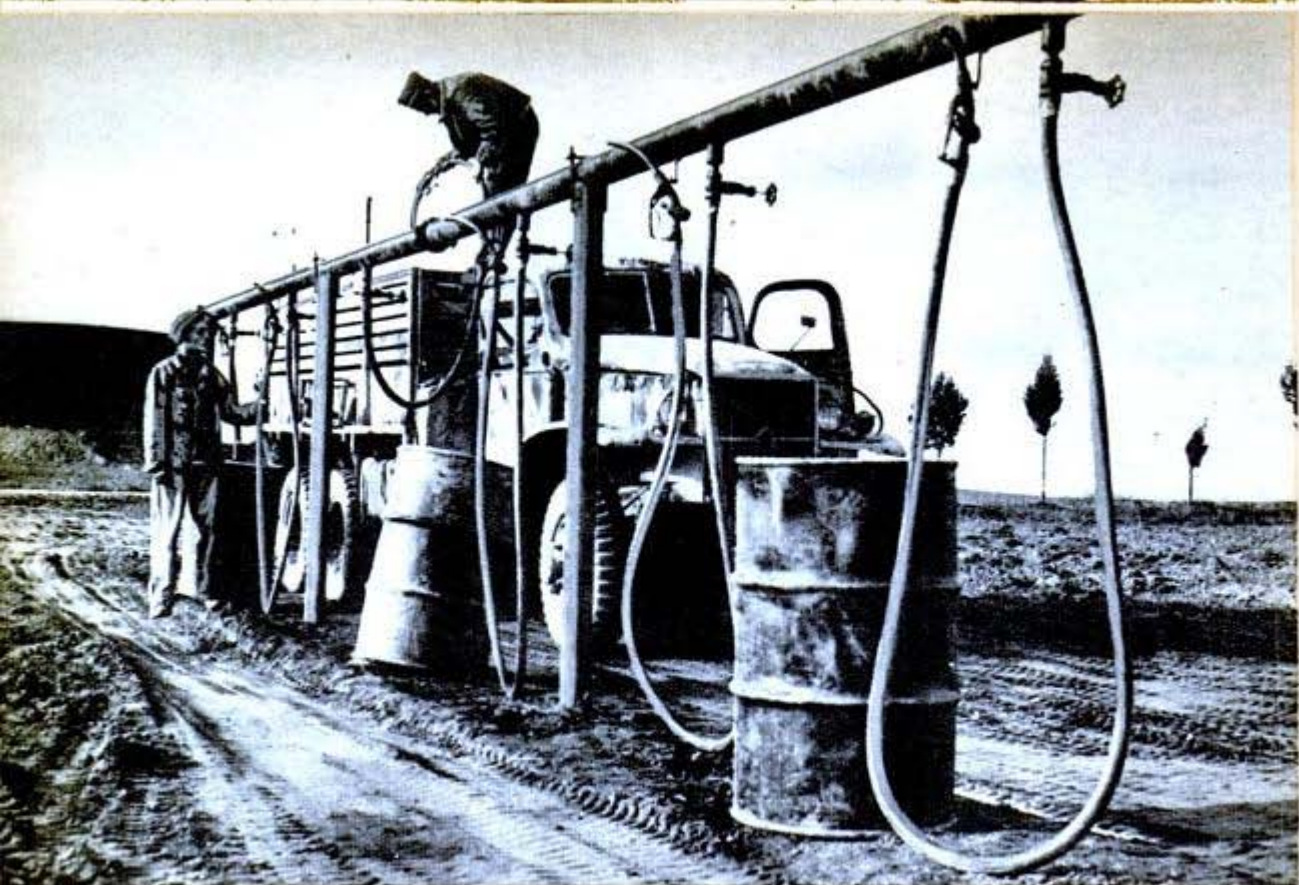
In southeast Asia heat, tropical rains, leeches, malarial mosquitoes and other insects made life for the engineers a hell on earth. Malaria control units had to be attached to the construction battalions. Drainage ditches were dug and slow-moving streams in the vicinity of camps were sprayed with oil to kill the mosquito larvae.

At one time 7,000 coolies were helping the United States forces in building the line. Later there was aid from the Indian Pioneer Corps. The 10th U. S. Army Air Force rendered valuable service by dropping rations, medical necessities and mail to detachments working in otherwise inaccessible places.

Official visitors have brought back praise

Drawing shows how pipe line is suspended to carry it over a river and ravine in the interior of Asia





A wartime filling station in Italy. With no pipe lines laid, fuel cans had to be supplied tediously by truck

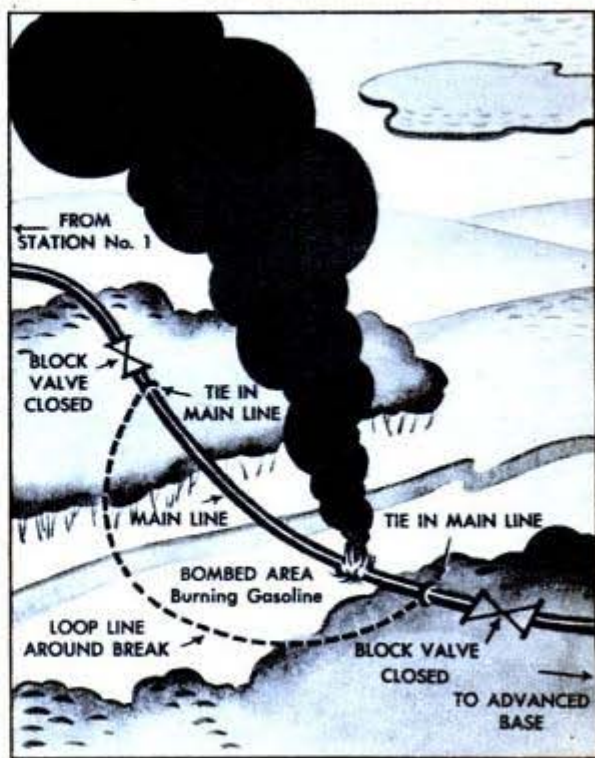
for this Army engineering feat. Congressman Mansfield of Montana told the House of Representatives about the "epic job" of the American engineers in the Burma jungles. He spoke of sections where the pipe was trucked as far as it would go and then dragged by bulldozers. Rafts and pontoons with outboard motors were called upon when pipe had to cross the thousand swamps and streams. Over the numerous ravines, the pipe had to be hung on cables.

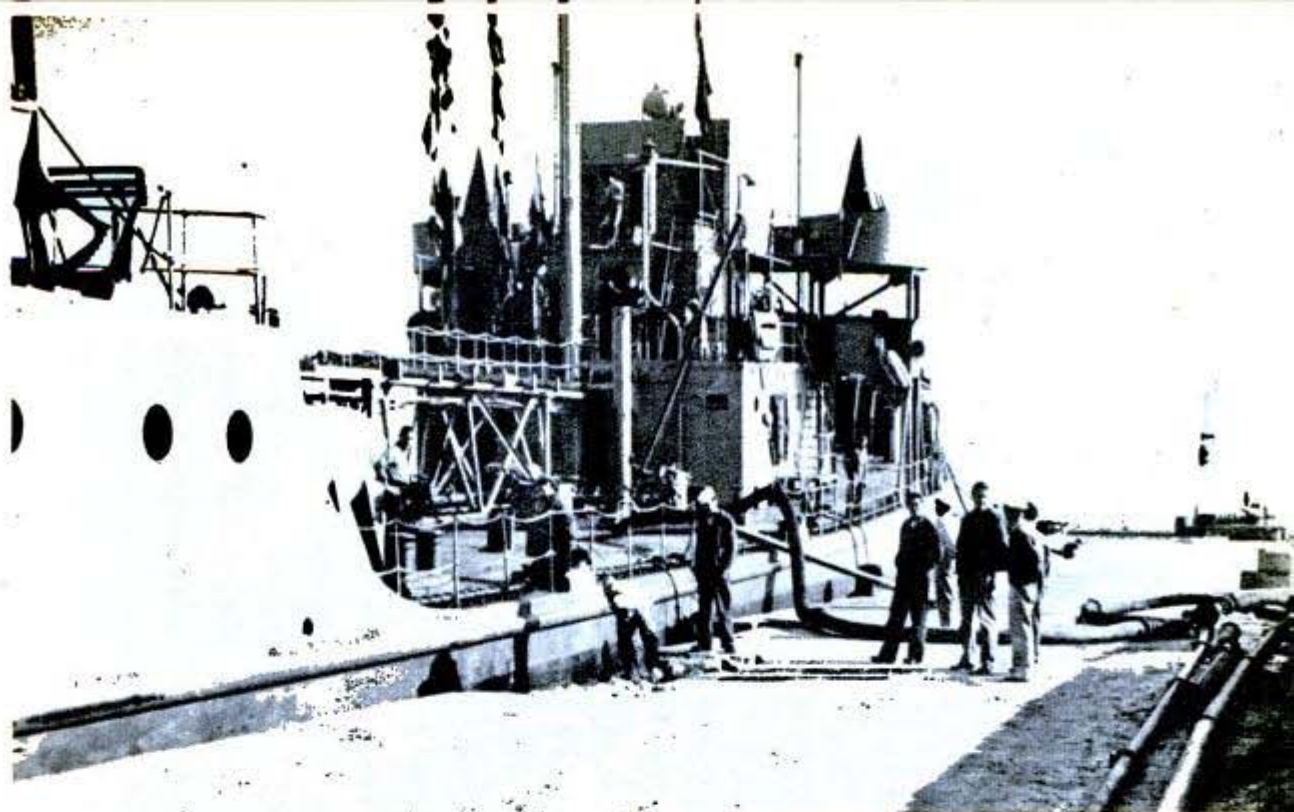
Pipe lines are used because they can send

Below, engineers laden with pipe plod into jungle. Right, map shows how pipe break is bypassed

liquids rapidly over terrain too rugged or distances too long for other means of transportation and relieve congestion where road capacity is limited. All these conditions are present in the China-Burma-India theater.

Military pipe lines are usually laid out along a course which provides maximum





Tanker discharges cargo at overseas port. Right, sample is taken from pipe to test quality of oil

concealment from enemy observation. Small brush may be an inconvenience in laying the line but it is left undisturbed because it provides camouflage. Lightweight pipe of the spiral or longitudinal weld types is commonly used. All pipe is grooved on each end to accommodate the Victaulic type of coupling and is supplied in standard lengths of 20 feet.

This Victaulic coupling has made possible the speedy construction of military pipe lines even on unstable ground. The coupling allows for angular deflection and for contraction and expansion of the line. The ease with which it may be connected and disconnected has made the coupling the standard jointing device for all our pipe lines. It requires only one tool, a wrench.

(Continued to page 148)



Superfortress converted to transport gasoline in India and China is minus turret and waist windows





## Plane Carries Tank Under Its Belly

Tanks may look massive and cumbersome but they can be whisked through the sky just like ordinary cargo by the Douglas Skymaster, long-range, four-motor transport plane. The Douglas Aircraft Company and the Army Air Force Technical Service Command worked out an arrangement in which the light T-9 tank's 2,000-pound turret is stored in the plane's tail, while the tank itself is hoisted to the belly of the C-54 by two hydraulic pumps and snapped to a special rack. Slinging the tank to the belly and take-off for flight require but six minutes. A field gun can be hung under the ship in the same way.

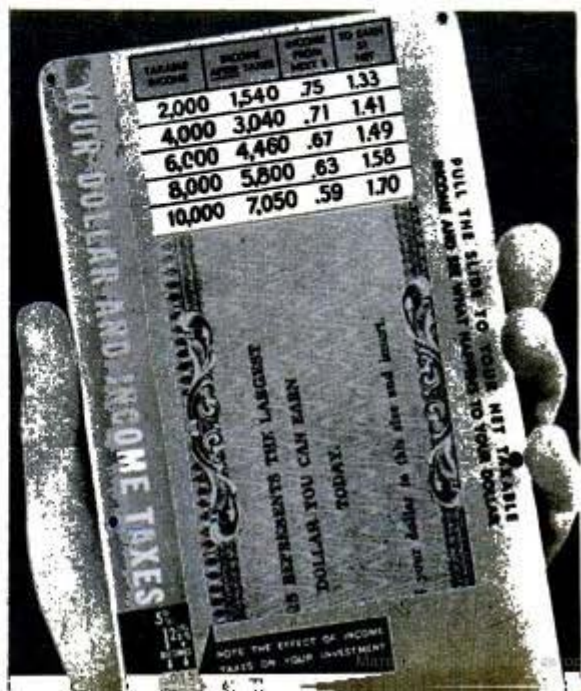
Left, above, tank turret is hoisted into plane's tail, after which the turretless tank is fastened to special rack beneath belly

## Gunners Talk While Firing With Gun-Grip Switch

B-17 gunners can talk to crew members over a throat microphone while firing at the enemy by flicking a switch on the machine-gun grip. The switch eliminates the connecting jack box for the microphone cable and is mounted on the gun adapter. Wiring is run directly to the plane's intercommunication system.

## Dollar Shrinks as You Watch Graphic Slide Rule Tax Calculator

Slide rule technique applied to a simple tax calculator gives a graphic—and somewhat painful—picture of the way your dollar shrinks as taxable income rises. Two pieces of cardboard are joined together, with a cutaway window showing taxable income, income after taxes, income from the next dollar, and the amount required to earn \$1 net for graduated stages of taxable income from \$2,000 to \$200,000. By fitting a dollar bill into a sliding insert, you can watch the dollar actually grow smaller as the income tax increases. For example, on a \$4,000 taxable income, the calculator shows income after taxes to be \$3,400, income from the next dollar to be 71 cents, and \$1.41 required to earn \$1 net. A slot at the left automatically gives the effect of income taxes on your investment return, 5 percent becoming 3.6 percent after taxes in the \$4,000 bracket.



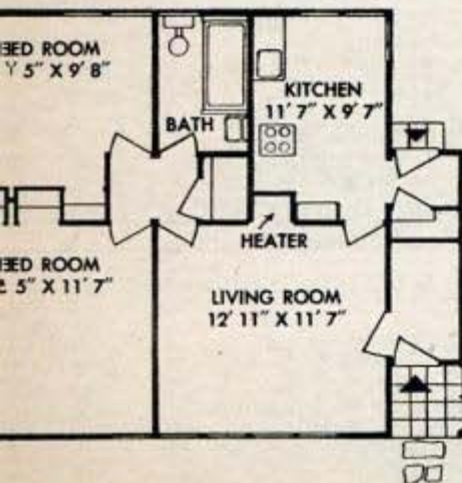


## "Blitz" Bungalows

To serve as temporary replacements for the millions of wrecked and damaged homes of our Allies, the Federal Public Housing Authority has designed a prefabricated "blitz" bungalow for shipment overseas. Thirty thousand of these homes are being manufactured by private contractors and shipped to England where in London, alone, only 10 percent of the population is living in undamaged homes.

The bungalows are constructed in panels which are easily crated to form compact cargo on shipboard. This type of construction makes it simple to assemble the houses, a vital factor in England's housing crisis due to a shortage of skilled construction labor.

The temporary houses, designed with the know-how gained by the federal agency in planning thousands of homes for war workers, are 24 feet square with flat roofs and without basements. Each contains two bedrooms, living room, kitchen and bath. Plumbing and plumbing fixtures are built in America and shipped with the houses, but wiring, heating and other equipment are installed in England. The construction price averages about \$1,310 with an additional cost of \$283 per unit for plumbing. Plans for the bungalows were worked out with British housing experts.



Even the floor of "blitz" bungalow is laid in sections. Here a sample house designed for Allies is being erected in Washington, D. C., park



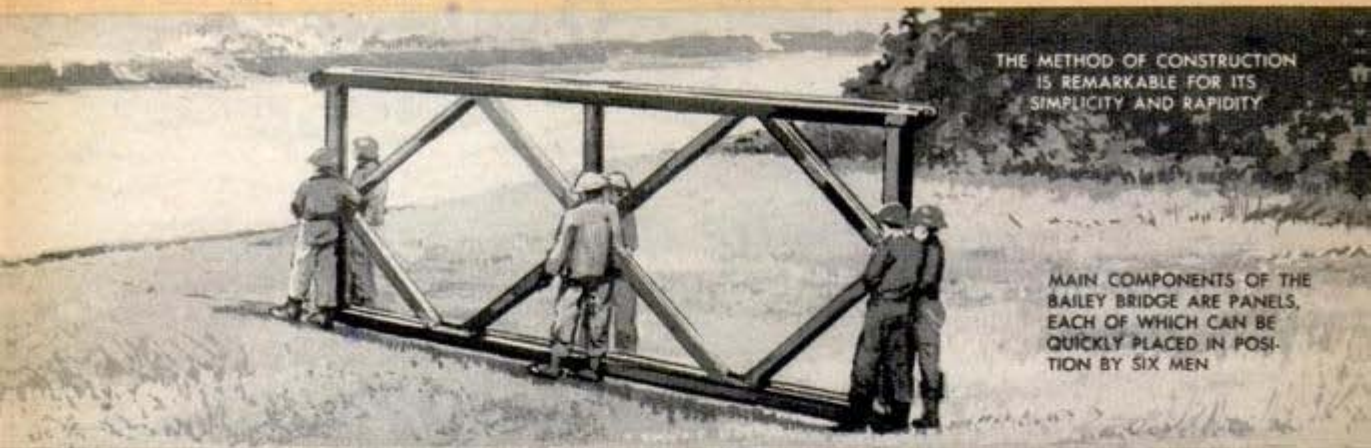
Above, workmen raise first of eight roof panels to proper level. Panelized construction makes job of assembly easy for unskilled workers



House nears completion (above) as panels for pantry and broom closet are raised into position. Below, completed four-room house designed as temporary home for British families has five cheery front windows



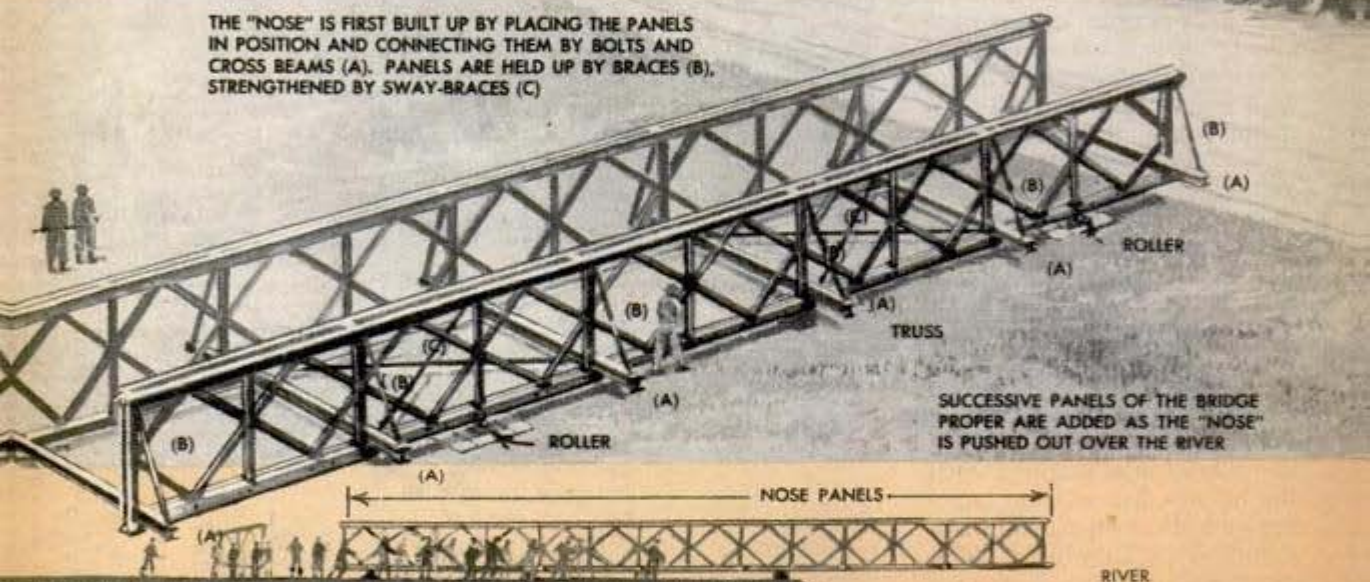
# Bailey Bridge Keeps Army Rolling Over Rivers



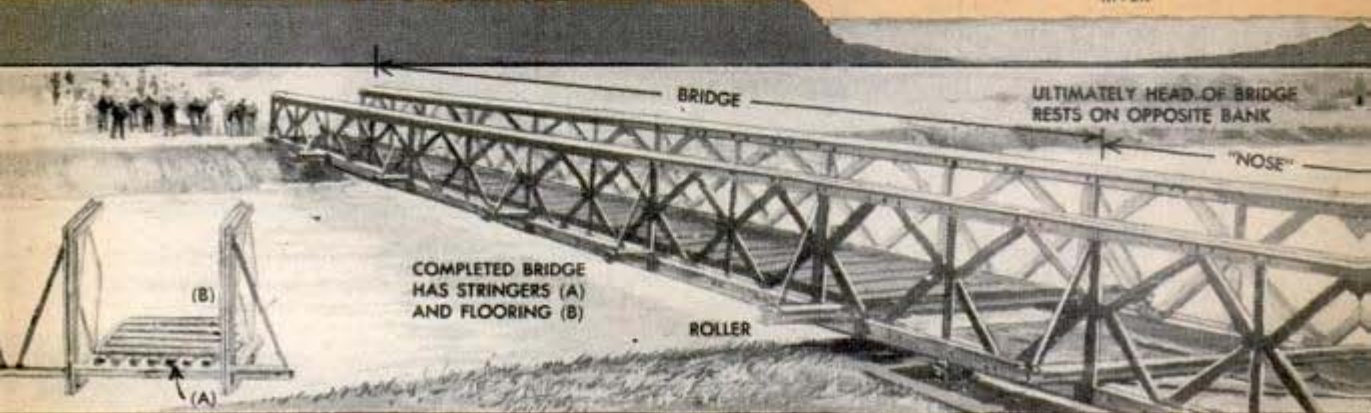
THE METHOD OF CONSTRUCTION IS REMARKABLE FOR ITS SIMPLICITY AND RAPIDITY

MAIN COMPONENTS OF THE BAILEY BRIDGE ARE PANELS, EACH OF WHICH CAN BE QUICKLY PLACED IN POSITION BY SIX MEN

THE "NOSE" IS FIRST BUILT UP BY PLACING THE PANELS IN POSITION AND CONNECTING THEM BY BOLTS AND CROSS BEAMS (A). PANELS ARE HELD UP BY BRACES (B), STRENGTHENED BY SWAY-BRACES (C)



SUCCESSIVE PANELS OF THE BRIDGE PROPER ARE ADDED AS THE "NOSE" IS PUSHED OUT OVER THE RIVER



COMPLETED BRIDGE HAS STRINGERS (A) AND FLOORING (B)

FINALLY, THE "NOSE" IS QUICKLY DISMANTLED AND REMOVED, FOUNDATIONS SECURED AND THE BRIDGE IS READY FOR USE



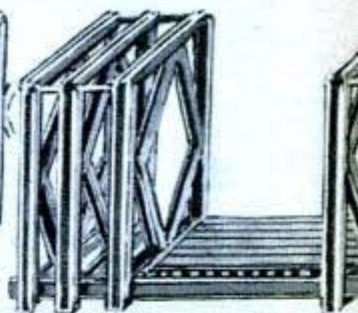
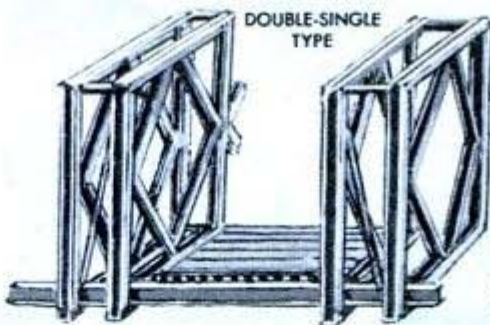
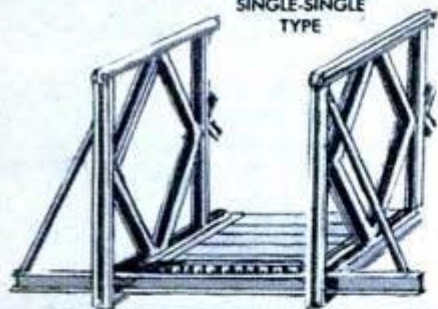
# Multiple Panels Fortify Span for Heavy Loads

VARIOUS FORMS OF BAILEY BRIDGES

TRIPLE-SINGLE TYPE

SINGLE-SINGLE TYPE

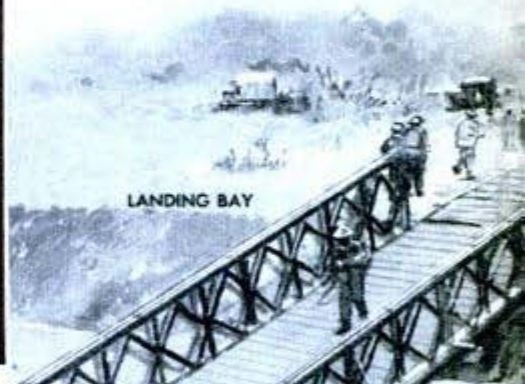
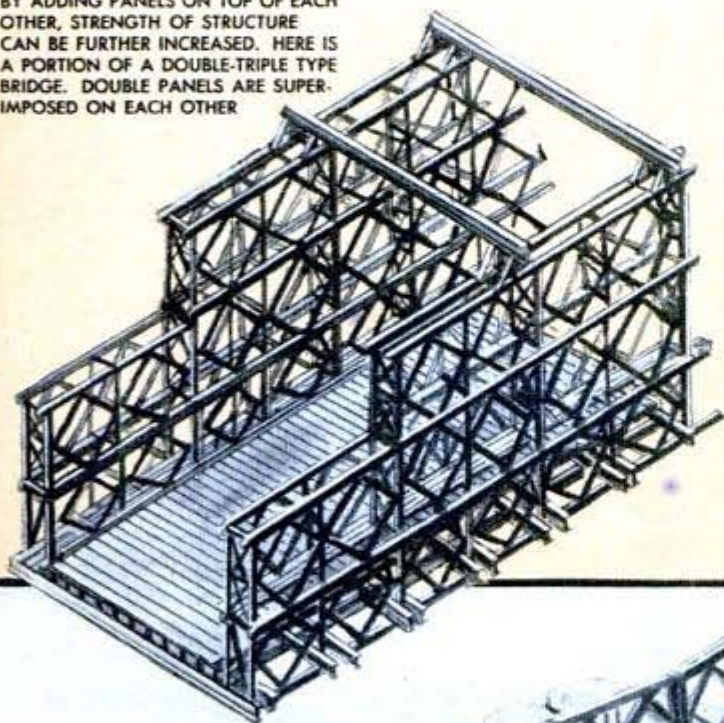
DOUBLE-SINGLE TYPE



BAILEY BRIDGE CAN BE INCREASED IN STRENGTH TO TAKE HEAVIER LOADS OR WIDER RIVERS BY DOUBLING AND TRIPLING PANELS

BY ADDING PANELS ON TOP OF EACH OTHER, STRENGTH OF STRUCTURE CAN BE FURTHER INCREASED. HERE IS A PORTION OF A DOUBLE-TRIPLE TYPE BRIDGE. DOUBLE PANELS ARE SUPER-IMPOSED ON EACH OTHER

THE BAILEY FLOATING BRIDGE IS USED FOR SPANNING WIDE RIVERS



LANDING BAY

FINAL FLOATING BAY

LANDING BAY SUPPORT, DISTRIBUTING THE LOAD OVER FOUR PONTONS

BAILEY FLOATING BRIDGE SPANNING A WIDE RIVER

G. HEAVY 19

## Gauge Warns if Engine Falters So Pilot Can Feather Prop



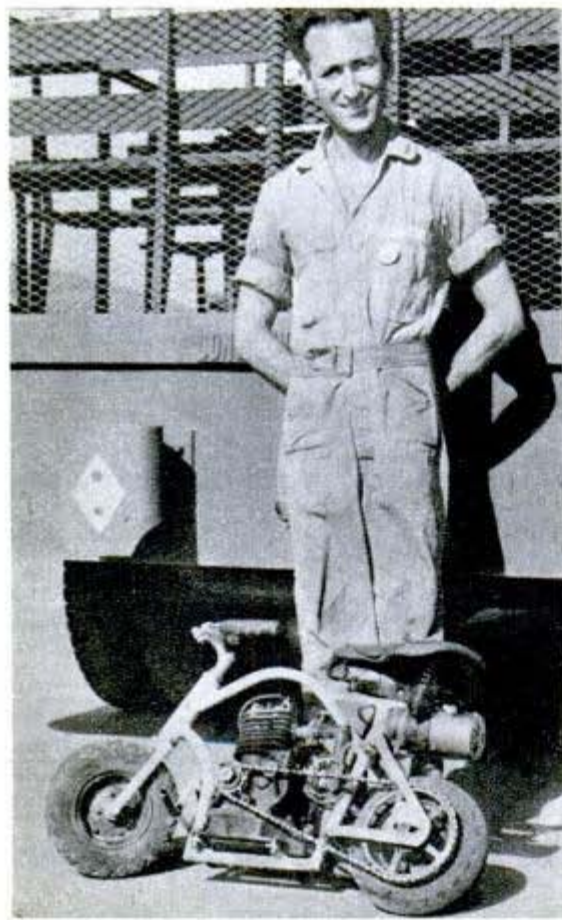
Calif. The device is a small rectangular metal box full of electrical equipment. It is installed adjacent to the carburetor of an airplane engine and its function is to measure the distance to which the engine is displaced when the propeller is rotating. By actuating a gauge inside the pilot's compartment, it shows more accurately than any other device how much horsepower the engine is putting out. If the engine begins to operate improperly, the gauge needle oscillates accordingly and a warning light glows on the pilot's panel, giving him plenty of time to cut the engines and feather the propeller. This elimi-

ates the possibility of an engine catching fire or tearing itself to pieces, and the danger of a windmilling propeller which makes a plane hard to control.

Pilots no longer need be caught unaware by failing engines, thanks to a performance indicator developed by the Consolidated-Vultee Aircraft Corporation at San Diego,

nates the possibility of an engine catching fire or tearing itself to pieces, and the danger of a windmilling propeller which makes a plane hard to control.

## Miniature Motorcycle Built From Junk Can Travel 40 Miles an Hour



Though it was made from junked parts and is no bigger than a toy, a midget motorcycle built by Sgt. James T. Calonico, of the Army Air Forces, can go 40 miles an hour. The machine is 24 inches long and 18 inches high and weighs 70 pounds. Using an old three-quarter horsepower gasoline engine, Sgt. Calonico rigged up a bicycle chain and sprockets that give it a 3.5 to 1 gear ratio. A discarded fire extinguisher serves as a gas tank.

## Surgical Sponges Made of Starch Left to Dissolve in Wounds

Surgical sponges made of starch may be placed inside wounds and left there until they are absorbed, an investigation by the U. S. Department of Agriculture at Peoria, Ill., has discovered. The sponges are made of starch paste slowly frozen and then thawed. A dry starch sponge, though hard and brittle, will absorb about 15 to 18 times its weight of liquid; when wet, the sponge is pliable, retaining most of the liquid if handled gently, but it dissolves in blood serum. If a starch sponge were inserted, wounds and incisions could be left to heal undisturbed. The sponge may be filled with penicillin or a sulfa drug, which will be released gradually as the starch dissolves.

## Wire Recorder Magazine Will Plug Into Radio

Wire recorders with magazines, or cartridges, for easy loading will be on the market for home use after the war. The package recorder is self-contained and plugs into the radio cabinet. The simple method of loading, similar to that in home movie cameras, replaces the system in which an operator had to handle the thin wire, making it subject to kinkage and breakage. The wire, which moves across the poles of a magnet, records and reproduces voice, music and other sounds with high fidelity. The sounds can be "erased" at will and the wire used over and over again indefinitely. With the simplified home unit, it will be possible to take programs off the air in the living room and play them back immediately. The playing time of the magazines runs from 15 minutes to an hour or longer. The magazine-style recorder also can be used for office dictation, for the recording of telephone conversation and in schools.

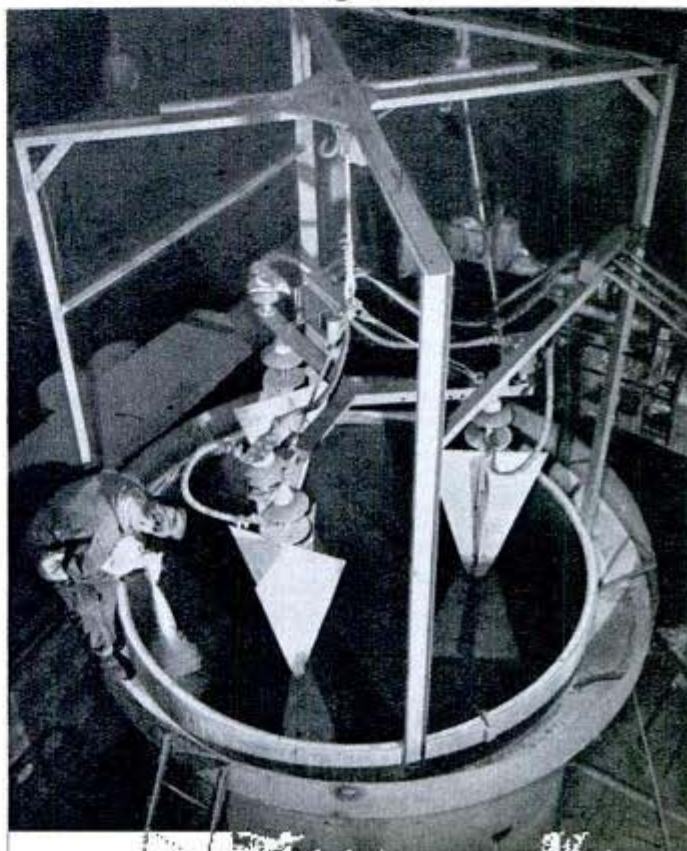


Above, girl "takes down" program on wire recorder magazine plugged into radio. Right, magazine unit is quickly detached

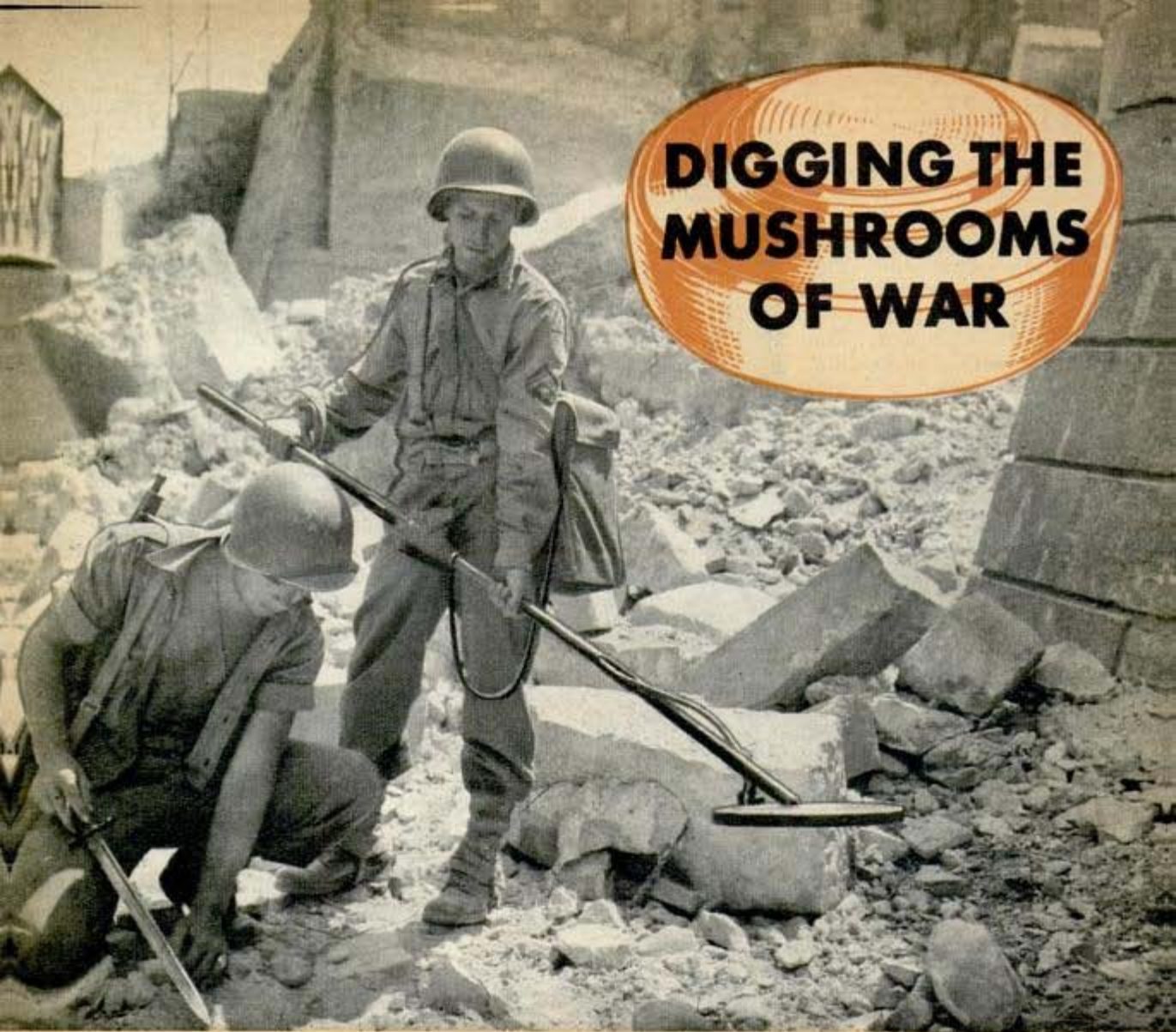


## Table Salt "Burns" Kilowatts in Testing Odd Generators

By pouring 300 pounds of ordinary table salt into a 4,000-gallon tank of water, thousands of kilowatts generated during the testing of portable power plants for the Army can be "thrown away." The current from a Diesel generator flows through cables to triangular electrodes which are lowered into the saline solution. The lower the electrodes and the greater the salt content, the more load is placed on the generator, literally "burning up" the current as it is tested. The units will be used to supply emergency power in areas where power stations were destroyed by retreating armies. Because the generators have an odd cycle output to conform with European power systems, the salting method had to be employed to dissipate current produced during test runs.



Current from Diesel generator goes to triangular electrodes sunk in salted water



## DIGGING THE MUSHROOMS OF WAR

Engineers use electrical mine detector and bayonet as digging tool in hunt for lethal mushrooms of warfare

**A**LL Army engineers' work is dangerous, but the special troops who remove land mines planted by the retreating enemy have the toughest job of all. Since all wheeled and tracked vehicles are vulnerable, the Army's Corps of Engineers has specially trained mine reconnaissance detachments which are sent ahead of troops and tanks to locate and remove mines.

Their work is done at night, for the enemy may have machine guns and snipers posted to prevent just such reconnaissance and removal. It must be done silently so as not to warn the enemy we are near.

The enemy lays anti-tank and antipersonnel mines at every opportunity and at every possible place. Roads, approaches to bridges and possible ferry crossings are sown with mines. The Germans laid out

**War has ended in Europe, yet for years death will spring from the soil where Nazis planted their deadly mushrooms. More than 100,000,000 land mines were sown over 300,000 acres of French farmland. In Belgium alone mines take a dozen lives a day**

whole fields of them, sometimes in orderly sequence so as to form geometrical patterns, each mine buried so many meters from another and six inches deep in rows up to 200 yards long, like fields of mushrooms. Our troops found them everywhere—in North Africa, Sicily, Italy, France and Belgium.

In France, especially, the reconnaissance detachments had their hands full. It was only 3 p.m.—much too early to stop for bivouac—when the jeeps and trucks of a mine reconnaissance detachment preceding a battalion of medium tanks were ordered to halt. Even as the drivers left their vehicles, word was passed that the road farther up was blocked by concrete and log barricades at two points and the area around the road block sown with mines.



Bouncing Betty booby trap, above, jumps before it explodes. Straight detector at right reaches places disks can't enter

For six days, the engineers had been removing so many mines that they began to suspect them everywhere. The detachment commander, a middle-aged lieutenant who only two years before was mining copper in Colorado, went forward to investigate.

The evidence was there, all right! In spots the light rain of the night before had caused the earth to settle, and shallow circular depressions appeared wherever the mines were buried.

Orders were given to prepare for mine removal and the reconnaissance officer sent word of the obstacles to the tank commander, now probably

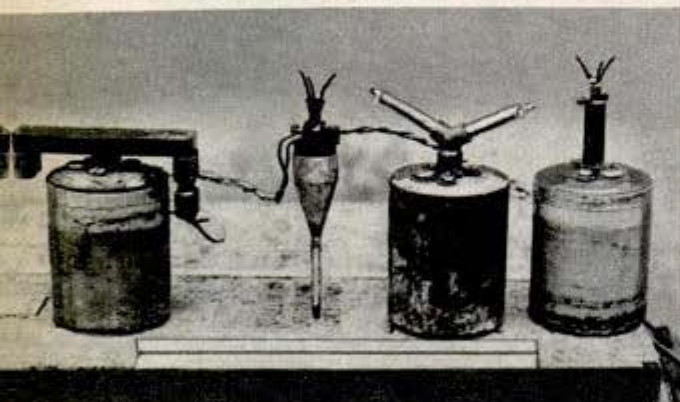


Contact with strings fastened to two fuses sets off mine below, left. Trip igniter in bottom of mine, center, explodes booby trap under it. Below, right, deft hands of an engineer make wooden box mine harmless





Mine platoon found deadly "clams" on beach above. Many had been attached to well planted booby traps



Mine at left above is connected to electric fuse. Center, with double fuse, and right, three-prong fuse. Below, engineer removes detonator of antitank mine



only 15 miles behind. While the tank battalion halted for the night, the engineers went to work.

To avoid detection, removal did not begin until after sunset. It was decided to clear a narrow gap or breach through the mine field on one side of the road.

What are these land mines? The Army defines them as encased charges of explosives fitted with detonating devices, or fuses, which explode when vehicles or foot troops pass over them.

There are two types, the larger the antitank mine, designed to stop tracked and wheeled vehicles and usually used in mine fields. The container is about six inches high and a foot in diameter. The detonator is screwed into the top, and sometimes at the side and bottom as well.

The smaller antipersonnel mine is used to produce casualties among personnel on foot. These are placed for specific tactical purposes, such as protection of the antitank mine field or other obstacle, so that when men on foot hunt the antitank mines they set off the smaller mines.

Usually mines must be made "safe" while still partly buried, and removed unexploded. Hand removal is slow and dangerous, and an accidental explosion causes loss of life and of secrecy as well. The operation is most delicate, as there is no limit to the diabolical ways devised by the enemy to make mines explode.



Mines are planted upside down, and booby traps are wired to the body of the mine, so that even after the fuse is rendered "safe," removal will explode the mine. Two mines may be buried together, and removal of the top one will explode the lower one. New types of fuses continually challenge the imagination of our engineers.

Experience has given the engineers a system for the expeditious removal of buried mines. Two groups are formed. The first or "detector" team locates the mines, and the second or "removal" team disarms and pulls the mines out of the ground.

The first team uses an electrical mine detector, a sensitive wired disk about a foot in diameter, on the end of a broomstick-like handle. With a sweeping motion, about eight inches from the ground, the operator covers the area, listening for any change in the intensity of the buzzing sound heard continually in the earphones connected to the device. When a mine is spotted, a marker is placed to guide the men on the "removal" team.

The job of this second team is about the most exacting in the Corps of Engineers. These men must place the "safety catch" on the fuses and separate the fuse from the mine to make it harmless.

But let's return to our halted reconnaissance detachments. As night fell, the mines systematically were located, marked, excavated, disarmed and moved outside of the white boundary tapes strung by the detector team to mark the width of the channel being cleared.

At 2 a.m. the lieutenant called a "break"—only 15 minutes, all the time that could be spared. The engineers had worked nearly six hours without a rest. Almost as one man they laid down tapes, pliers and detectors and crumpled exhausted to the ground. Some took out rations. Several started talking, almost in whispers.

Looking back, the engineers saw almost 200 feet of narrow passage set off by the silvery reflection of the two white tapes—the night's work so far.

Several neat piles of stones some 20 paces ahead showed that the mine field ended there. The Germans had forgotten to remove these warning signs to their own men.

Two men on the detector team rose and picked up their instruments. The others followed although no order had been given. They knew a whole battalion of tanks spread out alongside the road some 20 kilometers back had to get through the mine field—and soon.

With their bayonets and bare hands, the engineers started digging again. The sergeant on the left team signaled that he had found an upside-down mine. The men

(Continued to page 150)

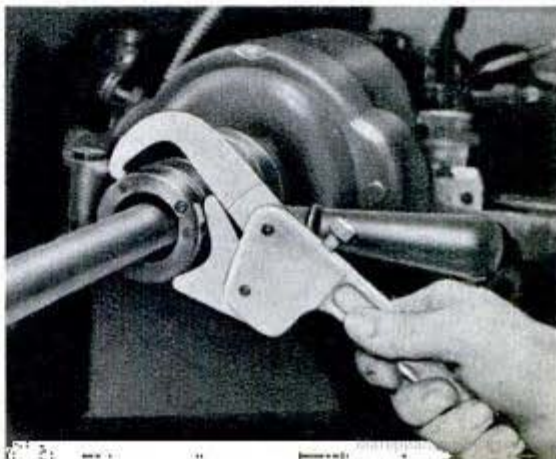


### Shell Cases Stay in the Scrap As Liberty Ship Propellers

Shell cases which already have taken a crack at the Axis remain in the fight by becoming the principal ingredient for manganese-bronze ingots used in casting Liberty Ship propellers. Spent cases were reclaimed and cast into 23-ton propellers for ships at the Doran Foundry in Seattle.

### Self-Adjusting Spanner Wrench Exerts Uniform Pressure

Several old-style, solid-type spanner nut wrenches can be replaced by a single versatile spanner wrench which is self-adjusting. Engineered to withstand high leverage factors, the wrench has a chrome molybdenum hook, hardened alloy steel seating jaw and a forged alloy steel handle. The three-point toggle action of the movable jaws exerts uniform pressure at geometrically spaced points and positively eliminates distortion or crushing of even the softest of alloy metal spanner nuts. Three models cover a wide range of diameters.

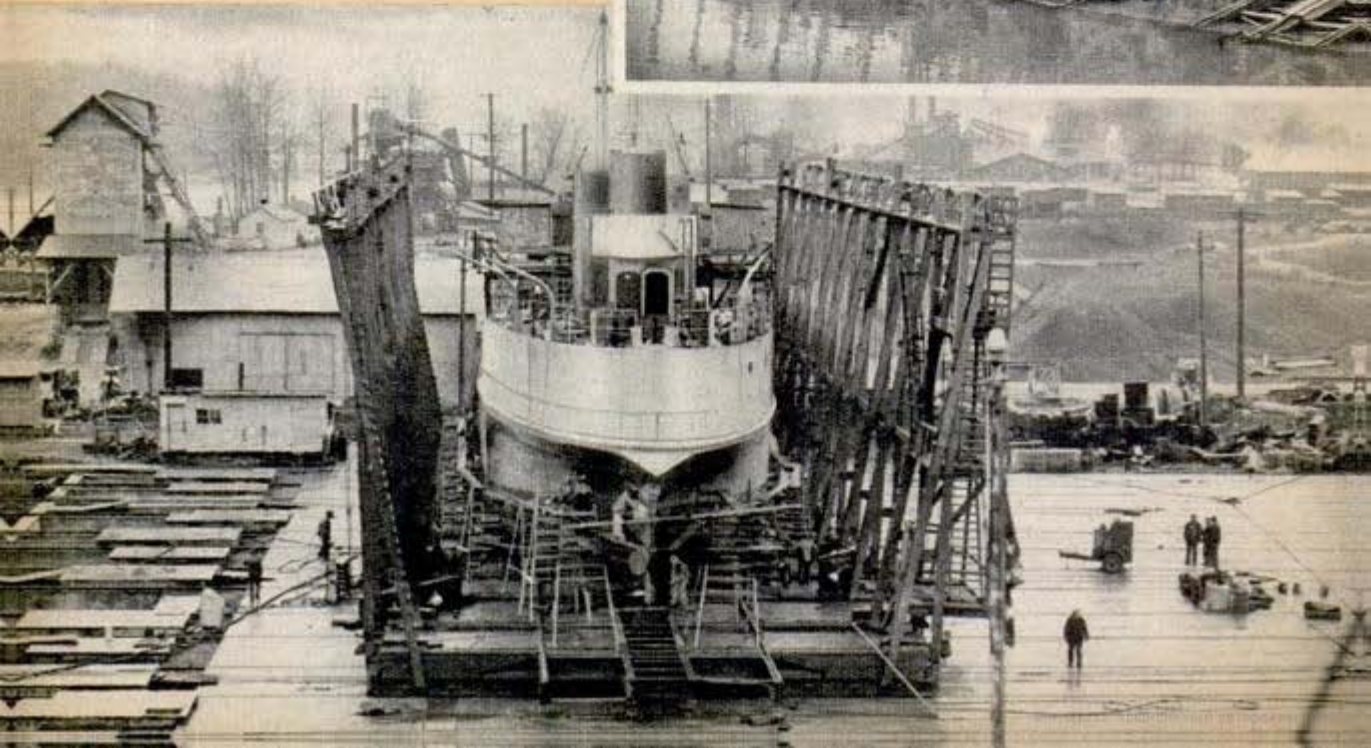
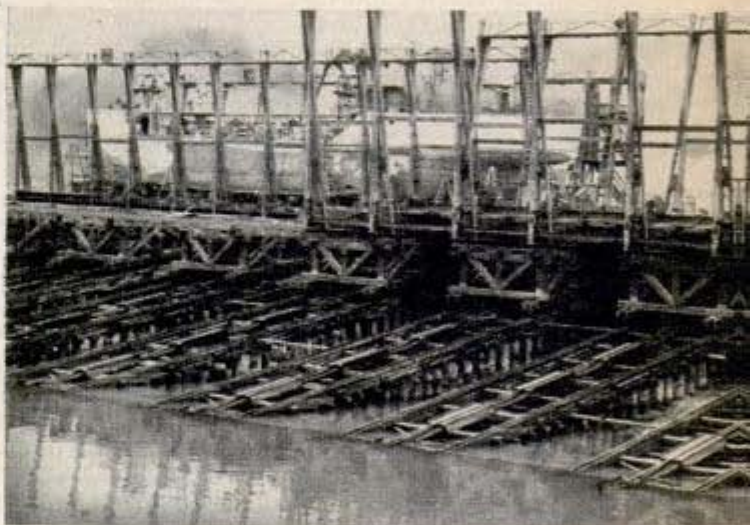


# *Ships* ON WHEELS



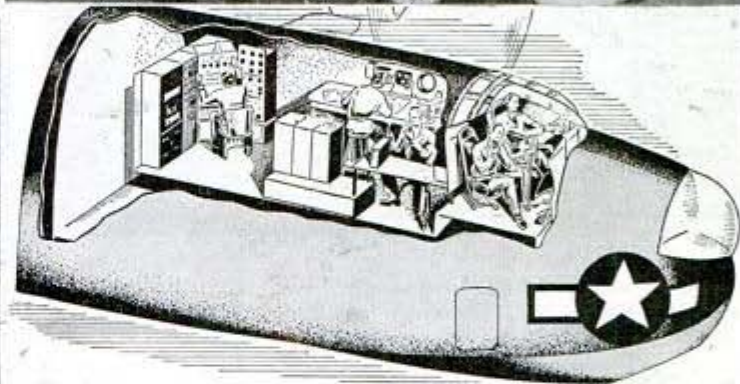
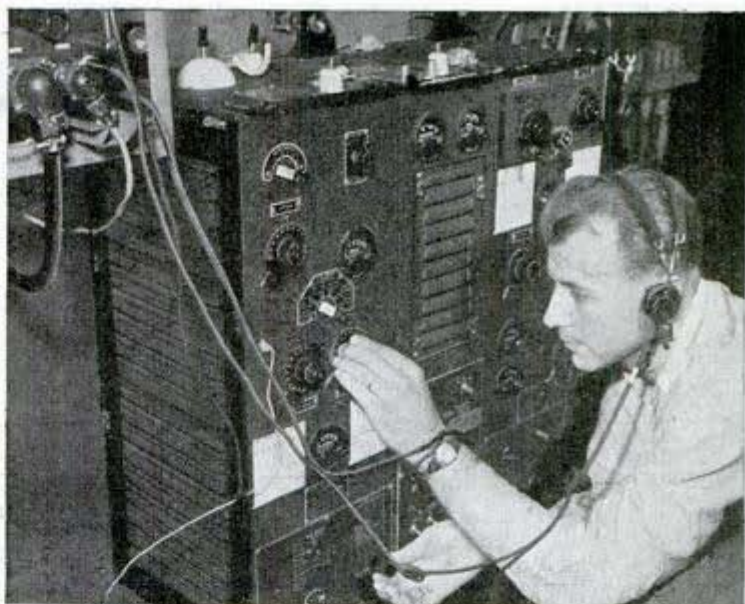
Cradles (above) rest on the shore while iron wheels are removed and greased. Below, two of the cradles, one carrying a ship, are ready to slide down the rails into water

Giant timber cradles moving on a railway that is partly under water haul U. S. Navy ships sidewise out of the Willamette River at Portland, Ore., onto the shore for repairs. The 12-track railway, which covers 14½ acres, extends 329 feet from shore to a depth of 40 feet. Bilge blocks operated by winches support the vessel while the ship-laden cradle is pulled ashore by chains. The ship above has had its cradle removed. The one below is still in its cradle while repair crews work on scaffoldings. Railway handles 400-foot vessels and top capacity of repair yard is 7 ships



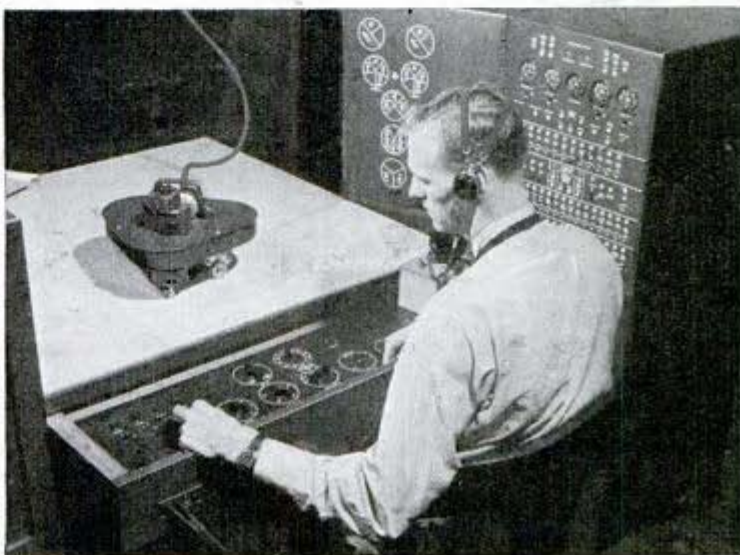
# PBM Crew Flies Test Run in Stationary Cockpit

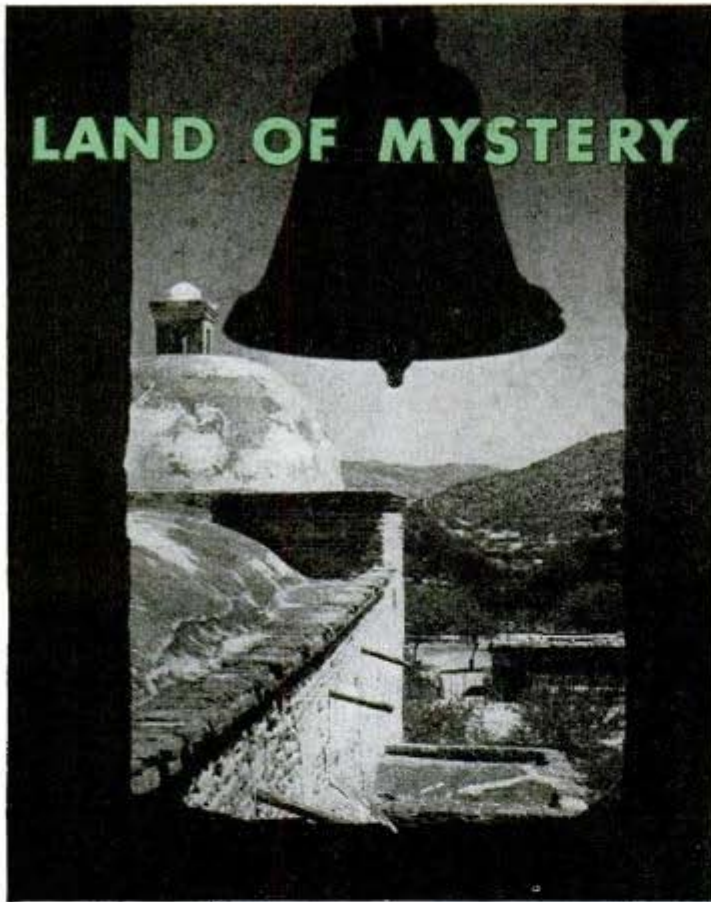
For newly trained Naval Air Transport Service crews at Patuxent, Md., the rehearsal "flight" offers plenty of problems but no hazards. The test is given in a realistic mock-up of a PBM flying boat's nose compartment jammed with electronic devices. The grounded "ship" has complete equipment for pilot, navigator, radioman and engineer. The navigator's desk, for example, has a chart table, an air speed indicator, a compass, a clock and a drift indicator through which he sees how the earth would look passing below. From a desk outside the cockpit the instructor introduces emergencies such as



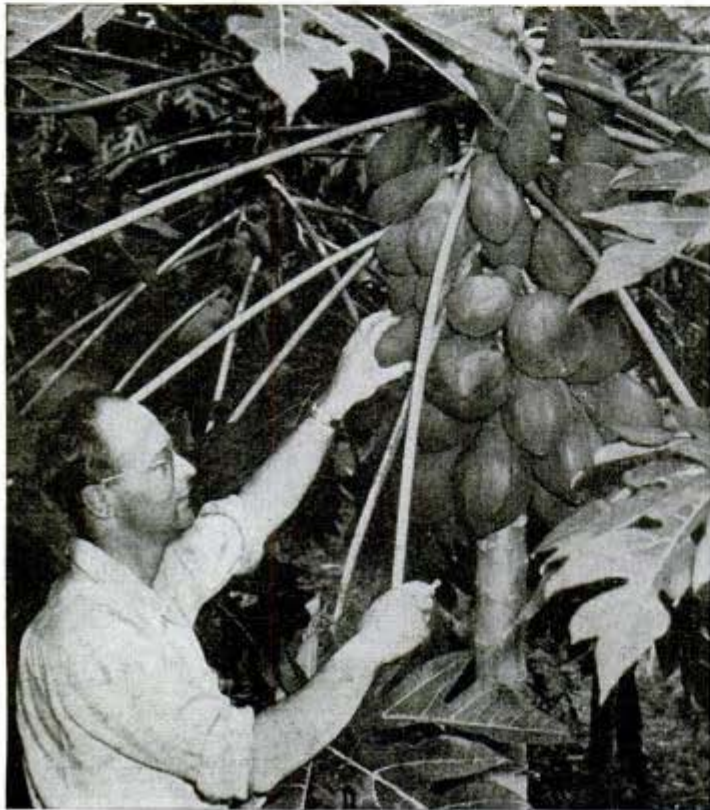
Left, a supervisor acts as pilot to demonstrate cockpit procedure in PBM flight trainer. Top, radio operator has same equipment as an actual plane. Above, cutaway drawing shows that the trainer is exactly like the nose of a real PBM flying boat, only it can't fly. Below, flight instructor at his desk, where, with switches and dials, he creates operational problems for the crew

engine failure, icing, rough air or fouled-up fuel system. Electronic controls and switches translate the plane's reactions into instrument readings and warning signals to the crew. Watching duplicate instruments, the instructor can tell how the flyers are meeting the trouble he continually creates. To give the crew the feel of flying, engine noise and hull vibration are reproduced. The trainer, which has 60 motors, 220 tubes, and eight miles of wire, was designed to protect lives and equipment formerly risked during rehearsals.





Bell tower of old mission provides a frame for this glimpse of Lower California. Tropic papaya fruit thrives in Mexico, below



**S**IDE by side with one of the world's ultracivilized spots there lies a land of deep mystery, an oddity of this modern age.

Southern California and its Hollywood are known the whole world over but Baja or Lower California, its neighbor next door, is virtually unexplored. Baja California is one of the wildest and least known portions of the globe.

This 800-mile-long peninsula parallels the west coast of Mexico from just below San Diego to south of the Tropic of Cancer. Mountain ranges that rise 10,000 feet above sea level form its backbone. Part of the peninsula is an arid desert, other parts are covered with lush tropical jungle growths. It's a biological, zoological and mineralogical wonderland, say scientists who have visited it.

There are mountains of pure marble on the peninsula. Rich deposits of gold, silver and other metals have been found in the ranges. Some cacti in its deserts grow 60 feet tall; others hug the ground like giant snakes. In certain cactus regions natives and their horses wear thick leather armor to ward off the spines.

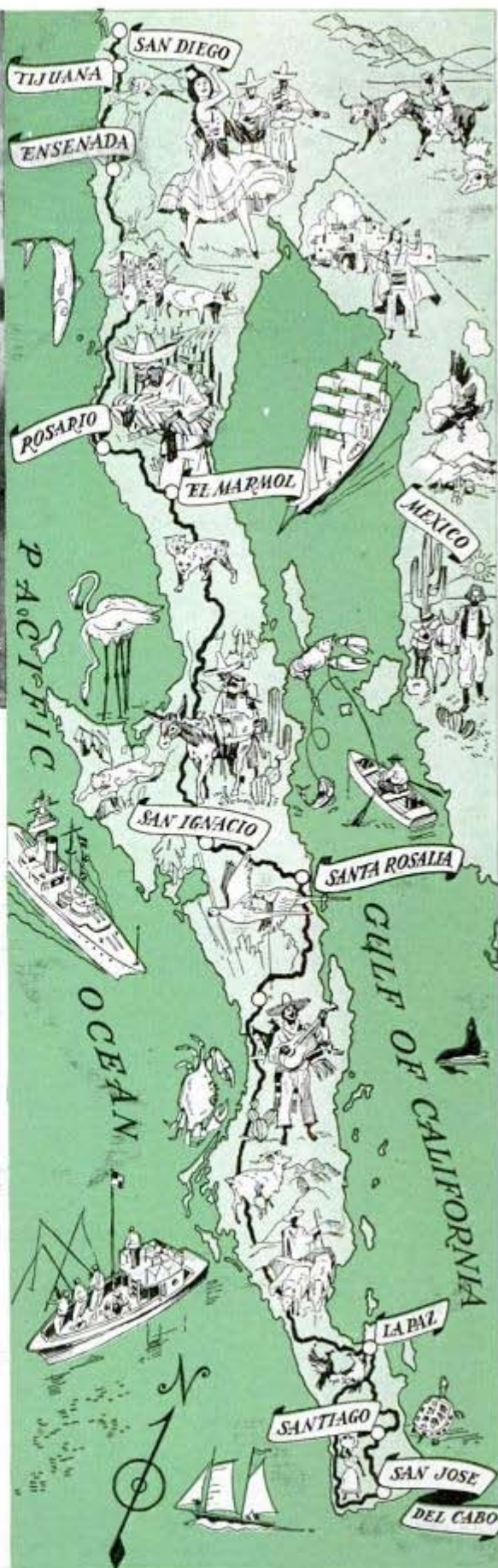


Indian woman in homemade boat displays pearls found in Gulf. Much of road on map is impassable

The population, largely native Indians, amounts to only two persons per square mile. Most of these live in Tijuana, Mexicali and other northern border towns or at La Paz and similar villages near the southern tip of the peninsula. You could travel for days without seeing another human, but you rarely would be out of sight of animals and birds. The peninsula's large animal population includes deer, antelope, bighorn mountain sheep and puma. Quail, dove, ducks and geese abound. Hunting on the peninsula compares with hunting in the western United States a century ago.

Much of the tuna consumed in the United States is caught in the ocean off Lower California. Whales, sea lions and seal are plentiful in the tropical waters. The Gulf of California is a fishing paradise of swordfish and sailfish, manta rays that weigh up to a ton and a half, sea turtles and many lesser known varieties of ocean life. Oysters grow to the size of large platters along the shores and some contain valuable black pearls that are found nowhere else in the world.

There are stories that a race of giants once populated Lower California and there also are stories that an Indian tribe on an island in the Gulf engaged in cannibalism until a few years ago. Some





Crude still on beach produces drinking water from the sea

larger islands contain the ruins of stone buildings that existed before the discovery of America.

Lower California was partly explored two centuries ago by the Spaniards. A string of missions was established, extending later as far north as San Francisco Bay. The Spaniards found a few gold deposits that the natives had worked and they extracted considerable gold themselves.

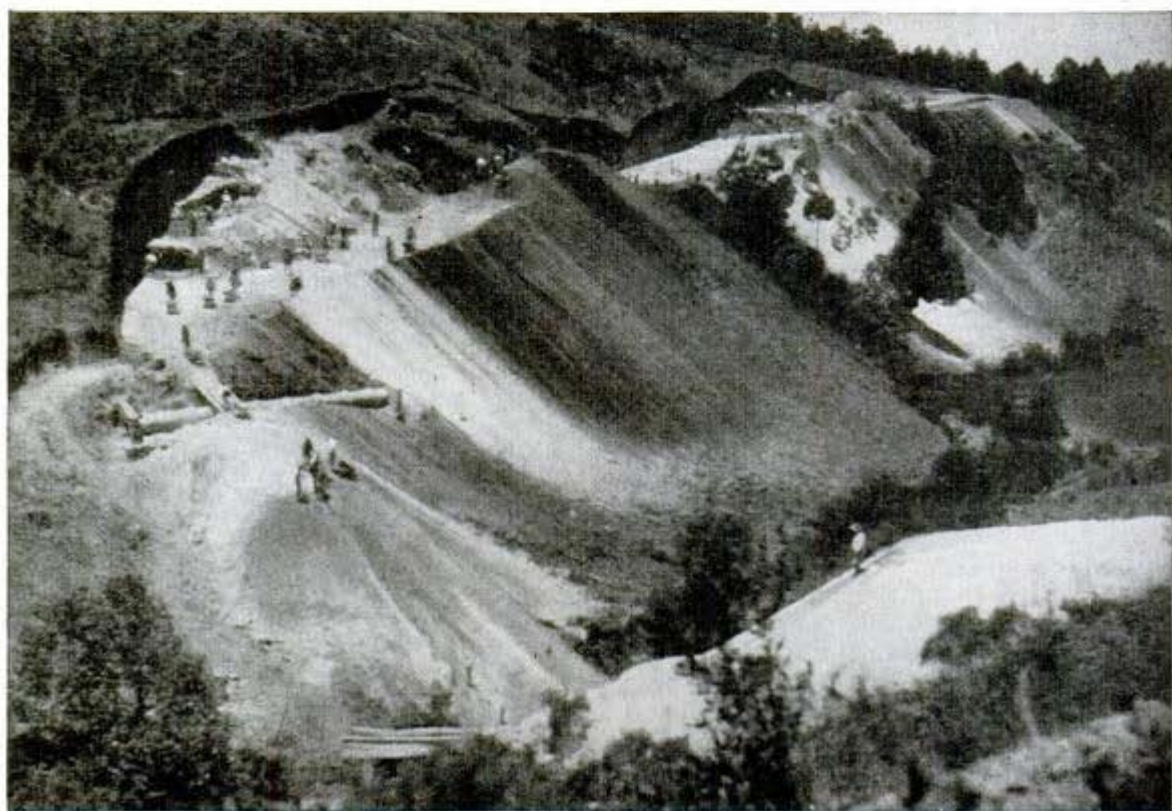
Later the missions were abandoned and the peninsula has been practically dormant since. There is little agriculture because

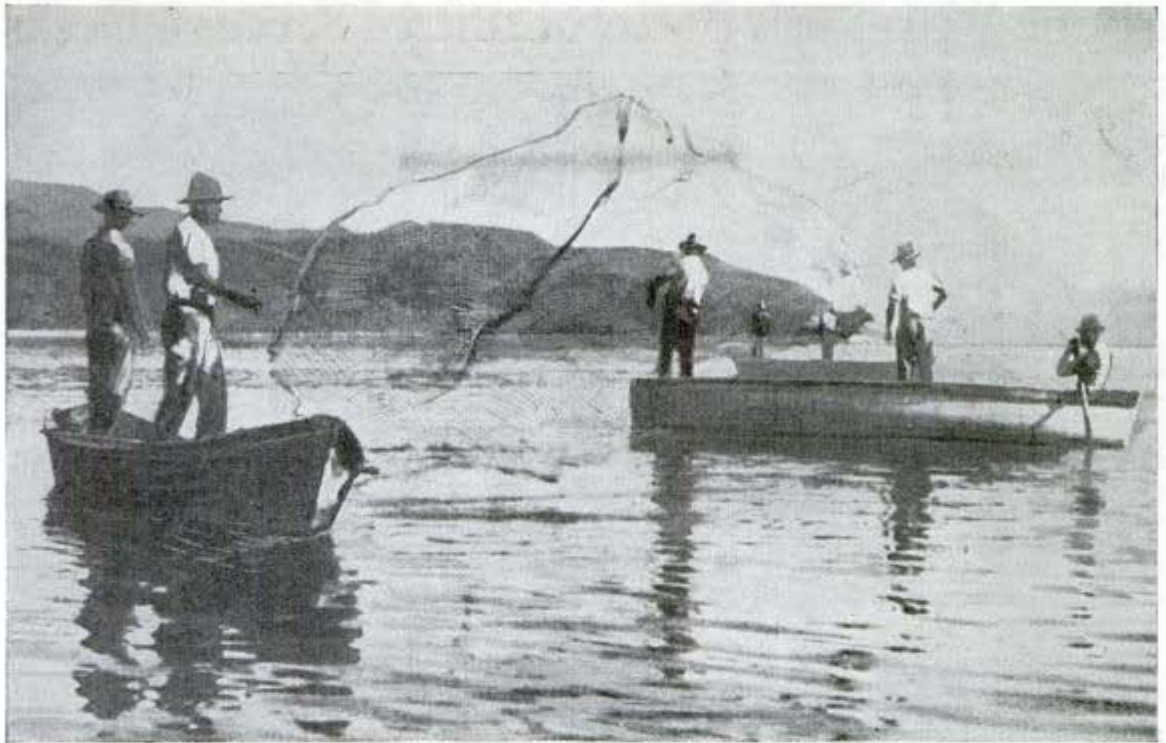
of lack of fresh water. One large deposit of copper adjacent to the Gulf is being worked but most of the other known mineral deposits are untouched. An occasional Indian mines placer gold by hand or by crude apparatus. A few small canneries and other sea industries are operated at several ports. By and large, the peninsula is untouched by civilization and some parts of it never have been mapped accurately.

Maps of the peninsula show an automobile road that extends its full length but this road exists principally on paper. A 60-mile stretch from Tijuana at the border to the seaport of Ensenada has been paved but farther south the road is a mere trace. In some

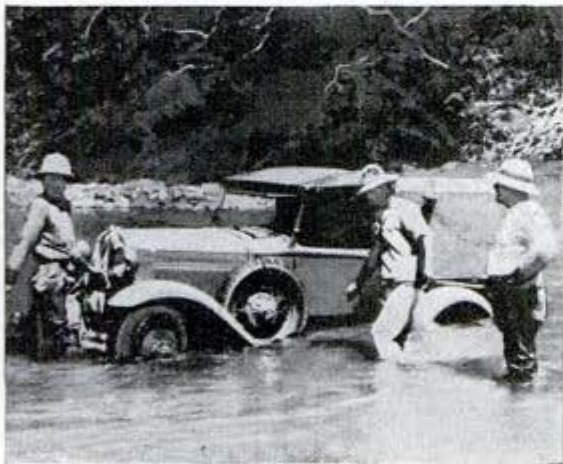
places it consists of cattle trails, in others the road can't be distinguished at all. Fifteen years ago the Automobile Club of Southern California sent an exploratory caravan of cars all the way to La Paz, and the caravan's route is the basis of the road shown on some maps. In some areas the expedition was able to make 15 miles an hour, often 15 miles was the full distance covered in a day. Sometimes the party had to camp for a few days because a river had suddenly swollen from a mountain cloud-burst, sometimes the drivers had to pave a

One reason why there isn't more good road on west coast of Mexico. Highway construction is done by hand





Native fishermen toss out nets for shrimp in Gulf of California. Below is part of the road shown by black line on map. Car of American caravan bogged down in attempting to cross stream on trip south



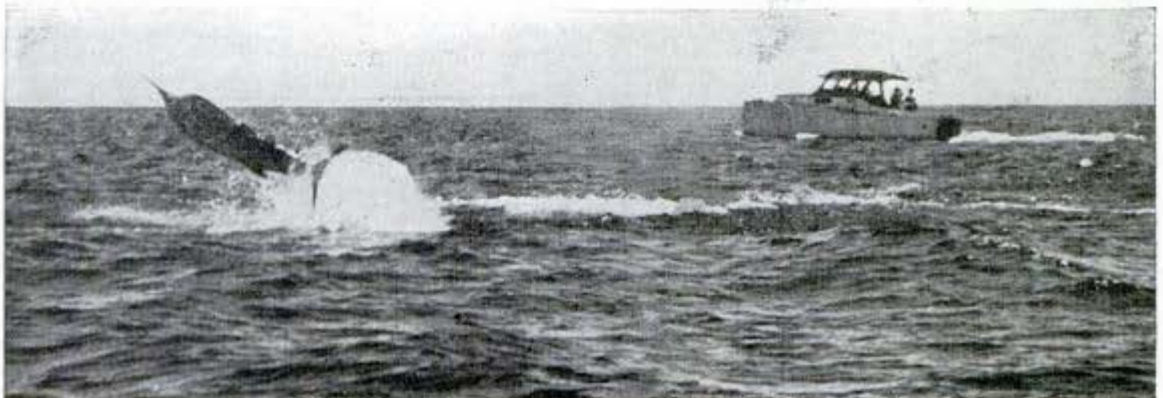
There's lots of sport in gulf off Lower California. Here a swordfish leaps from water after it's hooked

sandy stretch with brush to provide traction for their tires.

Since then a few additional cars have been driven to La Paz by adventurous drivers who carried large supplies of fuel, oil, water and such spare parts as extra springs and clutch plates. Water is always a problem except at the few villages. The inhabitants of one dry region near the ocean extract drinking water from the sea by boiling salt water in a large crude still.

Stories of lost mines and buried treasures abound in Lower California and many are so plausible that they could easily be true. The early Spaniards are said to have discovered an extremely rich gold mine high in the San Pedro Martir mountains and, working the richest portions of the deposit with crude hand-built tools, extracted a large fortune from it. The mine was abandoned when most of the gold in plain sight had been obtained. Torrential downpours

(Continued to page 154)



## Phone With Push Button Control Serves 4 Desks



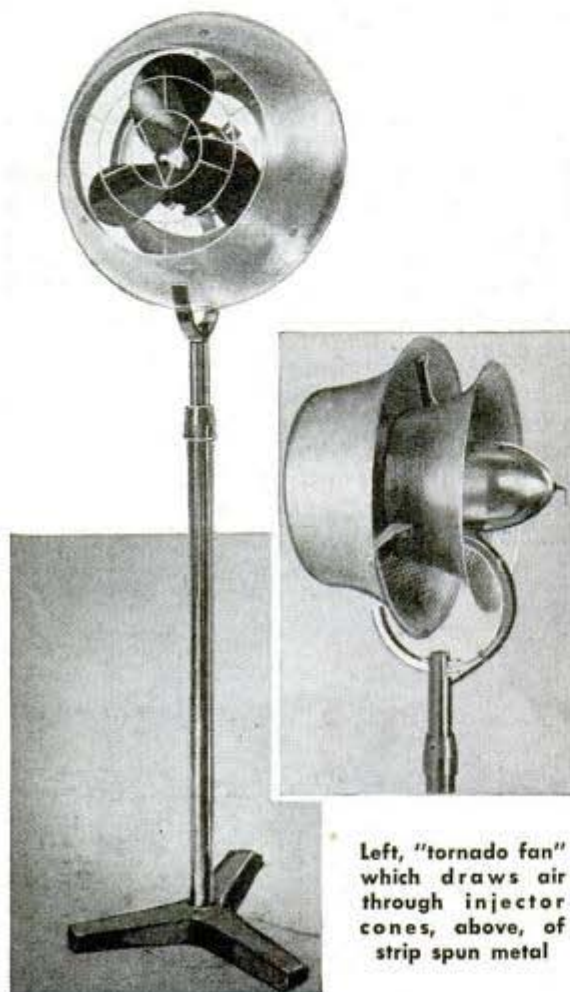
Forced by war shortages to use the same telephone, four clerks in a business office devised a motor-driven arm to hand it back and forth. Built from scrap parts, the stand and arm device is controlled by push buttons on each of the four desks. If one of the clerks wants to use the phone, which may

be lying on another clerk's desk 10 feet away, he merely presses the button and waits. The arm gently swings the instrument around, a soft chime sounds, and the phone is at his elbow. A slip clutch has been installed to prevent damage if anything should impede the gliding cradle on its flight and an automatic timer cuts off the motor to prevent further undue strain.

## Electric Fan With Intake Cones Spirals Air Like Tornado

Tornadolike air turbulence over a large area is accomplished by an electric fan equipped with air induction cones made from special strip spun metal. The fan's heat-formed plastic propeller blades are said to double the volume of air moved by ordinary blades of comparable size. Combined with the propeller blades, the cones direct the air in a vortex action which attracts surrounding dead air into the slip stream, increasing air circulation. The torpedo-shaped quarter-horsepower motor is suspended in cork and rubber to reduce noise and vibration.

☛ The United States Rubber Company produced 53 new types of synthetic rubber in three plants in 1944.



Left, "tornado fan" which draws air through injector cones, above, of strip spun metal

### It's War Paper Now!

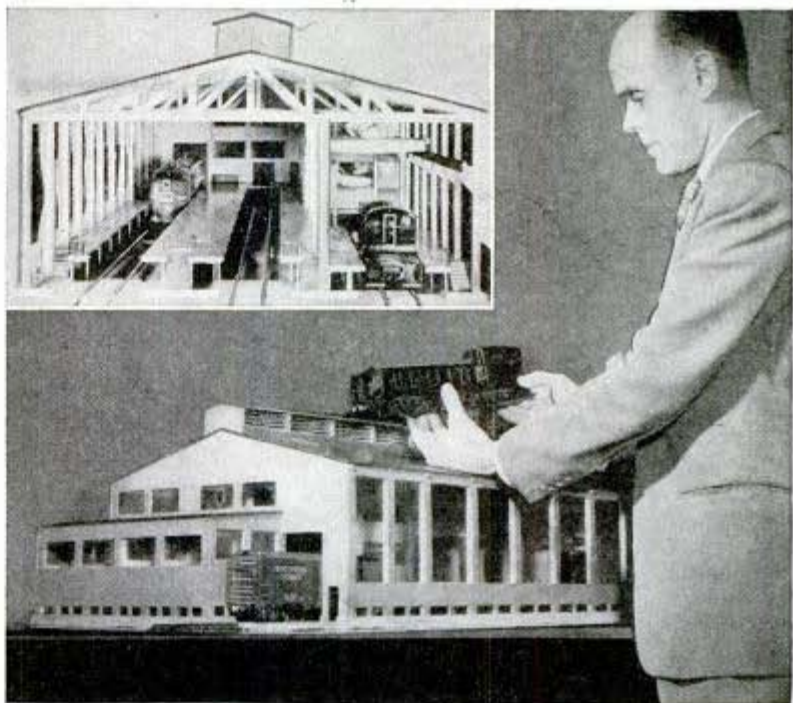
Here's the know-how you need to save waste paper essential to speed victory in the Pacific:

- Wastebasket Paper (Wrappers, Envelopes, etc.):** Flatten and pack down in box or bundle.
- Corrugated Boxes, Brown Paper and Bags:** Flatten and tie in bundles about 12 inches high.
- Magazines and Books:** Fold flat and tie in bundles about 12 inches high.



# Model Rail Shop Has Inspection Pit for Diesels

To save repair men constant ladder climbing and provide for one floor level movement of all parts, full width elevated platforms should be included in any basic plan for a Diesel locomotive running maintenance shop, according to H. B. Ellis of the Electro-Motive Division of General Motors Corporation, LaGrange, Ill. Ellis built a model plan for the maintenance of four 2,000-horsepower units and a switcher at one time. It includes two locomotive running tracks, a combined wheel and motor, or truck, release and repair track; auxiliary shop areas for the cleaning and reconditioning of parts, and a storeroom. Length of the main shop area is 175 feet. A continuous elevated platform at locomotive floor level permits servicing both sides of the engines,



besides facilitating repair work. The plan also calls for a full length well lighted inspection pit for each maintenance track.

## Film Measures Airplane's Takeoff Through Screen Grid

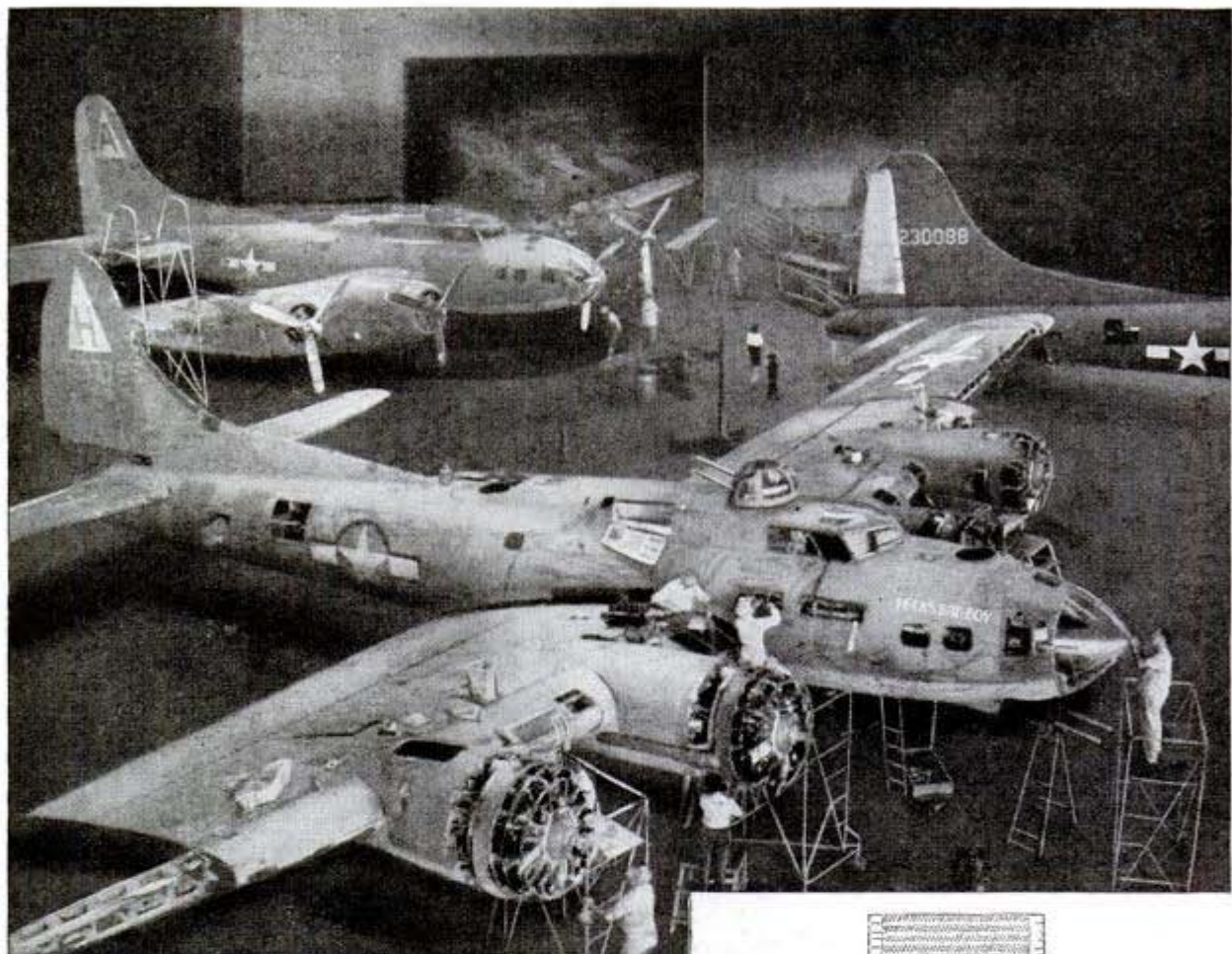
Factual knowledge of the efficiency of different propeller combinations in a Fairchild PT-19 airplane is obtained from motion pictures of the plane taken from behind a screen grid. A movie camera set to take four frames a second is mounted rigidly behind a screen whose grid is formed of fine wires spaced 1.2 inches apart, vertically and horizontally. At 1,000 feet from a runway, each square of the grid measures 20 feet of runway. With one quarter second elapsing between each exposure of the film, and each grid square covering 20 feet of runway, the resulting film gives a graphlike series of pictures of the plane. In a takeoff test, length of ground run, acceleration rate and rate of climb are easily determined from the film. Angle of climb is shown by a black stripe along the center line of the plane. For landings the film shows landing speed, rate of descent, angle of descent and ground roll. Relative efficiency of different fixed, adjustable and



variable propellers is readily determined by comparing graphs drawn from projections of various films.

## Bottle Seal Changes Its Color To Show Poor Preservation

Improper sterilization or refrigeration of bottles containing blood plasma or pharmaceutical products may be detected quickly with a protective seal made of cellulose. A green dye incorporated in the seal turns a bright orange when subjected to heat.



Thousands of warplanes "wounded in action" limp home for "hospitalization" which fits them for combat again or training. B-17s above are being rebuilt by Air Technical Service Command



Mechanics dismantle engines salvaged from planes laid to rest in "cemetery" at airbase in combat zone; engines will be reassembled for use in other ships

Right, "operating" on wing of P-47 to remove hydraulic landing gear for use in another injured but battleworthy plane. Every usable part is salvaged



## PURPLE HEART WARPLANES

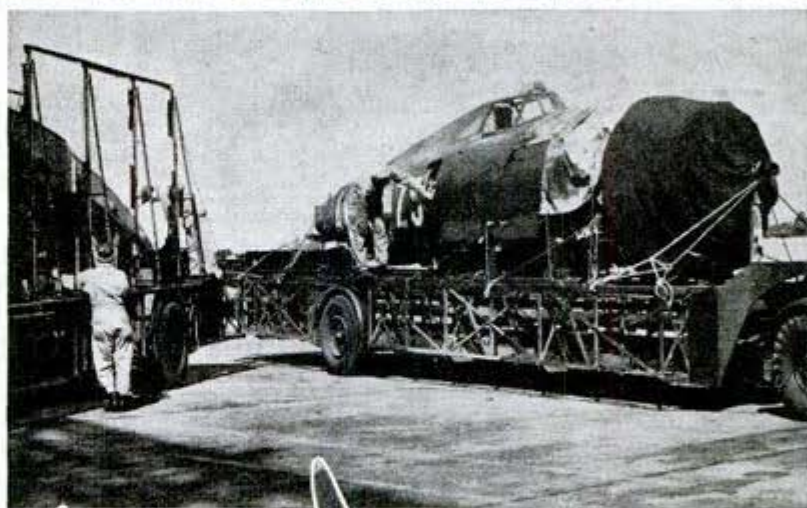




Fate of crippled fighter is in hands of inspector whose report may be summed up in words "repair" or "scrap." Above right, Nazi flak did this to B-17 that made home

Right, after fighter crashed, wings, guns and propellers were removed and "body" loaded on trailer for delivery to tactical depot for inspection by salvage experts

Below, Seabees lashed tarpaulin around holes in hull and used rubber rafts as pontoons to float \$250,000 Catalina ashore after it hit hidden reef off Pacific isle





## Electric Eye Winks At White Hot Steel

Applying electronics to still another use in industrial life, research experts of the United States Steel Corporation have developed a pyrometer which reads automatically the exact temperature of white hot steel. The gauge assures more uniform quality in vital tonnages of wartime open hearth steel. A photoelectric cell replaces the old optical pyrometer with which molten steel was observed through a six-foot length of two-inch steel pipe, one end of which was inserted into the steel bath. Two men were required for manual operation of the optical meter, while one can operate the electric meter, whose unit is similar to a photographer's light meter. The exact temperature is recorded on a dial in eight to 10 seconds. The tube will withstand more than a thousand readings before it has to be replaced.

A, nose of pyrometer; B, outer case; C, inner tube; D, antireflection diaphragm; E, air line; F, window; G, photronic cell

## Blower Sifts the Down From Quills by Floating It Up Into a Tower



Separating down from quills in chicken and turkey feathers is done quickly and neatly at the Beltsville, Md., agricultural department research center with the aid of a midget tower. Air currents from an electric blower float the lighter portion of feather fiber upward through the outlets to the top of the tower. The soft fiber is used as a substitute for duck or goose down in Army sleeping bags and coat linings.

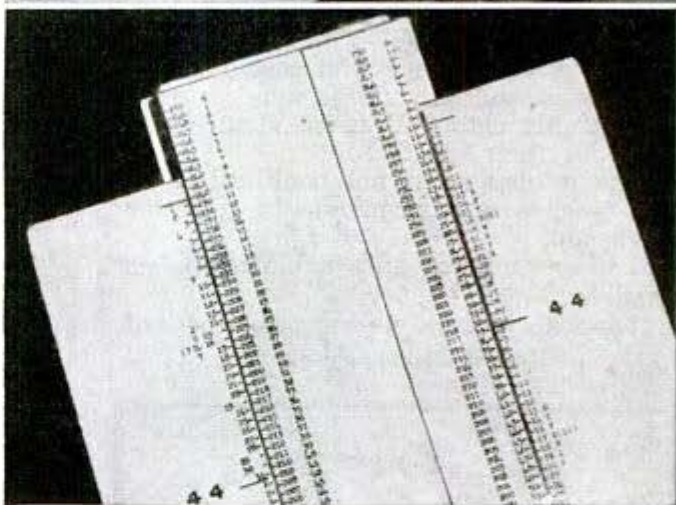
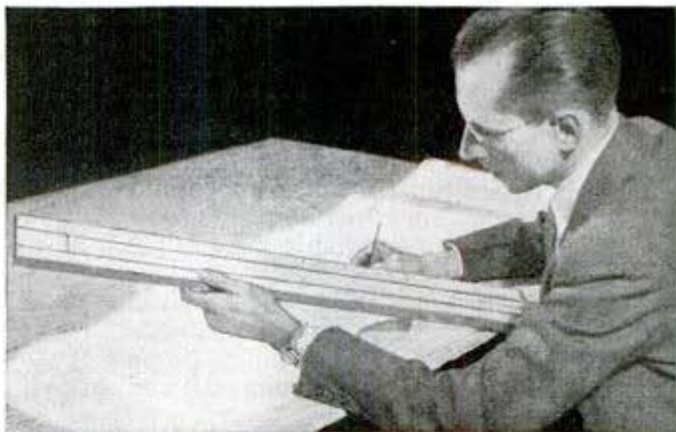
## "Color Detectives" Tell Content Of Chemicals in Solution

By changing the color of liquids which contain minute impurities, chemical compounds known as ortho-phenanthrolines simplify and speed up the analysis of such substances as milk, metals, wine and soap. When one of these "laboratory sleuths" combines with iron, for example, an intensely red water-soluble compound is formed. It is so sensitive it can detect one milligram of iron in one cubic meter of water. The compounds also have an affinity for copper, chromium, nickel, zinc, cobalt and other metals and can disclose their presence in water, alloys or foods. Only 15 minutes is now required for an analysis that formerly took half a day.

## Slide Rule Replaces War Job Calendar

Scheduling of war jobs becomes a matter of seconds with a slide rule designed from an employee suggestion at the Glenn L. Martin plant at Baltimore. Conventional in appearance, the calendar substitute has two fixed scales, one showing calendar days and the other working days, and a double removable scale calibrated in straight numerical graduations and running both forward and backward. To learn how many days before final test the keelson of a flying boat must be laid, or when parts must be on the floor, the working days scale is set for the number of days needed to complete the job. The calendar days scale is set for the date on which the job is due, and the rule then gives the date on which work must be started. Previously, counting out the days on a calendar took precious minutes, sometimes even hours.

**Job schedule slip stick has fixed scales for calendar days and working days, with double removable 0-250 up-and-down scale**



## Chemical Operates Like a Magnet to Clear Water of Its Impurities

Water becomes the chemical equivalent of distilled water when its impurities are removed by a chemical whose action resembles a magnet catching metal particles. The new filtration method uses resins derived from melamine and other chemicals to dissolve the salts in the water, transform them to corresponding acids, and absorb them. In cartridge form, the resins may be renewed like a flashlight battery. The smallest unit produces eight to 10 gallons of demineralized water an hour, containing as little as two parts per million of calcium carbonate. Bigger units can turn out thousands of gallons for industrial use.

## Working "Heat" of Metal Shown By Lacquer Coat

To determine the working temperature of metal, a newly developed lacquer is daubed on it and allowed to dry quickly. If the temperature of the metal comes within a specified limit, the lacquer sharply relieves. The lacquer is particularly valuable where the metal is not easily accessible. It indicates temperatures from 125 to 350 degrees F. in 25-degree steps and from 400 to 1,600 degrees F. in 50-degree steps.



By Richard W. Emery

LET the hard-bitten fisherman turn up his nose, if he must, at fishless fishing. Let him scoff, and sigh for the days ahead when gas rationing will be no more and a man can go fishing when he wants to.

The fact remains that fishless fishing is fun!

There's a name for it and even a national society for it. From Maine to California, its advocates meet beside their pools. Some are the sharpest anglers who ever schemed against a fish.

There are reasons why fly and bait casting—without the fish—gathers more followers yearly. Those who cast hookless trout flies and plugs into unpiscatorial park ponds claim all these virtues and more for their sport:

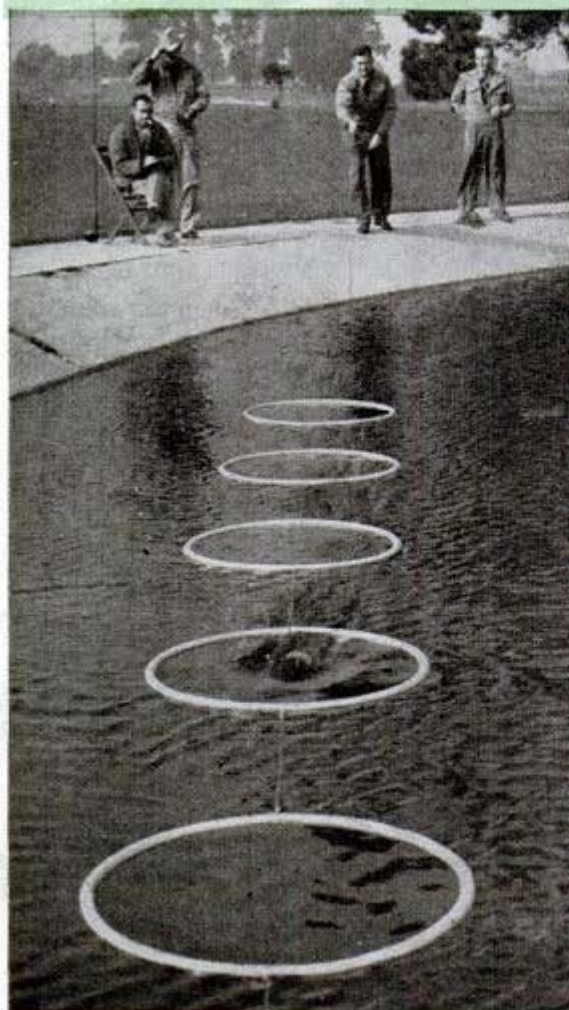
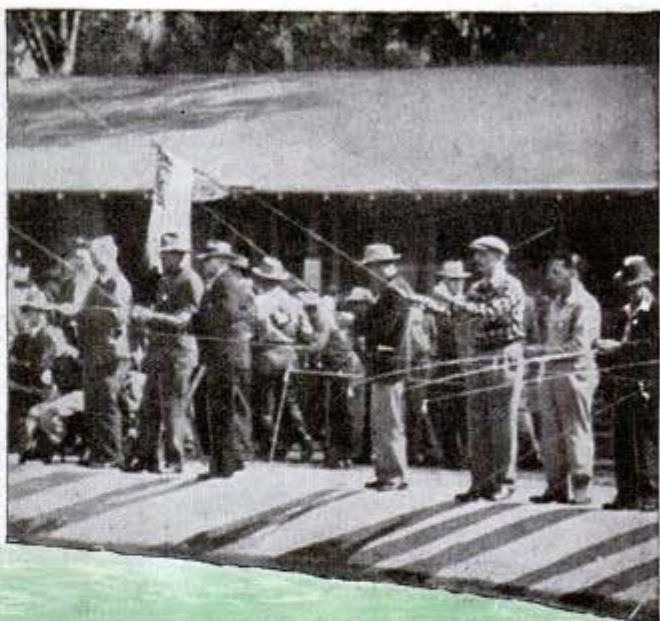
It's outdoors, active and healthful.

It teaches a fisherman to be a better fisherman.

It brings anglers and tackle hobbyists together.

It appeals to the kinetic senses—those of

(Continued to page 62)



## FISHLESS FISHING *is Fun*

Wet fly casting, left, is accuracy test. Rings are five feet apart. Ardent caster below is Claude Kreider, trout authority

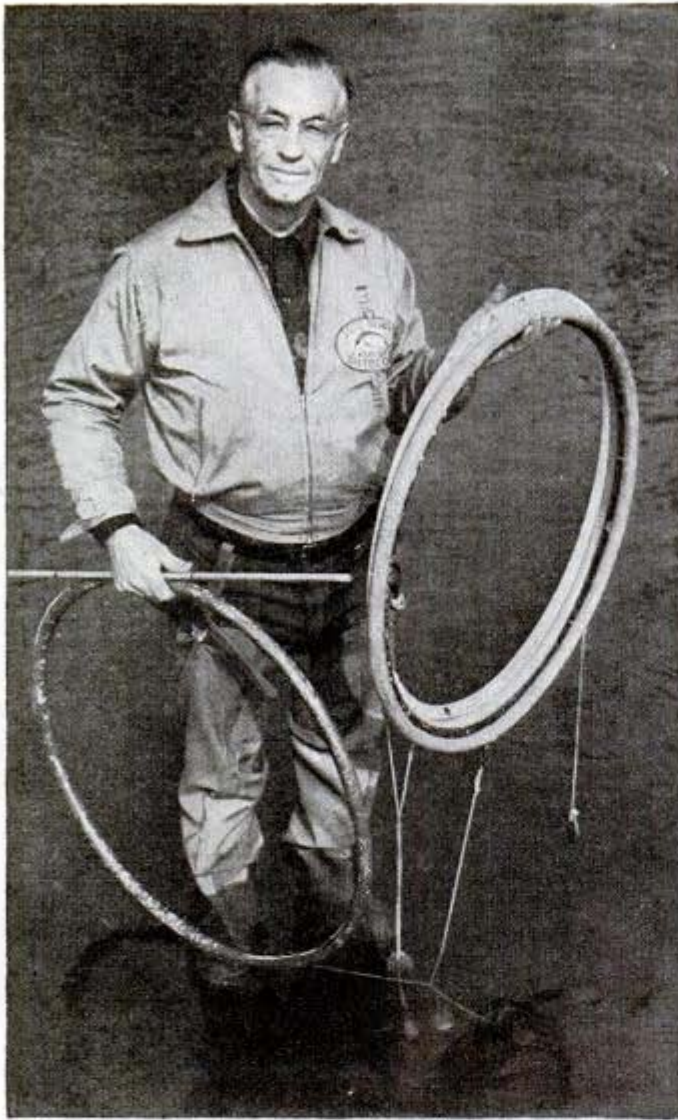




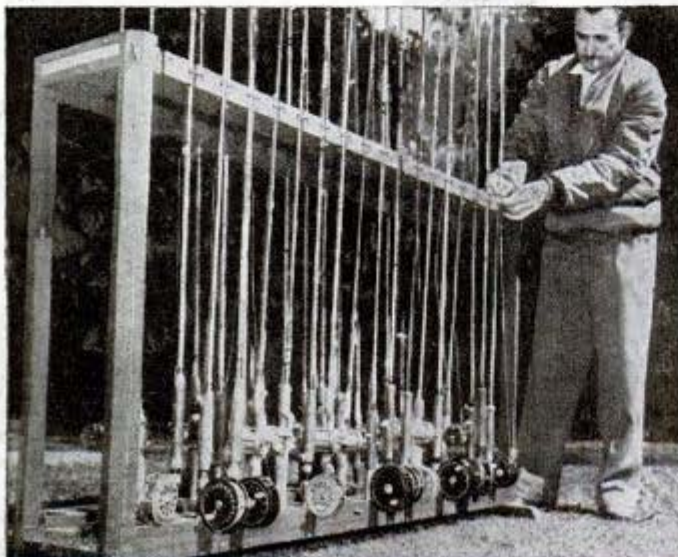
Women, too, join in fun at Casting Club in Long Beach, Calif. Casting a salmon fly, below left, is R. G. Miller, holder of 175-foot class record. Right, measuring a cast

All photos by Ray Chapin





These are standard casting targets, floating rings 30 inches in diameter, and three-foot measuring stick. Each foot missed knocks a point off 100 starting score. Below, handy tackle rack



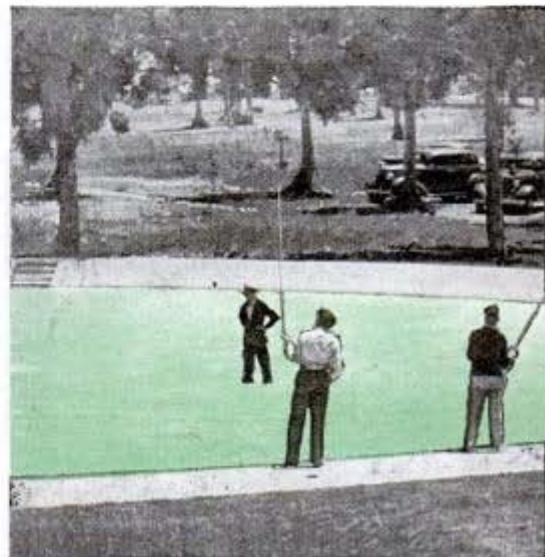
muscular coordination, weight and balance—just as does fishing for the genuine article.

Fishless fishing got started 'way back in 1864. Bewhiskered anglers of the New York State Sportsman's Association posted prizes for flycasters. The boys tried it and howled for more. Now casting has annual tournaments, a flourishing national association 39 years old, nearly 100 affiliated local clubs, thousands of men and women members—and millions of dollars worth of pools, clubhouses and tackle.

Typical of the thriving local groups is the Long Beach, Calif., Casting Club, which made an humble start in 1925 and by 1932 was America's host to Olympic Games contestants. The club has a large pool and clubhouse in the city's biggest park. Here is the group's advice on how to promote a casting club in your home town:

Find out which of your city fathers are fishermen and ask them to help you get park space for a casting pool. Perhaps you can find a pool ready-made. You'll need a clubhouse for meetings, fly tying, talks and movies about fishing. The Long Beach members rebuilt a temporary fire station. Each stone in its unique fireplace came from a different trout stream.

Your casting pool should be shallow and clean-bottomed, so that contest judges can wade in it to measure your casts. It must have a level bank or platform near the edge and not more than 18 inches higher than the water. If





you can't promote a pool, a smooth lawn will do.

Standard casting events are for accuracy and distance bait casting, wet fly and dry fly accuracy, distance fly, salmon fly and various team competitions.

Each type of casting calls for its own tackle. Casters start with one outfit and soon own three or four or a dozen. In fly casting, the fly is like thistledown and the line must be thick and heavy enough to be thrown. Fly casting reels are for storing the line, not for spinning it out. The line is stripped out by hand.

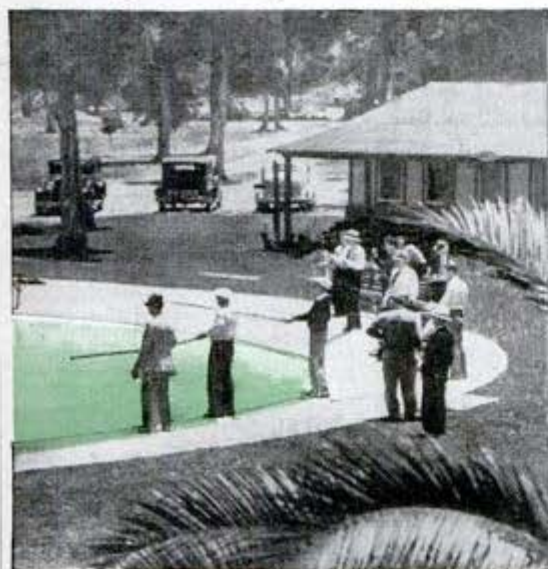
In plug casting the plug's weight is enough to throw, so the line is threadlike. The plug casting reel, high geared and smooth running, spins the line directly into the line guides as the plug sails through the air.

Standard targets for casting are round tubular metal floats painted bright colors. Old bicycle tires make a fair substitute. The targets may be anchored with short strings and eight-ounce sinkers.

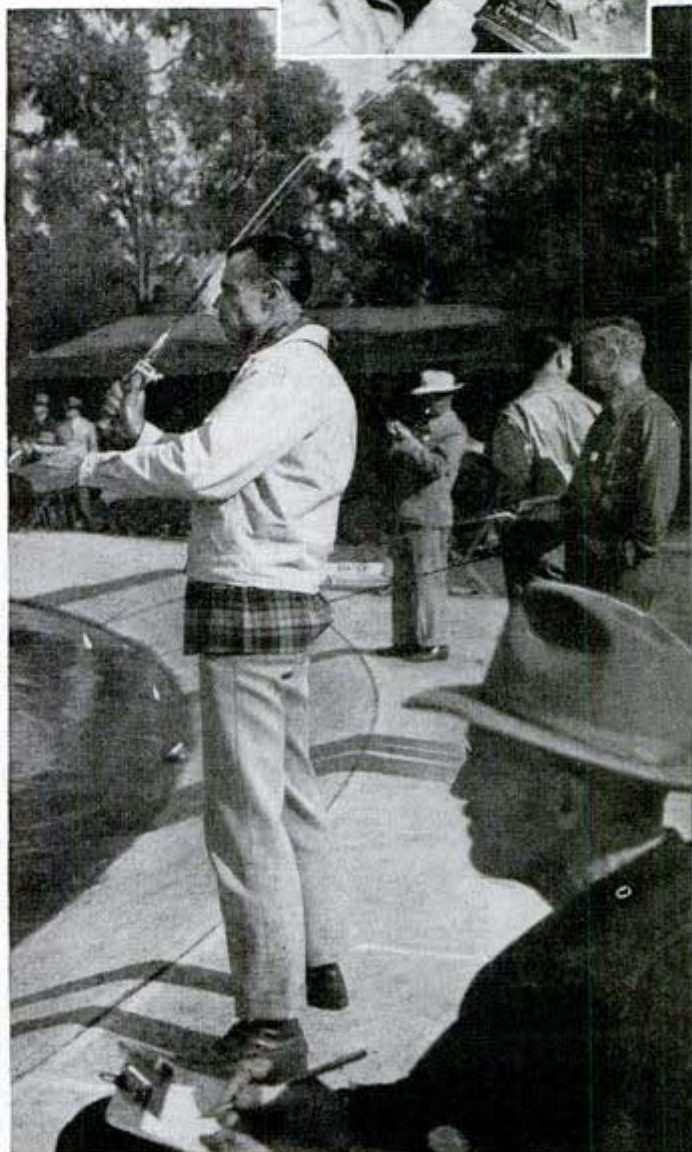
Facing one of those 30-inch rings at a distance of 50 feet, a seasoned fly caster can whisk a hookless trout fly into dead center and a plug caster can drop a  $\frac{3}{8}$  or  $\frac{5}{8}$ -ounce "bait" squarely into the ring from 75 feet away.

The novice smiles, steps up confidently, whips the air with the rod and spends the next 15 minutes unsnarling line. Casting looks easy—until you try it.

Judges wade easily in shallow pool below



Casters take a lesson in tying trout flies. Bobbin in right hand, thread is wound round fly in vise, at right. Below, casting a plug



## Electric Bicycle With a Sidecar Runs on Starting Motor



To supplement his reduced automobile mileage, Dr. William S. Voorhees, of Plainfield, N. J., designed and built an electric bicycle which runs on a Ford V-8 starting motor. Using a 130-ampere battery for power, the vehicle goes 14 miles on a battery charge and attains a speed of 13 m.p.h. Dr. Voorhees added a sidecar large enough to hold his 3½-year-old daughter.

## Light Beams Check Piston Rings And Signal Results in Color

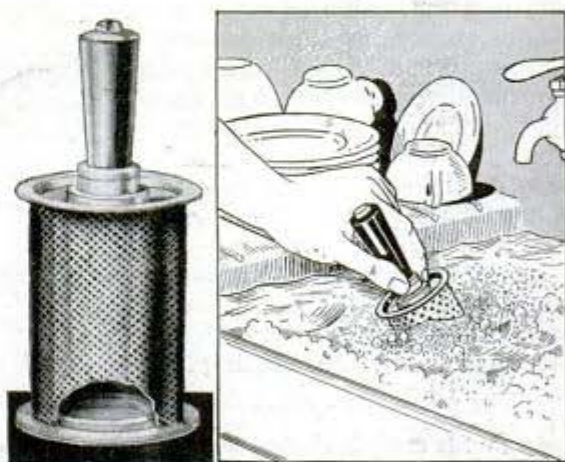
To avoid the possibility of human error, piston rings can be checked with an automatic electronic inspector which uses light



beams to examine the rings. Red, green and yellow lights signal the results. The piston ring is inserted inside a master ring which is placed on the instrument table and rotated by a power driven roller. The gauging functions are performed by scanning beams of light directed onto photoelectric cells which energize electronic circuits to illuminate the three signal lights. As the ring revolves, one beam of light is projected on the periphery of the ring. A clearance between it and the master ring permits part of the light beam to fall on the photoelectric cell. This cell is set to actuate a red rejection signal. A green signal will flash if the periphery and the width of the gap are within tolerance limits and a yellow signal if the gap is undersize.

## Perforated Holder Shakes Suds For Dishes or Laundry

To avoid wasting small bits of soap, a wartime soap saver has been designed in the form of a cylinder of perforated plated metal. The fine perforations keep dirt and sediment in soap scraps out of the water

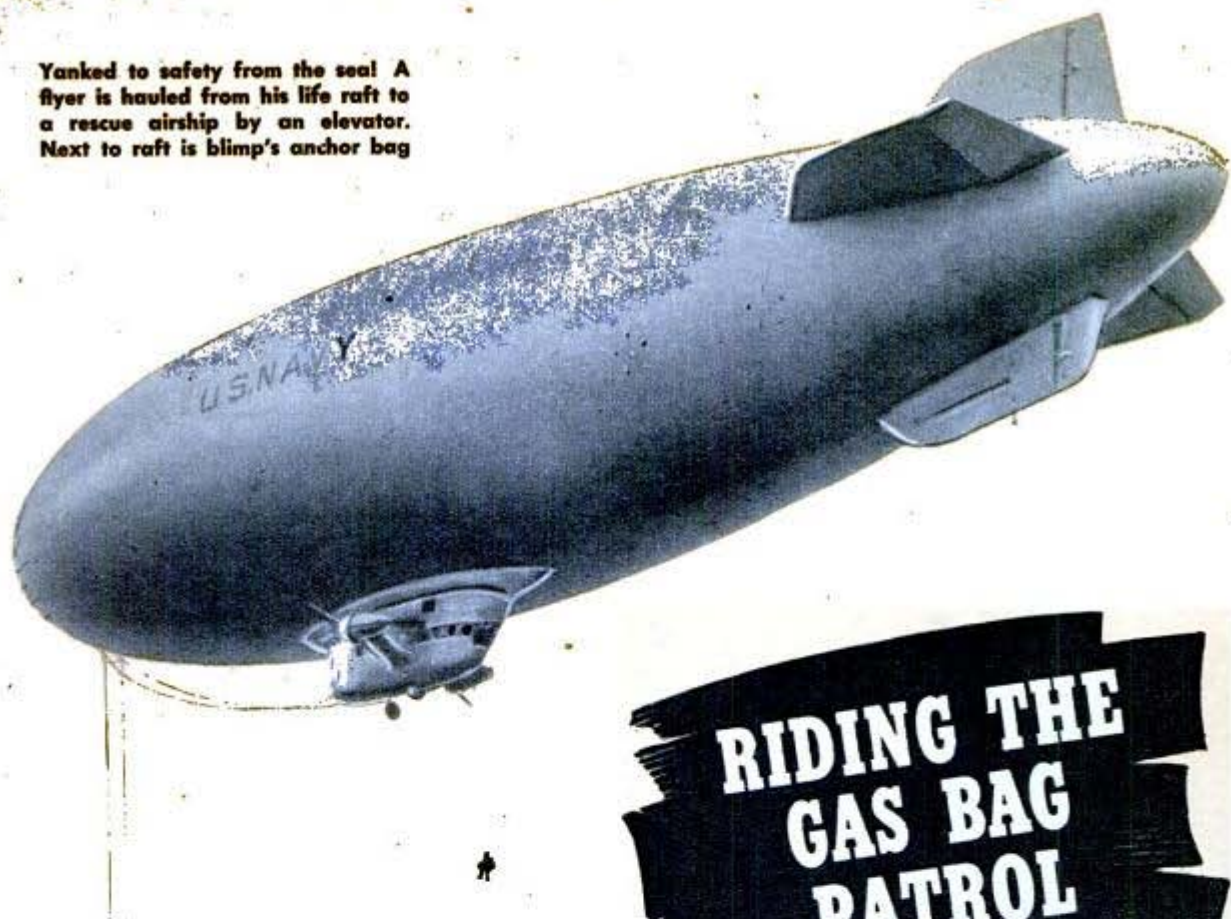


and allow chips, granules or flakes as well as scraps to be used. The cylinder is filled by removing the base, which is formed with a depression to catch and hold soap jelly created when the contents are in a semiliquid form.

## Motor Plant Has a Vast Thirst

More than 143 billion gallons of water were pumped from the Detroit river into the Ford Motor Company's Dearborn plant last year, equal to the combined volume of water consumed in a year by the cities of San Francisco, Detroit and Pittsburgh. Every minute some 388,900 gallons of water are required to cool the turbo-generator and turbo-blower units in the No. 1 powerhouse, rated as the largest industrial steam generating plant in the world.

**Yanked to safety from the sea! A flyer is hauled from his life raft to a rescue airship by an elevator. Next to raft is blimp's anchor bag**



## **RIDING THE GAS BAG PATROL**

**By Thomas E. Stimson, Jr.**

**O**N BOARD a United States lighter-than-air ship (over the Pacific)—A flying platform with an elevator that reaches down to the water to rescue survivors of disasters would have seemed fantastic a year ago.

Today I am sitting on just such an aerial platform, in the shape of a Navy blimp. Presently we will anchor in the air over a two-man raft and let down an elevator that will haul up the "castaways" in a training rehearsal.

Until now the job of an airship in air-sea rescue operations was confined to locating survivors and then lowering life rafts, food or other emergency supplies. A flying boat or surface craft usually was summoned to make the actual rescue.

But within the last year on two occasions airships have rescued aviators from the water who could not have lasted until other help arrived. One man was badly injured, the other was so exhausted that he was about to give up. In each case the airship crew lowered a parachute harness to the man in the water, then

**One of the two pilots mans rudder control wheel of blimp —>**





pulled him up to the warmth and safety of the airship's cabin.

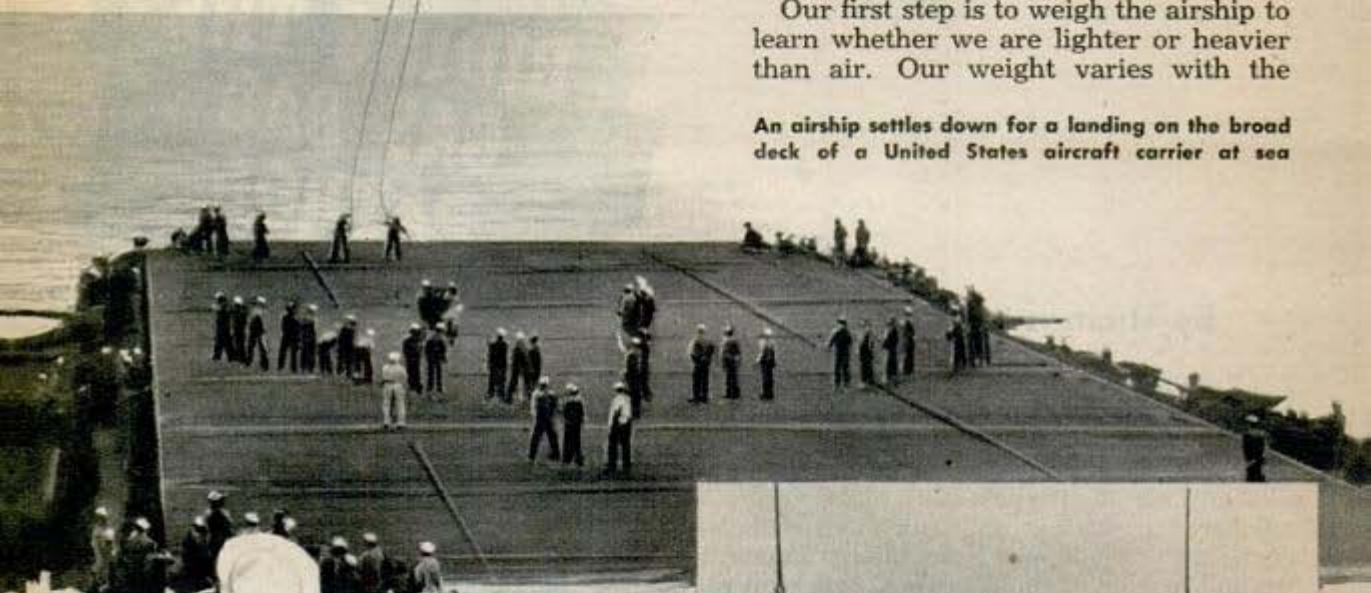
Since then the Airship Experimental Command has perfected rescue gear which makes an airship self-sufficient for handling practically any type of marine rescue in any weather.

We are cruising at 500 feet, with all hands watching for the drifting life raft we are expected to locate. Presently one of the lookouts points to a splotch of light green "sea marker" dye on the water, with two men in a tiny life raft at its edge. Smoke begins to drift up from the raft as the men ignite a smoke signal to guide us.

The pilot at the elevator control winds his wheel forward and we nose down to 200 feet. Meanwhile Lieutenant B. H. Hickman, the training officer, explains that while the rescue procedure will appear quite simple, it is actually a precise maneuver requiring constant vigilance.

Our first step is to weigh the airship to learn whether we are lighter or heavier than air. Our weight varies with the

**An airship settles down for a landing on the broad deck of a United States aircraft carrier at sea**



Aviator in life raft reaches out for elevator lowered from blimp →

← Elevator is a ring with webbed seat. Survivors can use the rope to pull selves to elevator



amounts of ballast and fuel on board, air temperature, the amount of "superheat" that the helium in the envelope has picked up and other factors. We weigh off by idling the motors and watching a gauge showing the rate of ascent or descent. The ship sinks slowly and, since the ideal condition is to be a couple of hundred pounds lighter than air before making the rescue, ballast is jettisoned until we begin to rise.

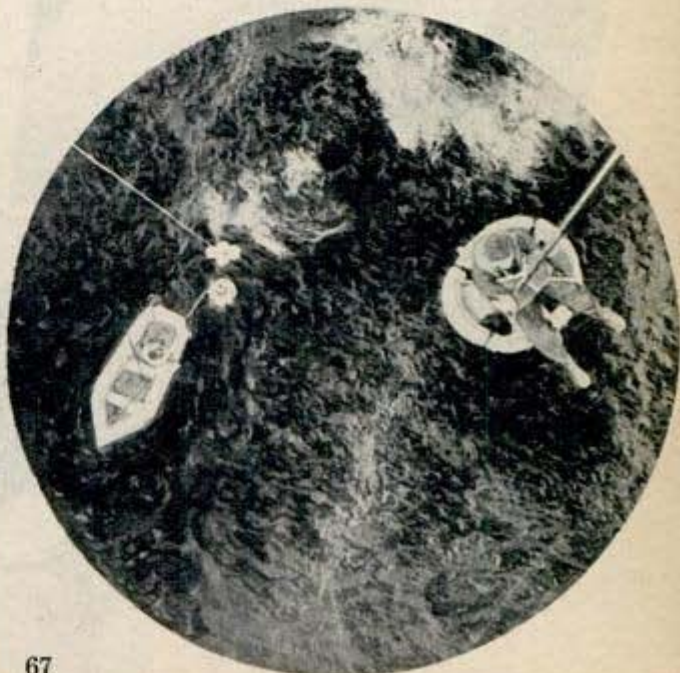
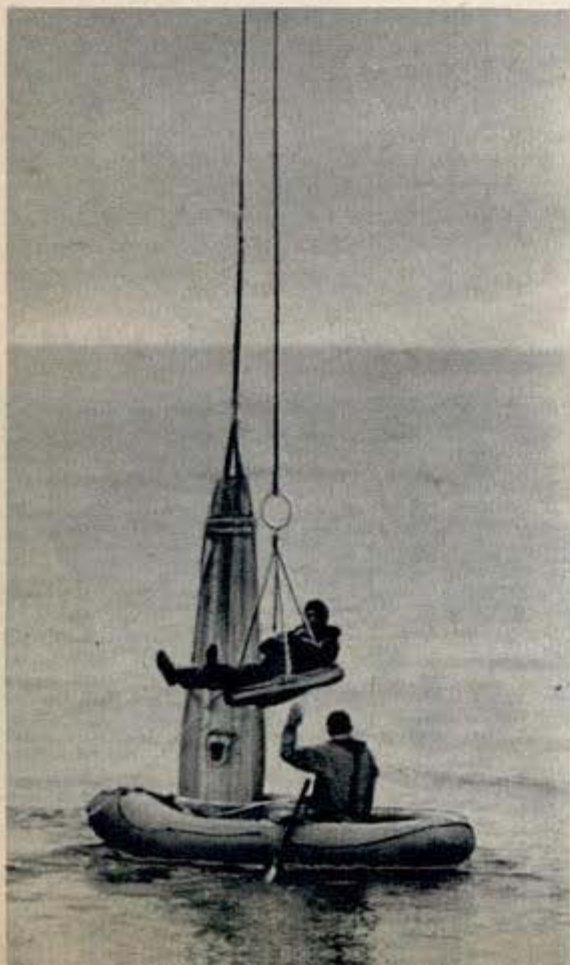
"The way the smoke is drifting up from the raft shows there is little or no wind close to the surface," Lieutenant Hickman tells us. "Without wind it will be best for us to moor the ship. If the smoke indicated a 15-knot breeze or better we could hold the ship on a dime simply by pointing into the wind and turning the engines over fast enough to overcome its force."

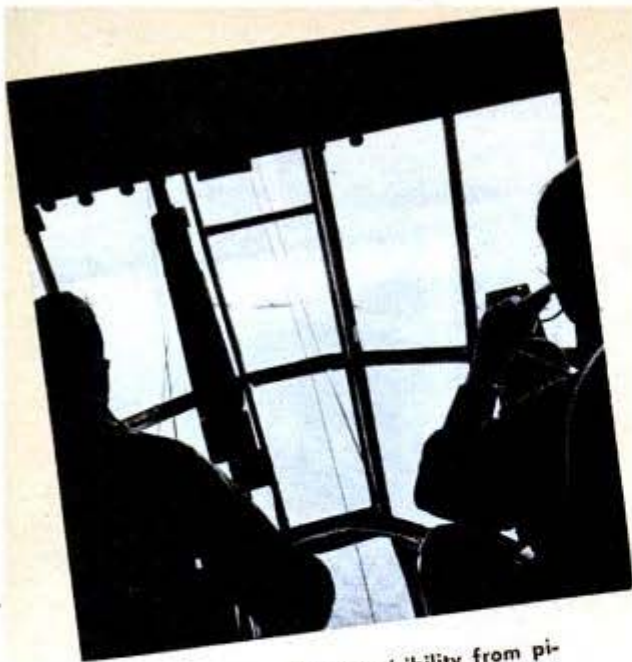
By now we have drifted downwind of the life raft and we swing around and head toward it. A ballast bag in the form of a large fabric sock, 12 feet long and with numerous one-way openings along its sides, is lowered out of the cabin at the end of a long line. This will be our anchor. As we move closer to the surface the ballast bag begins to scoop up water.

Filled, the ballast bag holds 1,800 pounds of sea water, more than enough to anchor us securely. It may be moved at will, however, by elevating the blimp's nose and going ahead slowly with the engines. Using this procedure, we move right up to the

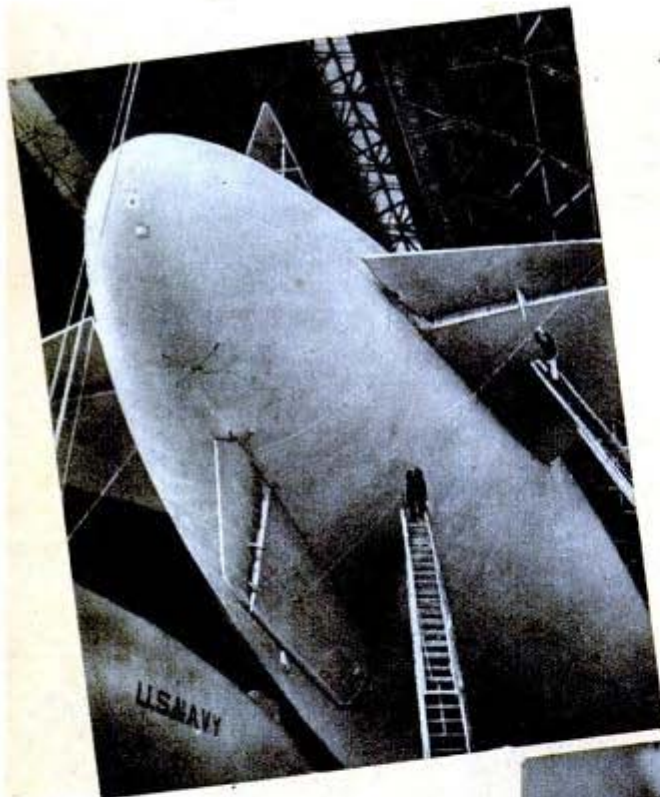


View of the forward end of the blimp cabin shows two pilots at their posts. Left, first of two "survivors" begins his ascent in elevator to blimp cabin overhead. Below, looking directly down on rescue: Aviator is hoisted up in ring from life raft which is tied to blimp's anchor bag during rescue operation





There's unlimited visibility from pilot's seat over a broad horizon



Tall firemen's ladder is used by ground crew to inspect fabric of an airship's envelope

Blimp engineer watches over instrument board and engine controls at his post in the cabin

raft. With engines idling, we float 175 feet above it.

Down goes the elevator, a large ring with a webbed seat inside it. The line attached to this conveyance passes through the airship's cabin and has a counterweight of 200 pounds of sand ballast at its other end.

One of the men in the raft grasps the life ring and climbs onto it. More ballast is jet-tisoned to compensate for his weight. Now two crewmen pull the elevator line through its blocks. The counterweight descends from one side of the cabin and the passenger rises up toward us from the other. After he climbs through the cabin door the elevator starts down for the other man.

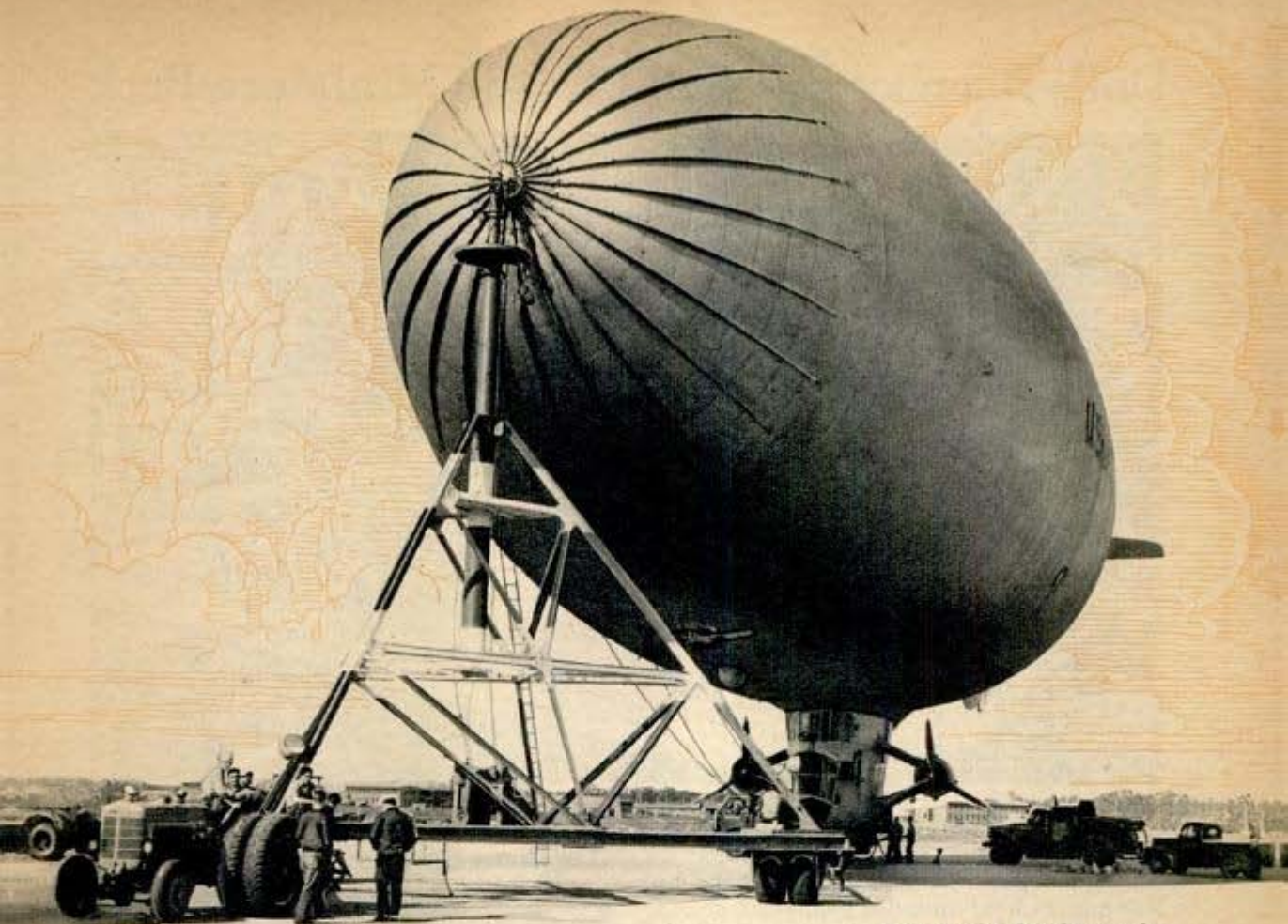
That's one way to rescue people from the sea. Another way, if the survivors are supported only by their life jackets and are injured or otherwise unable to help, is for one of the blimp's crew to ride down to the water with the airship's rubber life raft, inflate the raft and row around to collect the people, then bring them back under the airship, from where they are transferred one at a time to the elevator apparatus.

Behind a curtain of military secrecy, the Navy's airships have been performing a number of vital sea duties. They are an important part of our defense against enemy submarines in coastal waters and are used extensively in offshore patrol.

They also deliver mail and orders to ships at sea, they tow small boats that have broken down, and one of them once delivered a doctor to a ship offshore for an emergency operation. Used as observation platforms, they have enabled staff officers to watch battle rehearsals. Similarly, they are called upon for observing the run of experimental torpedoes and for locating them at the end of the run.

Their ability to make spot landings in constricted spaces makes them ideal vehicles for rescuing people from places other-





Occasionally the far-ranging Navy blimps rest. Here one is tied to a mobile mooring mast

wise inaccessible. They have picked up pilots whose aircraft were forced down in jungle areas and have even brought back essential parts of the aircraft themselves. Once when the survivors of a torpedoed vessel were stranded on a lonely island's beach, a rescue airship came down and touched its landing wheel on the sand, letting off one of its crew. The flyer then or-

ganized the survivors into a ground party to handle the lines so that the ship could make a normal landing. The Navy's airships have successfully completed every rescue operation they have attempted without injury to personnel.

The standard Navy lighter-than-air dirigible is the K type, 257 feet long and inflated with nearly half a million cubic feet of helium. Developed just at the start of the war, it has become the dependable work horse of the lighter-than-air service. It carries a crew of more than six men, can travel fast enough to cover long distances in a few hours, has the endurance to remain aloft and at work for more than a day and boasts a lifting capacity sufficient to carry weapons that can destroy a submarine. It is sturdy and safe. At low altitude blimps have no difficulty in crossing the United States. They have landed on aircraft carriers and have been refueled from ships at sea. By rendezvousing with surface ships, they can cross any ocean and travel to any part of the world.



Crewmember prepares a meal on blimp's electric stove. Blimps can stay aloft for more than a day

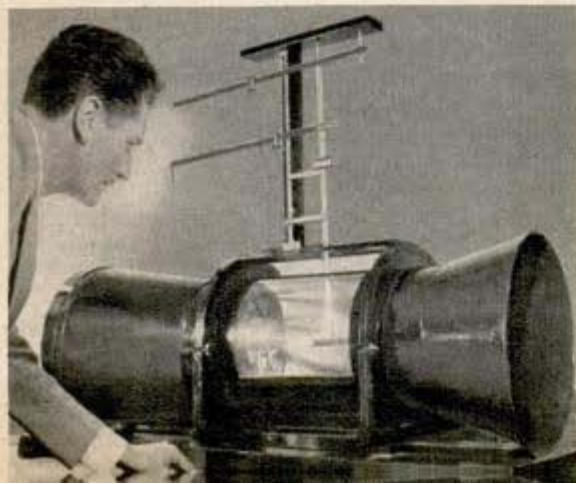
## Dolls Reenact Baseball Plays in Miniature Park



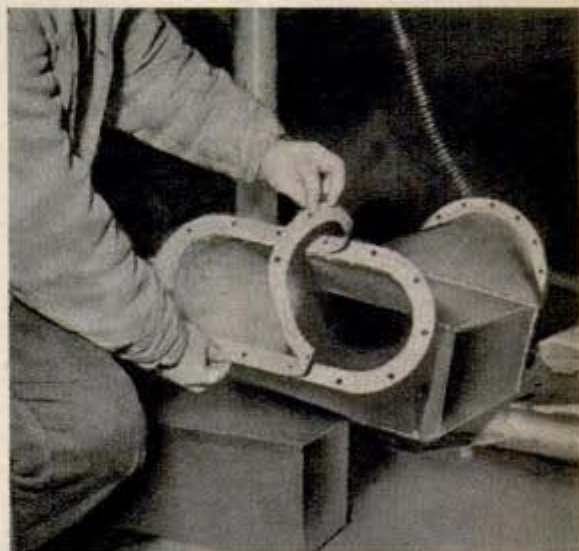
Some memorable plays in baseball history are reenacted by dolls on a miniature diamond set up in a fan's garage workshop. The midget field includes bleachers, grandstands, press box and even outdoor advertisements and the tiny doll-like players are moved from position to position to illustrate the game for the benefit of guests. The exhibit is part of a private baseball museum which includes autographed photographs, bats and balls dating back to 1890.

### Pupils Build Model Wind Tunnel

Pupils in Washington, D. C., schools deepen their knowledge of aircraft engineering principles by building their own scale model wind tunnels in classroom laboratories. The models, which function much like large-size tunnels, can be constructed inexpensively according to plans provided by the aviation education service of the Civil Aeronautics Administration.



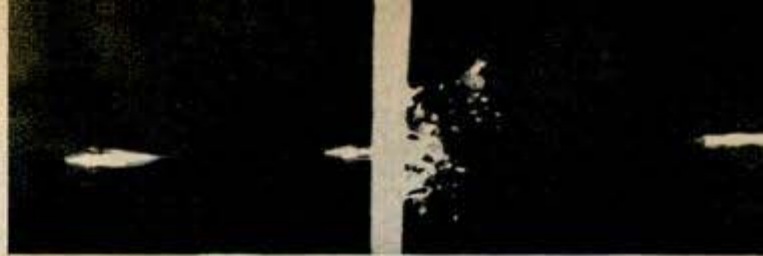
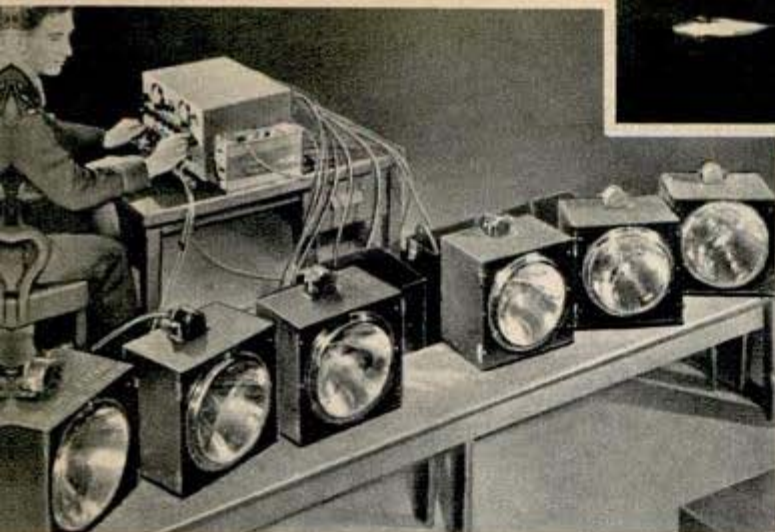
### Fireproof Gasket Made of Felt Replaces Sponge Rubber



Felt impregnated with a chromate pigmented compound is used instead of scarce sponge rubber for the base of a newly developed gasket. The compound makes the gasket fireproof, flexible and pressure-resistant. It can withstand air pressures of 25 pounds to the square inch, is insoluble in water, and may be obtained pre-cut or in sheets that can be cut without special tools. The gasket can be used on marine ventilating systems or as joint seals in water, fuel oil and Diesel oil systems. It also is suitable for flange-to-flange pipe joints.



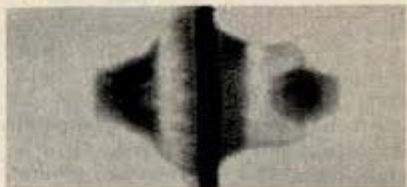
Bullet at right was "frozen" at three points on its trip through armor by six flashlamps below



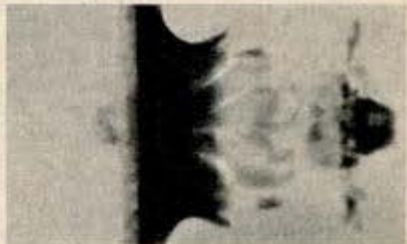
High speed pictures reveal how a shell looks entering steel plate and then exploding. Above, nose of shell is through



Here almost half the shell has passed through the plate. It has swelled to approximately twice its usual diameter



Above, the shell has just burst open. Below, it is now wide open. Petals on the plate curl to make a larger hole. All the pictures are on the same scale



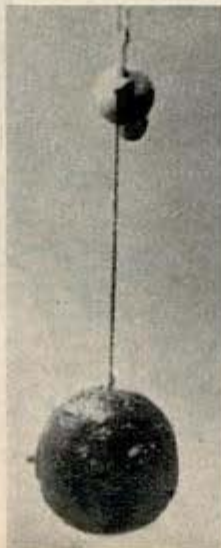
## Timer "Stops" Slug Piercing Steel

Photographs which "freeze" a .50-caliber machine-gun bullet at several points during its passage through armor plate have been made by the Air Technical Service Command with the aid of an electronic sequence timer. Developed as a means of studying the effects of gunfire on armor, rupturing propeller blades and the motion of other high speed objects, the timer synchronizes six microflash lamps so that they can be fired as a train or simultaneously. It utilizes linear charging of a condenser through a pentode tube. Linear charging produces a constant rate of voltage increase. The voltage is applied to six amplifiers which are set to progressively decreased sensitivity. As the rising voltage trips the amplifier with the most sensitivity first, the lamp to which it is connected is fired. To show how a 20-mm. high explosive projectile swells, bursts and then disintegrates when penetrating half-inch armor, Westinghouse has devised a superspeed X-ray tube which makes millionth of a second exposures.

## Plastic Compass for the Blind Tells Direction by Touch

Made of two small magnets, an aluminum disk, a marble and a ball of plastic wood suspended from a nylon string, the "touch compass" enables the blind to tell directions unerringly. The ball rotates when hanging free and comes to a stop with a protruding point indicating north. The blind user finds north by simply closing his hand on the ball.

☞ A single layer of oxygen of razor blade area—weighing about one hundredth as much as a speck of pepper—can be weighed by a sensitive balance in the Westinghouse Research laboratories.





U. S. Marine  
Corps photo

Attention, yachtsmen! Light but sturdy boats that last indefinitely can be built with a warborn molding material of olastic-bonded rope fibers. An auto (above) made by GIs from gas tank of the fabric suggests other postwar uses

Ice boat (right) is one of the many things which can be built of this tough material when plastics are available. Below is a plastic kayak made in a few hours from jettison tank shell discarded by the Navy. The composition will make dinghies, canoes and motorboats verminproof, rot-proof and wormproof. Continuous, tight skin hull means an absence of seams or crevices where leaks might occur

Plastic Boats Co. photo



# Boats FROM ROPE

Boats of Co-Ro-Lite, a patented plastic fiber, will be unsinkable and inexpensive, says Egmont Arens, designer, holding model below. Right, Jack Weber, another designer, lifts lightweight dinghy that can carry four

Durez Plastics photo



Vidal Research Corp. photo



Jettison tanks (below) for Navy planes are molded in one piece from cordage fibers impregnated with phenol resins. The preform is shown at the bottom. Surplus shells have been converted into small boats (below, right), toys, furniture, etc. Stronger than aluminum, these boat hulls are practically indestructible under ordinary boat usage  
Columbia Rope Co. photo



Photo by Van Dusen



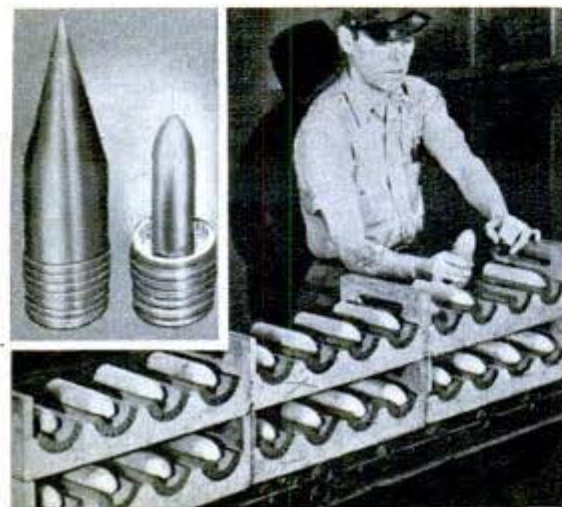
## Metal Tools Made to Last Longer With Aid of Demagnetizer



Undue wear on metal tools is prevented by a handy demagnetizer consisting of a round air-core coil mounted in a stand with an opening at a 45-degree angle. Drills, punches and other metal tools can be demagnetized by putting them inside the unit and withdrawing them slowly. Continuous operation is provided by a nonmetallic conveyor. Adhesion of metal particles by magnetism causes tools to generate more heat and wear out faster.

## Tungsten Case of Antitank Shell Rips Armor at 3,000 Yards

Fast-moving axis tanks have learned to be wary of a U. S. Army antitank weapon with a new type of armor piercing projectile, which owes its effectiveness to its core



of cemented tungsten carbide, hardest metal made by man. Its light weight permits it to be fired with much higher velocity than ordinary antitank shells. The higher velocity also gives it greater accuracy. The shell has stopped German tanks with a single shot at 3,000 yards. A projectile within a projectile, its core is centered in a housing made entirely of aluminum. The prime function of the outer body is to streamline the shell and permit a smaller diameter armor-piercing core to be fired from a larger bore gun. After penetration, the core breaks up into pieces, scattering inside the tank and often setting it afire.

## Meals Frozen on Paper Plates Save Work for Housewife

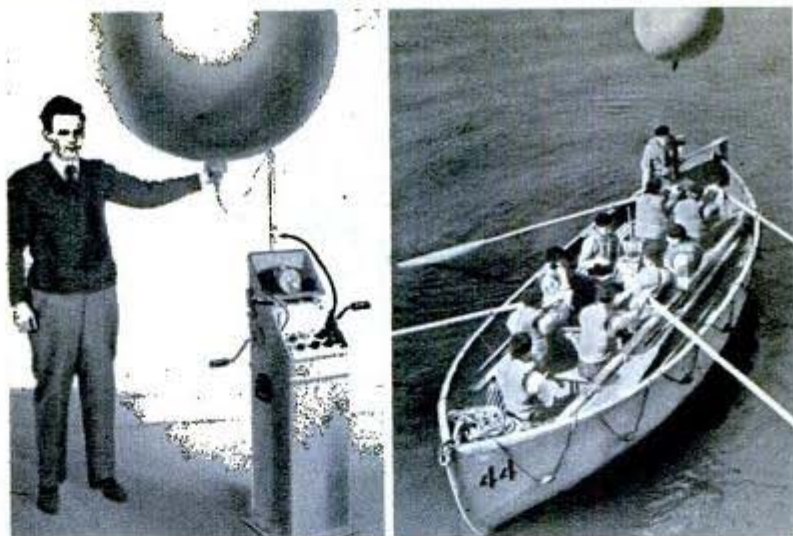
Two kitchen chores—cooking and dish-washing—will be reduced to a minimum for the postwar housewife if she purchases quick-frozen, partially cooked meals preserved on paper plates. When taken out of storage, the food is ready to be cooked for an additional 15 minutes, preferably in a specially designed oven, and then served



on the same plates. A synchronized cooking method is used in processing so that each food is precooked individually to within a brief period of the total time necessary. The partially cooked meals, known as Sky Plates, are being used by Naval Air Transport planes. The final minutes of cooking are done in a light, stainless steel, electric "whirlwind oven." Each plate is arranged on a different rack within the oven and a high-speed motor-driven fan at the rear distributes the hot air to provide a thorough final cooking.

## Balloon Aerial for Lifeboat Radio Gives 1,000-Mile Range

Carried aloft by a balloon or kite, depending on weather and wind conditions, a 300-foot antenna gives a range of 1,000 miles or more to new lifeboat radio equipment that transmits SOS and radio direction finder signals automatically. The kite and a collapsed balloon in a hermetically sealed container, with a small canister of helium, are standard parts of the equipment. The balloon is designed to stay up a week or more at a time. A hand-driven generator powers the two-way transmitter-receiver, using voice or code. Cranking of the generator causes an ingenious keying device to transmit series of SOS signals and long dashes for radio direction finder bearings. The transmitter delivers five watts to the antenna on the international distress fre-

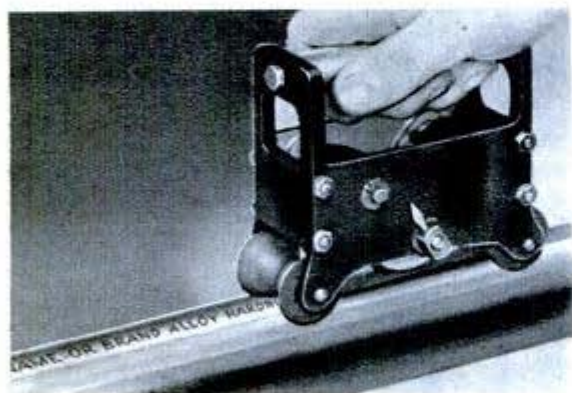


To send an SOS, just inflate balloon and turn crank of lifeboat radio

quency of 500 kilocycles, with a range of 50 to 200 miles, and on 8,280 kilocycles, reaching 1,000 miles or more. Any member of the crew can operate the unit without a knowledge of radio. The entire device is contained in a waterproof housing.

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## Roll-Along Printer Marks Pipes and Bars to Identify Cutoff Pieces



Marking pieces of long pipes, tubes, rods and bars so cutoff pieces can be identified is done quickly and easily with a roll-along hand printer. The tool marks the nature of the metal piece—its hardness, alloy and diameter—throughout its length and can be changed for various diameters by opening a wing nut, setting an indicator and then tightening the wing nut again. The die cylinder, equipped with interchangeable dies, is preceded and followed by "V" rollers to guide the impression to the top of the round metal piece and prevent running off the top of the tube or pipe.

## Net Towed by Ship Hooks Onto Catapult Plane for Hoisting From Sea

Catapult training for student pilots of the British Naval Air Arm includes instruction in the towed net method of recovery. Coming up to the ship, a Walrus plane taxis to the net and hooks on. It is hoisted inboard when it reaches a position directly under the hook.

☐ In gathering a pound of pollen, it is estimated bees visit and fertilize 8,000,000 flowers.



BUF 2-3	WRL 23	SOU 23
CALG DAD	N. Y. 34	ST. THO 1-2
CGO 1-2	N. BY 1-2	ST. JOH DAD
CLEV 2-3	OTWA 23	STFD 1-2
CBLT DAD	OW. SD 23	SUD DAD
DET DAD	PBO 34	SWAS 1-2
FT. WM DAD	PORQ DAD	VAN DAD
HFX DAD	REGINA DAD	WIND 1-2
	ROCH 34	WPG DAD



# TALKING OVER WAVES

Long distance headaches register on delay board, left. DAD means delay all day. Repeater bays shown below amplify signals. Bottom, how four calls travel over one line at once

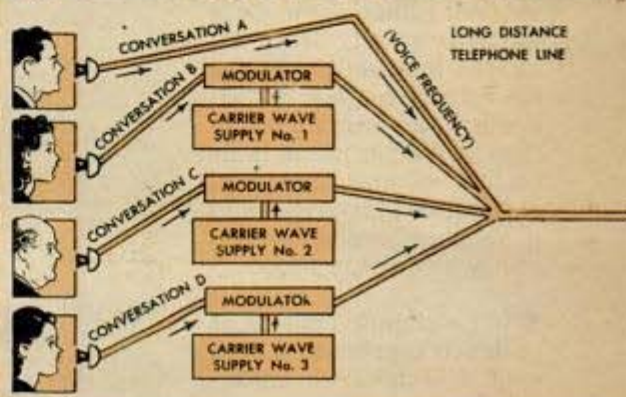
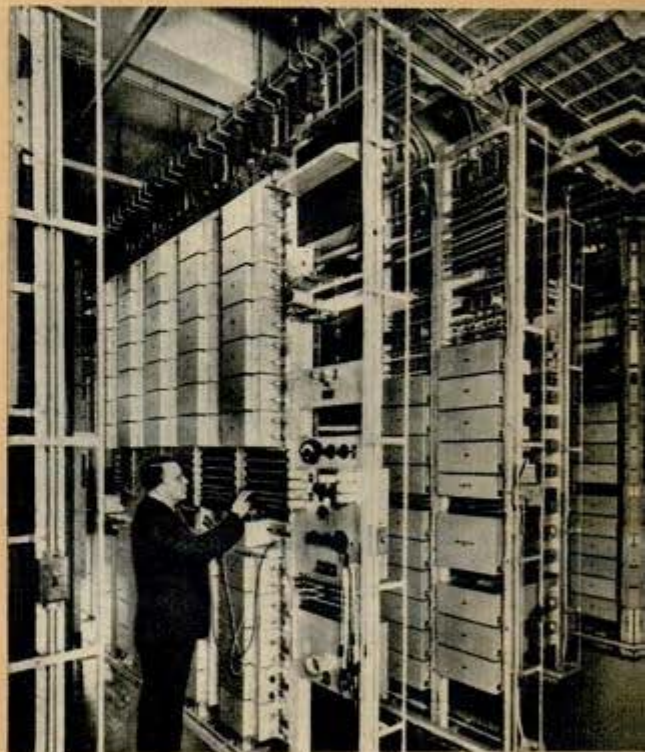
By S. G. Cooper

MODERN television stations have a range of not much more than 50 miles, but it won't be too long after the war before we have regional television networks and even a transcontinental chain. Strangely enough, we'll owe such networks to the telephone companies, which developed them incidentally while trying to make it possible to send several long distance conversations over the same pair of wires at the same time.

These networks, of course, will be wired and must not be confused with the radio networks which will use chains of satellite or relay transmitters to rebroadcast television and Frequency Modulation signals from a master station. Even now, the American Telephone and Telegraph Company is planning an experimental microwave radio relay between New York and Boston for long distance telephone calls and sound and television broadcasts.

Stringing telephone lines across the country is an expensive job and ever since the first long distance lines were set up the telephone companies have been looking for ways to increase the number of usable channels without stringing more wires. Electric circuits have to be closed, so it takes two wires to complete each telephone circuit. This means that when you talk from coast to coast you are using 7,000 miles of copper wire.

The first answer to the problem was the "ghost" or "phantom" circuit. If two pairs of wires are strung between two cities, one conversation can go on over each pair. In addition, we can use each pair as one wire of a third circuit, allowing one more con-

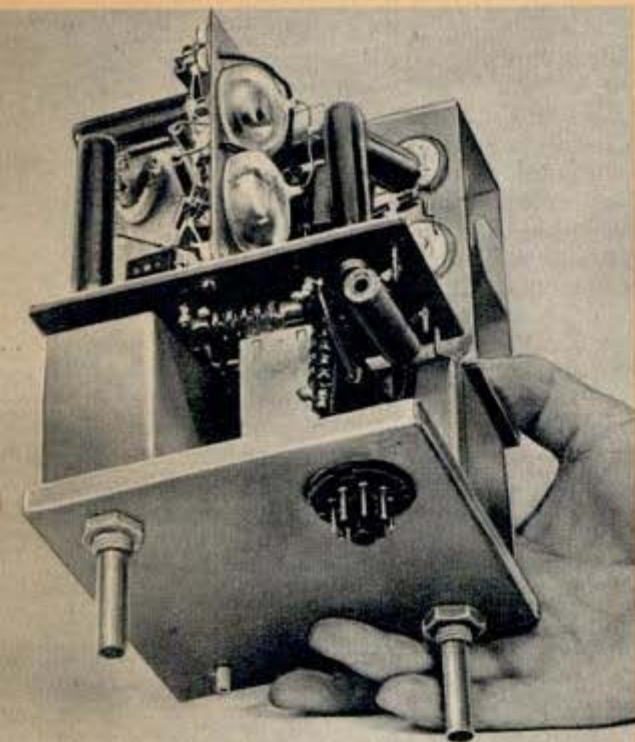


versation. This electrical trick gives a 50 percent increase in talking channels—and a corresponding cut in your long distance bill.

Phantom circuits, however, aren't enough. We have a much better way now, called a carrier system. The average human ear can pick up sound vibrations that go as high as 20,000 cycles per second, but ordinary speech can be understood well if it is limited to a band from 200 to 3,000 cycles. You wouldn't be satisfied if you heard a symphony orchestra held to this range, but it's quite good enough for talking and simplifies telephone design.



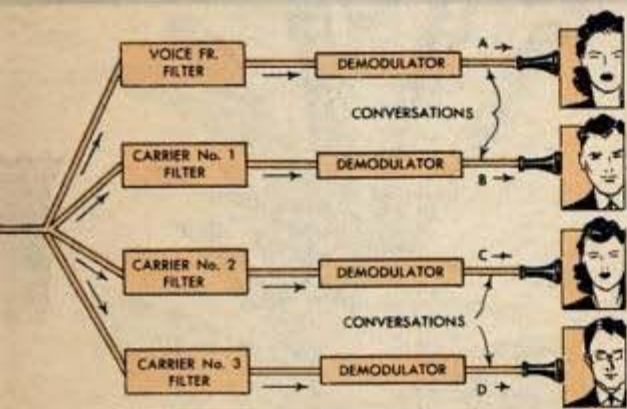
Pontoon method is used to lay submarine telephone cable across river, above. Coaxial cable amplifier, left, can handle frequency band up to 3,000,000 cycles wide



The carrier process makes this voice frequency system of waves ride piggy-back on one another. Radios work the same way, and the telephone carrier is really just wired radio.

In radio, the transmitter broadcasts a constant, high-frequency (carrier) wave; the voice current is fed into the transmitter and "modulates" or changes the carrier wave so that the result is a combination of the two. As the carrier is considerably higher in pitch, the combination modulated wave is reasonably close in frequency to it. At your receiving set the modulated wave is picked up, and a vacuum tube demodulates or strips off the carrier wave, leaving the voice current, which then is amplified and fed into the loudspeaker. Transmitters use different frequencies of carrier waves to avoid interference with each other.

When you speak into your telephone, the voice currents you set up travel to the central toll building, where they modulate a carrier wave, and the resulting signal goes over wires to a central office at its destination. There it is demodulated and the voice currents then pass through a local office to the phone which you are calling. To get more than one message on the wires at one time, different carrier frequencies are used, the jumbled mass traveling through the line as a whole. At the destination point it passes through electrical filters, each of which allows only a certain band of frequencies to get by. Thus the mass is broken up into its original number of modulated carrier waves. Each carrier wave then goes to its own demodulator for conversion into the corre-





Workmen grapple with one end of telephone cable laid under water

sponding voice current. If the voice current band is 3,000 cycles wide, then the carriers must be at least 3,000 cycles apart—preferably more, because the filters aren't perfect. The filters work something like your radio tuner, which often will bring in at the same time two stations whose frequencies are close together.

The biggest difference between radio and telephone carriers is in their frequency bands. The standard broadcast band ranges from 500,000 to 1,500,000 cycles, with short-wave bands of much higher frequencies. The ordinary phone carrier uses frequencies of 3,000 to 30,000 cycles, providing six

channels. This doesn't mean that six conversations can go on over the same pair of wires at once. It's a tricky job to balance a carrier circuit so the same wires can carry a two-way conversation with one carrier wave. Usually it isn't worth the trouble so half the channels are used for east-west communication and half for west-east. As well as the carrier conversations, one voice-frequency (200-3,000 cycle) conversation can be carried; this means that a four-wire "quad" (two pairs) can carry three complete carrier circuits on each pair, one voice-frequency circuit on each pair and one phantom voice-frequency circuit using both pairs. This adds up to a total of nine conversations taking place at the same time over the two pairs of wires.

Until recently, 30,000 cycles was about the highest frequency that could be used over wires. There is a big loss of power—telephone engineers call it attenuation—when you transmit signals either over cable or open wire, plus crosstalk difficulties, as nearby lines pick up a lot of interference at high frequencies. Two workable carrier systems for frequencies over 30,000 cycles were developed only a few years ago. The "K" carrier, for cables, gives 12 one-way channels in the band between 12,000 and 60,000 cycles. Two wire pairs are used, one for east-west and one for west-east conversations. The J-type carrier is for open wire strung on poles,

Splicing a coaxial cable, below left. At right, new cable carries six coaxials, many ordinary wire pairs





and has a frequency band of 36,000 to 140,000 cycles. The separation between carrier waves is 4,000 cycles, giving 24 one-way or 12 two-way channels on each pair of wires. With this system the old type of carrier can be used as well, making a total of 16 two-way channels on each pair. The J-type wave spacing gives a wider spread of voice frequencies, reproducing the human voice much better.

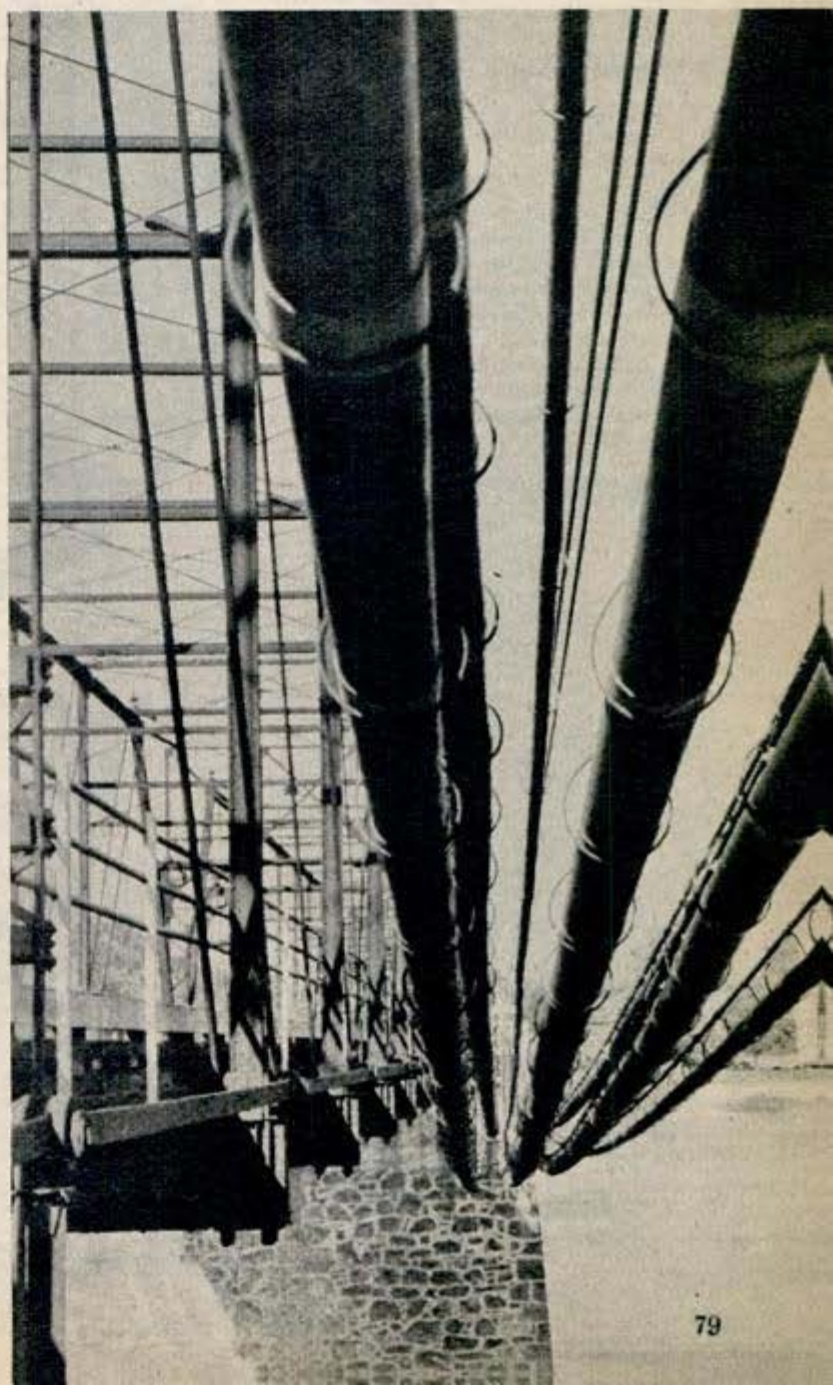
With these complicated electrical circuits, talking from Boston to San Francisco takes a lot of extra equipment. Without it, attenuation would make it impossible to carry a signal 3,500 miles, or probably even a tenth as far. Amplifiers—twin brothers to that in your radio, but called repeaters to make it harder—must be put into the circuit every so often to step up the strength of the current. A Boston-San Francisco circuit stops for amplification at New York, Harrisburg, Pittsburgh, Beaver Dam, Morrel Park, Davenport, Omaha, North Platte, Denver, Rawlins, Salt Lake City, Winnemucca and Sacramento. Power loss is terrific; to be heard clearly at San Francisco without repeaters, you would have to put in at Boston as much power as the sun delivers to the entire earth. The "K" cable carrier loss is so big that repeaters must be used every 16 miles.

Most repeater stations work automatically, with only an occasional visit from a service man. The weather isn't automatic, though, and temperature changes, sleet or high winds make the line resistance vary. This alters the strength of the signals coming through a repeater section and necessitates different amplification at each repeater. One carrier frequency is then used as a "pilot channel"; it carries no conversation, but just a steady signal. If the signal strength goes up or down, the repeater amplification is decreased or increased automatically to make up for it.

(Continued to page 152)



Coaxial cable eventually will enable you to see scenes like that above by television, no matter where you live. The coaxial across the Delaware, third from left below, is dwarfed by regular cables



## "SPUN-SUGAR" PLASTICS

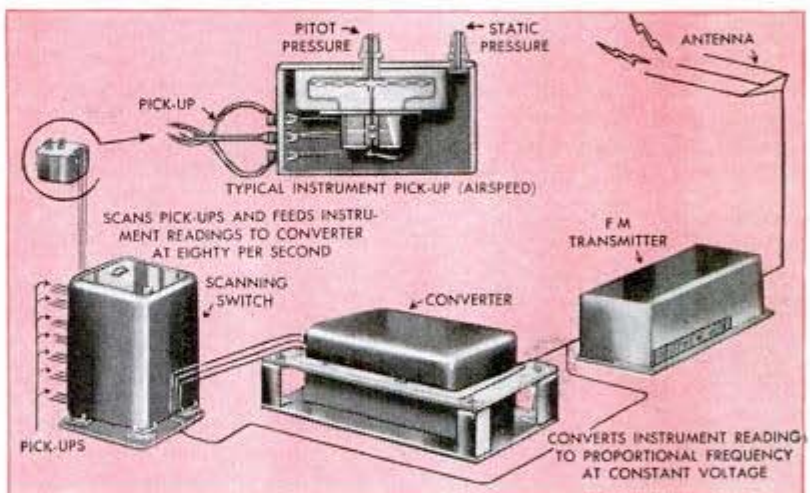
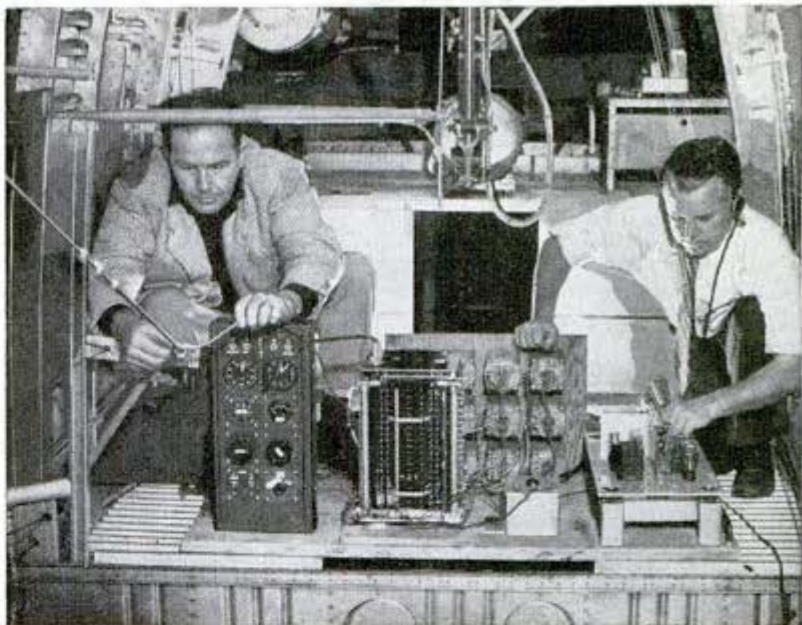


It's an art, this creation of one-of-a-kind masterpieces from scraps of plastic material. The originator, Emile Norman of California, had to invent his own tools, concoct glue and special dyes for his fine work, akin to the spun-sugar creations of a pastry chef. Above, a triple-sided flower holder. Right, plastic orchid with delicate veins for the hairdo. Below, a crown with fronds. Coach's top comes off, reveals flower holder



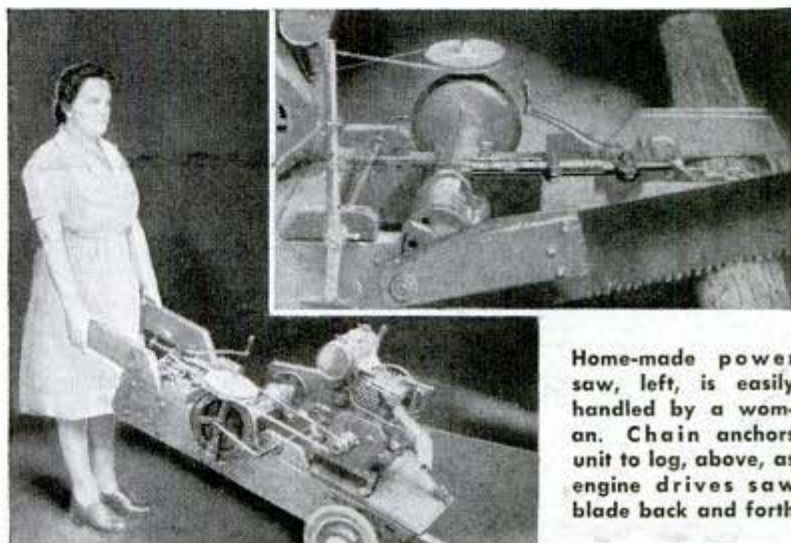
# Electronic Brain Radios Data on Test Flights

Research engineers at Consolidated-Vultee Aircraft Corporation have invented a flight recorder, a self-operating radio transmitter which automatically sends a continuous report of the test flight of a plane to a receiver on the ground. The electronic brain supplies a running account of the stresses, pressures, temperatures and other conditions to which the aircraft is subjected. These instrument indications—often coming in at 80 per second—are recorded on graphs, enabling ground engineers to check every phase of the plane's performance at all times. Before the flight recorder was developed, hundreds of test flights were required to obtain preliminary engineering data for a single fighter plane design. Even in bombers, which carried special observers, tests were not entirely satisfactory because even skilled eyes and hands cannot follow all details of the aircraft's performance, especially at high altitudes.



# Power Saw Made From Scrap for \$15 Cuts 12-Inch Logs

Constructed of salvaged parts, a light, portable cross-cut power saw is capable of sawing logs 12 inches in diameter. The engine cost \$10 secondhand and the 3½-foot saw was \$3.75 new. The crankshaft and gearing unit were salvaged from an old washing machine that cost 50 cents. The jack used to tighten the chain fastening the saw frame to the log was from an old tire rim spreader costing 25 cents, and the two toy wagon wheels were 50 cents each.



Home-made power saw, left, is easily handled by a woman. Chain anchors unit to log, above, as engine drives saw blade back and forth

# "BIG MO" CALLS HER SHOTS



U. S. Navy photos

**USS Missouri, mightiest of battleships, is 880 feet long and carries a main battery of nine 16-inch guns**

**N**OW the facts can be told about Uncle Sam's knockout punch, the USS Missouri, largest, fastest and deadliest battleship ever to plow the seas.

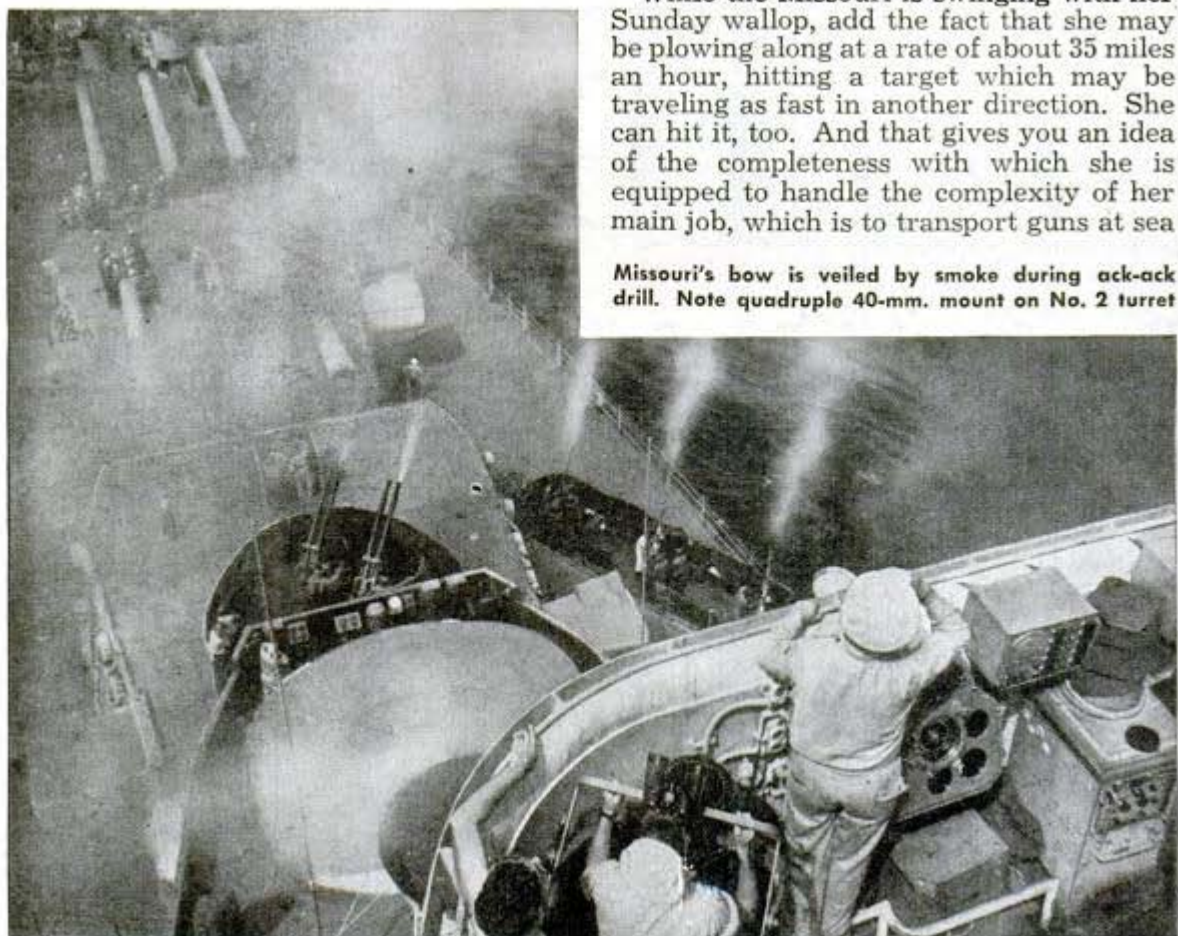
The simplest way to picture what happens on this gigantic superwarship when its main battery of nine armor piercing guns lets go a salvo is this: Imagine nine Ford automobiles hurled into the air at a

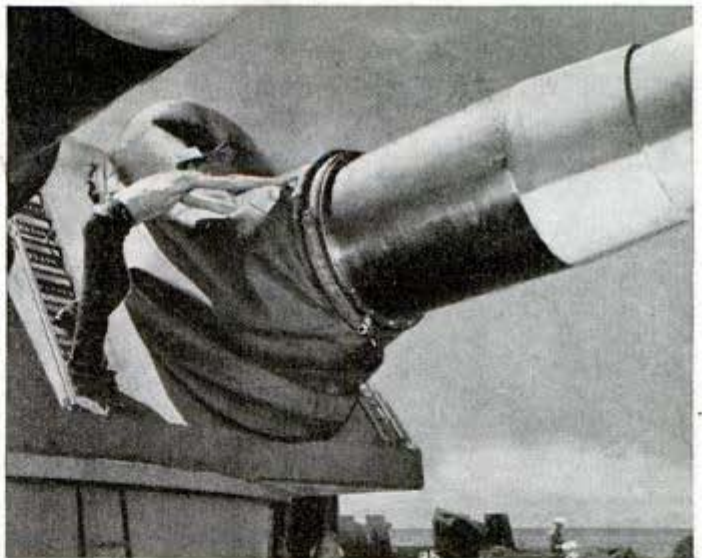
speed of 200 miles an hour, aimed so accurately that they will hit a target 20 miles away with tons of deadly explosive.

Repeat this main salvo over and over again and add the firepower of 149 more guns of various sizes and you have tossed something terrific in the midst of a Japanese task force. You have tossed in "Big Mo," as the navy calls her.

While the Missouri is swinging with her Sunday wallop, add the fact that she may be plowing along at a rate of about 35 miles an hour, hitting a target which may be traveling as fast in another direction. She can hit it, too. And that gives you an idea of the completeness with which she is equipped to handle the complexity of her main job, which is to transport guns at sea

**Missouri's bow is veiled by smoke during ack-ack drill. Note quadruple 40-mm. mount on No. 2 turret**





Above at right, adjusting rubber "bloomer" worn by 16-inch gun to protect turret juncture from weather

and let go with them wherever they may be called upon to bring destruction to our enemies.

Taking the Missouri in action at sea strictly as a manpower job, figure that 60 percent of her 2,500 to 3,000-man crew are connected with gunnery, then add between 500 and 700 more men who abandon other duties to man guns, pass powder, handle ammunition and otherwise lend a hand, and you see that it takes between 2,000 and 2,500 men working at top speed to rain ruin on the enemy.

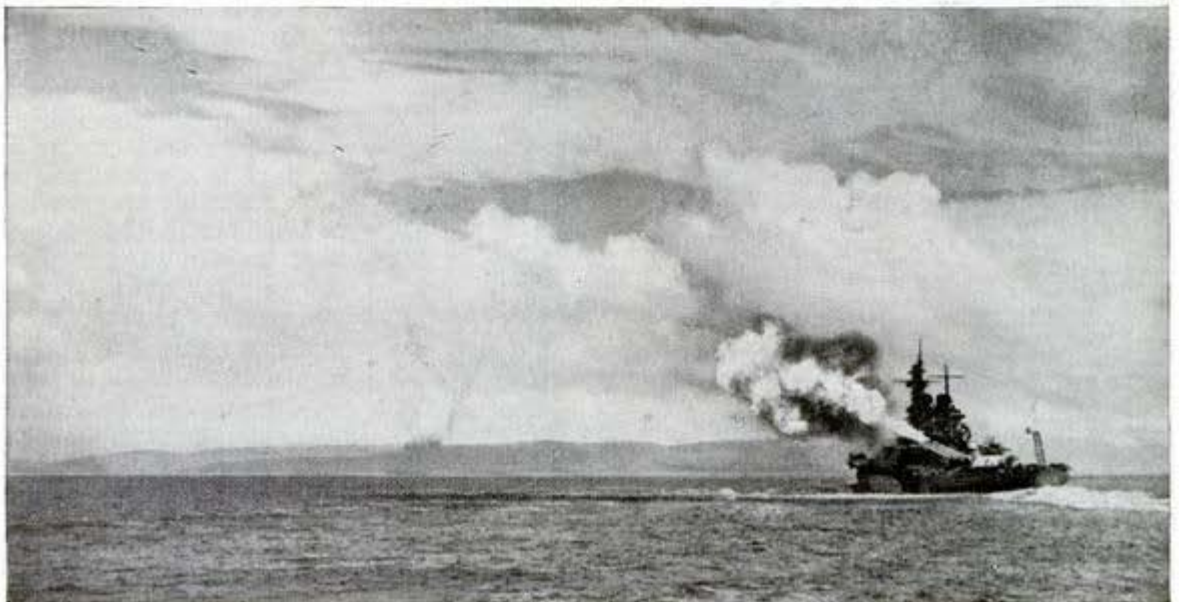
In fact, the Missouri is the "fightin'est" hunk of steel the world is likely to see for some time. Even navy men marvel at the forest of 158 guns bristling over her 880-foot length and 108-foot beam. Some guns extend over her sides and stern in 40-mm.

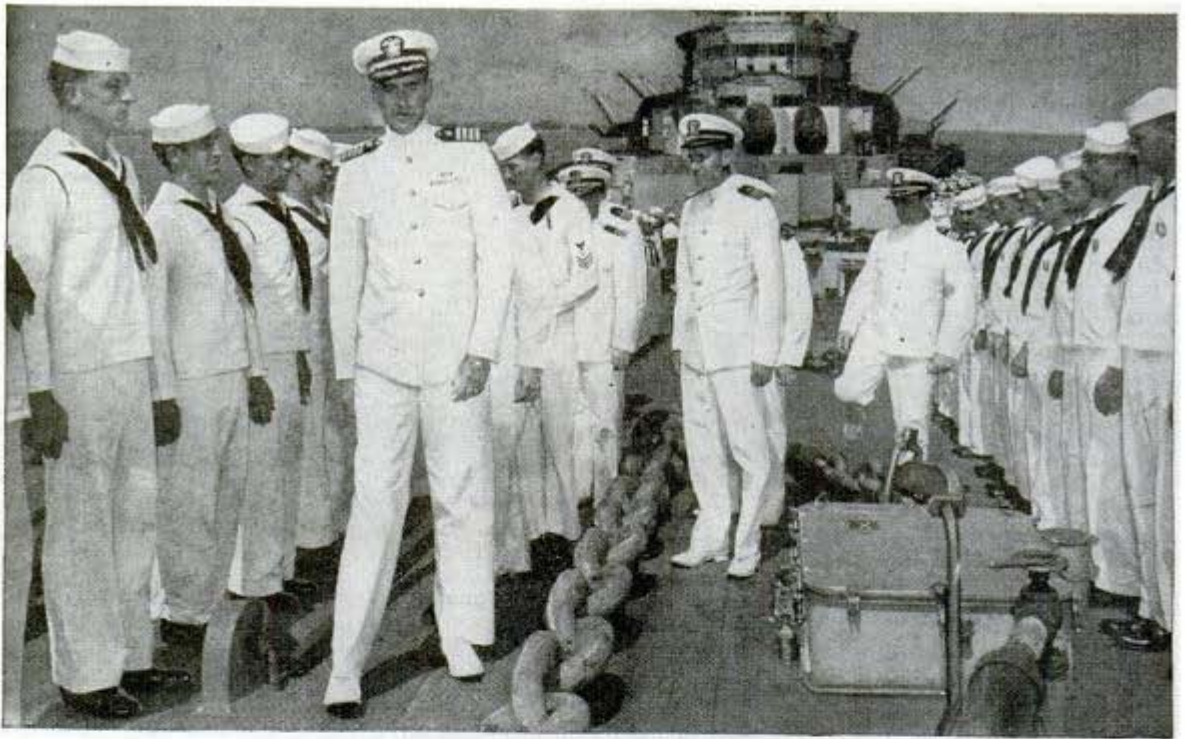
mounts which look so much like bathtubs that that's exactly what the crew calls them.

Aside from the nine 16-inch monsters contained in three 2,000-ton turrets—two forward and one aft the midship citadel—she has 20 five-inch guns ranged along her sides in two levels of twin mounts. These, reflecting the fact that sea warfare has taken largely to the air, are dual-purpose guns which may be elevated to knock down planes. The rest of the maze of guns is composed mostly of 40-mm. Bofors and 20-mm. Oerlikons.

Or, to look only at her weight, she is rated at 45,000 tons and weighs 52,600 tons loaded, but appears unusually slim and rakish with her clipper type bow and rounded stern. One reason for this slimness is that her beam of 108 feet is exactly two feet less

"Big Mo" lets go with main battery salvo from after turret. Note the three 16-inch projectiles at left





**Capt. Wm. Callaghan, Missouri skipper, inspects sailors on deck**

than the narrowest point in the Panama Canal, which governs the beam of all of Uncle Sam's big naval vessels, since the nation has two seacoasts to protect and warships must be able to shuttle back and forth in a hurry.

Like most 16-inch gun ships, her main armor is a 16-inch thick belt of the toughest steel yet devised for the purpose. In com-

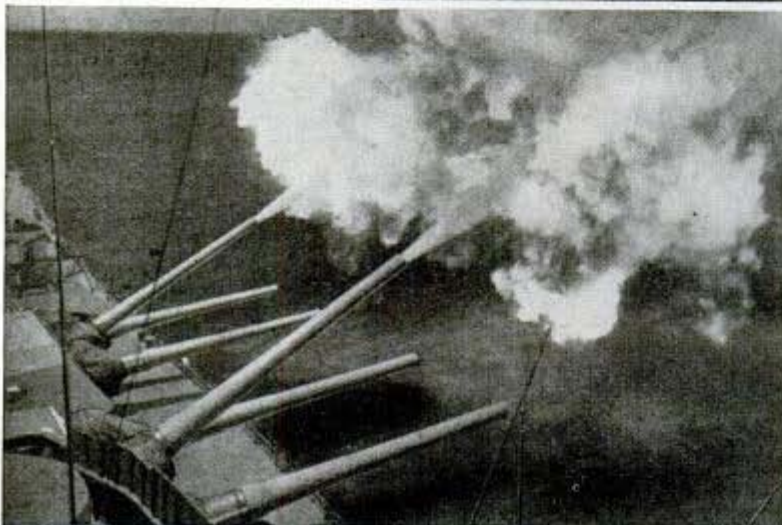
**Gun captain inside turret swings open breech of 16-incher. Below, flaming gases rush out of guns during main battery salvo**



mon with all really modern battleships, her waterline is buffered against submarine and plane torpedoes by a protective covering of oil and water compartments designed to absorb the force of water-borne missiles. So fast is the Missouri, however, that she can outrun any submarine afloat.

Nicely designed from her anchor chains, each link of which is as big as a man's torso, to her airplane crane at the stern, she provides the most stable gun platform ever devised to sail the sea. Even so, her salvos cause her to shudder from bow to stern and actually have been known to blow the cotton plugs out of the ears of the crew. When not in action she provides as steady walking underfoot in an ordinary sea as your own back yard.

To give yourself a conception of the size of this \$100,000,000 beauty, consider these facts: The Missouri displaces enough





**Ship's company lines up amid planes and guns for inspection**

water to flood 933 city building lots, roughly one sixth of the island of Manhattan. She has 418,000 square feet of deck and platform area, the equivalent of a 15-story office building.

In height, she may be compared with a 13-story structure, the first four floors of which would be occupied mostly by her power facilities, which include four great sets of boilers. These boilers produce superheated steam at 600 pounds pressure to operate turbines of 200,000 horsepower which are geared to four giant propellers. These screws produce such a wake that sailors wash their hammocks by tossing them into the sea at the ends of ropes.

So complicated is the maze of 15,000 valves in this floating powerhouse below decks that the handles are divided by colors so that a new crewman can be instructed to "close the red ones" or "open the yellow ones." The engine

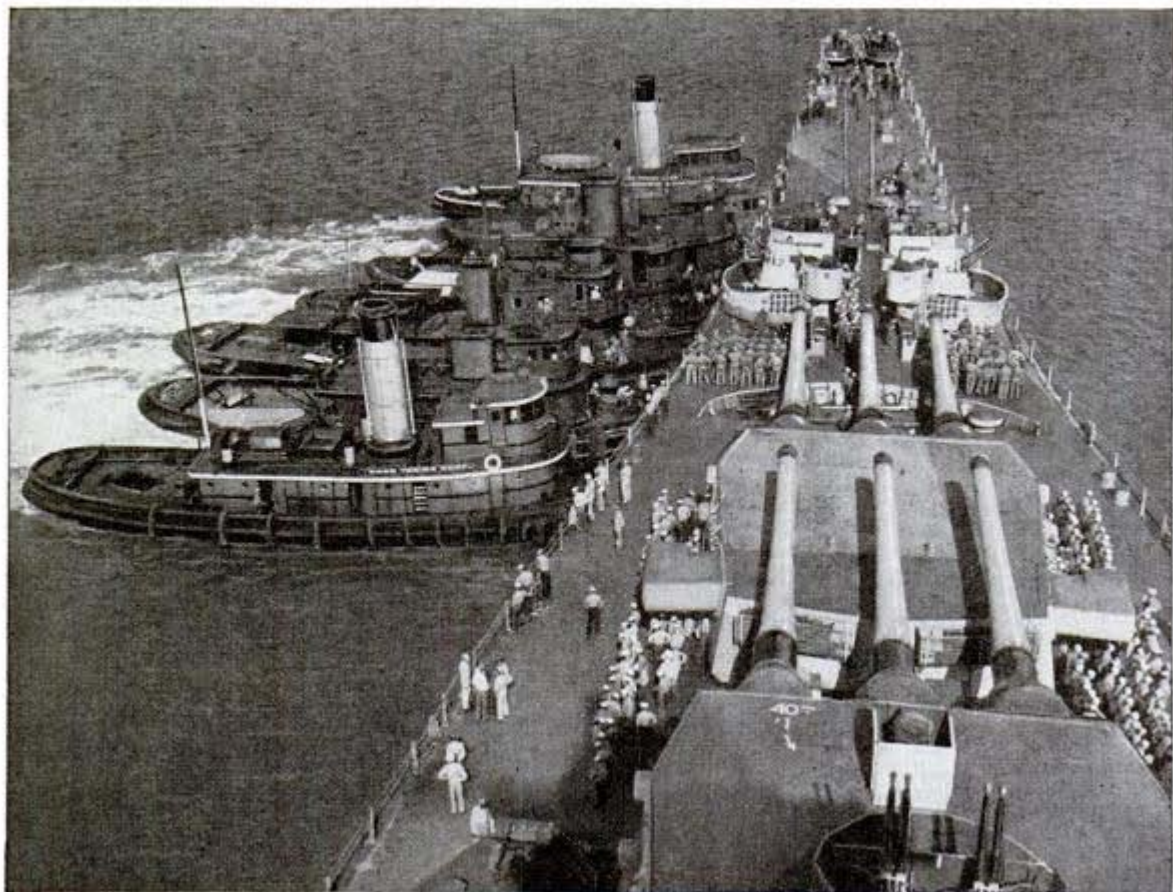


rooms have a total of 1,857 access openings, including 161 hatches, 844 doors and 852 manholes.

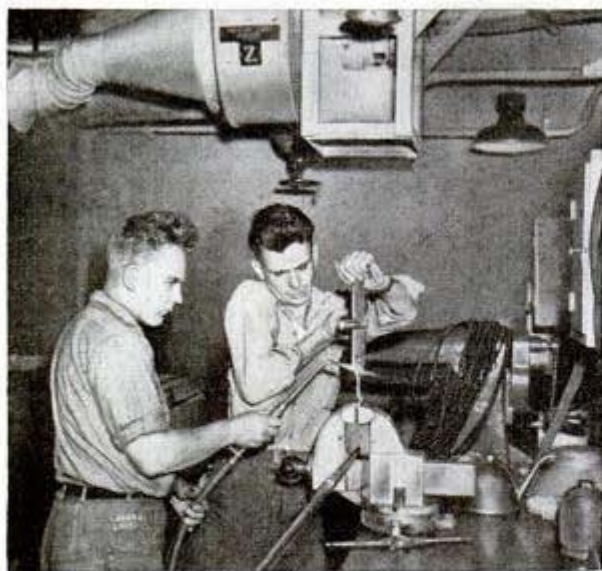
More than 2,500,000 feet of cable are in the ship's wiring system. She has 5,000 light sockets, 800 battle telephone headsets for station-to-station communication as well as 280 dial telephones and an automatic exchange which operates like a modern city's "central."

**Seaman runs up flag hoist on signal bridge. Below "back pockets" on "Big Mo" hold AA guns**





Seven tugs turn "Big Mo" away from dock as the crew musters on deck for morning quarters. Below, technicians bend a steel bracket in ship's metalsmith shop



Electricity operates a multitude of devices from her 2,000-ton main gun turrets to her 180 loudspeakers, her 36-inch searchlights which stab the night with brilliant glare and her complicated devices which give range, bearing and speed to aim her guns.

There are a total of more than 900 electric motors aboard and something like 1,700

miles of wiring. Enough piping is laid in her vital interior to extend the 90 miles from New York to Philadelphia and there are 17 miles of air conditioning and refrigeration ducts as well as 16 miles of ventilation carriers.

Skimpily coated with paint, as are all warships in wartime, to save weight for speed, the Missouri nevertheless carries 312,000 pounds. Fifteen miles of wire and manila rope are necessary for her operation.

She has a bakeshop which turns out 1,800 loaves of bread a day, an ice cream plant which can produce 1,000 quarts of this delicacy every 24 hours and a laundry which can handle the needs of 3,000 men with ease.

Almost every community service is offered by her tailor shop, cobbler shop, soda fountain, barber shop, print shop, clothing store, library and post office. There are five doctors and three dentists to look after the health of the floating populace. Hospital facilities are complete and any type of surgical operation can be undertaken at sea. The ship's broad fantail is a gymnasium for boxing matches in the afternoon, becomes a theater for movies at night and serves as a chapel for prayers on Sunday. There are two chaplains on board, and Protestant, Catholic and



Jewish services are conducted regularly.

The print shop not only publishes a newspaper for the officers and crew, but once it even turned out a 700-page organization book. It has photographic, photoengraving and offset facilities to make publishing at sea an efficient job.

Constructed at Brooklyn Navy Yard and commanded by Captain William McCombe Callaghan, the Missouri was known as a "happy ship" when she completed her shakedown cruise, so well did her crew respond to their assignment to the greatest battleship ever floated. More than 3,000 naval officers applied for service on her. So successful was the shakedown that she got in more target practice in these weeks than a battleship ordinarily gets in two peacetime years.

It took three years to complete the design for the ship and two years actually to build her.

Approximately 530,000 man days and 17 tons of blue prints were needed. Building required 3,300,000 man days and would have kept 20 draftsmen and 18 skilled mechanics busy six days a week for 506 years.

Any way you look at her, the Missouri is major league and she isn't merely tossing rivets, either, Mr. Hirohito.



By wielding a long fender pole, sailors keep Kingfisher scout plane's wing tip from bumping against ship's stern as it is hoisted aboard. Below, a main battery salvo as seen from the bow. No. 1 turret's three 16-inch guns blast so hard they churn the water and blow billowing smoke clouds



# Crash Boat Squad Saves Robot Target Planes



Upper left, robot plane's parachute must be detached swiftly by rescue squad. Plane is lifted tail up, as below, to shed salt water quickly. Gasoline bath, above, saves engine

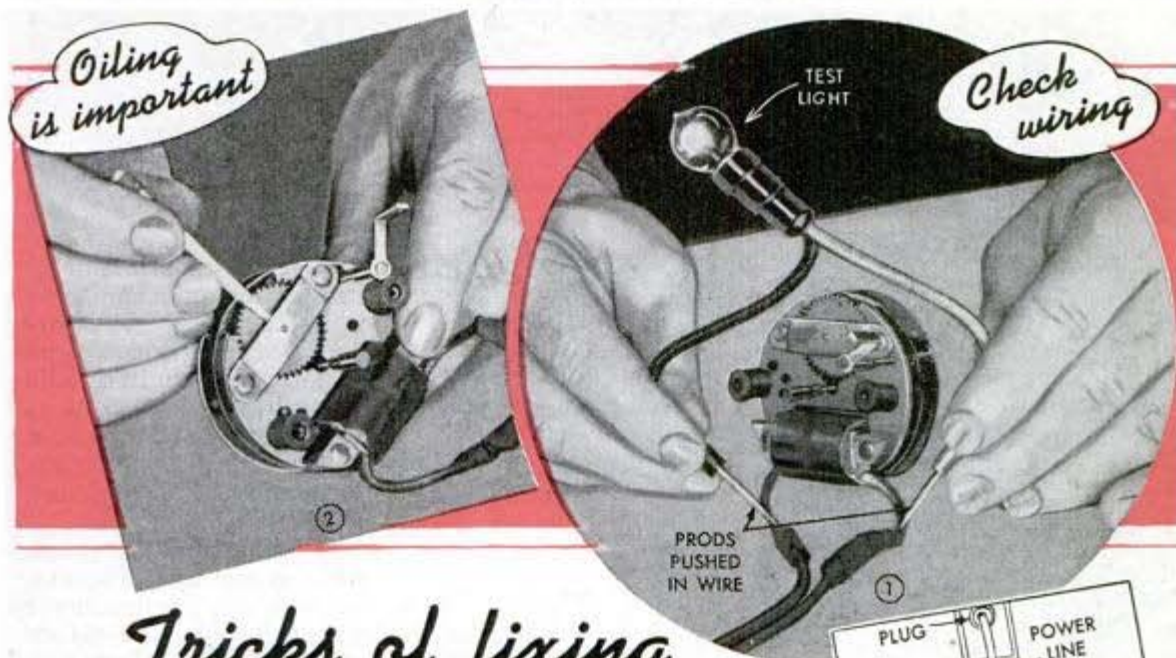
Robot target planes shot down in anti-aircraft drill are rescued from the Pacific by soldiers of the Panama Coast Artillery Command, who dare the choppy ocean in a flimsy, 16-foot, oar-powered boat. The rescues are part of the job of the Aerial Target Detachment, which keeps the fleet of target planes in operating order. Piloted by remote control, the planes fly over Panama's gun-studded coasts through geysers of anti-aircraft fire. When a plane is hit, a parachute opens and eases descent to the water where the craft floats on air-filled

wings. All guns are silenced as the rescue squad hurries to retrieve it. Parachutes must be disconnected before the robot may be taken from the water and the crew is in constant danger from vicious swells. The midget plane always is approached from the rear and lifted tail up to shed salt water, which might ruin the motor and electrical apparatus. Once in the hangar, the plane's electrical system is removed, all control parts washed and the motor started to boil out lingering salt water. A robot usually survives no more than 10 crashes.

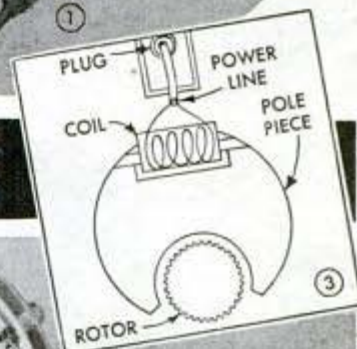
## Computer Figures Range and Keeps Pilot on the Beam



To keep instrument pilots on the beam, radio range problems are computed instantly by an orientator and turn and heading chart. The flight computer dial gives a continuous visual picture of the radio range being flown, quadrant bisector headings, time required for any given amount of turn and new magnetic headings after the turn, right angle course to average bisector, perpendicular heading to any selected beam leg, and magnetic headings to use during turn-around procedure on each beam leg. In direction-finding the computer aids in determining bearings and drift corrections. When four arms on the orientator are set to coincide with beam bearings on the radio range being flown, the four bisector headings are automatically indicated.

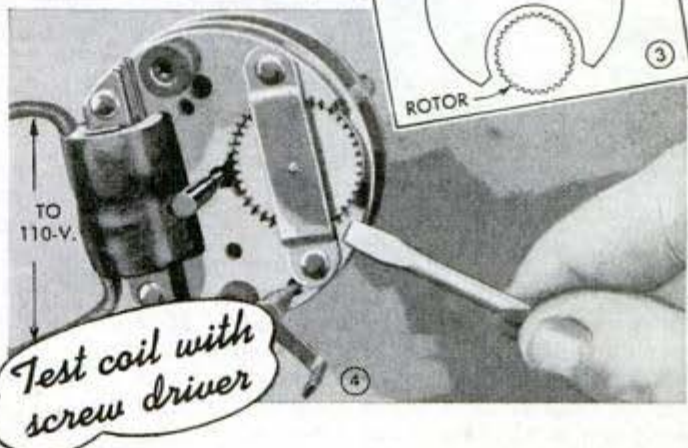


## Tricks of fixing ELECTRIC CLOCKS



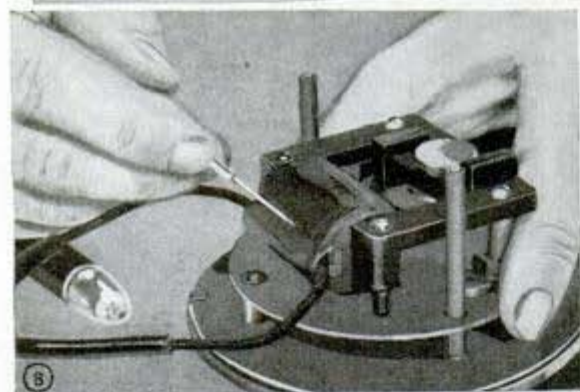
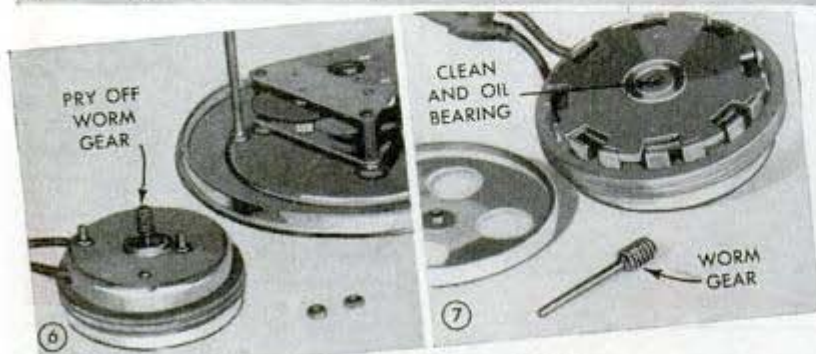
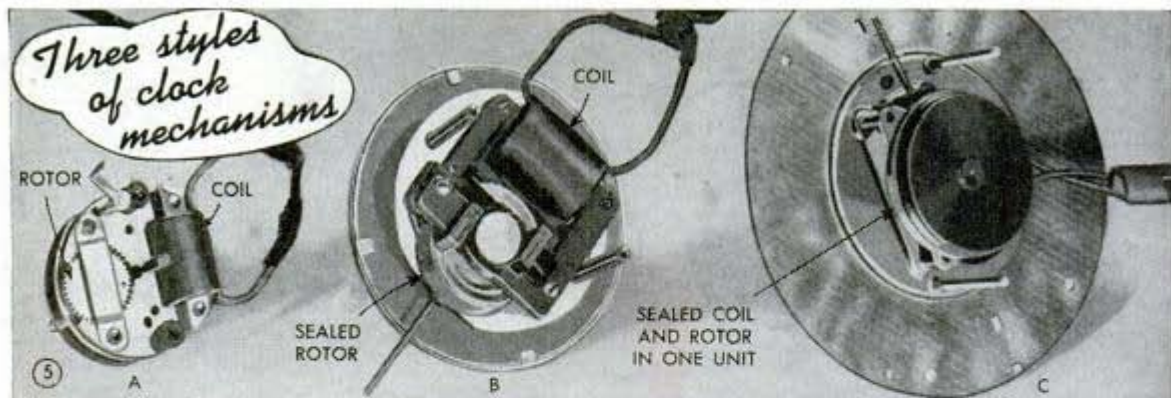
DO YOU have an electric clock that won't run? Just follow these simple steps and it's ten to one you can start the hands going again. First, dismantle the clock. This is a simple procedure, which involves taking out a couple of screws to remove the clock back or the entire mechanism from the case. It may be a simple unit like the one shown in Figs. 1 and 3, or the driving mechanism may be sealed, as those shown in details B and C of Fig. 5. At any rate, the actual operation is the same as diagrammed in Fig. 3—the current flows through the coil, setting up a magnetic field in the pole piece that causes the rotor to revolve.

Obviously, the first thing to check is the coil. Plug in at power source, then hold the clock to your ear. A faint hum indicates that the coil passes current. The coil hum is sometimes very faint and a more positive check is to touch a screwdriver to the pole piece near the rim of the rotor, as shown in Fig. 4. A gentle vibration indicates that the coil is in good condition. If the coil does not seem to pass current go over the wiring. Use any kind of electrical



tester and test the current flow right up to the coil, which is easily done by using sharp test prods and sticking them into the wires near the coil, as shown in Fig. 1. If the line tests okay and if the coil is not dead, the trouble, then, must be at the rotor or other point of the mechanism. Perhaps something is jammed.

In many cases, a dry, gummy bearing at the rotor is the source of the trouble. Clean the clock as well as you can with a small piece of cloth wrapped around a matchstick and dampened with any kind of cleaning fluid. Then, with a pointed match, care-



Coil repairs are usually impractical and, in sealed units, impossible. However, with the open type of coil as shown in details A and B of Fig. 5, it is worth looking into as a last resort. Split the insulation, Fig. 8, and unwind the first layer of wire. If you find a break, you can fix the coil by soldering.

If you don't find the break in the first layer you can stop right there because invariably the break is near one end or the other. Obviously, you can't get at the inside end. The final remedy is to write the manufacturer for a quotation on a new coil. Many manufacturers will exchange rebuilt units for your defective ones at a nominal service charge.

### Eye of Hammer Head Barbed To Secure Handle

You won't be bothered with a hammer head coming off the handle if you form small barbs inside the eye before inserting the handle. Use a small cold chisel to form the barbs and work from the front end of the eye. Then, drive the head on the



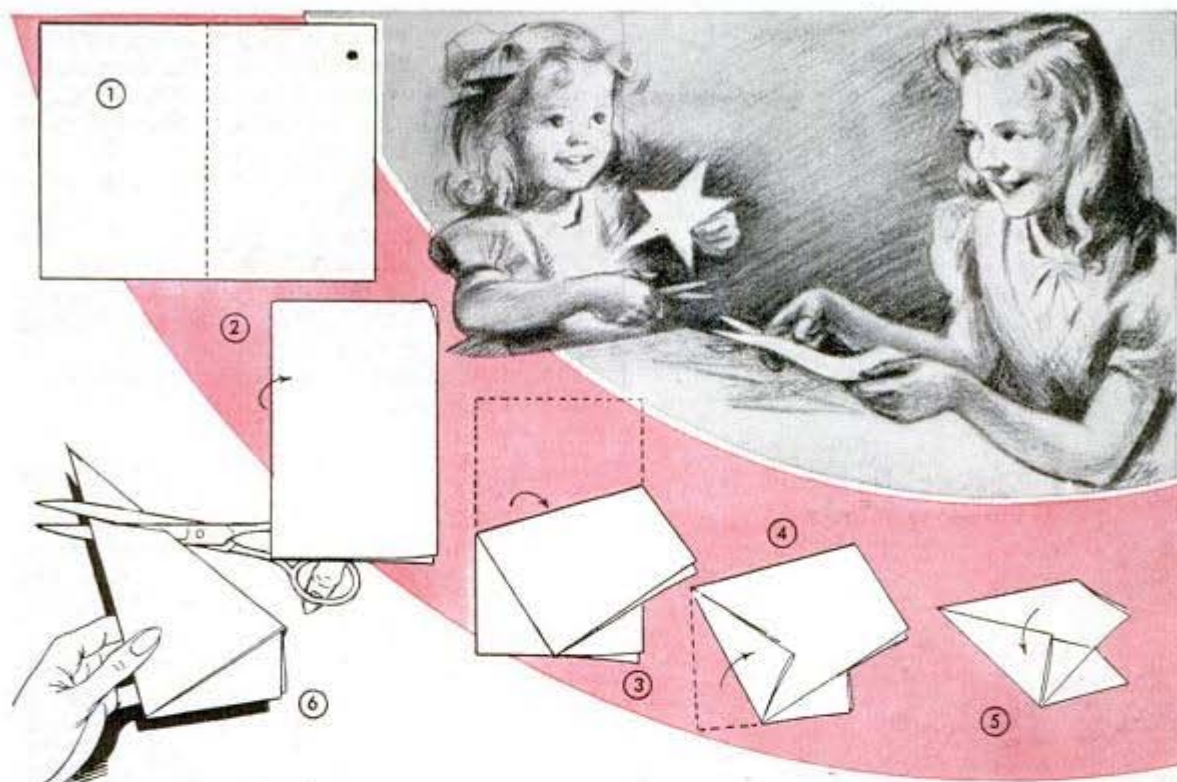
handle and use a wedge in the regular way. The wedge will expand the wood, forcing the barbs firmly into it. If a little shrinkage does take place, the imbedded barbs still will hold the handle. — A. H. Waychoff, Phoenix, Ariz.

fully oil all the bearings that you can see, and the rotor shaft, as in Fig. 2. Use any good grade of nondrying, nongumming oil, such as watch oil, gun oil, etc. After this, it's probable that the clock will run. If it doesn't, check the mounting—sometimes this is rubber tubing over studs and the rubber may have deteriorated, letting the clock sag so that hands or other parts rub. Rubber mounting can be replaced with "spaghetti" tubing used in radio work. Spin the rotor of the clock with your finger—it should revolve freely. Don't worry about end play at rotor shaft; it is made that way and centers automatically in the magnetic field when the clock is running.

If your clock has combined coil and motor like the one shown in detail C of Fig. 5, remove the whole unit by unscrewing two nuts that hold it in place. It will then look like Fig. 6. With slim pliers or other suitable tool, pry off the worm gear. The parts are shown at Fig. 7. Then the long bearing surface can be cleaned and reoiled.

☐ In replacing glass in car doors or windshields be sure to use the same type as the original equipment. Distorted vision may result from use of the wrong type.

# Five-Pointed Star With One Snip of Scissors



A perfectly proportioned five-pointed star can be cut from paper with a single cut of your scissors if the paper is folded four times as shown in Figs. 1 to 5. Ordinary  $8\frac{1}{2}$  by 11-in. paper, or other paper of the same proportions, is suitable. First, it is folded once through the middle as shown in Figs. 1 and 2. Then the upper left-hand corner is brought down to the center of the bottom edge and the paper is folded as in Fig. 3. Next, the lower left-hand corner is brought up and the paper is

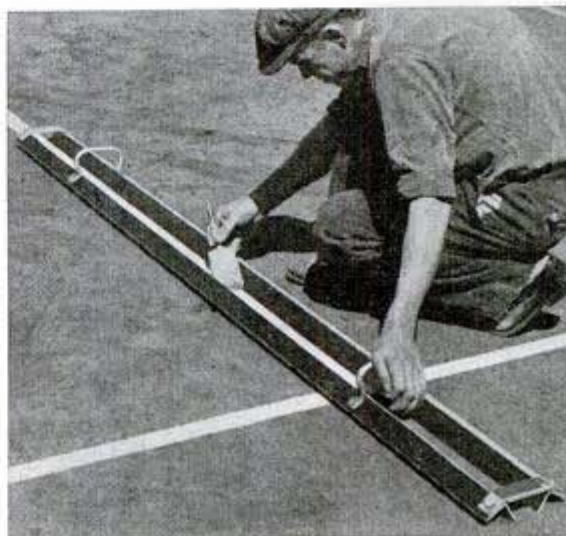
folded along the diagonal edge, Fig. 4. Finally, the right-hand edge is turned up to meet the left-hand edge as in Fig. 5, or the right-hand portion can be folded under at the edge of the left-hand flap. Now the folded paper is cut as in Fig. 6, and the cut-off portion will be the star. If long, narrow points are wanted, the cut should be made at an acute angle, slanting toward the tip. A cut made more nearly straight across the paper will produce a star with blunter points.—P. L. Brownell, Omaha, Nebr.

## Template Aids in Painting Lines on Various Game Courts

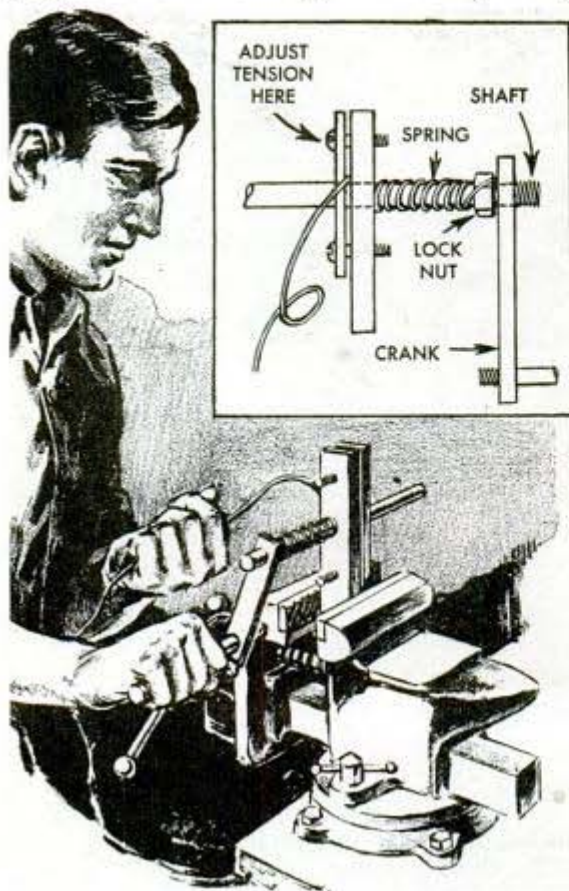
An easily made template greatly simplifies the task of painting uniform straight lines on playing courts. Two 8-ft. lengths of  $\frac{1}{8}$  by 2 by 2-in. angle iron are inverted, spaced 2 in. apart and then riveted at both ends to flat-iron spacers. Handles near the ends facilitate accurate placement of the template. A paint charged brush used with this template makes a 2-in. stripe. Broader markings are achieved by progressively overlapping the 2-in. line, while for narrower widths, 8-ft. spacing strips may be laid within the template.

Richard Kern, Belleville, Ill.

☛ A small cut in oilcloth will not widen into an unsightly hole if you put a strip of adhesive tape over the cut on the underside and press the edges down smoothly.



## Jig for Winding Small Springs Without Annealing the Wire



With this jig, which keeps the wire under tension, you can wind small helical springs without annealing and then retempering the wire. The jig consists of a shaft slightly smaller than the internal diameter of the springs to be wound, and a two-piece clamp that can be gripped in a vise. The

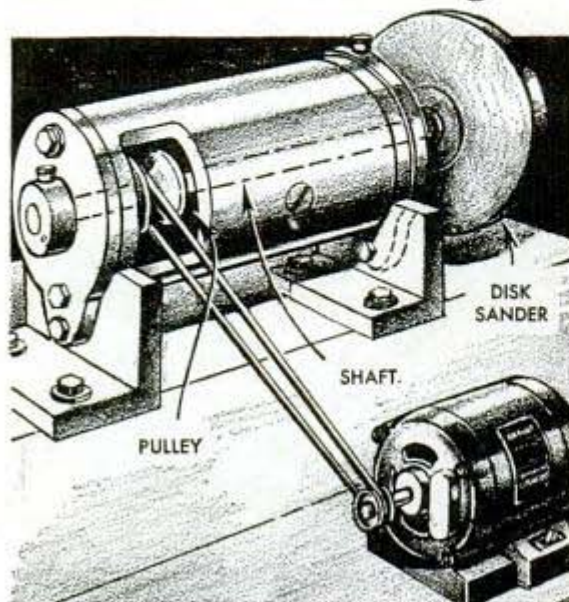
shaft is threaded at one end for a lock nut and a crank, which is tapped to screw onto the shaft. Although shown the same size through both parts of the clamp, the shaft hole in the larger part of the clamp should be of about the same diameter as the outside diameter of the spring, the hole in the shorter piece of the clamp being of the same diameter as that of the shaft. The wire is fed between the two parts of the clamp and the end clamped between the locknut and handle, tension being adjusted by tightening or loosening the screws as shown. As the wire is wound it pushes the shaft outward.

## Keep Ants Out of Storage Boxes

If you are bothered by ants getting into food storage boxes in your home or cabin, here is a good way to keep them out. On boxes that do not have casters or short legs, attach empty thread spools to the four corners of the box and set them in can lids in which is poured light oil. If there are no small children or animals around, you can use insect powder in the lids. If the boxes are moved around frequently, it may be more convenient to nail the lids to the spools, nail heads being soldered to prevent the oil leaking past them.



## Old Generator Housing Provides Long-Life Tool Mandrel

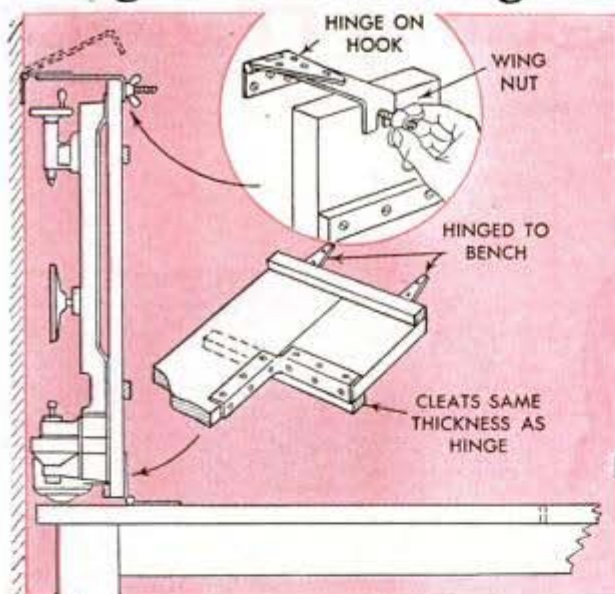


With a little altering, you can convert an old auto generator housing into a rugged mandrel for a small circular saw, sanding disk or grinding wheel; when fitted with a chuck it can even be used for drilling, routing, etc. All you have to do is take out the armature shaft, remove the commutator, put a V-pulley in its place and then cut a hole in the housing for a belt. The tools are mounted on the pulley end of the shaft. If you are unable to find a generator that has a shaft large enough for your tools, a new shaft can be made inexpensively. Mounting brackets will have to be made to suit your particular generator.

H. Sharples, London, Ont., Can.

☐ A strip of sandpaper glued or nailed to the auxiliary wood fence used with a circular-saw miter gauge will prevent work from creeping when making miter cuts.

## Hinged Lathe Swings Out of Way in Workshop



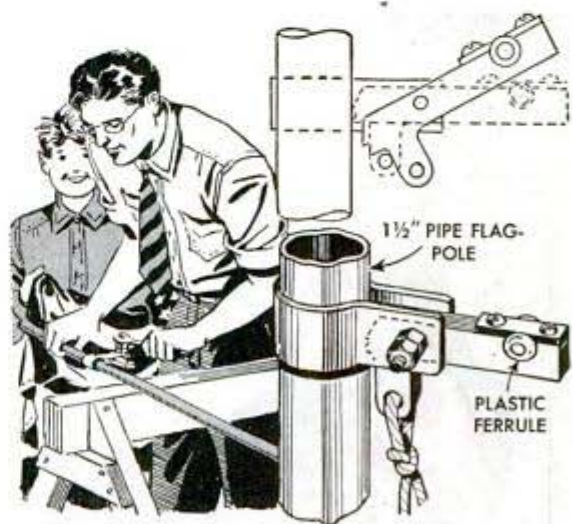
In small workshops, a woodworking lathe can be mounted on a baseboard, hinged to the workbench, to swing up against the wall when not in use, thus leaving the bench clear for other work. Cleats are nailed or screwed to the baseboard to raise it above the hinges, and angle iron, cut and bent as shown in the detail, joins the motor platform to the baseboard. The

mounted lathe is held solidly by a bolt that runs through the baseboard and into the workbench where it is held by a wing nut. When raised, the lathe is held against the wall by a length of flat iron bolted to a hinge and slotted to fit over the bolt as shown in the circular detail.

C. H. Hardy, Los Angeles, Cal.

## Rope Support on Flagpole Can Be Raised or Lowered

Having a 38-ft. flagpole that was too flexible for climbing to replace the rope, we made this sliding rope support. It is self-locking and can be pushed to the top of the pole with a long stick and pulled down with a rope. The support consists of a length of thin flat iron, which is bent to fit around the pole with  $\frac{1}{16}$  in. clearance. A short piece of steel bar is pivoted between the projecting ends, the end next to the pole being notched so that downward pressure at the outer end causes it to bite into the pole and hold tightly. A small projection at this end of the bar takes a light rope with which the support is released and pulled down. The outer end of the support is fitted with a plastic ferrule to receive the flag rope.—B. F. Martin, Chicago.



## Cement to Extend Life of Broken Element in Electric Heater or Stove

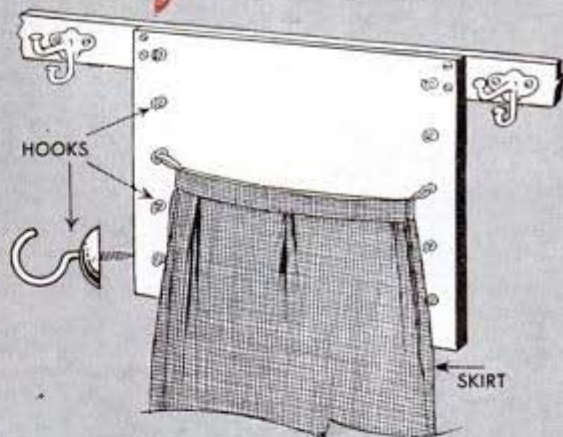
The life of a broken element in an electric heater or stove can be extended if the broken ends of the wire, after first being cleaned with fine sandpaper or emery cloth to remove corrosion, are twisted together and then coated liberally with a paste consisting of common borax, 1 part, and commercial iron cement, 3 parts by

volume. The ingredients are mixed with just enough water to make a workable paste and then forced in and around the junction point of the wires. After cementing, the current should be turned on to heat and set the cement. Of course, rough treatment should be avoided after making the repair.

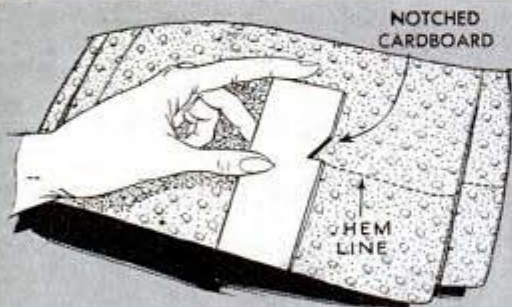
# Solving HOME



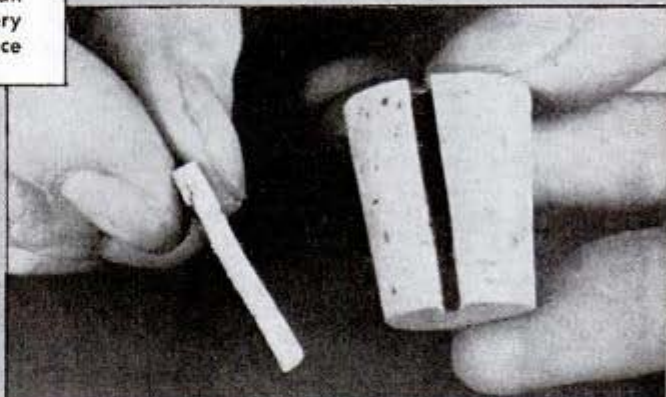
Mounted above a small breakfast table, this wall cabinet stores things that are needed at every meal. Lowered front provides extra table space



Several skirts can be hung in a restricted place if this hanger is used. It is simply a small panel in which hooks are driven in two vertical rows



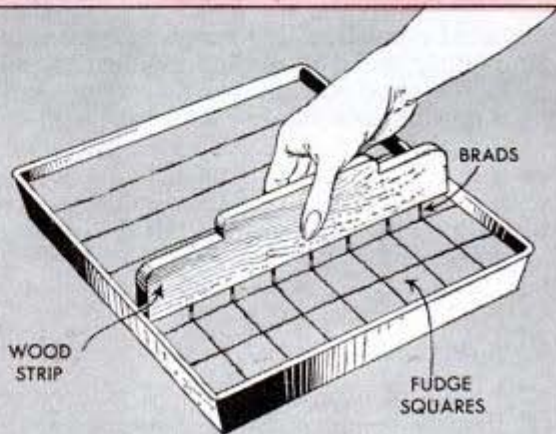
Notched as indicated, a piece of stiff cardboard provides a handy sewing gauge for measuring seam allowances, hems and similar work



When a cork is just a little too large for a bottle, cut a tapered slot in the side so it can be compressed slightly and thus reduce the diameter so it will fit



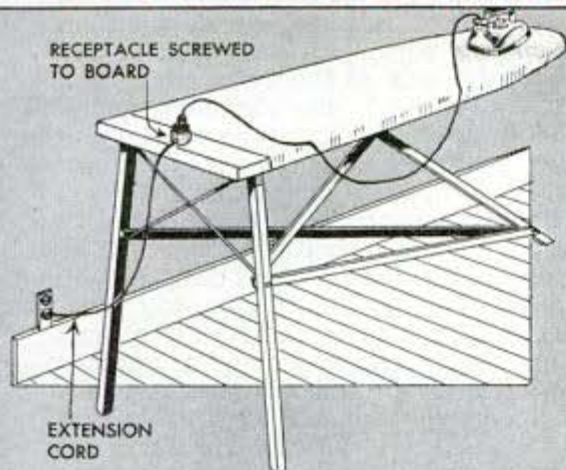
It is a simple matter to slice cheese if you use a piece of piano wire stretched in the frame of a coping saw as indicated above



Marking a pan of fudge into neat, uniform squares is an easy job if you use a wood strip in which a number of headless brads have been driven



# PROBLEMS



An extension cord wired to a receptacle on the ironing board permits you to work some distance from an outlet without using a long ironing cord

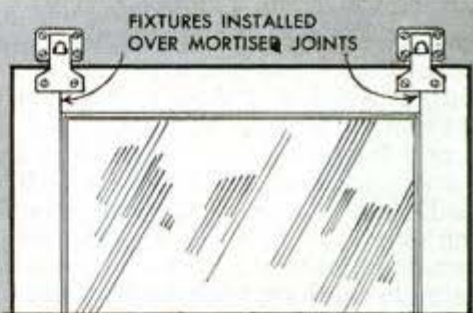
DISTANCE BETWEEN DRAWER BOTTOM AND TABLE TOP



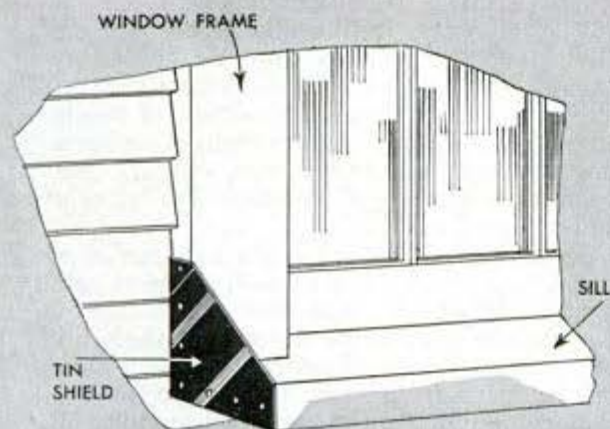
Substitute a board like the one above for the drawer in a desk or table and you will have an ideal support for using a portable typewriter



By applying nail polish to cloth and allowing it to dry before cutting buttonholes, the edges of the holes will be non-fraying and thus easy to stitch



When fitting storm sash or window screens with hangers, put the fixtures over the mortised joints as shown in order to strengthen them



If water runs off the end of a window sill and stains the siding, a tin shield nailed to the end of the sill as indicated will prevent this trouble



Dogs can't tip your garbage can or remove the lid if you set it between two stakes and provide a hinged strip across the top

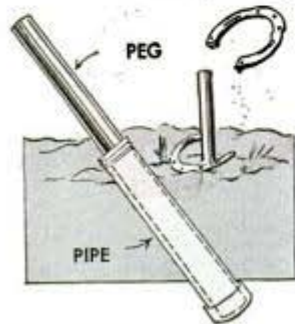


## More Mileage From Old Casings That Cannot Be Repaired

If you have some old tires that are worn beyond ordinary use, you can still get several hundred miles of wear from them by using them over good tires. Cut off the beads and then punch a row of large vent holes around the center of the tire as indicated. Deflate a tire on the car, slip the old one over it and then inflate the tire to its normal pressure. This arrangement is not suitable for long trips or high speeds, but will be satisfactory when the car is driven under 35 to 40 m.p.h. on short trips.

Milton Shep, Los Angeles, Calif.

## Pegs for Horseshoe Playing Set in Pipe Sockets



If you play horseshoes where the pegs must be removed each time you are through playing so that children or others will not fall over them, use pipe sockets to hold the pegs in the ground and

they will be easy to remove and insert. Put caps on the lower ends so that the pegs cannot work deeper when struck by a shoe, and set the pipes flush with the surface of the ground. Hardwood plugs will keep dirt out of the sockets when not in use.

A. Armstrong, Missoula, Mont.

## Several Trains on a Single Track Controlled by Gaps in Rails

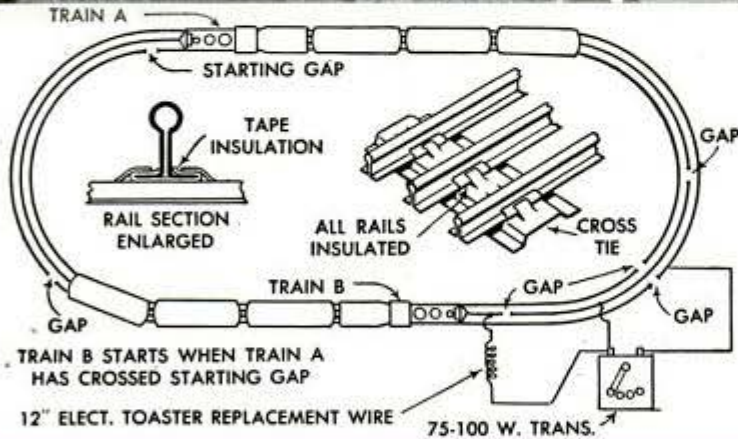
With a little change in the track system of your model railroad, as detailed on the opposite page, you can operate any number of trains at the same time on a single, endless track, starting and stopping them automatically, and thus eliminating the need of relays, triggers or auxiliary controls. Also, crossing gates, signal lights and other accessories can be operated in the same way. All that is necessary is to provide gaps in the rails to break the circuit, so that one train will run only when the current passes from the "live" rail through the wheels and axles of another train to the "dead" rail. The traction rails must be insulated from each other and from the third rail, so that current will not pass, as it ordinarily does, from one traction rail to the other through the metal cross ties. To insulate the tracks, bend up the tongues of the cross ties which hold the rails, and insert between each rail and tie a piece of friction tape. Then bend the tongues back in place.

Although, theoretically, any track length is suitable, in actual operation this system of train control is most effective only if there is enough trackage to allow for the coasting of trains without collision after the current is broken, as the ordinary model train will run about three times its length after power is cut off. Therefore, it is best to use trains of nearly the same overall length, with locomotives—preferably worm driven—requiring the same voltage. Locomotives can, of course, be prevented from running too fast or coasting too freely by tightening the tension on the commutator brushes.

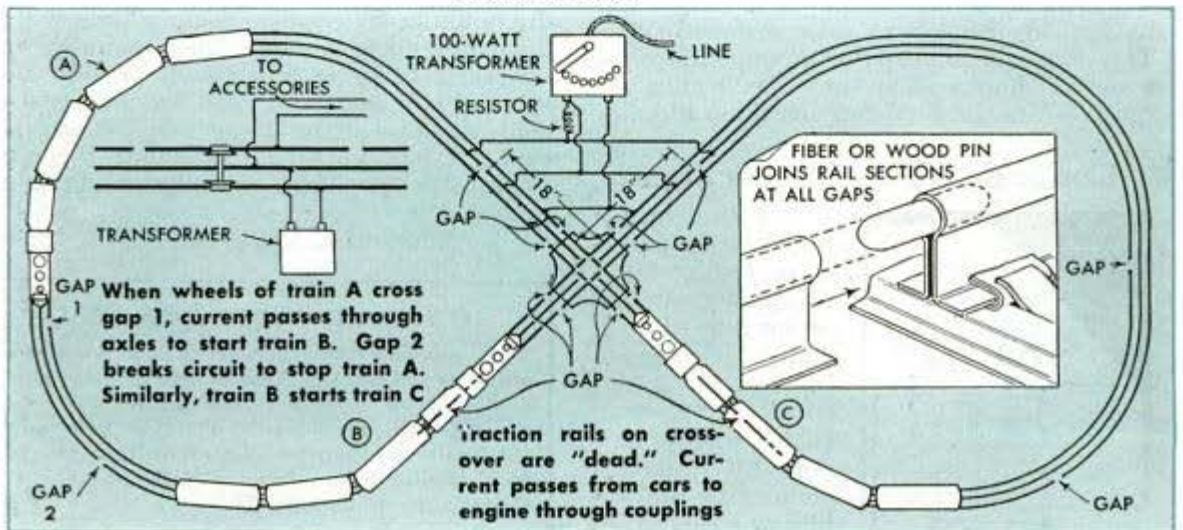
The upper diagram illustrates how two trains are operated at the same time on a simple, endless, oval track. Note the gaps at various points in the rails. Train A is on "live" track and is in motion. Train B is on "dead" track, as there is no return lead to the transformer from the section of track on which it stands. When train A crosses the starting gap, the return current for train B is completed through the wheels and axles of train A.

So that the waiting train can make a quick "get-away," the section of third rail upon which it rests is connected directly to the transformer, while the rest of that rail is fed through a small resistance coil, which can be made from 12 in. of electric toaster replacement wire, the required amount of which is determined by experiment. The same principle of operation can be used with longer tracks on which three or more trains can be run, as in the lower diagram, but a larger transformer must be used.

# MULTIPLE TRAIN CONTROL



By providing a number of circuit-breaking gaps in the rails of your model railway system, you can operate several trains simultaneously on one track so that they will start and stop automatically, thus eliminating the need for an elaborate control panel. Accessories, also, can be operated in the same way. Current passes from the "live" to the "dead" sections of the rails through the wheels, axles and couplings of the train



## Gasoline Syphoned From Tank By Sanitary Method

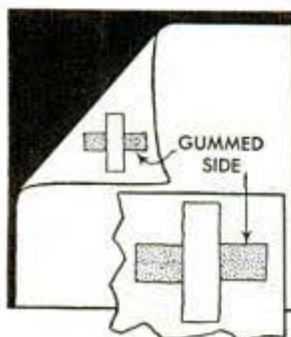


The next time you want to syphon gas from your car tank, start the syphon by the method shown and you won't get gas in your mouth. Insert the hose in the tank and then place your hand over the filler hole with the hose between your thumb and index finger to make an airtight cover. Be careful not to squeeze the hose tight enough to close it. Now, relax the thumb and finger sufficiently to blow into the tank alongside the hose. The slight air pressure built up inside the tank by blowing into it will be sufficient to start the syphon.

## Drapes Hung Without Hooks

Drapes will hang more evenly and their weight will be more uniformly distributed if a 3-in. strip of cloth is sewed across the back near the top to take a curtain rod. This also eliminates the inconvenience of inserting hooks each time the drapes are hung.—Mrs. R. E. Berry, Decker, Ind.

## Concealed Tape Holds Signs



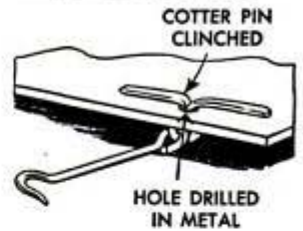
If you hang a paper sign, picture, etc., temporarily in a window or on a wall with tape, here is a method of applying the tape so that it will be hidden. First, place a strip with the adhesive side up on

the back of the sign. Then, over this, place a similar strip adhesive side down. This will stick to the sign and hold the first strip in place. When pressed against a wall or window, the first strip will adhere to it.

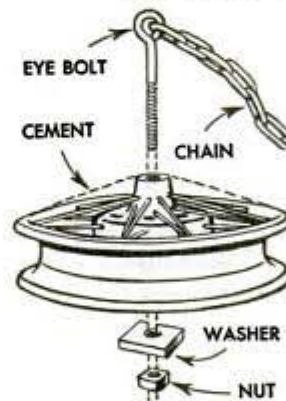
Robert Caporale, New York City.

## Attaching Screen-Door Hooks To Objects Made of Metal

Attaching a door hook to a metal object is no problem if you use a cotter pin. Select one of suitable size to take the hook and then drill a small hole through the metal. Insert the pin and clinch the legs on the opposite side as indicated. An eye for the hook can be provided by enlarging the eye of the pin and attaching it in the same way. Set the pin up tightly so that the eye will remain in position to receive the hook.



## Mooring Anchor for Small Boat Cast on Car Wheel



By using an old wire-spoke car wheel as the reinforcement for cast concrete an ideal mooring anchor can be formed. Simply clean the wheel of all grease and oil, lay it on a smooth surface, such as cardboard or sheet metal, with the outer side of the hub upward

and center a tube or stick about 1½ in. in diameter in the hub to form a hole when the concrete is poured. Then pour in the concrete, tamping it in well around the spokes, rim and hub, and trowel it to a conical shape at the upper side. When the concrete has set, attach the chain through the hole in the center of the hub and fasten it securely.

Richard E. Buck, East Lynn, Mass.

### LET YOUR WORKSHOP PAY FOR ITSELF

Kinks you find useful in solving your workshop problems will pay dividends to help get new tools and equipment. We pay promptly for any articles accepted. Send sketch, photo, or both, and tell briefly the purpose and "how-it's-done" to the Technical Editor, Popular Mechanics, 200 E. Ontario Street, Chicago 11.

## "Lazy Pony" Toy Sits Down When It Stops

This lazy pony is content to stand while you pull him around on his wheeled base, but he immediately assumes a sitting position as soon as the pull-string is relaxed. All four legs are pivoted to the body and the hind legs also are pivoted at the knees and to the base, the front legs being fastened rigidly to the base. The pull-string is run through a screw eye in the base and tacked to the pony's shoulder so that when it is taut the pony is raised to a standing position. All pivoted joints must work freely, and the pony must be almost balanced on its front legs, the hind part being slightly heavier so that he will assume a sitting position. A hole drilled in the head for lead shot will enable you to balance the pony, the stopper for the hole having a piece glued in to simulate a fore-top. The toy can be made any size desired. The original was about 13 in. long from nose to tip of tail, and about 8 in. high at the shoulders. The body is cut from 1½-in. stock, and the legs, ears, neck and tail are



made from ¼-in. plywood or hard-pressed board, the head being shaped from a wood block of suitable size. Wood axles support the base, and wooden disk wheels are attached to them by nails as indicated.

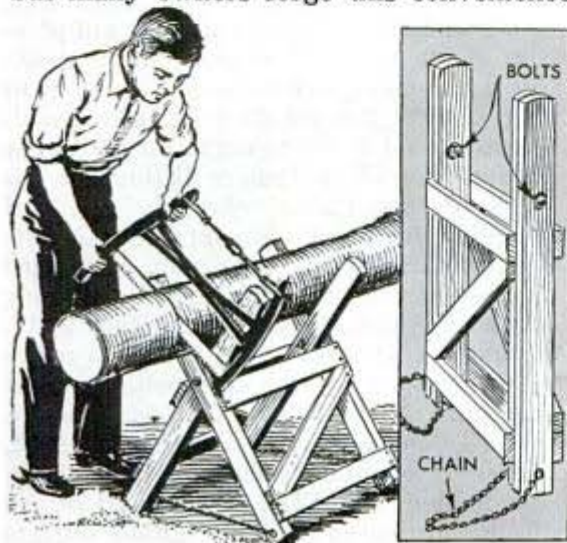
P. B. Horsley, Pembroke, Ont., Can.

## This Folding Sawbuck Requires Very Little Storage Space

Every home owner likes to have a sawbuck for occasional use when cutting up scrap wood, tree limbs, etc., for kindling, but many owners forgo this convenience

because a sawbuck of the regular type requires so much storage space. However, one that folds will solve the problem. It is made in the usual way except that the two parts of each X-member are pivoted together with a bolt, and a chain is substituted for the usual bottom brace. This permits the sawbuck to fold flat so that it takes practically no storage space.

Harold Jackson, Kankakee, Ill.



## Old Pieces Make Good Pattern For Reupholstering Job

For a smoother fit and an easier job in reupholstering furniture, remove the old material with care, taking it off in sections and numbering each section with crayon or chalk. After you have made a note of the position of each piece, use the old pieces as a pattern in cutting out the new material, and replace it according to your notes.

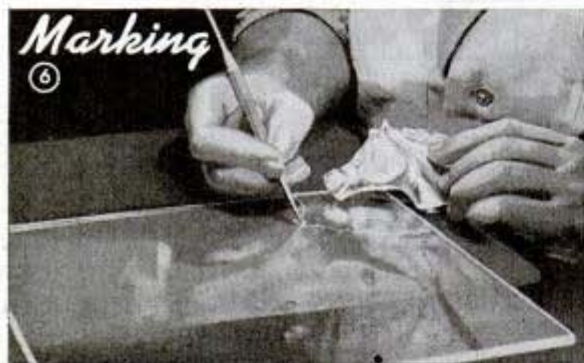
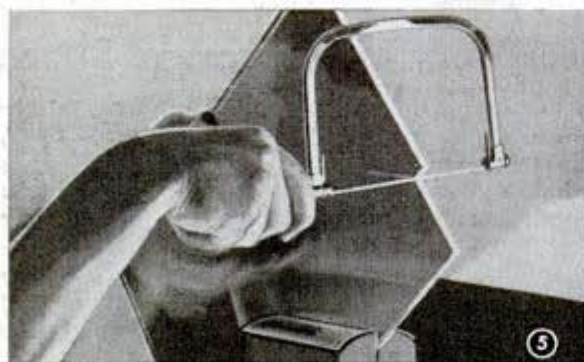
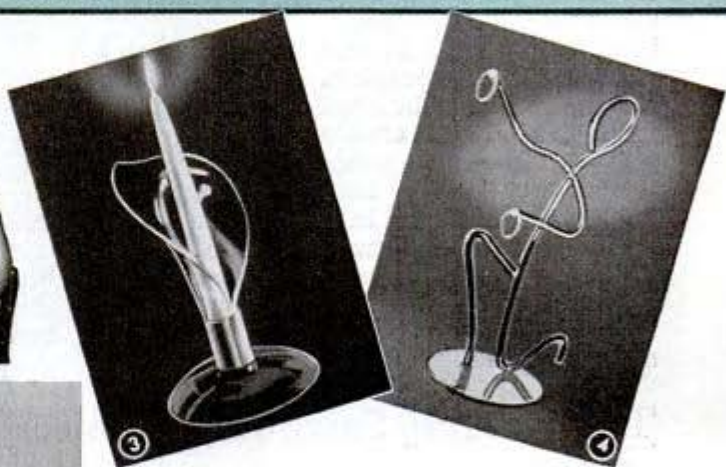
Bill Pasman, Detroit, Mich.

*Whether*  
 YOU'RE IN THE U. S.  
 SERVICE OR AT HOME,  
 THESE SIMPLE THINGS  
 ARE EASY TO MAKE  
 EITHER WITH HAND  
 OR MACHINE TOOLS

① SOME OF THE WORK DONE



## CRAFTWORK in



**T**HERE'S practically no limit to the number of small, colorful articles that you can fashion from scrap pieces of plastic. Some of the craftwork items made by servicemen and women are shown in Fig. 1. Once you get started working with plastics, and know what to do and what to avoid, you'll find many distinct advantages in using this relatively soft and grainless material. Among the many attractive things that you can make are rings, bracelets and all kinds of lapel pins, some of which are shown in Figs. 2, 17, 19 and 21. Or you might prefer to make novelty items such as candlesticks, starting with simple ones such as those in Figs. 1, 3 and 11. Photo frames, Fig. 12, envelope openers, salad forks, knitting-bag holders, etc., Figs. 1, 19, 21 and 22, are easily fabricated articles. Other objects

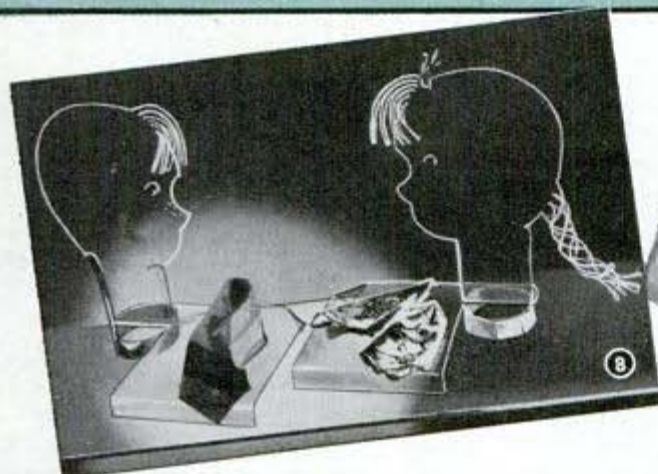
BY SERVICEMEN AND WOMEN



*Cutting off stock*



## PLASTICS .....



Photos in this article provided by courtesy of United Service Organization, Chicago Servicemen's Center, Rohm & Haas Co., and A. Steven Lewis & Associates

that have practical value and good sales possibilities are distinctive types of boxes, Fig. 18, cigarette and playing-card holders, bookends, napkin rings, candy dishes, pipe stands, desk sets, tie racks, and even bent and cutout caricatures such as shown in Figs. 4, 8 and 20, which can be used for window display purposes. Such individually made novelties always command higher prices than mass-produced articles when placed on sale in retail shops, which enables a craftsman in plastics to build up a profitable business of his own. With very little practice and experience, anybody can become adept in handling plastics. Unlike wood and other materials, plastics have many different characteristics; the kinds used in craftwork can be bent and shaped readily when heated, can be cut, drilled,

*Decorating with hand grinder*

ground, polished and cemented, and can be engraved with a stylus or, as in Fig. 9, with a hand grinder fitted with small dental drills or other small routers.

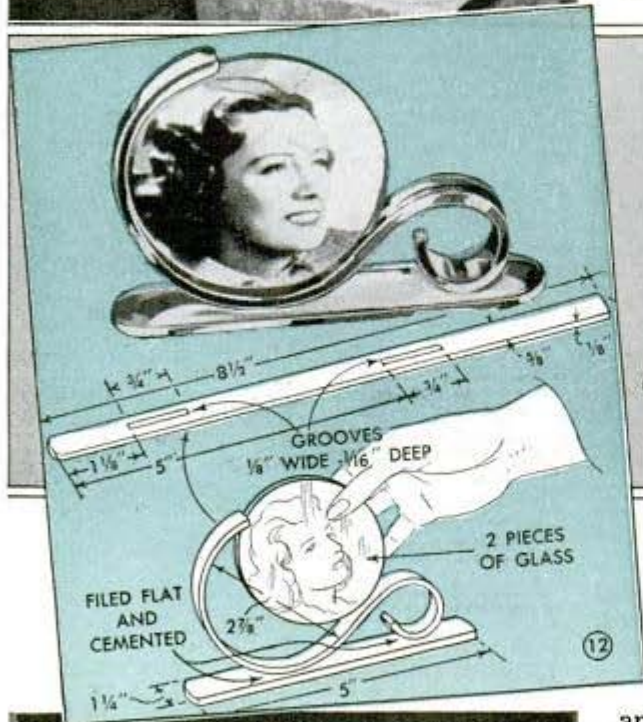
**Types of plastics:** Although there are about one hundred different types of plastic materials, comparatively few of these are used for craftwork. In a general way all plastics can be divided into two broad classes known as thermoplastic materials and thermosetting materials. Thermoplastics can be bent and shaped time after time with the application of heat, but thermosetting plastics, such as Bakelite, cannot be bent or shaped after they have been molded under heat. Therefore, thermoplastics are particularly adapted for craftwork and



⑩ Heat before bending

thermosetting materials are of more limited usefulness, for purposes where bending and shaping are unnecessary.

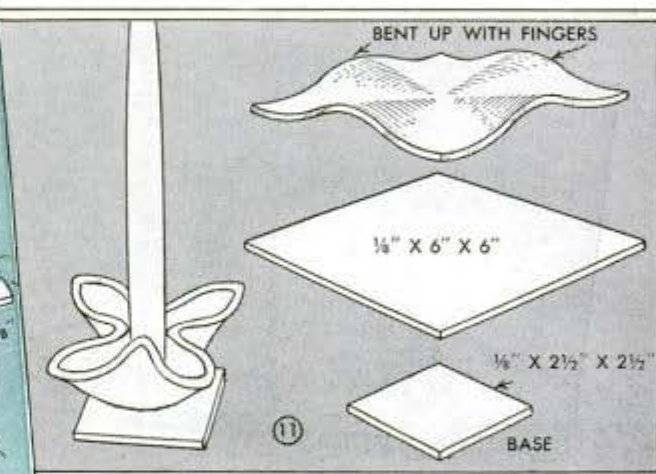
Besides knowing about these two general classes of plastics, you should be able to differentiate between two or three kinds of thermoplastics that are used widely in craftwork, since there are slight differences in their heating and bending characteristics, and also in the glues or cements used to join them. One kind is cellulose acetate and includes materials known under such trade names as Tenite and Lumarith, while another kind, made of acrylic resin, includes Plexiglas and Lucite. Both kinds are easy to tool and become pliable under heat ranging from 225 to 250 deg. F. The cellulose-acetate materials can be cemented together with acetone, which softens the material temporarily and makes it possible to produce strong joints. With acrylic-resin materials, it is necessary to use special cements produced by the manufacturers. Both the cellulose-acetate and



⑫



⑬ Bending while hot



⑪

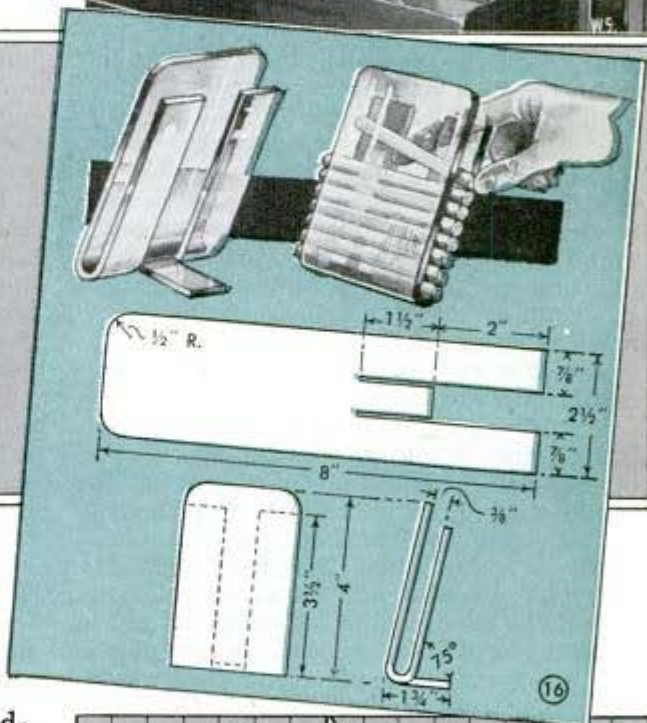
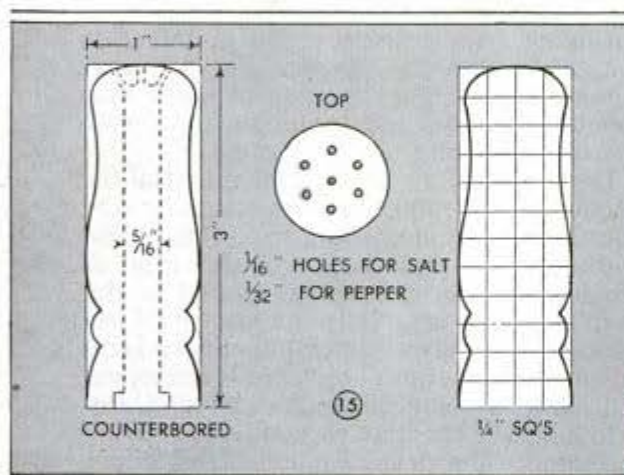
the acrylic-resin plastics can be obtained in either transparent or opaque colors. Many craftsmen use another kind of plastic, which, from a practical viewpoint, might be said to fall in between the thermoplastic and thermosetting materials. This is phenolic resin, of which a popular brand is Catalin. This plastic softens under heat but to a somewhat slower extent than the cellulose-acetate and acrylic-resin plastics.

**Identifying tests:** The simplest test to determine whether a plastic belongs to the thermoplastic or thermosetting type is to heat it to 250 deg., F. and see whether it softens and bends readily. Some craftsmen can judge the difference between the two types by tapping a sheet of the material with a small hammer or even with a finger ring. If the sound produced is sharp, the plastic is most likely thermo-



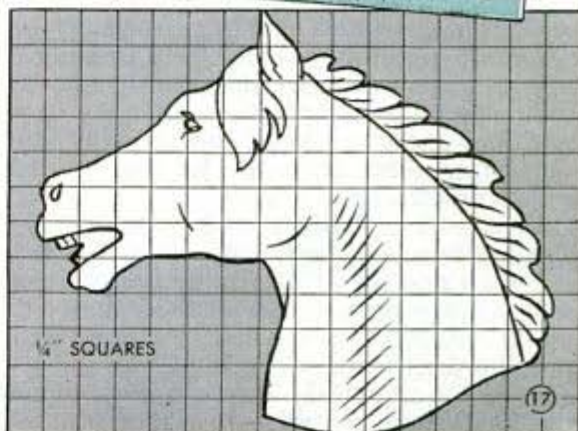
setting. If the sound is dull, it is probably thermoplastic. The way to find out if a thermoplastic is a cellulose acetate or an acrylic resin is to use a drop of acetone on it. If the material softens or tends to dissolve under the action of the acetone, it is a cellulose acetate.

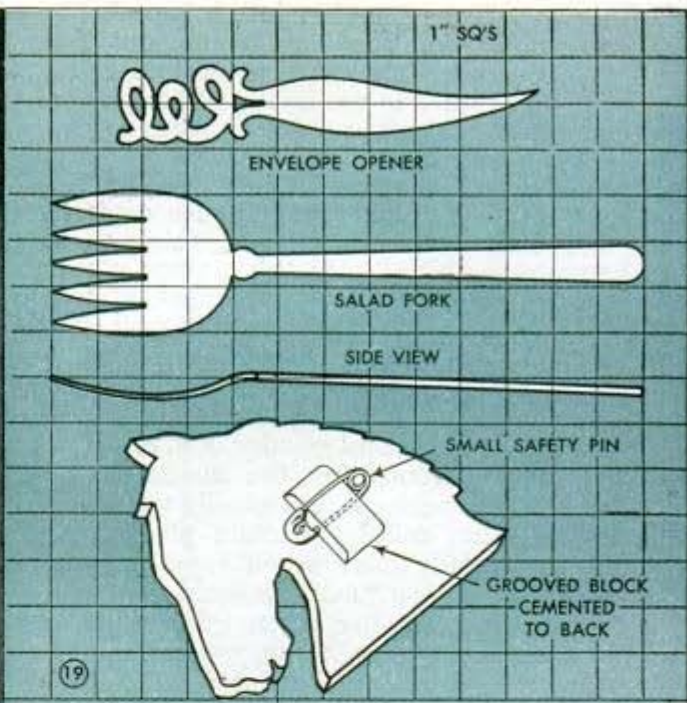
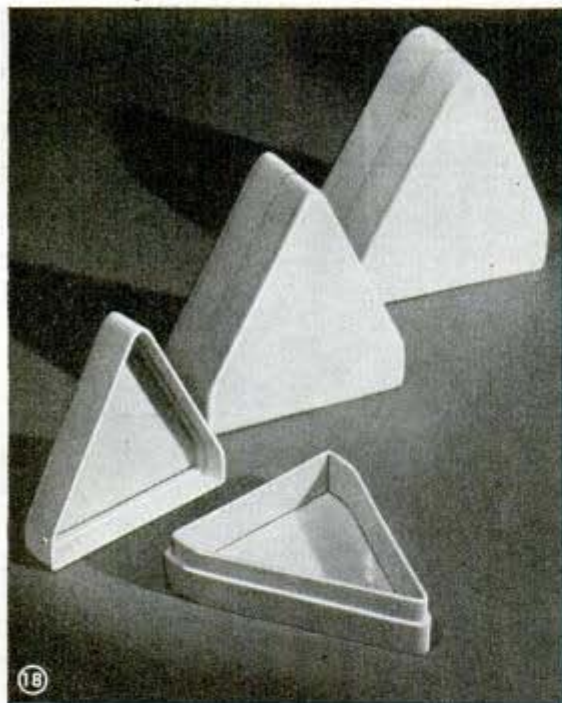
**Tools required:** Most plastics come in the form of sheets of varying thicknesses, square and round rods, tubes, rings, blocks and other shapes. To work them, all you need is a coping saw, Fig. 5, a drill, file, sandpaper and a stylus. However, if available, motor-driven tools such as a bandsaw or scrollsaw, Figs. 7 and 22, a lathe, Fig. 14, and a portable hand grinder, Fig. 9, can be used. For cementing the material, you need some acetone (chemically pure preferred) for cellulose-acetate plastics, or some specially made cement for other varieties, although a good household cement or lacquer cement has given fair results in some cases. For polishing, you can use ordinary furniture or automobile wax. Buff-



ing wheels can be used also for polishing as in Fig. 23. In order to bend the material, a source of heat is required. Use of an oven, either the usual home oven or a portable one set over a heat source, has been found most convenient, although merely holding the material over heat as in Fig. 10 is sometimes effective. Some craftsmen use hot water, but as the boiling point of water is not high enough to render most plastics sufficiently pliable, the use of hot oil, kept at a temperature of 225 to 250 deg. F., is preferred if an oven is not available. The oil should be stirred frequently and should not be permitted to get too hot, as it will render the plastic unworkable and may spoil it.

**Scribing and tooling:** Most sheet plastics, when they come from the manufacturer, are covered with a masking mate-





rial or tape. If possible, this should be left on until the heating operation or surface tooling requires its removal, as it prevents the relatively soft surface from being scratched. Also it provides a good surface on which you can sketch or trace designs to be followed in sawing, drilling and other operations. However, when using scrap plastics that are not so covered, you can scribe lines on the surface of the plastic itself as in Fig. 6.

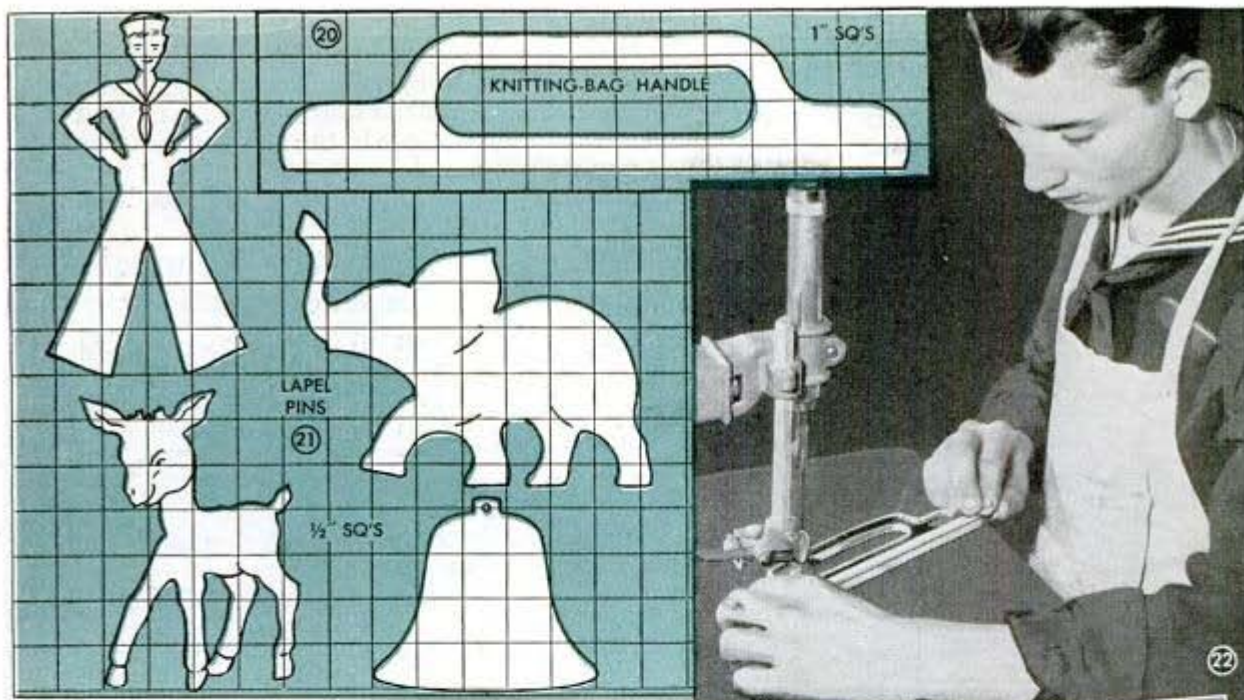
The first step in making an article is to lay out the various parts so that they can be cut from a given piece most economically. Sufficient margin should be allowed beyond the finish lines of the work for rough-cutting, filing and grinding down to size. Each piece then is cut out with a fine-tooth saw. You'll find that plastics cut very much like wood or soft metal such as pewter. Using too much pressure and speed in cutting should be avoided as the plastic may chip and even split, depending on the particular kind used, or may gum up your saw. The pressure and speed should be watched especially when you are using a motor-driven saw, as the blade may be gummed with the plastic, which in turn may become overheated considerably and possibly spoiled from the heat generated by cutting friction.

Next come drilling and grinding. In these operations also it is necessary to keep pressure and speed at a minimum. When drilling, always use a light feed that will avoid "grabbing" of the drill, and don't permit the drill to break through the underside of the material. This can be avoided by placing the material on a flat piece of

hardwood to receive the drill point as it comes through the plastic. For machine operations, some craftsmen use water as a coolant, which permits somewhat faster speeds and feeds.

**How to heat:** In heating the material for bending or forming, various temperatures may be needed, according to the thickness of the plastic and the particular type of plastic used, as well as the extent of the shaping operation. It is the advice of experts in the field to "watch the material and not the temperature." Seldom is a temperature higher than 250 deg. required. Carefully observe the material while it is being softened to the desired point of flexibility. Remember that if the results are not obtained at the first bending, the material can be reheated and reshaped. Avoid getting the material too hot as it may wrinkle or take on undesired impressions from handling or when shaping it on a form. A good rule to follow is never to let the plastic become more flexible than a thick sheet of rubber. Heated plastics can be handled comfortably if you wear clean cotton gloves as in Fig. 13, with perhaps a lighter pair underneath. The hot, soft plastic may be twisted or stretched into many shapes, and you will soon become adept at this.

**Forms for bending:** For bending or shaping sheet plastic, you may need a smooth form of some sort. This may be a specially cut wooden form or it may be merely a dish, tumbler, vase or bowl. The plastic can be shaped on either the inside or outside surface of a form. For bending the cigarette holder detailed in Fig. 16 you use a piece of wood  $\frac{3}{8}$  in. thick, so that the



space between the front and back will accommodate cigarettes piled upon each other. Less space than  $\frac{3}{8}$  in. would make it somewhat difficult to remove the cigarettes. Often it is advisable to cover the form with soft cloth such as felt or outing flannel in order to avoid getting impressions from the form on the surface of the plastic. However, forms are not necessary in all cases. You can twist strips of plastic as shown in Fig. 10, or bend a sheet with your fingers, which was done in shaping the candlestick shown in Fig. 11.

**Cementing:** When cementing two pieces of plastic together, it is important to apply the cement or acetone, as the case may be, to the edges or surfaces of both parts, after which they are held together firmly but not too tightly. Clamping, therefore, is not advised. Cement or acetone should not be spilled on the work as it will leave pits or blemishes.

**Cleaning and polishing:** To clean the plastic before polishing, do not use a dry cloth or chamois as this builds up an electrostatic charge that attracts lint and dust particles from the air. Instead use a damp chamois or sponge or a damp, grit-free, soft cloth. In removing dirt, grease, oil or crayon marks, it is best to rely mostly on soap and water. Never use alcohol, benzene or lacquer thinners, or any preparation containing these chemicals, as they will affect the surface.

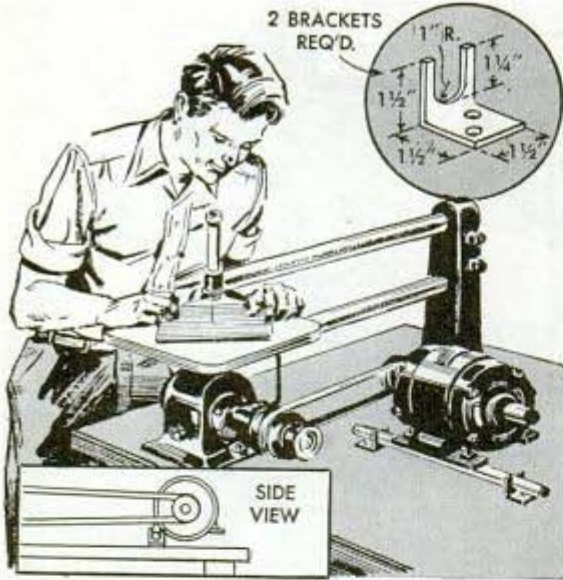
**Buffing:** If buffing is to be done by machine, as in Fig. 23, use a soft, unstitched buff and fine jeweler's rouge, applying only the lightest pressure and taking care to avoid the generation of heat, which would



tend to cause waviness or distortion in the nearly finished product. For polishing by hand, you can use a good automobile or furniture wax. Hand buffing with jeweler's rouge also is recommended. This should be done after all scratches have been removed from the surface. If the scratches are deep you may have to dress down the surface with the finest grade of sand or emery paper, after which the surface is buffed and polished. Minor scratches often can be removed by rubbing vigorously with a damp, soft cloth, applying at the same time a good cleaner such as used on automobile finish.

**Turning plastics:** Anyone who has the use of a wood or metal-turning lathe will find many possibilities in producing turned work, starting with such simple articles as the salt and pepper shakers shown and detailed in Fig. 15. Lathe cutting tools used for plastics should be very sharp and only shallow cuts are taken while the work is turning at comparatively low speeds—not at high wood-turning speeds.

## One Motor Operates Many Tools With This Quick-Change Mount



Using one motor to operate several tools is not a difficult task if you use a mounting like the one shown. It permits the motor to be moved from one tool to another by simply removing the belt, lifting the motor and carrying it to the desired tool. The mount consists of a length of  $\frac{3}{4}$ -in. pipe to which the motor is bolted, the pipe fitting into metal brackets provided at each tool. Weight of the motor keeps it in place, and it swings into the belt, which also helps to keep it in position.

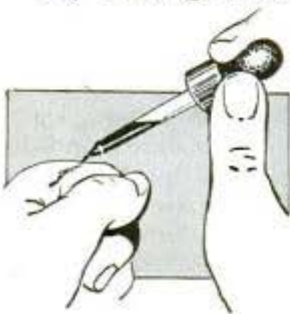
Donald F. Sauls, Villa Park, Ill.

## Brush Holder Makes Travel Kit

A kit consisting of a toothbrush holder filled with small necessary objects makes a popular gift for servicemen and women and also proves handy in civilian travel. Any number of items such as needles, pins and safety pins, thimbles, thread, pencils, buttons, hooks and eyes, brads and tacks can be included. Even thin sheets of paper, lightly folded, can be enclosed.

Mrs. H. M. Hobson, Washington, D. C.

## Germicide Applied as Desired By Using Medicine Dropper



If you are dissatisfied with using the glass-rod applicators provided with some germicides, try a medicine dropper. Have your druggist put the germicide in a bottle fitted with a dropper

and then you can apply a small drop at a time or as generously as desired. With the dropper filled you can cover a very large area, or if the cut or abrasion is small, you can use the dropper in the same manner as you would a rod.

R. H. Cochran, Phillips, Tex.

## Mesh Scouring Pad in Funnel Used as Household Strainer

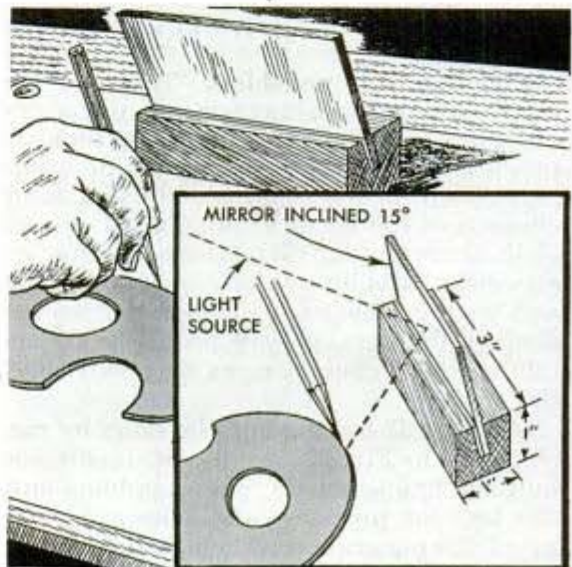
By inserting in a funnel a wire-mesh scouring pad that has been cleaned thoroughly, you can separate solids from liquids while they are being poured. A strainer of this kind will be found especially suitable in the kitchen, for instance, in separating pulp and seeds of fruits from liquids in jelly making and in similar work where actual filtering is not required.



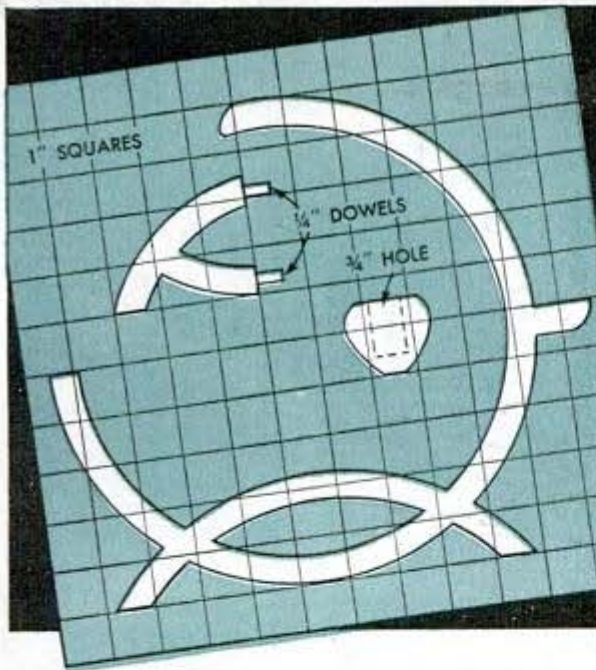
## Reflector on Drafting Board Reduces Eye Strain

This simple reflector enables an artist to work at a drafting table with the light source at his back or slightly to one side, thus providing plenty of illumination on his work without eye strain. Being small, the reflector can be shifted instantly to concentrate light wherever needed. The reflector is nothing more than a small mirror set into a wooden block, which serves as a supporting base, the mirror being set into the block at a 15-degree angle.

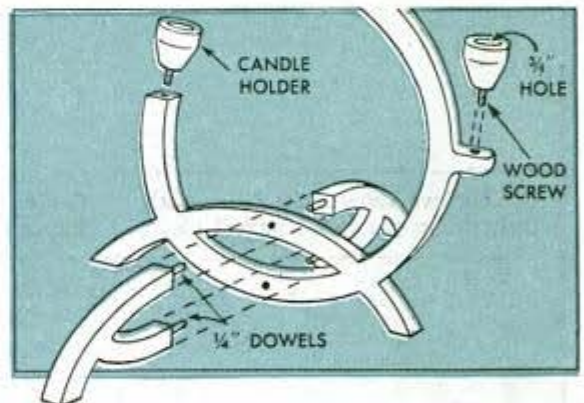
H. A. Wilkinson, Los Angeles, Calif.



# Hammered-Metal Finish on Wood Candelabrum

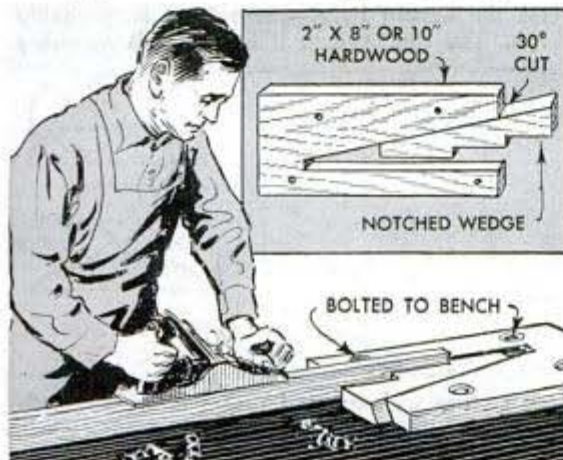


Although this modernistic candelabrum appears to be made of hammered metal, actually it is made of wood. The design, shown in the cross-hatched pattern, is traced to a piece of  $\frac{5}{8}$ -in. plywood and jigsawed to shape. Two leg pieces, shown at the upper left-hand corner of the cross-hatched detail, are required. These are doweled and glued in place as indicated in the lower detail. Three candle holders are turned from a piece of birch. A  $\frac{3}{4}$ -in. hole is drilled part way through each to take a candle, and the holders are screwed in place as shown. The hammered effect is produced by lightly tapping the entire surface with the rounded end of a 16d nail. A coat of black paint then is applied over the entire candelabrum, and when this is dry, the high spots are touched up with a coat



of aluminum paint. Only the thick part of the paint is used, the thin liquid being drained off.—R. L. Hedin, St. Paul, Minn.

# Adjustable Clamping Jig Holds Work Securely for Planing

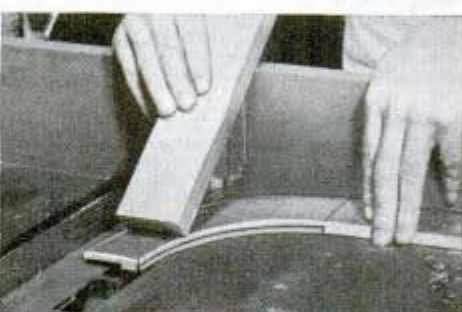
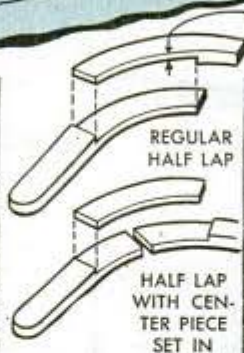
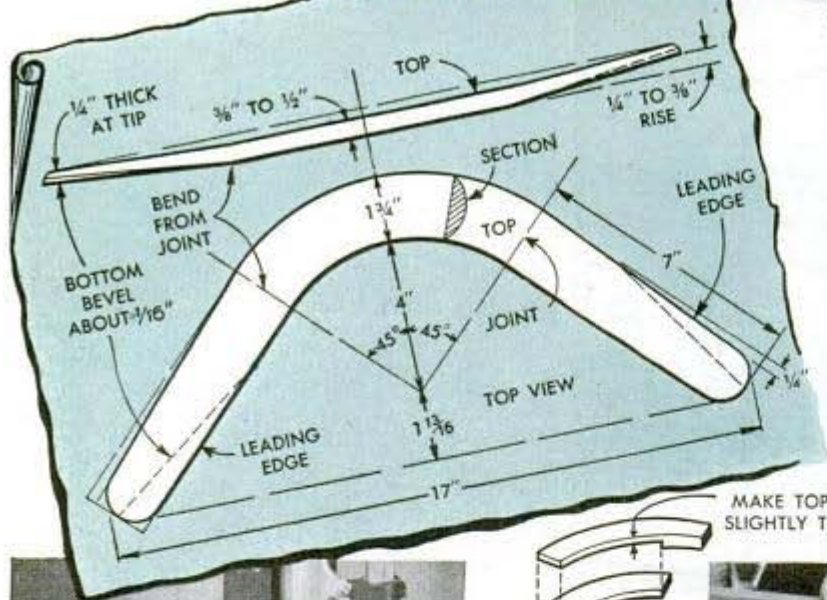


When planing edges of long work, or if your bench vise is not suitable for large work, a jig like the one shown will solve the problem. It is constructed as shown in the upper detail, one side of the cutout portion being beveled at a 30-deg. angle to form a keyway in which the stepped insert, also beveled, will be held. The insert should be just wide enough so that, when advanced nearly to the apex of the cutout, it will hold narrow work securely, and the steps should be  $\frac{3}{4}$  in. wide to take work of various widths without making it necessary to withdraw the insert too far or requiring a wide opening.

Pfc. Stanley J. Drazek, Fort Myers, Fla.

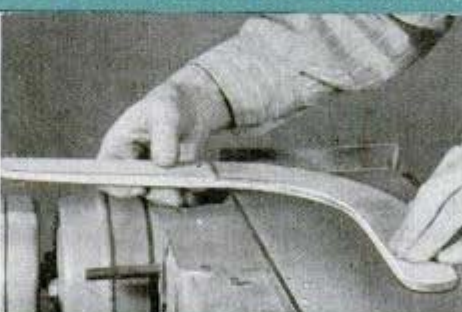
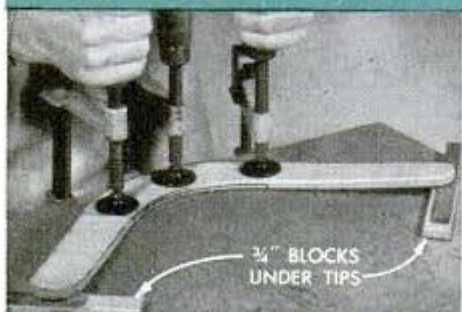
# Boomerangs are

When made and thrown correctly, boomerangs will describe a loop in the air and return to the thrower. Oak, maple or other tough wood is best to use. Laminated construction (several thin pieces glued up to provide the required thickness) is best because of less tendency to warp. However, you can use solid stock  $\frac{7}{8}$  in. thick. In either case, band-saw a piece to a size and shape to represent one half of the completed boomerang. Then rip this piece in half to produce two identical pieces. Glue these to-



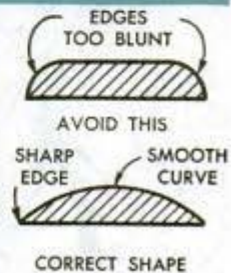
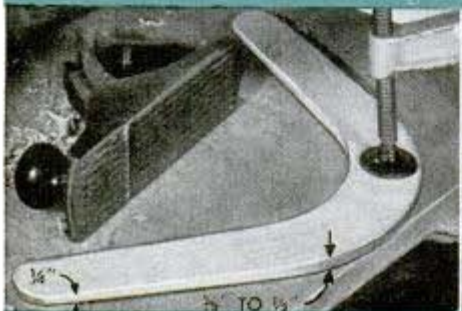
Cut outlined shape from  $\frac{7}{8}$ -in. stock, then rip to get two identical pieces

Cut a half-lap joint with a dado head or straight molding cutter. Leave the top lap a little thicker than the bottom



Glue the joint. Spring the tips upward on blocks to get required rise

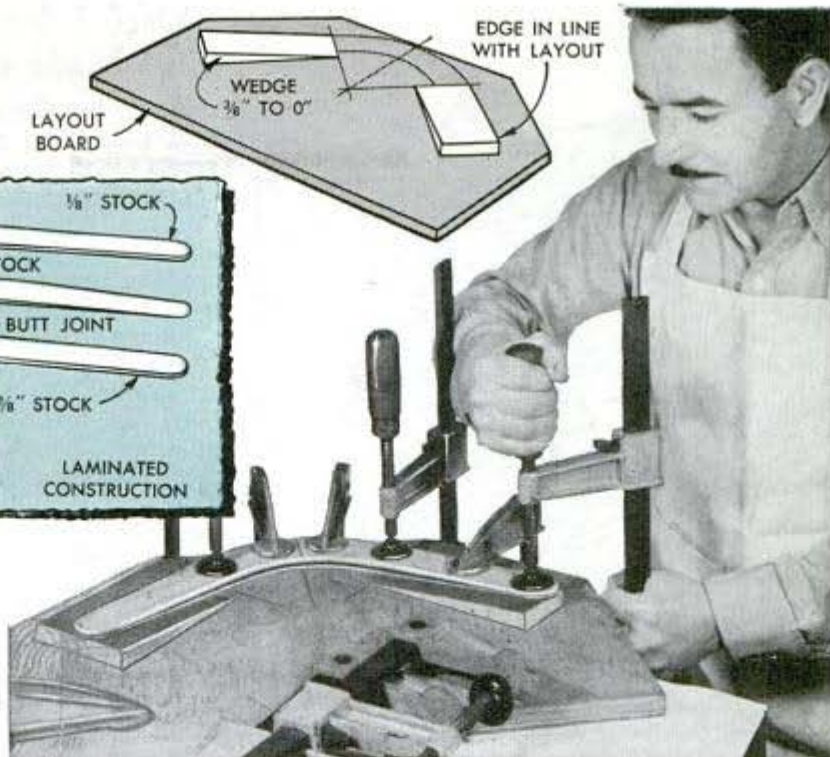
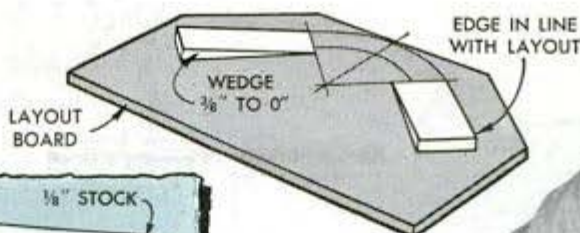
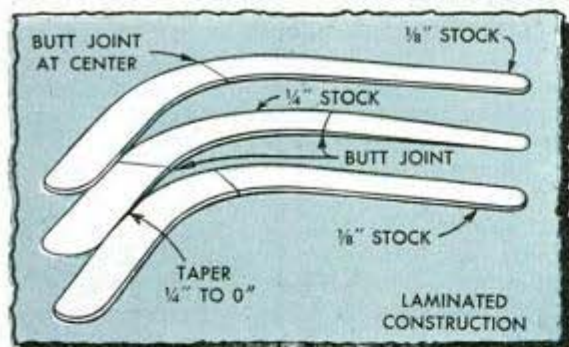
Sand or plane the bottom bevel—about  $\frac{1}{16}$  in. probably will be enough. You can increase it later if it is necessary



Plane the top surface from joint to tip

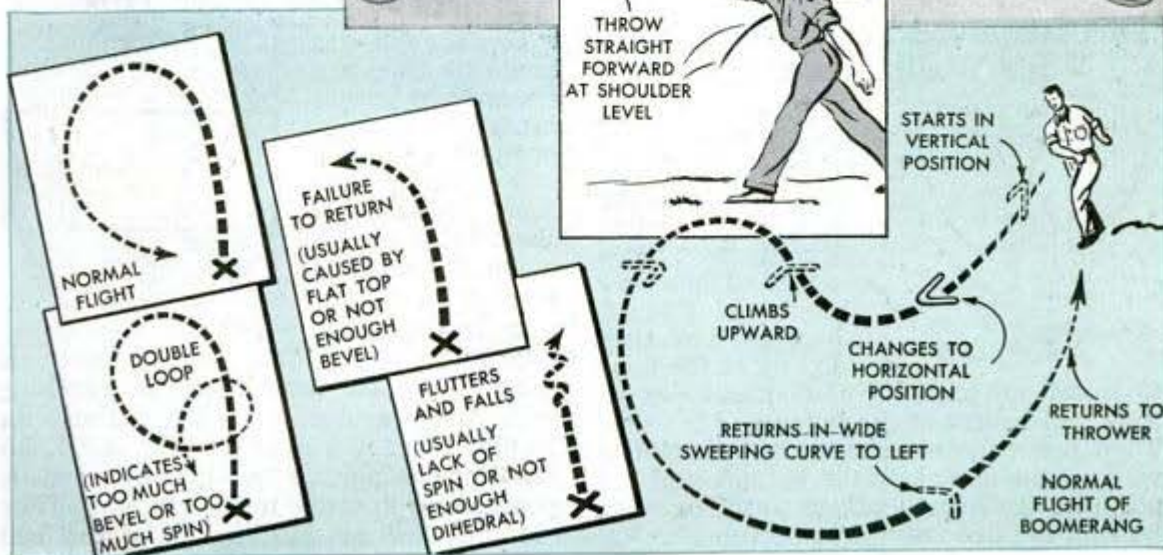
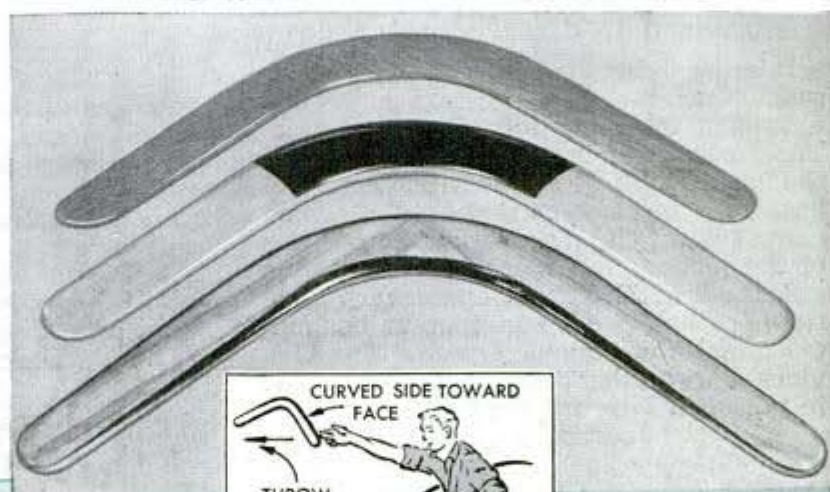
Round the top surface with a wood rasp and sand smooth

# Fun



LAMINATED CONSTRUCTION IS STRONG AND HOLDS ITS SHAPE

gether to form the completed shape, using a half-lap joint. You can use a regular half lap or one with a center piece set in as indicated, the latter being stronger. A joint is necessary to prevent splitting in the center. Follow the photos and diagrams in gluing the joint. The top surface is rounded and the bottom is flat except at the tips where it is beveled. If you throw left-handed, bevel the corners opposite those indicated. Normal flight is shown below. The diagrams also show some of the results of faulty construction and how to correct them. In throwing, use plenty of wrist action for a fast spin, yet not too much, as indicated in the lower left hand diagram. Test the boomerang on a calm day as it is erratic in a breeze



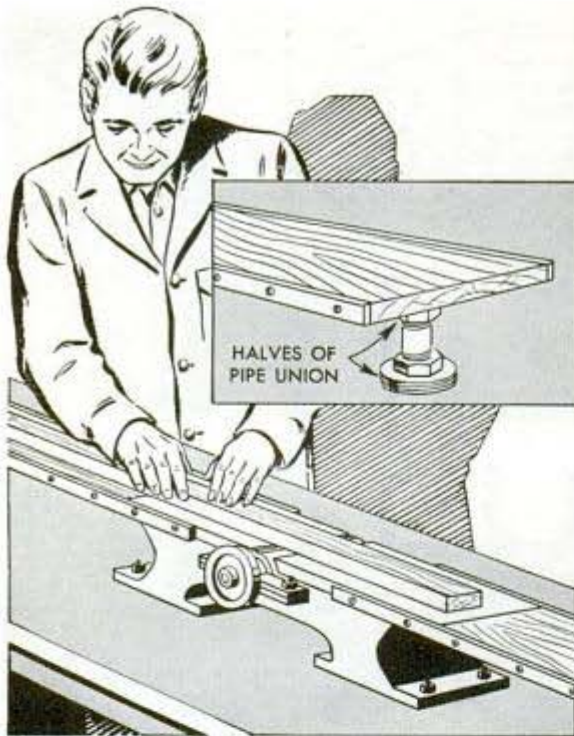
## Useful Articles for the Home Made of Scrap Wood

As pictured on the opposite page, useful and attractive articles may be made of scrap wood from crates and boxes. White pine, basswood, cucumber or wormeaten chestnut boards,  $\frac{3}{8}$  in. thick, are especially suitable for such things as waste baskets, shelves and cigarette or handkerchief boxes, as illustrated in the photos.

To make the waste basket, staves are cut to the dimensions given in the diagram, and holes are drilled for insertion of the cord that holds them together. The staves should be beveled slightly along the edges so that they will fit without leaving gaps. The bottom piece is beveled similarly to permit the staves to slant outward, and is attached to the staves with brads, as indicated in the detail. Heavy hemp cord is dipped in shellac and strung through the holes, and the assembly is finished with a coat of white shellac.

The shelf shown is made from cucumber wood having a dark center grain and lighter edges. The center diagram shows the shelf construction. The brackets are attached with screws and the finished assembly is given a coat of white shellac. For the cigarette box, worm-eaten chestnut is used. The edges of the side pieces are beveled and glued and the bottom is glued and nailed. Hinges and clasps are formed from scrap 22-ga. sheet copper or sheet metal, lightly hammered and rubbed with fine emery paper to give an antique appearance. The hardware is fastened with  $\frac{1}{4}$ -in. round-head screws, and the box is finished with a coat of white shellac.

Dick Hutchinson, Ithaca, N. Y.



### Capacity of Small Bench Jointer Increased by Extension Tables

In order to handle long work easily on a small bench-mounted jointer, I added two extension tables to increase the length. These consist of two hardwood boards of the same width as the jointer. They are bound on the sides by metal strips, which extend at one end for screwing to the sides of the jointer. Adjusting supports at the outer ends of the extension tables are made from the halves of  $\frac{3}{4}$ -in. pipe unions and two nipples of suitable length. This provides supports that permit fine adjustments in raising or lowering the tables.

Jack Bellah, Monrovia, Calif.

### Dirt Removed From Inside Tire With Wallpaper Cleaner



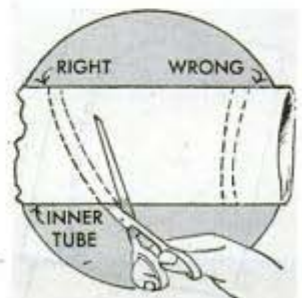
Removing dust and grit from inside a tire before inserting the tube is a simple matter if you use a piece of wallpaper cleaner. First, bounce the tire lightly on the floor

to loosen all particles of dirt and grit so they will collect at the bottom of the tire. Then press the cleaner against the inner walls of the tire along the bottom, and the particles of dirt will adhere to the cleaner, leaving the tire ready for the tube.

John Krill, Youngstown, O.

### Belts of Various Lengths Cut Out of Old Inner Tube

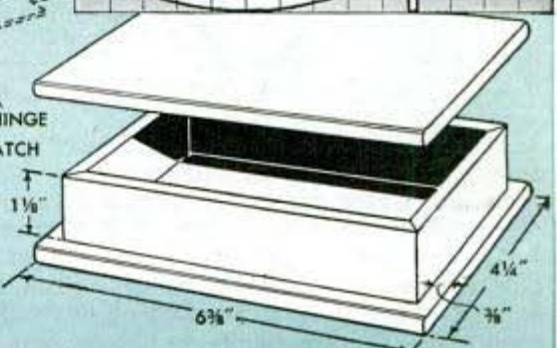
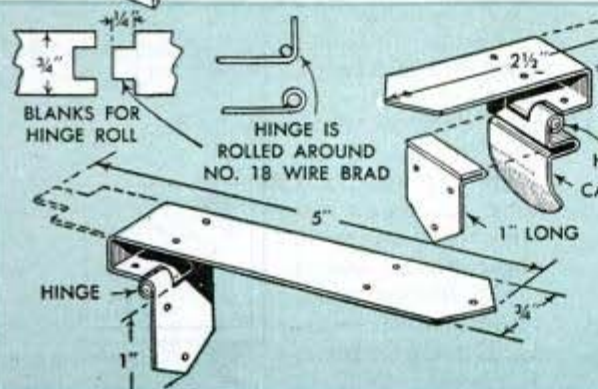
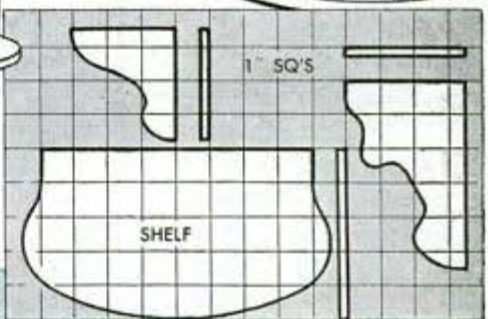
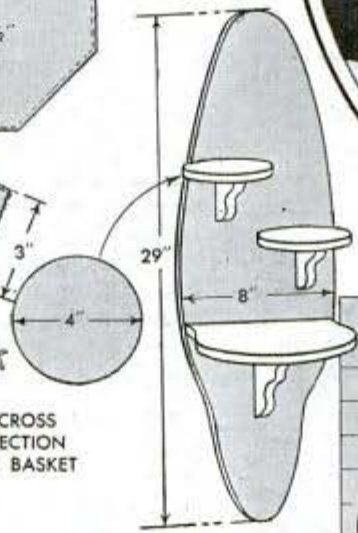
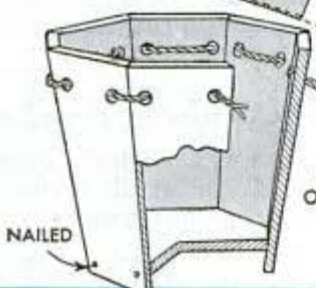
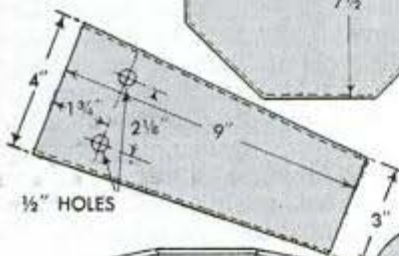
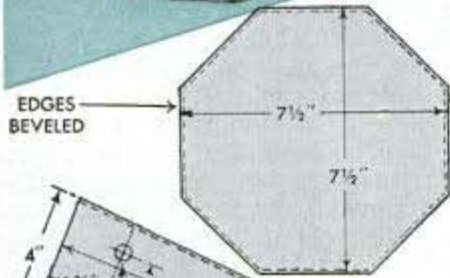
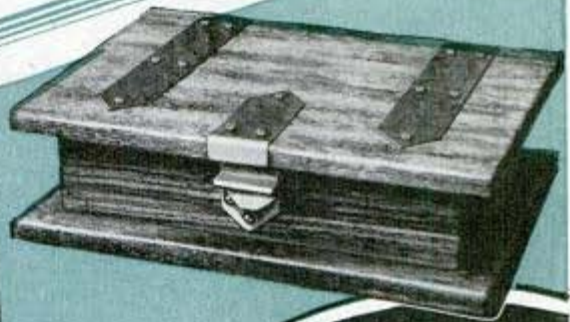
Endless belts made by cutting slices from an old inner tube provide good emergency substitutes for small round belts. Such belts can be made in various lengths by cutting



across the inner tube at an angle, the degree of the angle determining the length of the resulting belt. Use the old belt as a pattern for length. Place it around the tube and, holding it at one point, move it at an opposite point along the tube until it is taut. Then cut the tube at this angle and the belt should fit.



# From the WOOD PILE





## Rubber Disks on Card-Table Legs Keep Ants Out of Food

Picnic lunches spread on a card table can be protected from ants by simply cutting large disks or washers from an old inner tube and slipping these over the table legs. When in place, they form cone-shaped containers which are filled with a sufficient quantity of insect powder to turn the ants away.

## Anchor Chain Helps Diver Climb Into Boat From Water



When using a rowboat as a diving platform, difficulty in getting into the boat from the water can be overcome by using the anchor chain as a step. The step can be made any height desired by using a screw hook to fasten it as indicated. A length of garden hose slipped over the chain will provide a cushion for the feet.

## Masks for Wall Plaques Molded On Modeled Clay Base

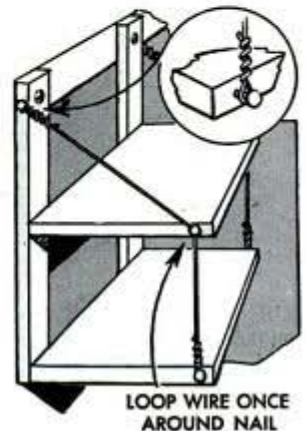
By Jack and Janice Holmes

Molding paper-mask wall decorations, such as those shown on the opposite page, is a fascinating hobby that even children can enjoy, as it is easy to do and costs very little. Materials needed are potters' modeling clay, a few wooden blocks, some crinoline or sheeting, casein glue, shellac and paper toweling or newspapers.

Fig. 1 shows various suggestions for masks. Other styles can be made as desired. First, wooden blocks are set on a base to provide a form over which the clay is pressed at least an inch thick to prevent its cracking, Fig. 3. The blocks can be removed easily when the clay has dried. Next, features are molded with the fingers or with any handy small tool such as a skewer or awl, Fig. 2, after which the model is left for about 24 hrs. When the clay is dry, vegetable oil or grease is applied all over, Fig. 4, and cloth is pressed into all the contours, Fig. 5. Paper towels now are torn into small pieces and dropped into a pan of casein glue, Fig. 6, then are laid on the cloth in three overlapping layers, Fig. 7, and allowed to dry. The moisture in the glue breaks down the fibers in the paper, leaving a skin-smooth papier-mache mask. The model is removed from the block form and the clay is picked out with an ice pick or other pointed tool, Fig. 8, without, of course, piercing the paper, after which the mask is coated with shellac, Fig. 9, and painted to suit. Gold or silver paint can be applied, or green poster color in a water-base gold paint will give a bronze finish. Other effects can be obtained with either water colors or oil paints.

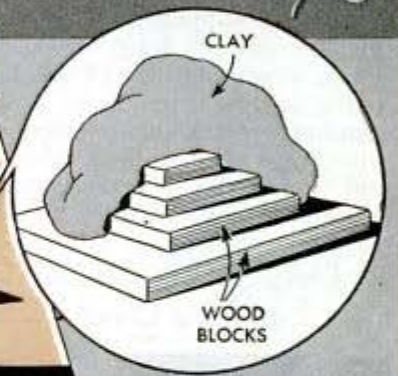
## Making Shelves Without Brackets

The next time you want to install some temporary shelves try the method shown. This is especially handy on masonry walls where it is difficult to attach brackets. To assemble the shelves, first attach a couple of vertical pieces to the wooden plate at the top of the wall. Then, nail the shelves to these and support their outer edges with heavy wire as indicated. — A. L. De Sadeleer, Riverside, Ont.

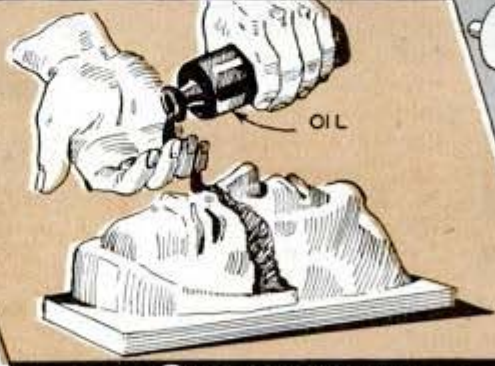




# It's Fun to Mold PAPER MASKS



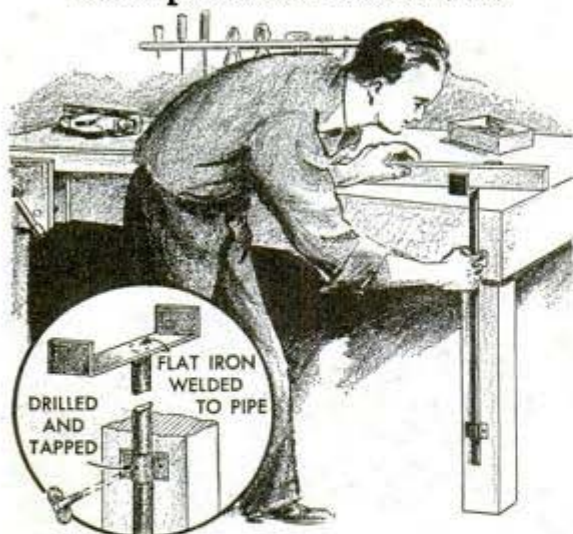
3 CLAY PRESSED OVER BLOCKS



4 APPLYING OIL TO MODEL

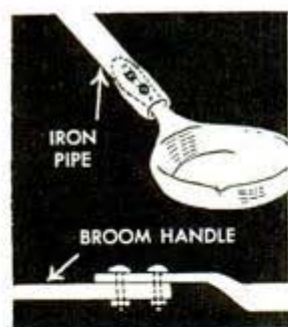


## Support for Holding Long Work Clamped in a Bench Vice



Fastened to one leg of a workbench, an adjustable support will be helpful in holding the end of long work clamped in a bench vice. A piece of flat iron is welded to the end of a length of pipe to form the support, which is attached to the bench with pipe straps. One of these is drilled and tapped for a setscrew that locks the support at the required height.

## Detachable Skillet Handles For Use Over Campfire



Most skillet handles are too short for use over an outdoor campfire, but it is easy to provide them with extension handles. Cast-iron skillets having loop-type handles are ideal for this purpose. You can provide an extension by flattening one end of a suitable length of pipe to slip over the handle. A couple of holes drilled through the flattened portion of the pipe will enable you to lock it on

Most skillet handles are too short for use over an outdoor campfire, but it is easy to provide them with extension handles. Cast-iron skillets having loop-type handles are ideal for this purpose. You can provide an extension by flattening one end of a suitable length of pipe to slip over the handle. A couple of holes drilled through the flattened portion of the pipe will enable you to lock it on

the skillet with small bolts. For skillets having flat handles you can attach a length of broomstick with a couple of small bolts. This is lighter and easier to carry than the pipe, of course, which is important if you are hiking, but you will have to watch to avoid burning it.

Maxine Stevenson, Indianapolis, Ind.

## Nonrattle Tool Pouch for Car From Old Storm Rubber

If small tools rattle around in the tool compartment of your car, slip them into an old storm rubber and snap a rubber band around it. A band cut from an old inner tube will serve nicely. Besides providing a good pouch for storing the tools, the rubber also acts as a tray to keep them together when it is necessary to take them out of the car for use while on the road.



## Repairing Clip on Fountain Pen



When the spring clip on a pen or pencil does not hold securely, its grip can be restored by bending down the end. To do this, slip a knife blade under the clip as indicated to raise the free end,

which then is bent down against the pen. When the blade is removed the clip will press firmly against the barrel of the pen.

Don C. Higbee, Downey, Calif.

When making hamburgers, use an ice-cream scoop to measure out the ground meat and all sandwiches will contain the same amount. The scoop is ideal for this purpose as it cleans itself.

## Articles of Interest to Servicemen

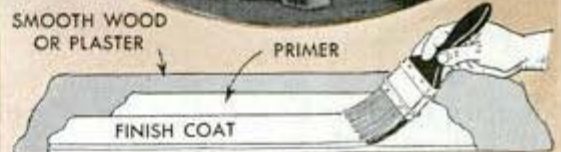
Whether it's the fun and profit that you get from craftwork in your spare-time, or the ideas that may fit into your plans for a small postwar business, just turn to *Plastics*, page 100; *Boomerangs*, 108; *Scrap-Wood Items*, 111; *Filing*, 130; *Masks*, 113; *Candelabra*, 107; *Electric Clocks*, 89; *Fish-Raising*, 118 and many shorter items in this issue



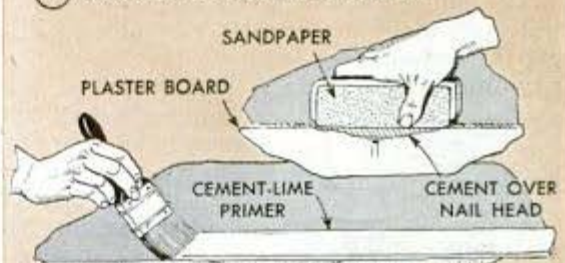
# WHAT PRIMER to Select

SELECTING the right primer for any paint job depends upon the kind of paint you intend to use and the surface to be covered. As shown in Fig. 1, on a smooth, indoor wood or plaster surface, the primer acts as a seal over the work surface, and combines readily with the paint to form a uniform, even finish coat. If, however, the surface is made up of both hard, compact areas and rough, soft spots, such as are produced on plaster board when cemented areas over joints or countersunk nail heads are sanded smooth, Fig. 2, the primer must equalize the surface texture so that when painted the hard areas will not show as slick spots and the rough areas will not absorb the paint and appear as dull blotches. Where oil paint having a lustrous finish is used on such a surface, it is best to apply two primers, one consisting of a cement-lime ingredient to produce a toothy layer that will equalize the surface, and another made up of the proper base ingredients to unite with the paint. Since primers are cheaper than finish paint, it is more economical to use two primer coats than to try to cover an imperfectly-prepared surface with several coats of finish paint.

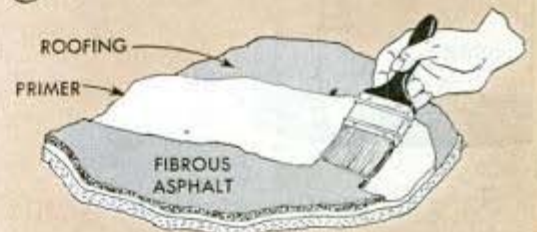
A primer used on dried-out composition roofs should be some nonfibrous asphalt liquid capable of resaturating the felt, after which a coat of heavy fibrous asphalt is applied, Fig. 3. Under heavy-bodied outdoor paints, primers having greater bonding strength than those applied on indoor work should be used. To gain this additional bonding strength, a primer must be able to penetrate the surface of wood or other porous material, Fig. 4. Therefore, it should contain penetrating and waterproofing oil. A satisfactory primer for metal surfaces must adhere firmly, be waterproof, and provide a suitable base for the finish paint. Also, it must have full drying time. Red lead and outdoor aluminum paint are commonly used over metals. If paint is applied before the primer has dried, the unevaporated, volatile content, sealed underneath by the nonporous metal, will be forced to penetrate the paint layer over it, Fig. 5. The result is a breakdown of the entire paint surface and a spoiled job.—J. Modroch, Danbury, Conn.



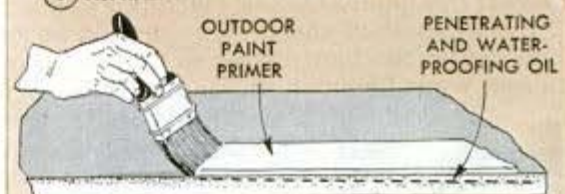
1 PRIMER UNITES SURFACE AND PAINT



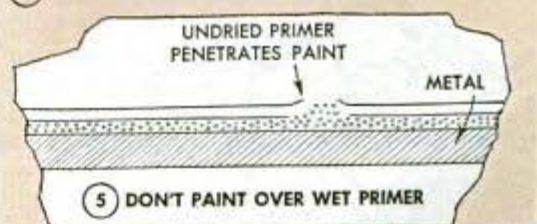
2 ROUGH AND SMOOTH AREAS EQUALIZED



3 ASPHALT PRIMER FOR DRY ROOFING

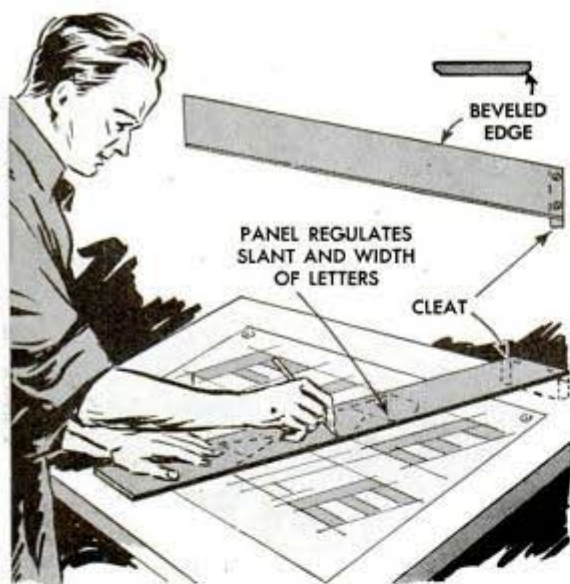


4 OIL PRIMER WATERPROOFS WOOD



5 DON'T PAINT OVER WET PRIMER

## Sign Writer Lays Out Lettering Quickly With This Guide

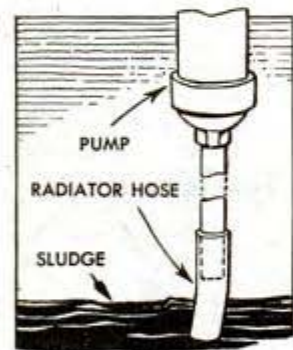


Laying out lettering to the desired angle and width is easy if you use a guide like the one shown. It is merely a strip of thin wood of the same width as the lettering and is screwed to a small cleat at the angle desired. In use, the guide is placed on the drawing board with the cleat against the top edge as indicated. Then the lettering is laid out by simply moving the guide along as required and marking off spaces for the letters. Any horizontal lines needed are laid out with a T-square.

Opie Read, Jr., Chicago.

## Rubber-Hose Extension on Pipe To Pump Sludge From Cistern

The annoyance of scooping sludge from the bottom of a cistern when cleaning it can be avoided by fitting a large piece of radiator hose over the lower end of the pump pipe.



This hose is left permanently in place so that it may be slid down almost to touch the bottom of the cistern during cleaning, or raised to prevent sucking up sediment when the pump is in ordinary use.

## Safe Way to Set Mousetraps

There is no danger of getting your finger caught in a mousetrap or rattrap if you set it by the method shown. Just bore a large hole under the bait trigger so that you can insert your finger from underneath.

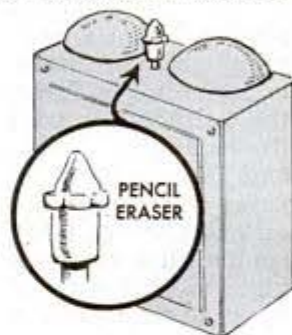


Set the trap in the usual way except that you push your finger up through the hole to raise the trigger instead of inserting it where the trap jaw can strike it if the trigger doesn't hold. — J. E. Griffith, Albin, Neb.

## Muffling Bells of Telephone

Instead of using paper inserted under telephone bells to muffle them when they disturb someone in the house, slip an eraser of the type shown over the striker. This will deaden the sound when the phone rings and will stay in place. If space between the bells is insufficient, pare down the eraser.

—Louis Chirey, Milwaukee, Wis.



## Keeping Fish Fresh on Long Trip

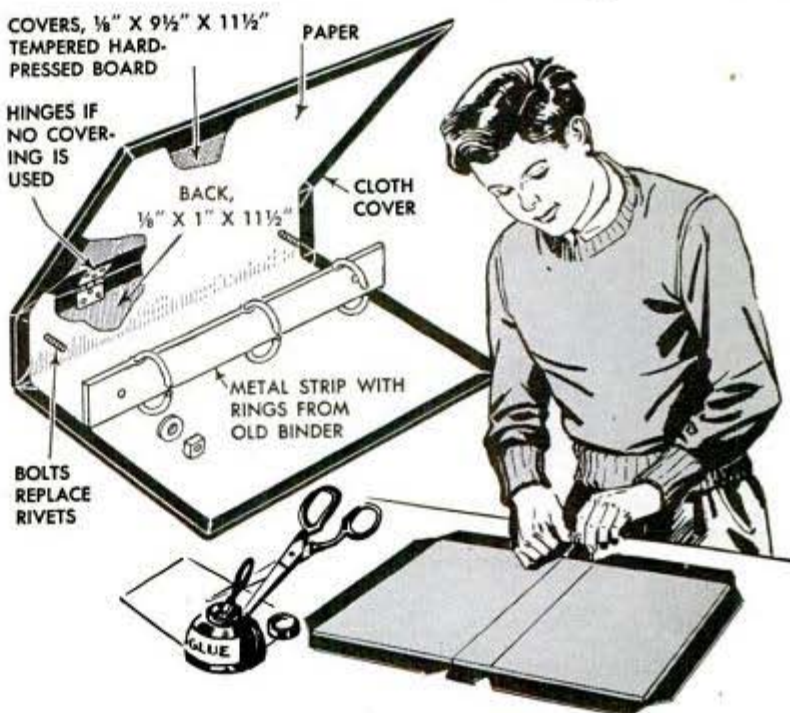
On your next fishing trip try this method of packing those you wish to bring home, and they will arrive in good condition regardless of whether the return trip takes a few hours or two or three days. First, clean and freeze the fish.



If refrigerator facilities are not available, you can do the job in a large ice-cream freezer. Then wrap them immediately, first in waxed paper and then in a towel. Place them in a water-tight container and pack sawdust around them. Put this container inside a larger one and pack cracked ice around it. Replenish the ice as often as necessary to keep it above the top of the smaller container. When you arrive home, instead of the usual soggy, discolored mess of fish floating in melted ice water, you will have firm, dry fish that are just as tasty as when taken from the lake.

# This Loose-Leaf Note Book Has Strong Cover

If a good loose-leaf note book is not available, or if you wish one stronger than the usual type having light cardboard covers, take the metal strip and rings from an old book and then cut two covers and a backing piece from  $\frac{1}{8}$ -in. tempered, hard-pressed board. After the rivets that hold the ring strip are removed, the strip is fastened to the backing piece with small bolts, and the backing piece is attached to the covers with small hinges. However, if the book is to be bound by gluing on cloth, hinges will be unnecessary as the cloth will serve as a hinge. If this is done, apply an extra strip of cloth over the back to extend about an inch onto the covers before applying the binding, which should be put on with the book closed. This will give you a double thickness of cloth for reinforcement where the covers hinge. Also, if

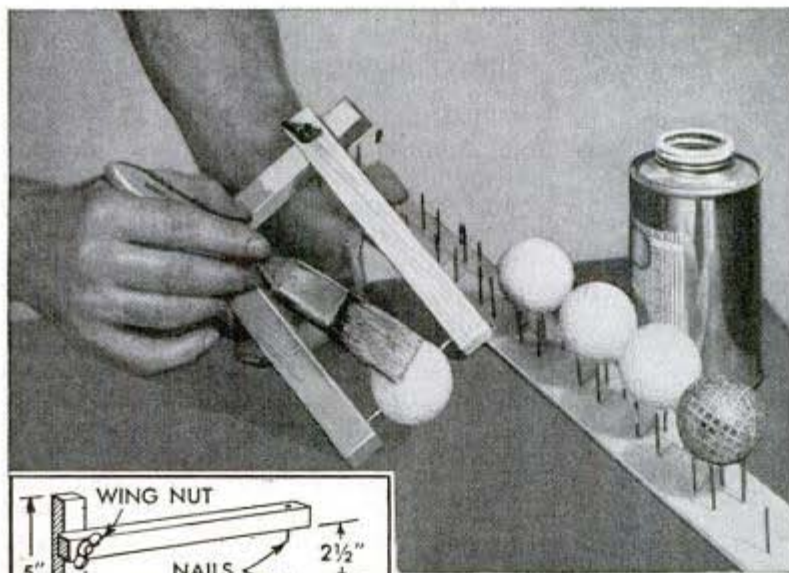


cloth is used as a binding, it is brought over the edges and extended about 1 in. on the inside of the covers, after which paper is glued on the inside to overlap the cloth. Paul H. Dunakin, Jr., Wheaton, Ill.

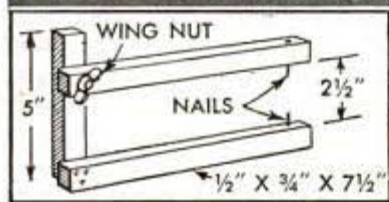
## Tongs and Drying Rack Aid in Painting Old Golf Balls

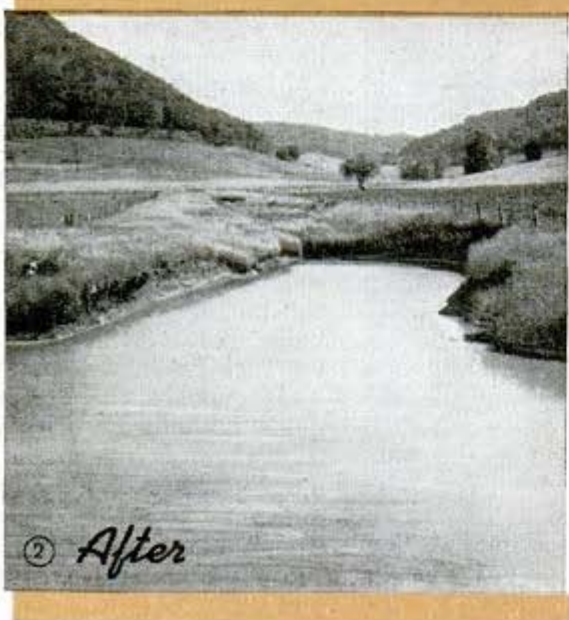
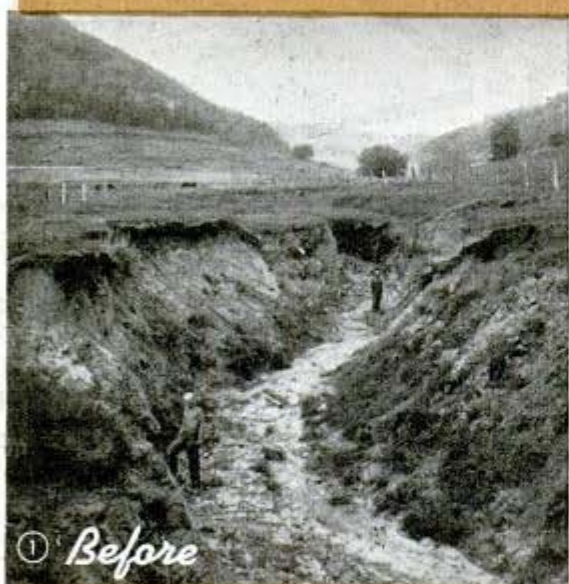
Old golf balls can be given a new appearance with a coat of white paint. All the common difficulties attendant on painting balls are eliminated by using the simple

holding tongs shown. The tongs, together with the drying rack, make the job perfectly clean. The same setup is equally good for spray application. Any kind of house-



hold gloss white enamel will give a satisfactory finish. Scrub the balls in warm soapy water with an old toothbrush before applying the paint. The tongs are made from three wood strips assembled as indicated in the lower detail, the upper tong arm being pivoted to permit adjustment of the nail points between which the ball is gripped while being painted. The drying rack, which holds the balls while the paint dries, is made by driving nails through a thin wood strip to project in groups of four, spaced so that the projecting ends form pockets or depressions in which the balls set.





By D. P. Rowe

**W**ITHIN one year after extending and deepening a gully on your meadow land, flooding and stocking it, you can enjoy all the thrills as well as the profits of fishing. Moreover, if the pond is fertilized and properly managed, fishing can be continuous year after year without the need for restocking the pond. Each year such a pond can yield from 200 to 400 lbs. of fish per acre of water at lower cost than most other food, whether field crop or livestock.

First of all, select a good location for your pond. If you live in a soil conservation district, your district conservation official will help you locate a good site. Or county agricultural agents can tell you what soil will hold water, whether a dam can be built without too much expense, and how to cut spillways in the event natural spillways are not available. An area where surface runoff would flow into a pond is an excellent location. A watershed of about 15 acres, with an annual rainfall of from 40 to 50 in., will supply enough water to fill a pond of one or two acres. In areas of less rainfall, the watershed should be correspondingly larger. You should make sure that a program of erosion control is being carried out on the watershed so that your pond won't choke up with silt. When a pond is built near a stream, water from the stream can be diverted into the pond.

Usually gullied land showing soil erosion can be deepened and widened if necessary, as in Fig. 4, to be converted into a pond that is a good place to fish and a restful spot for boating, swimming and other water sports. Such a gully is shown in Fig. 1, and the transformed pond in Fig. 2. Open, flat swampland usually cannot be used as it



# 300 pounds of **FISH** per Acre

Over 6,000 artificial ponds, properly stocked and fertilized, net the owners big dividends in food supply and provide the thrills of catching 'em—right at home

cannot be dammed to produce sufficient depth of water. Pond depth should be at least 6 ft. if the water level remains constant, and 8 ft. if it varies a foot or more. In arid regions, a depth of from 8 to 10 ft. is necessary. If a sufficient quantity of water can be enclosed in the selected area by a dam, the proposed water line should be staked off with the aid of a surveyor's level. All trees, shrubs and bushes must be removed from the area to be covered, for they are not needed as an aid to spawning. Furthermore, dead branches and leaves may clog the spillway, and rotting of trees and stumps may cause the dam to slump. A strip 15 ft. or more back from the water's edge also should be cleared of brush, trees and other growths, Fig. 5, since these definitely are undesirable at the edge of managed ponds.

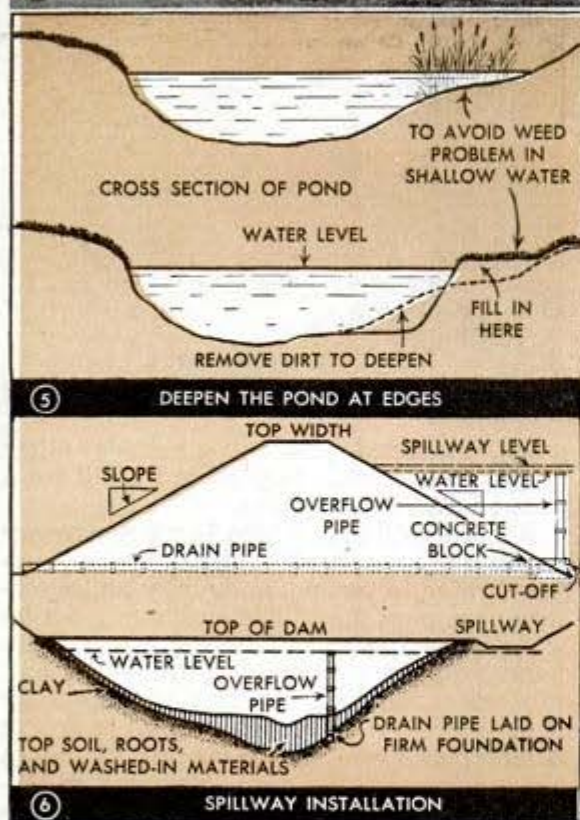
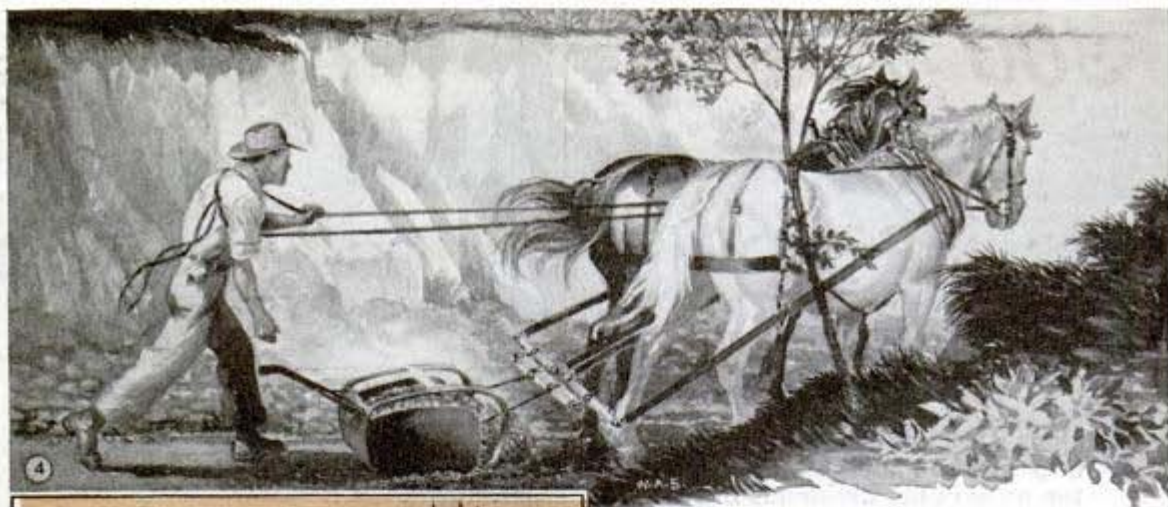
Two types of dams are shown in Fig. 9. For building the one shown in the upper detail, thin layers of loamy soil and stone, well tamped down, are best. If you use sandy soil, keep it on the downstream side and use heavier soil for the upstream third of the dam. Be sure to make the base wide enough to allow for adequate slopes and top width. For every 2 ft. of width at the base, there should be not more than 1 ft. of rise if firmly packing soils are used on both the upstream and downstream faces. With looser soils, there should be 3 ft. of width to every foot of rise. Also, the dam must be high enough above normal water level so that water will not overtop the dam and wash it out during sudden or heavy rains. For dams up to 12 ft. high on watersheds of not more than 50 acres, a height of at least 2 ft. above water level is recommended. As soon as the dam is completed, it can be seeded with Bermuda



grass, standard pasture grass or other adapted vegetation to protect the fill from erosion and wave action.

A good spillway, which is a passageway cut into the reservoir or dam to allow surplus water to escape, is equally as important as a good dam. The spillway must be wide enough to carry floodwater out of the pond without endangering the dam, and the water flowing through the spillway should flow over a slope so as not to create an overfall that would eventually cut a channel around the dam. To avoid excessive carrying away of the soil forming the spillway floor, boulders or large stones can be laid over it as a protection against the water. If a natural spillway is not available you can provide one at either end of the dam, as shown in Fig. 6. Digging such a spillway usually provides a large quantity of soil close at hand that can be used to construct the dam. Therefore, extra wide spillways lower the cost of dam construction as well as increase safety. If a large spillway cannot be built at one end, a smaller one at each end will accommodate the water that ordinarily would be carried off by a large spillway.

A reliable device for maintaining normal water level and keeping spillways in good working order is an overflow pipe connected to a drain pipe as shown in Fig. 6. If the



gate is kept shut against the drain pipe by pressure of water. The drain in the lower detail has a gate that slides between two wooden cleats and is opened by raising the handle which extends from the gate. In constructing a drain of this type, allowance must be made for the swelling of the wood, so that it does not bind the gate and prevent it from being pulled out. In installing a drain pipe, be sure that it is low enough to permit all water to flow out, otherwise there will be undrained pockets in which some fish will remain.

For the drain, Fig. 8, you can use asbestos-cement pipe, as it wears well and costs somewhat less than metal pipe of the same diameter. Most economical, however, is a vitrified-clay sewer pipe that lasts almost indefinitely and will serve the purpose equally well if it is laid on a firm foundation. For a pond of one or two acres in size, 6 or 8-in. pipe is satisfactory. To assure a firm foundation, the earth should be tamped solidly under the joints, which are united by cement mortar or joint compound.

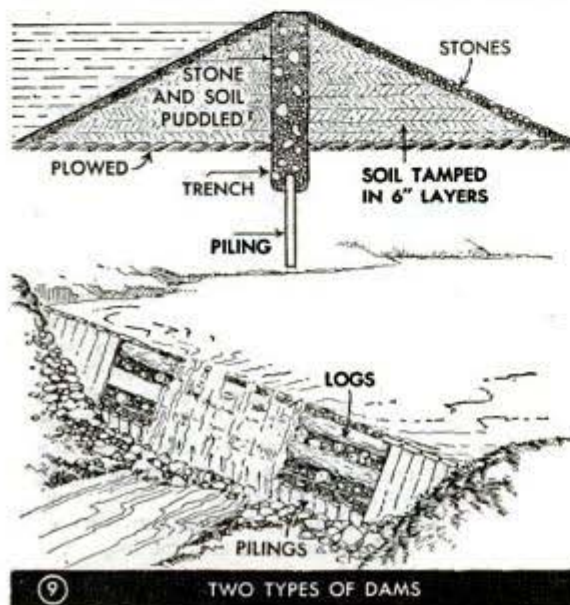
Before stocking your pond, it is best to obtain the advice of the U. S. Fish and Wildlife Service. You may consult, also, your local soil conservation official or your state game and fish department. Or you may find it convenient to patronize a private fish hatchery. Experts of the Soil Conservation Service, who have increased the number of farm and ranch ponds to over 6,000 during the past few years, say that you will get the best yields if you stock your pond with only two kinds of fish—large-mouth bass and bluegills. As bass are predators, eating most of the bluegills as well as their own young, the correct proportion for a 1-acre pond is about 1,500 bluegills to 100 bass. That number of fish should yield from 200 to 400 lbs. of food yearly.

upper end of the overflow pipe is from 4 to 6 in. below the level of the flood spillway, the normal flow, together with much of the runoff water, will be carried through the drain instead of over the spillway. There are many different types of drain cutoffs, two of which are shown in Fig. 7. These are merely pipe tees embedded in concrete, the overflow pipe being fitted into the upper opening. The drains are opened only to empty the pond, as when too many of one kind of fish accumulate at the expense of other kinds on which they prey for food. The drain shown in the upper detail is opened by lowering the gate by means of the projecting board attached to it, as shown by the dotted lines. Normally, the



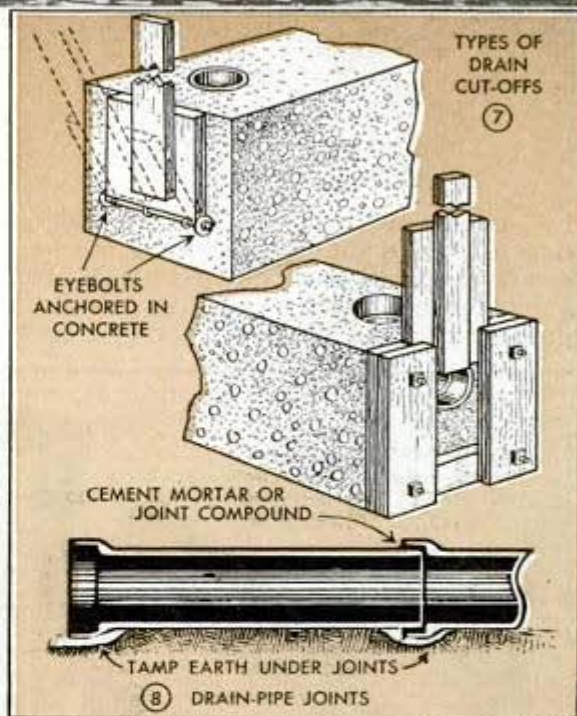
It must be remembered, however, that a given area will accommodate only a certain number of fish. Consequently, if there are too many fish, all are likely to be small. Therefore, instead of adding more fish to an already overstocked pond, it is good practice to drain it and remove all the fish, then restock the pond with the correct kinds in the proper amounts.

To insure a plentiful supply of insects upon which the smaller fish depend for food, the pond should be fertilized as in Fig. 3 to provide an abundance of the plants upon which the insects feed. A good fertilizer for a pond of about an acre in size is made by mixing 16-percent superphosphate, 60 lbs., with sulfate of ammonia, 40 lbs., ground limestone, 15 lbs., and muriate of potash, 5 lbs. Or you can use 6-8-4 commercial fertilizer, 100 lbs., and nitrate of soda, 10 lbs. The first application may be made as soon as the water warms up in the spring. Best results will be obtained if the fertilizer is applied monthly during the summer, or often enough to color the water a greenish brown. Ponds



⑨

TWO TYPES OF DAMS



of 4 or 5 acres can be broadcast from the shore toward the center, but you'll need a boat to fertilize larger ponds in which the water is from 1 to 6 ft. deep. However, do not apply fertilizer when the water is deeper than 6 ft.

Additional information can be obtained from pamphlets issued by the U. S. Soil Conservation Service, Washington 25, D. C., particularly Miscellaneous Publication No. 528, "Techniques of Fishpond Management," and Farmers' Bulletins No. 1879, "Ponds for Wildlife," and 1859, "Stockwater Developments: Wells, Springs and Ponds."

☐ The appearance of panama hats that have become darkened by age can be improved by bleaching them with a solution made by stirring oxalic acid, 1 teaspoonful, in water, 1 pt. The solution should be applied to the hat with a brush, and then rinsed out thoroughly as soon as the hat has been bleached.

## Mold for Casting Candles Made in an Empty Milk Carton



Candles appropriately shaped for birthdays, holidays and other special occasions can be cast from paraffin with little trouble. First, carve a pattern of the candle from paraffin or soap. Then place it in a milk

carton with one end cut out and pour in plaster of paris so that it covers the pattern to a depth of about an inch. After the plaster has hardened, tear away the carton and saw the cast in half straight through the center. If there are undercuts on the pattern, it may be necessary to saw the mold into four equal parts. Remove the remains of the pattern—if necessary you can melt it out—and coat the inside surfaces of the mold with water glass mixed with an equal amount of water. When this has hardened, apply mineral oil to the surfaces to keep the candle from sticking to the mold. Assemble the mold with rubber bands or other clamps, insert a heavy cord for a wick and hold it centered with a paper clamp or other means. Pour in the wax, let it harden and then gently remove the mold. Clip the wick to suitable length, square the bottom of the candle, scrape off the wax left at the joints and your first candle is done. You can make colored candles by tinting the wax, or dabs of colored wax may be brushed onto the finished candle.

G. B. Hayes, Jr., Mammoth Lakes, Calif.

CONTAINERS, No. 2-03826-3  
metal fiber shell; I.D. varies from  
1.60" to 6.92", inside length from  
3" to 43", 175,000 on hand

3 1/2"

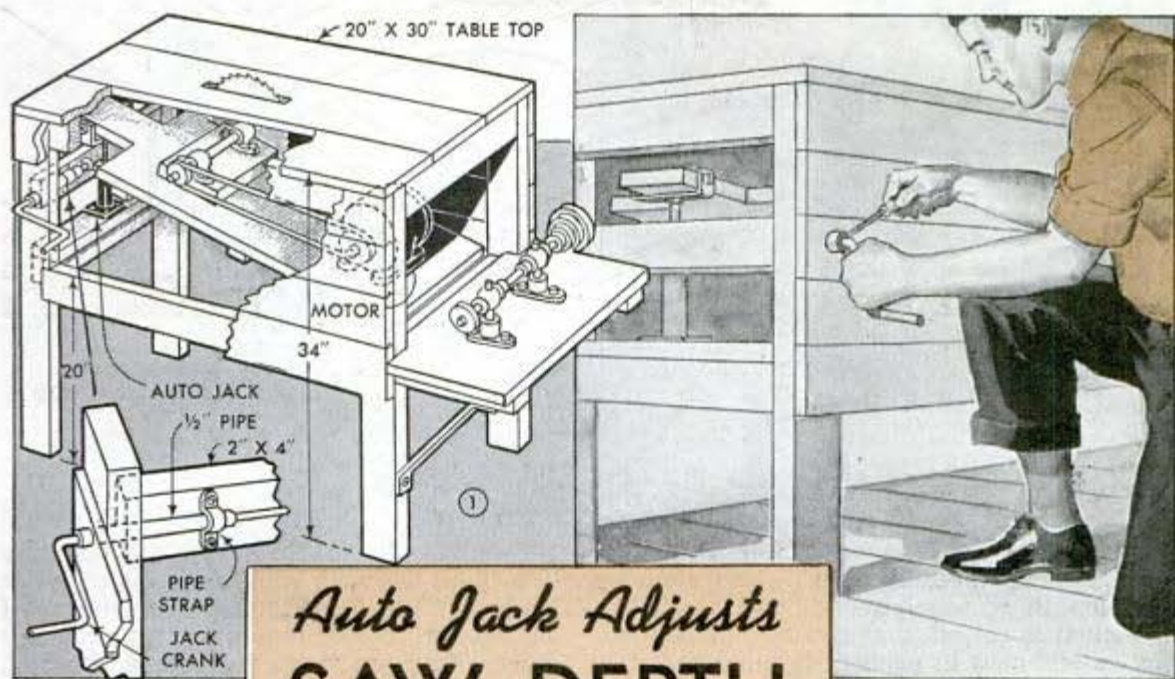
MAPLE BLOCKS, No. 4-03808-1-1  
77,420 on hand

7"  
1 1/4"  
1 1/2"

ASBESTOS FILTER DISKS  
IN 31-GA. STEEL CANS  
No. 4-03941-1  
3 1/8" disks, having 1/2" center hole and three  
1/8" holes, packed 50 per can. Cans are tinned  
or lacquered. 110,000,000 disks on hand

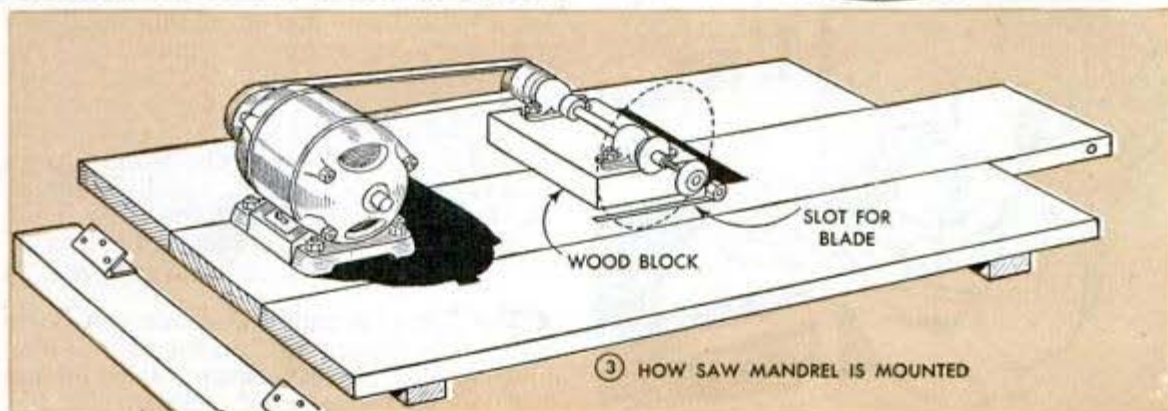
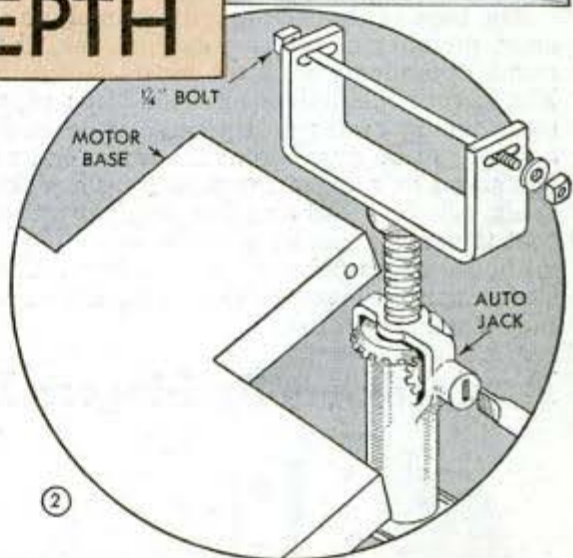
## What Do You Suggest?

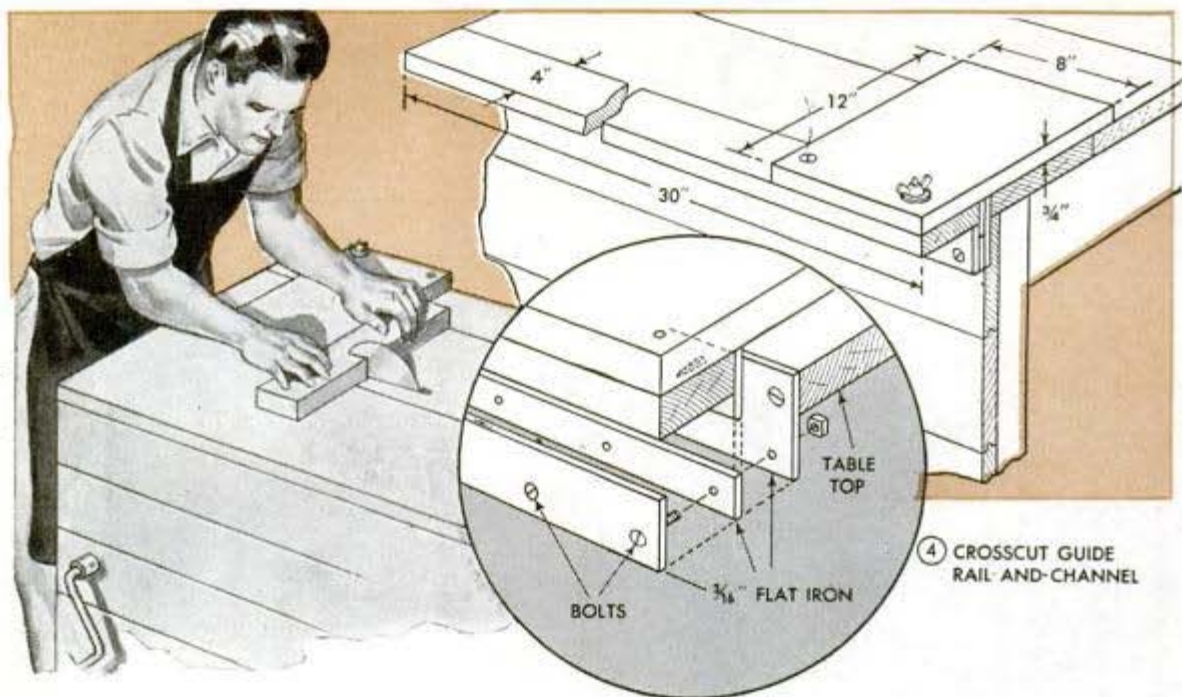
These are some of the surplus war commodities now available. Can you think of a practical use for any or all of them—not an individual or isolated use, but a use that will dispose of large quantities? Some might have widespread sales direct to the public, if advertised for a specific purpose to meet some general need, for instance as a clamp or holder in the home or workshop. Or an item might serve as a part of some machine, lighting fixture, sign, artist's easel, cart or other manufactured product. Perhaps a slight change would be required to make it suitable, or only part of it might be used. Whatever your answer is, write the number and description of the item, state to what it can be applied, as, for example, toy, refrigerator, fence, marine engine, etc., and explain the exact purpose you have in mind. Also mention or show any changes to make. Address your suggestion to OFFICE OF SURPLUS PROPERTY, DEPARTMENT OF COMMERCE, WASHINGTON, D. C. (Potential buyers of quantities of such commodities can obtain, by request on their firm letterhead, lists of items available. Or they can visit their Regional Treasury Office, where samples can be inspected, merchandising possibilities discussed and bids placed)



## *Auto Jack Adjusts* **SAW DEPTH**

**I**N A simple floor-stand or cabinet-type circular saw, raising and lowering the blade for depth of cut is easily done by means of a screw-type auto jack, as shown in Fig. 1. The motor and saw mandrel are mounted on a wooden base, Fig. 3. One end of the base is hinged to the saw cabinet, and the other end, which extends at the center in the form of a tongue, is attached to the jack. Fig. 2 shows how the tongue fits a wide, U-shaped bracket, which is welded to the upper end of the jack screw. The bracket is slotted to take a long bolt that runs through the tongue. Slots in the bracket are necessary to allow horizontal movement of the bolt as the





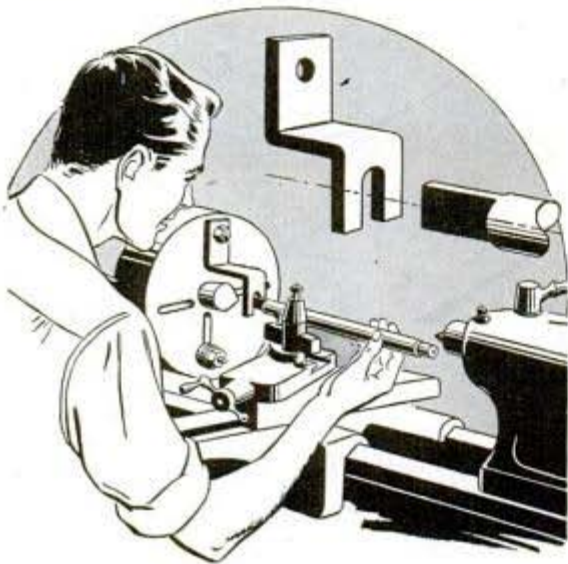
base is raised and lowered. Length of the slots depends upon several factors, such as the length of the base and the height to which it is raised, and can be determined by experiment in each installation.

The base of the jack is bolted firmly to a cross member of the saw cabinet, and the crank extends through the leg as shown in Fig. 1, a short length of pipe, held by a pipe strap, being used as a bearing. If desired, a shelf can be attached at the other end of the stand or cabinet for mounting a jack-shaft, grinder head or other equipment, so that the motor can be used for other work without being removed from the base. The shelf can be hinged to close into the cabinet when not in use.

Fences and crosscut guides can be made in various ways. A smooth-acting crosscut guide is shown in Fig. 4. Two lengths of flat iron are bolted together with a narrow spacer between them to form a channel. Then the assembly is screwed to the edge of the saw table. Another strip, the same thickness as the spacer, is screwed to the inner edge of the guide arm so that it will slide in the channel, as shown in the circular detail. The crosscut guide itself is attached to the arm with a screw and a bolt. The latter is inserted through a slightly oversized hole to permit minor adjustments for accuracy in cutting, after which it is tightened by means of a wingnut.

R. G. Davies, Grand Forks, N. D.

## Production of Bushings on Lathe Increased by Special Dog

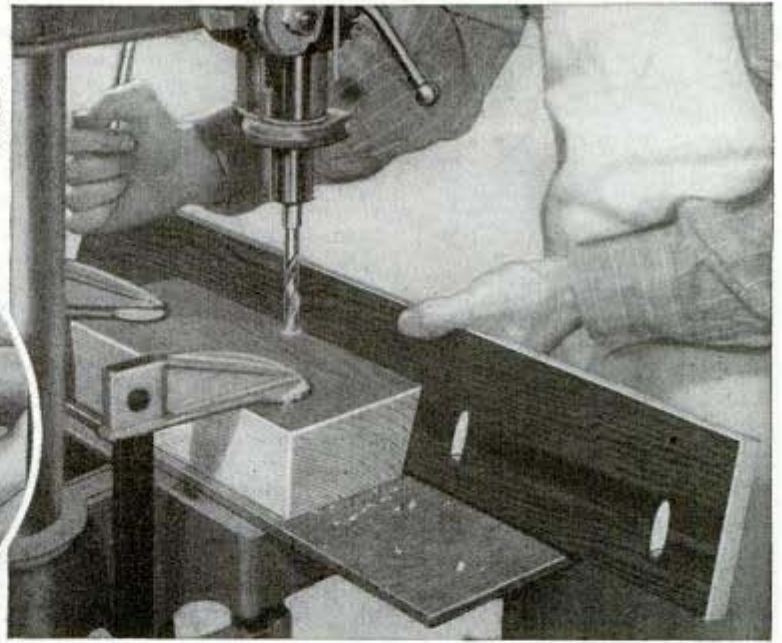
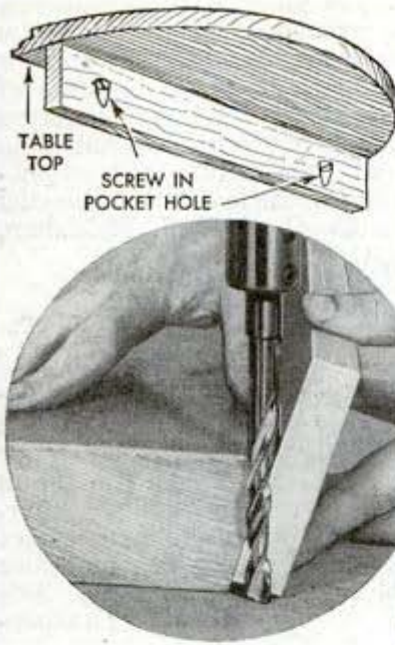


On a job of turning a number of brass bushings on a mandrel, much of the time lost in attaching and removing the lathe dog was saved by using the quick-change dog shown. With this dog, removing the mandrel is just a matter of slipping it in or out. Thus, by using two mandrels I was able to increase production from 26 bushings to 56 per hour. The dog is made from  $\frac{1}{8}$ -in. flat stock and is slotted at the lower end, the mandrel being ground flat at one end to slip loosely into the slot. In mounting the dog, be sure that the lathe center comes exactly in the center of the slot.

Ernest Sawade, Brooklyn, N. Y.

□ The life of a sanding sleeve can be increased by reversing it on the drum. Worn and clogged abrasive grains take on new life with this reversal of rotation.

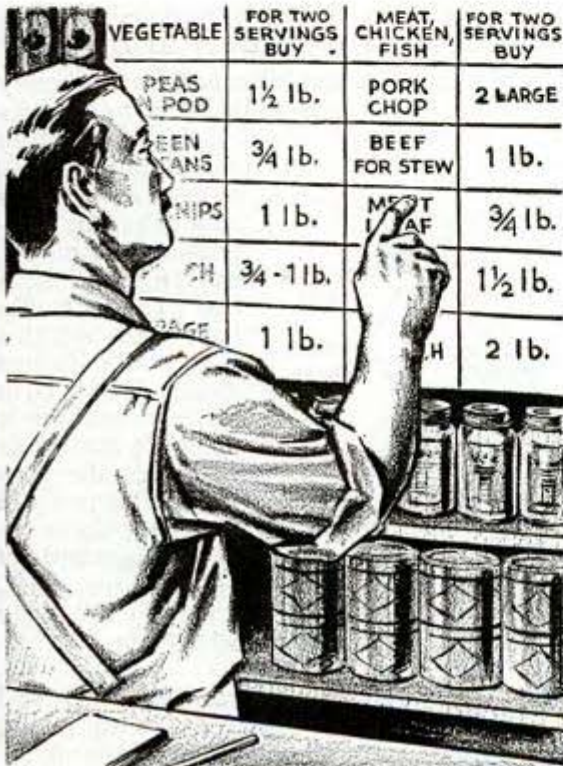
# Bevel Block Simplifies Drilling Pocket Holes



Screws fitted in pocket holes provide an inexpensive and durable method of fastening table tops and similar work. The holes are drilled easily with the use of a guide fence, the working face of which is beveled about 15 degrees. The fence is clamped to the drill table in such a position as to center the lower edge of the work directly

under the drill point, as shown in the circular detail. The drill-press depth stop is used to obtain the proper depth. After the setup has been made, as many holes as desired can be drilled quickly and accurately without any tendency of the bit to lead off. After drilling the pockets, a smaller bit is used for the screw pilot holes.

## Chart Shows Groceries to Buy for Two or More Servings



One grocer with many customers who were unfamiliar with the portions of meat and vegetables to purchase for two, three or four servings made up a chart as a guide, like the one shown. This saved time for the grocer and his clerks as any customer could glance at the chart and determine immediately, without asking the grocer, the amount of provisions she should purchase for her particular needs.

N. Campbell, Boston, Mass.

## Helps for Mimeograph Operators

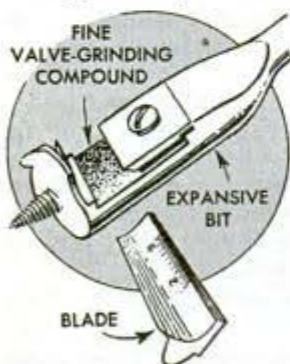
If you use your mimeograph machine only occasionally and the ink becomes oily or dry, you can get good prints without applying a new pad. First, run a thin knife blade under the pad around the entire drum to lift the pad from the perforated surface, thus freeing the clogged holes and presenting new surfaces of the pad over them. Then scrape the entire top surface of the pad with the edge of a dull knife or piece of stiff cardboard. This will raise the nap on the pad to assure a better flow of ink through it, and blacker prints will result.—Keith M. Merrick, Sibley, Ia.

## Rods Hold Seat Covers in Place While Mechanic Works



Seat covers, used by auto mechanics to prevent soiling upholstery when working in a car, have a tendency to slip out of place if not secured, especially if they are made of oilcloth or other smooth material. To keep them in place, hems can be sewed at top and bottom edges and through the center to take heavy rod weights, as shown. For this purpose solid metal curtain rods are excellent.

## Repairing Worn Expansive Bit



If your expansive bit has become worn so that the movable blade tends to creep out of adjustment when it is in use, apply a little fine valve-grinding compound as indicated. Usually, this will take care of the trouble unless the bit is badly worn or the clamping part sprung so that it does not grip the blade when tightened.

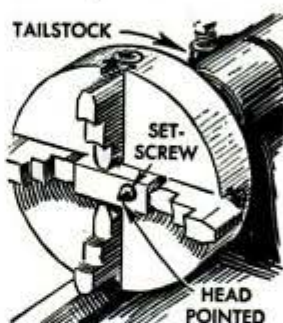
## Simple Tester for Short Circuits

Here is an easy way to locate short circuits without repeatedly burning out fuses, and at the same time have plenty of illumination where you are working. When a short circuit develops, first unscrew the burned out fuse and insert an ordinary light bulb of the proper voltage in place of the fuse. If there are two burned out fuses in the same circuit, replace the other

fuse with a new one. As soon as the short-circuited load is applied, the lamp in the fuse box will glow at full brilliance, enabling the repairman to work on the damaged equipment. An extension cord or other work light can be used in place of the lamp bulb if desired. When the shorted equipment is removed from the circuit, the lamp will go out completely, or at least partially, depending on the load still connected with the circuit.—Capt. R. J. McMahan, Signal Corps, U. S. Army.

## Tailstock Chuck Holds Center For Taper-Turning in Lathe

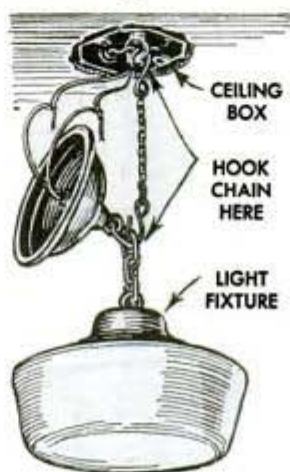
I have a four-jaw independent chuck for the tailstock of my lathe and use it to hold an adjustable center when I have any taper turning to do. A block of steel containing a hardened setscrew serves as the center, which is adjusted horizontally by means of two of the chuck jaws, the other two jaws holding the block centered vertically. Setting up for a taper-



turning job is just a matter of placing work between the headstock center and this one and then moving the latter to one side enough to produce the desired taper.—C. H. Moore, Gladewater, Tex.

## Electrical Fixture Suspended On Chain While Wiring It

On a construction job where many heavy ceiling fixtures were to be hung, one workman used a chain to hold each fixture while connecting the wires. The chain has a hook

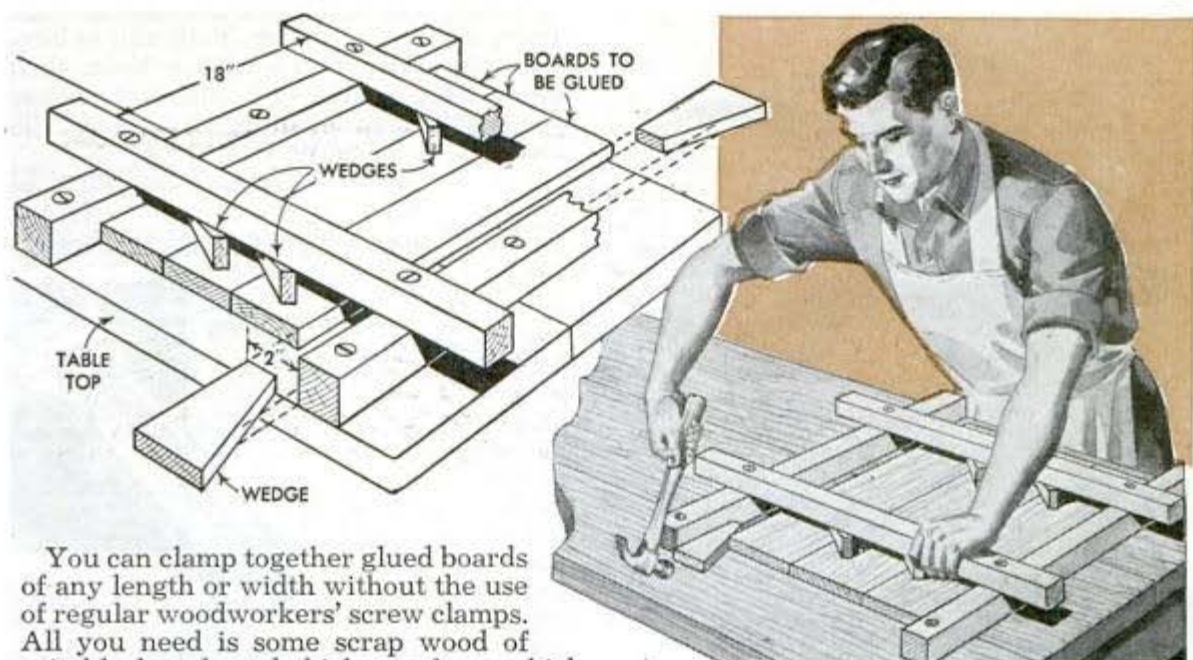


at each end, one to slip into the connector link at the ceiling box and the other to slip into one of the links of the fixture chain. With this arrangement, it is a simple matter to connect the fixture because it does not have to be supported by the wires.—A. Angen, Quaker Hill, Conn.

☐ If you have trouble reading the serial numbers on tires, rub them with chalk, which will make them stand out plainly.



# Wood Frame Substitutes for Clamps in Gluing

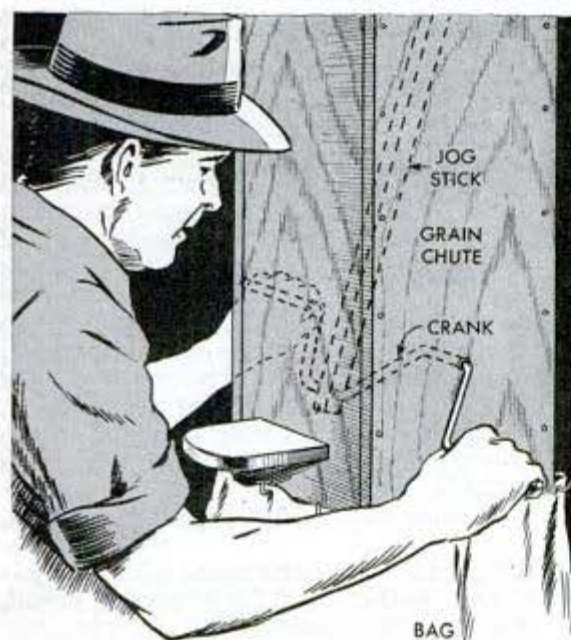


You can clamp together glued boards of any length or width without the use of regular woodworkers' screw clamps. All you need is some scrap wood of suitable length and thickness from which to improvise a frame, as shown in the detail. The frame can be screwed to an old table top or work bench—even to the floor or a wall, if the resulting screw holes are not objectionable. First measure the width of the work to be clamped. Add about 2 in. to the width, and screw two lengths of 2 by 4-in. stock or other wood this distance apart on the table, bench or other working surface. Of course, the pieces should run across the planks of the bench or table top so that these are not forced apart under pressure. Then screw crosspieces over the

frame near the ends. Slide the work into the frame, insert a wedge at each end and set smaller wedges under the crosspieces over each glued joint to prevent the work from buckling. It is advisable also to lay paper between the work and the wedges to prevent the latter from adhering to the work when the glue dries. When all wedges are in position, tap each slightly with a hammer, as shown in the illustration, to force the joints together tightly, and leave the work until the glue is dry.

Norbert Engels, South Bend, Ind.

## Jog Stick Prevents Small Grain From Packing in Bin Spout



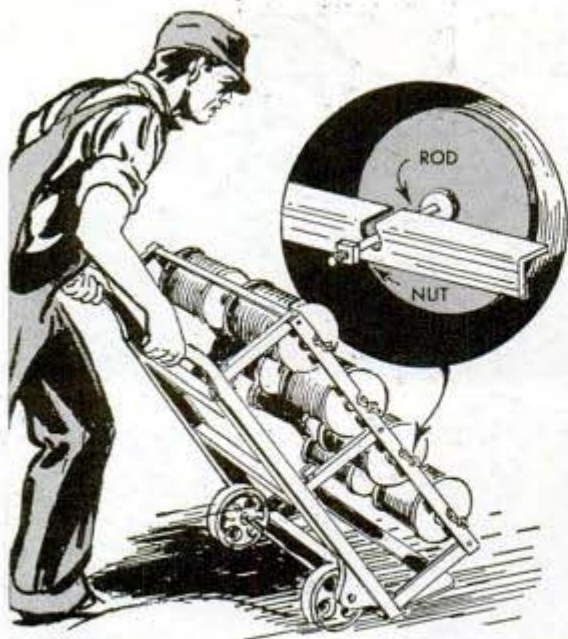
To keep grain from packing in a spout from an overhead bin, one farmer uses a jog stick, which is operated by a crank as shown. The stick is drilled at one end to receive the crank, then inserted into the spout, which also is drilled to take the crank. After this, a length of wire to form the crank is pushed through the spout and stick and then is pulled down to bend the wire as indicated by the dotted lines. Forming a crank on the end projecting from the spout completes the job.

## Uses for Socket-Screw Wrenches

Don't discard your old socket-screw wrenches because of rounded corners. They will make excellent cold chisels. Heat them to a bright red and hammer to rough shape, then grind to exact shape. Heat to a cherry red, then dip in oil, draw to color and quench in clear water.

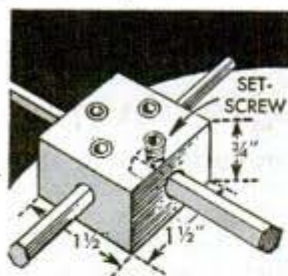
Wm. Bundschuh, St. Louis, Mo.

## Reels of Wire on Push Truck Are Easily Moved About



Electricians on one building project used a push truck to move the reels of electrical wire wherever needed on the job. The truck was fitted with a rack of angle iron similar to the one shown, the upper rails of the rack being notched to take rod axles on which the reels could be rotated when unwinding wire. Nuts on the ends of the rods kept them from slipping out of place.

## Multiple Socket-Screw Wrench



To save much of the time lost in picking up the wrong size of socket-screw wrench, or in looking for the right size, I made up a multiple wrench of the four sizes most commonly used. The L-shaped end of each wrench was cut off and the straight part inserted into a metal block as shown, where it was held by a socket-head setscrew. With this wrench you are sure to have the desired size at hand.

M. De Hern, Detroit, Mich.

## Drill Metal With Wood-Bit Brace

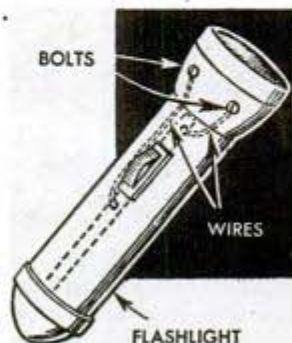
In an emergency, holes can be drilled through metal by using an ordinary brace and drill bits having shanks to fit it. Of course, it would be difficult to do this with a brace in the usual way because of inability to rotate the drill at a high enough speed but by using several sizes of drills

alternately the job can be done easily. For instance, to drill a  $\frac{1}{4}$ -in. hole start with a  $\frac{1}{8}$ -in. drill and sink it a fraction of an inch. Then, change to a  $\frac{3}{16}$ -in. drill and enlarge the hole. Follow this with a  $\frac{1}{4}$ -in. drill. Then, again use the  $\frac{1}{8}$ -in. size and proceed alternately with the different sizes of drills until the hole is finished.

P. F. McNamee, Chrisman, Ill.

## Use Flashlight to Check Fuses

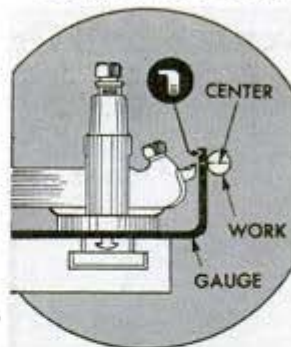
To test electrical fuses and other work requiring a continuity check you can use a flashlight, preferably one having a plastic case as it makes insulating the contact points unnecessary. All you have to do is place a couple of



small bolts in the flashlight case as indicated and wire them to the switch, one lead going to one side of the switch and the other to the opposite side. This "shorts" out the switch when a fuse or other object is placed across the bolt heads, and the flashlight bulb will glow if the fuse is not burned out. This alteration does not interfere with regular use of the flashlight, but care must be taken not to lay it down so that a metal object touches both of the bolt heads.

Howard Chattillion, New York City.

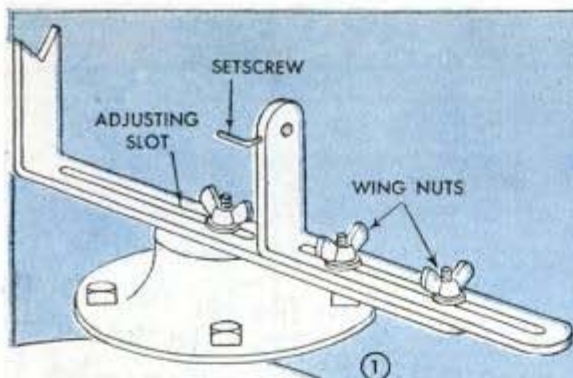
## Guide for Setting Lathe Tool



Setting a lathe tool exactly as required in respect to the work is no problem, even for an inexperienced operator, if a gauge like the one shown is used. It is made from flat iron and a small projection is formed on one edge at the upper end. The gauge is made so that when it is in place on the tool post, the underside of the projection is exactly in line with the center line of the lathe. In this way, the tool is easily adjusted to the centerline of the work by using the gauge as a guide.

Nathan Bogoch, Winnipeg, Man., Can.

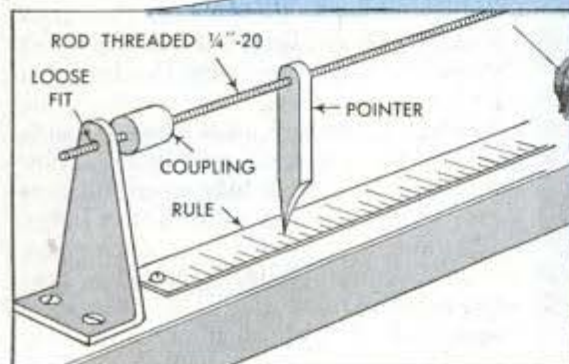
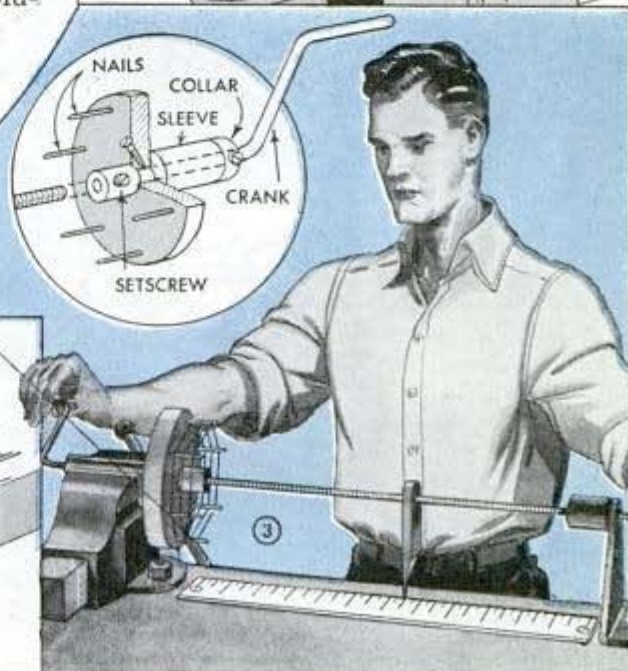
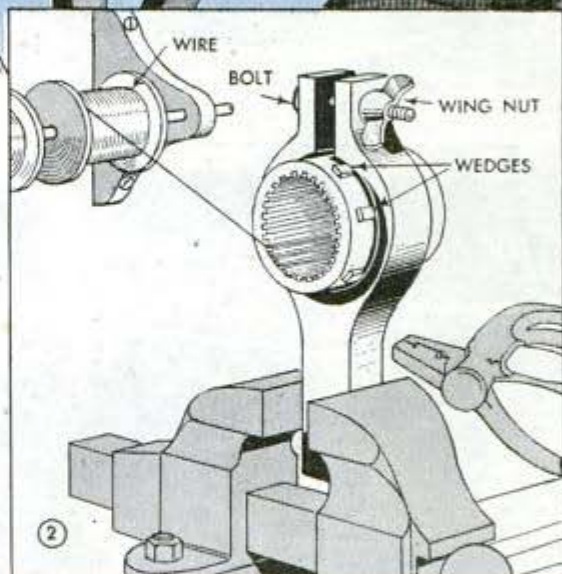
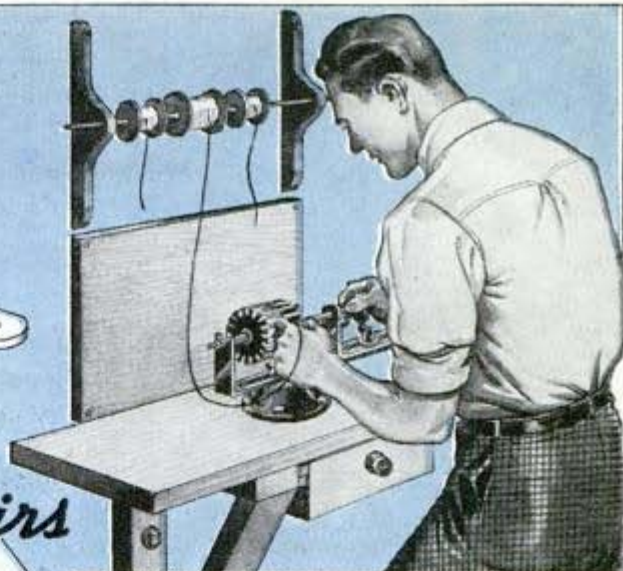
☐ A light rubbing each week with wax paper, such as that used for wrapping bread, will keep tables of power tools bright.



## Bench Jig for Motor Repairs

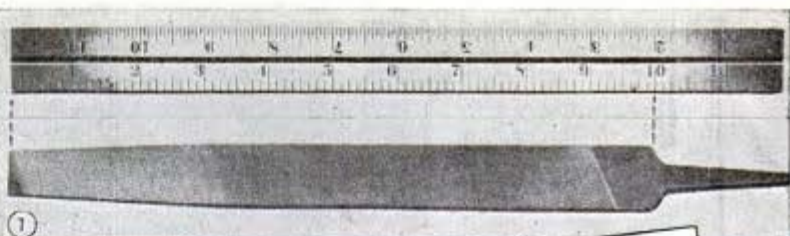
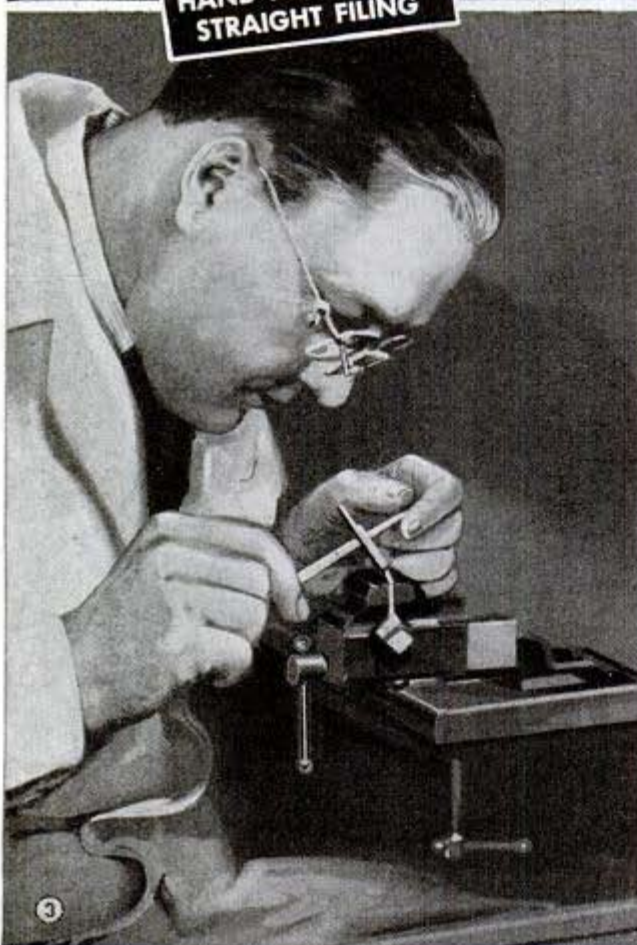
WITH a jig like that shown in Fig. 1, repairmen will be able to rewind rotors or make other adjustments quickly, as the jig permits the position of the work to be changed easily. One end of the motor shaft is laid on a notch in the end of one arm, while the other end of the shaft is inserted in a hole, where it is locked by a setscrew. The arms are adjustable for work of different lengths. For rewinding jobs, a rack for spools of wire is handy, Fig. 2. This consists of two brackets through which a length of rod is run to hold spools of wire most commonly used. The skein-winding jig, Fig. 3, is fitted with a length of  $\frac{1}{4}$ -in. rod, which is threaded so that a heavy pointer, swinging free, will advance as the rod is rotated. A discarded rule screwed to the bench under the pointer indicates the number of revolutions of the rod, each inch of the pointer's travel being equal to 20 turns of the crank. The rod is fitted with a coupling at each end so that it can be turned about when the pointer reaches the end of its travel.

—George Holman,  
Marissa, Ill.





**HAND POSITION IN STRAIGHT FILING**



To select the right file for the job every craftsman should know files and how to use them — he should know file size, cut, length, pattern, style and kind

## The "HOW" of

LIKE many other hand tools, in the use of which the worker's grip, stroke and pressure must be varied to suit the job, the proper use of the hand file requires the development of manual skill. There are three ways of using a file—straight filing, drawfiling and lathe filing. Straight filing includes perhaps the widest application of hand files; in general, it is an operation consisting simply of pushing the file in a lengthwise stroke across the work at right angles to it or slightly diagonally as may be required. Since hand files are designed primarily to cut only on the forward stroke it is important that the file be lifted or "carried" on the back stroke so that it does not touch the work, in order to prevent unnecessary dulling of the teeth. Figs. 2, 3 and 5 show examples of straight-filing operations. In drawfiling the file is gripped at each end and is both pushed and drawn over the work. The strokes usually are made parallel with the length of the work, and the file is held at right angles to it as shown in Fig. 21. Drawfiling thus differs from straight filing since both the forward and back strokes are cutting or "work" strokes. Lathe filing is commonly done, as indicated in Fig. 9, by stroking the file lightly over the surface of work being rotated in a lathe.

Among the first things anyone should know about hand files are: the method used to measure files, the sectional shapes of files commonly used and the basic "cuts" of files, the

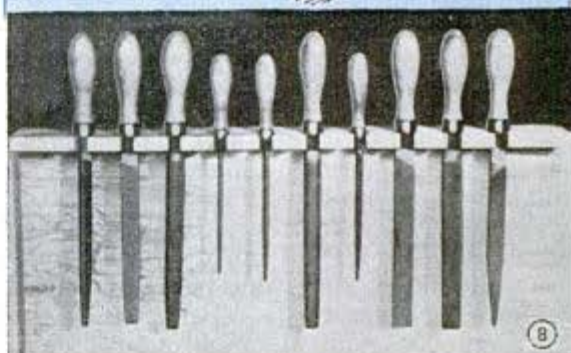
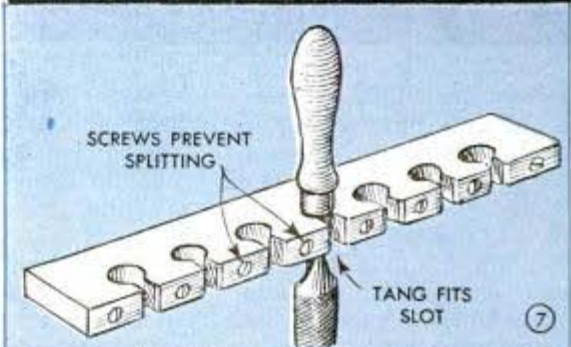
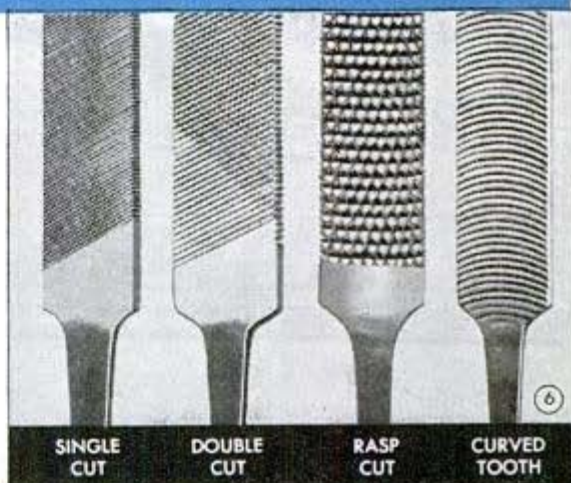


# HAND FILING

by W. C. Lamme

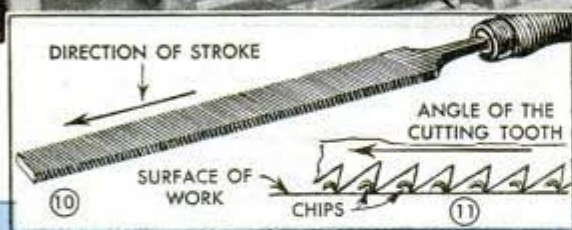
latter term referring in general to the coarseness and arrangement of the teeth. Fig. 1 shows the accepted method of measuring a file from tip to tang, a 10-in. file measuring 10 in. within these limits, and an 8-in. file 8 in. and so on. Sectional shapes of common files are given in Fig. 4. These cross-sectioned shapes are in no way indicative of file size, but show only the types or styles, such as flat, round, half-round, square, triangular, etc. As you can see from Fig. 4, there are three general classifications—circular, quadrangular, and triangular. There also are other irregular forms which are sometimes classified as "miscellaneous." Fig. 6 shows how the "cut" of common files is designated basically, the terms single cut, double cut, rasp cut, curved tooth, and so on referring to the kind of teeth. The relative coarseness of the teeth from extreme coarse to very fine is designated by the terms rough, coarse, bastard, second cut, smooth and dead smooth.

In general, the single-cut file is used most commonly under relatively light pressure for surface-finishing operations and for edging sharp tools. The double-cut file is designed for faster removal of metal and the use of heavier pressures where extreme accuracy and smooth finish are not essential. The rasp-cut file, or rasp, is used principally on wood but also can be used effectively on lead, solder, animal hoofs, certain plastics, aluminum, etc., where fast removal of material is the prime requirement. When working on aluminum and steel sheets and particularly in auto body and fender work, hand filers use the curved-tooth file, which can be ob-





HOW  
THE FILE  
CUTS



can be obtained at nominal cost. A file rack should be attached to the wall above your bench, not to a panel attached to the bench, as heavy hammering will cause the files to fall out.

The cutting action of a single-cut file on metal is very similar to that of a cabinet scraper on hardwood, except that the cut of the file tooth is more on the shear. Fig. 10 shows the direction of stroke and Fig. 11 the chip-removing action of file teeth. Each tooth removes metal in the form of fine chips as it passes over the work on the forward stroke. The coarseness range of the common file is related to the cutting action in that the size of the teeth varies with the size of the file, as will be noted from Figs. 12 and 13. The longer files generally are made proportionally larger in sectional size. It should be kept in mind that it is a commonly accepted practice to select and use files that are more or less proportional to the size and



12 COARSENESS RANGE OF MILL BASTARD FILE

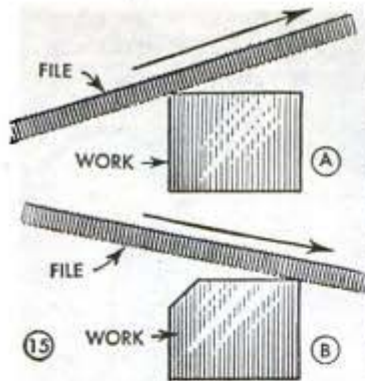


13 COARSENESS RANGE OF MACHINIST'S FLAT BASTARD FILE

tained in a rigid as well as a flexible form.

As files have a great number of sharp cutting edges which can be dulled easily by contact with metals of equal hardness, it always must be remembered that files should not be thrown together loosely in a toolbox or drawer either by themselves only or with other tools. One of the best ways to keep various sizes of files together, safe from damage and always ready for use, is to make a simple rack of the kind shown in Figs. 7 and 8. This can be made from a piece of  $\frac{3}{4}$  by 2-in. wood, cut to whatever length required to hold the number of files in regular use. Holes large enough to receive the tangs are drilled in the wood, and notches narrower than the diameter of the holes are cut in from the edge. All files should be fitted with individual handles, preferably having rounded ends. These are made especially for the purpose by various file manufacturers and





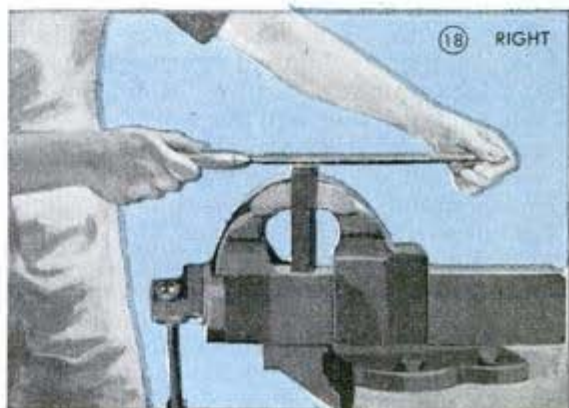
nature of the work. For example, the type of work shown in Fig. 14 would ordinarily call for the use of a medium large double-cut machinist's file, since even though the measurement required to bring the work to finish size might be small, the amount of material to be removed would still be considerable owing to the sectional size of the work.

Details A and B of Fig. 15 will serve in the illustration of two important points in hand-filing procedure. Assuming, for example, that the requirement is to bevel the edges of work as indicated in detail B, if the work is 6 in. or more in length, the bevels are more easily cut by drawfiling along the edges, but if the stock is nearly square the file strokes must be made at right angles to the edge. Experienced hand filers usually do this and similar jobs by first beveling the edge farthest away. If you start beveling on the near edge, the file is likely to chatter and clog, and moreover, you are apt to damage the teeth.

When doing both straight filing and drawfiling, the work generally is held in a vise. Here the height of the work is important. Ordinarily, for average light work, the jaws of a vise should be just above



elbow height, although when doing heavier work often it is more convenient to have the work positioned a little lower. Figs. 17 and 18 picture in a general way the right and wrong methods of holding a file in straight-filing operations. It takes some diligent practice to acquire the knack of "carrying" or "stroking" the file to produce a true, flat surface. If the file is gripped as shown in Fig. 17, and the stroke is made under heavy pressure, the action of the file will be similar to that indicated in the two details of Fig. 15 and the result will be more or less of a convex surface instead of a perfectly level surface as desired. The trick is to carry the file forward in as straight a line as possible and to apply just sufficient pressure, equalized with both hands, to keep the file cutting. Of course,





this applies to the longitudinal stroke only. On some materials it's necessary to change the course of the file slightly to prevent grooving. Sometimes the job calls for flat surfaces to be filed on adjacent sides of a right-angle section as is shown in Fig. 16. In doing this job the filer uses a file made with one blank, or "safe" edge. This feature of the file enables the operator to work into a corner without grooving or marring the adjacent surface.

Figs. 19 to 26 inclusive show various hand positions of skilled operators when doing jobs ranging from precision filing on small parts to the heavier work on large machine parts. As the job becomes specific the selection of files becomes equally so. For example, the experienced mechanic does not use an ordinary hand file for such rough work as "snagging" castings. For this particular work it is necessary to use a special foundry file, which is made with extra heavy teeth shaped to withstand the shock of being driven against the hard projections and sharp edges encountered in

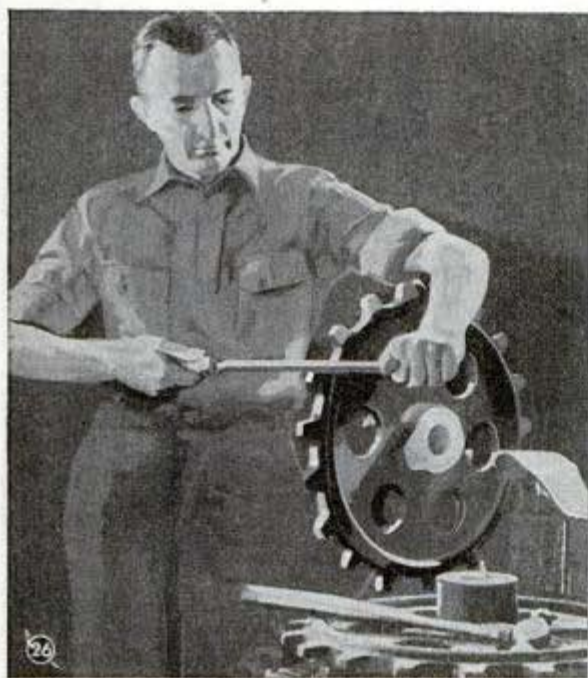
this kind of work. For filing on angles, curves, holes and slots found in fine-instrument assembly, jewelry making and repair, modelmaking and die sinking, the skilled mechanic keeps at hand a suitable assortment of the variety of shapes, sizes and cuts of the small precision files known generally as Swiss pattern files. In Figs. 19 and 23, you see these tiny precision files in use by skilled operators. Objects difficult to hold in a vise because of shape or the danger of breakage are usually held by or in one hand as shown in Figs. 20 and 25. Or use can be made of a filing block, which is simply a piece of hard, close-grained wood having a number of grooves of varying size cut in one or more of its sides. Filing blocks are used chiefly for holding small rods, pins, etc. To prevent marring work held in a vise, a pair of soft-metal pads often are put between the vise jaws and the work. Fig. 22 and the detail below it show how the bevel is started in a manner to ease the strain on the file teeth.

The great increase in the use of new metals and metal alloys has made necessary the designing of new files for special purposes. Figs. 27 to 31 inclusive show a number of these. The curved-tooth file shown in Figs. 27 and 28 is used universally by manufacturers and auto-body repair shops, and by those who work on sheet steel and aluminum and other softer metals. The files are provided with a tang for use of the conventional handle, or plain with a hole at each end for attachment to a holder of the type shown in the right-hand detail of Fig. 28. The flexible files of this special type fit a number of curved holders. They also come in fine and smooth cuts and in flat, square, half-round and other conventional styles. Figs. 29, 30 and 31 show comparisons between regular and special files. The lathe file, aluminum file and brass file, shown at the left in Figs. 29, 30 and 31, are compared with the mill file and the ordi-

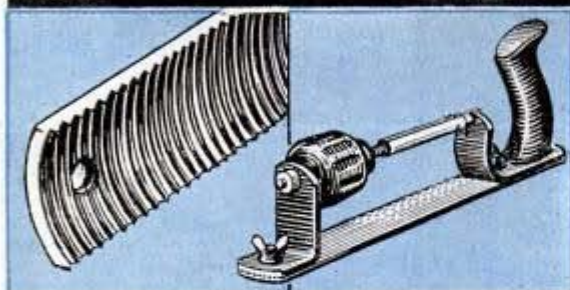




nary flat file detailed on the right-hand side. In addition to the forms shown, there are many others. For example, one particular file is furnished especially for producing a smooth finish on soft metals or their alloys, plastics, hard rubber and wood. It is similar to the ordinary mill file except that it is made in coarse single cut with a long-angle shear tooth. Another, especially made for smooth filing lead, is furnished with coarse teeth cut nearly square across at right angles to the length, thus resulting in a series of straight "blades" which shear away the soft metal very rapidly. Fig. 32 shows the common wood rasp in use. Another file also is made for working in wood. It is similar to the machinist's flat bastard file except that the teeth are somewhat coarser.



## FILES FOR SPECIAL PURPOSES

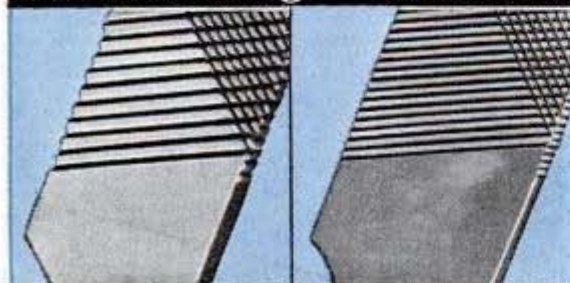


28 CURVED-TOOTH FILE



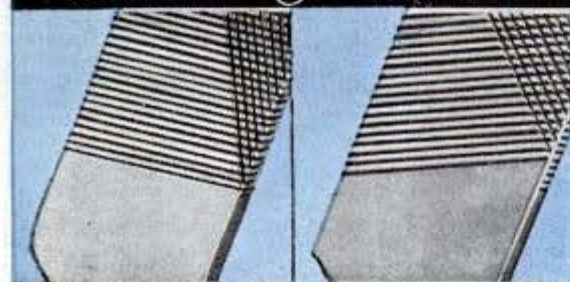
LONG-ANGLE LATHE FILE 29

MILL FILE



ALUMINUM FILE 30

FLAT FILE



BRASS FILE 31

FLAT FILE

Wherever files are used a file cleaner, or "card," should be kept handy for cleaning the files during and after use. Sometimes, on certain materials, even the right file for the purpose will show a persistent tendency to clog or "slug" with collections of chips. If cleaning thoroughly with the file card fails to correct the trouble, very often simply dusting the file and work with chalk will prove to be a good remedy. Always be sure that both the work and file are clean, free of oil or grease. Oil on either the file or the work will cause clogging, especially when using the fine-toothed files. Files rust easily if exposed to undue moisture conditions and any file used to clean up soldered joints on which acid flux was used will be ruined quickly by rust as some of the flux will get on the file.

Files thus exposed or those which are stored for a time can be protected with a coating of light machine oil, but the oil should be removed before the file is used. Carbon tetrachloride is a good solvent to use for the removal of oil and is not injurious to the file. Solutions of caustic acid also are used for the removal of grease and oil from metal surfaces, but care must be taken to remove all traces of acid from the files.

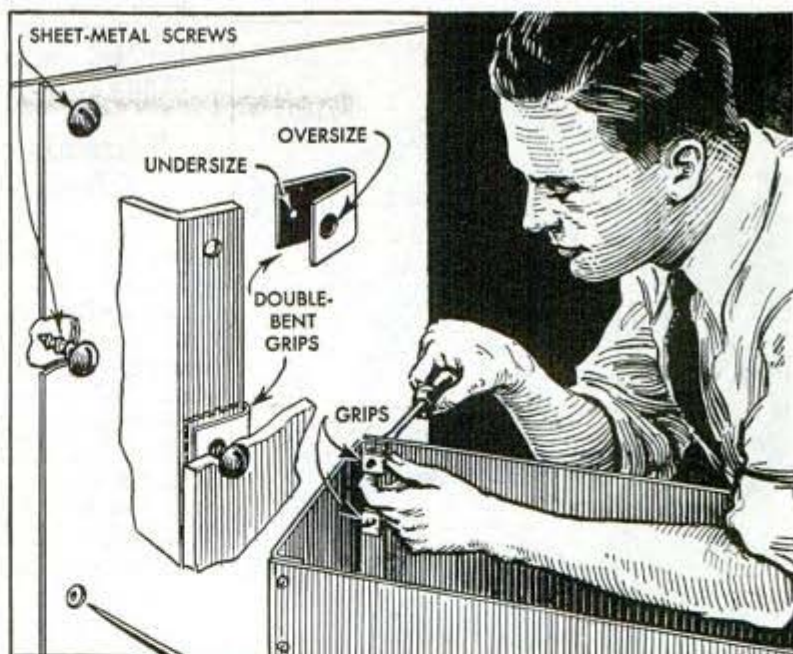
Photos and information by courtesy of the following: Nicholson File Co., Henry Disston & Sons, Inc., American Swiss File and Tool Co., and E. C. Atkins and Co.



# "Grips" Increase Uses of Sheet-Metal Screws

Joining sheets of metal and fastening covers, grilles and hoods in place can be done inexpensively and quickly by means of self-tapping sheet-metal screws. If the metal is thin, just punch undersize holes and drive in the screws. To use them to full advantage, however, sometimes it may be necessary to anchor them with grips instead of in the metal itself. The grips serve as nuts, and their use permits fairly thick sheet metal to be joined by lightweight screws. The grips may be single, flat pieces, or where possible, they may be folded to straddle the work. The screw hole in a single grip

is made undersize, but folded grips are drilled undersize on one side and oversize on the other. The holes in the work also



may be drilled oversize to allow the screws to be shifted slightly to relieve any sagging or buckling that might occur.

## Ventilating Shaft Helps Prevent Corn Spoiling in Crib

If weather conditions have prevented corn from completely ripening and drying in the field, and it has to be cribbed in a "soft" condition, here is an inexpensive way of ventilating the crib to aid in drying the corn, and thus help prevent spoilage. Before putting in the corn, build a shaft of wire mesh in the center of the crib as

indicated. If the crib is large, more than one may be required. Place posts about a foot apart and arrange them to form a triangular shape. Nail the lower ends to the crib floor and nail cleats across the upper ends to keep them spaced. In some cases, it may be necessary to attach the upper end of the assembly to the roof, or brace it from a wall, although the corn will tend to keep it in place. Cover the posts with wire mesh, such as chicken or hog wire.

Donald Schimpf, New Washington, O.

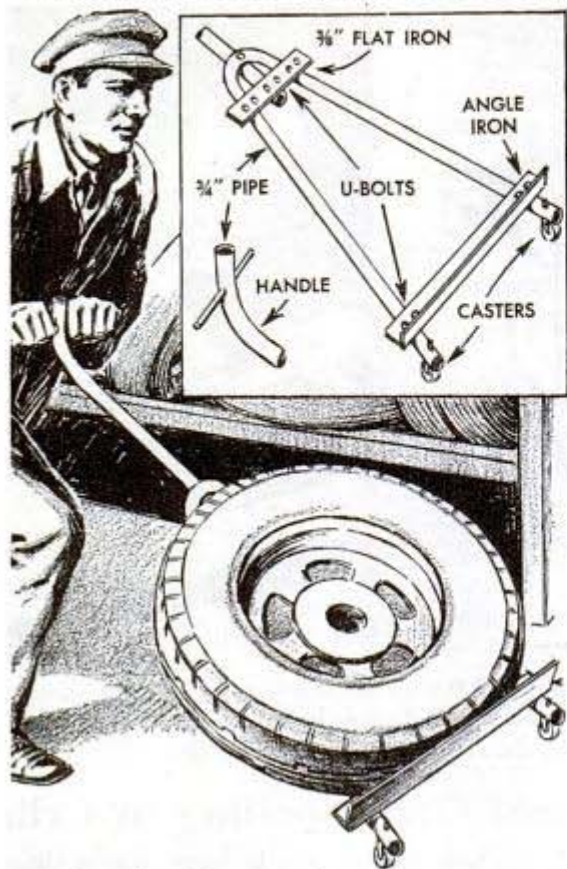


## Cutter Used on Brass Lubricated With Condensed Milk

In our shop we discovered quite by accident that condensed milk was ideal for lubricating cutters used on brass. Annoyed by the screeching sound of a cutter one employee, while eating his lunch, walked over and let a thin stream of condensed milk run from a can onto the cutter. Immediately the noise stopped. After some experimenting, it was found that the work was as smooth as any cutting edge could make it. Now that we are using the milk as a lubricant, our brass-cutting and threading work are greatly improved. Cost of the milk is less than that of other lubricants and it is more easily salvaged.

Joseph H. Bair, Camp Hill, Pa.

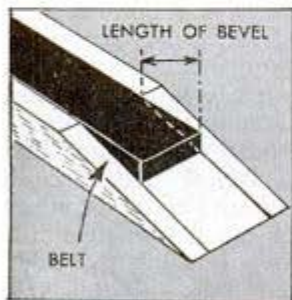
## Large Truck Tires Moved Easily On Simple Two-Wheeled Dolly



A firm handling truck and bus tires uses this dolly to move the heavy tires about as required. The framework is of  $\frac{3}{4}$ -in. pipe bent to a V-shape. Ball-bearing casters are inserted in the ends of the frame, and a piece of angle iron is bolted across the top and bottom to retain the tires. A handle, also of  $\frac{3}{4}$ -in. pipe, is bolted to the pipe and angle iron at the upper end. As the casters act independently, turns can be made as sharply as necessary.

John Krill, Youngstown, O.

## "Miter Box" to Bevel Belt Ends Accurately for Splicing



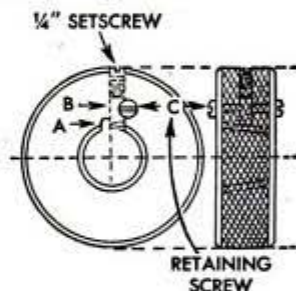
It's a simple matter to bevel the ends of a flat belt for splicing if you use a box like the one shown and do the work on a sander. The box is made from three strips of wood and one end is beveled to the same taper

as that desired on the belt. In use, place the belt in the box, keep it in place with the fingers and hold it lightly against the

sander, using the beveled end of the box as a guide. After beveling one end of the belt, be sure to turn it over and bevel the other end on the opposite side so that the beveled surfaces will fit together correctly at the joint.

## Threads on Old Pieces of Pipe Cleaned With Simple Tool

Having a number of pieces of 1-in. pipe on some of which the threaded ends were damaged, and being unable to purchase a 1-in. pipe die, I made this simple tool to do the job. It consists of a 1 by  $\frac{3}{4}$ -in. disk of steel, which is bored out in the center and threaded to size, after which slot A is cut to provide chip clearance, and slot B is made to take a threading bit ground to shape from tool steel. The bit is held in place by a retaining screw C on each side of the tool, and depth adjustment is obtained by a  $\frac{1}{4}$ -in. setscrew tapped in from the rim of the disk.



H. D. Chapman, Mt. Rainier, Md.

## Magnet Removes Metal Shavings From Close Places in Lathe

Removing metal shavings from a lathe in places that you cannot reach with a brush is a simple job if you use a magnet.



Wrap a length of iron wire around one leg of the magnet, letting one end of the wire extend an inch or two as indicated. The wire will be magnetized and can be inserted into the restricted places to pull out the shavings. — Edward Skora, Gary, Ind.

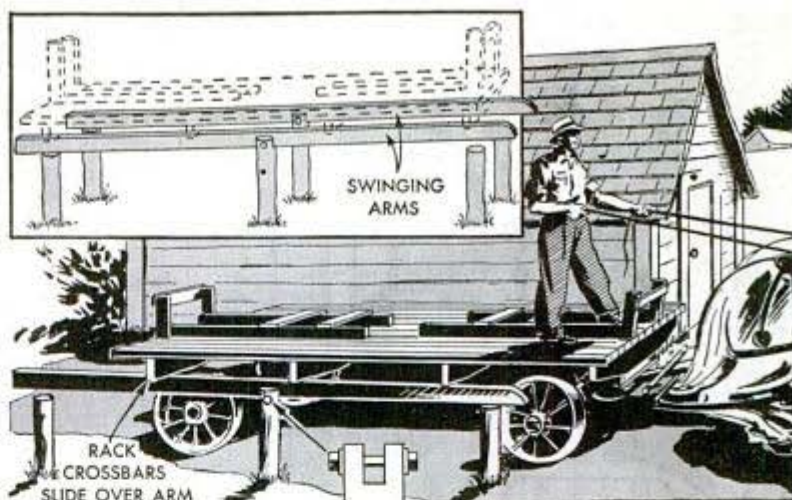
## Glass Cutter Serves as Stylus

A dull glass cutter that is no longer serviceable for its regular use provides a good ruling stylus for making lines on a mimeograph stencil. It is better than a ball-point stylus because the little wheel turns and will never tear the stencil. A small cog wheel from an old clock can be substituted for the plain wheel to make a stylus for drawing dotted lines.

Rev. Ben A. Bohn, Olney, Ill.

# Support Helps Remove Hayrack Singlehanded

Removing a rack from a hay wagon singlehanded is an easy job if you use a support similar to this one. It consists of two arm assemblies so spaced that they just clear the wheel hubs when a wagon is backed between them. Each assembly is made up of one arm and three posts, the arm being pivoted to the center post, which is 2 or 3 in. longer than the end posts so that the arm can be rocked slightly. The arms engage the rear cross members of the rack and lift it slightly. Continued backing slides the rack onto the arms to a point where it almost balances. Then the driver shifts his weight to balance the rack and lift it free of the



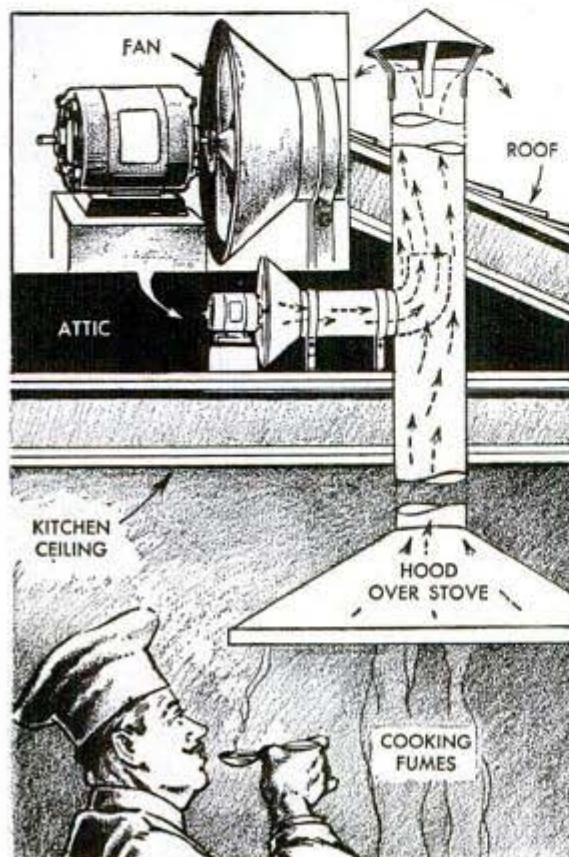
bolsters, after which the wagon is driven from under it. To load the rack, the wagon is backed under it, the front end pushed down, and the wagon driven out to pull the rack off the arms.

# Injector Type of Ventilator Keeps Dust Out of Fan Motor

Motors of ventilating fans used in restaurant kitchens will not become so impregnated with grease and smoke as to require frequent attention if they are installed as indicated. In this way, the motors

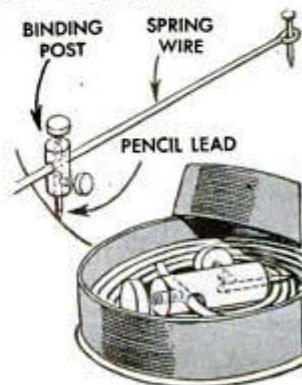
do not come in contact with greasy smoke or fumes, and the blast of air in the upper half of the ventilating pipe acts on the same principle as an injector, sucking the fumes and smoke from the hood above the stove.

Fred W. Wood, Long Beach, Calif.



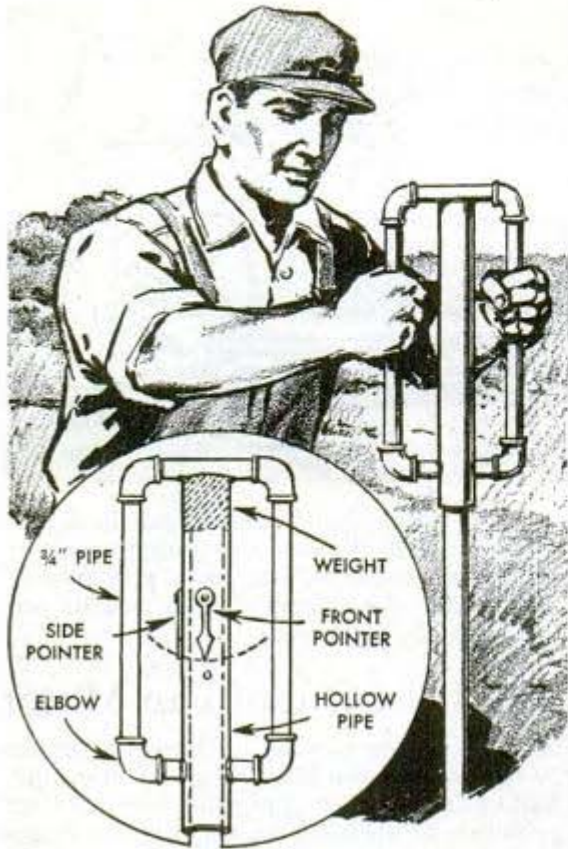
# Flexible Beam Compass Coils Into Pocket Container

Instead of carrying a heavy beam compass, one contractor made one of spring wire that he could coil into a small tin box and carry in his pocket. The compass consists of an electrical binding post having a thumb-screw at the top and one at the side. An eye is formed on one end of the wire to take a nail, which serves as a center when scribing a circle. The other end of the wire is run through the binding post where it is held at the desired radius by the top thumbscrew, the other screw being used to lock a scriber in place.



Ⓞ Taps for threading plastic can be made by roughly grinding two flutes on opposite sides of an ordinary bolt or machine screw of the required size.

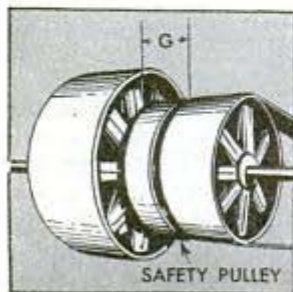
## Weighted Driver for Fence Posts Has Pointers for Leveling



Driving steel fence posts in a true vertical position is not a difficult job if you use a driver like the one shown. It consists of a frame of  $\frac{3}{4}$ -in. pipe welded to a piece of pipe large enough to slip over the upper end of the posts with a loose fit. A weight inside the larger pipe at the upper end helps provide the driving force. Loosely pivoted pointers on two sides of the large pipe enable you to start the post in a vertical position.

John L. Bumbalek, Whitewater, Wis.

## Safety Pulleys on Line Shafts Protect Your Flat Belts



If the space "G" between pulleys on a line shaft is less than 1.5 times the width of the widest adjacent belt, a safety pulley should be used between them as indicated. If this is not done and the belt runs off one of the pulleys it may catch between them and be broken or ruined. It may even pull the shafting, pulleys and hangers down onto the heads of

workers below. The diameter of the safety pulley should be not less than the diameter of the smaller pulley, or more than that of the larger one. Also, when a belt runs off a pulley located adjacent to a hanger provision should be made to prevent catching the belt between the pulley and hanger. Usually, this can be done by attaching a hook or guard to the hanger in such a way that the belt will drop onto the hook or guard.—W. F. Schaphorst, Newark, N. J.

## Opening Chain-Stitched Sacks

Farmers and others who buy feeds and farm materials in sacks often remove the stitches so that the cloth from which the sacks are made can be used for other purposes. To open such stitches easily, remember to place the sack at right angles to you with the single stitching at your left. Then begin raveling the end nearest you.

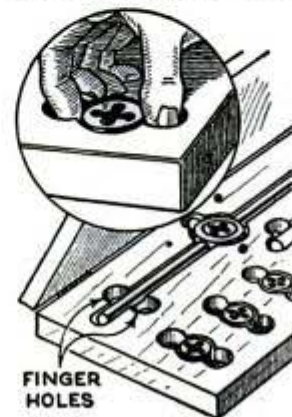
## Knotting Ends of Mop Strands Increases Its Life

Mops used on rough floors or around tables, desks and machines will last much longer if a knot is tied at the end of each strand before use. This prevents the strands from being frayed and torn against splinters or legs of tables and machines, and also makes the mop easier to use because you don't have to pick up frayed pieces that have been torn away.



## Fingerholes Make Taps and Dies Easy to Remove From Case

If you experience trouble in removing taps and dies from the case because it is difficult to grip them, especially when your



fingers are greasy, drill holes on opposite sides of the case openings for each die, tap and stock so they break into the openings as indicated in the drawing. These will enable you to insert your fingers and get a good grip on the die or tap.—M. Paschke, Ardock, N. D.

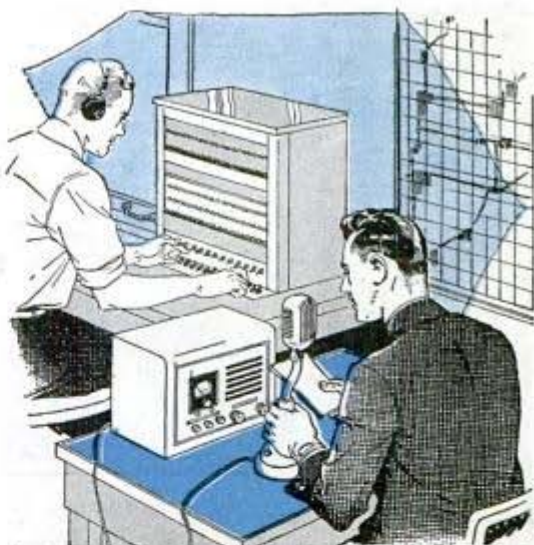


## TWO-WAY RADIO IN TAXICABS

WHEN the taxi driver can keep in constant touch with the dispatcher's office, "dead" cruising is cut to a minimum. Tried out experimentally in Cleveland, two-way FM radio in the 118-megacycle spectrum proved so successful that it may be a postwar economic necessity for many cab companies. Each cab would thus operate on comparatively constant pay loads and give the public far greater service than before.

Through a radio remote control station located in the cab dispatcher's office, outgoing orders and incoming messages to and from the cab drivers were transmitted and received with sufficient power to cover the entire Cleveland area. Fifteen watts for both the mobile and fixed transmitters gives static free reception.

The sketch shows the dispatcher at the "mike" of the remote control unit that operates the central transmitter-receiver located on one of the upper floors of the building. Photo A shows the mobile transmitter-receiver installation in the rear compartment of the taxicab, also the converter that was necessary in making the experiment. The Motorola transmitter-receiver system employed was originally built to operate in the 30 to 40-megacycle band and converters were required to change the frequency to the new ultra-high 118.65-megacycle spot in the mobile band. "Talk-listen" operated, the cab driver presses the switch on the handset to talk and releases it to listen, as illustrated in photo B. The dispatcher directs him to pick up a passenger at a nearby address; photo C is self explanatory: the young lady was immediately on her way.



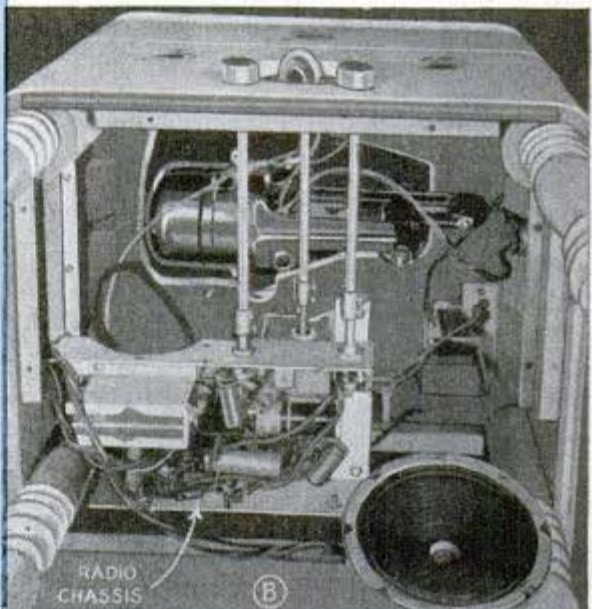
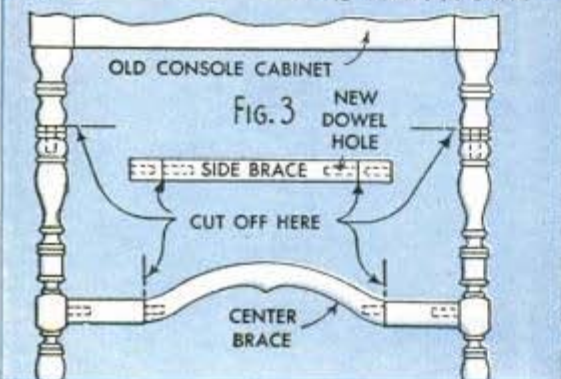
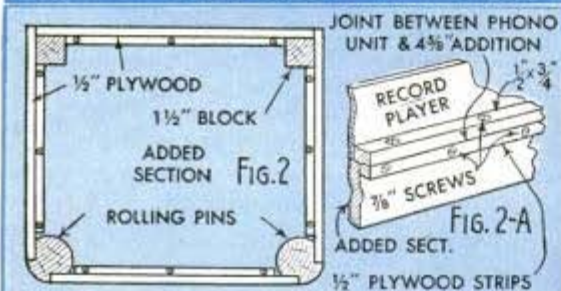
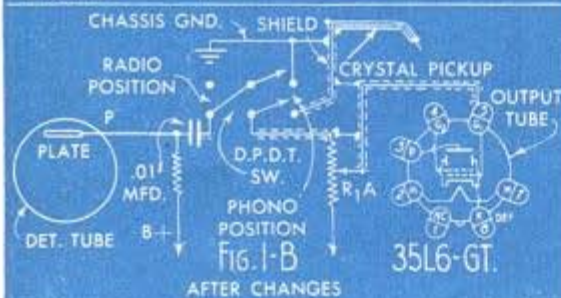
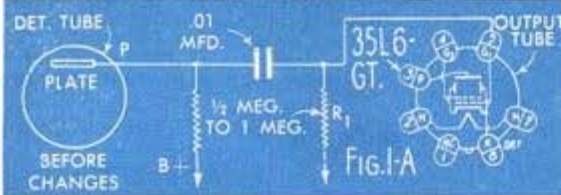
# PHONO-RADIO Combination

By Arthur I. Rattray



PERHAPS you have a small boy or girl in your home who would like to play records and listen in on radio programs with a phono-radio combination of their very own. Units of this type will no doubt be plentiful after the war, but that does not solve the immediate problem. Facing this situation, the writer found the answer by combining an old a.c.-d.c. midget radio with a small record player unit that was housed in a table-type cabinet provided with a lift lid. These units, together with the legs and braces from a discarded radio console cabinet, resulted in the combination phono-radio unit illustrated in photos A and E.

Necessary changes in any midget radio are shown in the partial schematic diagrams Figs. 1-A and 1-B. Connecting the pickup arm directly to the output tube plate does not permit full volume, which is an asset rather than a liability; however, the volume is sufficient on both radio and records. The extra parts required to change the receiver are few and are commonly found in the average radio experimenter's junk box. One 500,000-ohm audio taper potentiometer ( $R_1$ -A) is used to replace the small fixed grid load resistor ( $R_1$ ); a double-pole double-throw switch, plus some shielded wire, is also required. The output tube may be either 25L6-GT, 35L6-GT, 50L6-GT or similar type. The dotted lines in Fig. 1-B represent shielded leads that keep hum to a minimum. Carefully solder and ground all of these shields to the chassis base as indicated.

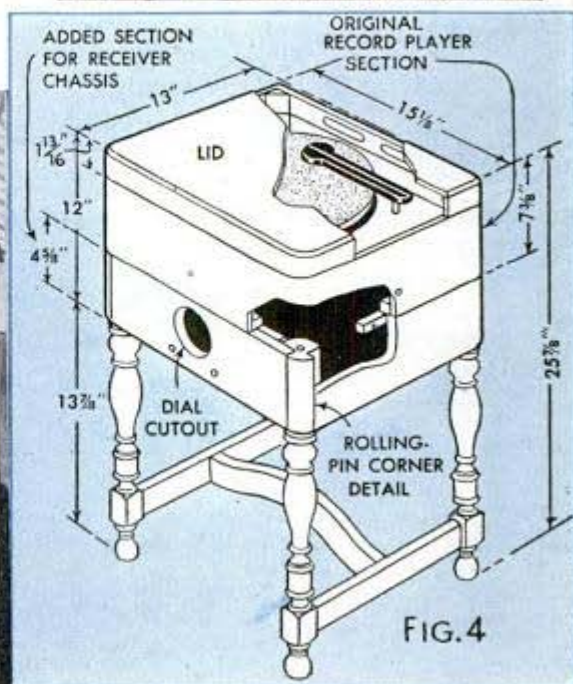
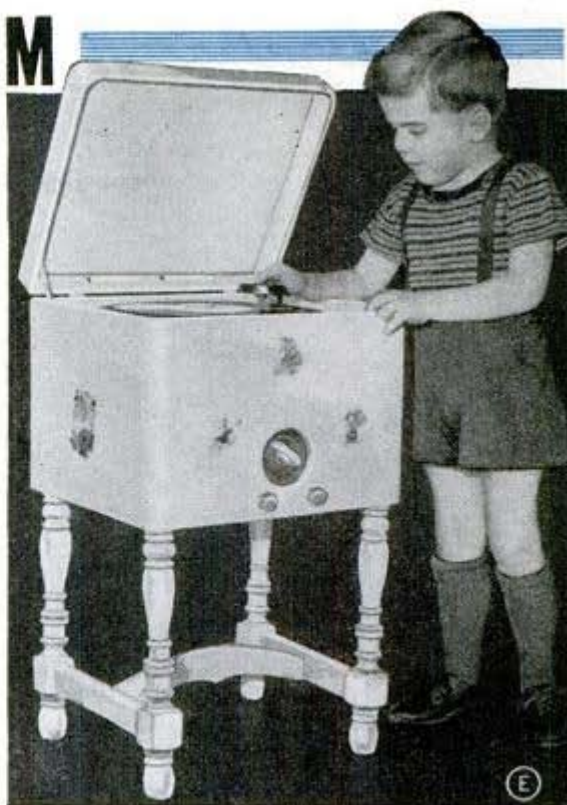




# FOR A CHILD'S ROOM

As the cabinet of the record player was too shallow to include the radio chassis it was made deeper by adding several inches to its underside, as will be noted in photos B, C and D. Complete construction details are given in Figs. 2, 2-A, 3 and 4. The old console legs and braces were cut down and dowel holes drilled, then pinned and re-glued. Figs. 2 and 4 show how short lengths cut from a wooden rolling pin were used to provide the rounded front corners of the extended section. The legs were doweled and glued into these corner posts. Plywood panels complete the added section, which then is joined to the record player section by means of  $\frac{1}{2}$  by  $\frac{3}{4}$ -in. wood strips as detailed in Fig. 2-A. Carefully sand all outside surface joints and apply three coats of white enamel. Decals of nursery subjects help to give the unit a "store bought" appearance.

The midget set chassis is mounted by means of angle brackets screwed to the plywood extension panel at rear. The speaker was removed from the chassis and the leads lengthened so that it could be mounted on a hard-pressed wood baffle in the bottom of the cabinet facing the floor, as shown in photo F. The radio controls are extended with  $\frac{1}{4}$ -in. rods and standard couplings provided with setscrews as illustrated in photo B. Ivory plastic dial and control knobs are used. The d.p.d.t. switch is mounted on the cabinet at rear, and the phono-motor switch is on the right side, as shown in photo A; a.c. line cords can be separate or interconnected. Small holes are cut in the speaker baffle for ventilation.



# Packet Model Wire Recorder



THIS tiny portable wire recorder for emergency and "spot" recording is the result of extensive experimenting by physicist Marvin Camras at the Armour Research Foundation. His larger standard models include recording, playback and erasing features already demonstrated to the public.

The experimental packet model records only and does not play back the recorded sound. Small enough to be carried in a woman's handbag, photo A, the dimensions are  $7\frac{3}{4}$  by 4 by  $1\frac{3}{4}$  in.; the weight is approximately 3 pounds. Interior view, photo B, shows the assembly and small lapel-type microphone. Operated by means of a tiny d.c. motor powered by rechargeable "flashlight" cells, it will record from 66 minutes up to  $2\frac{1}{4}$  hours depending upon the thickness of the wire used. The wire spools then can be transferred to the standard unit, photo C, and played back immediately.

Wire recorders operate without a stylus or other mechanical device. A wire, almost as fine as human hair, passes from one spool to the other through a magnetic recording head; the input of the microphone is converted electronically into a magnetic field through which the wire passes, as indicated in Figs. 1 and 2. In Fig. 2 the wire passes through a small slot cut along the side of a laminated core. The magnetic flux traverses the wire longitudinally at this gap. Should a knot occur in the wire the inclined portion of the head at A lifts the wire out of the slot momentarily without materially interfering with the recording.

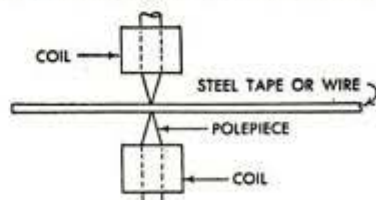
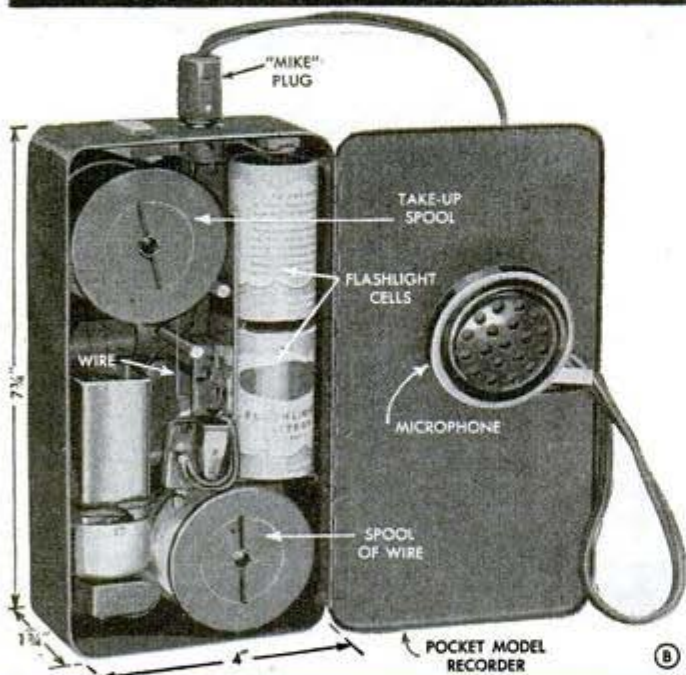


FIG. 1—EARLY FORM OF RECORDING MAGNET

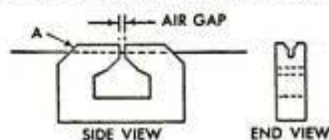
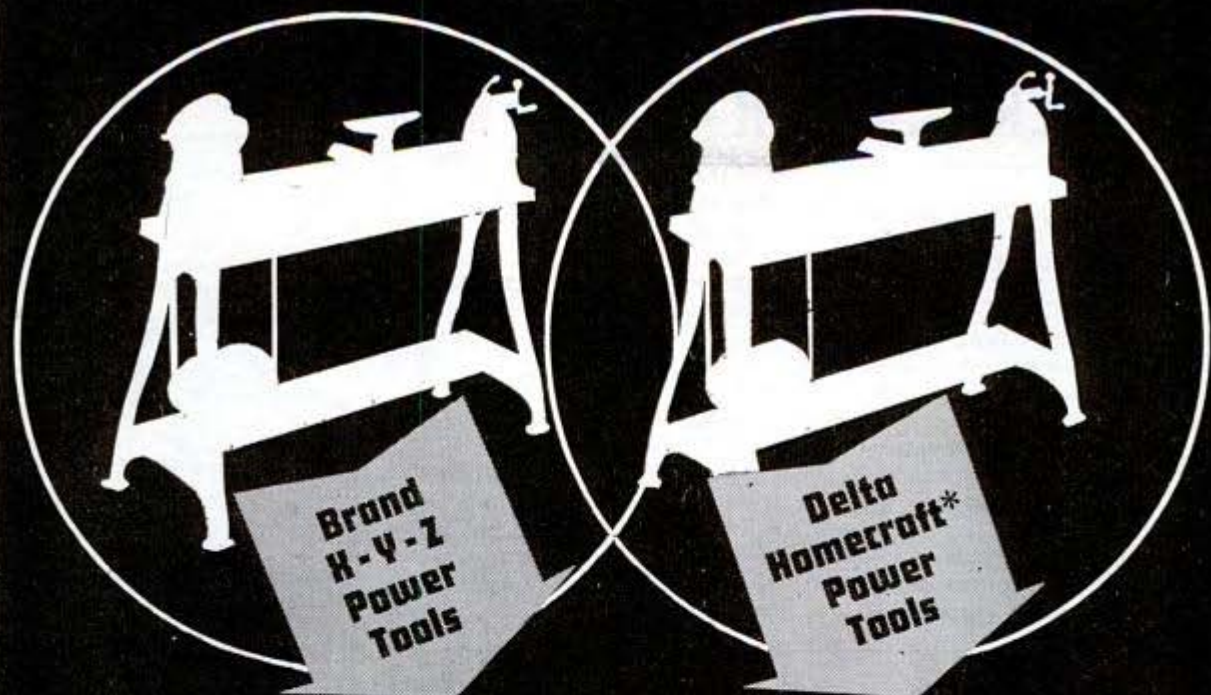
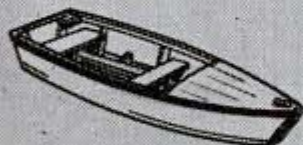


FIG. 2—IMPROVED RECORDING HEAD



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Ships? Tanks? Planes? Trains? X-acto cuts easily with or across the grain, round difficult curves and corners.



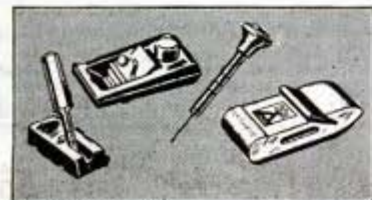
**For artists' sake**  
Every art and photographer's studio needs X-acto. For drawing, patching, re-touching, cutting mats or frames.



**Fine business!**  
Industry finds many uses for X-acto, e.g. For drafting; trimming dummies; finishing moulded rubber parts; erasers.

## X-ACTO TOOLS, TOO

X-acto Planer, single-bevel blade . . .	\$1.00
X-acto Sander, 3 grades sandpaper . . .	.50
X-acto Hand Drill & Pin Vise . . .	.75
X-acto Hobbycrafter's Saw (not shown) . . .	1.25
X-acto Balsa Stripper, movable guide . . .	1.00



## WONDERFUL GIFT!



"It's a treasure chest! It's a lulu!" wrote Mr. F.L. of Stamford, Conn., on receiving his X-acto Knife Chest. 3 X-acto Knives, with an assortment of 12 X-acto Blades, in a handy wooden box, \$3.50. Deluxe All-Metal Knife Chest, \$5.

## HERE'S "HOW TO"

Send for these helpful booklets. Only 10¢ each.



How to Build Scale Model Planes; Boat Whittler's Handbook; Twelve Techniques—The Knife as a Drawing Instrument; Commercial Artists' Handbook. Full of ideas.

X-acto Crescent Products Co., Inc.  
440 Fourth Ave., New York 16, N. Y.

8 blade shapes removable, interchangeable

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For carving, whittling

No. 19  
Broad blade for chiseling

No. 23X  
2 edged all-purpose blade

No. 22  
For long cuts, whittling

No. 24  
For light chiseling; paper

No. 10  
For small, fine whittling

No. 11  
For fine angles; deep cuts

No. 16  
For small holes; fine paper

3 Bulldog-grip handle styles



# X-acto KNIVES & TOOLS

At better hardware, hobby, and gift shops—or if not available write direct to X-acto Crescent Products Co., Inc., 440 Fourth Avenue, New York 16, N. Y.

No. 1 X-acto for fine delicate cutting 50¢ ea. With 5 extra blades	\$1.00
No. 2 X-acto for medium work 50¢ ea. With 5 extra blades . . .	1.00
No. 62 X-acto Double set with 10 extra blades . . .	2.00
No. 82 X-acto Fitted wooden knife chest . . .	3.50
No. 83 X-acto De Luxe chest with extra blades . . .	5.00

Say you saw it in Popular Mechanics!

# AUTO-LITE SPARK PLUGS

IN SERVICE ON EVERY FRONT



"Tain't no use maw . . . we shoul'da' got a 'Plug-Chek.'"

## STOP STALLING... GET A "PLUG-CHEK"

Of course, other things besides spark plugs can cause hard starting. But the way to make sure faulty spark plugs aren't making your car hard to start is to ask your friendly Auto-Lite Spark Plug Dealer for a "Plug-Chek." As much as 12% may be added to gas mileage when faulty plugs are corrected, according to tests conducted by the American Automobile Association.

See your Auto-Lite Spark Plug Dealer today and, when new plugs are needed, ask for ignition engineered Auto-Lite Spark Plugs.

THE ELECTRIC AUTO-LITE COMPANY

TOLEDO, 1 • Merchandising Division • OHIO  
BUY WAR BONDS

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Radio Show  
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HELEN FORREST • GORDON JENKINS'  
ORCHESTRA

Every Tuesday Night • NBC

Featuring men and women on  
the fighting fronts



# AVAILABLE!

**BURGESS  
BATTERIES**

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**FLASHLIGHT  
RADIO  
HEARING AID**



*Voted*  
**FIRST**  
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Nation-wide  
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**ELECTRICAL  
EXPERTS**

**BATTERIES  
STILL GO TO  
WAR—**  
Although war  
conditions now  
permit us to  
make batteries  
for civilian use,  
some are still  
going to the  
fighting fronts.

**BURGESS BATTERIES**

THE COMPLETE LINE FOR EVERY PURPOSE  
FLASHLIGHTS • RADIO • HEARING AID  
IGNITION • TELEPHONE • INDUSTRIAL

BURGESS BATTERY COMPANY • FREEPORT, ILLINOIS

## Oil for the Tanks in China

(Continued from page 37)

The coupling is composed of a malleable iron housing in two parts held together by two bolts, which mechanically engage the adjacent grooved pipe ends in a positive lock. A single continuous hollow-molded sealing gasket is so installed that internal pressure or vacuum serves only to increase the tightness of the seal. Bombs may drop and shells explode almost on top of the pipe, the concussion lifting the sections high into the air, but the couplings hold. Ordinarily pipe is distributed from trucks if road conditions permit. In the jungle or other rugged terrain, such as in Burma, pipe was carried by hand for great distances.

To force the oil through the pipe, pumping stations are installed along the line. Earlier Army installations used the reciprocating pumps employed on commercial pipe lines, but they proved heavy and cumbersome in the jungle and mountain country, so the Army started using centrifugal pumps. A two-stage centrifugal unit now being used is equipped with sand traps to hold back any impurities and is designed for a working pressure of 700 pounds per square inch. A built-in increaser gear and complete manifolding allow the two stages of the pump to be operated either in series or parallel. When operating in series, the pump has a capacity of 200 barrels per hour at 200 pounds pressure.

On downhill stretches of the lines, diaphragm-actuated regulators are used to reduce pressure in the line due to gravity. They are in a sense safety valves.

Normally a maintenance and repair crew is based at each pumping station. Security patrols are maintained along the line at all times to prevent sabotage, to search for small leaks and to report other mishaps to the line. These patrols are equipped with field telephones for communication with

(Continued to page 150)

**Model Builders  
Attention!**

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	3/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Sillment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

**CHAMPION**

SPARK PLUG COMPANY • TOLEDO 1, OHIO

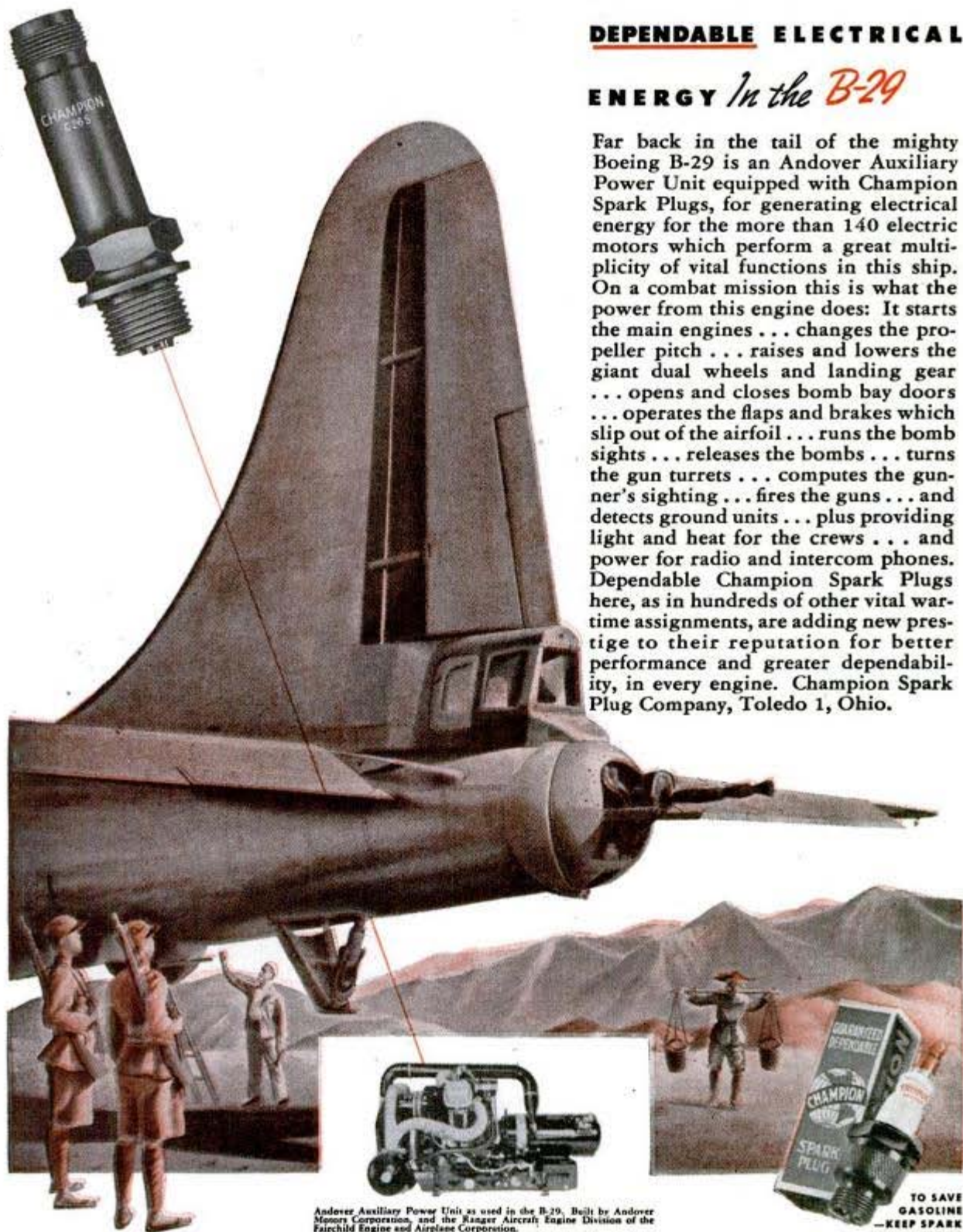
# CHAMPION

**SPARK PLUGS INSURE**

**DEPENDABLE ELECTRICAL**

**ENERGY** *In the B-29*

Far back in the tail of the mighty Boeing B-29 is an Andover Auxiliary Power Unit equipped with Champion Spark Plugs, for generating electrical energy for the more than 140 electric motors which perform a great multiplicity of vital functions in this ship. On a combat mission this is what the power from this engine does: It starts the main engines . . . changes the propeller pitch . . . raises and lowers the giant dual wheels and landing gear . . . opens and closes bomb bay doors . . . operates the flaps and brakes which slip out of the airfoil . . . runs the bomb sights . . . releases the bombs . . . turns the gun turrets . . . computes the gunner's sighting . . . fires the guns . . . and detects ground units . . . plus providing light and heat for the crews . . . and power for radio and intercom phones. Dependable Champion Spark Plugs here, as in hundreds of other vital wartime assignments, are adding new prestige to their reputation for better performance and greater dependability, in every engine. Champion Spark Plug Company, Toledo 1, Ohio.



Andover Auxiliary Power Unit as used in the B-29. Built by Andover Motors Corporation, and the Ranger Aircraft Engine Division of the Fairchild Engine and Airplane Corporation.

**TO SAVE  
GASOLINE  
—KEEP SPARK  
PLUGS CLEAN**



Harley-Davidson's in the thick of it? Read this from Pfc. Glenn S., recovering from wounds received in France:

"Was a dispatch rider for the Signal Corps, and at the time I was shot, I was on one of your Harley-Davidson 45's. I rode for ten months and that

motorcycle really took a beating and still kept running. There were 135 in our company and every man was issued a Harley-Davidson 45.

We gave them a lot of abuse but they still ran in tip-top condition. Every one of our boys says his first purchase after the war is going to be a new Harley-Davidson."

That's a swell tip, Pfc. Glenn S., to every fellow who's looking forward to the fun and thrills of motorcycling in the happier peace days to come!



# HARLEY-DAVIDSON MOTORCYCLES

HARLEY-DAVIDSON MOTOR CO.  
Department P, Milwaukee 1, Wisconsin

Please send at once free copy of 24-page "Enthusiast" Magazine, filled with motorcycle action pictures and thrilling stories.

Name.....

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City.....State.....

the pump station, which can quickly close down a line if necessary and prevent loss of oil or gasoline.

The worst part of the Ledo pipe line will come when it is taken over the high mountains into China. But Army engineers are determined that the vital fluid shall get to China to enable the Chinese and their Allies to defeat the foe as quickly as possible.

## Digging the Mushrooms of War

(Continued from page 47)

starting walking to the rear, for such mines sometimes explode when lifted out. Again, they may have concealed trip wires which pull on a fuse attached to a second mine under the top one.

Carefully removing the earth around the mine a handful at a time, the sergeant exposed the greater part of the saucer-shaped top. Gingerly he started digging under the mine, using only two fingers. Slowly, he felt under the mine for trip wires leading to the still buried fuse. Beads of sweat rolled down his face. His hands seemed clumsy, responded slowly—but he had to control them, for a false move meant death.

The mine slid sideways a little, exposing the fuse. Pulling out his flashlight for the first time, and screening the light with his hand, the sergeant looked for the little pinhole on the brass case of the fuse. The enemy's last act was to remove the pin. Taking a small nail out of his pocket, the sergeant inserted it into the pinhole, making the fuse safe, and unscrewed it from the mine. Although filled with high explosives, the mine is harmless without the fuse. But the engineer was not finished yet. A concealed wire might set off another mine alongside him.

A fraction of an inch at a time, the mine was brought up and deposited, intact, on its little mound of earth. With a sigh of relief, the men resumed their work.

So far, no "dummy" mines had been found. The Germans sometimes sowed dummy fields where the buried "mine" was not an explosive at all, but pieces of shrapnel or other metal. These register on the mine detector the same as a live mine and must be excavated as carefully until definitely proved to be scrap. Sometimes the enemy would scatter real mines at random through the dummy field.

It was dawn when the engineers reached the last two mines. Just as the last "safe" mine was pulled out, a distant rumbling mingled with a welcome cool breeze.

Half an hour later, the tanks could be seen on the crest of the road. Unknown to

(Continued to page 152)



# A TOOLSHOP IN YOUR HAND!



- GRIND • DRILL
- POLISH • ROUT
- ENGRAVE • CUT
- CARVE • SAND
- SAW, etc.

**HANDEE** TOOL OF 1001 USES

The original hand tool and today's finest for precision work on any metal, alloy, plastic, wood, horn, bone, glass, etc. Fits your hand comfortably, perfectly balanced, weighs only 12 ounces—it's the "non-fatiguing" tool. And Handee's usefulness is as extensive as the number of quick and easy-to-change accessories you own... choose from more than 300 in the Chicago line. Operates on AC or DC current at 25,000 r.p.m. With 7 accessories, postpaid..... \$18.50



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# ALLIED RADIO



## ANCIENT PIPE OF FRANCE



Today you see the

# LHS STERNCREST STERLING

in FRANCE, and everywhere

Strutting along the Rue de Rivoli, right now, is an American G. I. puffing away on his LHS — and many others are doing likewise, the world over.

That's why LHS's are limited in supply, but not in workmanship or materials. War over (and would that it were!) we couldn't produce a better pipe than the Sterncrest of today. It's prewar quality, from its briar bowl to its hard rubber bit. After the war, more models to choose from, but no finer pipes.

**\$5**

This is No. 46  
Plain Finish  
Also in Antique finish.  
Dozens of other models

Other LHS Pipes:  
\$10 — LHS  
Sterncrest Ultrafine  
\$7.50 — LHS  
Sterncrest 14K  
\$3.50 — LHS  
Certified Purex



Supplies limited — you may have to wait for some models, but it's worth it!

IMPORTED  
BRIAR

AT YOUR DEALERS



Write for "Pointers on Pipes" — FREE  
 L & H Stern, Inc., Stern Bldg., 56 Pearl St., Bklyn 1, N. Y.



## EVER LOOK A FILE "IN THE TEETH"?

**T**IME was when a file was simply a "many-toothed implement for abrading the surface or edges of metals and other materials." Today, with Nicholson setting the pace, files are highly specialized. Research and experiment have produced literally *thousands* of kinds, cuts and sizes—each designed for some particular type of material and operation.

Oddly enough, it is in their minuter details—the *teeth*—that files have one of their most important distinctions. Look at the teeth of different files through a microscope or magnifying glass. Height, thickness, spacing, angle, type of edge, relative depth of overcut and upcut—all make for incalculable combinations and characteristics. For instance, in Nicholson patented serrated-tooth construction, used on certain files, the teeth themselves have "little teeth"—to provide successive cutting edges.

"Know your files" is important in the training of a first-class mechanic. The Nicholson book, "*File Philosophy*," will prove helpful . . . 48 interesting illustrated pages. *Free*.

**NICHOLSON FILE CO., 22 Acorn Street, Providence 1, R. I.**  
(In Canada, Port Hope, Ont.)

**NICHOLSON**  
**FILES** FOR EVERY PURPOSE  
NICHOLSON  
U.S.A.  
MADE IN U.S.A.

the engineers, the reconnaissance officer, sure that his men would come through, had sent a message that the mine field would be breached by sunrise. It was!

The tanks reached the road block, veered off the road and headed for the narrow channel cut through the field.

A command car slowed down as it passed the detachment commander and his men watching the tanks. A figure next to the driver half-rose and waved. He smiled and above the roar of the tanks you could barely hear, "Good work!"

The tank commander's car jumped the ditch and followed the tanks through the tape-marked gap. They were on their way. The engineers had done their job.

## Talking Over Waves

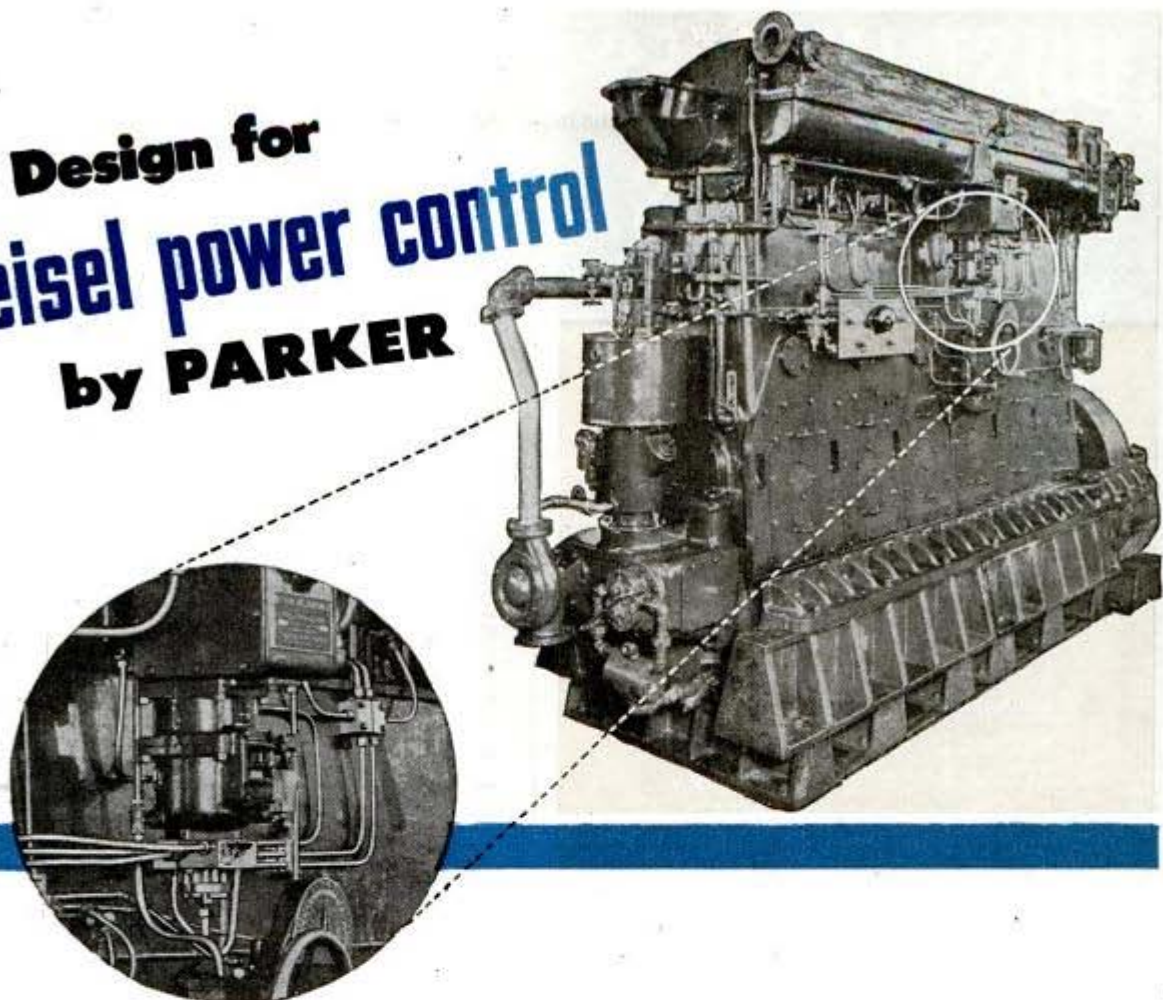
(Continued from page 79)

Another difficulty is the echo. At certain points in the line the electric waves may be reflected back, just as light from a mirror, and you will hear yourself as you speak, and again a fraction of a second later as the reflection returns. Now, the speed of current through a wire is not the same as that of radio waves (186,000 miles a second), but varies from 175,000 to 10,000 miles per second, depending on the kind of circuit it goes through. This still may seem fast enough, but it isn't; if you are talking to someone 2,500 miles away and the current is reflected back from that point, the reflection may take half a second. This will cause a bad echo and makes talking almost impossible at times; to eliminate it an echo suppressor is used. This is a sort of one-way valve; as soon as you speak over a long distance circuit the echo suppressor opens and lets your conversation through, and at the same time blocks all current coming the other way. When you stop speaking it releases, and waits for either party to take the line again. The same device is employed on the transatlantic telephone circuit.

The newest carrier equipment uses a coaxial cable. This is a copper wire running through the center of a flexible copper tube and supported by thin disks of fiber or hard rubber spaced slightly less than an inch apart. Two of these units are employed, one for each direction of transmission, and they are wound together and enclosed in a lead sheath. The shielding eliminates crosstalk trouble and the cables can bear a tremendously wide band of frequencies. Television programs with a band width of nearly 3,000,000 cycles have been carried. After the war this will be raised

(Continued to page 154)

# Design for diesel power control by PARKER



The "nervous" system and the circulation system of a Diesel power plant depend on tubing, with suitable fittings and valves.

Without the tubing installation, the engine can't run. And that's true of many other important kinds of machines.

Designing and building tubing installations, and making their valves and fittings, has been a Parker job for more than twenty years. We call it Fluid Power Engineering.

Parker is ready to supply you with hundreds of types of valves and fittings—all precision-built to precise specifications. Or with completely fabricated tubing jobs, ready to install.

And our Fluid Power Engineers are ready to work with you on plans and designs, with plenty of knowledge and broad experience to draw from.

Parker-Engineered tubing systems provide you with streamlined flow, to conserve power and lessen pressure drop—with compactness and neatness—with ease of access for service and maintenance—and with complete protection

against leakage, even under conditions of high pressure, vibration and abuse.

This complete service, or any part of it, is yours to command, for improving present products or in planning for the future.

For more information, or for the service of a Parker Fluid Power Engineer, write to The Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, O.

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**PARKER**  
APPLIANCE COMPANY  
CLEVELAND • LOS ANGELES  
**FLUID POWER ENGINEERING**

# DUST INVITES GERMS



Ordinary dust raised in sweeping carries myriads of germs which can remain virulent for weeks and even months. That is one reason why thousands of factories, shops, stores, and schools are adopting "Dustless" sweeping. Daily sweeping with a Dustless brush and Arbitrin sweeping fluid reduces bacteria in the air as much as 97%. You ought to know all about this better method of sweeping. Write for complete facts today.



- Dustless
- Speed Sweep
- Speed Wash brushes

## MILWAUKEE DUSTLESS BRUSH COMPANY

528 N. 22nd Street • Milwaukee 3, Wisconsin

to 7,000,000 cycles, with repeaters at 3½-mile intervals. You can get away from high-frequency crosstalk, but any one who can tell the engineers how to get away from attenuation can name his own price. Newer type television probably will use a 1,000-mile screen instead of the present 525 and then the television channel on coaxial cable will have to carry even a wider frequency band, plus about 480 long distance circuits; yes, that's one wire pair.

There isn't much coaxial cable yet. The first line was installed between New York and Philadelphia and later extended to Washington. If the cable-laying program goes as scheduled, by the end of the year there will be coaxial routes from New York to Charlotte, Atlanta to Fort Worth, Terre Haute to St. Louis, Macon to Jacksonville and Stevens Point to Minneapolis. In time the network will reach from Boston to Atlanta and across the southern route to Los Angeles and San Francisco. Another main line will stretch from the eastern seaboard through Chicago to St. Louis and New Orleans. As well as creating a great many high quality long distance telephone channels, coaxial cable will make possible the first national television network.

## Land of Mystery

(Continued from page 53)

and erosion have wrecked the burro trail that led to the mine and none of the later gold seekers has been able to find just where the Spaniards obtained their gold.

Another story concerns a "lost" mission that the early padres built. Later on the buildings were abandoned during an Indian uprising and the padres fled for their lives. The approximate location of the old mission is known but its sun-dried adobe brick walls have crumbled and disappeared in the brush. Too, the springs from which the mission drew its water appear to have dried up, and the few expeditions that have explored for it have been unable to carry enough water for a thorough search. Interest in the old mission will continue until it is found, for the story goes that before the padres fled they placed the mission treasure in a coffin and buried it in their graveyard. It's supposed to be there still.

The Manila galleons that engaged in transpacific trade several centuries ago coasted past the shores of the peninsula. Some were wrecked on Lower California and others were seized by pirates who came from around the Horn. Some of the spoils were taken ashore and buried. A few handfuls of early Spanish coins have been found

(Continued to page 156)

# ONE-MAN BOMBERS

Lockheed P-38 Lightnings — powered by Allison engines and originally designed as fighter planes — are now being used also as one-man bombers against the Japs. ★ When the two bombs — one ton under each wing — are released, the Lightnings continue

in combat as fighters — a dual attainment made possible by the engines' extremely light weight, less than one pound per horsepower,\* which gives the plane superlative lifting power as well as speed. ★ This extreme light weight — long the dream of engineers the world over — is a product of Allison precision and skill in handling metals — a precision and skill which will mark any product ever bearing the Allison name.

KEEP AMERICA STRONG  
BUY MORE WAR BONDS

## POWERED BY ALLISON

P-38 — Lightning  
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A-36 and P-51A — Mustang  
P-63 — Kingcobra

\*Actual weight of Allison engine is  $\frac{7}{8}$  lb. per hp. Allison was first engine of less than one lb. per hp.

## LIQUID-COOLED AIRCRAFT ENGINES

# Allison

DIVISION OF

Indianapolis, Indiana

Every Sunday Afternoon —

GENERAL MOTORS SYMPHONY OF THE AIR — NBC Network





On the "tough-nuts"  
 Watch a **Snap-on**  
 Go to Work!

In the sleekly streamlined structure of a modern plane, *tough nuts* are plentiful. Blocked, hidden, fox-holed in sharply restricted spaces, they defy ordinary wrenches to "reach in and do a job".

Along aviation's assembly lines and in maintenance shops, *watch the Snap-ons go to work!* Slim, flexible, dexterous, Snap-on "combinations" by-pass obstructions, slip into tight and tricky places, grip hidden nuts securely, turn them swiftly, solidly and *safely*.

Because they handle every nut turning job faster, easier and better, Snap-on wrenches have won the same outstanding preference in the aviation field that they long have held throughout the automotive industry. Everywhere they are "the choice of better mechanics". Write today for the 1945 Snap-on catalog.

**SNAP-ON TOOLS CORPORATION**  
 8062-G 28th AVENUE KENOSHA, WISCONSIN



on island beaches off the coast but no large treasures are known to have been found.

Still another story is related by two American prospectors who explored a cave on the Gulf side of the peninsula a number of years ago. A portion of the cave was walled up with adobe bricks. Breaking through, the prospectors discovered two clay pots full of pieces of eight as well as two large heaps of gold dust and nuggets. The men pocketed a small amount of the gold, intending to return with a vehicle to remove the rest of it. But on their way to the coast they were warned by hostile Indians that strangers weren't wanted and that they should never return. Presumably the gold is still in the cave.

Millions of tourists have visited Tijuana and Agua Caliente on the border but few traveled south of these resorts. The rest of the peninsula is still a land of mystery.

## Wood and Glue Form New Team

(Continued from page 31)

field between the two electrodes. This "radio welding" is widely used. Wood is not affected by the treatment and retains most of its original moisture content, and the time required for setting the glue is drastically reduced.

Paralleling its development of new glue materials, I. F. Laucks, Inc., has been working on other substances that impart desirable characteristics to wood structures. One new wood preservative doubles or triples the life of wooden fence posts after a 24-hour soaking in an open barrel. A new water-repellent sealer prevents wood from expanding or contracting in dimensions with the coming and going of moisture. Window frames and sash treated with this sealer don't stick in winter.

It is estimated that the use of wood and glue in new applications released more than five million tons of metal for military uses in 1944 alone.

## Our Wallop on Wings

(Continued from page 14)

But perhaps the most devastating new development in aerial armament has been the employment of rockets in air-to-ground operations, and today P-40 Warhawks, P-47 Thunderbolts, P-38 Lightnings, P-39 Airacobras and P-51 Mustangs bristle with 4.5-inch rockets, each having the explosive effect of a 105-mm. howitzer. After three years of painstaking research at the California Institute of Technology, the missiles

(Continued to page 158)

# Have you ever seen a Waltzing Hobby-Horse?

Neither have we—  
but if we *did* see one, we  
might pay handsomely for it,  
because we are looking for unusual  
ideas and designs in toys. In fact,



has been set up to reward amateur or professional inventors and designers *liberally* for brand new—different toys.

There's big money in Toy Designing if you act *NOW*, as this activity and its fund terminate November 30, 1945.

*Write Noma, Dept. 456,  
for full information.*

**Noma Electric Corporation**  
55 West 13th Street New York 11, New York

**NOMA'S**  
**\$50,000**  
**TOY-DESIGN**  
**FUND**

**IT'S TOO LATE**  
**when your**  
**BRAKES**  
**FAIL!**



Check your brakes! Use **FLARE** Hydraulic Brake Fluid! Blends perfectly with other first-quality fluids. Operates at 50° F. below zero or 180° F. above.

*"Keep your car fit to the finish!"*

**FOR CAR BEAUTY  
AND CARE USE...**

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BRAKE FLUID**

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**HELPS SAVE TIRES, GAS and TIME!**

Accurate. Durable. Helps save motor-ing time, money . . . irritation, too! Easily installed on dash or windshield. No tools required. Simple to operate. Modeled from Sherrill's instruments now used by Armed forces. Attractive, stream-lined plastic construction. Will give years of precision service. See your dealer. Supply is limited.

Sold at Hardware, Drug,  
Dept., Chain Stores and  
Service Stations. Only **\$2.00**

**SHERRILL RESEARCH CORP., Peru, Indiana**

# Must Your Car Look Its Age?

NOT IF YOU  
**SIMONIZ!**

Do It Now for Lasting Beauty  
Higher After-Victory Value

Your present car must last a long time yet. So, why let it look its age? **SIMONIZ!** Just use Simoniz Kleener and Simoniz to bring back sparkling, like-new beauty in no time. Besides, Simoniz protects and preserves the finish—makes beauty last. Also assures higher trade-in value when Victory comes. So, **SIMONIZ** now—the sooner the better. Sold by grocery, auto accessory, hardware, drug, paint and department stores.

The Simoniz Company Chicago (16) Ill.

MOTORISTS WISE  
**SIMONIZ**

HOUSEWIVES DO LIKEWISE



have not only established themselves as the scourge of enemy tanks and armored vehicles, but can be aimed with pinpoint precision from high or low levels and used in dive-bombing techniques against bivouac areas, rail and highway bridges, ammunition dumps and other military targets. Fired from launchers beneath the wings or slung alongside the fuselage, the rockets are set off in pairs or salvoed as required, since they produce no recoil.

Farther than any gun, cannon or rocket can shoot, however, go squadrons of heavy bombers carrying bigger and more devastating bomb loads than have ever been airborne before, dropping them at the right instant with the right bombing angle on the right target. To do this, bombsights have been perfected which theoretically insure direct hits on moving or stationary targets.

The latest type bombsight for most high altitude bombardment is the Norden M-9. It is a gyro-stabilized optical bombsight that enables the bombardier to peer through a two-power telescope and see a motionless terrain below. The bombardier draws a sightline on the target with the cross-hairs in the telescope and with a series of knobs, dials and levers sets necessary ballistics, drift, altitude and airspeed data into the sight's computer mechanism which automatically determines the proper bomb release point. The autopilot is controlled by two knobs on the bombsight in order to maintain the airplane on the proper approach line to the target, and also permits the bombardier to track a moving target. The bombsight can release bombs individually or in "train," depending on the nature of the target.

To get bomb loads into planes, improved electrical bomb hoists, slings, cable retainers and relay switches have been devised, and new shackles, hooks, latches and sway-braces for bomb suspension are lighter than any used before. In fighters, a new electric bomb release plus a modified shackle for holding bombs firmly under the fuselage now gives P-47s twice their old-time accuracy. Before this development, Allied pilots were noting wide errors in low altitude bombing because they had to release their loads by means of a manually-controlled lever placed in an awkward position in the cockpit.

All told, great strides have been made in past months to put more fight in fighters and to accent the bomb in bombing planes. Nevertheless, the research program of AAF engineers goes unremittingly on toward firepower developments that will make every shell, bullet, rocket and bomb a more powerful and more direct hit.



# Just the Thing for a Workshop or Hobby

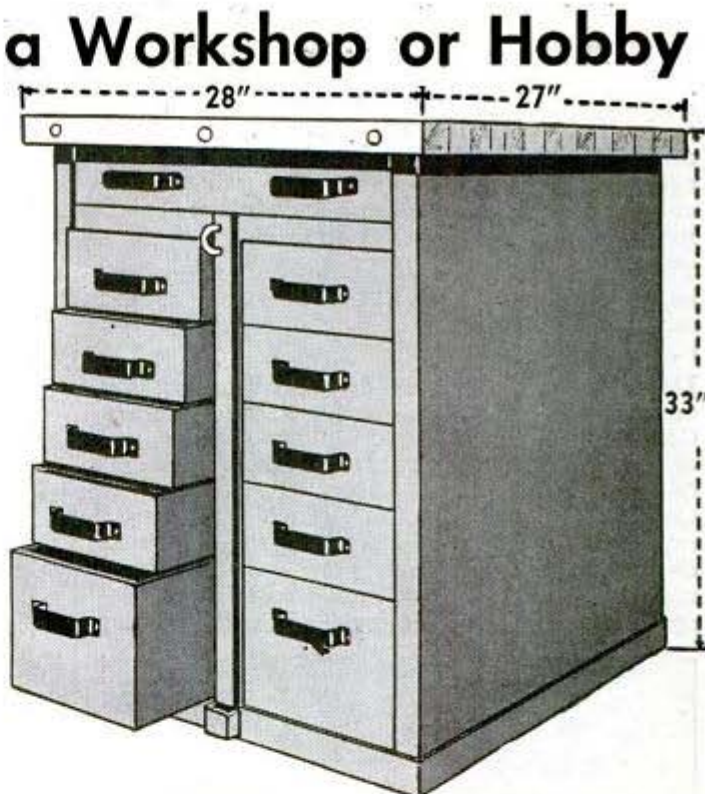
## UTILITY CABINET

(NO PRIORITY NEEDED)

Solid steel Tool Cabinet with laminated rock maple top, natural finish. This Tool Cabinet is perfect for service station operators, machinists, etc. And for home work shops it is the last word. Everybody who uses tools will find this Tool Cabinet one of the most convenient, sturdy and useful pieces of equipment they have ever owned. Power Tools can be easily mounted on its rock maple top.

Size of maple top.....28" x 27" and 1 1/2" thick  
 Size of steel cabinet.....25" square, 31 1/2" high  
 Top drawer.....21 1/2" wide x 25" long x 3" deep  
 Next four pairs of drawers.....10" wide x 25" long x 4" deep  
 Top bottom drawers. 10" wide x 25" long x 7 3/4" deep

Comes equipped with steel lock bar requiring only one lock for entire cabinet. Weighs 202 pounds. Cabinets can be used in multiples and can be easily fastened together. Sturdy Cabinet constructed of 18 gauge steel; drawers, 22 gauge steel; lock bar, 12 gauge steel.



LIMITED  
QUANTITY

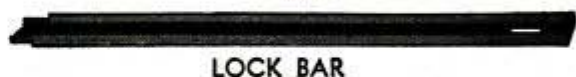
**\$35**

AVAILABLE  
IMMEDIATELY

(F. O. B., WASHINGTON, D. C.)

**PARKER-WHELEN & CO., INC.**

Dept. P4, 827 14th Street N. W., WASHINGTON 5, D. C.

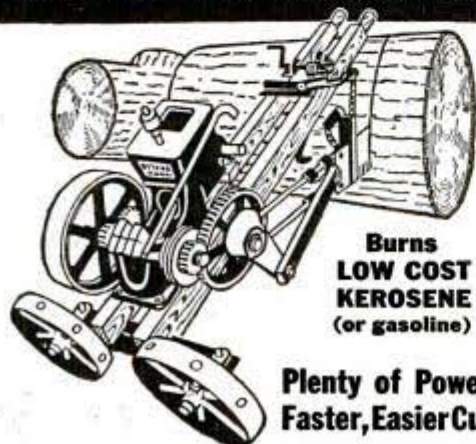


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GET BIG PROFITS from  
SMALL INVESTMENT

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Burns  
**LOW COST  
KEROSENE**  
(or gasoline)

**Plenty of Power for  
Faster, Easier Cutting**

Demand for wood is increasing. You can make real money sawing wood with an Ottawa. Equipped with a sturdy 5 H-P engine. Easy handling. Complete 1-man machine with Safety Saw Guide; other exclusive Ottawa features for fastsawing. **USE FOR OTHER JOBS**—when not sawing wood, use engine for any belt job. Thousands in use. Free Book, price list. Write now. **OTTAWA MFG. CO., 1927 Wood Ave., Ottawa, Kans.**



When day is done...  
enjoy this fine tobacco

To make the most of those precious hours, relax and fill your favorite pipe with Christian Peper Pouch Mixture — you'll enjoy its friendly fragrance and just-right mildness.



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**25¢**

**Christian Peper · St. Louis**  
*Fine Tobaccos Since 1852*

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### AC is chosen for utmost Reliability

Back in "civvies," TWA's great Stratoliners are again furnishing de luxe transportation from ocean to ocean. TWA has reconverted and equipped all five Stratoliners for *utmost reliability*, choosing AC Ceramic Aircraft Spark Plugs to fire the powerful engines.

TWA is one of several leading airlines whose engineers pin their faith on AC—just as do the engineers of 2 out of every 4 cars, trucks and coaches built in America.

During World War I, AC developed the first and only ceramic aircraft plugs for Liberty engines. Constantly improved, these plugs have helped to make aviation history, from Lindbergh's conquest of the Atlantic to the newest records of the Constellation and the C-97. Their war record extends from Berlin to Tokyo. So, too, does that of AC's automotive spark plugs—the kind you use in your car, truck or motor boat.

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION



One of TWA's 4-engine Boeing Stratoliners, *Navajo, Apache, Zuni, Comanche* and *Cherokee*, whose 1200 h.p. Wright engines are kept firing by AC Ceramic Aircraft Plugs.

**AC**  
**SPARK PLUGS**

SPEED FINAL VICTORY — BUY WAR BONDS

## When the Railroads Say "Let's Go!"

(Continued from page 5)

at high speeds, it's what you're running on that counts. Running gear comes first. What you put on it is secondary, if you wish to achieve the three fundamentals of safety, comfort and economy."

PRECO, as you may have guessed, has developed a new-type truck. Operating on the pendulum principle, this places the point of support for the car high in its sides, above the center of gravity, and gives the car a tendency to bank on curves rather than to swing out at the top. A two-thirds reduction in the lateral motion which causes most discomfort in fast trains results, Mr. Hill declared.

In building three cars adapted to the new truck, PRECO applied aircraft construction principles which greatly increased car strength. The cars were operated separately on Western roads for more than three years, and now are being used as a unit on the Burlington's Chicago-Omaha run. Skin-stress building methods resulted in a roof section end strength of 250,000 pounds and a 1,000,000-pound strength for center sill and floor sections.

But no matter what car you ride in tomorrow, none will be much good without motive power. That will be in wide variety. Stirred by the increasing challenge of the Diesel-electrics, proponents of coal-burning locomotives have their research departments working overtime on new models. Class I Railroad orders for new locomotives at the beginning of 1945 are interesting. Of a total of 495, there were 403 for Diesel-electrics, 90 for steam and two for electric engines. Five new 4,000-horsepower Diesels will pull the Great Northern's new streamlined Empire Builder trains in postwar days.

Much research is centered on the gas turbine locomotive, which doesn't require water for operation. Steam turbine locomotives include the Pennsylvania's Triplex, 9,000-horsepower direct drive turbine with coal supply and cab ahead of the boiler and water tender aft. Pennsylvania already has in use the T-1, a four-cylinder locomotive capable of 100-mile-an-hour speeds, and the S-2, first direct drive steam turbine locomotive built in this country. The New York Central has built the Niagara, its largest and most powerful coal-fired reciprocating steam locomotive for high-speed service, and has ordered 25 engines of similar design.

The Chesapeake & Ohio Railway plans

(Continued to page 162)

GRAPHITE GUS ASKS:

**HAVE YOU HAD  
YOUR FIRST LESSON  
IN GRAPHITE  
LUBRICATION?**



If not stop in at a Supply store and buy any one of the three graphite products pictured at the right and get the "feel" of these amazingly tough lubricants. They lubricate lastingly despite heat, pressure or speed—on metals, wood, leather, rubber or fibre surfaces.

These three lubricants will lick hundreds of problem jobs, but there are many more graphite products for endless other services.

Act today and send for Data Sheet Directory and learn the Where and How of all Dixon graphite products. Write to Graphite Gus.



30¢

**DIXON'S GRAPH-AIR GUN**

Filled with Microfyne powdered graphite, it's the slickest gadget you ever saw for lubricating locks and hard-to-reach mechanisms, in shop, office, car, boat, home. Will not leak or gum. Described on Data Sheet #8.



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**DIXON'S  
GRAPHITE SLIPSTIK**

For fast rub-on lubrication. Used like a crayon. Fine for fire arms, sticking doors and windows, bicycle chains—1001 mechanisms in shop, office, car, boat, home. Keep one near you. Described on Data Sheet #23.



20¢  
1 Oz.  
Tube

**DIXON'S GRAPHITE  
LATHE-CENTER LUBRICANT**

Used in thousands of plants for one of the toughest lube jobs known—lathe dead centers—under severest conditions of heat, pressure and speed. Use wherever "hot spot" lubrication is needed. Described on Data Sheet #15.

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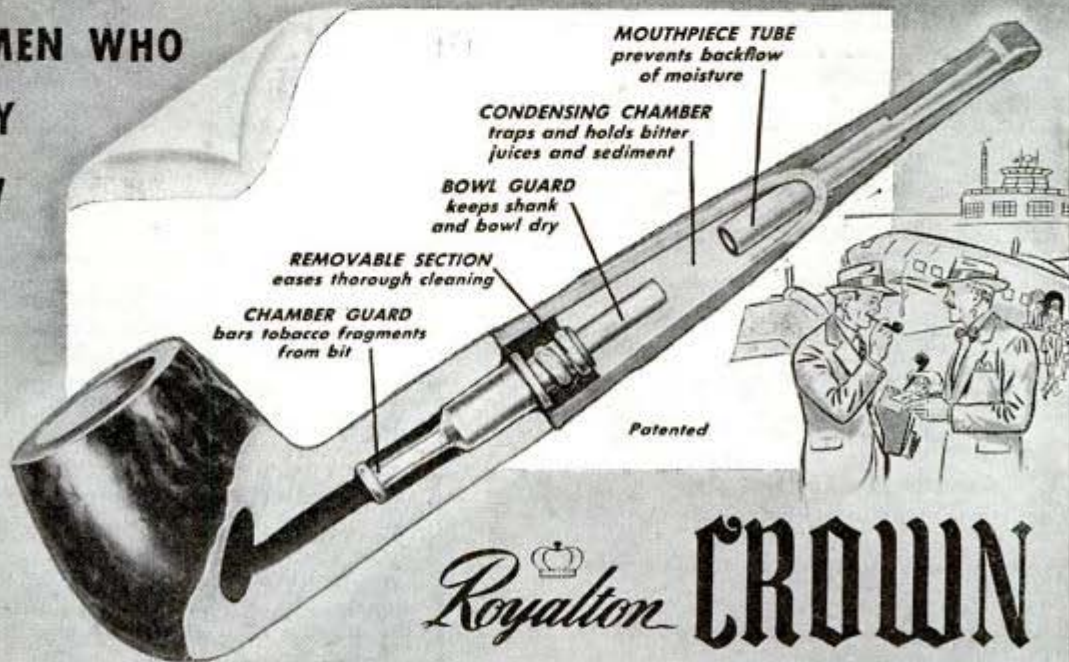


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Packing

**FOR MEN WHO  
REALLY  
KNOW  
PIPES**



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*Royalton* **CROWN**

YOU TASTE ONLY THE SMOKE when your pipe is a Royalton Crown. Bitter juices and slugs are taken into protective custody—permanently trapped by the condensing well and other patented features of this pipe. Its construction, different from all other pipes, keeps bowl and mouthpiece dry and cool . . .  
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Dear Bob:  
 You wouldn't know Mother now  
 that she can hear well again

... she goes to the movies and church with us and hears everything for the first time in years. She can hardly wait to hear about your experiences and share her new-found joy with you.

Our friends say it's a miracle. And I'll always bless the day I got her to go with me for a demonstration of that New Zenith Hearing Aid. She wouldn't part with it now for a thousand dollars...

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If you have friends or relatives who do not hear well, suggest that they visit the nearest Zenith dispenser and try a new Zenith Radionic Hearing Aid. Their own ears will decide how much better they hear. No one will ask them to buy.

There are three new Zenith Radionic Hearing Aids, priced at \$40 and \$50, to aid practically every type of correctable hearing loss. And the new Neutral-Color Earphone is so inconspicuous... makes wearing a Zenith as little noticeable as eyeglasses.

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turbine locomotive built in this country. The New York Central has built the Niagara, its largest and most powerful coal-fired reciprocating steam locomotive for high-speed service, and has ordered 25 engines of similar design.

The Chesapeake & Ohio Railway plans to build three coal-burning turbine electric locomotives able to travel more than 100 miles an hour. Like the Triplex, these carry the coal supply in front of the boiler.

Despite the high speeds which the new locomotives can attain, a Diesel-electric authority notes that the war has brought a tendency to abandon extremely high speeds for increases in loads. Locomotives once geared to hit 125 miles an hour in bursts now are geared to around 95 miles an hour, but pull much longer trains. These reach their destinations as fast or even faster than did some of the speedsters, since they reduce delays by maintaining good average rates of speed.

Many railroads have equipment on order for the postwar rush. The Illinois Central plans a deluxe all-coach streamliner, the City of New Orleans, to run on a 16-hour schedule between Chicago and New Orleans. Powered by Diesel-electrics, it will maintain an average speed of 57½ miles

## Open, Sesame!

If you've ever struggled with a balky vestibule door while en route to the diner or club car, you'll cheer the electronic door opener already being tried out by the Canadian Pacific. Handles on doors of some of the newest streamliners can be baffling in their utter simplicity, as many a passenger will testify. With the electronic opener, all you need do is touch the handle and the door opens automatically.

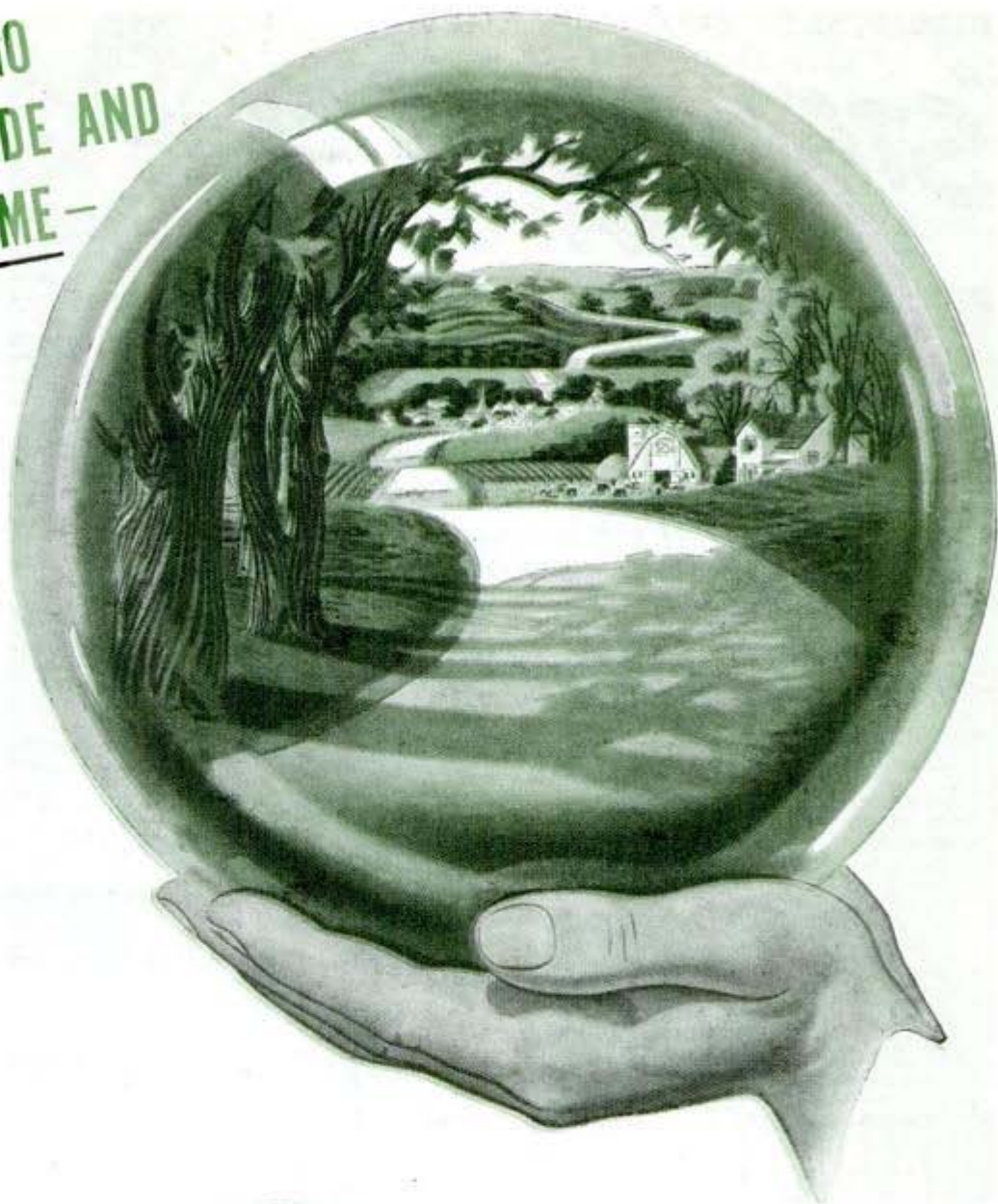
an hour. The New York Central is acquiring 300 new streamlined coaches. The Chicago & Eastern Illinois Railroad will have two new Diesel-electric streamliners.

Improved local service will be offered by the Minneapolis & St. Louis Railway, which has ordered six streamlined air-conditioned coaches for short runs.

Safety is the keynote of all the railroads' postwar plans, with better rails and fewer joints between them, centralized traffic control systems, radio-telephone systems giving constant communication between crews and dispatchers and improved electric brakes. Electrical signals have been devised to warn the crew when a hot box is developing.

All in all, the postwar coach traveler should ride better than many a prewar king.

YOU'LL GO  
HIGH, WIDE AND  
HANDSOME—



## There's a *Ford* in your future!

It will happen in the peacetime to come—when the tasks that now face America have been accomplished. Then a smart, new Ford will be waiting for you to drive it away. . . . Trip after trip you'll cruise along in ease and style. It will be so smooth and gentle riding—always such a joy to handle.

. . . Here will be a car that's big and sturdy—plenty of room in front and back. It will be smartly styled. And for all its fleet and eager power, you will find this new car thrifty in the time-honored Ford tradition.

. . . That's how it will be. And when the "go ahead" is flashed,

we'll be ready to start production plans. Meanwhile, the full Ford resources are helping to speed final Victory.

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# "STAY-MOIST" SHAVE



BOY! HOW LIFEBOUY'S RICH, HEAVY LATHER STAYS MOIST! IT KEEPS BEARDS SOFT FOR SMOOTHER, EASIER SHAVES

TRY LIFEBOUY SHAVING CREAM'S HEAVY, "STAY-MOIST" LATHER



LIFEBOUY'S "STAY-MOIST" LATHER SOFTENS TOUGH WHISKERS SO THEY COME OFF CLEAN AND EASY

EVEN WITH A USED BLADE IT REALLY DOES A JOB. I'M THROUGH WITH FAST-DRYING LATHERS



YOU'LL LIKE ITS MILD FRAGRANCE

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A genuine steel pack muffler WITH A BEAUTIFUL MOTORBOAT TONE. Sandee Mufflers feature improvements far in the lead, years ahead of competition. Increases mileage and power, reduces back pressure and gives better performance. Savings in gasoline will pay for a Sandee Muffler.

V-8 FORD AND MERCURY DUALS \$17.50  
SINGLES—FIT IN PLACE OF REGULAR MUFFLER  
Chev., V-8 Ford, Plym., \$5.00 Chrys., Olds., Buick, etc., \$7.00  
These mufflers will outlast two regular stock replacements.  
Dealers Wanted

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## LOVELY What-Not SHELF

SMART—BEAUTIFUL—USEFUL. Brighten up your home with a new, delightful Miracle What-Not Shelf! Gracefully designed and sturdily constructed of wood, it fits into any corner. Comes in the following colors— Ivory, Green Blue and Peach. And the cost—the ridiculously low price of only \$1.98! SEND NO MONEY! Tell us what color you want, and we'll send it C.O.D. You pay postman only \$1.98 plus C.O.D. charges (send remittance with order, we'll pay postage). Money back if not completely satisfied. Act now!

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using old auto parts, powered by 2 H.P. or larger air-cooled engine; or walking type Garden Tractor 1/2 to 3 H.P. or convert truck or auto into Farm Tractor. Each with steel or rubber tires; will plow, cultivate. Plans for building, in few hours, any one of above, postpaid for \$1.00 (state which wanted) or all 3 for \$2.00. Money Back Guaranteed!

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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.

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\*Prices F.O.B. Arcade, N. Y. Slightly higher west of Rockies. Stand illustrated extra.



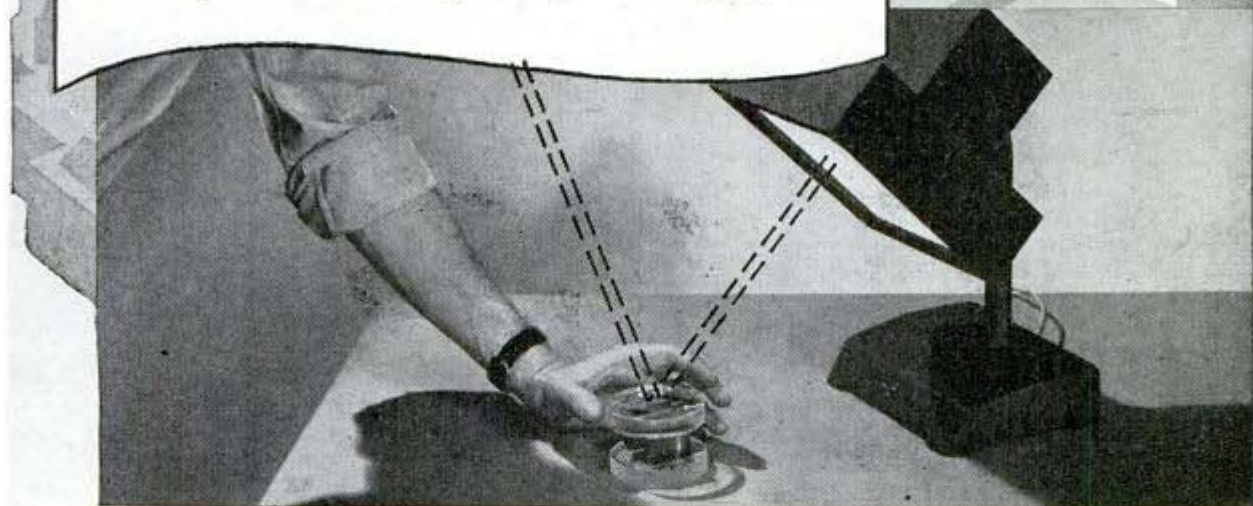
KRW Hydraulic Presses are built in 25, 50, 60 and 75 ton sizes. Prices start at \$198.00\*.



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Builders of Shop Equipment for Ford Dealers Since 1916

# Ingenious New Technical Methods

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



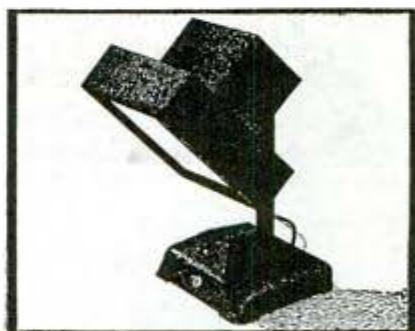
## Now! Shop Measurements to One Millionth of an Inch With Simple Light Wave Setup!

The wave length of light is the basis for this amazing new optical measuring equipment—which measures millionths of an inch as easily as a micrometer measures tenths! All that is required, in addition to a simple setup, is average eyesight, intelligence and arithmetic.

As shown above, the work was placed under the Monochromatic Light, upon the work and gauge block—and covered by the optical flat. The light, reflected back to the operator, by the top and bottom surfaces of the optical flat, creates interference bands, representing height intervals of 11.6 millionths of an inch. So that from the center of one dark band to the center of the next, the level of the work has risen or fallen 11.6 millionths of an inch. The bands, simply, are a contour map of the surface. This fact, in a simple mathematical formula, is sufficient to explain all the shop uses of optical flats, and give the work measurement, quickly and accurately.

No longer, however, can your dealer give you Wrigley's Spearmint Gum. Today, under present conditions, this product cannot be manufactured up to Wrigley's quality standards. To protect consumer and dealer alike, the makers of Wrigley's Spearmint have decided to keep the quality Wrigley's Spearmint wrapper empty. Remember this wrapper, it means chewing gum of finest quality and flavor.

You can get complete information from Acme Scientific Division  
of Acme Industrial Co., 200 No. Laflin St., Chicago 7, Ill.



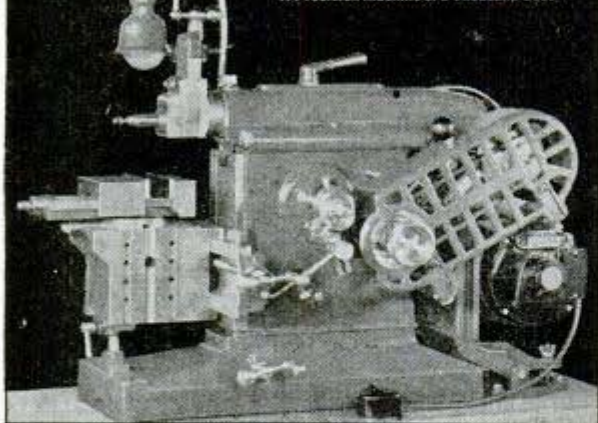
The Monochromatic Light.



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Interpretation of bands on  
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"A Precision Machine of a Thousand Uses"



A wide variety of jobs can be done accurately, quickly, easily, and economically on the AMMCO Shaper (7" stroke). Construction incorporates many features you would expect to find only in larger, more expensive machines... For example: WAYS of ram, tool head, and front face of the main frame are of the "VEE" type, hand scraped to insure accuracy and long life. Available for stationary installation or as portable unit.

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## No. 000 ANGLE VISE

For MILLING—DRILLING—GRINDING  
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Solve Difficult Angle Jobs



Quick, accurate setups at any angle. End make-shift methods—time loss—rejections. Ideal for tool rooms or home workshop. Accurately machined and graduated. Once set it stays locked. Jaws hardened steel—plain or grooved. Sizes 1 1/2" to 8" Jaws.

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For tool room, machine shop, school shop, home shop or repair shop. Accurately machined. Best semi-steel castings. Adjusting screw of hardened steel with fine pitch thread and long bearing. Jaws hardened steel, grooved or plain. Sizes 1 1/2" - 2 1/2" - 4" Jaws.



## No. 250 MILLING ATTACHMENT VISE

A most necessary fixture for small shops and even emergency work in large ones. Fits any 8"-9"-10" South Bend, Atlas, Craftsman, Sheldon or other lathes of similar sizes. Has graduated vertical feed screw and 360 degree graduation for vertical angle adjustments. Easily mounted on cross slide and held by one T-slot bolt. Equipped with PALMGREN VISE, 2 1/2" Jaws opening full 2 1/2". Vise has one plain and one grooved jaw for holding round pieces.



**MAKES MILLING OPERATIONS POSSIBLE ON ANY LATHE**

Width	Depth	Opening	Jaw	Jaw	Height	Price
2 1/2"	1-7/16"	2 1/2"	10 1/2"			\$24.75

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New! A sure cure for condensation drip from cold water pipes. Pliable, cork-filled NoDrip Tape eliminates wet floors, makes idle space usable!

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At hardware, dept. stores, lumberyards. \$125  
Roll, enough for 7 feet of 1/2" pipe...

Higher cost of Rockies and Canada

FREE CIRCULAR

J. W. MORTELL CO. 522 BURCH ST., KANKAKEE, ILL.

\$19.95  
Full Set



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Six piece set, in velvet lined leather case. Special price, only \$19.95.

Precision machined in one thousandths, up to 4" outside and 3 3/4" inside measurements. Guaranteed accurate, easy to read and adjust. Satisfaction guaranteed or money back. Also indicators and gauges. Shipped prepaid on receipt of remittance. On C.O.D. shipments, send deposit of \$2.00.

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OW-W-W—MY BACK'S SO LAME I DON'T THINK I CAN SWING A CLUB. SHOULD HAVE STAYED HOME TODAY.

YOU'LL HAVE TO GIVE ME 5 STROKES ON EACH SIDE TO MAKE THIS A MATCH, JOE.

GOSH, THAT'S TOO BAD, CHARLIE, I'LL GIVE YOU YOUR 5 STROKES A NINE . . . IF YOU REALLY THINK YOU SHOULD PLAY.

I'VE SEEN THIS ACT OF CHARLIE'S BEFORE! JOE MIGHT JUST AS WELL PAY THE BET NOW. WATCH HIS FACE FALL WHEN CHARLIE LACES THIS DRIVE 250 YARDS RIGHT DOWN THE ALLEY.



When your car needs new spark plug wires, battery cables or other wiring, *don't make a mistake*. You can't go wrong if you use Packard cable . . . it's *right* for the job.

Your assurance of this is the fact that Packard has been the top name in automotive wiring since the early days of the motor car industry. Backed by more than 40 years of intensive research and development—continually improved by the application of the most modern materials and manufacturing methods—Packard cable leads the field in performance and value.

**BE RIGHT  
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Packard cable is original equipment on America's leading cars . . . sparks the performance of high-altitude military planes . . . helps safeguard the dependability of Army tanks, trucks and combat vehicles of all types. They're "right with Packard" . . . and so are you!

**PACKARD  
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This sign means cable service at its best—the right Packard cable and the right methods. Thousands of dealers provide better electrical service as a result of the Packard Certified Re-Wiring Manual and Packard Certified Re-Wiring training films.



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Carves Wood



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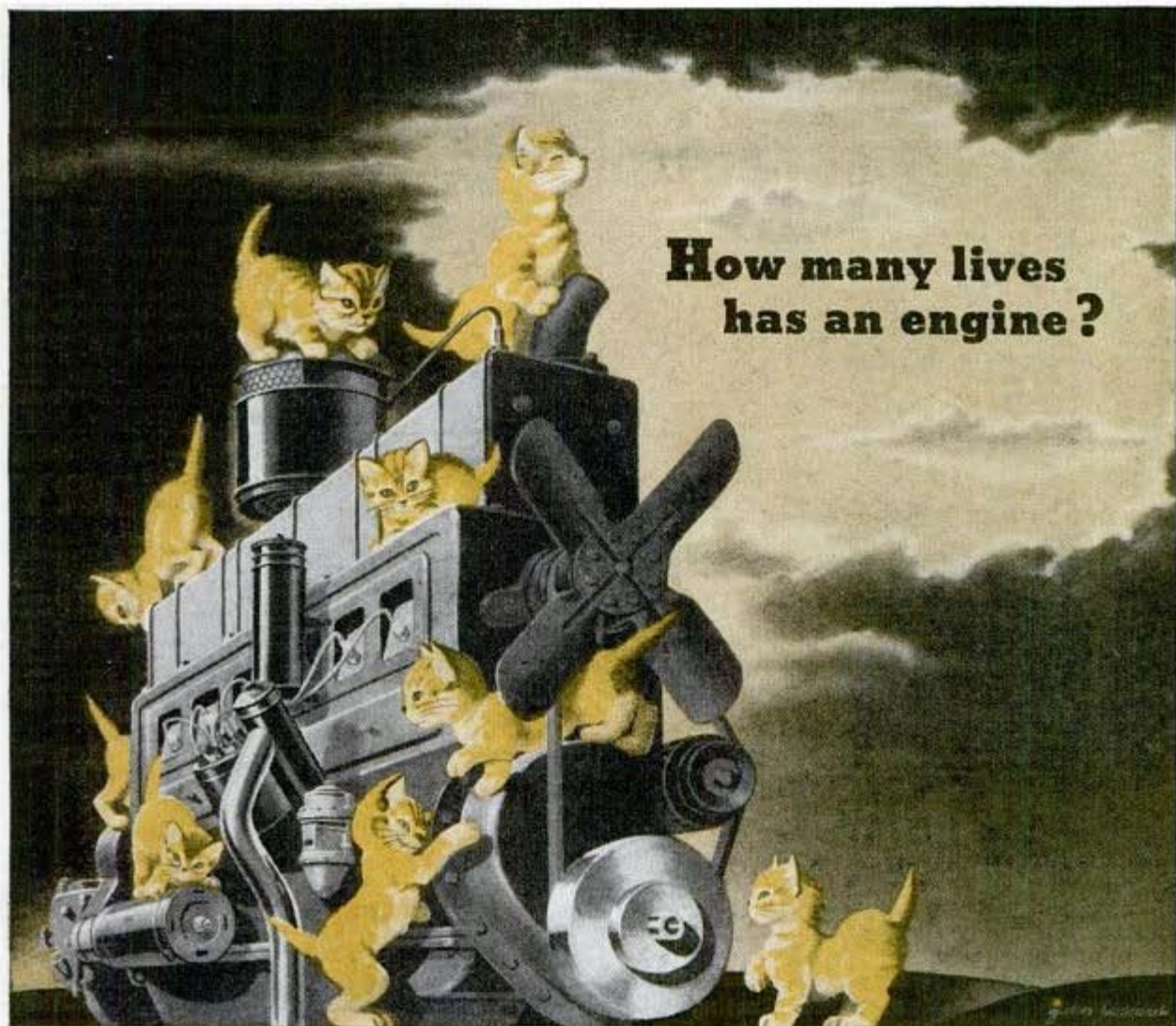
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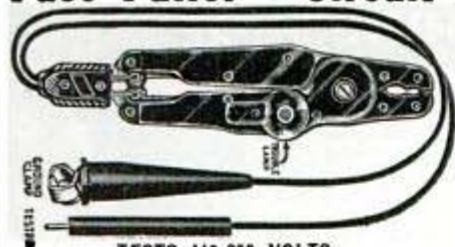
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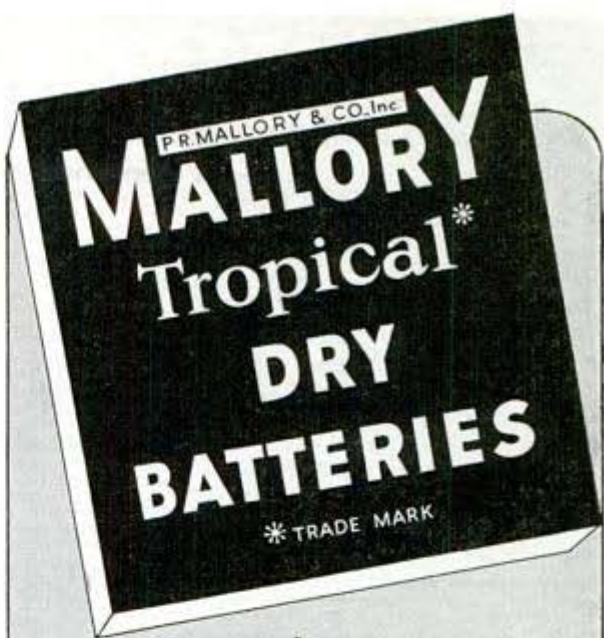
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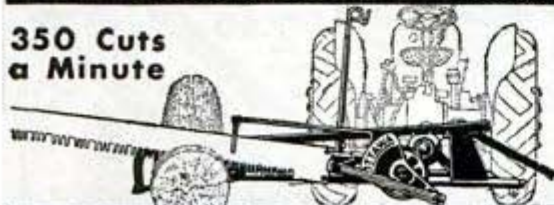
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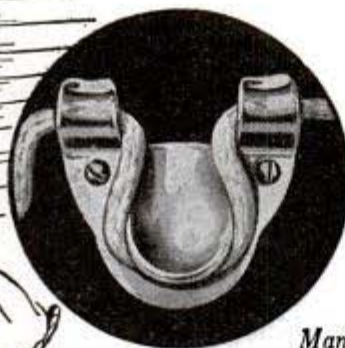
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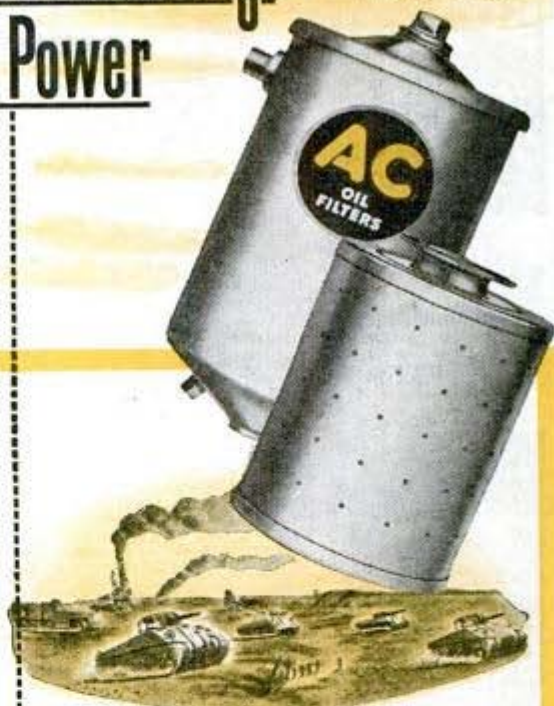
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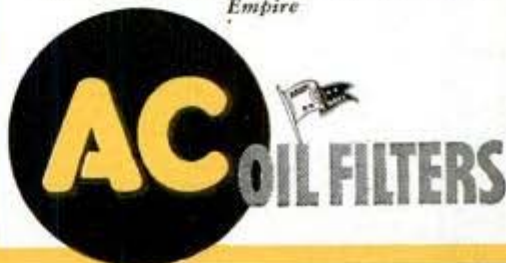
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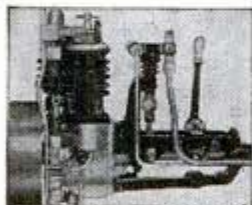
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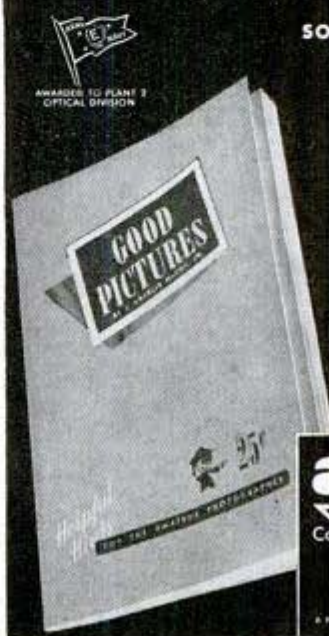
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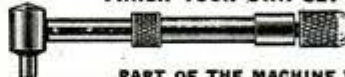


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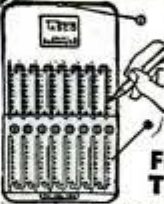
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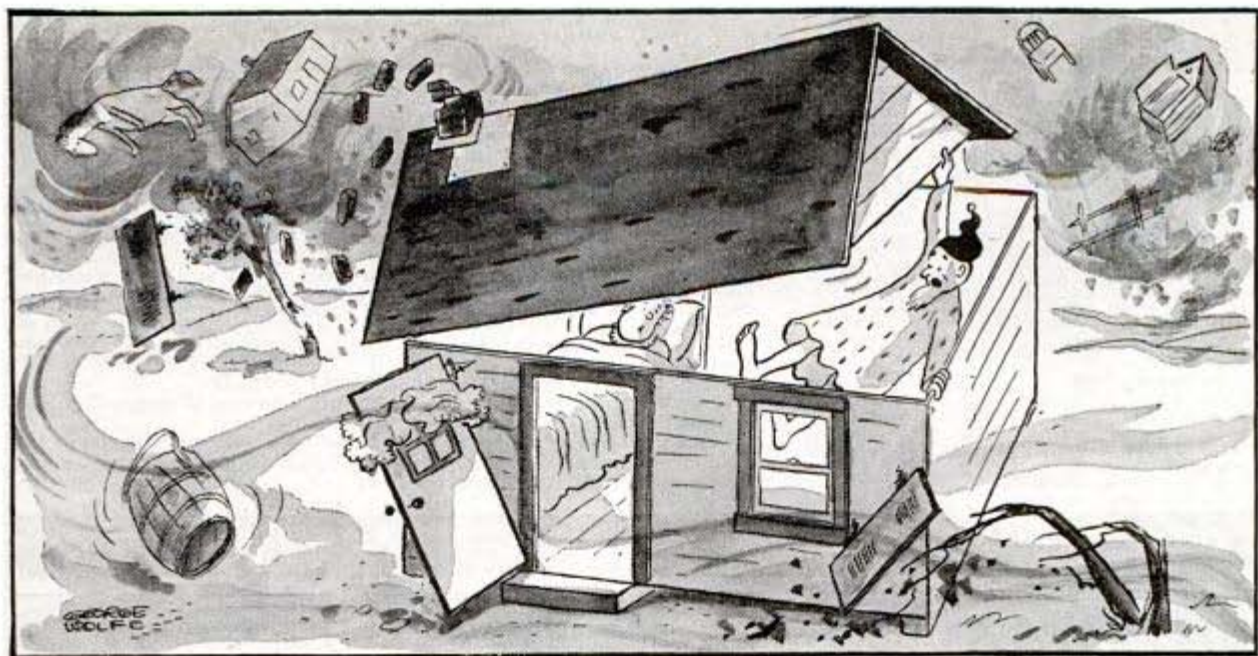
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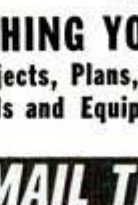
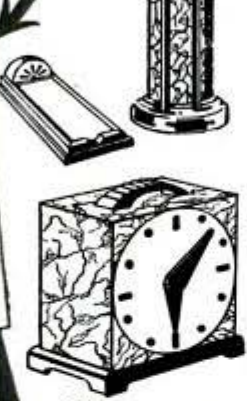
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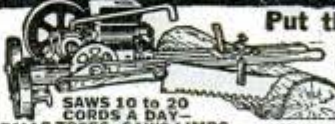
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