

NOVEMBER 1947

25 CENTS

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POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

W.C.D. TRADE MARK, G.P.O. REG. IN BRITAIN, NO. 40826

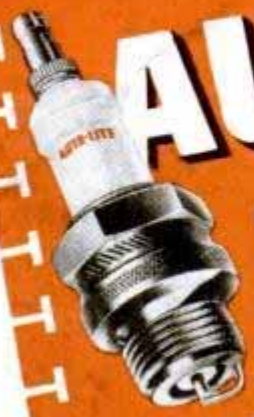
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NEW ARMY TANK CARRIER
PAGE 89

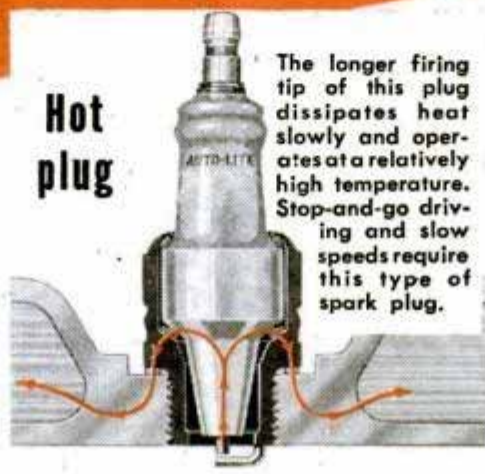


AUTO-LITE "Plug Tips"



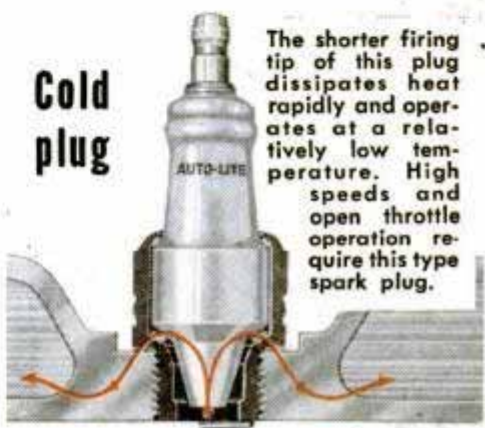
Are your plugs wasting time and money?

The right type of spark plug will save you time and money. Plugs which are faulty and mis-fire waste as high as 10 per cent of your fuel, according to experts. And hard-to-start engines can lose valuable time. Check all your spark plugs regularly to make sure you have the right plugs for your engines.



Hot plug

The longer firing tip of this plug dissipates heat slowly and operates at a relatively high temperature. Stop-and-go driving and slow speeds require this type of spark plug.



Cold plug

The shorter firing tip of this plug dissipates heat rapidly and operates at a relatively low temperature. High speeds and open throttle operation require this type spark plug.

Send for Auto-Lite "Plug-Chek" kit...only 10¢!



Too Hot *

If spark plug firing tips are fused or blistered, plugs are operating too hot and may be causing loss of power and damaging spark knock.



Normal *

If spark plugs look like this, they are of correct heat range. Get your Auto-Lite "Plug-Chek" Kit right now and check your spark plugs.



Too Cold *

If spark plug firing tips show deposits of carbon or are wet with oil, plugs are too cold, may cause poor starting and waste dollars in costly gas.

This Auto-Lite "Plug-Chek" Kit quickly helps you find spark plugs that are causing trouble. All you do is match plugs with pictures on the "Plug-Chek" Indicator—each example refers to a page in the "Plug-Chek" Data Book that shows you what to do.



* Because these illustrations are not in full color, they do not accurately reproduce the actual firing tip appearance. For accurate, full color reproduction, mail the coupon.

Switch to
AUTO-LITE
SPARK PLUGS

THE ELECTRIC AUTO-LITE COMPANY
Department PM2, Toledo 1, Ohio

Enclosed find ten cents for the Auto-Lite "Plug-Chek" Kit that includes: both the "Plug-Chek" Indicator and Data Book.

Name _____

Address _____

City _____



Now at less than prewar prices—the tire that outwears prewar tires

WHAT BETTER ADS for B. F. Goodrich tires are there than letters from typical B. F. Goodrich Silvertown owners? Here's one from Sheriff Edward Leemkuil of O'Brien County, Iowa, shown pointing to the tire in the picture above.

"I have driven over one million miles, over all types of roads and under adverse conditions, during my twenty-two years' service as sheriff. I have never found any tire that could compare with the new B. F. Goodrich tire. I have driven at extreme high speeds—in sub-zero winter weather over

frozen roads filled with chuck holes—and again over these roads in the extreme heat of summer.

"The B. F. Goodrich tires on my present car have gone over 32,000 trouble-free miles, and they are still good for many more miles of hard driving."

The picture was taken at the time this letter was written.

B. F. Goodrich tires have a wider tread that gives you more mileage because it puts more rubber on the ground—distributes the wear over a wider area. You get better traction on wet roads, quicker stops, greater safety. And

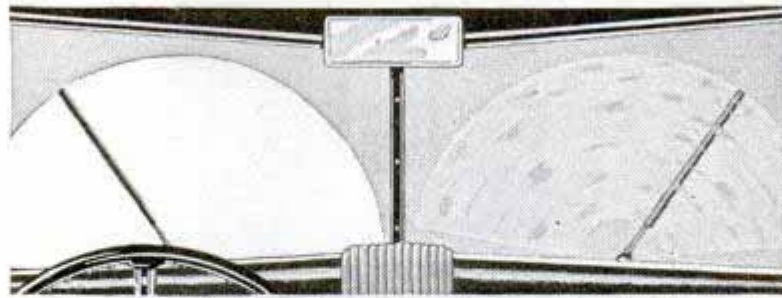
because the body of these tires is made with more cords and stronger cords, you get extra blowout protection.

You can now buy all popular sizes of B. F. Goodrich Silvertown tires for less than you paid before the war. And your B. F. Goodrich dealer will give you an allowance on your old tires if they are still good enough to be used or recapped. *The B. F. Goodrich Company, Akron, Ohio.*

B.F. Goodrich
FIRST IN RUBBER

AMAZE YOURSELF as our "guest"...with this CONTRASTING DEMONSTRATION on your own car

**CLEAR - FLEX
CLEARS!**



**OLD BLADE
SMEARS?**

Prove that your WINDSHIELD ... like all others ... has LOW SPOTS ... hard to wipe clearly ... using ANYTHING BUT the NEW ...

ANCO† **CLEAR-FLEX**‡ WINDSHIELD WIPER BLADE

END VIEW



FLEXORS

Pats. Pending



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**CAN'T FALL OFF—
CAN'T BLOW OFF**

FLEXES TO CLEAR THE LOW SPOTS

Know CLEAR-FLEX ... the first Wiper Blade to conform fully to all windshield surface irregularities. Even wipes uniformly all types of curved windshields. Keeps clear those annoying hard-to-reach low spots common to all FLAT windshield glass. Clears quickly ... WITHOUT HELP ... blinding road muck ... slapped against your windshield ... from sloppy pavements ... by passing cars. CLEAR-FLEX already has engineering approval for original equipment on coming models of high-grade cars.

COSTS LESS TO USE

CLEAR-FLEX ECONOMY REFILLS quickly MAKE LIKE NEW ... at your gas pump ... when rubber finally becomes worn or damaged. Holder **OUTLASTS** your CAR.

YOU WIN THIS WAY

Simply ask your good gas-pump man ... next time you buy gas ... to install for you ... quickly ... out on the driver's half of your windshield ... one ANCO Clear-Flex Wiper Blade.* Deposit with him only the regular price ... printed on its box. Keep your old Blade ... if you like.

THE CONTRAST TELLS

Leave untouched the used Blade and Arm on your OTHER wiper shaft ... until you compare it with CLEAR-FLEX performance ... in the next storm! You are delightfully amazed ... by CLEAR-FLEX. Eye-strain ... jangled nerves ... **FILM FATIGUE** ... **GONE!** You enjoy at last the relaxed comfort ... and added safety ... of crystal-clear driving vision.

YOUR MONEY BACK QUICKLY —IF YOU'LL TAKE IT!

If you then are willing to part with your ANCO Clear-Flex Blade ... the dealer who put it on for you is authorized by us to remove it ... put back your old Blade ... and refund pleasantly every cent you deposited for CLEAR-FLEX. We protect him in that. Show him this ad. You risk no money. Get yours today. Try it. Then make it a PAIR. May save you a costly smashup!

ANCO DEAD-LOCKER WIPER ARMS



*—Use CLEAR-FLEX Blade ONLY with the sturdy ANCO Dead-Locker Arm ... already on millions of cars. ANCO Arm fits quickly any wiper shaft. Suits any good wiper motor. Holds Blade true ... at correct pressure. If not now on your car, ask serviceman to install a PAIR quickly for you. More than 250,000 good gas stations and service stores sell ANCO BETTER Blades and Arms.

Made by the makers of long-famous ANCO RAIN-MASTER† Blades and Arms ... original equipment for years on DeLuxe models of high-grade cars. Your dealer knows ANCO.

†Trade Mark Reg. U. S. Pat. Off.

‡Trade Mark of—The Anderson Company

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GARY, INDIANA

Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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



WHEN one of our editors visited Aberdeen Proving Ground he was concerned at first by abandoned barracks and silent guns. Entering the restricted area where the big guns have their noses pointed out over the Potomac, he expressed this concern to his ordnance escort. The escort grinned and suddenly one of the big guns let go with a mighty roar that shook the earth. "You see the guns still roar at Aberdeen," said the officer. "Thanks for a perfect title," said the editor. You'll find it on our lead-off feature on page 89.

NEXT MONTH our western editor, Tom Stimson, presents a new angle in supersonic research with "How Fast Can Man Fly—And Live?" Another outstanding feature presents one solution to the high cost of buying and driving an automobile. Don't miss "Land of the Scooter and Cycle."

CRAFTSMAN headliners next month include full details on building a two-story, eight-room dollhouse with plywood walls, complete kitchen, bath and electric lights. Another feature gives the home craftsman an interesting slant on the use of foam rubber for upholstery projects. This new material makes it easy to turn out a professional job without extra cost. Photo fans are offered some advice in an article by a well-known authority on shooting close-ups with an ordinary camera.

EXPERIMENTERS will find a high-fidelity tuner for the new FM band in next month's Radio pages.

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To Help You
Simplify Production



New Automatic Device Provides Up-to-the-Minute Visual Record

The new CHART-O-MATIC provides an instant visual record of all production, shipments, purchases, absenteeism, etc. Avoids inventory surpluses. Guides purchasing department giving constant picture of all parts and supplies on hand. Requisitions can be made direct from chart. Information from all departments transmitted to operator by Telautograph permits instant recording on CHART-O-MATIC. Does away with big wall charts and card-systems and tedious, time-consuming search for data that is often far from current. With the CHART-O-MATIC, the complete activities of the entire plant can be determined in an instant.

The entire unit is easily portable and operates from 110 volts current. Chart rotates in either direction by finger-tip control. Speed may be governed by rheostat.

New devices are proving their worth in saving time and reducing nervous tension on the job. And modern plants throughout America are finding that chewing gum on the job helps relieve monotony and helps to keep workers alert. That is why more plants every day are making Wrigley's Spearmint Gum available to their employees.

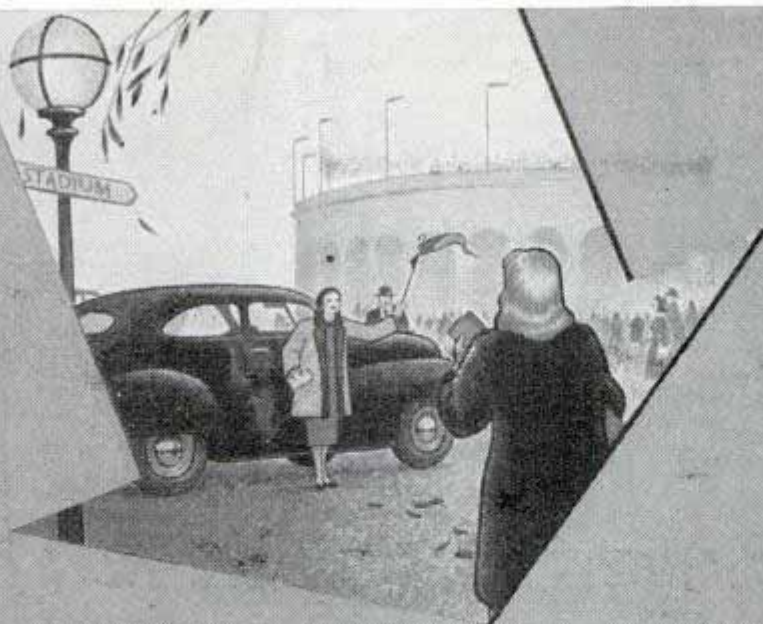
Complete details may be obtained from Spiral Mfg. Corporation, 3612 N. Kilbourn Avenue, Chicago 41, Illinois.



The New Chart-O-Matic



AB-78



★ WHEN IT'S AN **Exide** YOU START ★

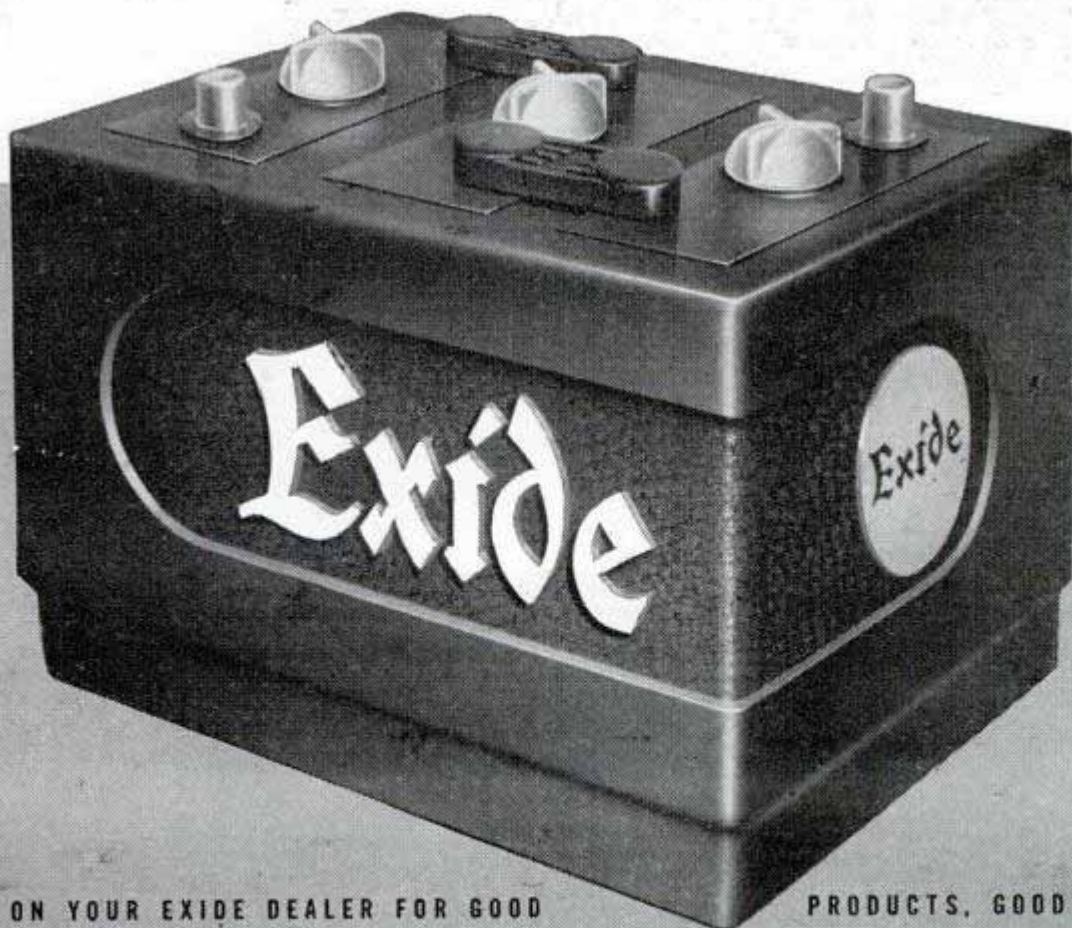
● When you buy a battery, you want to be sure it will start your car—today, tomorrow, this coming winter. Regardless of the age of your car, dependable starting power is your soundest investment. One starting failure can be far more

costly, than the little extra you pay for an Exide Battery.

Play safe—buy starting assurance.

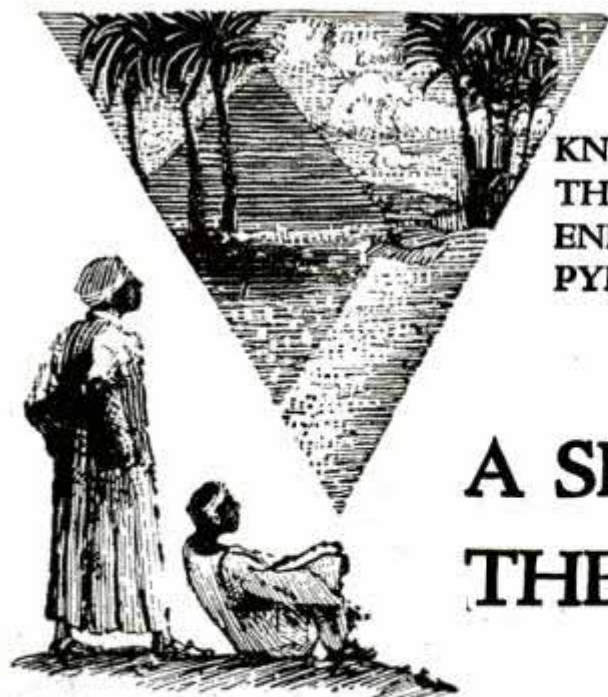
When it's an Exide—you start

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Philadelphia 32
Exide Batteries of Canada, Limited, Toronto



DEPEND ON YOUR EXIDE DEALER FOR GOOD

PRODUCTS, GOOD SERVICE



**KNOWLEDGE
THAT HAS
ENDURED WITH THE
PYRAMIDS**

A SECRET METHOD FOR THE MASTERY OF LIFE

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

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MORE MONEY \$\$\$ a BETTER JOB

Your Competition is Keen



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Competition for promotion is keen—people all around you are looking for more money—a better job—and so are you.

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Few people prepare themselves for that promotion—that better job and more money. Not many are making any special effort to learn outside of the time they put in each day on their work. They're taking the long, hard road to success. *How about you?* Are you, too, taking that same old, winding road—with its many disappointments and heartbreaks?

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we'll send you full information on that field without obligation. It may be the turning point in your life to a successful career, and more money.



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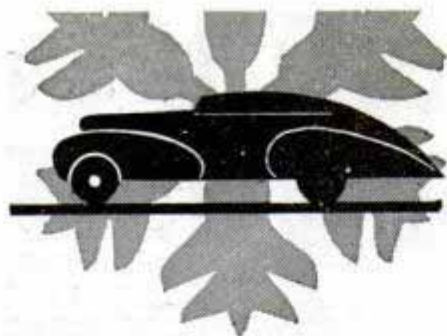
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Add miles to your car . . . ask your gas station attendant to add Pyroil.

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PYROIL COMPANY

73 Pyroil Bldg., La Crosse, Wisconsin

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

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Address _____

City or Town _____ State _____



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

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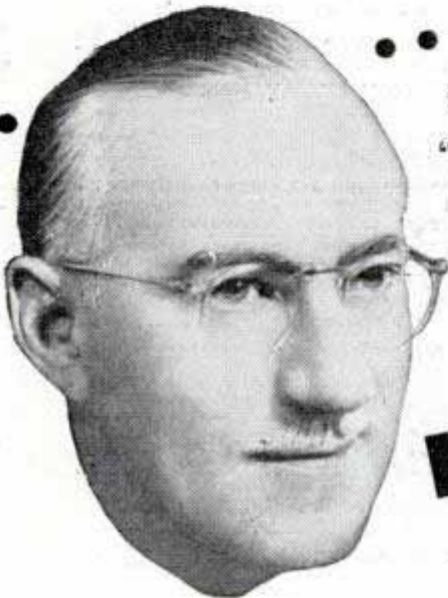
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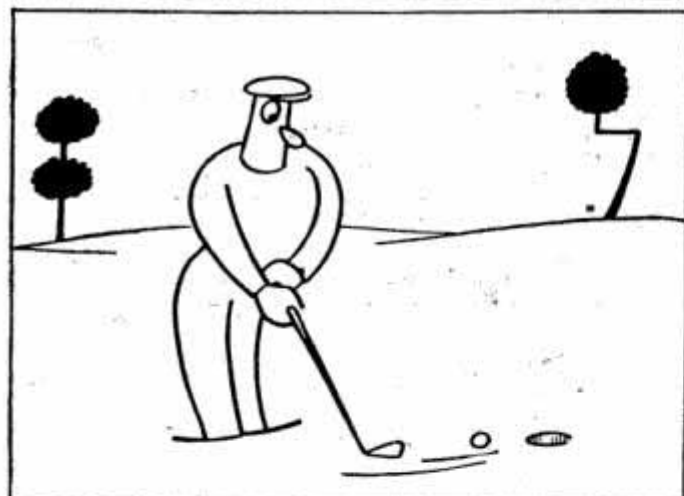
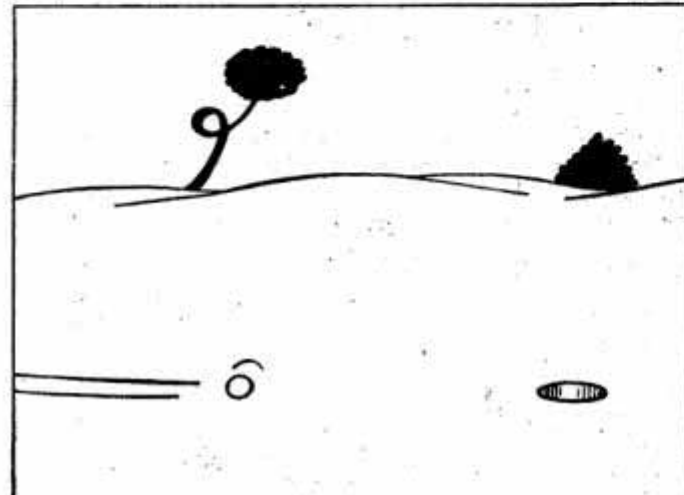
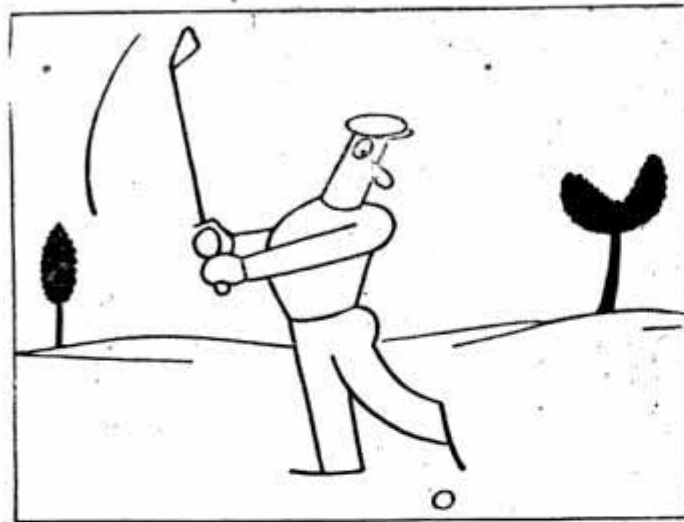
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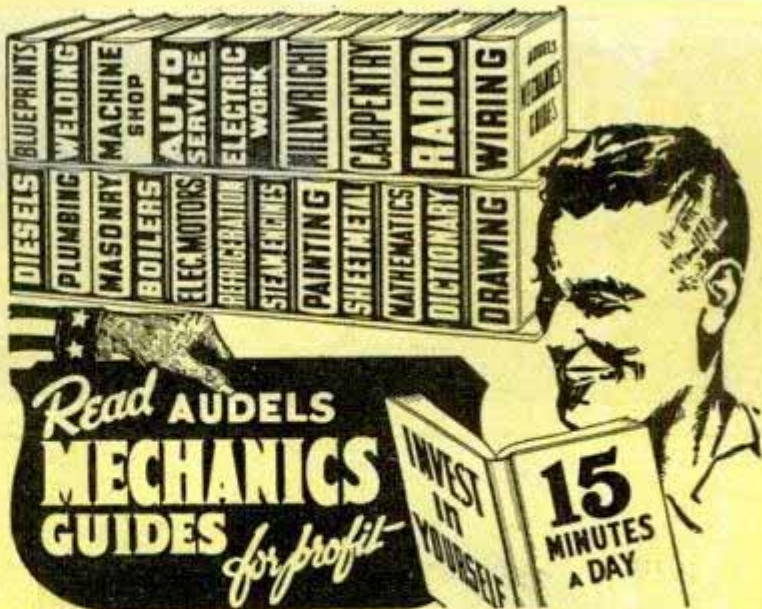
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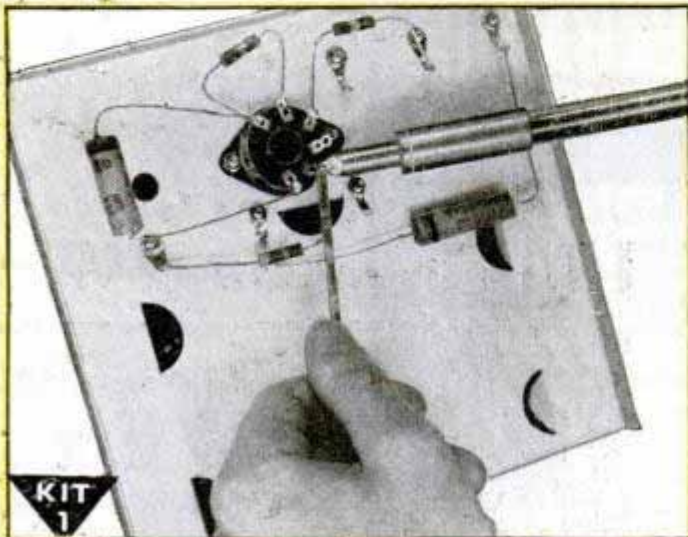
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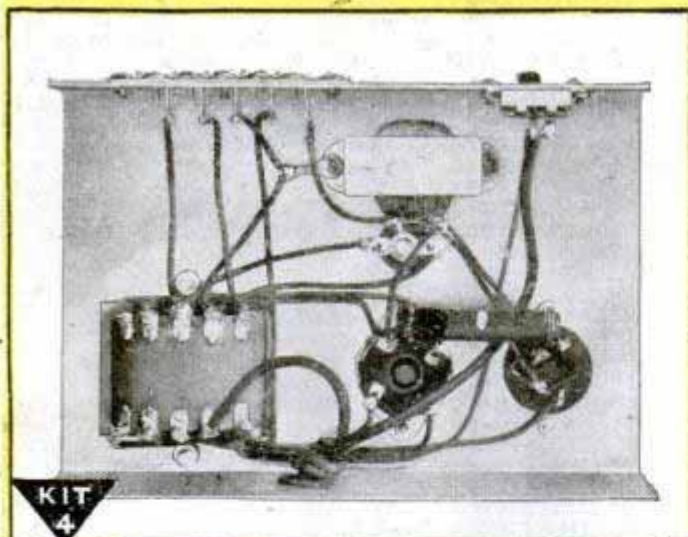
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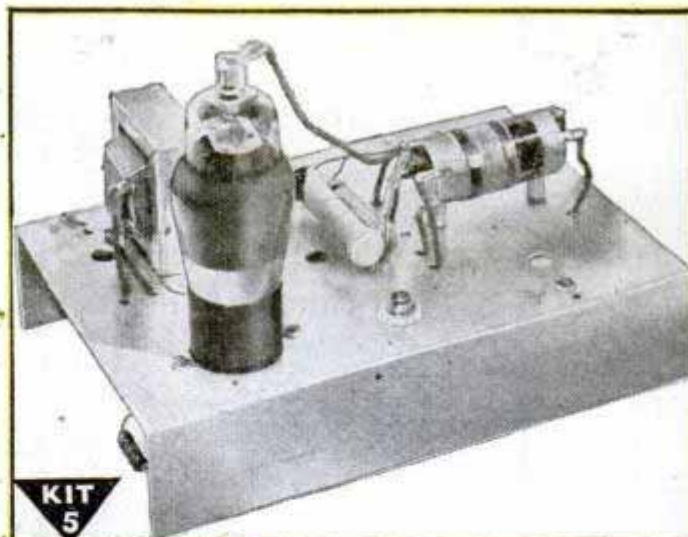
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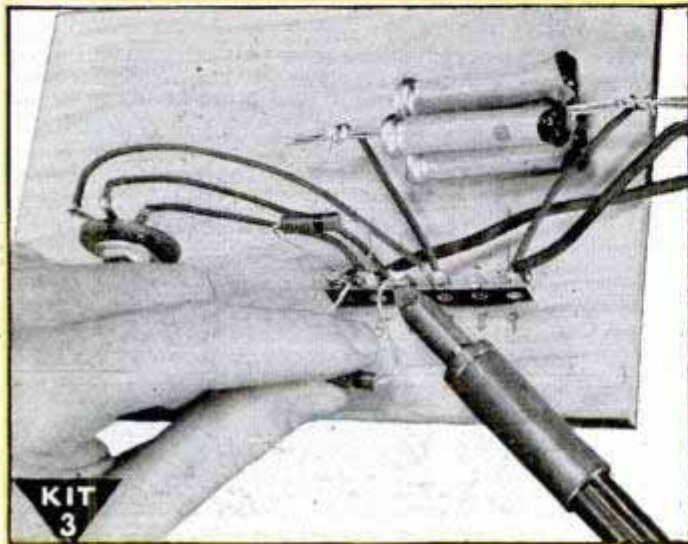
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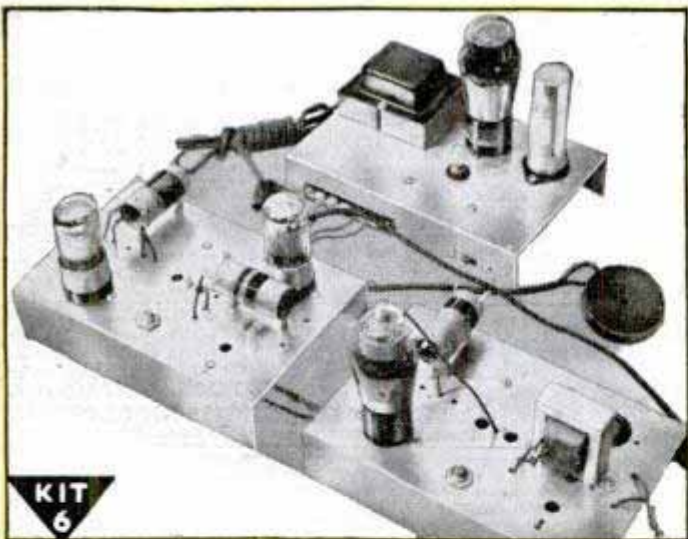
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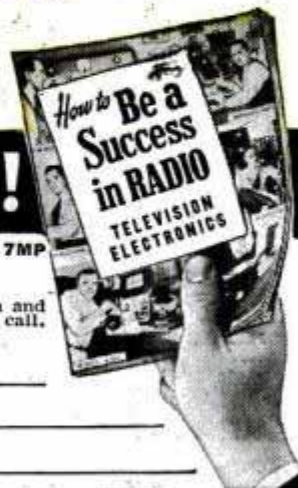
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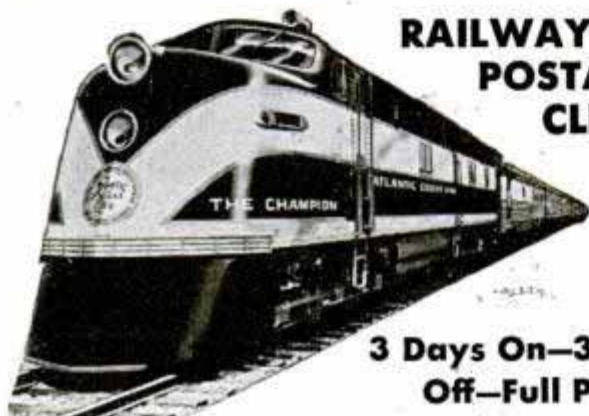
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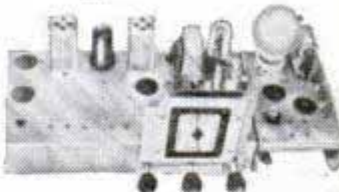


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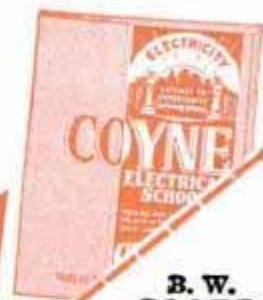
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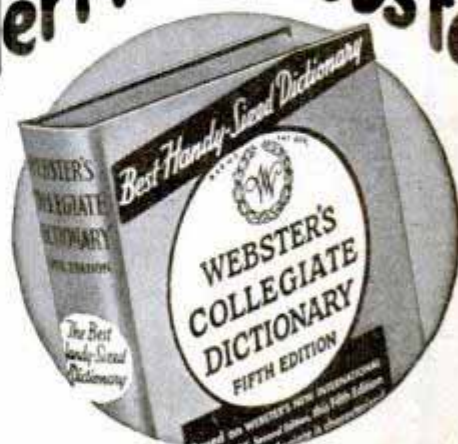
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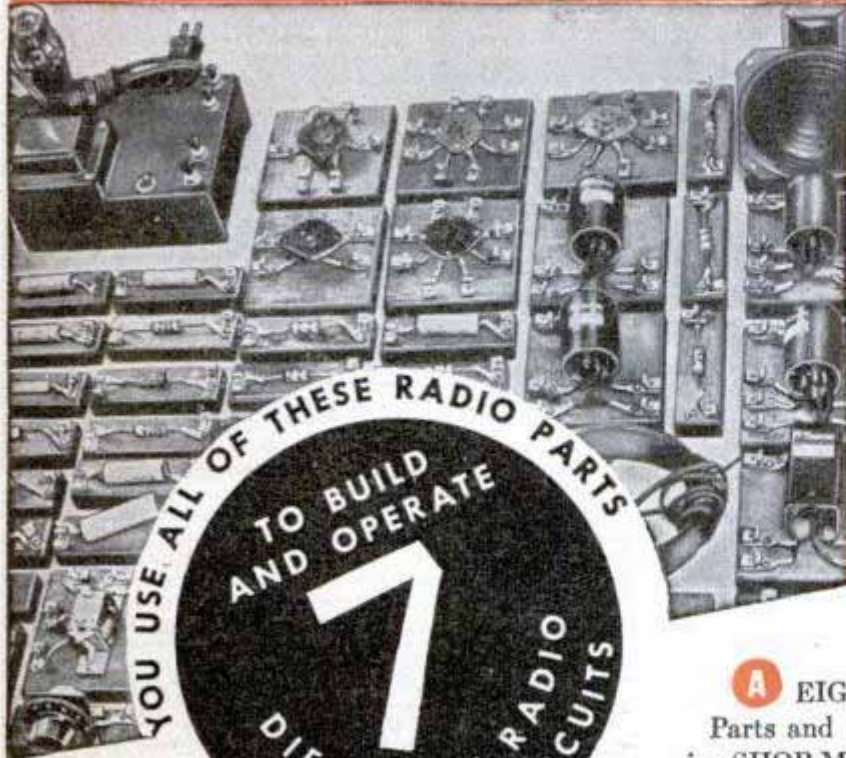
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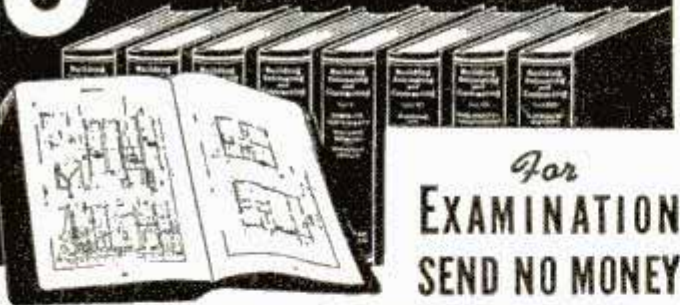
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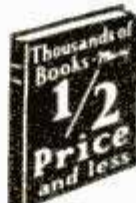
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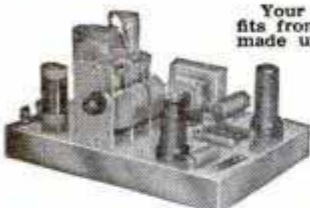
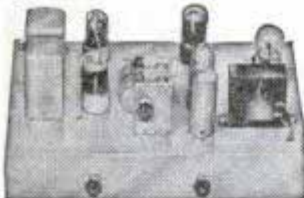
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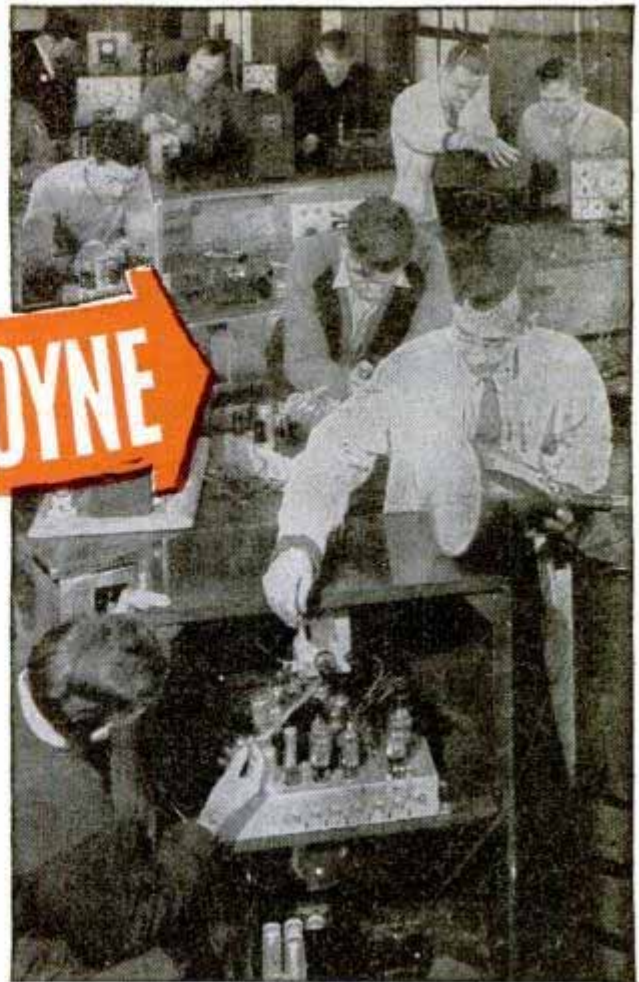
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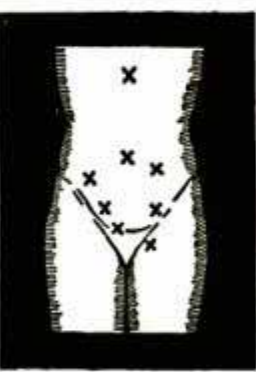
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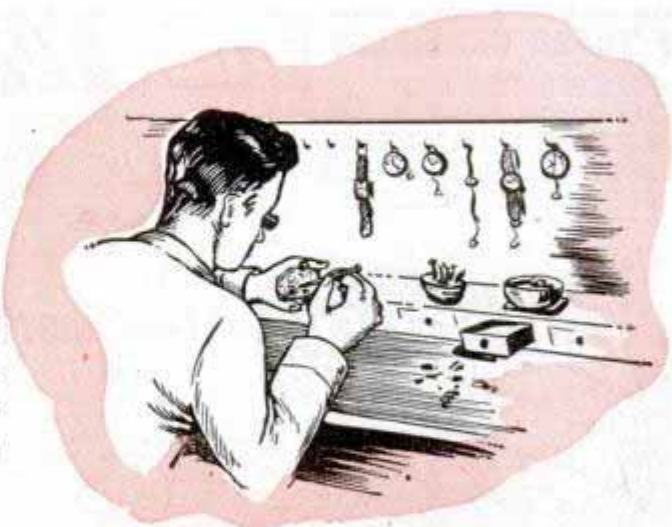


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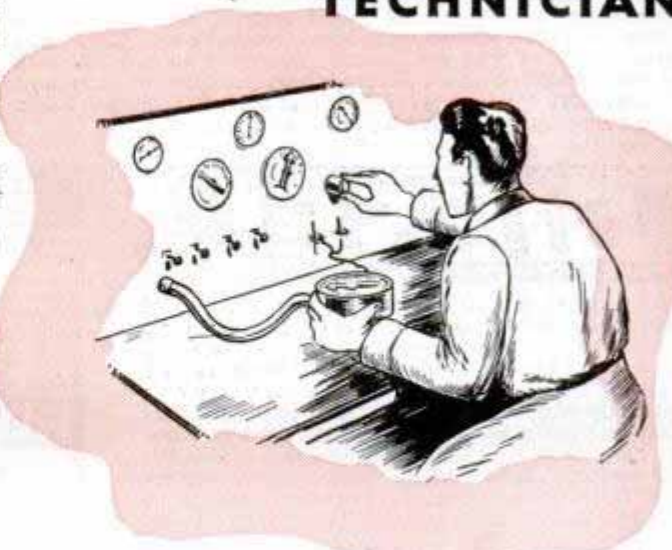


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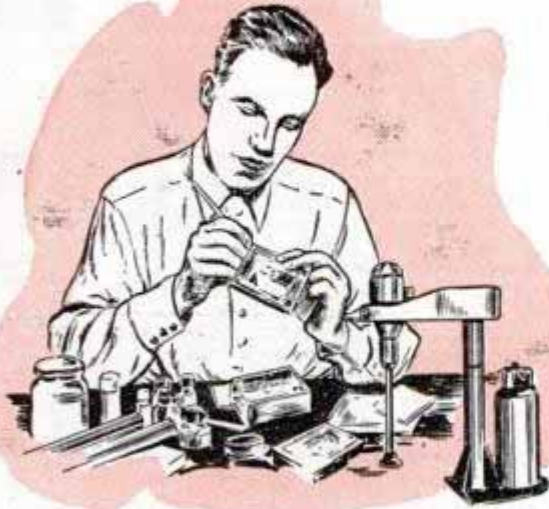
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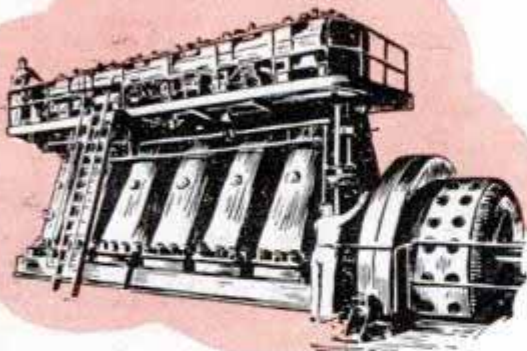
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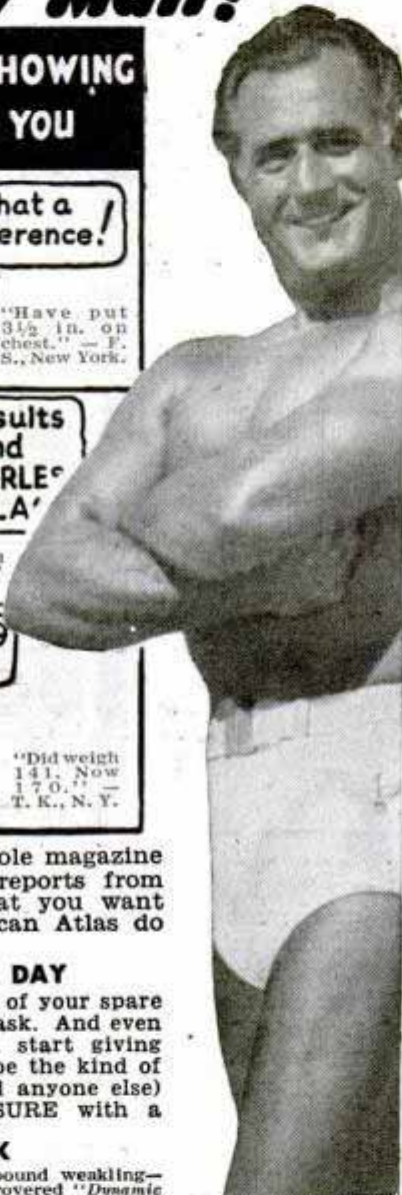
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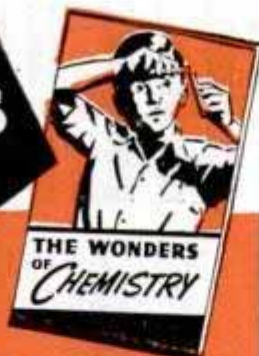
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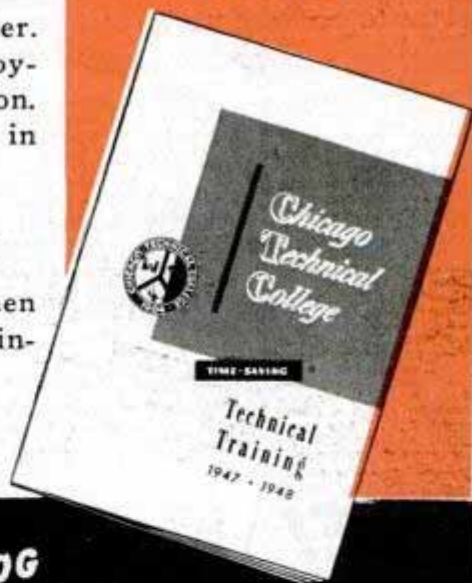
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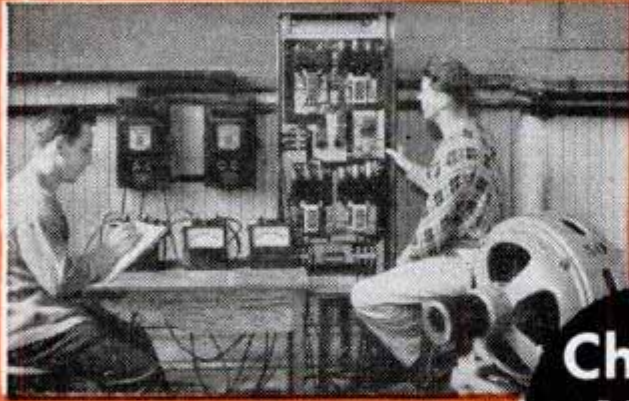
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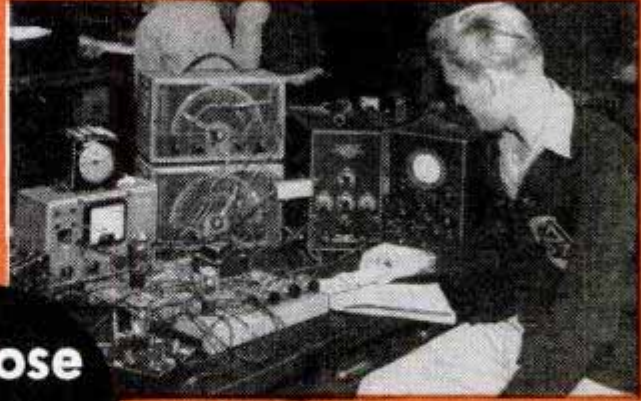
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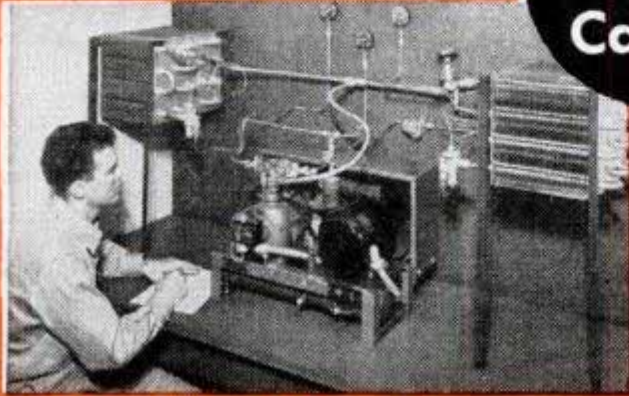


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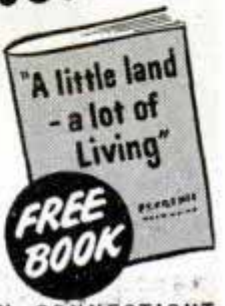
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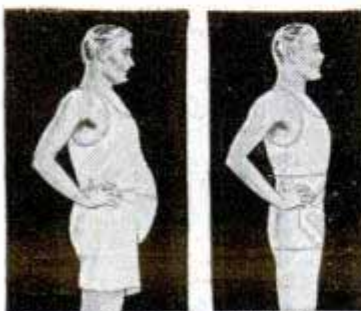
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SCHWINN Bicycles for Christmas. Send dime for list. Wholesale. Retail. Century Cycle, 3447 Lawrence, Chicago 25, Illinois.

BOYS, Repair your own bike. "Bicycle Repair Manual" teaches brake repairing, rebuilding wheels, etc. 65c. Robert Klausner, Shelbyville, Ill.

MOTOR Scooter tires, guaranteed nationally known make, first quality. Size 3.50 x 6, 4-ply, with inner tube, \$7.54. Size 4.00 x 8, 4-ply, with tube, \$8.15. Size 6.00 x 6, 4-ply, with tube, \$15.00. Prices f.o.b. Akron. Check or money order. Also have sizes to 18" diameter. Jahant Company, 626 E. Exchange Street, Akron 6, Ohio.

BICYCLE Repairing. Begin at once. Manual explains everything. Make money from start. Postpaid, one dollar. Cahill Cycle Shop, Centerville, Maryland.

MOTOR Scooters, bicycle engines. 120 miles gallon. Dime for catalog. Clymer, Dept. A115, 2125 W. Pico, Los Angeles 6, Calif.

MIDGET Racer less motor \$25; midget car complete \$58; factory built motor-scooters \$50 up complete; others \$25 up; German Sachs motorcycle \$50; 74 Harley \$25; Henderson motor \$5; plenty of brand new two horsepower gasoline engines in original crates; plenty new midget highway racers; plenty brand new motorscooters; over 5,400 small tires \$1 up. (Mail order only), send 25c for big war-bargain catalogue number 22, just out, listing the above and hundreds of other bargains in motorscooters, midget cars, motorcycles, engines, parts, plans, etc. (35c by first class mail). Midget Motors Directory, Athens, Ohio.

JUST Out. Bulletin containing bargains in race cars, motorbikes, motorcycles and motors. Send 25c. Behnke's, 5721 Leland, Chicago 30, Ill.

PROPELLERS For ice-snow sleds, air boats. Catalog 10c. Banks-Maxwell, R.F.D. 12, Ft. Worth, Texas.

MOTORCYCLE Parts for all English and American makes, tires, batteries, pistons, valves, bearings and carburetors. Catalog on request. Nicholson Brothers, Saskatoon, Canada.

BICYCLE Supplies—wholesale, retail. Metal disc wheels, List 10c. Universal, 4713 Virginia, St. Louis, Missouri.

MOTORCYCLE News—monthly. Yearly subscription \$1.00. Introductory copy 10c. Motorcycle News, 5424-A Sawyer, Chicago 25.

NEW British motorcycles, unequalled for design, performance and operating economy. Immediate deliveries available. Catalog on request. Nicholson Brothers, Saskatoon, Canada.

HARLEY-DAVIDSON Parts, accessories, batteries, and tires, 24 hour service. Authorized factory dealer. Philadelphia Harley-Davidson Company, 857 North Broad Street, Philadelphia 23, Penna.

CUSHMAN Motorscooter \$15. Shaw bicycle motor \$15. Harley-Davidson motorcycle, \$35! Send 25c for bargain catalog #8 packed with money saving buys in motor-scooters, motorbikes, midget cars, motors, wheels, tires and parts. Gail and Company, 538 Erie, Toledo, Ohio.

WHEELS! Build wagons, scooters, mowers, trailers, wheelbarrows, grocery carts, baby carts, play pens, baby carriages. 4" to 16". Free list. Trulsen Mfg. Co., 811 E. 31, Kansas City, Mo.

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.

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

LARGE Stock Indian parts. Expert motor rebuilding. New and rebuilt Chief motorcycle, motors only. Indian Motorcycle Sales, Kansas City 1, Mo.

HARLEY-DAVIDSON—New and used 45" motors, service, parts, accessories, tires. Send \$2.25 for army motorcycle manual, 10c for bulletins. Knuth's (Harley-Davidson factory dealer), 2491 Fondulac, Milwaukee, Wis.

CUSHMAN Motorscooter \$20 (includes motor and extra tires). Midget racer \$15! Send 25c for big catalog #938 listing these and scores of other sensational bargains in motors, wheels, motorscooters, motorbikes, servicers, tires, etc. Associated, Box CS-1764, Toledo, Ohio.

AVIATION

FLIGHT Engineers Manual just published by Charles A. Zweng. Prepares for flight engineer rating. 420 pages, illustrated \$4.00 postpaid or C.O.D. Free aeronautical catalog. Pan American Navigation Service, 12021 Ventura Blvd., North Hollywood, Calif.

FREE Catalog describes world's most complete line of navigation instruments and texts. Includes famous Weems Mark II Plotters, Dalton E6B and Mark VII Computers, protractors, star charts, plotting boards, watches, celestial coordinators, charts, sextants, navigation notebooks, many more. Weems equipment standard with Army-Navy air forces, commercial airlines. Write Dept. 2, Weems System of Navigation, Annapolis, Md.

JET Propulsion experiments. New design. Drive bicycle. Circular on plans. Rush name. Maupin, Tipp City 3, Ohio.

PROPELLERS—2 And 3 blade, designed for ice-snow sleds, boats. Literature. Standard Aircraft, Box 387, Ft. Worth, Texas.

WOOD Propellers, all types duplicated. Universal Aircraft Co., Box 2256, Fort Worth, Texas.

FOR Sale—Aeronca 30 hp., two cylinder, excellent shape and complete, \$175.00; Aeromarine 55 hp., 3 cylinder, excellent shape and complete, \$200.00; Franklin 90 hp., 4 cylinder, good condition, complete \$200.00. Prices quoted include pusher or tractor propeller. Excellent engine for snow or ice sleds. Curtiss Conqueror, 600 hp., 12 cylinder, complete \$200.00. Airplane propellers for fire place or den \$9.95 each. Sensenich Corporation, Dept. PM, Lancaster, Penna.

B-29 COMPUTERS, 400 Cycle dynamometers, 60VDC amplitudes and servo amplifiers, turret drives, bomb releases, starter solenoids, collector rings, etc. List. Erec, 2912 Hewitt, Everett 1, Washington.

SKI-TOWS, Portable, auto-powered, 500 ft. long. Pulls you both ways. Up, level or downhill. Set up in 20 minutes. Only \$125. Send card for particulars. Great-Northern Mart, North Adams, Mass.

VETERANS: Flight training under the G. I. Bill. Tuition paid. Private, commercial, flight instruction, instrument and multi-engine ratings. Opportunities to work for living expenses or tuition, if not a veteran. Write Gottschalk School of Aeronautics, Adrian, Mich.

4" 6" PUSHER Propellers. Three blade pusher propeller. Finest birch laminated construction, brass tipping. 50 to 85 h.p. for boats, sleds, etc. \$75.00. Same type as used on the famous CallAir SnowCar. Call-Air, Afton, Wyoming.

GIANT Glider kites. Double. 14x10 ft. Lifts 100 lbs., tows car, etc. Cost government \$108. Yours for \$20. Satisfaction guaranteed. Great Northern Mart, North Adams, Mass.

BATTERIES, GENERATORS

\$150.00 NEW Generators, only \$33.00. See Greer advertisement under "Welding."

EDISON Non-acid lifetime storage batteries for home lighting, motors, radios, etc. Free complete interesting literature. T. Hawley Smith Company, Croton Falls, N. Y.

ELECTRICAL SUPPLIES, EQUIPMENT

CHRISTMAS Tree light sets and bulbs. Jeannette Electric, 159 West 23rd St., New York 11, N.Y.

BLOWERS, Motors, gas burners, gas furnaces, controls, oil burners, oil furnaces, oil circulators, water heaters, exhaust fans, pumps, "Superior's," 120 El-nido, Monrovia, Calif.

DIRECT Factory agents for fast-selling, fine commercial popcorn machines. Nationally advertised. Sales leads furnished. Excellent profit. Viking Popcorn Machines, Inc., 114 W. 18th, Kansas City, Mo.

VOLTMETERS 3 1/2" Burlington or Supreme, 0-10 d.c. plus special battery charging scale. Easily converted to other ranges. Instructions included. \$1.39 each, five for \$5.00 p.p. Boutwell Electric, 203 Gilbert, Kirkwood 22, Mo.

GENERATOR Flashlight. No batteries to wear out! Easily make your own from simple household materials and tools. Complete guaranteed copyrighted instructions. 50c (cash, check or money order). Reiss, 3017-M Ocean Parkway, Brooklyn 24, N. Y.

\$150.00 NEW Generators, only \$33.00. See Greer advertisement under "Welding."

MAGNET, "Ainico" 4 oz. horseshoe, powerful (lifts about 5 lb.) \$1.00, 8 oz. (lifts 10 lb.) \$1.50, 3 lb. (lifts 20 lb.) \$6.00; all postpaid. Ross, C68 West Broadway, New York, N. Y.

VOLTAGE Regulators. Autolite, silver contacts and large radio filter. Like new condition. Original cost \$140.90. Price \$5.95 prepaid. Also new Delco Remy regulators. Platinum contacts. \$3.95 prepaid. Both 24 volt, 50 amp. State Ignition, 2521 Indiana, Chicago 16, Ill.

FREE Catalog of welders, welding supplies, generators, fences, electric lawn mowers, freezers, and other electrical items. LeJay Company, Minneapolis, Minn.

LAMPS—All parts to build or repair. Harps, sockets, vase caps, bases, hard to get items. Illustrated catalog 10c. Gyro Lamps, 5416 Clark, Chicago 40.

LAMPS—Build your own, all parts furnished at wholesale prices. Write for free photos. Brown Lamp Company, Box 501, Welston, St. Louis 12, Mo.

NEW Surplus wire and cable. 200 sizes and types. Armored, Tirez, lead. Free list. Ercco, 2912 Hewitt, Everett 1, Washington.

WANTED Ex. G.I. electricians to start motor repair shops. Write Electrical Engineering Consultation Service, 3013 East 6th St., Long Beach 4, California.

TATTOOING Machines, outfits. Free catalogue, Jensen, 120 West 83rd Street, Los Angeles 3.

ELECTRIC Pencil—Writes, engraves all metals. Battery model \$1.00—110 volt model \$3.00. Complete. C.O.D.'s accepted. Reb Industries, Dept. 265-CC, Elmhurst, Illinois.

BUILD Your own lamps. Save half. Be different. Write for free photos, also lamp parts. Buddy Products Mfg. Co., Dept. 30, 1123 W. Belmont, Chicago, Ill.

ELECTRIC Pencil: Writes, engraves all metals. \$1.00 postpaid. Beyer Mfg., 229-H Dixon Blvd., Uniontown, Penna.

LITTLE Library of Useful Information. 102 different books. Catalog free. Popular Mechanics Press, 200 E. Ontario St., Chicago 11, Ill.

WELDING, SOLDERING, PLATING

ERGOLYTE Welding kit—Industrial type, junior model, glass insulation, both flame and metallic arc. Compact carrying case. Ideal home and shop use. 110 volt, \$44.85 complete. Ergolyte Mfg. Company, 3627 N. Lawrence St., Philadelphia 40, Penna.

A.C. Welders, 110v. Welds 1/2" steel, \$29. Guaranteed. Morris Welding Service, 1850A State St., Schenectady 4, N. Y.

NEW Model electric welder, 110 volt a.c.-d.c.; will weld all metals; easy to use; full directions. Complete with power unit, flame and metallic arc attachments, carbons, fluxes, rods, mask; all for \$19.95. Used by the navy. Magic Welder Mfg. Co., 239 MP11 Canal St., New York City.

WELDERS—Govt. surplus tested gasoline driven. Save up to 50%. Iowa Machinery Co., Des Moines.

WELD, Cut, braze with gasoline! Amazing discovery shatters costs. Range jewelry to railroad steel. For farm, factory, shop. New opportunities. New wealth. Important! Investigate. Matthews Mfg. Co., Calgary 21, Canada.

ACETYLENE Welding outfit approved by Underwriters and oxygen and acetylene cylinders I.C.C. inspected. All for \$75.00 complete. Best's Service, M8215 S. Honore St., Chicago 20, Ill.

OXY-ACETYLENE Welding and cutting outfit complete with cylinders and carrying case. Designed especially for hobby-shops, small repair shops, refrigeration and electrical service men. You own the cylinders. Free literature. A-A Welding Supply Co., C9228 S. Ada St., Chicago 20, Ill.

CLOSEOUT—While 250 last. Nine page pamphlet "Electroplating" including formulas and plating instruction for gold, silver, nickel, copper, chrome, etc. 25c. F. D. Hyde, 432 "F" St., San Diego, California.

WELDERS (Acetylene) become expert on white metal. Use own inexpensive rod made from scrap. LaCombe, Oakland 6-M, California.

NEW Aircraft lighting generators. War surplus. Only \$49.50. Original cost \$250.00. Can be used for lighting or converted for use as welder, electric plater, fast battery charger, auxiliary power unit, etc. Model R.2, manufactured by Jack & Heintz, 30 volts, 300 amp. d.c., shipping weight 68 lbs. Size 16"x7". Also new G.E. and Westinghouse P.1 generators, d.c., 200 amp., 28 1/2 volts, cost \$150.00, price \$33.00 each. Immediate shipment. Check with order. Greer, 460 South State Street, Chicago, Illinois.

PORTABLE Arc welder, "build your own." Your engine plus Hobart welding generator saves \$350. Starts paying business. Free instruction book. Write Hobart Welders, Box M-1074, Troy, Ohio.

WELDERS For all requirements. Free catalog. Write Hobartweld, Box M-1075, Troy, Ohio.

BUY Direct from factory. Welding outfit \$48.36; soldering outfits \$12.70 to \$9.70 complete prepaid. Box 331, Hamilton, Ohio.

NEW Portable champion special; transformer welder; 110/120 volt a.c.; 8 heat stages. Welds, brazes, solders, cuts all metals. Complete with electro holder, mask, rods, carbons, fluxes, cables, also special flame weld torch. Full directions, easy to use. Splendid for shop, farm and home repairs. Guaranteed 1 year. Only \$27.50. Magic Welder Mfg. Co., 241 NW Canal St., New York City.

BUILD Heavy duty industrial transformer type welder. Primary, secondary separate. Operates 110 or 220 volts. Alternating current. Complete detailed plans \$1.00. Atomic Welder, 1038 So. 19th St., Omaha, Nebr.

30 AMP. Selenium plating rectifiers with Powerstat control, \$85.00. Lead lined tanks, geared motors for agitation. Complete line of bronzed baby shoe mounts. Hollywood Bronze Supply, 1770 N. Vermont, Hollywood 27, Calif.

MACHINERY, TOOLS AND SUPPLIES

FOUNDRY Castings, blueprints, materials for woodworking and metalworking machine tools. Suitable for commercial or home shop production. 23 items, catalog 10c. Lewis Machine Tool Co., 3217 Union Pacific Avenue, Dept. M, Los Angeles 23, California.

BENDIX Compass—Magnetic, aircraft liquid filled type. Used, good condition, guaranteed, \$7.95. Other big values in surplus motors, switches, flexible shafts, gears, speed reducers, etc. Delta Sales, 738 Kirby, Shreveport, Louisiana.

"WAR Surplus" bargains! All new! Flexible drive cables! Three sizes, 10", 25", 72". Over \$5.00 value. Combination offer of all 3 sizes, \$1.75. Precision built right angle drives. Complete with flexible drive cables. Only \$3.50. Magnet wire 1/2 lb. coils No. 22, 10 rolls for \$3. Dual drive assembly. Geared 7 to 1 reduction, driven by powerful 1/5 hp. a.c. or d.c. motor. Operated on 6-27- or 110 volts with transformer. Standard attachments convert this unit into a dual, hand or table drill, polisher, buffer, router, sander, etc. May be used as individual drill, sander, etc., by detaching flexible drive shaft. Comes set-up as drill equipped with 3 flexible drive cables and mounting bracket. Original cost to govt. over \$300.00. Now \$15.00. Splendid values! Order today. No c.o.d. "Amazing Bachman's," 23 Herman Street, Rochester 5, N. Y.

CONCRETE Building block machines and molds. Catalog free. Concrete Machine Co., 5466 Gravois, St. Louis, Mo.

WOODWORKING Machine knives. Low prices. Also precision sharpening service. Free circular. Colman Tools, 204 North Buchanan, Amarillo, Texas.

DAYTON "V" belts and pulleys. All sizes for every need; prompt shipments. Free circular and prices. Hydraulic Products Co., East Main Street, Southold, N. Y., Box 206.

LATHE Milling attachment. Photograph for dime. Depoy Model Shop, Muncie, Ind.

HARDWARE, Tools, drills, taps, dies, pattern, model supplies, electrical equipment, steel, brass, drill rod. Catalog 10c. Terek, 6304 Patterson, Chicago 34.

12" BAND Saw, tilting table, Oillite bearings, \$35.00. 6" jointer, ball bearing, 43" long, \$59.50. Spindle shaper, ball bearing, 15x20 table, interchangeable spindles, \$49.50. 8" bench saw, large tilting table, ball bearing, complete, \$29.50. Immediate delivery. Dealers wanted. Write for catalog. Backus Machine Co., Boyd, Wis.

ELECTRIC Foot switch—For power tools. Leaves both hands free. Just plug it in. \$3.95 postpaid. C.O.D.'s accepted. Reb Industries, Dept. 265-CB, Elmhurst, Illinois.

VALVE Guide inserter and extractor. Self-centering and machined to assure proper alignment of tool and guide. Available two sizes. Chev. \$1.00. Buick \$1.25. Luson Enterprises, 1333 So. 6th St., Minneapolis 4, Minn.

ASSORTED Scissor screws, saw supplies, list 10c. Overland Saw Service, Independence, Iowa.

WOOD Shaper assembly with 1/2" ball bearing spindle, fence, table plate and plans for floor model stand. \$14.75. Woodcraft Tool and Supply Co., Sylacauga, Ala.

GEAR Reductions! Values ranging from \$500 to \$1100 each. All new! Complete with 1/2 h.p. motor a.c. or d.c. 110 volt. 25 or 60 cy. Single phase. Variable speeds. Bearing assembly with machined gears. Absolutely the thing for sanders, polishers, winches, hoist, conveyors. Adaptable for many uses. Special \$39.50. No c.o.d. "Amazing Bachman's," 23 Herman Street, Rochester 5, N. Y.

ARC Welders, A.C. or D.C. 150-600 ampere. Portable, stationary. Prompt delivery. Reasonable terms. Also electrodes and accessories. Free catalogs. Write Hobart Welders, Box M-1076, Troy, Ohio.

BENCH, Jig saws, drills, mandrels, sanders, etc. Circulars 3c. Sunshine, Berkshire Heights, Penna.

DRILLS, High speed, 1-60 \$10.95. Send dime for sample and list. V-B Sales, Roselle, Illinois.

UNIVERSAL Angle plate, 4"x3"x3", rib is handle, precision ground 6 sides. \$4.45. Tool catalog. Model Tool Service, Rock Falls, Ill.

DRILL Grinder for twist drills \$2.95. See ad on page 266.

NEW Band saw for home workshop or factory use, ideal for hobbyists. Special \$14.95. Circular free. Woodcraft Tools, 147 E. Lake, Minneapolis, Minn.

SOCKET-SCREW Key handles (Aluminum). Free trial. Wittle Manufacturing, 1041 Lititz Avenue, Lancaster, Penna.

MAKE Easy money with our drain tile machines. Bird bath, flower pot and other miscellaneous molds. Concrete Machinery Company, Hickory 22, N. C.

DECIMAL Equivalents, tap drill sizes, and temperature color charts for wall or tool chest lid. 50c each or all three \$1.00. Northcott, Box 486, Hays, Kans.

ELECTRIC Sander low as \$7.65. Circular. Handy Tools, 255PM Charles, Grand Rapids 6, Michigan.

WE Offer 60 tons of new war surplus bolts, nuts, washers, screws, etc. All popular sizes. A good mixture for hobby shops, garages, machine shops and farms. A big 40 lb. box for only \$6.85. War Surplus Co., Morris and John Sts., New Brunswick, N. J.

SHEBEL Saw Filer files all saws. Circular. A. P. Shebel, 730B So. 2nd St., Milwaukee 4, Wis.

BALL Bearings one-fourth list price; gears, switches, rheostats. Free list. Burgess, Box 168, Ferguson, Mo.

V-BLOCKS At low prices. 10 sizes for all purposes. Free literature. Miles Products, 2532 Wabash, Chicago 16.

HOME Shop owners attention.—Send for actual photograph and sample of the work our attachments will do. The photograph and sample speak for themselves. Have fun in your home shop. Cut gears, sprockets, ratchets, lay out holes accurately, cut keyways, build complete clocks and other interesting jobs. Build these attachments yourself from our reasonably priced blue prints. Don't limit your lathe to round work only. The Home Shop, 415 Raymond Avenue, Glendale 1, California.

DRILL Grinder—Grinds drills to factory accuracy. Calipers with direct reading scales. Circle cutters. New Tool grinder. Lowest prices. Free literature. Factory, 811-B East 31st, Kansas City 3, Mo.

MACHINE Shop tools released for private industry; small bench lathe \$90. Logan loose change \$250. Quick change \$350. 14" screw cutting engine lathe \$150. 16"-180. 15" quick change \$440. 16"-17" \$510. 17" and 32"x10" gap lathe \$650. 22"x17" \$550. Hand miller \$100. 20"-30" upright drills. \$100-\$300. Amco bench shaper \$350. Gasoline driven 200 amp. welder \$315. Electric motors 30"-36" band saws \$140-\$275. Money back guarantee. Conversion Parts Co., 278 Adams St., Boston 22, Mass.

ENGINES, MOTORS, DYNAMOS

MIDGET Motors—4 r.p.m., 110 volts, 60 cycle a.c. Perfect for timing machines, displays, models. Price delivered \$5.00 each. McLaren Products Co., P.O. Box 1021, Riverside, California.

MOTORS, Water, air, steam driven. 3" novelty, \$3.50. 4" novelty, \$5.50. 6" novelty, \$9.50. 8" novelty, \$12.50. Heavy duty, 1/4 hp. \$5.50. 1/2 hp. \$7.50. 3/4 hp. \$12.50. 1 hp. \$20.00. Cash with order. Prepaid, Duplex Motors, Burlington, Ia.

"**BUILD Your own**" portable arc welder. Your engine plus Hobart welding generator saves \$350. Starts paying business. Free instruction book. Write Hobart Welders, Box M-1077, Troy, Ohio.

WELDERS For all requirements. Free catalog. Write Hobartweld, Box M-1078, Troy, Ohio.

\$150.00 **NEW Generators**, only \$33.00. See Greer advertisement under "Welding."

MOTORS! 1/2 HP. d.c. converted to a.c. All new. High speed 110 volt. 25 or 60 cycle, ball-bearing motors with forward and reverse switches. Actual cost about \$100.00. Now \$19.50, three for \$50, or same motor without reverse switch \$15. Three for \$40. Countless uses for home mechanics. Order today! No c.o.d. orders. "Amazing Bachman's," 23 Herman Street, Rochester 5, N. Y.

AC MOTOR Winder, winds concentric coils for electric motors, adjustable 1/2 to 2 h.p. Send for bulletin. Motor Industries, Quincy, Illinois.

WELDING Generator, 150 ampere, \$47.50. Other bargains. Butler, 1885 Milwaukee, Chicago.

WINDING Data, listing 225 motors, single and three phase, \$1.00. Motor Data Co., Box 7631, Kansas City 3, Mo.

BOATS, OUTBOARD MOTORS, ETC.

FREE Catalog describes famous Weems line of navigation instruments and texts. Write Dept. 2, Weems System of Navigation, Annapolis, Md.

SKATE, Iceboat sails, canvas all widths, wingdope, boat builders' equipment, Everdure screws, marine hardware, fitted boat covers, etc. Alan-Clarke, 96 Chambers, New York City.

P-38 BELLY Tank speed boat. Complete plans, instructions \$1.00. Twintank Boat Company, 1032 62nd Street, Oakland, Calif.

DUCK And rowboats, kayaks, Weldwood ready cut kits. Booklet, E. J. Croot Co., 103-D, Basking Ridge, N. J.

CATALOGUE—Over 30 world's best plywood designs sent with Wm. Deed's book "Plywood Boats." Send \$1.00. Marine Mart, Buffalo 7, N. Y.

BUILD Your own boat by the Welch system with knock down kits. Save 2/3 cost. Rowboats to cruisers. Send 10c for illustrated catalog. Midwest Boat Company, Menomonee Falls, Wisconsin.

TWENTY Plywood boat plans \$1.00. 6 to 20 feet, sail, power. The Rudder, 15 Murray Street, New York.

MOLDED And sheet plywood boat kits, ready to assemble, 8 to 14 ft. \$40.00 up. Genuine weldwood marine type plywood in various thicknesses and lengths. Send 25c for literature. Marine Mart, Buffalo 7, N. Y.

KAYAK Blueprints, deluxe models—catalogue 10c. Viking Canoes, Merrick, N. Y.

MARINE Catalogue—15,000 deliverable items pictured that should be pictured at price. Send \$1.00. Marine Mart, Buffalo 7, N. Y.

\$35 SEA SHELL Pre-fabricated 8' plywood rowboat. Free illustrated folder. Hagerty, Cohasset, Massachusetts.

AIRPLANE Jettison tanks—Streamlined. 10 1/2 foot, tear drop shaped. 165 gallon. Of light weight lead coated steel, weighs 75 pounds. Floats over 1200 pounds. Ideal for making trim, inexpensive boats, canoes, kayaks, dinghys, duck boats, powered catamarans and runabouts. Prices \$12.50 complete. \$9.75 each for three or more. U. S. freight prepaid. General Sales, 205 Market, Grand Rapids 3, Michigan.

NEPTUNE Outboard motor parts, complete stock. Limited supply new motors, 1 1/2 to 9 1/2 h.p. Citizens Supply Co., P.O. Box 1241 M, Muncie, Indiana.

MARINE Power—Easily convert any Jeep or Ford motor (domestic or foreign) with Convo parts and kits. Complete catalog 25c (coin). Osco Motors Corporation, 2020B East Orleans Street, Philadelphia 34, Penna.

P-38 BELLY Tanks, new, steel. 10 ft. 2 in. 165 gallon \$9.95. Anzio Boat Co., Box 89, Merced, California.

OUTBOARD Motor parts, new and used, for all makes. New pistons, standard and oversize. Cylinders rebored. Outboard Motor Mart, Inc., 309 Atlantic Ave., Boston 10, Mass.

NEW, Used, rebuilt marine motors. Marine conversions, fittings. Free catalog. Stokes Marine Supply, Dept. 24, Coldwater, Michigan.

ALL Copper water jacketed exhaust manifolds for marine conversions of automobile and aviation engines and marine engine replacements; any make, model or age. Joseph Van Bierck & Son, 391 Woodcleft Ave., Freeport, N. Y.

MARINE Conversions for Ford and Jeep engines. Catalog 10c. Lehman Manufacturing Company, Department D, Newark 2, New Jersey.

BOATS And all about them. How to select, build, repair and operate. For 40 years the leading practical boating magazine. Half price trial subscription. 12 issues for \$1.00. Motor Boat, 62 Gold Street, New York 7.

BOAT Designers are highly paid professionals. Complete course by mail. Catalog. Westlawn, Montville, N. J.

ATHLETIC EQUIPMENT, BODY BUILDING COURSES

BARBELLS! Catalog! Bur Barbell Co., 319 Orient Way, Lyndhurst, N. J.

DEADLY Judo—Fiercest fighting technique. Trick knockouts. (200 photographs plus illustrations). Expert instructions. Three volumes. Complete \$2.25. Variety House, Box 46-BX, Wall Station, New York 5.

MUSCLES—Power bulging muscles with "Herculex Crusher Grip Outfit" \$3.00. Includes course plus big pictured list of equipment and free booklet on weightlifting. Nat Berent, 1090 W. 43rd, Norfolk 8, Va.

HANDBALANCING—Acrobatics easily learned. Write. Power, 923a W. Vine, Kalamazoo, Michigan.

HEALTH—Build perfectly developed body. Fast and easy. World's greatest system. Literature free. Todd Foundation, Springfield 9, Massachusetts.

BARBELLS \$11.00 up. Stamp for folders. Jackson International Barbells, Springfield, N. J.

BARBELLS, Exercise equipment. Courses. Free booklet. Good Barbell Co., Reading, Penna.

SPORTING GOODS, GUNS, FISHING TACKLE, ARCHERY, TRAPPING

COMMANDO Sheath knife, 6 inch, extra heavy, blood grooved blade; built to last lifetime with rough leather washer handle; per Army specifications. Excellent for hunters, trappers, fishermen. Guaranteed brand new. \$3.00. C. Strickler, Kleinfeltersville, Penna.

GUN Grips, Pearl, Wholesale, Miracle Product, 44 North Albany, Chicago.

GUARANTEED tapered leaders, 3 times stronger. Santa Fe Products, Santa Fe, N. Mex.

FREE! Klein's big, new complete all-sports catalog. Features 1000 guns, gun-trading information, \$800 prize contest entry blank. Write Klein's, 227 West Washington Street, Dept. CTM, Chicago 6. (Send \$1.25 for new gun encyclopedia "The Gun Digest.")

SHOTGUNS, Rifles, revolvers. Over 500 modern, obsolete. Also cartridges. List 10c coin. Ed Howe, 52 Main, Coopers Mills, Maine.

GOLF. Improve your game immediately. \$1.00 brings amazing results from our book. Golf Instruction Book Co., 6943 Saybrook Ave., Philadelphia 42, Penna. Wholesale rates to dealers.

GUN Stock blanks \$1.50 up. Information. Banks-Maxwell, R.F.D. 12, Ft. Worth, Texas.

AUTOMATIC Lure—Positively weedless. Greatest invention in ages. Nothing like it. Circular free. Babcock Reel Co., Oak Harbor, Ohio.

CARTRIDGES, Firearms, ammunition complete list 25c. Frank Parish, Vicksburg, Mississippi.

TEAM Uniforms, equipment, trophies, awards. Craig Dare Company, 670 East 42, Brooklyn 3, N. Y.

5000 BARGAINS, Firearms, binoculars, war relics. Catalog 40c. Smith Firearms, Rummene, New Jersey.

BOWS-Arrows. Write headquarters for archery equipment. Quality products. Popular prices. Catalog 10c. Large illustrated hand book instructions, making and shooting, 50c. Archery, 617-B So. State, Chicago 5.

AMMUNITION—New and used shotguns, rifles, handarms, fishing tackle. List 10c. Rudolph's, Atchison, Kansas.

TAXIDERMISTRY

"**MODERN Taxidermist Magazine.**" Greenfield Center, N. Y. Devoted exclusively to taxidermy. Two sample copies 25c.

FINEST Glass eyes; taxidermy supplies. Catalog free. Elwood Company, Department 234, Omaha 2, Nebr.

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NEW Laboratory supply catalog of chem-icals and apparatus, contains over 5000 items with illustrations, 212 pages. Send 50c. Standard Science Supply Co., 1232 No. Paulina Street, Chicago 22, Ill.

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CHEMICALS And apparatus for indus-trial, analytical, and private laboratories. Complete supply service for correspond-ence school students. Send 3c for catalog. Dept. M-43, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 7, New York.

HELP WANTED

FREE Sample. Nameplates—homes, offices, honor rolls. Whitney Signs, Box 41, Waterbury, Conn.

SAVE Coal, demonstrate: Samples, 100 free test circulars, obtains profitable re-turns, 90c prepaid. Refundable guarantee. Coalaid, Waterloo 4, Iowa.

MIRACLE Arch supports, sell \$3.95. Send shoe size, get sample pair \$1.95. Masten's, Box 702, Winston-Salem, N. C.

EXTRA Money—Quick profits: selling personalized buckles, belts, cap-badges, tie clasps, 2000 emblems, caps, shirts, ties. Write, Hook-Fast Products, Dept. A, Columbus 6, Ohio.

SELL Christmas Cards, stationery, gift wraps. Gold imprinting free. Samples on approval. Carleton, 25a W. 17th, Bayonne, N. J.

AGENTS WANTED

STRANGE "Dry" window cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee, 115, Akron, Ohio.

AGENTS—Wagon jobbers, direct sales-men, choice territories open for house-hold product of merit. Good profit. De-tails free. Plastic Sales, 34-A Davenport, Detroit 1, Mich.

MAKE Money at home like I do! Write immediately. Duffy, Covington, Ky.

\$1 STARTS You in business. Sell De-Luxe ties, 100% wool interlining. Costs you only \$7 per dozen, you make \$5.00 dozen. Send \$1.00 for special introductory offer two DeLuxe ties. Catalog complete line free. Philip's Neckwear, 20 West 22nd St., Dept. K-17, New York 10.

"27" AGENTS—Salesmen wanted! Lib-eral territory allotted. Demonstrate amaz-ing "27 Second" eye glass cleaner. Whirl-wind seller. Year's supply in compact only 59c. 2 for \$1.00. \$40.00 per gross—110% profit. 27 Second Cleaner Co., Dept. 49-P, 6337 N. Talman, Chicago 45.

DISTRIBUTORS—28% To 75% profit selling Reflex spark plugs (guaranteed) to garages, service stations, fleets, along with other lines, steady repeat business. Exclusive territory. Reflex Spark Plug Co., 10902 Madison Ave., Cleveland 2, Ohio.

RADIOS, Plastic specialties, gloves, toys; buy wholesale, sell retail. Big prof-its. Catalogue free. Diverso, 510 Water, Milwaukee, Wis.

AGENTS! Earn up to \$300 a week. Take orders now for Xmas cards from stores. \$15 profit every sale. Free rack, free in-structions, free kit. No investment. Hur-ry. Write. Stores want in November. Castlecraft Cards (Mrs.), Dept. C, 175 Fifth Ave., New York, N. Y.

DISTRIBUTORS Wanted for unusual household products. Levine's, 15-X Boule-vard Station, New York 59, N. Y.

400% PROFIT—Sensationally successful upholstery cleaner. Weber Cleaners, Al-lentown 45, Pennsylvania.

BIG Commissions. Boost income quickly. Sell stores, restaurants, bars. Plastic tickets, shelf moulding, menu covers, signs. Write today. Pricing Press, 124 White St., Dept. P.K., New York 13, N. Y.

FREE Water and our concentrates, makes flavors, lotions, shampoos, 72 products, labels, bottles furnished. Qualco, E-20030 Russell, Detroit.

DIRECT Factory agents for fast-selling, fine commercial popcorn machines. Nationally advertised. Sales leads furnished. Excellent profit. Viking Popcorn Machines, Inc., 114 W. 18th, Kansas City, Mo.

EARN Christmas money taking magazine renewals in spare time. Need no capital. Big commissions. Supplies—helps furnished. Free book tells how. Write today. McGregor Magazine Agency, Dept. PM-4, Mount Morris, Ill.

SILVER Plating liquid. Apply with cloth. Renews silverplated ware. Cleans, silverplates, polishes, one rubbing. Genuine silverplate. Lasting finish by occasionally going over again. Won't wash, boil, brush off. Also silverplates on brass and copper. Female and male selling representatives wanted. Part time or full. Any age, wonderful profits. Exclusive territory. Sells by showing and demonstrating. Retail and wholesale. NuProcess Products, Aurora, Illinois.

MAKE Money fast selling Christmas cards. 75 popular assortments. Big profits. Request \$1.00 Christmas assortment on approval. Free samples 50 for \$1.00 cards. Hedenkamp, 343 Broadway, Dept. N-21, New York.

CHRISTMAS Greeting cards, gift wrappings, personalized papeteries, novelties. Raum, 4154 5th Street, Philadelphia 40.

200% PROFIT Selling beautiful latest design artificial Christmas corsages, guaranteed durable. Samples 3 for \$1.00. Retail for \$1.00 each. Floral Art Studio, 169 William Street, Springfield, Massachusetts.

AGENTS—Stop! Never buy plastic aprons, tablecloths, etc., until you get our new low prices. They're amazing. Riddell Sales Co., 1313-P East 62nd Street, Chicago 37.

AMAZINGLY Quick profits selling new, gorgeous satin, velvet-embossed, gold-trimmed Christmas banners to business firms, homes, etc. Write for details now. Samples \$1.00. Velva-Sheen Mfg. Co., Cincinnati 14, Ohio.

THE Most irresistible gift ever created. Economy Distributing Co., 308A West Superior, Cleveland 13, Ohio.

SELL Ultra blue stock signs to stores, 1000 slogans, comedy, general, religious. 7x11, cost 6c, sells 35c. Make money. Sample free. Lowy, 8 West Broadway, Dept. 345, New York City 7.

CHOOSE Your own future with importing-exporting. Sell, buy abroad; make 1,000% profit. Master world trade principles quickly, easily. Send \$1 for two bulletins supplying addresses of hundreds overseas firms seeking connections. Money refunded if unsatisfied. Benko, 246-P Fifth Ave., New York 1.

AGENTS Make big profits selling sensational new diapers which require no folding. Every new mother a prospect. Rush name for free sample. Fred Dexter and Staff, 234 West 17th, Houston 8, Texas.

SELL Enchanting French perfumes for Christmas and build up all year 'round trade! Pricelist and sample dozen, retailing \$3.00 postpaid \$1.00. Act quick. Reserve territory. Willingmyre, Merchantsville 2, N. J.

EXTRA Money. Send for new plan. Inspirational Books, Box 106 Old Chelsea Station, New York 11, N. Y.

AGENTS—Big money for men, women, boys, girls—selling gorgeous night-glowing orchids, gardenias; perfect imitation real flowers, last for years, all the rage for wear on hair or clothes. Write for wholesale prices. Marney's, Dept. M-7, P.O. Box 581, Ogden, Utah.

NEW Sensational seat covers. Mono. 6545 Santa Monica Blvd., Hollywood 38, Calif.

NEW Moneymaker. Sell amazing aluminum brush pen. Every store prospect. Marx, Ampere 54, New Jersey.

WHITE Shirts, pajamas, nylon slips, liberal commission. Sales kit. Jarod Mfg. Corp., Rockville Centre 4, N. Y.

AMAZING: Fast, easy, money maker. New patent rubber stamp ink. Sells everywhere. Big profits. Hudson, 934K Lakeside, Chicago.

SELL Xmas signs. Send \$1.00 for 10 samples. Sample money refunded if not satisfied. Deduct your \$1.00 from first order. Novelty Sign Co., 133 Thatford Ave., Brooklyn 12, N. Y.

SELL Jewelry. Dollar brings samples. Guaranteed value, \$4.00. George Sassen, 154 Nassau Street, New York 7.

AGENTS. Sell finest food products direct to homes. Successfully sold for 25 years. Big profits. Powerful combination sale plans make sales easy. Permanent repeat business. Samples furnished. Live territories open to distributors. Mother Hubbard Products Co., 4139 Grand, Dept. P.M., Chicago.

WE Pay you \$25 for selling 50 boxes Xmas cards, 21 for \$1. Also 50 and 25 for \$1. Costs nothing to try, samples free. Victory Studios, Mt. Vernon, N. Y.

AGENTS—Make big money from now on, selling the sensational new low priced transparent plastic table cloth cover. Saves on laundry bills. Every woman a prospect. Sample swatches free. Carwell Products, 330DZ South Wells, Chicago 6.

SELL "Glass-Sure-Shine." Retail 50c. Your price 25c, postpaid. Tested and proven repeater. Cash profits daily! Paragon Products (Manufacturer), P.O. Box 142, Oil City 2, Penna.

CHRISTMAS Cards. Earn \$5.00 with every ten 21 card \$1.00 boxes you sell. Also new plastic cards, wrappings, imprint cards. Write for samples today. Howard P. Ellis, Dept. PM-12, Pitman, N. J.

MARVEL Wax, world's fastest 25c seller, agents profit 150%. Write Marvel Belt Wax Co., Batavia, N. Y.

A NATURAL! Big money, selling new line one piece, lace plastic tablecloths! Sizes to 54x108. Also women's aprons; novel, embroidered cotton pillow cases. Free, "interesting details." Royalty, Box 748-K, Passaic, N. J.

AGENTS Make big money selling the "Sure Heat" oil conversion burner units. Converts wood or coal cook stoves, heaters, brooder houses, small steam boilers, syrup mills, potato curing houses, tobacco barns, most any type of furnace from wood and coal to a cheap grade of fuel oil. Clean, economical, cheap, safe. Immediate delivery. Write for descriptive literature and prices. Standard Manufacturing Co., P.O. Box 427, Wallace, N. C.

FOOT-MASTER Tablets. Amazing seller to those afflicted with foot trouble. Proven seller 45 years. Good profit. Repeats fast. Write Master Products Co., 6 East Oak Avenue, Moorestown, New Jersey.

BIG Money for Xmas. Sell beautiful plastic lace table covers, raincoats. Twenty other terrific gift items. Free swatches. Star, 261 Fifth Avenue, New York.

HOUSE-TO-HOUSE Salesmen. make 85c on the dollar. 25c for sample. Austin Mail Service, 5538 Lexington, Chicago 44, Illinois.

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JUST Take orders. We deliver. "Gadgets," 210 5th Ave., New York City.

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SELL Handkerchiefs. Xmas boxed and bulk. Stanchief, 491 Broadway, New York 12, N. Y.

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SELL Personalized gifts. Hildebrands, 4554 North Uber Street, Philadelphia 40, Penna.

AGENTS: All ages, earn \$30 to \$50 weekly selling for yourself, fibre brooms, mops, and floor dusters, start now. Write Burtz Fibre Broom Co., Columbia, Penna., Dept. A.

\$1.00 INVESTED Brings \$29.00. Nothing else to buy. In great demand. Write for details. Kohen, 506 W. 45th, Chicago 9.

AGENTS—Big line including food products. Fast selling premium and bargain deals. Low prices. Send card for big outfit offer with gift. Ho-Ro-Co, 2725 Dodier, St. Louis 7, Mo.

AMAZING New Glow in the dark house numbers, switch plates, decals, pictures, religious articles, etc. Factory representative wanted. Wonderful opportunity. Free samples. Madison Mills, 303 Fourth Avenue, New York, N. Y.

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PROFITS To 100%, selling Xmas and everyday greeting card assortments. Details and assortment on approval. Glorian, (Dept. 10) 515 East 45th St., Brooklyn 3, N. Y.

MAKE UP to \$50 a week in spare time selling greatly in demand oil burners for kitchen stoves. Oil Burner Supply, Box 327, Cambridge, Mass.

SCHOOL Seniors! Your postal will bring our wonder, Kwick-Sell Cardalog of popular graduation name cards. Biggest profits! Only firm giving free souvenir chest and card case. Don't miss out! Hurry that postal! Craftcards, Box 235(L), Pittsburgh 30, Pennsylvania.

SCHOOL Seniors: Sell classmates superb Craftcards for super profits. Write Craftcards, Box 235(AK), Pittsburgh 30, Pennsylvania.

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BIG Bargains for big profits. Over 100 sensational values. Men's used suits \$2.00, pants 35c, topcoats \$1.25, overcoats \$2.00, shoes 20c. Experience unnecessary. Free wholesale catalog. Superior, 1250-B Jefferson, Chicago 7.

GREETING Card agents, "line up" with "Pines" for bigger, better, quicker profits. Rush name, address on postcard today. Box 32, Flushing 5, New York.

AGENTS: Stamping names on pocket-protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

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AGENTS—300 % Profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

GOLD Lacquered window sign letters. Large sizes penny each. New foils. Absolutely beautiful. Free samples. Atlas, 544 W. 79th, Chicago 20.

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START Your own business on our capital. Always your own boss. Hundreds average \$6,000 to \$25,000 annual sales. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh's, Dept. K-U-PPM, Freeport, Ill.

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PLASTIC Tablecloths, aprons, new nationally advertised fast selling Firestone Velon kitchen ensemble. K & D Products Co., Room 104-A, 4955 Delmar, St. Louis 8, Mo.

AUTOMATIC Fire extinguishers. Red Ball Co., Box 1552, Salt Lake City, Utah.

SALESMEN Wanted by factory for original keyhole light. Handled by all stores. Buyers Products Co., 18994 Fairfield, Detroit 21, Mich.

ADVERTISING Deals. key cases and specialties. 25% commission. Catalog, samples free. Adv. Novelty Service, Dept. PM, Kenhorst, Reading, Penna.

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FOR Rugs, nylons, plastic garments, cleaners, household specialties. Consumers Products, Tiffin, Ohio.

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POCKET Pal: The all-purpose cutting tool, wagon jobbers, salesmen. Sell to retailers and jobbers. 50c seller. Steady repeat item. Exceptional profit. Sample 25c. Nelson Manufacturing Company, 222 W. Kellogg, St. Paul 2, Minnesota.

AMAZING Profits selling personal initialed individualized buckles, belts, cap badges, tie holders, flexible cap bands, 2000 emblems to choose from. Repeats. Write today special outfit offer. Hook-Fast Company, Box 480-PM, Roanoke, Virginia.

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NATIONAL School of foot correction. Extension. Box 2894, Juneau, Alaska.

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INVESTIGATOR Training, Phillips Secret Service, 1917B North Kenneth, Chicago 39, Ill.

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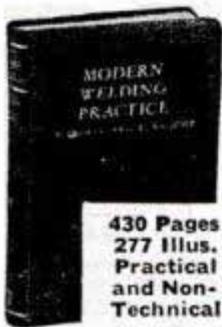
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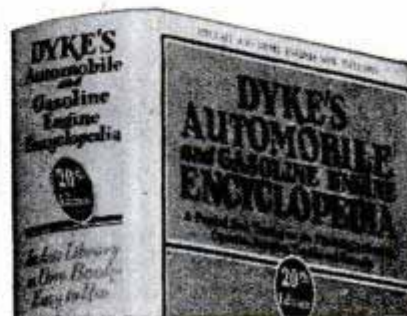
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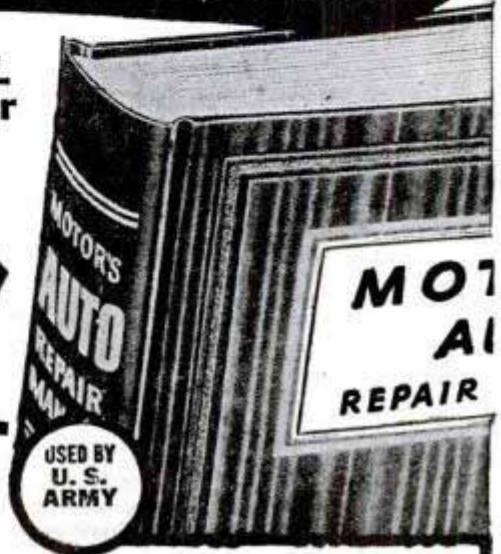
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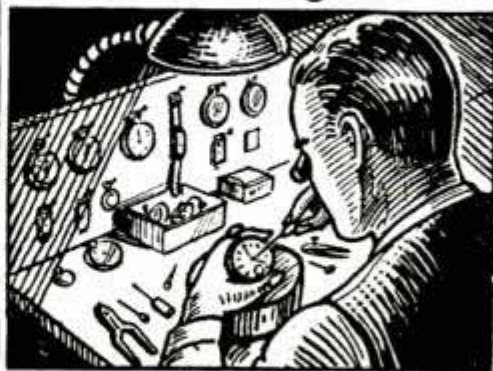
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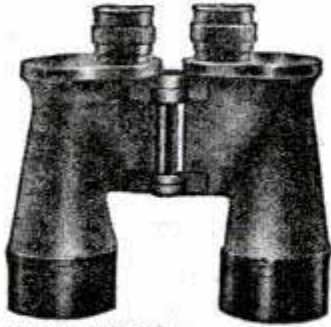
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OPTICS—Set includes all Lenses and Prisms you need for assembling 7X 50 Binoculars. These are in excellent condition—perfect or near-perfect—and have new low reflection coating.

Stock #5102-H.....\$25.00 Postpaid

NOTICE! If you buy both Binocular Optics and Binocular Metal Parts, add 20% Federal Excise Tax to above prices.

ARMY'S 6X 30 BINOCULARS

No Carrying Case with any Sets shown below. (None yet available in Surplus Market.) M-13A1 sets are waterproof model. M-3 sets are not waterproof. Limit—1 Set to a Customer on all Sets shown below.

COMPLETE OPTICS & METAL PARTS—Model M-13A1, 6X 30 Binoculars. Everything you need—ready for assembly. When finished will look like a regular factory job costing \$102 to \$120. The Optics are new, in perfect or near-perfect condition. Have new low reflection coating. Metal Parts are new and perfect, all completely finished. No machining required. Bodies factory hinged and covered. Complete assembly instructions included.

Stock #830-H.....\$40.00 Postpaid plus \$8.00 tax—Total—\$48.00

COMPLETE OPTICS & METAL PARTS—Model M-3, 6X 30 Binoculars. The Optics in this set are new, perfect or near-perfect. Prisms have new low reflection coating. Factory mounted Eye Piece and Objective Assemblies not coated. Metal Parts are perfect, new, ready for assembly. When finished, this will look like a regular factory job, except a name has been filed off a cover plate. No machining required. Bodies factory hinged and covered.

Stock #831-H.....\$35.00 Postpaid, plus \$7.00 Tax—Total—\$42.00

METAL PARTS ONLY—Model M-13A1, 6X 30 Binoculars. No Optics. Same Metal Parts as described for Stock #830-H.

Stock #832-H 6X 30 Metal Parts.....\$25.00 Postpaid

OPTICS FOR 6X 30 BINOCULARS (No Metal Parts). Perfect, and low reflection coated.

Stock #5130-H.....\$15.00 Postpaid

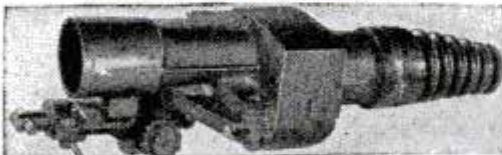
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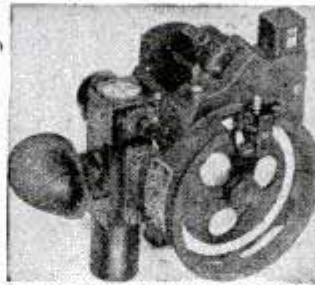
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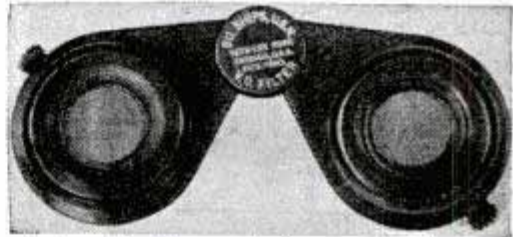
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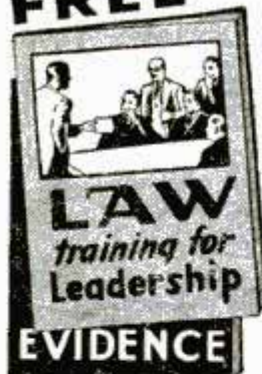
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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946, of Popular Mechanics Magazine, published monthly at Chicago, Illinois, for October 1, 1947.

State of Illinois, County of Cook, ss.
Before me, a Notary Public in and for the State and county aforesaid, personally appeared H. H. Windsor, Jr., who, having been duly sworn according to law, deposes and says that he is the Editor of the Popular Mechanics Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management and if a daily, weekly, semiweekly or triweekly newspaper, the circulation, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), printed on the reverse of this form, to wit: First. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Popular Mechanics Company, 200 E. Ontario St., Chicago, Ill.; Editor, H. H. Windsor, Jr., 200 E. Ontario St., Chicago, Ill.; Managing Editor, R. M. Grant, 200 E. Ontario St., Chicago, Ill.; Business Manager, J. H. Dunlap, 200 E. Ontario St., Chicago, Ill. Second. That the owner is: (If owned by a corporation its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Popular Mechanics Company, 200 E. Ontario St., Chicago, Ill., H. H. Windsor, Jr., 200 E. Ontario St., Chicago, Ill., H. H. Windsor, Jr., Trustee for H. H. Windsor III and Wm. T. Windsor, 200 E. Ontario St., Chicago, Ill. Third. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) The Equitable Life Assurance Society of the United States, 29 S. LaSalle St., Chicago, Ill. Fourth. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. Fifth. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is (not daily publication). (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.) H. H. Windsor, Jr., Editor. Sworn to and subscribed before me this 19th day of September, 1947. N. E. Toole, Notary Public. (My commission expires March 23, 1948.)



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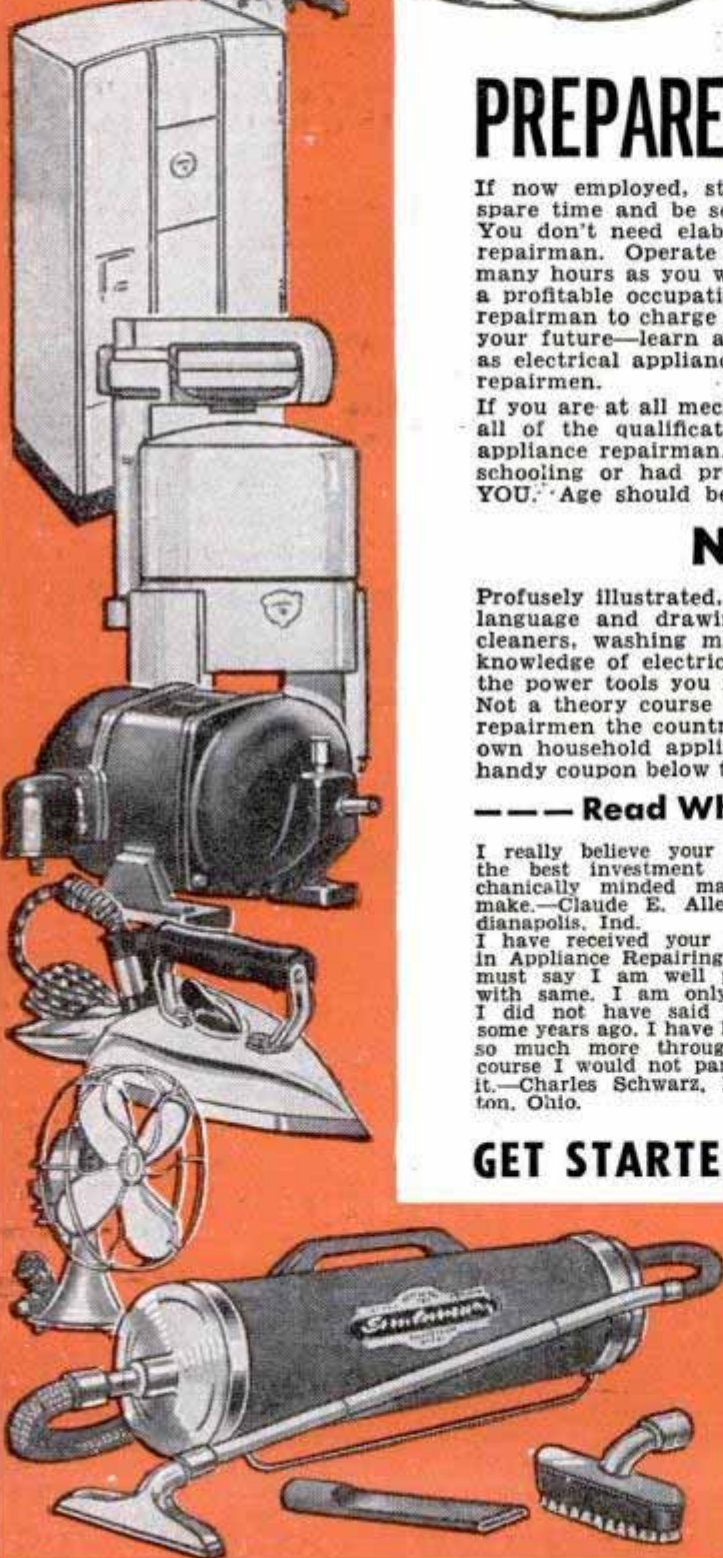
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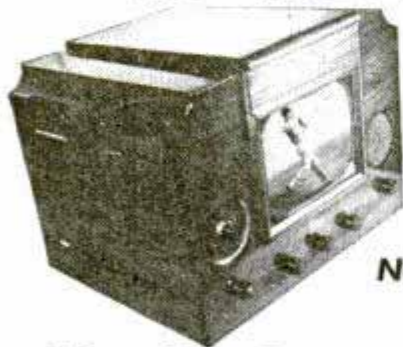
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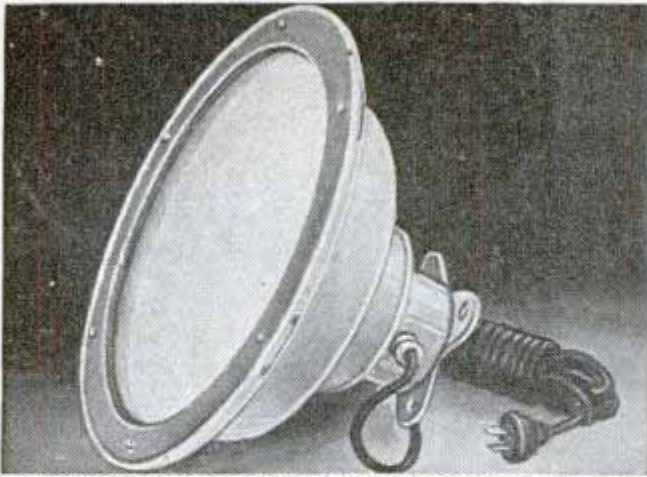
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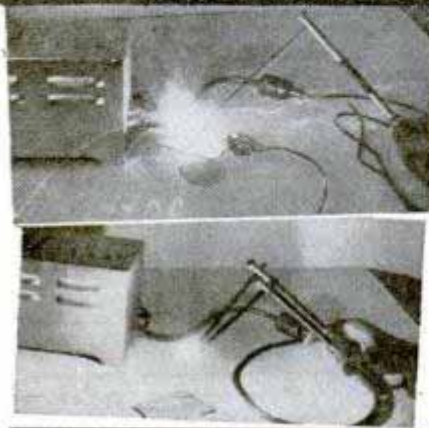
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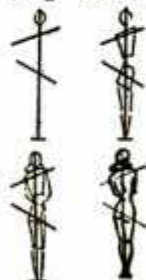
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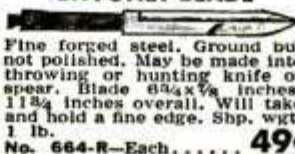
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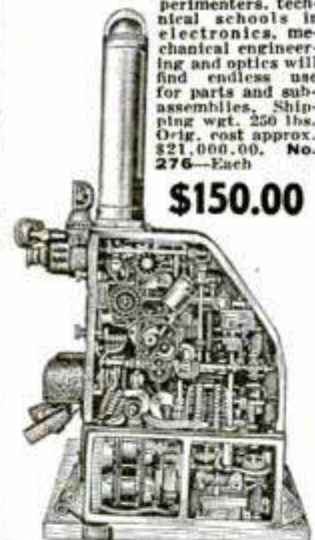
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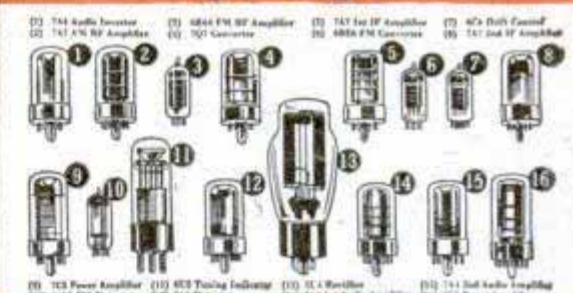
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VOL. 88 NO. 5

The Guns Still Roar AT ABERDEEN



U. S. Army Signal Corps photo

The Army's new tank transporter (also pictured in the cover painting) has an engine at either end

STARTLED Philadelphians along Broad Street recently stared in wonder at a giant olive-drab vehicle that rolled by while patrol cars chased traffic to side streets. The steel giant—all of 60 feet long and under Army escort—seemed to have two “heads.” Engine cabs mounted on four huge rubber-tired wheels were at either end and suspended between these cabs was a low carrier deck.

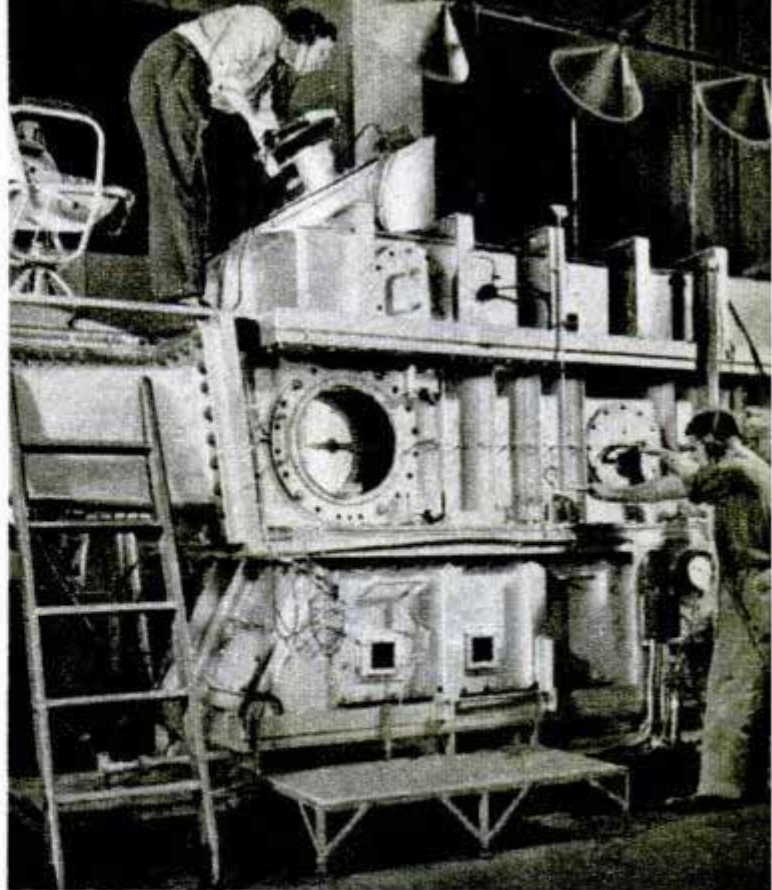
The vehicle, known to Army Ordnance as the T8 tank transporter, was on its way from a manufacturing plant at Allentown, Pa., to Aberdeen Proving Ground at the top of Chesapeake Bay in Maryland. It is designed to transport tanks across country and to maneuver sharp turns in narrow city streets. Atop each cab is an anti-aircraft gun mount. The crews in either cab com-

municate by using the interphone system.

If the amazed onlookers along the route of the tank transporter could have followed it all the way to Aberdeen their wonder and respect for the Army's Ordnance Department in time of peace would have been increased a hundredfold. The new tank carrier is only one of scores of developments that have moved ahead at a swift pace since the end of World War II. For at Aberdeen Proving Ground, largest military installation of its kind, the big guns still roar and some of the best scientific brains are working night and day.

“The nation learned a lesson during World War II,” said an officer at Aberdeen, “that any inventor knows. The development of new and better tools, whether for war or peace, is a continuing process. You

By Wayne Whittaker



A large array of switches (left) control compressors and 24 valves of \$2,000,000 supersonic wind tunnel at Aberdeen. Engineers at right are adjusting test missile in the model-working section of the big tunnel

can't go to sleep on the job and then when faced with an emergency produce overnight a better rocket or recoilless rifle than the other fellow. Much that is going on here today will be obsolete in a short time, but that is the only way we can keep abreast of modern military improvements vital to our welfare."

Some indication of the War Department's regard for the work being carried on at Aberdeen today is evidenced by the difficulty in obtaining a pass to the industrial area of the proving ground. Special passes into this area, where new tools of war are being tested and much research conducted, must be cleared by the Office of the Chief of Ordnance in Washington.

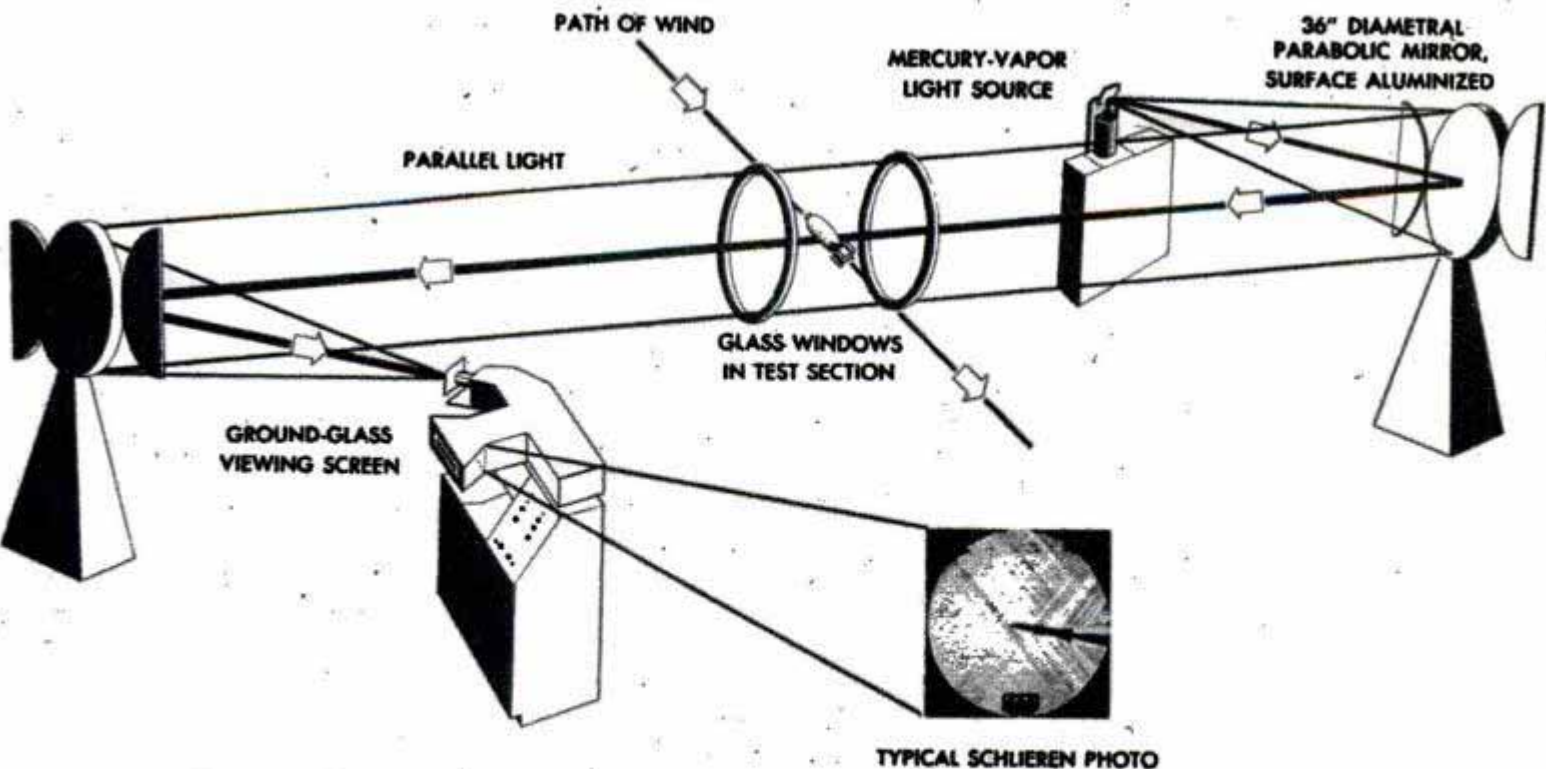
A visitor to peacetime Aberdeen gets a false impression of the place during the first few miles after entering the grounds. These grounds, incidentally, cover 74,000 acres of land and water and the big guns in permanent mounts at the head of the bay can shoot over more than 20 miles of water within the reservation. Military personnel has been reduced from 21,000 during war-time to less than 2500, and empty barracks and abandoned buildings of all types line the roads. Even Aberdeen's own railroad, about 45 miles of track known as the "Shuttle" or the "Back and Forth," seems semi-deserted.

A different picture greets the visitor at A. P. G. Headquarters in the offices surrounding those of Brig. Gen. A. B. Quin-

ton, commander of the proving ground. The general explains that although thousands of men are trained in the ordnance school at Aberdeen in time of war the basic personnel of the ground is civilian experts—engineers, scientists, mechanics and others. An outstanding exception is Colonel Leslie E. Simon, graduate of West Point and Massachusetts Institute of Technology, who is director of the Ballistic Research Laboratories and one of the top men in his field in the world; other exceptions are Colonel W. E. Becker, director of Development and Proof Services, and a veteran of the North African and Pacific campaigns, and Colonel R. K. Haskell, command officer of the Ordnance School which sends officers and enlisted men into the field with a special knowledge of ammunition, artillery, fire control, and the maintenance of all motorized equipment.

During the early part of World War II all transport vehicles were under the Quartermaster. In 1942 automotive vehicles were transferred to ordnance, part of a general move to make the army more close-knit and streamlined.

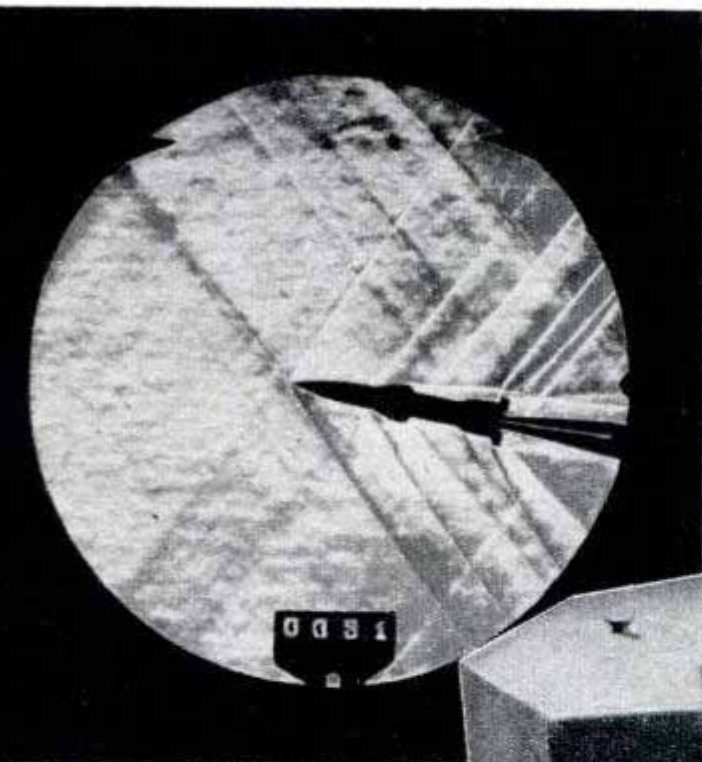
"This program of modernizing the Army did not stop with the end of the war," explains C. F. Waters, director of the automotive division. "One thing we learned was that the Germans were far ahead of us in standardizing their motorized equipment. Right now one of our big goals here is the standardization of engines for all



TYPICAL SCHLIEREN PHOTO

WIND TUNNEL SCHLIEREN SYSTEM

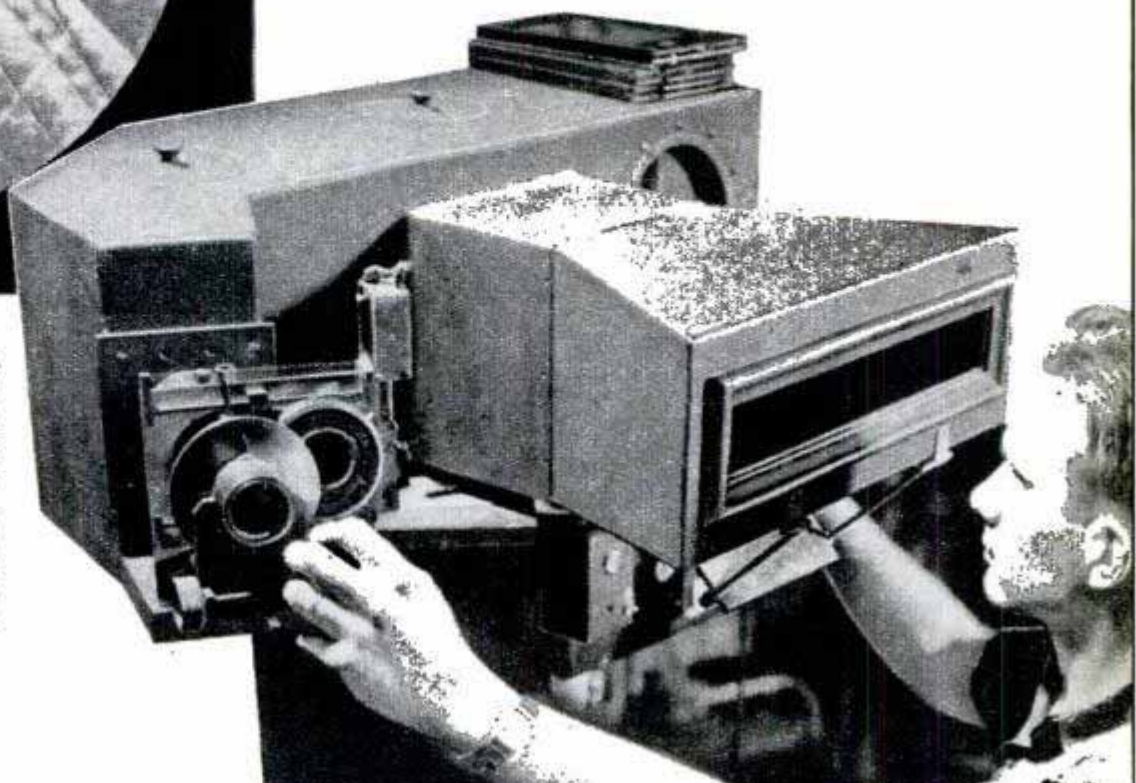
Want a photograph of the wind? The amazing Schlieren camera shows how supersonic missiles "shatter" air



types of military vehicles. The advantage of this can be readily seen; in the field, tank engines could be repaired with truck engine parts, and vice versa. This standardization could be extended beyond the engines to a score of other automotive parts. Tires are another example."

The experts at Aberdeen are more concerned with practical weapons now in a state of near-perfection than they are with talk about atomic missiles of the future. The most exciting weapons which can be

The photo above is what you see when you look at viewing screen of the Schlieren camera (right). As in an ordinary camera, the flick of a switch takes the picture. This camera used in conjunction with the wind tunnel saves thousands of dollars by revealing defects in models at an early stage in development





The 57-mm. recoilless rifle (above) and heavier 75-mm. (below) give the infantry the potent firepower of an artillery unit



Below, new superheavy tank weighs 95 tons and mounts 105-mm. high-velocity gun; it has 12-in. armor in front

talked about at Aberdeen are the recoilless rifles—57-mm. and 75-mm. This type of rifle, according to Captain C. V. Gandy of the arms and ammunition division, will create as great an effect on the conduct of warfare as the invention of gunpowder. These powerful recoilless weapons give the all-important infantry the striking force of an artillery unit.

The recoilless rifle was tested briefly in combat toward the end of the war with highly satisfactory results. The shoulder-fired 57 resembles the bazooka in appearance, but is not to be confused with rocket weapons, the projectiles of which carry their own propellants. In the recoilless rifle only the shell goes through the air. Its ammunition is easily recognized by the perforations in the cartridge case which permit the hot propellant gases to escape to the rear through a breech provided with escape vents. More potent than the shoulder-fired 57 is the 75-mm. portable recoilless rifle, which is mounted and fired from a machine-gun tripod. The 75 fires a 14-pound projectile approximately 7200 yards with the speed and accuracy of a rifle bullet. It weighs only 105 pounds compared with 1200 pounds for the pack howitzer, smallest of the 75-mm. artillery pieces. This rifle can be carried into action by four men and fired from terrain which is inaccessible to conventional artillery.

Despite the general tendency, obvious in equipment being tested at Aberdeen, to decrease weight for greater mobility, there is one department where there is no substitute for tons of thick armor. Tank experts

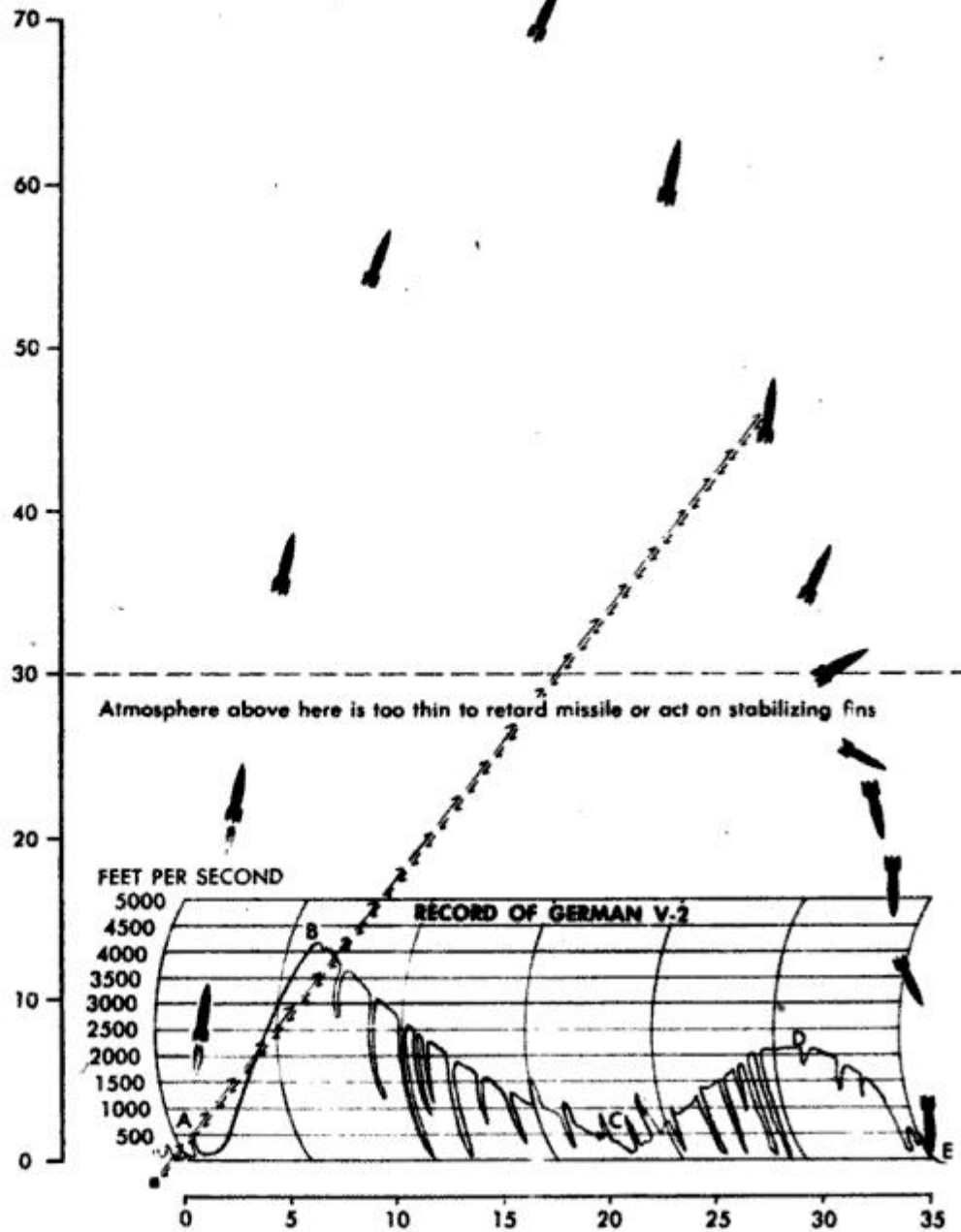


Graphic record at right shows flight of big V-2 rocket which rises to height of 70 miles in air. Points A, B, C, D and E show variations of speed during six-minute flight. Figures at bottom show the range scale in miles

have developed the Army Ordnance Department's heaviest tank—the 95-ton T28. This low-slung behemoth has 12-inch armor across the front. Instead of a turret mounting, as in conventional tanks, a new 105-mm. high-velocity tank gun is in a gimbal-type mount near the front and has but limited traverse. This mounting reduces silhouette, an extremely important factor. Another new feature of the tank is dual tracks and suspensions, the outer tracks being removable. This provides greater mobility over rough terrain for such a heavy vehicle and still permits movement by train and across narrow bridges. The tracks can be replaced by four men in two hours.

The development of the tank transporter was inspired by the difficulty in getting tank transporters around corners in the narrow streets of European cities. It was frequently necessary to knock down part of a building to move tanks to the front. The transporter, which created something of a sensation on its maiden trip from the Mack Manufacturing Company plant to Aberdeen, must be steered from both ends and has enough power from either of its two engines to roll along at 30 miles per hour. The cargo deck, suspended between the power units, can be lowered to the ground at the rear end to permit loading of vehicles. Each engine is supplied with fuel from individual 100-gallon gasoline tanks and the T8's cruising range is about 150 miles.

Another machine which would startle motorists if it ever ventured on a cross-



HOW TO MEASURE PATH OF A LONG-RANGE MISSILE BY RADIO

A radio doppler station, located two miles behind the launching site broadcasts a frequency of 38.5 million cycles per second. A station in the missile receives the signal; doubles it and rebroadcasts at 77 million cycles. The doppler station receives the missile's signal, and beats it against the first harmonic of its own signal. The beat difference is the doppler frequency; and each doppler beat means a change of radio path of one wave length, or about 6.4 feet, from which the change in position of the missile can be inferred. Thus, from the sum of the beats one determines the length of path; from the beat frequency, the velocity; and from the slant of the frequency curve, one determines the acceleration. For precise work, three such stations are used, the results recorded photographically, and reductions made accurately by special machines. This is the most precise system the world has known for getting exact ballistic data and was developed by Army Ordnance

country trip is the disk-type mine exploder. It consists of two sets of five 96-inch disks which are pushed over mined areas to detonate the mines with its weight of 4600 pounds. These exploders can operate in 18 inches of mud and across broken terrain. They clear a path 33¾ inches wide in front of each track.



Mine exploder pushed by tank clears path 33 $\frac{3}{4}$ inches wide before each disk section. Disks weigh 4600 lbs.

Man at right and 500-lb. bomb, left, are dwarfed by 42,000-lb. super-bomb developed by Army Ordnance



On a tour through the proving ground one sees the "hog wallow" where mud tests are conducted on all types of equipment. Aberdeen has facilities for tests on every type of terrain known to man. There are smooth strips of concrete, coarse and fine gravel roads, rough Belgian block pavements, several varieties of "corduroy" concrete, a snake-like frame-twisting course which pulls the frame of a vehicle four different ways at the same time, a climbing course with hills rising at 10-percent increases from a gentle 20-percent angle to a sharp 60 percent, and sharp curves and inclines of all types. Over this course are tested all the tanks, trucks, jeeps, gun transporters and everything built for the Army that moves on wheels. After a test, the experts know exactly how much a vehicle can or cannot take—vital information either to an engineer bent on improving the vehicle or a general planning a tactical move in the field.

Along the miles of roads through Aberdeen Proving Ground is a virtual "world's fair" of military equipment, past and present. A vast outdoor museum contains almost every type of tank, truck and gun of every nation from World War I to the present time. These range from the lofty and antiquated-looking early British tanks of 1918 to the pink-camouflaged tanks used by the Nazis in the African desert during World War II. Another more formal museum, this one boasting four walls and a roof, is devoted entirely to equipment used in World War II. This collection, the only one of its kind in the world, is the pride of the Ordnance Department. Here are all the Jap tanks and guns, German (47-ton Panther, 60-ton Tiger and 75-ton King Tiger), and Russian tanks carefully cut away to reveal equipment inside, the Nazi V-1 and the deadly V-2 rockets.

Farther along the road one passes what seem like miles of artillery pieces carefully protected from the elements with special preservatives; some of the guns are "canned" in experimental aluminum containers. Maintenance crews work over this equipment constantly; even the

(Continued to page 252)



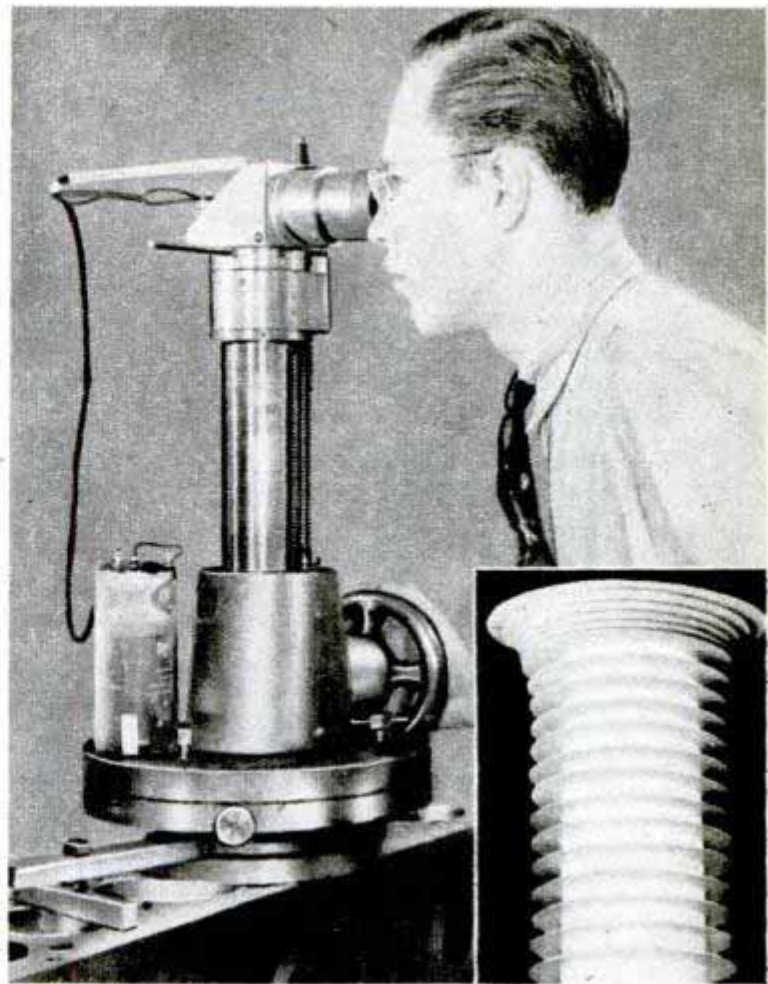
Sight Corrects Archer's Faults

Adding a further mechanical twist to an ancient sport, G. T. Bradley of Los Angeles has developed an adjustable bow sight that corrects common archery faults and simplifies shooting technique. Bradley's sight is light in weight, with front and rear sighting elements that assure proper alignment of the arrow. Length of draw is controlled by a check mirror which reflects the arrow tip directly on the line of vision. There is a graduated dial which allows the archer to correct for windage variations, and a single rear-aperture lens. It has dual prismatic lenses, calibrated for elevation and windage, which are separately adjustable. The sight can be used by either right or left-hand archers. With the sight, Bradley doubled his score in six months.

Mobile Bandstand

With the help of a large lift truck, a Shrine band from Cleveland provides its own mobile bandstand for parades. A platform was built on the truck's lift and a canvas canopy erected over the platform. Band members ride on the mobile bandstand while one man drives the truck.

Every day new products for homes and workshops, farms and factories, are appearing on the nation's markets, and every month you'll find them described in *Popular Mechanics*. For additional information about the products featured in this issue, write to Bureau of Information, *Popular Mechanics Magazine*, 200 E. Ontario St., Chicago 11, Ill.



Cylinder Gauge Checks Contour

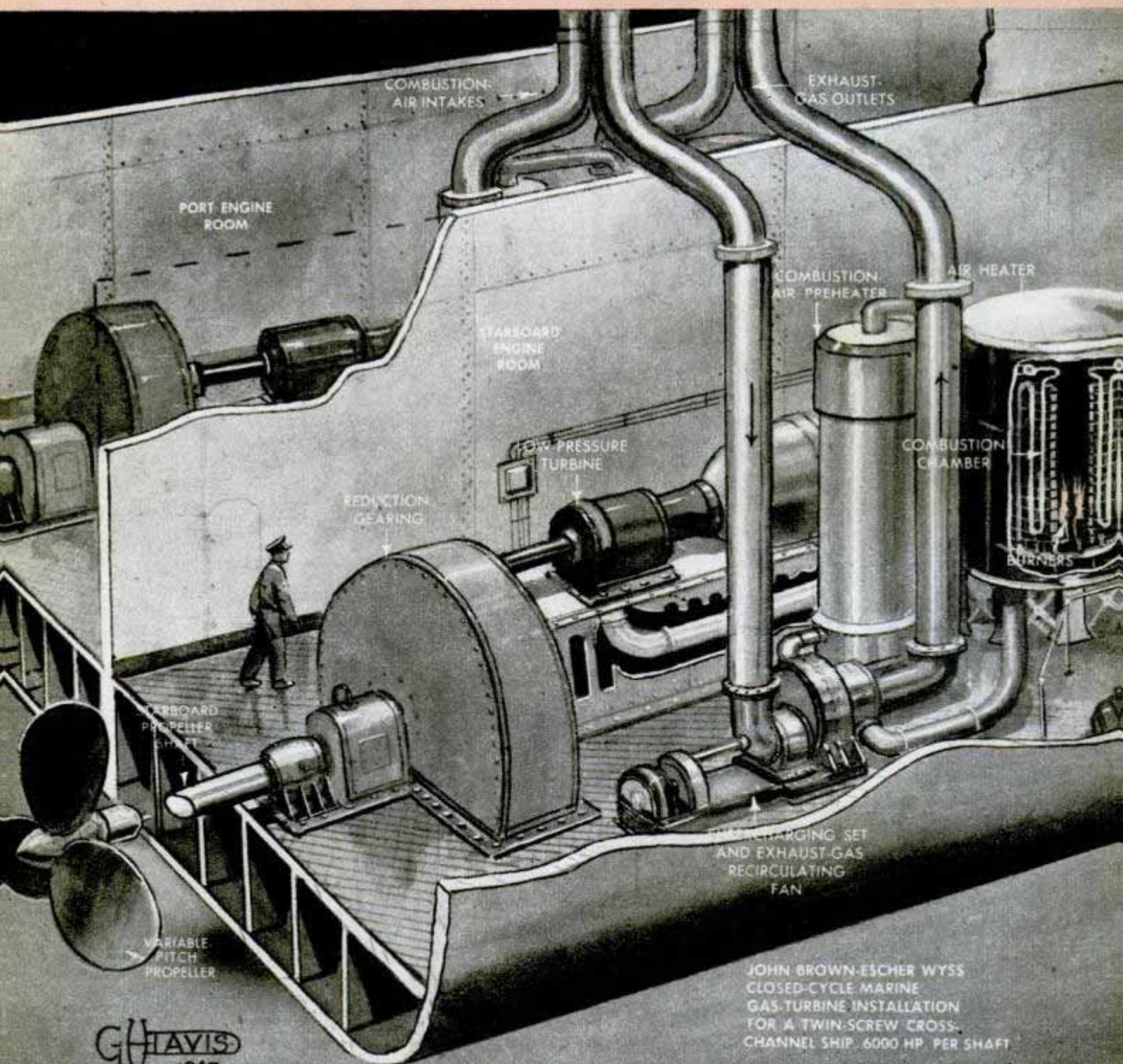
Cylinder wear and distortion are measured by a contour gauge which makes radial instead of diametric measurements. The measurements are reproduced in scale models and for easy visualization, the deviations from the original cylinder diameter are magnified 300 times.



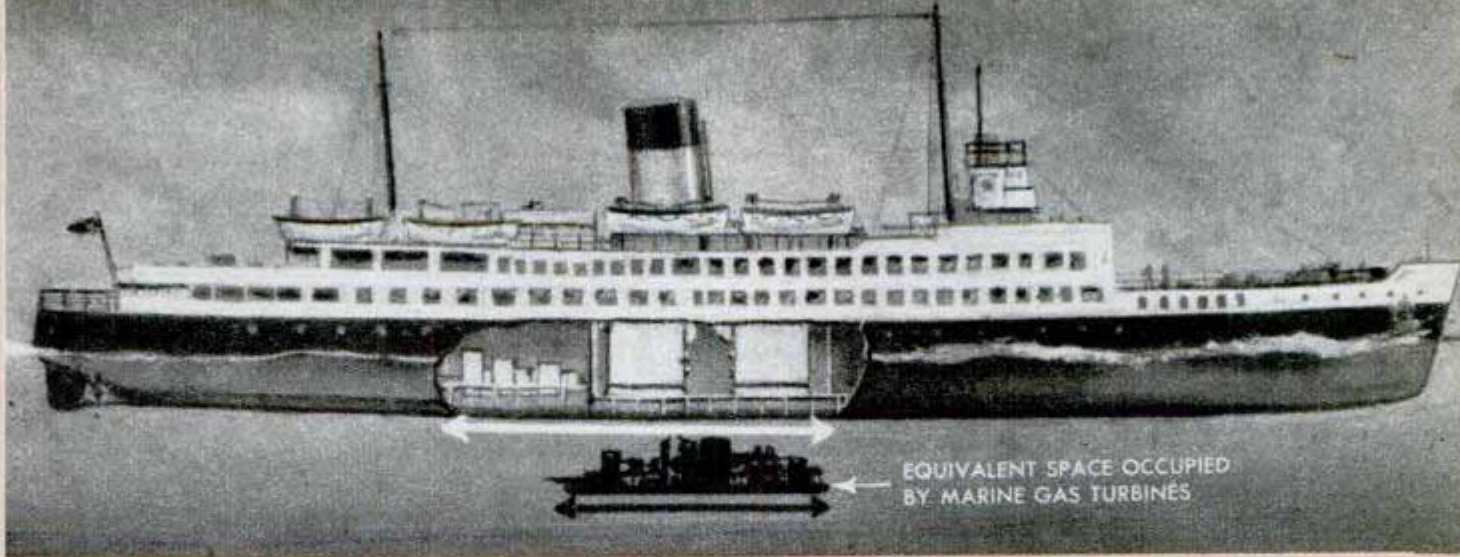
GAS-TURBINE FERRY FOR THE ENGLISH CHANNEL

PASSENGERS BOUND for France from England soon will be ferried across the channel on a ship powered by a closed-cycle gas turbine. Because of its relatively high efficiency the turbine-type power plant is expected to compete economically with older types of marine propulsion. The ferry will have two 6000-shaft-horsepower turbines burning a heavy grade of fuel oil. The closed-cycle type is particularly suitable for large engines and the two now under construction may be followed by others generating 50,000 shaft-horsepower. To start the cycle of the turbine, compressed

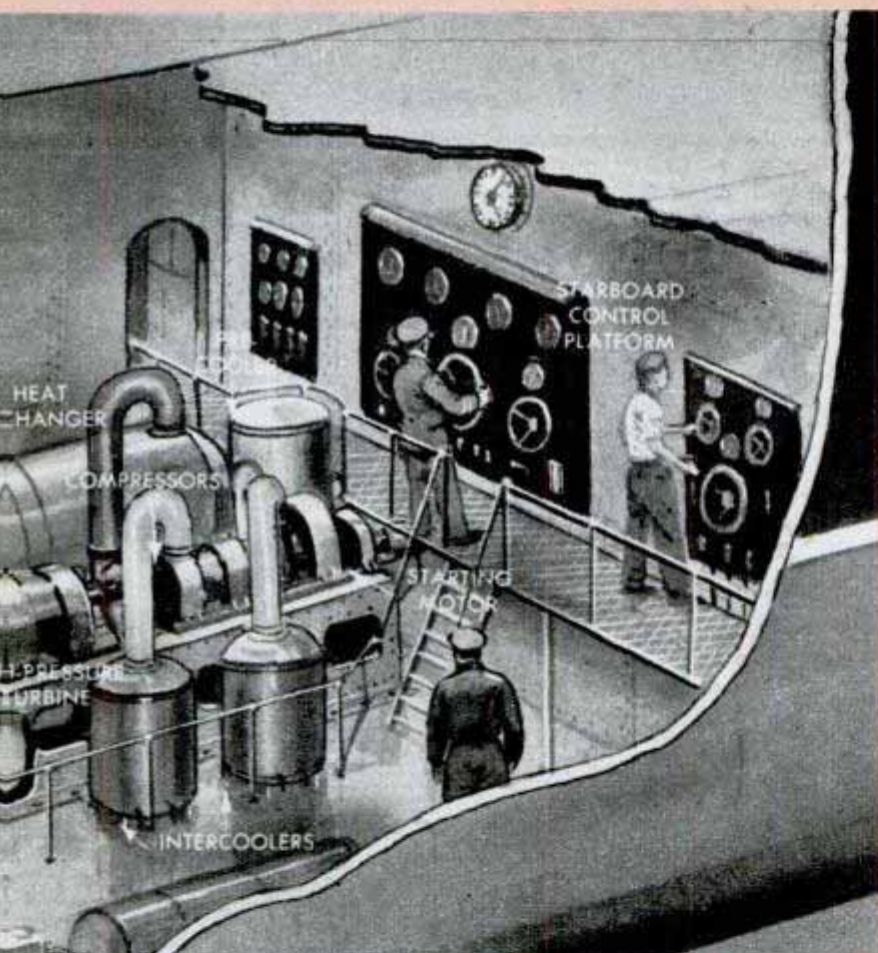
air enters an air heater where it passes through closed coils, emerging at a temperature of 1200 degrees Fahrenheit. It then drives a high-pressure turbine and the exhaust air is carried off to a low-pressure turbine. This turbine in turn powers a variable-pitch propeller through reduction gears. Exhaust from the low-pressure turbine passes through a heat exchanger, where it raises the temperature of more compressed air about to enter the turbine. In the pre-cooler the temperature is lowered by sea water. The air then enters the compressors where the pressure is raised



JOHN BROWN-ESCHER WYSS
CLOSED-CYCLE MARINE
GAS-TURBINE INSTALLATION
FOR A TWIN-SCREW CROSS-
CHANNEL SHIP. 6000 HP PER SHAFT

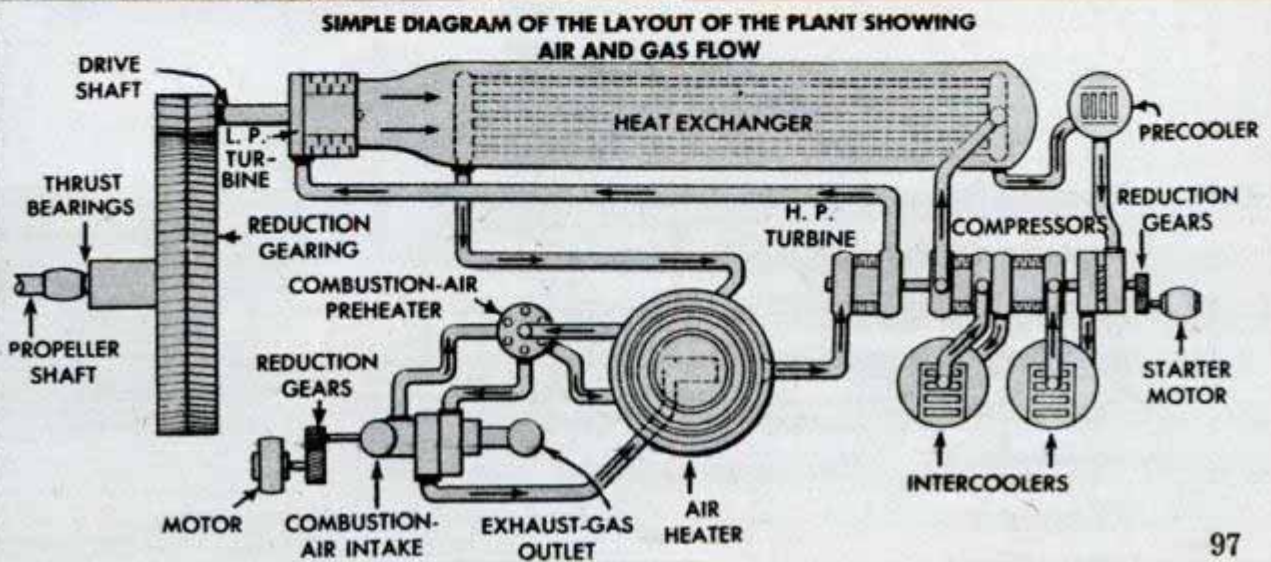


Long arrow shows the size of the engine room of a conventional cross-channel steamer fitted with a standard steam engine. Below it is shown the space required for a closed-cycle gas turbine of equivalent power



from 90 to 340 pounds per square inch. It passes through the heat exchanger again, this time in fine tubes, and enters the air heater to complete the cycle. As a result of the fine tubing throughout the engine, the closed-cycle turbine uses only pure air, unpolluted by combustion gases, preventing the parts from being fouled by deposits of ash and soot. The ferry in which the turbines are installed will be equipped with variable-pitch propellers eliminating the need for reversing gears. According to estimates, the efficiency of the completed engine will be about 31 percent but will vary depending on the quality of the fuel oil. The engine, operating at a maximum temperature of 1200 degrees Fahrenheit, will have an estimated life of 100,000 hours.

↓ Diagram shows the major parts of the gas turbine. Trace the path of the air after it enters the air heater to the completion of a full cycle of the turbine's operation





A.F.P. photo

Windshield Protects Cyclist

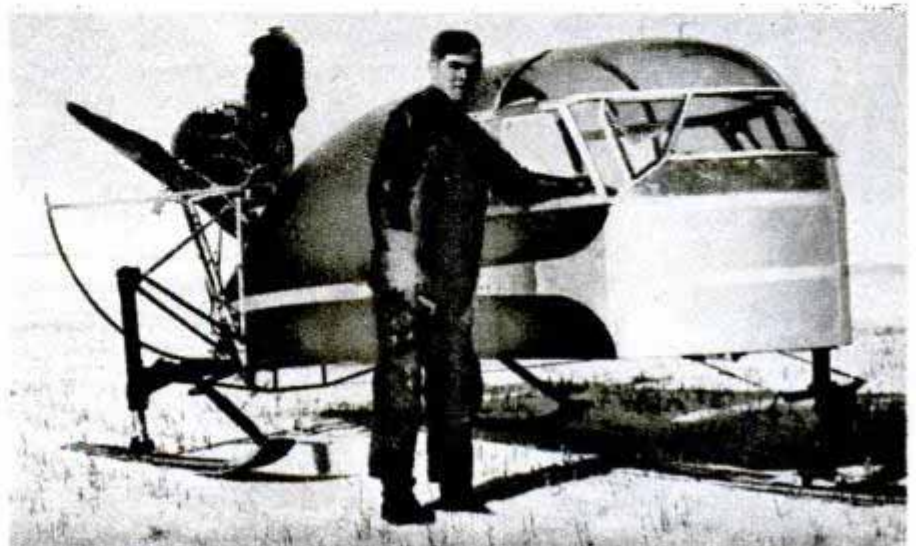
Cyclists are protected from the rain by a combination wind-breaker and umbrella that attaches in front of the handle bars. Designed in Italy, the plaid shield is complete with windows for good visibility. The transportation shortage in that country makes bicycle-riding a necessity and this new item of rainwear protects madame's clothes as she pedals to and from the office.

Stainless-Steel Salvage

Chemical recovery of valuable nickel and chromium alloys increases the value of stainless-steel scrap such as waste lathe turnings. In small machine shops, where stainless is made into a variety of articles, the stainless scrap is usually mixed with ordinary carbon steel, lessening its value. In a process developed by Virginia Polytechnic Institute, the stainless scrap is dissolved in a hydrochloric-acid solution. The addition of other chemicals separates the nickel and chromium from the iron.

Snowplane for Two Travels 30 M.P.H.

Transportation across the snow and ice of Canadian prairies is no problem for Richard Sunter of Beechy, Saskatchewan, who built a snowplane from salvaged and homemade parts. The skis and propeller of the streamlined vehicle are made of laminated wood. A single ski on the front is used for steering and two other runners support the rear end. The cockpit is glass-enclosed for all-around vision. A direct-drive model A motor at the rear powers the vehicle at speeds up to 30 miles an hour. In order to save weight, Sunter uses a motorcycle battery with a special control on the generator.



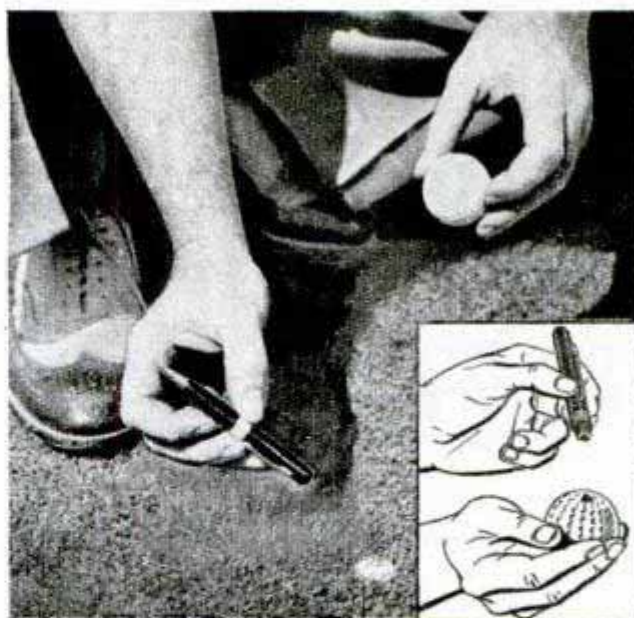
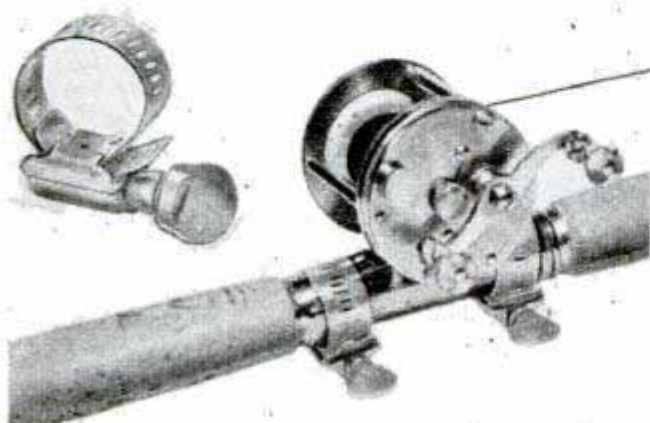


High-Speed Drill Converter

Standard drill presses can be converted into high-speed drills by adding a self-contained electric drill which fits any chuck of $\frac{3}{8}$ -inch capacity, or larger. The tool supplies its own power— $\frac{1}{18}$ horsepower—and 17,000 revolutions per minute for drills up to $\frac{1}{8}$ -inch diameter. The drill also will fit the chuck of any standard lathe, milling machine or specially designed machine and fixture. It provides a quick method of setting up for small production drilling jobs at minimum cost.

Nonslip Clamp for Reels

Reels are held securely on fishing rods by a nonslip clamp which is tightened with a thumbscrew. A "worm" that engages slots in the band of the clamp prevents the reel from wobbling or slipping.



Talc Pencil Marks Golf Greens

White talc powder carried in the top of a golfer's pencil marks the position of a ball on the green when it is in line with another player's ball. The pencil also has a die to mark golf balls with a personal identification mark. A third feature is a knurled section to rough up the leather grip of a club handle to provide a better grip for the hands.

Adjustment For Soft-Focus Photos

Any lens can be made to take soft-focus photographs by attaching a new control device. It is a calibrated ring that can be adjusted for desired diffusions from razor sharp to misty soft. No increase in exposure time is necessary. The attachment also can be used on enlargers.





There are 22 million people in Mexico and 16 million depend on their home workshops to produce thousands of items needed for their everyday life

Typical Mexican potter still uses primitive wheel powered by foot to make beautiful ceramics ware



LAND OF THE HOME WORKSHOP



Left, Diego Rivera, noted artist, at work on mural in the National Palace, Mexico City. Right, Mexican craftsman uses a hand roller to apply ink to a lithograph stone





Many Mexican cities are famous for a particular type of craftsmanship. The intricate silver jewelry at the left was made by Taxco artisans; at right are carved wax figures from the studio of Luis Hidalgo in Mexico City

IN 1519 Hernando Cortes landed at Vera Cruz as Mexico's first tourist. Like the thousands who later discovered the charm of this south-of-the-border country, Cortes sent back home gifts of filigreed gold and silver, jade and obsidian ornaments, capes of bright-colored feathers and other examples of what he termed "workmanship of exceeding exquisiteness and rare design . . ."

Today, 428 years later, approximately 272,000 United States tourists visit Mexico each year and spend something like \$80,000,000. A whopping chunk of it goes to buy Mexico's amazing variety of arts and crafts—multi-hued pottery, gay serapes and other textiles, glassware, lacquer ware, finely woven baskets, hand-tooled leather, beautiful silver jewelry, furniture and toys.

This is not surprising. The average American tourist, in spite of some of his gringo faults, is descended from a long line of Yankee inventors and tinkerers. As such, he finds a special kinship with his neighbors below the Rio Grande. After all,

Colorful serape (shawl) weaver warps his yarn in preparation for the actual weaving process

it is not such a far cry from the home workshop where you build a hanging shelf or repair a radio to a mud-walled hut where a Mexican craftsman turns a potter's wheel or works a serape loom.

Mexico is one of the three great craft centers of the world, along with Russia and China. The Aztecs, Toltecs and other ancient peoples who built flourishing civilizations in the land that we now call



Broad-brimmed sombreros, always popular with tourists from north of the Rio Grande, are decorated with gay colors by this young señorita:



Mexico were essentially agricultural people. These farmers had settled down in one spot and between harvests had plenty of time to fashion household implements, fancy costumes, jewelry and objects of sacred worship.

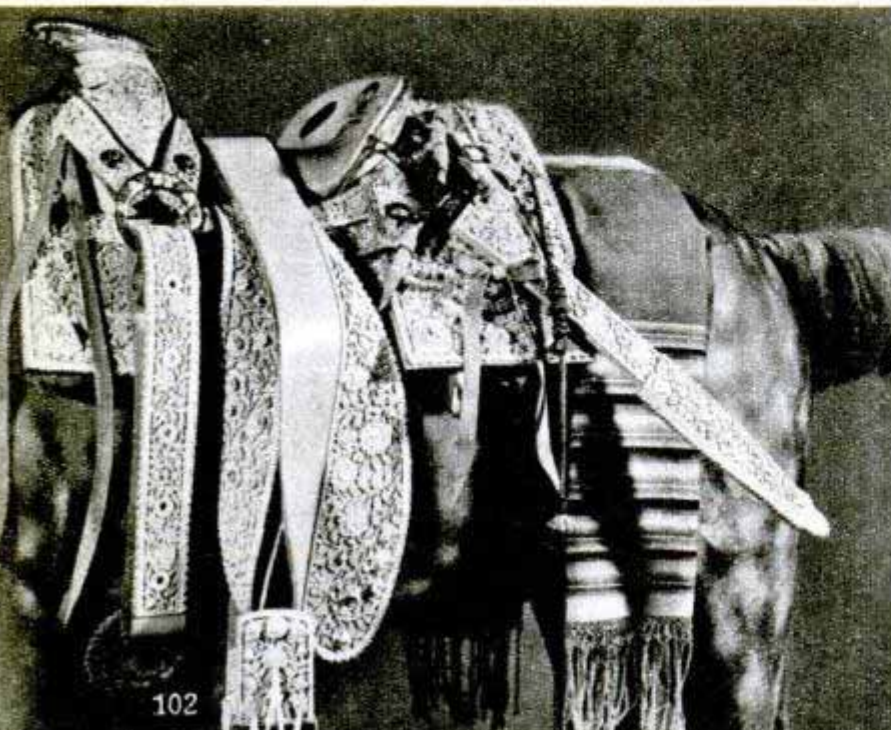
In the arts and crafts of Mexico today it is easy to pick out the three major influences:

First and most prominent is the native Indian influence. In many craft objects, especially household items like pottery, serapes and baskets, many designs and techniques have come down almost unchanged from the days when the great Aztec emperor, Montezuma, ruled a mighty nation in the Valley of Mexico.

Second is the Spanish influence which crossed the Atlantic with Cortes and his followers. You see it in glasswork (the Indians didn't know about glass), in the glazed surfaces on pottery (Indian pottery is rough), and in wrought ironwork (a metal that was unknown to the natives). The Spaniards also encouraged wood-carving and tile-making which was put to use in Mexico's churches.

Third—and this may surprise you—China has influenced certain Mexican arts and crafts. Mexican lacquer ware, for example, follows the designs and techniques brought from China in 16th-century Spanish galleons that sailed the Pacific.

Left, hand-tooled saddle of intricate design. Right, artist prepares linoleum block for printing fabrics



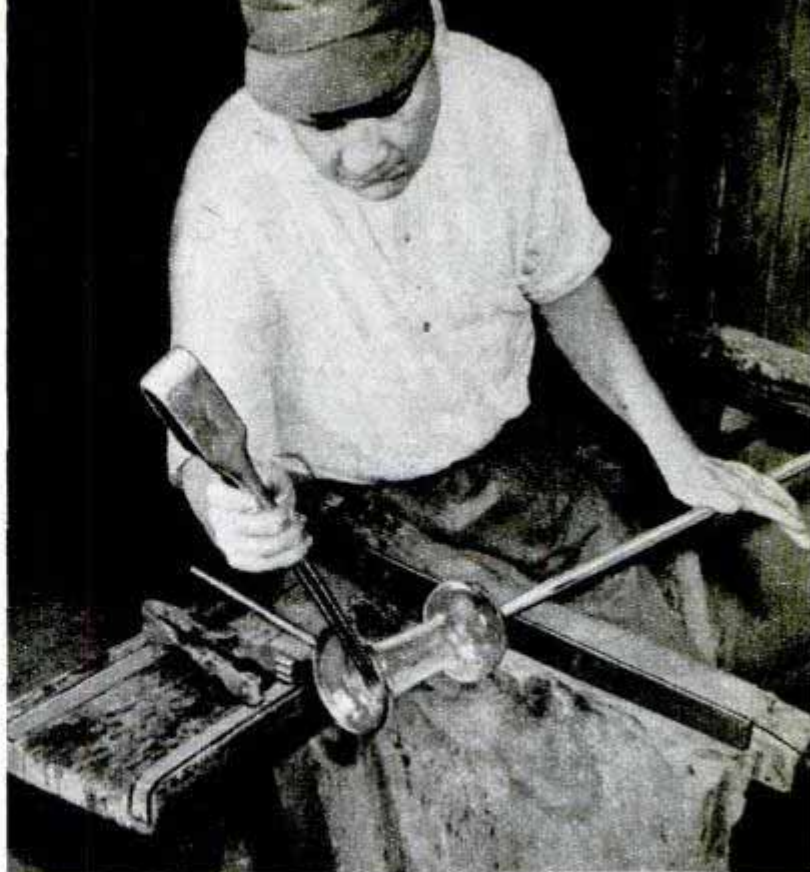
The typical Mexican native costume—the red and green sequined skirt and the white embroidered blouse—was also influenced by China. According to legend, a Chinese princess was carried back to Mexico by Spanish sailors as a slave and was Christianized by a pious Mexican couple in Puebla. Because of the princess' good works, she was much beloved, and the dress she adopted is the national woman's costume today, the China Poblana.

Mexican arts and crafts are still in what might be called the "cottage industry" stage. A whole family, for example, may join in making a piece of pottery. The mother grinds the clay, the father shapes the bowl on his potter's wheel, the children bake it in the oven. They all collaborate on the decoration: mama paints the flowers, papa the animals, the kids put on the dots.

Often whole villages specialize in making one certain product. Tlaquepaque, near Guadalajara, for example, is famous for its fine pottery; Taxco, south of Mexico City, is known throughout the world for its beautiful silver jewelry and plateware; and Saltillo is synonymous with beautiful wool serapes. We follow the same practice in the United States: Detroit for automobiles, Pittsburgh for steel, Los Angeles for sports clothes.

The difference is that we turn out a standardized product on the assembly line. Mexico produces a wide variety of useful goods, no two of which are exactly alike. From huaraches to sombreros, flowerpots to rugs, jewelry to saddles; each is an unsigned piece of art by a Mexican craftsman.

Most of Mexico's arts and crafts are sold in the market—an institution which combines some of the features of a state fair, a town meeting and a box social. The farmer brings his tomatoes, corn and avocados;

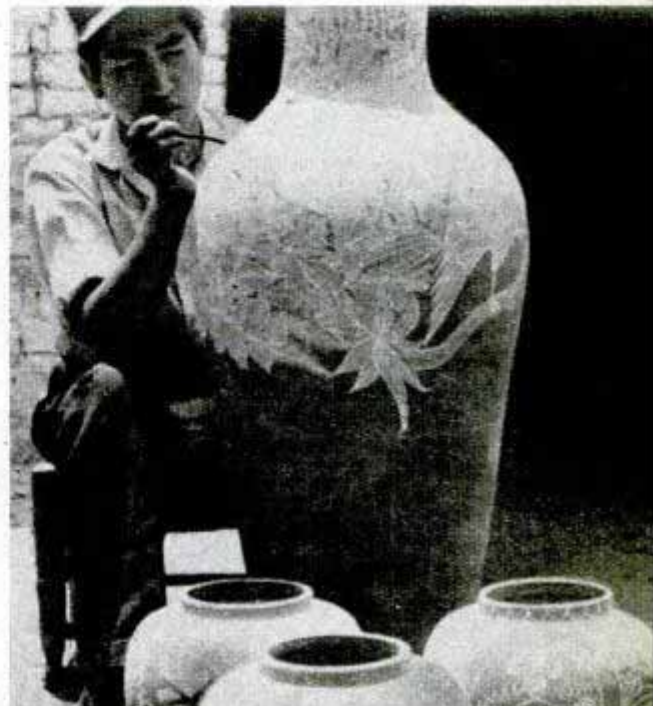


Brought to Mexico by the Spaniards, glass-blowing has become a highly skilled craft in that country

the wood carver has for sale images of Guadalupe, or delicately-carved swizzle sticks for Mexican chocolate; the basket weaver displays an amazing variety of colors and designs in his products.

Wherever it may be—in the public square of some small village, along the Pan-American highway, or in the throbbing metropolis of Mexico City—the market is not devoted entirely to the serious pursuits of business and commerce. It is a place where one may chat about the crops, borrow a peso or two from a friend, discuss the latest in politics, or drowse in the sun.

Left, tiny glass figures made by Mexican glass blowers. Right, artist paints design on an earthenware jug





Senoritas from Michoacan hold samples of the lacquer work for which that part of Mexico is famous. These designs show the Chinese influence on Mexican art



Above, fine lacquer work from the Patzcuaro region. Below, these examples of Mexican basket weaving are made of lightweight bamboo and are extremely sturdy



Unfortunately, it's true that some Mexican arts and crafts are rapidly becoming commercialized and stylized. Old Aztec designs have been cheapened, and some curios and trinkets are as useless as those on sale at Coney Island or Niagara Falls. One author describes tiny whips in a Mexico City store "so small they couldn't be used for anything but to beat the canary."

In general, Mexican artisans turn their craftsmanship into three channels: (1) Making objects of utilitarian value for the village in which they live, (2) providing curios for the tourist trade, and (3) making objects to swap with other villages. Among items in the latter category, artistry and craftsmanship reach their peak.

Basic in Mexico, pottery is one of the oldest and most widely distributed of human crafts. The most typical Indian pottery is made of unglazed earthenware, plain or decorated. If the jug is a little lopsided or the bowl has thumb marks on it, it's merely a sign of an individual piece of art.

Glazed pottery, made also in many parts of Mexico, is the Spanish introduction. Dominican friars who helped found Puebla in 1532 sent to their monastery at Talavera de la Reina, near Toledo, Spain, for glazers among the brotherhood to come and teach the Indians how to make glazed pottery and tiles. The Mexicans quickly learned the art and improved upon it.

In Mexican lacquer work you can see most distinctly the Chinese influence. Gourds, calabashes and sweet-smelling linaloa wood are used as a base for this art. There are many styles and designs, depending on the region in which the work is done, and each has its distinctive beauty.

There are two techniques for lacquer work. In one, the design is inlaid in various-colored lacquers on a solid base. In the other, a series of solid colors is applied to an object and then a fine point is used to cut through to the underlying layers which consist of all the colors appearing in the final product.

Each coat is highly polished by endless rubbing and a final coat of clear lacquer is applied to the final product—and then rubbed and polished again. The secret of genuine lacquer work can be told by touching the surface; it looks and feels like engraving.

Textiles are as fundamental as pottery and many Mexican families still weave their own cloth as they did in Aztec days. As with pottery, different sections of Mexico produce various patterns and it is said that you can guess an Indian's town from the color, weave and design of his serape.

For peasant men, the serape is the basic unit of clothing. It serves as a blanket at

(Continued to page 260)

TEST YOUR SCIENCE

By Rex Taylor



CAN ENERGY BE DESTROYED?
One of the fundamental laws of physics is that energy, like matter, can never be created or destroyed. Here's an experiment that appears to destroy energy:

Take a small brass or steel spring—compress it—tie it down with impregnated catgut. The energy placed in the spring by compression is now imprisoned there. Drop it into a beaker of dilute sulphuric acid. Acid soon dissolves spring and the catgut holds fast. The spring did not expand—nor can it ever!



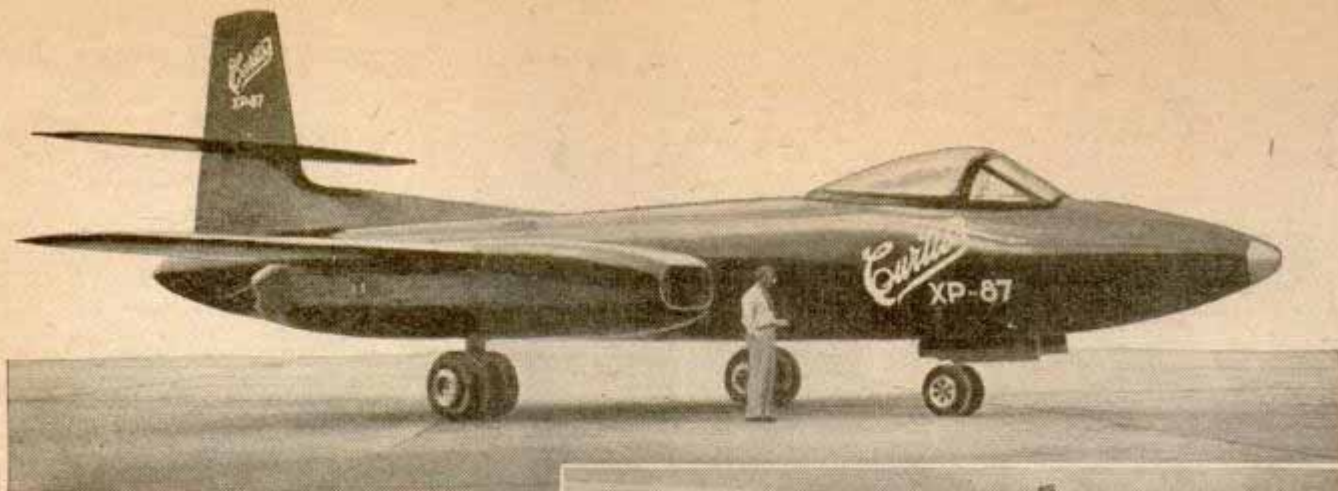
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WHAT BECAME OF THE ENERGY?

Logic says it was destroyed.
Was it?

(Answer on page 250)



Curtiss-Wright photos

All-Weather Fighter

Elaborate radar and de-icing equipment are featured in the Curtiss XP-87, first of the U. S. Air Force's all-weather jet fighters. A two-man crew sits tandem fashion on ejection seats for high-speed emergency escape. The plane has four engines which are 24 inches in diameter, permitting pairs to be installed in the long, thin nacelles to give the plane a 620-mile-an-hour top speed. Armament, concentrated in the nose, consists of six fixed 50-caliber machine guns and a four-gun radar-controlled turret. The pressurized XP-87 weighs 15 tons



Long, flat nacelles and a sharp nose are distinguishing marks of the XP-87. It is 65 feet long and has a 60-foot wing span



Boeing Aircraft photos



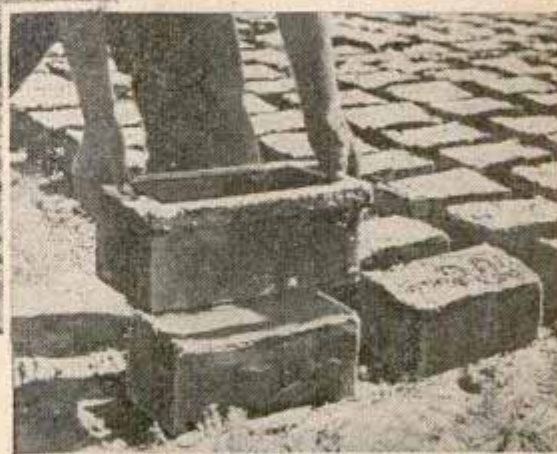
Nearly as large as a Superfortress, the six-jet XB-47 is the first of the heavyweights to employ swept-back wings and tail surfaces. It is 108 feet long, with a span of nearly 116 feet

Swept-Back Jet

Sharply swept-back wings and tail surfaces make their first big-plane appearance in the Boeing XB-47, which is nearly as large as a Superfortress. Six jet engines hang from the ultra-thin wings, a pair of them in each of the double inboard nacelles. The main landing gear is tandem type, aided by a pair of small outrigger wheels during operation on the ground



← Mud solves New Zealand's housing muddle: Farmers are building homes of mud bricks in a local process 70 years old. The field is plowed, watered. Then horses are ridden across it for two hours making a dough which (below) is molded into bricks



Mansions From Mud



↑ Farmers construct the interior walls of a house, laying mud brick in the same way the outside walls are built. A mortar made of both lime and cement is used. Tough grass sprinkled into the mud dough strengthens the bricks and completed walls. The homes are built on conventional foundations. The house at right is completed except for a rough stucco-like finish that will be applied to the walls to give them a more attractive appearance. The result is a durable house, easily heated in winter and cool throughout the summer



MOVE OVER, DOBBIN, and make room for the sturdy little planes that are fast taking over your traditional farm chores. The men whose lives and hopes are entwined in the soil are becoming the most air-minded of all.

Manufacturers estimate about 60 percent of the new personal aircraft will go to farmers, who are already a sizable bloc of the flying public. With their products bringing good prices and help hard to get, farmers have both the means and the reasons to use "air jeeps" for more and more odd jobs. Time is a precious commodity to them and the air offers many opportunities to do the work quicker. And, when there's a lull for family relaxation, the plane can assume transportation duties that used to fall to buggies and autos.

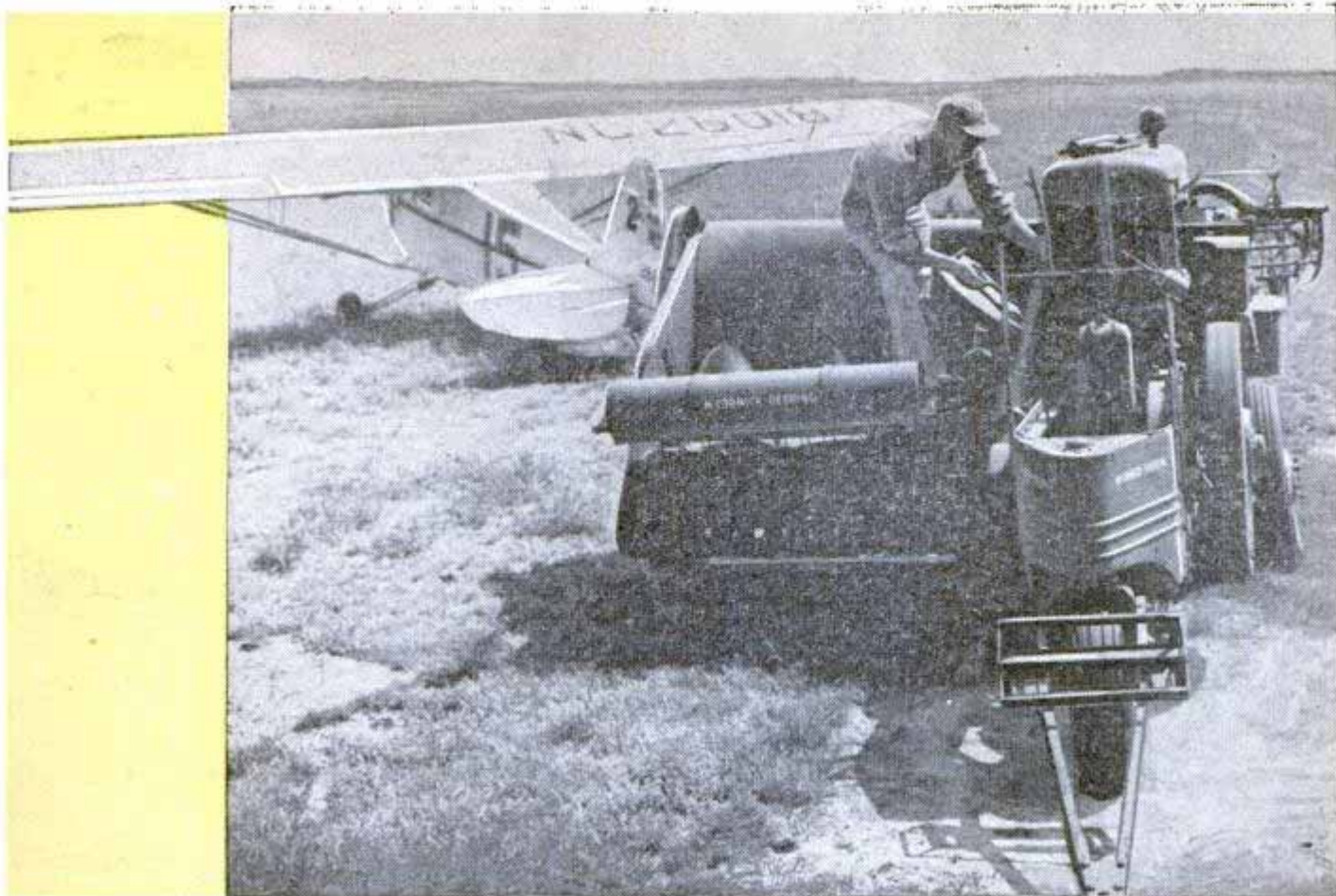
Years ago a few hundred miles' travel represented a full day's work loss to the farmer. With planes, little time is wasted now when those emergency trips come up for urgently needed farm-ma-

"Plane-Dirt" Farmers

By Aubrey O. Cookman, Jr.

Like most farmers, Orville Brown is curious about the potentialities of helicopters. Here he's learning how a Bell model flies





For speeding repair of badly needed farm equipment, planes can't be beaten. Parts can be picked up at the nearest town and flown back to machinery, like this baler, in a few hours

chine parts, for seed or supplies. And rural communities are beginning to cooperate by bringing the landing field closer to Main Street. In one Kansas town a street from the airport to the business section has been made a taxi strip, along which planes roll directly to an aircraft parking section.

Flying farmers refute the assumption that it's a "young man's game." Most of them are in their late thirties and forties and many learn to fly at fifty and more. Among the reasons for this are that the ships aren't "hot" and difficult to handle and, more important, few young fellows have cash and land to justify the expense.

As a group they're among the most careful, with only a single fatality chalked up against them in nearly two million air miles. About three-fourths regularly provide shelter for their plane and have landing strips on their own property. Less than two years old, the National Flying Farmers Association already has nearly 3000 rural pilot members.

The airplane helps them keep abreast of the latest in agricultural methods and equipment. More than 900 planes flew into the University of Illinois airport recently for a two-day meeting of farmers from four states. Lined up alongside the runway for their inspection was the newest farm machinery, everything from grain driers and

electric silo unloaders to septic tanks.

Instructors from the university's agricultural college were on hand to discuss farm problems, or the visitors watched demonstrations of agricultural and aviation equipment. At night, about 2000 gathered for a fish fry served by the Famous Jonah Club of Akron, Ind., a farmers' fun group dedicated to "avenging Jonah" by offering up thousands of the whale's small descendants at banquets and outings.

Among those at the Illinois meeting was a typical flying farmer who is "sold" on the advantages of a plane. Orville Brown, 36 years old, operates 460 acres near Gessie, Ind., raising corn, wheat, clover, soy beans and alfalfa. During the four years he has flown, Brown has logged approximately 450 hours. His plane, a Piper Super-Cruiser, was \$3295 new and operating costs have come to about \$300 yearly.

His land is split between two farms only four miles apart, too close to justify flying, but he says the time saved by using a plane for many required business trips and errands gives him many extra working hours on the farm, where he is shorthanded. Without it he'd have to cut down his farming or try to get another hand, at considerably more than it costs to operate the plane.

Brown has made a sod strip 70 by 1800 feet at one edge of his "home field" and,



Some of the 900 planes flown to the University of Illinois for a demonstration of the latest agricultural equipment and techniques. Families like the Browns came for combined "shopping tour" and brief holiday

Prairie Farmer photo

by rotating crops and always having one in clover, he has an additional east-west clover runway at right angles to the main strip. He built a 28 by 40-foot hangar of sheet metal and railway ties, storing farm machines in the extra space on both sides of the plane. As an indication of how deeply the flying bug hit the Browns, his wife is taking lessons and Johnny, 11, already handles the controls with a little help. But they've never lost sight of the fact that they're first of all a farm family, as three gold metals for agricultural achievements testify. Brown has worked up one of the state's top averages in corn competition.

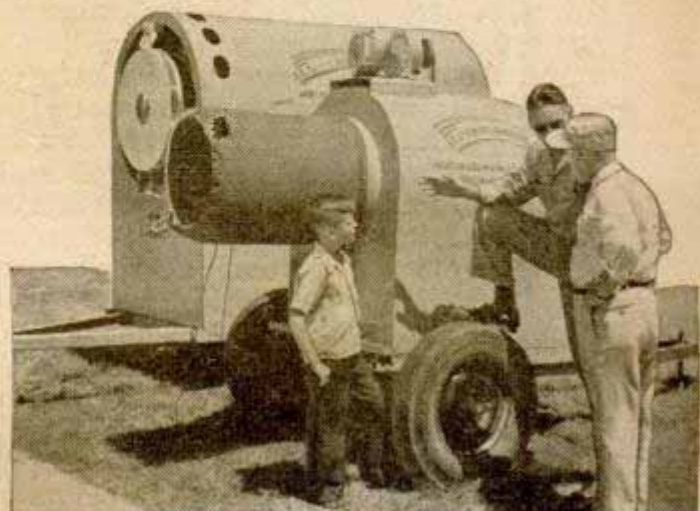
Planes are finding an ever-widening utility on the farm. They're invaluable on

inspections to check soil erosion; in locating wind, storm and insect damage; surveying water supplies and broken fences; and for running miscellaneous errands. In 20 minutes aloft a rancher can inspect as much as he would during a full day in the saddle. Oklahomans, especially, have found that they're by far the most effective means of hunting coyotes, bagging hundreds during a three-day shoot last year.

One of numerous state agricultural officials who has complimentary things to say about the air age on the farm is New Jersey's state secretary, W. H. Allen. According to him: "There is greater use for a plane on the farm than in any business, with the exception of transportation."

Landing at the campus air field, the Brown youngsters are the first to alight and head for the exhibit area

Brown and son look over an all-crop drier at the exhibit. It blows hot air over wet hay and grains



Someone else called the plane the farmer's "key to the city."

Among the bigger operators there is Paul Thompson of Terre Haute, Ind., with cattle-feeding operations in Kentucky and Mississippi, as well as the Hoosier state. Thompson uses two single-engine craft, as well as a twin-engine Cessna, putting in close to 75,000 miles a year on strictly business travel. As a small illustration of mileage saving, it is 250 road miles from Terre Haute to Lexington, Ky., one of his most regular trips, and only 170 by air. In the Cessna, that takes little more than an hour.

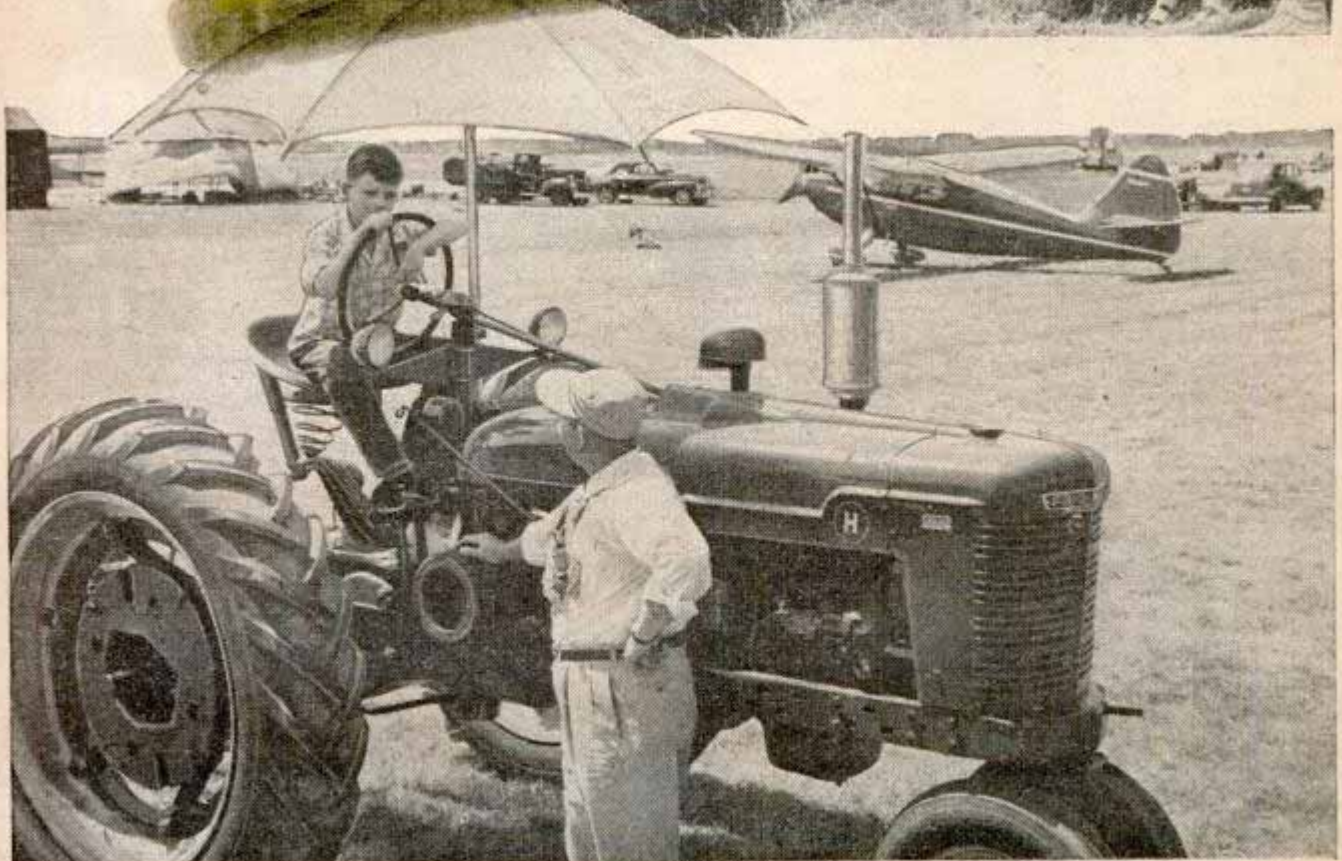
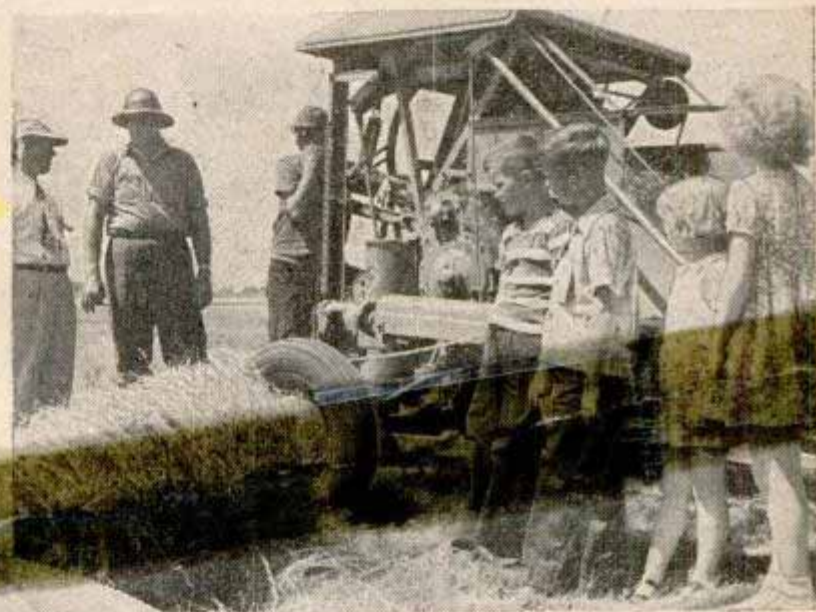
Since its beginnings in the 20s and 30s as a crop-dusting agent and seed layer, the airplane has come a long way in its fight for recognition as a farm machine. Though still in the experimental stage in many of its agricultural uses, farmers are learning by trial and error how to get the most out of their sky buggies.

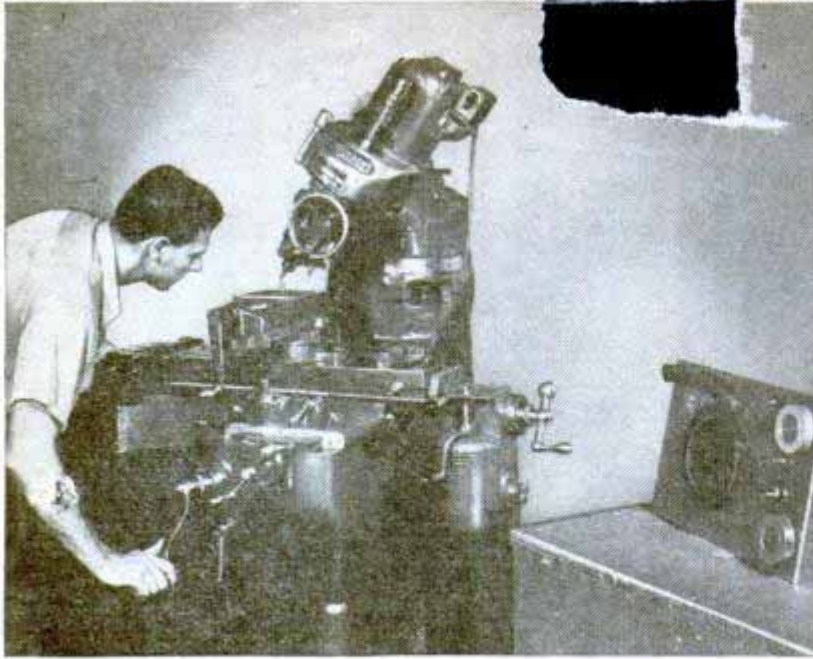
Most promising of all, the farmer is "up in the air" now—and he likes it!

Since he'll be piloting one soon, Johnny Brown tests the "feel" of a new tractor

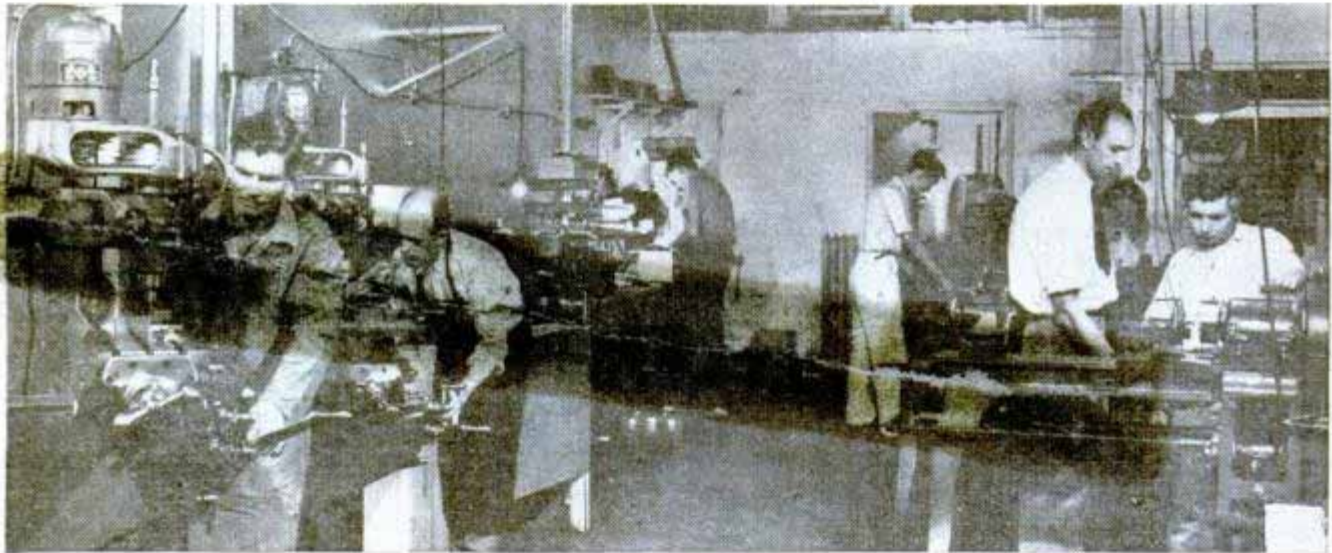


Farmers check their planes carefully. Below, Browns see unit that makes round bales, which resist weather better than square type



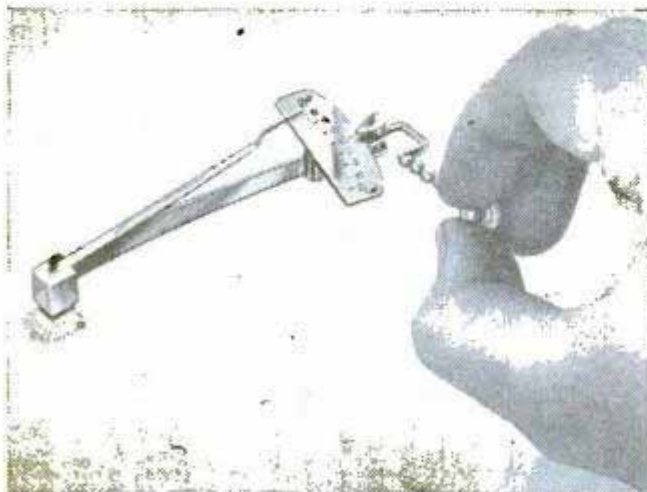


Above, inventor works on a shaft for recorder of his own design shown at right of photo. Right, girl runs a rented lathe. Below, view of machine shop on a busy evening with owner, Xelphin Dugal, standing at right



Craftsmen and inventors rent power tools by the hour in a rental machine shop recently opened in New York City. A variety of precision equipment including milling machines, drill presses, lathes, sur-

face grinder, metal-cutting planer and pantograph engraver can be rented at rates averaging about 75 cents an hour. The operator is a machinist of many years experience and he acts as teacher and adviser.



Pygmy Torque Wrench

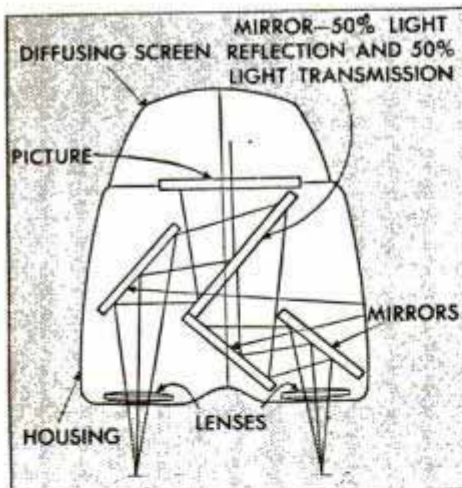
Delicate measurements of the tightness of small screws in gauges and instruments are recorded by a pygmy torque wrench measuring only $3\frac{7}{8}$ inches in length. Furnished with a $\frac{1}{4}$ -inch drive square, the little wrench has a scale from zero to eight inch ounces. This extreme range of the wrench is equivalent in measurement to only $\frac{1}{24}$ th of a foot pound.

Ⓞ Gasoline is stored and handled like a solid when packaged in a transparent, cellulose film that is almost completely nonflammable.



Making Miniature Spinning Wheels

Fifteen years ago Henri Legault of Montreal, Canada, read an article in *Popular Mechanics* explaining how to make miniature spinning wheels. He decided to make one according to the instructions and enjoyed the work and result so much that he established his own business of making tiny spinning wheels for souvenirs. Today, Legault, his wife, 11-year-old daughter and 10-year-old son work as a team, producing about 400 models a month. Each little spinning wheel consists of 30 pieces of solid maple, scaled $\frac{1}{8}$ inch to one inch.



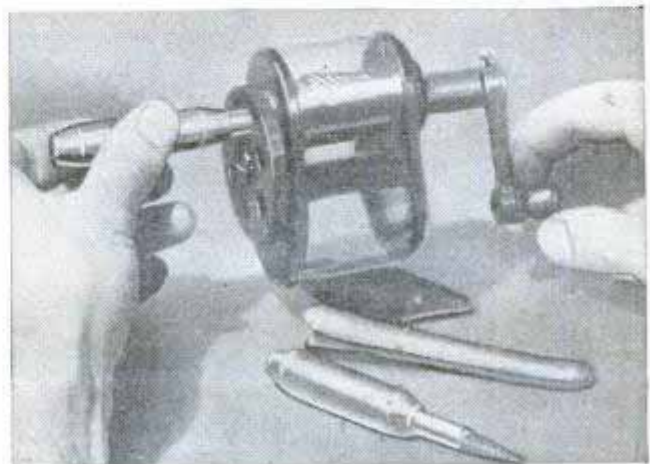
Slide Viewer Gives Illusion of Depth

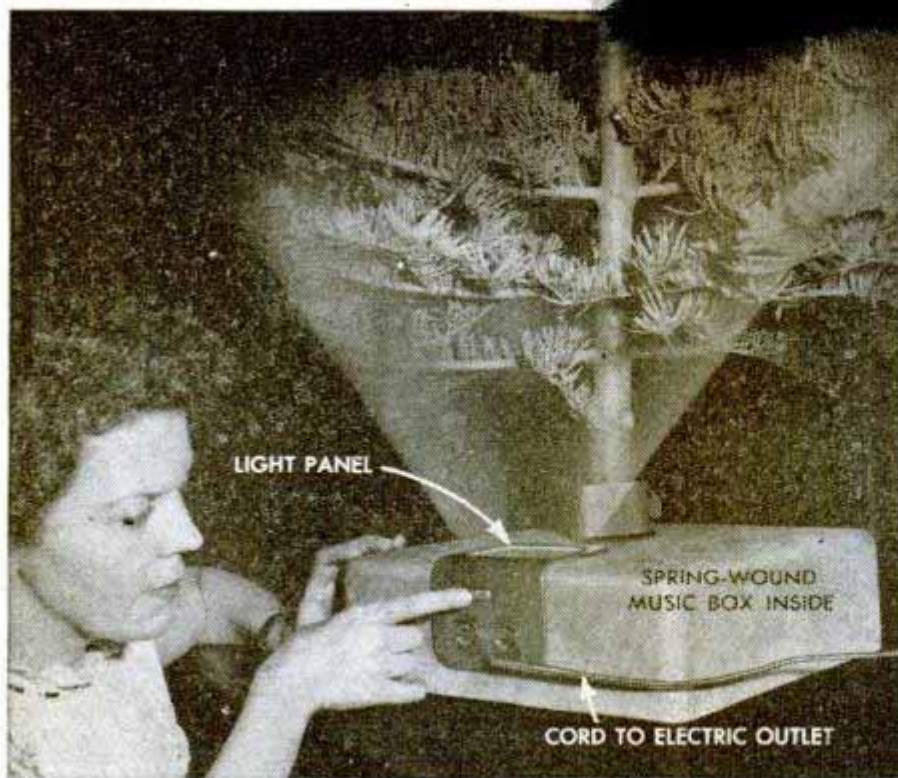
With two lenses, a transparency viewer achieves a three-dimensional effect from a single slide, according to the manufacturer. A mirror that reflects half the light and transmits the rest is a feature of the unusual optical system that gives each eye a separate view of the transparency.

Pencil-Sharpener Hone

Dull pencil sharpeners are sharpened quickly with a pencil-shaped hone that is easy to use. The hone is placed in the sharpener, the handle turned backwards several times and the blades are like new. The hone comes equipped with a leather carrying case.

Information, including manufacturers' names, concerning products described in this issue may be obtained by writing Bureau of Information, *Popular Mechanics Magazine*, 200 E. Ontario, Chicago





Musical Tree Stand Plays Carols

Concealed in an aluminum stand for Christmas trees, a spring-wound music box plays carols. The stand has an electrical connection into which the tree lights may be plugged. A frosted glass window on the stand covers a light bulb which adds illumination. Tree trunks fit into a tube which may be filled with water to prevent the tree from drying out, or with a fireproofing liquid that makes the tree fire-resistant. The stand is made of aluminum coated with green flocking. Setscrews hold the tree securely.

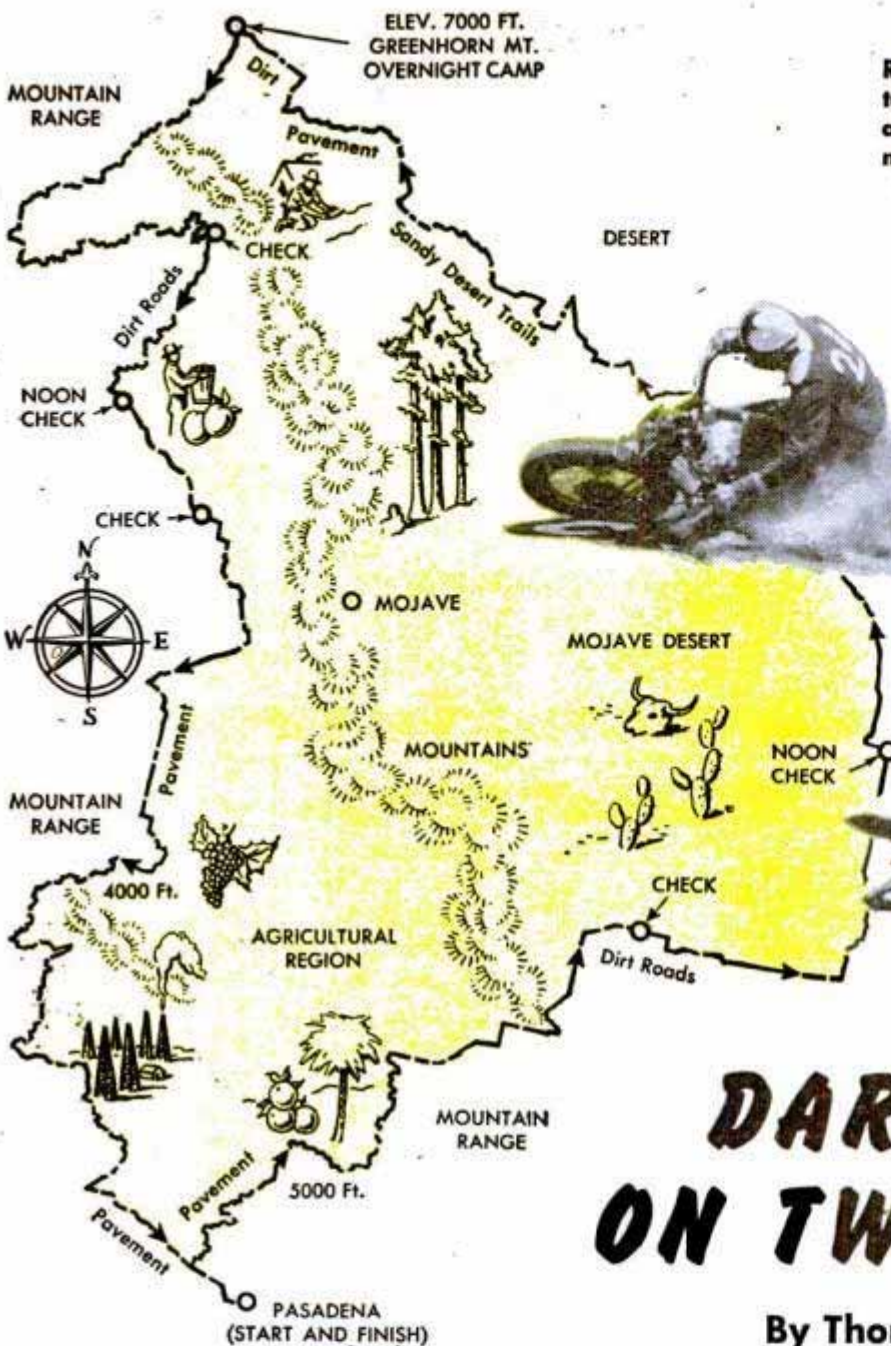
Revolving Christmas Tree →

Christmas decorations for the home can be made refreshingly novel with a motor-driven stand that slowly revolves the tree. The tree turner is adjustable to fit almost any tree and will hold 200 pounds safely. A built-in two-way outlet rotates with the tree to provide for tree lighting. The cast-aluminum holder makes three revolutions a minute.

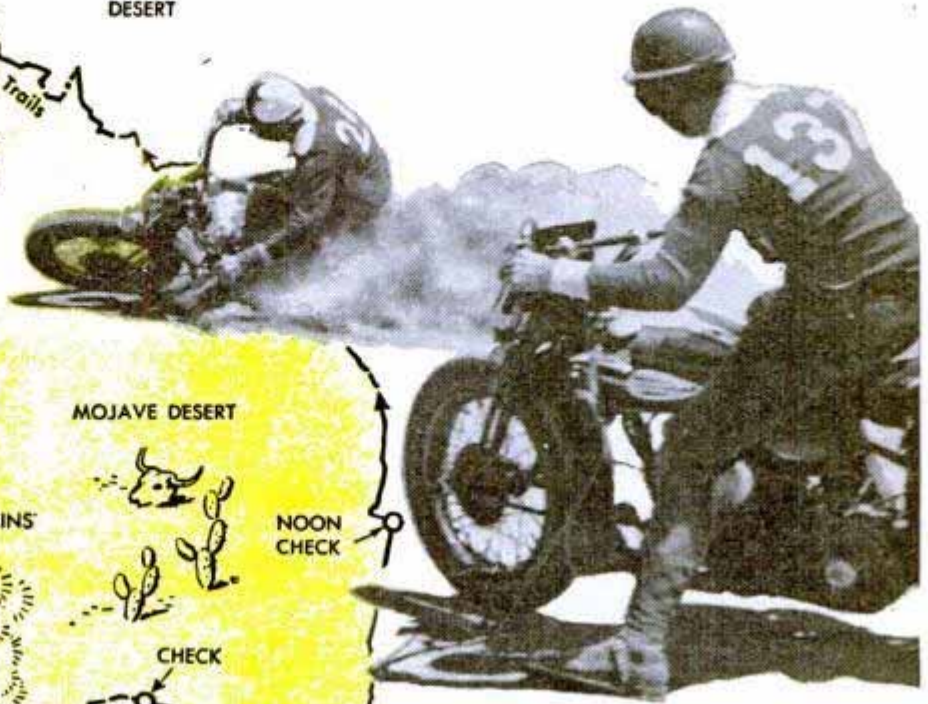


Coaster Wagon Steers Like an Automobile

With its front wheels mounted on caster supports, a new coaster wagon steers like an automobile. A tie rod connects the wheels to a vertical steering column. The pulling handle, attached to the steering column near the right side of the wagon, serves as a tiller. So that sharp turns can be made without tipping, the rear wheels are farther apart than the front pair. The wagon is assembled with nuts and bolts requiring special tools to keep curious boys from tearing it apart. Because of the welded frame chassis, the hardwood body is strong enough to support 900 pounds.



Riders below take a sharp turn on the tough 500-mile endurance course shown at left. This course crosses several big mountains and 100 miles of desert



DAREDEVILS ON TWO WHEELS

By Thomas E. Stimson, Jr.

ONLY THE HARDEST-RIDING motorcycle pilots stand much chance of winning the grueling endurance contests that motorbike clubs hold every year. The pace may average no more than 24 miles per hour and yet two thirds of the contestants are apt to fall out before the contest is over.

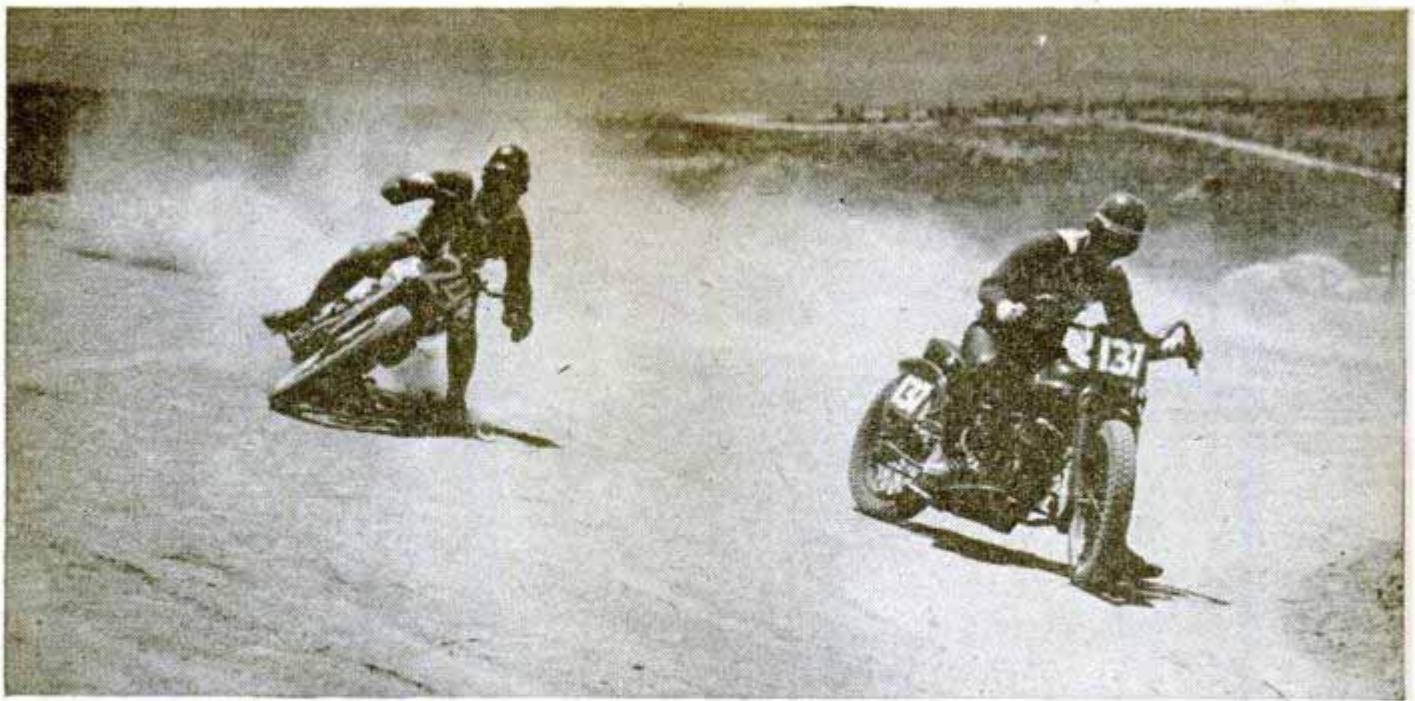
The thing that breaks the riders' hearts and punishes their machines is the course over which a run is held. Picked for trouble, it is the roughest 500 or 600 miles of roads, trails, and cross-country terrain that a club can find in its vicinity.

Part of one western endurance course is a four-mile downhill stretch of slick clay. The trail is like grease and the contestants slip and slide most of the way to the bottom. A three-mile stretch on the same course is through deep adobe. During the wet season a cyclist needs almost an hour to ride and push his machine from one end to the other. The famous Jack Pines course

in Michigan, through timber and along old logging trails, is a slippery, rough and treacherous course on which no one has ever made a perfect score.

In California the Greenhorn Mountain run, starting from Pasadena, climbs across the summits of three mountain ranges of up to 7000 feet altitude and includes 100 miles or so of blistering desert. Old abandoned dirt roads and forestry trails are followed across the mountains; most of the run across the desert is simply in the tracks of a motorcycle that had been through the region a week before to chart the route. Only 90 miles of the 500 is on pavement. Contestants carry maps with them and although all the turns are marked with signs many of the riders lose precious minutes or hours when they make wrong turns and become lost.

Another famous course is the Sandy Lane that starts at Camden, N. J. Scene of



Skidding wide on a turn, rider uses his steel-plated left shoe to keep his balance and avoid spill. These riders wear sturdy crash helmets, leather pants and knee boots. The cyclist below could use bathing suit

the 1947 championship endurance run, Sandy Lane is 500 miles of deep sand, rough country roads, and narrow twisting trails. Contestants grind along in the low gears a good part of the way.

An endurance run is not a race. It is a contest in which each rider tries to adhere to a certain schedule so that he arrives at the numerous check points on time. He knows the location of a number of the check points and in addition there are secret checks that he encounters unexpectedly along the route. One point is knocked off his score for every minute behind schedule at any of the checking points. He can arrive 29 minutes early, but if he arrives 30 minutes or more ahead of schedule he is disqualified.

From 50 to 100 riders participate in the numerous endurance runs that American motorcycle clubs hold during the year. All the big runs are two-day affairs and the riders cover some 250 miles during the first day. Sleeping bags and food arrive by truck at their camp site. The return to the starting point, over a different route, is made on the second day.

Some of the riders are eliminated long

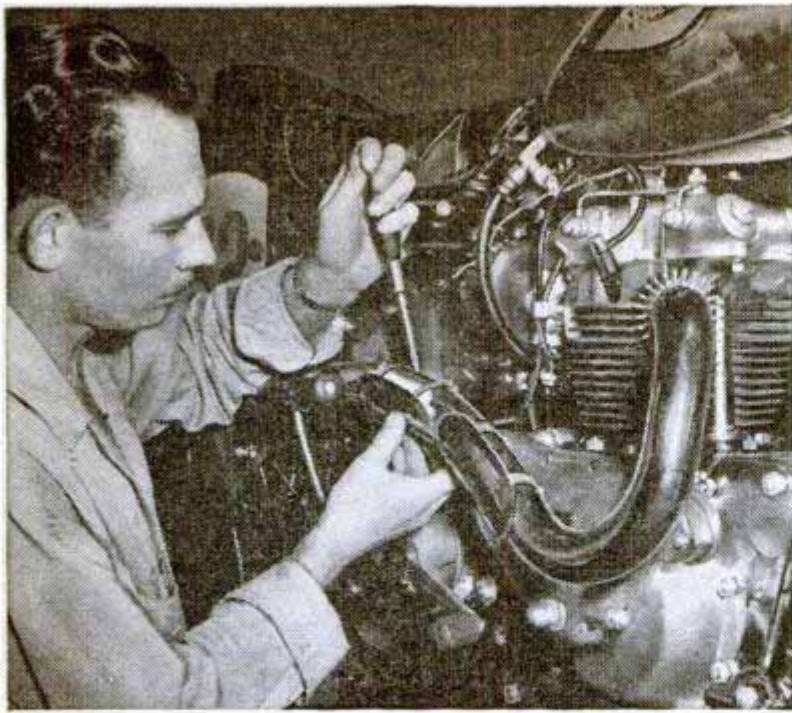


before the first day ends. Utterly exhausted, they've had all they can take. Most of the men who stay in the contest will have fallen off their motorcycles once or twice before they make camp that night. Some of the machines will break down and be eliminated and few of them finish without some mechanical trouble. The riders carry a handful of spare chain links, a spare timer, tools, an extra inner tube, and a boot.

Endurance runs are open competitions and the riders may use any kind of machine they desire, modified in any way. Mufflers and headlights must be retained if any part of the course is over public roads. To

provide greater clearance for rough stretches it is a common practice to lengthen the forks or to use wheels of greater diameter. The new "hydraulic" front forks that contain a built-in shock absorber and the new rubber-mounted handle bars are popular accessories among endurance riders. The hydraulic forks iron out much of the usual pounding on rough ground and the rubber-mounted bars absorb most of the vibration on any kind of surface.

Motorcycles plus sidecars make up a



special class in many endurance runs. Usually the sidecar has a rear entrance so that the passenger can jump out and push without loss of time when a steep grade or deep sand is encountered. The passenger rides mostly in a kneeling position, ready to lean far to the left or right to help the vehicle around sharp turns. Some sidecar combinations use a long axle so that both rear wheels are powered.

Many competitors rework their engines to deliver as much as 50 percent greater power. A higher compression ratio, longer stroke, and a faster cam action are among the usual changes that give more power. Combustion

Above left, rider attaches shield over asbestos pad that protects leg from hot exhaust stacks. Right, machine leaps in air as rider tops short, steep hill. Below, racer relaxes during pause in pits where mechanic changes his carburetor





Left, ready and "raring to go," rider awaits start of endurance race. The motorcycle tires above are for use on pavement (left), pavement and dirt (two in center), hills and endurance contests (knobby tire at right)

chambers often are reshaped and the weight of the intake valves may be reduced by grinding and polishing metal from their flat tops. All moving parts are balanced. Everything with which the lubricating oil comes in contact, including the inside surface of the crankcase and the flywheel, is given a high polish to reduce friction.

A stock 45-cubic-inch motor with an original top speed of around 85 miles per hour can be made to deliver as much as 115 miles per hour by such changes. High speed is rarely a factor in an endurance run, but a reworked engine also produces additional power in the lower gears. This is important in deep sand and in climbing steep hills.

Motorcycle riders compete in more different kinds of contests than do the owners of other types of vehicles; for one thing because their machines are so adaptable to sport. For this reason, too, membership in

the different motorcycle clubs is high. Clubs that are affiliated with the American Motorcycle Association sponsor a wide variety of events that include short-track racing, hill climbs, and reliability trials that last one or two days and that are comparable with the endurance runs. Short-track racing is virtually for experts only although special races are held for riders of the novice class.

Field meets in which club members compete in different events are a popular sport, as are the so-called English trials in which the emphasis is on good riding over a short, tough course and in which penalties are called for touching the ground with a foot, stalling the engine, and for other mistakes. Hare-and-hound races, in which one rider is given a long start over a cross-country course before the other riders start out and attempt to overtake him, are other popular club events.

Signs along race course from left to right mean: Right Turn, Wrong Turn, Straight Ahead and Left Turn



Contests of this kind culminate in the TT races, the abbreviation for "tourist trophy." To the riders the real meaning of TT is "tough track," they declare. Most TT tracks consist of a closed course half a mile or so long, containing all the obstacles and difficult situations, except water hazards, that might be encountered during an ordinary cross-country tour by motorcycle. Sharp left and right-hand turns, rough spots, unexpected dips, steep climbs, and short stretches of sidehill are all built into a TT track.

Such a course is a hard test of riding ability when one rider alone tries to get around it at high speed. In a race there may be 20 or 30 machines pounding around the short track. Spills and collisions are frequent. For self protection the riders wear goggles, crash helmets, heavy sweaters, leather pants, knee boots, and long gauntlets. The left shoe is protected by a metal plate that curls up over the toe, allowing a rider to use his foot to help balance and pivot the machine around sharp left turns.

Worst, or best of the TT courses, depending on the point of view, is the treacherous Box Springs track at Riverside, Calif., scene of the 1947 national championship TT race. Skip Fordyce, one of the sponsors of the event, spent a month seeking a satisfactory location for the race before the Box Springs course was chosen. Then the dirt road was scraped and graded to make it harder than before. Almost every foot of it is a challenge to a good rider. Six tenths of a mile long, it is possible to get around the course in 50 seconds, equal to about 43 miles per hour. Even this speed is reduced before the race is over for the 100 mile TT championship race calls for 168 laps around the course.

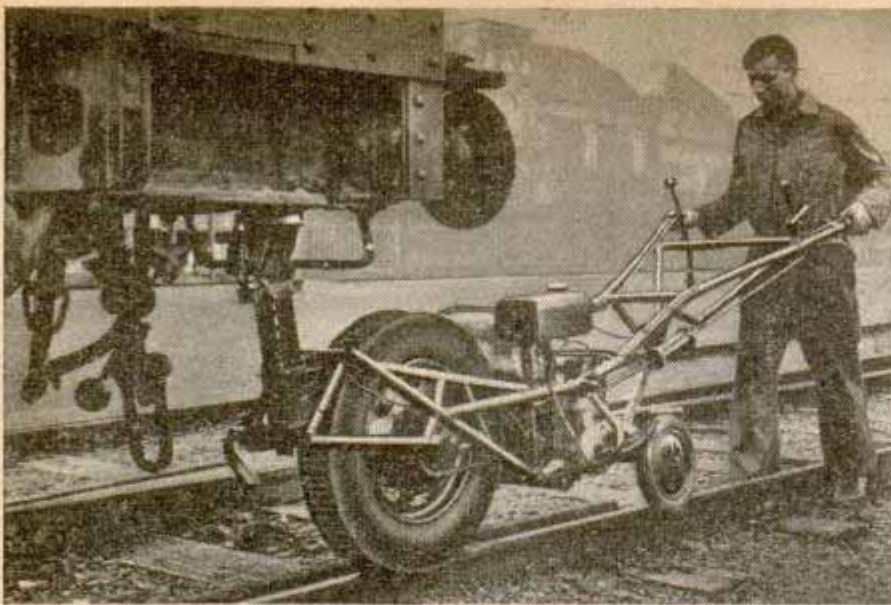
"Sugar-Coating"

Table sugar can be converted into a durable, transparent coating for wood. Highly resistant to wear, hot oils and heat, the film is insoluble in organic solvents, according to chemists in the Department of Agriculture. The coating has a high gloss finish. Being transparent, it may be used as an adhesive for glass.



Thrilling moments in a hill-climbing contest—rider above is struggling to maintain control of machine on steep grade, and below both wheels are off ground during race to the top





European Tractor Moves Freight Cars

Freight cars in Europe are moved with a small tractor powered by a one-cylinder gasoline motor. Used in freight yards for making up trains, the machine is called a Locopulseur. Traction is provided by a pneumatic tire with a treaded groove to fit the rail. The driving wheel forces its way in a wedge-like manner between the car and the rail and can push an entire freight train.

Motorcycle Speeds Baled-Hay Drying

Bunting hay bales with a motorcycle is a technique recently tested near Elm Grove, Wis. Harley-Davidson is checking this means of expediting the drying of hay bales. The round bales roll out of the baler onto the ground. Later, the cyclist rides across the field, bunting each bale with the safety guard to expose the damp side to the sun. Over 1000 bales have been turned in 38 minutes in tests.



Practice Set Uses Stylus To Sound Code Symbols

Telegraphic code is learned quickly with a device on which the student sounds code letters by sliding a stylus across a contact plate. The code symbols are sounded on the buzzer in the proper rhythm regardless of whether the stylus is moved slowly or rapidly. By repeating the code on the hand key after hearing it sounded by the stylus, the student learns proper timing of dots and dashes. Power is provided by flashlight batteries. Two sets can be connected for practice transmissions.

By crossing cultivated potatoes with a wild species from South America, Dr. D. K. Reddick of Cornell University has produced a potato that is immune to blight.

Mechanical cutter at Robena slices nine feet deep into bituminous coal vein in the first step of mining operation. Miner adjusts a water spray to minimize coal dust



COLOSSUS OF COAL

Robena is a sort of infant prodigy among coal mines. When it really gets going, its underground caverns will discharge 24,000 tons a day—but not a pound for your furnace

A FEW hundred yards from the bank of the lazy Monongahela River in southwestern Pennsylvania you enter a rather unprepossessing hole in the ground and descend a moderate grade as a conveyor belt rumbles upward with a softly gleaming load of black stuff.

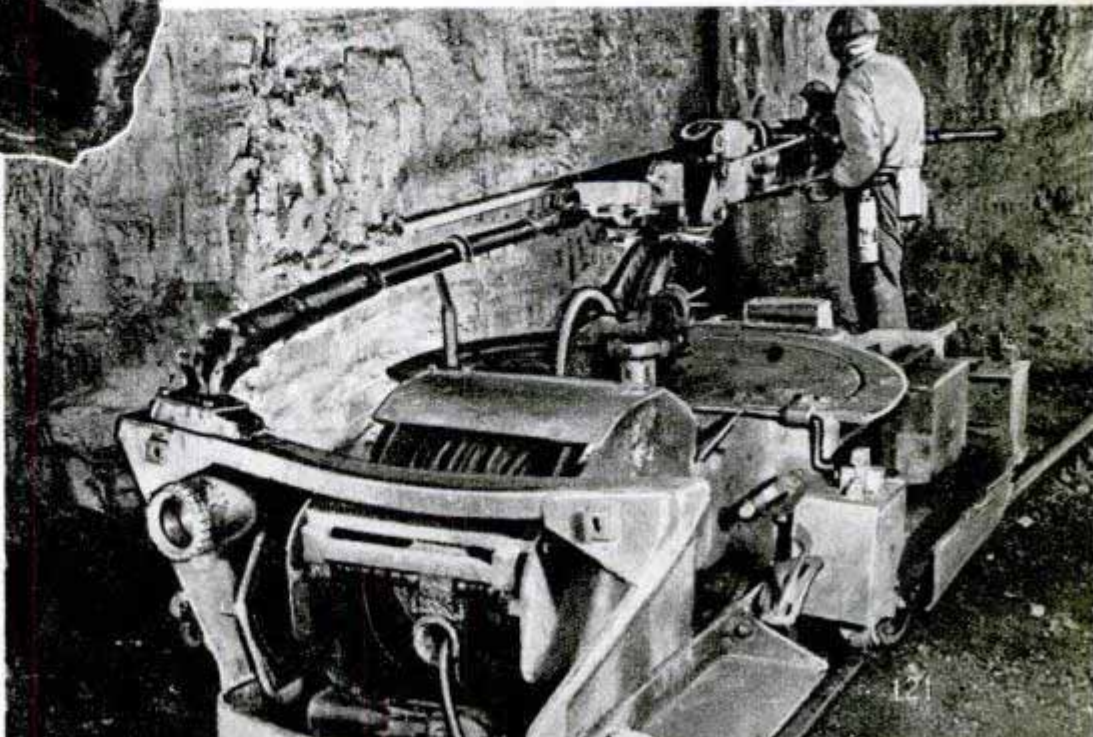
To the most inexperienced observer what he is entering is obviously a coal mine—but a few vital statistics about this particular hole in the ground are enough to make a mining expert whistle.

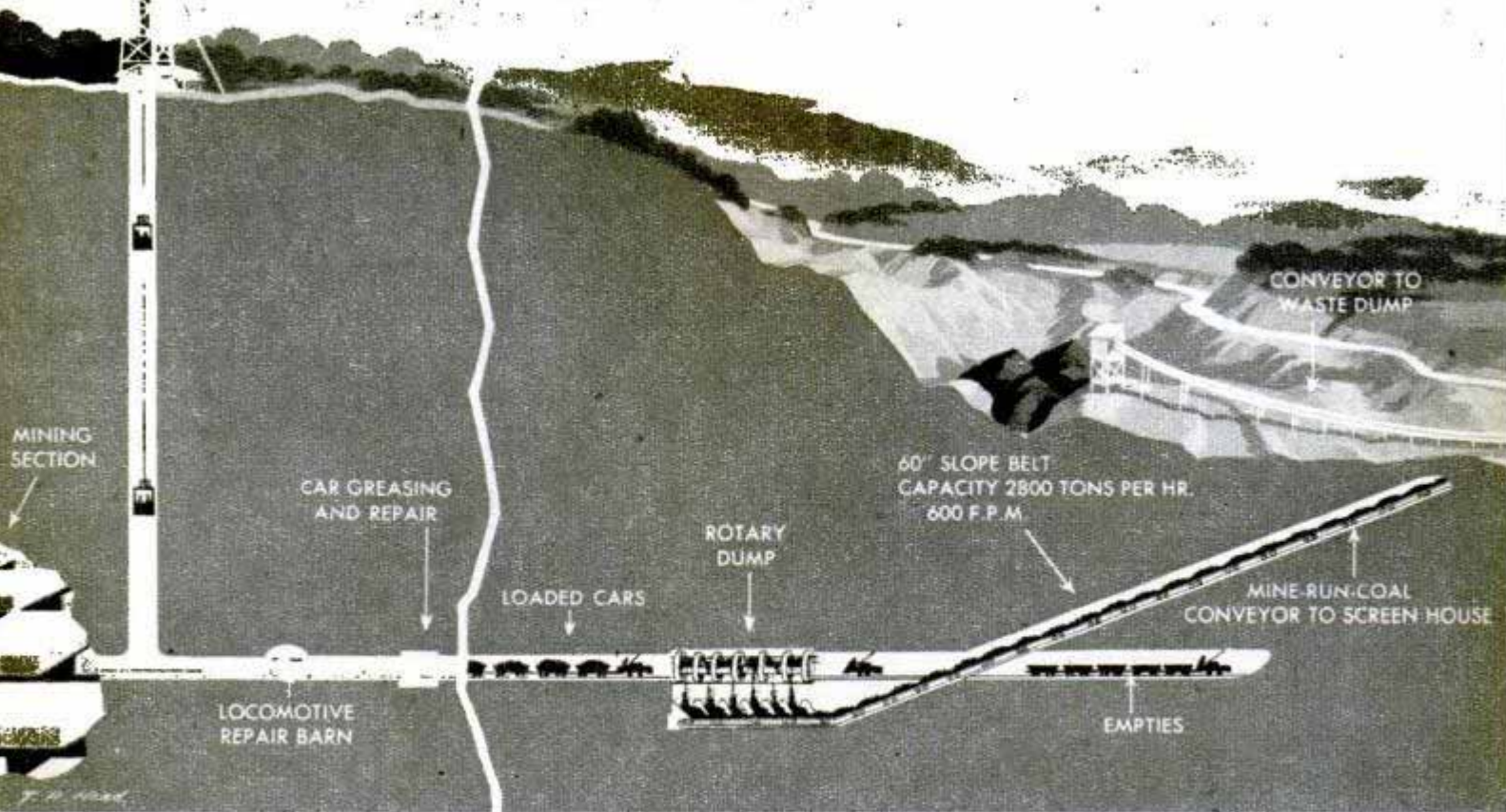
This is Robena—the atom age grandpappy of the world's coal mines—the biggest and the most completely mechanized. Mines which produce from 5000 to 10,000 tons a day are considered big; Robena, when completely developed, will mine a whopping 24,000 tons daily.

A single day's shipment would be enough to heat 2000 average homes for

By Bill Reiche

Power drill cuts into face of vein making it ready for charging with blasting powder. Machine runs on tracks and gets its power through the trailing electric cable





an entire winter—but not a ton of Robena's black diamonds will warm a home or a factory or drive a locomotive. This coal has a rendezvous with iron ore and limestone; it will make steel.

The mine is a property of the H. C. Frick Coke Co., fuel producing subsidiary of the United States Steel Corporation. It is a captive mine whose owner has an insatiable appetite for metallurgical coke—an appetite which demands the gaudy total of 31,000 tons of coking coal a day.

This is used by three of Big Steel's subsidiaries—Carnegie Illinois, National Tube and American Steel and Wire—in the Pittsburgh-Youngstown area alone. The mills in this area of these three companies have an annual capacity of 12,500,000 tons of ingots and steel for castings—more than 13 percent of the national output.

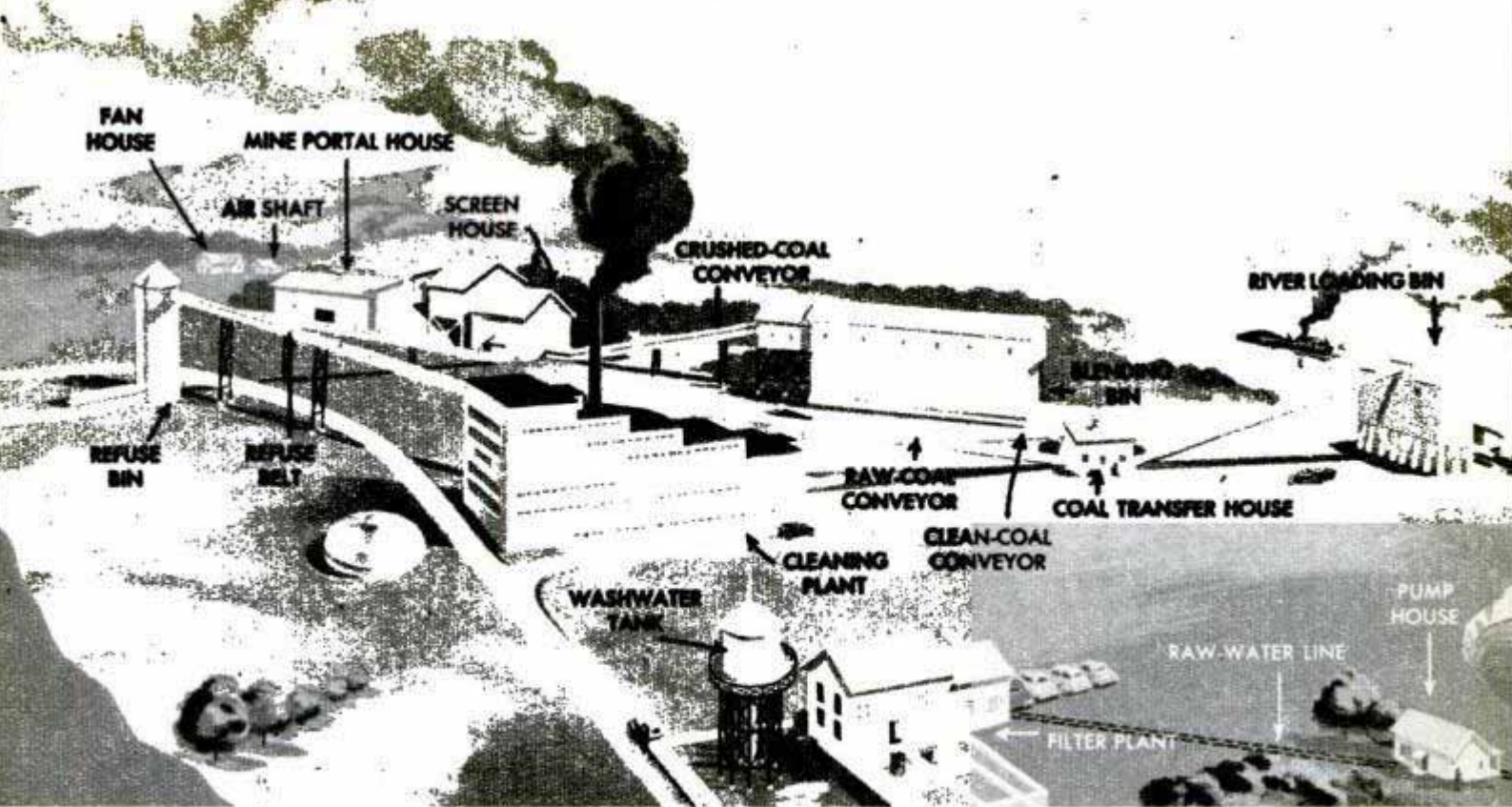
Heavy wartime steel production put a heavy drain on reserves of first class coking coal, such as is found in Fayette County, Pa. A new source of satisfactory—if slightly inferior—coking coal had to be provided or the companies would be in trouble. There are three prime factors in steel making: ore, coal and customers, and two of them must be within a reasonable distance of the mills. Since the ore comes from the western Great Lakes region that meant that the bituminous and the buyers had to be kept handy.

Samples were taken from the Pittsburgh No. 8 seam in Greene County, where Frick had a 69,000-acre reserve—approximately 100 square miles of coal in a vein eight feet thick. It was of generally higher sulphur and ash content than the coal then being used, but the sulphur content ranged from low to high.

This geological inconsistency made it possible for the Frick people to blend high sulphur and low

Explosive expert inserts blasting cap in final powder stick to be packed in hole. Blast sets off charge, loosening the coal





sulphur coals before they leave the vein level; by the time the coal reaches the coking ovens at Clairton, 61 miles down the river, it has been blended seven times. In addition to this mixing process the Robena output will soon be beneficiated — washed and cleaned to reduce the sulphur and ash content—at a new and efficient washing plant at the mine.

The main service shaft of the Robena mine is 454 feet deep and is 38 feet 10 inches by 15 feet 9 inches. It is lined with concrete ranging in thickness from 12 inches at the top to 18 inches at the base. This shaft is divided into four compartments, two for hoisting, one for a stairway, and a fourth for up-cast ventilation. The latter is connected to the main exhaust fan and the other three serve as air intakes.

The big exhaust fan plays a vital part in the Robena ventilation system. This unit is housed in a 24 by 40-foot brick building adjoining the shaft and the variable-pitch eight-blade fan is 96 inches in diameter. It removes 300,000 cubic feet of air a minute.

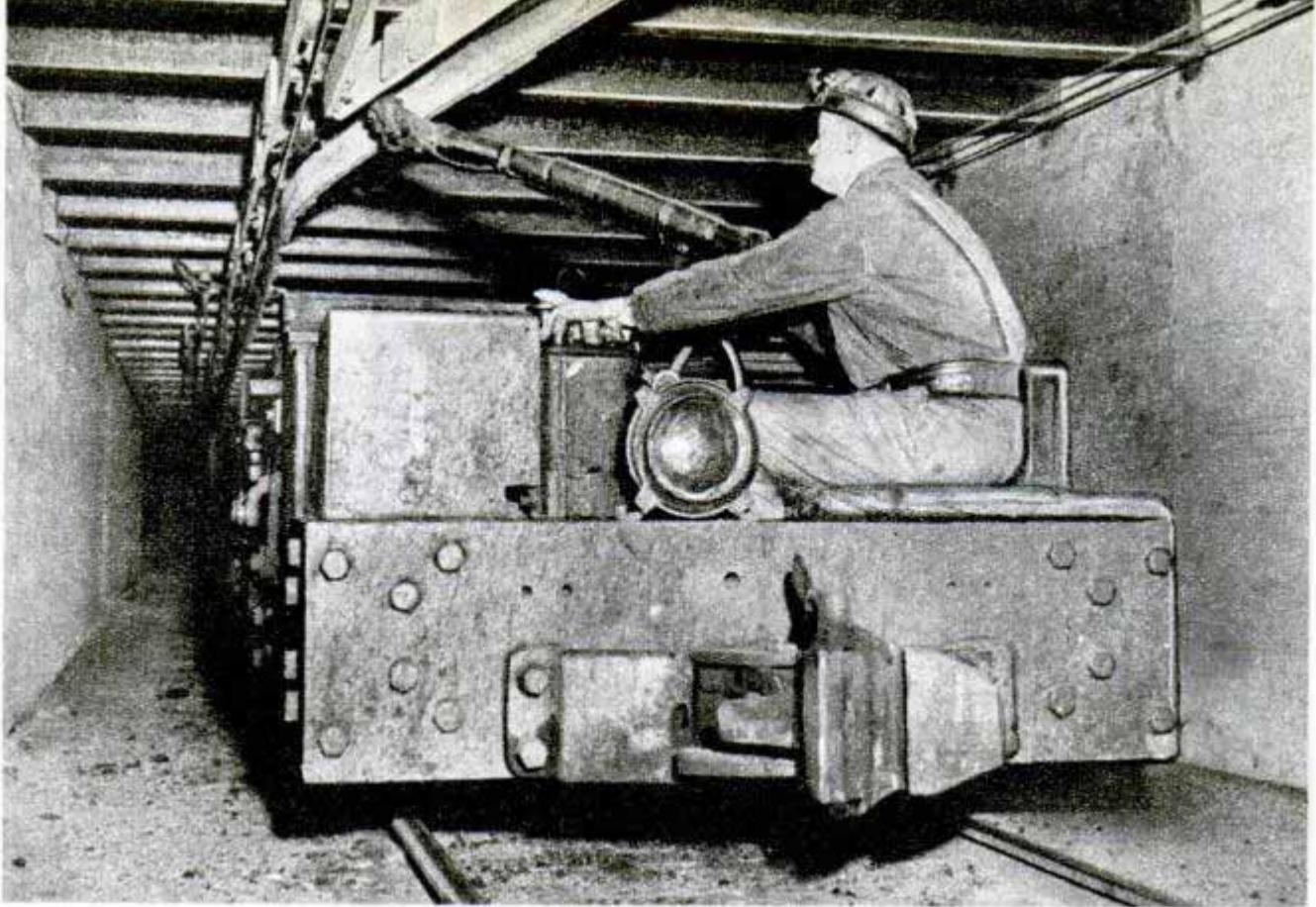
Another nearby structure is the lamp and bathhouse which provides accommodations for 1345 miners and 45 foremen. This building has two huge dressing rooms

Above, cutaway drawing shows the mechanized transport of coal from the mining sections to the above-ground processing plant. Carried on long conveyor belts, the processed coal is loaded on river barges at right. Below, power loader in mine scoops up the coal and drops it into cars



with overhead clothes-drying facilities. It also contains the first-aid room and offices for the superintendent, mine foreman, cost clerk, and a payroll office with a fireproof vault. The lamp room has facilities for maintaining 2500 cap lamps and the necessary flame safety lamps.

Let's start our tour of inspection at the mine face, where the coal starts its streamlined journey from vein to steel mill, noting what's done to fit it for its exacting role in the making of the basic material of



Electric trolleys haul 35 loaded cars up to 12 miles an hour along the ten miles of mine tunnels

our country's industrial production, steel.

Traveling on the Robena underground railroad system, a visitor is struck with its resemblance to a city subway. In the main haulage way tunnels there are practically no posts used as roof supports, but steel beams with four-inch flanges, are firmly anchored into the coal or rock on either side of the tunnel. In the temporary entry tunnels, leading to the sections where the productive mining is done, cross timbers are installed in the same manner and only near the working faces are the older-type roof supports employed.

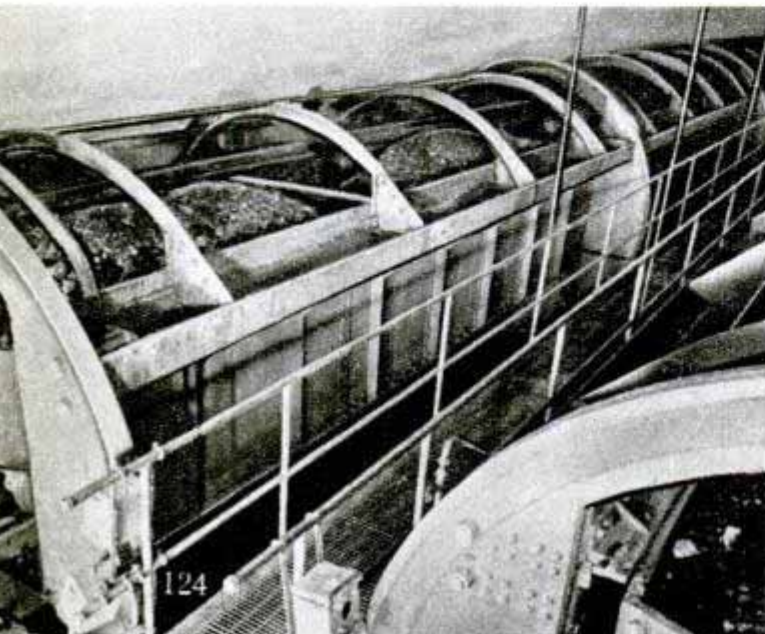
A smooth ride is provided by 60-pound track set on slate ballast throughout the more than 22 miles of main haulage ways. Two and a half feet of clearance are re-

quired on the wide side—between car and wall—for the protection of persons on foot, and wall niches are cut at frequent intervals to shelter personnel from the possible derailment of a fast-moving train.

A brisk, fresh breeze, moved by three ventilating fans with a combined capacity of 750,000 cubic feet per minute, keeps the air fresher underground than it is in many cities. Water pipes with drinking fountains are a mine innovation and account in part for the necessity of having a million-gallon-a-day water filtering system. Even the rolling stock is cared for underground, a completely equipped repair shop at mine level taking care of all but major repair and overhaul jobs.

At Robena, the open-end system of mining is used, a technique pioneered by Frick 20 years ago—which permits maximum output per section developed, operation at a high degree of safety, low maintenance when operations are curtailed or suspended—and which lends itself to a high degree of mechanization.

The development of a mine is something like that of a community except that the purpose is to remove rather than to create something. The ways are the streets and avenues, pushed through the coal seam to bring men, machines, electricity, air and water to the place where the job's to be done. In an eight-foot vein such as this, the burrowing can be done entirely within



Cars are unloaded by rotary dumps which turn them upside down. Coal is mixed before moving to surface

the coal seam and 25 percent of the coal recovered comes from the development work.

The sections might be compared to rectangular communities, with regular rows of houses and streets. The mining is begun at one end or corner of the section and proceeds, row by row, to the opposite end—leaving a sort of collapsed emptiness behind it. This latter results from the fact that as a lane is emptied of coal the timbers are pulled out and the roof permitted to fall in. This reduces pressure on the adjacent working area and eliminates what would eventually be a vast shored-up area which would invite accidents.

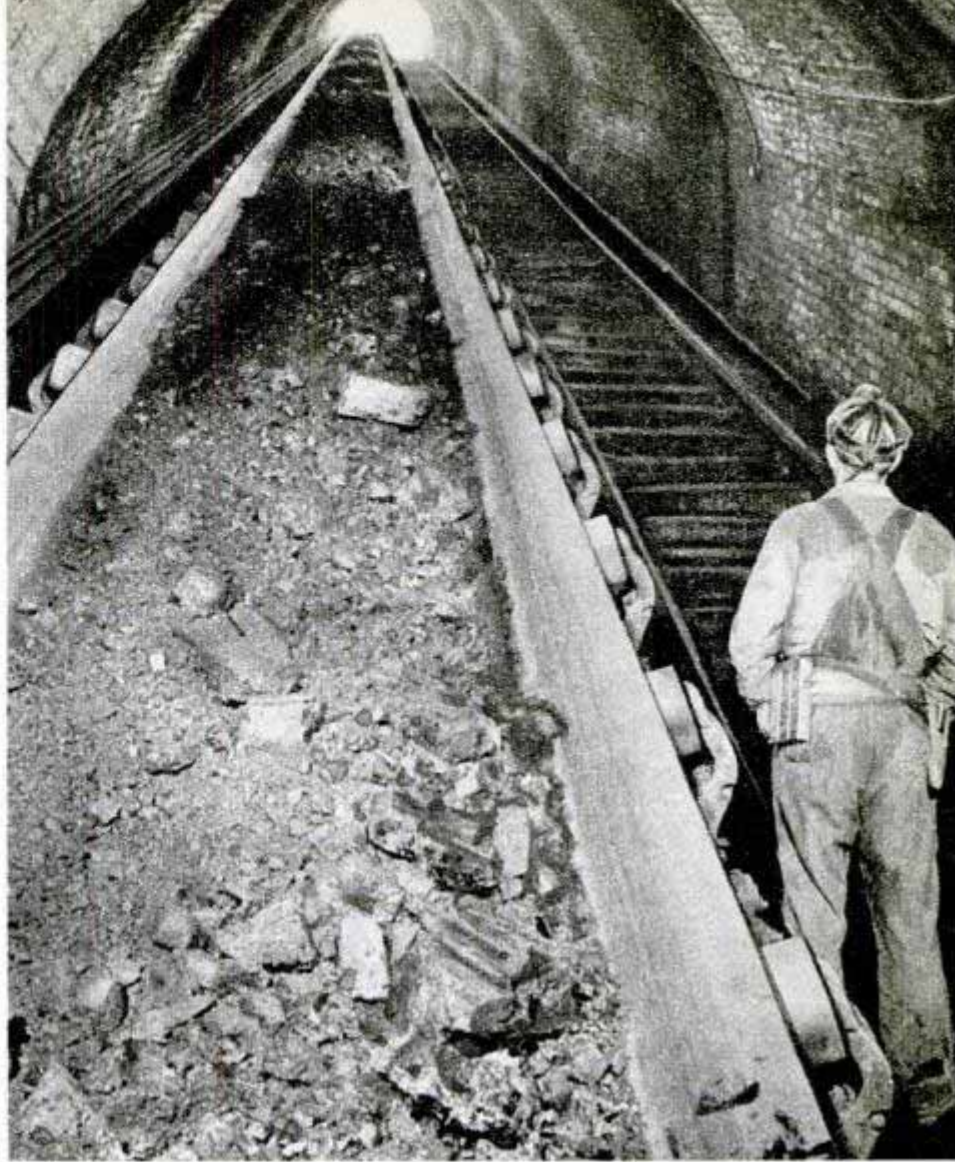
In each working place the extraction of coal is carried on with the efficiency of a well-drilled backfield driving the length of a football field, but probably with less expenditure of human energy.

Up to the working face of the coal seam rolls a track-mounted cutting machine. The saw teeth of its oblong revolving cutter swiftly make an incision 8 feet deep extending across the top of the working face. Water is constantly played on the cutting area to lay the coal dust and to reduce sparking when the teeth hit shale.

A drilling machine then moves in and bores three to six holes in the face. The man doing the blasting places explosives, detonator cap, and tamping in each hole and then detonates them one hole at a time. This method is slower than blasting them simultaneously, but it is safer since an unexploded charge is immediately detected and does not turn up as a gruesome surprise when the coal is being loaded.

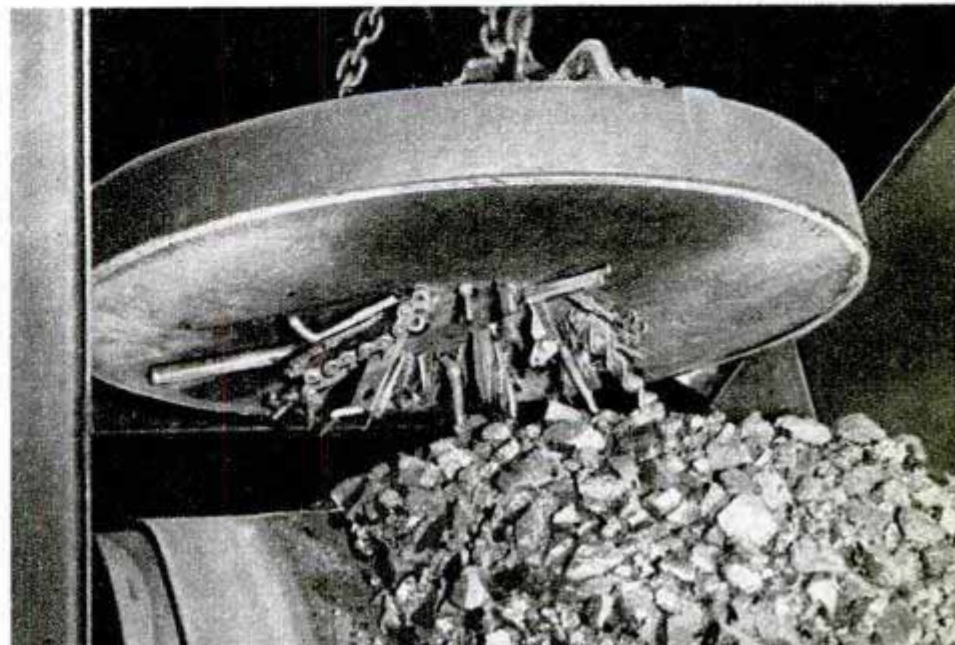
When the face has been shot, 25 to 45 tons of coal have been jolted loose from their ancestral home and the mechanical loader moves into the scene. Its long nose with its endless chain conveyor is shoved into the pile of loose coal and the black chunks are whisked over the loader into the eight-wheeled steel cars, each of which has a 6½-ton capacity. However, before the loading is done the face is inspected for gas and soundness of the roof.

Cutters, drillers and loaders are all electrified and track-mounted. Shuttle locomotives pull the loaded cars to a main haulage way where they are made up into trains of 35 to 40 cars. Fifteen-ton locomotives, operating on 500 volts of direct current, haul the trains to the rotary dump at a maximum speed of 12 miles an hour. En route the trains pass a check point at which every car is weighed and the initial check on



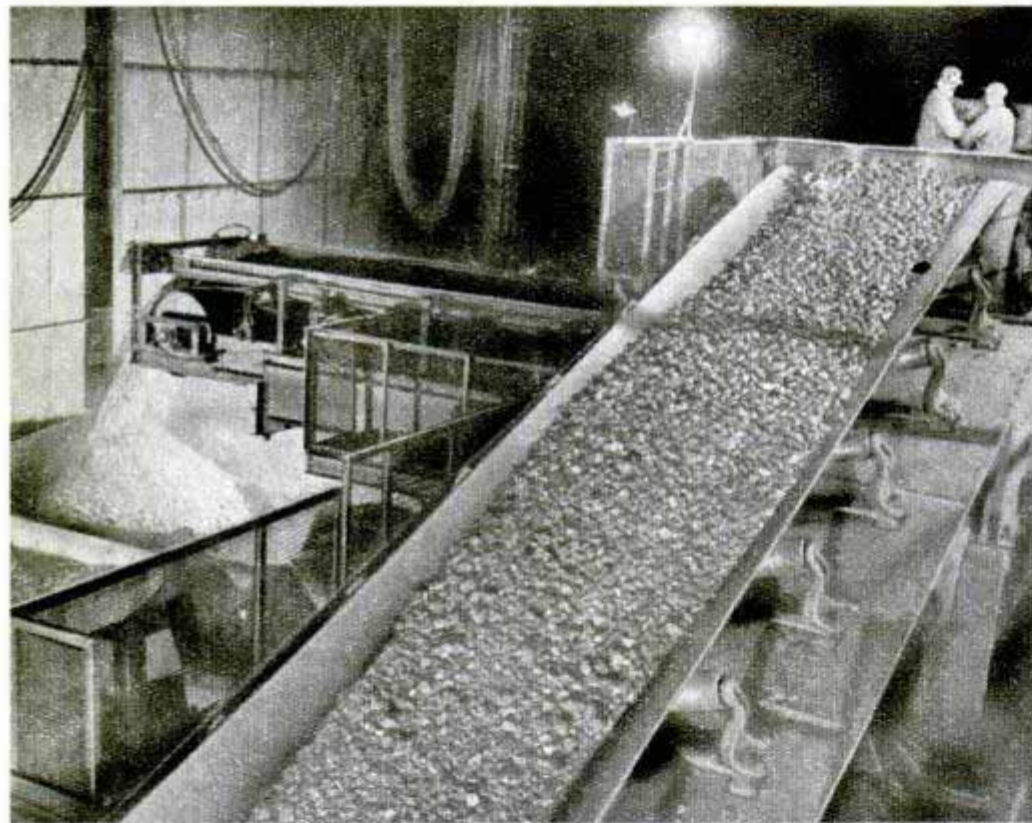
At a rate of 2800 tons an hour, Robena coal is carried from the rotary dump to the surface on this long conveyor belt

Below, a strong electromagnet, hanging over the top end of the conveyor, removes broken tools and equipment from the coal





Above, workmen remove slate and other refuse from the coal as it moves on to the screen breakers where it is reduced to three inches or less in size. Below, conveyor belts distribute the coal into blending bins which mix it to insure the chemical uniformity needed for producing metallurgical coke



the tremendous output of the mine is made.

The cars are left in a classification yard near the car dumper; separated according to the sulphur content of the coal. Two ten-car rotary dumps are loaded with high and low sulphur coal, which is dumped simultaneously into a 700-ton bin. This is the first step in the blending.

Ten apron feeders move the coal onto the slope belt—five feet wide and more than 1600 feet long—which can carry 2800 tons an hour to ground level, 171 feet above. From ground level it goes higher and higher until it reaches the great tippie, from which it will be loaded into barges;

it gets cleaner, and it gets smaller.

Its first step above ground is in the screen house and breaker where it goes over two 12 by 25-foot shaking screens with three-inch perforations, then two more smaller screens similarly perforated. This removes all the minus three-inch pieces—the size which it must all eventually reach. From here the remaining large-size chunks are fed onto brightly illuminated picking tables where slate and other refuse is removed by hand—one of the few manual operations at the mine—and dropped into chutes which load it on the main refuse belt.

The coal then passes to the Bradford breakers, consisting of two revolving cylinders, 12 feet in diameter and 17 feet long, which again have three-inch perforations. The breakers reduce the coal to the desired size and the freed unbroken slate and sulphur balls are carried off to the main refuse belt. This belt has a capacity of 7200 tons a day, more than the total output of many large mines. After the reject material is crushed it is conveyed to a concrete bin six stories high, from which it is loaded on trucks for disposal.

As the coal passes from the screen house to the blending bins on a conveyor belt it passes beneath a 65-inch electromagnet which removes tramp iron in a wide variety of forms, including tools, personal effects, etc. Here also is an automatic sampler which removes 350 pounds of coal from each 1000 tons for laboratory analysis and reduces it to pass through a $\frac{1}{4}$ -inch screen.

It is in the blending bin that the mixing process really reaches its zenith. The bins consist of 168 pockets, each holding more than 100 tons and arranged in six rows of 28 each. Over this elaborate filing system runs an electrically operated flying bridge

which can distribute the incoming coal to each bin in succession or in any order that is desired. The coal is then withdrawn from a set of 56 bins simultaneously via undercut gates and represents a blended average of 6000 tons of production from the mine. It is conveyed to the tipple on a belt from which another automatic sampler takes coal for analysis.

In the huge tipple, two five-foot conveyor belts take the coal from the main belt and "layer-load" it into a 14-pocket bin. Thus some part of every 100 tons of coal which reaches the tipple goes into each pocket. Undercut gates and feeder belts connected with seven adjustable telescopic chutes then convey the product from the bin, loading 800 tons on a barge in $4\frac{1}{2}$ minutes.

Sixty-one miles down the river the cargo reaches Big Steel's Clairton By-Product Coke Plant where it is unloaded, washed, and placed horizontally into bins with the rich Fayette and Westmoreland County coal. When it is withdrawn in vertical slices to go into the coking ovens it has received its final blending.

In the coke ovens, under tremendous heat and pressure, the volatile matter burns off and $20\frac{1}{2}$ tons of coal becomes 14 tons of metallurgical coke—a super-tough variety that will stand up under tons of iron ore and limestone in the blast furnace. As by-products each ton of coal produces, along with about $\frac{2}{3}$ ton of coke, 11,000 cubic feet of gas, 11 gallons of tar, 25 pounds of ammonium sulphate and 3.4 pounds of benzol products.

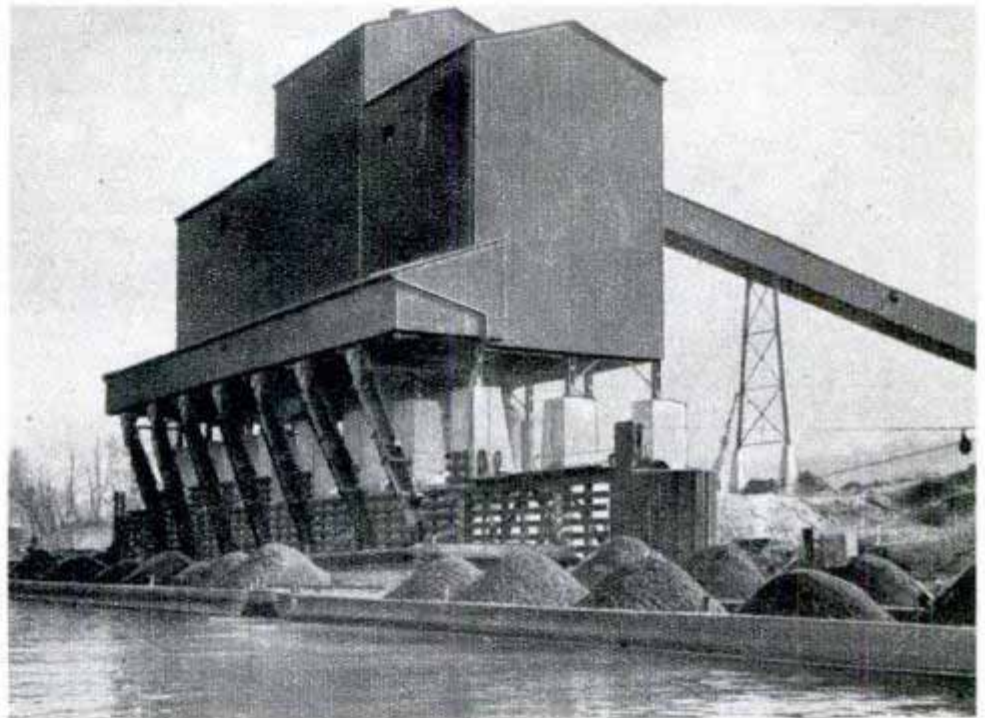
The whole steel process depends on the quality of the resultant coke, which in turn is established by the coal which fathers it. Badly blended coal makes a weak coke, which cannot support the ore and limestone in the furnace. High sulphur and ash content results in too much slag, requiring a large amount of limestone to neutralize it. An excess of sulphur or silicon carries through into the iron and requires a longer period for refine-

ment during the open hearth steel process.

Design engineers are confident that the washery now being constructed at Robena will, when completed, produce coking coal that will require a minimum of upgrading for satisfactory performance.

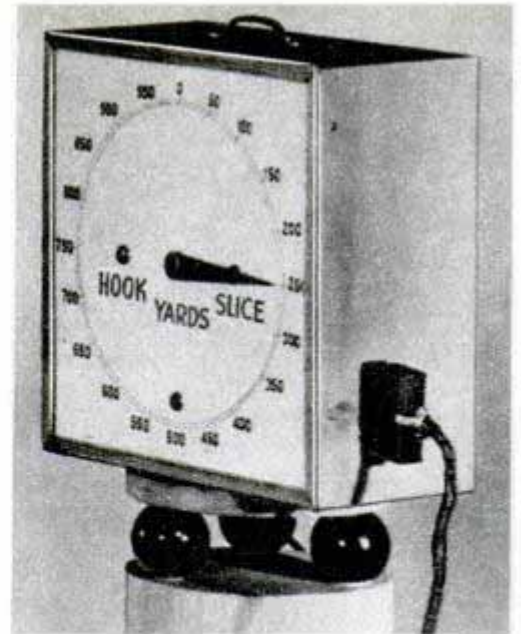
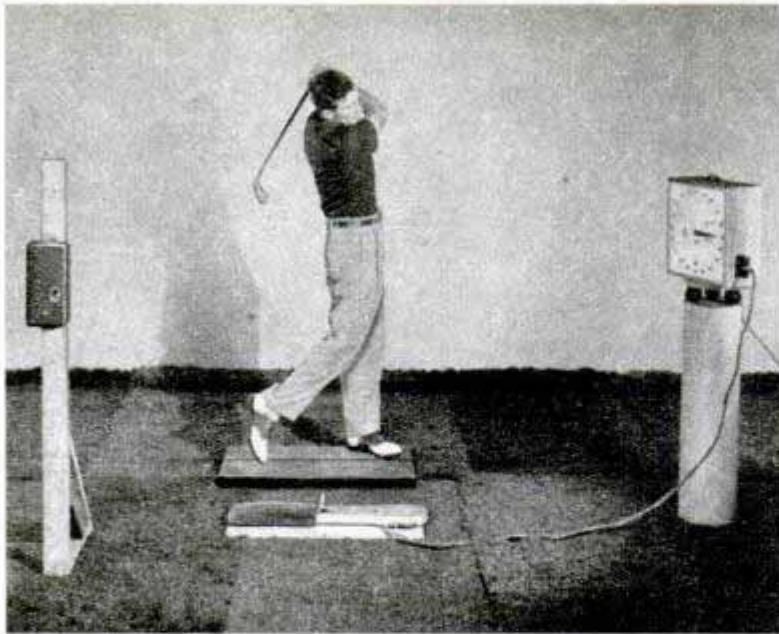
The portion of this coal reserve earmarked for Robena comprises 22,000 acres and assays 10,000 tons per acre—enough coal to last more than 24 years, mining 20,000 tons a day 365 days a year. The total reserve is 69,000 acres—a 78-year supply.

The art of mining coal has come a long way since the days of the donkey cart. Maybe the highly mechanized Robena mine forecasts a future day when coal will be delivered "untouched by human hands."



Above, enclosed in elevated passageway at the right, the conveyor belt pours coal into this 2000-ton tipple. A complex conveyor system inside the tipple carries the coal to the seven barge-loading chutes. Below, loading chutes fill barge with 900 tons of coal in about five minutes

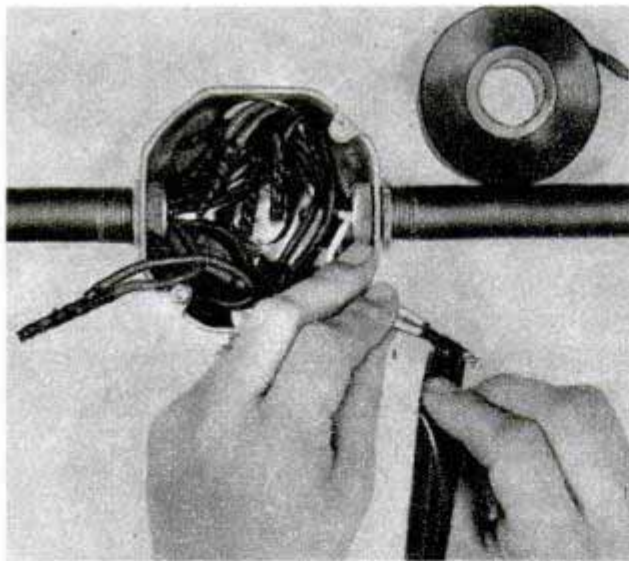




Golf-Practice Device Detects Hooks, Slices

In addition to registering yardage, a new golf-practice recorder flashes a light if the swing would produce a hook or slice. The player, using either a wood or iron, hits a rubber-and-canvas target just as he would hit a golf ball. If his swing is to the left, which would cause a slice, a light flashes on the meter above "slice." If the

swing is to the right, the "hook" light flashes. The machine is designed for coin operation—five shots for a nickel. Yardage on the meter extends to 1000, so that players know total "distance" for several shots. Or, games can be played by setting the distance for a hole and then hitting the target with the force considered necessary.



Rotating Typewriter Eraser

With the action of an automatic push drill, a mechanical typewriter eraser removes typing errors by the revolving motion of its rubber tip. The operator fits the adjustable guide in the V-slot type guide of the typewriter. Then as she pushes on the handle of the pencil-shaped eraser, the rubber tip spins clockwise against the paper. As pressure is released, the handle springs back and the rubber tip revolves counterclockwise. The rubber eraser is removable and can be replaced.

Plastic-Backed Cellulose Tape

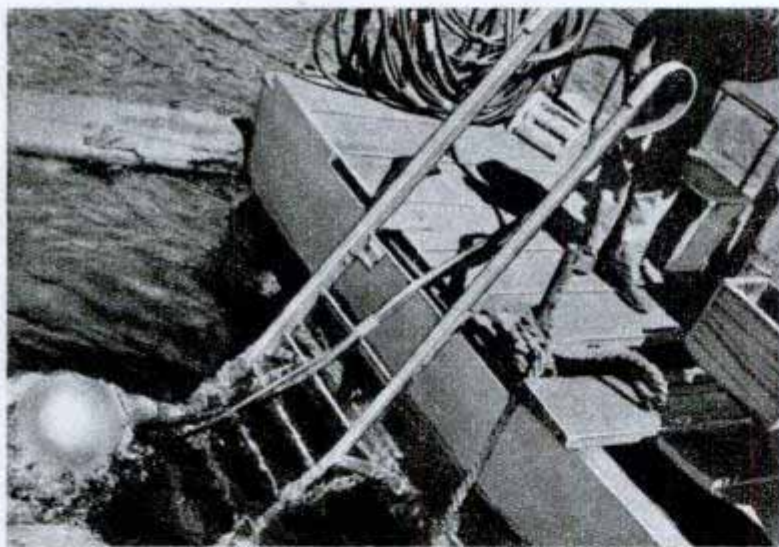
Designed to make the wrapping of wire splices a one-tape operation, a special cellulose tape with plastic backing provides the electrical insulation of rubber tape and the physical strength of friction tape. The tape is weather-resistant and has a dielectric strength of 1000 volts per mil. Also resistant to oils, acids and water, the tape is being used for automotive and aviation ignition systems and for exposed wiring in manufacturing plants. It comes in thicknesses from 7 to 12 mils and in yellow, white and black.





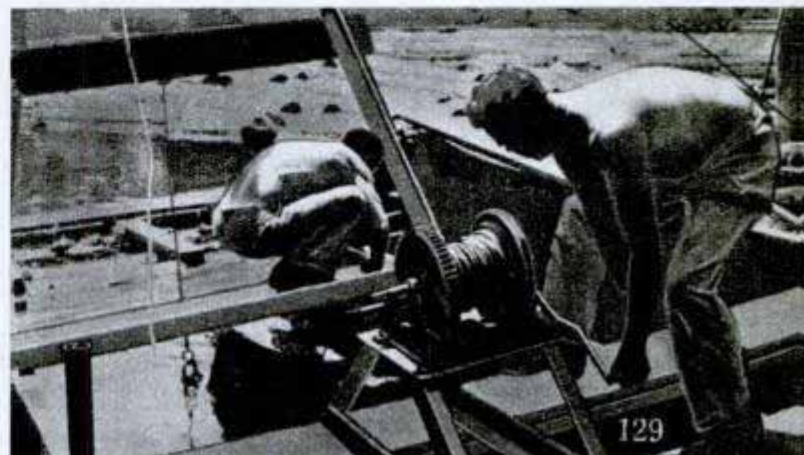
Above, water-soaked log breaks water between pontoons of raft. Below, underwater lumberjack begins a 75-foot descent to bottom

DIVING FOR LOGS



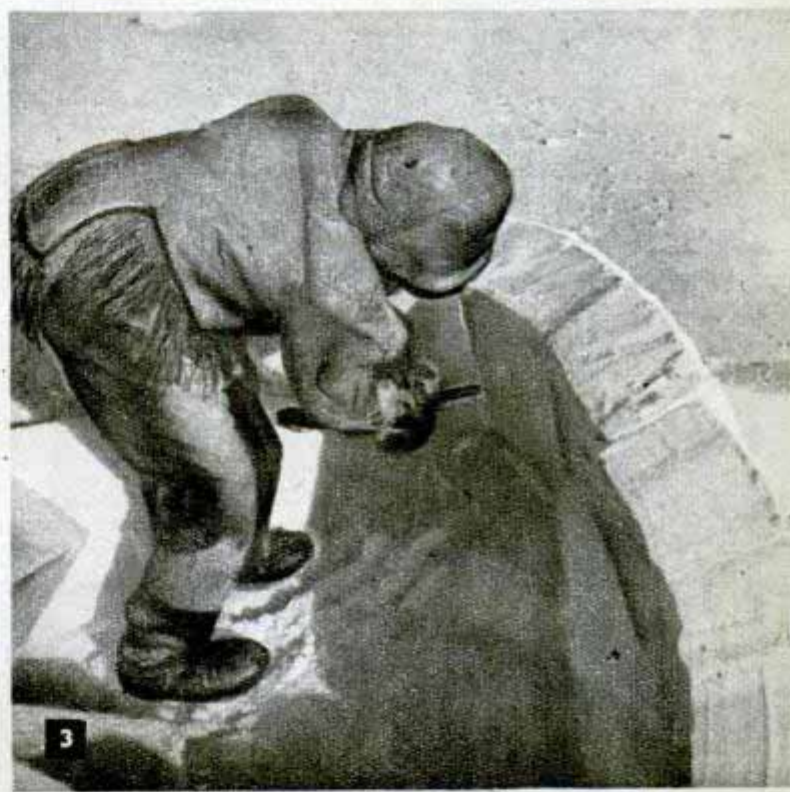
Underwater lumberjacks in northern Idaho have no use for axes and saws. Their tools are diving suits and the logs they are after are already cut. River bottoms in that timber country hide thousands of sunken logs that were kept from floating downstream by rocks until they became waterlogged. These water-soaked logs sank to the bottom and never reached the sawmill. Three veterans, former Navy divers, are now salvaging this valuable timber which, when properly dried, still holds marketable quality.

Below, left, the three veterans take turns diving. The other two help the diver into his war-surplus outfit. Right, no danger of falling timber here. The soakers have to be pulled up from the bottom by a hand winch



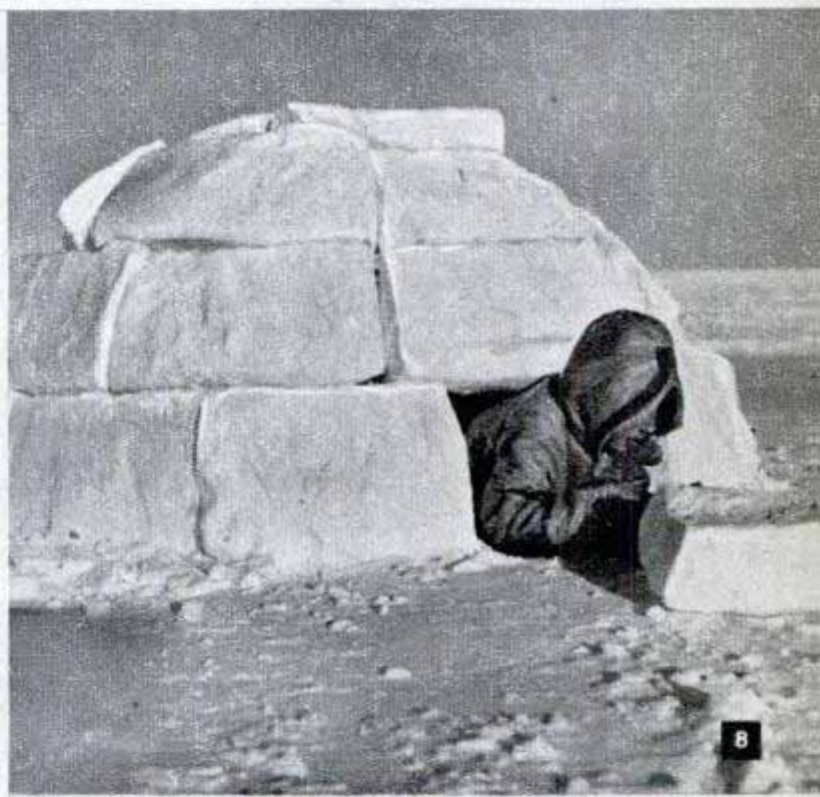
Keenarlik Builds an Igloo

Housing problem? Keenarlik, a 12-year-old Eskimo girl, demonstrates an age-old technique in building herself an igloo. Photos were taken with the temperature at 42 degrees below zero. 1. Snow is scored into blocks with a butcher knife, then each block is cut free with a final undercut. 2. As Keenarlik cuts each block she erects it to form the base of the igloo wall. Thus the hole in the snow increases the height of the finished igloo. 3. She tilts each block slightly inward to start shaping the walls. 4. The knife is passed beneath the blocks several times to make the edges match. Slight holes and cracks then are filled with cut snow. 5. As the second row is built up, the tilt of the walls can be plainly seen. 6. Blocks in the top rows



Photos by Ven. Donald B. Marsh Archdeacon of Aklavik, N.W.T.

are almost flat and are held in place by contact with the last block that was set. The snow is heavy, and in a full-size igloo each block would weigh about 60 pounds. 7. With the igloo almost completed, Keenarlik barely can be seen. 8. She now is sealed in the igloo and must push away one of the blocks before she can crawl out. This loose block will be used as the door when the igloo is finished. 9. Rough edges are pared away and the cracks and holes filled with powdered snow. The extremely low temperature freezes it almost instantly. 10. Keenarlik makes the finishing touches on her home. When heated inside, the igloo will settle into a solid mass of snow to make it completely windproof. However, igloos built of the wrong kind of snow may be demolished by a high wind. A grown man can stand on top of the igloo.





Mobile Chair on Tank Tracks Climbs Curbs and Steps

Miniature tank-type tracks drive a mobile chair designed for disabled veterans, invalids and the aged. The hard-rubber tracks make it possible for the chair to climb steps, mount curbs and travel over rough terrain. The chair is 27 inches wide and can pass through ordinary doorways. Powered by an electric motor run from a storage battery, it travels faster than the normal walking speed. Two steering levers control the tracks and the chair can turn in its own length—50 inches. It was invented by E. C. Gleason of Everett, Wash., while he was stationed with the Navy in the Aleutians. He calls it a "gleep."

V-Shaped Paddles For Stern-Wheeler

By using V-shaped paddles instead of the usual parallel arrangement, stern-wheel steamboats may be operated more economically and with less strain on the engines. With parallel paddles the drive shaft and engine are subjected to great strain as the paddles dig into the water at regular intervals. The new design, tried out successfully on the river steamer *George M. Verity*, provides a continuous thrust in the water and results in smoother operation. In backing, the V-paddles deliver water to the sides instead of pouring it over the stern as do the parallel paddles. Nine percent saving in

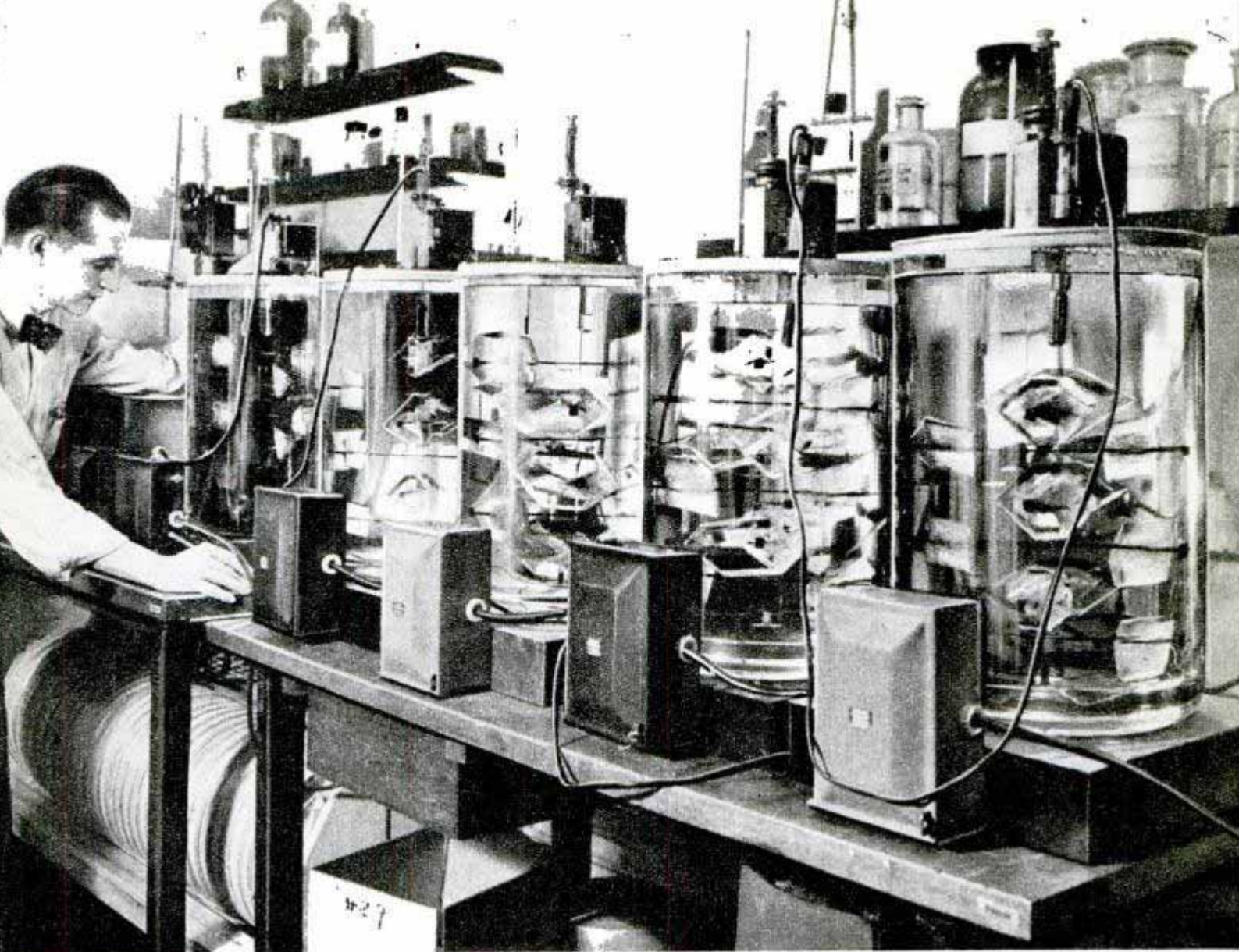


fuel and 10 percent slower wheel speed for the same tow tonnage at the same boat speed were reported from the tests.



Grain Unloader

Farmers save time and cut grain waste in livestock feeding with an unloader designed for 38-inch wagon boxes. Two augers, driven by the tractor's power take-off, transport the grain up a tube which swings over feeder boxes. Unloading speed is 20 bushels a minute. The unit is easily removed.



Grown from seeds, these artificial crystals, in final stage of growth, are ready for harvesting

CRYSTALS GROWN FROM SEED

SCIENTISTS have taken a leaf from the rock-candy makers' cook book. They are using a similar technique to produce artificial crystals now used in long-distance telephone circuits.

Prior to the discovery of a way to grow crystals artificially, the telephone companies relied on scarce natural quartz. When wartime demands for that material in the production of sonar equipment threatened to exhaust the supply, scientists went to work on production of artificial crystals.

Engineers now predict that within a few years, artificial crystals will replace as much as 90 percent of the natural quartz used in long-distance telephone systems—and it will do as efficient a job as its natural brother. Already, some New York City to St. Louis circuits are operating with the synthetic crystal units.

The new crystals, ethylene diamine tartrate, are familiarly known in the laboratory as EDT. Different from natural quartz

in chemical composition, the artificial crystals react electrically in the same way as their natural brothers. Both can convert mechanical energy to electrical energy and both can reverse the process. To demonstrate this unusual characteristic, the scientists at the Bell Telephone Laboratories use a 110-volt glow lamp of the gas-filled type. Properly wired to the lamp, the crystal, when struck a sharp blow with a padded hammer, will cause the lamp to light up momentarily.

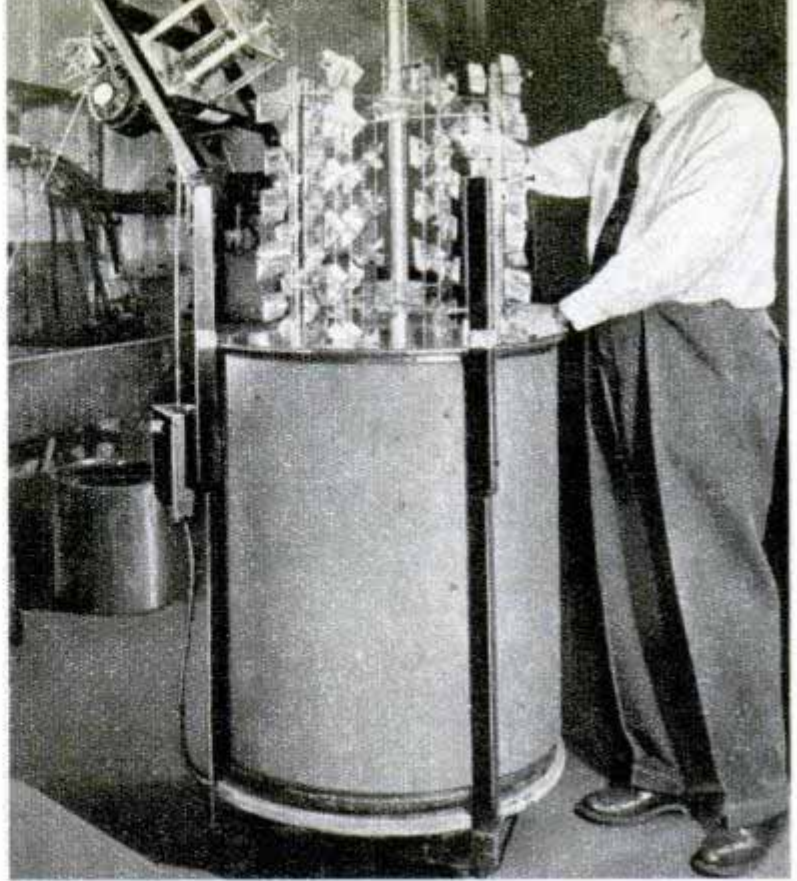
A small slice of the crystal vibrates with unvarying frequency when electric current is applied to it. Telephone engineers use this characteristic to send many telephone conversations over the same wire simultaneously, but at different frequencies. The crystals filter each conversation into its proper channel so there is no interference. In effect, the filtering process does the same thing a radio listener does when he tunes his dial to select a station.

Similar in basic outline to the process used to make rock candy, the crystal-growing technique is much more refined than that used by the candy makers. Since it must produce single crystals rather than a haphazard growth of many crystals, the entire growing process has to be controlled precisely. For example, temperature variations are kept within a tenth of one degree during the growing period.

The original seeds to which millions of artificial crystals could trace their ancestry were only a third of an inch wide. They were produced by evaporating a saturated solution of the chemical in a shallow dish, just as ocean water can be evaporated to obtain salt. The chemical used was nothing more complicated than a pulverized chemical salt, commonly used as fertilizer, dissolved in water.

Today, the seeds used in the production-line growing process are small slices of the transparent crystal material harvested from a previous batch, but rejected for electronic use because of flaws. Strangely enough, though the seeds are imperfect, the crystal bars that grow from them are not. From these imperfect seeds, perfect crystals result.

Several dozen seeds, each about a half



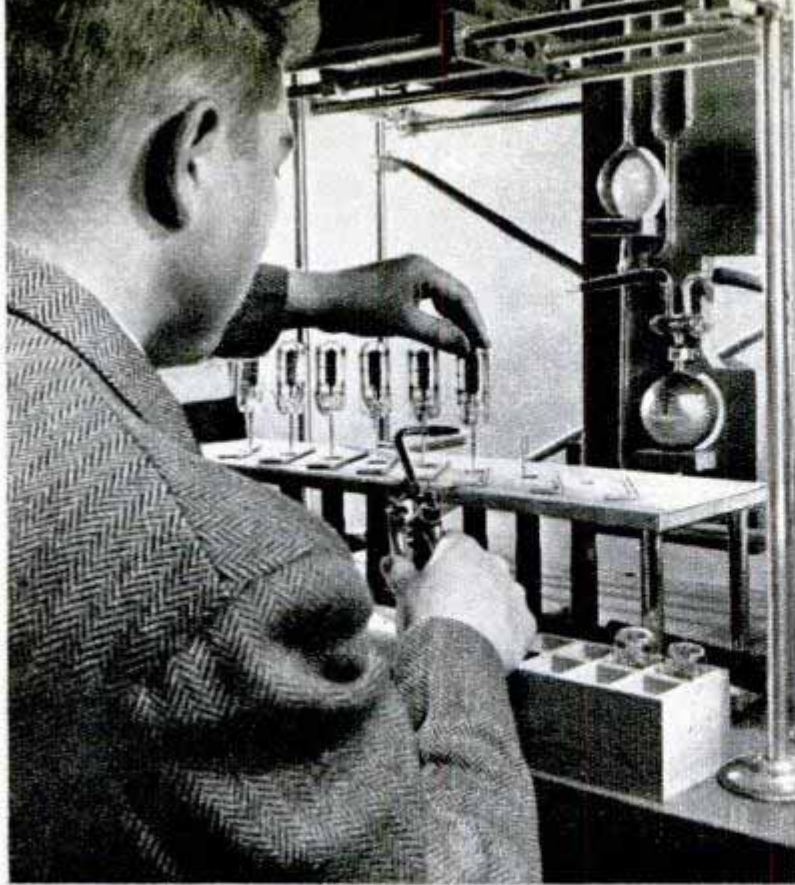
Crystal seeds, mounted on frames, being placed in growing bath

inch thick and one to two inches square, are mounted on a framework of metal bars and placed in the saturated chemical solution. The seeds are rocked slowly back and forth in the solution for several days while its temperature is lowered from 135 degrees Fahrenheit to room temperature.

As the temperature of the solution drops,

Left, crystal plates are polished before being gold-plated. Right, test unit measures crystal's frequency





Glass envelope containing crystal is sealed tight by blowtorch

the salt crystallizes and is deposited on each face of the seed, forming a four-sided pyramid on each end.

After they have been removed from the first bath, the crystals are inspected and placed in glass jars where the process is repeated. For 45 to 60 days, the growing seeds are rocked continuously in the solu-

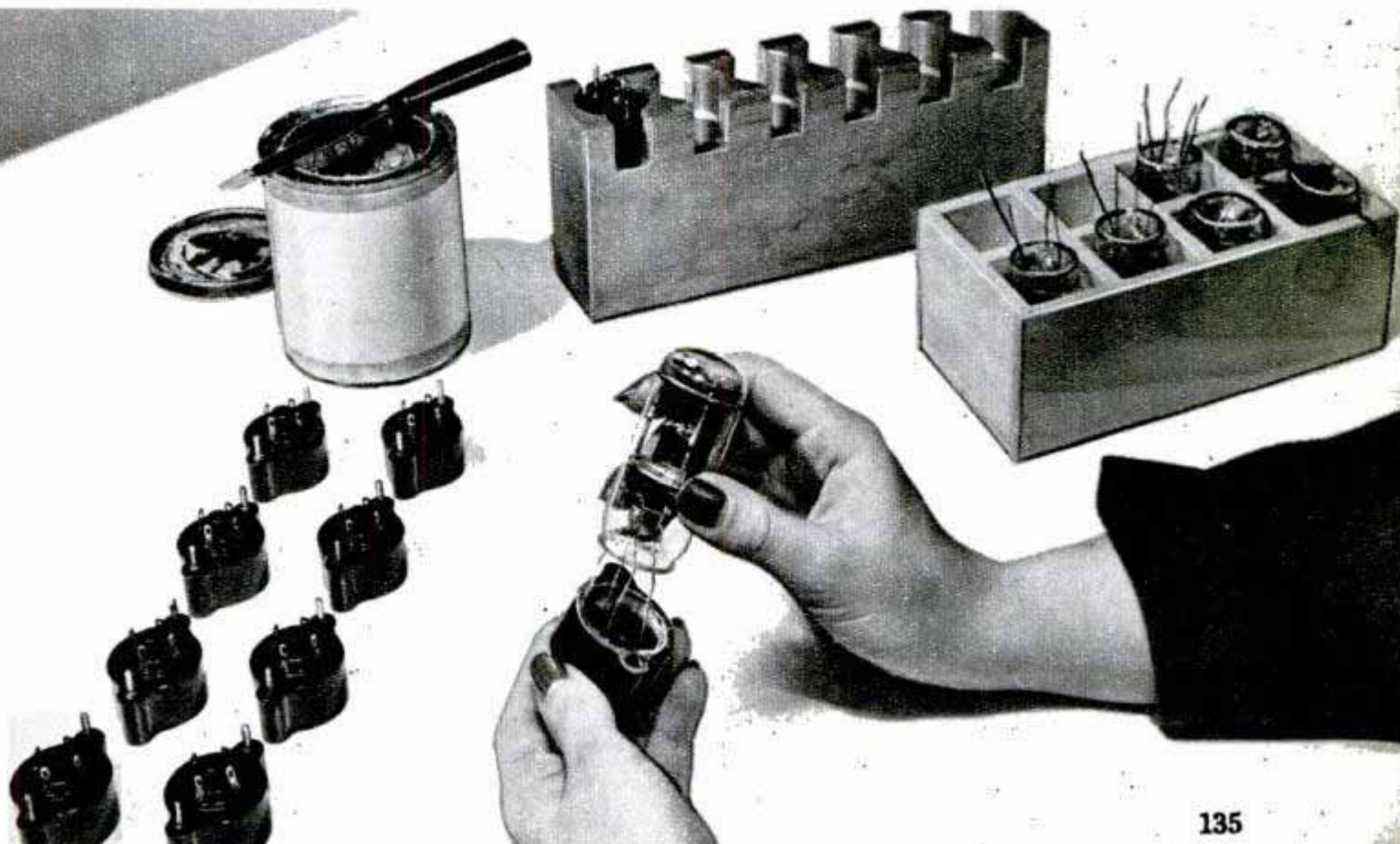
tion. Gradually, the crystals increase in size as the salt is deposited on them. When harvested, they have grown to transparent bars six inches or more in length and weighing about a pound each. Seeds are cut from the imperfect portions of the full-grown crystals for use in planting a new growth.

The full-grown crystals are then cut into plates about an eighth of an inch thick, an inch and a half long and a half inch wide. These plates are coated with a film of gold a millionth of an inch thick. This gold-plating serves as an electrical connection when the crystals are installed in the electronic equipment. The crystals are then mounted in a glass envelope to form a crystal unit, the selective element for separating phone conversations.

Bell Telephone engineers will never get around to doing it, but if all the crystals they have grown with the "rock-candy"

process were piled in one spot, it probably would rival the famous Big Rock Candy Mountain in size. By mass production methods, they produced 20,000,000 crystals during the war for use in sonar equipment. Today, however, engineers are too busy filling the demand for these crystals to think about the hill made famous in song.

Artificial crystal in sealed envelope is mounted in tube base for use as selector in long-distance circuit



They're Always Fooling the Public



You can't always believe your ears. In every major broadcasting studio there's a man whose principal duty is to fool you. He's the sound-effects man, and each has his own bag of tricks—some of which are illustrated here. On one program not long ago you could hear thunder rolling, horses' hoofs click-clacking on the pavement, the patter of rain (shown above), a door slammed, the splash of a waterfall, monkeys chattering, a ship's whistle and the screech of auto brakes. But the sounds were all made to order—there wasn't a monkey or a steamer or a storm within miles

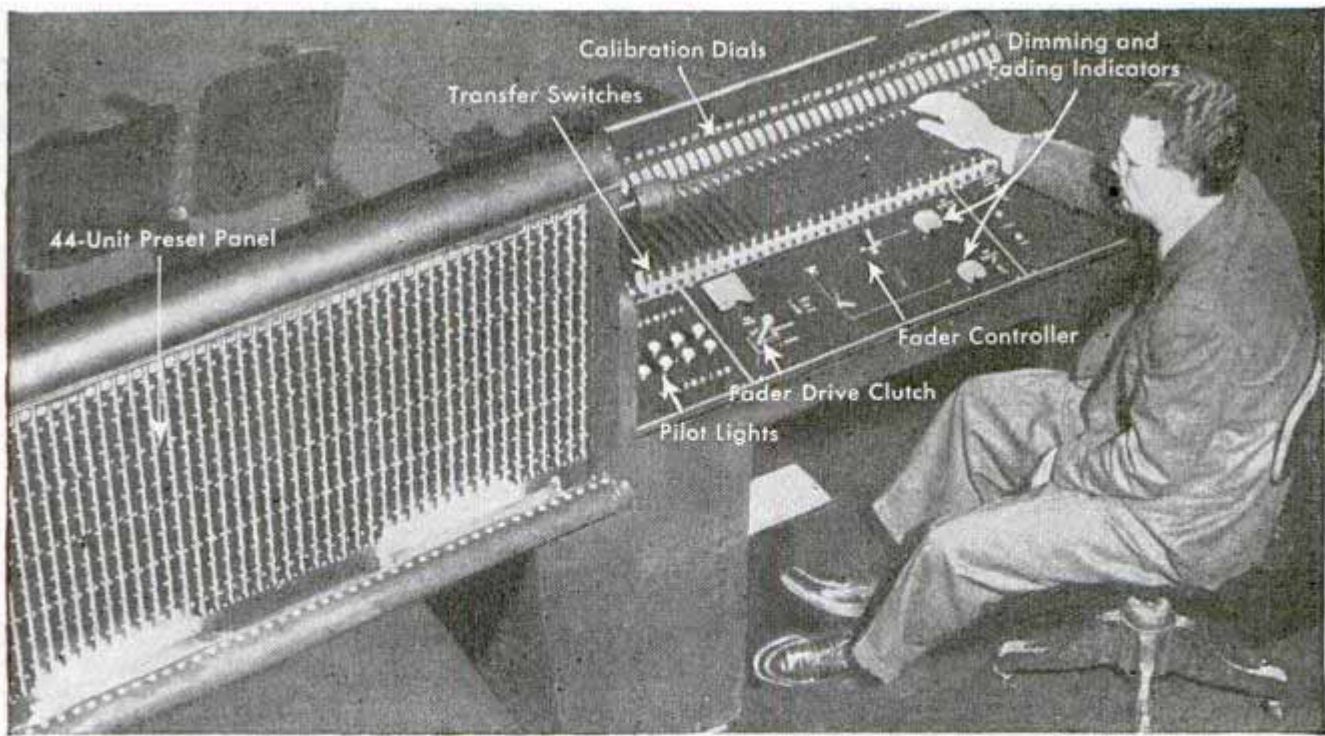


Squeak box (above) makes a noise like a creaking door or prying open a crate

Studio version of a kiss is achieved by disengaging rubber disks shown at left

Sound equipment at right makes noise of falling junk in Fibber McGee's closet

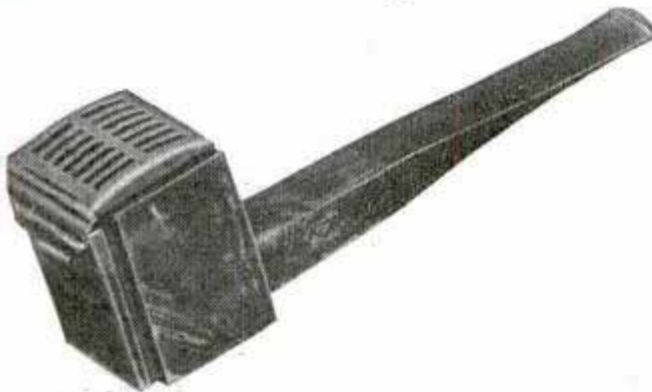




Electronic Panel Controls Lights for Theater Stages

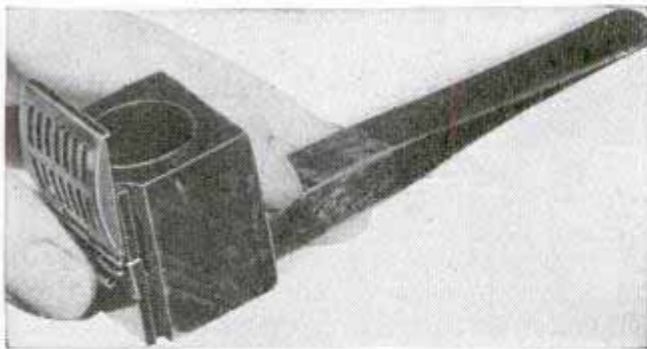
Complicated operations in controlling stage lights are simplified by an electronic system developed by Prof. George C. Izenour of Yale University. The unit makes

it possible to set the controls so that one operation, involving change of intensity of all lights, becomes a single manual or automatic movement. With old-style stage switchboards, 44 manual adjustments would be required to accomplish the same results. Professor Izenour's system enables the operator to switch and dim lights from one electronic control network.



Sliding Cover on Windproof Pipe Prevents Flying Ashes

No hot ashes or burning tobacco can blow from a windproof pipe equipped with a sliding metal cover. A flick of the thumb moves the cover out of the way so the pipe can be cleaned and filled. Available in natural, walnut and plum finishes, it has a bowl of imported briar.



Bumper Guard for Parking →

Room to drive out of a parking space is guaranteed by a combination bumper, grille guard and luggage rack that attaches to the front bumper. Inventor Guy Kibbee, Hollywood actor, demonstrates how the guard is let down to prevent bumper-to-bumper parking. Used as a luggage rack, it will support 300 pounds. When not in use, it folds back to protect the grille.



New Methods for Plotters



Bausch & Lomb Optical Co. photo

By making a mosaic map from aerial photographs these modern map makers save hundreds of hours of work

G. Washington, surveyor, would envy his modern counterpart the tools of his trade. Today's surveyor can measure one ten-millionth of a circle

THE SURVEYOR today still climbs the high mountains, slogs through the jungles, and crosses the deserts—but he doesn't toil painfully through the land. He uses modern instruments which measure easily and accurately, and he climbs into an airplane to map, in a matter of minutes, what formerly took months. His equipment is improving so rapidly that what he learned to use last year can easily be obsolete today.

There are instruments that will measure distances for the highway surveyor without his touching a measuring tape. He can have levels that are fantastically accurate and transits that will measure one ten-millionth of a circle. He can work more accurately and rapidly but, even so, the greatest improvements are not his—they are for the surveyors of huge land areas, the explorers, the map-

pers of states, the city planners, and the surveyors of large government projects.

The war brought many advancements to these men and the greatest and most radical is aerial photography. It is the key to inexpensive yet accurate surveys of large areas—soon to map the entire United States, a great portion of which is not yet mapped with any accuracy. And "measuring" photography has been made a really accurate method because of the war research in three things: the improvement of cameras, the use of the compact optical theodolite, and the Multiplex.

During the war, many complicated aerial cameras were developed for reconnaissance and mapping. They did a good job for the invasion mappers but every one of them is now obsolete for precise aerial surveying. They

By Thomas E. Riley

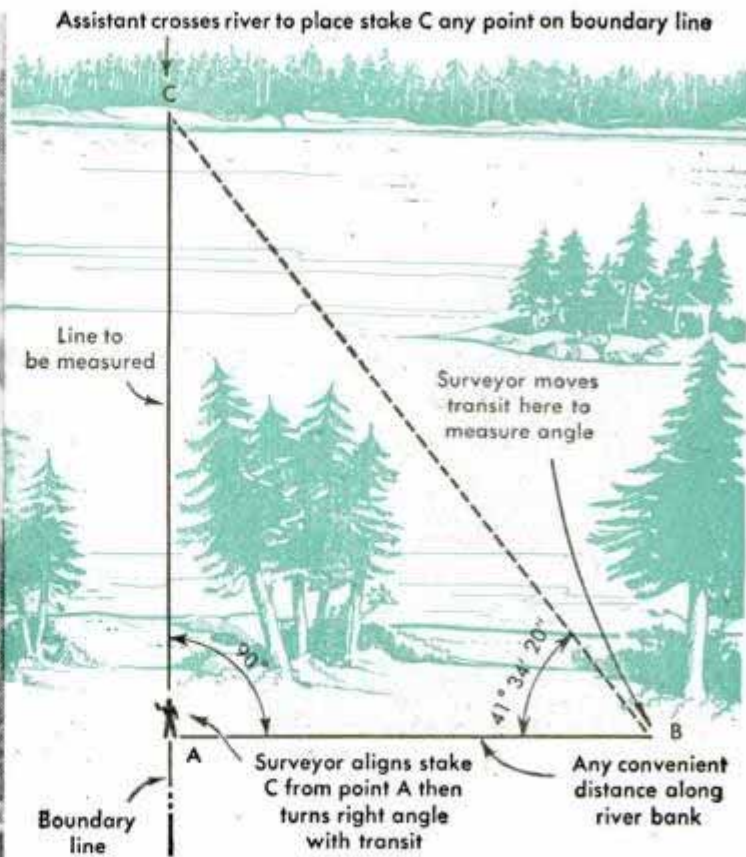


Photo at left shows the surveyor standing at point A shown in sketch above. Line AB is 2000 feet. After reading angle ABC, surveyor uses mathematics to compute line AC across river. Distance is 1773.9 feet

are simply not accurate enough. Today's aerial cameras are basically similar, but are greatly improved models made to more rigid specifications. They have eliminated the Rube Goldberg gadgets, such as the horizon recorder and the time counter that blossomed on the earlier models. Finely machined, permanently adjusted, these cameras have to be perfect—their photos are to give the height and position of valuable lands. They can measure the height of trees from an altitude of 20,000 feet.

Of course, the lenses must be perfect. For modern aerial surveying an extremely wide-angle lens is needed. The Metrogon lens used in these aerial cameras has so wide an angle it resembles half an orange or a door knob. Its four, deep-curved lens elements represent the lens maker's highest skill, two elements being ground paper-thin at the center and two paper-thin at the edges. The lens is so free from distortion that all parts of the negatives, even the corners, can be accurately scaled to represent equal distances on the ground.

But the aerial camera does not eliminate surveyors—not even for aerial mapping. No accurate map can be made from photographs or anything else without control points. Men can compute the elevations and distances and types of terrain from the photos, but they must have accurate positions to start with and from which to check their work. Surveyors must locate—with what is called second-order accuracy—these control points on the ground; control points that can be identified on the photos,



Surveyor on western prairie is reading off angles to his assistant who records and computes them as fast as he can to prevent any expansion of metal or settling of tripod from affecting accuracy





Survey ship, the U.S.S. Garbage Box, used by government surveyors to make survey of river for dam site

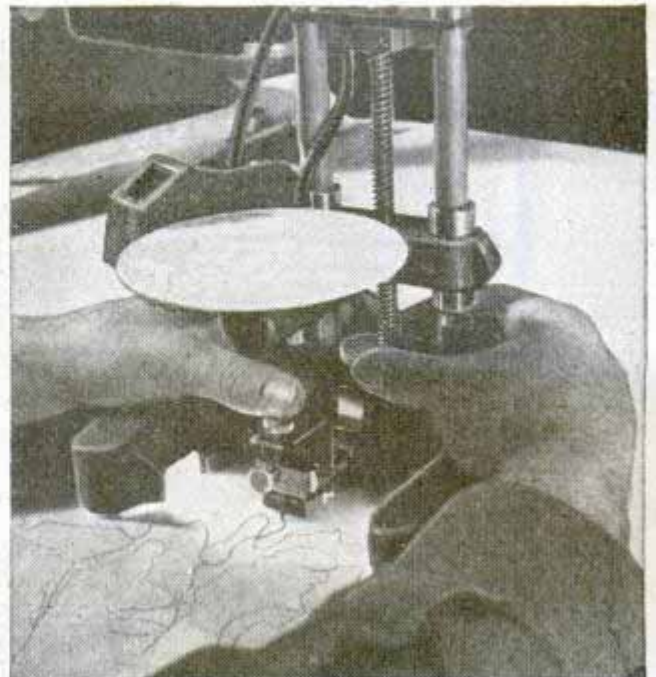
such as the top rock on a mountain or the center of a road junction. And to do this phase of aerial mapping efficiently, they need super-accurate transits (theodolites) light and sturdy enough to be carried easily over any terrain.

Until just recently, even the Coast and Geodetic Survey, foremost surveyors in the United States, believed the ultimate in a lightweight theodolite was one reading angles to one second ($1/1,290,000$ of a circle) and even these were too bulky and slow in operation. But the Wild theodolites had been developed in Switzerland; highly advanced, compact little instruments that read to $1/10$ of a second—and do it faster! The U. S. Army bought quite a few of these instruments shortly before the war, and they stood the abuse of surveying in Alaska and later in the jungles of New Guinea. The engineers called them optical theodolites, and during the war developed a similar model in the U. S. and in England.

The heart of these Wild instruments is two 5.5-inch-diameter, circular plates, made of optical glass on which superfine graduations are etched. The most important of these plates is the horizontal circle, located in the cone-shaped base of the instrument. Above it are ingenious micrometers that further divide the graduations by means of the movement of light rays through a combination of prisms. The resulting answer is read by the surveyor as simply as the speedometer on your car and his reading is automatically the average of two readings on opposite sides of the glass circle. The surveyor does not have to step around his theodolite as he once did to take his readings—with the constant danger of jarring it. He merely looks through a small tube alongside the telescope and by means of another series of prisms views the micrometer and the circle in the base of the instrument.

Some of these modern optical theodolites

Five Multiplex projectors above map maker's head (left) recreate line of flight of five aerial photos. Close-up of operator's tracing table (right) shows him tracing in a contour line on map. He gets stereoscopic view



do not use plumb bobs, a great advantage on a windy mountaintop. The surveyor simply sights through still another lens and prism to adjust a cross-hair that centers his instrument. At night, he plugs in a wire from a small battery and everything on the instrument, including the telescope cross-hairs, is illuminated.

With these compact, accurate theodolites, the surveyor can now move rapidly over the wildest regions, placing the few control points necessary for the Multiplex. Then with the aid of the aerial photos of the region, the Multiplex will grind out accurate maps cheaply and quickly.

The Multiplex, itself, is a group of projectors mounted on a rigid bar above a heavy metal table, usually set in immovable concrete. The projectors are ingeniously built so that each can reproduce the exact position of the aerial camera at the spot in the air each photo was taken. This is done by alignment with the field surveyor's control points. The projectors have similar lens and other characteristics of the aerial cameras—actually, they are miniature reproductions of the aerial camera.

The operator sits there in the dark pro-

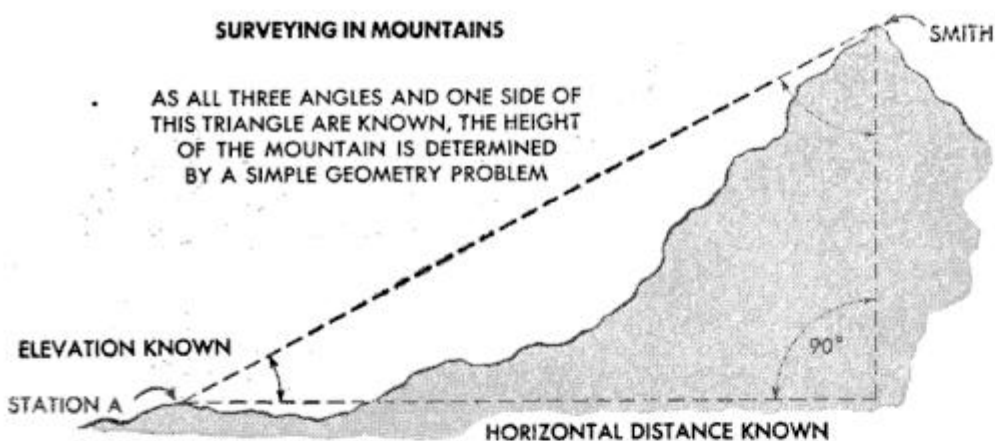
jection room, his only light the alternate red and green beams from the Multiplex projectors. Wearing peculiar glasses—one lens red, one green—he moves his small tracing table across his unfinished map. What he sees is a three dimensional view of the area. Above his tracing table, he also sees a bobbing dot or "V" that seems to float in the air. By moving and adjusting the little table, he moves the dot through the air until it seems to touch one of the mountainsides that protrude up towards him. There! He has an exact elevation and he pushes a lever and slides the dot around the mountainside to trace in that contour on the map.

The whole procedure is based on the simple principle of the old-fashioned scenic stereoscope. The most remarkable thing is that the operator—with just a few points that the surveyor has positioned on the photos—can accurately map a whole mountain range in a few weeks, more than field surveyors alone can do in years.

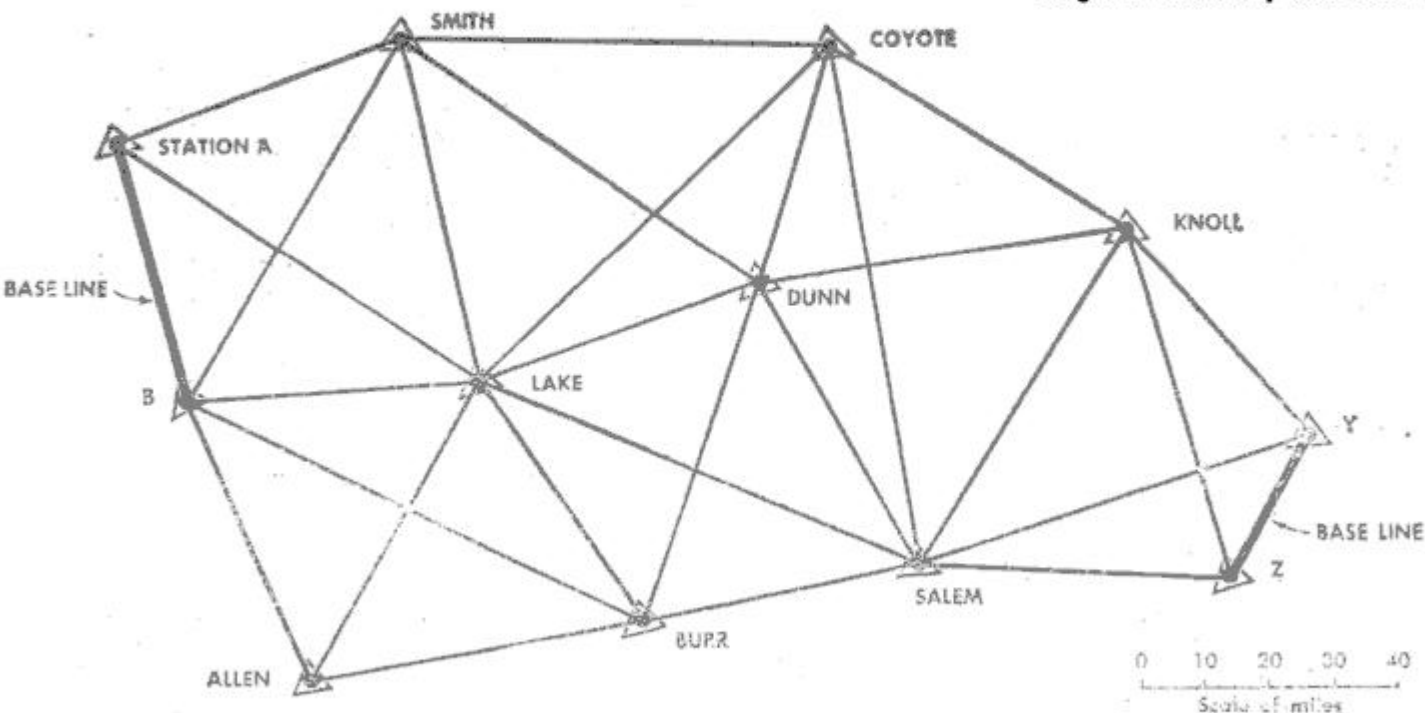
The Army used this system for its best maps; Admiral Byrd recently surveyed the Antarctic with it, and now the civilian agencies will have their chance.

SURVEYING IN MOUNTAINS

AS ALL THREE ANGLES AND ONE SIDE OF THIS TRIANGLE ARE KNOWN, THE HEIGHT OF THE MOUNTAIN IS DETERMINED BY A SIMPLE GEOMETRY PROBLEM



Here is the surveyor's answer to: How high is a mountain? Note the locations of Station A and mountain Smith shown at left and in the triangulation network below. In the mountainous region shown in the network only two distances (see base lines) were measured by tape. The theodolite was moved rapidly from station to station reading angles at each point. With vertical angles and horizontal distance between mountains known, height is accurately determined



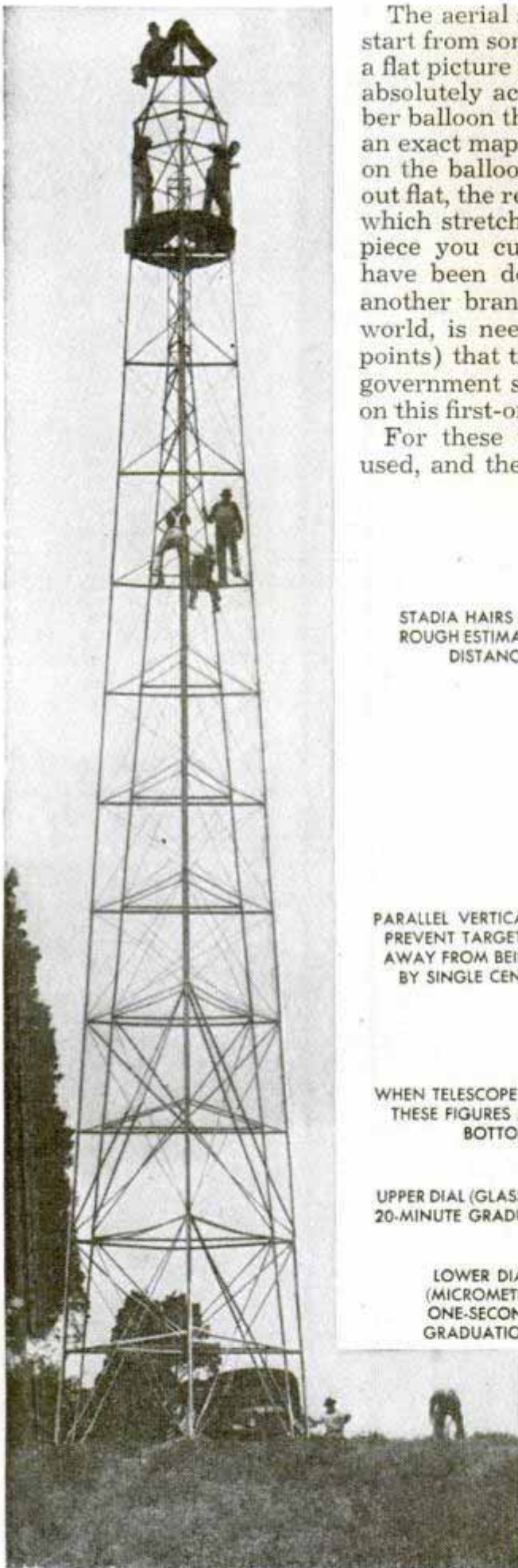
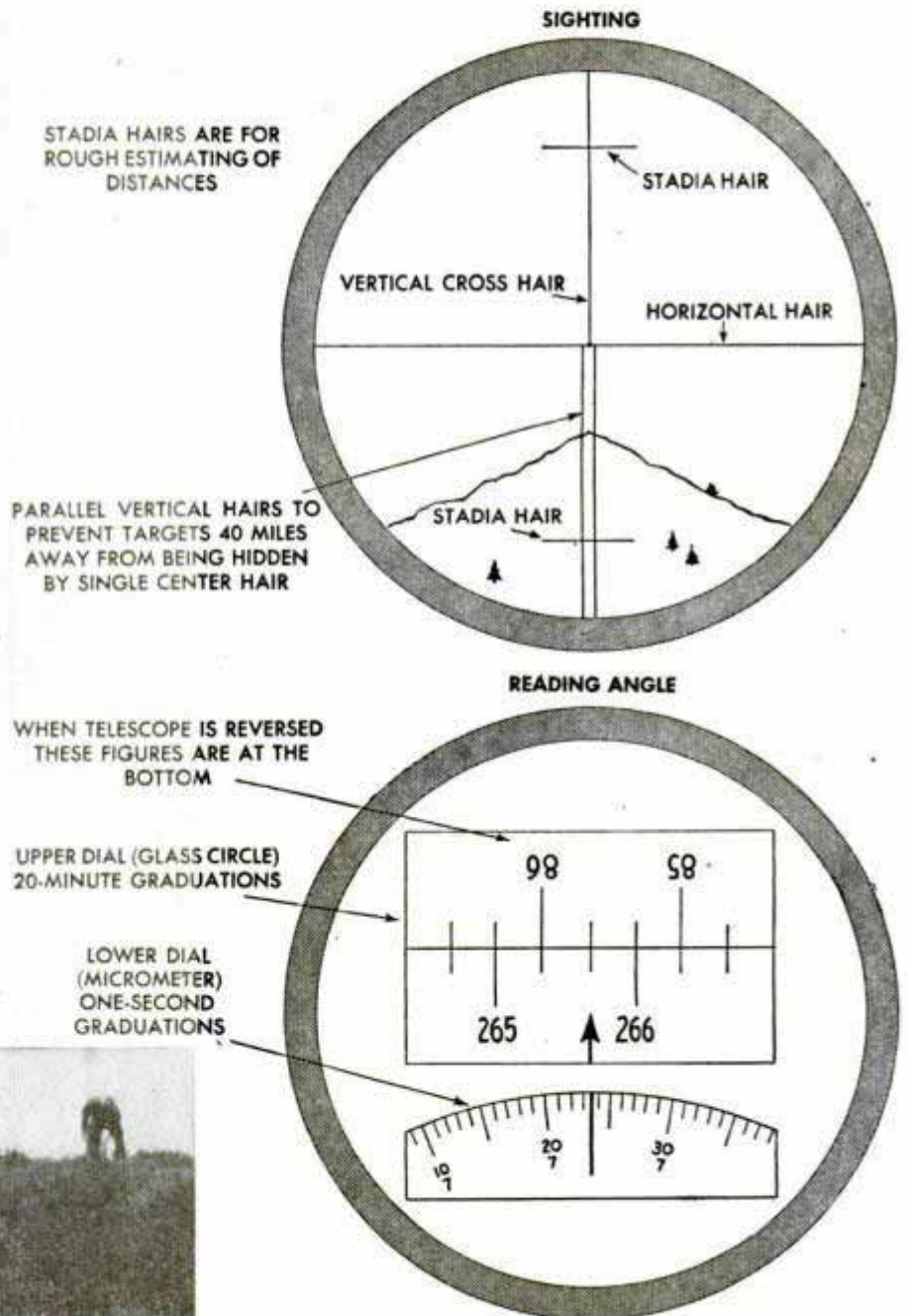


Photo courtesy of The Military Engineer

Portable Bilby tower raises theodolite above forests and earth's curvature. Inner tower supports theodolite; outer one is for surveyor's platform

The aerial surveys are large projects, but even they must start from somewhere. And a map of any part of the world is a flat picture of a round surface and, therefore, can never be absolutely accurate. For instance, suppose you have a rubber balloon that is a replica of the world. Any portion of it is an exact map of that portion of the world as long as it is left on the balloon. But, if you cut out a portion and stretch it out flat, the resulting map will be distorted. And the corners, which stretch the most, will not match at all with the next piece you cut. Many complicated and ingenious methods have been devised to overcome this—none is perfect. So another branch of surveying, figured on the shape of the world, is needed to place monuments (permanent control points) that tie together the flat maps. In the United States, government surveyors still have a tremendous job to finish on this first-order geodetic triangulation.

For these triangulation networks, huge theodolites are used, and the most accurate of the new optical theodolites



In sighting (top), telescope is lowered until horizontal hair touches mountain. Then a knob is flipped to read vertical angle through micrometer

are also coming into use as they are much speedier in operation.

First-order level networks are important, too, for such work as keeping a state-wide irrigation system from draining backwards. For these, the surveyors have special levels with 40-or-more-power telescopes and extremely sensitive bubbles. The rods on which these levels are aimed are made of invar steel, a metal with practically no expansion in heat or cold—its temperature coefficient is 0.000001 per degree Centigrade. Even so, these metal rods have thermometers which are read constantly to compute minute changes in length from expansion. Also, flattening of the earth towards its poles must be considered.

Surveying needs many grades and types of instruments. Besides the precise control instruments, there are the American transits and levels, the all-around workers in construction. For a tall office building or a dam, there are none better. These transits and levels are rugged and tough and accurate enough for this work. They have been constantly improved and today are foolproof instruments for construction, subdividing, and the like.

The transits in the past used the delicate strands from spider webs for their cross-hairs. Now they use a platinum wire, drawn to the same fineness, which will not break when jarred and which never sags in damp weather. The transits have many ingenious attachments, such as the extra telescope that enables a mine surveyor to map the position of a vertical shaft at the same time his other telescope is sighted

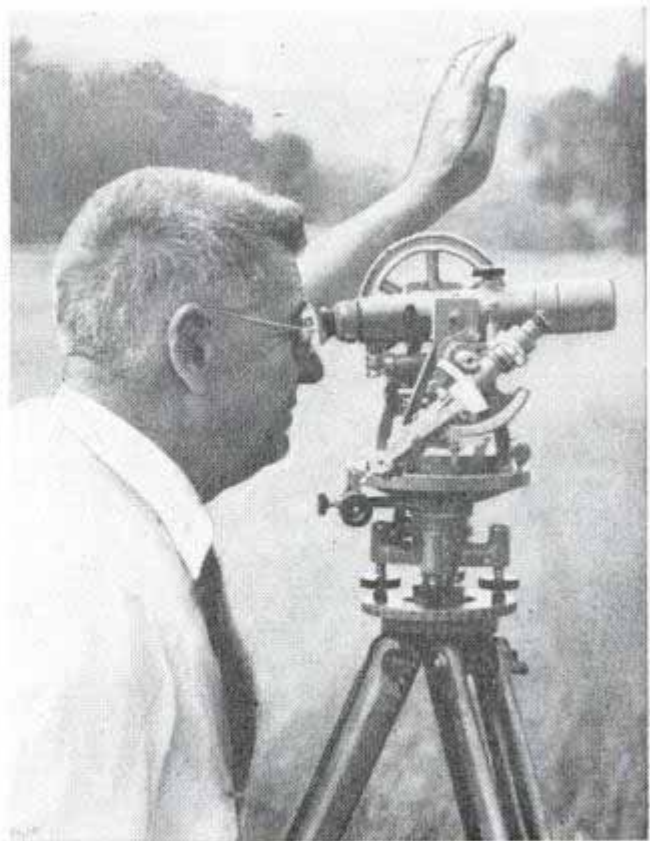


Photo courtesy of Gurley Instrument Co.

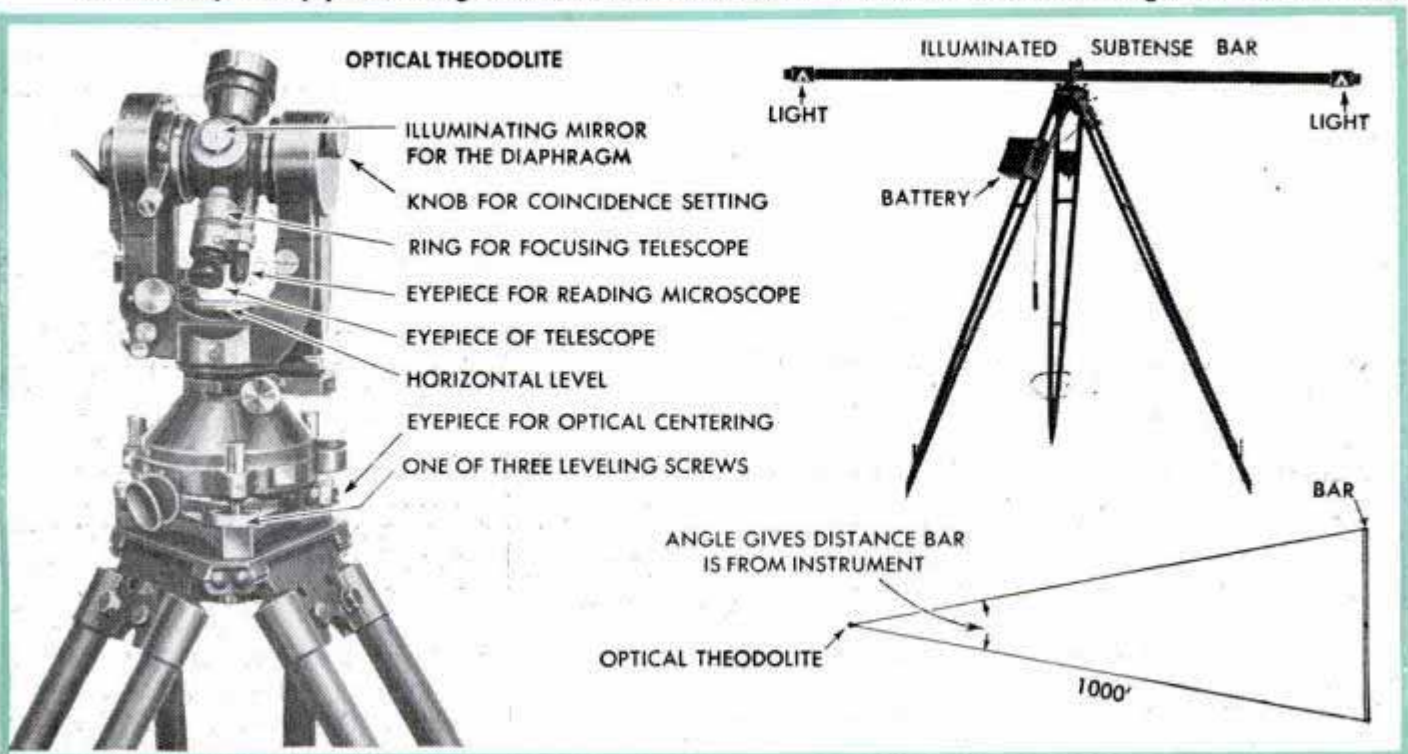
Government engineer determines latitude and longitude with aid of the sun, the correct time and a solar attachment on transit. He is signalling helper

down a horizontal tunnel. There are attachments for determining the longitude and latitude from the sun or the stars—much more accurately than with the sextant a mariner uses.

The third common instrument used by the construction or county surveyor is the

(Continued to page 234)

With the optical theodolite (left) surveyor can use subtense bar shown at right to measure distances up to 1000 feet. Surveyor simply reads angle between two markers on bar and refers to table to get the measurement

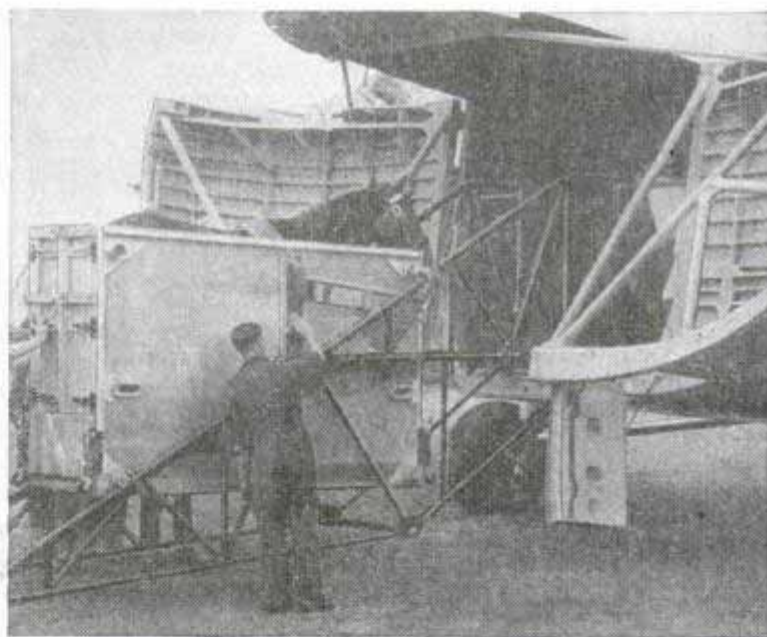


FLYING HORSES

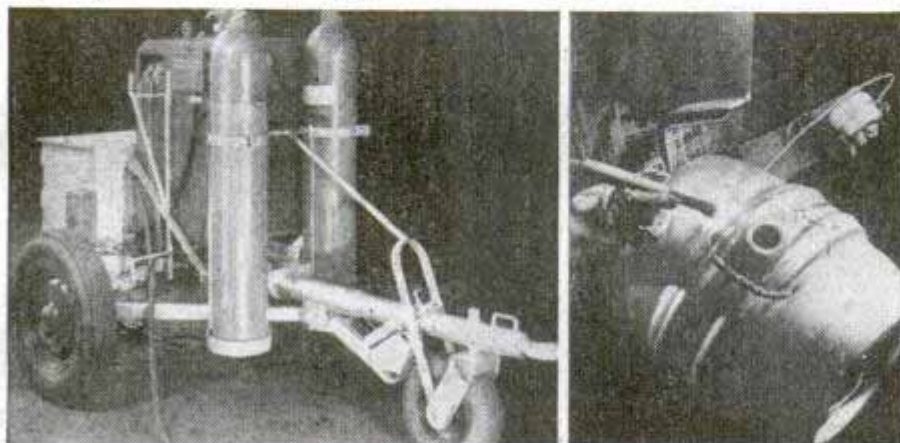


Bristol Aeroplane Company photos

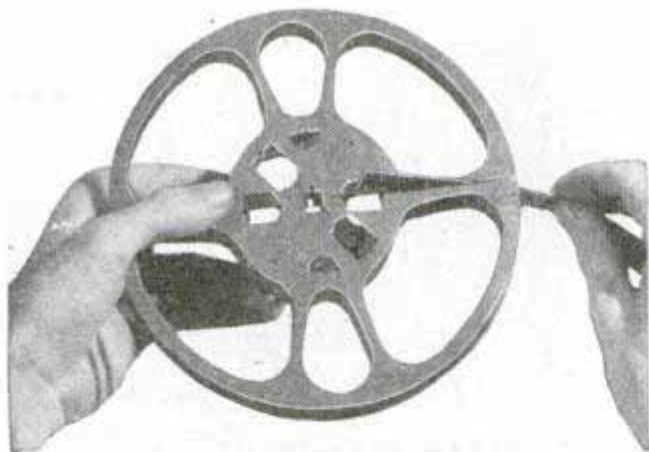
Air movement of valuable horses has been simplified by a British-designed stall box and loading ramp. The box remains level as the horse is hoisted up the ramp, which operates on the principle of a funicular railway. A canvas screen in the rear prevents the horse from injuring his hind legs. The box was used in shipping Attley, champion Australian miler, on a seven-hour flight from Melbourne to Brisbane for an important race. After loading, the 250-pound ramp is dismantled and stowed inside the plane for use at the destination. It eliminates the hydraulic-lift trucks or long ramps too heavy or too large to be flown.



Compact Welding Unit Mounted on Trailer Uses Argon as Inert Gas



Argon is used as the inert gas in a compact aluminum arc-welding unit mounted on a road-type trailer. The unit's inert-gas process requires no welding flux. Both the welding torch and the power cable are water-cooled. The trailer carries the cylinders of gas, and has 75-foot torch leads permitting a large radius of operation.



Side-Threaded Movie Reel

Movie film is threaded through a slot in the side of a quick-loading projection reel to minimize bending and breaking. The film is pushed into the slot where tiny jaws grip it for projection. When the film is re-wound the end is released automatically without snagging or pulling. The reels are available in 200 and 400-foot sizes for 16-mm. projectors and a 200-foot size for 8-mm. films.

Handles Grip Heavy Sacks

Sacks of grain and feed that are awkward to move can be lifted more easily with handles that grip them with hundreds of tiny hooks. The handles are made of curved stainless-steel plates in which triangular hooks have been stamped and bent inward. When the handles are slapped against the sack the hooks penetrate the cloth to distribute the weight over a relatively large area.

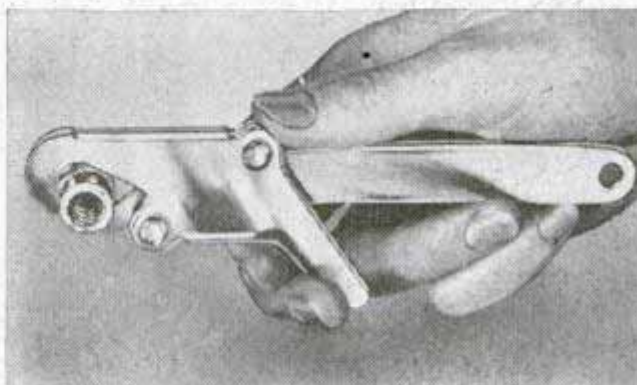


Phone Holder Clamps Around Neck To Leave Both Hands Free

Both hands are left free by a neck clamp for handset telephones that holds the phone in the correct position. The clamp remains fastened to the phone at all times and is slipped around the neck when in use. The neckband is padded for comfort and does not interfere with normal use of the phone. The device was exhibited at an exposition of inventions at Chicago.

Noncrushing Wrench For Soft Metals

Because of its three-sided grip, a trigger-operated wrench handles tubular fittings and nuts made of soft metal without crushing them. It is nonslipping and adjustable for nuts from $\frac{3}{8}$ to $\frac{9}{16}$ inch. A ratchet on the trigger holds the self-equalizing jaws snugly against the nut.



SEE INDEX IN FRONT OF BOOK FOR MFR.

WRENCH ON PAGE 142
SEE INDEX IN FRONT OF BOOK FOR MFR.

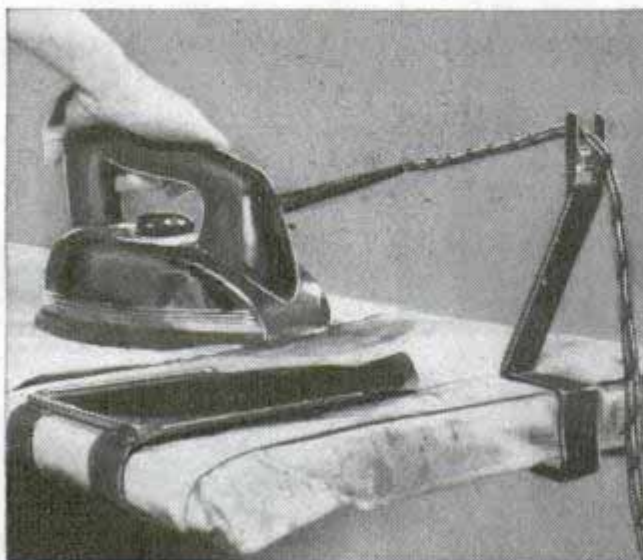


Track-Laying Garden Tractor

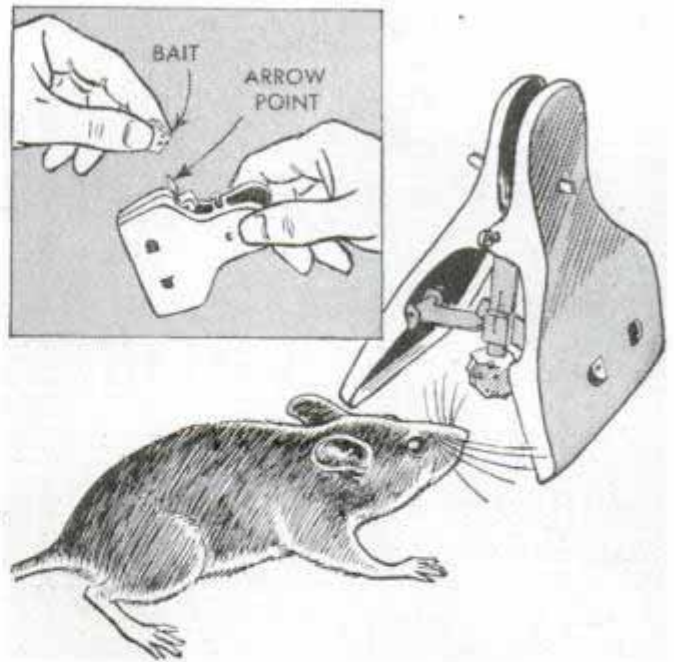
Instead of the conventional wheel, a new garden tractor has a cleat-type, continuous track. Weighing only 100 pounds, the tractor is powered by a 1½-horsepower gasoline motor. All controls are on the handle bar. Attachments are available to convert it into a mower, seeder, snowplow and other tools. A power take-off permits its use as a stationary power unit.

Ironing-Board Bracket Holds Cord

Tangled electric-iron cords are eliminated by a bracket that clamps on the end of the ironing board. The cord is held off the board by a roller at the top of the bracket. A weight, tied to the cord between the wall socket and the board, takes up the slack cord during use.



SEE WHERE-TO-FIND-IT IN FRONT OF MAG.



Trap Clips Mouse

Resembling a giant spring clip, an all-metal trap catches mice between two jaws that are sprung by an inside mechanism. Bait is placed on an arrow point while the jaws are closed, and swings inward when the trap is set. The protected location of the trap mechanism reduces the danger of injury to children and pets.

Toy Paste-Up Village (SEE WHERE-TO-FIND-IT)

Toy bricks, timbers, windows and doors included in a model building set are pasted together by youngsters to form stores in a miniature village. To disassemble a structure, it is placed in warm water which dissolves the paste.



CAPTAIN JOSHUA JAMES, American coastal pilot of the last century who saved several hundred lives in storms along the Atlantic coast, had a canny sense of direction. No matter where he was on the sea—in darkness or high noon, in fog or clear weather—he always had his bearings. When asked about this extraordinary sixth sense, he said:

"I can hear the land talk."

Today's skippers rely upon

Traffic Signals OF THE SEA

By Andrew Hamilton

scientific devices. It is the U. S. Coast Guard's job to maintain the 35,000 aids to navigation along 40,000 miles of coastline in the United States, Puerto Rico, Panama, the Hawaiian Islands and Alaska.

During the war many lighthouses, buoys and lightships in harbors and river mouths were blacked out—lest they silhouette Allied vessels and provide landmarks for enemy planes and submarines. By now all aids to navigation have been reconditioned and re-lit. New cutters and lighthouse tenders have been acquired by the coast guard. And several thousand new navigational aids have been installed.

All traffic signals of the sea serve the same general purpose whether they be small buoys or an expensive lighthouse: to help the mariner know at all times his exact position. Through navigational aids, ship captains are assisted in making landfalls when approaching from overseas, warned of isolated dangers, aided in following natural and improved channels, and provided with a continuous chain of charted marks for coast piloting.

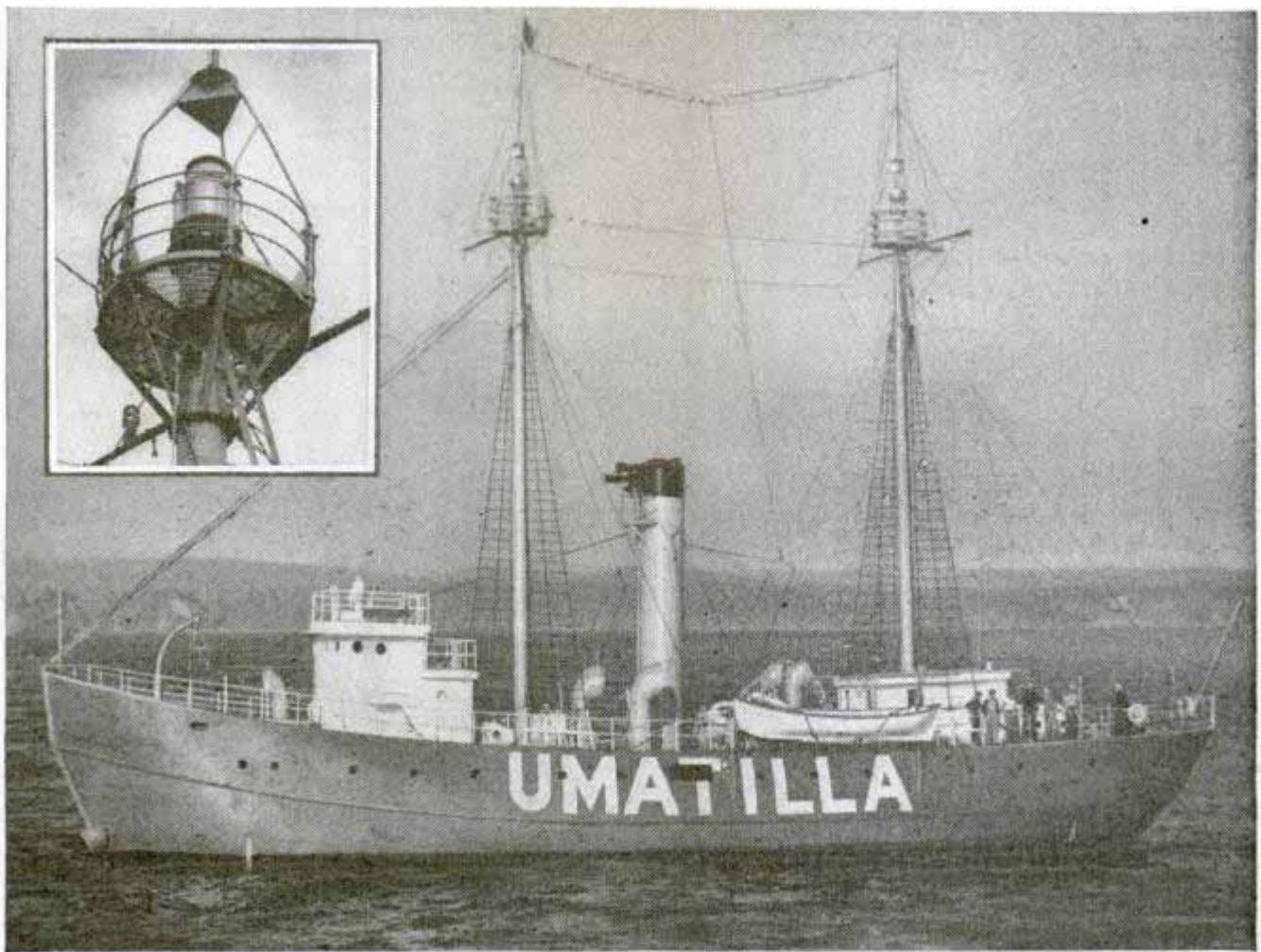
Here are a few of the more



Official Coast Guard photos

New and old: helicopter for sea rescues flies by 231-year-old Boston lighthouse. Below, emergency kerosene lighthouse lamp





Ocean traffic off Washington coast is guided by light beacons (one shown in inset) on this lightship

important types of aids to navigation:

1. Lighthouses. Still standing as a sentinel of safety at the entrance to Massachusetts Bay is the first lighthouse erected in North America. Known as the Boston Light, it was built in 1716 and remains a monument to the early settlers and their regard for shipping.

Types of light towers vary, each adapted to the coast and climate where it is located. On the Pacific coast, where there are many high bluffs, lighthouses may be low, since the lights are elevated sufficiently for visibility at great distances. The generally low-lying Atlantic coast requires tall towers.

In a century and a half, extraordinary developments in lighting methods have marked the progress of navigational aids. Up to 1877, lighthouses were illuminated with whale, colza and lard oils. Then kerosene became the chief fuel until 1916, when it was supplanted by electricity. The Sandy Hook, N. J., light was electrified as early as 1888. In the larger lighthouses of today, electric incandescent lamps inside lenses produce beams up to 9,000,000 candlepower.

The flashing characteristics which distinguish many lighthouses are produced by revolving the entire lens. In earlier days, lightkeepers wound heavy weights attached to a clockwork device to turn the

light. Now most modern lighthouses are equipped with electric motors to perform the work. Larger light stations also are fitted with fog signals and radio beacons. Many lighthouses originally cared for by resident keepers are operated automatically. Most automatic lights are powered by compressed acetylene gas or by battery.

Highest marine light maintained by the coast guard is Lehua Rock Light, an automatic light on Lehua Island, northwest of the Hawaiian Islands. It rises 709 feet above sea level. Tallest lighthouse tower is at Hog Island on the coast of Virginia. This structure, of skeleton iron, is 191 feet in height. Two feet higher but no longer in use is the old Cape Hatteras lighthouse. The Pensacola lighthouse, Fla., 171 feet, is the tallest brick structure in use.

Most powerful light in the United States used as an aid to marine navigation—9,000,000 candlepower—is at the Navesink lighthouse, N. J., marking the approaches to the harbor of New York.

2. Lightships. Earliest lightships were small boats anchored at harbor entrances or at dangerous shoals—with lights displayed at mast or tower. They had no crews, but were visited daily, when possible, by attendants to refuel the lights and pump out the hulls. Later, small vessels

were rigged as lightships, in most cases small sailing ships manned by crews when on station.

America's 29 present-day lightships are equipped with lights, fog signals and radio beacons. They take the form of ships only because they are placed in waters where it would be impractical to build lighthouses. They mark entrances to harbors, estuaries and shoals, and serve as leading marks for transoceanic and coastwise traffic.

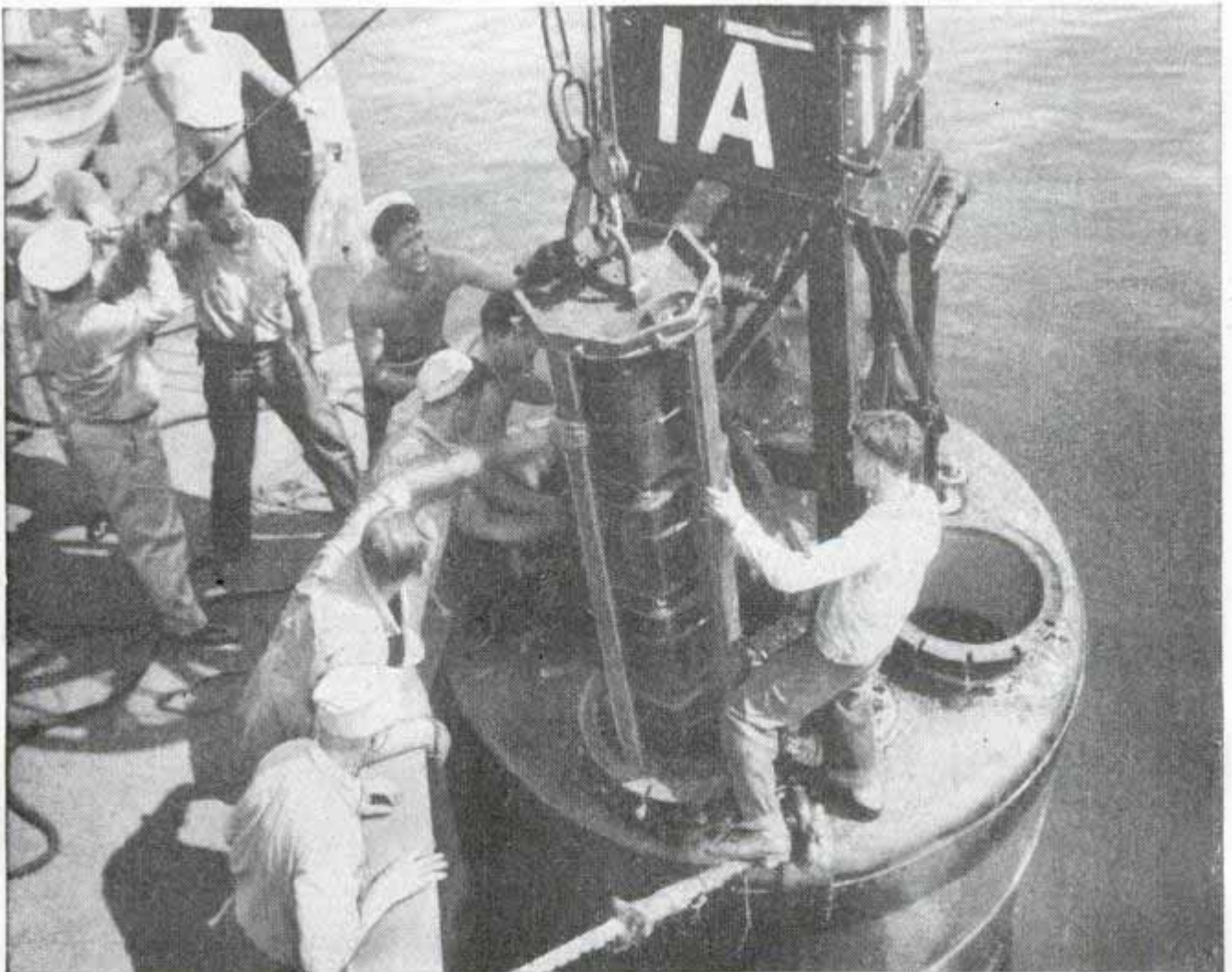
While on station, a lightship shows only the masthead light and a less brilliant light on the forestay, the latter serving to indicate the direction in which the ship is heading. As lightships ride to a single anchor, the light on the forestay also indicates the direction of the current.

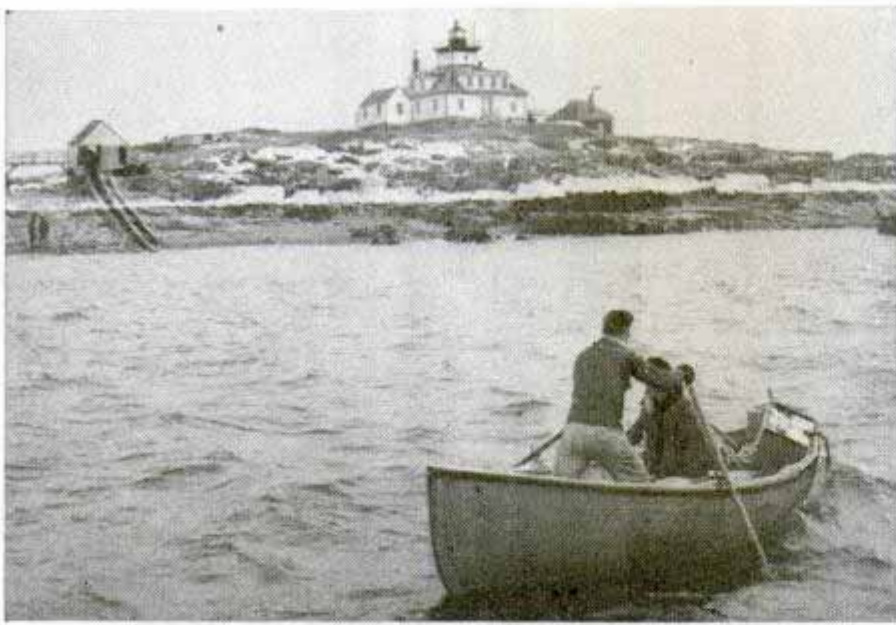
3. Range lights. Range lights are established at bay entrances and in rivers as markers to enable sailors to obtain bearings. Two lights are located at some distance apart and visible in one direction only. They are so placed that to the mariner, when his ship is brought into line, the lights will appear one over the other and guide his ship to the axis of the channel. If a captain steers his ship so that the lights remain continuously in line, he will remain within the confines of the channel.

The lights of ranges may be of any of

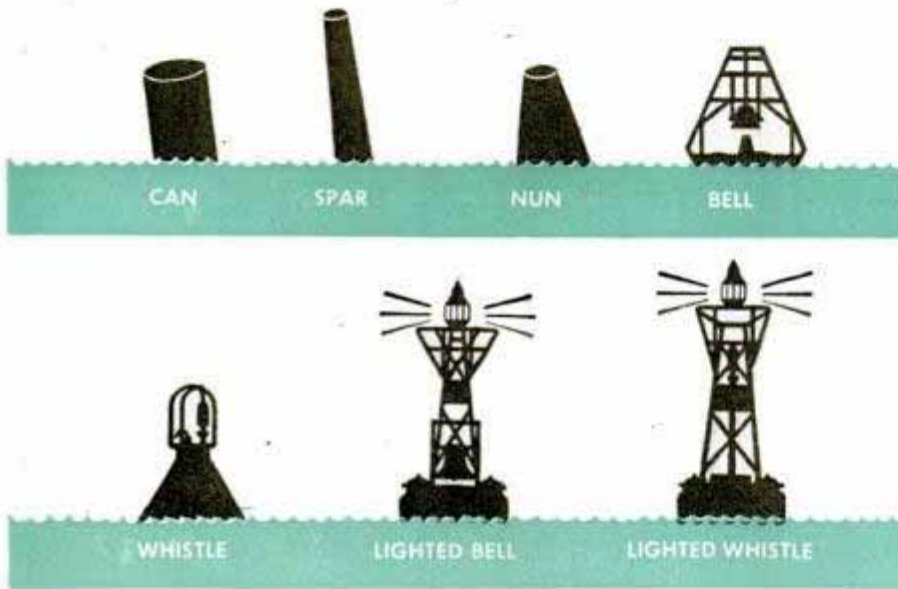


Installing antenna (above) and batteries (below) on radio-equipped buoy which aids navigation in fog





After five-day shore leave, Maine lighthouse keeper returns to his post



Various types of buoys are represented by drawings. Below, each man has a particular duty as coastguardmen go through regular lifeboat drills



three standard colors—white, red or green—and may be fixed, flashing or eclipsing. Principal requirement is that they stand out distinctly from their surroundings. Most range lights lose brilliance rapidly as a ship diverges from the range line.

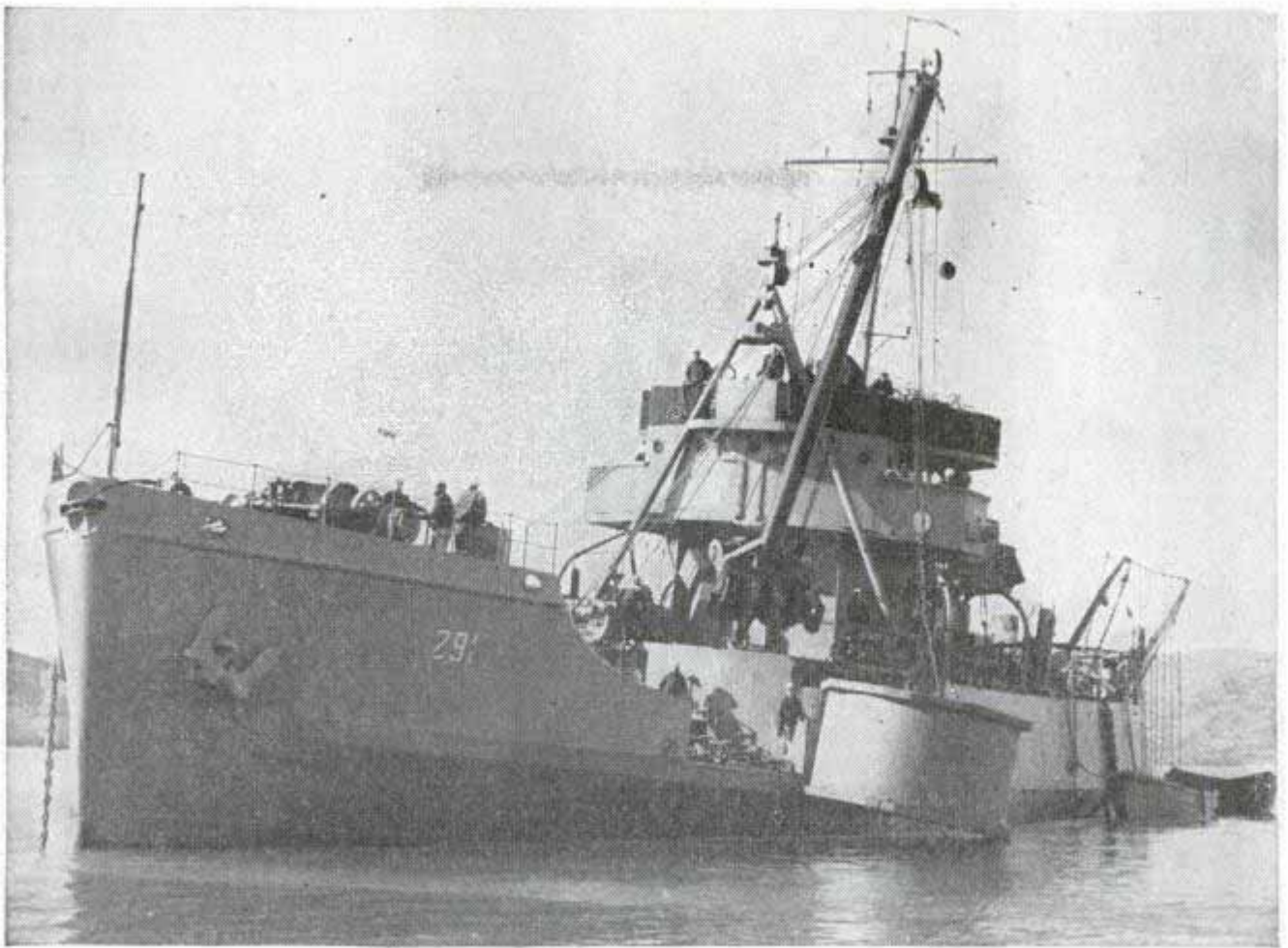
4. Fog signals. Since the placing of a cannon at Boston Light in 1719 to warn ships in fog, many types of sound signals have been developed to overcome poor visibility. Hot-air engines, forerunners of today's internal-combustion engines, were once used to produce the power for sounding horns and trumpets. Steam fog signals were employed for many years. In recent times, powerful fog signals are operated by compressed air or electricity.

The various types of apparatus used for sounding the coast guard's 2159 fog signals produce distinctive sounds, composed of blasts and silent periods. A definite time is required for each signal to perform a complete cycle of changes. Differing in tone, their sound may aid in recognition of various stations.

Equipment for sounding signals includes diaphones, diaphragm horns, reed horns and sirens. Simpler signals are bells and whistles on buoys, and bells struck by hand at a lighthouse.

5. Buoys. Primary function of buoys is to warn of some danger, obstruction, or change in the contours of the sea bottom, and to sketch the channels leading to various harbors.

In the early days, buoys were haphazardly marked, if at all, and were made of wood. A standardized system of buoy markings was



adopted in the 1850s, along with the introduction of iron buoys. The great majority of buoys today are metal. The larger are, in fact, miniature lighthouses—and some are equipped both with light and sound signals.

Utmost advantage is obtained from buoys when they mark definitely identified spots. If the skipper of a ship knows his precise location of the moment and is properly equipped with charts, he can plot a safe course. Such features as size, shape, coloring, number and signaling equipment are important means to warn, guide and orient the mariner.

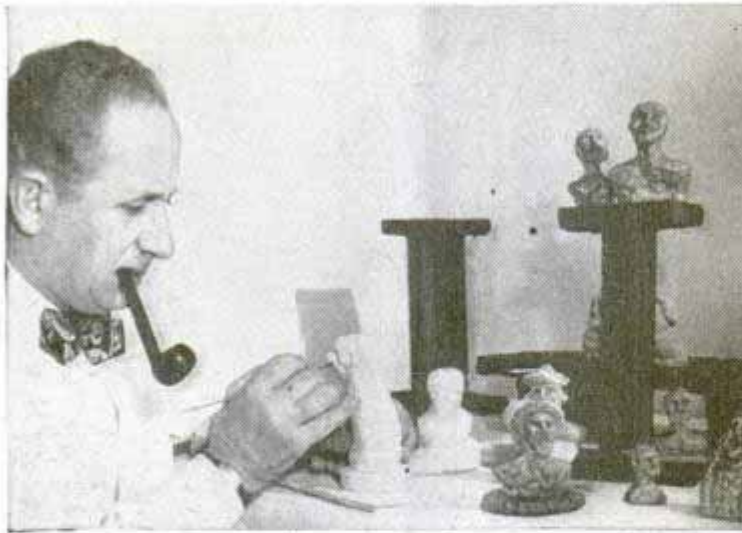
Principal types of the 18,096 buoys operated by the coast guard are: spar buoys, large logs trimmed, shaped and painted; can and nun buoys, usually of steel; bell buoys, steel floats on which bells are fixed; gong buoys, similar to bell buoys; whistle buoys, the mechanism operated by wave motion; lighted buoys, metal floats with lights operated by acetylene gas or battery, and combination buoys, in which lights and sound are combined.

(Continued to page 240)

Ship lists as 20-ton mooring buoy is lowered by boom over her side in a Greenland fjord. Below, lowering a 10-ton anchor which is to hold a mooring buoy and the ship tied up to it. When the anchor reaches bottom, the lowering hawser is returned to deck



FIGURES MOLDED FROM BREAD LOOK AND FEEL LIKE STONE



Above, the soft inside of the loaf is dampened before molding. Left, Mr. Podell adds facial expression to a rye-bread statuette

Obtaining material for his sculpturing is easy for Maurice Podell of Long Branch, N. J. He simply stops in at a bakery and buys a loaf of rye bread. Podell tears out the inside of the loaf, dampens it and molds it into artistic shapes and realistic busts of

famous persons. The only tool he uses is a slender stick for the final touches. After the figure is completed, it is dried thoroughly and looks and feels like stone. The figures are about three inches high and take approximately three hours to make.

Materiel Command Tests Opposing Techniques of Helicopter Design



U. S. Air Force photos

German-designed Flettner 282, above, counteracts torque with intermeshing rotors, tilted so axis of each is at 24-degree angle to the other. Five-place Bell XR-12, below, achieves same result with rotor on the tail boom



Opposing techniques of helicopter design are being tested by the Air Materiel Command in the big Bell XR-12 and the Flettner 282. The former, a five-seater, employs a two-bladed main rotor system with a gyroscopic stabilizer bar. Weighted at both ends, the bar is attached to the blades at right angles to decrease vibration. Torque is eliminated by a rotor on the tail boom. The German-designed Flettner attacks the torque problem with two intermeshing, contrarotating, twin-bladed rotors, mounted so that the axis of each is at a 24-degree angle to the other. While the right-hand rotor is revolving clockwise the other spins in the opposite direction.

If you would like the names and addresses of the manufacturers of the new products described in this issue, write to the Bureau of Information, Popular Mechanics, 200 East Ontario St., Chicago 11, Ill.

Grandpappy Refuses to Die

Ancient locomotives still chug over the famous old Virginia & Truckee Railroad, whose silver spike was driven in 1869. But the line never did get to Truckee

By Thomas E. Stimson, Jr.

PASSENGERS on the crack streamliners that pause at Reno sometimes see on an adjacent track a steam train so ancient that they walk over to it in surprise.

"What's this?" they ask, surveying the 40-year-old locomotive and its wooden open-end coaches. "Historical exhibit?"

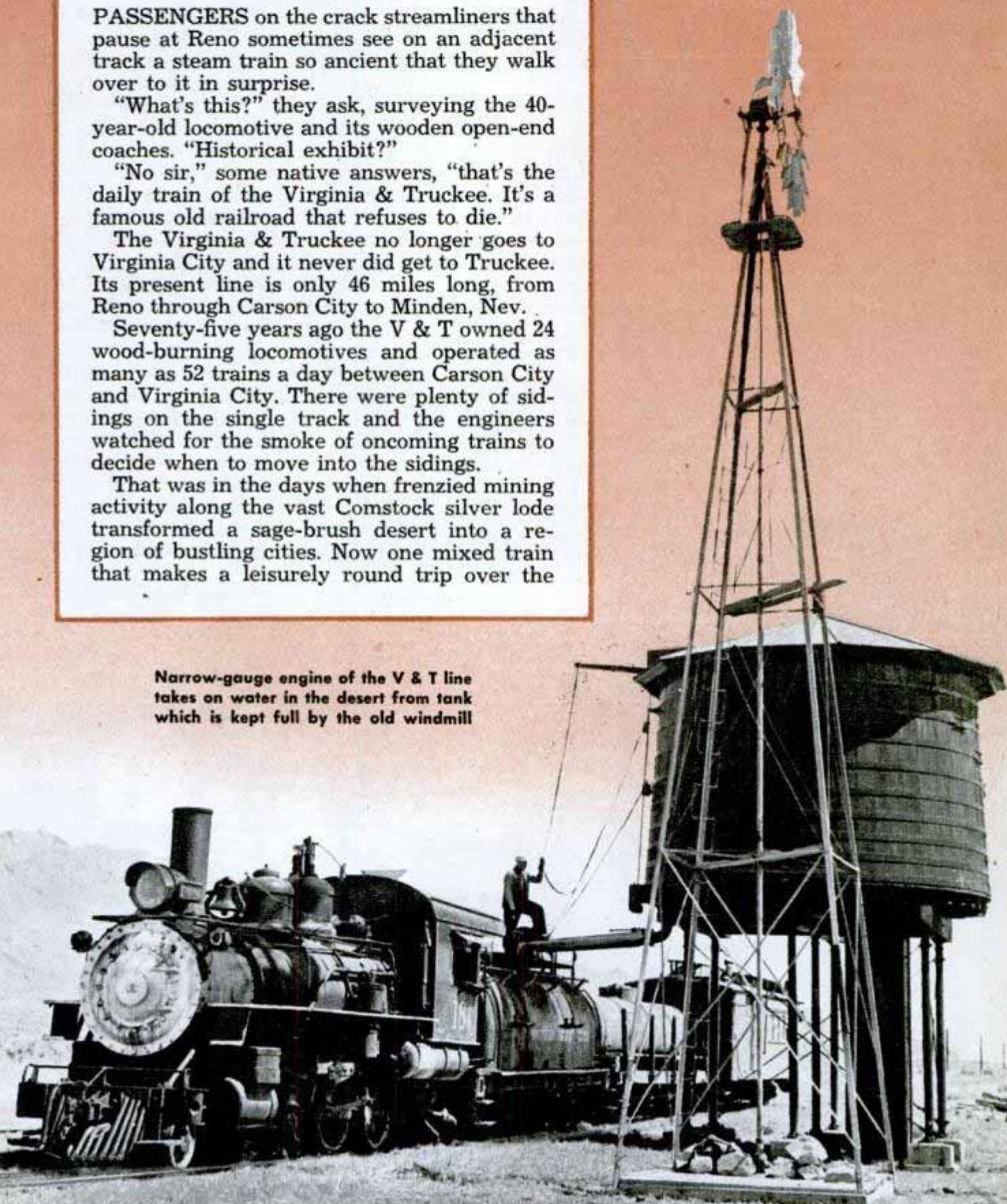
"No sir," some native answers, "that's the daily train of the Virginia & Truckee. It's a famous old railroad that refuses to die."

The Virginia & Truckee no longer goes to Virginia City and it never did get to Truckee. Its present line is only 46 miles long, from Reno through Carson City to Minden, Nev.

Seventy-five years ago the V & T owned 24 wood-burning locomotives and operated as many as 52 trains a day between Carson City and Virginia City. There were plenty of sidings on the single track and the engineers watched for the smoke of oncoming trains to decide when to move into the sidings.

That was in the days when frenzied mining activity along the vast Comstock silver lode transformed a sage-brush desert into a region of bustling cities. Now one mixed train that makes a leisurely round trip over the

Narrow-gauge engine of the V & T line takes on water in the desert from tank which is kept full by the old windmill



railroad six days a week handles all the passengers, mail and freight.

In today's modern high-speed transportation picture the old fashioned "bonanza railway" furnishes a living picture of the early days of western railroading. Once the line paid \$100,000 a month in dividends; now years have passed since the stockholders received a cent. Unable to afford up-to-date equipment, the little line struggles along with the rolling stock and equipment it has inherited from the past.

Its wooden passenger coaches were all built in the last century. Painted canary yellow with light green trim, they still preserve their early color scheme. Some are equipped with their original kerosene lamps and wood-burning heat stoves. Switchmen along the line use ancient "harp" switch stands for throwing the stub switches that were installed when the road was built.

The vast shops, built in the '70s and once the largest and best equipped west of Omaha, are now a virtual museum of early-day machinery. Much of the original shop equipment is still in use and a new machinist spends hours learning the tolerances of the old belt-driven lathes and mills.

The Virginia & Truckee's first silver spike was driven in 1869 and early the next year the line was completed from Carson City to Virginia City, 21 miles away. Rails were 50 and 60-pound, brought by boat from Liverpool to San Francisco and thence overland. The first five locomotives were hauled across the desert from Reno by 10 yoke of oxen each, broad tires pro-

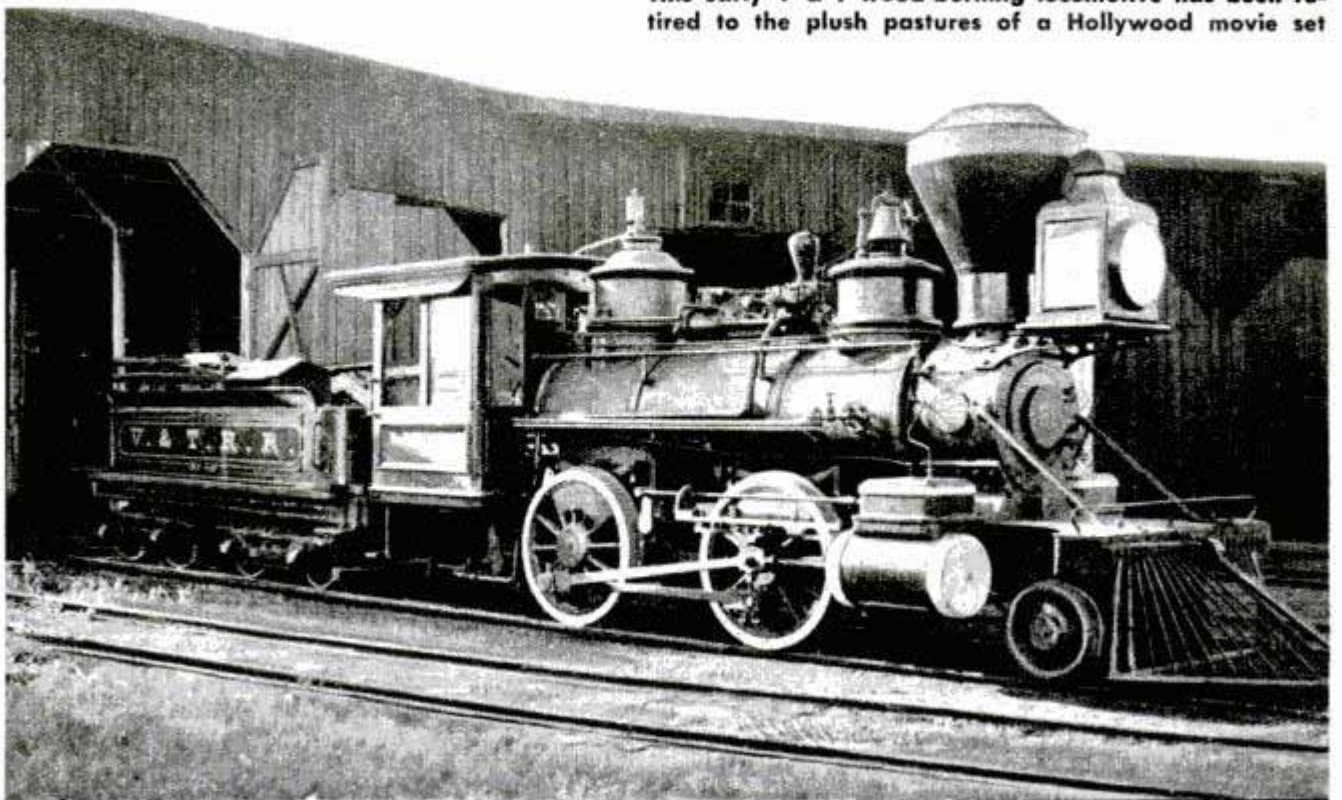
tecting the flanges of the engine wheels. The railroad was one of the first standard-gauge lines in the West.

The V & T's volume business consisted of carrying silver ore down the mountain from Virginia City to the mills located on a river and in hauling mine timbers and supplies back uphill. Most trains were double or triple-headers. The line climbed 1600 feet in 15 miles and had a curvature equaling 17 full circles.

In 1872 the tiny railroad built its present line from Carson City to Reno, connecting there with the Central Pacific that later became the Southern Pacific. Business boomed. In a typical six-month period, beside thousands of passengers, the V & T hauled a tonnage that was tremendous for those days, amounting to a quarter of a million tons of wood, coal, ore, livestock and merchandise, including 80 tons of silver bullion. The tradition is that during its early history the line moved its entire weight in sterling silver, including all its rolling stock and ties and rails.

Supplying timbers for the Comstock mines was a problem in transportation that the pioneers solved in a unique way. The nearest trees in sufficient quantities were on the shores of Lake Tahoe on the Nevada-California border. There the trees were cut, towed by steamer to a sawmill on the lake, and the timbers were then carried by a narrow-gauge railroad to the summit of the Sierra Nevada mountains. From here they were dropped by means of a V-shaped water flume to a point near Carson City and were loaded on V & T

This early V & T wood-burning locomotive has been retired to the plush pastures of a Hollywood movie set





Dressed up with an old funnel, a V & T special carries state officials on an inspection trip over the line

flatcars for the final haul up to the Virginia City mines.

With the decline of the mines in the late '70s the railroad built a subsidiary narrow-gauge railroad from just east of Carson City to Keeler, Calif., 300 miles to the south. Called the Carson & Colorado, the narrow gauge traversed barren desert that had no mines, no agriculture, no industry. There was practically no traffic. Then the line was bought by the Southern Pacific and renamed the Nevada & California. Later the V & T and the N & C both flourished when Tonopah became a mining center. Traffic became so heavy, in fact, that freight was delayed for weeks.

One gambler who had a freight car full of roulette wheels at Reno, destined for Tonopah, was faced with a month's delay until he had a bright idea. Cars containing livestock had an immediate priority, he learned, and so he made room in his carload of gambling paraphernalia for one cow. That constituted livestock and he demanded shipment at once. The cow and the roulette wheels were en route to Tonopah the next day.

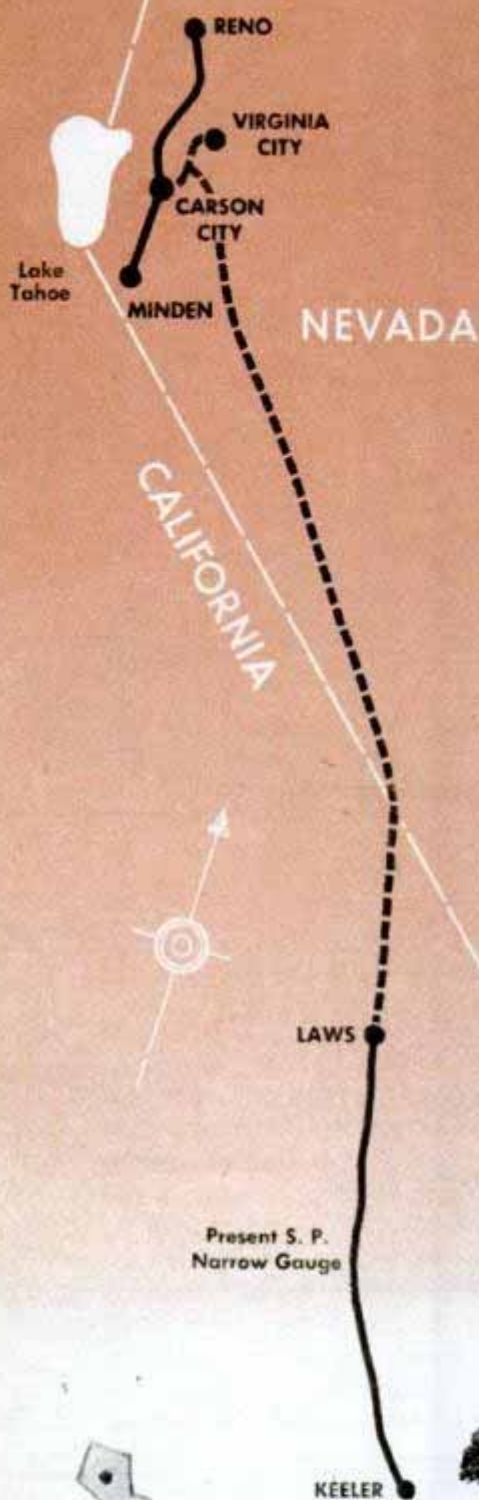
In 1906 V & T built a branch line from Carson City to Minden. When the road abandoned its Virginia City run in 1938 the Reno-to-Minden route became its main line.

Old passenger coaches built in the V & T shops retain original kerosene lamps in addition to electric lights

The history of the V & T reads like a wild-west thriller. It has had its share of wrecks, derailments and express robberies. The timbers in the tunnels along its line have been burned out, it has had runaway locomotives, and its train crews have fought snowstorms that created drifts as high as the stacks of their locomotives.

In recent years the old railroad has been at death's door a dozen times and each time it has pulled itself out of the hole. On several occasions when the outlook was dark it sold some of its aged rolling stock to Hollywood for use in motion pictures, other times it rented part of its roadbed and equipment to motion-picture companies on location.





In Hollywood today, on the Paramount lot, two early V & T locomotives are working in a railroad picture called "Whispering Smith." Converted from wood to oil burners for convenience and with their big diamond stacks replaced by the stacks of a later period, the engines have been rebuilt as good as new.

Each has had its boiler reflued, each carries a standard inspection card, and each is equipped with forced-feed lubrication, monitor injectors, electric generators, and air brakes and air sanders. In all, Paramount owns 25 pieces of old rolling stock, including a wrecker, blacksmith car, passenger coaches, and assorted box, flat, and livestock cars, nearly all of which was purchased from the V & T.

On some occasions, too, when the V & T seemed doomed, its officials have been able to sell enough scrap and old trackage to keep it out of the red for another year. Still other times its shops have picked up enough outside work to meet part of its deficit. Again, promotion and publicity campaigns among its poten-

Switchman below checks clearance of an ancient stub switch. At bottom, after switch is thrown the engineer of oncoming train is waved through



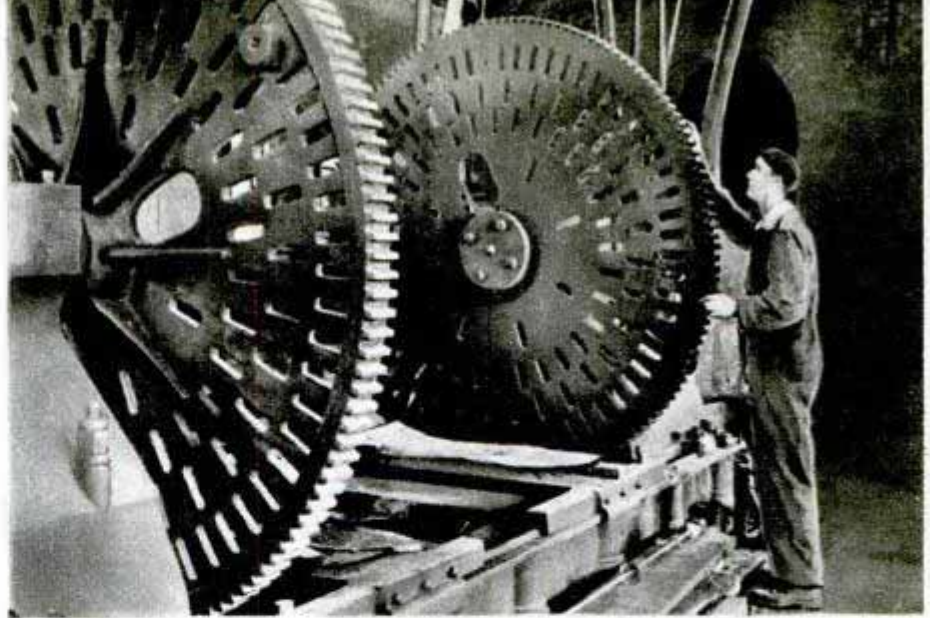
tial customers have brought in enough business to carry the railroad over a financial hump. G. A. Sampson, vice president and general manager of the line, never knows what kind of crisis will occur next nor how he will solve it.

The V & T owns less than 25 pieces of rolling stock and the road is operated by less than 50 people. Last year it moved 1277 carloads of inbound freight, mostly petroleum products and livestock, and originated 239 carloads of outbound freight.

Right now the old line is in the midst of a modernization program. There isn't enough money to burn all the weeds from its right of way or to keep its signs and buildings gleaming under fresh paint, but section crews are maintaining the roadbed in adequate condition and are keeping the bridges in good enough shape for the traffic.

During the next few years the ancient stub switches are to be replaced and other early equipment is to be retired from use. In the shops a big electric motor has replaced the steam plant that formerly powered the overhead system of leather belts that drives lathes and other power tools.

A few months ago the V & T splurged



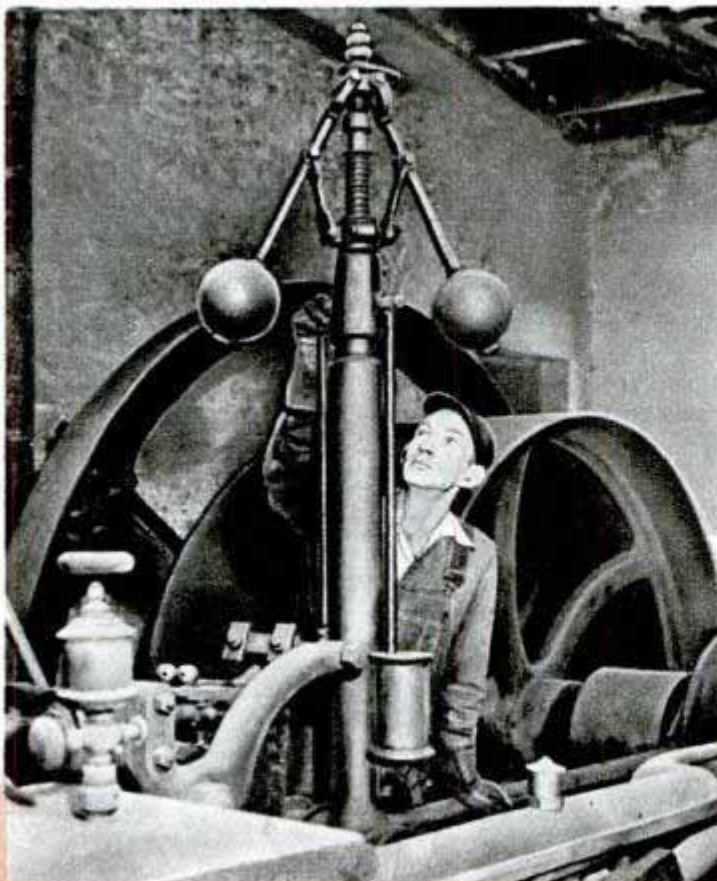
Wheel lathe used in the V & T shops to turn flanges of car wheels

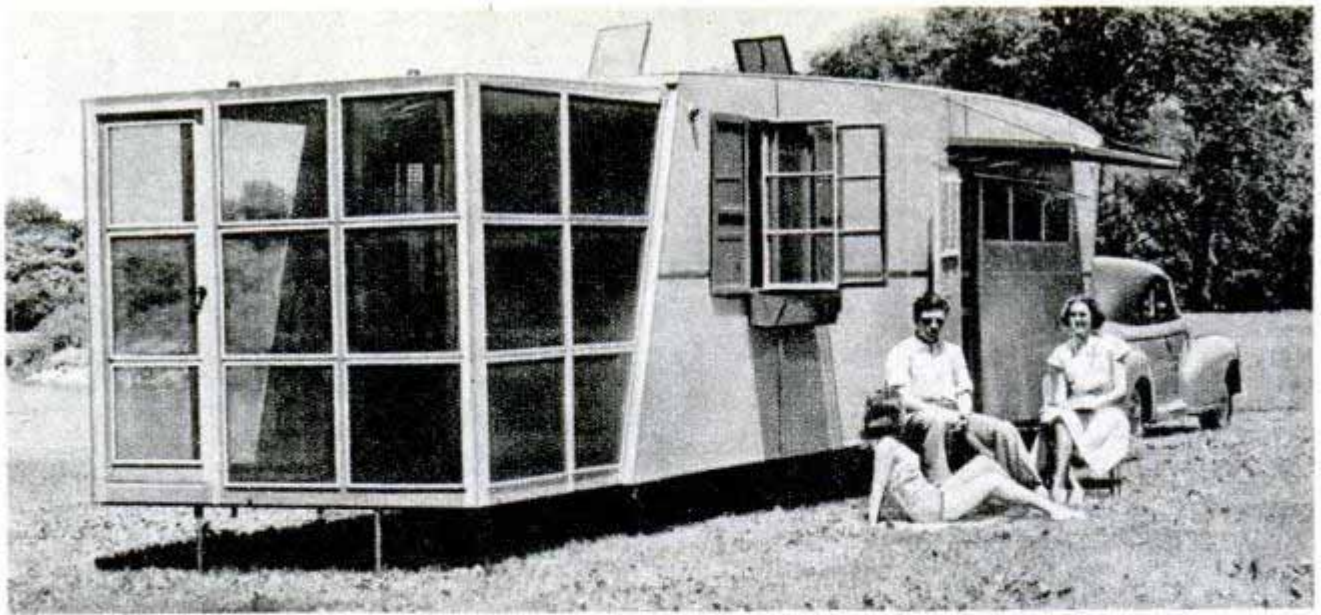
and bought its newest engine, a 1925 locomotive that can outpull both of its other two remaining engines. These are a pair of 4-6-0 Baldwins, one of which was built in 1913 and the other in 1907. The new engine can pull the hill north of Carson City all by itself and it's no longer necessary to send out a helper engine with the daily train. All of the V & T's rolling stock is maintained to the safety standards of the I.C.C.

Down in California, a portion of the narrow gauge that was built by the V & T is

(Continued to page 252)

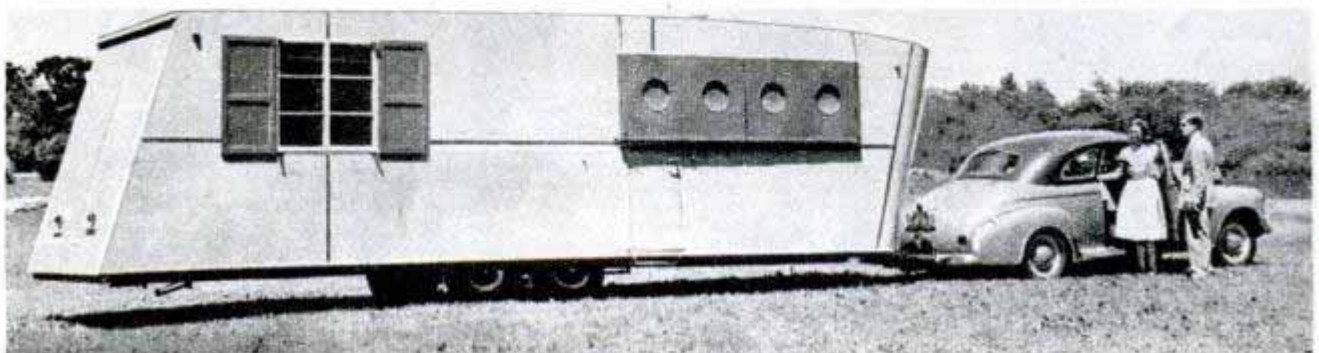
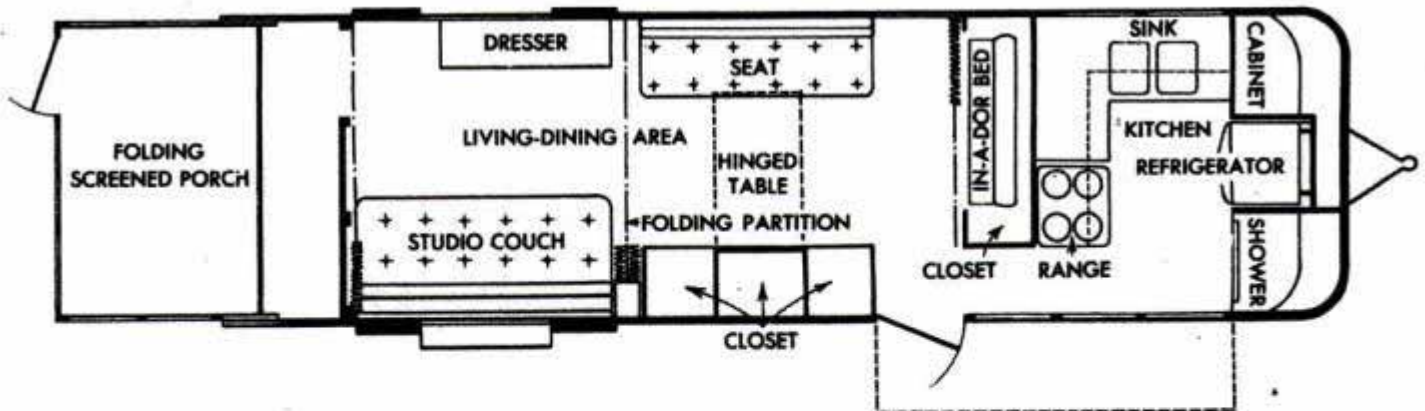
V & T shop equipment includes (left) steam plant kept in stand-by status in case of electric power failure, and (right) 75-year-old hand-operated wooden crane still in use; only base of the crane is shown in the photo





SUN-PORCH TRAILER

With a screened porch that folds into the rear of the coach for traveling, a new trailer provides a roomy home on wheels. Above, the seven-foot-long porch comes equipped with screens that bolt into place easily. Left, porch interior is separated from living room by a glass wall. Below, floor plan shows large living area. Folding partition converts space into two bedrooms. Modern kitchen has an electric refrigerator. Electric heater provides hot water for sink and built-in shower. Bottom, ready for travel, the coach is 28 feet 8 inches long. Folding porch forms screen-storage space in rear of trailer. Partholed sun shields for windows and door fold against body. Its tandem wheels have electric brakes.





Movie camera is bolted to the X-ray machine prior to photographing bone movement in hand and wrist. Vertical strip shows completed pictures. Right, doctors adjust camera for filming heart's pumping action

X-Ray Movies Record Body Movements

By synchronizing a 16-mm. camera with an X-ray machine, medical researchers take movies of the inner movements of the body and its organs. This technique, developed by the University of Southern Cali-

fornia and Northrop Aircraft, Inc., is expected to result in better artificial limbs, more effective treatment of infantile paralysis, and greater knowledge of circulatory and respiratory functions.



Wheel Chair Folds To 10-Inch Width

Weighing only 35 pounds, a wheel chair folds to a 10-inch width to fit easily in an automobile, plane or train. The chairs maneuver so easily that users play basketball while seated. On women's chairs, stainless-steel skirt guards are provided. For persons who have lost an arm, a special chair is operated from one side.

Plastic Fog Lens

Eliminating the need for special fog lamps, clip-on fog lenses made of amber plastic quickly equip a car's headlights for foggy-weather driving. The lenses fit any standard sealed-beam unit and are held in place by three metal clips. The specially developed plastic is water repellent, heat resistant and has excellent light-transmission qualities. The clips are formed of non-corrodible Monel metal.

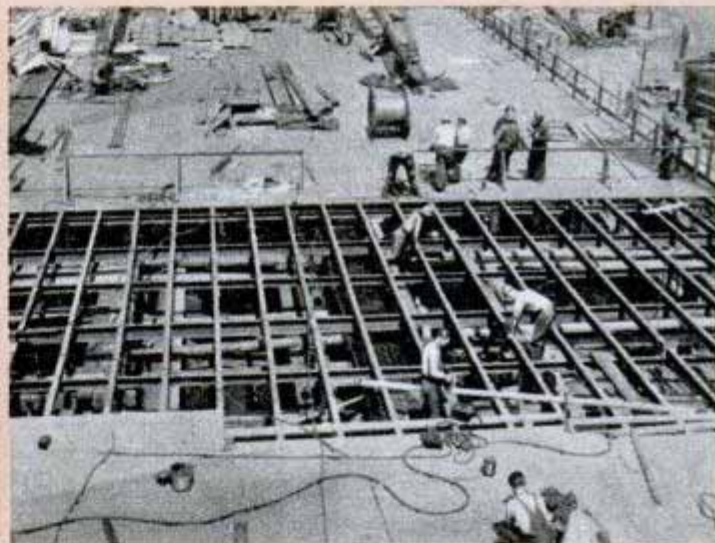
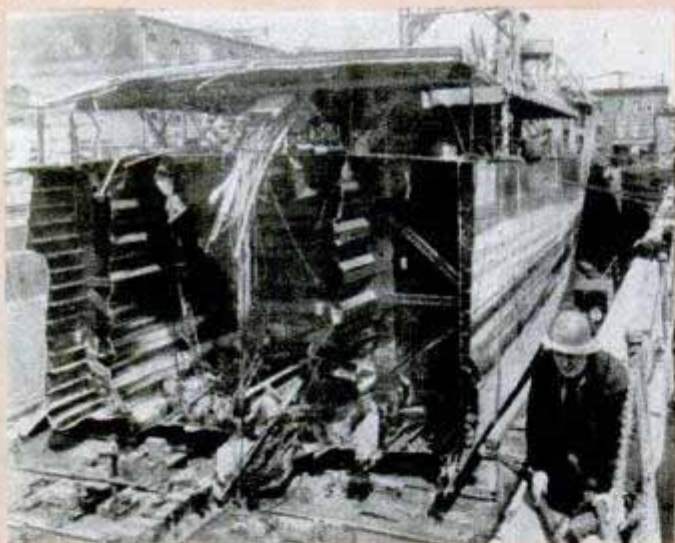


Information, including manufacturers' and distributors' names and addresses, concerning products described in this issue may be obtained by writing to Bureau of Information, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11

Savered bow of oil tanker is towed into Todd shipyards after a storm ripped the vessel asunder amidship

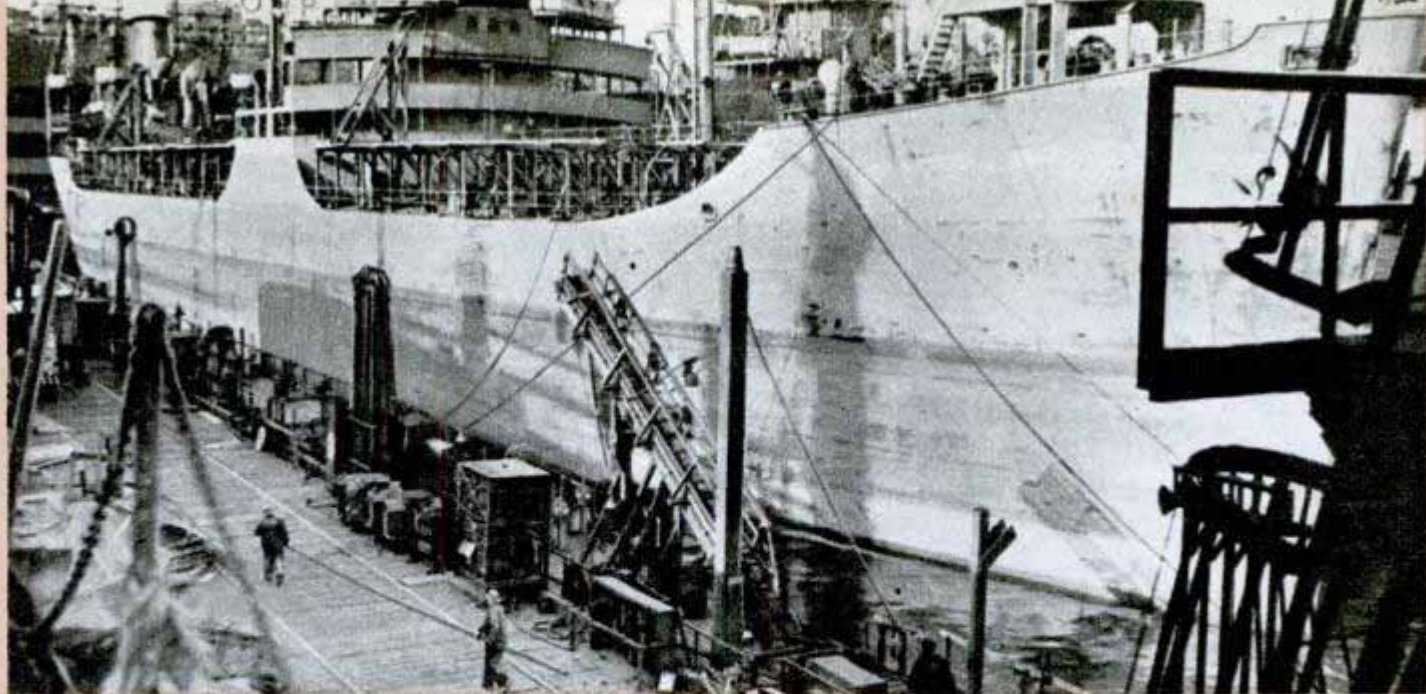


They Stitch Broken Ships

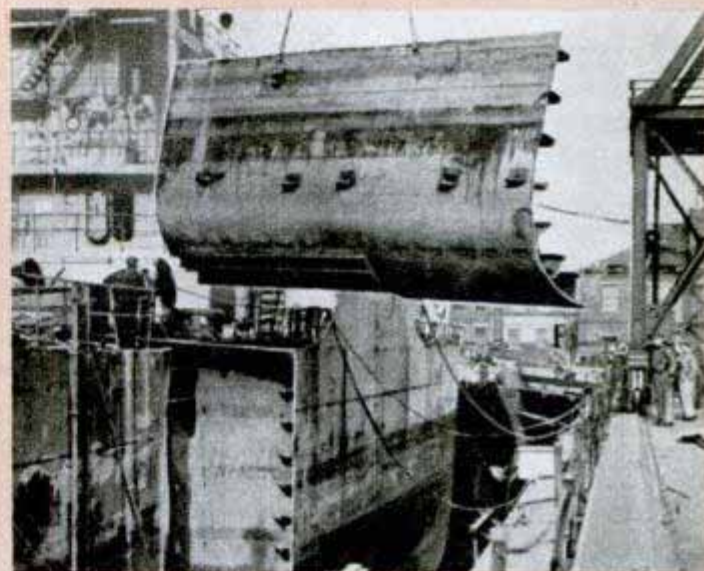


Mangled stern half (left) awaits repairs before being "sewed" together with bow. The two halves are re-joined (right) by strong iron beams. After only 63 days in the ship "hospital" at Brooklyn, the reunited sections leave as a complete tanker, staunch and seaworthy. The ship has an entirely new midships section

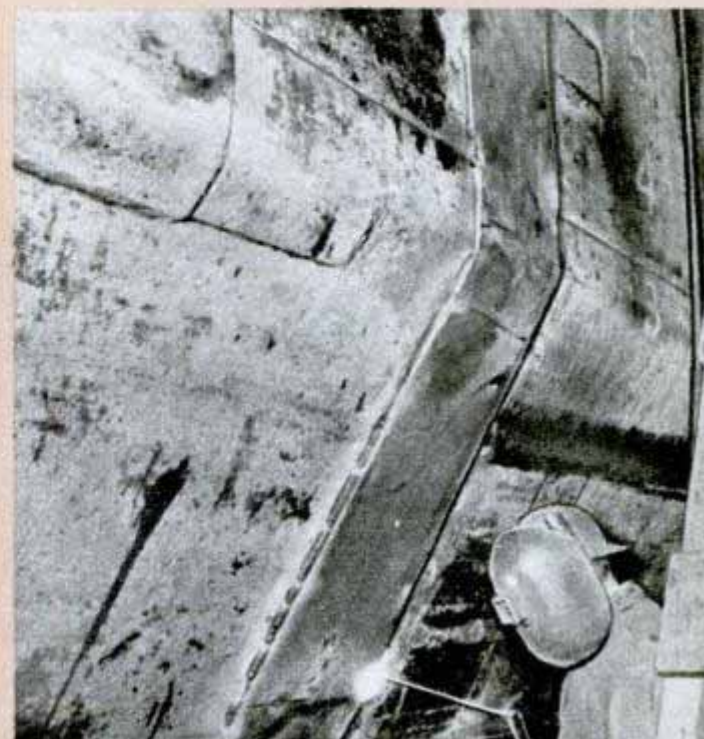
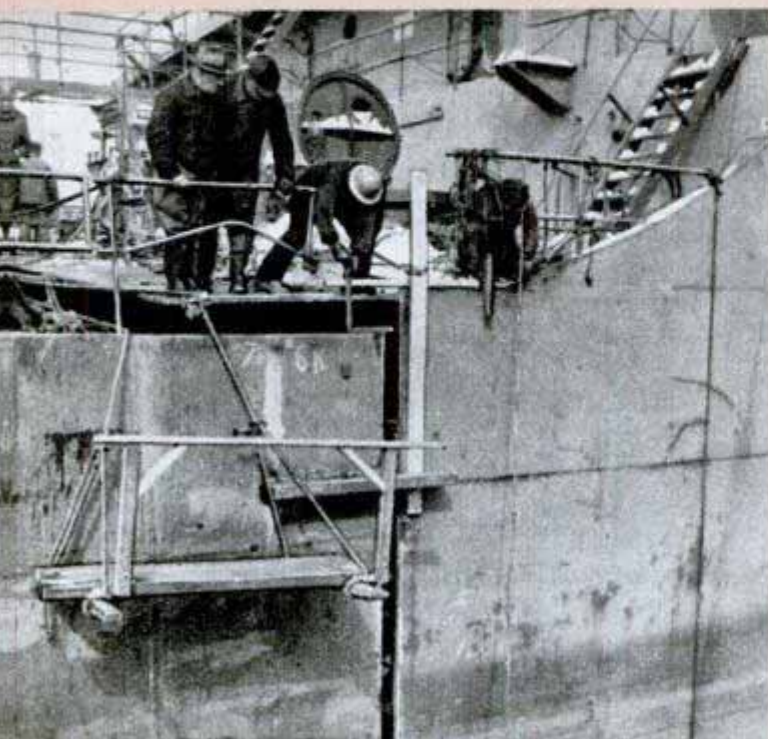


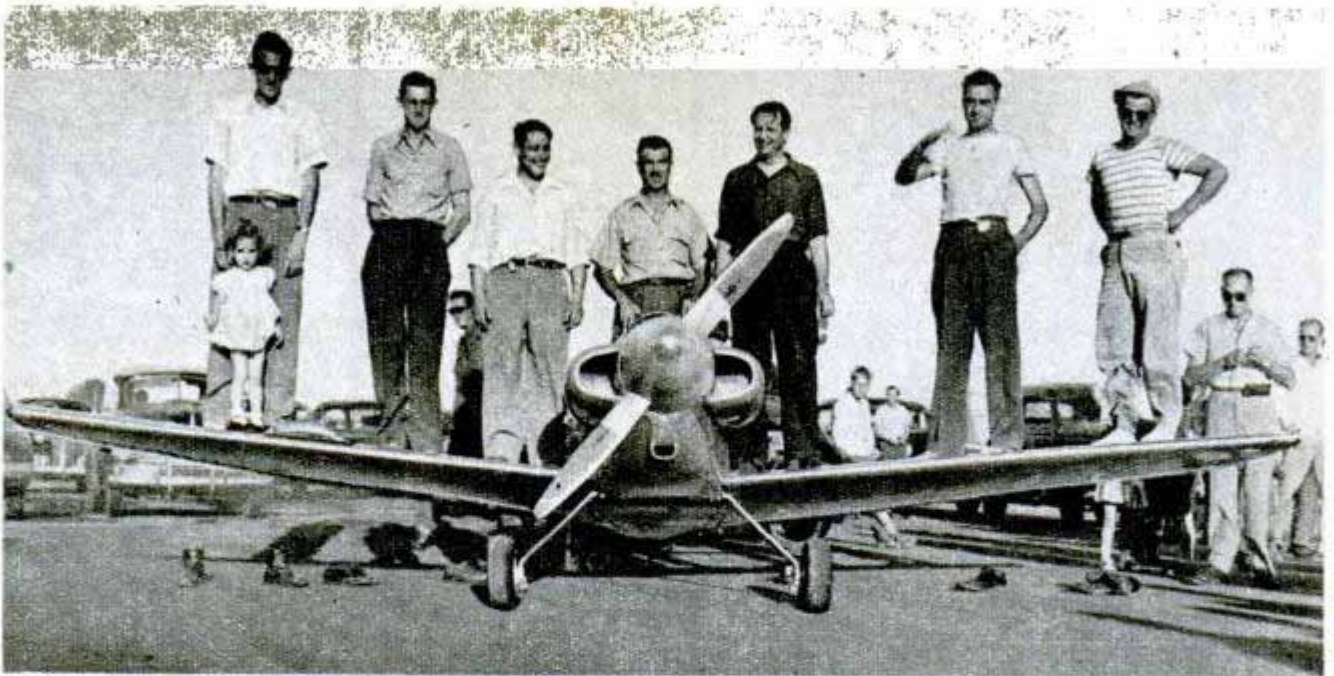


The tanker, Gold Creek, comes to the shipyard to be shortened to negotiate turns in South American rivers



After a ship "can opener" (left) sears its way through the tough hull, a crane (right) removes the last severed section. Then the two halves are floated together (below, left), and the sections are welded together





Nineteen-foot wing span of midget racer supports seven men and a child. Built by Tony Levier, Lockheed test pilot, it has a top speed of 200 miles an hour. With pilot and three hours' fuel, the craft weighs 800 pounds



Midget All-Metal Racer Flies 200 Miles An Hour

Midget-plane racing is a new week-end sport envisioned by Tony Levier, Lockheed test pilot, and a group of friends who are building five identical racers with 85-horsepower engines. One of the smallest all-metal planes ever built, the first of the

class is 16 feet long, has a 19-foot span and stands 4½ feet off the ground. It has a fixed-pitch propeller, fixed landing gear and weighs 800 pounds, including pilot and a three-hour fuel supply. Its top speed is estimated near 200 miles an hour.

British Combine photo



Dutch Pusher-Type Air Taxi

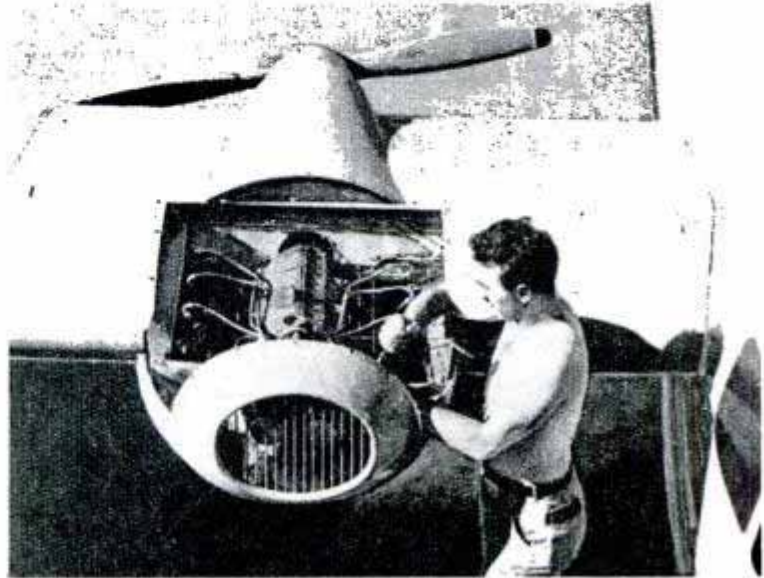
Judged best among small taxi or feeder planes at an international show in Paris was a pusher-type Fokker. Seating four, it cruises between 130 and 140 miles an hour. The plane was built by the Fokker Aircraft Company, Ltd., in Amsterdam, Holland.

POPULAR MECHANICS



Top of Squat Transport Just Six Feet Off Ground

Mechanics don't need ladders or stands to work on the Brigadier, a twin-engine pusher transport whose cabin top is only six feet off the ground. It is low enough to allow the five occupants to enter without using a step. Slightly more than 27 feet long and with a 41-foot wing span, two 125-horsepower engines are expected to give it a 150-mile-an-hour cruising speed. It weighs 3200 pounds fully loaded, climbs 300 feet per minute, lands at less than 60 miles an hour.



Overhead Stick Replaces Helicopter "Wobble Plate"

Helicopter control is simplified by an overhead stick that directly rolls the rotor head to get the desired direction, replacing the conventional "wobble plate." Since the rotor blades are mounted rigidly one to the other, the rolling increases the pitch of one blade and decreases that of the other. The test model has been flying for more than a year. Eliminating cables, pulleys, rods, cams and levers required by the universally mounted head saves weight and increases carrying capacity.



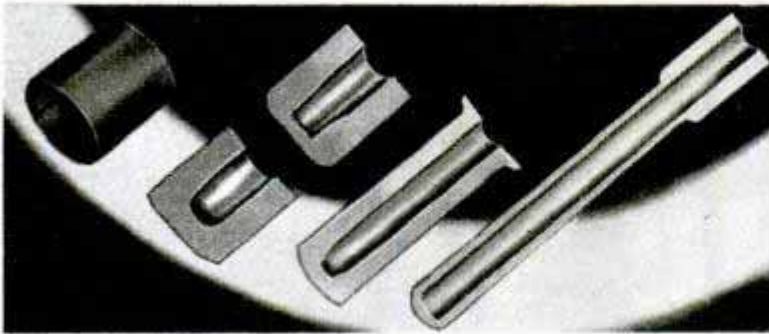
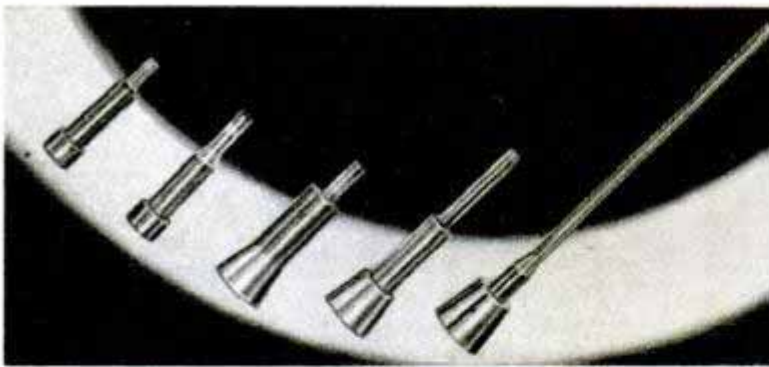
United Helicopters photo

Hollow-Handle Car Cleaner

By using a long, hollow-handle brush, motorists can wash their cars without getting wet. The handle attaches to a garden hose and water pours out of the soft brush to dislodge dirt and grime from the car surface.

Freight cars built of concrete except for wheels, springs and drawbars are under construction in Germany.

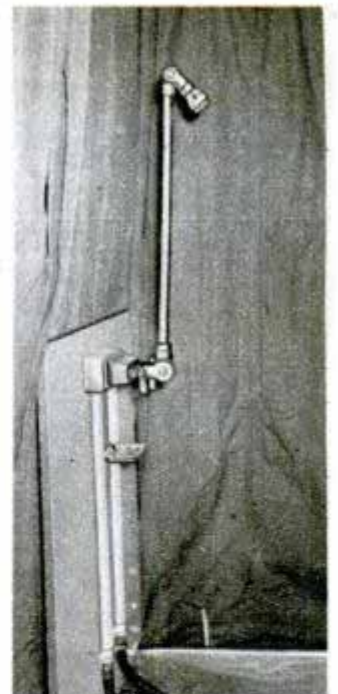
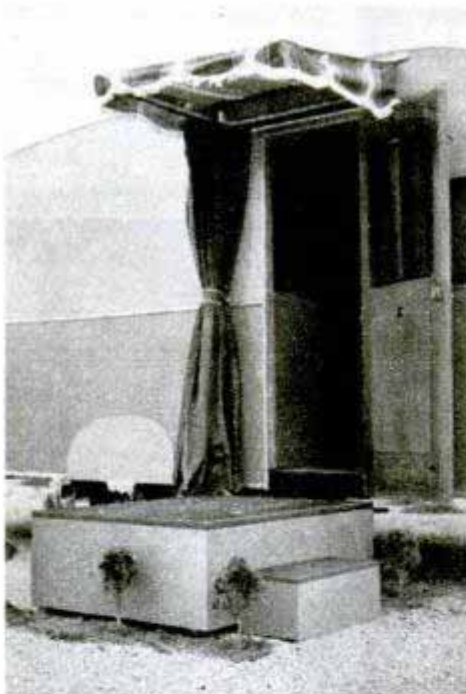




Cold Steel Made to "Flow" Under Pressure

Tests are being made of a German method for making cold steel "flow" under tremendous pressure to produce extruded steel parts and shapes. An advancement on techniques used for shaping softer metals, such as copper, brass and lead, it can greatly simplify production of many com-

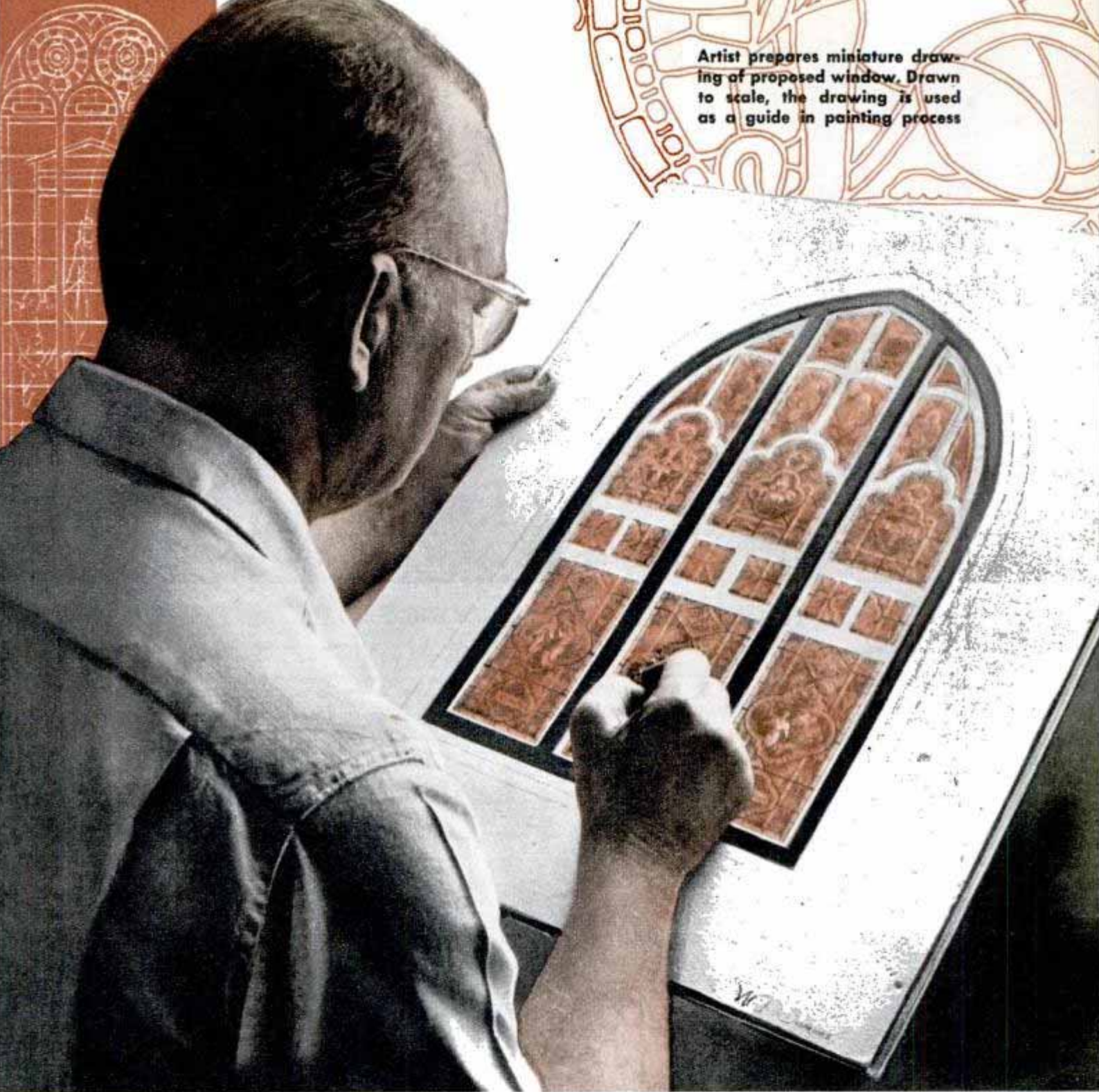
mon steel objects since only a small number of working operations and little or no machining are required. One secret of the German method appears to be coating the steel with a thin layer of phosphate. This holds lubricants so well that friction between steel and die is greatly reduced.



Trailer Doorstep Becomes Shower Stall

Shower baths for trailers are provided with a doorstep—that can be converted in a few minutes into a stall with hot and cold running water. The shower pipe and head are hinged to the underside of the step top and swing into place when it is raised upright. A canopy and a curtain with fas-

teners give the bather privacy. Water is supplied through hose connections and heated by an electric unit with a five-gallon-an-hour capacity. The tub portion is nearly 3 feet square and 14 inches deep. Drain water can be either piped away or disposed of in a seepage pit.



Artist prepares miniature drawing of proposed window. Drawn to scale, the drawing is used as a guide in painting process

STAINED-GLASS ARTIST

PICTURE windows are an old story to William D. Somers. He's been making them for 50 years. But his picture windows are not merely transparent areas of glass disclosing a pretty view, they're the beautiful, stained-glass windows seen in churches, colleges and other buildings.

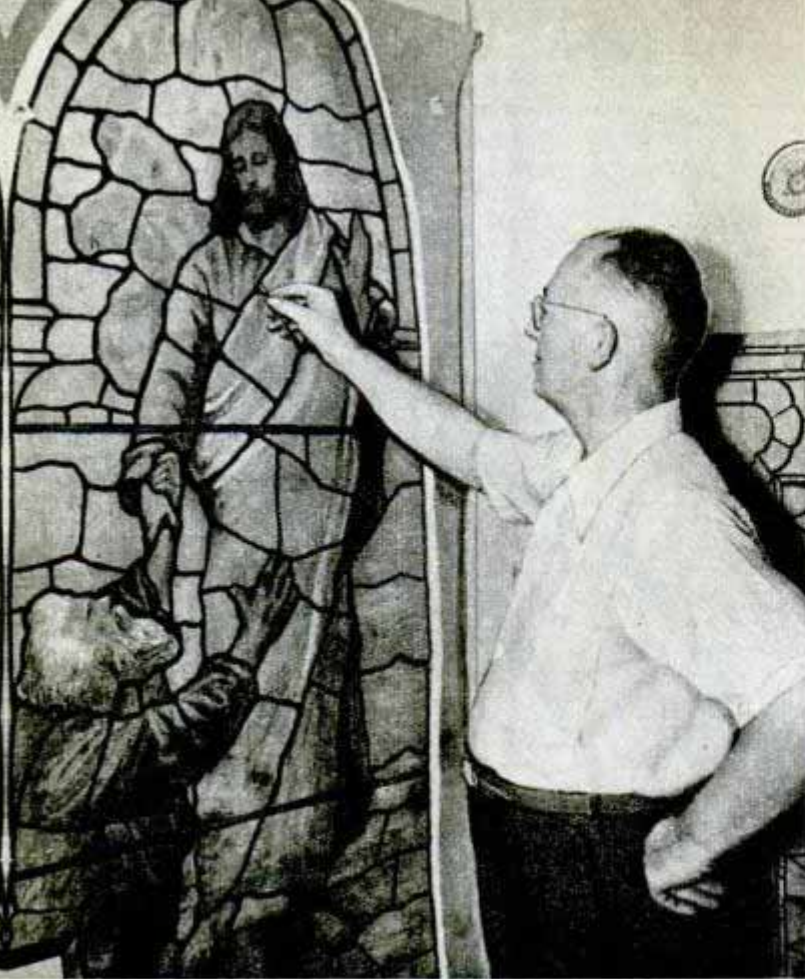
Somers not only paints on glass, but he is one of the few men in his profession who does the entire job. He starts at the very beginning by making the original design,

By Stanley J. Dreyfuss

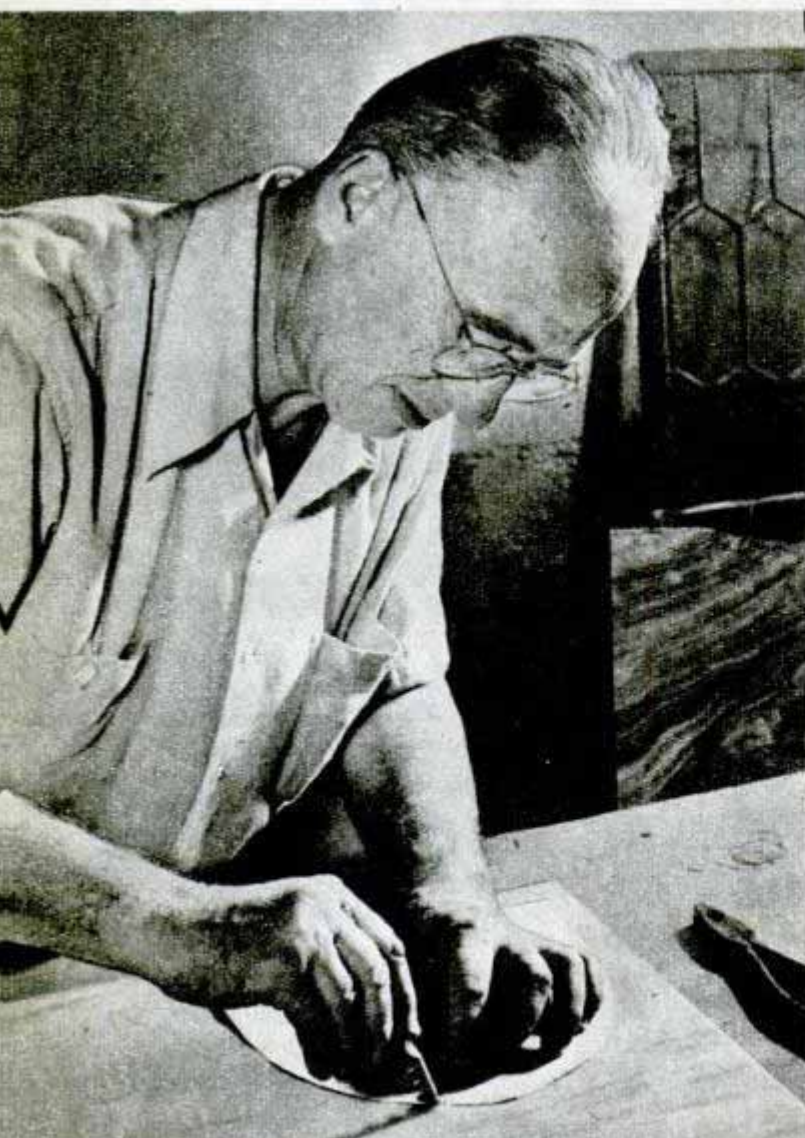
then he selects and colors the glass, assembles the window and finally mounts it in the building.

With more than 5000 windows of all shapes and sizes already to his credit, the 65-year-old artist is swamped with more orders than he can possibly handle.

"There are perhaps fewer than 75 recognized glass painters at work in the world today," he points out, stressing the need for courses on stained-glass painting in college art schools. "With no apparent effort



Charcoal drawing of design is divided into sections that are used as patterns for cutting glass (below)



When stained-glass sections are cut, they're assembled on a clear-glass plate prior to being painted

being made to train apprentices to replace us as we die off, one of the most ancient crafts seems doomed to become a lost art."

Of Dutch descent, Somers is the first of his family to take up any phase of art work. He began working for a Brooklyn firm that made stained windows for churches, cathedrals and theaters when he was only fifteen. He wanted to learn more about the art so he attended night school, first at Cooper Union, then Pratt Institute where he studied under several European stained-glass painters and majored in the related subjects of the trade: architecture, literature, history and anatomy. On his twentieth birthday he decided to go into business for himself.

Today, his ten-room, three-story home on the outskirts of New York City serves as his workshop. In a large attic below the building's pitched roof is the studio where he does his designing and colored-glass assembling. A room on the second floor is used for the meticulous work of painting stained-glass sections. Another room on the same floor contains the equipment used for glass cutting and baking. The garage houses a store of antique and plate glass and a large, flat-topped bench in the basement, is used for cutting down the large glass sections and for the messy task of soldering and cementing.

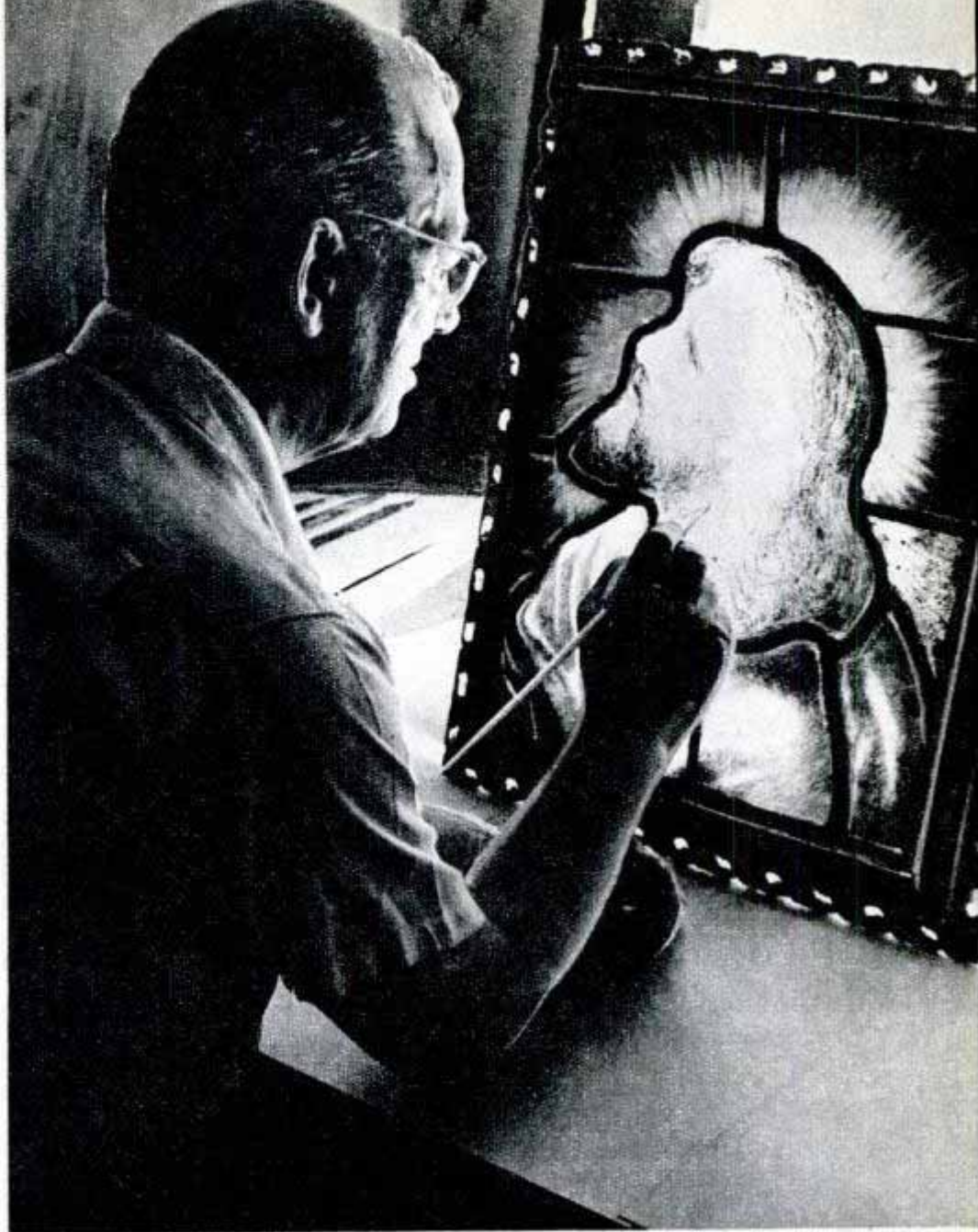
The tastes and the budgets of the people who order the window, plus its location, are considered before the initial step of laying out the design is begun. The design and the subject must harmonize with the window's surroundings. A thorough study of the architecture and contours of the building is made by the artist.

After this research, Somers sits down at his easel and makes a rough sketch of the design. When the sketch has been approved, Somers starts work on the detailed drawing of the window, carried out in every particular of color and characters as well as design. Some drawings take only a few days to complete, while others are so complex they require as long as several months. Next, a full-scale charcoal drawing on heavy wrapping paper is made for a pattern. This is sprayed with shellac to prevent the charcoal from smudging or rubbing off when handled.

After the full-scale drawing has been traced on pattern paper, special shears, imported from Germany before the war, are used to cut out the many sections. The shears have a forked blade to allow for spaces in which lead strips are to be inserted.

Using the master drawing as a guide for color and the paper patterns for dimensions, the artist selects various colored glass to be cut with a "wheel" or glass cutter. Antique glass in striking reds, blues, greens and hundreds of other bright and handsome colors, shades and hues are used to obtain the proper background effect for the painted design. Some of Mr. Somers' glass was produced in the United States, but more than two thirds came from England, which has excelled in that industry since World War I.

When the stained-glass pieces have been cut to shape they are



Placed in front of a light, the assembled sections are painted by Somers. Any mistake is costly as the pigment cannot be painted over. Below, after paint is baked, the sections are fixed in place with strips of came lead





Came-lead strips are soldered to insure permanence. Below, the artist cleans a \$10,000 window before re-painting part of the design. Window is 50 years old

ready for painting. Using a clear-glass plate as a base and working from one section of his drawing at a time, the artist assembles the pieces into the proper design, leaving spaces between them. Hot beeswax mixed with rosin is dropped in these spaces to hold the sections temporarily.

Somers then places the assembled plate on an easel in front of a window or a strong light. Using imported, fusible-glass paint pigments, he adds the many details of figures, faces, clothing and backgrounds. As soon as the paint has dried, he applies a murky brown stipple to the glass and with a dry brush removes some of the stipple to produce artistic highlights.

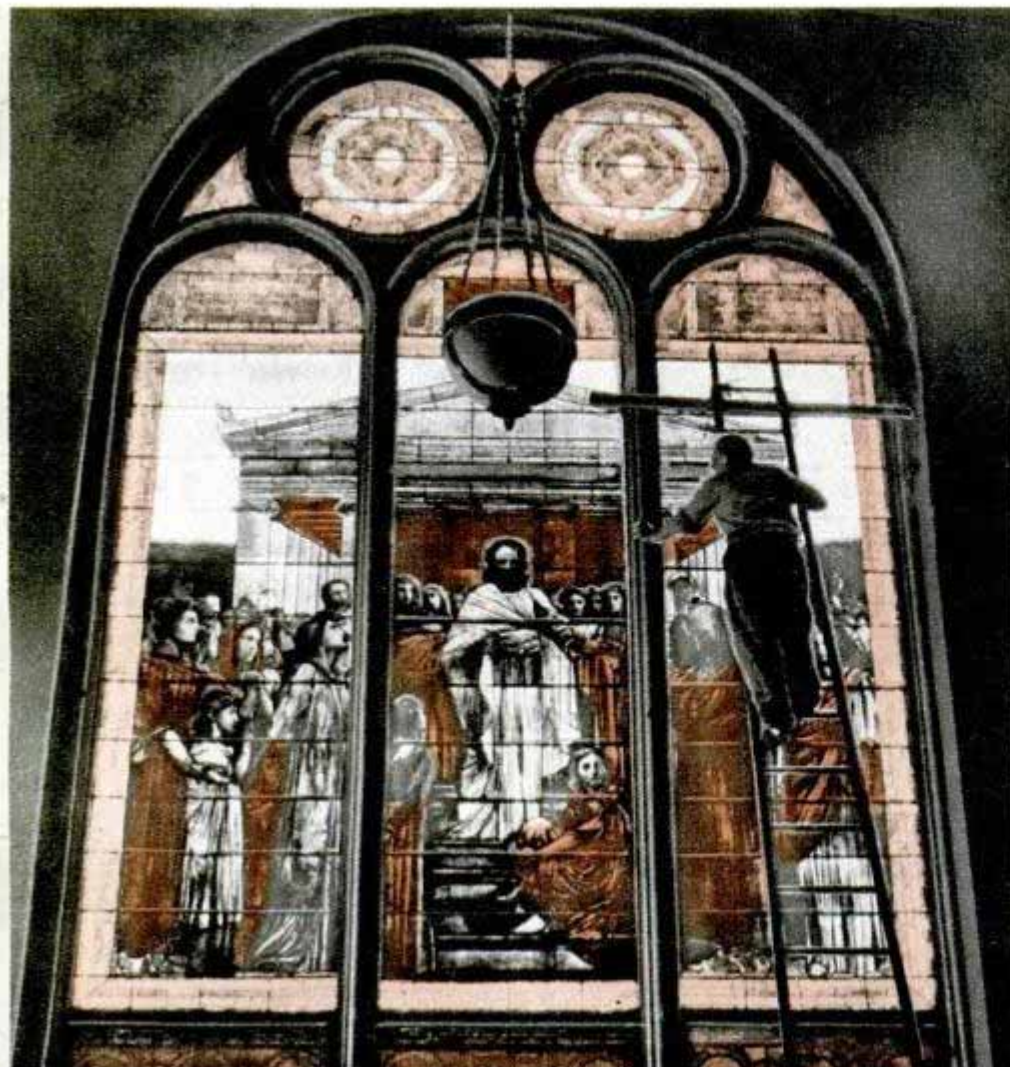
The wax is removed from the glass sections before they are placed in a gas kiln where they are baked from 20 minutes to three quarters of an hour. When the glass is heated to a cherry red, the jets are turned off and the glass allowed to cool for 24 hours.

Then, the sections are reassembled on the full-scale drawing. The artist uses came lead, a pliable compound that comes in six-foot lengths and many thicknesses, to bind together the glass sections. The arrangement of the lead was planned in advance to fit into the design effectively, helping to form important lines, such as folds of drapery. It is soldered and then weatherproofed. Stained-glass windows, no matter how beautiful, are impractical if

they cannot withstand weather. Cement, mixed so that it is fairly stiff, is spread over the exterior surface of the window with a scrubbing brush and pressed into the cracks. Excess cement is removed at once and the window is set out to dry for a week or ten days, after which it is ready to install.

Some windows, like those in Great Britain's noted cathedrals and St. Peter's Church, adjoining the Vatican in Rome, cost as much as \$25,000 each. The most inexpensive are the opal type. Opalescent windows are less costly because they represent the least amount of labor. Somers has made stained-glass windows priced from \$100 to \$5000.

With orders coming in faster than he can fill them, Somers is worried that the stained-glass art may be lost in the future. And, he says, the windows are much too beautiful for that.



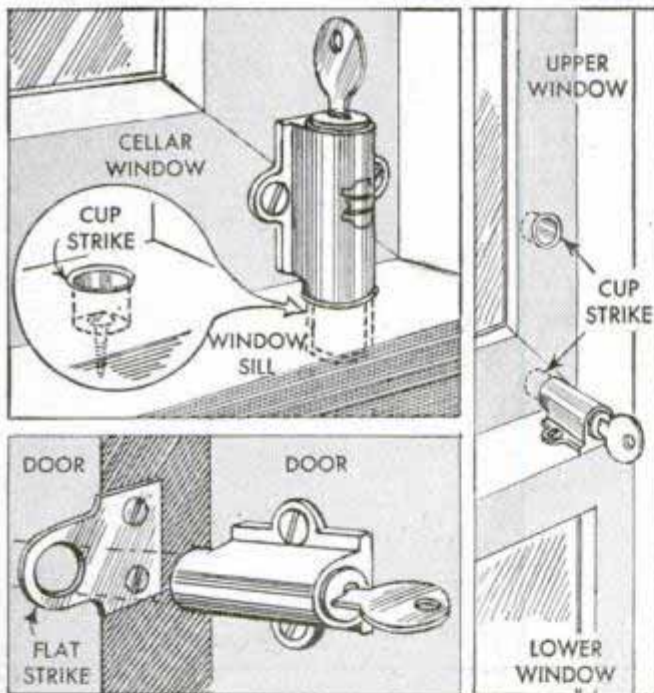
Most Powerful Helicopter

Most powerful and first all-metal helicopter, the XR-10 flies well over 100 miles an hour and climbs to a near-record altitude of 18,800 feet. It carries pilot, co-pilot and 10 passengers. The U. S. Air Force plans to use it for transport and air-ambulance assignments. It has a hoist and a 33 by 52-inch hatch through which litter patients and cargo can be loaded from otherwise inaccessible places. Two 525-horsepower engines drive contrarotating rotors, placed close together so that the three blades of each intermesh as they turn. Each rotor is 65 feet in diameter. Both engines are outside the fuselage, allowing added cabin space, but faired against the side so that no extra structure is needed.



U. S. Air Force photo

The craft has a gross weight of 11,000 pounds, lifts 2000 pounds and has a 350-mile range at 90 miles an hour.



Window Lock Permits Ventilation

Windows can be locked fully closed or partially open for ventilation with a cylinder sash lock that has two sockets. Turning the key moves the striker in or out of the socket and the key can be removed in either locked or unlocked positions. One of the sockets is installed so the window can be locked shut and the other is fastened a few inches away so the window can be locked partially open. When the window frame is moved, the second socket comes opposite the lock. Special screws that can be turned in one direction only are used to fasten the lock in place.

Of the 300,000 known organic chemicals only about 9000 are currently useful while the other 291,000 await development, according to Hoyt M. Corley of Armour and Company's chemical research department.

Pontoons Prevent Capsizing Boat

Rubberized pontoons, inflated by mouth and attached to both sides of a canoe or small boat, help prevent the vessel from capsizing. They can be used on any boat up to 42 inches in width. A clamp is fastened to each side of the boat and a telescoping arm of square steel tubing, which carries a pontoon at its outer end, is fastened to the clamp. An additional sliding part on each arm extends inward from the clamp to the center of the boat where the two ends are locked together.

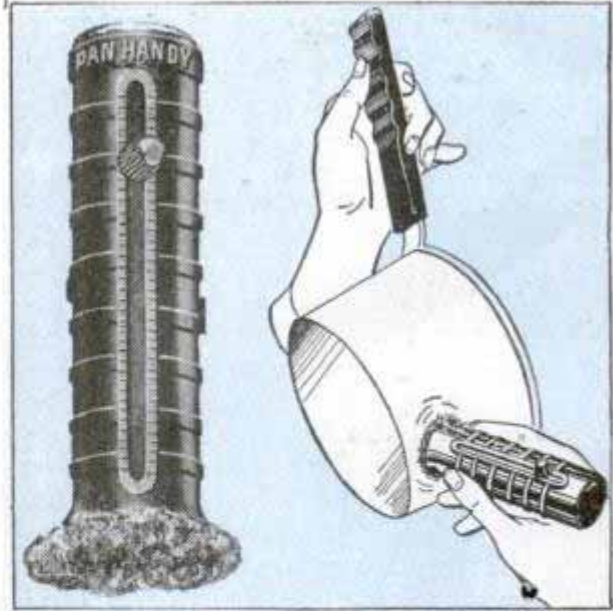
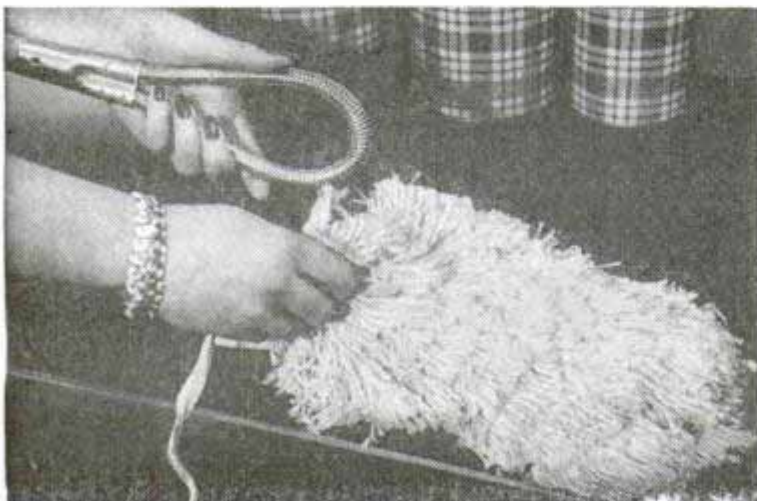




JAR TOP OPENER is adjustable to fit any size lid and works on either screw or pry-off caps. Right, shopping list that requires no pencil is made up by punching holes in printed sheet. Transparent cover over sheets has openings for punch

WHAT'S NEW For Your Home

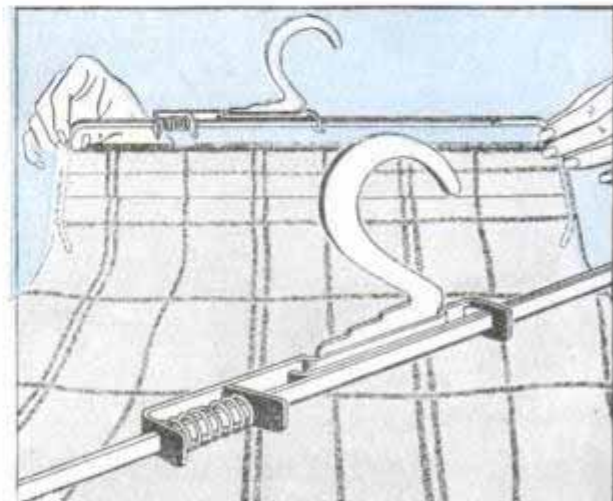
FLEXIBLE MOP HEAD that will bend in any direction reaches hard-to-get spots. The coiled spring keeps the long cotton strands pressed evenly against the surface being cleaned. The washable head can be used dry, with soap or with oil



↑ **STEEL WOOL HOLDER** is shatterproof and holds a tube of steel wool that is coated with soap for quick suds. Wool refills are easily inserted in the handy plastic case



↓ **SKIRT HANGER** holds garment straight, smooth, making it unnecessary to press the skirt before wearing. Pressure of spring on waist line tends to smooth out creases





Curtiss-Weight photo

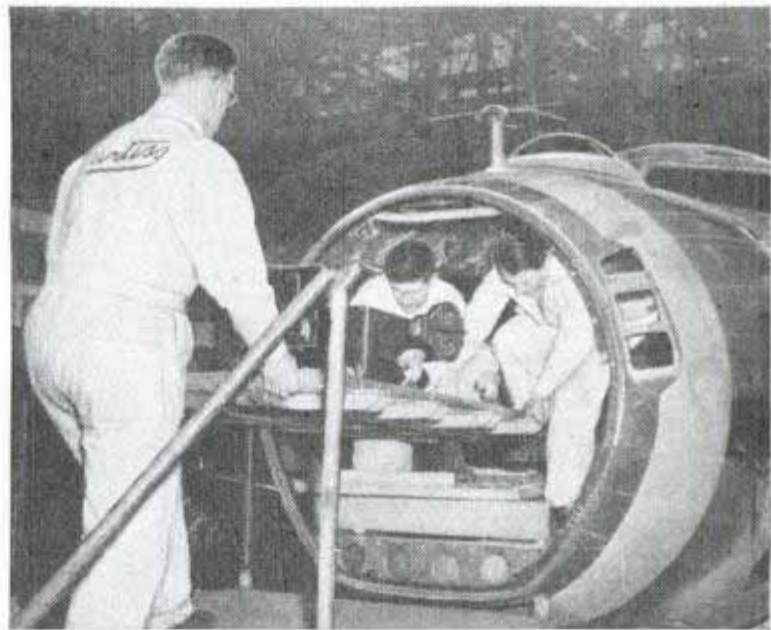


Air Materiel Command photo

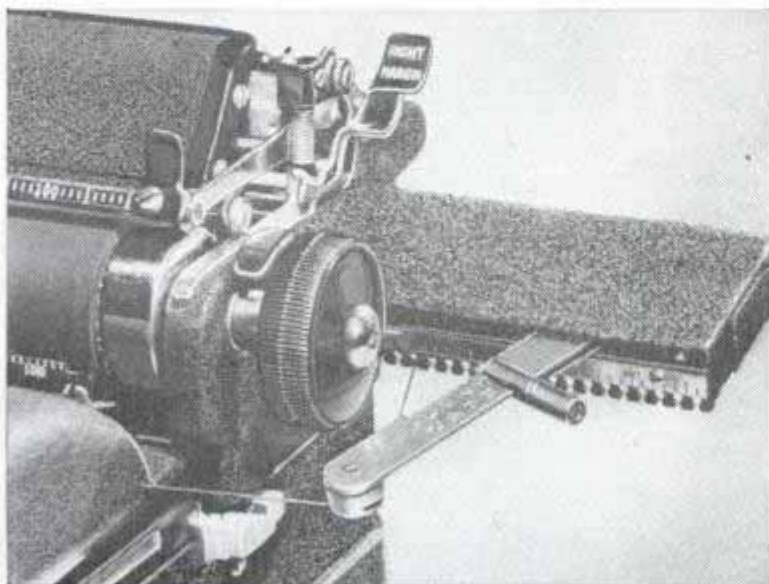
Left, adjusting lens before sealing camera in watertight box. Shielded flood lamps are above and below case. Above, ditched "Fort" settling into Gulf of Mexico. Tray load of television and photo equipment, below, being installed in bomber's nose

Cameras Provide "Eyes" To Study B-17 Ditchings

Automatic cameras sealed in waterproof boxes are the "eyes" through which the U. S. Air Force is studying what happens when big land planes are ditched. Ten crewless B-17s, controlled by radio, are being dunked in the Gulf of Mexico during the two-year program. The results will be used in future airframe design and in training crews for emergency water landings. Eight cameras peer from strategic points to record structural damage, while television transmits instrument readings to a receiver in the "mother" plane. Floodlights with a Plexiglas and canvas shield illuminate the interior when the instruments begin recording. To aid divers recovering them, the aluminum-alloy cam-



era boxes are striped black and white. The weak signals from water-pressure pickups are amplified and picked up by a highly sensitive recording oscillograph.



Justifier for Typewriter Evens Right Margins

Uneven right-hand margins of typewritten material can be aligned perfectly with a spacing device which fits any typewriter. The justifier has nine different settings to expand or condense the typewritten line as needed. It also has a neutral position which permits regular typing when justification is not desired. Typewritten copy prepared with the spacing justifier is suitable for mimeograph sheets, catalogues, price lists, sales manuals, booklets or narrow-column papers.

Harvesting The "Backwoods" Crop

"TURPENTINING," the backwoods industry of Florida, Georgia and the Carolinas, is going to town. Antiquated rosin stills and uneconomical collecting methods have given way to a number of revolutionary improvements.

For almost 200 years, rosin, tars and gum turpentine, commonly called "naval stores," have been made from the sap or gum of southern pine trees in crude stills in the woods.

Slowly, the naval-stores industry changed from its original purpose of producing pitch and pine tar for calking ships to supplying turpentine and rosin for everyday use. Turpentine is a basic mate-



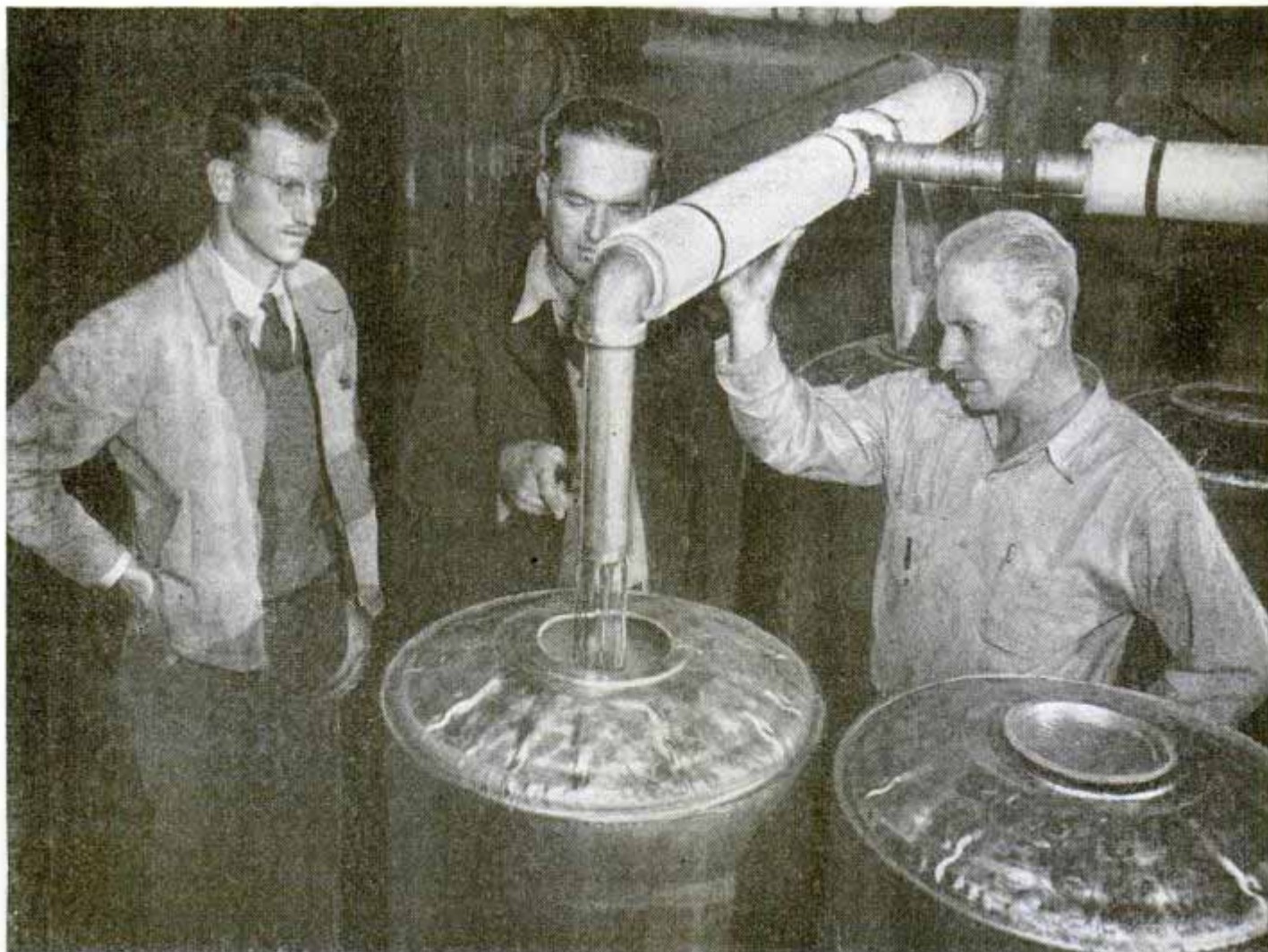
By John L. Kent

rial in the paint industry, for insecticides, polishes and medicinal ointments. Rosin is used in soap, paper, plastics, varnish, cements, waxes and soldering flux.

Collection methods have changed little. Several times a month during the spring and summer, chipping crews go from tree to tree cutting through the inner bark of each tree with a sharp cutting tool. Each chip wound is known as a streak, and each new streak is made just above the last one. The combined streaks are known as a "face."

The operator cuts about 32 streaks in each face being worked during the gum-flowing season. Ten thousand faces consti-

In tests by the Department of Agriculture, rosin flows from the "flash" chamber of a continuous-process still

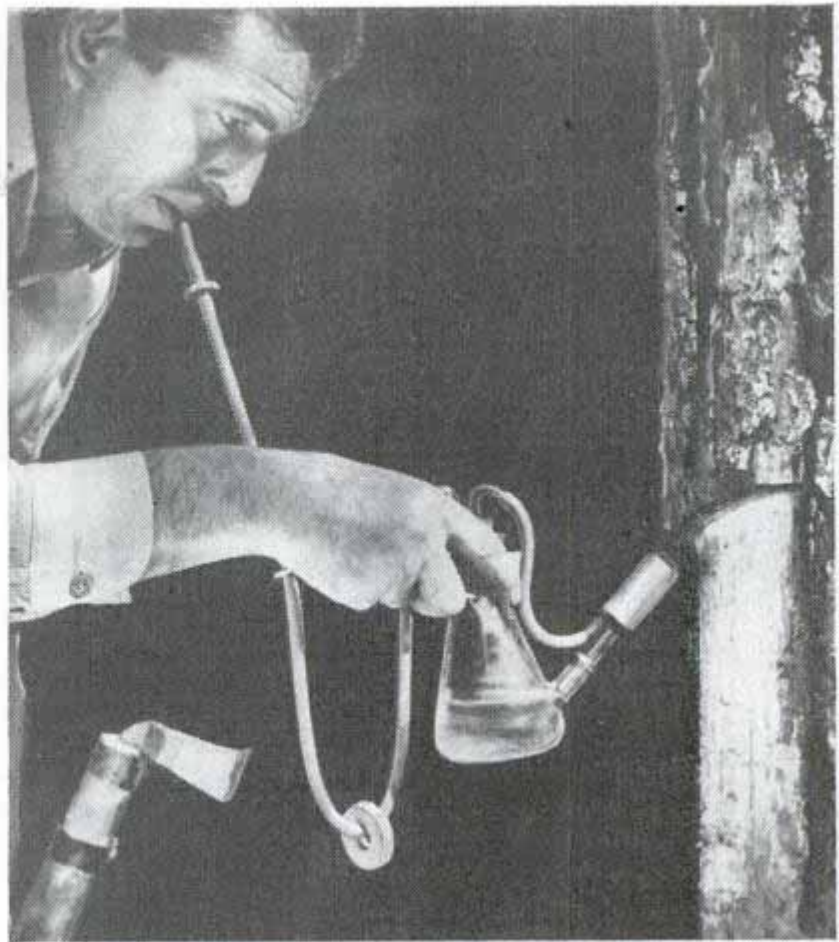


tute a "crop," the working unit of the industry.

A clean cut through the inner bark allows the clear oleoresin to flow over a sheet-metal apron or gutter which guides the gum into a collecting cup. These cups fill up about once a month; the contents are collected in buckets, transferred to wooden barrels and hauled to the distillery.

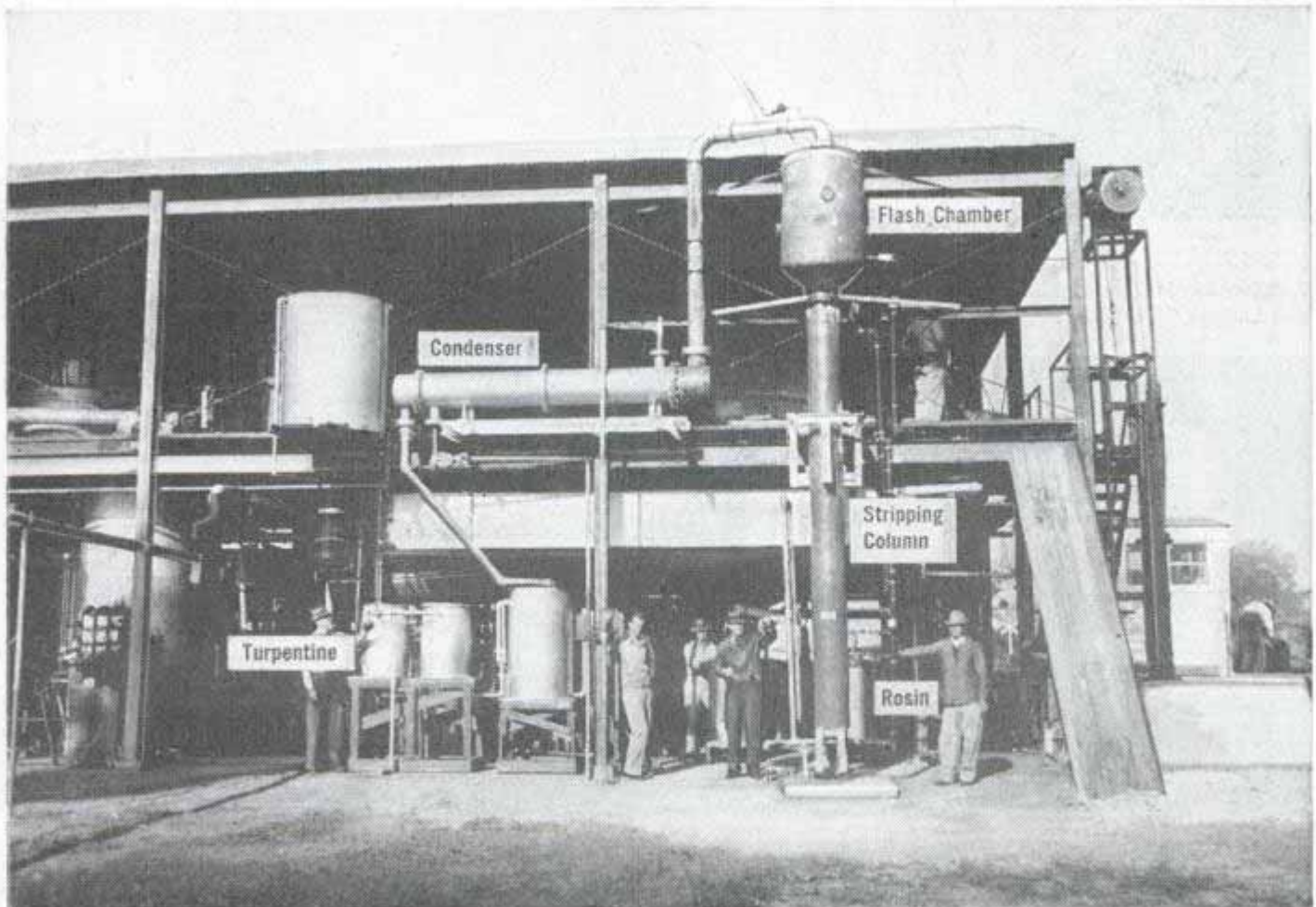
Pine gum usually has been processed, without preliminary cleaning, in copper pot stills heated directly by wood fires. To help distill off the spirits, water was added to the gum in the pot. These stills were easy to operate and to move to new virgin timber. Distillation was controlled partly by guess. Contamination and scorching resulted in poor grades of rosin, with the thick residue remaining.

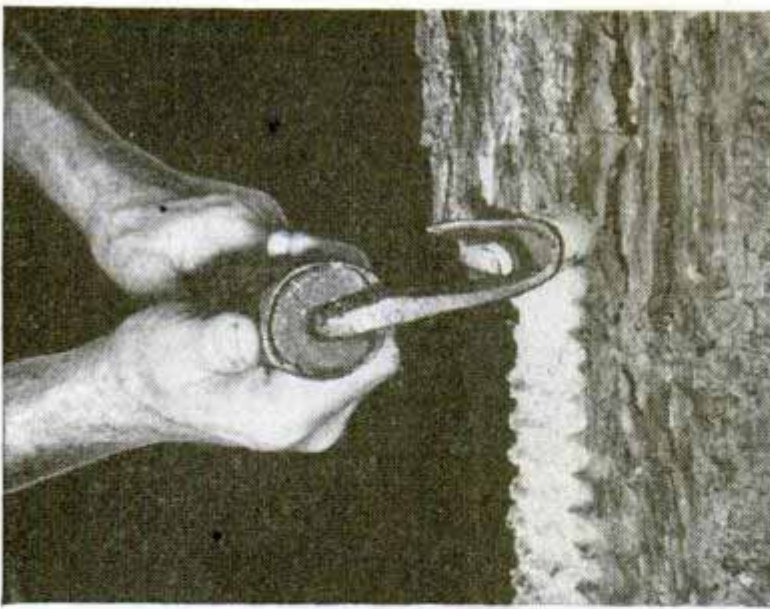
Recently, a new method was tried on a semicommercial scale by U. S. Department of Agriculture naval stores' scientists. They developed a new-type continuous-steam still with a "flash" chamber.



U. S. Forest Service photo

Applying sulphuric acid to turpentine tree to stimulate flow of oleoresin. Below, turpentine distillery depends for its operation on the condenser, flash chamber, stripping column. Note product outlets





Close-up of conventional wood-chipping hack in use, showing a worker cutting through the inner bark of a tree to reach the gum



New bark-chipping hack was devised by Keith Dorman at the Olustee Experimental Forest in Baker County, Fla. Below, glass cup shaped like flowerpot catches oleoresin, or gum, from tree



Gum is fed into one end, and turpentine and rosin flow out through separate holes at the other end.

The cleaned gum is first preheated to a temperature of 350 degrees, and then pumped through a spray nozzle into the flash chamber atop a 20-foot column. The flash chamber is so named because approximately 80 percent of the turpentine in the gum vaporizes instantly at this point. Turpentine vapors leave the chamber and are conducted through a condensing tank and then, as a liquid, to storage.

The rosin, not being volatile, flows toward the bottom of the upright "stripping" column, which is surrounded by a steam jacket carrying steam under pressure of 125 pounds. As the rosin flows down this stripping column, it meets an ascending current of live steam which drives out the last of the turpentine. The remaining residue—the rosin—leaves at the bottom of the column and is piped into containers. The still turns out over a ton of liquid rosin per hour.

The continuous still uses less than two thirds as much steam and half as much labor as the old process. One man can manage the new still and package the rosin it produces. Its cost is less than that of the batch still.

Dr. L. B. Howard, Chief of the Bureau of Agricultural and Industrial Chemistry, says the new still was developed to increase the income of 50,000 people who "turpentine" over 100,000,000 slash and long-leaf pine trees in the southeastern states. The trees produce a "crop" valued at \$40,000,000 a year.

The new still is in operation near Lake City, Fla., where it is running in competition with a modern steam batch still. Both stills take their cleaned gum from the same tank and both are producing about the same quality rosin and turpentine.

Several improvements have been made in collection of the gum. One is the acid-spray treatment. By treating the streaks, or cuts, on the tree with a sulphuric-acid solution, more gum is made to flow. The gum also flows longer—often for as long as three weeks. With

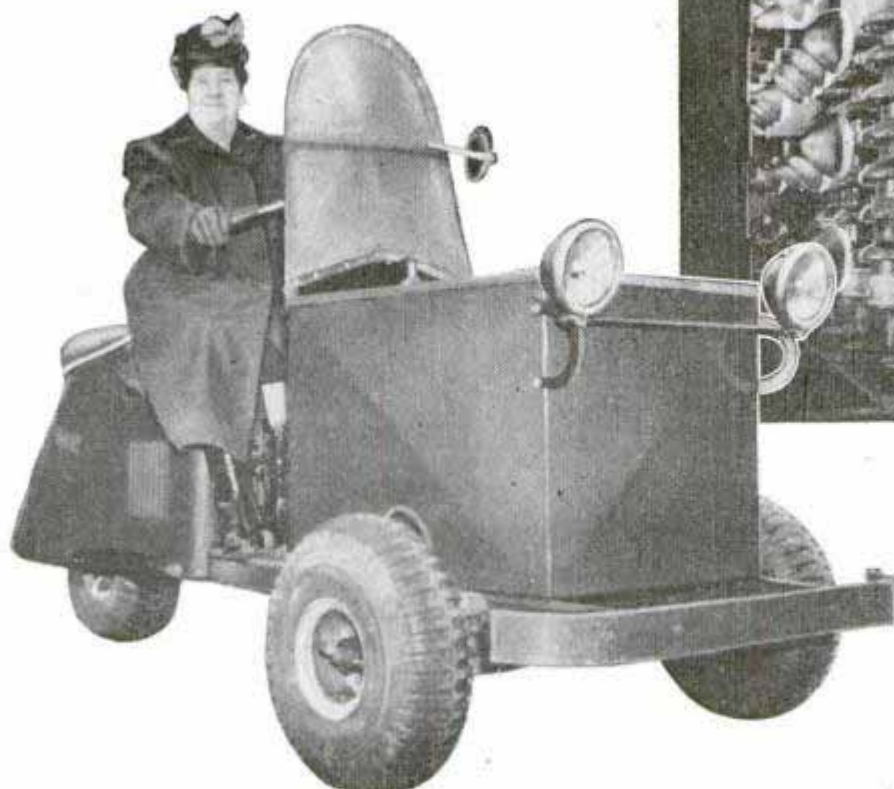
(Continued to page 244)

PHONOGRAPH ON ELEVATOR rises when a knob is → turned, providing easy access to the turntable. Another turn of the knob sends it back into the recess. A lamp atop the section will not be disturbed by the action

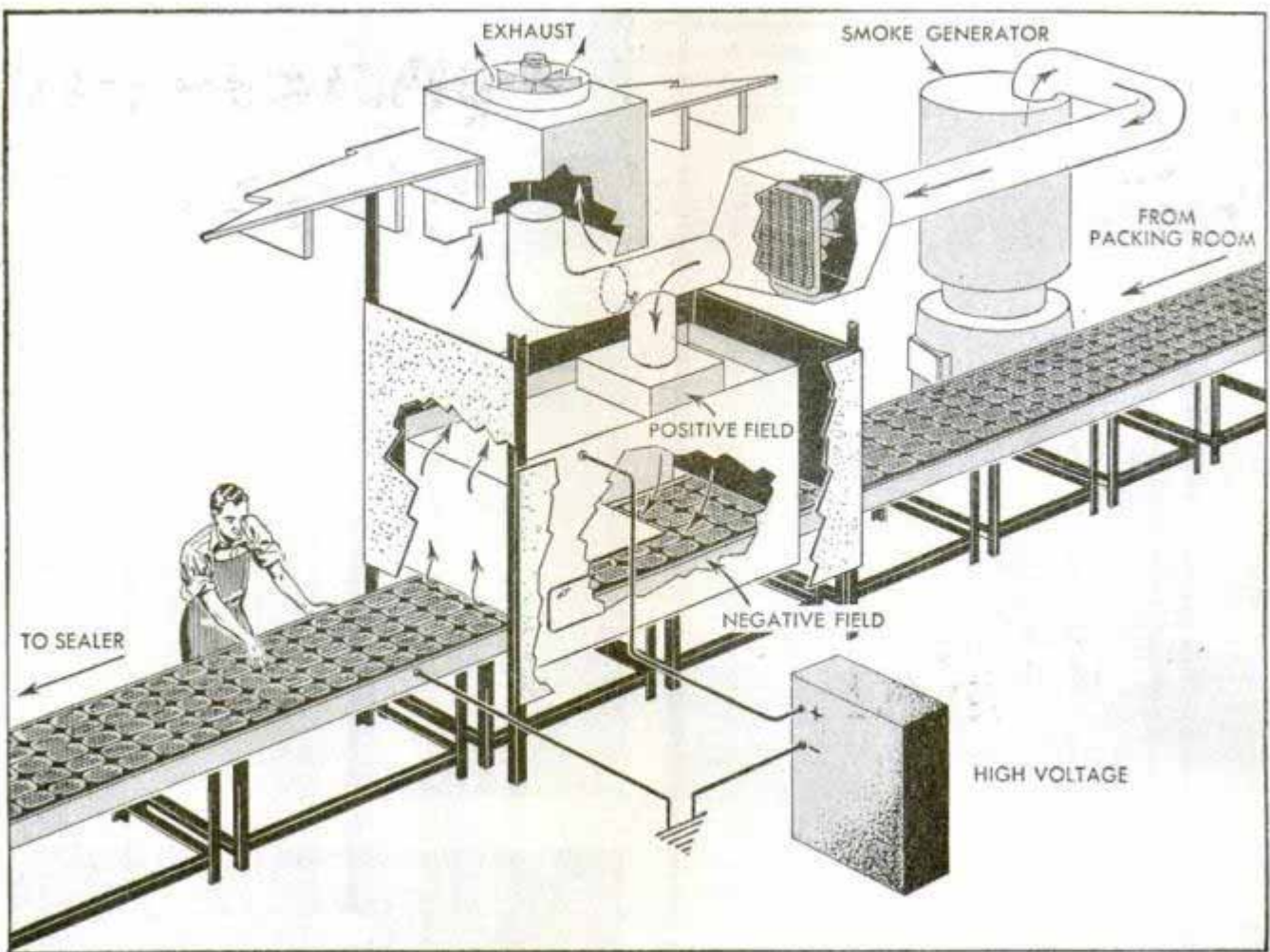


↑ **CONSTRUCTION SET** for seven to 15-year-olds has rivets and rubber grommets instead of bolts and nuts to hold the pieces together. Miniature traveling cranes, derricks, dump trucks and other toys can be built with the set. Individual pieces are made of square aluminum tubing and some sets include motors

↓ **MOTOR SCOOTER** provides the transportation when 71-year-old Mrs. Mary R. Spoor of Danville, Illinois, goes shopping or visiting. Sometimes her 74-year-old husband rides the back seat of the open-air vehicle



↑ **'ARTIFICIAL FEVER'** is induced into porcelain condenser bushings by Westinghouse engineers to prevent them from cracking when they are filled with hot insulating plastic. The bushings, used in circuit breakers and transformers, are heated to 266 degrees Fahrenheit by battery of 120 infrared lamps in the process



Drawing from Fish and Wildlife Service

High-Voltage Box Smokes Sardines Inside The Can

Sardines are being smoked right in the cans by a new method of smoke precipitation used by Maine fish packers. The process smokes the sardines in one sixth the time formerly required. The little fish, packed in open cans, are carried on a moving metal belt through a closed six-foot box. Along the top of the box, high-voltage tungsten wires form a positive field, while

the metal belt and cans are charged to form a negative electrode. Birch smoke blown into the top of the box is charged by the positive field and attracted downward by the negative field. The smoke particles penetrate through the sardine layers in the few seconds that the cans move through the box, flavoring the fish. The new process can be used on meats and cheeses.



Foot Steering for Outboards

Fishermen who use outboard motors have both hands free for casting, trolling or changing bait when they use the foot-control steering attachment. By pressing down on the pedal, the fisherman turns the boat to the right; by lifting up, to the left. A simple linkage system made of rustproof metal runs along the gunwale to the motor. The attachment can be adjusted for operation from the stern or center seat.

Names and addresses of manufacturers of new products described in this issue may be obtained by writing to Bureau of Information, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11



CHRISTMAS TOYS

TILTING-ARBOR SAW



The CRAFTSMAN

★ Selected from Santa's advance showing, 14 home-made gifts described in a feature beginning on page 192 get you off to an early start on your Christmas "workshopping." There are toys, games and furniture to please every member of your family

★ You asked for it and here it is—a tilting-arbor table saw that has everything, a 10-in. blade, scaled handwheel adjustment, and drop-leaf extensions that make the table large enough to handle a 4 by 8-ft. panel. Starting on page 218 a two-part story gives complete constructional details

★ Tailor-made springs, tension or compression type, are easy to wind with the tool detailed on page 209

★ And on page 178 there is a rotating bookcase for students and others who live in small quarters

ROTATING BOOKCASE



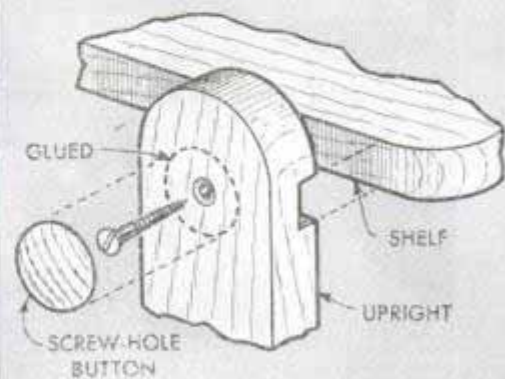
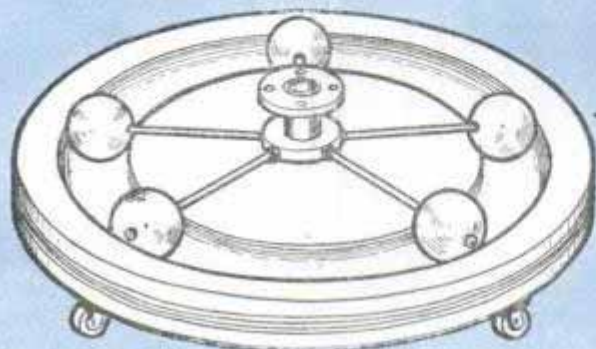
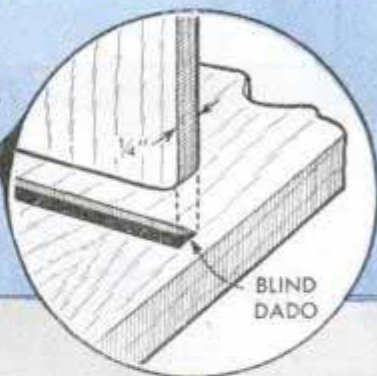
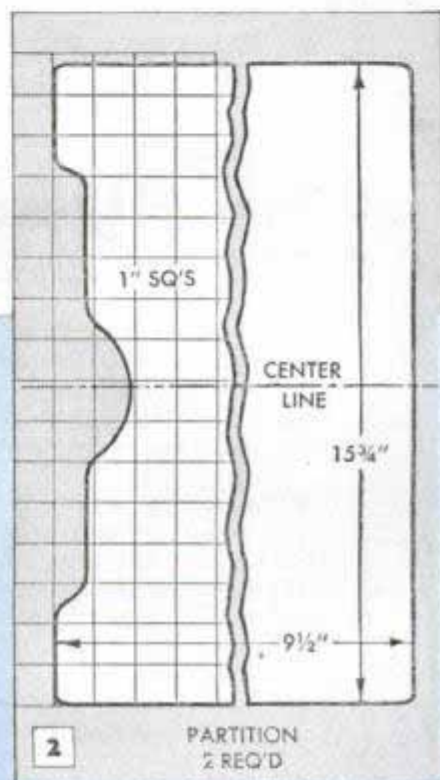
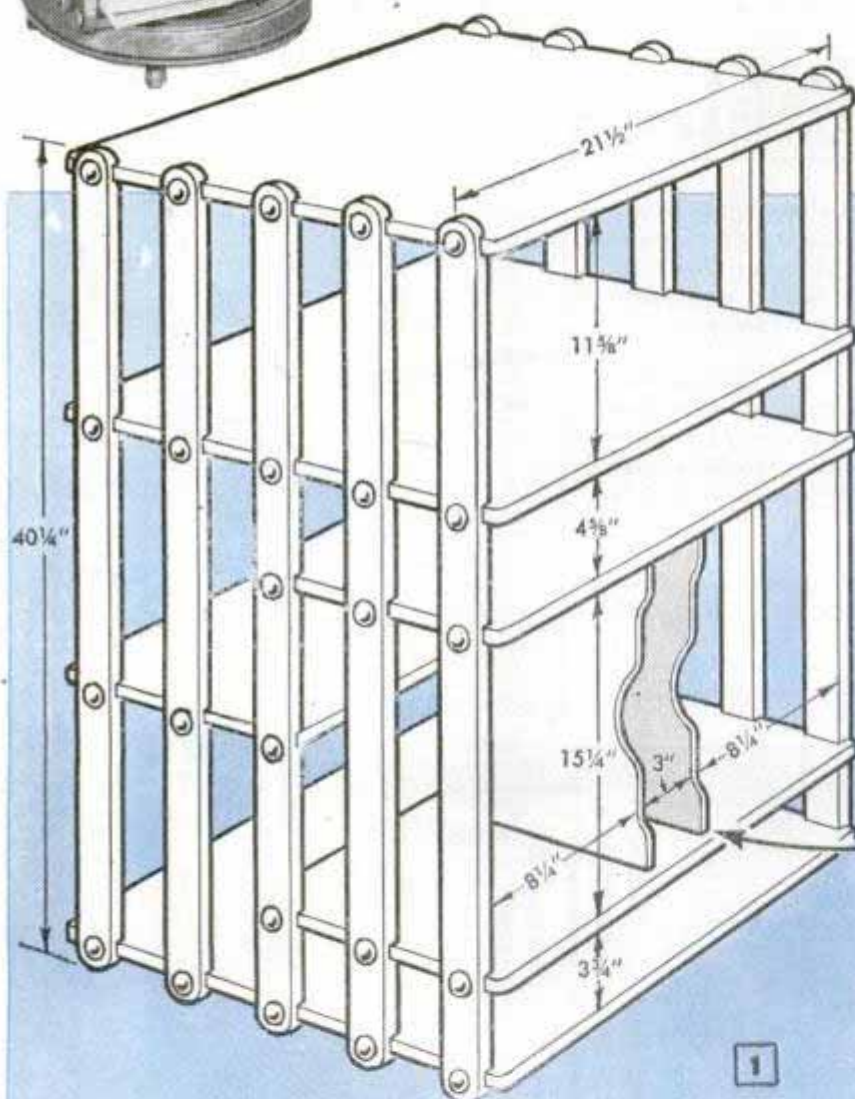
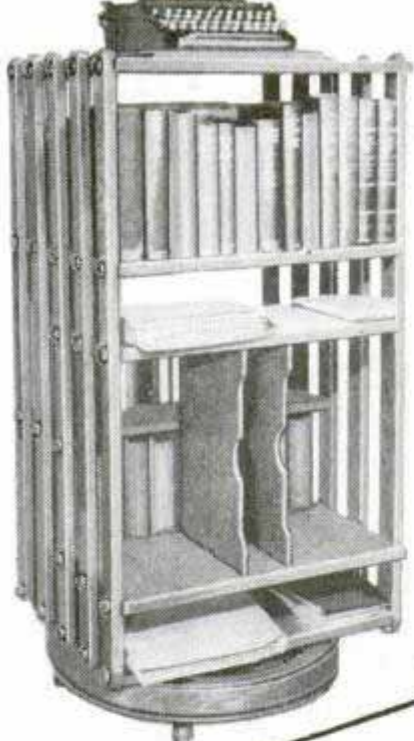
SPRING-WINDING TOOL

ROTATING BOOKCASE

TAKING little space in comparison to its large capacity, this rotating bookcase is made to order for the limited study quarters of a high school or college student. It features a novel "ball bearing" base on which the bookcase itself rotates on five wooden balls which roll in a track turned in the surface of the base. With the balls spaced to distribute the load uniformly, the upper part can be rotated very easily for quick selection of books from either side.

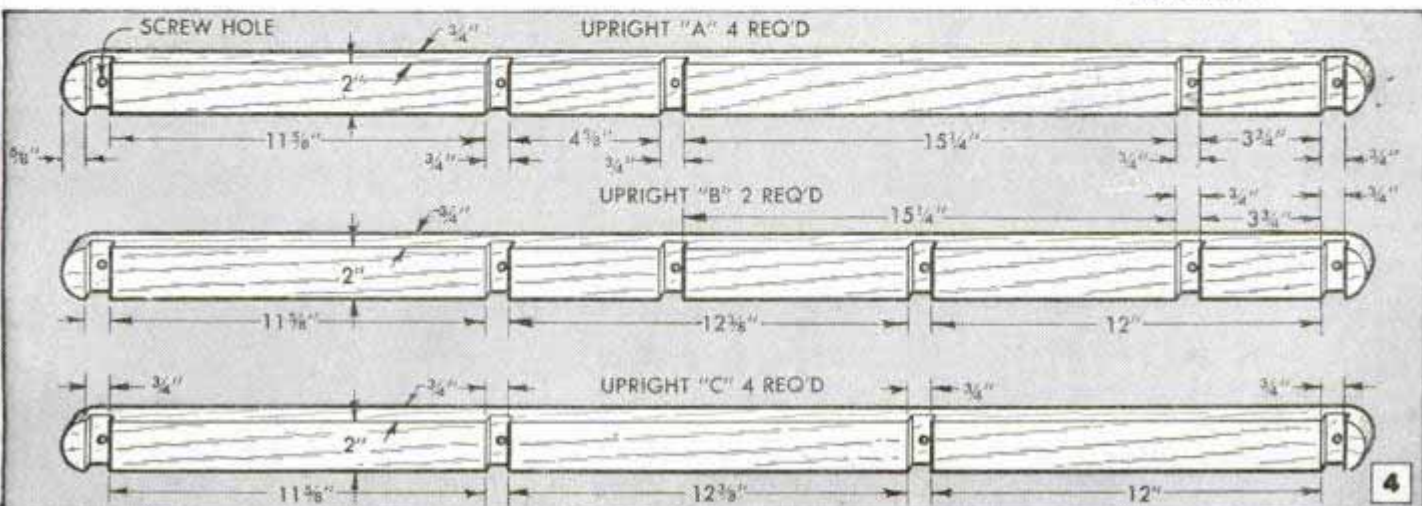
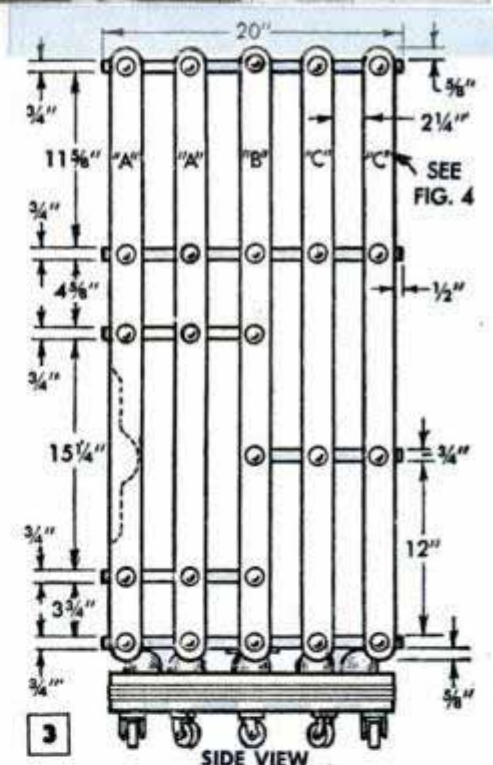
The book section is constructed first, preferably of hardwood, such as maple, birch, walnut or mahogany. Fig. 4 gives

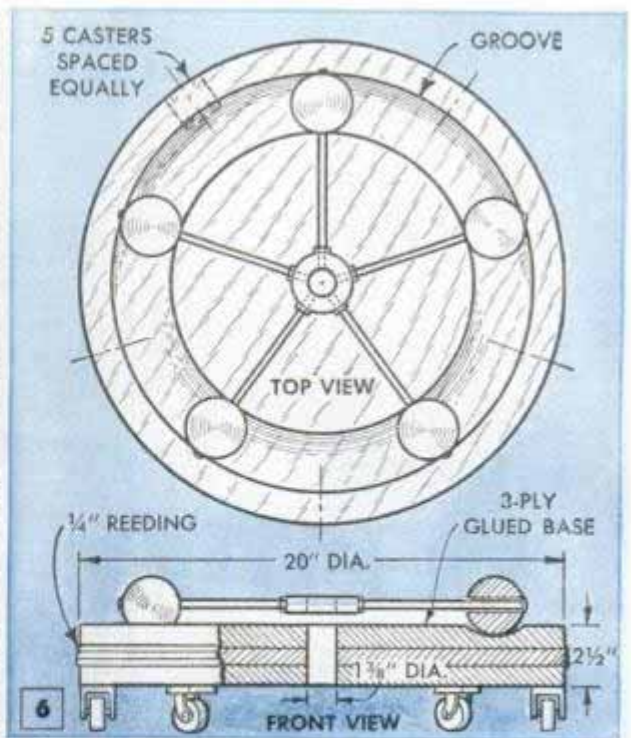
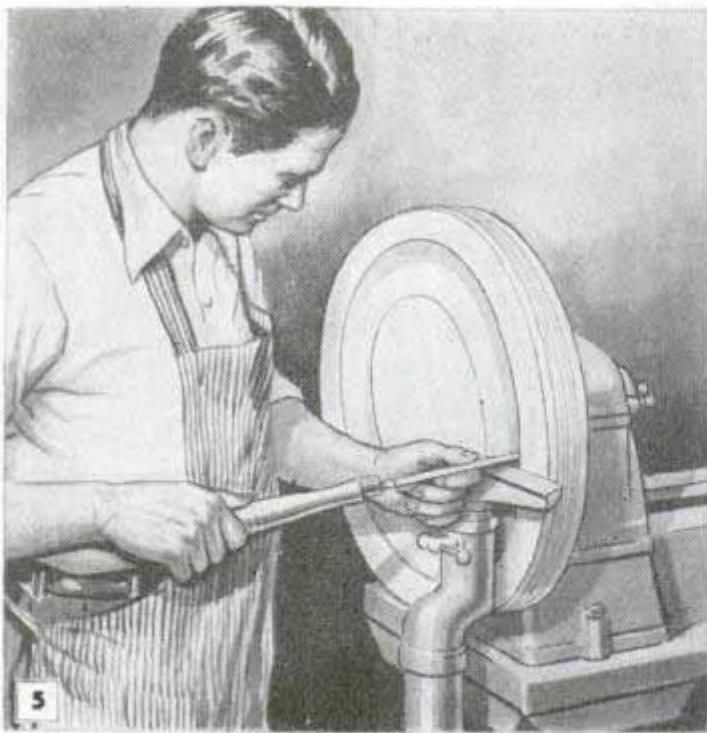
By Norbert Engels





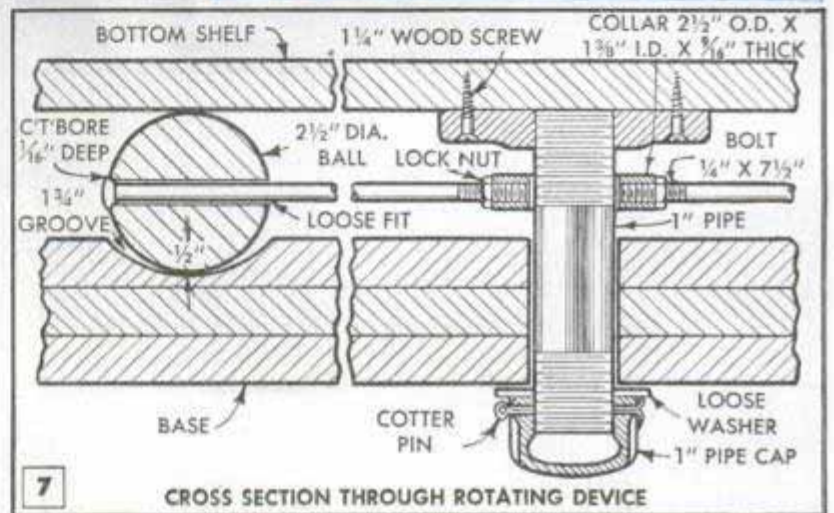
the size and shape of the 10 side members and indicates where each one is notched to receive the shelves. Each member is keyed with the assembly drawing in Fig. 3 to show just where it goes. The wide shelves can be made of plywood, or of solid stock by gluing edgewise several pieces of random widths. Note that between two of the shelves there are two scrolled partitions, Fig. 2, which form a compartment for magazines and newspapers. These are glued vertically in blind dados, 3 in. apart. Top surfaces of the shelves, and all other parts, should be sanded smooth before assembling. Holes for flathead screws are bored through each side member, at the notch, and then countersunk slightly so that the screwheads will be flush. Use glue in addition to screws in assembling the parts, and check the whole unit for squareness. Each screwhead is covered by a wood screw-hole button, which is made for the purpose. Wood dress buttons will do also, as well as metal furniture glides. The wooden buttons are simply glued over the screwheads. In the case of the bottom shelf, it will be necessary to stain or paint it before it is screwed in place.





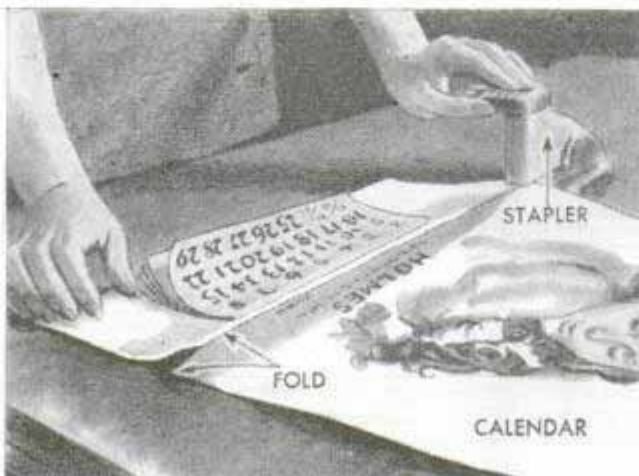
The base is built up of three wood disks totaling 2½ in. in thickness. Cut each slightly oversize and glue all three together with the grain at right angles, one to the other. To turn work of this size, it is necessary to mount it on the left-hand end of the lathe headstock as shown in Fig. 5. The ball track in the face of the base is made 1¾ in. wide and ½ in. deep and ¼-in. reeding is turned in the edge as shown in Fig. 6.

The rotating device is detailed in Fig. 7. It consists of a threaded length of 1-in. pipe, which turns freely in a hole bored through the base at the center, and has a floor flange at one end for fastening the pipe to the bottom of the bookcase. The axles or spokes on which the five wooden balls rotate, are ¼-in. bolts turned into tapped holes equidistantly



spaced in the edge of a metal collar. This collar slips over the pipe kingpin like a wheel, after which the base is locked in place by a pipe cap as shown. Five swivel plate casters are screwed to the base. You can use balls from an indoor croquet set and turn the ball race in the base to suit.

Double Fold in Wall Calendar Forms a Handy Pocket for Memos



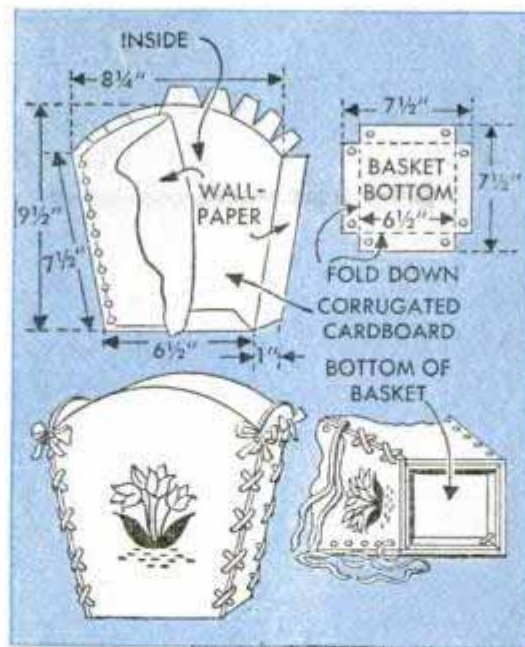
To provide a handy pocket on a wall for holding current memos and notes, double-fold a calendar—as indicated by arrows on the drawing—and staple the edges to close the sides. Strengthen the sides and top edge of the pocket, by reinforcing them with gummed tape. If you want to keep memos and notes separated, divide the pocket into several compartments, using staples to make the divisions.

Louis Hochman, New York, N. Y.

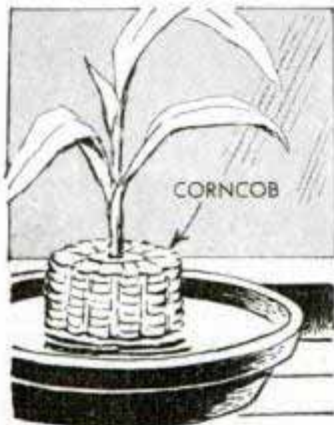
Crayon marks can be erased from parchment-type lamp shades if a ball of soft bread is rubbed over the spots.

Cardboard-Box Wastebasket

Simple and easy to make, this wastebasket will add color to almost any room where it is used. The sides and bottom are cut from corrugated cardboard to the dimensions given in the two upper details, and laced together with ribbon. It's best to lace from the bottom up and finish with bows at each corner. Then cover with a glazed-surface wallpaper and decorate with decals that harmonize with the color scheme.—Eileen M. Briggs, North Rose, N. Y.



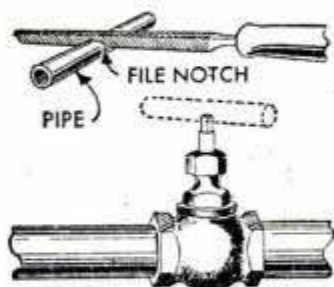
Corncob "Pots" Start Plants



Small "pots" for starting plants without soil may be made from sections of dried corn-cobs. The seed is embedded in the center of the cob and moisture is supplied by setting the cob in a shallow bowl of water. If desired, suitable chemicals

can be added to the water to stimulate growth. The improvised pots are transplanted in the garden, just as they are.

Pipe Used as Emergency Handle For Steam or Water Valve



If the hand-wheel on a steam or water valve is lost or broken, an emergency one can be made, using a short piece of small-diameter pipe. With a triangular file, cut a V-notch in the pipe. This will form a square hole that fits over the valve stem.

G. E. Hendrickson, Argyle, Wis.

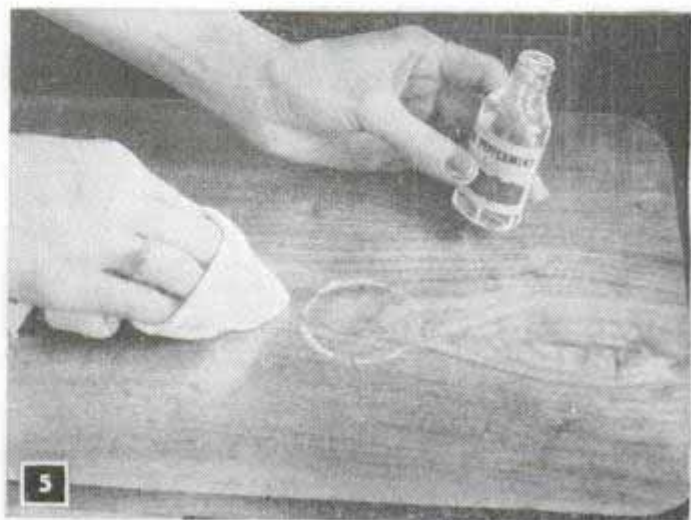
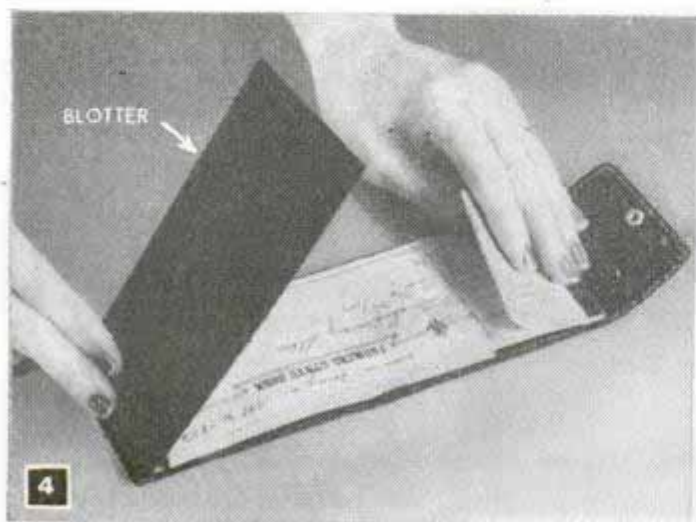
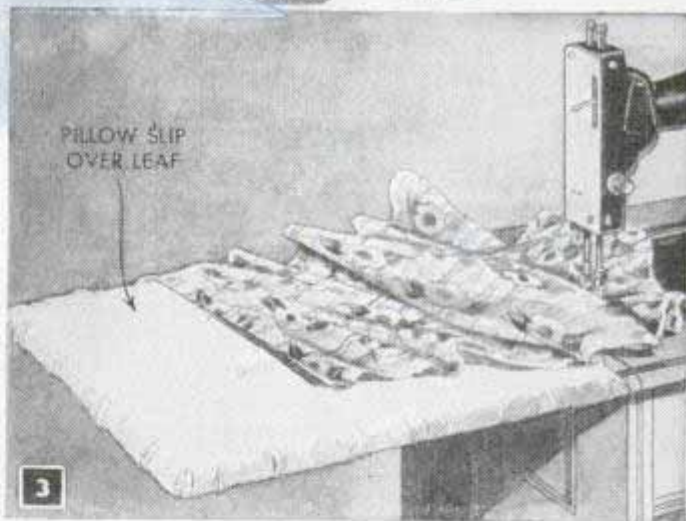
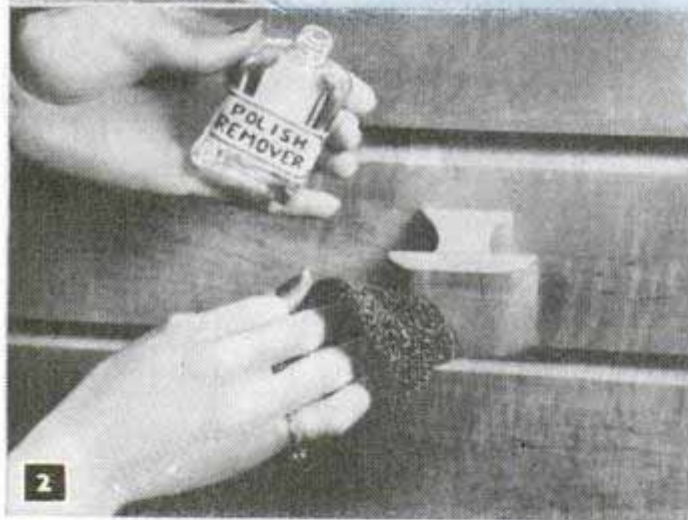
Instead of cutting one paper for the bird cage each morning, cut six or eight papers, place them in the cage and then remove the top one as required.

Drawings for Illustrated Lecture Made With Tracing Wheel

Those who, from time to time, have occasion to give talks or lectures that are illustrated with drawings made on the stage can employ an old trick of the chalk-talk artist and prepare the drawings beforehand. One way to do this so the audience will not be able to detect the prepared drawings is to outline them with a dress-maker's tracing wheel. Then the perforations are followed when making the sketch on the stage.



Solving HOME PROBLEMS



Measuring the amount of bluing to be added to rinse water is much easier and more exact when it is dispensed from a beverage bottle or similar container that has been fitted with a clothes-sprinkler head

It's no trick to remove scuff marks from blond-finish furniture if you rub over them with a pad moistened with furniture-polish remover or cleaner

When the edge of the table-top leaf on your sewing machine becomes worn and roughened it will catch and snag cloth that is being sewed. A pillow slip placed over the leaf when sewing will prevent this

Glue a strip of blotting paper inside the cover of a checkbook as a convenience when writing checks. Then it won't be necessary to wait for the ink to dry and a blotter will always be at hand when needed

White heat marks on a walnut surface are removed by rubbing a cloth dampened with essence of peppermint over the spots. When dry, apply polish sparingly; let stand for about 20 min. and rub with a dry cloth

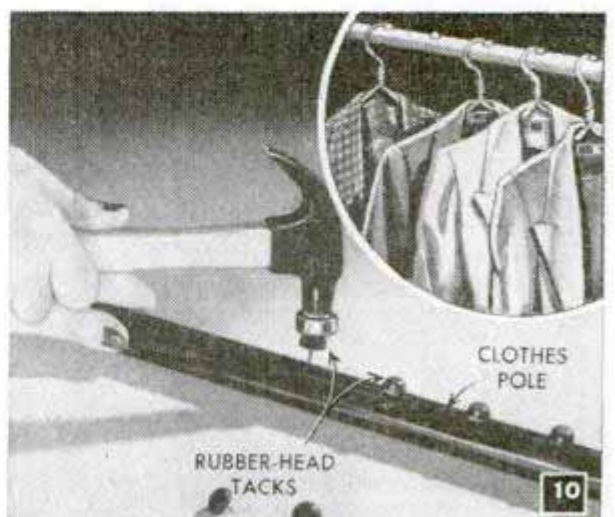
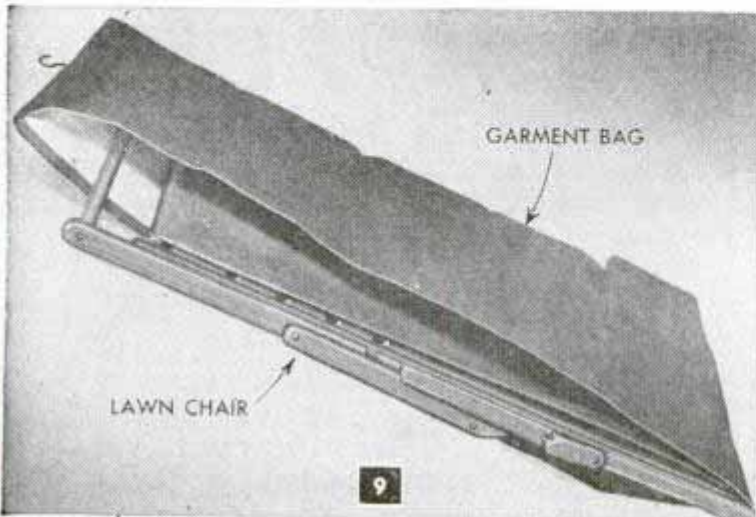
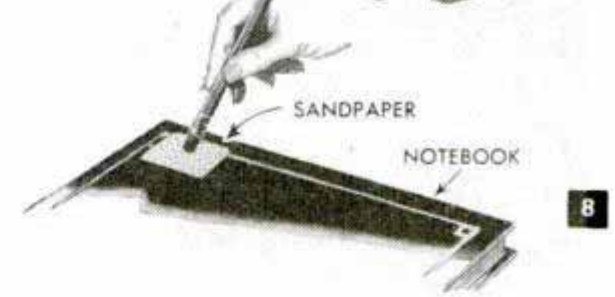
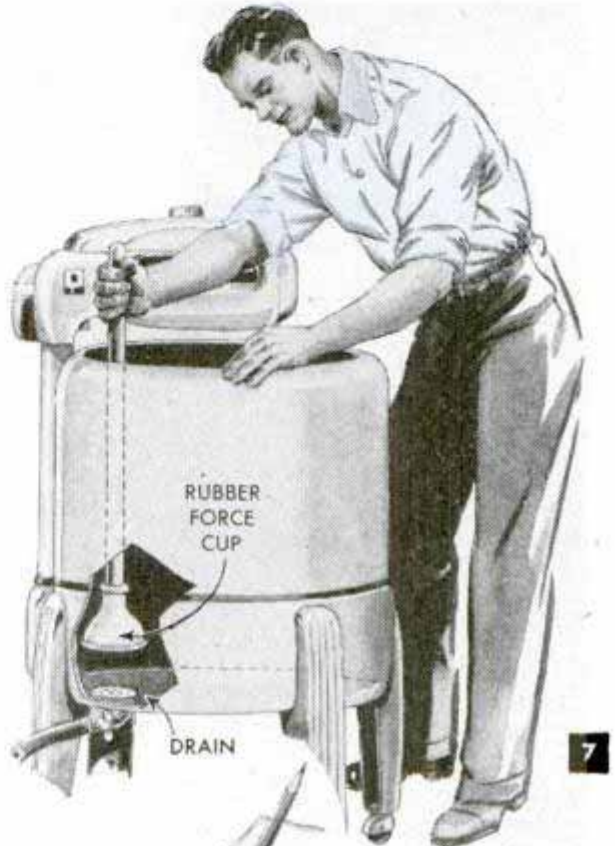
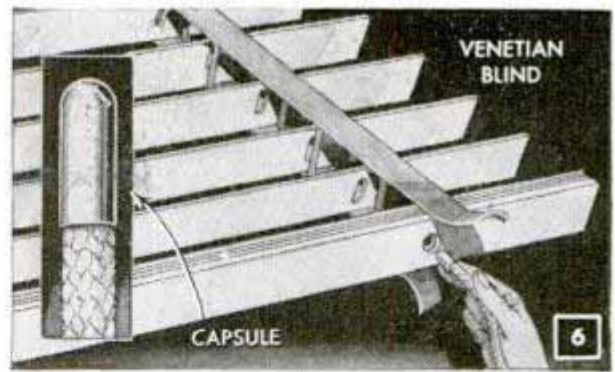
Installing cords in venetian blinds is difficult because the ends unravel, making it hard to thread the cord through the slats. To prevent fraying, cover the end of the cord with one half a gelatin capsule, which can be removed when the job is done

Periodically clean the drain of a washing machine by using a force cup. This removes accumulations of thread and lint that retard the flow of water

Glue a square of sandpaper on the outside of your notebook cover to clean pencil erasers. Then papers in the book won't become smudged when erased

Lawn chairs and other pieces of furniture that fold flat can be stored in paper garment bags when not in use. This will protect the chairs from dust and scratches. Hang the bags from the hooks provided

If rubber-head tacks are driven into the top of a closet clothes pole to serve as garment spacers, they will help keep coat hangers from bunching



Wire Solder Fed Through Tube For Close and Fine Work

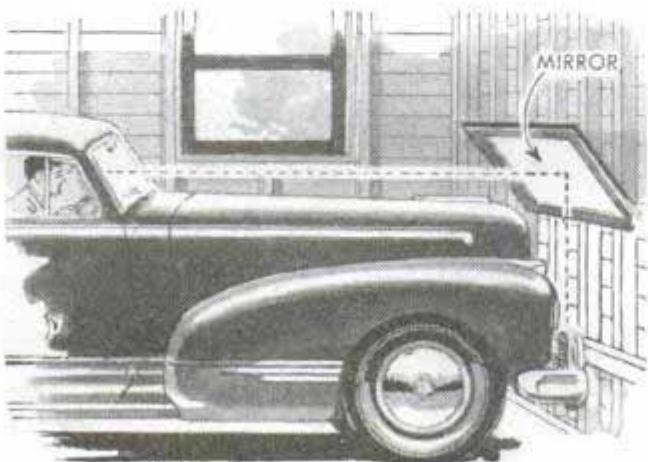


Handy for all kinds of soldering, but especially when working in close quarters or on fine work, this tube-and-spool holder is easy to make and will be a help when you want to do a neat job. Parts required and the method of assembly are given in the detail. Dimensions of the parts are optional and can be made to fit whatever size adhesive-tape spool is on hand. The tube can be of any suitable length.

E. J. Murawski, Baltimore, Md.

Mirror Fastened to Wall of Garage Aids When Parking Car

Set at a 45-deg. angle on the rear wall of a garage, a mirror will enable the driver to see how far the bumper of the car is from the wall and thus prevent damage to



either the building or the car. The mirror should be mounted at about the height of the windshield. On cars with long hoods and projecting bumpers, this device will prove especially helpful.

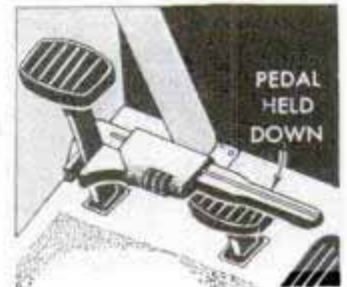
Filling Nail Holes in Plaster

To fill a nail hole in plaster so it will be invisible, carve a cone-shaped plug from a piece of chalk. Insert the plug in the hole and rub the part that extends with a cloth until it is flush with the surface of the plaster. Chalk dust will fill any small cracks around the hole.



Wrench Depresses Brake Pedal While Working on Auto

When working on a car, either clutch or brake pedal may be held down by using an adjustable wrench that has a handle long enough to reach from one pedal to the pad of the adjoining pedal. Hold the clutch or brake down and tighten the jaws of the wrench around the other pedal.



Push Pin Used as Dowel Center

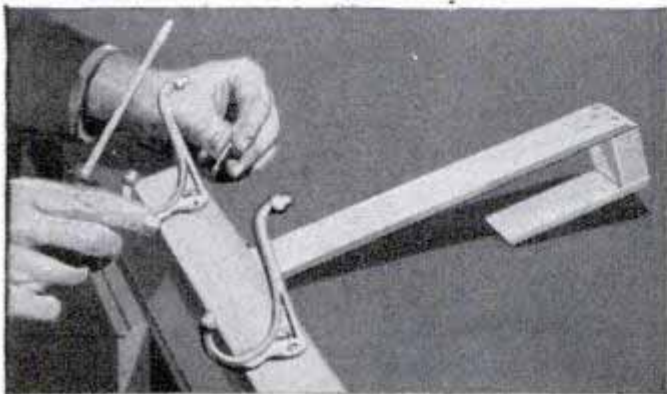
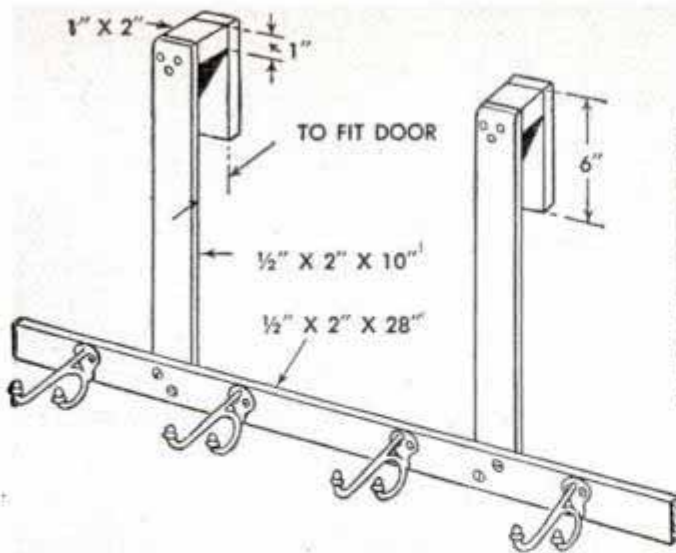
If you do not have a set of dowel centers, substitutes for most sizes can be had by using ordinary push pins. These can be purchased in several sizes. To use them, press the head into the dowel hole, letting the pin point project so that it will mark the center of the hole to be drilled in the joining member when both pieces are placed on a flat surface.



Removing Feathers From Fowl

One of the most difficult tasks when picking wild—or tame—waterfowl is the removal of the downy feathers. However, with a gum-type eraser, this is the easiest part of the job. After plucking the feathers, use the eraser to remove the down.

Portable Clothes Rack Hangs on Top of Door



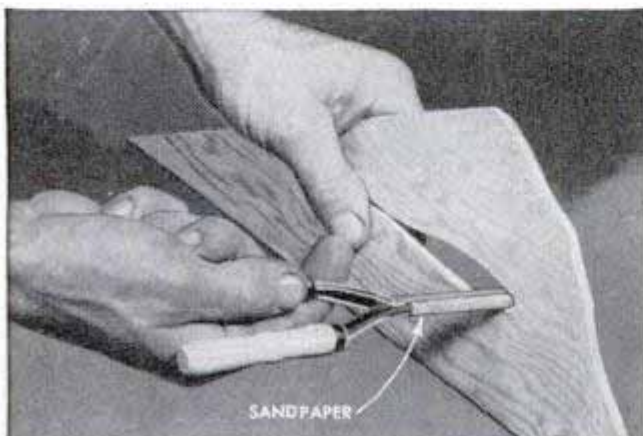
This clothes rack was designed primarily to take care of the overflow from the average clothes closet, but in an emergency it provides additional hanger space for the coats and hats of guests on party nights and also serves as a special rack for choice garments on ironing days. When not in use, it takes very little storage space. All parts

except the spacer blocks at the top of the hanger hooks are cut from 1/2 by 2-in. hardwood. Join the parts with flathead screws and glue. Sand the wood smooth and round all corners and ends. Finish in the natural color of the wood or with enamel. Then attach the metal coat hooks with screws, spacing them on 7-in. centers.

Curling Iron Holds Abrasive Paper for Sanding Inside Scroll Cuts

As a sandpaper holder when smoothing curves or irregularly shaped surfaces, spread the jaws of an ordinary curling iron and wrap a small strip of abrasive paper on the round jaw. When the iron is closed, the curved jaw will hold the strip in a tight

grip and make the sanding operation easy. If the spring that holds the jaws shut is weak and the sandpaper tends to slip, use rubber cement to hold it in place. Spread cement over the smooth side of the paper and also on the round jaw; allow it to dry until slightly tacky and then wrap the paper around the jaw.



How to Sharpen Food Grinders

One way to sharpen dull knives of food and sausage grinders is to use a small amount of valve-grinding compound. Take the grinder apart and spread compound over the edge of each knife and the inside of the body. Then assemble and turn the blade for a few minutes. Finally, clean all parts thoroughly in soap and hot water so the compound cannot contaminate food.

H. W. Swope, Danville, Pa.

COME OUT OF YOUR IGLOO

DOES IT TAKE more fuel than it should to keep your home comfortably warm? Then, now is the time to come out of your igloo and plug the cracks that are letting the heat escape. Heat loss from the average house can be figured in approximately equal proportions: 25 percent through the glass of windows and doors and 25 percent through openings around them. Another 25 percent is lost through uninsulated side walls and 25 percent more through the

roof. These figures will vary, of course, with each type of house, but they offer a basis for weighing the value of storm sash, weather stripping, caulking and insulation. Insulation, besides reducing fuel costs, adds healthful comfort both winter and summer; for just as it keeps the heat in, it also keeps the heat out. Rooms will be 8 to 15 percent cooler in summer. Below are things you can do to help keep the heat at home and money in your pocket.



Storm sash can save you 15 percent or more on winter fuel bills by reducing heat loss through windows. It pays to put them on every window of the house, including basement windows, and especially on those with a north and west exposure



Like windows, exterior doors let heat escape, too, if they are left unprotected. The best storm door to use here is the popular combination type which has an interchangeable sash-and-screen unit. For best results the storm door should fit snugly



Closing off unused rooms during the winter months is another way of saving the heat and promoting greater comfort. If the opening is large, French doors are both practical and smart looking. A heavy drape can be used to close off a doorway



Cracks around doors and window sash provide another exit for heat and an entrance for drafts, but you can seal them effectively with a metal weather stripping which is simply tacked to the casing. Being flexible, it bears against the door



By Wayne C. Leckey



Lining an unfinished attic with wallboard will help keep the heat in and provide useful rooms at the same time. Standard-width sheets permit direct application to studs and rafters. Joints can be covered neatly with plain wooden battens

Up to 25-percent saving in fuel can be had by insulating your home. Not only will you have a warmer home in winter, but a cooler one in summer. Blanket and batt-type insulation are ideal for new construction and fill insulation for old

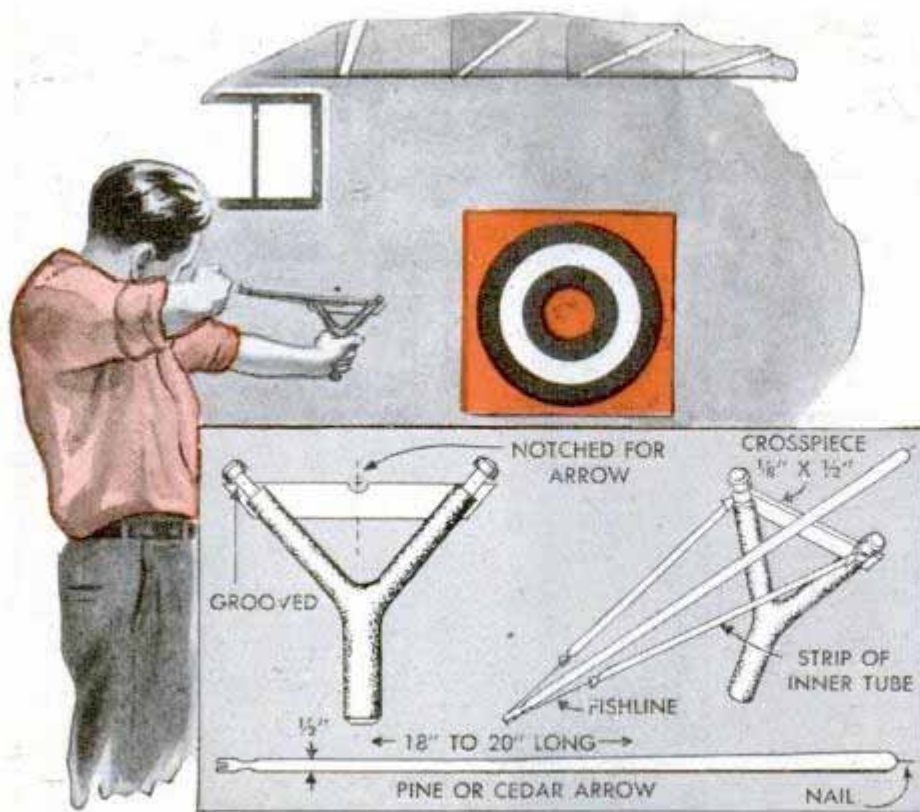


Sealing cracks due to shrinkage that develop around window frames of brick homes can be done with caulking compound. You can use either a mastic-type compound, or one marketed in rope form which is pressed into the joint with a knife



Cold and drafty floors of homes constructed without foundations can be eliminated by banking straw and leaves around the outside. Asphalt roofing felt is first tacked to building as shown, and boards weighted with stones anchor the straw

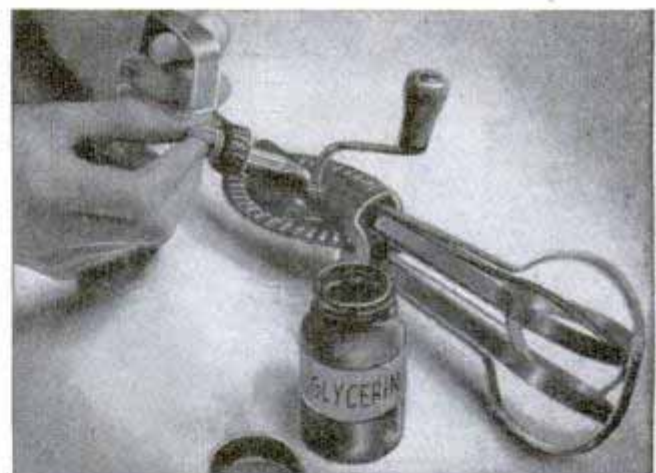
'Crossbow' Slingshot Shoots Dart-Shaped Arrows



Indoor target practice with a slingshot becomes real competitive sport when the sling is equipped to shoot arrows. Converting a regular slingshot into one to shoot arrows is a simple job. A notched crosspiece is fastened to the crotch of the handle and the regular rubber sling bands are replaced with longer ones as shown in the detail. Note that the arrow, which should be made of light wood, is tapered and has a pointed nail at the tip. A saw cut forms a nock at the opposite end of the arrow to engage a length of fishline tied securely to the sling bands.

Funnel Soldered to Cap of Gas Can Is Always at Hand

To assure always having a funnel at hand when filling the tank on a gasoline engine or other small container, solder a small funnel to the cap of the gasoline can. In use, simply unscrew the cap and place the funnel in the filler opening. Remove the cap from the can when soldering the funnel in place to avoid any possibility of explosion.



Glycerin Lubricates Egg Beater

For egg beaters or other kitchen utensils having moving parts, glycerin makes an excellent lubricant. Unlike oil, it will not spoil the taste of food if mixed with it by accident. The glycerin can be applied with a medicine dropper.

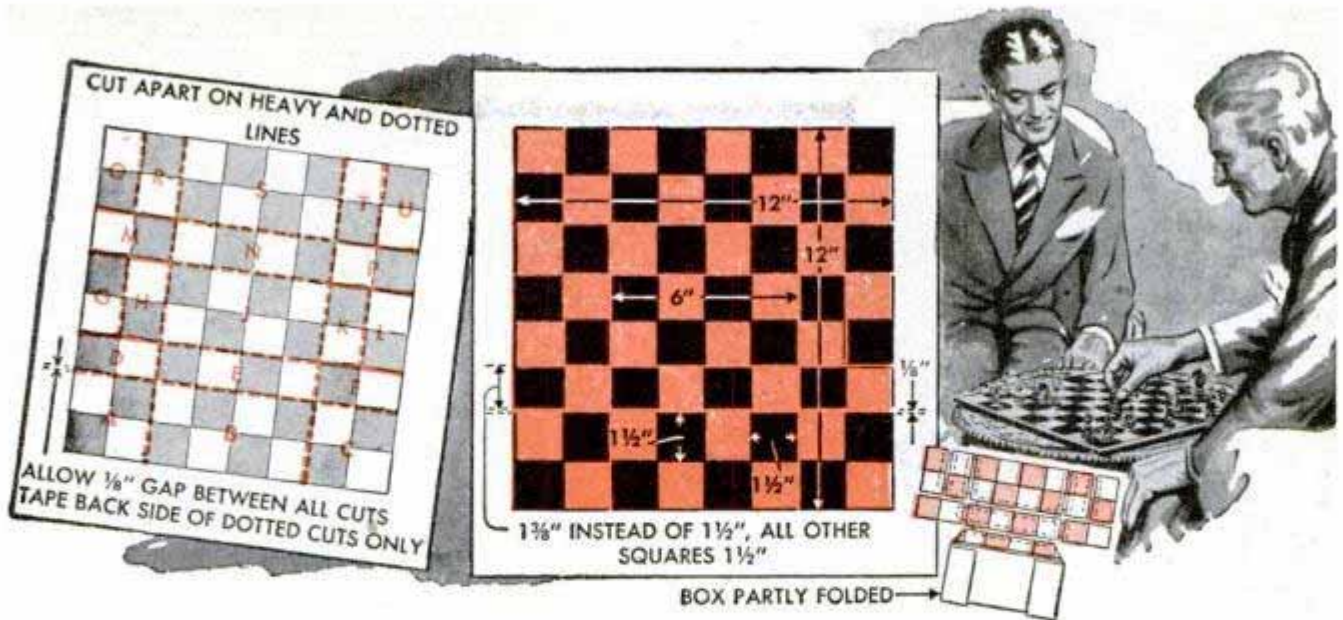
Benj. Nielsen, Aurora, Nebr.

Correcting Slip in Refrigerator Belt

If the V-belt on a refrigerator unit is slipping or making noise, the trouble can be corrected in some cases by rubbing a little naphtha laundry soap on the sides of the belt while the unit is running. When working around a unit in operation, be careful to avoid catching your tie or loose clothing in the machinery.

Charles F. Smith, Chicago.

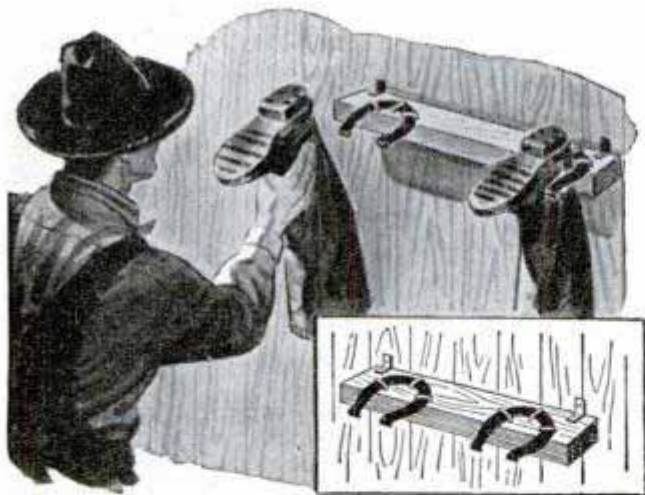
Chessboard Folds to Form Container for "Men"



With a checker or chessboard that can be folded to form a compact little box for storing the "men," you can easily carry the game anywhere. To make such a board, first rule a 12 by 12-in. piece of heavy cardboard into 64 squares as shown above. The size to make the squares is dependent upon the amount of storage space that the set at hand requires. If the men are small, $1\frac{1}{4}$ or 1-in. squares may do. Note that row D-E-F is ruled $1\frac{3}{8}$ in. wide instead of $1\frac{1}{2}$ in. This is necessary as some pieces fold under others. After ruling the cardboard, cut it apart where indicated in the drawing by the solid and dotted red lines and then reassemble the pieces by hinging them together

with adhesive tape along the dotted lines only. In taping the pieces, space them $\frac{1}{8}$ in. apart to permit folding.

Now to fold the board: First, fold lines A-D and C-F on top of B-E. Next, fold line A-B-C at right angles to D-E-F, then, D-E-F at right angles to J. Follow this by folding lines G-H and K-L at right angles to J. At this stage, the box should look like the one shown in the small detail. To complete the box, line N is folded downward to close the open side, and then line M is folded against H, and P against K. A rubber band can be used to keep the box folded.—Philippe St. Gelais, Jonquiere, Quebec, Can.



Old Horseshoes Used as Boot Racks

To hold rubber boots upside down for drying them out, one farmer nailed a pair of horseshoes to a 2 by 4-in. wood block and hinged this to a convenient wall. The open ends of the shoes extend outward so the ankles of the boots will slip between them. When not in use, the rack is swung up out of the way.

Tape Protects Edges of Booklet

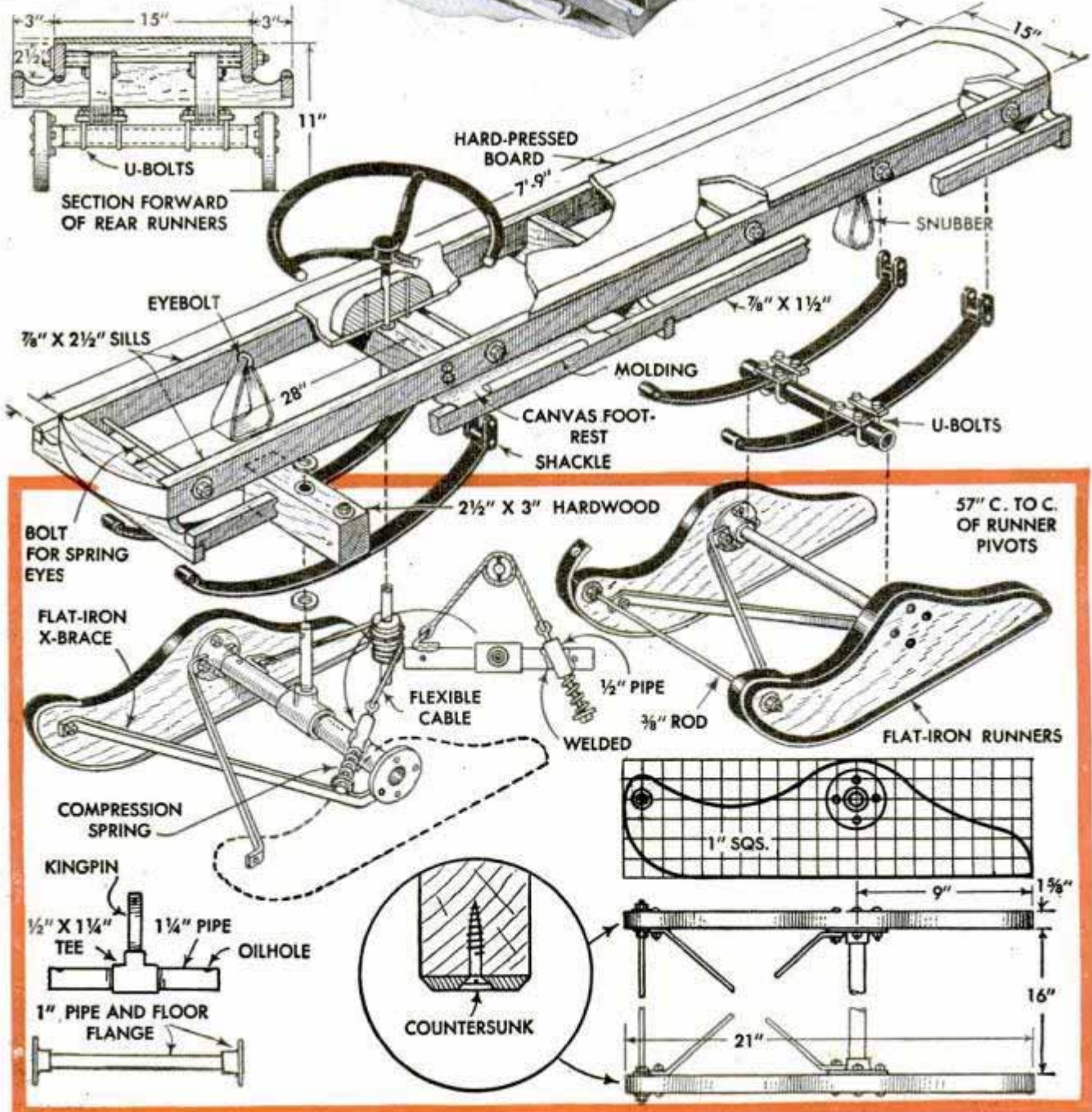
After a certain amount of wear and tear, the edges of paper-bound booklets become worn, and in time, the entire book will be damaged. To prevent this, bind the edges of the covers with cellulose tape. This will prevent them from bending and tearing, and the cost is small compared to the replacement value of most books.



Spring-Slung Runners Take the Bumps

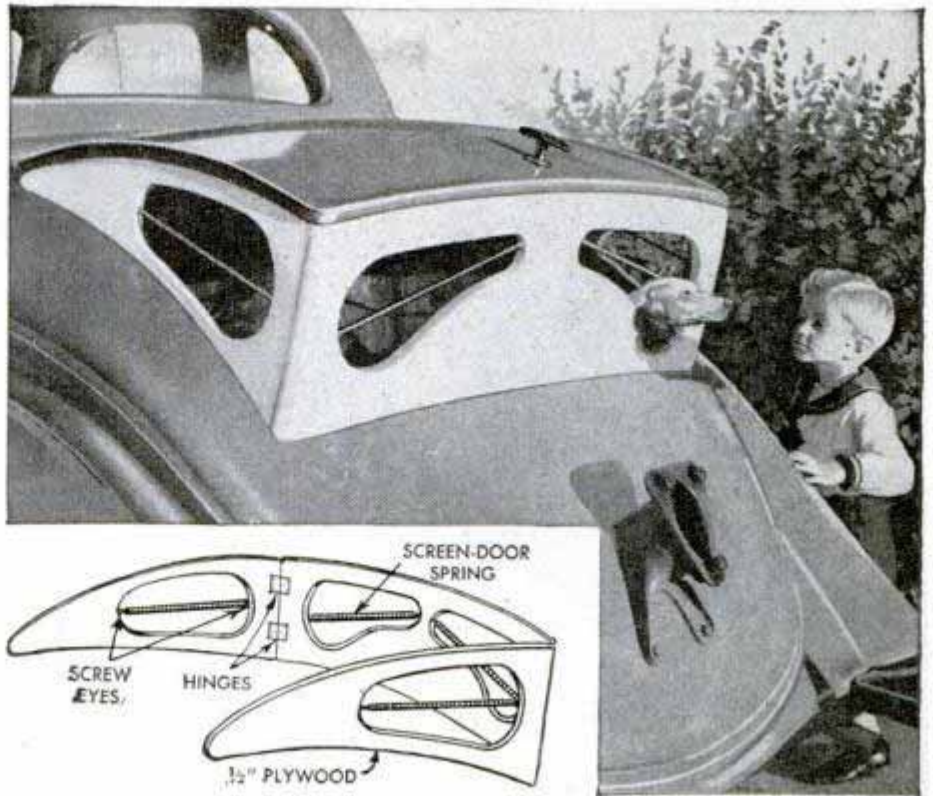


Anyone who has experienced a spine-jarring ride down a rough hill on an ordinary bobsled will appreciate a sled equipped with spring-suspended runners. On this one runners are sprung to the frame with the main leaves of light auto springs, which can be picked up at a wrecking yard. The rear runners oscillate on a pipe sleeve to which the spring leaves are clamped at each end with U-bolts. At the front, the leaves are bolted to a hardwood block in which the kingpin pivots. The eyes of the spring leaves slip over tie rods inserted crosswise in the frame, and snubbers of leather belting are looped around the block and the pipe sleeve on rear runners to control the rebound



Taking the family dog along on a trip in a car, especially in a coupe, usually happens only once—the next time he is left at home. This was our experience until I converted the rear deck of the car into a separate compartment in which the pet could ride without disturbing others. I shaped the three pieces as shown to match the contour of the deck door, which forms the roof of the compartment, and hinged the three together so that the whole unit would fold compactly. Screen-door springs placed across the openings prevent the dog from jumping out and a large box provides a bed.—P. Gowland, Los Angeles, Calif.

Folding "Dog House" Fits Auto Rear Deck To Keep Your Dog Happy on Long Trips

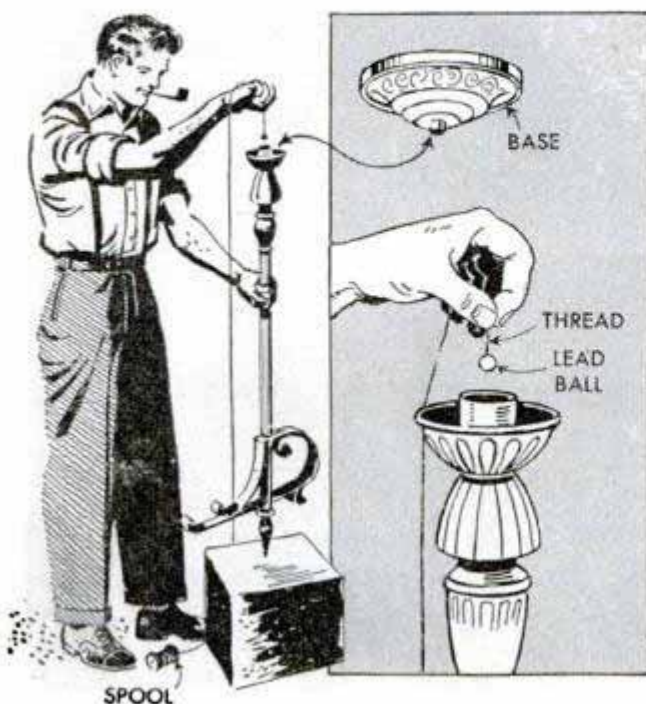


Thread and Lead Weight Are Used To Pull Wire Through Lamp

Difficulty sometimes experienced in threading new wire through the standard of a floor lamp when rewiring it, can be avoided by using a lead weight, such as a lead shot or round fishline sinker, and a length of heavy thread or cord to pull the wire into place. This trick is especially handy if the lamp is fitted with an arm, or the surface of the hollow interior of the standard is rough. After removing the old

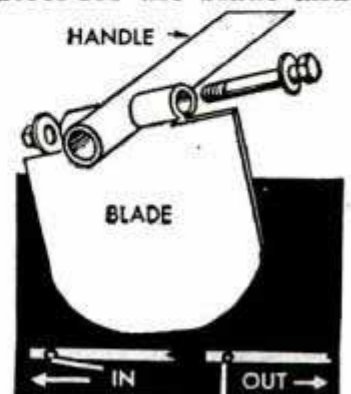
wire, tie the weight to one end of the cord, turn the lamp upside down and feed the weight and cord through the standard from the base end and out the socket end. Then tie the new wire to the free end of the cord and pull the wire into position. If the position of the socket permits, you can do the job still easier. Disconnect the old wire from the socket, connect the end of the new wire to it and simply pull the new wire into place from the socket end of the lamp as you pull out the old wire.

David B. Clapp, Livingston, N. J.



Hinged Hoe Blade to Clean Culvert

With the hinged blade on this hoe, it's a simple matter to clean debris and dirt from a culvert or covered drain. When the hoe is inserted in the drain, the blade folds against the handle so it is out of the way, and when withdrawn, the blade opens out to catch and remove dirt. Construction is simple: Use 16-ga. steel for the blade and cut it to a size best suited for your purpose leaving two projections which are bent into offset eyes for the hinge bolt. A bolt pivots the blade to the pipe handle. Flat washers keep the bolt from binding.

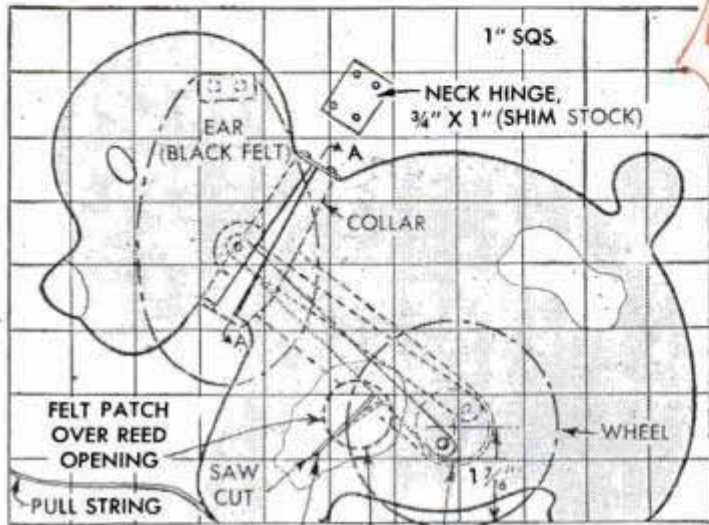




14 HOMEMADE CHRISTMAS

MERRY CHRISTMAS

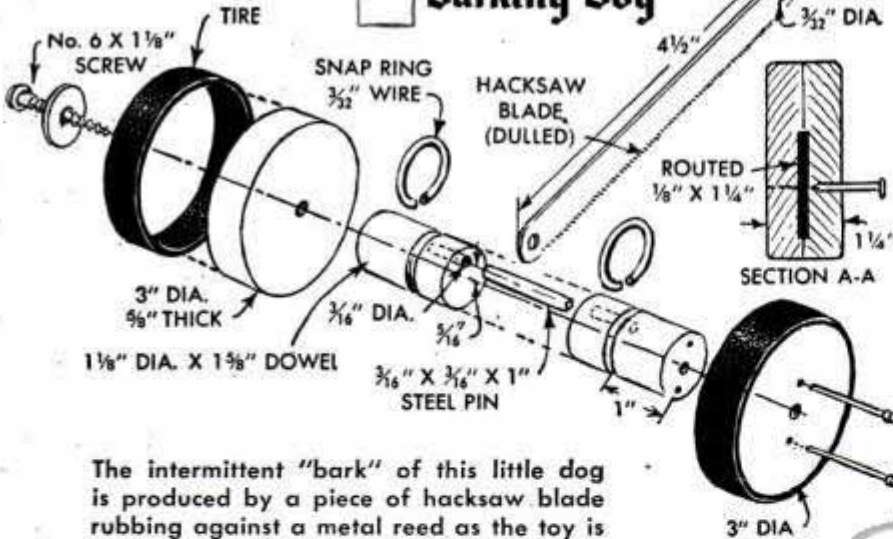
from Your Workshop



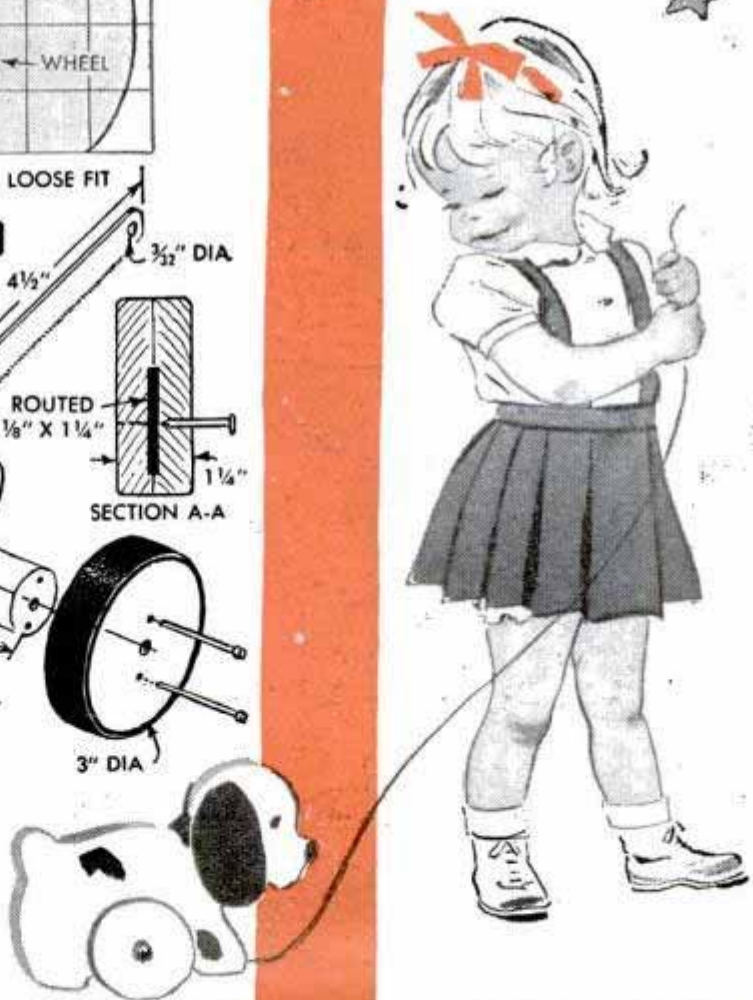
REED (SHIM STOCK)
7/8" X 1 3/8"

1" DIA. 1 1/8" DIA., LOOSE FIT

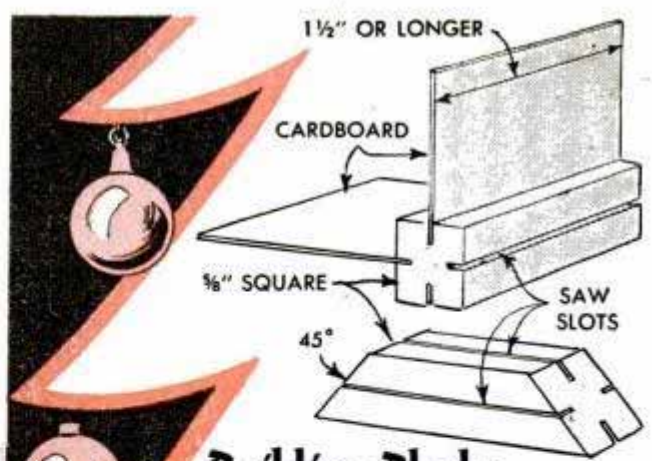
Barking Dog



The intermittent "bark" of this little dog is produced by a piece of hacksaw blade rubbing against a metal reed as the toy is pulled. The saw blade, pivoted off-center in a dowel axle held in place by snap rings, lifts the dog's head realistically on each upward stroke. Body consists of two parts with both parts routed to provide space for the saw blade. The head hinges on shim stock; a felt patch conceals the reed

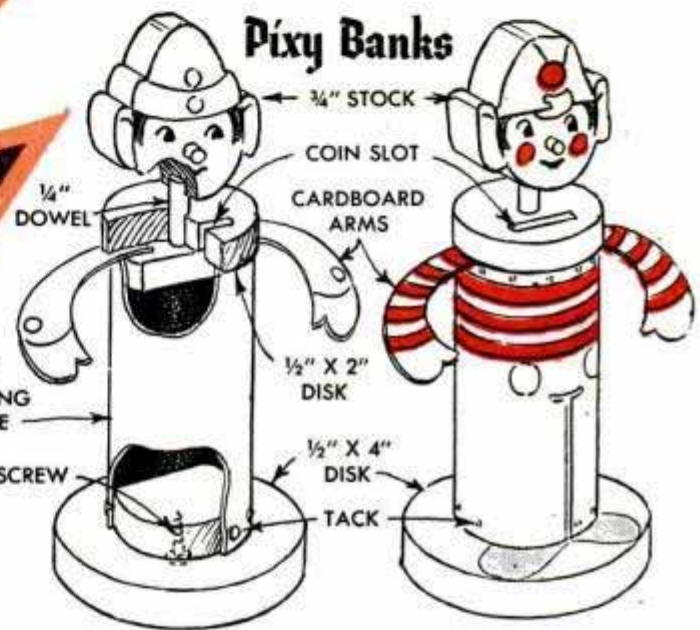
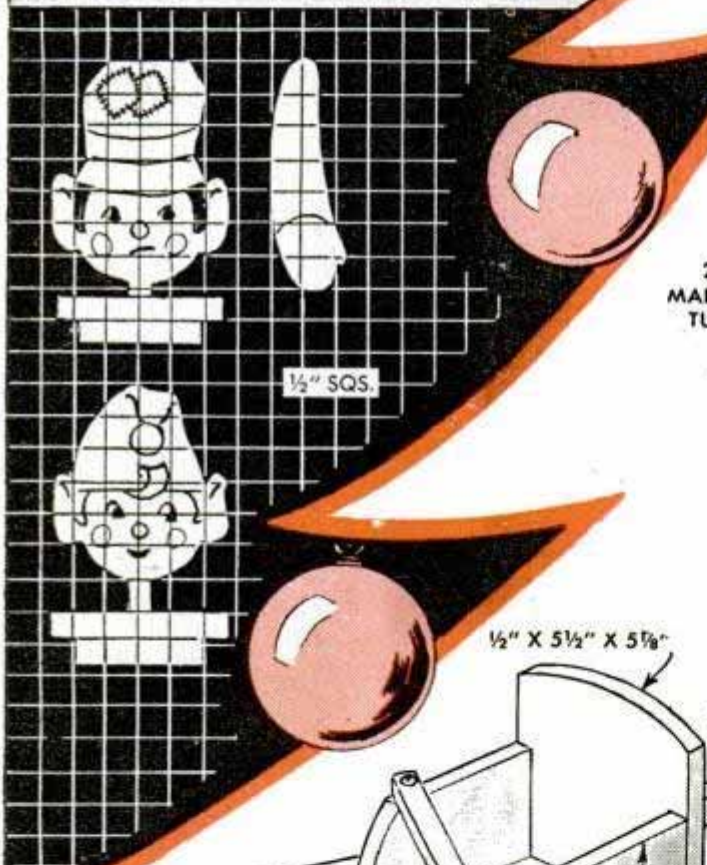


GIFTS YOU CAN MAKE...



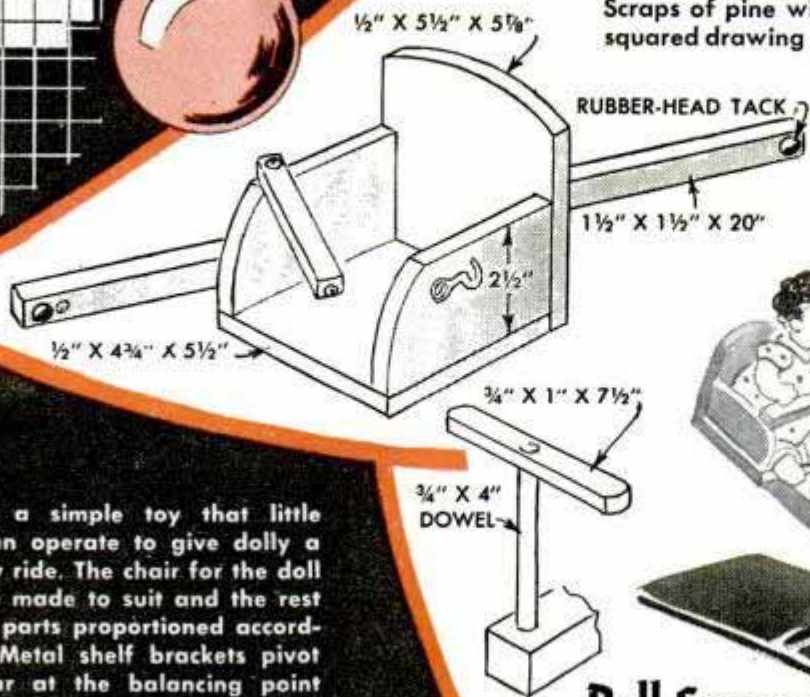
Building Blocks

Something new in building toys combines cardboard with grooved blocks. The blocks—some are cut at an angle—can be produced on a power saw



Pixy Banks

Sections of mailing tube form the bodies of these little pixy banks, which can be made short or tall. Scraps of pine will do for the wooden parts. The squared drawing gives two different head patterns

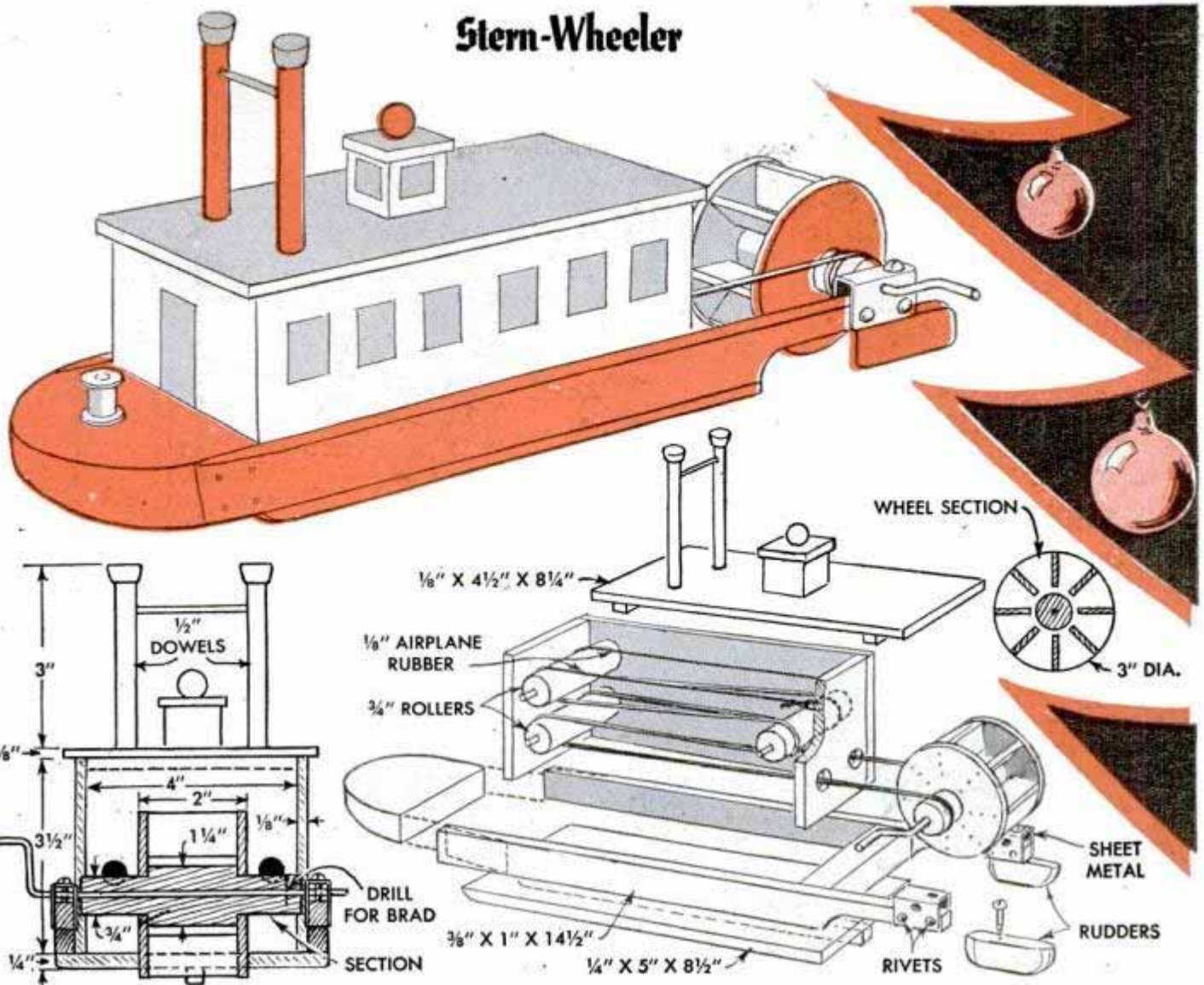


Here's a simple toy that little tots can operate to give dolly a seesaw ride. The chair for the doll can be made to suit and the rest of the parts proportioned accordingly. Metal shelf brackets pivot the bar at the balancing point

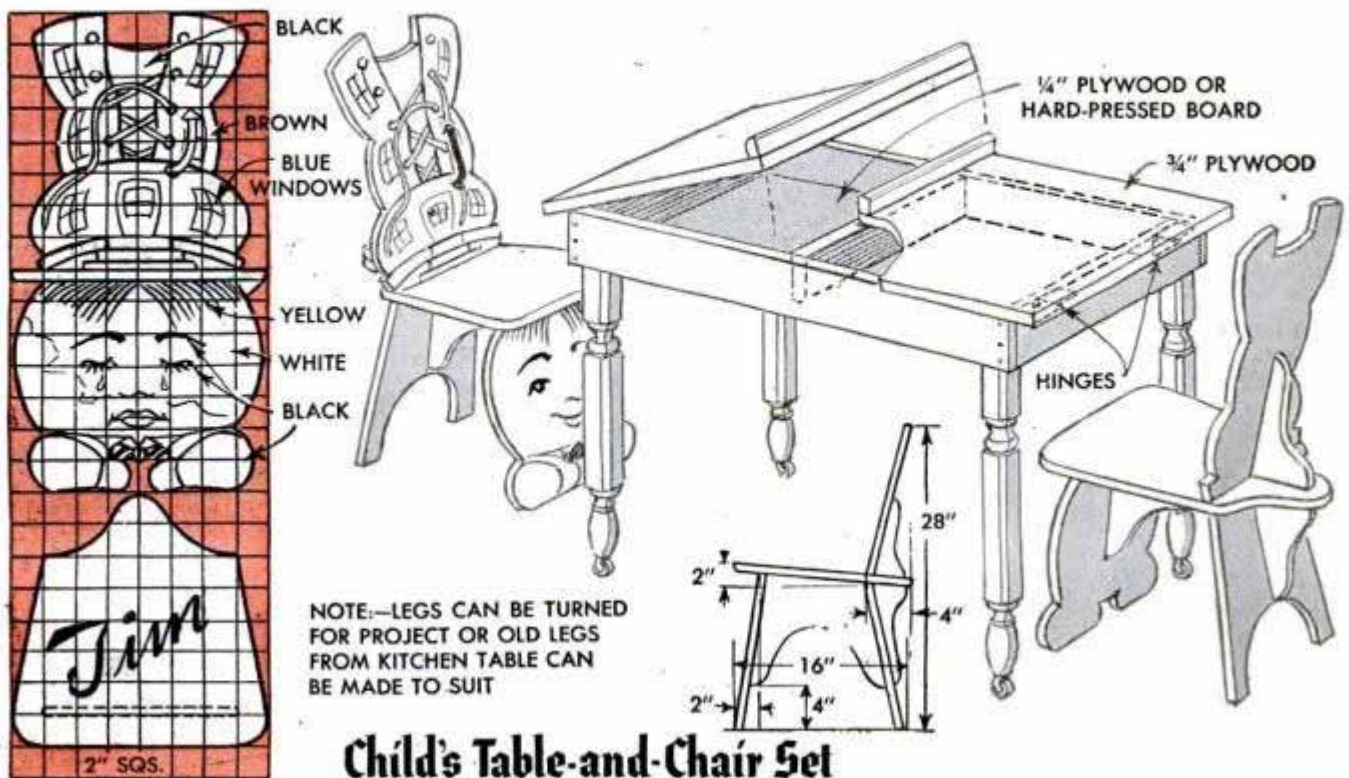


Doll Seesaw

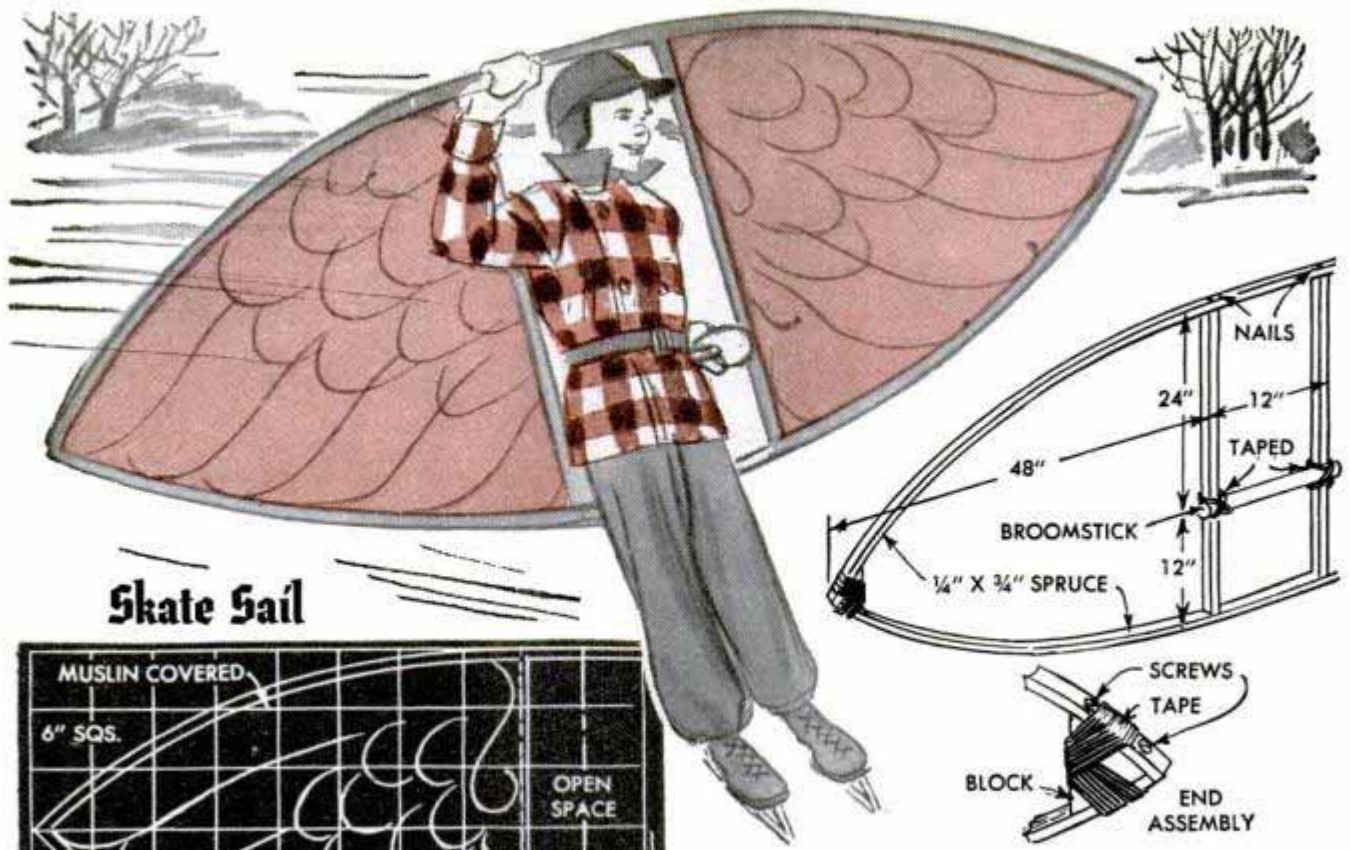
Stern-Wheeler



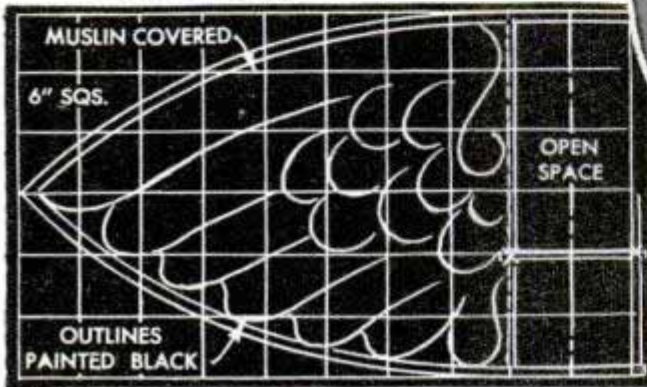
Above: Propelled by a rubber-band "engine," this stern-wheeler will travel a considerable distance on one winding. Twin rudders can be set for a straight or circular course. Below: Mother-Goose rhymes pictured on the legs and backs of the chairs of this table-and-chair set will delight little folks. The table, about 26 in. high, is divided into two storage compartments having hinged covers. Plywood, 1/2 or 3/4 in., is best for the chairs



Child's Table-and-Chair Set



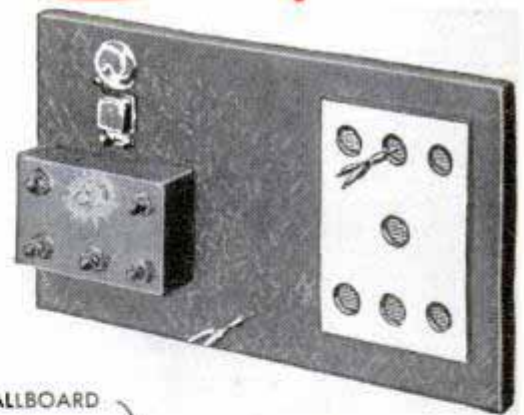
Skate Sail



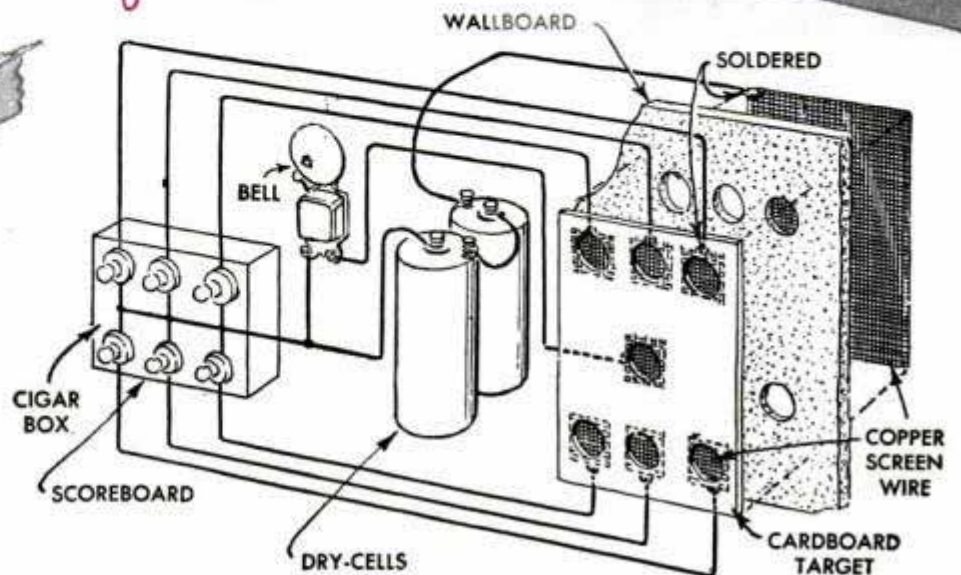
Gliding swiftly across the ice with a skate sail is thrilling sport and lots of fun. The sail shown here consists of a wooden frame covered with muslin and decorated to represent the wings of a bird. Spruce is best for the framework, although it can be of pine



An electric dart game, which flashes a light or rings a bell when a dart pierces certain bull's-eyes, will entertain both young and old. The two parts of the game, the scoreboard and the target, are mounted on a sheet of soft wallboard. Seven holes are cut through the wallboard to align with seven holes in a cardboard target. Then the holes in each are backed with copper screen wire which is wired to scoreboard, bell and dry cells. Bell rings only when center hole is hit

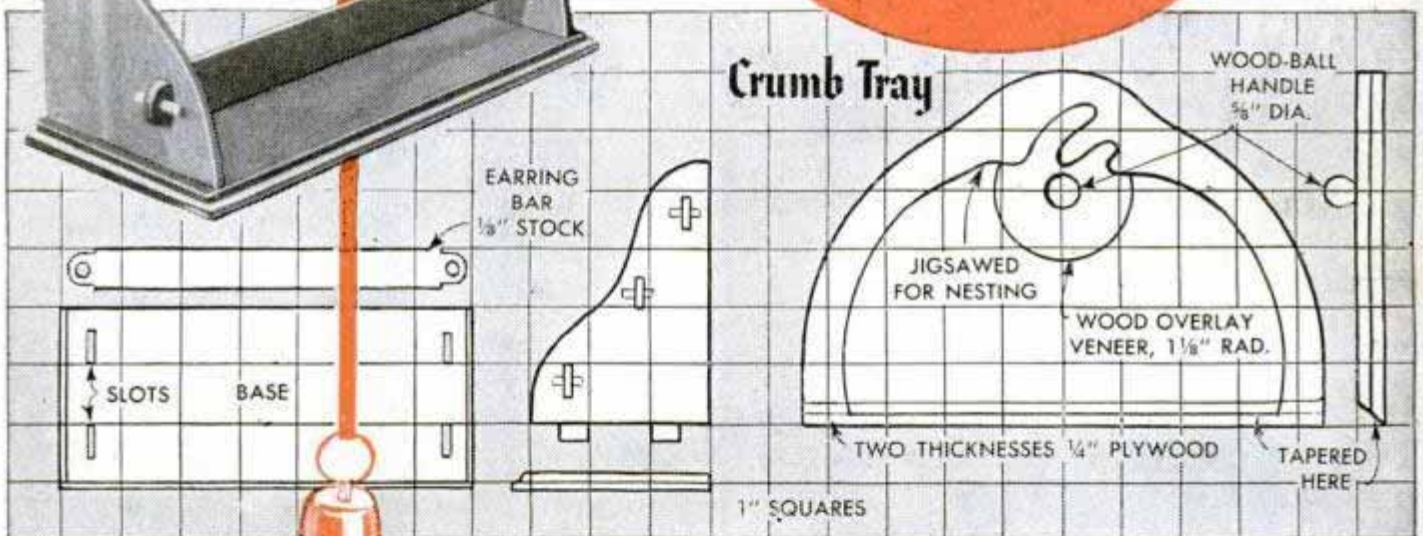
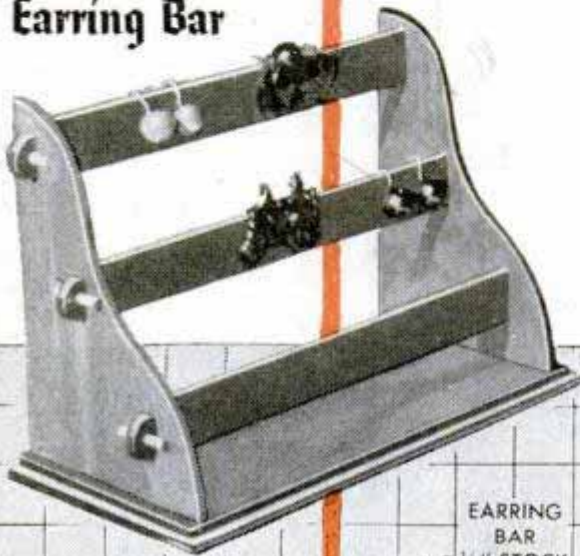


Dart Game *Book for Boys*

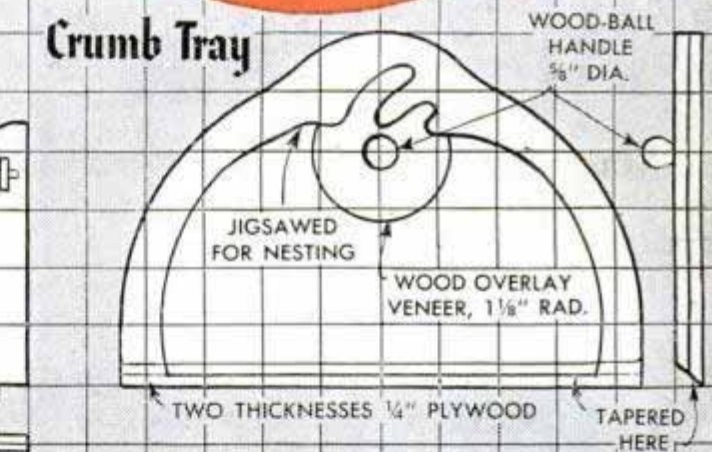


Below: Mom, sister or sweetheart will be pleased with this little earring bar. The base is $\frac{1}{4}$ -in. plywood; all other parts are $\frac{1}{8}$ in. Rail tenons projecting through slots in the side pieces are pegged with short dowels; the base is glued. Right: The crumb tray features a nesting scraper which locks itself within the tray when not in use. It is jigsawed from $\frac{1}{4}$ -in. stock and glued together

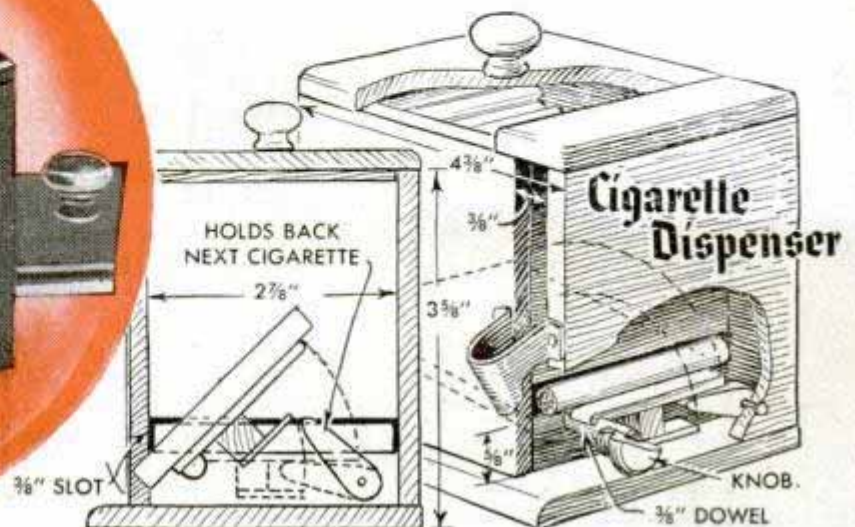
Earring Bar



Crumb Tray



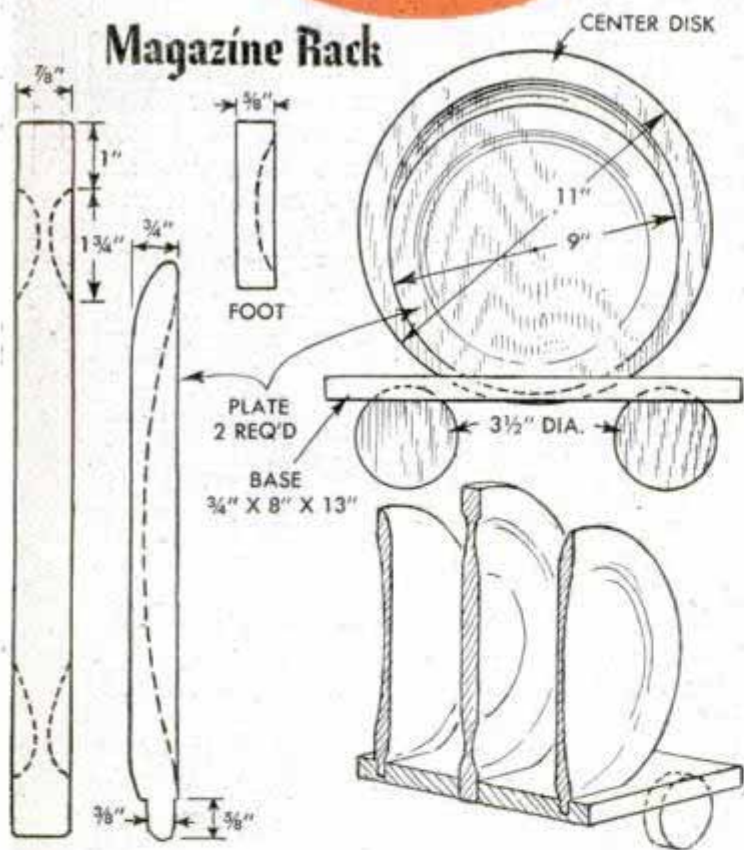
Dad will go for this novel cigarette dispenser. It ejects a cigarette on end with each turn of a knob. The bottom of the hopper is slanted toward a narrow slot through which cigarettes feed to the ejector unit



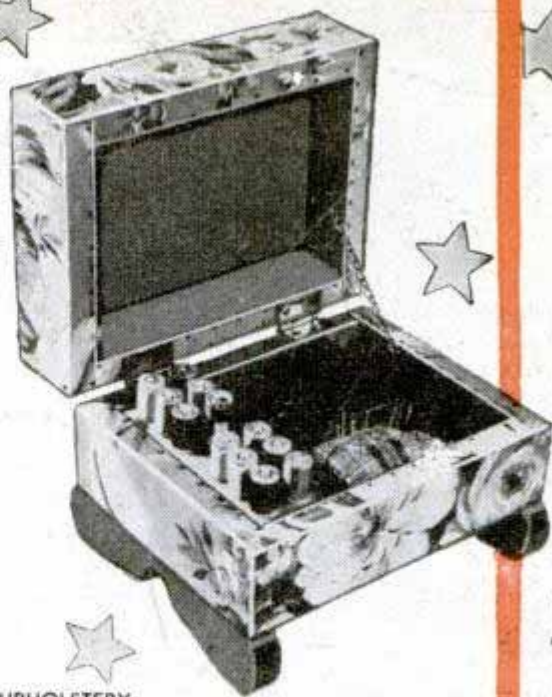
The gifts on these pages are appropriate for adults, and most of them are simple enough for the boy craftsman to make for Mom or Dad. With the exception of the magazine rack, which requires a lathe, all the projects can be duplicated with ordinary hand tools. Finish can be paint or varnish



Magazine Rack

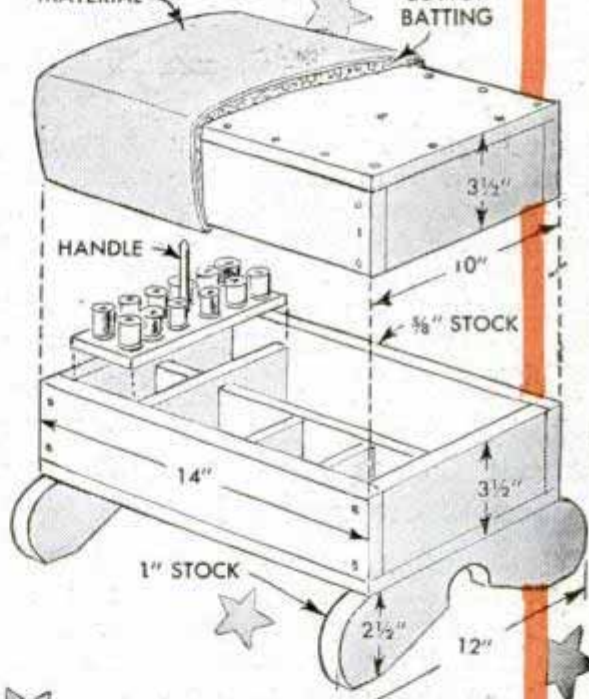


Resembling a little wagon, this unusual magazine rack has disk partitions which are dished like saucers. It's almost entirely a lathe job, except for the base which is grooved top and bottom to hold the disks and the "wheel" feet. Grooves for the two outer disks are spaced about 2 1/2 in. from the center one, the latter one being cut completely through the base



UPHOLSTERY MATERIAL

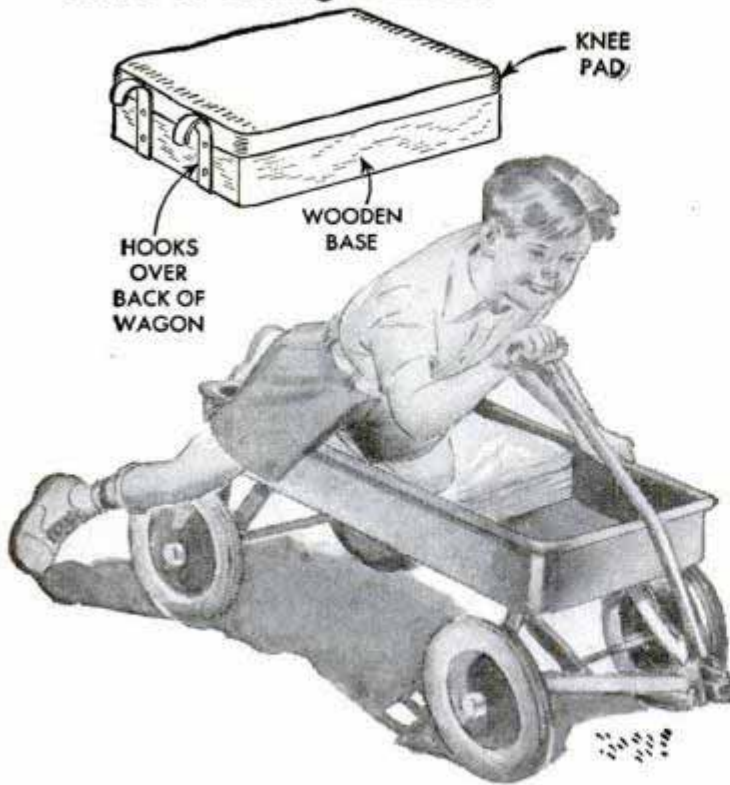
COTTON BATTING



Footstool Sewing Kit

It's not just a footstool but a sewing kit, too. Raise the lid and you have a divided compartment for thread, pin-cushion, etc. Make a box with a top and bottom and saw it in half, length-wise, to form the two parts. Pad and upholster both; hinge the lid and attach feet with screws in counterbored holes. The spool rack is made removable so that the space under it can be used

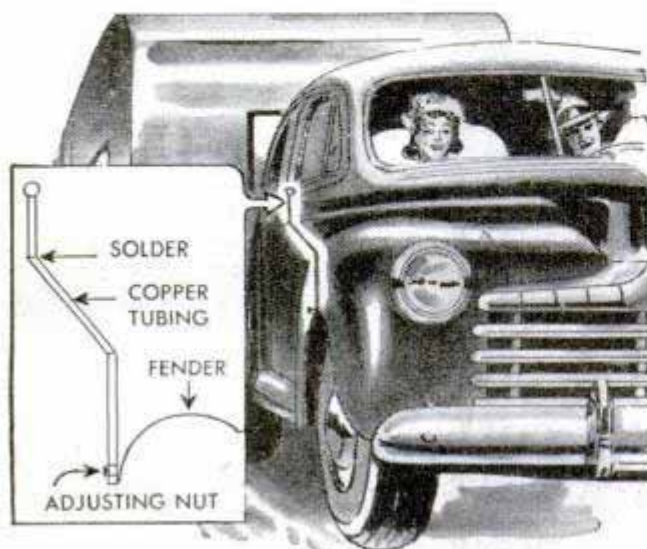
Knee Cushion on Coaster Wagon Adds to Riding Comfort



Chafed and sore knees can be avoided if this knee pad is used on a coaster wagon. The base is made of wood and covered with padding material. Two flat-iron hooks are screwed to the back of the cushion to hold it in place when being used. Size of the base is governed by the inside dimensions of the wagon.

Fender Guide for Use With Trailer Indicates Clearance Needed

When pulling a trailer, often it's difficult to judge the clearance required when parking or driving in congested traffic. But with this fender guide to aid you, maneuvering is a lot easier. An ordinary fender guide is adapted for this purpose by sol-

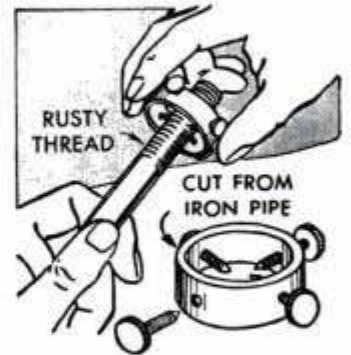


dering it to an offset piece of copper tubing. When not towing the trailer, loosen the adjusting nut and set the guide parallel with the fender.

Harold J. Reine, Tucson, Ariz.

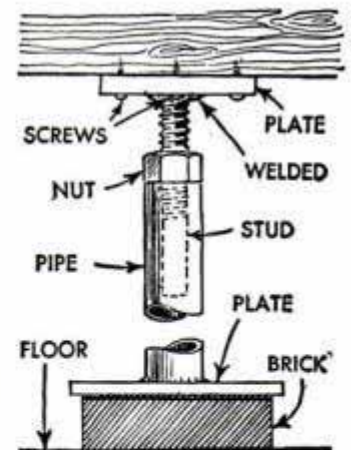
Improved Bolt-Thread Cleaner

Rusted or dirty threads on bolts and pipe can be cleaned with this improvised tool, which consists of a collar cut from a length of pipe and four pointed screws that have knurled heads. The collar is drilled and tapped for the screws which are spaced equidistantly around the circumference. To use the device, slip the collar over the bolt and adjust the screws to fit in the bottom of the threads. Then use it like a threading die.



Sagging Floors Levelled Easily With Iron-Pipe Jack

It is a simple matter to level sagged floors with this inexpensive jack, which may be left in place as a permanent support. The jack is nothing more than a length of heavy pipe having a steel plate welded to the lower end, and a screw assembly fitted at the upper end. The screw assembly consists of a nut large enough to rest on the end of the pipe and a stud bolt. A plate is welded to the bolt after turning on the nut. Holes through the plate take screws for attaching it to the joist or beam to be raised. In use, the jack is set in place, the screw plate attached to the joist or beam, and the nut backed off the bolt. This forces the latter upward, raising the floor. If the jack is to be left in place only temporarily, a brick under it will provide sufficient bearing surface. On a permanent installation, a concrete block or a poured concrete footing should be used. If you pour a footing it should be above 12 in. square and 12 in. deep for the average load. For a heavy load increase the size.

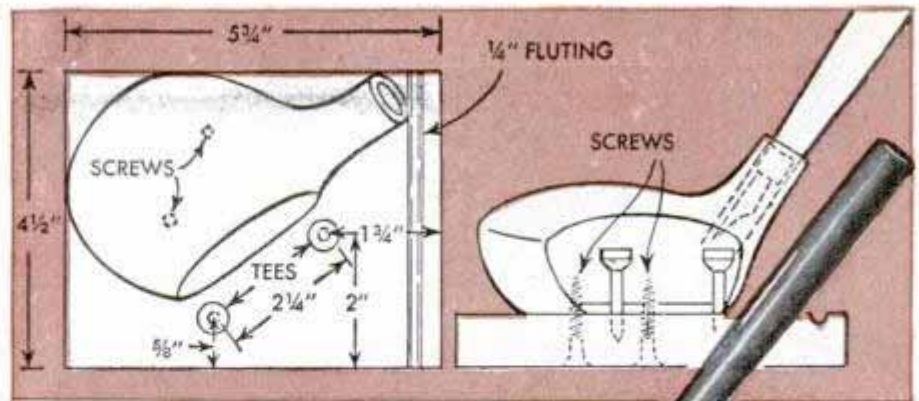


Joseph Roth, Chicago.

Broken Golf Club Is Pen Holder of Novel Desk Set

Don't throw away that broken driver. You can use it to make a novel desk set, which will suit any golf enthusiast to a "tee." The golf-club head, which can be a driver, brassie or spoon, provides the pen holder of the set, while two golf-ball tees form a letter rack. A groove in the base is is for a pencil. First, saw off the broken shaft at the head and smooth the cut with a fine file; then bore a hole into the shank. This hole should be made to fit the desk pen to be used and should be drilled deep enough to prevent the pen point from touching the bottom. A generous application of shellac to the hole will keep the wood from absorbing ink.

If the club head is scarred badly, remove the old finish, fill any nicks with plastic wood and rescore the original grooving in the face of the head. Then stain the whole thing, except the face, and apply two coats of shellac or clear lacquer. Attach the head to a $\frac{3}{4}$ -in. walnut or mahogany base in the position shown, using two flat-



head screws, driven from the underside. The tees are forced into undersize holes, and the bottom of the completed set is covered with a piece of felt.

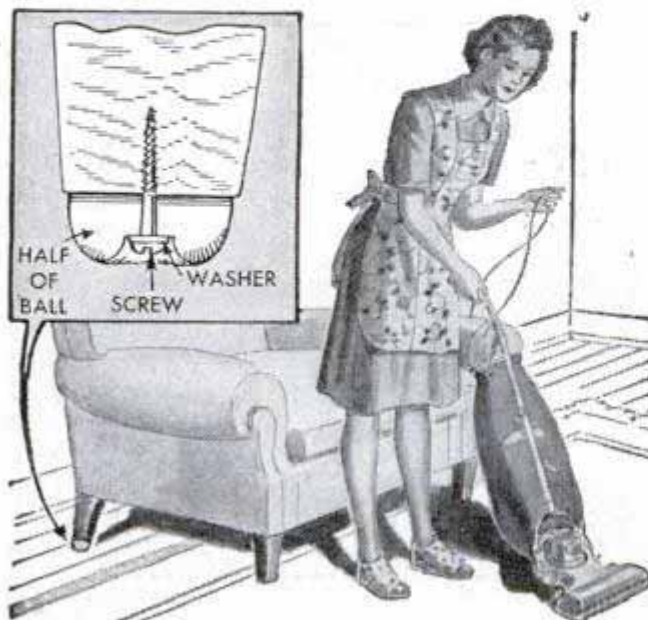
Walter Burton, Akron, Ohio.

Non-Slip Glides of Sponge Rubber Keep Chairs Away From Wall

To prevent chairs and other pieces of heavy furniture from sliding on bare floors around rugs, casters can be made of

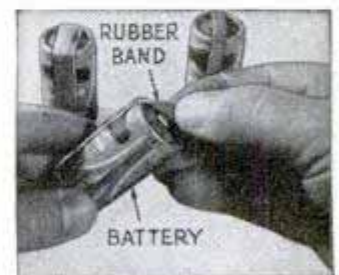
sponge-rubber balls that will hold the furniture in place. Remove any metal domes or casters from the chairs and fasten half of a ball to each leg with a wood screw and washer. Sink the screwheads deeply into the rubber so they will not mar the floor.

Joseph B. Moses, Blacksburg, Va.

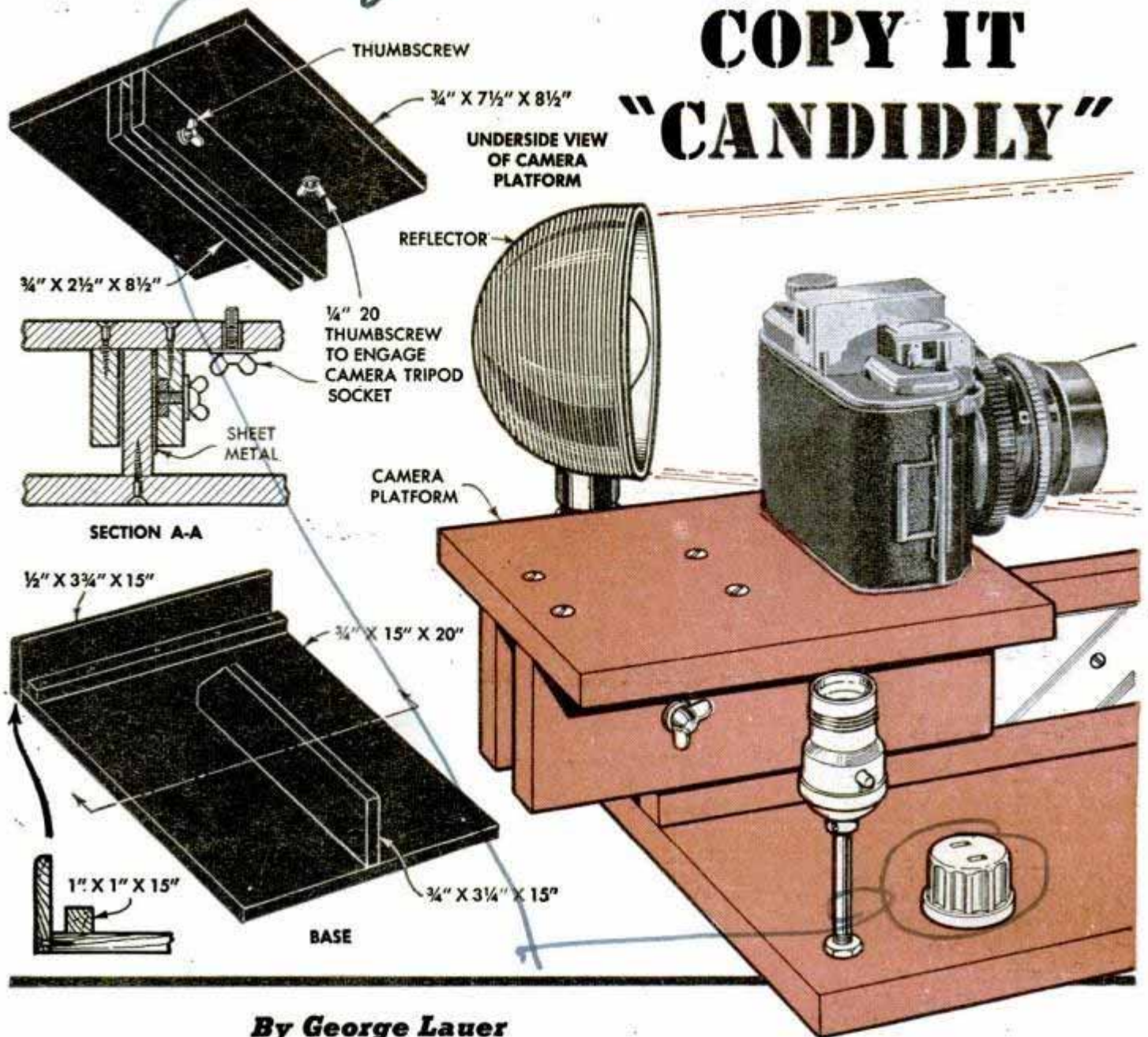


Rubber Bands Protect Dry Cells

When flashlight dry cells are placed in a drawer or stored elsewhere, there's always the chance that they may become short circuited by touching metal articles in the same compartment. As a precaution, stretch a wide rubber band over the contacts or ends of each cell as indicated to prevent "shorts."



COPY IT "CANDIDLY"



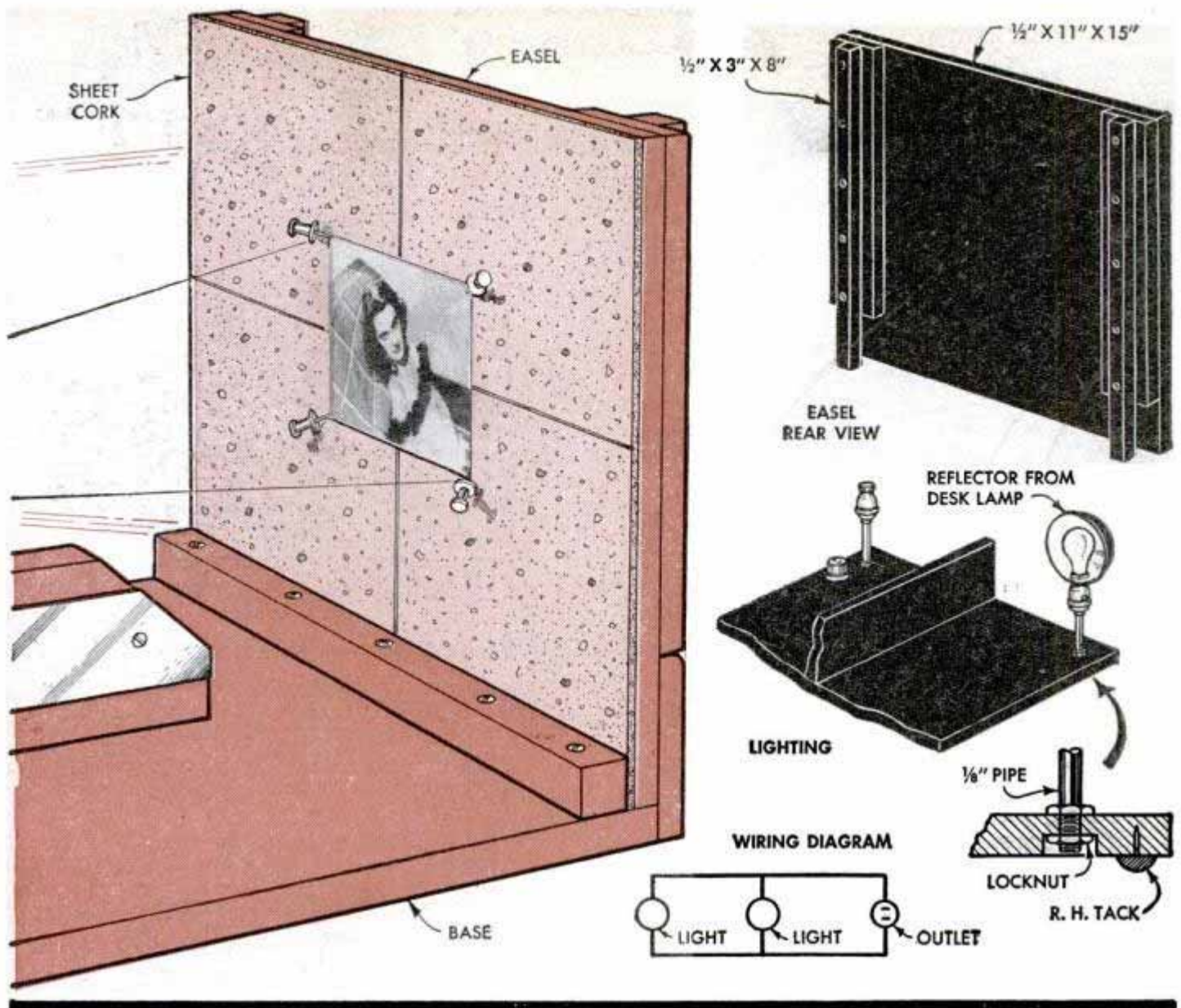
By George Lauer

SUBJECT DISTANCE AND APPROXIMATE PICTURE SIZE FOR ROLL-FILM CAMERAS WITH SUPPLEMENTARY LENSES

Distance in inches between subject and lens

Approx. size of negative	Average focal length	2+ portrait lens (focal length: 19 $\frac{3}{4}$ in.)		3+ portrait lens (focal length: 13 $\frac{3}{8}$ in.)	
		Camera focused at inf. Subject distance 19 $\frac{1}{2}$ in.	Camera focused at 3 $\frac{1}{2}$ ft. Subject distance 13 $\frac{3}{8}$ in.	Camera focused at inf. Subject distance 13 in.	Camera focused at 3 $\frac{1}{2}$ ft. Subject distance 10 in.
1 x 1 $\frac{1}{2}$ inches 24 x 36 mm.	50 mm.	9 $\frac{3}{8}$ x 14	6 $\frac{1}{8}$ x 9 $\frac{1}{4}$	6 $\frac{1}{4}$ x 9 $\frac{3}{8}$	4 $\frac{1}{2}$ x 6 $\frac{7}{8}$
1 $\frac{1}{8}$ x 1 $\frac{9}{10}$ inches 28 x 40 mm.	50 mm.	10 $\frac{7}{8}$ x 15 $\frac{1}{8}$	7 $\frac{1}{8}$ x 10 $\frac{1}{8}$	7 $\frac{1}{4}$ x 10 $\frac{3}{8}$	5 $\frac{1}{4}$ x 7 $\frac{1}{2}$
1 $\frac{1}{2}$ x 2 $\frac{1}{4}$ inches 4.5 x 6.0 cm.	75 mm.	10 $\frac{5}{8}$ x 14 $\frac{3}{4}$	6 $\frac{3}{8}$ x 8 $\frac{7}{8}$	7 $\frac{1}{8}$ x 9 $\frac{7}{8}$	5 x 7
2 $\frac{1}{4}$ x 2 $\frac{1}{4}$ inches 6.0 x 6.0 cm.	75 mm.	14 $\frac{3}{4}$ x 14 $\frac{3}{4}$	8 $\frac{7}{8}$ x 8 $\frac{7}{8}$	9 $\frac{7}{8}$ x 9 $\frac{7}{8}$	7 x 7
2 $\frac{1}{4}$ x 3 $\frac{3}{4}$ inches 6.0 x 9.0 cm.	100 mm.	11 $\frac{1}{8}$ x 16 $\frac{1}{8}$	6 $\frac{7}{8}$ x 10	7 $\frac{1}{2}$ x 10 $\frac{3}{4}$	5 $\frac{1}{4}$ x 7 $\frac{1}{2}$

Eastman Kodak Co.



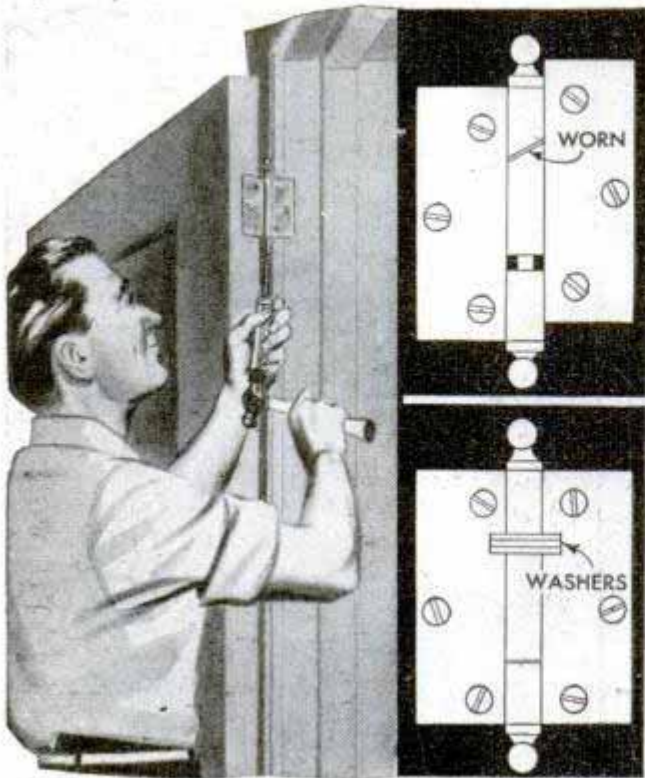
A SMALL CAMERA of the folding or candid type not fitted with a ground glass can be used for copying by mounting the camera on a firm support and fitting it with a supplementary lens. For this work the support should be a self-contained unit consisting of lights, camera platform and easel mounted on a rigid base. As in the details left to right above, the platform, base and easel should be cut from plywood to the size and thickness given. All other wood parts, platform guides, cleats and spacers are of straight-grained solid stock. The center member of the platform guide, section A-A, is glued and screwed to the base, and is fitted with a sheet-metal bearing plate, as shown, to take the end of a thumbscrew.

The easel is made so it can be removed. It has $\frac{1}{8}$ -in. sheet cork glued to the face side for mounting the print to be copied. Horizontal and vertical pencil lines aid in centering the print. Lighting units are duplicates, each consisting of a short length of $\frac{1}{8}$ -in. pipe, threaded at both ends, a con-

ventional light socket and a desk-lamp reflector of the screw-on type. The lamps are wired as detailed in the wiring diagram. Use an extension cord with a feed-through switch to control the lights, or operate each at the socket.

A data table supplied with the supplementary portrait lens gives the relative picture size in inches covered by the lens at given distances. If you know the focal length of your camera and the size of the negative, it's easy to determine the distance from the supplementary lens to the subject, as well as the size of the area in inches covered by the lens at that distance. For example, reading from the sample table at the left, if the negative size is 1 by $1\frac{1}{2}$ in. and focal length of the camera lens is 50 mm., then, with a 2+ portrait lens attached and the camera focused at $3\frac{1}{2}$ ft., the distance from lens to subject (photo or other copy mounted on the easel) will be $13\frac{3}{8}$ in. and the area covered at that distance $6\frac{1}{8}$ by $9\frac{1}{4}$ in. Distance from lens to subject must be measured carefully.

Worn Door Hinges Are Repaired By Using Small Washers



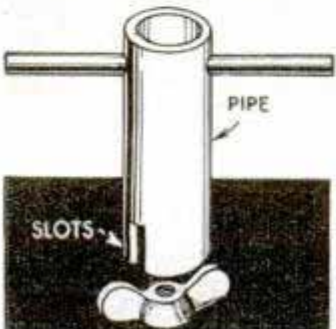
On door hinges carrying a heavy load the pin sleeves eventually become worn something like those shown in the exaggerated upper detail. To repair, remove the hinge, separate the halves and file the ends of the sleeves square. When replacing, shim the parts with small washers as shown in the lower detail.

Hacksaw Blade Perforates Paper



Here is an easy way to perforate paper so that it can be torn from a pad. Place the pad on a hard surface, such as a wooden cutting board, and set a hacksaw along the line to be scored. Then strike the blade with a hammer to produce the perforations. Only a few sheets can be scored at a time.

Slotted Wrench for Wing Nuts

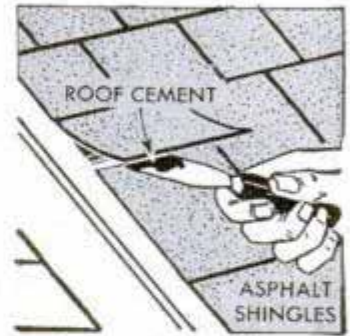


A slotted-end wrench like this one will take care of tight wing nuts in inaccessible places. The body is made from a section of $\frac{3}{4}$ -in. pipe slotted at one end and drilled at

the other end for a $\frac{5}{16}$ -in. handle, 6 in. long. The slots should be about 1 in. deep to fit over the wing nut.

Asphalt Shingles Cemented at Edge To Prevent Loosening by Wind

Should the wind loosen asphalt shingles at the ends of gables, the individual shingles can be anchored securely with roofing cement applied to the underside of the exposed portions. This can be done when laying a new roof or on shingles already laid. In the latter case apply the cement only along the lower edge.



Socks Protect Shoes in Suitcase

If traveling on a vacation or for business, you'll find it handy to have an extra pair of socks for covering shoes carried in the suitcase. This will protect clothing and do away with the necessity of wrapping the shoes in a bulky parcel.

Robert S. Martin, Iowa City, Iowa.

Covered Wire in Plastic Lamp Has Neater Appearance

When making electric lamps that have transparent standards, a better looking job will result if the wire is covered in some manner. One way to do this is to slip white plastic covering over the wire and then run this through the standard. The covering keeps the wire straight.

Leslie K. Prescott, Newport, N. H.

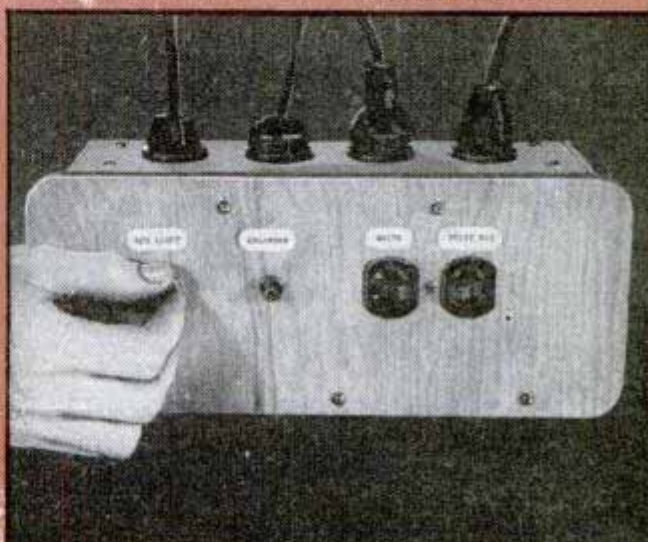
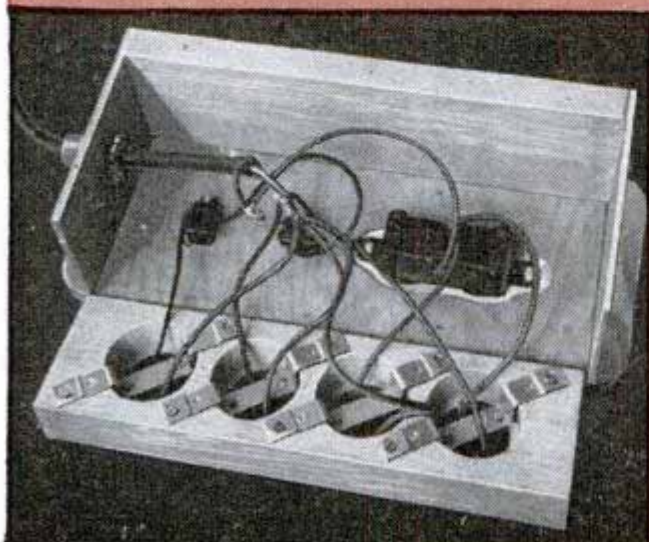
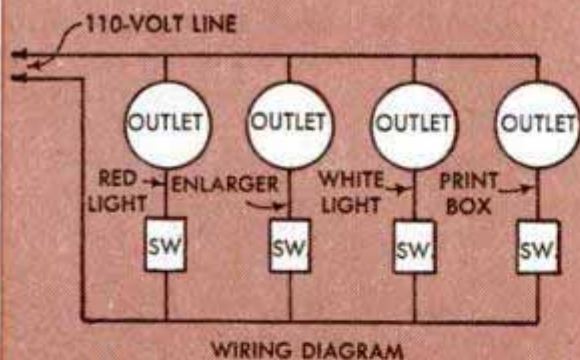
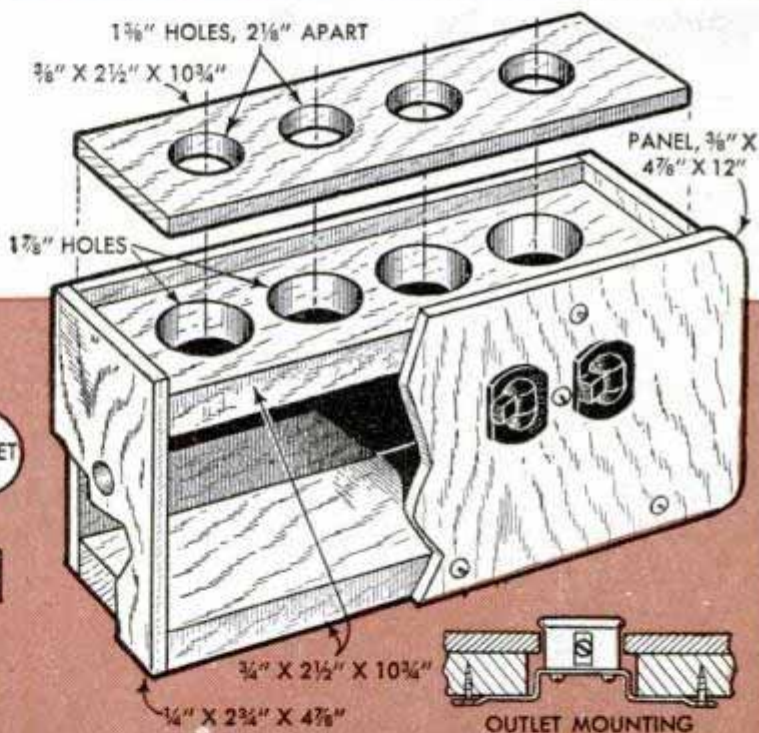


DARKROOM SWITCH BOX

By Henry Hanscom

This unit groups all darkroom lighting switches on one panel and speeds up both darkroom and photographic work by supplying finger-tip control to all lighting circuits. The unit is designed for table use or wall mounting, and is easily portable for photoflood lighting as well. Outlet mounting brackets are inverted to allow each outlet to fit flush with the top of the box. Brackets are placed at an angle to conserve space. Three different kinds of switches are used so that each can be readily identified.

Wiring is done according to the diagram before the box is completely assembled. The line wire is brought into the box through a flexible-conduit connector, which is fitted with a wood reducing plug made by drilling and slotting a length of dowel. A porcelain or rubber bushing also can be used. Solder and tape all connections.



Cloth Bag Tied Over Bottle Neck Filters Photo Solutions



Large bottles of hypo solution or similar photographic chemicals can be filtered as they are poured by simply tying a cloth mailing bag or a clean tobacco sack over the mouth of the bottle. The drawstring provided with the bag will serve to tie it. When enough solution has been poured, empty the chemical that has been filtered into a clean bottle and wash the bag.

Way to Control Water Temperature



If you have a mixing faucet in your darkroom, you can control water temperatures within close limits by inserting a dial thermometer in the faucet. Drill a hole near the end so that the rod element will slip through and be covered with water for a distance of about 2 in. when the faucet is turned on. A rubber grommet on the rod will hold the thermometer in place. Because this type of thermometer changes quickly, regulation of water temperature can be fairly exact.

Leonard Hart, Chicago.

Improved Photographic Spotting

Because of the relatively high surface tension of enlarging paper, it is difficult for spotting colors to penetrate the emulsion. Instead, the color gathers in globules

and is not deposited uniformly. To correct this condition, mix a few drops of commercial wetting agent with the color to reduce surface tension and it will spread more evenly.—Henry Zave, Chicago.

Camera-Cable Release Reinforced

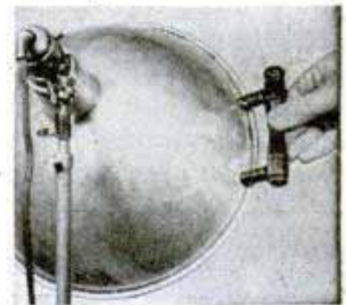
Sharp bends will be less likely to "kink" a camera-cable release if the part next to the operating button is given one or two coats of fingernail polish. This reinforces the cable housing at the point where there is the most strain. On cloth-covered releases, the polish also will prevent wear caused by rubbing and twisting.



Handle on Photoflood Reflector Prevents Burned Fingers

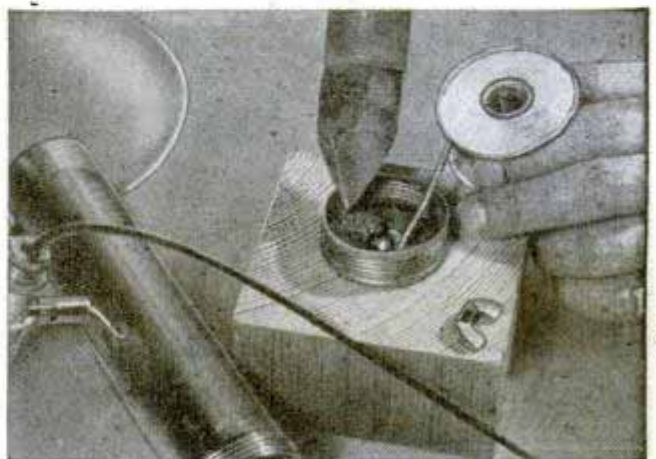
A wooden handle from a coffee percolator can be attached to a photoflood reflector and thus make it safe to adjust the reflector when hot. Usually

the handle can be purchased with mounting screws so that it's necessary only to drill two small holes near the rim of the reflector to fasten the handle in place.—H. Leeper, Canton, Ohio.



Reinforcing Cap of Battery Case

Battery cases for many synchronized flash units are supported by means of a bracket bolt that passes through the cap at the bottom of the case, and often the latter becomes bent out of shape. To reinforce the cap and prevent this, solder an iron or brass washer to the inside. Then the case may be screwed tightly to the supporting bracket and will not get out of line.



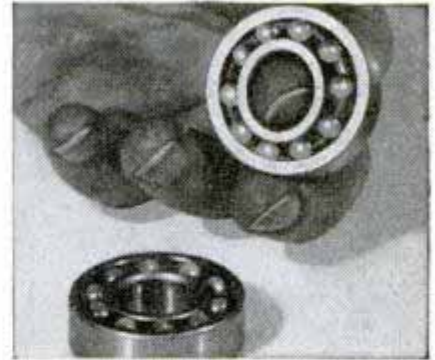
CRAFT QUIZ



1. When this is necessary, you—
 (a) Remove faucets (c) Plug overflow
 (b) Turn off water (d) Look at meter



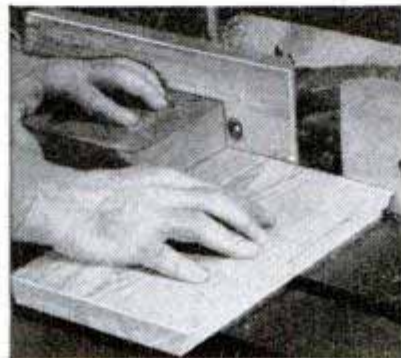
2. This dado-head cutter is—
 (a) Swage set (c) Hollow ground
 (b) Rabbeted (d) Spring set



3. Bearing shown here is—
 (a) Radial (c) Thrust
 (b) Self-sealed (d) Roller



4. Novelty coaster set uses—
 (a) Multiple thread (c) Split turning
 (b) Flutes (d) Splines



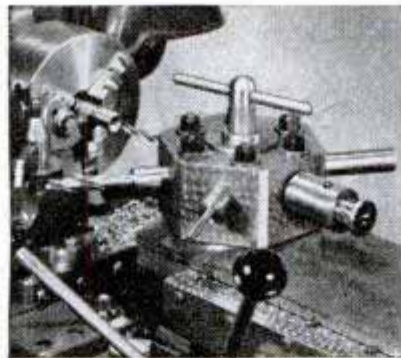
5. Wrong in this job is—
 (a) Order of cuts (c) Hands
 (b) Fence (d) Push block



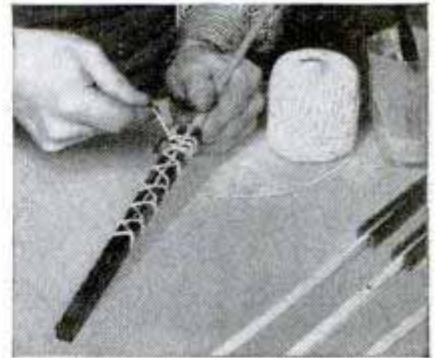
6. This saw has a—
 (a) Swing splitter (c) Offset center
 (b) Depth stop (d) Fixed splitter



7. He is using a—
 (a) Strike board (c) Spiling board
 (b) Kingpin (d) Edger



8. Lathe setup shows a—
 (a) Milling table (c) Die head
 (b) Tailstock turret (d) Bed turret



9. He knows his—
 (a) Veneers (c) Beefwood
 (b) Rudders (d) Acrylics

ANSWERS: 1—c (force cup is not effective unless water overflow is plugged with rags); 2—a; 3—a; 4—c; 5—a (end grain cut will splinter side cut previously made); 6—a; 7—a; 8—d; 9—c (wood used in arrow-making); 10—c; 11—d (thread chasing with hand tool)

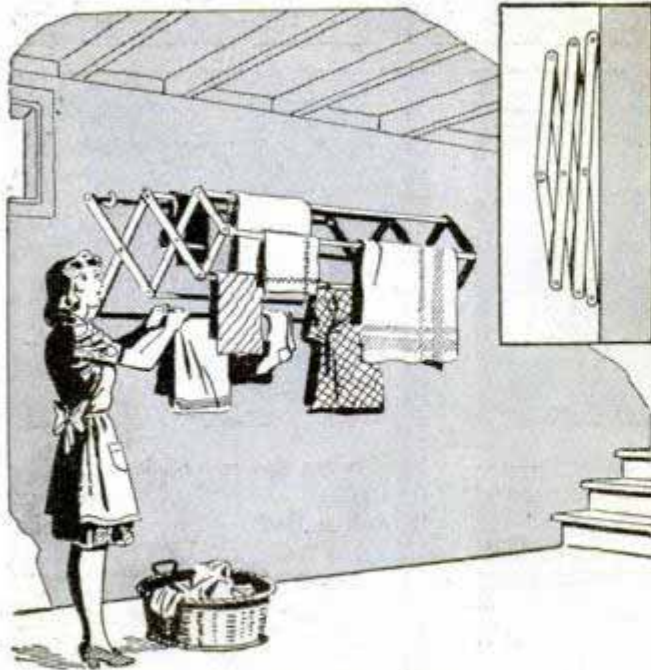


10. Stain maker is using—
 (a) Litmus paper (c) Filter paper
 (b) Wax paper (d) Tracing paper



11. He is all set to do—
 (a) Firing (c) Reeding
 (b) Shaping (d) Chasing

Clothes Rack Attached to Wall Saves Floor Space

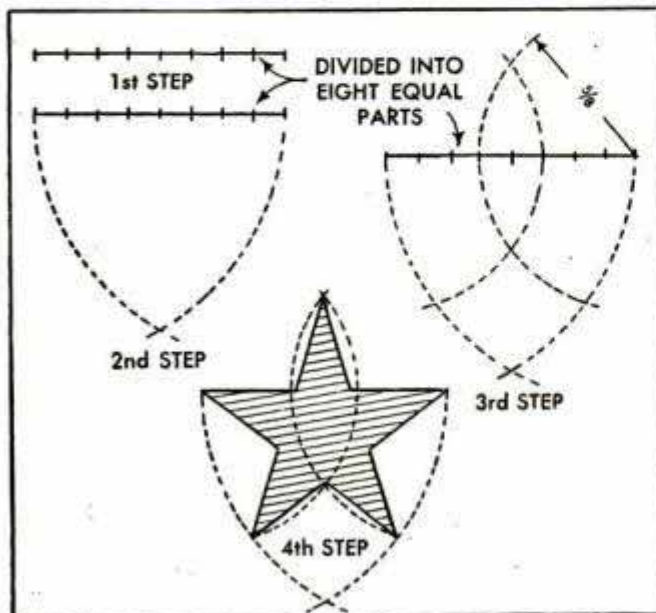


Ordinarily set on the floor, a folding-type clothes rack can be mounted on a kitchen or basement wall so that, when in use, it's difficult for small children to reach the clothes and, when folded, it takes little space. One lower bar of the rack fastens to screw hooks that are set in the wall. Locate the rack as high as conveniently possible to take full advantage of the warmer air near the ceiling.

Nicholas Cappella, Waterbury, Conn.

Drawing a Five-Pointed Star

In laying out a five-pointed star, first draw a straight line to represent the width of the star and divide it into eight equal parts as in step 1. Then strike intersecting arcs from each end of the line with a compass, step 2. Next, adjust the compass to strike an arc through the fifth division



mark from each end, step 3. This establishes the five points of the star. Connect these with straight lines, step 4.

Molding Around Kneading Board Retains Excess Flour

To keep flour from being brushed or otherwise worked off the kneading board onto the table or floor when making bread or pastry, attach strips of molding around the edges of the board. The molding is glued and screwed to the board in such a manner that it will form a trough. It's best to use a waterproof glue because the board will have to be washed often.



Safe Shipment of Glass Jars



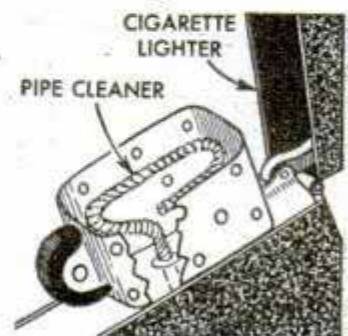
Often people find that glass jars of food which they thought were well packed have been broken in shipment. One way to protect such containers is to place them in tin cans that are several

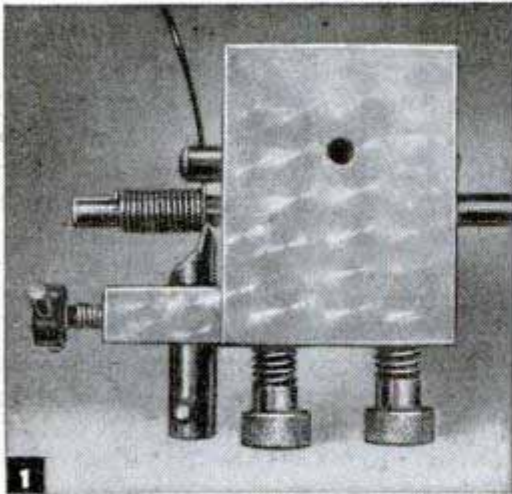
inches larger and pack paper around the jars. Handled in this way, the glass will not be broken easily.

Jack Dempsey, Seattle, Wash.

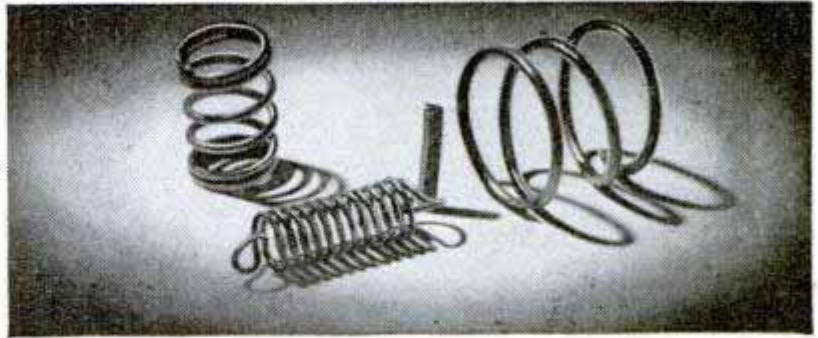
Pipe Cleaner Used as Lighter Wick

As a substitute for a standard wick, a pipe cleaner can be used in some cigarette lighters. Coil the cleaner inside the windshield and insert the end in the wick hole. It will be necessary to shorten the cleaner. Be sure not to obstruct the small holes in the shield when coiling the wick.—Eugene S. Darlington, New Orleans, La.





1 Above: Relative position of pitch guide and wire when winding a tension spring, and below, setup for compression spring

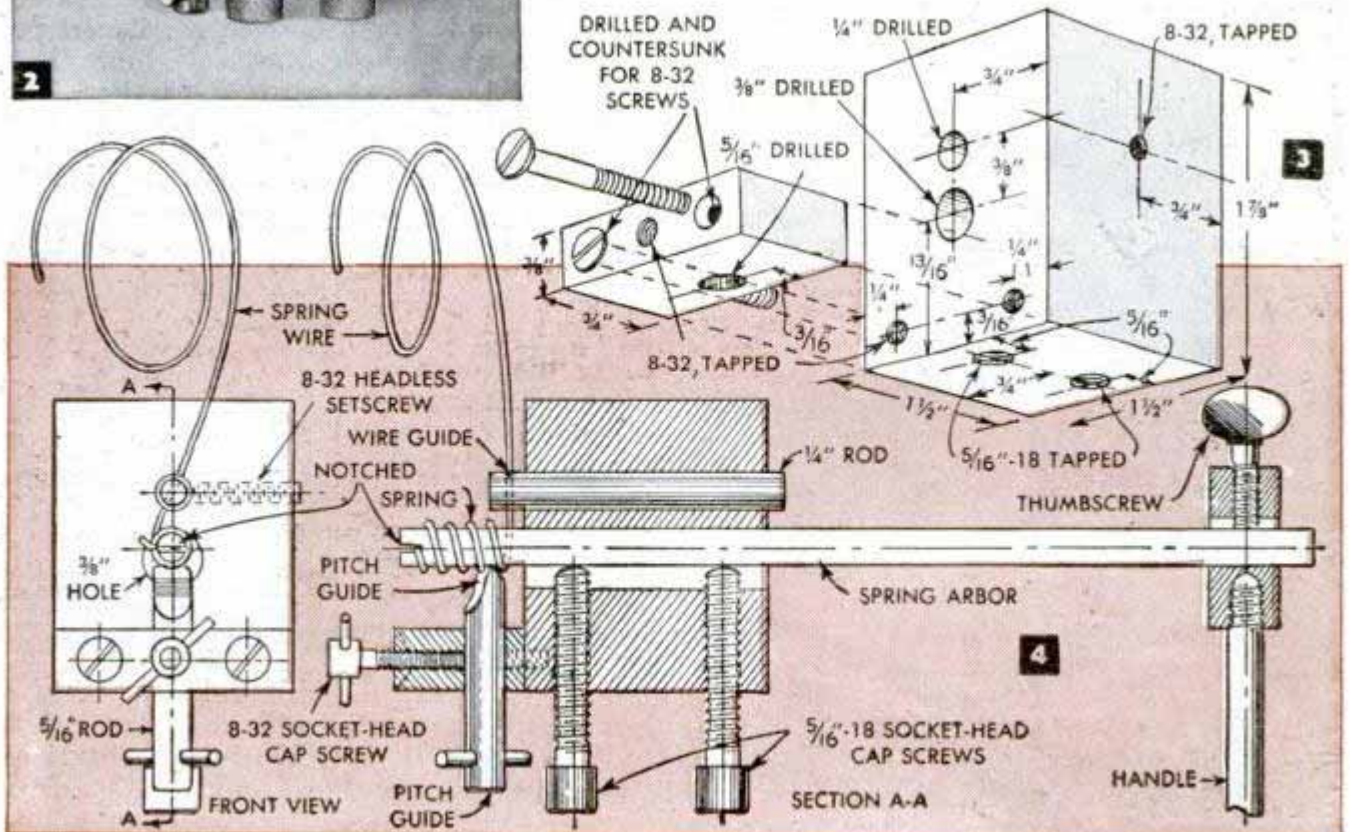
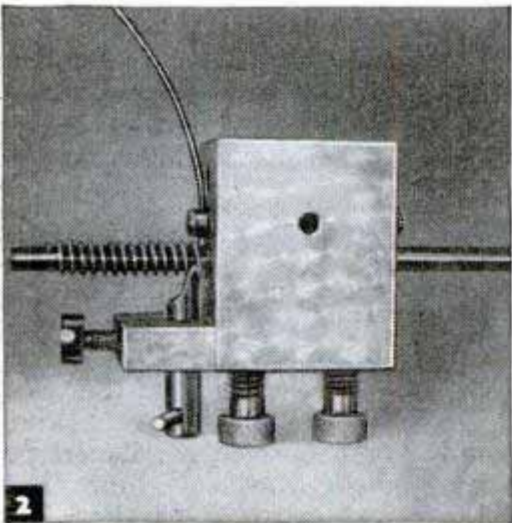


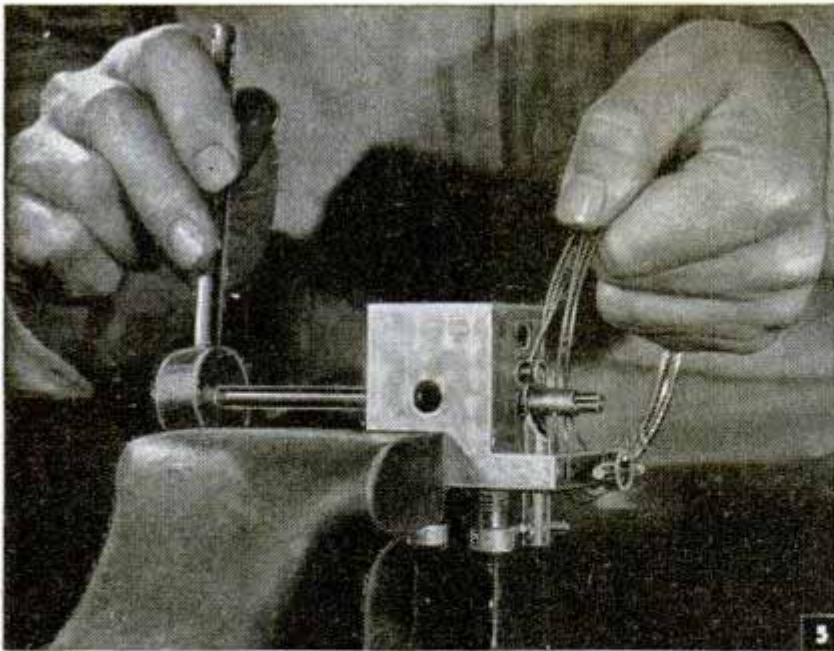
SPRINGS

Wind Them Yourself

By E. F. Bowley

Ranging in size from approximately $\frac{1}{8}$ to $\frac{3}{4}$ -in. outside dia., tension or compression springs of almost any pitch can be made with this winder. Construction of the tool is simple and requires only two pieces of steel bar stock for the body, some rods and several cap screws. Fig. 3 gives the necessary dimensions for the body, which is composed of a main block and a smaller one for the pitch guide. When drilling and tapping the two pieces, note that the hole for the spring arbor is made large enough to accommodate rods up to about $\frac{3}{8}$ in. in dia. Two





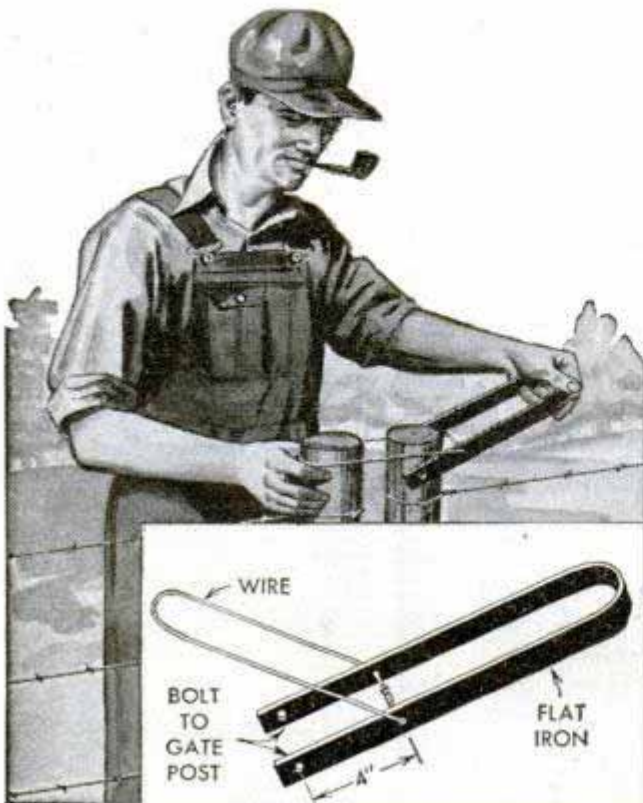
cap screws in the bottom of the body serve to position the arbors. Although the body of the tool is spot finished for appearance, this is not necessary. Lengths of the rods for the pitch guide and wire guide are made to suit. Both rods are locked in position by means of setscrews after being adjusted. The locking screw for the pitch guide is a cap screw fitted with a small pin that serves as a handle to permit easier

adjustment. The end of the pitch guide is ground to the shape indicated in Fig. 4 and it, also, is provided with an adjusting handle. Complete assembly of the tool is indicated in Fig. 4. While no dimensions are given for the spring-arbor handle, it should provide sufficient leverage to turn the arbor against the tension produced by the spring, Fig. 5. Diameters and lengths of the arbors are determined by individual requirements. Some practice in the use of the winder will be necessary before you can produce springs of the exact size you wish to obtain. This is due in part to the fact that the spring will increase in diameter when removed from the arbor, the amount of expansion depending on the type and diameter of wire used to wind them. Fig. 1 shows how the pitch guide presses against the wire for a tension spring and Fig. 2 shows the way the guide is set to wind a compression spring. Pitch of the coils in a compression spring is controlled by twisting the guide to space them as desired.

Lever-Operated "Latch" Helps Keep Fence-Wire Gate Stretched Tautly

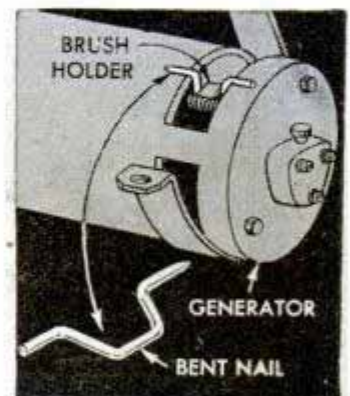
If you have a gate made of fencing wire, here's a locking device that will keep it stretched tightly. A U-shaped piece of flat iron is pivoted to the end post of the gate and two holes for the wire loop are drilled

about 4 in. from the pivot holes. A length of wire is passed through these holes and looped over the stationary fence post. The flat iron acts as a lever to tighten the gate when pulled over as shown. If, after a time, the gate tends to become loose, it can be tightened by making the wire loop that slips over the stationary post smaller.



Nail Holds Brush off Commutator When Working on Generator

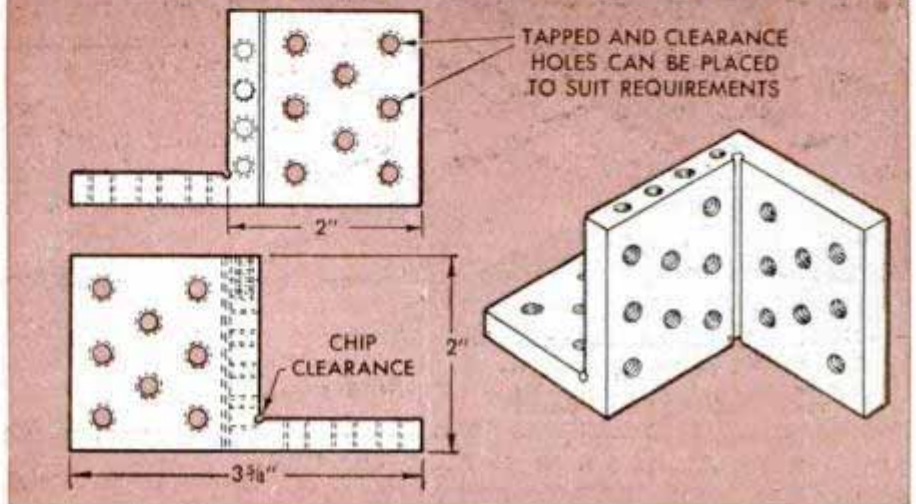
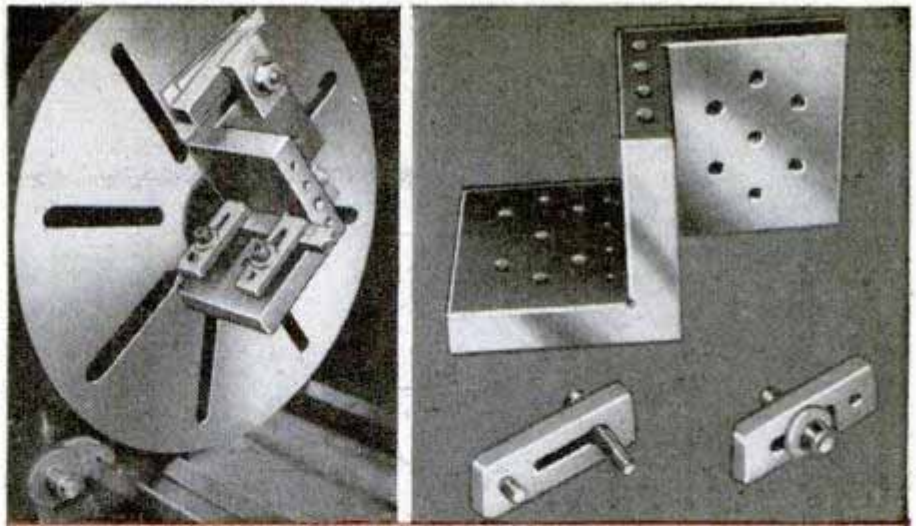
When working on an auto generator, either to dress the commutator or get at other parts for removal, it's difficult to keep the commutator brushes out of the way, but by slipping a bent nail under the brush holder, it's no trick at all. Although the brush-holding device varies with different types of generators, a nail bent somewhat as shown will be suitable in most cases.



G. H. Enyart, Jackson, Mich.

Double Angle Plate For Tricky Setups

This angle plate has all the advantages of the regular plate plus an additional surface and precision angle, which is parallel with the axis of the lathe when mounted on the faceplate. It's small, as you will see from the dimensions, and can be cast in gray iron from a simple wood pattern, or milled from a block of steel. Any number of clamps for holding the work can be made, but those shown proved satisfactory for a wide range of small work. Pattern of the drilled and tapped holes on the flat surfaces may be made to suit your requirements. After machining, drilling and tapping, the plate is hardened and ground on all flat surfaces.—Edmund L. Johnson, Pittsburgh, Pa.

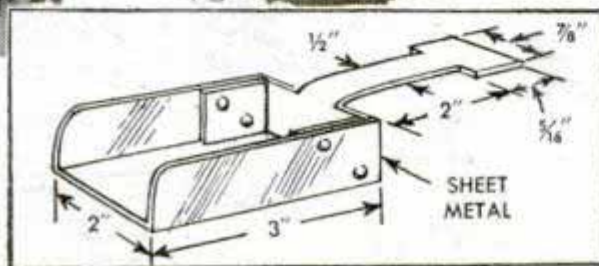
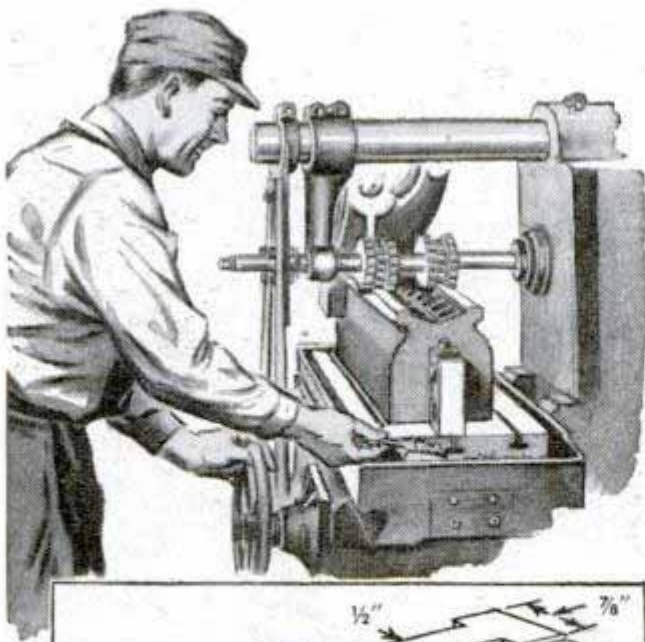


Scoop Made With T-Shaped Handle Cleans Slots In Machine Table

It's difficult to clean chips from T-slots on milling-machine tables and do a clean job, but with this special scoop, the work

can be done in a short time. The detail gives dimensions for the scoop, but these may have to be altered to fit a specific machine; especially the handle, which must be a loose fit in the table slots. To use the device, clean the chips from the slots by using the handle and then pick them up with the scoop. This handy tool can be used on many types of machines.

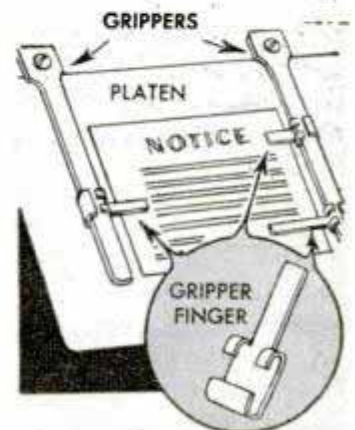
Harold B. Eastman, Cleveland, Ohio.



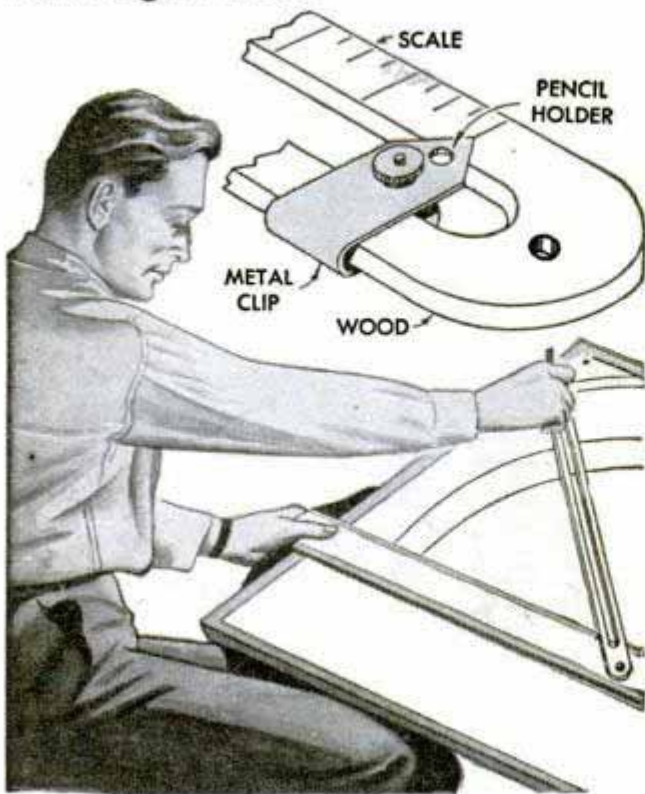
"Gripper Fingers" Hold Small Forms

Printed forms that are too small to be held by the regular grippers on a job press will stay in position when these gripper fingers are used.

They can be formed from light sheet metal cut and bent as shown in the circular detail. Dimensions are governed by the size of the grippers and the size of the forms.—George T. Clayton, Los Angeles, Calif.

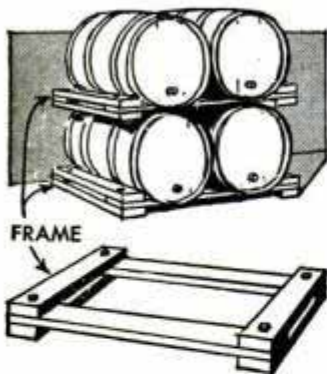


Compass Attachment to T-Square Aids Sign Painter



Useful when drawing curved guide lines for lettering, this compass attachment will speed the work of a sign painter. The unit is made of wood and attached to the right-hand end of a T-square. An adjustable pencil holder is used to set different radii on the scale. When not in use, the arm of the compass swings over the T-square out of the way.

Drums Piled on Removable Frames



Good use of storage space can be made by using wooden frames on which to stack oil or gasoline drums. The frames are built as indicated in the lower detail and the containers are placed in pairs, piled one on top of the other. Handling drums stored in this manner is comparatively easy. If the dimensions of the frames are altered to fit, any barrel-shaped containers can be stored similarly.

Watertight Fit for Cistern Covers

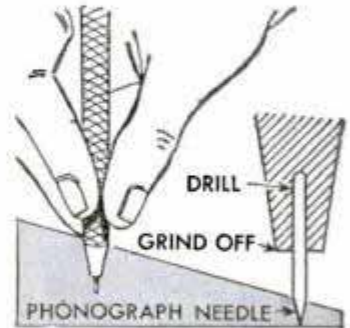
If it's a tight fit, a concrete cover for a cistern will keep out insects and surface water. One way to insure the proper fit between the cistern and the cover is to spread mortar or cement on top of the cis-

tern wall, lay waxed or waterproof paper on the mortar and set the cover on this. The cover will seat itself in the soft mortar and the paper will prevent sticking until the cement sets.

Paul Criton, Jr., Kayville, Sask., Can.

Prick Punch Has Replaceable Point Made From Phonograph Needle

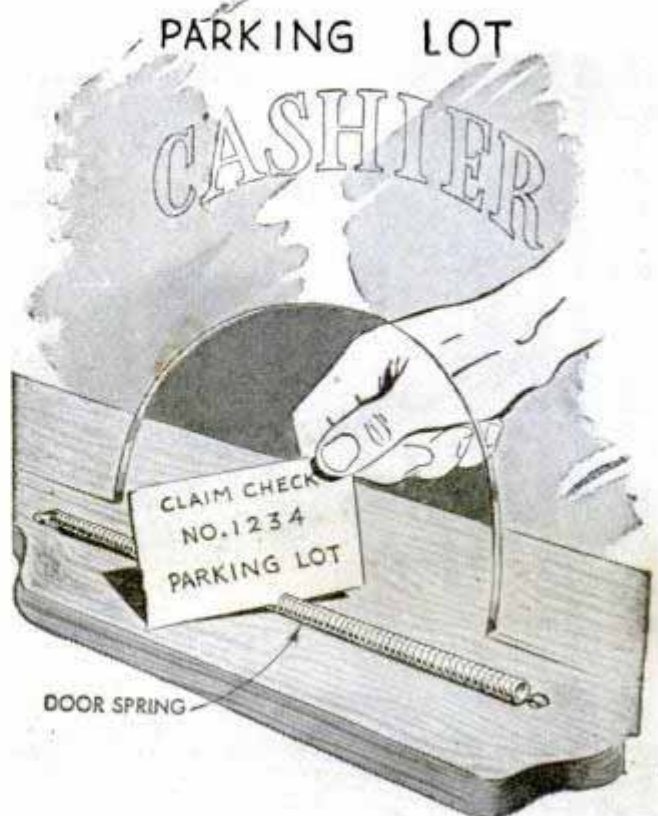
For fine layout on sheet metal having an easily marked surface, a punch with a replaceable phonograph needle will do excellent work. Take a small punch or scriber and grind down the point, then drill a hole in the end for the needle. The latter should be a tight fit so that it will not drop out. Needles too dull for use on a phonograph will do.

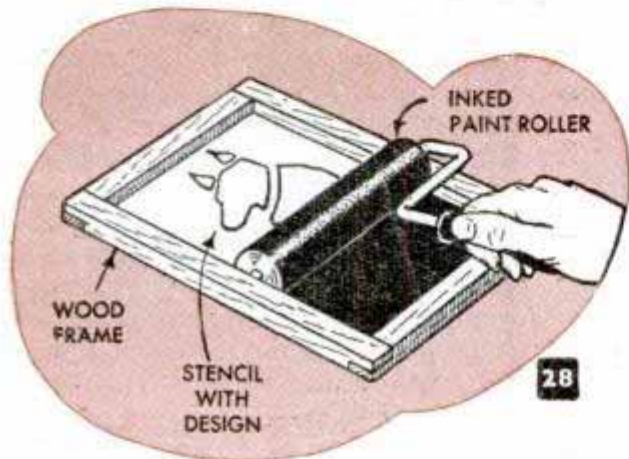
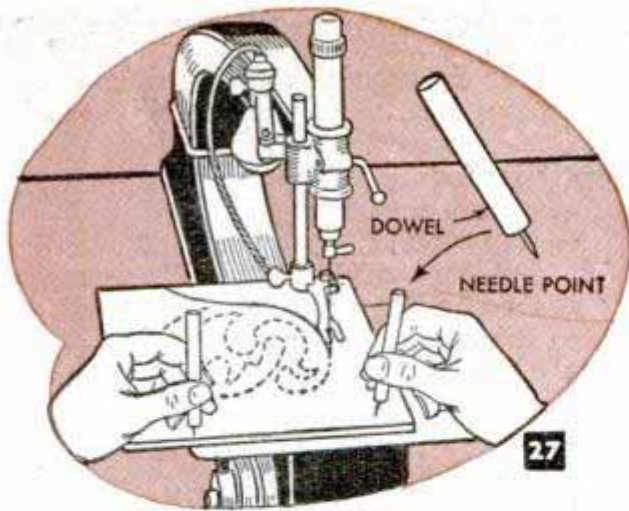


Clarence Klumb, Rockfield, Wis.

Screen-Door Spring Holds Check At Parking-Lot Window

To prevent claim checks from being blown away at the cashier's window, a parking-lot attendant fastened a screen-door spring to the outside of the window ledge. The spring is extended slightly to open the coils for inserting the check. Held in this manner, the check also is easy to reach from the car.





POWER-TOOL SHORT CUTS

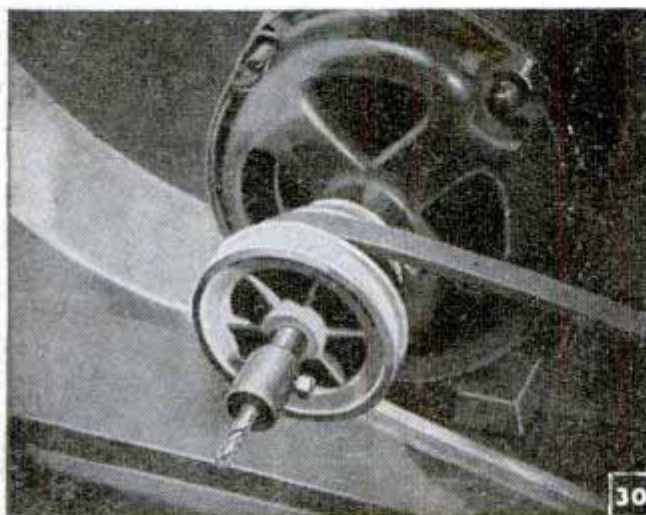
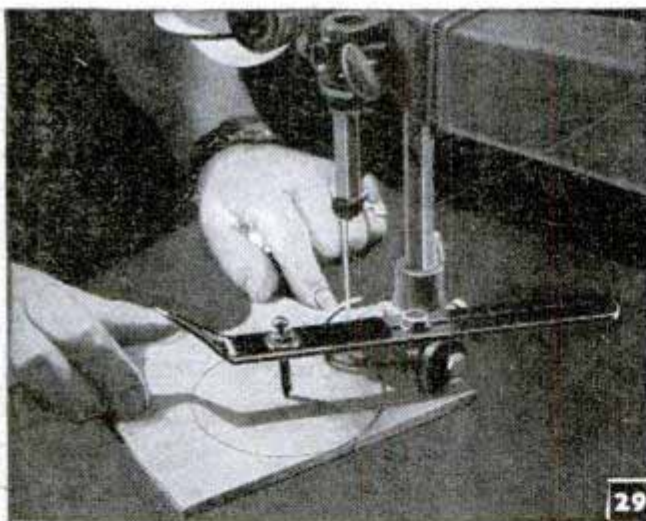
Part II

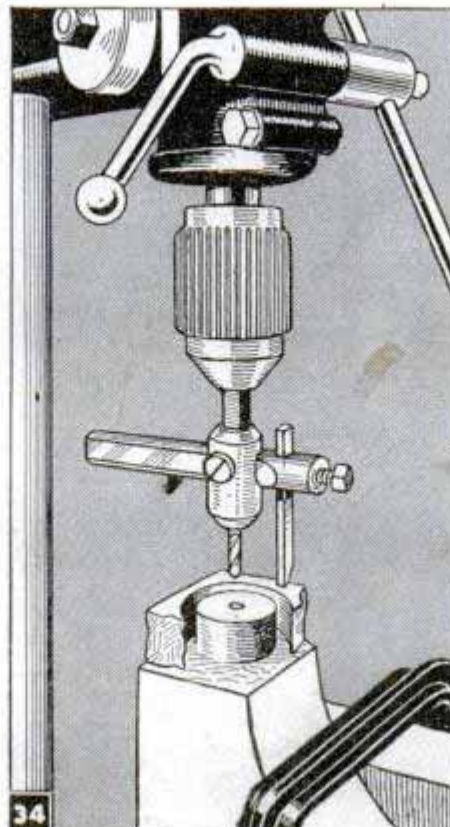
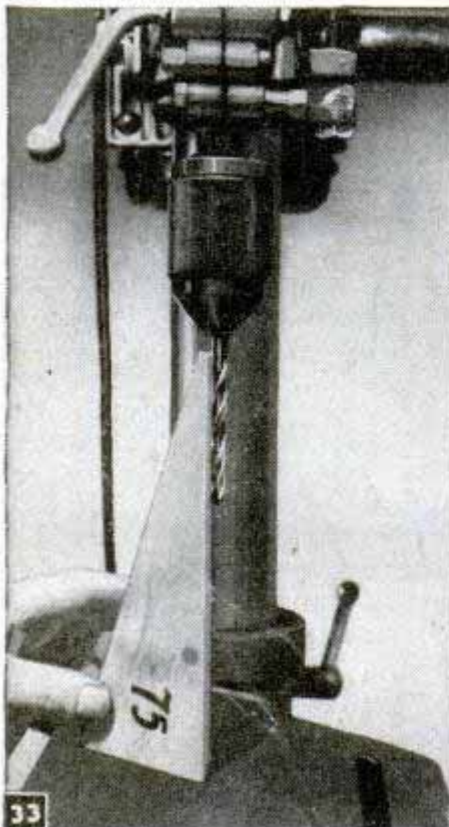
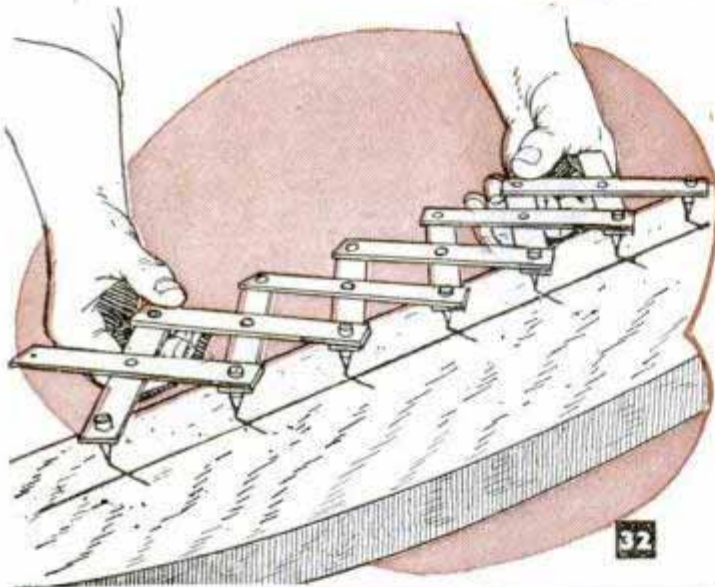
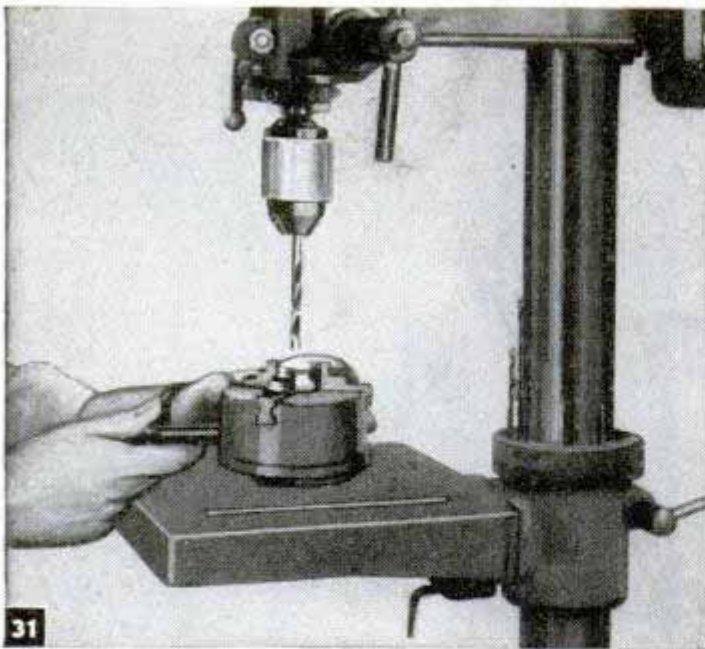
By Kenneth Murray

AS EXPLAINED last month in Part I of this story, simple jigs and fixtures for power tools enable owners of small job shops and home workshops to adapt their machines to a variety of uses. Also, by using suitable jigs, it is possible to do production work on machines not originally intended for such work.

Jigsaw: The crosscut gauge for use on a jigsaw in Fig. 26, and the pivot fixture in Fig. 29 for cutting disks are two good examples. The gauge is one from a circular saw and is turned upside down and used on a jigsaw table as pictured. The pivot fixture is merely a length of flat iron having a point at one end and a slot at the other to straddle a machine screw on the blade-guide assembly. The slot also permits adjustment of the pivot to cut disks of various radii. A pointed stove bolt serves as the pivot. It is important that the pivot be at right angles to the blade teeth so that the latter will not draw to one side.

When cutting intricate scrolls in thin stock, the needle-pointed jigs shown in Fig. 27 will aid in maneuvering the work over a jigsaw table. When duplicating a design on several pieces of work, time can be saved by making a mimeograph stencil of the design, then cementing it to the underside of a light wood frame and using it as a means of transferring the design out-





line to the work as indicated in Fig. 28.

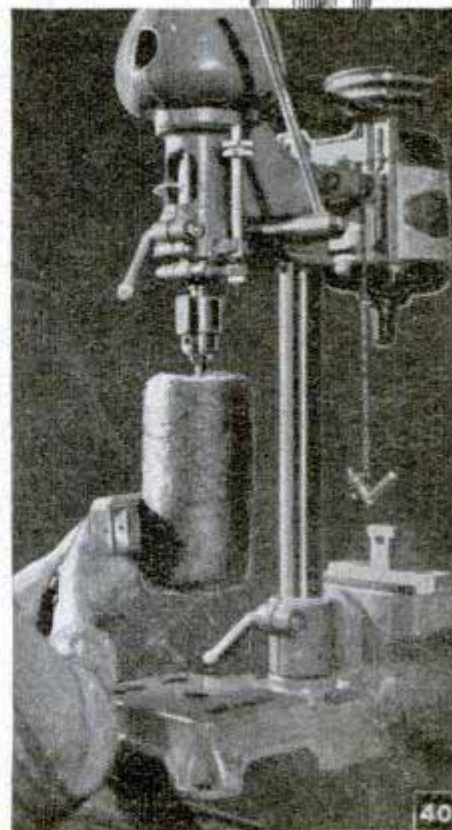
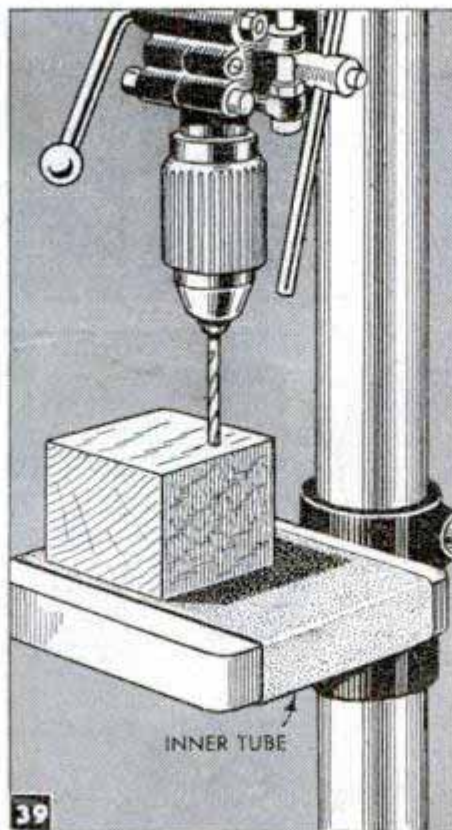
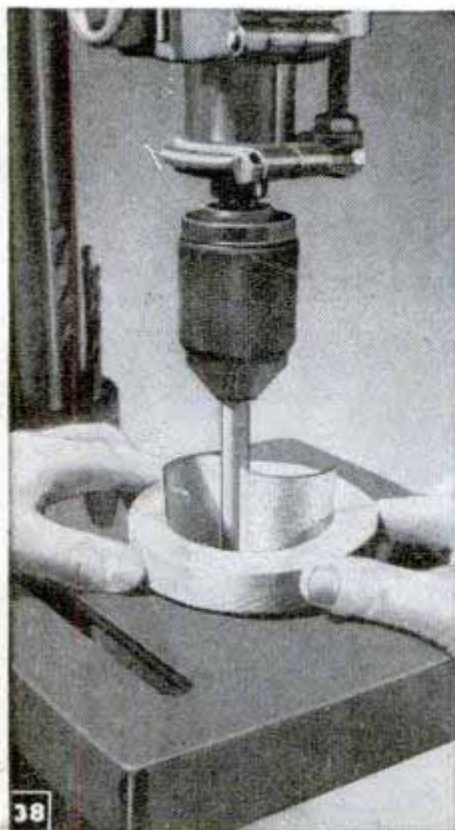
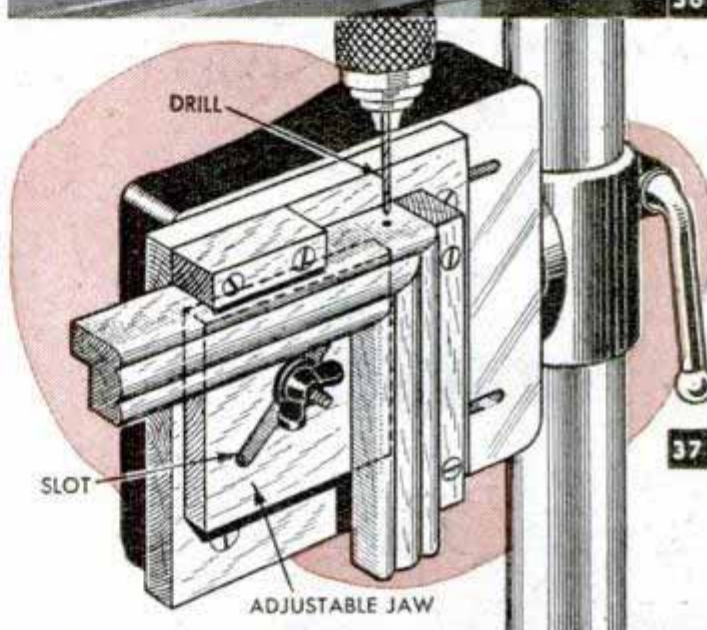
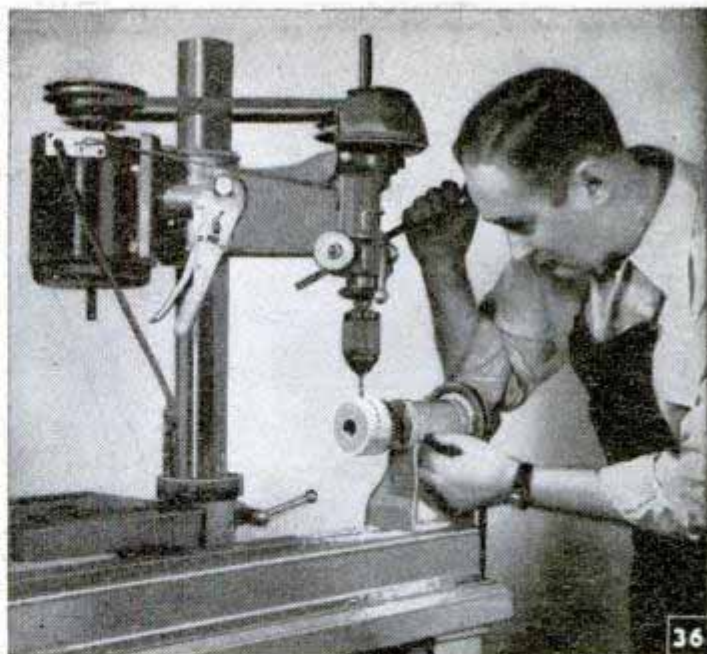
Fig. 30 shows a fixture on a jigsaw motor for making starting holes when cutting inside designs. In this case, the fixture was made from a hole cutter by removing the cutter arm and then inserting the cutter-arm holder tightly in the cone pulley on the motor.

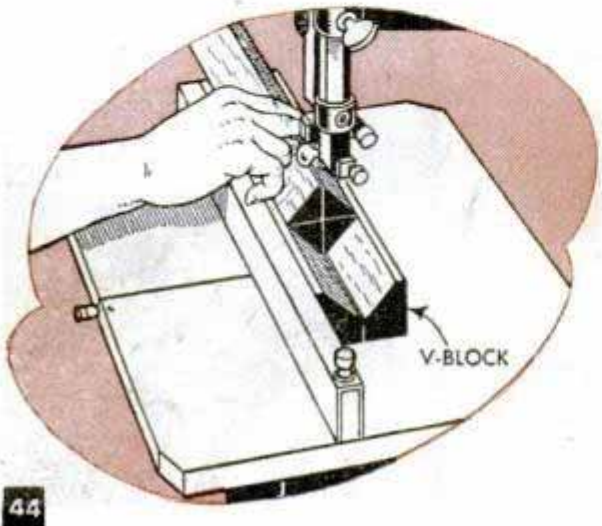
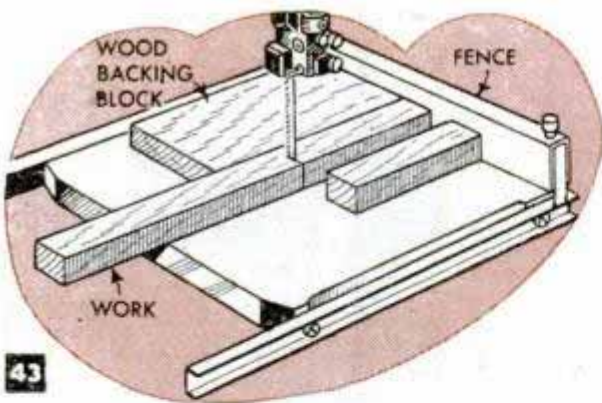
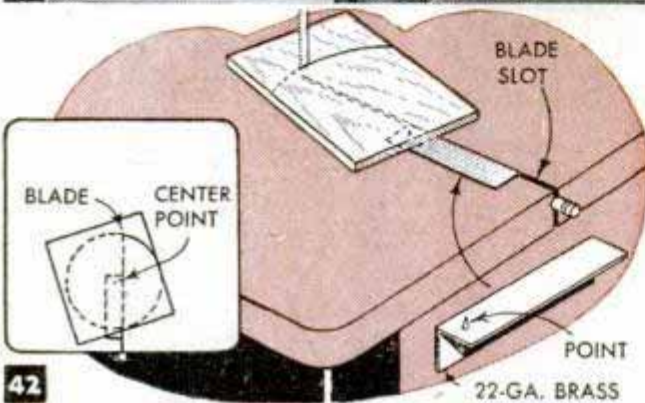
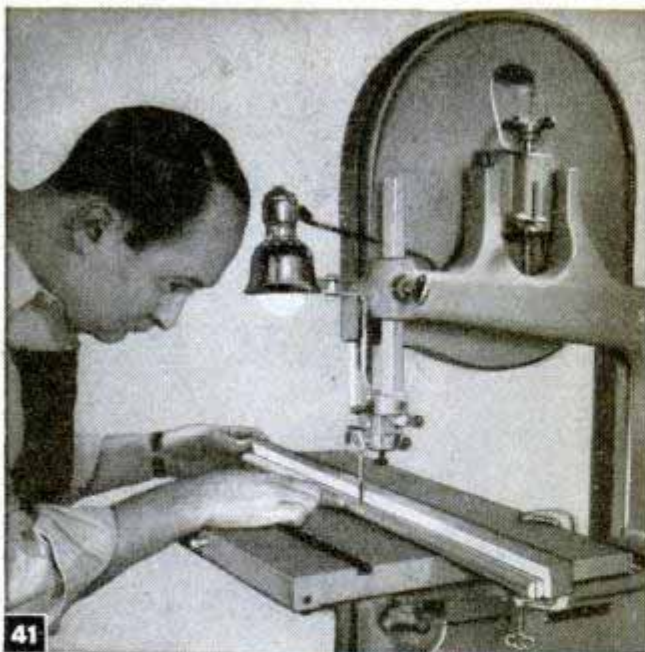
Drill press: Likely, few inexperienced operators realize the versatility of this machine when jigs and fixtures are used in connection with it. As an example, lack of a drill-press vise need not be a handicap if a lathe chuck is at hand. It makes a good substitute as shown in Fig. 31, and can be bolted to the table when used on special setups. As a timesaver when laying out equally spaced holes to be drilled, the jig shown in Fig. 32 is hard to beat. It is nothing more than a "lazy tong" having the pivot holes along one side enlarged to take short pencils. A drill press not having a tilting scale can be set accurately by using angle blocks as shown in Fig. 33.

The problem of cutting round tenons on irregularly shaped work is solved by using a hole cutter in a drill press as shown in Fig. 34. Shoulders are cut after the tenon has been formed. If you have experienced difficulty in holding small round work to drill the end, a cam-locking vise like the one shown in Fig. 35 will help. Pulling the handle causes the wood cam to wedge the work tightly against two blocks screwed to a base.

In Fig. 36 the operator, lacking an indexing head for drilling, moved the drill press up to his lathe and used the indexing head on the latter. The jig pictured in Fig. 37 takes all the worry out of drilling holes in mitered frames for starting nails or screws. If you have a job that requires sanding the inner surfaces of rings it can be done quickly on a drill press using a strip of abrasive cloth held in a split dowel, Fig. 38. A wide strip cut from inner tube and snapped around the drill-press table, Fig. 39, provides a non-slip surface for flat work. A mandrel for a variety of cleaning and polishing operations is shown in Fig. 40. It consists of a wood cylinder wrapped with steel wool in the roll form. The cylinder is mounted on a steel arbor and is grooved lengthwise to hold one end of the steel-wool roll, which then is wound onto the cylinder in a direction opposite to that of rotation. No other fastening is required as the wool will quickly mat itself together in use. Always wear goggles when operating this polisher.

Bandsaws: Although bandsaws usually are limited to sawing irregular outside shapes in wood and metal, there are several simple jigs and fixtures that can be made to increase the versatility of these saws. The jig for splitting a dowel, Fig. 41, is just one of many. It is merely a straightedge to which the dowel to be split is nailed at one end. In use, the straightedge is pushed along a fence. Such a jig is

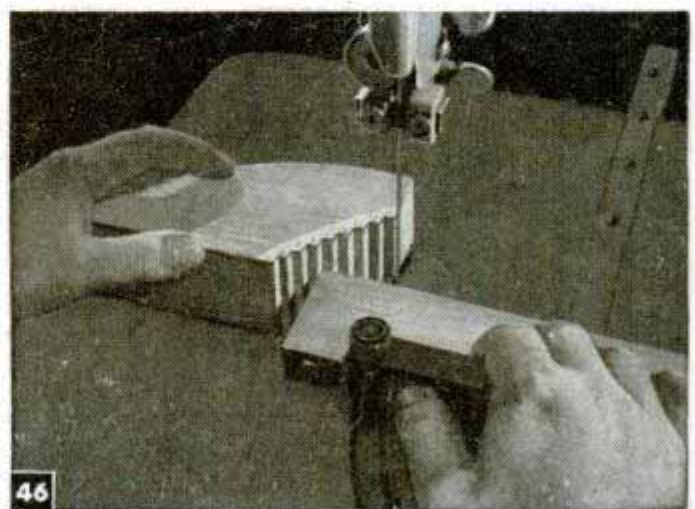
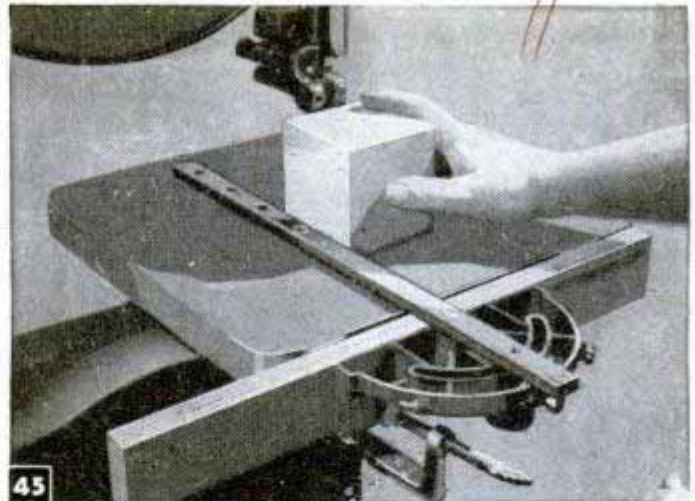




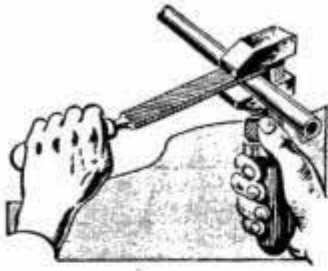
handy for flattening one side of long dowels, which later are cut into short lengths for making doweled-and-glued joints.

The pivot point shown in Fig. 42 simplifies the job of cutting true disks on a bandsaw. The point is soldered near one end of a piece of brass, which is bent at right angles to slip into the blade slot in the table. A wedge holds the brass piece in place. For cutting duplicate pieces to length, a setup like the one shown in Fig. 43 makes a production machine of your bandsaw. The backing block serves as a crosscut guide. If your bandsaw is equipped with a ripping fence, it can be used to center turning squares quickly and accurately. Make a long V-block to slide along the fence and run the saw blade in from one end as shown in Fig. 44. Then place the work in the block and push the assembly against the blade just enough to score the work.

If a bandsaw does not have a ripping fence, one can be improvised for some kinds of work by simply turning the crosscut gauge upside down and using it as shown in Fig. 45. A C-clamp will keep the gauge in position. The step gauge in Fig. 46 is handy when you have varied short lengths of work to cut off. It also is useful in cutting dowels to short lengths when using them in assembly work.



Monkey Wrench Used on Pipe

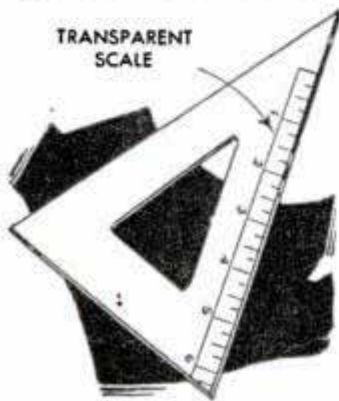


If you want to tighten or loosen pipe and a pipe wrench is not at hand, a monkey wrench and a coarse file can be used. Hold the file against the fixed

jaw and tighten the wrench so that the file and the movable jaw clamp the pipe. Apply leverage with both tools. Also, a monkey wrench can be used in close quarters where the handle of a pipe wrench will not clear obstructions.

Plastic Scale Improves Triangle

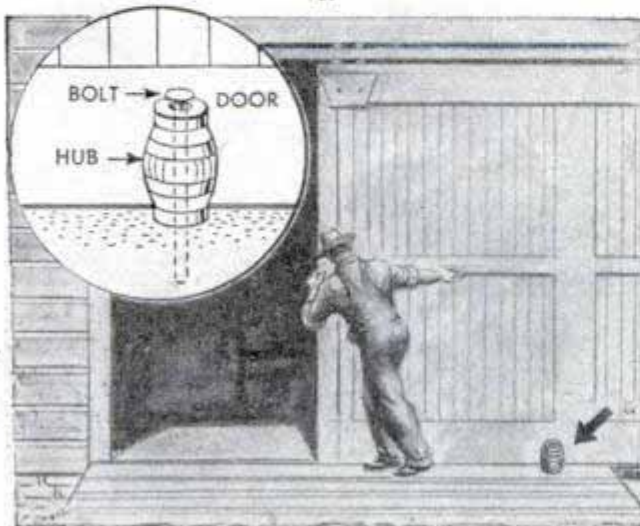
By cementing a transparent plastic scale or rule to one side of a triangle, I found that the instrument would serve a twofold



purpose and save time that is wasted ordinarily in picking up one instrument and laying down the other. A transparent rule is used so that lines on the drawing can be seen through it.—John Krill, Youngstown, Ohio.

Wheel Hub in Concrete Apron Guides Barn Door

Barn doors hung from tracks are inclined to swing outward when being opened or closed, making them difficult to manage. However, if one or more wooden wagon-wheel hubs are mounted on spindles and set in the concrete apron outside the door, they will serve as guides so that handling the door is easy.—Ray Harrison, Fort Qu'Appelle, Sask., Can.



Reflector Sign on Stalled Truck Warns Approaching Traffic

In addition to the required flares, one trucker has a warning sign made of bicycle reflectors which he hangs on the back of his truck when stopping for repairs on the road at night. The letters of the word "Slow" are sufficiently large to be seen easily by any approaching motorist. Hooks are provided to hang the sign.

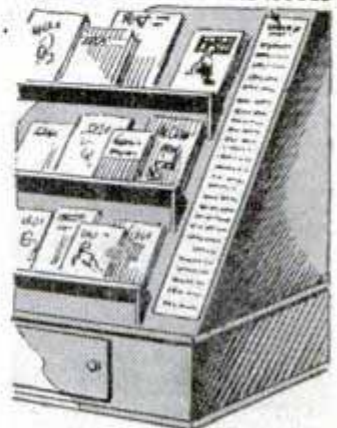
Ends of Welding Hose Reversed To Obtain Longer Wear

Due to continual handling, the hose of an oxyacetylene outfit gets the most wear at the end nearest the torch, and leaks and breaks develop here first. Instead of cutting off the worn section, thereby shortening the hose, reverse it and connect the worn part to the tank end.

Publication Dates for Magazines Posted on Display Rack

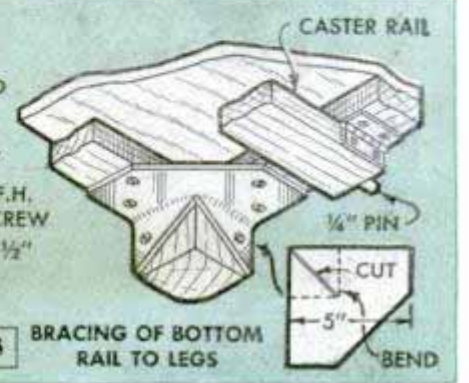
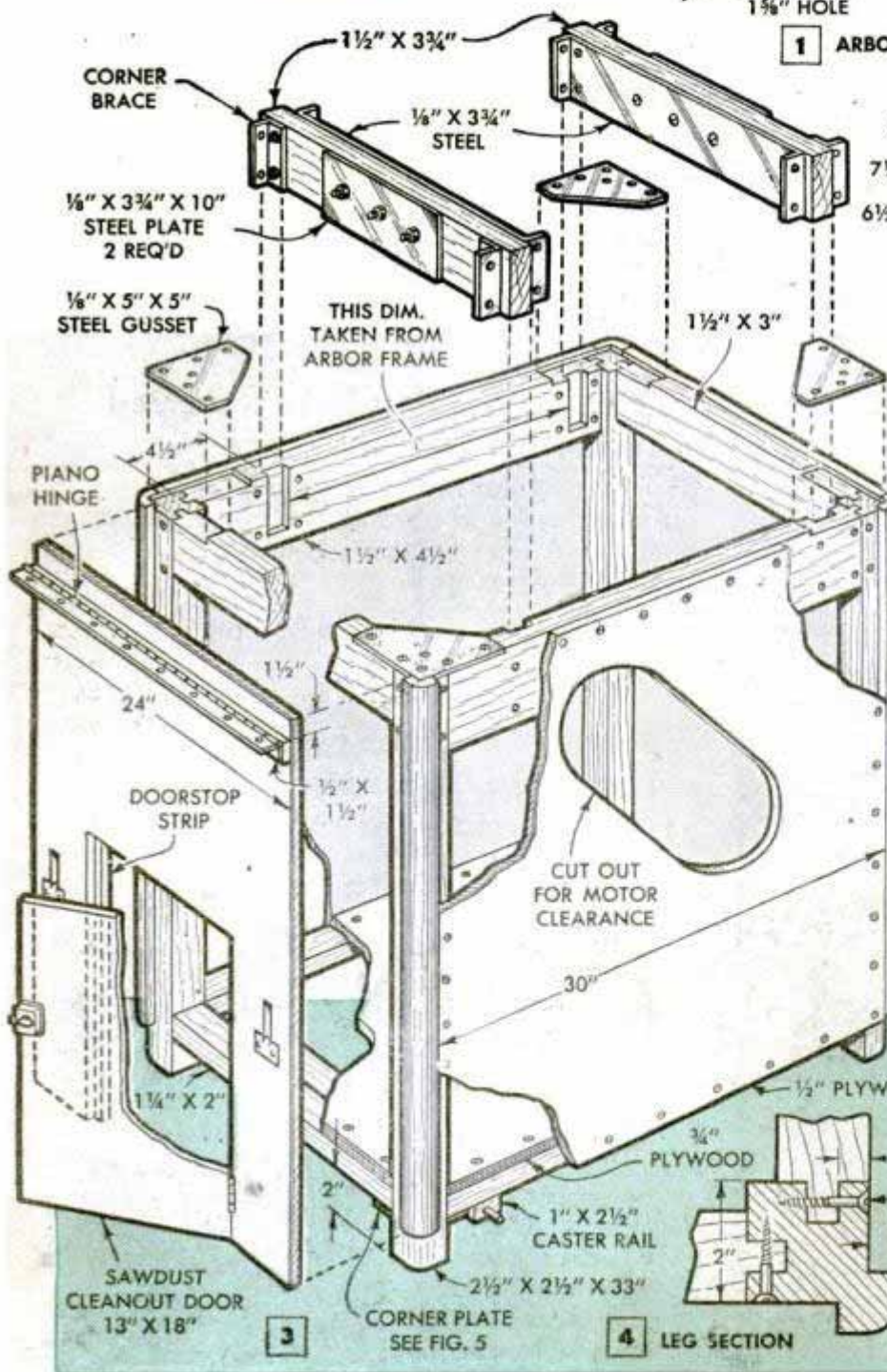
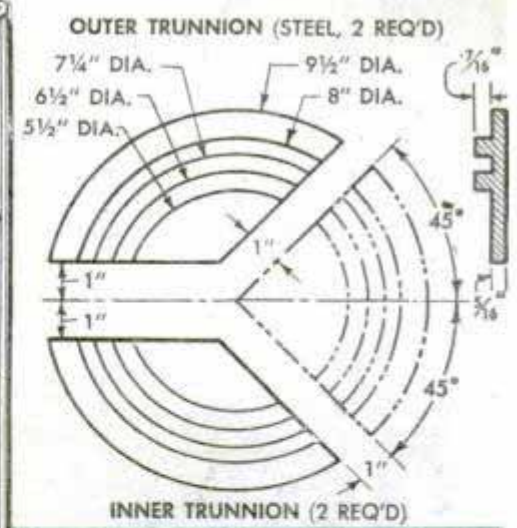
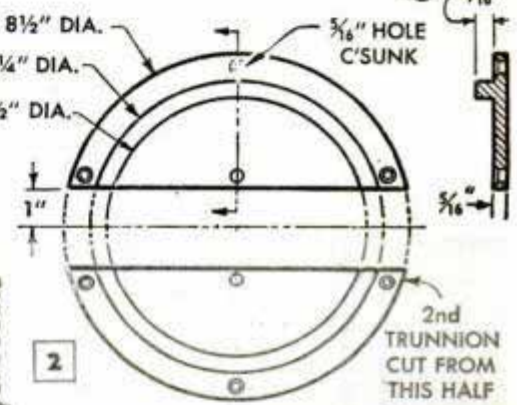
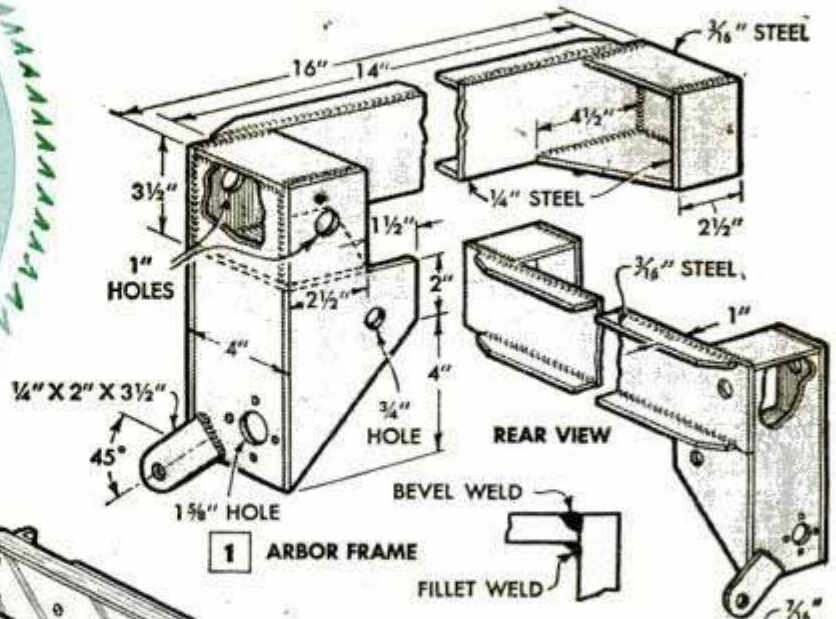
To inform regular customers when the next issue of their favorite magazine is due to appear on the newsstands, a dealer prints a list of publication dates, along with the names of the magazines, on a large panel which is fastened to one side of the display rack. Thus, if the magazine is not on the stand, the reader can tell when the next issue is due by reference to the list.

DATE MAGAZINES ARE ISSUED



Features

Takes a 10-in. blade,
which raises, lowers, tilts
Has built-in sawdust chute
Large 30 by 40-in. table
Cuts 2½ in. deep with
a 10-in. blade



HAS TILTING-ARBOR

By Elman Wood

Part I

Hinged side and back extensions increase the size of the table so that the ripping fence can be set 25 in. from the saw blade. Rips to the center of 48-in. plywood panel

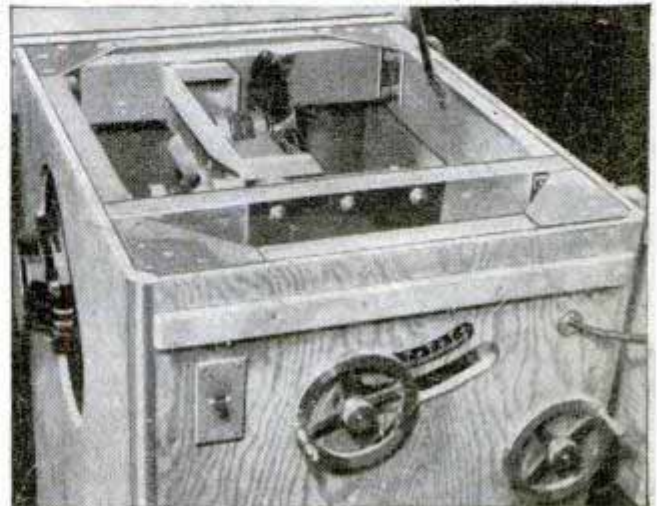
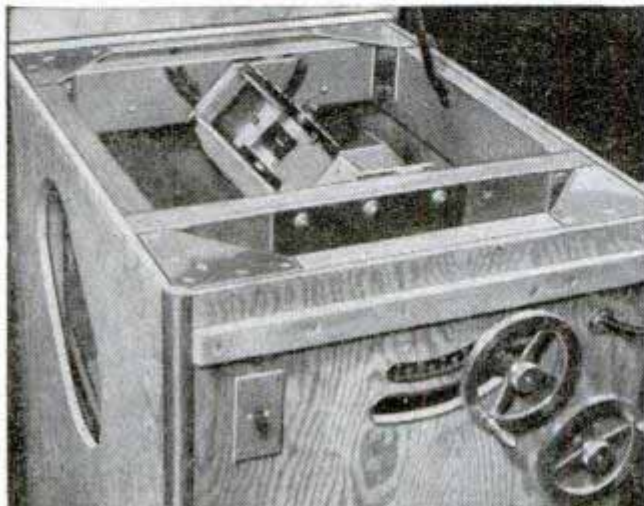
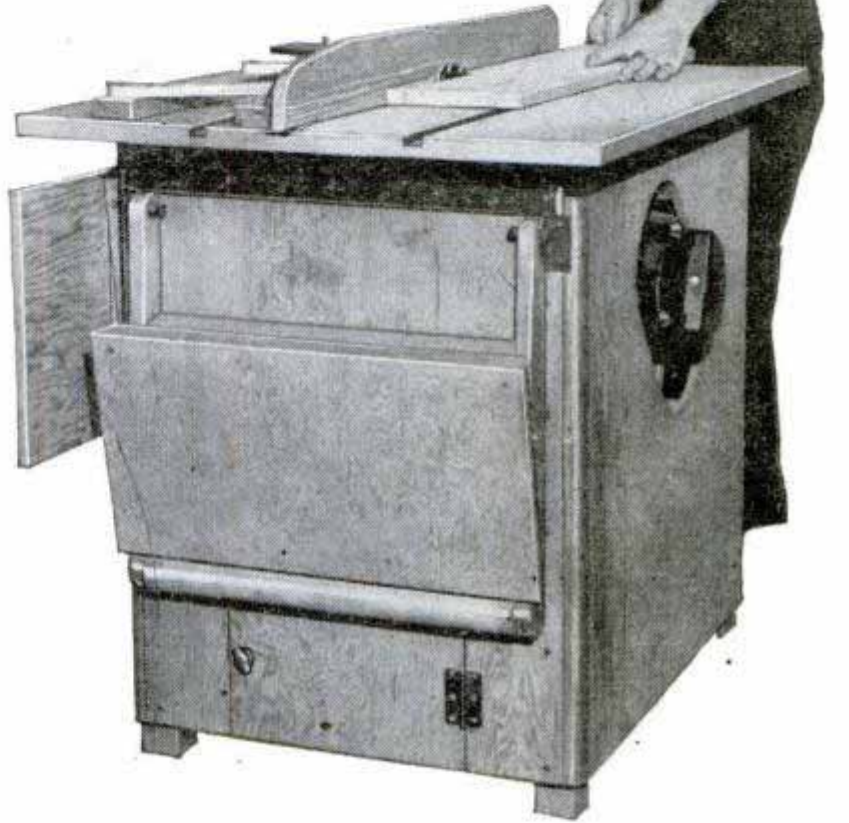
WOODWORKING craftsmen will rate this tilting-arbor table saw "tops" because of its versatility, speed and accuracy. By turning one handwheel the blade is raised or lowered for any depth setting within its capacity. A few turns of another handwheel tilt the blade for any angle cut up to 45 deg., the settings being indicated by a degree scale and pointer. The saw table remains always in a horizontal position; only the saw arbor tilts. The hardwood table with hinged extensions is plenty large enough to handle a 4 by 8-ft. plywood panel. An enclosed base catches all the sawdust, and swivel casters fitted to built-in foot lifts enable the operator to roll the saw to any part of the shop.

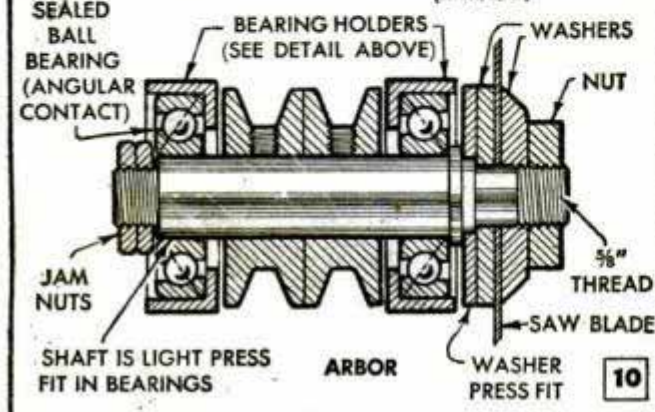
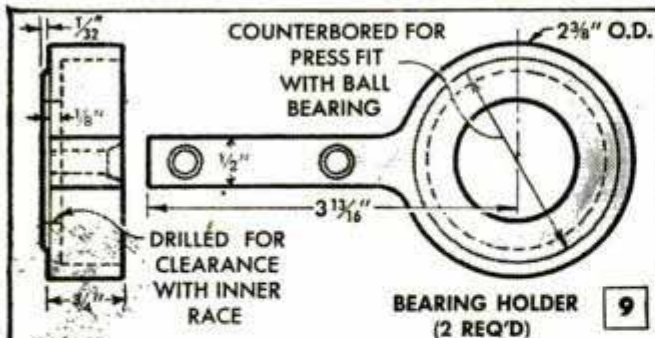
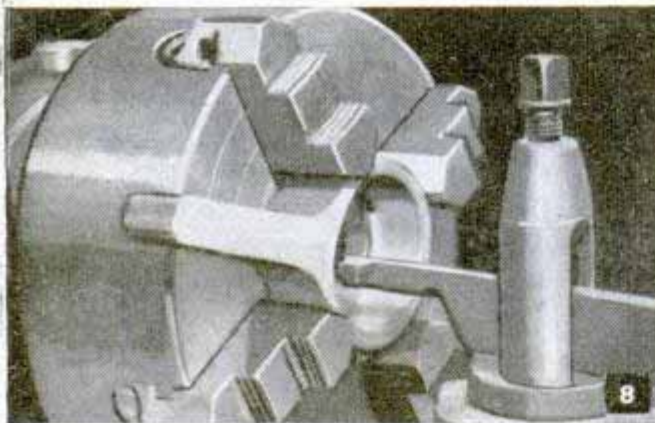
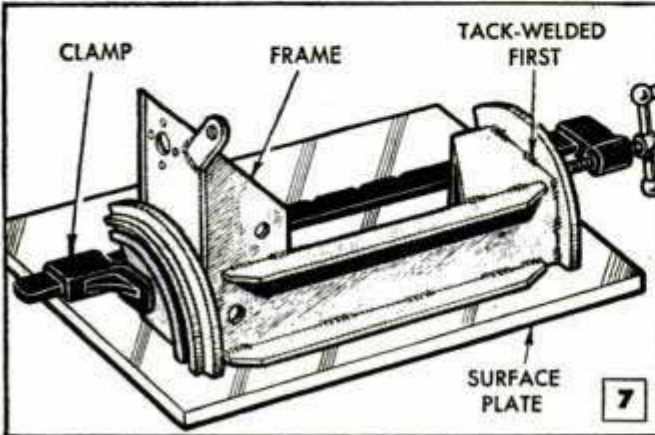
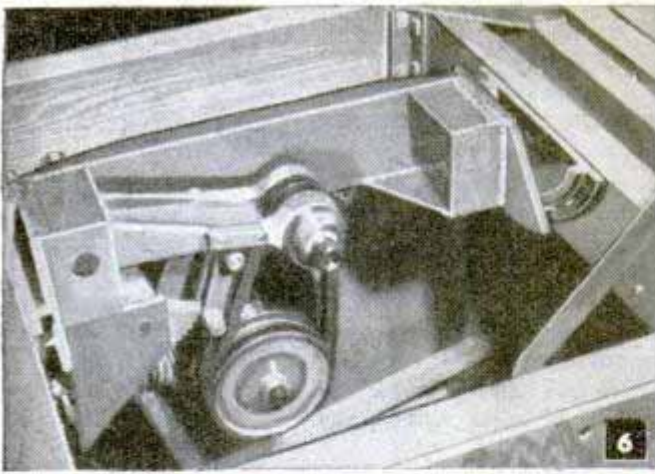
Construction should begin with the saw-base frame, Fig. 3. Building the base requires care in cutting and fitting as it must be strong and rigid to support the motor and arbor assembly. Use well-seasoned, selected oak for legs and rails. Rabbet the legs on adjacent sides as in Fig. 4 to take side and end panels flush. Both top and bottom rails are mortised into the legs, but note that the upper side rails are 4½ in. wide and that the end ones are 3 in. The tenons are glued and keyed with screws, and after the joining is completed, steel gussets are mortised into the

top rails across the four corners, and the bottom rails are braced to the legs with steel corner plates cut, bent and attached as in Fig. 5. Caster rails, one across each end, are hinged to the underside of the

An accurate scale with pointer shows all angles from 0 to 45 deg. Here blade is tilted to full 45-deg. angle

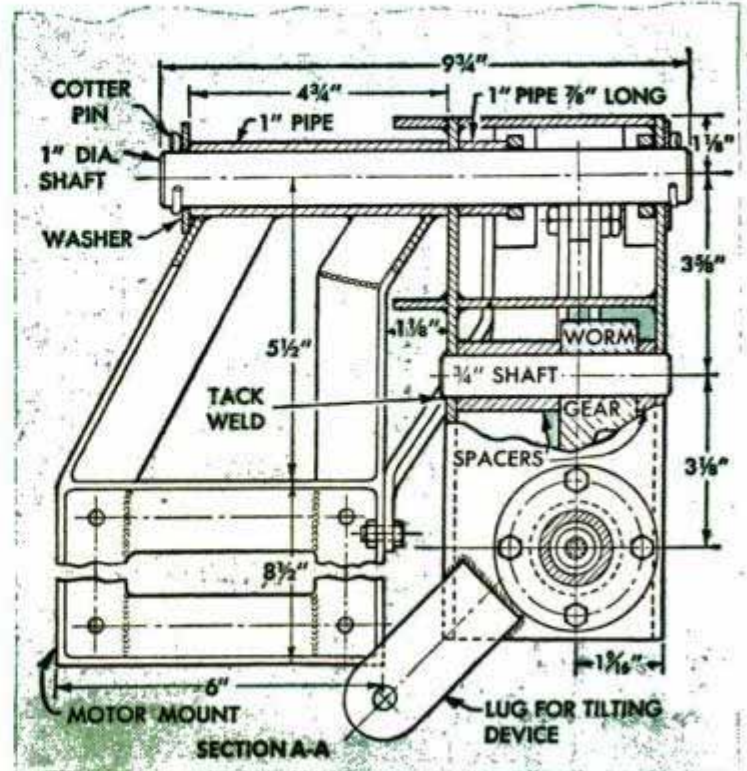
Saw frame and arbor assembly completed ready for the table. Base is painted before table is installed





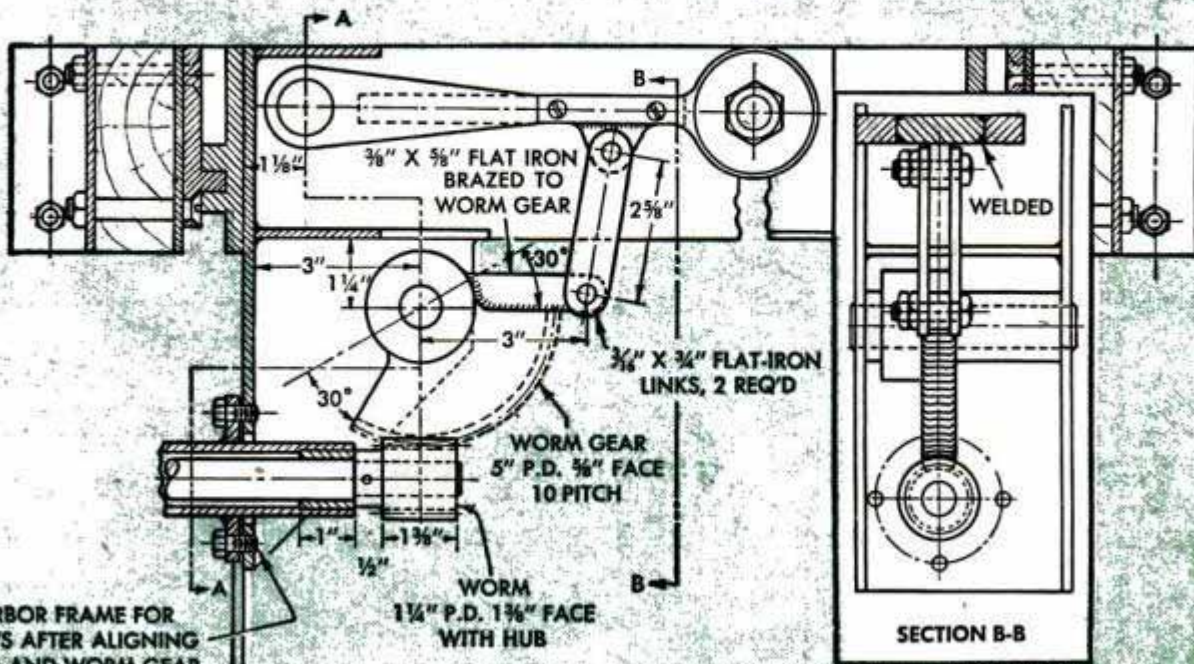
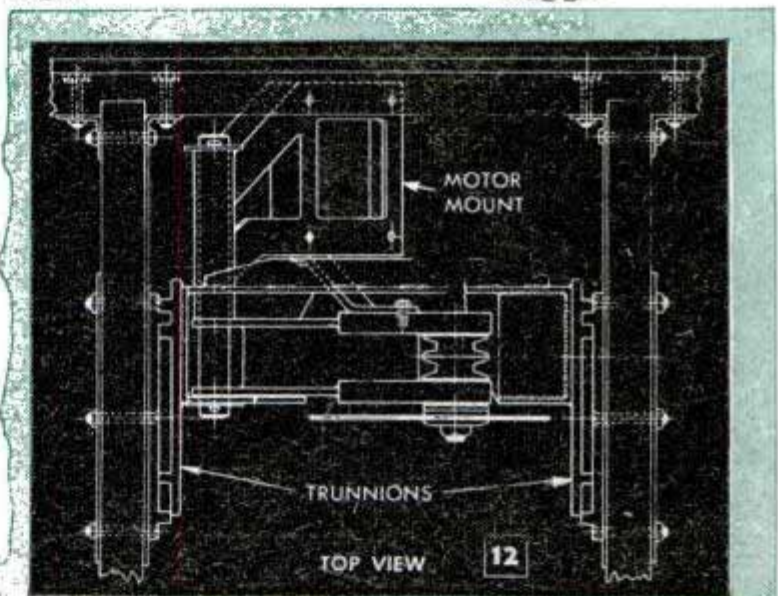
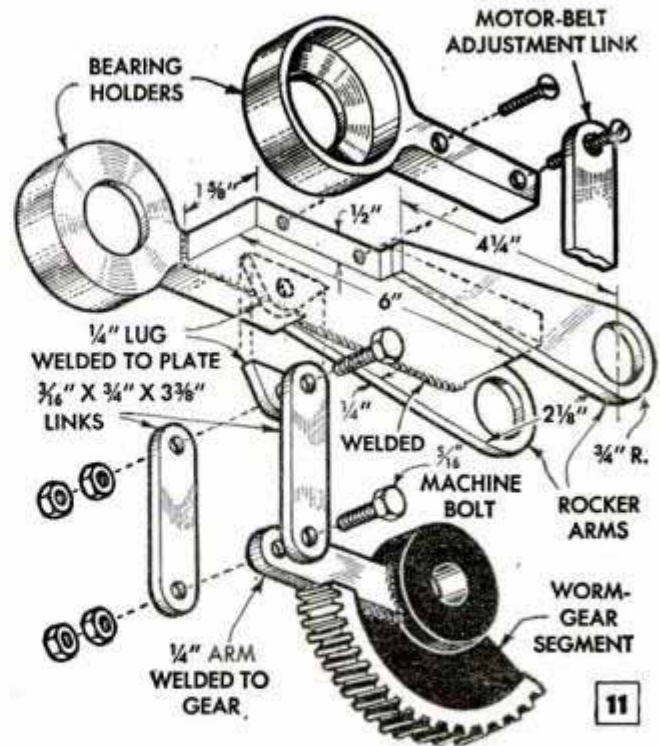
frame rails as in Figs. 3 and 5. The plywood bottom and the rear and right-side panels can now be installed, but the front and left-side panels are omitted at this stage as it is necessary to determine later the location of the handwheels and the size of the opening for the motor.

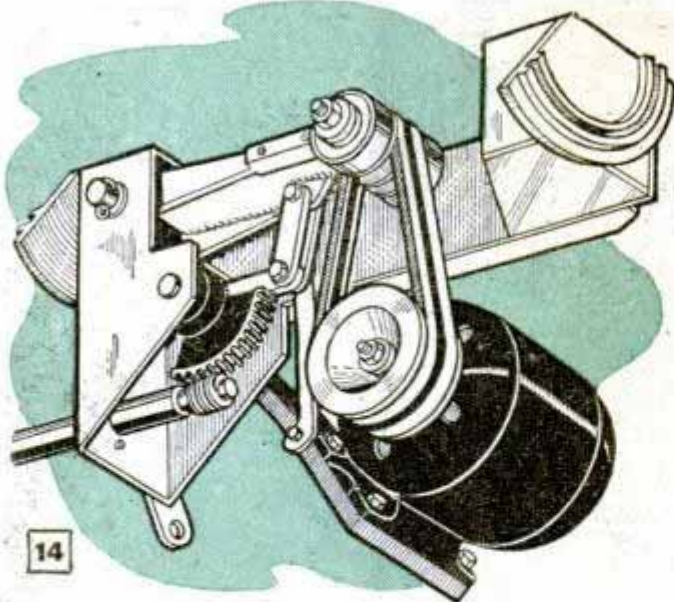
The arbor frame, shown in front and rear views in Fig. 1, comes next. This consists of a number of parts cut from steel plate and welded together to form the unit shown. This frame swings on trunnions made as detailed in Fig. 2. Each trunnion consists of an inner and outer segment, the two trunnions requiring four segments in all. These four segments are obtained from 3/4-in. mild-steel plate turned first to the form of disks, which are then cut into segments as indicated in Fig. 2. Inner segments are welded to the arbor frame while the outer ones are attached to the steel-faced cross members in Fig. 3. In installing a trunnion-mounted saw arbor there are two precise requirements: The center line of the blade must coincide exactly with the center line of the outer trunnion segments and the center of rotation of the trunnions must be at that point where the plane of the blade intersects that of the saw-table top. Fig. 6 shows the arbor and arbor frame in position and Fig. 7 shows the first step in positioning the inner trunnion segments on the arbor frame. Use a surface plate or other flat surface and make sure that the parts are exactly in line before welding. This done, measure the length of the arbor frame, plus the four trunnion segments. This gives you the distance between the two trunnion-support members, Fig. 1. Face the members with steel plates as



shown and drill the bolt holes. While the members are temporarily in position determine the center line of the saw base and scribe it on both members for guidance in locating the trunnions. Then slip the arbor frame and trunnions between the supports. The arbor frame should fit snugly but should swing on the trunnions with only a slight frictional drag. With all parts located on the center line of the saw base, clamp the outer trunnion segments to the cross members and lift out the whole assembly. Using each trunnion segment as a drilling jig, drill holes and bolt the segments to the cross members.

Next, come the arbor-bearing holders shown in detail in Fig. 9, and in section in Fig. 10, with the arbor, pulley and bearings in place. Holders are rough-cut from $\frac{3}{4}$ -in. steel plate with a cutting torch or metal-cutting bandsaw and are recessed and bored through to suit the bearings as in Fig. 8. Bearings should be a fairly tight press fit in the recesses. The arbor or spindle is machined from steel and finish-ground to final dimensions. Note that it is flanged at the saw-blade end to form a seat for the press-fitted spacing washer. The spindle is shouldered and threaded at the left-hand end for jam nuts for pre-loading the bearings. Pulleys are locked on the spindle with socket-head setscrews, the ends of the setscrews seating on a flat, milled or filed on the saw spindle. Dimensions of the spindle through the bearings, Fig. 9, and also the bearing-recess diameter in Fig. 10, have been



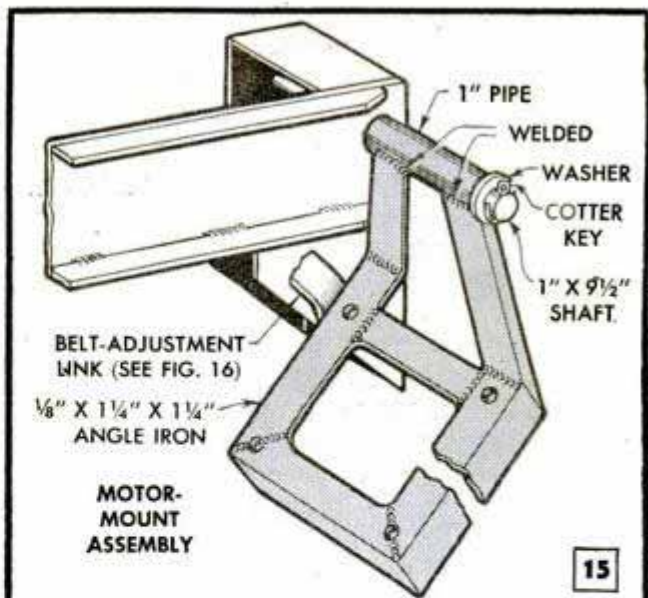


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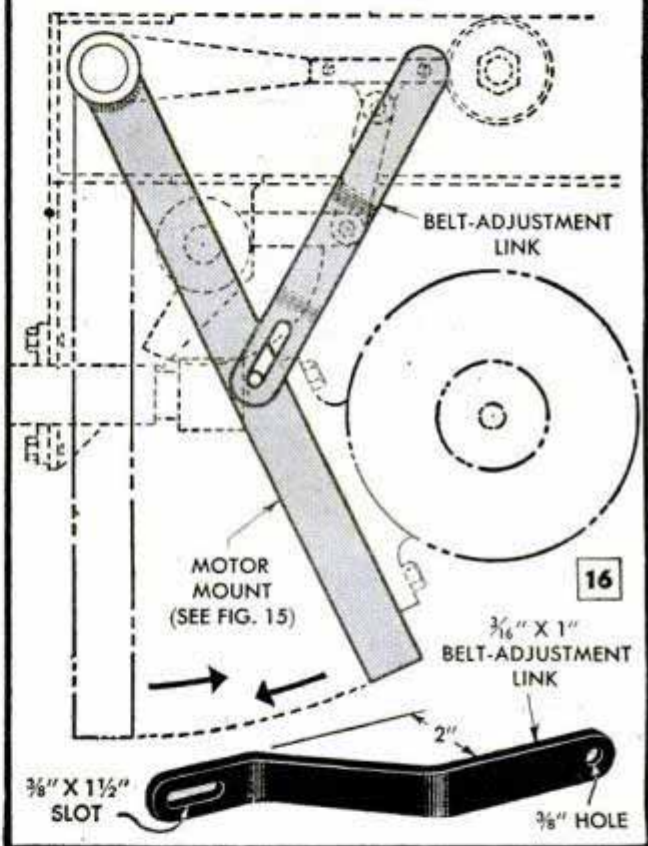
purposely omitted. These measurements must be taken from the bearings at hand.

Now, before going farther, study carefully sections A-A and B-B in Fig. 13, also the perspective and top views in Figs. 11 and 12. From Fig. 11 you will see that a 1/2-in. steel plate forms the mounting base for the saw-arbor assembly. Notches milled in opposite edges take the ends of the bearing holders, and rocker arms welded to the mounting base allow it to pivot on a rocker shaft for raising and lowering the saw blade and motor as a unit. When this assembly is complete, the saw spindle should turn freely in the bearings. Check this before finally welding the bearing holders in place. The motor mount, a separate assembly built up by welding together steel angles and flats, is welded to a length of 1-in. pipe which telescopes over the rocker shaft and fits snugly against the rocker arms. See Fig. 13, section A-A, and also the top view, Fig. 12. Shaft, pipe sleeve and arbor mounting are held in place in the arbor frame by washers and cotter keys. When assembled, the parts should move freely but without any end play. The motor mount is not fully dimensioned as it must be made to fit the base of the motor you are to use. Final unit in this assembly is the belt-adjustment link, Figs. 15 and 16. It's made from flat iron, bent to approximately a 2-in. offset and drilled and slotted as indicated. Upper end is bolted to the left bearing holder, Fig. 12, and the lower end to the motor mount. Loosening the lower bolt allows the motor to be moved up or down to obtain correct belt tension.

The raising-and-lowering mechanism consists of a worm and worm-gear segment, the latter made from an ordinary gear by simply cutting away all but a 120-deg. segment. An arm made from 1/4-in. flat iron is welded or brazed to the segment as in Figs. 11 and 13. This arm is connected to



15



16

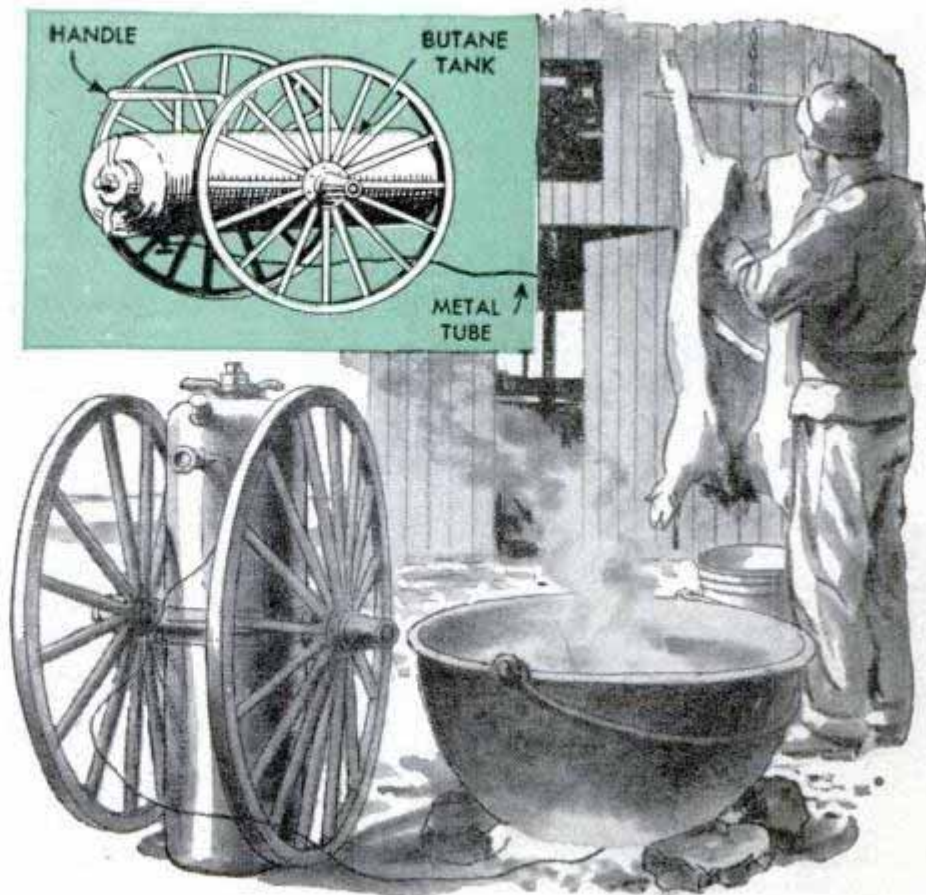
a lug welded to the underside of the arbor plate by two links as shown. The gear segment turns on a shaft passing through the sides of the boxed end of the arbor frame as in Fig. 14. The shaft is made a drive fit in the holes drilled in the frame. Spacers cut from pipe position the worm-gear segment on the shaft, as shown in Fig. 13, section A-A. Although not detailed, the raising mechanism will operate more smoothly if the gear segment is fitted with a bronze bushing. If this is done, the bushing should be a tight drive fit in a reamed hole. Fig. 13 shows worm and worm shaft in position.

(To be continued)

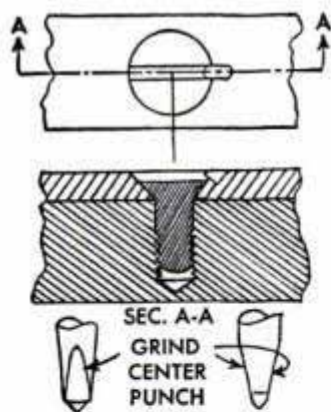
☐ A set of socket wrenches can be made by using the heads of hexagon socket screws and welding handles to them.

For cooking feed mixtures in an open kettle, heating water at butchering time and for other purposes requiring quick, concentrated heat, one farmer uses a tank of bottled gas mounted on a cart so that it can be moved about as needed. Large-diameter wheels on the cart make the unit easy to push over rough ground. The tank carriage consists of stub axles welded to a heavy metal band which is drawn tightly around the tank with clamping bolts. Although wood wheels from an old buggy are shown, any metal implement wheels will do very well. Gas from the tank feeds through a copper tube, 5 to 7 ft. long. The flame is controlled by the outlet valve on the tank and the tubing can be bent to direct the flame to any point desired.

"Bottled Gas" Tank Mounted on Cart Makes a Portable Farm Heating Unit

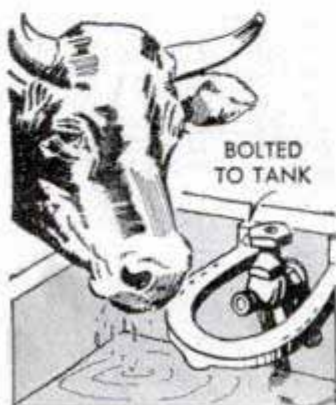


Locking Countersunk Screws



Locking countersunk screws can be done by punching the metal at the edge of the countersunk hole to force the metal into the screw slot. Flats are ground on two sides of the punch, to make a better "lock."

Watering-Tank Faucet Is Guarded By Old Horseshoe

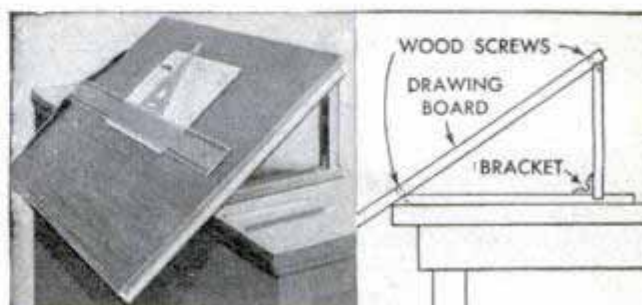


If a horseshoe is bolted to the side of a watering tank to serve as a guard for the faucet, it will keep cattle from bending or breaking the pipe connection. This may occur when a number of cattle crowd around the

tank. The guard should be bolted firmly in place by means of bolts extending through the shoe calks and the end of the tank.

Rack Tilts Drawing Board For Table-Top Use

Although this little rack holds a drawing board at a fixed angle, it also tilts the board so that it is more convenient to use than in a flat position on a desk or table. Each half of the rack is a right-angle brace, consisting of two parts which are assembled with a metal angle bracket as shown. Each brace is attached to the drawing board with flat-head screws, and the bottom surfaces of both are padded with felt to prevent marring the table on which the rack is used. Note that the braces are attached to the upper half of the board to allow it to extend over the edge of the table.



Mechanics' Cleaning Tank and Rack Made From Oil Drum

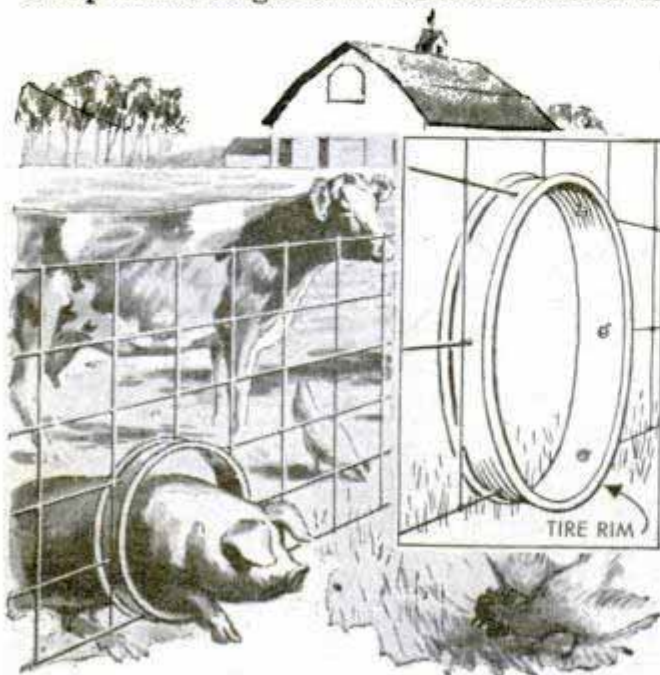


Inexpensive to make, this cleaning tank and racks require only an oil drum and a few odds and ends of lumber. The drum is cut lengthwise and then halfway around the ends so the sides can be bent back to form the racks. The ends are cut to be level. When cutting and forming, be sure to lay out the work so the drain plug will be at the bottom. A wooden cradle holds the tank at the proper working level.

Wilford Leach, Williamsburg, Va.

Auto-Wheel Rim Makes Creep For Farm Animals

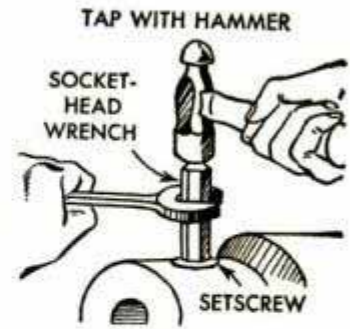
Small animals, such as hogs and sheep will be able to pass through this auto-rim creep while larger animals are confined to



one field. The rim is held in place by means of holes to which the wires of the fence are attached.—Wm. P. Houser, Organ, N. Mex.

Loosening "Frozen" Setscrews

Socket-head setscrews, which are "frozen" or rusted in, can be loosened and removed by the following method: Grip the setscrew wrench with an end wrench as shown and tap the former lightly with a hammer as tension is applied. The hammering plus the tension of the end wrench helps break the threads loose. Square-head setscrews are loosened by a similar method.



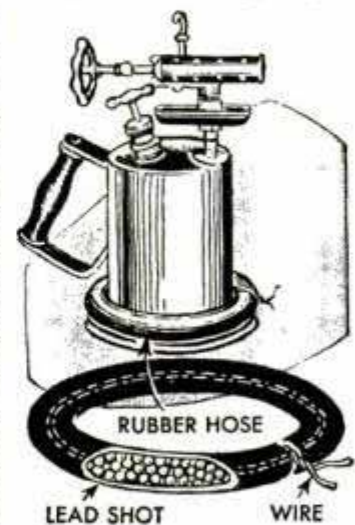
Replacing Flywheel Ring Gears

Since ring gears on flywheels are a shrink fit, it's necessary to heat them before they can be installed and this calls for the use of an acetylene torch or some similar source of heat. However, if such equipment is not at hand, the gear can be heated as follows: After removing the old ring, lay the new one on several bricks to support it 3 or 4 in. above the ground. Then place some old rags in a circle beneath it and saturate them with gasoline. Ignite the rags and allow them to burn down. Then lift the gear with two pairs of pliers and slip it in place. Adjust the gear by tapping it with a punch as the metal cools.

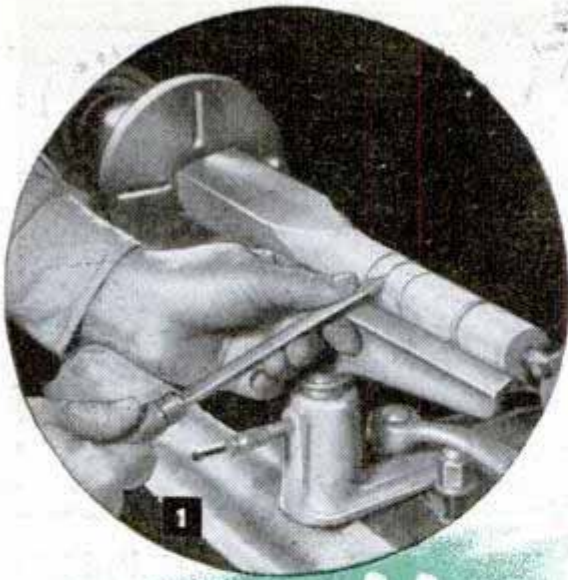
D. W. Brentlinger, Richmond, Calif.

Weighted Hose Keeps Torch Upright

One plumber who had trouble keeping his blowtorch from tipping over fitted a piece of garden hose filled with lead shot around the base. This adds enough weight to the bottom of the torch to prevent it being top heavy. A piece of wire is inserted in the hose and the ends are twisted tightly to keep the shot from spilling out. As a further precaution, wrap tape around the hose where the ends join.



Edgar Barnhart, Whittier, Calif.



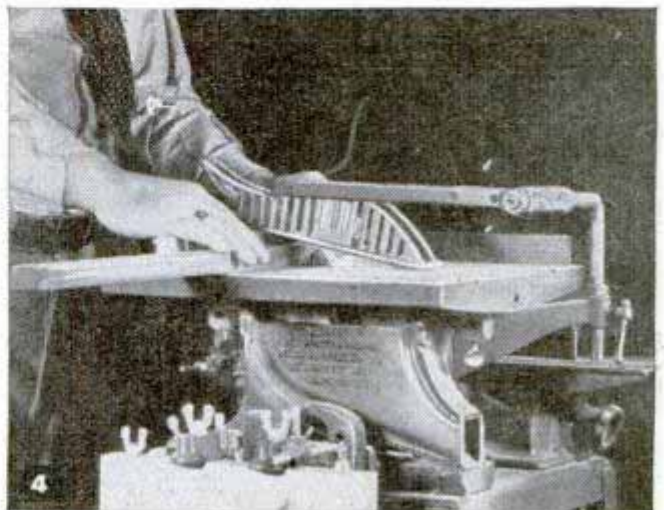
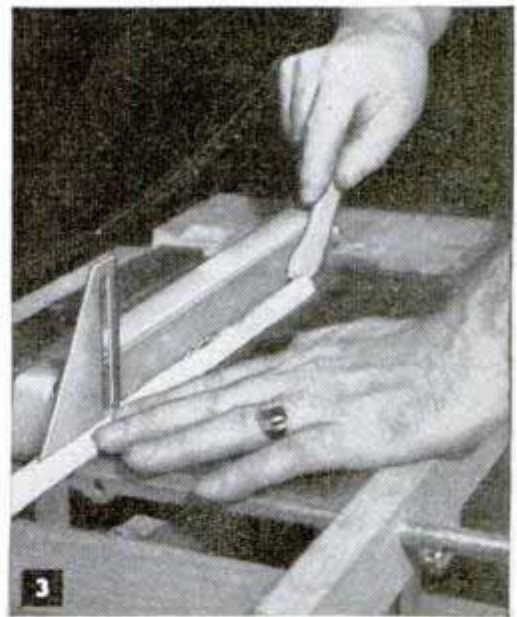
Do it Safely

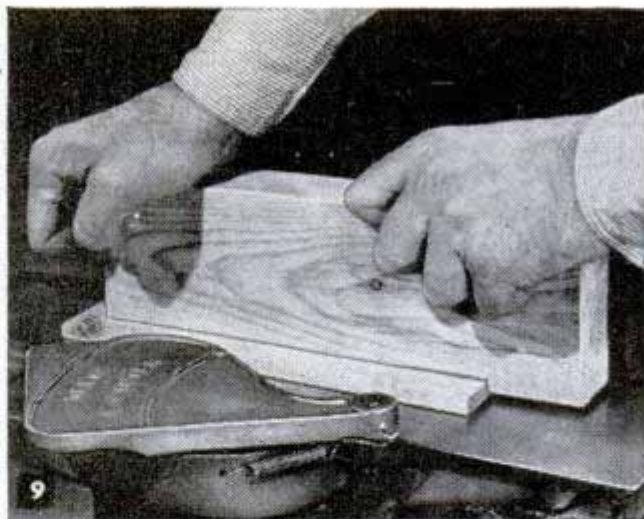
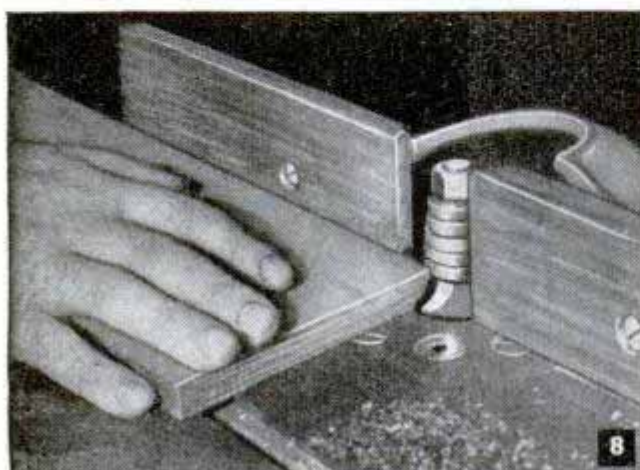
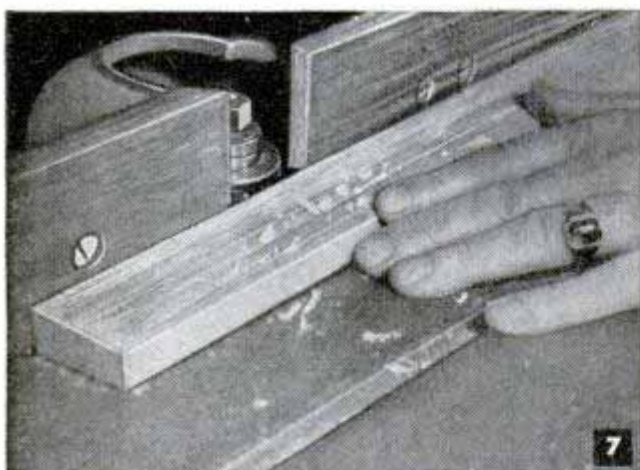
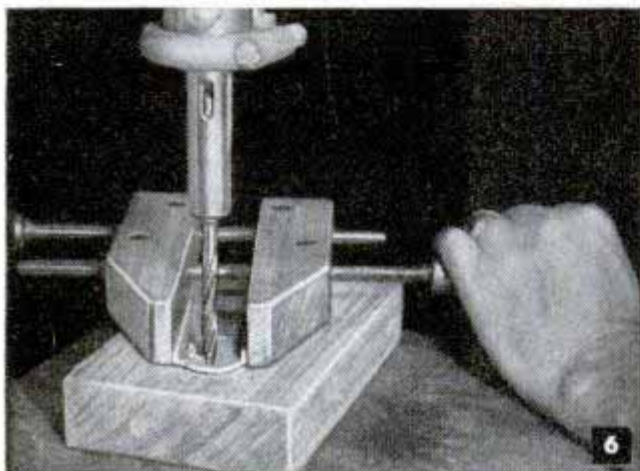
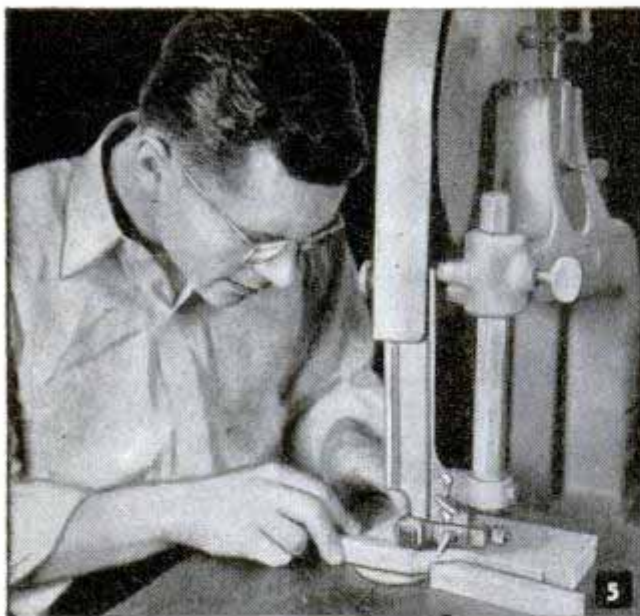
By Edward R. Lucas



HOME WORKSHOP power machines can be operated safely if you make a habit of always observing simple safety precautions. As an example, take the wood lathe, Figs. 1 and 2. With the exception of the jigsaw it is one of the safest machines to operate provided the work is properly mounted, correctly centered and securely fastened, either between the centers or on the faceplate or screw chuck. When rough-turning a square into a spindle, Fig. 1, spindle speed as a rule should not exceed 500 to 700 r.p.m., depending on the size of the stock. After the square has been turned round, the turning tools do better work at higher speeds, ranging up to 3000 r.p.m. on turnings of small diameter. Unless you regularly wear glasses, goggles are a good eye protection when doing any wood-lathe work, Fig. 2. Clip a necktie to your shirt or remove it entirely and avoid reaching over the rotating work with a dangling shirt sleeve. Keep the tool rest close to the work and hold the turning tool firmly with both hands as in Fig. 2.

A careful operator uses a push stick, Fig. 3, when ripping narrow strips from thin stock on the circular saw. The stick also serves as a hold-down. The saw blade is lowered, or the table raised, so that the teeth just cut through the thickness of the stock, exposing as little of the blade as possible. When crosscutting long pieces, wide boards, or in any operation where one setting is made for the duplication of parts, it's a good idea to use the blade guard, Fig. 4. Most late-model machines are equipped with a combination guard and splitter, also an anti-kickback device which is a part of



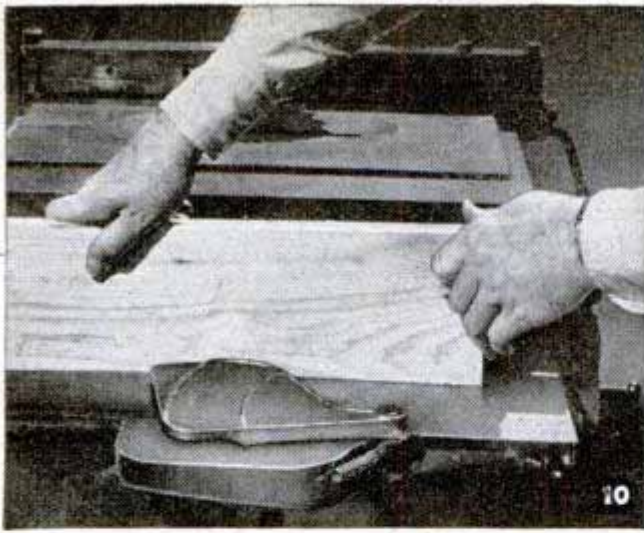


the unit. This unit is so arranged that you can use the guard and splitter in combination, the guard alone as in Fig. 4, or the splitter separately as in Fig. 3. It's a good safety device and should be used on all sawing operations except, of course, when grooving or tenoning with the dado head or in any sawing operation where the blade does not cut through the stock.

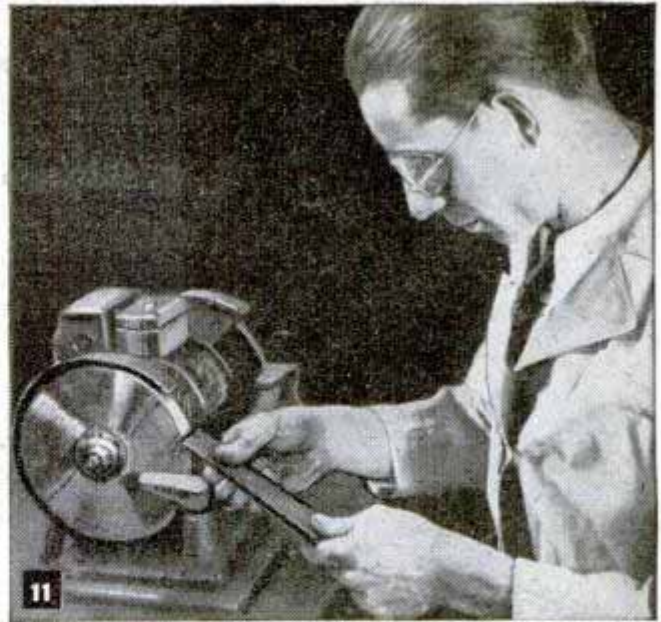
The bandsaw, Fig. 5, is another of the comparatively safe workshop power tools because all moving parts are well guarded and during almost all common operations the entire cutting area of the blade is in the wood. The important thing about safe bandsaw operation is adjusting the upper blade guide so that the stock just clears under it. Adjust the blade tension according to manufacturer's directions. If you're working on small pieces of stock, as in Fig. 5, be very cautious as the blade breaks through at the finish of the cut. That's the time it might nip your fingers unless you are careful to have a part of each hand resting firmly on the machine table. Note position of the operator's hands in Fig. 5.

Small metal parts to be drilled should always be held with a clamp, Fig. 6, or in a drill vise. Otherwise you're really asking for it as the work may "pick up" at the instant the hole breaks through and rotate with the bit. If your hands happen to be in the way you may get a serious injury. Make it a rule always to clamp small work securely before drilling.

In all straight shaper work a fence is used to guide the stock, Figs. 7 and 8, and the adjustable fixture which supports the fence usually has a housing or cover that partially encloses the spindle and cutters. When molding curved work the stock is held against a pin inserted into the machine table near the spindle. The pin serves as a guide to start the cut. After the cut has been started, uncut portions of the edge being molded ride on depth collars which keep the stock the same distance from the spindle, resulting in a molding cut of uni-



form depth. In this operation the cutters are covered by a large flat disk which rotates with the spindle. The essential thing in safe shaper operation is to keep a firm hold on the stock, more especially when shaping curved work. Press the stock into close contact with the table and shift the hands alternately when feeding the work, either freehand or along the fence. When cutting a deep molded shape, start with a light cut and make several passes, adjusting the spindle and shaper head to take a slightly deeper cut at each pass of the work. Mount the cutter to work on the lower corner of the stock, Fig. 8, as in this position the cutting edges are not exposed above the surface. Be sure that the spindle nut, fence and spindle-adjusting device are



tightened securely into place before you start the machine.

To be safe when planing thin stock on the jointer, use a notched hold-down as in Fig. 9. This is made from a length of 2 by 4-in. stock, notched, or fitted with a small block which catches the end of the stock and prevents the material from being thrown backward by the action of the cutter head. When edging stock, plane with the grain as in Fig. 10. This gives a smoother cut and it's safer because there's no danger of the stock being kicked back by the knives. If you sharpen tools on a high-speed grinder, Fig. 11, not equipped with eye shields, it's safer to wear goggles.

Route Map Is Pasted to Window-Shade Roller for Ready Reference

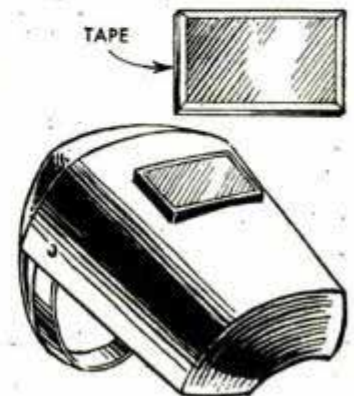
Salesmen, truck drivers and others whose work carries them over unfamiliar highways and streets will find that a road



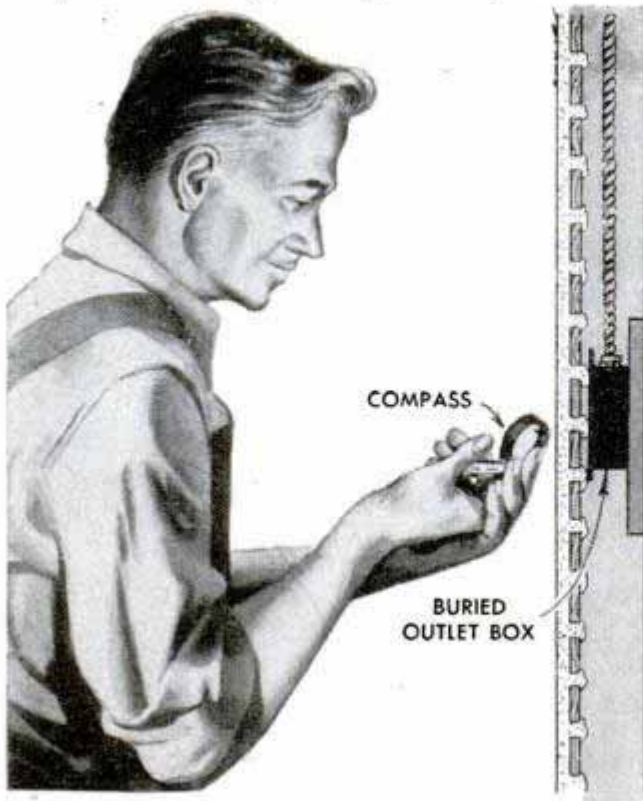
or city map pasted to a window-shade roller and attached to the car above the windshield is handy for quick reference. The roller is shortened to fit the width of the map and is held by regular shade brackets screwed to the car.

"Gasket" for Welding-Helmet Lens

Frequently the gaskets that are used on welding-helmet lenses are lost or damaged so that light from the electric arc leaks through, resulting in severe eyestrain. To overcome this, one welder wraps friction tape around the edges of the dark glass only, allowing it to overlap slightly. This serves as an efficient gasket that will not become lost or leak light.—G. J. Davis, New York City.



Location of Hidden Outlet Boxes Determined by Using Compass



Electrical outlet boxes for wall plugs often become "lost" when covered by mistake during plastering. To locate the buried box, use a magnetic compass instead of marring the wall by tapping and exploratory digging. Hold the compass in the normal, horizontal position and slide it up and down the wall. When near any large piece of metal, such as an outlet box, a marked deflection of the needle will occur.

H. A. Highstone, Santa Rosa, Calif.

Wrench Speeds Chuck Operation

Time is saved when opening or closing the jaws of a universal chuck if one arm of the wrench is fitted with a round knob or handle so that it can be spun rapidly. Drill a hole in the end of one arm and attach the metal or wooden handle with a bolt, washer and nut.—Kenneth Murray, Colon, Mich.



Clogged Breather Tube in Auto Causes Back Pressure

Back pressure in an automobile crankcase, caused by a clogged breather tube, sometimes has misleading symptoms that cause one to look elsewhere for the trouble. The car may be using excessive amounts of oil, or it may be noticed that

a few drops are coming from the rear end of the crankcase or flywheel pan, ordinarily indicating worn bearings. But before replacing the rear main bearing, check to see that the breather tube is clear. It may be that the loss is due to back pressure caused by the reciprocating action of the pistons, which would act like an air compressor; then the air, instead of going out the breather, is forced through the bearings, taking oil with it. To remedy the condition, remove the breather cap and tube and clean with gasoline.

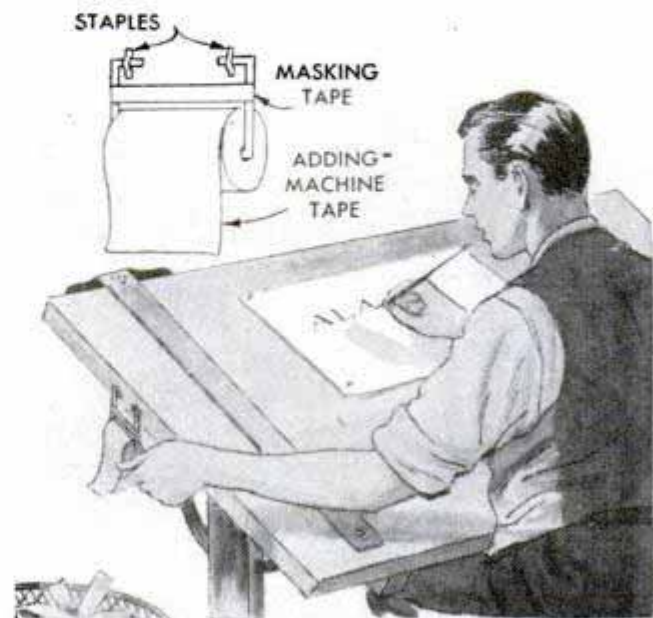
Oil Spread on Grease-Gun Tip Keeps It Clean

Light oil spread over the tip of a grease gun will prevent grease from sticking to the tip. If grease adheres to the tip, it will collect dirt, which may eventually be worked into the lubricating system where it can damage bearings or other equipment. An oilcan is used to apply the oil. Of course, fittings and other parts of the gun should be cleaned occasionally.



Adding-Machine Tape Convenient To Test Artists' Pens

One artist solved the problem of keeping paper on hand to test his pens by attaching a holder and roll of adding-machine tape to his drawing board. The holder was formed of wire and stapled to the board. Masking tape was used to prevent the sides of the holder from spreading.





GENERAL PURPOSE POWER SUPPLY

By George D. Hansen

PERHAPS the most useful unit on the radio experimenter's workbench is a utility power supply. These usually consist of odds and ends of power units salvaged from discarded receivers, and the output voltages are seldom the values needed. The compact general-purpose unit illustrated is flexible as to voltage output and it has good regulation. It is capable of delivering about 450 volts d.c., with less than 2 percent ripple, at approximately 125 milliamperes. There are also two 6.3-volt a.c. filament supplies at different load capabilities.

By means of the combination bleeder voltage-divider resistor (R1), this unit adapts itself to various voltages necessary for testing or operating receivers and amplifiers. It is also ideal for powering a small CW transmitter. Adjustable sliding terminal contacts on R1 can be set to the voltage values desired by checking with a suitable voltmeter. Photos A, B and C show bottom, back and front views. All parts values are given in Fig. 1, and a standard 2 by 7 by 11-in. sheet-metal base is employed. A red jewel pilot light is included and large "dime" store drawer pulls provide handles for moving the unit to convenient positions on the experimenter's workbench.

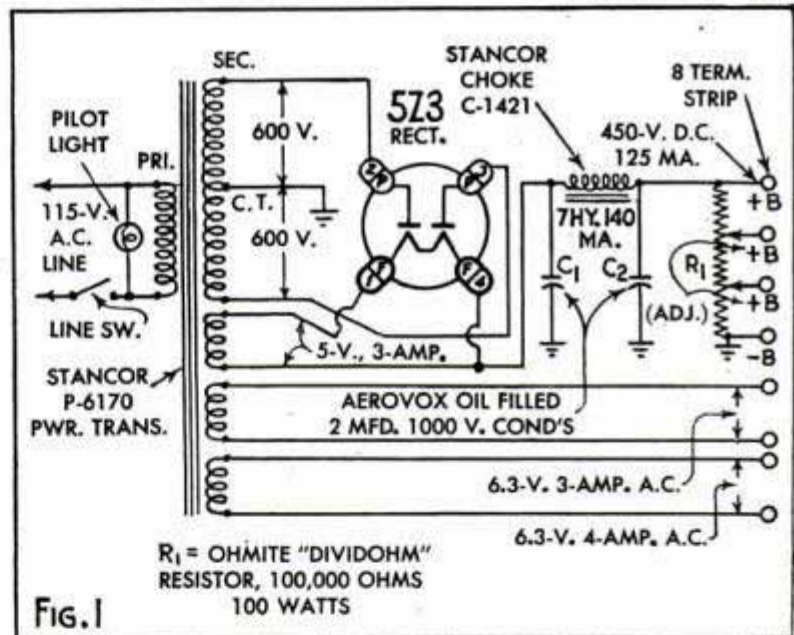
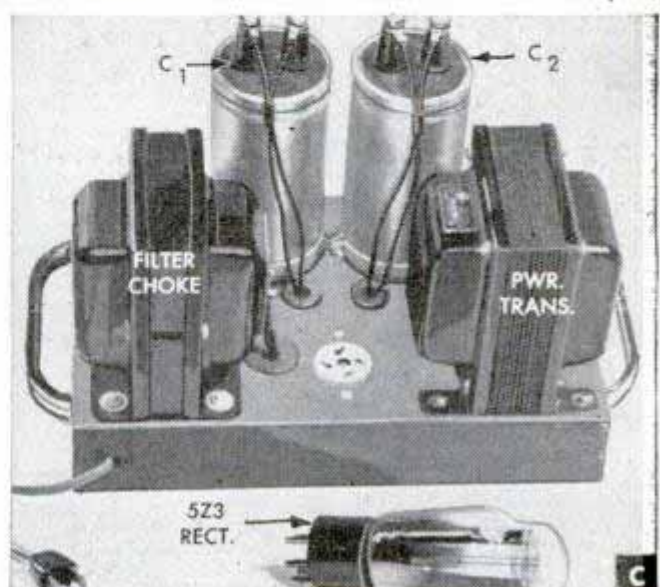
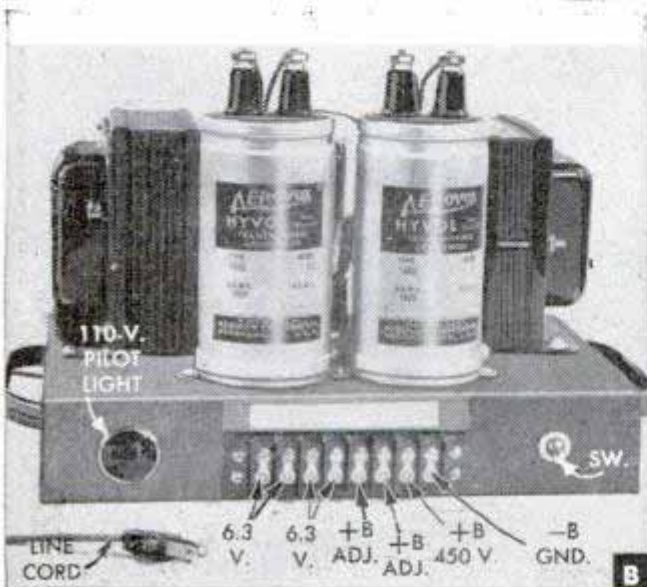


FIG. 1

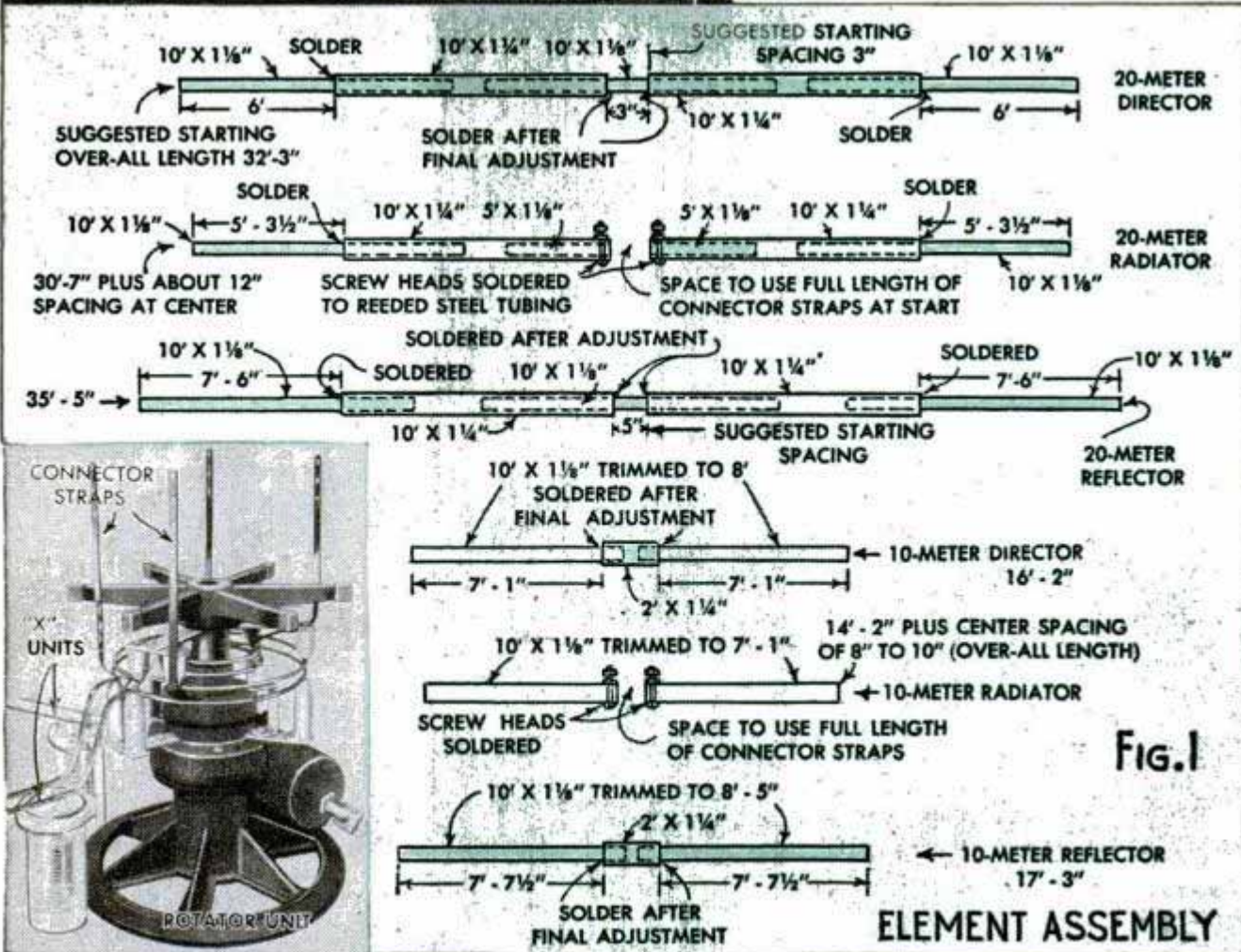




DUAL-BAND ROTARY



WITH present-day conditions of crowding in the 10 and 20-meter bands, a rotary beam system that combines antennas for both of these bands on the same supporting framework is one of the most desirable pieces of amateur equipment imaginable. It operates by confining all of the radiated energy to a fairly narrow beam, and the effect is equal to an increase of several times in the power from the transmitter. For receiving, it improves reception to the same degree. Original experiments conducted by M. P. Mims, W5BDB, of Texarkana, Ark., several years before the war, were highly successful and the signal strength delivered into receivers all over the world by his "signal squirter" made the Mims name one of the best-known in the amateur-radio fraternity. Since the war, certain refinements have been made in the rotator unit and indicator system by the American Phenolic Corporation in Chicago. Selsyn motors in the indicator system now replace the stepping relay and ratchet of the original indicator which operated in steps of about 6 degrees. With the new, smooth-running system



BEAM ANTENNA SYSTEM

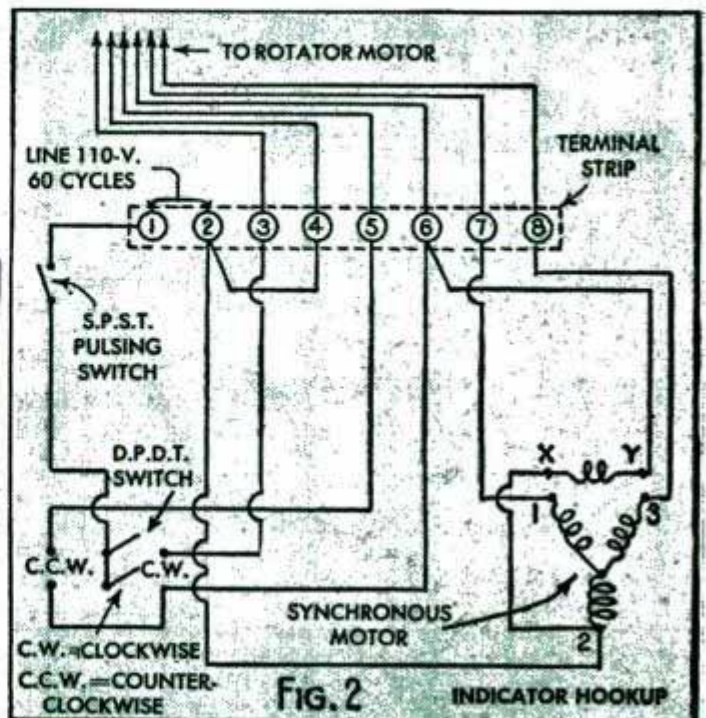
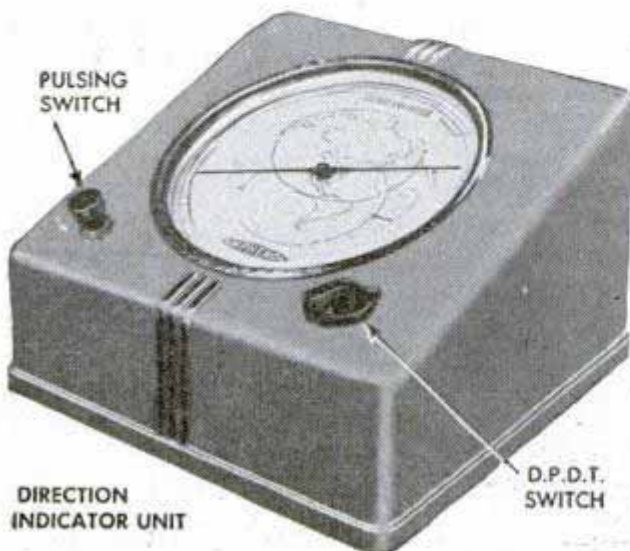
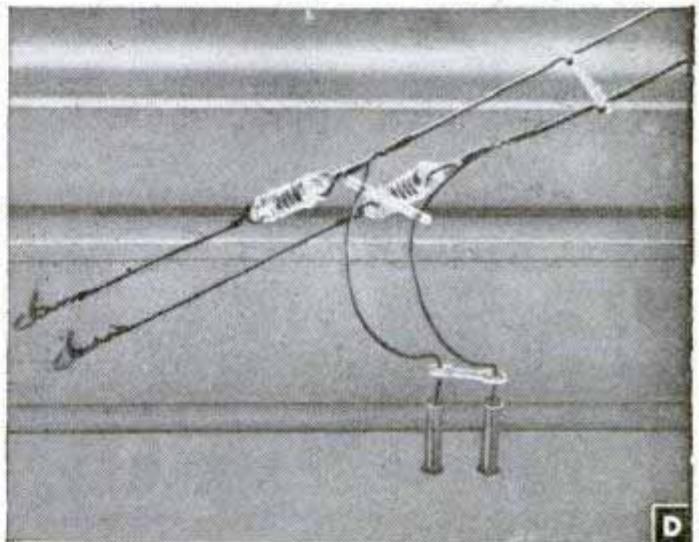
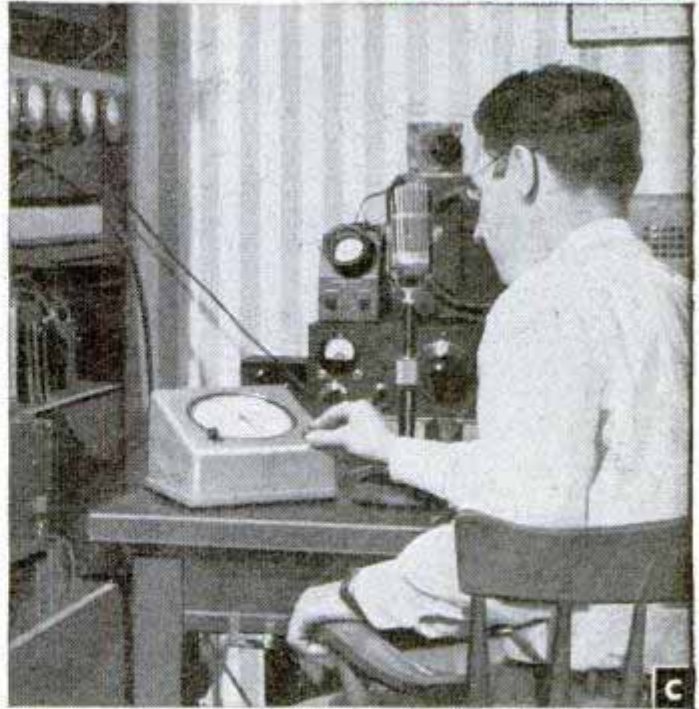


the selsyn direction-indicator unit shown in photo C is synchronized with the antenna array, photo A, indicating the direction of the beam at all times.

The rotator unit supports the wooden boom and crossarms on which the telescoping brass-plated reeded steel elements are mounted; the dimensions of the elements for both the 10 and 20-meter bands are given in Fig. 1. Both radiators, or driven elements, receive power direct from the transmitter; the reflector and director elements are adjusted for length and spaced to reflect and direct the transmitted signal for maximum forward gain. Reception off the ends of the antenna, and signals coming from the reflector side are reduced to a point of non-interference. Installation may be made on any supporting mast or tower which should be from 35 to 50 ft. high. Telephone poles, Sky-Lane and similar wooden towers can be used. The homemade one shown in photo A is a simple type with a suitable platform so that the element centers can be reached for adjustments after the antenna is in place.

Rugged insulators of special design are employed to mount the elements on the crossarms as indicated in photo B. The open-wire feed lines are spaced with low-loss Amphenol polystyrene line spreaders as shown in photos A and D. A single transmission line may be used for both bands if a suitable relay is installed at the rotator, or, individual lines may be employed. Perhaps the most interesting feature of this dual-band rotary beam antenna system is the method of coupling the transmission

(Continued to page 234)

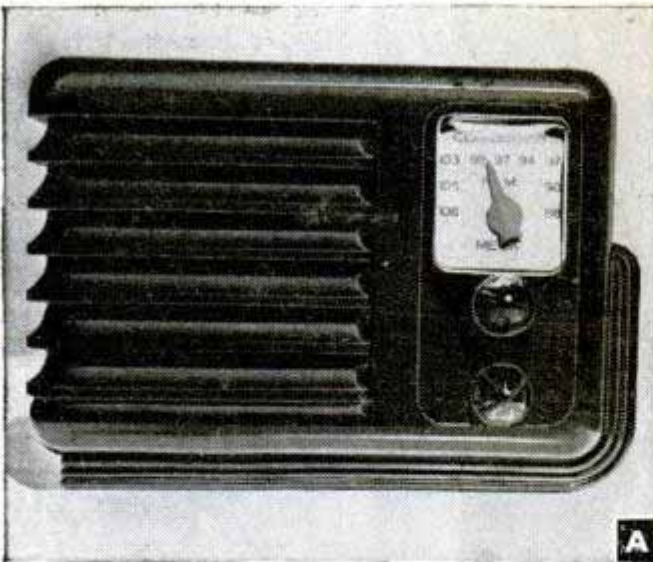


Compact FM Converter Unit Operates on A.C. or D.C.

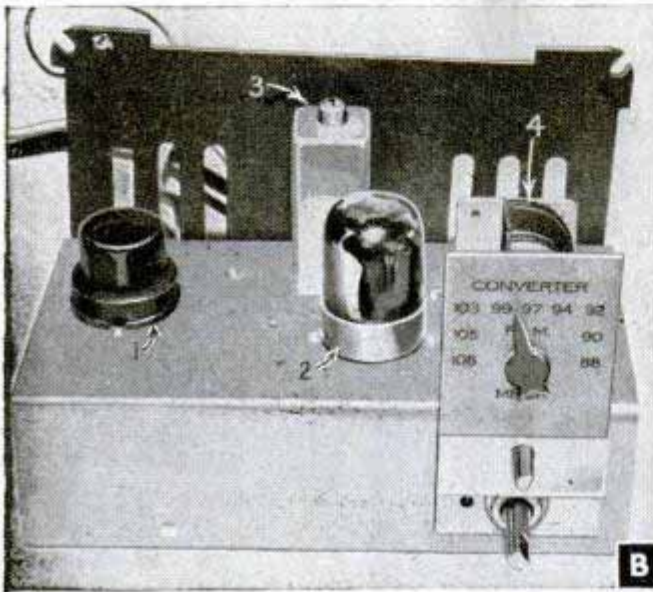
Any standard broadcast receiver can now be converted to receive FM programs on the new FM band from 88 to 108 megacycles just as easily as you can connect a crystal phono pickup to your radio receiver or audio amplifier. Receivers that do not have phono attachments are simply adapted by the installation of a phono input jack and switch. The converter merely uses the audio stages in the AM broadcast receiver. If your present set has quality output on standard broadcast programs you can expect excellent FM reproduction.

The unit is a superheterodyne converter operating on an intermediate frequency of 21.75 megacycles. It includes a self-contained power supply and operates on any 117-volt a.c. or d.c. line with a current drain of only a little more than that required for a 25-watt lamp. Recently demonstrated in Chicago by the Meck Industries, of Plymouth, Ind., this tiny receiver is claimed to employ a new regenerative circuit and a special tube adapted from wartime radar equipment. The circuit was worked out by Meck engineers in cooperation with the Hazeltine Laboratories. It is housed in a neat plastic case, available in several colors to match the AM broadcast receiver with which it is to be used; a front view of the converter unit, which looks like a tiny table model receiver, appears in photo A; the unit measures 9½ in. by 7 in. The lower knob is the off-on switch, and the upper knob is the tuning control; the radio set that is being converted to receive FM is turned on in the usual manner and switched to prepare for FM reception, in the same way you would switch to use a record player. The tuning control on the converter is rotated to tune in the FM station selected and the volume control on your broadcast receiver is set for the desired volume. A view of the chassis base is shown in photo B.

A short length of wire is usually sufficient for local FM reception. Improved results in locations unfavorable to FM reception can be had by using an inside or outside dipole or folded dipole antenna which can be installed by your local radio serviceman. In areas where FM transmissions are available this unit makes it possible for the listener to hear excellent static-free, FM programs at comparatively low cost. With thousands of new FM listeners, a new listening audience is being created, and, like television, it opens new fields of entertainment and commercial possibilities. Photo C shows the FM converter unit connected to a small table model receiver.



A



B

Above: No. 1, type 6H6 tube; No. 2, 7F8; No. 3, 21.75 mc. I.F. transformer; No. 4, tuning condenser



C

**It projects
bright images**

up to 40 inches wide



**and it
costs
only
\$27.50**

THE NEW KODASLIDE PROJECTOR, MODEL 1A



It's simple to operate, easy to store. *Lumenized Optical System*—boosts screen brilliance 50%; *Kodak Projection Ektanon Lens* 4-inch $f/3.5$ —easily focused, needle-sharp; *Heat-absorbing Glass*—protects transparencies from overheating; *150-Watt Lamp*—throws plenty of light across average-size room.

For that "professional touch" use the **KODASLIDE CHANGER**, illustrated above. One slide follows smoothly right after another. The changer does the work...you just push the plunger for the next slide. The screen is darkened while slides are being changed. One loading shows up to 46 cardboard slides.



Visit your nearest Kodak dealer for a demonstration
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Kodak

**"You can't get laughs
when you've got
ACID
INDIGESTION
so Tums for me!"**

Says WILLIAM BENDIX
Famous Screen and Radio Star



"On the air or before the camera," says Bill, "I always have a roll of Tums handy in my pocket — ready to relieve acid indigestion fast. Believe me, you can't get laughs if you've got acid upset!"

When you want relief from acid indigestion, there's nothing *faster*—nothing *surer*—nothing *handier* than Tums. Just slip one or two Tums in your mouth, as you would candy mints. Tums not only neutralize excess acid almost instantly—Tums also coat the stomach with protective medication, so relief is more prolonged. Tums sweeten sour stomach, relieve gas, heartburn and that bloated feeling. No soda in Tums—no raw, harsh alkali to irritate your delicate stomach. And when acid upset comes at bedtime, don't count sheep—count on Tums for a refreshing night's rest. Get Tums today—then, *never* overalkalize, always *neutralize* excess acidity with Tums for the tummy!

**Night and day, at home or
away, always carry Tums!**

10¢
Handy Roll

3-roll package, a
quarter—everywhere



TUMS ARE ANTACID — not a laxative. For a laxative, use mild, dependable, all-vegetable **NR** (Nature's Remedy).
Caution: Take only as directed. Get a 25c box today.

Dual-Band Antenna System

(Continued from page 231)

line to the radiator elements of both antennas. Coupling is obtained through single "inducto" rings thus making it possible to operate with no mechanical connection between the antenna and feed lines so that continuous rotation in either direction is provided. One pair of rings is used for 20, and a second, smaller pair for 10 meters, as will be noted in the photo of the rotator unit. The "X" units are tuning condensers which raise the impedance of the primary rings to 465 ohms at the point where the transmission line attaches to the copper primary strips. No complicated element adjustments are necessary. A long 6-wire cable is employed to connect the indicator and rotator units; the circuit connections for the direction indicator are shown in Fig. 2. A solenoid brake in the rotator unit automatically locks the beam in any desired position. The direction indicator is furnished with a compass-card dial. Azimuth map cards centered on the East Coast, Middle West or West Coast of the United States may be used if preferred.

New Methods for Plotters

(Continued from page 143)

plane-table and its alidade. This is a complicated sketching board that makes accurate maps in the field. Its use for the mapping of large areas is now made obsolete by the faster and cheaper aerial mapping, but it is still needed for small detailed maps of industrial sites or subdivisions. It is also used for maps of areas not quite big enough to be worth the expense of aerial photography.

But here another postwar instrument can now do the job. It is the camera-transit—exactly what it is called, a combination camera and transit. The camera contains a Goertz Aerotar lens, is as carefully calibrated as the latest aerial cameras, and its photographs are taken on glass plates to prevent any error from shrinkage of the film. The photo-surveying is done by snapping photos at different angles and by tying them together with a simple triangulation and leveling procedure with the transit part of the instrument. Everything else is done in the office, making the system rapid and efficient. This "ground measuring" photography was used in the planning of Hoover Dam and the instrument is now being used by the Navy to survey rugged coast lines.

Even the plain, old measuring tape is

(Continued to page 236)

**FIGHTS 5-FOOT DRIFTS
IN EMERGENCY CALL**
Stork arrives in year's worst blizzard

*When safety's a must
... it's "Prestone!"*

ANTI-FREEZE



"Driving an ambulance is always 'emergency.' I can't take chances on freeze-ups—I always use 'Prestone' anti-freeze!"

Chester Raffia

*In your
car too!*

**NO RUST...
NO FOAM...
NO FREEZE...
NO FAILURE...**

One shot lasts all winter!

IF YOU drove an ambulance...if lives depended on you...you wouldn't have to be reminded that "Prestone" is the anti-freeze for your radiator.

The weather can shoot up or plunge down—"Prestone" anti-freeze won't boil away...you're safe and you know it! Give your car the protection it needs. One shot of "Prestone" brand anti-freeze!

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Chuckle-filled comedy amid the planets! (No. 116)

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UNDERWATER					
BUCK CHEEZER	STREAMLINER ONLY				

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now being replaced by other methods. For first-order measuring of long distances, triangulation has always been used. To measure with a tape—say, a thousand miles across country—is not only difficult, but the expansion of the steel tape (even the invar tapes) and the errors of marking off every tape length make it too inaccurate. But for ordinary measuring along a highway the steel tape has been "king."


Today, the subtense bar method from Europe is gradually being recognized. With one model of the compact Wild theodolites, a subtense bar can be set up over a point and the distance to it read accurately and quickly by a simplified, miniature form of triangulation. The same theodolite can be used for most general surveying. The bar is simply a two-meter-long rod that rests horizontally across another tripod.

But the steel tape will still be used in the construction of buildings and the like—and the timber-cruiser doesn't give a hang for any precise instrument. He needs only a good compass and an ability to judge timber with the bark still on it. Today, he can have several different compasses that will read angles and elevations and still go in his shirt pocket.

Altogether, so many intricate and superior instruments are appearing that the old-time, jack-of-all-trades surveyor is fast becoming a specialist. He and his fellow surveyors follow one another throughout the land, each an expert in his own field and with his own particular instrument. With the value of the land increasing every year, with the air lines scheduling flights throughout the world, with all the myriad demands of the postwar world for his work—the surveyor has needed these better instruments, as much as a doctor needs the X-ray.

Longest stretch of straight track in this country is a 78.86-mile stretch on the Seaboard Air Line Railway between Wilmington and Hamlet, N. C.

Model Builders Attention!



	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

Champion Spark Plugs for model gas engines give the same dependable performance as regular Champions. Champion Ceramic insulation—Sillment sealed. Alloy needlepoint electrodes for easy starting. One piece construction.

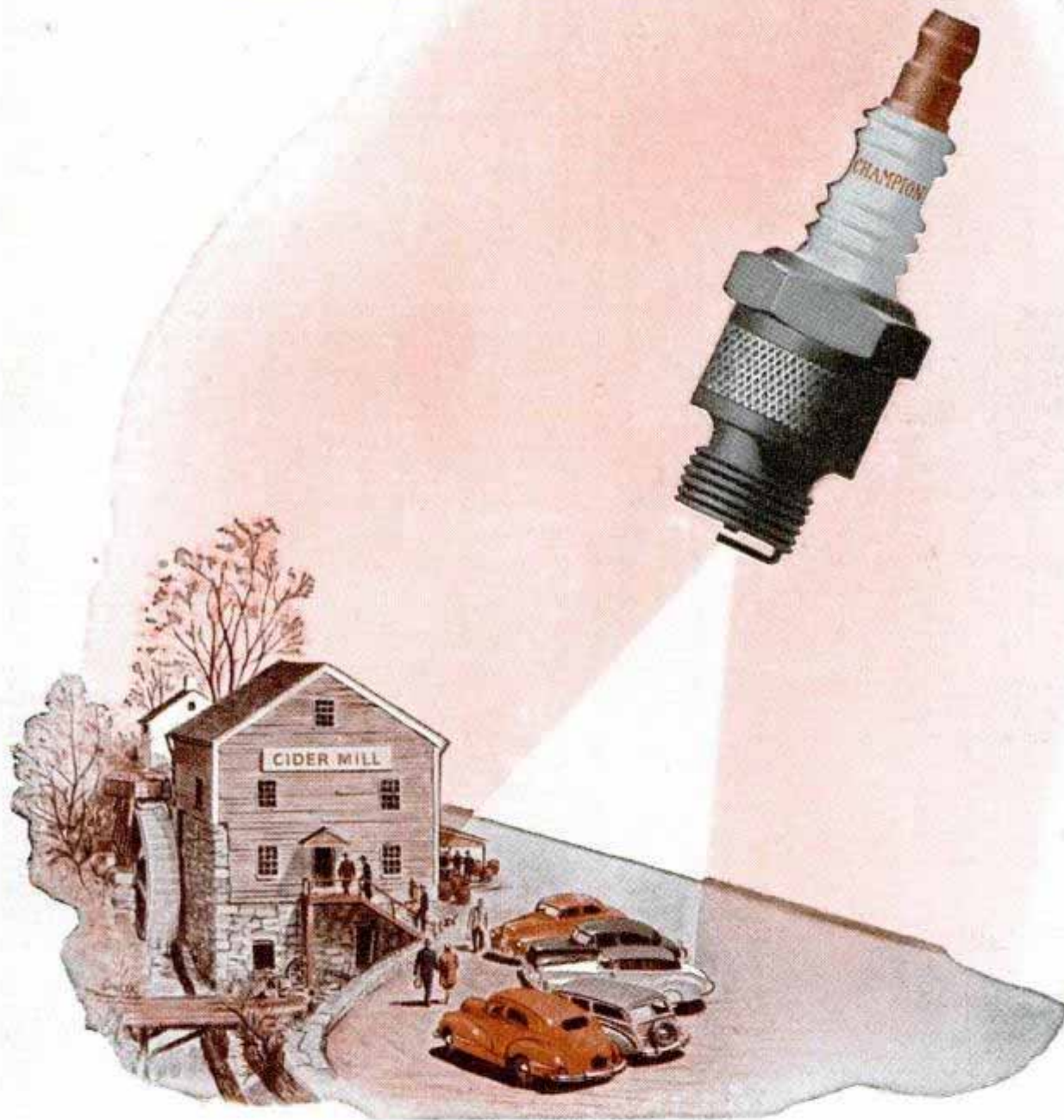
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AMERICA'S FAVORITE SPARK PLUG



Dependable Champion Spark Plugs will give you sparkling performance in cider season as in every season. But the first few crisp days of Fall should be a reminder to you that your spark plugs should be serviced. If you find that new ones are needed, be sure to ask for dependable Champions—America's Favorite Spark Plug for every engine.

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Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

Where "The Good Earth" is H₂O

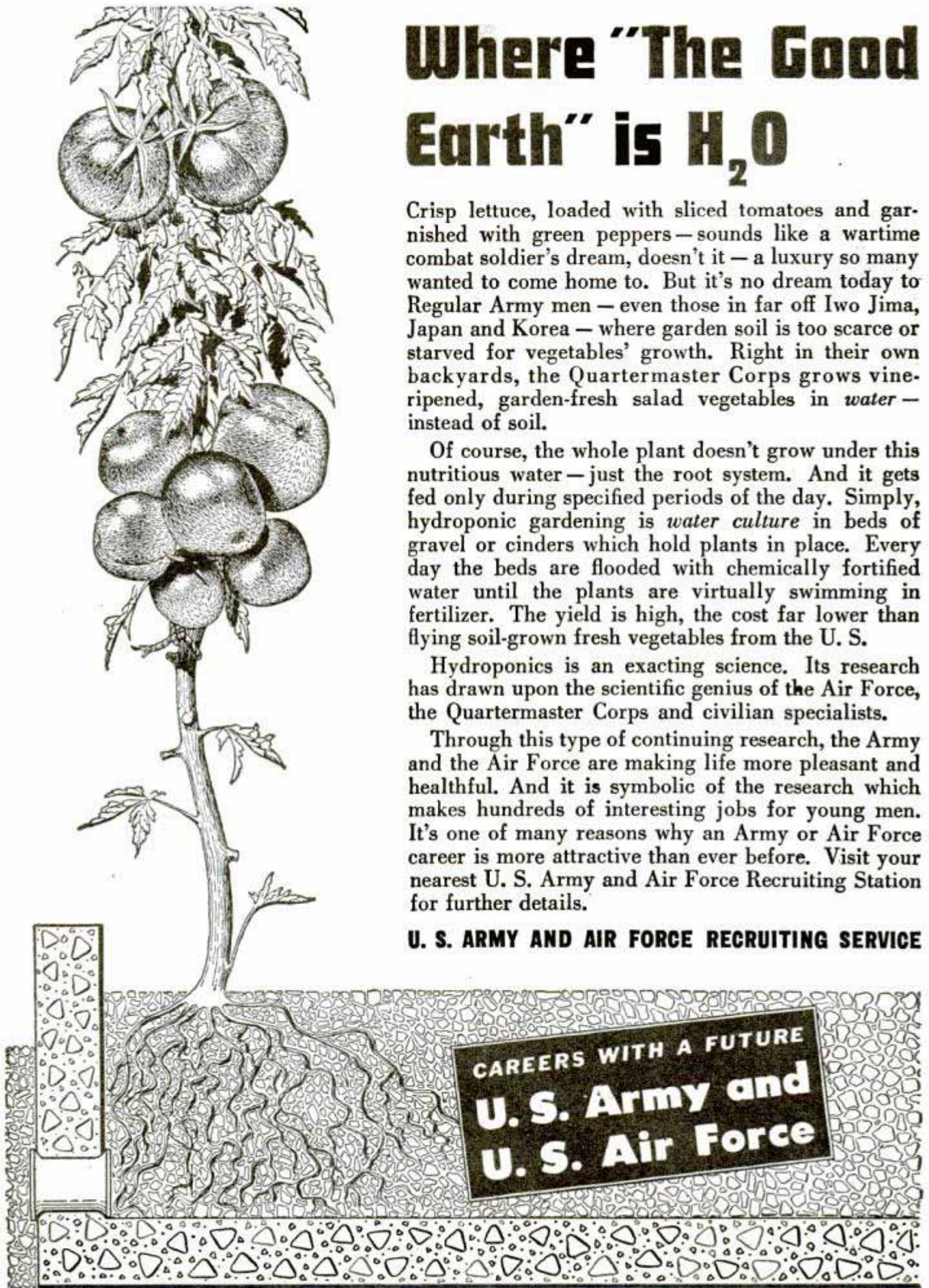
Crisp lettuce, loaded with sliced tomatoes and garnished with green peppers—sounds like a wartime combat soldier's dream, doesn't it—a luxury so many wanted to come home to. But it's no dream today to Regular Army men—even those in far off Iwo Jima, Japan and Korea—where garden soil is too scarce or starved for vegetables' growth. Right in their own backyards, the Quartermaster Corps grows vine-ripened, garden-fresh salad vegetables in *water*—instead of soil.

Of course, the whole plant doesn't grow under this nutritious water—just the root system. And it gets fed only during specified periods of the day. Simply, hydroponic gardening is *water culture* in beds of gravel or cinders which hold plants in place. Every day the beds are flooded with chemically fortified water until the plants are virtually swimming in fertilizer. The yield is high, the cost far lower than flying soil-grown fresh vegetables from the U. S.

Hydroponics is an exacting science. Its research has drawn upon the scientific genius of the Air Force, the Quartermaster Corps and civilian specialists.

Through this type of continuing research, the Army and the Air Force are making life more pleasant and healthful. And it is symbolic of the research which makes hundreds of interesting jobs for young men. It's one of many reasons why an Army or Air Force career is more attractive than ever before. Visit your nearest U. S. Army and Air Force Recruiting Station for further details.

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automatically warm throughout
the night. Just a turn of the dial
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and — no coal to carry, no fires to build, no ashes to empty, no soot-streaked walls to clean!

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Model 750 for
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Plumb tools have outstanding features of quality—the one-piece steel head, the comfortable shock-absorbing handle made from tested second-growth hickory, the perfect "hang" and fine appearance. Plumb's constant research, engineering and design in fine tool-making have made Plumb tools the outstanding choice of five generations of craftsmen. Fayette R. Plumb, Inc., Phila. 37, Pa.

The red handle with the black head—exclusively Plumb.

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HAMMERS • HATCHETS • AXES • FILES

Traffic Signals of the Sea

(Continued from page 151)

7. Radio aids. Comparable in its effect to the introduction of the high-powered prismatic lens in 1859, the radio-beacon system first used in 1941 ranks as the outstanding achievement in the coast guard's aid-to-navigation program.

Radio beacons are radio stations installed in lighthouses, lightships or other points known to mariners for sending out signals in all directions to guide vessels equipped with radio direction finders. Each radio beacon has a distinguishing signal and is marked on marine charts. On a ship, the direction finder enables the navigation officer to obtain bearings without delay and to get a "fix" through a series of cross bearings by tuning on two or more radio beacons.

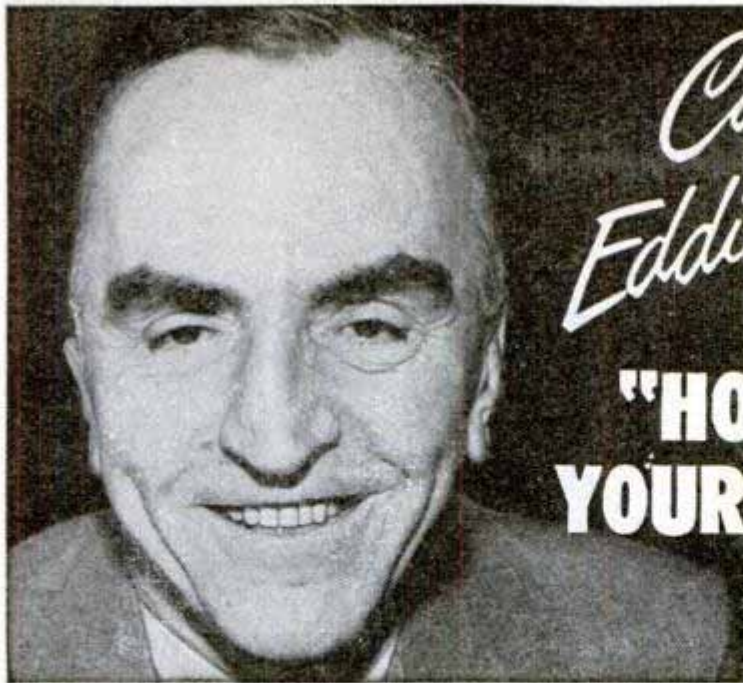
Many radio-beacon stations are also equipped to send out synchronized radio and sound fog signals for distance-finding purposes. Distance-finding signals are based on the fact that radio signals are transmitted practically instantaneously, while sound signals travel through air at the rate of about one mile every five seconds. Distance thus may be calculated by the difference in time between receiving the two sets of signals. Normally, radio beacons operate continuously only during fog or low visibility, and on fixed schedules in clear weather.

Similar in purpose to the radio beacons—but differing markedly in method of operation—are radio direction finders. Radio direction finders are shore stations which supply ships at sea with their locations through a series of bearings taken on radio transmissions from the vessel. These bearings are then transmitted by radio to ships requesting the information. Greatest usefulness is in locating vessels in distress from their SOS signals.

Wartime development of radar is fast being put to peacetime uses—and one of the greatest of these is expected to be applicable to peacetime shipping. Radar "eyes" are fast being installed on many types of ships.

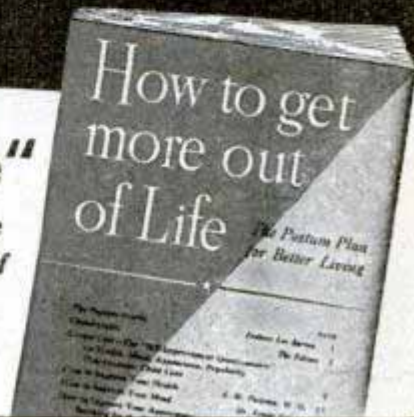
Mechanics and science have joined in developing modern navigation aids. These traffic signals of the sea mean greater safety for ships traveling in American waters. Captain Joshua James would be amazed to hear the land "talk" today.

☐ Watery waste from breweries known as "slurry" can be converted to a superior poultry feed by treating it with ultraviolet rays, according to tests conducted at St. Joseph's College, Collegeville, Ind.



Capt. Eddie Rickenbacker
tells you
"HOW TO IMPROVE YOUR OPPORTUNITIES!"

Send for book "How to Get More Out of Life"
ONLY 10 CENTS with purchase of a package of POSTUM



HERE'S your *big opportunity* to get the help of top-notchers like Eddie Rickenbacker, Dale Carnegie, Gene Tunney, and others in a *Private Edition**—yours for only 10c!

Simply go to your grocer today, buy a package of Postum, and fill in the coupon below. Mail with 10c in coin... This sensational offer is made solely to introduce you to POSTUM—and to the chance for a better, more successful life...

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Both coffee and tea contain caffeine. It is a drug—a nerve stimulant! While many people can drink coffee or tea without ill-effect, others suffer nervousness, indigestion, and sleepless nights.

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JONES: Sure it does—to you hardware dealers. Tools with advertised names get you higher prices. But how about me? I want the most I can get for my money.

DEALER: Well, sir, let me ask you this. Do you think you get more for your money when you buy unknown tools at bargain counter prices?

JONES: Not necessarily. But I know this much—you can't change a poor tool into a good one just by putting a well-known name on it.

DEALER: Of course not. But don't forget that when a reliable manufacturer puts his advertised brand name on a tool—or

any other piece of hardware—it's got to be good.

JONES: How do you figure that?

DEALER: The manufacturer has a reputation to protect. Thousands of men *believe* in that brand name... *depend* on it... and he can't afford to let them down. It's the same way with me and my hardware store. I've got to keep *my* reputation for quality merchandise or I couldn't even stay in business.

Your **HARDWARE DEALER** sells **QUALITY tools**
and hardware... Buy from HIM



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Ever zip over a hill with the fresh morning air in your face, a companion clinging tight and happy laughter ringing in your ears? Ever feel the thrill of swinging down a beautiful country road on a swift, sleek Harley-Davidson that seems alive with power and anxious to go places? Ever hear the roar of races, hillclimbs and other spine-tingling events that only motorcycling provides? Ever join a jolly caravan of riders on a sight-seeing tour of scenic wonderlands, out-of-way places, distant cities? If you haven't, you're missing the world's greatest sport—motorcycling! And it's so *easy* to enjoy . . . easier to own a Harley-Davidson than you think. See your dealer today. Mail coupon now!

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use **PLASTIC WOOD**

You can get a professional finish on those jobs for the kids! For a slick, smooth finish that takes paint, lacquer or varnish perfectly, use Plastic Wood as your filler. Repairs such as cracks, gouges or loose joints are quickly mended and the toy is back in apple-pie order! *Handles like putty—hardens into wood!*

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- Countersunk screws
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At all Hardware,
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PLASTIC WOOD

Tube or Can

A CELLULOSE FIBRE FILLER

Harvesting the "Backwoods" Crop

(Continued from page 174)

the regular chipping process and no acid treatment, the flow of gum dwindles after the first two or three days.

It pays the turpentine farmer to apply acid. Chipping only and applying no acid, a man can handle about 5000 tree faces each week. By chipping and spraying, he can tend about 4000 faces a week. That means he can take care of 8000 faces by using two-week intervals and 12,000 faces by using three-week intervals. By chipping and treating at two or three-week intervals, a man can obtain from one and one half to two times the amount of gum per season normally produced by weekly chipping without acid treatment.

The acid solution, 40-percent strength for slash pine and 60-percent strength for long-leaf pine, is obtainable ready-mixed. It is sprayed on the freshly cut streak with a lung-powered spray gun.

The acid-spray treatment has resulted in the development of a new slashing method called "bark chipping." In this method, only the bark is removed, and the usual incision into the wood is omitted. Ordinarily, it is necessary to chip into the wood to get a normal gum yield, but when acid is applied the gum flows freely without the tree being cut.

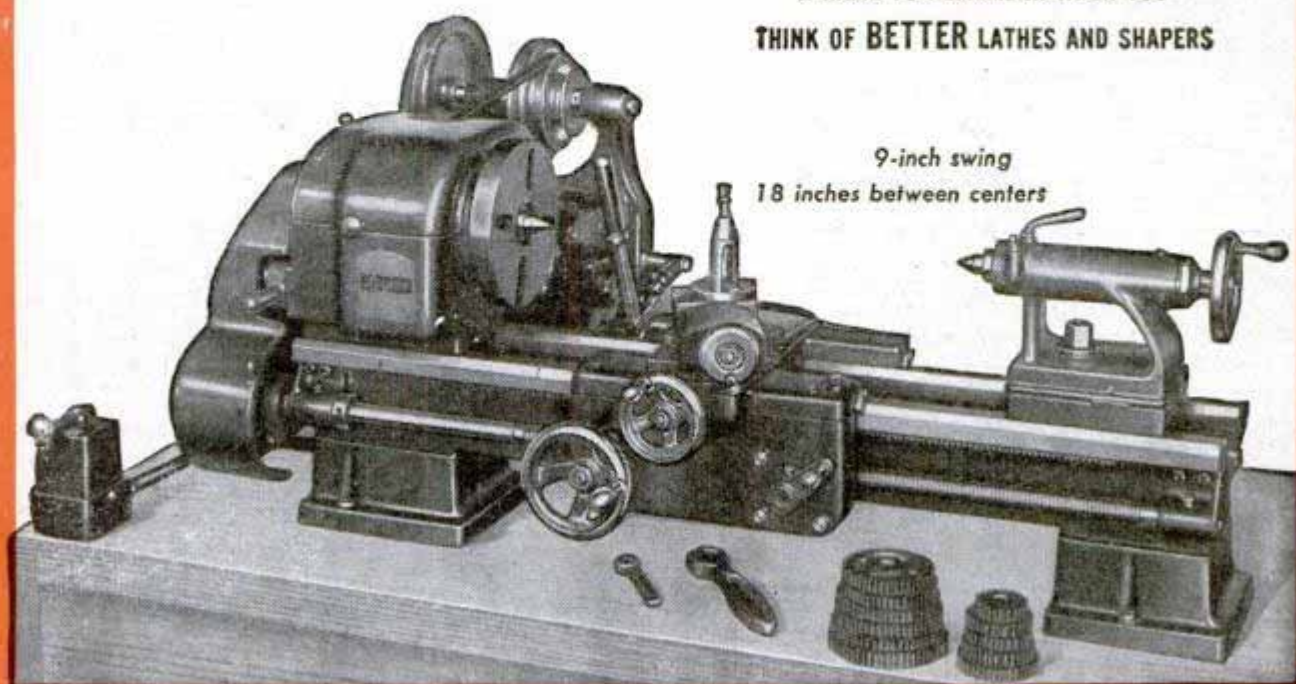
Pine gum is providing an income for nearly 400,000 people who depend largely upon the naval-stores industry for their living. With the advent of central gum-distilling plants and the continuous-process method, many owners of land on which there are small stands of southern yellow pine are finding a new source of cash income in the sale of crude oleoresin.

Aluminum from Clay

Aluminum can be produced from clay in a process developed by Dr. James I. Hoffman, government chemist. In the past, bauxite ore has served as the raw material but according to wartime estimates, only a six-year supply of bauxite remains in this country. In the Hoffman process, clay is heated, treated with dilute hydrochloric acid, and filtered. The aluminum is obtained as hydrated chloride by adding hydrochloric-acid gas. The rest of the process consists of separating and washing the aluminum-chloride crystals, heating them to drive off the chloride and then recovering the hydrochloric acid for re-use. This process costs about twice as much as the bauxite process.

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The Logan 9-inch Lathe is as accurately, ruggedly built as larger Logan Lathes. Whether you use this new 9-inch lathe for precision manufacturing operations, general machine shop and tool room work, maintenance, or as the key tool of a home or farm work shop, it gives you big lathe accuracy and dependability. Its bed ways are machined to within .0005" of parallelism. Its ball bearing mounted spindle is inherently well adapted to high speed work. Its rugged, rigid construction assures steadiness on heavy cuts. In brief, here is a truly fine small lathe, at a low price that only the most efficient methods of lathe construction could make possible. Complete information at your Logan Lathe dealer's, or on written request.

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Complete with Plastic Cabinet,
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It's here! The first ultra-modern 5 Tube AC-DC Superhet kit at so low a price! Here's what you get—full broadcast band coverage (550-1600 Kc); built-in loop antenna;

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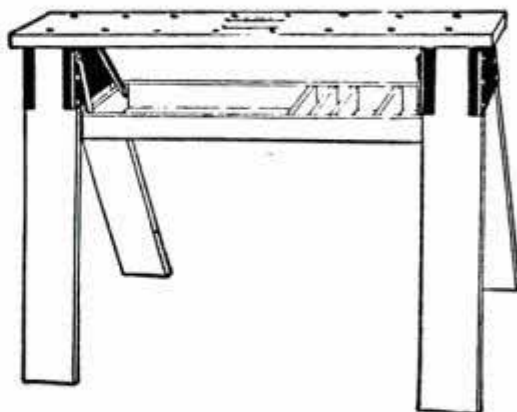
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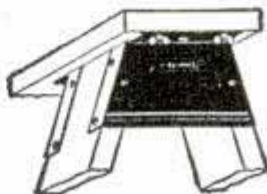
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City.....Zone.....State.....

Larson

"MAKE YOUR OWN" CARPENTER'S SAW-HORSE SET



Makes a rigid saw horse that is actually a **PORTABLE HOME WORK BENCH** with many uses. Has a novel **SWINGING TOOL TRAY**. Complete hardware and copyrighted instruction sheet for easy assembly. Lumber is not included.

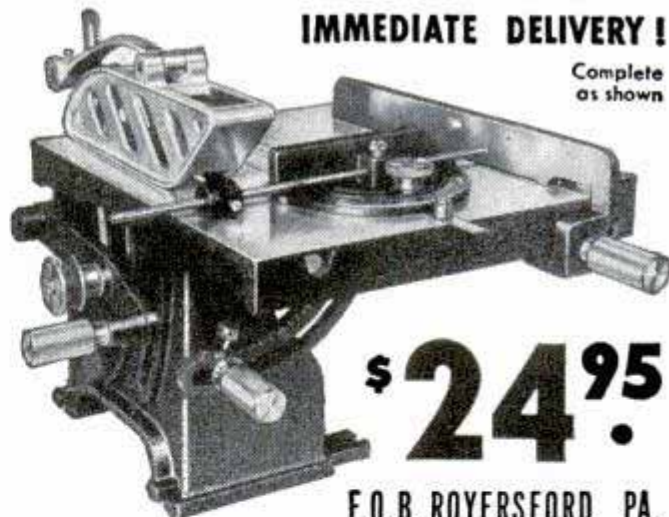


Prepaid \$1.35

CHAS. O. LARSON CO., BOX 358, STERLING, ILLINOIS

IMMEDIATE DELIVERY!

Complete as shown



\$24.95

F.O.B. ROYERSFORD, PA.

QUALITY 8" BENCH SAW CUTS THROUGH 2⁵/₁₆"

UNCONDITIONALLY GUARANTEED ONE YEAR

(Write for Free Booklet and Guarantee Bond)

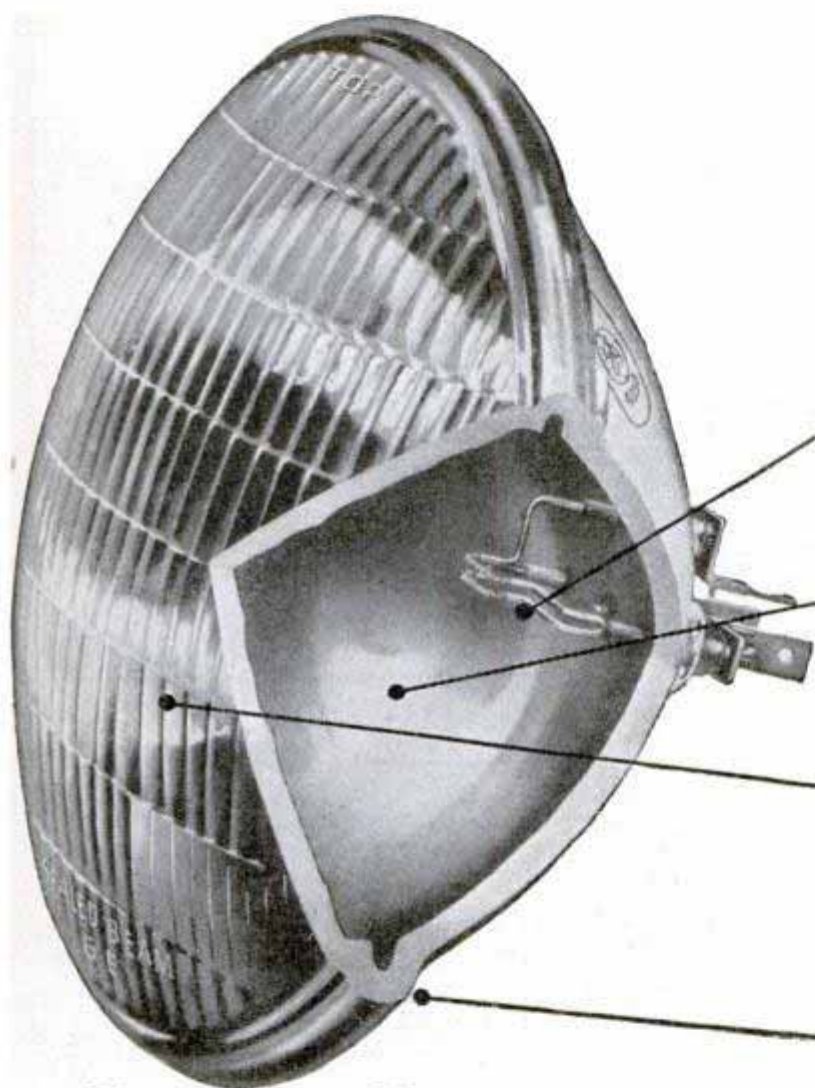
Comes complete with Floating motor mount—miter gauge with adjustable stop—aluminum guard—soft aluminum insert—spring steel splitter—heavy gray iron fence—(no motor—no blade). Table 12" x 14". Tilts to 45°—Oilite bearings. Shipping Wt. 50 lbs.

AMERICAN MACHINE & TOOL CO. Inc.

DEPT. 100

ROYERSFORD, PA.

Here's an Auto Headlamp that Does Not Grow Dim!



GENERAL ELECTRIC Sealed Beam Headlamps Do Not Grow Dim! Road and laboratory tests prove that the average G-E Sealed Beam Headlamp maintains 99% of original light output right up to the end of lamp life! Here's why the "all-glass" construction is the biggest value in headlamps today:

1. FIXED-FOCUS FILAMENTS HELD IN VISE-LIKE GRIP. Filaments are securely placed in the lamp. Firmly held so that road shock and vibration will not shake them loose.

2. MIRROR-LIKE, BUILT-IN REFLECTOR. Hard-glass, scientifically designed. Since dirt and moisture can't get in the bulb, the reflector can't tarnish . . . another reason why G-E Sealed Beam Headlamps do not grow dim!

3. RUGGED, HARD-GLASS PRECISION LENS. The special hard-glass used for G-E Sealed Beam Headlamps and the one-piece construction give maximum strength and ruggedness. And the lens is designed to put an accurate pattern of light where you need it . . . *on the road.*

4. ONE-PIECE, "ALL-GLASS" CONSTRUCTION. The whole thing is a bulb! Dirt and moisture cannot get in to reduce light output. Another reason why the average G-E Sealed Beam Headlamp maintains 99% of original light output right up to the end of lamp life!



G-E FOG LAMP. Same "all-glass" construction as G-E Sealed Beam Headlamps.



G-E SPOT LAMP Clear, penetrating beam you'll find useful on dozens of occasions.



INSTRUMENT Indicator bulb. Typical of the many efficient G-E miniature automotive bulbs.

NOW! *More light than ever before. Today's G-E Sealed Beam Headlamps give you 12% more light on the road for driving, 16% more light for passing!*

FOR EVERY SOCKET...FOR EVERY CAR

G-E LAMPS

GENERAL  ELECTRIC

Be sure your headlamps are aimed properly, and whatever lamps you need for your car be sure to insist on...



USE AC's FOR
**UTMOST
RELIABILITY**

"The mail must go through"—and does, with the help of today's AC's in thousands of mail cars and trucks. You can enjoy utmost reliability in spark plug performance by having your spark plugs checked to be sure they are right for today's driving and fuels.



Look for this sign



Spark Plugs cleaned and adjusted "By the AC Method" may save as much gas as 1 gallon in 10

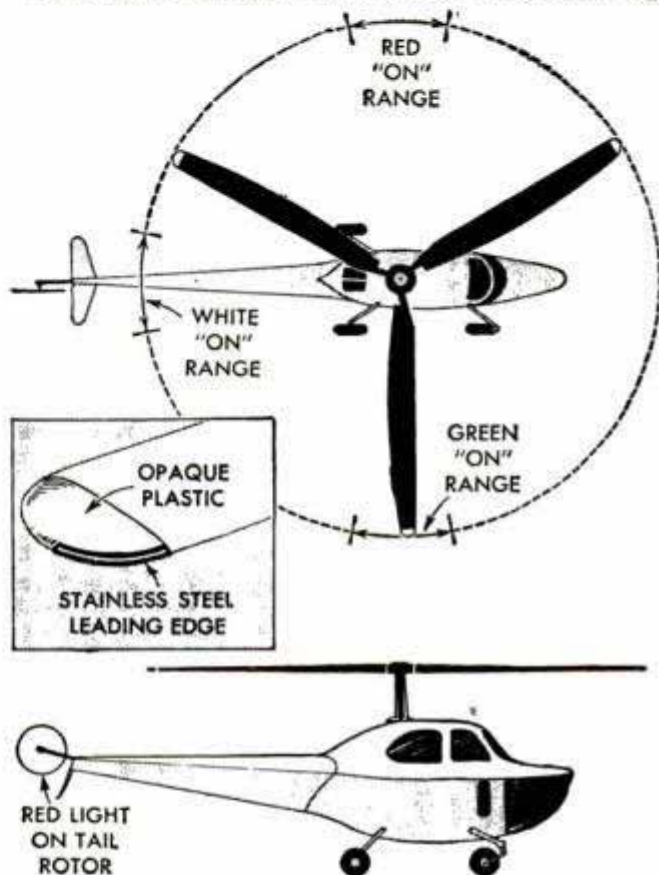


SPARK PLUGS

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

G.A. SPANGLER
Box 193, WILLIAMSVILLE, N.Y.
Blade-Tip Lights for Helicopters

Automatic signaling lights in the blade tips of helicopters are designed to distinguish them in flight from conventional aircraft. Both now use the same system despite their radically different flight characteristics. The lights also act as an automatic distress signal. In the new system the tips of a three-bladed helicopter are fitted with three different-colored lights—red, green and white. As the blades revolve the red light flashes on when the tip



in which it is mounted is at the port (left) side; the green light flashes when its blade is at the starboard (right) side; the white light goes on when the third blade points aft. The relatively low revolutions per minute produces a distinctive pulsating signal. As a hovering signal all three lights stay on through complete rotation. As a distress signal, only the red light stays on. If a tail rotor is used it constantly displays a red light for safety. The system, developed by Gervase A. Spangler of Universal Helicopter Corporation, can be used on helicopters with various combinations of rotor blades.

Lard Kept Fresh By Adding Chemical

By adding a small amount of chemical called propyl gallate, lard and all types of edible animal fats and oils are kept fresh for a longer period of time. The chemical retards or prevents auto-oxidation, which creates a rancid odor and unpleasant taste.

NO WORKSHOP IS COMPLETELY EQUIPPED WITHOUT
BOTH THESE TOOLS



**IT'S BACK
MOTO-SAW**

THE AMAZING ELECTRIC SCROLL SAW



7,200 Strokes Per Minute
JUST GUIDE IT

Only
\$5.85

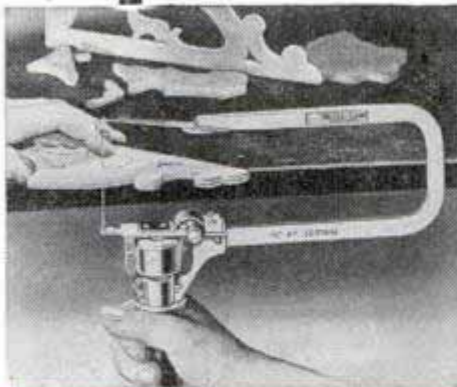
COMPLETE
With 3 Saw Blades
POSTPAID

**AVERAGE CUTTING SPEED
ONE FOOT PER MINUTE**

Boys from 8 to 80 (and girls, too) have fun with a Moto-Saw . . . it works more like magic than any tool you ever saw! Takes no effort to run, no perceptible pressure to feed . . . only a trifle heavier than a hand scroll saw, and better balanced in your hand. Runs 7,200 strokes a minute . . . leaves no rough edges . . . easily cuts intricate scroll designs in medium-hard wood up to 3/4" thick. Blade holder faces blade 4 ways . . . permits sawing sideways as well as forward and backward. No limit to length of stock it will cut . . . saws to center of 19" widths. Plug into any 110-120 Volt, 50 or 60 cycle alternating current outlet (does not operate on direct current). See Dremel Moto-Saw at your dealer's. If he cannot supply you, use coupon below to order on 10 day, money-back trial.

AS SAFE AS A HAND SAW

The versatile Moto-Saw is as safe as a hand saw . . . a touch of the trigger switch sets it going . . . releasing stops it instantly. A thrill awaits you when you first feel the hang of Moto-Saw in your hand and sense its surge of precision power. Sturdily constructed . . . only two moving parts . . . never needs oiling . . . requires no bench room or floor space. Thousands of satisfied users.



**IMPROVED
MOTO-TOOL**

**"THE POCKET-SIZE
MACHINE SHOP"**

Look at the rest . . . then buy the best! Only Moto-Tool offers about 27,000 R.P.M. (the speed necessary to conserve cutters, do fine work). Owners declare Moto-Tool the handiest tool in the home or shop . . . find new uses for it daily.

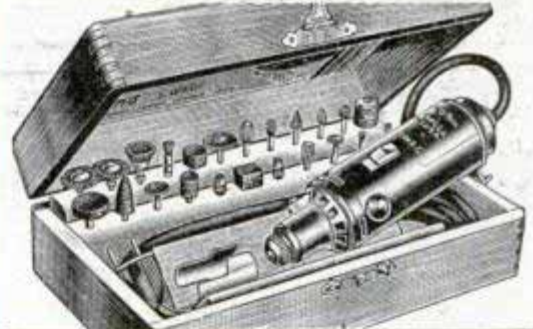


Approx.
27,000
R.P.M.

14 REASONS WHY MOTO-TOOL IS A BETTER BUY

- Housing has "pencil-type" finger grip.
- Instant-action, wrench-less chuck.
- Patented automatic chuck-lock pin.
- 110 Volt universal type (A.C.-D.C.) motor.
- Oversize armature shaft; hardened, ground and polished.
- Easily replaced commutator brushes.
- Oil-less, (sealed) trouble-proof bearings.
- About 27,000 R.P.M.
- Cuts cleaner . . . saves cutters.
- Dust-filtered air-cooling system.
- Dynamically balanced for vibrationless operation.
- Sturdy, shockproof bakelite housing.
- Sliding, snap-type switch.
- Handy hanger hook; cord protector.
- Weighs only 13 oz. . . shaped to fit the hand.

MODERN CRAFTSMEN'S KITS



PRE-WAR PRICES STILL PREVAIL

Moto-Tool Kit No. 2, with 23 accessories (high-speed steel cutters, grinding wheels, polishing accessories) and heavy-duty professional Model 2 Moto-Tool in natural-finish, hardwood case . . . \$23.50 (Items purchased separately would cost about \$30.00; you save \$6.50).
Model 2 Moto-Tool, with one emery point, \$16.50
Moto-Tool Kit No. 1, with 34 accessories and Model 1 Moto-Tool in wood case . . . \$17.50
Model 1 Moto-Tool, with one wheel point, \$9.85

MONEY-BACK GUARANTEE; Buy Dremel Moto-Tool from your dealer. If he cannot supply you, order direct from the factory on 10 day trial. Shipped postpaid for payment in full (send check or money order); or send only \$2.00, we will ship C.O.D. You pay balance plus postage.

DREMEL MFG. CO. • DEPT. 117-L • RACINE, WIS.

IF YOUR DEALER CANNOT SUPPLY YOU, USE THIS COUPON TO ORDER

DREMEL MANUFACTURING CO. • DEPT. 117-L • RACINE, WISCONSIN

- Enclosed find \$_____ (Check or money order). Ship items checked below at once Postpaid.
 Enclosed find \$2.00 as part payment on items checked. I will pay postman balance plus postage upon COD delivery.
 Moto-Saw, with 3 blades, \$5.85 Model 1 Moto-Tool, \$9.85 Universal Stand, \$4.50
 _____dozen blades (60c per doz.) Moto-Tool Kit No. 2, \$23.50 Shaping Table, \$2.50
 Moto-Tool Kit No. 1, \$17.50 Model 2 Moto-Tool, \$16.50 Free catalog of Dremel Tools and Equipment

NAME _____ ADDRESS _____

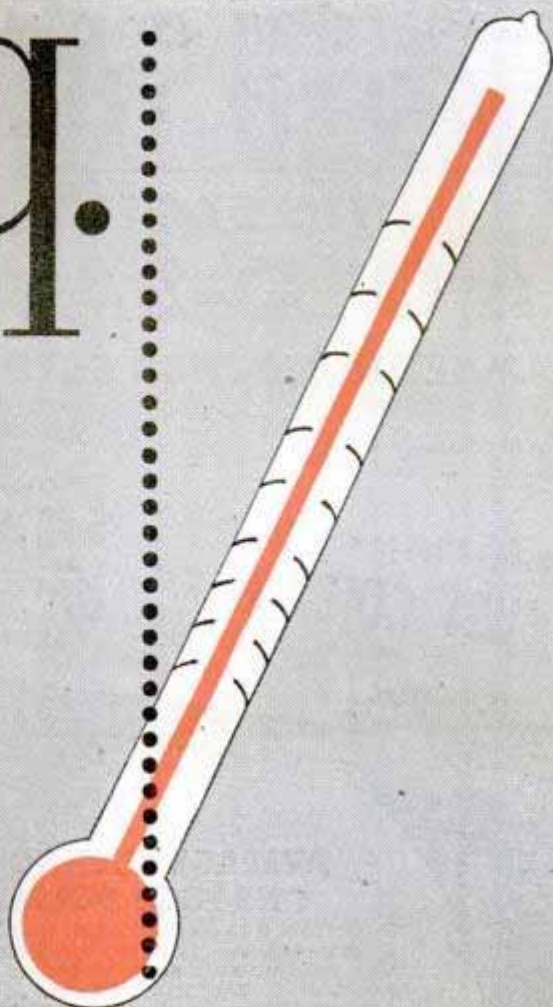
CITY _____ ZONE _____ STATE _____

i.q.

Answer to problem on page 105

The energy is not destroyed, but released in the form of HEAT. To prove this, repeat the experiment with two identical springs, two beakers of acid and two sensitive thermometers. Compress one spring and tie it with catgut before dropping into the acid; leave the other free. The temperature of both beakers will rise during the dissolving, but that in the beaker containing the spring under compression will rise higher.

By Rex Taylor.



Honeys for warm comfort on the job

Test Yank-er-Jac's full-cut comfort—roomy shoulders, bloused body. Warm as only wool can be, handsome as black and red plaid always is. And Big Yank cotton plaid shirts have features like storm cuffs, elbow-action sleeves, large flap pockets, tailored collars. Get a Big Yank cold weather work-and-play favorite today at better stores . . . also corduroy or moleskin pants.



BIG YANK

SHIRTS · PANTS

OUTER WEAR

Reliance Manufacturing Co., 212 West Monroe Street, Chicago 6



HAND TRUCKS for every job!



REFRIGERATOR TRUCKS—Heavy 1½" tubular steel construction. Ball-bearing rubber tired wheels. Height 60½", Width 27", Weight 67 lbs.\$27.95

BARREL TRUCKS—D-2200, M-205 1 Handle, 10" Rubber tires\$17.45
D-2200, M-201 1 Handle, 5" Steel Wheels 8.95
No. 5503—Bar construction 5" Rubber Wheels, No. 2203 Tubular construction 5" Rubber Wheels\$8.95
D-3300, M-205 2 Handles, 10" Rubber tires\$17.95

CYLINDER TRUCKS—Heavy steel base 12"x24", 10" Rubber, puncture-proof tires\$24.45

MILK TRUCKS—8" Dual wheels, Ball bearing\$13.95

BATTERY TRUCKS—5x1½ Ball bearing solid rubber wheels...\$6.95

GARBAGE TRUCKS—5x1½ Ball bearing solid rubber wheels \$10.95

WHEELBARROW WHEELS

Ball bearing, steel or aluminum, 4-ply rubber tires and tube 4.00 x 8...\$13.95

RUBBER WHEELS

5 x 1½ \$1.50 6 x 2 \$4.50
8 x 2 \$2.25 10 x 2:75 \$6.84

10 x 1:75 \$2.95

Heavy duty, double-dual wheel, ball bearing 8 x 1¼ \$3.50

No C. O. D.'s — Send Money with Order.

Jobbers wanted. write for particulars.



UNITED SUPPLY CO. 420 WEST JUNEAU AVE. MILWAUKEE 3, WIS.

WHIPCO HANDY BRACKET CLAMP

the handiest tool you can have around
HOME, HOBBY SHOP OR OFFICE
Attractively finished in light metallic blue.

Slides in holding bracket snugly, holding clamps securely in two positions.



Will lend prestige wherever used. With a Whipco Clamp and a little glue that broken piece of furniture will be back in use.

HOME For many repair jobs, holding quilting frames, curtain frames, flower pots in window, and a thousand other uses.

HOBBY SHOP Holding small parts while shaping, gluing and cutting, holding files while winding, and many holding jobs in the photography dark room.

OFFICE Holding and hanging bulky papers, clamping various accessories to desk and typewriter stands.

Large clamp opening, 2½"; medium size 1½"; small size, ¾". Order special set today, consisting of 2 large, 2 medium, 2 small and 6 holding brackets — 12 pieces in all, packed in neat box, for only \$4.50 per set post paid in U.S.A. Will make excellent gift.

WHIPPLE MFG. CO.

SPIRIT LAKE, IOWA

Masonry Spraying

... Today's Outstanding Business Opportunity



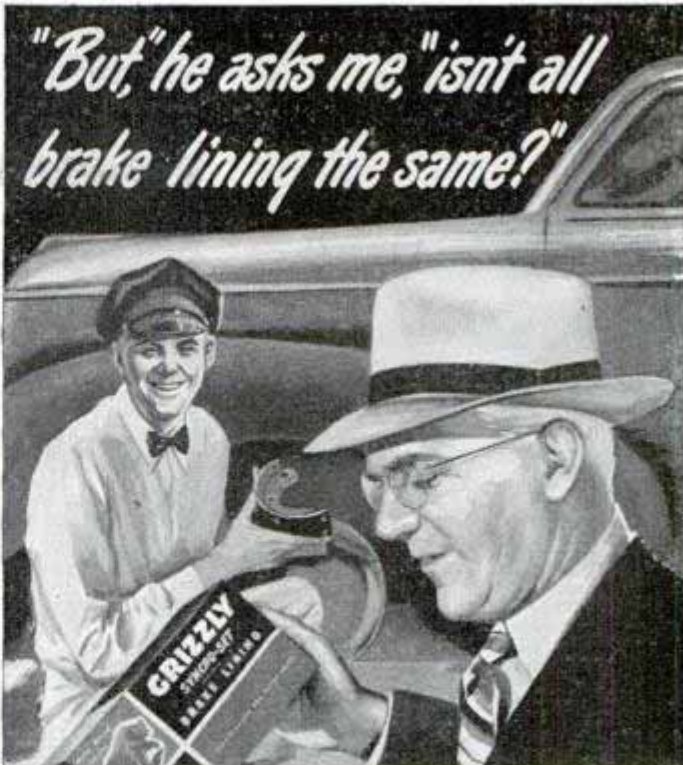
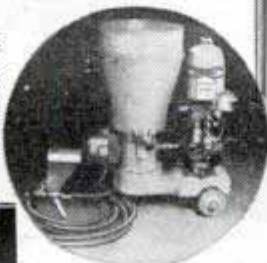
Beauty and protection are sprayed on old and new buildings... exterior and interior surfaces... by COLORCRETE. It's a plastic, water-resistant material, spread evenly over surfaces and forced into cracks by air pressure. Fuses to masonry with enduring tenacity. Many textures. Range of 30 smart colors. Fully proven by 20 years of actual use under all conditions.

BIG EARNINGS FOR COLORCRETERS

Colorcrete ties in with today's huge building program. Renews old buildings. Makes new construction more attractive and enduring. Large waiting market, because building owners get long lasting beauty and protective values at low price. Yet your selling price can be several times your basic cost. Machine is easy to operate. Moderate investment. Write or wire for complete information.

COLORCRETE INDUSTRIES, INC.
570 Ottawa Avenue Holland, Mich.

COLORCRETE



"But, he asks me, 'isn't all brake lining the same?'"

"Look, Joe," he says, as he watches me reline his brakes. "Isn't all brake lining the same?"

"Not quite," I answer. "For example, Grizzly Brake Lining is an exclusive, asbestos-friction compound, molded on a strong wire grid back. There are plenty of other features too, but what's most important is the way Grizzly gives better braking action to both 'Big Foot' and 'Little Foot' drivers."

"How's that?" he asks.

"Just this," I reply. "The many fine Grizzly features assure superior brake performance in the largest trucks down to the smallest passenger cars. Women, as well as men, find Grizzly gives them quick, smooth, sure stops with a 'soft' pedal."

"Well," he grins, "if the quality of your work equals Grizzly's quality, I'll be satisfied."

"Don't worry," I assure him. "Grizzly and I make a combination that satisfies every time!"

BIG FOOT... LITTLE FOOT

both share equally in Grizzly's superior all-around performance. Remember — for smooth, easy stops and amazing freedom from adjustment, reline with Grizzly. Grizzly Manufacturing Company, Pauldine, Ohio.

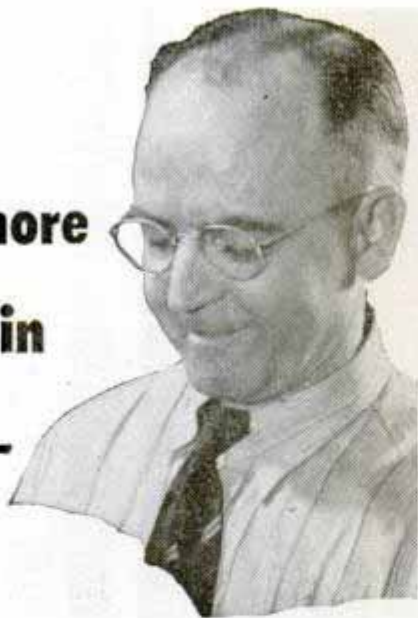


"Bear in Mind"... ask for

GRIZZLY
BRAKE LINING

WHEREVER BRAKES ARE SERVICED

There's more
pleasure in
working—
with an



ATKINS



Equip your home workshop with a "Silver Steel" Handsaw and you'll promptly discover what genuine pleasure there can be in working with a saw. To feel the "rightness" of an Atkins in your hand is to realize what a top-quality saw can do to make shop work simple and enjoyable. Those extra-sharp teeth go slicing straight and true—and so fast and easy—through the wood. And the fine work you can turn out . . . that's one more reason for using Atkins saws. Remember, too, that Atkins "Silver Steel" Saws hold that keen cutting edge much longer.



E. C. ATKINS AND COMPANY
Indianapolis 9, Indiana

ALWAYS ASK FOR "Silver Steel"

Grandpappy Refuses to Die

(Continued from page 157)

still being operated by the Southern Pacific as a branch of its desert line that serves the Owens Valley region. There, too, there is just enough traffic to keep the line in business. Nonmetallic minerals such as clays, pumice, sulphur, and diatomaceous earth are the principal commodities hauled. One freight train is operated three times a week over the 71-mile portion that remains of the original line. There are no passenger accommodations and the occasional visitor who makes the trip needs no ticket to ride the caboose.

Parts of the roadbed on the narrow gauge are so rough that the bell on the small engine rings all by itself when the speed creeps up past 23 miles per hour, but there is no hurry and the engineer slows down when he hears this warning. Some of the original 35-pound rail is still in use.

Much of the rolling stock, built by the V & T in the '80s, is still at work and most of the wheels under the diminutive boxcars were cast in the V & T foundry. When one of the aged boxcars or flats is no longer safe it is tipped off the end of a spur track and burned.

Automobile tourists in Nevada who spot a V & T train and tourists in California who see one of the narrow-gauge freights usually stop their cars and grin while the old equipment rattles by. The engineers wave an arm and grin right back at them, for operating the old trains is fun.

The Guns Still Roar at Aberdeen

(Continued from page 94)

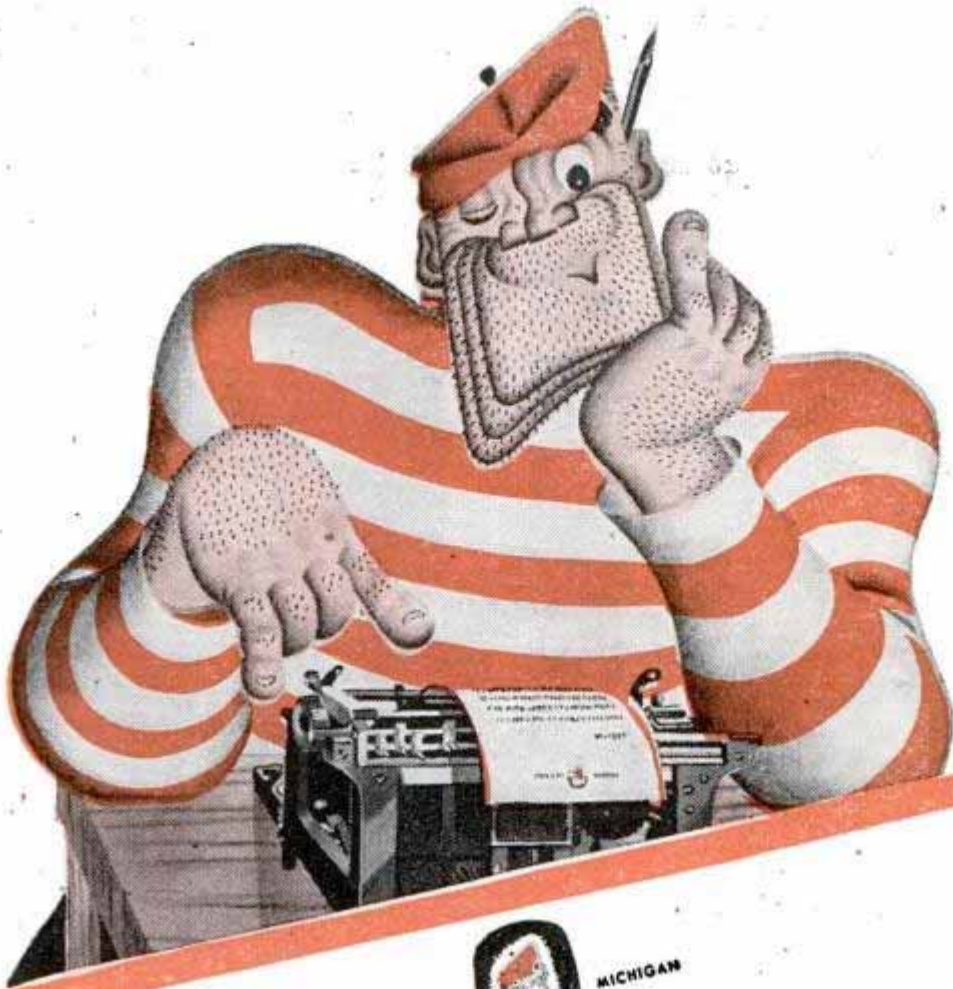
pressure of tires on the big mounts is checked regularly.

Here and there are guns that made history during World War II. Parked peacefully alongside our own giant artillery pieces are the German "Leopold" and "Anzio Annie," the latter being a 15-inch railroad gun used with devastating effect against our soldiers on the Italian beach. Our own giant 914-mm. mortar, the famous "Little David," is also on display.

Anchored near the shore where the big guns points out over Chesapeake Bay is the Aberdeen fleet. It consists of small boats that patrol the water areas during tests. Despite the daily thunder of the guns at Aberdeen it is necessary to remind some fishermen that those big shells are deadly.

The modern machine shops in the industrial section are equipped to modify almost any weapon or vehicle. These shops are

(Continued to page 256)



Dear Joe:

You're ~~right~~ right, oil-pumping is the first sign of worn-out piston rings. And the only sensible ~~thing~~ thing to do is hurry to a good mechanic and get them replaced.

Naterally I'd recommend Hastings rings. Cause I KNOW from experience they DO stop ~~put~~ oil-pumping, engine restore/performance and check cylinder wear.

Tough Guy

p.s. My boss says, "They'RE the best money you can spend on your car."

TOUGH BUT OH SO GENTLE



HASTINGS

STEEL-VENT PISTON RINGS

TOUGH on Oil-pumping
GENTLE on Cylinder Walls

HASTINGS MANUFACTURING CO.
HASTINGS, MICHIGAN
Hastings Ltd., Toronto



It shouldn't happen to a dog!

"I've been feeling as low as a dog-catcher, lately. I've got worms—and they shouldn't happen to any dog!"

"Sergeant's SURE SHOT Capsules are what I need. They clean out worms fast, surely, and safely. For pups, and small dogs weighing less than 10 pounds, use Sergeant's Puppy Capsules. They're specially made for worming the little fellows."

Sergeant's 73 years of clinical research have developed 19 dependable dog care products. Each one helps you to give your dog the care he deserves.



• You can keep your dog happy and healthy with just a little attention. Sergeant's new FREE Dog Book contains many interesting dog care hints. Ask for it at any drug or pet store, or write Sergeant's, Richmond 20, Virginia.

Sergeant's DOG CARE PRODUCTS

SAY YOU SAW IT IN POPULAR MECHANICS

SAFE HANDS

WORK FASTER

with Steel-Grip Gloves



The best opportunity for lower costs lies in speeding production. Keep materials moving with Steel-Grip Reinforced Gloves. They handle rough, heavy, jagged materials at breathless pace. Chrome tanned cowhide. Steel ribbon reinforced palm and fingers. Steel thread sewed. Protect against cuts, bruises. Or what's your need? Over 4,300 proved Steel-Grip Safeguards may give immediate answer. Used by big industrials since 1910. Write for catalog or state your need today.

INDUSTRIAL GLOVES CO.
647 Garfield Blvd., Danville, Ill.
In Canada: Safety Supply Co., Toronto



SHOCK ABSORBING

Tow Strap



FITS ALL CARS

Unbelievably strong—fastens to any car or truck bumper like a belt. Attaches in a jiffy. 10" s-t-r-e-t-c-h avoids jerks and car damage when starting and towing. Widely used on farms for pulling stumps, securing heavy loads, etc. Woven linen web—breaking strength 5000 lbs., more than most tow chains. In compact box—fits in corner of glove compartment. Send check (or M.O.) for only \$2.95 and your Motorists' Tow Web will be sent prepaid anywhere in U.S.

Cee-eN Mfg. Co., 7241 N. Hamilton Ave., Chicago 45, Ill.

GOODBYE to BURGLARS

Protect your belongings and the lives of your family. Send \$1.50 (or 7/8) by International Money Order for complete plans for combined burglar alarm and automatic locking device (electrical). It's unique. You make it from scrap.

SAFETY INVENTIONS, 110 Cranbourne Ave., Benoni, South Africa

ACE LATHE TOOL SET

Be permanently tooled-up for every operation on your Metal Cutting Lathe



The ACE Set is complete—there's nothing more to buy. Drop forged by the manufacturers of cutting tools used by 96 per cent of the plants and shops in industry they are correctly designed, are of special steel, are finely finished, are stronger—will last a lifetime. You can cut easier, faster and more accurately with ACE TOOLS.

At your Hardware Store—

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"
368 N. Francisco Ave., Chicago 12, U.S.A.

3 Turning Tools, 2 Cutting Tools, 2 Grinding Tools, 2 Boring Tools, 2 Threading Tools, 2 High Speed Steel Cutters and Blades, and 2 Wrenches in Fitted Steel Case.

The Chief's WORK BENCH

Built to Last a Lifetime!

With Bottom Shelf and 18" Sq. Drawer. 2"x6", Solid Plank, Grooved and Dovetailed Top and 1"x8" Back Rail, Shellacked to a Smooth, Satiny Finish.

MOHAWK LUMBER CO. Dept. 32
14525 W. Chicago Blvd. Detroit 27, Mich.
Enclosed Check Money Order for \$
Ship Quantity CHIEF WORK BENCHES at
\$16.95 each, F.O.B. Detroit, Mich.
 Send C.O.D., \$5 Deposit Enclosed.

NAME

ADDRESS

CITY STATE

No Priority Necessary!

• 6 Ft. Long • 34" High • 26" Deep. Shipped Knock-down, with Bolts, Nuts and Screws and ABC Chart for Quick, Simple Assembly.

Prompt Delivery
MOHAWK LUMBER CO.
14525 W. Chicago Boulevard
DETROIT 27, MICHIGAN

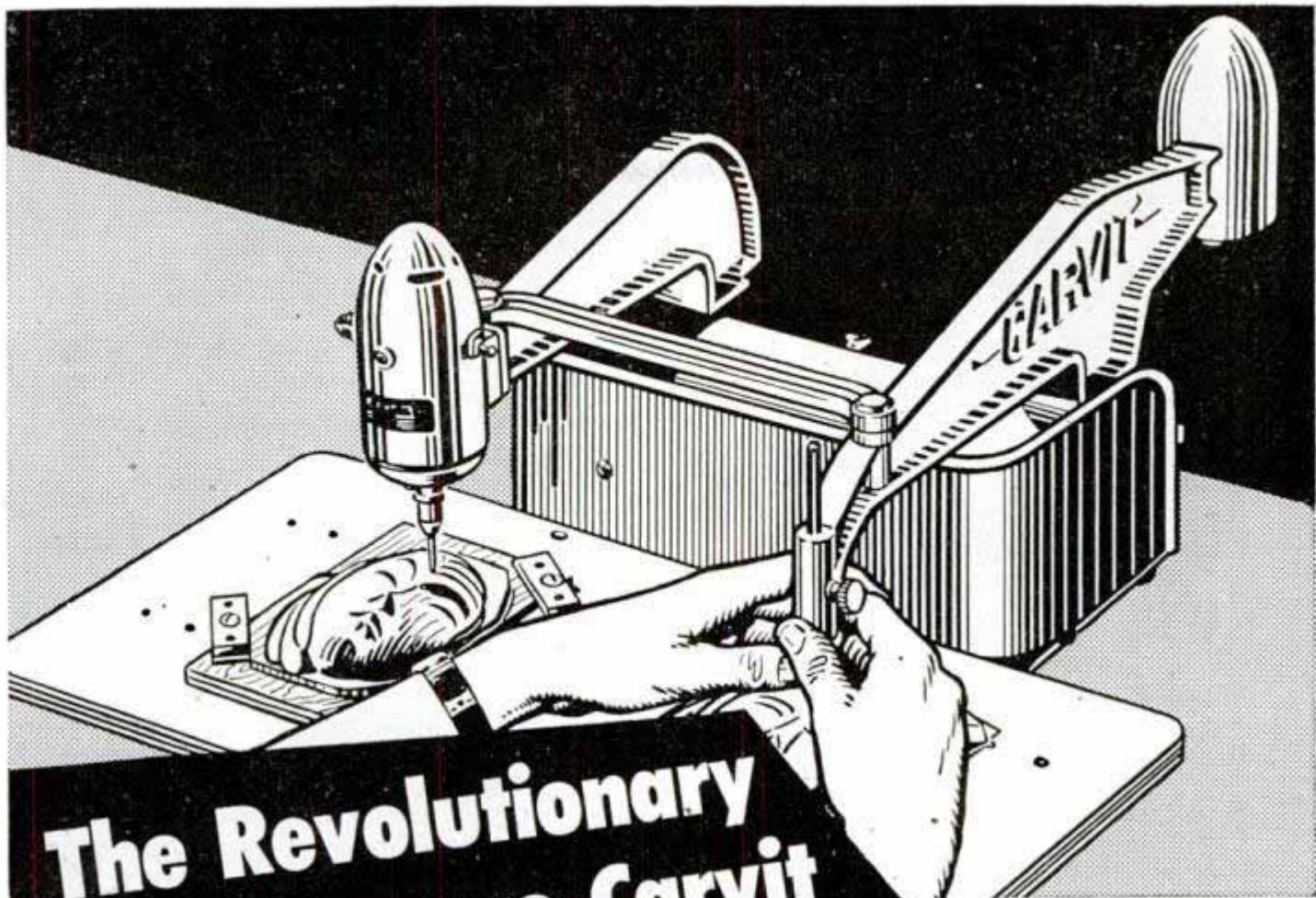


A CHRISTMAS PRESENT HE'D APPRECIATE

\$16.95
F.O.B. DETROIT

Send Check or Money Order, or Will Ship C. O. D. (\$5 Deposit)

POPULAR MECHANICS



The Revolutionary New Dumore Carvit

makes you a skilled wood-carver in 20 minutes!

Here's a fascinating new hobby — complete in one tool. Making fine wood carvings with the Carvit is so simple a child can do it! The unbelievable perfection of your first carving amazes your friends! Experienced craftsmen use the Carvit to give their woodworking projects that *real* professional touch.

With the Carvit, you make beautiful replicas of inexpensive objects you can find in any dime store or gift shop — reproducing them in mahogany, walnut, and other fine woods. Your carvings are many times more beautiful and valuable than your original models!

You're an expert at once — with a Carvit!

Here's how the easy-to-use Carvit works: You clamp a model to the table below the tracer, and a wood block below the cutter. Then you switch on the motor and guide the tracer over the raised contours of your model. The cutter moves with the tracer to carve an

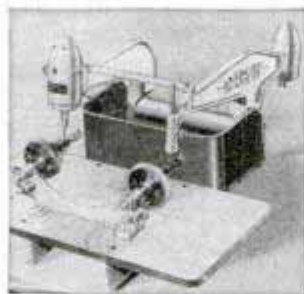
exact duplicate of the model.

Carving with the Carvit is fascinating fun for everyone. The Carvit is *the ideal gift for your sweetheart, husband, or son!* See the Carvit at your local hardware store today — or mail us the coupon below!



No skill or training needed to do work like this

Carve useful ornaments for the home — distinctive gifts — fine carvings that *sell!*



With an index attachment, the Carvit reproduces objects in the round — statuettes, and busts.

The Dumore Company, Dept. L-51, Racine, Wisconsin

- Please send complete information on the Carvit.
- Please send one Carvit. \$48.50 enclosed.
- Please send one Carvit with index attachment. \$58.25 enclosed. Shipping charges C.O.D.

Name.....

Address.....

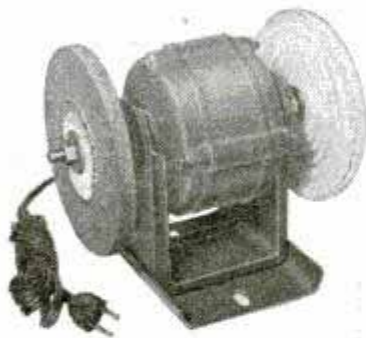
City..... (.....) State.....

H-8

**Satisfaction
guaranteed or
your money back
in 10 days!**

**Tear out coupon
and mail today!**

AT LAST!



A WORKSHOP GRINDER OF YOUR OWN for only **\$14.95**

(\$15.95 West of Denver)

FULL YEAR GUARANTEE

Just what you've been waiting for—this sturdy new, grinder-buffer-polisher. Designed and built especially for the home and hobby shop . . . Perfect for small industrial jobs.

HAS COUNTLESS USES

You will need this amazing home workshop grinder to sharpen knives, scissors, screwdrivers, small tools, lathe bits and many other around-the-house items . . . polish silverware, jewelry, golf clubs and keys.

NOTE THESE FEATURES

Safe operating speeds of 1725 rpm—will withstand stalling for 20 minutes without injury to motor. Oversized rubber cushions make it whisper-quiet—a must for home workshops and offices. Low cost operation—uses same current as 100 watt bulb. Will not interfere with radio. It is light enough to be carried to place of work.

NOTHING EXTRA TO BUY

Comes fully equipped—ready to go to work. Includes rugged six foot cord set, dura-hard, silicon carbide grinding wheel, polishing wheel. Has famous Victron motor mounted on resilient, non-vibration base. Finished in gray baked enamel—equipped with oil reservoirs and felt seals to last for the lifetime of the grinder. Weighs approximately 12 pounds. Can be clamped or bolted to table or work bench. Designed specifically for hobbyist, handyman, housewife, mechanic, doctor, dentist, optician, watch maker and jeweler. Send check or money order today. Postpaid in U. S. A.



good evidence of some of the \$50,000,000 spent for construction at Aberdeen during the war. One building houses a 1,000,000-volt X-ray machine and has facilities for examining entire units, such as gun tubes.

All roads at Aberdeen lead eventually to the Ballistic Research Laboratories and the office of Colonel Simon.

"Our laboratories here are responsible for all the Army's ballistic measurements," said Colonel Simon, "including the rocket and guided-missile tests at White Sands. Things around here actually move with the speed of light. The measurements for guided objects are largely electronic and all electromagnetic radiation moves with the speed of light. The instruments we use in this work change and improve so swiftly that we scarcely bother to write research reports because they would be obsolete before they could be printed."

To measure the flight of a single guided missile, the laboratory normally uses ordinary radar, pulse radar, the radar plotting board, several unique ballistic cameras, including a new one which can take a picture of a V-2 at 30 miles which occupies only one-third of a moving-picture frame, a specially built Knapp-Bowen camera, and Mitchell and German theodolites. The radio doppler system (see illustration) is used to measure and record the position, velocity, and acceleration of a guided missile hurtling through space at many times the speed of sound. Intensive research, both at White Sands and in the \$2,000,000 supersonic wind tunnel at Aberdeen, is causing rapid changes in the design of rockets and guided objects. The wind tunnel, which was completed before the war ended, saved the country millions of dollars by revealing a fault in a heavy bomb before it went into production.

In regard to guided objects, the colonel points out that no one has yet guided a supersonic missile in the accepted meaning of the term except for a few test models of a German flak rocket. Guidance of a German V-2 functions only when the rocket is burning and therefore it is actually guided much as an artillery shell is aimed. Despite the many factors to be overcome in perfecting guided missiles, Colonel Simon says: "It is reasonable to expect that long-range rockets and guided missiles will largely replace the tactical and long-range bombing planes, the long-range gun, and the large antiaircraft gun."

How soon? The answer to that question is buried deep at Aberdeen Proving Ground where the roar of guns in time of peace assures a nation that its best military minds are very much on the alert.

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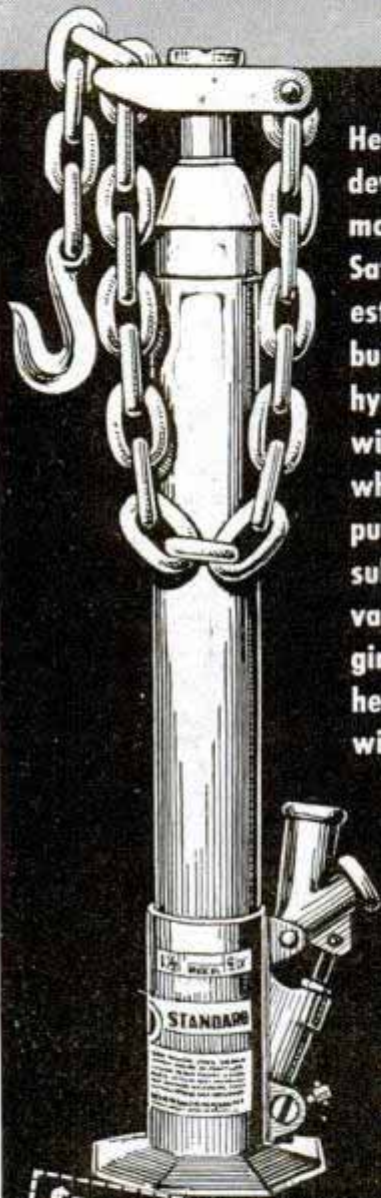


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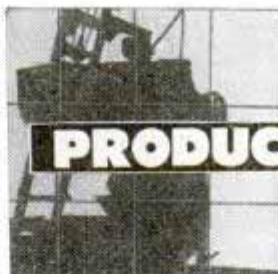
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Land of Home Workshops

(Continued from page 104)

night, a raincoat during thundershowers, and as a display for wares in the market place. For women, the rebozo or shawl worn around the head is almost as versatile. It keeps out the morning chill, serves as a cradle in which to carry a baby and becomes a market basket in which to bring home food.

Mexicans do some amazing things with their basket weaving. The materials that go into these products include the maguey fiber (the plant that also produces pulque, the poor man's drink), grass, fine bamboo, henequen and horsehair. A great variety of techniques are used to produce a wide range of colorful articles—sleeping mats, hammocks, earrings, sandals, toys, hats and baskets of all sizes and shapes.

One of the interesting sights in Mexico City is a man born without arms who cheerfully weaves with his feet. All day long he sits on Juarez Avenue, Mexico's Broadway, using his toes as cleverly as most persons use their fingers.

Since Mexico is the world's No. 1 producer of silver, it is only natural that her craftsmen should be highly skilled in fashioning jewelry and platework of a purity higher than Sterling. In Aztec days, much filigree work was produced, but today simpler designs for rings, bracelets, necklaces, earrings, pins and other jewelry are favored. Many designs are set with coral, amethyst, opal, jade, onyx, obsidian and other semiprecious stones.

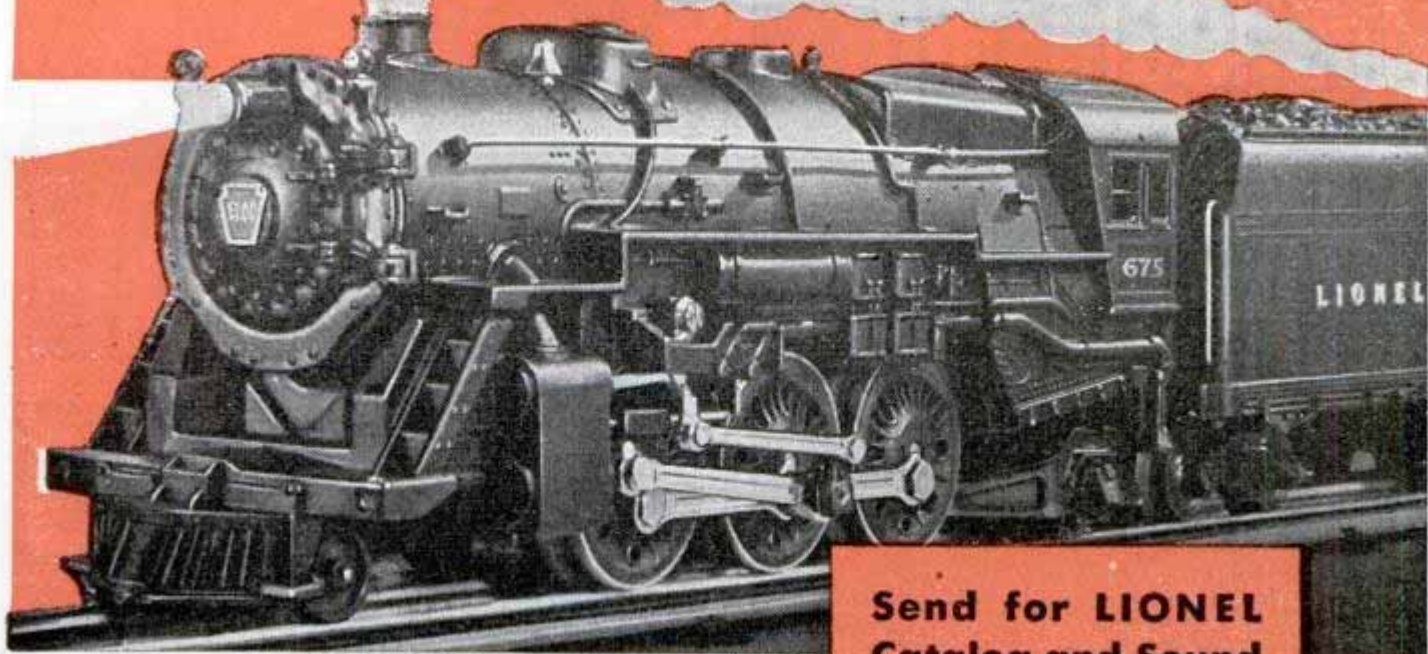
Glass working was brought to Mexico by the Spaniards. It is an art whose secrets are jealously guarded and handed down from father to son. In Mexico City, the Avalos family have been glass blowers for several hundred years, producing everything from tiny, colored glass animals to stained-glass windows for churches.

There are a number of other crafts which flourish and which produce objects of real art. Fine leather work—belts, pocketbooks, wallets, boxes—are produced in Mexico City. The ancient craft of tinworking has been revived and exists side by side with silver in Taxco. Toys of all kinds for Mexico's many fiestas and saint's days are fashioned in Tlaquepaque and Celaya. Wrought-iron work flourishes in Mexico City, Puebla and Amozoc. Furniture is turned out in Mexico City, Cuernavaca, Toluca and Guadalajara.

Mural painting, one of the great arts of Mexico's ancient peoples, has come to life again under the brushes of Diego Rivera,

(Continued to page 264)

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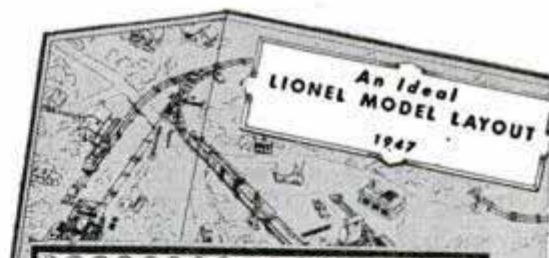


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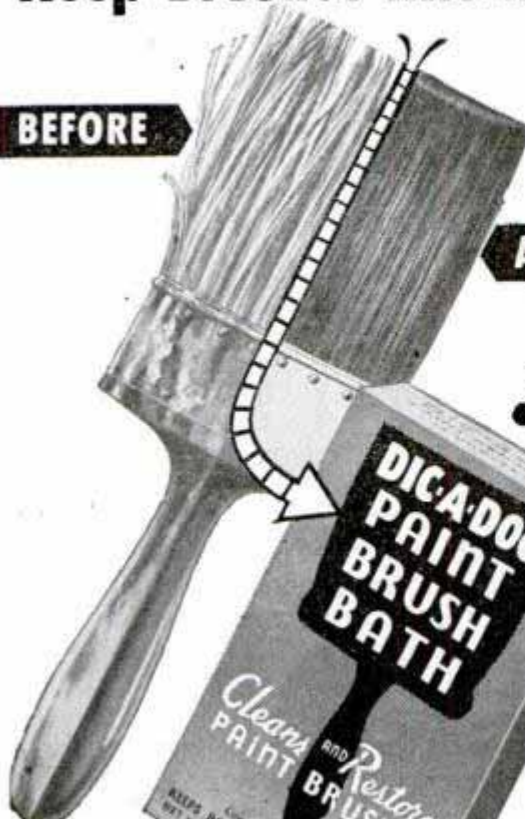
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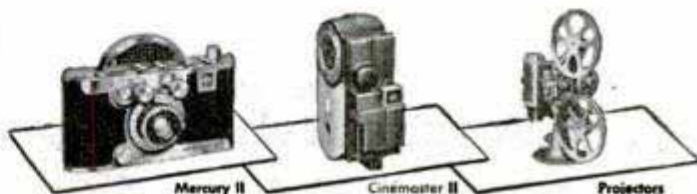
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David Alfaro Siqueiros, and Jose Clemente Orozco. In its libraries, schools and government buildings, Mexico City has perhaps the greatest collection of mural paintings of any city in the world. Mural painting combines the craftsmanship of a house painter with the artistry of an expert in oils.

It is estimated that 16,000,000 of Mexico's 22,000,000 people make and use exclusively the products of their own home workshops. These are the peasants who cannot afford to purchase factory-made goods. Why, for example, pay 5 pesos (\$1) for an iron skillet when you can purchase a terra-cotta cooking pot in the market place for 25 centavos (5 cents)?

But Mexico is on the march under her young, dynamic president, Miguel Aleman. He is trying to spread the benefits of a mass-production, industrial economy to all his people—not just the few millions that live in Mexico City and some of the larger cities.

This means that Mexico, the workshop of the western world, is threatened by the spinning machines, the stamp presses and the machine lathes of the United States. It is a safe wager, however, that when Mexico's millions begin to wear factory-made shoes, hats and shirts, the artisans and craftsmen will continue to make many objects for their own enjoyment and amusement. The average American handicraft hobbyist understands that.

Self-Closing Electrical Outlet

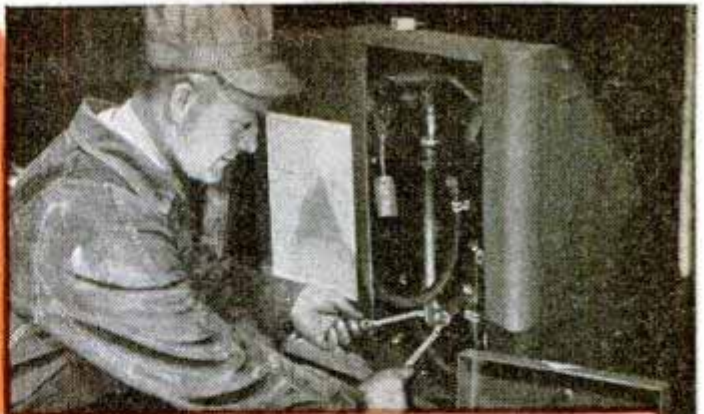


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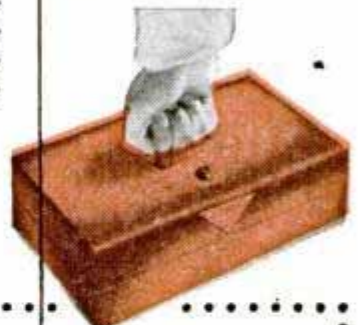
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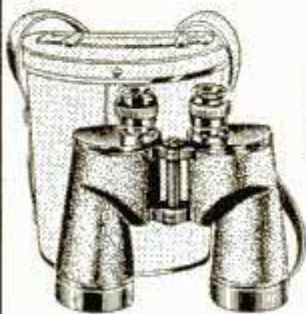
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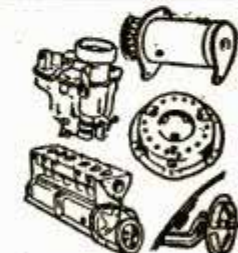
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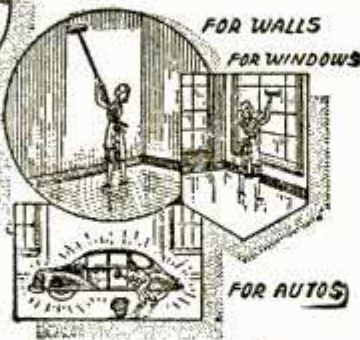
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48" Long Handle

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Holds 20 times its weight in water.





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But run any motor long enough and hard enough and *you'll want service...* and no nonsense about it!

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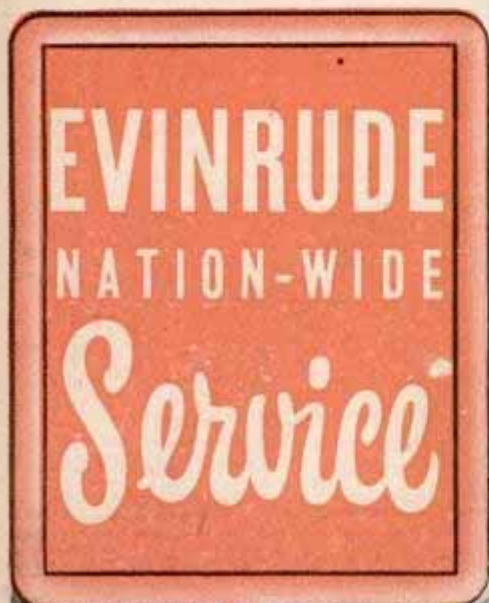
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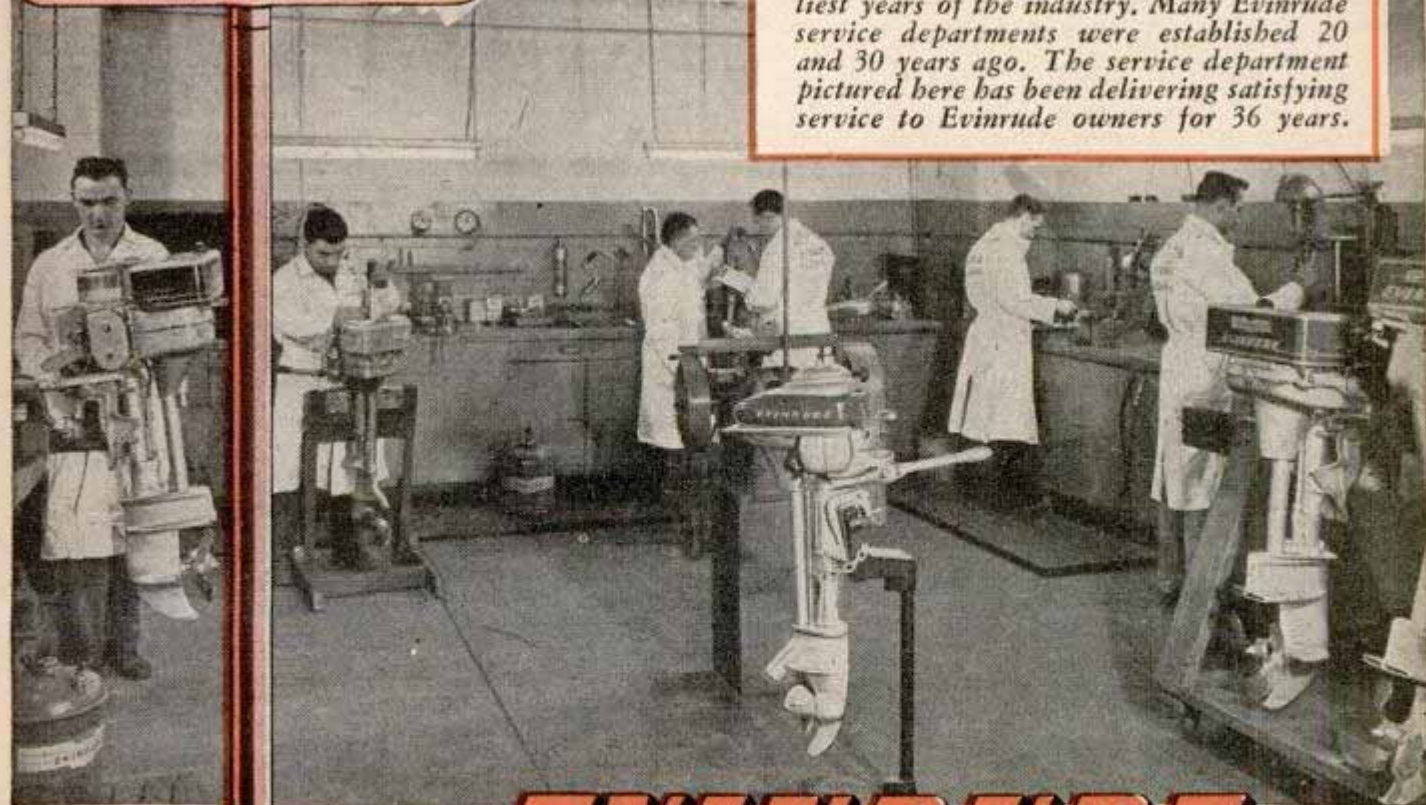
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67"x87" grommeted. Makes excellent small tarpaulin **\$3.45** postpaid



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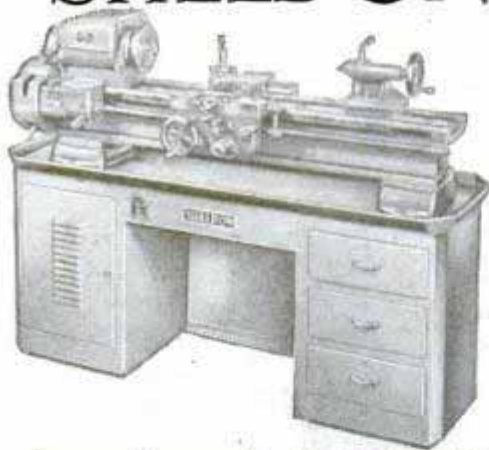
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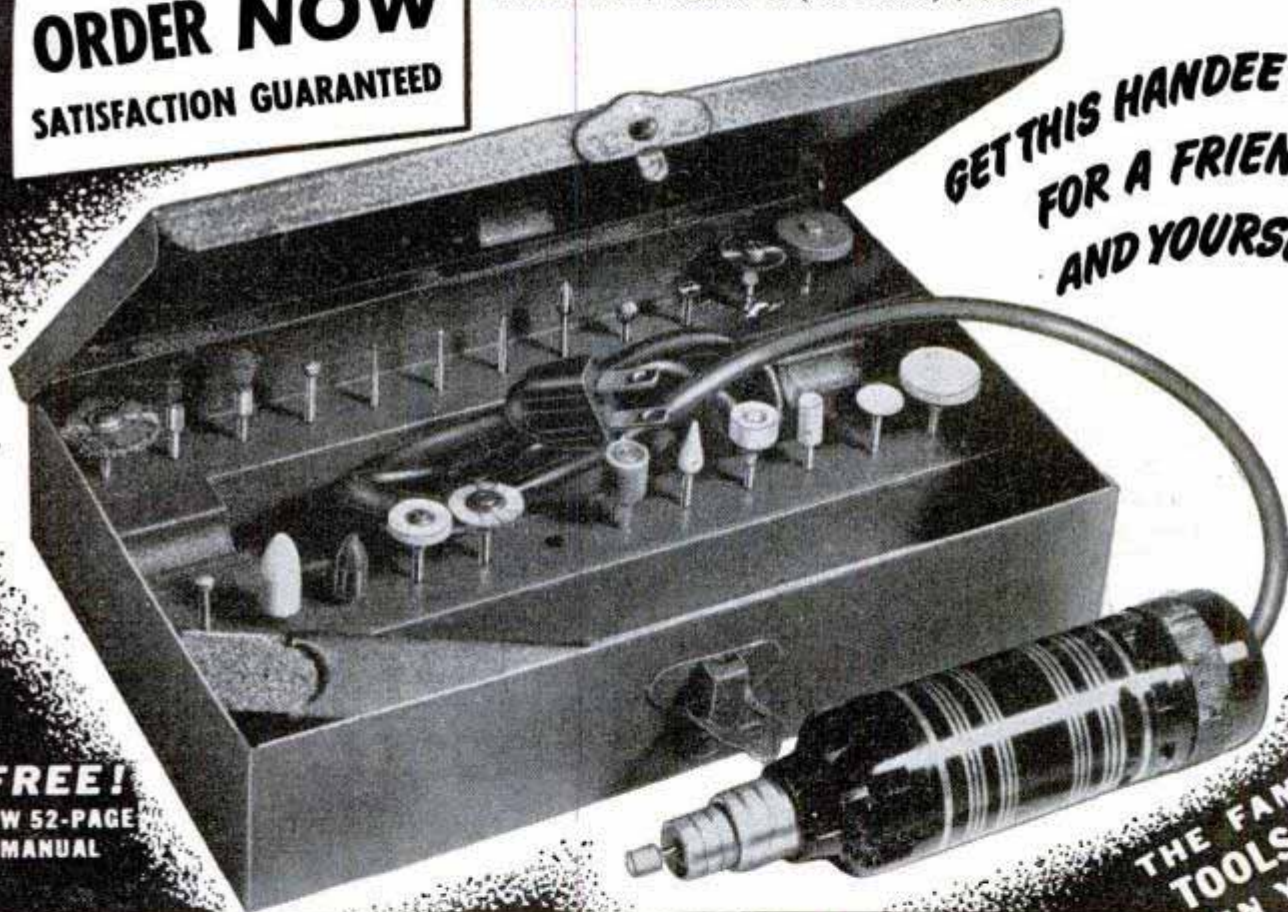
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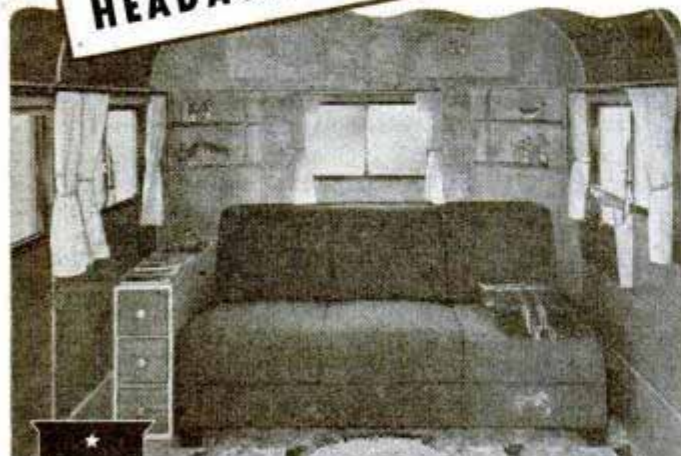
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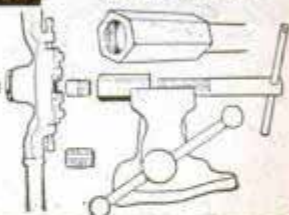
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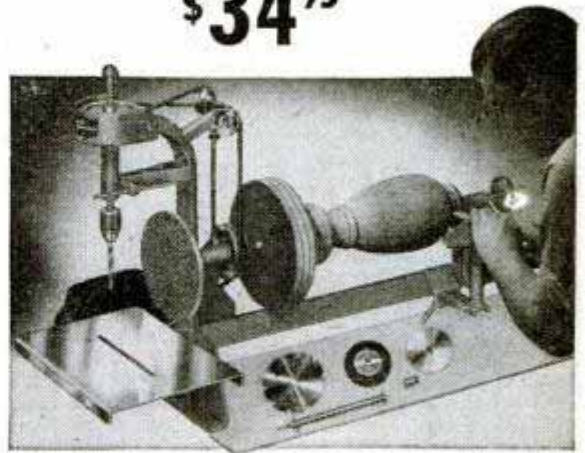
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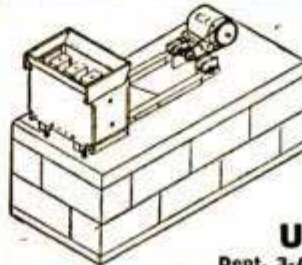
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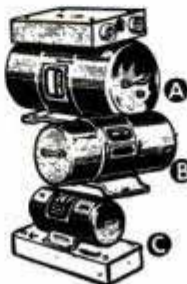
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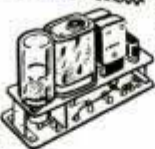
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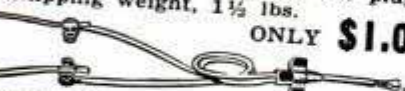
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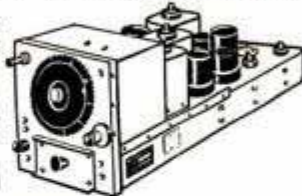
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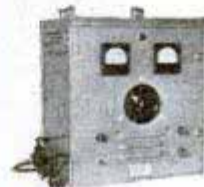
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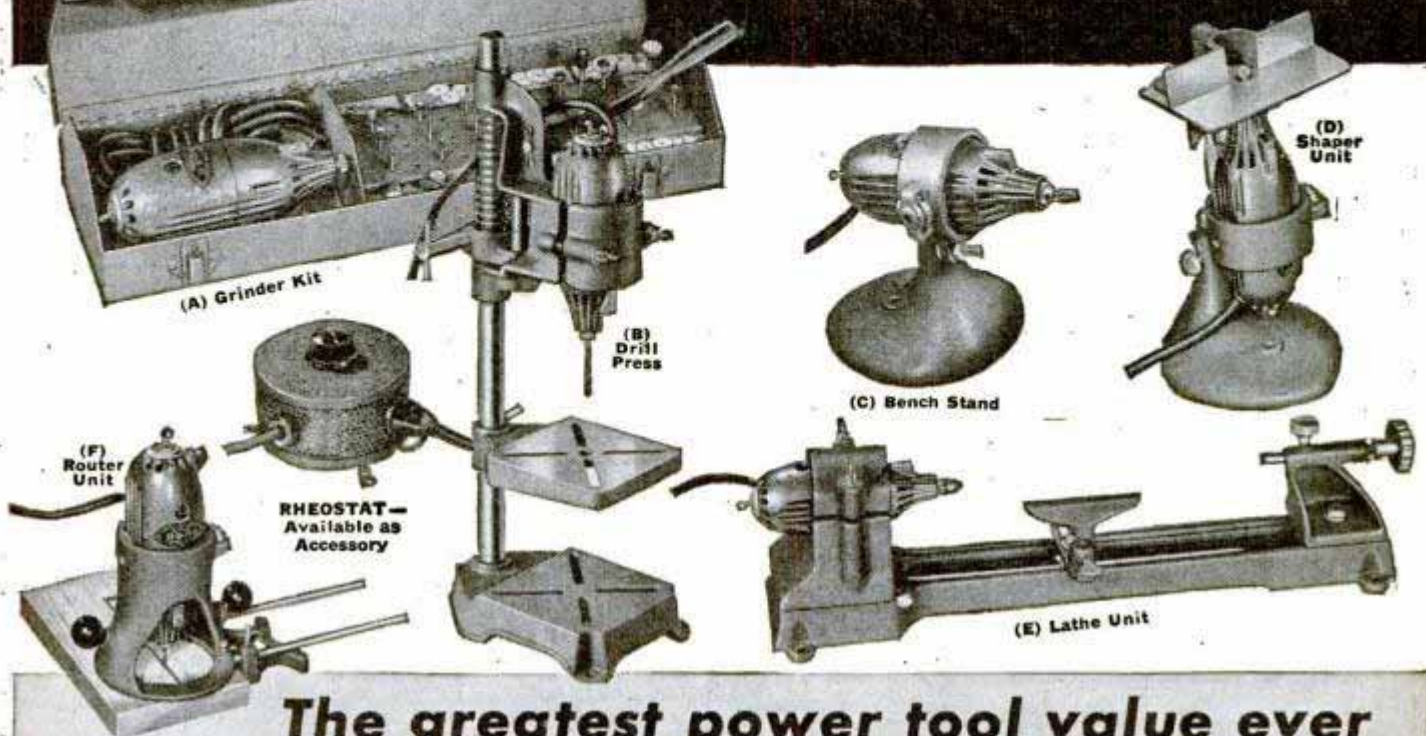
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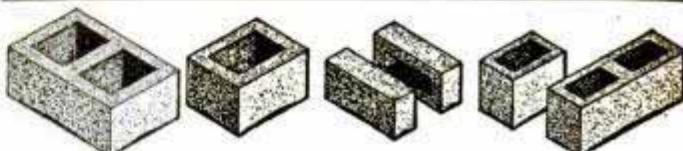
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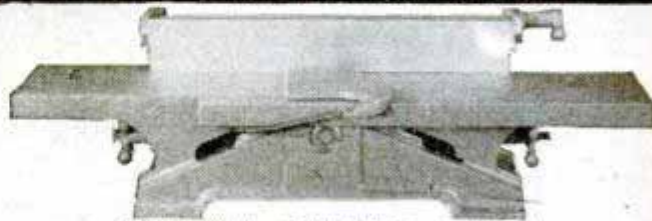


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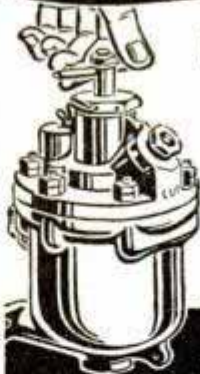
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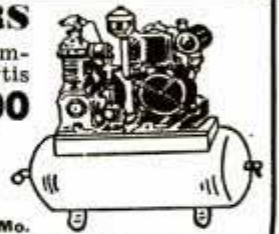
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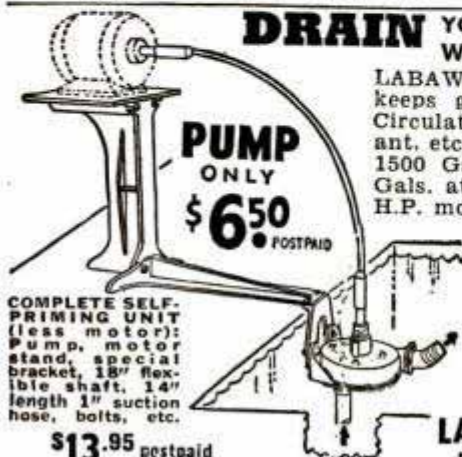
LABAWCO Type P Pump keeps garden pools fresh. Circulates oil or refrigerant, etc. DOES NOT CLOG! 1500 Gals. per hr. — 300 Gals. at 30'. Uses 1/8 to 1/2 H.P. motor.

Pump alone \$6.50. Pump with complete self-priming unit . . . \$13.95

POSTPAID if cash with order. West of Mississippi, add 50c.

SEND ORDER TODAY

LABAWCO PUMPS
BELLE MEAD 4, N.J.



PUMP ONLY
\$6.50 POSTPAID

COMPLETE SELF-PRIMING UNIT (less motor): Pump, motor stand, special bracket, 18" flexible shaft, 14" length 1" suction hose, bolts, etc.

\$13.95 postpaid

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A motor with the name you know

The New HOOVER Fractional Horsepower Motors



1/4 horsepower and up

You know what you are buying when you see "Hoover" on the name plates of these new fractional horsepower motors.

You know Hoover is the "great name" in electric cleaners; you know its reputation for fine products.

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Induction run . . . single phase . . . 60 cycles . . . 1725 R.P.M. . . heavy duty . . . built for continuous operation.

Capacitor start . . . more than 300% full load starting torque with minimum current flow.

No vibration or "shift" . . . integral feet, carefully machined to give solid mounting and quiet operation.

Low temperature . . . electrical and mechanical design for low-temperature operation. Ventilated open type. 40° C. Rise.

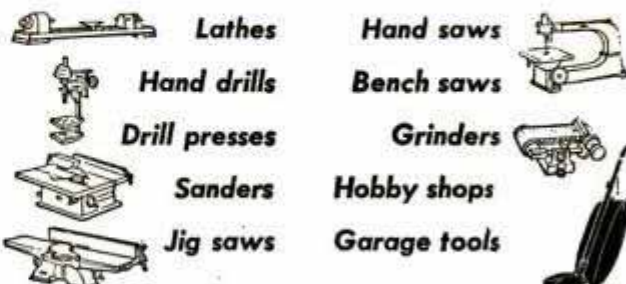
Laminated steel rotor . . . carefully ground and balanced for maximum efficiency.

Centrifugal starting switch . . . built for years of trouble-free operation.

High-grade ball bearings . . . sealed against dust and grit, give smooth performance and long wear.

Rotation . . . clock or counterclockwise.

POPULAR USES OF HOOVER MOTORS



See your authorized Hoover motor dealer. If unable to locate, write:

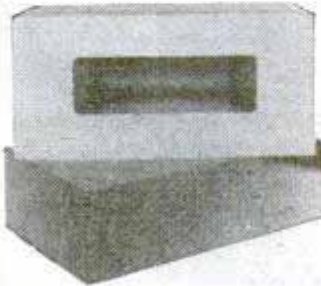
THE HOOVER COMPANY
Electric Motor Division
North Canton, Ohio; Hamilton, Ontario, Canada

Makers of the World-Famous
HOOVER
CLEANERS

Be the Local Manufacturer of this Modern Building Unit

Choice new territories are being opened up for the local manufacturing of Dunbrik and Dunstone—America's finest masonry. Several hundred new local plants are needed to keep pace with the fast-growing consumer demand.

Millions of Dunbrik are used annually for the building of homes, and all types of public and commercial structures. It is outstanding in design, symmetry, and colorful beauty. And has price appeal of tremendous significance. Dunstone—a companion unit broadens the usefulness and market possibilities of Dunbrik.



The Lifetime Opportunity for Men of Vision and Enterprise

Dunbrik and Dunstone are vital contributions to the nation's crying demand for low-cost homes. A demand that is only beginning to be supplied. Better yet, they deliver all the advantages of masonry at its best without price penalty. Strength—safety—long life—low depreciation. These factors indicate that market possibilities are almost unlimited.

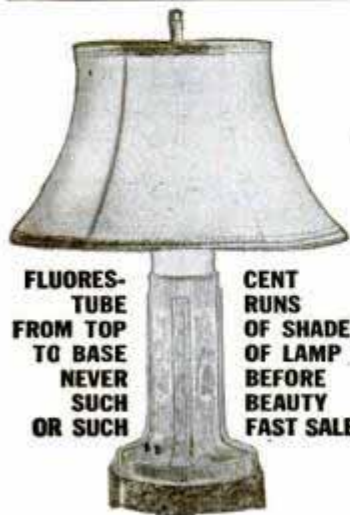
We supply complete plant equipment for local manufacturing, using local materials and local labor. This explains why selling prices can be low, yet profit margin high. Moderate investment. Franchise-protected territory. Twenty years of consumer acceptance. Wire or write for full information and territorial reservation.

W. E. DUNN MFG. CO.

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FLUORESCENT TUBE FROM TOP TO BASE NEVER SUCH OR SUCH

CENT RUNS OF SHADE OF LAMP BEFORE BEAUTY FAST SALES

Agents

For the First Time— FLUORESCENT All-Lite TABLE LAMP!

FIRST to utilize the exclusive feature of UPRIGHT fluorescent illumination, the ALL-LITE gives off a soft, even distribution of light without glare—from shade top to bottom of base.

Selling like mad. Men order sample, show it and reorder in gross lots. Instant appeal. Plug it in and watch them buy. Comes complete with tube and plastic shade.

MAXILUME COMPANY

Send name for **FREE SAMPLE OFFER**

DON'T send a penny. Sample offer is free—Rush name for selling outfit and make money from the day it arrives. We will show you how to sell to hundreds of homes, restaurants and public places and to stores by the dozens for resale. Also immediate delivery on standard fluorescent fixtures. Get going with the MAXILUME line. It's a winner for others—it can bring big, fast profits to you. Rush name on penny postcard.

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Precision-made steel wheels, red enamel finish.

WHEELS WITH SEMI-PNEUMATIC TIRES

6" X 1.50 with 3/8" Oilite bearing.....\$1.75
8" X 1.75 with 3/8" or 1/2" Oilite bearing..... 2.25
10" X 1.75 with 1/2" Oilite bearing..... 2.75

WHEELS WITH SOLID RUBBER TIRES

4" X 1 1/2" tire, 1/4" steel bushing......65
6" X 2 1/4" tire, 3/8" steel bushing..... 1.00

INDUSTRIAL & AGRICULTURAL WHEELS

PAINTED BLACK

10 X 2.75 with Semi-solid lug tire, load cap. 400 lbs. Ballbearings 1 1/2", 5/8" or 3/4". Hub length 3"..... 7.00
3.00 X 5 with 2-ply Pneumatic tire and tube. Ballbearings 1 1/2", 5/8" or 3/4". Hub length 3"..... 9.75
4.00 X 8 with 4-ply Pneumatic tire and tube. Ballbearings 1 1/2", 5/8" or 3/4". Hub length 4" or 6"..... 13.95
Roller Bearings in 3/8", 3/4" or 1" supplied at \$1.00 extra



AXLES, COLD ROLLED STEEL

THREADED, NICKEL CAP NUTS

1/2" x 14" long..... .40 1/2" x 18" long..... .80
3/8" x 16" long..... .60 1/2" x 24" long..... 1.00
3/8" axle with washers and cotter pins, per ft..... .75
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Shipped postpaid in U. S. on receipt of price. Other wheel sizes available. Send stamp for catalog.

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THIMBLE DROME RACER

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Completely Finished



Only \$3.95 Postpaid

New, accurate scale model of midget racer, the classiest thing you ever laid eyes on. Die cast malleable aluminum body, turned aluminum rubber-tired wheels, Chrome exhaust stacks, Wobble pump. Simulated leather seat and back. Instrument panel and numbers. Equipped with bridle lugs for cable track racing. Car is 9 3/8" long, 4" high. Weighs 18 oz. Order one today—you can't beat this for fun!

Speed! Action! Can be adapted for Class A miniature engine or other power.

4" high. Weighs 18 oz. Order one today—you can't beat this for fun!

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The Modern PLASTIC for lasting Home Repairs

PERMANENTLY mends cracks or holes in wood, tile, stone or plaster. Sticks and stays put—Does not chip, shrink or fall out. Easy to use. Economical Mold it, chisel it, polish or paint it. If unobtainable from your lumber, paint or hardware dealer, the big 4-lb. can will be sent you postpaid (in U.S.) for only \$1. Full money-back guarantee, order now.

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SpeedWay

No. 117 PORTABLE BENCH GRINDER \$1495



A new type air cooled motor that has 3 times the power of the pre-war model. Protected self-aligning, oil impregnated bronze bearings. A new 1-piece die cast aluminum housing with integral wheel guards and tool rests. Built in switch, rubber covered cord and plug. 1 coarse wheel, 1 fine wheel (4 1/2" x 3/8" x 3/8"). You can never appreciate the sweet running balance and grinding efficiency of this grinder until you test it. Ask your SpeedWay dealer to demonstrate.

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SpeedWay Blue Line Tools are built for use. Each operates at the correct speed for its capacity and operation: Grinders grind at the proper speed to give efficient f.p.m. without excessive wheel wear; drills drill at speeds that cut rapidly thru work but won't burn drill bits . . . or with one of the stands illustrated, quickly convert into a sturdy, inexpensive, lever-operated drill press.

Each has its own specially wound, high torque, long life, air cooled SpeedWay tool motor, and all embody the quality features and "tool sense" developed thru SpeedWay's 35 years of specialization in the design and manufacture of portable electric tools.

Standardize on SpeedWay Tools. You will not only have better tools but in each case more tool for the money.

Sold by hardware, farm implement tool dealers, and tool departments everywhere . . . by many household appliance outlets and electrical stores.



No. 129 GRINDER
\$825



GA KIT
\$1395



No. 209
Drill Stand
(Less Drill)
\$1295



No. 89
1/2" ELECTRIC
DRILL \$2995



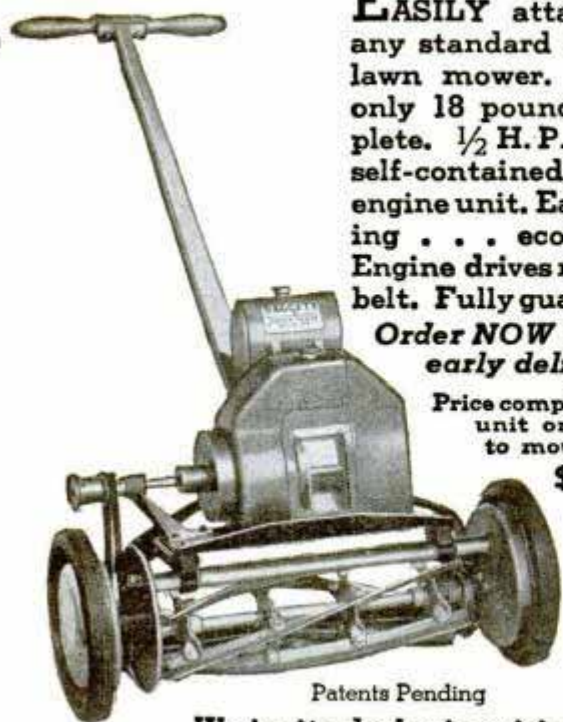
No. 69
1/4" DRILL \$1180

No. 229 DRILL STAND
(Less Drill) \$525



SPEEDWAY MFG. CO.
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COMPLETELY *New* MOWER POWER UNIT



EASILY attached to any standard make of lawn mower. Weighs only 18 pounds, complete. $\frac{1}{2}$ H. P., 2 cycle, self-contained gasoline engine unit. Easy starting . . . economical. Engine drives reel by V-belt. Fully guaranteed.

Order NOW to insure early delivery.

Price complete (power unit only), ready to mount . . .

\$49.50
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We invite dealer inquiries.

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MEADVILLE, PA.



NOW Install your own LOW COST 2-WAY TELEPHONE

Talk from house to barn, warehouse office to shop, etc.

Easy to use! Just hook up terminals to any 2-strand wire; several phones on same line if desired.

Operates on standard flashlight batteries. Compact, rugged . . . portable. Performance equals best present day commercial telephones . . . GOOD UP TO 17 MILES!

NEW - per pair, complete with heavy canvas case . . . \$29.50; leather \$32.50.
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Extra wire, new 500 ft. \$3.50.
1/2 mile reel \$10.50. 1-mile reel \$16.00. FOB Sacramento. No COD



FREE
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The Hagerty SEA SHELL is a complete kit of precision cut wood and waterproof plywood parts. Write for illustrated folder today.

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Mica Condensers, Assorted, 100 for \$3.49
Allen Bradley etc. volume controls 50 ohm to 1 meg.; 12 for . \$2.59
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Our Introductory Offer—Excellent Assortment—Big Value—Tremendous Savings. This kit includes a quantity of items listed in the above kits, PLUS many others. It's our New **\$10.98** Customer Special

25% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS.

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(No extra charge for left hand threads) CS- $\frac{5}{8}$ Pictured

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\$3.50 PP. 1 INCH BETWEEN WASHER AND COLLAR
SHAPER ARBORS 3 inches between collars, C4- $\frac{1}{2}$ \$14.25, C5- $\frac{5}{8}$ \$14.25, C6- $\frac{3}{4}$ \$15.25, D8-1 \$23.00. All P.P.
SPECIAL SAW ARBORS with 4 in., 5 in., 6 in., 7 in., housing length, add \$1.40, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$ models. Ask about other designs.
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$\frac{1}{4}$, $\frac{1}{3}$ H.P. MOTORS

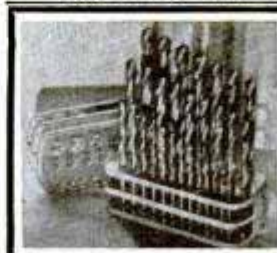
NEW, LIFETIME, GREASE-SEALED, BALL-BEARING, BASE-MOUNTED; Unconditionally guar. by OHIO ELECTRIC MFG. CO., mfrs.

$\frac{1}{4}$ H.P. \$19.95 $\frac{1}{3}$ H.P. \$26.50

Freight prepaid CHECK or MONEY ORDER. Freight collect C.O.D.

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These Complete High Speed Drill Sets Now Available at Low Prices

#1 to 60 Drills \$12.95 Per Set
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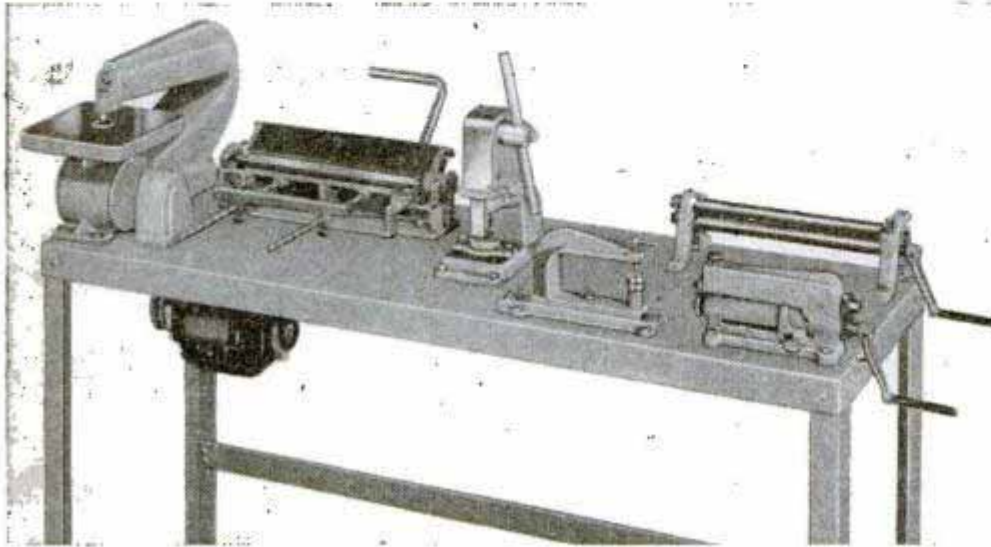
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Berkroy...

sheet metal equipment

Something New
in Metal Working



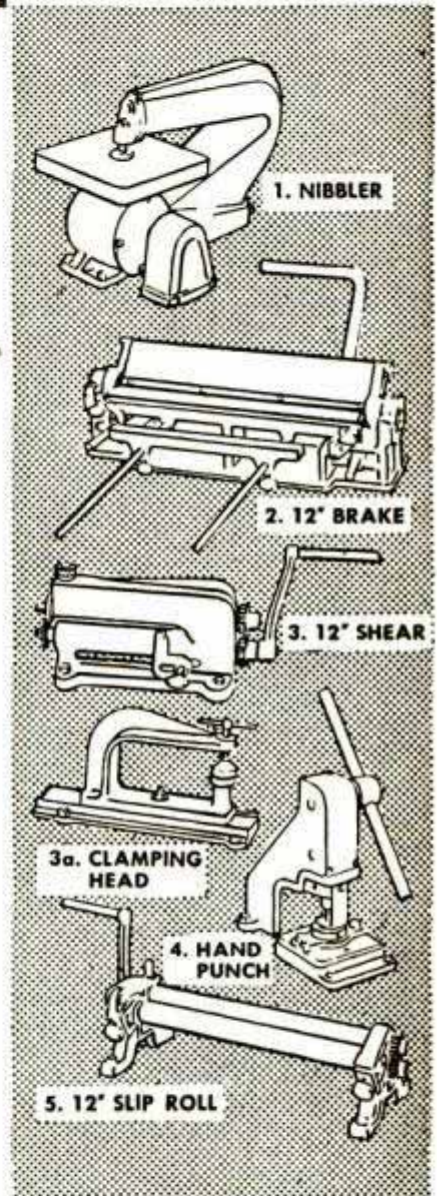
The compact Berkroy Unit completely equips your workshop for fascinating projects in sheet metal working. Mounted on the steel stand nearly 6 feet long, are five versatile metal working tools, that within their capacity, compare in performance to larger, far more expensive equipment. Each tool processes up to 16 gauge sheet steel with the exception of the Nibbler which will handle 20 gauge steel. Heavier gauges of aluminum, zinc, pewter, copper, plastics and other softer materials can be worked. The Berkroy Unit also has wide uses in industrial shops handling medium and small work at reduced costs and increased profits.

Complete set, stand and five tools, **\$217.50**
less motor No. 150

F. O. B. Factory



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1. NIBBLER ...
For cutting odd shapes, straight or scroll work. 8" square cast table, less motor.

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2. 12" BRAKE ...
For square or rectangular work and simple types of trim. Forms flanges, boxes, tabs, etc.

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Hardened and tempered cutters for straight line cutting, trimming, etc. No. 30

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For cutting inside or outside circles. No. 3001

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Used to punch sheet metal and to install pressed fits into small work. (Die sets and shear blades extra.)

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5. 12" SLIP ROLL ...
For forming cylinders, scrolls, reverse curves, etc. Simple, easy adjustment on rollers.

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Everyday Items For Farmers, Sportsmen, Mechanics and Laborers



NAVY FIELD JACKET (New)
Poplin outer shell with 100% wool knit lining. OD color. Zipper and button front. Has 2 slash pockets. Lightweight for both fall and winter. Sizes 34 and 36. Each... **\$6.95**

FACE AND NECK PROTECTOR

Navy blue wool felt (NEW) snug fit adjustable head bands. Button down mouth flap with bib collar (buttons in back). Finest of tailoring. Perfect cold weather protector. Each... **\$1.29**



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Heavy, durable, cream colored horsehide leather with wool lining. Dark colored elastic knit wrist. Small size only. Right hand glove has flap in palm for use by hunters. Per pair... **\$2.98**



HEAVY OVERALL TROUSERS (New)
N-1 Navy deck all wool flannel lined bib type trousers. Keeps out dampness and are water repellent. Outer shell made of durable jungle cloth. Has 2 front and two hip patch pockets. Sizes small, medium and large. Per pair... **\$4.95**



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2 Gal. capacity. New, collapsible. For use when motoring, fishing, in a trailer camp, or as a clothespin bag. Made of double canvas lining, heavy web belting handle, reinforced bottom, metal band top and bottom. A handy item for any use. Each only... **79c**



POPLIN FLYING TROUSERS Brand New

Intermediate, type A-9 OD, made of cotton twill cloth lined with an alpaca wool pile fabric. Three leg and two hip pockets. Adjustable suspenders included. Knee pocket and lower end leg inseam fitted with slide fasteners. Asst. sizes ranging from 32-44. Per pair... **\$5.95**



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Made of converted government flying clothing. A wonderful value and practical garment for protection against cold weather. Brown. New, standard size. Per pair... **\$2.98**



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Made of recon-verted highest grade sheep shearing. Natural color inside. Brown out. Zipper front. Right hand pocket. Well tailored and a wonderful value. Sizes small, medium, large. Each... **\$24.95**



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Brand new - Made of 100% OD wool felt, double layer reinforced. Used to prevent outdoor rash and chaps. Also wonderful buffer against cold weather. Plenty of room for eyes and nose; held in place by small elastic band. Each... **89c**



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Brand NEW, sheepskin lined, with rubber sole. Waterproof, can be used with or without shoes. State size needed, comes small, medium or large. Sale price, per pair **\$11.95**
Some Used Boots - Reconditioned and perfect in every sense. Same as above in every respect and size. Per pair... **\$6.95**



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Army OD, absolutely perfect, full sized. Cleaned and sterilized. Each only **\$4.98**
New Wool gray blankets, full sized. Only **\$7.95** ea.



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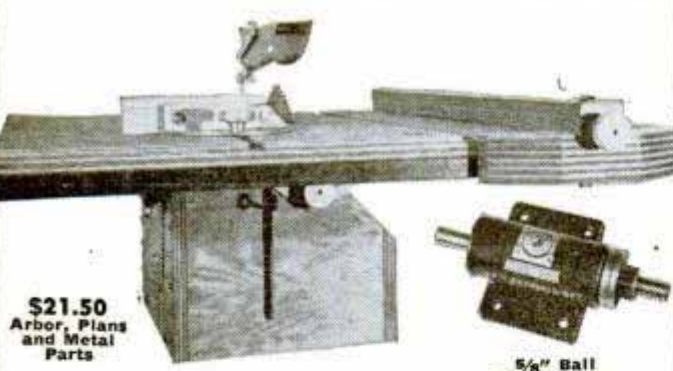
Made of Heavy Leather with carrying straps. Each **\$2.95** only



IMMEDIATE DELIVERY - Add 10% for Postage and Handling

ROKO, INC. 809 CHERRY ST. KANSAS CITY, MO.

CRANDALL TILTING TABLE SAW



\$21.50
Arbor, Plans and Metal Parts

5/8" Ball Bearing Arbor

BUILD IT YOURSELF

In your own shop - with our Ball Bearing Arbor, Plans and Metal Parts. Here's the saw you've been wanting for your shop! With our easy to follow step-by-step plans and instructions, you can build it with ordinary hand tools for a fraction the cost of all metal saws of comparable size and capacity. Sturdy wood, steel and aluminum construction.

Features-
Big roomy top 27" x 32" with 13 1/2" clearance ahead of saw. Tilts to 45°. Precision built ball bearing arbor lubricated and sealed. No further lubrication required. Self aligning, full length rip fence. Indexed mitre gauge. Indexed table tilting quadrant. Adjustable saw arm - cuts from 0" to 2 1/4".

Complete Kit- In California add 2 1/2% sales tax
Includes Ball Bearing Arbor with Saw Plans and instructions, and all metal parts, bolts, washers and screws **\$21.50** (less saw blade)
5/8" Ball Bearing Arbor only - with Saw Plans and instructions **\$6.95**
Metal Parts only - **\$14.95** less Arbor

If your dealer cannot supply you, send check or money order - we will ship promptly postpaid in U.S.A. or possessions. DEALER INQUIRIES INVITED

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The SPEED SAW FILER

Saves You Time, Money



Now you can do expert saw filing at home. Lifetime tool makes precision filing easy for even the most inexperienced. Two simple adjustments make it fit any type hand saw. Keep your saws extra sharp and true-cutting with a Speed Saw Filer. Complete with file, ready to use. Money back guarantee. Cash with order, prepaid (C.O.D. postage extra.)

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\$2.95

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New B-24 Aircraft Lighting **GENERATORS**



30 Volts
300 Amp. D. C.

\$49.50

Original cost \$250
MODEL R. 2, BUILT BY JACK & HEINTZ, CLEVELAND, O.

Can be used for lighting or converted for use as welder, electric plater, fast battery charger, auxiliary power unit, etc. Small but mighty. Size 16"x7". Air cooled. Shipping weight 68 lbs. Immediate shipment. Original crates. Send check with order to save time. We also offer new 200 Amp. G.E. and Westinghouse Lighting Generators, 30 Volts D.C. Model P. 1 at \$39.50.

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A BONANZA for the HOME WORKSHOP
ACTUALLY \$50.00 WORTH OF

Grinding Wheels

Abrasive discs, felt and buffing wheels, mandrels, rotary files, sheets, etc.

327 PIECES
ASS'T. SIZES
FOB CHICAGO
ALL FOR ONLY **\$6.95**

The buy of a lifetime! 327 pieces including 35 ass't. Grinding and Cut-off wheels up to 10 inches diameter, 1/16 to 1 1/4 in. face, 1/8 to 3 in. holes. Assorted grits—all brand new—made by Norton, Carborundum, Macklin, Bay State, etc. Also included are 100 slotted disc cloths; 100 paper discs; 3 round wire brushes on handles; 2 felt bobs; 2 felt wheels; 1 4" rag buff; 3 honing stones; 10 abrasive sleeves; 10 mounted stones, 1/8 and 1/4 shank; 2 mandrels; 2 rotary files, 1/4 shank; 50 abrasive discs; 2 7/2" abrasive belts; 5 9x11 abrasive sheets. Satisfaction guaranteed. Order today. It's better than **\$6.95** a \$50.00 value for only



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TOOL STEEL DRILL ROD

\$1.95
POSTPAID
in Continental U.S.
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25 RODS SAMPLER KIT 25 SIZES
1001 Uses for Craftsmen, Hobbyists, Mechanics, etc.

For Making
Punches
Chisels
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Tools
Shafts, Etc.

Free machining, easily worked, yet can be made file hard. Hardening instructions included!

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With Every Kit or first order 6" Steel comb. rule and depth gage with pocket clip.

FLAT TOOL STEEL

The Precision ground flat tool steel with the satin-smooth finish. Simple to work, easy to harden, ready to use.

SHOP ASSORTMENT \$4.80

5 dif. Pieces—1 1/32" to 1 7/8" thick 1 1/2" wide; 18" long. Include 25¢ postage on orders under \$5.00.

We can supply ALL your Tool Steel Needs.

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Year around comfort for Jeep owners. Kiln dried hardwoods, safety glass. Finest hardware, varnishes, top materials. Full opening rear door, locks. Send 25¢ with order balance **\$165** COD. FOB Cleveland plus tax, complete, semi-assembled.

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OTHER CARS converted to station wagons. Write for details.

**STURDY!
VERSATILE!
EFFICIENT!**

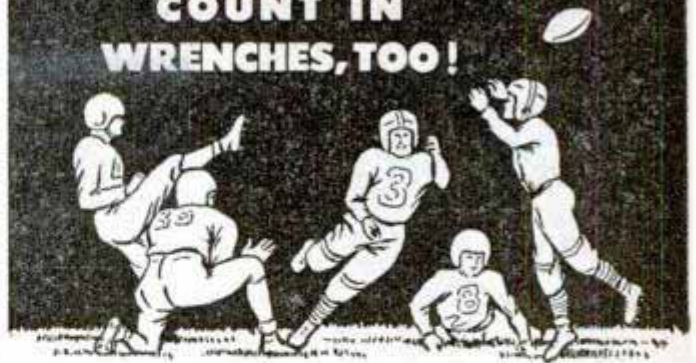
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LAWN and GARDEN TRACTOR

There's nothing at all like Garden-All! Instant Tool Attachment, Exclusive Depth Control, A Tool for Every Need. Write for folder.

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EXTRA POINTS COUNT IN WRENCHES, TOO!



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Billings' thinness gets them in and out of close quarters like a broken field runner. You can really save time with Billings.

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Billings are so light and easy to use they save your strength for the job and let you finish with plenty of time to spare.

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Good wrench heads must be able to take a beating. That's why Billings' extra tough heads are made to take it for years.

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There's no slipping when you put a Billings on a nut or bolt. It hangs on like a tackle and runs 'em off or sets 'em down surely.

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The extra points all add up to that wonderful feeling you get when the tough job's well done in short order with great ease.

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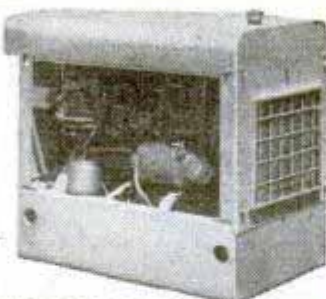
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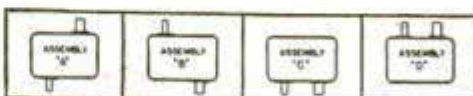
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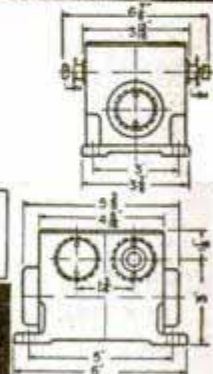
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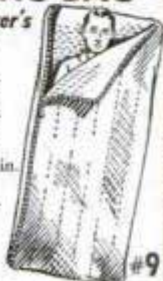
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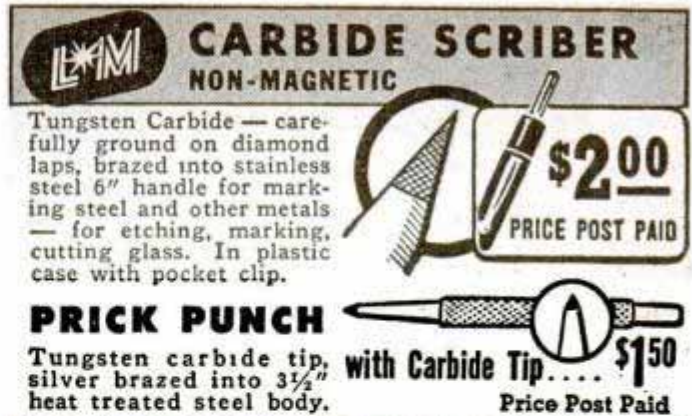
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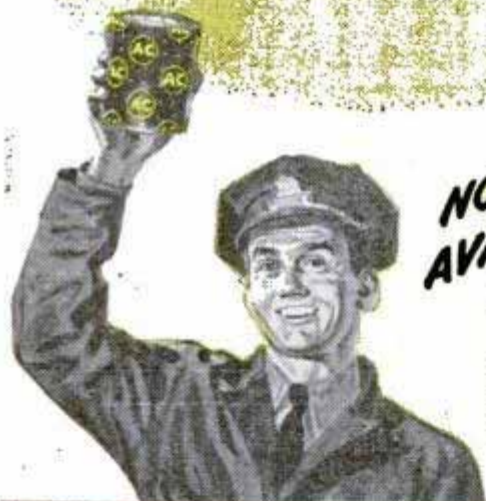
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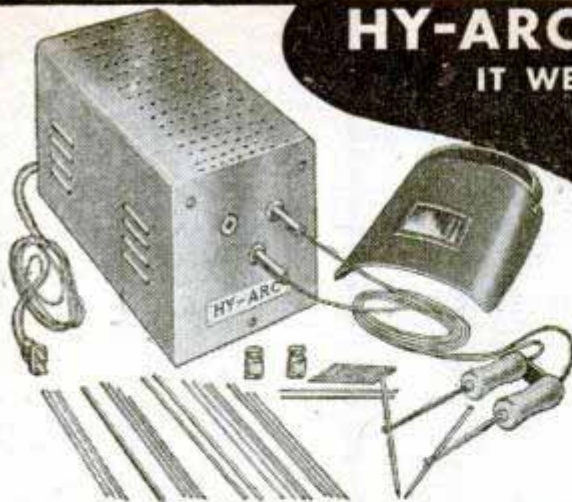
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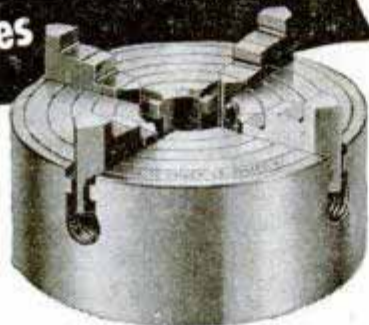
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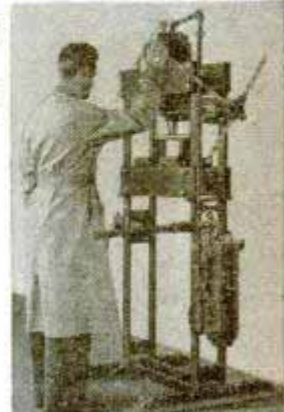
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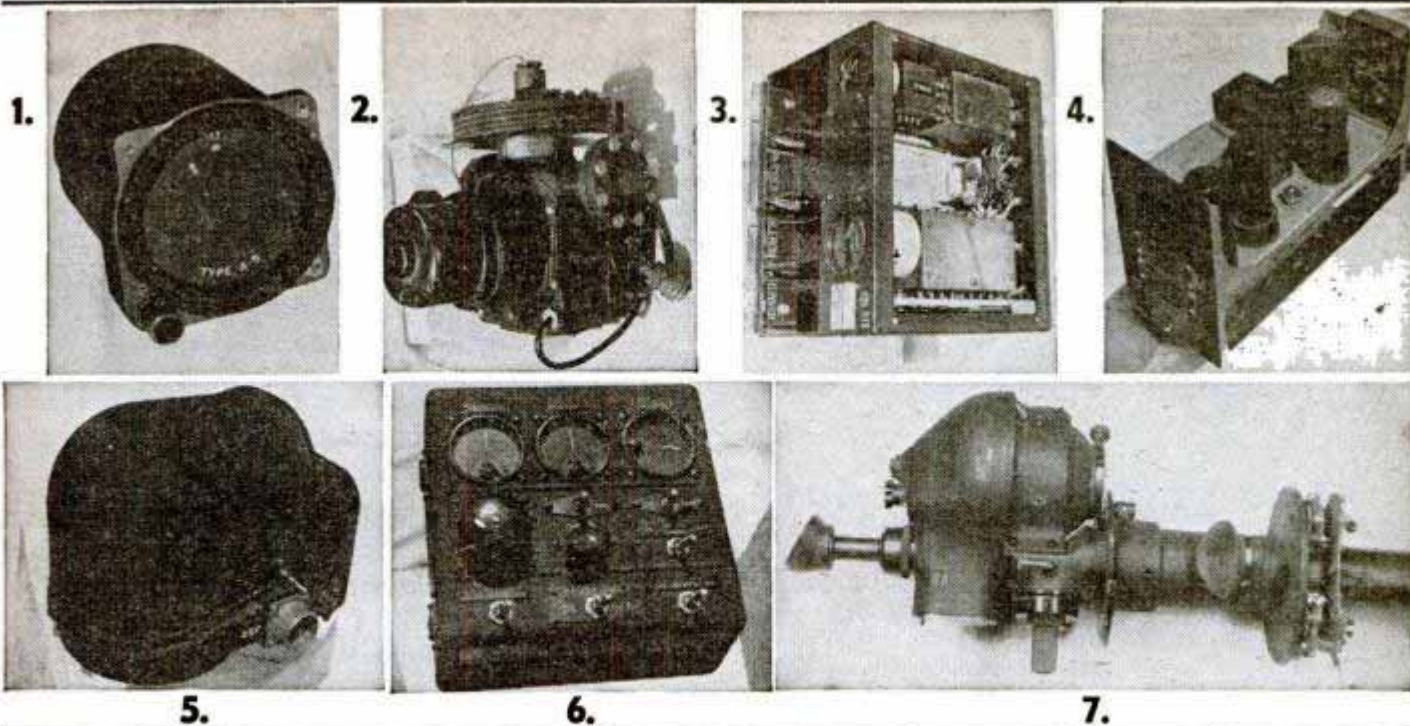
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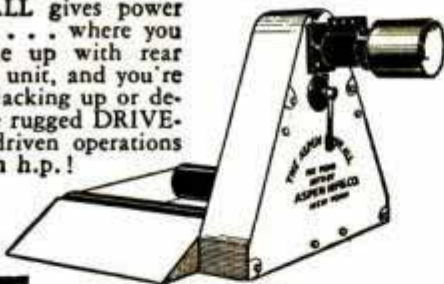
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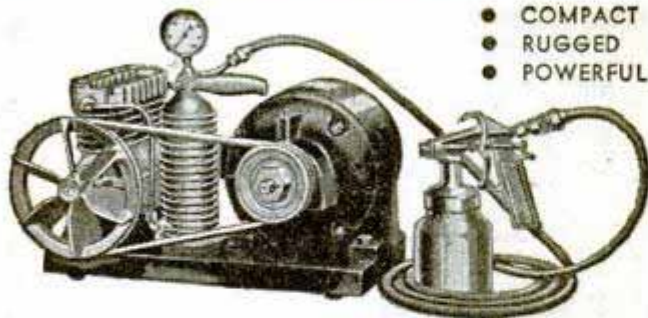
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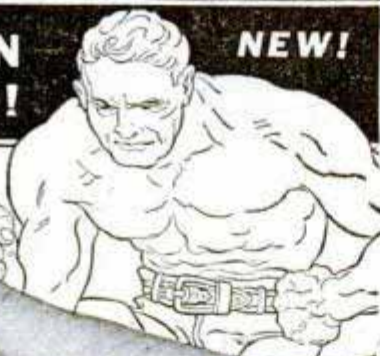
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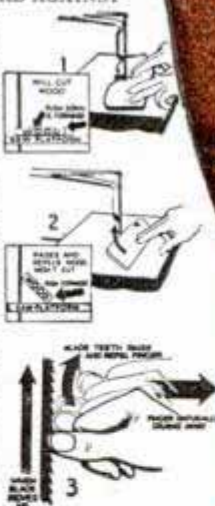
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SYNCRO has NO continuous cutting blade nor "Long stroke" blade to pull fingers into teeth—instead there are 14,400 strokes per minute—7,200 short cutting strokes plus 7,200 upward NON-CUTTING, REPELLING strokes! (Fig. 1) SYNCRO will not even CUT wood unless piece is pushed FIRMLY DOWNWARD AGAINST blade and FIRMLY FORWARD — both actions at SAME time! SYNCRO blade teeth cut ONLY on DOWN stroke. (Fig. 2) Teeth raise, repel, push away any object on UP stroke. (Fig. 3) When blade moves UP it KICKS finger away free. On down stroke, blade does not move far enough to accidentally cut finger unless finger is intentionally, deliberately fed into blade like wood is fed in Figure 1. No wonder SYNCRO is the world's SAFEST saw . . . a feature old and young users acclaim!



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"The SYNCRO POWER SAW ordered from you in 1940 is still saving merrily away. My son (then 8) has used it in the attic, kitchen, his room, and basement shop. I use it too. We never worry about accidents due to its MAGNETIC SAFETY STROKE feature. It's truly a family saw."—Mr. B. H. Smith, Rexburg, Idaho.

Complete with Cord,
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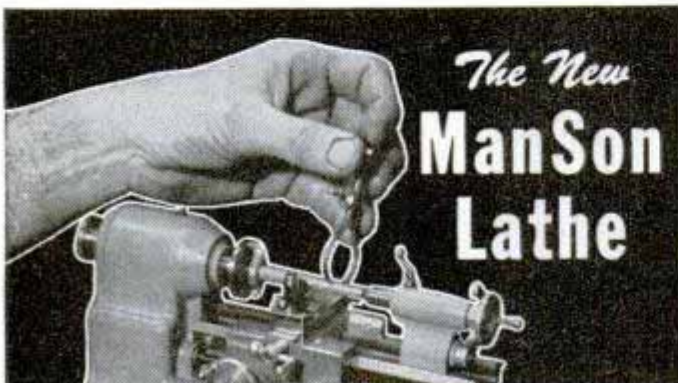
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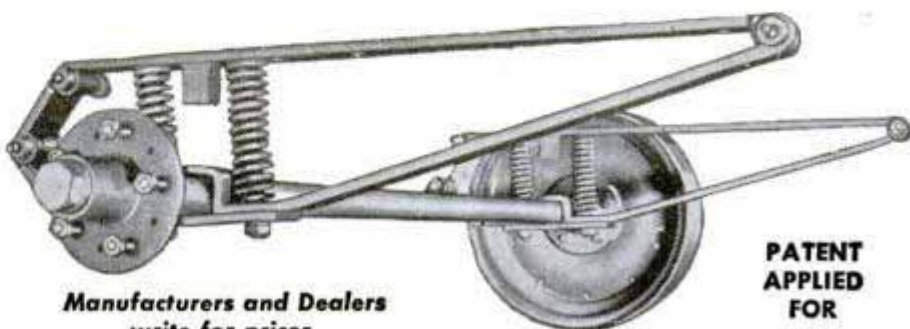
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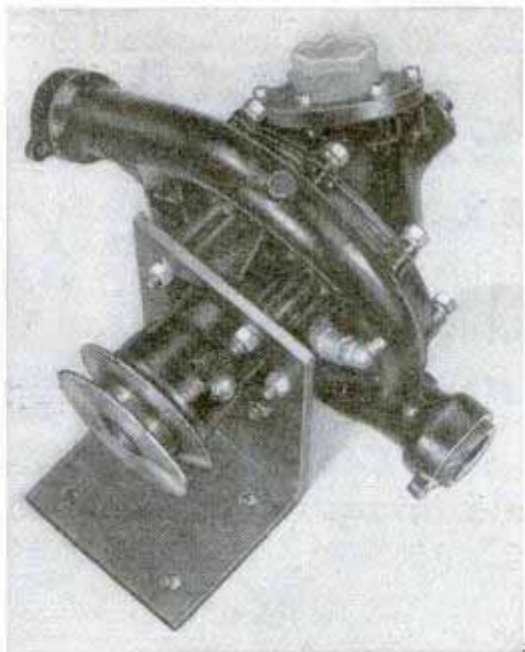


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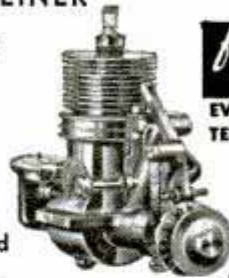
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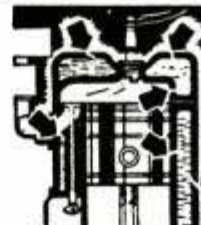
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Yes — we've got over 2500 names in stock! That's why we can offer you these fine personalized Strikalite Pocket Lighters at the incredibly low price of only 3 for \$1.00.

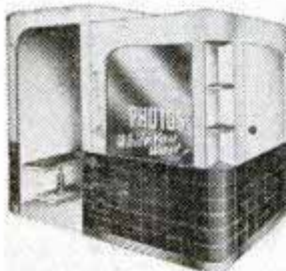
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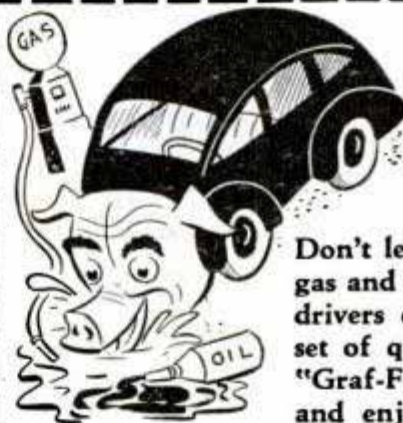


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HANDLES LIKE A PEN*

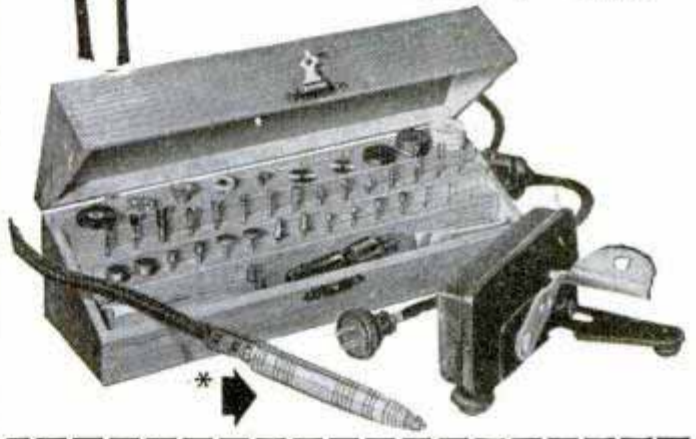


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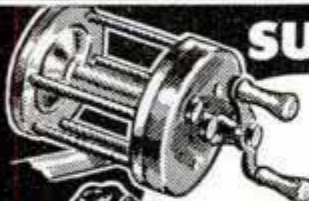
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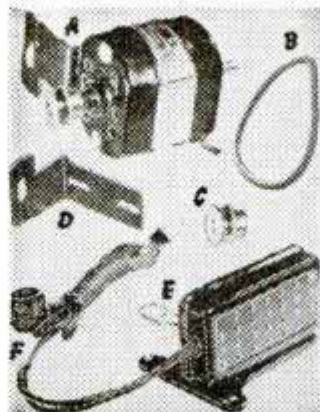
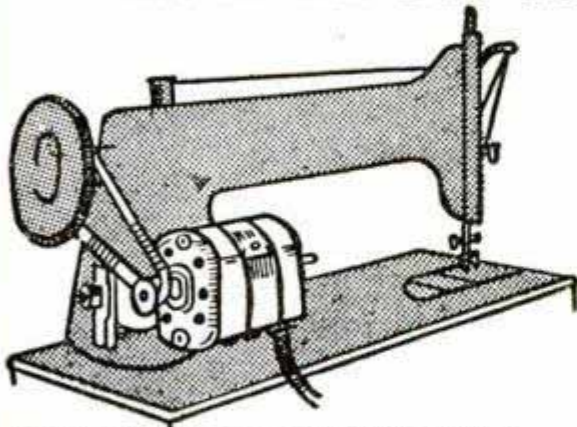
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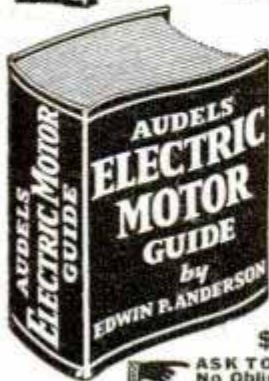
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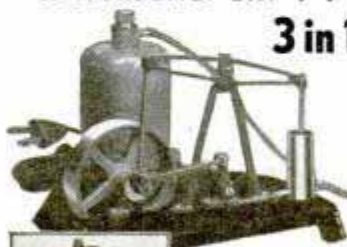


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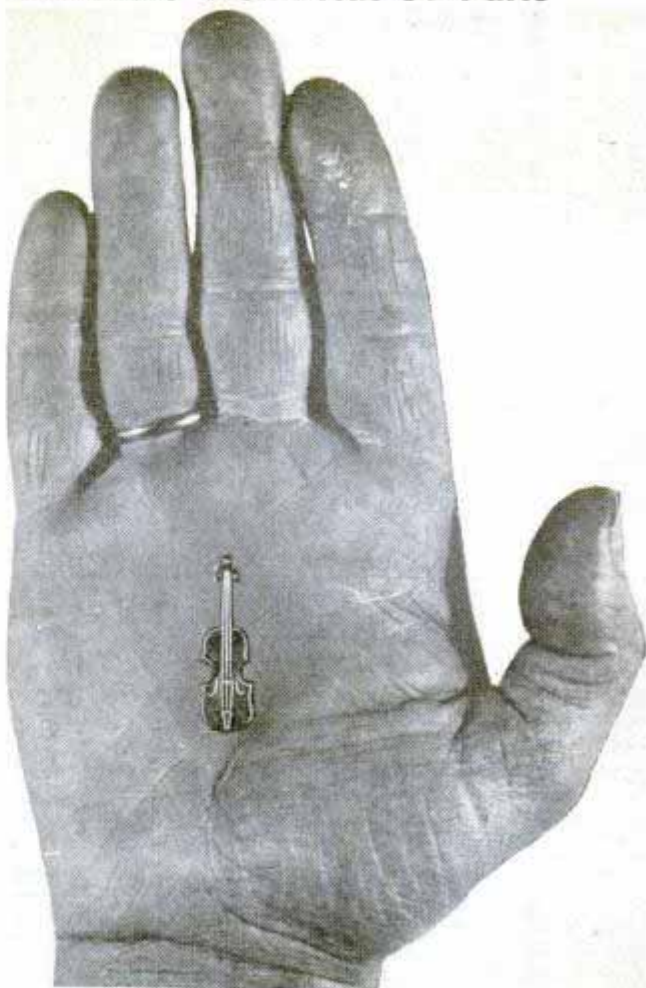


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Sulfa Drugs Check Grain Mold

Molds that feed on stored grain are checked by the same sulfa drugs that kill germs in human beings, according to recent experiments at the University of Minnesota. When stored grain becomes damp the molds multiply rapidly and often spoil the grain for use as seed or food. Fumigants and preservatives have been used to check the mold but they often give the grain disagreeable tastes or make it poisonous. Dr. Max Milner discovered that one part of powdered sulfanilamide to 250 parts of damp grain held mold growth in check. Other sulfa drugs which were tested also gave encouraging results.



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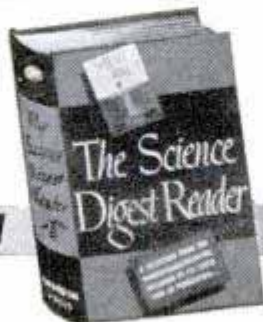
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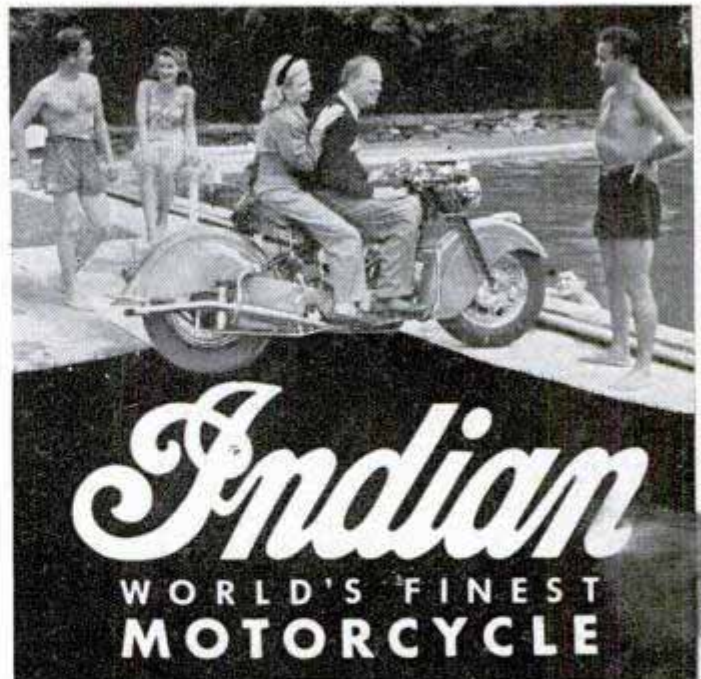
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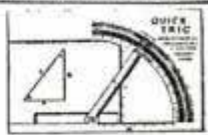
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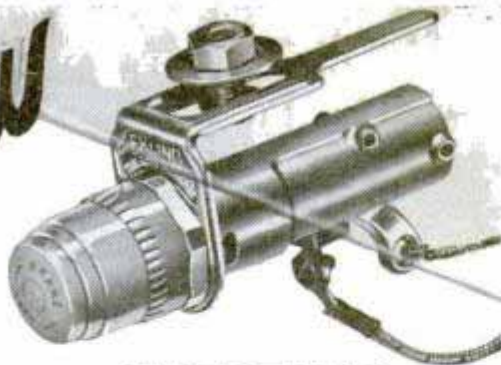


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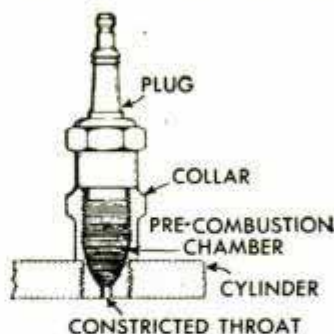
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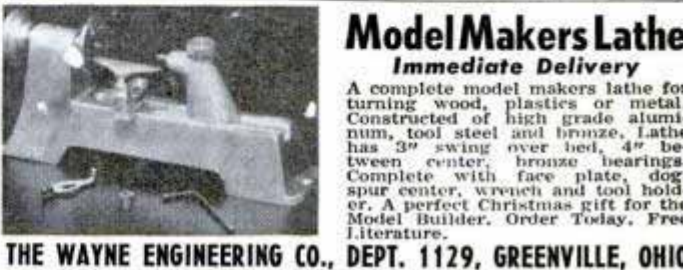
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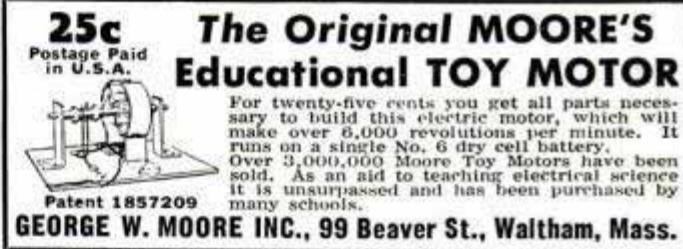
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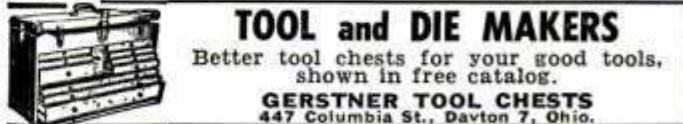
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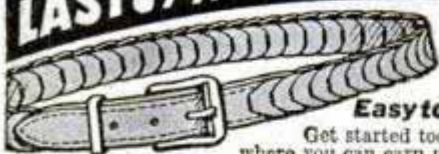
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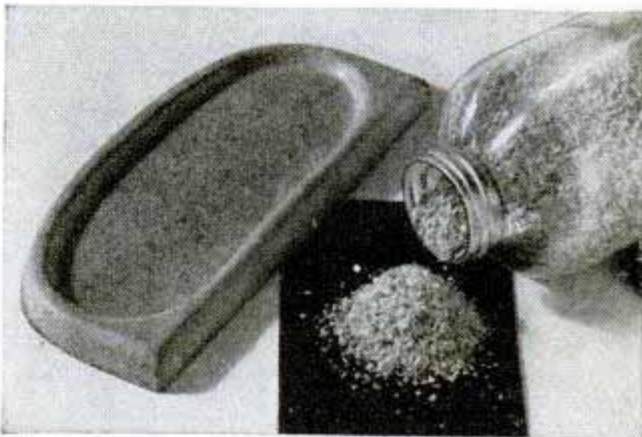
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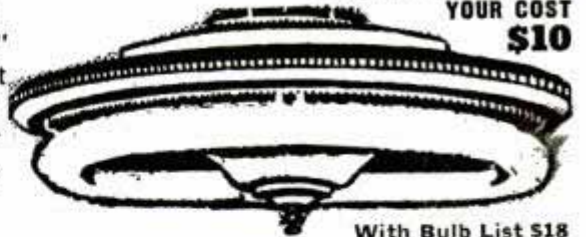
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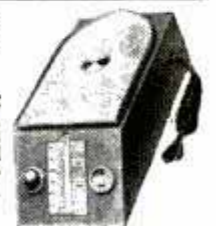
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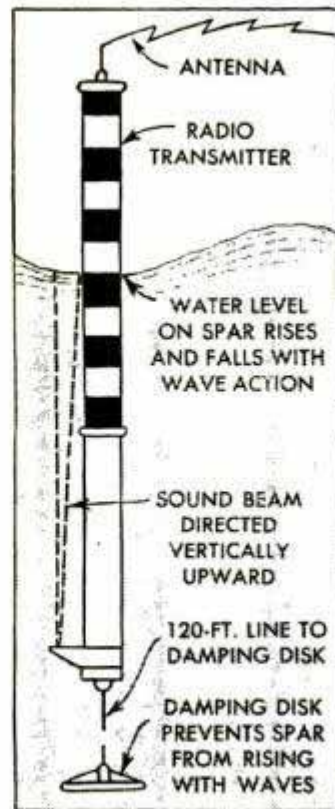
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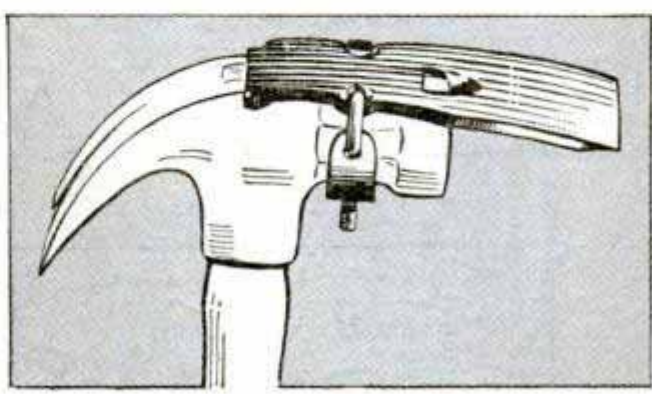


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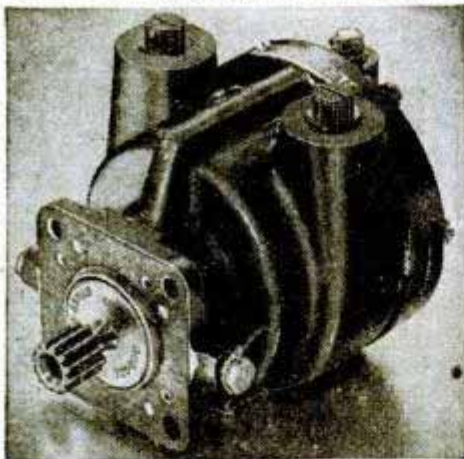
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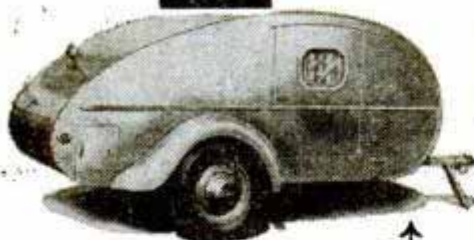
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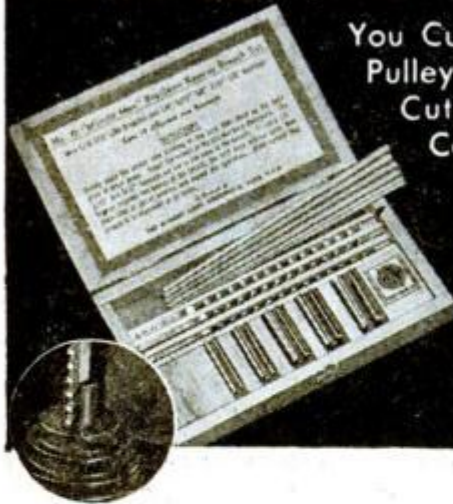
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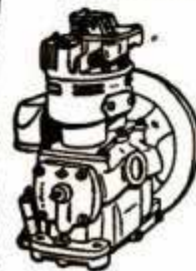
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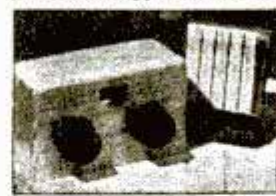
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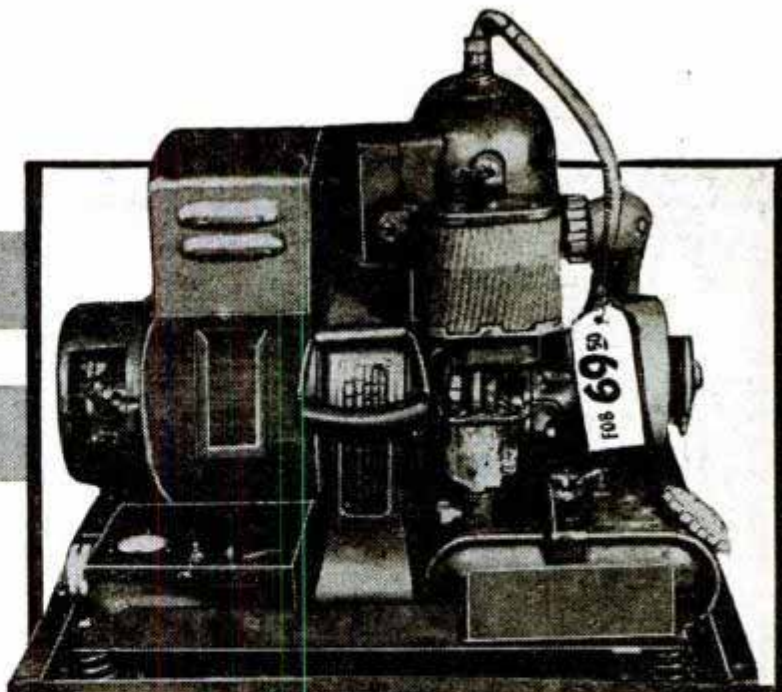
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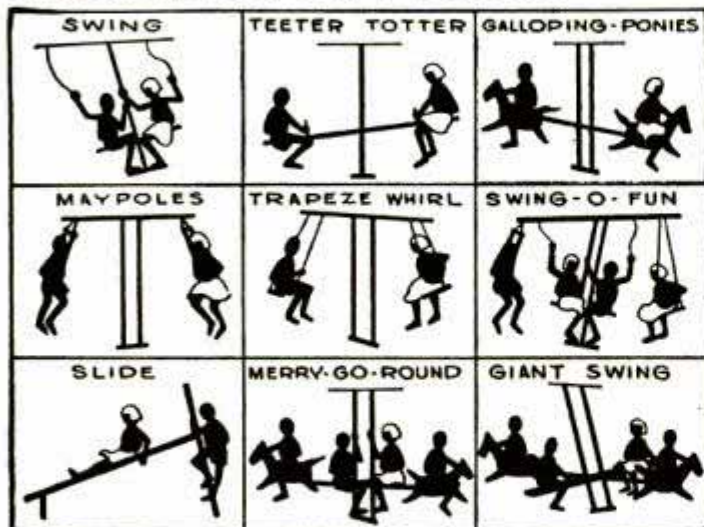


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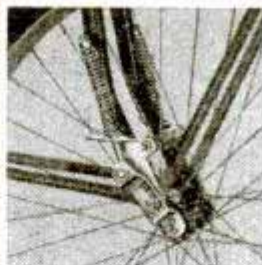
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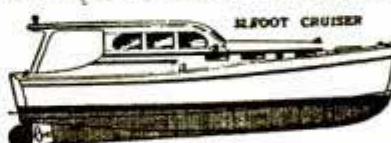


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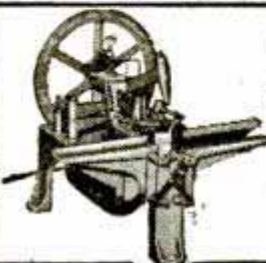
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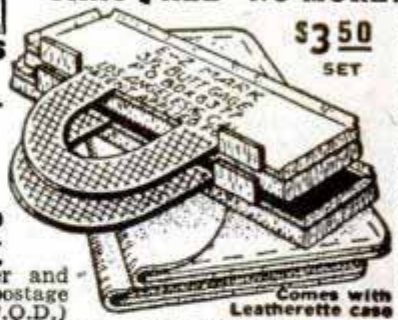


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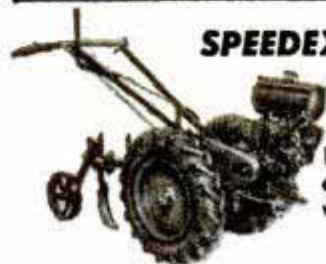


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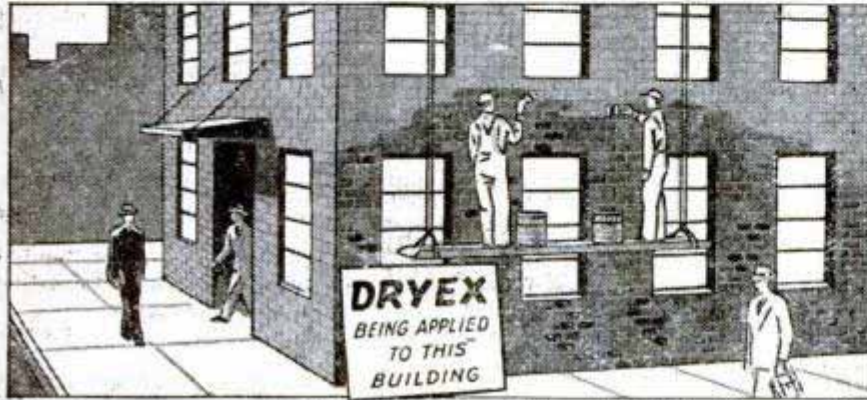
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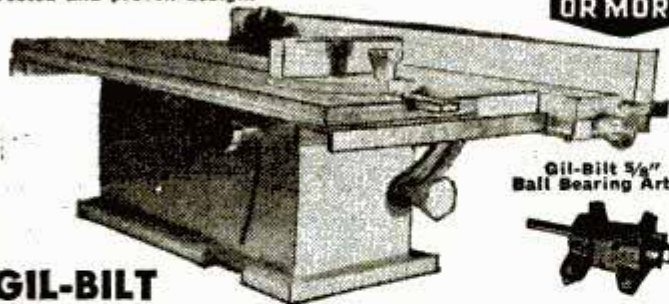
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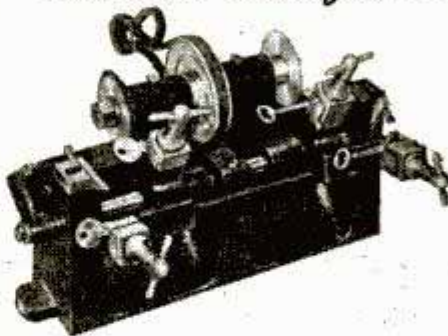
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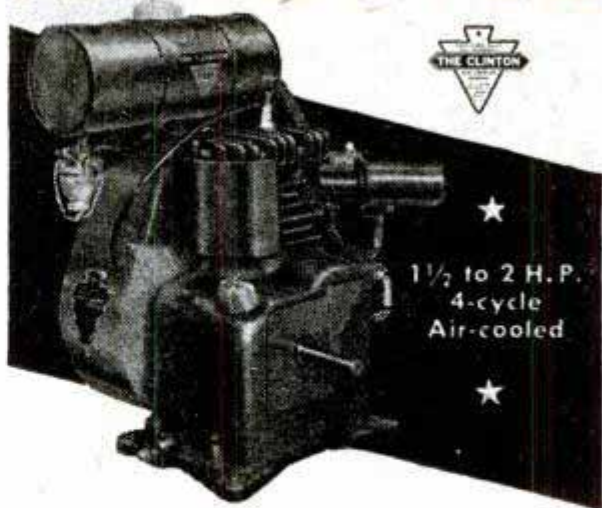
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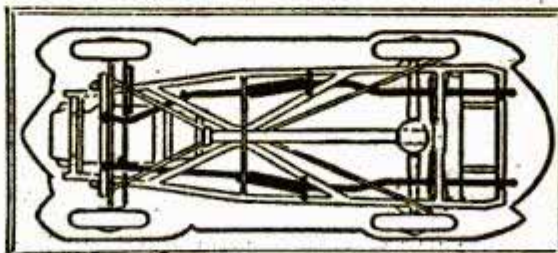
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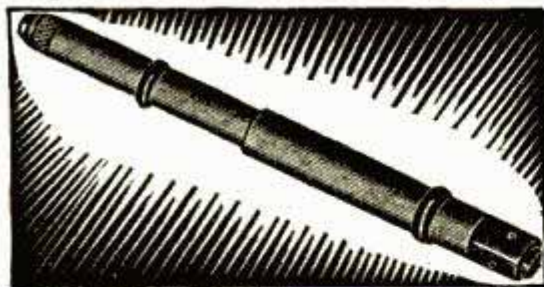
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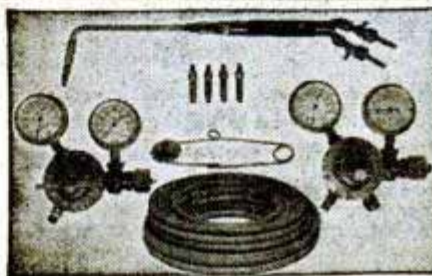
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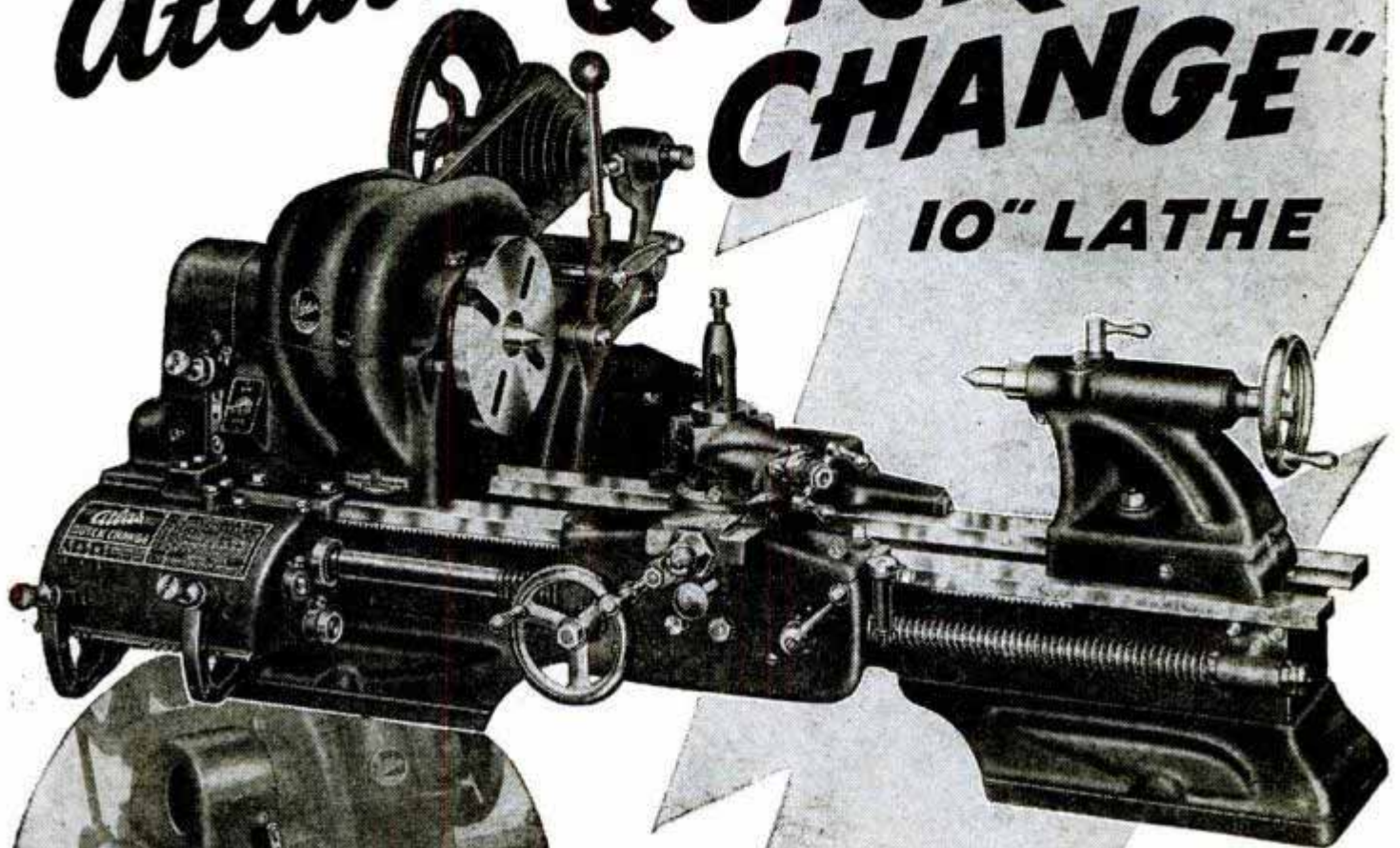
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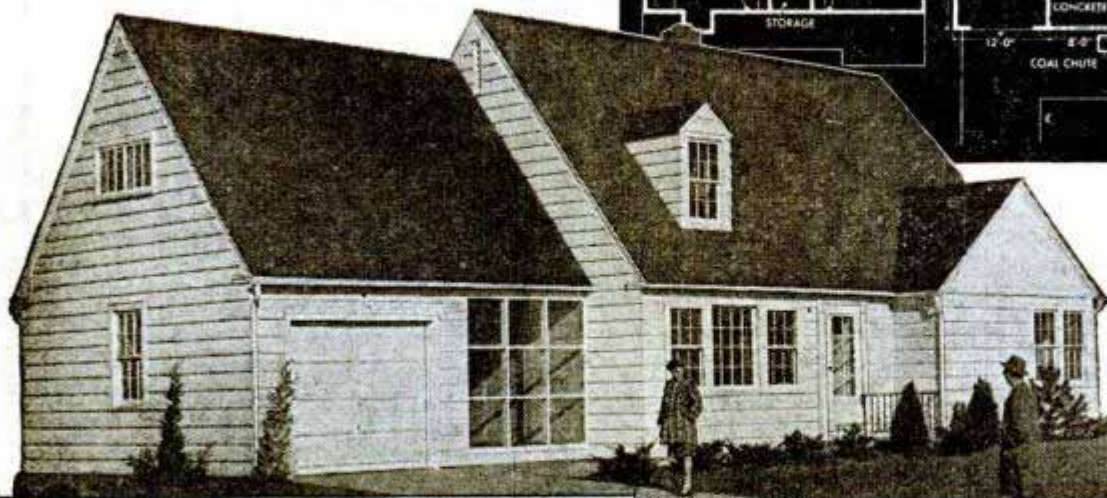
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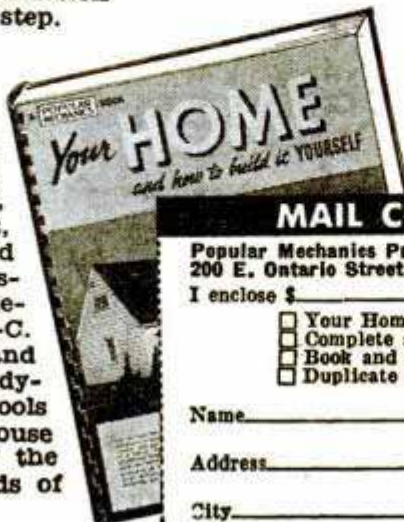
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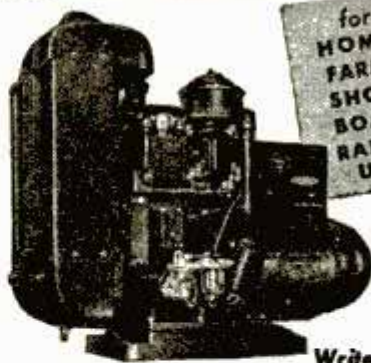


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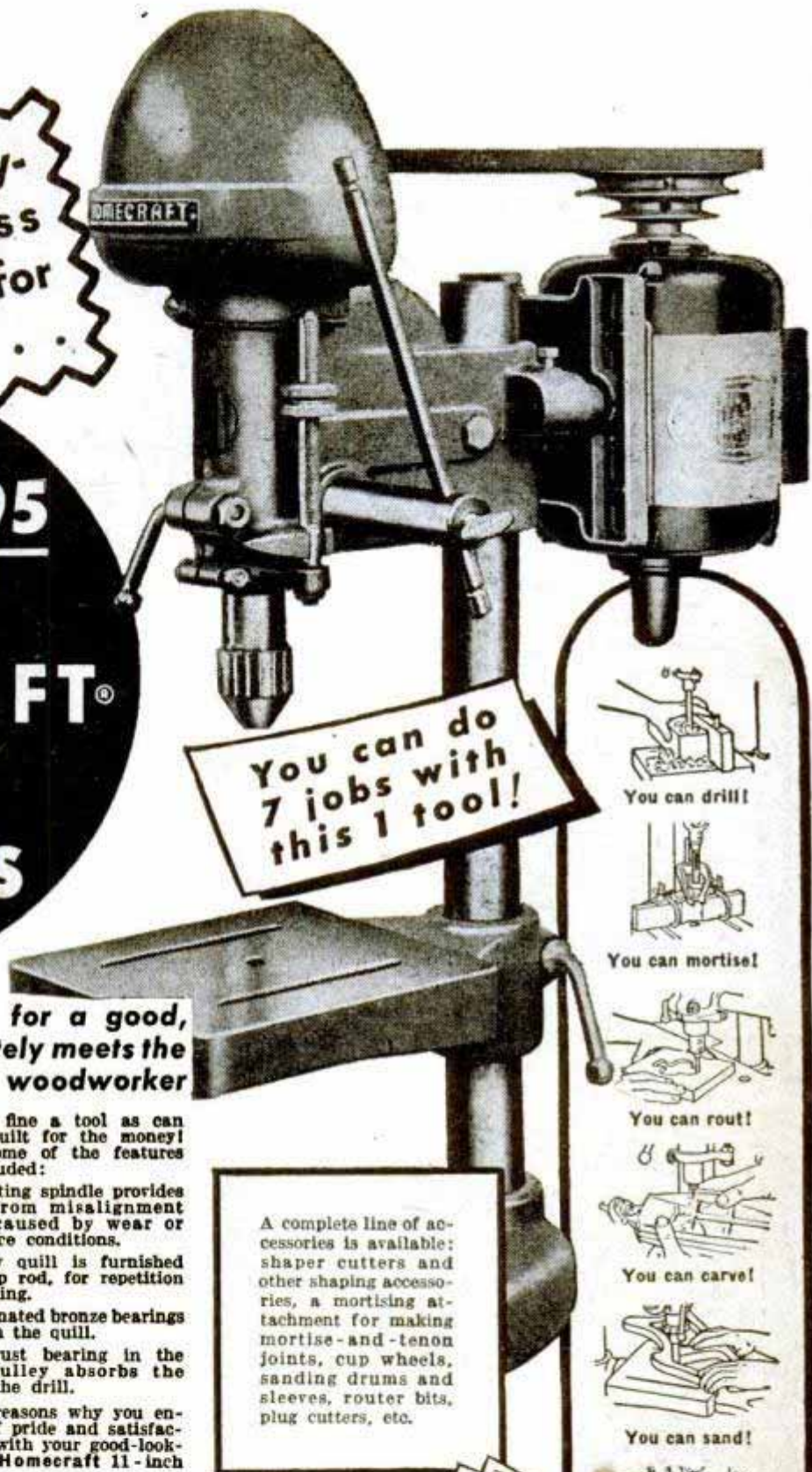
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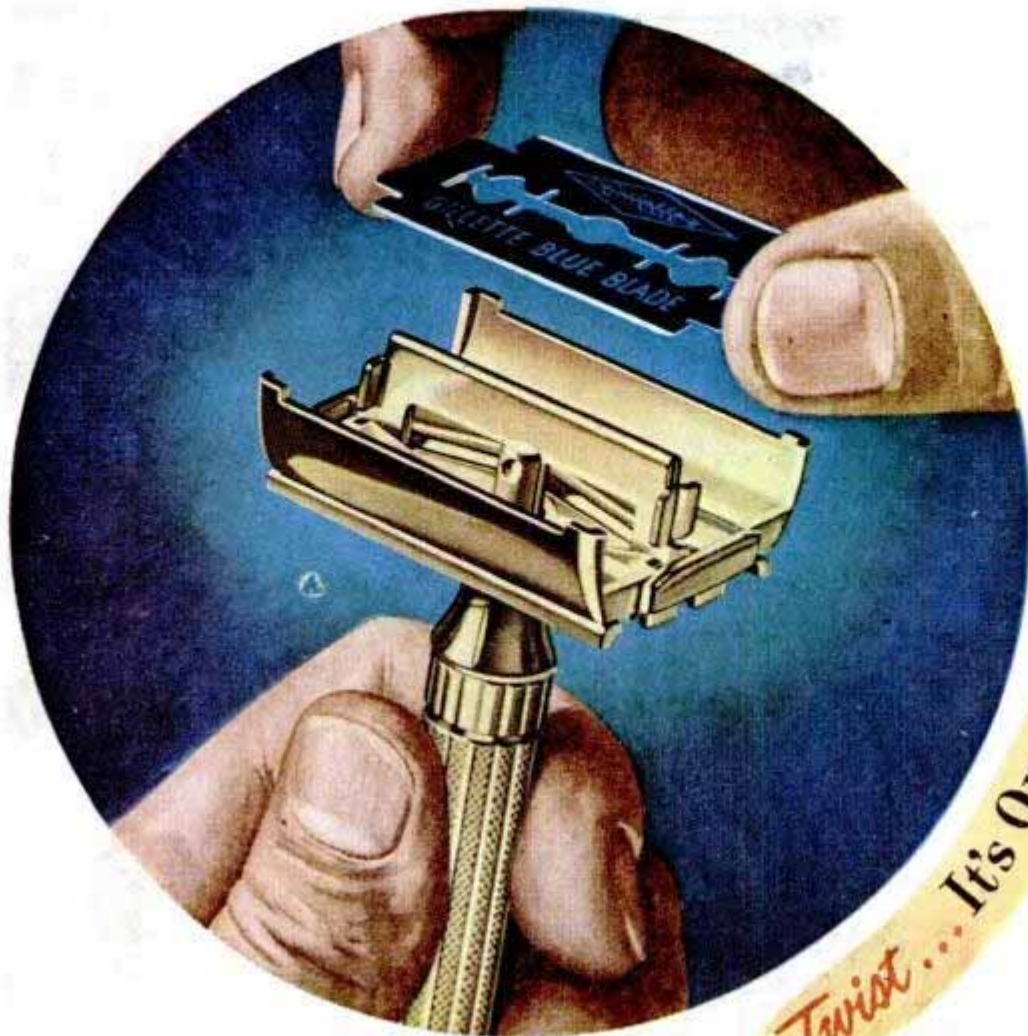
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